Service Guide

Publication Number 33250-90011 (*order as 33250-90100 manual set*)
Edition 2, March 2003

For Safety information, Warranties, and Regulatory information, see the pages following the Index.

Agilent 33250A
80 MHz Function / Arbitrary Waveform Generator

Agilent 33250A at a Glance

The Agilent Technologies 33250A is a high-performance 80 MHz synthesized function generator with built-in arbitrary waveform and pulse capabilities. Its combination of bench-top and system features makes this function generator a versatile solution for your testing requirements now and in the future.

Convenient bench-top features

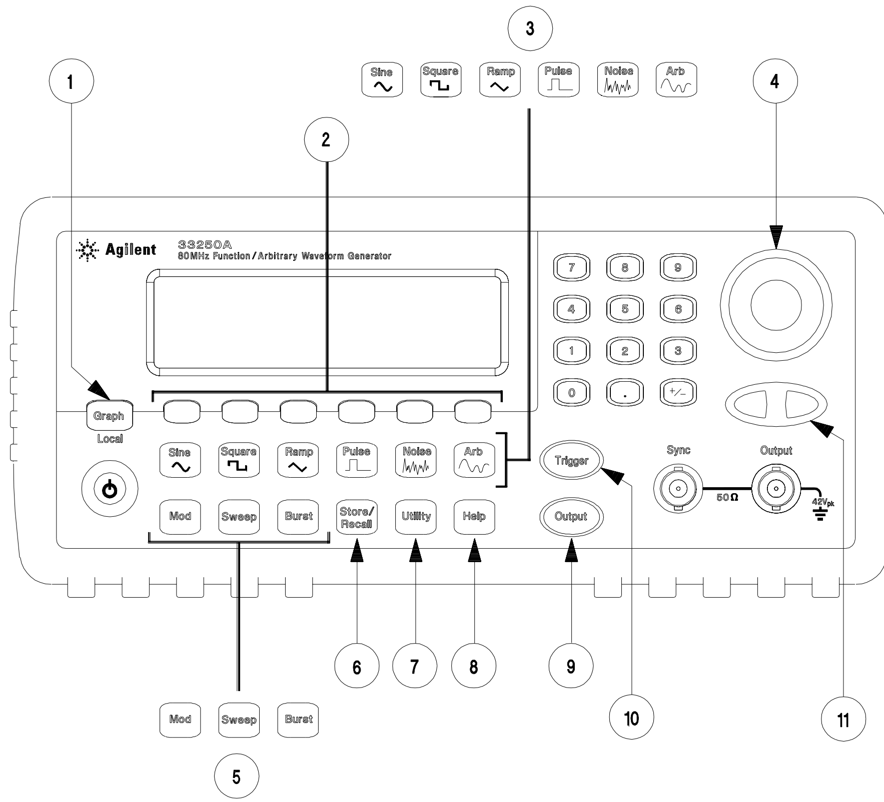
- 10 standard waveforms
- Built-in 12-bit 200 MSa/s arbitrary waveform capability
- Precise pulse waveform capabilities with adjustable edge time
- LCD color display provides numeric and graphical views
- Easy-to-use knob and numeric keypad
- Instrument state storage with user-defined names
- Portable, ruggedized case with non-skid feet

Flexible system features

- Four downloadable 64K-point arbitrary waveform memories
- GPIB (IEEE-488) interface and RS-232 interface are standard
- SCPI (Standard Commands for Programmable Instruments) compatibility

Note: *Unless otherwise indicated, this manual applies to all Serial Numbers.*

The Front Panel at a Glance

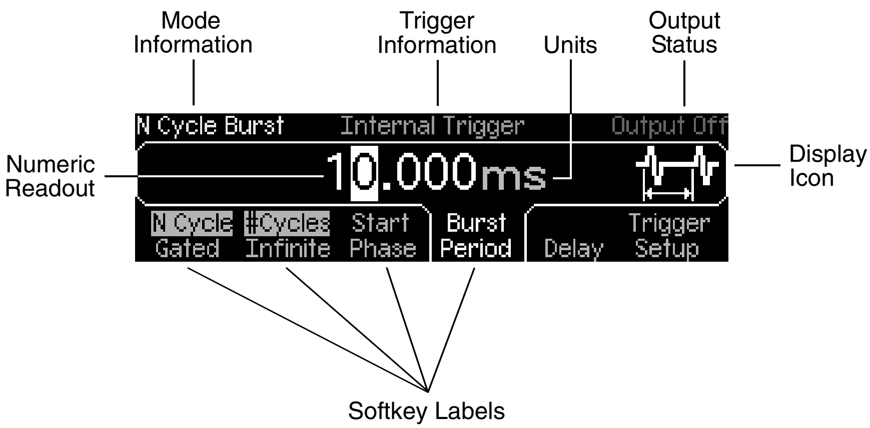


1 Graph Mode/Local Key
2 Menu Operation Softkeys
3 Waveform Selection Keys
4 Knob
5 Modulation/Sweep/Burst Menus
6 State Storage Menu
7 Utility Menu
8 Instrument Help Topic Menu
9 Output Enable/Disable Key
10 Manual Trigger Key (*used for Sweep and Burst only*)
11 Cursor Keys

Note: *To get context-sensitive help on any front-panel key or menu softkey, press and hold down that key.*

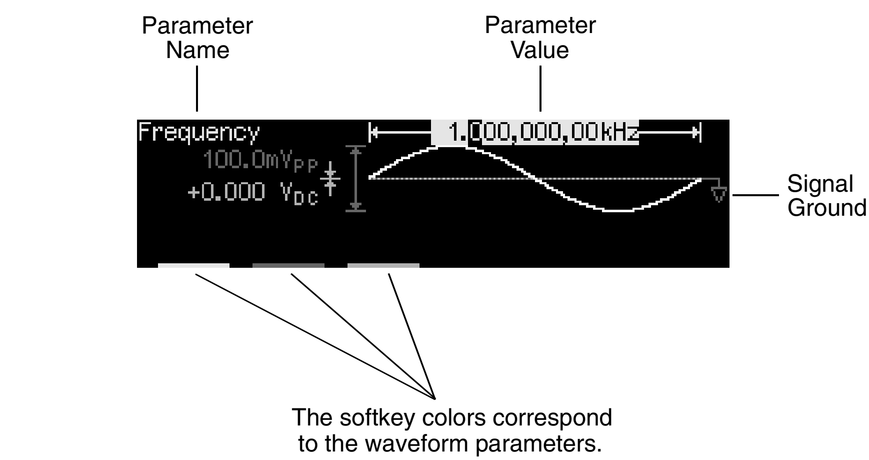
The Front-Panel Display at a Glance

Menu Mode



Graph Mode

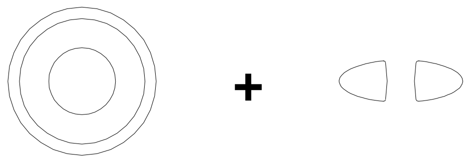
To enter the Graph Mode, press the Graph *key.*



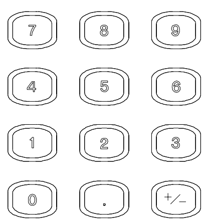
Front-Panel Number Entry

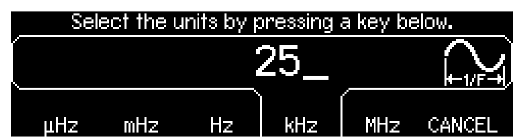
You can enter numbers from the front-panel using one of two methods.

Use the knob and arrow keys to modify the displayed number.

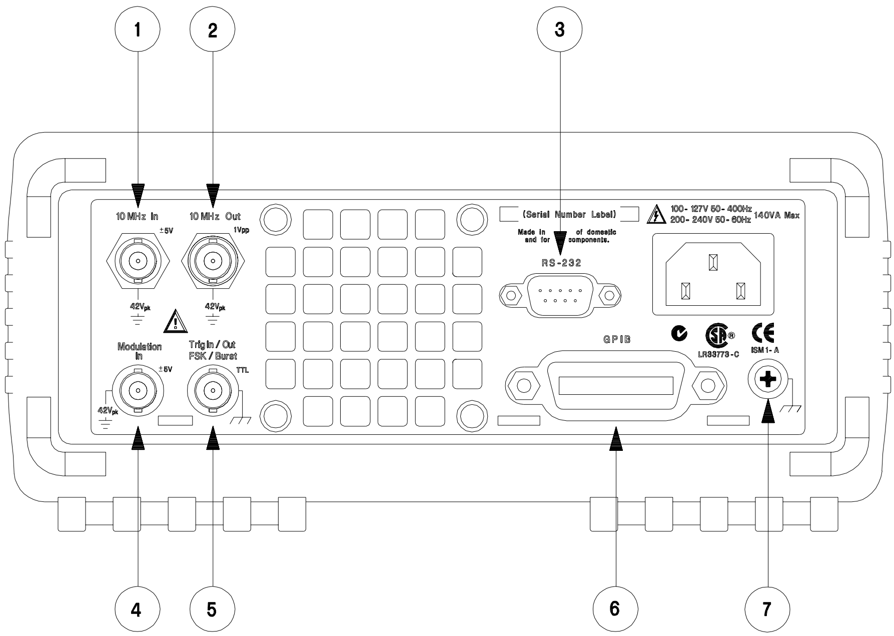


Use the numeric keypad and menu softkeys to select the units.





The Rear Panel at a Glance



1 External 10 MHz Reference Input Terminal
2 Internal 10 MHz Reference Output Terminal
3 RS-232 Interface Connector
4 External Modulation Input Terminal
5 Input: External Trig/FSK/Burst Gate
Output: Trigger Output
6 GPIB Interface Connector
7 Chassis Ground

Use the Utility menu to:

- Select the GPIB or RS-232 interface (see chapter 2 in User’s Guide).
- Select the GPIB address (see chapter 2 in User’s Guide).
- Set the RS-232 baud rate, parity, and handshake (see chapter 2 in User’s Guide).

WARNING *For protection from electrical shock, the power cord ground must not be defeated. If only a two-contact electrical outlet is available, connect the instrument’s chassis ground screw (see above) to a good earth ground.*

In This Book

Specifications Chapter 1 lists the function generator's specifications.

Quick Start Chapter 2 prepares the function generator for use and helps you get familiar with a few of its front-panel features.

Front-Panel Menu Operation Chapter 3 introduces you to the front-panel menu and describes some of the function generator's menu features.

Calibration Procedures Chapter 4 provides calibration, verification, and adjustment procedures for the function generator.

Theory of Operation Chapter 5 describes the block diagram and circuit-level theory related to the operation of the function generator.

Service Chapter 6 provides guidelines for returning your function generator to Agilent Technologies for servicing, or for servicing it yourself.

Replaceable Parts Chapter 7 contains a detailed parts list of the function generator.

Backdating Chapter 8 describes the differences between this manual and older issues of this manual.

Schematics Chapter 9 contains the function generator's schematics and component locator drawings.

If you have questions relating to the operation of the Agilent 33250A, call **1-800-452-4844** in the United States, or contact your nearest Agilent Technologies Office.

If your 33250A fails within three years of purchase, Agilent will either repair or replace it free of charge. Call **1-877-447-7278** in the United States (and ask for "Agilent Express") or contact your local Agilent Technologies Office.

Contents

Chapter 4 Calibration Procedures (*continued*)

Chapter 5 Theory of Operation

Chapter 5 Theory of Operation (*continued*)

Chapter 6 Service

Chapter 7 Replaceable Parts

Chapter 9 Schematics

1

Specifications

WAVEFORMS

Standard Waveforms: Sine, Square, Ramp, Pulse, Noise, Sin(x)/x, Exponential Rise, Exponential Fall, Negative Ramp, Cardiac, DC Volts

Arbitrary Waveforms

Waveform Length:	1 to 64K points
Amplitude Resolution:	12 bits (including sign)
Repetition Rate:	1 μHz to 25 MHz
Sample Rate:	200 MSa/s
Filter Bandwidth:	50 MHz
Non-Volatile Memory:	Four 64K waveforms [1]

FREQUENCY CHARACTERISTICS

Sine:	1 μHz to 80 MHz
Square:	1 μHz to 80 MHz
Ramp:	1 μHz to 1 MHz
Pulse:	500 μHz to 50 MHz
Noise (Gaussian)**:**	50 MHz bandwidth
Arb:	1 μHz to 25 MHz

Resolution: 1 μHz; except pulse, 5 digits

Accuracy (1 year)**:** 2 ppm, 18°C to 28°C; 3 ppm, 0°C to 55°C

SINEWAVE SPECTRAL PURITY

Harmonic Distortion

	< 3 Vpp[2]	> 3 Vpp
DC to 1 MHz:	-60 dBc	-55 dBc
1 MHz to 5 MHz:	-57 dBc	-45 dBc
5 MHz to 80 MHz:	-37 dBc	-30 dBc

Total Harmonic Distortion

DC to 20 kHz: < 0.2% + 0.1 mVrms

Spurious (non-harmonic) [3]

DC to 1 MHz:	-60 dBc
1 MHz to 20 MHz:	-50 dBc
20 MHz to 80 MHz:	-50 dBc + 6 dBc/octave

Phase Noise (30 kHz band)

10 MHz	< -65 dBc (typical)
80 MHz	< -47 dBc (typical)

SIGNAL CHARACTERISTICS

Square Wave

Rise / Fall Time:	< 8 ns [4]
Overshoot:	< 5%
Asymmetry:	1% of period + 1 ns
Jitter (rms)	
< 2 MHz:	0.01% + 525 ps
≥ 2 MHz:	0.1% + 75 ps
Duty Cycle	
≤ 25 MHz:	20.0% to 80.0%
25 MHz to 50 MHz:	40.0% to 60.0%
50 MHz to 80 MHz:	50.0% (fixed)

Pulse

Period:	20.00 ns to 2000.0 s
Pulse Width:	8.0 ns to 1999.9 s
Variable Edge Time:	5.00 ns to 1.00 ms
Overshoot:	< 5%
Jitter (rms):	100 ppm + 50 ps

Ramp

Linearity:	< 0.1% of peak output
Symmetry:	0.0% to 100.0%

Arb

Minimum Edge Time:	< 10 ns
Linearity:	< 0.1% of peak output
Settling Time:	< 50 ns to 0.5% of final value
Jitter (rms):	30 ppm + 2.5 ns

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[1] A total of four waveforms can be stored.

[2] Harmonic distortion at low amplitudes is limited by a -70 dBm floor.

[3] Spurious noise at low amplitudes is limited by a -75 dBm floor.

[4] Edge time decreased at higher frequency.

OUTPUT CHARACTERISTICS [1]

Amplitude (into 50Ω):	10 mVpp to 10 Vpp [2]
Accuracy (at 1 kHz, >10 mVpp, Autorange On):	± 1% of setting ±1 mVpp
Flatness (sinewave relative to 1 kHz, Autorange On)	
< 10 MHz:	± 1% (0.1 dB) [3]
10 MHz to 50 MHz:	± 2% (0.2 dB)
50 MHz to 80 MHz	± 5% (0.4 dB)
Units:	Vpp, Vrms, dBm, High Level, Low Level
Resolution:	0.1 mV or 4 digits
Offset (into 50Ω):	± 5 Vpk ac + dc
Accuracy:	1% of setting + 2 mV + 0.5% of amplitude

Waveform Output

Impedance:	50Ω typical (fixed) >10 MΩ (output disabled)
Isolation:	42 Vpk max. to Earth
Protection:	Short-circuit protected; [4] Overload relay automatically disables main output

MODULATION CHARACTERISTICS

AM Modulation

Carrier Waveforms:	Sine, Square, Ramp, Arb
Modulating Waveforms:	Sine, Square, Ramp, Noise, Arb
Modulating Frequency:	2 mHz to 20 kHz
Depth:	0.0% to 120.0%
Source:	Internal / External

FM Modulation

Carrier Waveforms:	Sine, Square, Ramp, Arb
Modulating Waveforms:	Sine, Square, Ramp, Noise, Arb
Modulating Frequency:	2 mHz to 20 kHz
Peak Deviation:	DC to 80 MHz
Source:	Internal / External

FSK

Carrier Waveforms:	Sine, Square, Ramp, Arb
Modulating Waveforms:	50% duty cycle square
Internal Rate:	2 mHz to 100 kHz
Frequency Range:	1 μHz to 80 MHz
Source:	Internal / External

External Modulation Input

Voltage Range:	± 5V full scale
Input Impedance:	10 kΩ
Frequency:	DC to 20 kHz

BURST

Waveforms:	Sine, Square, Ramp, Pulse, Noise, Arb [5]
Frequency:	1 μHz to 80 MHz
Burst Count:	1 to 1,000,000 cycles, or Infinite
Start / Stop Phase:	-360.0° to +360.0°
Internal Period:	1 ms to 500 s
Gate Source:	External Trigger
Trigger Source:	Single, External, or Internal Rate
Trigger Delay	
N-Cycle, Infinite:	0.0 ns to 85.000 s

SWEEP

Waveforms:	Sine, Square, Ramp, Arb
Type:	Linear or Logarithmic
Direction:	Up or Down
Start F / Stop F:	100 μHz to 80 MHz
Sweep Time:	1 ms to 500 s
Trigger:	Single, External, or Internal
Marker:	Falling edge of Sync signal (programmable)

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1 Add 1/10th of output amplitude and offset specification per °C for operation outside of 18 °C to 28 °C range (1-year specification).

2 20 mVpp to 20 Vpp into open-circuit load.

3 dB rounded to 1 digit. Instrument adheres to “%” specification.

4 Short-circuit protected to ground at all times.

5 Sine and square waveforms above 25 MHz are allowed only with an “Infinite” burst count.

SYSTEM CHARACTERISTICS

Configuration TImes (typical) [1]

Function Change
- Standard: [2] — 102 ms
- Pulse: — 660 ms
- Built-In Arb: [2] — 240 ms

Frequency Change: 24 ms
Amplitude Change: 50 ms
Offset Change: 50 ms
Select User Arb: < 400 ms for < 16K points
Modulation Change: < 200 ms

Arb Download Times GPIB / RS-232 (115 Kbps) [3]

Arb Length	Binary	ASCII Integer	ASCII Real
64K points	23 sec	92 sec	154 sec
16K points	6 sec	23 sec	39 sec
8K points	3 sec	12 sec	20 sec
4K points	1.5 sec	6 sec	10 sec
2K points	0.75 sec	3 sec	5 sec

TRIGGER CHARACTERISTICS

Trigger Input

Input Level: TTL-compatible
Slope: Rising or falling (selectable)
Pulse Width: > 100 ns
Input Impedance: 10 kΩ, DC coupled
Latency
- Sweep: < 10 μs (typical)
- Burst: < 100 ns (typical)

Jitter (rms)
- Sweep: 2.5 μs
- Burst: 1 ns; except pulse, 300 ps

Trigger Output

Level: TTL-compatible into 50Ω
Pulse Width: > 450 ns
Maximum Rate: 1 MHz
Fanout: ≤ 4 Agilent 33250As

CLOCK REFERENCE

Phase Offset

Range: -360° to +360°
Resolution: 0.001°

External Reference Input

Lock Range: 10 MHz ± 35 kHz
Level: 100 mVpp to 5 Vpp
Impedance: 1 kΩ nominal, ac coupled
Lock Time: < 2 s

Internal Reference Output

Frequency: 10 MHz
Level: 632 mVpp (0 dBm), nominal
Impedance: 50Ω nominal, ac coupled

SYNC OUTPUT

Level: TTL-compatible into > 1 kΩ
Impedance: 50Ω nominal

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[1] Time to change parameter and output new signal.

[2] Modulation or sweep off.

[3] Times for 5-digit integer and 12-digit real numbers.

GENERAL SPECIFICATIONS

Power Supply:	100-240 V (±10%) for 50-60 Hz operation, 100-127 V (±10%) for 50-400 Hz operation. IEC 60664 CAT II
Power Consumption:	140 VA
Operating Environment:	0 °C to 55 °C 80% R.H. to 40 °C
Operating Altitude:	3000 meters
Pollution Degree:	Indoor or Sheltered Use, IEC 60664 Degree 2
Storage Temperature:	-30 °C to 70 °C
Stored States:	Four (4) named user configurations
Power-On State:	Default or Last
Interface:	IEEE-488 and RS-232 standard
Language:	SCPI-1997, IEEE-488.2
Dimensions (WxHxD)	
Bench Top:	254 x 104 x 374 mm
Rack Mount:	213 x 89 x 348 mm
Weight:	4.6 kg
Safety Designed to:	EN61010-1, CSA1010.1, UL-3111-1
EMC Tested to: [1]	IEC-61326-1 IEC-61000-4-3 criteria B IEC-61000-4-6 criteria B
Acoustic Noise:	40 dBA
Warm-Up Time:	1 hour
Calibration Interval:	1 year
Warranty:	3 years standard
Accessories Included:	User's Guide, Service Guide, Quick Reference Guide, Test Data, Connectivity Software, RS-232 Cable, Power Cord

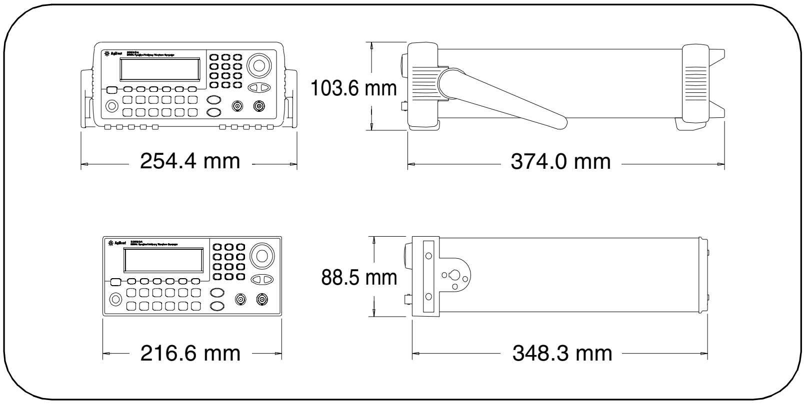
[1] Radiated and conducted immunity testing: When the product is tested at 3 V/m according to IEC/EN 61000-4-3:1995 or tested at 3 Vrms according to IEC/EN 61000-4-6:1996, the product may not meet criteria A, but does meet criteria B.

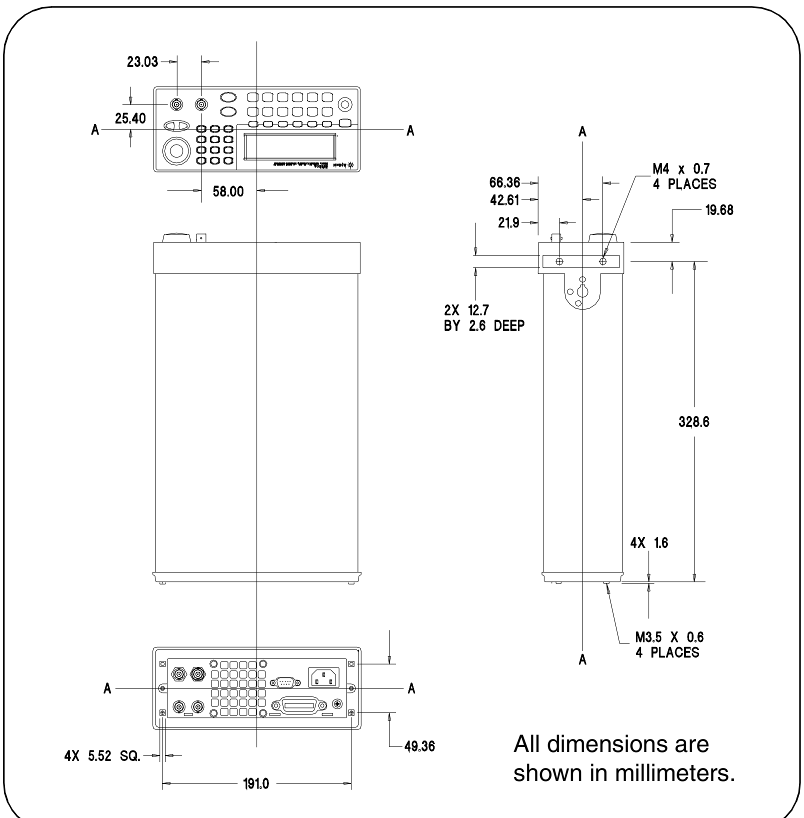
This ISM device complies with Canadian ICES-001.

Cet appareil ISM est conforme à la norme NMB-001 du Canada.

N10149

PRODUCT DIMENSIONS





Quick Start

2

Quick Start

One of the first things you will want to do with your function generator is to become acquainted with the front panel. We have written the exercises in this chapter to prepare the instrument for use and help you get familiar with some of its front-panel operations. This chapter is divided into the following sections:

2

To Prepare the Function Generator for Use

1 Check the list of supplied items.

Verify that you have received the following items with your instrument. If anything is missing, please contact your nearest Agilent Sales Office.

- ❑ One power cord.
- ❑ One *User's Guide*.
- ❑ This *Service Guide*.
- ❑ One folded *Quick Reference Guide*.
- ❑ Certificate of Calibration.
- ❑ Connectivity software on CD-ROM.
- ❑ One RS-232 cable.

Power Switch

2 Connect the power cord and turn on the function generator.

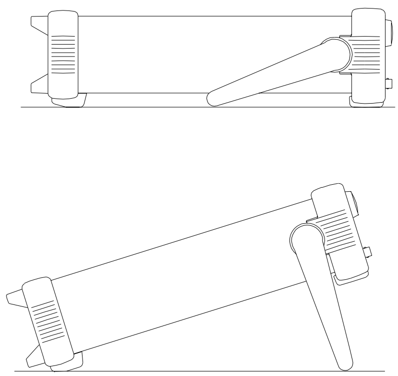
Several power-on information messages are displayed after the function generator performs its power-on self-test. The GPIB address is displayed. The function generator powers up in the *sine wave* function at 1 kHz with an amplitude of 100 mV peak-to-peak (into a 50Ω termination). At power-on, the *Output* connector is disabled. To enable the *Output* connector, press the Output key.

If the function generator *does not* turn on, verify that the power cord is firmly connected to the power receptacle on the rear panel (the power-line voltage is automatically sensed at power-on). You should also make sure that the function generator is connected to a power source that is energized. Then, verify that the function generator is turned on.

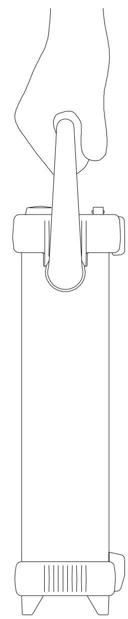
If you need further assistance, refer to chapter 6 for instructions on returning the function generator to Agilent for service.

To Adjust the Carrying Handle

To adjust the position, grasp the handle by the sides and *pull outward*. Then, rotate the handle to the desired position.



Bench-top viewing positions



Carrying position

To Set the Output Frequency

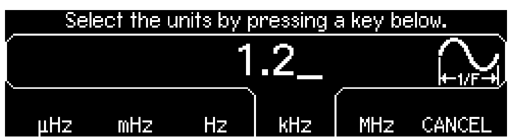
At power-on, the function generator outputs a sine wave at 1 kHz with an amplitude of 100 mV peak-to-peak (into a 50Ω termination).
The following steps show you how to change the frequency to 1.2 MHz.

1 Press the "Freq" softkey.

The displayed frequency is either the power-on value or the frequency previously selected. When you change functions, the same frequency is used if the present value is valid for the new function. To set the waveform *period* instead, press the **Freq** softkey again to toggle to the **Period** softkey (the current selection is highlighted).

2 Enter the magnitude of the desired frequency.

Using the numeric keypad, enter the value "1.2".



3 Select the desired units.

Press the softkey that corresponds to the desired units. When you select the units, the function generator outputs a waveform with the displayed frequency (if the output is enabled). For this example, press **MHz**.

Note: *You can also enter the desired value using the knob and arrow keys.*

To Set the Output Amplitude

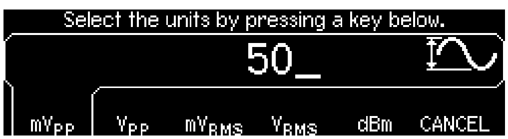
At power-on, the function generator outputs a sine wave with an amplitude of 100 mV peak-to-peak (into a 50Ω termination).
The following steps show you how to change the amplitude to 50 mVrms.

1 **Press the "Ampl" softkey.**

The displayed amplitude is either the power-on value or the amplitude previously selected. When you change functions, the same amplitude is used if the present value is valid for the new function. To set the amplitude using a *high level* and *low level*, press the **Ampl** softkey again to toggle to the **HiLevel** and **LoLevel** softkeys (the current selection is highlighted).

2 **Enter the magnitude of the desired amplitude.**

Using the numeric keypad, enter the value "50".



3 **Select the desired units.**

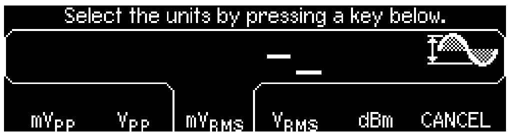
Press the softkey that corresponds to the desired units. When you select the units, the function generator outputs the waveform with the displayed amplitude (if the output is enabled). For this example, press **mV$_{RMS}$**.

Note: *You can also enter the desired value using the knob and arrow keys.*

You can easily convert the displayed amplitude from one unit to another. For example, the following steps show you how to convert the amplitude from Vrms to Vpp.

4 Enter the numeric entry mode.

Press the +/- key to enter the numeric entry mode.



5 Select the new units.

Press the softkey that corresponds to the desired units. The displayed value is converted to the new units. For this example, press the **Vpp** softkey to convert 50 mVrms to its equivalent in volts peak-to-peak.

To change the displayed amplitude by *decades*, press the right-arrow key to move the cursor to the units on the right side of the display. Then, rotate the knob to increase or decrease the displayed amplitude by decades.

To Set a DC Offset Voltage

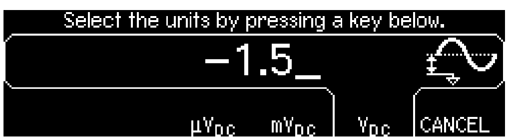
At power-on, the function generator outputs a sine wave with a dc offset of 0 volts (into a 50Ω termination). *The following steps show you how to change the offset to –1.5 mVdc.*

1 Press the "Offset" softkey.

The displayed offset voltage is either the power-on value or the offset previously selected. When you change functions, the same offset is used if the present value is valid for the new function.

2 Enter the magnitude of the desired offset.

Using the numeric keypad, enter the value "–1.5".



3 Select the desired units.

Press the softkey that corresponds to the desired units. When you select the units, the function generator outputs the waveform with the displayed offset (if the output is enabled). For this example, press **mVdc**.

Note: *You can also enter the desired value using the knob and arrow keys.*

Note: *To select dc volts from the front panel, press* Utility *and then select the* **DC On** *softkey. Press the* **Offset** *softkey to enter the desired voltage level.*

To Set the Duty Cycle

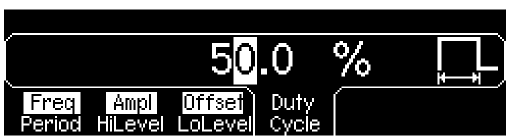
Applies only to square waves. At power-on, the duty cycle for square waves if 50%. You can adjust the duty cycle from 20% to 80% for output frequencies up to 25 MHz. *The following steps show you how to change the duty cycle to 30%.*

1 Select the square wave function.

Press the Square key and then set the desired output frequency to any value less than 25 MHz.

2 Press the "Duty Cycle" softkey.

The displayed duty cycle is either the power-on value or the percentage previously selected. The duty cycle represents the amount of time per cycle that the square wave is at a *high* level (note the icon on the right side of the display).



3 Enter the desired duty cycle.

Using the numeric keypad or the knob, select a duty cycle value of "30". The function generator adjusts the duty cycle immediately and outputs a square wave with the specified value (if the output is enabled).

To Configure a Pulse Waveform

You can configure the function generator to output a pulse waveform with variable pulse width and edge time. *The following steps show you how to configure a 500 ms pulse waveform with a pulse width of 10 ms and edge times of 50 µs.*

1 Select the pulse function.

Press the Pulse key to select the pulse function and output a pulse waveform with the default parameters.

2 Set the pulse period.

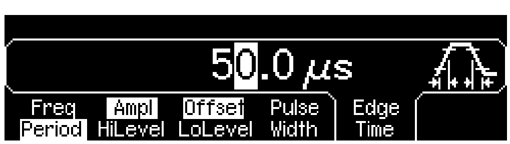
Press the **Period** softkey and then set the pulse period to 500 ms.

3 Set the pulse width.

Press the **Pulse Width** softkey and then set the pulse width to 10 ms. The pulse width represents the time from the 50% threshold of the rising edge to the 50% threshold of the next falling edge (note the display icon).

4 Set the edge time for both edges.

Press the **Edge Time** softkey and then set the edge time for *both* the rising and falling edges to 50 µs. The edge time represents the time from the 10% threshold to the 90% threshold of each edge (note the display icon).

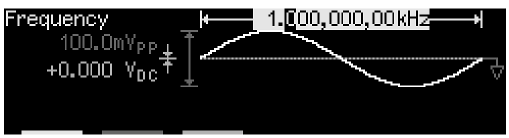


To View a Waveform Graph

In the *Graph Mode*, you can view a graphical representation of the current waveform parameters. Each softkey parameter is shown in a different color corresponding to the lines above the softkeys at the bottom of the display. Note that the softkeys are listed in the same order as in the normal display mode.

1 Enable the Graph Mode.

Press the [Graph] key to enable the Graph Mode. The name of the parameter currently selected is shown in the upper-left corner of the display and the numeric value is highlighted.



2 Select the desired parameter.

To select a specific parameter, note the colored bars above the softkeys at the bottom of the display and select the corresponding color. For example, to select amplitude, press the softkey below the magenta-colored bar.

- As in the normal display mode, you can edit numbers using the numeric keypad or the knob and arrow keys.
- Parameters which normally toggle when you press a key a second time (e.g., **Freq / Period**) also toggle in the Graph Mode.
- To exit the Graph Mode, press [Graph] again.

> The [Graph] key also serves as a [Local] key to restore front-panel control after remote interface operations.

To Output a Stored Arbitrary Waveform

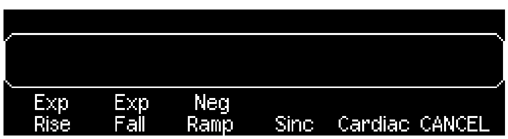
There are five built-in arbitrary waveforms stored in non-volatile memory. *The following steps show you how to output the built-in "exponential fall" waveform from the front panel.*

1 Select the arbitrary waveform function.

When you press the Arb key to select the arbitrary waveform function, a temporary message is displayed indicating which waveform is currently selected (the default is "exponential rise").

2 Select the active waveform.

Press the **Select Wform** softkey and then press the **Built-In** softkey to select from the five built-in waveforms. Then press the **Exp Fall** softkey. The waveform is output using the present settings for frequency, amplitude, and offset unless you change them.



The selected waveform is now assigned to the Arb key. Whenever you press this key, the selected arbitrary waveform is output. To quickly determine which arbitrary waveform is currently selected, press Arb .

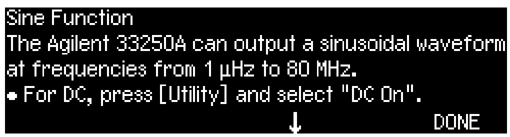
2

To Use the Built-In Help System

The built-in help system is designed to provide context-sensitive assistance on any front-panel key or menu softkey. A list of help topics is also available to assist you with several front-panel operations.

1 View the help information for a function key.

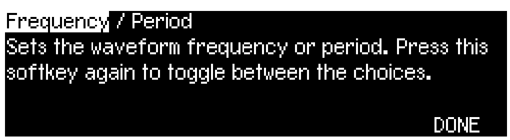
Press and hold down the Sine key. If the message contains more information than will fit on the display, press the ↓ softkey or turn the knob clockwise to view the remaining information.



Press **DONE** to exit the help menu.

2 View the help information for a menu softkey.

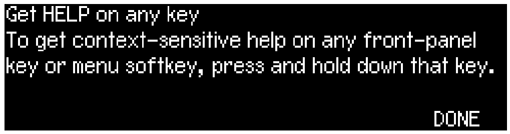
Press and hold down the **Freq** softkey. If the message contains more information than will fit on the display, press the ↓ softkey or rotate the knob clockwise to view the remaining information.



Press **DONE** to exit the help menu.

3 View the list of help topics.

Press the Help key to view the list of available help topics. To scroll through the list, press the ↑ or ↓ softkey or rotate the knob. Select the third topic "*Get HELP on any key*" and then press **SELECT**.

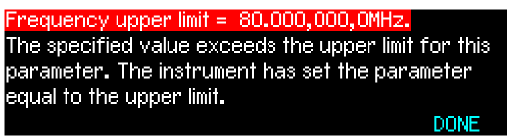


Press **DONE** to exit the help menu.

4 View the help information for displayed messages.

Whenever a limit is exceeded or any other invalid configuration is found, the function generator will display a message. For example, if you enter a value that exceeds the frequency limit for the selected function, a message will be displayed. The built-in help system provides additional information on the most recent message to be displayed.

Press the Help key, select the first topic "*View the last message displayed*", and then press **SELECT**.



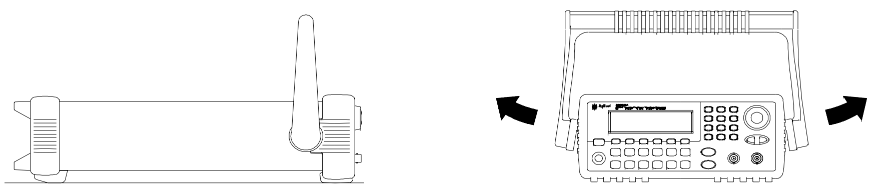
Local Language Help: The built-in help system in available in multiple languages. All messages, context-sensitive help, and help topics appear in the selected language. The menu softkey labels and status line messages are not translated.

To select the local language, press the Utility key, press the **System** softkey, and then press the **Help In** softkey. Select the desired language.

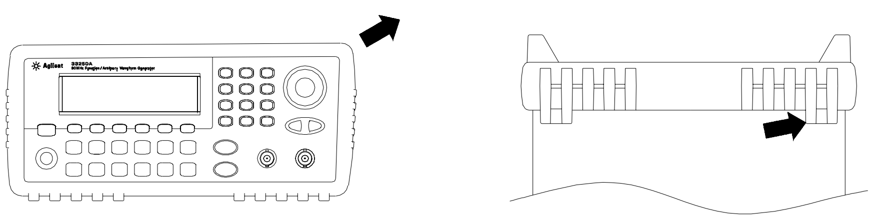
To Rack Mount the Function Generator

You can mount the Agilent 33250A in a standard 19-inch rack cabinet using one of two optional kits available. Instructions and mounting hardware are included with each rack-mounting kit. Any Agilent *System II* instrument of the same size can be rack-mounted beside the Agilent 33250A.

Note: *Remove the carrying handle, and the front and rear rubber bumpers, before rack-mounting the instrument.*



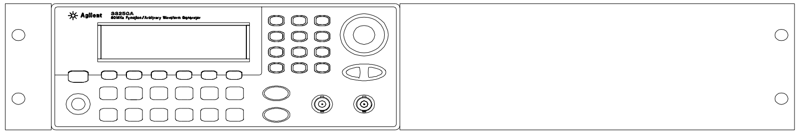
To remove the handle, rotate it to vertical and pull the ends outward.



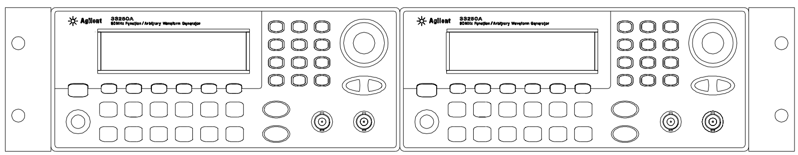
Front

Rear (bottom view)

To remove the rubber bumper, stretch a corner and then slide it off.



To rack mount a single instrument, order adapter kit 5063-9240.



To rack mount two instruments side-by-side, order lock-link kit 5061-9694 and flange kit 5063-9212. Be sure to use the support rails in the rack cabinet.

In order to prevent overheating, do not block the flow of air into or out of the instrument. Be sure to allow enough clearance at the rear, sides, and bottom of the instrument to permit adequate internal airflow.

Front-Panel Menu Operation

Front-Panel Menu Operation

This chapter introduces you to the front-panel keys and menu operation. This chapter does not give a detailed description of every front-panel key or menu operation. It does, however, give you an overview of the front-panel menus and many front-panel operations. See the *Agilent 33250A User's Guide* for a complete discussion of the function generator's capabilities and operation.

3

Front-Panel Menu Reference

This section gives an overview of the front-panel menus. The remainder of this chapter shows examples of using the front-panel menus.

Mod	**Configure the modulation parameters for AM, FM, and FSK.**

- Select the modulation type.
- Select an internal or external modulation source.
- Specify the AM modulation depth, modulating frequency, and modulation shape.
- Specify the FM frequency deviation, modulating frequency, and modulation shape.
- Specify the FSK "hop" frequency and FSK rate.

Sweep	**Configure the parameters for frequency sweep.**

- Select linear or logarithmic sweeping.
- Select the start/stop frequencies or center/span frequencies.
- Select the time in seconds required to complete a sweep.
- Specify a marker frequency.
- Specify an internal or external trigger source for the sweep.
- Specify the slope (rising or falling edge) for an external trigger source.
- Specify the slope (rising or falling edge) of the "Trig Out" signal.

Burst	**Configure the parameters for burst.**

- Select the triggered (N Cycle) or externally-gated burst mode.
- Select the number of cycles per burst (1 to 1,000,000, or Infinite).
- Select the starting phase angle of the burst (-360° to +360°).
- Specify the time from the start of one burst to the start of the next burst.
- Specify a delay between the trigger and the start of the burst.
- Specify an internal or external trigger source for the burst.
- Specify the slope (rising or falling edge) for an external trigger source.
- Specify the slope (rising or falling edge) of the "Trig Out" signal.

Store/Recall	**Store and recall instrument states.**

- Store up to four instrument states in non-volatile memory.
- Assign a custom name to each storage location.
- Recall stored instrument states.
- Restore all instrument settings to their factory default values.
- Select the instrument's power-on configuration (last or factory default).

Utility	**Configure system-related parameters.**

- Generate a dc-only voltage level.
- Enable/disable the Sync signal which is output from the "Sync" connector.
- Select the output termination (1Ω to 10 kΩ, or Infinite).
- Enable/disable amplitude autoranging.
- Select the waveform polarity (normal or inverted).
- Select the GPIB address.
- Configure the RS-232 interface (baud rate, parity, and handshake mode).
- Select how periods and commas are used in numbers displayed on the front panel.
- Select the local language for front-panel messages and help text.
- Enable/disable the tone heard when an error is generated.
- Enable/disable the display bulb-saver mode.
- Adjust the contrast setting of the front-panel display.
- Perform an instrument self-test.
- Secure/unsecure the instrument for calibration and perform manual calibrations.
- Query the instrument's firmware revision codes.

Help	**View the list of Help topics.**

- View the last message displayed.
- View the remote command error queue.
- Get HELP on any key.
- How to generate a dc-only voltage level.
- How to generate a modulated waveform.
- How to create an arbitrary waveform.
- How to reset the instrument to its default state.
- How to view a waveform in the Graph Mode.
- How to synchronize multiple instruments.
- How to obtain Agilent Technical Support.

3

To Reset the Function Generator

To reset the instrument to its factory default state, press [Store/Recall] and then select the **Set to Defaults** softkey. Select **YES** to confirm the operation.

A complete listing of the instrument's power-on and reset conditions, see the "Factory Default Settings" table inside the rear cover of this manual.

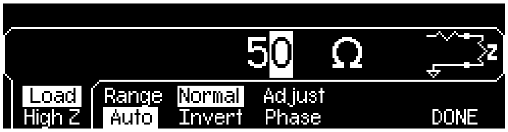
To Select the Output Termination

The Agilent 33250A has a fixed series output impedance of 50 ohms to the front-panel *Output* connector. If the actual load impedance is different than the value specified, the displayed amplitude and offset levels will be incorrect. The load impedance setting is simply provided as a convenience to ensure that the displayed voltage matches the expected load.

1 Press [Utility].

2 Navigate the menu to set the output termination.

Press the **Output Setup** softkey and then select the **Load** softkey.



3 Select the desired output termination.

Use the knob or numeric keypad to select the desired load impedance or press the **Load** softkey again to choose "High Z".

3

To Read the Calibration Information

You can use the instrument's calibration memory to read the calibration count and calibration message.

Calibration Count You can query the instrument to determine how many calibrations have been performed. Note that your instrument was calibrated before it left the factory. When you receive your instrument, read the count to determine its initial value. The count value increments by one for each calibration point, and a complete calibration may increase the value by many counts.

Calibration Message The instrument allows you to store one message in calibration memory. For example, you can store such information as the date when the last calibration was performed, the date when the next calibration is due, the instrument's serial number, or even the name and phone number of the person to contact for a new calibration.

> You can **record** a calibration message only from the remote interface and only when the instrument is unsecured.
>
> You can **read** the message from either the front-panel or over the remote interface. You can read the calibration message whether the instrument is secured or unsecured.

1 Select the Cal Info interface.

Press [Utility] and then select the **Cal Info** softkey from the "Test/Cal" menu.

The first line in the display shows the calibration count.
The second line shows the calibration message.
The last line indicates the current version of the firmware.

The calibration information will time-out and disappear after a few seconds. Select the **Cal Info** softkey to show the information again.

2 Exit the menu.

Press the **DONE** softkey.

To Unsecure and Secure for Calibration

This feature allows you to enter a security code to prevent accidental or unauthorized adjustments of the instrument. When you first receive your instrument, it is secured. Before you can adjust the instrument, you must unsecure it by entering the correct security code.

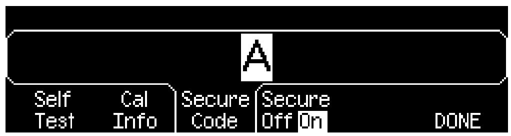
- The security code is set to **AT33250A** when the instrument is shipped from the factory. The security code is stored in non-volatile memory, and does not change when power has been off, after a Factory Reset (`*RST` command), or after an Instrument Preset (`SYSTem:PRESet` command).
- The security code may contain up to 12 alphanumeric characters. The first character must be a letter, but the remaining characters can be letters, numbers, or an underscore (_). You do not have to use all 12 characters but the first character must always be a letter.

Note: *If you forget your security code, you can disable the security feature by applying a temporary short inside the instrument as described in "To Unsecure the Instrument Without the Security Code", on page 69.*

To Unsecure for Calibration

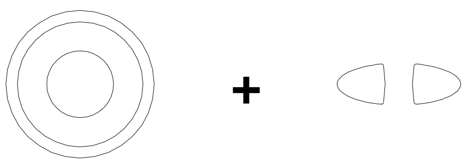
1 Select the Secure Code interface.

Press Utility and then select the **Test/Cal** softkey.



2 Enter the Secure Code.

Use the knob to change the displayed character. Use the arrow keys to move to the next character.



When the last character of the secure code is entered, the instrument will be unsecured.

3 Exit the menu.

Press the **DONE** softkey.

To Secure After Calibration

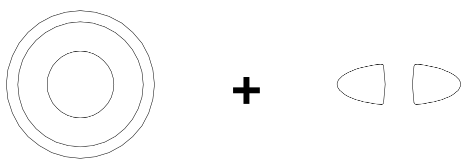
1 Select the Secure Code interface.

Press Utility and then select the **Test/Cal** softkey.

2 Enter a Secure Code.

Enter up to 12 alphanumeric characters. The first character must be a letter.

Use the knob to change the displayed character. Use the arrow keys to move to the next character.



3 Secure the Instrument.

Select the **Secure** softkey.

4 Exit the menu.

Press the **DONE** softkey.

To Store the Instrument State

You can store the instrument state in one of four non-volatile storage locations. A fifth storage location automatically holds the power-down configuration of the instrument. When power is restored, the instrument can automatically return to its state before power-down.

1 Select the desired storage location.

Press [Store/Recall] and then select the **Store State** softkey.

2 Select a custom name for the selected location.

If desired, you can assign a custom name to each of the four locations.

- The name can contain up to 12 characters. The first character must be a letter but the remaining characters can be letters, numbers, or the underscore character ("_").
- To add additional characters, press the right-arrow key until the cursor is to the right of the existing name and then turn the knob.
- To delete all characters to the right of the cursor position, press [+/-].
- To use numbers in the name, you can enter them directly from the numeric keypad. Use the decimal point from the numeric keypad to add the underscore character ("_") to the name.

3 Store the instrument state.

Press the **STORE STATE** softkey. The instrument stores the selected function, frequency, amplitude, dc offset, duty cycle, symmetry, as well as any modulation parameters in use. The instrument *does not* store volatile waveforms created in the arbitrary waveform function.

To Configure the Remote Interface

The instrument is shipped with both a GPIB (IEEE-488) interface and an RS-232 interface. Only one interface can be enabled at a time. The GPIB interface is selected when the instrument is shipped from the factory.

GPIB Configuration

1 Select the GPIB interface.

Press Utility and then select the **GPIB** softkey from the “I/O” menu.

2 Select the GPIB address.

Press the **GPIB Address** softkey and enter the desired address using the numeric keypad or knob. The factory setting is “10”.

The GPIB address is shown on the front-panel display at power-on.

3 Exit the menu.

Press the **DONE** softkey.

RS-232 Configuration

1 **Select the RS-232 interface.**

Press Utility and then select the **RS-232** softkey from the “I/O” menu.

2 **Set the baud rate.**

Press the **Baud Rate** softkey and select one of the following:
300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600 (*factory setting*), or 115200 baud.

3 **Select the parity and number of data bits.**

Press the **Parity / # Bits** softkey and select one of the following:
None (8 data bits, *factory setting*), Even (7 data bits), or Odd (7 data bits). When you set the parity, you are also setting the number of data bits.

4 **Select the handshake mode.**

Press the **Handshake** softkey and select one of the following:
None, DTR / DSR (*factory setting*), Modem, RTS / CTS, or XON / XOFF.

5 **Exit the menu.**

Press the **DONE** softkey.

Calibration Procedures

Calibration Procedures

This chapter contains procedures for verification of the instrument's performance and adjustment (calibration). The chapter is divided into the following sections:

Closed-Case Electronic Calibration The instrument features closed-case electronic calibration. No internal mechanical adjustments are required. The instrument calculates correction factors based upon the input reference value you set. The new correction factors are stored in non-volatile memory until the next calibration adjustment is performed. Non-volatile EEPROM calibration memory does not change when power has been off or after a remote interface reset.

Agilent Technologies Calibration Services

When your instrument is due for calibration, contact your local Agilent Technologies Service Center for a low-cost recalibration. The Agilent 33250A is supported on automated calibration systems which allow Agilent to provide this service at competitive prices.

4

Calibration Interval

The instrument should be calibrated on a regular interval determined by the measurement accuracy requirements of your application. A 1-year interval is adequate for most applications. Accuracy specifications are warranted only if adjustment is made at regular calibration intervals. Accuracy specifications are not warranted beyond the 1-year calibration interval. Agilent Technologies does not recommend extending calibration intervals beyond 2 years for any application.

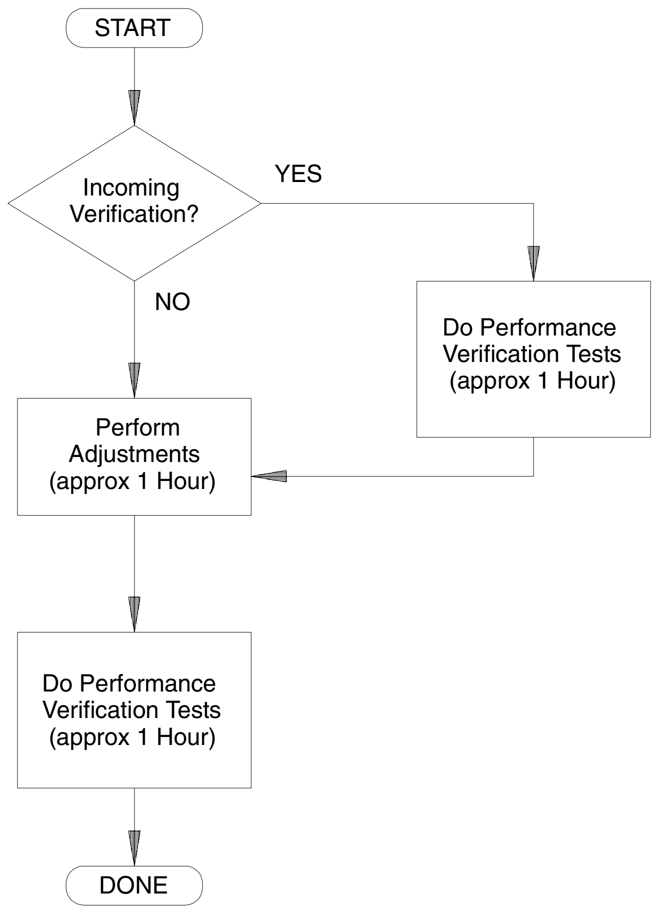
Adjustment is Recommended

Whatever calibration interval you select, Agilent Technologies recommends that complete re-adjustment should always be performed at the calibration interval. This will assure that the Agilent 33250A will remain within specification for the next calibration interval. This criteria for re-adjustment provides the best long-term stability. Performance data measured using this method can be used to extend future calibration intervals.

Use the Calibration Count (see page 70) to verify that all adjustments have been performed.

Time Required for Calibration

The Agilent 33250A can be automatically calibrated under computer control. With computer control you can perform the complete calibration procedure and performance verification tests in approximately 30 minutes once the instrument is warmed-up (see “Test Considerations” on page 54). Manual adjustments and verifications, using the recommended test equipment, will take approximately 2 hours.



Automating Calibration Procedures

You can automate the complete verification and adjustment procedures outlined in this chapter if you have access to programmable test equipment. You can program the instrument configurations specified for each test over the remote interface. You can then enter readback verification data into a test program and compare the results to the appropriate test limit values.

You can also adjust the instrument from the remote interface. Remote adjustment is similar to the local front-panel procedure. You can use a computer to perform the adjustment by first selecting the required function and range. The calibration value is sent to the instrument and then the calibration is initiated over the remote interface. The instrument must be unsecured prior to initiating the calibration procedure.

For further information on programming the instrument, see chapters 3 and 4 in the *Agilent 33250A User's Guide*.

4

Recommended Test Equipment

The test equipment recommended for the performance verification and adjustment procedures is listed below. If the exact instrument is not available, substitute calibration standards of equivalent accuracy.

Instrument	Requirements	Recommended Model	Use*
Digital Multimeter (DMM)	ac volts, true rms, ac coupled accuracy: ±0.02% to 1 MHz dc volts accuracy: 50 ppm resolution: 100 µV Resistance Offset-compensated accuracy: ±0.1Ω	Agilent 3458A	Q, P, T
Power Meter	100 kHz to 100 MHz 1 µW to 100 mW (–30 dBm to +20 dBm) accuracy: 0.02 dB resolution: 0.01 dB	Agilent E4418B	Q, P, T
Power Head	100 kHz to 100 MHz 1 µW to 100 mW (–30 dBm to +20 dBm)	Agilent 8482A	Q, P, T
Attenuator	–20 dB	Agilent 8491A Opt 020	Q, P, T
Frequency Meter	accuracy: 0.1 ppm	Agilent 53131A Opt 010 (high stability)	Q, P, T
Oscilloscope	500 MHz 2 Gs/second 50Ω input termination	Agilent 54831B	Q, P, T
Adapter	N type (m) to BNC (m)	N type (m) to BNC (m)	Q, P, T
Cable	BNC (m) to dual-banana (f)	Agilent 10110B	Q, P, T
Cable (2 required)	Dual banana (m) to dual banana (m)	Agilent 11000-60001	Q, P, T
Cable	RG58, BNC (m) to dual banana	Agilent 11001-60001	Q, P, T
Cable	RG58, BNC (m) to BNC (m)	Agilent 8120-1840	Q, P, T

* Q = Quick Verification P = Performance Verification
T = Troubleshooting O = Optional Verification

4

Test Considerations

For optimum performance, all procedures should comply with the following recommendations:

- Assure that the calibration ambient temperature is stable and between 18 °C and 28 °C. Ideally, the calibration should be performed at 23 °C ±1 °C.
- Assure ambient relative humidity is less than 80%.
- Allow a 1-hour warm-up period before verification or adjustment.
- Keep the measurement cables as short as possible, consistent with the impedance requirements.
- Use only RG-58 or equivalent 50Ω cable.

Performance Verification Tests

Use the Performance Verification Tests to verify the measurement performance of the instrument. The performance verification tests use the instrument's specifications listed in the "Specifications" chapter beginning on page 13.

You can perform four different levels of performance verification tests:

- **Self-Test** A series of internal verification tests that give high confidence that the instrument is operational.
- **Quick Verification** A combination of the internal self-tests and selected verification tests.
- **Performance Verification Tests** An extensive set of tests that are recommended as an acceptance test when you first receive the instrument or after performing adjustments.
- **Optional Verification Tests** Tests not performed with every calibration. Perform these tests following repairs to the output amplifier.

Self-Test

A brief power-on self-test occurs automatically whenever you turn on the instrument. This limited test assures that the instrument is operational.

To perform a complete self-test:

1 Press [Utility] on the front panel.

2 Select the **Self Test** softkey from the "Test/Cal" menu.

A complete description of the self-tests can be found in chapter 6. The instrument will automatically perform the complete self-test procedure when you release the key. The self-test will complete in approximately 30 seconds.

- If the self-test is successful, "Self Test Pass" is displayed on the front panel.
- If the self-test fails, "Self Test Fail" and an error number are displayed. If repair is required, see chapter 6, "Service," for further details.

4

Quick Performance Check

The quick performance check is a combination of internal self-test and an abbreviated performance test (specified by the letter **Q** in the performance verification tests). This test provides a simple method to achieve high confidence in the instrument's ability to functionally operate and meet specifications. These tests represent the absolute minimum set of performance checks recommended following any service activity. Auditing the instrument's performance for the quick check points (designated by a **Q**) verifies performance for normal accuracy drift mechanisms. This test does not check for abnormal component failures.

To perform the quick performance check, do the following:

1 Perform a complete self-test. A procedure is given on page 56.

2 Perform only the performance verification tests indicated with the letter **Q**.

3 If the instrument fails the quick performance check, adjustment or repair is required.

Performance Verification Tests

The performance verification tests are recommended as acceptance tests when you first receive the instrument. The acceptance test results should be compared against the specifications given in chapter 1. After acceptance, you should repeat the performance verification tests at every calibration interval.

If the instrument fails performance verification, adjustment or repair is required.

Adjustment is recommended at every calibration interval. If adjustment is not made, you must guard band, using no more than 80% of the specifications listed in chapter 1, as the verification limits.

Amplitude and Flatness Verification Procedures

Special Note: Measurements made during the AC Amplitude (high-impedance) Verification procedure (see page 61) are used as reference measurements in the flatness verification procedures (beginning on page 62). Additional reference measurements and calculated references are used in the flatness verification procedures. Photo-copy and use the table on page 59 to record these reference measurements and perform the calculations.

The flatness verification procedures use both a DMM and a Power Meter to make the measurements. To correct the difference between the DMM and Power Meter measurements, the Power Meter reference measurement level is adjusted to set the 0.00 dB level to the DMM measurement made at 1 kHz. The flatness error of the DMM at 100 kHz is used to set the required 0.00 dB reference.

The instrument internally corrects the difference between the high-Z input of the DMM and the 50Ω input of the Power Meter when setting the output level.

The reference measurements must also be converted from Vrms (made by the DMM) to dBm (made by the Power Meter).

The equation used for the conversion from Vrms (High-Z) to dBm (at 50Ω) is as follows:

$$\text{Power (dBm)} = 10 \log(5.0 * V_{rms}^2)$$

Flatness measurements for the –10 dB, –20dB, and –30 dB attenuator ranges are verified as a part of the 0 dB verification procedure.
No separate verification procedure is given for these ranges.

Amplitude and Flatness Verification Worksheet

1. Enter the following measurements (from procedure on page 61).

1kHz_0dB_reference = ____________________________ Vrms

1kHz_10dB_reference = ____________________________ Vrms

1kHz_20dB_reference = ____________________________ Vrms

2. Calculate the dBm value of the rms voltages.

1kHz_0dB_reference_dBm = 10 * log(5.0 * *1kHz_0dB_reference*^{2})
= ____________________________ dBm

1kHz_10dB_reference_dBm = 10 * log(5.0 * *1kHz_10dB_reference*^{2})
= ____________________________ dBm

1kHz_20dB_reference_dBm = 10 * log(5.0 * *1kHz_20dB_reference*^{2})
= ____________________________ dBm

3. Enter the following measurements (from the procedure on page 62).

100kHz_0dB_reference = ____________________________ Vrms

100kHz_10dB_reference = ____________________________ Vrms

100kHz_20dB_reference = ____________________________ Vrms

4. Calculate the dBm value of the rms voltages.

100kHz_0dB_reference_dBm = 10 * log(5.0 * *100kHz_0dB_reference*^{2})
= ____________________________ dBm

100kHz_10dB_reference_dBm = 10 * log(5.0 * *100kHz_10dB_reference*^{2})
= ____________________________ dBm

100kHz_20dB_reference_dBm = 10 * log(5.0 * *100kHz_20dB_reference*^{2})
= ____________________________ dBm

5. Calculate the offset values.

100kHz_0dB_offset = *100kHz_0dB_reference_dBm – 1kHz_0dB_reference_dBm*
= ____________________________ dBm (use on page 63)

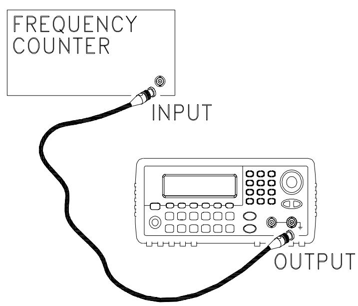
100kHz_10dB_offset = *100kHz_10dB_reference_dBm – 1kHz_10dB_reference_dBm*
= ____________________________ dBm (use on page 65)

100kHz_20dB_offset = *100kHz_20dB_reference_dBm – 1kHz_20dB_reference_dBm*
= ____________________________ dBm (use on page 66)

Internal Timebase Verification

This test verifies the output frequency accuracy of the instrument. All output frequencies are derived from a single generated frequency.

1 Connect a frequency counter as shown below (the frequency counter input should be terminated at 50Ω).



2 Set the instrument to the output described in the table below and measure the output frequency. *Be sure the instrument output is enabled.*

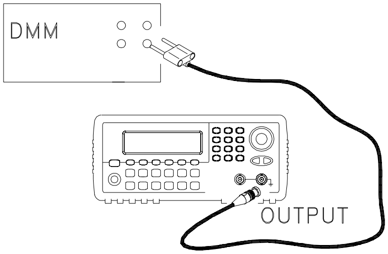
	Agilent 33250A			Measurement	
	Function	Amplitude	Frequency	Nominal	Error
Q	Sine Wave	1.00 Vpp	10.000,000,0 MHz	10.000 MHz	**± 20 Hz**

3 Compare the measured frequency to the test limits shown in the table.

AC Amplitude (high-impedance) Verification

This procedure checks the ac amplitude output accuracy at a frequency of 1 kHz, and establishes reference measurements for the higher frequency flatness verification procedures.

1 Set the DMM to measure Vrms Volts. Connect the DMM as shown below.



2 Set the instrument to each output described in the table below and measure the output voltage with the DMM. *Press* Utility *to set the output impedance to High-Z. Be sure the output is enabled.*

	Agilent 33250A				Measurement	
	Output Setup	Function	Frequency	Amplitude	Nominal	Error*
Q	High Z	Sine Wave	1.000 kHz	20.0 mVrms	0.020 Vrms	**± 0.00091 Vrms**
Q	High Z	Sine Wave	1.000 kHz	67.0 mVrms	0.067 Vrms	**± 0.00138 Vrms**
Q	High Z	Sine Wave	1.000 kHz	200.0 mVrms	0.200 Vrms	**± 0.00271 Vrms**
Q	High Z	Sine Wave	1.000 kHz	670.0 mVrms	0.670 Vrms [1]	**± 0.00741 Vrms**
Q	High Z	Sine Wave	1.000 kHz	2.000 Vrms	2.0000 Vrms [2]	**± 0.0207 Vrms**
Q	High Z	Sine Wave	1.000 kHz	7.000 Vrms	7.000 Vrms [3]	**± 0.0707 Vrms**
Q	High Z	Square Wave [4]	1.000 kHz	900.0 mVrms	0.900 Vrms	**± 0.0100 Vrms**

* Based upon 1% of setting ±1 mVpp (50Ω); converted to Vrms for High-Z.
[1] Enter the measured value on the worksheet (page 59) as *1kHz_0dB_reference*.
[2] Enter the measured value on the worksheet (page 59) as *1kHz_10dB_reference*.
[3] Enter the measured value on the worksheet (page 59) as *1kHz_20dB_reference*.
[4] Square wave amplitude accuracy is not specified. This measurement and error may be used as a guideline for typical operation.

3 Compare the measured voltage to the test limits shown in the table.

4

Low Frequency Flatness Verification

This procedure checks the AC amplitude flatness at 100 kHz using the reference measurements recorded in the Amplitude and Flatness Verification Worksheet. These measurements also establish an error value used to set the power meter reference. The transfer measurements are made at a frequency of 100 kHz using both the DMM and the power meter.

1 Set the DMM to measure ac Volts. Connect the DMM as shown in the figure on page 61.

2 Set the instrument to each output described in the table below and measure the output voltage with the DMM. *Press* Utility *to set the output impedance to High-Z. Be sure the output is enabled.*

	Agilent 33250A				Measurement	
	Output Setup	Function	Frequency	Amplitude	Nominal	Error
Q	High Z	Sine Wave	100.000 kHz	670.0 mVrms	0.670 Vrms [1]	**± 0.0067 Vrms**
Q	High Z	Sine Wave	100.000 kHz	2.0 Vrms	2.000 Vrms [2]	**± 0.020 Vrms**
Q	High Z	Sine Wave	100.000 kHz	7.000 Vrms	7.000 Vrms [3]	**± 0.070 Vrms**

[1] Enter the measured value on the worksheet (page 59) as *100kHz_0dB_reference*.
[2] Enter the measured value on the worksheet (page 59) as *100kHz_10dB_reference*.
[3] Enter the measured value on the worksheet (page 59) as *100kHz_20dB_reference*.

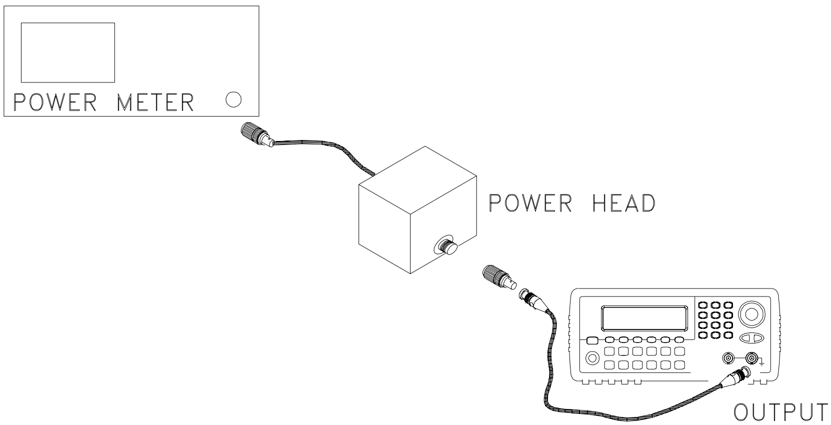
3 Compare the measured voltage to the test limits shown in the table.

4 You have now recorded all the required measurements on the worksheet (page 59). Complete the worksheet by making all the indicated calculations.

0 dB Range Flatness Verification

This procedure checks the high frequency ac amplitude flatness above 100 kHz on the 0 dB attenuator range.

1 Connect the power meter to measure the output amplitude of the instrument as shown below.



2 Set the power meter reference level to equal *100kHz_0dB_offset*. This sets the power meter to directly read the flatness error specification. *100kHz_0dB_offset* is calculated on the Amplitude and Flatness Verification Worksheet.

4

3 Set the instrument to each output described in the table below and measure the output amplitude with the power meter. *Press* Utility *to set the output impedance to 50Ω. Be sure the output is enabled.*

	Agilent 33250A				Measurement	
	Output Setup	Function	Amplitude	Frequency	Nominal	Error
Q	50 Ω	Sine Wave	+3.51 dBm	100.000 kHz	0 dB	**± 0.086 dB**
	50 Ω	Sine Wave	+3.51 dBm	200.000 kHz	0 dB	**± 0.086 dB**
	50 Ω	Sine Wave	+3.51 dBm	500.000 kHz	0 dB	**± 0.086 dB**
	50 Ω	Sine Wave	+3.51 dBm	1.500 MHz	0 dB	**± 0.086 dB**
	50 Ω	Sine Wave	+3.51 dBm	5.000 MHz	0 dB	**± 0.086 dB**
Q	50 Ω	Sine Wave	+3.51 dBm	10.000 MHz	0 dB	**± 0.086 dB**
	50 Ω	Sine Wave	+3.51 dBm	25.000 MHz	0 dB	**± 0.177 dB**
	50 Ω	Sine Wave	+3.51 dBm	40.000 MHz	0 dB	**± 0.177 dB**
Q	50 Ω	Sine Wave	+3.51 dBm	50.000 MHz	0 dB	**± 0.177 dB**
	50 Ω	Sine Wave	+3.51 dBm	60.000 MHz	0 dB	**± 0.423 dB**
	50 Ω	Sine Wave	+3.51 dBm	65.000 MHz	0 dB	**± 0.423 dB**
	50 Ω	Sine Wave	+3.51 dBm	70.000 MHz	0 dB	**± 0.423 dB**
	50 Ω	Sine Wave	+3.51 dBm	75.000 MHz	0 dB	**± 0.423 dB**
Q	50 Ω	Sine Wave	+3.51 dBm	80.000 MHz	0 dB	**± 0.423 dB**

4 Compare the measured output to the test limits shown in the table.

+10 dB Range Flatness Verification

This procedure checks the high frequency ac amplitude flatness above 100 kHz on the +10 dB attenuator range.

1 Connect the power meter to measure the output amplitude of the instrument as shown on page 63.

2 Set the power meter reference level to equal to the calculated *100kHz_10dB_offset* value. This sets the power meter to directly read the flatness error specification. *100kHz_10dB_offset* is calculated on the Amplitude and Flatness Verification Worksheet.

3 Set the instrument to each output described in the table below and measure the output amplitude with the power meter. *Press* [Utility] *to set the output impedance to 50Ω. Be sure the output is enabled.*

	Agilent 33250A				Measurement	
	Output Setup	Function	Amplitude	Frequency	Nominal	Error
Q	50 Ω	Sine Wave	+13.00 dBm	100.000 kHz	0 dB	**± 0.086 dB**
	50 Ω	Sine Wave	+13.00 dBm	200.000 kHz	0 dB	**± 0.086 dB**
	50 Ω	Sine Wave	+13.00 dBm	500.000 kHz	0 dB	**± 0.086 dB**
	50 Ω	Sine Wave	+13.00 dBm	1.500 MHz	0 dB	**± 0.086 dB**
	50 Ω	Sine Wave	+13.00 dBm	5.000 MHz	0 dB	**± 0.086 dB**
Q	50 Ω	Sine Wave	+13.00 dBm	10.000 MHz	0 dB	**± 0.086 dB**
	50 Ω	Sine Wave	+13.00 dBm	25.000 MHz	0 dB	**± 0.177 dB**
	50 Ω	Sine Wave	+13.00 dBm	40.000 MHz	0 dB	**± 0.177 dB**
Q	50 Ω	Sine Wave	+13.00 dBm	50.000 MHz	0 dB	**± 0.177 dB**
	50 Ω	Sine Wave	+13.00 dBm	60.000 MHz	0 dB	**± 0.423 dB**
	50 Ω	Sine Wave	+13.00 dBm	65.000 MHz	0 dB	**± 0.423 dB**
	50 Ω	Sine Wave	+13.00 dBm	70.000 MHz	0 dB	**± 0.423 dB**
	50 Ω	Sine Wave	+13.00 dBm	75.000 MHz	0 dB	**± 0.423 dB**
Q	50 Ω	Sine Wave	+13.00 dBm	80.000 MHz	0 dB	**± 0.423 dB**

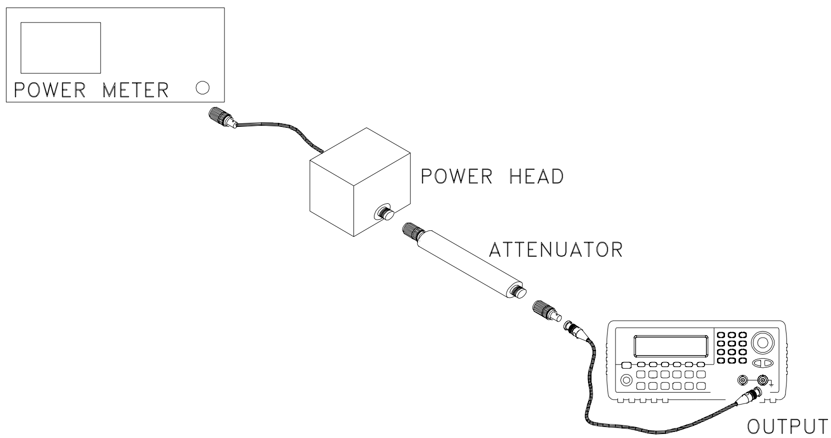
4 Compare the measured output to the test limits shown in the table.

4

+20 dB Range Flatness Verification

This procedure checks the high frequency ac amplitude flatness above 100 kHz on the +20 dB attenuator range.

1 Connect the power meter to measure the output voltage of the instrument as shown below.



2 Set the power meter reference level to equal to the calculated *100kHz_20dB_offset* value. This sets the power meter to directly read the flatness error specification. *100kHz_20dB_offset* is calculated on the Amplitude and Flatness Verification Worksheet.

Caution *Most power meters will require an attenuator or special power head to measure the +20 dB output.*

3 Set the instrument to each output described in the table below and measure the output amplitude with the power meter. *Press* [Utility] *to set the output impedance to 50Ω. Be sure the output is enabled*

	Agilent 33250A				Measurement	
	Output Setup	Function	Amplitude	Frequency	Nominal	Error
Q	50 Ω	Sine Wave	+23.90 dBm	100.000 kHz	0 dB	**± 0.086 dB**
	50 Ω	Sine Wave	+23.90 dBm	200.000 kHz	0 dB	**± 0.086 dB**
	50 Ω	Sine Wave	+23.90 dBm	500.000 kHz	0 dB	**± 0.086 dB**
	50 Ω	Sine Wave	+23.90 dBm	1.500 MHz	0 dB	**± 0.086 dB**
	50 Ω	Sine Wave	+23.90 dBm	5.000 MHz	0 dB	**± 0.086 dB**
Q	50 Ω	Sine Wave	+23.90 dBm	10.000 MHz	0 dB	**± 0.086 dB**
	50 Ω	Sine Wave	+23.90 dBm	25.000 MHz	0 dB	**± 0.177 dB**
	50 Ω	Sine Wave	+23.90 dBm	40.000 MHz	0 dB	**± 0.177 dB**
Q	50 Ω	Sine Wave	+23.90 dBm	50.000 MHz	0 dB	**± 0.177 dB**
	50 Ω	Sine Wave	+23.90 dBm	60.000 MHz	0 dB	**± 0.423 dB**
	50 Ω	Sine Wave	+23.90 dBm	65.000 MHz	0 dB	**± 0.423 dB**
	50 Ω	Sine Wave	+23.90 dBm	70.000 MHz	0 dB	**± 0.423 dB**
	50 Ω	Sine Wave	+23.90 dBm	75.000 MHz	0 dB	**± 0.423 dB**
Q	50 Ω	Sine Wave	+23.90 dBm	80.000 MHz	0 dB	**± 0.423 dB**

4 Compare the measured output to the test limits shown in the table.

Calibration Security

This feature allows you to enter a security code to prevent accidental or unauthorized adjustments of the instrument. When you first receive your instrument, it is secured. Before you can adjust the instrument, you must unsecure it by entering the correct security code.

See "To Unsecure and Secure for Calibration", on page 41 for a procedure to enter the security code.

- The security code is set to **AT33250A** when the instrument is shipped from the factory. The security code is stored in non-volatile memory, and does not change when power has been off, after a Factory Reset (`*RST` command), or after an Instrument Preset (`SYSTem:PRESet` command).
- The security code may contain up to 12 alphanumeric characters. The first character must be a letter, but the remaining characters can be letters, numbers, or an underscore (_). You do not have to use all 12 characters but the first character must always be a letter.

Note: *If you forget your security code, you can disable the security feature by applying a temporary short inside the instrument as described on the following page.*

To Unsecure the Instrument Without the Security Code

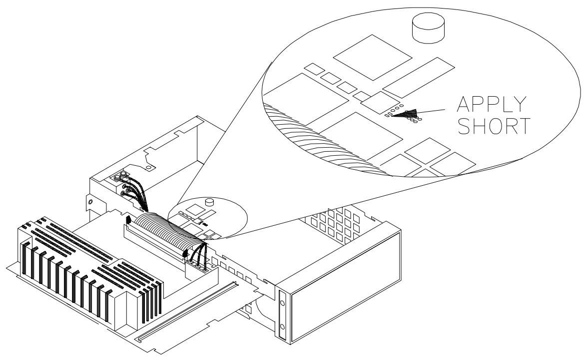
To unsecure the instrument without the correct security code, follow the steps below. See “To Unsecure and Secure for Calibration” on page 41. See “Electrostatic Discharge (ESD) Precautions” on page 133 before beginning this procedure.

1 Disconnect the power cord and all input connections.

2 Remove the instrument cover. See “Disassembly” on page 140.

3 Remove the main power supply.

4 Apply a temporary short between the two exposed metal pads on the A1 assembly. The general location is shown in the figure below. On the PC board, the pads are marked **CAL ORIDE**.



5 Apply power and turn on the instrument.

WARNING *Be careful not to touch the power line connections or high voltages on the power supply module.*

6 The display will show the message “Calibration security has been disabled”. The instrument is now unsecured.

7 Turn off the instrument and remove the power cord.

8 Reassemble the instrument.

Now you can enter a new security code, see “To Unsecure and Secure for Calibration”, on page 41. Be sure you record the new security code.

Calibration Message

The instrument allows you to store one message in calibration memory. For example, you can store such information as the date when the last calibration was performed, the date when the next calibration is due, the instrument's serial number, or even the name and phone number of the person to contact for a new calibration.

You can **record** a calibration message only from the remote interface and only when the instrument is unsecured.

You can **read** the message from either the front-panel or over the remote interface. You can read the calibration message whether the instrument is secured or unsecured. Reading the calibration message from the front panel is described on "To Read the Calibration Information", on page 40.

Calibration Count

You can query the instrument to determine how many calibrations have been performed. Note that your instrument was calibrated before it left the factory. When you receive your instrument, read the count to determine its initial value. The count value increments by one for each calibration point, and a complete calibration may increase the value by many counts. See "To Read the Calibration Information", on page 40.

General Calibration/Adjustment Procedure

The following procedure is the recommended method to complete an instrument calibration. This procedure is an overview of the steps required for a complete calibration. Additional details for each step in this procedure are given in the appropriate sections of this chapter.

1 Read "Test Considerations" on page 54.

2 Unsecure the instrument for calibration (see page 68).

3 Perform the verification tests, beginning on page page 55, to characterize the instrument (incoming data).

4 Press [Utility] on the front panel.

5 Select the "Test / Cal" menu.

6 Select **Perform Cal**.

7 Enter the **Setup Number** for the procedure being performed. The default setup number is "1" and, from the front panel, the number will increment as the procedures are performed.

8 Select **BEGIN**.

9 For setups that require an input, adjust the value shown in the display to the measured value and select **ENTER VALUE**.

10 The setup will automatically advance to the next required value.

Note *To cancel the adjustment procedure, select* **CANCEL STEP**. *The display will return to the setup number entry.*

11 When finished, select **END CAL**.

12 Secure the instrument against calibration.

13 Note the new security code and calibration count in the instrument's maintenance records.

Aborting a Calibration in Progress

Sometimes it may be necessary to abort a calibration after the procedure has already been initiated. You can abort a calibration at any time by turning off the power. When performing a calibration from the remote interface, you can abort a calibration by issuing a remote interface device clear message followed by a `*RST`.

The instrument stores calibration constants at the end of each adjustment procedure. If you lose power, or otherwise abort an adjustment in progress, you will only need to perform the interrupted adjustment procedure again.

Caution *If you abort a calibration in progress when the instrument is attempting to write new calibration constants to EEPROM, you may lose all calibration constants for the function. Typically, upon re-applying power, the instrument will report error "705 Calibration Aborted".*

Sequence of Adjustments

The adjustment sequence shown in the following sections of this chapter is recommended to minimize the number of test equipment set-up and connection changes.

You may perform individual adjustments as necessary. Setups 1 through 7 **must** be performed in order and **must** be performed **before** any other setup procedure.

Note *If you have repaired the output amplifier circuitry (U1903, U1904, and associated components) you should perform the "Output Amplifier Adjustment (Optional)", on page 90* ***before*** *beginning any other adjustment procedures.*

Self-Test

Self-Test is performed as the first step to ensure the instrument is in working order before beginning any additional adjustments.

1 Press [Utility] on the front panel. Select **Perform Cal** on the "Test / Cal" menu. Enter setup number "1" and select **BEGIN**.

Setup	
1	Performs the Self-test. The Main Output is disabled during test.

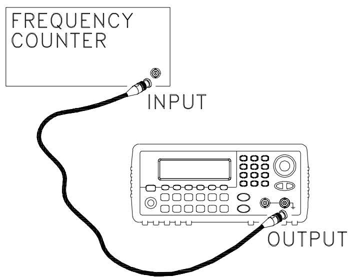
2 If the instrument fails any self-test, you must repair the instrument before continuing the adjustment procedures.

4

Frequency (Internal Timebase) Adjustment

The function generator stores a calibration constant that sets the TCXO to output exactly 10 MHz.

1 Set the frequency counter resolution to better than 0.1 ppm and the input termination to 50Ω (if your frequency counter does not have a 50Ω input termination, you must provide an external termination). Make the connections shown below.



2 Use a frequency counter to measure the output frequency for each setup in the following table.

	Nominal Signal		
Setup	Frequency	Amplitude	
2	<10 MHz	1 Vpp	Output frequency is slightly less than 10 MHz
3	>10 MHz	1 Vpp	Output frequency is slightly more than 10 MHz
4	~10 MHz	1 Vpp	Output frequency should be near 10 MHz
5*	10 MHz	1 Vpp	Output frequency should be 10 MHz ±0.5 ppm

* Constants are stored after completing this setup.

3 Using the numerical keypad or knob, adjust the displayed frequency at each setup to match the measured frequency. Select **ENTER VALUE**.

4 After performing setup 5:

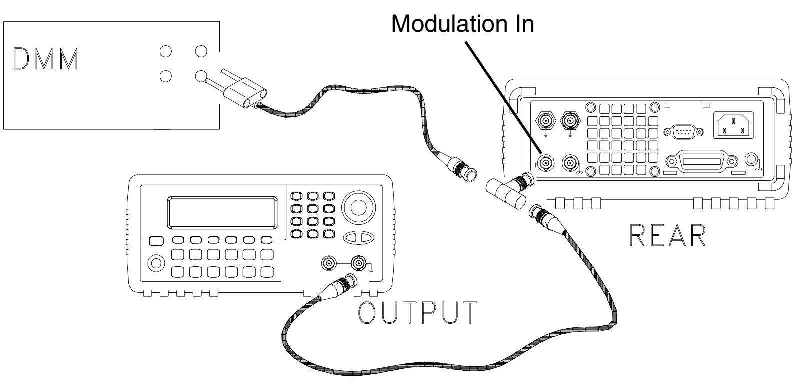
a. If your calibration procedures require you to verify the adjustment just made, exit the calibration menu and perform “Internal Timebase Verification”, on page 60.

b. If you are making all the adjustments and then verifying the instrument’s performance, continue with the next procedure in this chapter.

Internal ADC Adjustment

The function generator stores calibration constants related to the gain and offset of the internal ADC. Setup 6 **must** always be performed **before** any other adjustments are attempted. The internal ADC is then used as a source for the calibration constants generated in setup 7.

1 Make the connections as shown below.



2 Set the DMM to display 5½ digits and measure the dc value. Record the measurement.

3 Enter the following setup and use the numeric keypad or knob to enter the measured value of the dc source.

	Nominal Signal	
Setup	DC level	
6*	~1 Vdc ±10%	Calibrates the internal ADC.

* Constants are stored after completing this setup.

4 Disconnect all cables from the rear panel *Modulation In* connector.

5 Enter and begin the following setup.

Setup	
7*	Self-calibration. The Main Output is disabled during test.

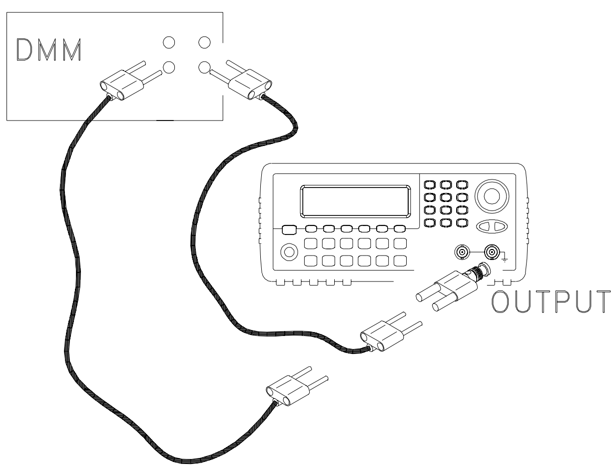
* Constants are stored after completing this setup.

6 There are no specific operational verification tests for setups 6 and 7 since the constants generated affect almost all behavior of the instrument. Continue with the next adjustment procedure in this chapter.

Output Impedance Adjustment

The function generator stores calibration constants for the output impedance. The output impedance constants are generated with and without the distortion filter and using all five attenuator paths.

1 Set the DMM to measure offset-compensated, four-wire Ohms. Set the DMM to use 100 NPLC integration. Make the connections as shown below.



2 Use the DMM to make a resistance measurement at the front panel Output connector for each setup in the following table. The expected measured value is approximately 50Ω.

Setup	
8*	-30 dB range with distortion filter
9*	-20 dB range with distortion filter
10*	-10 dB range with distortion filter
11*	0 dB range with distortion filter
12*	+10 dB range with distortion filter
13*	-30 dB range without distortion filter
14*	-20 dB range without distortion filter
15*	-10 dB range without distortion filter
16*	0 dB range without distortion filter
17*	+10 dB range without distortion filter

* Constants are stored after completing this setup.

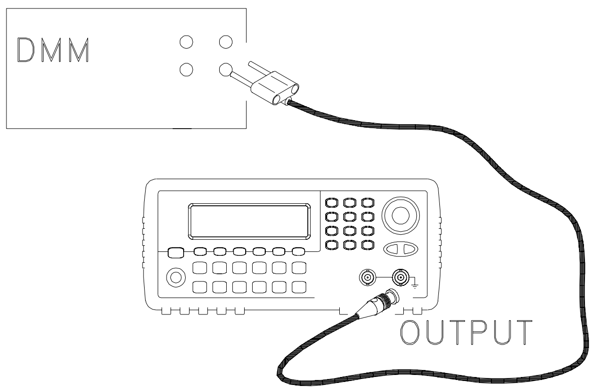
3 Using the numeric keypad or knob, adjust the displayed impedance at each setup to match the measured impedance. Select **ENTER VALUE**.

4 There are no specific operational verification tests for Output Impedance. Continue with the next adjustment procedure in this chapter.

AC Amplitude (high-impedance) Adjustment

The function generator stores a calibration constant for each high-impedance attenuator path. The gain coefficient of each path is calculated using two measurements; one with the waveform DAC at the **+** output and one with waveform DAC at the **–** output. The setups, therefore, must be performed in pairs.

1 Connect the DMM as shown below.



2 Use the DMM to measure the dc voltage at the front-panel *Output* connector for each setup in the following table.

	Nominal Signal	
Setup	DC level	
18	+0.015 V	Output of -30 dB range
19*	-0.015 V	Output of -30 dB range
20	+0.05 V	Output of -20 dB range
21*	-0.05 V	Output of -20 dB range
22	+0.15 V	Output of -10 dB range
23*	-0.15 V	Output of -10 dB range
24	+0.50 V	Output of 0 dB range
25*	-0.50 V	Output of 0 dB range
26	+0.15 V	Output of -10 dB range (Amplifier In)
27*	-0.15 V	Output of -10 dB range (Amplifier In)
28	+0.50 V	Output of 0 dB range (Amplifier In)
29*	-0.50 V	Output of 0 dB range (Amplifier In)
30	+1.5 V	Output of +10 dB range (Amplifier In)
31*	-1.5 V	Output of +10 dB range (Amplifier In)
32	+5 V	Output of +20 dB range (Amplifier In)
33*	-5 V	Output of +20 dB range (Amplifier In)

* Constants are stored after completing this setup.

3 Using the numeric keypad or knob, adjust the displayed voltage at each setup to match the measured voltage. Select **ENTER VALUE**. (Entered values are rounded to the nearest 100 μV.)

4 After performing setup 33:

a. If your calibration procedures require you to verify the adjustment just made, exit the calibration menu and perform “AC Amplitude (high-impedance) Verification”, on page 61.

b. If you are making all the adjustments and then verifying the instrument’s performance, continue with the next procedure in this chapter.

4

Low Frequency Flatness Adjustment

The Low Frequency Flatness adjustment calculates the flatness response of 3 attenuator paths with the Elliptical filter and 2 attenuator paths with the Linear Phase filter.

1 Set the DMM to measure Vrms. Make the connections shown on page 78.

2 Use the DMM to measure the output voltage for each of the setups in the table below.

	Nominal Signal		
Setup	Frequency	Amplitude	
34*	1 kHz	0.56 Vrms	Flatness for 0 dB, Elliptical Filter
35*	100 kHz	0.56 Vrms	Flatness for 0 dB, Elliptical Filter
36*	1 kHz	0.56 Vrms	Flatness for 0 dB, Linear Phase Filter
37*	100 kHz	0.56 Vrms	Flatness for 0 dB, Linear Phase Filter
38*	1 kHz	1.7 Vrms	Flatness for +10 dB, Elliptical Filter
39*	100 kHz	1.7 Vrms	Flatness for +10 dB, Elliptical Filter
40*	1 kHz	5.6 Vrms	Flatness for +20 dB, Elliptical Filter
41*	100 kHz	5.6 Vrms	Flatness for +20 dB, Elliptical Filter
42*	1 kHz	5.6 Vrms	Flatness for +20 dB, Linear Phase Filter
43*	100 kHz	5.6 Vrms	Flatness for +20 dB, Linear Phase Filter

* Constants are stored after completing this setup.

3 Using the numeric keypad or knob, adjust the displayed voltage at each setup to match the measured voltage. Select **ENTER VALUE**.

4 After performing setup 43:

a. If your calibration procedures require you to verify the adjustment just made, exit the calibration menu and perform “Low Frequency Flatness Verification”, on page 62.

b. If you are making all the adjustments and then verifying the instrument’s performance, continue with the next procedure in this chapter.

0 dB Range Flatness Adjustments

1 Connect the power meter as shown on page 83.

2 Use the power meter to measure the output amplitude for each of the setups in the table below.

Note *Setup 44 establishes the power meter reference for all the remaining setups in this table. You must always perform setup 44 before any of the following setups.*

	Nominal Signal			
Setup	Frequency	Amplitude		
44*	100 kHz	0.28 Vrms	2 dBm	Power Meter Reference for 0 dB Range
45*	200 kHz	0.28 Vrms	2 dBm	Flatness for 0 dB, Elliptical Filter
46*	500 kHz	0.28 Vrms	2 dBm	Flatness for 0 dB, Elliptical Filter
47*	1.5 MHz	0.28 Vrms	2 dBm	Flatness for 0 dB, Elliptical Filter
48*	5 MHz	0.28 Vrms	2 dBm	Flatness for 0 dB, Elliptical Filter
49*	10.1 MHz	0.28 Vrms	2 dBm	Flatness for 0 dB, Elliptical Filter
50*	25.1 MHz	0.28 Vrms	2 dBm	Flatness for 0 dB, Elliptical Filter
51*	40.1 MHz	0.28 Vrms	2 dBm	Flatness for 0 dB, Elliptical Filter
52*	50.1 MHz	0.28 Vrms	2 dBm	Flatness for 0 dB, Elliptical Filter
53*	60.1 MHz	0.28 Vrms	2 dBm	Flatness for 0 dB, Elliptical Filter
54*	65.1 MHz	0.28 Vrms	2 dBm	Flatness for 0 dB, Elliptical Filter
55*	70.1 MHz	0.28 Vrms	2 dBm	Flatness for 0 dB, Elliptical Filter
56*	75.1 MHz	0.28 Vrms	2 dBm	Flatness for 0 dB, Elliptical Filter
57*	79.9 MHz	0.28 Vrms	2 dBm	Flatness for 0 dB, Elliptical Filter

* Constants are stored after completing this setup.

Continued on next page...

	Nominal Signal			
Setup	Frequency	Amplitude		
58*	200 kHz	0.28 Vrms	2 dBm	Flatness for 0 dB, Linear Phase
59*	500 kHz	0.28 Vrms	2 dBm	Flatness for 0 dB, Linear Phase
60*	1.5 MHz	0.28 Vrms	2 dBm	Flatness for 0 dB, Linear Phase
61*	5 MHz	0.28 Vrms	2 dBm	Flatness for 0 dB, Linear Phase
62*	10.1 MHz	0.28 Vrms	2 dBm	Flatness for 0 dB, Linear Phase
63*	25.1 MHz	0.28 Vrms	2 dBm	Flatness for 0 dB, Linear Phase
64	25.1 MHz	0.15 Vrms	–4 dBm	Flatness reference measurement
65*	79.9 MHz	<0.15 Vrms	–4 dBm	Flatness high frequency measurement

* Constants are stored after completing this setup.

3 Using the numeric keypad or knob, adjust the displayed amplitude at each setup to match the measured amplitude (in dBm). Select **ENTER VALUE**.

4 After performing setup 65:

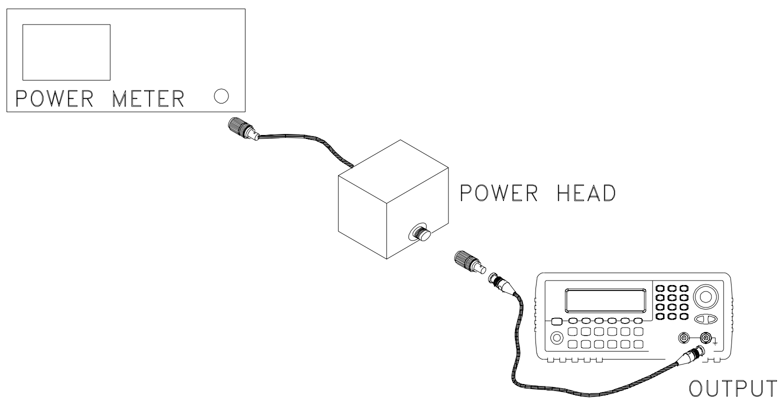
a. If your calibration procedures require you to verify the adjustment just made, exit the calibration menu and perform “0 dB Range Flatness Verification”, on page 63.

b. If you are making all the adjustments and then verifying the instrument’s performance, continue with the next procedure in this chapter.

+10 dB Range Flatness Adjustments

Note *The Linear Phase path is not adjusted. It is approximated using the other path's values.*

1 Connect the power meter as shown below.



2 Use the power meter to measure the output amplitude for each of the setups in the table on the next page.

Note *Setup 66 establishes the power meter reference for all the remaining setups in this table. You must always perform setup 66 before any of the following setups.*

	Nominal Signal			
Setup	Frequency	Amplitude		
66*	100 kHz	0.9 Vrms	12 dBm	Power Meter Reference for +10 dB Range
67*	200 kHz	0.9 Vrms	12 dBm	Flatness for +10 dB, Elliptical Filter
68*	500 kHz	0.9 Vrms	12 dBm	Flatness for +10 dB, Elliptical Filter
69*	1.5 MHz	0.9 Vrms	12 dBm	Flatness for +10 dB, Elliptical Filter
70*	5 MHz	0.9 Vrms	12 dBm	Flatness for +10 dB, Elliptical Filter
71*	10.1 MHz	0.9 Vrms	12 dBm	Flatness for +10 dB, Elliptical Filter
72*	25.1 MHz	0.9 Vrms	12 dBm	Flatness for +10 dB, Elliptical Filter
73*	40.1 MHz	0.9 Vrms	12 dBm	Flatness for +10 dB, Elliptical Filter
74*	50.1 MHz	0.9 Vrms	12 dBm	Flatness for +10 dB, Elliptical Filter
75*	60.1 MHz	0.9 Vrms	12 dBm	Flatness for +10 dB, Elliptical Filter
76*	65.1 MHz	0.9 Vrms	12 dBm	Flatness for +10 dB, Elliptical Filter
77*	70.1 MHz	0.9 Vrms	12 dBm	Flatness for +10 dB, Elliptical Filter
78*	75.1 MHz	0.9 Vrms	12 dBm	Flatness for +10 dB, Elliptical Filter
79*	79.9 MHz	0.9 Vrms	12 dBm	Flatness for +10 dB, Elliptical Filter

* Constants are stored after completing this setup.

3 Using the numeric keypad or knob, adjust the displayed amplitude at each setup to match the measured amplitude (in dBm).
Select **ENTER VALUE**.

4 After performing setup 79:

a. If your calibration procedures require you to verify the adjustment just made, exit the calibration menu and perform “+10 dB Range Flatness Verification”, on page 65.

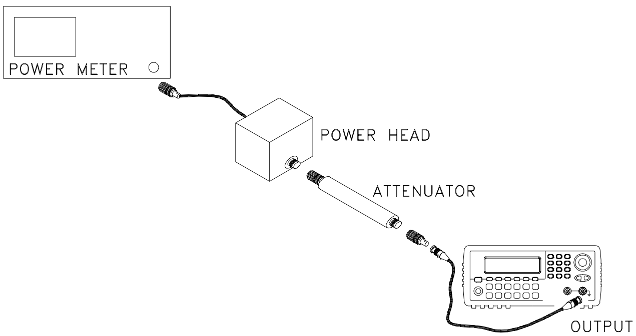
b. If you are making all the adjustments and then verifying the instrument’s performance, continue with the next procedure in this chapter.

+20 dB Range Flatness Adjustment

Caution *Most power meters will require an attenuator (-20 dB) or special power head to measure the +20 dB output.*

Be sure to correct the measurements for the specifications of the attenuator you use. For example, if the nominal attenuator value is –20 dB at the specified frequency, you must add 20 dB to the power meter reading before entering the value.

1 Make the connections as shown below.



2 Use the power meter to measure the output amplitude for each of the setups in the table on the next page.

Note *Setup 80 establishes the power meter reference for all the remaining setups in this table. You must always perform setup 80 before any of the following setups.*

	Nominal Signal			
Setup	Frequency	Amplitude		
80*	100 kHz	2.8 Vrms	22 dBm	Power Meter Reference
81*	200 kHz	2.8 Vrms	22 dBm	Flatness for +20 dB, Elliptical Filter
82*	500 kHz	2.8 Vrms	22 dBm	Flatness for +20 dB, Elliptical Filter
83*	1.5 MHz	2.8 Vrms	22 dBm	Flatness for +20 dB, Elliptical Filter

* Constants are stored after completing this setup.

Continued on next page...

	Nominal Signal			
Setup	Frequency	Amplitude		
84*	5 MHz	2.8 Vrms	22 dBm	Flatness for +20 dB, Elliptical Filter
85*	10.1 MHz	2.8 Vrms	22 dBm	Flatness for +20 dB, Elliptical Filter
86*	25.1 MHz	2.8 Vrms	22 dBm	Flatness for +20 dB, Elliptical Filter
87*	40.1 MHz	2.8 Vrms	22 dBm	Flatness for +20 dB, Elliptical Filter
88*	50.1 MHz	2.8 Vrms	22 dBm	Flatness for +20 dB, Elliptical Filter
89*	60.1 MHz	2.8 Vrms	22 dBm	Flatness for +20 dB, Elliptical Filter
90*	65.1 MHz	2.8 Vrms	22 dBm	Flatness for +20 dB, Elliptical Filter
91*	70.1 MHz	2.8 Vrms	22 dBm	Flatness for +20 dB, Elliptical Filter
92*	75.1 MHz	2.8 Vrms	22 dBm	Flatness for +20 dB, Elliptical Filter
93*	79.9 MHz	2.8 Vrms	22 dBm	Flatness for +20 dB, Elliptical Filter
94*	200 kHz	2.8 Vrms	22 dBm	Flatness for +20 dB, Linear Phase Filter
95*	500 kHz	2.8 Vrms	22 dBm	Flatness for +20 dB, Linear Phase Filter
96*	1.5 MHz	2.8 Vrms	22 dBm	Flatness for +20 dB, Linear Phase Filter
97*	5 MHz	2.8 Vrms	22 dBm	Flatness for +20 dB, Linear Phase Filter
98*	10.1 MHz	2.8 Vrms	22 dBm	Flatness for +20 dB, Linear Phase Filter
99*	25.1 MHz	2.8 Vrms	22 dBm	Flatness for +20 dB, Linear Phase Filter
100	60.1 MHz	3.4 Vrms	24 dBm	Flatness reference measurement
101*	79.9 MHz	~3.2 Vrms	23 dBm	Flatness high frequency measurement

* Constants are stored after completing this setup.

3 Using the numeric keypad or knob, adjust the displayed amplitude at each setup to match the measured amplitude (in dBm).
Select **ENTER VALUE**.

4 After performing setup 101:

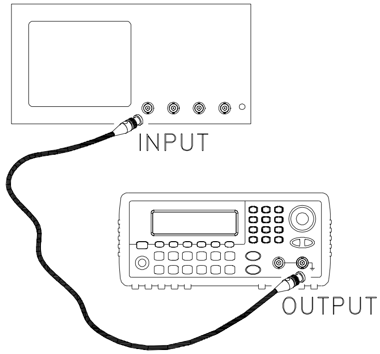
a. If your calibration procedures require you to verify the adjustment just made, exit the calibration menu and perform “+20 dB Range Flatness Verification”, on page 66.

b. If you are making all the adjustments and then verifying the instrument’s performance, continue with the next procedure in this chapter.

Pulse Width (Trailing Edge Delay) Adjustment

The function generator stores calibration constants used to set the trailing edge delay (see the discussion on page 110). These setups place the instrument in pulse mode (at 8 MHz). Setup 102 must be performed *immediately* prior to setup 103.

1 Set the oscilloscope to use averaging to determine the pulse width. Set the oscilloscope to 50Ω input termination (if your oscilloscope does not have a 50Ω input termination, you must provide an external termination). Make the connections as shown below.



2 Use the oscilloscope to measure the pulse width of signal at the front-panel *Output* terminal for each of the following setups.

	Nominal Signal		Measurement: Pulse Width(s)	
Setup	Freq	Amplitude	Pulse Width	
102	8 MHz	1 Vpp	30 ns	Narrow pulse width
103*	8 MHz	1 Vpp	42 ns	Wide pulse width

* Constants are stored after completing this setup.

3 Using the numeric keypad or knob, adjust the displayed pulse width at each setup to match the measured pulse width. Select **ENTER VALUE**.

4 There are no specific operational verification tests for the Pulse Width Adjustment. Continue with the next adjustment procedure in this chapter.

Pulse Edge Time Adjustment

The function generator stores calibration constants used to calculate the slope and offset of the edge time DAC outputs. These setups output 100 Hz pulses with 5 ms pulse widths. The setups, following the first three, **must** be done in pairs (i.e., 107 immediately before 108).

1 Set the oscilloscope to 50Ω input termination (if your oscilloscope does not have a 50Ω input termination, you must provide an external termination). Measure the rise time from the 10% to 90% points on the waveform. Make the connections shown on page 87.

2 Use an oscilloscope to measure the rise time of the output signal at the front-panel *Output* connector for each setup in the following table.

	Nominal Signal			
Setup	Freq	Amplitude	Rise Time [1]	
104	100 Hz	1 Vpp	3.2 ns	Fastest transition range 0
105*	100 Hz	1 Vpp	4.5 ns	Mid transition range 0
106*	100 Hz	1 Vpp	64 ns	Slowest transition range 0
107	100 Hz	1 Vpp	8 ns	Fastest transition range 1
108*	100 Hz	1 Vpp	241 ns	Slowest transition range 1
109	100 Hz	1 Vpp	161 ns	Fastest transition range 2
110*	100 Hz	1 Vpp	4.9 µs	Slowest transition range 2
111	100 Hz	1 Vpp	2.6 µs	Fastest transition range 3
112*	100 Hz	1 Vpp	82 µs	Slowest transition range 3
113	100 Hz	1 Vpp	57 µs	Fastest transition range 4
114*	100 Hz	1 Vpp	1.75 ms	Slowest transition range 4

* Constants are stored after completing this setup.
[1] Rise time measured can vary greatly from the nominal values shown.

3 Using the numeric keypad or knob, adjust the displayed rise time (10% to 90%) at each setup to match the measured rise time. Select **ENTER VALUE**.

4 There are no specific operational verification tests for the Pulse Edge Time Adjustment. Continue with the next adjustment procedure in this chapter.

Duty Cycle Adjustment

The function generator stores a calibration constant used to calculate the square wave duty cycle. This setup outputs a 25.1 MHz square wave. The output frequency in this procedure is chosen to avoid artifacts of DDS signal generation and internal clock frequencies.

The “Internal ADC Adjustment”, on page 75 **must** be completed before doing this procedure.

1 Set the oscilloscope to 50Ω input termination (if your oscilloscope does not have a 50Ω input termination, you must provide an external termination). Make the connections shown on page 87.

2 Use an oscilloscope to measure the duty cycle of the signal at the front-panel *Output* connector.

	Nominal Signal			
Setup	Freq	Amplitude	Duty Cycle	
115*	25.1 MHz	1 Vpp	50%	Enter measured duty cycle

* Constants are stored after completing this setup.

3 Using the numeric keypad or knob, adjust the displayed duty cycle at each setup to match the measured duty cycle. Select **ENTER VALUE**.

4 There are no specific operational verification tests for the Duty Cycle Adjustment.

5 Secure the instrument against further adjustments as described on page 43.

You have now completed the recommended adjustment procedures. You should now verify the output specifications of the instrument using the “Performance Verification Tests”, on page 55.

Output Amplifier Adjustment (Optional)

This adjustment should **only** be performed if repairs have been made the output amplifier circuitry (U1903, U1904, and associated components). This adjustment is performed at the factory and re-adjustment is not needed or recommended.

Note *You must perform a complete calibration of the instrument following this adjustment.*

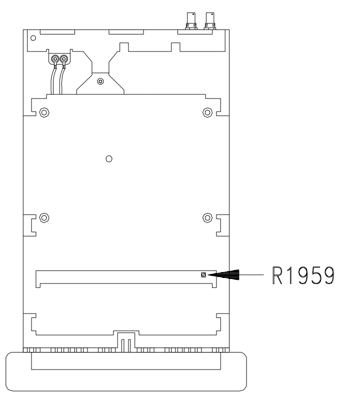
1 Disconnect the power cord and all input connections.

2 Remove the instrument cover. See “Disassembly”, on page 140.

3 Attach the power cord. Press and hold the “1” button and then turn on the instrument. ***Be careful not to touch the power line connections.***

4 The display shows a bar graph.

5 Use a long, small, flat-bladed screwdriver to adjust R1959 to minimize the length of the bar in the display. The adjustment tool can reach R1959 through the slot in the sheet metal as shown.



6 Turn off the instrument and remove the power cord.

7 Re-assemble the instrument.

8 Perform the Adjustment and Verification procedures.

Calibration Errors

The following errors are failures that may occur during a calibration. System error messages are described in chapter 5 of the *Agilent 33250A User's Guide*. Self-test error messages are described in this manual beginning on page 137.

701 **Calibration error; security defeated by hardware jumper**
If you short the calibration secure jumper while turning ON the instrument, this error will occur indicating the security password has been overwritten.

702 **Calibration error; calibration memory is secured**

703 **Calibration error; calibration memory is secured**

704 **Calibration error; secure code provided was invalid**

705 **Calibration error; calibration aborted**

706 **Calibration error; value out of range**
You have typed in a value that was unexpected by the calibration firmware. For example, if a number is expected such a 50.XX ohms, and you enter 10 ohms, that number is outside the expected range of valid inputs.

707 **Calibration error; value out of range**
Occurs during the ADC Adjustment, setup 6, if the 1 Volt input voltage is too high.

850 **Calibration error; set up is invalid**
You have selected an invalid calibration setup number.

851 **Calibration error; set up is out of order**
Certain calibration steps require a specific beginning and ending sequence. You may not enter into the middle of a sequence of calibration steps.

4

Theory of Operation

Theory of Operation

This chapter provides descriptions of the circuitry shown on the schematics in chapter 9.

Block Diagram

A block diagram is shown on the next page. The function generator's circuits may be divided into three main categories: power supplies, analog circuits, and digital circuits. Each portion of the block diagram is described in the following sections.

The line input voltage is filtered, and then applied to the main power supply. The main power supply provides all power to the instrument. Secondary power supplies are contained on the main circuit board. The secondary supplies control the fan, create the –2.1 V and +3.3 V voltages, and provide the isolated +5 V supply.

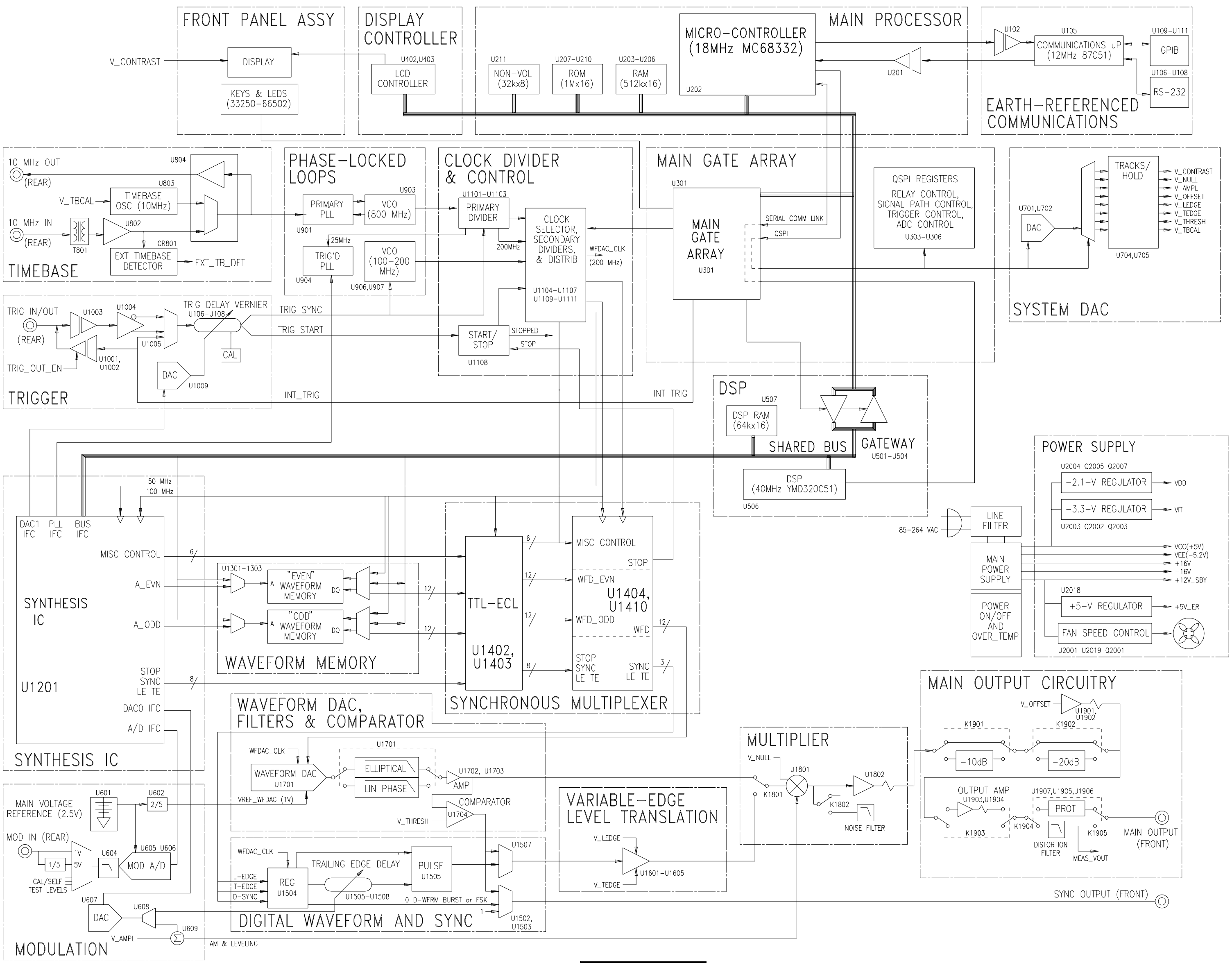
The analog circuitry begins at the Waveform DAC and continues to the main output. Sine, ramp, noise, and arbitrary waveforms pass directly from the Waveform DAC to the main output circuitry. Square waves and pulses are formed in the digital waveform and variable rate edge and level translation circuits.

The digital circuitry contains all the waveform generation circuitry and waveform memory. The main CPU and communications CPU (outguard) are also included.

Conventions Used on Schematics and in this Discussion

Major signal and control lines are marked with a name in uppercase. If the name is followed by an * (for example, TRIG_SYNC*), the line is inverted logic. If the name is followed by a lowercase **e**, (for example, TRIGe), the line is the ECL-level version of a TLL or CMOS signal.

Agilent 33250A Block Diagram



Power Supplies

The line input voltage is filtered, and then applied to the main power supply. The main power supply provides all power to the instrument. Secondary power supplies are contained on the main circuit board. The secondary supplies control the fan, create the –2.1 V and +3.3 V voltages, and provide the isolated +5 V supply.

Main Power Supply

The main power supply is a switching supply. No schematic is given for this supply since it should be replaced as a unit. It features a universal input, eliminating the need to set power line voltage or frequency.

The main supply provides the following voltages to the main board:

- +5 V (for logic and analog circuitry)
- +16 V, –16 V (for analog circuitry)
- –5.2 V (for ECL logic and analog circuitry)
- +12 V isolated (for fan and earth-referenced logic)
- +12 V standby (for power switch and over-temperature shutdown circuitry)

The main supply uses an electronic power switch, controlled by logic on the main board, to turn the supplies on or off. The +12 V standby power is always available when line power is applied. All the power supply outputs can be checked on the main board.

On-Board Power Supplies

See "A1 Power Supply Schematic" on page 204.

The on-board power supply controls the on/off state of the power supply and conditions the main supplies for use by the analog and digital circuits. Over-temperature protection is also provided.

The main supply provides a +12 V standby power supply that is used by the power on/off circuitry. The electronic power switch is controlled by the PWR_SWITCH* line. This line is grounded when the front-panel power switch is pushed and turns on Q2004 through R2026.

Pressing the power switch turns on Q2004, and C2043 and C2047 begin to charge up. Depending upon the state of relay K2001, R2025 will be in parallel with either R2023 or R2024, so one of the capacitors will charge much faster than the other. The charged capacitor turns on either Q2006 or Q2008 and energizes the coil of K2001, changing the relay to the opposite state. Repeatedly pushing the power switch toggles the relay from one state to the other. In the ON state, PWR_ON* is grounded through Q2009, turning on the main power supply.

Q2009 can turn off the main supplies if an over-temperature condition is sensed by U2006, which is powered by the +12 V standby power supply. U2006 has two trip points for over-temperature. The first trip point is set at approximately 85 °C and is asserted by OUT 1. This is a warning to the microprocessor and this condition can be read via GPIB in the status byte. The second trip point is set at approximately 90 °C and is an actual over-temperature condition that asserts OUT 2. This turns off Q2009 and shuts off the main supplies.

The actual temperature sensed by U2006 can be read by the microprocessor through the MEAS_TEMP signal. This reading is used during the calibration and adjustment process.

Secondary logic supplies are derived from the main power supply's +5 V (VCC). Switching regulator U2004 provides the +3.3 V supply (VDD) for the synthesis IC and waveform memory. U2005 provides the –2.1 V ECL termination supply (VTT).

The +12 V earth-referenced supply, +12V_ER, is reduced to +5 V by voltage regulator U2003. This is the earth-referenced logic power supply (+5_ER).

The variable-speed fan is driven by a temperature-controlled switching regulator which is powered by +12V_ER. Comparator U2002-A is configured as an oscillator whose output (at C2013) is a triangle wave. Thermistor R2016 senses the incoming air temperature and U2001-A converts it to a voltage. U2002-B compares this voltage to the triangle wave and outputs a square wave whose duty cycle varies with temperature. The square wave is buffered by U104-C and Q2001 and then filtered by L2003 and C2004 to create a dc voltage that varies with the temperature and is used to power the fan. Below 30 °C, the fan voltage is set to approximately 7 volts by R2003 and R2015 (since CR2004 is reverse-biased). Above 50 °C, U2001-A's output voltage is below the minimum voltage of the triangle wave, keeping Q2001 on constantly and applying full voltage to the fan.

The PWR_FAIL* line is provided by the main supply to indicate brown-out or sagging line input condition. The microprocessor uses this line to initiate saving the current state of the instrument in non-volatile memory.

Analog Circuitry

The analog circuitry begins at the Waveform DAC and continues to the main output.

Sine, ramp, noise, and arbitrary waveforms pass directly from the Waveform DAC to the main output circuitry. Square waves and pulses are formed in the digital waveform and variable-rate level translation circuits.

Waveform DAC and Filters

See "A1 Waveform DAC, Filters, and Comparator Schematic" on page 201.

The 12-bit waveform DAC, U1701, is loaded with data by the Synchronous Multiplexer of the digital circuitry. The most significant bit of this data is inverted by U1401-B to convert the 2's complement value in memory to the offset-binary representation required by the DAC. Data is clocked at a 200 MHz rate through differential clock inputs WFDAC_CLK±. The waveform DAC clock is out of phase with the LOGIC_CLK to provide ample setup and hold times for the data.

The DAC output, at pins 17 and 18, is centered at –250 mV and ranges from 0 mV to –500 mV full scale.

Latching relay K1701 connects the DAC output to one of two filters:

- A 9^{th} order elliptical filter with a cutoff frequency of 85 MHz. This filter includes sin(x)/x correction. It is used for continuous sine and square waves.
- A 7^{th} order linear-phase filter with a cutoff frequency of 50 MHz. It is used for ramp, noise, and arbitrary waveforms. It is also used for sine and square waves in burst mode.

Relay K1701 is driven by the SET_STEP and SET_SINE lines from U306.

The output of the selected filter is applied to amplifier U1703. U1703 has a gain of 4.3 and the output is level shifted to center at ground potential. The output ranges from –1.1 V to +1.1 V. U1702 uses VREF (+2.5 V) to provide an output level appropriate to shift the waveform DAC output to center around ground.

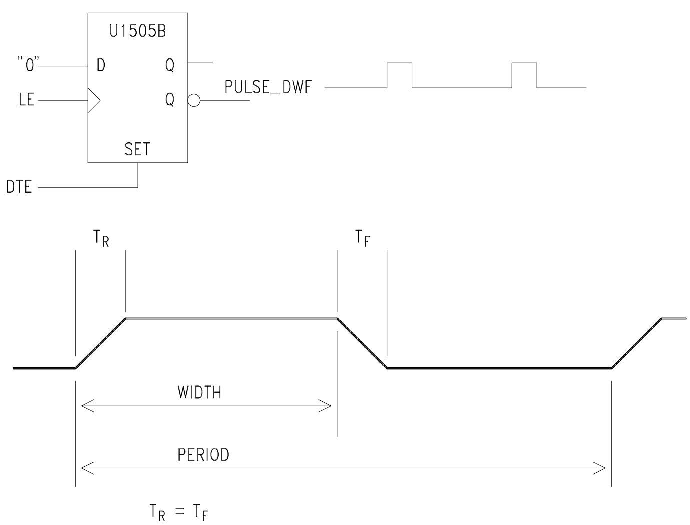
U1704 is a comparator driven by the 2.2 Vp-p signal from U1703 to generate square waves. System DAC signal, V_THRESH, sets the duty cycle of the square wave. The square wave output, SQUARE_DWF, is sent to the SYNC selector (U1502) and the AND gate U1507-B where, if it is enabled by SQUARE_DWF_EN being high, it is passed to the Digital Waveform Translator.

Digital Waveform, Pulse, and Sync

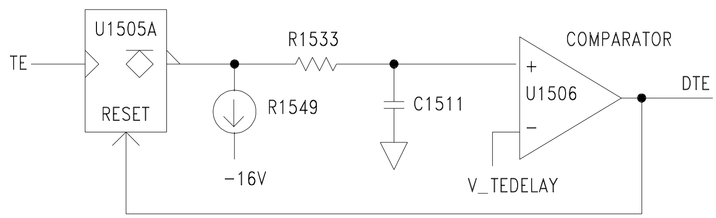
See "A1 Digital Waveform and Sync Schematic" on page 199.

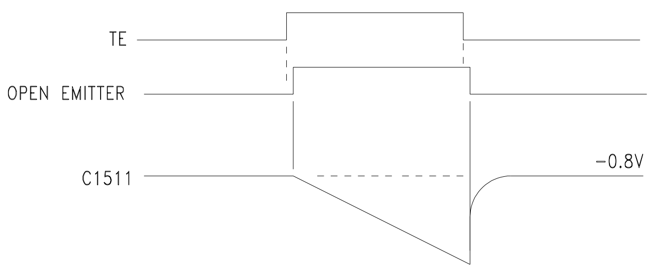
There are three timing parameters for pulse waveforms: period, width, and leading/trailing edge time. At the beginning of each period, a short pulse on LE clocks a "0" into flip-flop U1505-B to initiate the leading edge on PULSE_DWF. Later, a short pulse on TE triggers a variable-delay circuit consisting of U1505-A,U1506-A, U1507-D and associated components. The output of the delay circuit, DTE, sets U1505-B to cause the pulse's trailing edge.

PULSE_DWF is the digital version of the pulse waveform. If U1507-A is enabled (PULSE_DWF_EN is high), the signal is passed to the Digital Waveform Translator, where leading- and trailing-edge times are controlled.



LE and TE are outputs from register U1504 which is clocked differentially by WFDAC_CLK±. The pulse period always consists of an integral number of clocks; the clock frequency is controlled to achieve fine period resolution. The pulse itself consists of a number of clocks plus the delay provided by the delay circuit; fine control of the pulse width is achieved by varying the delay via a control voltage, V_TEDLY.





Before the TE pulse, U1505-A holds integrating capacitor C1511 at an ECL high logic level (approximately –0.8 V). When the TE pulse occur, the flip-flop's output goes low, but being an open-emitter output, it cannot sink current from the capacitor. Instead, the capacitor begins charging in a negative direction through R1549. U1506-A compares the voltage on C1511 to a threshold determined by V_TEDLY. When the capacitor's voltage crosses the threshold, the comparator's inverting output goes high and sets U1505-A back to its original state. This rapidly charges C1511 back to its original voltage and circuit is ready to be triggered by the next TE pulse. The brief pulse that results at U1506-A's output while the capacitor voltage is below the threshold voltage is OR-ed with the global reset signal, INITe, in U1507-D. The result is DTE, which forces PULSE_DWF back to the low state to end the pulse.

U1508-D sets the current in Q1501 (from 0 to 60 µA) according to the voltage difference between V_TEDLY and VREF (as buffered by U1508-A). This current is converted to U1506-A's threshold voltage (approximately –0.8 V to –1.4 V) by U1508-B.

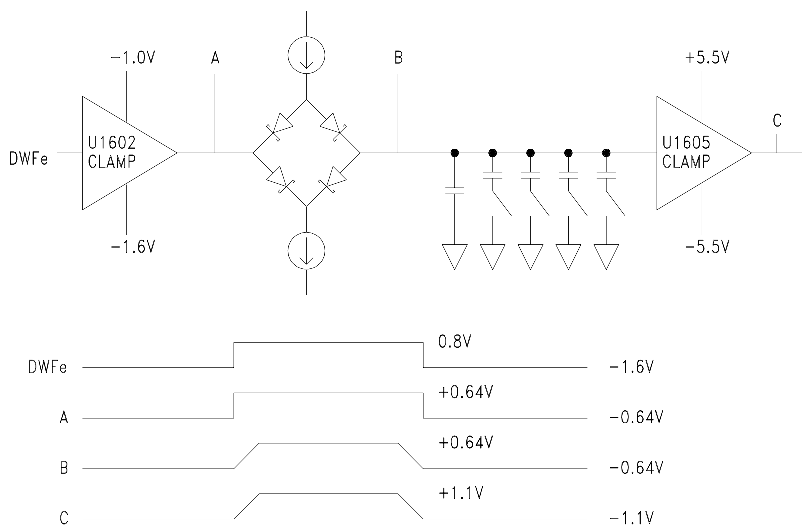
Multiplexer U1502 selects which signal is put out at the SYNC connector, depending on the states of SYNC_CTL0 and SYNC_CTL1 from the Synthesis IC. The SYNC signal may be a constant low, a constant high, the output of square wave comparator U1704-A, or a signal, DSYNC, generated within the Synthesis IC and coming by way of the Synchronous Multiplexer and U1504. The output of U1502 (SYNCe) is buffered and translated to TTL levels by U1503.

Digital Waveform Translator

See "A1 Variable-Edge Level Translation Schematic" on page 200.

Digital Waveform Translator converts the square or pulse waveform's (DWFe) ECL levels to the ±1 V levels required by Amplitude Multiplier. It also sets the rise and fall time of the square wave or pulse.

The input signal, DWFe, is amplified and level translated to ±640 mV by clamping amplifier U1602. Clamping levels are set by R1613, R1616, R1628, and R1631. U1602's output drives a diode switch (CR1601 and CR1602) that steers currents from Q1606 and Q1608 into one of five integrating capacitors (C1609 through C1613). The charge current is set by U1601, Q1601, Q1602, and associated components, according to the value of V_LEDGE (0 to +2.5 V). Similarly, the discharge current is set by U1603, Q1607, Q1608, and associated components, according to the value of V_TEDGE (0 to –2.5 V).



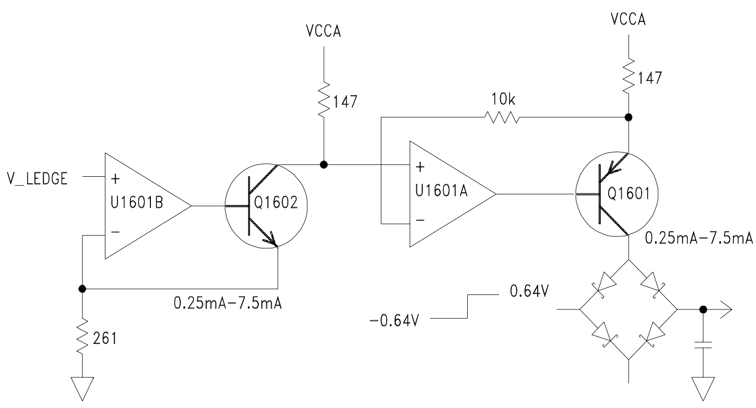
The voltage on the integrating capacitor is amplified and buffered by another clamp amplifier, U1605, to ±1.1 V as required by the Amplitude Multiplier. U1605's clamp levels are set by U1604 and associated components.

Edge speed range is set by TR_RNG(4:1) which control transistors Q1603 through Q1606. If a transistor is off, the associated integrating capacitor (C1610 through C1613) floats and is effectively out of the circuit. If a transistor is on, however, one end of the its capacitor is grounded and capacitor is switched into the circuit.

U1602 converts the –0.8 V to –1.6 V to ±0.64 V levels. The upper clamp voltage of –1.0 V is obtained from resistive divider R1613 and R1616 and the VEE (–5.2 V) supply. The lower clamp level of –1.6 V is obtained from resistive divider R1628 and R1631 and VEE.

The Schottky-diode bridge (CR1601 and CR1602) switches one of two current sources into the capacitive charge circuit. The current source used is set by the +0.64 V to –0.64 V input from level shifter U1602.

The two current sources are similar. They are controlled by the System DAC signals V_LEDGE and V_TEDGE.



The V_LEDGE input varies from +65 mV to +1.95 V. This input range is applied through amplifier U1601-B to Q1602 where it varies the current through R1614 from 0.25 mA to 7.5 mA.

This varying current is applied to a current mirror consisting of U1601-A and Q1601. The Schottky-diode bridge the steers this current in to the integration capacitor.

There are five integration capacitors: C1609 through C1613. C1609 is always in the circuit (<10 ns) and the other four are switched in response to signals from the Main Gate Array (TR_RNG[4:1]).

The value on the integration capacitor is amplified to +1.1 V to –1.1 V levels by clamp amplifier U1605. V_REF is used by U1604 to set the upper and lower clamping levels.

Amplitude Multiplier

See "A1 Multiplier Schematic" on page 202.

Latching relay K1801 selects either the analog waveform, AWF, or the digital waveform, DWF, for application to multiplier U1801. K1801 is controlled by SET_AWF and SET_DWF from U306.

The amplitude multiplier provides approximately 10 dB of fine control to the instrument's output amplitude, interpolating between attenuator steps. The multiplier also performs AM modulation.

U1801's gain is determined by the differential voltage present at its "X" input. This voltage, V_GAIN±, is generated in the Modulation circuitry and typically ranges from 230 mV to 750 mV.

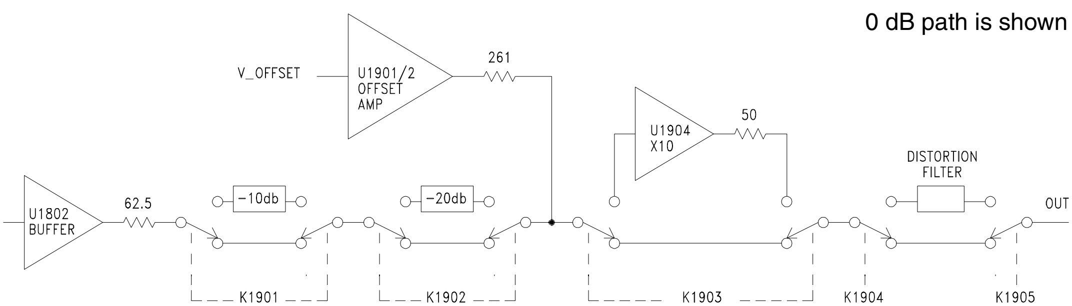
The waveform signal, as selected by K1801, is applied to U1801's "Y1" input and nominally ranges from –1 V to +1 V. The "Y2" input is driven by V_NULL from the System DAC. V_NULL is set to correct for any offset voltage present in the "Y1" input to ensure the multiplier's output offset remains constant as the gain voltage is changed.

The output of U1801 is buffered by U1802 to become the instrument's 0 dB output (BUF_OUT).

Main Output Circuitry

See "A1 Main Output Circuitry Schematic" on page 203.

The main output circuitry attenuates or amplifies the waveform to its final amplitude level and adds any dc offset required. The output is also protected against harmful combinations of load impedance and output voltage.



R1915, R1917, and R1918 form a –10 dB attenuator that is switched by K1901. Similarly, R1916, R1919, R1920, and R1921 form a 20 dB attenuator that is switched by K1902. U1903, U1904, and the associated components form a 20 dB amplifier that is switched by K1903. K1901 through K1903 are latching relays controlled by signals from U305.

Attenuators and/or the amplifier are switched in to set the output amplitude range according to the following table:

	Offset < 1 V			**Offset > 1 V**		
Amplitude Range (V_{pp} into 50Ω)	**–10 dB**	**–20 dB**	**Amp**	**–10 dB**	**–20 dB**	**Amp**
< 31.6 mV	In	In	Out	N/A	N/A	N/A
30 mV to 100 mV	Out	In	Out	N/A	N/A	N/A
96 mV to 316 mV	In	Out	Out	In	In	In
300 mV to 1 V	Out	Out	Out	Out	In	In
0.96 V to 3.16 V	In	Out	In	In	Out	In
3 V to 10 V	Out	Out	In	Out	Out	In

Note that adjacent ranges overlap, so relay chatter is eliminated when small amplitude changes are made near range edges.

U1901, U1902, and associated components form a high-current amplifier that injects DC Offset into the signal path through the parallel combination of R1912, R1913, and R1914. Injecting the offset after the attenuators allows small signals to be offset by relatively high dc voltages. The impedance of the system up to the offset injection point is 62.5Ω, but the parallel combination of R1912 through R1914 (260Ω) lowers the impedance to 50Ω. V_OFFSET from the System DAC (±2.5 V range) is amplified by 5.2 (to ±13 V at U1902's output), but is then attenuated by R1912 through R1914. The range of offset available from this circuit is, therefore, ±1.2 V into 50Ω.

When the peak ac voltage or dc offset of the signal exceeds 1 V, the output amplifier consisting of U1903, U1904, and associated components is switched in. U1904 is a hybrid circuit capable of driving 10 V_{pp} signals into 50Ω at 80 MHz. U1903 is a "servo" amplifier that improves U1904's accuracy at frequencies below 1 MHz. R1959 must be adjusted to match U1903's gain to that of U1904. In a special adjustment mode (described on page 90), the peak-to-peak voltage of MEAS_OA_ADJ is measured by the Modulation A/D and displayed as a bar on the display. R1959 is then set to minimize the width of the bar.

Non-latching relays K1904 and K1905 switch a 100-MHz, 5^{th}-order, low-pass filter (L1907 through L1909 and C1923 through C1926) into the signal path to reduce high-frequency distortion on continuous sine waves. If the instrument is off, if the output has been disabled, or if the output protection circuitry has been activated, the coils of both relays are de-energized and the main output is disconnected from the rest of the instrument.

There are two separate output protection circuits. U1905 and U1906 (configured as comparators) monitor U1904's output voltage and current, and assert OUT_FAULT* (low) if potentially harmful conditions exist. When the output amplifier is switched out, dual comparator U1907 monitors the output voltage and asserts OUT_FAULT* if it exceeds ±3.5 V. Once OUT_FAULT* is asserted, the condition is latched in the Main Gate Array, and relays K1904 and K1905 are de-energized. User intervention is required to re-enable the output.

System ADC

See "A1 Modulation Schematic" on page 190.

Modulation by an external source, both AM and FM, is performed digitally by sampling the external input at the modulation BNC, adjusting the data to match the current modulation specification (deviation in FM, depth in AM). The sampled data are sent to the DSP which applies the resulting data to the waveform generation hardware. The sample rate is 468.75 kHz. All modulation processes in the 33250A are DC-coupled, and can follow DC changes in the external modulation signal.

Modulation by an internal source is similar, except that the modulation waveform is stored in the DSP memory and "played" back at the frequency specified by the current instrument setup. The sample rate for internal modulation is the same as for external modulation, 468.75 kHz.

In Amplitude Modulation, the modulation data are applied to the amplitude control DACs, which control the amplitude multiplier and thereby, the amplitude of the carrier waveform. When amplitude modulation is enabled in the 33250A, the carrier waveform amplitude is reduced to 50% of its unmodulated value, and the modulation signal then may vary its amplitude up to the full nominal setting (or above, if greater than 100% modulation is specified).

In Frequency Modulation, the modulation data are applied to the Phase Increment Register (PIR) of the main DDS waveform synthesizer to vary the frequency of the carrier waveform. The amount of frequency deviation depends upon the amplitude of the modulating signal and the current instrument setting for deviation.

Modulation circuitry consists of an input multiplexer, U603, an anti-alias filter, U604, an analog-to-digital converter (ADC), U606, and a digital-to-analog converter (ADC), U607. There is also a voltage reference, U601, that is used by the ADC and other circuits in the system. In addition to modulation, the ADC is used for calibration and self-test.

U603 is the final stage of a multiplexer used to select the ADC input source. The rear panel modulation input is applied directly to one of the multiplexer inputs for the ±1 V input range, and through divider R618 and R620 for the ±5 V input range. Other U603 inputs include ground, +1.25 V (VREF_d2), MEAS_OA_ADJ from U1903, and three MEAS lines, each of which are multiplexed signals from the first stage multiplexers U706, U707, and U708. The multiplexer is controlled by the MSEL lines from U308.

U603's output is first buffered by U604-B and then applied to a 3^{rd}-order, low-pass filter. U604-A and associated components form a 2^{nd}-order, Gaussian, low-pass filter at 720 kHz. R613 and C620 form an additional 1-pole filter at 900 kHz. Together, the first two filter sections produce a frequency response that is flat to 200 kHz. U604-A also shifts the ±1.25 V range of its input to 2.5 ±1.25 V, as required by the analog-to-digital converter.

The analog-to-digital converter, U606, is clocked at 15 MHz by U605. On-chip digital filtering reduces the output rate to 468.75 kHz. Output samples are sent in a serial fashion using ADC_SCLK, ADC_SDATA, and ADC_DRDY to the Synthesis IC, U1201, where they can be read by either the DSP or Main Processor. ADC_DVAL is set low if the analog-to-digital converter's input is over-driven.

U601 provides the voltage reference. The 2.5 V output of U601 is applied directly as the reference for the analog-to-digital converter U606. The 2.5 V is divided by resistors R603 and R604 to 1 V, buffered by U602, and then used as the reference for the waveform DAC.

Digital-to-analog converter U607 receives serial data from the Synthesis IC, U1201, using DAC0_CLK, DAC0_STRB*, and DAC0_DATA. The analog voltage from U607 is applied to multiplexer U608, which is controlled by AM_nTEDLY from U302, and selects one of two functions for the U607 output. The two functions are:

- Trailing edge delay for fine control of the pulse width (AM_nTEDLY "low")
- Summing with V_AMPL (from the System DAC) to form the V_GAIN± signal used by U1801 to set the amplitude multiplier factor. This allows the DAC signal to be used for both amplitude modulation and sine wave flatness correction.

System DAC

See “A1 System DAC Schematic” on page 191.

The System DAC provides dc voltages that control various parameters of the instrument’s operation. This schematic page also includes analog multiplexers that select various signals for measurement by the A/D Converter.

The System DAC U701 is loaded with serial data from the Main Gate Array, U302, using SYSDAC_CLK, SYSDAC_STRB*, and SYSDAC_DATA. The DAC’s voltage reference is 2.5 V, provided by U601, and its nominal output ranges from 0 V to +2.5 V. The DAC’s output is buffered and amplified to a ±2.5 V range by U702-A and applied to multiplexer U703.

Each switch in U703, along with an associated holding capacitor (C701 through 703, C707, and C709 through C712) and a buffer amplifier (U704, U705, U1601-B, and U1603-B), makes up a track-and-hold circuit whose output is a control voltage. In operation, SYSDAC_SEL(2:0) (from U302) are driven to select one of the track-and-hold circuits, and the DAC is loaded with a corresponding value. After allowing 1.5 µs for the DAC to settle, the selected channel of the multiplexer is closed by the assertion of SYSDAC_SMPL and the holding capacitor is driven to U702-A’s output voltage. After 12.7 µs, SYSDAC_SMPL is negated and process repeats for the next track-and-hold. All channels are continuously refreshed in this manner by hardware in U302 and U202.

U703 Output Channel		Function	Range
0	V_CONTRAST	Sets the display viewing angle.	0 to +5 V
1	V_NULL	Nulls the multiplier input offset voltage.	±2.5 V
2	V_AMPL	Sets the output amplitude.	±2.5 V
3	V_OFFSET	Sets the output offset.	±2.5 V
4	V_LEDGE	Sets the pulse leading edge time.	0 to +2.5 V
5	V_TEDGE	Sets the pulse trailing edge time.	0 to –2.5 V
6	V_THRESH	Sets the square wave duty cycle.	±2.5 V
7	V_TBCAL	Sets the timebase frequency.	0 to +5 V

Multiplexers U706, U707, and U708 switch various measurement signals into three output lines (MEAS1, MEAS2, and MEAS3). These lines are applied to multiplexer U603 and are used to monitor the instrument’s output and measure signals for self-test and calibration.

Digital Circuitry

The digital circuitry contains all the waveform generation circuitry and waveform memory. The main CPU and communications CPU (outguard) are also included.

Synthesis IC

See "A1 Synthesis IC Schematic" on page 196.

U1201 is an SRAM-based field-programmable gate array that implements most of the logic for waveform generation. The Main Processor loads data into U1201 from main memory to implement one of two "personalities": DDS waveform generation or Pulse waveform generation.

The instructions are loaded into the Synthesis IC at wakeup or when the instrument's output mode is changed between DDS and Pulse. The instructions are loaded via a serial interface using SYN_CLK, SYN_STATUS*, SYN_CONFIG*, SYN_CONFDONE, and SYN_DATA0.

The Synthesis IC interfaces to the DSP and Main Processor through a shared 16-bit bus (SHR_D(0:15) and SHR_A(0:15)).

The analog-to-digital converter sends serial data to U1201 using ACD_SDATA, ADC_SCLK, and ADC_DRDY. The 15-MHz ADC_SCLK clocks the data during the first half of the 32-cycle analog-to-digital conversion cycle. ADC_DRDY marks the beginning of a new word and synchronizes the internal shift register.

U1201 has two identical DAC interfaces, DAC0 and DAC1. DAC0 (U607) is used for frequency-response leveling and amplitude modulation, as well as fine delay for pulses. DAC1 (U1009) is the fine control for the trigger delay.

Data is sent to the triggered phase lock loop (U904) through a serial interface using TRG_DCLK, TRG_DATA, TRG_STRB. The VCO(0:6) lines are used by U907 to coarsely set the triggered VCO's frequency.

The main Synthesis IC clock is CLK_d4. This is the 200 MHz clock divided by 4 (50 MHz). A second clock, CLK_d2, provides a 100 MHz clock used by the Synthesis IC to "accelerate" the waveform addresses.

DDS Behavior

DDS waveform generation begins with a high-resolution phase accumulator. The most significant phase bits are interpolated into four waveform address streams. These four address streams are then interleaved into two streams at twice the rate. These two streams become the A_EVN and A_ODD waveform address lines.

During burst operations, an on-chip counter provides coarse trigger delay and circuitry that counts waveform cycles and stops the process when the end of a burst is reached.

Pulse Behavior

"Even" and "Odd" leading- and trailing-edge bit streams are generated in the Synthesis IC and emitted at the CLK_d2 rate (50 MHz to 100 MHz). These bit streams are interleaved by the Synchronous Multiplexer into single leading- and trailing-edge pulses which determine pulse period and width to within one CLK cycle (5 ns to 10 ns). To achieve better period resolution the frequency of the clock is varied between 100 MHz and 200 MHz by the Triggered PLL. To achieve better pulse-width resolution, a trailing-edge delay vernier circuit (U1505-A, U1506-A, U1508, and associated components) is employed.

Timebase

See "A1 Timebase Schematic" on page 192.

The Timebase provides a 10 MHz clock from which all the waveform generation timing signals are ultimately derived. This clock can have one of two sources: the internal crystal oscillator (U803) or an External BNC input connector.

U803's frequency is controlled by the System DAC signal, V_TBCAL. When an external timebase is used, EXT_TB_EN is asserted, turning Q801 and U803 off. EXT_TB_EN also turns Q802 on, grounding U803's control voltage input. U804-buffers U803's output and inverts it so when U803 is off, U804-D's output is high.

The external input is isolated by T801 and applied to comparator U802. U802 has two complementary outputs. One output is enabled by EXT_TB_EN. The other output drives a charge pump circuit made up of C809, CR801, C811, and R808. The voltage on C811 builds up when an external signal is present and asserts EXT_TB_DET to inform the main controller to use the external input (and assert EXT_TB_EN).

The outputs of the two timebase sources are ORed by U804-A and become the FREF and PRI_FREF reference signals used by various parts of the instrument. U804-B buffers FREF, then drives it out the "10 MHz Out" BNC, J802.

The +16 V supply is filtered then regulated to a clean +5 V by U801 for use by the frequency reference circuits.

Phase Locked Loops

See "A1 Phase-Locked Loops Schematic" on page 193.

There are two phase locked loops (PLLs). A primary PLL, which ultimately furnishes the clocks for DDS waveforms, and a triggered PLL, which is used in pulse generation.

The primary PLL multiplies the 10 MHz frequency reference to 800 MHz. The PLL synthesizer, U901, is programmed at power on using the serial transfer lines PRI_DATA, PRI_DCLCK, and PRI_STRB from the Main Processor U202. The frequency reference, PRI_FREF, is obtained from U804 in the timebase circuits.

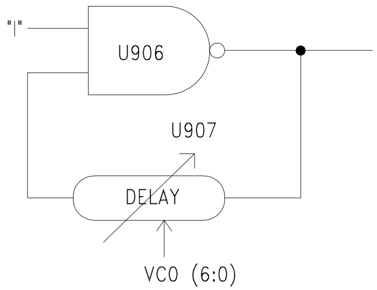
Voltage controlled oscillator, U903, can be tuned from 797 MHz to 803 MHz. Part of the 800 MHz output is fed back to the PLL synthesizer and phase-compared to the reference frequency.

U901 asserts PRI_LOCK when the PLL is locked. This signal is used by the main processor (and can be reported to the front panel display and the GPIB status byte).

U902 buffers the VCO control voltage and sends it through U707 to be measured during self-test. Q901 provides a means to turn off U903 for testing.

The triggered phase lock loop is programmed by the Synthesis IC through lines TRG_DCLK, TRG_STRB, and TRG_DATA. The 25 MHz frequency reference is derived from the 800 MHz clock by U1101, U1102, and U1103. The triggered PLL is tuned from 100 MHz to 200 MHz in 2 kHz steps.

The triggered PLL synthesizer, U904, drives U905 which shifts and scales the output voltage to match the input requirements of varactor CR901. U907 is a programmable delay, fed back upon itself through a differential RC network (the capacitance of CR901, resistors R929 and R930, and gate U906). U907 is programmed through the VCO(6:0) lines from the Synthesizer IC.



VCO(6:0) are chosen to set the frequency as close as possible to the desired frequency, then the loop adjusts the voltage on the varactor to fine tune the frequency.

When the instrument is generating pulses, PRI_nTRGe is low to enable U907; otherwise, PRI_nTGRe is high. TRIG_SYNC* for the Trigger Delay Circuit goes low briefly when the instrument is triggered, disabling U906 and stopping the oscillator. When TRIG_SYNC* goes high again, the oscillator starts up synchronized to the trigger.

Clock Divider

See “A1 Clock Divider and Control Schematic” on page 195.

U1101 divides the 800 MHz clock from U903 by two, producing a differential 400 MHz clock signal, CLKx2±. TRIG_SYNC from the Trigger Delay circuits goes high briefly when the instrument is triggered, disabling this divider for a short time to synchronize the synthesizer with the trigger. U1102 and U1103 divide CLKx2± by 16 to create the 25 MHz frequency reference, TRG_FREF, for the triggered PLL. U1104 and U1105 form a divide-by-2 circuit that can be disabled by negating PRI_nTRGe (when the triggered PLL is used) or by asserting STOPPEDe (when waiting for a trigger).

STOPPEDe also disables the output from the triggered PLL (TRG_VCO±) at U1106-D. The differential outputs of U1105 (PRI_CLK±) and U1106-D (TRG_CLK±) are OR-ed together by U1106-A and U1106-B to form duplicate versions of the clock from which all other waveform-generation timing is derived. Note that either PRI_CLK± or TRG_CLK±, but not both, will be active (as determined by the state of PRI_nTRGe).

The output of U1106-A is fed to U1106-C, where it can be disabled by WFDAC_HOLDe. U1106-C’s differential output (WFDAC_CLK±) clocks the waveform DAC, U1701, and U1504. It is disabled by WFDAC_HOLDe to keep the instrument’s output fixed while changing functions.

The complimentary outputs of U1106-B, LOGIC_CLK and LOGIC_CLK*, provide timing for the remainder of the waveform-generation logic. LOGIC_CLK is 180° out of phase with WFDAC_CLK to satisfy the timing requirements of the waveform DAC.

One half of U1109-A divides LOGIC_CLK by two to create the 100 MHz signal, CLK_d2e. The other half of U1109-A divides CLK_d2e by two to create a 50 MHz signal that is delayed by 2.5 ns in U1110 to become CLK_d4e. CLK_d2e* is gated by U1107-A and U1107-B, then re-clocked by U1109-B to form two 100 MHz clocks, CLK_d2_ODDe and CLK_d2_EVNe, that can be individually disabled by negating either CLK_EN_ODD or CLK_EN_EVN. U1111 translates CLK_d4 and CLK_d2_ODDe, CLK_d2_EVNe, and CLK_d2e into their TTL equivalents. CLK_d4 and CLK_d2 are used by the Synthesis IC. CLK_d2_ODD and CLK_d2_EVN are used by the Waveform RAM.

The state of the flip-flop U1108 determines whether the synthesizer is “stopped” (waiting for trigger) or “running”. In normal operation, a trigger is required to start the synthesizer and an assertion of STOP (from the Synthesis IC by way of the Synchronous Multiplexer) is required to stop it. When a trigger occurs, TRIG_SYNC is asserted to disable clock divider U1108, causing STOPPEDe to go low. Then when TRIG_SYNC is negated, clocks are allowed to propagate to the rest of the system and synthesis begins. Normally, when STOP is asserted, a “1” is clocked into U1108 and the system stops. In gated burst mode, however, STOP is asserted at the end of each waveform cycle, but U1107-D and U1107-E force U1108’s “D” input low unless the gate signal (TRIGe) is false.

Trigger and Delay

See "A1 Trigger Schematic" on page 194.

The instrument has a bi-directional, chassis referenced, TTL trigger BNC connector. Triggering can occur either from the external trigger BNC input or from the instrument's internal trigger. The user can elect to send the instrument's internal trigger out the trigger BNC connector to synchronize other instruments.

External trigger inputs are buffered by U1002-A and applied to the opto-isolator U1003. U1002-A has a small amount of positive feedback through R1019 to provide hysteresis. U1004-A converts the external trigger to ECL voltages.

When the internal trigger is selected and a trigger out is desired, the TRIG_OUT signal provides the trigger out. This signal is opto-isolated by U1001 and applied to three-state buffers, U1002-B, C, D which provide the current drive for the external trigger. TRG_OUT_EN* from U105 enables the outputs of U1002-B, C, D.

U1005-A, U1005-B, and U1005-C are AND gates whose outputs are connected together to form the trigger input selector. Either slope of the external input (EXT_TRG+ or EXT_TRG–) or the internal trigger signal (INT_TRG) can be selected by asserting the proper enable signal (EXT_TRG+_EN, EXT_TRG–_EN, INT_TRG_EN). U1005-D ensures that the instrument cannot be triggered unless triggers are enabled (TRG_CTL(0) is high) and the synthesizer is stopped.

A variable trigger-delay circuit consisting of U12004-B, U1006 through U1009, and associated components is used to synchronize the synthesizer to the selected trigger. This circuit can provide up to 40 ns of delay with approximately 10 ps resolution. Trigger delays up to 85 seconds are achieved by counting clocks in the Synthesis IC, and then interpolating between the clocks with this circuit.

Assuming the synthesizer is stopped and triggers enabled, TRIG_ARM will be high. A rising edge on TRIGe will then clock a “1” into flip-flop U1007, causing U1008 pin 2 to go “low”, and allowing C1007 to begin charging in a negative direction through R1049. TRIG_SYNC is also asserted at this time to disable the synthesizer clocks. Comparator U1004-B monitors the voltage on C1007 and asserts TRIG_START when it falls below a threshold set by U1009, U1006, and associated components. When TRIG_START is asserted, U1007 is reset, thereby negating TRIG_SYNC and causing C1007 to quickly discharge back to the high output level of U1008. When the voltage on C1007 rises above the comparator’s threshold, TRIG_START is negated. When this circuit is properly calibrated, TRIG_SYNC’s pulse width will vary from a minimum of 15 ns (corresponding to a 0 ns trigger delay setting) to 55 ns. TRIG_START’s pulse width is typically 5 ns.

U1009 is a DAC that sets the delay of this circuit by controlling U1004-B’s threshold voltage. It receives serial data from U1201 via the DAC1_CLK, DAC1_STRB, and DAC1_DATA lines. U1009’s output, V_TRIGDLY, ranges from –3 V to +2.5 V (the lower the voltage, the longer the delay). U1006-B sets the current in Q1001 (from 0 to 120 µA) according to the difference between V_TRIGDLY and VREF, as buffered by U1006-A. This current is converted to the comparator’s threshold voltage (approximately –0.9 V to –1.6 V) by U1006-C.

U1007’s differential output is low-pass filtered and amplified by U1006-D to form MEAS_TDCAL. The dc voltage on MEAS_TDCAL varies linearly with TRIG_SYNC’s duty cycle. This voltage is measured by the modulation A/D converter when the instrument internally calibrates this circuit.

Waveform RAM

See "A1 Waveform Memory Schematic" on page 197.

There are two banks of waveform RAM, referred to as "ODD" (U1305) and "EVEN" (U1304). These RAMs perform all operations synchronously. When writing, address and data are clocked into input latches and then stored in the memory by on-chip self-timed circuitry. When reading, address is latched on one clock edge and data is clocked out on the next clock edge.

U1304 and U1305 have two clock sources. In normal operation they are clocked at 100 MHz using the CLK_d2_EVEN and CLK_d2_ODD clocks generated by U1111. When being accessed by the Main CPU or DSP, they are clocked by WFRAM_CLK from U302.

U1301, U1302, and U1303 are address multiplexers. U1306 and U1307 are data multiplexers. These multiplexers allow the waveform RAM to be disconnected from the normal signal path and connected to the shared bus. The multiplexers are "zero-delay" analog switches controlled by PROG_USE*_EVN and PROG_USE*_ODD from U1201.

CR1301 is placed in the multiplexer's power supply to lower the supply voltage to approximately 4.3 V to protect the waveform RAM from higher signal swings that may be exist on the shared bus.

Synchronous Multiplexer

See "A1 Synchronous Multiplexer Schematic" on page 198.

Waveform data from the Waveform RAM is converted from TTL levels to ECL levels using resistive dividers (R1402 through R1413, R1417 through R1428, R1437 through R1448, and R1455 through R1466). The control signals from U1202 are converted from TTL to ECL by U1402 and U1403.

U1404 through U1407 form a pipeline stage clocked at 100 MHz by CLK_d2e. U1408 and U1409 interleave "even" and "odd" data from U1404 through U1406 into a single 200 MHz data stream, WFD(11:0), for the Waveform DAC. Similarly, "even" and "odd" signals from U1407 are interleaved by U1410. U1408 through U1410 are registers, clocked at 200 MHz by LOGIC_CLK, with input multiplexers that are controlled by EVN_nODD (derived from CLK_d2e).

In normal operation, "even" waveform data is fed to the registers with CLK_d2e is high, and "odd" data is selected when CLK_d2e is low. However, U1401-D and U1401-C can override the state of CLK_d2e and force EVN_nODD to be high or low, depending upon the states of EVN_ONLY and ODD_ONLY (from U1201). Asserting EVN_ONLY causes data from the "odd" waveform memory to be ignored, allowing the memory to be accessed by the main processor or DSP while the system is running. Similarly, asserting ODD_ONLY allows the "even" memory to be accessed. Certain parameters, such as burst phase and ramp symmetry, are modified by re-writing waveform memory while the system is running.

Main Processor

See “A1 Main Processor Schematic” on page 186.

U202 is the main CPU for the instrument. U214 provides the 18 MHz clock for the main CPU. The main CPU incorporates a number of on-chip peripherals including:

- Asynchronous serial communications (UART)
- Autonomous synchronous serial communications (QSPI)
- Programmable periodic interrupt timer (PIT)
- 16-channel intelligent timer/counter (TPU)

Reset circuit U401 (shown on schematic 4) is the main CPU reset and power failure circuit. U401 performs three functions:

1. Generates a shutdown on power fail.
2. At power up, ensures the clocks and CPU have stable power before the CPU starts running.
3. Prevent multiple turn-on/turn-off cycles during unstable power conditions by keeping RESET* asserted until power is steady.

The PWR_FAIL* signal from the main power supply indicates when ac power has been lost. When PWR_FAIL* is asserted, U401 asserts ACFAIL* for approximately 4 ms and then asserts RESET* for a timed minimum duration or until power completely fails. The ACFAIL* signal is applied to the CPU IRQ6 input and instructs the main CPU to save the current state in non-volatile memory. The RESET* signal suspends main CPU operation. The main CPU wake-up configuration is set by R228 through R235.

The main CPU uses seven chip select lines; CS0 through CS5 and CSBOOT. These lines select the RAM, FRAM, and Flash ROM when appropriate. ROMs U207, U208, U209, and U210 are each 512k x 8, providing 1 Meg of 16-bit words. U203 and U204 are 512k x 8 SRAM chips, providing 512 k-words of 16-bit RAM space. U211 is a ferro-electric RAM used to store non-volatile calibration coefficients and the power-on state of the instrument.

Main Gate Array

See "A1 Main Gate Array Schematic" on page 187.

U302 is a Field-Programmable Gate Array. When RESET* is asserted, U301 serially loads the gate array with its contents. U302 asserts MAR_AWAKE* to indicate to the CPU that it is loaded and ready.

The Main Gate Array performs many functions within the instrument including:

- Main CPU address decoding and bus handshaking. It detects two address ranges; one for internal register programming and one for accessing devices on the shared bus (including DSP program RAM, DSP data RAM, and the Synthesis IC control registers.
- DSP and Waveform RAM bus interface.
- Timers. U302 has two internal timers. One timer is used for internal trigger operations. The other timer generates the front panel LCD clock.
- DSP serial communications. This serial communication allows the Main Gate Array to send incremental, low impact changes in the waveform to the synthesizer without affecting the continuity of the waveform or modulation output.
- QSPI scanned serial bus support. The QSPI data is decoded into signals that control the analog output path attenuators and relays. Additionally, the QSPI data can be set to a "loop-back" mode to test the external data path and shift registers.
- Provides the serial interface required to load the configuration of the Synthesis Gate Array, U1201.
- System DAC control. The Main Gate Array controls and times the System DAC operations, including the sequence; disconnect the System DAC from the present sample-and-hold output, latch new data into the DAC, change the multiplexer address to the new output, allow the System DAC to settle, and then connect the System DAC to the new sample-and-hold circuit.

U303 and U304 act as a 16-bit serial-in parallel-out shift register. The register converts serial data from the QSPI output of the Main CPU to a parallel word. Registers U305, U306, U307, and U308 capture the converted words and drive various logic-level signals. Registers U305 and U306 are devoted to driving relays.

DSP and Gateway

See “A1 DSP Schematic” on page 189.

U506 is the digital signal processor. It is clocked at 40.96 MHz from U505. The DSP RAM, U507, is loaded by the Main CPU through the gateway. U506 also communicates with the main CPU via a serial connection, assisted by U302.

The bus gateway is controlled by the Main CPU U302. The gateway uses U501, U502, U503, and U504 to allow the Main CPU to load the DSP RAM (U507) and then isolates the two busses so the DSP can operate independently of the main CPU.

The DSP has no ROM and instructions are loaded by the main CPU.

Earth-Referenced Logic

See “A1 Earth Referenced Communications Schematic” on page 185.

The earth-referenced logic provides triggers and communications. Microprocessor U105 handles GPIB (IEEE-488) control through bus interface chip U109 and bus receiver and driver chips U110 and U111. U105 also controls the RS-232 interface through UART U106 and transceiver chips U107 and U108. U107 and U108 provide the required level shifting between the RS-232 ±9 V levels and the +5 V logic levels by internal charge pumping circuits using capacitors C104 and C110.

Communication between the main CPU and the earth-referenced logic is through an optically-isolated, bi-directional serial interface, U102 and U201.

U101 provides an independent reset of the floating microprocessor based upon the +5_ER supply. The chassis ground and earth-referenced logic ground (IOCOM) are dc coupled through transformer T101. IO Power (IOVCC) is derived from the earth-referenced power supply (+5_ER) through T101. T101 acts as a balun to reduce EMI.

Front Panel

See "A2 Keyboard Schematic" on page 205 and "A2 Display Schematic" on page 206.

The front panel contains a keyboard, a liquid crystal display (LCD), a piezoelectric speaker, and a rotary encoder.

The keyboard is arranged in five columns and eight rows. The keys are scanned one column at a time. Some of the keys have an LED incorporated into the key to indicate the instrument's operating state. U301 scans the columns and reads the key presses.

The rotary encoder uses a quadrature coding technique to allow the motion, speed and direction to be detected. The two sense lines from the rotary encoder are buffered by U215 and applied to two of the TPUCH inputs of the main CPU. The main CPU tracks and accumulates knob motion information.

The display is a 256 X 64 passive matrix color LCD. This display assembly includes the backlight lamp and LCD driver circuitry. The display is lighted by a replaceable, 3-watt, cold cathode fluorescent lamp. The lamp is powered by an inverter module that is current-regulated to supply 4.8 mA at approximately 300 Vdc. The backlight inverter module can be turned off by the LCD control circuitry.

U402 (on schematic 4) is the display controller. This controller reads the main CPU data and address lines and stores appropriate display data in SRAM U403. U403 runs continuously. U402 checks for main CPU activity before turning on the display to prevent burn-out. The CPU firmware incorporates a "bulb saver" feature that turns off the display after 1 hour of inactivity. R410, R412, R413, R415, and R418 provide the wake up configuration for the display controller.

The speaker is a piezoelectric element driven by U213-C from signals generated in the main CPU U202. The frequency and duration of the beeps are set by the main CPU.

5

6

Service

Service

This chapter discusses the procedures involved for returning a failed instrument to Agilent Technologies for service or repair. Subjects covered include the following:

Operating Checklist

Before returning your instrument to Agilent Technologies for service or repair, check the following items:

Is the instrument inoperative?

- Verify that the ac power cord is connected to the instrument.
- Verify that the front-panel On/Standby switch has been pushed.

Does the instrument fail self-test?

Remove all external connections to the instrument. Errors may be induced by ac signals present on the external wiring during a self-test. Long test leads can act as an antenna causing pick-up of ac signals.

Types of Service Available

If your instrument fails during the warranty period (within three years of original purchase), Agilent Technologies will replace or repair it free of charge. After your warranty expires, Agilent will replace or repair it at a competitive price. The standard repair process is “whole unit exchange”. The replacement units are fully refurbished and are shipped with new calibration certificates.

Standard Repair Service (worldwide)

Contact your nearest Agilent Technologies Service Center. They will arrange to have your instrument repaired or replaced.

Agilent Express Unit Exchange (U.S.A. Only)

You will receive a refurbished, calibrated replacement Agilent 33250A in 1 to 4 days.

1 Call **1-877-447-7278** (toll free) to place your Agilent Express order.

   a You will be asked for your serial number, shipping address, and a credit card number to guarantee the return of your failed unit.

   b If you do not return your failed unit within 15 business days, your credit card will be billed for the cost of a new Agilent 33250A.

2 Agilent will immediately send a replacement 33250A directly to you.

   a The replacement unit will come with instructions for returning your failed unit. Please retain the shipping carton and packing materials to return the failed unit to Agilent. If you have any questions regarding these instructions, please call 1-877-447-7278.

   b The replacement unit will have a different serial number than your failed unit. If you need to track your original serial number, a blank label will be shipped with the replacement unit to record your original serial number.

Repackaging for Shipment

If the unit is to be shipped to Agilent for service or repair, be sure to:

- Attach a tag to the unit identifying the owner and indicating the required service or repair. Include the model number and full serial number.
- Place the unit in its original container with appropriate packaging material for shipping.
- Secure the container with strong tape or metal bands.

If the original shipping container is not available, place your unit in a container which will ensure at least 4 inches of compressible packaging material around all sides for the instrument. Use static-free packaging materials to avoid additional damage to your unit.

Agilent suggests that you always insure shipments.

Cleaning

Clean the outside of the instrument with a soft, lint-free, slightly dampened cloth. Do not use detergent. Disassembly is not required or recommended for cleaning.

Electrostatic Discharge (ESD) Precautions

Almost all electrical components can be damaged by electrostatic discharge (ESD) during handling. Component damage can occur at electrostatic discharge voltages as low as 50 volts.

The following guidelines will help prevent ESD damage when servicing the instrument or any electronic device.

- Disassemble instruments *only* in a static-free work area.
- Use a conductive work area to reduce static charges.
- Use a conductive wrist strap to reduce static charge accumulation.
- Minimize handling.
- Keep replacement parts in original static-free packaging.
- Remove all plastic, foam, vinyl, paper, and other static-generating materials from the immediate work area.
- Use *only* anti-static solder suckers.

Surface Mount Repair

Surface mount components should only be removed using soldering irons or desoldering stations expressly designed for surface mount components. Use of conventional solder removal equipment will almost always result in permanent damage to the printed circuit board and will void your Agilent Technologies factory warranty.

Troubleshooting Hints

This section provides a brief check list of common failures. Before troubleshooting or repairing the instrument, make sure the failure is in the instrument rather than any external connections. Also make sure that the instrument is accurately calibrated within the last year (*see "Calibration Interval", on page 50*). The instrument's circuits allow troubleshooting and repair with basic equipment such as a 6½ digit multimeter.

Unit is Inoperative

- Verify that the ac power cord is connected to the instrument.
- Verify that the front-panel On/Standby switch has been pushed.

Unit Reports Error 705

This error may be produced if you accidentally turn off power to the unit during a calibration or while changing a non-volatile state of the instrument. Recalibration or resetting the state should clear the error.

If the error persists, a hardware failure may have occurred.

Unit Fails Self-Test

Ensure that all terminal connections (both front panel and rear terminals) are removed while the self-test is performed.

Power Supplies

Verify the power supplies generated on the A1 board.

WARNING ***Shock Hazard. To check the power supplies, remove the instrument cover as described in "Disassembly", on page 140. Be sure to use the correct ground point when checking the supplies.***

The power supply voltages are tabulated below.

Power Supply	Minimum	Maximum
+12v_ER	11.4 V	12.6 V
+5V_ER	4.75 V	5.25 V
–5.2 V	–5.46 V	–4.94 V
–16 V	–16.8 V	–15.2 V
+16 V	15.2 V	16.8 V
+5.2 V	4.94 V	5.46 V
+3.3 V	3.135	3.465
–2.1 V	–2.205	–1.995

- Power supply test points are marked on the A1 circuit board.
- Circuit failures can cause heavy supply loads which may pull down the regulator output voltage.
- Always check that the power supplies are free of ac oscillations using an oscilloscope.
- The main power supply contains a fuse rated F5AH250V. Replacing this fuse is not recommended. Replace the entire main power supply assembly.

Self-Test Procedures

Power-On Self-Test

Each time the instrument is powered on, a small set of self-tests are performed. These tests check that the minimum set of logic and output hardware are functioning properly. The power-on self test consists of tests 601 through 606.

Complete Self-Test

To perform a complete self-test:

1 Press (Utility) on the front panel.

2 Select the **Self Test** softkey from the “Test / Cal” menu.

A complete description of the self-tests is given in the next section. The instrument will automatically perform the complete self-test procedure when you release the key. The self-test will complete in approximately 30 seconds.

- If the self-test is successful, “Self Test Pass” is displayed on the front panel.
- If the self-test fails, “Self Test Fail” and an error number are displayed.

Self-Tests

A complete self-test performs the following tests. A failing test is indicated by the test number and description in the display.

601 **System logic failed**
This test performs a write/readback test on the two control registers (Control Register 1 and Control Register 2/Keyboard Readback) the main logic FPGA, U302. Failure of this test indicates that the main CPU (U202) can't communicate with the main logic FPGA (U301).

602 **DSP Failed**
This test checks if the DSP (U506) is running and able to respond to commands from the main processor.

603 **Waveform logic failed**
This test performs a write/readback test on several of the registers in the waveform logic FPGA (U1201). Failure of this test indicates that the main CPU (U202) can't communicate with the waveform logic FPGA.

604 **Even Waveform memory failed**
This test performs a write/readback test of the entire waveform memory (64k). The following procedure is carried out for each 16K memory block in the even and odd memory banks (8 total). Waveform memory is zeroed out then readback to verify that all memory locations are zero. Each memory location is written with a data value equal to its address (modulo 16384). The entire memory is readback to make sure that the appropriate data values were written. When a memory address fails a test, the routine reports an error and skips ahead to the next block of waveform memory, without testing any more addresses in bad memory block. Failure can occur due to waveform memory or waveform logic problems.

605 **Odd Waveform Memory Failed**
Same as test 604, but is performed on the odd waveform memory bank.

606 **Cross-isolation interface failed**
This test verifies that the cross-isolation communications interface is working properly. This test has the I/O processor U105-A) perform an internal self-test and return the result. A failure indicates that I/O processor either timed out or failed its self-test.

607 - 614 **Power supplies failed**

This test uses the internal ADC to measure the voltages of the internal power supplies. A failure means one or more of the power supplies measured outside the expected range. The error numbers and their corresponding power supplies are listed below.

607: Ground
608: +16
609: +12V
610: +5V
611: +3.3V
612: -2.1V
613: -5.2V
614: -16V

615 **Primary phase locked loop failed**

This test looks at the lock signal on the primary phase locked loop to determine if the PLL is locked. The instrument is then switched to pulse mode and the secondary PLL's lock is tested at 200 MHz and 100 MHz. Primary PLL's lock state is checked again after returning to normal (DDS) mode. A failure indicates that the PLL's (primary or secondary) are having trouble maintaining a lock.

616 **Secondary phase locked loop failed at 200MHz**

This test looks at the lock signal on the secondary phase locked loop at a frequency of 200 MHz to determine if the PLL is locked.

617 **Secondary phase locked loop failed at 100MHz**

Same as test 616 except the PLL is tested at 100 MHz.

618 - 625

System DAC failed

These tests use the internal ADC (U1701) to verify that the system DACs are working correctly. There are eight system DACs. For each DAC, ADC readings are taken at 25%, 50%, and 75% of full scale. The delta between ADC readings are compared to the delta of DAC values to make sure the DAC outputs scale proportionally to the inputs. A failure indicates a malfunctioning system DAC(s), sysDac Mux channel(s) circuit, or ADC Mux channel(s).

618: Contrast DAC
619: Leading Edge DAC
620: Trailing Edge DAC
621: Threshold DAC
622: Timebase Cal DAC
623: Offset DAC
624: Null DAC
625: Amplitude DAC

626 - 630

Relays failed

This test uses the internal ADC to test whether the output path relays, hybrid amplifier, and output attenuators are working properly. First, the straight through, no attenuator/amplifier, path is setup and an ADC reading is taken. Each of the other attenuators and hybrid amplifier are switched in, only one in the path at a time, and an ADC reading is taken for each one. The gain of each path is given by the ratio of its ADC reading to ADC reading of the straight through path.
A failure means that either the relay isn't being properly switched or the attenuator/amplifier isn't providing the expected attenuation/gain.

626: Analog/Digital path selector
627: -10 dB attenuator path
628: -20 dB attenuator path
629: +20 dB amplifier path
630: Internal ADC overranged during one of the above tests

Disassembly

The following tools are recommended for disassembly.

- T15 Torx® driver (all screws)
- 11 mm nut driver (front-panel disassembly)
- 14 mm nut driver (rear-panel BNC connectors)
- 5 mm nut driver (rear-panel RS-232 connector)
- #1 Pozi-Drive (for display assembly)

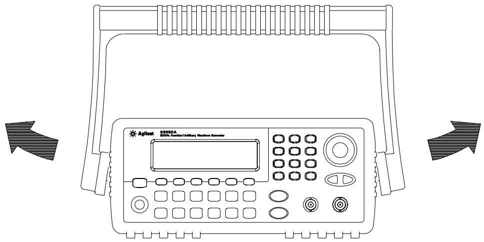
WARNING ***SHOCK HAZARD. Only service-trained personnel who are aware of the hazards involved should remove the instrument covers. To avoid electrical shock and personal injury, make sure to disconnect the power cord from the instrument before removing the covers.***

Torx® is a registered trademark of Camcor/Textron, Inc.

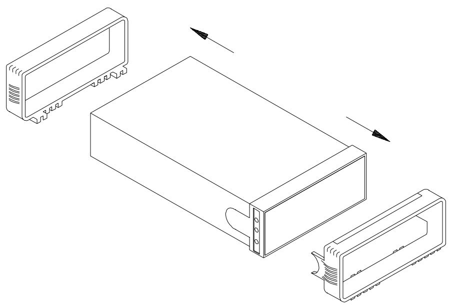
General Disassembly Procedure

1 Turn off the power. Remove all cables from the instrument.

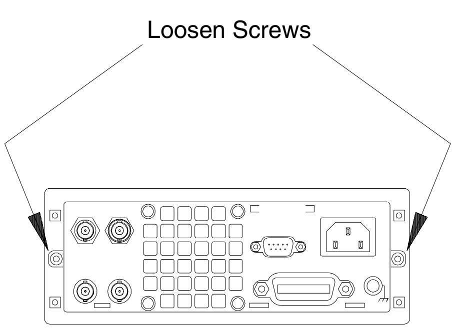
2 Rotate the handle upright and pull off.



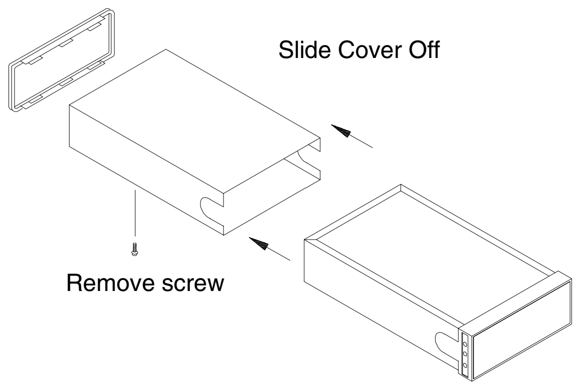
3 Pull off the instrument bumpers.



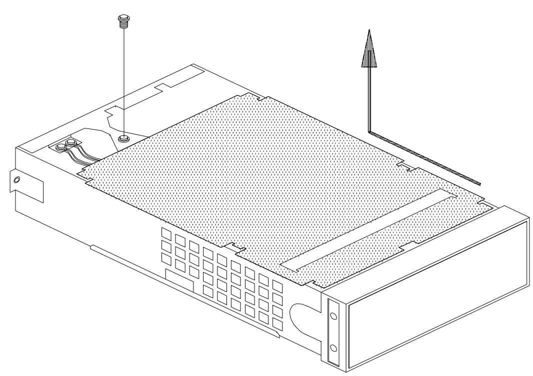
4 Loosen the two captive screws in the rear bezel and remove the rear bezel.



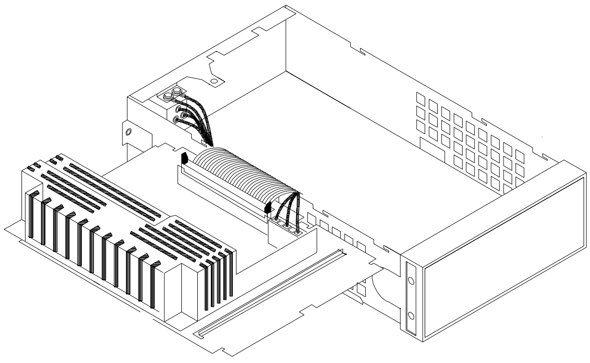
5 Remove the screw in the bottom of the instrument cover. Slide off the cover.



6 Remove the screw securing the top shield. Slide the shield back and then up to lift off. The A3 power supply assembly is attached to the top shield.



7 Lay the top shield and power supply assembly to the side.

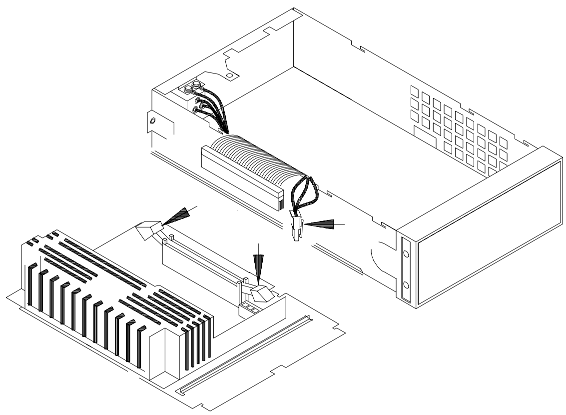


Many of the service procedures can now be performed without further disassembly. Troubleshooting and service procedures that require power be applied can be performed with the instrument in this state of disassembly.

WARNING ***SHOCK HAZARD. Only service-trained personnel who are aware of the hazards involved should remove the instrument covers. Dangerous voltages may be encountered with the instrument covers removed.***

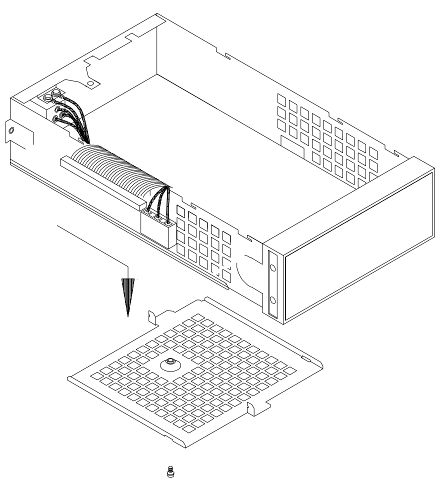
Removing the Main Power Supply Assembly

Disconnect the ribbon cable and the power cable. The main power supply should be replaced as an assembly. Remove the four screws to remove the power supply assembly from the top shield and safety shield. Be sure to retain the top shield and safety shield for re-use.

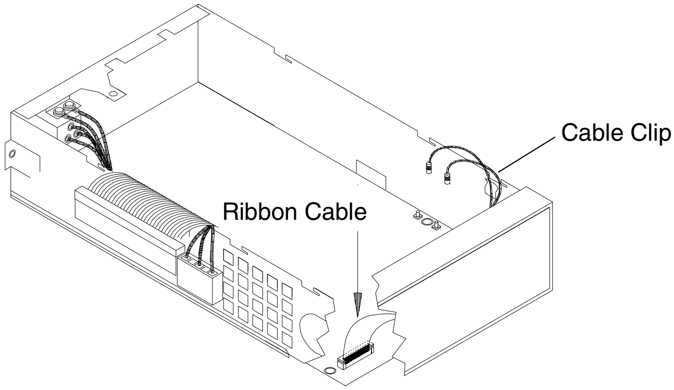


Front-Panel Removal Procedure

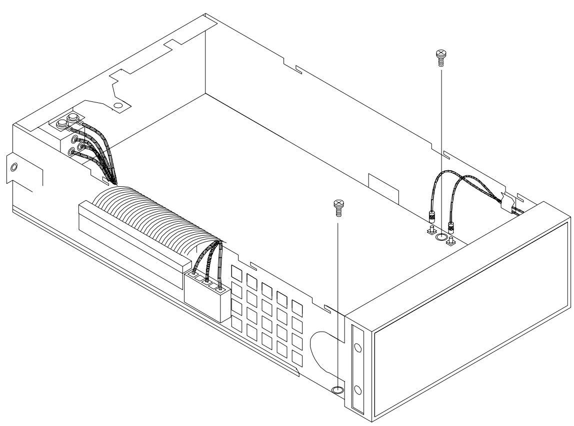
1 Turn the unit over. Remove the bottom shield screw and bottom shield.



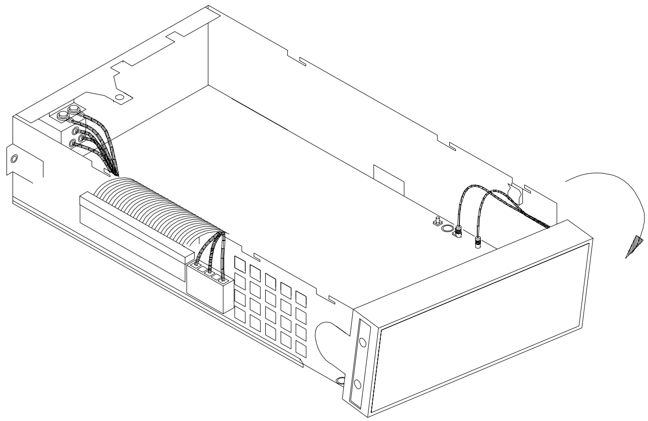
2 Pull up to remove the Sync and Output cable from the cable clip. Disconnect the Sync and Output cable from the main board. Pull up the clamp and disconnect the front panel ribbon cable from the main board.



3 Remove the two screws holding the front edge of the A1 assembly to the chassis.

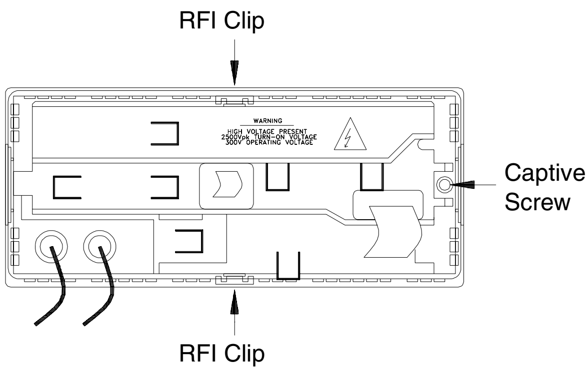


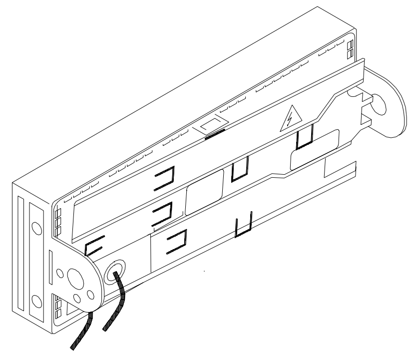
4 There should now be enough play in the chassis sides and front panel plastic to allow the side of the front panel to be disconnected from the chassis. Remove the right side first as shown.



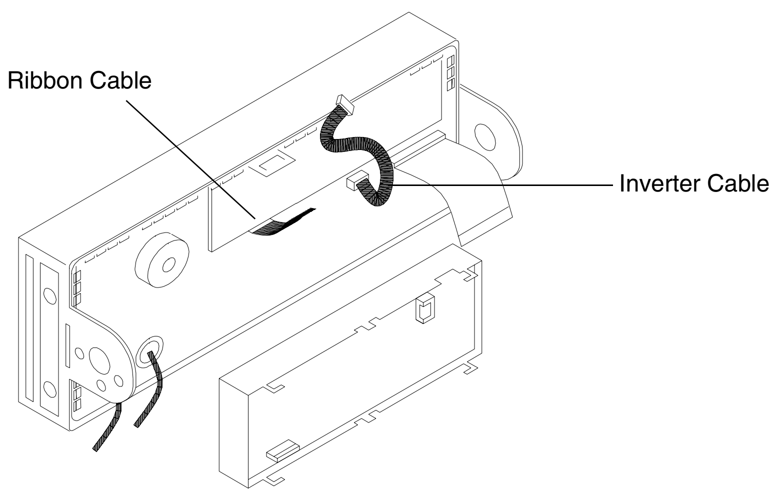
Front-Panel Disassembly

1 Remove the captive screw holding the safety shield. Carefully pry the RFI shield clips out of the slots in the safety shield and remove the safety shield.

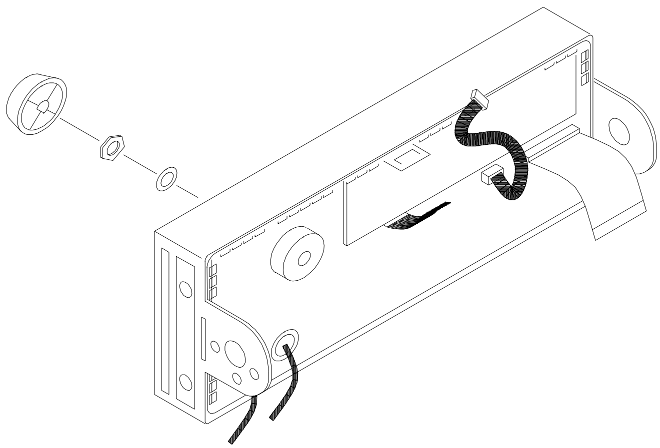




2 Unplug the inverter cable on the display assembly. Lift up the clamp and unplug the ribbon cable. Lift out the display assembly.

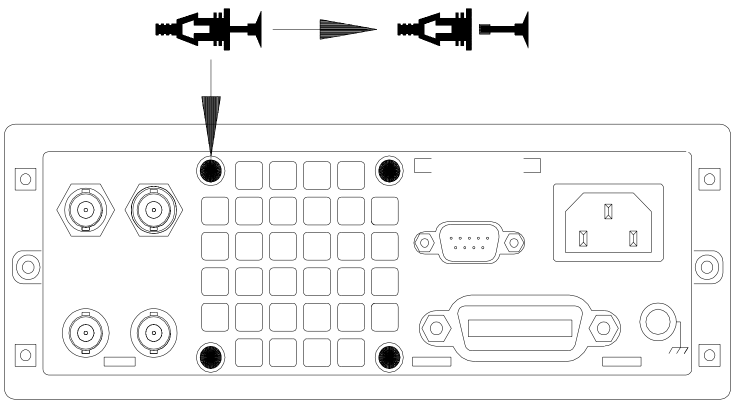


3 Remove the knob. Remove the nut holding the rotary encoder to the front-panel. Lift out the A2 assembly.



Removing and Replacing the Fan

The fan is held in place by four custom vibration-reducing fasteners. To remove the fan, disconnect the fan cable from the A1 assembly. Pry up and pull out the center tab of the fasteners.



Replaceable Parts

Replaceable Parts

This chapter contains information for ordering replacement parts for your instrument. The parts lists are divided into the following sections.

Parts are listed in alphanumeric order according to their schematic reference designators. The parts lists include a brief description of each part with applicable Agilent part number and manufacturer part number.

To Order Replaceable Parts

You can order replaceable parts from Agilent using the Agilent part number or directly from the manufacturer using specified manufacturer's part number shown. Note that not all parts listed in this chapter are available as field-replaceable parts. To order replaceable parts from Agilent, do the following:

1. Contact your nearest Agilent Sales Office or Service Center.
2. Identify the parts by the Agilent part number shown in the replaceable parts list.
3. Provide the instrument model number and serial number.

33250-66511 – Main PC Assembly (A1)

Reference Designator	Agilent Part Number	Qty	Part Description	Mfr. Code	Mfr. Part Number
C101 - C102	0160-7798	288	CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C103	0160-5947	11	CAP-FXD 1000pF 50 V	02010	08055C102KAT A
C104 - C107	0160-7736	56	CAP-FXD 1uF +-10% 16 V CER X7S	06352	C3216X7R1C105K
C108	0160-5961	2	FIXED CAPACITOR; 22PF 50 VOLTS	02010	08055A220JAT A
C109	0160-5957	4	CAP-FXD 47pF +-5% 50 V CER C0G	02010	08055A470JAT A
C110 - C113	0160-7736		CAP-FXD 1uF +-10% 16 V CER X7S	06352	C3216X7R1C105K
C114	0180-4918	1	CAP 100UF 10V 20% TANTD	05524	293D107X0010D2
C115 - C125	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C201	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C202	0160-5947		CAP-FXD 1000pF 50 V	02010	08055C102KAT A
C203 - C205	0160-7736		CAP-FXD 1uF +-10% 16 V CER X7S	06352	C3216X7R1C105K
C206 - C229	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C301 - C323	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C401	0160-5947		CAP-FXD 1000pF 50 V	02010	08055C102KAT A
C402	0160-7061	3	CAP-FXD 2200pF 50 V	02010	08055C222KAT
C403	0180-3751	1	CAP-FXD 1uF +-20% 35 V TA	02010	TAJB105M035
C404	0160-7736		CAP-FXD 1uF +-10% 16 V CER X7S	06352	C3216X7R1C105K
C405	0180-4577	3	CAP-FXD 10uF +-20% 10 V TA	12340	T491B106M010AS
C406	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C407	0160-8361	4	CAP 0.22UF 25 V	06352	C2012X7R1E224K
C408	0160-5947		CAP-FXD 1000pF 50 V	02010	08055C102KAT A
C409 - C413	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C501	0160-7736		CAP-FXD 1uF +-10% 16 V CER X7S	06352	C3216X7R1C105K
C502	0160-5947		CAP-FXD 1000pF 50 V	02010	08055C102KAT A
C503 - C518	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C601 - C603	0160-7736		CAP-FXD 1uF +-10% 16 V CER X7S	06352	C3216X7R1C105K
C604	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C605 - C606	0160-7736		CAP-FXD 1uF +-10% 16 V CER X7S	06352	C3216X7R1C105K
C607	0180-4538	16	CAP-FXD 100uF +-20% 10 V TA	12340	T495X107M010AS
C608	0160-7736		CAP-FXD 1uF +-10% 16 V CER X7S	06352	C3216X7R1C105K
C609	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C610	0160-5945	21	C MLYS .01U 50V CAP.	02010	08055C103KAT A
C611	0160-5957		CAP-FXD 47pF +-5% 50 V CER C0G	02010	08055A470JAT A
C612	0160-7736		CAP-FXD 1uF +-10% 16 V CER X7S	06352	C3216X7R1C105K
C613	0160-5945		C MLYS .01U 50V CAP.	02010	08055C103KAT A
C614	0160-7736		CAP-FXD 1uF +-10% 16 V CER X7S	06352	C3216X7R1C105K
C615	0160-5945		C MLYS .01U 50V CAP.	02010	08055C103KAT A
C616	0160-5950	3	CAP-FXD 470pF 50 V	02010	08055A471JAT A
C617 - C618	0160-7736		CAP-FXD 1uF +-10% 16 V CER X7S	06352	C3216X7R1C105K
C619	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C620	0160-7911	2	CAP-FXD 4700pF +-1% 50 V CER C0G	12340	C1206C472F5GAC
C621	0160-7307	1	CAP-FXD 180pF 50 V	02010	08055A181FAT_A

Reference Designator	Agilent Part Number	Qty	Part Description	Mfr. Code	Mfr. Part Number
C622	0160-7061		CAP-FXD 2200pF 50 V	02010	08055C222KAT
C623	0160-7736		CAP-FXD 1uF +-10% 16 V CER X7S	06352	C3216X7R1C105K
C624	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C625	0160-7736		CAP-FXD 1uF +-10% 16 V CER X7S	06352	C3216X7R1C105K
C626	0160-5945		C MLYS .01U 50V CAP.	02010	08055C103KAT A
C627	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C628	0160-6444	3	CAP-FXD 0.022uF 50 V	02010	08055C223KAT
C629	0160-7061		CAP-FXD 2200pF 50 V	02010	08055C222KAT
C630	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C631 - C632	0160-7736		CAP-FXD 1uF +-10% 16 V CER X7S	06352	C3216X7R1C105K
C701 - C703	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C704	0160-7736		CAP-FXD 1uF +-10% 16 V CER X7S	06352	C3216X7R1C105K
C705	0160-5945		C MLYS .01U 50V CAP.	02010	08055C103KAT A
C706	0160-5975	4	CAP-FXD 10pF 50 V	02010	08055A100JAT A
C707	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C708	0160-7736		CAP-FXD 1uF +-10% 16 V CER X7S	06352	C3216X7R1C105K
C709 - C718	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C801	0180-4758	2	CAP-FXD 47uF +-20% 20 V TA	12340	T491D476M020AS
C802 - C804	0160-7736		CAP-FXD 1uF +-10% 16 V CER X7S	06352	C3216X7R1C105K
C805	0180-4577		CAP-FXD 10uF +-20% 10 V TA	12340	T491B106M010AS
C806 - C808	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C809	0160-5967	9	CF 100PF 5%	06352	C2012COG1H101J
C810	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C811	0160-7708	19	CAP 1000pF 50 V	02010	08055A102JATRA
C812 - C813	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C814	0160-5945		C MLYS .01U 50V CAP.	02010	08055C103KAT A
C815	0160-7736		CAP-FXD 1uF +-10% 16 V CER X7S	06352	C3216X7R1C105K
C816	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C817	0160-7757	5	CAP-FXD 47pF +-1% 50 V CER C0G	02010	08055A470FATMA
C901	0160-7736		CAP-FXD 1uF +-10% 16 V CER X7S	06352	C3216X7R1C105K
C902	0160-5945		C MLYS .01U 50V CAP.	02010	08055C103KAT A
C903	0160-5958	1	CAP-FXD 39pF +-5% 50 V CER C0G	02010	08055A390JAT A
C904	0160-5947		CAP-FXD 1000pF 50 V	02010	08055C102KAT A
C905	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C906	0160-5967		CF 100PF 5%	06352	C2012COG1H101J
C907	0160-7911		CAP-FXD 4700pF +-1% 50 V CER C0G	12340	C1206C472F5GAC
C908	0160-5950		CAP-FXD 470pF 50 V	02010	08055A471JAT A
C909	0160-5947		CAP-FXD 1000pF 50 V	02010	08055C102KAT A
C911	0160-8361		CAP 0.22UF 25 V	06352	C2012X7R1E224K
C912	0160-7736		CAP-FXD 1uF +-10% 16 V CER X7S	06352	C3216X7R1C105K
C913	0160-5945		C MLYS .01U 50V CAP.	02010	08055C103KAT A
C914	0160-7708		CAP 1000pF 50 V	02010	08055A102JATRA
C915 - C917	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C918	0160-5945		C MLYS .01U 50V CAP.	02010	08055C103KAT A
C919	0160-6982	1	CAP-FXD 0.033uF 50 V	02010	08055C333KAT_A

Reference Designator	Agilent Part Number	Qty	Part Description	Mfr. Code	Mfr. Part Number
C920	0160-5945		C MLYS .01U 50V CAP.	02010	08055C103KAT A
C921	0160-7707	2	CAP-FXD 0.47uF +-10% 16 V CER X7R	06352	C3216X7R1C474K
C922 - C923	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C924 - C925	0160-5945		C MLYS .01U 50V CAP.	02010	08055C103KAT A
C926	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C1001 - C1002	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C1003	0160-5947		CAP-FXD 1000pF 50 V	02010	08055C102KAT A
C1004 - C1005	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C1006	0160-5957		CAP-FXD 47pF +-5% 50 V CER C0G	02010	08055A470JAT A
C1007	0160-7721	1	CAP-FXD 82pF +-1% 50 V CER C0G	02010	08055A820FATMA
C1008	0160-7708		CAP 1000pF 50 V	02010	08055A102JATRA
C1009	0160-7736		CAP-FXD 1uF +-10% 16 V CER X7S	06352	C3216X7R1C105K
C1010	0160-5945		C MLYS .01U 50V CAP.	02010	08055C103KAT A
C1011	0160-7736		CAP-FXD 1uF +-10% 16 V CER X7S	06352	C3216X7R1C105K
C1012	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C1013	0160-5952	4	CAP-FXD 330pF +-5% 50 V CER C0G	02010	08055A331JAT A
C1014	0160-5967	9	CF 100PF 5%	06352	C2012COG1H101J
C1015- C1017	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C1018 - C1019	0160-5944	15	CAP-FXD 0.047uF +-10% 50 V CER X7R	02010	08055C473KAT A
C1020 - C1025	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C1101	0160-5967		CF 100PF 5%	06352	C2012COG1H101J
C1102	0160-5945		C MLYS .01U 50V CAP.	02010	08055C103KAT A
C1103	0160-5963	1	CAP-FXD 18pF 50 V	02010	08055A180JAT A
C1104	0160-5955	2	CAP-FXD 68pF +-5% 50 V CER C0G	02010	08055A680JATRA
C1105	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C1106	0160-7736		CAP-FXD 1uF +-10% 16 V CER X7S	06352	C3216X7R1C105K
C1107	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C1108 - C1117	0160-5944		CAP-FXD 0.047uF +-10% 50 V CER X7R	02010	08055C473KAT A
C1118	0160-5945		C MLYS .01U 50V CAP.	02010	08055C103KAT A
C1119	0160-5944		CAP-FXD 0.047uF +-10% 50 V CER X7R	02010	08055C473KAT A
C1120 - C1126	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C1201	0180-4538		CAP-FXD 100uF +-20% 10 V TA	12340	T495X107M010AS
C1202 - C1219	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C1220	0160-7736		CAP-FXD 1uF +-10% 16 V CER X7S	06352	C3216X7R1C105K
C1301 - C1329	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C1401 - C1426	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C1501	0160-5945		C MLYS .01U 50V CAP.	02010	08055C103KAT A
C1502	0160-7736		CAP-FXD 1uF +-10% 16 V CER X7S	06352	C3216X7R1C105K
C1503	0160-5945		C MLYS .01U 50V CAP.	02010	08055C103KAT A
C1504	0180-4577		CAP-FXD 10uF +-20% 10 V TA	12340	T491B106M010AS
C1505	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C1506	0160-7736		CAP-FXD 1uF +-10% 16 V CER X7S	06352	C3216X7R1C105K
C1507	0160-5945		C MLYS .01U 50V CAP.	02010	08055C103KAT A
C1508	0160-5976	2	CAP-FXD 12pF 50 V	02010	08051A120JAT A
C1509	0160-5945		C MLYS .01U 50V CAP.	02010	08055C103KAT A

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C1510	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C1511	0160-7722	4	CAP-FXD 39pF +-1% 50 V CER C0G	02010	08055A390FATMA
C1512	0160-7708		CAP 1000pF 50 V	02010	08055A102JATRA
C1513	0160-7736		CAP-FXD 1uF +-10% 16 V CER X7S	06352	C3216X7R1C105K
C1514	0160-5952		CAP-FXD 330pF +-5% 50 V CER C0G	02010	08055A331JAT A
C1515	0160-5967		CF 100PF 5%	06352	C2012COG1H101J
C1516 - C1522	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C1523	0160-7736		CAP-FXD 1uF +-10% 16 V CER X7S	06352	C3216X7R1C105K
C1524 - C1531	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C1532	0160-7736		CAP-FXD 1uF +-10% 16 V CER X7S	06352	C3216X7R1C105K
C1533	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C1601	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C1602	0180-4559	2	CAP-FXD 68uF +-20% 10 V TA	12340	T491D686M010AS
C1603	0160-8361		CAP 0.22UF 25 V	06352	C2012X7R1E224K
C1604	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C1605	0160-6444		CAP-FXD 0.022uF 50 V	02010	08055C223KAT
C1606 - C1607	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C1610	0160-5956	2	CAP-FXD 56pF 50 V	02010	08055A560JAT A
C1611	0160-6102	1	CAT008 CAP,CER,CHIP	02010	12065A152JATRA
C1612	0160-7940	1	CAP-FXD 0.027uF +-10% 50 V CER X7R	02010	08055C273KATA
C1613	0160-8779	1	CAP .056UF 50V 10% COG 1206	12340	C1206C564K4RAC
C1615	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C1616	0160-6444		CAP-FXD 0.022uF 50 V	02010	08055C223KAT
C1617	0160-5942	1	CAP-FXD 1pF 50 V	02010	08051A1R0CAT A
C1618	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C1619	0160-8361		CAP 0.22UF 25 V	06352	C2012X7R1E224K
C1620	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C1621	0180-4559		CAP-FXD 68uF +-20% 10 V TA	12340	T491D686M010AS
C1622 - C1625	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C1701	0160-8279	2	CAP 2.7PF 50V +1-0.05PF COG 0805	02010	08055A2R7CATA
C1702	0160-5962	3	CAP-FXD 15pF +-5% 50 V CER C0G	09939	GRM40C0G150J050
C1703	0160-5961		FIXED CAPACITOR; 22PF 50 VOLTS	02010	08055A220JAT A
C1704	0160-5975		CAP-FXD 10pF 50 V	02010	08055A100JAT A
C1705	0160-5962		CAP-FXD 15pF +-5% 50 V CER C0G	09939	GRM40C0G150J050
C1707	0160-7757		CAP-FXD 47pF +-1% 50 V CER C0G	02010	08055A470FATMA
C1708	0160-5969	2	CAPACITOR, FIXED CERAMIC CHIP	02010	08051A3R3CAT A
C1709	0160-7722		CAP-FXD 39pF +-1% 50 V CER C0G	02010	08055A390FATMA
C1710	0160-5970	1	CAP-FXD 3.9pF 50 V	06352	C2012COG1H3R9C
C1711	0160-7722		CAP-FXD 39pF +-1% 50 V CER C0G	02010	08055A390FATMA
C1712	0160-8280	1	CAP-FXD 4.7PF +-5% 50 V CER COG	02010	08055A4R7CATA
C1713	0160-5975		CAP-FXD 10pF 50 V	02010	08055A100JAT A
C1714	0160-5976		CAP-FXD 12pF 50 V	02010	08051A120JAT A
C1716 - C1717	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C1718	0160-7324	1	CAP-FXD 120pF 50 V	02010	08055A121FATMA
C1719	0160-5975		CAP-FXD 10pF 50 V	02010	08055A100JAT A

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C1720	0160-7757		CAP-FXD 47pF +-1% 50 V CER C0G	02010	08055A470FATMA
C1721	0160-5972	2	CAP-FXD 5.6pF 50 V CER C0G	06352	C2012COG1H5R6D
C1722	0160-7722		CAP-FXD 39pF +-1% 50 V CER C0G	02010	08055A390FATMA
C1723	0160-5972		CAP-FXD 5.6pF 50 V CER C0G	06352	C2012COG1H5R6D
C1724	0160-5969		CAPACITOR, FIXED CERAMIC CHIP	02010	08051A3R3CAT A
C1725	0160-7707		CAP-FXD 0.47uF +-10% 16 V CER X7R	06352	C3216X7R1C474K
C1726 - C1732	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C1733 - C1734	0160-7708		CAP 1000pF 50 V	02010	08055A102JATRA
C1735	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C1737	0160-7416	1	CAP-FXD 1500pF +-10% 50 V CER X7R	06352	C2012X7R1H152KT
C1738	0160-7736		CAP-FXD 1uF +-10% 16 V CER X7S	06352	C3216X7R1C105K
C1739	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C1740	0160-5962		CAP-FXD 15pF +-5% 50 V CER C0G	09939	GRM40C0G150J050
C1741	0160-7736		CAP-FXD 1uF +-10% 16 V CER X7S	06352	C3216X7R1C105K
C1742 - C1746	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C1801 - C1802	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C1803	0160-5971	1	CAP-FXD 4.7pF +-10.64pct 50 V CER C0G	09939	GRM2165C1H4R7DD01D
C1804	0160-7736		CAP-FXD 1uF +-10% 16 V CER X7S	06352	C3216X7R1C105K
C1805	0160-8279		CAP 2.7PF 50V +1-0.05PF COG 0805	02010	08055A2R7CATA
C1806	0160-5949	1	CAP-FXD 680pF 50 V	06352	C2012COG1H681J
C1807	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C1808 - C1809	0160-7708		CAP 1000pF 50 V	02010	08055A102JATRA
C1810	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C1901	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C1902	0160-5950		CAP-FXD 470pF 50 V	02010	08055A471JAT A
C1903	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C1904	0160-5945		C MLYS .01U 50V CAP.	02010	08055C103KAT A
C1905	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C1906	0160-7736		CAP-FXD 1uF +-10% 16 V CER X7S	06352	C3216X7R1C105K
C1907 - C1910	0160-7708		CAP 1000pF 50 V	02010	08055A102JATRA
C1911	0180-3975	2	CAP-FXD 2.2uF +-20% 20 V TA	02010	TAJB225M020
C1912	0180-4535	7	CAP-FXD 47uF +-20% 20 V TA	12340	T495X476M020AS
C1913	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C1914	0160-7736		CAP-FXD 1uF +-10% 16 V CER X7S	06352	C3216X7R1C105K
C1915 - C1918	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C1919	0160-5979	1	CAP-FXD 1.5pF 50 V	00939	GRM40-001COG1R5C050
C1920 - C1921	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C1923	0160-5977	2	CAPACITOR, CERAMIC	02010	08051A2CATRA
C1924	0160-7757		CAP-FXD 47pF +-1% 50 V CER C0G	02010	08055A470FATMA
C1925	0160-5977		CAPACITOR, CERAMIC	02010	08051A2CATRA
C1926	0160-7757		CAP-FXD 47pF +-1% 50 V CER C0G	02010	08055A470FATMA
C1927	0160-5947		CAP-FXD 1000pF 50 V	02010	08055C102KAT A
C1929	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C1930	0160-7736		CAP-FXD 1uF +-10% 16 V CER X7S	06352	C3216X7R1C105K
C1931	0180-3975		CAP-FXD 2.2uF +-20% 20 V TA	02010	TAJB225M020

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C1932	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C1933	0180-4535		CAP-FXD 47uF +-20% 20 V TA	12340	T495X476M020AS
C1934	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C1935 - C1941	0160-7708		CAP 1000pF 50 V	02010	08055A102JATRA
C1942	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C1950	0160-5972		CAP-FXD 5.6pF 50 V CER C0G	06352	C2012COG1H5R6D
C2001	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C2002 - C2003	0180-4535		CAP-FXD 47uF +-20% 20 V TA	12340	T495X476M020AS
C2004	0180-4758		CAP-FXD 47uF +-20% 20 V TA	12340	T491D476M020AS
C2005	0180-4538		CAP-FXD 100uF +-20% 10 V TA	12340	T495X107M010AS
C2006	0160-7736		CAP-FXD 1uF +-10% 16 V CER X7S	06352	C3216X7R1C105K
C2007	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C2008	0180-4538		CAP-FXD 100uF +-20% 10 V TA	12340	T495X107M010AS
C2009	0180-4535		CAP-FXD 47uF +-20% 20 V TA	12340	T495X476M020AS
C2010	0160-7736		CAP-FXD 1uF +-10% 16 V CER X7S	06352	C3216X7R1C105K
C2011	0160-5945		C MLYS .01U 50V CAP.	02010	08055C103KAT A
C2012	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C2013	0160-5955		CAP-FXD 68pF +-5% 50 V CER C0G	02010	08055A680JATRA
C2014	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C2015 - C2016	0180-4538		CAP-FXD 100uF +-20% 10 V TA	12340	T495X107M010AS
C2017	0180-4535		CAP-FXD 47uF +-20% 20 V TA	12340	T495X476M020AS
C2018	0160-7736		CAP-FXD 1uF +-10% 16 V CER X7S	06352	C3216X7R1C105K
C2019	0180-4545	2	CAP-FXD 4.7uF +-20% 20 V TA	12340	T491B475M020AS
C2020 - C2022	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C2023	0180-4538		CAP-FXD 100uF +-20% 10 V TA	12340	T495X107M010AS
C2024	0160-7736		CAP-FXD 1uF +-10% 16 V CER X7S	06352	C3216X7R1C105K
C2025	0160-5967		CF 100PF 5%	06352	C2012COG1H101J
C2026	0160-5952		CAP-FXD 330pF +-5% 50 V CER C0G	02010	08055A331JAT A
C2027 - C2028	0180-4538		CAP-FXD 100uF +-20% 10 V TA	12340	T495X107M010AS
C2029	0160-7736		CAP-FXD 1uF +-10% 16 V CER X7S	06352	C3216X7R1C105K
C2030	0160-5956		CAP-FXD 56pF 50 V	02010	08055A560JAT A
C2031	0160-5947		CAP-FXD 1000pF 50 V	02010	08055C102KAT A
C2032	0160-5967		CF 100PF 5%	06352	C2012COG1H101J
C2033	0160-7734	2	Capacitor-FXD 68pF +-1% 50 V CER C0G	02010	08055A680FAT_A
C2034	0180-4535		CAP-FXD 47uF +-20% 20 V TA	12340	T495X476M020AS
C2035	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C2036 - C2038	0180-4538		CAP-FXD 100uF +-20% 10 V TA	12340	T495X107M010AS
C2039	0180-4545		CAP-FXD 4.7uF +-20% 20 V TA	12340	T491B475M020AS
C2040 - C2042	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C2043	0160-5944		CAP-FXD 0.047uF +-10% 50 V CER X7R	02010	08055C473KAT A
C2044	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C2045	0160-5952		CAP-FXD 330pF +-5% 50 V CER C0G	02010	08055A331JAT A
C2046	0160-5957		CAP-FXD 47pF +-5% 50 V CER C0G	02010	08055A470JAT A
C2047	0160-5944		CAP-FXD 0.047uF +-10% 50 V CER X7R	02010	08055C473KAT A
C2048	0160-5947		CAP-FXD 1000pF 50 V	02010	08055C102KAT A

Reference Designator	Agilent Part Number	Qty	Part Description	Mfr. Code	Mfr. Part Number
C2049	0160-5967		CF 100PF 5%	06352	C2012COG1H101J
C2050	0160-7734		Capacitor-FXD 68pF +-1% 50 V CER C0G	02010	08055A680FAT_A
C2051 - C2052	0180-4538		CAP-FXD 100uF +-20% 10 V TA	12340	T495X107M010AS
C2053	0160-5967		CF 100PF 5%	06352	C2012COG1H101J
C2054	0160-7736		CAP-FXD 1uF +-10% 16 V CER X7S	06352	C3216X7R1C105K
C2055 - C2056	0180-4538		CAP-FXD 100uF +-20% 10 V TA	12340	T495X107M010AS
CR101	1906-0291	17	DIODE-DUAL 70V 100MA T0-236AA	02910	BAV99
CR301	1906-0291		DIODE-DUAL 70V 100MA T0-236AA	02910	BAV99
CR601 - CR602	1906-0291		DIODE-DUAL 70V 100MA T0-236AA	02910	BAV99
CR603	1906-0334	1	DIODE- 200V 200MA	02237	3K49
CR604	1906-0291		DIODE-DUAL 70V 100MA T0-236AA	02910	BAV99
CR701 - CR702	1906-0291		DIODE-DUAL 70V 100MA T0-236AA	02910	BAV99
CR801	1900-0245	1	DIODE-SCHOTTKY SM SIG	02364	HSMS-2805
CR802	1906-0291		DIODE-DUAL 70V 100MA T0-236AA	02910	BAV99
CR901	0122-0374	1	DIO VAR 2X OT23	02865	SMV1255-004
CR1001	1906-0291		DIODE-DUAL 70V 100MA T0-236AA	02910	BAV99
CR1101	1906-0291		DIODE-DUAL 70V 100MA T0-236AA	02910	BAV99
CR1301	1906-0291		DIODE-DUAL 70V 100MA T0-236AA	02910	BAV99
CR1501	1906-0291		DIODE-DUAL 70V 100MA T0-236AA	02910	BAV99
CR1601 - CR1602	1900-0321	2	DIODE-PAIR MATCHED	02364	HSMS-2865
CR1801	1906-0291		DIODE-DUAL 70V 100MA T0-236AA	02910	BAV99
CR1901	1902-1512	1	DIODE-ZNR 7.5V 5% TO-236 (SOT-23)	02910	BZX84C7V5
CR1902 - CR1903	1906-0291		DIODE-DUAL 70V 100MA T0-236AA	02910	BAV99
CR1904 - CR1906	1902-1487	3	DIODE-ZENER 12V 5% TO 236	02910	BZX84-C12
CR2001	1901-1582	3	DIO-PWR-S	36633	MBR0530T1
CR2002	1901-1332	3	DIODE-PWR-S 40V 1A	02037	MBRS140T3
CR2003	1901-1335	2	DIO-PWR RECT W/CURRENT >5A	36633	MURS140T3
CR2004	1906-0291		DIODE-DUAL 70V 100MA T0-236AA	02910	BAV99
CR2005	1901-1335		DIO-PWR RECT W/CURRENT >5A	36633	MURS140T3
CR2006	1901-1582		DIO-PWR-S	36633	MBR0530T1
CR2007	1901-1332		DIODE-PWR-S 40V 1A	02037	MBRS140T3
CR2008 - CR2010	1906-0395	3	DIODE-DUAL 75V TO-253	02910	BAS28
CR2011	1901-1582		DIO-PWR-S	36633	MBR0530T1
CR2012	1901-1332		DIODE-PWR-S 40V 1A	02037	MBRS140T3
CR2013	1906-0291		DIODE-DUAL 70V 100MA T0-236AA	02910	BAV99
HS1901	1251-5613	1	CONN-SGL CONT	01380	62409-1
J101	1252-1325	2	CONN-POST-TP-HDR	04726	N2510-6002UB
J102	1252-2161	1	CONN-RECT MICRORBN 24-CKT 24-CONT	01380	554923-2
J401	1252-8157	1	CONN_FFC_VERT_FEM_40PIN_FP_SMT	03418	52559-4092
J601	1250-2886	4	CONN_RF_BNC_RA	05879	456-117
J801 - J802	1250-2886		CONN_RF_BNC_RA	05879	456-117
J803	1252-1325		CONN-POST-TP-HDR	04726	N2510-6002UB
J1001	1250-2886		CONN_RF_BNC_RA	05879	456-117
J1501	1250-0257	2	CONN-RF SMB	01380	5162-5021-09
J1901	1250-0257		CONN-RF SMB	01380	5162-5021-09

Reference Designator	Agilent Part Number	Qty	Part Description	Mfr. Code	Mfr. Part Number
J2001	1251-5066	1	CONN-POST TYPE 2.5-PIN-SPCG-MTG-END	03418	22-04-1021
K1701	0490-1937	5	RELAY 2C 3VDC-COIL 1A 125VAC	00467	G6HU-2-100-DC3
K1801	0490-1937		RELAY 2C 3VDC-COIL 1A 125VAC	00467	G6HU-2-100-DC3
K1901 - K1903	0490-1937		RELAY 2C 3VDC-COIL 1A 125VAC	00467	G6HU-2-100-DC3
K1904 - K1905	0490-1638	2	RELAY 2C 5VDC-COIL 1A 125VAC	01850	TQ2E-5V
K2001	0490-2653	1	RELAY 2C 12VDC-COIL 2A LOW-SIGNAL	00467	G6SK-2F-DC12
L201 - L203	9170-1584	63	CORE MAGNETIC	06352	MMZ2012Y102B
L401 - L402	9170-1584		CORE MAGNETIC	06352	MMZ2012Y102B
L403	9170-1739	1	CORE-SHIELDING BEAD	11702	FBMH4532HM681
L501	9170-1584		CORE MAGNETIC	06352	MMZ2012Y102B
L601	9170-1584		CORE MAGNETIC	06352	MMZ2012Y102B
L602 - L606	9170-1584		CORE MAGNETIC	06352	MMZ2012Y102B
L701 - L703	9170-1584		CORE MAGNETIC	06352	MMZ2012Y102B
L801 - L804	9170-1584		CORE MAGNETIC	06352	MMZ2012Y102B
L805	9140-2501	4	IDCTR 120nH 2% SMT 400MA 0805	01886	0805HS-121TGBC
L901	9170-1584		CORE MAGNETIC	06352	MMZ2012Y102B
L902	9140-1200	2	INDUCTOR 33nH +-5% 2.8W-mmX3.4LG-mm Q=25	09891	KL32TE033J
L903 - L904	9170-1584		CORE MAGNETIC	06352	MMZ2012Y102B
L1001	9140-2501		IDCTR 120nH 2% SMT 400MA 0805	01886	0805HS-121TGBC
L1002 - L1006	9170-1584		CORE MAGNETIC	06352	MMZ2012Y102B
L1101	9140-1099	1	INDUCTOR 220nH +-5% 2.8W-mmX3.4LG-mm	09891	KL32TER22J
L1102 - L1110	9170-1584		CORE MAGNETIC	06352	MMZ2012Y102B
L1501 - L1503	9170-1584		CORE MAGNETIC	06352	MMZ2012Y102B
L1504	9140-1200		INDUCTOR 33nH +-5% 2.8W-mmX3.4LG-mm Q=25	09891	KL32TE033J
L1506 - L1507	9170-1584		CORE MAGNETIC	06352	MMZ2012Y102B
L1601 - L1602	9170-1678	7	CORE-SHIELDING BEAD,FERRITE,NOT TRANSF	11702	FBMJ3216HS800-T
L1701	9140-2501		IDCTR 120nH 2% SMT 400MA 0805	01886	0805HS-121TGBC
L1702	9140-2503	2	IDCTR 100nH 2% SMT 400MA 0805	01886	0805HS-101TGBC
L1703	9140-2502	4	IDCTR 82nH 2% SMT 400MA 0805	01886	0805HS-820TGBC
L1704	9140-2503		IDCTR 100nH 2% SMT 400MA 0805	01886	0805HS-101TGBC
L1705	9140-2509	1	IDCTR 180nH 2% SMT 400MA 0805	01886	0805HS-181TGBC
L1706	9140-2500	1	IDCTR 56nH 2% SMT 500MA 0805	01886	0805HS-560TGBC
L1707 - L1708	9140-2502		IDCTR 82nH 2% SMT 400MA 0805	01886	0805HS-820TGBC
L1709	9140-2501		IDCTR 120nH 2% SMT 400MA 0805	01886	0805HS-121TGBC
L1710	9140-2502		IDCTR 82nH 2% SMT 400MA 0805	01886	0805HS-820TGBC
L1711 - L1714	9170-1584		CORE MAGNETIC	06352	MMZ2012Y102B
L1715	9140-1100	1	INDUCTOR 330nH +-5% 2.8W-mmX3.4LG-mm	09891	KL32TER33J
L1716 - L1718	9170-1584		CORE MAGNETIC	06352	MMZ2012Y102B
L1801	9170-1584		CORE MAGNETIC	06352	MMZ2012Y102B
L1802	9170-1678		CORE-SHIELDING BEAD,FERRITE,NOT TRANSF	11702	FBMJ3216HS800-T
L1803 - L1804	9170-1584		CORE MAGNETIC	06352	MMZ2012Y102B
L1805	9170-1678		CORE-SHIELDING BEAD,FERRITE,NOT TRANSF	11702	FBMJ3216HS800-T
L1806	9170-1584		CORE MAGNETIC	06352	MMZ2012Y102B
L1901 - L1904	9170-1584		CORE MAGNETIC	06352	MMZ2012Y102B
L1905	9170-1678		CORE-SHIELDING BEAD,FERRITE,NOT TRANSF	11702	FBMJ3216HS800-T

Reference Designator	Agilent Part Number	Qty	Part Description	Mfr. Code	Mfr. Part Number
L1906	9140-1240	1	INDUCTOR 47uH +-5% 2.8W-mmX3.4LG-mm Q=30	06352	NL322522T-470J
L1907	9140-2498	2	IDCTR 105nH THT SHIELDED	01886	X8088-A
L1908	9140-2499	1	IDCTR 179nH 5% THT SHIELDED	01886	X8089-A
L1909	9140-2498		IDCTR 105nH THT SHIELDED	01886	X8088-A
L1910	9170-1584		CORE MAGNETIC	06352	MMZ2012Y102B
L1911 - L1912	9170-1678		CORE-SHIELDING BEAD,FERRITE,NOT TRANSF	11702	FBMJ3216HS800-T
L1913 - L1917	9170-1584		CORE MAGNETIC	06352	MMZ2012Y102B
L2001	9170-1663	9	CORE-SHIELDING BEAD	11702	FBMH4532HM132
L2002	9140-2512	1	IDCTR 150uH 20% 0.6ASMT	01886	DT3316P-154
L2003	9140-2504	1	IDCTR 330uH 20% SMT 200MA	01886	DS1608C-334
L2004 - L2006	9170-1663		CORE-SHIELDING BEAD	11702	FBMH4532HM132
L2007	9140-1904	3	INDUCTOR 3.3uH +20% -20%	01886	DT3316P-332
L2008 - L2009	9170-1663		CORE-SHIELDING BEAD	11702	FBMH4532HM132
L2010	9140-2108	2	L SMT 10UH 20% 4.8A SLF12565	06352	CDRH127-100MC
L2011 - L2013	9170-1663		CORE-SHIELDING BEAD	11702	FBMH4532HM132
L2014	9140-1904		INDUCTOR 3.3uH +20% -20%	01886	DT3316P-332
L2015	9140-2108		L SMT 10UH 20% 4.8A SLF12565	06352	CDRH127-100MC
L2016	9140-1904		INDUCTOR 3.3uH +20% -20%	01886	DT3316P-332
MAJ102	33120-00614	2	SHIELD - RFI	02362	33120-00614
MAJ1501	3050-1557	4	WASHER - FLAT	05313	5606-4-31
MAJ1901	3050-1557		WASHER - FLAT	05313	5606-4-31
MBJ102	0380-0643	2	STANDOFF-HEX .255-IN-LG 6-32-THD	02121	0380-0643
MCJ102	0380-0643		STANDOFF-HEX .255-IN-LG 6-32-THD	02121	0380-0643
MDJ102	2190-0577	3	WASHER- NO. 10 .194-IN-ID .294-IN-OD	03118	2190-0577
MEJ102	2190-0577		WASHER- NO. 10 .194-IN-ID .294-IN-OD	03118	2190-0577
MFJ102	2190-0577		WASHER- NO. 10 .194-IN-ID .294-IN-OD	03118	2190-0577
MP2	0590-1397	1	THD INSR-STAINLESS STEEL	03981	KFS2-M4
P801	33250-61616	1	CABLE, 10 POS. PA	02364	33250-61616
P2001	33250-61605	1	CABLE, POWER SUPPLY	02364	33250-61605
Q401	1855-0734	7	TRANSISTOR,SRFCE MNTD,225mW,1 MHZ	02883	2N7002
Q801	1853-0580	2	TRANSISTOR PNP SI SOT-23 (TO-236AB)	12125	KST4403
Q802	1855-0734		TRANSISTOR,SRFCE MNTD,225mW,1 MHZ	02883	2N7002
Q901	1853-0580		TRANSISTOR PNP SI SOT-23 (TO-236AB)	12125	KST4403
Q1001	1853-0568	3	TRANSISTOR PNP SI TO-236AA PD=350MW	36633	MMBT5087LT1
Q1501	1853-0568		TRANSISTOR PNP SI TO-236AA PD=350MW	36633	MMBT5087LT1
Q1601	1853-0516	2	TRANSISTOR PNP SI SOT-23 (TO-236AB)	02237	MMBTH81
Q1602 - Q1606	1854-1148	6	TRANSISTOR NPN SI SOT-23 (TO-236AB)	02237	MMBTH10
Q1607	1853-0516		TRANSISTOR PNP SI SOT-23 (TO-236AB)	02237	MMBTH81
Q1608	1854-1148		TRANSISTOR NPN SI SOT-23 (TO-236AB)	02237	MMBTH10
Q1901 - Q1902	1855-0734		TRANSISTOR,SRFCE MNTD,225mW,1 MHZ	02883	2N7002
Q2001 - Q2003	1855-0997	5	TRANSISTOR MOSFET N-CHAN E-MODE SI	02883	SI4410DY
Q2004	1853-0568		TRANSISTOR PNP SI TO-236AA PD=350MW	36633	MMBT5087LT1
Q2005	1855-0997		TRANSISTOR MOSFET N-CHAN E-MODE SI	02883	SI4410DY
Q2006	1855-0734		TRANSISTOR,SRFCE MNTD,225mW,1 MHZ	02883	2N7002

Reference Designator	Agilent Part Number	Qty	Part Description	Mfr. Code	Mfr. Part Number
Q2007	1855-0997		TRANSISTOR MOSFET N-CHAN E-MODE SI	02883	SI4410DY
Q2008 - Q2009	1855-0734		TRANSISTOR,SRFCE MNTD,225mW,1 MHZ	02883	2N7002
R101	0699-3051	161	RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R102	0699-2977	5	RES 681 1% .1W	05524	CRCW08056810F
R103	0699-3034	46	RESISTOR 1K +-1% .1W TKF TC=0+-100	05524	CRCW08051001F
R104	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R105	0699-3034		RESISTOR 1K +-1% .1W TKF TC=0+-100	05524	CRCW08051001F
R106	0699-3058	89	RESISTOR 100 +-1% .1W TKF TC=0+-100	05524	CRCW08051000F
R107	0699-3034		RESISTOR 1K +-1% .1W TKF TC=0+-100	05524	CRCW08051001F
R108	0699-3053	24	RESISTOR 100K +-1% .1W TKF TC=0+-100	05524	CRCW08051003F
R109	0699-3077	7	RESISTOR 1M +-1% .1W TKF TC=0+-100	05524	CRCW08051004F
R110 - R111	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R112	0699-3035	3	RESISTOR 1.47K +-1% .1W TKF TC=0+-100	05524	CRCW08051471F
R113 - R114	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R115	0699-2965	12	RESISTOR 46.4K +-1% .1W TKF TC=0+-100	05524	CRCW08054642F
R116	0699-3073	2	RESISTOR 51.1K +-1% .1W TKF TC=0+-100	00746	MCR10-F-5112
R117	0699-2965		RESISTOR 46.4K +-1% .1W TKF TC=0+-100	05524	CRCW08054642F
R118	0699-3058		RESISTOR 100 +-1% .1W TKF TC=0+-100	05524	CRCW08051000F
R119	0699-2965		RESISTOR 46.4K +-1% .1W TKF TC=0+-100	05524	CRCW08054642F
R120 - R126	0699-2965		RESISTOR 46.4K +-1% .1W TKF TC=0+-100	05524	CRCW08054642F
R201	0699-3034		RESISTOR 1K +-1% .1W TKF TC=0+-100	05524	CRCW08051001F
R202 - R206	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R207	0699-3058		RESISTOR 100 +-1% .1W TKF TC=0+-100	05524	CRCW08051000F
R208	0699-3034		RESISTOR 1K +-1% .1W TKF TC=0+-100	05524	CRCW08051001F
R209 - R217	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R218	0699-2643	1	RESISTOR 0 +-5% .1W TKF TC=0+-300	00746	MCR10-J-000
R219	0699-3058		RESISTOR 100 +-1% .1W TKF TC=0+-100	05524	CRCW08051000F
R220 - R221	0699-3053		RESISTOR 100K +-1% .1W TKF TC=0+-100	05524	CRCW08051003F
R222 - R223	0699-3058		RESISTOR 100 +-1% .1W TKF TC=0+-100	05524	CRCW08051000F
R224 - R225	0699-3034		RESISTOR 1K +-1% .1W TKF TC=0+-100	05524	CRCW08051001F
R226	0699-3058		RESISTOR 100 +-1% .1W TKF TC=0+-100	05524	CRCW08051000F
R227 - R235	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R301 - R306	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R307	0699-3058		RESISTOR 100 +-1% .1W TKF TC=0+-100	05524	CRCW08051000F
R308	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R310	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R313 - R320	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R321 -R336	0699-3058		RESISTOR 100 +-1% .1W TKF TC=0+-100	05524	CRCW08051000F
R337 - R338	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R339 - R340	0699-3058		RESISTOR 100 +-1% .1W TKF TC=0+-100	05524	CRCW08051000F
R341	0699-2977		RES 681 1% .1W	05524	CRCW08056810F
R342 - R347	0699-3058		RESISTOR 100 +-1% .1W TKF TC=0+-100	05524	CRCW08051000F
R401	0699-3773	1	RESISTOR 20.5K +-1% .1W TKF TC=0+-100	00746	MCR10-F-2052
R402	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R403	0699-3063	3	RESISTOR 825 +-1% .1W TKF TC=0+-100	05524	CRCW08058250F

Reference Designator	Agilent Part Number	Qty	Part Description	Mfr. Code	Mfr. Part Number
R404 - R405	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R406 - R407	0699-3063		RESISTOR 825 +-1% .1W TKF TC=0+-100	05524	CRCW08058250F
R408	0699-3073		RESISTOR 51.1K +-1% .1W TKF TC=0+-100	00746	MCR10-F-5112
R409 - R410	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R411	0699-3058		RESISTOR 100 +-1% .1W TKF TC=0+-100	05524	CRCW08051000F
R412 - R413	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R414	0699-3058		RESISTOR 100 +-1% .1W TKF TC=0+-100	05524	CRCW08051000F
R415	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R416 - R417	0699-3058		RESISTOR 100 +-1% .1W TKF TC=0+-100	05524	CRCW08051000F
R418	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R419 - R425	0699-3058		RESISTOR 100 +-1% .1W TKF TC=0+-100	05524	CRCW08051000F
R501 - R505	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R506 - R507	0699-3058		RESISTOR 100 +-1% .1W TKF TC=0+-100	05524	CRCW08051000F
R508 - R529	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R530	0699-3058		RESISTOR 100 +-1% .1W TKF TC=0+-100	05524	CRCW08051000F
R531	0699-3034		RESISTOR 1K +-1% .1W TKF TC=0+-100	05524	CRCW08051001F
R532 - R533	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R534	0699-3832	19	RESISTOR 51.1 +-1% .1W TKF TC=0+-100	00746	MCR10-F-51R1
R601	0699-3058		RESISTOR 100 +-1% .1W TKF TC=0+-100	05524	CRCW08051000F
R602	0699-3034		RESISTOR 1K +-1% .1W TKF TC=0+-100	05524	CRCW08051001F
R603	0699-2828	1	RESISTOR 1.5K +-0.1% .125W TF TC=0+-25	01172	BLU-1206 1K5 .1% 25PPM
R604	0699-2490	1	RESISTOR 1K +-0.1% .125W TF TC=0+-25	01172	BLU-1206 1K .1% 25PPM
R605	1810-1854	1	NET-RES 0 10.0K OHM	05524	MPM2002AT
R606	0699-3058		RESISTOR 100 +-1% .1W TKF TC=0+-100	05524	CRCW08051000F
R607	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R608	0699-3058		RESISTOR 100 +-1% .1W TKF TC=0+-100	05524	CRCW08051000F
R609	0699-3077		RESISTOR 1M +-1% .1W TKF TC=0+-100	05524	CRCW08051004F
R610	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R611	0699-2840	2	RESISTOR 2.5K +-0.1% .125W TF TC=0+-25	02499	W1206R032501BT
R612	0699-2998	2	RESISTOR 162K +-1% .1W TKF TC=0+-100	05524	CRCW08051623F
R613	0699-3829	1	RESISTOR 38.3 +-1% .1W TKF TC=0+-100	05524	CRCW080538R3FRT2
R614	0699-2840		RESISTOR 2.5K +-0.1% .125W TF TC=0+-25	02499	W1206R032501BT
R615	0699-3061	6	RESISTOR 261 +-1% .1W TKF TC=0+-100	05524	CRCW08052610F
R616	0699-4288	2	RESISTOR 68 +-5% 1W TKF TC=0+-200	00746	MCR100-J-68R0
R617	0699-3058		RESISTOR 100 +-1% .1W TKF TC=0+-100	05524	CRCW08051000F
R618	0699-2823	1	RESISTOR 8K +-0.1% .125W TF TC=0+-25	02499	W1206R038001BT
R619	0699-3058		RESISTOR 100 +-1% .1W TKF TC=0+-100	05524	CRCW08051000F
R620	0699-2847	1	RESISTOR 2K +-0.1% .125W TF TC=0+-25	01172	BLU-1206 2K .1% 25PPM
R621	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R622 - R623	0699-3058		RESISTOR 100 +-1% .1W TKF TC=0+-100	05524	CRCW08051000F
R624 - R625	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R626	0699-3058		RESISTOR 100 +-1% .1W TKF TC=0+-100	05524	CRCW08051000F
R627	0699-3034		RESISTOR 1K +-1% .1W TKF TC=0+-100	05524	CRCW08051001F
R628 - R629	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R630	0699-2975	3	RESISTOR 562 +-1% .1W TKF TC=0+-100	05524	CRCW08055620F

Reference Designator	Agilent Part Number	Qty	Part Description	Mfr. Code	Mfr. Part Number
R631	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R632	0699-3058		RESISTOR 100 +-1% .1W TKF TC=0+-100	05524	CRCW08051000F
R633	0699-3034		RESISTOR 1K +-1% .1W TKF TC=0+-100	05524	CRCW08051001F
R634	0699-3069	7	RESISTOR 19.6K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1962
R635	0699-3058		RESISTOR 100 +-1% .1W TKF TC=0+-100	05524	CRCW08051000F
R636	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R637	0699-3058		RESISTOR 100 +-1% .1W TKF TC=0+-100	05524	CRCW08051000F
R701	0699-3034		RESISTOR 1K +-1% .1W TKF TC=0+-100	05524	CRCW08051001F
R702	0699-3479	4	RESISTOR 40.2K +-1% .1W TKF TC=0+-100	09891	RK73H2A4022F
R703 - R704	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R705 - R706	0699-3032	15	RESISTOR 511 +-1% .1W TKF TC=0+-100	05524	CRCW08055110F
R707 - R708	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R709	0699-3034		RESISTOR 1K +-1% .1W TKF TC=0+-100	05524	CRCW08051001F
R710	0699-3032		RESISTOR 511 +-1% .1W TKF TC=0+-100	05524	CRCW08055110F
R711	0699-3029	19	RESISTOR 316 +-1% .1W TKF TC=0+-100	05524	CRCW08053160F
R712	0699-3832		RESISTOR 51.1 +-1% .1W TKF TC=0+-100	00746	MCR10-F-51R1
R713	0699-3034		RESISTOR 1K +-1% .1W TKF TC=0+-100	05524	CRCW08051001F
R714	0699-3058		RESISTOR 100 +-1% .1W TKF TC=0+-100	05524	CRCW08051000F
R715 - R716	0699-3034		RESISTOR 1K +-1% .1W TKF TC=0+-100	05524	CRCW08051001F
R717	0699-3075	2	RESISTOR 147K +-1% .1W TKF TC=0+-100	05524	CRCW08051473F
R718	0699-3034		RESISTOR 1K +-1% .1W TKF TC=0+-100	05524	CRCW08051001F
R719	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R720	0699-2995	1	RESISTOR 110K +-1% .1W TKF TC=0+-100	05524	CRCW08051103F
R721 - R722	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R723	0699-3034		RESISTOR 1K +-1% .1W TKF TC=0+-100	05524	CRCW08051001F
R724	0699-3479		RESISTOR 40.2K +-1% .1W TKF TC=0+-100	09891	RK73H2A4022F
R725	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R726	0699-3479		RESISTOR 40.2K +-1% .1W TKF TC=0+-100	09891	RK73H2A4022F
R727	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R728	0699-2987	1	RESISTOR 23.7K +-1% .1W TKF TC=0+-100	05524	CRCW08052372F
R729	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R730	0699-3828	2	RESISTOR 21.5 +-1% .1W TKF TC=0+-100	05524	CRCW080521R5FRT
R731	0699-3034		RESISTOR 1K +-1% .1W TKF TC=0+-100	05524	CRCW08051001F
R732	0699-3075		RESISTOR 147K +-1% .1W TKF TC=0+-100	05524	CRCW08051473F
R733	0699-3032		RESISTOR 511 +-1% .1W TKF TC=0+-100	05524	CRCW08055110F
R734	0699-3479		RESISTOR 40.2K +-1% .1W TKF TC=0+-100	09891	RK73H2A4022F
R735 - R739	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R801	0699-4288		RESISTOR 68 +-5% 1W TKF TC=0+-200	05524	CRCW2512680J
R802	0699-2979	5	RESISTOR 1.21K +-1% .1W TKF TC=0+-100	05524	CRCW08051211F
R803	0699-2998		RESISTOR 162K +-1% .1W TKF TC=0+-100	05524	CRCW08051623F
R804	0699-3058		RESISTOR 100 +-1% .1W TKF TC=0+-100	05524	CRCW08051000F
R805	0699-3037	6	RESISTOR 2.15K +-1% .1W TKF TC=0+-100	05524	CRCW08052151F
R806	0699-3058		RESISTOR 100 +-1% .1W TKF TC=0+-100	05524	CRCW08051000F
R807	0699-3037		RESISTOR 2.15K +-1% .1W TKF TC=0+-100	05524	CRCW08052151F
R808	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002

Reference Designator	Agilent Part Number	Qty	Part Description	Mfr. Code	Mfr. Part Number
R809	0699-3834	109	RESISTOR 68.1 +-1% .1W TKF TC=0+-100	00746	MCR10-F-68R1
R810	0699-3077		RESISTOR 1M +-1% .1W TKF TC=0+-100	05524	CRCW08051004F
R811	0699-2976	2	RESISTOR 619 +-1% .1W TKF TC=0+-100	05524	CRCW08056190F
R812	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R813	0699-3038	2	RESISTOR 2.37K +-1% .1W TKF TC=0+-100	00746	MCR10-F-2371
R814	0699-2971	12	RESISTOR, FIXED, .1W, SMT, FLAT CHIP	05524	CRCW08051470F
R815	0699-3034		RESISTOR 1K +-1% .1W TKF TC=0+-100	05524	CRCW08051001F
R816	0699-3032		RESISTOR 511 +-1% .1W TKF TC=0+-100	05524	CRCW08055110F
R817	0699-3058		RESISTOR 100 +-1% .1W TKF TC=0+-100	05524	CRCW08051000F
R818	0699-3033	1	RESISTOR 750 +-1% .1W TKF TC=0+-100	05524	CRCW08057500F
R819 - R820	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R821	0699-2972	3	RESISTOR 178 +-1% .1W TKF TC=0+-100	05524	CRCW08051780F
R822	0699-3029		RESISTOR 316 +-1% .1W TKF TC=0+-100	05524	CRCW08053160F
R823	0699-3832		RESISTOR 51.1 +-1% .1W TKF TC=0+-100	00746	MCR10-F-51R1
R824	0699-3834		RESISTOR 68.1 +-1% .1W TKF TC=0+-100	00746	MCR10-F-68R1
R901	0699-3053		RESISTOR 100K +-1% .1W TKF TC=0+-100	05524	CRCW08051003F
R902	0699-3037		RESISTOR 2.15K +-1% .1W TKF TC=0+-100	05524	CRCW08052151F
R903	0699-2986	3	RESISTOR 21.5K +-1% .1W TKF TC=0+-100	05524	CRCW08052152F
R904	0699-3037		RESISTOR 2.15K +-1% .1W TKF TC=0+-100	05524	CRCW08052151F
R905	0699-3832		RESISTOR 51.1 +-1% .1W TKF TC=0+-100	00746	MCR10-F-51R1
R906	0699-3034		RESISTOR 1K +-1% .1W TKF TC=0+-100	05524	CRCW08051001F
R907	0699-2988	3	RESISTOR 31.6K +-1% .1W TKF TC=0+-100	05524	CRCW08053162F
R908	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R909	0699-2986		RESISTOR 21.5K +-1% .1W TKF TC=0+-100	05524	CRCW08052152F
R910	0699-3058		RESISTOR	05524	CRCW08051000F
R911	0699-2988		RESISTOR 31.6K +-1% .1W TKF TC=0+-100	05524	CRCW08053162F
R912	0699-2965		RESISTOR 46.4K +-1% .1W TKF TC=0+-100	05524	CRCW08054642F
R913	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R914	0699-3053		RESISTOR 100K +-1% .1W TKF TC=0+-100	05524	CRCW08051003F
R915	0699-3844	15	RESISTOR 42.2 +-1% .1W TKF TC=0+-100	05524	CRCW080542R2FRT2
R916	0699-3058		RESISTOR 100 +-1% .1W TKF TC=0+-100	05524	CRCW08051000F
R917	0699-3834		RESISTOR 68.1 +-1% .1W TKF TC=0+-100	00746	MCR10-F-68R1
R918 - R919	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R920	0699-3067	3	RESISTOR 14.7K +-1% .1W TKF TC=0+-100	05524	CRCW08051472F
R921	0699-2988		RESISTOR 31.6K +-1% .1W TKF TC=0+-100	05524	CRCW08053162F
R923	0699-3058		RESISTOR 100 +-1% .1W TKF TC=0+-100	05524	CRCW08051000F
R924	0699-3034		RESISTOR 1K +-1% .1W TKF TC=0+-100	05524	CRCW08051001F
R925 - R926	0699-2972		RESISTOR 178 +-1% .1W TKF TC=0+-100	05524	CRCW08051780F
R927 - R928	0699-3844		RESISTOR 42.2 +-1% .1W TKF TC=0+-100	05524	CRCW080542R2FRT2
R929 - R930	0699-3058		RESISTOR 100 +-1% .1W TKF TC=0+-100	05524	CRCW08051000F
R931 - R932	0699-3029		RESISTOR 316 +-1% .1W TKF TC=0+-100	05524	CRCW08053160F
R933 - R939	0699-3064	49	RESISTOR 909 +-1% .1W TKF TC=0+-100	05524	CRCW08059090F
R940 - R946	0699-3631	50	RESISTOR 301 +-1% .1W TKF TC=0+-100	09891	RK73H2A3010F
R1001 - R1002	0699-3045	8	RESISTOR 5.11K +-1% .1W TKF TC=0+-100	00746	MCR10-F-5111
R1003	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002

Reference Designator	Agilent Part Number	Qty	Part Description	Mfr. Code	Mfr. Part Number
R1004 - R1005	0699-3045		RESISTOR 5.11K +-1% .1W TKF TC=0+-100	00746	MCR10-F-5111
R1006	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R1007 - R1008	0699-3064		RESISTOR 909 +-1% .1W TKF TC=0+-100	05524	CRCW08059090F
R1009	0699-3034		RESISTOR 1K +-1% .1W TKF TC=0+-100	05524	CRCW08051001F
R1010	0699-3834		RESISTOR 68.1 +-1% .1W TKF TC=0+-100	00746	MCR10-F-68R1
R1011 - R1012	0699-3064		RESISTOR 909 +-1% .1W TKF TC=0+-100	05524	CRCW08059090F
R1013	0699-3834		RESISTOR 68.1 +-1% .1W TKF TC=0+-100	00746	MCR10-F-68R1
R1014	0699-2975		RESISTOR 562 +-1% .1W TKF TC=0+-100	05524	CRCW08055620F
R1015 - R1016	0699-3064		RESISTOR 909 +-1% .1W TKF TC=0+-100	05524	CRCW08059090F
R1017	0699-3739	2	RESISTOR 47 +-5% .5W TKF TC=0+-200	00746	MCR50-J-470
R1018	0699-3058		RESISTOR 100 +-1% .1W TKF TC=0+-100	05524	CRCW08051000F
R1019	0699-3067		RESISTOR 14.7K +-1% .1W TKF TC=0+-100	05524	CRCW08051472F
R1020	0699-3032		RESISTOR 511 +-1% .1W TKF TC=0+-100	05524	CRCW08055110F
R1021	0699-3064		RESISTOR 909 +-1% .1W TKF TC=0+-100	05524	CRCW08059090F
R1022	0699-2975		RESISTOR 562 +-1% .1W TKF TC=0+-100	05524	CRCW08055620F
R1023	0699-3832		RESISTOR 51.1 +-1% .1W TKF TC=0+-100	00746	MCR10-F-51R1
R1024	0699-3834		RESISTOR 68.1 +-1% .1W TKF TC=0+-100	00746	MCR10-F-68R1
R1025	0699-3844		RESISTOR 42.2 +-1% .1W TKF TC=0+-100	05524	CRCW080542R2FRT2
R1026	0699-3034		RESISTOR 1K +-1% .1W TKF TC=0+-100	05524	CRCW08051001F
R1027 - R1028	0699-3834		RESISTOR 68.1 +-1% .1W TKF TC=0+-100	00746	MCR10-F-68R1
R1029 - R1030	0699-3029		RESISTOR 316 +-1% .1W TKF TC=0+-100	05524	CRCW08053160F
R1031 - R1032	0699-3030	7	RESISTOR 383 +-1% .1W TKF TC=0+-100	05524	CRCW08053830F
R1033 - R1039	0699-3029		RESISTOR 316 +-1% .1W TKF TC=0+-100	05524	CRCW08053160F
R1040	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R1041	0699-3045		RESISTOR 5.11K +-1% .1W TKF TC=0+-100	00746	MCR10-F-5111
R1042	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R1043	0699-2981	2	RESISTOR 1.78K +-1% .1W TKF TC=0+-100	05524	CRCW08051781F
R1044	0699-3058		RESISTOR 100 +-1% .1W TKF TC=0+-100	05524	CRCW08051000F
R1045	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R1046	0699-3053		RESISTOR 100K +-1% .1W TKF TC=0+-100	05524	CRCW08051003F
R1047	0699-2992	2	RESISTOR 75K +-1% .1W TKF TC=0+-100	00746	MCR10-F-7502
R1048 - R1049	0699-3049	3	RESISTOR 8.25K +-1% .1W TKF TC=0+-100	05524	CRCW08058251F
R1050	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R1051	0699-3058		RESISTOR 100 +-1% .1W TKF TC=0+-100	05524	CRCW08051000F
R1052	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R1101	0699-3064		RESISTOR 909 +-1% .1W TKF TC=0+-100	05524	CRCW08059090F
R1102	0699-3029		RESISTOR 316 +-1% .1W TKF TC=0+-100	05524	CRCW08053160F
R1103	0699-3034		RESISTOR 1K +-1% .1W TKF TC=0+-100	05524	CRCW08051001F
R1104	0699-3058		RESISTOR 100 +-1% .1W TKF TC=0+-100	05524	CRCW08051000F
R1105	0699-3834		RESISTOR 68.1 +-1% .1W TKF TC=0+-100	00746	MCR10-F-68R1
R1106	0699-3034		RESISTOR 1K +-1% .1W TKF TC=0+-100	05524	CRCW08051001F
R1107	0699-3032		RESISTOR 511 +-1% .1W TKF TC=0+-100	05524	CRCW08055110F
R1108 - R1110	0699-3030		RESISTOR 383 +-1% .1W TKF TC=0+-100	05524	CRCW08053830F
R1112 - R1113	0699-3844		RESISTOR 42.2 +-1% .1W TKF TC=0+-100	05524	CRCW080542R2FRT2
R1114	0699-3058		RESISTOR 100 +-1% .1W TKF TC=0+-100	05524	CRCW08051000F
R1115 - R1117	0699-3844		RESISTOR 42.2 +-1% .1W TKF TC=0+-100	05524	CRCW080542R2FRT2

Reference Designator	Agilent Part Number	Qty	Part Description	Mfr. Code	Mfr. Part Number
R1118	0699-3834		RESISTOR 68.1 +-1% .1W TKF TC=0+-100	00746	MCR10-F-68R1
R1119 - R1122	0699-3631		RESISTOR 301 +-1% .1W TKF TC=0+-100	09891	RK73H2A3010F
R1123 - R1127	0699-3832		RESISTOR 51.1 +-1% .1W TKF TC=0+-100	00746	MCR10-F-51R1
R1128	0699-3058		RESISTOR 100 +-1% .1W TKF TC=0+-100	05524	CRCW08051000F
R1129 - R1130	0699-3844		RESISTOR 42.2 +-1% .1W TKF TC=0+-100	05524	CRCW080542R2FRT2
R1131 - R1132	0699-3631		RESISTOR 301 +-1% .1W TKF TC=0+-100	09891	RK73H2A3010F
R1133 - R1134	0699-3844		RESISTOR 42.2 +-1% .1W TKF TC=0+-100	05524	CRCW080542R2FRT2
R1135 - R1136	0699-3058		RESISTOR 100 +-1% .1W TKF TC=0+-100	05524	CRCW08051000F
R1137 - R1138	0699-3631		RESISTOR 301 +-1% .1W TKF TC=0+-100	09891	RK73H2A3010F
R1139	0699-3844		RESISTOR 42.2 +-1% .1W TKF TC=0+-100	05524	CRCW080542R2FRT2
R1140 - R1141	0699-3631		RESISTOR 301 +-1% .1W TKF TC=0+-100	09891	RK73H2A3010F
R1142	0699-3029		RESISTOR 316 +-1% .1W TKF TC=0+-100	05524	CRCW08053160F
R1143 - R1147	0699-3064		RESISTOR 909 +-1% .1W TKF TC=0+-100	05524	CRCW08059090F
R1148 -R1152	0699-3631		RESISTOR 301 +-1% .1W TKF TC=0+-100	09891	RK73H2A3010F
R1153 - R1158	0699-3834		RESISTOR 68.1 +-1% .1W TKF TC=0+-100	00746	MCR10-F-68R1
R1159	0699-3832		RESISTOR 51.1 +-1% .1W TKF TC=0+-100	00746	MCR10-F-51R1
R1160	0699-3834		RESISTOR 68.1 +-1% .1W TKF TC=0+-100	00746	MCR10-F-68R1
R1161 - R1162	0699-3841	6	RESISTOR 23.7 +-1% .1W TKF TC=0+-100	09891	RK73H2A23R7F
R1163	0699-3834		RESISTOR 68.1 +-1% .1W TKF TC=0+-100	00746	MCR10-F-68R1
R1164	0699-3841		RESISTOR 23.7 +-1% .1W TKF TC=0+-100	09891	RK73H2A23R7F
R1165 - R1168	0699-3834		RESISTOR 68.1 +-1% .1W TKF TC=0+-100	00746	MCR10-F-68R1
R1169	0699-3841		RESISTOR 23.7 +-1% .1W TKF TC=0+-100	09891	RK73H2A23R7F
R1170	0699-3834		RESISTOR 68.1 +-1% .1W TKF TC=0+-100	00746	MCR10-F-68R1
R1201 - R1205	0699-3034		RESISTOR 1K +-1% .1W TKF TC=0+-100	05524	CRCW08051001F
R1206	0699-3058		RESISTOR 100 +-1% .1W TKF TC=0+-100	05524	CRCW08051000F
R1207	0699-3034		RESISTOR 1K +-1% .1W TKF TC=0+-100	05524	CRCW08051001F
R1208 - R1209	0699-3058		RESISTOR 100 +-1% .1W TKF TC=0+-100	05524	CRCW08051000F
R1210	0699-3034		RESISTOR 1K +-1% .1W TKF TC=0+-100	05524	CRCW08051001F
R1211 - R1222	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R1223 - R1225	0699-3058		RESISTOR 100 +-1% .1W TKF TC=0+-100	05524	CRCW08051000F
R1301 - R1302	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R1303	0699-3034		RESISTOR 1K +-1% .1W TKF TC=0+-100	05524	CRCW08051001F
R1304 - R1305	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R1400	0699-3064		RESISTOR 909 +-1% .1W TKF TC=0+-100	05524	CRCW08059090F
R1401	0699-3029		RESISTOR 316 +-1% .1W TKF TC=0+-100	05524	CRCW08053160F
R1402 - R1413	0699-3064		RESISTOR 909 +-1% .1W TKF TC=0+-100	05524	CRCW08059090F
R1414 - R1416	0699-3834		RESISTOR 68.1 +-1% .1W TKF TC=0+-100	00746	MCR10-F-68R1
R1417 - R1428	0699-3631		RESISTOR 301 +-1% .1W TKF TC=0+-100	09891	RK73H2A3010F
R1429 - R1436	0699-3834		RESISTOR 68.1 +-1% .1W TKF TC=0+-100	00746	MCR10-F-68R1
R1437 - R1448	0699-3064		RESISTOR 909 +-1% .1W TKF TC=0+-100	05524	CRCW08059090F
R1449 - R1454	0699-3834		RESISTOR 68.1 +-1% .1W TKF TC=0+-100	00746	MCR10-F-68R1
R1455 - R1466	0699-3631		RESISTOR 301 +-1% .1W TKF TC=0+-100	09891	RK73H2A3010F
R1467 - R1480	0699-3834		RESISTOR 68.1 +-1% .1W TKF TC=0+-100	00746	MCR10-F-68R1
R1481 - R1482	0699-3832		RESISTOR 51.1 +-1% .1W TKF TC=0+-100	00746	MCR10-F-51R1
R1483 - R1499	0699-3834		RESISTOR 68.1 +-1% .1W TKF TC=0+-100	00746	MCR10-F-68R1
R1501 - R1502	0699-3834		RESISTOR 68.1 +-1% .1W TKF TC=0+-100	00746	MCR10-F-68R1

Reference Designator	Agilent Part Number	Qty	Part Description	Mfr. Code	Mfr. Part Number
R1503 - R1504	0699-3064		RESISTOR 909 +-1% .1W TKF TC=0+-100	05524	CRCW08059090F
R1505 - R1506	0699-3834		RESISTOR 68.1 +-1% .1W TKF TC=0+-100	00746	MCR10-F-68R1
R1507 - R1508	0699-3631		RESISTOR 301 +-1% .1W TKF TC=0+-100	09891	RK73H2A3010F
R1509	0699-3834		RESISTOR 68.1 +-1% .1W TKF TC=0+-100	00746	MCR10-F-68R1
R1510	0699-3034		RESISTOR 1K +-1% .1W TKF TC=0+-100	05524	CRCW08051001F
R1511 - R1512	0699-3032		RESISTOR 511 +-1% .1W TKF TC=0+-100	05524	CRCW08055110F
R1513	0699-3739		RESISTOR 47 +-5% .5W TKF TC=0+-200	00746	MCR50-J-470
R1514 - R1515	0699-3834		RESISTOR 68.1 +-1% .1W TKF TC=0+-100	00746	MCR10-F-68R1
R1516 - R1517	0699-3032		RESISTOR 511 +-1% .1W TKF TC=0+-100	05524	CRCW08055110F
R1518	0699-3832		RESISTOR 51.1 +-1% .1W TKF TC=0+-100	00746	MCR10-F-51R1
R1519 - R1522	0699-3834		RESISTOR 68.1 +-1% .1W TKF TC=0+-100	00746	MCR10-F-68R1
R1523 R1524	0699-3035		RESISTOR 1.47K +-1% .1W TKF TC=0+-100	05524	CRCW08051471F
R1525	0699-3845	1	RESISTOR,FIXED, .1W, SMT, FLAT CHIP	00746	MCR10-F-61R9
R1526 - R1528	0699-3834		RESISTOR 68.1 +-1% .1W TKF TC=0+-100	00746	MCR10-F-68R1
R1529 - R1530	0699-3631		RESISTOR 301 +-1% .1W TKF TC=0+-100	09891	RK73H2A3010F
R1531 - R1532	0699-3834		RESISTOR 68.1 +-1% .1W TKF TC=0+-100	00746	MCR10-F-68R1
R1533	0699-3828		RESISTOR 21.5 +-1% .1W TKF TC=0+-100	05524	CRCW080521R5FRT
R1534	0699-3029		RESISTOR 316 +-1% .1W TKF TC=0+-100	05524	CRCW08053160F
R1535	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R1536	0699-3834		RESISTOR 68.1 +-1% .1W TKF TC=0+-100	00746	MCR10-F-68R1
R1537	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R1538 - R1539	0699-3834		RESISTOR 68.1 +-1% .1W TKF TC=0+-100	00746	MCR10-F-68R1
R1540	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R1541	0699-2981		RESISTOR 1.78K +-1% .1W TKF TC=0+-100	05524	CRCW08051781F
R1542	0699-3058		RESISTOR 100 +-1% .1W TKF TC=0+-100	05524	CRCW08051000F
R1543	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R1544 - R1545	0699-3834		RESISTOR 68.1 +-1% .1W TKF TC=0+-100	00746	MCR10-F-68R1
R1546	0699-3053		RESISTOR 100K +-1% .1W TKF TC=0+-100	05524	CRCW08051003F
R1547	0699-2992		RESISTOR 75K +-1% .1W TKF TC=0+-100	00746	MCR10-F-7502
R1548 - R1550	0699-3046	4	RESISTOR 6.19K +-1% .1W TKF TC=0+-100	00746	MCR10-F-6191
R1551	0699-3058		RESISTOR 100 +-1% .1W TKF TC=0+-100	05524	CRCW08051000F
R1552	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R1553 - R1554	0699-4451	2	RESISTOR 2.2 +-5pct .1W TKF TC=0+-500	00746	MCR10-J-2R2
R1601	0699-3049		RESISTOR 8.25K +-1% .1W TKF TC=0+-100	05524	CRCW08058251F
R1602 - R1603	0699-2971		RESISTOR, FIXED, .1W, SMT, FLAT CHIP	05524	CRCW08051470F
R1604	0699-3038		RESISTOR 2.37K +-1% .1W TKF TC=0+-100	00746	MCR10-F-2371
R1605 - R1606	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R1607	0699-3058		RESISTOR 100 +-1% .1W TKF TC=0+-100	05524	CRCW08051000F
R1608	0699-3841		RESISTOR 23.7 +-1% .1W TKF TC=0+-100	09891	RK73H2A23R7F
R1609	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R1610	0699-3834		RESISTOR 68.1 +-1% .1W TKF TC=0+-100	00746	MCR10-F-68R1
R1611	0699-3069		RESISTOR 19.6K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1962
R1612	0699-3832		RESISTOR 51.1 +-1% .1W TKF TC=0+-100	00746	MCR10-F-51R1
R1613	0699-2976		RESISTOR 619 +-1% .1W TKF TC=0+-100	05524	CRCW08056190F
R1614	0699-3061		RESISTOR 261 +-1% .1W TKF TC=0+-100	05524	CRCW08052610F
R1615	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002

Reference Designator	Agilent Part Number	Qty	Part Description	Mfr. Code	Mfr. Part Number
R1616	0699-2971		RESISTOR, FIXED, .1W, SMT, FLAT CHIP	05524	CRCW08051470F
R1617 - R1618	0699-3058		RESISTOR 100 +-1% .1W TKF TC=0+-100	05524	CRCW08051000F
R1619	0699-3834		RESISTOR 68.1 +-1% .1W TKF TC=0+-100	00746	MCR10-F-68R1
R1620	0699-3061		RESISTOR 261 +-1% .1W TKF TC=0+-100	05524	CRCW08052610F
R1621	0699-3032		RESISTOR 511 +-1% .1W TKF TC=0+-100	05524	CRCW08055110F
R1622	0699-2977		RES 681 1% .1W	05524	CRCW08056810F
R1623 - R1626	0699-3053		RESISTOR 100K +-1% .1W TKF TC=0+-100	05524	CRCW08051003F
R1627	0699-3032		RESISTOR 511 +-1% .1W TKF TC=0+-100	05524	CRCW08055110F
R1628	0699-3029		RESISTOR 316 +-1% .1W TKF TC=0+-100	05524	CRCW08053160F
R1629	0699-3061		RESISTOR 261 +-1% .1W TKF TC=0+-100	05524	CRCW08052610F
R1630	0699-3846	1	RESISTOR 75 +-1% .1W TKF TC=0+-100	00746	MCR10-F-75R0
R1631	0699-2971		RESISTOR, FIXED, .1W, SMT, FLAT CHIP	05524	CRCW08051470F
R1632	0699-3061		RESISTOR 261 +-1% .1W TKF TC=0+-100	05524	CRCW08052610F
R1633	0699-3834		RESISTOR 68.1 +-1% .1W TKF TC=0+-100	00746	MCR10-F-68R1
R1634 - R1637	0699-3053		RESISTOR 100K +-1% .1W TKF TC=0+-100	05524	CRCW08051003F
R1638	0699-3061		RESISTOR 261 +-1% .1W TKF TC=0+-100	05524	CRCW08052610F
R1639	0699-3069		RESISTOR 19.6K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1962
R1640	0699-3058		RESISTOR 100 +-1% .1W TKF TC=0+-100	05524	CRCW08051000F
R1641	0699-3841		RESISTOR 23.7 +-1% .1W TKF TC=0+-100	09891	RK73H2A23R7F
R1642 - R1645	0699-2979		RESISTOR 1.21K +-1% .1W TKF TC=0+-100	05524	CRCW08051211F
R1646 - R1647	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R1648 - R1649	0699-2971		RESISTOR, FIXED, .1W, SMT, FLAT CHIP	05524	CRCW08051470F
R1701 - R1709	0699-3834		RESISTOR 68.1 +-1% .1W TKF TC=0+-100	00746	MCR10-F-68R1
R1710 - R1711	0699-3832		RESISTOR 51.1 +-1% .1W TKF TC=0+-100	00746	MCR10-F-51R1
R1712 - R1715	0699-3834		RESISTOR 68.1 +-1% .1W TKF TC=0+-100	00746	MCR10-F-68R1
R1716	0699-3058		RESISTOR 100 +-1% .1W TKF TC=0+-100	05524	CRCW08051000F
R1717	0699-3832		RESISTOR 51.1 +-1% .1W TKF TC=0+-100	00746	MCR10-F-51R1
R1718	0699-3834		RESISTOR 68.1 +-1% .1W TKF TC=0+-100	00746	MCR10-F-68R1
R1719	0699-3836	1	RESISTOR 90.9 +-1% .1W TKF TC=0+-100	00746	MCR10-F-90R9
R1720	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R1721	0699-3058		RESISTOR 100 +-1% .1W TKF TC=0+-100	05524	CRCW08051000F
R1722	0699-2973	1	RES 215, FIXED THIN FILM	00746	MCR10-F-2150
R1723	0699-3604	1	RESISTOR 909 +-0.1% .125W TF TC=0+-25	02499	W1206R03-9090B
R1724	0699-3766	1	RESISTOR 232 +-0.1% .125W TF TC=0+-25	01172	BLU-1206 2320 .1% 25PPM
R1725	0699-2489	1	RESISTOR 10K +-0.1% .125W TF TC=0+-25	01172	BLU-1206 10K .1% 25PPM
R1726	0699-3037		RESISTOR 2.15K +-1% .1W TKF TC=0+-100	05524	CRCW08052151F
R1727	0699-1447	1	RESISTOR 261K +-1% .125W TKF TC=0+-100	09891	RK73H2BT2613F
R1728	0699-3575	1	RESISTOR 75 +-0.1% .125W TF TC=0+-25	01172	BLU-1206 75R .1% 25PPM
R1729	0699-3054	1	RES 287K 1% .1W	05524	CRCW08052873F
R1730	0699-2848	1	RESISTOR 18K +-0.1% .125W TF TC=0+-25	01172	BLU-1206 18K .1% 25PPM
R1731	0699-3058		RESISTOR 100 +-1% .1W TKF TC=0+-100	05524	CRCW08051000F
R1732	0699-3040	2	RESISTOR 3.16K +-1% .1W TKF TC=0+-100	00746	MCR10-F-3161
R1733	0699-3032		RESISTOR 511 +-1% .1W TKF TC=0+-100	05524	CRCW08055110F
R1801	0699-2887	1	RESISTOR 31.6 +-1% .1W TKF	00746	MCR10-F-31R6
R1802	0699-2963	1	RESISTOR 121 +-1% .1W TKF TC=0+-100	05524	CRCW08051210F

Reference Designator	Agilent Part Number	Qty	Part Description	Mfr. Code	Mfr. Part Number
R1803 - R1804	0699-1356	2	RESISTOR 31.6 +-1% .125W TKF TC=0+-100	09891	RK73H2BT31R6F
R1805	0699-3032		RESISTOR 511 +-1% .1W TKF TC=0+-100	05524	CRCW08055110F
R1806	0699-3029		RESISTOR 316 +-1% .1W TKF TC=0+-100	05524	CRCW08053160F
R1807	0699-3042	5	RESISTOR 3.83K +-1% .1W TKF TC=0+-100	05524	CRCW08053831F
R1808	0699-3052	1	RESISTOR 12.1K +-1% .1W TKF TC=0+-100	05524	CRCW08051212F
R1809	0699-3030		RESISTOR 383 +-1% .1W TKF TC=0+-100	05524	CRCW08053830F
R1810	0699-3069		RESISTOR 19.6K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1962
R1811	0699-2971		RESISTOR, FIXED, .1W, SMT, FLAT CHIP	05524	CRCW08051470F
R1901	0699-2855	1	RESISTOR 9.09K +-0.1% .125W TF TC=0+-25	01172	BLU-1206 9K09 .1% 25PPM
R1902	0699-2842	1	RESISTOR 38.3K +-0.1% .125W TF TC=0+-25	02499	W1206R033832BT
R1903	0699-3698	1	RESISTOR 10 +-1% .1W TKF TC=0+-100	09891	RK73H2A10R0F
R1904	0699-3037		RESISTOR 2.15K +-1% .1W TKF TC=0+-100	05524	CRCW08052151F
R1905	0699-2986		RESISTOR 21.5K +-1% .1W TKF TC=0+-100	05524	CRCW08052152F
R1906	0699-3053		RESISTOR 100K +-1% .1W TKF TC=0+-100	05524	CRCW08051003F
R1907	0699-2989	1	RESISTOR 38.3K +-1% .1W TKF TC=0+-100	05524	CRCW08053832F
R1908	0699-3042		RESISTOR 3.83K +-1% .1W TKF TC=0+-100	05524	CRCW08053831F
R1909	0699-2994	1	RESISTOR 90.9K +-1% .1W TKF TC=0+-100	00746	MCR10-F-9092
R1910	0699-3064		RESISTOR 909 +-1% .1W TKF TC=0+-100	05524	CRCW08059090F
R1911	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R1912 - R1914	0699-3212	3	RESISTOR 781 +-0.1% .125W TF TC=0+-25	05524	TNPW12067810BT-9
R1915	0699-6232	1	RESISTOR 90.9 0.1% .100W TC=25 100V 0805	09891	RN73E2A90R9B
R1916	0699-6233	1	R316 0.1% 0805	09891	RN73A3160B
R1917 - R1918	0699-6229	2	R121 0.1% 1206	00746	RN73E2B1210B
R1919	0699-6230	1	R78.7 0.1% 1206	09891	RN73E2B78R7B
R1920 - R1921	0699-6231	2	R154 0.1% 1206	09891	RN73E2B1540B
R1922	0699-3042		RESISTOR 3.83K +-1% .1W TKF TC=0+-100	05524	CRCW08053831F
R1923	0699-2971		RESISTOR, FIXED, .1W, SMT, FLAT CHIP	05524	CRCW08051470F
R1924	0699-3068	1	RESISTOR 16.2K +-1% .1W TKF TC=0+-100	05524	CRCW08051622F
R1925	0699-3039	5	RESISTOR 2.61K +-1% .1W TKF TC=0+-100	05524	CRCW08052611F
R1926	0699-3064		RESISTOR 909 +-1% .1W TKF TC=0+-100	05524	CRCW08059090F
R1927	0699-3042		RESISTOR 3.83K +-1% .1W TKF TC=0+-100	05524	CRCW08053831F
R1928	0699-2962	3	RESISTOR 68.1K +-1% .1W TKF TC=0+-100	05524	CRCW08056812F
R1929	0699-3740	2	RESISTOR 3.32K +-1% .1W TKF TC=0+-100	09891	RK73H2A3321F
R1930	0699-2971		RESISTOR, FIXED, .1W, SMT, FLAT CHIP	05524	CRCW08051470F
R1931 - R1934	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R1935	0699-3039		RESISTOR 2.61K +-1% .1W TKF TC=0+-100	05524	CRCW08052611F
R1936	0699-2442	2	RESISTOR 2.2 +-5% .125W TKF TC=0+-200	09891	RM73B2BT2R2J
R1937	0699-2962		RESISTOR 68.1K +-1% .1W TKF TC=0+-100	05524	CRCW08056812F
R1938	0699-3832		RESISTOR 51.1 +-1% .1W TKF TC=0+-100	00746	MCR10-F-51R1
R1939	0699-2971		RESISTOR, FIXED, .1W, SMT, FLAT CHIP	05524	CRCW08051470F
R1940	0699-3042		RESISTOR 3.83K +-1% .1W TKF TC=0+-100	05524	CRCW08053831F
R1941 - R1942	0699-6917	4	RESISTOR 49.9 OHM +-1% 1W TF TC=0+-25	05524	PTN2512E49R9FB
R1943	0699-3048	2	RESISTOR 7.5K +-1% .1W TKF TC=0+-100	05524	CRCW08057501F
R1944 - R1945	0699-6917		RESISTOR 49.9 OHM +-1% 1W TF TC=0+-25	05524	PTN2512E49R9FB
R1946	0699-3069		RESISTOR 19.6K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1962

Reference Designator	Agilent Part Number	Qty	Part Description	Mfr. Code	Mfr. Part Number
R1947	0699-3077		RESISTOR 1M +-1% .1W TKF TC=0+-100	05524	CRCW08051004F
R1948	0699-2491	2	RESISTOR 20K +-0.1% .125W TF TC=0+-25	02499	W1206R032002BT
R1949	0699-3048		RESISTOR 7.5K +-1% .1W TKF TC=0+-100	05524	CRCW08057501F
R1950	0699-3039		RESISTOR 2.61K +-1% .1W TKF TC=0+-100	05524	CRCW08052611F
R1951	0699-3045		RESISTOR 5.11K +-1% .1W TKF TC=0+-100	00746	MCR10-F-5111
R1952	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R1953	0699-2962		RESISTOR 68.1K +-1% .1W TKF TC=0+-100	05524	CRCW08056812F
R1954	0699-2971		RESISTOR, FIXED, .1W, SMT, FLAT CHIP	05524	CRCW08051470F
R1955	0699-4284	1	RESISTOR 2.1K +-0.1% .125W TF TC=0+-25	09891	RN73E2B2101B
R1956	0699-2442		RESISTOR 2.2 +-5% .125W TKF TC=0+-200	09891	RM73B2BT2R2J
R1957	0699-3740		RESISTOR 3.32K +-1% .1W TKF TC=0+-100	09891	RK73H2A3321F
R1959	2100-4198	1	RESISTOR-TRMR 200 20% TKF TOP-ADJ 1-TRN	03744	3314G-1-201E
R1960	0699-3069		RESISTOR 19.6K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1962
R1961 - R1962	0699-3053		RESISTOR 100K +-1% .1W TKF TC=0+-100	05524	CRCW08051003F
R2001	0699-3053		RESISTOR 100K +-1% .1W TKF TC=0+-100	05524	CRCW08051003F
R2002	0699-3530	1	RESISTOR 3.01K +-1% .1W TKF TC=0+-100	05524	CRCW08053011F
R2003	0699-3721	1	RESISTOR 5.9K +-1% .1W TKF TC=0+-100	09891	RK73H2A5901F
R2004	0699-3053		RESISTOR 100K +-1% .1W TKF TC=0+-100	05524	CRCW08051003F
R2005 - R2006	0699-3034		RESISTOR 1K +-1% .1W TKF TC=0+-100	05524	CRCW08051001F
R2007	0699-3040		RESISTOR 3.16K +-1% .1W TKF TC=0+-100	00746	MCR10-F-3161
R2008	0699-3053		RESISTOR 100K +-1% .1W TKF TC=0+-100	05524	CRCW08051003F
R2009	0699-3058		RESISTOR 100 +-1% .1W TKF TC=0+-100	05524	CRCW08051000F
R2010	0699-3053		RESISTOR 100K +-1% .1W TKF TC=0+-100	05524	CRCW08051003F
R2011	0699-3045		RESISTOR 5.11K +-1% .1W TKF TC=0+-100	00746	MCR10-F-5111
R2012	0699-3053		RESISTOR 100K +-1% .1W TKF TC=0+-100	05524	CRCW08051003F
R2013	0699-3034		RESISTOR 1K +-1% .1W TKF TC=0+-100	05524	CRCW08051001F
R2014	0699-2977		RES 681 1% .1W	05524	CRCW08056810F
R2015	0699-3045		RESISTOR 5.11K +-1% .1W TKF TC=0+-100	00746	MCR10-F-5111
R2016	0837-0487	1	THERMISTOR RECT CHIP 5K-OHM	05524	NTHS-1006N-02-5K-5%
R2017	0699-3360	2	RESISTOR .02 +-1% .5W TKF TC=0+-600	05524	WSL2010.021%
R2018	0699-2491		RESISTOR 20K +-0.1% .125W TF TC=0+-25	02499	W1206R032002BT
R2019	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R2020	0699-4311	2	RESISTOR 11.3K .1% 0805 100V .100W TC=25	01172	BLU-0805 11.3K .1% 25PPM
R2021	0699-3034		RESISTOR 1K +-1% .1W TKF TC=0+-100	05524	CRCW08051001F
R2022	0699-3049	1	RESISTOR 8.25K +-1pct .1W TKF TC=0+-100	00746	MCR10-FZHM-F-8251
R2023 - R2024	0699-3076	2	RESISTOR 464K +-1% .1W TKF TC=0+-100	05524	CRCW08054643F
R2025	0699-3067		RESISTOR 14.7K +-1% .1W TKF TC=0+-100	05524	CRCW08051472F
R2026	0699-2965		RESISTOR 46.4K +-1% .1W TKF TC=0+-100	05524	CRCW08054642F
R2027	0699-3039		RESISTOR 2.61K +-1% .1W TKF TC=0+-100	05524	CRCW08052611F
R2028	0699-3077		RESISTOR 1M +-1% .1W TKF TC=0+-100	05524	CRCW08051004F
R2029	0699-3360		RESISTOR .02 +-1% .5W TKF TC=0+-600	05524	WSL2010.021%
R2030	0699-3039		RESISTOR 2.61K +-1% .1W TKF TC=0+-100	05524	CRCW08052611F
R2031	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R2032	0699-3077		RESISTOR 1M +-1% .1W TKF TC=0+-100	05524	CRCW08051004F
R2033	0699-3053		RESISTOR 100K +-1% .1W TKF TC=0+-100	05524	CRCW08051003F

Reference Designator	Agilent Part Number	Qty	Part Description	Mfr. Code	Mfr. Part Number
R2034	0699-3046		RESISTOR 6.19K +-1% .1W TKF TC=0+-100	00746	MCR10-F-6191
R2035	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R2036	0699-2977		RES 681 1% .1W	05524	CRCW08056810F
R2037	0699-3069		RESISTOR 19.6K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1962
R2038	0699-4311		RESISTOR 11.3K .1% 0805 100V .100W TC=25	01172	BLU-0805 11.3K .1% 25PPM
R2039	0699-3008	1	RESISTOR	05524	CRCW08055113F
R2040	0699-2841	1	RESISTOR 9K +-0.1% .125W TF TC=0+-25	02499	W1206R039001BT
R2041 - R2047	0699-3034		RESISTOR 1K +-1% .1W TKF TC=0+-100	05524	CRCW08051001F
R2048	0699-3077		RESISTOR 1M +-1% .1W TKF TC=0+-100	05524	CRCW08051004F
T101	9170-1629	4	CORE-SHIELDING BEAD	06352	ACM4532-801-2P
T601	9170-1629		CORE-SHIELDING BEAD	06352	ACM4532-801-2P
T801	9100-4372	1		02739	T1-1-X65
T802	9170-1629		CORE-SHIELDING BEAD	06352	ACM4532-801-2P
T1901	9170-1629		CORE-SHIELDING BEAD	06352	ACM4532-801-2P
U101	1826-2264	1	IC 34064	36633	MC34064D-5R2
U102	1990-2050	4	40 NS PROP DELAY, SO-8 OPTOCOUPLER	02364	HCPL-0710
U103	1821-0055	1	IC SCHMITT-TRIG CMOS/ACT NAND QUAD 2-INP	36633	MC74ACT132D
U104	1820-7312	3	IC SCHMITT-TRIG CMOS/ACT INV HEX	01698	SN74ACT14D
U106	1820-6863	1	IC-16550	03406	PC16550DVX
U107 - U108	1821-0250	2	IC-INTERFACE DRVR/RCVR CMOS INV EIA	11302	MAX232CWE
U109	1821-1721	1	IC-GPIB CONTROLLER	01698	MP9914FNL
U110	1820-6175	1	IC-INTERFACE XCVR BIPOLAR BUS OCTL	01698	SN75ALS162DW
U111	1820-6176	1	IC-INTERFACE XCVR BIPOLAR BUS OCTL	01698	SN75ALS160DW
U201	1990-2050		40 NS PROP DELAY, SO-8 OPTOCOUPLER	02364	HCPL-0710
U202	1821-0765	1	IC-32-BIT CPU W/2K RAM,TPU,QSM	02037	MC68332ACFC20
U203 - U204	1818-5651	2	IC 4M-BIT SRAM 70-NS CMOS	12125	KM684000BLG-7
U211	1818-8163	1	64KB FRAM	14543	FM1608S-180SI
U212	1820-7312		IC SCHMITT-TRIG CMOS/ACT INV HEX	01698	SN74ACT14D
U213	1820-5938	2	IIC GATE CMOS/ACT NAND QUAD 2-INP	01698	SN74ACT00D
U214	1813-1450	1	CRYSTAL CLOCK OSCILLATOR	09235	F3345-18.000MHZ
U215	1820-7312		IC SCHMITT-TRIG CMOS/ACT INV HEX	01698	SN74ACT14D
U302	1821-2584	1	EPF10K10QC208-4	12880	EPF10K10QC208-4
U303 - U304	1821-0299	4	IC FF BICMOS/ABT D-TYPE POS-EDGE-TRIG	01698	74ABT273DW
U305 - U306	1821-0308	2	74ACTQ273-FF,OCTAL,D-TYPE WL CLEAR	02237	74ACTQ273SCX.
U307 - U308	1821-0299		IC FF BICMOS/ABT D-TYPE POS-EDGE-TRIG	01698	74ABT273DW
U401	1826-2198	1	IC PWR MGT-V-REG-SWG 0/5V 16 PINS P-SOIC	01698	TL7770-5CDW
U402	1821-4361	1	IC INTF LCD CONTLR COLOR DOT MATRIX	12768	SED1353F0A
U403	1818-6217	2	IC SRAM, 1 MBIT, 15NS ACCESS	10253	IDT71016S15Y
U501 - U504	1821-0501	4	IC TRANSCEIVER BICMOS/ABT BUS OCTL	01698	SN74AABT245BDB
U505	1813-1448	1	OSC 40.96MHZ 5V CMOS 100PPM SMT	09235	F3345-40.960MHZ
U506	1821-2095	1	IC D&P 16BIT 25NS 2KRAM	01698	TMS320BC51PQ80
U507	1818-6217		IC SRAM, 1 MBIT, 15NS ACCESS	10253	IDT71016S15Y
U601	1826-3045	1	IC PWR MGT-V-REF-ADJ 2.5/3V 8 PINS	03285	AD780AR
U602	1826-1925	1	IC OP AMP LOW-NOISE SINGLE 8 PIN	03285	OP-27GS

Reference Designator	Agilent Part Number	Qty	Part Description	Mfr. Code	Mfr. Part Number
U603	1826-2147	5	ANALOG MULTIPLEXER 8 CHNL 16 -P-SOIC	02883	DG408DY
U604	1826-2176	4	IC OP AMP PRCN DUAL 8 PIN PLSTC-SOIC	03285	AD712JR
U605	1813-1449	1	Crystal-Clock Oscillator	09235	F3345-15.000MHZ
U606	1826-6561	1	IC-AD-16BPAR/SER-51G/DEL-EXT-AD7721AR	03285	AD7721AR
U607	1826-2793	2	D/A 16-BIT 16-P-SOIC BICMOS	03285	AD1851R
U608	1820-4346	1	IC MUXR/DATA-SEL CMOS/HC 2-TO-1-LINE TPL	02910	74HC4053D
U609	1826-2176		IC OP AMP PRCN DUAL 8 PIN PLSTC-SOIC	03285	AD712JR
U701	1826-6642	1	D/A 14-BIT 14-SOIC +5V SERIAL INPUT	11302	MAX545BCSD
U702	1826-2176		IC OP AMP PRCN DUAL 8 PIN PLSTC-SOIC	03285	AD712JR
U703	1826-2147		ANALOG MULTIPLEXER 8 CHNL 16 -P-SOIC	02883	DG408DY
U704	1826-1622	3	IC OP AMP LOW-BIAS-H-IMPD QUAD 14 PIN	01698	TL074CD
U705	1826-2176		IC OP AMP PRCN DUAL 8 PIN PLSTC-SOIC	03285	AD712JR
U706 - U708	1826-2147		ANALOG MULTIPLEXER 8 CHNL 16 -P-SOIC	02883	DG408DY
U801	1826-1734	1	IC PWR MGT-V-REG-FXD-POS 4.8/5.2V 3 PINS	01698	UA78M05CKTP
U802	1826-2387	1	IC COMPARATOR HS 14 PIN PLSTC-SOIC	02910	NE529D
U803	1813-1433	1	TCXO 10 MHZ 5V CMOS	14847	TV2045A-LX-1-10.000
U804	1820-5938		IC GATE CMOS/ACT NAND QUAD 2-INP	01698	SN74ACT00D
U901	1827-0030	2	IC FREQ-SYNTH 20 PIN PLSTC-TSSOP	03406	LMX2332LTM
U902	1826-3184	5	IC OP AMP LP 5 PIN PLSTC SOT23-5	03406	LMC7101AIM5
U903	1813-1506	1	PRECISION VCXO 797 to 803MHZ	12685	CLV0795E
U904	1827-0030		IC FREQ-SYNTH 20 PIN PLSTC-TSSOP	03406	LMX2332LTM
U905	1826-3184		IC OP AMP LP 5 PIN PLSTC SOT23-5	03406	LMC7101AIM5
U906	1821-0459	2	IC GATE ECL/10E AND-NAND 2-INP	36633	MC10EL05D
U907	1820-7756	1	IC MISC ECL/10E	36633	MC10E195FN
U1001	1990-2050		40 NS PROP DELAY, SO-8 OPTOCOUPLER	02364	HCPL-0710
U1002	1820-8770	1	IC BFR CMOS/ACT NON-INV QUAD	02237	74ACT125SCX.
U1003	1990-2050		40 NS PROP DELAY, SO-8 OPTOCOUPLER	02364	HCPL-0710
U1004	1826-3813	3	IC-COMP SPT9687, DUAL HIGH-SPEED	13735	SPT9687SIS
U1005	1820-5606	2	IC GATE ECL/10KH AND QUAD 2-INP	36633	MC10H104FNR2
U1006	1826-1622		IC OP AMP LOW-BIAS-H-IMPD QUAD 14 PIN	01698	TL074CD
U1007	1821-0442	3	IC FF ECL/10E D-TYPE POS-EDGE-TRIG	36633	MC10EL31D
U1008	1821-0882	1	IC GATE ECL/10E	36633	MC10EL89D
U1009	1826-2793		D/A 16-BIT 16-P-SOIC BICMOS	03285	AD1851R
U1101	1821-0076	2	IC RGTR ECL/10E 5-BIT	36633	MC10E452FN
U1102 - U1103	1821-0658	2	IC DIVR ECL/10E DIV-X-4	36633	MC10EL33D
U1104	1821-0459		IC GATE ECL/10E AND-NAND 2-INP	36633	MC10EL05D
U1105	1821-3534	1	IC-MC10EL51D, FF, D-TYPE W/DIFF CLOCK	36633	MC10EL51D
U1106	1821-1985	1	IC-MC10E404FN, GATE, QUAD DIFF AND/NAND	36633	MC10E404FN
U1107	1820-7650	2	IC GATE ECL/10E AND-NAND QUINT 2-INP	36633	MC10E104FN
U1108	1821-0442	3	IC FF ECL/10E D-TYPE POS-EDGE-TRIG	36633	MC10EL31D
U1109	1820-6946	2	IC FF ECL/10E D-M/S POS-EDGE-TRIG COM	36633	MC10E131FN
U1110	1821-0442		IC FF ECL/10E D-TYPE POS-EDGE-TRIG	36633	MC10EL31D
U1111	1820-5390	3	IC XLTR ECL/10KH ECL-TO-TTL QUAD	36633	MC10H125FN
U1201	1821-8744	1	IC PLD CPLD UNPRGMD CMOS 1K30	12880	EP1K30FC256-3
U1202	1820-5940	1	IC GATE CMOS/ACT AND QUAD 2-INP	02237	74ACT08SCX

Reference Designator	Agilent Part Number	Qty	Part Description	Mfr. Code	Mfr. Part Number
U1203	1826-8786	1	IC PWR MGT-V-REG-LDO 2.5V 8 PIN SOIC	01698	TPS77625D
U1301 - U1303	1821-3346	5	IC MUXR/DATA-SEL CMOS 2-TO-1-LINE 2-INP	01698	SN74CBT16233DLR
U1304 - U1305	1818-8134	2	SYNCH FAST STATIC RAM IC	02037	MCM69P618CTQ5R
U1306 - U1307	1821-3346		IC MUXR/DATA-SEL CMOS 2-TO-1-LINE 2-INP	01698	SN74CBT16233DLR
U1401	1820-7650		IC GATE ECL/10E AND-NAND QUINT 2-INP	36633	MC10E104FN
U1402 - U1403	1821-0698	2	IC XLTR ECL/10KH 6-BIT	36633	MC10H604FN
U1404 - U1407	1820-7647	4	IC RGTR ECL/10E STOR 9-BIT	36633	MC10E143FN
U1408 - U1410	1820-7686	3	IC MUXR/DATA-SEL ECL/10E 2-TO-1-LINE	36633	MC10E167FN
U1501	1820-5390		IC XLTR ECL/10KH ECL-TO-TTL QUAD	36633	MC10H125FN
U1502	1820-6781	1	IC-MC10H164FN	36633	MC10H164FN
U1503	1820-5390		IC XLTR ECL/10KH ECL-TO-TTL QUAD	36633	MC10H125FN
U1504	1821-0076		IC RGTR ECL/10E 5-BIT	36633	MC10E452FN
U1505	1820-6946		IC FF ECL/10E D-M/S POS-EDGE-TRIG COM	36633	MC10E131FN
U1506	1826-3813		IC-COMP SPT9687, DUAL HIGH-SPEED	13735	SPT9687SIS
U1507	1820-5606		IC GATE ECL/10KH AND QUAD 2-INP	36633	MC10H104FNR2
U1508	1826-1622		IC OP AMP LOW-BIAS-H-IMPD QUAD 14 PIN	01698	TL074CD
U1601	1826-3258	4	IC OP AMP PRCN DUAL 8 PIN PLSTC-SOIC	10858	LT1112S8
U1602	1826-6553	2	SPECIAL PURPOSE AMP WIDEBAND SNGL 8 PIN	03285	AD8037AR
U1603 - U1604	1826-3258		IC OP AMP PRCN DUAL 8 PIN PLSTC-SOIC	10858	LT1112S8
U1605	1826-6553		SPECIAL PURPOSE AMP WIDEBAND SNGL 8 PIN	03285	AD8037AR
U1701	1827-0356	1	D/A 12-BIT 64-TQFP BIPOLAR	11302	MAX555CCB
U1702	1826-3184		IC OP AMP LP 5 PIN PLSTC SOT23-5	03406	LMC7101AIM5
U1703	1826-3564		IC RF/IF AMPL HS 8 PIN PLSTC-SOIC	03285	AD8009AR
U1704	1826-3813		IC-COMP SPT9687, DUAL HIGH-SPEED	13735	SPT9687SIS
U1801	1826-3242	1	IC MULTIPLIER 4-QUAD 8 PIN PLSTC-SOIC	03285	AD835AR
U1802	1826-3564	2	IC RF/IF AMPL HS 8 PIN PLSTC-SOIC	03285	AD8009AR
U1802	1826-3564		IC RF/IF AMPL HS 8 PIN PLSTC-SOIC	03285	AD8009AR
U1901	1826-3258		IC OP AMP PRCN DUAL 8 PIN PLSTC-SOIC	10858	LT1112S8
U1902	1827-0112	1	IC OP AMP HS VOLT-FDBK SGL 8-SOIC	01698	THS4061CDGN
U1903	1826-2144	1	IC OP AMP LOW-NOISE SINGLE 8 PIN	03285	OP-37GS
U1904	1NB7-8420	1	HYBRID PART	02296	1NB7-8420
U1905 - U1906	1826-3184		IC OP AMP LP 5 PIN PLSTC SOT23-5	03406	LMC7101AIM5
U1907	1826-1572	2	IC COMPARATOR PRCN DUAL 8 PIN PLSTC-SOIC	02910	LM393D
U2001	1826-1862	1	IC OP AMP LOW-BIAS-H-IMPD DUAL 8 PIN	02037	TL072CD
U2002	1826-1572		IC COMPARATOR PRCN DUAL 8 PIN PLSTC-SOIC	02910	LM393D
U2003	1826-3825	1	I/C PWR MNGR VOLTAGE REG. SWITCHING	03406	LM2594M-ADJ
U2004 - U2005	1826-3740	2	IC PWR MGT-V-REG-SWG 1.178/1.202V 16	10858	LTC1435CS
U2006	1826-3826	1	IC-THERMOSTAT-DUAL-LOW POWER-LM56BIM	03406	LM56BIM
VR601	1901-1276	6	DIODE, TRANSORB-ZENER	02664	SMBJ5.0A
VR602	0960-1073	7	ESD SUPPRESS OR (COL/0155633250-66511/ODIN)	02805	0805ESDA
VR603	1901-1276		DIODE, TRANSORB-ZENER	02664	SMBJ5.0A
VR801 - VR802	0960-1073		ESD SUPPRESS OR (COL/01556-66501/ODIN)	02805	0805ESDA
VR803	1901-1346	4	DIO,TVS,D0214AB,43V,1500WP,SMCJ43CA	22280	SMCJ43CA

Reference Designator	Agilent Part Number	Qty	Part Description	Mfr. Code	Mfr. Part Number
VR804	1901-1276		DIODE, TRANSORB-ZENER	02664	SMBJ5.0A
VR805	0960-1073		ESD SUPPRESS OR (COL/01556-66501/ODIN)	02805	0805ESDA
VR1001	1901-1276		DIODE, TRANSORB-ZENER	02664	SMBJ5.0A
VR1002	0960-1073		ESD SUPPRESS OR (COL/01556-66501/ODIN)	02805	0805ESDA
VR1501	1901-1276		DIODE, TRANSORB-ZENER	02664	SMBJ5.0A
VR1502	0960-1073		ESD SUPPRESS OR (COL/01556-66501/ODIN)	02805	0805ESDA
VR1503	1901-1346		DIO,TVS,D0214AB,43V,1500WP,SMCJ43CA	22280	SMCJ43CA
VR1901	1901-1276		DIODE, TRANSORB-ZENER	02664	SMBJ5.0A
VR1902	0960-1073		ESD SUPPRESS OR (COL/01556-66501/ODIN)	02805	0805ESDA
VR1903	1901-1346		DIO,TVS,D0214AB,43V,1500WP,SMCJ43CA	22280	SMCJ43CA
VR2001	1901-1346		DIO,TVS,D0214AB,43V,1500WP,SMCJ43CA	22280	SMCJ43CA
XJ1501	3050-1557		WASHER - FLAT	05313	5606-4-31
XJ1901	3050-1557		WASHER - FLAT	05313	5606-4-31
XJ9	33120-00614		SHIELD - RFI	02362	33120-00614
XU105	1200-1592	1	SOCKET-IC-PLCC 44-CONT SQUARE J-LEAD	01380	3-822275-1
XU207 - XU210	1200-1593	4	SOCKET-IC-PLCC 32-CONN RECT J-LEAD	01380	3-822273-1
XU301	1200-1590	1	SOCKET-IC-PLCC 20-CONT SQUARE J-LEAD	01380	3-822269-1
Y101	0410-4009	1	CERO-RES 12MHZ +1-0.8%	02010	PBRC-12.00BR07
Y102	0410-2622	1	CRYSTAL-QUARTZ 3.6864 MHZ	09235	FPX0368-20

33250-66502 – Front-Panel PC Assembly (A2)

Reference Designator	Agilent Part Number	Qty	Part Description	Mfr. Code	Mfr. Part Number
C101	0160-7798	9	CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C103	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C105 - C109	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C111	0180-4758	1	CAP-FXD 47uF +-20% 20 V TA	12340	T491D476M020AS
C117 - C118	0180-4538	2	CAP-FXD 100uF +-20% 10 V TA	12340	T495X107M010AS
C221	0160-5967	2	CF 100PF 5%	06352	C2012COG1H101J
C222 - C223	0160-7798		CAP 0.1UF 50V 10% X7R 0805	06352	C2012X7R1H104K
C224	0160-5967		CF 100PF 5%	06352	C2012COG1H101J
CR100 - CR107	1901-1227	8	DIODE-SWITCHING 75V 200MA 6NS TO-236	02910	BAS16
DS201 - DS215	1990-2411	15	GREEN LED	12416	CMD67-21VGC
E100	9164-0173	1	BEEPER, PC MOUNT	09939	PKM22EPP-4002 S
J100	1252-8157	1	CONN_FFC_VERT_FEM_40PIN_FP_SMT	03418	52559-4092
J101	1253-0078	1	CONN FFC VERT FEM 14PIN .5MM SMT FP SMC	02010	04-6214-014-010-800
L101	9170-1739	1	CORE-SHIELDING BEAD	11702	FBMH4532HM681
L102	9170-1663	1	CORE-SHIELDING BEAD	11702	FBMH4532HM132
L201	9170-1584	1	CORE MAGNETIC	06352	MMZ2012Y102B
P102	1253-3587	1	VERTICAL, SMT 4 POS 1.25MM PITCH	03418	53398-0490
Q100	1854-1037	1	TRANSISTOR NPN SI TO-236AA PD=350MW	00746	SST3904T116
R105 - R109	0699-3051	10	RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R120 - R121	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R123 - R124	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
R200 - R214	0699-3059	15	RESISTOR 162 +-1% .1W TKF TC=0+-100	05524	CRCW08051620F
R216	0699-3051		RESISTOR 10K +-1% .1W TKF TC=0+-100	00746	MCR10-F-1002
S203	0960-0892	1	ROTARY ENCODER	11318	EC16B2410402A
U201 - U202	1821-0299	2	IC FF BICMOS/ABT D-TYPE POS-EDGE-TRIG	01698	74ABT273DW
U204	1826-2264	1	IC 34064	36633	MC34064D-5R2

33250A Chassis Assembly

Reference Designator	Agilent Part Number	Qty	Part Description	Mfr. Code	Mfr. Part Number
CBL1	33250-61612	1	CABLE, RS-232	02364	33250-61612
CLP1	1400-1780	1	CLIP-CABLE HOLDER	39442	DCS-150-CZC
FAN1	33250-68501	1	FAN ASSEMBLY	02634	33250-68501
FLT1	33250-67601	1	LINE FILTER ASSEMBLY	02634	33250-67601
FRM1	33250-00611	1	POWER SUPPLY FRAME	02364	33250-00611
INS1	33250-44105	1	INSULATOR, POWER SUPPLY	02634	33250-44105
MP2	33250-80111	1	CHASSIS	02634	33250-80111
MP5	33250-84111	1	COVER	02364	33250-84111
MP6	34401-45011	1	HANDLE	02364	33250-45011
MP7	34401-86010	1	KIT-BUMPERS/COVER	02364	34401-86010
MP9	34401-88304	1	REAR BEZEL	02364	34401-88304
NUT1 - NUT2	2940-0256	2	NUT-HEX-DBL-CHAM 1/2-28-THD .095-IN-THK	01380	1-329631-2
NUT3	0535-0154	1	CABLE 3COPPER 600V 12 AWG .635IN OD	19400	8121-1070
PLT1	5065-6621	1	HEX STANDOFF-MALE	02364	5065-6621
PWR1	33250-87910	1	POWER SUPPLY ASSEMBLY	02634	33250-87910
RVT1 - RVT4	0361-1840	4	RIVET-FAN SNAP	11855	FSP-2
SCR1 - SCR9	0515-0433	9	SCREW M4x0.7x8MM	05610	0515-0433
SHD1	33250-40603	1	SAFETY SHIELD, POWER SUPPLY	02634	33250-40603
STD1 - STD2	0380-1858	2	STANDOFF-HEX .312-IN-LG 4-40-THD	02121	ST9532-36
SW1	33250-13603	1	INTUILINK ARB SOFTWARE	02634	33250-13603
WSH1- WSH2	2190-0699	2	WASHER-LK INTL T 1/2 IN .5-IN-ID	01380	1-329632-2

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33250A Front-Panel Assembly

Reference Designator	Agilent Part Number	Qty	Part Description	Mfr. Code	Mfr. Part Number
ASY1	33250-60201	1	FRONT-PANEL ASSEMBLY (includes 33250-40201 and 33250-40202)	02634	33250-60201
CBL2-CBL3	33250-61606	2	CABLE, 50 OHM, BNC - SMB	02634	33250-61606
CBL4	33250-61611	1	CABLE, 14 CONDUCTOR RIBBON	02364	33250-61611
CBL5	33250-61613	1	CABLE, 40 CONDUCTOR RIBBON	02634	33250-61613
KNB1	33250-87401	1	KNOB	02634	33250-87401
MP1	33250-40201	1	BEZEL, FRONT	02634	33250-40201
MP2	33250-40202	1	WINDOW FRAME	02634	33250-40202
NUT3	0535-0154	1	NUT-HEX SGL-CHAM M9.0 X 0.75 2MM-THK	11239	3-9-03
PAD1	33250-88001	1	KEYPAD	02634	33250-88001
PLT2	33250-04102	1	PLATE, PLASTIC BACKER PLATE	02634	33250-04102
PLT3	33250-44104	1	SUPPORT PLATE, FRONT PANEL	02634	33250-44104
SHD2	33250-00604	1	SHIELD- EMC	02634	33250-00604
WIN1	33250-49301	1	WINDOW, FRONT	02634	33250-49301
WSH3	2190-0016	1	WASHER-LK INTL T 3/8 IN .377-IN-ID	02440	2190-0016

Manufacturer's List

Mfr Code	Manufacturer's Name	Manufacturer's Address			Zip Code
00467	OMRON ELECTRONICS INC	SCHAUMBURG	IL	US	60173
00746	ROHM CO LTD	KYOTO		JP	00746
01172	RCD COMPONENTS INC	MANCHESTER	NH	US	03101
01380	AMP INC	HARRISBURG	PA	US	17101
01698	TEXAS INSTRUMENTS INC	DALLAS	TX	US	75201
01886	COILCRAFT INC	CARY	IL	US	60013
01850	AROMAT CORP	NEW PROVIDENCE	NJ	US	07974
02010	AVX CORP	MYRTLE BEACH	SC	US	29572
02037	MOTOROLA INC	SCHAUMBURG	IL	US	60159
02121	LYN-TRON INC	SPOKANE	WA	US	99201
02213	HUGHES,R S COMPANY INC	SUNNYVALE	CA	US	94086
02237	FAIRCHILD SEMICONDUCTOR CORP FSC	SOUTH PORTLAND	ME	US	04106
02364	AGILENT TECHNOLOGIES, INC.	PALO ALTO	CA	US	94303
02440	THOMPSON BREMER DIV VARE	CHICAGO	IL	US	60601
02499	INTERNATIONAL RESISTIVE CO	BOONE	NC	US	28607
02664	SEMTECH CORPORATION	NEWBURY PARK	CA	US	91319
02805	COOPER INDUSTRIES INC	HOUSTON	TX	US	77044
02865	SKYWORKS SOLUTIONS INC	WOBURN	MA	US	01801
02883	VISHAY/SILICONIX INC	SANTA CLARA	CA	US	53201
02910	PHILIPS SEMICONDUCTORS BV	EINDHOVEN		NL	
03038	AMPHENOL CORP	WALLINGFORD	CT	US	06492
03118	ILLINOIS TOOL WORKS INC	MILWAUKEE	WI	US	53201
03285	ANALOG DEVICES INC	NORWOOD	MA	US	02062
03406	NATIONAL SEMICONDUCTOR CORP	SANTA CLARA	CA	US	95050
03418	MOLEX INC	LISLE	IL	US	60532
04726	3M/MINNESOTA MINING & MANUFACTURING	SAINT PAUL	MN	US	55101
05232	BRADY W H CO	MILWAUKEE	WI	US	53201
05313	SEASTROM MFG CO INC	TWIN FALLS	ID	US	83301
05524	VISHAY INTERTECHNOLOGY INC	MALVERN	PA	US	19355
05610	TEXTRON INC	PROVIDENCE	RI	US	02901
06337	KONINKLIJKE PHILIPS ELECTRONICS NV	AMSTERDAM		NL	
06352	TDK CORPORATION OF AMERICA	MOUNT PROSPECT	IL	US	60056
07606	ITW / MEDALIST	GLENVIEW	IL	US	60025
09141	ALPS ELECTRIC CO LTD	OTA-KU		JP	
09891	KOA CORPORATION	INA		JP	
09235	FOX ELECTRONICS	FORT MYERS	FL	US	33901
09939	MURATA ELECTRONICS NORTH AMERICA	SMYRNA	GA	US	30080
10800	OPTREX CORP	BUNKYO-KU	13	JP	
10858	LINEAR TECHNOLOGY CORPORATION	MILPITAS	CA	US	95035
11116	SPECIALTY ENTERPRISES INC	MONTEBELLO	CA	US	90640
11239	NOBEL MERCANTILE CO	ALBUQUERQUE	NM	US	87101
11302	MAXIM INTEGRATED PRODUCTS INC	SUNNYVALE	CA	US	94085
11702	TAIYO YUDEN CO LTD	TOKYO		JP	
11855	DELTA ELECTRONIC INDUSTRIES CO	TAIPEI		TW	

Mfr Code	Manufacturer's Name	Manufacturer's Address			Zip Code
12125	SAMSUNG SEMICONDUCTOR INC	SAN JOSE	CA	US	95101
12322	MAINE POLY INC	GREENE	ME	US	04236
12340	KEMET ELECTRONICS CORP	SIMPSONVILLE	SC	US	29680
12416	SLI INC/ CHICAGO MINIATURE LAMP INC	CANTON	MA	US	02021
12880	ALTERA CORP	SAN JOSE	CA	US	95101
14543	RAMTRON	COLORADO SPRINGS	CO	US	80901
19400	COLOTEX ELECTRIC SUPPLY	LOVELAND	CO	US	80537
22280	GENERAL SEMICONDUCTOR INC	MELVILLE	NY	US	11747
25936	TAI-TECH ADVANCED	SINGAPORE		SG	
36633	ON SEMICONDUCTOR	PHOENIX	AZ	US	85001
39442	DIE CO INC	WILLOUGHBY	OH	US	44094

Backdating

Backdating

This chapter normally contains information necessary to adapt this manual to instruments not directly covered by the current content.

At this printing, the manual applies to all instruments.

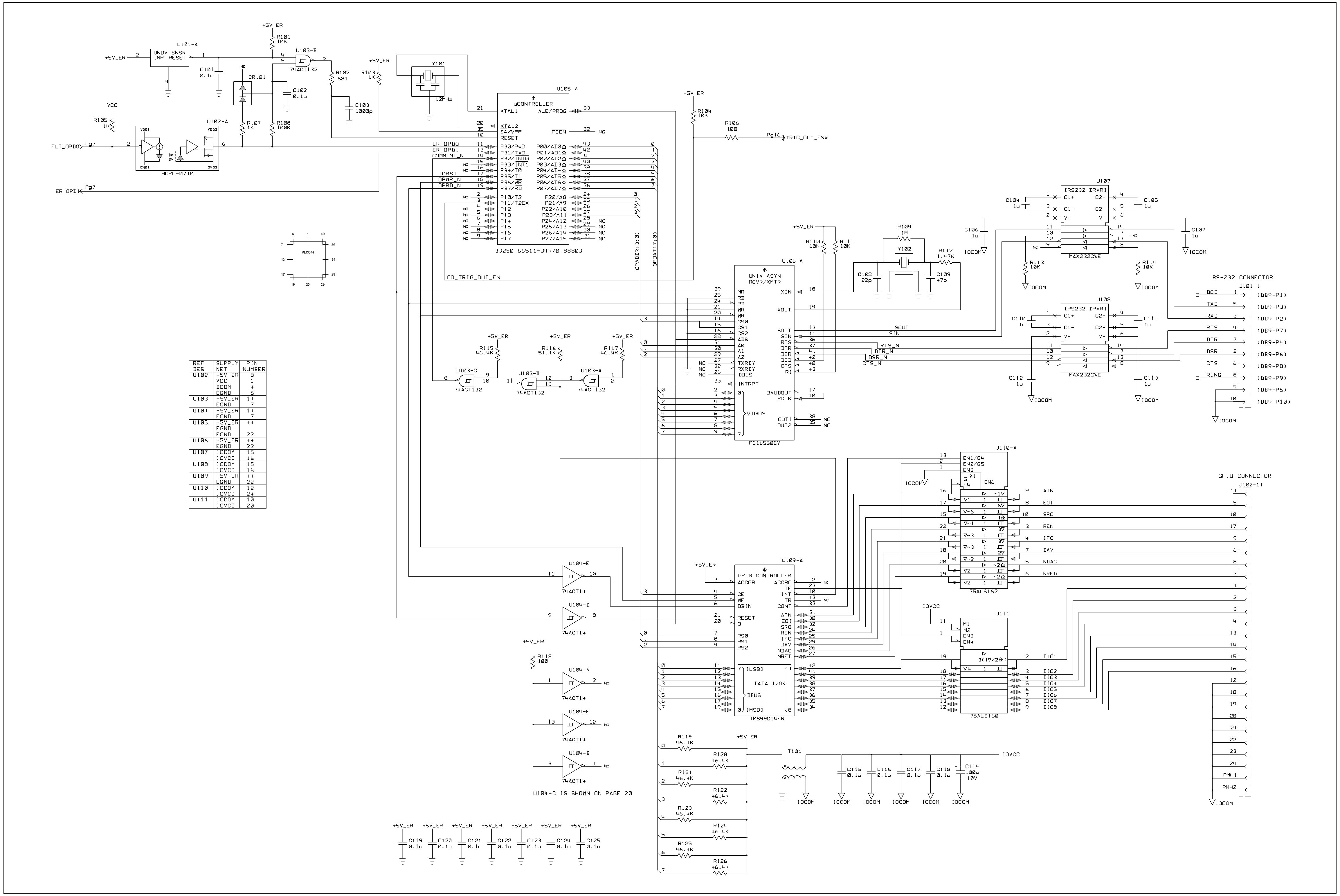
8

Schematics

9

Schematics

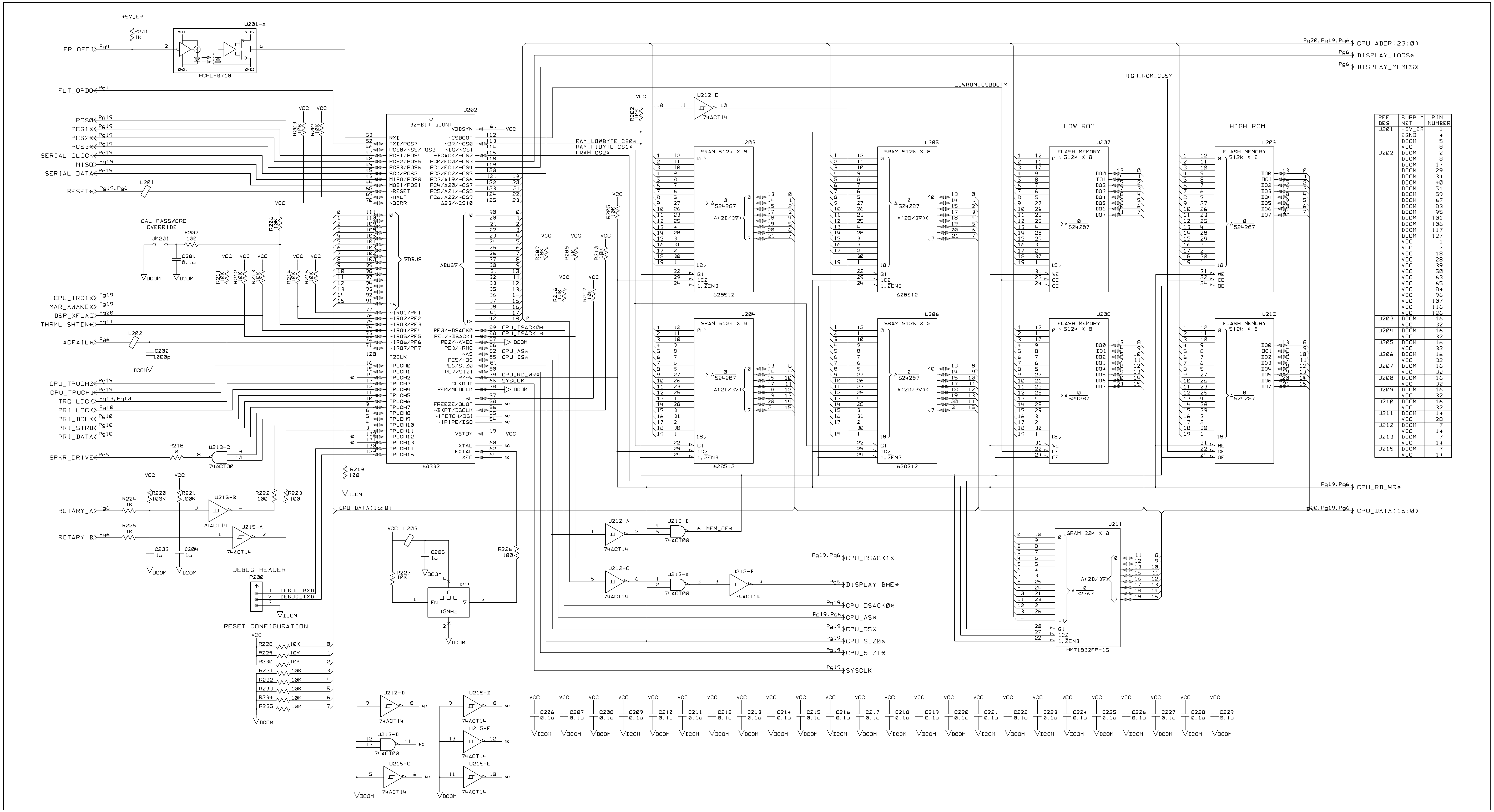
You may notice parts labeled as “No Load” on several of the schematics. These are parts that were included for design and development but were later removed to enhance performance or reduce cost.

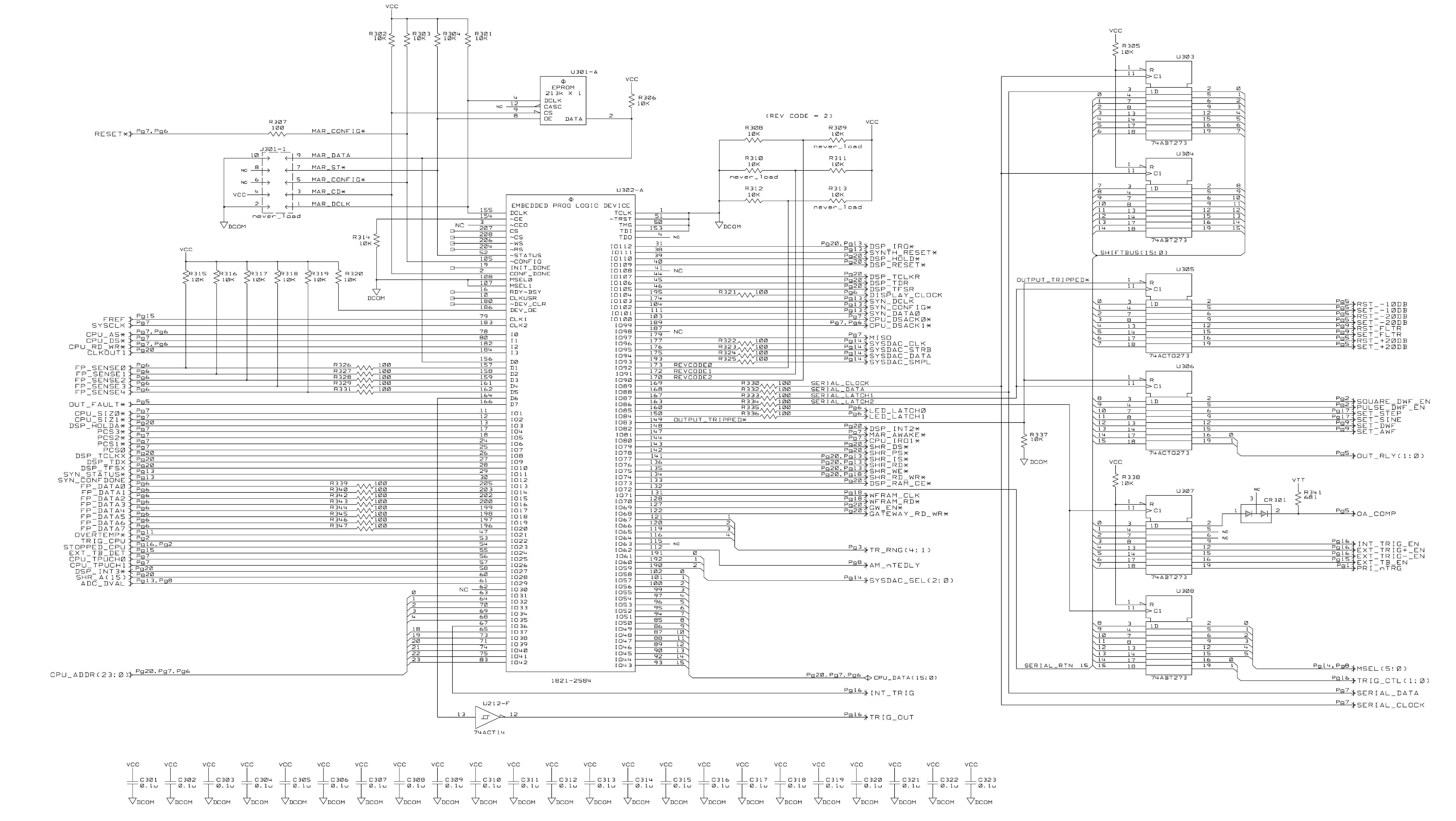


REF DES	SUPPLY NET	PIN NUMBER
U102	+5V_ER	8
	VCC	1
	DCOM	4
	EGND	5
U103	+5V_ER	14
	EGND	7
U104	+5V_ER	14
	EGND	7
U105	+5V_ER	44
	EGND	1
	EGND	22
U106	+5V_ER	44
	EGND	22
U107	IOCOM	15
	IOVCC	16
U108	IOCOM	15
	IOVCC	16
U109	+5V_ER	44
	EGND	22
U110	IOCOM	12
	IOVCC	24
U111	IOCOM	10
	IOVCC	20

33250-66511 (sheet 1 of 20)

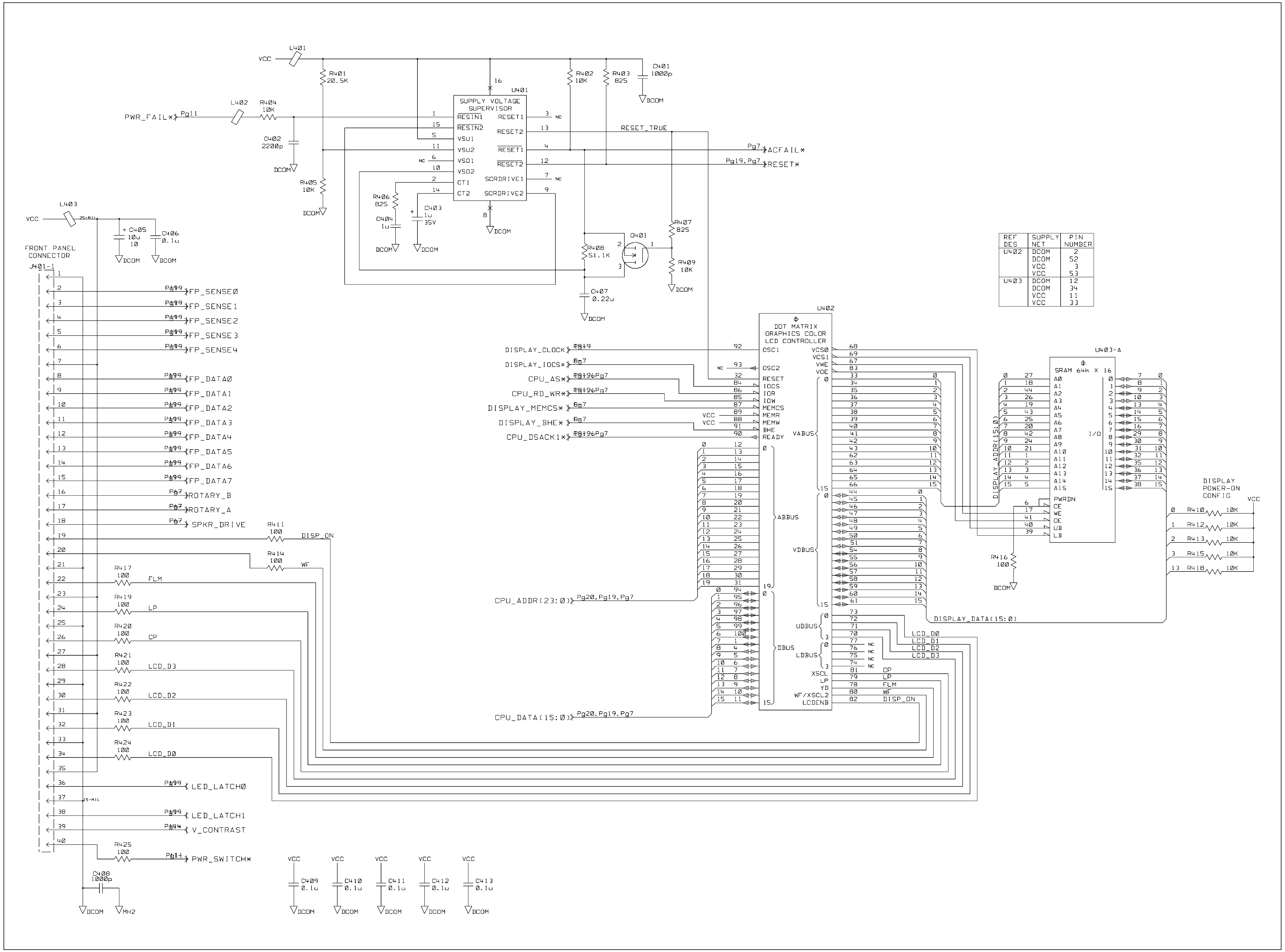
A1 Earth Referenced Communications Schematic


ER_OPDI
FLT_OPDO
PCS0
PCS1*
PCS2*
PCS3*
SERIAL_CLOCK
MISO
SERIAL_DATA
RESET*
CAL PASSWORD OVERRIDE
CPU_IRQ1*
MAR_AWAKE*
DSP_XFLAG
THRML_SHTDN*
ACFAIL*
CPU_TPUCH0
CPU_TPUCH1
TRG_LOCK
PRI_LOCK
PRI_DCLK
PRI_STRB
PRI_DATA
SPKR_DRIVE
ROTARY_A
ROTARY_B
DEBUG HEADER
RESET CONFIGURATION
HCPL-0710
32-BIT µCONT
68332
SRAM 512k X 8
628512
LOW ROM
HIGH ROM
FLASH MEMORY 512k X 8
SRAM 32k X 8
HM71832FP-15
18MHz
74ACT14
74ACT00
RAM_LOWBYTE_CS0*
RAM_HIBYTE_CS1*
FRAM_CS2*
HIGH_ROM_CS5*
LOWROM_CSBOOT*
CPU_ADDR(23:0)
DISPLAY_IOCS*
DISPLAY_MEMCS*
CPU_RD_WR*
CPU_DATA(15:0)
MEM_OE*
CPU_DSACK1*
DISPLAY_BHE*
CPU_DSACK0*
CPU_AS*
CPU_DS*
CPU_SIZ0*
CPU_SIZ1*
SYSCLK
REF DES
SUPPLY NET
PIN NUMBER

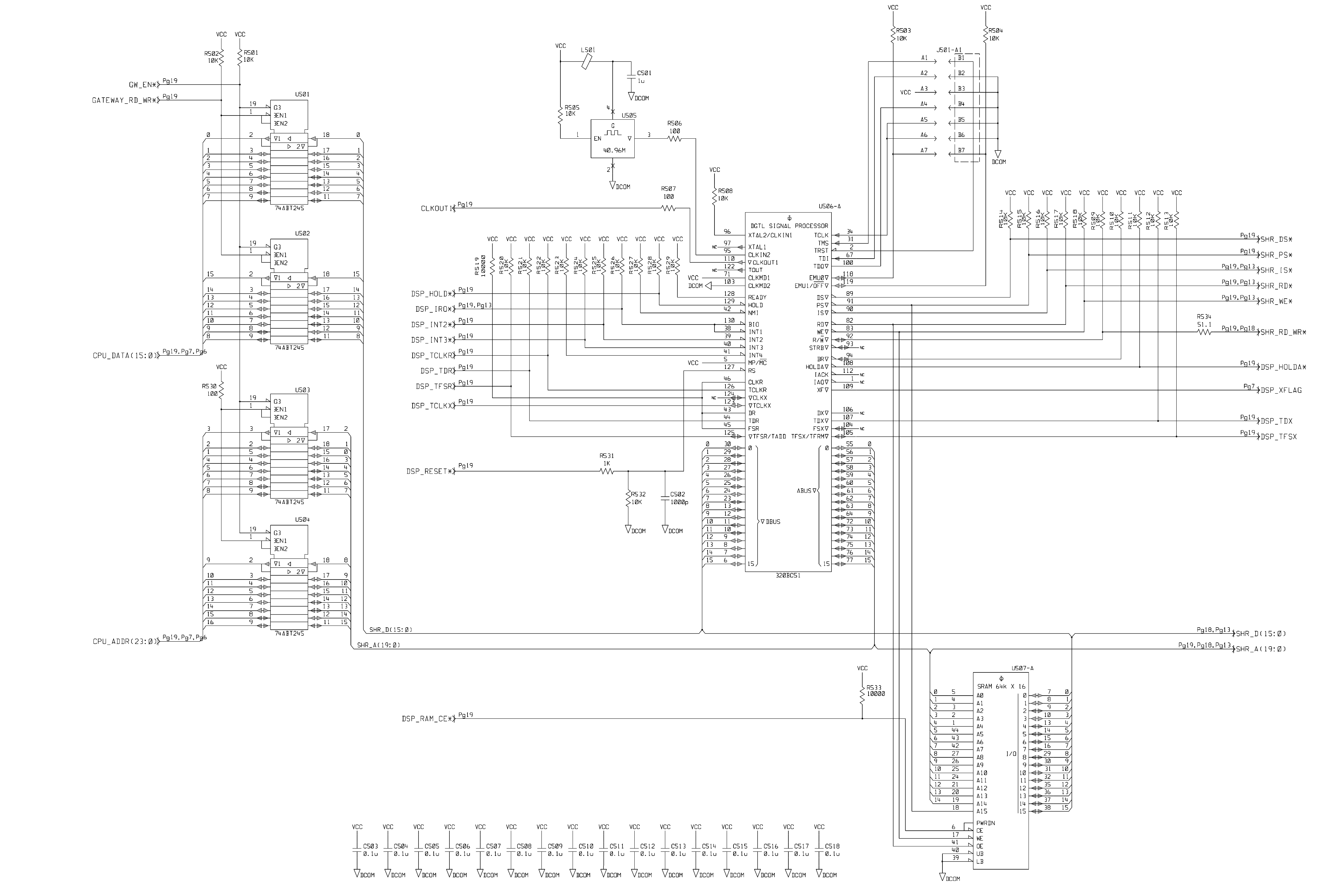


REF DES	SUPPLY NET	PIN NUMBER
U212	DCOM	7
	VCC	14
U302	DCOM	20
	DCOM	21
	DCOM	32
	DCOM	33
	DCOM	48
	DCOM	49
	DCOM	59
	DCOM	72
	DCOM	81
	DCOM	82
	DCOM	91
	DCOM	123
	DCOM	124
	DCOM	129
	DCOM	130
	DCOM	151
	DCOM	152
	DCOM	171
	DCOM	185
	DCOM	188
	DCOM	201
	VCC	5
	VCC	6
	VCC	22
	VCC	23
	VCC	34
	VCC	35
	VCC	42
	VCC	43
	VCC	66
	VCC	76
	VCC	77
	VCC	84
	VCC	98
	VCC	106
	VCC	109
	VCC	110
	VCC	117
	VCC	118
	VCC	137
	VCC	138
	VCC	145
	VCC	146
	VCC	165
	VCC	178
	VCC	181
	VCC	194
U303	DCOM	10
	VCC	20
U304	DCOM	10
	VCC	20
U305	DCOM	10
	VCC	20
U306	DCOM	10
	VCC	20
U307	DCOM	10
	VCC	20
U308	DCOM	10
	VCC	20

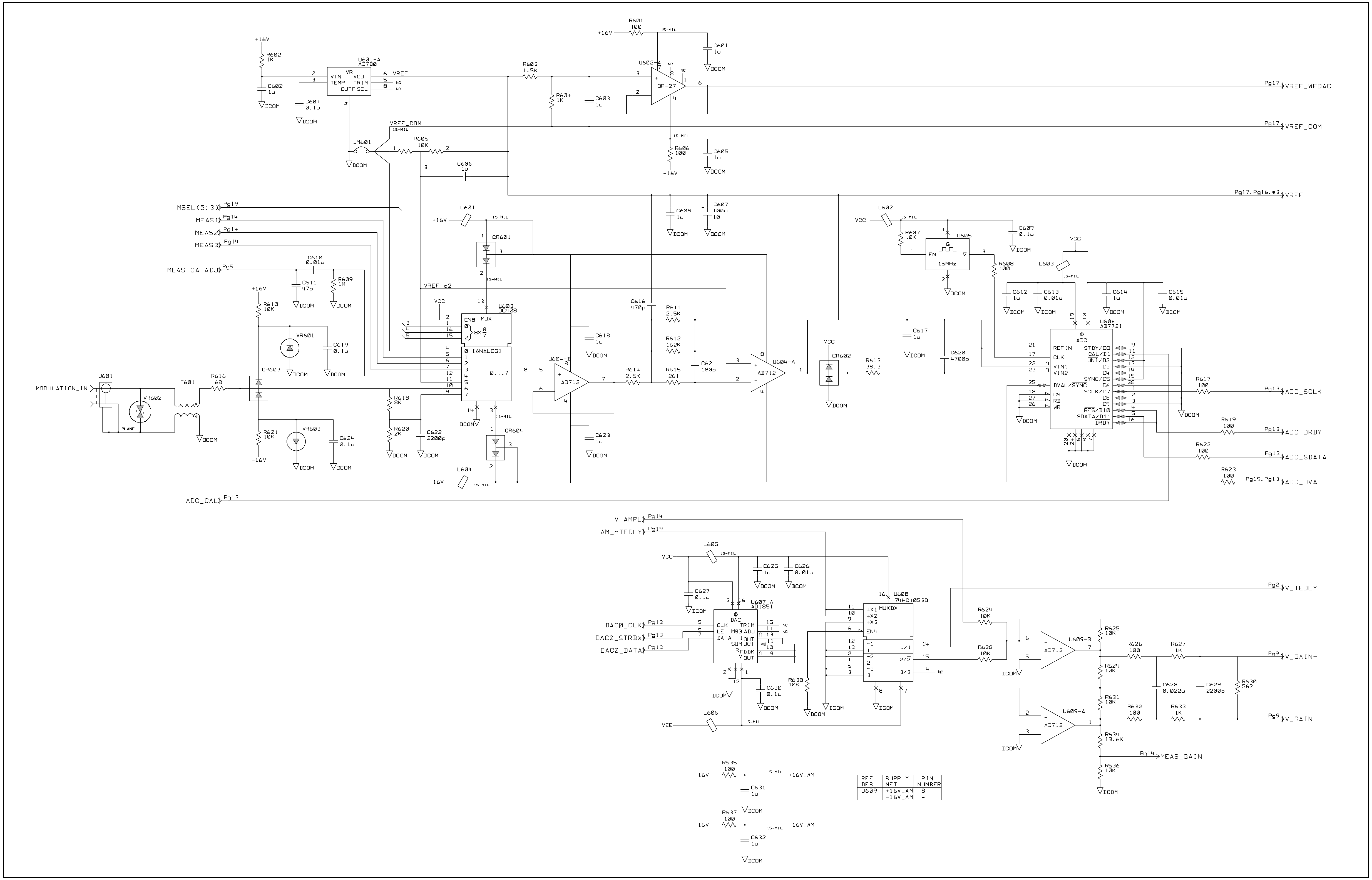
33250-66511 (sheet 3 of 20)
A1 Main Gate Array Schematic



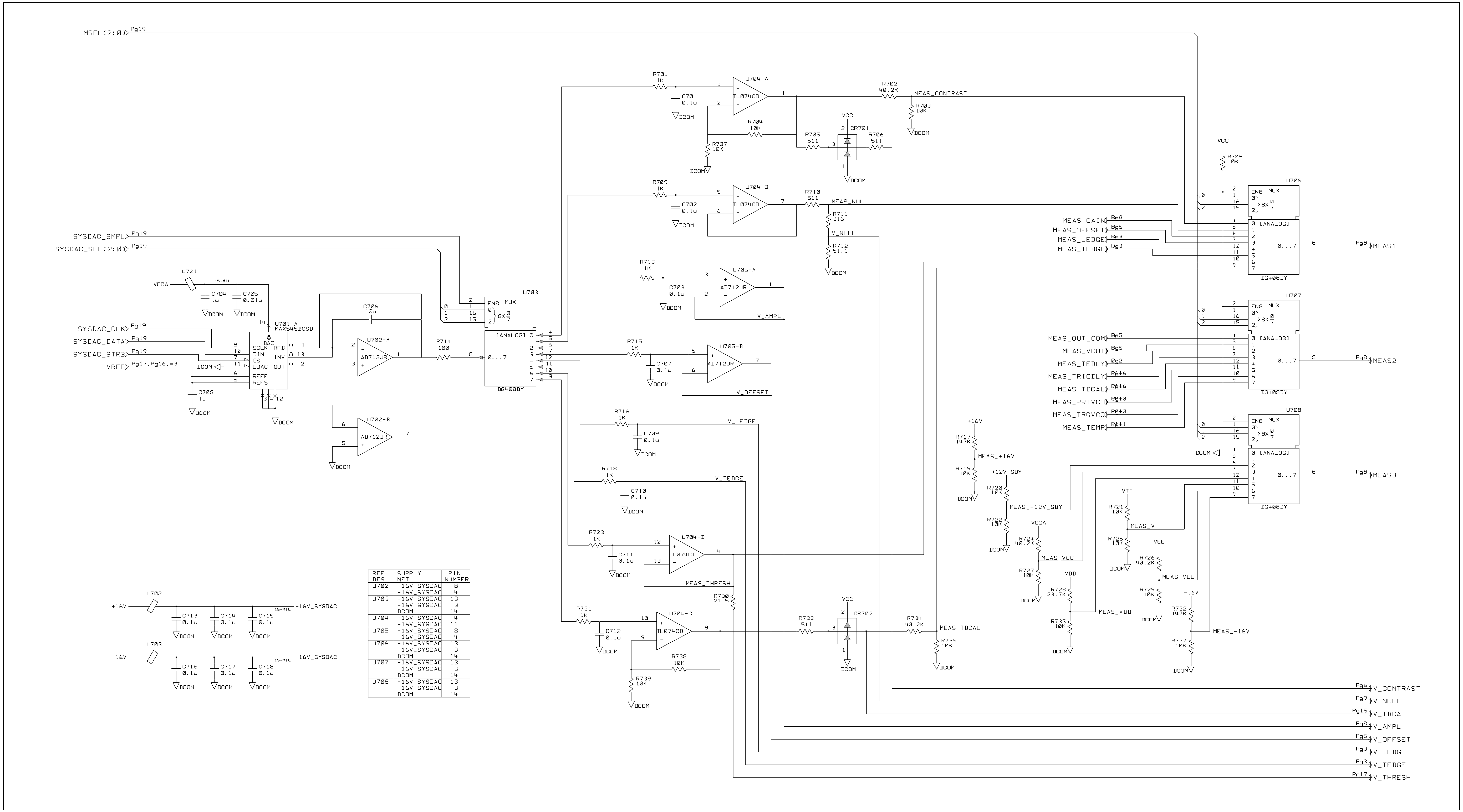
33250-66511 (sheet 4 of 20)
A1 Display Controller Schematic



REF DES	SUPPLY NET	PIN NUMBER
U501	DCOM	10
	VCC	20
U502	DCOM	10
	VCC	20
U503	DCOM	10
	VCC	20
U504	DCOM	10
	VCC	20
U506	DCOM	3
	DCOM	4
	DCOM	20
	DCOM	21
	DCOM	35
	DCOM	36
	DCOM	53
	DCOM	54
	DCOM	68
	DCOM	69
	DCOM	86
	DCOM	87
	DCOM	101
	DCOM	102
	DCOM	120
	DCOM	121
	VCC	14
	VCC	15
	VCC	32
	VCC	33
	VCC	47
	VCC	48
	VCC	65
	VCC	66
	VCC	80
	VCC	81
	VCC	98
	VCC	99
	VCC	113
	VCC	114
	VCC	131
	VCC	132
U507	DCOM	12
	DCOM	34
	VCC	11
	VCC	33

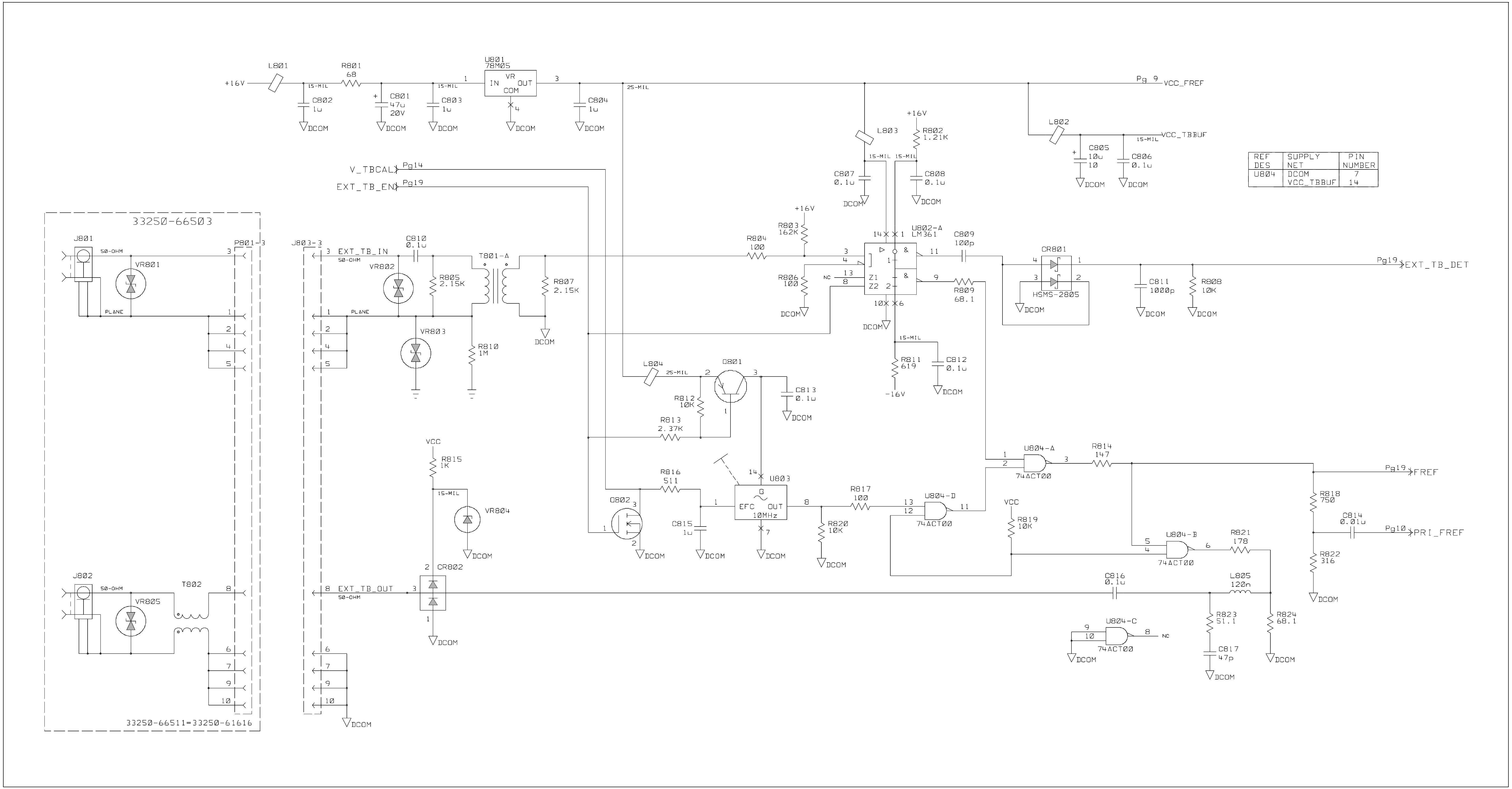


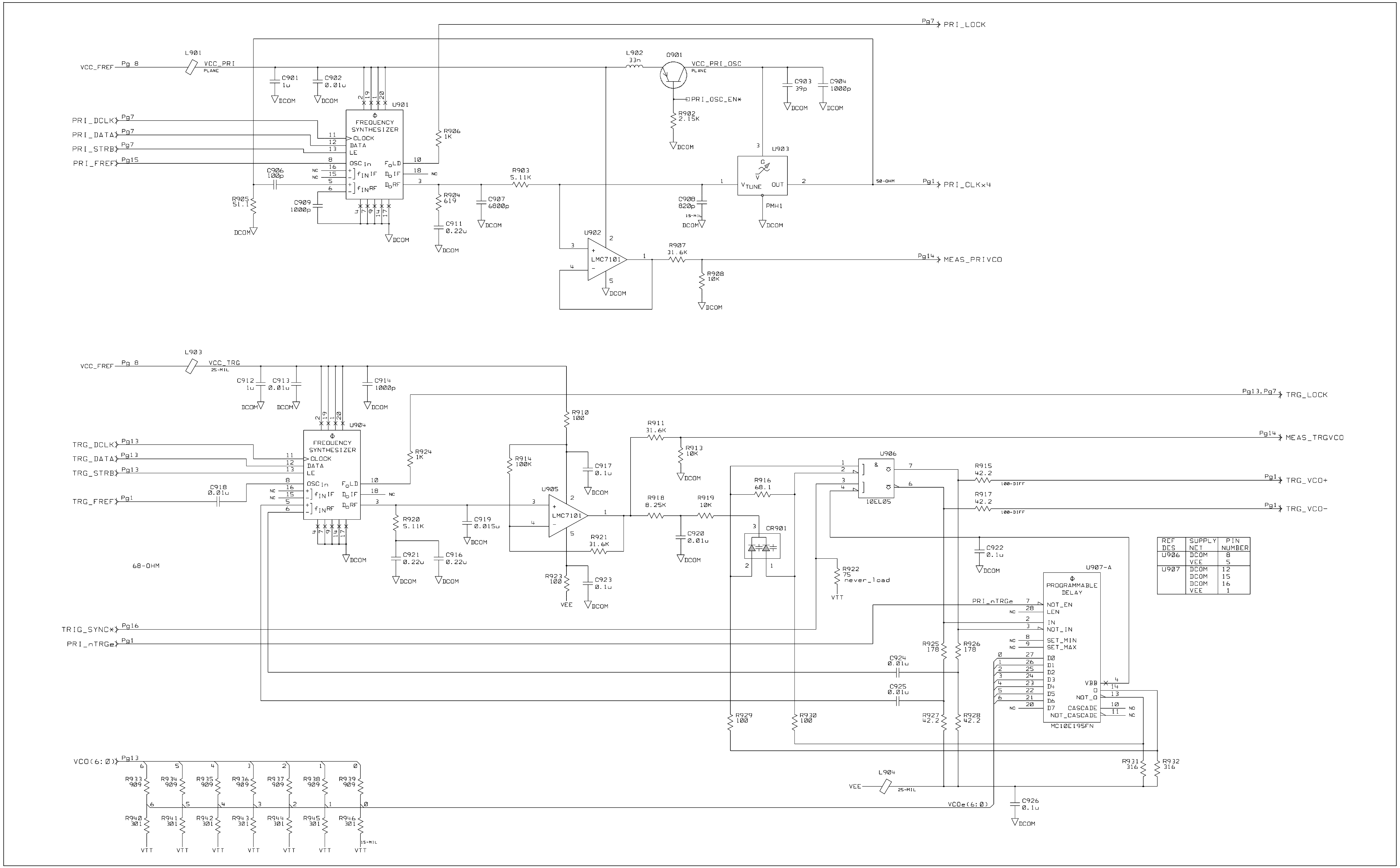
33250-66511 (sheet 6 of 20)
A1 Modulation Schematic

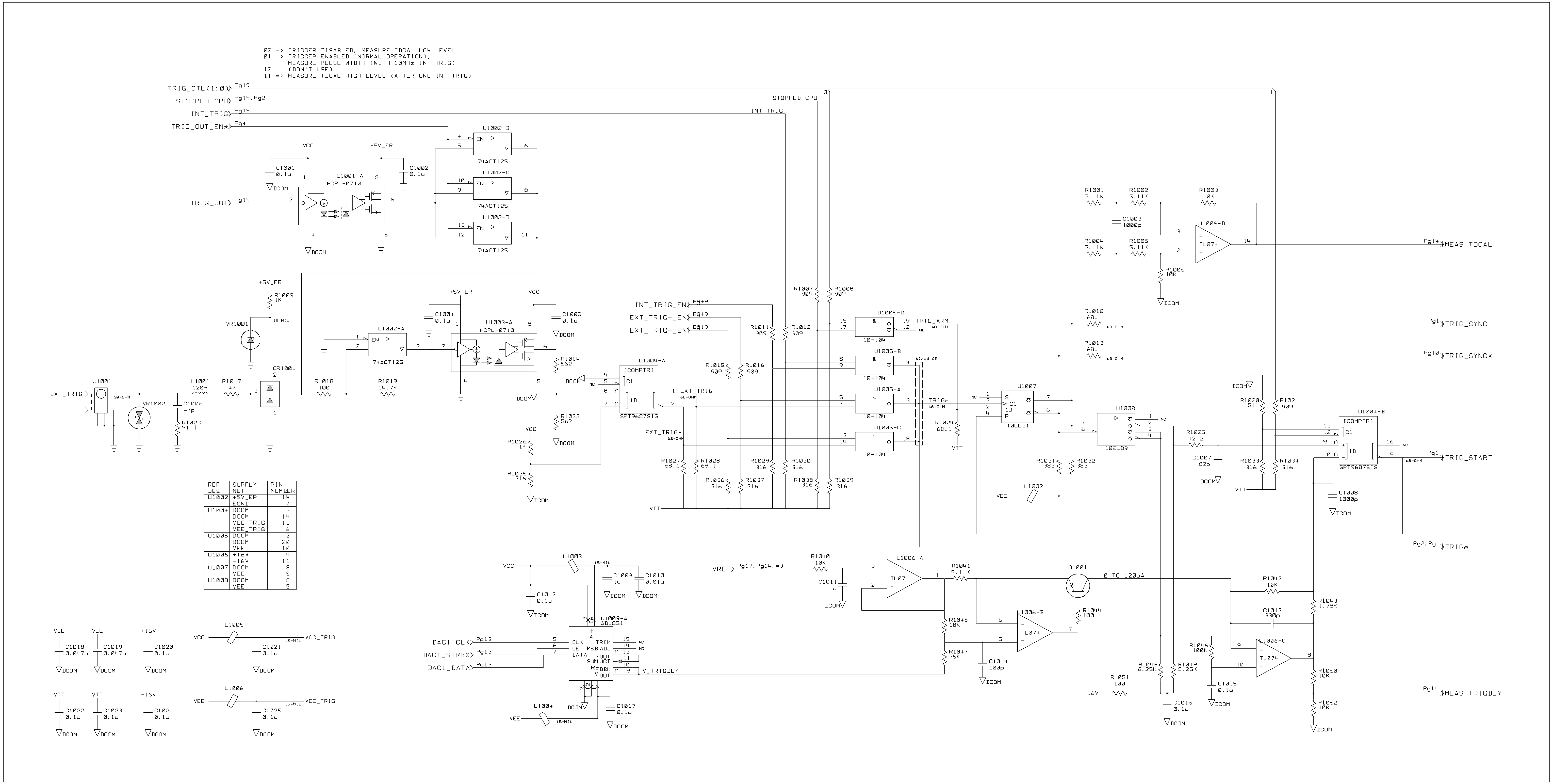


REF DES	SUPPLY NET	PIN NUMBER
U702	+16V_SYSDAC	8
	-16V_SYSDAC	4
U703	+16V_SYSDAC	13
	-16V_SYSDAC	3
	DCOM	14
U704	+16V_SYSDAC	4
	-16V_SYSDAC	11
U705	+16V_SYSDAC	8
	-16V_SYSDAC	4
U706	+16V_SYSDAC	13
	-16V_SYSDAC	3
	DCOM	14
U707	+16V_SYSDAC	13
	-16V_SYSDAC	3
	DCOM	14
U708	+16V_SYSDAC	13
	-16V_SYSDAC	3
	DCOM	14

33250-66511 (sheet 7 of 20)
A1 System DAC Schematic

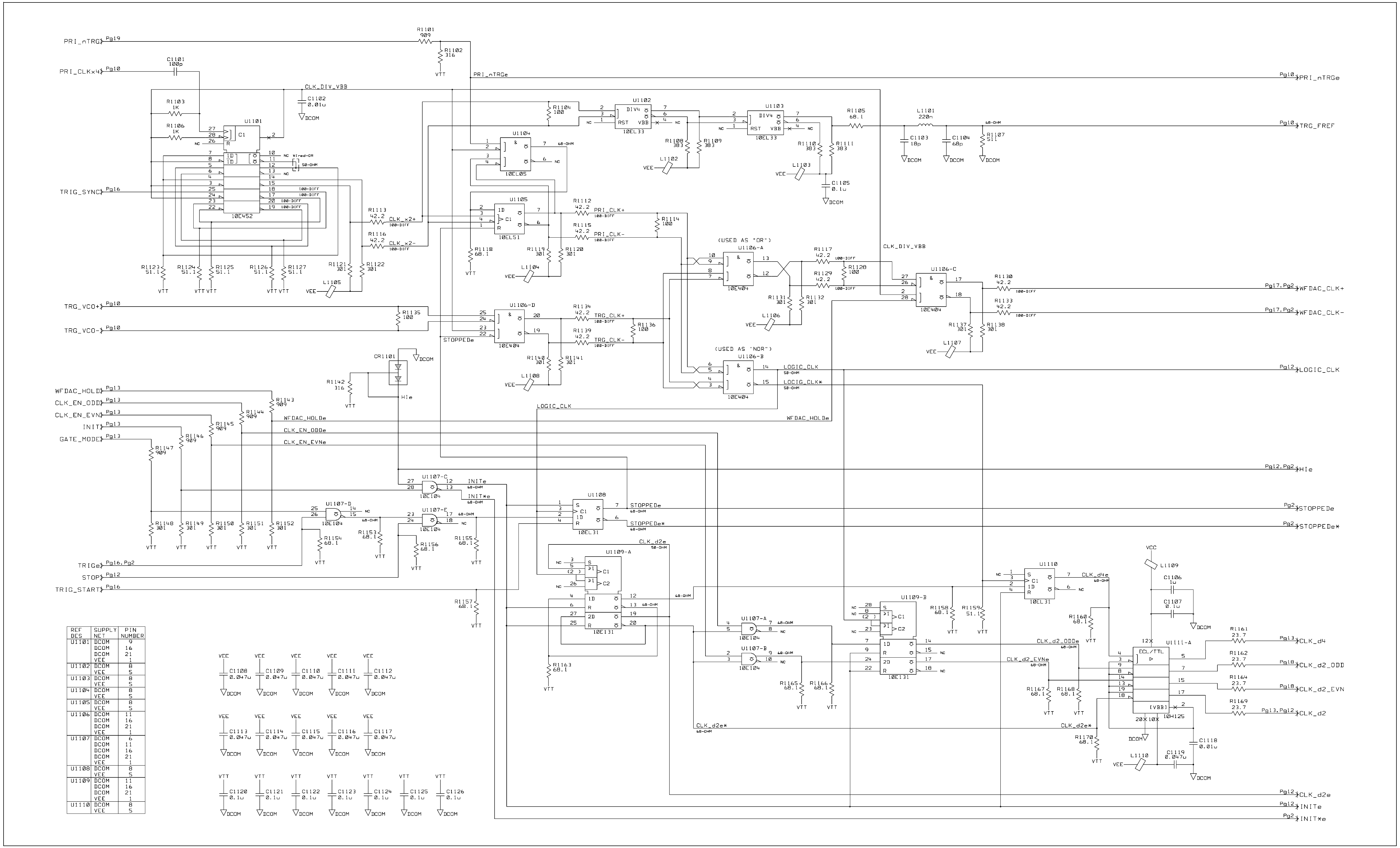

+16V
L801
R801
68
U801
78M05
VR
IN
OUT
COM
C802
1u
C801
47u
20V
C803
1u
C804
1u
DCOM
15-MIL
25-MIL
Pg 9
VCC_FREF
L802
VCC_TBBUF
C805
10u
10
C806
0.1u
REF DES
SUPPLY NET
PIN NUMBER
U804
DCOM
VCC_TBBUF
7
14
V_TBCAL
Pg14
EXT_TB_EN
Pg19
L803
R802
1.21K
C807
0.1u
C808
0.1u
R803
162K
R804
100
R806
100
U802-A
LM361
C809
100p
CR801
HSMS-2805
C811
1000p
R808
10K
Pg19
EXT_TB_DET
R809
68.1
R811
619
C812
0.1u
-16V
33250-66503
J801
50-OHM
VR801
PLANE
P801-3
J803-3
EXT_TB_IN
C810
0.1u
VR802
R805
2.15K
T801-A
R807
2.15K
VR803
R810
1M
L804
Q801
C813
0.1u
R812
10K
R813
2.37K
VCC
R815
1K
VR804
Q802
R816
511
C815
1u
U803
G
EFC
OUT
10MHz
R817
100
R820
10K
U804-A
74ACT00
R814
147
Pg19
FREF
U804-D
74ACT00
R819
10K
U804-B
74ACT00
R821
178
R818
750
C814
0.01u
Pg10
PRI_FREF
R822
316
J802
VR805
T802
EXT_TB_OUT
CR802
C816
0.1u
L805
120n
R823
51.1
C817
47p
R824
68.1
U804-C
74ACT00
NC
33250-66511=33250-61616


PRI_LOCK
VCC_FREF
L901
VCC_PRI
C901 1u
C902 0.01u
DCOM
U901
FREQUENCY SYNTHESIZER
CLOCK
DATA
LE
PRI_DCLK
PRI_DATA
PRI_STRB
PRI_FREF
C906 100p
R905 51.1
C909 1000p
R906 1K
R904 619
C911 0.22u
C907 6800p
R903 5.11K
L902 33n
Q901
VCC_PRI_OSC
PRI_OSC_EN*
R902 2.15K
C903 39p
C904 1000p
U903
VTUNE
OUT
PMH1
C908 820p
PRI_CLKx4
U902
LMC7101
R907 31.6K
R908 10K
MEAS_PRIVCO
L903
VCC_TRG
C912 1u
C913 0.01u
C914 1000p
TRG_LOCK
U904
TRG_DCLK
TRG_DATA
TRG_STRB
TRG_FREF
C918 0.01u
R924 1K
R910 100
R914 100K
C917 0.1u
U905
R920 5.11K
C919 0.015u
C921 0.22u
C916 0.22u
R921 31.6K
R923 100
C923 0.1u
VEE
R911 31.6K
R913 10K
MEAS_TRGVCO
R916 68.1
R918 8.25K
R919 10K
C920 0.01u
CR901
U906
10EL05
R915 42.2
R917 42.2
TRG_VCO+
TRG_VCO-
C922 0.1u
R922 75 never_load
VTT
68-OHM
TRIG_SYNC*
PRI_nTRGe
U907-A
PROGRAMMABLE DELAY
NOT_EN
LEN
IN
NOT_IN
SET_MIN
SET_MAX
CASCADE
NOT_CASCADE
MC10E195FN
R925 178
R926 178
C924 0.01u
C925 0.01u
R927 42.2
R928 42.2
R929 100
R930 100
R931 316
R932 316
L904
C926 0.1u
VCO(6:0)
VCOe(6:0)
R933 909
R934 909
R935 909
R936 909
R937 909
R938 909
R939 909
R940 301
R941 301
R942 301
R943 301
R944 301
R945 301
R946 301
REF DES | SUPPLY NET | PIN NUMBER
U906 | DCOM | 8
 | VEE | 5
U907 | DCOM | 12
 | DCOM | 15
 | DCOM | 16
 | VEE | 1



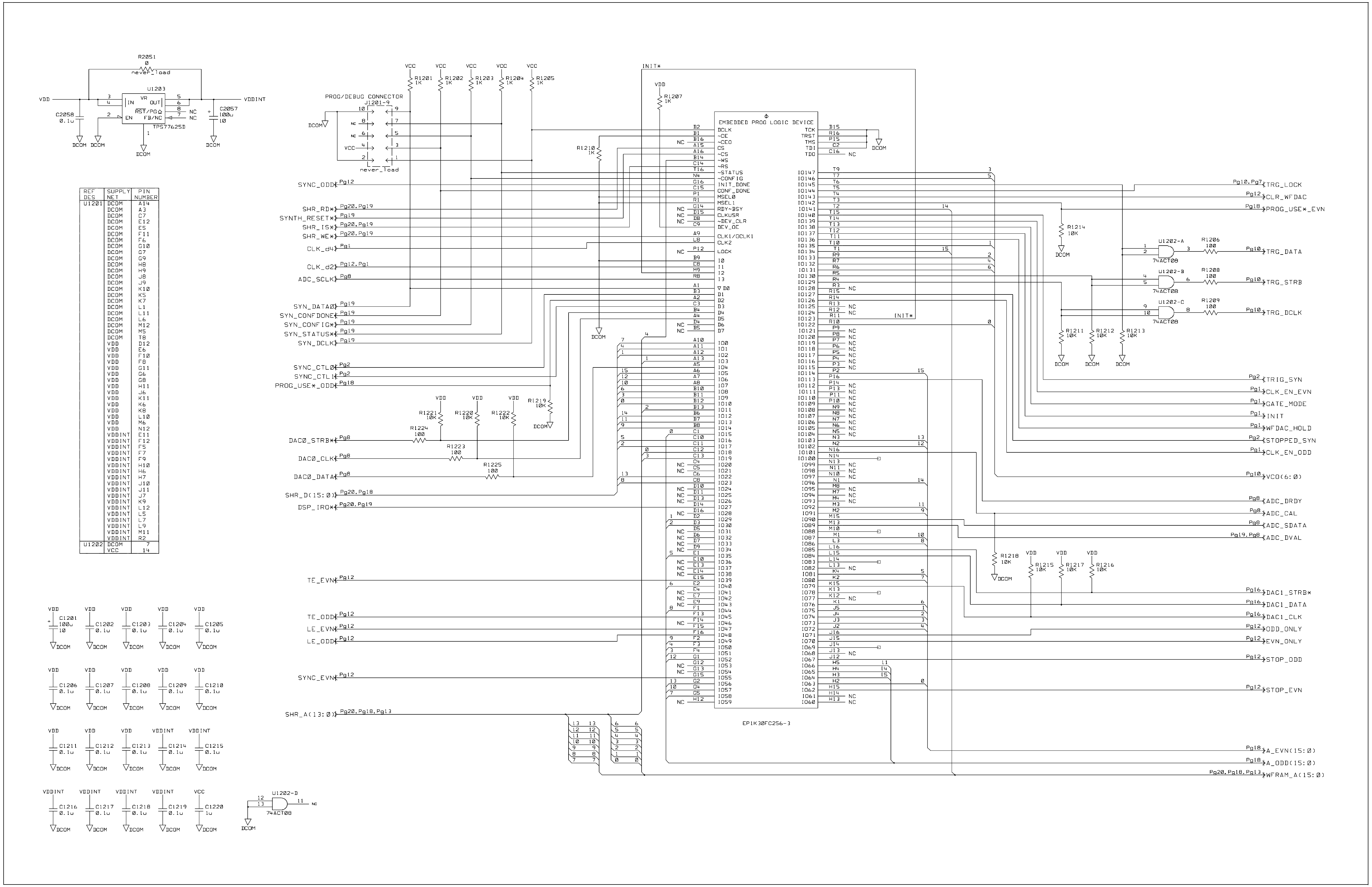
REF DES	SUPPLY NET	PIN NUMBER
U1002	+5V_ER	14
	EGND	7
U1004	DCOM	3
	DCOM	14
	VCC_TRIG	11
	VEE_TRIG	6
U1005	DCOM	2
	DCOM	20
	VEE	10
U1006	+16V	4
	-16V	11
U1007	DCOM	8
	VEE	5
U1008	DCOM	8
	VEE	5

33250-66511 (sheet 10 of 20)
A1 Trigger Schematic

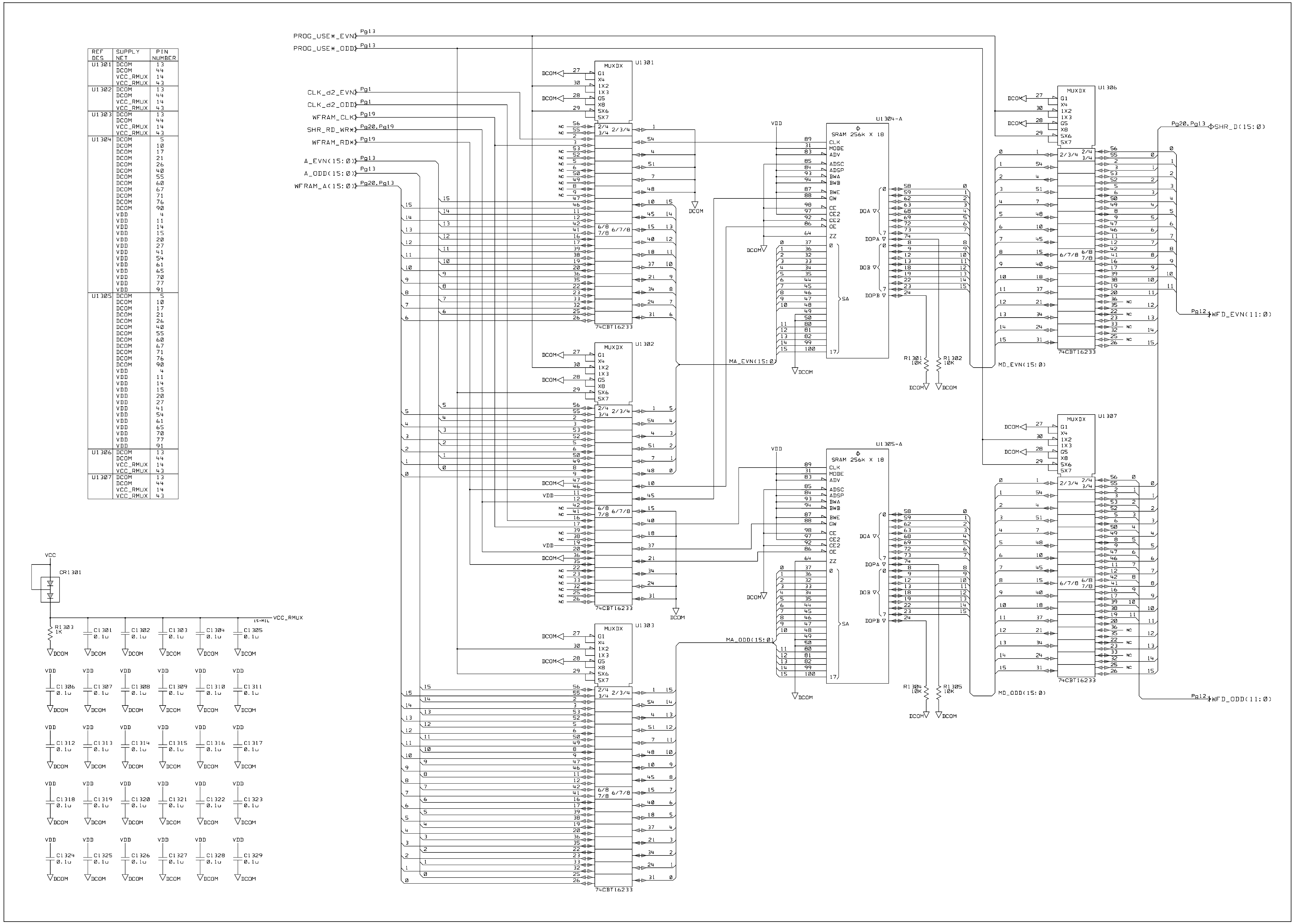


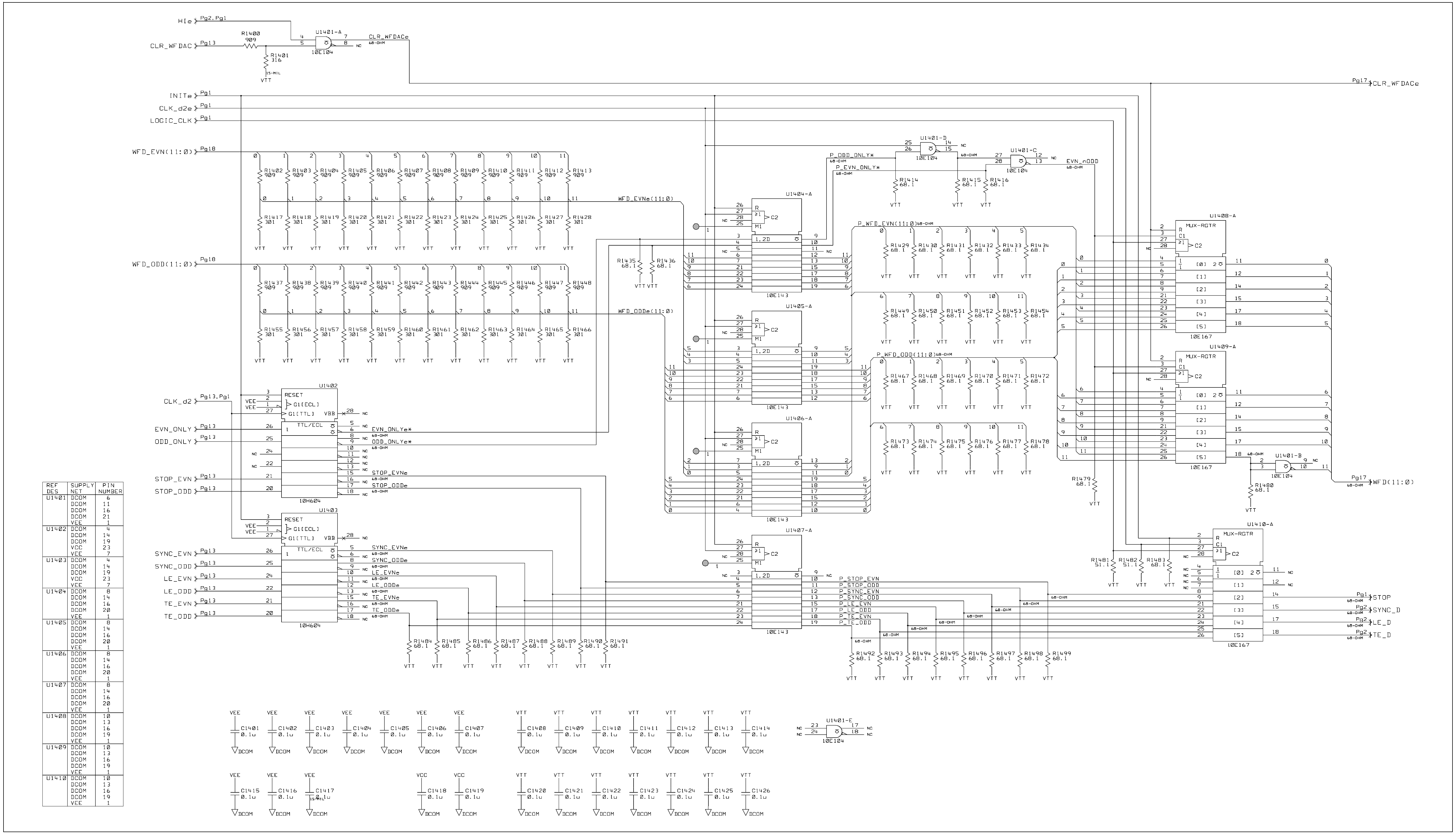
REF DES	SUPPLY NET	PIN NUMBER
U1101	DCOM	9
	DCOM	16
	DCOM	21
	VEE	1
U1102	DCOM	8
	VEE	5
U1103	DCOM	8
	VEE	5
U1104	DCOM	8
	VEE	5
U1105	DCOM	8
	VEE	5
U1106	DCOM	11
	DCOM	16
	DCOM	21
	VEE	1
U1107	DCOM	6
	DCOM	11
	DCOM	16
	DCOM	21
	VEE	1
U1108	DCOM	8
	VEE	5
U1109	DCOM	11
	DCOM	16
	DCOM	21
	VEE	1
U1110	DCOM	8
	VEE	5

33250-66511 (sheet 11 of 20)
A1 Clock Divider and Control Schematic


PROG/DEBUG CONNECTOR
J1201-9
never_load
TPS77625D
U1203
R2051
C2058
C2057
VDD
VDDINT
VCC
DCOM
EMBEDDED PROG LOGIC DEVICE
EP1K30FC256-3
INIT*
SYNC_ODD
SHR_RD*
SYNTH_RESET*
SHR_IS*
SHR_WE*
CLK_d4
CLK_d2
ADC_SCLK
SYN_DATA0
SYN_CONFDONE
SYN_CONFIG
SYN_STATUS
SYN_DCLK
SYNC_CTL0
SYNC_CTL1
PROG_USE*_ODD
DAC0_STRB
DAC0_CLK
DAC0_DATA
SHR_D(15:0)
DSP_IRQ
TE_EVN
TE_ODD
LE_EVN
LE_ODD
SYNC_EVN
SHR_A(13:0)
TRG_LOCK
CLR_WFDAC
PROG_USE*_EVN
TRG_DATA
TRG_STRB
TRG_DCLK
TRIG_SYN
CLK_EN_EVN
GATE_MODE
INIT
WFDAC_HOLD
STOPPED_SYN
CLK_EN_ODD
VCO(6:0)
ADC_DRDY
ADC_CAL
ADC_SDATA
ADC_DVAL
DAC1_STRB*
DAC1_DATA
DAC1_CLK
ODD_ONLY
EVN_ONLY
STOP_ODD
STOP_EVN
A_EVN(15:0)
A_ODD(15:0)
WFRAM_A(15:0)
U1202-A
U1202-B
U1202-C
U1202-D
74ACT08
REF DES
SUPPLY NET
PIN NUMBER
U1201
U1202

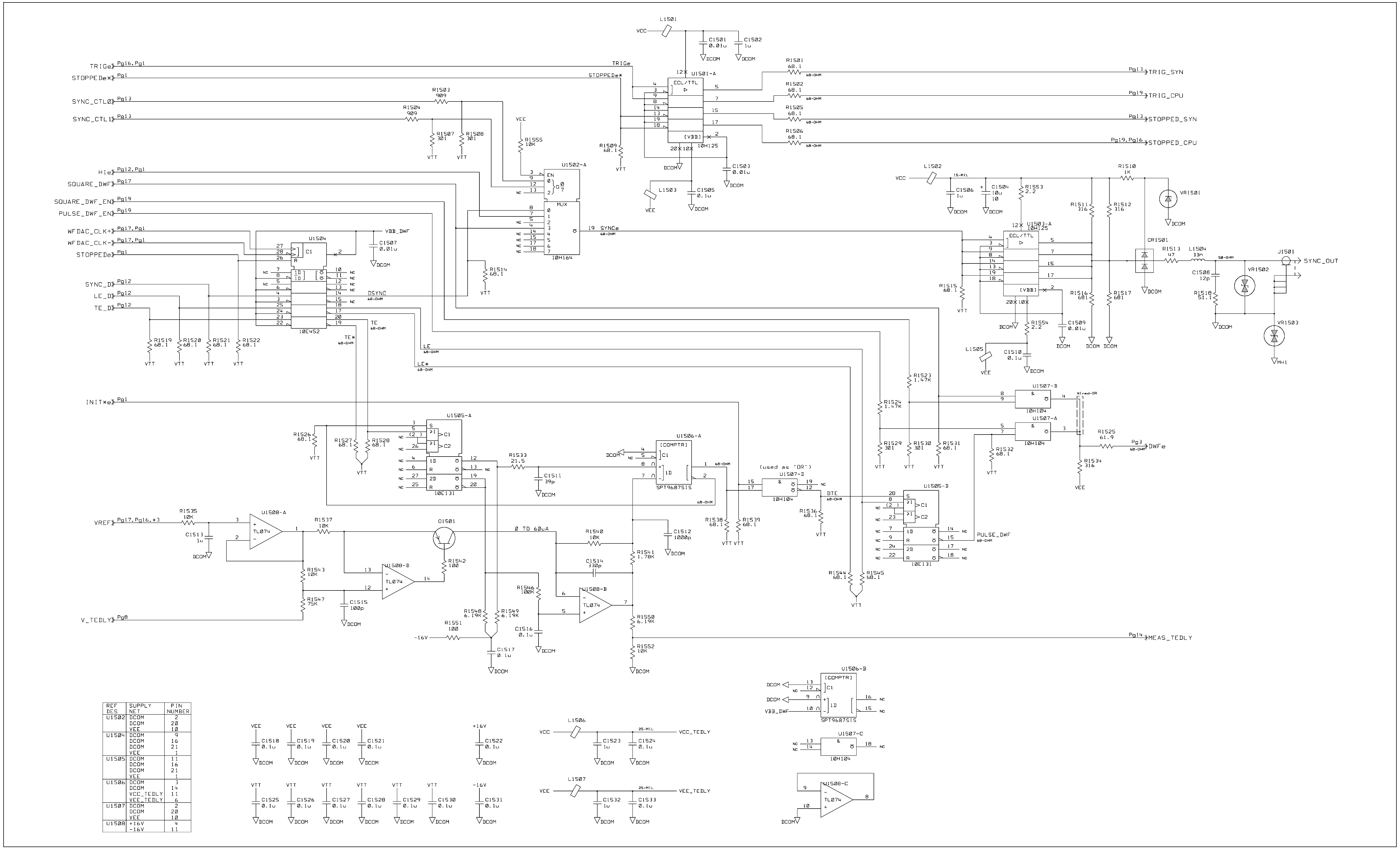
REF DES	SUPPLY NET	PIN NUMBER
U1301	DCOM	13
	DCOM	44
	VCC_RMUX	14
	VCC_RMUX	43
U1302	DCOM	13
	DCOM	44
	VCC_RMUX	14
	VCC_RMUX	43
U1303	DCOM	13
	DCOM	44
	VCC_RMUX	14
	VCC_RMUX	43
U1304	DCOM	5
	DCOM	10
	DCOM	17
	DCOM	21
	DCOM	26
	DCOM	40
	DCOM	55
	DCOM	60
	DCOM	67
	DCOM	71
	DCOM	76
	DCOM	90
	VDD	4
	VDD	11
	VDD	14
	VDD	15
	VDD	20
	VDD	27
	VDD	41
	VDD	54
	VDD	61
	VDD	65
	VDD	70
	VDD	77
	VDD	91
U1305	DCOM	5
	DCOM	10
	DCOM	17
	DCOM	21
	DCOM	26
	DCOM	40
	DCOM	55
	DCOM	60
	DCOM	67
	DCOM	71
	DCOM	76
	DCOM	90
	VDD	4
	VDD	11
	VDD	14
	VDD	15
	VDD	20
	VDD	27
	VDD	41
	VDD	54
	VDD	61
	VDD	65
	VDD	70
	VDD	77
	VDD	91
U1306	DCOM	13
	DCOM	44
	VCC_RMUX	14
	VCC_RMUX	43
U1307	DCOM	13
	DCOM	44
	VCC_RMUX	14
	VCC_RMUX	43

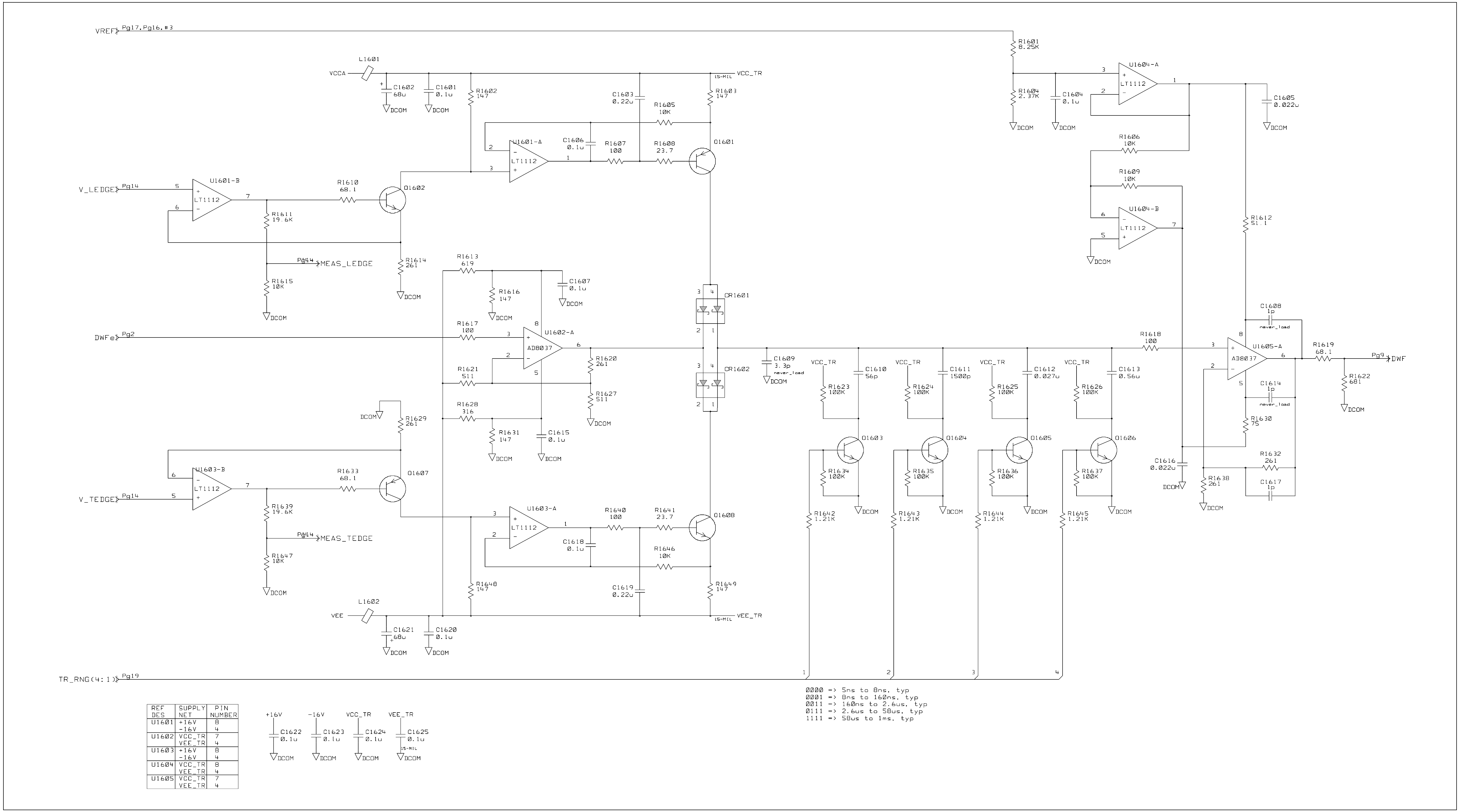




REF DES	SUPPLY NET	PIN NUMBER
U1401	DCOM	6
	DCOM	11
	DCOM	16
	DCOM	21
	VEE	1
U1402	DCOM	4
	DCOM	14
	DCOM	19
	VCC	23
	VEE	7
U1403	DCOM	4
	DCOM	14
	DCOM	19
	VCC	23
	VEE	7
U1404	DCOM	8
	DCOM	14
	DCOM	16
	DCOM	20
	VEE	1
U1405	DCOM	8
	DCOM	14
	DCOM	16
	DCOM	20
	VEE	1
U1406	DCOM	8
	DCOM	14
	DCOM	16
	DCOM	20
	VEE	1
U1407	DCOM	8
	DCOM	14
	DCOM	16
	DCOM	20
	VEE	1
U1408	DCOM	10
	DCOM	13
	DCOM	16
	DCOM	19
	VEE	1
U1409	DCOM	10
	DCOM	13
	DCOM	16
	DCOM	19
	VEE	1
U1410	DCOM	10
	DCOM	13
	DCOM	16
	DCOM	19
	VEE	1

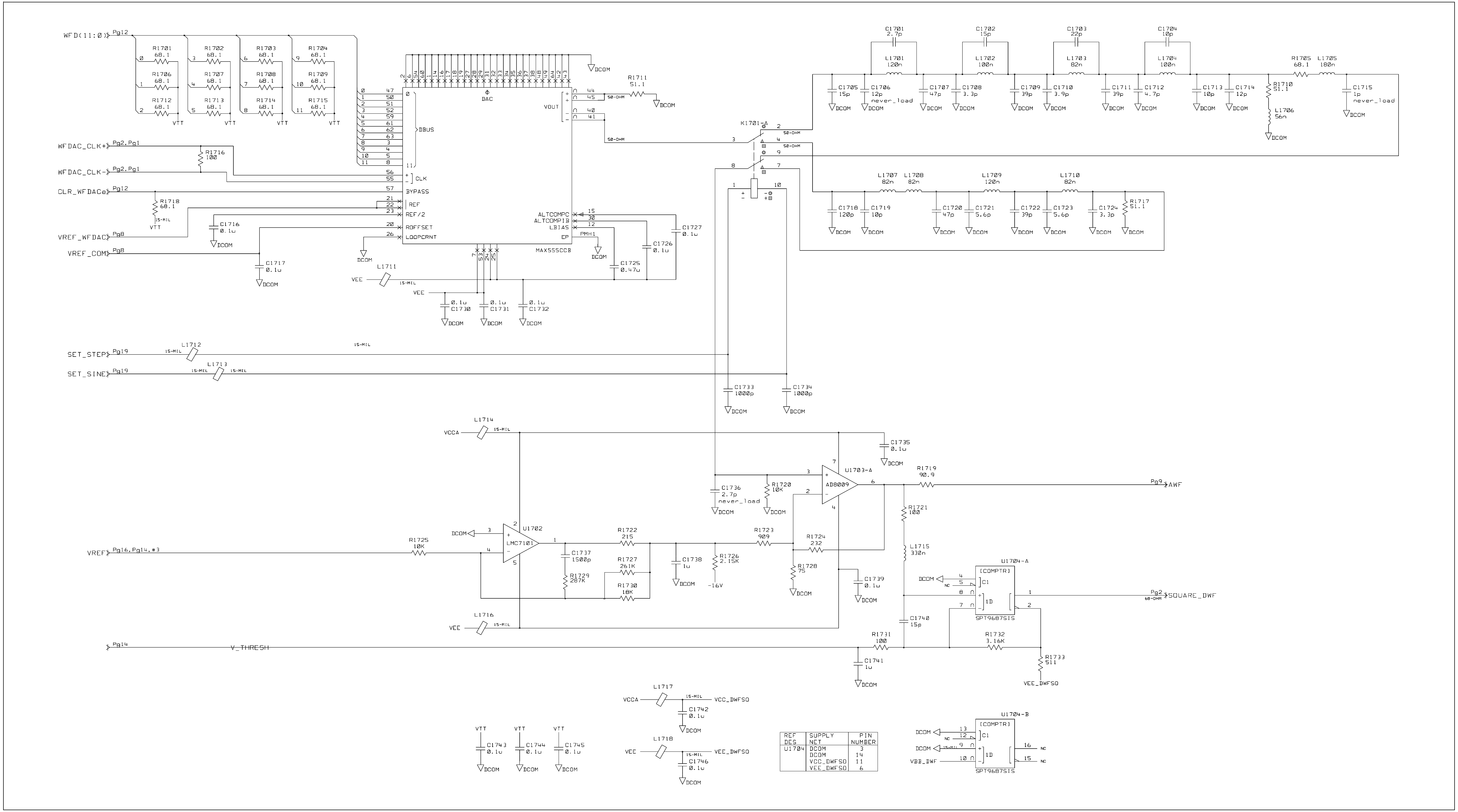
33250-66511 (sheet 14 of 20)
A1 Synchronous Multiplexer Schematic


TRIGe
STOPPEDe*
SYNC_CTL0
SYNC_CTL1
HIe
SQUARE_DWF
SQUARE_DWF_EN
PULSE_DWF_EN
WFDAC_CLK+
WFDAC_CLK-
STOPPEDe
SYNC_D
LE_D
TE_D
INIT*e
VREF
V_TEDLY
TRIG_SYN
TRIG_CPU
STOPPED_SYN
STOPPED_CPU
SYNC_OUT
DWFe
MEAS_TEDLY
PULSE_DWF
U1501-A
ECL/TTL
10H125
U1502-A
MUX
10H164
U1503-A
U1504
10E452
U1505-A
10E131
U1505-B
U1506-A
SPT9687SIS
U1506-B
U1507-A
U1507-B
U1507-C
U1507-D
10H104
(used as "OR")
U1508-A
U1508-B
U1508-C
U1508-D
TL074
0 TO 60uA
VCC_TEDLY
VEE_TEDLY
VBB_DWF
J1501
Q1501
CR1501
VR1501
VR1502
VR1503
REF DES	SUPPLY NET	PIN NUMBER
U1502	DCOM	2
	DCOM	20
	VEE	10
U1504	DCOM	9
	DCOM	16
	DCOM	21
	VEE	1
U1505	DCOM	11
	DCOM	16
	DCOM	21
	VEE	1
U1506	DCOM	3
	DCOM	14
	VCC_TEDLY	11
	VEE_TEDLY	6
U1507	DCOM	2
	DCOM	20
	VEE	10
U1508	+16V	4
	-16V	11

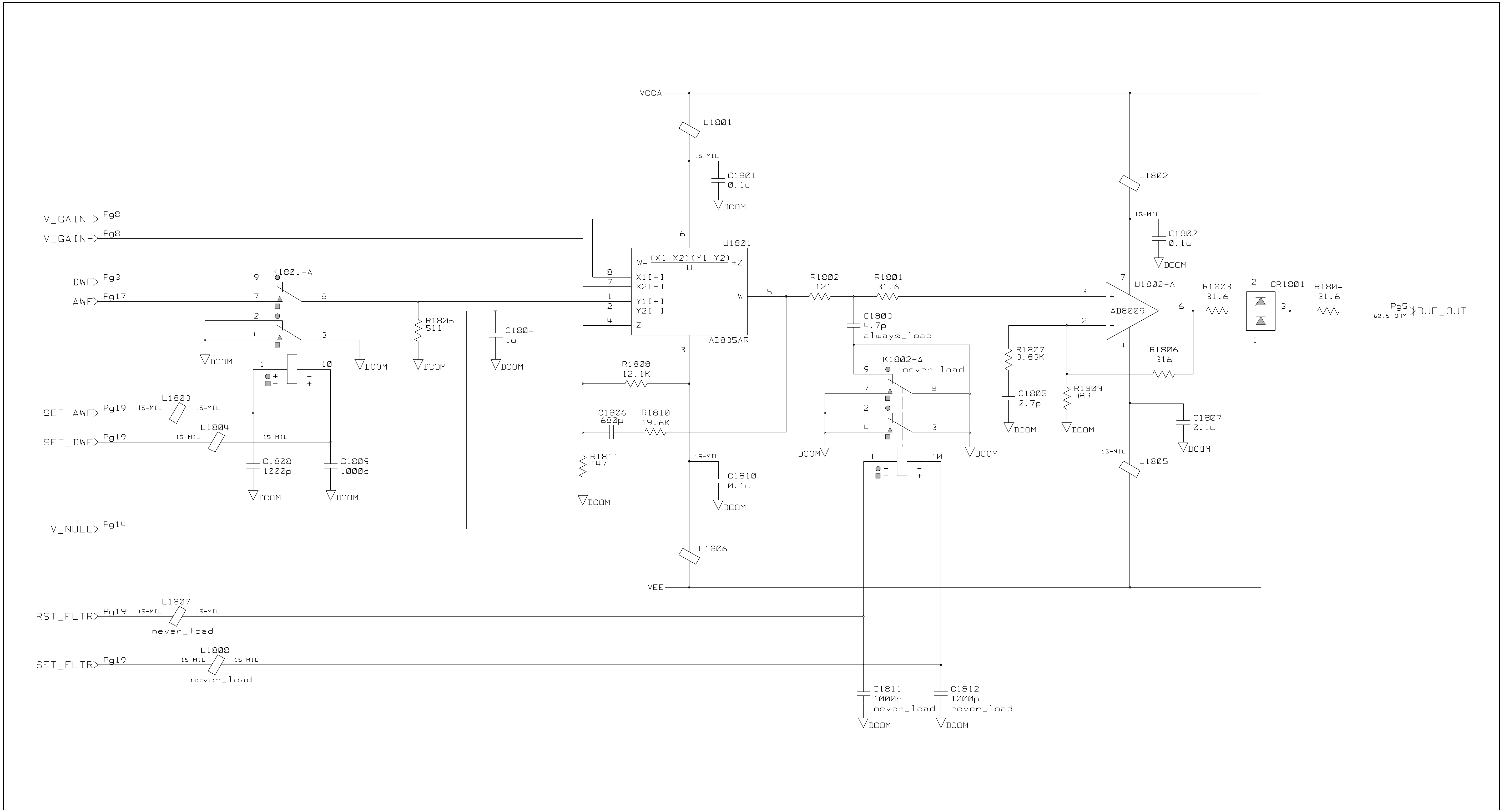


REF DES	SUPPLY NET	PIN NUMBER
U1601	+16V	8
	-16V	4
U1602	VCC_TR	7
	VEE_TR	4
U1603	+16V	8
	-16V	4
U1604	VCC_TR	8
	VEE_TR	4
U1605	VCC_TR	7
	VEE_TR	4

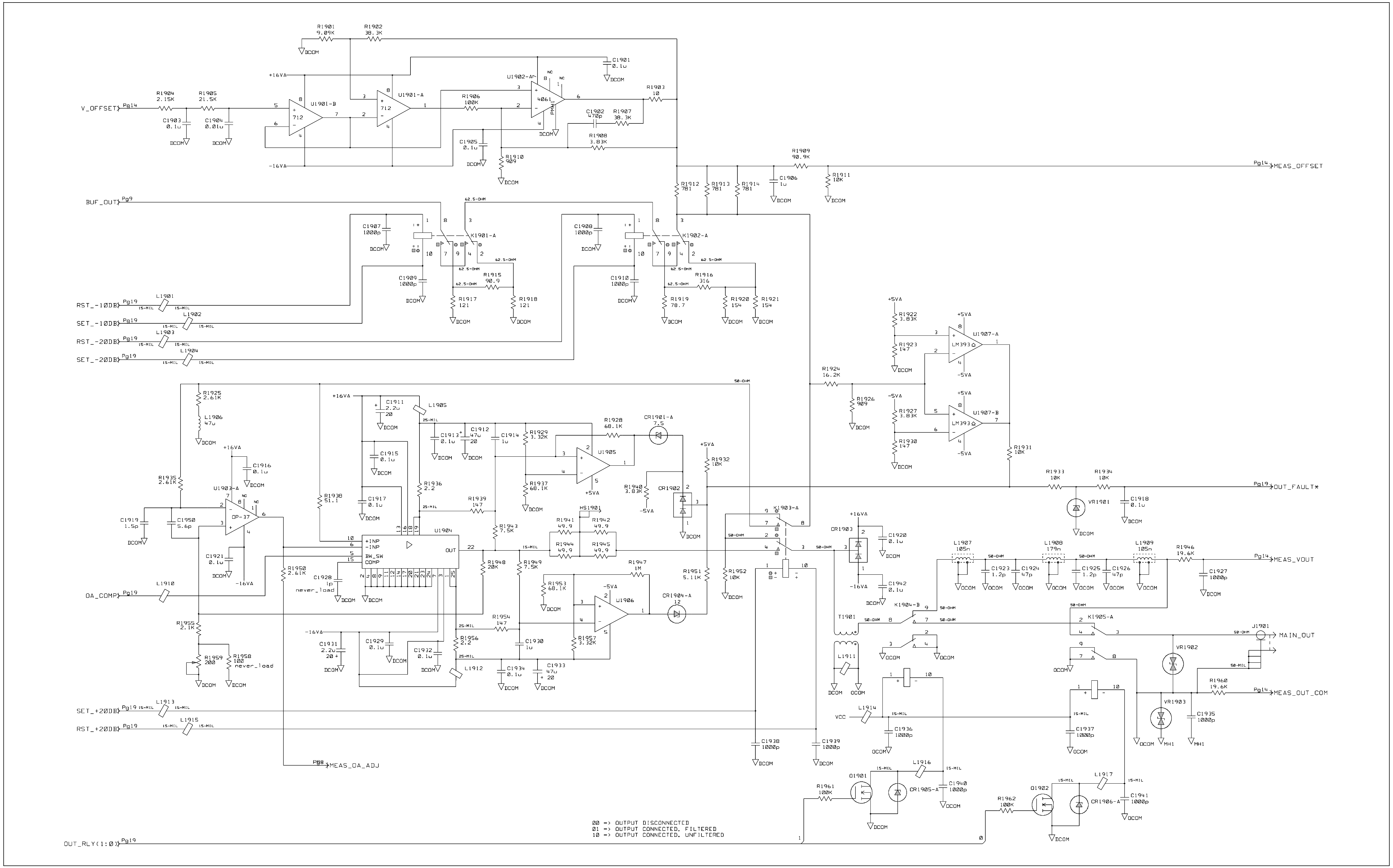
0000 => 5ns to 8ns, typ
0001 => 8ns to 160ns, typ
0011 => 160ns to 2.6us, typ
0111 => 2.6us to 58us, typ
1111 => 58us to 1ms, typ

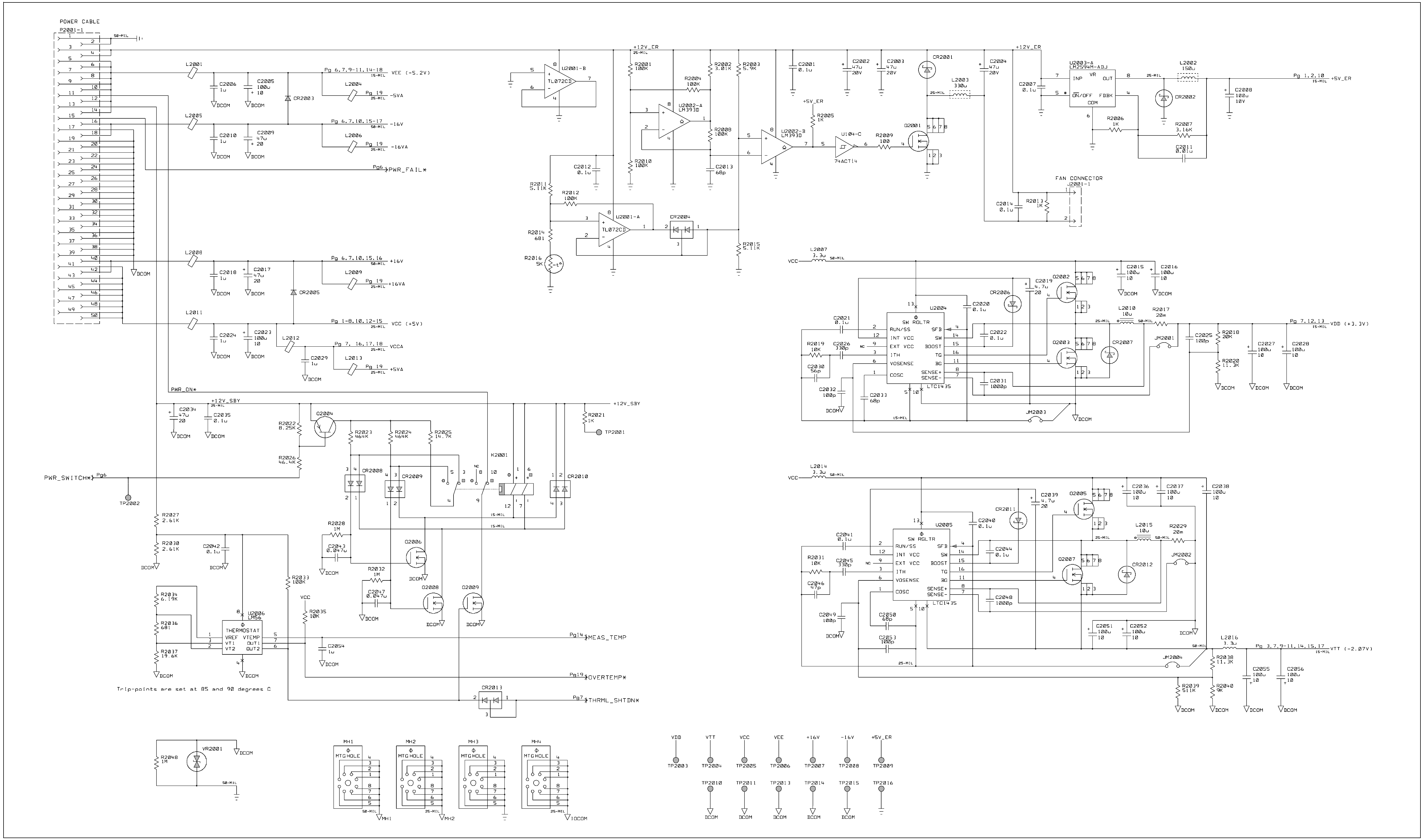


33250-66511 (sheet 17 of 20)
A1 Waveform DAC, Filters, and Comparator Schematic

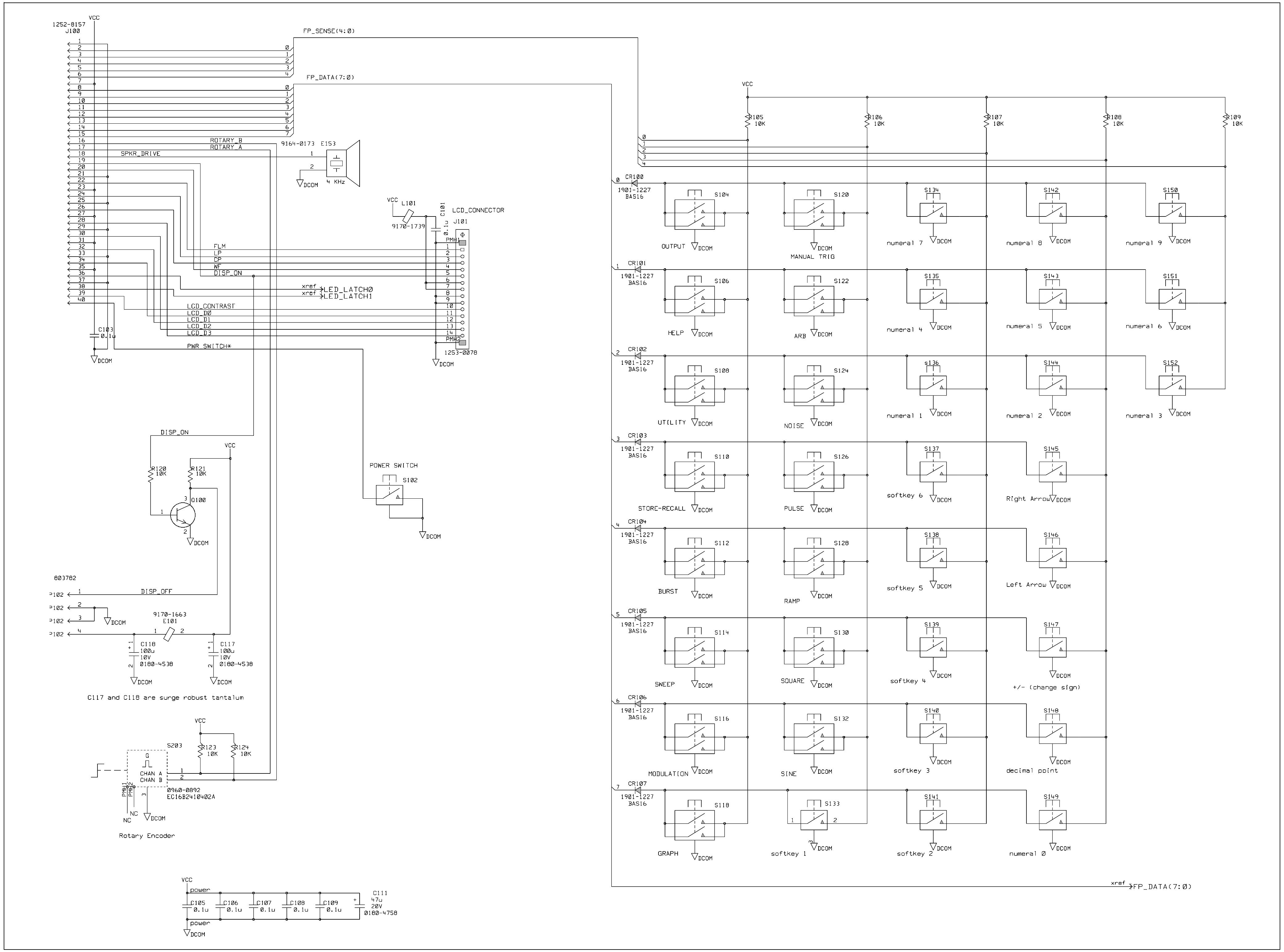


33250-66511 (sheet 18 of 20)
A1 Multiplier Schematic

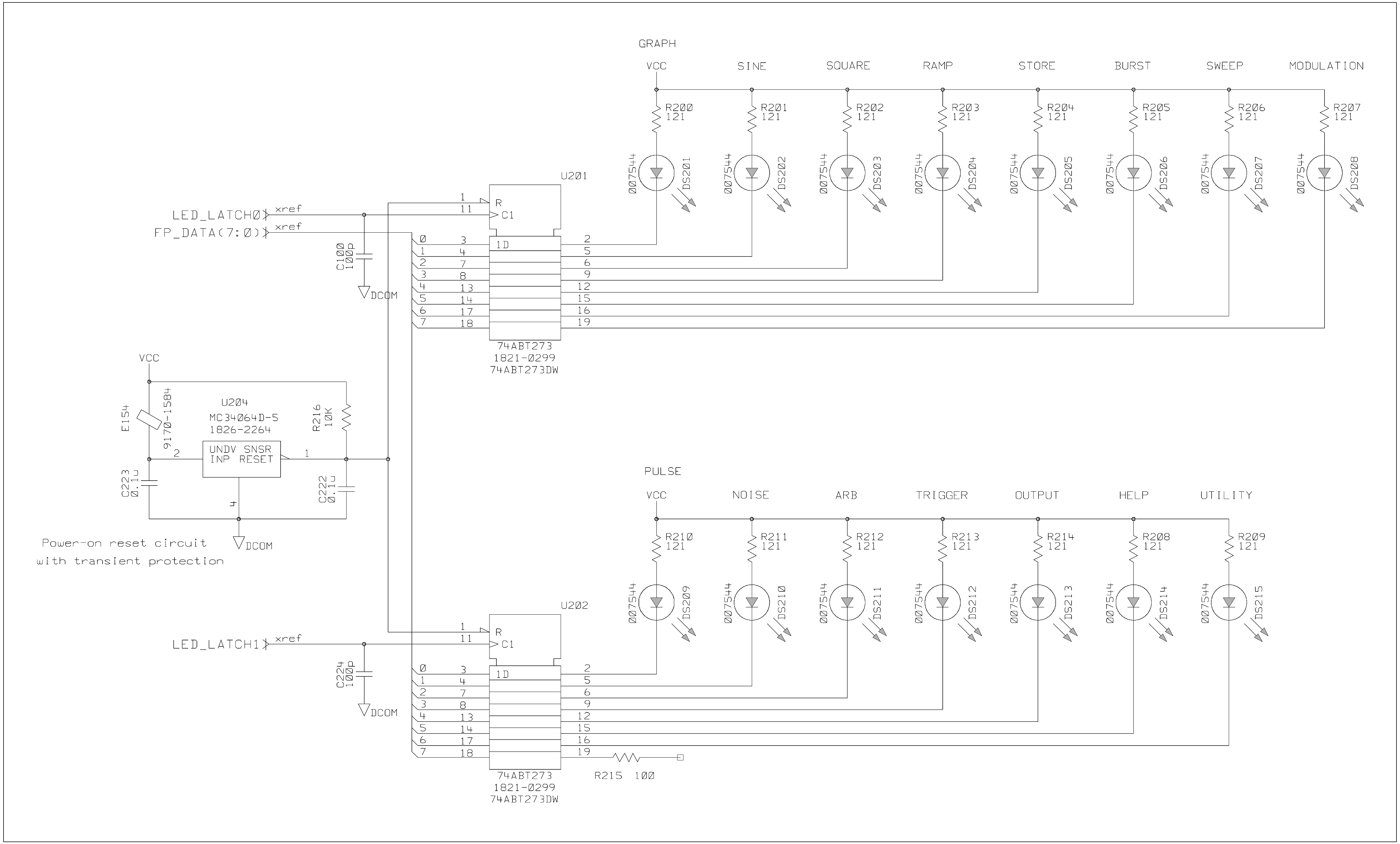

V_OFFSET
BUF_OUT
RST_-10DB
SET_-10DB
RST_-20DB
SET_-20DB
OA_COMP
SET_+20DB
RST_+20DB
OUT_RLY(1:0)
MEAS_OFFSET
OUT_FAULT*
MEAS_VOUT
MAIN_OUT
MEAS_OUT_COM
MEAS_OA_ADJ
00 => OUTPUT DISCONNECTED
01 => OUTPUT CONNECTED, FILTERED
10 => OUTPUT CONNECTED, UNFILTERED

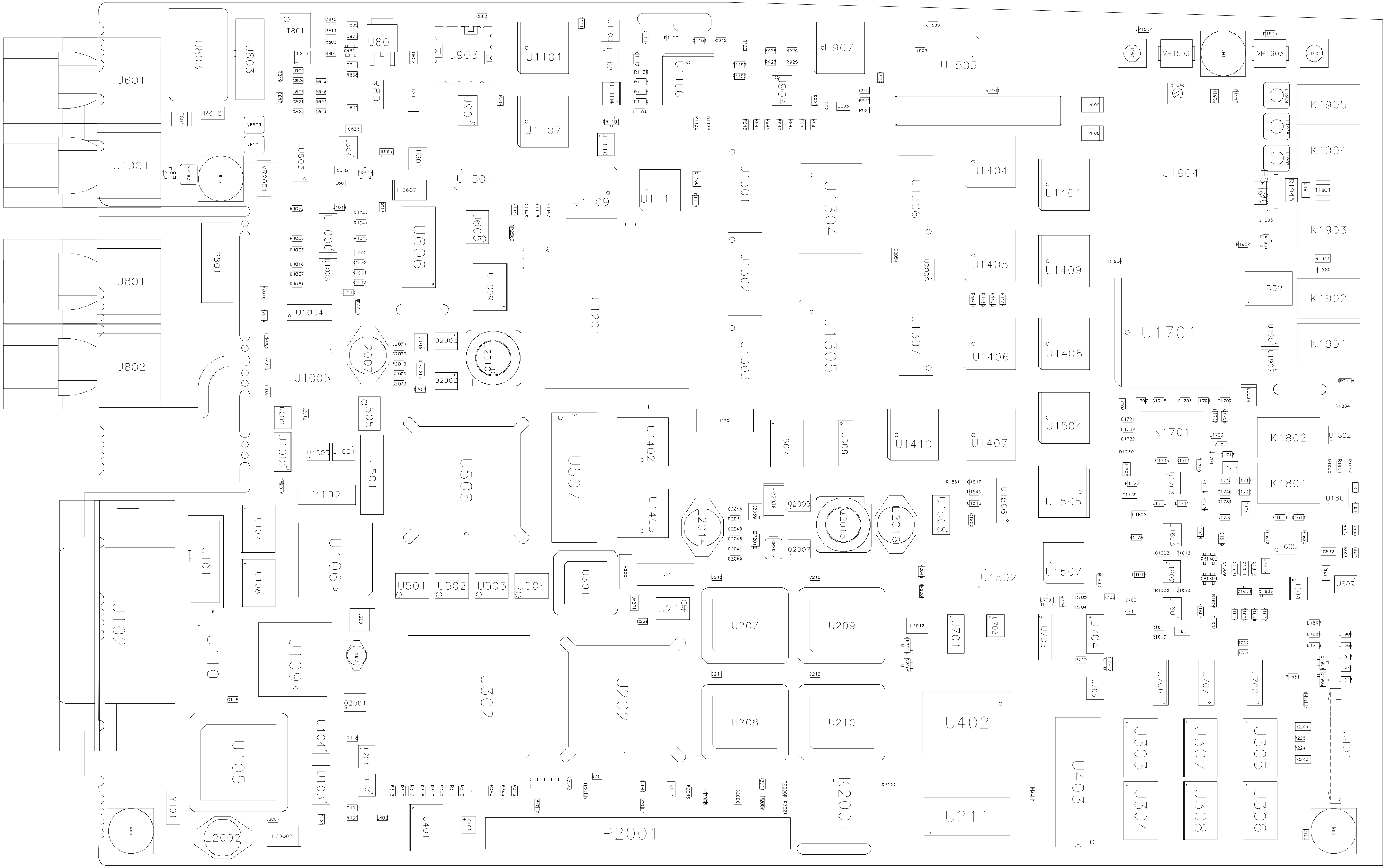


33250-66511 (sheet 20 of 20)
A1 Power Supply Schematic

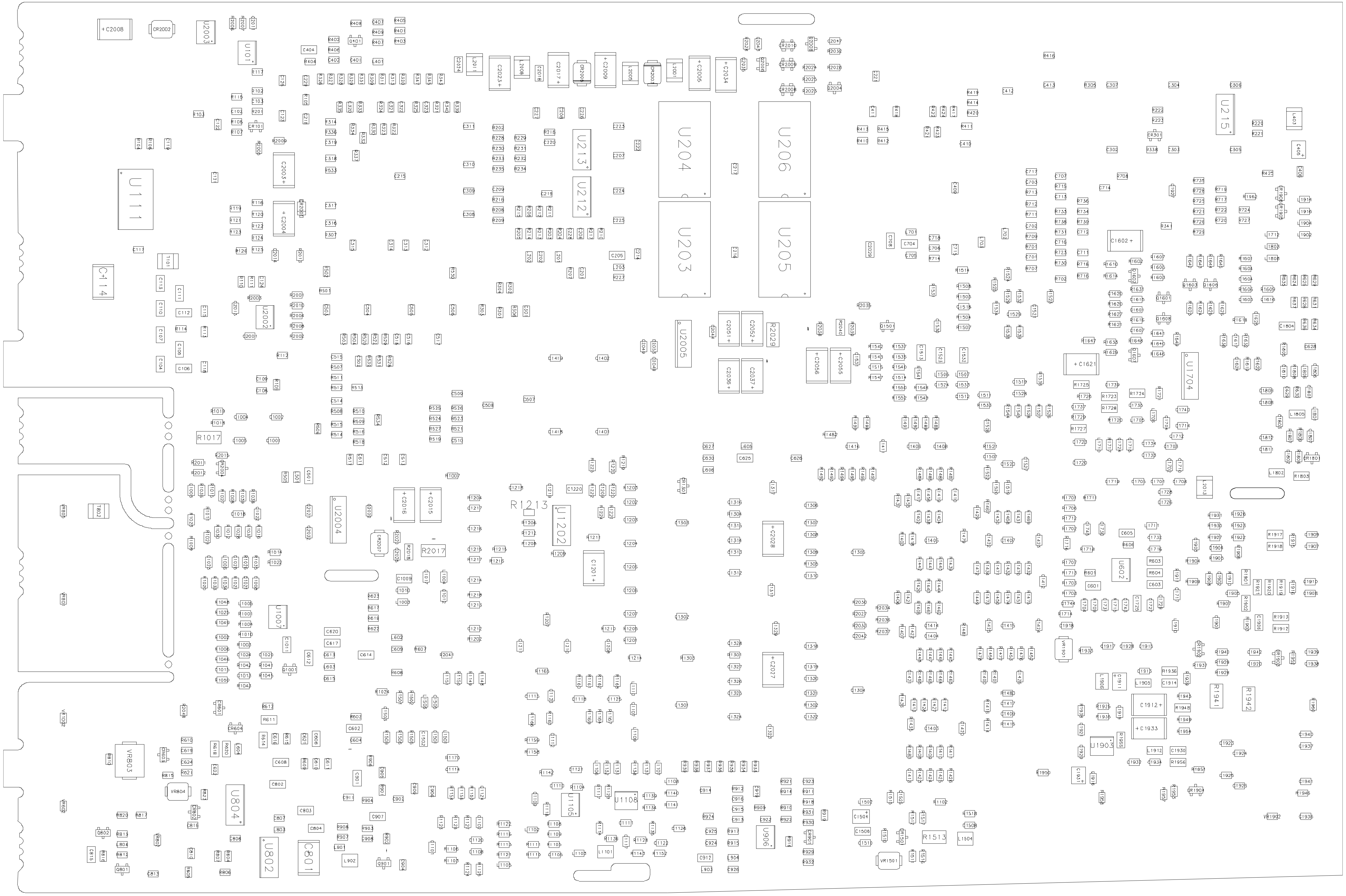


33250-66502 (sheet 1 of 2)
A2 Keyboard Schematic

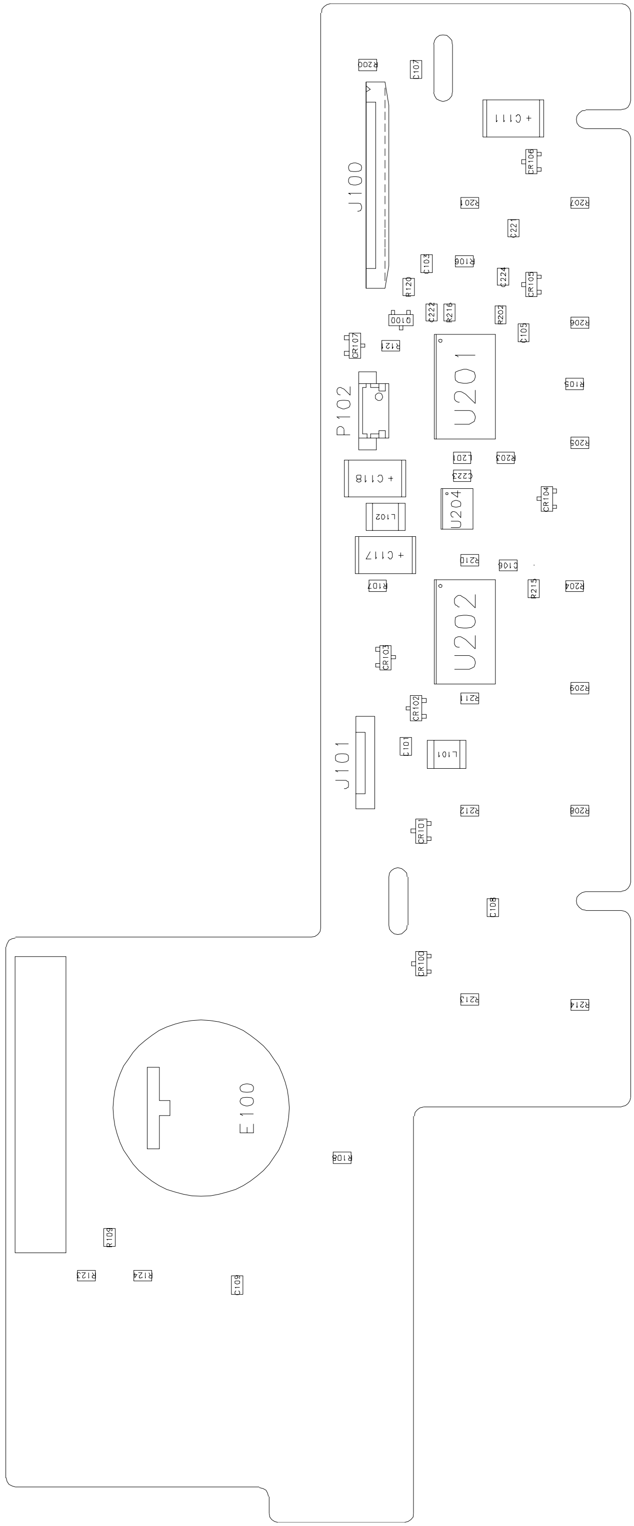

GRAPH
VCC
SINE
SQUARE
RAMP
STORE
BURST
SWEEP
MODULATION
R200 121
R201 121
R202 121
R203 121
R204 121
R205 121
R206 121
R207 121
007544
DS201
DS202
DS203
DS204
DS205
DS206
DS207
DS208
U201
LED_LATCH0
FP_DATA(7:0)
xref
R
C1
1D
C100 100p
DCOM
74ABT273
1821-0299
74ABT273DW
VCC
E154
9170-1584
U204
MC34064D-5
1826-2264
R216 10K
UNDV SNSR
INP RESET
C223 0.1u
C222 0.1u
Power-on reset circuit
with transient protection
PULSE
NOISE
ARB
TRIGGER
OUTPUT
HELP
UTILITY
R210 121
R211 121
R212 121
R213 121
R214 121
R208 121
R209 121
DS209
DS210
DS211
DS212
DS213
DS214
DS215
U202
LED_LATCH1
C224 100p
R215 100



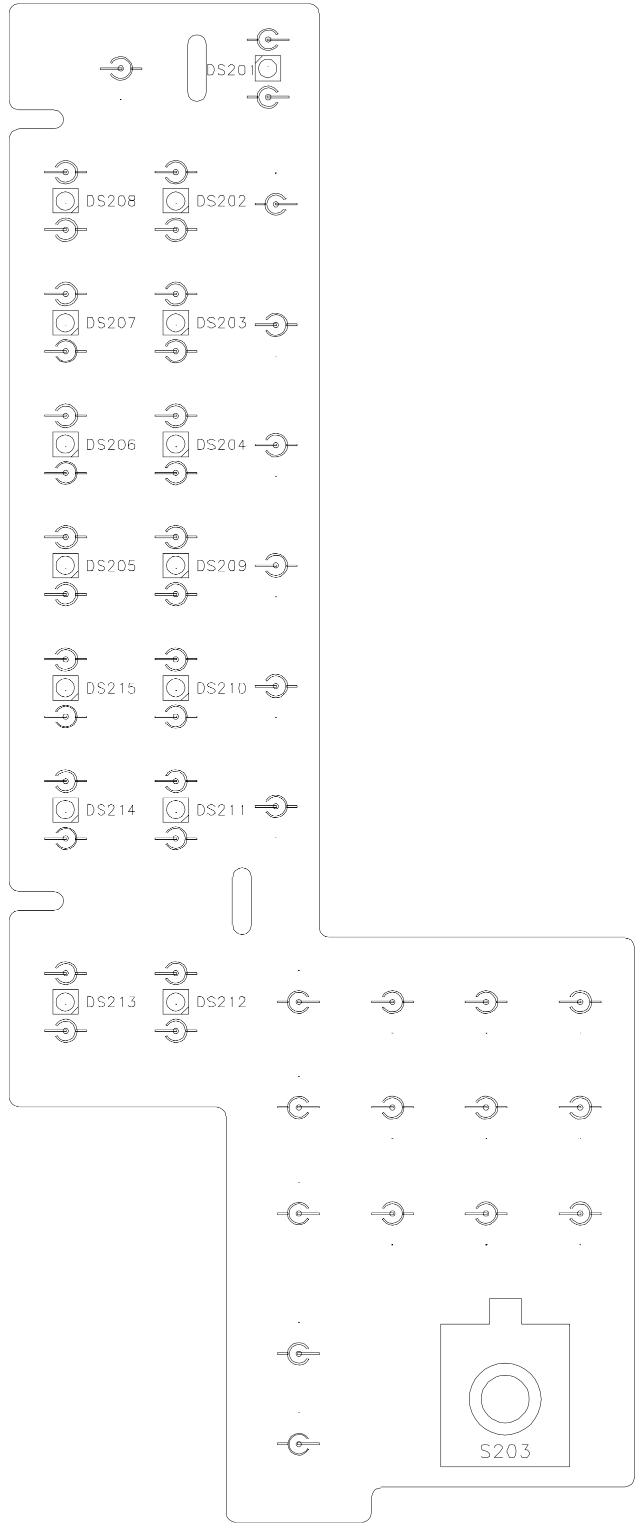
33250-66511 (sheet 1 of 2)
A1 Component Locator (top)



33250-66511 (sheet 2 of 2)
A1 Component Locator (bottom)



33250-66502 (sheet 1 of 2)
A2 Component Locator (top)



33250-66502 (sheet 2 of 2)
A2 Component Locator (bottom)

Manual Part Number

33250-90011, March 2003
(*order as 33250-90100 manual set*)

Edition

Edition 2, March 2003
Edition 1, April 2000

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Safety Notices

Do not defeat power cord safety ground feature. Plug in to a grounded outlet.

Do not use product in any manner not specified by the manufacturer.

Do not install substitute parts or perform any unauthorized modification to the product. Return the product to an Agilent Technologies Sales and Service Office for service and repair to ensure that safety features are maintained.

WARNING

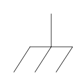
A WARNING notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

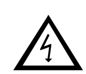
CAUTION

A CAUTION notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a CAUTION notice until the indicated conditions are fully understood and met.

Symbols


Earth ground


Chassis ground


Risk of electric shock

WARNING

Main power disconnect: Unplug product from wall outlet and remove power cord before servicing. Only qualified, service-trained personnel should remove the cover from the instrument.

For continued protection against fire, replace the line fuse only with a fuse of the specified type and rating.