Precision LVPECL/LVDS Runt Pulse Eliminator 1:10 Fanout Buffer with 2:1 MUX and Internal Termination

SY89464/465U Evaluation Board

General Description

The SY89464/465U evaluation board is designed for convenient setup and quick evaluation of the SY89464U, and SY89465U. The boards are optimized to interface directly to a 50Ω oscilloscope.

For best AC performance, the boards are configured in AC-coupled In and AC-coupled Out configuration. For applications that require a DC-coupled configuration, step-by-step instructions for modifying the board are included.

All data sheets and support documentation can be found on Micrel's web site at: www.micrel.com.

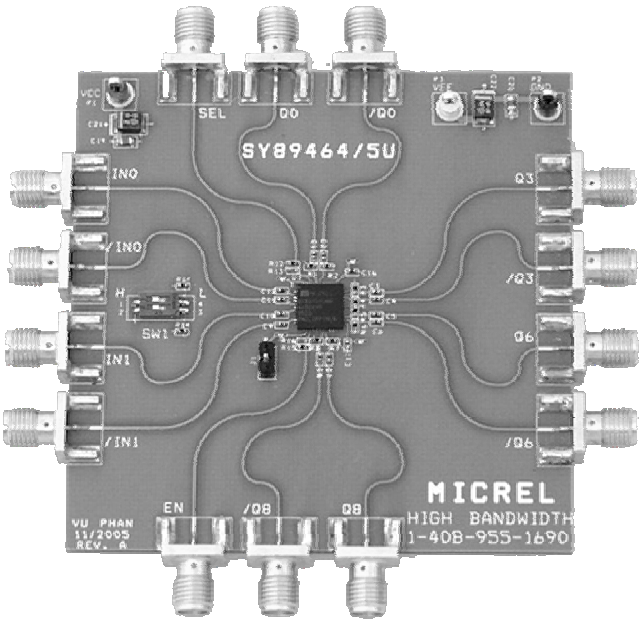
Features

- +2.5V or +3.3V power supply for the SY89464U
- +2.5V power supply for the SY89465U
- AC-coupled configuration for ease-of-use
- I/O interface includes on-board termination
- Fully assembled and tested
- Can be reconfigured for DC-coupled operation

Related Documentation

- SY89464U, Precision LVPECL Runt Pulse Eliminator 1:10 Fanout Buffer with 2:1 MUX and Internal Termination Data Sheet
- SY89465U, Precision LVDS Runt Pulse Eliminator 1:10 Fanout Buffer with 2:1 MUX and Internal Termination Data Sheet

Evaluation Board



Evaluation Board Description

The default configurations for the SY89464/5U boards are AC-coupled. The choice between AC-coupled and DC-coupled configurations offers the user flexibility for specific applications.

AC-Coupled Evaluation Board

The AC-coupled configuration is suited to most customer applications and is preferred by the majority of users because of its ease-of-use. It requires only a single power supply and offers the most flexibility in interfacing to a variety of signal sources.

The DC-bias levels and AC-coupling capacitors are supplied on-board for each input, making it unnecessary to vary the offset voltage or change any components on the board as the power supply voltage varies over the +2.5V ±5% and +3.3V ±10% operating range. The user needs only to supply a minimum input voltage swing and the bias voltage will automatically adjust the input to the correct level as the power supply voltage varies.

DC-Coupled Evaluation Board

For applications that are not suited to AC-coupling, such as clock that can be turned off for extended periods of time, the board can be user-configured for DC-coupled operation.

SY89464U

DC-coupled operation can be accomplished by modifying the board to use two power supplies in a "split-supply configuration." Since LVPECL is referenced to V_{CC}, and standard PECL termination is 50Ω to V_{CC}-2V, split-supply is an easy method to interface to a 50Ω (to ground) scope. Therefore, a 3.3V supply will be split into +2V and –1.3V, and a 2.5V supply will be split into a +2V and -0.5V.

The +2V offset in this two-power supply configuration then provides the correct terminations for the device by setting the GND potential on the board to 2 volts below the V_{CC} supply. The V_{EE} voltage is then set to –1.3V for 3.3V devices, or –0.5V for 2.5V devices to ensure proper V_{CC} to V_{EE} voltage difference.

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DC-coupled operation can be accomplished by modifying the board to use two power supplies into a "split-supply configuration." In order to correctly interface LVDS to a 50Ω (to ground) scope, V_{CC} must be V_{OCM} above the GND level. Therefore, a 2.5V supply will be split into +1.2V and –1.3V to ensure proper V_{CC} to V_{EE} voltage difference.

Runt Pulse Eliminator

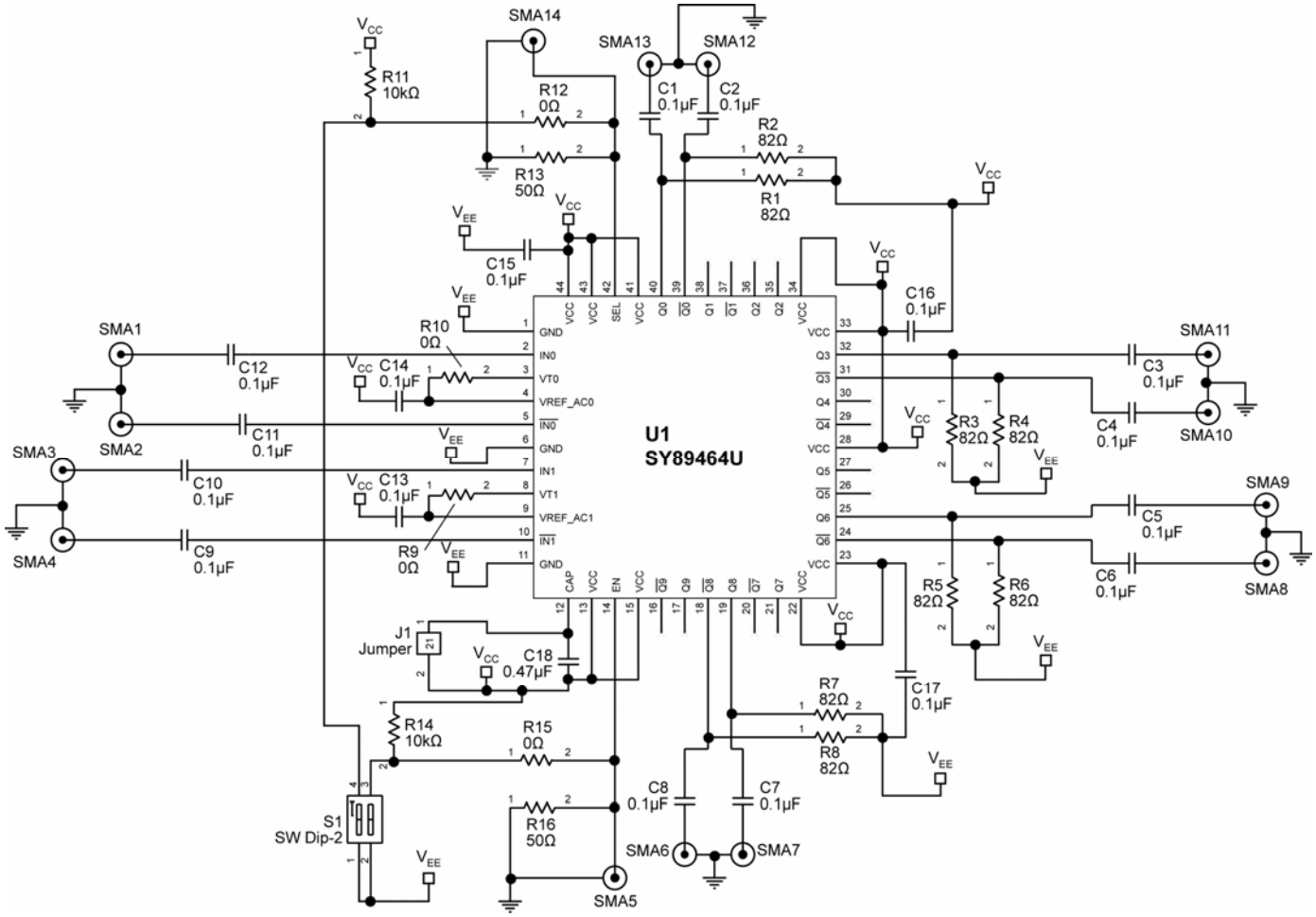
The SY89464/5U evaluation board allows the user to test the runt pulse eliminator function. The runt pulse eliminator function prevents any short cycles or "runt" pulses during switchover.

To see the effects of the runt pulse eliminator function, disable it by replacing C18 with a 0Ω resistor. Sweep the frequency of the function generator to see runt pulses develop. Enable the runt pulse eliminator function by restoring C18, and perform the same frequency sweep.

Any-Input Interface

The unique internal input termination sets the input common mode voltage. This enables the input to interface with any differential signal over the supply voltage without modifying the board.

Evaluation Board

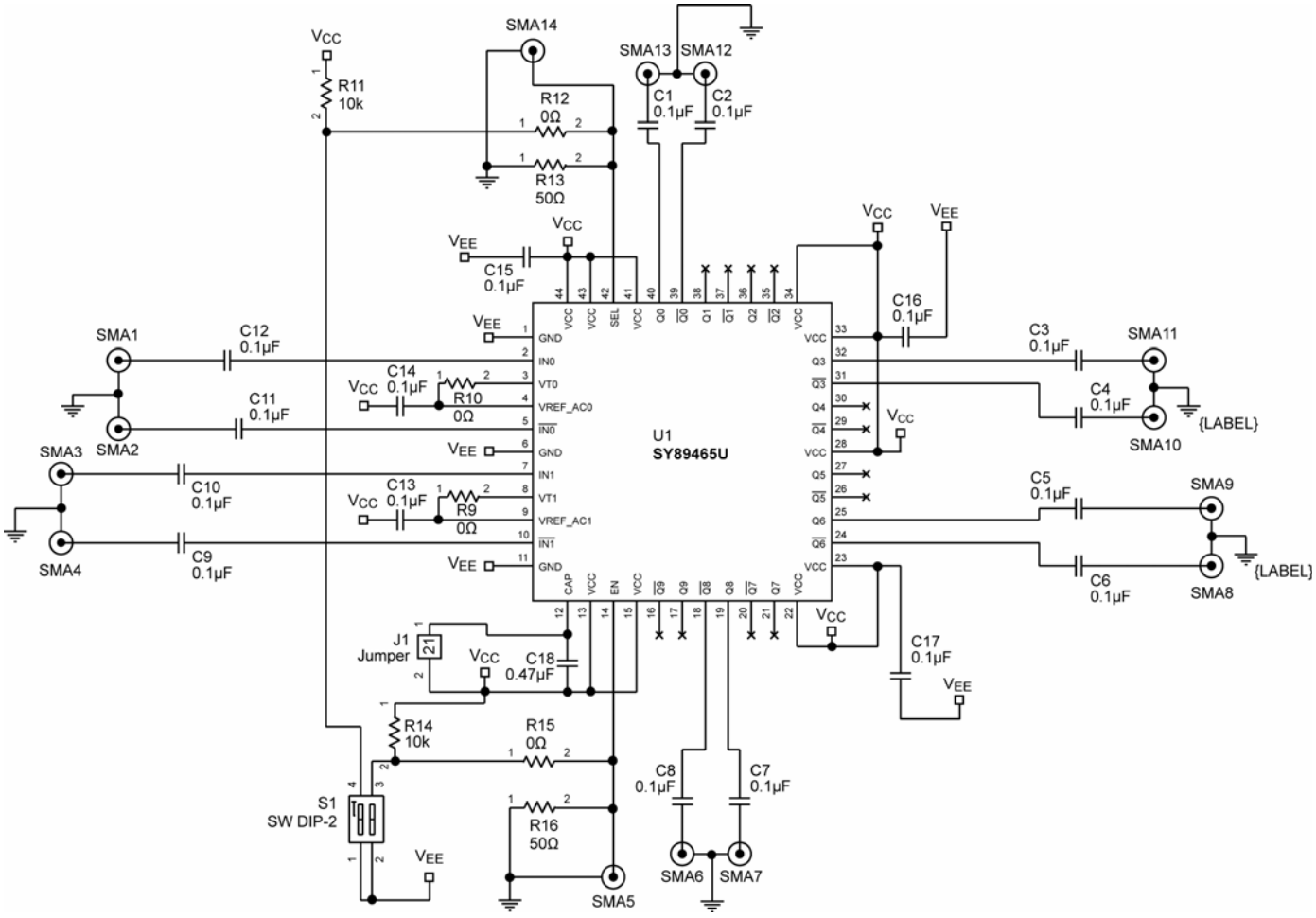


SY89464U AC-Coupled Evaluation Board

I/O	Power Supply	V_{CC}	GND	V_{EE}
AC-Coupled Input/AC-Coupled Output	2.5V	+2.5V	0V	0V
AC-Coupled Input/AC-Coupled Output	3.3V	+3.3V	0V	0V

Table 1. SY89464U AC-Coupled Evaluation Board Power Supply Connections

Evaluation Board

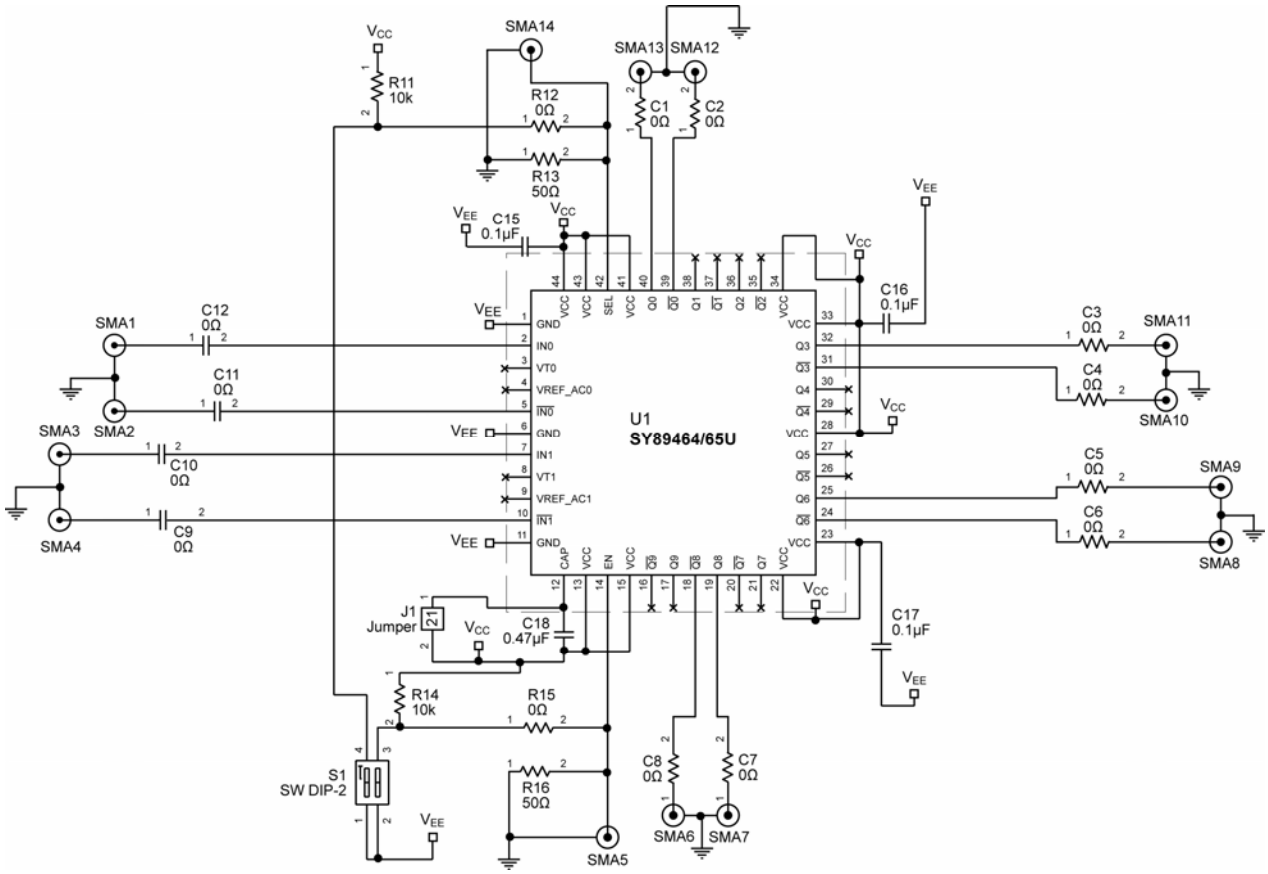


SY89465U AC-Coupled Evaluation Board

I/O	Power Supply	V_{CC}	GND	V_{EE}
AC-Coupled Input/AC-Coupled Output	2.5V	+2.5V	0V	0V

Table 2. SY89465U AC-Coupled Evaluation Board Power Supply Connections

Evaluation Board



SY89464/465U DC-Coupled Evaluation Board

Note:

When reconfiguring an AC-coupled board into a DC-coupled board, replace capacitors C1 to C12 with a 0Ω resistor.

I/O	Power Supply	V_{CC}	GND	V_{EE}
SY89464U DC-Coupled Input/DC-Coupled Output	2.5V	+2.0V	0V	-0.5V
SY89464U DC-Coupled Input/DC-Coupled Output	3.3V	+2.0V	0V	-1.3V
SY89465U DC-Coupled Input/DC-Coupled Output	2.5V	+1.2V	0V	-1.3V

Table 3. DC-Coupled Evaluation Board Power Supply Connections

AC-Coupled Evaluation Board Setup

Setting up the SY89464/5U AC-Coupled Evaluation Board

The following steps describe the procedure for setting up the evaluation board:

1. Set the voltage setting for a DC supply to either 2.5V or 3.3V, depending upon your application, and turn off the supply.
2. Connect the GND and V_{EE} terminal to the negative side of a DC power supply. This is the 0V ground potential.
3. Connect the V_{CC} terminal to the positive side of the DC power supply.
4. Turn on the power supply and verify the power supply current is <160mA.
5. Turn off the power supply.
6. Using a differential signal source, set the amplitude of each side of the differential pair to be 400mV (800mV measured differentially). Set the offset to be a positive value, the value of this offset is not critical, as the AC-coupled inputs will be automatically biased to the correct offset. Turn off, or disable, the outputs of the signal source.
7. Using equal length 50Ω impedance coaxial cables, connect the signal source to the inputs on the evaluation board.
8. Using equal length 50Ω impedance coaxial cables, connect the outputs of the evaluation board to the oscilloscope or other measurement device that has an internal 50Ω termination. Any of these eight outputs that are not connected to a scope or other instrument should be terminated with a 50Ω-to-ground at the SMA on the board.
9. Turn on the power supply and verify the current is <200mA.
10. Enable the signal source and monitor the outputs.

Modifying AC-Coupled Outputs for DC-Coupled Operation

When DC-Coupling is Necessary

For applications where AC-coupling is not appropriate, the board can be reconfigured for DC-coupled operation. An example where DC-coupling is required is if the input data or clock can be disabled. This would result in a DC-signal at the inputs and the on-board biasing resistors would apply the same level to both the true and complement inputs. Since these inputs are differential, this would result in an intermediate non-differential state at the inputs and the outputs would be in an indeterminate condition. Reconfiguring the board for DC-coupled operation, and using two power supplies, can avoid this condition.

Reconfiguring an AC-Coupled Board into a DC-Coupled Board

SY89464U

The following procedure details the steps for converting an AC-coupled board to a DC-coupled board:

1. Remove resistors R1-R10.
2. Remove C13 and C14.
3. Replace capacitors C1 to C8 with 0Ω resistors.

SY89465U

The following procedure details the steps for converting an AC-coupled board to a DC-coupled board:

1. Replace capacitors C1 to C8 with 0Ω resistors.
2. Remove R1 and R10. Remove C13 and C14.

Setting up the DC-Coupled Evaluation Board

SY89464U

The following steps describe the procedure for setting up the DC-Coupled evaluation board:

1. Set the voltage for DC supply number 1 to be 2.0V and connect it to P1 (V_{CC}).
2. Set the voltage for DC supply number 2 to be –1.3V (for 3.3V operation) or –0.5V (for 2.5V operation) and connect it to P3 (V_{EE}).
3. Connect the negative side of power supply 1 to the positive side of power supply 2. This is the 0V ground potential for the board.
4. Turn off the power supplies and connect the GND terminal on the board, P2, to the negative side of a DC power supply 1 and the positive side of DC power supply 2.
5. Turn on the power supply and verify that the power supply current is <160mA. Using a voltmeter.
6. Turn off the power supply.
7. Disable the outputs of the differential signal source and set the $V_{OH} = V_{CC}–1.0V$ and the $V_{OL} = V_{CC}–1.75V$) as shown in the following table:

I/O Voltage Level	+3.3V Supply	+2.5V Supply
$V_{OH} = V_{CC}$-1.0V	+1.0V	+1.0V
$V_{OL} = V_{CC}$-1.75V	+0.25V	+0.25V

Table 4. LVPECL I/O Levels

8. Using equal length 50Ω impedance coaxial cables, connect the outputs of the evaluation board to the oscilloscope or other measurement device that has an internal 50Ω termination. Any of these eight outputs that are not connected to a scope or other instrument should be terminated with a 50Ω termination-to-ground at the SMA on the board.
9. Turn on the power and verify the current is <200mA.
10. Enable the signal source and monitor the outputs.

SY89465U

The following steps describe the procedure for setting up the DC-coupled evaluation board:

1. Set the voltage for DC supply number 1 to be 1.20V and connect it to P1 (V_{CC}).
2. Set the voltage for DC supply number 2 to be –1.3V and connect it to P3 (V_{EE}).
3. Connect the negative side of power supply 1 to the positive side of power supply 2. This is the 0V ground potential for the board.
4. Turn off the power supplies and connect the GND terminal on the board, P2, to the negative side of a DC power supply 1 and the positive side of DC power supply 2.
5. Turn on the power supply and verify that the power supply current is <160mA. Using a voltmeter.
6. Turn off the power supply.
7. Disable the outputs of the differential signal source and set the V_{OH} = 1.450V and the V_{OL} = 1.1V.
8. Using equal length 50Ω impedance coaxial cables, connect the outputs of the evaluation board to the oscilloscope or other measurement device that has an internal 50Ω termination. Any of these four outputs that are not connected to a scope, or other instrument, should be

terminated with a 50Ω termination-to-ground at the SMA on the board.

9. Turn on the power and verify the current is <200mA.
10. Enable the signal source and monitor the outputs.

Note:

If EN is driven from an external signal, remove R15 and add R16. Do not leave EN floating. To enable the outputs, connect EN to V_{CC} or connect to V_{EE} to disable the outputs.

Evaluation Board Layout

PC Board Layout

The evaluation board is constructed with Rogers 4003 material, coplanar in design, fabricated to minimize noise, achieve high bandwidth and minimize crosstalk.

Top	Signal and GND
L1	GND
L2	V_{CC}
L3	V_{EE}
L4	Signal
Bottom	Signal and GND

Table 6. Layer Stack

Bill of Materials

Item	Part Number	Manufacturer	Description	Qty.
C1-C17, C19, C20	VJ0402Y104KXXAT	Vishay[1]	0.1µF, 25V, 10% Ceramic Capacitor, Size 0402, X7R Dielectric	19
C18	VJ0402Y474KXXAT	Vishay[1]	0.47µF, 25V, 10% Ceramic Capacitor, Size 0402, X7R Dielectric	1
C21, C22	293D106X0025C2T	Vishay[1]	10µF, 20V, Tantalum Electrolytic Capacitor, Size C	2
J1	TSW-102-7-5-5	Samtec[2]	0.1mil center through hole terminal strip	1
R1 – R8	CRCW04028250F	Vishay[1]	82Ω, 1/16W, 5% Thick-film Resistor, Size 0402	8
R9, R10, R12, R15	CRCW0402000F	Vishay[1]	0Ω, 1/16W, Resistor SMD, Size 0402	4
R11, R14	CRCW04021002F	Vishay[1]	10kΩ, 1/16W, Resistor SMD, Size 0402	2
R13, R16	CRCW040249R9F	Vishay[1]	50Ω, 1/16W, Resistor SMD, Size 0402	2
P1	5005K-ND	Keystone Electronics[3]	Red Test Point	1
P2	5006K-ND	Keystone Electronics[3]	Black Test Point	1
P3	5009K-ND	Keystone Electronics[3]	Yellow Test Point	1
SMA1-SMA14	142-0701-851	Johnson-Components[4]	Jack Assembly End Launch SMA	14
SW1	TDA02	Digi-Key[5]	Dip Switch	**1**
U1	**SY89464U**	**Micrel[6]**	**Precision LVPECL Runt Pulse Eliminator 1:2 Fanout Buffer with 2:1 MUX and Internal Termination**	**1**
U1	**SY89465U**	**Micrel[6]**	**Precision LVDS Runt Pulse Eliminator 1:2 Fanout Buffer with 2:1 MUX and Internal Termination**	**1**

Additional Components for DC-Coupled Boards

Item	Part Number	Manufacturer	Description	Qty.
C1-C12	CRCW0402000F	Vishay[1]	0Ω, 1/16W, Resistor SMD, Size 0402	12

Notes:

1. Vishay: www.vishay.com.
2. Semtec: www.samtec.com.
3. Keystone Electronics: www.keyelco.com.
4. Johnson Components: www.johnsoncomponents.com.
5. Digi-Key: www.digikey.com.
6. **Micrel, Inc.**: **www.micrel.com**.

HBW Support

Hotline: 408-955-1690

Email Support: HBWHelp@micrel.com

Application Hints and Notes

For application notes on high-speed termination on PECL and LVPECL products, clock synthesizer products, SONET jitter measurement, and other High Bandwidth products, go to Micrel's website at http://www.micrel.com/. Once in Micrel's website, follow the steps below:

1. Click on "Product Info."
2. In the Applications Information Box, choose "Application Hints and Application Notes."

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