2.0GHz, Low Power, 1:6 LVPECL Fanout Buffer with 2:1 Input MUX and Internal Termination

SY89856U Evaluation Board

General Description

The SY89856U evaluation board is designed for convenient setup and quick evaluation of the SY89856U. The board is optimized to interface directly to a 50Ω oscilloscope.

For best AC performance, the board is 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.

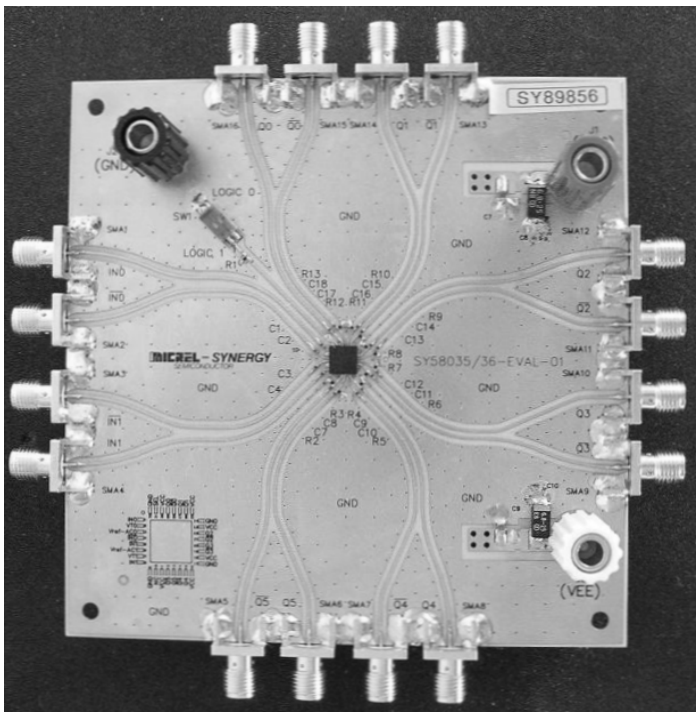
Features

- Fully assembled and tested SY89856U
- +2.5V or +3.3V power supply
- AC-coupled configuration for ease-of-use
- I/O interface includes on-board termination
- Fully assembled and tested
- Can be reconfigured for DC-coupling operation

Related Documentation

- SY89856U 2.0GHz, Low Power, 1:6 LVPECL Fanout Buffer with 2:1 Input MUX and Internal Termination Data Sheet

Evaluation Board



Evaluation Board Description

The default configuration for the SY89856U board is AC-coupled. The choice between AC-coupled and DC-coupled configurations offers the user flexibility for specific applications. With the current board layout, Q0 is meant for DC-coupled operation. In default AC-coupled configuration, Q0 is not brought out.

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 applications that can be turned off for extended periods of time, the board can be user-configured for DC-coupled operation.

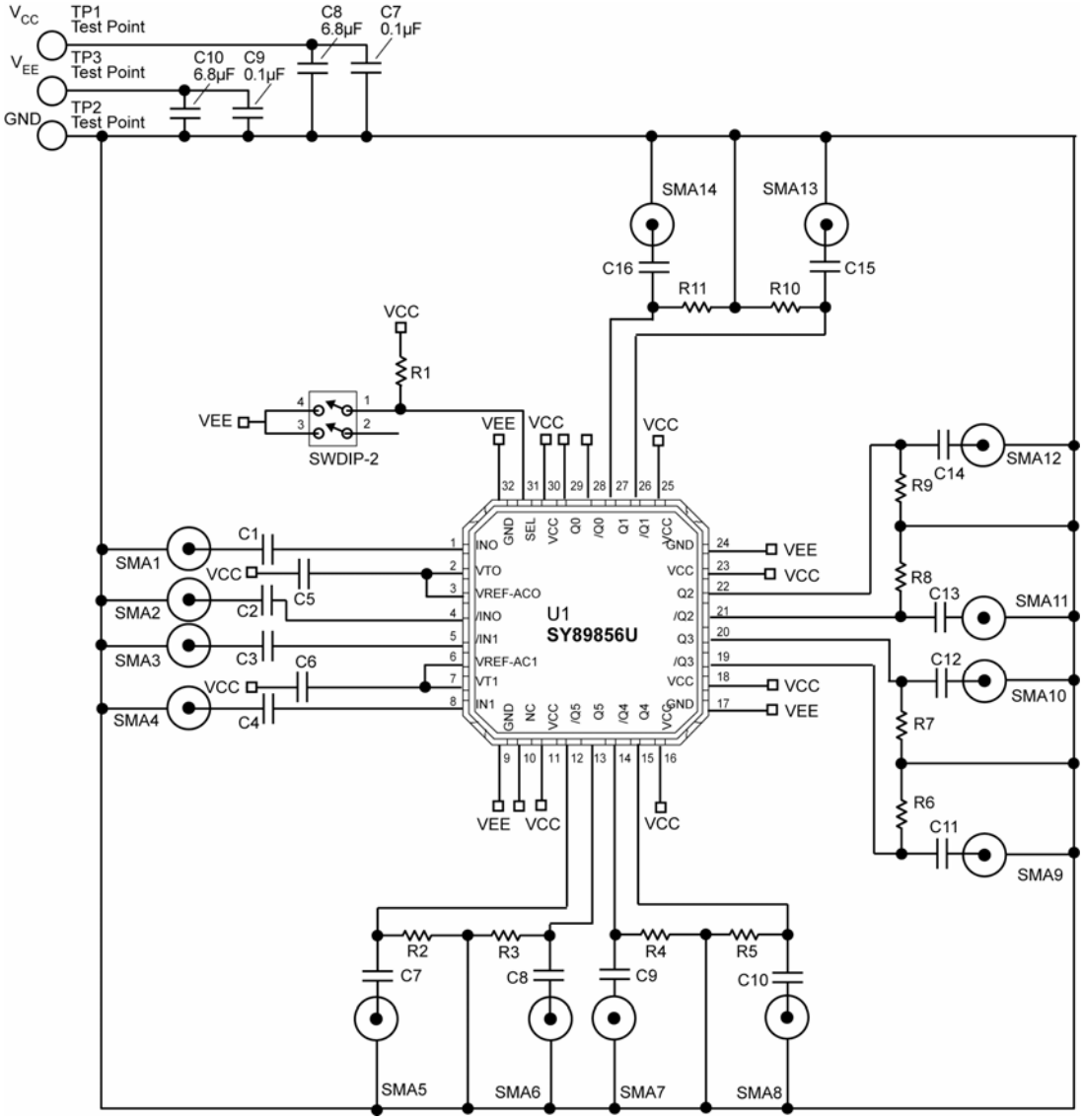
This can be accomplished by modifying the board to use two power supplies into a “split-supply configuration”. Since LVPECL is referenced to V_{CC}, and standard PECL termination is 50Ω to V_{CC}-2V. Split-supply is an easy method to interface to a 50Ω (to ground) scope. Therefore, a 3.3V supply will 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 provides the correct terminations for the device by setting the Ground potential on the board to be exactly 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.

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

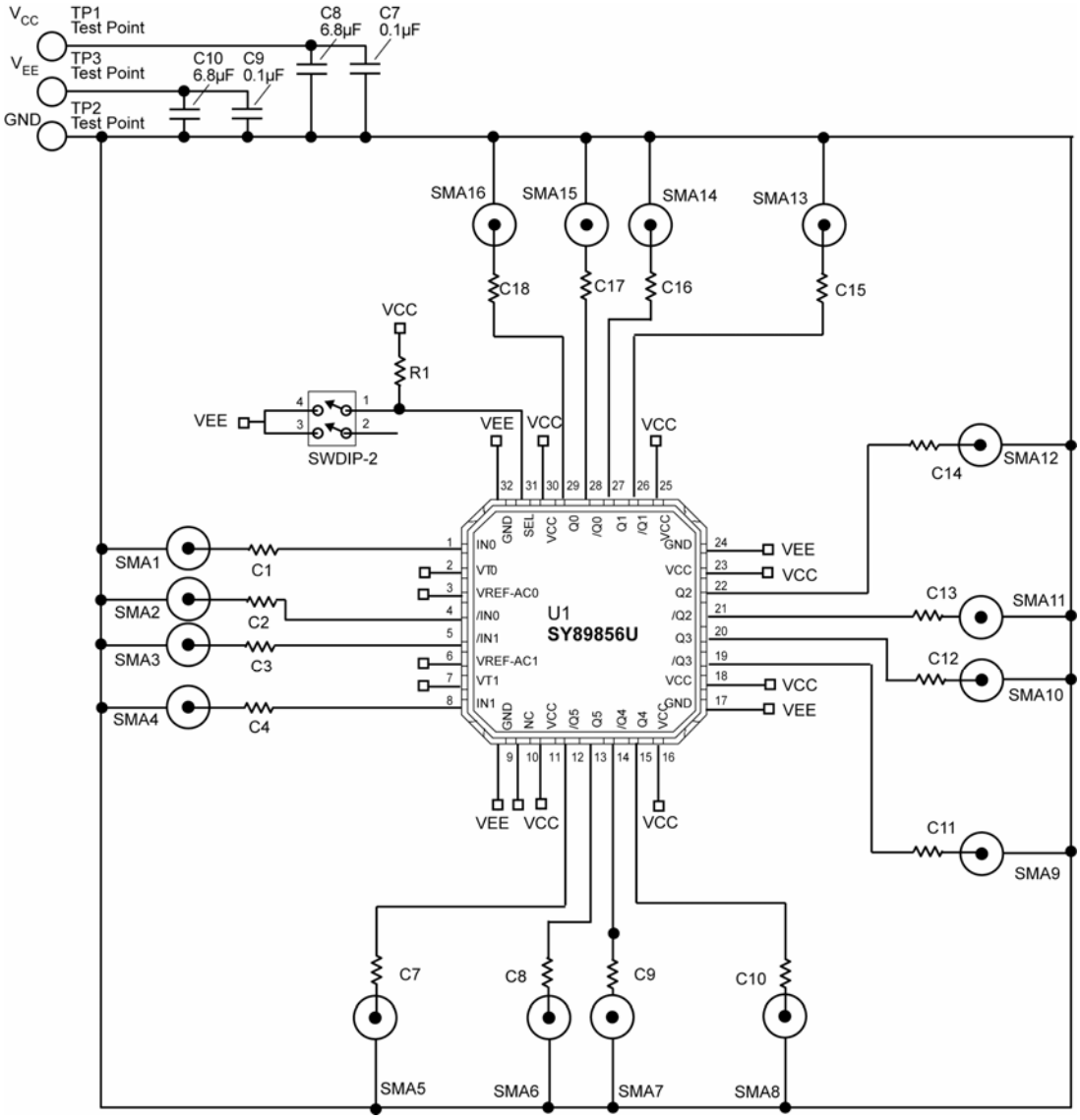


AC-Coupled Evaluation Board

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. AC-Coupled Evaluation Board Power Supply Connections

Evaluation Board



DC-Coupled Evaluation Board

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

Table 2. DC-Coupled Evaluation Board Power Supply Connections

hbwhelp@micrel.com or (408) 955-1690

AC-Coupled Evaluation Board Setup

Setting up the SY89856U 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 be 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 a 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 800mV (1600mV measured differentially). Set the offset to be a positive value, the value of this offset is not critical, since the AC-coupled inputs will automatically bias 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 (SMA1 and SMA2 or SMA3 and SMA4).
8. Using equal length 50Ω impedance coaxial cables, connect the outputs of the evaluation board (SMA5 and SMA6 or SMA7 and SMA8 or SMA9 and SMA10 or SMA11 and SMA12 or SMA13 and SMA14 or to the oscilloscope or other measurement device that has an internal 50Ω termination. Any of these 10 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 when AC-coupling is not appropriate, the board can be reconfigured for DC-coupled operation. An example when 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 (R1 and R2) 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 the AC-coupled Board into a DC-coupled Board

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

1. Disconnect $V_{REF\text{-}AC0}$ and V_{T0}
2. Disconnect $V_{REF\text{-}AC1}$ and V_{T1}
3. Remove resistors R2-R11
4. Replace capacitors C1–C4 and C7–C16 with 0Ω resistors.

Setting up the DC-coupled Evaluation Board

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 J1 (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 J3 (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, J2, 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
$V_{OH} = V_{CC}–1.0V$	+2.3V	+1.5V
$V_{OL} = V_{CC}–1.75V$	+1.55V	+0.75V

Table 3. LVPECL I/O Levels

8. Using equal length 50Ω impedance coaxial cables, connect the outputs of the evaluation board (SMA5 and SMA6 or SMA7 and SMA8 or SMA9 and SMA10 or SMA11 and SMA12 or SMA13 and SMA14 or SMA15 and SMA16) to the oscilloscope or other measurement device that has an internal 50Ω termination. Any of these 12 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.

Evaluation Board Layout

PC Board Layout

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

L1	GND and Signal
L2	GND
L3	VCC
L4	GND

Table 4. Layer Stack

Bill of Materials

Item	Part Number	Manufacturer	Description	Qty.
C1-C18 C21, C22	VJ0402Y104KXXAT	Vishay[1]	0.1μF, 25V, 10% Ceramic Capacitor, Size 0402, X7R Dielectric	20
C19, C20	293D685X0025C2T	Vishay[1]	6.8μF, 20V, Tantalum Electrolytic Capacitor, Size C	2
J1	111-0702-001	Johnson[2]	Red Banana Jack	1
J2, J3	111-0703-001	Johnson[2]	Black Banana Jack	2
R1	CRCW04023001F	Vishay[1]	3kΩ, 10%, 1/16W Resistor SMD, Size 0402	1
R2-R11	CRCW040282R5F	Vishay[1]	82Ω, 1/10W, 5% Thick-film Resistor, Size 0402	10
SMA1- SMA16	142-0701-851	Johnson[2]	Jack Assembly End Launch SMA	16
SW1	CT2182LPST-ND	DigiKey[3]	2-Position Dip	1
U1	**SY89856U**	**Micrel[4]**	**2.0GHz, Low-Power, 1:6 LVPECL Fanout Buffer with 2:1 Input MUX and Internal Termination**	1

Additional Components for AC-Coupled Outputs

Item	Part Number	Manufacturer	Description	Qty.
C1-C4, C7-C18	CRCW0402000F	Vishay[1]	0Ω, 1/16W, Resistor SMD, Size 0402	16

Notes:

1. Vishay: www.vishay.com.
2. Johnson: www.johnsoncomponents.com.
3. DigiKey: www.digikey.com.
4. Micrel, Inc.: www.micrel.com.

Micrel Cross Reference

To find an equivalent Micrel part, go to Micrel's website at: http://www.micrel.com and follow the steps below:

1. Click on Dynamic Cross Reference.
2. Enter competitor's part number in the Dynamic Cross Reference field.
3. To download a PDF version of this information, click on the Cross Reference PDF tab.

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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