



SY89855U

Precision Low Power Differential LVPECL 4:1 MUX with 1:2 Fanout and Internal Termination

General Description

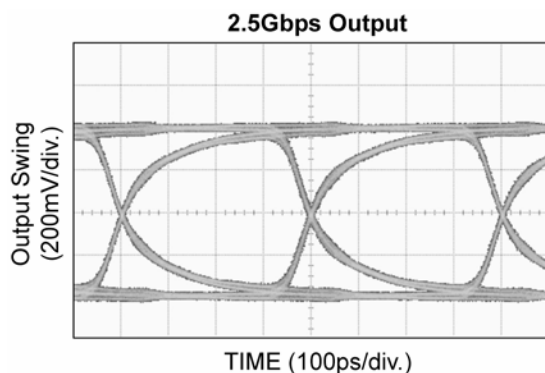
The SY89855U is a 2.5V/3.3V precision, high-speed, 4:1 differential multiplexer with 100K LVPECL (800mV) compatible outputs, capable of handling clocks up to 2.5GHz and data streams up to 2.5Gbps. In addition, a 1:2 fanout buffer provides two copies of the selected inputs.

The differential input includes Micrel's unique, 3-pin input termination architecture that allows customers to interface to any differential signal (AC- or DC-coupled) as small as 100mV without any level shifting or termination resistor networks in the signal path. The result is a clean, stub-free, low-jitter interface solution. The outputs are 800mV LVPECL, (100K temperature compensated) with fast rise/fall times guaranteed to be less than 180ps.

The SY89855U operates from a 2.5V $\pm 5\%$ supply or a 3.3V $\pm 10\%$ supply and is guaranteed over the full industrial temperature range of -40°C to $+85^{\circ}\text{C}$. For applications that require higher performance, consider the SY58029U. The SY89855U is part of Micrel's high-speed, Precision Edge[®] product line.

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

Typical Performance



Precision Edge[®]

Features

- Select 1 of 4 differential inputs
- Provides two copies of the selected input
- Low power 260mW ($V_{CC} = 2.5\text{V}$)
- Guaranteed AC performance over temperature and voltage:
 - DC-to->2.5Gbps data rate throughput
 - $<410\text{ps}$ In-to-Q t_{pd}
 - $<180\text{ps}$ t_r / t_f times
- Ultra low-jitter design:
 - $<10\text{ps}_{PP}$ total jitter (clock)
 - $<1\text{ps}_{RMS}$ random jitter
 - $<10\text{ps}_{PP}$ deterministic jitter
 - $<0.7\text{ps}_{RMS}$ crosstalk-induced jitter
- Unique, patent-pending input design minimizes crosstalk
- Accepts an input signal as low as 100mV
- Unique patented input termination and VT pin accepts DC- and AC-coupled inputs (CML, LVPECL, LVDS)
- 800mV 100K LVPECL output swing
- Power supply 2.5V $\pm 5\%$ or 3.3V $\pm 10\%$
- -40°C to $+85^{\circ}\text{C}$ temperature range
- Available in 32-pin (5mm x 5mm) MLF[®] package

Applications

- Redundant clock and/or data distribution
- All SONET/OC-3 to OC-48 clock/data distribution
- Loopback
- All Fibre Channel applications
- All GigE applications

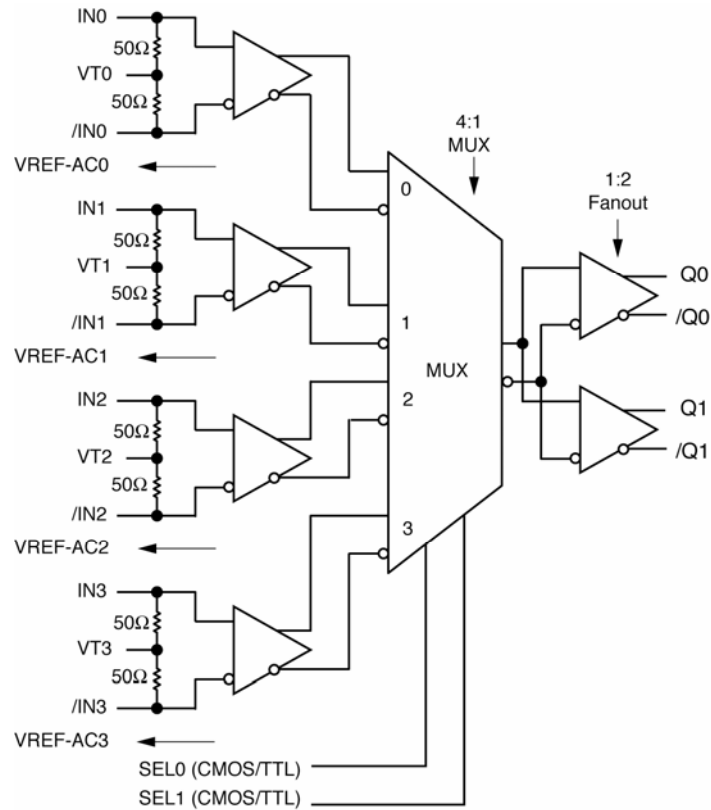
Markets

- LAN/WAN communication
- Enterprise servers
- ATE
- Test and measurement

Precision Edge is a registered trademark of Micrel, Inc
MLF and MicroLeadFrame are registered trademarks of Amkor Technology.

Micrel Inc. • 2180 Fortune Drive • San Jose, CA 95131 • USA • tel +1 (408) 944-0800 • fax + 1 (408) 474-1000 • <http://www.micrel.com>

Functional Block Diagram



Truth Table

SEL1	SEL0	Q
0	0	IN0 Input Select
0	1	IN1 Input Select
1	0	IN2 Input Select
1	1	IN3 Input Select

Absolute Maximum Ratings⁽¹⁾

Supply Voltage (V_{CC})	.....	-0.5V to +4.0V
Input Voltage (V_{IN})	.....	-0.5V to V_{CC}
LVPECL Output Current (I_{OUT})		
Continuous	± 50 mA
Surge	± 100 mA
Termination Current		
Source or Sink Current on V_T	± 100 mA
Input Current		
Source or Sink Current on IN, /IN	± 50 mA
Current (V_{REF-AC})		
Source or Sink Current on V_{REF-AC}	± 2 mA
Lead Temperature (soldering, 20sec.)	.....	260°C
Storage Temperature (T_s)	.....	-65°C to +150°C

Operating Ratings⁽²⁾

Supply Voltage (V_{CC})	.....	+2.375V to +2.625V
	.....	+3.0V to +3.6V
Ambient Temperature (T_A)	.....	-40°C to +85°C
Package Thermal Resistance ⁽³⁾		
MLF [®] (θ_{JA})		
Still-Air	.....	35°C/W
500lfpm	.....	28°C/W
MLF [®] (ψ_{JB})		
Junction-to-Board	.....	16°C/W

DC Electrical Characteristics⁽⁴⁾

$T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$, unless otherwise noted.

Symbol	Parameter	Condition	Min	Typ	Max	Units
V_{CC}	Power Supply Voltage	$V_{CC} = 2.5\text{V}$ $V_{CC} = 3.3\text{V}$	2.375 3.0	2.5 3.3	2.625 3.6	V V
I_{CC}	Power Supply Current	No load, max. V_{CC} .		65	85	mA
R_{IN}	Input Resistance (IN-to- V_T)		45	50	55	Ω
R_{DIFF_IN}	Differential Input Resistance (IN-to-/IN, /IN-to- V_T)		90	100	110	Ω
V_{IH}	Input High Voltage (IN, /IN)		$V_{CC} - 1.2$		V_{CC}	V
V_{IL}	Input Low Voltage (IN, /IN)		0		$V_{IH} - 0.1$	V
V_{IN}	Input Voltage Swing (IN-to-/IN)	See Figure 1a.	100		1700	mV
V_{DIFF_IN}	Differential Input Voltage Swing $|IN - /IN|$	See Figure 1b.	200			mV
V_{T_IN}	Maximum Input Voltage (IN-to- V_T)				1.28	V
V_{REF-AC}	Output Reference Voltage		$V_{CC} - 1.3$	$V_{CC} - 1.2$	$V_{CC} - 1.1$	V

Notes:

1. Permanent device damage may occur if absolute maximum ratings are exceeded. This is a stress rating only and functional operation is not implied at conditions other than those detailed in the operational sections of this data sheet. Exposure to absolute maximum ratings conditions for extended periods may affect device reliability.
2. The data sheet limits are not guaranteed if the device is operated beyond the operating ratings.
3. Package thermal resistance assumes exposed pad is soldered (or equivalent) to the devices most negative potential on the PCB. θ_{JA} and ψ_{JB} values are determined for a 4-layer board in still-air, unless otherwise stated.
4. The circuit is designed to meet the DC specifications shown in the above table after thermal equilibrium has been established.

LVPECL Output DC Electrical Characteristics⁽⁵⁾

$V_{CC} = 2.5V \pm 5\%$ or $3.3V \pm 10\%$; $R_L = 50\Omega$ to $V_{CC}-2V$; $T_A = -40^\circ C$ to $+85^\circ C$, unless otherwise noted.

Symbol	Parameter	Condition	Min	Typ	Max	Units
V_{OH}	Output High Voltage (Q, /Q)		$V_{CC}-1.145$		$V_{CC}-0.895$	V
V_{OL}	Output Low Voltage (Q, /Q)		$V_{CC}-1.945$		$V_{CC}-1.695$	V
V_{OUT}	Output Voltage Swing (Q, /Q)	See Figure 1a.	400	800		mV
$V_{DIFF-OUT}$	Differential Output Voltage Swing (Q, /Q)	See Figure 1b.	800	1600		mV

LVTTTL/CMOS DC Electrical Characteristics⁽⁵⁾

$V_{CC} = 2.5V \pm 5\%$ or $3.3V \pm 10\%$; $T_A = -40^\circ C$ to $+85^\circ C$, unless otherwise noted.

Symbol	Parameter	Condition	Min	Typ	Max	Units
V_{IH}	Input High Voltage		2.0			V
V_{IL}	Input Low Voltage				0.8	V
I_{IH}	Input High Current	$V_{IN} = V_{CC}$			75	μA
I_{IL}	Input Low Current	$V_{IN} = 0.5V$	-300			μA

Notes:

- The circuit is designed to meet the DC specifications shown in the above table after thermal equilibrium has been established.

AC Electrical Characteristics⁽⁶⁾

$V_{CC} = 2.5V \pm 5\%$ or $3.3V \pm 10\%$; $T_A = -40^\circ C$ to $+85^\circ C$, $R_L = 50\Omega$ to $V_{CC}-2V$, unless otherwise stated.

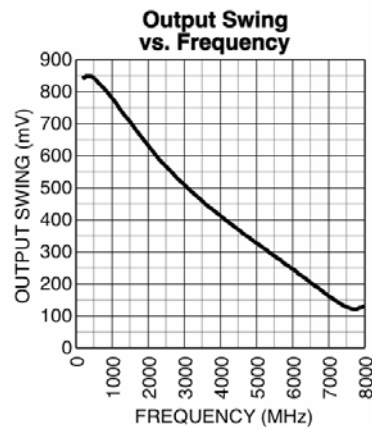
Symbol	Parameter	Condition	Min	Typ	Max	Units
f_{MAX}	Maximum Operating Frequency	NRZ Data	2.5			Gbps
		Clock, $V_{OUT} > 400mV$	2.5			GHz
t_{pd}	Propagation Delay IN-to-Q SEL-to-Q	$V_{IN} > 100mV$	210	300	410	ps
			100	300	500	ps
t_{pd} Tempco	Differential Propagation Delay Temperature Coefficient			234		fs/ $^\circ C$
t_{SKEW}	Output-to-Output Part-to-Part	Note 7		9	20	ps
		Note 8			150	ps
t_{JITTER}	Data Random Jitter (RJ)	Note 9			1	ps _{RMS}
	Deterministic Jitter (DJ)	Note 10			10	ps _{PP}
	Clock Cycle-to-Cycle Jitter	Note 11			1	ps _{RMS}
	Total Jitter (TJ)	Note 12			10	ps _{PP}
	Crosstalk-induced Jitter (Adjacent Channel)	Note 13			0.7	ps _{RMS}
	t_r, t_f	Output Rise/Fall Time (20% to 80%)	At full output swing.	50	100	180	ps

Notes:

6. High frequency AC electricals are guaranteed by design and characterization.
7. Output-to-output skew is measured between outputs under identical input conditions.
8. Part-to-part skew is defined for two parts with identical power supply voltages at the same temperature and with no skew of the edges at the respective inputs.
9. Random jitter is measured with a K28.7 character pattern, measured at $<f_{MAX}$.
10. Deterministic jitter is measured at 2.5Gbps with both K28.5 and $2^{23}-1$ PRBS pattern.
11. Cycle-to-cycle jitter definition: the variation of periods between adjacent cycles, $T_n - T_{n-1}$ where T is the time between rising edges of the output signal.
12. Total jitter definition: with an ideal clock input of frequency $<f_{MAX}$, no more than one output edge in 10^{12} output edges will deviate by more than the specified peak-to-peak jitter value.
13. Crosstalk is measured at the output while applying two similar differential clock frequencies that are asynchronous with respect to each other at the inputs.

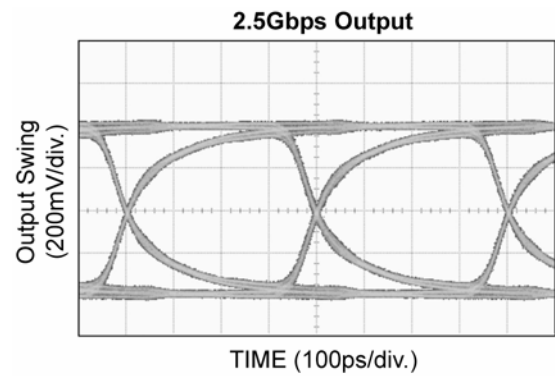
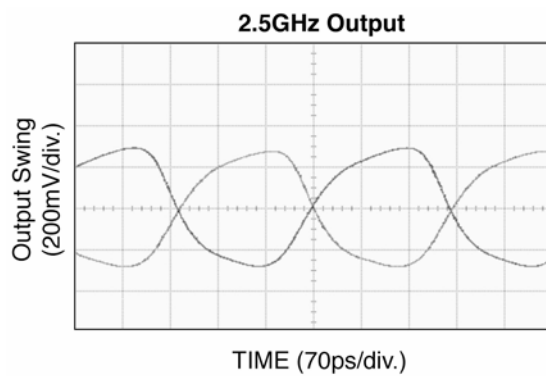
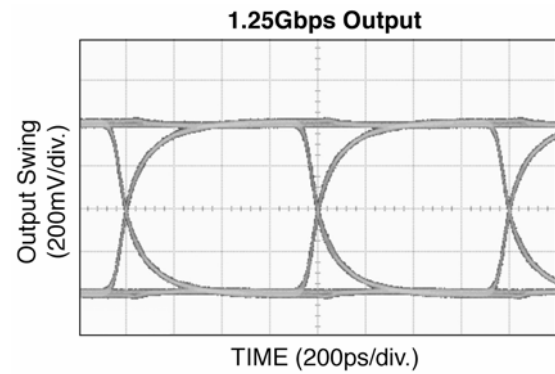
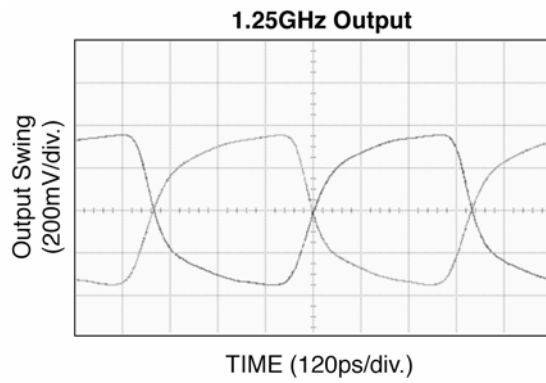
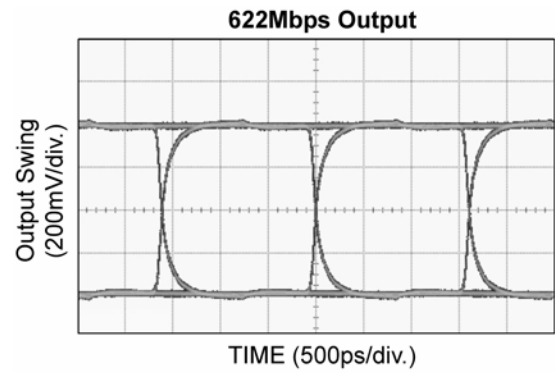
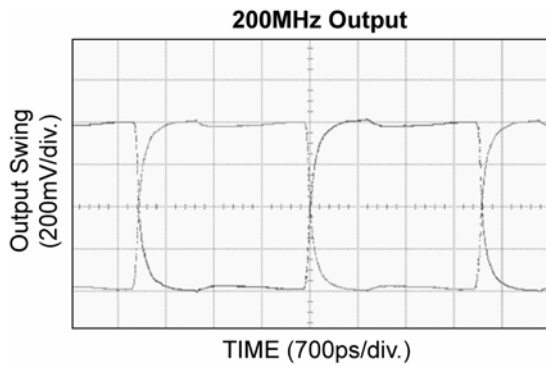
Typical Operating Characteristics

$V_{CC} = 2.5V$, $GND = 0$, $V_{IN} = 100mV$; $T_A = -40^{\circ}C$ to $+85^{\circ}C$, $R_L = 50\Omega$ to $V_{CC}-2V$, unless otherwise stated.



Functional Characteristics

$V_{CC} = 3.3V \pm 10\%$; $T_A = -40^\circ C$ to $+85^\circ C$, $R_L = 50\Omega$ to $V_{CC}-2V$, unless otherwise stated.



Single-Ended and Differential Swings

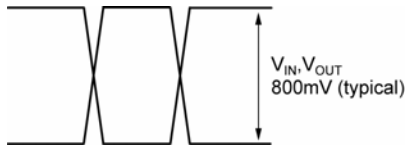


Figure 1a. Single-Ended Voltage Swing

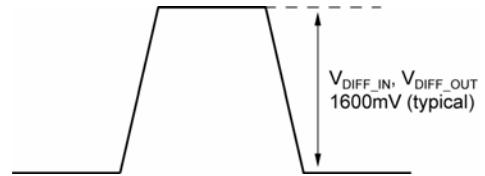
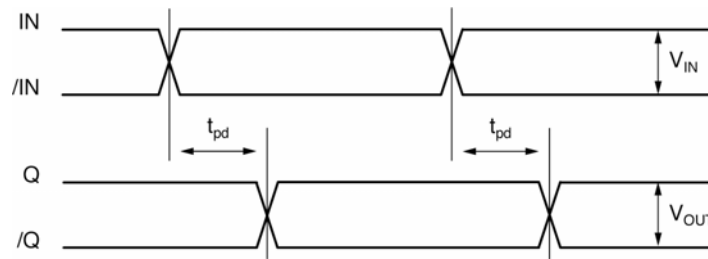
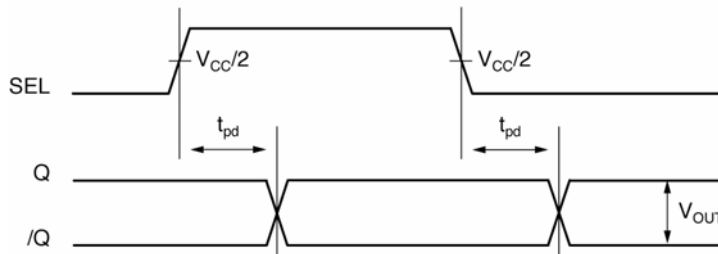


Figure 1b. Differential Voltage Swing

Timing Diagram



IN-to-Q Timing Diagram



SEL-to-Q Timing Diagram

Input and Output Stages

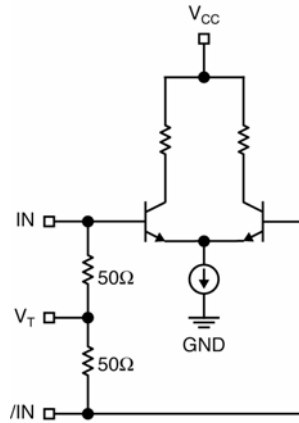


Figure 2a. Simplified Differential Input Stage

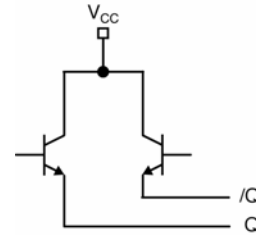


Figure 2b. PECL Output Stage

Input Interface Applications

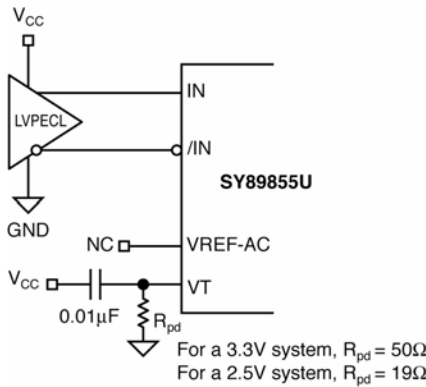


Figure 3a. LVPECL Interface (DC-Coupled)

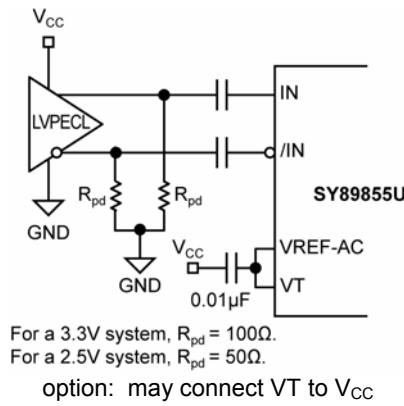


Figure 3b. LVPECL Interface (AC-Coupled)

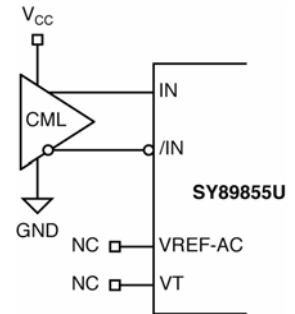


Figure 3c. CML Interface (DC-Coupled)

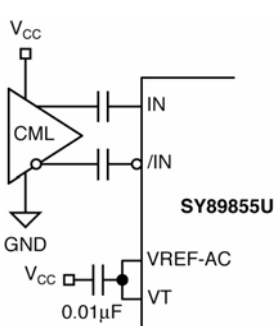


Figure 3d. CML Interface (AC-Coupled)

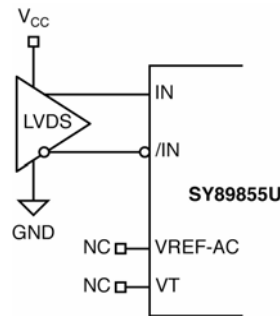
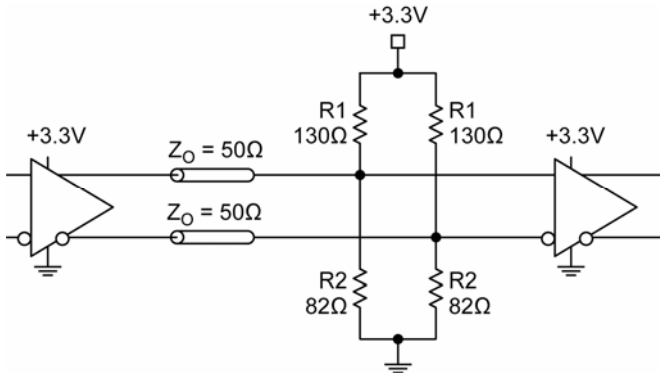


Figure 3e. LVDS Interface

Output Interface Applications

LVPECL has high input impedance, very low output (open emitter) impedance, and small signal swing, which result in low EMI. LVPECL is ideal for driving 50Ω and 100Ω controlled impedance transmission lines. There are different techniques for terminating

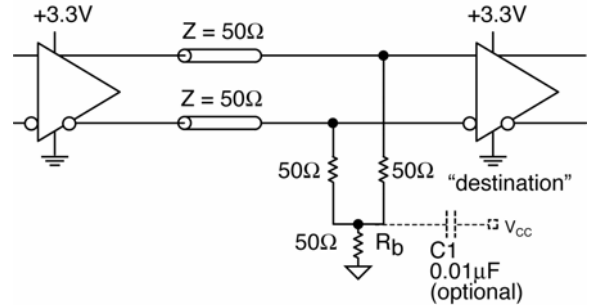
LVPECL outputs: parallel termination thevenin-equivalent, parallel termination (3-resistor), and AC-coupled termination. Unused output pairs may be left floating; however, single-ended outputs must be terminated or balanced.



Note:

For a 2.5V system, R1 = 250Ω, R2 = 62.5Ω.

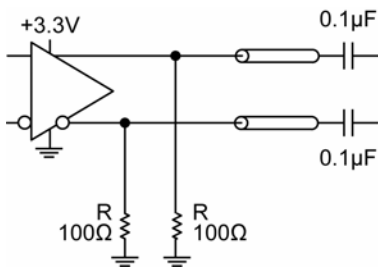
Figure 4a. Parallel Thevenin-Equivalent Termination



Note:

1. For a 2.5V system, R_b = 19Ω.

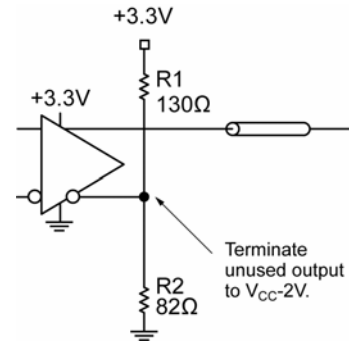
Figure 4b. Parallel Termination (3-Resistor)



Note:

For a 2.5V system, R = 50Ω.

Figure 4c. AC-Coupled Termination



Note:

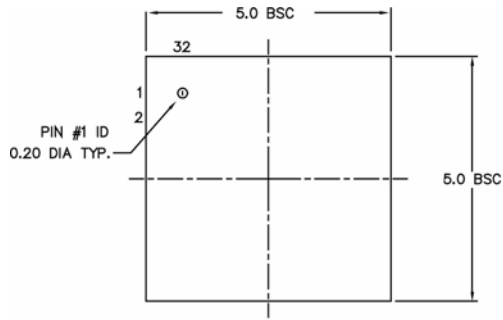
For a 2.5V system, R1 = 250Ω, R2 = 62.5Ω.

Figure 4d. Parallel Thevenin-Equivalent Termination

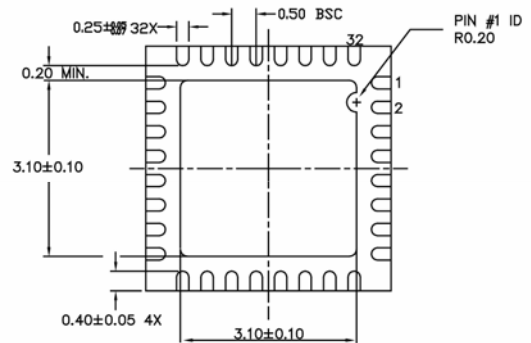
Related Product and Support Documentation

Part Number	Function	Data Sheet Link
SY58029U	Ultra Precision Differential LVPECL 4 :1 MUX with 1 :2 Fanout Internal Termination	www.micrel.com/product-info/products/sy58029u.shtml .
	MLF [®] Application Note	www.amkor.com/products/notes_papers/MLFAppNote.pdf
HBW Solutions	New Products and Applications	www.micrel.com/product-info/products/solutions.shtml

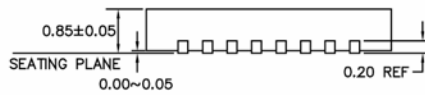
Package Information



TOP VIEW



BOTTOM VIEW

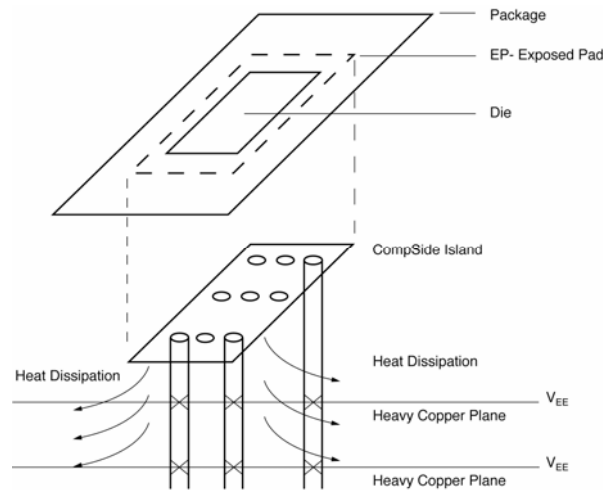


SIDE VIEW

NOTE:

1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. MAX. PACKAGE WARPAGE IS 0.05 mm.
3. MAXIMUM ALLOWABLE BURRS IS 0.076 mm IN ALL DIRECTIONS.
4. PIN #1 ID ON TOP WILL BE LASER/INK MARKED.

32-Pin MLF[®] (MLF-32)



PCB Thermal Consideration for 32-Pin MLF[®] Package (Always solder, or equivalent, the exposed pad to the PCB)

Packages Notes:

1. Package meets Level 2 Moisture Sensitivity Classification.
2. All parts are dry-packed before shipment.
3. Exposed pads must be soldered to a ground for proper thermal management.

MICREL, INC. 2180 FORTUNE DRIVE SAN JOSE, CA 95131 USA
TEL +1 (408) 944-0800 FAX +1 (408) 474-1000 WEB <http://www.micrel.com>

The information furnished by Micrel in this data sheet is believed to be accurate and reliable. However, no responsibility is assumed by Micrel for its use. Micrel reserves the right to change circuitry and specifications at any time without notification to the customer.

Micrel Products are not designed or authorized for use as components in life support appliances, devices or systems where malfunction of a product can reasonably be expected to result in personal injury. Life support devices or systems are devices or systems that (a) are intended for surgical implant into the body or (b) support or sustain life, and whose failure to perform can be reasonably expected to result in a significant injury to the user. A Purchaser's use or sale of Micrel Products for use in life support appliances, devices or systems is a Purchaser's own risk and Purchaser agrees to fully indemnify Micrel for any damages resulting from such use or sale.

© 2005 Micrel, Incorporated.