

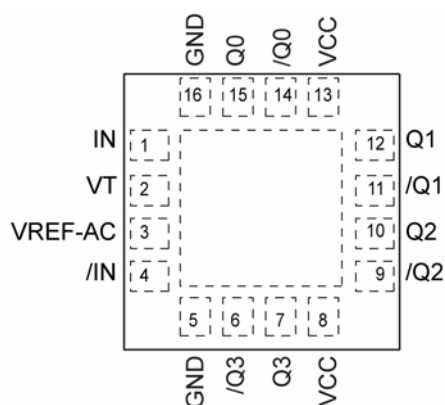
## Ordering Information<sup>(1)</sup>

Part Number	Package Type	Operating Range	Package Marking	Lead Finish
SY58021UMI	QFN-16	Industrial	021U	Sn-Pb
SY58021UMITR <sup>(2)</sup>	QFN-16	Industrial	021U	Sn-Pb
SY58021UMG <sup>(3)</sup>	QFN-16	Industrial	021U with Pb-Free bar-line indicator	Pb-Free NiPdAu
SY58021UMGTR <sup>(2, 3)</sup>	QFN-16	Industrial	021U with Pb-Free bar-line indicator	Pb-Free NiPdAu

### Notes:

1. Contact factory for die availability. Dice are guaranteed at  $T_A = 25^\circ\text{C}$ , DC electrical only.
2. Tape and Reel.
3. Pb-Free package recommended for new designs.

## Pin Configuration



16-Pin QFN

## Pin Description

Pin Number	Pin Name	Pin Function
1, 4	IN, /IN	Differential Input: This input pair receives the signal to be buffered. Each pin of this pair internally terminates with 50 $\Omega$ to the VT pin. Note that this input will default to an indeterminate state if left open. See "Input Interface Applications" section.
2	VT	Input Termination Center-Tap: Each input terminates to this pin. The VT pin provides a center-tap for each input (IN, /IN) to the termination network for maximum interface flexibility. See "Input Interface Applications" section.
3	VREF-AC	Reference Output Voltage: This output biases to VCC –1.2V. It is used when AC-coupling to differential inputs. Connect VREF-AC directly to the VT pin. Bypass with 0.01 $\mu$ F low ESR capacitor to VCC. See "Input Interface Applications" section.
8, 13	VCC	Positive Power Supply: Bypass with 0.1 $\mu$ F//0.01 $\mu$ F low ESR capacitors as close to the VCC pins as possible.
5, 16	GND, Exposed Pad	Ground. Exposed pad must be connected to a ground plane that is the same potential as the ground pin.
14, 15, 11, 12, 9, 10, 6, 7	/Q0, Q0, /Q1, Q1, /Q2, Q2, /Q3, Q3	LVPECL Differential Output Pairs: Differential buffered output copy of the input signal. The output swing is typically 800mV. Proper termination is 50 $\Omega$ to VCC–2V at the receiving end. Unused output pairs may be left floating with no impact on jitter or skew. See "LVPECL Output Termination" section.

**Absolute Maximum Ratings<sup>(1)</sup>**

Power Supply Voltage ( $V_{CC}$ )	–0.5V to +4.0V
Input Voltage ( $V_{IN}$ )	–0.5V to $V_{CC}$
LVPECL Output Current ( $I_{OUT}$ )	
Continuous	50mA
Surge	100mA
Source or Sink Current on VT Pin	
$V_T$ Current	±100mA
Source or Sink Current on IN, /IN	
Input Current	±50mA
Source or Sink Current on $V_{REF-AC}$ <sup>(4)</sup>	
$V_{REF}$ Current	±1.5mA
Soldering (20s)	260°C
Storage Temperature ( $T_s$ )	–65°C to +150°C

**Operating Ratings<sup>(2)</sup>**

Power Supply Voltage ( $V_{CC}$ )	+2.375V to +3.60V
Operating Temperature Range ( $T_A$ )	–40°C to +85°C
Package Thermal Resistance	
QFN ( $\theta_{JA}$ )	
Still-Air	+60°C/W
500 lpm	+54°C/W
QFN ( $\psi_{JB}$ )	
Junction-to-Board Resistance <sup>(3)</sup>	+33°C/W

**Input DC Electrical Characteristics<sup>(5)</sup>**

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

Symbol	Parameter	Condition	Min.	Typ.	Max.	Units
$V_{CC}$	Power Supply Voltage	$V_{CC} = 2.5\text{V}$	2.375	2.5	2.625	V
		$V_{CC} = 3.3\text{V}$	3.0	3.3	3.60	
$I_{CC}$	Power Supply Current	No load, $V_{CC} = \text{maximum}$		125	160	mA
$V_{IH}$	Input HIGH Voltage	IN, /IN (Note 6)	$V_{CC} - 1.6$		$V_{CC}$	V
$V_{IL}$	Input LOW Voltage	IN, /IN	0		$V_{IH} - 0.1$	V
$V_{IN}$	Input Voltage Swing	IN, /IN (see Figure 1a)	0.1		1.7	V
$V_{DIFF\_IN}$	Differential Input Voltage Swing	IN, /IN (see Figure 1b)	0.2			V
$R_{IN}$	IN-to- $V_T$ Resistance		40	50	60	$\Omega$
$V_{T\_IN}$	IN-to- $V_T$ Voltage				1.28	V
$V_{REF-AC}$	Output Reference Voltage		$V_{CC} - 1.30$	$V_{CC} - 1.2$	$V_{CC} - 1.1$	V

**Notes:**

1. Permanent device damage may occur if ratings in the "Absolute Maximum Ratings" section are exceeded. This is a stress rating only and functional operation is not implied for 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. Thermal performance assumes exposed pad is soldered (or equivalent) to the device's most negative potential on the PCB.
4. Due to the limited drive capability, use for input of the same package only.
5. The circuit is designed to meet the DC specifications shown in the above table after thermal equilibrium has been established.
6.  $V_{IH}$  (minimum) not lower than 1.2V.

## LVPECL Output DC Electrical Characteristics<sup>(5)</sup>

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

Symbol	Parameter	Condition	Min.	Typ.	Max.	Units
$V_{OH}$	Output HIGH Voltage		$V_{CC} - 1.145$		$V_{CC} - 0.895$	V
$V_{OL}$	Output LOW Voltage		$V_{CC} - 1.945$		$V_{CC} - 1.695$	V
$V_{OUT}$	Output Voltage Differential Swing	(see Figure 1a)	550	780	1050	mV
$V_{DIFF\_OUT}$	Differential Output Voltage Swing	(see Figure 1b)	1100	1560	2100	mV

## AC Electrical Characteristics

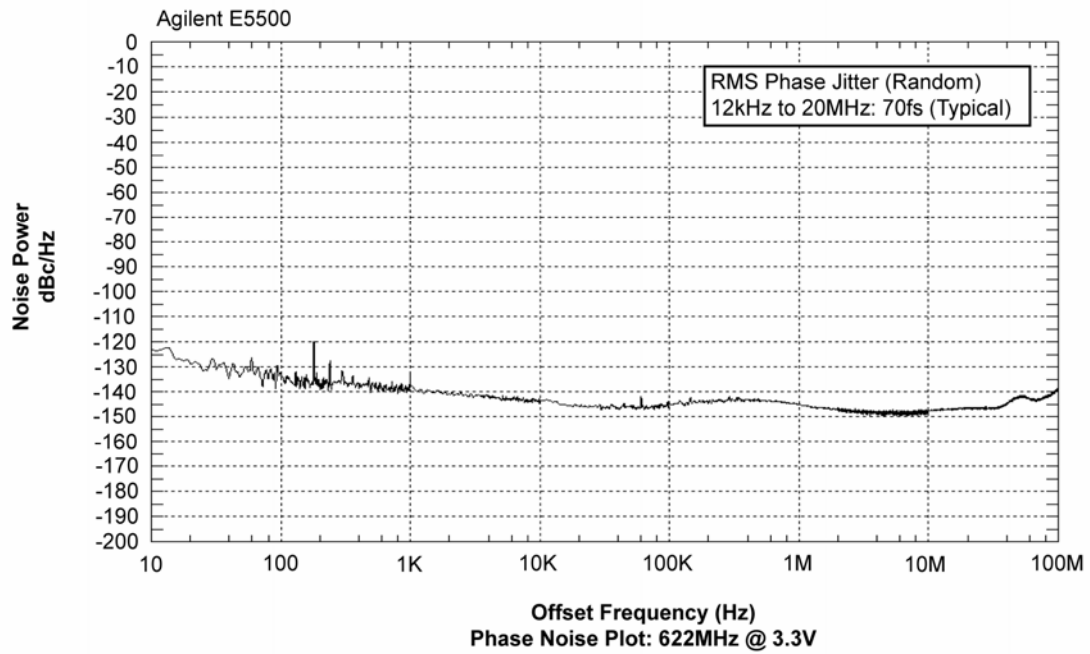
$V_{CC} = 2.5V \pm 5\%$  or  $3.3 \pm 10\%$ ;  $R_L = 50\Omega$  to  $V_{CC} - 2V$ ;  $T_A = -40^\circ C$  to  $+85^\circ C$ , unless otherwise stated.

Symbol	Parameter	Condition	Min.	Typ.	Max.	Units
$f_{MAX}$	Maximum Operating Frequency	$V_{OUT} \geq 400mV$ Clock NRZ Data	4			GHz
				5		Gbps
$t_{PD}$	Propagation Delay		150	220	300	ps
$t_{CHAN}$	Channel-to-Channel Skew	Note 7		4	15	ps
$t_{SKEW}$	Part-to-Part Skew	Note 8			50	ps
$t_{JITTER}$	RMS Phase Jitter	Output: 622MHz Integration Range: 12kHz – 20MHz		70		fs
$t_r, t_f$	Output Rise/Fall Time (20% to 80%)	At full swing	35	75	110	ps

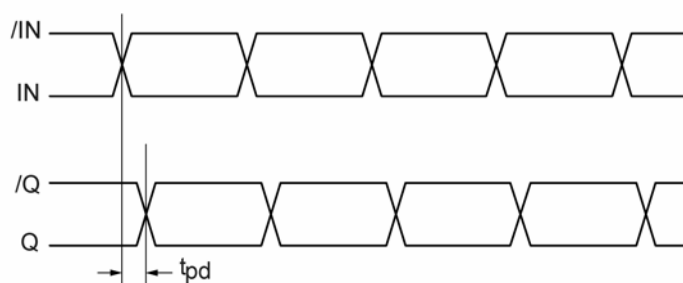
### Notes:

7. Skew is measured between outputs of the same bank under identical transitions.
8. 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.

## Phase Noise Graph



## Timing Diagram



## Single-Ended and Differential Swings

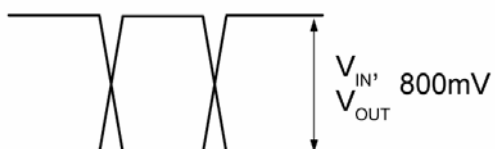


Figure 1a. Single-Ended Voltage Swing

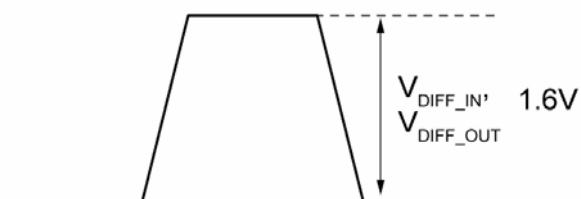
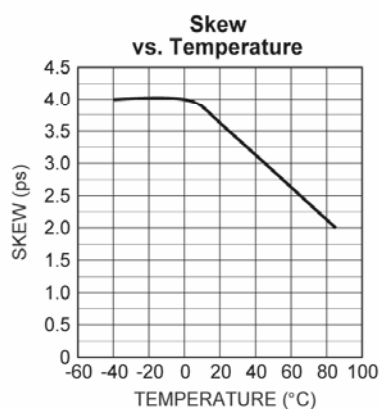
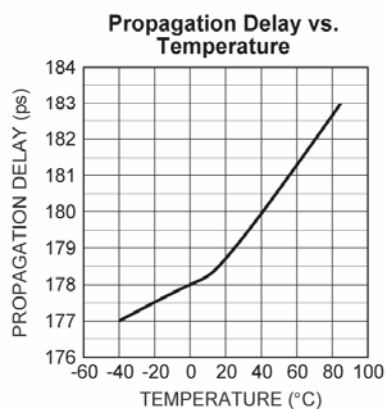
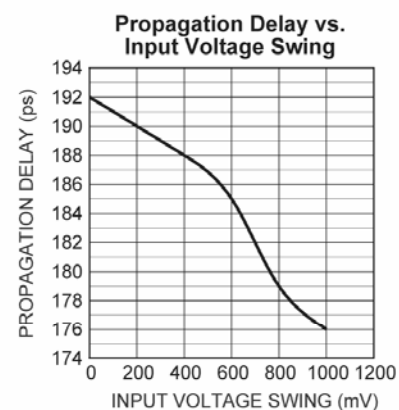
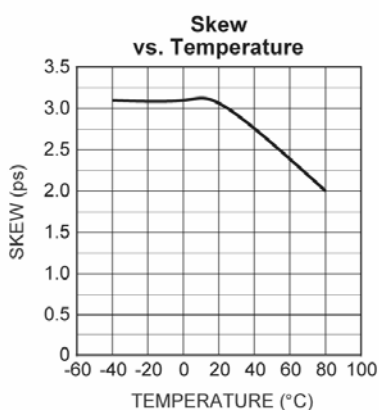
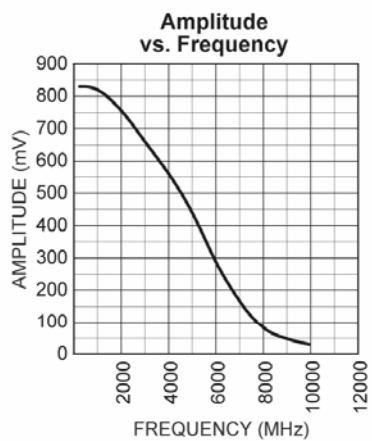


Figure 1b. Differential Voltage Swing

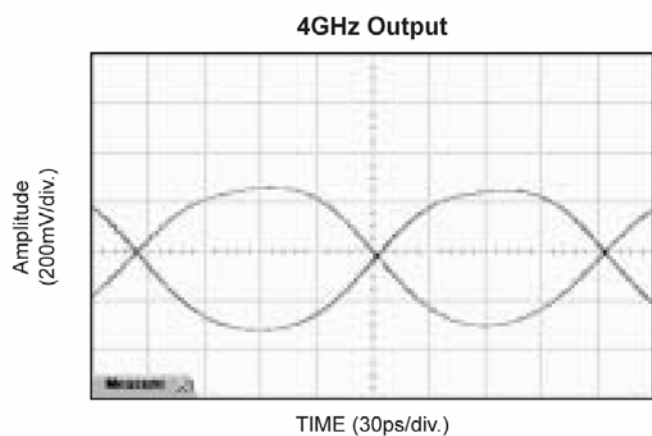
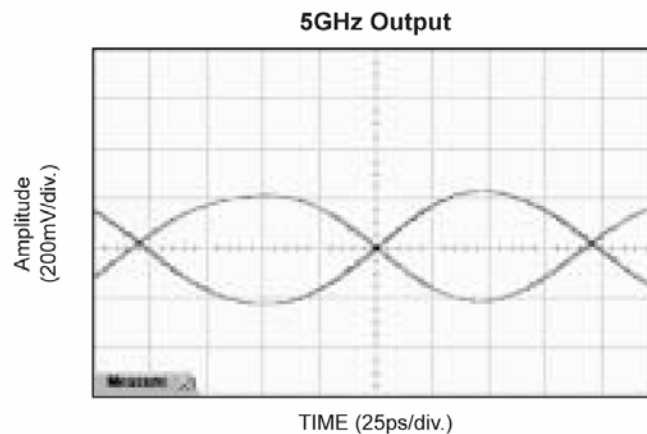
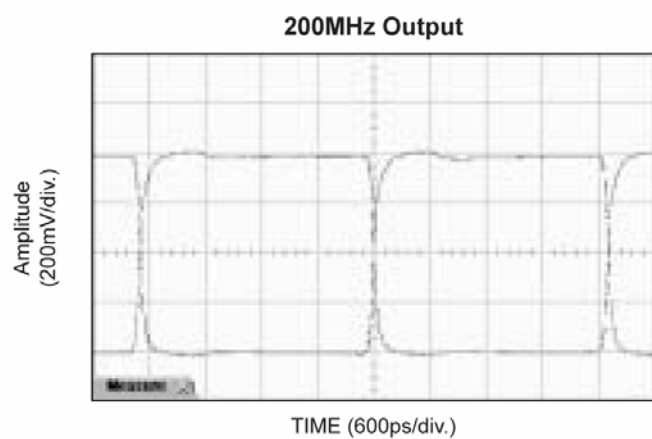
## Typical Characteristics

$V_{CC} = 2.5V$ ,  $GND = 0$ ,  $V_{IN} = 100mV$ ,  $T_A = 25^\circ C$ , unless otherwise stated.



## Functional Characteristics

$V_{CC} = 2.5V$ ,  $GND = 0$ ,  $V_{IN} = 100mV$ ,  $T_A = 25^\circ C$ , unless otherwise stated.



## Input Stage

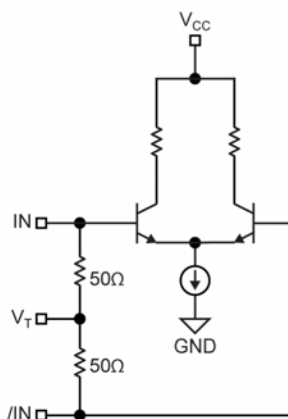


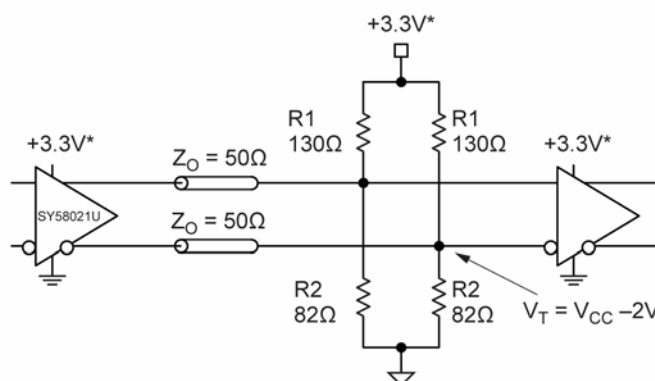
Figure 2. Simplified Differential Input Buffer



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## LVPECL Output

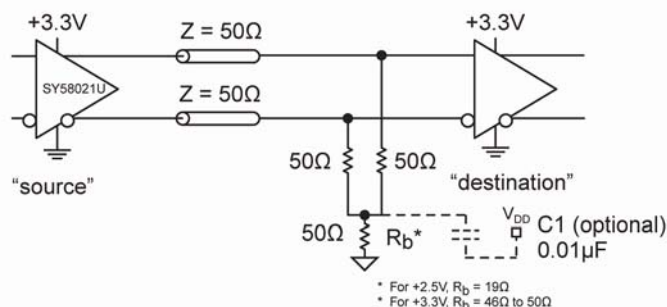
LVPECL outputs have very-low output impedance (open emitter), and small signal swing which results in low EMI. LVPECL is ideal for driving 50Ω- and 100Ω-controlled impedance transmission lines. There are several techniques in terminating the LVPECL output (Figures 4 through 6).



**Note:**

1. For +2.5V systems,  $R1 = 250\Omega$ ,  $R2 = 62.5\Omega$ .

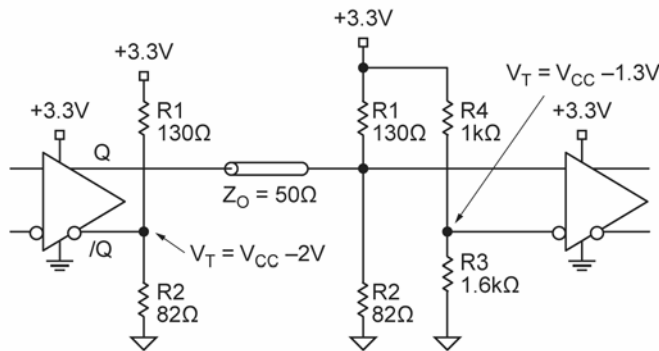
**Figure 4. Parallel Termination-Thevenin Equivalent**



**Notes:**

1. Power-saving alternative to Thevenin termination.
2. Place termination resistors as close to destination inputs as possible.
3.  $R_b$  resistor sets the DC bias voltage, equal to  $V_T$ .

**Figure 5. Parallel Termination (3-Resistor)**



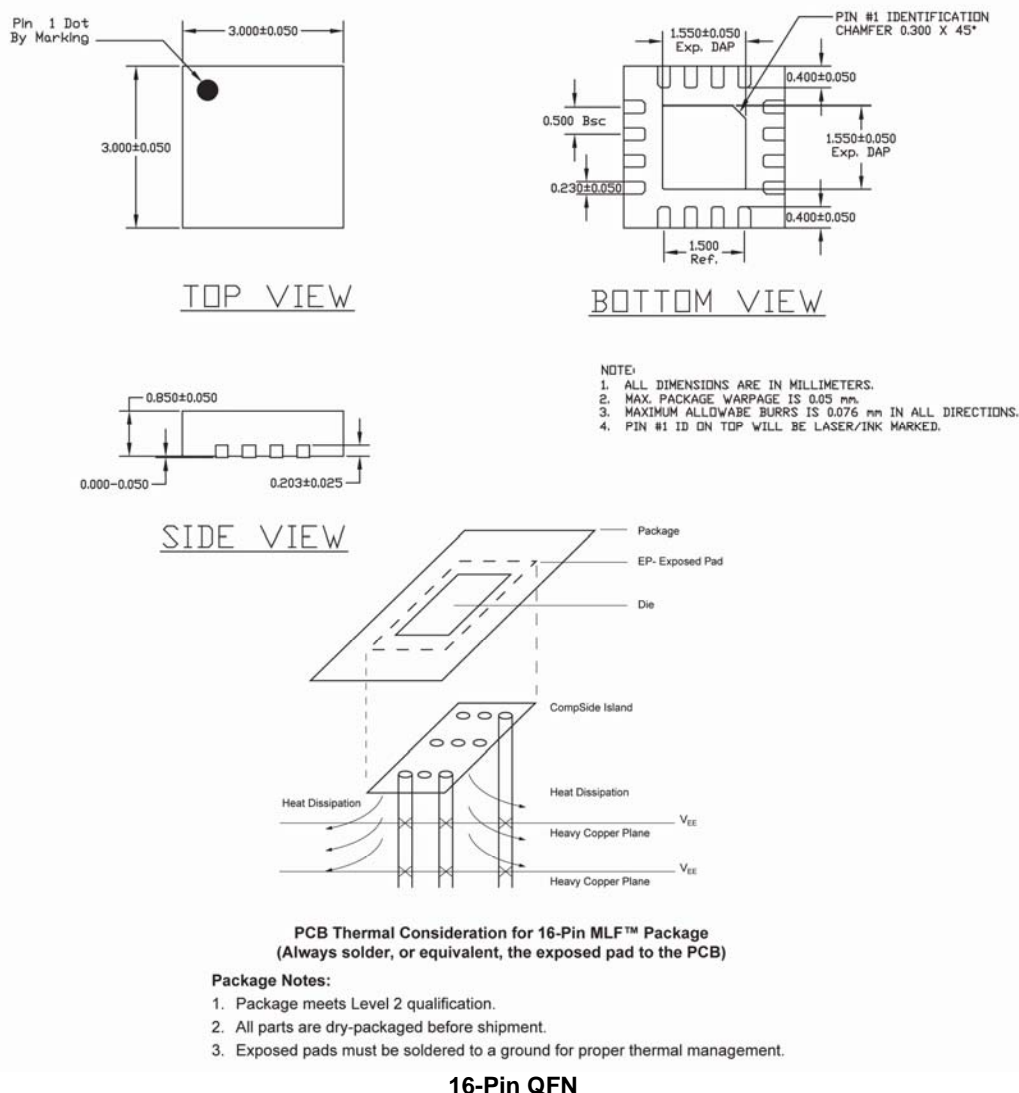
- Notes:**
- 1. Unused output (/Q) must be terminated to balance the output.
  - 2. For +2.5V systems: R1 = 250, R2 = 62.5, R3 = 1.25k, R4 = 1.2k  
For +3.3V systems: R1 = 130, R2 = 82, R3 = 1k, R4 = 1.6k
  - 3. Unused output pairs (Q and /Q) may be left floating.

Figure 6. Terminating Unused I/O

Related Micrel Products and Support Documentation

Part Number	Function	Data Sheet Link
SY58020U	6GHz, 1:4 CML Fanout Buffer/Translator with Internal I/O Terminations	<a href="http://www.micrel.com/product-info/products/sy58020u.shtml">www.micrel.com/product-info/products/sy58020u.shtml</a>
SY58021U	4GHz, 1:4 LVPECL Fanout Buffer/Translator with Internal Termination	<a href="http://www.micrel.com/product-info/products/sy58021u.shtml">www.micrel.com/product-info/products/sy58021u.shtml</a>
SY58022U	5.5GHz, 1:4 Fanout Buffer/Translator with 400mV LVPECL Outputs and Internal Terminations	<a href="http://www.micrel.com/product-info/products/sy58022u.shtml">www.micrel.com/product-info/products/sy58022u.shtml</a>
M-0317	HBW Solutions	<a href="http://www.micrel.com/product-info/as/solutions.shtml">www.micrel.com/product-info/as/solutions.shtml</a>

## Package Information



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