

# ESD8024

## ESD Protection Diode

### Low Capacitance ESD Protection Diode for High Speed Data Line

The ESD8024 surge protection is designed specifically to protect Low Voltage Differential Signals (LVDS) for LCD panels. Ultra-low capacitance and low ESD clamping voltage make this device an ideal solution for protecting voltage sensitive data lines. The integrated 24 lines of protection offers a simplified solution with premier performance for LVDS applications.

#### Features

- Full Function LVDS Solution
- 4 pF Max, I/O to GND
- Protection for the Following IEC Standards:
  - IEC 61000-4-2 (ESD)  $\pm 8$  kV (Contact)
  - IEC 61000-4-5 (Lightning) 20 A (8/20  $\mu$ s)
- UL Flammability Rating of 94 V-0
- This is a Pb-Free Device

#### Typical Applications

- LVDS
- LCD Panel TCON

#### MAXIMUM RATINGS ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

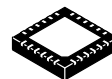
Rating	Symbol	Value	Unit
Operating Junction Temperature Range	$T_J$	-55 to +125	$^\circ\text{C}$
Storage Temperature Range	$T_{\text{stg}}$	-55 to +150	$^\circ\text{C}$
Lead Solder Temperature – Maximum (10 Seconds)	$T_L$	260	$^\circ\text{C}$
IEC 61000-4-2 Contact (ESD)	ESD	$\pm 30$	kV
IEC 61000-4-2 Air (ESD)	ESD	$\pm 30$	kV
Maximum Peak Pulse Current 8/20 $\mu$ s @ $T_A = 25^\circ\text{C}$	$I_{\text{pp}}$	20	A

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.



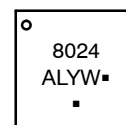
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QFN24  
CASE 485L

#### MARKING DIAGRAM



8024 = Specific Device Code  
A = Assembly Location  
L = Wafer Lot  
Y = Year  
W = Work Week  
▪ = Pb-Free Package  
(Note: Microdot may be in either location)

#### ORDERING INFORMATION

Device	Package	Shipping
ESD8024MNTAG	QFN24 (Pb-Free)	4000 / Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

See Application Note AND8308/D for further description of survivability specs.

# ESD8024

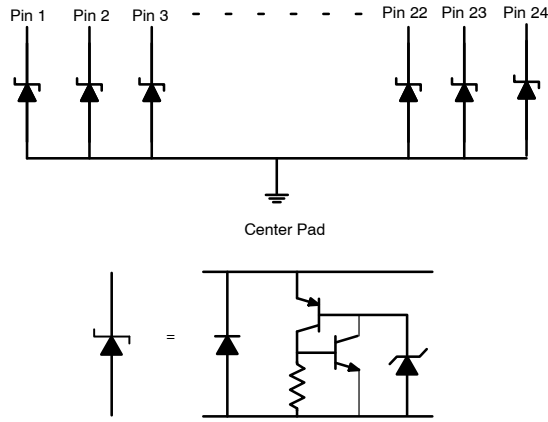
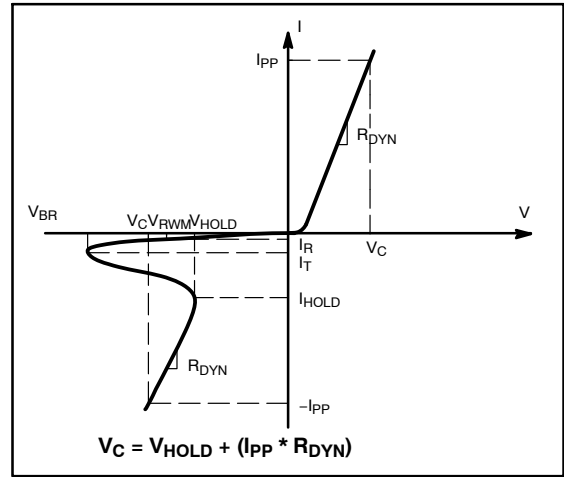


Figure 1. Pin Schematic

## ELECTRICAL CHARACTERISTICS

( $T_A = 25^\circ\text{C}$  unless otherwise noted)

Symbol	Parameter
$V_{RWM}$	Working Peak Voltage
$I_R$	Maximum Reverse Leakage Current @ $V_{RWM}$
$V_{BR}$	Breakdown Voltage @ $I_T$
$I_T$	Test Current
$V_{HOLD}$	Holding Reverse Voltage
$I_{HOLD}$	Holding Reverse Current
$R_{DYN}$	Dynamic Resistance
$I_{PP}$	Maximum Peak Pulse Current
$V_C$	Clamping Voltage @ $I_{PP}$ $V_C = V_{HOLD} + (I_{PP} * R_{DYN})$



## ELECTRICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ unless otherwise specified)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Reverse Working Voltage	$V_{RWM}$	All Pins (1–24) to GND (Note 1)			2.5	V
Forward Voltage	$V_F$	$I_F = 10\text{ mA}$ , GND to All Pins (1–24)	0.5	0.85	1.1	V
Breakdown Voltage	$V_{BR}$	$I_T = 1\text{ mA}$ , All Pins (1–24) to GND	5.5	7.0	9.0	V
Reverse Leakage Current	$I_R$	$V_{RWM} = 2.5\text{ V}$ , All Pins (1–24) to GND			0.5	$\mu\text{A}$
Holding Reverse Voltage	$V_{HOLD}$	I/O Pin to GND	1	1.5		V
Holding Reverse Current	$I_{HOLD}$	I/O Pin to GND		50		mA
Clamping Voltage	$V_C$	$I_{PP} = 1\text{ A}$ , All Pins (1–24) to GND (8/20 $\mu\text{s}$ pulse)			4.0	V
Clamping Voltage	$V_C$	$I_{PP} = 10\text{ A}$ , All Pins (1–24) to GND (8/20 $\mu\text{s}$ pulse)			7.0	V
Clamping Voltage	$V_C$	$I_{PP} = 15\text{ A}$ , All Pins (1–24) to GND (8/20 $\mu\text{s}$ pulse)			8.0	V
Clamping Voltage	$V_C$	IEC61000–4–2, $\pm 8\text{ kV}$ Contact	See Figures 2 and 3			V
Junction Capacitance	$C_J$	$V_R = 0\text{ V}$ , $f = 1\text{ MHz}$ between I/O Pins			2.0	pF
Junction Capacitance	$C_J$	$V_R = 0\text{ V}$ , $f = 1\text{ MHz}$ between I/O Pins and GND			4.0	pF

1. Surge protection devices are normally selected according to the working peak reverse voltage ( $V_{RWM}$ ), which should be equal or greater than the DC or continuous peak operating voltage level.

TYPICAL CHARACTERISTICS

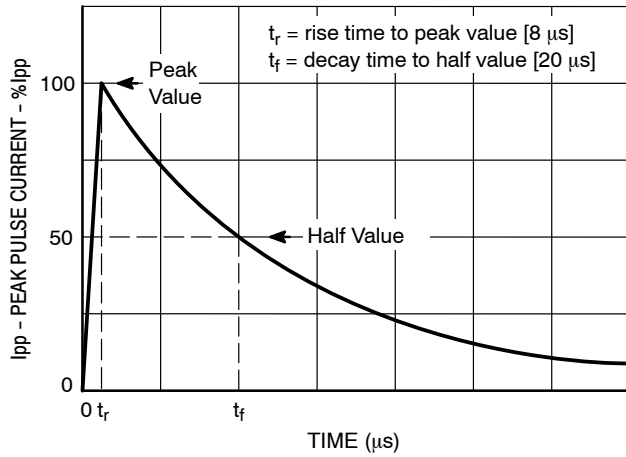


Figure 2. IEC61000-4-5 8/20  $\mu$ s Pulse Waveform

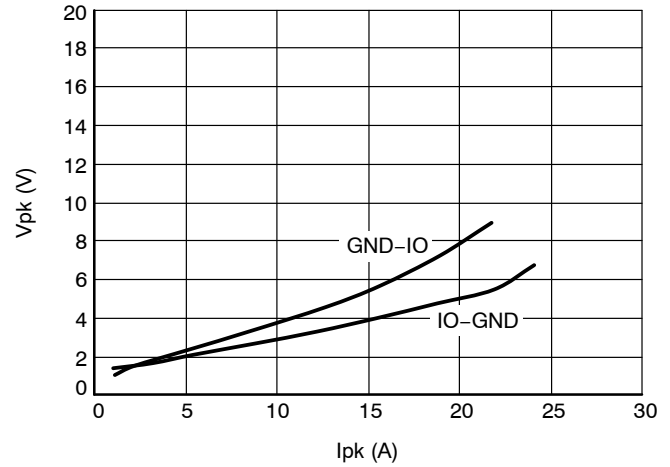


Figure 3. Clamping Voltage vs. Peak Pulse Current ( $t_p$  = 8/20  $\mu$ s per Figure 2)

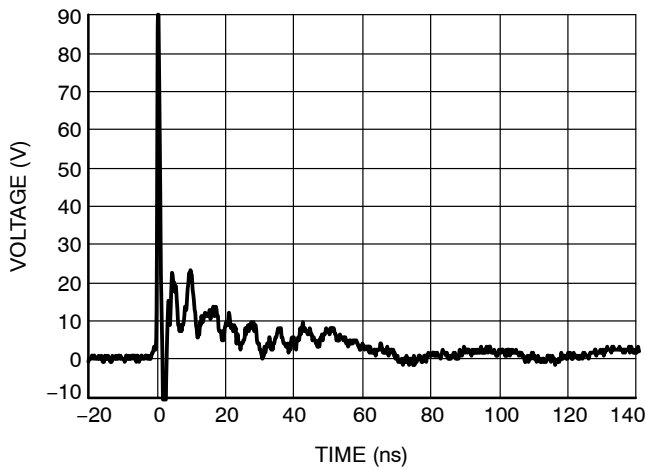


Figure 4. IEC61000-4-2 + 8 kV Contact Clamping Voltage

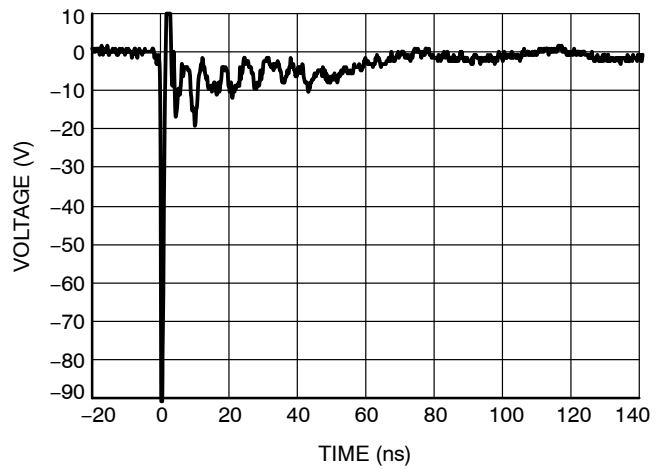


Figure 5. IEC61000-4-2 - 8 kV Contact Clamping Voltage

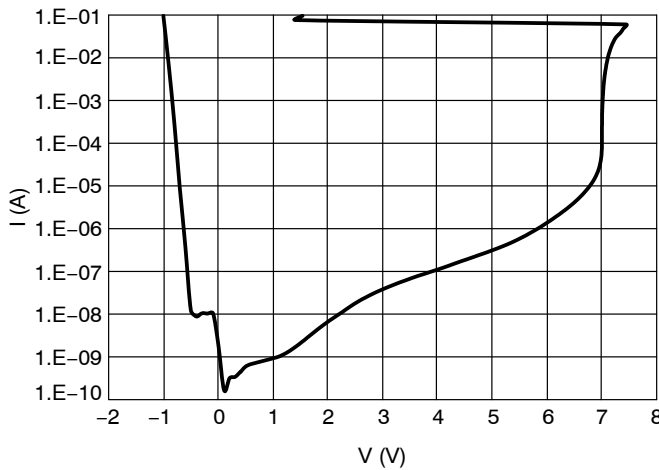


Figure 6. IV Characteristics

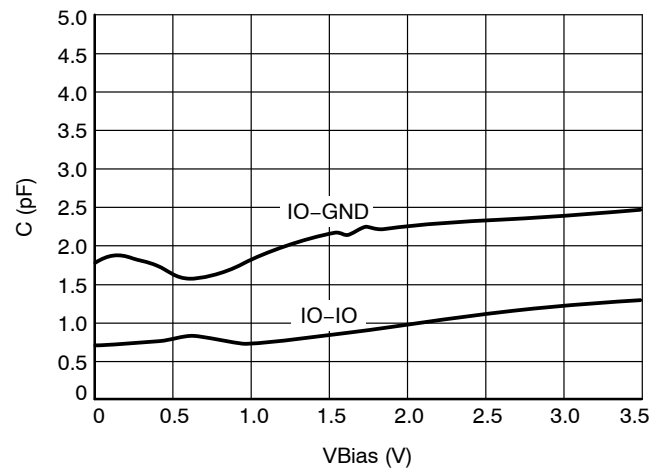


Figure 7. CV Characteristics

## TYPICAL CHARACTERISTICS

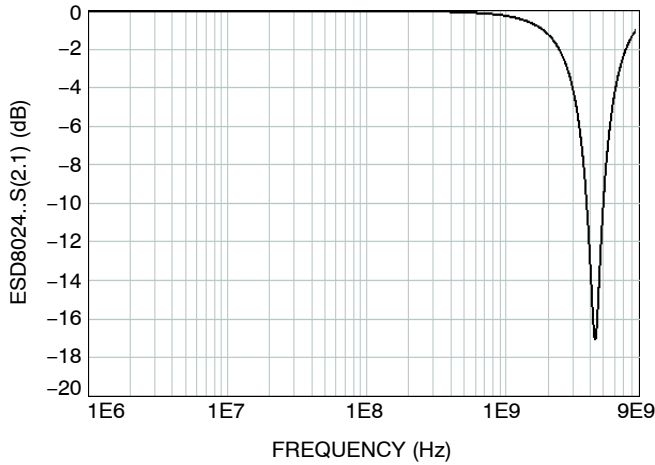


Figure 8. RF Insertion Loss

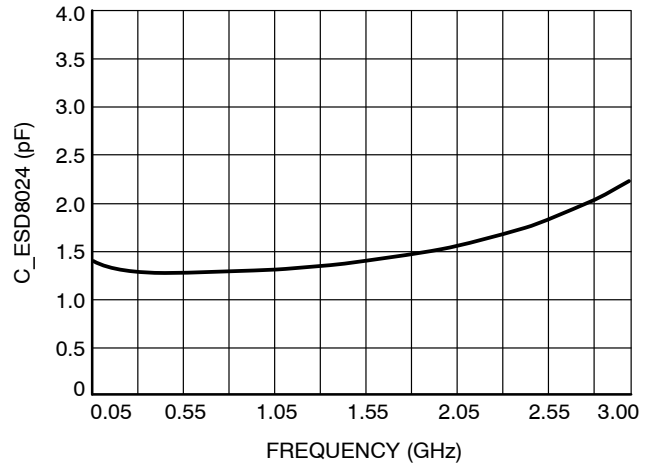


Figure 9. Capacitance over Frequency

**PCB Layout Guidelines**

Steps must be taken for proper placement and signal trace routing of the protection device in order to ensure the maximum survivability and signal integrity for the application. Such steps are listed below.

- Place the protection device as close as possible to the I/O connector to reduce the transient path to ground and improve the protection performance.
  - ◆ Consequently, place the device under protection as far as possible from the protection device to help further improve protection performance.
- Keep trace lengths connecting protection device pins to data lines as short as possible. These “stub” traces, if long enough, can create voltage drops that impede the turn-on of the protection device.
- Make sure to use differential design methodology and impedance matching of all high speed signal traces.
  - ◆ Use curved traces when possible to avoid unwanted reflections.
  - ◆ Keep the trace lengths equal between the positive and negative lines of the differential data lanes to avoid common mode noise generation and impedance mismatch.

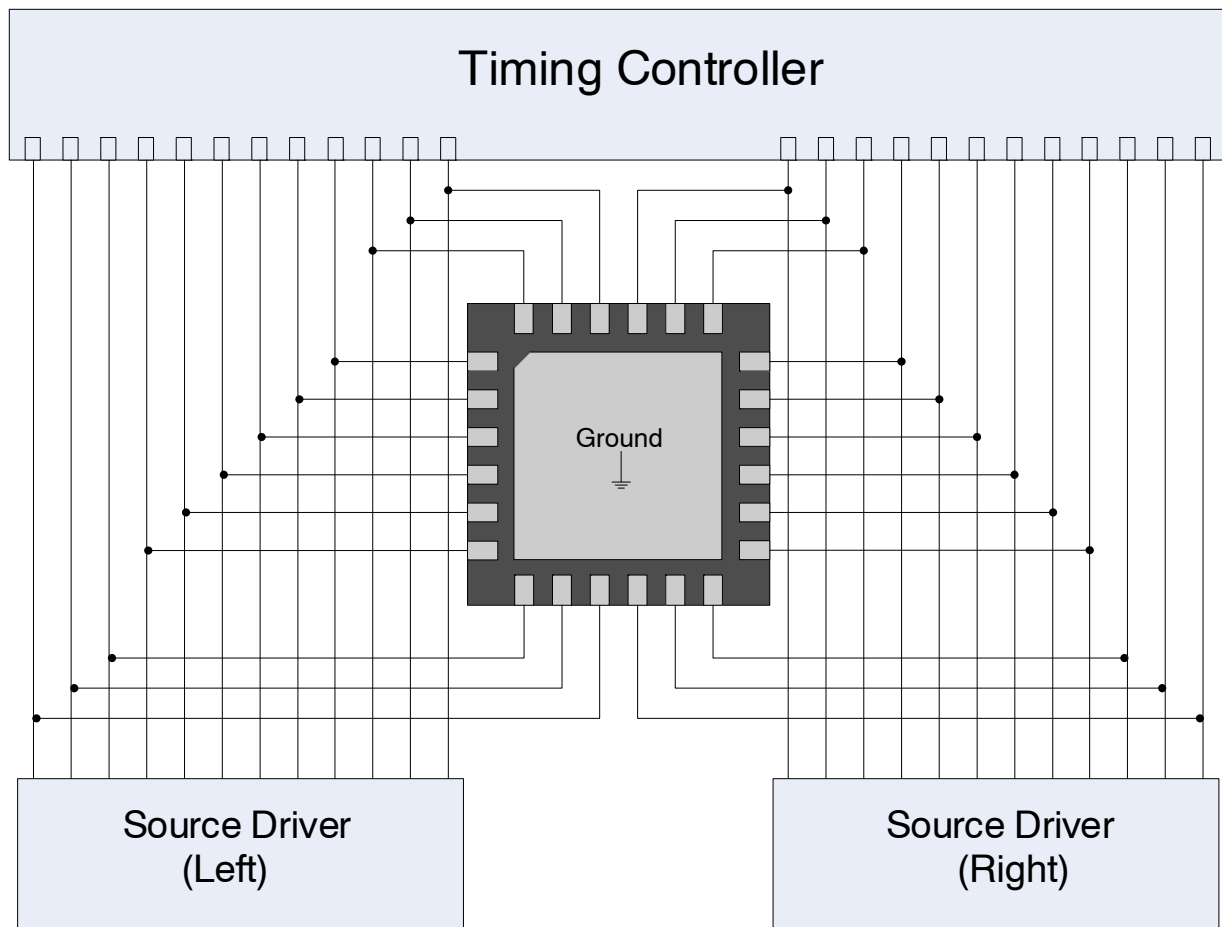


Figure 10. Board Routing Diagram – TCON LVDS Interface

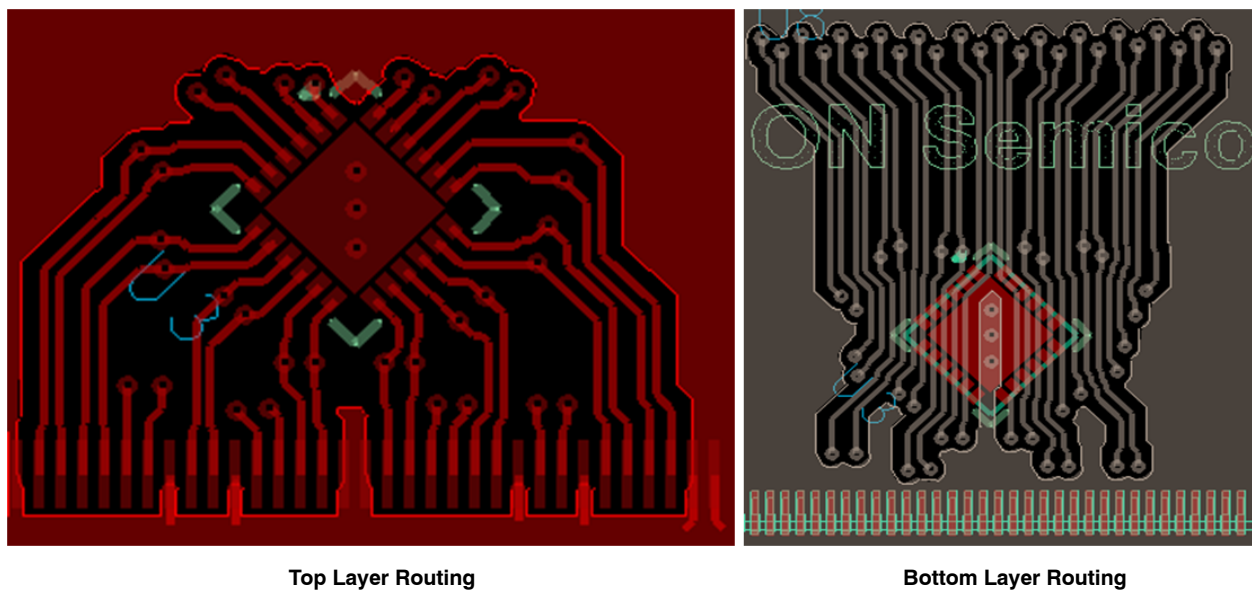
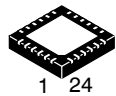
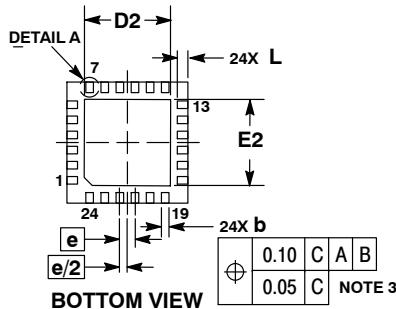
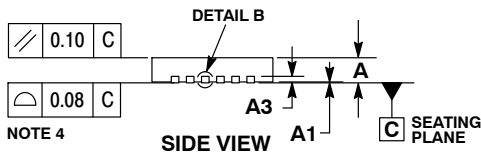
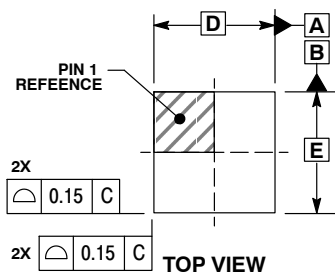


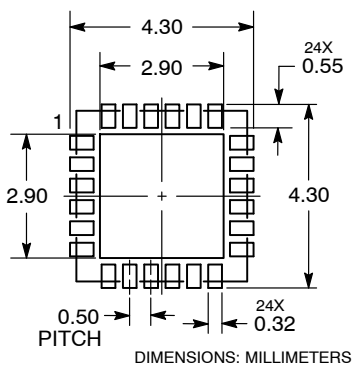
Figure 11. ESD8024 Recommended PCB Layout



SCALE 2:1

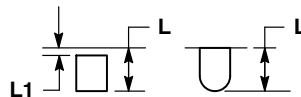


### RECOMMENDED SOLDERING FOOTPRINT

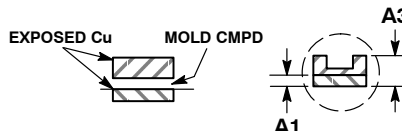


### QFN24, 4x4, 0.5P CASE 485L ISSUE B

DATE 05 JUN 2012



DETAIL A  
ALTERNATE  
CONSTRUCTIONS



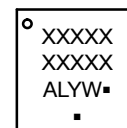
DETAIL B  
ALTERNATE TERMINAL  
CONSTRUCTIONS

#### NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.25 AND 0.30 MM FROM THE TERMINAL TIP.
4. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.

DIM	MILLIMETERS	
	MIN	MAX
A	0.80	1.00
A1	0.00	0.05
A3	0.20	REF
b	0.20	0.30
D	4.00	BSC
D2	2.70	2.90
E	4.00	BSC
E2	2.70	2.90
e	0.50	BSC
L	0.30	0.50
L1	0.05	0.15

### GENERIC MARKING DIAGRAM\*



- XXXXX = Specific Device Code  
 A = Assembly Location  
 L = Wafer Lot  
 Y = Year  
 W = Work Week  
 ■ = Pb-Free Package

(Note: Microdot may be in either location)

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "■", may or may not be present. Some products may not follow the Generic Marking.

\*For additional information on our Pb-Free strategy and soldering details, please download the **onsemi** Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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