

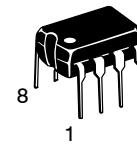
## Low Offset Voltage Dual Comparators

### LM393, LM393E, LM293, LM2903, LM2903E, LM2903V, NCV2903

The LM393 series are dual independent precision voltage comparators capable of single or split supply operation. These devices are designed to permit a common mode range-to-ground level with single supply operation. Input offset voltage specifications as low as 2.0 mV make this device an excellent selection for many applications in consumer, automotive, and industrial electronics.

#### Features

- Wide Single-Supply Range: 2.0 Vdc to 36 Vdc
- Split-Supply Range:  $\pm 1.0$  Vdc to  $\pm 18$  Vdc
- Very Low Current Drain Independent of Supply Voltage: 0.4 mA
- Low Input Bias Current: 25 nA
- Low Input Offset Current: 5.0 nA
- Low Input Offset Voltage: 5.0 mV (max) LM293/393
- Input Common Mode Range to Ground Level
- Differential Input Voltage Range Equal to Power Supply Voltage
- Output Voltage Compatible with DTL, ECL, TTL, MOS, and CMOS Logic Levels
- ESD Clamps on the Inputs Increase the Ruggedness of the Device without Affecting Performance
- NCV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant



PDIP-8  
N SUFFIX  
CASE 626

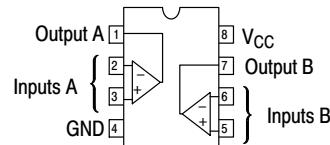


SOIC-8  
D SUFFIX  
CASE 751



Micro8™  
DM SUFFIX  
CASE 846A

#### PIN CONNECTIONS

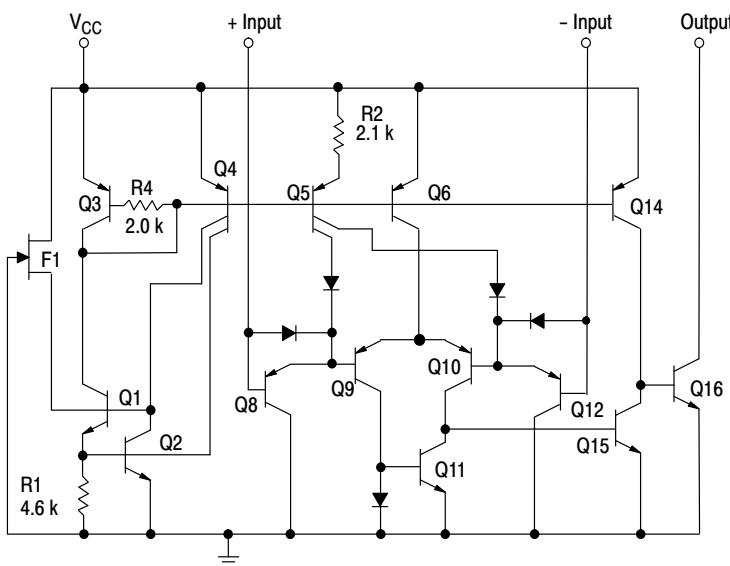


(Top View)

#### DEVICE MARKING AND ORDERING INFORMATION

See detailed marking information and ordering and shipping information on page 7 of this data sheet.

## LM393, LM393E, LM293, LM2903, LM2903E, LM2903V, NCV2903



**Figure 1. Representative Schematic Diagram**

(Diagram shown is for 1 comparator)



# LM393, LM393E, LM293, LM2903, LM2903E, LM2903V, NCV2903

## MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Power Supply Voltage	$V_{CC}$	+36 or $\pm 18$	V
Input Differential Voltage	$V_{IDR}$	36	V
Input Common Mode Voltage Range	$V_{ICR}$	-0.3 to +36	V
Output Voltage	$V_O$	36	V
Output Short Circuit-to-Ground Output Sink Current (Note 1)	$I_{SC}$ $I_{Sink}$	Continuous 20	mA
Power Dissipation @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$ $1/R_{\theta JA}$	570 5.7	mW mW/ $^\circ\text{C}$
Operating Ambient Temperature Range LM293 LM393, LM393E LM2903, LM2903E LM2903V, NCV2903 (Note 2)	$T_A$	-25 to +85 0 to +70 -40 to +105 -40 to +125	$^\circ\text{C}$
Maximum Operating Junction Temperature LM393, LM393E, LM2903, LM2903E, LM2903V LM293, NCV2903	$T_{J(max)}$	150 150	$^\circ\text{C}$
Storage Temperature Range	$T_{stg}$	-65 to +150	$^\circ\text{C}$

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.

1. The maximum output current may be as high as 20 mA, independent of the magnitude of  $V_{CC}$ , output short circuits to  $V_{CC}$  can cause excessive heating and eventual destruction.
2. *NCV2903 is qualified for automotive use.*

## ESD RATINGS

Rating	HBM	MM	Unit
ESD Protection at any Pin (Human Body Model – HBM, Machine Model – MM) NCV2903 (Note 2)	2000	200	V
LM393E, LM2903E	1500	150	V
LM393DG/DR2G, LM2903DG/DR2G	250	100	V
All Other Devices	1500	150	V



# LM393, LM393E, LM293, LM2903, LM2903E, LM2903V, NCV2903

**ELECTRICAL CHARACTERISTICS** ( $V_{CC} = 5.0$  Vdc,  $T_{low} \leq T_A \leq T_{high}$ , unless otherwise noted.)

Characteristic	Symbol	LM293, LM393, LM393E			LM2903/E/V, NCV2903			Unit
		Min	Typ	Max	Min	Typ	Max	
Input Offset Voltage (Note 4) $T_A = 25^\circ C$ $T_{low} \leq T_A \leq T_{high}$	$V_{IO}$	- -	$\pm 1.0$ -	$\pm 5.0$ $\pm 9.0$	- -	$\pm 2.0$ $\pm 9.0$	$\pm 7.0$ $\pm 15$	mV
Input Offset Current $T_A = 25^\circ C$ $T_{low} \leq T_A \leq T_{high}$	$I_{IO}$	- -	$\pm 5.0$ -	$\pm 50$ $\pm 150$	- -	$\pm 5.0$ $\pm 50$	$\pm 50$ $\pm 200$	nA
Input Bias Current (Note 5) $T_A = 25^\circ C$ $T_{low} \leq T_A \leq T_{high}$	$I_{IB}$	- -	20 -	250 400	- -	20 20	250 500	nA
Input Common Mode Voltage Range (Note 6) $T_A = 25^\circ C$ $T_{low} \leq T_A \leq T_{high}$	$V_{ICR}$	0 0	- -	$V_{CC} - 1.5$ $V_{CC} - 2.0$	0 0	- -	$V_{CC} - 1.5$ $V_{CC} - 2.0$	V
Voltage Gain $R_L \geq 15 \text{ k}\Omega$ , $V_{CC} = 15$ Vdc, $T_A = 25^\circ C$	$A_{VOL}$	50	200	-	25	200	-	V/mV
Large Signal Response Time $V_{in} = \text{TTL Logic Swing}$ , $V_{ref} = 1.4$ Vdc $V_{RL} = 5.0$ Vdc, $R_L = 5.1$ k $\Omega$ , $T_A = 25^\circ C$	-	-	300	-	-	300	-	ns
Response Time (Note 7) $V_{RL} = 5.0$ Vdc, $R_L = 5.1$ k $\Omega$ , $T_A = 25^\circ C$	$t_{TLH}$	-	1.3	-	-	1.5	-	$\mu s$
Input Differential Voltage (Note 8) All $V_{in} \geq \text{GND or } V_-$ Supply (if used)	$V_{ID}$	-	-	$V_{CC}$	-	-	$V_{CC}$	V
Output Sink Current $V_{in} \geq 1.0$ Vdc, $V_{in+} = 0$ Vdc, $V_O \leq 1.5$ Vdc $T_A = 25^\circ C$	$I_{Sink}$	6.0	16	-	6.0	16	-	mA
Output Saturation Voltage $V_{in} \geq 1.0$ Vdc, $V_{in+} = 0$ , $I_{Sink} \leq 4.0$ mA, $T_A = 25^\circ C$ $T_{low} \leq T_A \leq T_{high}$	$V_{OL}$	- -	150 -	400 700	- -	- 200	400 700	mV
Output Leakage Current $V_{in-} = 0$ V, $V_{in+} \geq 1.0$ Vdc, $V_O = 5.0$ Vdc, $T_A = 25^\circ C$ $V_{in-} = 0$ V, $V_{in+} \geq 1.0$ Vdc, $V_O = 30$ Vdc, $T_{low} \leq T_A \leq T_{high}$	$I_{OL}$	- -	0.1 -	- 1000	- -	0.1 -	- 1000	nA
Supply Current $R_L = \infty$ Both Comparators, $T_A = 25^\circ C$ $R_L = \infty$ Both Comparators, $V_{CC} = 30$ V	$I_{CC}$	- -	0.4 -	1.0 2.5	- -	0.4 -	1.0 2.5	mA

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

LM293  $T_{low} = -25^\circ C$ ,  $T_{high} = +85^\circ C$

LM393, LM393E  $T_{low} = 0^\circ C$ ,  $T_{high} = +70^\circ C$

LM2903, LM2903E  $T_{low} = -40^\circ C$ ,  $T_{high} = +105^\circ C$

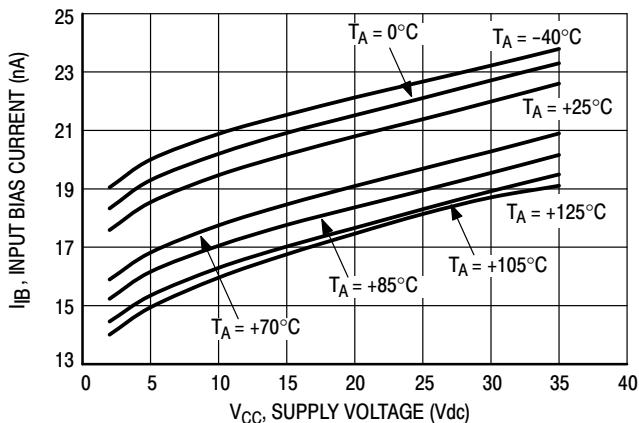
LM2903V & NCV2903  $T_{low} = -40^\circ C$ ,  $T_{high} = +125^\circ C$

NCV2903 is qualified for automotive use.

3. The maximum output current may be as high as 20 mA, independent of the magnitude of  $V_{CC}$ , output short circuits to  $V_{CC}$  can cause excessive heating and eventual destruction.
4. At output switch point,  $V_O \approx 1.4$  Vdc,  $R_S = 0 \Omega$  with  $V_{CC}$  from 5.0 Vdc to 30 Vdc, and over the full input common mode range (0 V to  $V_{CC} = -1.5$  V).
5. Due to the PNP transistor inputs, bias current will flow out of the inputs. This current is essentially constant, independent of the output state, therefore, no loading changes will exist on the input lines.
6. Input common mode of either input should not be permitted to go more than 0.3 V negative of ground or minus supply. The upper limit of common mode range is  $V_{CC} - 1.5$  V.
7. Response time is specified with a 100 mV step and 5.0 mV of overdrive. With larger magnitudes of overdrive faster response times are obtainable.
8. The comparator will exhibit proper output state if one of the inputs becomes greater than  $V_{CC}$ , the other input must remain within the common mode range. The low input state must not be less than -0.3 V of ground or minus supply.

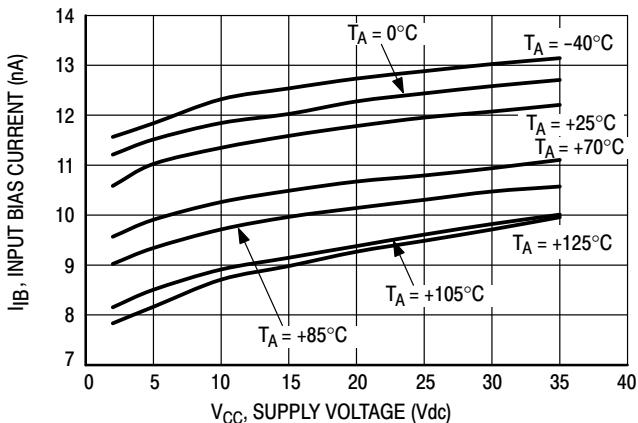
# LM393, LM393E, LM293, LM2903, LM2903E, LM2903V, NCV2903

**LM293/393**

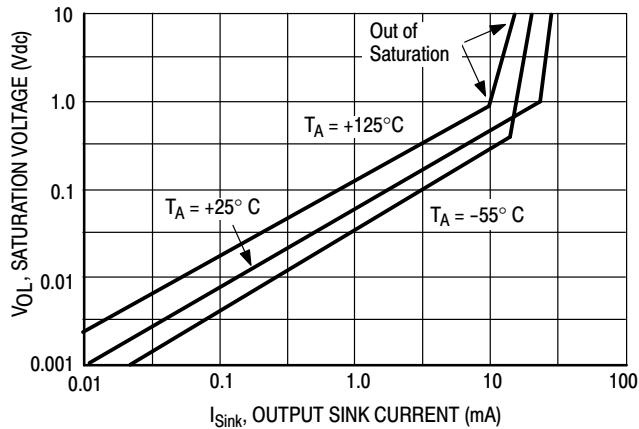


**Figure 2. Input Bias Current versus Power Supply Voltage**

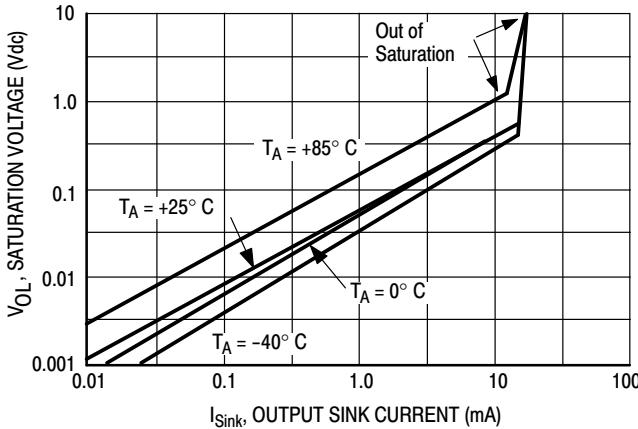
**LM2903**



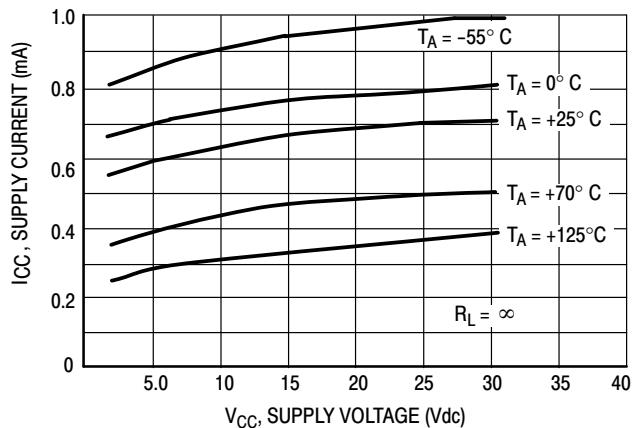
**Figure 3. Input Bias Current versus Power Supply Voltage**



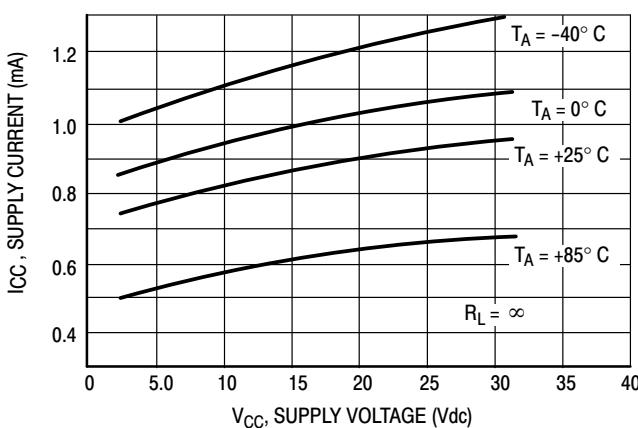
**Figure 4. Output Saturation Voltage versus Output Sink Current**



**Figure 5. Output Saturation Voltage versus Output Sink Current**



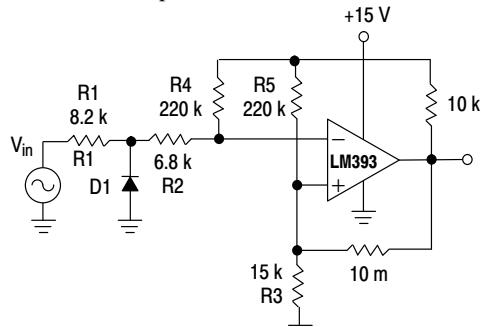
**Figure 6. Power Supply Current versus Power Supply Voltage**



**Figure 7. Power Supply Current versus Power Supply Voltage**

## APPLICATIONS INFORMATION

These dual comparators feature high gain, wide bandwidth characteristics. This gives the device oscillation tendencies if the outputs are capacitively coupled to the inputs via stray capacitance. This oscillation manifests itself during output transitions ( $V_{OL}$  to  $V_{OH}$ ). To alleviate this situation, input resistors  $< 10\text{ k}\Omega$  should be used.



D1 prevents input from going negative by more than 0.6 V.

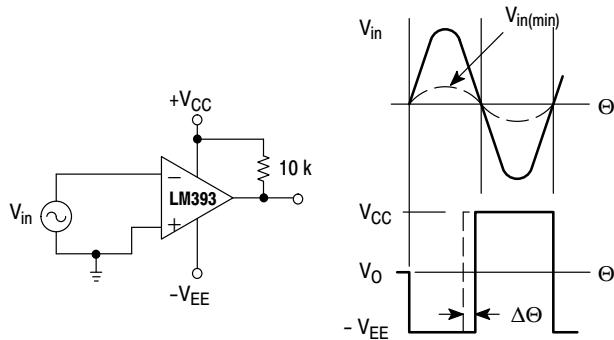
$$R_1 + R_2 = R_3$$

$$R_3 \leq \frac{R_5}{10} \text{ for small error in zero crossing.}$$

**Figure 8. Zero Crossing Detector  
(Single Supply)**

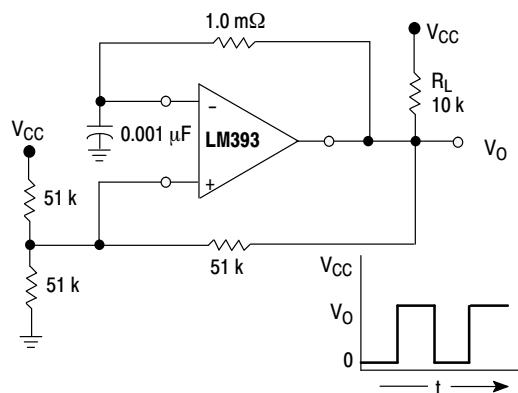
The addition of positive feedback (<10 mV) is also recommended. It is good design practice to ground all unused pins.

Differential input voltages may be larger than supply voltage without damaging the comparator's inputs. Voltages more negative than -0.3 V should not be used.

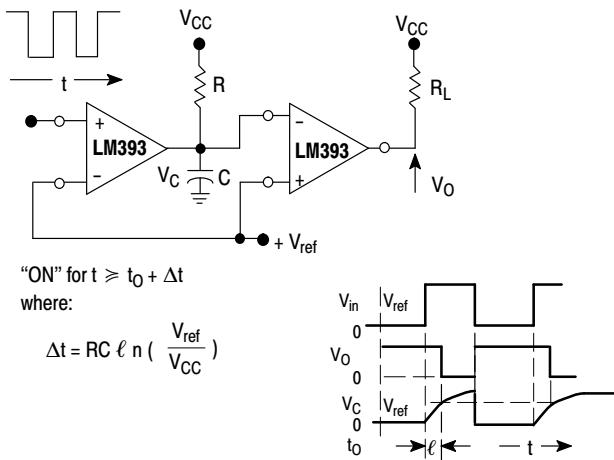


$$V_{in(\min)} \approx 0.4 \text{ V peak for } 1\% \text{ phase distortion } (\Delta\Theta).$$

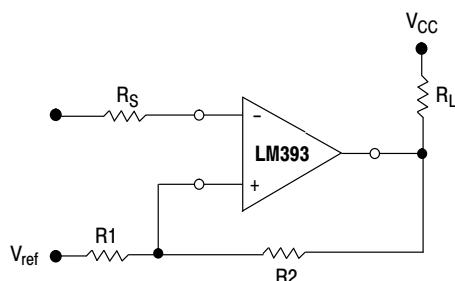
**Figure 9. Zero Crossing Detector  
(Split Supply)**



**Figure 10. Free-Running Square-Wave Oscillator**



**Figure 11. Time Delay Generator**



**Figure 12. Comparator with Hysteresis**

$$R_S = R_1 || R_2$$

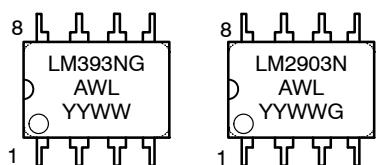
$$V_{th1} = V_{ref} + \frac{(V_{CC} - V_{ref}) R_1}{R_1 + R_2 + R_L}$$

$$V_{th2} = V_{ref} - \frac{(V_{ref} - V_{O \text{ Low}}) R_1}{R_1 + R_2}$$

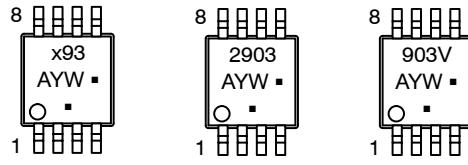
# LM393, LM393E, LM293, LM2903, LM2903E, LM2903V, NCV2903

## MARKING DIAGRAMS

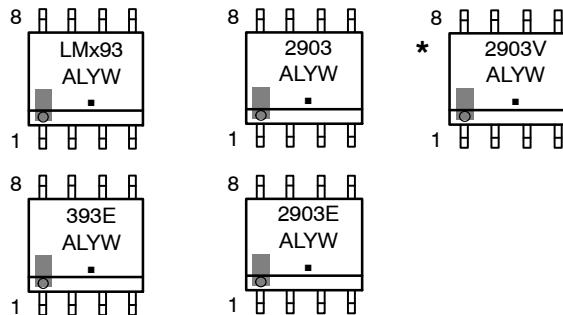
PDIP-8  
CASE 626



Micro8  
CASE 846A



SOIC-8  
CASE 751



x = 2 or 3  
A = Assembly Location  
WL, L = Wafer Lot  
YY, Y = Year  
WW, W = Work Week  
•, G = Pb-Free Package

(Note: Microdot may be in either location)

\*This marking diagram also applies to NCV2903DR2G

# LM393, LM393E, LM293, LM2903, LM2903E, LM2903V, NCV2903

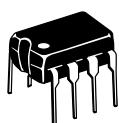
## ORDERING INFORMATION

Device	Operating Temperature Range	Package	Shipping <sup>†</sup>
LM293DG	-25°C to +85°C	SOIC-8 (Pb-Free)	98 Units / Rail
LM293DR2G			2500 / Tape & Reel
LM293DMR2G		Micro8 (Pb-Free)	4000 / Tape and Reel
LM393DG	0°C to +70°C	SOIC-8 (Pb-Free)	98 Units / Rail
LM393DR2G			2500 / Tape & Reel
LM393EDR2G		SOIC-8 (Pb-Free)	2500 / Tape & Reel
LM393NG		PDIP-8 (Pb-Free)	50 Units / Rail
LM393DMR2G		Micro8 (Pb-Free)	4000 / Tape and Reel
LM2903DG		SOIC-8 (Pb-Free)	98 Units / Rail
LM2903DR2G	-40°C to +105°C		2500 / Tape & Reel
LM2903EDR2G		SOIC-8 (Pb-Free)	2500 / Tape & Reel
LM2903DMR2G		Micro8 (Pb-Free)	4000 / Tape and Reel
LM2903NG		PDIP-8 (Pb-Free)	50 Units / Rail
LM2903VDG		SOIC-8 (Pb-Free)	98 Units / Rail
LM2903VDR2G	-40°C to +125°C		2500 / Tape & Reel
LM2903VNG		PDIP-8 (Pb-Free)	50 Units / Rail
NCV2903DR2G*		SOIC-8 (Pb-Free)	2500 / Tape & Reel
NCV2903DMR2G*		Micro8 (Pb-Free)	4000 / Tape & Reel

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

\*NCV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable.

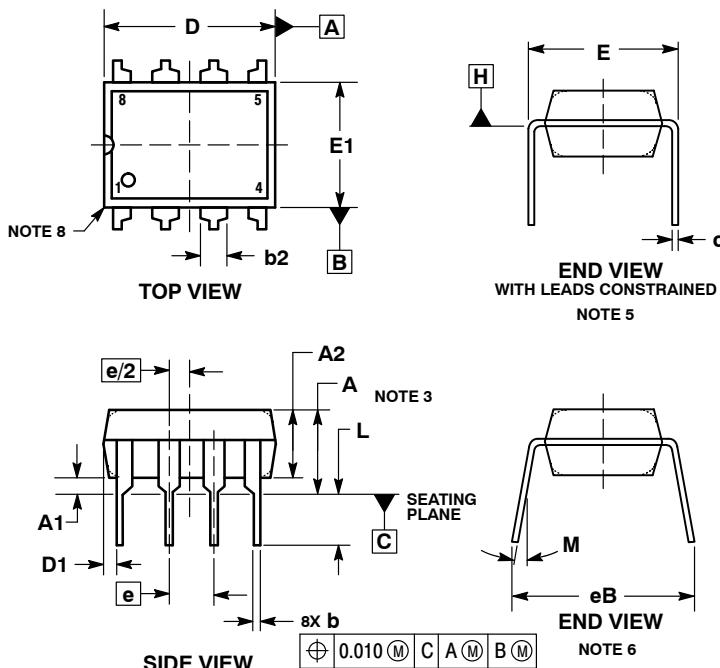




SCALE 1:1

PDIP-8  
CASE 626-05  
ISSUE P

DATE 22 APR 2015

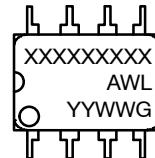


**STYLE 1:**  
 PIN 1. AC IN  
 2. DC + IN  
 3. DC - IN  
 4. AC IN  
 5. GROUND  
 6. OUTPUT  
 7. AUXILIARY  
 8. VCC

## NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: INCHES.
3. DIMENSIONS A, A1 AND L ARE MEASURED WITH THE PACKAGE SEADED IN JEDEC SEATING PLANE GAUGE GS-3.
4. DIMENSIONS D, D1 AND E1 DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS. MOLD FLASH OR PROTRUSIONS ARE NOT TO EXCEED 0.10 INCH.
5. DIMENSION E IS MEASURED AT A POINT 0.015 BELOW DATUM PLANE H WITH THE LEADS CONSTRAINED PERPENDICULAR TO DATUM C.
6. DIMENSION eB IS MEASURED AT THE LEAD TIPS WITH THE LEADS UNCONSTRAINED.
7. DATUM PLANE H IS COINCIDENT WITH THE BOTTOM OF THE LEADS, WHERE THE LEADS EXIT THE BODY.
8. PACKAGE CONTOUR IS OPTIONAL (ROUNDED OR SQUARE CORNERS).

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	---	0.210	---	5.33
A1	0.015	---	0.38	---
A2	0.115	0.195	2.92	4.95
b	0.014	0.022	0.35	0.56
b2	0.060 TYP		1.52 TYP	
C	0.008	0.014	0.20	0.36
D	0.355	0.400	9.02	10.16
D1	0.005	---	0.13	---
E	0.300	0.325	7.62	8.26
E1	0.240	0.280	6.10	7.11
e	0.100 BSC		2.54 BSC	
eB	---	0.430	---	10.92
L	0.115	0.150	2.92	3.81
M	---	10°	---	10°

GENERIC  
MARKING DIAGRAM\*

XXXX = Specific Device Code  
 A = Assembly Location  
 WL = Wafer Lot  
 YY = Year  
 WW = Work Week  
 G = Pb-Free Package

\*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.

DOCUMENT NUMBER:	98ASB42420B	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	PDIP-8	PAGE 1 OF 1

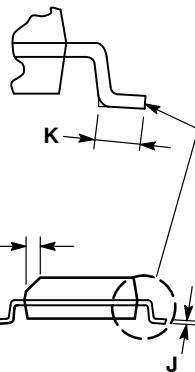
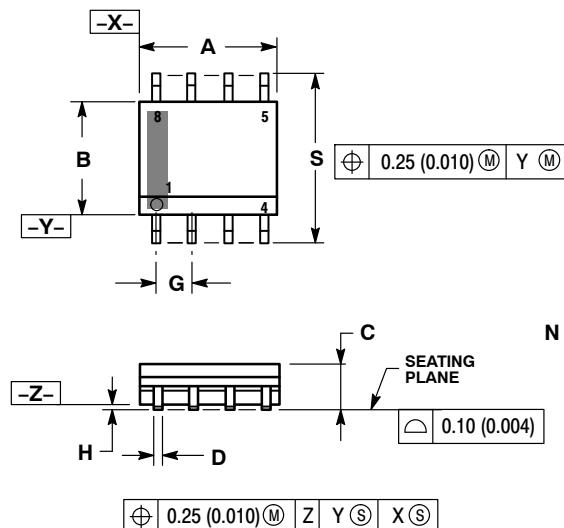
onsemi and Onsemi are trademarks of Semiconductor Components Industries, LLC dba onsemi or its subsidiaries in the United States and/or other countries. onsemi reserves the right to make changes without further notice to any products herein. onsemi makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does onsemi assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. onsemi does not convey any license under its patent rights nor the rights of others.



SCALE 1:1

SOIC-8 NB  
CASE 751-07  
ISSUE AK

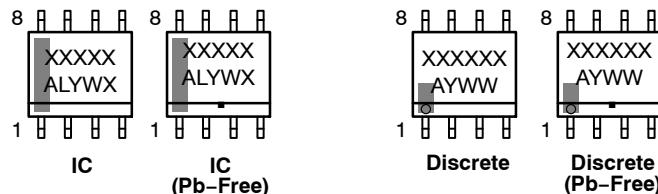
DATE 16 FEB 2011



## NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. 751-01 THRU 751-06 ARE OBSOLETE. NEW STANDARD IS 751-07.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.80	5.00	0.189	0.197
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.053	0.069
D	0.33	0.51	0.013	0.020
G	1.27 BSC		0.050 BSC	
H	0.10	0.25	0.004	0.010
J	0.19	0.25	0.007	0.010
K	0.40	1.27	0.016	0.050
M	0 °	8 °	0 °	8 °
N	0.25	0.50	0.010	0.020
S	5.80	6.20	0.228	0.244

GENERIC  
MARKING DIAGRAM\*

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

XXXXXX = Specific Device Code  
A = Assembly Location  
Y = Year  
WW = Work Week  
▪ = Pb-Free Package

\*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.

## STYLES ON PAGE 2

DOCUMENT NUMBER:	98ASB42564B	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	SOIC-8 NB	PAGE 1 OF 2

**onsemi** and **Onsemi** are trademarks of Semiconductor Components Industries, LLC dba **onsemi** or its subsidiaries in the United States and/or other countries. **onsemi** reserves the right to make changes without further notice to any products herein. **onsemi** makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. **onsemi** does not convey any license under its patent rights nor the rights of others.

**SOIC-8 NB**  
**CASE 751-07**  
**ISSUE AK**

DATE 16 FEB 2011

STYLE 1: PIN 1. Emitter 2. Collector 3. Collector 4. Emitter 5. Emitter 6. Base 7. Base 8. Emitter	STYLE 2: PIN 1. Collector, Die #1 2. Collector, #1 3. Collector, #2 4. Collector, #2 5. Base, #2 6. Emitter, #2 7. Base, #1 8. Emitter, #1	STYLE 3: PIN 1. Drain, Die #1 2. Drain, #1 3. Drain, #2 4. Drain, #2 5. Gate, #2 6. Source, #2 7. Gate, #1 8. Source, #1	STYLE 4: PIN 1. Anode 2. Anode 3. Anode 4. Anode 5. Anode 6. Anode 7. Anode 8. Common Cathode
STYLE 5: PIN 1. Drain 2. Drain 3. Drain 4. Drain 5. Gate 6. Gate 7. Source 8. Source	STYLE 6: PIN 1. Source 2. Drain 3. Drain 4. Source 5. Source 6. Gate 7. Gate 8. Source	STYLE 7: PIN 1. Input 2. External bypass 3. Third stage source 4. Ground 5. Drain 6. Gate 3 7. Second stage Vd 8. First stage Vd	STYLE 8: PIN 1. Collector, Die #1 2. Base, #1 3. Base, #2 4. Collector, #2 5. Collector, #2 6. Emitter, #2 7. Emitter, #1 8. Collector, #1
STYLE 9: PIN 1. Emitter, Common 2. Collector, Die #1 3. Collector, Die #2 4. Emitter, Common 5. Emitter, Common 6. Base, Die #2 7. Base, Die #1 8. Emitter, Common	STYLE 10: PIN 1. Ground 2. Bias 1 3. Output 4. Ground 5. Ground 6. Bias 2 7. Input 8. Ground	STYLE 11: PIN 1. Source 1 2. Gate 1 3. Source 2 4. Gate 2 5. Drain 2 6. Drain 2 7. Drain 1 8. Drain 1	STYLE 12: PIN 1. Source 2. Source 3. Source 4. Gate 5. Drain 6. Drain 7. Drain 8. Drain
STYLE 13: PIN 1. N.C. 2. Source 3. Source 4. Gate 5. Drain 6. Drain 7. Drain 8. Drain	STYLE 14: PIN 1. N-Source 2. N-Gate 3. P-Source 4. P-Gate 5. P-Drain 6. P-Drain 7. N-Drain 8. N-Drain	STYLE 15: PIN 1. Anode 1 2. Anode 1 3. Anode 1 4. Anode 1 5. Cathode, Common 6. Cathode, Common 7. Cathode, Common 8. Cathode, Common	STYLE 16: PIN 1. Emitter, Die #1 2. Base, Die #1 3. Emitter, Die #2 4. Base, Die #2 5. Collector, Die #2 6. Collector, Die #2 7. Collector, Die #1 8. Collector, Die #1
STYLE 17: PIN 1. VCC 2. V2OUT 3. V1OUT 4. TXE 5. RXE 6. VEE 7. GND 8. ACC	STYLE 18: PIN 1. ANODE 2. ANODE 3. SOURCE 4. GATE 5. DRAIN 6. DRAIN 7. CATHODE 8. CATHODE	STYLE 19: PIN 1. SOURCE 1 2. GATE 1 3. SOURCE 2 4. GATE 2 5. DRAIN 2 6. MIRROR 2 7. DRAIN 1 8. MIRROR 1	STYLE 20: PIN 1. SOURCE (N) 2. GATE (N) 3. SOURCE (P) 4. GATE (P) 5. DRAIN 6. DRAIN 7. DRAIN 8. DRAIN
STYLE 21: PIN 1. Cathode 1 2. Cathode 2 3. Cathode 3 4. Cathode 4 5. Cathode 5 6. Common Anode 7. Common Anode 8. Cathode 6	STYLE 22: PIN 1. I/O LINE 1 2. COMMON CATHODE/VCC 3. COMMON CATHODE/VCC 4. I/O LINE 3 5. COMMON ANODE/GND 6. I/O LINE 4 7. I/O LINE 5 8. COMMON ANODE/GND	STYLE 23: PIN 1. LINE 1 IN 2. COMMON ANODE/GND 3. COMMON ANODE/GND 4. LINE 2 IN 5. LINE 2 OUT 6. COMMON ANODE/GND 7. COMMON ANODE/GND 8. LINE 1 OUT	STYLE 24: PIN 1. BASE 2. Emitter 3. Collector/Anode 4. Collector/Anode 5. Cathode 6. Cathode 7. Collector/Anode 8. Collector/Anode
STYLE 25: PIN 1. VIN 2. N/C 3. REXT 4. GND 5. IOUT 6. IOUT 7. IOUT 8. IOUT	STYLE 26: PIN 1. GND 2. dv/dt 3. ENABLE 4. ILIMIT 5. SOURCE 6. SOURCE 7. SOURCE 8. VCC	STYLE 27: PIN 1. ILIMIT 2. OVLO 3. UVLO 4. INPUT+ 5. SOURCE 6. SOURCE 7. SOURCE 8. DRAIN	STYLE 28: PIN 1. SW_TO_GND 2. DASIC_OFF 3. DASIC_SW_DET 4. GND 5. V_MON 6. VBUCK 7. VBUCK 8. VIN
STYLE 29: PIN 1. BASE, Die #1 2. Emitter, #1 3. BASE, #2 4. Emitter, #2 5. Collector, #2 6. Collector, #2 7. Collector, #1 8. Collector, #1	STYLE 30: PIN 1. DRAIN 1 2. DRAIN 1 3. GATE 2 4. SOURCE 2 5. SOURCE 1/DRAIN 2 6. SOURCE 1/DRAIN 2 7. SOURCE 1/DRAIN 2 8. GATE 1		

DOCUMENT NUMBER:	98ASB42564B	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	SOIC-8 NB	PAGE 2 OF 2

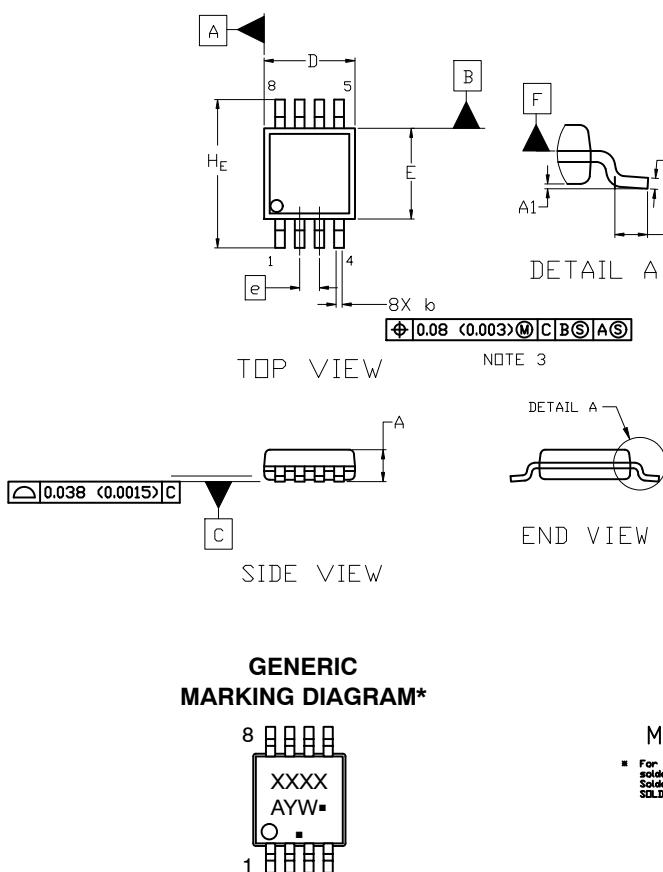
**onsemi** and **OnSemi** are trademarks of Semiconductor Components Industries, LLC dba **onsemi** or its subsidiaries in the United States and/or other countries. **onsemi** reserves the right to make changes without further notice to any products herein. **onsemi** makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. **onsemi** does not convey any license under its patent rights nor the rights of others.



SCALE 2:1

**Micro8**  
CASE 846A-02  
ISSUE K

DATE 16 JUL 2020



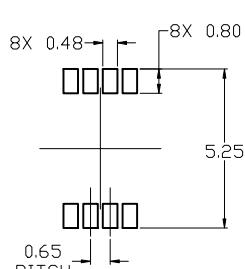
- XXXX = Specific Device Code
- A = Assembly Location
- Y = Year
- W = Work Week
- = Pb-Free Package

(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.

**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE PROTRUSION SHALL BE 0.10 mm IN EXCESS OF MAXIMUM MATERIAL CONDITION.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSION OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.15 mm PER SIDE. DIMENSION E DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 mm PER SIDE. DIMENSIONS D AND E ARE DETERMINED AT DATUM F.
5. DATUMS A AND B ARE TO BE DETERMINED AT DATUM F.
6. A1 IS DEFINED AS THE VERTICAL DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT ON THE PACKAGE BODY.

**RECOMMENDED MOUNTING FOOTPRINT**

For additional information on our Pb-Free strategy and soldering details, please download the On Semiconductor Soldering and Mounting Techniques Reference Manual, SODERRM/D.

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	---	---	1.10
A1	0.05	0.08	0.15
b	0.25	0.33	0.40
c	0.13	0.18	0.23
D	2.90	3.00	3.10
E	2.90	3.00	3.10
e	0.65 BSC		
H <sub>E</sub>	4.75	4.90	5.05
L	0.40	0.55	0.70

**STYLE 1:**

- PIN 1. SOURCE
- 2. SOURCE
- 3. SOURCE
- 4. GATE
- 5. DRAIN
- 6. DRAIN
- 7. DRAIN
- 8. DRAIN

**STYLE 2:**

- PIN 1. SOURCE 1
- 2. GATE 1
- 3. SOURCE 2
- 4. GATE 2
- 5. DRAIN 2
- 6. DRAIN 2
- 7. DRAIN 1
- 8. DRAIN 1

**STYLE 3:**

- PIN 1. N-SOURCE
- 2. N-GATE
- 3. P-SOURCE
- 4. P-GATE
- 5. P-DRAIN
- 6. P-DRAIN
- 7. N-DRAIN
- 8. N-DRAIN

DOCUMENT NUMBER:	98ASB14087C	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	MICRO8	PAGE 1 OF 1

onsemi and Onsemi are trademarks of Semiconductor Components Industries, LLC dba onsemi or its subsidiaries in the United States and/or other countries. onsemi reserves the right to make changes without further notice to any products herein. onsemi makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does onsemi assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. onsemi does not convey any license under its patent rights nor the rights of others.

**onsemi**, **ONSEMI**, and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi**'s product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

## ADDITIONAL INFORMATION

### TECHNICAL PUBLICATIONS:

Technical Library: [www.onsemi.com/design/resources/technical-documentation](http://www.onsemi.com/design/resources/technical-documentation)  
onsemi Website: [www.onsemi.com](http://www.onsemi.com)

### ONLINE SUPPORT: [www.onsemi.com/support](http://www.onsemi.com/support)

For additional information, please contact your local Sales Representative at  
[www.onsemi.com/support/sales](http://www.onsemi.com/support/sales)

