Single Inverter with Open Drain Output

NL17SZ06

The NL17SZ06 is a single inverter with open drain output in tiny footprint packages.

Features

- Designed for 1.65 V to 5.5 V V_{CC} Operation
- 2.1 ns t_{PD} at $V_{CC} = 5 \text{ V (typ)}$
- Input/Output Overvoltage Tolerant up to 5.5 V
- I_{OFF} Supports Partial Power Down Protection
- Source/Sink 24 mA at 3.0 V
- Available in SC-88A, SC-74A, SOT-553, SOT-953 and UDFN6 Packages
- Chip Complexity < 100 FETs
- NLV 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

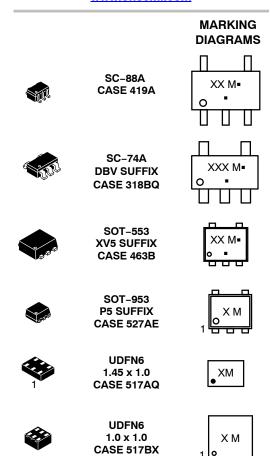


Figure 1. Logic Symbol



ON Semiconductor®

www.onsemi.com



XX = Specific Device Code

M = Date Code*

= Date Code* = Pb-Free Package

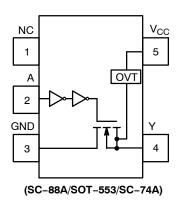
(Note: Microdot may be in either location)

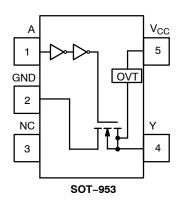
*Date Code orientation and/or position may vary depending upon manufacturing location.

ORDERING INFORMATION

See detailed ordering, marking and shipping information in the package dimensions section on page 7 of this data sheet.

1





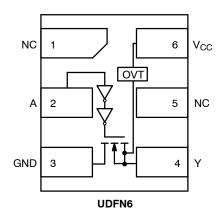


Figure 2. Pinout (Top View)

PIN ASSIGNMENT (SC-88A/SOT-553/SC-74A)

Pin	Function
1	NC
2	Α
3	GND
4	Υ
5	V _{CC}

PIN ASSIGNMENT (SOT-953)

Pin	Function
1	Α
2	GND
3	NC
4	Y
5	V _{CC}

PIN ASSIGNMENT (UDFN)

Pin	Function
1	NC
2	Α
3	GND
4	Υ
5	NC
6	V _{CC}

FUNCTION TABLE

A Input	Y Output
L	Z
Н	L

MAXIMUM RATINGS

Symbol	Cha	racteristics	Value	Unit
V _{CC}	DC Supply Voltage	SC-88A (NLV) 74A, SC-88A, SOT-553, SOT-953, UDFN6	-0.5 to +7.0 -0.5 to +6.5	V
V _{IN}	DC Input Voltage	SC-88A (NLV) 74A, SC-88A, SOT-553, SOT-953, UDFN6	-0.5 to +7.0 -0.5 to +6.5	V
V _{OUT}	DC Output Voltage SC-88A (NLV)	Active-Mode (High or Low State) Tri-State Mode (Note 1) Power-Down Mode (V _{CC} = 0 V)	-0.5 to V _{CC} + 0.5 -0.5 to +7.0 -0.5 to +7.0	V
	DC Output Voltage SC-74A, SC-88A, SOT-553, SOT-953, UDFN6	Active-Mode (High or Low State) Tri-State Mode (Note 1) Power-Down Mode (V _{CC} = 0 V)	-0.5 to V _{CC} + 0.5 -0.5 to +6.5 -0.5 to +6.5	V
I _{IK}	DC Input Diode Current	V _{IN} < GND	-50	mA
I _{OK}	DC Output Diode Current	V _{OUT} < GND	-50	mA
I _{OUT}	DC Output Source/Sink Current		±50	mA
I _{CC} or I _{GND}	DC Supply Current per Supply Pin of	±100	mA	
T _{STG}	Storage Temperature Range		-65 to +150	°C
TL	Lead Temperature, 1 mm from Case	e for 10 secs	260	°C
TJ	Junction Temperature Under Bias		+150	°C
$\theta_{ extsf{JA}}$	Thermal Resistance (Note 2)	SC-88A SC-74A SOT-553 SOT-953 UDFN6	377 320 324 254 154	°C/W
P _D	Power Dissipation in Still Air	SC-88A SC-74A SOT-553 SOT-953 UDFN6	332 390 386 491 812	mW
MSL	Moisture Sensitivity		Level 1	-
F _R	Flammability Rating	Oxygen Index: 28 to 34	UL 94 V-0 @ 0.125 in	-
V _{ESD}	ESD Withstand Voltage (Note 3)	Human Body Model Charged Device Model	2000 1000	V
I _{Latchup}	Latchup Performance (Note 4)		±100	mA

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. Applicable to devices with outputs that may be tri-stated.

2. Measured with minimum pad spacing on an FR4 board, using 10mm-by-1inch, 2 ounce copper trace no air flow per JESD51-7.

3. HBM tested to ANSI/ESDA/JEDEC JS-001-2017. CDM tested to EIA/JESD22-C101-F. JEDEC recommends that ESD qualification to EIA/JESD22-A115-A (Machine Model) be discontinued per JEDEC/JEP172A.

4. Tested to EIA/JESD78 Class II.

RECOMMENDED OPERATING CONDITIONS

Symbol	Chara	Characteristics			Unit
V _{CC}	Positive DC Supply Voltage		1.65	5.5	V
V _{IN}	DC Input Voltage		0	5.5	V
V _{OUT}	DC Output Voltage	Active–Mode (High or Low State) Tri–State Mode (Note 1) Power–Down Mode ($V_{\rm CC}$ = 0 V)	0 0 0	V _{CC} 5.5 5.5	
T _A	Operating Temperature Range		-55	+125	°C
t _r , t _f	Input Rise and Fall Time SC-88A (NLV)	$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$ $V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	0 0	100 20	ns/V
	Input Rise and Fall Time SC-74A, SC-88A, SOT-553, SOT-953, UDFN6	$\begin{array}{c} V_{CC} = 1.65 \ V \ to \ 1.95 \ V \\ V_{CC} = 2.3 \ V \ to \ 2.7 \ V \\ V_{CC} = 3.0 \ V \ to \ 3.6 \ V \\ V_{CC} = 4.5 \ V \ to \ 5.5 \ V \end{array}$	0 0 0	20 20 10 5	

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

DC ELECTRICAL CHARACTERISTICS

			V _{CC}	$T_A = 25^{\circ}C$		-55°C ≤ T _A ≤ 125°C			
Symbol	Parameter	Condition	(V)	Min	Тур	Max	Min	Max	Units
V _{IH}	High-Level Input		1.65 to 1.95	0.65 V _{CC}	-	-	0.65 V _{CC}	-	V
	Voltage		2.3 to 5.5	0.70 V _{CC}	-	-	0.70 V _{CC}	-	
V _{IL}	Low-Level Input		1.65 to 1.95	-	-	0.35 V _{CC}	-	0.35 V _{CC}	V
	Voltage		2.3 to 5.5	-	1	0.30 V _{CC}	-	0.30 V _{CC}	
V _{OL}	Low-Level Output Voltage	$\begin{array}{l} V_{IN} = V_{IH} \text{ or } V_{IL} \\ I_{OL} = 100 \ \mu\text{A} \\ I_{OL} = 4 \ \text{mA} \\ I_{OL} = 8 \ \text{mA} \\ I_{OL} = 12 \ \text{mA} \\ I_{OL} = 16 \ \text{mA} \\ I_{OL} = 24 \ \text{mA} \\ I_{OL} = 32 \ \text{mA} \end{array}$	1.65 to 5.5 1.65 2.3 2.7 3.0 3.0 4.5	111111	0.08 0.2 0.22 0.28 0.38 0.42	0.1 0.24 0.3 0.4 0.4 0.55 0.55	111111	0.1 0.24 0.3 0.4 0.4 0.55 0.55	V
I _{IN}	Input Leakage Current	V _{IN} = 5.5 V or GND	1.65 to 5.5	-	-	±0.1	-	±1.0	μΑ
l _{OZ}	3-State Output Leakage Current	V _{OUT} = 0 V to 5.5 V	1.65 to 5.5	ı	ı	±0.5	ı	±5.0	μА
l _{OFF}	Power Off Leakage Current	V _{IN} = 5.5 V or V _{OUT} = 5.5 V	0	_	_	1.0	-	10	μΑ
Icc	Quiescent Supply Current	V _{IN} = V _{CC} or GND	5.5	-	-	1.0	-	10	μА

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.

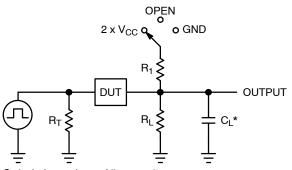
AC ELECTRICAL CHARACTERISTICS

			V _{CC}	T,	_A = 25°	С	-55°C ≤ T	_A ≤ 125°C	
Symbol	Parameter	Condition	(V)	Min	Тур	Max	Min	Max	Units
t _{PZL}	Propagation Delay,		1.65 to 1.95	-	6.0	9.0	_	9.5	ns
	(Figures 3 and 4)	A to Y (Figures 3 and 4)	2.3 to 2.7	-	3.6	6.1	-	6.5	
		3.0 to 3.6	-	2.7	5.6	=	6.0		
			4.5 to 5.5	-	2.1	4.4	=	4.8	
t _{PLZ}	Propagation Delay,		1.65 to 1.95	-	4.0	9.0	=	9.5	ns
	A to Y (Figures 3 and 4)	2.3 to 2.7	-	2.8	6.1	-	6.5		
			3.0 to 3.6	_	2.5	5.6	_	6.0	
			4.5 to 5.5	_	2.2	4.4	_	4.8	

CAPACITIVE CHARACTERISTICS

Symbol	Parameter	Condition	Typical	Units
C _{IN}	Input Capacitance	$V_{CC} = 5.5 \text{ V}, V_{IN} = 0 \text{ V or } V_{CC}$	2.5	pF
C _{OUT}	Output Capacitance	$V_{CC} = 5.5 \text{ V}, V_{IN} = 0 \text{ V or } V_{CC}$	2.5	pF
C _{PD}	Power Dissipation Capacitance (Note 5)	10 MHz, V_{CC} = 3.3 V, V_{IN} = 0 V or V_{CC} 10 MHz, V_{CC} = 5.5 V, V_{IN} = 0 V or V_{CC}	9 11	pF

^{5.} C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load. Average operating current can be obtained by the equation: I_{CC(OPR)} = C_{PD} • V_{CC} • f_{in} + I_{CC}. C_{PD} is used to determine the no–load dynamic power consumption; P_D = C_{PD} • V_{CC}² • f_{in} + I_{CC} • V_{CC}.



Test	Switch Position	C _L , pF	R_L, Ω	R ₁ , Ω	
t _{PLH} / t _{PHL}	Open	See AC Characteristics Table			
t _{PLZ} / t _{PZL}	2 x V _{CC}	50	500	500	
t _{PHZ} / t _{PZH}	GND	50	500	500	

X = Don't Care

C_L includes probe and jig capacitance

 R_T is Z_{OUT} of pulse generator (typically 50 Ω) f=1 MHz

Figure 3. Test Circuit

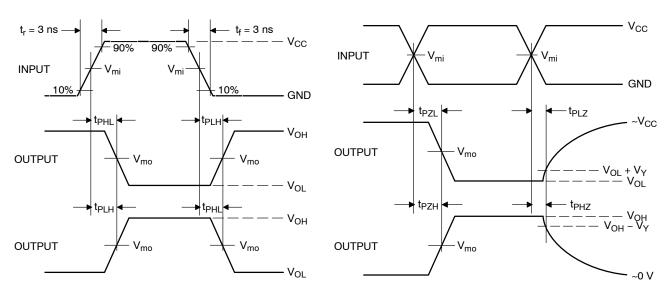


Figure 4. Switching Waveforms

		V _m		
V _{CC} , V	V _{mi} , V	t _{PLH} , t _{PHL}	t _{PZL} , t _{PLZ} , t _{PZH} , t _{PHZ}	V _Y , V
1.65 to 1.95	V _{CC} /2	V _{CC} /2	V _{CC} /2	0.15
2.3 to 2.7	V _{CC} /2	V _{CC} /2	V _{CC} /2	0.15
3.0 to 3.6	V _{CC} /2	V _{CC} /2	V _{CC} /2	0.3
4.5 to 5.5	V _{CC} /2	V _{CC} /2	V _{CC} /2	0.3

DEVICE ORDERING INFORMATION

Device	Packages	Specific Device Code	Pin 1 Orientation (See below)	Shipping [†]
NL17SZ06DFT2G	SC-88A	LF	Q4	3000 / Tape & Reel
NLV17SZ06DFT2G*	SC-88A	LF	Q4	3000 / Tape & Reel
NL17SZ06DBVT1G	SC-74A	AF	Q4	3000 / Tape & Reel
NL17SZ06XV5T2G	SOT-553	LF	Q4	4000 / Tape & Reel
NL17SZ06P5T5G (In Development)	SOT-953	TBD	Q2	8000 / Tape & Reel
NL17SZ06MU1TCG (In Development)	UDFN6, 1.45 x 1.0 x 0.5P	TBD	Q4	3000 / Tape & Reel
NL17SZ06MU3TCG (In Development)	UDFN6, 1.0 x 1.0 x 0.35P	TBD	Q4	3000 / Tape & Reel

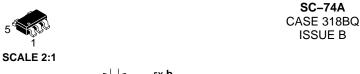
[†]For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

Pin 1 Orientation in Tape and Reel

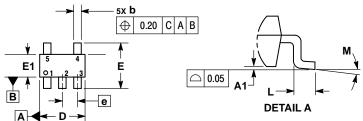
Direction of Feed

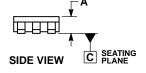


^{*}NLV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable.

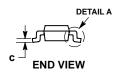


DATE 18 JAN 2018

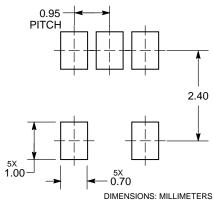




TOP VIEW



RECOMMENDED SOLDERING FOOTPRINT*



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

- NOTES:

 1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.

 2. CONTROLLING DIMENSION: MILLIMETERS.

 3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.

 4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.15 PER SIDE.

	MILLIMETERS			
	MILLIMETERS			
DIM	MIN MAX			
Α	0.90	1.10		
A1	0.01	0.10		
b	0.25	0.50		
С	0.10	0.26		
D	2.85	3.15		
E	2.50	3.00		
E1	1.35 1.65			
е	0.95 BSC			
L	0.20 0.60			
М	0 °	10°		

GENERIC MARKING DIAGRAM*



XXX = Specific Device Code

= Date Code M

= 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.

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98AON66279	G

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DEVICION DATE					
ISSUE	REVISION	DATE			
0	RELEASED FOR PRODUCTION. REQ BY I. HYLAND.	27 JUN 2017			
Α	CORRECTED MARKING DIAGRAM FROM 6 TO 5-LEAD. REQ BY I. HYLAND.	20 SEP 2017			
В	CORRECTED SOLDERING FOOTPRINT PITCH FROM 3.40MM TO 2.40MM. REQ. BY I. HYLAND.	18 JAN 2018			

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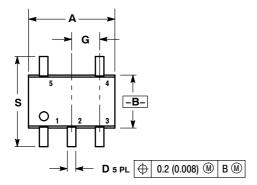


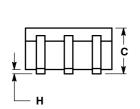


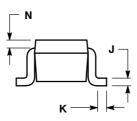
SC-88A (SC-70-5/SOT-353) CASE 419A-02 ISSUE L

DATE 17 JAN 2013

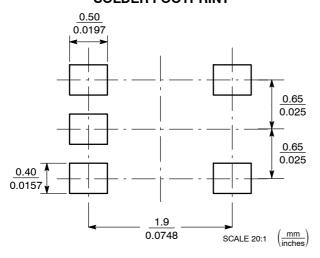
SCALE 2:1







SOLDER FOOTPRINT



- NOTES:
 1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: INCH.
- 419A-01 OBSOLETE. NEW STANDARD 419A-02.
- DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE

	INCHES		MILLIN	IETERS
DIM	MIN	MAX	MIN	MAX
Α	0.071	0.087	1.80	2.20
В	0.045	0.053	1.15	1.35
С	0.031	0.043	0.80	1.10
D	0.004	0.012	0.10	0.30
G	0.026	BSC	0.65 BSC	
Н		0.004		0.10
J	0.004	0.010	0.10	0.25
K	0.004	0.012	0.10	0.30
N	0.008 REF		0.20	REF
S	0.079	0.087	2.00 2.20	

GENERIC MARKING DIAGRAM*



XXX = Specific Device Code

= Date Code

= Pb-Free Package

(Note: Microdot may be in either location)

*This infomration is generic. Please refer to device data sheet for actual part marking.

STYLE 5: PIN 1. CATHODE 2. COMMON ANODE 3. CATHODE 2 4. CATHODE 3

5. CATHODE 4

STYLE 1:	STYLE 2:	STYLE 3:	STYLE 4:
PIN 1. BASE	PIN 1. ANODE	PIN 1. ANODE 1	PIN 1. SOURCE 1
2. EMITTER	2. EMITTER	2. N/C	2. DRAIN 1/2
3. BASE	3. BASE	3. ANODE 2	3. SOURCE 1
4. COLLECTOR	4. COLLECTOR	4. CATHODE 2	4. GATE 1
5. COLLECTOR	5. CATHODE	5. CATHODE 1	5. GATE 2
STYLE 6:	STYLE 7:	STYLE 8: PIN 1. CATHODE 2. COLLECTOR 3. N/C 4. BASE 5. EMITTER	STYLE 9:
PIN 1. EMITTER 2	PIN 1. BASE		PIN 1. ANODE
2. BASE 2	2. EMITTER		2. CATHODE
3. EMITTER 1	3. BASE		3. ANODE
4. COLLECTOR	4. COLLECTOR		4. ANODE
5. COLLECTOR 2/BASE 1	5. COLLECTOR		5. ANODE

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PAGE 2 OF 2

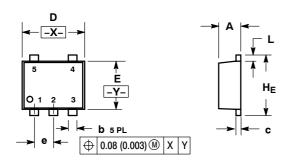
ISSUE	REVISION	DATE
С	CONVERTED FROM PAPER DOCUMENT TO ELECTRONIC. REQ. BY N LAFEB-RE.	20 JUN 1998
D	CONVERTED FROM MOTOROLA TO ON SEMICONDUCTOR. ADDED STYLE 5. REQ. BY E. KIM.	24 JUL 2000
Е	ADDED STYLES 6 & 7. REQ. BY S. BACHMAN.	03 AUG 2000
F	DELETED DIMENSION V, WAS 0.3-0.44MM/0.012-0.016IN. REQ. BY G. KWONG.	14 JUN 2001
G	ADDED STYLE 8, REQ. BY S. CHANG; ADDED STYLE 9, REQ. BY S. BACHMAN; ADDED NOTE 4, REQ. BY S. RIGGS	25 JUN 2003
Н	CHANGED STYLE 6. REQ. BY C. LIM	28 APR 2005
J	CHANGED TITLE DESCRIPTION. REQ. BY B. LOFTS.	31 AUG 2005
K	CORRECTED TITLE AND DESCRIPTION TO SC-88A (SC-70-5/SOT-353). CORRECTED MARKING DIAGRAM. REQ. BY D. TRUHITTE.	13 JUL 2010
L	ADDED SOLDER FOOTPRINT. REQ. BY I. MARIANO.	17 JAN 2013
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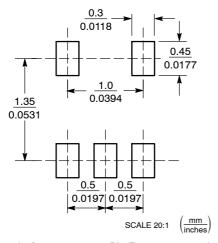


SOT-553, 5 LEAD CASE 463B ISSUE C

DATE 20 MAR 2013



RECOMMENDED SOLDERING FOOTPRINT*



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

NOTES:

- NOTES:

 1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.

 2. CONTROLLING DIMENSION: MILLIMETERS

 3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH
 THICKNESS: MINIMUM LEAD THICKNESS IS THE MINIMUM
 THICKNESS OF BASE MATERIAL.

	MILLIMETERS				INCHES	
DIM	MIN	NOM	MAX	MIN	NOM	MAX
Α	0.50	0.55	0.60	0.020	0.022	0.024
b	0.17	0.22	0.27	0.007	0.009	0.011
С	0.08	0.13	0.18	0.003	0.005	0.007
D	1.55	1.60	1.65	0.061	0.063	0.065
E	1.15	1.20	1.25	0.045	0.047	0.049
е	0.50 BSC				0.020 BSC	
L	0.10	0.20	0.30	0.004	0.008	0.012
He	1.55	1.60	1 65	0.061	0.063	0.065

GENERIC MARKING DIAGRAM*



XX = Specific Device Code

M = Date Code

= 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.

STYLE 1: PIN 1. BASE 2. EMITTER 3. BASE 4. COLLECTOR 5. COLLECTOR	STYLE 2: PIN 1. CATHODE 2. COMMON ANODE 3. CATHODE 2 4. CATHODE 3 5. CATHODE 4	STYLE 3: PIN 1. ANODE 1 2. N/C 3. ANODE 2 4. CATHODE 2 5. CATHODE 1	STYLE 4: PIN 1. SOURCE 1 2. DRAIN 1/2 3. SOURCE 1 4. GATE 1 5. GATE 2	STYLE 5: PIN 1. ANODE 2. EMITTER 3. BASE 4. COLLECTOR 5. CATHODE
STYLE 6: PIN 1. EMITTER 2 2. BASE 2 3. EMITTER 1 4. COLLECTOR 1 5. COLLECTOR 2/BASE 1	STYLE 7: PIN 1. BASE 2. EMITTER 3. BASE 4. COLLECTOR 5. COLLECTOR	STYLE 8: PIN 1. CATHODE 2. COLLECTOR 3. N/C 4. BASE 5. EMITTER	STYLE 9: PIN 1. ANODE 2. CATHODE 3. ANODE 4. ANODE 5. ANODE	

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PAGE 2 OF 2

ISSUE	REVISION	DATE
Α	ADDED STYLES 3-9. REQ. BY D. BARLOW	11 NOV 2003
В	ADDED NOMINAL VALUES AND UPDATED GENERIC MARKING DIAGRAM. REQ. BY HONG XIAO	27 MAY 2005
С	UPDATED DIMENSIONS D, E, AND HE. REQ. BY J. LETTERMAN.	20 MAR 2013

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