onsemi

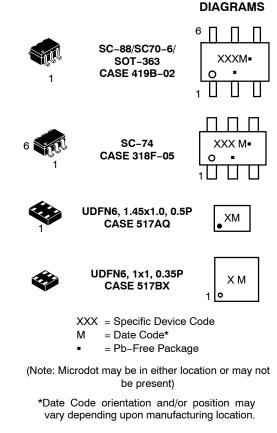
MARKING

Configurable Multifunction Gate NL7SZ57

The NL7SZ57 is an advanced high-speed CMOS multifunction gate. The device allows the user to choose logic functions AND, OR, NAND, NOR, XNOR, INVERT and BUFFER. The device has Schmitt-trigger inputs, thereby enhancing noise immunity.

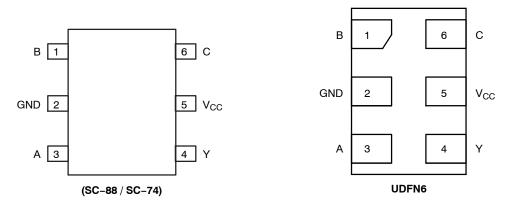
Features

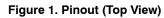
- Designed for 1.65 V to 5.5 V V_{CC} Operation
- 3.3 ns t_{PD} at $V_{CC} = 5 V (Typ)$
- Inputs/Outputs Overvoltage Tolerant up to 5.5 V
- IOFF Supports Partial Power Down Protection
- Sink 24 mA at 3.0 V
- Chip Complexity < 100 FETs
- –Q Suffix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC–Q100 Qualified and PPAP Capable
- These Devices are Pb–Free, Halogen Free/BFR Free and are RoHS Compliant

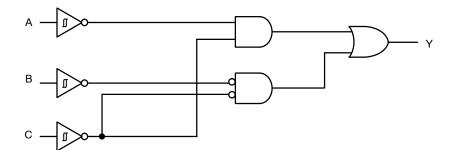


ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 8 of this data sheet.









PIN ASSIGNMENT

Pin	Function
1	В
2	GND
3	А
4	Y
5	V _{CC}
6	С

FUNCTION TABLE*

	Input		Output
А	В	С	Y
L	L	L	Н
L	L	Н	L
L	Н	L	Н
L	Н	Н	Н
Н	L	L	L
Н	L	Н	L
Н	Н	L	L
Н	Н	Н	Н

*To select a logic function, please refer to "Logic Configurations section".

LOGIC CONFIGURATIONS

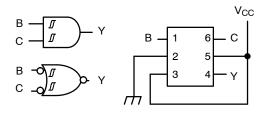


Figure 3. 2-Input AND (When A = "H")

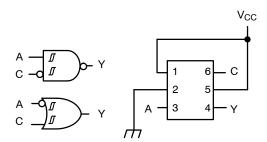


Figure 5. 2–Input NAND with Input C Inverted (When B = "H")

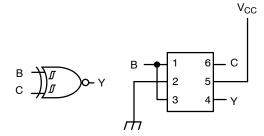


Figure 7. 2–Input XNOR (When A = B)

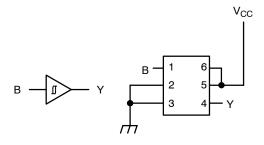


Figure 9. Buffer (When A = "L" and C = "H")

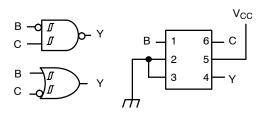


Figure 4. 2–Input NAND with input B inverted (When A = "L")

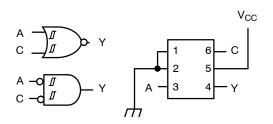


Figure 6. 2–Input NOR (When B = "L")

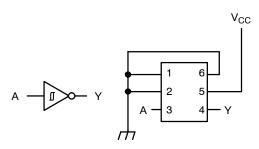


Figure 8. Inverter (When B = C = "L")

MAXIMUM RATINGS

Symbol	Parame	eter	Value	Unit
V _{CC}	DC Supply Voltage		–0.5 to +6.5	V
V _{IN}	DC Input Voltage		–0.5 to +6.5	V
V _{OUT}	DC Output Voltage	Active-Mode (High or Low State) Tri-State Mode (Note 1) Power-Down Mode (V _{CC} = 0 V)	$\begin{array}{r} -0.5 \text{ to } V_{CC} + 0.5 \\ -0.5 \text{ to } +6.5 \\ -0.5 \text{ to } +6.5 \end{array}$	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
$I_{\rm CC}$ or $I_{\rm GND}$	DC Supply Current per Supply Pin or Grou	ind Pin	±100	mA
T _{STG}	Storage Temperature Range		–65 to +150	°C
ΤL	Lead Temperature, 1 mm from Case for 10) Secs	260	°C
TJ	Junction Temperature Under Bias		+150	°C
θ_{JA}	Thermal Resistance (Note 2)	SC-88 SC-74 UDFN6	377 320 154	°C/W
P _D	Power Dissipation in Still Air	SC-88 SC-74 UDFN6	332 390 812	mW
MSL	Moisture Sensitivity		Level 1	
F _R	Flammability Rating Oxygen	Oxygen Index: 28 to 34	UL 94 V-0 @ 0.125 in	
V _{ESD}	ESD Withstand Voltage (Note 3)	Human Body Mode Charged Device Model Charged Device Model	>2000 >200 N/A	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.

 Measured with minimum pad spacing on an FR4 board, using 10 mm-by-1 inch, 2 ounce copper trace no air flow per JESD51-7.
 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	Para	Min	Мах	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 _{CC} = 0 V)	0 0 0	V _{CC} 5.5 5.5	V
T _A	Operating Free–Air Temperature		-55	+125	°C
t _r , t _f	Input Rise or Fall Rate	$\begin{array}{l} V_{CC} = 1.65 \ V \ to \ 1.95 \ V \\ V_{CC} = 2.3 \ V \ to \ 2.7 \ V \\ V_{CC} = 3.0 \ V \ to \ 3.6 \ V \\ V_{CC} = 4.5 \ V \ to \ 5.5 \ V \end{array}$	0 0 0 0	No Limit No Limit No Limit No Limit	nS/V

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}	-	Γ _A = 25°(C		≤ T _A ≤ 5°C		≤ T _A ≤ 5°C	
Symbol	Parameter	Condition	(V)	Min	Тур	Max	Min	Max	Min	Max	Unit
V_{T+}	Positive Input		1.65	-	-	1.4	-	1.4	-	1.4	V
	Threshold Voltage		2.3	-	-	1.8	-	1.8	-	1.8	
			3.0	-	-	2.2	-	2.2	-	2.2	
			4.5	-	-	3.1	-	3.1	-	3.1	
			5.5	-	-	3.6	-	3.6	-	3.6	
V_{T-}	Negative Input		1.65	0.2	-	-	0.2	-	0.2	-	V
	Threshold Voltage		2.3	0.4	-	-	0.4	-	0.4	-	
			3.0	0.6	-	-	0.6	-	0.6	-	
			4.5	1.0	-	-	1.0	-	1.0	-	
			5.5	1.2	-	-	1.2	-	1.2	-	
V _H	Negative Input		1.65	0.1	0.1	0.9	0.48	0.9	0.1	0.9	V
	Threshold Voltage		2.3	0.25	0.25	1.1	0.75	1.1	0.25	1.1	
			3.0	0.4	0.4	1.2	0.93	1.2	0.4	1.2	
			4.5	0.6	0.6	1.5	1.2	1.5	0.6	1.5	
		5.5 0.7 0.7	1.7	1.4	1.7	0.7	1.7				
V _{OH}	High-Level Output Voltage	I _{OH} = -50 μA	1.65 to 5.5	V _{CC} - 0.1	V _{CC}	-	V _{CC} - 0.1	-	V _{CC} - 0.1	-	V
	$V_{IN} = V_{IH} \text{ or } V_{IL}$	I _{OH} = -4 mA	1.65	1.20	1.52	-	1.20	-	1.20	-	
		I _{OH} = -8 mA	2.3	1.9	2.1	-	1.9	-	1.9	-	
		I _{OH} = -16 mA	3	2.4	2.7	-	2.4	-	2.4	-	
		I _{OH} = -24 mA	3	2.3	2.5	-	2.3	-	2.3	-	
		I _{OH} = -32 mA	4.5	3.8	4	-	3.8	-	3.8	-	
V _{OL}	Low-Level Output Voltage	I _{OL} = 100 μA	1.65 to 5.5	-	-	0.1	-	0.1	-	0.1	V
	$V_{IN} = V_{IH} \text{ or } V_{IL}$	I _{OL} = 4 mA	1.65	-	0.08	0.45	-	0.45	-	0.45	
		I _{OL} = 8 mA	2.3	-	0.2	0.3	-	0.3	-	0.4	
		I _{OL} = 16 mA	3	-	0.28	0.4	-	0.4	-	0.5	
		I _{OL} = 24 mA	3	-	0.38	0.55	-	0.55	-	0.55	
		I _{OL} = 32 mA	4.5	-	0.42	0.55	-	0.55	-	0.65	
I _{IN}	Input Leakage Current	V _{IN} = 5.5 V or GND	1.65 to 5.5	-	-	+0.1	-	+1.0	-	+1.0	μA
I _{OFF}	Power Off Leakage Current	$V_{IN} = 5.5 V \text{ or}$ $V_{OUT} = 5.5 V$	0	-	-	1.0	_	10	_	10	μA
ICC	Quiescent Supply Current	V _{IN} = 5.5 V or GND	5.5	-	-	1.0	-	10	-	10	μA

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.

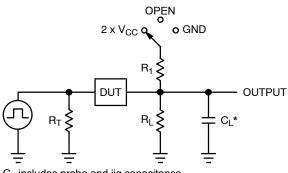
AC ELECTRICAL CHARACTERISTICS

				1	Γ _A = 25°C	•		≤ T _A 5°C	-55°C ≤ 12	≤ T _A 25°C	
Symbol	Parameter	Condition	V _{CC} (V)	Min	Тур	Max	Min	Max	Min	Max	Unit
t _{PLH} , t _{PHL}	Propagation Delay, (A or B or C) to Y (Fig- ures 10 and 11)	$\begin{array}{l} R_L = 1 \ k\Omega, \\ C_L = 30 \ pF \end{array}$	1.65 to 1.95	-	8.6	14.4	-	14.4	-	14.4	ns
	ules to and try	$\begin{array}{l} R_{L} = 500 \ \Omega, \\ CL = 30 \ pF \end{array}$	2.3 to 2.7	-	5.1	8.3	-	8.3	-	8.3	
		$R_L = 500 \Omega,$ $C_L = 50 pF$	3.0 to 3.6	-	3.9	6.3	-	6.3	-	6.3	
		0 _L = 50 pF	4.5 to 5.5	-	3.3	5.1	-	5.1	-	5.1	

CAPACITIVE CHARACTERISTICS

Symbol	Parameter	Condition	Typical	Unit
C _{IN}	Input Capacitance	V_{CC} = 5.5 V, V_{IN} = 0 V or V_{CC}	2.5	pF
C _{OUT}	Output Capacitance	V_{CC} = 5.5 V, V_{IN} = 0 V or V_{CC}	4.0	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} = 5.0 V, V_{IN} = 0 V or V_{CC}	16 19.5	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: $I_{CC(OPR)} = C_{PD} \bullet V_{CC} \bullet f_{in} + I_{CC}$. C_{PD} is used to determine the no-load dynamic power consumption; $P_D = C_{PD} \bullet V_{CC}^2 \bullet f_{in} + I_{CC} \bullet V_{CC}$.

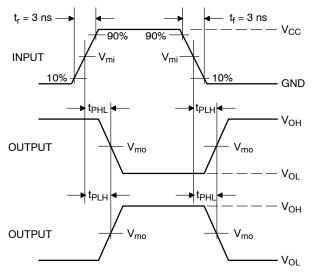


Switch Position	C _L , pF	R_{L}, Ω	R ₁ , Ω	
Open	See AC Characteristics Table			
$2 \times V_{CC}$	50	500	500	
GND	50	500	500	
	Position Open 2 x V _{CC}	Position See AC Character Open See AC Character 2 x V _{CC} 50	Position Image: Constraint of the set of the se	

X = Don't Care

 C_L includes probe and jig capacitance R_T is Z_{OUT} of pulse generator (typically 50 $\Omega)$ f = 1 MHz

Figure 10. Test Circuit



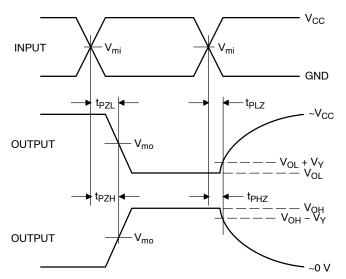


Figure 11. Switching Waveforms

		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

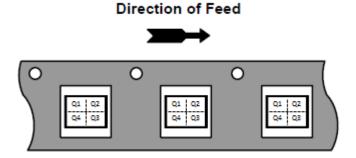
ORDERING INFORMATION

Device	Package	Specific Device Code	Pin 1 Orientation (See below)	Shipping [†]
NL7SZ57DFT2G	SC-88 (Pb-Free)	MN	Q4	3000 / Tape & Reel
NL7SZ57DFT2G-Q*	SC-88 (Pb-Free)	MN	Q4	3000 / Tape & Reel
NL7SZ57DBVT1G	SC-74 (Pb-Free)	AL	Q4	3000 / Tape & Reel
NL7SZ57MU1TCG (Contact onsemi)	UDFN6, 1.45 x 1.0, 0.5P (Pb-Free)	TBD	Q4	3000 / Tape & Reel
NL7SZ57MU3TCG (Contact onsemi)	UDFN6, 1.0 x 1.0, 0.35P (Pb-Free)	P (Rotated 270° CW)	Q4	3000 / Tape & Reel

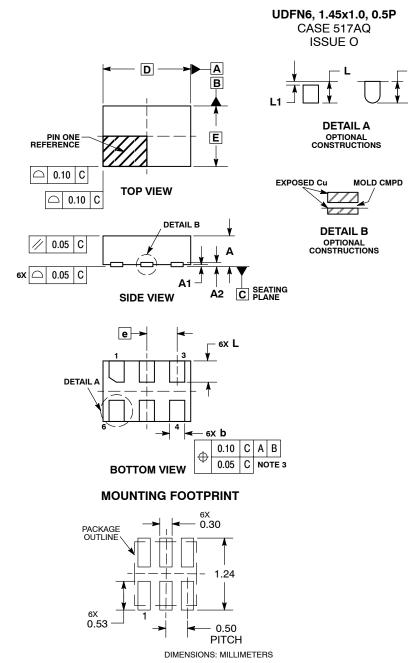
+For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.
 *-Q Suffix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP

Capable.

Pin 1 Orientation in Tape and Reel



PACKAGE DIMENSIONS



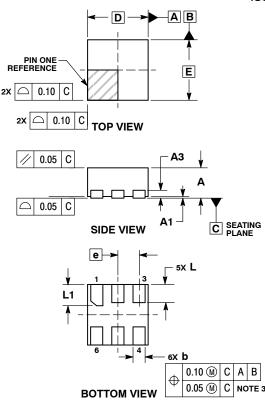
*For additional information on our Pb-Free strategy and soldering details, please download the onsemi Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

- NOTES:
 DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
 CONTROLLING DIMENSION: MILLIMETERS.
 DIMENSION & APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30 mm FROM THE TERMINAL TIP.

	MILLIM	ETERS			
DIM	MIN	MAX			
Α	0.45	0.55			
A1	0.00	0.05			
A2	0.07	REF			
b	0.20	0.30			
D	1.45	BSC			
Е	1.00	BSC			
е	0.50 BSC				
L	0.30	0.40			
L1		0.15			

PACKAGE DIMENSIONS

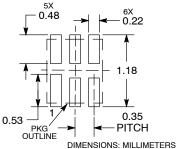
UDFN6, 1x1, 0.35P CASE 517BX **ISSUE O**



- NOTES: 1. DIMENSIONING AND TOLERANCING PER
- DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994. CONTROLLING DIMENSION: MILLIMETERS. DIMENSION & APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.20 MM FROM TERMINAL TIP. PACKAGE DIMENSIONS EXCLUSIVE OF BURRS AND MOLD FLASH. 2 3

	MILLIMETERS				
DIM	MIN	MAX			
Α	0.45	0.55			
A1	0.00	0.05			
A3	0.13	REF			
b	0.12	0.22			
D	1.00	BSC			
E	1.00	BSC			
е	0.35 BSC				
L	0.25	0.35			
L1	0.30	0.40			

RECOMMENDED **SOLDERING FOOTPRINT***



*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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Email Requests to: orderlit@onsemi.com

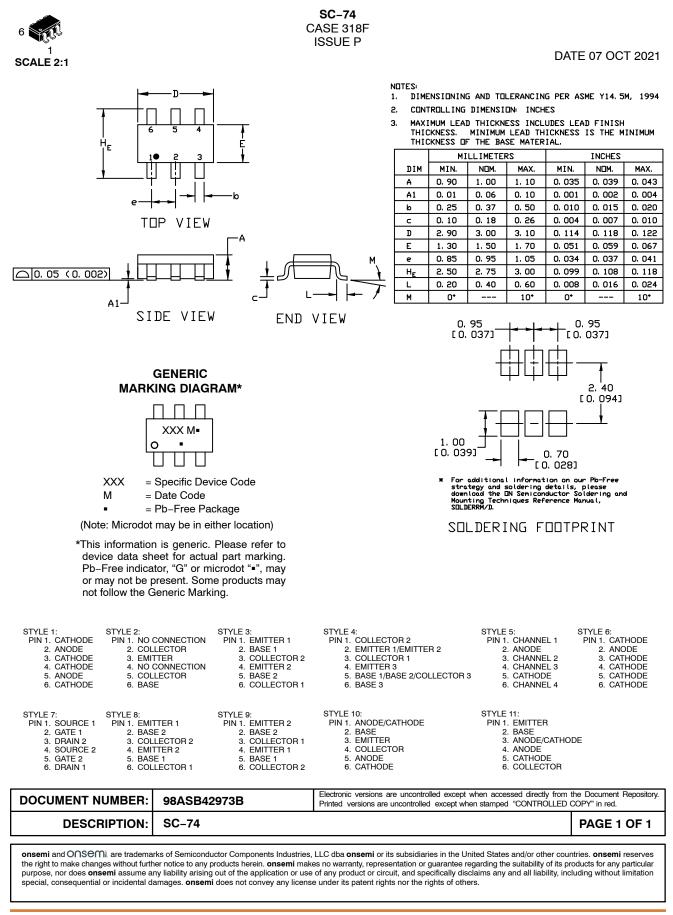
TECHNICAL SUPPORT

onsemi Website: www.onsemi.com

North American Technical Support: Voice Mail: 1 800–282–9855 Toll Free USA/Canada Phone: 011 421 33 790 2910

Europe, Middle East and Africa Technical Support: Phone: 00421 33 790 2910 For additional information, please contact your local Sales Representative

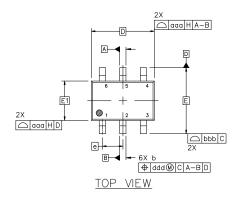
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semi

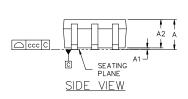
SC-88 2.00x1.25x0.90, 0.65P CASE 419B-02 **ISSUE Z**

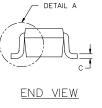
DATE 18 APR 2024

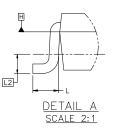


NOTES:

- DIMENSIONING AND TOLERANCING CONFORM TO ASME 1. Y14.5-2018.
- 2.
- ALL DIMENSION ARE IN MILLIMETERS. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.20 3. PER END.
- 4. DIMENSIONS D AND E1 AT THE OUTERMOST EXTREMES OF DATUMS A AND B ARE DETERMINED AT DATUM H.
- 5.
- DIMENSIONS & AND C APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN 0.08 AND 0.15 FROM THE TIP. 6.
- DIMENSION & DOES NOT INCLUDE DAMBAR PROTRUSION. 7 ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 TOTAL IN EXCESS OF DIMENSION & AT MAXIMUM MATERIAL CONDITION. THE DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OF THE FOOT.







	MILLIMETERS		
DIM	MIN.	NOM.	MAX.
A			1.10
A1	0.00		0.10
A2	0.70	0.90	1.00
b	0.15	0.20	0.25
с	0.08	0.15	0.22
D	2.00 BSC		
E	2.10 BSC		
E1	1.25 BSC		
е	0.65 BSC		
L	0.26	0.36	0.46
L2	0.15 BSC		
aaa	0.15		
bbb	0.30		
ccc	0.10		
ddd	0.10		

6X 0.66 6X 0.30-2.50 0.65 PITCH

RECOMMENDED MOUNTING FOOTPRINT*

FOR ADDITIONAL INFORMATION ON OUR Pb-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ONSEMI SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERRM/D.

XXXM. . 0

GENERIC **MARKING DIAGRAM***

6

Μ

XXX = Specific Device 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.

*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.

STYLES ON PAGE 2

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SC-88 2.00x1.25x0.90, 0.65P CASE 419B-02 ISSUE Z

DATE 18 APR 2024

STYLE 1: PIN 1. EMITTER 2 2. BASE 2 3. COLLECTOR 1 4. EMITTER 1 5. BASE 1 6. COLLECTOR 2	STYLE 2: CANCELLED	STYLE 3: CANCELLED	STYLE 4: PIN 1. CATHODE 2. CATHODE 3. COLLECTOR 4. EMITTER 5. BASE 6. ANODE	STYLE 5: PIN 1. ANODE 2. ANODE 3. COLLECTOR 4. EMITTER 5. BASE 6. CATHODE	STYLE 6: PIN 1. ANODE 2 2. N/C 3. CATHODE 1 4. ANODE 1 5. N/C 6. CATHODE 2
STYLE 7: PIN 1. SOURCE 2 2. DRAIN 2 3. GATE 1 4. SOURCE 1 5. DRAIN 1 6. GATE 2	STYLE 8: CANCELLED	STYLE 9: PIN 1. EMITTER 2 2. EMITTER 1 3. COLLECTOR 1 4. BASE 1 5. BASE 2 6. COLLECTOR 2	STYLE 10: PIN 1. SOURCE 2 2. SOURCE 1 3. GATE 1 4. DRAIN 1 5. DRAIN 2 6. GATE 2	STYLE 11: PIN 1. CATHODE 2 2. CATHODE 2 3. ANODE 1 4. CATHODE 1 5. CATHODE 1 6. ANODE 2	STYLE 12: PIN 1. ANODE 2 2. ANODE 2 3. CATHODE 1 4. ANODE 1 5. ANODE 1 6. CATHODE 2
STYLE 13:	STYLE 14:	STYLE 15:	STYLE 16:	STYLE 17:	STYLE 18:
PIN 1. ANODE	PIN 1. VREF	PIN 1. ANODE 1	PIN 1. BASE 1	PIN 1. BASE 1	PIN 1. VIN1
2. N/C	2. GND	2. ANODE 2	2. EMITTER 2	2. EMITTER 1	2. VCC
3. COLLECTOR	3. GND	3. ANODE 3	3. COLLECTOR 2	3. COLLECTOR 2	3. VOUT2
4. EMITTER	4. IOUT	4. CATHODE 3	4. BASE 2	4. BASE 2	4. VIN2
5. BASE	5. VEN	5. CATHODE 2	5. EMITTER 1	5. EMITTER 2	5. GND
6. CATHODE	6. VCC	6. CATHODE 1	6. COLLECTOR 1	6. COLLECTOR 1	6. VOUT1
STYLE 19:	STYLE 20:	STYLE 21:	STYLE 22:	STYLE 23:	STYLE 24:
PIN 1. I OUT	PIN 1. COLLECTOR	PIN 1. ANODE 1	PIN 1. D1 (i)	PIN 1. Vn	PIN 1. CATHODE
2. GND	2. COLLECTOR	2. N/C	2. GND	2. CH1	2. ANODE
3. GND	3. BASE	3. ANODE 2	3. D2 (i)	3. Vp	3. CATHODE
4. V CC	4. EMITTER	4. CATHODE 2	4. D2 (c)	4. N/C	4. CATHODE
5. V EN	5. COLLECTOR	5. N/C	5. VBUS	5. CH2	5. CATHODE
6. V REF	6. COLLECTOR	6. CATHODE 1	6. D1 (c)	6. N/C	6. CATHODE
STYLE 25:	STYLE 26:	STYLE 27:	STYLE 28:	STYLE 29:	STYLE 30:
PIN 1. BASE 1	PIN 1. SOURCE 1	PIN 1. BASE 2	PIN 1. DRAIN	PIN 1. ANODE	PIN 1. SOURCE 1
2. CATHODE	2. GATE 1	2. BASE 1	2. DRAIN	2. ANODE	2. DRAIN 2
3. COLLECTOR 2	3. DRAIN 2	3. COLLECTOR 1	3. GATE	3. COLLECTOR	3. DRAIN 2
4. BASE 2	4. SOURCE 2	4. EMITTER 1	4. SOURCE	4. EMITTER	4. SOURCE 2
5. EMITTER	5. GATE 2	5. EMITTER 2	5. DRAIN	5. BASE/ANODE	5. GATE 1
6. COLLECTOR 1	6. DRAIN 1	6. COLLECTOR 2	6. DRAIN	6. CATHODE	6. DRAIN 1

Note: Please refer to datasheet for style callout. If style type is not called out in the datasheet refer to the device datasheet pinout or pin assignment.

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