

# TinyLogic UHS 2-Input Non-Inverting Multiplexer

## **NC7SZ157**

#### **Description**

The NC7SZ157 is a single, high performance, 2–to–1 CMOS non–inverting multiplexer from **onsemi**'s Ultra–High Speed series of TinyLogic. The device is fabricated with advanced CMOS technology to achieve ultra high speed with high output drive while maintaining low static power dissipation over a broad  $V_{CC}$  operating range. The device is specified to operate over the 1.65 V to 5.5 V  $V_{CC}$  operating range. The inputs and outputs are high impedance when  $V_{CC}$  is 0 V. Inputs tolerate voltages up to 5.5 V independent of  $V_{CC}$  operating range.

#### **Features**

- Broad V<sub>CC</sub> Operating Range: 1.65 V to 5.5 V
- Ultra High-Speed
- Power Down High-Impedance Inputs / Outputs
- Over-Voltage Tolerance Inputs Facilitate 5 V to 3 V Translation
- Proprietary Noise / EMI Reduction Circuitry
- Ultra-Small MicroPak<sup>TM</sup> Packages
- Space-Saving SC-88 Package
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

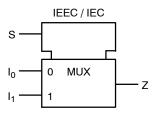
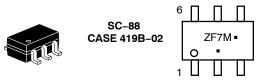


Figure 1. Logic Symbol

#### MARKING DIAGRAMS







B9, ZF7 = Specific Device Code

KK = 2-Digit Lot Run Traceability Code XY = 2-Digit Date Code Format Z = Assembly Plant Code

M = 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 6 of this data sheet.

## **Pin Configurations**

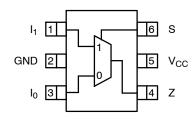


Figure 2. SC-88 (Top View)

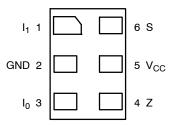
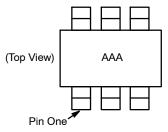


Figure 3. MicroPak (Top Through View)



#### NOTES:

- AAA represents product code top mark (see Ordering Information).
   Orientation of top mark determines pin one location.
   Reading the top mark left to right, pin one is the lower left pin.

Figure 4. Pin 1 Orientation

#### **PIN DEFINITIONS**

Pin # SC-88	Pin # MicroPak	Name	Description
1	1	I <sub>1</sub>	Data Input
2	2	GND	Ground
3	3	l <sub>0</sub>	Data Input
4	4	Z	Output
5	5	V <sub>CC</sub>	Supply Voltage
6	6	S	Control Input

#### **FUNCTION TABLE**

	Inputs		Output
S	I <sub>1</sub>	I <sub>0</sub>	$Z = (I_0) \cdot (\overline{S}) + (I_1) \cdot (S)$
L	Х	L	L
L	X	Н	Н
Н	L	Х	L
Н	Н	Х	Н

H = HIGH Logic Level L = LOW Logic Level X = Don't Care

#### **NC7SZ157**

#### **ABSOLUTE MAXIMUM RATINGS**

Symbol	Paramete	Min	Max	Unit	
V <sub>CC</sub>	Supply Voltage		-0.5	6.5	V
V <sub>IN</sub>	DC Input Voltage		-0.5	6.5	V
V <sub>OUT</sub>	DC Output Voltage		-0.5	6.5	V
I <sub>IK</sub>	DC Input Diode Current	V <sub>IN</sub> < 0 V	-	-50	mA
I <sub>OK</sub>	DC Output Diode Current	V <sub>OUT</sub> < 0 V	-	-50	mA
I <sub>OUT</sub>	DC Output Current	-	±50	mA	
I <sub>CC</sub> or I <sub>GND</sub>	DC V <sub>CC</sub> or Ground Current	-	±50	mA	
T <sub>STG</sub>	Storage Temperature Range	Storage Temperature Range			°C
TJ	Junction Temperature Under Bias		-	+150	°C
T <sub>L</sub>	Junction Lead Temperature (Solderin	g, 10 Seconds)	-	+260	°C
$P_{D}$	Power Dissipation in Still Air	SC-88	-	332	mW
		MicroPak-6	-	812	
		MicroPak2™-6	-	812	
ESD	Human Body Model, JEDEC: JESD22-A114		-	4000	V
	Charge Device Model, JEDEC: JESE	)22-C101	-	2000	

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.

#### **RECOMMENDED OPERATING CONDITIONS**

Symbol	Parameter	Conditions	Min	Max	Unit
V <sub>CC</sub>	Supply Voltage Operating		1.65	5.5	٧
	Supply Voltage Data Retention		1.50	5.5	1
V <sub>IN</sub>	Input Voltage		0	5.5	V
V <sub>OUT</sub>	Output Voltage		0	V <sub>CC</sub>	V
T <sub>A</sub>	Operating Temperature		-40	+85	°C
t <sub>r</sub> , t <sub>f</sub>	Input Rise and Fall Times	$V_{CC}$ at 1.8 V $\pm$ 0.15 V, 2.5 V $\pm$ 0.2 V	0	20	ns/V
		V <sub>CC</sub> at 3.3 V ±0.3 V	0	10	
		V <sub>CC</sub> at 5.0 V ±0.5 V	0	5	
$\theta_{\sf JA}$	Thermal Resistance	SC-88	-	377	°C/W
		MicroPak-6	-	154	
		MicroPak2-6	-	154	°C/W

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.

## NC7SZ157

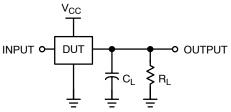
#### DC ELECTRICAL CHARACTERISTICS

				T,	$T_A = +25^{\circ}C$			T <sub>A</sub> = -40 to +85°C							
Symbol	Parameter	V <sub>CC</sub> (V)	C	onditions	Min	Тур	Max	Min	Max	Unit					
V <sub>IH</sub>	HIGH Level	1.65 to 1.95			0.65 V <sub>CC</sub>	-	-	0.65 V <sub>CC</sub>	-	V					
	Input Voltage	2.30 to 5.50			0.70 V <sub>CC</sub>	-	-	0.70 V <sub>CC</sub>	-						
V <sub>IL</sub>	LOW Level	1.65 to 1.95			-	-	0.35 V <sub>CC</sub>	-	0.35 V <sub>CC</sub>	V					
	Input Voltage	2.30 to 5.50			-	-	0.30 V <sub>CC</sub>	-	0.30 V <sub>CC</sub>						
V <sub>OH</sub>	HIGH Level	1.65	V <sub>IN</sub> = V <sub>IH</sub>	I <sub>OH</sub> = -100 μA	1.55	1.65	-	1.55	-	V					
	Output Voltage	2.30	or V <sub>IL</sub>		2.20	2.30	-	2.20	-						
		3.00			2.90	3.00	-	2.90	-						
		4.50			4.40	4.50	-	4.40	-						
		1.65		I <sub>OH</sub> = -4 mA	1.29	1.52	-	1.29	-						
		2.30		I <sub>OH</sub> = -8 mA	1.90	2.15	-	1.90	-						
		3.00		I <sub>OH</sub> = -16 mA	2.40	2.80	-	2.40	-						
		3.00		I <sub>OH</sub> = -24 mA	2.30	3.68	-	2.30	-						
	4.50	4.50		I <sub>OH</sub> = -32 mA	3.90	4.20	-	3.80	-						
V <sub>OL</sub>	LOW Level	1.65	V <sub>IN</sub> = V <sub>IH</sub>	I <sub>OL</sub> = 100 μA	-	0	0.10	-	0.10	٧					
	Output Voltage	2.30	or V <sub>IL</sub>	or V <sub>IL</sub>		_	0	0.10	-	0.10					
		3.00				-	0	0.10	-	0.10					
		4.50										-	0	0.10	-
		1.65		I <sub>OL</sub> = 4 mA	-	0.08	0.24	-	0.24						
		2.30		I <sub>OL</sub> = 8 mA	-	0.10	0.30	-	0.30						
		3.00		I <sub>OL</sub> = 16 mA	-	0.15	0.40	-	0.40						
		3.00		I <sub>OL</sub> = 24 mA	-	0.22	0.55	-	0.55						
		4.50		I <sub>OL</sub> = 32 mA	-	0.22	0.55	-	0.55						
I <sub>IN</sub>	Input Leakage Current	1.65 to 5.5		V <sub>IN</sub> = 5.5 V, GND	-	-	±0.1	-	±1	μΑ					
I <sub>OFF</sub>	Power Off Leakage Current	0		V <sub>IN</sub> or V <sub>OUT</sub> = 5.5 V	-	-	1.0	-	10	μΑ					
I <sub>CC</sub>	Quiescent Supply Current	1.65 to 5.50		V <sub>IN</sub> = 5.5 V, GND	_	-	1.0	-	10	μΑ					

#### **AC ELECTRICAL CHARACTERISTICS**

				-	T <sub>A</sub> = +25°C	;	T <sub>A</sub> = -40	to +85°C	
Symbol	Parameter	V <sub>CC</sub> (V)	Conditions	Min	Тур	Max	Min	Max	Unit
t <sub>PLH</sub> , t <sub>PHL</sub>	Propagation Delay S to Z	1.80 ±0.15	C <sub>L</sub> = 15 pF,	-	6.0	11.5	-	12.0	ns
	(Figure 5, 6)	2.50 ±0.20	$R_L = 1 M\Omega$ ,	-	3.5	6.1	_	6.5	
		3.30 ±0.30		-	2.6	4.1	-	4.5	
		5.00 ±0.50		-	1.9	3.2	_	3.5	
	Propagation Delay I <sub>n</sub> to Z	1.80 ±0.15	C <sub>L</sub> = 15 pF,	-	5.9	10.0	-	10.5	
	(Figure 5, 6)	5.00 ±0.50	$R_L = 1M\Omega$ ,	-	3.5	5.8	-	6.1	
		3.30 ±0.30		-	2.6	3.9	_	4.2	
		5.00 ±0.50		-	1.9	3.1	_	3.3	
	Propagation Delay S to Z	3.30 ±0.30	C <sub>L</sub> = 50 pF,	-	3.2	4.8	_	5.2	
	(Figure 5, 6)	5.00 ±0.50	$R_L = 500 \Omega$ ,	-	2.4	3.8	_	4.1	
	Propagation Delay I <sub>n</sub> to Z	3.30 ±0.30	C <sub>L</sub> = 50 pF,	-	3.2	4.6	<u> </u>	5.0	
(Figure 5, 6)		5.00 ±0.50	$R_L = 500 \Omega$ ,	-	2.4	3.7	<u> </u>	4.0	
C <sub>IN</sub>	Input Capacitance	0.00		-	2	-	_	_	pF
C <sub>PD</sub>	C <sub>PD</sub> Power Dissipation Capacitance			-	14	-	<u> </u>	_	pF
	(Note 4) (Figure 7)	5.00		-	17	-	_	-	

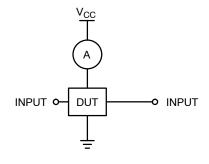
C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is derived from dynamic operating current consumption (I<sub>CCD</sub>) at no output loading and operating at 50% duty cycle. C<sub>PD</sub> is related to I<sub>CCD</sub> dynamic operating current by the expression:
 I<sub>CCD</sub> = (C<sub>PD</sub>) (V<sub>CC</sub>) (f<sub>IN</sub>) + (I<sub>CC</sub>static).



#### NOTE:

5.  $C_L$  includes load and stray capacitance; inputs PRR = 1.0 MHz,  $t_W$  = 500 ns.

Figure 5. AC Test Circuit



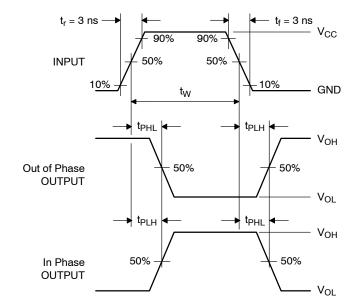


Figure 6. AC Waveforms

#### NOTE:

6. Input = AC Waveform; PRR = Variable; Duty Cycle = 50%.

Figure 7. I<sub>CCD</sub> Test Circuit

#### **NC7SZ157**

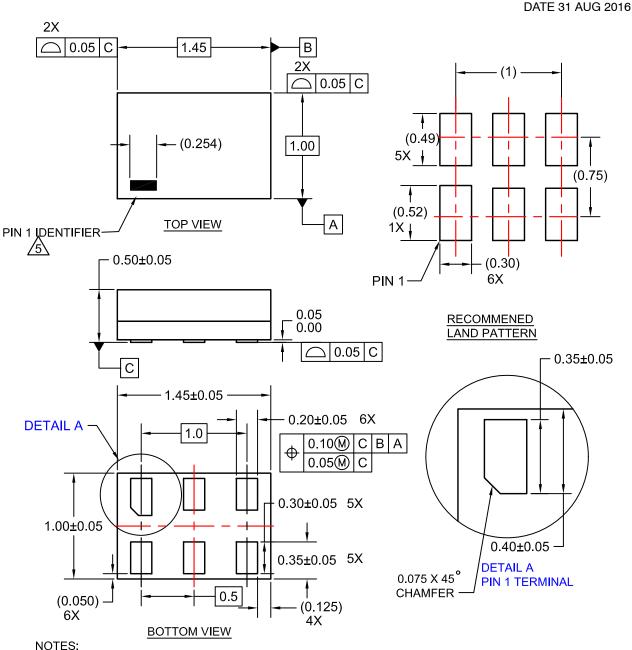
#### **DEVICE ORDERING INFORMATION**

Device	Top Mark	Packages	Shipping <sup>†</sup>
NC7SZ157P6X	ZF7	6-Lead SC70, EIAJ SC-88, 1.25 mm Wide	3000 / Tape & Reel
NC7SZ157P6X-L22347	ZF7	6-Lead SC70, EIAJ SC-88, 1.25 mm Wide	3000 / Tape & Reel
NC7SZ157L6X	В9	6-Lead MicroPak, 1.00 mm Wide	5000 / Tape & Reel
NC7SZ157L6X-L22175	В9	6-Lead MicroPak, 1.00 mm Wide	5000 / Tape & Reel
NC7SZ157FHX	В9	6-Lead, MicroPak2, 1x1 mm Body, .35 mm Pitch	5000 / Tape & Reel
NC7SZ157FHX-L22175	В9	6-Lead, MicroPak2, 1x1 mm Body, .35 mm Pitch	5000 / 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.

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- 1. CONFORMS TO JEDEC STANDARD MO-252 VARIATION UAAD
- 2. DIMENSIONS ARE IN MILLIMETERS
- 3. DRAWING CONFORMS TO ASME Y14.5M-2009
  4. PIN ONE IDENTIFIER IS 2X LENGTH OF ANY

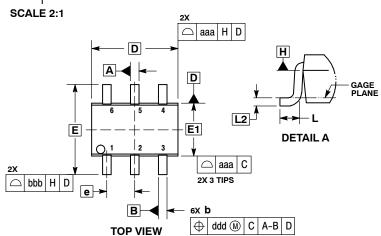
  - OTHER LINE IN THE MARK CODE LAYOUT.

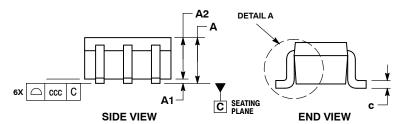
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#### SC-88/SC70-6/SOT-363 CASE 419B-02 **ISSUE Y**

**DATE 11 DEC 2012** 





## NOTES:

- DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
   CONTROLLING DIMENSION: MILLIMETERS
- CONTROLLING DIMENSION: MILLIMETERS.
  DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.20 PER END. DIMENSIONS D AND E1 AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY AND DATUM H. DATUMS A AND B ARE DETERMINED AT DATUM H. DIMENSIONS b AND c APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN 0.08 AND 0.15 FROM THE TIP.

- DIMENSION & DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 TOTAL IN EXCESS OF DIMENSION 6 AT MAXIMUM MATERIAL CONDITION. THE DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OF THE FOOT.

	MIL	LIMETE	RS		INCHES	3
DIM	MIN	NOM	MAX	MIN	NOM	MAX
Α			1.10			0.043
A1	0.00		0.10	0.000		0.004
A2	0.70	0.90	1.00	0.027	0.035	0.039
b	0.15	0.20	0.25	0.006	0.008	0.010
С	0.08	0.15	0.22	0.003	0.006	0.009
D	1.80	2.00	2.20	0.070	0.078	0.086
Е	2.00	2.10	2.20	0.078	0.082	0.086
E1	1.15	1.25	1.35	0.045	0.049	0.053
е		0.65 BS	С	0	.026 BS	С
L	0.26	0.36	0.46	0.010	0.014	0.018
L2		0.15 BS	C		0.006 BS	SC
aaa	0.15				0.006	
bbb	0.30				0.012	
ccc		0.10			0.004	
ddd		0.10			0.004	

#### **GENERIC MARKING DIAGRAM\***



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.

#### **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.

#### **STYLES ON PAGE 2**

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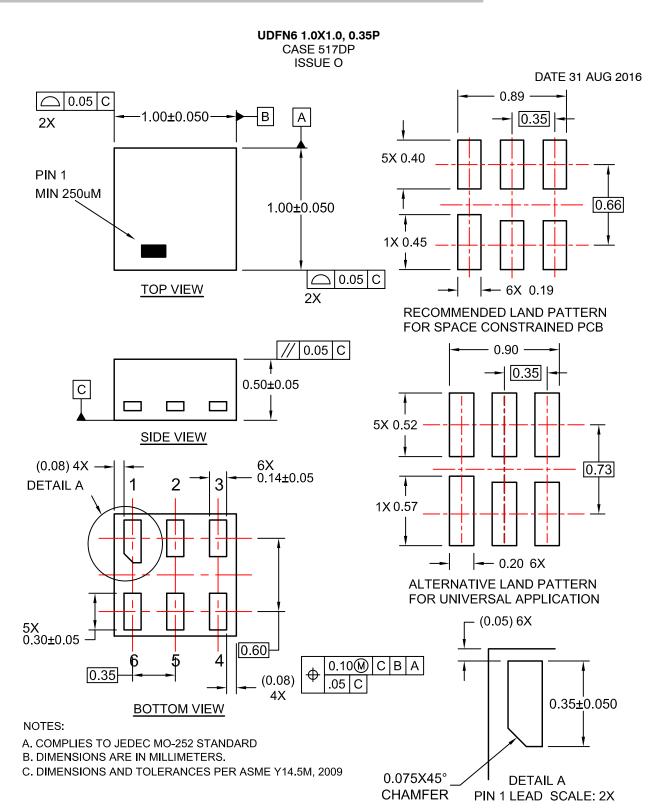
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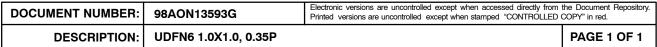
STYLE 1: PIN 1. EMITTER 2 2. BASE 2 3. COLLECTOR 1 4. EMITTER 1 5. BASE 1 6. COLLECTOR 2	STYLE 2: CANCELLED	STYLE 3: CANCELLED	STYLE 4: PIN 1. CATHODE 2. CATHODE 3. COLLECTOR 4. EMITTER 5. BASE 6. ANODE	STYLE 5: PIN 1. ANODE 2. ANODE 3. COLLECTOR 4. EMITTER 5. BASE 6. CATHODE	STYLE 6: PIN 1. ANODE 2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