

# NSS20200W6

## 20 V, 3.0 A, Low $V_{CE(sat)}$ PNP Transistor

ON Semiconductor's e<sup>2</sup>PowerEdge family of low  $V_{CE(sat)}$  transistors are miniature surface mount devices featuring ultra low saturation voltage ( $V_{CE(sat)}$ ) and high current gain capability. These are designed for use in low voltage, high speed switching applications where affordable efficient energy control is important.

Typical applications are DC-DC converters and power management in portable and battery powered products such as cellular and cordless phones, PDAs, computers, printers, digital cameras and MP3 players. Other applications are low voltage motor controls in mass storage products such as disc drives and tape drives. In the automotive industry they can be used in air bag deployment and in the instrument cluster. The high current gain allows e<sup>2</sup>PowerEdge devices to be driven directly from PMU's control outputs, and the Linear Gain (Beta) makes them ideal components in analog amplifiers.

- This is a Pb-Free Device

### MAXIMUM RATINGS ( $T_A = 25^\circ\text{C}$ )

Rating	Symbol	Max	Unit
Collector-Emitter Voltage	$V_{CEO}$	-20	Vdc
Collector-Base Voltage	$V_{CBO}$	-20	Vdc
Emitter-Base Voltage	$V_{EBO}$	-7.0	Vdc
Collector Current - Continuous	$I_C$	-2.0	A
Collector Current - Peak	$I_{CM}$	-3.0	A

### THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Total Device Dissipation $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$ (Note 1)	426 3.4	mW mW/ $^\circ\text{C}$
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$ (Note 1)	293	$^\circ\text{C}/\text{W}$
Total Device Dissipation $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$ (Note 2)	555 4.4	mW mW/ $^\circ\text{C}$
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$ (Note 2)	225	$^\circ\text{C}/\text{W}$
Junction and Storage Temperature Range	$T_J, T_{stg}$	-55 to +150	$^\circ\text{C}$

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

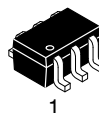
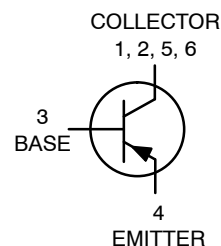
1. FR-4 @ 100 mm<sup>2</sup>, 1 oz. copper traces.
2. FR-4 @ 500 mm<sup>2</sup>, 1 oz. copper traces.



ON Semiconductor®

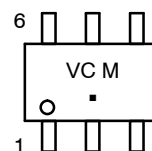
<http://onsemi.com>

**-20 VOLTS, 3.0 AMPS  
PNP LOW  $V_{CE(sat)}$  TRANSISTOR  
EQUIVALENT  $R_{DS(on)}$  65 m $\Omega$**



SC-88/SOT-363  
CASE 419B  
STYLE 20

### DEVICE MARKING



VC = Specific Device Code  
M = Date Code  
■ = Pb-Free Package

### ORDERING INFORMATION

Device	Package	Shipping†
NSS20200W6T1G	SC-88 (Pb-Free)	3000/ 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.

# NSS20200W6

## ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
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### OFF CHARACTERISTICS

Collector–Emitter Breakdown Voltage (I <sub>C</sub> = –10 mA, I <sub>B</sub> = 0)	V <sub>(BR)CEO</sub>	–20	–	–	Vdc
Collector–Base Breakdown Voltage (I <sub>C</sub> = –0.1 mA, I <sub>E</sub> = 0)	V <sub>(BR)CBO</sub>	–20	–	–	Vdc
Emitter–Base Breakdown Voltage (I <sub>E</sub> = –0.1 mA, I <sub>C</sub> = 0)	V <sub>(BR)EBO</sub>	–7.0	–	–	Vdc
Collector Cutoff Current (V <sub>CB</sub> = –20 Vdc, I <sub>E</sub> = 0)	I <sub>CBO</sub>	–	–	–0.1	μAdc
Emitter Cutoff Current (V <sub>EB</sub> = –7.0 Vdc)	I <sub>EBO</sub>	–	–	–0.1	μAdc

### ON CHARACTERISTICS

DC Current Gain (Note 3) (I <sub>C</sub> = –10 mA, V <sub>CE</sub> = –2.0 V) (I <sub>C</sub> = –500 mA, V <sub>CE</sub> = –2.0 V) (I <sub>C</sub> = –1.0 A, V <sub>CE</sub> = –2.0 V) (I <sub>C</sub> = –2.0 A, V <sub>CE</sub> = –2.0 V)	h <sub>FE</sub>	250 220 200 160	370 325 290 245	– – – –	
Collector–Emitter Saturation Voltage (Note 3) (I <sub>C</sub> = –0.1 A, I <sub>B</sub> = –0.010 A) (Note 4) (I <sub>C</sub> = –1.0 A, I <sub>B</sub> = –0.100 A) (I <sub>C</sub> = –1.0 A, I <sub>B</sub> = –0.010 A) (I <sub>C</sub> = –2.0 A, I <sub>B</sub> = –0.200 A) (I <sub>C</sub> = –2.0 A, I <sub>B</sub> = –0.020 A)	V <sub>CE(sat)</sub>	– – – – –	–0.010 –0.067 –0.102 –0.128 –0.177	–0.014 –0.092 –0.126 –0.165 –0.215	V
Base–Emitter Saturation Voltage (Note 3) (I <sub>C</sub> = –1.0 A, I <sub>B</sub> = –0.01 A)	V <sub>BE(sat)</sub>	–	–	–0.900	V
Base–Emitter Turn–on Voltage (Note 3) (I <sub>C</sub> = –1.0 A, V <sub>CE</sub> = –2.0 V)	V <sub>BE(on)</sub>	–	–	–0.900	V
Cutoff Frequency (I <sub>C</sub> = –100 mA, V <sub>CE</sub> = –5.0 V, f = 100 MHz)	f <sub>T</sub>	100	–	–	MHz
Input Capacitance (V <sub>EB</sub> = –0.5 V, f = 1.0 MHz)	C <sub>ibo</sub>	–	–	330	pF
Output Capacitance (V <sub>CB</sub> = –3.0 V, f = 1.0 MHz)	C <sub>obo</sub>	–	–	90	pF

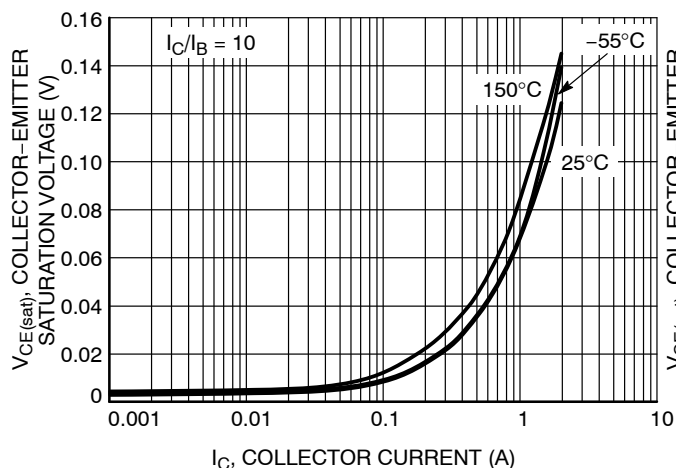
### SWITCHING CHARACTERISTICS

Delay (V <sub>CC</sub> = –10 V, I <sub>C</sub> = 750 mA, I <sub>B1</sub> = 15 mA)	t <sub>d</sub>	–	–	65	ns
Rise (V <sub>CC</sub> = –10 V, I <sub>C</sub> = 750 mA, I <sub>B1</sub> = 15 mA)	t <sub>r</sub>	–	–	100	ns
Storage (V <sub>CC</sub> = –10 V, I <sub>C</sub> = 750 mA, I <sub>B1</sub> = 15 mA)	t <sub>s</sub>	–	–	320	ns
Fall (V <sub>CC</sub> = –10 V, I <sub>C</sub> = 750 mA, I <sub>B1</sub> = 15 mA)	t <sub>f</sub>	–	–	125	ns

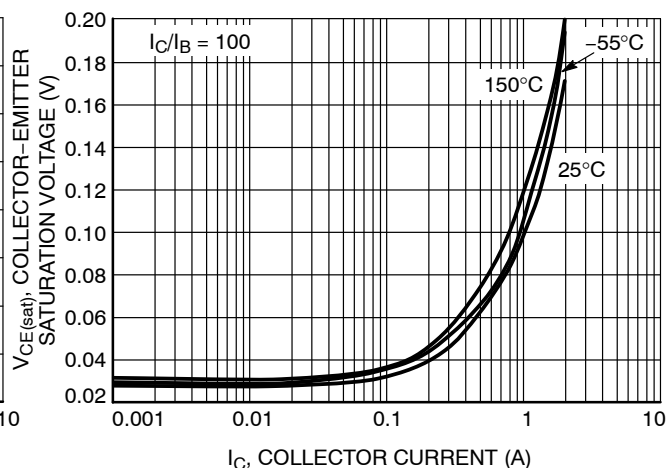
3. Pulsed Condition: Pulse Width = 300 msec, Duty Cycle ≤ 2%.

4. Guaranteed by design but not tested.

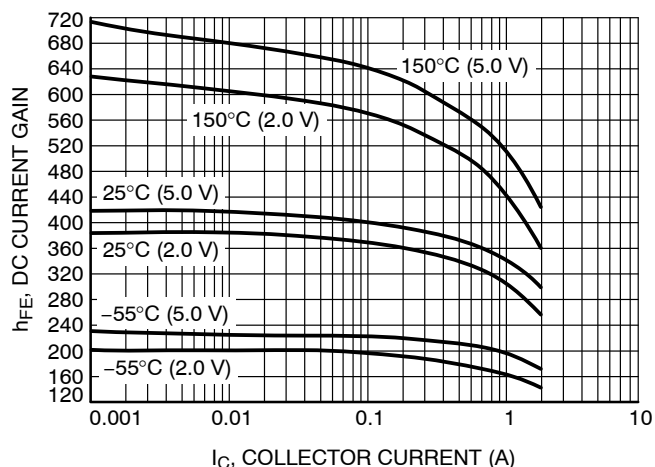
# TYPICAL CHARACTERISTICS



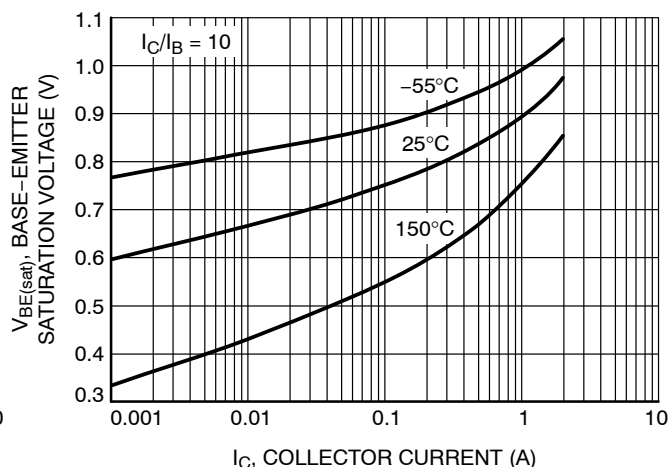
**Figure 1. Collector Emitter Saturation Voltage vs. Collector Current**



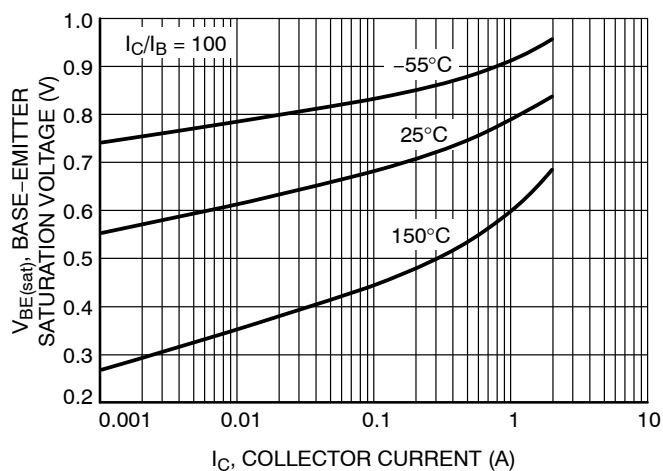
**Figure 2. Collector Emitter Saturation Voltage vs. Collector Current**



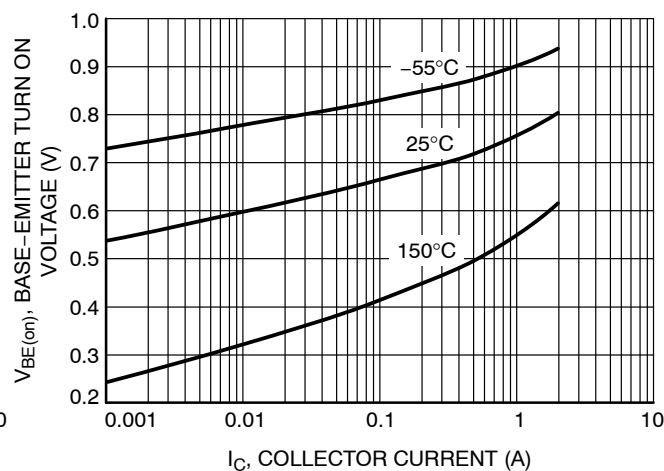
**Figure 3. DC Current Gain vs. Collector Current**



**Figure 4. Base Emitter Saturation Voltage vs. Collector Current**



**Figure 5. Base Emitter Saturation Voltage vs. Collector Current**



**Figure 6. Base Emitter Turn-On Voltage vs. Collector Current**

TYPICAL CHARACTERISTICS

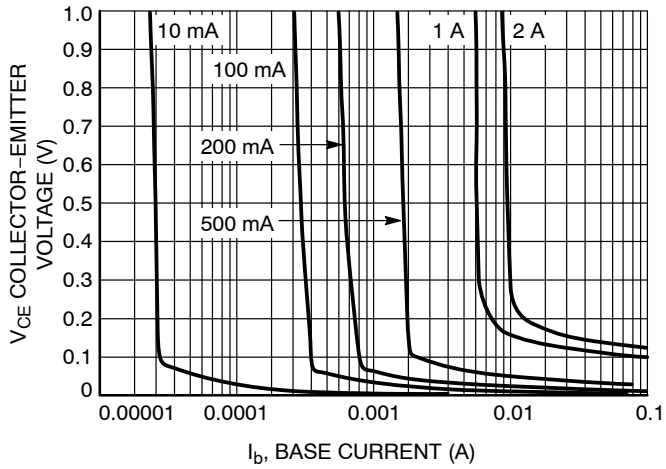


Figure 7. Saturation Region

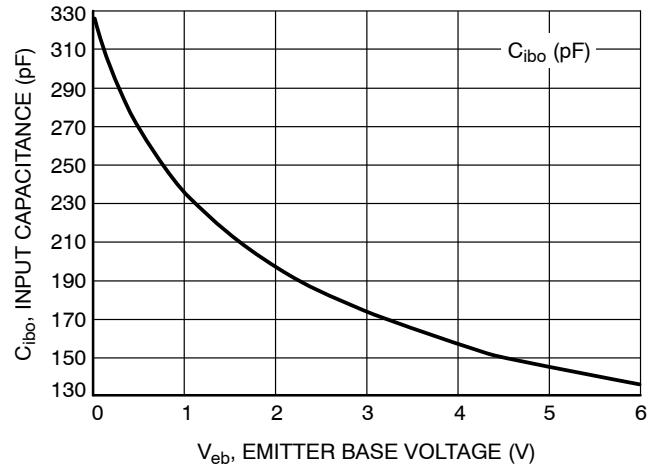


Figure 8. Input Capacitance

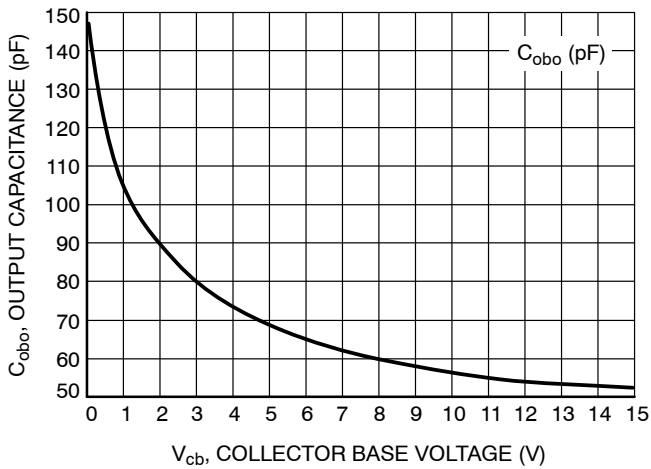


Figure 9. Output Capacitance

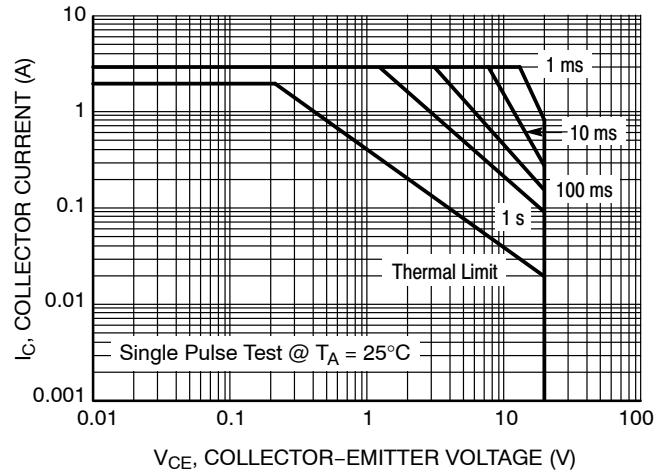


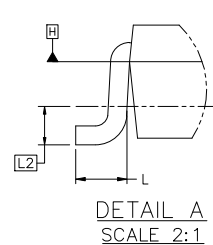
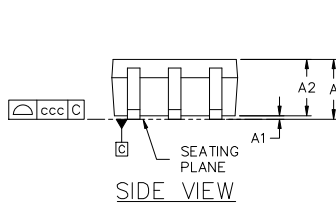
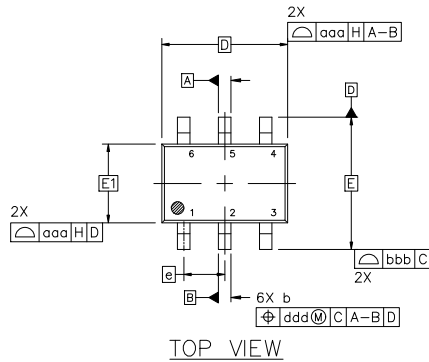
Figure 10. Safe Operating Area


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

DATE 18 APR 2024

## NOTES:

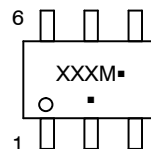
1. DIMENSIONING AND TOLERANCING CONFORM TO ASME Y14.5-2018.
2. ALL DIMENSION ARE IN MILLIMETERS.
3. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.20 PER END.
4. DIMENSIONS D AND E1 AT THE OUTERMOST EXTREMES OF THE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



DIM	MILLIMETERS		
	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
c	0.08	0.15	0.22
D	2.00 BSC		
E	2.10 BSC		
E1	1.25 BSC		
e	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		



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

**GENERIC MARKING DIAGRAM\***


XXX = Specific Device 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.

\*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: 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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