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## Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832

Email & Skype: info@chipsmall.com Web: www.chipsmall.com

Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China



# NSS2020W6

## 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	mW
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	mW
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.

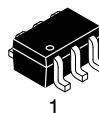
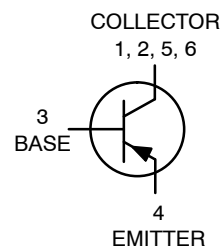
1. FR-4 @ 100 mm<sup>2</sup>, 1 oz. copper traces.
2. FR-4 @ 500 mm<sup>2</sup>, 1 oz. copper traces.



ON Semiconductor®

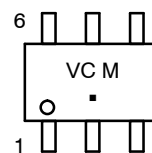
<http://onsemi.com>

**-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†
NSS2020W6T1G	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

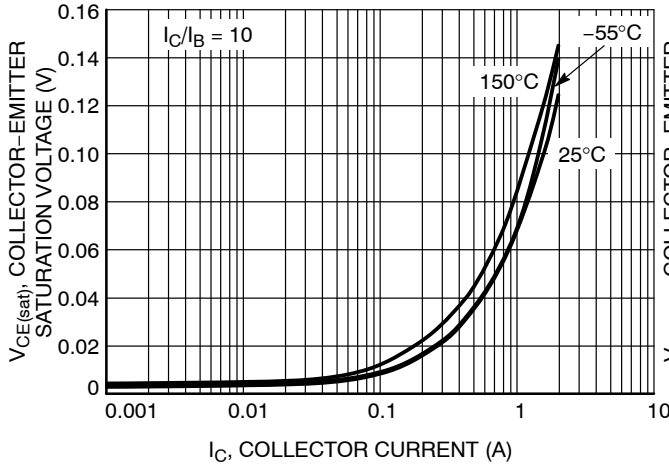


Figure 1. Collector Emitter Saturation Voltage vs. Collector Current

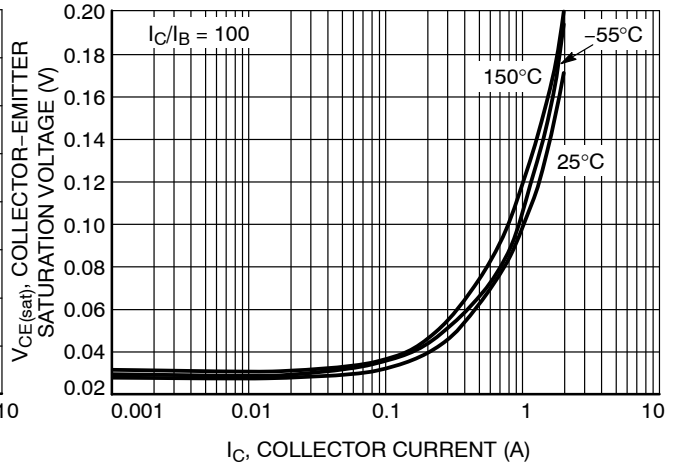


Figure 2. Collector Emitter Saturation Voltage vs. Collector Current

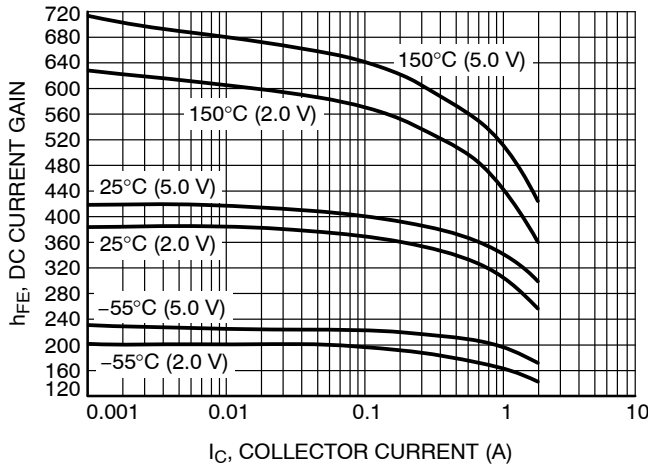


Figure 3. DC Current Gain vs. Collector Current

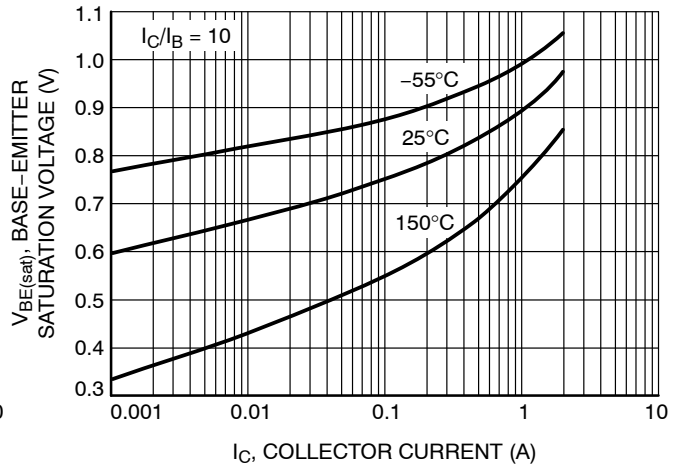


Figure 4. Base Emitter Saturation Voltage vs. Collector Current

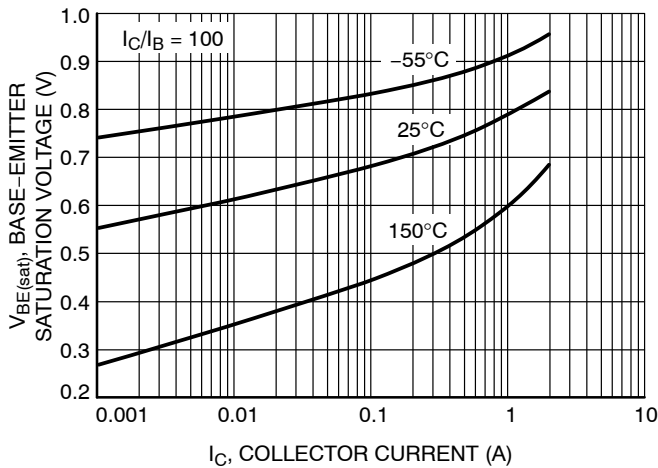


Figure 5. Base Emitter Saturation Voltage vs. Collector Current

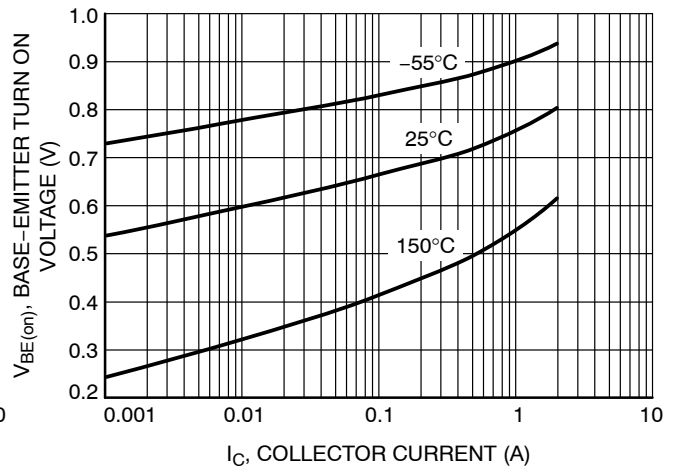


Figure 6. Base Emitter Turn-On Voltage vs. Collector Current

TYPICAL CHARACTERISTICS

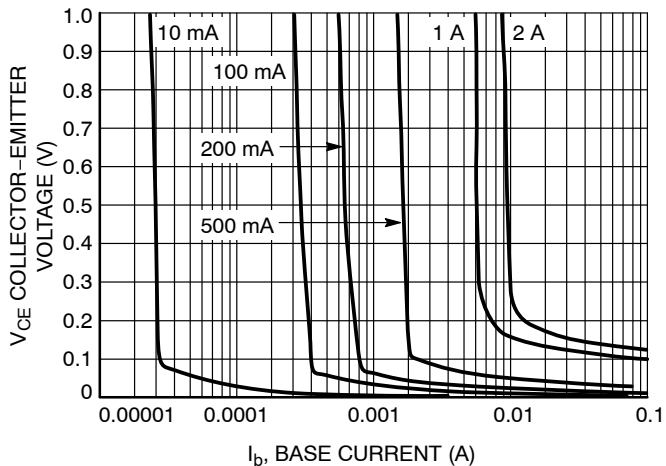


Figure 7. Saturation Region

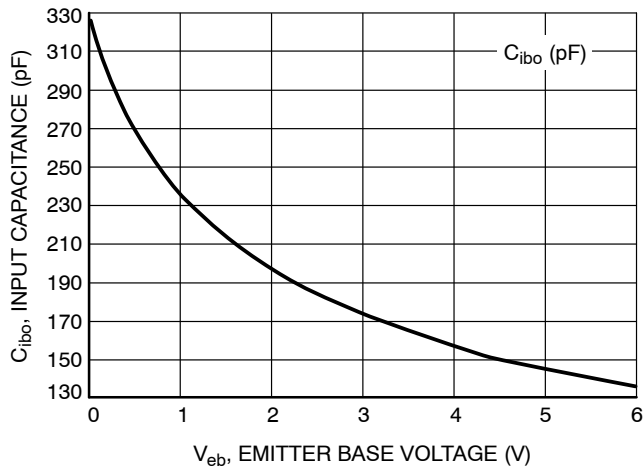


Figure 8. Input Capacitance

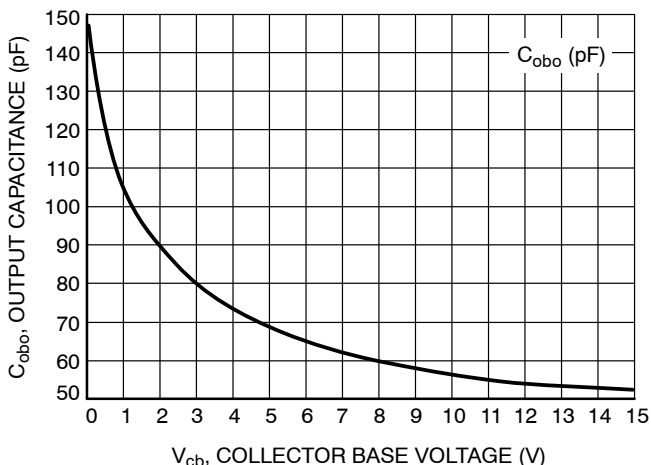


Figure 9. Output Capacitance

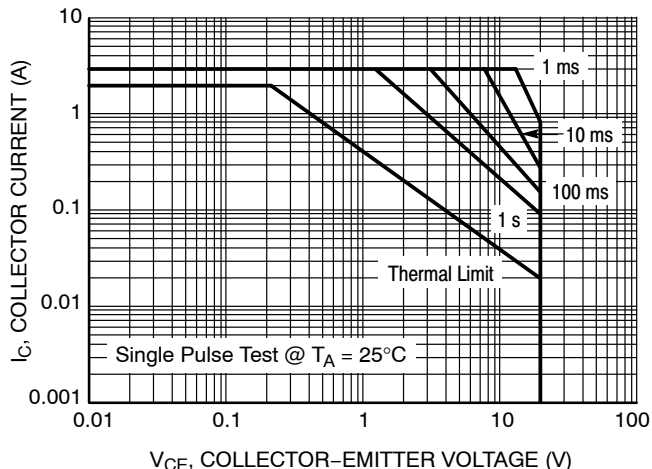
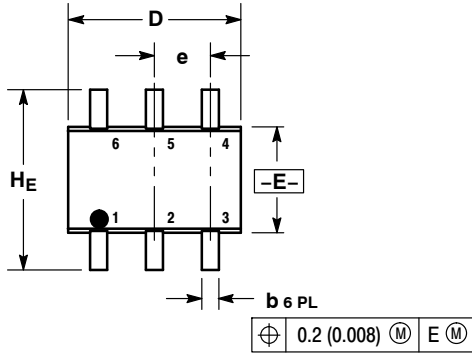


Figure 10. Safe Operating Area

# NSS2020W6

## PACKAGE DIMENSIONS

SC-88/SC70-6/SOT-363  
CASE 419B-02  
ISSUE W

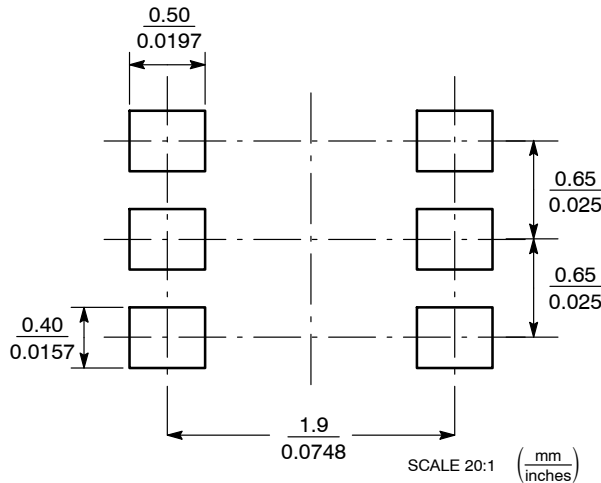


- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.
  3. 419B-01 OBSOLETE, NEW STANDARD 419B-02.

DIM	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.80	0.95	1.10	0.031	0.037	0.043
A1	0.00	0.05	0.10	0.000	0.002	0.004
A3	0.20 REF			0.008 REF		
b	0.10	0.21	0.30	0.004	0.008	0.012
C	0.10	0.14	0.25	0.004	0.005	0.010
D	1.80	2.00	2.20	0.070	0.078	0.086
E	1.15	1.25	1.35	0.045	0.049	0.053
e	0.65 BSC			0.026 BSC		
L	0.10	0.20	0.30	0.004	0.008	0.012
HE	2.00	2.10	2.20	0.078	0.082	0.086

- STYLE 20:  
PIN 1. COLLECTOR  
2. COLLECTOR  
3. BASE  
4. EMITTER  
5. COLLECTOR  
6. COLLECTOR

### 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.

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