

# NSS20200LT1G, NSV20200LT1G

## 20 V, 4.0 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.

### Features

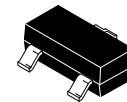
- NSV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant



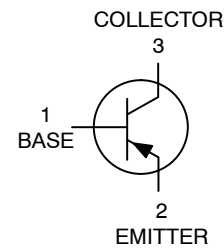
ON Semiconductor®

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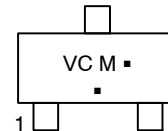
**-20 VOLTS  
4.0 AMPS  
PNP LOW  $V_{CE(sat)}$  TRANSISTOR  
EQUIVALENT  $R_{DS(on)}$  65 mΩ**



SOT-23 (TO-236)  
CASE 318  
STYLE 6



### MARKING DIAGRAM



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

(Note: Microdot may be in either location)  
\*Date Code orientation and/or overbar may vary depending upon manufacturing location.

### ORDERING INFORMATION

| Device       | Package             | Shipping†              |
|--------------|---------------------|------------------------|
| NSS20200LT1G | SOT-23<br>(Pb-Free) | 3,000 /<br>Tape & Reel |
| NSV20200LT1G | SOT-23<br>(Pb-Free) | 3,000 /<br>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.

# NSS20200LT1G, NSV20200LT1G

## 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       | $I_{CM}$  | -4.0                       | A    |
| Electrostatic Discharge        | ESD       | HBM Class 3B<br>MM Class C |      |

## THERMAL CHARACTERISTICS

| Characteristic  | Symbol                           | Max         | Unit                       |
|---|----------------------------------|-------------|----------------------------|
| Total Device Dissipation<br>$T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$ (Note 1)                   | 460<br>3.7  | mW<br>mW/ $^\circ\text{C}$ |
| Thermal Resistance,<br>Junction-to-Ambient  | $R_{\theta JA}$ (Note 1)         | 270         | $^\circ\text{C}/\text{W}$  |
| Total Device Dissipation<br>$T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$ (Note 2)                   | 540<br>4.3  | mW<br>mW/ $^\circ\text{C}$ |
| Thermal Resistance,<br>Junction-to-Ambient  | $R_{\theta JA}$ (Note 2)         | 230         | $^\circ\text{C}/\text{W}$  |
| Total Device Dissipation<br>(Single Pulse < 10 sec.)                                    | $P_{D\text{single}}$<br>(Note 3) | 710         | mW                         |
| Junction and Storage Temperature Range  | $T_J, T_{stg}$                   | -55 to +150 | $^\circ\text{C}$           |

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

# NSS20200LT1G, NSV20200LT1G

## ELECTRICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ unless otherwise noted)

| Characteristic | Symbol | Min | Typ | Max | Unit |
|----------------|--------|-----|-----|-----|------|
|----------------|--------|-----|-----|-----|------|

### OFF CHARACTERISTICS

|  |               |      |   |      |                 |
|--|---------------|------|---|------|-----------------|
| Collector - Emitter Breakdown Voltage<br>( $I_C = -10\text{ mA}$ , $I_B = 0$ ) | $V_{(BR)CEO}$ | -20  | - | -    | Vdc             |
| Collector - Base Breakdown Voltage<br>( $I_C = -0.1\text{ mA}$ , $I_E = 0$ )   | $V_{(BR)CBO}$ | -20  | - | -    | Vdc             |
| Emitter - Base Breakdown Voltage<br>( $I_E = -0.1\text{ mA}$ , $I_C = 0$ )     | $V_{(BR)EBO}$ | -7.0 | - | -    | Vdc             |
| Collector Cutoff Current<br>( $V_{CB} = -20\text{ Vdc}$ , $I_E = 0$ )          | $I_{CBO}$     | -    | - | -0.1 | $\mu\text{Adc}$ |
| Emitter Cutoff Current<br>( $V_{EB} = -7.0\text{ Vdc}$ )                       | $I_{EBO}$     | -    | - | -0.1 | $\mu\text{Adc}$ |

### ON CHARACTERISTICS

|  |               |                          |                                      |                                      |     |
|--|---------------|--------------------------|--------------------------------------|--------------------------------------|-----|
| DC Current Gain (Note 4)<br>( $I_C = -10\text{ mA}$ , $V_{CE} = -2.0\text{ V}$ )<br>( $I_C = -500\text{ mA}$ , $V_{CE} = -2.0\text{ V}$ )<br>( $I_C = -1.0\text{ A}$ , $V_{CE} = -2.0\text{ V}$ )<br>( $I_C = -2.0\text{ A}$ , $V_{CE} = -2.0\text{ V}$ )                            | $h_{FE}$      | 250<br>250<br>180<br>150 | -<br>300<br>-<br>-                   | -<br>-<br>-<br>-                     |     |
| Collector - Emitter Saturation Voltage (Note 4)<br>( $I_C = -0.1\text{ A}$ , $I_B = -0.010\text{ A}$ ) (Note 5)<br>( $I_C = -1.0\text{ A}$ , $I_B = -0.100\text{ A}$ )<br>( $I_C = -1.0\text{ A}$ , $I_B = -0.010\text{ A}$ )<br>( $I_C = -2.0\text{ A}$ , $I_B = -0.200\text{ A}$ ) | $V_{CE(sat)}$ | -<br>-<br>-<br>-         | -0.008<br>-0.065<br>-0.100<br>-0.130 | -0.013<br>-0.090<br>-0.120<br>-0.180 | V   |
| Base - Emitter Saturation Voltage (Note 4)<br>( $I_C = -1.0\text{ A}$ , $I_B = -0.01\text{ A}$ )   | $V_{BE(sat)}$ | -                        | -                                    | -0.900                               | V   |
| Base - Emitter Turn-on Voltage (Note 4)<br>( $I_C = -1.0\text{ A}$ , $V_{CE} = -2.0\text{ V}$ )  | $V_{BE(on)}$  | -                        | -                                    | -0.900                               | V   |
| Cutoff Frequency<br>( $I_C = -100\text{ mA}$ , $V_{CE} = -5.0\text{ V}$ , $f = 100\text{ MHz}$ )   | $f_T$         | 100                      | -                                    | -                                    | MHz |
| Input Capacitance ( $V_{EB} = 0.5\text{ V}$ , $f = 1.0\text{ MHz}$ )   | $C_{ibo}$     | -                        | -                                    | 330                                  | pF  |
| Output Capacitance ( $V_{CB} = 3.0\text{ V}$ , $f = 1.0\text{ MHz}$ )  | $C_{obo}$     | -                        | -                                    | 100                                  | pF  |

### SWITCHING CHARACTERISTICS

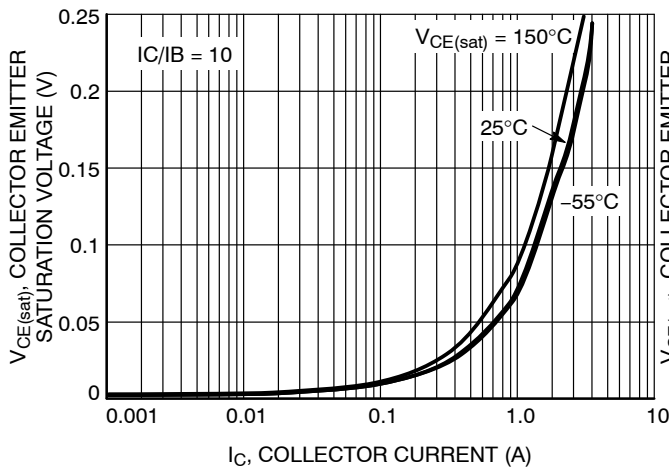
|   |       |   |   |     |    |
|---|-------|---|---|-----|----|
| Delay ( $V_{CC} = -15\text{ V}$ , $I_C = 750\text{ mA}$ , $I_{B1} = 15\text{ mA}$ )   | $t_d$ | - | - | 60  | ns |
| Rise ( $V_{CC} = -15\text{ V}$ , $I_C = 750\text{ mA}$ , $I_{B1} = 15\text{ mA}$ )    | $t_r$ | - | - | 120 | ns |
| Storage ( $V_{CC} = -15\text{ V}$ , $I_C = 750\text{ mA}$ , $I_{B1} = 15\text{ mA}$ ) | $t_s$ | - | - | 300 | ns |
| Fall ( $V_{CC} = -15\text{ V}$ , $I_C = 750\text{ mA}$ , $I_{B1} = 15\text{ mA}$ )    | $t_f$ | - | - | 130 | ns |

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.

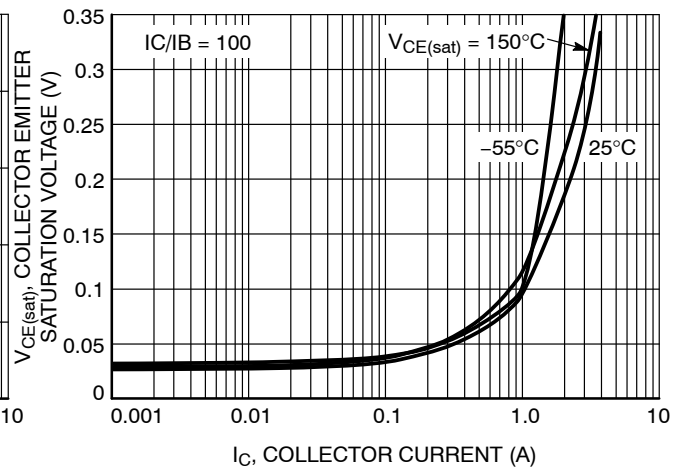
4. Pulsed Condition: Pulse Width = 300 msec, Duty Cycle  $\leq 2\%$ .

5. Guaranteed by design but not tested.

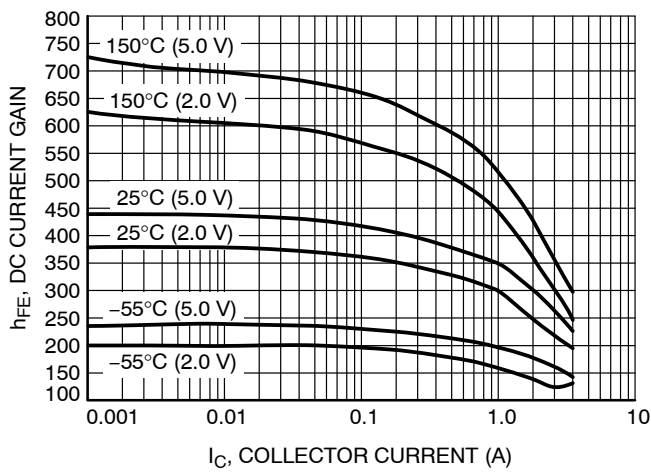
# NSS20200LT1G, NSV20200LT1G



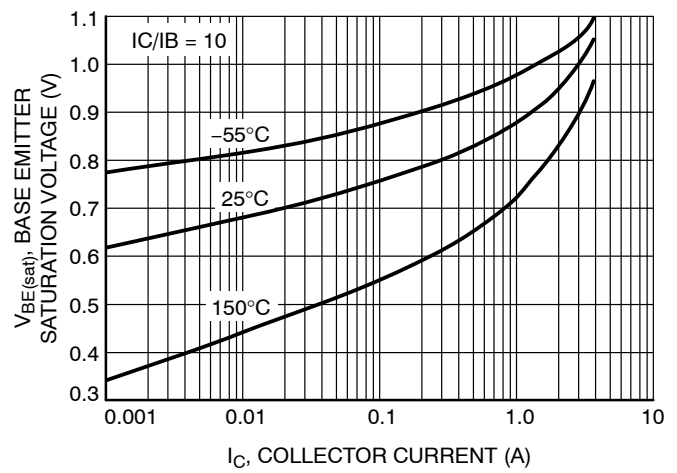
**Figure 1. Collector Emitter Saturation Voltage vs. Collector Current**



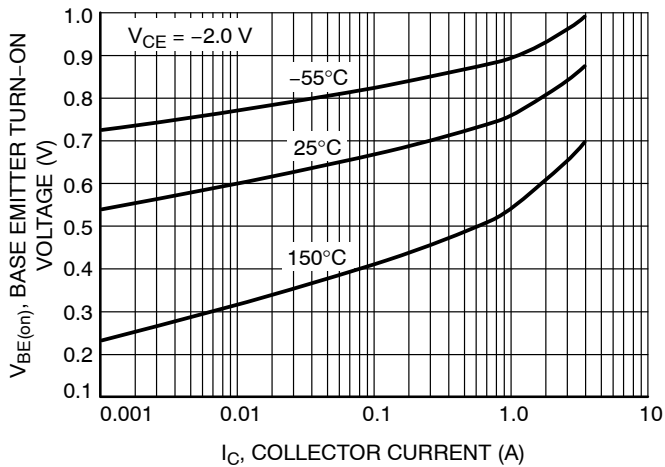
**Figure 2. Collector Emitter Saturation Voltage vs. Collector Current**



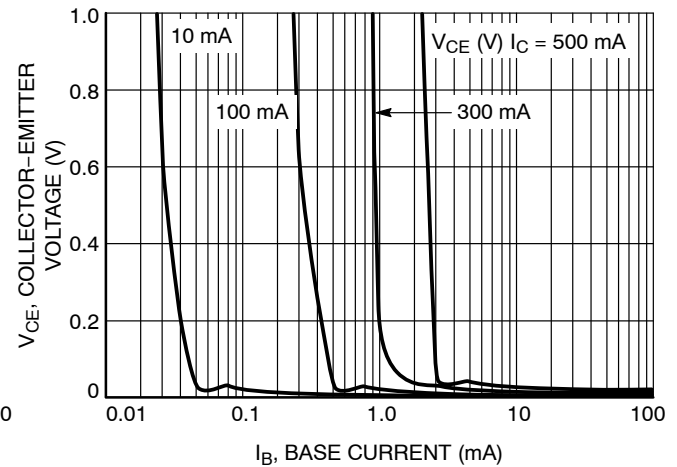
**Figure 3. DC Current Gain vs. Collector Current**



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

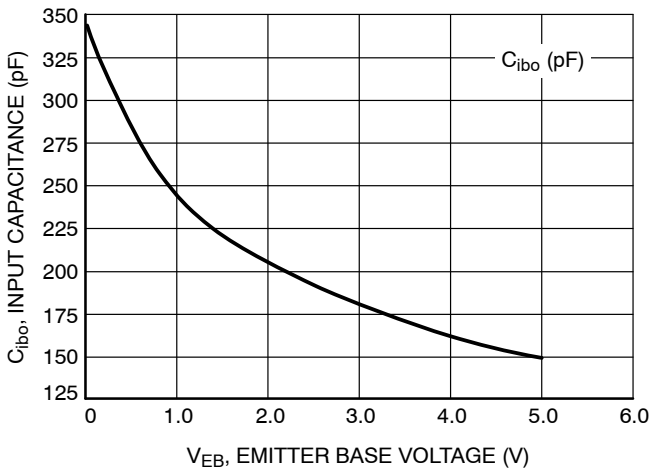


**Figure 5. Base Emitter Turn-On Voltage vs. Collector Current**

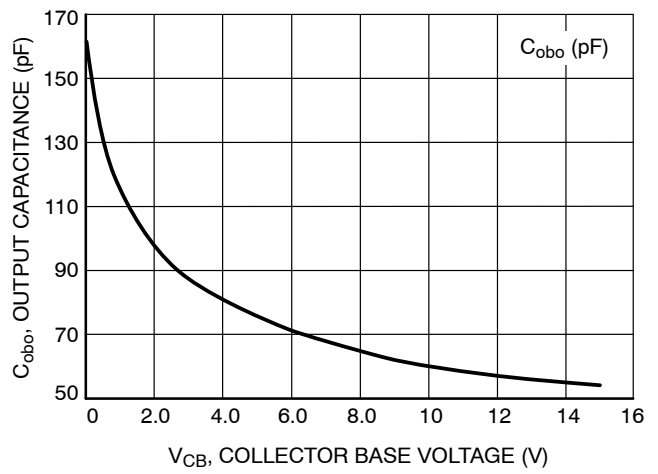


**Figure 6. Saturation Region**

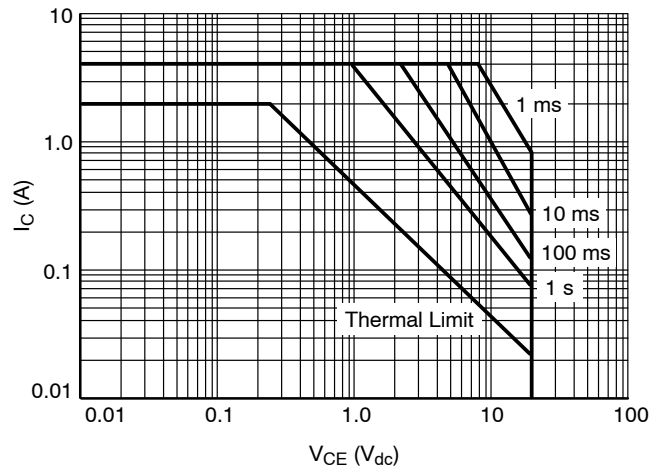
# NSS20200LT1G, NSV20200LT1G



**Figure 7. Input Capacitance**



**Figure 8. Output Capacitance**

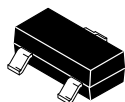


**Figure 9. Safe Operating Area**

# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

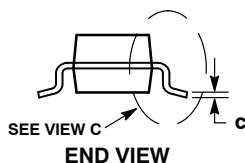
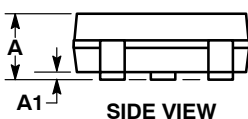
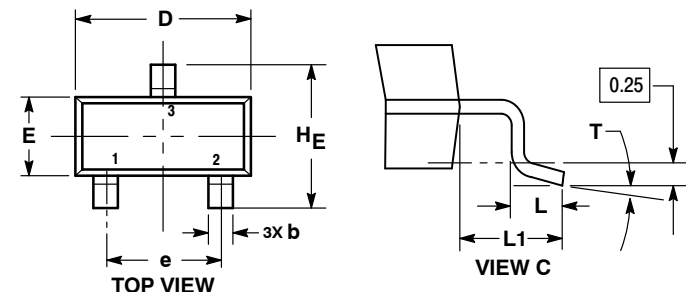
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**SOT-23 (TO-236)**  
CASE 318-08  
ISSUE AS

DATE 30 JAN 2018

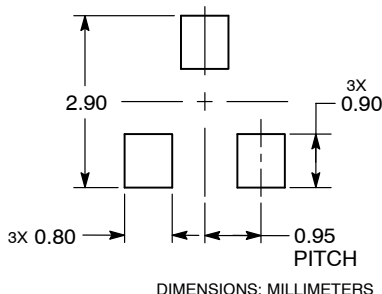
SCALE 4:1



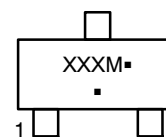
- NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
  2. CONTROLLING DIMENSION: MILLIMETERS.
  3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF THE BASE MATERIAL.
  4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

| DIM | MILLIMETERS |      |      | INCHES |       |       |
|-----|-------------|------|------|--------|-------|-------|
|     | MIN         | NOM  | MAX  | MIN    | NOM   | MAX   |
| A   | 0.89        | 1.00 | 1.11 | 0.035  | 0.039 | 0.044 |
| A1  | 0.01        | 0.06 | 0.10 | 0.000  | 0.002 | 0.004 |
| b   | 0.37        | 0.44 | 0.50 | 0.015  | 0.017 | 0.020 |
| c   | 0.08        | 0.14 | 0.20 | 0.003  | 0.006 | 0.008 |
| D   | 2.80        | 2.90 | 3.04 | 0.110  | 0.114 | 0.120 |
| E   | 1.20        | 1.30 | 1.40 | 0.047  | 0.051 | 0.055 |
| e   | 1.78        | 1.90 | 2.04 | 0.070  | 0.075 | 0.080 |
| L   | 0.30        | 0.43 | 0.55 | 0.012  | 0.017 | 0.022 |
| L1  | 0.35        | 0.54 | 0.69 | 0.014  | 0.021 | 0.027 |
| HE  | 2.10        | 2.40 | 2.64 | 0.083  | 0.094 | 0.104 |
| T   | 0°          | ---  | 10°  | 0°     | ---   | 10°   |

### RECOMMENDED SOLDERING FOOTPRINT



### GENERIC MARKING DIAGRAM\*



XXX = Specific Device Code  
M = Date Code  
▪ = Pb-Free Package

\*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 THRU 5:  
CANCELLED

STYLE 6:  
PIN 1. BASE  
2. EMITTER  
3. COLLECTOR

STYLE 7:  
PIN 1. EMITTER  
2. BASE  
3. COLLECTOR

STYLE 8:  
PIN 1. ANODE  
2. NO CONNECTION  
3. CATHODE

STYLE 9:  
PIN 1. ANODE  
2. ANODE  
3. CATHODE

STYLE 10:  
PIN 1. DRAIN  
2. SOURCE  
3. GATE

STYLE 11:  
PIN 1. ANODE  
2. CATHODE  
3. CATHODE-ANODE

STYLE 12:  
PIN 1. CATHODE  
2. CATHODE  
3. ANODE

STYLE 13:  
PIN 1. SOURCE  
2. DRAIN  
3. GATE

STYLE 14:  
PIN 1. CATHODE  
2. GATE  
3. ANODE

STYLE 15:  
PIN 1. GATE  
2. CATHODE  
3. ANODE

STYLE 16:  
PIN 1. ANODE  
2. CATHODE  
3. CATHODE

STYLE 17:  
PIN 1. NO CONNECTION  
2. ANODE  
3. CATHODE

STYLE 18:  
PIN 1. NO CONNECTION  
2. CATHODE  
3. ANODE

STYLE 19:  
PIN 1. CATHODE  
2. ANODE  
3. CATHODE-ANODE

STYLE 20:  
PIN 1. CATHODE  
2. ANODE  
3. GATE

STYLE 21:  
PIN 1. GATE  
2. SOURCE  
3. DRAIN

STYLE 22:  
PIN 1. RETURN  
2. OUTPUT  
3. INPUT

STYLE 23:  
PIN 1. ANODE  
2. ANODE  
3. CATHODE

STYLE 24:  
PIN 1. GATE  
2. DRAIN  
3. SOURCE

STYLE 25:  
PIN 1. ANODE  
2. CATHODE  
3. GATE

STYLE 26:  
PIN 1. CATHODE  
2. ANODE  
3. NO CONNECTION

STYLE 27:  
PIN 1. CATHODE  
2. CATHODE  
3. CATHODE

STYLE 28:  
PIN 1. ANODE  
2. ANODE  
3. ANODE

|                         |                        |  |
|-------------------------|------------------------|--|
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| <b>DESCRIPTION:</b>     | <b>SOT-23 (TO-236)</b> | <b>PAGE 1 OF 1</b>   |

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