

# High Voltage Transistor

## PNP Silicon

### MMBT6520L, NSVMMBT6520L

#### 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

#### MAXIMUM RATINGS

| Symbol    | Rating                         | Value | Unit |
|-----------|--------------------------------|-------|------|
| $V_{CEO}$ | Collector – Emitter Voltage    | –350  | Vdc  |
| $V_{CBO}$ | Collector – Base Voltage       | –350  | Vdc  |
| $V_{EBO}$ | Emitter – Base Voltage         | –5.0  | Vdc  |
| $I_B$     | Base Current                   | –250  | mA   |
| $I_C$     | Collector Current – Continuous | –500  | mAdc |

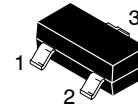
#### THERMAL CHARACTERISTICS

| Symbol          | Characteristic                                                                                                      | Max         | Unit                       |
|-----------------|---------------------------------------------------------------------------------------------------------------------|-------------|----------------------------|
| $P_D$           | Total Device Dissipation FR–5 Board,<br>(Note 1) $T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$        | 225<br>1.8  | mW<br>mW/ $^\circ\text{C}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient                                                                             | 556         | $^\circ\text{C/W}$         |
| $P_D$           | Total Device Dissipation Alumina<br>Substrate, (Note 2) $T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | 300<br>2.4  | mW<br>mW/ $^\circ\text{C}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient                                                                             | 417         | $^\circ\text{C/W}$         |
| $T_J, T_{stg}$  | Junction and Storage Temperature                                                                                    | –55 to +150 | $^\circ\text{C}$           |

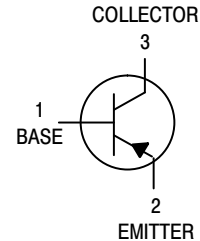
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. FR–5 = 1.0 x 0.75 x 0.062 in.

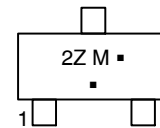
2. Alumina = 0.4 x 0.3 x 0.024 in. 99.5% alumina.



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



#### MARKING DIAGRAM



2Z = 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 <sup>†</sup> |
|-----------------|---------------------|-----------------------|
| MMBT6520LT1G    | SOT-23<br>(Pb-Free) | 3,000 / Tape & Reel   |
| NSVMMBT6520LT1G | SOT-23<br>(Pb-Free) | 3,000 / Tape & Reel   |

#### DISCONTINUED (Note 1)

|              |                     |                      |
|--------------|---------------------|----------------------|
| MMBT6520LT3G | SOT-23<br>(Pb-Free) | 10,000 / 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 Specification Brochure, [BRD8011/D](http://BRD8011/D).

1. **DISCONTINUED:** These devices are not recommended for new design. Please contact your **onsemi** representative for information. The most current information on these devices may be available on [www.onsemi.com](http://www.onsemi.com).

# MMBT6520L, NSVMMBT6520L

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

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

### OFF CHARACTERISTICS

|               |                                                                         |      |     |     |
|---------------|-------------------------------------------------------------------------|------|-----|-----|
| $V_{(BR)CEO}$ | Collector–Emitter Breakdown Voltage<br>( $I_C = -1.0\text{ mA}$ )       | -350 | –   | Vdc |
| $V_{(BR)CBO}$ | Collector–Base Breakdown Voltage<br>( $I_C = -100\text{ }\mu\text{A}$ ) | -350 | –   | Vdc |
| $V_{(BR)EBO}$ | Emitter–Base Breakdown Voltage<br>( $I_E = -10\text{ }\mu\text{A}$ )    | -5.0 | –   | Vdc |
| $I_{CBO}$     | Collector Cutoff Current<br>( $V_{CB} = -250\text{ V}$ )                | –    | -50 | nA  |
| $I_{EBO}$     | Emitter Cutoff Current<br>( $V_{EB} = -4.0\text{ V}$ )                  | –    | -50 | nA  |

### ON CHARACTERISTICS

|               |                                                                                                                                                                                                                                                                                                      |                            |                                 |     |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|---------------------------------|-----|
| $h_{FE}$      | DC Current Gain<br>( $I_C = -1.0\text{ mA}$ , $V_{CE} = -10\text{ V}$ )<br>( $I_C = -10\text{ mA}$ , $V_{CE} = -10\text{ V}$ )<br>( $I_C = -30\text{ mA}$ , $V_{CE} = -10\text{ V}$ )<br>( $I_C = -50\text{ mA}$ , $V_{CE} = -10\text{ V}$ )<br>( $I_C = -100\text{ mA}$ , $V_{CE} = -10\text{ V}$ ) | 20<br>30<br>30<br>20<br>15 | –<br>–<br>200<br>200<br>–       | –   |
| $V_{CE(sat)}$ | Collector–Emitter Saturation Voltage<br>( $I_C = -10\text{ mA}$ , $I_B = -1.0\text{ mA}$ )<br>( $I_C = -20\text{ mA}$ , $I_B = -2.0\text{ mA}$ )<br>( $I_C = -30\text{ mA}$ , $I_B = -3.0\text{ mA}$ )<br>( $I_C = -50\text{ mA}$ , $I_B = -5.0\text{ mA}$ )                                         | –<br>–<br>–<br>–           | -0.30<br>-0.35<br>-0.50<br>-1.0 | Vdc |
| $V_{BE(sat)}$ | Base–Emitter Saturation Voltage<br>( $I_C = -10\text{ mA}$ , $I_B = -1.0\text{ mA}$ )<br>( $I_C = -20\text{ mA}$ , $I_B = -2.0\text{ mA}$ )<br>( $I_C = -30\text{ mA}$ , $I_B = -3.0\text{ mA}$ )                                                                                                    | –<br>–<br>–                | -0.75<br>-0.85<br>-0.90         | Vdc |
| $V_{BE(on)}$  | Base–Emitter On Voltage<br>( $I_C = -100\text{ mA}$ , $V_{CE} = -10\text{ V}$ )                                                                                                                                                                                                                      | –                          | -2.0                            | Vdc |

### SMALL-SIGNAL CHARACTERISTICS

|          |                                                                                                               |    |     |     |
|----------|---------------------------------------------------------------------------------------------------------------|----|-----|-----|
| $f_T$    | Current–Gain – Bandwidth Product<br>( $I_C = -10\text{ mA}$ , $V_{CE} = -20\text{ V}$ , $f = 20\text{ MHz}$ ) | 40 | 200 | MHz |
| $C_{cb}$ | Collector–Base Capacitance<br>( $V_{CB} = -20\text{ V}$ , $f = 1.0\text{ MHz}$ )                              | –  | 6.0 | pF  |
| $C_{eb}$ | Emitter–Base Capacitance<br>( $V_{EB} = -0.5\text{ V}$ , $f = 1.0\text{ MHz}$ )                               | –  | 100 | pF  |

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.

TYPICAL CHARACTERISTICS

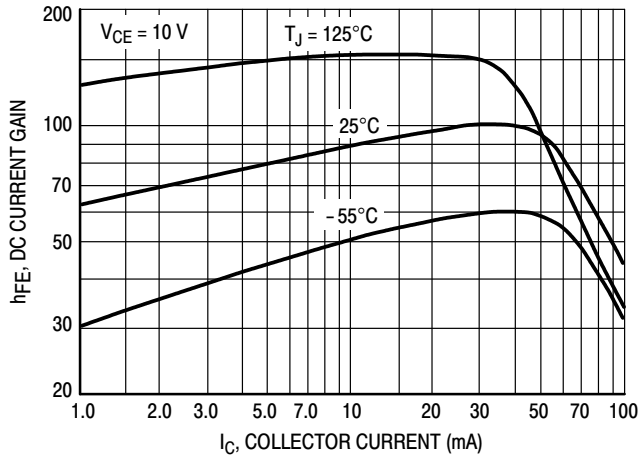


Figure 1. DC Current Gain

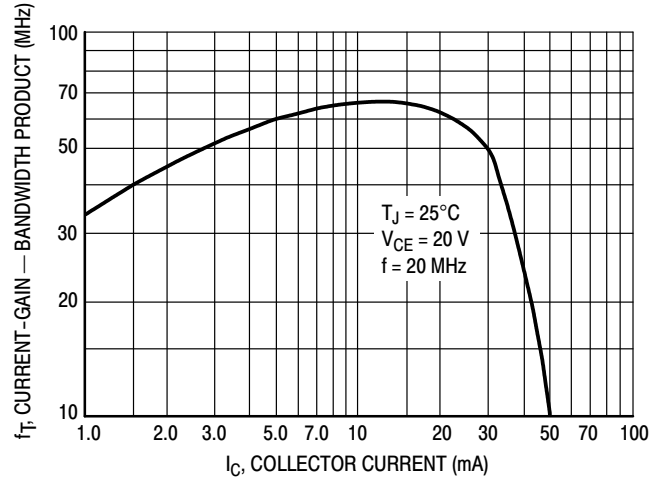


Figure 2. Current-Gain — Bandwidth Product

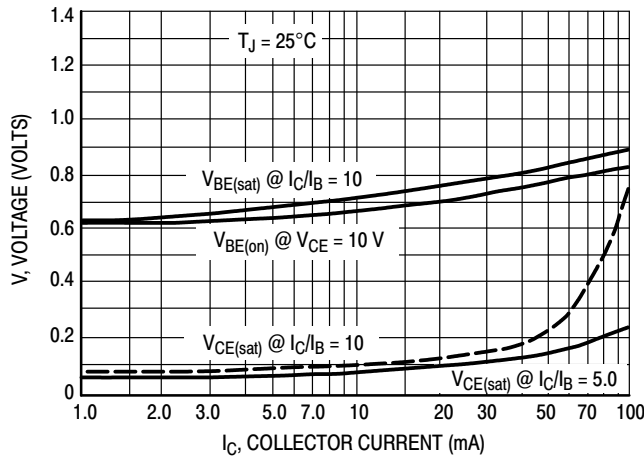


Figure 3. "On" Voltages

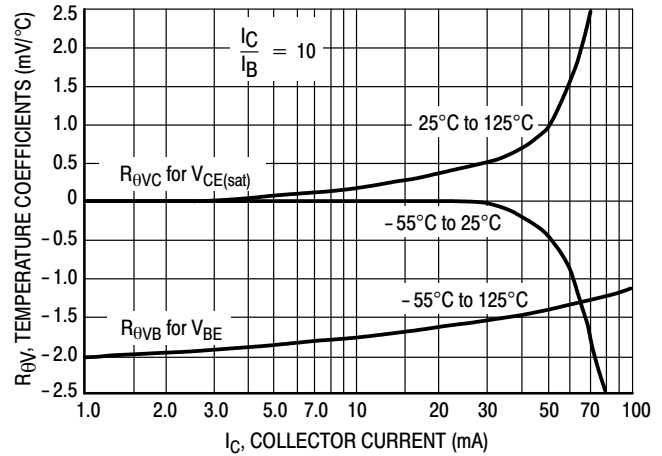


Figure 4. Temperature Coefficients

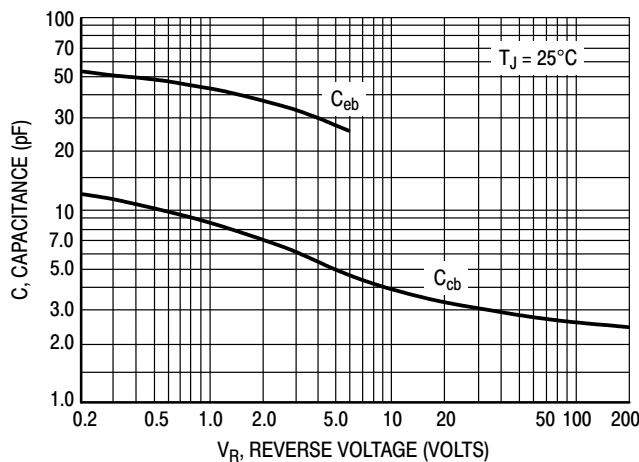


Figure 5. Capacitance

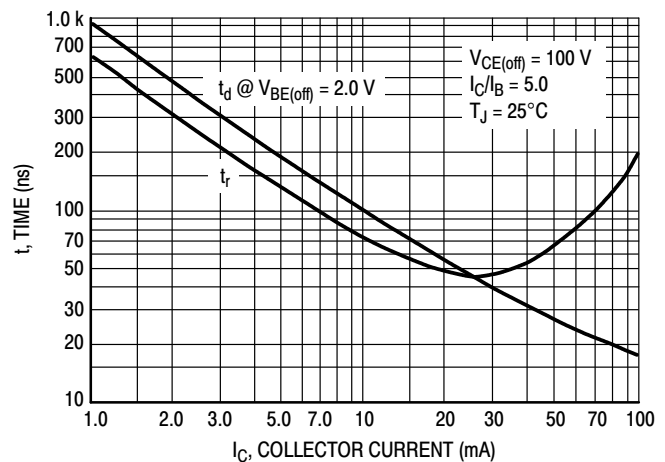


Figure 6. Turn-On Time

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## TYPICAL CHARACTERISTICS (continued)

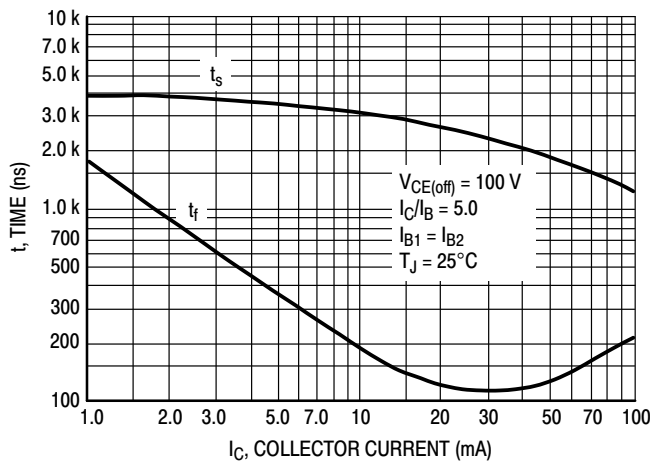


Figure 7. Turn-Off Time

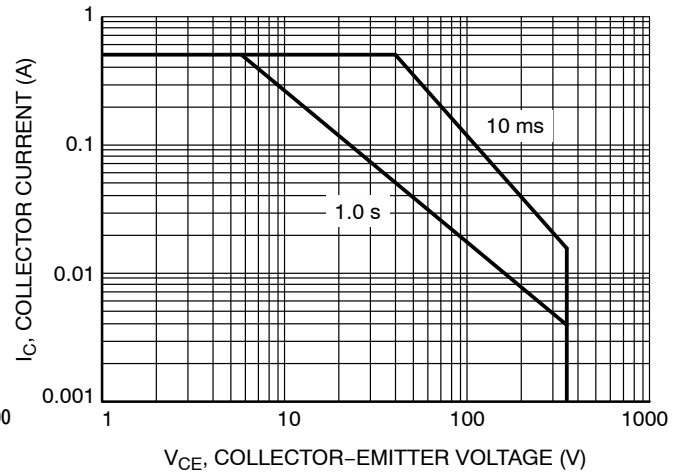


Figure 8. Safe Operating Area

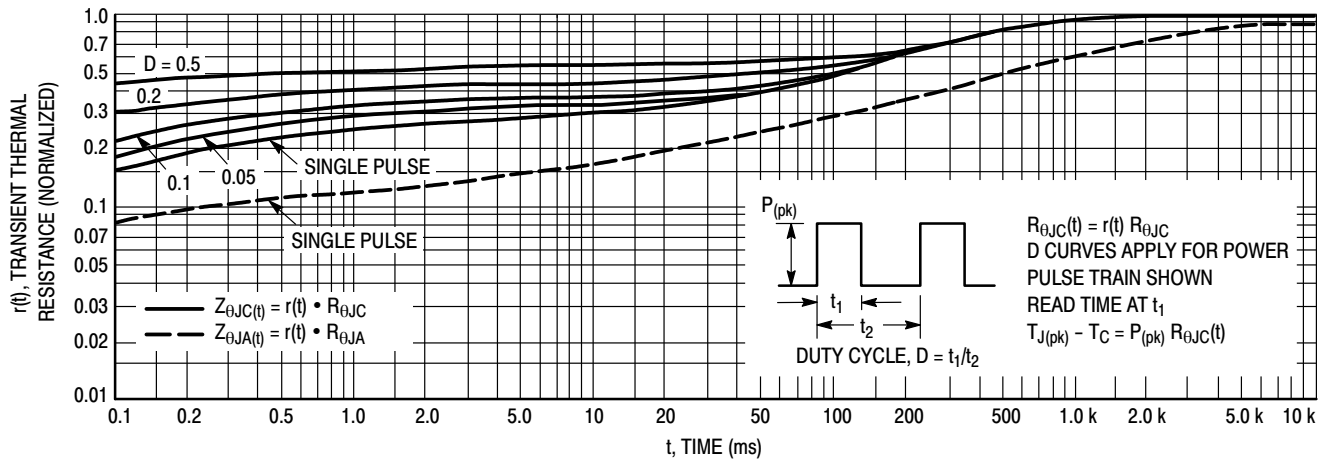


Figure 9. Thermal Response

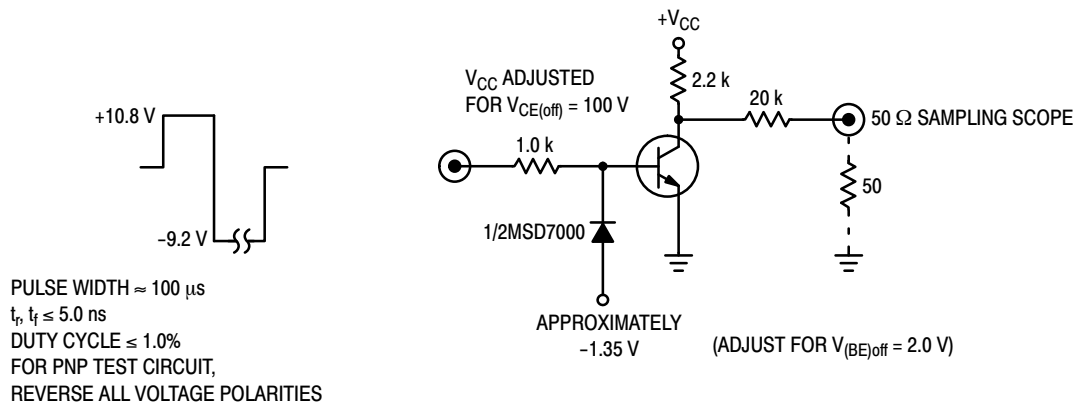
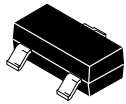


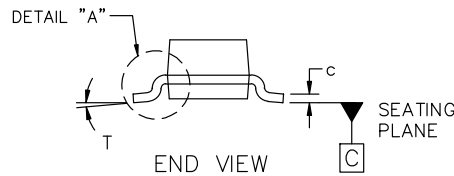
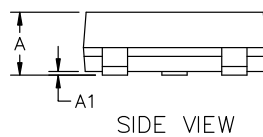
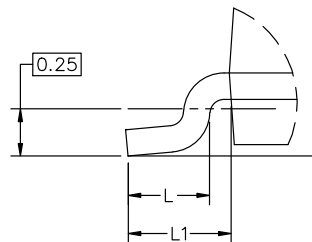
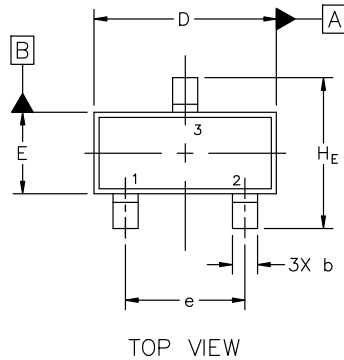
Figure 10. Switching Time Test Circuit



SCALE 4:1

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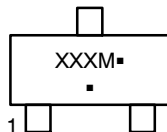


| MILLIMETERS |      |      |      |
|-------------|------|------|------|
| DIM         | MIN  | NOM  | MAX  |
| A           | 0.89 | 1.00 | 1.11 |
| A1          | 0.01 | 0.06 | 0.10 |
| b           | 0.37 | 0.44 | 0.50 |
| c           | 0.08 | 0.14 | 0.20 |
| D           | 2.80 | 2.90 | 3.04 |
| E           | 1.20 | 1.30 | 1.40 |
| e           | 1.78 | 1.90 | 2.04 |
| L           | 0.30 | 0.43 | 0.55 |
| L1          | 0.35 | 0.54 | 0.69 |
| HE          | 2.10 | 2.40 | 2.64 |
| T           | 0°   | ---  | 10°  |

NOTES:

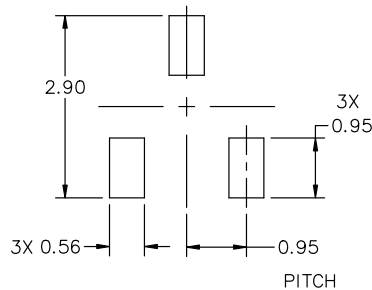
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2018.
2. CONTROLLING DIMENSIONS: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF THE BASE MATERIAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

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. Some products may not follow the Generic Marking.



RECOMMENDED  
MOUNTING FOOTPRINT

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

STYLES ON PAGE 2

|                  |                                      |                                                                                                                                                                                     |
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**CASE 318**  
**ISSUE AU**

DATE 14 AUG 2024

|                                                         |                                                       |                                                             |                                                             |                                                             |                                                             |
|---------------------------------------------------------|-------------------------------------------------------|-------------------------------------------------------------|-------------------------------------------------------------|-------------------------------------------------------------|-------------------------------------------------------------|
| STYLE 1 THRU 5:<br>CANCELLED                            | STYLE 6:<br>PIN 1. BASE<br>2. EMITTER<br>3. COLLECTOR | STYLE 7:<br>PIN 1. EMITTER<br>2. BASE<br>3. COLLECTOR       | STYLE 8:<br>PIN 1. ANODE<br>2. NO CONNECTION<br>3. CATHODE  |                                                             |                                                             |
| STYLE 9:<br>PIN 1. ANODE<br>2. ANODE<br>3. CATHODE      | STYLE 10:<br>PIN 1. DRAIN<br>2. SOURCE<br>3. GATE     | STYLE 11:<br>PIN 1. ANODE<br>2. CATHODE<br>3. CATHODE-ANODE | STYLE 12:<br>PIN 1. CATHODE<br>2. CATHODE<br>3. ANODE       | STYLE 13:<br>PIN 1. SOURCE<br>2. DRAIN<br>3. GATE           | STYLE 14:<br>PIN 1. CATHODE<br>2. GATE<br>3. ANODE          |
| STYLE 15:<br>PIN 1. GATE<br>2. CATHODE<br>3. ANODE      | STYLE 16:<br>PIN 1. ANODE<br>2. CATHODE<br>3. CATHODE | STYLE 17:<br>PIN 1. NO CONNECTION<br>2. ANODE<br>3. CATHODE | STYLE 18:<br>PIN 1. NO CONNECTION<br>2. CATHODE<br>3. ANODE | STYLE 19:<br>PIN 1. CATHODE<br>2. ANODE<br>3. CATHODE-ANODE | STYLE 20:<br>PIN 1. CATHODE<br>2. ANODE<br>3. GATE          |
| STYLE 21:<br>PIN 1. GATE<br>2. SOURCE<br>3. DRAIN       | STYLE 22:<br>PIN 1. RETURN<br>2. OUTPUT<br>3. INPUT   | STYLE 23:<br>PIN 1. ANODE<br>2. ANODE<br>3. CATHODE         | STYLE 24:<br>PIN 1. GATE<br>2. DRAIN<br>3. SOURCE           | STYLE 25:<br>PIN 1. ANODE<br>2. CATHODE<br>3. GATE          | STYLE 26:<br>PIN 1. CATHODE<br>2. ANODE<br>3. NO CONNECTION |
| STYLE 27:<br>PIN 1. CATHODE<br>2. CATHODE<br>3. CATHODE | STYLE 28:<br>PIN 1. ANODE<br>2. ANODE<br>3. ANODE     |                                                             |                                                             |                                                             |                                                             |

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