

# MMBTA05L, MMBTA06L

## Driver Transistors

### NPN Silicon

#### Features

- S and 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

| Rating  | Symbol    | Value                                      | Unit |
|---|-----------|--|------|
| Collector–Emitter Voltage<br>MMBTA05L<br>MMBTA06L | $V_{CEO}$ | 60<br>80                                   | Vdc  |
| Collector–Base Voltage<br>MMBTA05L<br>MMBTA06L    | $V_{CBO}$ | 60<br>80                                   | Vdc  |
| Emitter–Base Voltage                              | $V_{EBO}$ | 4.0  | Vdc  |
| Collector Current – Continuous                    | $I_C$     | 500  | mAdc |
| Electrostatic Discharge                           | ESD       | HBM Class 3B<br>MM Class C<br>CDM Class IV |      |

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.

#### THERMAL CHARACTERISTICS

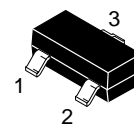
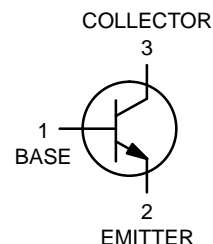
| Characteristic   | Symbol          | Max         | Unit        |
|--|-----------------|-------------|-------------|
| Total Device Dissipation FR–5 Board (Note 1) $T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$         | $P_D$           | 225<br>1.8  | mW<br>mW/°C |
| Thermal Resistance,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

1. FR–5 =  $1.0 \times 0.75 \times 0.062$  in.
2. Alumina =  $0.4 \times 0.3 \times 0.024$  in. 99.5% alumina.



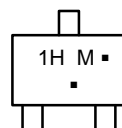
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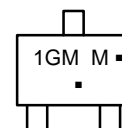


SOT-23  
CASE 318  
STYLE 6

#### MARKING DIAGRAMS



MMBTA05LT1



MMBTA06LT1,  
SMMBTA06L

1H, 1GM = 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

See detailed ordering and shipping information in the package dimensions section on page 5 of this data sheet.

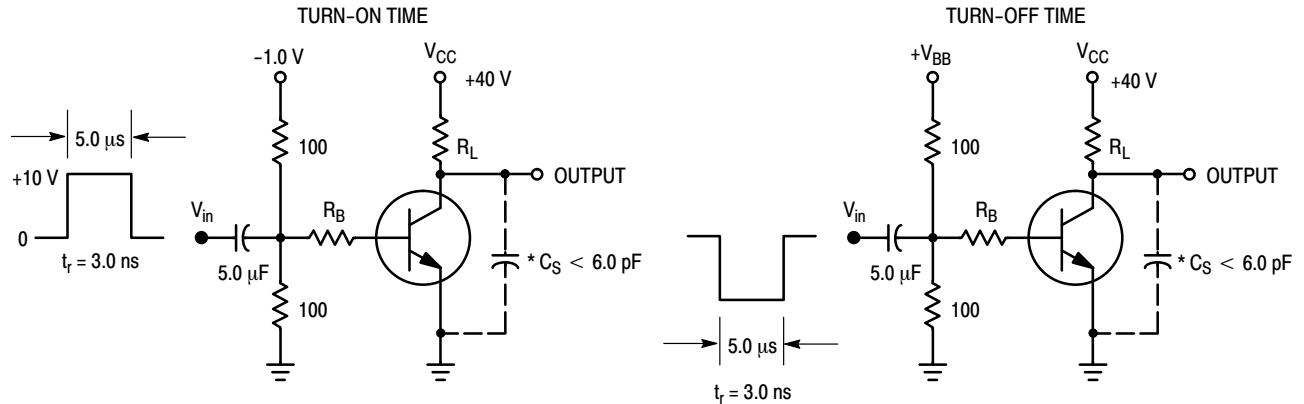
# MMBTA05L, MMBTA06L

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

| Characteristic   | Symbol        | Min        | Max        | Unit          |
|--|---------------|------------|------------|---------------|
| <b>OFF CHARACTERISTICS</b>   |               |            |            |               |
| Collector–Emitter Breakdown Voltage (Note 3)<br>( $I_C = 1.0\text{ mA}$ , $I_B = 0$ )  | $V_{(BR)CEO}$ | 60<br>80   | –          | Vdc           |
| Emitter–Base Breakdown Voltage<br>( $I_E = 100\ \mu\text{A}$ , $I_C = 0$ )   | $V_{(BR)EBO}$ | 4.0        | –          | Vdc           |
| Collector Cutoff Current<br>( $V_{CE} = 60\text{ Vdc}$ , $I_B = 0$ )   | $I_{CES}$     | –          | 0.1        | $\mu\text{A}$ |
| Collector Cutoff Current<br>( $V_{CB} = 60\text{ Vdc}$ , $I_E = 0$ )<br>( $V_{CB} = 80\text{ Vdc}$ , $I_E = 0$ )                 | $I_{CBO}$     | –          | 0.1<br>0.1 | $\mu\text{A}$ |
| <b>ON CHARACTERISTICS</b>  |               |            |            |               |
| DC Current Gain<br>( $I_C = 10\text{ mA}$ , $V_{CE} = 1.0\text{ Vdc}$ )<br>( $I_C = 100\text{ mA}$ , $V_{CE} = 1.0\text{ Vdc}$ ) | $h_{FE}$      | 100<br>100 | –          | –             |
| Collector–Emitter Saturation Voltage<br>( $I_C = 100\text{ mA}$ , $I_B = 10\text{ mA}$ )   | $V_{CE(sat)}$ | –          | 0.25       | Vdc           |
| Base–Emitter On Voltage<br>( $I_C = 100\text{ mA}$ , $V_{CE} = 1.0\text{ Vdc}$ )   | $V_{BE(on)}$  | –          | 1.2        | Vdc           |
| <b>SMALL-SIGNAL CHARACTERISTICS</b>  |               |            |            |               |
| Current–Gain – Bandwidth Product (Note 4)<br>( $I_C = 10\text{ mA}$ , $V_{CE} = 2.0\text{ V}$ , $f = 100\text{ MHz}$ )           | $f_T$         | 100        | –          | MHz           |

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.

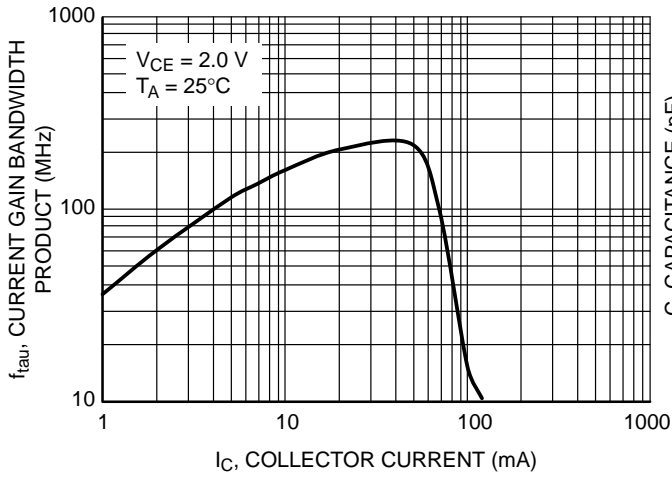
- Pulse Test: Pulse Width  $\leq 300\ \mu\text{s}$ , Duty Cycle  $\leq 2.0\%$ .
- $f_T$  is defined as the frequency at which  $|h_{fe}|$  extrapolates to unity.



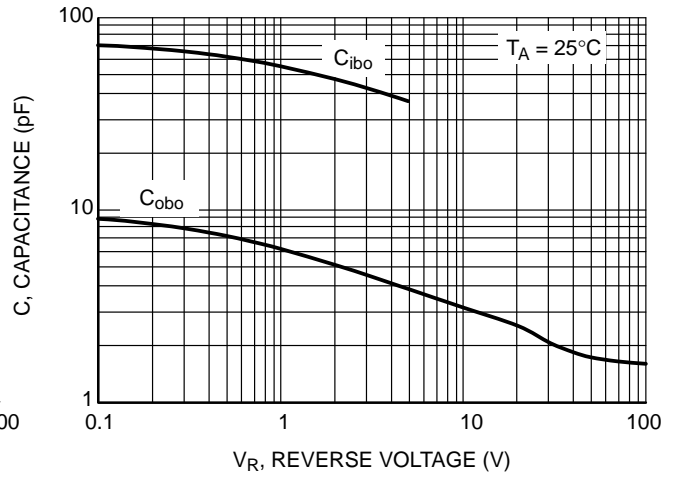
\*Total Shunt Capacitance of Test Jig and Connectors  
For PNP Test Circuits, Reverse All Voltage Polarities

**Figure 1. Switching Time Test Circuits**

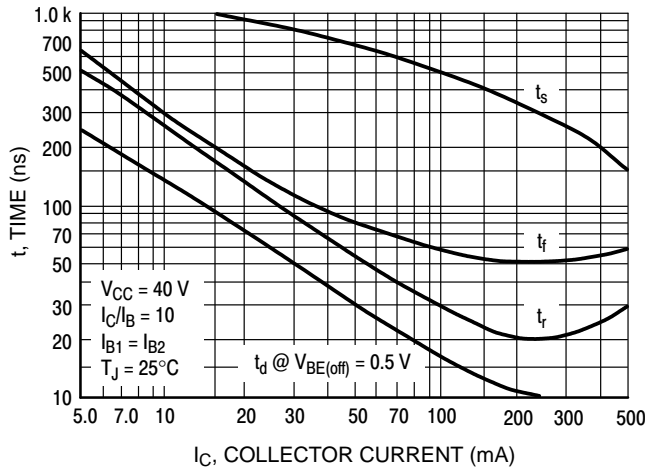
# MMBTA05L, MMBTA06L



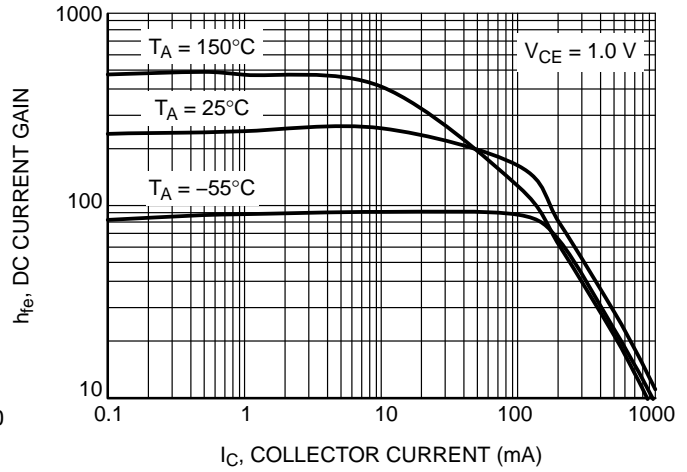
**Figure 2. Current Gain Bandwidth Product vs. Collector Current**



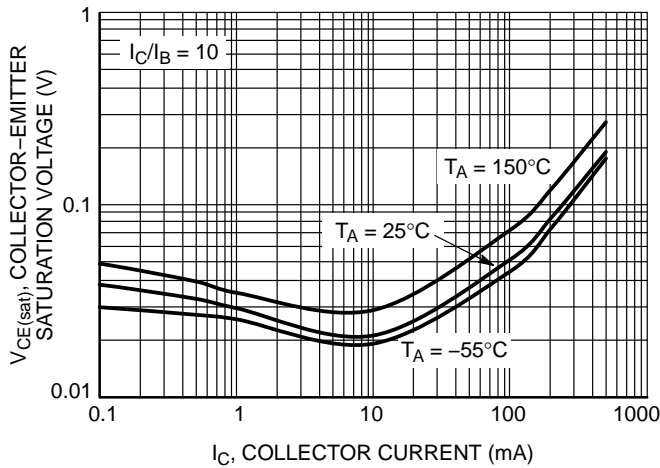
**Figure 3. Capacitance**



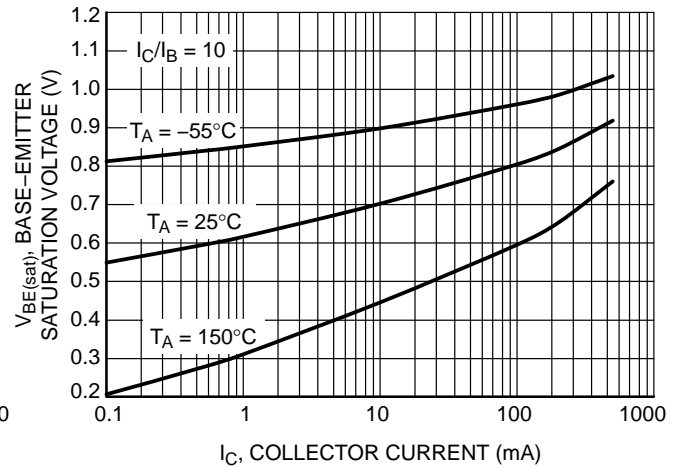
**Figure 4. Switching Time**



**Figure 5. DC Current Gain vs. Collector Current**

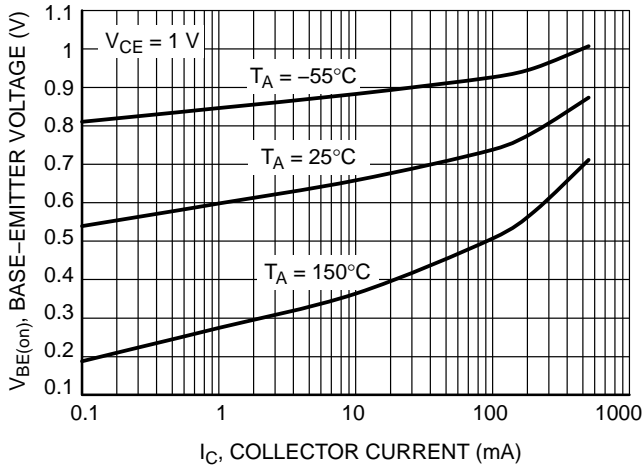


**Figure 6. Collector Emitter Saturation Voltage vs. Collector Current**

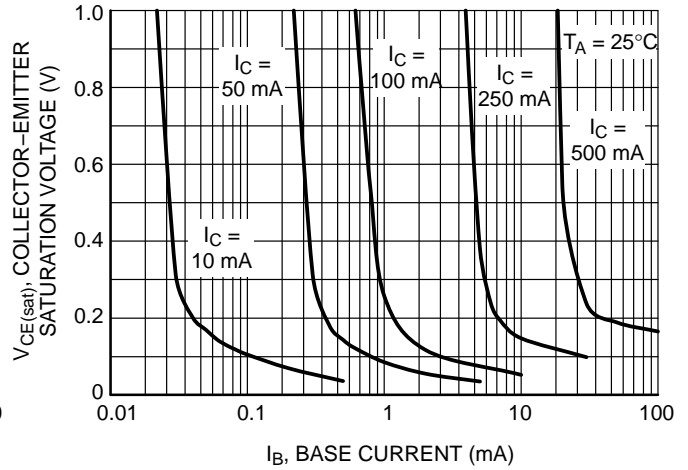


**Figure 7. Base Emitter Saturation Voltage vs. Collector Current**

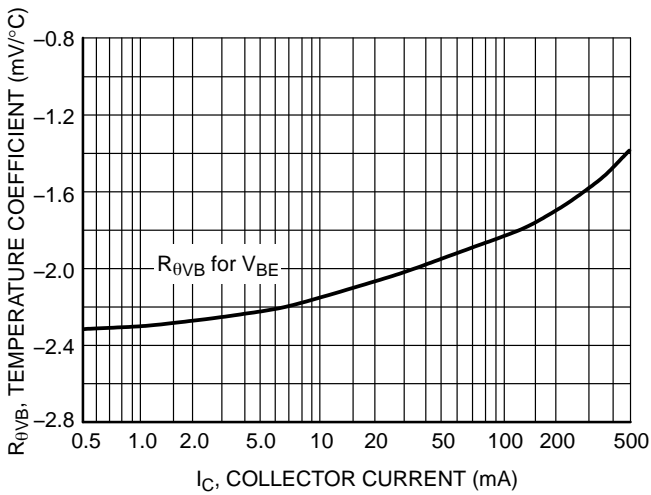
# MMBTA05L, MMBTA06L



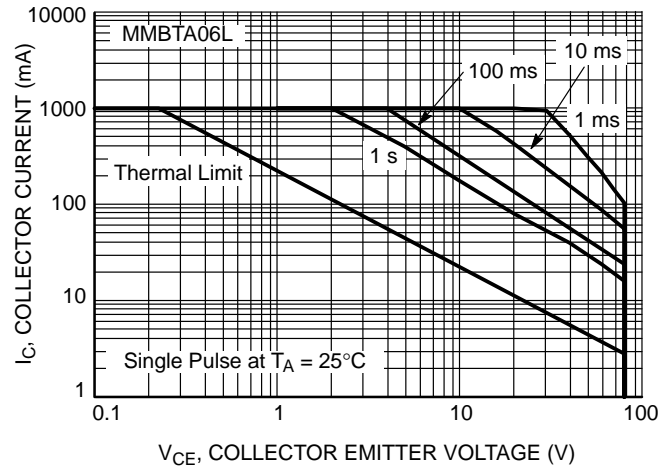
**Figure 8. Base-Emitter Turn-ON Voltage vs. Collector Current**



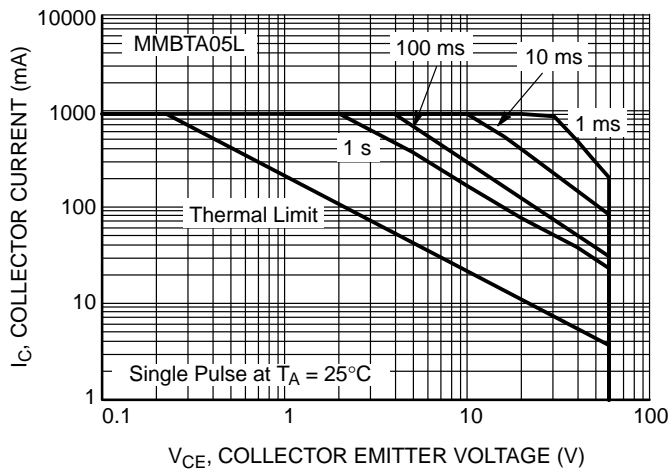
**Figure 9. Saturation Region**



**Figure 10. Base-Emitter Temperature Coefficient**



**Figure 11. Safe Operating Area**



**Figure 12. Safe Operating Area**

## MMBTA05L, MMBTA06L

### ORDERING INFORMATION

| Device          | Package             | Shipping†            |
|-----------------|---------------------|----------------------|
| MMBTA05LT1G     | SOT-23<br>(Pb-Free) | 3,000 / Tape & Reel  |
| NSVMMBTA05LT1G* | SOT-23<br>(Pb-Free) | 3,000 / Tape & Reel  |
| MMBTA05LT3G     | SOT-23<br>(Pb-Free) | 10,000 / Tape & Reel |
| MMBTA06LT1G     | SOT-23<br>(Pb-Free) | 3,000 / Tape & Reel  |
| SMMBTA06LT1G*   | SOT-23<br>(Pb-Free) | 3,000 / Tape & Reel  |
| MMBTA06LT3G     | SOT-23<br>(Pb-Free) | 10,000 / Tape & Reel |
| SMMBTA06LT3G*   | SOT-23<br>(Pb-Free) | 10,000 / Tape & Reel |

†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.

\*S and NSV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable.

# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



**SOT-23 (TO-236)**  
CASE 318  
ISSUE AT

DATE 01 MAR 2023

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 |
| H <sub>E</sub> | 2.10        | 2.40 | 2.64 | 0.083  | 0.094 | 0.104 |
| T              | 0°          | ---  | 10°  | 0°     | ---   | 10°   |

**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 ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

**STYLES ON PAGE 2**

|                         |                        |  |
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**MECHANICAL CASE OUTLINE**  
**PACKAGE DIMENSIONS**



**SOT-23 (TO-236)**  
**CASE 318**  
**ISSUE AT**

DATE 01 MAR 2023

- |   |   |   |   |   |   |
|---|---|---|---|---|---|
| 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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