

# MOSFET – Single, N-Channel, SOT-23 30 V, 2.1 A MGSF1N03L, MVGSF1N03L

These miniature surface mount MOSFETs low  $R_{DS(on)}$  assure minimal power loss and conserve energy, making these devices ideal for use in space sensitive power management circuitry. Typical applications are dc-dc converters and power management in portable and battery-powered products such as computers, printers, PCMCIA cards, cellular and cordless telephones.

## Features

- Low  $R_{DS(on)}$  Provides Higher Efficiency and Extends Battery Life
- Miniature SOT-23 Surface Mount Package Saves Board Space
- MV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable
- These Devices are Pb-Free and are RoHS Compliant

## MAXIMUM RATINGS ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

| Parameter                                                           |                                   |                            | Symbol         | Value      | Unit               |
|---------------------------------------------------------------------|-----------------------------------|----------------------------|----------------|------------|--------------------|
| Drain-to-Source Voltage                                             |                                   |                            | $V_{DSS}$      | 30         | V                  |
| Gate-to-Source Voltage                                              |                                   |                            | $V_{GS}$       | ±20        | V                  |
| Continuous Drain Current $R_{\theta JL}$                            | Steady State                      | $T_A = 25^{\circ}\text{C}$ | $I_D$          | 2.1        | A                  |
|                                                                     |                                   | $T_A = 85^{\circ}\text{C}$ |                | 1.5        |                    |
| Power Dissipation $R_{\theta JL}$                                   | Steady State                      | $T_A = 25^{\circ}\text{C}$ | $P_D$          | 0.69       | W                  |
| Continuous Drain Current (Note 1)                                   | Steady State                      | $T_A = 25^{\circ}\text{C}$ | $I_D$          | 1.6        | A                  |
|                                                                     |                                   | $T_A = 85^{\circ}\text{C}$ |                | 1.2        |                    |
| Power Dissipation (Note 1)                                          |                                   | $T_A = 25^{\circ}\text{C}$ | $P_D$          | 0.42       | W                  |
| Pulsed Drain Current                                                | $t_p = 10\ \mu\text{s}$           |                            | $I_{DM}$       | 6.0        | A                  |
| ESD Capability (Note 3)                                             | C = 100 pF,<br>RS = 1500 $\Omega$ |                            | ESD            | 125        | V                  |
| Operating Junction and Storage Temperature                          |                                   |                            | $T_J, T_{STG}$ | –55 to 150 | $^{\circ}\text{C}$ |
| Source Current (Body Diode)                                         |                                   |                            | $I_S$          | 2.1        | A                  |
| Lead Temperature for Soldering Purposes (1/8" from case for 10 sec) |                                   |                            | $T_L$          | 260        | $^{\circ}\text{C}$ |

## THERMAL RESISTANCE RATINGS

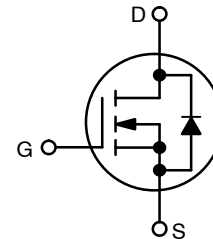
| Parameter                                         | Symbol          | Max | Unit               |
|---------------------------------------------------|-----------------|-----|--------------------|
| Junction-to-Foot – Steady State                   | $R_{\theta JL}$ | 180 | $^\circ\text{C/W}$ |
| Junction-to-Ambient – Steady State (Note 1)       | $R_{\theta JA}$ | 300 |                    |
| Junction-to-Ambient – $t < 10 \text{ s}$ (Note 1) | $R_{\theta JA}$ | 250 |                    |
| Junction-to-Ambient – Steady State (Note 2)       | $R_{\theta JA}$ | 400 |                    |

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.

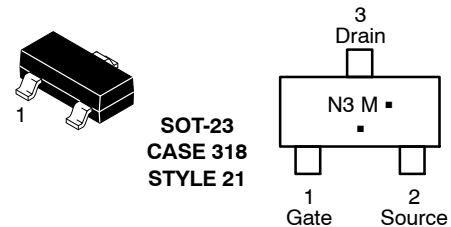
1. Surface-mounted on FR4 board using  $650 \text{ mm}^2$ , 1 oz. Cu pad size.
2. Surface-mounted on FR4 board using  $50 \text{ mm}^2$ , 1 oz. Cu pad size.
3. ESD Rating Information: HBM Class 0.

| $V_{(BR)DS}$ | $R_{DS(on)}$ TYP       | $I_D$ MAX |
|--------------|------------------------|-----------|
| 30 V         | 80 m $\Omega$ @ 10 V   | 2.1 A     |
|              | 125 m $\Omega$ @ 4.5 V |           |

## N-Channel



## MARKING DIAGRAM/ PIN ASSIGNMENT



N3 = 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†          |
|---------------|---------------------|--------------------|
| MGSF1N03LT1G  | SOT-23<br>Pb-Free   | 3000 / Tape & Reel |
| MVGSF1N03LT1G | SOT-23<br>(Pb-Free) | 3000 / Tape & Reel |

## DISCONTINUED (Note 1)

|              |                     |                     |
|--------------|---------------------|---------------------|
| MGSF1N03LT3G | SOT-23<br>(Pb-Free) | 10000 / 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](http://BRD8011/D).

1. **DISCONTINUED:** This device is not recommended for new design. Please contact your onsemi representative for information. The most current information on this device may be available on [www.onsemi.com](http://www.onsemi.com).

# MGSF1N03L, MVGSF1N03L

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

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

### OFF CHARACTERISTICS

|                                                                                                                                                                                 |               |        |        |           |                 |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|--------|--------|-----------|-----------------|
| Drain-to-Source Breakdown Voltage<br>( $V_{GS} = 0\text{ Vdc}$ , $I_D = 10\text{ }\mu\text{Adc}$ )                                                                              | $V_{(BR)DSS}$ | 30     | –      | –         | Vdc             |
| Zero Gate Voltage Drain Current<br>( $V_{DS} = 30\text{ Vdc}$ , $V_{GS} = 0\text{ Vdc}$ )<br>( $V_{DS} = 30\text{ Vdc}$ , $V_{GS} = 0\text{ Vdc}$ , $T_J = 125^\circ\text{C}$ ) | $I_{DSS}$     | –<br>– | –<br>– | 1.0<br>10 | $\mu\text{Adc}$ |
| Gate-Body Leakage Current ( $V_{GS} = \pm 20\text{ Vdc}$ , $V_{DS} = 0\text{ Vdc}$ )                                                                                            | $I_{GSS}$     | –      | –      | $\pm 100$ | nAdc            |

### ON CHARACTERISTICS (Note 4)

|                                                                                                                                                         |              |        |               |               |          |
|---------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|--------|---------------|---------------|----------|
| Gate Threshold Voltage<br>( $V_{DS} = V_{GS}$ , $I_D = 250\text{ }\mu\text{Adc}$ )                                                                      | $V_{GS(th)}$ | 1.0    | 1.7           | 2.4           | Vdc      |
| Static Drain-to-Source On-Resistance<br>( $V_{GS} = 10\text{ Vdc}$ , $I_D = 1.2\text{ Adc}$ )<br>( $V_{GS} = 4.5\text{ Vdc}$ , $I_D = 1.0\text{ Adc}$ ) | $r_{DS(on)}$ | –<br>– | 0.08<br>0.125 | 0.10<br>0.145 | $\Omega$ |

### DYNAMIC CHARACTERISTICS

|                      |                               |           |   |     |   |    |
|----------------------|-------------------------------|-----------|---|-----|---|----|
| Input Capacitance    | ( $V_{DS} = 5.0\text{ Vdc}$ ) | $C_{iss}$ | – | 140 | – | pF |
| Output Capacitance   | ( $V_{DS} = 5.0\text{ Vdc}$ ) | $C_{oss}$ | – | 100 | – |    |
| Transfer Capacitance | ( $V_{DG} = 5.0\text{ Vdc}$ ) | $C_{rss}$ | – | 40  | – |    |

### SWITCHING CHARACTERISTICS (Note 5)

|                            |                                                                                        |              |   |      |   |    |
|----------------------------|----------------------------------------------------------------------------------------|--------------|---|------|---|----|
| Turn-On Delay Time         | (V <sub>DD</sub> = 15 Vdc, I <sub>D</sub> = 1.0 Adc,<br>R <sub>L</sub> = 50 $\Omega$ ) | $t_{d(on)}$  | – | 2.5  | – | ns |
| Rise Time                  |                                                                                        | $t_r$        | – | 1.0  | – |    |
| Turn-Off Delay Time        |                                                                                        | $t_{d(off)}$ | – | 16   | – |    |
| Fall Time                  |                                                                                        | $t_f$        | – | 8.0  | – |    |
| Gate Charge (See Figure 6) |                                                                                        | $Q_T$        | – | 6000 | – | pC |

### SOURCE-DRAIN DIODE CHARACTERISTICS

|                          |          |   |     |      |   |
|--------------------------|----------|---|-----|------|---|
| Continuous Current       | $I_S$    | – | –   | 0.6  | A |
| Pulsed Current           | $I_{SM}$ | – | –   | 0.75 |   |
| Forward Voltage (Note 5) | $V_{SD}$ | – | 0.8 | –    | V |

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. Pulse Test: Pulse Width  $\leq 300\text{ }\mu\text{s}$ , Duty Cycle  $\leq 2\%$ .

5. Switching characteristics are independent of operating junction temperature.

# MGSF1N03L, MVGSF1N03L

## TYPICAL ELECTRICAL CHARACTERISTICS

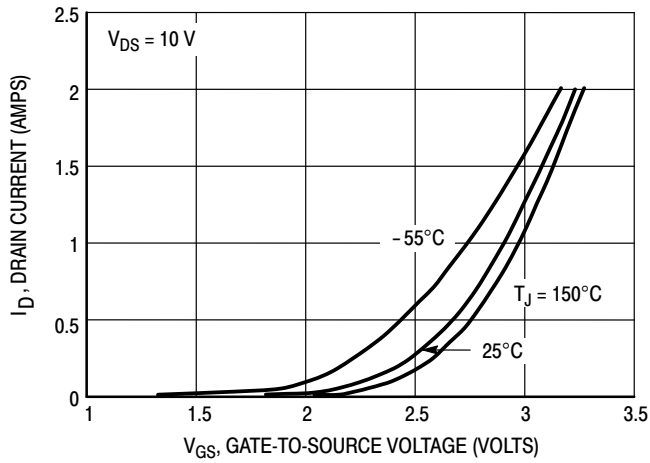


Figure 1. Transfer Characteristics

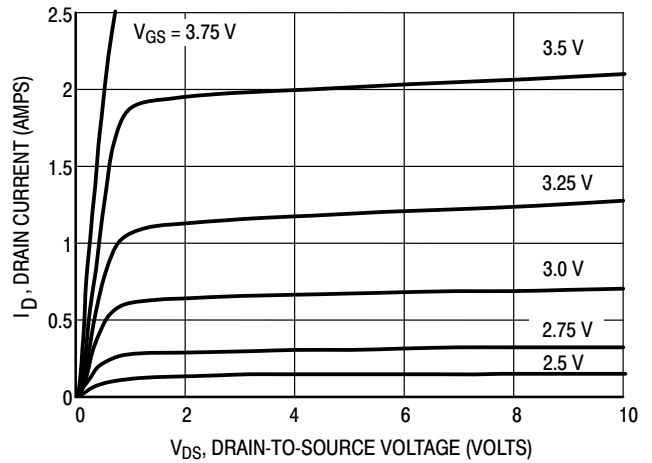


Figure 2. On-Region Characteristics

## TYPICAL ELECTRICAL CHARACTERISTICS

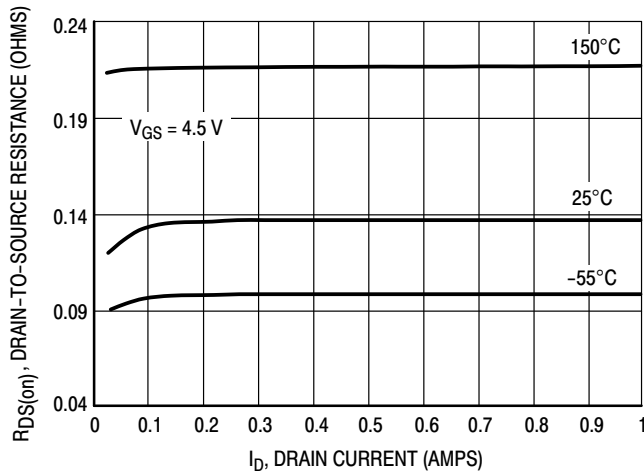


Figure 3. On-Resistance versus Drain Current

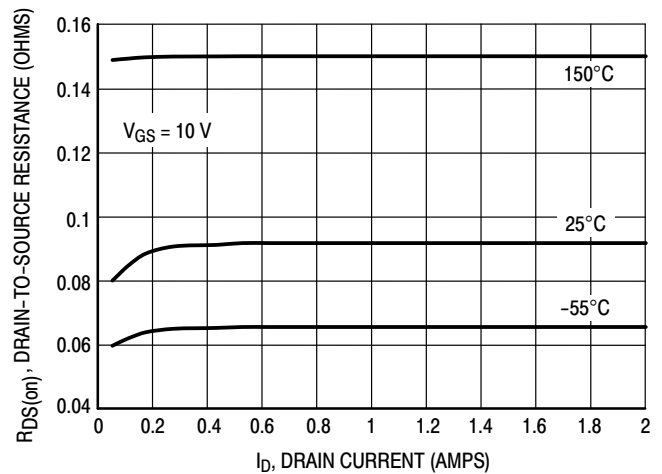


Figure 4. On-Resistance versus Drain Current

# MGSF1N03L, MVGSF1N03L

## TYPICAL ELECTRICAL CHARACTERISTICS

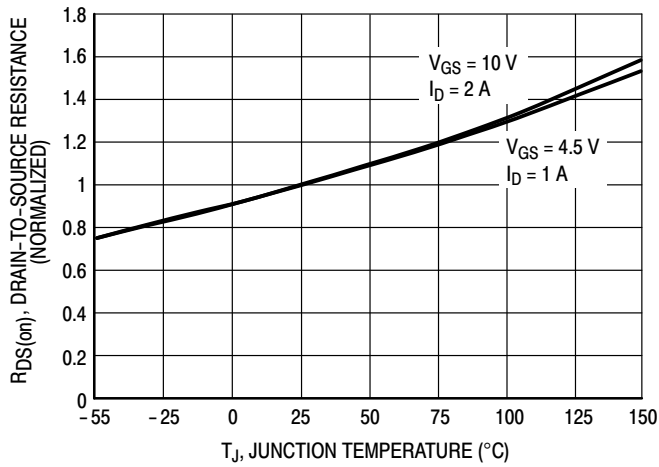


Figure 5. On-Resistance Variation with Temperature

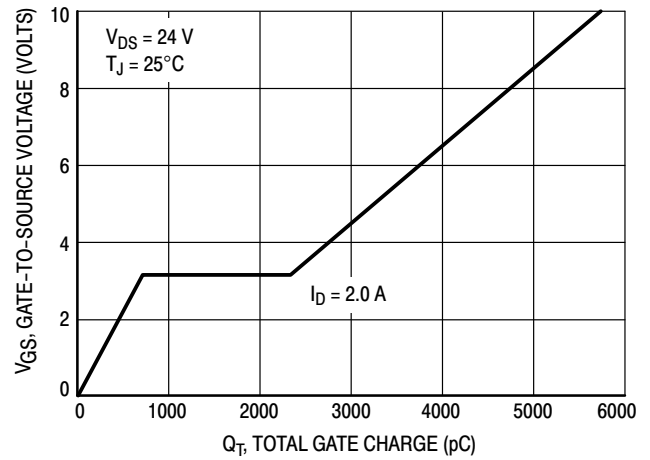


Figure 6. Gate Charge

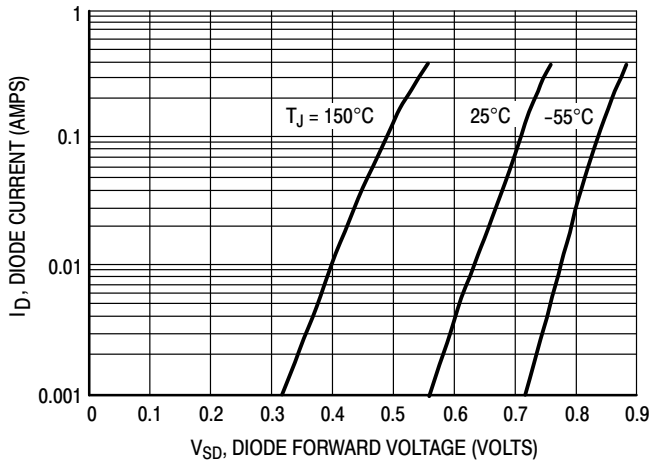


Figure 7. Body Diode Forward Voltage

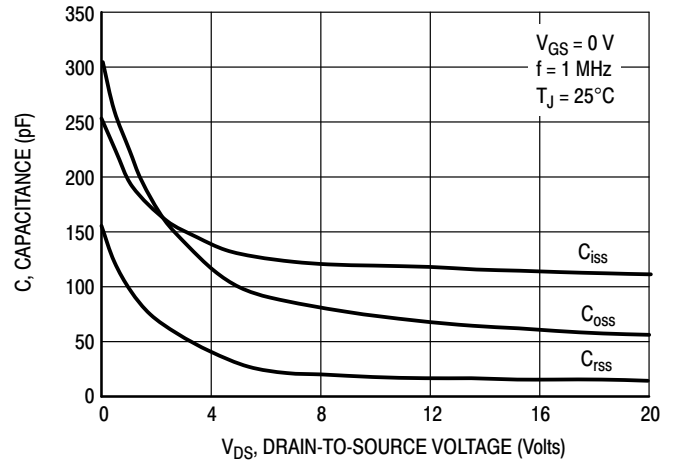
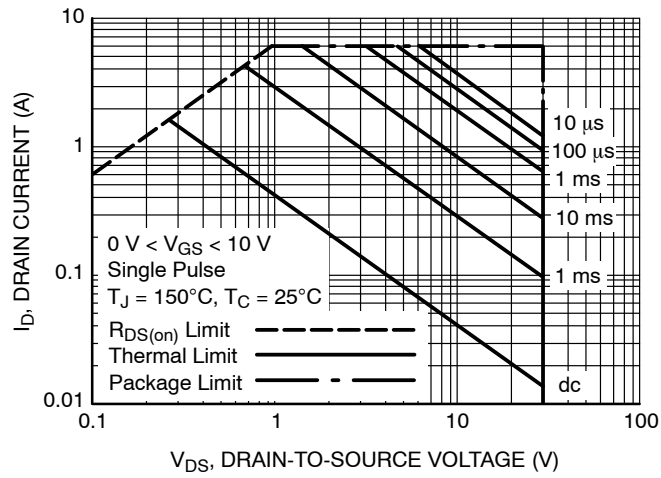


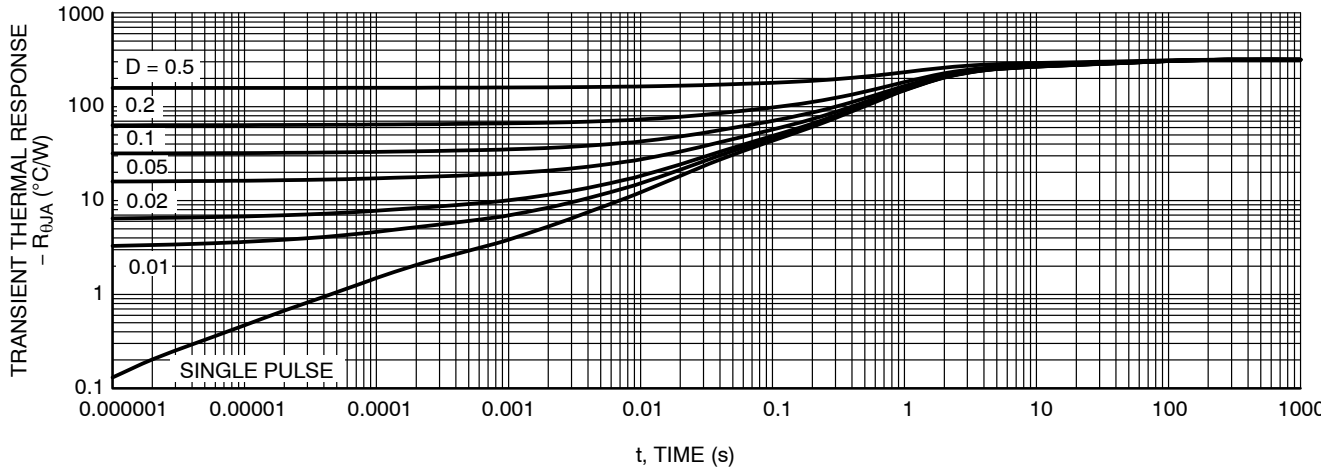
Figure 8. Capacitance

# MGSF1N03L, MVGSF1N03L

## TYPICAL ELECTRICAL CHARACTERISTICS



**Figure 9. Maximum Rated Forward Biased Safe Operating Area**



**Figure 10. Thermal Response**



SCALE 4:1

**SOT-23 (TO-236) 2.90x1.30x1.00 1.90P**  
**CASE 318**  
**ISSUE AU**

DATE 14 AUG 2024



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