

# Digital FET, N-Channel

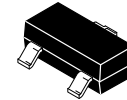
## FDV303N

### General Description

These N-Channel enhancement mode field effect transistors are produced using onsemi's proprietary, high cell density, DMOS technology. This very high density process is tailored to minimize on-state resistance at low gate drive conditions. This device is designed especially for application in battery circuits using either one lithium or three cadmium or NMH cells. It can be used as an inverter or for high-efficiency miniature discrete DC/DC conversion in compact portable electronic devices like cellular phones and pagers. This device has excellent on-state resistance even at gate drive voltages as low as 2.5 V.

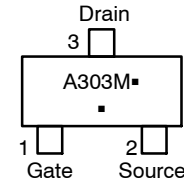
### Features

- 25 V, 0.68 A Continuous, 2 A Peak
  - ♦  $R_{DS(ON)} = 0.45 \Omega @ V_{GS} = 4.5 V$
  - ♦  $R_{DS(ON)} = 0.6 \Omega @ V_{GS} = 2.7 V$
- Very Low Level Gate Drive Requirements Allowing Direct Operation in 3 V Circuits,  $V_{GS(th)} < 1 V$
- Gate-Source Zener for ESD Ruggedness, > 6 kV Human Body Model
- Compact Industry Standard SOT-23 Surface Mount Package
- This Device is Pb-Free, Halogen Free/BFR Free and is RoHS Compliant



SOT-23 (TO-236)  
CASE 318-08  
STYLE 21

### MARKING DIAGRAM



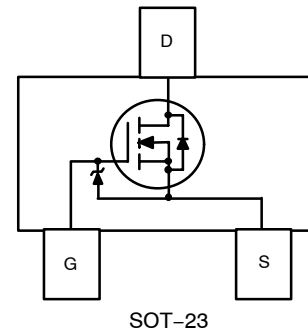
A or blank = One/two character Location Code  
 303 = Specific Device Code  
 M = Date Code  
 ■ = Pb-Free Package

(Note: Microdot may be in either location)

\* Location code can be blank or with characters indicating manufacturing location

\* Date Code orientation and overbar may vary depending upon manufacturing location.

### PIN ASSIGNMENT



### ORDERING INFORMATION

See detailed ordering and shipping information on page 2 of this data sheet.

# FDV303N

## MOSFET MAXIMUM RATINGS $T_A = 25^\circ\text{C}$ unless otherwise noted

| Symbol                         | Parameter                                                                                 | FDV303N    | Units            |
|--------------------------------|-------------------------------------------------------------------------------------------|------------|------------------|
| $V_{\text{DSS}}$               | Drain–Source Voltage, Power Supply Voltage                                                | 25         | V                |
| $V_{\text{GSS}}$               | Gate–Source Voltage, $V_{\text{IN}}$                                                      | 8          | V                |
| $I_{\text{D}}$                 | Drain/Output Current<br>– Continuous<br>– Pulsed                                          | 0.68<br>2  | A                |
| $P_{\text{D}}$                 | Maximum Power Dissipation                                                                 | 0.35       | W                |
| $T_{\text{J}}, T_{\text{STG}}$ | Operating and Storage Temperature Range                                                   | –55 to 150 | $^\circ\text{C}$ |
| ESD                            | Electrostatic Discharge Rating MIL–STD–883D Human Body Model<br>(100 pF / 1500 $\Omega$ ) | 6.0        | kV               |

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

| Symbol                | Parameter                               | Ratings | Units              |
|-----------------------|-----------------------------------------|---------|--------------------|
| $R_{\theta\text{JA}}$ | Thermal Resistance, Junction–to–Ambient | 357     | $^\circ\text{C/W}$ |

## ORDERING INFORMATION

| Device  | Package               | Shipping <sup>†</sup> |
|---------|-----------------------|-----------------------|
| FDV303N | SOT–23<br>Case 318–08 | 3000 / 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 Specifications Brochure, [BRD8011/D](#).

# FDV303N

ELECTRICAL CHARACTERISTICS  $T_J = 25^\circ\text{C}$  unless otherwise noted

| Symbol | Parameter | Conditions | Min | Typ | Max | Units |
|--------|-----------|------------|-----|-----|-----|-------|
|--------|-----------|------------|-----|-----|-----|-------|

## OFF CHARACTERISTICS

|                                      |                                     |                                                                   |    |    |     |                      |
|--------------------------------------|-------------------------------------|-------------------------------------------------------------------|----|----|-----|----------------------|
| $BV_{DSS}$                           | Drain-Source Breakdown Voltage      | $V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$               | 25 |    |     | V                    |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temp. Coefficient | $I_D = 250\text{ }\mu\text{A}$ , Referenced to $25^\circ\text{C}$ |    | 26 |     | mV/ $^\circ\text{C}$ |
| $I_{DSS}$                            | Zero Gate Voltage Drain Current     | $V_{DS} = 20\text{ V}, V_{GS} = 0\text{ V}$                       |    |    | 1   | $\mu\text{A}$        |
|                                      |                                     | $T_J = 55^\circ\text{C}$                                          |    |    | 10  | $\mu\text{A}$        |
| $I_{GSS}$                            | Gate – Body Leakage Current         | $V_{GS} = 8\text{ V}, V_{DS} = 0\text{ V}$                        |    |    | 100 | nA                   |

## ON CHARACTERISTICS (Note 1)

|                                        |                                                |                                                                   |      |      |      |                      |
|----------------------------------------|------------------------------------------------|-------------------------------------------------------------------|------|------|------|----------------------|
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate Threshold Voltage Temperature Coefficient | $I_D = 250\text{ }\mu\text{A}$ , Referenced to $25^\circ\text{C}$ |      | -2.6 |      | mV/ $^\circ\text{C}$ |
| $V_{GS(th)}$                           | Gate Threshold Voltage                         | $V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$                   | 0.65 | 0.8  | 1    | V                    |
| $R_{DS(on)}$                           | Static Drain-Source On-Resistance              | $V_{GS} = 4.5\text{ V}, I_D = 0.5\text{ A}$                       |      | 0.33 | 0.45 | $\Omega$             |
|                                        |                                                | $T_J = 125^\circ\text{C}$                                         |      | 0.52 | 0.8  |                      |
|                                        |                                                | $V_{GS} = 2.7\text{ V}, I_D = 0.2\text{ A}$                       |      | 0.44 | 0.6  |                      |
| $I_{D(on)}$                            | On-State Drain Current                         | $V_{GS} = 2.7\text{ V}, V_{DS} = 5\text{ V}$                      | 0.5  |      |      | A                    |
| $g_{FS}$                               | Forward Transconductance                       | $V_{DS} = 5\text{ V}, I_D = 0.5\text{ A}$                         |      | 1.45 |      | S                    |

## DYNAMIC CHARACTERISTICS

|           |                              |                                                                 |  |    |  |    |
|-----------|------------------------------|-----------------------------------------------------------------|--|----|--|----|
| $C_{iss}$ | Input Capacitance            | $V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}$ |  | 50 |  | pF |
| $C_{oss}$ | Output Capacitance           |                                                                 |  | 28 |  | pF |
| $C_{rss}$ | Reverse Transfer Capacitance |                                                                 |  | 9  |  | pF |

## SWITCHING CHARACTERISTICS (Note 1)

|              |                       |                                                                                              |  |      |     |    |
|--------------|-----------------------|----------------------------------------------------------------------------------------------|--|------|-----|----|
| $t_{D(on)}$  | Turn – On Delay Time  | $V_{DD} = 6\text{ V}, I_D = 0.5\text{ A}, V_{GS} = 4.5\text{ V}, R_{GEN} = 50\text{ }\Omega$ |  | 3    | 6   | ns |
| $t_r$        | Turn – On Rise Time   |                                                                                              |  | 8.5  | 18  | ns |
| $t_{D(off)}$ | Turn – Off Delay Time |                                                                                              |  | 17   | 30  | ns |
| $t_f$        | Turn – Off Fall Time  |                                                                                              |  | 13   | 25  | ns |
| $Q_g$        | Total Gate Charge     | $V_{DS} = 5\text{ V}, I_D = 0.5\text{ A}, V_{GS} = 4.5\text{ V}$                             |  | 1.64 | 2.3 | nC |
| $Q_{gs}$     | Gate-Source Charge    |                                                                                              |  | 0.38 |     | nC |
| $Q_{gd}$     | Gate-Drain Charge     |                                                                                              |  | 0.45 |     | nC |

## DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS

|                 |                                                       |                                                        |  |      |     |   |
|-----------------|-------------------------------------------------------|--------------------------------------------------------|--|------|-----|---|
| I <sub>S</sub>  | Maximum Continuous Drain–Source Diode Forward Current |                                                        |  |      | 0.3 | A |
| V <sub>SD</sub> | Drain–Source Diode Forward Voltage                    | V <sub>GS</sub> = 0 V, I <sub>S</sub> = 0.5 A (Note 1) |  | 0.83 | 1.2 | 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.

1. Pulse Test: Pulse Width < 300  $\mu\text{s}$ , Duty Cycle < 2.0%.

## TYPICAL CHARACTERISTICS

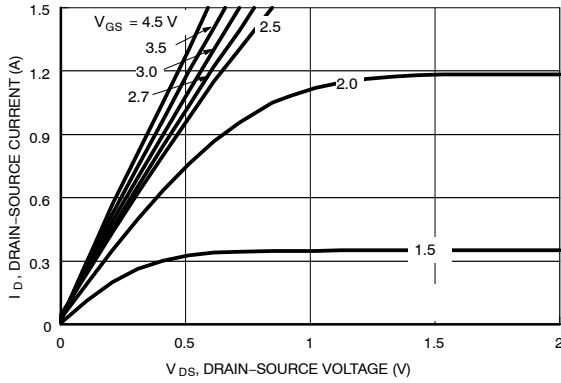


Figure 1. On-Region Characteristics

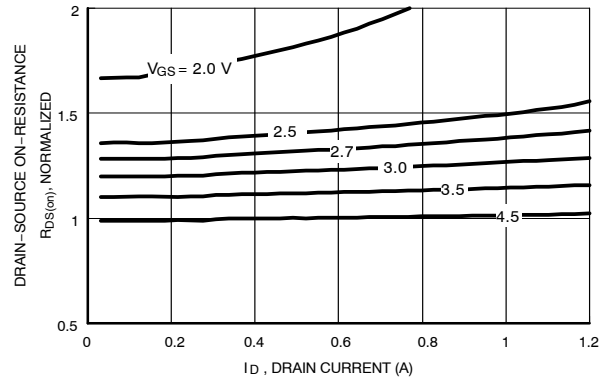


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage

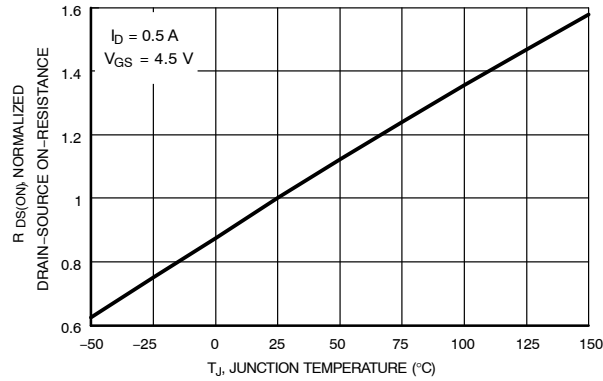


Figure 3. On-Resistance Variation with Temperature

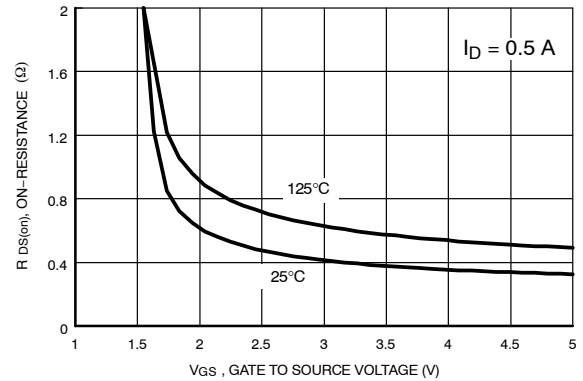


Figure 4. On Resistance Variation with Gate-To-Source Voltage

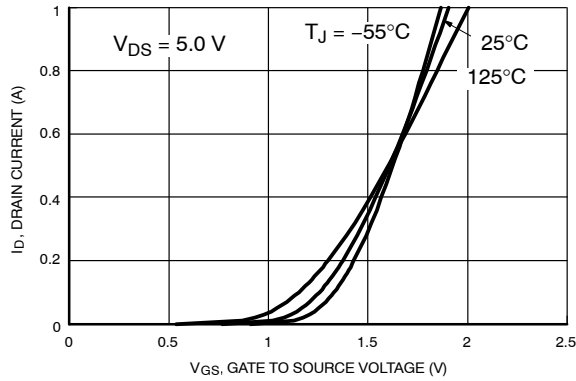


Figure 5. Transfer Characteristics

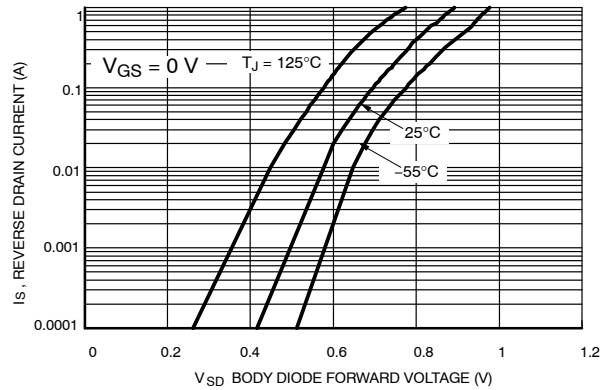


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature

TYPICAL CHARACTERISTICS  $T_J = 25^\circ\text{C}$  Unless Otherwise Noted (continued)

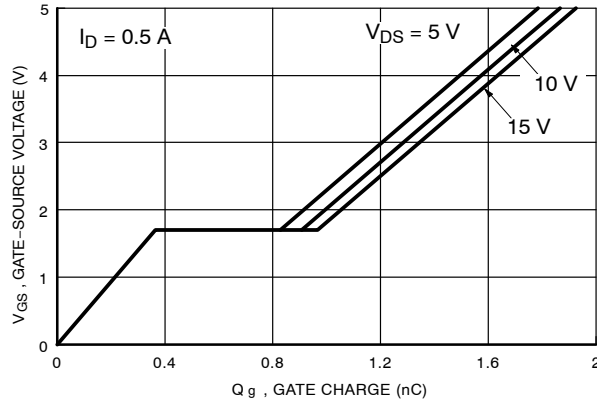


Figure 7. Gate Charge Characteristics

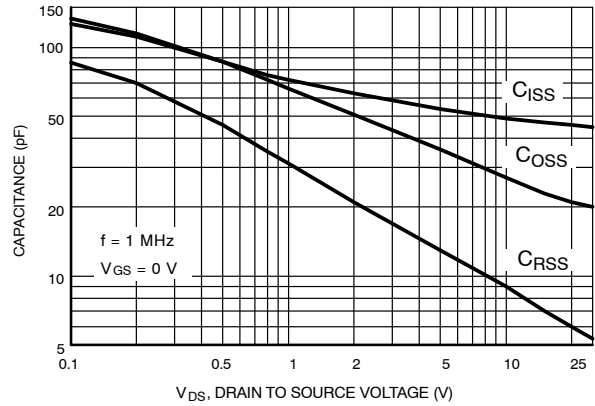


Figure 8. Capacitance Characteristics

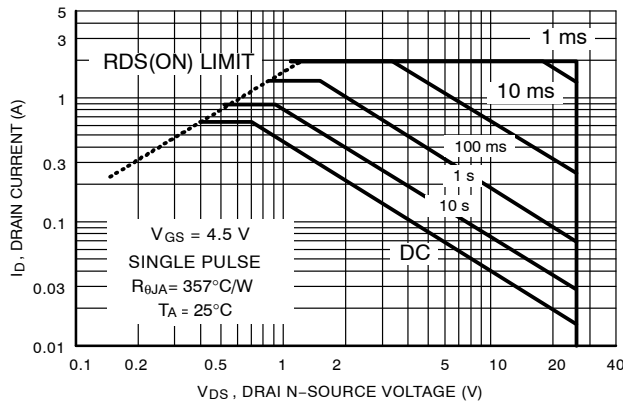


Figure 9. Maximum Safe Operating Area

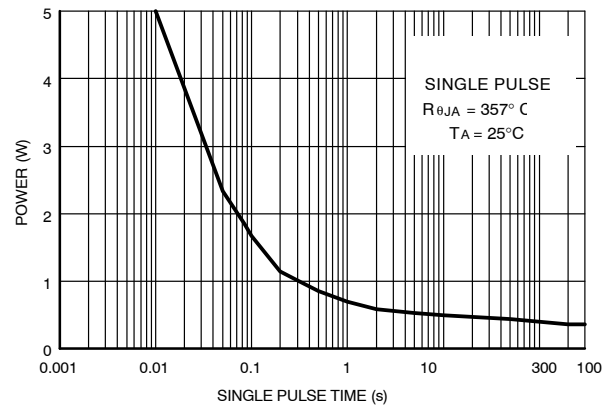


Figure 10. Single Pulse Maximum Power Dissipation

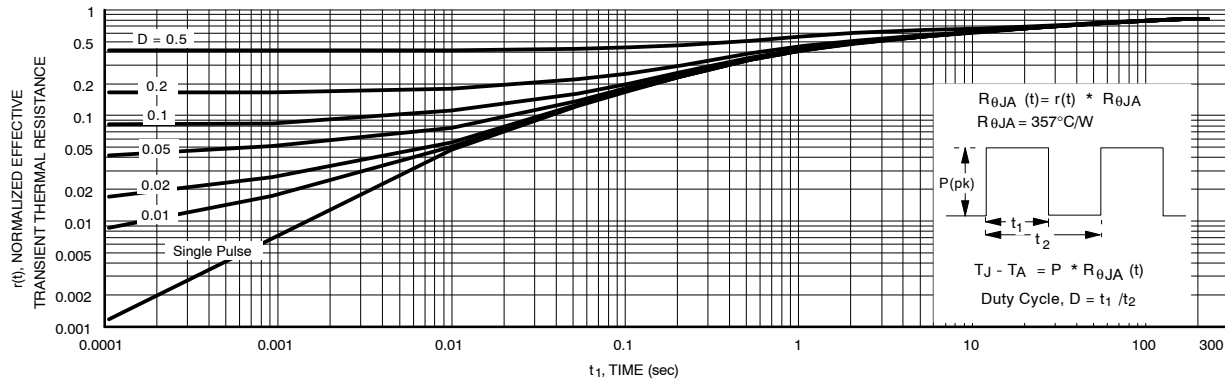
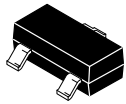


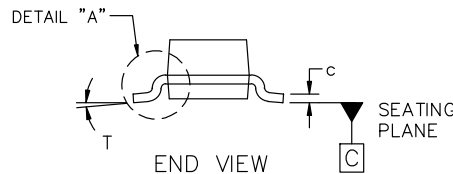
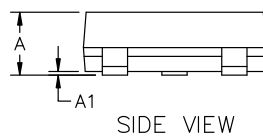
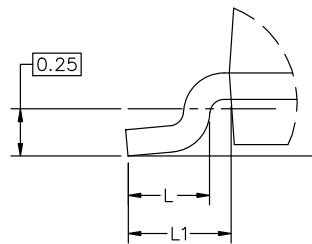
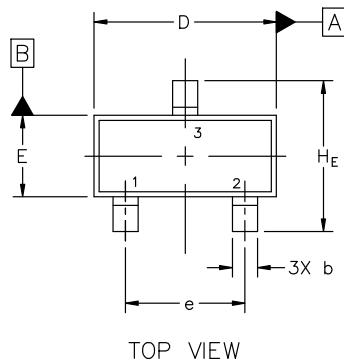
Figure 11. Transient Thermal Response Curve



SCALE 4:1

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CASE 318  
ISSUE AU

DATE 14 AUG 2024

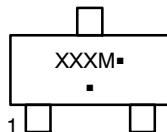


| MILLIMETERS |      |      |      |
|-------------|------|------|------|
| DIM         | MIN  | NOM  | MAX  |
| A           | 0.89 | 1.00 | 1.11 |
| A1          | 0.01 | 0.06 | 0.10 |
| b           | 0.37 | 0.44 | 0.50 |
| c           | 0.08 | 0.14 | 0.20 |
| D           | 2.80 | 2.90 | 3.04 |
| E           | 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:

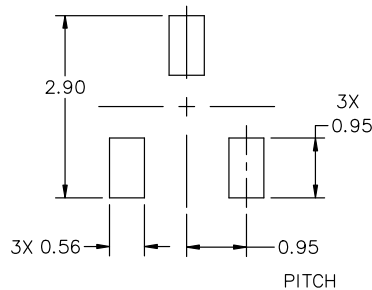
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2018.
2. CONTROLLING DIMENSIONS: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF THE BASE MATERIAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

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, SOLDERRM/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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