

# NPN & PNP General-Purpose Amplifier

## FFB2227A, FMB2227A

### Description

This complementary device is a medium-power amplifier and switch, requiring collector currents up to 500 mA. Sourced from Process 19 and 63. See FFB2222A (NPN) and FFB2907A (PNP) for characteristics.

### ABSOLUTE MAXIMUM RATINGS (Note 1)

(T<sub>A</sub> = 25 °C, unless otherwise noted)

| Symbol                               | Parameter                                        | Value       | Unit |
|--------------------------------------|--------------------------------------------------|-------------|------|
| V <sub>CEO</sub>                     | Collector-Emitter Voltage                        | 30          | V    |
| V <sub>CBO</sub>                     | Collector-Base Voltage                           | 60          | V    |
| V <sub>EBO</sub>                     | Emitter-Base Voltage                             | 5           | V    |
| I <sub>C</sub>                       | Collector Current – Continuous                   | 500         | mA   |
| T <sub>J</sub> ,<br>T <sub>STG</sub> | Operating and Storage Junction Temperature Range | –55 to +150 | °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.

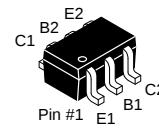
- These ratings are based on a maximum junction temperature of 150 °C.
- These are steady-state limits. onsemi should be consulted on applications involving pulsed or low-duty cycle operations.
- All voltages (V) and currents (A) are negative polarity for PNP transistors.
- These Ratings are limiting values above which the serviceability of any semiconductor device may be impaired.

### THERMAL CHARACTERISTICS (Note 5)

(T<sub>A</sub> = 25 °C, unless otherwise noted)

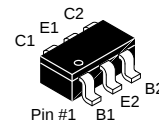
| Symbol           | Parameter                               | Maximum  |          | Unit  |
|------------------|-----------------------------------------|----------|----------|-------|
|                  |                                         | FFB2227A | FMB2227A |       |
| P <sub>D</sub>   | Total Device Dissipation                | 300      | 700      | mW    |
|                  | Derate Above 25 °C                      | 2.4      | 5.6      | mW/°C |
| R <sub>θJA</sub> | Thermal Resistance, Junction to Ambient | 415      | 180      | °C/W  |

- PCB board size: FR-4 76 x 114 x 0.6T mm<sup>3</sup> (3.0 inch x 4.5 inch x 0.062 inch) with minimum land pattern size.



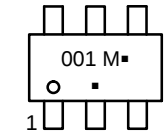
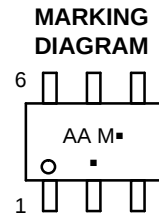
SC-88  
CASE 419B-02

FFB2227A



TSOT23 6-Lead  
CASE 419BL

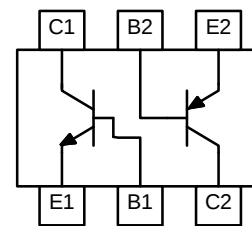
FMB2227A



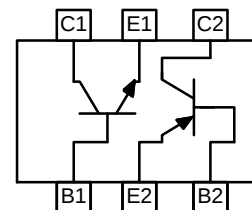
AA, 001 = Specific Device Code  
M = Date Code  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

### INTERNAL CONNECTION



FFB2227A



FMB2227A

| TRANSISTOR TYPE |    |    |     |
|-----------------|----|----|-----|
| C1              | B1 | E1 | NPN |
| C2              | B2 | E2 | PNP |

### ORDERING INFORMATION

| Device   | Package                          | Shipping <sup>†</sup> |
|----------|----------------------------------|-----------------------|
| FFB2227A | SC-88<br>(Pb-Free, Halide Free)  | 3000 / Tape & Reel    |
| FMB2227A | TSOT23<br>(Pb-Free, Halide Free) | 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](http://BRD8011/D).

# FFB2227A, FMB2227A

## ELECTRICAL CHARACTERISTICS (Note 6) ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

| Symbol | Parameter | Test Condition | Min | Typ | Max | Unit |
|--------|-----------|----------------|-----|-----|-----|------|
|--------|-----------|----------------|-----|-----|-----|------|

### OFF CHARACTERISTICS

|               |                                              |                                        |    |   |    |    |
|---------------|----------------------------------------------|----------------------------------------|----|---|----|----|
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage (Note 7) | $I_C = 10\text{ mA}, I_B = 0$          | 30 | – | –  | V  |
| $V_{(BR)CBO}$ | Collector-Base Breakdown Voltage             | $I_C = 10\text{ }\mu\text{A}, I_E = 0$ | 60 | – | –  | V  |
| $V_{(BR)EBO}$ | Emitter-Base Breakdown Voltage               | $I_E = 10\text{ }\mu\text{A}, I_C = 0$ | 5  | – | –  | V  |
| $I_{CBO}$     | Collector Cut-Off Current                    | $V_{CB} = 50\text{ V}, I_E = 0$        | –  | – | 30 | nA |
| $I_{EBO}$     | Emitter Cut-Off Current                      | $V_{EB} = 3.0\text{ V}, I_C = 0$       | –  | – | 30 | nA |

### ON CHARACTERISTICS

|               |                                               |                                                      |     |   |     |   |
|---------------|-----------------------------------------------|------------------------------------------------------|-----|---|-----|---|
| $h_{FE}$      | DC Current Gain                               | $I_C = 1.0\text{ mA}, V_{CE} = 10\text{ V}$          | 50  | – | –   |   |
|               |                                               | $I_C = 10\text{ mA}, V_{CE} = 10\text{ V}$           | 75  | – | –   |   |
|               |                                               | $I_C = 150\text{ mA}, V_{CE} = 10\text{ V}$ (Note 7) | 100 | – | –   |   |
|               |                                               | $I_C = 300\text{ mA}, V_{CE} = 10\text{ V}$ (Note 7) | 30  | – | –   |   |
| $V_{CE(sat)}$ | Collector-Emitter Saturation Voltage (Note 7) | $I_C = 150\text{ mA}, I_B = 15\text{ mA}$            | –   | – | 0.4 | V |
|               |                                               | $I_C = 300\text{ mA}, I_B = 30\text{ mA}$            | –   | – | 1.4 | V |
| $V_{BE(sat)}$ | Base-Emitter Saturation Voltage (Note 7)      | $I_C = 150\text{ mA}, I_B = 15\text{ mA}$            | –   | – | 1.3 | V |

### SMALL SIGNAL CHARACTERISTICS

|           |                                  |                                                                                                    |   |     |   |     |
|-----------|----------------------------------|----------------------------------------------------------------------------------------------------|---|-----|---|-----|
| $f_T$     | Current Gain – Bandwidth Product | $I_C = 50\text{ mA}, V_{CE} = 20\text{ V}, f = 100\text{ MHz}$                                     | – | 250 | – | MHz |
| $C_{obo}$ | Output Capacitance               | $V_{CB} = 10\text{ V}, I_E = 0, f = 100\text{ kHz}$                                                | – | 4.0 | – | pF  |
| $C_{ibo}$ | Input Capacitance                | $V_{EB} = 2.0\text{ V}, I_C = 0, f = 100\text{ kHz}$                                               | – | 12  | – | pF  |
| NF        | Noise Figure                     | $I_C = 100\text{ }\mu\text{A}, V_{CE} = 10\text{ V}, R_S = 1.0\text{ k}\Omega, f = 1.0\text{ kHz}$ | – | 2.0 | – | dB  |

### SWITCHING CHARACTERISTICS

|           |               |                                                                              |   |     |   |    |
|-----------|---------------|------------------------------------------------------------------------------|---|-----|---|----|
| $t_{on}$  | Turn-on Time  | $V_{CC} = 30\text{ V}, I_C = 150\text{ mA}, I_{B1} = 15\text{ mA}$           | – | 30  | – | ns |
| $t_d$     | Delay Time    |                                                                              | – | 8.0 | – | ns |
| $t_r$     | Rise Time     |                                                                              | – | 20  | – | ns |
| $t_{off}$ | Turn-off Time | $V_{CC} = 6.0\text{ V}, I_C = 150\text{ mA}, I_{B1} = I_{B2} = 15\text{ mA}$ | – | 80  | – | ns |
| $t_s$     | Storage Time  |                                                                              | – | 60  | – | ns |
| $t_f$     | Fall Time     |                                                                              | – | 20  | – | 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.

6. All voltages (V) and currents (A) are negative polarity for PNP transistors.

7. Pulse test: pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2.0\%$ .

## FFB2227A, FMB2227A

### REVISION HISTORY

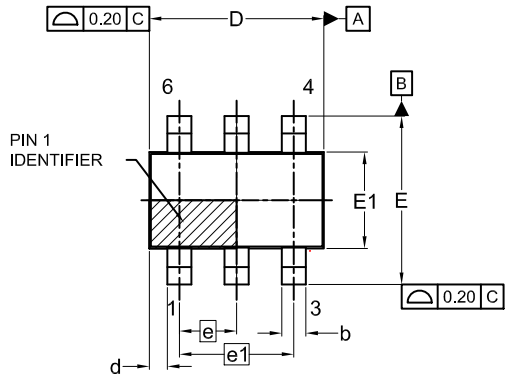
| Revision | Description of Changes                                                                          | Date       |
|----------|-------------------------------------------------------------------------------------------------|------------|
| 3        | Converted the Data Sheet to <b>onsemi</b> format. Updated the Case Outline from 419AG to 419BL. | 05/06/2025 |



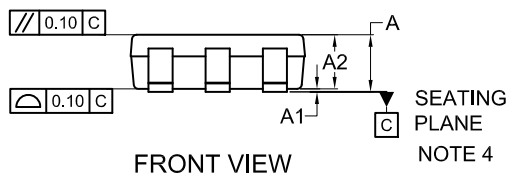
SCALE 2:1

**TSOT23 6-Lead**  
**CASE 419BL**  
**ISSUE A**

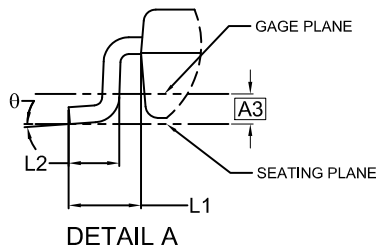
DATE 31 AUG 2020



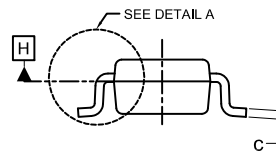
TOP VIEW



FRONT VIEW

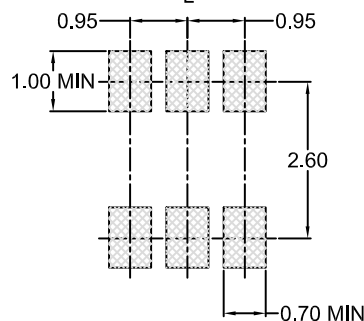


DETAIL A



SIDE VIEW

SYMM

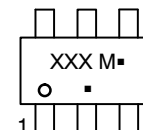

**LAND PATTERN**  
**RECOMMENDATION**

\*FOR ADDITIONAL INFORMATION ON OUR  
PB-FREE STRATEGY AND SOLDERING DETAILS,  
PLEASE DOWNLOAD THE ON SEMICONDUCTOR  
SOLDERING AND MOUNTING TECHNIQUES  
REFERENCE MANUAL, SOLDERM/D.

## NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS OR GATE BURRS SHALL NOT EXCEED 0.25MM PER END. DIMENSIONS D AND E1 ARE DETERMINED AT DATUM H.
4. SEATING PLANE IS DEFINED BY THE TERMINALS. "A1" IS DEFINED AS THE DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT ON THE PACKAGE BODY.

| DIM | MILLIMETERS |      |      |
|-----|-------------|------|------|
|     | MIN.        | NOM. | MAX. |
| A   | 0.90        | 1.00 | 1.10 |
| A1  | 0.00        | 0.05 | 0.10 |
| A2  | 0.70        | 0.85 | 1.00 |
| A3  | 0.25 BSC    |      |      |
| b   | 0.25        | 0.38 | 0.50 |
| c   | 0.10        | 0.18 | 0.26 |
| D   | 2.80        | 2.95 | 3.10 |
| d   | 0.30 REF    |      |      |
| E   | 2.50        | 2.75 | 3.00 |
| E1  | 1.30        | 1.50 | 1.70 |
| e   | 0.95 BSC    |      |      |
| e1  | 1.90 BSC    |      |      |
| L1  | 0.60 REF    |      |      |
| L2  | 0.20        | 0.40 | 0.60 |
| Θ   | 0°          | —    | 10°  |

**GENERIC**  
**MARKING DIAGRAM\***


XXX = Specific Device Code

M = Date Code

▪ = Pb-Free Package

(Note: Microdot may be in either location)

\*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.

|                         |                      |                                                                                                                                                                                  |
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| <b>DESCRIPTION:</b>     | <b>TSOT23 6-Lead</b> | <b>PAGE 1 OF 1</b>                                                                                                                                                               |

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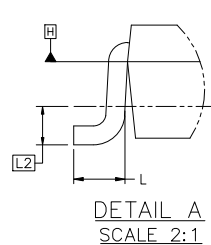
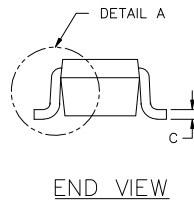
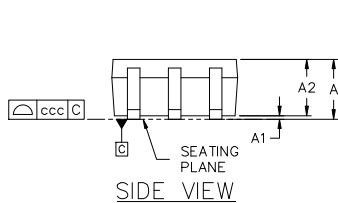
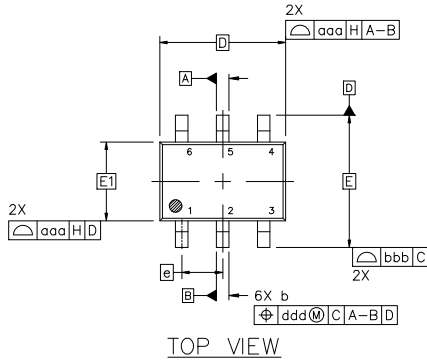


SC-88 2.00x1.25x0.90, 0.65P  
CASE 419B-02  
ISSUE Z

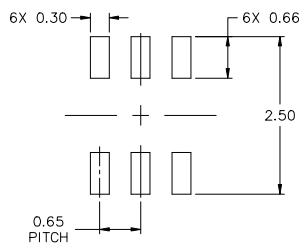
DATE 18 APR 2024

NOTES:

1. DIMENSIONING AND TOLERANCING CONFORM TO ASME Y14.5-2018.
2. ALL DIMENSION ARE IN MILLIMETERS.
3. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.20 PER END.
4. DIMENSIONS D AND E1 AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY AND DATUM H.
5. DATUMS A AND B ARE DETERMINED AT DATUM H.
6. DIMENSIONS b AND c APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN 0.08 AND 0.15 FROM THE TIP.
7. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 TOTAL IN EXCESS OF DIMENSION b AT MAXIMUM MATERIAL CONDITION. THE DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OF THE FOOT.



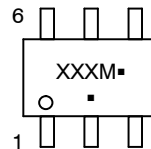
| DIM | MILLIMETERS |      |      |
|-----|-------------|------|------|
|     | MIN.        | NOM. | MAX. |
| A   | ---         | ---  | 1.10 |
| A1  | 0.00        | ---  | 0.10 |
| A2  | 0.70        | 0.90 | 1.00 |
| b   | 0.15        | 0.20 | 0.25 |
| c   | 0.08        | 0.15 | 0.22 |
| D   | 2.00 BSC    |      |      |
| E   | 2.10 BSC    |      |      |
| E1  | 1.25 BSC    |      |      |
| e   | 0.65 BSC    |      |      |
| L   | 0.26        | 0.36 | 0.46 |
| L2  | 0.15 BSC    |      |      |
| aaa | 0.15        |      |      |
| bbb | 0.30        |      |      |
| ccc | 0.10        |      |      |
| ddd | 0.10        |      |      |



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.

GENERIC  
MARKING DIAGRAM\*



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

(Note: Microdot may be in either location)

\*Date Code orientation and/or position may vary depending upon manufacturing location.

\*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.

STYLES ON PAGE 2

|                  |                             |                                                                                                                                                                                  |
|------------------|-----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
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| DESCRIPTION:     | SC-88 2.00x1.25x0.90, 0.65P | PAGE 1 OF 2                                                                                                                                                                      |

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SC-88 2.00x1.25x0.90, 0.65P  
CASE 419B-02  
ISSUE Z

DATE 18 APR 2024

|                                                                                                            |                                                                                                        |                                                                                                             |                                                                                                             |                                                                                                             |                                                                                                       |
|------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
| STYLE 1:<br>PIN 1. EMITTER 2<br>2. BASE 2<br>3. COLLECTOR 1<br>4. EMITTER 1<br>5. BASE 1<br>6. COLLECTOR 2 | STYLE 2:<br>CANCELLED                                                                                  | STYLE 3:<br>CANCELLED                                                                                       | STYLE 4:<br>PIN 1. CATHODE<br>2. CATHODE<br>3. COLLECTOR<br>4. EMITTER<br>5. BASE<br>6. ANODE               | STYLE 5:<br>PIN 1. ANODE<br>2. ANODE<br>3. COLLECTOR<br>4. EMITTER<br>5. BASE<br>6. CATHODE                 | STYLE 6:<br>PIN 1. ANODE 2<br>2. N/C<br>3. CATHODE 1<br>4. ANODE 1<br>5. N/C<br>6. CATHODE 2          |
| STYLE 7:<br>PIN 1. SOURCE 2<br>2. DRAIN 2<br>3. GATE 1<br>4. SOURCE 1<br>5. DRAIN 1<br>6. GATE 2           | STYLE 8:<br>CANCELLED                                                                                  | STYLE 9:<br>PIN 1. EMITTER 2<br>2. EMITTER 1<br>3. COLLECTOR 1<br>4. BASE 1<br>5. BASE 2<br>6. COLLECTOR 2  | STYLE 10:<br>PIN 1. SOURCE 2<br>2. SOURCE 1<br>3. GATE 1<br>4. DRAIN 1<br>5. DRAIN 2<br>6. GATE 2           | STYLE 11:<br>PIN 1. CATHODE 2<br>2. CATHODE 2<br>3. ANODE 1<br>4. CATHODE 1<br>5. CATHODE 1<br>6. ANODE 2   | STYLE 12:<br>PIN 1. ANODE 2<br>2. ANODE 2<br>3. CATHODE 1<br>4. ANODE 1<br>5. ANODE 1<br>6. CATHODE 2 |
| STYLE 13:<br>PIN 1. ANODE<br>2. N/C<br>3. COLLECTOR<br>4. EMITTER<br>5. BASE<br>6. CATHODE                 | STYLE 14:<br>PIN 1. VREF<br>2. GND<br>3. GND<br>4. IOUT<br>5. VEN<br>6. VCC                            | STYLE 15:<br>PIN 1. ANODE 1<br>2. ANODE 2<br>3. ANODE 3<br>4. CATHODE 3<br>5. CATHODE 2<br>6. CATHODE 1     | STYLE 16:<br>PIN 1. BASE 1<br>2. EMITTER 2<br>3. COLLECTOR 2<br>4. BASE 2<br>5. EMITTER 1<br>6. COLLECTOR 1 | STYLE 17:<br>PIN 1. BASE 1<br>2. EMITTER 1<br>3. COLLECTOR 2<br>4. BASE 2<br>5. EMITTER 2<br>6. COLLECTOR 1 | STYLE 18:<br>PIN 1. VIN1<br>2. VCC<br>3. VOUT2<br>4. VIN2<br>5. GND<br>6. VOUT1                       |
| STYLE 19:<br>PIN 1. I OUT<br>2. GND<br>3. GND<br>4. V CC<br>5. V EN<br>6. V REF                            | STYLE 20:<br>PIN 1. COLLECTOR<br>2. COLLECTOR<br>3. BASE<br>4. EMITTER<br>5. COLLECTOR<br>6. COLLECTOR | STYLE 21:<br>PIN 1. ANODE 1<br>2. N/C<br>3. ANODE 2<br>4. CATHODE 2<br>5. N/C<br>6. CATHODE 1               | STYLE 22:<br>PIN 1. D1 (i)<br>2. GND<br>3. D2 (i)<br>4. D2 (c)<br>5. VBUS<br>6. D1 (c)                      | STYLE 23:<br>PIN 1. Vn<br>2. CH1<br>3. Vp<br>4. N/C<br>5. CH2<br>6. N/C                                     | STYLE 24:<br>PIN 1. CATHODE<br>2. ANODE<br>3. CATHODE<br>4. CATHODE<br>5. CATHODE<br>6. CATHODE       |
| STYLE 25:<br>PIN 1. BASE 1<br>2. CATHODE<br>3. COLLECTOR 2<br>4. BASE 2<br>5. EMITTER<br>6. COLLECTOR 1    | STYLE 26:<br>PIN 1. SOURCE 1<br>2. GATE 1<br>3. DRAIN 2<br>4. SOURCE 2<br>5. GATE 2<br>6. DRAIN 1      | STYLE 27:<br>PIN 1. BASE 2<br>2. BASE 1<br>3. COLLECTOR 1<br>4. EMITTER 1<br>5. EMITTER 2<br>6. COLLECTOR 2 | STYLE 28:<br>PIN 1. DRAIN<br>2. DRAIN<br>3. GATE<br>4. SOURCE<br>5. DRAIN<br>6. DRAIN                       | STYLE 29:<br>PIN 1. ANODE<br>2. ANODE<br>3. COLLECTOR<br>4. EMITTER<br>5. BASE/ANODE<br>6. CATHODE          | STYLE 30:<br>PIN 1. SOURCE 1<br>2. DRAIN 2<br>3. DRAIN 2<br>4. SOURCE 2<br>5. GATE 1<br>6. DRAIN 1    |

Note: Please refer to datasheet for style callout. If style type is not called out in the datasheet refer to the device datasheet pinout or pin assignment.

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