



## N-Channel Enhancement-Mode Vertical DMOS FETs

### Features

- ▶ Free from secondary breakdown
- ▶ Low input and output leakage
- ▶ Low  $C_{ISS}$  and fast switching speeds
- ▶ High input impedance and high gain

### Applications

- ▶ Motor controls
- ▶ Converters
- ▶ Amplifiers
- ▶ Switches
- ▶ Power supply circuits
- ▶ Drivers (relays, hammers, solenoids, lamps, memories, displays, bipolar transistors, etc.)

### General Description

This enhancement-mode (normally-off) transistor utilizes a vertical DMOS structure and Supertex's well-proven silicon-gate manufacturing process. This combination produces a device with the power handling capabilities of bipolar transistors and with the high input impedance and positive temperature coefficient inherent in MOS devices. Characteristic of all MOS structures, this device is free from thermal runaway and thermally induced secondary breakdown.

Supertex's vertical DMOS FETs are ideally suited to a wide range of switching and amplifying applications where high breakdown voltage, high input impedance, low input capacitance, and fast switching speeds are desired.

### Ordering Information

| Device | Package Options |                      | $BV_{DSS}/BV_{DGS}$<br>(V) | $R_{DS(ON)}$<br>(max)<br>( $\Omega$ ) | $I_{D(ON)}$<br>(min)<br>(mA) |
|--------|-----------------|----------------------|----------------------------|---------------------------------------|------------------------------|
|        | TO-92           | TO-243AA<br>(SOT-89) |                            |                                       |                              |
| VN2450 | VN2450N3-G      | VN2450N8-G           | 500                        | 13                                    | 500                          |

-G indicates package is RoHS compliant ('Green')



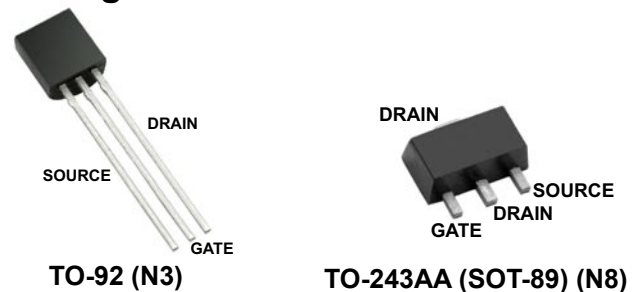
### Absolute Maximum Ratings

| Parameter                         | Value                             |
|-----------------------------------|-----------------------------------|
| Drain-to-source voltage           | $BV_{DSS}$                        |
| Drain-to-gate voltage             | $BV_{DGS}$                        |
| Gate-to-source voltage            | $\pm 20V$                         |
| Operating and storage temperature | $-55^{\circ}C$ to $+150^{\circ}C$ |
| Soldering temperature*            | $+300^{\circ}C$                   |

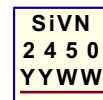
Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied. Continuous operation of the device at the absolute rating level may affect device reliability. All voltages are referenced to device ground.

\* Distance of 1.6mm from case for 10 seconds.

### Pin Configurations



### Product Marking



YY = Year Sealed  
 WW = Week Sealed  
 \_\_\_\_\_ = "Green" Packaging

Package may or may not include the following marks: Si or

**TO-92 (N3)**



W = Code for week sealed  
 \_\_\_\_\_ = "Green" Packaging

Package may or may not include the following marks: Si or

**TO-243AA (SOT-89) (N8)**

### Thermal Characteristics

| Package  | I <sub>D</sub><br>(continuous)*<br>(mA) | I <sub>D</sub><br>(pulsed)<br>(mA) | Power Dissipation<br>@T <sub>A</sub> = 25°C<br>(W) | θ <sub>jc</sub><br>(°C/W) | θ <sub>ja</sub><br>(°C/W) | I <sub>DR</sub> †<br>(mA) | I <sub>DRM</sub><br>(mA) |
|----------|---|------------------------------------|--|---------------------------|---------------------------|---------------------------|--------------------------|
| TO-92    | 200                                     | 650                                | 0.74   | 125                       | 170                       | 200                       | 650                      |
| TO-243AA | 250                                     | 750                                | 1.6‡   | 15                        | 78‡                       | 250                       | 750                      |

**Notes:**

- † I<sub>D</sub> (continuous) is limited by max rated T<sub>p</sub>
- ‡ Mounted on FR5 board, 25mm x 25mm x 1.57mm.

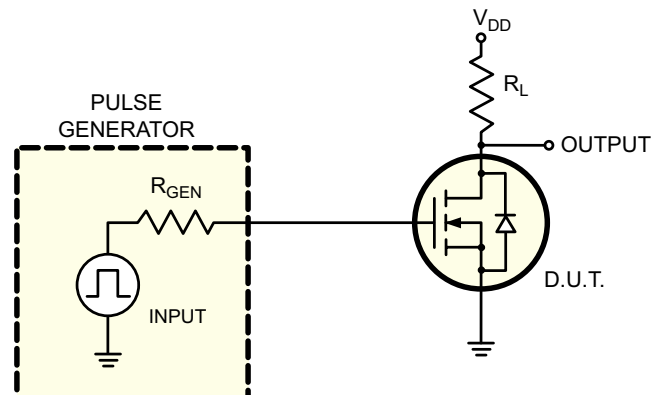
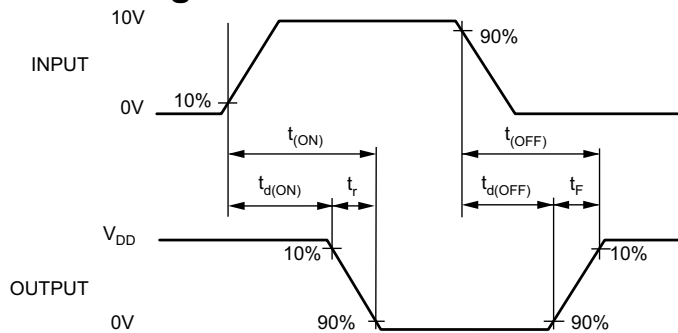
### Electrical Characteristics (T<sub>A</sub> = 25°C unless otherwise specified)

| Sym                  | Parameter                                      | Min | Typ | Max  | Units | Conditions  |
|----------------------|--|-----|-----|------|-------|---|
| BV <sub>DSS</sub>    | Drain-to-source breakdown voltage              | 500 | -   | -    | V     | V <sub>GS</sub> = 0V, I <sub>D</sub> = 2.0mA                                      |
| V <sub>GS(th)</sub>  | Gate threshold voltage                         | 1.5 | -   | 4.0  | V     | V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = 1.0mA                        |
| ΔV <sub>GS(th)</sub> | Change in V <sub>GS(th)</sub> with temperature | -   | -   | -5.5 | mV/°C | V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = 1.0mA                        |
| I <sub>GSS</sub>     | Gate body leakage current                      | -   | -   | 100  | nA    | V <sub>GS</sub> = ±20V, V <sub>DS</sub> = 0V                                      |
| I <sub>DSS</sub>     | Zero gate voltage drain current                | -   | -   | 10   | μA    | V <sub>GS</sub> = 0V,<br>V <sub>DS</sub> = Max Rating                             |
|                      |  | -   | -   | 1.0  | mA    | V <sub>DS</sub> = 0.8 Max Rating,<br>V <sub>GS</sub> = 0V, T <sub>A</sub> = 125°C |
| I <sub>D(ON)</sub>   | On-state drain current                         | 0.5 | -   | -    | A     | V <sub>GS</sub> = 10V, V <sub>DS</sub> = 25V                                      |
| R <sub>DS(ON)</sub>  | Static drain-to-source on-state resistance     | -   | -   | 20   | Ω     | V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 100mA                                    |
|                      |  | -   | -   | 13   |       | V <sub>GS</sub> = 10V, I <sub>D</sub> = 400mA                                     |
| ΔR <sub>DS(ON)</sub> | Change in R <sub>DS(ON)</sub> with temperature | -   | -   | 1.7  | %/°C  | V <sub>GS</sub> = 10V, I <sub>D</sub> = 400mA                                     |
| G <sub>FS</sub>      | Forward transconductance                       | 50  | -   | -    | mmho  | V <sub>DS</sub> = 25V, I <sub>D</sub> = 200mA                                     |
| C <sub>ISS</sub>     | Input capacitance                              | -   | -   | 150  | pF    | V <sub>GS</sub> = 0V,<br>V <sub>DS</sub> = 25V,<br>f = 1.0MHz                     |
| C <sub>OSS</sub>     | Common source output capacitance               | -   | -   | 50   |       |   |
| C <sub>RSS</sub>     | Reverse transfer capacitance                   | -   | -   | 25   |       |   |
| t <sub>d(ON)</sub>   | Turn-on delay time                             | -   | -   | 10   | ns    | V <sub>DD</sub> = 25V,<br>I <sub>D</sub> = 250mA,<br>R <sub>GEN</sub> = 25Ω       |
| t <sub>r</sub>       | Rise time                                      | -   | -   | 10   |       |   |
| t <sub>d(OFF)</sub>  | Turn-off delay time                            | -   | -   | 25   |       |   |
| t <sub>f</sub>       | Fall time                                      | -   | -   | 20   |       |   |
| V <sub>SD</sub>      | Diode forward voltage drop                     | -   | -   | 1.5  | V     | V <sub>GS</sub> = 0V, I <sub>SD</sub> = 400mA                                     |

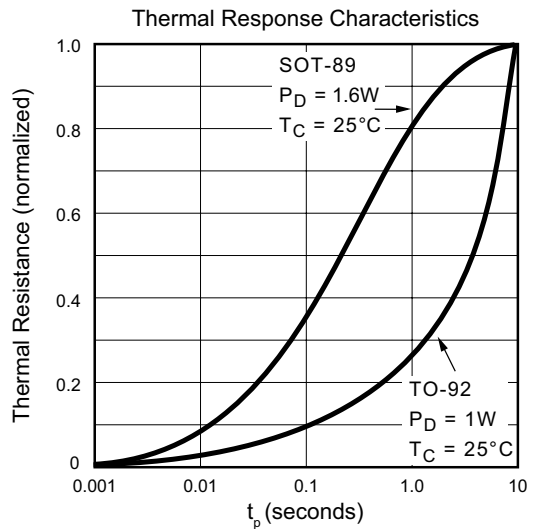
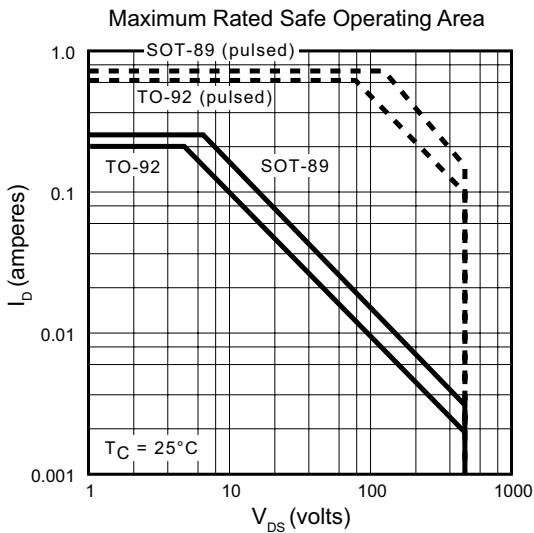
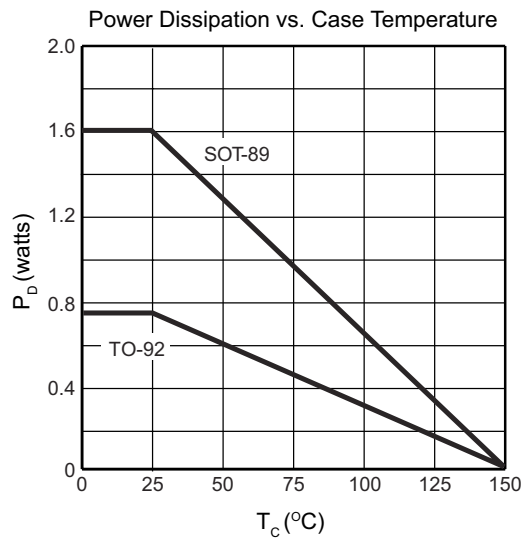
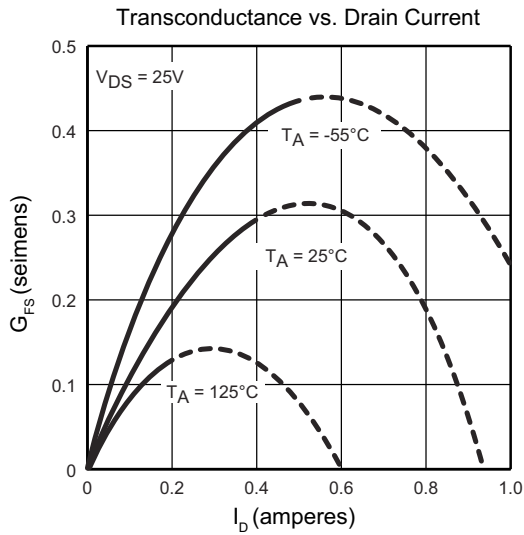
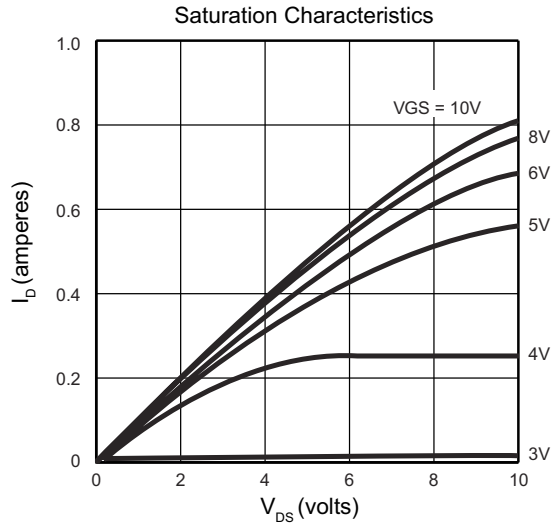
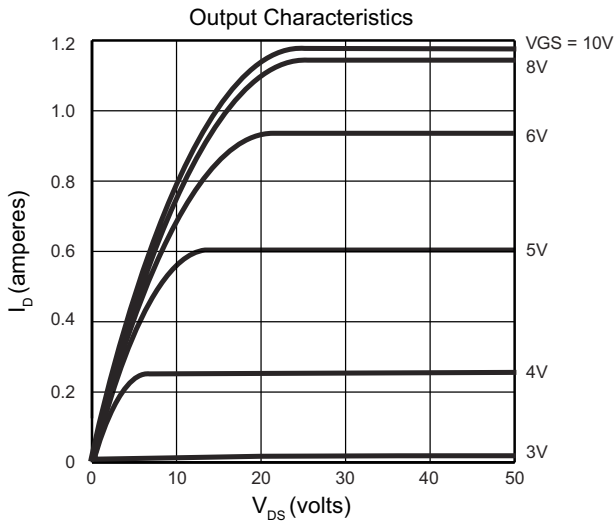
**Notes:**

1. All D.C. parameters 100% tested at 25°C unless otherwise stated. (Pulse test: 300μs pulse, 2% duty cycle.)
2. All A.C. parameters sample tested.

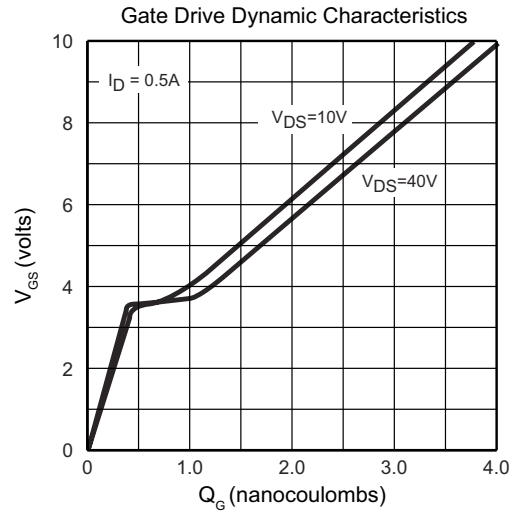
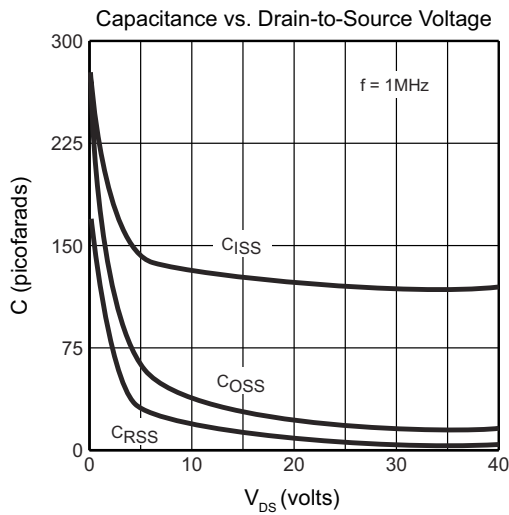
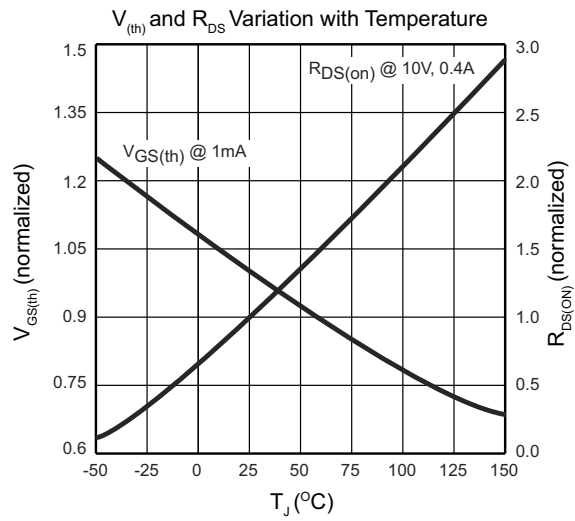
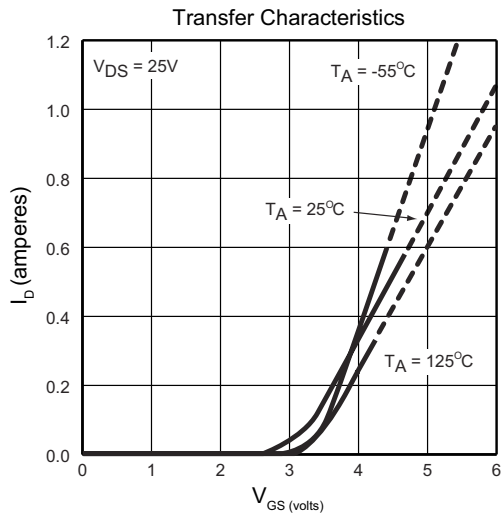
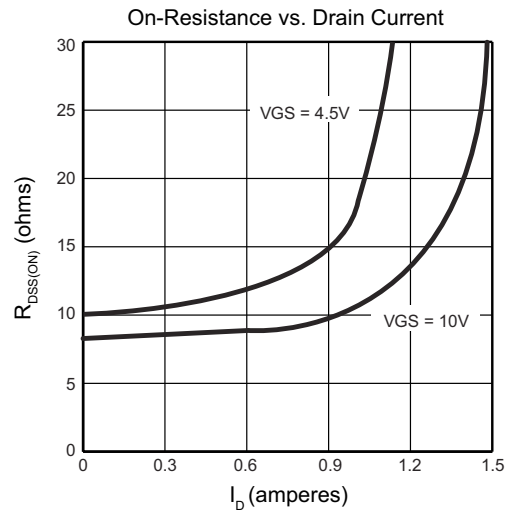
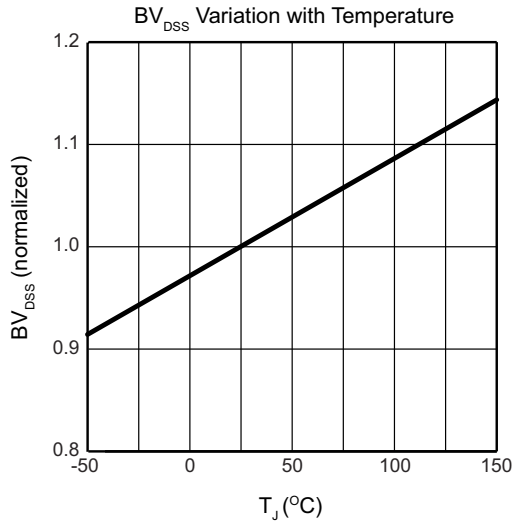
### Switching Waveforms and Test Circuit



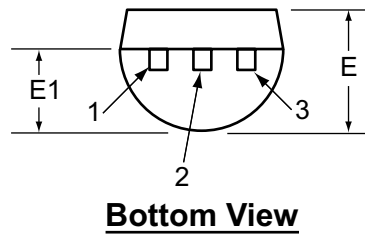
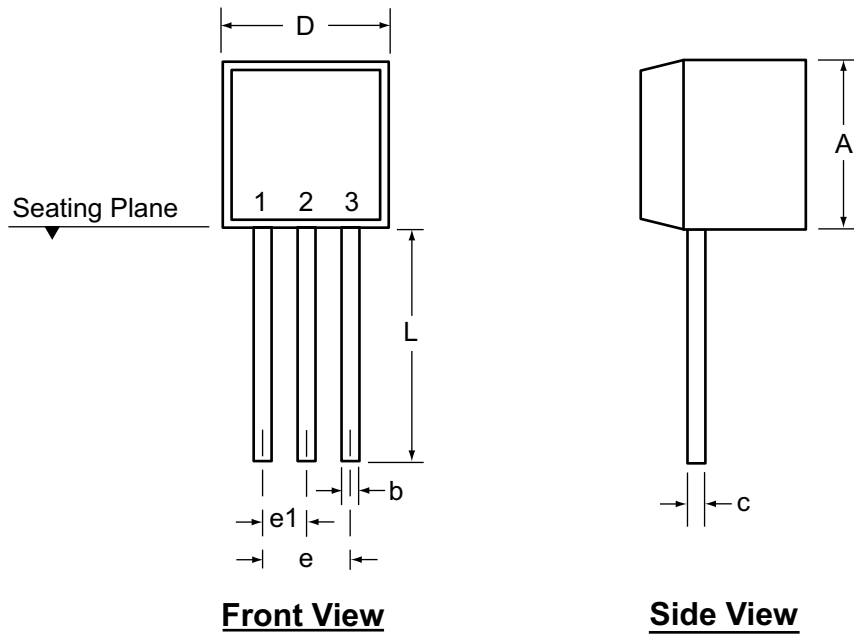
# Typical Performance Curves



Typical Performance Curves (cont.)



### 3-Lead TO-92 Package Outline (N3)



| Symbol                 | A   | b    | c                 | D                 | E    | E1   | e    | e1   | L    |       |
|------------------------|-----|------|-------------------|-------------------|------|------|------|------|------|-------|
| Dimensions<br>(inches) | MIN | .170 | .014 <sup>†</sup> | .014 <sup>†</sup> | .175 | .125 | .080 | .095 | .045 | .500  |
|                        | NOM | -    | -                 | -                 | -    | -    | -    | -    | -    | -     |
|                        | MAX | .210 | .022 <sup>†</sup> | .022 <sup>†</sup> | .205 | .165 | .105 | .105 | .055 | .610* |

JEDEC Registration TO-92.

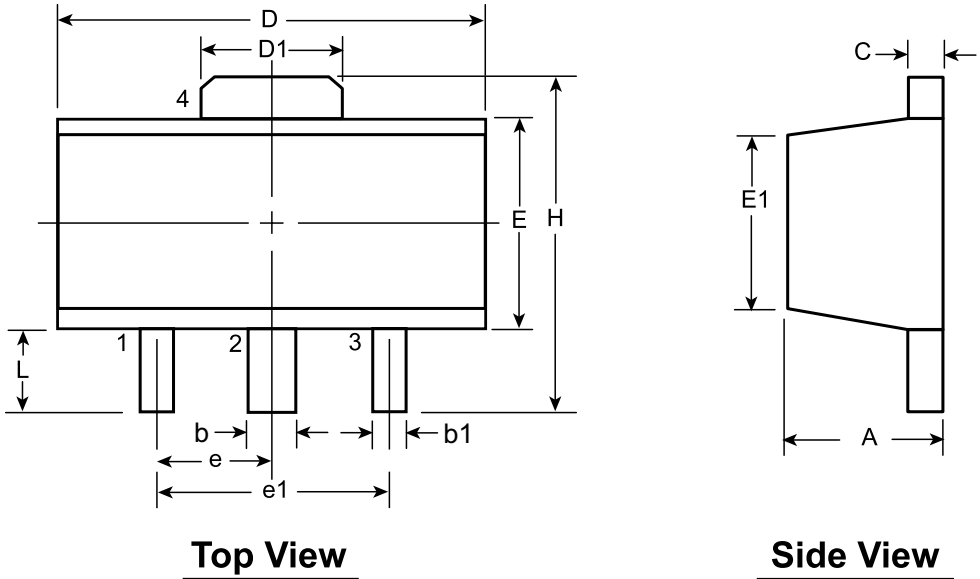
\* This dimension is not specified in the JEDEC drawing.

† This dimension differs from the JEDEC drawing.

Drawings not to scale.

Supertex Doc.#: DSPD-3TO92N3, Version E041009.

### 3-Lead TO-243AA (SOT-89) Package Outline (N8)



**Top View**

**Side View**

| Symbol          |     | A    | b    | b1   | C    | D    | D1   | E    | E1    | e        | e1       | H    | L    |   |
|-----------------|-----|------|------|------|------|------|------|------|-------|----------|----------|------|------|---|
| Dimensions (mm) | MIN | 1.40 | 0.44 | 0.36 | 0.35 | 4.40 | 1.62 | 2.29 | 2.00† | 1.50 BSC | 3.00 BSC | 3.94 | 0.89 |   |
|                 | NOM | -    | -    | -    | -    | -    | -    | -    | -     |          |          | -    | -    | - |
|                 | MAX | 1.60 | 0.56 | 0.48 | 0.44 | 4.60 | 1.83 | 2.60 | 2.29  |          |          | 4.25 | 1.20 |   |

JEDEC Registration TO-243, Variation AA, Issue C, July 1986.

† This dimension differs from the JEDEC drawing

Drawings not to scale.

Supertex Doc. #: DSPD-3TO243AAN8, Version E051509.

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information go to <http://www.supertex.com/packaging.html>.)

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