



## N-Channel Depletion-Mode Vertical DMOS FET

### Features

- ▶ High input impedance
- ▶ Low input capacitance
- ▶ Fast switching speeds
- ▶ Low on resistance
- ▶ Free from secondary breakdown
- ▶ Low input and output leakage

### Applications

- ▶ Normally-on switches
- ▶ Solid state relays
- ▶ Converters
- ▶ Linear amplifiers
- ▶ Constant current sources
- ▶ Power supply circuits
- ▶ Telecom

### General Description

These depletion-mode (normally-on) transistors utilize an advanced vertical DMOS structure and Supertex's well-proven silicon-gate manufacturing process. This combination produces devices 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, these devices are 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.

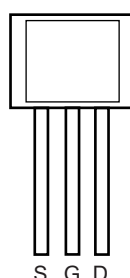
### Absolute Maximum Ratings

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

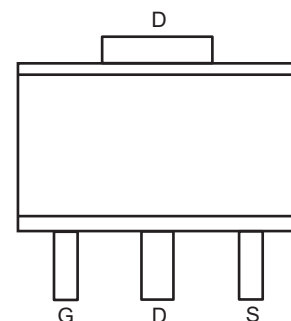
*Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied. Continuous operation of the device at the absolute rating level may affect device reliability. All voltages are referenced to device ground.*

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

### Package Options



**TO-92**  
(front view)



**TO-243AA**  
(top view)

### Ordering Information

| $BV_{DSX}/$<br>$BV_{DGX}$ | $R_{DS(ON)}$<br>(max) | $I_{DSS}$<br>(min) | Package Options |                   |
|---------------------------|-----------------------|--------------------|-----------------|-------------------|
|                           |                       |                    | TO-92           | TO-243AA (SOT-89) |
| 450V                      | 20 $\Omega$           | 200mA              | DN3545N3        | DN3545N8          |
|                           |                       |                    | DN3545N3-G      | DN3545N8-G        |

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



## Thermal Characteristics

| Package  | $I_D$<br>(continuous) <sup>1</sup> | $I_D$<br>(pulsed) | Power Dissipation<br>@ $T_A = 25^\circ\text{C}$ | $\theta_{jc}$<br>$^\circ\text{C/W}$ | $\theta_{ja}$<br>$^\circ\text{C/W}$ | $I_{DR}^1$ | $I_{DRM}$ |
|----------|------------------------------------|-------------------|-------------------------------------------------|-------------------------------------|-------------------------------------|------------|-----------|
| T0-92    | 136mA                              | 550mA             | 0.74W                                           | 125                                 | 170                                 | 136mA      | 550mA     |
| TO-243AA | 200mA                              | 550mA             | 1.6W <sup>2</sup>                               | 15                                  | 78 <sup>2</sup>                     | 200mA      | 550mA     |

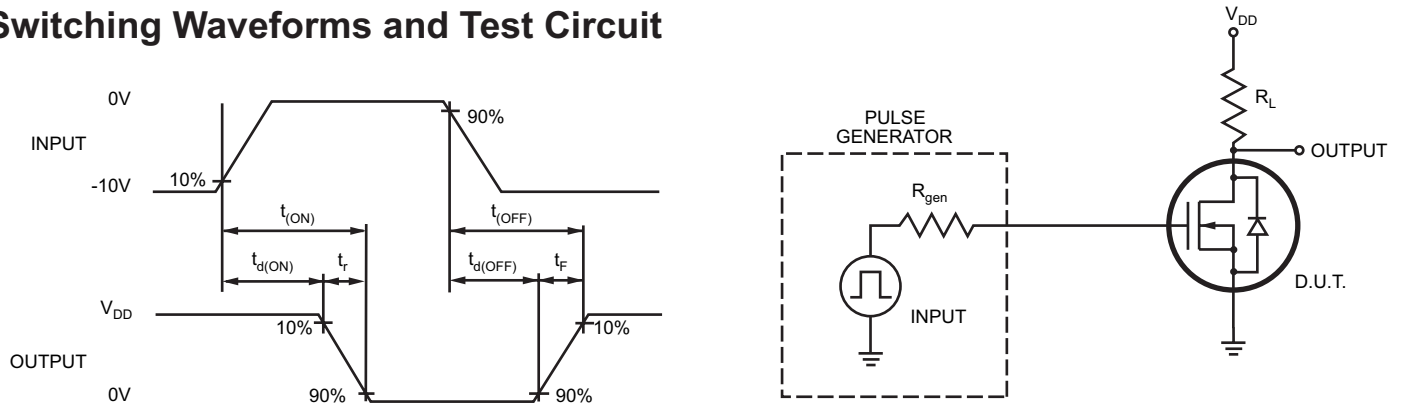
Notes:

- $I_D$  (continuous) is limited by max rated  $T_r$
- Mounted on FR4 board, 25mm x 25mm x 1.57mm. Significant  $P_D$  increase possible on ceramic substrate.

## Electrical Characteristics (@ $25^\circ\text{C}$ unless otherwise specified)

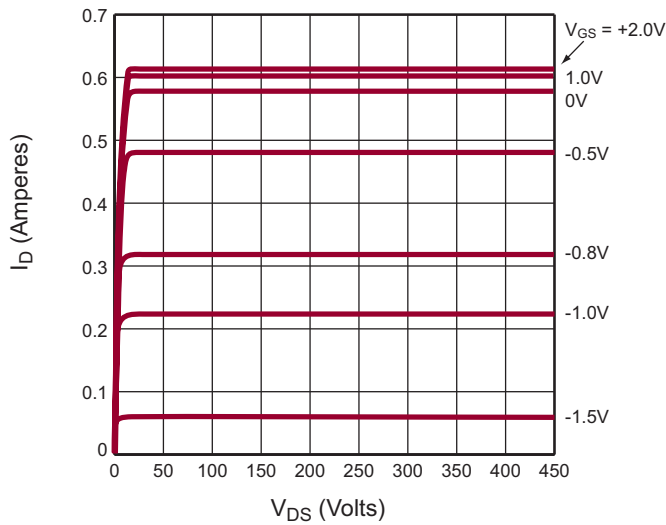
| Symbol               | Parameter                                  | Min  | Typ | Max  | Units                | Conditions                                                                         |
|----------------------|--------------------------------------------|------|-----|------|----------------------|------------------------------------------------------------------------------------|
| $BV_{DSX}$           | Drain-to-source breakdown voltage          | 450  | -   | -    | V                    | $V_{GS} = -5V, I_D = 100\mu A$                                                     |
| $V_{GS(OFF)}$        | Gate-to-source OFF voltage                 | -1.5 | -   | -3.5 | V                    | $V_{DS} = 25V, I_D = 10\mu A$                                                      |
| $\Delta V_{GS(OFF)}$ | Change in $V_{GS(OFF)}$ with temperature   | -    | -   | 4.5  | mV/ $^\circ\text{C}$ | $V_{DS} = 25V, I_D = 10\mu A$                                                      |
| $I_{GSS}$            | Gate body leakage current                  | -    | -   | 100  | nA                   | $V_{GS} = \pm 20V, V_{DS} = 0V$                                                    |
| $I_{D(OFF)}$         | Drain-to-source leakage current            | -    | -   | 1.0  | $\mu A$              | $V_{GS} = -5V, V_{DS} = \text{Max Rating}$                                         |
|                      |                                            | -    | -   | 1.0  | mA                   | $V_{GS} = -5V, V_{DS} = 0.8 \text{ Max Rating}$<br>$T_A = 125^\circ\text{C}$       |
| $I_{DSS}$            | Saturated drain-to-source current          | 200  | -   | -    | mA                   | $V_{GS} = 0V, V_{DS} = 15V$                                                        |
| $R_{DS(ON)}$         | Static drain-to-source on-state resistance | -    | -   | 20   | $\Omega$             | $V_{GS} = 0V, I_D = 150mA$                                                         |
| $\Delta R_{DS(ON)}$  | Change in $R_{DS(ON)}$ with temperature    | -    | -   | 1.1  | %/ $^\circ\text{C}$  | $V_{GS} = 0V, I_D = 150mA$                                                         |
| $G_{FS}$             | Forward transconductance                   | 150  | -   | -    | mS                   | $I_D = 100mA, V_{DS} = 10V$                                                        |
| $C_{ISS}$            | Input capacitance                          | -    | -   | 360  | pF                   | $V_{GS} = -5V, V_{DS} = 25V, f = 1MHz$                                             |
| $C_{OSS}$            | Common source output capacitance           | -    | -   | 40   |                      |                                                                                    |
| $C_{RSS}$            | Reverse transfer capacitance               | -    | -   | 15   |                      |                                                                                    |
| $t_{d(ON)}$          | Turn-ON delay time                         | -    | -   | 20   | ns                   | $V_{DD} = 25V, I_D = 150mA,$<br>$R_{GEN} = 25\Omega, V_{GS} = 0V \text{ to } -10V$ |
| $t_r$                | Rise time                                  | -    | -   | 30   |                      |                                                                                    |
| $t_{d(OFF)}$         | Turn-OFF delay time                        | -    | -   | 30   |                      |                                                                                    |
| $t_f$                | Fall time                                  | -    | -   | 40   |                      |                                                                                    |
| $V_{SD}$             | Diode forward voltage drop                 | -    | -   | 1.8  | V                    | $V_{GS} = -5V, I_{SD} = 150mA$                                                     |
| $t_{rr}$             | Reverse recovery time                      | -    | 800 | -    | ns                   | $V_{GS} = -5V, I_{SD} = 150mA$                                                     |

## Switching Waveforms and Test Circuit

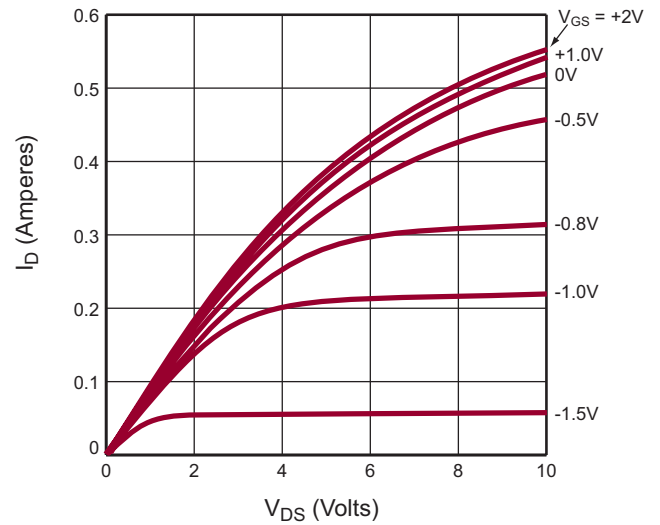


# Typical Performance Curves

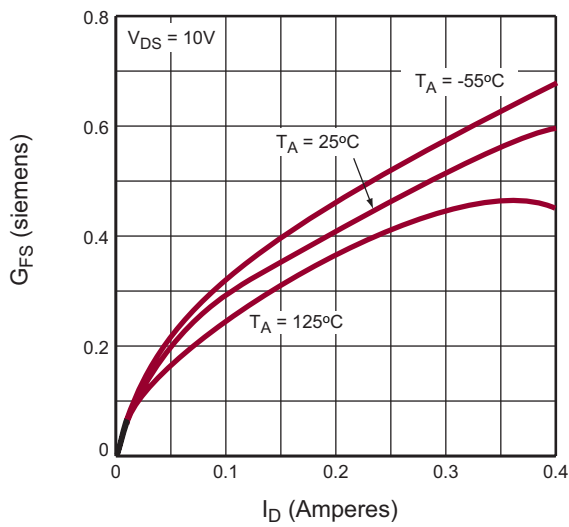
Output Characteristics



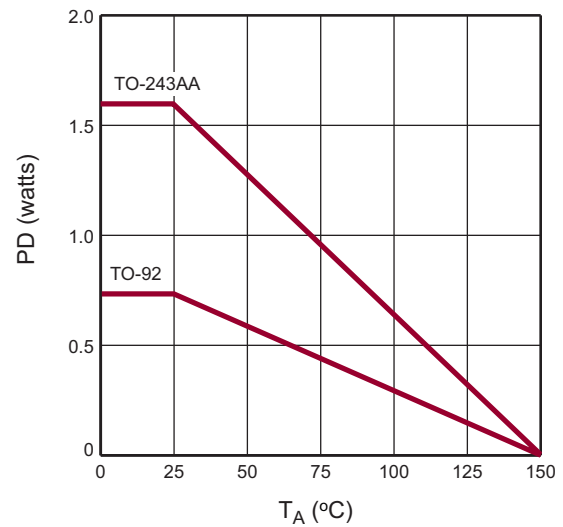
Saturation Characteristics



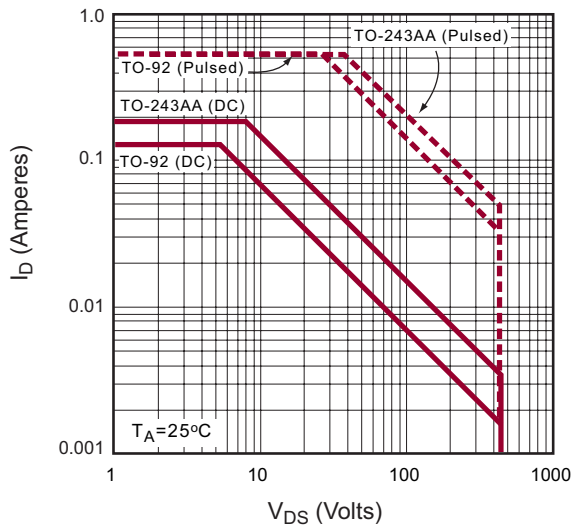
Transconductance vs. Drain Current



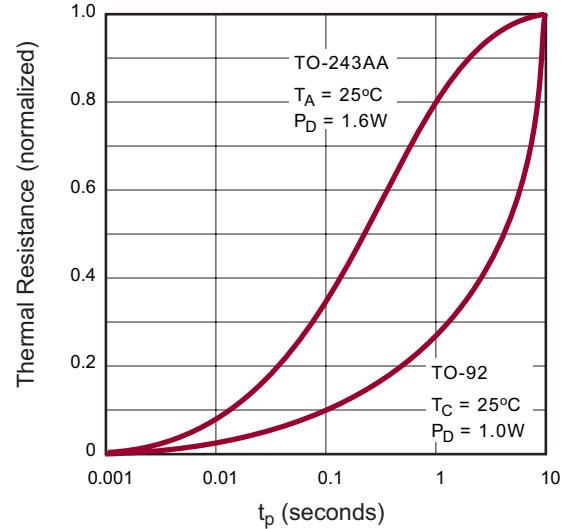
Power Dissipation vs. Ambient Temperature



Maximum Rated Safe Operating Area

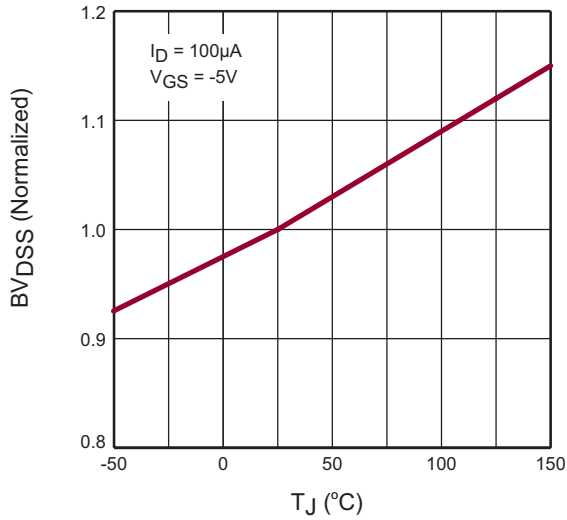


Thermal Response Characteristics

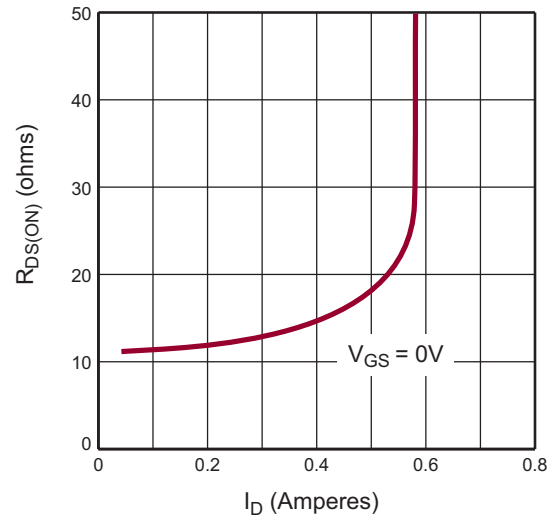


# Typical Performance Curves (cont.)

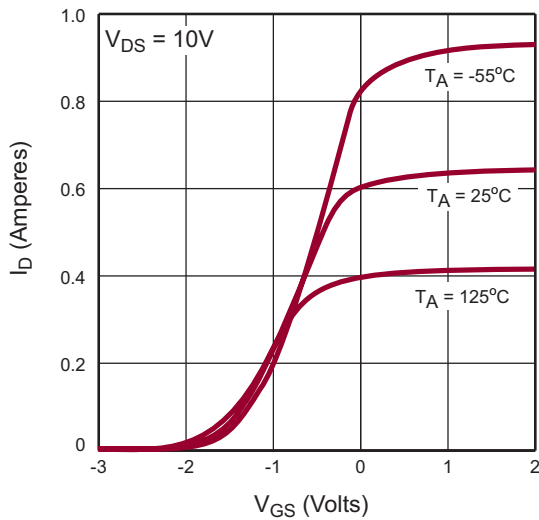
BV<sub>DSS</sub> Variation with Temperature



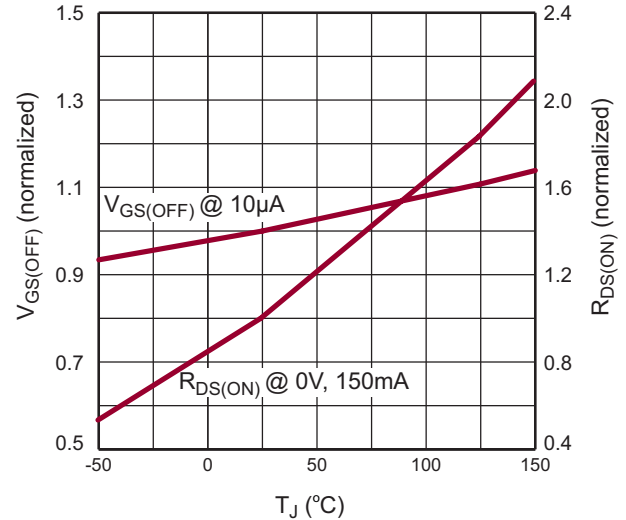
On Resistance vs. Drain Current



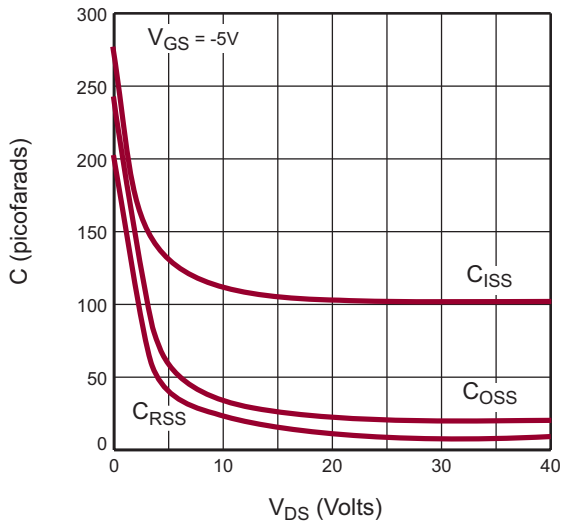
Transfer Characteristics



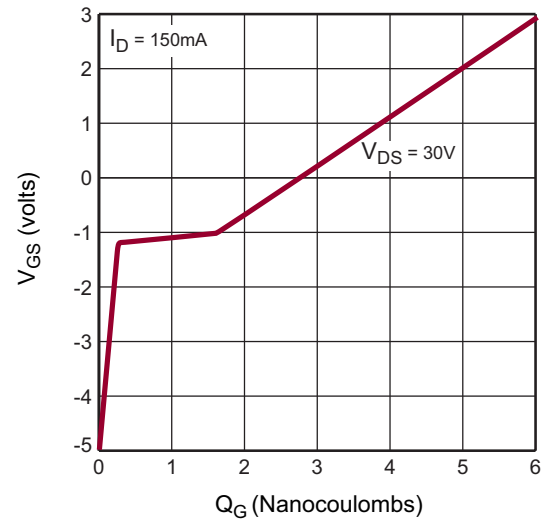
V<sub>GS(OFF)</sub> and R<sub>DS(ON)</sub> w/ Temperature



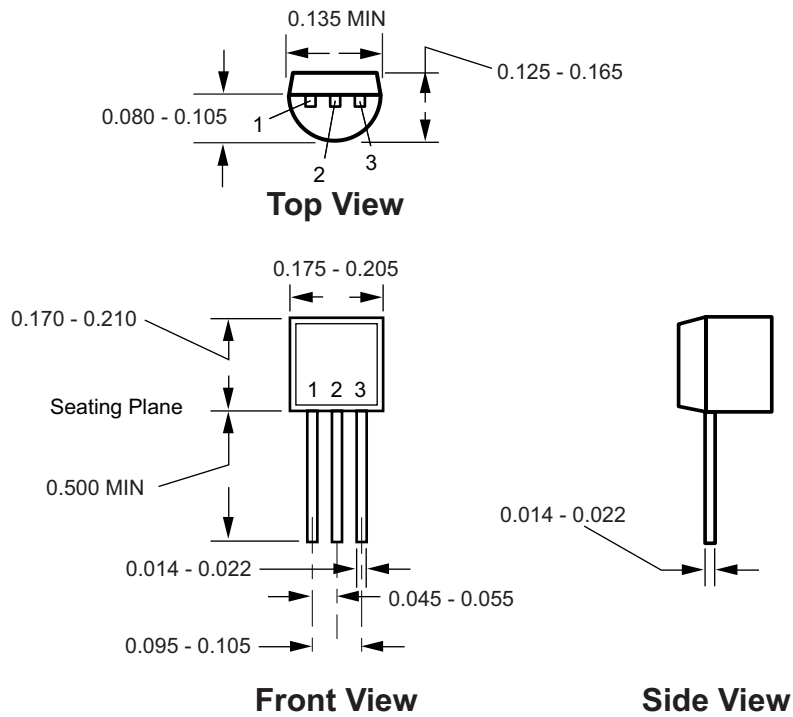
Capacitance vs. Drain Source Voltage



Gate Drive Dynamic Characteristics



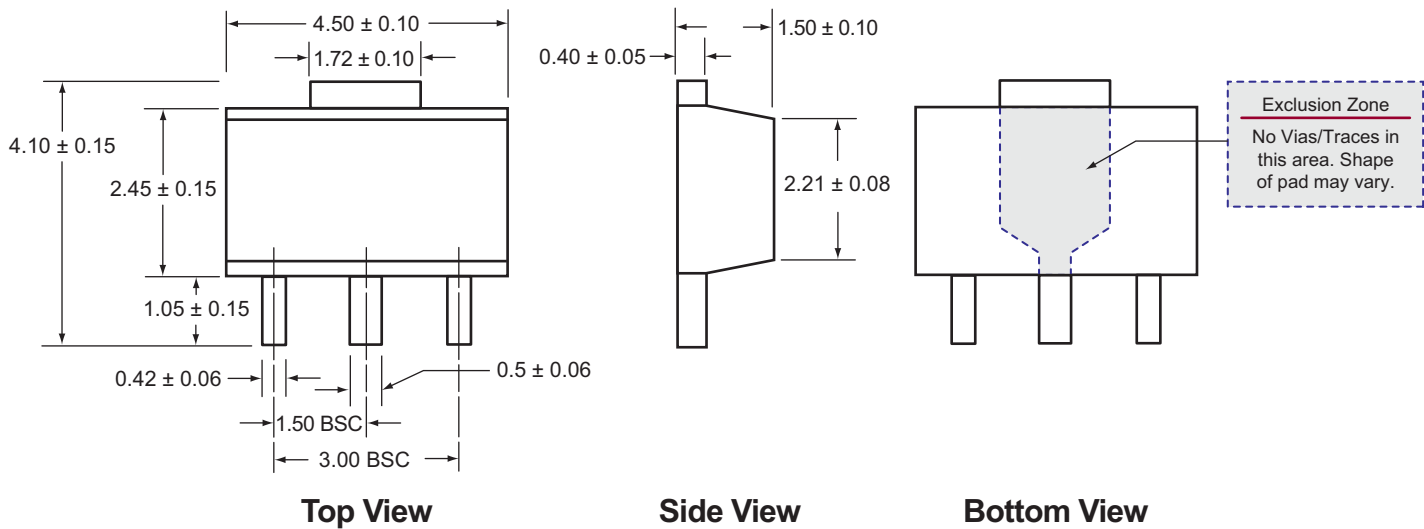
### 3-Lead TO-92 Surface Mount Package (N3)



**Notes:**

All dimensions are in millimeters; all angles in degrees.

3-Lead TO-243AA (SOT-89) Surface Mount Package (N8)



**Notes:**  
All dimensions are in millimeters; all angles in degrees.

(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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