



N-Channel Depletion-Mode Vertical DMOS FETs

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

Ordering Information

| Part Number | Package Option | Packing |
|-----------------|-------------------|-----------|
| DN2540N3-G | TO-92 | 1000/Bag |
| DN2540N3-G P002 | TO-92 | 2000/Reel |
| DN2540N3-G P003 | | |
| DN2540N3-G P005 | | |
| DN2540N3-G P013 | | |
| DN2540N3-G P014 | | |
| DN2540N5-G | TO-220 | 50/Tube |
| DN2540N8-G | TO-243AA (SOT-89) | 2000/Reel |

-G denotes a lead (Pb)-free / RoHS compliant package.
 Contact factory for Wafer / Die availability.
 Devices in Wafer / Die form are lead (Pb)-free / RoHS compliant.

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 $+150^{\circ}C$ |

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.

General Description

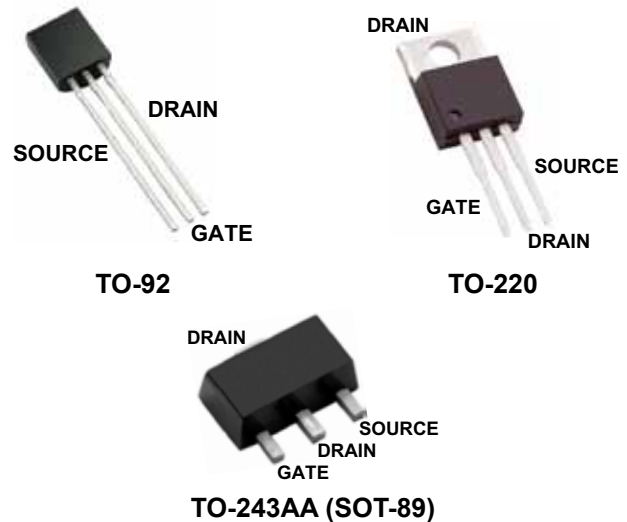
The Supertex DN2540 is a low threshold depletion mode (normally-on) transistor utilizing an advanced vertical DMOS structure and Supertex's well-proven silicon-gate manufacturing process. This combination produces a device with the power handling capabilities of bipolar transistors and with the high 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.

Product Summary

| BV_{DSX}/BV_{DGX} | $R_{DS(ON)}$ (max) | I_{DSS} (min) |
|---------------------|-----------------------|--------------------|
| 400V | 25Ω | 150mA |

Pin Configuration



Typical Thermal Resistance

| Package | θ_{ja} |
|-------------------|---------------|
| TO-92 | 132°C/W |
| TO-220 | 29°C/W |
| TO-243AA (SOT-89) | 133°C/W |

Product Marking



YY = Year Sealed
 WW = Week Sealed
 _____ = "Green" Packaging



L = Lot Number
 YY = Year Sealed
 WW = Week Sealed
 _____ = "Green" Packaging

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

TO-92

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

TO-220



W = Code for week sealed
 _____ = "Green" Packaging

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

TO-243AA (SOT-89)

Thermal Characteristics

| Package | I_D (continuous) [†] | I_D (pulsed) | Power Dissipation @ $T_c = 25^\circ C$ | I_{DR} [†] | I_{DRM} |
|----------|------------------------------------|-------------------|---|-----------------------|-----------|
| TO-92 | 120mA | 500mA | 1.0W | 120mA | 500mA |
| TO-220 | 500mA | 500mA | 15W | 500mA | 500mA |
| TO-243AA | 170mA | 500mA | 1.6W [‡] | 170mA | 500mA |

Notes:

- [†] I_D (continuous) is limited by max rated T_f
- [‡] Mounted on FR5 board, 25mm x 25mm x 1.57mm, $T_A = 25^\circ C$.

Electrical Characteristics ($T_A = 25^\circ C$ unless otherwise specified)

| Sym | Parameter | Min | Typ | Max | Units | Conditions |
|----------------------|--|------|-----|------|----------------|---|
| BV_{DSX} | Drain-to-source breakdown voltage | 400 | - | - | V | $V_{GS} = -5.0V, I_D = 100\mu A$ |
| $V_{GS(OFF)}$ | 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/ $^\circ C$ | $V_{DS} = 25V, I_D = 10\mu A$ |
| I_{GSS} | Gate body leakage current | - | - | 100 | nA | $V_{GS} = \pm 20V, V_{DS} = 0V$ |
| $I_{D(OFF)}$ | Drain-to-source leakage current | - | - | 10 | μA | $V_{DS} = \text{Max rating}, V_{GS} = -10V$ |
| | | - | - | 1.0 | mA | $V_{DS} = 0.8 \text{ Max Rating}, V_{GS} = -10V, T_A = 125^\circ C$ |
| I_{DSS} | Saturated drain-to-source current | 150 | - | - | mA | $V_{GS} = 0V, V_{DS} = 25V$ |
| $R_{DS(ON)}$ | Static drain-to-source on-state resistance | - | 17 | 25 | Ω | $V_{GS} = 0V, I_D = 120mA$ |
| $\Delta R_{DS(ON)}$ | Change in $R_{DS(ON)}$ with temperature | - | - | 1.1 | %/ $^\circ C$ | $V_{GS} = 0V, I_D = 120mA$ |
| G_{FS} | Forward transconductance | - | 325 | - | mmho | $V_{DS} = 10V, I_D = 100mA$ |
| C_{ISS} | Input capacitance | - | 200 | 300 | pF | $V_{GS} = -10V,$ $V_{DS} = 25V,$ $f = 1MHz$ |
| C_{OSS} | Common source output capacitance | - | 12 | 30 | | |
| C_{RSS} | Reverse transfer capacitance | - | 1.0 | 5.0 | | |

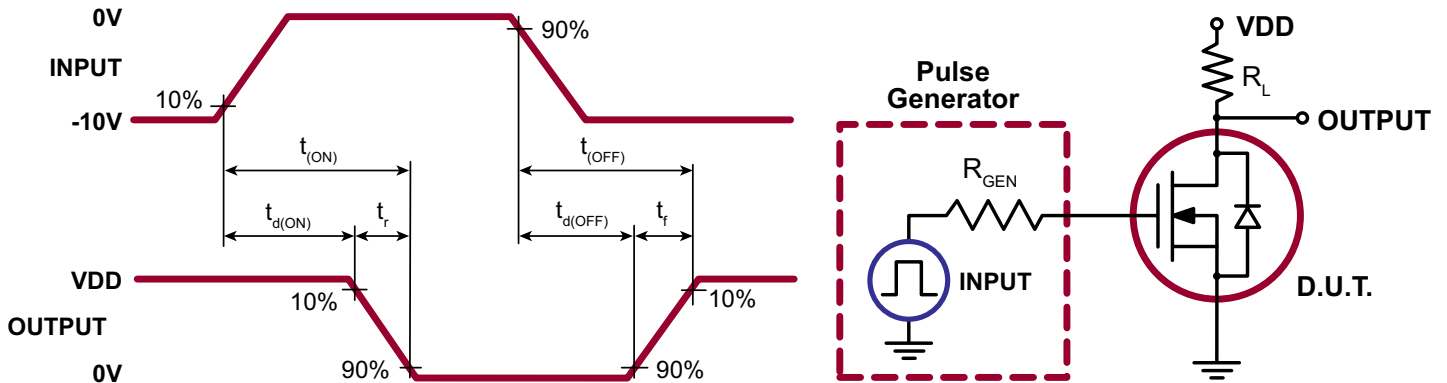
Electrical Characteristics (cont.)

| Sym | Parameter | Min | Typ | Max | Units | Conditions |
|--------------|----------------------------|-----|-----|-----|-------|--|
| $t_{d(ON)}$ | Turn-on delay time | - | - | 10 | ns | $V_{DD} = 25V,$ $I_D = 150mA,$ $R_{GEN} = 25\Omega,$ |
| t_r | Rise time | - | - | 15 | | |
| $t_{d(OFF)}$ | Turn-off delay time | - | - | 15 | | |
| t_f | Fall time | - | - | 20 | | |
| V_{SD} | Diode forward voltage drop | - | - | 1.8 | V | $V_{GS} = -10V, I_{SD} = 120mA$ |
| t_{rr} | Reverse recovery time | - | 800 | - | ns | $V_{GS} = -10V, I_{SD} = 1.0A$ |

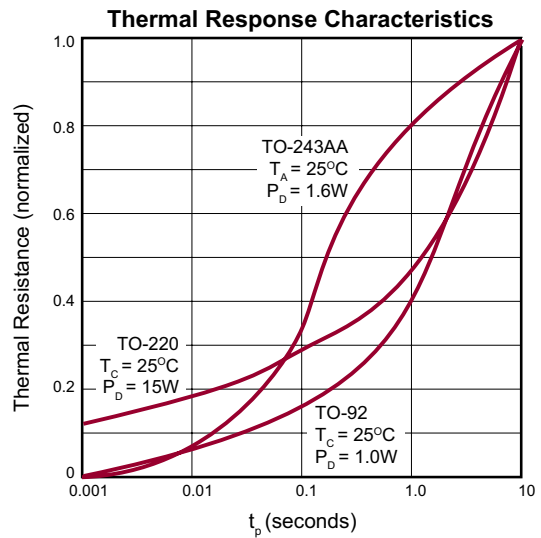
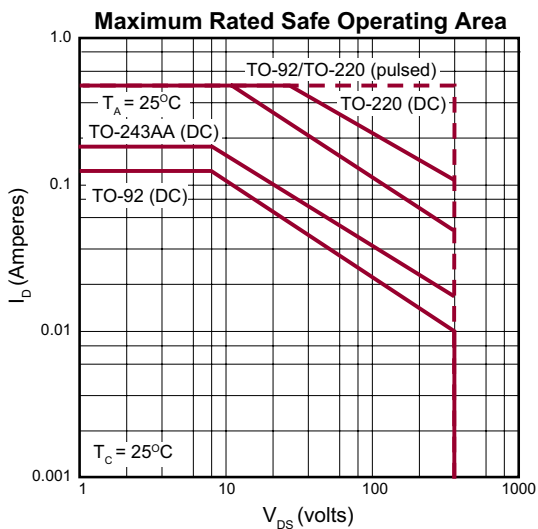
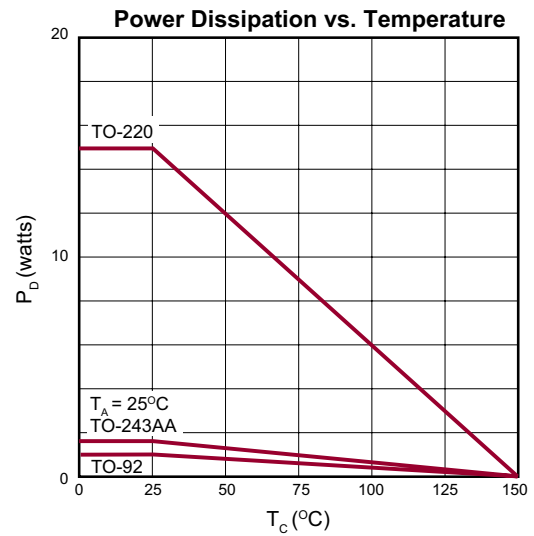
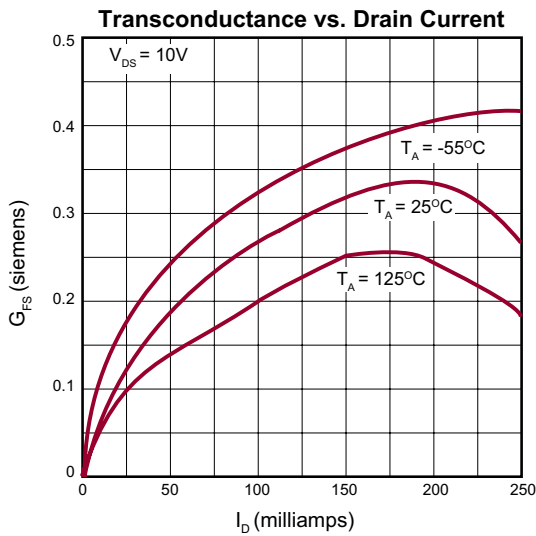
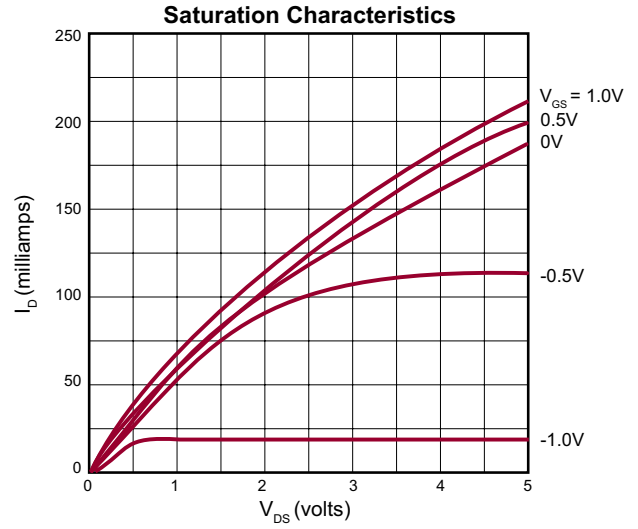
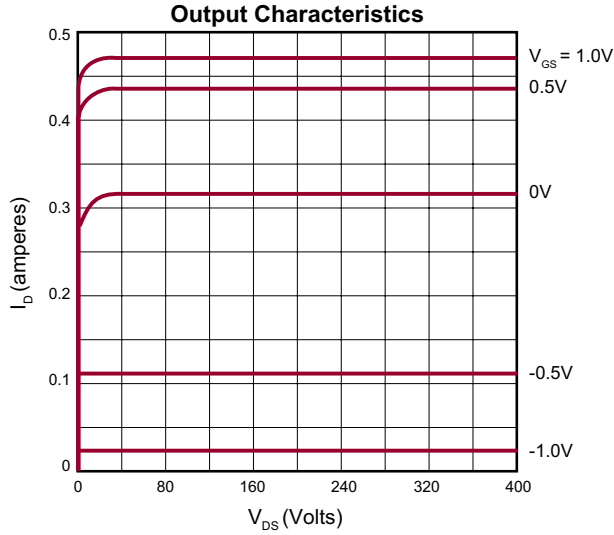
Notes:

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.

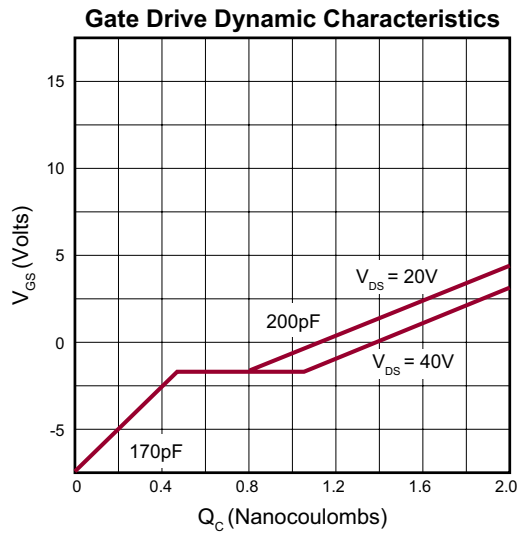
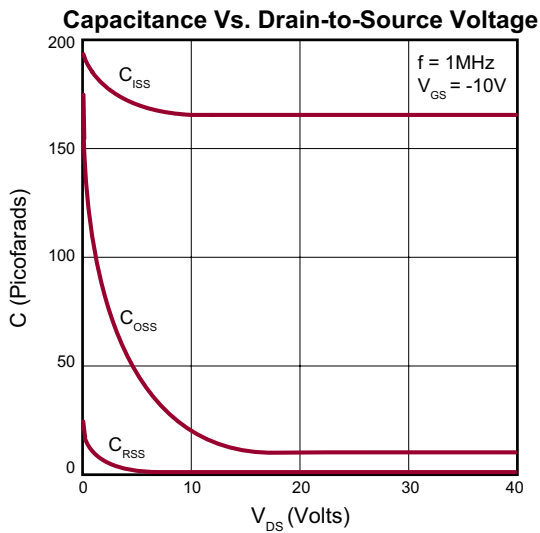
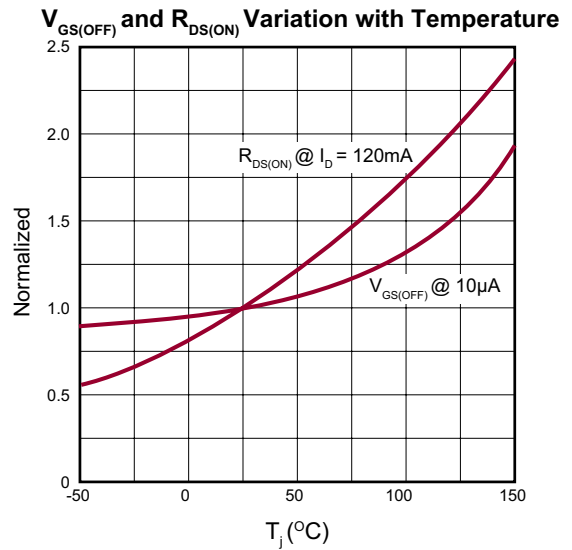
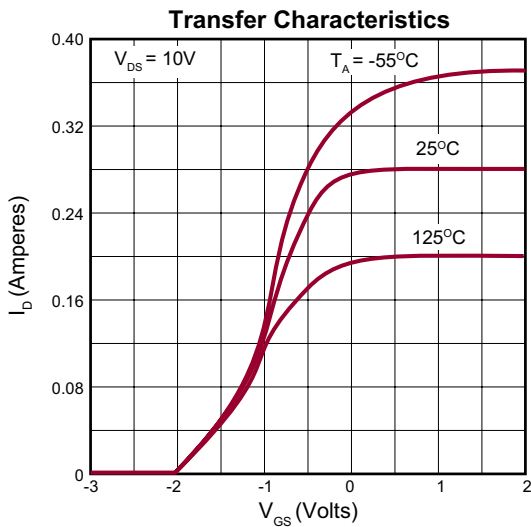
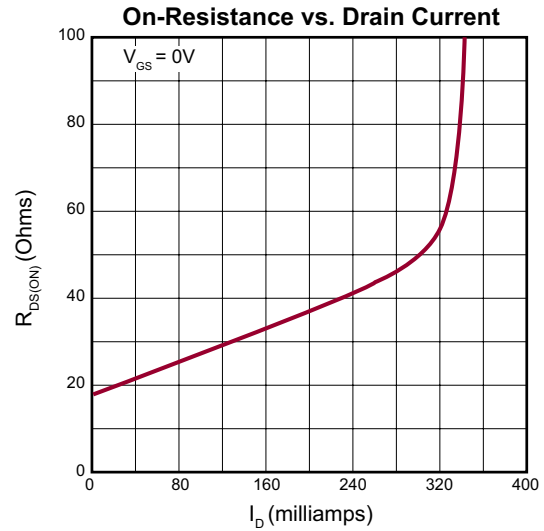
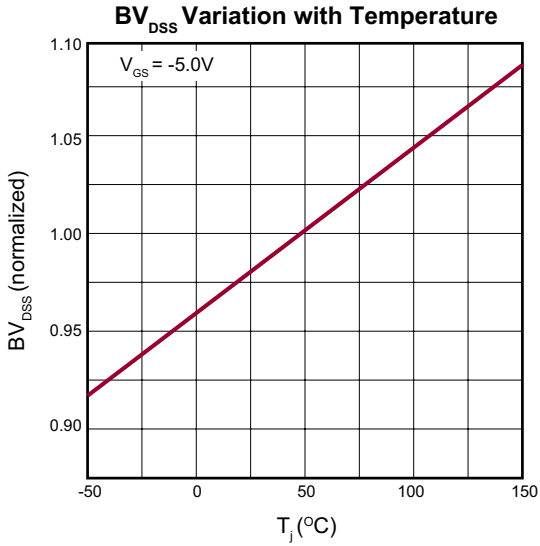
Switching Waveforms and Test Circuit



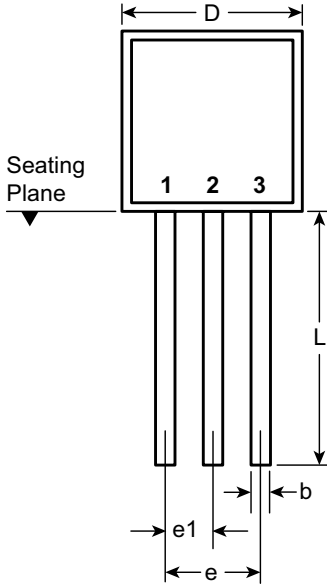
Typical Performance Curves



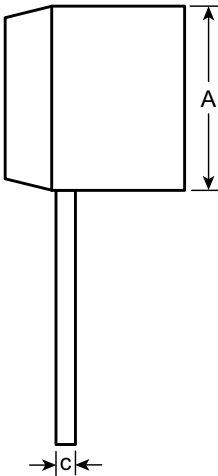
Typical Performance Curves (cont.)



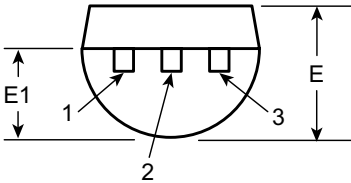
3-Lead TO-92 Package Outline (N3)



Front View



Side View

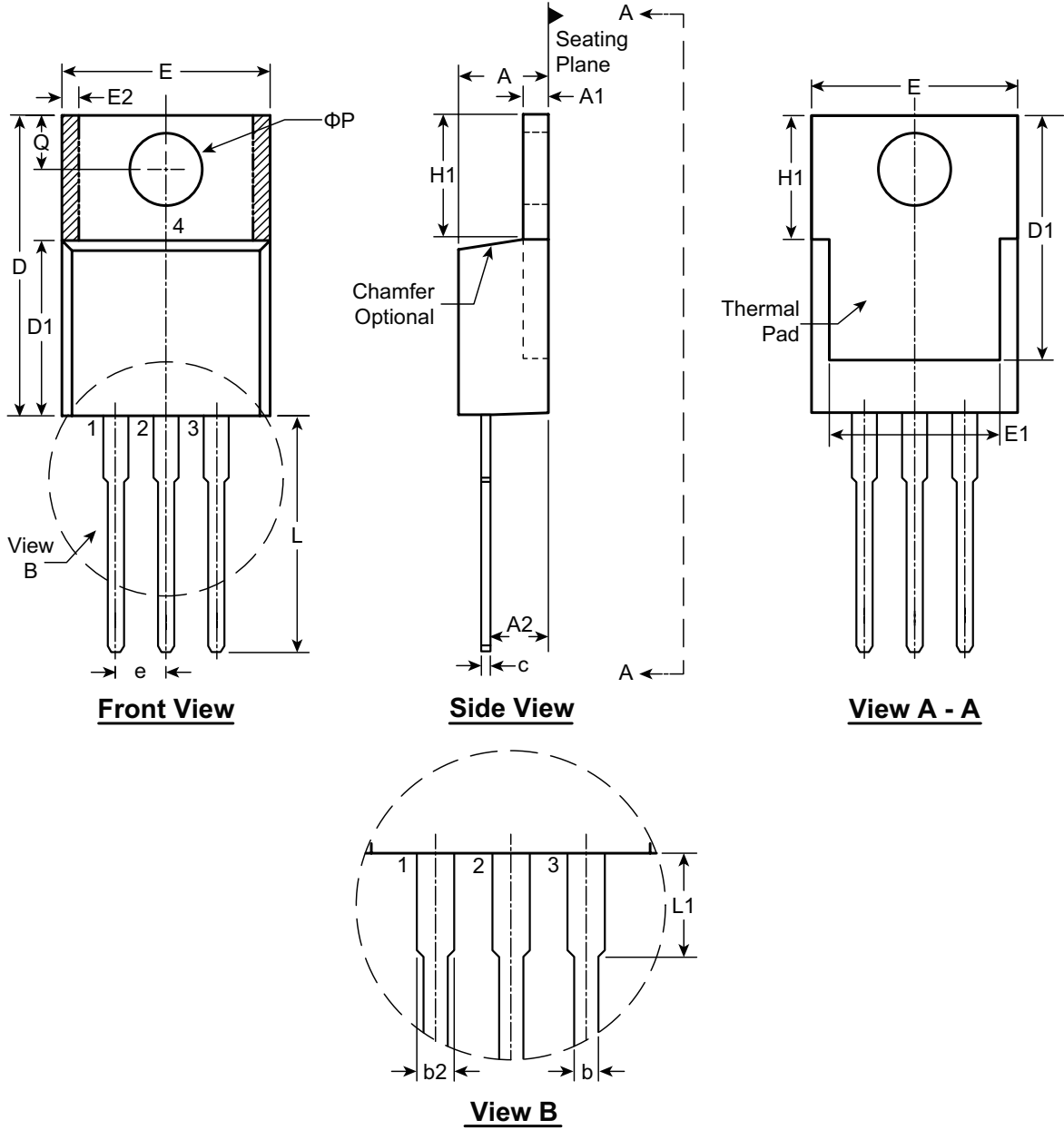


Bottom View

| Symbol | A | b | c | D | E | E1 | e | e1 | L | |
|---------------------|-----|------|-------------------|-------------------|------|------|------|------|------|-------|
| Dimensions (inches) | MIN | .170 | .014 [†] | .014 [†] | .175 | .125 | .080 | .095 | .045 | .500 |
| | NOM | - | - | - | - | - | - | - | - | - |
| | MAX | .210 | .022 [†] | .022 [†] | .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-220 Package Outline (N5)



| Symbol | A | A1 | A2 | b | b2 | c | D | D1 | D2 | E | E1 | E2 | e | H1 | L | L1 | Q | ϕP | | |
|--------------------|-----|------|------|-------------------|------|------|-------------------|------|-------------------|-------------------|------|------|-------|-------------|------|------|-------|----------|------|---|
| Dimension (inches) | MIN | .140 | .020 | .080 | .015 | .045 | .012 [†] | .560 | .326 [†] | .474 [†] | .380 | .270 | 0.20* | .100 BSC | .230 | .500 | .200* | .100 | .139 | |
| | NOM | - | - | - | .027 | .057 | - | - | - | - | - | - | - | | - | - | - | - | - | - |
| | MAX | .190 | .055 | .120 [†] | .040 | .070 | .024 | .650 | .361 [†] | .507 | .420 | .350 | .030 | | .270 | .580 | .250 | .135 | .161 | |

JEDEC Registration TO-220, Variation AB, Issue K, April 2002.

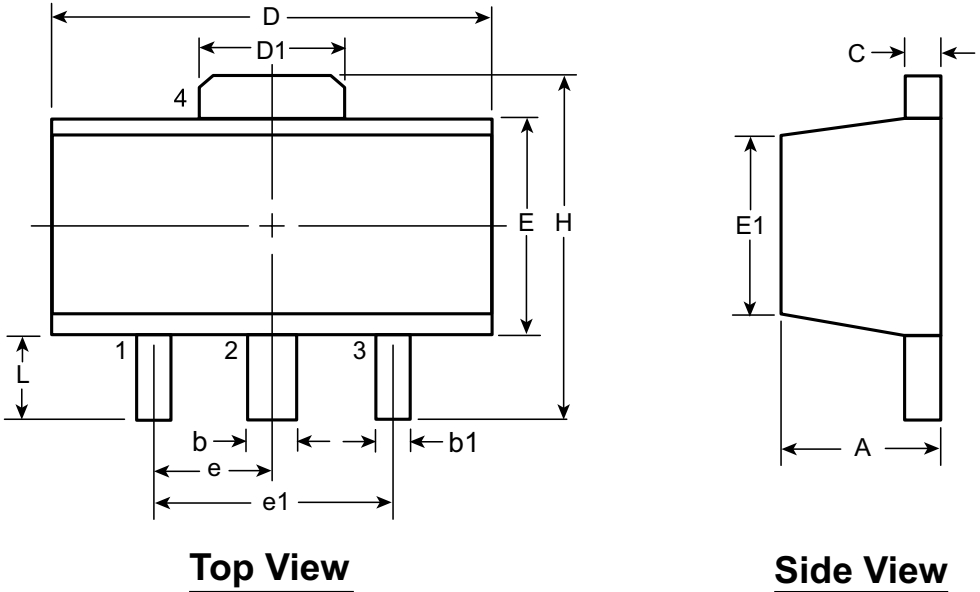
* This dimension is not specified in the JEDEC drawing.

† This dimension differs from the JEDEC drawing.

Drawings not to scale.

Supertex Doc. #: DSPD-3TO220N5, Version C041009.

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 | 0.73† | | |
| | 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 F111010.

(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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