# 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

## General Description

The Supertex DN2535 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.

## Ordering Information

| Part Number | Package Option | Packing |
|---|---|---|
| DN2535N3-G | TO-92 | 1000/Bag |
| DN2535N3-G P002 | TO-92 | 2000/Reel |
| DN2535N3-G P003 | | |
| DN2535N3-G P005 | | |
| DN2535N3-G P013 | | |
| DN2535N3-G P014 | | |
| DN2535N5-G | TO-220 | 50/Tube |

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

## Product Summary

| $BV_{DSX}/BV_{DGX}$ | $R_{DS(ON)}$ (max) | $I_{DSS}$ (min) |
|---|---|---|
| 350V | 25Ω | 150mA |

## Absolute Maximum Ratings

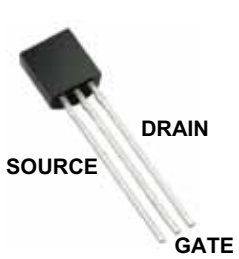
| Parameter | Value |
|---|---|
| Drain-to-source voltage | $BV_{DSX}$ |
| Drain-to-gate voltage | $BV_{DGX}$ |
| Gate-to-source voltage | ±20V |
| Operating and storage temperature | -55°C to +150°C |

*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.*

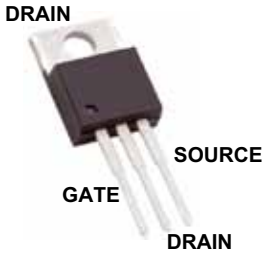
## Typical Thermal Resistance

| Package | $\theta_{ja}$ |
|---|---|
| TO-92 | 132°C/W |
| TO-220 | 29°C/W |

## Pin Configuration




**3-Lead TO-92**




**3-Lead TO-220**

## Product Marking


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

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

**3-Lead TO-92**


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

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

**3-Lead TO-220**

## Thermal Characteristics

| Package | $I_D$ (continuous)† | $I_D$ (pulsed) | Power Dissipation @$T_C$ = 25°C | $I_{DR}$† | $I_{DRM}$ |
|---|---|---|---|---|---|
| TO-92 | 120mA | 500mA | 1.0W | 120mA | 500mA |
| TO-220 | 500mA | 500mA | 15W | 500mA | 500mA |

***Notes:***

† $I_D$ *(continuous) is limited by max rated* $T_j$.

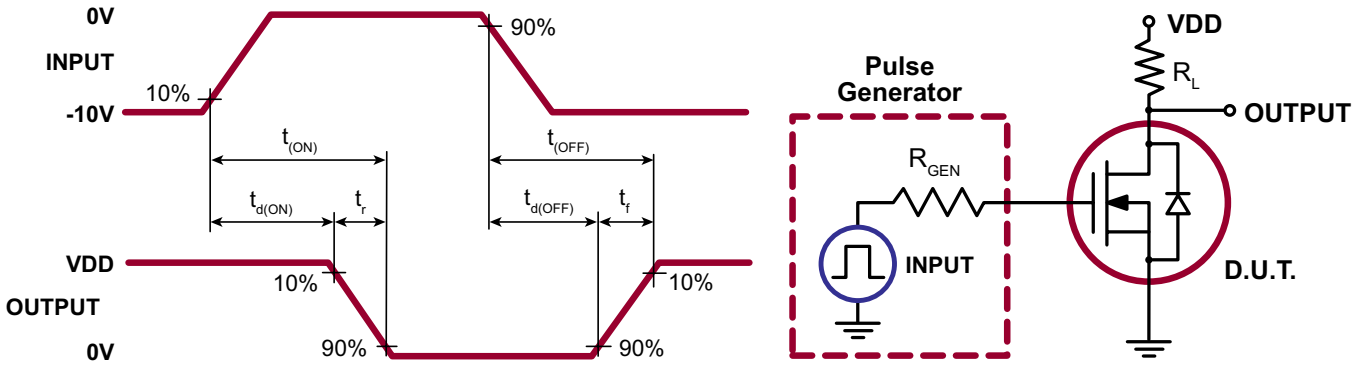
## Electrical Characteristics *($T_A$ = 25°C unless otherwise specified)*

| Sym | Parameter | Min | Typ | Max | Units | Conditions |
|---|---|---|---|---|---|---|
| $BV_{DSX}$ | Drain-to-source breakdown voltage | 350 | - | - | V | $V_{GS}$ = -5.0V, $I_D$ = 100µA |
| $V_{GS(OFF)}$ | Gate-to-source off voltage | -1.5 | - | -3.5 | V | $V_{DS}$ = 25V, $I_D$ = 10µA |
| $\Delta V_{GS(OFF)}$ | Change in $V_{GS(OFF)}$ with temperature | - | - | -4.5 | mV/°C | $V_{DS}$ = 25V, $I_D$ = 10µA |
| $I_{GSS}$ | Gate body leakage current | - | - | 100 | nA | $V_{GS}$ = ±20V, $V_{DS}$ = 0V |
| $I_{D(OFF)}$ | Drain-to-source leakage current | - | - | 10 | µA | $V_{DS}$ = Max rating, $V_{GS}$ = -10V |
| | | - | - | 1.0 | mA | $V_{DS}$ = 0.8 Max Rating, $V_{GS}$ = -10V, $T_A$ = 125°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 | %/°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 = 1.0MHz |
| $C_{OSS}$ | Common source output capacitance | - | 12 | 30 | | |
| $C_{RSS}$ | Reverse transfer capacitance | - | 1.0 | 5.0 | | |
| $t_{d(ON)}$ | Turn-on delay time | - | - | 10 | ns | $V_{DD}$ = 25V, $I_D$ = 150mA, $R_{GEN}$ = 25Ω, |
| $t_r$ | 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:***

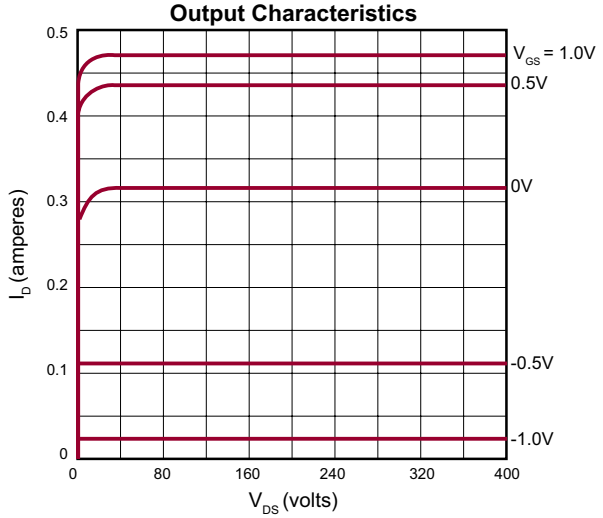
1. *All D.C. parameters 100% tested at 25°C unless otherwise stated. (Pulse test: 300µs pulse, 2% duty cycle.)*
2. *All A.C. parameters sample tested.*

## Switching Waveforms and Test Circuit

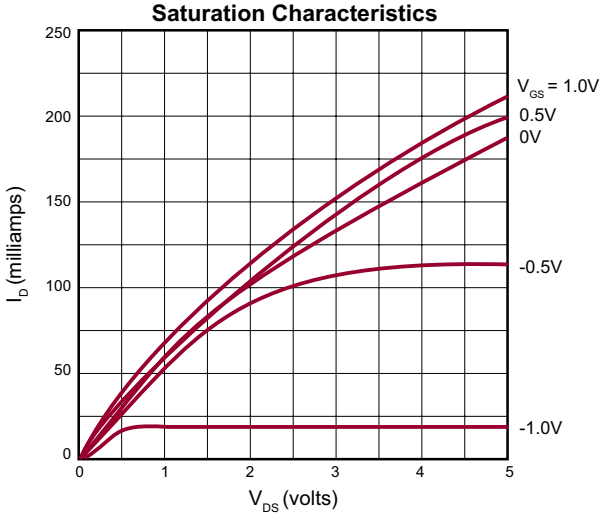


# Typical Performance Curves

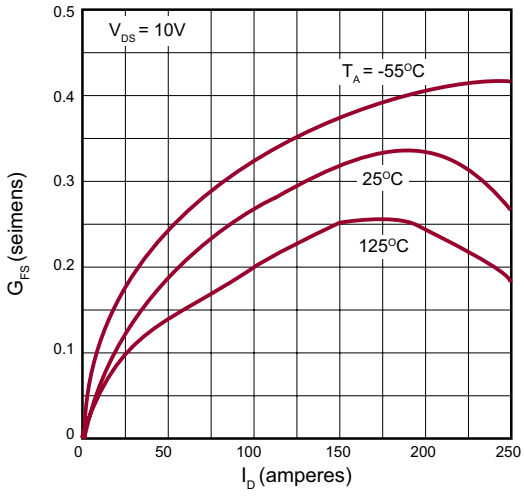
### Output Characteristics



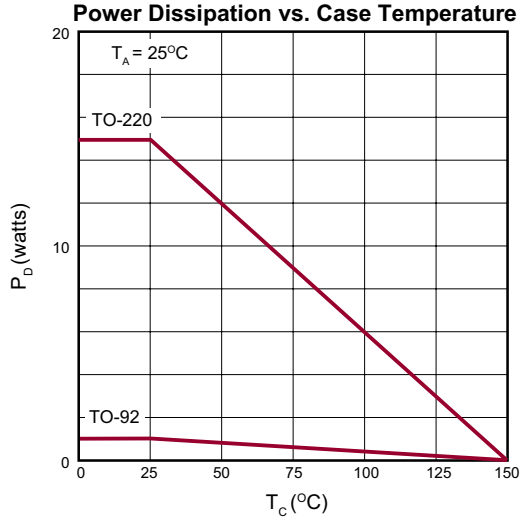

### Saturation Characteristics



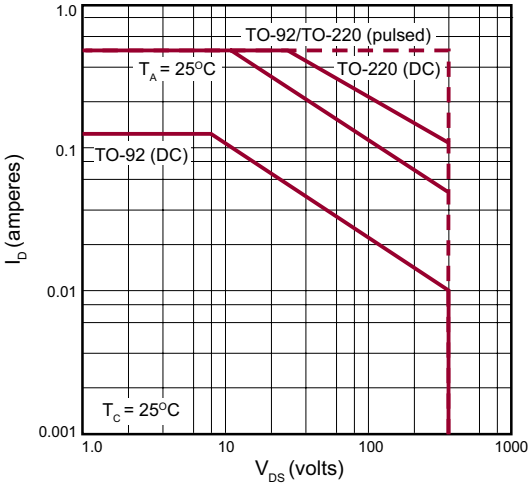

### Transconductance vs. Drain Current



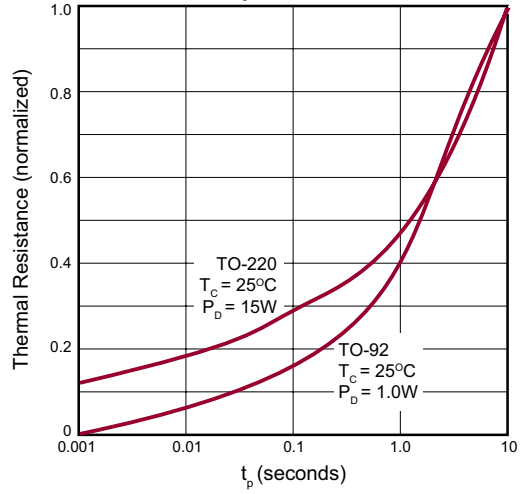

### Power Dissipation vs. Case Temperature




### Maximum Rated Safe Operating Area

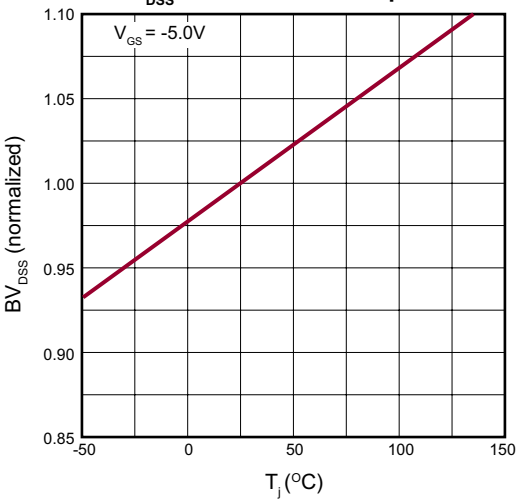



### Thermal Response Characteristics

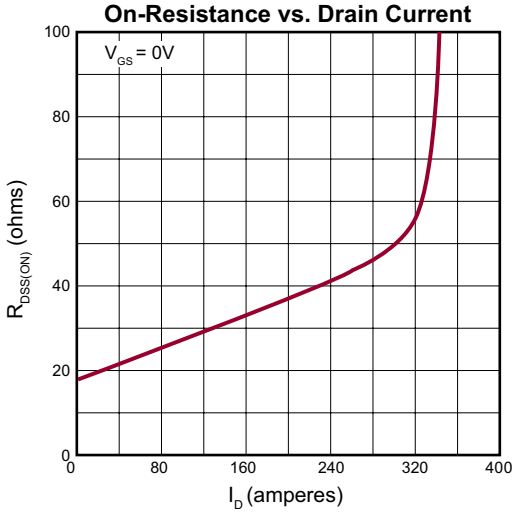


## Typical Performance Curves *(cont.)*

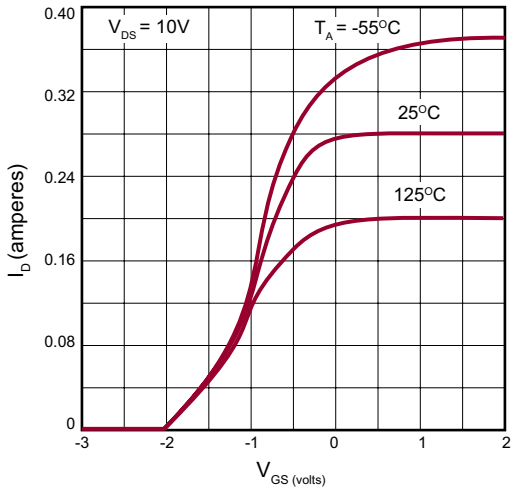
**$BV_{DSS}$ Variation with Temperature**



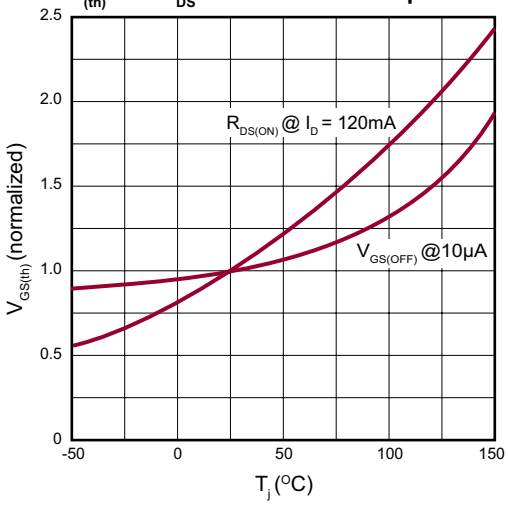

**On-Resistance vs. Drain Current**



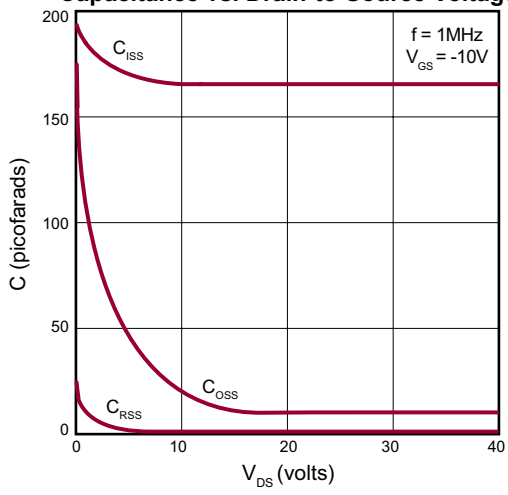

**Transfer Characteristics**



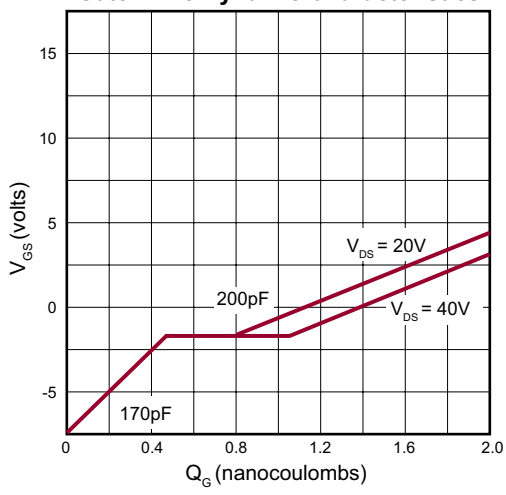

**$V_{(th)}$ and $R_{DS}$ Variation with Temperature**



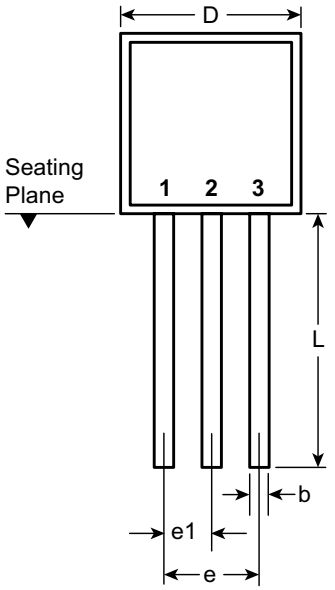

**Capacitance vs. Drain-to-Source Voltage**



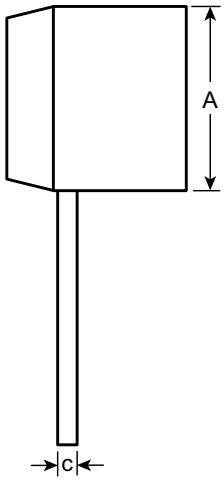

**Gate Drive Dynamic Characteristics**



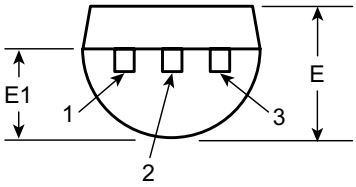
# 3-Lead TO-92 Package Outline (N3)




**Front View**




**Side View**

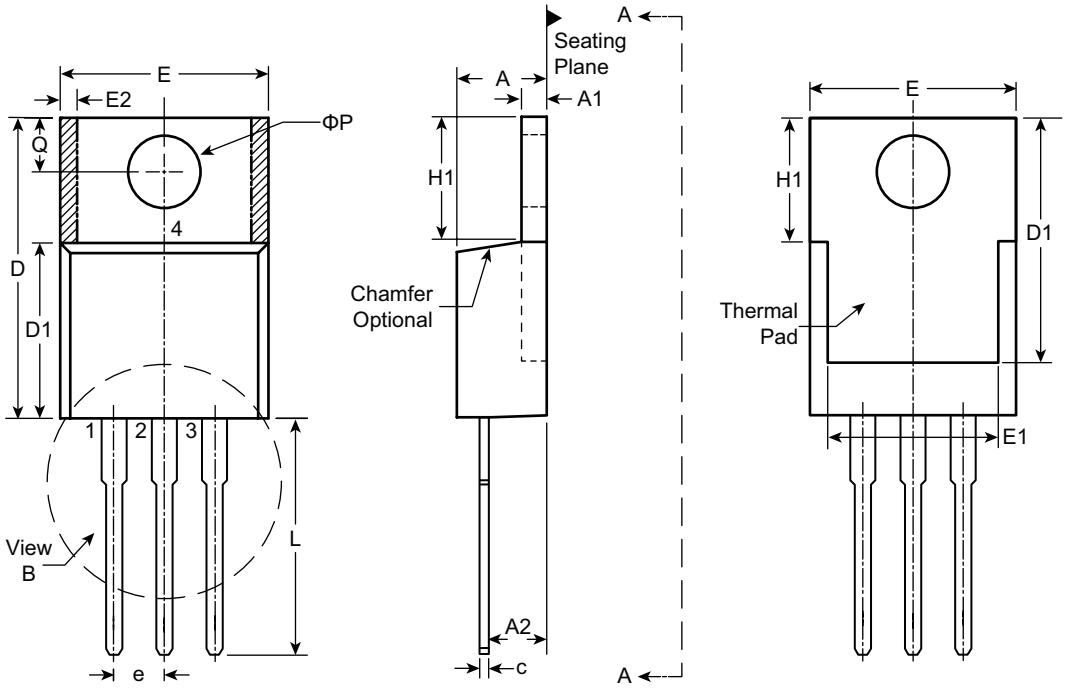



**Bottom View**

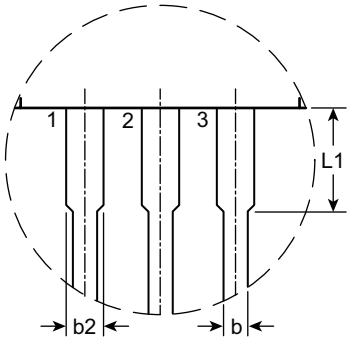
| Symbol | | A | b | c | D | E | E1 | e | e1 | L |
|---|---|---|---|---|---|---|---|---|---|---|
| Dimensions (inches) | MIN | .170 | .014† | .014† | .175 | .125 | .080 | .095 | .045 | .500 |
| | NOM | - | - | - | - | - | - | - | - | - |
| | MAX | .210 | .022† | .022† | .205 | .165 | .105 | .105 | .055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




**Front View** **Side View** **View A - A**




**View B**

| 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.*

*(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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