



## 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

Device	Package Options		BV <sub>DSX</sub> /BV <sub>DGX</sub> (V)	R <sub>DS(ON)</sub> (max) (Ω)	I <sub>DSS</sub> (min) (mA)
	TO-92	TO-220			
DN2535	DN2535N3-G	DN2535N5-G	350	25	150

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



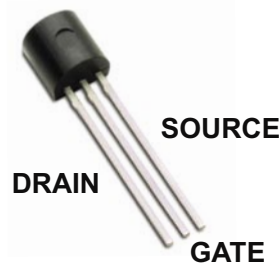
### Absolute Maximum Ratings

Parameter	Value
Drain-to-source voltage	BV <sub>DSX</sub>
Drain-to-gate voltage	BV <sub>DGX</sub>
Gate-to-source voltage	±20V
Operating and storage temperature	-55°C to +150°C
Soldering temperature*	300°C

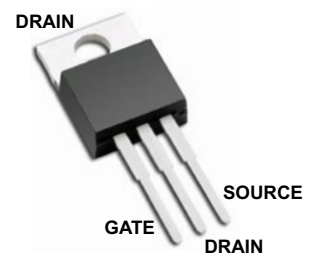
Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied. Continuous operation of the device at the absolute rating level may affect device reliability. All voltages are referenced to device ground.

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

### Pin Configurations

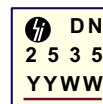


3-Lead TO-92 (N3)



3-Lead TO-220 (N5)

### Product Marking



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

3-Lead TO-92 (N3)



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

3-Lead TO-220 (N5)

## Thermal Characteristics

Package	$I_D$ (continuous) <sup>†</sup> (mA)	$I_D$ (pulsed) (mA)	Power Dissipation @ $T_c = 25^\circ\text{C}$ (W)	$\theta_{jc}$ ( $^\circ\text{C}/\text{W}$ )	$\theta_{ja}$ ( $^\circ\text{C}/\text{W}$ )	$I_{DR}^\dagger$ (mA)	$I_{DRM}$ (mA)
TO-92	120	500	1.0	125	170	120	500
TO-220	500	500	15	8.3	70	500	500

### Notes:

<sup>†</sup>  $I_D$  (continuous) is limited by max rated  $T_f$ .

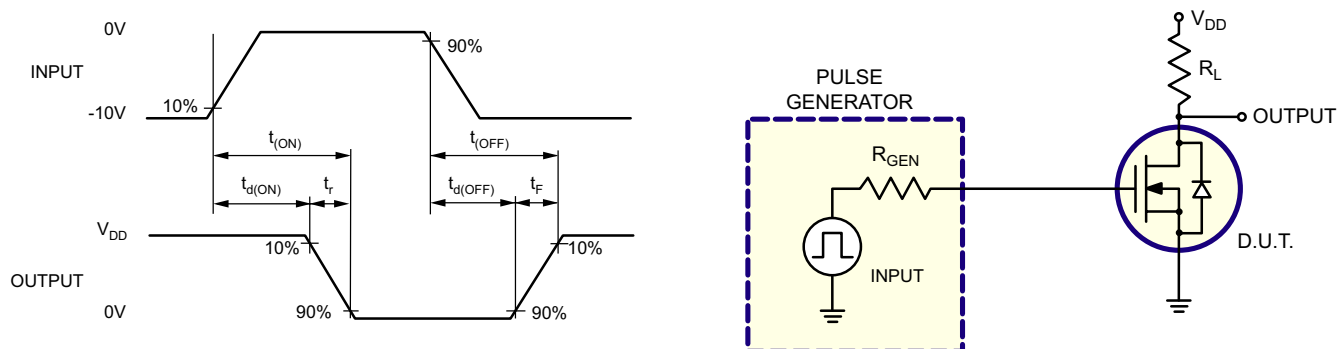
## Electrical Characteristics ( $T_A = 25^\circ\text{C}$ unless otherwise specified)

Sym	Parameter	Min	Typ	Max	Units	Conditions
$BV_{DSX}$	Drain-to-source breakdown voltage	350	-	-	V	$V_{GS} = -5.0\text{V}$ , $I_D = 100\mu\text{A}$
$V_{GS(OFF)}$	Gate-to-source off voltage	-1.5	-	-3.5	V	$V_{DS} = 25\text{V}$ , $I_D = 10\mu\text{A}$
$\Delta V_{GS(OFF)}$	Change in $V_{GS(OFF)}$ with temperature	-	-	-4.5	mV/ $^\circ\text{C}$	$V_{DS} = 25\text{V}$ , $I_D = 10\mu\text{A}$
$I_{GSS}$	Gate body leakage current	-	-	100	nA	$V_{GS} = \pm 20\text{V}$ , $V_{DS} = 0\text{V}$
$I_{D(OFF)}$	Drain-to-source leakage current	-	-	10	$\mu\text{A}$	$V_{DS} = \text{Max rating}$ , $V_{GS} = -10\text{V}$
		-	-	1.0	mA	$V_{DS} = 0.8 \text{ Max Rating}$ , $V_{GS} = -10\text{V}$ , $T_A = 125^\circ\text{C}$
$I_{DSS}$	Saturated drain-to-source current	150	-	-	mA	$V_{GS} = 0\text{V}$ , $V_{DS} = 25\text{V}$
$R_{DS(ON)}$	Static drain-to-source on-state resistance	-	17	25	$\Omega$	$V_{GS} = 0\text{V}$ , $I_D = 120\text{mA}$
$\Delta R_{DS(ON)}$	Change in $R_{DS(ON)}$ with temperature	-	-	1.1	%/ $^\circ\text{C}$	$V_{GS} = 0\text{V}$ , $I_D = 120\text{mA}$
$G_{FS}$	Forward transconductance	-	325	-	mmho	$V_{DS} = 10\text{V}$ , $I_D = 100\text{mA}$
$C_{ISS}$	Input capacitance	-	200	300	pF	$V_{GS} = -10\text{V}$ , $V_{DS} = 25\text{V}$ , $f = 1.0\text{MHz}$
$C_{OSS}$	Common source output capacitance	-	12	30		
$C_{RSS}$	Reverse transfer capacitance	-	1.0	5.0		
$t_{d(ON)}$	Turn-on delay time	-	-	10	ns	$V_{DD} = 25\text{V}$ , $I_D = 150\text{mA}$ , $R_{GEN} = 25\Omega$
$t_r$	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	$V_{GS} = -10\text{V}$ , $I_{SD} = 120\text{mA}$
$t_{rr}$	Reverse recovery time	-	800	-	ns	$V_{GS} = -10\text{V}$ , $I_{SD} = 1.0\text{A}$

### Notes:

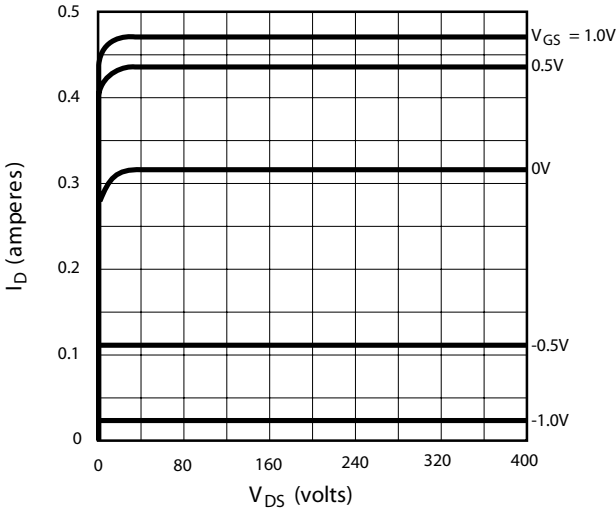
- All D.C. parameters 100% tested at  $25^\circ\text{C}$  unless otherwise stated. (Pulse test:  $300\mu\text{s}$  pulse, 2% duty cycle.)
- All A.C. parameters sample tested.

## Switching Waveforms and Test Circuit

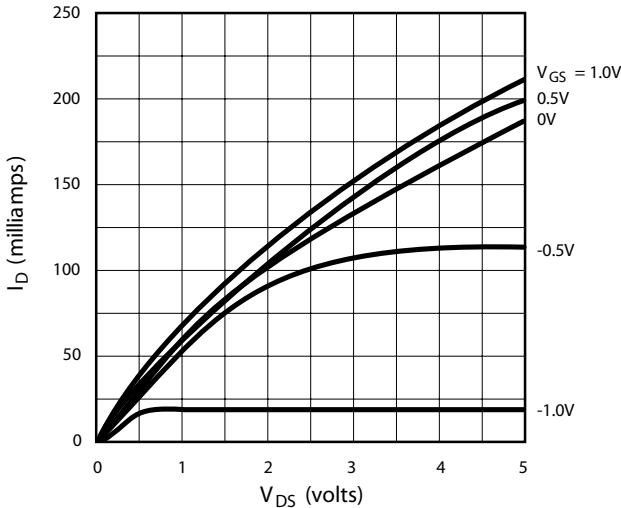


Typical Performance Curves

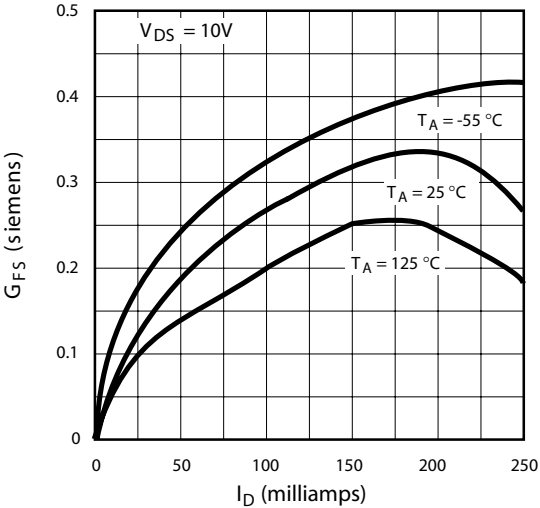
Output Characteristics



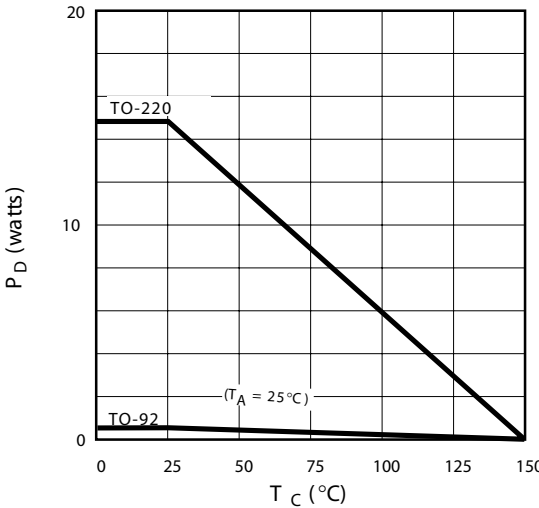
Saturation Characteristics



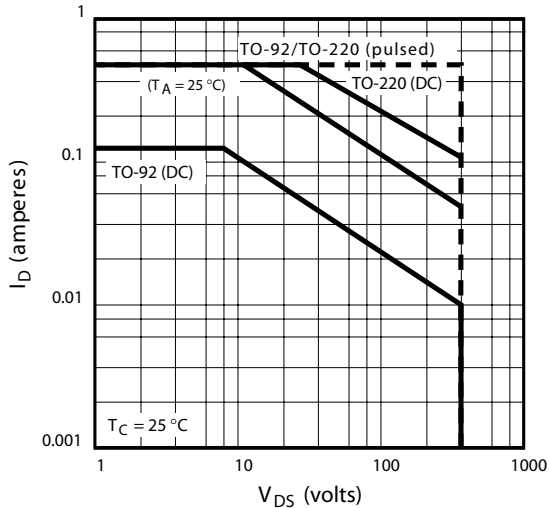
Transconductance vs. Drain Current



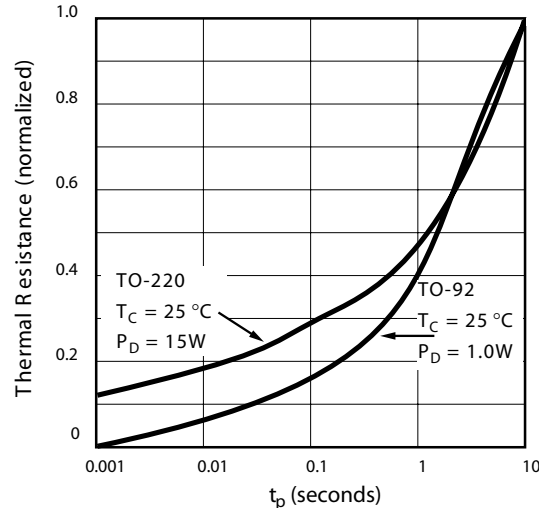
Power Dissipation vs. Ambient Temperature



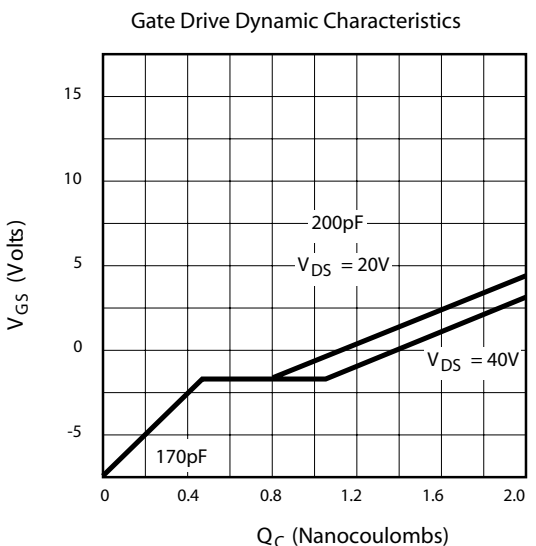
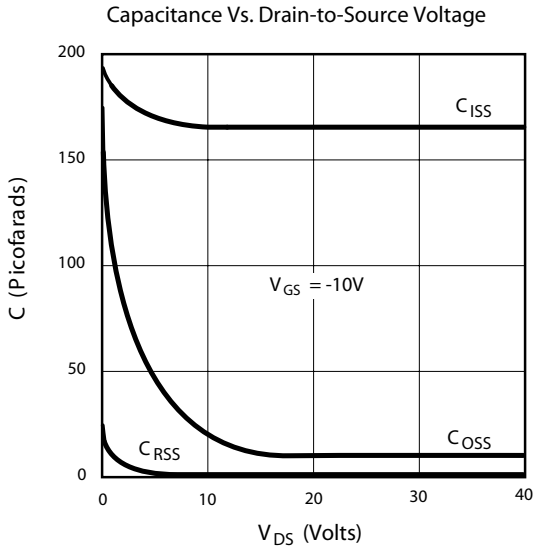
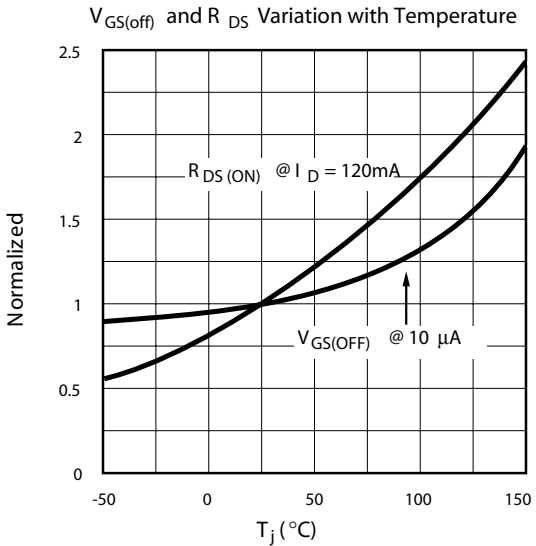
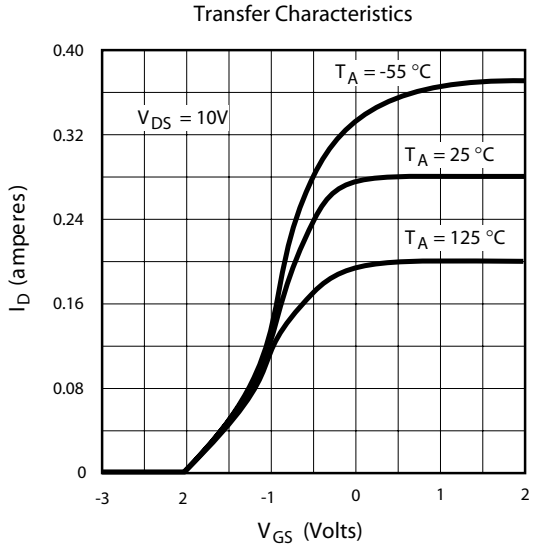
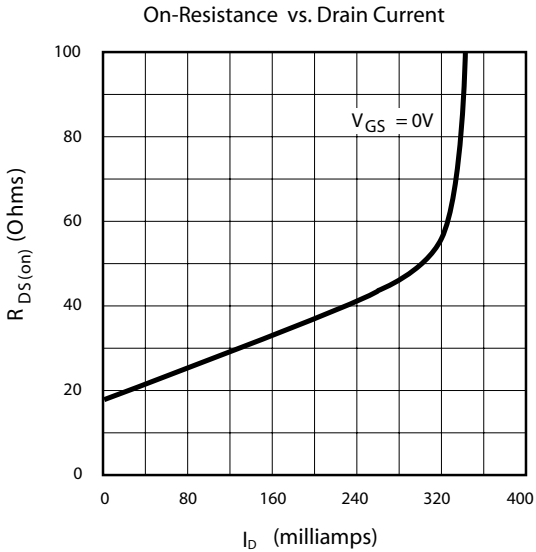
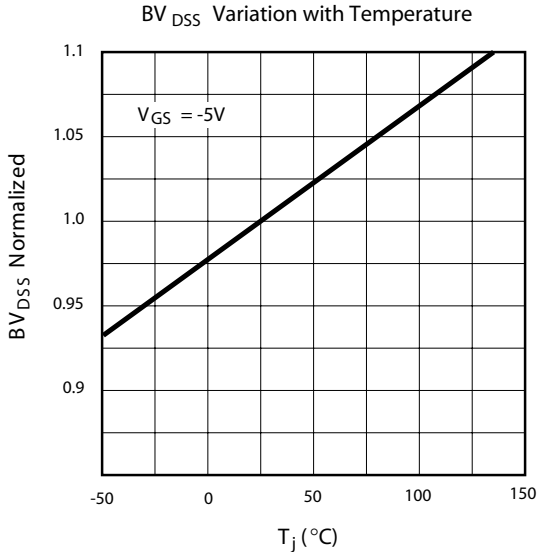
Maximum Rated Safe Operating Area



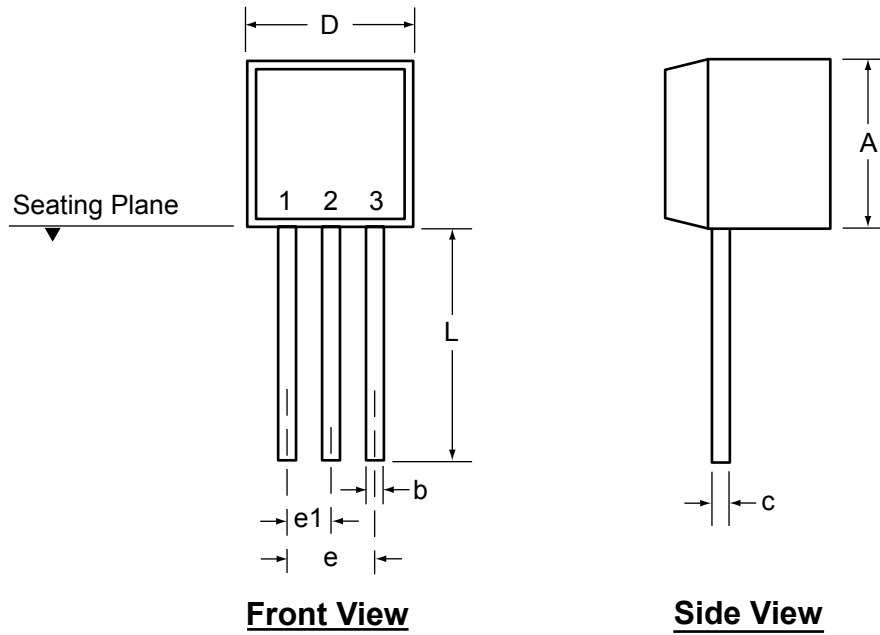
Thermal Response Characteristics



Typical Performance Curves (cont.)



### 3-Lead TO-92 Package Outline (L/LL/N3)



Symbol	A	b	c	D	E	E1	e	e1	L	
Dimensions (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.

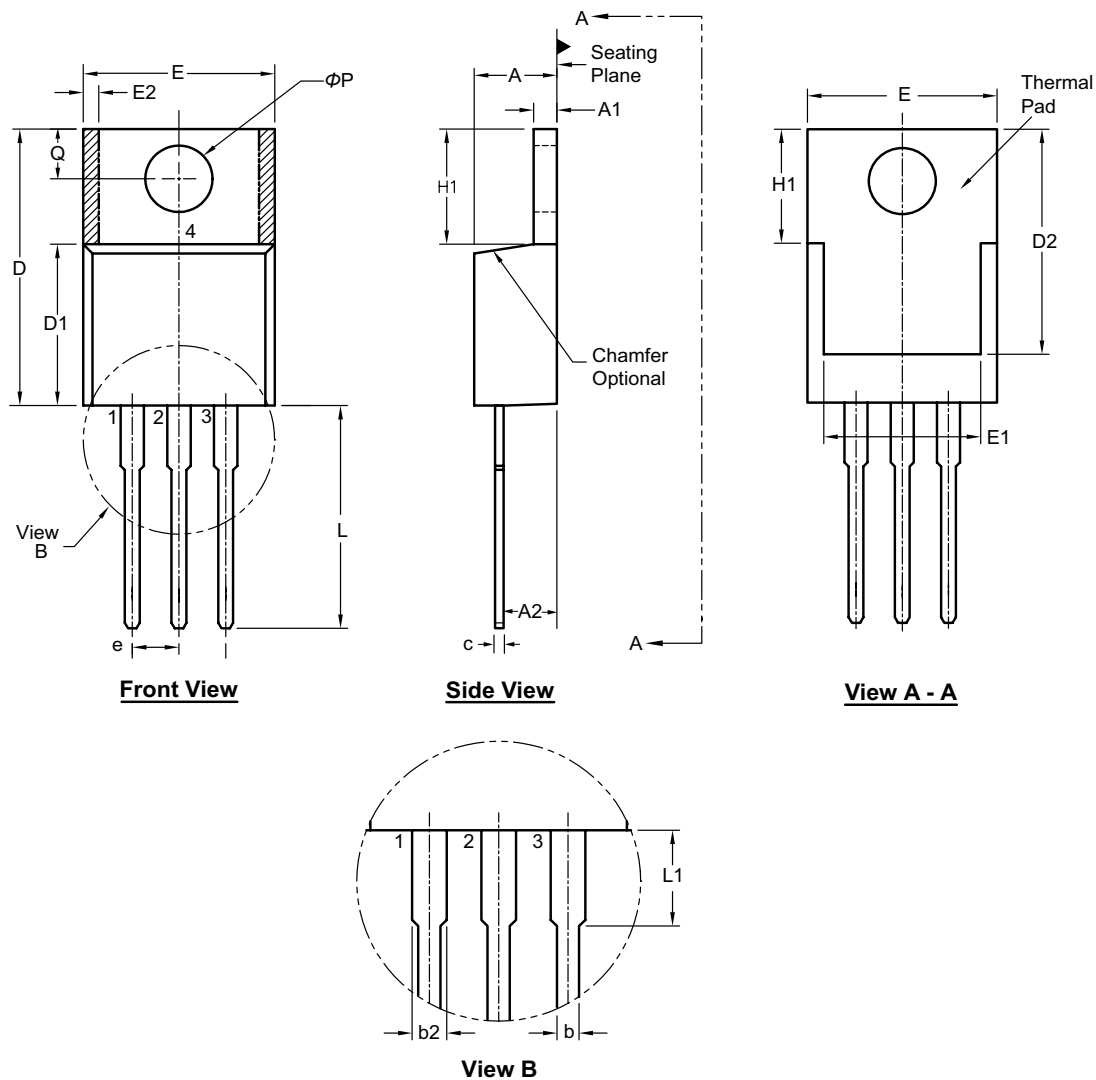
\* This dimension is not specified in the original JEDEC drawing. The value listed is for reference only.

† This dimension is a non-JEDEC dimension.

Drawings not to scale.

Supertex Doc.#: DSPD-3TO92N3, Version D080408.

### 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	$\phi P$		
Dimension (inches)	MIN	.140	.020	.080	.015	.045	.012 <sup>†</sup>	.560	.326 <sup>†</sup>	.474 <sup>†</sup>	.380	.270	0.20*	.100 BSC	.230	.500	.200*	.100	.139	
	NOM	-	-	-	.027	.057	-	-	-	-	-	-	-		-	-	-	-	-	-
	MAX	.190	.055	.120 <sup>†</sup>	.040	.070	.024	.650	.361 <sup>†</sup>	.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 original JEDEC drawing. The value listed is for reference only.

† This dimension is a non-JEDEC dimension.

Drawings not to scale.

Supertex Doc. #: DSPD-3TO220N5, Version B090308.

(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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