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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 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.

Ordering Information

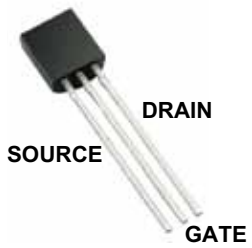
Part Number	Package Option	Packing
DN2540N3-G	TO-92	1000/Bag
DN2540N3-G P002	TO-92	2000/Reel
DN2540N3-G P003		
DN2540N3-G P005		
DN2540N3-G P013		
DN2540N3-G P014		
DN2540N5-G	TO-220	50/Tube
DN2540N8-G	TO-243AA (SOT-89)	2000/Reel

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

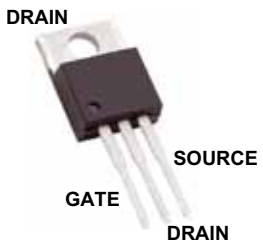
Product Summary

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

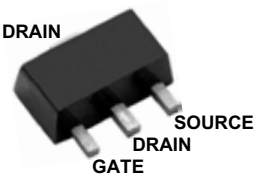
Pin Configuration



TO-92



TO-220



TO-243AA (SOT-89)

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

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Product Marking



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

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

TO-92



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

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°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_j.
‡ *Mounted on FR5 board, 25mm x 25mm x 1.57mm,* T_A = 25°C.

Electrical Characteristics *(T_A = 25°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 = 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 = 1MHz
C_{OSS}	Common source output capacitance	-	12	30		
C_{RSS}	Reverse transfer capacitance	-	1.0	5.0		

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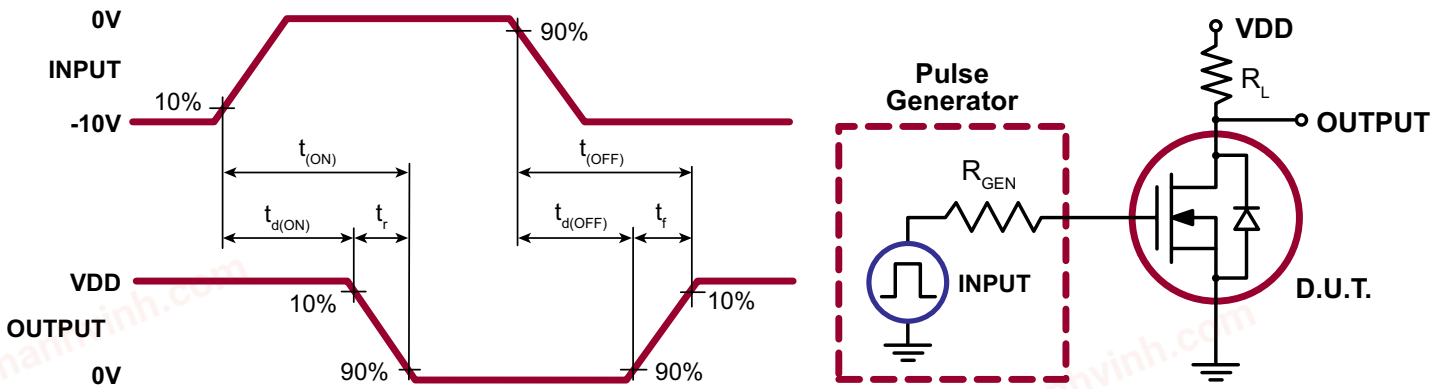
Electrical Characteristics *(cont.)*

Sym	Parameter	Min	Typ	Max	Units	Conditions
$t_{d(ON)}$	Turn-on delay time	-	-	10	ns	V_{DD} = 25V, I_D = 150mA, R_{GEN} = 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.*

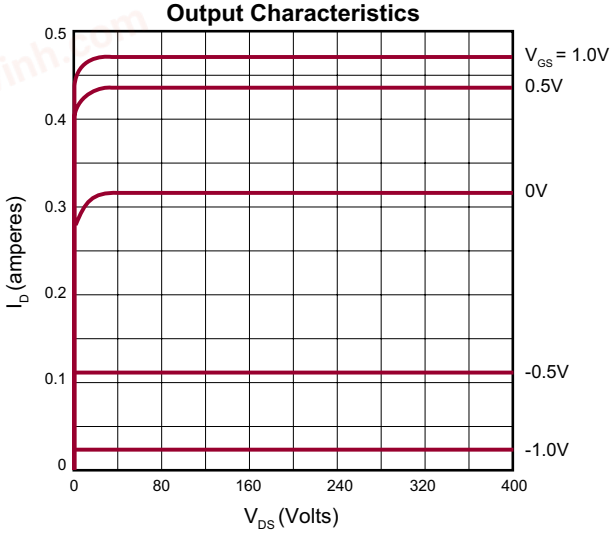
Switching Waveforms and Test Circuit



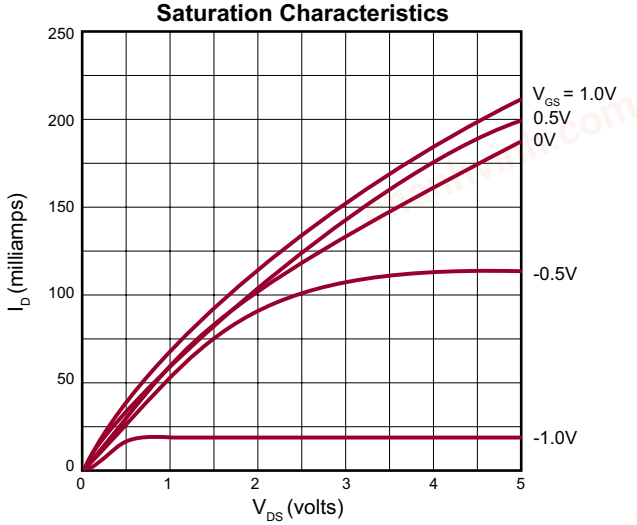
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Typical Performance Curves

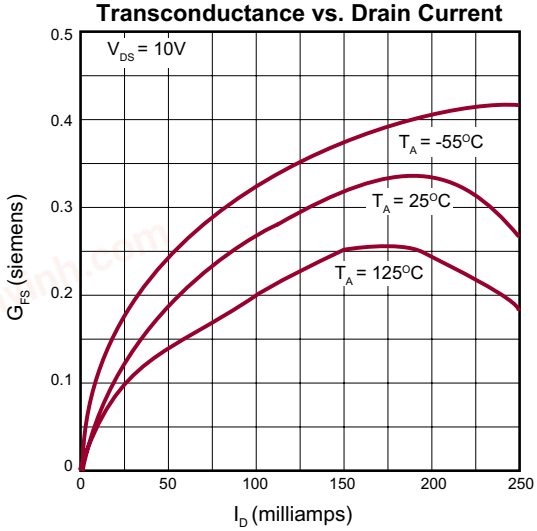
Output Characteristics



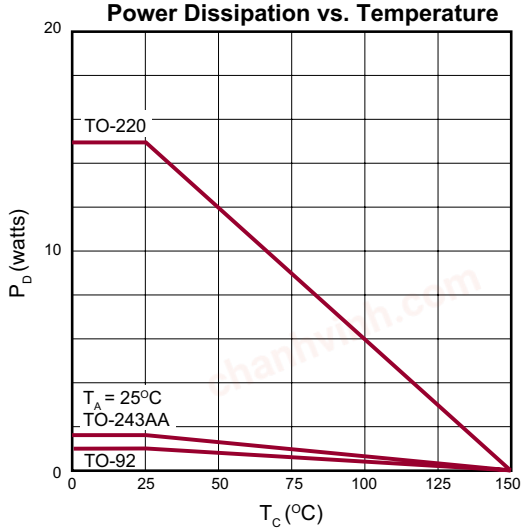
Saturation Characteristics



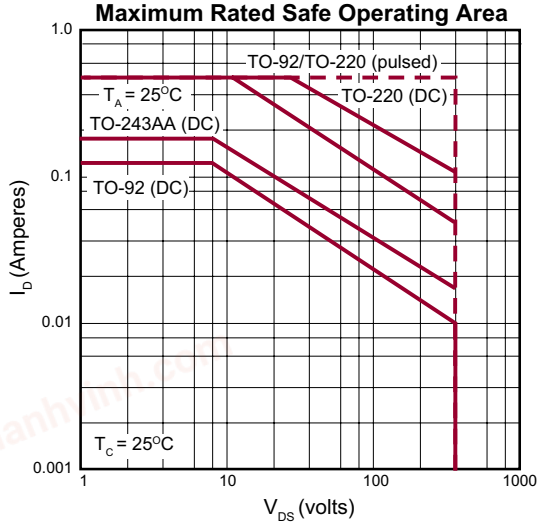
Transconductance vs. Drain Current



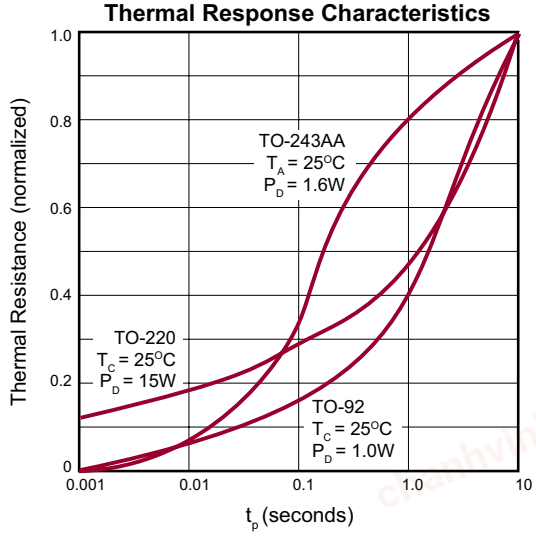
Power Dissipation vs. Temperature



Maximum Rated Safe Operating Area



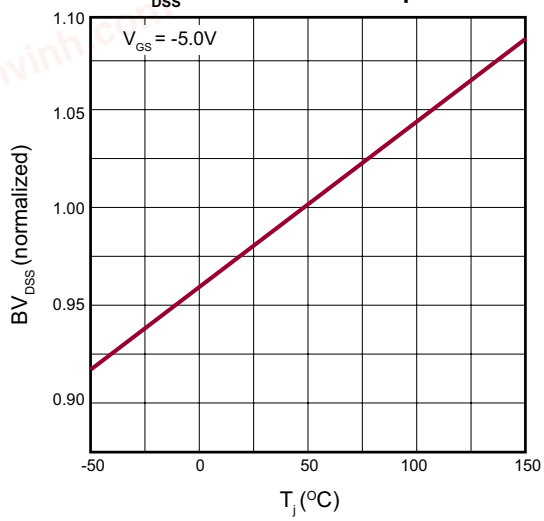
Thermal Response Characteristics



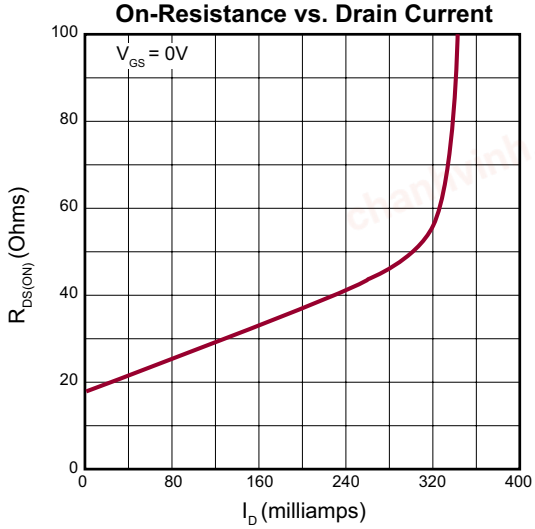
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Typical Performance Curves *(cont.)*

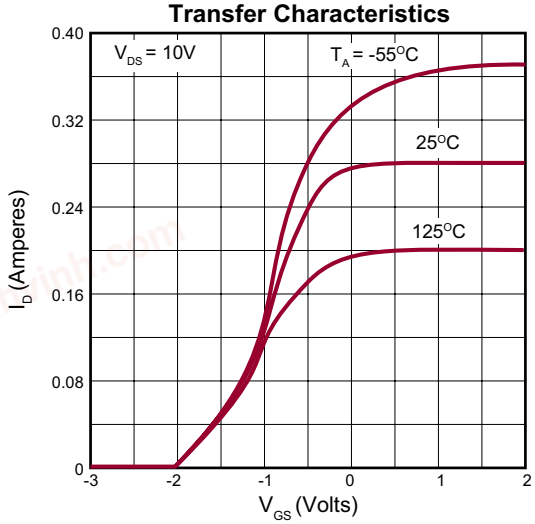
BV_{DSS} Variation with Temperature



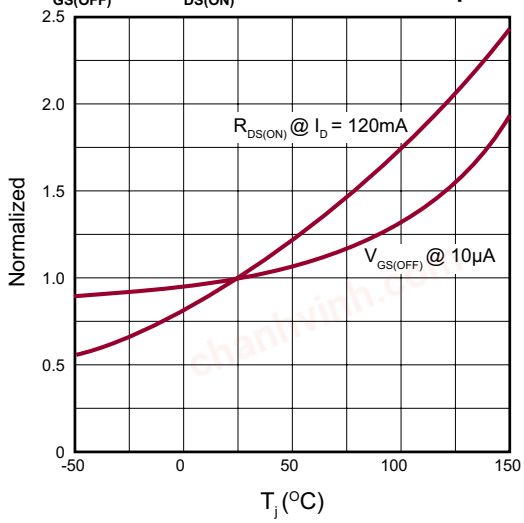
On-Resistance vs. Drain Current



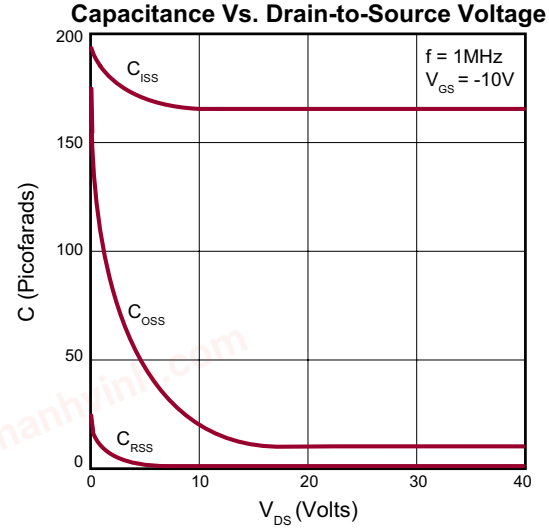
Transfer Characteristics



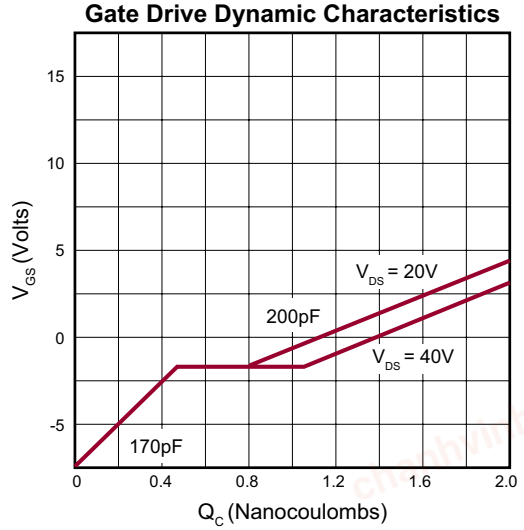
$V_{GS(OFF)}$ and $R_{DS(ON)}$ Variation with Temperature



Capacitance Vs. Drain-to-Source Voltage

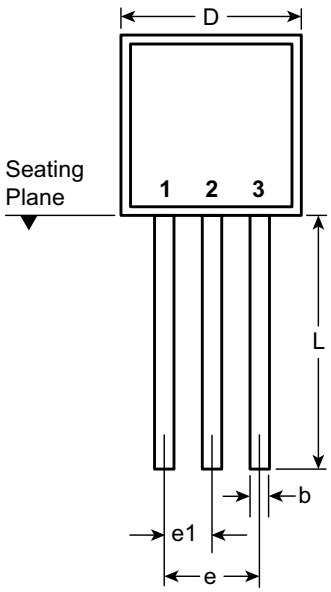


Gate Drive Dynamic Characteristics

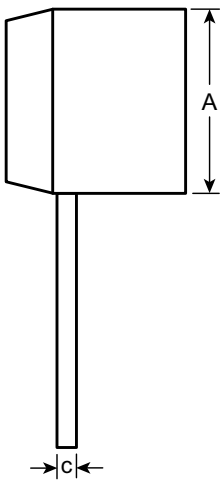


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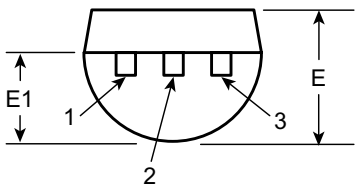
3-Lead TO-92 Package Outline (N3)



Front View



Side View



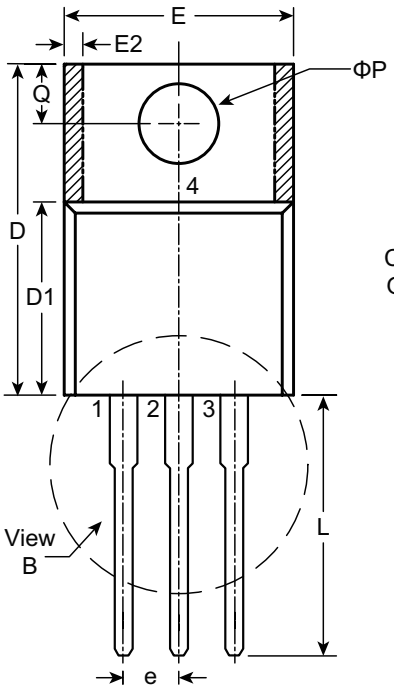
Bottom View

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*

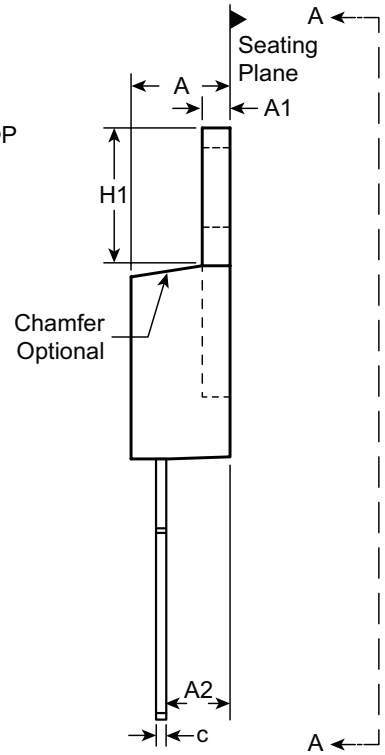
JEDEC Registration TO-92.
** This dimension is not specified in the JEDEC drawing.*
† This dimension differs from the JEDEC drawing.
Drawings not to scale.
***Supertex Doc.#:** DSPD-3TO92N3, Version E041009.*

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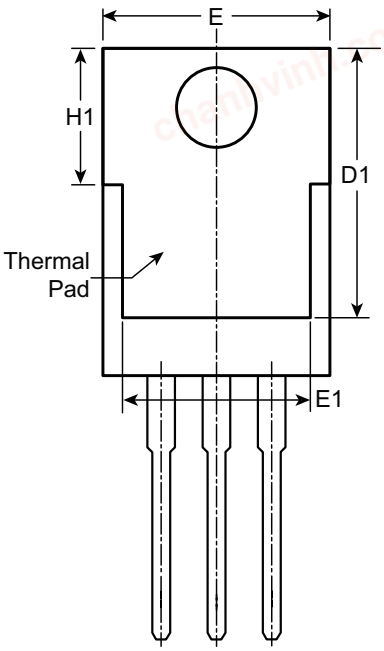
3-Lead TO-220 Package Outline (N5)



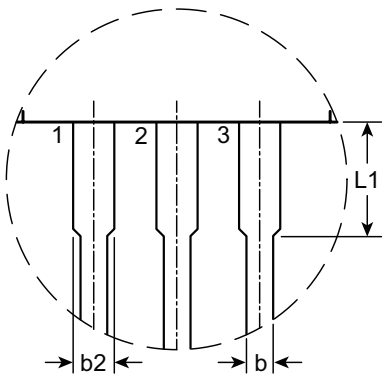
Front View



Side View



View A - A



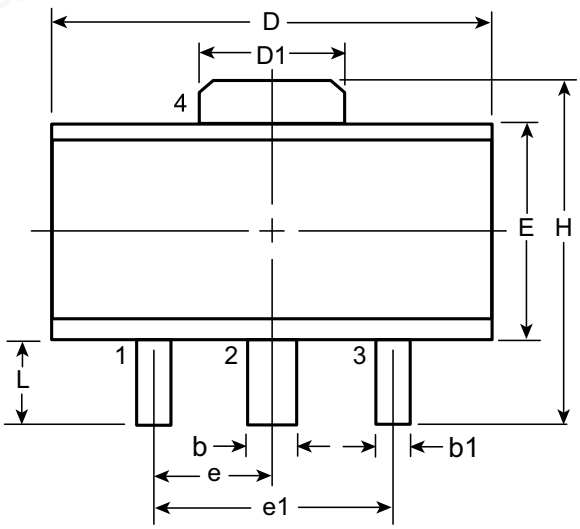
View B

Symbol		A	A1	A2	b	b2	c	D	D1	D2	E	E1	E2	e	H1	L	L1	Q	ΦP
Dimen-sion (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

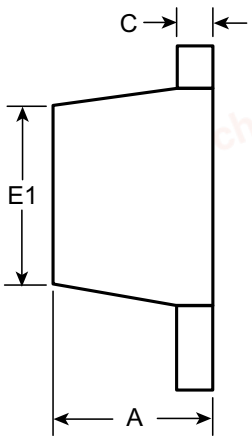
JEDEC Registration TO-220, Variation AB, Issue K, April 2002.
** This dimension is not specified in the JEDEC drawing.*
† This dimension differs from the JEDEC drawing.
Drawings not to scale.
***Supertex Doc. #:** DSPD-3TO220N5, Version C041009.*

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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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