N-Channel Enhancement-Mode Vertical DMOS FETs

Features

- Free from secondary breakdown
- Low power drive requirement
- Ease of paralleling
- Low C_{ISS} and fast switching speeds
- Excellent thermal stability
- Integral source-drain diode
- High input impedance and high gain

Applications

- Motor controls
- Converters
- Amplifiers
- Switches
- Power supply circuits
- Drivers (relays, hammers, solenoids, lamps, memories, displays, bipolar transistors, etc.)

General Description

This enhancement-mode (normally-off) transistor utilizes a 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_{DSS}/BV_{DGS} (V)	$R_{DS(ON)}$ max (Ω)	$V_{GS(th)}$ max (V)
	TO-92	14-Lead PDIP	TO-243AA (SOT-89)	Die*			
VN3205	VN3205N3-G	VN3205P-G	VN3205N8-G	VN3205ND	50	0.3	2.4

-G indicates package is RoHS compliant ('Green')
** MIL visual screening available.*

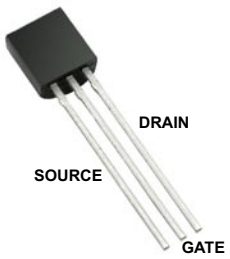
Absolute Maximum Ratings

Parameter	Value
Drain-to-source voltage	BV_{DSS}
Drain-to-gate voltage	BV_{DGS}
Gate-to-source voltage	±20V
Operating and storage temperature	-55°C to +150°C
Soldering temperature*	+300°C

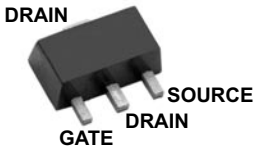
Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied. Continuous operation of the device at the absolute rating level may affect device reliability. All voltages are referenced to device ground.

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

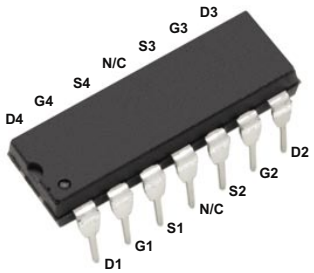
Pin Configurations



TO-92 (N3)



TO-243AA (SOT-89) (N8)



14-Lead PDIP (P)

Product Markings

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

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

TO-92 (N3)

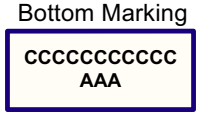
W = Code for week sealed
_____ = "Green" Packaging

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

TO-243AA (SOT-89) (N8)

Top Marking

Bottom Marking



YY = Year Sealed
WW = Week Sealed
L = Lot Number
C = Country of Origin*
A = Assembler ID*
_____ = "Green" Packaging
**May be part of top marking*

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

14-Lead PDIP (P)

Thermal Characteristics

Package	I_D (continuous)* (A)	I_D (pulsed) (A)	Power Dissipation @T_C = 25°C (W)	θ_{jc} (°C/W)	θ_{ja} (°C/W)	I_{DR}† (A)	I_{DRM} (A)
TO-92	1.2	8.0	1.0	125	170	1.2	8.0
14-Lead PDIP	1.5	8.0	3.0†	41.6†	83.3†	1.5	8.0
TO-243AA	1.5	8.0	1.6 (T_A = 25°)	15	78‡	1.5	8.0

Notes:
* I_D (continuous) is limited by max rated T_J, T_A = 25°C.
† Total for package.
‡ Mounted on FR5 board, 25mm x 25mm x 1.57mm.

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

Sym	Parameter		Min	Typ	Max	Units	Conditions
BV_{DSS}	Drain-to-source breakdown voltage		50	-	-	V	V_{GS} = 0V, I_D = 10mA
$V_{GS(th)}$	Gate threshold voltage		0.8	-	2.4	V	V_{GS} = V_{DS}, I_D = 10mA
$\Delta V_{GS(th)}$	Change in $V_{GS(th)}$ with temperature		-	-4.3	-5.5	mV/°C	V_{GS} = V_{DS}, I_D = 10mA
I_{GSS}	Gate body leakage current		-	1.0	100	nA	V_{GS} = ±20V, V_{DS} = 0V
I_{DSS}	Zero gate voltage drain current		-	-	10	µA	V_{GS} = 0V, V_{DS} = Max Rating
			-	-	1.0	mA	V_{DS} = 0.8 Max Rating, V_{GS} = 0V, T_A = 125°C
$I_{D(ON)}$	On-state drain current		3.0	14	-	A	V_{GS} = 10V, V_{DS} = 5.0V
$R_{DS(ON)}$	Static drain-to-source on-state resistance	TO-92 and PDIP	-	-	0.45	Ω	V_{GS} = 4.5V, I_D = 1.5A
		TO-243AA	-	-	0.45		V_{GS} = 4.5V, I_D = 0.75A
		TO-92 and PDIP	-	-	0.3		V_{GS} = 10V, I_D = 3.0A
		TO-243AA	-	-	0.3		V_{GS} = 10V, I_D = 1.5A
$\Delta R_{DS(ON)}$	Change in $R_{DS(ON)}$ with temperature		-	0.85	1.2	%/°C	V_{GS} = 10V, I_D = 3.0A
G_{FS}	Forward transconductance		1.0	1.5	-	mho	V_{DS} = 25V, I_D = 2.0A

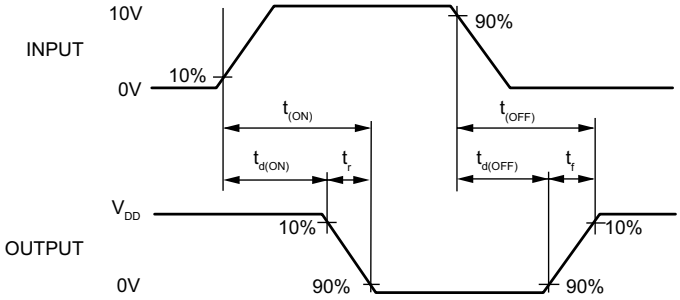
Electrical Characteristics *(cont.) (T_A = 25°C unless otherwise specified)*

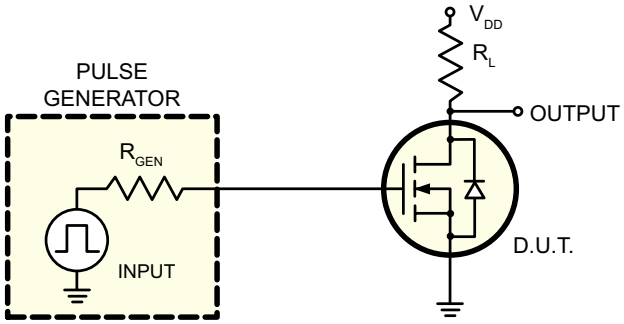
Sym	Parameter	Min	Typ	Max	Units	Conditions
C_{ISS}	Input capacitance	-	220	300	pF	V_{GS} = 0V, V_{DS} = 25V, f = 1.0MHz
C_{OSS}	Common source output capacitance	-	70	120		
C_{RSS}	Reverse transfer capacitance	-	20	30		
$t_{d(ON)}$	Turn-on delay time	-	-	10	ns	V_{DD} = 25V, I_D = 2.0A, R_{GEN} = 10Ω
t_r	Rise time	-	-	15		
$t_{d(OFF)}$	Turn-off delay time	-	-	25		
t_f	Fall time	-	-	25		
V_{SD}	Diode forward voltage drop	-	-	1.6	V	V_{GS} = 0V, I_{SD} = 1.5A
t_{rr}	Reverse recovery time	-	300	-	ns	V_{GS} = 0V, 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.*

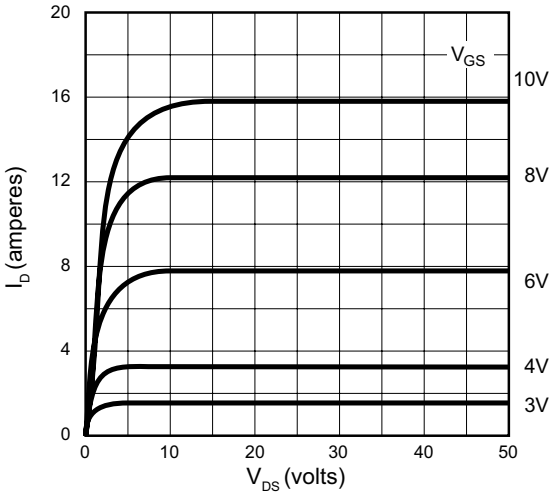
Switching Waveforms and Test Circuit



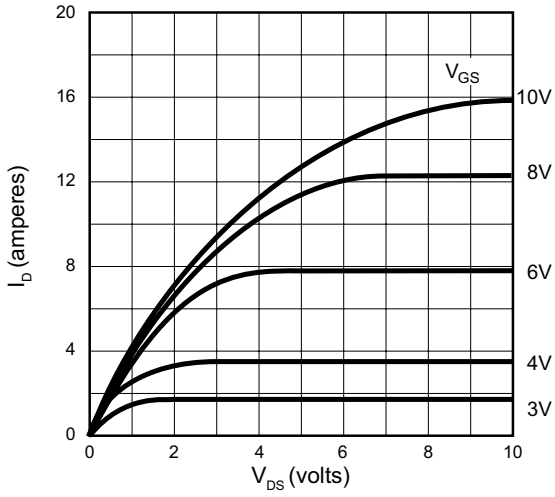


Typical Performance Curves

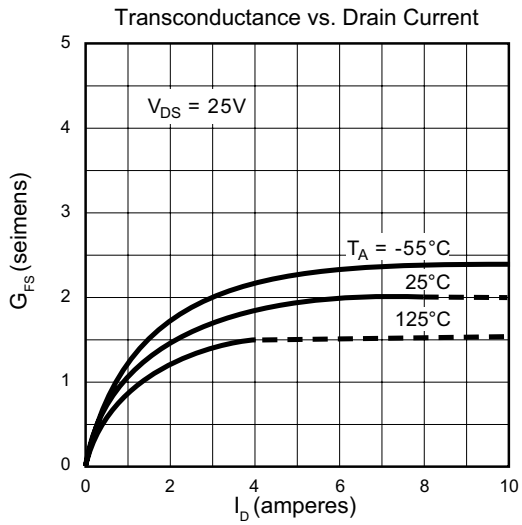
Output Characteristics



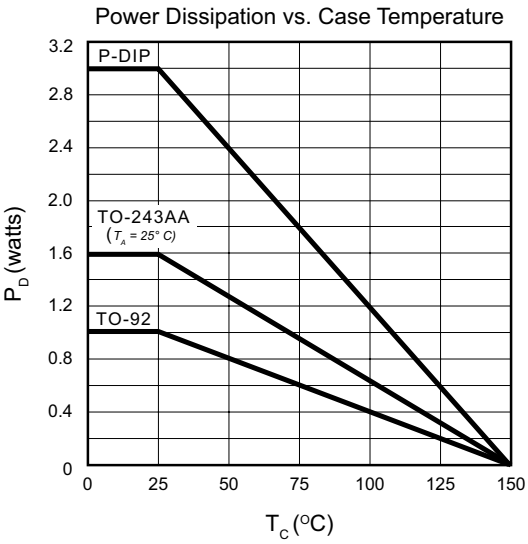
Saturation Characteristics



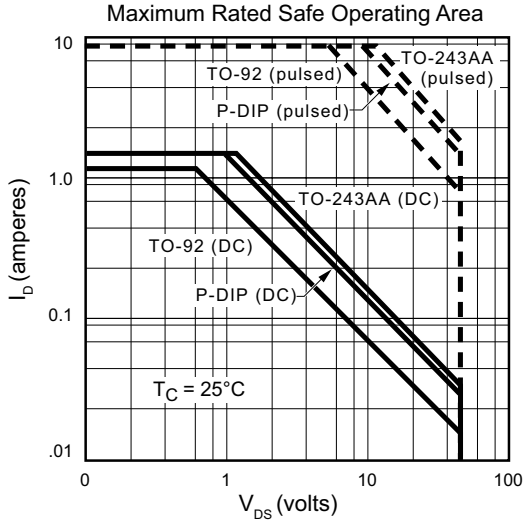
Transconductance vs. Drain Current



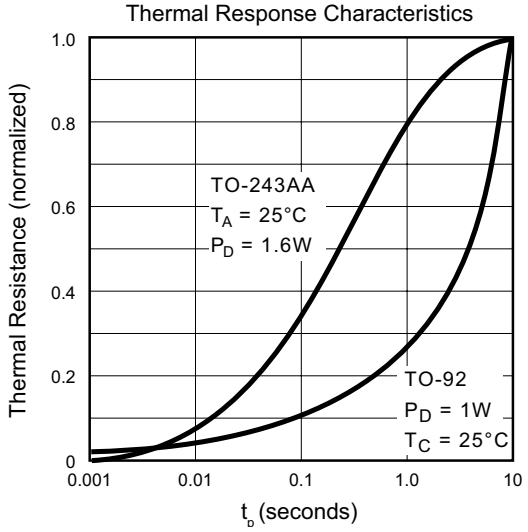
Power Dissipation vs. Case Temperature



Maximum Rated Safe Operating Area

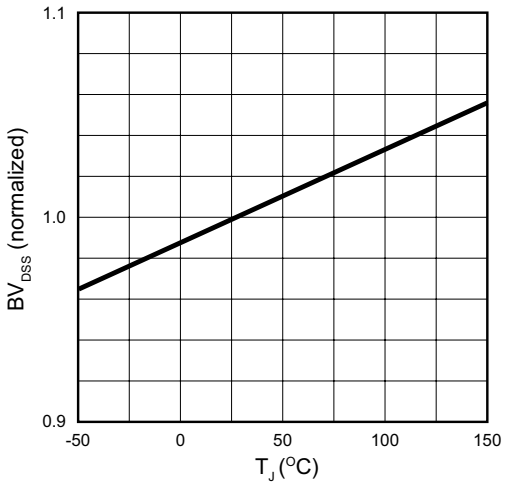


Thermal Response Characteristics

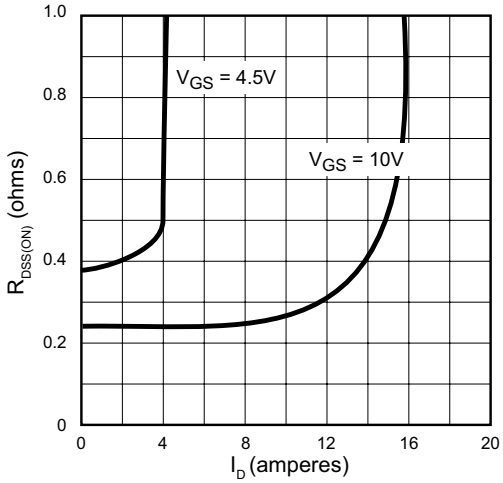


Typical Performance Curves *(cont.)*

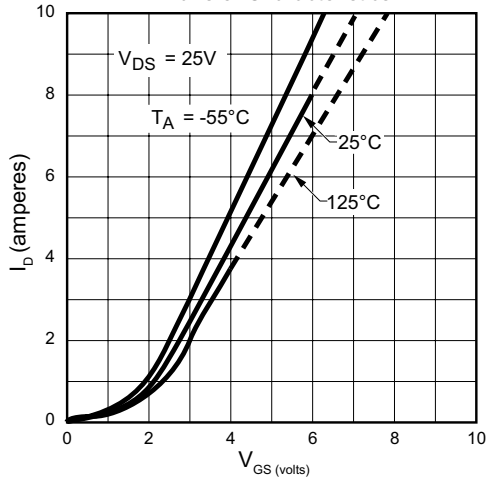
BV_{DSS} Variation with Temperature



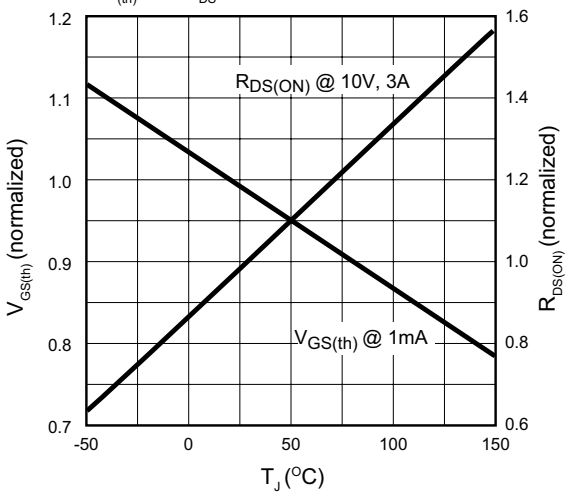
On-Resistance vs. Drain Current



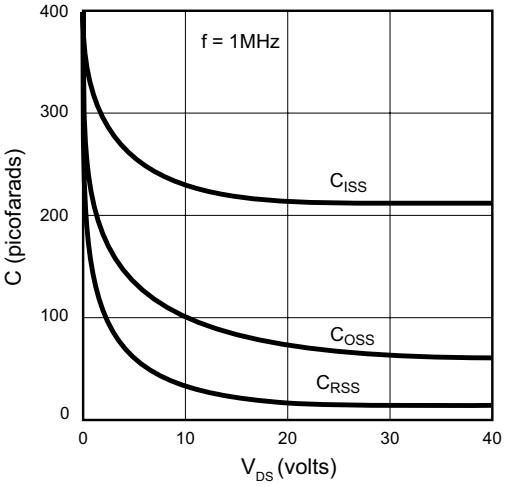
Transfer Characteristics



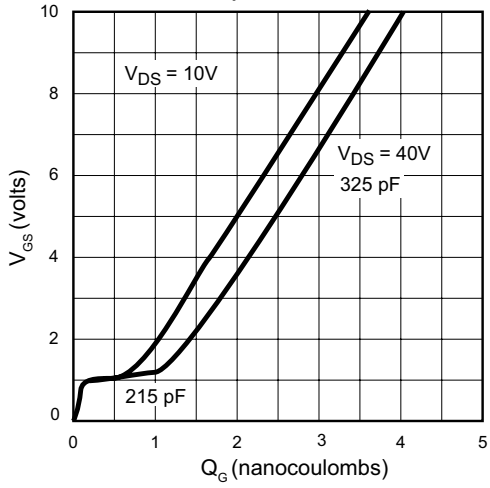
$V_{(th)}$ and R_{DS} Variation with Temperature



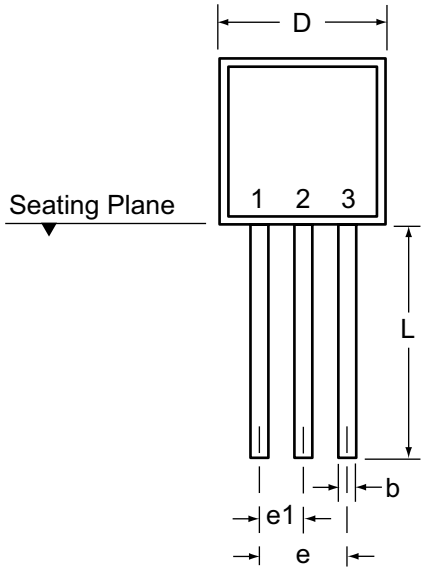
Capacitance vs. Drain-to-Source Voltage



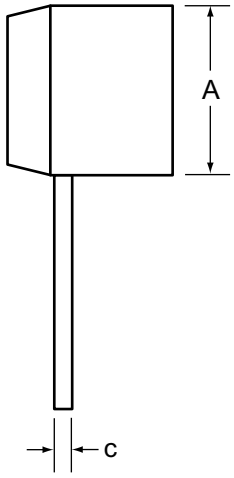
Gate Drive Dynamic Characteristics



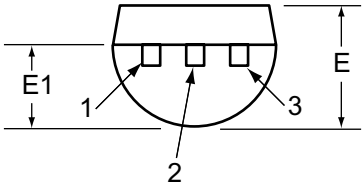
3-Lead TO-92 Package Outline (N3)



Front View



Side View

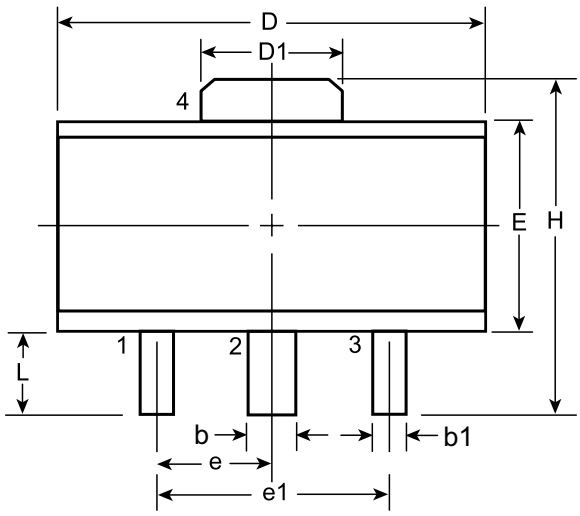


Bottom View

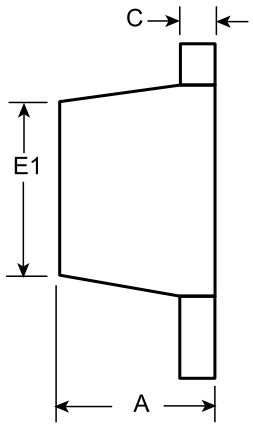
Symbol		A	b	c	D	E	E1	e	e1	L
Dimensions (inches)	MIN	.170	.014†	.014†	.175	.125	.080	.095	.045	.500
	NOM	-	-	-	-	-	-	-	-	-
	MAX	.210	.022†	.022†	.205	.165	.105	.105	.055	.610*

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-243AA (SOT-89) Package Outline (N8)



Top View



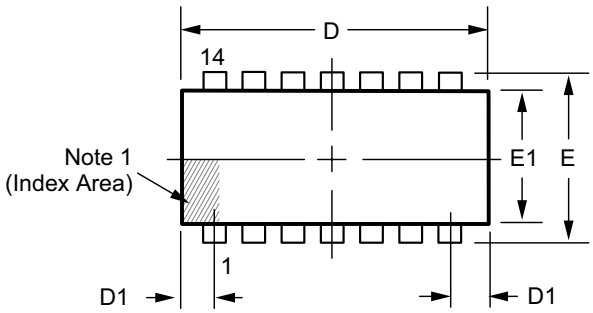
Side View

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	0.89
	NOM	-	-	-	-	-	-	-	-			-	-
	MAX	1.60	0.56	0.48	0.44	4.60	1.83	2.60	2.29			4.25	1.20

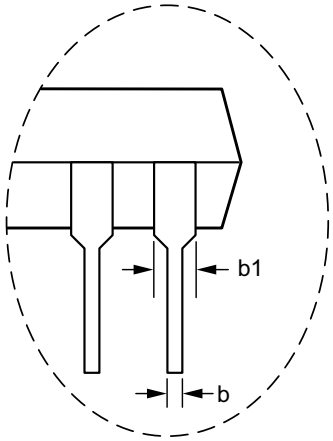
JEDEC Registration TO-243, Variation AA, Issue C, July 1986.
† *This dimension differs from the JEDEC drawing*
Drawings not to scale.
Supertex Doc. #: *DSPD-3TO243AAN8, Version E051509.*

14-Lead PDIP (.300in Row Spacing) Package Outline (P)

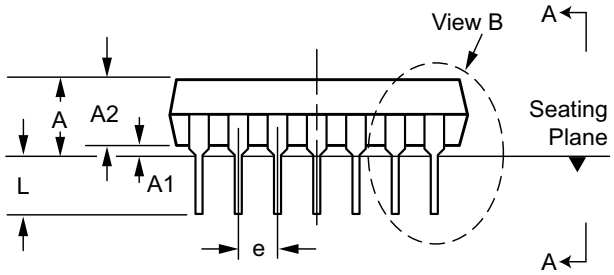
.750x.250in body, .210in height (max), .100in pitch



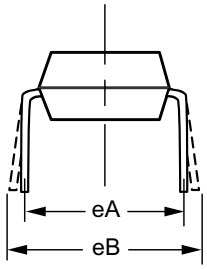
Top View



View B



Side View



View A - A

Note:

1. *A Pin 1 identifier must be located in the index area indicated. The Pin 1 identifier can be: a molded mark/identifier; an embedded metal marker; or a printed indicator.*

Symbol		A	A1	A2	b	b1	D	D1	E	E1	e	eA	eB	L
Dimension (inches)	MIN	.130*	.015	.115	.014	.045	.735	.065†	.290†	.240	.100 BSC	.300 BSC	.300*	.115
	NOM	-	-	.130	.018	.060	.750	-	.310	.250			-	.130
	MAX	.210	.035*	.195	.023†	.070	.810†	.085*	.325	.280			.430	.150

JEDEC Registration MS-001, Variation AA, Issue D, June, 1993.
** This dimension is not specified in the JEDEC drawing.*
† This dimension differs from the JEDEC drawing.
Drawings not to scale.
***Supertex Doc. #:** DSPD-14DIPP, Version B041009.*

(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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