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

The Supertex VN2224 is an enhancement-mode (normally-off) transistor that 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 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 very low threshold voltage, high breakdown voltage, high input impedance, low input capacitance, and fast switching speeds are desired.

Ordering Information

Device	Package Option	BV_{DSS}/BV_{DGS} (V)	$R_{DS(ON)}$ (max) (Ω)	$I_{D(ON)}$ (min) (A)
	TO-92			
VN2224	VN2224N3-G	240	1.25	5.0

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

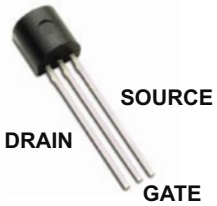
Absolute Maximum Ratings

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 Configuration



TO-92 (N3)

Product Marking

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

TO-92 (N3)

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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	0.54	5.0	1.0	125	170	0.54	5.0

Notes:

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

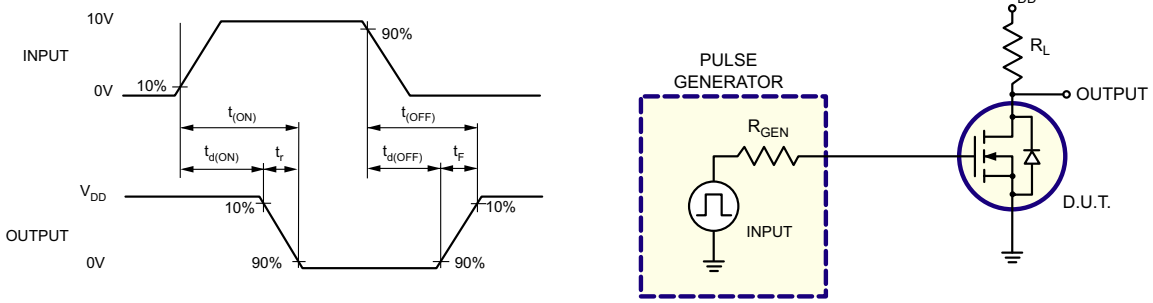
Electrical Characteristics *(T_A = 25°C unless otherwise specified)*

Sym	Parameter	Min	Typ	Max	Units	Conditions
BV_{DSS}	Drain-to-source breakdown voltage	240	-	-	V	V_{GS} = 0V, I_D = 5.0mA
$V_{GS(th)}$	Gate threshold voltage	1.0	-	3.0	V	V_{GS} = V_{DS}, I_D = 5.0mA
$\Delta V_{GS(th)}$	Change in $V_{GS(th)}$ with temperature	-	-4.0	-5.0	mV/°C	V_{GS} = V_{DS}, I_D = 5.0mA
I_{GSS}	Gate body leakage current	-	1.0	100	nA	V_{GS} = ±20V, V_{DS} = 0V
I_{DSS}	Zero gate voltage drain current	-	-	50	µA	V_{GS} = 0V, V_{DS} = Max Rating
		-	-	5.0	mA	V_{DS} = 0.8 Max Rating, V_{GS} = 0V, T_A = 125°C
$I_{D(ON)}$	On-state drain current	2.0	-	-	A	V_{GS} = 5.0V, V_{DS} = 25V
		5.0	10	-		V_{GS} = 10V, V_{DS} = 25V
$R_{DS(ON)}$	Static drain-to-source on-state resistance	-	1.0	1.5	Ω	V_{GS} = 5.0V, I_D = 2.0A
		-	0.9	1.25		V_{GS} = 10V, I_D = 2.0A
$\Delta R_{DS(ON)}$	Change in $R_{DS(ON)}$ with temperature	-	1.0	1.4	%/°C	V_{GS} = 10V, I_D = 2.0A
G_{FS}	Forward transconductance	1000	2200	-	mmho	V_{DS} = 25V, I_D = 2.0A
C_{ISS}	Input capacitance	-	300	350	pF	V_{GS} = 0V, V_{DS} = 25V, f = 1.0MHz
C_{OSS}	Common Source output capacitance	-	85	150		
C_{RSS}	Reverse transfer capacitance	-	20	35		
$t_{d(ON)}$	Turn-on delay time	-	6.0	15	ns	V_{DD} = 25V, I_D = 2.0A, R_{GEN} = 10Ω
$t_{d(OFF)}$	Turn-off delay time	-	65	90		
t_r	Rise time	-	16	25		
t_f	Fall time	-	30	60		
t_{rr}	Reverse recovery time	-	500	-	ns	V_{GS} = 0V, I_{SD} = 1.0A
V_{SD}	Diode forward voltage drop	-	0.8	1.0	V	V_{GS} = 0V, I_{SD} = 100mA

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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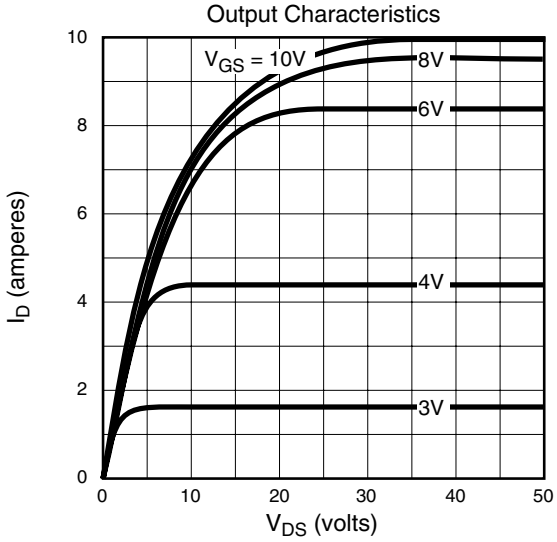
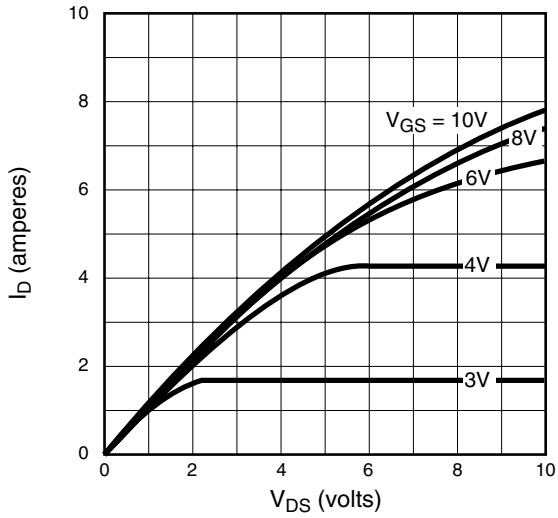
Typical Performance Curves

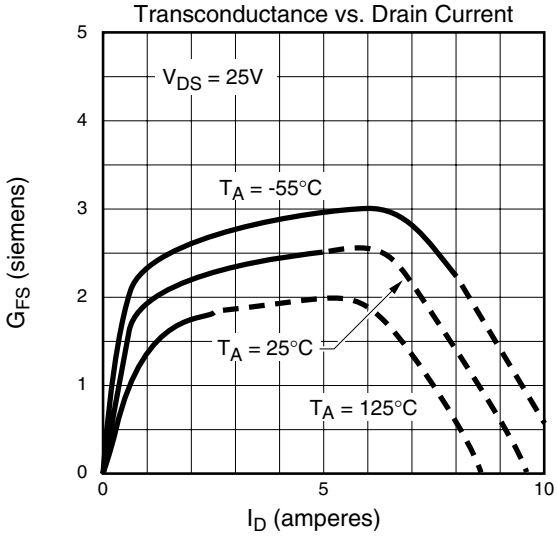
Output Characteristics



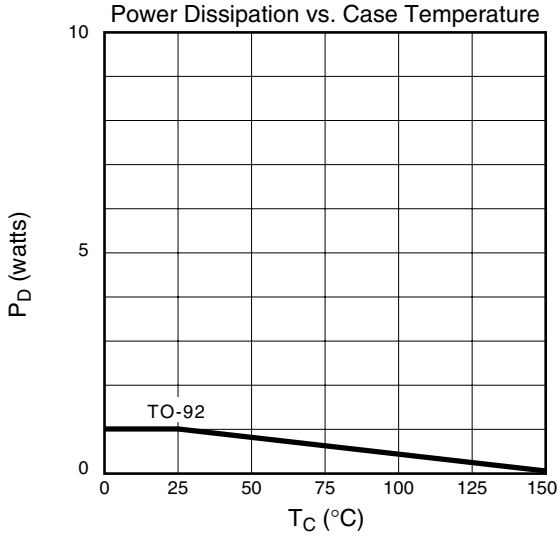
Saturation Characteristics



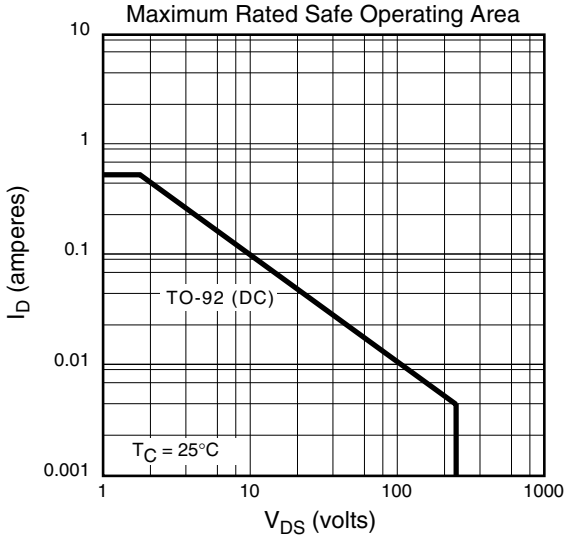
Transconductance vs. Drain Current



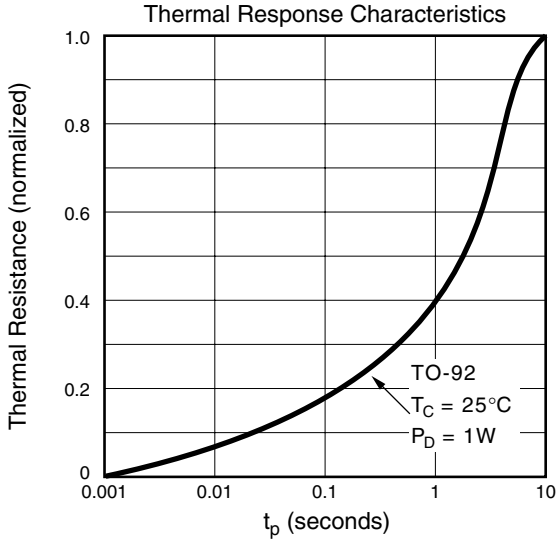
Power Dissipation vs. Case Temperature



Maximum Rated Safe Operating Area



Thermal Response Characteristics



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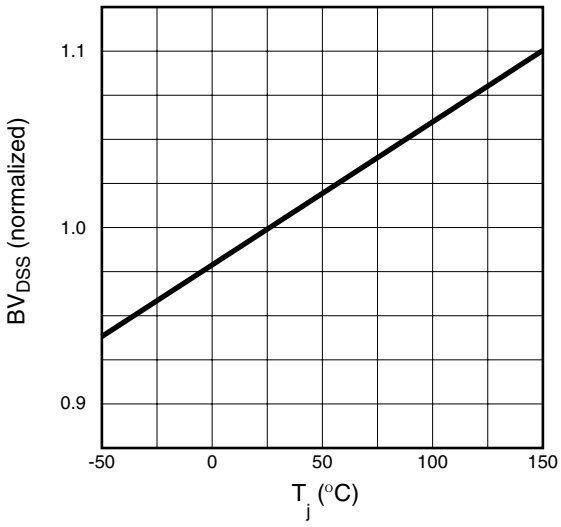
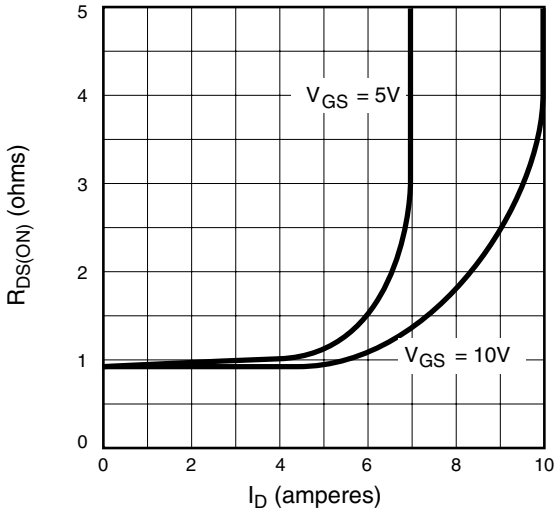
Typical Performance Curves *(cont.)*

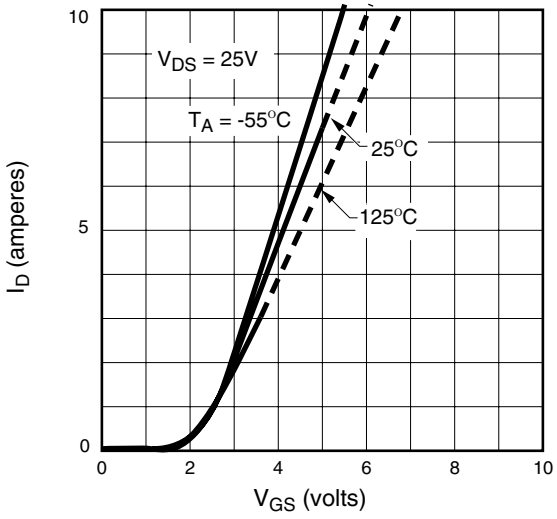
BV$_{DSS}$ Variation with Temperature



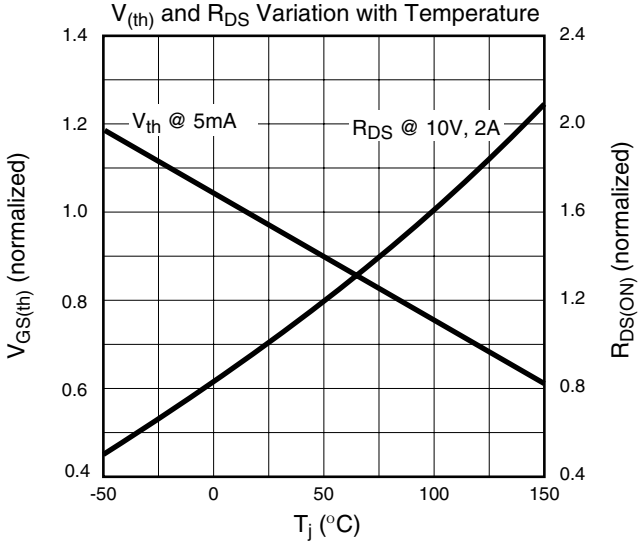
On-Resistance vs. Drain Current



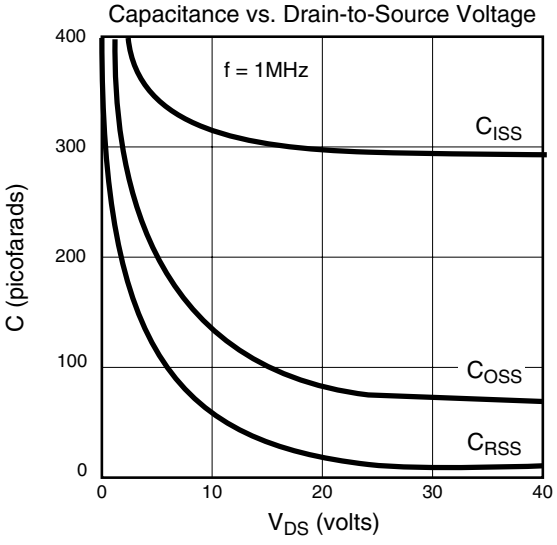
Transfer Characteristics



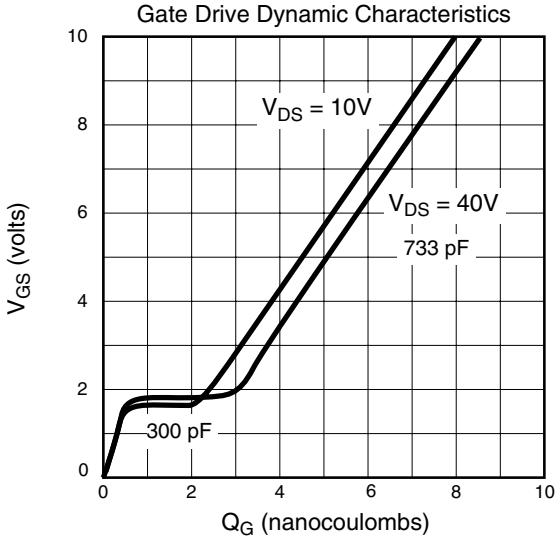
V$_{(th)}$ and R$_{DS}$ Variation with Temperature



Capacitance vs. Drain-to-Source Voltage



Gate Drive Dynamic Characteristics



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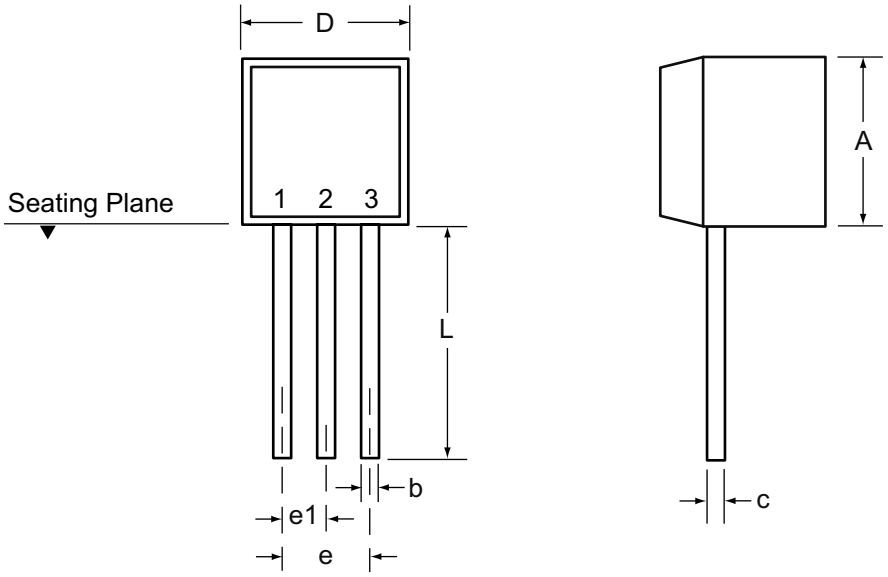
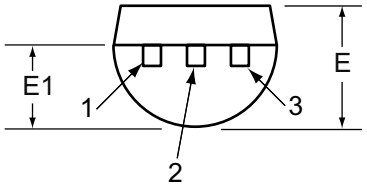
3-Lead TO-92 Package Outline (N3)



Front View **Side View**



Bottom View

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

Drawings not to scale.

Supertex Doc.#: *DSPD-3TO92N3, Version D061608.*

(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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