



## P-Channel Enhancement-Mode Vertical DMOS FET

### Features

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

### Applications

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

### General Description

The Supertex VP3203 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 Options			$BV_{DSS}/BV_{DGS}$ (V)	$R_{DS(ON)}$ (max) ( $\Omega$ )	$I_{D(ON)}$ (min) (A)
	TO-92	TO-243AA (SOT-89)	Die*			
VP3203	VP3203N3-G	VP3203N8-G	VP3203ND	-30	0.6	-4.0

-G indicates package is RoHS compliant ("Green").

\* Mil visual screening available.



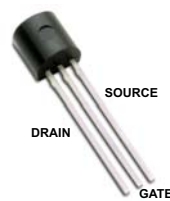
### Absolute Maximum Ratings

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

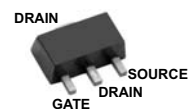
Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied. Continuous operation of the device at the absolute rating level may affect device reliability. All voltages are referenced to device ground.

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

### Pin Configurations

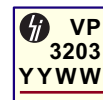


TO-92 (N3)



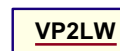
TO-243AA (SOT-89) (N8)

### Product Marking



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

TO-92 (N3)



W = Code for week sealed  
 \_\_\_\_\_ = "Green" Packaging

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

### Thermal Characteristics

Package	$I_D$ (continuous) <sup>†</sup> (mA)	$I_D$ (pulsed) (A)	Power Dissipation @ $T_A = 25^\circ\text{C}$ (W)	$\theta_{jc}$ ( $^\circ\text{C}/\text{W}$ )	$\theta_{ja}$ ( $^\circ\text{C}/\text{W}$ )	$I_{DR}$ <sup>†</sup> (mA)	$I_{DRM}$ (A)
TO-92	-650	-4.0	0.74	125	170	-650	-4.0
TO-243AA (SOT-89)	-1100	-4.0	1.6 <sup>‡</sup>	15	78 <sup>‡</sup>	-1100	-4.0

<sup>†</sup>  $I_D$  (continuous) is limited by max rated  $T_j$ .  
<sup>‡</sup> Mounted on FR5 board, 25mm x 25mm x 1.57mm.

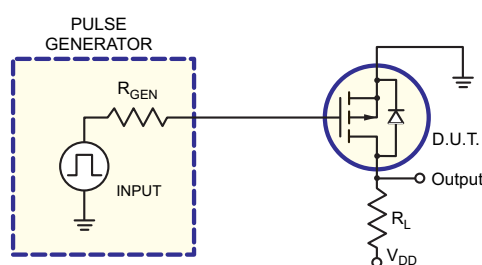
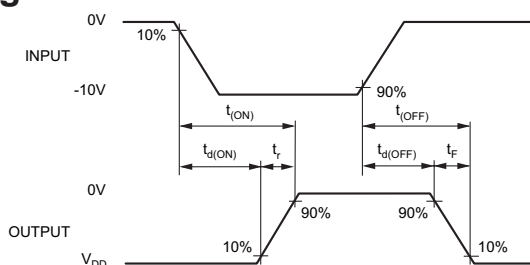
### Electrical Characteristics ( $T_A = 25^\circ\text{C}$ unless otherwise specified)

Sym	Parameter	Min	Typ	Max	Units	Conditions	
$BV_{DSS}$	Drain-to-source breakdown voltage	-30	-	-	V	$V_{GS} = 0V, I_D = -10mA$	
$V_{GS(th)}$	Gate threshold voltage	-1.0	-	-3.5	V	$V_{GS} = V_{DS}, I_D = -10mA$	
$\Delta V_{GS(th)}$	Change in $V_{GS(th)}$ with temperature	-	-	-5.5	mV/ $^\circ\text{C}$	$V_{GS} = V_{DS}, I_D = -10mA$	
$I_{GSS}$	Gate body leakage	-	-1.0	-100	nA	$V_{GS} = \pm 20V, V_{DS} = 0V$	
$I_{DSS}$	Zero gate voltage drain current	-	-	-10	$\mu\text{A}$	$V_{GS} = 0V, V_{DS} = \text{Max Rating}$	
		-	-	-1.0	mA	$V_{DS} = 0.8 \text{ Max Rating}, V_{GS} = 0V, T_A = 125^\circ\text{C}$	
$I_{D(ON)}$	On-state drain current	-	-14	-	A	$V_{GS} = -10V, V_{DS} = -5V$	
$R_{DS(ON)}$	Static drain-to-source on-state resistance	TO-92	-	-	1.0	$\Omega$	$V_{GS} = -4.5V, I_D = -1.5A$
		SOT-89	-	-	1.0		$V_{GS} = -4.5V, I_D = -750mA$
		TO-92	-	-	0.6		$V_{GS} = -10V, I_D = -3.0A$
		SOT-89	-	-	0.6		$V_{GS} = -10V, I_D = -1.5A$
$\Delta R_{DS(ON)}$	Change in $R_{DS(ON)}$ with temperature	-	-	1.0	%/ $^\circ\text{C}$	$V_{GS} = -10V, I_D = -1.5A$	
$G_{FS}$	Forward transductance	1000	2000	-	mmho	$V_{DS} = -25V, I_D = -2.0A$	
$C_{ISS}$	Input capacitance	-	200	300	pF	$V_{GS} = 0V, V_{DS} = -25V, f = 1.0MHz$	
$C_{OSS}$	Common source output capacitance	-	100	120			
$C_{RSS}$	Reverse transfer capacitance	-	45	60			
$t_{d(ON)}$	Turn-on delay time	-	-	10	ns	$V_{DD} = -25V, I_D = -2.0A, R_{GEN} = 10\Omega$	
$t_r$	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	$V_{GS} = 0V, I_{SD} = -1.0A$	

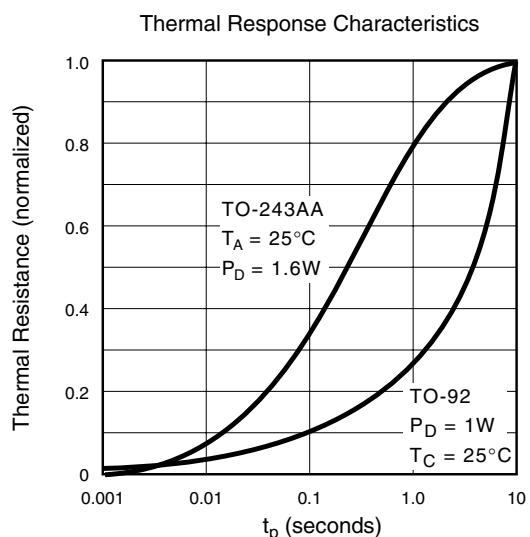
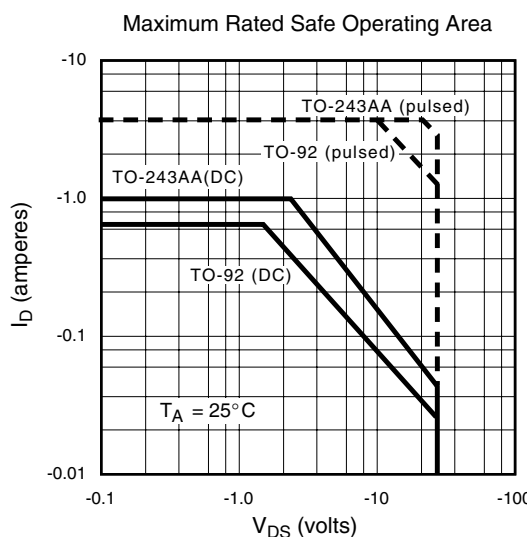
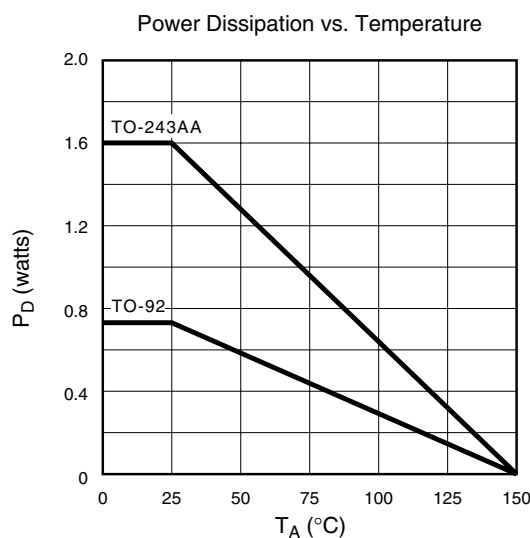
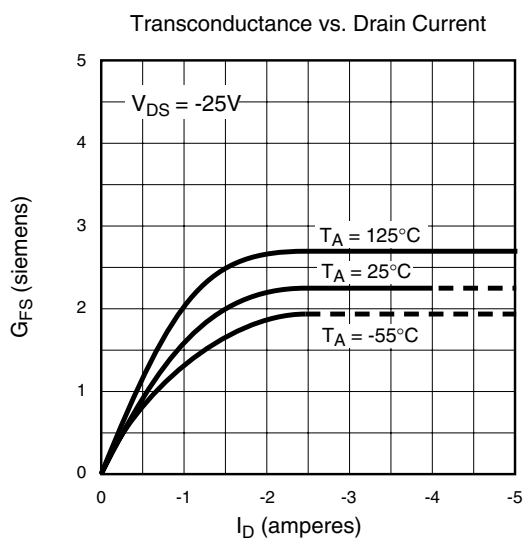
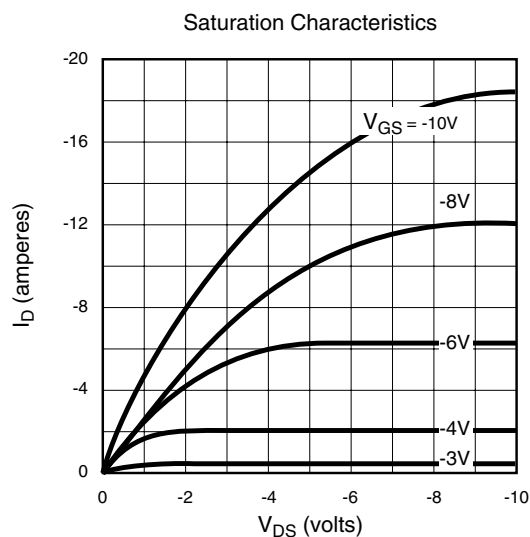
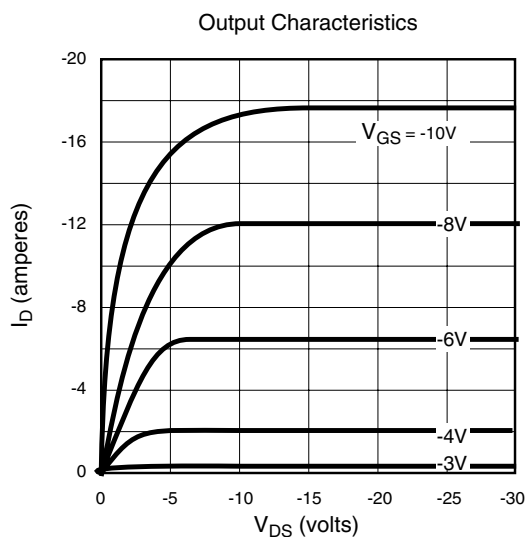
**Notes:**

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

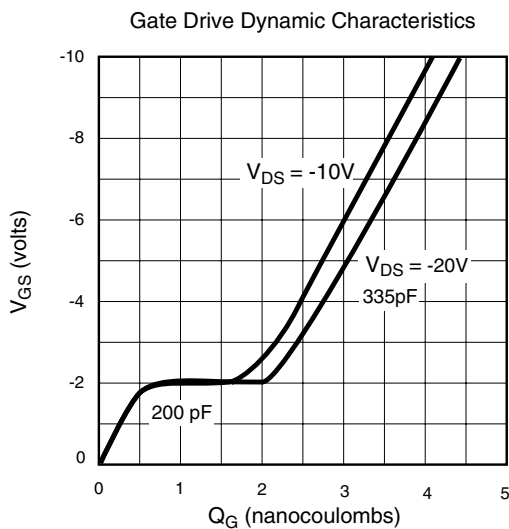
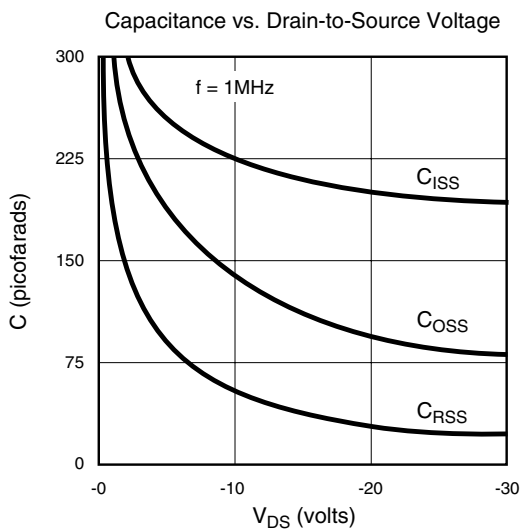
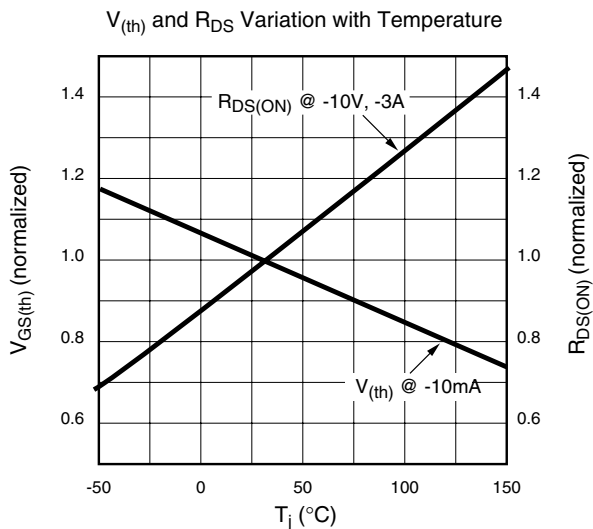
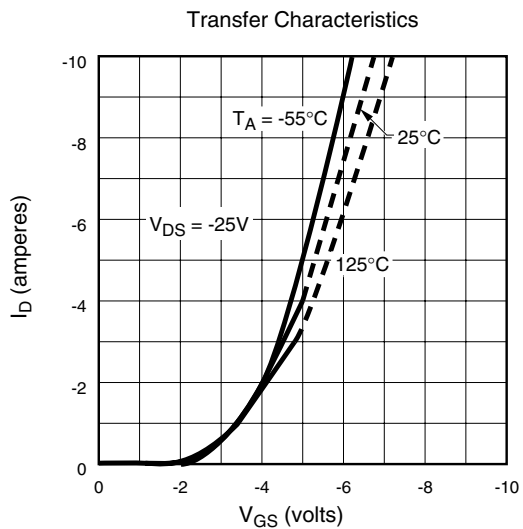
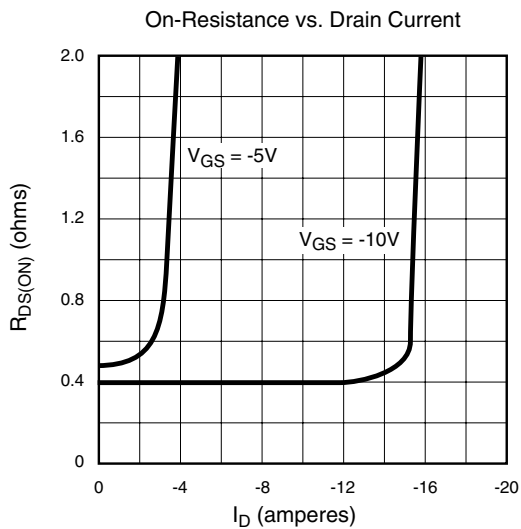
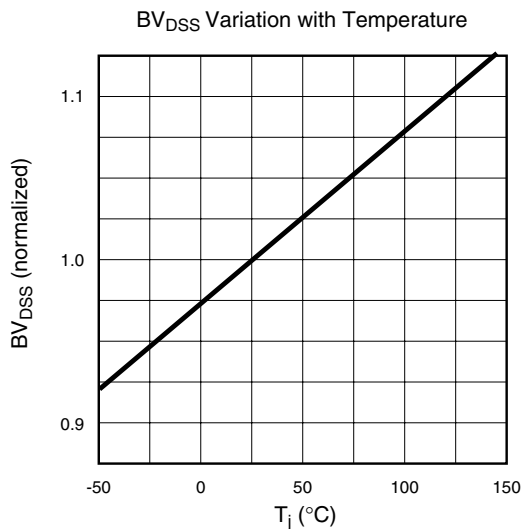
### Switching Waveforms and Test Circuit



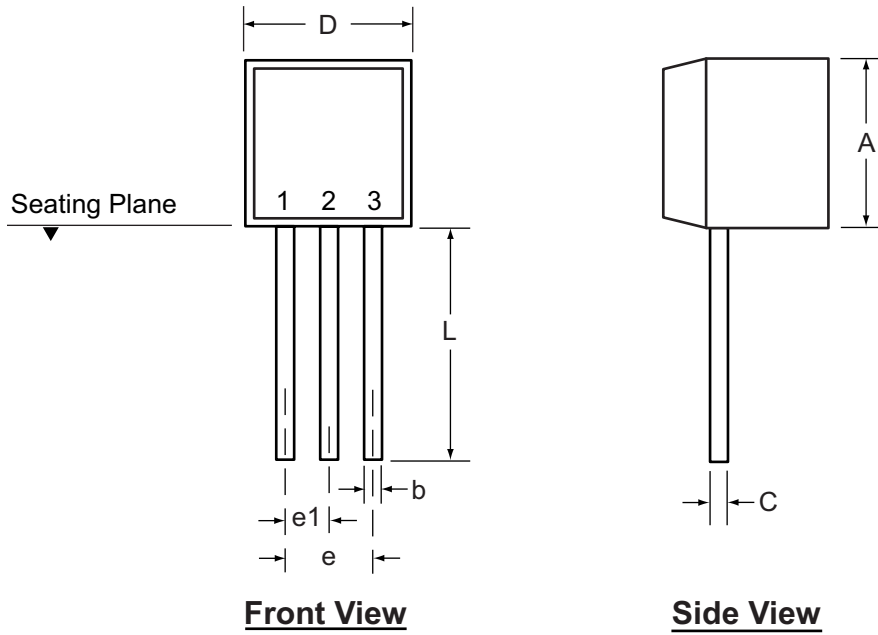
# Typical Performance Curves



Typical Performance Curves (cont.)



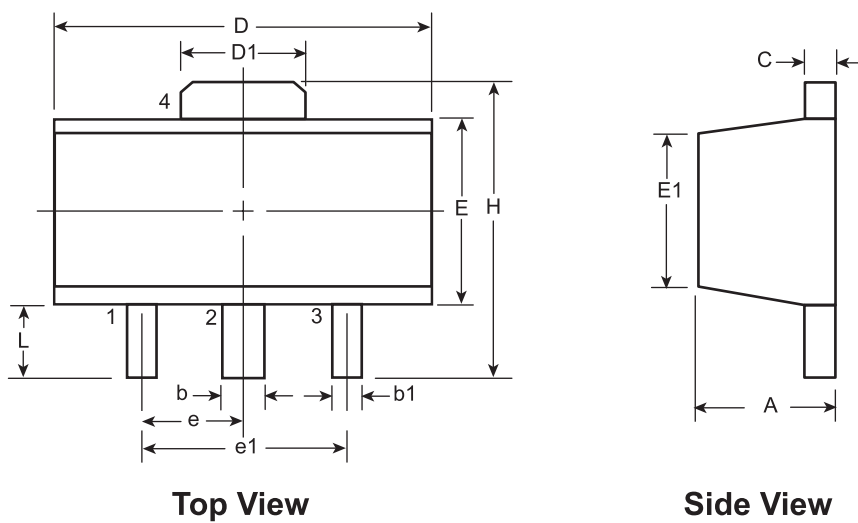
### 3-Lead TO-92 Package Outline (N3)



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	-

Drawings not to scale.

### 3-Lead TO-243AA (SOT-89) Package Outline (N8)



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	2.13	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.  
 Drawings not to scale.

(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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**Supertex inc.**  
 1235 Bordeaux Drive, Sunnyvale, CA 94089  
 TEL: (408) 222-8888 / FAX: (408) 222-4895  
[www.supertex.com](http://www.supertex.com)