



T-39-13



## N-Channel Enhancement-Mode Vertical DMOS Power FETs

### Ordering Information

BV <sub>DSS</sub> / BV <sub>DGS</sub>	R <sub>DS(ON)</sub> (max)	I <sub>D(ON)</sub> (min)	Order Number / Package			
			TO-3	TO-39	TO-220	Dice
40V	0.3Ω	20A	VN1204N1	VN1204N2	VN1204N5	VN1204ND
60V	0.3Ω	20A	VN1206N1	VN1206N2	VN1206N5	VN1206ND
100V	0.3Ω	20A	VN1210N1	VN1210N2	VN1210N5	VN1210ND

### Features

- Freedom from secondary breakdown
- Low power drive requirement
- Ease of paralleling
- Low C<sub>ISS</sub> and fast switching speeds
- Excellent thermal stability
- Integral Source-Drain diode
- High input impedance and high gain
- Complementary N- and P-Channel devices

### Applications

- Motor control
- Converters
- Amplifiers
- Switches
- Power supply circuits
- Drivers (Relays, Hammers, Solenoids, Lamps, Memories, Displays, Bipolar Transistors, etc.)

### Absolute Maximum Ratings

Drain-to-Source Voltage	BV <sub>DSS</sub>
Drain-to-Gate Voltage	BV <sub>DGS</sub>
Gate-to-Source Voltage	± 20V
Operating and Storage Temperature	-55°C to +150°C
Soldering Temperature*	300°C

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

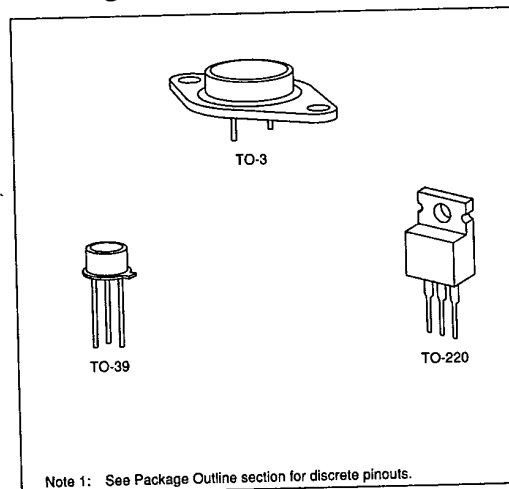
### Advanced DMOS Technology

These enhancement-mode (normally-off) power transistors utilize a vertical DMOS structure and Supertex's well-proven silicon-gate manufacturing process. This combination produces devices with the power handling capabilities of bipolar transistors and with the high input impedance and negative temperature coefficient inherent in MOS devices. Characteristic of all MOS structures, these devices are free from thermal runaway and thermally-induced secondary breakdown.

Supertex Vertical DMOS Power 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.

### Package Options

(Note 1)



Note 1: See Package Outline section for discrete pinouts.

**Thermal Characteristics**

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Package	$I_D$ (continuous)*	$I_D$ (pulsed)*	Power Dissipation @ $T_C = 25^\circ\text{C}$	$\theta_{JA}$ °C/W	$\theta_{JC}$ °C/W	$I_{DR}$	$I_{DRM}^*$
TO-3	12A	35A	100W	30	1.25	12A	35A
TO-39	3.5A	15A	6.5W	125	20	3.5A	15A
TO-220	9A	35A	45W	70	2.75	9A	35A

\* $I_D$  (continuous) is limited by max rated  $T_J$ .

**Electrical Characteristics (@ 25°C unless otherwise specified)**

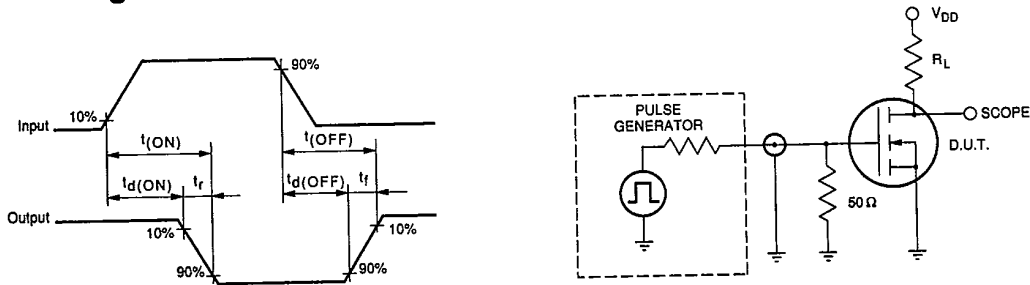
(Notes 1 and 2)

Symbol	Parameter	Min	Typ	Max	Unit	Conditions
$BV_{DSS}$	Drain-to-Source Breakdown Voltage	VN1210	100		V	$V_{GS} = 0, I_D = 10\text{mA}$
		VN1206	60			
		VN1204	40			
$V_{GS(th)}$	Gate Threshold Voltage	0.8		2.4	V	$V_{GS} = V_{DS}, I_D = 10\text{mA}$
$\Delta V_{GS(th)}$	Change in $V_{GS(th)}$ with Temperature		-4.3	-5.5	mV/°C	$V_{GS} = V_{DS}, I_D = 10\text{mA}$
$I_{GSS}$	Gate Body Leakage		1	100	nA	$V_{GS} = \pm 20\text{V}, V_{DS} = 0$
$I_{DSS}$	Zero Gate Voltage Drain Current			100	$\mu\text{A}$	$V_{GS} = 0, V_{DS} = \text{Max Rating}$
				10	mA	$V_{GS} = 0, V_{DS} = 0.8 \text{ Max Rating}$ $T_A = 125^\circ\text{C}$
$I_{D(ON)}$	ON-State Drain Current	5	10		A	$V_{GS} = 5\text{V}, V_{DS} = 25\text{V}$
		20	35			$V_{GS} = 10\text{V}, V_{DS} = 25\text{V}$
$R_{DS(ON)}$	Static Drain-to-Source ON-State Resistance		0.22	0.45	$\Omega$	$V_{GS} = 5\text{V}, I_D = 2\text{A}$
			0.2	0.3		$V_{GS} = 10\text{V}, I_D = 10\text{A}$
$\Delta R_{DS(ON)}$	Change in $R_{DS(ON)}$ with Temperature		0.85	1.2	%/°C	$V_{GS} = 10\text{V}, I_D = 10\text{A}$
$G_{FS}$	Forward Transconductance	4.0	4.5		$\text{S}$	$V_{DS} = 25\text{V}, I_D = 2\text{A}$
$C_{ISS}$	Input Capacitance		600	650	pF	$V_{GS} = 0, V_{DS} = 25\text{V}$ $f = 1 \text{ MHz}$
$C_{OSS}$	Common Source Output Capacitance		300	350		
$C_{RSS}$	Reverse Transfer Capacitance		50	75		
$t_{d(ON)}$	Turn-ON Delay Time		8	20	ns	$V_{DD} = 25\text{V}$ $I_D = 5\text{A}$ $R_S = 50\Omega$
$t_r$	Rise Time		8	20		
$t_{d(OFF)}$	Turn-OFF Delay Time		70	90		
$t_f$	Fall Time		40	60		
$V_{SD}$	Diode Forward Voltage Drop		1.2	1.4	V	$V_{GS} = 0, I_{SD} = 10\text{A}$
$t_{rr}$	Reverse Recovery Time		500		ns	$V_{GS} = 0, I_{SD} = 1\text{A}$

Note 1: All D.C. parameters 100% tested at 25°C unless otherwise stated. (Pulse test: 300µs pulse, 2% duty cycle.)

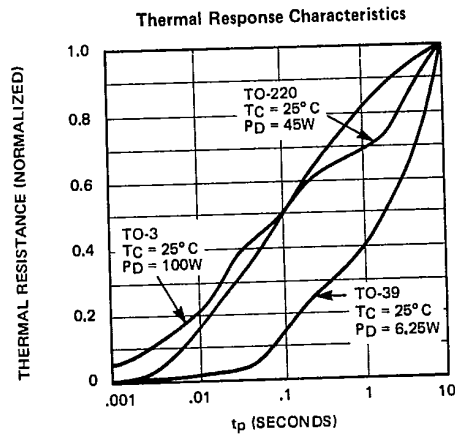
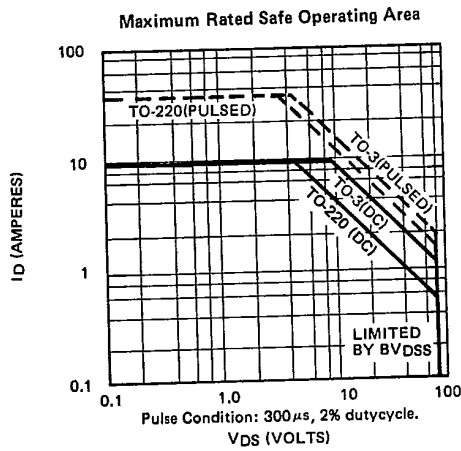
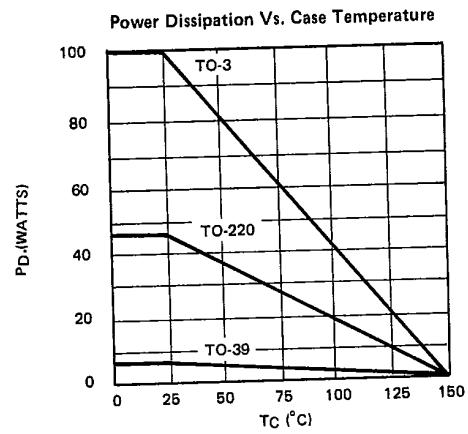
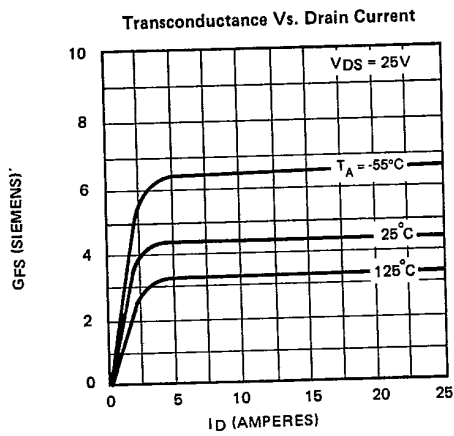
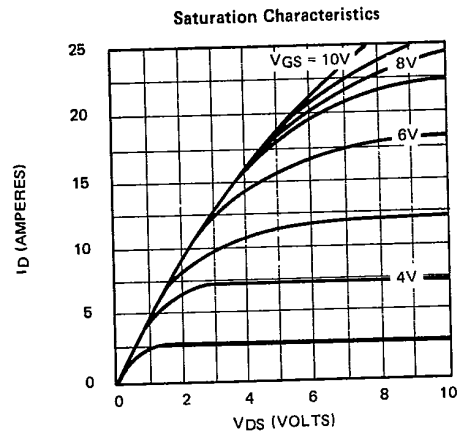
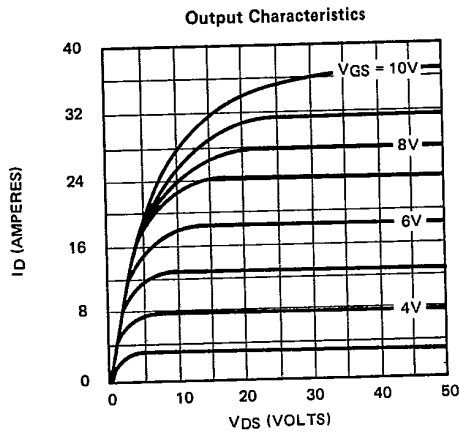
Note 2: All A.C. parameters sample tested.

**Switching Waveforms and Test Circuit**



Typical Performance Curves

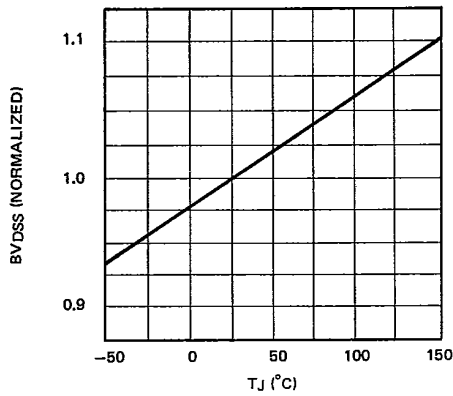
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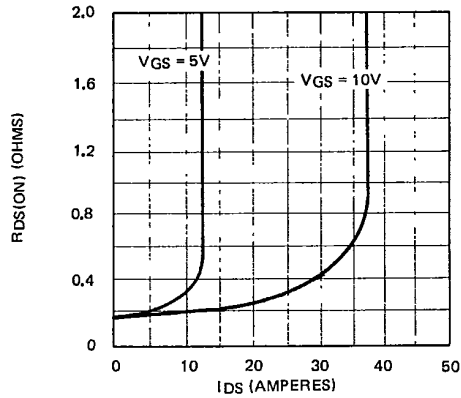
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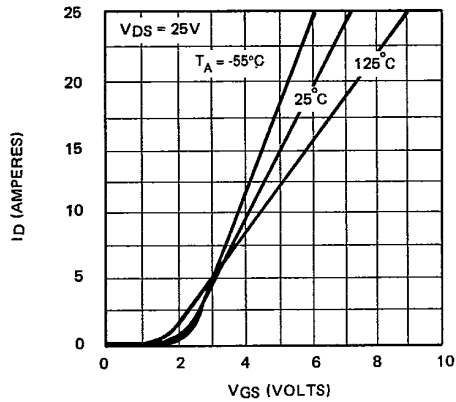
BVDSS Variation with Temperature



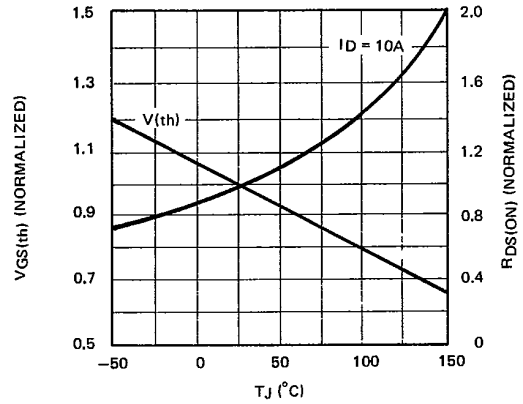
ON - Resistance Vs. Drain Current



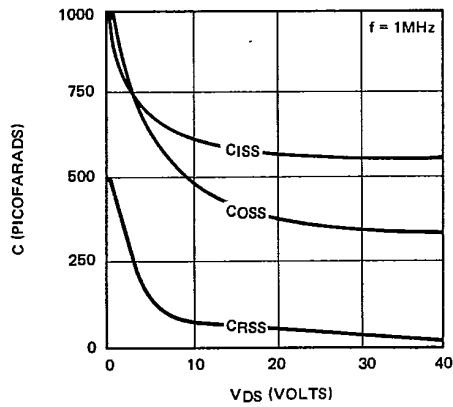
Transfer Characteristics



V(th) and RDS Variation with Temperature



Capacitance Vs. Drain-to-Source Voltage



Gate Drive Dynamic Characteristics

