



**N-Channel Enhancement-Mode  
Vertical DMOS 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-39	TO-92	Die†
450V	16Ω	0.5A	VN0645N2	—	—
500V	16Ω	0.5A	—	VN0650N3	VN0650ND

† MIL visual screening available

**High Reliability Devices**

See pages 5-4 and 5-5 for MILITARY STANDARD Process Flows and Ordering Information.

**Features**

- Free 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 controls
- 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.

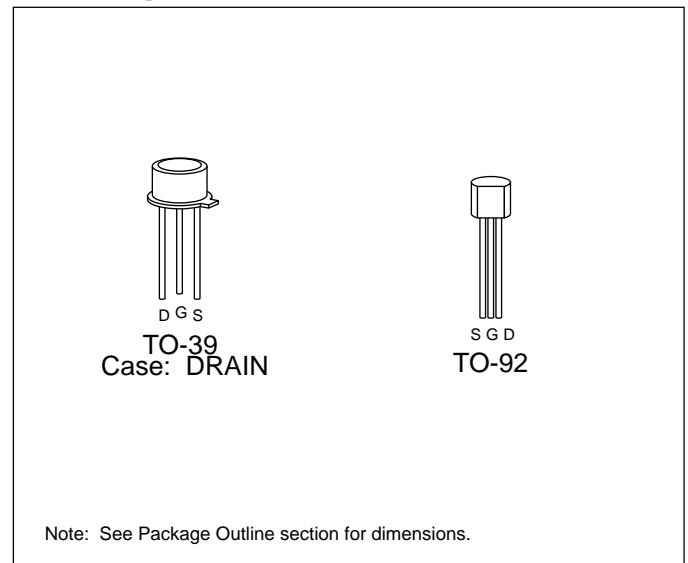
**Advanced DMOS Technology**

**The VN0650 is NOT recommended for new designs. Please use VN2450 instead.**

These enhancement-mode (normally-off) 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 positive temperature coefficient inherent in MOS devices. Characteristic of all MOS structures, these devices are 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.

**Package Options**



## Thermal Characteristics

Package	$I_D$ (continuous)*	$I_D$ (pulsed)	Power Dissipation @ $T_C = 25^\circ\text{C}$	$\theta_{jc}$ $^\circ\text{C/W}$	$\theta_{ja}$ $^\circ\text{C/W}$	$I_{DR}^*$	$I_{DRM}$
TO-39	0.4A	1.5A	6W	21	125	0.4A	1.5A
TO-92	0.2A	1.0A	1W	125	170	0.2A	1.0A

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

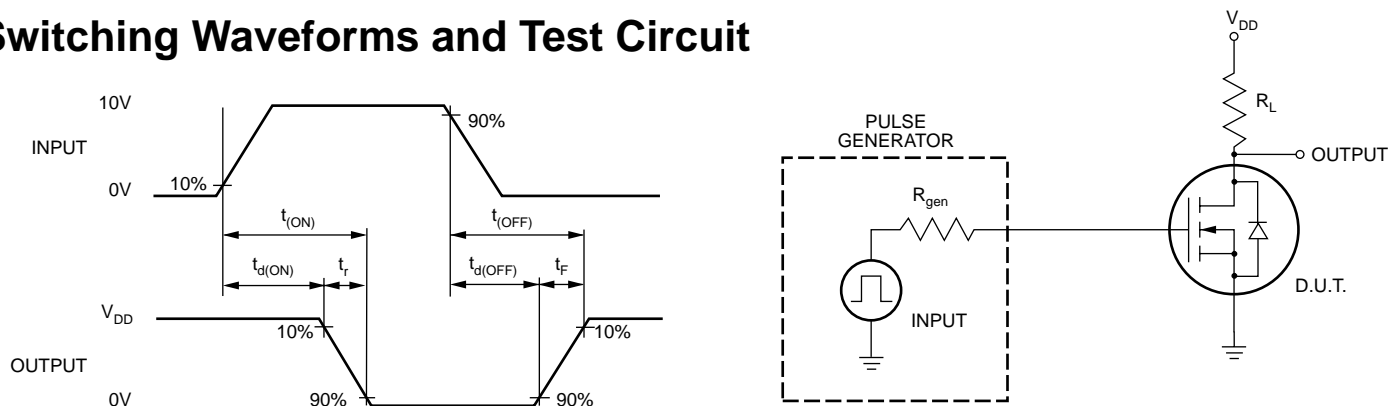
## Electrical Characteristics (@ $25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter	Min	Typ	Max	Unit	Conditions
$BV_{DSS}$	Drain-to-Source Breakdown Voltage	VN0650	500			V $V_{GS} = 0V, I_D = 2mA$
		VN0645	450			
$V_{GS(th)}$	Gate Threshold Voltage	2		4	V	$V_{GS} = V_{DS}, I_D = 2mA$
$\Delta V_{GS(th)}$	Change in $V_{GS(th)}$ with Temperature			-4.5	mV/ $^\circ\text{C}$	$V_{GS} = V_{DS}, I_D = 2mA$
$I_{GSS}$	Gate Body Leakage			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	mA	$V_{GS} = 0V, V_{DS} = 0.8 \text{ Max Rating}$ $T_A = 125^\circ\text{C}$
$I_{D(ON)}$	ON-State Drain Current		0.8		A	$V_{GS} = 5V, V_{DS} = 25V$
		0.5	1.1			$V_{GS} = 10V, V_{DS} = 25V$
$R_{DS(ON)}$	Static Drain-to-Source ON-State Resistance		12		$\Omega$	$V_{GS} = 5V, I_D = 100mA$
			11	16		$V_{GS} = 10V, I_D = 400mA$
$\Delta R_{DS(ON)}$	Change in $R_{DS(ON)}$ with Temperature			0.75	%/ $^\circ\text{C}$	$V_{GS} = 10V, I_D = 400mA$
$G_{FS}$	Forward Transconductance	100			m $\bar{S}$	$V_{DS} = 25V, I_D = 400mA$
$C_{ISS}$	Input Capacitance		120	130	pF	$V_{GS} = 0V, V_{DS} = 25V$ $f = 1 \text{ MHz}$
$C_{OSS}$	Common Source Output Capacitance		20	75		
$C_{RSS}$	Reverse Transfer Capacitance		10	20		
$t_{d(ON)}$	Turn-ON Delay Time			10	ns	$V_{DD} = 25V,$ $I_D = 0.5A,$ $R_{GEN} = 25\Omega$
$t_r$	Rise Time			10		
$t_{d(OFF)}$	Turn-OFF Delay Time			20		
$t_f$	Fall Time			10		
$V_{SD}$	Diode Forward Voltage Drop			1.8	V	$V_{GS} = 0V, I_{SD} = 0.4A$
$t_{rr}$	Reverse Recovery Time		300		ns	$V_{GS} = 0V, I_{SD} = 0.4A$

### Notes:

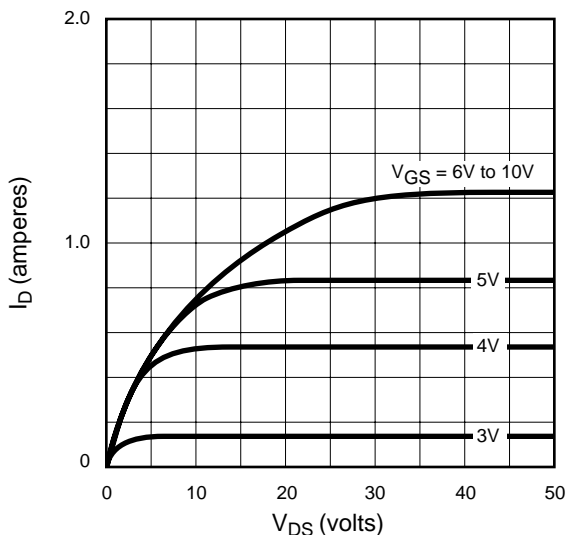
- All D.C. parameters 100% tested at  $25^\circ\text{C}$  unless otherwise stated. (Pulse test: 300 $\mu\text{s}$  pulse, 2% duty cycle.)
- All A.C. parameters sample tested.

## Switching Waveforms and Test Circuit

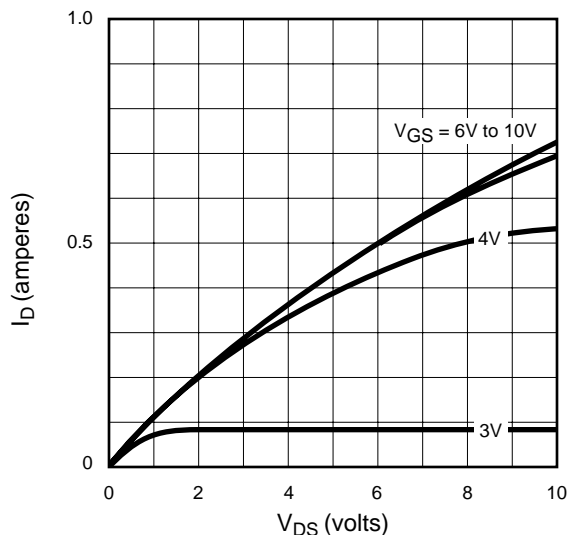


# Typical Performance Curves

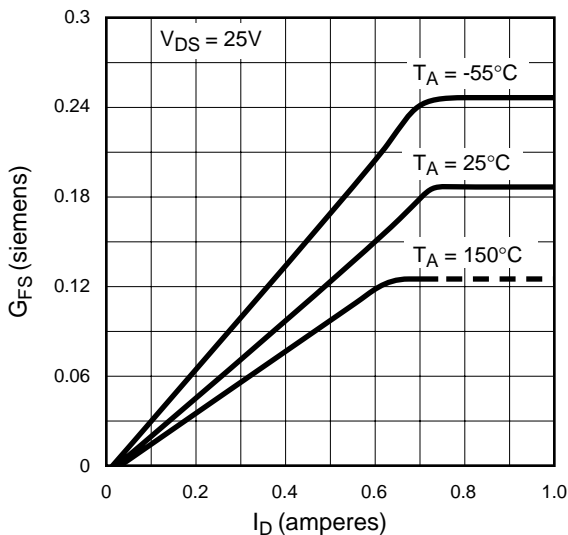
Output Characteristics



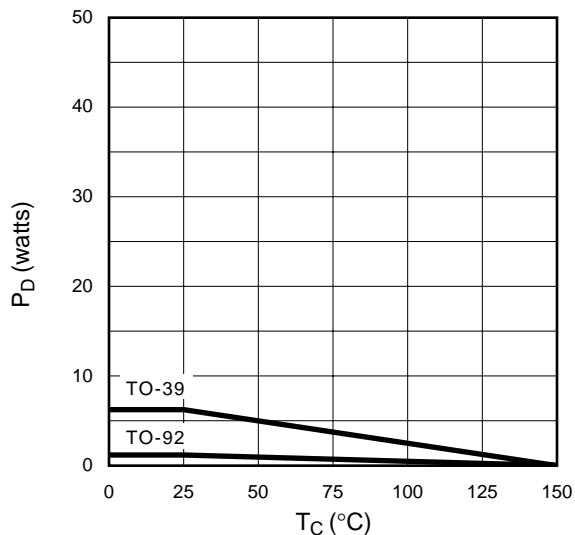
Saturation Characteristics



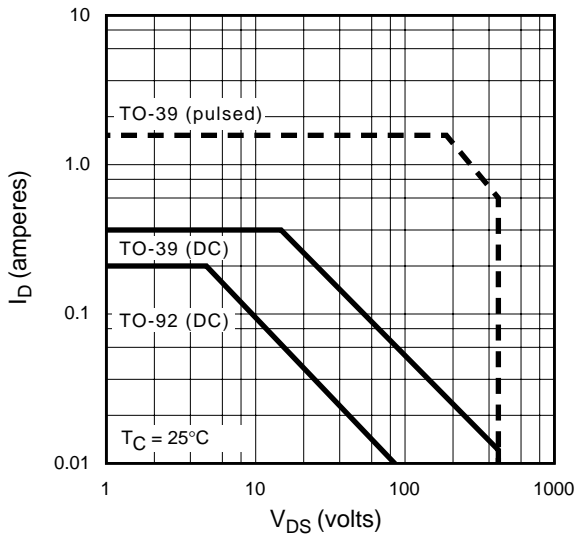
Transconductance vs. Drain Current



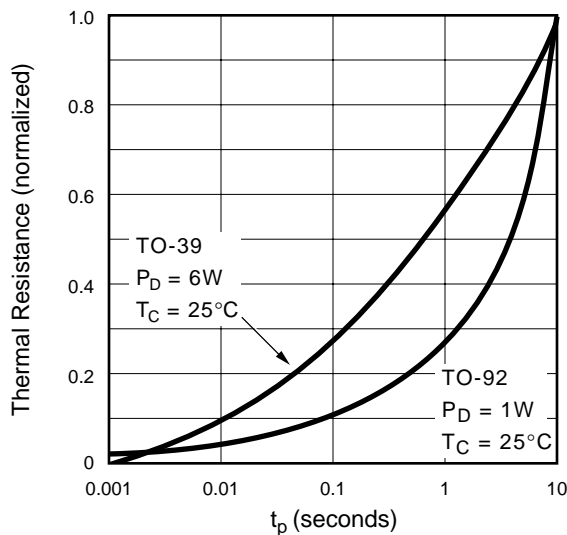
Power Dissipation vs. Case Temperature



Maximum Rated Safe Operating Area

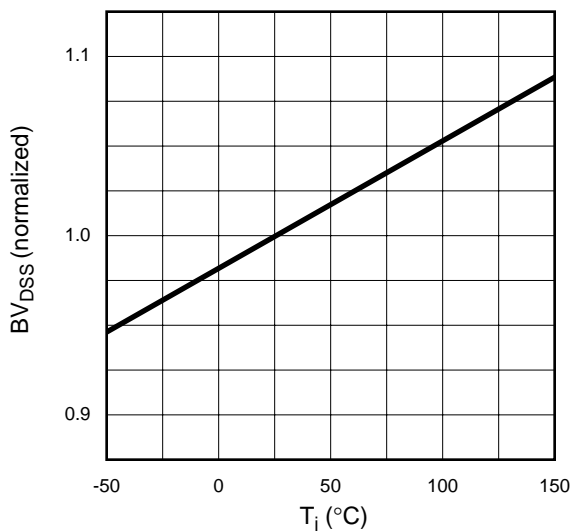


Thermal Response Characteristics

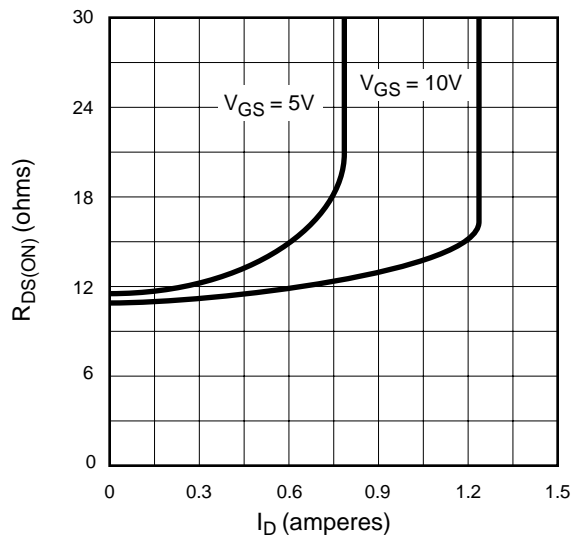


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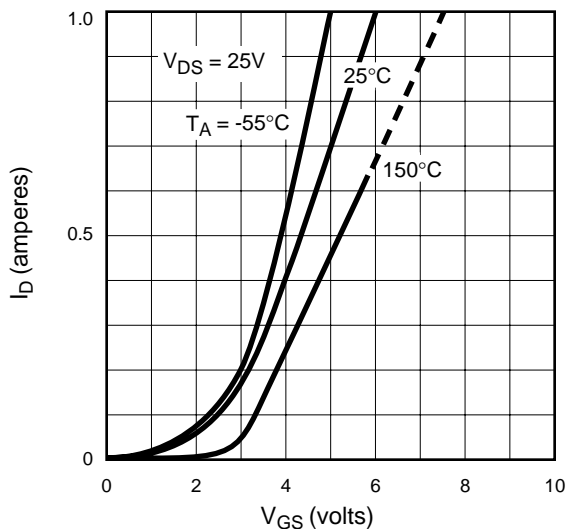
BV<sub>DSS</sub> Variation with Temperature



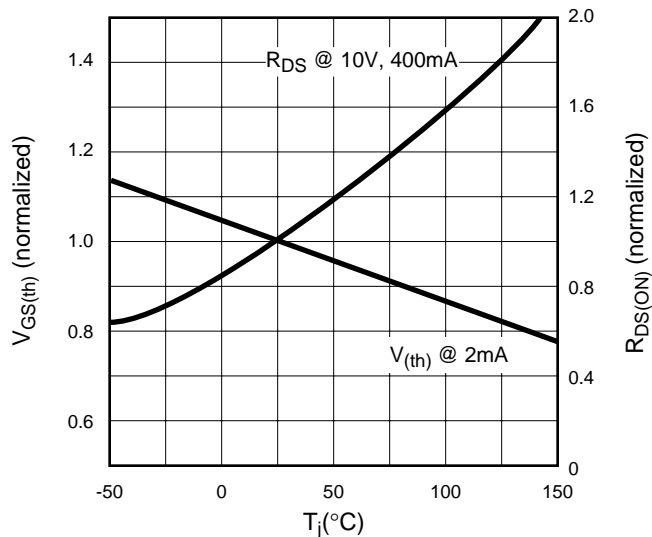
On-Resistance vs. Drain Current



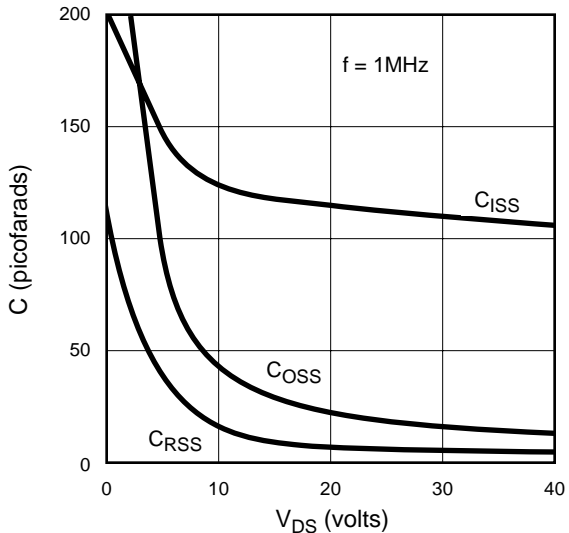
Transfer Characteristics



V<sub>(th)</sub> and R<sub>DS</sub> Variation with Temperature



Capacitance vs. Drain-to-Source Voltage



Gate Drive Dynamic Characteristics

