



N-Channel Enhancement-Mode Vertical DMOS FETs

Ordering Information

$BV_{DSS} /$ BV_{DGS}	$R_{DS(ON)}$ (max)	$I_{D(ON)}$ (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_{ISS} 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_{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

* Distance of 1.6 mm from case for 10 seconds.

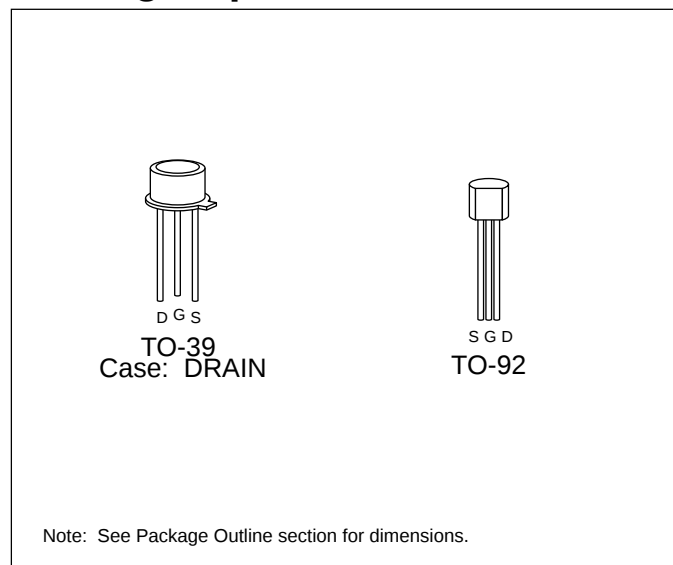
Advanced DMOS Technology

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 @ $T_C = 25^\circ\text{C}$	θ_{jc} $^\circ\text{C/W}$	θ_{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 .

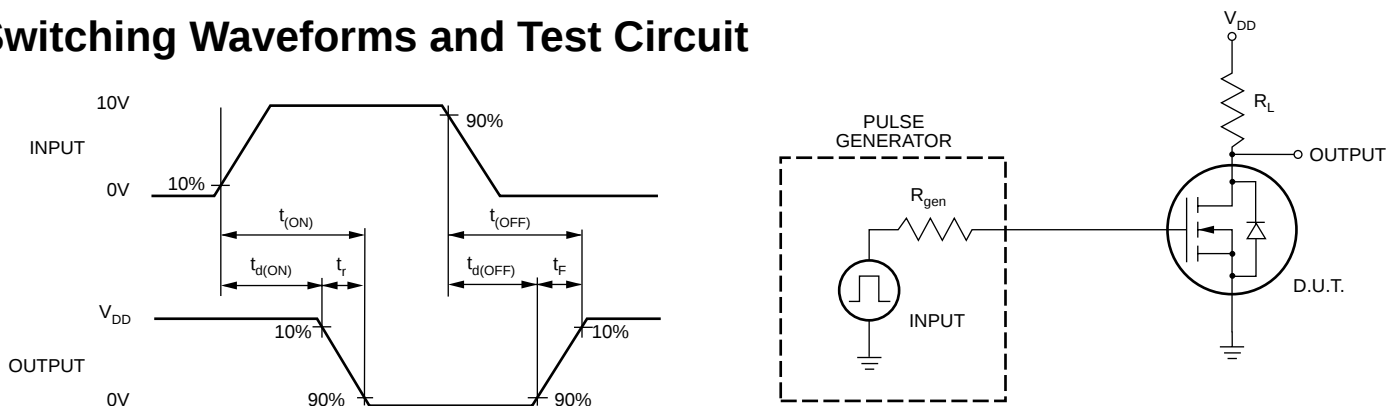
Electrical Characteristics (@ 25°C unless otherwise specified)

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	μA	$V_{GS} = 0V, V_{DS} = \text{Max Rating}$
				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		Ω	$V_{GS} = 5V, I_D = 100mA$
			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			mS	$V_{DS} = 25V, I_D = 400mA$
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:

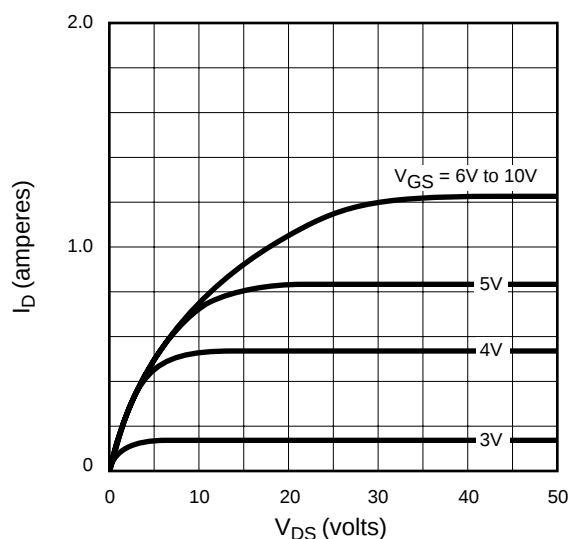
1. All D.C. parameters 100% tested at 25°C unless otherwise stated. (Pulse test: 300 μs pulse, 2% duty cycle.)
2. All A.C. parameters sample tested.

Switching Waveforms and Test Circuit

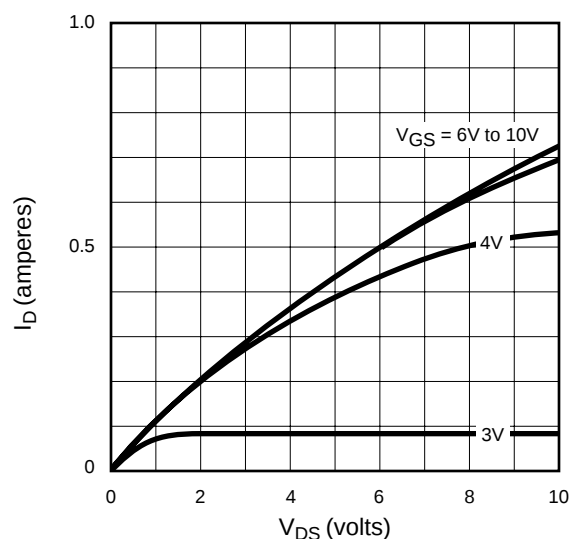


Typical Performance Curves

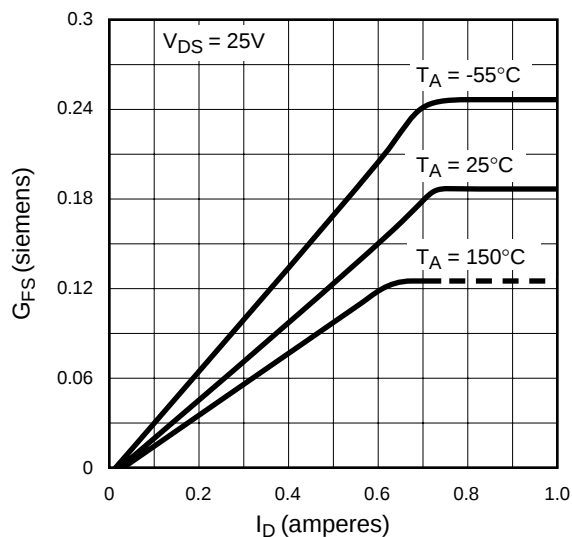
Output Characteristics



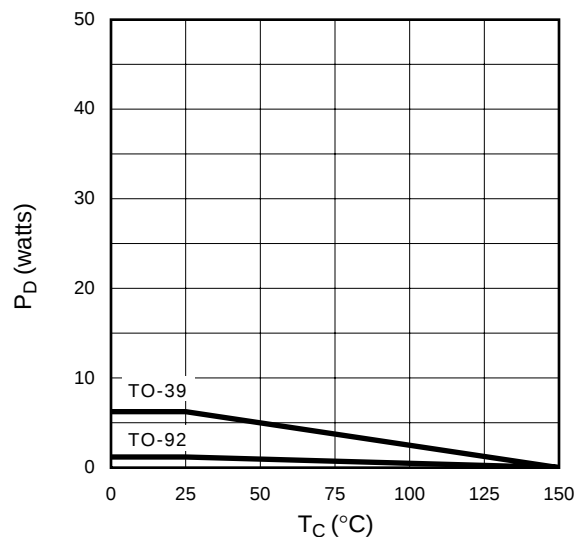
Saturation Characteristics



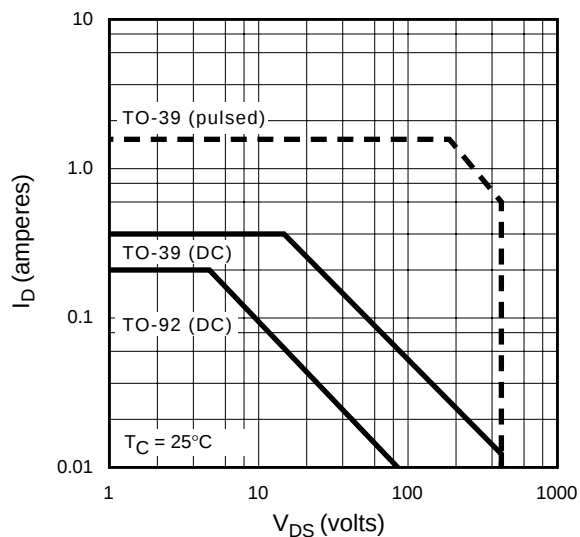
Transconductance vs. Drain Current



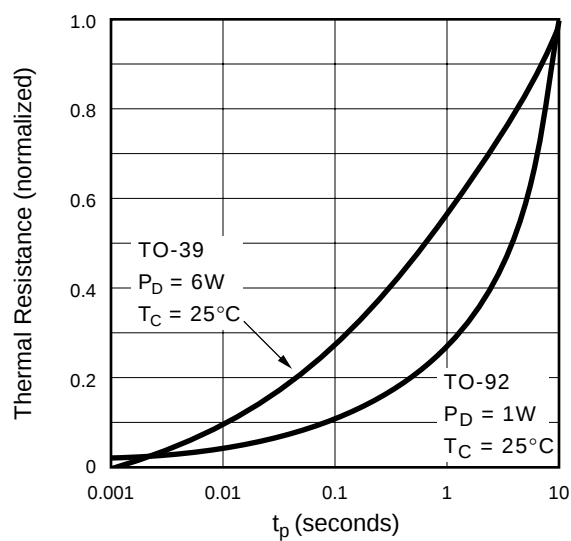
Power Dissipation vs. Case Temperature



Maximum Rated Safe Operating Area

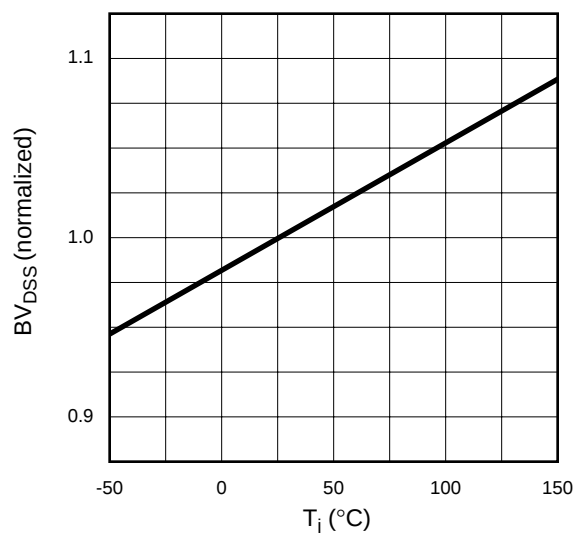


Thermal Response Characteristics

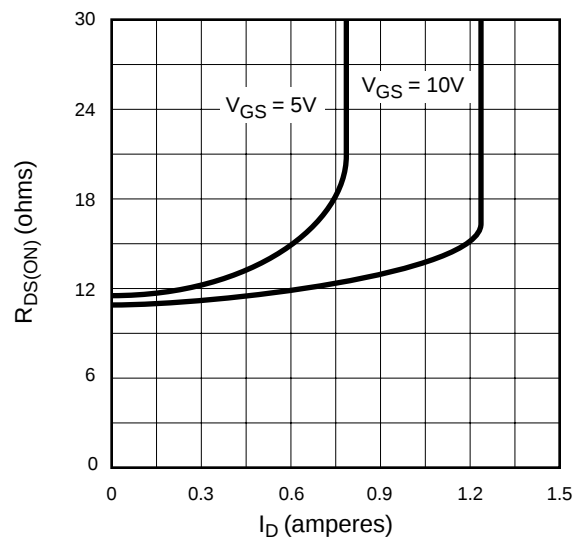


Typical Performance Curves

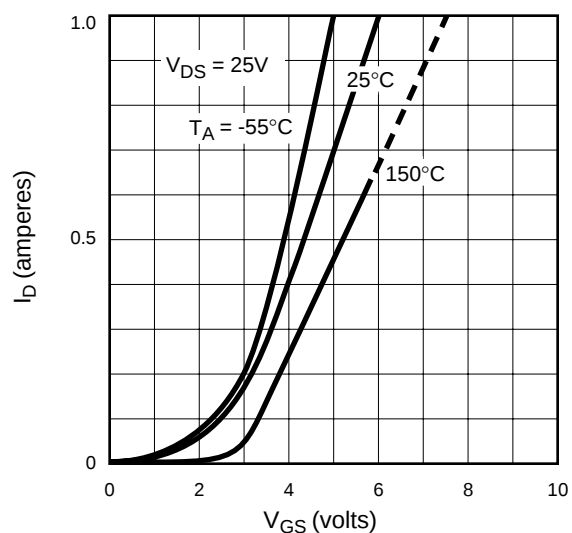
BV_{DSS} Variation with Temperature



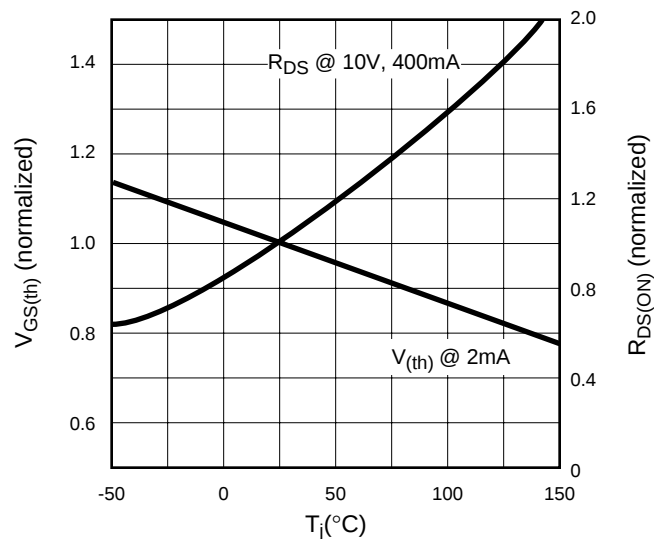
On-Resistance vs. Drain Current



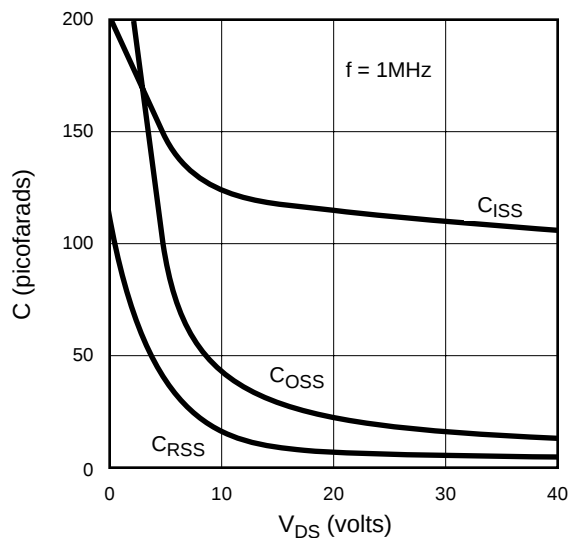
Transfer Characteristics



V_{th} and R_{DS} Variation with Temperature



Capacitance vs. Drain-to-Source Voltage



Gate Drive Dynamic Characteristics

