Supertex inc.

**VP0645
VP0650**

P-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	TO-220	Die†
-450V	30Ω	-0.2A	VP0645N2	—	—	VP0645ND
-500V	30Ω	-0.2A	—	VP0650N3	VP0650N5	VP0650ND

† MIL visual screening available

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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.)

Advanced DMOS Technology

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

TO-220
TAB: DRAIN

TO-39
Case: DRAIN

TO-92

Note: See Package Outline section for dimensions.

Absolute Maximum Ratings

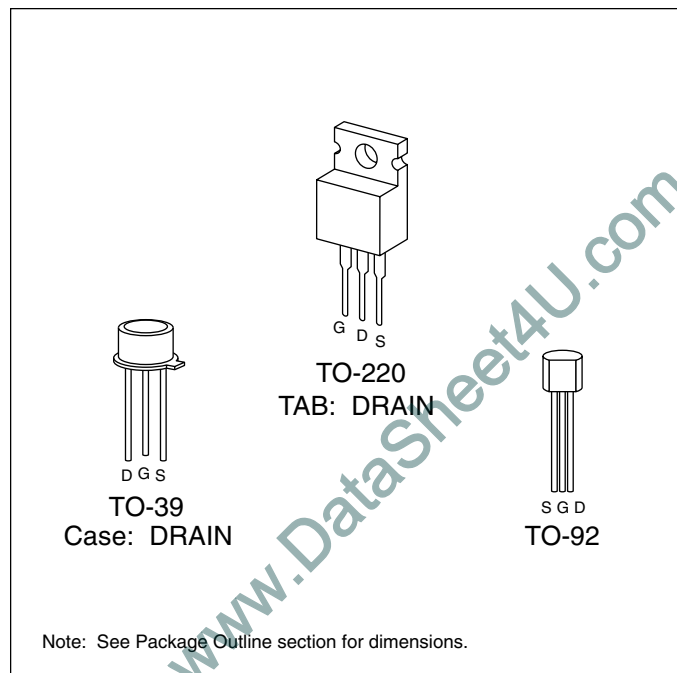|	
Drain-to-Source Voltage	BV_{DSS}
Drain-to-Gate Voltage	BV_{DGS}
Gate-to-Source Voltage	± 20V
Operating and Storage Temperature	-55°C to +150°C
Soldering Temperature*	300°C

* Distance of 1.6 mm from case for 10 seconds.

Thermal Characteristics

Package	I_D (continuous)*	I_D (pulsed)	Power Dissipation @ T_C = 25°C	θ_{jc} °C/W	θ_{ja} °C/W	I_{DR}*	I_{DRM}
TO-92	-0.1A	-0.3A	1W	125	170	-0.1A	-0.3A
TO-39	-0.25A	-0.5A	6W	21	125	-0.25A	-0.5A
TO-220	-0.25A	-0.5A	45W	2.7	70	-0.25A	-0.5A

* 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	VP0650	-500			V	V_{GS} = 0V, I_D = -2mA
		VP0645	-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				-4.8	mV/°C	V_{GS} = V_{DS}, I_D = -2mA
I_{GSS}	Gate Body Leakage				-100	nA	V_{GS} = ±20V, V_{DS} = 0V
I_{DSS}	Zero Gate Voltage Drain Current				-10	μA	V_{GS} = 0V, V_{DS} = Max Rating
					-1	mA	V_{GS} = 0V, V_{DS} = 0.8 Max Rating T_A = 125°C
$I_{D(ON)}$	ON-State Drain Current			-200		mA	V_{GS} = -5V, V_{DS} = -25V
			-200	-700			V_{GS} = -10V, V_{DS} = -25V
$R_{DS(ON)}$	Static Drain-to-Source ON-State Resistance			27		Ω	V_{GS} = -5V, I_D = -100mA
				22	30		V_{GS} = -10V, I_D = -100mA
$\Delta R_{DS(ON)}$	Change in $R_{DS(ON)}$ with Temperature				0.75	%/°C	V_{GS} = -10V, I_D = -100mA
G_{FS}	Forward Transconductance		50	125		m℧	V_{DS} = -25V, I_D = -100mA
C_{ISS}	Input Capacitance			95	160	pF	V_{GS} = 0V, V_{DS} =- 25V f = 1 MHz
C_{OSS}	Common Source Output Capacitance			50	75		
C_{RSS}	Reverse Transfer Capacitance			10	20		
$t_{d(ON)}$	Turn-ON Delay Time				10	ns	V_{DD} = -25V I_D = -200mA R_{GEN} = 25Ω
t_r	Rise Time				10		
$t_{d(OFF)}$	Turn-OFF Delay Time				20		
t_f	Fall Time				15		
V_{SD}	Diode Forward Voltage Drop				-1.8	V	V_{GS} = 0V, I_{SD} = -50mA
t_{rr}	Reverse Recovery Time			300		ns	V_{GS} = 0V, I_{SD} = -50mA

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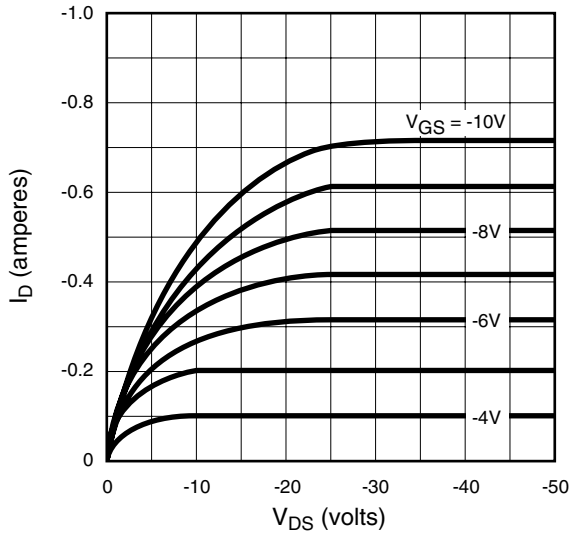2. All A.C. parameters sample tested.
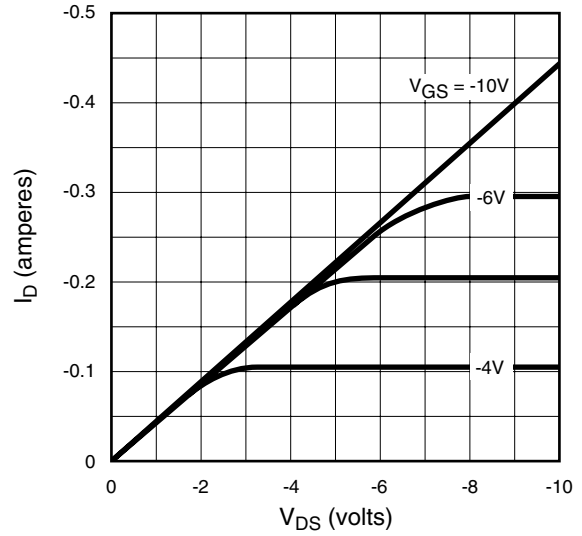
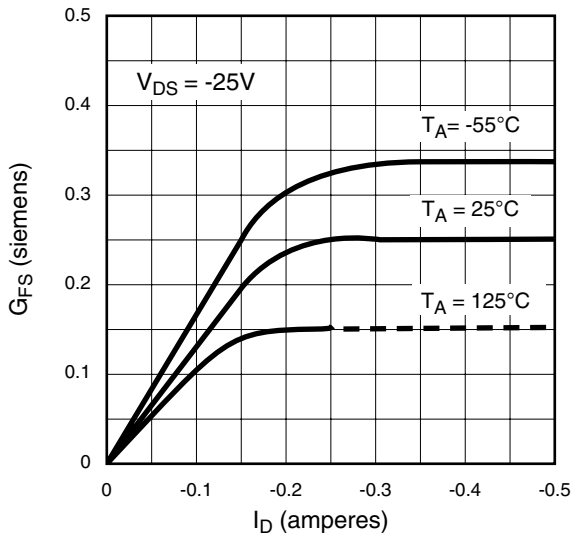## Switching Waveforms and Test Circuit

7-246
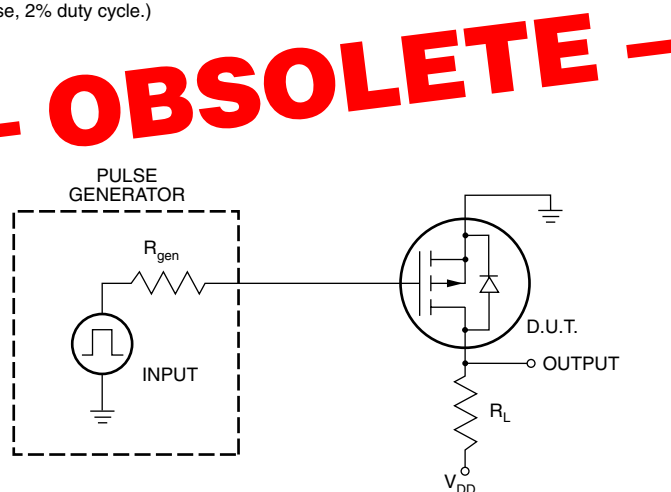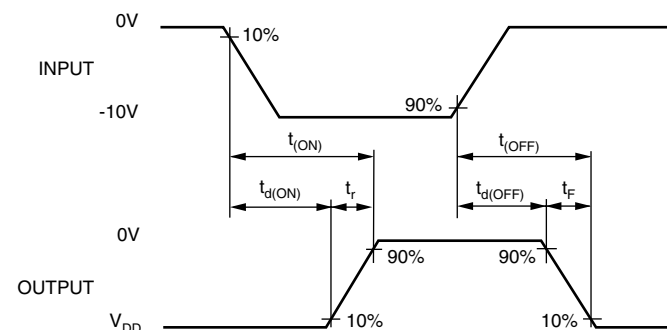
Typical Performance Curves

– **OBSOLETE –**

Output Characteristics

V_{GS} = -10V

-8V

-6V

-4V

I_D (amperes)

V_{DS} (volts)

Saturation Characteristics

V_{GS} = -10V

-6V

-4V

I_D (amperes)

V_{DS} (volts)

Transconductance vs. Drain Current

V_{DS} = -25V

T_A = -55°C

T_A = 25°C

T_A = 125°C

G_{FS} (siemens)

I_D (amperes)

Power Dissipation vs. Case Temperature

TO-220

TO-39

TO-92

P_D (watts)

T_C (°C)
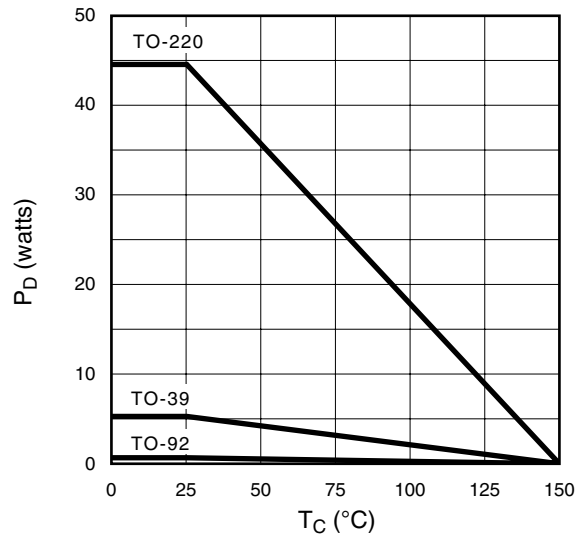
Maximum Rated Safe Operating Area

TO-39 (pulsed)

TO-220 (DC)

TO-39 (DC)

TO-92 (DC)

T_C = 25°C

I_D (amperes)

V_{DS} (volts)
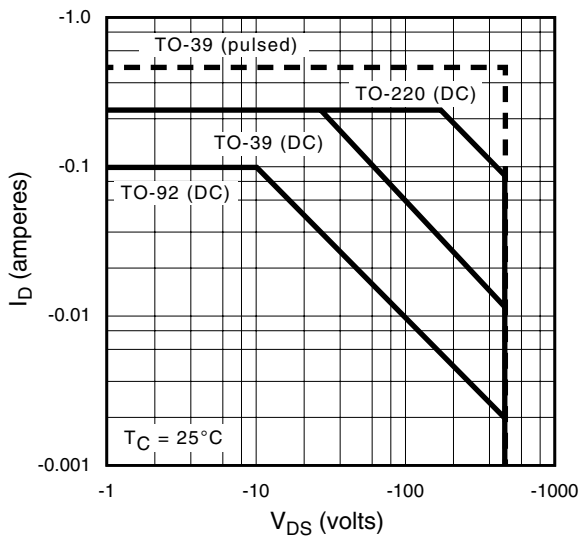
Thermal Response Characteristics

TO-220
P_D = 45W
T_C = 25°C

TO-39
P_D = 6W
T_C = 25°C

TO-92
P_D = 1W
T_C = 25°C

Thermal Resistance (normalized)

t_p (seconds)

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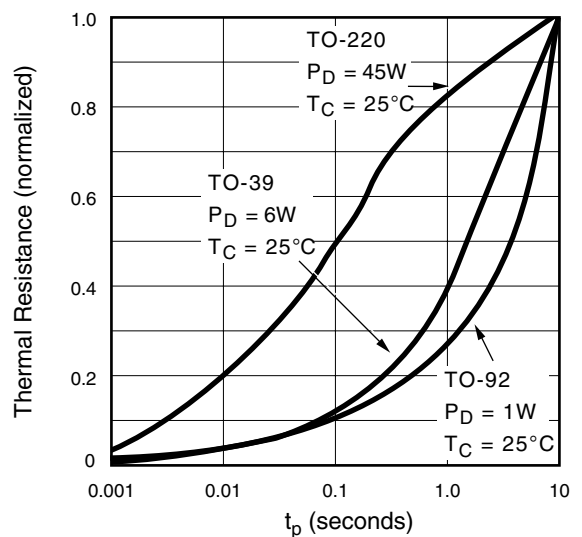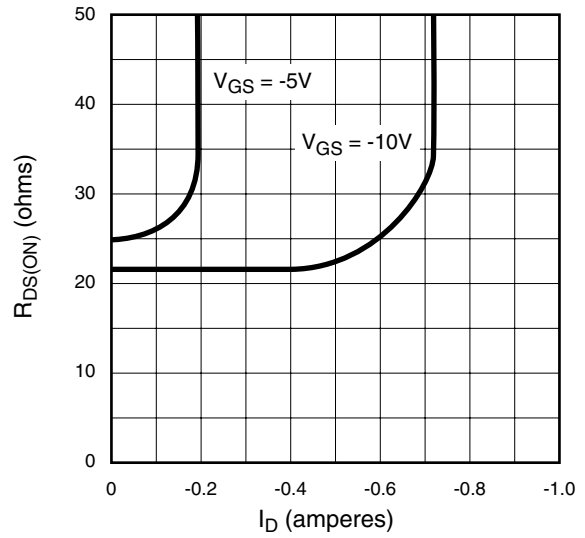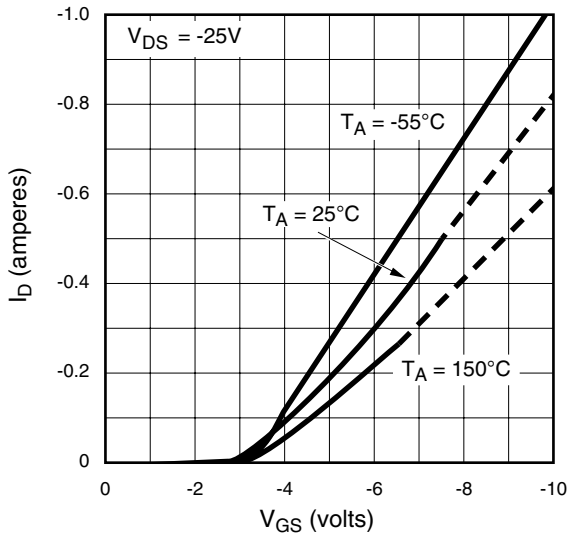
Typical Performance Curves

– OBSOLETE –

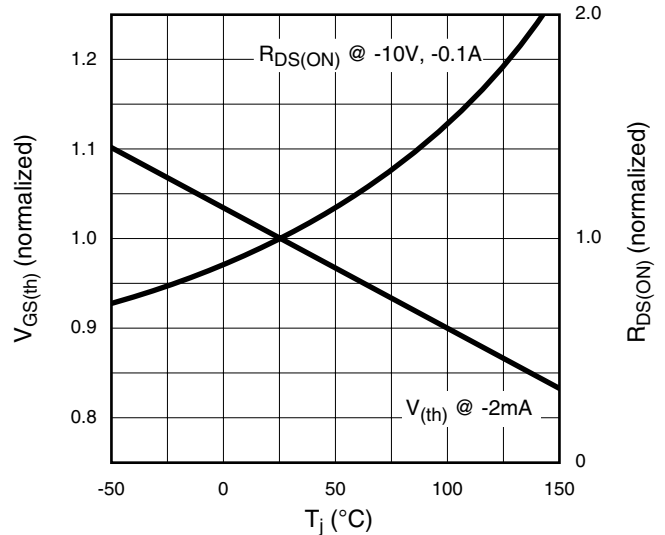BV$_{DSS}$ Variation with Temperature
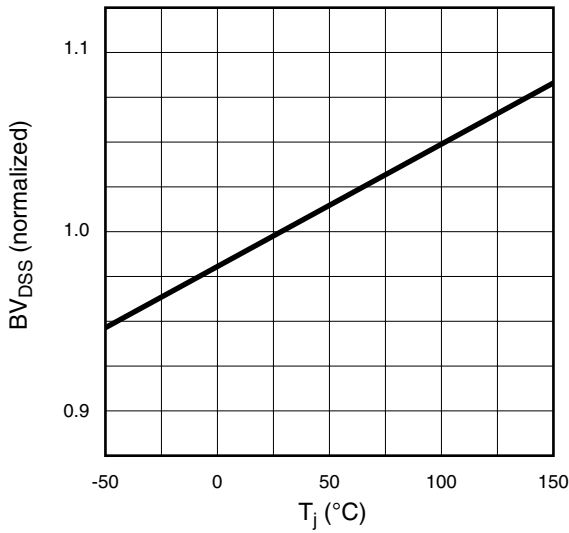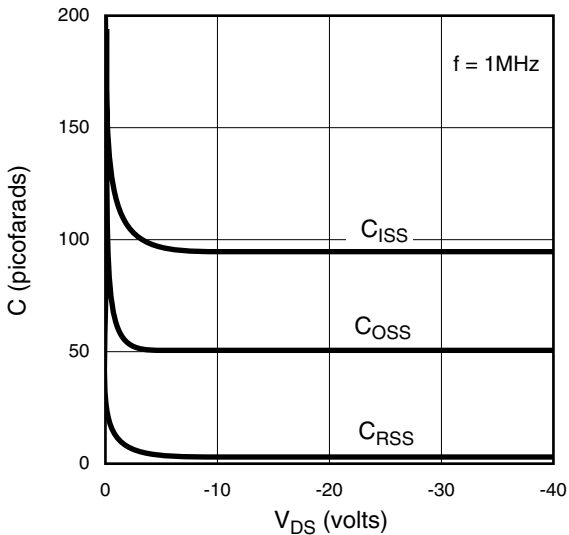
On-Resistance vs. Drain Current

Transfer Characteristics

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

Capacitance vs. Drain-to-Source Voltage

Gate Drive Dynamic Characteristics