



## P-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-92	Die†
-40V	8.0Ω	-0.5A	VP0104N3	—
-60V	8.0Ω	-0.5A	VP0106N3	—
-90V	8.0Ω	-0.5A	VP0109N3	VP0109ND

### 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

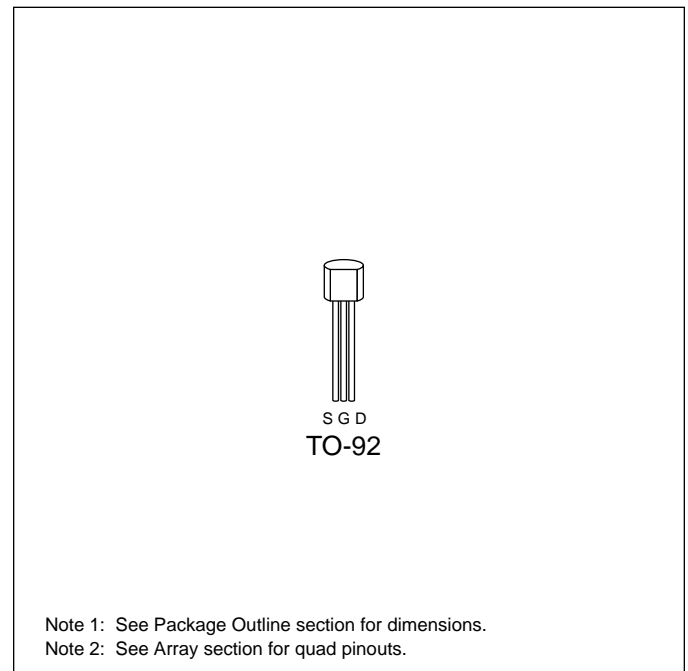
\* Distance of 1.6 mm from case for 10 seconds.

### Advanced DMOS Technology

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-92	-0.25A	-0.8A	1.0W	125	170	-0.25A	-0.8A
Ceramic DIP	Refer to Arrays & Special Functions Section.						

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

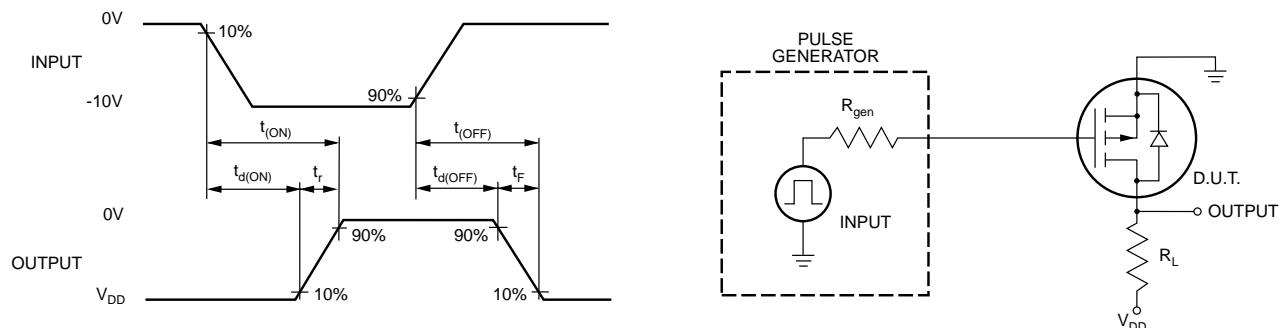
## Electrical Characteristics (@ $25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter		Min	Typ	Max	Unit	Conditions
$BV_{DSS}$	Drain-to-Source Breakdown Voltage	VP0109	-90			V	$I_D = -1.0\text{mA}$ , $V_{GS} = 0\text{V}$
		VP0106	-60				
		VP0104	-40				
$V_{GS(th)}$	Gate Threshold Voltage		-1.5		-3.5	V	$V_{GS} = V_{DS}$ , $I_D = -1.0\text{mA}$
$\Delta V_{GS(th)}$	Change in $V_{GS(th)}$ with Temperature			5.8	6.5	mV/ $^\circ\text{C}$	$I_D = -1.0\text{mA}$ , $V_{GS} = V_{DS}$
$I_{GSS}$	Gate Body Leakage			-1.0	-100	nA	$V_{GS} = \pm 20\text{V}$ , $V_{DS} = 0\text{V}$
$I_{DSS}$	Zero Gate Voltage Drain Current				-10	$\mu\text{A}$	$V_{GS} = 0\text{V}$ , $V_{DS} = \text{Max Rating}$
					-1	mA	$V_{GS} = 0\text{V}$ , $V_{DS} = 0.8 \text{ Max Rating}$ $T_A = 125^\circ\text{C}$
$I_{D(ON)}$	ON-State Drain Current		-0.15	-0.25		A	$V_{GS} = -5\text{V}$ , $V_{DS} = -25\text{V}$
			-0.50	-1.2			$V_{GS} = -10\text{V}$ , $V_{DS} = -25\text{V}$
$R_{DS(ON)}$	Static Drain-to-Source ON-State Resistance			11	15	$\Omega$	$V_{GS} = -5\text{V}$ , $I_D = -0.1\text{A}$
				6.0	8.0		$V_{GS} = -10\text{V}$ , $I_D = -0.5\text{A}$
$\Delta R_{DS(ON)}$	Change in $R_{DS(ON)}$ with Temperature			0.55	1.0	%/ $^\circ\text{C}$	$V_{GS} = -10\text{V}$ , $I_D = -0.5\text{A}$
$G_{FS}$	Forward Transconductance		150	190		m $\Omega$	$V_{DS} = -25\text{V}$ , $I_D = -0.5\text{A}$
$C_{ISS}$	Input Capacitance			45	60	pF	$V_{GS} = 0\text{V}$ , $V_{DS} = -25\text{V}$ $f = 1 \text{ MHz}$
$C_{OSS}$	Common Source Output Capacitance			22	30		
$C_{RSS}$	Reverse Transfer Capacitance			3	8		
$t_{d(ON)}$	Turn-ON Delay Time			4	6	ns	$V_{DD} = -25\text{V}$ $I_D = -0.5\text{A}$ $R_{GEN} = 25\Omega$
$t_r$	Rise Time			7	10		
$t_{d(OFF)}$	Turn-OFF Delay Time			3	7		
$t_f$	Fall Time			4	10		
$V_{SD}$	Diode Forward Voltage Drop			-1.2	-2.0		
$t_{rr}$	Reverse Recovery Time			400		ns	$I_{SD} = -1.0\text{A}$ , $V_{GS} = 0\text{V}$

### 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.

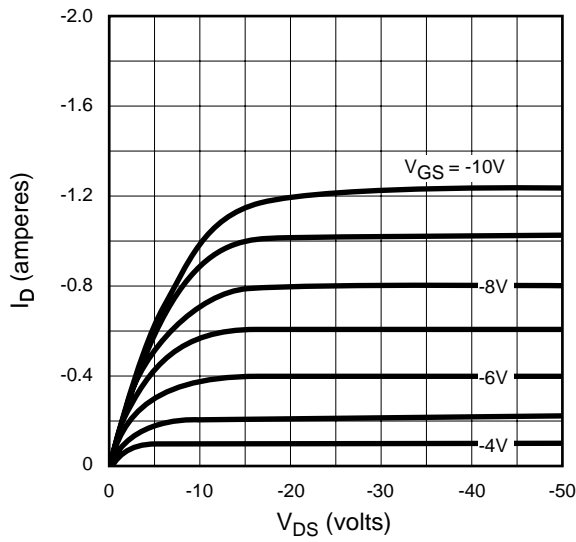
## Switching Waveforms and Test Circuit



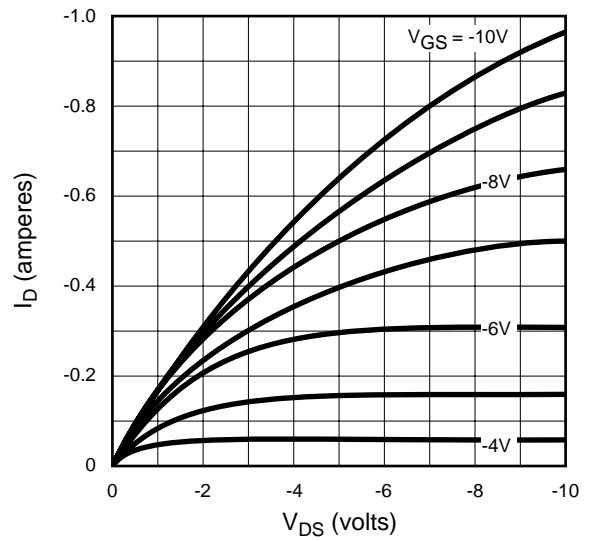
# Typical Performance Curves

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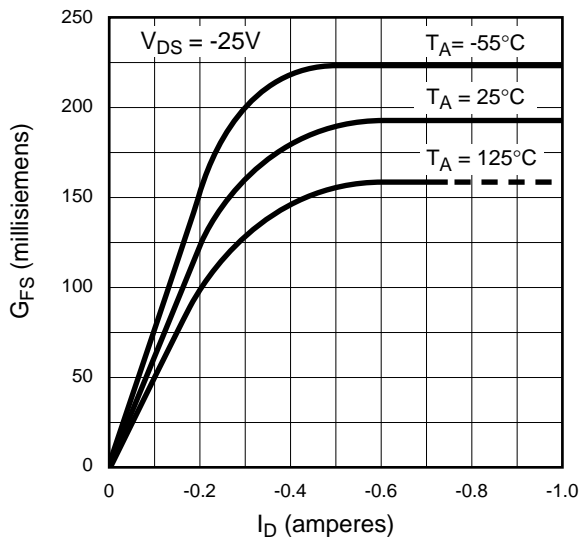
Output Characteristics



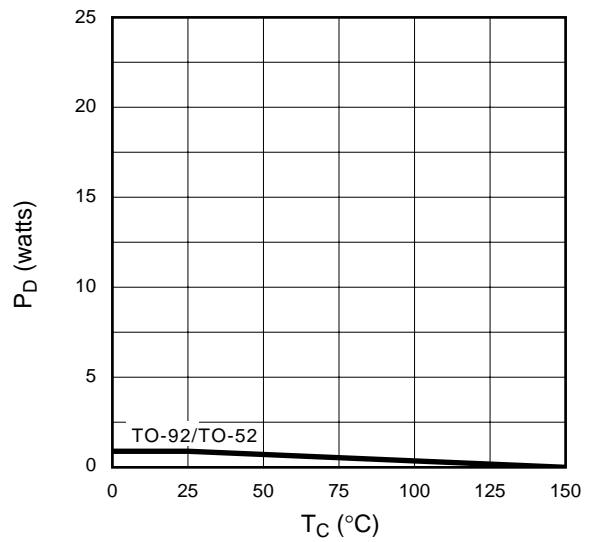
Saturation Characteristics



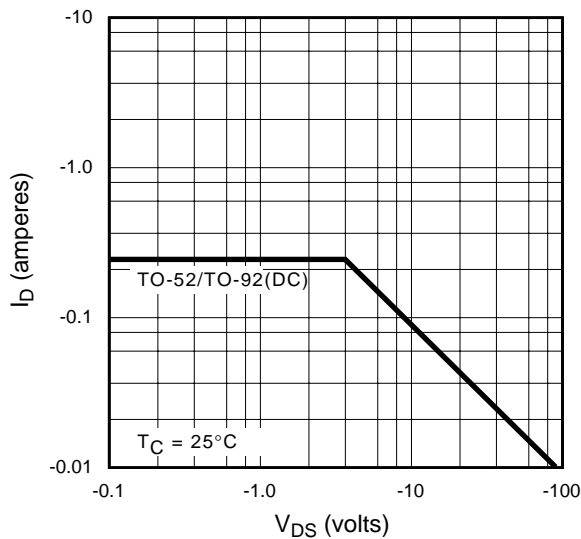
Transconductance vs. Drain Current



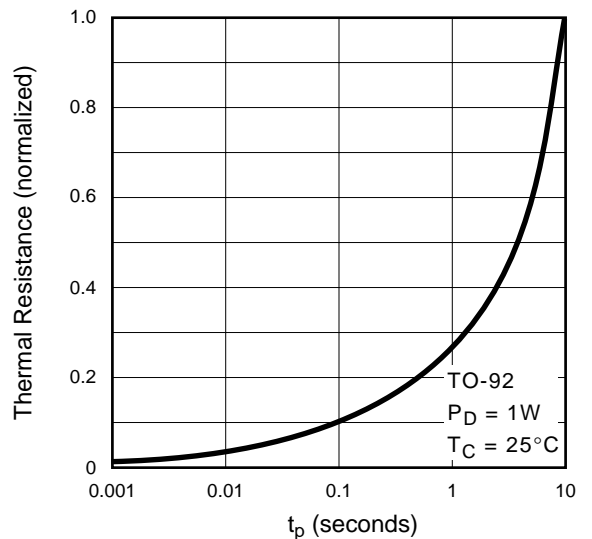
Power Dissipation vs. Case Temperature



Maximum Rated Safe Operating Area

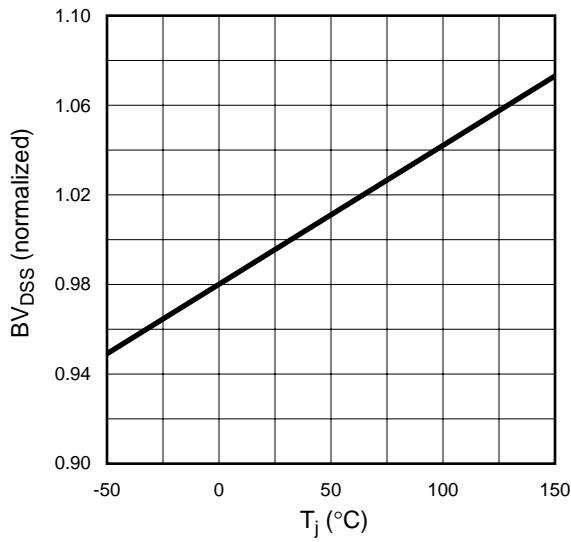


Thermal Response Characteristics

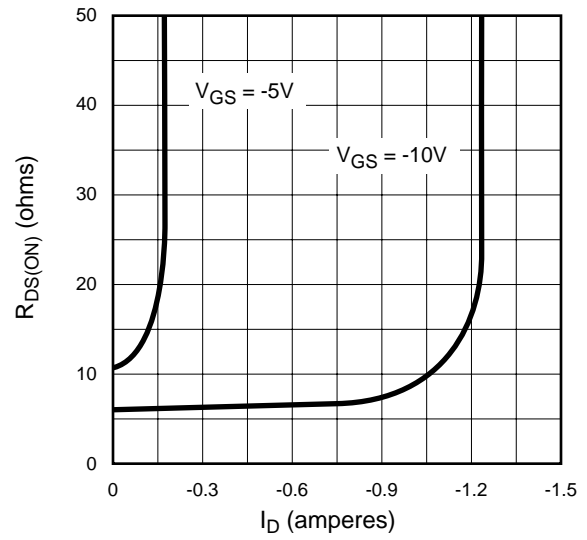


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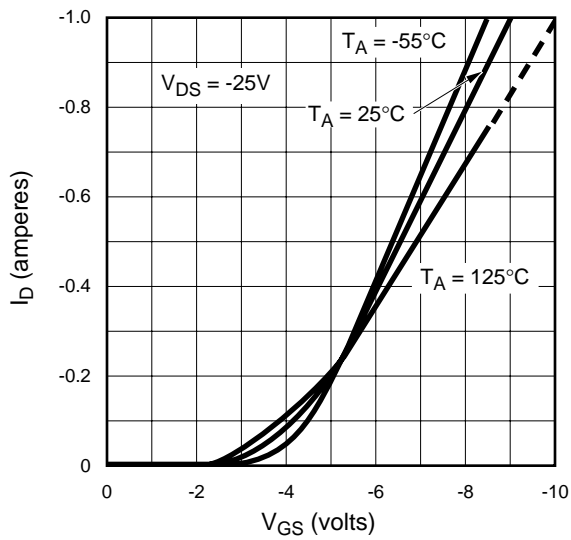
BV<sub>DSS</sub> Variation with Temperature



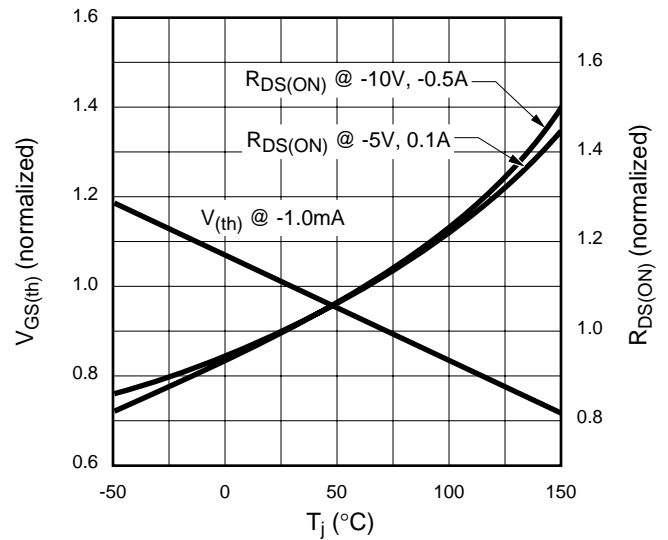
On-Resistance vs. Drain Current



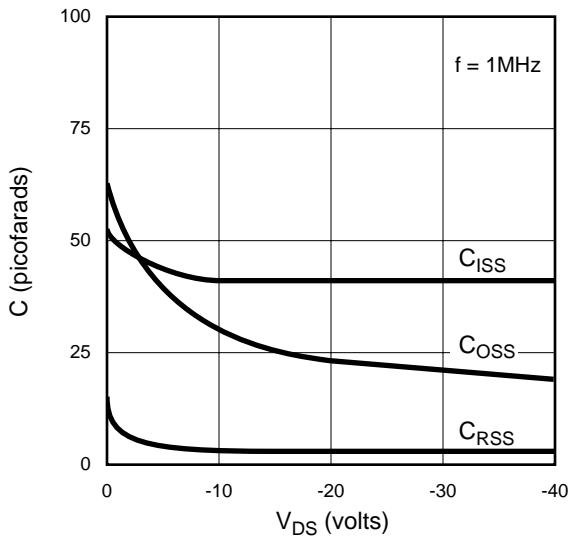
Transfer Characteristics



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



Capacitance vs. Drain-to-Source Voltage



Gate Drive Dynamic Characteristics

