



## P-Channel Enhancement-Mode Vertical DMOS FETs

### Ordering Information

BV <sub>DSS</sub> / BV <sub>DGS</sub>	R <sub>DS(ON)</sub> (max)	V <sub>GS(th)</sub> (max)	Order Number/Package		
			TO-236AB*	TO-92	Die
-40V	6.0Ω	-2.0V	TP2104K1	TP2104N3	TP2104ND

Product marking for SOT-23: <div style="border: 1px solid black; padding: 2px; display: inline-block;">P1L*</div> where * = 2-week alpha date code
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\*Same as SOT-23. All units shipped on 3,000 piece carrier tape reels.

### 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

- Logic level interfaces – ideal for TTL and CMOS
- Solid state relays
- Battery operated systems
- Photo voltaic drives
- Analog switches
- General purpose line drivers
- Telecom switches

### 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

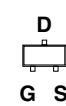
\* Distance of 1.6 mm from case for 10 seconds.

### Advanced DMOS Technology

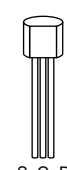
These enhancement-mode (normally-off) transistors utilize a vertical DMOS structure and Supertex's well-proven silicon-gate manufacturing process. This combination produces devices with the power handling capabilities of bipolar transistors and with the high input impedance and positive temperature coefficient 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



TO-236AB  
(SOT-23)  
top view



TO-92

Note: See Package Outline section for dimensions.

# Thermal Characteristics

Package	I <sub>D</sub> (continuous)*	I <sub>D</sub> (pulsed)	Power Dissipation @ T <sub>A</sub> = 25°C	θ <sub>jc</sub> °C/W	θ <sub>ja</sub> °C/W	I <sub>DR</sub> *	I <sub>DRM</sub>
SOT-23	-0.16A	-0.8A	0.36W	200	350	-0.16A	-0.8A
TO-92	-0.25A	-1.0A	0.74W	125	170	-0.25A	-1.0A

\* I<sub>D</sub> (continuous) is limited by max rated T<sub>j</sub>.

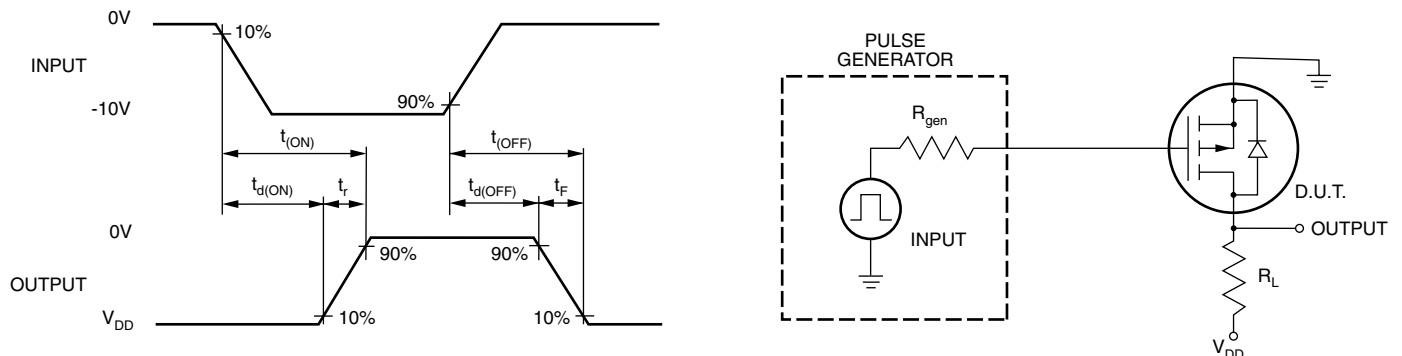
# Electrical Characteristics (@ 25°C unless otherwise specified)

Symbol	Parameter	Min	Typ	Max	Unit	Conditions
BV <sub>DSS</sub>	Drain-to-Source Breakdown Voltage	-40			V	V <sub>GS</sub> = 0V, I <sub>D</sub> = -1.0mA
V <sub>GS(th)</sub>	Gate Threshold Voltage	-1.0		-2.0	V	V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = -1.0mA
ΔV <sub>GS(th)</sub>	Change in V <sub>GS(th)</sub> with Temperature		5.8	6.5	mV/°C	V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = -1.0mA
I <sub>GSS</sub>	Gate Body Leakage		-1.0	-100	nA	V <sub>GS</sub> = ±20V, V <sub>DS</sub> = 0V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current			-10	μA	V <sub>GS</sub> = 0V, V <sub>DS</sub> = Max Rating
				-1	mA	V <sub>GS</sub> = 0V, V <sub>DS</sub> = 0.8 Max Rating T <sub>A</sub> = 125°C
I <sub>D(ON)</sub>	ON-State Drain Current	-0.6			A	V <sub>GS</sub> = -10V, V <sub>DS</sub> = -25V
R <sub>DS(ON)</sub>	Static Drain-to-Source ON-State Resistance			10.0	Ω	V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -50mA
				6.0	Ω	V <sub>GS</sub> = -10V, I <sub>D</sub> = -0.5A
ΔR <sub>DS(ON)</sub>	Change in R <sub>DS(ON)</sub> with Temperature		0.55	1.0	%/°C	V <sub>GS</sub> = -10V, I <sub>D</sub> = -0.5A
G <sub>FS</sub>	Forward Transconductance	150	200		mS	V <sub>DS</sub> = -25V, I <sub>D</sub> = -0.5A
C <sub>ISS</sub>	Input Capacitance		35	60	pF	V <sub>GS</sub> = 0V, V <sub>DS</sub> = -25V f = 1 MHz
C <sub>OSS</sub>	Common Source Output Capacitance		22	30		
C <sub>RSS</sub>	Reverse Transfer Capacitance		8	10		
t <sub>d(ON)</sub>	Turn-ON Delay Time		4	6	ns	V <sub>DD</sub> = -25V I <sub>D</sub> = -0.5A R <sub>GEN</sub> = 25Ω
t <sub>r</sub>	Rise Time		4	8		
t <sub>d(OFF)</sub>	Turn-OFF Delay Time		5	9		
t <sub>f</sub>	Fall Time		5	8		
V <sub>SD</sub>	Diode Forward Voltage Drop		-1.2	-2.0	V	V <sub>GS</sub> = 0V, I <sub>SD</sub> = -0.5A
t <sub>rr</sub>	Reverse Recovery Time		400		ns	V <sub>GS</sub> = 0V, I <sub>SD</sub> = -0.5A

**Notes:**

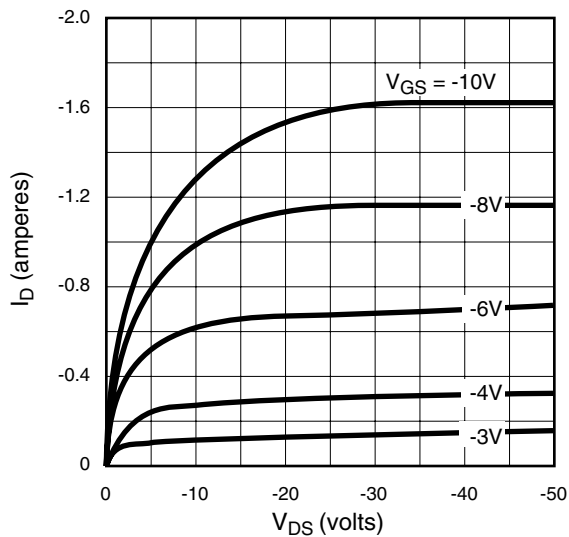
1. All D.C. parameters 100% tested at 25°C unless otherwise stated. (Pulse test: 300μs pulse, 2% duty cycle.)
2. All A.C. parameters sample tested.

# Switching Waveforms and Test Circuit

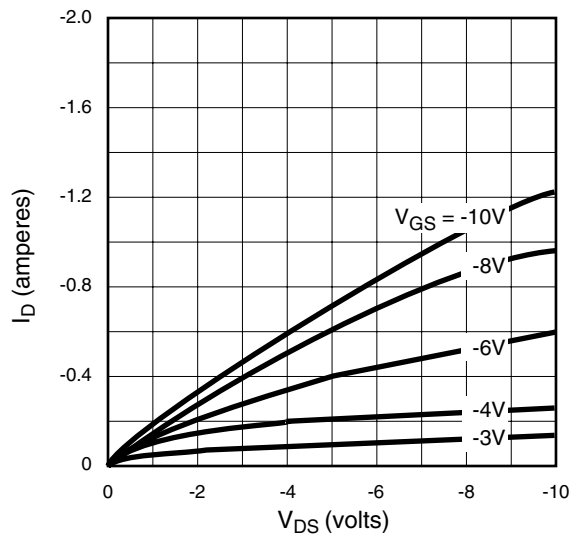


# Typical Performance Curves

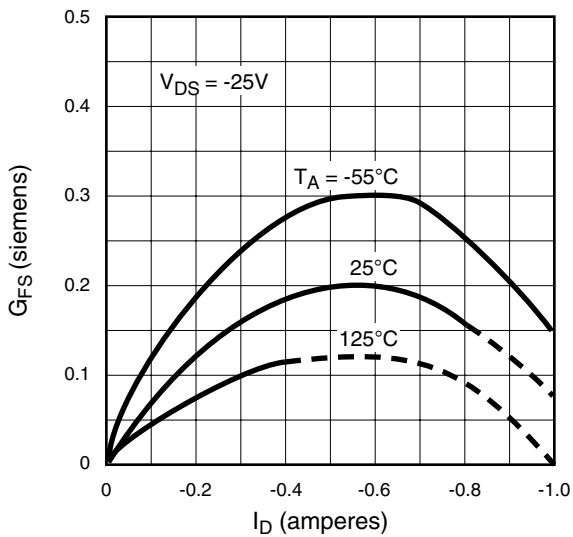
Output Characteristics



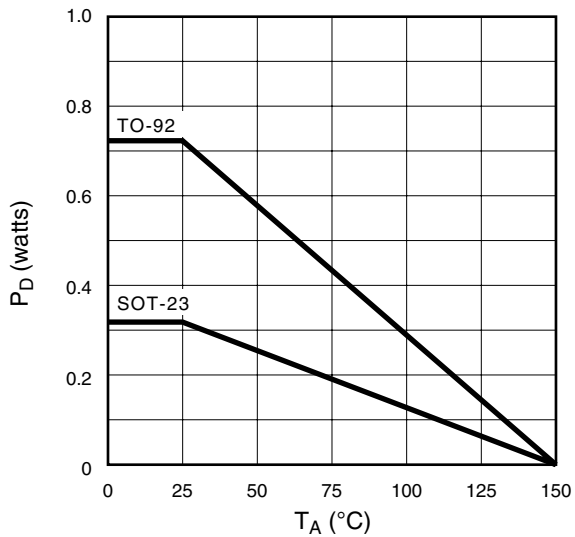
Saturation Characteristics



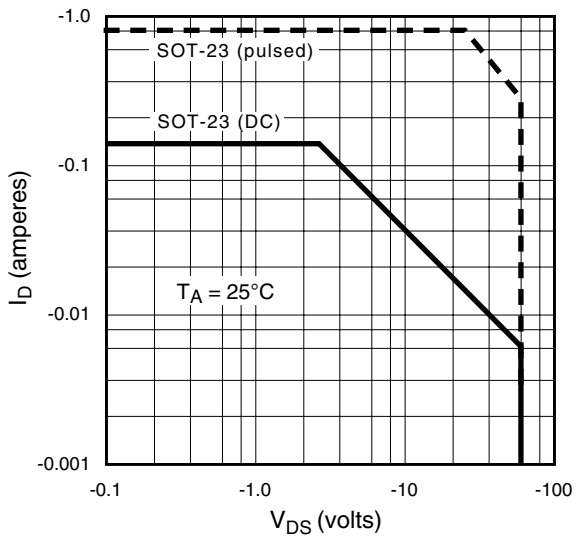
Transconductance vs. Drain Current



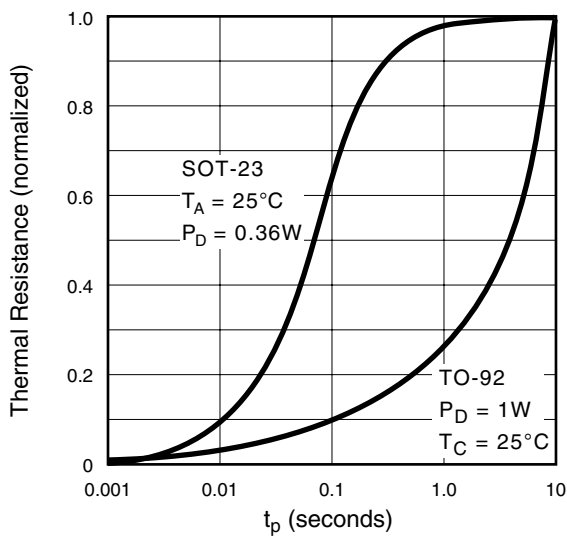
Power Dissipation vs. Temperature



Maximum Rated Safe Operating Area

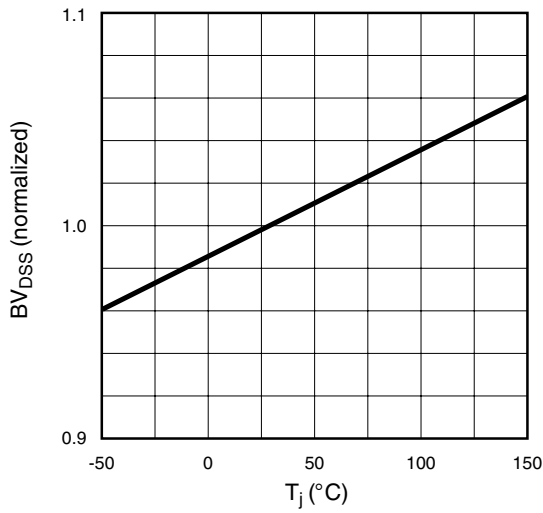


Thermal Response Characteristics

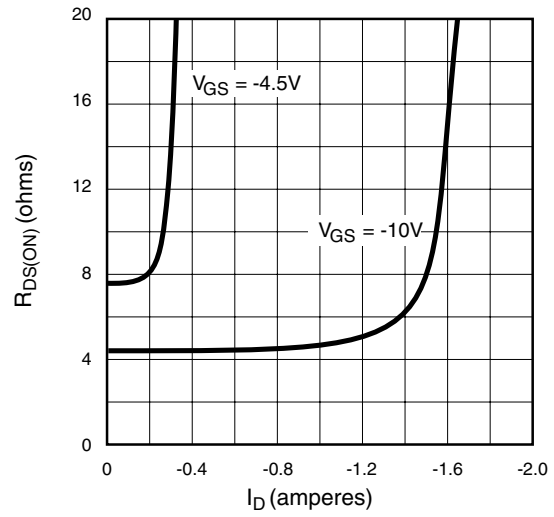


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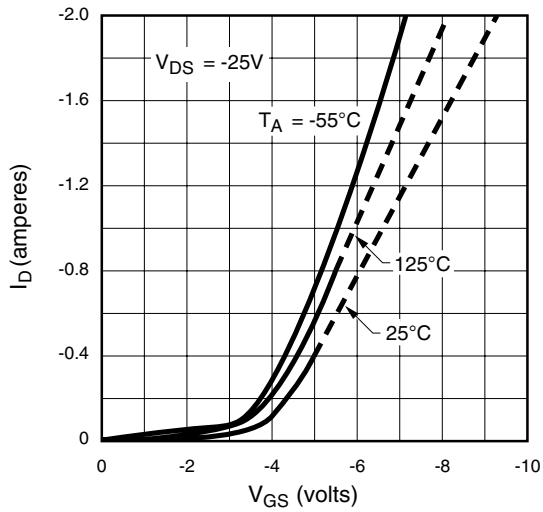
BV<sub>DSS</sub> Variation with Temperature



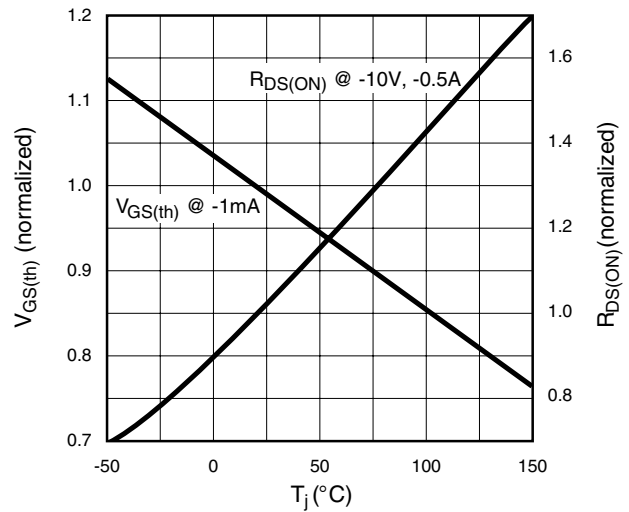
On-Resistance vs. Drain Current



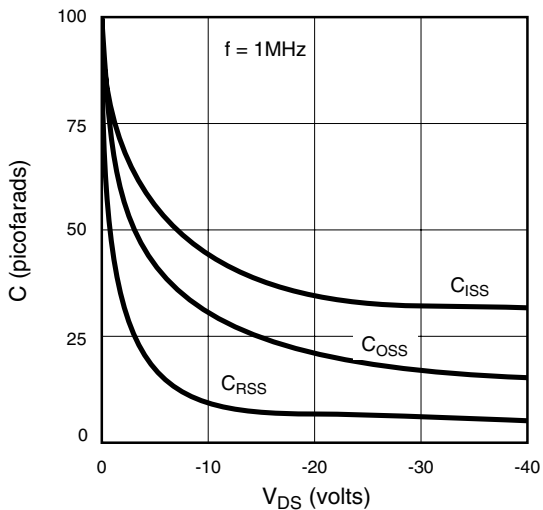
Transfer Characteristics



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



Capacitance vs. Drain-to-Source Voltage



Gate Drive Dynamic Characteristics

