

Supertex inc.

TP2535
TP2540
Low Threshold



P-Channel Enhancement-Mode Vertical DMOS FETs

Ordering Information

$BV_{DSS} /$ BV_{DGS}	$R_{DS(ON)}$ (max)	$V_{GS(th)}$ (max)	$I_{D(ON)}$ (min)	Order Number / Package		
				TO-92	TO-243AA*	Die†
-350V	25Ω	-2.4V	-0.4A	TP2535N3	—	—
-400V	25Ω	-2.4V	-0.4A	TP2540N3	TP2540N8	TP2540ND

* Same as SOT-89. Product supplied on 2000 piece carrier tape reels.

† MIL visual screening available.

Features

- ☐ Low threshold — -2.4V max.
- ☐ High input impedance
- ☐ Low input capacitance — 125pF max.
- ☐ Fast switching speeds
- ☐ Low on resistance
- ☐ Free from secondary breakdown
- ☐ Low input and output leakage
- ☐ 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_{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.

Product marking for TO-243AA

TP5D*

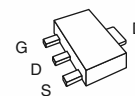
Where * = 2-week alpha date code

Low Threshold DMOS Technology

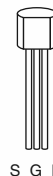
These low threshold enhancement-mode (normally-off) transistors utilize a vertical DMOS structure and Supertex's well-proven silicon-gate manufacturing process. This combination produces devices with the power handling capabilities of bipolar transistors and with the high input impedance and positive 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 very low threshold voltage, high breakdown voltage, high input impedance, low input capacitance, and fast switching speeds are desired.

Package Options



TO-243AA
(SOT-89)



TO-92

Note: See Package Outline section for dimensions.



Thermal Characteristics

Package	I_D (continuous)*	I_D (pulsed)	Power Dissipation @ $T_A = 25^\circ\text{C}$	θ_{jc} $^\circ\text{C/W}$	θ_{ja} $^\circ\text{C/W}$	I_{DR}^*	I_{DRM}
TO-92	-86mA	-0.6A	0.74W	125	170	-86mA	-0.6A
TO-243AA	-125mA	-1.2A	1.6W [†]	15	78 [†]	-125mA	-1.2A

* I_D (continuous) is limited by max rated T_J .

[†] Mounted on FR5 Board, 25mm x 25mm x 1.57mm. Significant P_D increase possible on ceramic substrate.

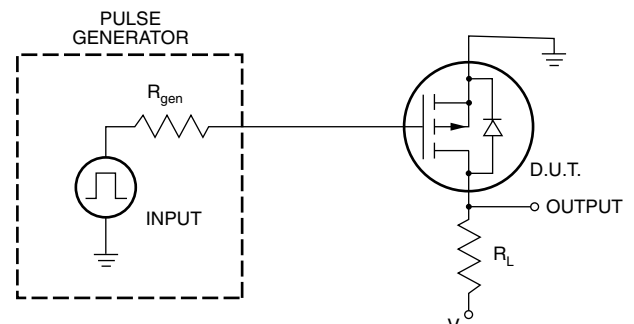
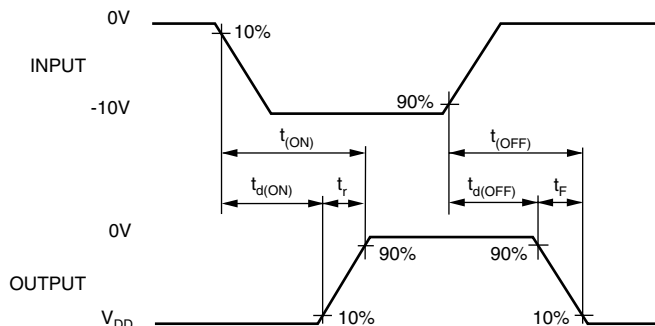
Electrical Characteristics (@ 25°C unless otherwise specified)

Symbol	Parameter		Min	Typ	Max	Unit	Conditions
BV_{DSS}	Drain-to-Source Breakdown Voltage	TP2540 TP2535	-400 -350			V	$V_{GS} = 0V, I_D = -2mA$
$V_{GS(th)}$	Gate Threshold Voltage		-1.0		-2.4	V	$V_{GS} = V_{DS}, I_D = -1mA$
$\Delta V_{GS(th)}$	Change in $V_{GS(th)}$ with Temperature				4.8	mV/ $^\circ\text{C}$	$V_{GS} = V_{DS}, I_D = -1mA$
I_{GSS}	Gate Body Leakage				-100	nA	$V_{GS} = \pm 20V, V_{DS} = 0V$
I_{DSS}	Zero Gate Voltage Drain Current				-10	μA	$V_{GS} = 0V, V_{DS} = \text{Max Rating}$
					-1.0	mA	$V_{GS} = 0V, V_{DS} = 0.8 \text{ Max Rating}$ $T_A = 125^\circ\text{C}$
$I_{D(ON)}$	ON-State Drain Current		-0.2	-0.3		A	$V_{GS} = -4.5V, V_{DS} = -25V$
			-0.4	-1.1			$V_{GS} = -10V, V_{DS} = -25V$
$R_{DS(ON)}$	Static Drain-to-Source ON-State Resistance			20 19	30 25	Ω	$V_{GS} = -4.5V, I_D = -100mA$
							$V_{GS} = -10V, I_D = -100mA$
$\Delta R_{DS(ON)}$	Change in $R_{DS(ON)}$ with Temperature				0.75	%/ $^\circ\text{C}$	$V_{GS} = -10V, I_D = -100mA$
G_{FS}	Forward Transconductance		100	175		mS	$V_{DS} = -25V, I_D = -100mA$
C_{ISS}	Input Capacitance			60	125	pF	$V_{GS} = 0V, V_{DS} = -25V$ $f = 1 \text{ MHz}$
C_{OSS}	Common Source Output Capacitance			20	70		
C_{RSS}	Reverse Transfer Capacitance			10	25		
$t_{d(ON)}$	Turn-ON Delay Time				10	ns	$V_{DD} = -25V$ $I_D = -0.4A$ $R_{GEN} = 25\Omega$
t_r	Rise Time				10		
$t_{d(OFF)}$	Turn-OFF Delay Time				20		
t_f	Fall Time				13		
V_{SD}	Diode Forward Voltage Drop				-1.8	V	$V_{GS} = 0V, I_{SD} = -100mA$
t_{rr}	Reverse Recovery Time			300		ns	$V_{GS} = 0V, I_{SD} = -100mA$

Notes:

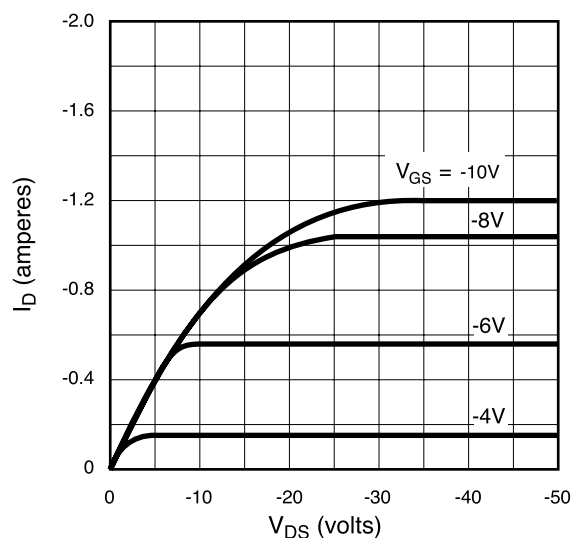
1. All D.C. parameters 100% tested at 25°C unless otherwise stated. (Pulse test: 300 μs pulse, 2% duty cycle.)
2. All A.C. parameters sample tested.

Switching Waveforms and Test Circuit

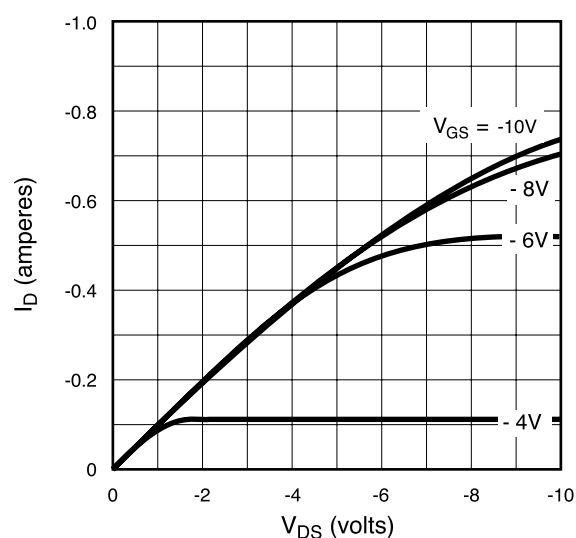


Typical Performance Curves

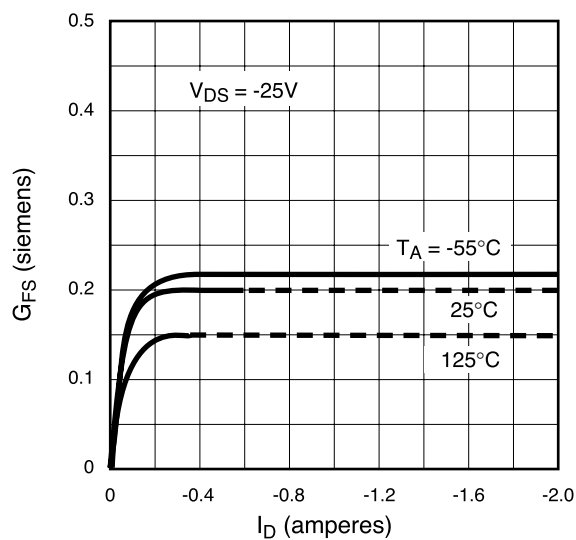
Output Characteristics



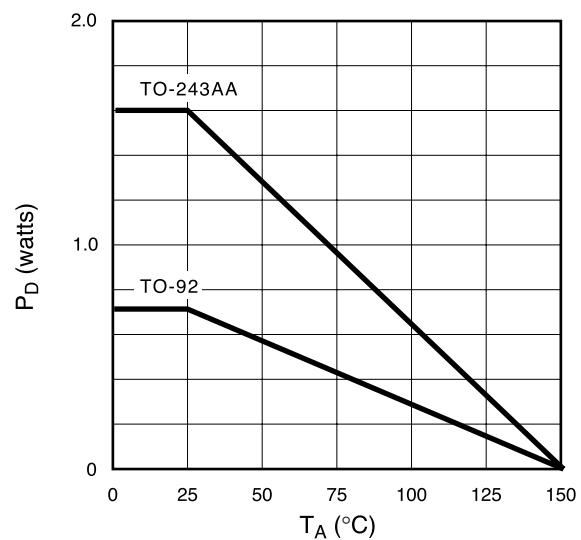
Saturation Characteristics



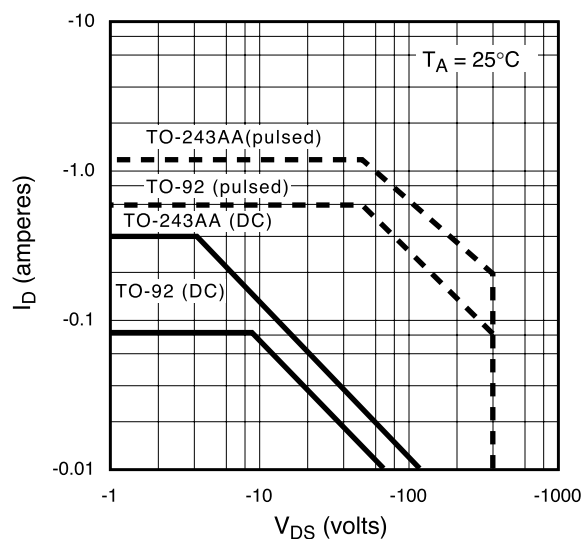
Transconductance vs. Drain Current



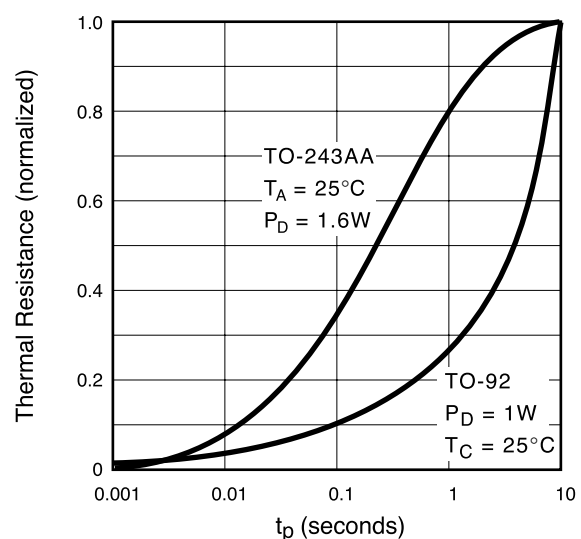
Power Dissipation vs. Ambient Temperature



Maximum Rated Safe Operating Area

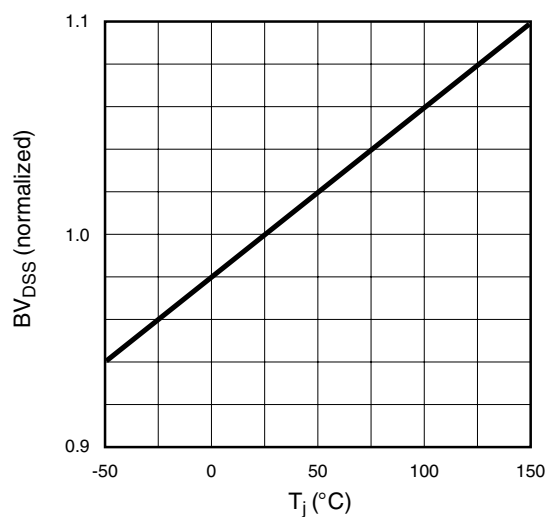


Thermal Response Characteristics

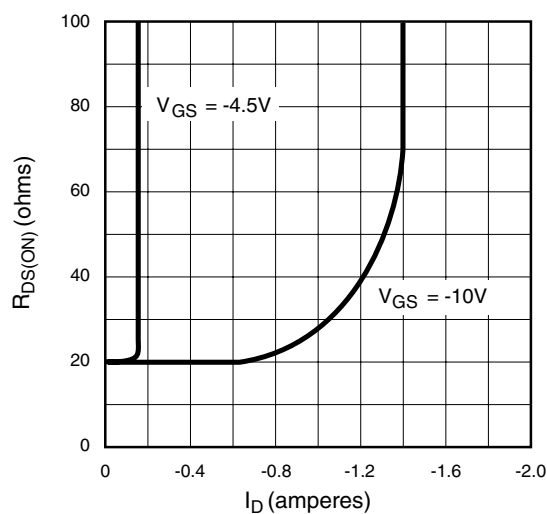


Typical Performance Curves

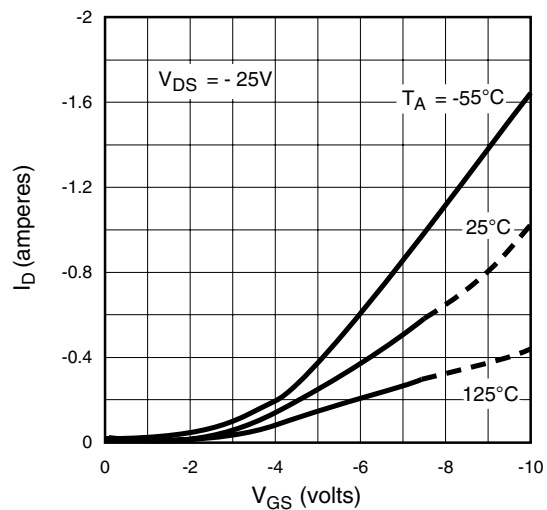
BV_{DSS} Variation with Temperature



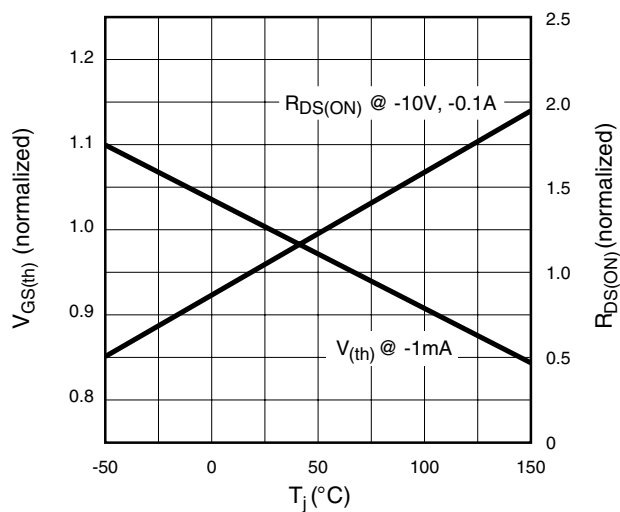
On-Resistance vs. Drain Current



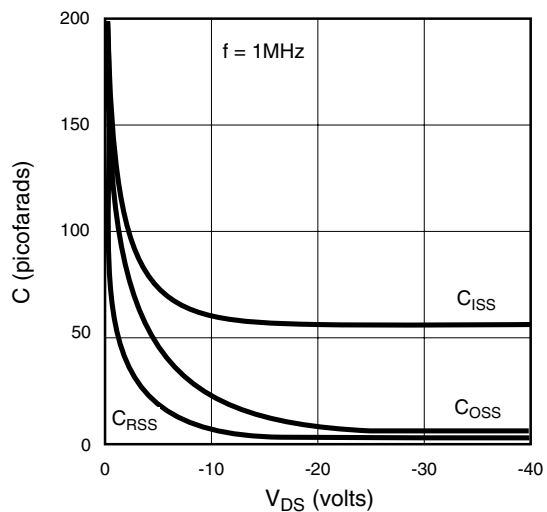
Transfer Characteristics



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



Capacitance vs. Drain-to-Source Voltage



Gate Drive Dynamic Characteristics

