

**Supertex inc.**

**TN0104**  
Low Threshold



**N-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)	I <sub>D(ON)</sub> (min)	Order Number / Package		
				TO-92	TO-243AA*	Die†
40V	1.8Ω	1.6V	2.0A	TN0104N3	—	TN0104ND
40V	2.0Ω	1.6V	2.0A	—	TN0104N8	—

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

† MIL visual screening available

**Features**

- Low threshold —1.6V max.
- High input impedance
- Low input capacitance
- 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 <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

\* For TO-39 and TO-92, distance of 1.6 mm from case for 10 seconds.

**Product marking for TO-243AA:**

**TN1L\***

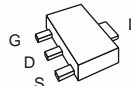
Where \* = 2-week alpha date code

**Low Threshold DMOS Technology**

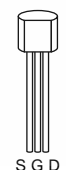
These low threshold enhancement-mode (normally-off) transistors utilize a vertical DMOS structure and Supertex's well-proven silicon-gate manufacturing process. This combination produces devices with the power handling capabilities of bipolar transistors and with the high input impedance and positive 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 <sub>D</sub> (continuous)*	I <sub>D</sub> (pulsed)	Power Dissipation @ T <sub>C</sub> = 25°C	θ <sub>jc</sub> °C/W	θ <sub>ja</sub> °C/W	I <sub>DR</sub> *	I <sub>DRM</sub>
TO-92	0.80A	2.40A	1.0W	125	170	0.80A	2.40A
TO-243AA	1.40A	2.90A	1.6W <sup>†</sup>	15	78 <sup>†</sup>	1.40A	2.90A

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

<sup>†</sup> T<sub>A</sub> = 25°C. Mounted on FR5 Board, 25mm x 25mm x 1.57mm. Significant P<sub>D</sub> increase possible on ceramic substrate.

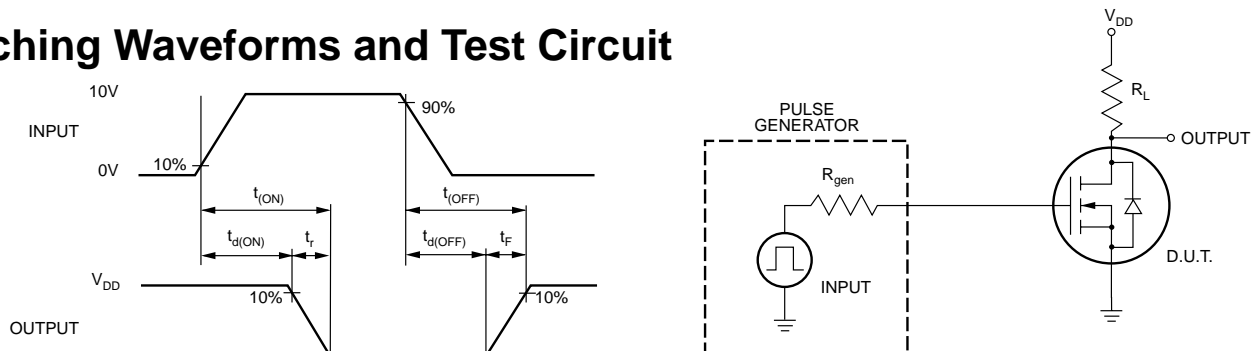
## Electrical Characteristics (@ 25°C unless otherwise specified)

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	0.6		1.6	V	V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = 500µA
ΔV <sub>GS(th)</sub>	Change in V <sub>GS(th)</sub> with Temperature		-3.8	-5.0	mV/°C	V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = 1.0mA
I <sub>GSS</sub>	Gate Body Leakage		0.1	100	nA	V <sub>GS</sub> = ±20V, V <sub>DS</sub> = 0V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current			1	µA	V <sub>GS</sub> = 0V, V <sub>DS</sub> = Max Rating
				100	µA	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		0.35		A	V <sub>GS</sub> = 3V, V <sub>DS</sub> = 20V
		0.5	1.1	V <sub>GS</sub> = 5V, V <sub>DS</sub> = 20V		
		2.0	2.6	V <sub>GS</sub> = 10V, V <sub>DS</sub> = 20V		
R <sub>DS(ON)</sub>	Static Drain-to-Source ON-State Resistance	All Packages	5.0		Ω	V <sub>GS</sub> = 3V, I <sub>D</sub> = 50mA
			2.3	2.5		V <sub>GS</sub> = 5V, I <sub>D</sub> = 250mA
		TO-92	1.5	1.8		V <sub>GS</sub> = 10V, I <sub>D</sub> = 1A
		TO-243AA		2.0		V <sub>GS</sub> = 10V, I <sub>D</sub> = 1A
ΔR <sub>DS(ON)</sub>	Change in R <sub>DS(ON)</sub> with Temperature		0.7	1.0	%/°C	V <sub>GS</sub> = 10V, I <sub>D</sub> = 1A,
G <sub>FS</sub>	Forward Transconductance	0.34	0.45		∅	V <sub>DS</sub> = 20V, I <sub>D</sub> = 0.5A
C <sub>ISS</sub>	Input Capacitance			70	pF	V <sub>GS</sub> = 0V, V <sub>DS</sub> = 20V f = 1 MHz
C <sub>OSS</sub>	Common Source Output Capacitance			50		
C <sub>RSS</sub>	Reverse Transfer Capacitance			15		
t <sub>d(ON)</sub>	Turn-ON Delay Time		3.0	5.0	ns	V <sub>DD</sub> = 20V, I <sub>D</sub> = 1A R <sub>GEN</sub> = 25Ω
t <sub>r</sub>	Rise Time		7.0	8.0		
t <sub>d(OFF)</sub>	Turn-OFF Delay Time		6.0	9.0		
t <sub>f</sub>	Fall Time		5.0	8.0		
V <sub>SD</sub>	Diode Forward Voltage Drop	TO-92	1.2	1.8	V	V <sub>GS</sub> = 0V, I <sub>SD</sub> = 1.0A
		TO-243AA		2.0		V <sub>GS</sub> = 0V, I <sub>SD</sub> = 0.5A
t <sub>rr</sub>	Reverse Recovery Time		300		ns	V <sub>GS</sub> = 0V, I <sub>SD</sub> = 1A

**Notes:**

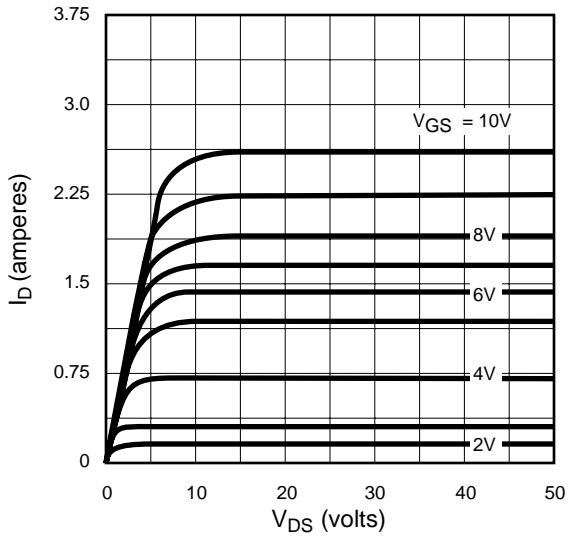
1. All D.C. parameters 100% tested at 25°C unless otherwise stated. (Pulse test: 300µs pulse, 2% duty cycle.)
2. All A.C. parameters sample tested.

## Switching Waveforms and Test Circuit

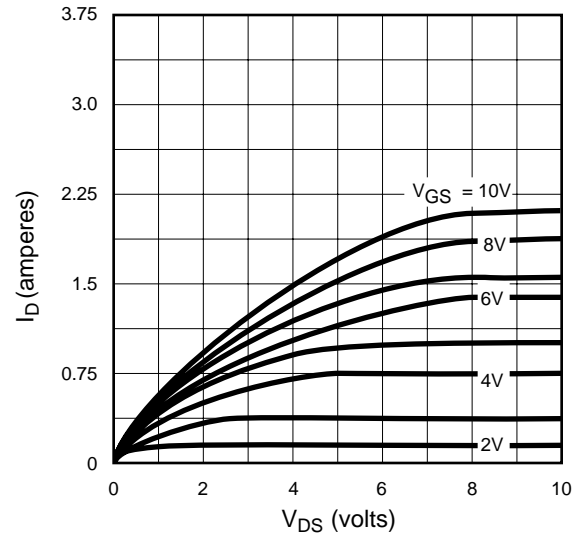


# Typical Performance Curves

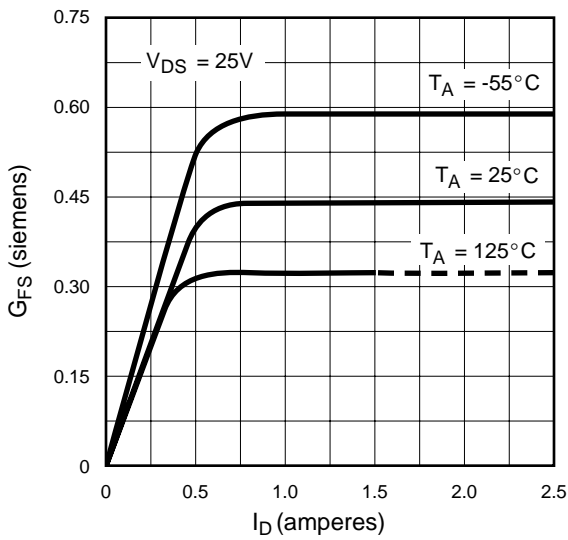
Output Characteristics



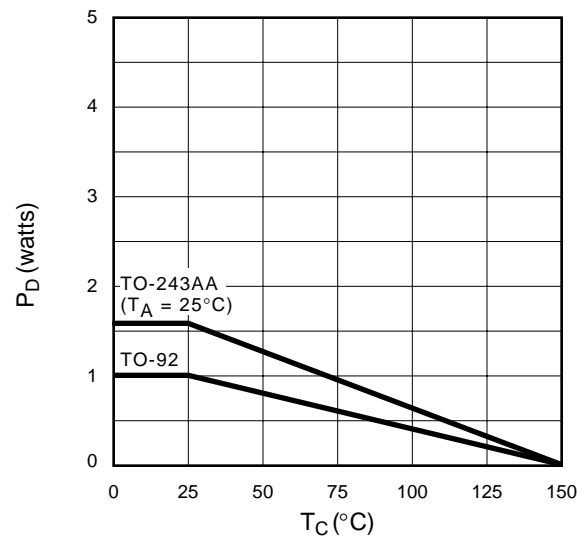
Saturation Characteristics



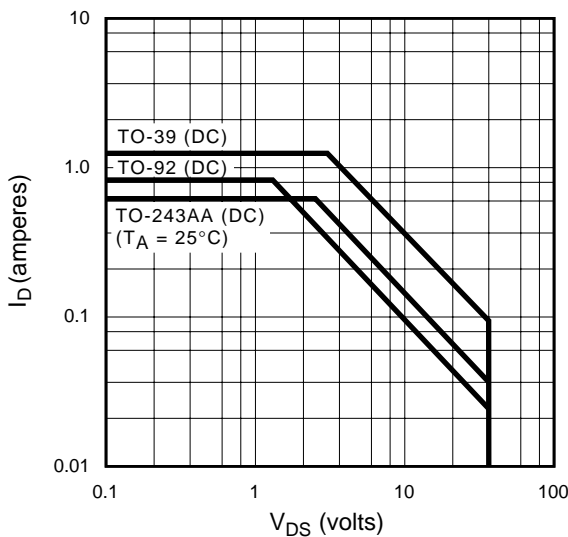
Transconductance vs. Drain Current



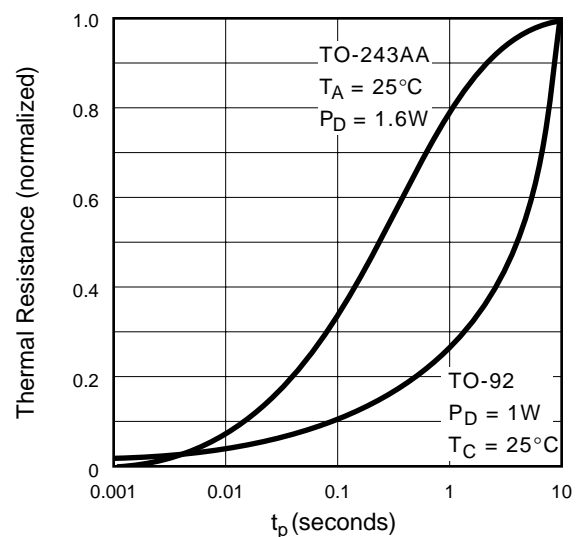
Power Dissipation vs. Case Temperature



Maximum Rated Safe Operating Area

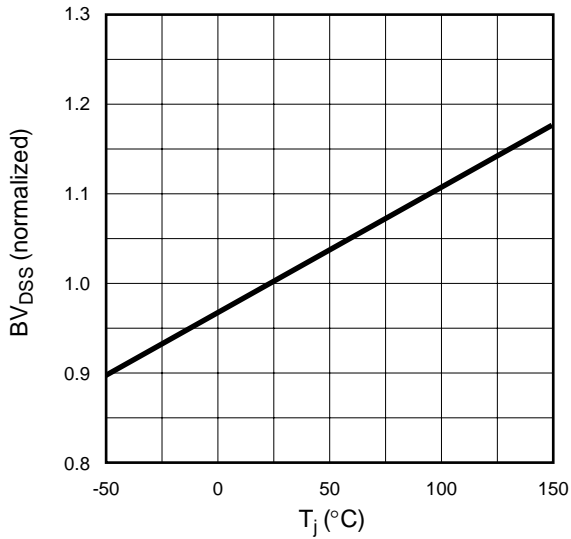


Thermal Response Characteristics

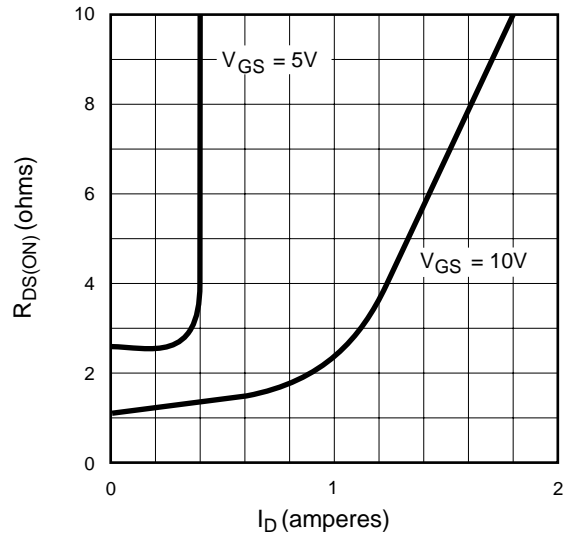


# Typical Performance Curves

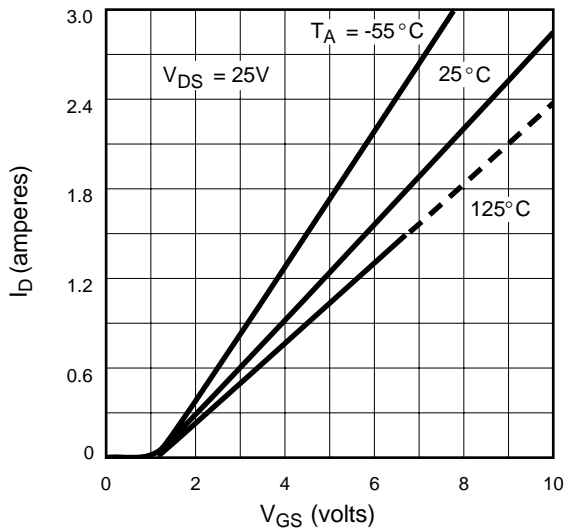
BV<sub>DSS</sub> Variation with Temperature



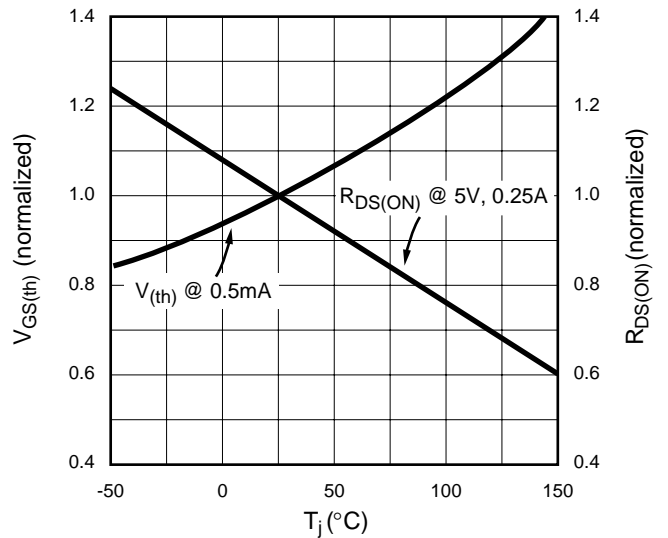
On-Resistance vs. Drain Current



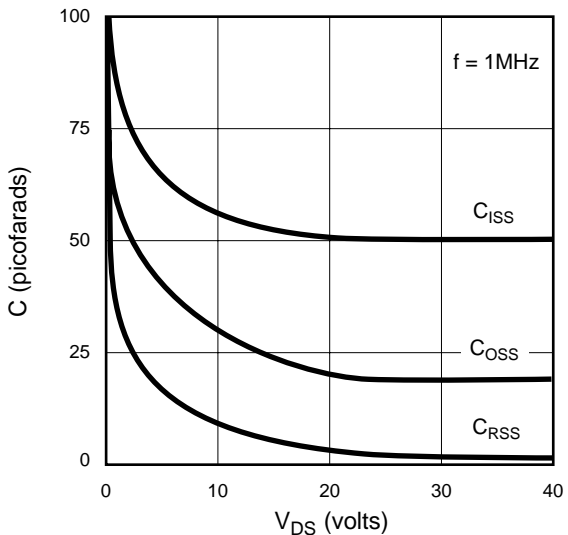
Transfer Characteristics



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



Capacitance vs. Drain-to-Source Voltage



Gate Drive Dynamic Characteristics

