



## N-Channel Enhancement-Mode Vertical DMOS FETs

# **Ordering Information**

BV <sub>DSS</sub> /	R <sub>DS(ON)</sub>	V <sub>GS(th)</sub>	I <sub>D(ON)</sub>	Order Number / Package			
BV <sub>DGS</sub>	(max)	(max)	(min)	TO-243AA*	Die <sup>†</sup>		
40V	1.0Ω	1.6V	4.0A	TN2504N8	TN2504ND		

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

#### **Features**

- Low threshold 1.6V 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

<sup>\*</sup> Distance of 1.6 mm from case for 10 seconds.

# Product marking for TO-243AA: TN5L\*

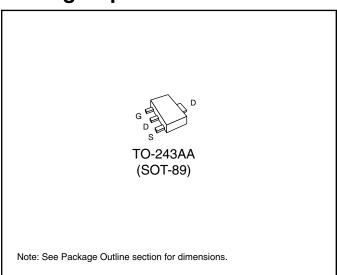
Where \* = 2-week alpha date code

## **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 Option**



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<sup>†</sup> MIL visual screening available.

## **Thermal Characteristics**

Package	I <sub>D</sub> (continuous)*	I <sub>D</sub> (pulsed)	Power Dissipation @ T <sub>A</sub> = 25°C	$ heta_{ extsf{jc}}$ $^{\circ}$ C/W			I <sub>DRM</sub>	
TO-243AA	0.89A	4.5A	1.6W <sup>†</sup>	15	78 <sup>†</sup>	0.89A	4.5A	

 $_{\rm D}^{\star}$  I<sub>D</sub> (continuous) is limited by max rated T<sub>i</sub>.

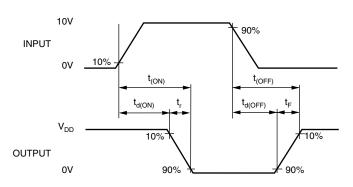
# Electrical Characteristics (@ 25°C unless otherwise specified)

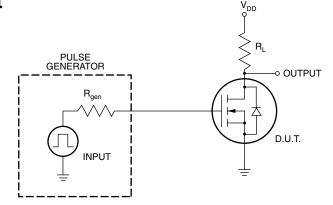
Symbol	Parameter	Min	Тур	Max	Unit	Conditions	
BV <sub>DSS</sub>	Drain-to-Source Breakdown Voltage	40			V	$V_{GS} = 0V$ , $I_D = 2mA$	
V <sub>GS(th)</sub>	Gate Threshold Voltage	0.6		1.6	V	$V_{GS} = V_{DS}, I_{D} = 1 \text{mA}$	
$\Delta V_{GS(th)}$	Change in V <sub>GS(th)</sub> with Temperature		-3.8	-4.5	mV/°C	$V_{GS} = V_{DS}$ , $I_D = 1mA$	
I <sub>GSS</sub>	Gate Body Leakage			100	nA	$V_{GS} = \pm 20V, V_{DS} = 0V$	
I <sub>DSS</sub>	Zero Gate Voltage Drain Current			10	μΑ	V <sub>GS</sub> = 0V, V <sub>DS</sub> = Max Rating	
				1	mA	$V_{GS} = 0V$ , $V_{DS} = 0.8$ Max Rating $T_A = 125$ °C	
I <sub>D(ON)</sub>	ON-State Drain Current	1.0	1.7		Α	V <sub>GS</sub> = 5V, V <sub>DS</sub> = 15V	
		4.0	4.5			$V_{GS} = 10V, V_{DS} = 15V$	
R <sub>DS(ON)</sub>	Static Drain-to-Source		1.25	1.5	Ω	$V_{GS} = 5V, I_D = 300mA$	
	ON-State Resistance		0.8	1.0		$V_{GS} = 10V, I_D = 1.5A$	
$\Delta R_{DS(ON)}$	Change in R <sub>DS(ON)</sub> with Temperature			0.75	%/°C	$V_{GS} = 10V, I_D = 1.5A$	
G <sub>FS</sub>	Forward Transconductance	0.5	0.7		ប	$V_{DS} = 15V, I_{D} = 2.0A$	
C <sub>ISS</sub>	Input Capacitance		70	125		$V_{GS} = 0V$ , $V_{DS} = 20V$ f = 1 MHz	
C <sub>OSS</sub>	Common Source Output Capacitance		50	70	pF		
C <sub>RSS</sub>	Reverse Transfer Capacitance		20	25			
t <sub>d(ON)</sub>	Turn-ON Delay Time			10			
t <sub>r</sub>	Rise Time			10		$V_{DD} = 20V$ ,	
t <sub>d(OFF)</sub>	Turn-OFF Delay Time			25	ns	$I_D = 500 \text{mA},$ $R_{GEN} = 25\Omega$	
t <sub>f</sub>	Fall Time			13		GEN	
V <sub>SD</sub>	Diode Forward Voltage Drop		1.2	1.8	V	$V_{GS} = 0V, I_{SD} = 1.5A$	
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  $25^{\circ}$ C unless otherwise stated. (Pulse test:  $300\mu$ s pulse, 2% duty cycle.)
- 2. All A.C. parameters sample tested.

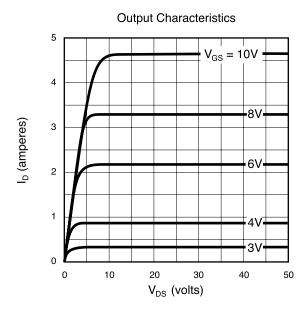
# **Switching Waveforms and Test Circuit**

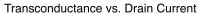


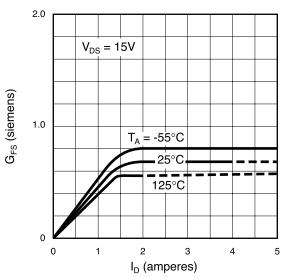


<sup>†</sup> Mounted on FR5 board, 25mm x 25mm x 1.57mm. Significant P<sub>D</sub> increase possible on ceramic substrate.

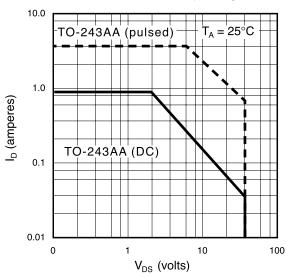
# **Typical Performance Curves**



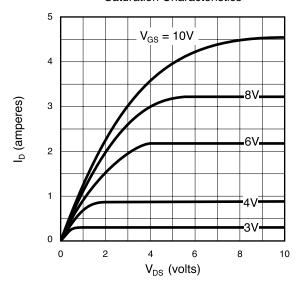




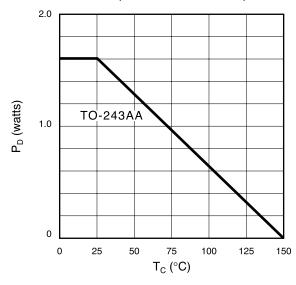
#### Maximum Rated Safe Operating Area



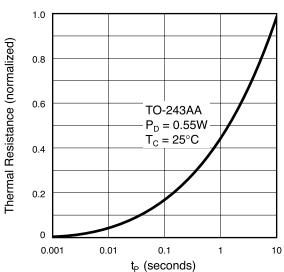
#### Saturation Characteristics



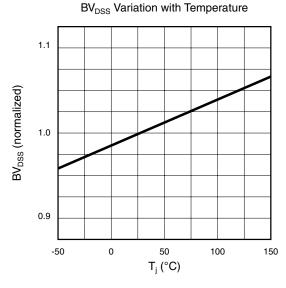
#### Power Dissipation vs. Ambient Temperature

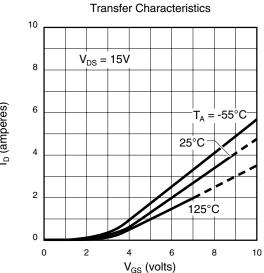


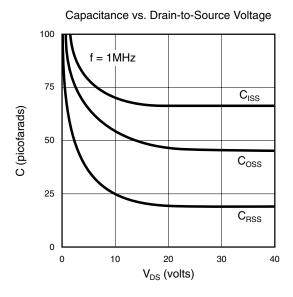
#### Thermal Response Characteristics

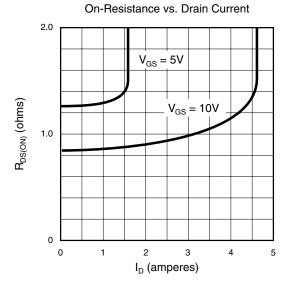


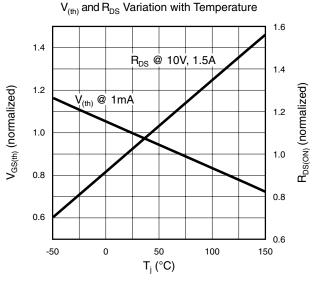
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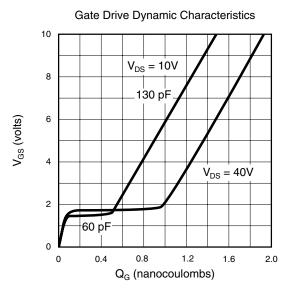












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