N-Channel Enhancement-Mode Vertical DMOS FETs

Features

- Free from secondary breakdown
- Low power drive requirement
- Ease of paralleling
- Low C_{ISS} 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.)

General Description

The Supertex 2N7002 is an enhancement-mode (normally-off) transistor that utilizes a vertical DMOS structure and Supertex's well-proven silicon-gate manufacturing process. This combination produces a device with the power handling capabilities of bipolar transistors, and the high input impedance and positive temperature coefficient inherent in MOS devices. Characteristic of all MOS structures, this device is 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.

Ordering Information

Device	Package Option	BV_{DSS}/BV_{DGS} (V)	$R_{DS(ON)}$ (max) (Ω)	$I_{D(ON)}$ (min) (A)
2N7002-G	TO-236AB (SOT-23)	60	7.5	0.5

-G indicates package is RoHS compliant ('Green')

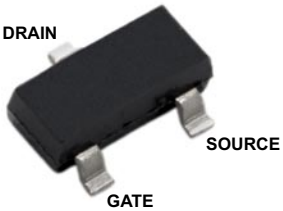
Absolute Maximum Ratings

Parameter	Value
Drain-to-source voltage	BV_{DSS}
Drain-to-gate voltage	BV_{DGS}
Gate-to-source voltage	±30V
Operating and storage temperature	-55°C to +150°C
Soldering temperature*	+300°C

Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied. Continuous operation of the device at the absolute rating level may affect device reliability. All voltages are referenced to device ground.

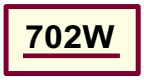
** Distance of 1.6mm from case for 10 seconds.*

Pin Configuration



TO-236AB (SOT-23)

Product Marking



W = Code for week sealed
_____ = "Green" Packaging

TO-236AB (SOT-23)

Thermal Characteristics

Package	I_D (continuous)† (mA)	I_D (pulsed) (mA)	Power Dissipation @T_A = 25°C (W)	θ_{jc} (°C/W)	θ_{ja} (°C/W)	I_{DR}† (mA)	I_{DRM} (mA)
TO-236AB	115	800	0.36	200	350	115	800

Notes:

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

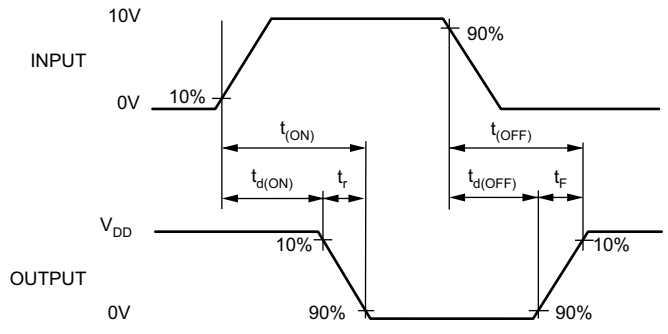
Electrical Characteristics *(T_A = 25°C unless otherwise specified)*

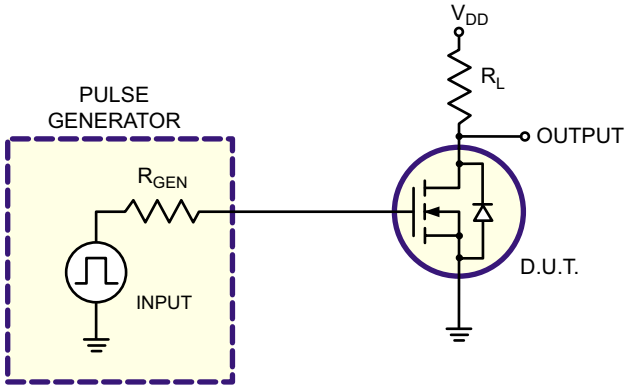
Sym	Parameter	Min	Typ	Max	Units	Conditions
BV_{DSS}	Drain-to-source breakdown voltage	60	-	-	V	V_{GS} = 0V, I_D = 10µA
$V_{GS(th)}$	Gate threshold voltage	1.0	-	2.5	V	V_{GS} = V_{DS}, I_D = 250µA
$\Delta V_{GS(th)}$	Change in $V_{GS(th)}$ with temperature	-	-	-5.5	mV/°C	V_{GS} = V_{DS}, I_D = 250µA
I_{GSS}	Gate body leakage current	-	-	±100	nA	V_{GS} = ±20V, V_{DS} = 0V
I_{DSS}	Zero gate voltage drain current	-	-	1.0	µA	V_{GS} = 0V, V_{DS} = Max rating
		-	-	500		V_{GS} = 0V, V_{DS} = 0.8Max rating, T_A = 125°C
$I_{D(ON)}$	On-state drain current	500	-	-	mA	V_{GS} = 10V, V_{DS} = 25V
$R_{DS(ON)}$	Static drain-to-source on-state resistance	-	-	7.5	Ω	V_{GS} = 5.0V, I_D = 50mA
		-	-	7.5		V_{GS} = 10V, I_D = 500mA
$\Delta R_{DS(ON)}$	Change in $R_{DS(ON)}$ with temperature	-	-	1.0	%/°C	V_{GS} = 10V, I_D = 500mA
G_{FS}	Forward transconductance	80	-	-	mmho	V_{DS} = 25V, I_D = 500mA
C_{ISS}	Input capacitance	-	-	50	pF	V_{GS} = 0V, V_{DS} = 25V, f = 1.0MHz
C_{OSS}	Common source output capacitance	-	-	25		
C_{RSS}	Reverse transfer capacitance	-	-	5.0		
$t_{(ON)}$	Turn-on time	-	-	20	ns	V_{DD} = 30V, I_D = 200mA, R_{GEN} = 25Ω
$t_{(OFF)}$	Turn-off time	-	-	20		
V_{SD}	Diode forward voltage drop	-	1.2	-	V	V_{GS} = 0V, I_{SD} = 200mA
t_{rr}	Reverse recovery time	-	400	-	ns	V_{GS} = 0V, I_{SD} = 800mA

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.*

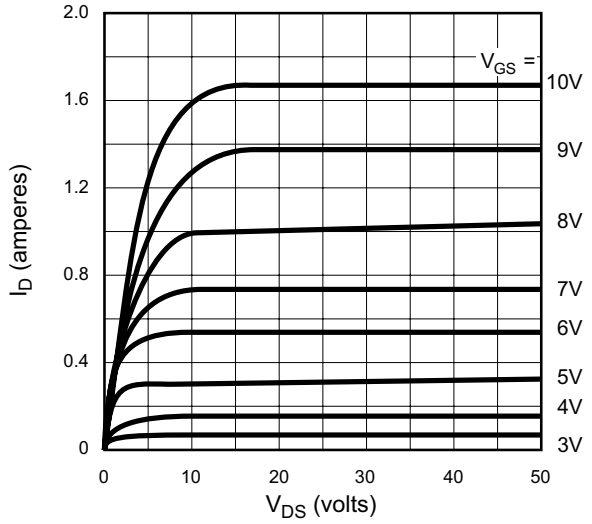
Switching Waveforms and Test Circuit



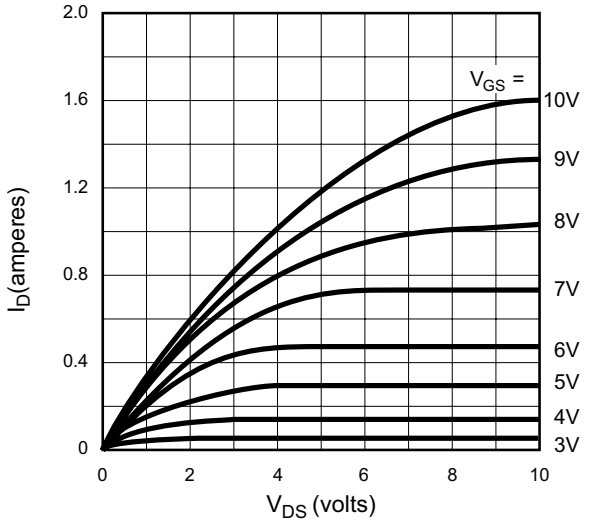


Typical Performance Curves

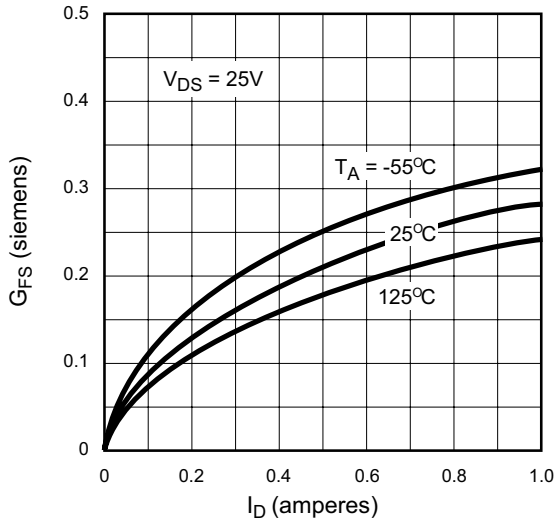
Output Characteristics



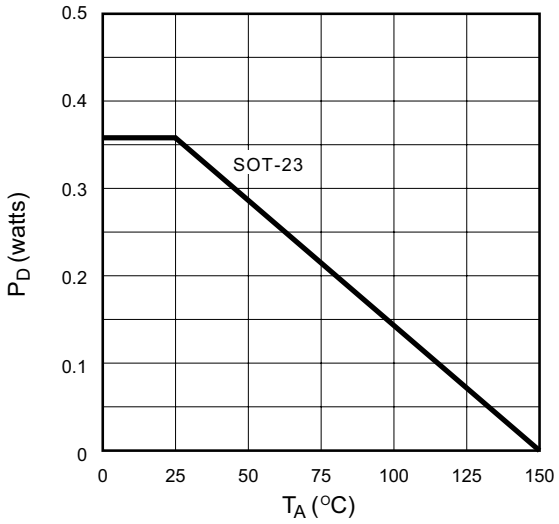
Saturation Characteristics



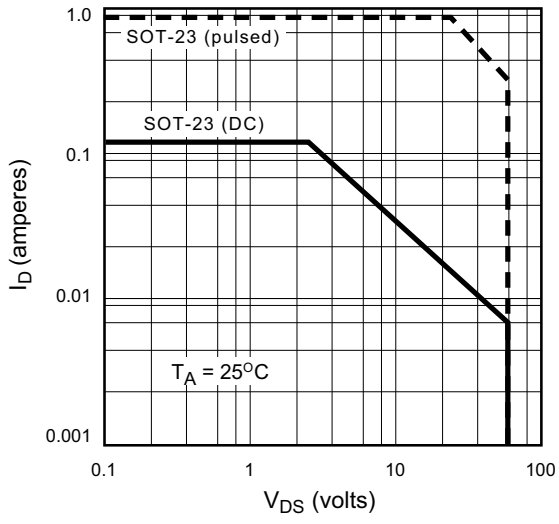
Transconductance vs. Drain Current



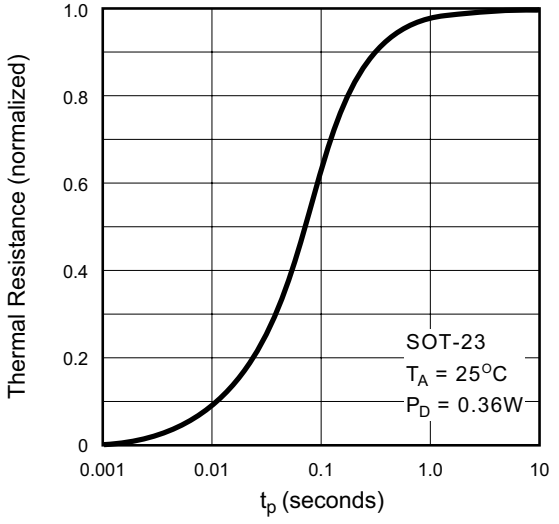
Power Dissipation vs. Temperature



Maximum Rated Safe Operating Area

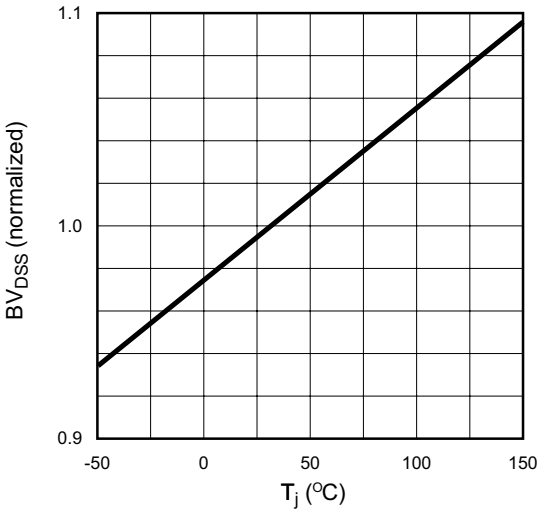


Thermal Response Characteristics

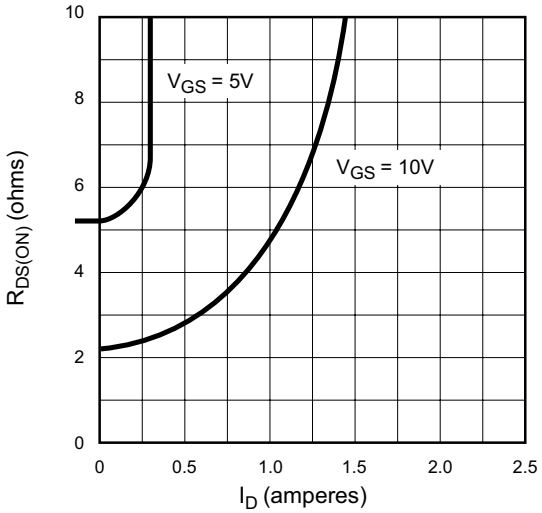


Typical Performance Curves *(cont.)*

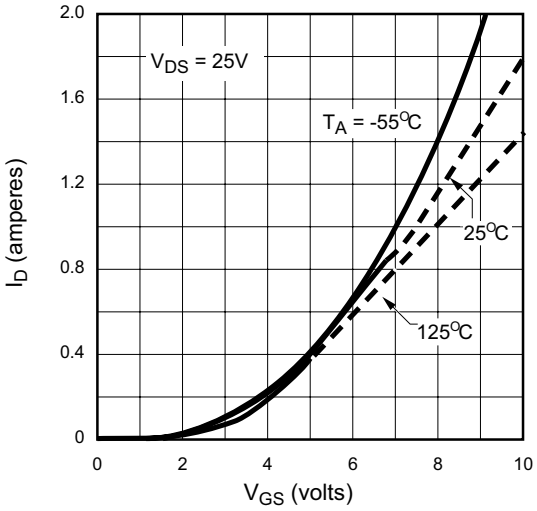
BV_{DSS} Variation with Temperature



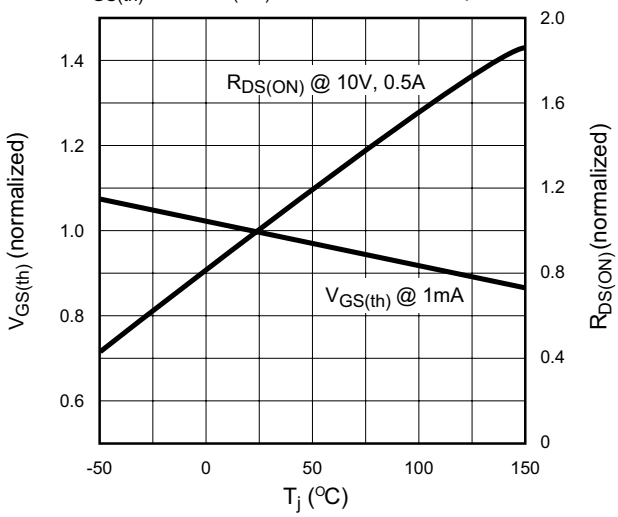
On-Resistance vs. Drain Current



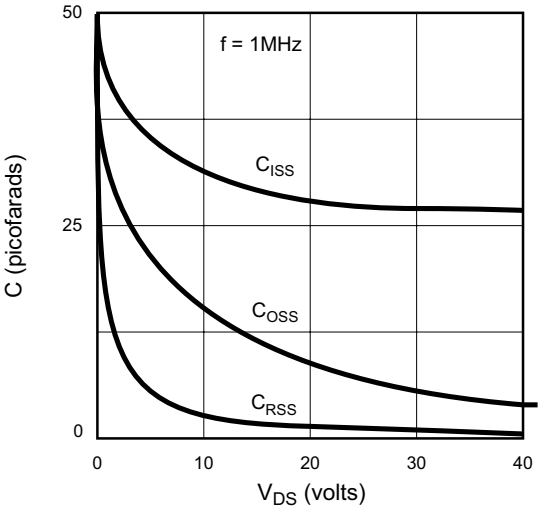
Transfer Characteristics



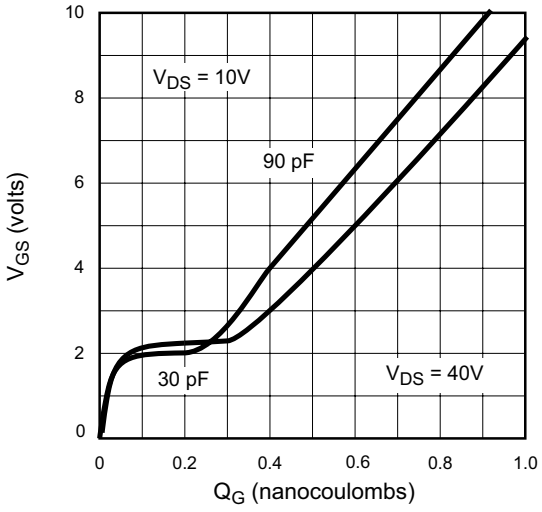
$V_{GS(th)}$ and $R_{DS(ON)}$ Variation with Temperature



Capacitance vs. Drain-to-Source Voltage

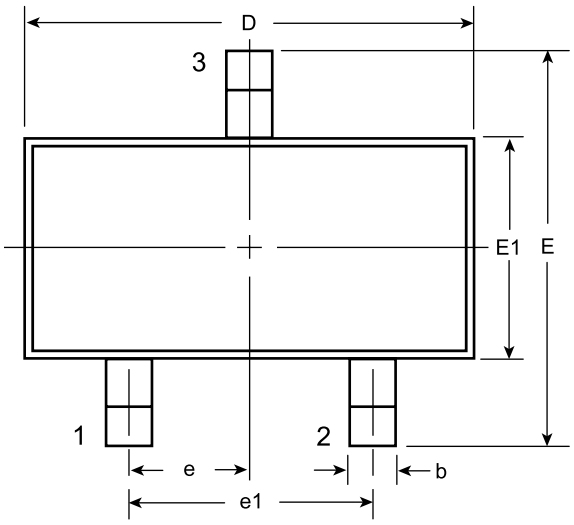


Gate Drive Dynamic Characteristics

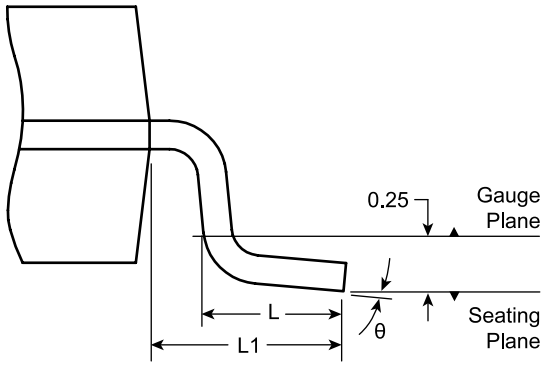


3-Lead TO-236AB (SOT-23) Package Outline (K1)

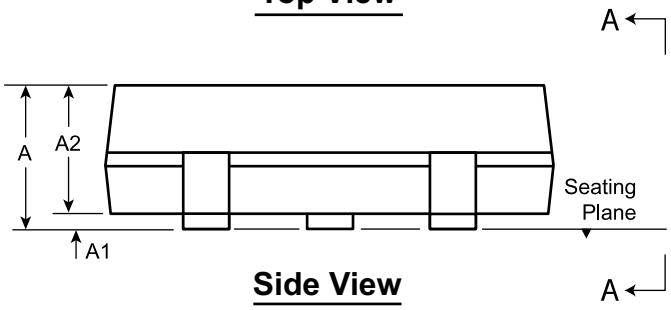
2.90x1.30mm body, 1.12mm height (max), 1.90mm pitch



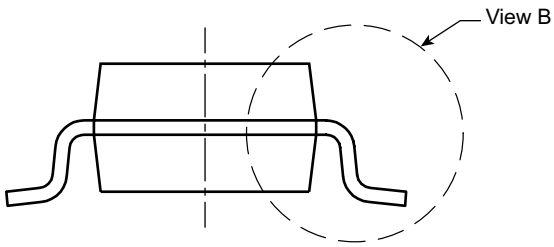
Top View



View B



Side View



View A - A

Symbol		A	A1	A2	b	D	E	E1	e	e1	L	L1	θ
Dimension (mm)	MIN	0.89	0.01	0.88	0.30	2.80	2.10	1.20	0.95 BSC	1.90 BSC	0.20†	0.54 REF	0°
	NOM	-	-	0.95	-	2.90	-	1.30			0.50		-
	MAX	1.12	0.10	1.02	0.50	3.04	2.64	1.40			0.60		8°

JEDEC Registration TO-236, Variation AB, Issue H, Jan. 1999.
† This dimension is a non-JEDEC dimension.
Drawings not to scale.
***Supertex Doc.#:** DSPD-3TO236ABK1, Version B072208.*

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information go to http://www.supertex.com/packaging.html.)

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