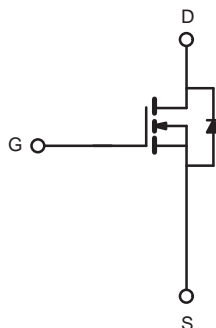
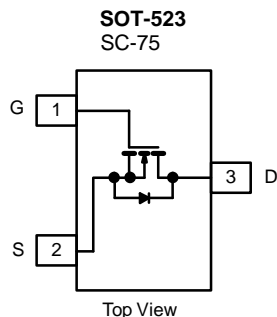


2N7002T-NL-VB Datasheet

N-Channel 60V (D-S) MOSFET

PRODUCT SUMMARY

V_{DS} (V)	$R_{DS(on)}$ (Ω)	I_D (mA)
60	1.2 at $V_{GS} = 10$ V	330



FEATURES

- **Halogen-free According to IEC 61249-2-21 Definition**
- Low On-Resistance: 2 Ω
- Low Threshold: 2 V (typ.)
- Low Input Capacitance: 25 pF
- Fast Switching Speed: 25 ns
- Low Input and Output Leakage
- Trench Power MOSFET
- Compliant to RoHS Directive 2002/95/EC



RoHS
COMPLIANT

BENEFITS

- Low Offset Voltage
- Low-Voltage Operation
- Easily Driven Without Buffer
- High-Speed Circuits
- Low Error Voltage

APPLICATIONS

- Direct Logic-Level Interface: TTL/CMOS
- Drivers: Relays, Solenoids, Lamps, Hammers, Display, Memories, Transistors, etc.
- Battery Operated Systems
- Solid-State Relays

ABSOLUTE MAXIMUM RATINGS $T_A = 25$ °C, unless otherwise noted

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	V_{DS}	60	V
Gate-Source Voltage	V_{GS}	± 20	
Continuous Drain Current ($T_J = 150$ °C) ^b	$T_A = 25$ °C	I_D	mA
	$T_A = 100$ °C	330	
Pulsed Drain Current ^a	I_{DM}	800	
Power Dissipation ^b	$T_A = 25$ °C	P_D	W
	$T_A = 100$ °C	0.35	
Maximum Junction-to-Ambient ^b	R_{thJA}	350	°C/W
Operating Junction and Storage Temperature Range	T_J, T_{stg}	- 55 to 150	°C

Notes:

a. Pulse width limited by maximum junction temperature.

b. Surface Mounted on FR4 board.

SPECIFICATIONS $T_A = 25\text{ }^{\circ}\text{C}$, unless otherwise noted						
Parameter	Symbol	Test Conditions	Limits			Unit
			Min.	Typ. ^a	Max.	
Static						
Drain-Source Breakdown Voltage	V_{DS}	$V_{GS} = 0\text{ V}, I_D = 10\text{ }\mu\text{A}$	60			V
Gate-Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	1		2.5	
Gate-Body Leakage	I_{GSS}	$V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$			± 10	μA
		$V_{DS} = 0\text{ V}, V_{GS} = \pm 15\text{ V}$			1	
		$V_{DS} = 0\text{ V}, V_{GS} = \pm 10\text{ V}$			± 150	nA
		$V_{DS} = 0\text{ V}, V_{GS} = \pm 10\text{ V}, T_J = 85\text{ }^{\circ}\text{C}$			± 1000	
		$V_{DS} = 0\text{ V}, V_{GS} = \pm 5\text{ V}$			± 100	
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 60\text{ V}, V_{GS} = 0\text{ V}$			1	μA
		$V_{DS} = 60\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^{\circ}\text{C}$			500	
On-State Drain Current ^a	$I_{D(on)}$	$V_{GS} = 10\text{ V}, V_{DS} = 7.5\text{ V}$	800			mA
		$V_{GS} = 4.5\text{ V}, V_{DS} = 10\text{ V}$	500			
Drain-Source On-Resistance ^a	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 500\text{ mA}$		1.2		Ω
		$V_{GS} = 4.5\text{ V}, I_D = 200\text{ mA}$		2		
Forward Transconductance ^a	g_{fs}	$V_{DS} = 10\text{ V}, I_D = 200\text{ mA}$	100			mS
Diode Forward Voltage	V_{SD}	$I_S = 200\text{ mA}, V_{GS} = 0\text{ V}$			1.3	V
Dynamic ^a						
Total Gate Charge	Q_g	$V_{DS} = 10\text{ V}, V_{GS} = 4.5\text{ V}$ $I_D \cong 250\text{ mA}$		0.4	0.6	nC
Input Capacitance	C_{iss}	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V}$ $f = 1\text{ MHz}$		30		pF
Output Capacitance	C_{oss}			6		
Reverse Transfer Capacitance	C_{rss}			2.5		
Switching ^{a, b, c}						
Turn-On Time	$t_{d(on)}$	$V_{DD} = 30\text{ V}, R_L = 150\text{ }\Omega$			25	ns
Turn-Off Time	$t_{d(off)}$	$I_D \cong 200\text{ mA}, V_{GEN} = 10\text{ V}, R_G = 10\text{ }\Omega$			35	

Notes:

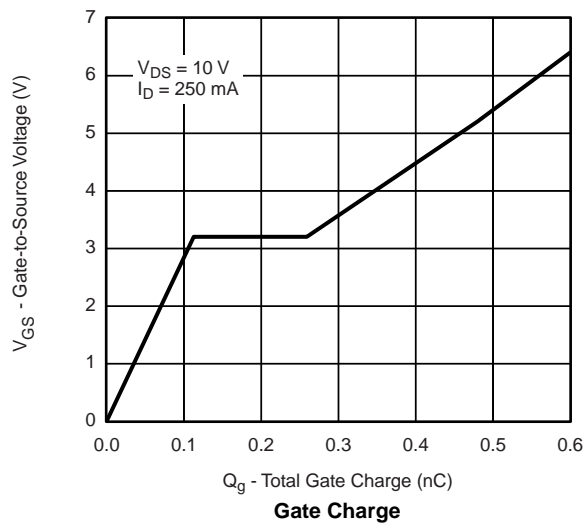
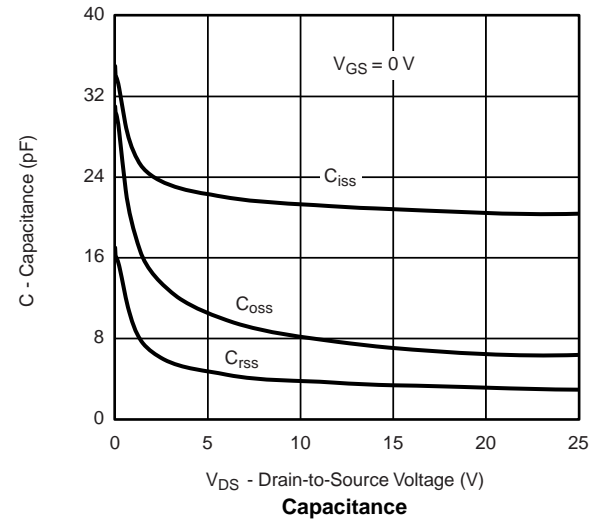
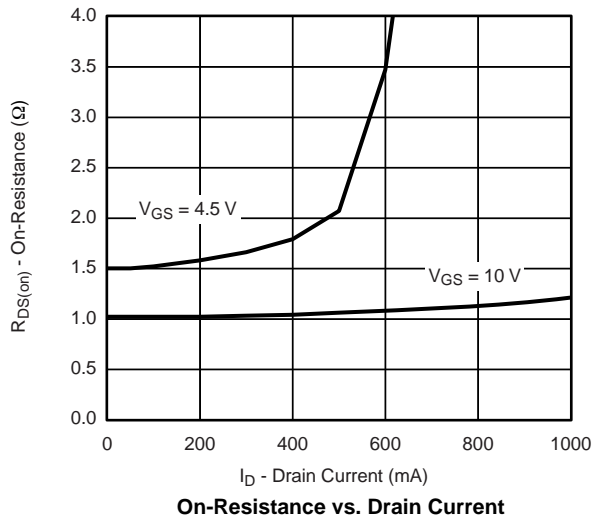
a. For DESIGN AID ONLY, not subject to production testing.

b. Pulse test: $PW \leq 300\text{ }\mu\text{s}$ duty cycle $\leq 2\%$.

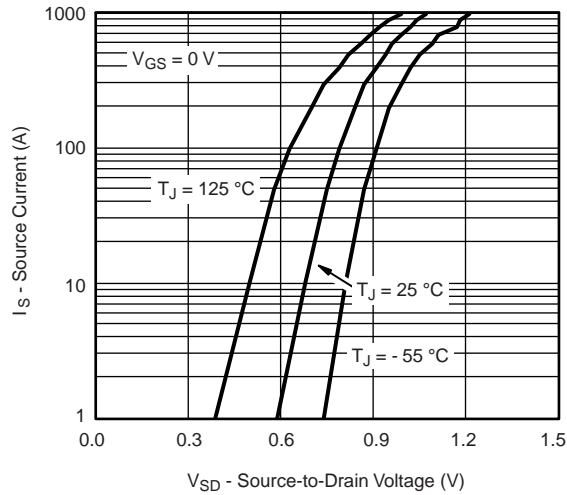
c. Switching time is essentially independent of operating temperature.

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

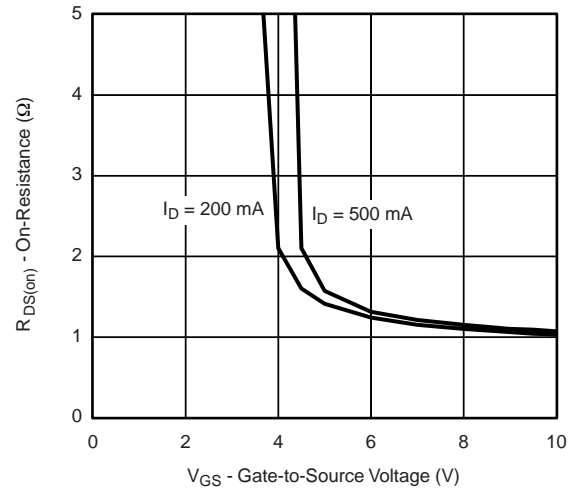
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



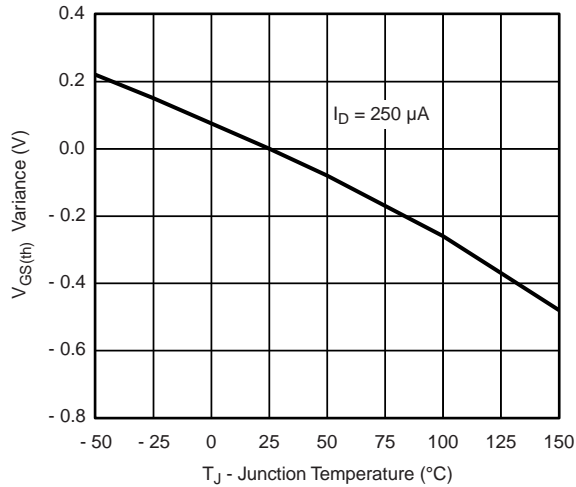
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



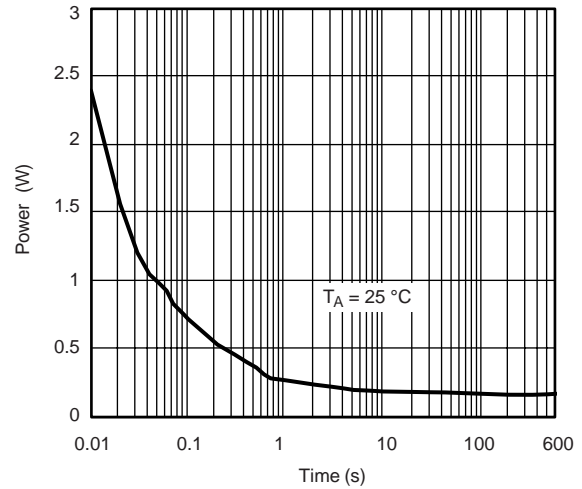
Source-Drain Diode Forward Voltage



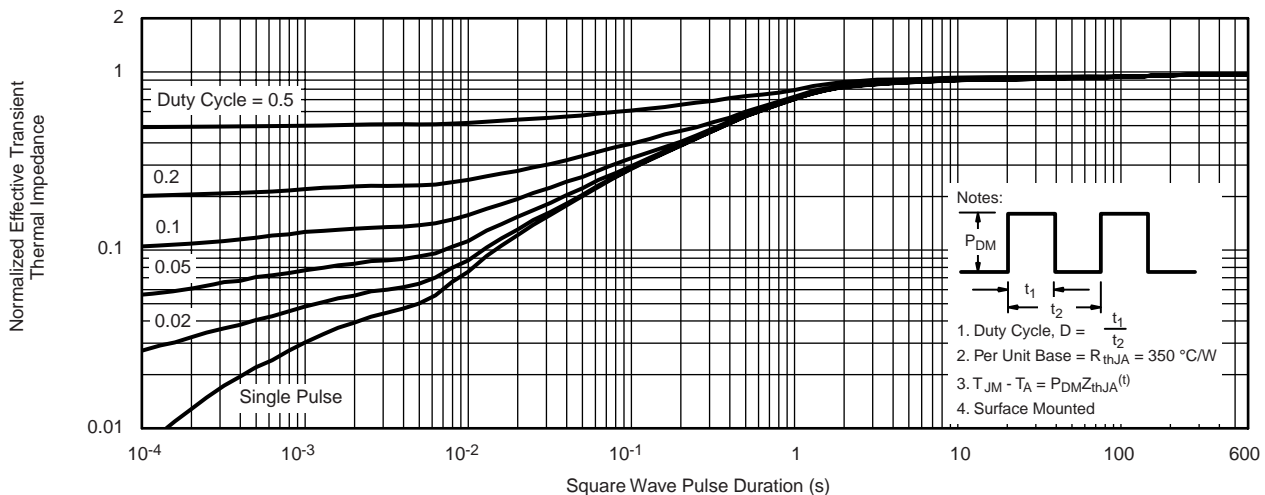
On-Resistance vs. Gate-Source Voltage



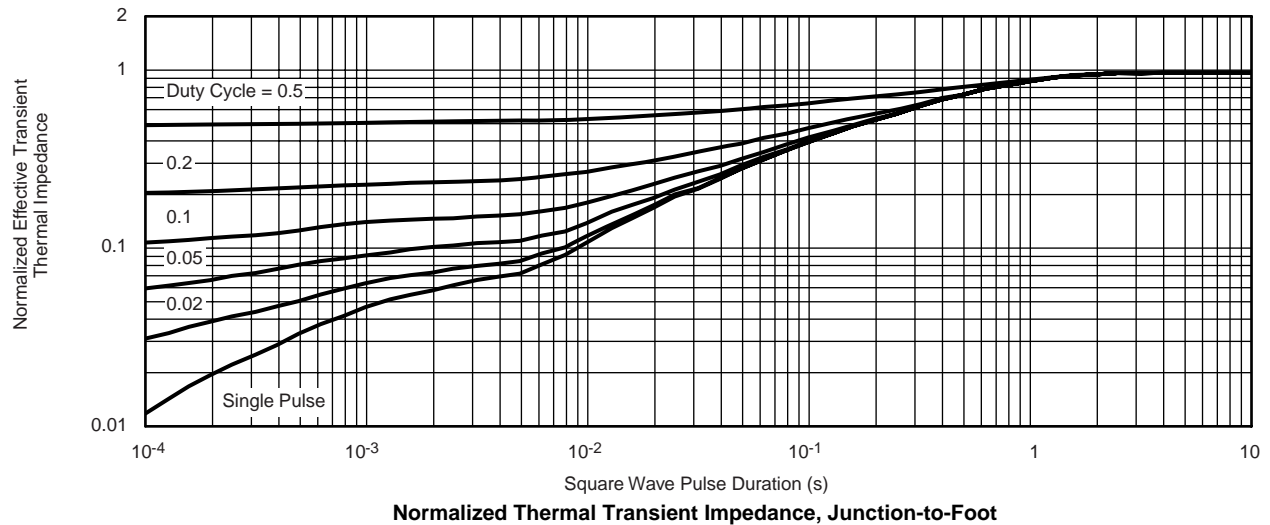
Threshold Voltage Variance Over Temperature



Single Pulse Power, Junction-to-Ambient

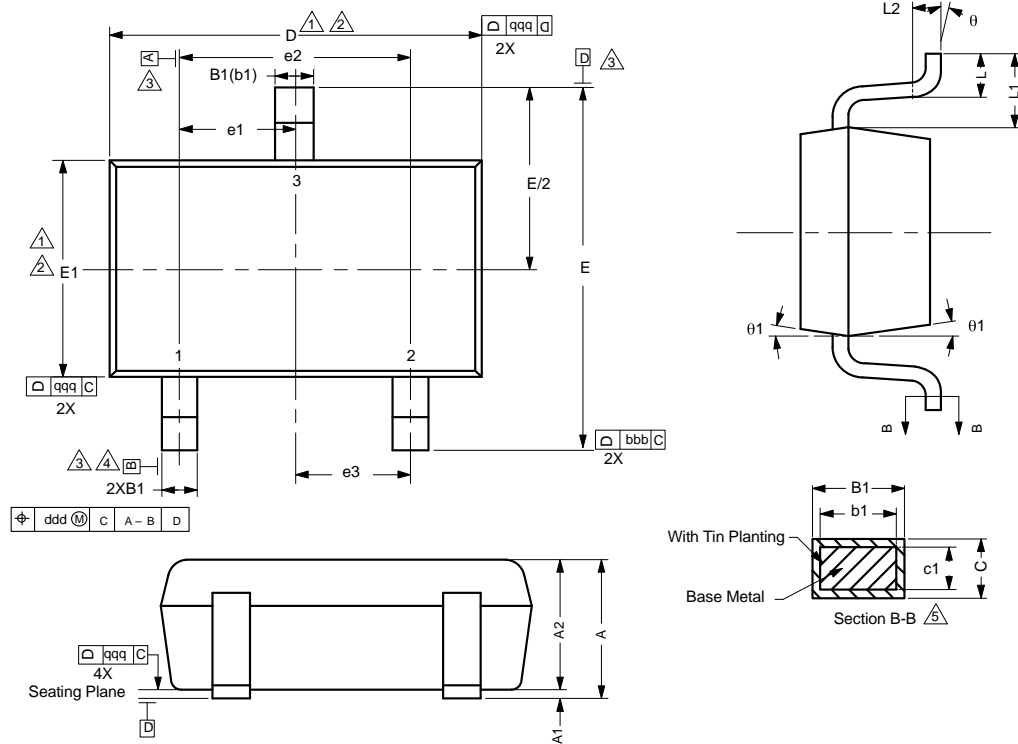


Normalized Thermal Transient Impedance, Junction-to-Ambient

THERMAL RATINGS ($T_A = 25\text{ }^{\circ}\text{C}$, unless otherwise noted)

Note

- The characteristics shown in the two graphs
 - Normalized Transient Thermal Impedance Junction-to-Ambient ($25\text{ }^{\circ}\text{C}$)
 - Normalized Transient Thermal Impedance Junction-to-Foot ($25\text{ }^{\circ}\text{C}$)
 are given for general guidelines only to enable the user to get a "ball park" indication of part capabilities. The data are extracted from single pulse transient thermal impedance characteristics which are developed from empirical measurements. The latter is valid for the part mounted on printed circuit board - FR4, size 1" x 1" x 0.062", double sided with 2 oz. copper, 100 % on both sides. The part capabilities can widely vary depending on actual application parameters and operating conditions.

SC-75A: 3 Leads



Notes

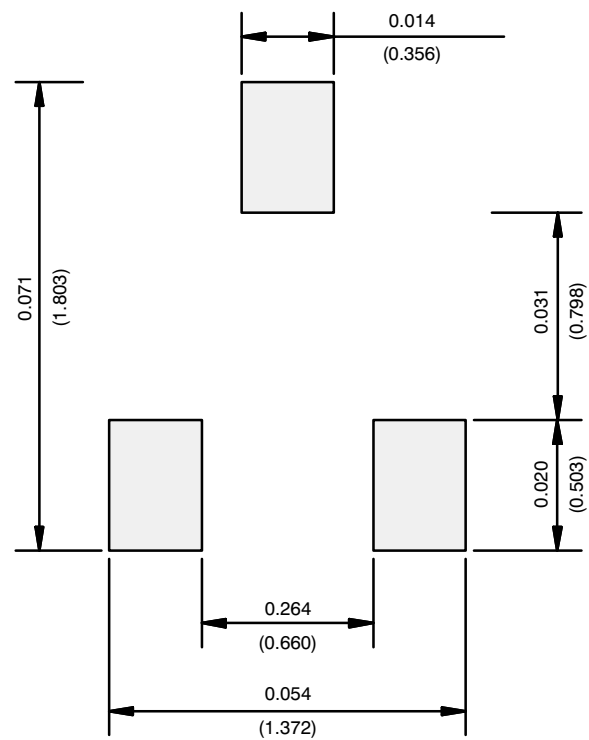
Dimensions in millimeters will govern.

1. Dimension D does not include mold flash, protrusions or gate burrs. Mold flash protrusions or gate burrs shall not exceed 0.10 mm per end. Dimension E1 does not include Interlead flash or protrusion. Interlead flash or protrusion shall not exceed 0.10 mm per side.
2. Dimensions D and E1 are determined at the outmost extremes of the plastic body exclusive of mold flash, tie bar burrs, gate burrs and interlead flash, but including any mismatch between the top and bottom of the plastic body.
3. Datums A, B and D to be determined 0.10 mm from the lead tip.
4. Terminal positions are shown for reference only.
5. These dimensions apply to the flat section of the lead between 0.08 mm and 0.15 mm from the lead tip.

DIMENSIONS	TOLERANCES
aaa	0.10
bbb	0.10
ccc	0.10
ddd	0.10

DIM.	MILLIMETERS			NOTE
	MIN.	NOM.	MAX.	
A	-	-	0.80	
A ₁	0.00	-	0.10	
A ₂	0.65	0.70	0.80	
B ₁	0.19	-	0.24	5
b ₁	0.17	-	0.21	
c	0.13	-	0.15	5
c ₁	0.10	-	0.12	5
D	1.48	1.575	1.68	1, 2
E	1.50	1.60	1.70	
E ₁	0.66	0.76	0.86	1, 2
e ₁	0.50 BSC			
e ₂	1.00 BSC			
e ₃	0.50 BSC			
L	0.15	0.205	0.30	
L ₁	0.40 ref.			
L ₂	0.15 BSC			
θ	0°	-	8°	
θ ₁	4°	-	10°	

RECOMMENDED MINIMUM PADS FOR SC-75A: 3-Lead



Recommended Minimum Pads
Dimensions in Inches/(mm)

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