FREE





N-Channel 60 V (D-S) MOSFET

PRODUCT SUMMARY				
V _{DS} (V)	$R_{DS(on)}$ (Ω)	I _D (mA)		
60	3 at V _{GS} = 10 V	240		

FEATURES Halogen-free According to IEC 61249-2-21 Definition

Low On-Resistance: 3 Ω
Low Threshold: 2 V (typ.)
Low Input Capacitance: 25 pF

Fast Switching Speed: 7.5 nsLow Input and Output Leakage

• Compliant to RoHS Directive 2002/95/EC

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

TO-236 (SOT-23)	
G 1 3 D	Marking Code: 7E
Top View	

Ordering Information: 2N7002E-T1-E3 (Lead (Pb)-free)

2N7002E-T1-GE3 (Lead (Pb)-free and Halogen-free)

ABSOLUTE MAXIMUM RATINGS (T _A = 25 °C, unless otherwise noted)					
Parameter		Symbol	Limit	Unit	
Drain-Source Voltage		V _{DS}	60		
Gate-Source Voltage		V _{GS}	± 20	V	
Continuous Drain Current (T _{.I} = 150 °C)	T _A = 25 °C	I _D	240	mA	
Continuous Diain Current (1) = 150 C)	T _A = 70 °C	סי	190		
Pulsed Drain Current ^a		I _{DM}	1300		
Power Dissipation	T _A = 25 °C	P _D	0.35	W	
Power Dissipation	T _A = 70 °C	' D	0.22	VV	
Thermal Resistance, Junction-to-Ambient		R _{thJA}	357	°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.

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			Limits				
Parameter	Symbol	Test Conditions	Min.	Typ. ^a	Max.	Unit	
Static							
Drain-Source Breakdown Voltage	V _{DS}	$V_{GS} = 0 \text{ V, } I_{D} = 10 \mu\text{A}$	60	68		V	
Gate-Threshold Voltage	V _{GS(th)}	$V_{DS} = V_{GS}, I_{D} = 250 \mu A$	1	2	2.5	V	
Gate-Body Leakage	I _{GSS}	$V_{DS} = 0 \text{ V}, V_{GS} = \pm 15 \text{ V}$			± 10	nA	
		V _{DS} = 60 V, V _{GS} = 0 V	1		1		
Zero Gate Voltage Drain Current	I _{DSS}	V_{DS} = 60 V, V_{GS} = 0 V , T_{J} = 125 °C			500	μA	
On-State Drain Current ^b		V _{GS} = 10 V, V _{DS} = 7.5 V	800	1300			
	I _{D(on)}	V _{GS} = 4.5 V, V _{DS} = 10 V	500	700		mA	
Drain-Source On-Resistance ^b	В	V _{GS} = 10 V, I _D = 250 mA		1.2	3		
	R _{DS(on)}	V _{GS} = 4.5 V, I _D = 200 mA		1.8	4	Ω	
Forward Transconductance ^b	9 _{fs}	V _{DS} = 15 V, I _D = 200 mA		600		mS	
Diode Forward Voltage	V _{SD}	I _S = 200 mA, V _{GS} = 0 V		0.85	1.2	V	
Dynamic ^a			•		•		
Total Gate Charge	Q _g	V 40 V V 45 V		0.4	0.6	nC	
Gate-Source Charge	Q _{gs}	$V_{DS} = 10 \text{ V}, V_{GS} = 4.5 \text{ V}$ $I_{D} \cong 250 \text{ mA}$		0.06			
Gate-Drain Charge	Q _{gd}			0.06			
Input Capacitance	C _{iss}			21		pF	
Output Capacitance	C _{oss}	$V_{DS} = 5 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$		7			
Reverse Transfer Capacitance	C _{rss}			2.5			
Switching ^{a, c}				•			
Turn-On Time	t _{d(on)}	V_{DD} = 10 V, R_L = 40 Ω		13	20	ns	
Turn-Off Time	t _{d(off)}	$I_D \cong 250 \text{ mA}, V_{GEN} = 10 \text{ V}, R_g = 10 \Omega$		18	25		

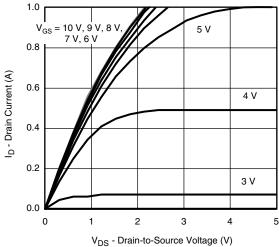
Notes:

- a. For DESIGN AID ONLY, not subject to production testing.
- b. Pulse test: pulse width \leq 300 μ s duty cycle \leq 2 %.
- c. Switching time is essentially independent of operating temperature.

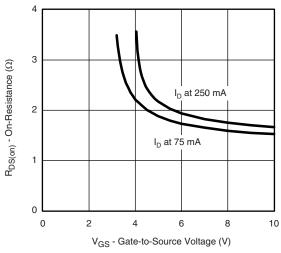
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



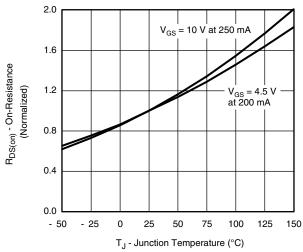
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



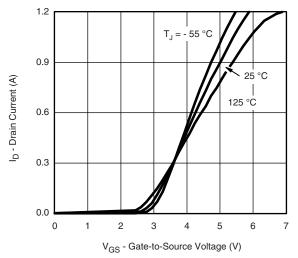




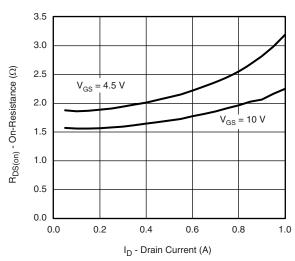
On-Resistance vs. Gate-Source Voltage



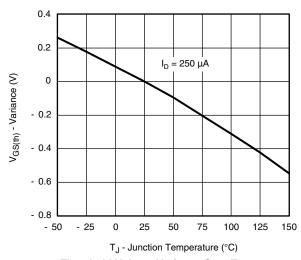
On-Resistance vs. Junction Temperature



Transfer Characteristics



On-Resistance vs. Drain Current

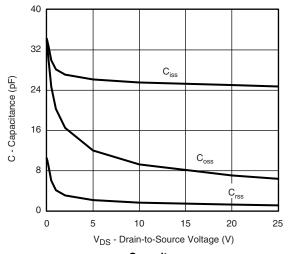


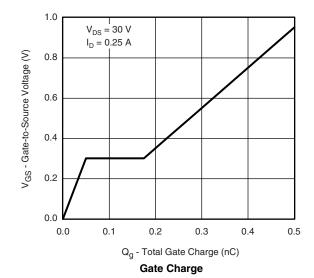
Threshold Voltage Variance Over Temperature

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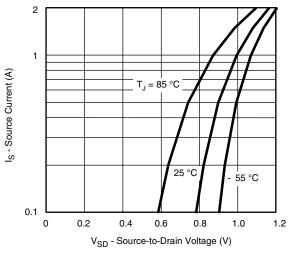
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TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)









Source-Drain Diode Forward Voltage

Vishay Siliconix maintains worldwide manufacturing capability. Products may be manufactured at one of several qualified locations. Reliability data for Silicon Technology and Package Reliability represent a composite of all qualified locations. For related documents such as package/tape drawings, part marking, and reliability data, see www.vishay.com/ppg270860.

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SOT-23 (TO-236): 3-LEAD







Dim	MILLIMETERS		INCHES		
	Min	Max	Min	Max	
Α	0.89	1.12	0.035	0.044	
A ₁	0.01	0.10	0.0004	0.004	
A ₂	0.88	1.02	0.0346	0.040	
b	0.35	0.50	0.014	0.020	
С	0.085	0.18	0.003	0.007	
D	2.80	3.04	0.110	0.120	
E	2.10	2.64	0.083	0.104	
E ₁	1.20	1.40	0.047	0.055	
е	0.95 BSC		0.0374 Ref		
e ₁	1.90 BSC		0.0748 Ref		
L	0.40	0.60	0.016	0.024	
L ₁	0.64 Ref		0.025 Ref		
S	0.50 Ref		0.020 Ref		
q	3°	8°	3°	8°	
FCN: S-03946-Rev K 09-	lul-01	•			

ECN: S-03946-Rev. K, 09-Jul-01

DWG: 5479

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RECOMMENDED MINIMUM PADS FOR SOT-23



Recommended Minimum Pads Dimensions in Inches/(mm)

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APPLICATION NOTE



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