N-Channel 60-V (D-S) MOSFET

PRODUCT SUMMARY		
V_{DS} (V)	$r_{DS(on)}$ (Ω)	I_D (mA)
60	3 @ V_{GS} = 10 V	240

FEATURES

- Low On-Resistance: 3 Ω
- Low Threshold: 2 V (typ)
- Low Input Capacitance: 25 pF
- Fast Switching Speed: 7.5 ns
- Low Input and Output Leakage

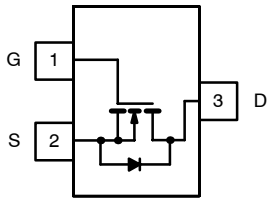
BENEFITS

- 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)



Top View

Ordering Information: 2N7002E-T1

Marking Code: 7E*wl*

E = Part Number Code for 2N7002E
w = Week Code
l = Lot Traceability

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)	T_A = 25°C	I_D	240	mA
	T_A = 70°C		190	
Pulsed Drain Current[a]		I_{DM}	1300	
Power Dissipation	T_A = 25°C	P_D	0.35	W
	T_A = 70°C		0.22	
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.

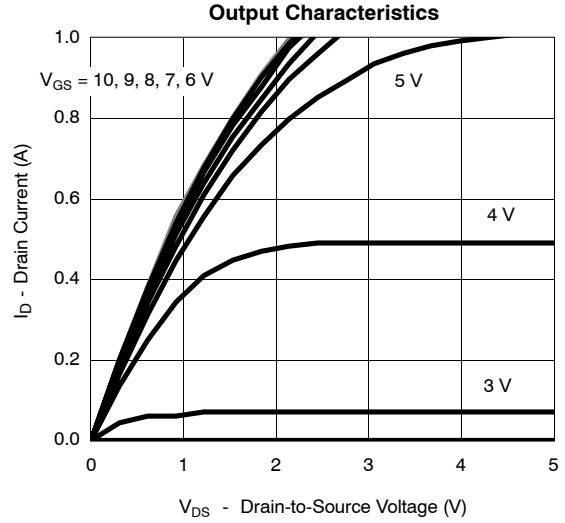
SPECIFICATIONS (T_J = 25°C UNLESS OTHERWISE NOTED)

Parameter	Symbol	Test Conditions	Limits			Unit
			Min	Typ[a]	Max	
Static						
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	V_{GS} = 0 V, I_D = 10 μA	60	68		V
Gate-Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 250 μA	1	2	2.5	
Gate-Body Leakage	I_{GSS}	V_{DS} = 0 V, V_{GS} = ±15 V			±10	nA
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 60 V, V_{GS} = 0 V			1	μA
		V_{DS} = 60 V, V_{GS} = 0 V, T_C = 125°C			500	
On-State Drain Current[b]	$I_{D(on)}$	V_{GS} = 10 V, V_{DS} = 7.5 V	800	1300		mA
		V_{GS} = 4.5 V, V_{DS} = 10 V	500	700		
Drain-Source On-Resistance[b]	$r_{DS(on)}$	V_{GS} = 10 V, I_D = 250 mA		1.2	3	Ω
		V_{GS} = 4.5 V, I_D = 200 mA		1.8	4	
Forward Transconductance[b]	g_{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_{DS} = 10 V, V_{GS} = 4.5 V I_D ≅ 250 mA		0.4	0.6	nC
Gate-Source Charge	Q_{gs}			0.06		
Gate-Drain Charge	Q_{gd}			0.06		
Input Capacitance	C_{iss}	V_{DS} = 5 V, V_{GS} = 0 V, f = 1 MHz		21		pF
Output Capacitance	C_{oss}			7		
Reverse Transfer Capacitance	C_{rss}			2.5		
Switching[a, c]						
Turn-On Time	t_{on}	V_{DD} = 10 V, R_L = 40 Ω I_D ≅ 250 mA, V_{GEN} = 10V R_G = 10 Ω		13	20	ns
Turn-Off Time	t_{off}			18	25	

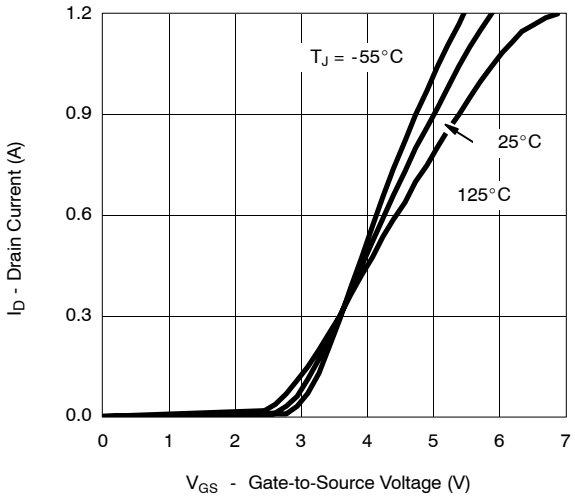
Notes
a. For DESIGN AID ONLY, not subject to production testing.
b. Pulse test: PW ≤300 μs duty cycle ≤2%.
c. Switching time is essentially independent of operating temperature.

TYPICAL CHARACTERISTICS (T_A = 25°C UNLESS OTHERWISE NOTED)

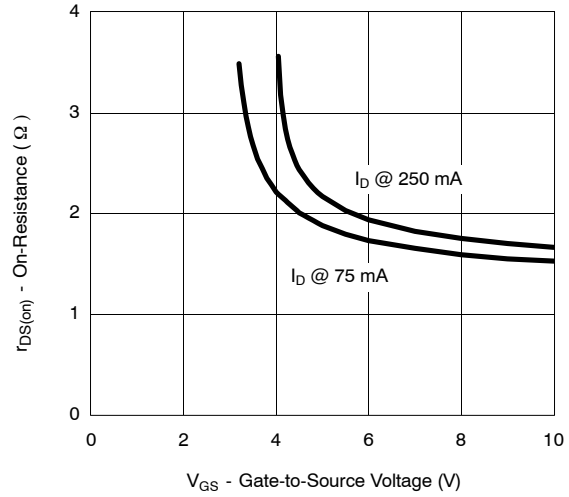
Output Characteristics



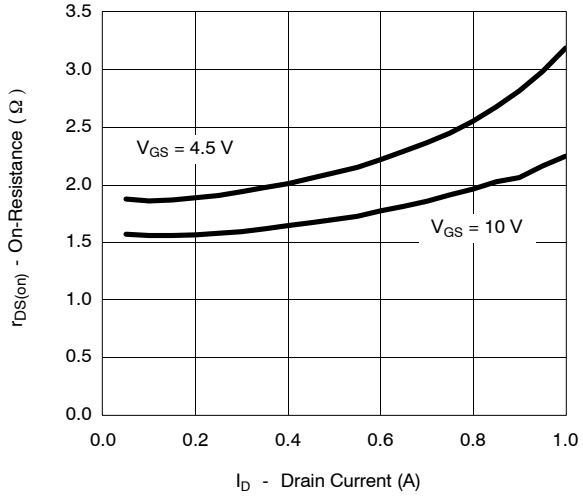
Transfer Characteristics



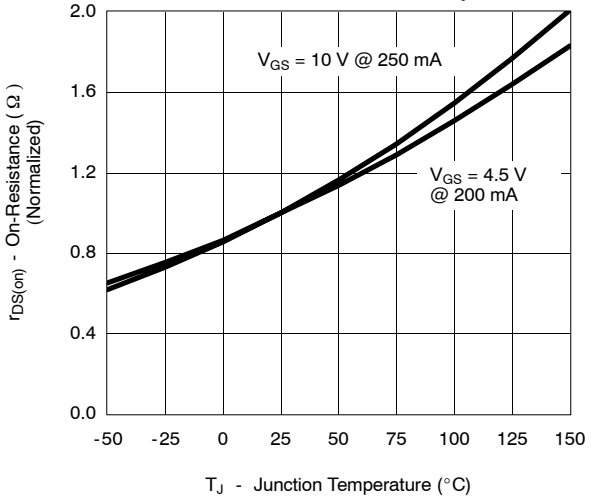
On-Resistance vs. Gate-Source Voltage



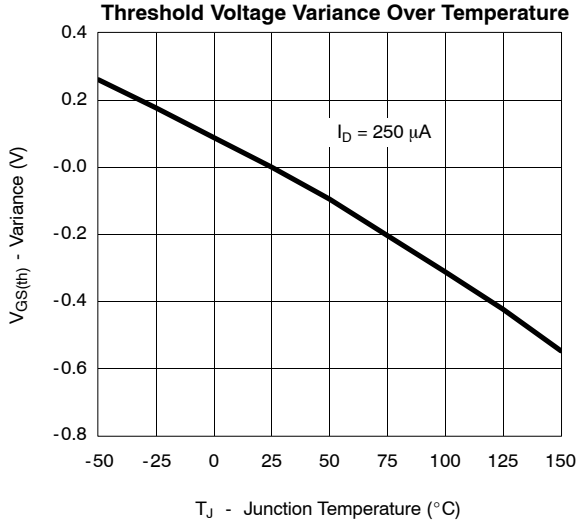
On-Resistance vs. Drain Current



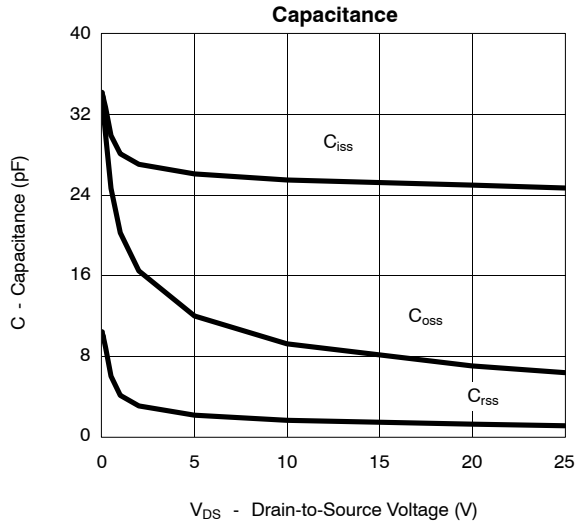
On-Resistance vs. Junction Temperature

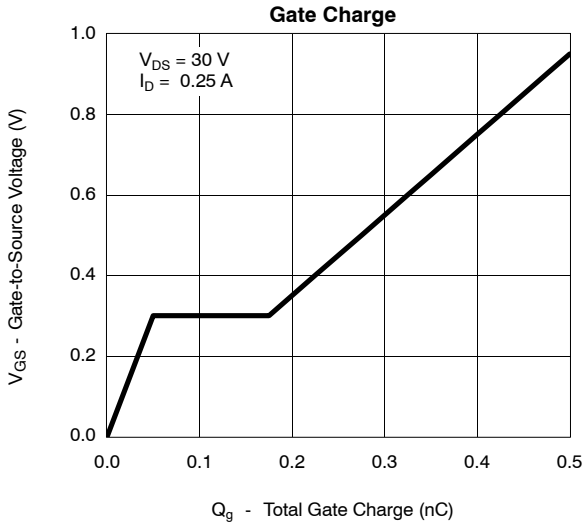


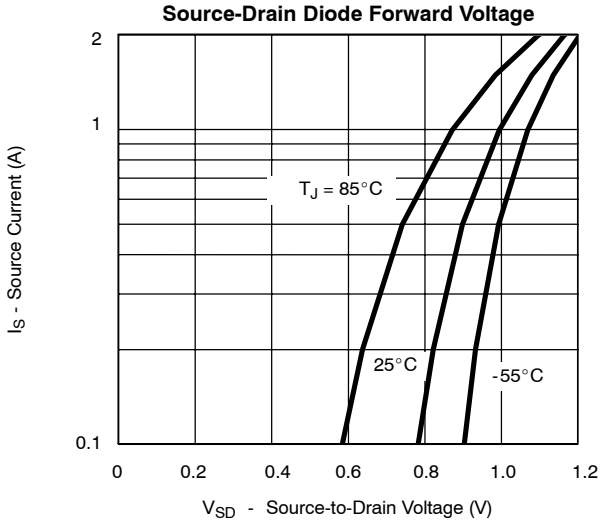
Threshold Voltage Variance Over Temperature



TYPICAL CHARACTERISTICS (T_A = 25°C UNLESS OTHERWISE NOTED)







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