

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

PRODUCT SUMMARY		
$V_{DS}$ (V)	$R_{DS(on)}$ ( $\Omega$ )	$I_D$ (mA)
60	2 at $V_{GS} = 10$ V	300

### FEATURES

- Low On-Resistance:  $2 \Omega$
- Low Threshold: 2 V (typ.)
- Low Input Capacitance: 25 pF
- Fast Switching Speed: 25 ns
- Low Input and Output Leakage
- TrenchFET<sup>®</sup> Power MOSFET
- 2000 V ESD Protection



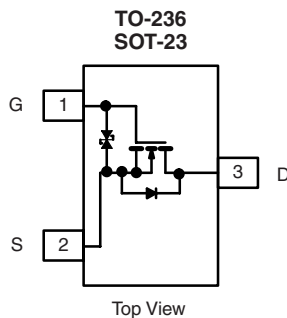
Available  
**RoHS\***  
COMPLIANT

### 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



2N7002K (7K)\*  
\* Marking Code

Ordering Information: 2N7002K-T1  
2N7002K-T1-E3 (Lead (Pb)-free)

ABSOLUTE MAXIMUM RATINGS $T_A = 25 \text{ }^\circ\text{C}$ , unless otherwise noted				
Parameter		Symbol	Limit	Unit
Drain-Source Voltage		$V_{DS}$	60	V
Gate-Source Voltage		$V_{GS}$	$\pm 20$	
Continuous Drain Current ( $T_J = 150 \text{ }^\circ\text{C}$ ) <sup>b</sup>	$T_A = 25 \text{ }^\circ\text{C}$	$I_D$	300	mA
	$T_A = 100 \text{ }^\circ\text{C}$		190	
Pulsed Drain Current <sup>a</sup>		$I_{DM}$	800	
Power Dissipation <sup>b</sup>	$T_A = 25 \text{ }^\circ\text{C}$	$P_D$	0.35	W
	$T_A = 100 \text{ }^\circ\text{C}$		0.14	
Maximum Junction-to-Ambient <sup>b</sup>		$R_{thJA}$	350	$^\circ\text{C/W}$
Operating Junction and Storage Temperature Range		$T_J, T_{stg}$	- 55 to 150	$^\circ\text{C}$

Notes:

- a. Pulse width limited by maximum junction temperature.  
b. Surface Mounted on FR4 board.

\* Pb containing terminations are not RoHS compliant, exemptions may apply.

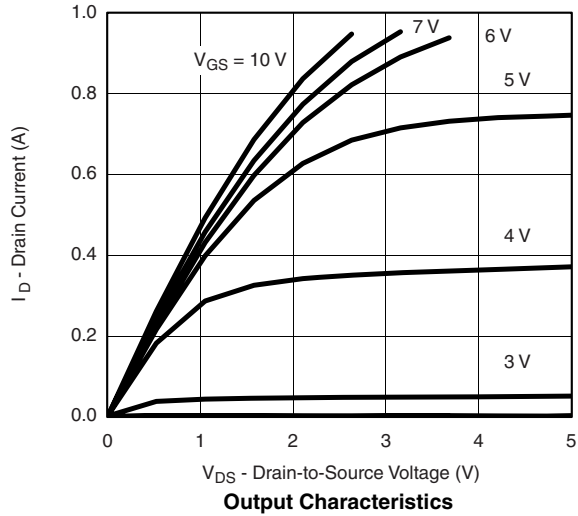
<b>SPECIFICATIONS</b> $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted						
Parameter	Symbol	Test Conditions	Limits			Unit
			Min.	Typ. <sup>a</sup>	Max.	
<b>Static</b>						
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{GS} = 0\text{ V}, I_D = 10\text{ }\mu\text{A}$	60			V
Gate-Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	1		2.5	
Gate-Body Leakage	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$			$\pm 10$	$\mu\text{A}$
		$V_{DS} = 0\text{ V}, V_{GS} = \pm 15\text{ V}$			1	
		$V_{DS} = 0\text{ V}, V_{GS} = \pm 10\text{ V}$			$\pm 150$	nA
		$V_{DS} = 0\text{ V}, V_{GS} = \pm 10\text{ V}, T_J = 85\text{ }^\circ\text{C}$			$\pm 1000$	
		$V_{DS} = 0\text{ V}, V_{GS} = \pm 5\text{ V}$			$\pm 100$	
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 50\text{ V}, V_{GS} = 0\text{ V}$			10	$\mu\text{A}$
		$V_{DS} = 50\text{ V}, V_{GS} = 0\text{ V}, T_J = 85\text{ }^\circ\text{C}$			100	
		$V_{DS} = 60\text{ V}, V_{GS} = 0\text{ V}$			1	$\mu\text{A}$
		$V_{DS} = 60\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$			500	
On-State Drain Current <sup>a</sup>	$I_{D(on)}$	$V_{GS} = 10\text{ V}, V_{DS} = 7.5\text{ V}$	800			mA
		$V_{GS} = 4.5\text{ V}, V_{DS} = 10\text{ V}$	500			
Drain-Source On-Resistance <sup>a</sup>	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 500\text{ mA}$			2	$\Omega$
		$V_{GS} = 4.5\text{ V}, I_D = 200\text{ mA}$			4	
Forward Transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = 10\text{ V}, I_D = 200\text{ mA}$	100			mS
Diode Forward Voltage	$V_{SD}$	$I_S = 200\text{ mA}, V_{GS} = 0\text{ V}$			1.3	V
<b>Dynamic<sup>a</sup></b>						
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		
<b>Switching<sup>a, b, c</sup></b>						
Turn-On Time	$t_{d(on)}$	$V_{DD} = 30\text{ V}, R_L = 150\text{ }\Omega$ $I_D \cong 200\text{ mA}, V_{GEN} = 10\text{ V}, R_G = 10\text{ }\Omega$			25	ns
Turn-Off Time	$t_{d(off)}$				35	

## Notes:

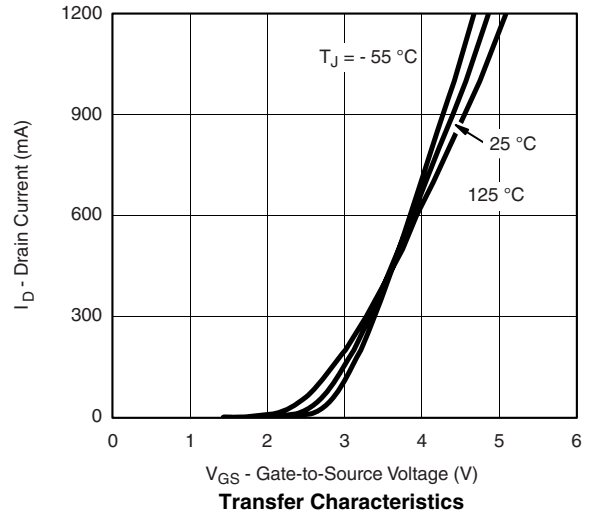
- a. For DESIGN AID ONLY, not subject to production testing.  
b. Pulse test:  $PW \leq 300\text{ }\mu\text{s}$  duty cycle  $\leq 2\%$ .  
c. Switching time is essentially independent of operating temperature.

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.

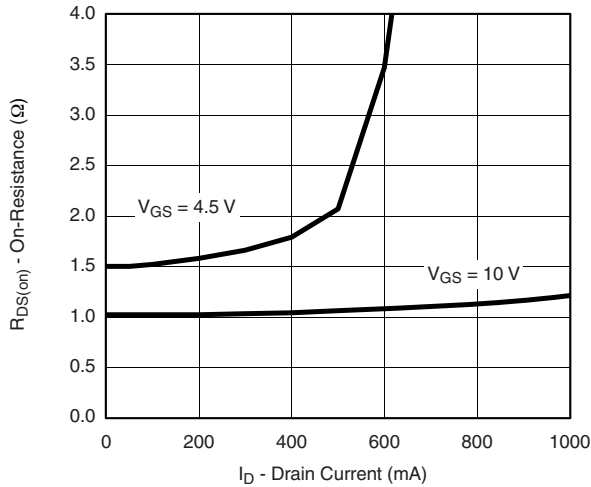
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



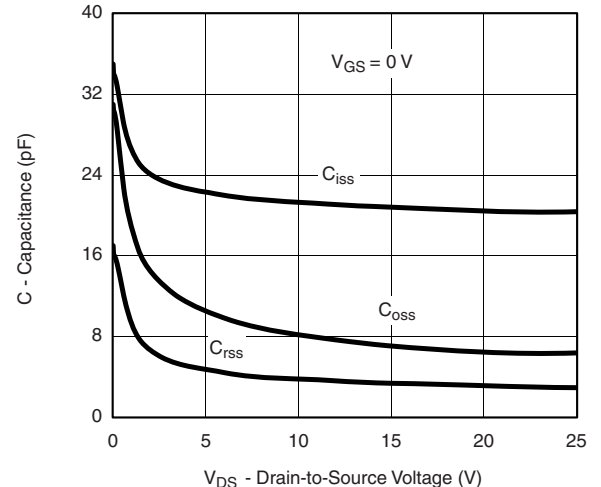
**Output Characteristics**



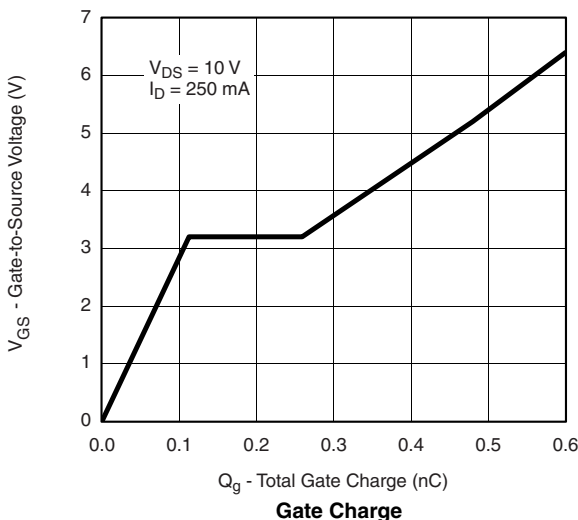
**Transfer Characteristics**



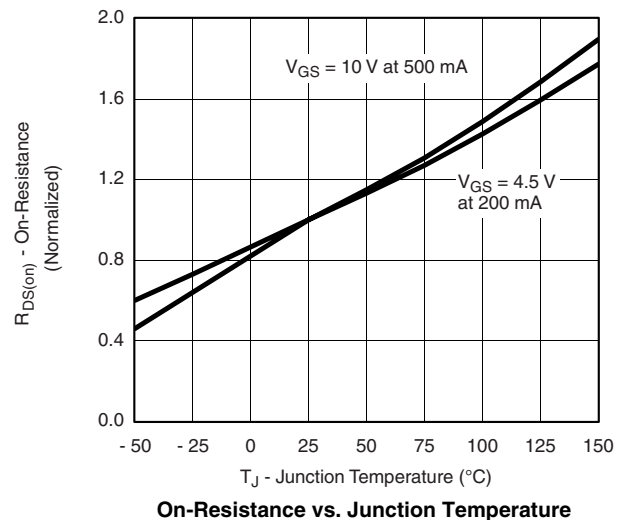
**On-Resistance vs. Drain Current**



**Capacitance**

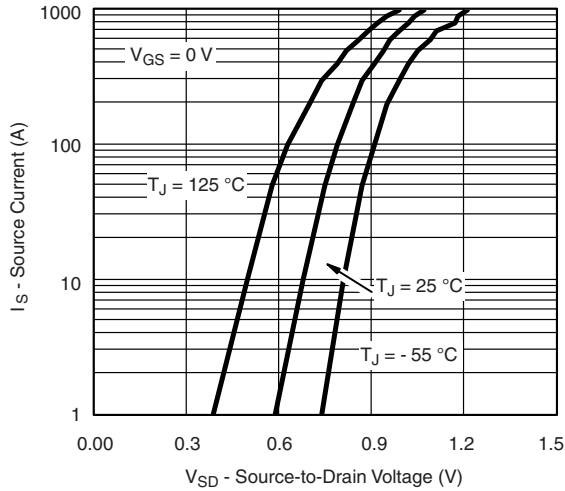


**Gate Charge**

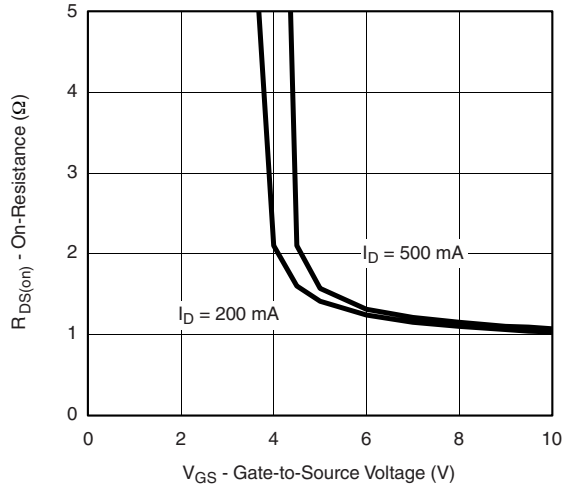


**On-Resistance vs. Junction Temperature**

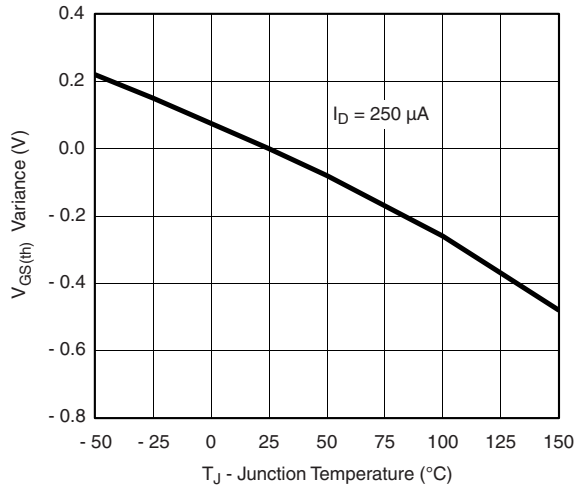
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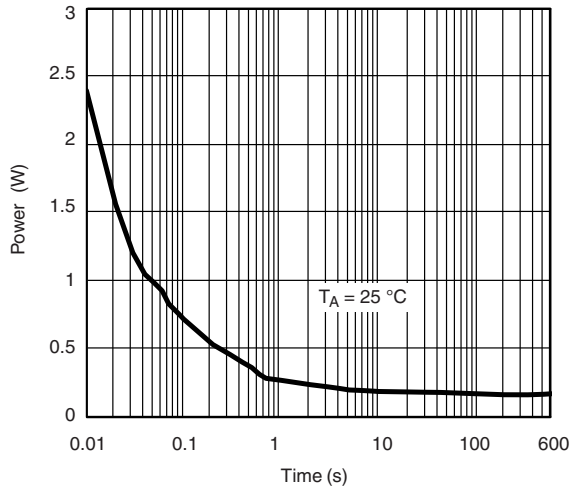
Source-Drain Diode Forward Voltage



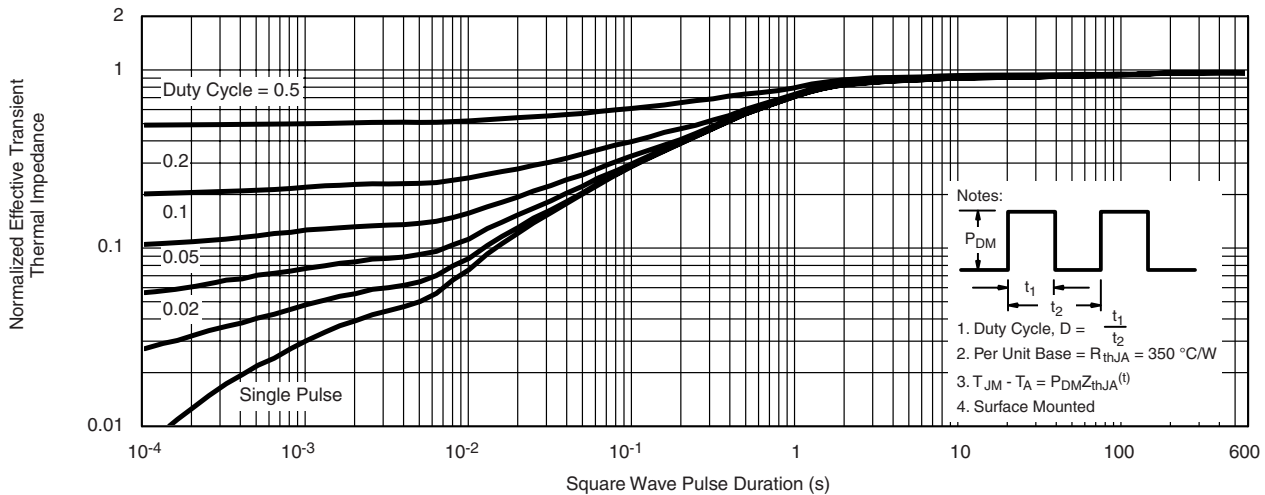
On-Resistance vs. Gate-Source Voltage



Threshold Voltage Variance Over Temperature



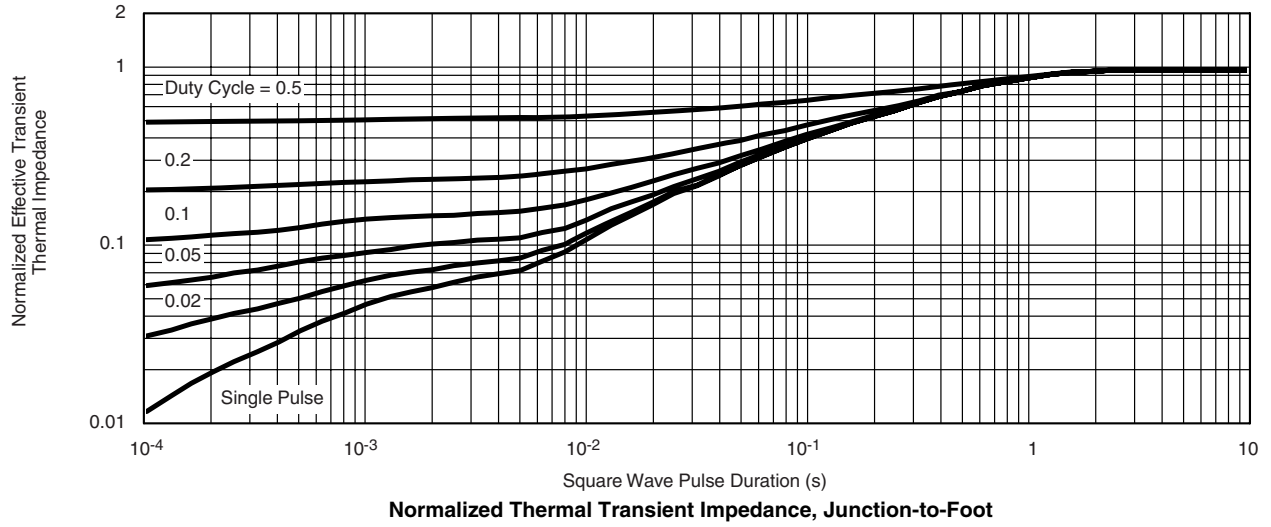
Single Pulse Power, Junction-to-Ambient



Normalized Thermal Transient Impedance, Junction-to-Ambient



**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



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