

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

PRODUCT SUMMARY			
V_{DS} (V)	$r_{DS(on)}$ (Ω)	$V_{GS(th)}$ (V)	I_D (A)
60	2 at $V_{GS} = 10$ V	1.0 to 2.5	0.47
	4 at $V_{GS} = 4.5$ V		0.33

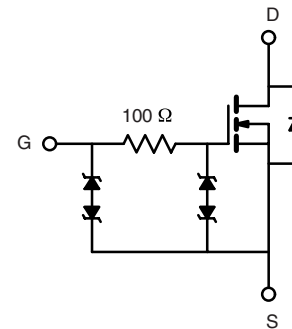
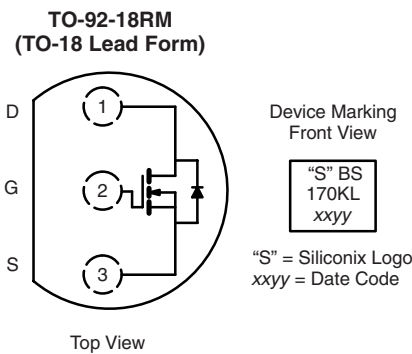
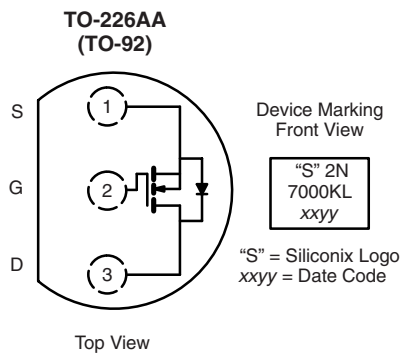
FEATURES

- TrenchFET[®] Power MOSFET
- ESD Protected: 2000 V


 Available
RoHS*
 COMPLIANT

APPLICATIONS

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



Ordering Information: 2N7000KL-TR1
 2N7000KL-TR1-E3 (Lead (Pb)-free)

Ordering Information: BS170KL-TR1
 BS170KL-TR1-E3 (Lead (Pb)-free)

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	I_D	$T_A = 25$ °C	0.47
		$T_A = 70$ °C	0.37
Pulsed Drain Current ^a	I_{DM}	1.0	A
Power Dissipation	P_D	$T_A = 25$ °C	0.8
		$T_A = 70$ °C	0.51
Maximum Junction-to-Ambient	R_{thJA}	158	°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.

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

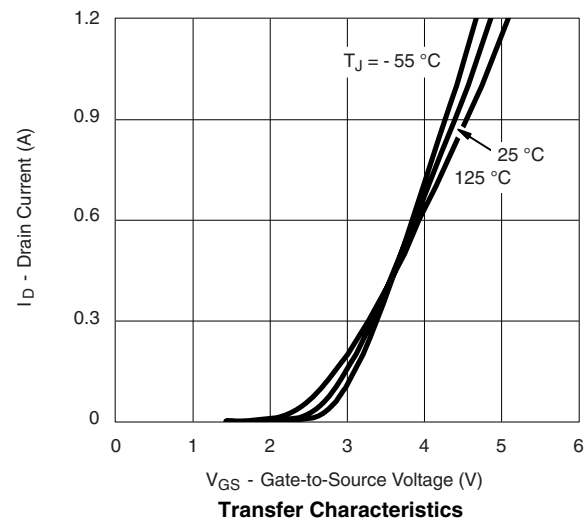
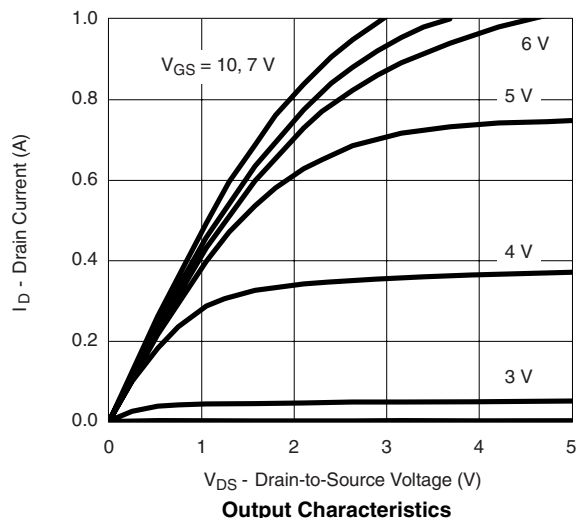
SPECIFICATIONS $T_A = 25\text{ }^\circ\text{C}$, unless otherwise noted						
Parameter	Symbol	Test Conditions	Limits			Unit
			Min	Typ	Max	
Static						
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 10\text{ }\mu\text{A}$	60			V
Gate-Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	1	2.0	2.5	
Gate-Body Leakage	I_{GSS}	$V_{DS} = 0\text{ V}, V_{GS} = \pm 10\text{ V}$			± 1	μA
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 60\text{ V}, V_{GS} = 0\text{ V}$ $V_{DS} = 60\text{ V}, V_{GS} = 0\text{ V}, T_J = 55\text{ }^\circ\text{C}$			1 10	
On-State Drain Current ^b	$I_{D(on)}$	$V_{GS} = 10\text{ V}, V_{DS} = 7.5\text{ V}$ $V_{GS} = 4.5\text{ V}, V_{DS} = 10\text{ V}$	0.8 0.5			A
Drain-Source On-Resistance ^b	$r_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 0.5\text{ A}$ $V_{GS} = 4.5\text{ V}, I_D = 0.2\text{ A}$		1.1 1.6	2 4	
Forward Transconductance ^b	g_{fs}	$V_{DS} = 10\text{ V}, I_D = 0.5\text{ A}$		550		ms
Diode Forward Voltage	V_{SD}	$I_S = 0.3\text{ A}, V_{GS} = 0\text{ V}$		0.87	1.3	V
Dynamic^b						
Total Gate Charge	Q_g	$V_{DS} = 10\text{ V}, V_{GS} = 4.5\text{ V}$ $I_D \cong 0.25\text{ A}$		0.4	0.6	nC
Gate-Source Charge	Q_{gs}			0.11		
Gate-Drain Charge	Q_{gd}			0.15		pF
Gate Resistance	R_g		173			
Turn-On Time	$t_{d(on)}$	$V_{DD} = 30\text{ V}, R_L = 150\text{ }\Omega$ $I_D \cong 0.2\text{ A}, V_{GEN} = 10\text{ V}, R_G = 10\text{ }\Omega$		3.8	10	ns
	t_r			4.8	15	
Turn-Off Time	$t_{d(off)}$			12.8	20	
	t_f			9.6	15	

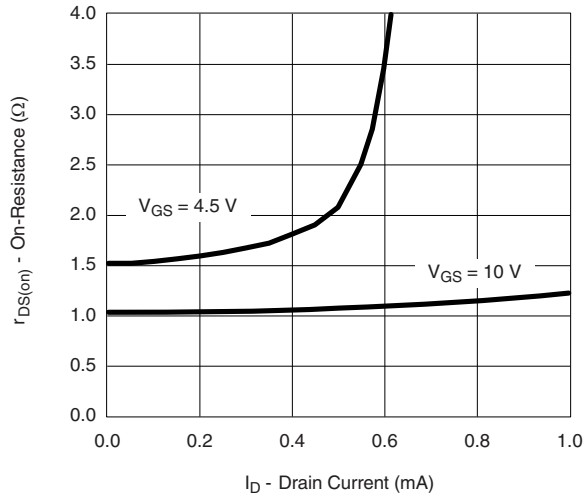
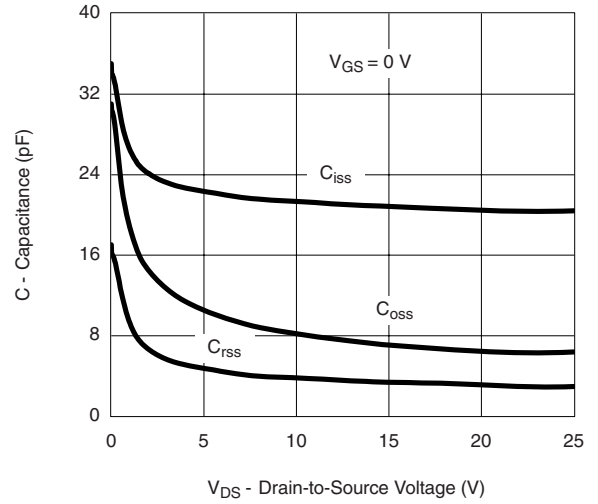
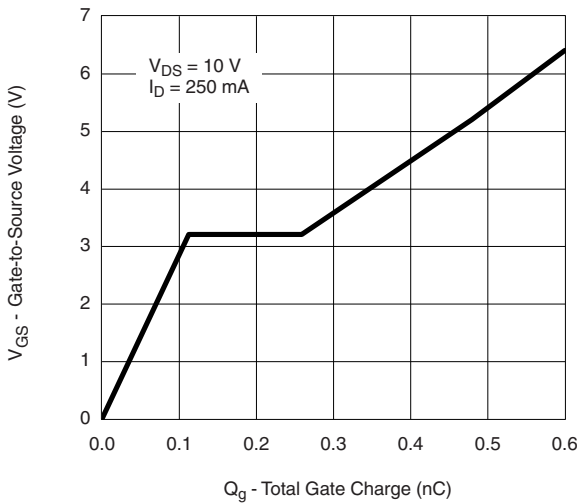
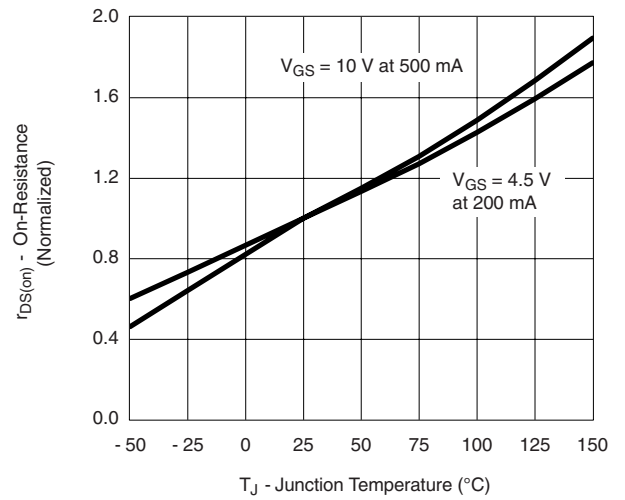
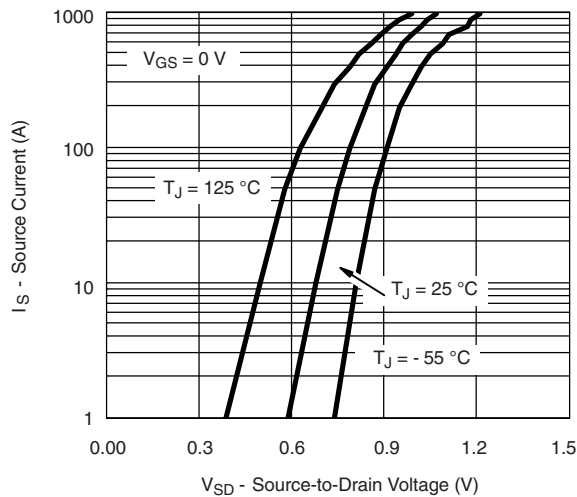
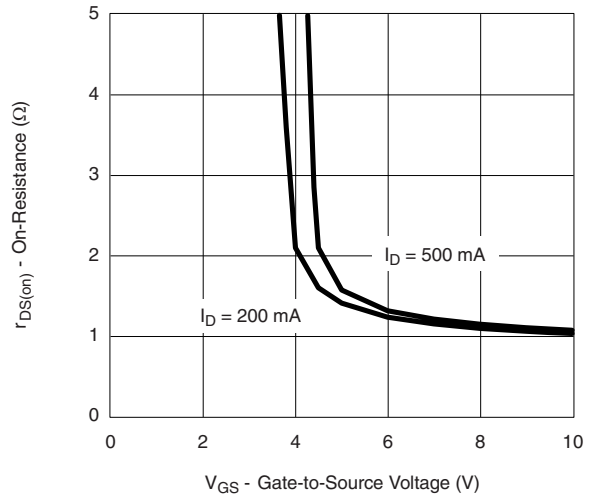
Notes:

- Pulse test: $PW \leq 300\text{ }\mu\text{s}$ duty cycle $\leq 2\%$.
- Guaranteed by design, not subject to production testing.

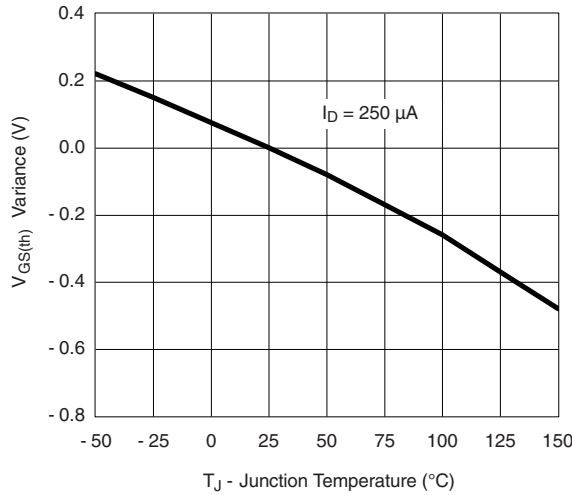
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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

TYPICAL CHARACTERISTICS $25\text{ }^\circ\text{C}$, unless otherwise noted

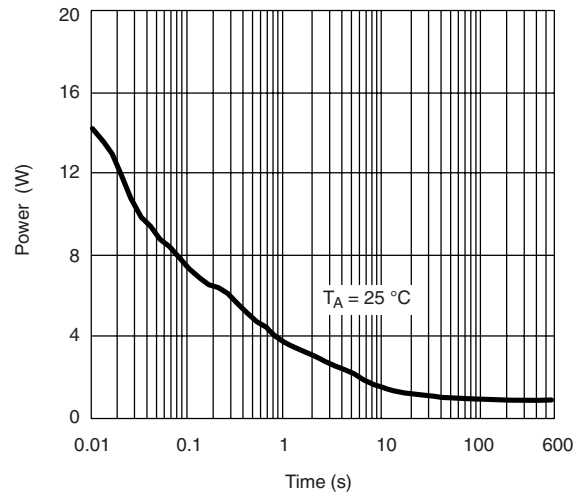


TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

On-Resistance vs. Drain Current

Capacitance

Gate Charge

On-Resistance vs. Junction Temperature

Source-Drain Diode Forward Voltage

On-Resistance vs. Gate-Source Voltage

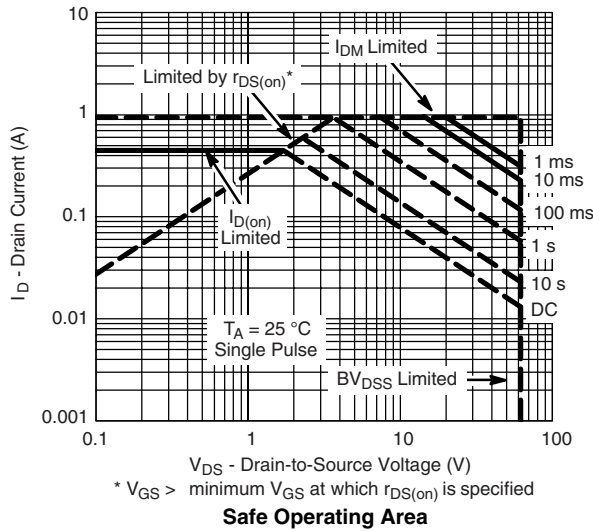
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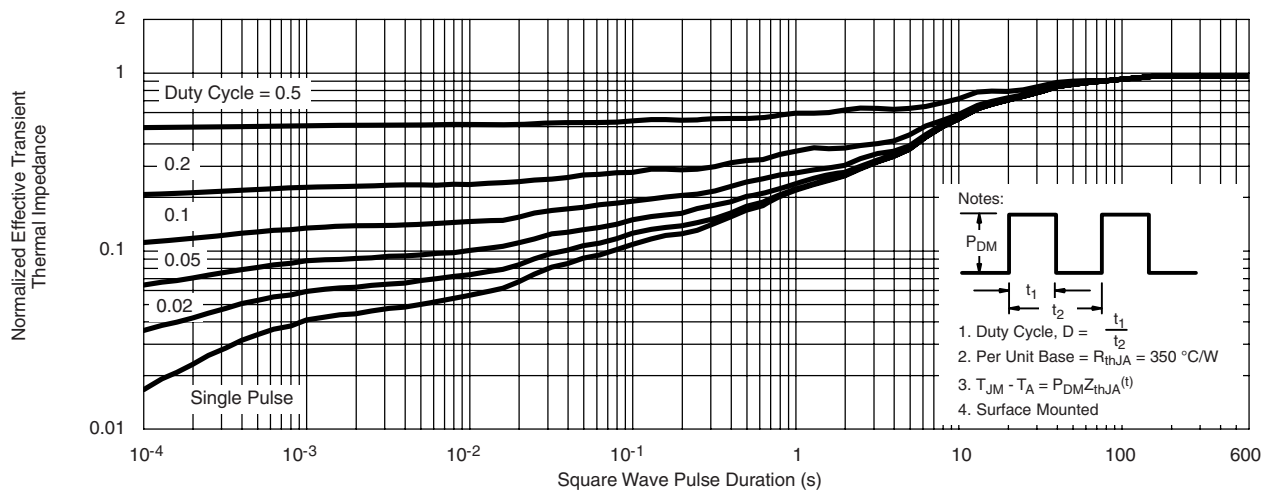
Threshold Voltage Variance Over Temperature



Single Pulse Power, Junction-to-Ambient



Safe Operating Area



Normalized Thermal Transient Impedance, Junction-to-Ambient

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