

N-Channel 40-V (D-S) MOSFET with Sensing Diode

PRODUCT SUMMARY

$V_{(BR)DSS}$ (V)	$r_{DS(on)}$ (Ω)	I_D (A)
40	0.0055 at $V_{GS} = 10$ V	60 ^a

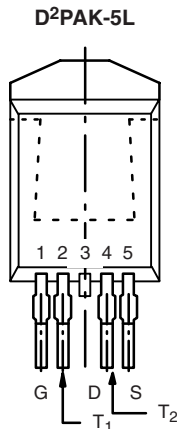
FEATURES

- TrenchFET[®] Power MOSFETS Plus Temperature Sensing Diode
- 175 °C Junction Temperature
- New Low Thermal Resistance Package

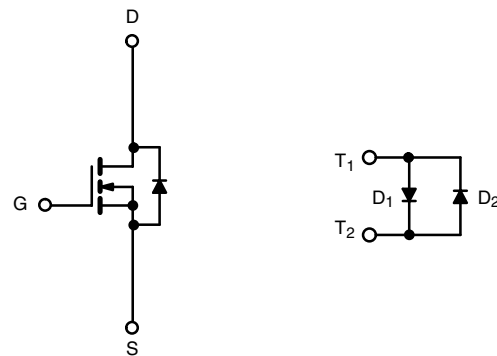

 Available
RoHS*
 COMPLIANT

APPLICATIONS

- Industrial



Ordering Information: SUM60N04-06T-E3 (Lead (Pb)-free)



N-Channel MOSFET

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

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	V_{DS}	40	V
Gate-Source Voltage	V_{GS}	± 20	
Continuous Drain Current ($T_J = 175$ °C) ^d	I_D	$T_C = 25$ °C	60 ^a
		$T_C = 100$ °C	60 ^a
Pulsed Drain Current	I_{DM}	250	A
Continuous Diode Current (Diode Conduction) ^d	I_S	60 ^a	
Avalanche Current	I_{AR}	60 ^a	
Repetitive Avalanche Energy ^b	E_{AR}	180	mJ
Maximum Power Dissipation ^a	P_D	$T_C = 25$ °C	200 ^c
		$T_A = 25$ °C	3.75 ^d
Operating Junction and Storage Temperature Range	T_J, T_{stg}	- 55 to 175	°C

THERMAL RESISTANCE RATINGS

Parameter	Symbol	Limit	Unit
Junction-to-Ambient ^d	R_{thJA}	40	°C/W
Junction-to-Case	R_{thJC}	0.75	

Notes:

- Package limited.
- Duty cycle ≤ 1 %.
- See SOA curve for voltage derating.
- When mounted on 1" square PCB (FR-4 material).

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

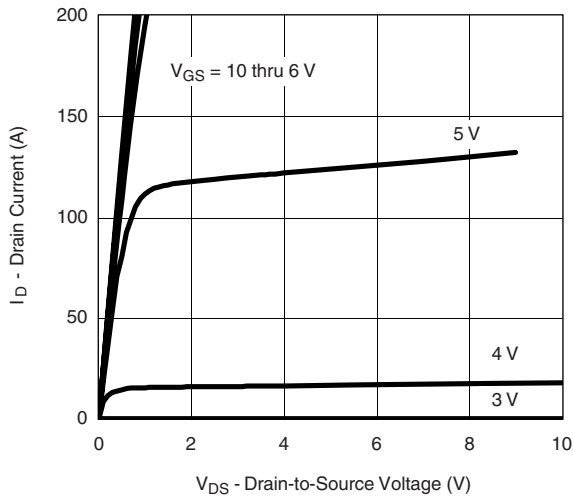
MOSFET SPECIFICATIONS $T_J = 25\text{ }^\circ\text{C}$, unless otherwise noted						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Static						
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	40			V
Gate-Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_{DS} = 250\text{ }\mu\text{A}$	2			
Gate-Body Leakage	I_{GSS}	$V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$			± 100	nA
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 32\text{ V}, V_{GS} = 0\text{ V}$			1	μA
		$V_{DS} = 32\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$			50	
		$V_{DS} = 32\text{ V}, V_{GS} = 0\text{ V}, T_J = 175\text{ }^\circ\text{C}$			500	
On-State Drain Current ^a	$I_{D(on)}$	$V_{DS} = 5\text{ V}, V_{GS} = 10\text{ V}$	120			A
Drain-Source On-State Resistance ^a	$r_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 25\text{ A}$		0.0044	0.0055	Ω
		$V_{GS} = 10\text{ V}, I_D = 25\text{ A}, T_J = 125\text{ }^\circ\text{C}$			0.0088	
		$V_{GS} = 10\text{ V}, I_D = 25\text{ A}, T_J = 175\text{ }^\circ\text{C}$			0.011	
Sense Diode Forward Voltage	V_{FD1}	$I_F = 50\text{ }\mu\text{A}$	655		715	mV
	V_{FD2}	$I_F = 25\text{ }\mu\text{A}$	600		660	
Sense Diode Forward Voltage Increase	ΔV_F	From $I_F = 25\text{ }\mu\text{A}$ to $I_F = 50\text{ }\mu\text{A}$	30		80	
Forward Transconductance ^a	g_{fs}	$V_{DS} = 15\text{ V}, I_D = 20\text{ A}$		35		S
Dynamic^b						
Input Capacitance	C_{iss}	$V_{GS} = 0\text{ V}, V_{DS} = 25\text{ V}, f = 1\text{ MHz}$		6400		pF
Output Capacitance	C_{oss}			1100		
Reverse Transfer Capacitance	C_{rss}			630		
Total Gate Charge ^c	Q_g	$V_{DS} = 20\text{ V}, V_{GS} = 10\text{ V}, I_D = 25\text{ A}$		115	150	nC
Gate-Source Charge ^c	Q_{gs}			35		
Gate-Drain Charge ^c	Q_{gd}			35		
Turn-On Delay Time ^c	$t_{d(on)}$	$V_{DD} = 20\text{ V}, R_L = 0.8\text{ }\Omega$ $I_D \cong 25\text{ A}, V_{GEN} = 10\text{ V}, R_G = 2.5\text{ }\Omega$		15	20	ns
Rise Time ^c	t_r			150	210	
Turn-Off Delay Time ^c	$t_{d(off)}$			60	85	
Fall Time ^c	t_f			80	110	
Source-Drain Diode Ratings and Characteristics $T_C = 25\text{ }^\circ\text{C}^b$						
Continuous Current	I_S				60	A
Pulsed Current	I_{SM}				200	
Forward Voltage ^a	V_{SD}	$I_F = 60\text{ A}, V_{GS} = 0\text{ V}$		1.0	1.5	V
Reverse Recovery Time	t_{rr}	$I_F = 60\text{ A}, di/dt = 100\text{ A}/\mu\text{s}$		45	70	ns
Peak Reverse Recovery Current	$I_{RM(REC)}$			2.5	5	A
Reverse Recovery Charge	Q_{rr}			0.06	0.18	μC

Notes:

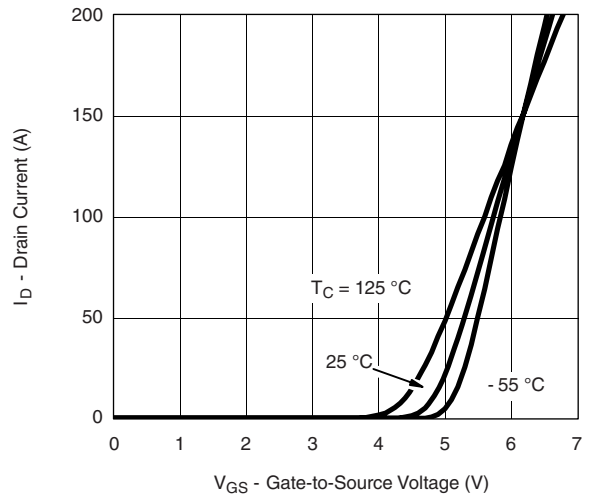
- Pulse test; pulse width $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$.
- Guaranteed by design, not subject to production testing.
- Independent of operating temperature.

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.

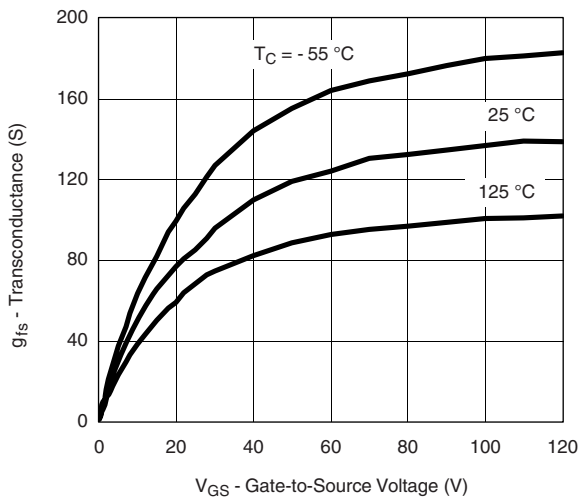
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



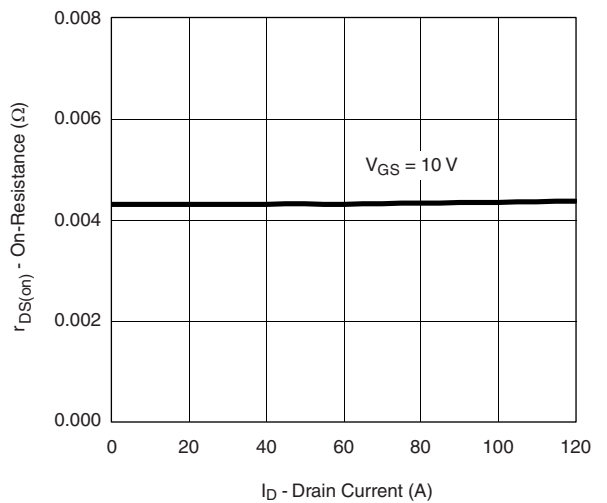
Output Characteristics



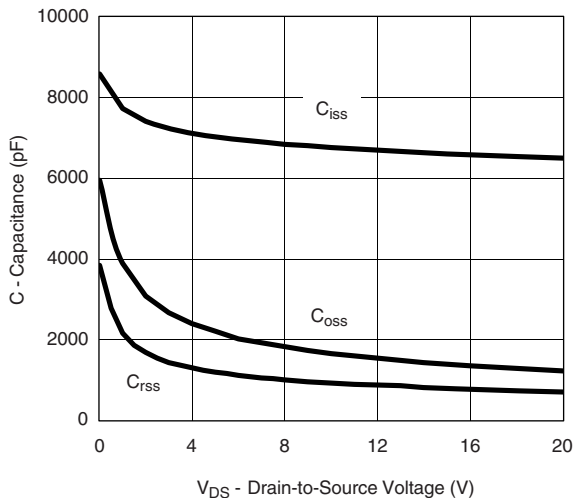
Transfer Characteristics



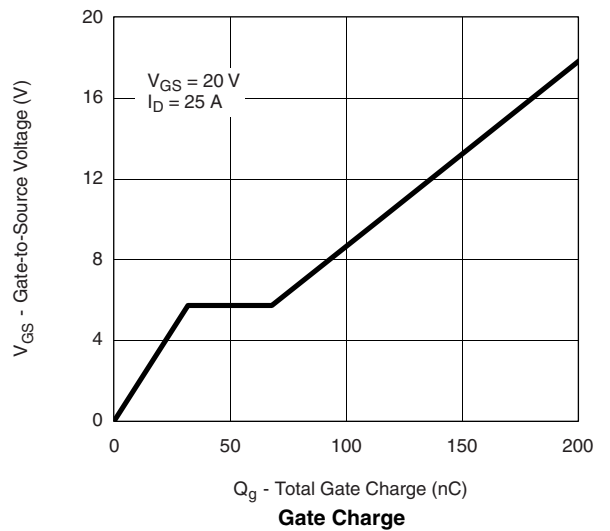
Transconductance



On-Resistance vs. Drain Current

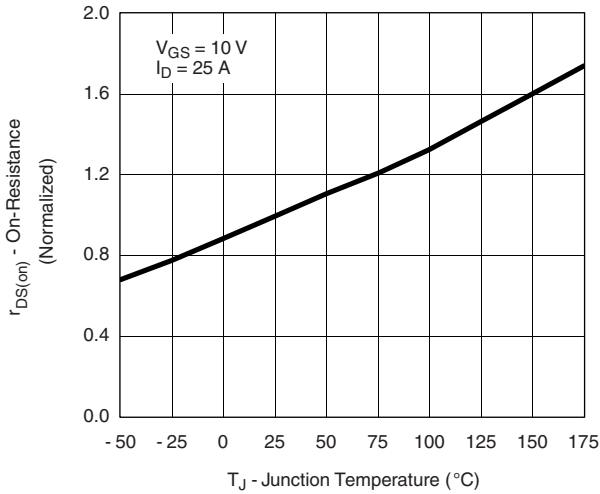


Capacitance

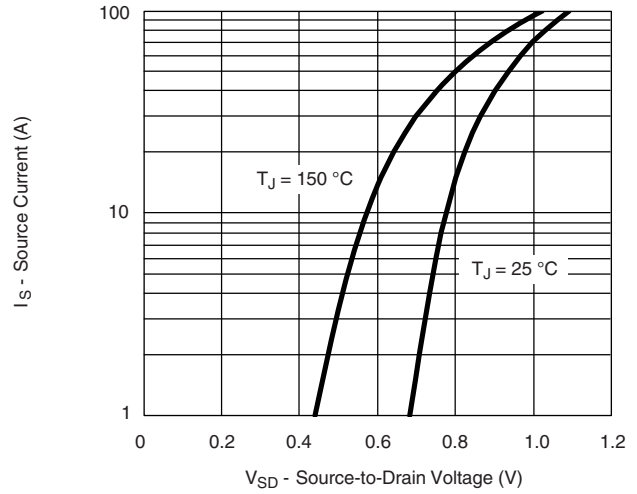


Gate Charge

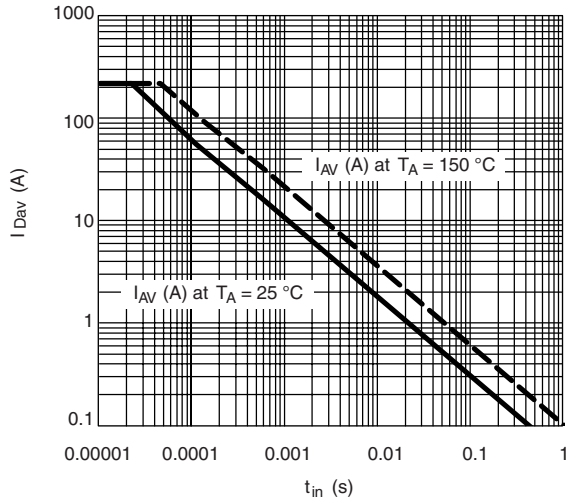
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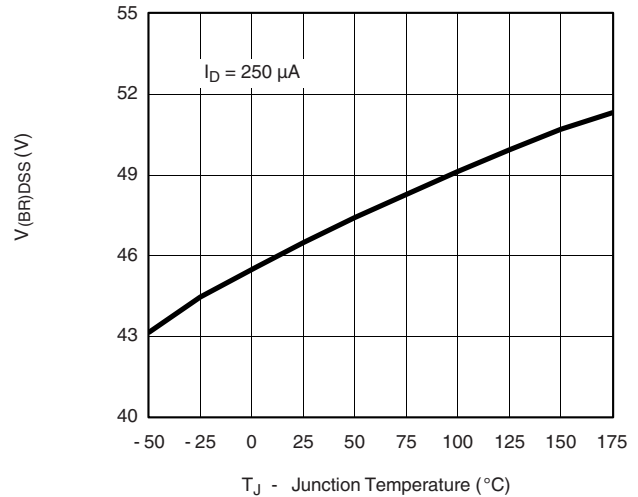
On-Resistance vs. Junction Temperature



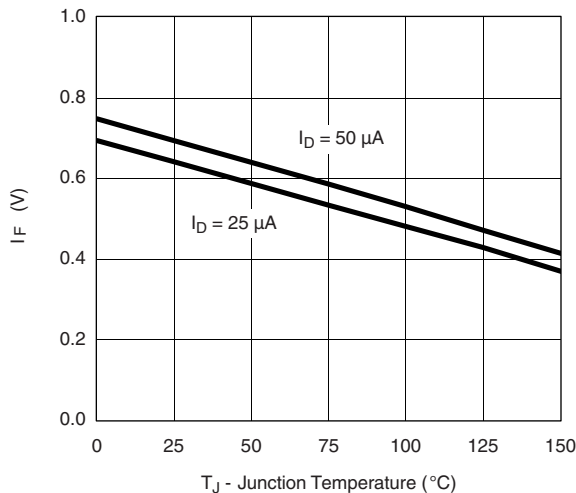
Source-Drain Diode Forward Voltage



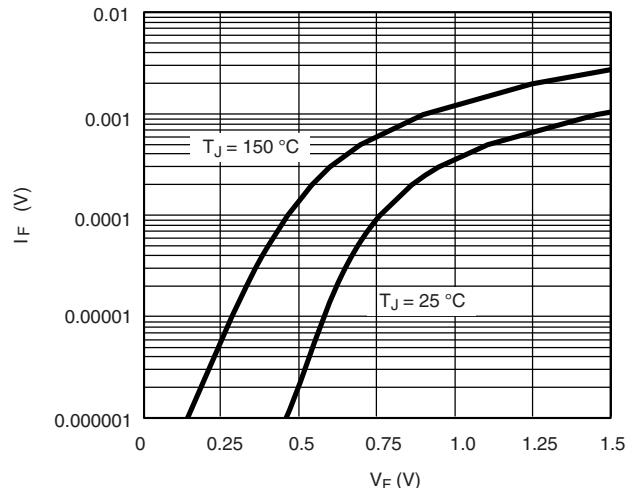
Avalanche Current vs. Time



Drain Source Breakdown vs. Junction Temperature

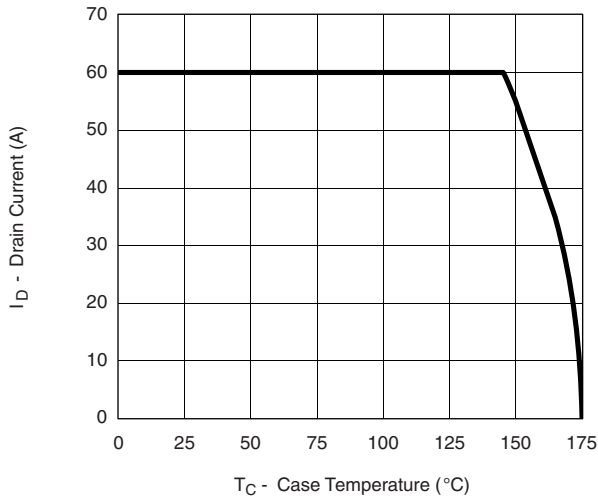


Sense Diode Forward Voltage vs. Temperature

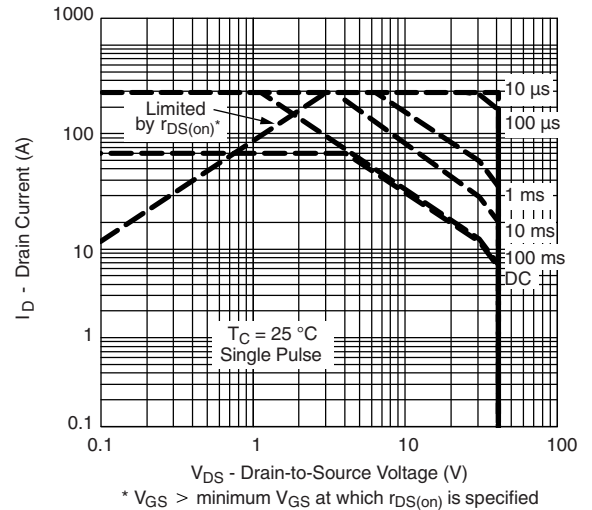


Sense Diode Forward Voltage

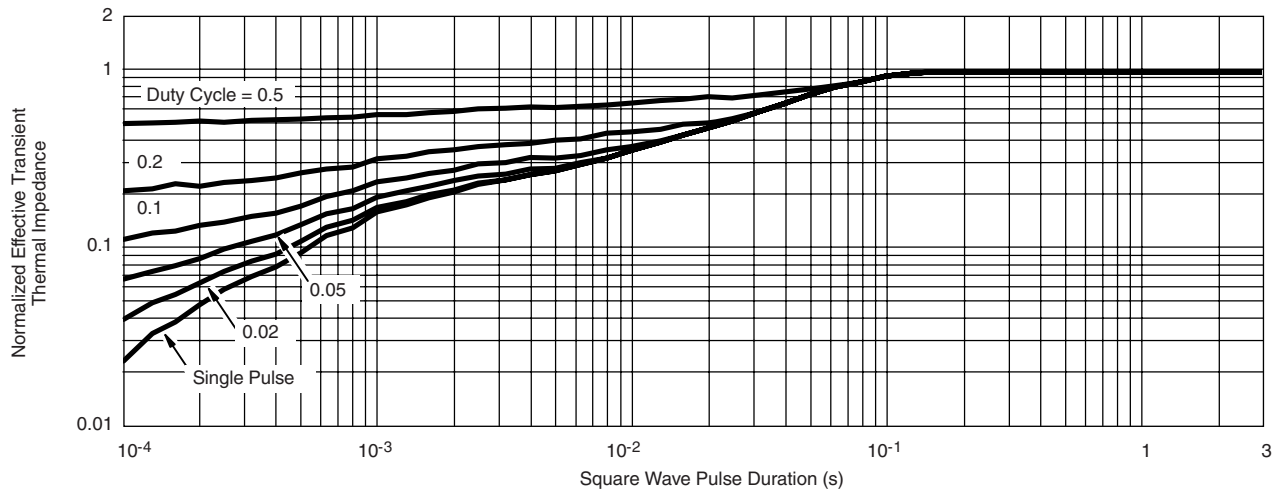
THERMAL RATINGS



Maximum Avalanche and Drain Current vs. Case Temperature



Safe Operating Area



Normalized Thermal Transient Impedance, Junction-to-Case

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