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

PRODUCT SUMMARY		
$V_{(BR)DSS}$ (V)	$r_{DS(on)}$ (Ω)	I_D (A)
40	0.0045 at V_{GS} = 10 V	60[a]
	0.0065 at V_{GS} = 4.5 V	20[a]

FEATURES

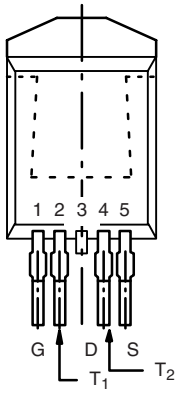
- TrenchFET® Power MOSFETS Plus Temperature Sensing Diode
- 175 °C Junction Temperature
- Low Thermal Resistance Package

Pb Available
RoHS* COMPLIANT

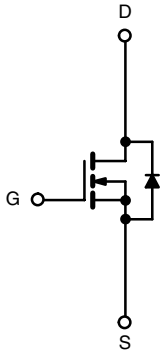
APPLICATIONS

- Industrial

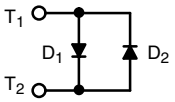
D²PAK-5L



Ordering Information: SUM60N04-05LT
SUM60N04-05LT-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]	T_C = 25 °C	I_D	60[a]	A
	T_C = 100 °C		60[a]	
Pulsed Drain Current		I_{DM}	250	
Continuous Diode Current (Diode Conduction)[d]		I_S	60[a]	
Avalanche Current		I_{AR}	60[a]	
Repetitive Avalanche Energy[b]	L = 0.1 mH	E_{AR}	180	mJ
Maximum Power Dissipation[a]	T_C = 25 °C	P_D	200[c]	W
	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]	PCB Mount[d]	R_{thJA}	40	°C/W
Junction-to-Case		R_{thJC}	0.75	

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

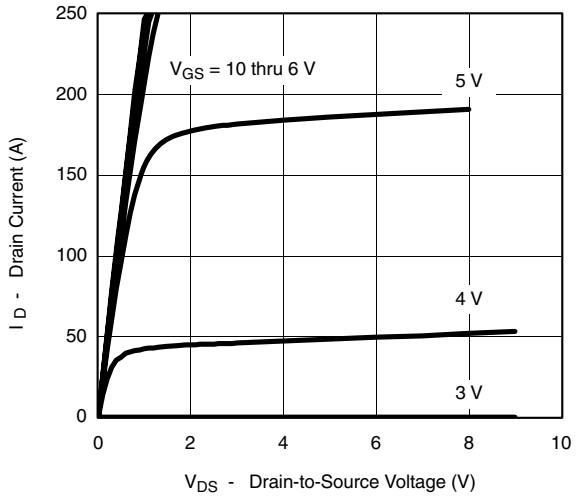
* Pb containing terminations are not RoHS compliant, exemptions may apply.

MOSFET SPECIFICATIONS T_J = 25 °C, unless otherwise noted						
Parameter	**Symbol**	**Test Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
Static						
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	V_{GS} = 0 V, I_D = 250 µA	40			V
Gate-Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_{DS} = 250 µA	1		3	
Gate-Body Leakage	I_{GSS}	V_{DS} = 0 V, V_{GS} = ± 20 V			± 100	nA
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 40 V, V_{GS} = 0 V			1	µA
		V_{DS} = 40 V, V_{GS} = 0 V, T_J = 125 °C			50	
		V_{DS} = 40 V, V_{GS} = 0 V, T_J = 175 °C			500	
On-State Drain Current[a]	$I_{D(on)}$	V_{DS} = 5 V, V_{GS} = 10 V	120			A
Drain-Source On-State Resistance[a]	$r_{DS(on)}$	V_{GS} = 10 V, I_D = 60 A		0.0035	0.0045	Ω
		V_{GS} = 4.5 V, I_D = 20 A		0.0051	0.0065	
		V_{GS} = 10 V, I_D = 60 A, T_J = 125 °C			0.0069	
		V_{GS} = 10 V, I_D = 60 A, T_J = 175 °C			0.0086	
Sense Diode Forward Voltage	V_{FD1} and V_{FD2}	I_F = 50 µA	655		715	mV
		I_F = 25 µA	600		660	
Sense Diode Forward Voltage Increase	ΔV_F	From I_F = 25 µA to I_F = 50 µA	30		80	
Forward Transconductance[a]	g_{fs}	V_{DS} = 15 V, I_D = 20 A		35		S
Dynamic[b]						
Input Capacitance	C_{iss}	V_{GS} = 0 V, V_{DS} = 25 V, f = 1 MHz		6000		pF
Output Capacitance	C_{oss}			1100		
Reverse Transfer Capacitance	C_{rss}			700		
Total Gate Charge[c]	Q_g	V_{DS} = 20 V, V_{GS} = 10 V, I_D = 25 A		130		nC
Gate-Source Charge[c]	Q_{gs}			25		
Gate-Drain Charge[c]	Q_{gd}			40		
Turn-On Delay Time[c]	$t_{d(on)}$	V_{DD} = 20 V, R_L = 0.8 Ω $I_D \cong$ 25 A, V_{GEN} = 10 V, R_g = 2.5 Ω		15	20	ns
Rise Time[c]	t_r			80	120	
Turn-Off Delay Time[c]	$t_{d(off)}$			100	150	
Fall Time[c]	t_f			100	150	
Source-Drain Diode Ratings and Characteristics T_C = 25 °C[b]						
Continuous Current	I_S				60	A
Pulsed Current	I_{SM}				200	
Forward Voltage[a]	V_{SD}	I_F = 60 A, V_{GS} = 0 V		1.0	1.5	V
Reverse Recovery Time	t_{rr}	I_F = 60 A, di/dt = 100 A/µs		60	90	ns
Peak Reverse Recovery Current	$I_{RM(REC)}$			2.1	4	A
Reverse Recovery Charge	Q_{rr}			0.065	0.18	µC

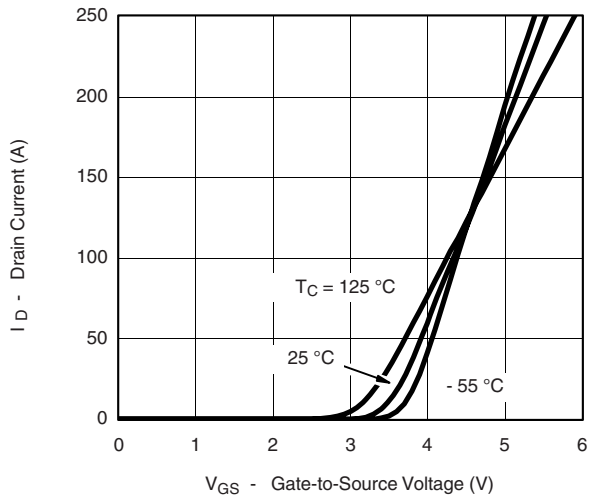
Notes:
a. Pulse test; pulse width ≤ 300 µs, duty cycle ≤ 2 %.
b. Guaranteed by design, not subject to production testing.
c. Independent of operating temperature.

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.

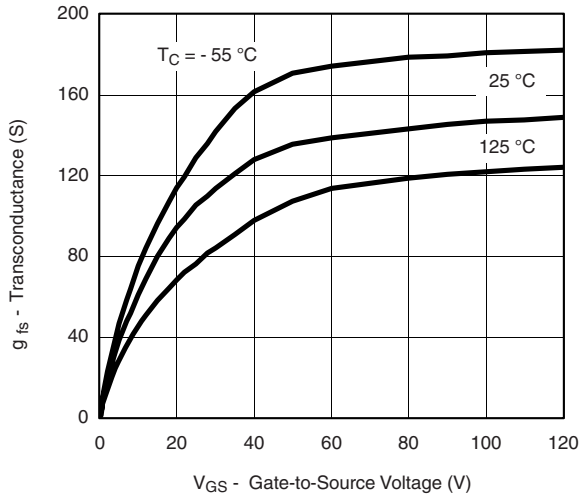
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



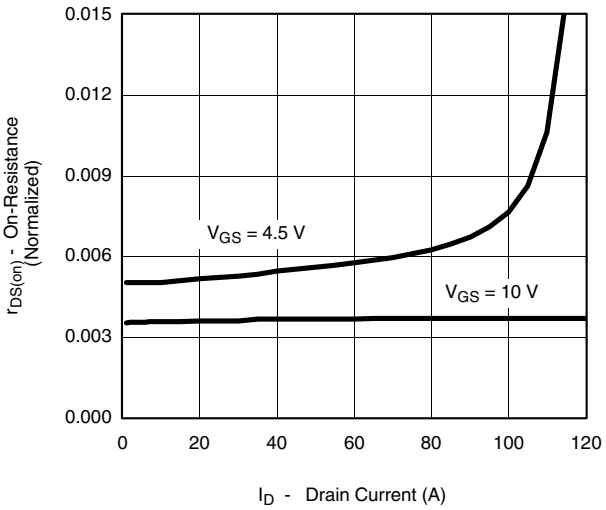
Output Characteristics



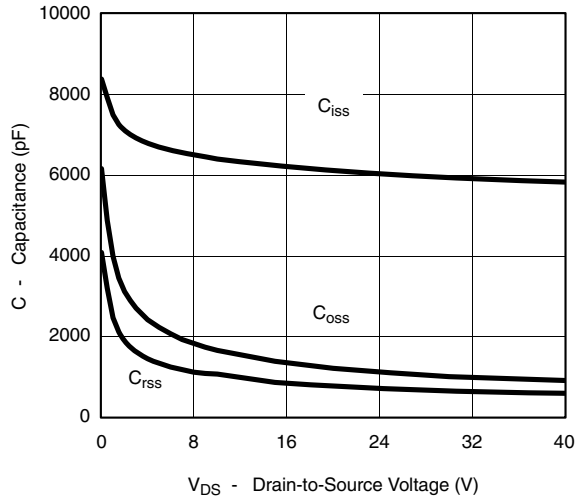
Transfer Characteristics



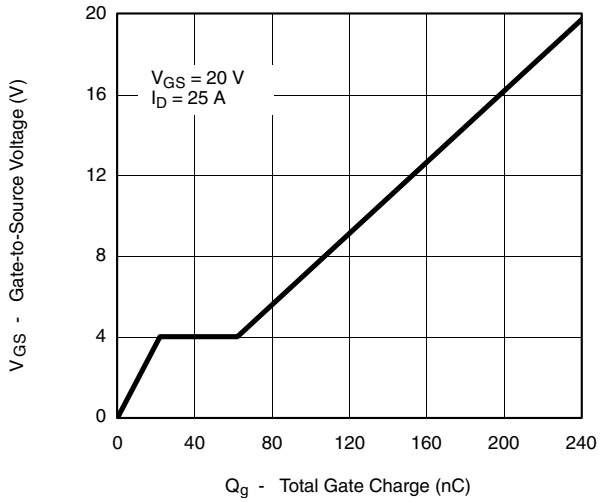
Transconductance



On-Resistance vs. Drain Current

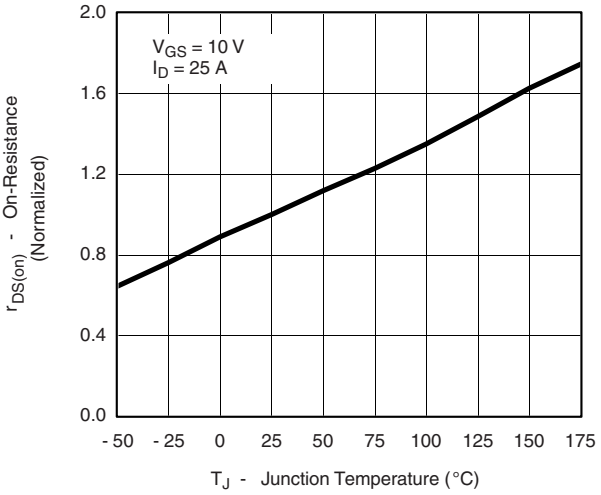


Capacitance

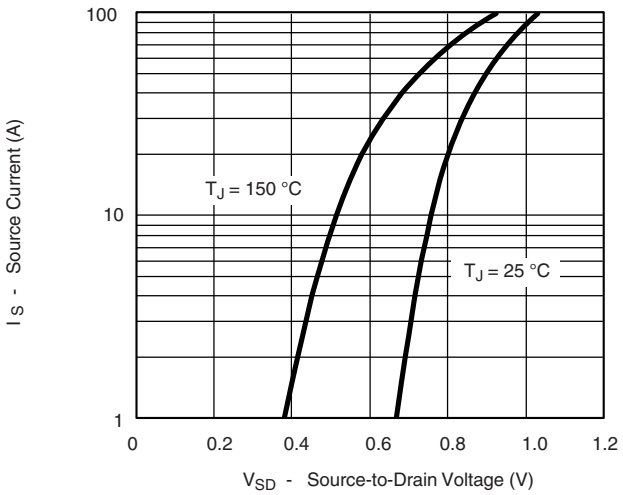


Gate Charge

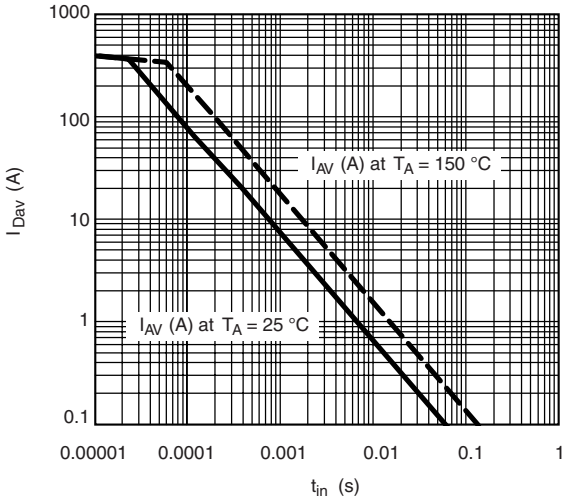
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



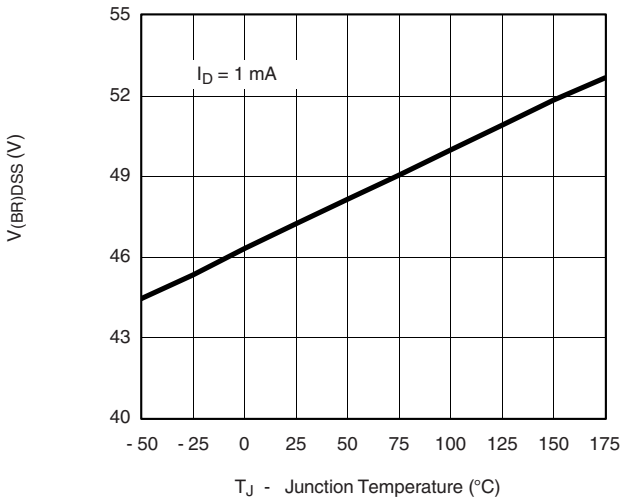
On-Resistance vs. Junction Temperature



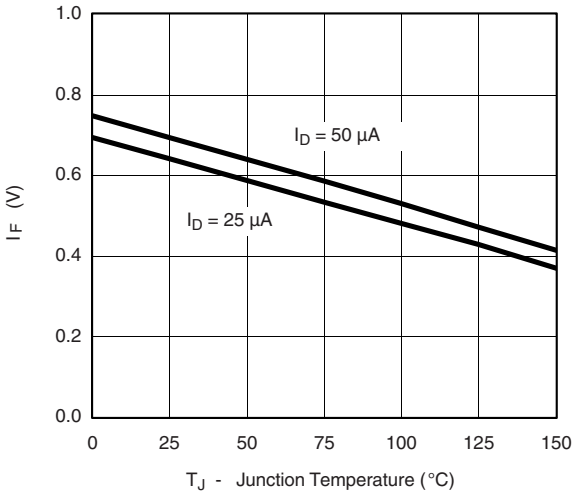
Source-Drain Diode Forward Voltage



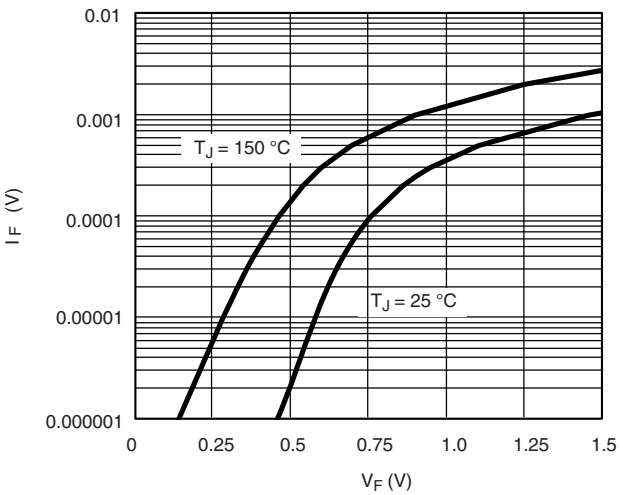
Avalanche Current vs. Time



Drain Source Breakdown vs. Junction Temperature

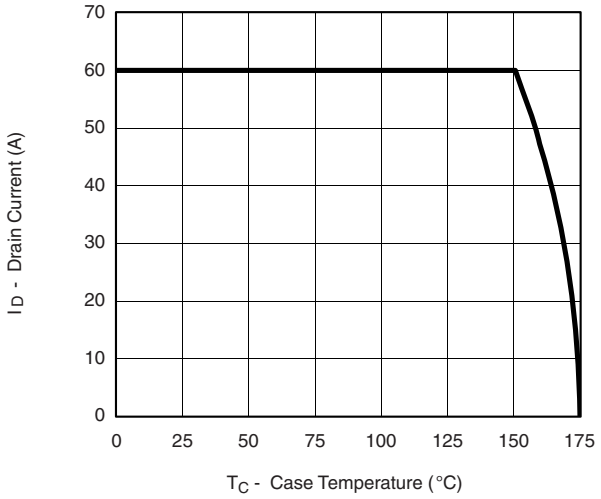


Sense Diode Forward Voltage vs. Temperature

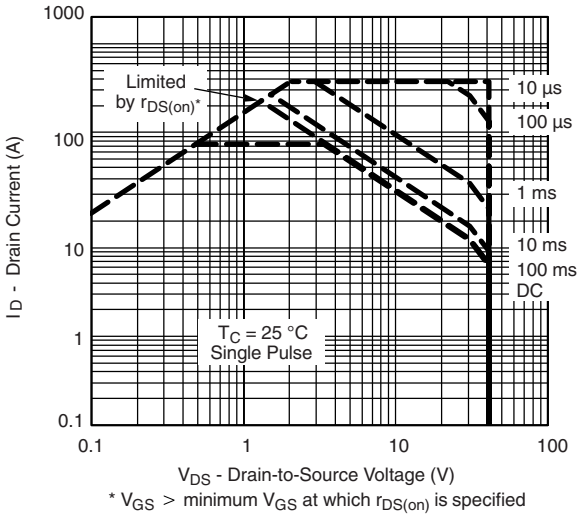


Sense Diode Forward Voltage

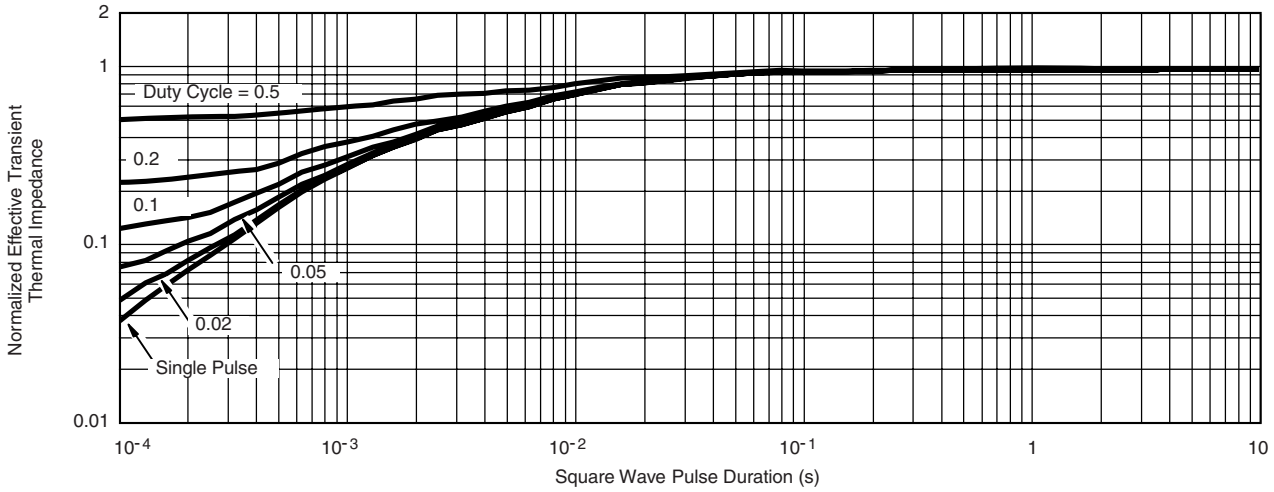
THERMAL RATINGS



Maximum Avalanche and Drain Current vs. Case Temperature



Safe Operating Area



Normalized Thermal Transient Impedance, Junction-to-Case

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