N-Channel 40-V (D-S) MOSFET with Current Sense Terminal

PRODUCT SUMMARY		
$V_{(BR)DSS}$ (V)	$r_{DS(on)}$ (Ω)	I_D (A)
40	0.0054 @ V_{GS} = 10 V	60[a]

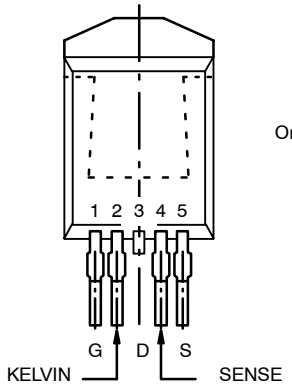
FEATURES

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

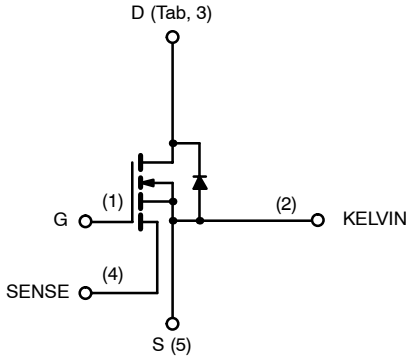
APPLICATIONS

- Automotive
  - 12-V Boardnet
  - ABS and EPS
  - Motor Drives

D²PAK-5



Ordering Information: SUM60N04-05C



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	
Continous Diode Current (Diode Conduction)[d]		I_S	60[a]	
Avalanche Current	L = 0.1 mH	I_{AS}	60[a]	
Single Pulse Avalanche Energy[b]		E_{AS}	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).

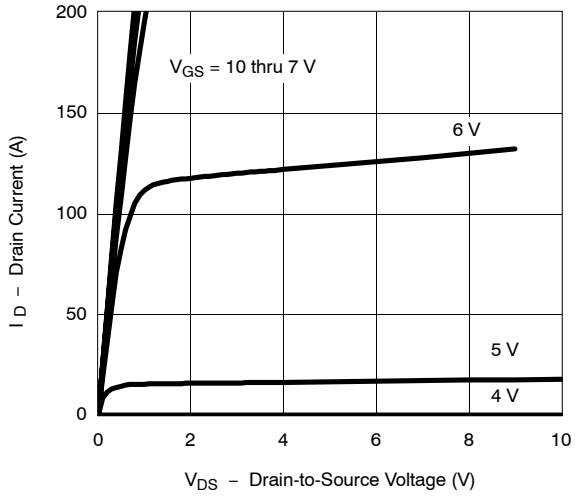
MOSFET SPECIFICATIONS (T_J = 25°C UNLESS OTHERWISE NOTED)

Parameter	Symbol	Test Condition	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	2.5		4.5	
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 = 25 A		0.0043	0.0054	Ω
		V_{GS} = 10 V, I_D = 25 A, T_J = 125°C			0.0088	
		V_{GS} = 10 V, I_D = 25 A, T_J = 175°C			0.011	
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		6400		pF
Output Capacitance	C_{oss}			1100		
Reversen Transfer Capacitance	C_{rss}			630		
Total Gate Charge[c]	Q_g	V_{DS} = 20 V, V_{GS} = 10 V, I_D = 25 A		115	150	nC
Gate-Source Charge[c]	Q_{gs}			35		
Gate-Drain Charge[c]	Q_{gd}			35		
Gate Resistance	R_g	f = 1 MHz		2.2		Ω
Turn-On Delay Time[c]	$t_{d(on)}$	V_{DD} = 20 V, R_L = 0.8 Ω I_D ≃ 25 A, V_{GEN} = 10 V, R_G = 2.5 Ω		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°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		45	70	ns
Peak Reverse Recovery Current	$I_{RM(REC)}$			2.5	5	A
Reverse Recovery Charge	Q_{rr}			0.06	0.18	μC
Current Sense Characteristics						
Current Sense Ratio	r	I_D = 3.5 A, V_{GS} = 10 V, R_{SENSE} = 2 Ω	1660	1880	2100	
Mirror Active Resistance	$r_{m(on)}$	V_{GS} = 10 V, I_D = 10 mA		5.5		Ω

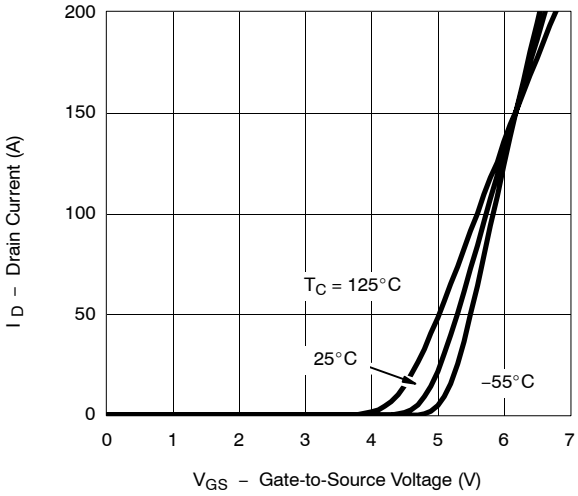
Notes:
a. Pulse test; pulse width ≤ 300 μs, duty cycle ≤ 2%.
b. Guaranteed by design, not subject to production testing.
c. Independent of operating temperature.

TYPICAL CHARACTERISTICS (25°C UNLESS NOTED)

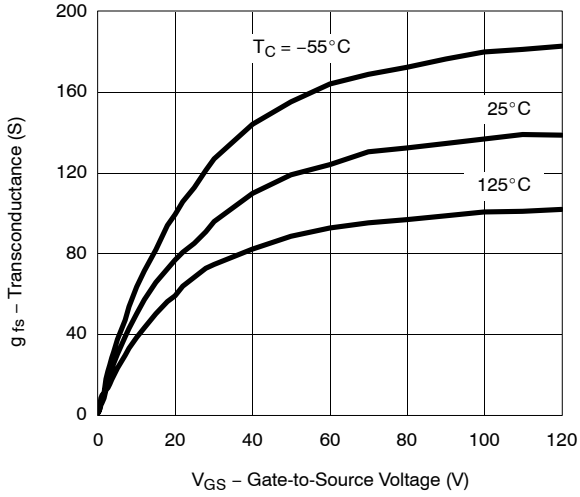
Output Characteristics



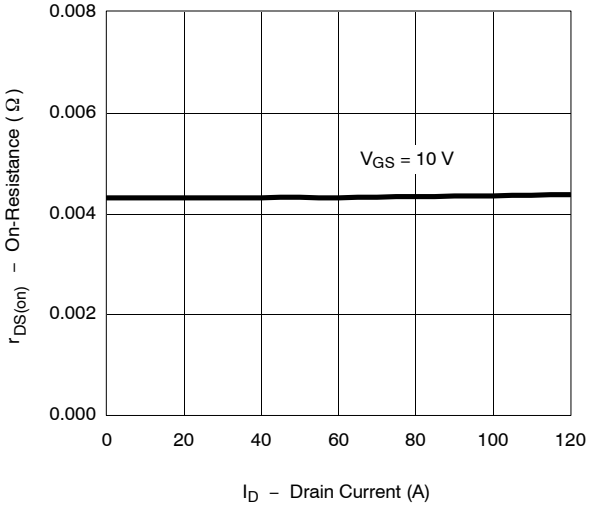
Transfer Characteristics



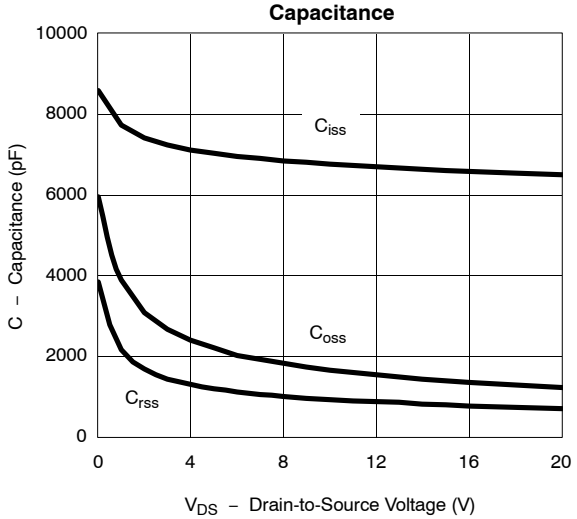
Transconductance



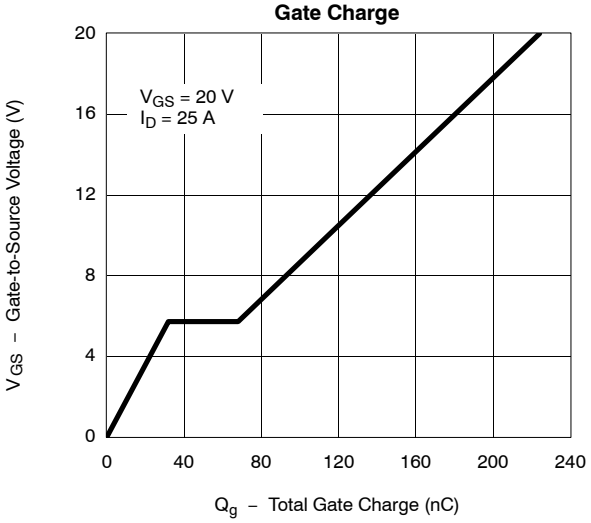
On-Resistance vs. Drain Current



Capacitance

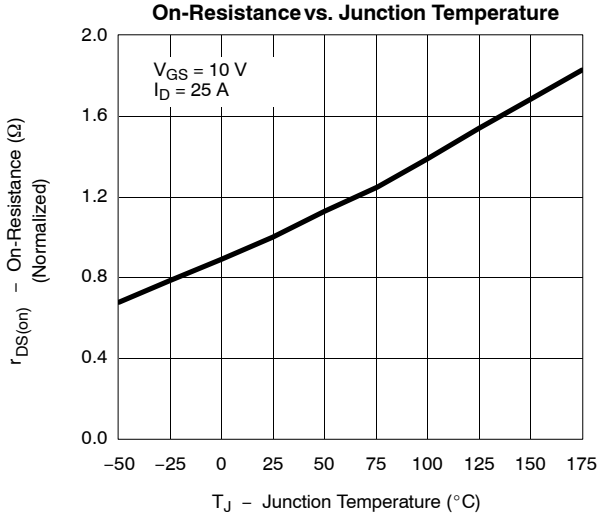


Gate Charge

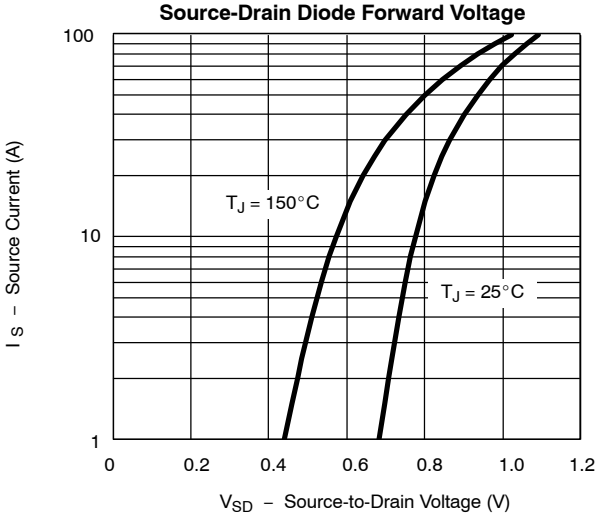


TYPICAL CHARACTERISTICS (25°C UNLESS NOTED)

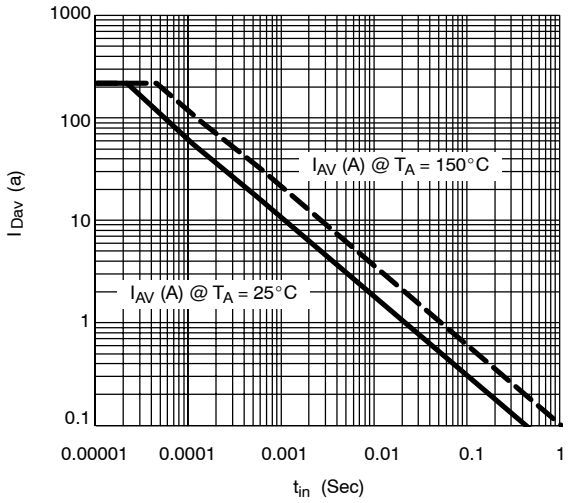
On-Resistance vs. Junction Temperature



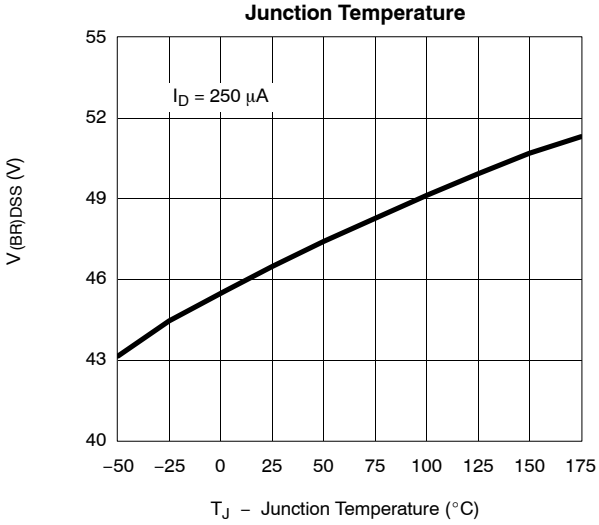
Source-Drain Diode Forward Voltage



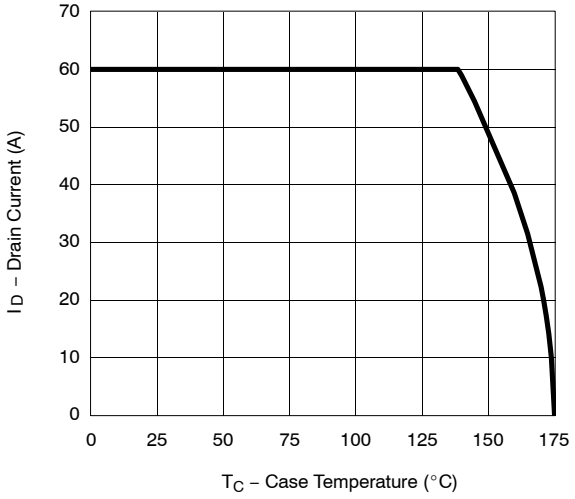
Avalanche Current vs. Time



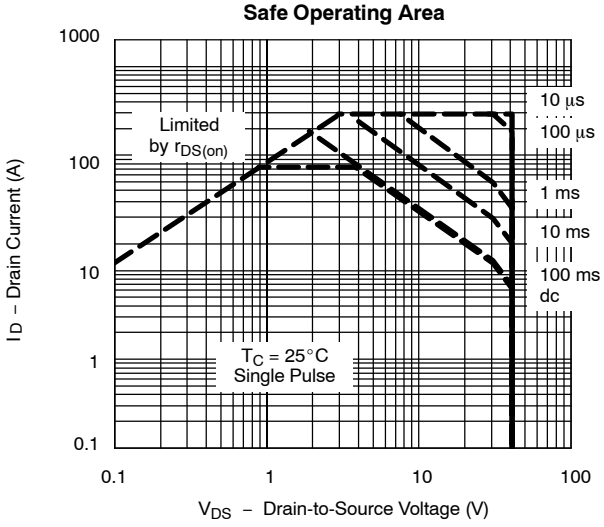
Drain Source Breakdown vs. Junction Temperature



Maximum Avalanche and Drain Current vs. Case Temperature

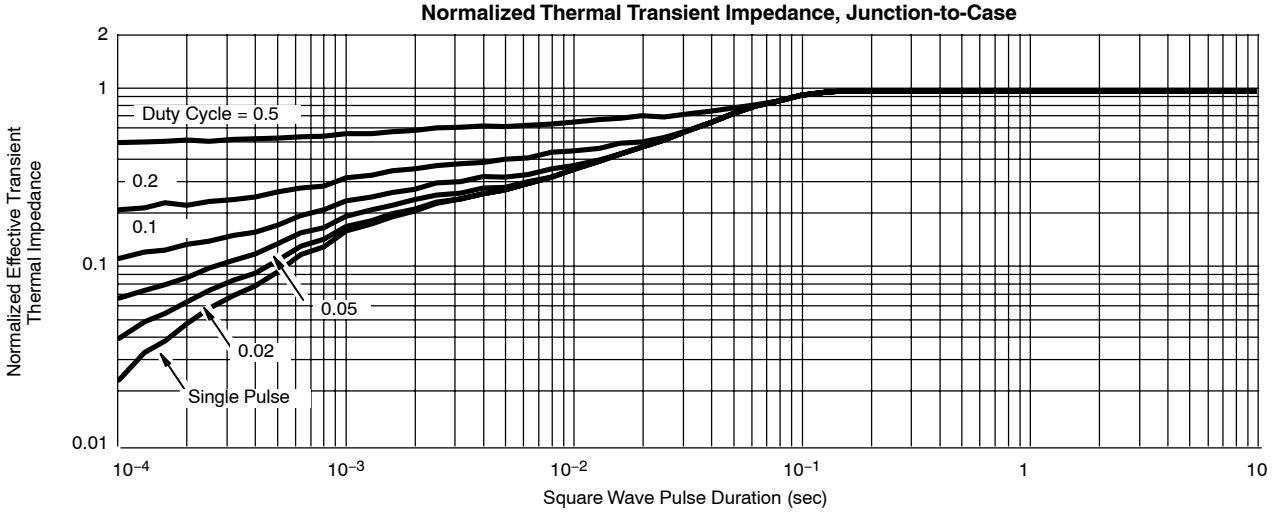


Safe Operating Area



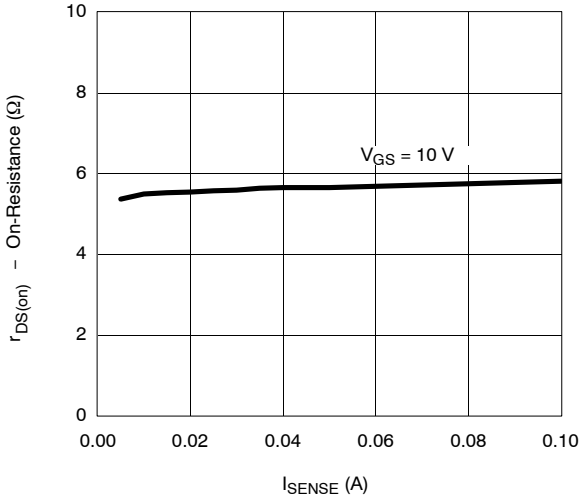
THERMAL RATINGS

Normalized Thermal Transient Impedance, Junction-to-Case

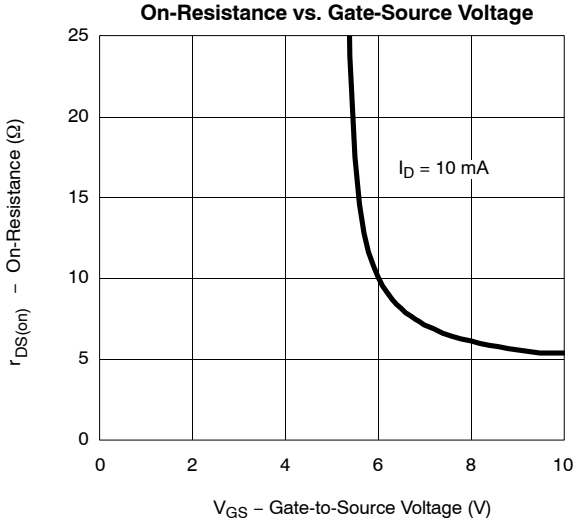


TYPICAL CHARACTERISTICS (25°C UNLESS NOTED) SENSE DIE

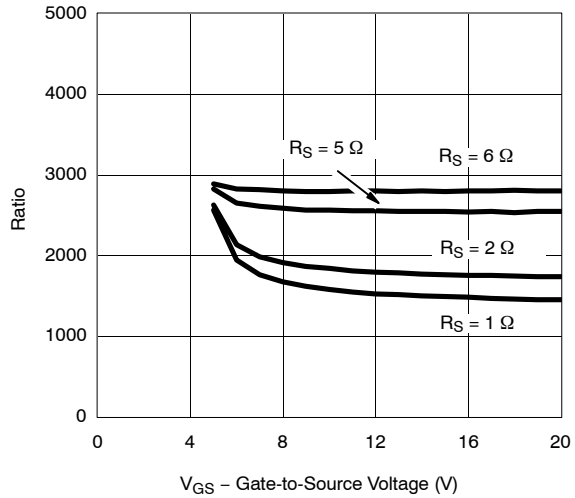
On-Resistance vs. Sense Current



On-Resistance vs. Gate-Source Voltage



Current Ratio ($I_{(MAIN)/IS}$) vs. Gate-Source Voltage (Figure 1)



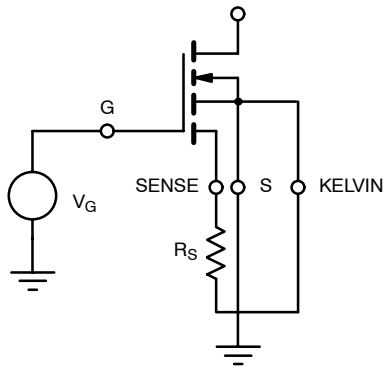


Figure 1