

# N-Channel 40-V (D-S), 175 °C MOSFET

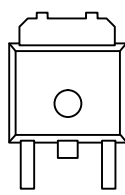
## PRODUCT SUMMARY

$V_{(BR)DSS}$ (V)	$r_{DS(on)}$ ( $\Omega$ )	$I_D$ (A) <sup>c</sup>	$Q_g$ (Typ)
40	0.006 at $V_{GS} = 10$ V	109	95

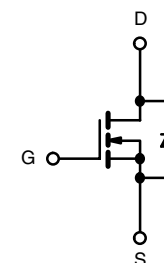
## FEATURES

- TrenchFET® Power MOSFETS
- 175 °C Junction Temperature
- High Threshold Voltage At High Temperature


**RoHS**  
COMPLIANT

**TO-252**

G D S  
Top View

Drain Connected to Tab

**Ordering Information:** SUD50N04-06H-E3 (Lead (Pb)-free)


N-Channel MOSFET

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

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	40	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	
Continuous Drain Current ( $T_J = 175$ °C)	$I_D$	$T_C = 25$ °C	A
		$T_C = 100$ °C	
Pulsed Drain Current	$I_{DM}$	100	
Avalanche Current (Single Pulse)	$I_{AS}$	50	
Repetitive Avalanche Energy (Single Pulse) <sup>a</sup>	$E_{AS}$	125	mJ
Power Dissipation	$P_D$	136	W
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	- 55 to 175	°C

## THERMAL RESISTANCE RATINGS

Parameter	Symbol	Typical	Maximum	Unit
Junction-to-Ambient <sup>b</sup>	$R_{thJA}$	$t \leq 10$ sec	15	°C/W
		Steady State	40	
Junction-to-Case	$R_{thJC}$	0.85	1.1	

Notes:

a. Duty cycle  $\leq 1$  %.

b. Surface Mounted on 1" FR4 board.

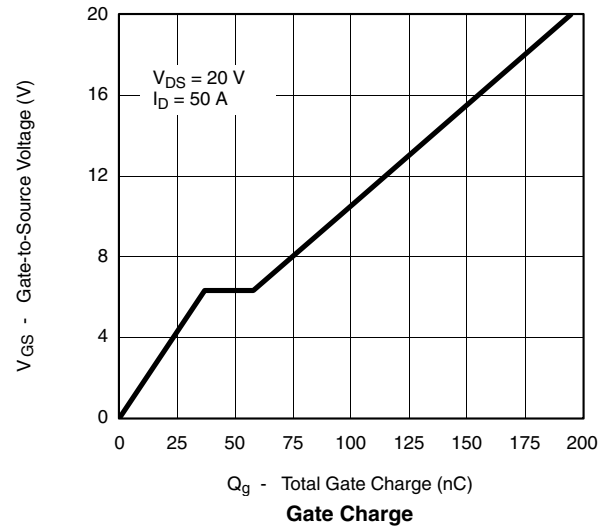
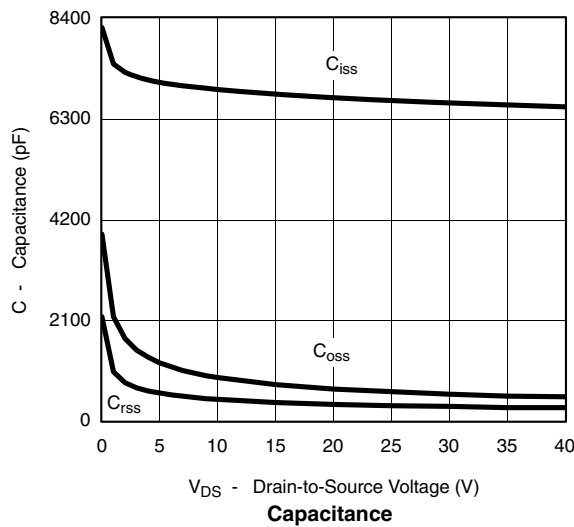
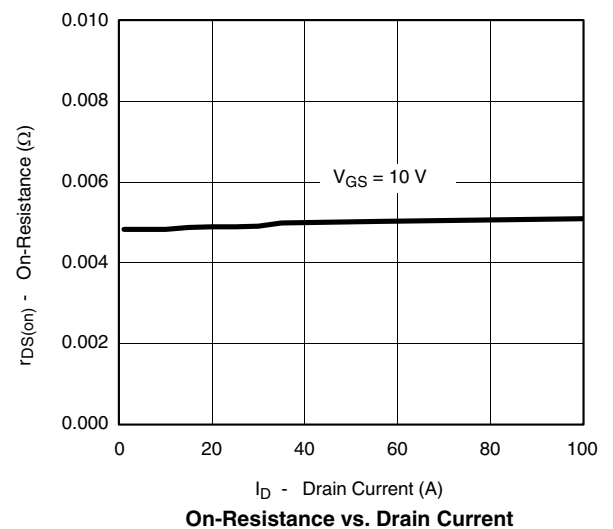
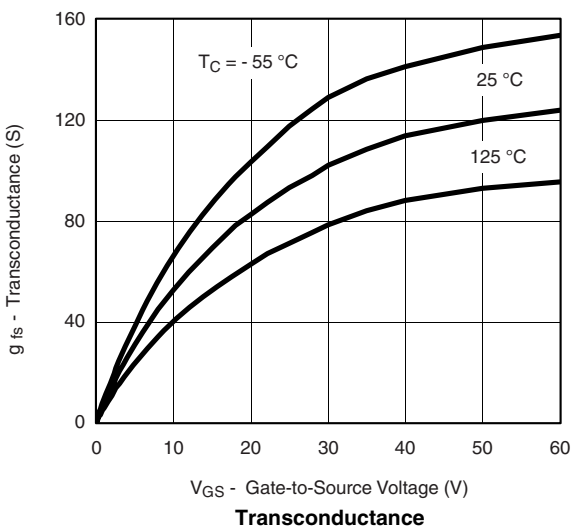
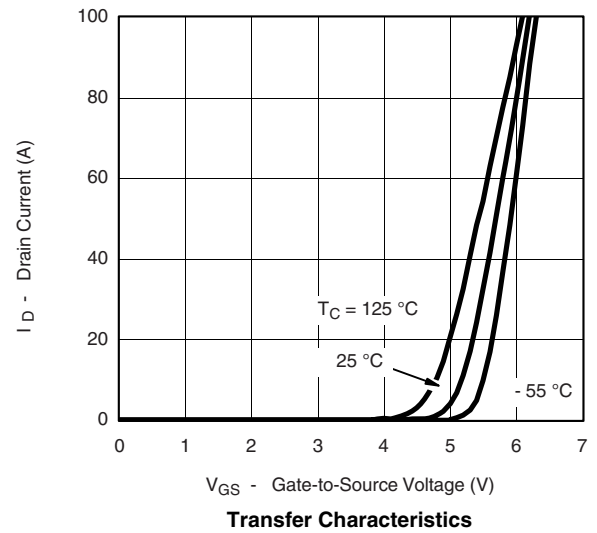
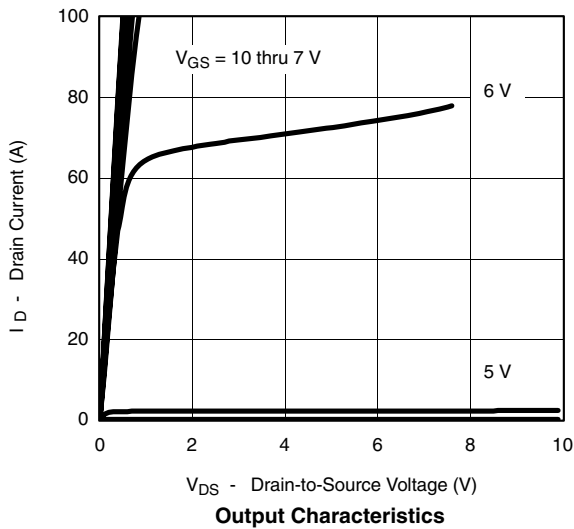
c. Based on maximum allowable Junction Temperature. Package limitation current is 50 A.

SPECIFICATIONS T <sub>J</sub> = 25 °C, unless otherwise noted						
Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Static						
Drain-Source Breakdown Voltage	V <sub>(BR)DSS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA	40			V
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA	3.4		5.0	
Gate-Body Leakage	I <sub>GSS</sub>	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ± 20 V			± 100	nA
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> = 40 V, V <sub>GS</sub> = 0 V			1	μA
		V <sub>DS</sub> = 40 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 125 °C			50	
		V <sub>DS</sub> = 40 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 175 °C			150	
On-State Drain Current <sup>a</sup>	I <sub>D(on)</sub>	V <sub>DS</sub> = 5 V, V <sub>GS</sub> = 10 V	50			A
Drain-Source On-State Resistance <sup>a</sup>	r <sub>DS(on)</sub>	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 20 A		0.0049	0.006	Ω
		V <sub>GS</sub> = 10 V, I <sub>D</sub> = 20 A, T <sub>J</sub> = 125 °C			0.009	
		V <sub>GS</sub> = 10 V, I <sub>D</sub> = 20 A, T <sub>J</sub> = 175 °C			0.012	
Forward Transconductance <sup>a</sup>	g <sub>fs</sub>	V <sub>DS</sub> = 15 V, I <sub>D</sub> = 15 A	20	50		S
Dynamic <sup>b</sup>						
Input Capacitance	C <sub>iss</sub>	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 25 V, f = 1 MHz		6700		pF
Output Capacitance	C <sub>oss</sub>			600		
Reversen Transfer Capacitance	C <sub>rss</sub>			320		
Total Gate Charge <sup>c</sup>	Q <sub>g</sub>	V <sub>DS</sub> = 20 V, V <sub>GS</sub> = 10 V, I <sub>D</sub> = 50 A		95		nC
Gate-Source Charge <sup>c</sup>	Q <sub>gs</sub>			37		
Gate-Drain Charge <sup>c</sup>	Q <sub>gd</sub>			21		
Gate Resistance	R <sub>g</sub>	f = 1.0 MHz		1.7		Ω
Turn-On Delay Time <sup>c</sup>	t <sub>d(on)</sub>	V <sub>DD</sub> = 20 V, R <sub>L</sub> = 0.4 Ω I <sub>D</sub> ≅ 50 A, V <sub>GEN</sub> = 10 V, R <sub>g</sub> = 2.5 Ω		20	30	ns
Rise Time <sup>c</sup>	t <sub>r</sub>			95	145	
Turn-Off Delay Time <sup>c</sup>	t <sub>d(off)</sub>			50	75	
Fall Time <sup>c</sup>	t <sub>f</sub>			12	20	
Source-Drain Diode Ratings and Characteristics (T <sub>C</sub> = 25 °C) <sup>b</sup>						
Continuous Current	I <sub>S</sub>				50	A
Pulsed Current	I <sub>SM</sub>				100	
Forward Voltage <sup>a</sup>	V <sub>SD</sub>	I <sub>F</sub> = 30 A, V <sub>GS</sub> = 0 V		0.90	1.50	V
Reverse Recovery Time	t <sub>rr</sub>	I <sub>F</sub> = 30 A, di/dt = 100 A/μs		40	60	ns

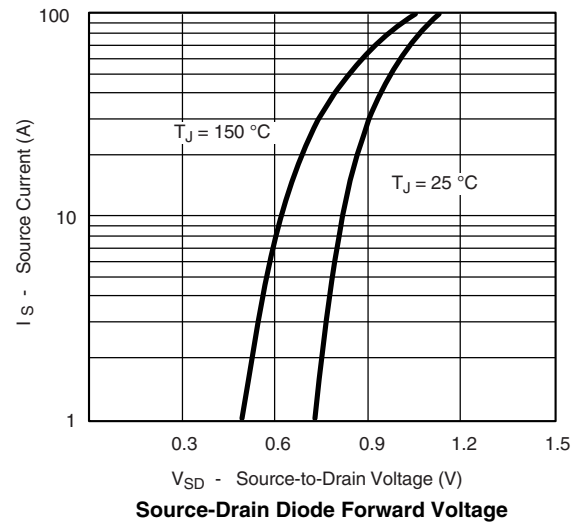
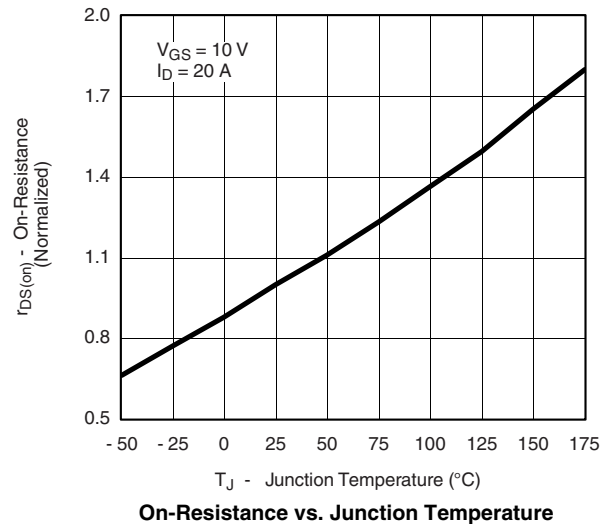
## Notes:

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

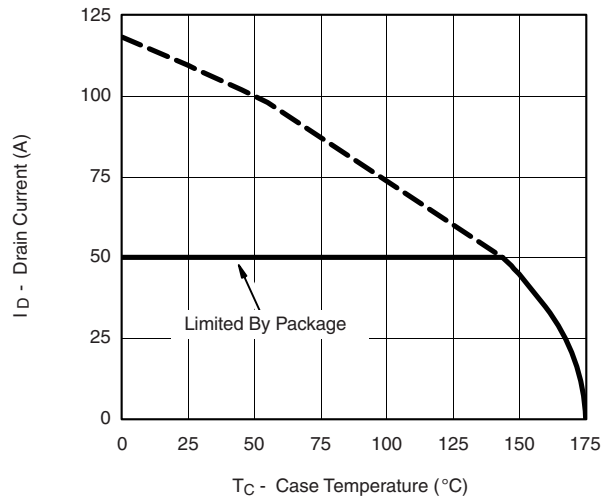
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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

**TYPICAL CHARACTERISTICS** 25 °C unless noted


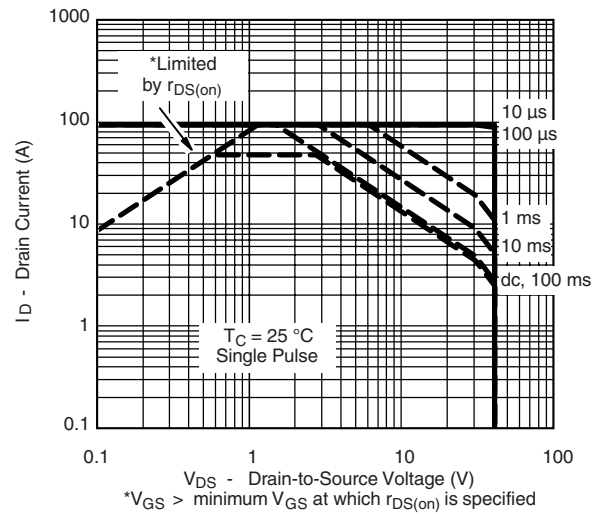
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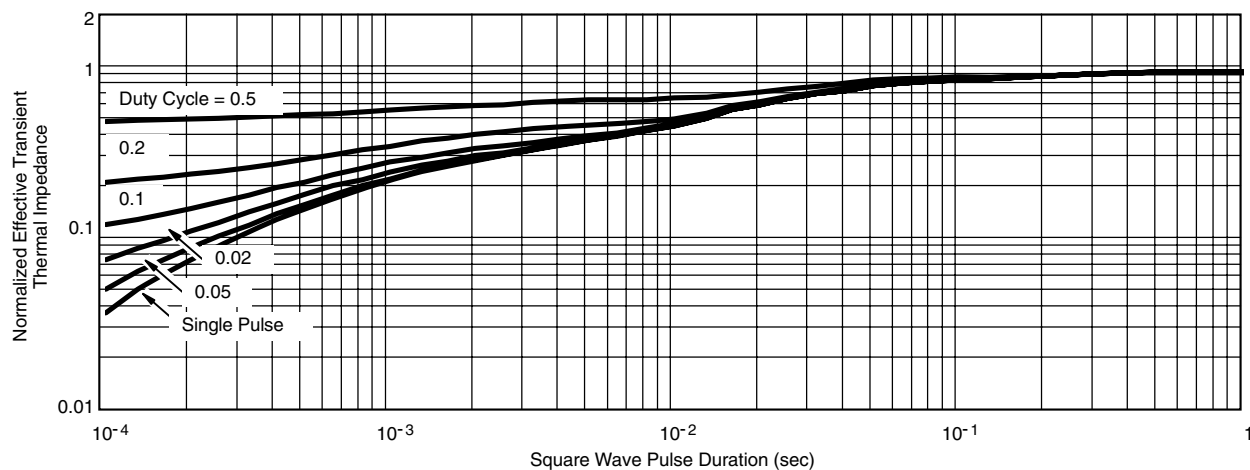
# THERMAL RATINGS



**Maximum Avalanche and Drain Current  
vs. Case Temperature**



**Safe Operating Area**



**Normalized Thermal Transient Impedance, Junction-to-Case**

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