

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

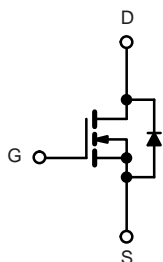
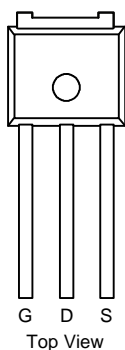
### PRODUCT SUMMARY

$V_{DS}$ (V)	$R_{DS(on)}$ ( $\Omega$ )	$I_D$ (A) <sup>a</sup>
60	0.012 at $V_{GS} = 10$ V	55
	0.015 at $V_{GS} = 4.5$ V	47

### FEATURES

- 175 °C Junction Temperature
- Trench Power MOSFET
- Material categorization:


**RoHS**  
 COMPLIANT

**TO-251**


N-Channel MOSFET

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

Parameter		Symbol	Limit	Unit
Gate-Source Voltage		$V_{GS}$	$\pm 20$	V
Continuous Drain Current ( $T_J = 175$ °C) <sup>b</sup>	$T_C = 25$ °C	$I_D$	55	A
	$T_C = 100$ °C		46 <sup>a</sup>	
Pulsed Drain Current		$I_{DM}$	110	
Continuous Source Current (Diode Conduction)		$I_S$	50 <sup>a</sup>	
Avalanche Current		$I_{AS}$	50	
Single Avalanche Energy (Duty Cycle $\leq 1$ %)	$L = 0.1$ mH	$E_{AS}$	125	mJ
Maximum Power Dissipation	$T_C = 25$ °C	$P_D$	136	W
	$T_A = 25$ °C		3 <sup>b</sup> , 8.3 <sup>b, c</sup>	
Operating Junction and Storage Temperature Range		$T_J, T_{stg}$	- 55 to 175	°C

### THERMAL RESISTANCE RATINGS

Parameter		Symbol	Typical	Maximum	Unit
Maximum Junction-to-Ambient <sup>a</sup>	$t \leq 10$ sec	$R_{thJA}$	15	18	°C/W
	Steady State		40	50	
Maximum Junction-to-Case		$R_{thJC}$	0.85	1.1	

Notes:

a. Package limited.

b. Surface mounted on 1" x 1" FR4 board.

 c.  $t \leq 10$  s.

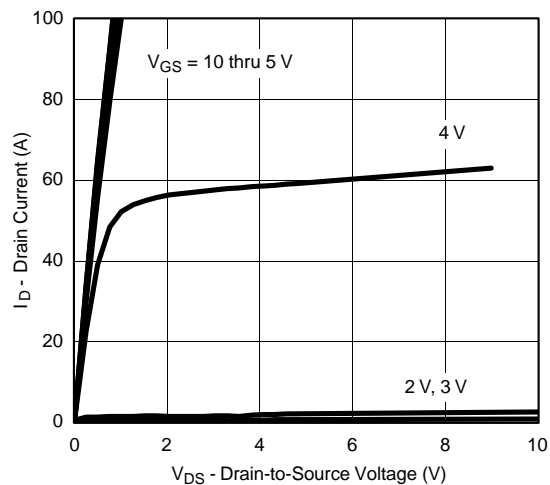
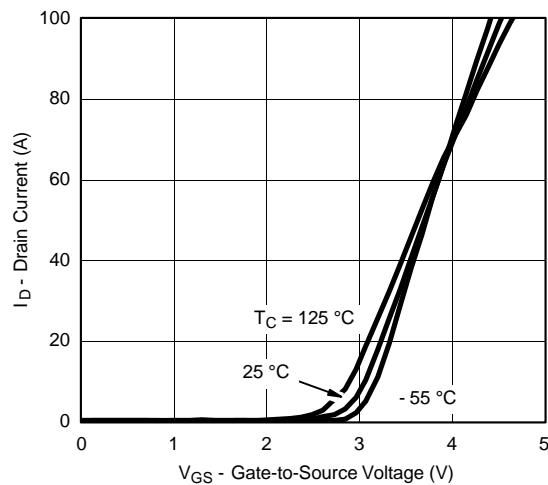
**SPECIFICATIONS** ( $T_J = 25\text{ }^{\circ}\text{C}$ , unless otherwise noted)

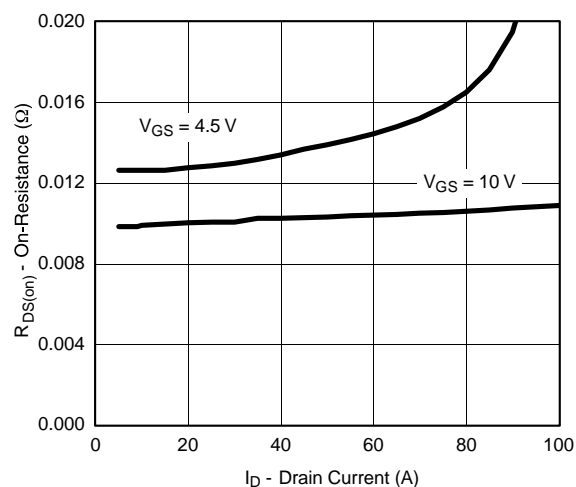
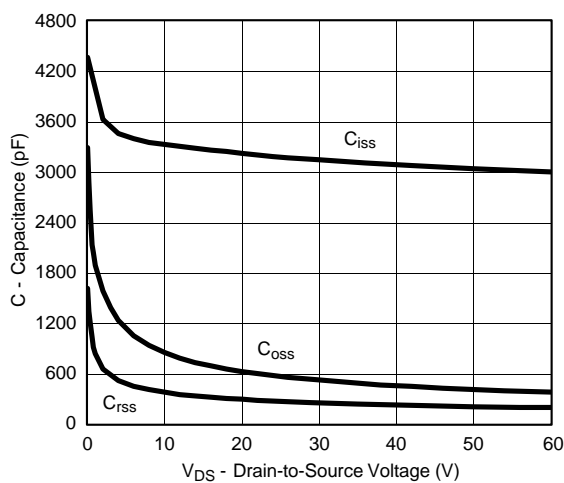
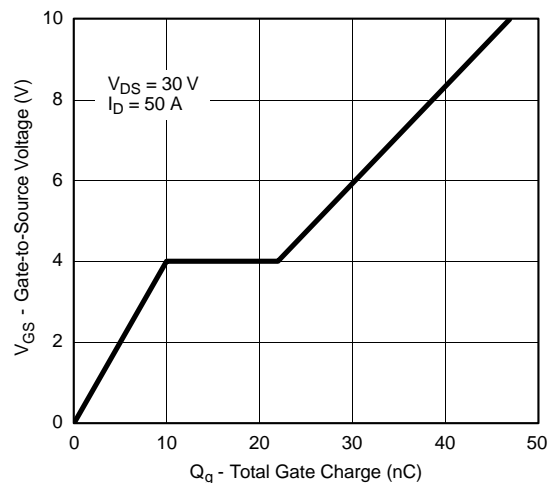
Parameter	Symbol	Test Conditions	Min.	Typ. <sup>a</sup>	Max.	Unit
Static						
Drain-Source Breakdown Voltage	V <sub>DS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA	60			V
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA	1		3	
Gate-Body Leakage	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> = 60 V, V <sub>GS</sub> = 0 V			1	μA
		V <sub>DS</sub> = 60 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 125 °C			50	
		V <sub>DS</sub> = 60 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 175 °C			250	
On-State Drain Current <sup>b</sup>	I <sub>D(on)</sub>	V <sub>DS</sub> = 5 V, V <sub>GS</sub> = 10 V	60			A
Drain-Source On-State Resistance <sup>b</sup>	R <sub>DS(on)</sub>	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 20 A		0.012		Ω
		V <sub>GS</sub> = 10 V, I <sub>D</sub> = 20 A, T <sub>J</sub> = 125 °C		0.013		
		V <sub>GS</sub> = 10 V, I <sub>D</sub> = 20 A, T <sub>J</sub> = 175 °C		0.017		
		V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 15 A		0.015		
Forward Transconductance <sup>b</sup>	g <sub>fs</sub>	V <sub>DS</sub> = 15 V, I <sub>D</sub> = 20 A		60		S
Dynamic						
Input Capacitance	C <sub>iSS</sub>	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 25 V, f = 1 MHz		3650		pF
Output Capacitance	C <sub>oSS</sub>			570		
Reverse Transfer Capacitance	C <sub>rSS</sub>			325		
Total Gate Charge <sup>c</sup>	Q <sub>g</sub>	V <sub>DS</sub> = 30 V, V <sub>GS</sub> = 10 V, I <sub>D</sub> = 50 A		46		nC
Gate-Source Charge <sup>c</sup>	Q <sub>gs</sub>			10		
Gate-Drain Charge <sup>c</sup>	Q <sub>gd</sub>			12		
Turn-On Delay Time <sup>c</sup>	t <sub>d(on)</sub>	V <sub>DD</sub> = 30 V, R <sub>L</sub> = 0.6 Ω I <sub>D</sub> ≅ 50 A, V <sub>GEN</sub> = 10 V, R <sub>g</sub> = 2.5 Ω		10	20	ns
Rise Time <sup>c</sup>	t <sub>r</sub>			15	25	
Turn-Off Delay Time <sup>c</sup>	t <sub>d(off)</sub>			35	50	
Fall Time <sup>c</sup>	t <sub>f</sub>			20	30	
Source-Drain Diode Ratings and Characteristics (T <sub>C</sub> = 25 °C)						
Pulsed Current	I <sub>SM</sub>				60	A
Diode Forward Voltage	V <sub>SD</sub>	I <sub>F</sub> = 20 A, V <sub>GS</sub> = 0 V		1	1.5	V
Reverse Recovery Time	t <sub>rr</sub>	I <sub>F</sub> = 20 A, di/dt = 100 A/μs		45	100	ns

Notes:

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

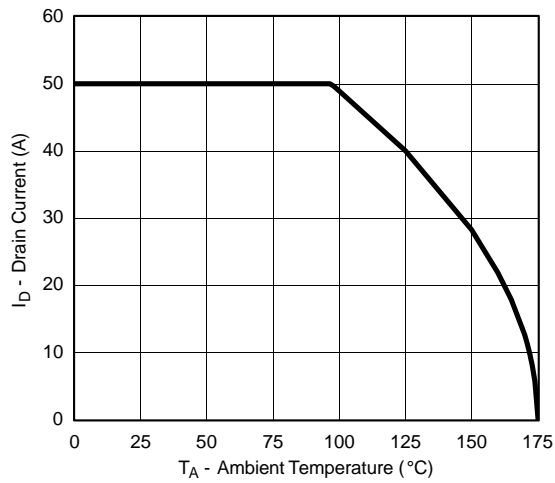
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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

**TYPICAL CHARACTERISTICS** (25 °C unless noted)

**Output Characteristics**

**Transfer Characteristics**

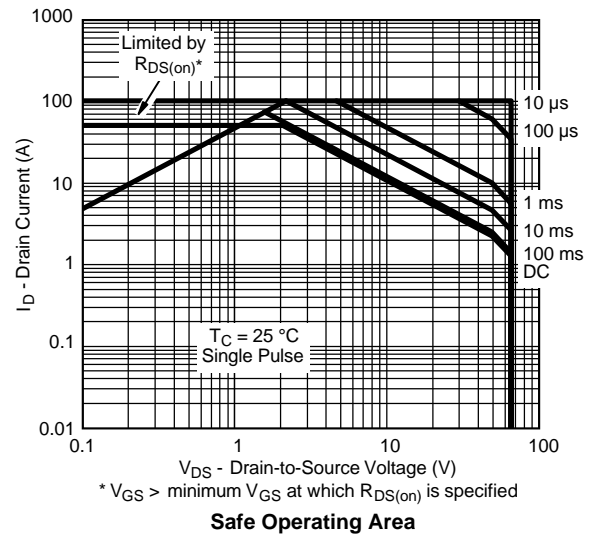
**Transconductance**

**On-Resistance vs. Drain Current**

**Capacitance**

**Gate Charge**

**TYPICAL CHARACTERISTICS** (25 °C unless noted)**On-Resistance vs. Junction Temperature****Source-Drain Diode Forward Voltage**

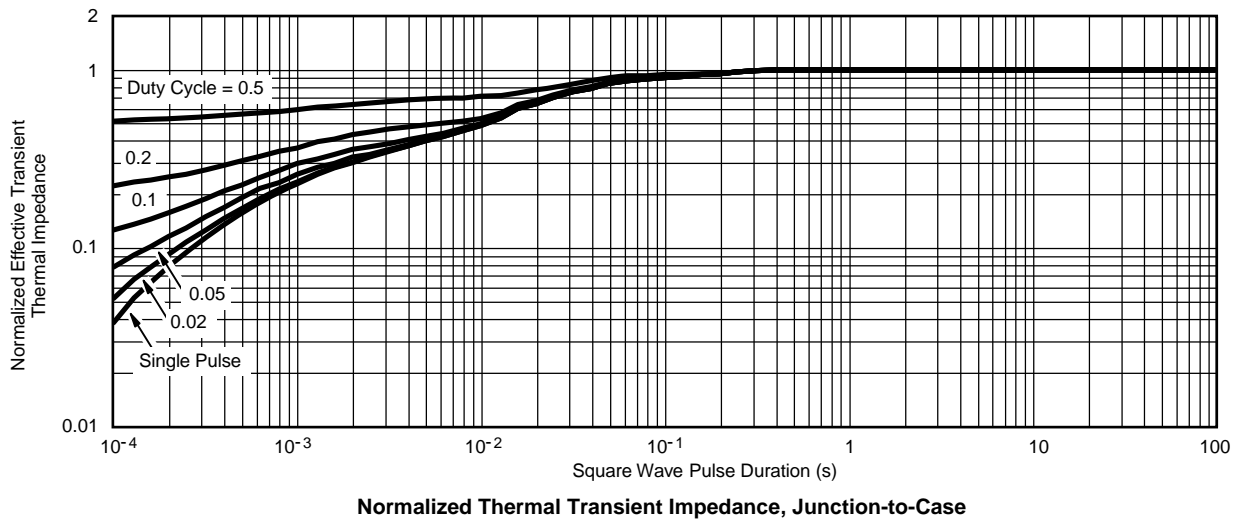
## THERMAL RATINGS



Maximum Drain Current vs. Ambient Temperature



Safe Operating Area



Normalized Thermal Transient Impedance, Junction-to-Case

TO-251AA (DPAK)



Note: Dimension L3 is for reference only.

Dim	MILLIMETERS		INCHES	
	Min	Max	Min	Max
A	2.21	2.38	0.087	0.094
A1	0.89	1.14	0.035	0.045
b	0.71	0.89	0.028	0.035
b1	0.76	1.14	0.030	0.045
b2	5.23	5.43	0.206	0.214
c	0.46	0.58	0.018	0.023
c1	0.46	0.58	0.018	0.023
D	5.97	6.22	0.235	0.245
E	6.48	6.73	0.255	0.265
e	2.28 BSC		0.090 BSC	
L	8.89	9.53	0.350	0.375
L1	1.91	2.28	0.075	0.090
L2	0.89	1.27	0.035	0.050
L3	1.15	1.52	0.045	0.060
ECN: S-03946—Rev. E, 09-Jul-01 DWG: 5346				

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