



## N-Channel 60-V (D-S) 175°C MOSFET

PRODUCT SUMMARY		
$V_{(BR)DSS}$ (V)	$r_{DS(on)}$ ( $\Omega$ )	$I_D$ (A)
60	0.0049 @ $V_{GS} = 10$ V	90 <sup>a</sup>
	0.0055 @ $V_{GS} = 4.5$ V	

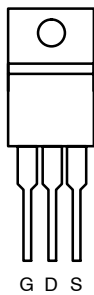
### FEATURES

- TrenchFET® Power MOSFET
- 175°C Maximum Junction Temperature

### APPLICATIONS

- Automotive Such As
  - High-Side Switch
  - Motor Drives
  - 12-V Battery
- Synchronous Rectification

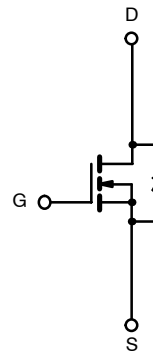
TO-220AB



Top View

DRAIN connected to TAB

Ordering Information: SUP90N06-05L—E3



N-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS ( $T_C = 25^\circ\text{C}$ UNLESS OTHERWISE NOTED)				
Parameter	Symbol	Limit	Unit	
Drain-Source Voltage	$V_{DS}$	60	V	
Gate-Source Voltage	$V_{GS}$	$\pm 20$		
Continuous Drain Current ( $T_J = 175^\circ\text{C}$ )	$I_D$	$T_C = 25^\circ\text{C}$	90 <sup>a</sup>	A
		$T_C = 125^\circ\text{C}$	90 <sup>a</sup>	
Pulsed Drain Current	$I_{DM}$	240		
Avalanche Current, Single Pulse	$I_{AS}$	75		
Repetitive Avalanche Energy, Single Pulse	$E_{AS}$	L = 0.1 mH	280	mJ
Maximum Power Dissipation			$P_D$	300 <sup>b</sup>
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	-55 to 175	$^\circ\text{C}$	

THERMAL RESISTANCE RATINGS			
Parameter	Symbol	Limit	Unit
Junction-to-Ambient (Free Air)	$R_{thJA}$	62.5	$^\circ\text{C/W}$
Junction-to-Case	$R_{thJC}$	0.5	

Notes

- Package limited.
- See SOA curve for voltage derating.

SPECIFICATIONS (T <sub>J</sub> = 25 °C UNLESS OTHERWISE NOTED)						
Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
<b>Static</b>						
Drain-Source Breakdown Voltage	V <sub>(BR)DSS</sub>	V <sub>DS</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>a</sup>	I <sub>D(on)</sub>	V <sub>DS</sub> ≥ 5 V, V <sub>GS</sub> = 10 V	120			A
Drain-Source On-State Resistance <sup>a</sup>	r <sub>DS(on)</sub>	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 30 A		0.0039	0.0049	Ω
		V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 20 A		0.0044	0.0055	
		V <sub>GS</sub> = 10 V, I <sub>D</sub> = 30 A, T <sub>J</sub> = 125 °C			0.0083	
		V <sub>GS</sub> = 10 V, I <sub>D</sub> = 30 A, T <sub>J</sub> = 175 °C			0.0103	
Forward Transconductance <sup>a</sup>	g <sub>fs</sub>	V <sub>DS</sub> = 15 V, I <sub>D</sub> = 30 A	30			S
<b>Dynamic<sup>b</sup></b>						
Input Capacitance	C <sub>iss</sub>	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 25 V, f = 1 MHz		12900		pF
Output Capacitance	C <sub>oss</sub>			1060		
Reverse Transfer Capacitance	C <sub>rss</sub>			700		
Gate Resistance	R <sub>g</sub>	f = 1.0 MHz		1.3		Ω
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> = 90 A		200	300	nC
Gate-Source Charge <sup>c</sup>	Q <sub>gs</sub>			50		
Gate-Drain Charge <sup>c</sup>	Q <sub>gd</sub>			33		
Turn-On Delay Time <sup>c</sup>	t <sub>d(on)</sub>	V <sub>DD</sub> = 30 V, R <sub>L</sub> = 0.33 Ω I <sub>D</sub> ≅ 90 A, V <sub>GEN</sub> = 10 V, R <sub>g</sub> = 2.5 Ω		22	35	ns
Rise Time <sup>c</sup>	t <sub>r</sub>			130	200	
Turn-Off Delay Time <sup>c</sup>	t <sub>d(off)</sub>			110	165	
Fall Time <sup>c</sup>	t <sub>f</sub>			280	420	
<b>Source-Drain Diode Ratings and Characteristics (T<sub>C</sub> = 25 °C)<sup>b</sup></b>						
Continuous Current	I <sub>S</sub>				90	A
Pulsed Current	I <sub>SM</sub>				240	
Forward Voltage <sup>a</sup>	V <sub>SD</sub>	I <sub>F</sub> = 90 A, V <sub>GS</sub> = 0 V		1.1	1.5	V
Reverse Recovery Time	t <sub>rr</sub>	I <sub>F</sub> = 90 A, di/dt = 100 A/μs		55	82	ns
Peak Reverse Recovery Current	I <sub>RM(REC)</sub>			3.6	5.4	A
Reverse Recovery Charge	Q <sub>rr</sub>				0.1	0.22

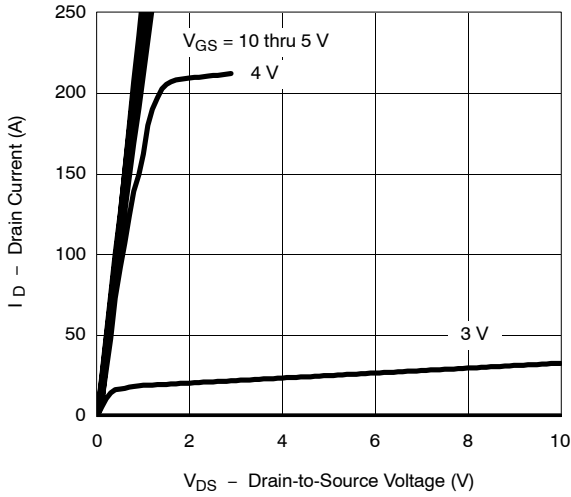
Notes

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

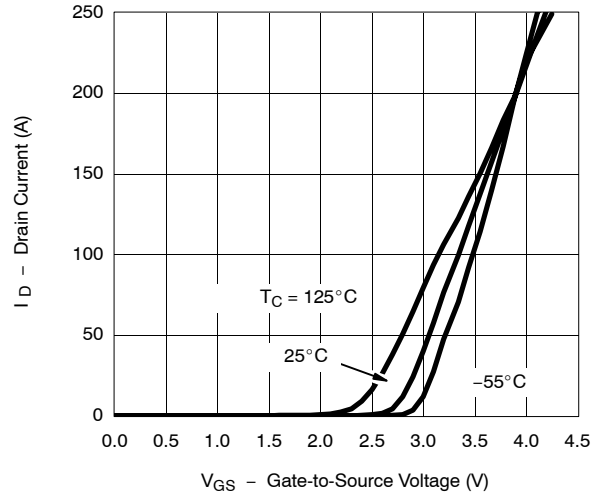


**TYPICAL CHARACTERISTICS (25°C UNLESS NOTED)**

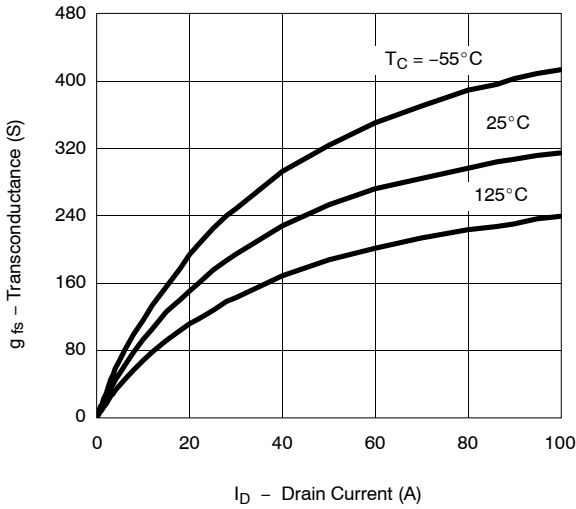
Output Characteristics



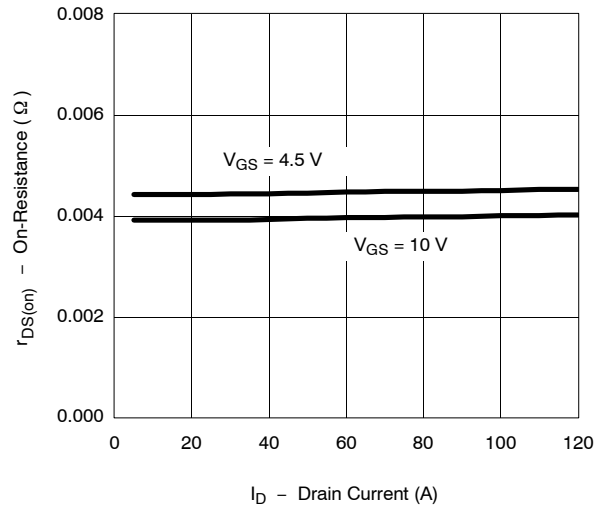
Transfer Characteristics



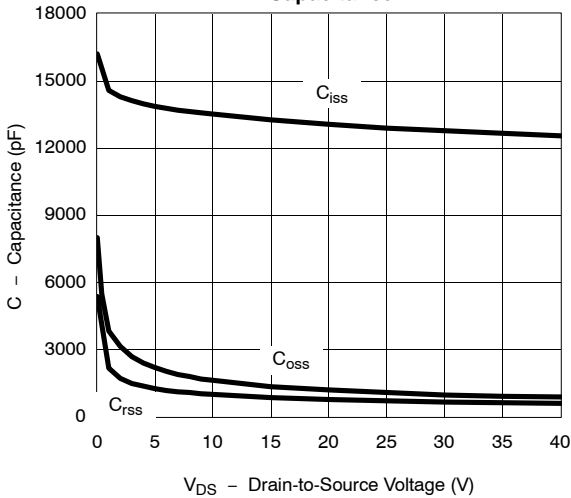
Transconductance



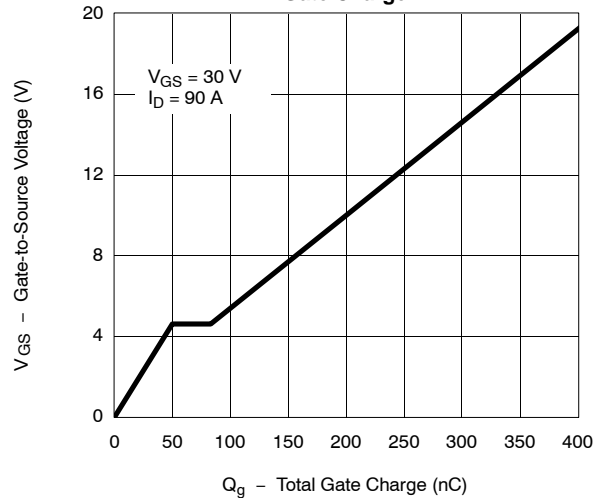
On-Resistance vs. Drain Current



Capacitance

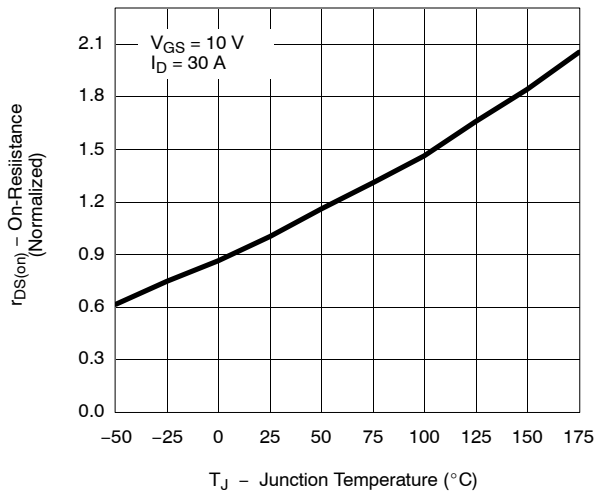


Gate Charge

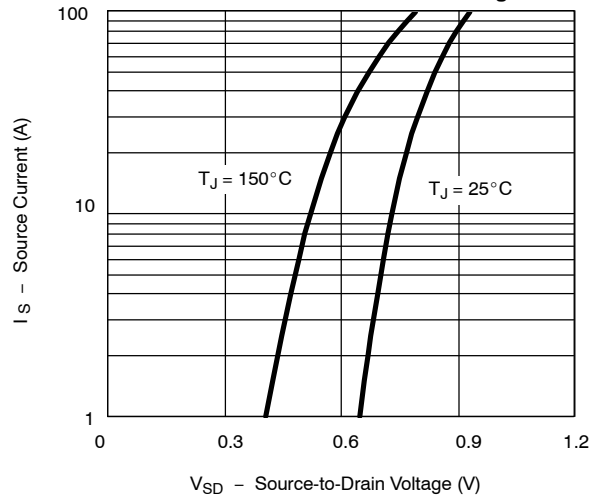


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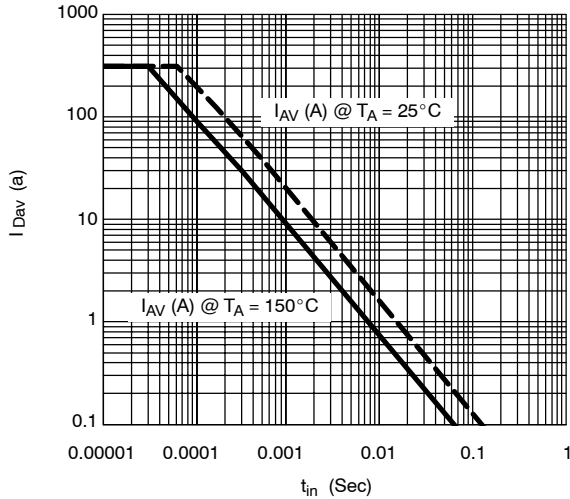
**On-Resistance vs. Junction Temperature**



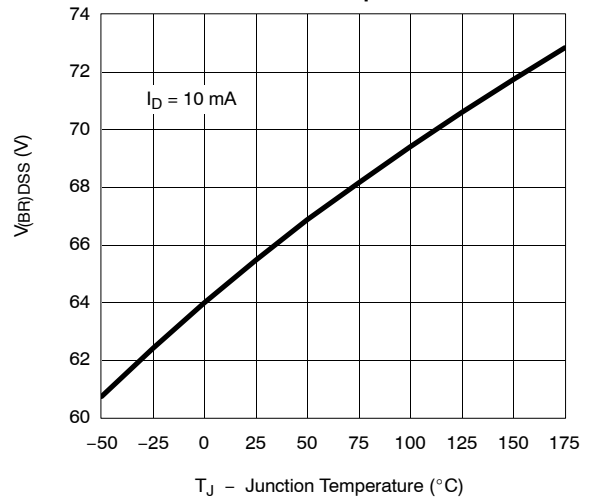
**Source-Drain Diode Forward Voltage**



**Avalanche Current vs. Time**



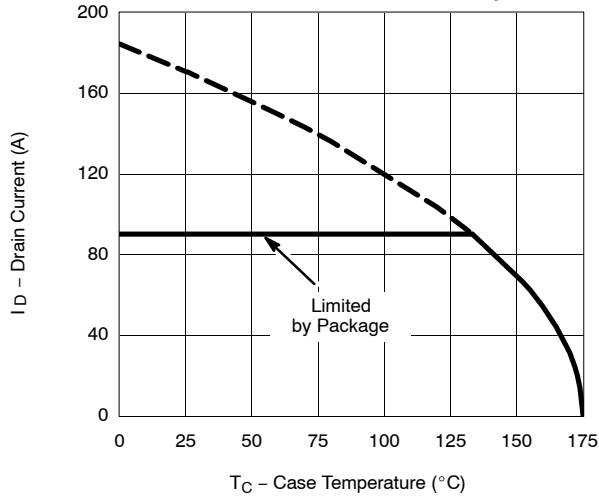
**Drain Source Breakdown vs. Junction Temperature**



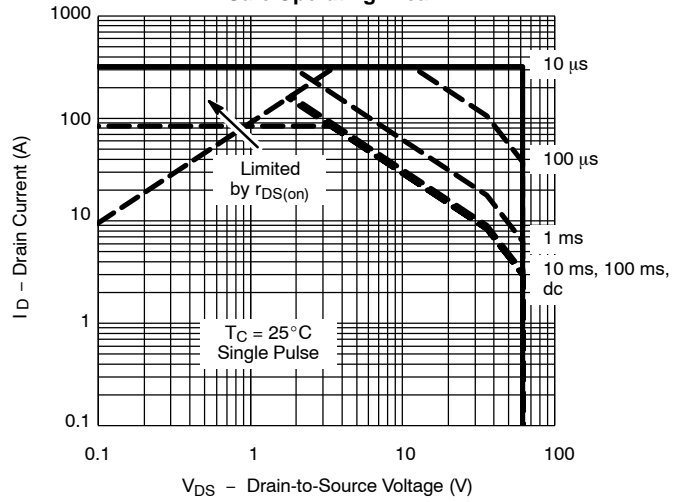


**THERMAL RATINGS**

Maximum Drain Current vs. Case Temperature



Safe Operating Area



Normalized Thermal Transient Impedance, Junction-to-Case

