

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

PRODUCT SUMMARY			
V <sub>DS</sub> (V)	R <sub>DS(on)</sub> (Ω)	I <sub>D</sub> (A) <sup>a</sup>	Q <sub>g</sub> (Typ.)
- 60	0.019 at V <sub>GS</sub> = - 10 V	- 53	38 nC
	0.026 at V <sub>GS</sub> = - 4.5 V	- 42	

### FEATURES

- TrenchFET<sup>®</sup> Power MOSFET
- 100 % UIS Tested

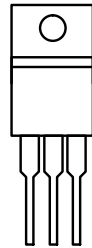
### APPLICATIONS

- Load Switch

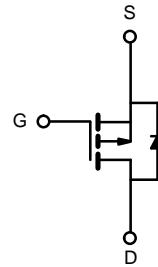


RoHS  
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TO-220AB



G D S  
Top View



P-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS (T <sub>A</sub> = 25 °C, unless otherwise noted)				
Parameter	Symbol	Limit	Unit	
Drain-Source Voltage	V <sub>DS</sub>	- 60	V	
Gate-Source Voltage	V <sub>GS</sub>	± 20		
Continuous Drain Current (T <sub>J</sub> = 150 °C)	I <sub>D</sub>	T <sub>C</sub> = 25 °C	- 53 <sup>a</sup>	A
		T <sub>C</sub> = 70 °C	- 46.8	
		T <sub>A</sub> = 25 °C	- 9.2 <sup>b</sup>	
		T <sub>A</sub> = 70 °C	- 8.1 <sup>b</sup>	
Pulsed Drain Current	I <sub>DM</sub>	- 200		
Avalanche Current Pulse	I <sub>AS</sub>	- 45	L = 0.1 mH	
Single Pulse Avalanche Energy				
Continuous Source-Drain Diode Current	I <sub>S</sub>	T <sub>C</sub> = 25 °C	69 <sup>a</sup>	A
		T <sub>A</sub> = 25 °C	2.1 <sup>b</sup>	
Maximum Power Dissipation	P <sub>D</sub>	T <sub>C</sub> = 25 °C	104.2 <sup>a</sup>	W
		T <sub>C</sub> = 70 °C	66.7 <sup>a</sup>	
		T <sub>A</sub> = 25 °C	3.1 <sup>b</sup>	
		T <sub>A</sub> = 70 °C	2 <sup>b</sup>	
Operating Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	- 55 to 150	°C	

THERMAL RESISTANCE RATINGS					
Parameter	Symbol	Typical	Maximum	Unit	
Maximum Junction-to-Ambient <sup>b</sup>	Steady State	R <sub>thJA</sub>	33	40	°C/W
		R <sub>thJC</sub>	0.98	1.2	

Notes:

a. Based on T<sub>C</sub> = 25 °C.

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

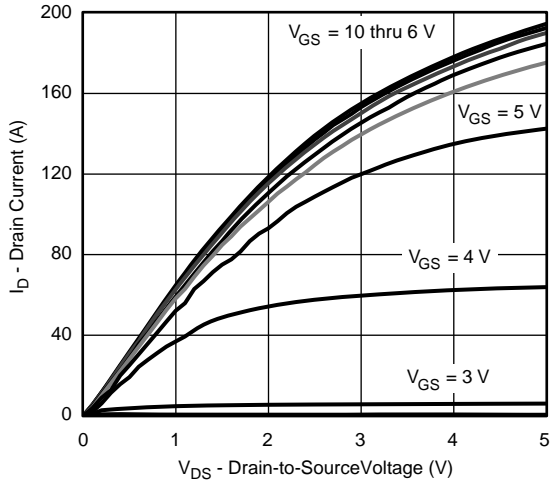
<b>SPECIFICATIONS</b> ( $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted)						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
<b>Static</b>						
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{GS} = 0\text{ V}, I_D = -250\text{ }\mu\text{A}$	-60			V
$V_{DS}$ Temperature Coefficient	$\Delta V_{DS}/T_J$	$I_D = -250\text{ }\mu\text{A}$		68		mV/°C
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$			-5.2		
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = -250\text{ }\mu\text{A}$	-1		-3	V
Gate-Source Leakage	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$			$\pm 100$	nA
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = -60\text{ V}, V_{GS} = 0\text{ V}$			-1	$\mu\text{A}$
		$V_{DS} = -60\text{ V}, V_{GS} = 0\text{ V}, T_J = 55\text{ }^\circ\text{C}$			-10	
On-State Drain Current <sup>a</sup>	$I_{D(on)}$	$V_{DS} = -5\text{ V}, V_{GS} = -10\text{ V}$	-120			A
Drain-Source On-State Resistance <sup>a</sup>	$R_{DS(on)}$	$V_{GS} = -10\text{ V}, I_D = -30\text{ A}$		0.019		$\Omega$
		$V_{GS} = -4.5\text{ V}, I_D = -20\text{ A}$		0.026		
Forward Transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = -15\text{ V}, I_D = -50\text{ A}$	20			S
<b>Dynamic<sup>b</sup></b>						
Input Capacitance	$C_{iss}$	$V_{DS} = -25\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$		3500		pF
Output Capacitance	$C_{oss}$			390		
Reverse Transfer Capacitance	$C_{rss}$			290		
Total Gate Charge	$Q_g$	$V_{DS} = -30\text{ V}, V_{GS} = -10\text{ V}, I_D = -55\text{ A}$		76	115	nC
				38	60	
Gate-Source Charge	$Q_{gs}$	$V_{DS} = -30\text{ V}, V_{GS} = -4.5\text{ V}, I_D = -55\text{ A}$		16		
Gate-Drain Charge	$Q_{gd}$			19		
Gate Resistance	$R_g$	$f = 1\text{ MHz}$		5.2		$\Omega$
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = -2\text{ V}, R_L = 2\text{ }\Omega$ $I_D \cong -10\text{ A}, V_{GEN} = -10\text{ V}, R_g = 1\text{ }\Omega$		10	15	ns
Rise Time	$t_r$			7	15	
Turn-Off Delay Time	$t_{d(off)}$			70	110	
Fall Time	$t_f$			40	60	
<b>Drain-Source Body Diode Characteristics</b>						
Continuous Source-Drain Diode Current	$I_S$	$T_C = 25\text{ }^\circ\text{C}$			-69	A
Pulse Diode Forward Current <sup>a</sup>	$I_{SM}$				-150	
Body Diode Voltage	$V_{SD}$	$I_S = -30\text{ A}$		-1	-1.5	V
Body Diode Reverse Recovery Time	$t_{rr}$	$I_F = -50\text{ A}, di/dt = 100\text{ A}/\mu\text{s}, T_J = 25\text{ }^\circ\text{C}$		45	68	ns
Body Diode Reverse Recovery Charge	$Q_{rr}$			59	120	nC
Reverse Recovery Fall Time	$t_a$			29		ns
Reverse Recovery Rise Time	$t_b$			16		

Notes:

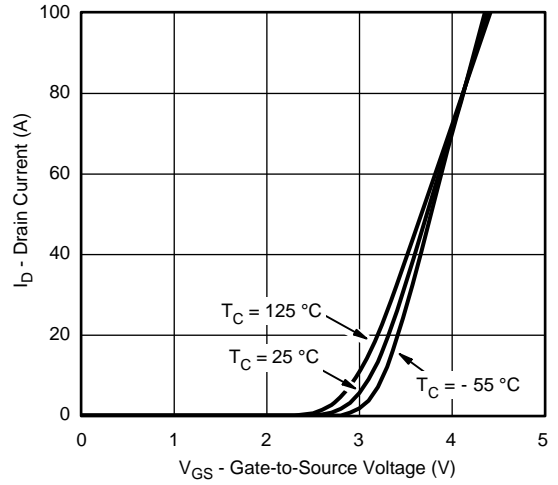
- a. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .  
 b. Guaranteed by design, not subject to production testing.

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)



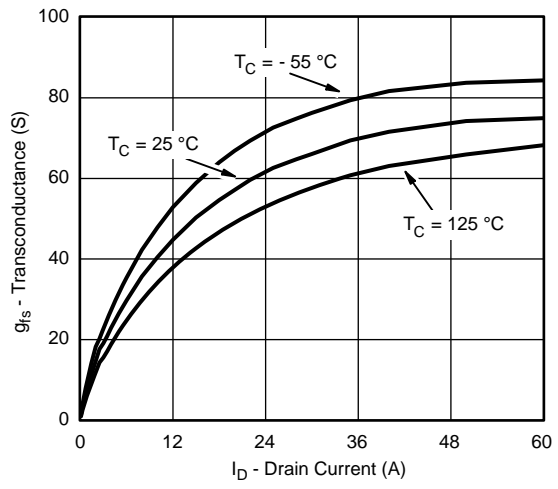
**Output Characteristics**



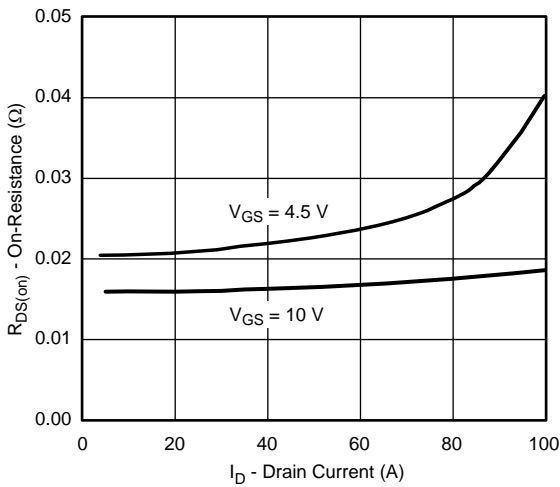
**Transfer Characteristics**



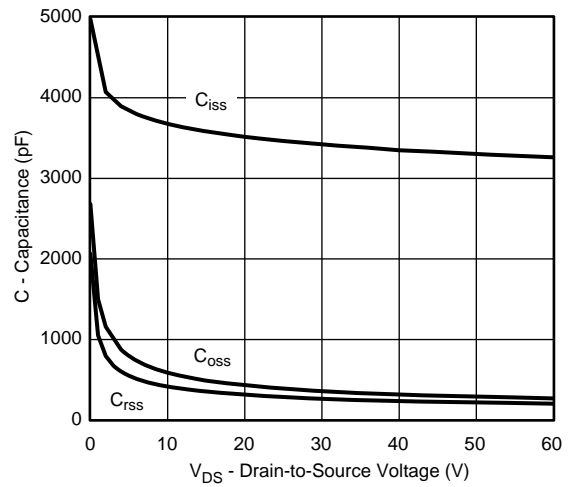
**Transfer Characteristics**



**Transconductance**

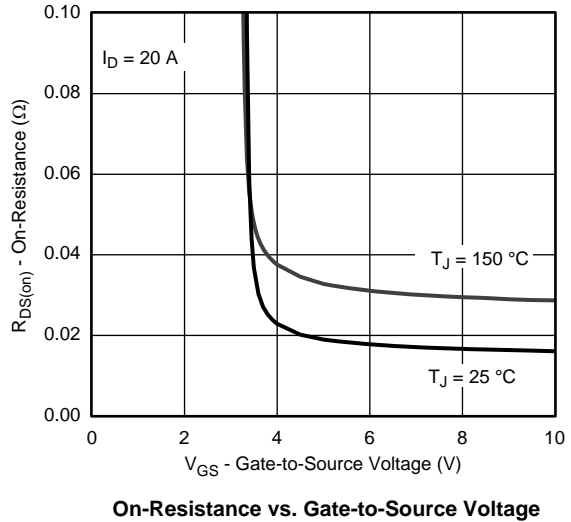
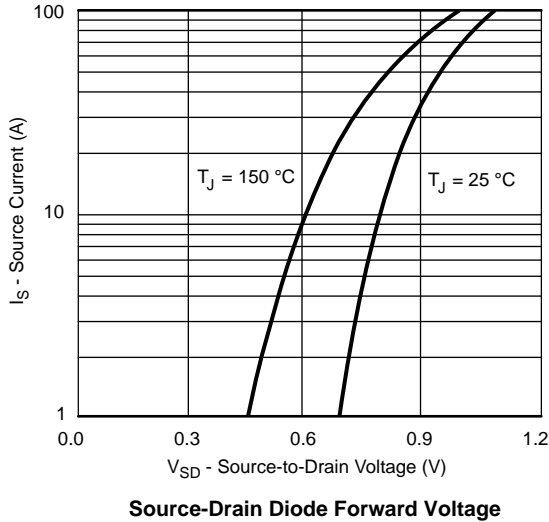
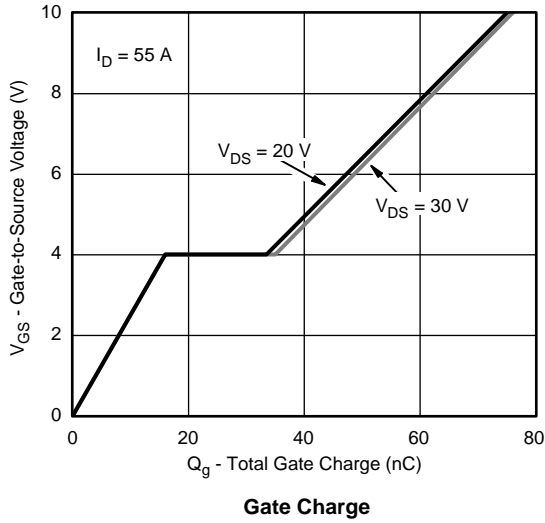


**On-Resistance vs. Drain Current**



**Capacitance**

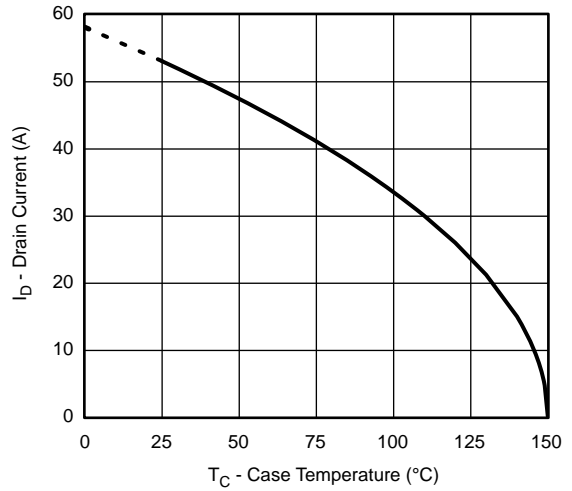
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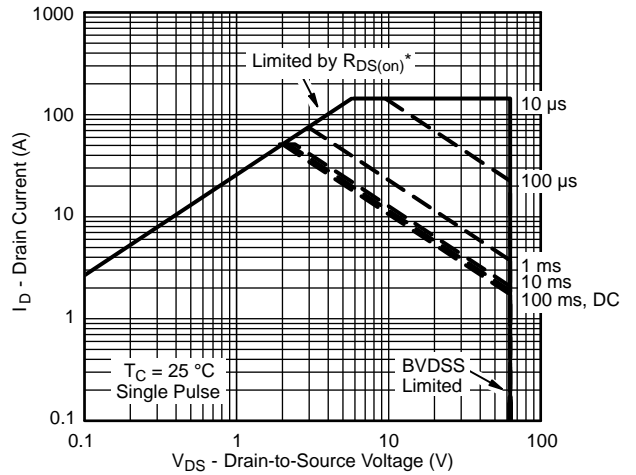
**Threshold Voltage**



**Max. Drain Current vs. Case Temperature**



**Power Derating, Junction-to-Case**



**Safe Operating Area, Junction-to-Case**



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

### TO-220AB



DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.25	4.65	0.167	0.183
b	0.69	1.01	0.027	0.040
b(1)	1.20	1.73	0.047	0.068
c	0.36	0.61	0.014	0.024
D	14.85	15.49	0.585	0.610
E	10.04	10.51	0.395	0.414
e	2.41	2.67	0.095	0.105
e(1)	4.88	5.28	0.192	0.208
F	1.14	1.40	0.045	0.055
H(1)	6.09	6.48	0.240	0.255
J(1)	2.41	2.92	0.095	0.115
L	13.35	14.02	0.526	0.552
L(1)	3.32	3.82	0.131	0.150
Ø P	3.54	3.94	0.139	0.155
Q	2.60	3.00	0.102	0.118

ECN: X12-0208-Rev. N, 08-Oct-12  
DWG: 5471

**Notes**

\* M = 1.32 mm to 1.62 mm (dimension including protrusion)  
Heatsink hole for HVM

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