

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

PRODUCT SUMMARY			
V _{DS} (V)	R _{DS(on)} (Ω)	I _D (A) ^a	Q _g (Typ.)
- 60	0.0078 at V _{GS} = - 10 V	- 98	141 nC
	0.0098 at V _{GS} = - 4.5 V	- 80	

FEATURES

- DT-Trench Power MOSFET
- 100 % R_g and UIS Tested

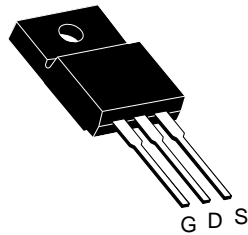


RoHS
COMPLIANT

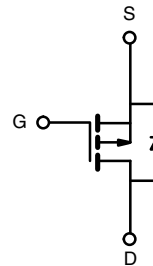
APPLICATIONS

- Load Switch

TO-220 FULLPAK



Top View



P-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS (T _A = 25 °C, unless otherwise noted)			
Parameter	Symbol	Limit	Unit
Drain-Source Voltage	V _{DS}	- 60	V
Gate-Source Voltage	V _{GS}	± 20	
Continuous Drain Current (T _J = 150 °C)	T _C = 25 °C	- 98 ^a	A
	T _C = 70 °C	- 56	
	T _A = 25 °C	12 ^b	
	T _A = 70 °C	- 8.9 ^b	
Pulsed Drain Current	I _{DM}	- 320	
Avalanche Current Pulse	I _{AS}	- 90	
Single Pulse Avalanche Energy	E _{AS}	320	mJ
Continuous Source-Drain Diode Current	T _C = 25 °C	98 ^a	A
	T _A = 25 °C	3.4 ^b	
Maximum Power Dissipation	T _C = 25 °C	185 ^a	W
	T _C = 70 °C	116 ^a	
	T _A = 25 °C	4.5 ^b	
	T _A = 70 °C	2.3 ^b	
Operating Junction and Storage Temperature Range	T _J , T _{stg}	- 55 to 150	°C

THERMAL RESISTANCE RATINGS					
Parameter	Symbol	Typical	Maximum	Unit	
Maximum Junction-to-Ambient ^b	R _{thJA}	35	65	°C/W	
Maximum Junction-to-Case					

Notes:

a. Based on T_C = 25 °C.

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

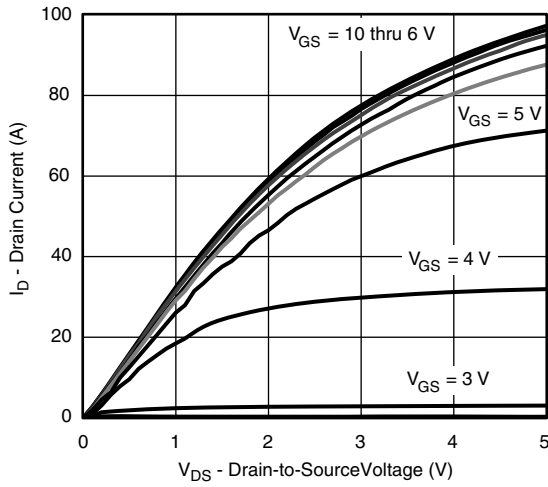
SPECIFICATIONS ($T_J = 25\text{ }^\circ\text{C}$, unless otherwise noted)						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Static						
Drain-Source Breakdown Voltage	V_{DS}	$V_{GS} = 0\text{ V}, I_D = -250\text{ }\mu\text{A}$	-60			V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	$I_D = -250\text{ }\mu\text{A}$		38		mV/ $^\circ\text{C}$
$V_{GS(th)}$ 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}	$V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$			± 100	nA
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = -48\text{ V}, V_{GS} = 0\text{ V}$			-1	μA
		$V_{DS} = -48\text{ V}, V_{GS} = 0\text{ V}, T_J = 55\text{ }^\circ\text{C}$			-10	
On-State Drain Current ^a	$I_{D(on)}$	$V_{DS} = -5\text{ V}, V_{GS} = -10\text{ V}$	-98			A
Drain-Source On-State Resistance ^a	$R_{DS(on)}$	$V_{GS} = -10\text{ V}, I_D = -30\text{ A}$		0.0078	0.0096	Ω
		$V_{GS} = -4.5\text{ V}, I_D = -20\text{ A}$		0.0098	0.0126	
Forward Transconductance ^a	g_{fs}	$V_{DS} = -15\text{ V}, I_D = -50\text{ A}$		20		S
Dynamic^b						
Input Capacitance	C_{iss}	$V_{DS} = -48\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$		8500		pF
Output Capacitance	C_{oss}			490		
Reverse Transfer Capacitance	C_{rss}			280		
Total Gate Charge	Q_g	$V_{DS} = -48\text{ V}, V_{GS} = -10\text{ V}, I_D = -30\text{ A}$		141		nC
				39		
Gate-Source Charge	Q_{gs}	$V_{DS} = -48\text{ V}, V_{GS} = -4.5\text{ V}, I_D = -20\text{ A}$		16		
Gate-Drain Charge	Q_{gd}			23		
Gate Resistance	R_g	$f = 1\text{ MHz}$		4.5		Ω
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = -48\text{ V}, R_L = 2\text{ }\Omega$ $I_D \cong -10\text{ A}, V_{GEN} = -10\text{ V}, R_g = 1\text{ }\Omega$		70		ns
Rise Time	t_r			155		
Turn-Off Delay Time	$t_{d(off)}$			210		
Fall Time	t_f			160		
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I_S	$T_C = 25\text{ }^\circ\text{C}$			-98	A
Pulse Diode Forward Current ^a	I_{SM}				-320	
Body Diode Voltage	V_{SD}	$I_S = -30\text{ A}$		-0.7	-1.2	V
Body Diode Reverse Recovery Time	t_{rr}	$I_F = -50\text{ A}, di/dt = 100\text{ A}/\mu\text{s}, T_J = 25\text{ }^\circ\text{C}$		48		ns
Body Diode Reverse Recovery Charge	Q_{rr}			59		nC
Reverse Recovery Fall Time	t_a			29		ns
Reverse Recovery Rise Time	t_b			12		

Notes:

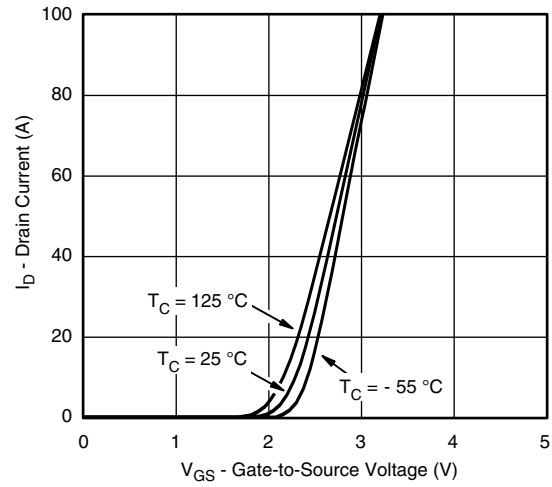
- Pulse test; pulse width $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$.
- Guaranteed by design, not subject to production testing.

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.

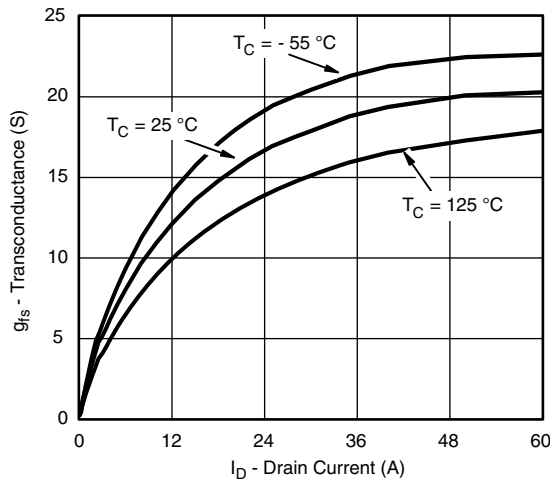
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



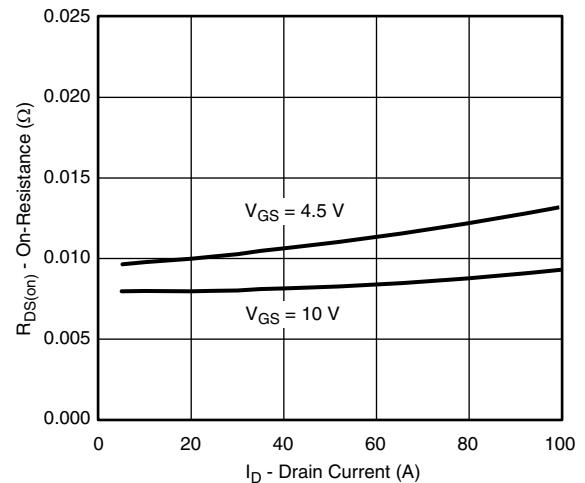
Output Characteristics



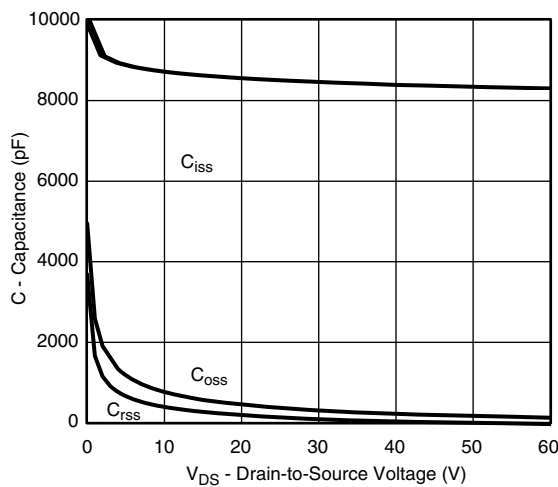
Transfer Characteristics



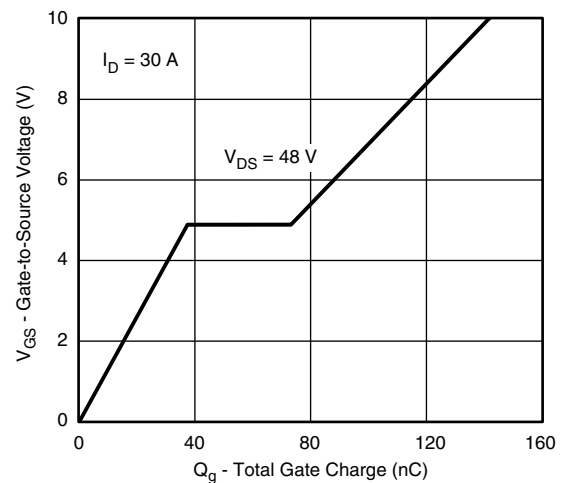
Transconductance



On-Resistance vs. Drain Current

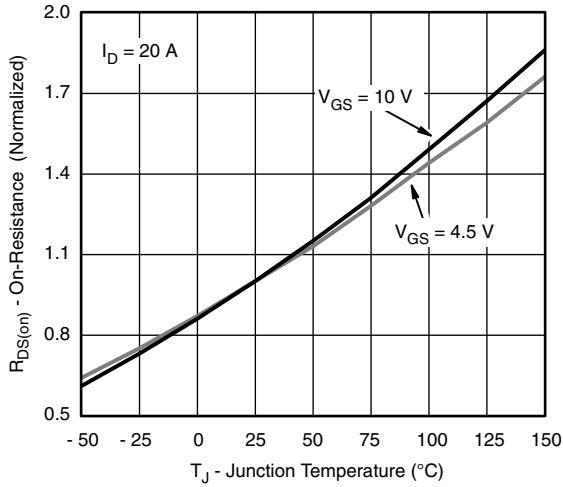


Capacitance

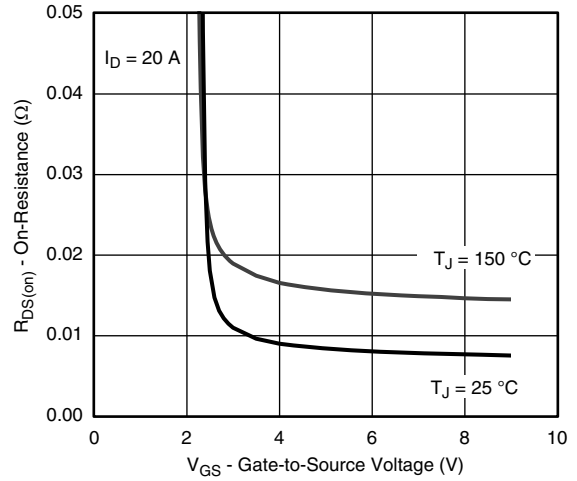


Gate Charge

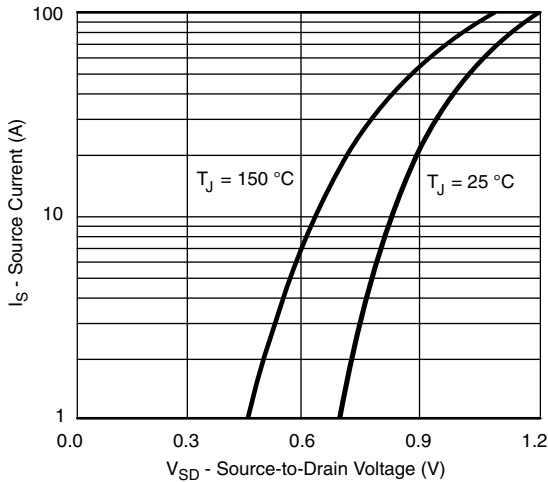
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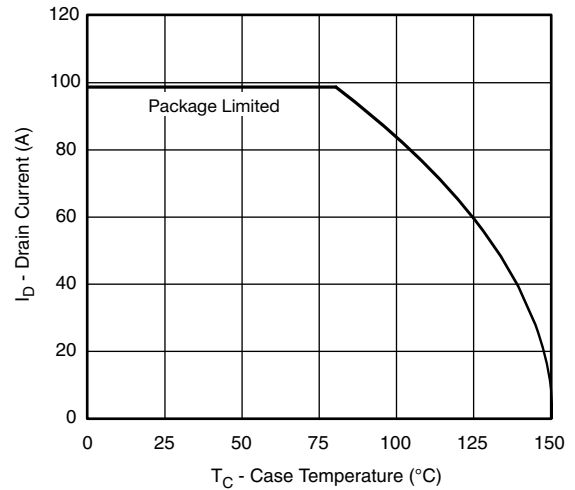
On-Resistance vs. Gate-to-Source Voltage



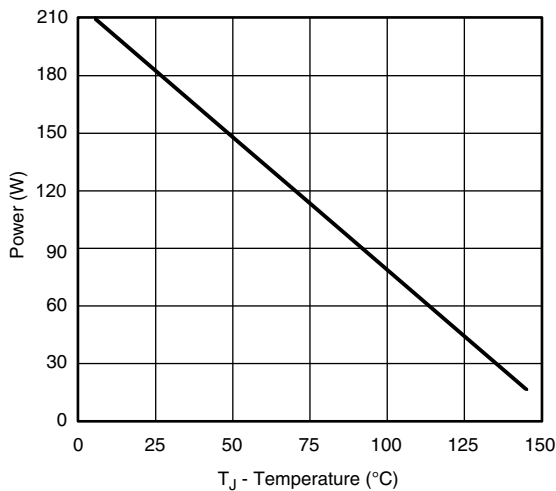
On-Resistance vs. Gate-to-Source Voltage



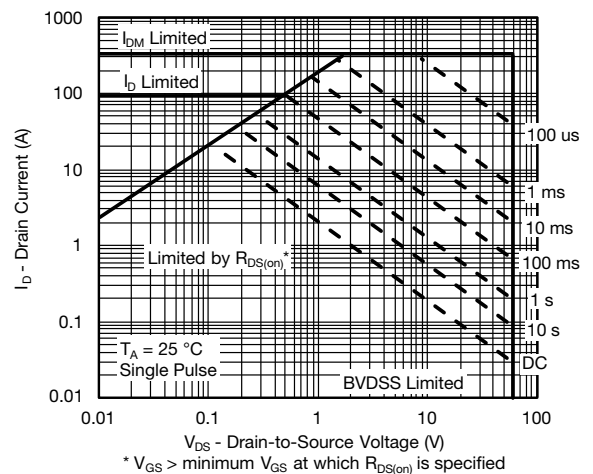
Source-Drain Diode Forward Voltage



Max. Drain Current vs. Case Temperature



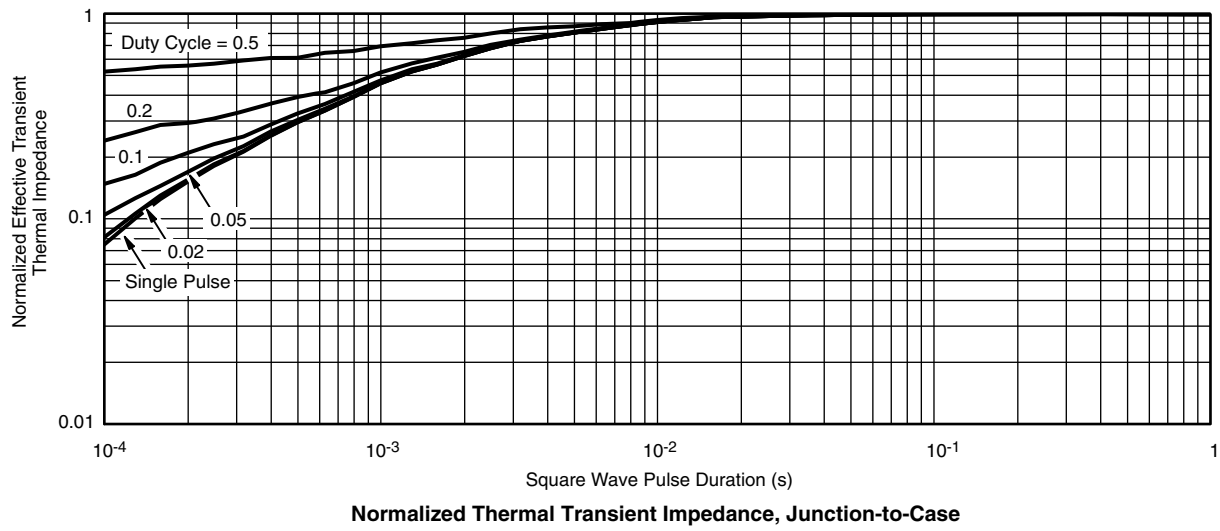
Power Derating, Junction-to-Case



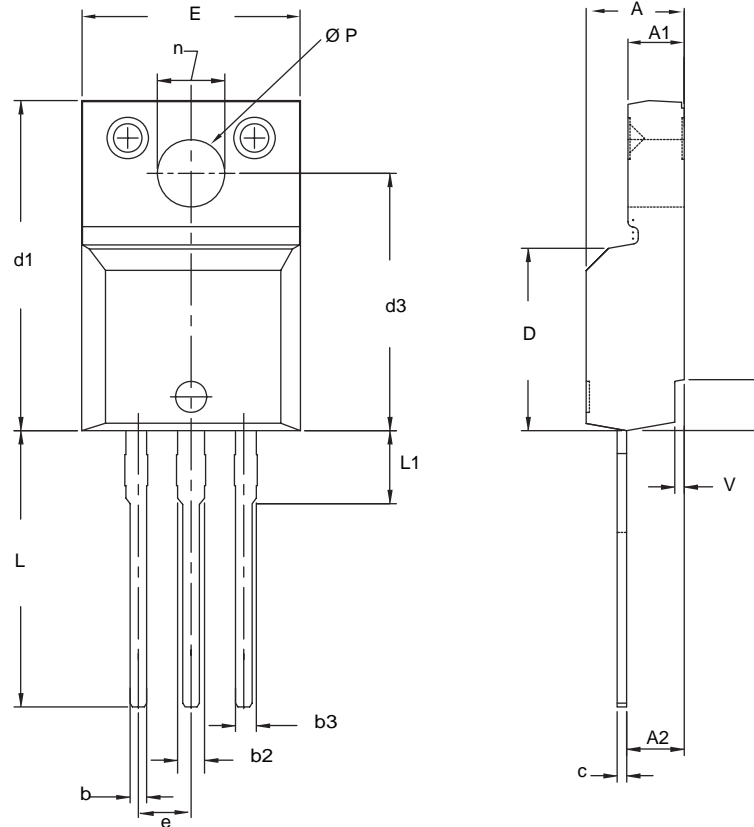
* $V_{GS} >$ minimum V_{GS} at which $R_{DS(on)}$ is specified

Safe Operating Area, Junction-to-Ambient

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



TO-220 FULLPAK (HIGH VOLTAGE)



DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.570	4.830	0.180	0.190
A1	2.570	2.830	0.101	0.111
A2	2.510	2.850	0.099	0.112
b	0.622	0.890	0.024	0.035
b2	1.229	1.400	0.048	0.055
b3	1.229	1.400	0.048	0.055
c	0.440	0.629	0.017	0.025
D	8.650	9.800	0.341	0.386
d1	15.88	16.120	0.622	0.635
d3	12.300	12.920	0.484	0.509
E	10.360	10.630	0.408	0.419
e	2.54 BSC		0.100 BSC	
L	13.200	13.730	0.520	0.541
L1	3.100	3.500	0.122	0.138
n	6.050	6.150	0.238	0.242
Ø P	3.050	3.450	0.120	0.136
u	2.400	2.500	0.094	0.098
v	0.400	0.500	0.016	0.020

ECN: X09-0126-Rev. B, 26-Oct-09
DWG: 5972

Notes

1. To be used only for process drawing.
2. These dimensions apply to all TO-220, FULLPAK leadframe versions 3 leads.
3. All critical dimensions should C meet $C_{pk} > 1.33$.
4. All dimensions include burrs and plating thickness.
5. No chipping or package damage.

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