
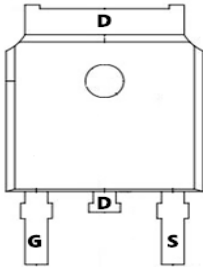


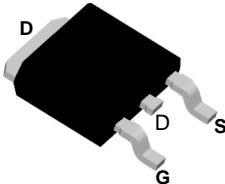
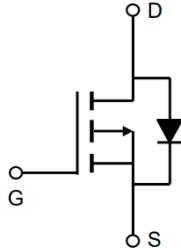
TM60P02D

P -Channel Enhancement Mosfet

<p>General Description</p> <ul style="list-style-type: none"> • Low $R_{DS(ON)}$ • RoHS and Halogen-Free Compliant <p>Applications</p> <ul style="list-style-type: none"> • Load switch • PWM 	<p>General Features</p> <p>$V_{DS} = -20V$ $I_D = -60A$</p> <p>$R_{DS(ON)} = 9m\Omega$ (typ.) @ $V_{GS} = -4.5V$</p> <p>100% UIS Tested 100% R_g Tested</p> 
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D:TO-252-3L

Marking: 60P02

Absolute Maximum Ratings ($T_c=25^\circ C$ Unless otherwise noted)

Symbol	Parameter	Rating	Units
V_{DS}	Drain-Source Voltage	-20	V
V_{GS}	Gate-Source Voltage	± 12	V
$I_D@T_c=25^\circ C$	Continuous Drain Current, $V_{GS} @ -4.5V^1$	-60	A
$I_D@T_c=70^\circ C$	Continuous Drain Current, $V_{GS} @ -4.5V^1$	-25	A
I_{DM}	Pulsed Drain Current ²	-68	A
$P_D@T_c=25^\circ C$	Total Power Dissipation ³	38	W
$P_D@T_c=70^\circ C$	Total Power Dissipation ³	18	W
T_{STG}	Storage Temperature Range	-55 to 150	$^\circ C$
T_J	Operating Junction Temperature Range	-55 to 150	$^\circ C$

Thermal Data

Symbol	Parameter	Max.	Unit
$R_{\theta JA}$	Thermal Resistance Junction-Ambient ¹	75	$^\circ C/W$
$R_{\theta JA}$	Thermal Resistance Junction-Ambient ¹ ($t \leq 10s$)	40	$^\circ C/W$
$R_{\theta JC}$	Thermal Resistance Junction-Case ¹	4.2	$^\circ C/W$

Electrical Characteristics (T_J=25 °C, unless otherwise noted)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} =0V, I _D =-250uA	-20	---	---	V
ΔBV _{DSS} /ΔT _J	BV _{DSS} Temperature Coefficient	Reference to 25°C, I _D =-1mA	---	-0.012	---	V/°C
R _{DS(on)}	Static Drain-Source On-Resistance ²	V _{GS} =-4.5V, I _D =-10A	---	9	13	mΩ
		V _{GS} =-2.5V, I _D =-8A	---	12	18	
V _{GS(th)}	Gate Threshold Voltage	V _{GS} =V _{DS} , I _D =-250uA	-0.5	-0.7	-1.0	V
ΔV _{GS(th)}	V _{GS(th)} Temperature Coefficient		---	2.94	---	mV/°C
I _{DSS}	Drain-Source Leakage Current	V _{DS} =-15V, V _{GS} =0V, T _J =25°C	---	---	1	uA
I _{GSS}	Gate-Source Leakage Current	V _{GS} =±12V, V _{DS} =0V	---	---	±100	nA
g _{fs}	Forward Transconductance	V _{DS} =-5V, I _D =-10A	---	43	---	S
Q _g	Total Gate Charge (-4.5V)	V _{DS} =-10V, V _{GS} =-4.5V, I _D =-10A	---	35	---	nC
Q _{gs}	Gate-Source Charge		---	5.0	---	
Q _{gd}	Gate-Drain Charge		---	10	---	
T _{d(on)}	Turn-On Delay Time	V _{DD} =-10V, V _{GS} =-4.5V, R _G =3.3Ω, I _D =-10A	---	12.0	---	ns
T _r	Rise Time		---	40.0	---	
T _{d(off)}	Turn-Off Delay Time		---	30	---	
T _f	Fall Time		---	10	---	
C _{iss}	Input Capacitance	V _{DS} =-15V, V _{GS} =0V, f=1MHz	---	2800	---	pF
C _{oss}	Output Capacitance		---	690	---	
C _{rss}	Reverse Transfer Capacitance		---	590	---	
I _S	Continuous Source Current ^{1,4}	V _G =V _D =0V, Force Current	---	---	-60.0	A
I _{SM}	Pulsed Source Current ^{2,4}		---	---	---	A
V _{SD}	Diode Forward Voltage ²	V _{GS} =0V, I _S =-1A, T _J =25°C	---	---	-1.2	V
t _{rr}	Reverse Recovery Time	I _F =-10A, dI/dt=100A/μs,	---	27	---	nS
Q _{rr}	Reverse Recovery Charge	T _J =25°C	---	17.8	---	nC

Note :

1. The data tested by surface mounted on a 1 inch² FR-4 board with 20Z copper.
2. The data tested by pulsed, pulse width ≤ 300us, duty cycle ≤ 2%
3. The power dissipation is limited by 150°C junction temperature
4. The data is theoretically the same as I_D and I_{DM}, in real applications, should be limited by total power dissipation.

Typical Characteristics

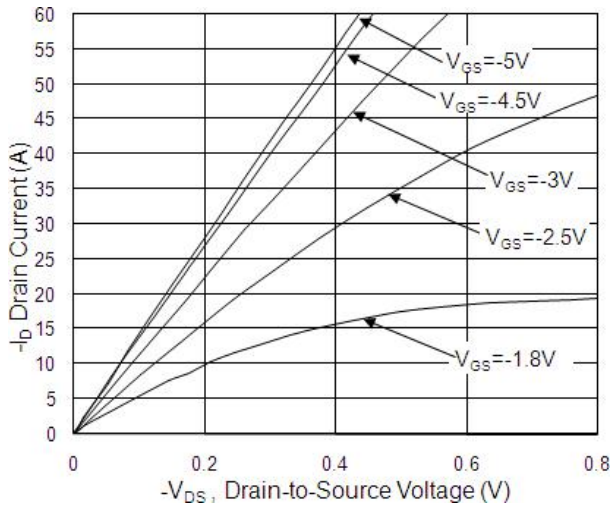


Fig.1 Typical Output Characteristics

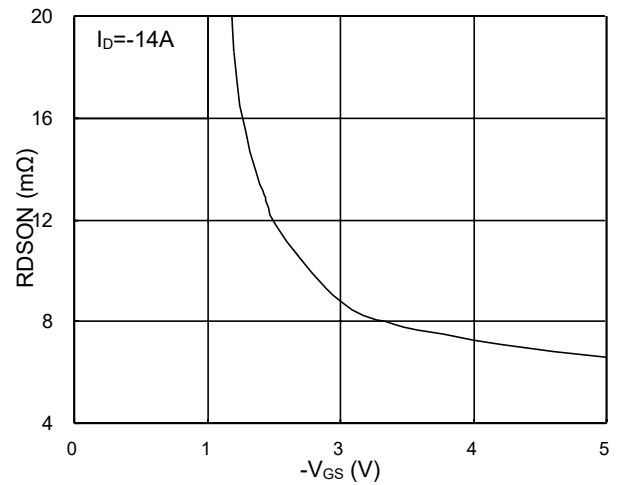


Fig.2 On-Resistance vs. G-S Voltage

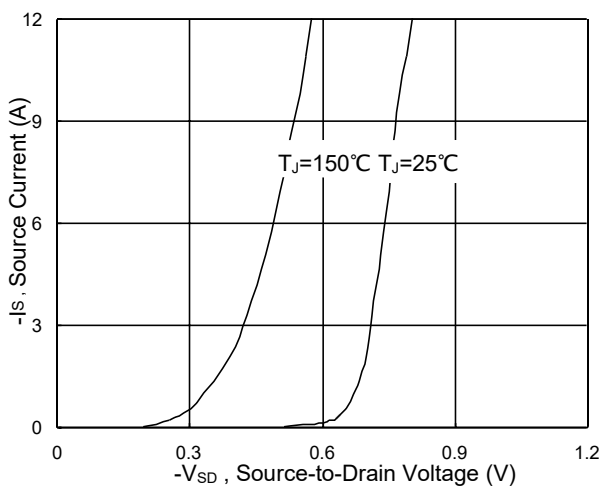


Fig.3 Forward Characteristics of Reverse

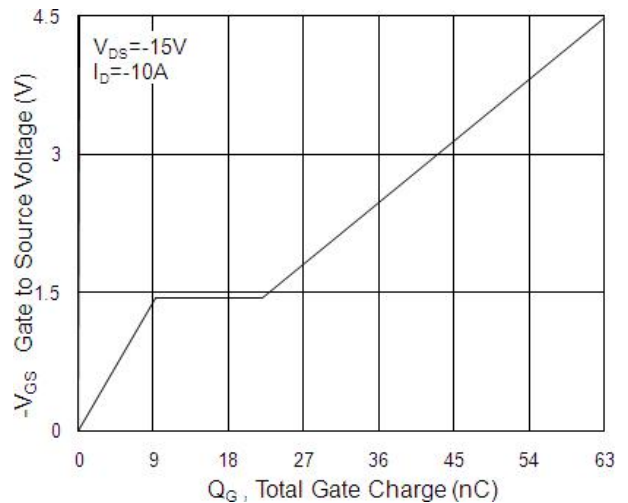


Fig.4 Gate-charge Characteristics

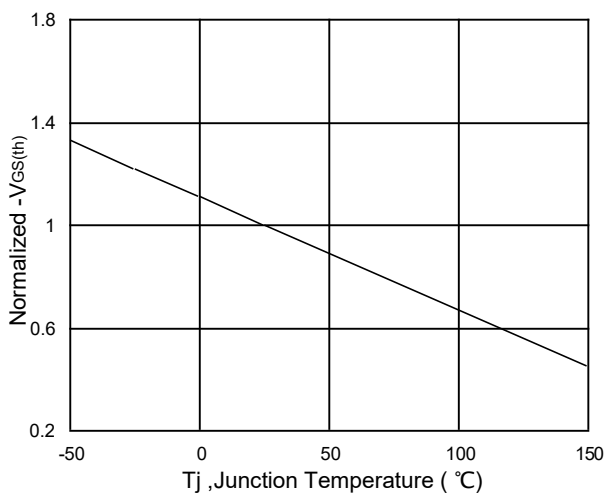


Fig.5 Normalized $V_{GS(th)}$ vs. T_J

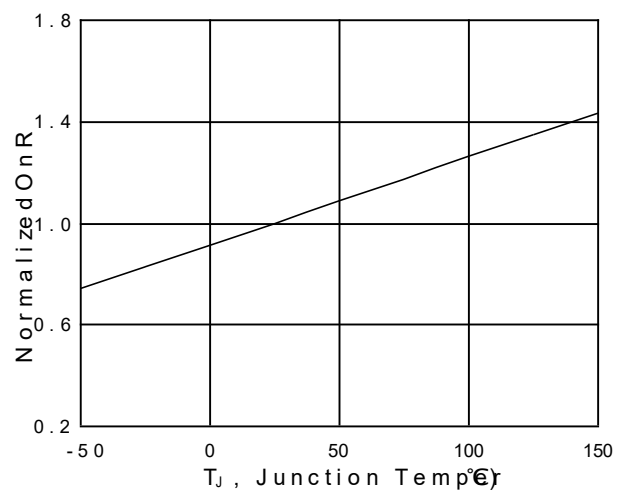


Fig.6 Normalized $R_{DS(on)}$ vs. T_J

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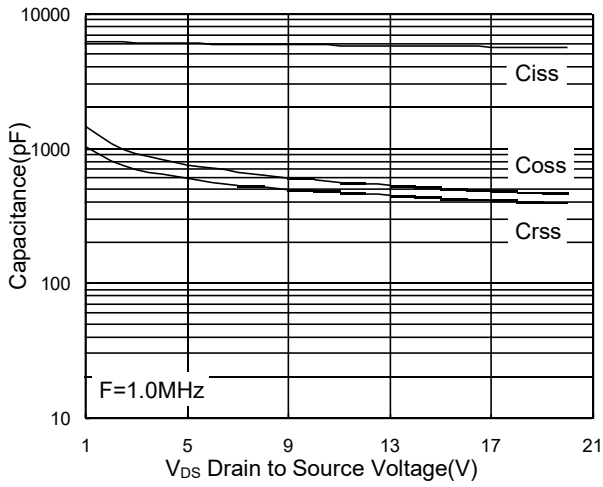


Fig.7 Capacitance

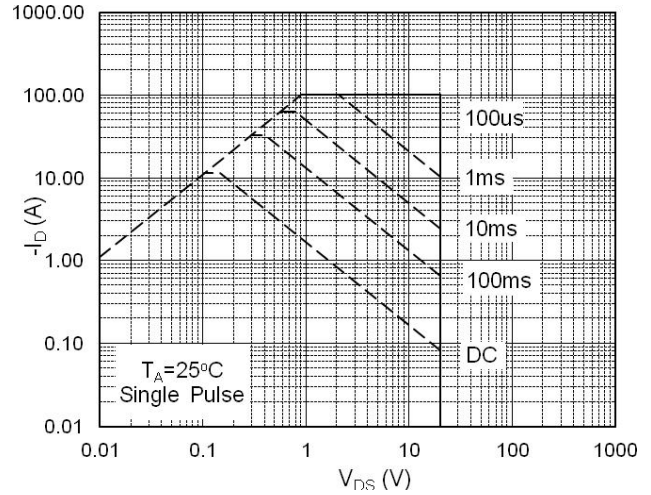


Fig.8 Safe Operating Area

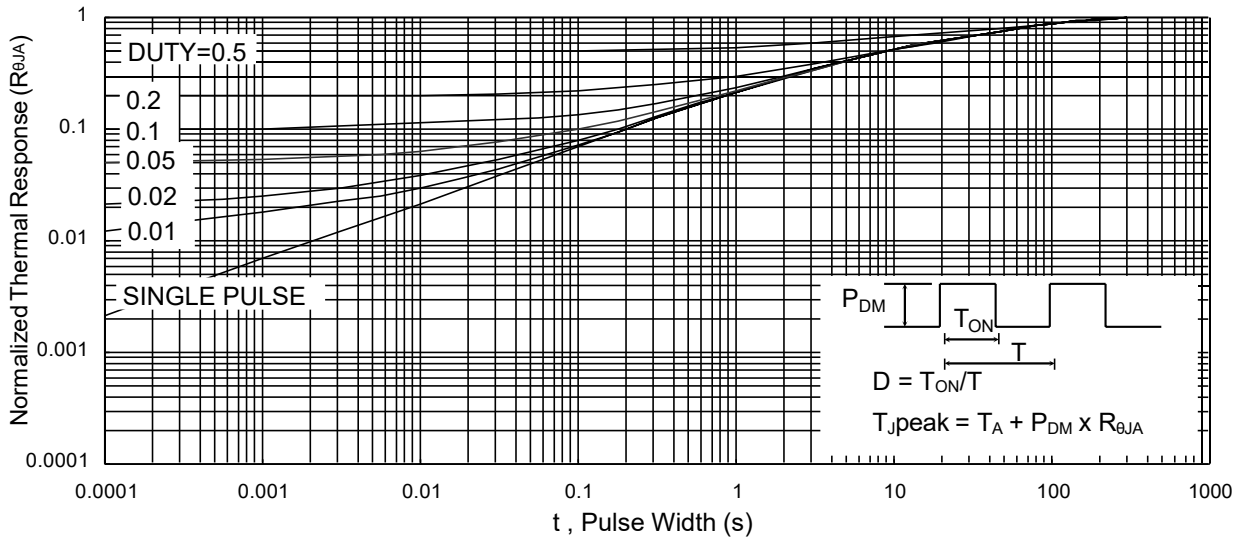


Fig.9 Normalized Maximum Transient Thermal Impedance

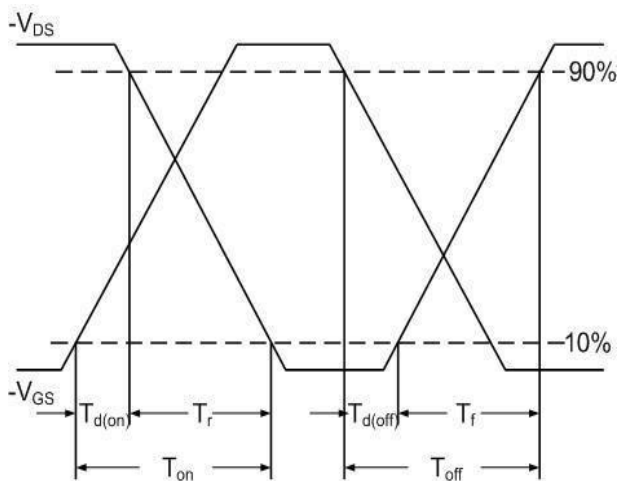


Fig.10 Switching Time Waveform

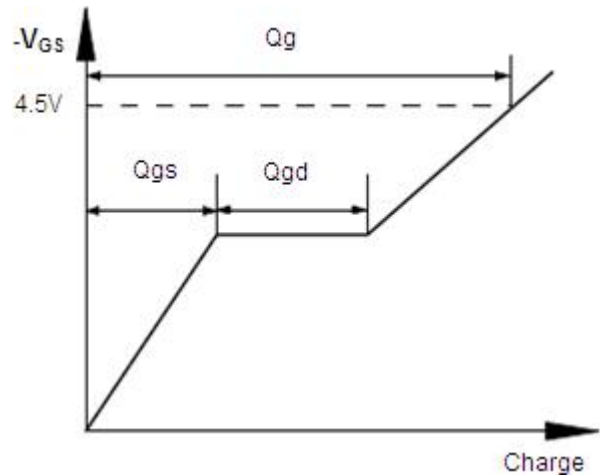
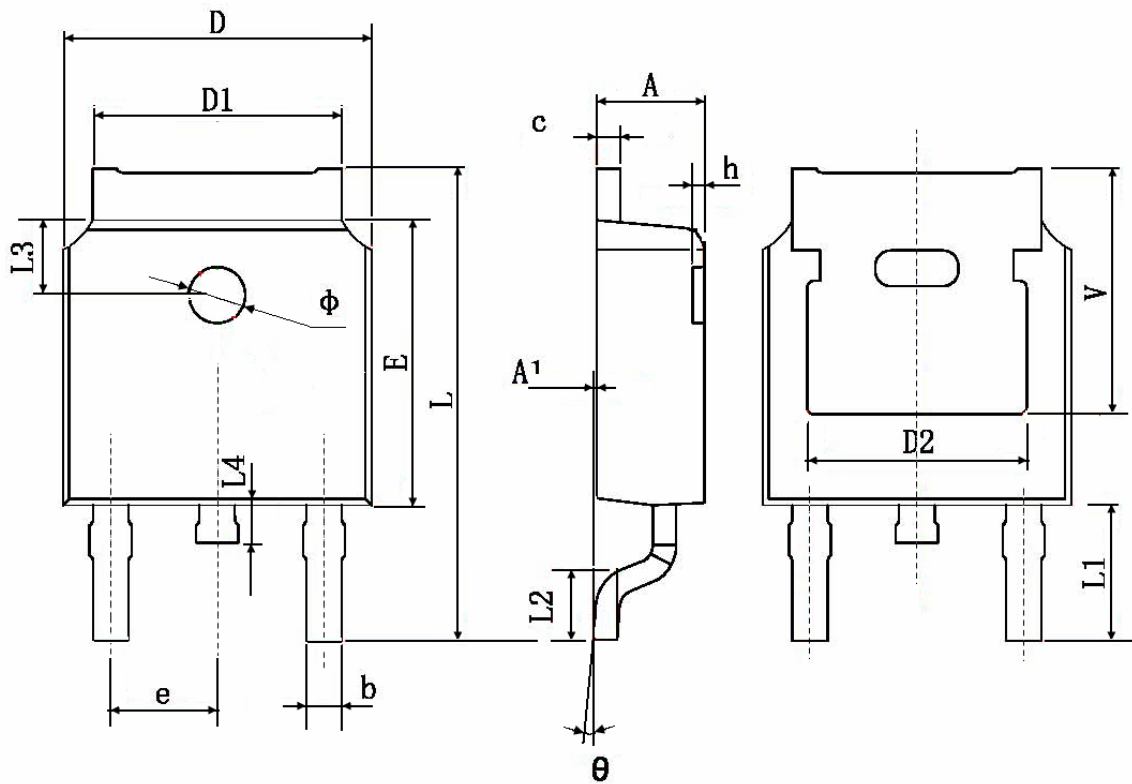


Fig.11 Gate Charge Waveform

Package Mechanical Data: TO-252-3L



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	2.200	2.400	0.087	0.094
A1	0.000	0.127	0.000	0.005
b	0.660	0.860	0.026	0.034
c	0.460	0.580	0.018	0.023
D	6.500	6.700	0.256	0.264
D1	5.100	5.460	0.201	0.215
D2	4.830 TYP.		0.190 TYP.	
E	6.000	6.200	0.236	0.244
e	2.186	2.386	0.086	0.094
L	9.800	10.400	0.386	0.409
L1	2.900 TYP.		0.114 TYP.	
L2	1.400	1.700	0.055	0.067
L3	1.600 TYP.		0.063 TYP.	
L4	0.600	1.000	0.024	0.039
φ	1.100	1.300	0.043	0.051
θ	0°	8°	0°	8°
h	0.000	0.300	0.000	0.012
V	5.350 TYP.		0.211 TYP.	