



Description

The HD2190 uses advanced trench technology to provide excellent $R_{DS(ON)}$, low gate charge and operation with gate voltages as low as 4.5V. This device is suitable for use as a Battery protection or in other Switching application.

General Features

$V_{DS} = 60V$ $I_D = 20A$

$R_{DS(ON)} < 34m\Omega$ @ $V_{GS}=10V$

$V_{DS} = -60V$ $I_D = -15A$

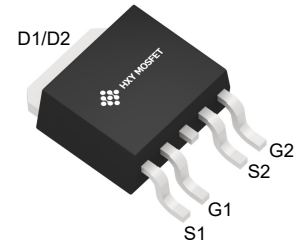
$R_{DS(ON)} < 86m\Omega$ @ $V_{GS}=-10V$

Application

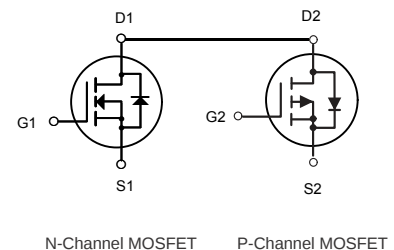
Wireless charging

Boost driver

Brushless motor



TO-252-4L



N-Channel MOSFET

P-Channel MOSFET

Package Marking and Ordering Information

Product ID	Pack	Marking	Qty(PCS)
HD2190	TO-252-4L	HD2190 XXXX	2500

Absolute Maximum Ratings ($T_c=25^{\circ}C$ unless otherwise noted)

Symbol	Parameter	Rating		Units
		N-Channel	P-Channel	
VDS	Drain-Source Voltage	60	-60	V
VGS	Gate-Source Voltage	± 20	± 20	V
$I_{D@T_A=25^{\circ}C}$	Continuous Drain Current, V_{GS} @ 10V ¹	20	-15	A
$I_{D@T_A=70^{\circ}C}$	Continuous Drain Current, V_{GS} @ 10V ¹	14	-8.5	A
IDM	Pulsed Drain Current ²	60	-30	A
EAS	Single Pulse Avalanche Energy ³	22	29.8	mJ
IAS	Avalanche Current	21	-24.4	A
$P_D@T_A=25^{\circ}C$	Total Power Dissipation ⁴	50	50	W
TSTG	Storage Temperature Range	-55 to 150	-55 to 150	$^{\circ}C$
TJ	Operating Junction Temperature Range	-55 to 150	-55 to 150	$^{\circ}C$
R θ JA	Thermal Resistance Junction-Ambient ¹	62		$^{\circ}C/W$
R θ JC	Thermal Resistance Junction-Case ¹	3		$^{\circ}C/W$



N-Channel Electrical Characteristics ($T_J=25^\circ\text{C}$, unless otherwise noted)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS}=0V$, $I_D=250\mu A$	60	---	---	V
$R_{DS(ON)}$	Static Drain-Source On-Resistance ²	$V_{GS}=10V$, $I_D=15A$	---	26	34	$m\Omega$
		$V_{GS}=4.5V$, $I_D=7A$	---	35	45	
$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS}=V_{DS}$, $I_D=250\mu A$	1.0	---	2.5	V
I_{DSS}	Drain-Source Leakage Current	$V_{DS}=48V$, $V_{GS}=0V$, $T_J=25^\circ\text{C}$	---	---	1	μA
		$V_{DS}=48V$, $V_{GS}=0V$, $T_J=55^\circ\text{C}$	---	---	5	
I_{GSS}	Gate-Source Leakage Current	$V_{GS}=\pm 20V$, $V_{DS}=0V$	---	---	± 100	nA
g_{fs}	Forward Transconductance	$V_{DS}=5V$, $I_D=15A$	---	25.3	---	S
Q_g	Total Gate Charge (10V)	$V_{DS}=48V$, $V_{GS}=10V$, $I_D=15A$	---	19	---	nC
Q_{gs}	Gate-Source Charge		---	2.5	---	
Q_{gd}	Gate-Drain Charge		---	5	---	
$T_{d(on)}$	Turn-On Delay Time	$V_{DD}=30V$, $V_{GS}=10V$, $R_G=3.3\Omega$ $I_D=15A$	---	2.8	---	ns
T_r	Rise Time		---	16.6	---	
$T_{d(off)}$	Turn-Off Delay Time		---	21.2	---	
T_f	Fall Time		---	5.6	---	
C_{iss}	Input Capacitance	$V_{DS}=15V$, $V_{GS}=0V$, $f=1\text{MHz}$	---	1027	---	pF
C_{oss}	Output Capacitance		---	65	---	
C_{rss}	Reverse Transfer Capacitance		---	46	---	
I_S	Continuous Source Current ^{1,6}	$V_G=V_D=0V$, Force Current	---	---	20	A
V_{SD}	Diode Forward Voltage ²	$V_{GS}=0V$, $I_S=1A$, $T_J=25^\circ\text{C}$	---	---	1.2	V

Note :

- 1.The data tested by surface mounted on a 1 inch² FR-4 board with 2OZ copper.
- 2.The data tested by pulsed , pulse width $\leq 300\mu s$, duty cycle $\leq 2\%$
- 3.The EAS data shows Max. rating . The test condition is $V_{DD}=25V$, $V_{GS}=10V$, $L=0.1mH$, $I_{AS}=21A$
- 4.The power dissipation is limited by 150°C junction temperature
- 5.The data is theoretically the same as I_D and I_{DM} , in real applications , should be limited by total power dissipation.



P-Channel Electrical Characteristics ($T_J=25\text{ }^{\circ}\text{C}$, unless otherwise noted)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS}=0V$, $I_D=-250\mu A$	-60	---	---	V
$R_{DS(ON)}$	Static Drain-Source On-Resistance ²	$V_{GS}=-10V$, $I_D=-10A$	---	78	86	m Ω
		$V_{GS}=-4.5V$, $I_D=-5A$	---	85	100	
$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS}=V_{DS}$, $I_D=-250\mu A$	-1.0	---	-2.5	V
I_{DSS}	Drain-Source Leakage Current	$V_{DS}=-48V$, $V_{GS}=0V$, $T_J=25^{\circ}\text{C}$	---	---	1	μA
		$V_{DS}=-48V$, $V_{GS}=0V$, $T_J=55^{\circ}\text{C}$	---	---	5	
I_{GSS}	Gate-Source Leakage Current	$V_{GS}=\pm 20V$, $V_{DS}=0V$	---	---	± 100	nA
g_{fs}	Forward Transconductance	$V_{DS}=-5V$, $I_D=-4A$	---	8.7	---	S
Q_g	Total Gate Charge (-4.5V)	$V_{DS}=-12V$, $V_{GS}=-4.5V$, $I_D=-6A$	---	11.8	---	nC
Q_{gs}	Gate-Source Charge		---	1.9	---	
Q_{gd}	Gate-Drain Charge		---	6.5	---	
$T_{d(on)}$	Turn-On Delay Time	$V_{DD}=-15V$, $V_{GS}=-10V$, $R_G=3.3\Omega$, $I_D=-1A$	---	8.8	---	ns
T_r	Rise Time		---	19.6	---	
$T_{d(off)}$	Turn-Off Delay Time		---	47.2	---	
T_f	Fall Time		---	9.6	---	
C_{iss}	Input Capacitance	$V_{DS}=-15V$, $V_{GS}=0V$, $f=1\text{MHz}$	---	1080	---	pF
C_{oss}	Output Capacitance		---	73	---	
C_{rss}	Reverse Transfer Capacitance		---	50	---	
I_S	Continuous Source Current ^{1,5}	$V_G=V_D=0V$, Force Current	---	---	-15	A
V_{SD}	Diode Forward Voltage ²	$V_{GS}=0V$, $I_S=-1A$, $T_J=25^{\circ}\text{C}$	---	---	-1	V

Note :

1.The data tested by surface mounted on a 1 inch² FR-4 board with 2OZ copper.

2.The data tested by pulsed , pulse width $\leq 300\mu s$, duty cycle $\leq 2\%$

3.The EAS data shows Max. rating . The test condition is $V_{DD}=-25V$, $V_{GS}=-10V$, $L=0.1\text{mH}$, $I_{AS}=-24.4A$

4.The power dissipation is limited by 150 $^{\circ}\text{C}$ junction temperature

5.The data is theoretically the same as I_D and I_{DM} , in real applications , should be limited by total power dissipation.



N-Channel Typical Characteristics

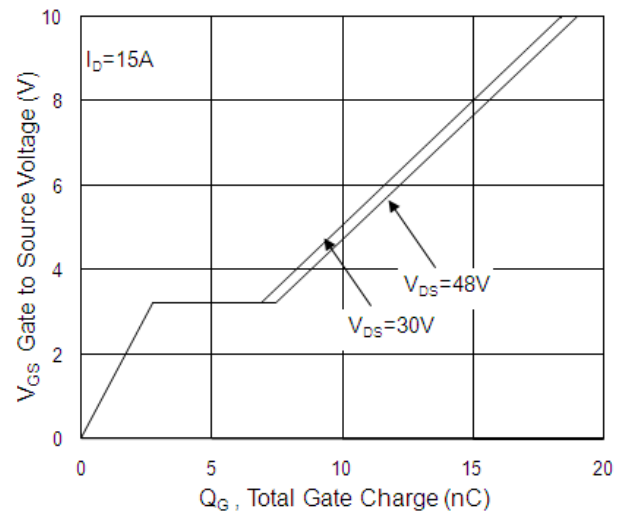
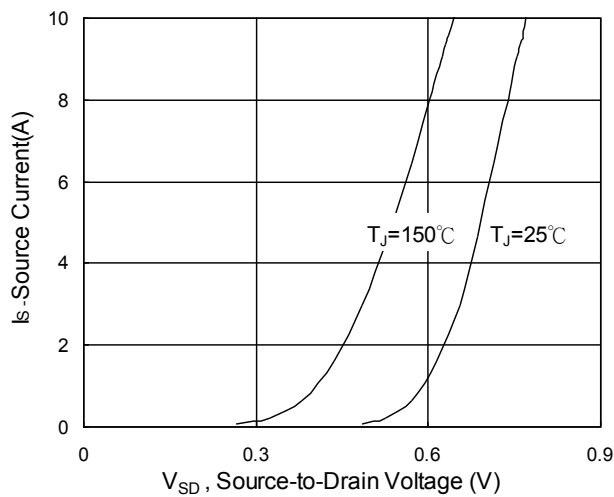
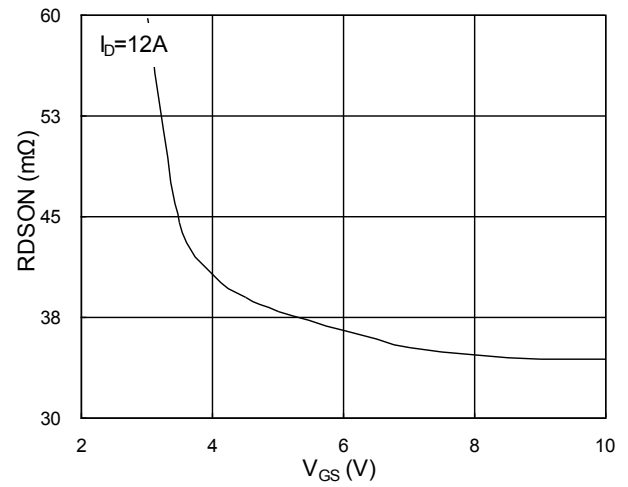
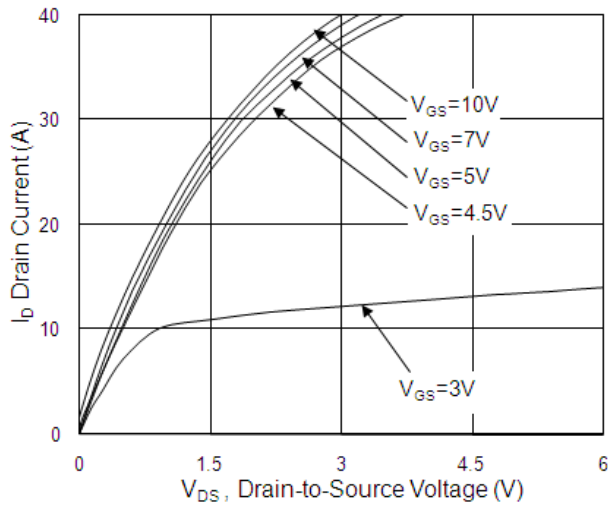


Fig.5 Normalized $V_{GS(th)}$ vs. T_J

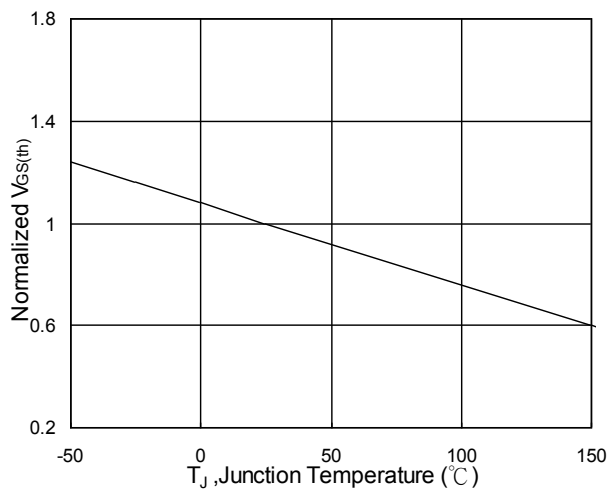
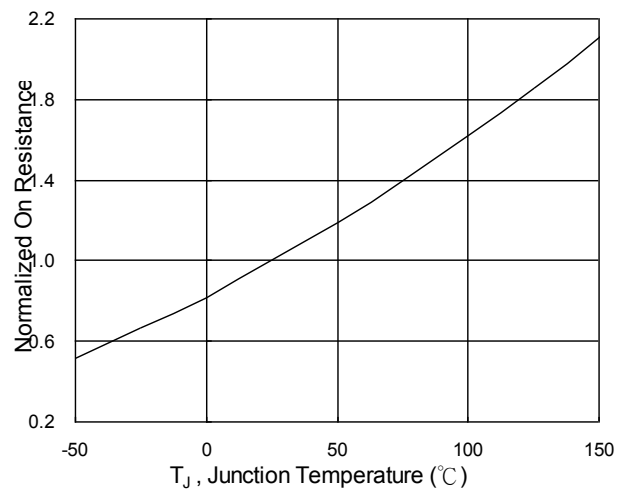


Fig.6 Normalized $R_{DS(on)}$ vs. T_J



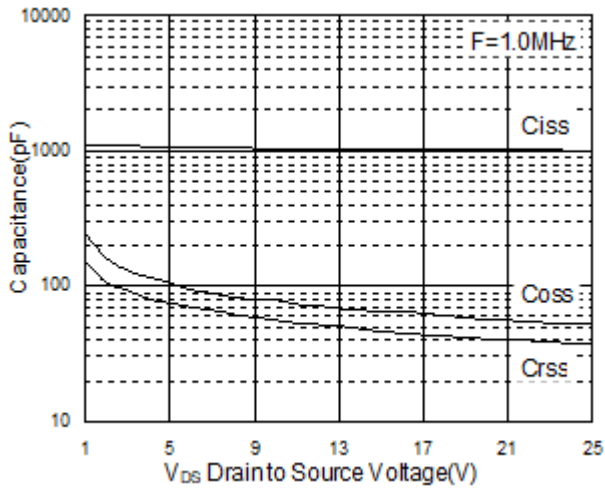


Fig.7 Capacitance

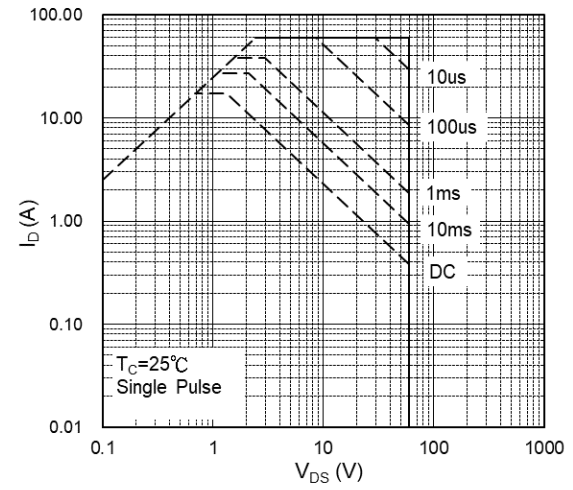


Fig.8 Safe Operating Area

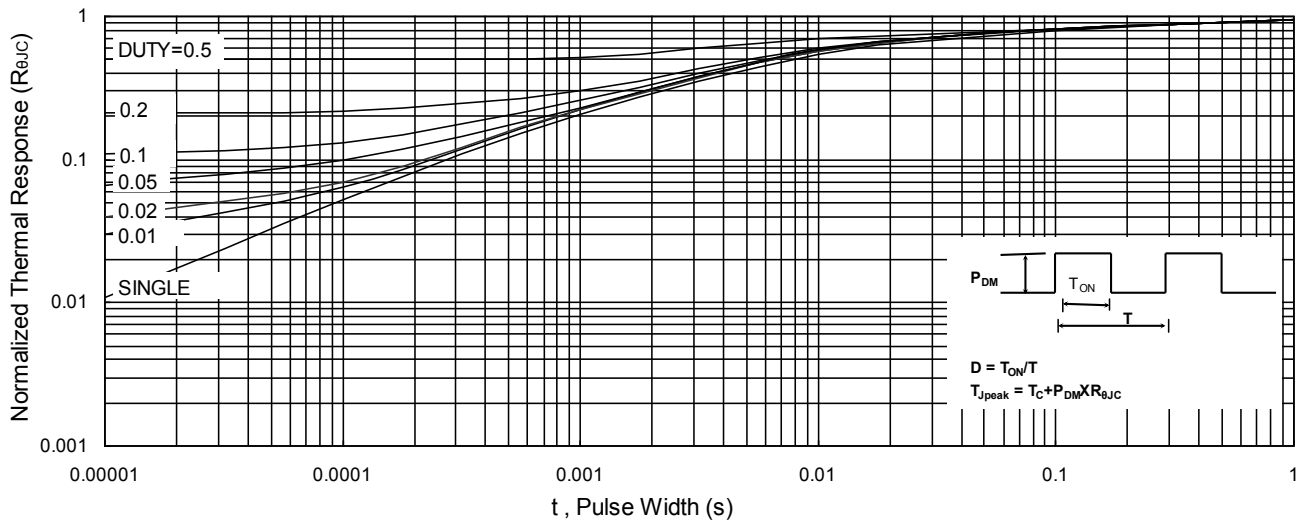


Fig.9 Normalized Maximum Transient Thermal Impedance

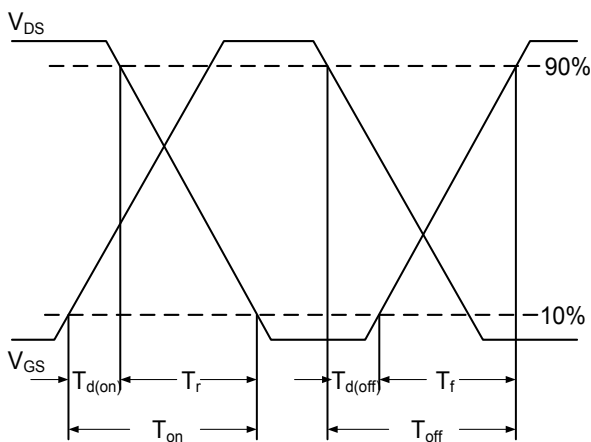


Fig.10 Switching Time Waveform

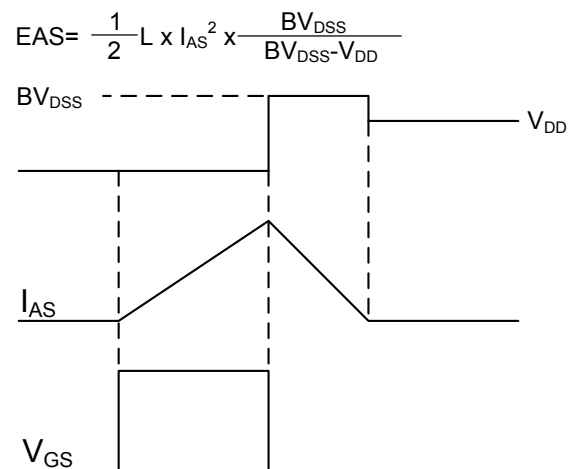


Fig.11 Unclamped Inductive Switching Waveform



P-Channel Typical Characteristics

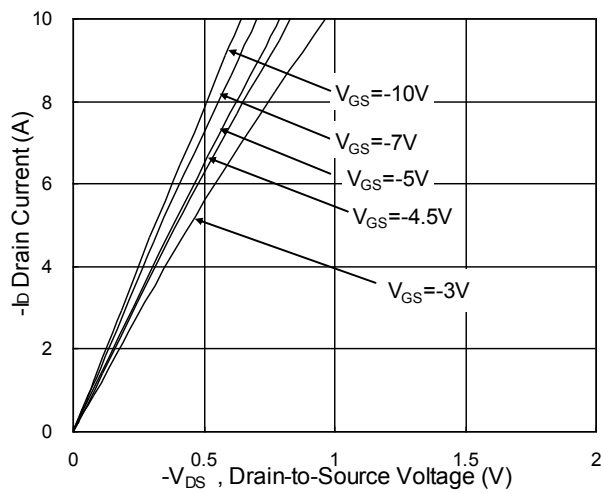


Fig.1 Typical Output Characteristics

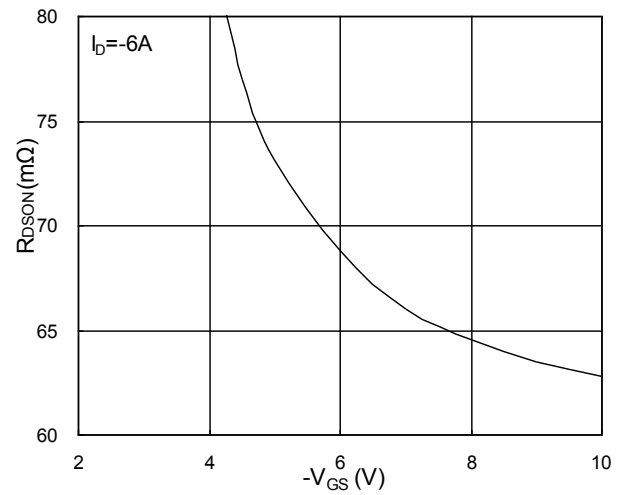


Fig.2 On-Resistance vs. G-S Voltage

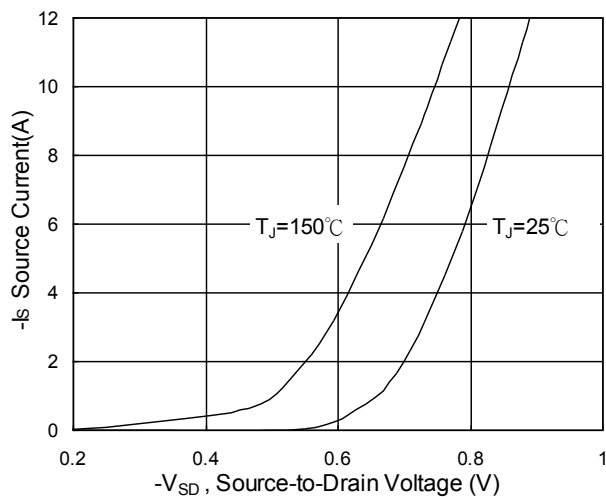


Fig.3 Source Drain Forward Characteristics

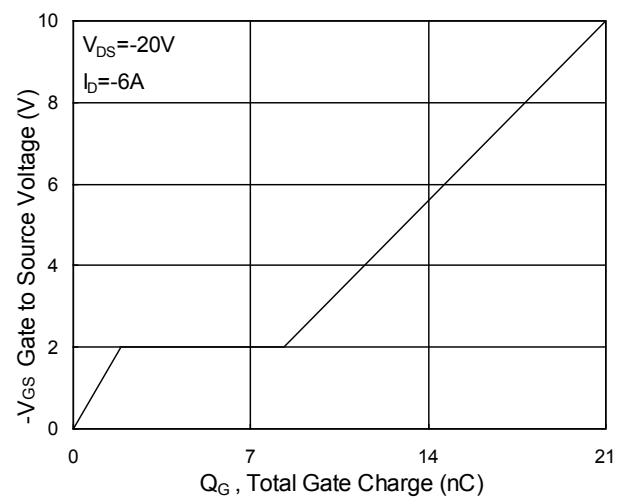


Fig.4 Gate-Charge Characteristics

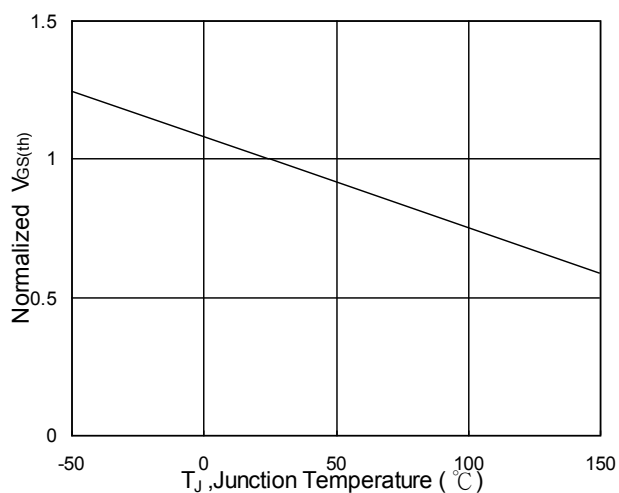


Fig.5 Normalized $V_{GS(th)}$ vs. T_J

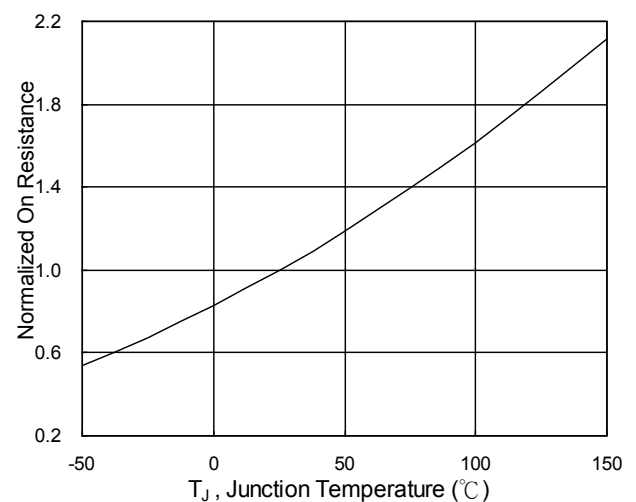


Fig.6 Normalized $R_{DS(on)}$ vs. T_J

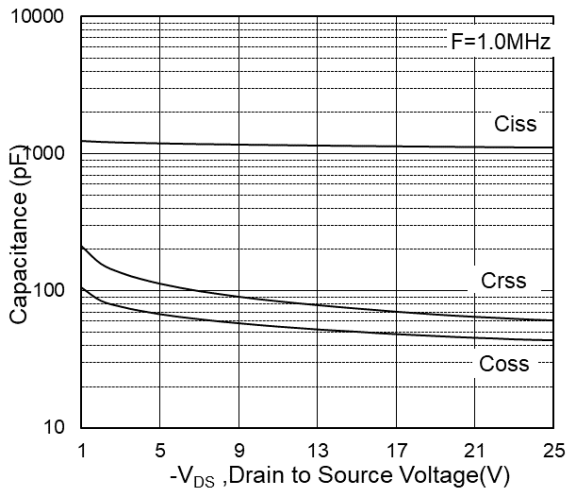


Fig.7 Capacitance

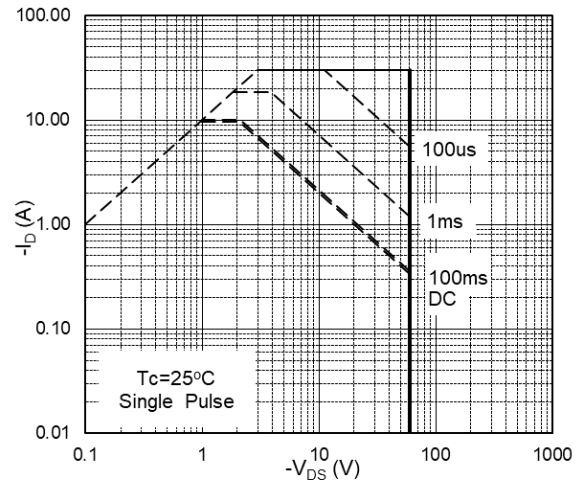


Fig.8 Safe Operating Area

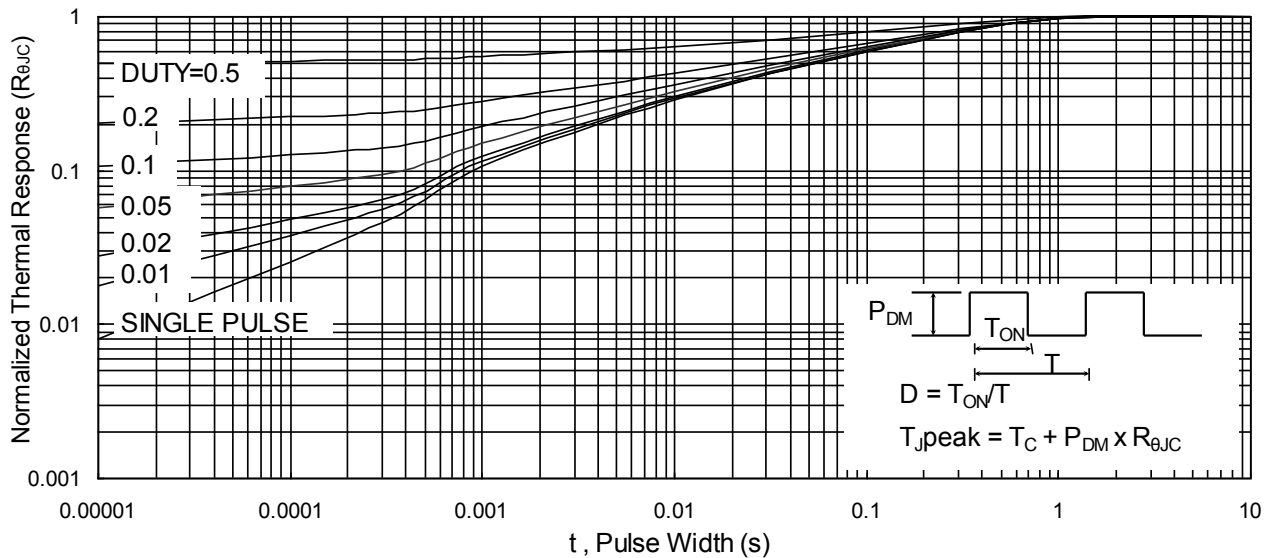


Fig.9 Normalized Maximum Transient Thermal Impedance

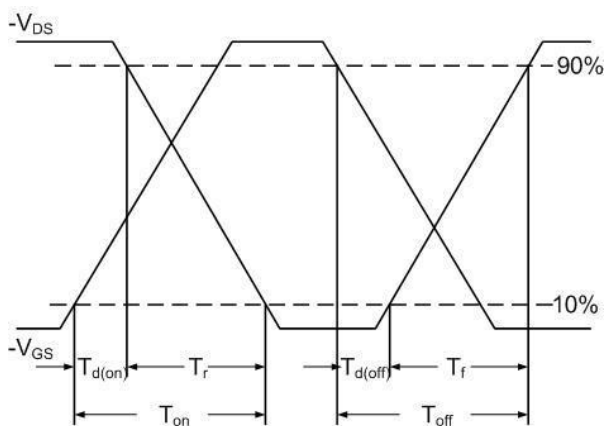


Fig.10 Switching Time Waveform

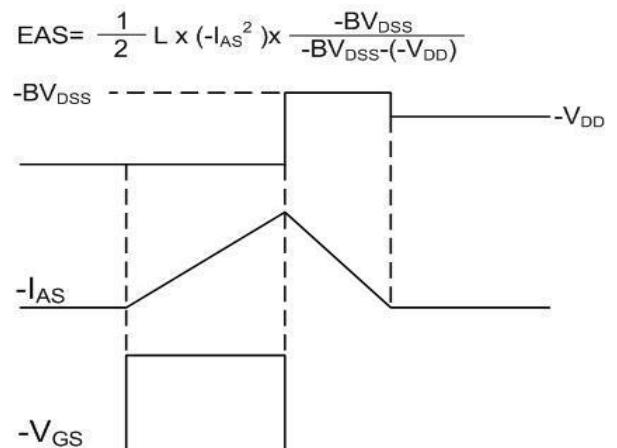
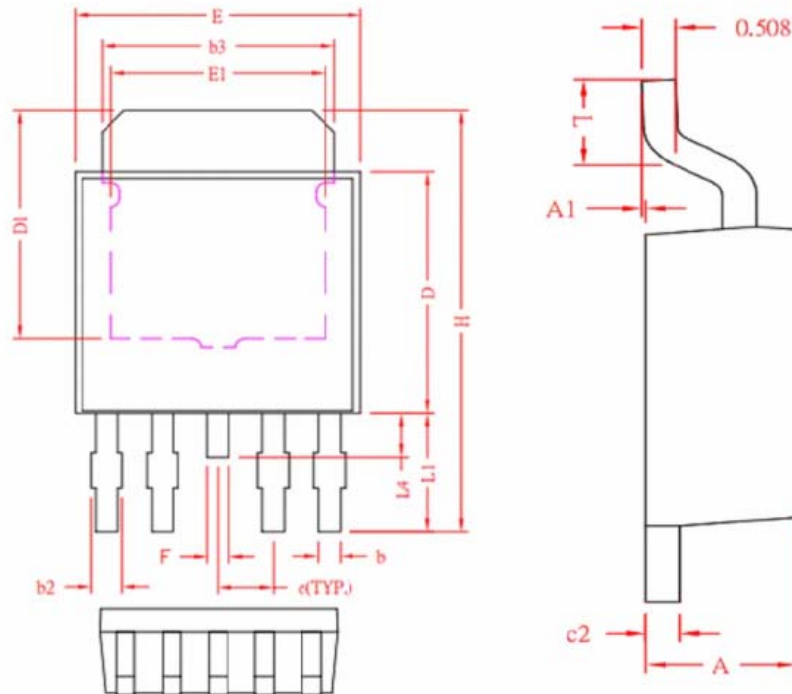


Fig.11 Unclamped Inductive Switching Waveform



TO-252-4L Package Information



COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	2.20	2.30	2.40
A1	0	0.08	0.15
b	0.45	0.53	0.60
b2	0.50	0.65	0.80
b3	5.20	5.35	5.50
c2	0.45	0.50	0.55
D	5.40	5.60	5.80
D1	4.57	-	-
E	6.40	6.60	6.80
E1	3.81	-	-
e	1.27 REF.		
F	0.40	0.50	0.60
H	9.40	9.80	10.20
L	1.40	1.59	1.77
L1	2.40	2.70	3.00
L4	0.80	1.00	1.20



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