

N-Ch 120V Fast Switching MOSFETs

Features

- Fast Switching
- Low Gate Charge and $R_{DS(on)}$
- Low Reverse transfer capacitances

Product Summary



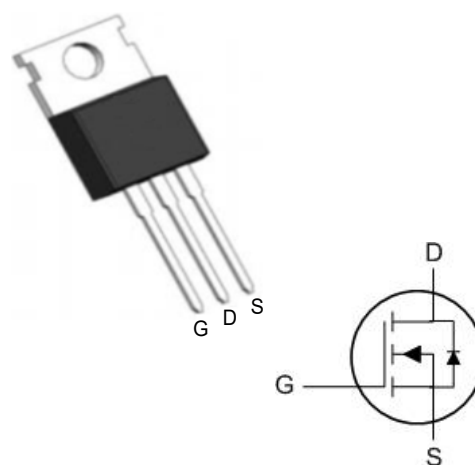
BVDSS	RDSON	ID
120V	10mΩ	60A

Applications

- DC-DC converter
- Portable Equipment
- Power management

100% DVDS Tested
100% Avalanche Tested

TO220 Pin Configuration



Absolute Maximum Ratings

Symbol	Parameter	Rating	Units
V_{DS}	Drain-Source Voltage	120	V
V_{GS}	Gate-Source Voltage	± 20	V
$I_D @ T_C = 25^\circ C$	Continuous Drain Current, $V_{GS} @ 10V^{1,6}$	60	A
$I_D @ T_C = 100^\circ C$	Continuous Drain Current, $V_{GS} @ 10V^{1,6}$	35	A
I_{DM}	Pulsed Drain Current ²	220	A
EAS	Single Pulse Avalanche Energy ³	210	mJ
I_{AS}	Avalanche Current	---	A
$P_D @ T_C = 25^\circ C$	Total Power Dissipation ⁴	85	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	Typ.	Max.	Unit
$R_{\theta JA}$	Thermal Resistance Junction-Ambient ¹	---	---	$^\circ C/W$
$R_{\theta JC}$	Thermal Resistance Junction-Case ¹	---	1.47	$^\circ C/W$

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

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS}=0V$, $I_D=250\mu A$	120	---	---	V
$\Delta BV_{DSS}/\Delta T_J$	BV_{DSS} Temperature Coefficient	Reference to 25°C , $I_D=1mA$	---	---	---	$V/^\circ\text{C}$
$R_{DS(ON)}$	Static Drain-Source On-Resistance ²	$V_{GS}=10V$, $I_D=84A$	---	10	12.5	$m\Omega$
		$V_{GS}=4.5V$, $I_D=84A$	---	11.5	15	
$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS}=V_{DS}$, $I_D=250\mu A$	1.4	1.8	2.2	V
$\Delta V_{GS(th)}$	$V_{GS(th)}$ Temperature Coefficient		---	---	---	$mV/^\circ\text{C}$
I_{DSS}	Drain-Source Leakage Current	$V_{DS}=120V$, $V_{GS}=0V$, $T_J=25^\circ\text{C}$	---	---	1	μA
		$V_{DS}=120V$, $V_{GS}=0V$, $T_J=125^\circ\text{C}$	---	---	100	
I_{GSS}	Gate-Source Leakage Current	$V_{GS}=\pm 20V$, $V_{DS}=0V$	---	---	± 100	nA
g_{fs}	Forward Transconductance	$V_{DS}=5V$, $I_D=84A$	---	---	---	S
R_g	Gate Resistance	$V_{DS}=0V$, $V_{GS}=0V$, $f=1MHz$	---	---	---	Ω
Q_g	Total Gate Charge	$V_{DS}=60V$, $V_{GS}=10V$, $I_D=20A$	---	31	---	nC
Q_{gs}	Gate-Source Charge		---	9.4	---	
Q_{gd}	Gate-Drain Charge		---	7.5	---	
$T_{d(on)}$	Turn-On Delay Time	$V_{DD}=60V$, $R_{G_ext}=5\Omega$, $V_{GS}=10V$, $I_D=20A$	---	15	---	ns
T_r	Rise Time		---	10	---	
$T_{d(off)}$	Turn-Off Delay Time		---	32	---	
T_f	Fall Time		---	9	---	
C_{iss}	Input Capacitance	$V_{DS}=60V$, $V_{GS}=0V$, $f=1MHz$	---	1807	---	pF
C_{oss}	Output Capacitance		---	212	---	
C_{rss}	Reverse Transfer Capacitance		---	6	---	

Diode Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
I_S	Continuous Source Current ^{1,4}	$V_G=V_D=0V$, Force Current	---	---	60	A
V_{SD}	Diode Forward Voltage ²	$V_{GS}=0V$, $I_S=84A$, $T_J=25^\circ\text{C}$	---	---	1.4	V
t_{rr}	Reverse Recovery Time	$I_F=40A$, $di/dt=100A/\mu s$, $T_J=25^\circ\text{C}$	---	60	---	nS
Q_{rr}	Reverse Recovery Charge		---	100	---	nC

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 $\leq 2\%$

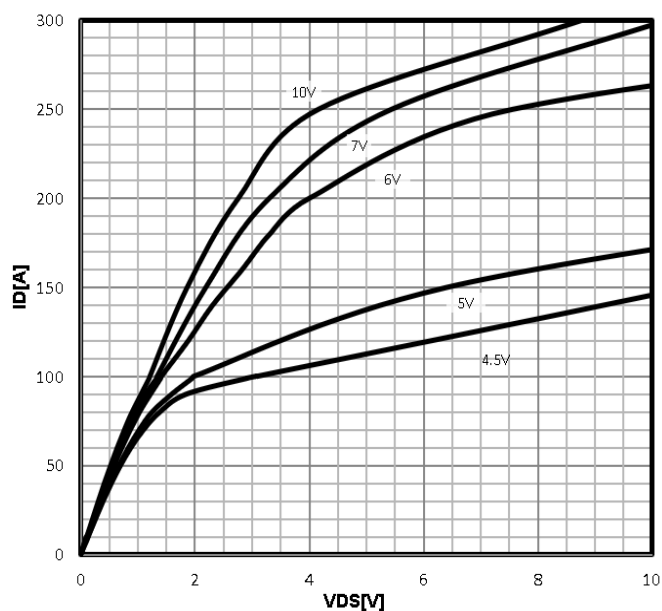
3. The EAS data shows Max. rating. The test condition is $V_{DD}=25V$, $V_{GS}=10V$, $L=0.5mH$,

4. The power dissipation is limited by 150°C junction temperature

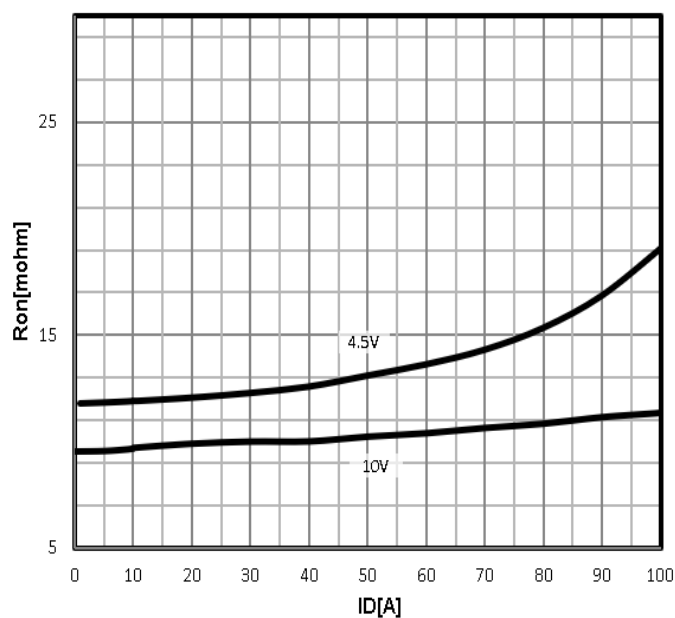
5. The data is theoretically the same as I_D and I_{DM} , in real applications, should be limited by total power dissipation.

Characteristics Curve:

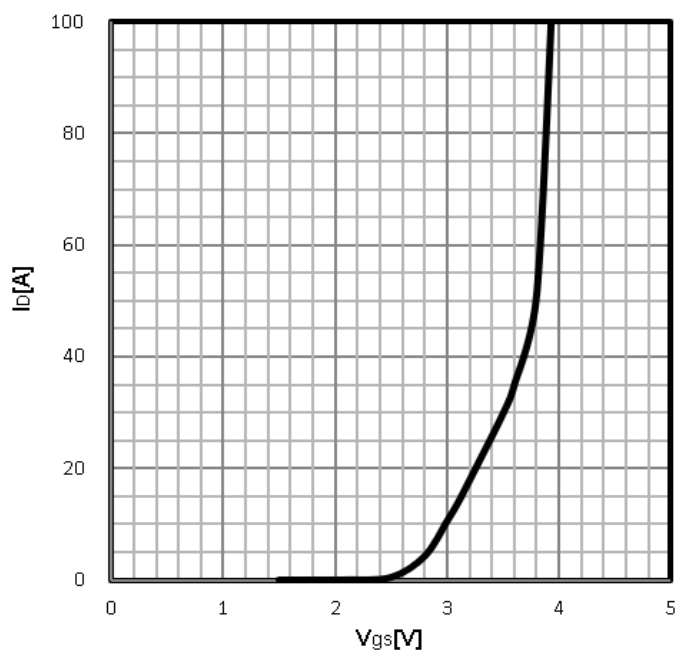
Typ. output characteristics
 $I_D = f(V_{DS})$



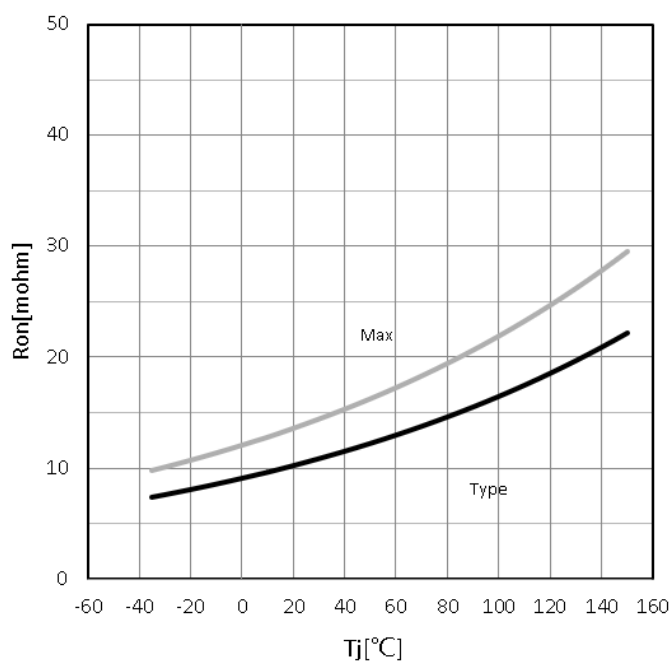
Typ. drain-source on resistance
 $R_{DS(on)} = f(I_D)$



Typ. transfer characteristics
 $I_D = f(V_{GS})$



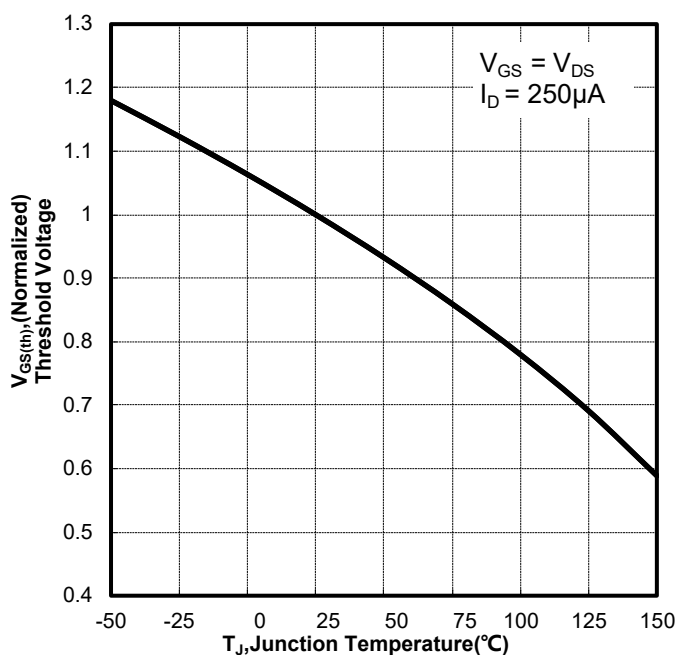
Drain-source on-state resistance
 $R_{DS(on)} = f(T_J); I_D = 20A; V_{GS} = 10V$



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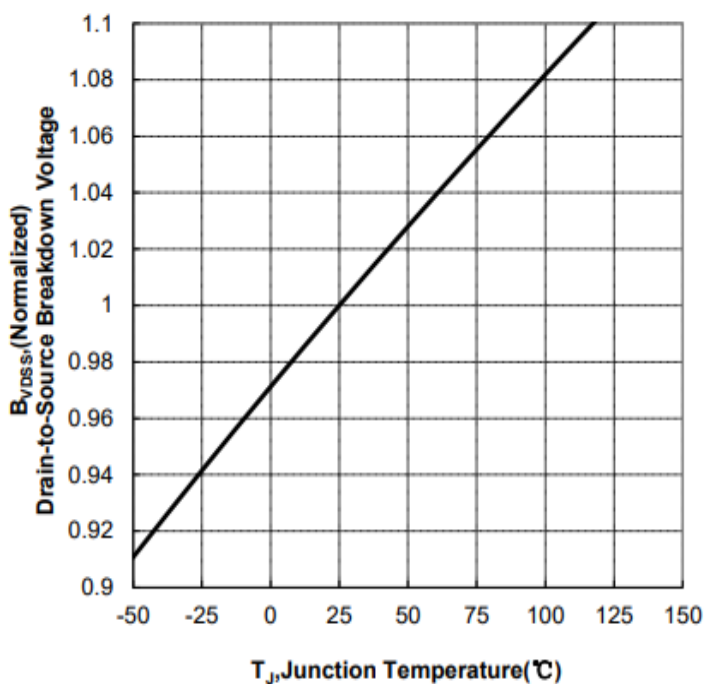
Gate Threshold Voltage

$$V_{TH}=f(T_J); I_D=250\mu A$$



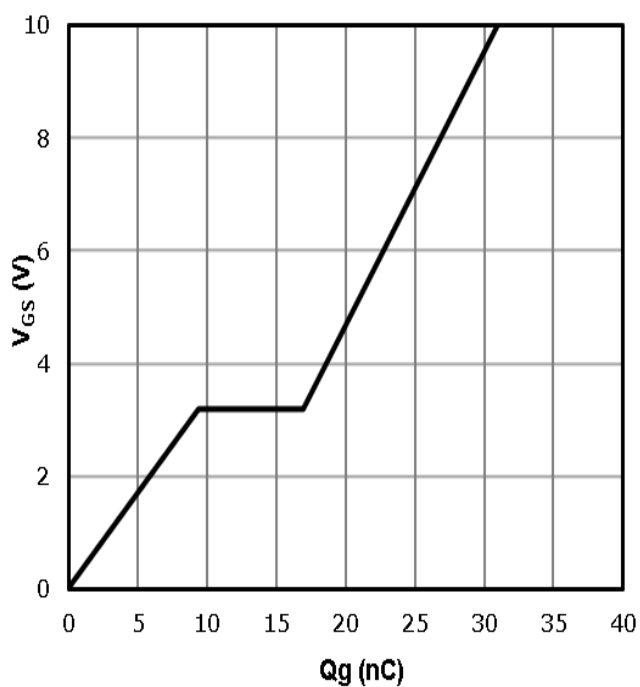
Drain-source breakdown voltage

$$V_{BR(DSS)}=f(T_J); I_D=250\mu A$$



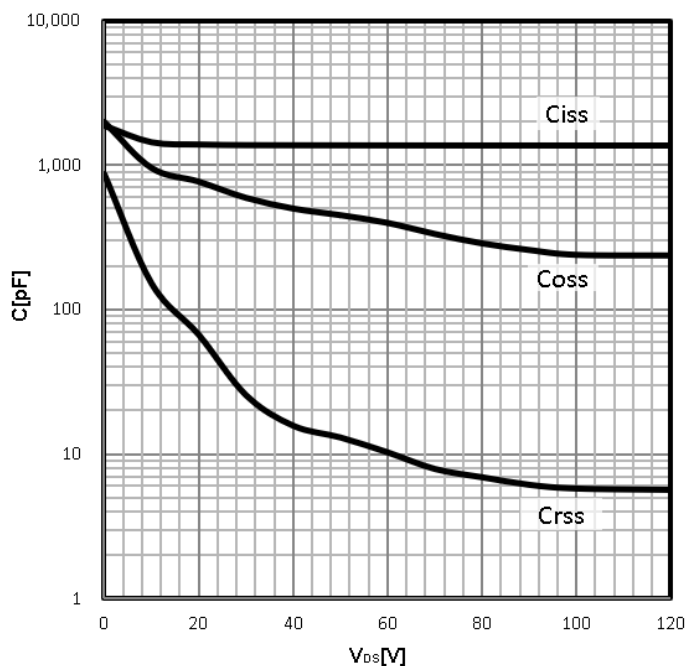
Typ. gate charge

$$V_{GS}=f(Q_{gate})$$



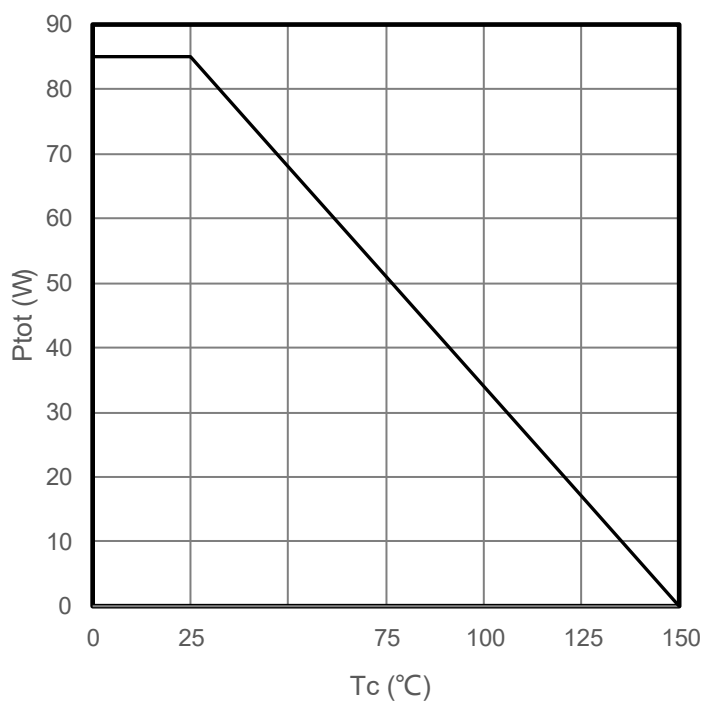
Typ. capacitances

$$C=f(V_{DS}); V_{GS}=0V; f$$



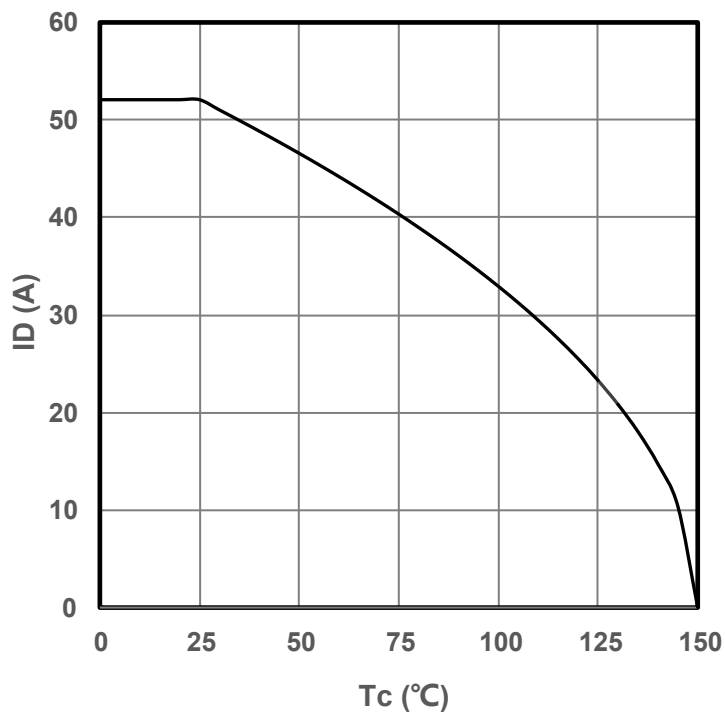
Power Dissipation

$$P_{\text{tot}} = f(T_j)$$

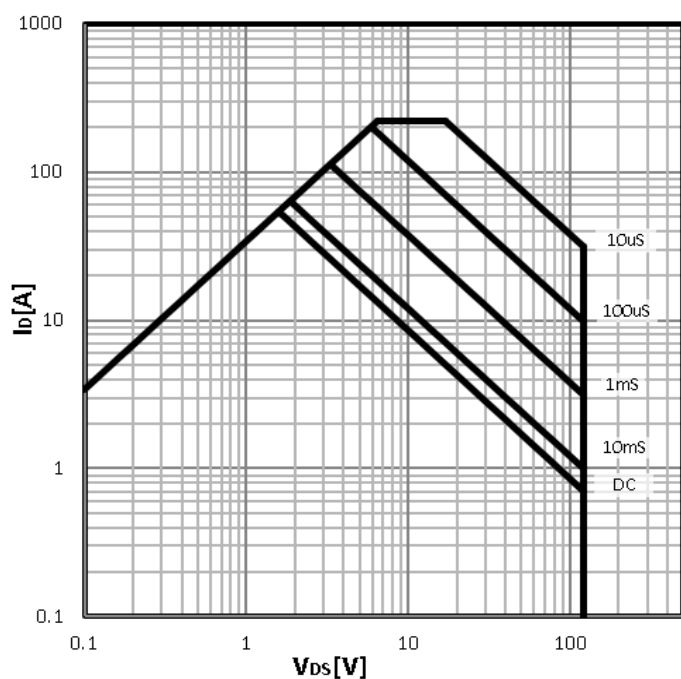


Maximum Drain Current

$$I_D = f(T_c)$$

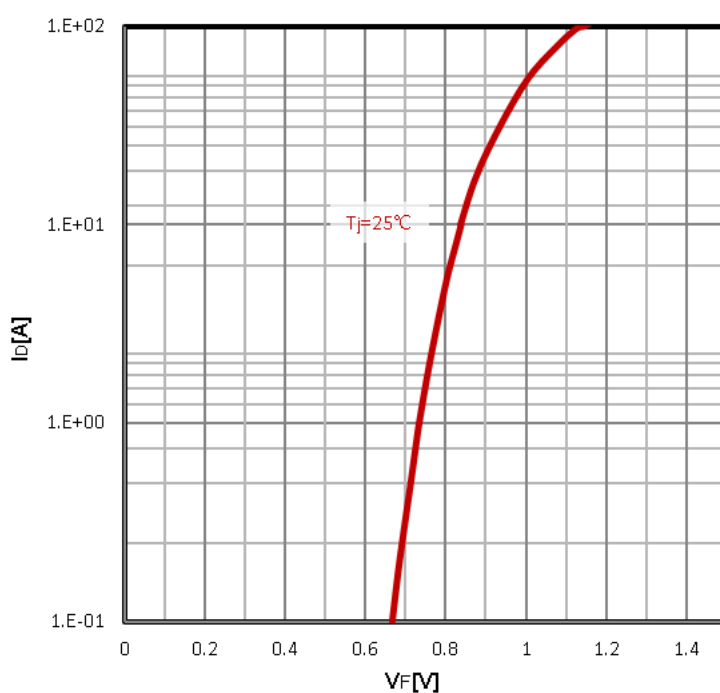


Safe operating area $I_D = f(V_{DS})$



Body Diode Forward Voltage Variation

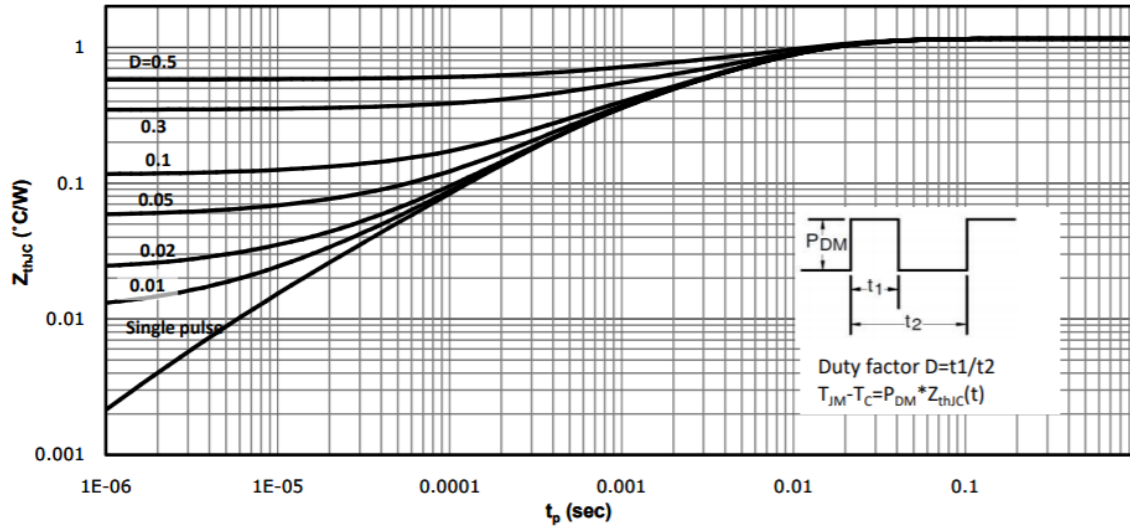
$$I_F = f(V_{GS})$$



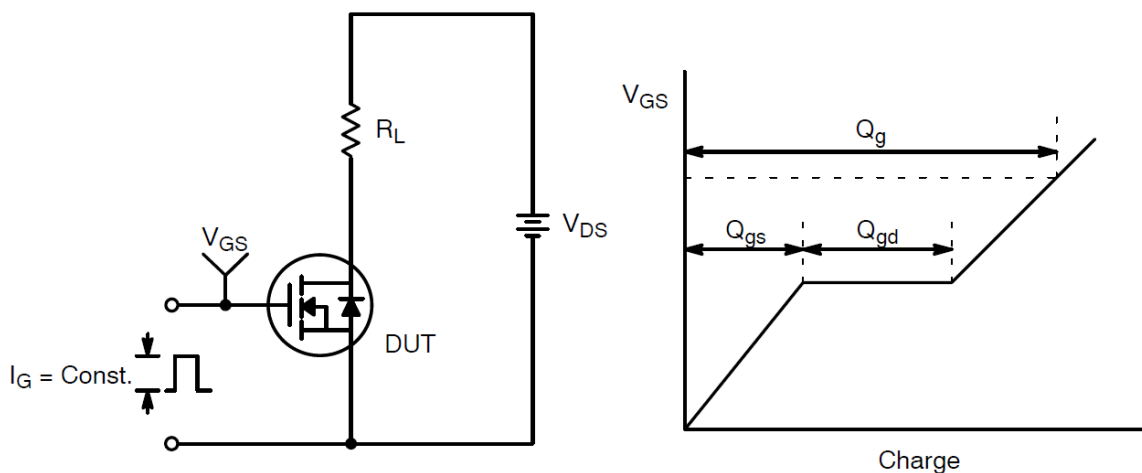


Max. transient thermal impedance

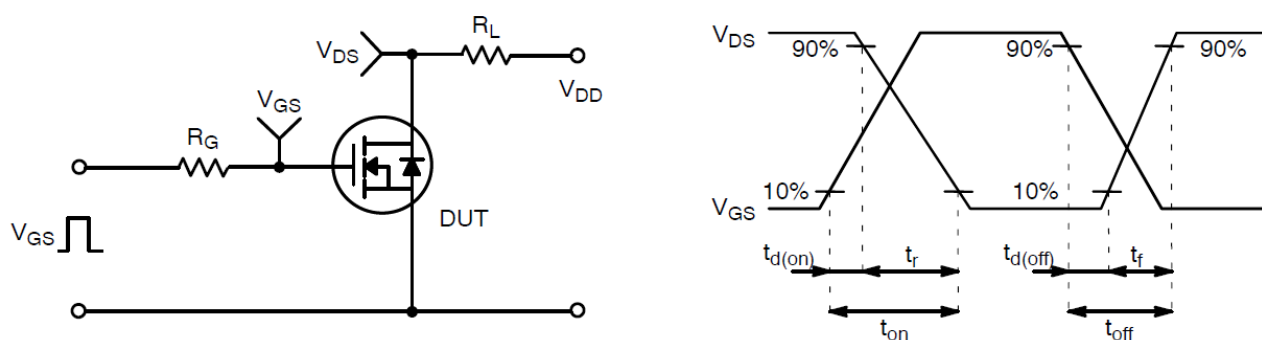
$$Z_{thJC}=f(t_p)$$



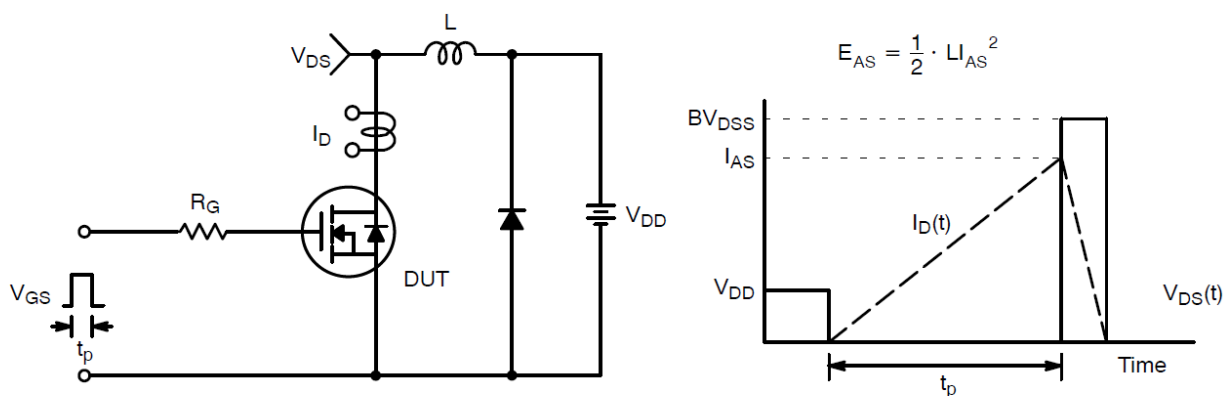
Test Circuit and Waveform:



Gate Charge Test Circuit & Waveform

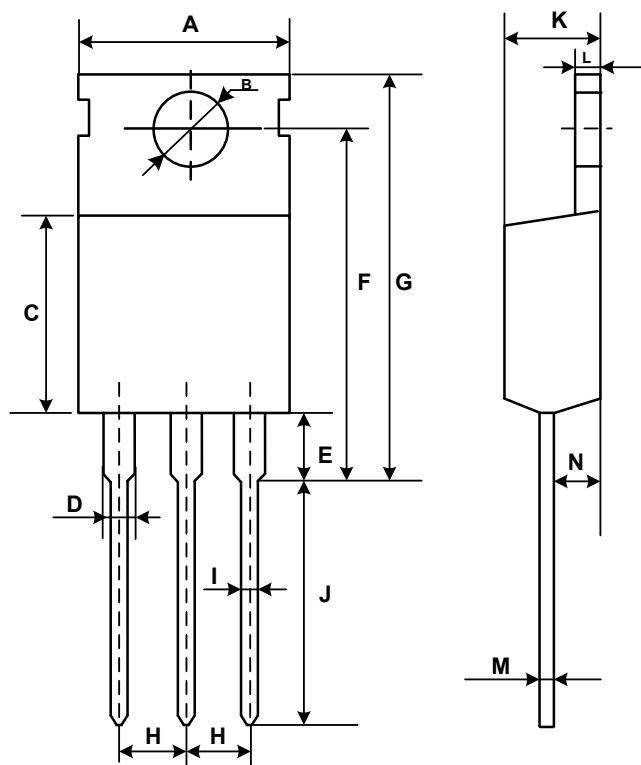


Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms

Mechanical Dimensions for TO-220



COMMON DIMENSIONS

SYMBOL	MM	
	MIN	MAX
A	9.70	10.30
B	3.40	3.80
C	8.80	9.40
D	1.17	1.47
E	2.60	3.50
F	15.10	16.70
G	19.55MAX	
H	2.54REF	
I	0.70	0.95
J	9.35	11.00
K	4.30	4.77
L	1.20	1.45
M	0.40	0.65
N	2.20	2.60