

P-Ch 60V Fast Switching MOSFETs

Features

- Split Gate Trench MOSFET technology
- Excellent package for heat dissipation
- High density cell design for low $R_{DS(ON)}$

Product Summary

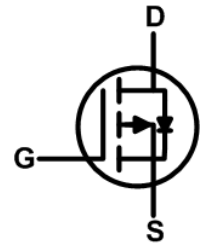
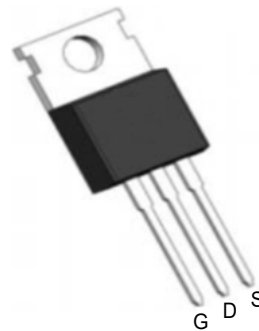


BVDSS	RDSON	ID
-60V	5.5 mΩ	-110A

Applications

- DC-DC Converters
- Power management functions
- Synchronous-rectification applications

TO220 Pin Configuration



Absolute Maximum Ratings ($T_C = 25^\circ\text{C}$ unless otherwise specified) :

Symbol	Parameter		Value	Units
V_{DSS}	Drain-to-Source Voltage		-60	V
I_D	Continuous Drain Current	$T_C = 25^\circ\text{C}$	-110	A
	Continuous Drain Current	$T_C = 100^\circ\text{C}$	-70	A
I_{DM}^{a1}	Pulsed Drain Current		-440	A
V_{GS}	Gate-to-Source Voltage		± 20	V
P_D	Power Dissipation		180	W
E_{AS}^{a2}	Single pulse avalanche energy		960	mJ
T_J, T_{STG}	Operating Junction and Storage Temperature Range		150, -55 to 150	$^\circ\text{C}$
T_L	Maximum Temperature for Soldering		260	$^\circ\text{C}$

Thermal Characteristics:

Symbol	Parameter	Value	Units
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	0.69	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	60	$^\circ\text{C/W}$

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

Static Characteristics						
Symbol	Parameter	Test Conditions	Value			Units
			Min.	Typ.	Max.	
V_{DSS}	Drain to Source Breakdown Voltage	$V_{GS}=0V, I_D=-250\mu A$	-60	--	--	V
I_{DSS}	Drain to Source Leakage Current	$V_{DS} = -60V, V_{GS}= 0V$	--	--	1	μA
$I_{GSS(F)}$	Gate to Source Forward Leakage	$V_{GS} = -20V$	--	--	100	nA
$I_{GSS(R)}$	Gate to Source Reverse Leakage	$V_{GS} = +20V$	--	--	-100	nA
$V_{GS(TH)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_D=-250\mu A$	-1.6	-2.0	-2.4	V
$R_{DS(ON)}$	Drain-to-Source On-Resistance	$V_{GS}=-10V, I_D=-15A$	--	5.5	7.0	$m\Omega$

Dynamic Characteristics						
Symbol	Parameter	Test Conditions	Value			Units
			Min.	Typ.	Max.	
C_{iss}	Input Capacitance	$V_{GS}=0V$ $V_{DS}=-30V$ $f=1.0MHz$	--	5403	--	pF
C_{oss}	Output Capacitance		--	941	--	
C_{rss}	Reverse Transfer Capacitance		--	48	--	
R_g	Gate resistance	$V_{GS}=0V, V_{DS}Open$	--	2.0	--	Ω

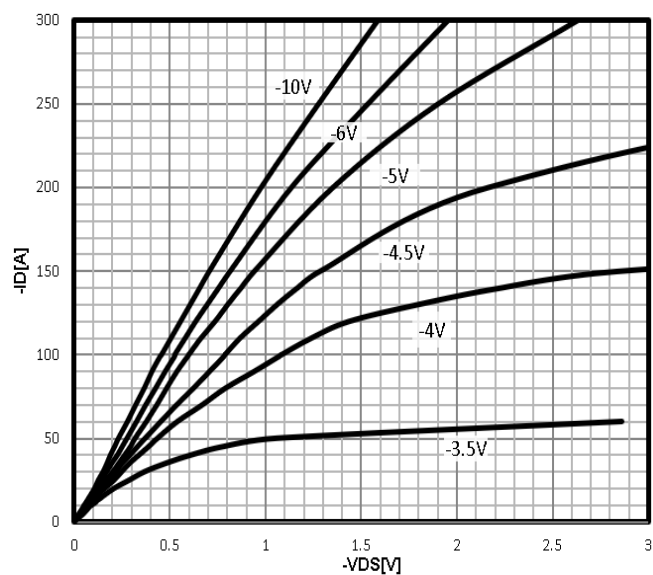
Resistive Switching Characteristics						
Symbol	Parameter	Test Conditions	Value			Units
			Min.	Typ.	Max.	
$t_{d(ON)}$	Turn-on Delay Time	$I_D=-15A, R_L=0.75\Omega$ $V_{DS}= -30V$ $V_{GS}= -10V$ $R_G= 3\Omega$	--	4.5	--	ns
t_r	Rise Time		--	2.5	--	
$t_{d(OFF)}$	Turn-Off Delay Time		--	14.5	--	
t_f	Fall Time		--	3.5	--	
Q_g	Total Gate Charge	$V_{GS}=-10V$ $V_{DS}=-30V$ $I_D=-15A$	--	80.2	--	nC
Q_{gs}	Gate Source Charge		--	15.2	--	
Q_{gd}	Gate Drain Charge		--	11	--	

Source-Drain Diode Characteristics						
Symbol	Parameter	Test Conditions	Value			Units
			Min.	Typ.	Max.	
I_S	Diode Forward Current	$T_C=25^\circ\text{C}$	--	--	-110	A
V_{SD}	Diode Forward Voltage	$I_S=-15A, V_{GS}=0V$	--	--	-1.2	V
t_{rr}	Reverse Recovery time	$I_S=-15A, V_{DD}=-30V$ $dI/dt=100A/\mu s$	--	60	--	ns
Q_{rr}	Reverse Recovery Charge		--	105	--	nC

Characteristics Curve:

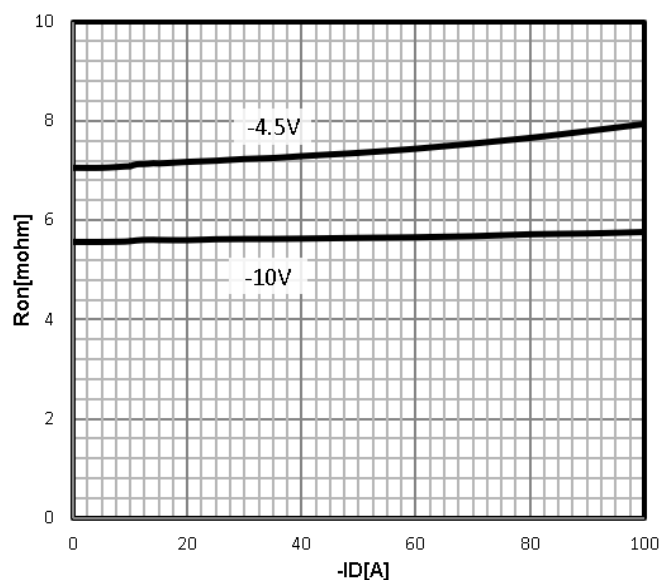
Typ. output characteristics

$$I_D = f(V_{DS})$$



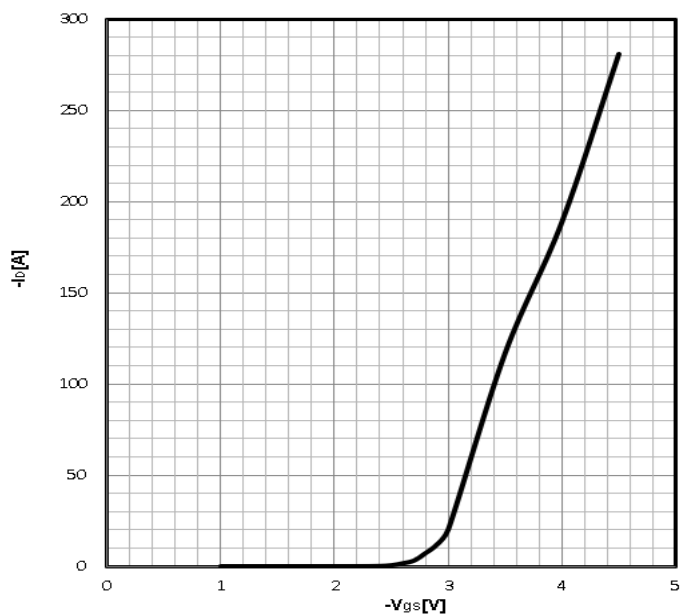
Typ. drain-source on resistance

$$R_{DS(on)} = f(I_D)$$



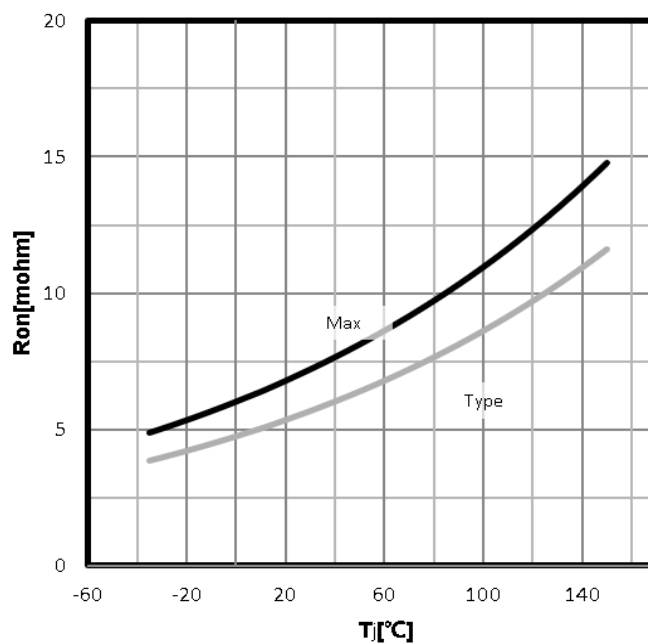
Typ. transfer characteristics

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

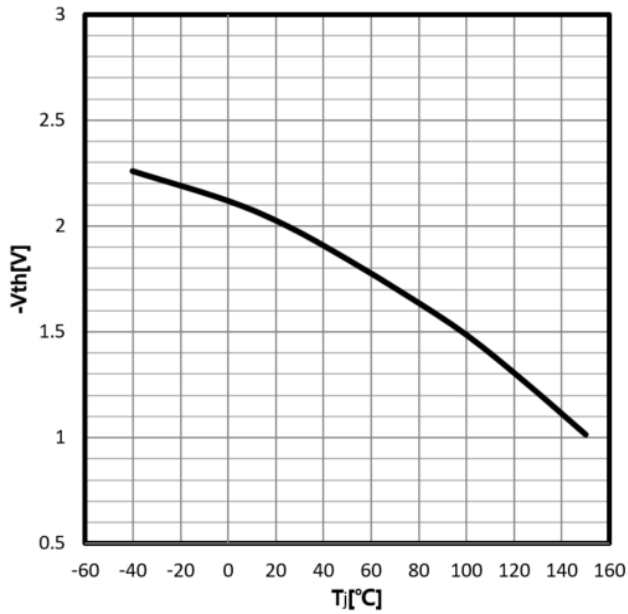


Drain-source on-state resistance

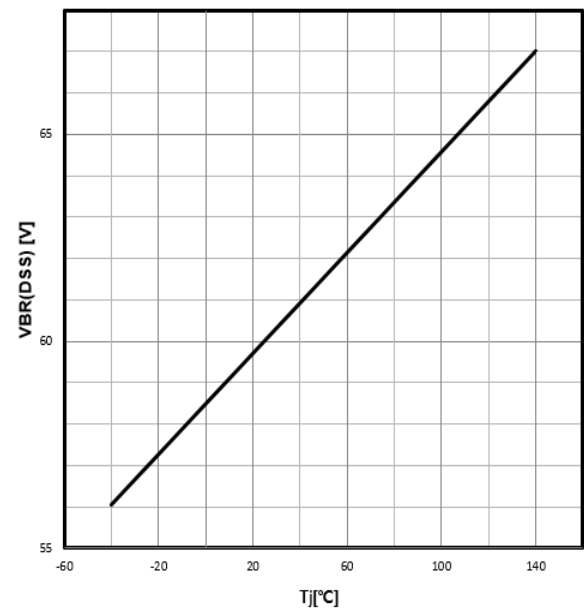
$$R_{DS(on)} = f(T_j); I_D = -15A; V_{GS} = -10V$$



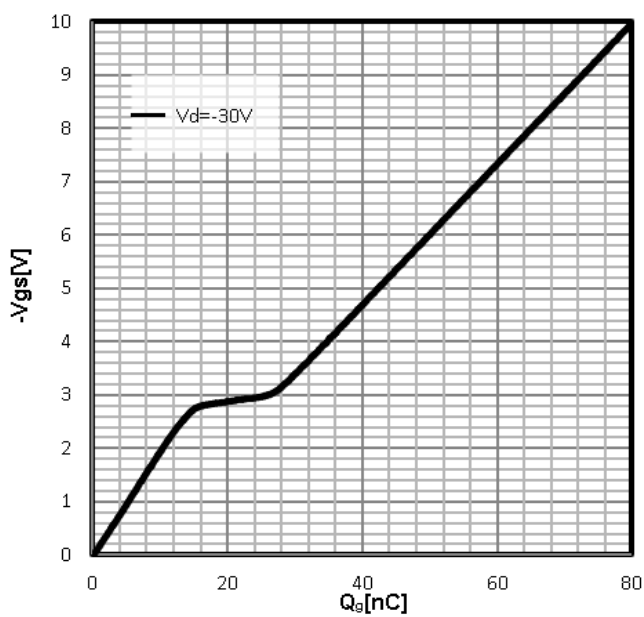
Gate Threshold Voltage
 $-V_{TH}=f(T_j); I_D=-250\mu A$



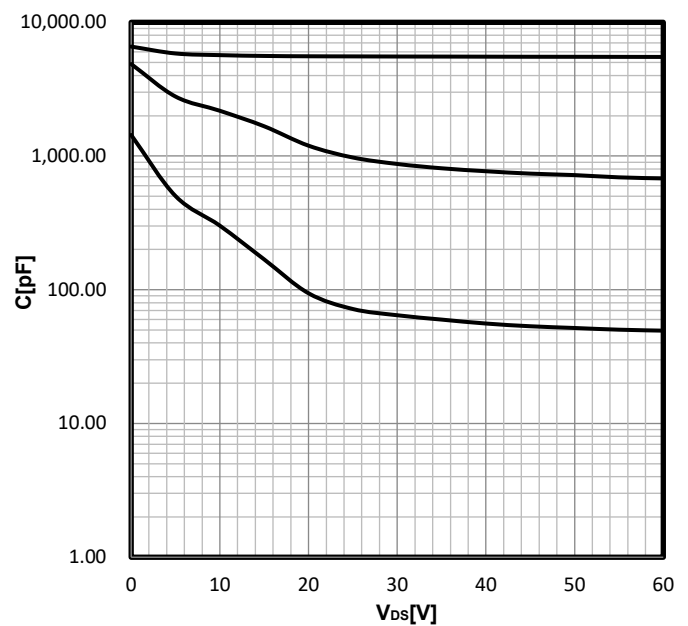
Drain-source breakdown voltage
 $V_{BR(DSS)}=f(T_j); I_D=-250\mu A$



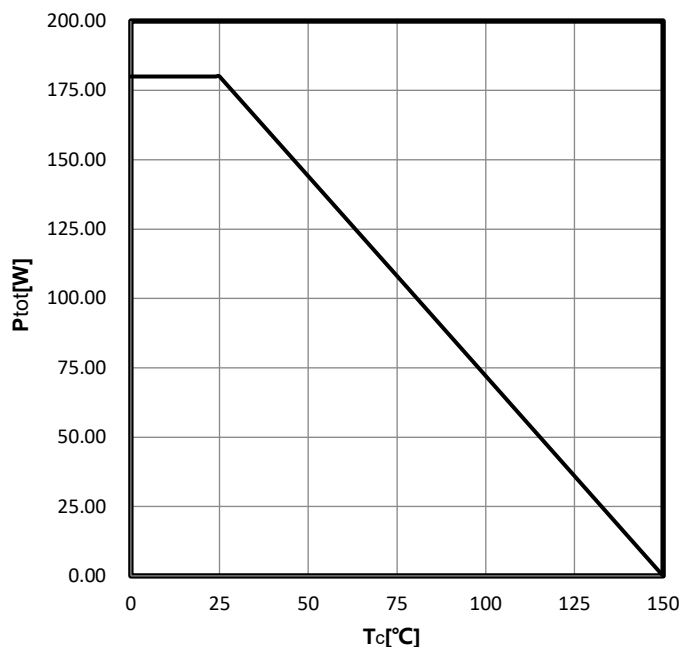
Typ. gate charge
 $V_{GS}=f(Q_{gate}); I_D=-15A$



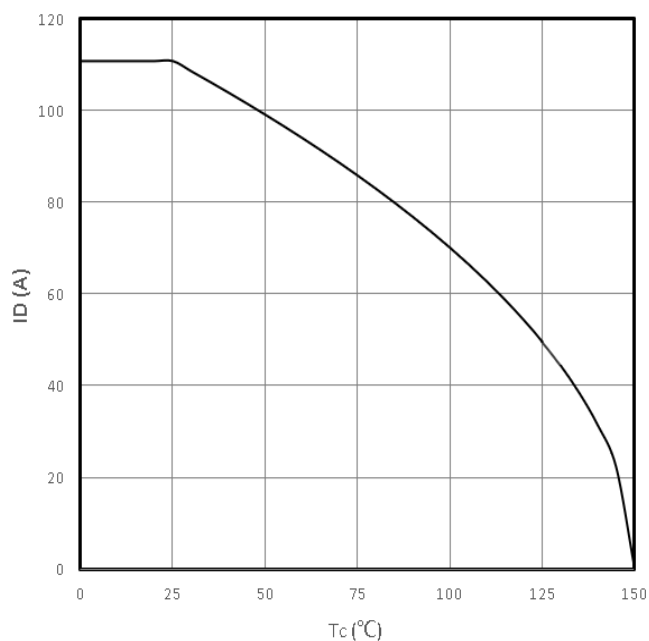
Typ. capacitances
 $C=f(V_{DS}); V_{GS}=0V; f=1MHz$



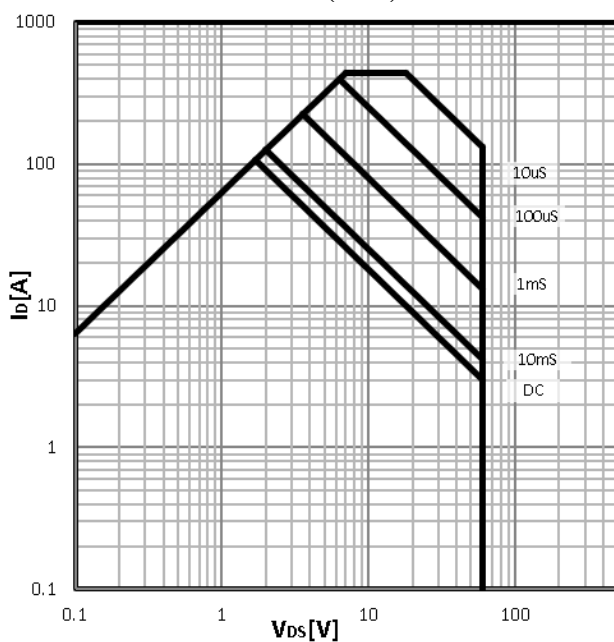
Power Dissipation
 $P_{tot}=f(T_C)$



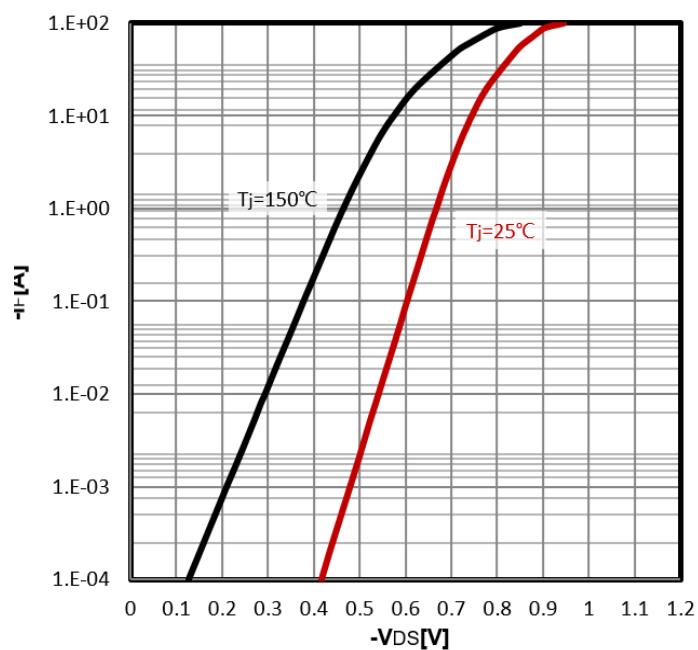
Maximum Drain Current
 $-I_D=f(T_C)$



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



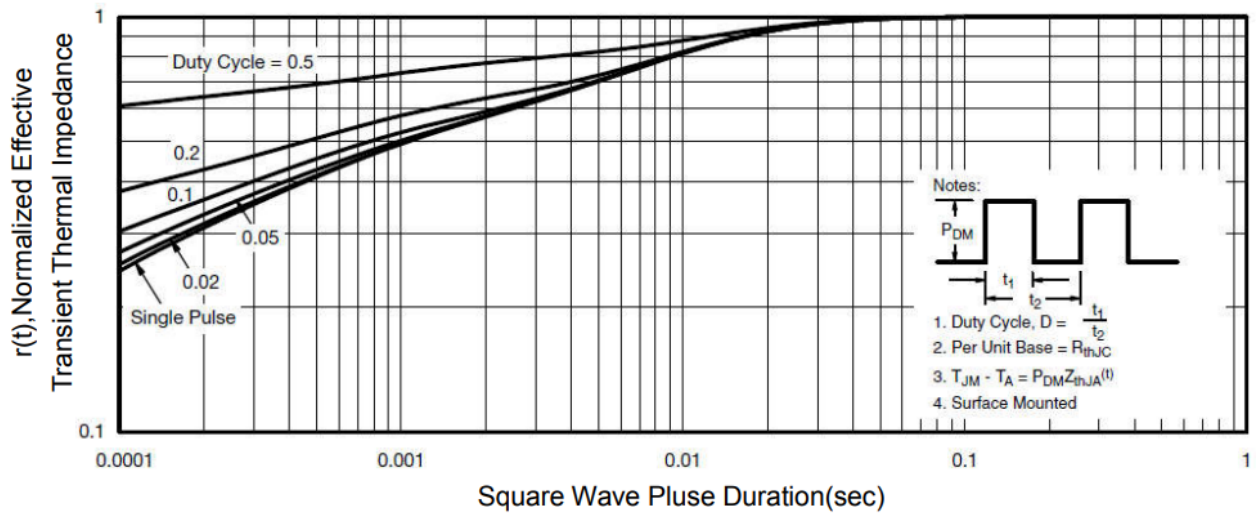
Body Diode Forward Voltage Variation
 $-I_F=f(-V_{DS})$





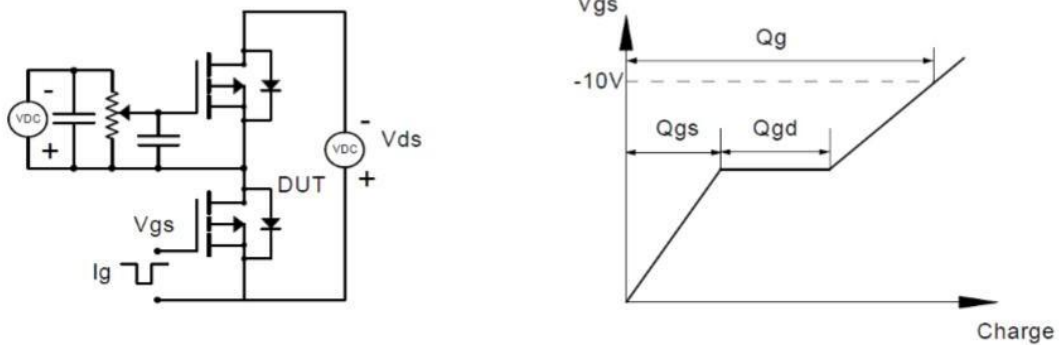
Max. transient thermal impedance

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

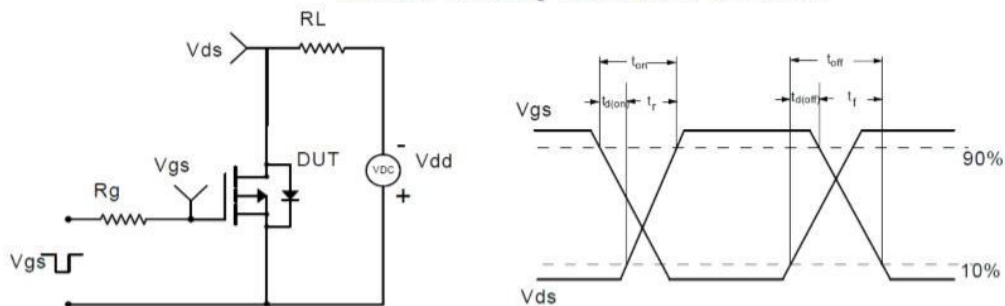


Test Circuit and Waveform:

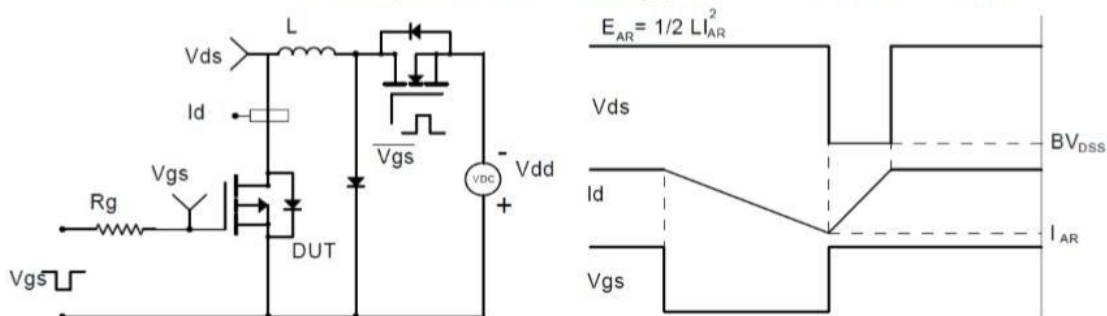
Gate Charge Test Circuit & Waveform



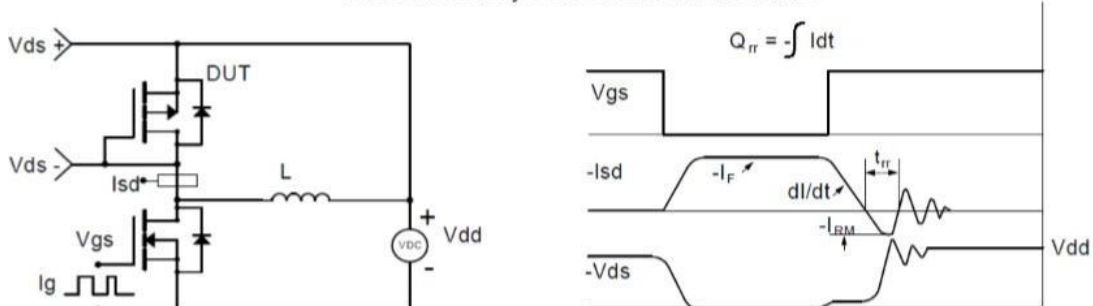
Resistive Switching Test Circuit & Waveforms



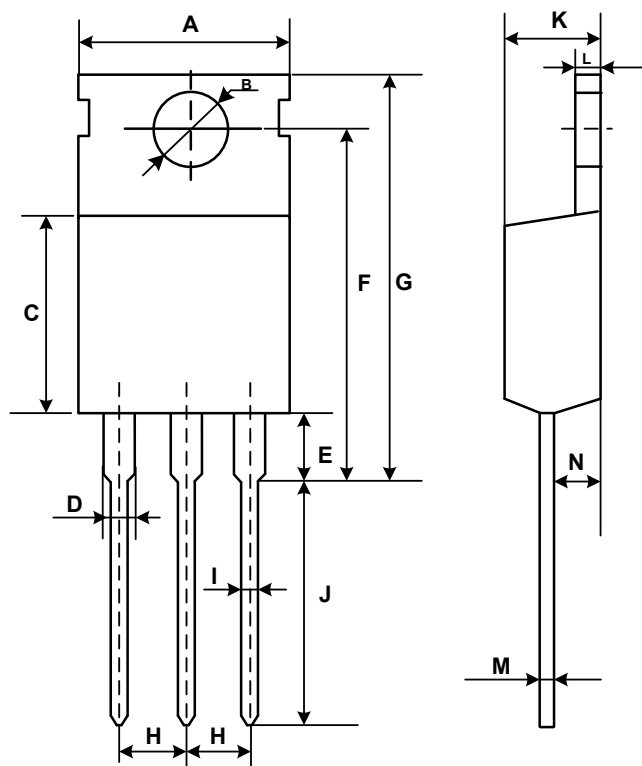
Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery 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