650V, 6A IGBT with soft and fast recovery anti-parallel diode

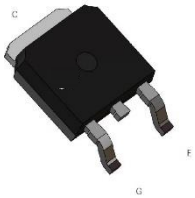
Product Summary

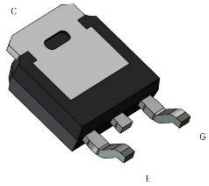
VCE	650V
IC(TC=100℃)	6A
VCE(sat)(TJ=25℃)	1.73V

Description and Applications

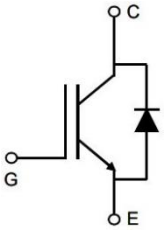
- Trench epi-Fs Technology
- High efficient turn-on di/dt controllability
- Low VCE(SAT) enable high efficiencies
- Low Turn-off switching loss and softness
- Very Good EMI and High Short-Circuit Ruggedness
- Motor Drives, Home Appliance Applications
- Fan, Pumps, Vacuum Cleaner
- Other Hard Switching Applications

View and Internal Schematic Diagram





TO252 DPAK



Internal Schematic

Ordering Information

Part Number	Case	Packaging
MT06B65S	DPAK	2,500/Tape & Reel

Maximum Ratings (@TA = +25°C unless otherwise specified.)

Parameters		Symbol	Max	Units
Collector-Emitter Voltage		V_{CE}	650	V
Gate-Emitter Voltage		V_{GE}	±30	V
Continuous Collector Current	T_C = +25°C T_C= +100°C	I_C	12 6	A
Pulsed Collector Current , Limited by T_{Jmax}		I_{CM}	35	A
Turn off SOA, V_{CE}≤650V, Limited by T_{Jmax}		I_{LM}	35	A
Continuous Diode Forward Current	T_C = +25°C T_C= +100°C	I_F	12 6	A
Short Circuit with standing time V_{GE}=15V,V_{CC}≤400V,T_J≤175℃		t_{SC}	5	us
Power Dissipation	T_C = +25°C T_C = +100°C	P_D	69 28	W
Operating and Storage Temperature Range		T_J, T_{STG}	-55 to+150	°C
Maximum lead temperature for soldering purpose,1/8" from case for 5s		T_L	300	°C

Thermal Characteristics

Characteristic	Symbol	Typ	Unit
Maximum Junction-to-Ambient	$R_{\theta JA}$	40	°C/W
Maximum IGBT Junction-to-Case	$R_{\theta JC}$	1.8	°C/W
Maximum Diode Junction-to-Case	$R_{\theta JC}$	2.2	°C/W

Electrical Characteristics (@T_A = +25°C unless otherwise specified.)

Symbol	Parameter	Conditions		Min	Typ	Max	Units
STATIC PARAMETERS							
BV_{CES}	Collector-Emitter Breakdown Voltage	I_C=1mA, V_{GE}=0V		650	-	-	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	V_{GE}=15V, I_C=6A	T_J=25℃	-	1.73	1.98	V
			T_J=125℃	-	2.05	-	
			T_J=175℃	-	2.21	-	
V_F	Diode Forward Voltage	V_{GE}=0V, I_C=6A	T_J=25℃	-	1.9	2.25	V
			T_J=125℃	-	1.58	-	
			T_J=175℃	-	1.3	-	
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	V_{CE}=5V I_C=1mA		-	5.3	-	V
I_{CES}	Zero Gate Voltage Collector current	V_{CE}=650V, V_{GE}=0A	T_J=25℃	-	-	10	uA
			T_J=125℃	-	-	100	
			T_J=175℃	-	-	5000	
I_{GES}	Gate-Emitter leakage current	V_{CE}=0V, V_{GE}= ±30V		-	-	±100	nA
g_{FS}	Forward Trans conductance	V_{CE}=20V, I_C=6A		-	2.8		S
DYNAMIC PARAMETERS							
C_{ies}	Input Capacitance	V_{GE}=0V, V_{CC}=25V, f=1MHz		-	243	-	pF
C_{oes}	Output Capacitance			-	36	-	pF
C_{res}	Reverse Transfer Capacitance			-	22	-	pF
Q_g	Total Gate Charge	V_{GE}=15V, V_{CC}=520V, I_C=6A		-	10	-	nC
Q_{ge}	Gate to Emitter Charge			-	3.2	-	nC
Q_{gc}	Gate to Collector Charge			-	3.5	-	nC
$I_{C(SC)}$	Short circuit collector current	V_{GE}=15V,V_{CC}=400V, t_{sc}≤5us, T_J≤175℃		-	30	-	A
R_g	Gate resistance	f=1MHz		-	6	-	Ω
SWITCHING PARAMETERS, (Load Inductive, TJ=25℃)							
$t_{D(on)}$	Turn-On Delay Time	T_J=25℃, V_{GE}=15V, V_{CC}=400V,		-	6	-	ns
t_r	Turn-On Rise Time			-	21	-	ns
$t_{D(off)}$	Turn-Off Delay Time			-	39	-	N

t_f	Turn-Off Fall Time	I_C=6A, R_G=60Ω	-	121	-	ns
E_{on}	Turn-On Energy		-	0.09	-	mJ
E_{off}	Turn-Off Energy		-	0.13	-	mJ
E_{total}	Total Switching Energy		-	0.22	-	mJ
t_{rr}	Diode Reverse Recovery Time	T_J=25℃, I_F=6A, di/dt=200A/μs, V_{CC}=400V	-	91	-	ns
Q_{rr}	Diode Reverse Recovery Charge		-	0.25	-	uC
I_{rm}	Diode Peak Reverse Recovery Current		-	4.9	-	A
SWITCHING PARAMETERS, (Load Inductive, TJ=175℃)						
$t_{D(on)}$	Turn-On Delay Time	T_J=175℃, V_{GE}=15V, V_{CC}=400V, I_C=6A, R_G=60Ω	-	8	-	ns
t_r	Turn-On Rise Time		-	27	-	ns
$t_{D(off)}$	Turn-Off Delay Time		-	57	-	ns
t_f	Turn-Off Fall Time		-	180	-	ns
E_{on}	Turn-On Energy		-	0.11	-	mJ
E_{off}	Turn-Off Energy		-	0.19	-	mJ
E_{total}	Total Switching Energy		-	0.3	-	mJ
t_{rr}	Diode Reverse Recovery Time	T_J=175℃, I_F=6A, di/dt=200A/μs, V_{CC}=400V	-	122	-	ns
Q_{rr}	Diode Reverse Recovery Charge		-	0.44	-	uC
I_{rm}	Diode Peak Reverse Recovery Current		-	6.5	-	nC

TYPICAL ELECTRICAL AND THERMAL CHARACTERIS

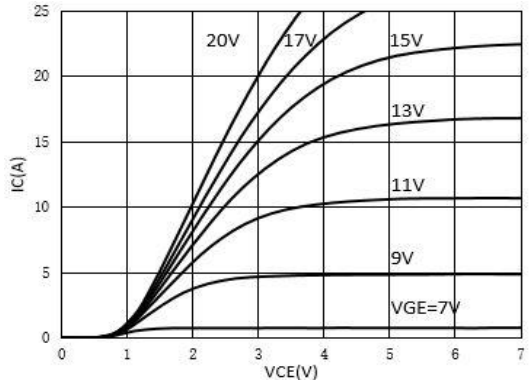


Figure1: Output Characteristics (T_J=25℃)

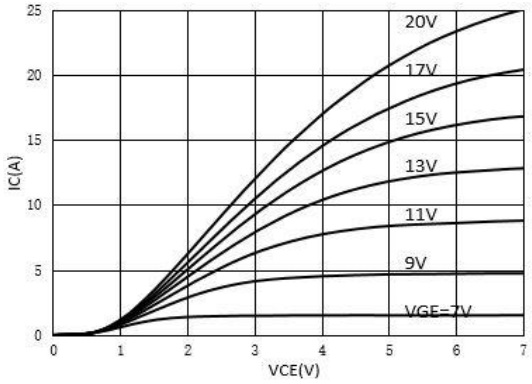
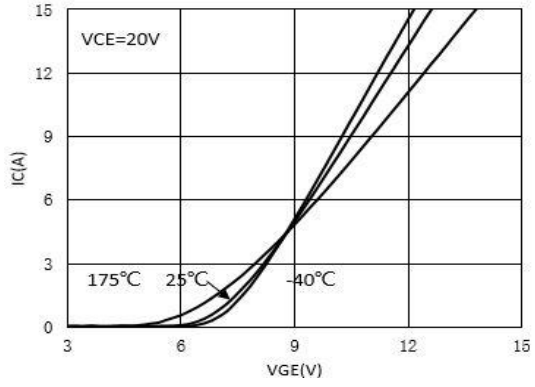


Figure 2: Output Characteristic (T_J=175℃)



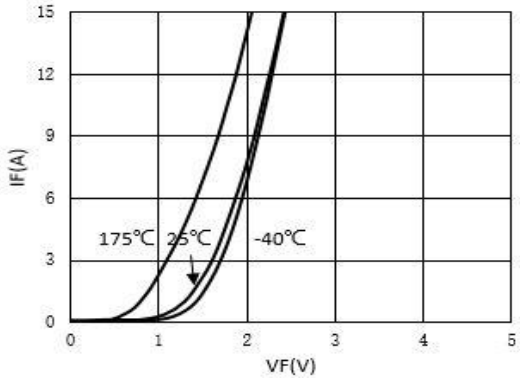


Figure3:Transfer Characteristic

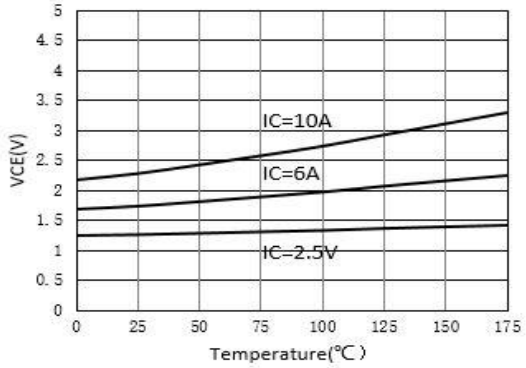


Figure 4: Diode Characteristic

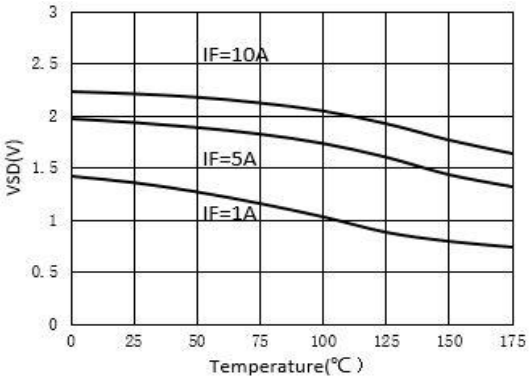
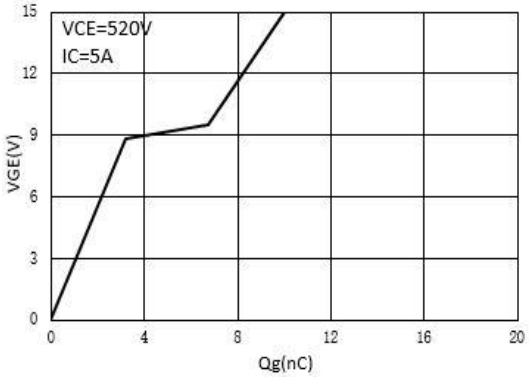


Figure 5: Collector-Emitter Saturation Voltage vs.Junction Temperature

Figure 6:Diode Forward Voltage vs. Junction Temperature



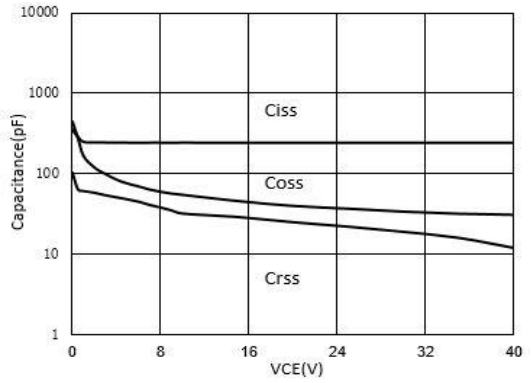
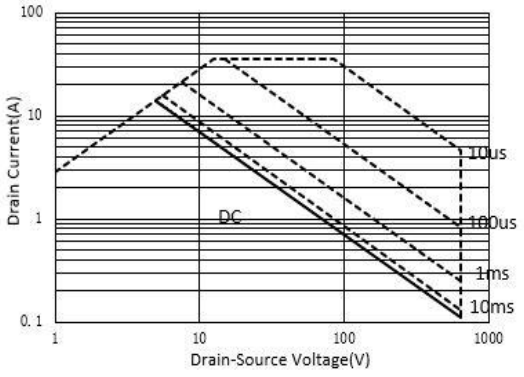


Figure 7:Gate-Charge Characteristics

Figure 8:Capacitance Characteristics



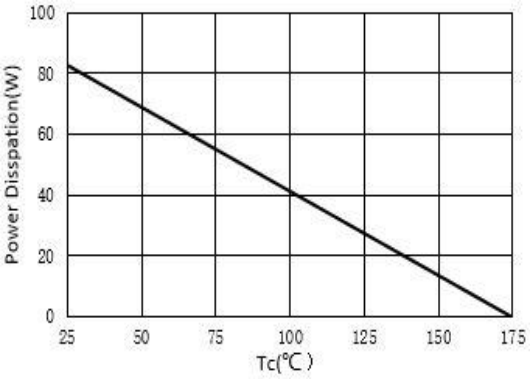


Figure 9: Forward Bias Safe Operating Area

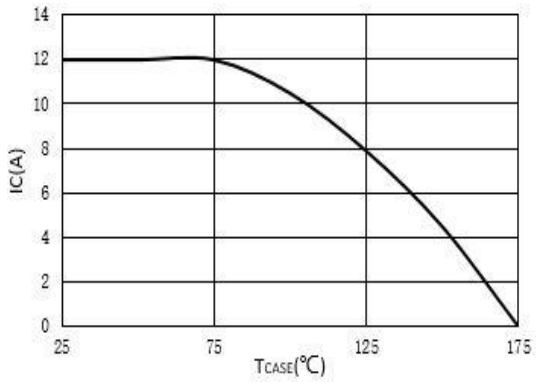


Figure 10: Power Disspation as Function of Case

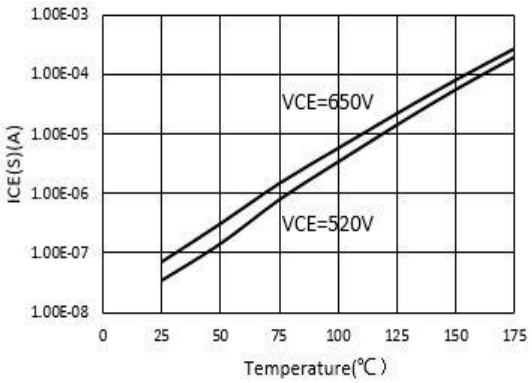
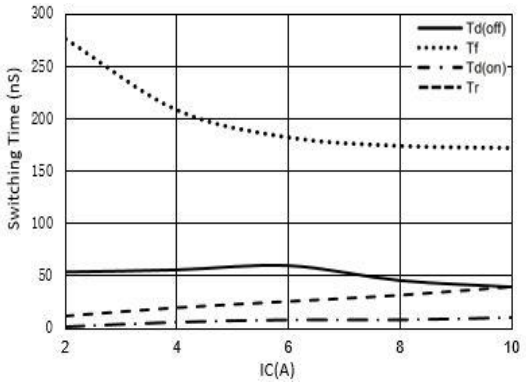


Figure 11: Current De-rating

Figure 12:Diode Reverse Leakage Current vs. Junction Temperature



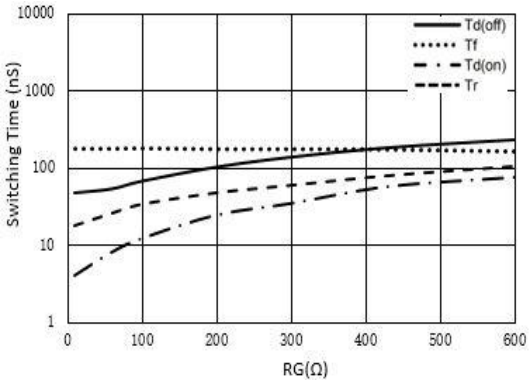
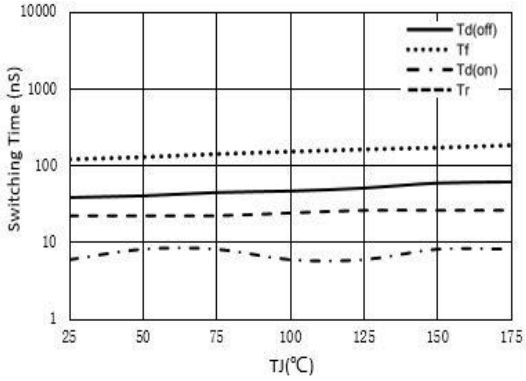


Figure 13:Switching Time vs. I_C (T_J=175℃,V_{GE}=15V,V_{CE}=400V,R_g=60Ω)

Figure 14: Switching Time vs. Rg (T_J=175℃,V_{GE}=15V,V_{CE}=400V,I_C=6A)



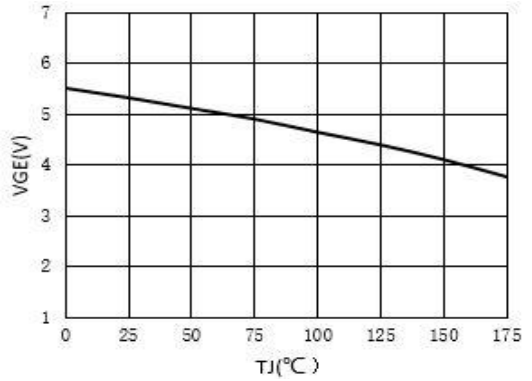


Figure 15: Switching Time vs. T_J

(V_{GE}=15V,V_{CE}=400V,I_C=6A,R_g=60Ω)

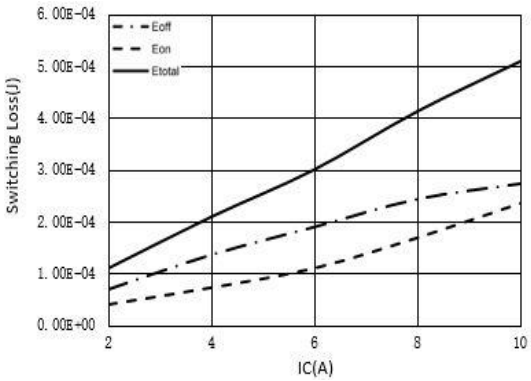


Figure 16: V_{CE} vs. T_J

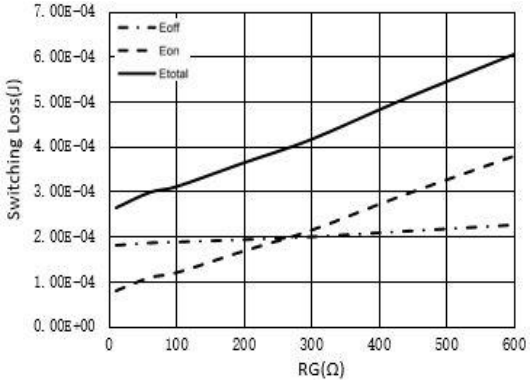


Figure 17: Switching Loss vs. I_C

(T_J=175℃,V_{GE}=15V,V_{CE}=400V,R_g=60Ω)

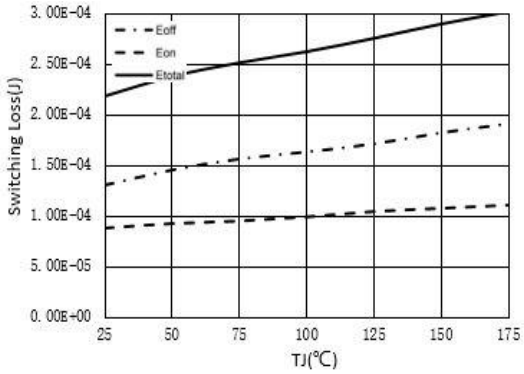


Figure 18: Switching Loss vs. R_g

(T_J=175℃,V_{GE}=15V,V_{CE}=400V,I_C=6A)

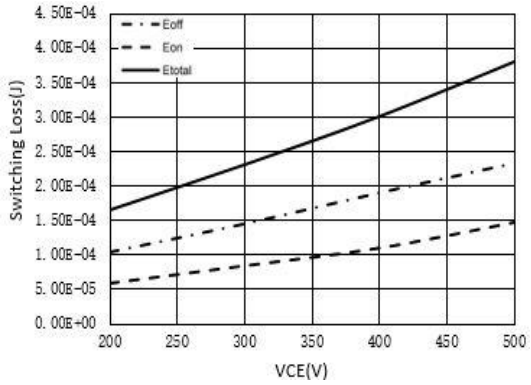


Figure 19: Switching Loss vs. T_J

(V_{GE}=15V,V_{CE}=400V,I_C=6A,R_g=60Ω)

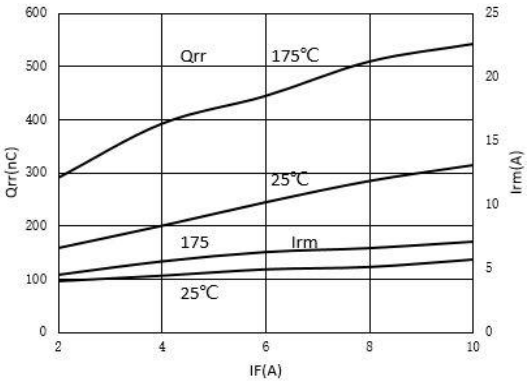


Figure 20: Switching Loss vs. V_{CE}

(T_J=175℃,V_{GE}=15V,I_C=6A,R_g=60Ω)

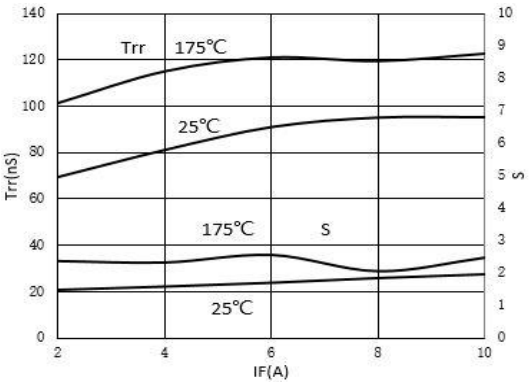


Figure 21: Diode Reverse Recovery Charge and Peak Current vs. Conduction Current (V_{GE}=15V,V_{CE}=400V,di/dt=200A/us)

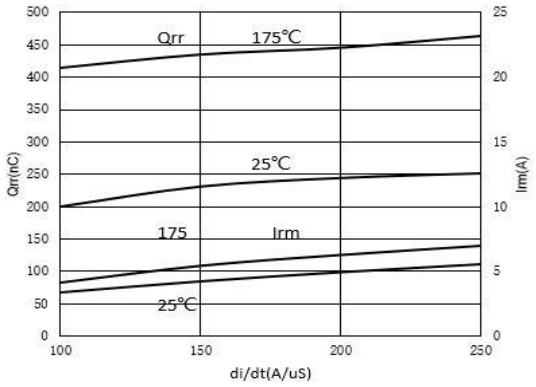


Figure 22: Diode Reverse Recovery Time and Softness Factor vs. Conduction Current (V_{GE}=15V,V_{CE}=400V,di/dt=200A/us)

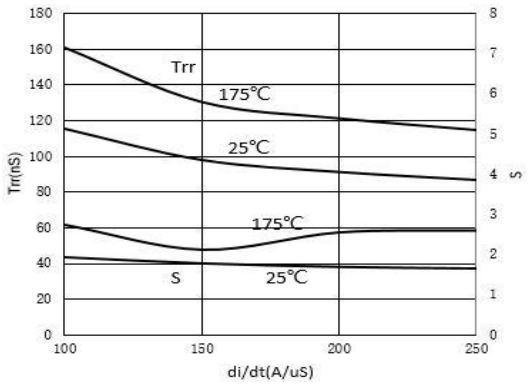


Figure 23: Diode Reverse Recovery Charge and Peak Current vs. di/dt (V_{GE}=15V,V_{CE}=400V,di/dt=200A/us)

Figure 24: Diode Reverse Recovery Time and Softness Factor vs. di/dt (V_{GE}=15V,V_{CE}=400V,di/dt=200A/us)

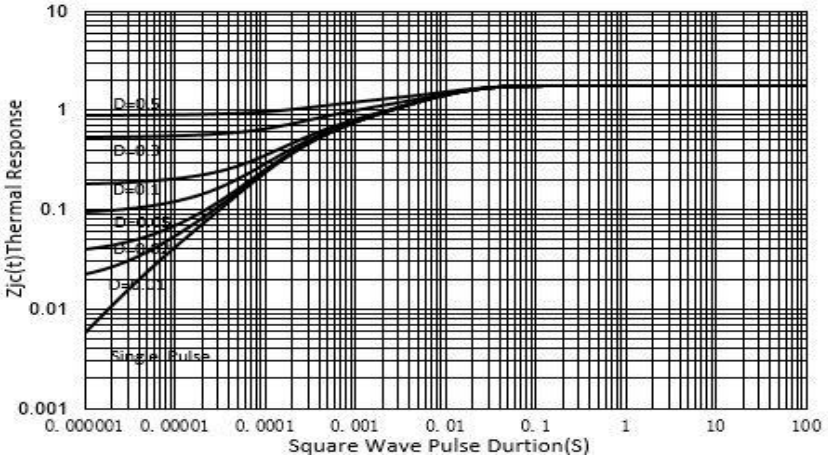


Figure 25: Normalized Maximum Transient Thermal Impedance for IGB

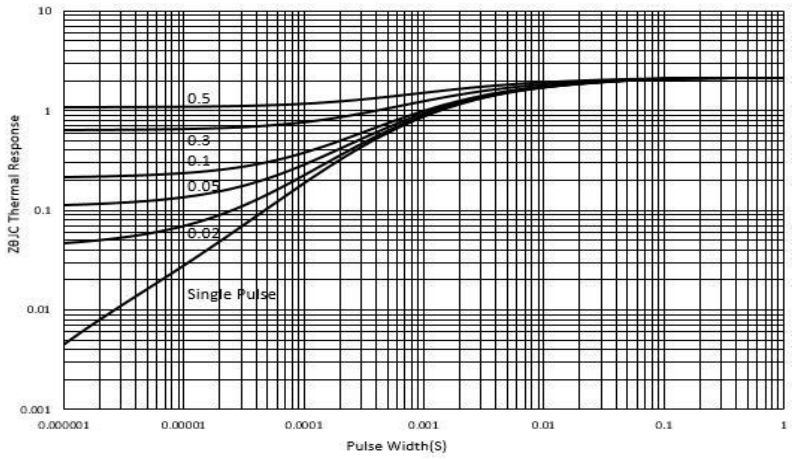


Figure 26: Normalized Maximum Transient Thermal Impedance for Diode

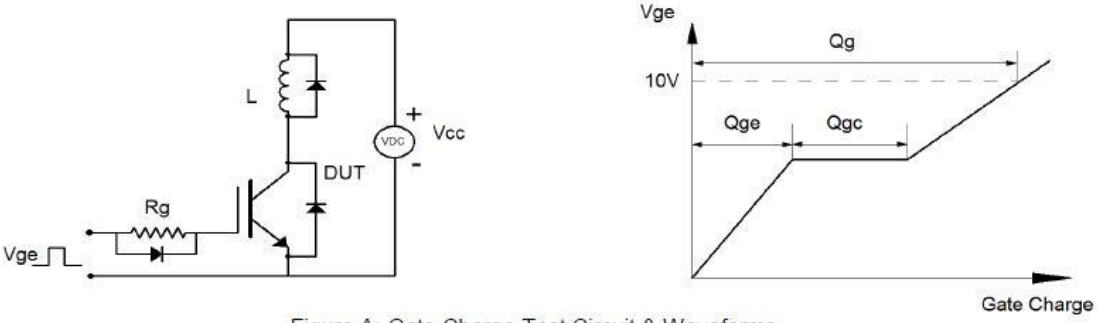


Figure A: Gate Charge Test Circuit & Waveforms

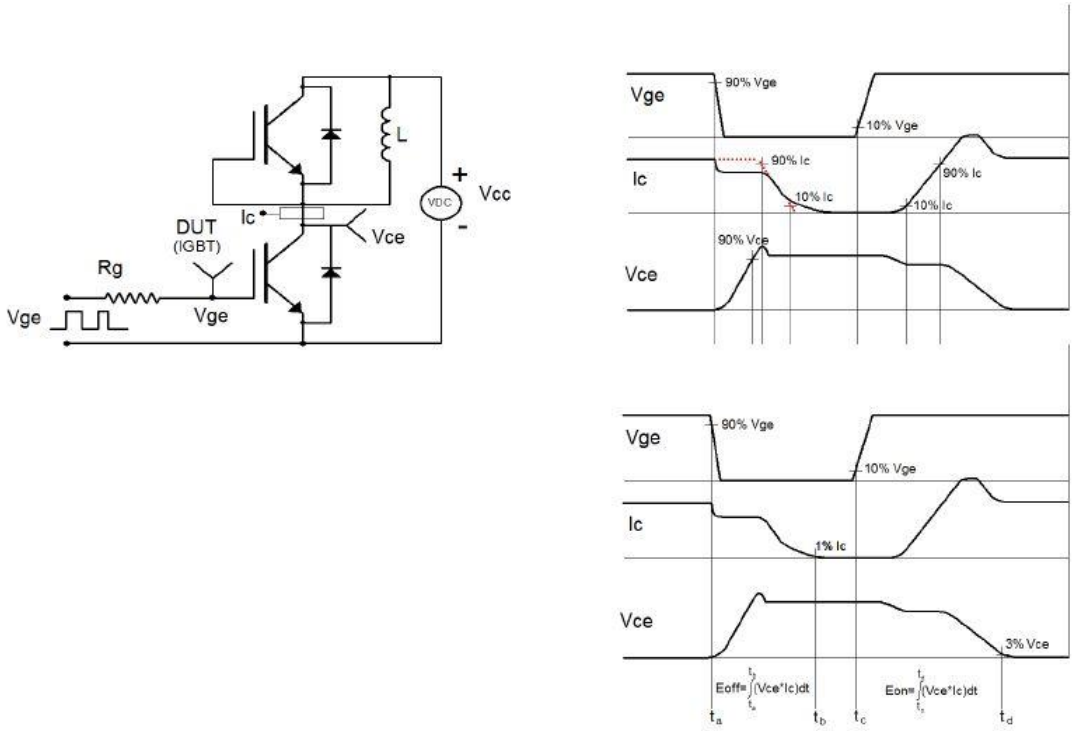


Figure B: Inductive Switching Test Circuit & Waveforms

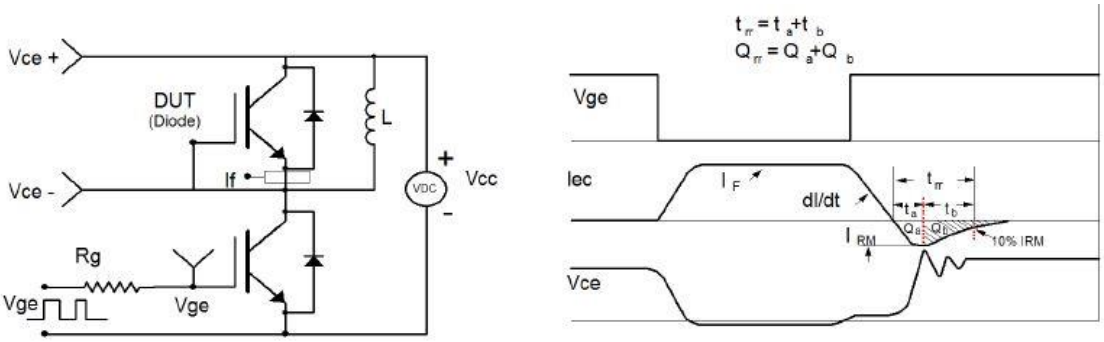


Figure C: Diode Recovery Test Circuit & Waveforms