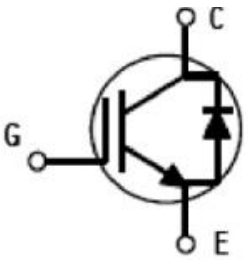
6A 650V Trenchstop Insulated Gate Bipolar Transistor

1 Description

Using DongHai's proprietary Trench design and advance FS technology, the 650V FS IGBT offers superior and switching performances, high avalanche ruggedness easy parallel operation

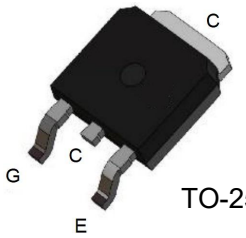


2 Features

- FS Trench Technology, Positive temperature coefficient
- Low saturation voltage: VCE(sat), typ = 1.73V @ I_C =6A and T_j = 25°C
- Extremely enhanced avalanche capability

3 Applications

- Welding
- UPS
- Three-level Inverter



TO-252B

Type	V_{CE}	Ic	Vcesat,T_j=25℃	T_{jmax}	Package
DGD06F65M2	650V	6A	1.73V	150℃	TO-252B

4 Electrical Characteristics

4.1 Absolute Maximum Ratings （Tj=25℃，unless otherwise noted）

Parameter		Symbol	Value	Units
Collector-to-Emitter Voltage		V_{CE}	650	V
Gate-to-Emitter Voltage		V_{GE}	±30	V
DC Collector current	T_j=25℃	I_C	12	A
	T_j=100℃		6	A
Pulsed Collector Current(1)		I_{CM}	35	A
Diode forward current	T_j=25℃	I_F	12	A
	T_j=100℃		6	
Diode Pulsed Current		I_{FM}	35	A
Short circuit withstand time，V_{GE}=15V，V_{CC}=400V，TJ≤175℃		T_{SC}	5	μs
Short circuit collector current VGE=15V,VCC=400V, tsc≤5us, TJ≤175℃		$I_{C(SC)}$	30	A
Power Dissipation	T_C=25℃	P_{tot}	69	W
	T_C=100℃		28	W
Junction Temperature Range		T_j	-55～150	℃
Storage Temperature Range		T_{stg}	-55～150	℃
Soldering temperature		T_L	300	℃

4.2 Thermal Characteristics

Parameter	Symbol	Rating	Units
IGBT Thermal Resistance,Junction to Case-sink	R_{thJC}	1.8	℃/W
IGBT Thermal Resistance,Junction to Ambient	R_{thJA}	40	℃/W
Diode Thermal Resistance,Junction to Case-sink	R_{thJC}	2.2	℃/W

4.3 Electrical Characteristics （T_j=25℃， unless otherwise noted）

Parameter	Symbol	Test Condition	Value			Units
			Min	Typ	Max	
Off Characteristics						
Collector-to-Emitter Breakdown Voltage	V_{CE}	I_C=1mA,V_{GE}=0V	650	--	--	V
Collector-to-Emitter Leakage Current	I_{CES}	V_{CE}=650V,V_{GE}=0V,T_j=25℃	--	--	10	μA
		V_{CE}=650V,V_{GE}=0V,T_j=125℃	--	--	100	
		V_{CE}=650V,V_{GE}=0V,T_j=175℃	--	--	5000	
Gate-to-Emitter Leakage Current	I_{GES}	V_{GE}=±30V,V_{CE}=0V	--	--	±100	nA
On Characteristics						
Gate Threshold Voltage	$V_{GE(th)}$	V_{CE}=V_{GE},I_C=1mA	4	5.3	7	V
Collector-emitter saturation voltage	V_{cesat}	V_{GE}=15V,I_C=6A,T_j=25℃	--	1.73	1.98	V
		V_{GE}=15V,I_C=6A,T_j=125℃	--	2.05	2.2	V
		V_{GE}=15V,I_C=6A,T_j=175℃	--	2.21	--	V
Transconductance	g_{fs}	V_{CE}=20V,I_C=6A	--	2.8	--	S
Dynamic Characteristics						
Input Capacitance	C_{iss}	V_{CE}=25V,V_{GE}=0V f=1MHz	--	243	--	pF
Output Capacitance	C_{oss}		--	36	--	
Reverse Transfer Capacitance	C_{rss}		--	22	--	
Switching Characteristics						
Turn-on delay time	$t_{d(on)}$	V_{CE}=400V,I_C=6A, R_g=60Ω,V_{GE}=15V, 感性负载,T_j=25℃	--	6	--	nS
Rise time	t_r		--	21	--	
Turn-off delay time	$t_{d(off)}$		--	39	--	
Fall time	t_f		--	121	--	
Turn-on energy	E_{on}		--	0.09	--	mJ
Turn-off energy	E_{off}		--	0.13	--	
Total switching energy	E_{ts}		--	0.22	--	
Turn-on delay time	$t_{d(on)}$	V_{CE}=400V,I_C=6A, R_g=60Ω,V_{GE}=15V, 感性负载,T_j=175℃	--	8	--	nS
Rise time	t_r		--	27	--	
Turn-off delay time	$t_{d(off)}$		--	57	--	
Fall time	t_f		--	180	--	
Turn-on energy	E_{on}		--	0.11	--	mJ
Turn-off energy	E_{off}		--	0.19	--	
Total switching energy	E_{ts}		--	0.3	--	
Gate charge	Q_g	V_{CE}=520V,I_C=6A, V_{GE}=15V	--	48	--	nC
Gate to Emitter Charge	Q_{ge}		--	3.2	--	
Gate to Collector Charge	Q_{gc}		--	3.5	--	

Parameter	Symbol	Test Condition	Value			Units
			Min	Typ	Max	
Diode Characteristic						
Diode forward voltage	V_F	I_F=6A,T_j=25℃	--	1.9	2.25	V
		I_F=6A,T_j=175℃	--	1.3	--	V
Diode reverse recovery time	t_{rr}	I_F=6A,di/dt=200A/uS, V_{CC}=400V,T_j=25℃	--	91	--	nS
Diode peak reverse recovery current	I_{RRM}		--	4.9	--	A
Diode reverse recovery charge	Q_{rr}		--	0.25	--	uC
Diode reverse recovery time	t_{rr}	I_F=6A,di/dt=200A/uS, V_{CC}=400V,T_j=175℃	--	122	--	nS
Diode peak reverse recovery current	I_{RRM}		--	6.5	--	uC
Diode reverse recovery charge	Q_{rr}		--	0.44	--	A

Notes：

1.Pulse duration is limited bv $T_{j,max}$

5 Typical Characteristic Curves

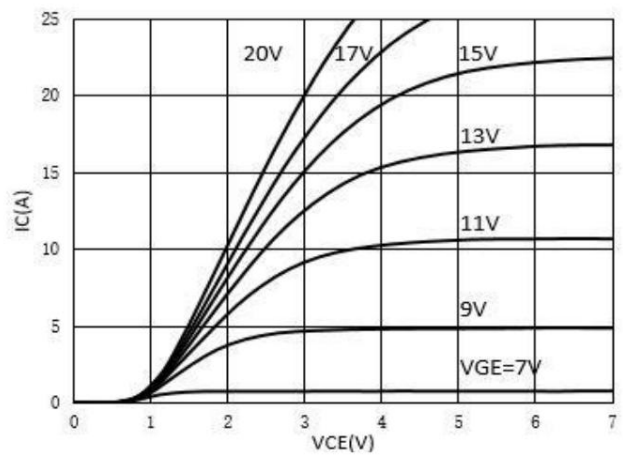


Figure1: Output Characteristics (T_J=25℃)

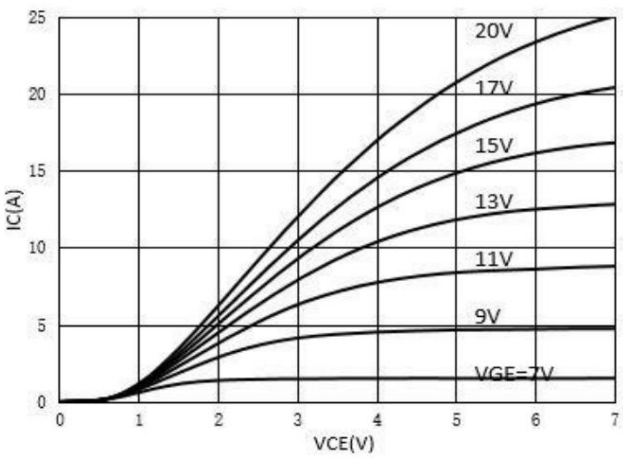


Figure 2: Output Characteristic (T_J=175℃)

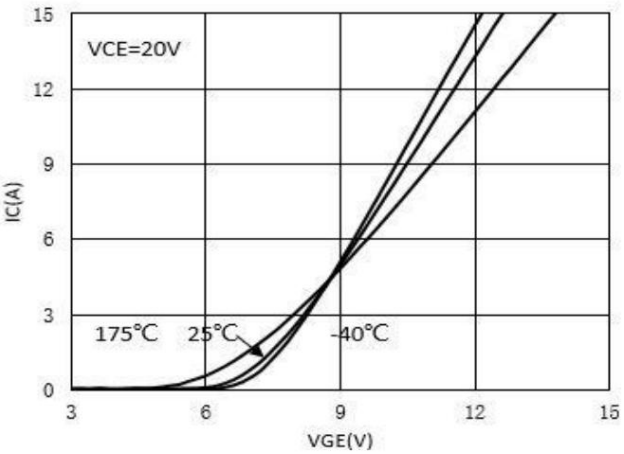


Figure3:Transfer Characteristic

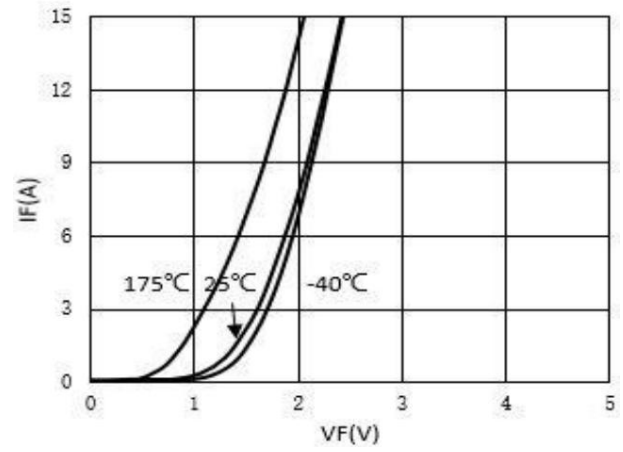


Figure 4: Diode Characteristic

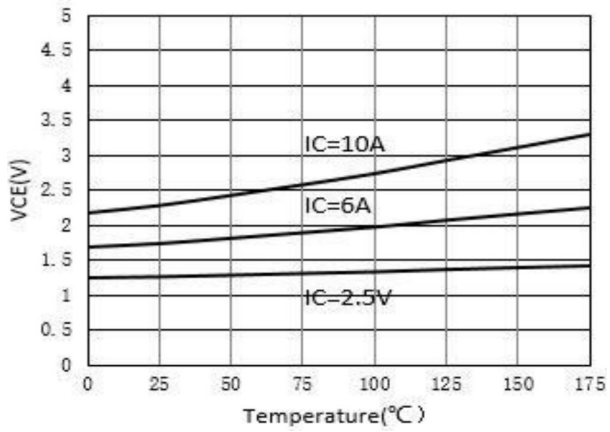


Figure 5: Collector-Emitter Saturation Voltage vs.Junction Temperature

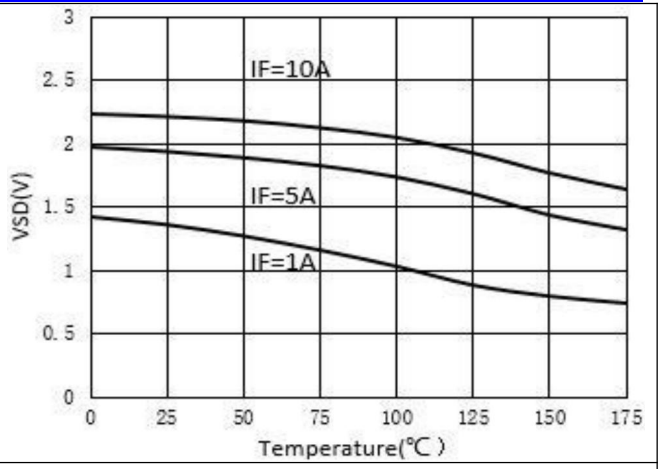


Figure 6:Diode Forward Voltage vs. JunctionTemperature

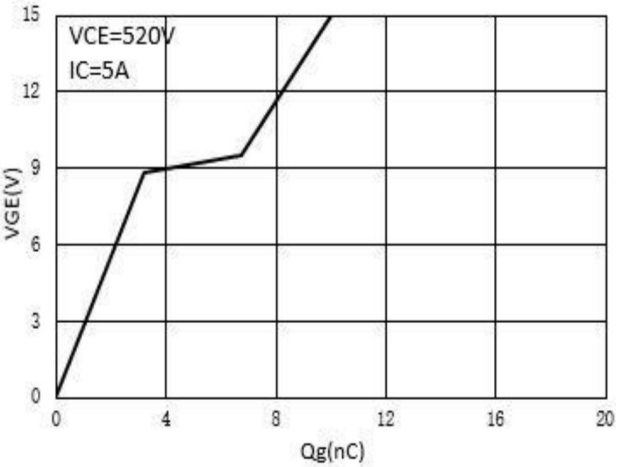


Figure 7:Gate-Charge Characteristics

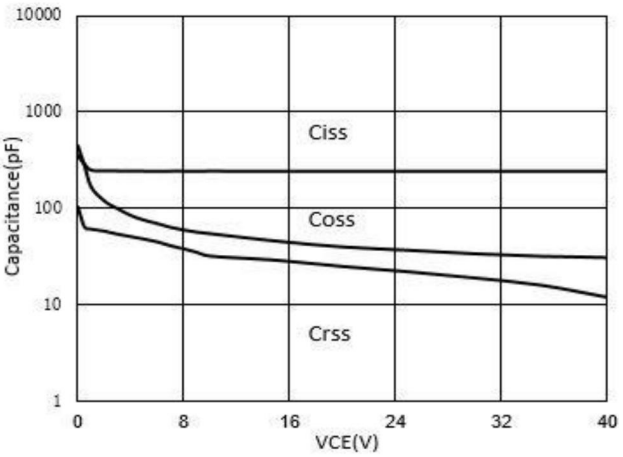


Figure 8:Capacitance Characteristics

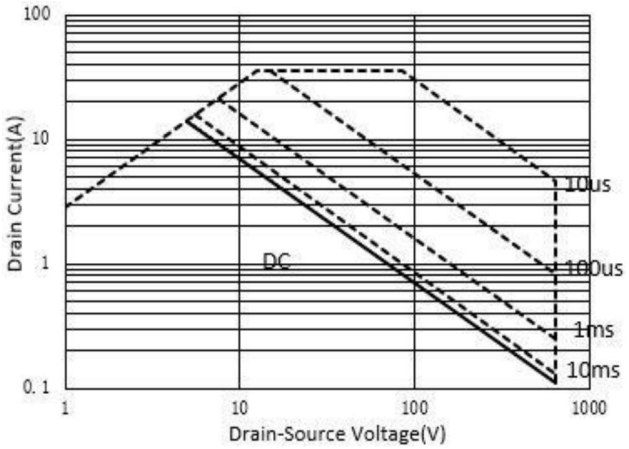


Figure 9: Forward Bias Safe Operating Area

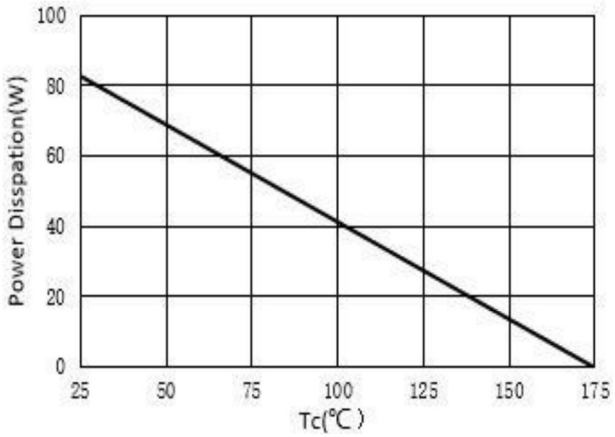


Figure 10: Power Disspation as Function of Case

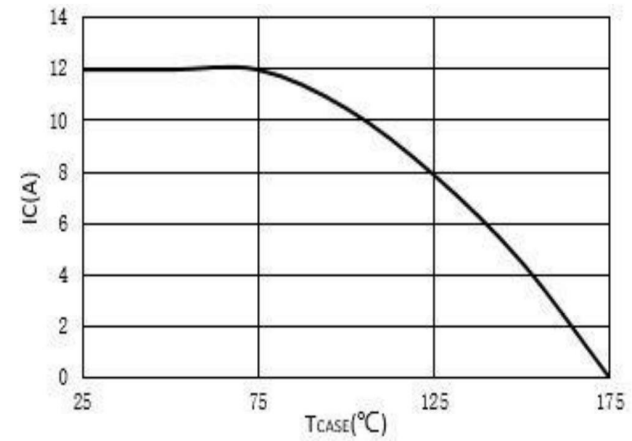


Figure 11: Current De-rating

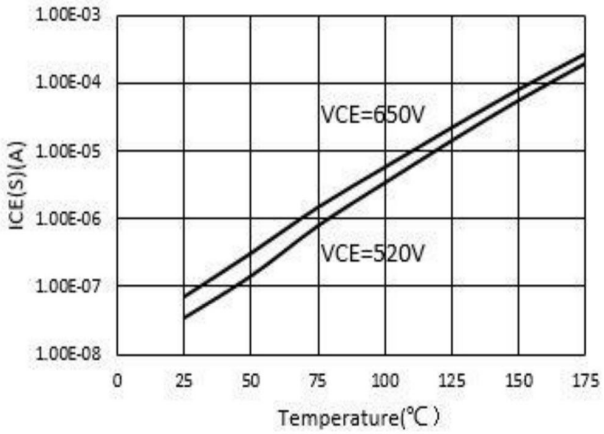


Figure 12:Diode Reverse Leakage Current vs. Junction Temperature

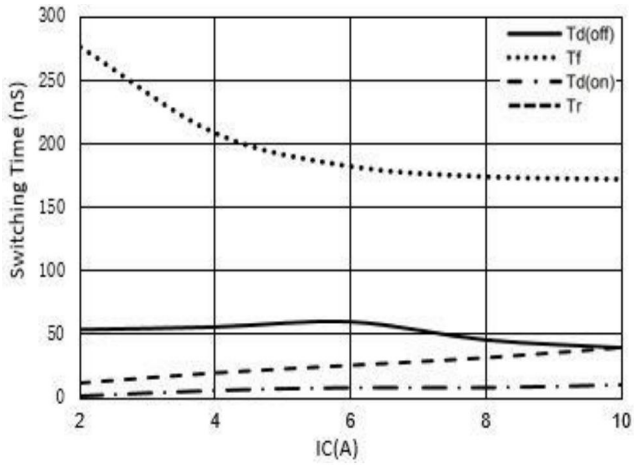


Figure 13:Switching Time vs. I_C (T_J=175℃,V_{GE}=15V,V_{CE}=400V,R_g=60Ω)

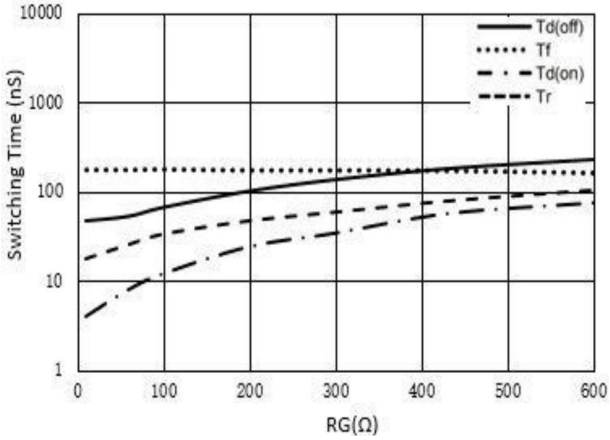


Figure 14: Switching Time vs. Rg (T_J=175℃,V_{GE}=15V,V_{CE}=400V,I_C=6A)

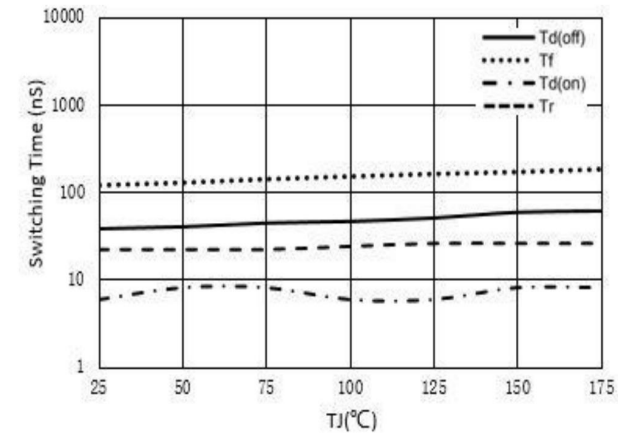


Figure 15: Switching Time vs. T_J (V_{GE}=15V,V_{CE}=400V,I_C=6A,R_g=60Ω)

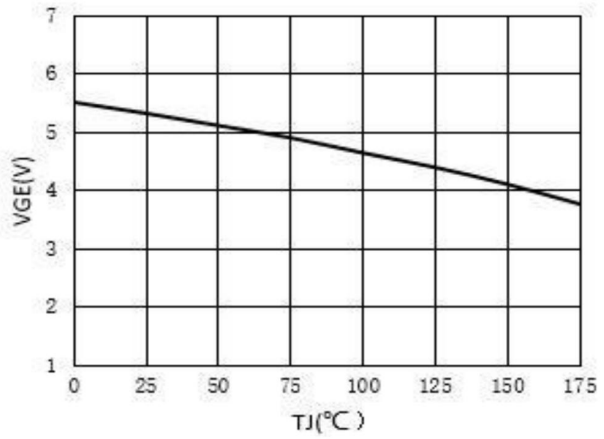


Figure 16: V_{CE} vs. T_J (V_{GE}=15V,V_{CE}=400V,I_C=6A,R_g=60Ω)

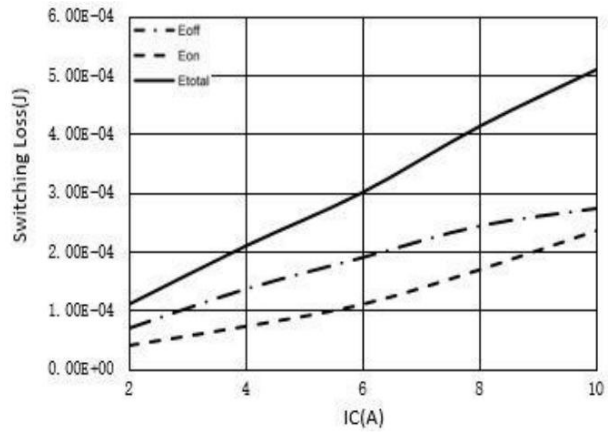


Figure 17: Switching Loss vs. I_C
(T_J=175℃,V_{GE}=15V,V_{CE}=400V,R_g=60Ω)

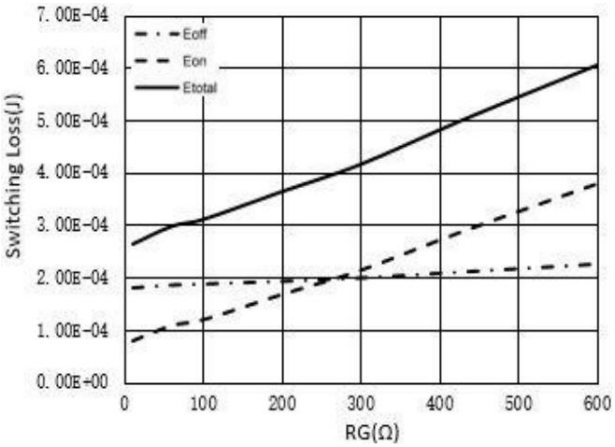


Figure 18: Switching Loss vs. R_g
(T_J=175℃,V_{GE}=15V,V_{CE}=400V,I_C=6A)

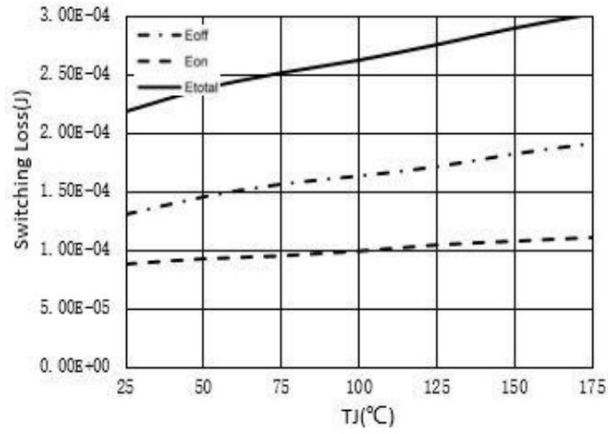


Figure 19: Switching Loss vs. T_J
(V_{GE}=15V,V_{CE}=400V,I_C=6A,R_g=60Ω)

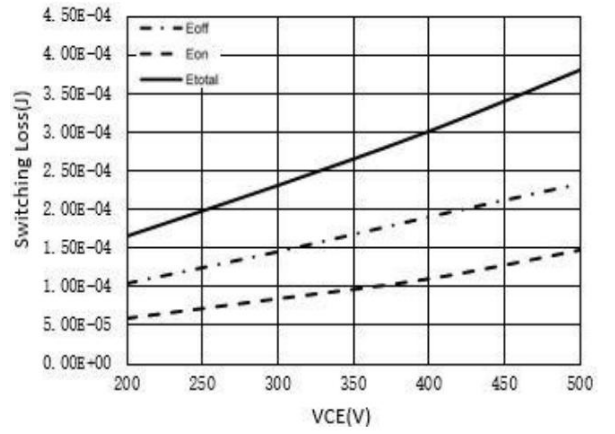


Figure 20: Switching Loss vs. V_{CE}
(T_J=175℃,V_{GE}=15V,I_C=6A,R_g=60Ω)

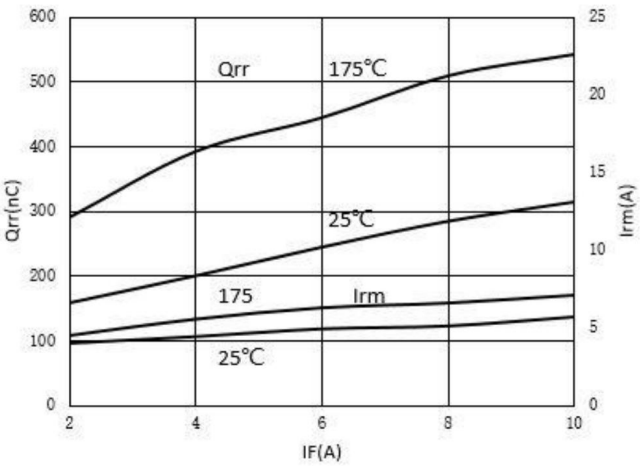


Figure 21: Diode Reverse Recovery Charge and Peak Current vs. Conduction Current
(V_{GE}=15V,V_{CE}=400V,di/dt=200A/us)

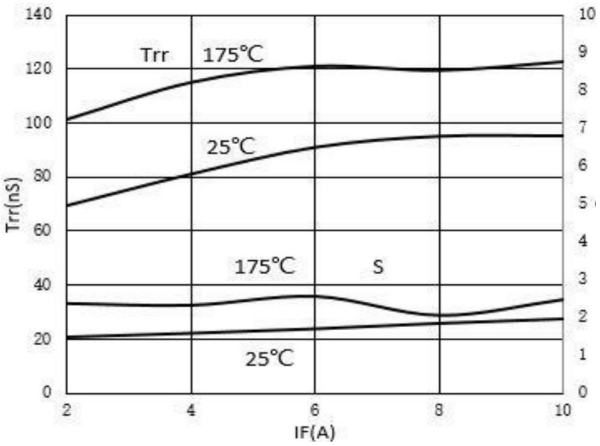


Figure 22: Diode Reverse Recovery Time and Softness Factor vs. Conduction Current
(V_{GE}=15V,V_{CE}=400V,di/dt=200A/us)

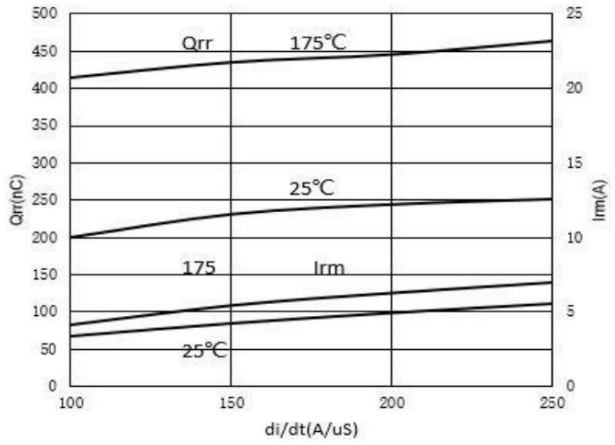


Figure 23: Diode Reverse Recovery Charge and Peak Current vs. di/dt (V_{GE}=15V,V_{CE}=400V,di/dt=200A/us)

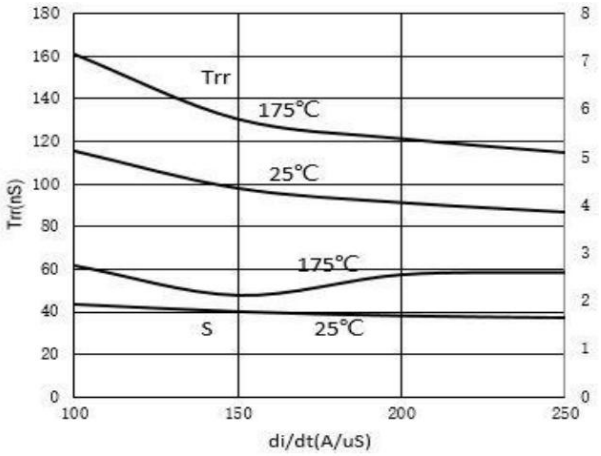


Figure 24: Diode Reverse Recovery Time and Softness Factor vs. di/dt (V_{GE}=15V,V_{CE}=400V,di/dt=200A/us)

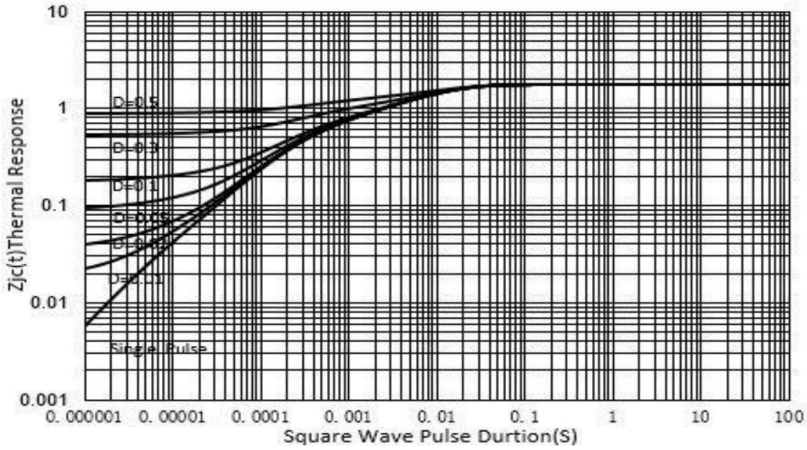


Figure 25: Normalized Maximum Transient Thermal Impedance for IGB

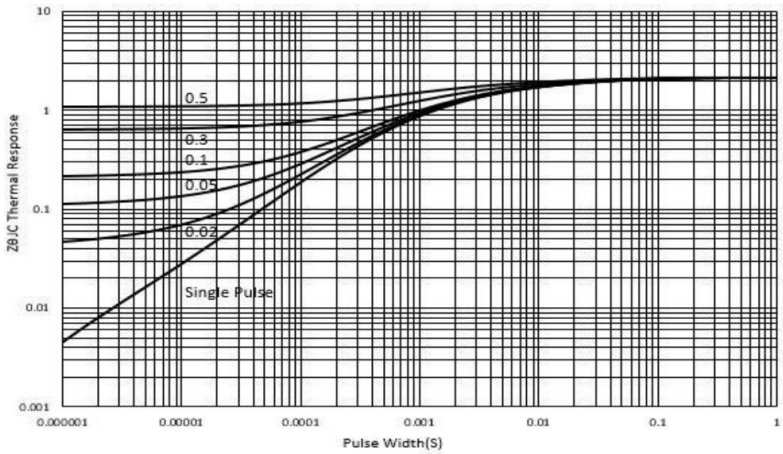


Figure 26: Normalized Maximum Transient Thermal Impedance for Diode

6 Attentions

- Jiangsu Donghai Semiconductor CO.,LTD. reserves the right to change the specification without prior notice! The customer should obtain the latest version of the information before making the order and verify that the information is complete and up to date.
- It is the responsibility of the purchaser for any failure or failure of any semiconductor product under certain conditions. It is the responsibility of the purchaser to comply with safety standards and to take safety measures in the system design and machine manufacturing of Donghai products in order to avoid potential risk of failure. Injury or property damage.
- Product promotion is endless, our company will be dedicated to provide customers with better products.

7 Appendix

Revision history:

Date	REV.	Description	Page
2023.1.30	1.0	Original	