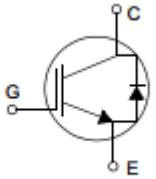
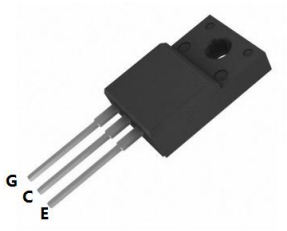
IGBT



Features

- 650V 20A,$V_{CE(sat)(typ.)}$ = 1.70 V@20A
- Field Stop IGBT Technology.
- 10μs Short Circuit Capability.
- Square RBSOA.
- Positive VCE (on) Temperature Coefficient.

TO-220F



Benefits

- High Efficiency for Motor Control.
- Rugged Performance.
- Excellent Current Sharing in Parallel Operation

Absolute Maxinmun Ratings

Symbol	Parameter	Value	Units
V_{CES}	Collector-Emitter Voltage	650	V
V_{GES}	Gate-Emitter Voltage	±30	V
I_C	Continuous Collector Current (T_C=25 ℃)	40	A
	Continuous Collector Current (T_C=100℃)	20	A
I_{CM}	Pulsed Collector Current (Note 1)	80	A
I_F	Diode Continuous Forward Current (T_C=100 ℃)	20	A
I_{FM}	Diode Maximum Forward Current (Note 1)	80	A
t_{sc}	Short Circuit Withstand Time	10	us
Isc	Short Circuit Current	150	A
P_D	Maximum Power Dissipation (T_C=25 ℃)	37	W
P_D	Maximum Power Dissipation (T_C=100℃)	15	W
T_J	Operating Junction Temperature Range	-55 to +150	℃
T_{STG}	Storage Temperature Range	-55 to +150	℃

Thermal Characteristics

Symbol	Parameter	Max.	Units
$R_{th\ j\text{-}c}$	Thermal Resistance, Junction to case for IGBT	3.3	℃/ W
$R_{th\ j\text{-}c}$	Thermal Resistance, Junction to case for Diode	4.3	℃/ W
$R_{th\ j\text{-}a}$	Thermal Resistance, Junction to Ambient	80	℃/ W

Electrical Characteristics (T_C=25℃ unless otherwise noted)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
BV_{CES}	Collector-Emitter Breakdown Voltage	V_{GE}= 0V, I_C= 250uA	650	-	-	V
I_{CES}	Collector-Emitter Leakage Current	V_{CE}= 650V, V_{GE}= 0V	-	-	250	uA
I_{GES}	Gate Leakage Current, Forward	V_{GE}=30V, V_{CE}= 0V	-	-	100	nA
	Gate Leakage Current, Reverse	V_{GE}= -30V, V_{CE}= 0V	-	-	-100	nA
$V_{GE(th)}$	Gate Threshold Voltage	V_{GE}= V_{CE}, I_C= 250uA	4.0	-	5.5	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	V_{GE}=15V, I_C= 20A	-	1.70		V
Qg	Total Gate Charge	V_{CC}=480V V_{GE}=15V I_C=20A	-	79		nC
Qge	Gate-Emitter Charge		-	11		nC
Qgc	Gate-Collector Charge		-	43		nC
$t_{d(on)}$	Turn-on Delay Time	V_{CC}=400V V_{GE}=15V I_C=20A R_G=10Ω Inductive Load T_C=25℃	-	16	-	ns
t_r	Turn-on Rise Time		-	27	-	ns
$t_{d(off)}$	Turn-off Delay Time		-	113	-	ns
t_f	Turn-off Fall Time		-	26	-	ns
Eon	Turn-on Switching Loss		-	0.49	-	mJ
Eoff	Turn-off Switching Loss		-	0.31	-	mJ
C_{ies}	Input Capacitance	V_{CE}=25V V_{GE}=0V f = 1MHz	-	980	-	pF
C_{oes}	Output Capacitance		-	130	-	pF
C_{res}	Reverse Transfer Capacitance		-	60	-	pF
R_{Gint}	Integrated gate resistor	f=1MHz;Vpp=1V		2.30		Ω

Electrical Characteristics of Diode (T_C=25℃ unless otherwise noted)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
V_F	Diode Forward Voltage	I_F=20A	-	2.3		V
t_{rr}	Diode Reverse Recovery Time	V_{CE} = 400V I_F= 20A dI_F/dt = 500A/us	-	42		ns
I_{rrm}	Diode peak Reverse Recovery Current		-	7.6		A
Q_{rr}	Diode Reverse Recovery Charge		-	186		nC

Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature

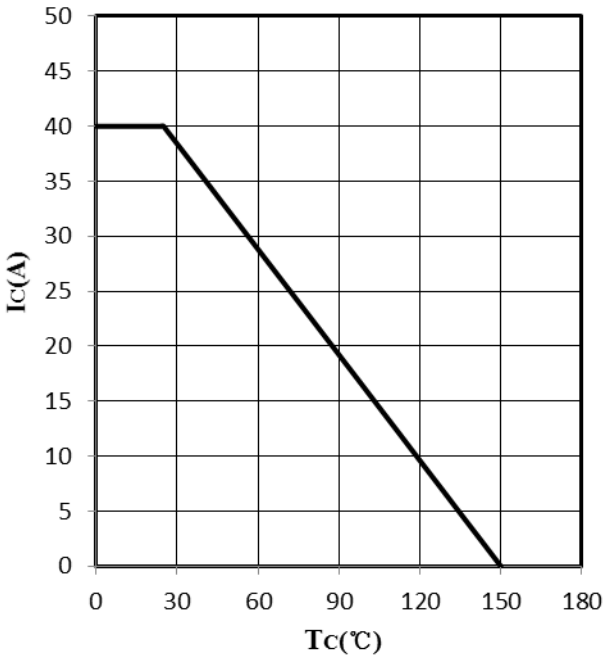


Fig 1. DC Collector current as a function of case temperature (VGE≥15V , Tj≤150℃)

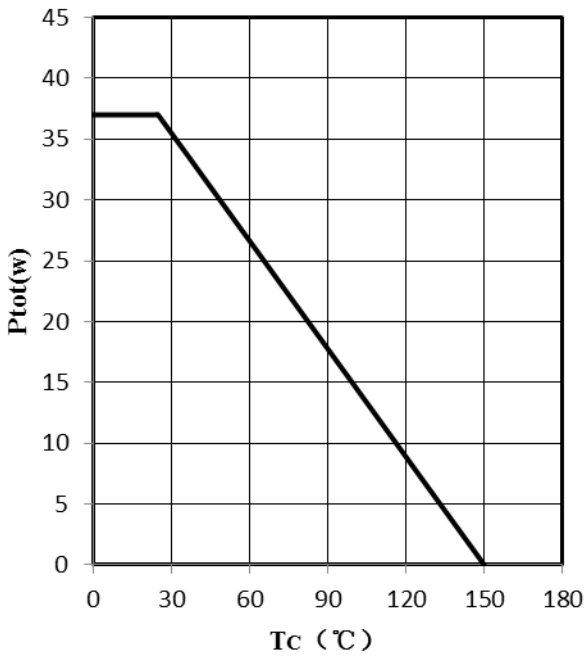


Fig 2. Power dissipation as a function of case temperature (Tj≤150℃)

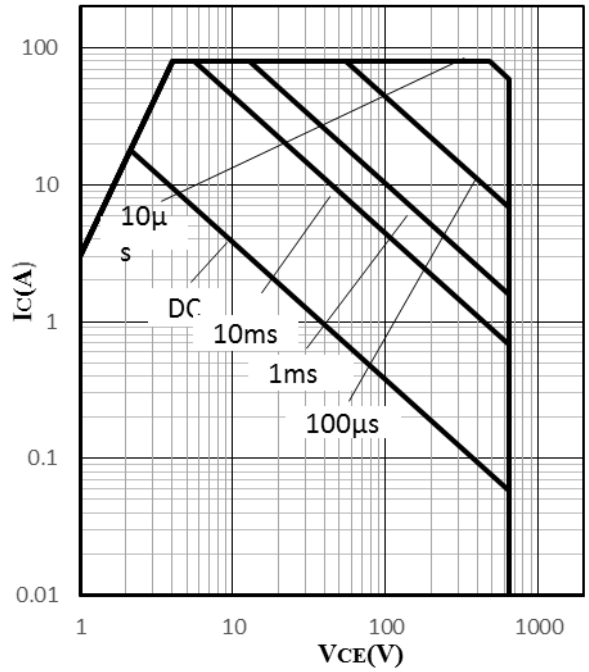


Fig 3. IGBT Forward safe operation area

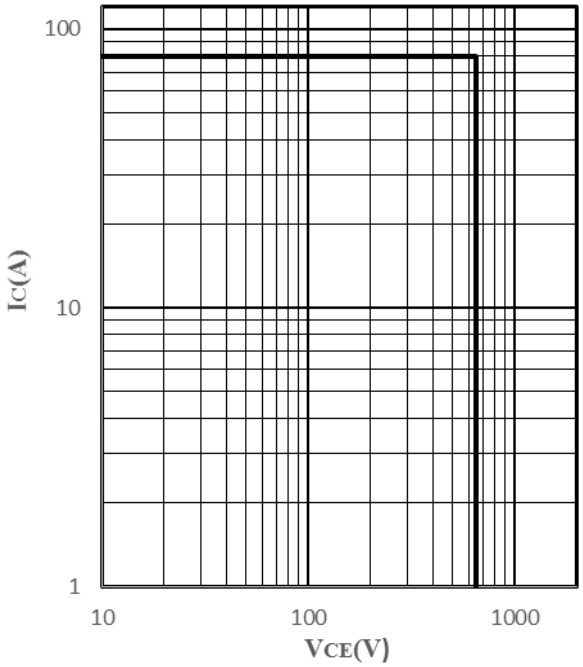


Fig 4. IGBT Reverse safe operation area

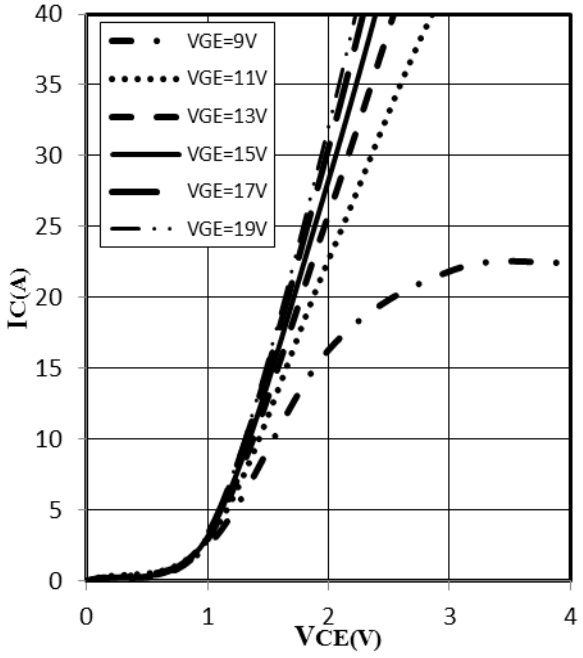


Fig 5. Typical output characteristic （Tj=25℃）

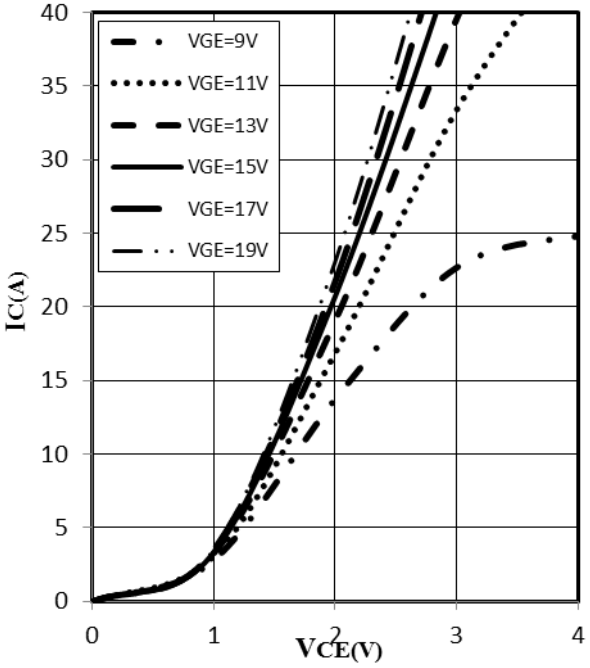


Fig 6. Typical output characteristic （Tj=125℃）

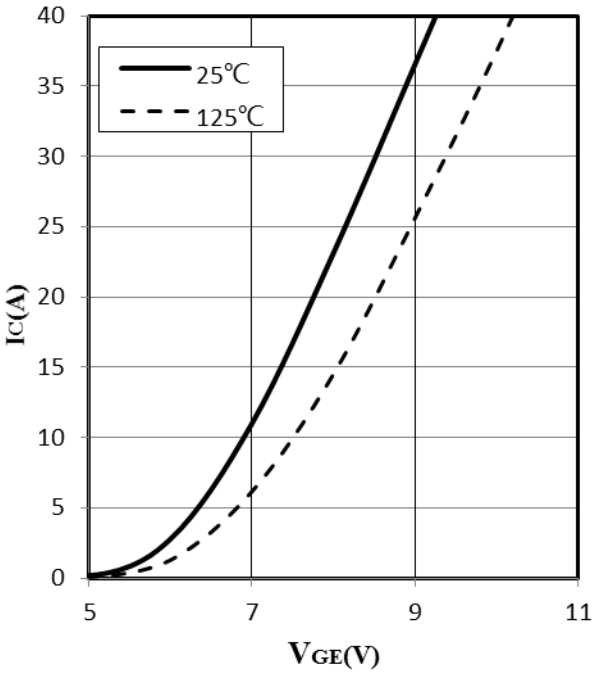


Fig 7. Typical transfer characteristic （V_{CE}=20V）

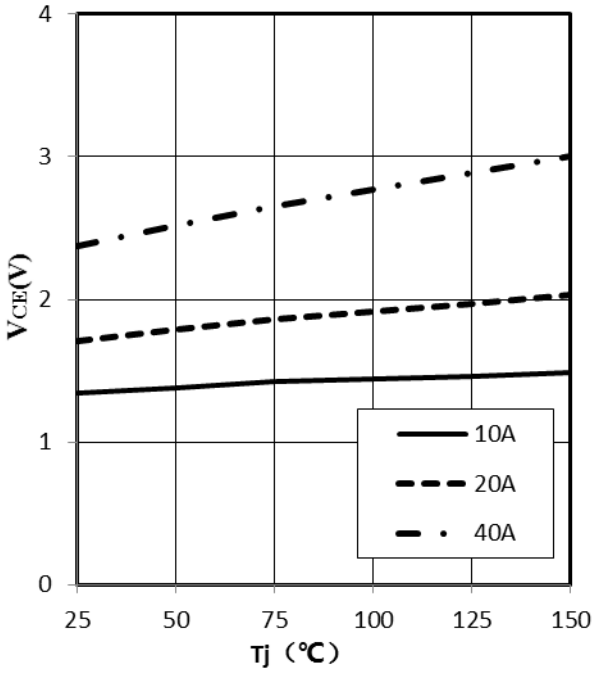


Fig 8. Typical collector-emitter saturation voltage as a function of junction temperature (VGE=15V)

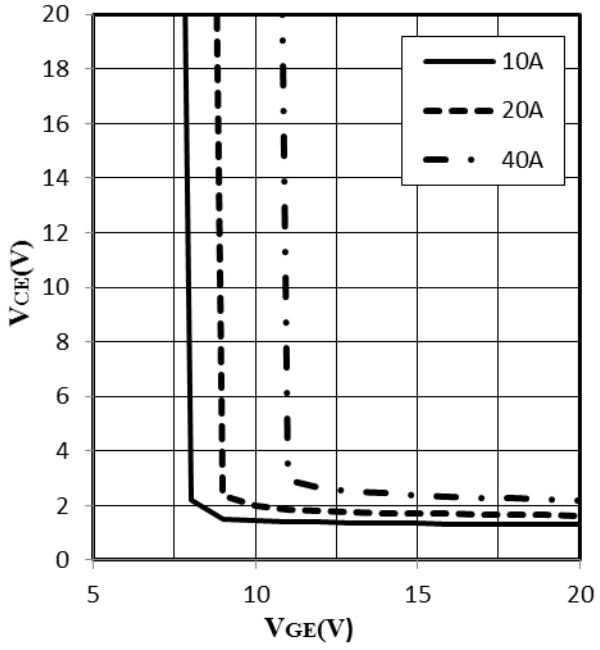


Fig 9. Typical collector-emitter saturation voltage as a function of V_{GE} (Tj=25℃)

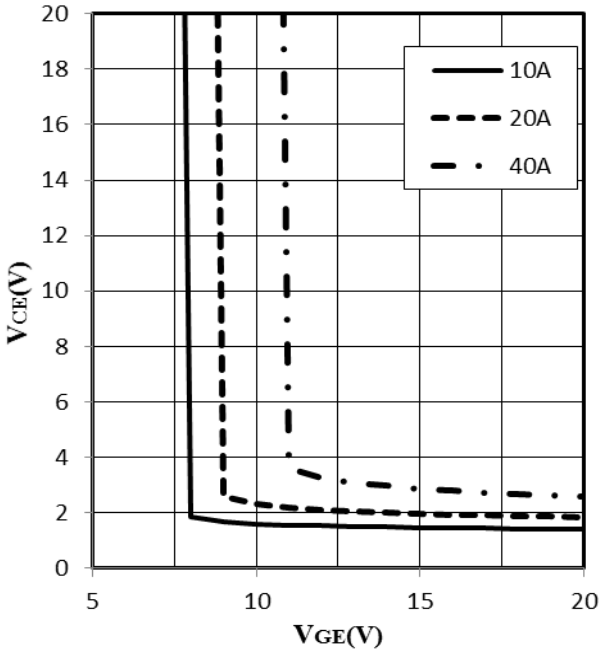


Fig 10. Typical collector-emitter saturation voltage as a function of V_{GE} (Tj=125℃)

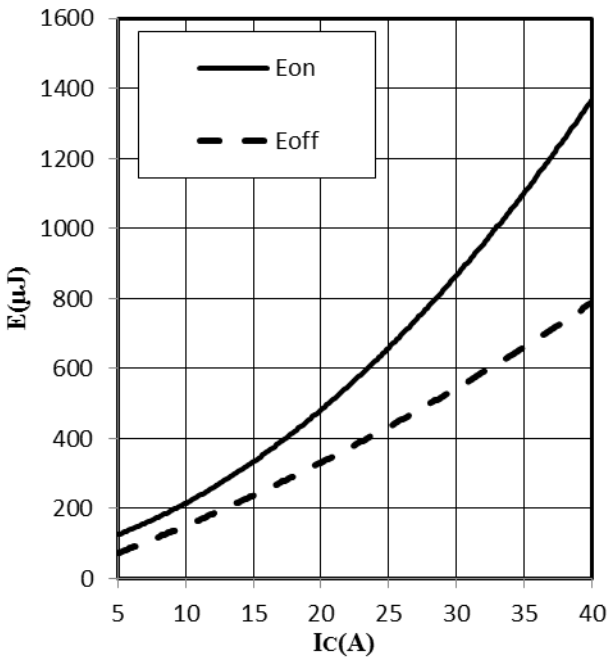


Fig 11. Typical switch energy as a function of Ic

(inductive load，T_j=25℃，V_{CE}=400V,V_{GE}=15V,R_G=10Ω)

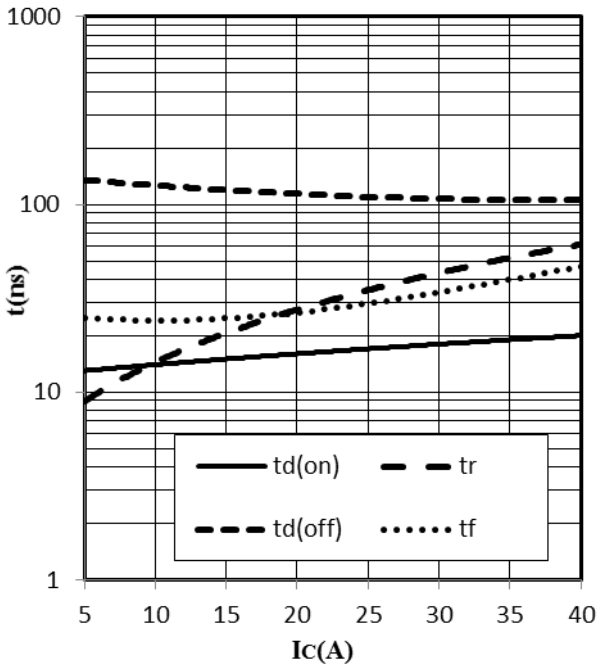


Fig 12. Typical switch time as a function of Ic

(inductive load，T_j=25℃，V_{CE}=400V,V_{GE}=15V,R_G=10Ω)

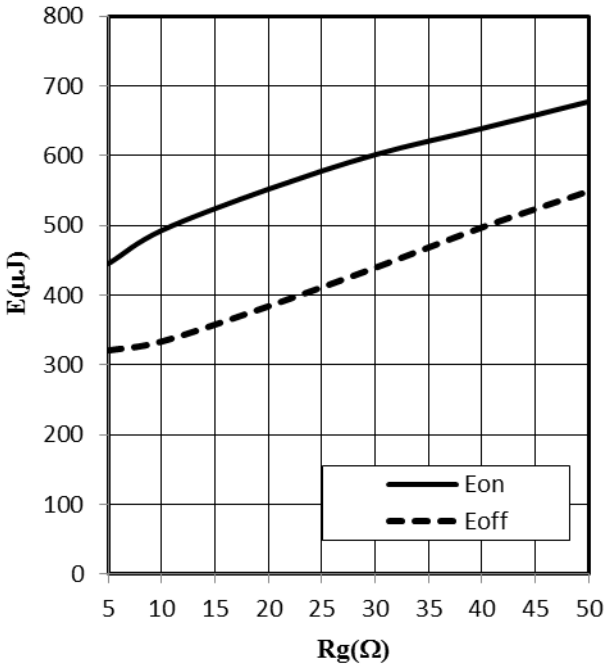


Fig 13. Typical switch energy as a function of R_G
(inductive load，T_j=25℃，V_{CE}=400V,V_{GE}=15V,Ic=20A)

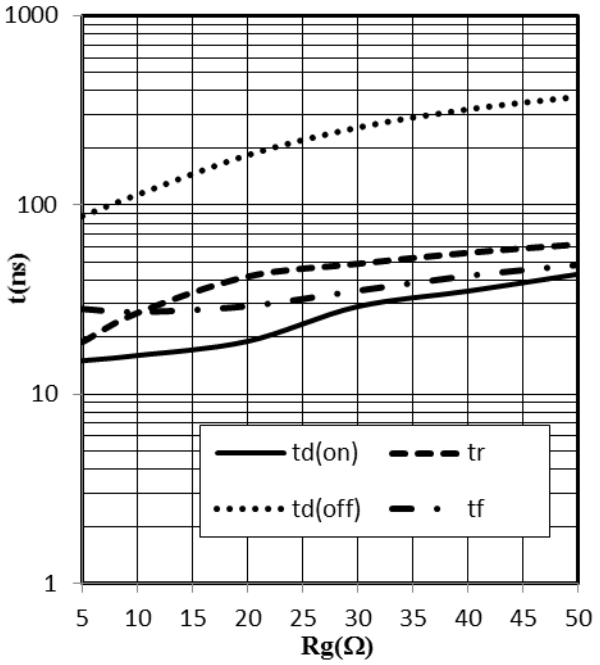


Fig 14. Typical switch time as a function of R_G
(inductive load，T_j=25℃，V_{CE}=400V,V_{GE}=15V,Ic=20A)

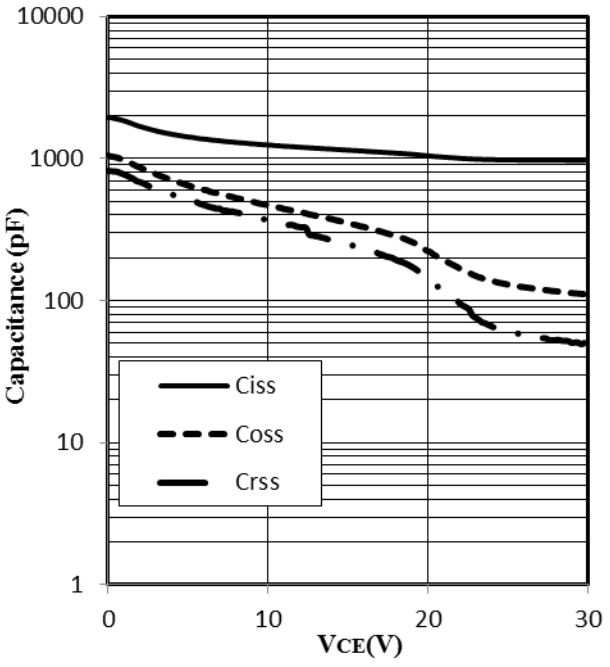


Fig 15. Typical capacitance as a function of collector-emitter voltage (V_{GE}=0V,f=1MHz)

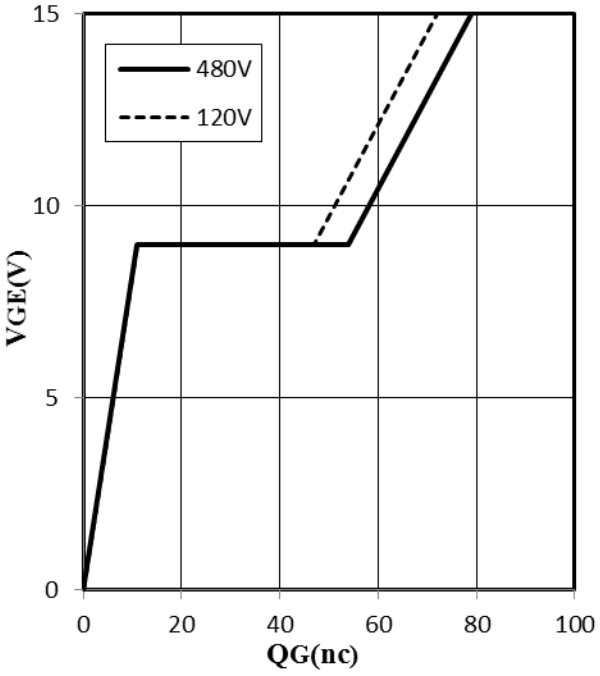


Fig 16. Typical gate charge (I_C=20A)

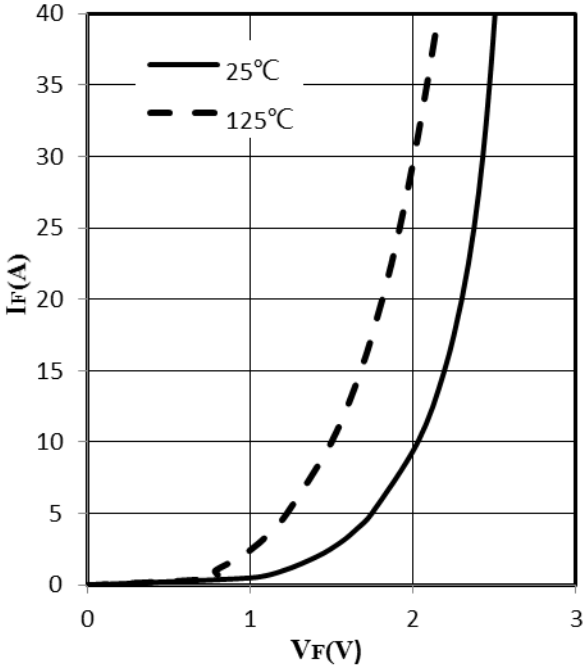


Fig 17. Typical diode forward current as a function of forward voltage

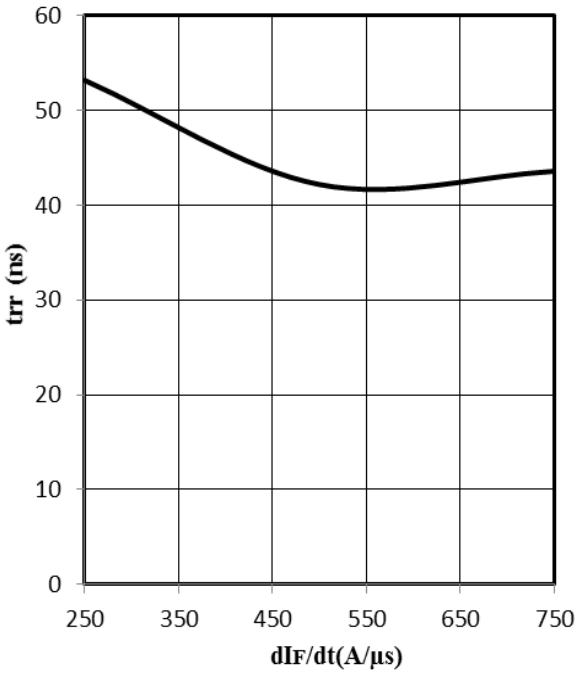


Fig 18. Typical trr as a function of dI_F/dt

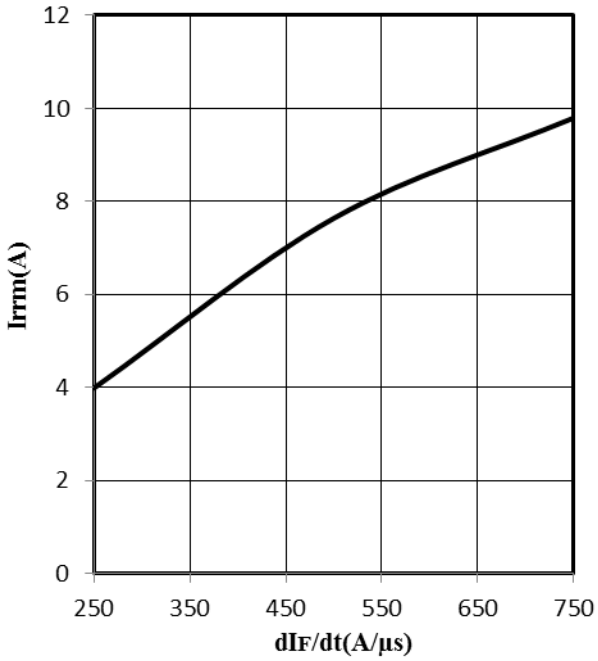


Fig 19. Typical I_{rrm} as a function of dI_F/dt

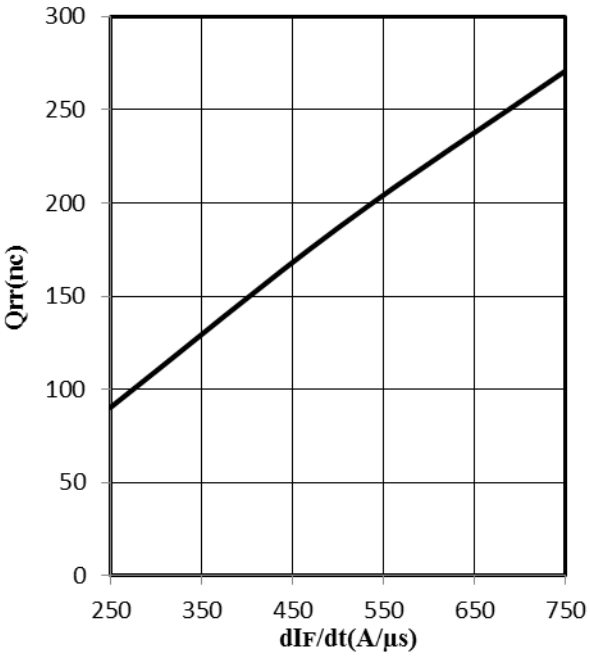


Fig 20. Typical Q_{rr} as a function of dI_F/dt

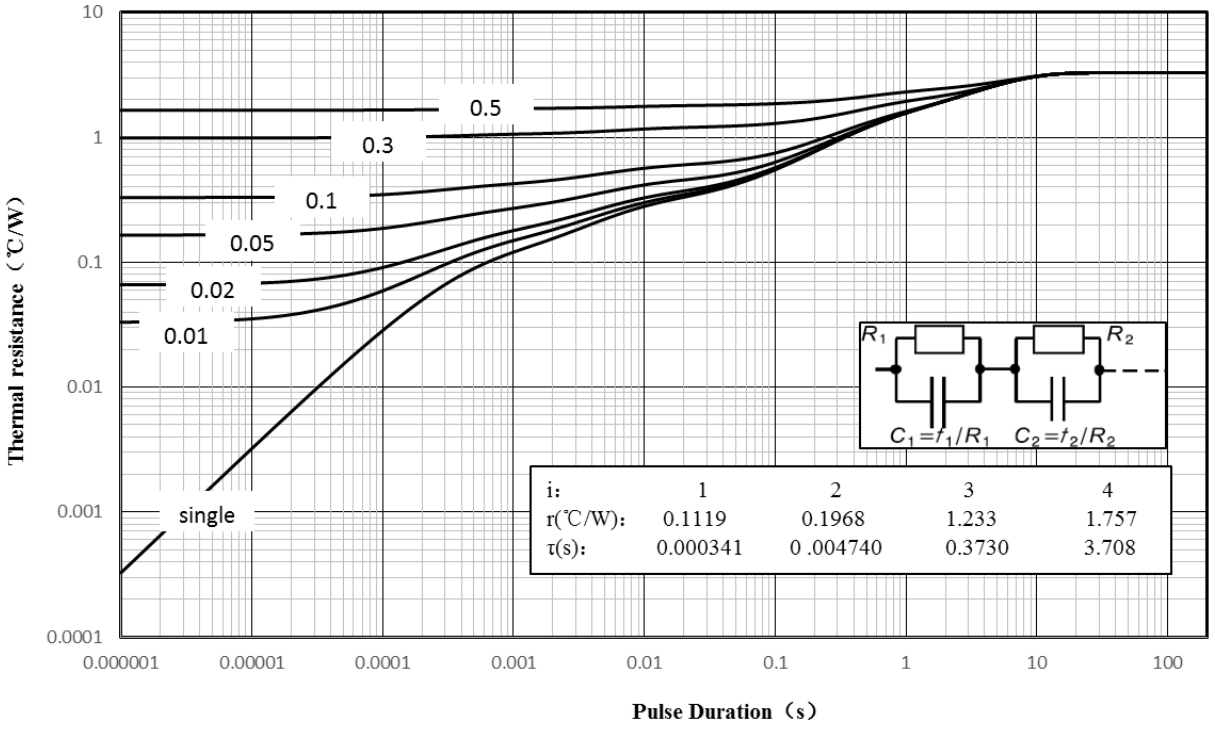


Fig 21. IGBT transient thermal resistance(D=tp/T)