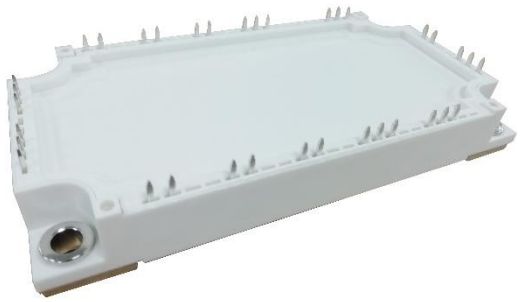
DFI50PM12P4D1

1200V/50A PIM IGBT Module

Description

The DFI50PM12P4D1 offer lower losses and higher energy for application such as motor drive, inverter and other soft switching applications.



Features

- 1200V50A, VCE (sat) (typ.) = 2.10V
- Lower losses and higher energy
- Excellent short circuit ruggedness
- PIM module

Applications

- Inverter
- Power supply
- Motion/servo control

Circuit diagram

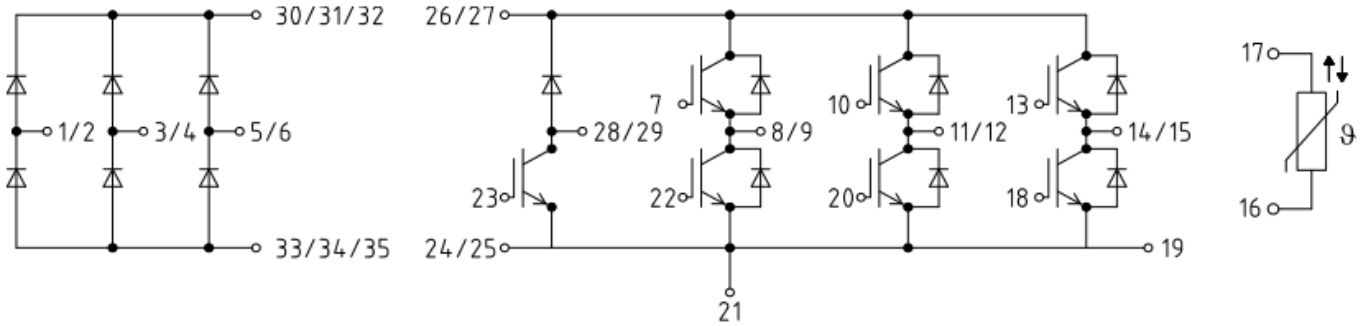


Figure 1. Out drawing & circuit diagram for DFI50PM12P4D1

Pin Configuration and Marking Information

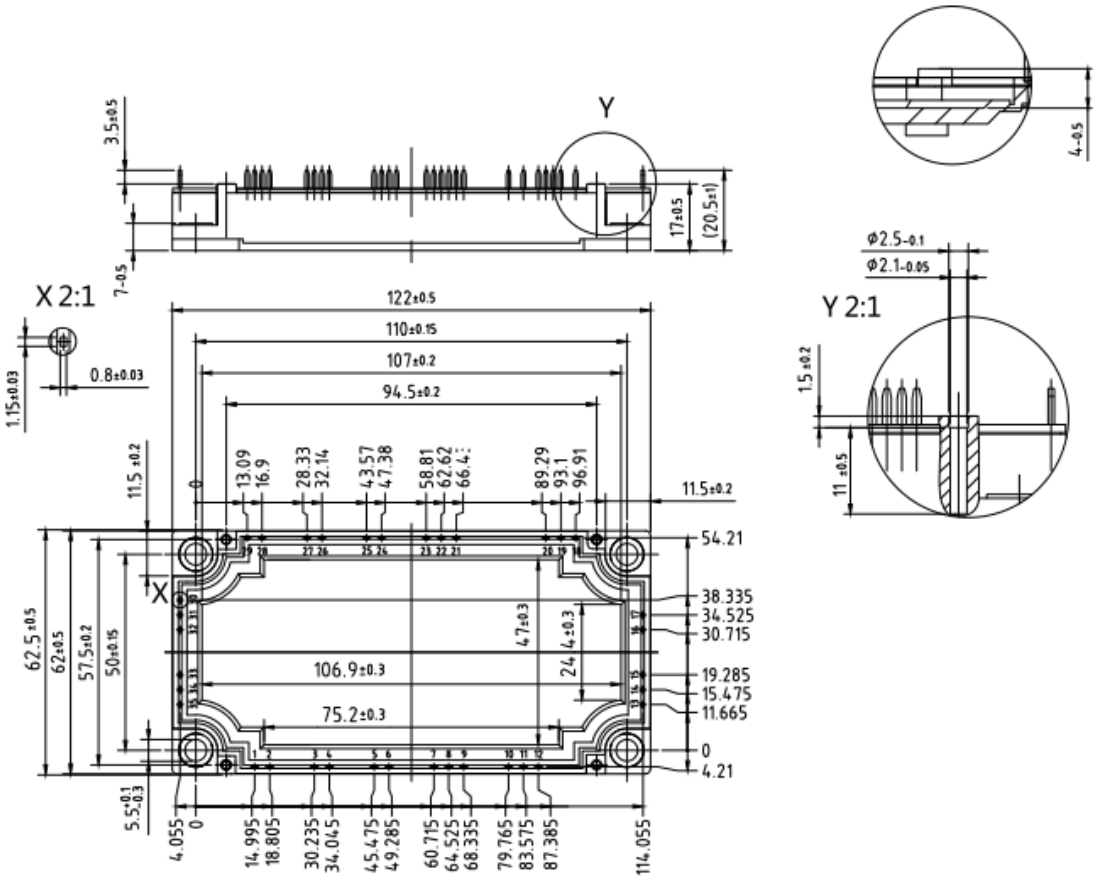


Figure 2. Pin configuration

Module

Parameter	Conditions	Value	Unit
Isolation Voltage	RMS, f =50Hz, t =1min	2.5	KV
Material of module baseplate	-	Cu	-
Creepage distance	terminal to heatsink terminal to terminal	17 3.81	mm
Clearance	terminal to heatsink terminal to terminal	17 3.81	mm
CTI	-	>200	-
Module lead resistance, terminals – chip	T_C =25°C	0.8	mΩ
Mounting torque for module mounting	M5	3 to 6	Nm
Weight	-	300	g

Maximum Ratings (IGBT, T_j=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CES}	Collector-Emitter Voltage	G-E Short	1200	V
V_{RRM}	Peak Repetitive Revers Voltage	-	1200	V
V_{GES}	Gate-Emitter Voltage	C-E Short	±30V	V
I_C	DC Continuous Collector Current	T_C=100°C	50	A
I_{CM}	Pulse Collector Current	t_p=1ms, Note1	100	A
P_C	Maximum Power Dissipation		365	W
T_j	junction temperature	-	-40 to 150	°C
T_{stg}	Storage temperature	-	-40 to 125	°C

Note1: Pulse width limited by maximum junction temperature

Maximum Ratings (Freewheeling diode, T_j=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{RRM}	Peak Repetitive Revers Voltage	-	1200	V
I_F	Diode forward Current	-	50	A
I_{FRM}	Repetitive peak forward Current	t_p=1ms, Note1	100	A
T_j	junction temperature	-	-40 to 150	°C
T_{stg}	Storage temperature	-	-40 to 125	°C

Note1: Pulse width limited by maximum junction temperature

Maximum Ratings (IGBT, Brake-chopper, T_j=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CES}	Collector-Emitter Voltage	G-E Short	1200	V
V_{RRM}	Peak Repetitive Revers Voltage	-	1200	V
V_{GES}	Gate-Emitter Voltage	C-E Short	±30V	V
I_C	DC Continuous Collector Current	T_C=100°C	25	A
I_{CM}	Pulse Collector Current	t_p=1ms, Note1	50	A
P_C	Maximum Power Dissipation		280	W
T_j	junction temperature	-	-40 to 150	°C
T_{stg}	Storage temperature	-	-40 to 125	°C

Note1: Pulse width limited by maximum junction temperature

Maximum Ratings (diode, Brake-chopper, T_j=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{RRM}	Peak Repetitive Revers Voltage	-	1200	V
I_F	Diode forward Current	-	25	A
I_{FRM}	Repetitive peak forward Current	t_p=1ms, Note1	50	A
T_j	junction temperature	-	-40 to 150	°C
T_{stg}	Storage temperature	-	-40 to 125	°C

Note1: Pulse width limited by maximum junction temperature

NTC characteristics

Symbol	Parameter	Condition	Value			Unit
			Min.	Typ.	Max.	
R_{25}	Resistance	T_C =25°C	-	5	-	kΩ
ΔR/R	Deviation of R100	T_C =100°C, R_{100} =493Ω	-5	-	5	%
P_{25}	Power dissipation	T_C =25°C	-	-	50	mW
$B_{25/50}$	B-value	R2 = R25 exp [$B_{25/50}$(1/T2 - 1/(298,15 K))]	-	3375	-	K
$B_{25/80}$	B-value	R2 = R25 exp [$B_{25/80}$(1/T2 - 1/(298,15 K))]	-	3410	-	K
$B_{25/100}$	B-value	R2 = R25 exp [$B_{25/100}$(1/T2 - 1/(298,15 K))]	-	3433	-	K

IGBT Electrical characteristics (T_j =25°C unless otherwise specified, chip)

Symbol	Item	Condition		Value			Unit
				Min.	Typ.	Max	
$V_{CE(sat)}$ (Chip)	Collector-Emitter Saturation Voltage	I_C =50A, V_{GE} =15V	T_j =25°C	-	2.1	2.3	V
			T_j =125°C	-	2.5	-	V
$V_{GE(th)}$	Gate-Emitter threshold Voltage	I_C =1mA, V_{CE} =V_{GE}		4.5	-	5.7	V
Q_G	Gate charge	V_{GE} =-15V to +15V		-	430	-	nC
R_{Gint}	Internal gate resistor	f=1M, Vpp=1V	T_j =25°C	-	2.2	-	Ω
C_{ies}	Input Capacitance	V_{CE} =25V, V_{GE} =0V, f =1MHz	T_j =25°C	-	3.8	-	nF
C_{oes}	Output Capacitance				0.51		nF
C_{res}	Reverse transfer Capacitance			-	0.33	-	nF
I_{CES}	Collector- Emitter Cut off Current	V_{CE} =1200V, V_{GE} =0V	T_j =25°C	-	-	1	mA
I_{GES}	Gate-Emitter Leakage Current	V_{GE} =30V, V_{CE} =0V	T_j =25°C	-	-	100	nA
$t_{d(on)}$	Turn-on delay time	V_{CC} =600V, I_C = 50A, V_{GE} =+15V/-15V, R_G =10Ω, Inductive load	T_j =25°C	-	20	-	ns
t_r	Rise time		T_j =25°C	-	35	-	ns
$t_{d(off)}$	Turn-off delay time		T_j =25°C	-	250	-	ns
t_f	Fall time		T_j =25°C	-	330	-	ns
E_{on}	Turn-on power dissipation		T_j =25°C	-	3.9	-	mJ
E_{off}	Turn-off power dissipation		T_j =25°C	-	2.2	-	mJ
$R_{th(j-c)}$	Thermal Resistance, Junction to Case (IGBT)			-	-	0.343	°C/W

Freewheeling Diode Electrical characteristics (T_j=25°C unless otherwise specified, chip)

Symbol	Item	Condition		Value			Unit
				Min.	Typ.	Max	
V_F	Diode Forward Voltage	I_F=50A, V_{GE}=0V	T_j=25°C	-	1.90	2.20	V
			T_j=125°C	-	1.90	-	
t_{rr}	Reverse recovery time	(Switch side) V_{rr}=600V, I_F=50A di/dt=890A/μs	T_j=25°C	-	110	-	ns
I_{rr}	Peak reverse recovery Current		T_j=25°C	-	55	-	A
Q_{rr}	Recovered charge		T_j=25°C	-	3.00	-	uC
E_{rr}	Reverse recovered energy		T_j=25°C	-	0.80	-	mJ
$R_{th(j-c)}$	Thermal Resistance, Junction to Case (Diode)			-		0.652	°C/W

IGBT, Brake-chopper Electrical characteristics (T_j=25°C unless otherwise specified, chip)

Symbol	Item	Condition		Value			Unit
				Min.	Typ.	Max	
$V_{CE(sat)}$ (Chip)	Collector-Emitter Saturation Voltage	I_C=25A V_{GE}=15V	T_j=25°C	-	2.1	2.3	V
			T_j=125°C	-	2.5	-	V
$V_{GE(th)}$	Gate-Emitter threshold Voltage	I_C=1mA, V_{CE}=V_{GE}		4.5	-	5.7	V
Q_G	Gate charge	V_{GE}=-15V to +15V		-	140	-	nC
R_{Gint}	Internal gate resistor	f=1M, Vpp=1V	T_j=25°C	-	8.0	-	Ω
C_{ies}	Input Capacitance	V_{CE}=25V, V_{GE}=0V f=1MHz	T_j=25°C	-	1.08	-	nF
C_{oes}	Output Capacitance			-	0.17	-	nF
C_{res}	Reverse transfer Capacitance			-	0.12	-	nF
I_{CES}	Collector- Emitter Cut off Current	V_{CE}=1200V, V_{GE}=0V	T_j=25°C	-	-	1	mA
I_{GES}	Gate-Emitter Leakage Current	V_{GE}=30V, V_{CE}=0V	T_j=25°C	-	-	100	nA
$t_{d(on)}$	Turn-on delay time	V_{CC}=600V I_C=25A V_{GE}=+15V/-15V R_G=13Ω Inductive load	T_j=25°C	-	20	-	ns
t_r	Rise time		T_j=25°C	-	40	-	ns
$t_{d(off)}$	Turn-off delay time		T_j=25°C	-	280	-	ns
t_f	Fall time		T_j=25°C	-	210	-	ns
E_{on}	Turn-on power dissipation		T_j=25°C	-	1.8	-	mJ
E_{off}	Turn-off power dissipation		T_j=25°C	-	1.7	-	mJ
$R_{th(j-c)}$	Thermal Resistance, Junction to Case (IGBT)			-	-	0.45	°C/W

Diode, Brake-chopper **Electrical characteristics** (T_j=25°C unless otherwise specified, chip)

Symbol	Item	Condition		Value			Unit
				Min.	Typ.	Max	
V_F	Diode Forward Voltage	I_F =25A, V_{GE} =0V	T_j =25°C	-	1.90	2.2	V
			T_j =125°C	-	1.9	-	
t_{rr}	Reverse recovery time	(Switch side) V_{rr} =600V, I_F =25A di/dt=1200A/μs	T_j =25°C	-	120	-	ns
I_{rr}	Peak reverse recovery Current		T_j =25°C	-	17	-	A
Q_{rr}	Recovered charge		T_j=25°C	-	1.3	-	uC
E_{rr}	Reverse recovered energy		T_j =25°C	-	0.4	-	mJ
$R_{th(j-c)}$	Thermal Resistance, Junction to Case (Diode)			-		1.31	°C/W

Maximum Ratings (Rectifier diode, T_j =25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{RRM}	Peak Repetitive Revers Voltage	T_J = 25°C	1800	V
I_{FRMSM}	Maximum RMS forward current per chip	T_C =80°C	50	A
I_{RMSM}	Maximum RMS current at rectifier output	T_C =80°C	100	A
I_{FSM}	Surge Current @t_p=10 ms	T_J =25°C	420	A
I^2t	I²t - value	T_J =25°C	880	A^2s
T_j	junction temperature	-	-40 to 150	°C
T_{stg}	Storage temperature	-	-40 to 125	°C

Note1: Pulse width limited by maximum junction temperature

Rectifier Diode Electrical characteristics (T_j =25°C unless otherwise specified, chip)

Symbol	Item	Condition		Value			Unit
				Min.	Typ.	Max	
V_F	Diode Forward Voltage	I_F = 50A	T_J = 25°C		1.05		V
			T_J = 125°C		0.85		
I_R	Reverse current		T_J = 125°C		1.0		mA
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case (Diode)					0.85	°C/W

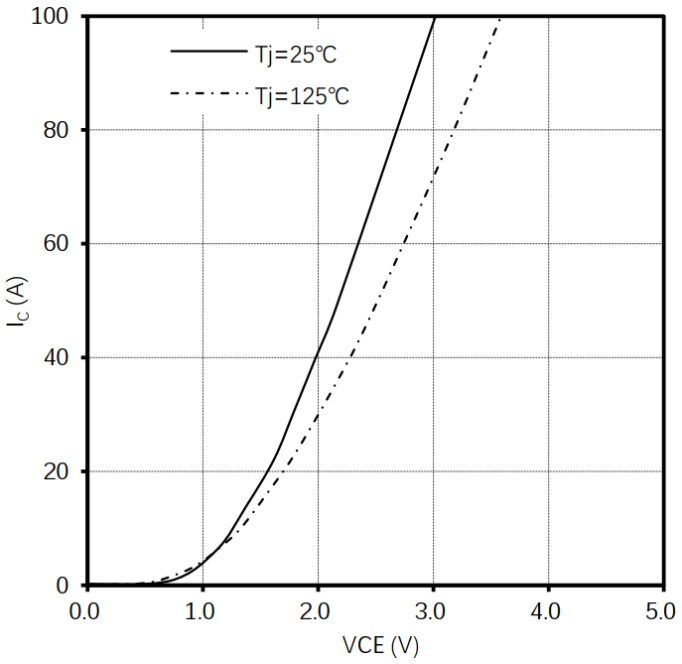


Fig 1. output characteristic IGBT，

$I_C=f(V_{CE})$, VGE=15V

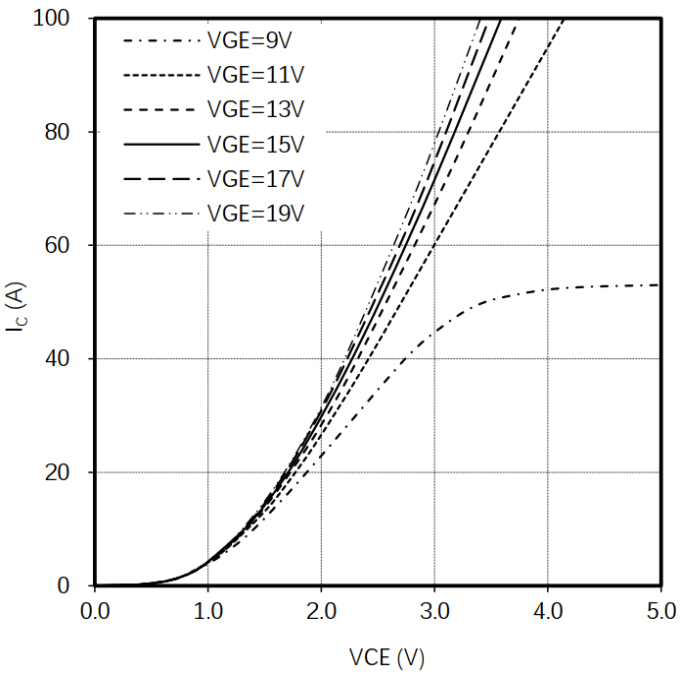


Fig 2. output characteristic IGBT，

$I_C=f(V_{CE})$,T_j=125℃

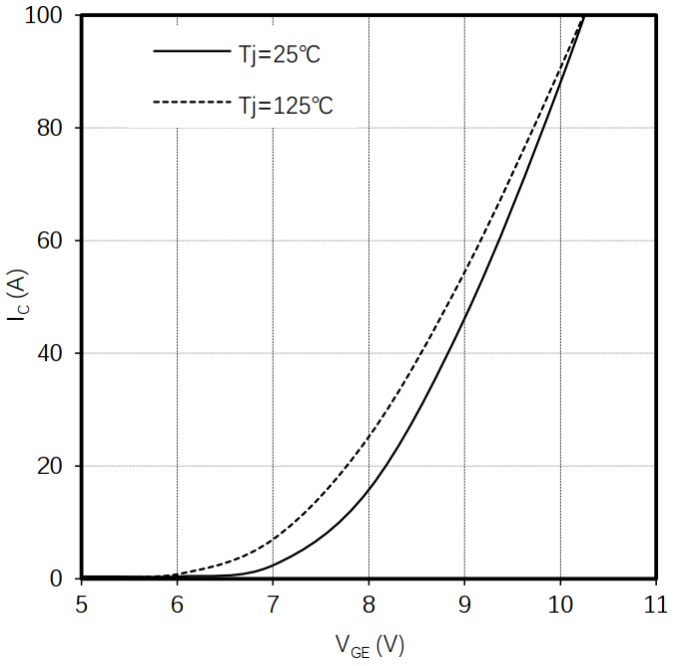


Fig 3. transfer characteristic IGBT，

$I_C=f(V_{GE})$, V_{CE}=20V

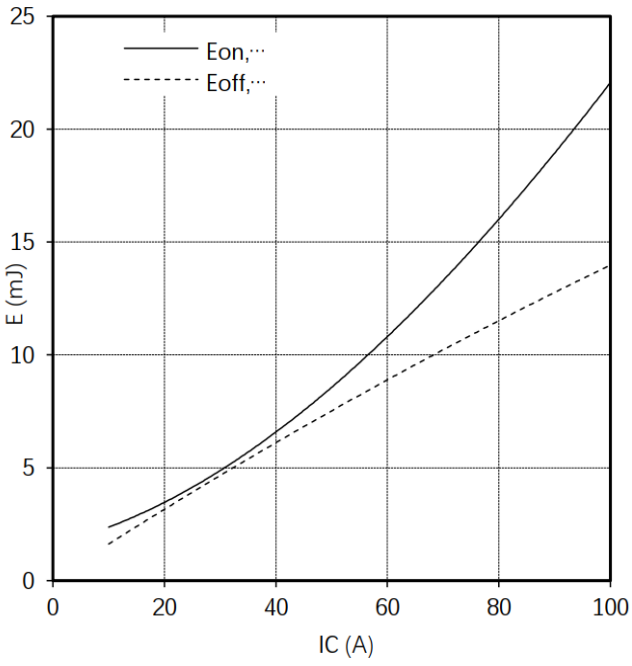


Fig 4. switching losses IGBT,

$E_{on}=f(Ic)$, $E_{off}=f(I_c)$,

VGE=±15V,RGon=18Ω,RGoff=18Ω,VCE=600V

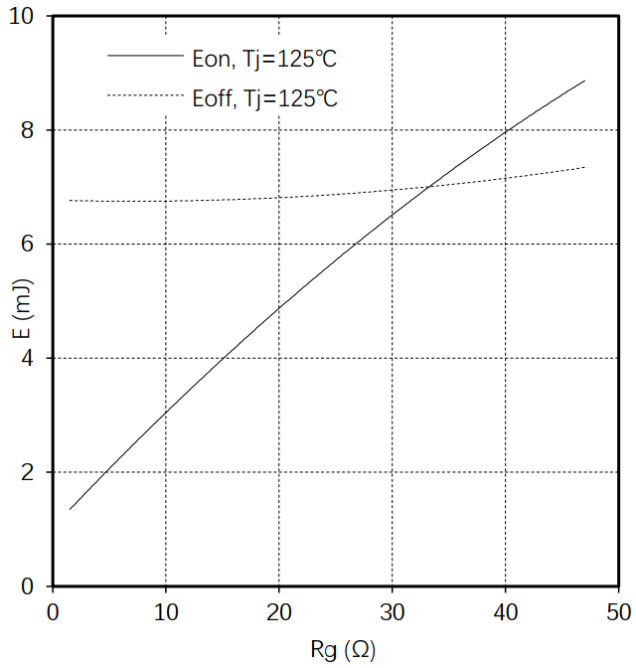


Fig 5. switching losses IGBT, $E_{on}=f(R_G)$,$E_{off}=f(R_G)$, $V_{GE}=\pm15V$,$I_C=50A$,$V_{CE}=600V$

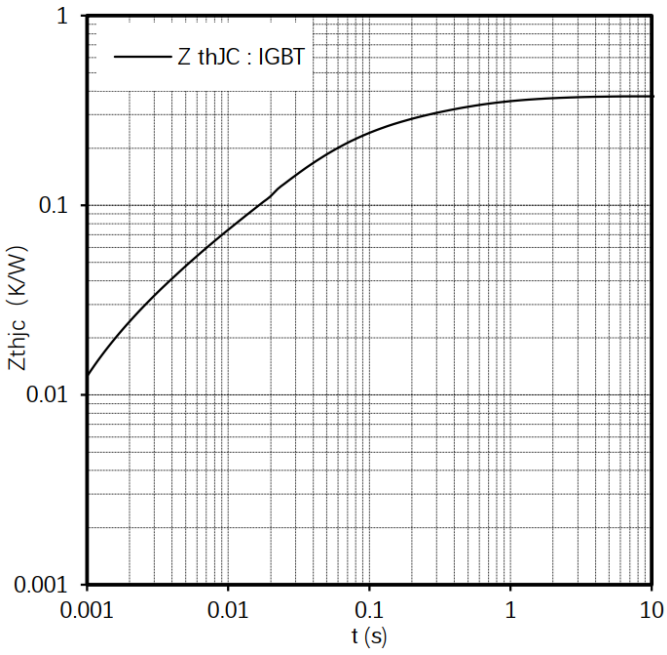


Fig 6. transient thermal impedance IGBT , Zthjc=f(t)

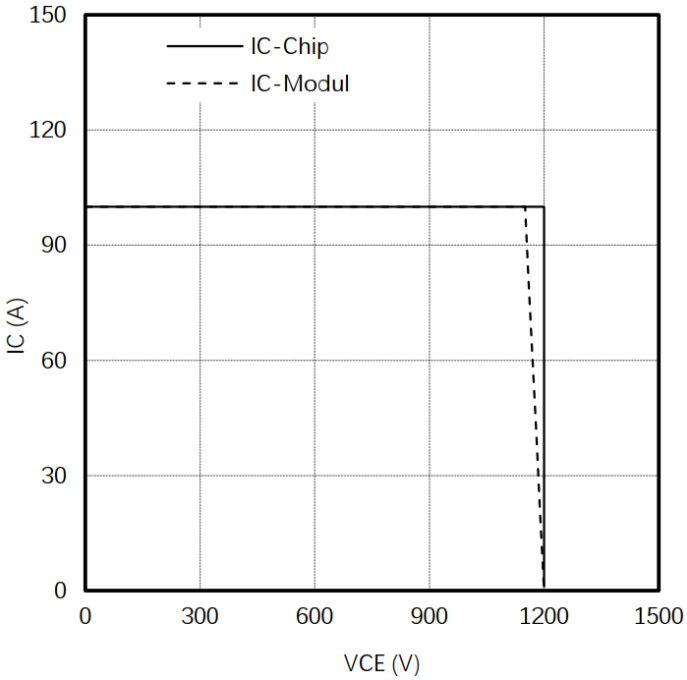


Fig 7. reverse bias safe operating area IGBT, $I_C=f(V_{CE})$,$V_{GE}=\pm15V$,$R_{Goff}=18\Omega$，Tvj=125℃

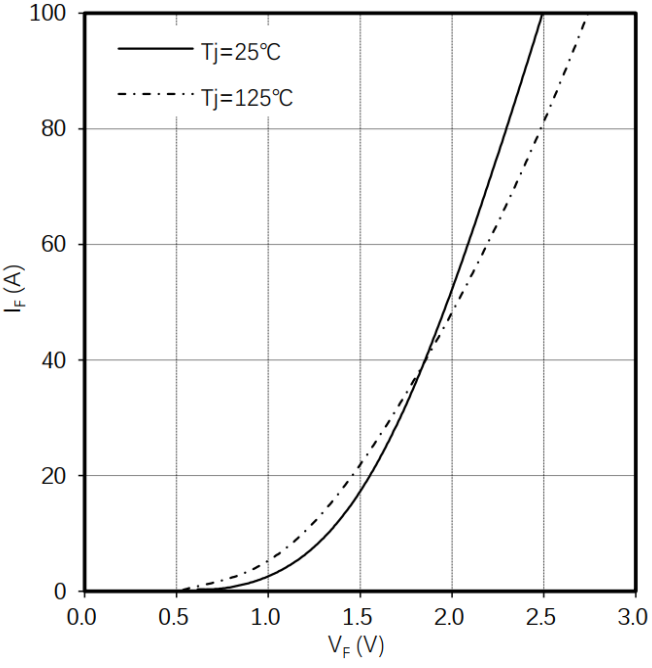


Fig 8. forward characteristic of Diode ， $I_F=f(V_F)$

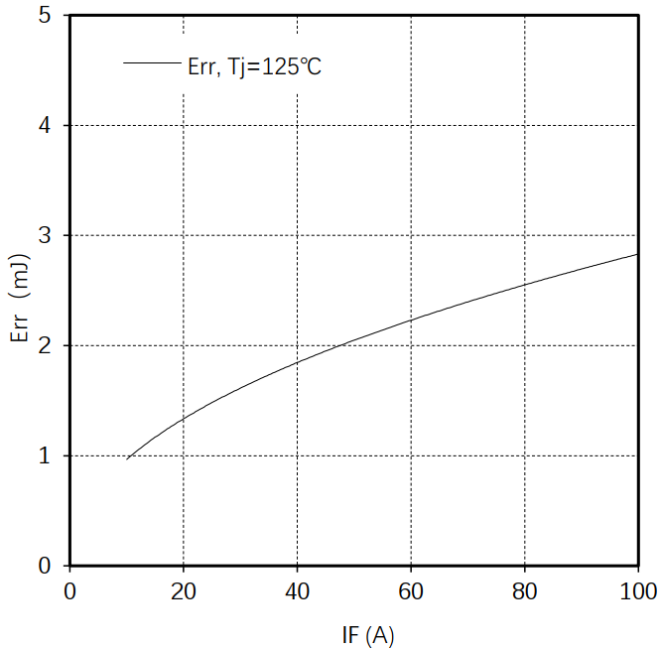


Fig9. switching losses Diode,
$E_{rr}=f(I_F)$,,$R_{Gon}=18\Omega$,$V_{CE}=600V$

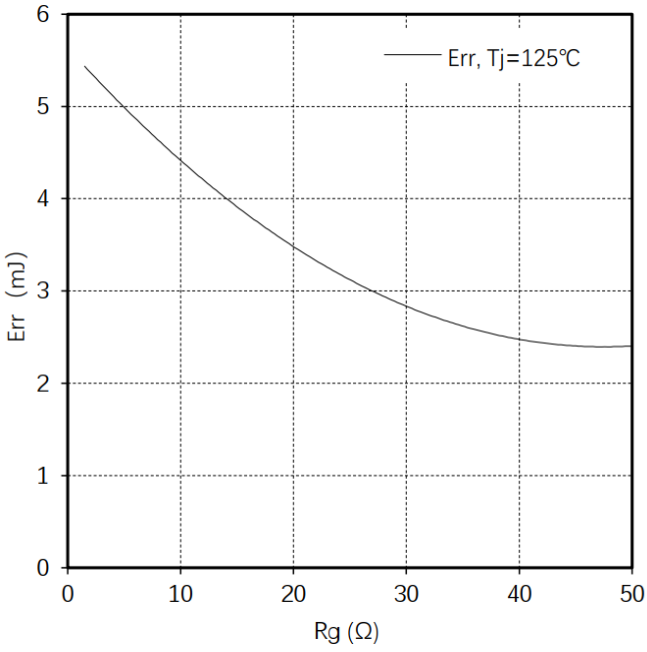


Fig 10. switching losses Diode,
$E_{rr}=f(R_G)$,$I_F=50A$,$V_{CE}=600V$

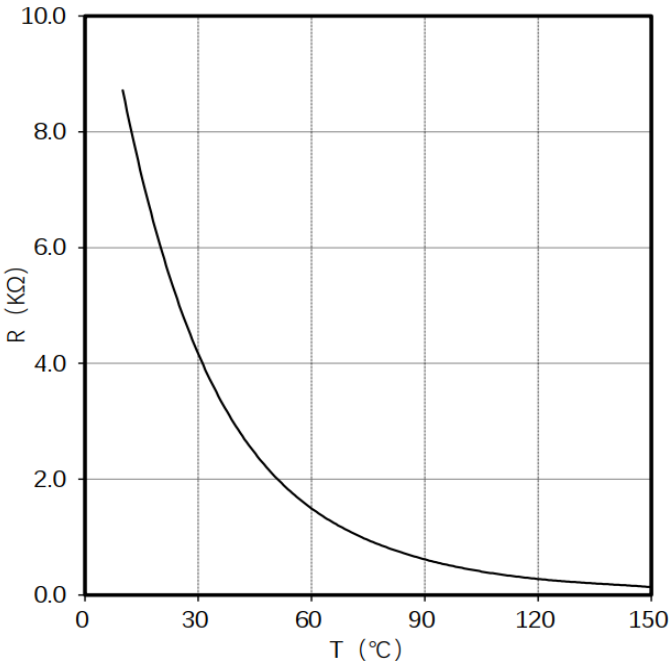


Fig11.NTC-Thermistor-temperature characteristic(typical)

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