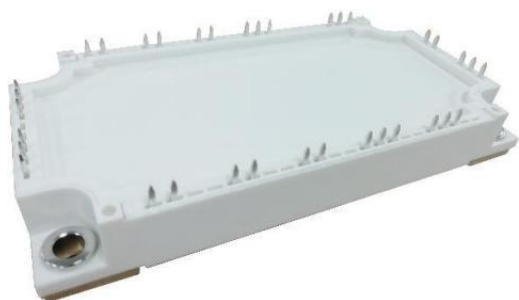


Description

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



Features

- 1200V/50A, $V_{CE(sat)}$ (typ.) = 2.10V
- Lower losses and higher energy
- Excellent short circuit ruggedness
- PIM module

Applications

- Inverter
- Power supply
- Motion/servo control

Circuit diagram

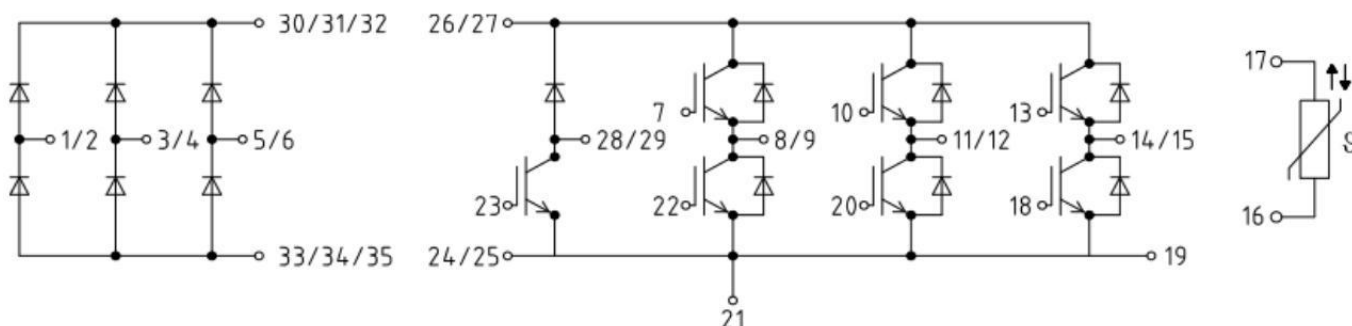


Figure 1. Out drawing & circuit diagram for DFI50PM12P4D1

Pin Configuration and Marking Information

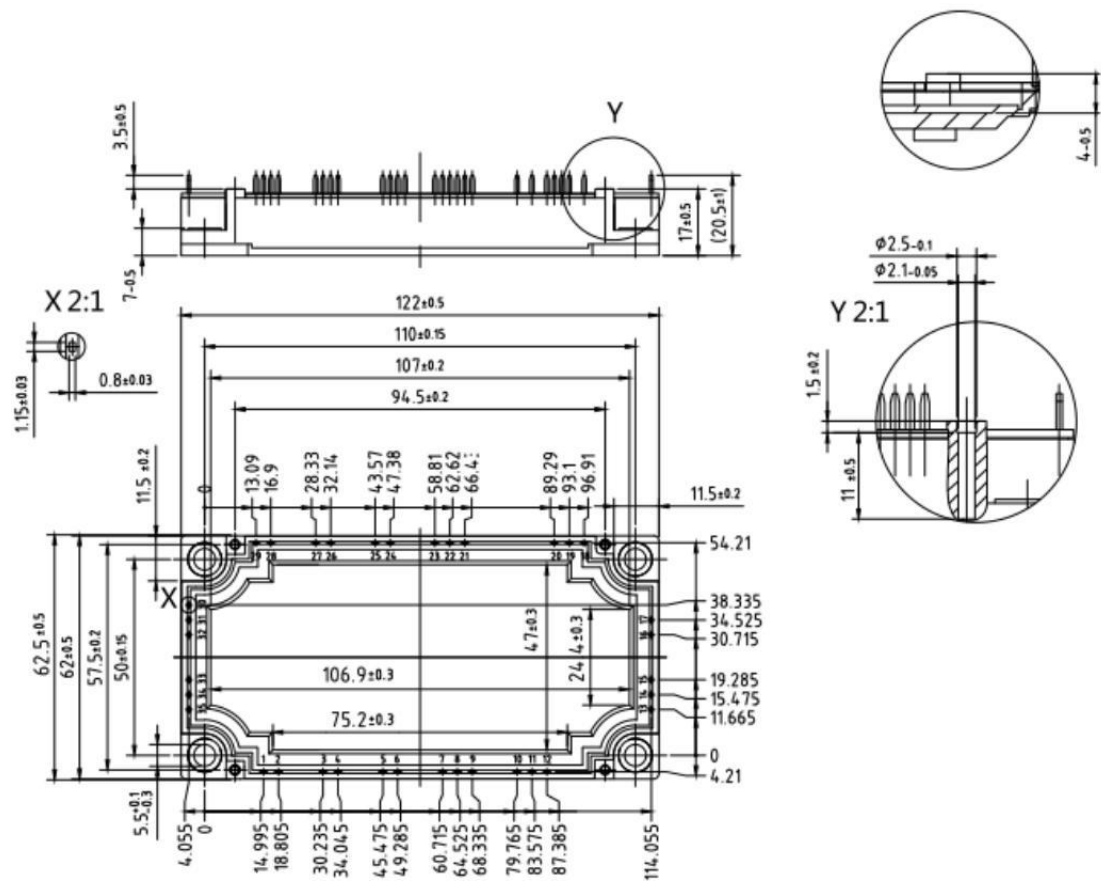


Figure 2. Pin configuration

Module

Parameter	Conditions	Value	Unit
Isolation Voltage	RMS, f=50Hz, t =1 min	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, $T_j=25^{\circ}\text{C}$ 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	$\pm 30\text{V}$	V
I_C	DC Continuous Collector Current	$T_C=100^{\circ}\text{C}$	50	A
I_{CM}	Pulse Collector Current	$t_p=1\text{ms}$, Note1	100	A
P_C	Maximum Power Dissipation		365	W
T_j	junction temperature	-	-40 to 150	$^{\circ}\text{C}$
T_{stg}	Storage temperature	-	-40 to 125	$^{\circ}\text{C}$

Note1: Pulse width limited by maximum junction temperature

Maximum Ratings (Freewheeling diode, $T_j=25^{\circ}\text{C}$ 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	$t_p=1\text{ms}$, Note1	100	A
T_j	junction temperature	-	-40 to 150	$^{\circ}\text{C}$
T_{stg}	Storage temperature	-	-40 to 125	$^{\circ}\text{C}$

Note1: Pulse width limited by maximum junction temperature

Maximum Ratings (IGBT, Brake-chopper, $T_j=25^{\circ}\text{C}$ 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	$\pm 30\text{V}$	V
I_C	DC Continuous Collector Current	$T_C=100^{\circ}\text{C}$	25	A
I_{CM}	Pulse Collector Current	$t_p=1\text{ms}$, 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

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NTC characteristics

Symbol	Parameter	Condition	Value			Unit
			Min.	Typ.	Max.	
R ₂₅	Resistance	T _C =25°C	-	5	-	kΩ
ΔR/R	Deviation of R ₁₀₀	T _C =100°C, R ₁₀₀ =493Ω	-5	-	5	%
P ₂₅	Power dissipation	T _C =25°C	-	-	50	mW
B _{25/50}	B-value	$R_2 = R_{25} \exp [B_{25/50}(1/T_2 - 1/(298,15 \text{ K}))]$	-	3375	-	K
B _{25/80}	B-value	$R_2 = R_{25} \exp [B_{25/80}(1/T_2 - 1/(298,15 \text{ K}))]$	-	3410	-	K
B _{25/100}	B-value	$R_2 = R_{25} \exp [B_{25/100}(1/T_2 - 1/(298,15 \text{ K}))]$	-	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, V _{pp} =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	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	V _{GE} =+15V/-15V R _G =10Ω Inductive load	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 ($T_j=25^{\circ}\text{C}$ 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 ($T_j=25^{\circ}\text{C}$ unless otherwise specified, chip)

Symbol	Item	Condition		Value			Unit
				Min.	Typ.	Max	
$V_{CE(sat)}$ (Chip)	Collector-Emitter Saturation Voltage	$I_C=25\text{A}$ $V_{GE}=15\text{V}$	$T_j=25^{\circ}\text{C}$	-	2.1	2.3	V
			$T_j=125^{\circ}\text{C}$	-	2.5	-	V
$V_{GE(th)}$	Gate-Emitter threshold Voltage	$I_C=1\text{mA}$, $V_{CE}=V_{GE}$		4.5	-	5.7	V
Q_G	Gate charge	$V_{GE}=-15\text{V}$ to $+15\text{V}$		-	140	-	nC
R_{Gint}	Internal gate resistor	$f=1\text{M}$, $V_{pp}=1\text{V}$	$T_j=25^{\circ}\text{C}$	-	8.0	-	Ω
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}$, $V_{GE}=0\text{V}$ $f=1\text{MHz}$	$T_j=25^{\circ}\text{C}$	-	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	$V_{CE}=1200\text{V}$, $V_{GE}=0\text{V}$	$T_j=25^{\circ}\text{C}$	-	-	1	mA
I_{GES}	Gate-Emitter Leakage Current	$V_{GE}=30\text{V}$, $V_{CE}=0\text{V}$	$T_j=25^{\circ}\text{C}$	-	-	100	nA
$t_{d(on)}$	Turn-on delay time	$V_{CC}=600\text{V}$ $I_C=25\text{A}$	$T_j=25^{\circ}\text{C}$	-	20	-	ns
t_r	Rise time		$T_j=25^{\circ}\text{C}$	-	40	-	ns
$t_{d(off)}$	Turn-off delay time		$T_j=25^{\circ}\text{C}$	-	280	-	ns

t _f	Fall time	V _{GE} =+15V/-15V R _G =13Ω Inductive load	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

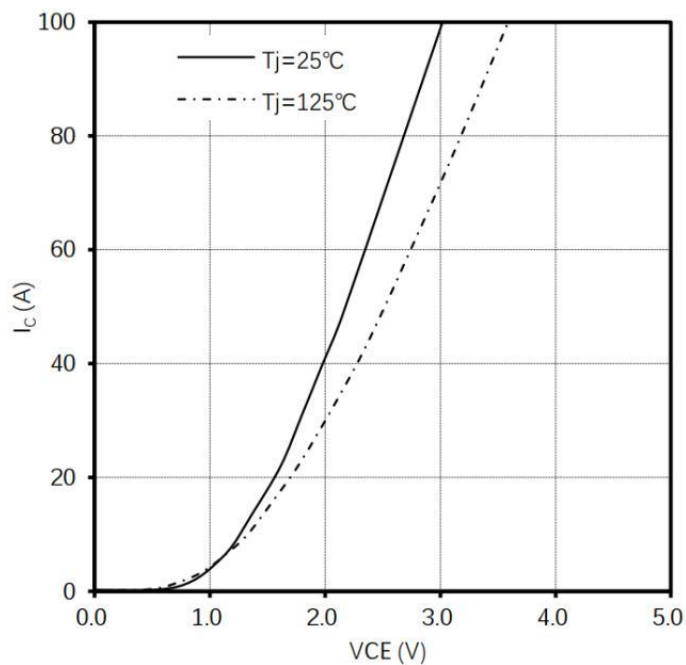
Maximum Ratings (Rectifier diode, T_j=25°C unless otherwise specified)

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 ² t	I ² t - value	T _j =25°C	880	A ² s
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 _{θJC}	Thermal Resistance, Junction-to-Case (Diode)				0.85	°C/W	



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

Fig 1. output characteristic IGBT,

$$I_c = f(V_{CE}), V_{GE} = 15V$$

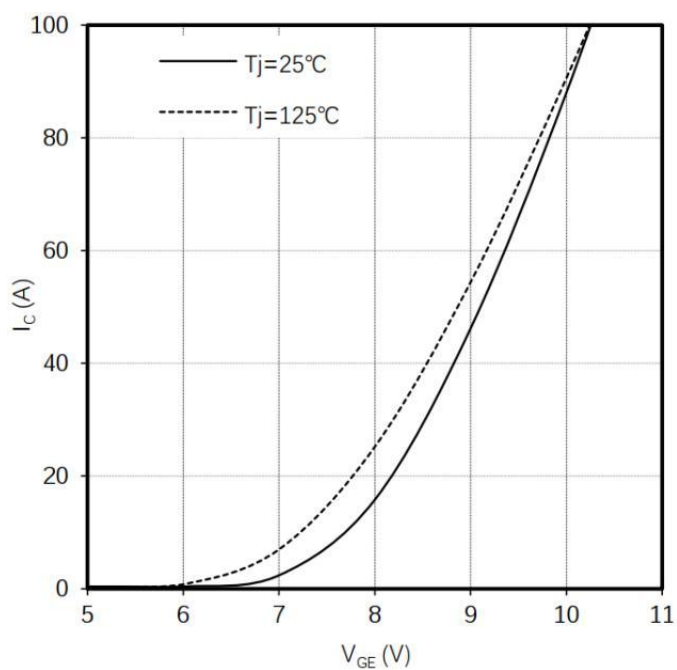


Fig 3. transfer characteristic IGBT,

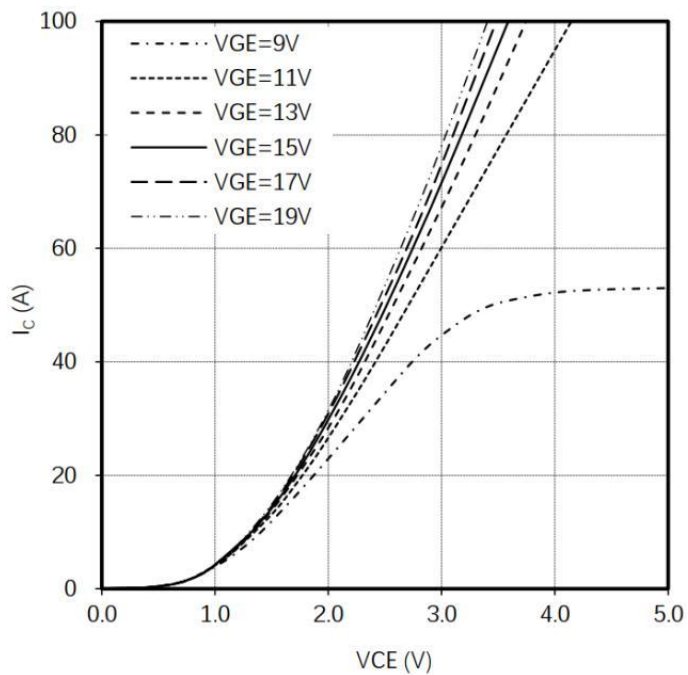


Fig 2. output characteristic IGBT,

$$I_c = f(V_{ce}), T_j = 125^\circ\text{C}$$

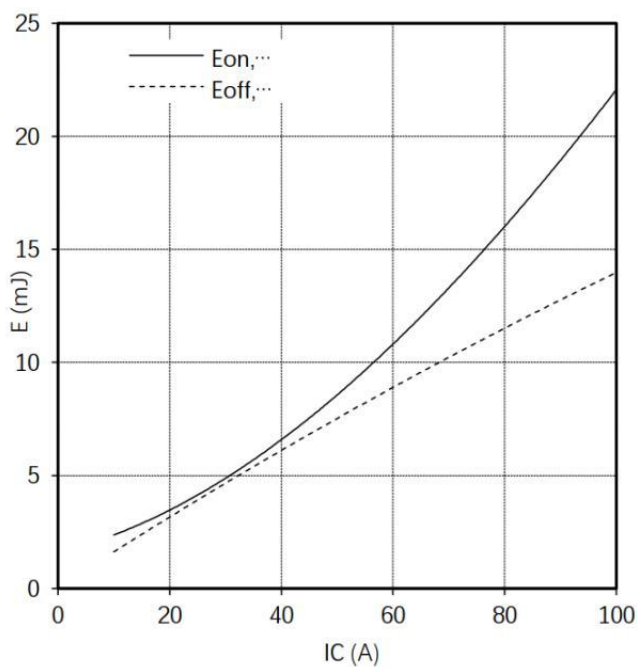


Fig 4. switching losses IGBT,

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

$$V_{ge} = \pm 15V, R_{Gon} = 18\Omega, R_{Goff} = 18\Omega, V_{ce} = 600V$$

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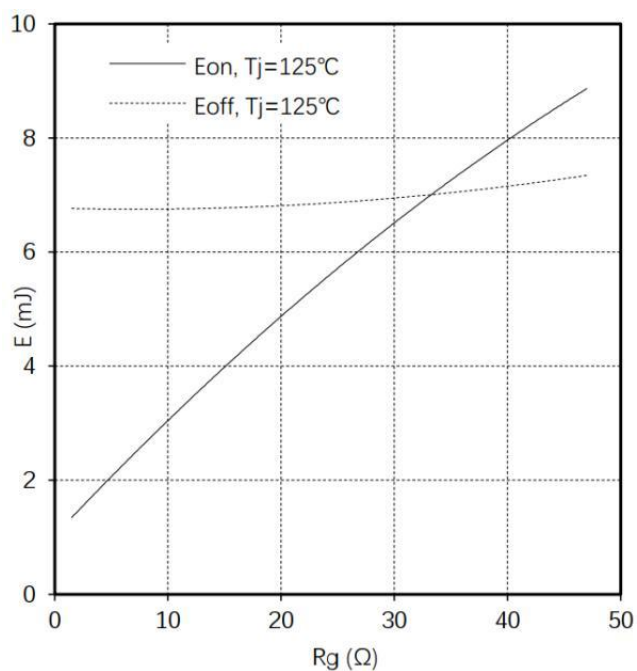


Fig 5. switching losses IGBT, $E_{on}=f(R_g)$, $E_{off}=f(R_g)$,
 $V_{GE}=\pm 15\text{V}$, $I_c=50\text{A}$, $V_{CE}=600\text{V}$

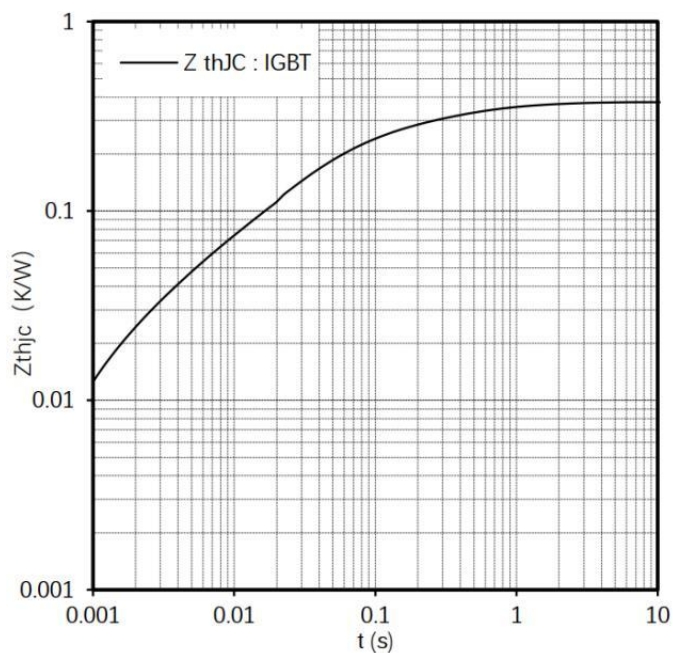


Fig 6. transient thermal impedance IGBT ,
 $Z_{thjc}=f(t)$

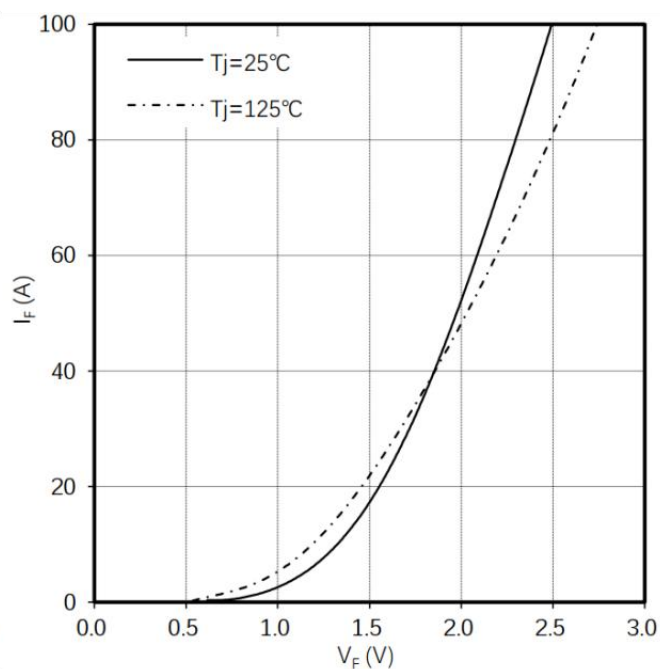
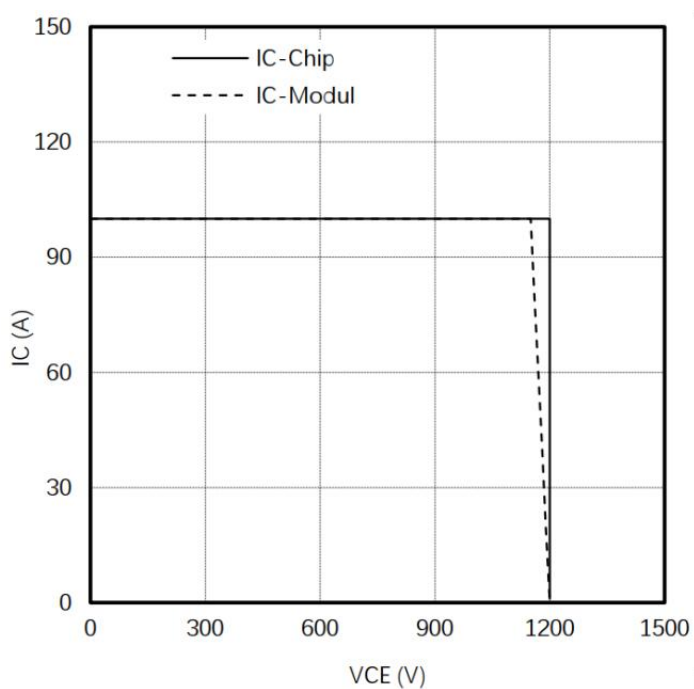


Fig 7. reverse bias safe operating area IGBT,

$I_C = f(V_{CE}), V_{GE} = \pm 15V, R_{Goff} = 18\Omega, T_{vj} = 125^\circ C$

Fig 8. forward characteristic of Diode ,

$I_F = f(V_F)$

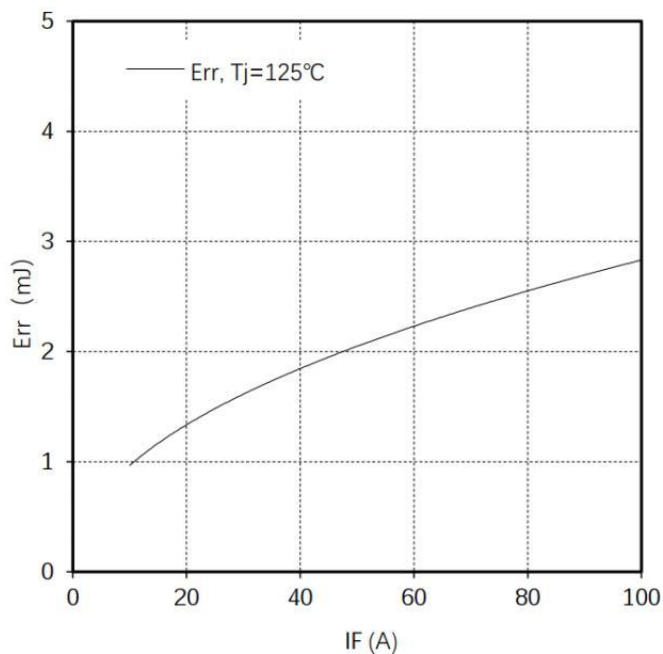


Fig9. switching losses Diode,
 $E_{rr}=f(I_F)$, $R_{Gon}=18\Omega$, $V_{CE}=600V$

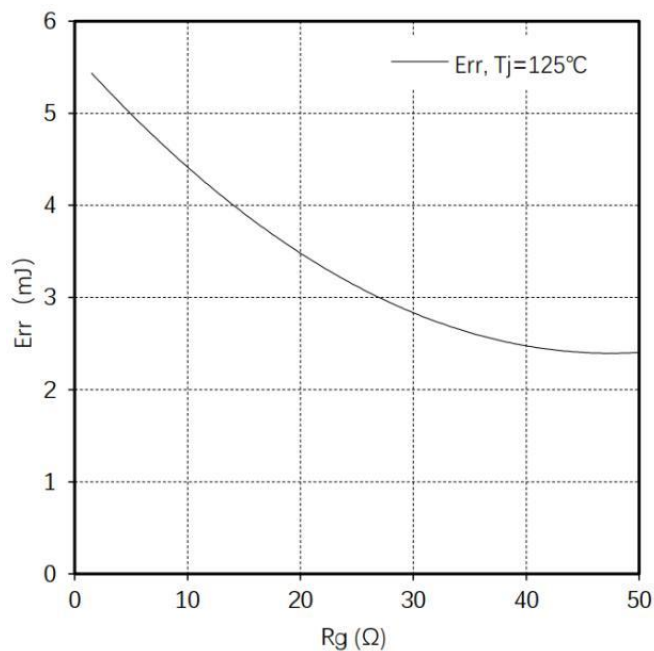


Fig 10. switching losses Diode,
 $E_{rr}=f(R_G)$, $I_F=50A$, $V_{CE}=600V$

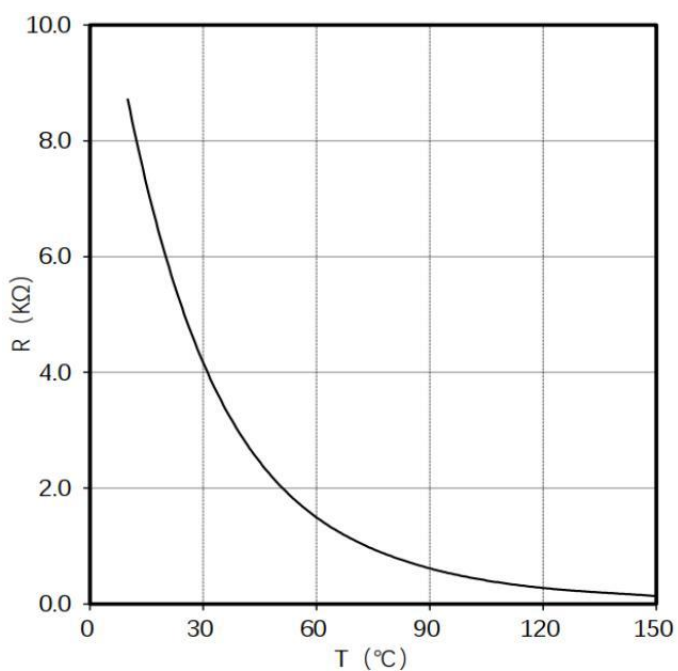


Fig11.NTC-Thermistor-temperature
characteristic(typical)

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