QMFP40R12MFF

1200V 40A IGBT Module

Electrical Features

- Trench/Fieldstop IGBT
- V_{CEsat} with positive Temperature Coefficient
- Low V_{CEsat}

Typical Applications

- Motor Drives
- Servo Drives
- Auxiliary Inverters

Mechanical Features

- High power density
- Integrated NTC temperature sensor
- Copper base plate
- Solder contact technology
- Standard housing

IGBT ,Inverter

Maximum Rated Values

Symbol	Item	Conditions	Rating	Unit
IGBT				
V_{CES}	Collector- emitter voltage	T_{vj}=25℃	1200	V
V_{GES}	Gate-emitter voltage	-	±20	V
I_C	Collector current,DC	T_C=80℃,T_{vj}= 175℃	40	A
I_{CRM}	Repetitive peak collector current	t_p= 1ms	80	A
P_{tot}	Total power dissipation	T_C=25℃,T_{vj}= 175℃	250	W

Characteristics Values

Symbol	Item	Conditions		Values			Unit
IGBT				Min.	Typ.	Max.	
I_{CES}	Collector-emitter cut-off current	V_{CE}= 1200V,V_{GE}=0V,T_{vj}=25℃		-	-	1	mA
I_{GES}	Gate leakage current	V_{CE}=0V,V_{GE}=20V,T_{vj}=25℃		-	-	100	nA
$V_{GE(th)}$	Gate-emitter threshold voltage	I_C= 1.5mA,V_{CE}=V_{GE},T_{vj}=25℃		5.2	5.6	6.6	V
V_{CEsat}	Collector-emitter saturation voltage	I_C=40A V_{GE}= 15V	T_{vj}=25℃	-	2.23	-	V
			T_{vj}= 125℃	-	2.52	-	
			T_{vj}= 150℃	-	2.69	-	
C_{ies}	Input capacitance	V_{CE}=25V,V_{GE}=0V f=1MHz,T_{vj}=25℃		-	1.77	-	nF
C_{oes}	Output capacitance			-	0. 17	-	
C_{res}	Reverse transfer capacitance			-	0.06	-	
Q_G	Gate charge	V_{CC}=600V,I_C=40A V_{GE}=- 15...+ 15V,T_{vj}=25℃		-	0. 171	-	μC
R_g	Internal gate resistance	T_{vj}=25℃		-	-	-	Ω

$t_{d(on)}$	Turn-on delay time	V_{CC}=600V I_C=40A V_{GE}=±15V $R_{G(on)}$=51Ω $R_{G(off)}$=51Ω	T_{vj}=25℃	-	200.1	-	ns
			T_{vj}= 125℃	-	170.4	-	
			T_{vj}= 150℃	-	160.4	-	
t_r	Rise time		T_{vj}=25℃	-	94.6	-	
			T_{vj}= 125℃	-	87.6	-	
			T_{vj}= 150℃	-	83.6	-	
$t_{d(off)}$	Turn-off delay time		T_{vj}=25℃	-	480.5	-	
			T_{vj}= 125℃	-	512.0	-	
			T_{vj}= 150℃	-	524.8	-	
t_f	Fall time		T_{vj}=25℃	-	209.0	-	
			T_{vj}= 125℃	-	330.8	-	
			T_{vj}= 150℃	-	340.0	-	
E_{on}	Turn-on energy (per pulse)	V_{CC}=600V， I_C=40A V_{GE}=±15V， $R_{G(on)}$=51Ω di/dt=890A/μs(T_{vj}= 150℃)	T_{vj}=25℃	-	11.14	-	mJ
			T_{vj}= 125℃	-	12.81	-	
			T_{vj}= 150℃	-	13.37	-	
E_{off}	Turn-off energy (per pulse)	V_{CC}=600V， I_C=40A V_{GE}=±15V， $R_{G(off)}$=51Ω du/dt=5531V/μs(T_{vj}= 150℃)	T_{vj}=25℃	-	2.59	-	
			T_{vj}= 125℃	-	3.36	-	
			T_{vj}= 150℃	-	3.52	-	
SC data	Short-circuit current	V_{CC}=600V,V_{GE}≤ 15V,T_{vj}= 125℃ V_{CES}≤ 1200V,t_P≤ 10μs		-	180	-	A
R_{thJC}	Thermal resistance,junction to case	Per IGBT		-	-	0.6	K/W
R_{thCH}	Thermalresistance,case to heatsink	Per IGBT λgrease= 1W/(m·K)		-	-	-	K/W
T_{vjop}	Temperature under switching conditions			-40		150	℃

Diode， Inverter

Maximum Rated Values

Symbol	Item	Conditions	Rating	Unit
V_{RRM}	Repetitive peak reverse voltage	T_{vj}=25℃	1200	V
I_F	Forward current,DC	T_C=80℃,T_{vj}= 175℃	40	A
I_{FRM}	Repetitive peak forward current	t_p= 1ms	80	A
I^2t	I^2t-value	V_R=0V,t_p= 10ms,T_{vj}= 125℃	320	A^2s

Characteristic Values

				Min.	Typ.	Max.	
V_F	Continuous forward voltage	I_F=40A V_{GE}=0V	T_{vj}=25℃	-	2.41	-	V
			T_{vj}= 125℃	-	2. 11	-	
			T_{vj}= 150℃	-	2.04	-	
I_{RM}	Peak reverse recovery current	V_R=600V I_F=40A V_{GE}=- 15V -di$_F$/dt=650A/ μs (T_{vj}= 150℃)	T_{vj}=25℃	-	15.3	-	A
			T_{vj}= 125℃	-	20.9	-	
			T_{vj}= 150℃	-	22.9	-	
t_{rr}	Reverse recovery time		T_{vj}=25℃	-	90.9	-	ns
			T_{vj}= 125℃	-	246.0	-	
			T_{vj}= 150℃	-	644.4	-	
Q_r	Recovered charge		T_{vj}=25℃	-	1.87	-	μC
			T_{vj}= 125℃	-	6.30	-	
			T_{vj}= 150℃	-	7.34	-	

E_{rec}	Reverse recovery energy		T_{vj}=25℃	-	0 82	-	mJ
			T_{vj}= 125℃	-	2.01	-	
			T_{vj}= 150℃	-	2.27	-	
R_{thJC}	Thermal resistance, junction to case	per diode		-	-	0.95	K/W
R_{thCH}	Thermal resistance, case to heatsink	Per diode， λ_{grease}= 1 W/(m • K)		-	-	-	K/W
T_{vjop}	Temperature under switching conditions			-40		150	℃

Diode, Rectifier

Maximum Rated Values							
Symbol	Item	Conditions		Rating			Unit
V_{RRM}	Repetitive peak reverse voltage	T_{vj}=25℃		1800			V
I_{FRMSM}	Maximum RMS forward current per chip	T_C=80℃		50			A
I_{RMSM}	Maximum RMS current at rectifier output	T_C=80℃		60			A
I_{FSM}	Surge forward current	t_p = 10 ms, Tvj = 150° C		350			A
I^2t	I^2t-value	t_p= 10ms,T_{vj}= 150℃		605			A^2s
Characteristic Values							
Symbol	Item	Conditions		Values			Unit
				Min.	Typ.	Max.	
V_F	Continuous forward voltage	I_F=40A V_{GE}=0V	T_{vj}=25℃	-	1.36	-	V
			T_{vj}= 125℃	-	1.25	-	
			T_{vj}= 150℃	-	1.17	-	
I_R	Reverse current	V_R= 1800V	T_{vj}=25℃	-	-	10	uA
			T_{vj}= 125℃	-	-	-	
			T_{vj}= 150℃	-	-	-	
T_{vjop}	Temperature under switching conditions			-40		150	℃

IGBT， Brake-Chopper

Maximum Rated Values							
Symbol	Item	Conditions		Values			Unit
V_{CES}	Collector- emitter voltage	T_{vj}=25℃		1200			V
V_{GES}	Gate- emitter voltage	-		±20			V
I_C	Collector current, DC	T_C= 100℃ ,T_{vj}= 175℃		15			A
I_{CRM}	Repetitive peak collector current	t_p= 1ms		30			A
P_{tot}	Total power dissipation	T_C=25℃,T_{vj}= 175℃		125			W
Characteristic Values							
Symbol	Item	Conditions		Values			Unit
IGBT				Min.	Typ.	Max.	
I_{CES}	Collector-emitter cut-off current	V_{CE}= 1200V,V_{GE}=0V,T_{vj}=25℃		-	-	1	mA
I_{GES}	Gate leakage current	V_{CE}=0V,V_{GE}=20V,T_{vj}=25℃		-	-	100	nA
$V_{GE(th)}$	Gate-emitter threshold voltage	I_C=0.5mA,V_{CE}=V_{GE},T_{vj}=25℃		5.7	6.2	6.7	
V_{CEsat}	Collector-emitter saturation voltage	I_C= 15A V_{GE}= 15V	T_{vj}=25℃	-	1.89	-	V
			T_{vj}= 125℃	-	2.25	-	
			T_{vj}= 150℃	-	2.32	-	

C_{ies}	Input capacitance	V_{CE}=25V,V_{GE}=0V f=1MHz,T_{vj}=25℃		-	1.19	-	nF
C_{oes}	Output capacitance			-	0.08	-	
C_{res}	Reverse transfer capacitance			-	0.04	-	
Q_G	Gate charge	V_{CC}=600V,I_C= 15A V_{GE}=- 15...+ 15V,T_{vj}=25℃		-	0.094	-	μC
R_g	Internal gate resistance	T_{vj}=25℃		-	-	-	Ω
$t_{d(on)}$	Turn-on delay time	V_{CC}=600V I_C= 15A V_{GE}=±15V $R_{G(on)}$=51Ω $R_{G(off)}$=51Ω	T_{vj}=25℃	-	270.2	-	ns
			T_{vj}= 125℃	-	143.5	-	
			T_{vj}= 150℃	-	133.9	-	
t_r	Rise time		T_{vj}=25℃	-	204.1	-	
			T_{vj}= 125℃	-	111.1	-	
			T_{vj}= 150℃	-	99.2	-	
$t_{d(off)}$	Turn-off delay time		T_{vj}=25℃	-	198.4	-	
			T_{vj}= 125℃	-	153.8	-	
			T_{vj}= 150℃	-	131.2	-	
t_f	Fall time		T_{vj}=25℃	-	298.4	-	
			T_{vj}= 125℃	-	165.3	-	
			T_{vj}= 150℃	-	132.1	-	
E_{on}	Turn-on energy (per pulse)		T_{vj}=25℃	-	3.3	-	mJ
			T_{vj}= 125℃	-	3.8	-	
			T_{vj}= 150℃	-	3.9	-	
E_{off}	Turn-off energy (per pulse)		T_{vj}=25℃	-	0.94	-	
			T_{vj}= 125℃	-	1.22	-	
			T_{vj}= 150℃	-	1.29	-	
SC data	Short-circuit current	V_{CC}=600V,V_{GE}≤ 15V,T_{vj}= 125℃ V_{CES}≤ 1200V,t_P≤ 10μs		-	60	-	A
R_{thJC}	Thermal resistance,junction to case	Per IGBT		-	-	1.2	K/W
R_{thCH}	Thermalresistance,case to heatsink	Per IGBT λgrease= 1W/(m·K)		-	-	-	K/W
T_{vjop}	Temperature under switching conditions			-40		150	℃

Diode ， Brake- Chopper

Maximum Rated Values

Symbol	Item	Conditions	Rating	Unit
V_{RRM}	Repetitive peak reverse voltage	T_{vj}=25℃	1200	V
I_F	Forward current,DC	T_C=80℃,T_{vj}= 175℃	10	A
I_{FRM}	Repetitive peak forward current	t_p= 1ms	20	A
I^2t	I^2t-value	V_R=0V,t_p= 10ms,T_{vj}= 125℃	20	A^2s

Characteristic Values

				Min.	Typ.	Max.	
V_F	Continuous forward voltage	I_F= 10A V_{GE}=0V	T_{vj}=25℃	-	2.35	-	V
			T_{vj}= 125℃	-	2.06	-	
			T_{vj}= 150℃	-	2.02	-	

I_{RM}	Peak reverse recovery current	V_R=600V I_F= 10A V_{GE}=- 15V -di$_F$/dt=600A/ μs (T_{vj}= 150℃)	T_{vj}=25℃	-	9.7	-	A
			T_{vj}= 125℃	-	8.6	-	
			T_{vj}= 150℃	-	8.4	-	
t_{rr}	Reverse recovery time		T_{vj}=25℃	-	1054	-	ns
			T_{vj}= 125℃	-	969.7	-	
			T_{vj}= 150℃	-	943.1	-	
Q_r	Recovered charge		T_{vj}=25℃	-	3.2	-	μC
			T_{vj}= 125℃	-	3.5	-	
			T_{vj}= 150℃	-	3.8	-	
E_{rec}	Reverse recovery energy		T_{vj}=25℃	-	0.88	-	mJ
			T_{vj}= 125℃	-	1.41	-	
			T_{vj}= 150℃	-	1 46	-	
R_{thJC}	Thermal resistance, junction to case	per diode		-	-	2.3	K/W
R_{thCH}	Thermal resistance, case to heatsink	per diode， λ_{grease}= 1 W/(m • K)		-	-	-	K/W
T_{vjop}	Temperature under switching conditions			-40		150	℃

Note:
IGBT electrical characteristics according to IEC 60747 – 9
Diode electrical characteristics according to IEC 60747 – 2

Module

Symbol	Item	Conditions	Rating			Unit
V_{ISOL}	Isolation voltage	Terminals to baseplate，RMS,f=50Hz,t=1min	2500			V
T_{vjmax}	Maximum junction temperature	-	175			℃
T_{vjop}	Operatingjunction temperature	Continuous operationg(under switching)	-40~ 150			℃
T_{stg}	Storage temperature	-	-40~ 125			℃
Symbol	**Item**	**Conditions**	**Values**			**Unit**
			Min.	Typ.	Max.	
Ms	Mounting torque	Mounting to heat sink,M5 screw	3	-	6	Nm
ds	Creepage distance	Terminal to terminal	-	-	-	mm
		Terminal to base plate	-	10	-	
da	Clearance	Terminal to terminal	-	-	-	mm
		Terminal to base plate	-	7.5	-	
m	Weight	-	-	180	-	g

NTC Thermistor Characteristics

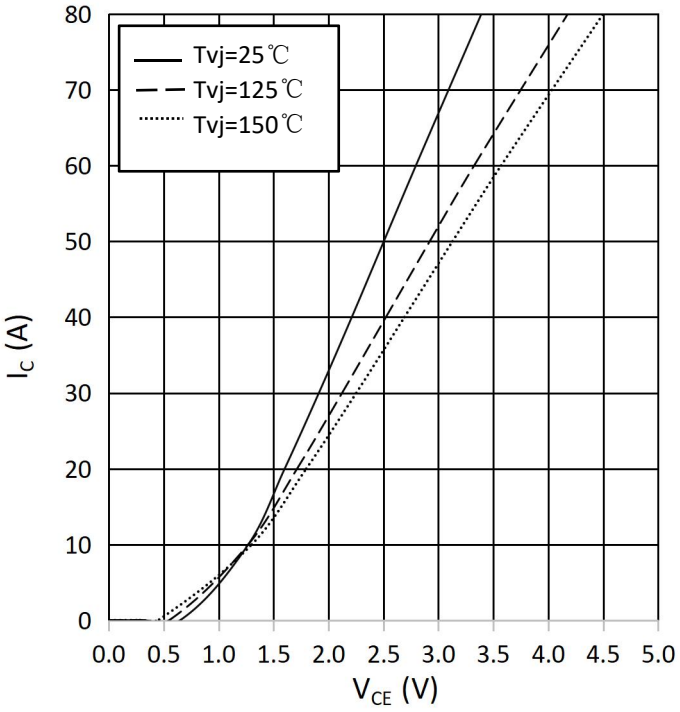
Symbol	Item	Conditions	Values			Unit
			Min.	Typ.	Max.	
R_{25}	Rated resistance	T_C=25℃	-	5	-	kΩ
ΔR/R	Deviation of resistance	T_C= 100℃ ,R_{100}=493Ω	-5	-	5	%
P_{25}	Power dissipation	T_C=25℃	-	-	20	mW

$B_{25/100}$	B-constant	R_2=R_{25}exp[$B_{25/100}$(1/T_2- 1/(298. 15K))	-	3433	-	
$B_{25/50}$	B- constant	R_2=R_{25}exp[$B_{25/50}$(1/T_2- 1/(298. 15K))	-	3375	-	K
$B_{25/80}$	B- constant	R_2=R_{25}exp[$B_{25/80}$(1/T_2- 1/(298. 15K))	-	3411	-	

output characteristic IGBT,Inverter (typical)

$I_C = f(V_{CE})$

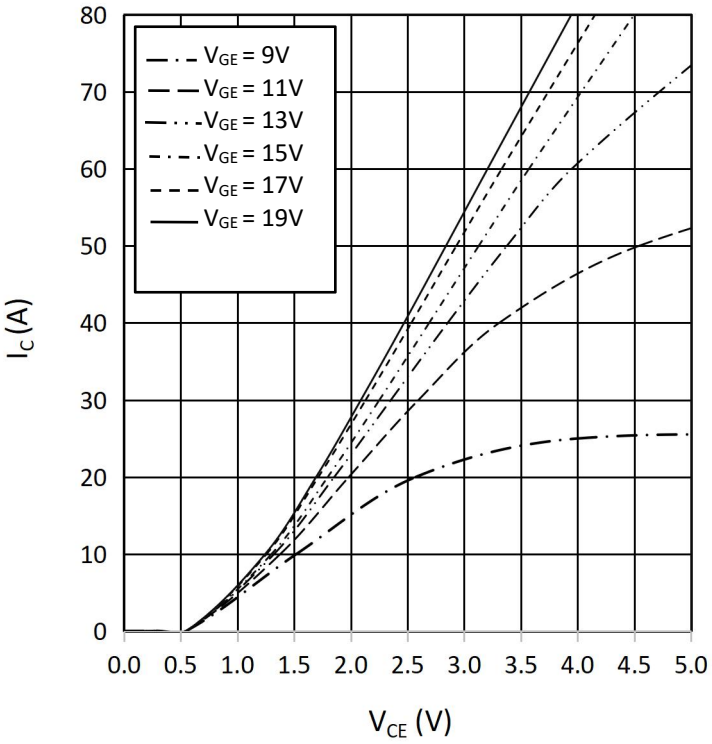
$V_{GE} = 15V$



output characteristic IGBT,Inverter (typical)

$I_C = f(V_{CE})$

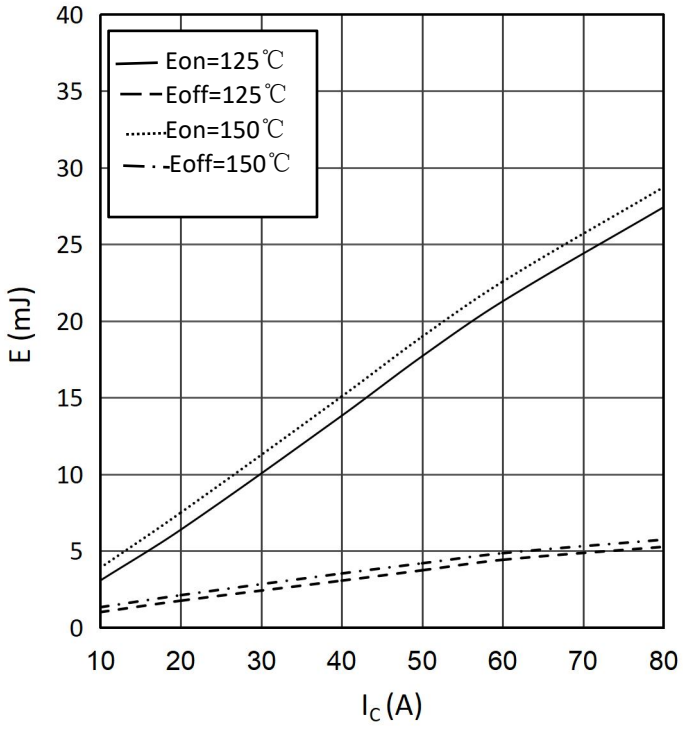
$T_{vj} = 150°C$



switching losses IGBT,Inverter (typical)

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

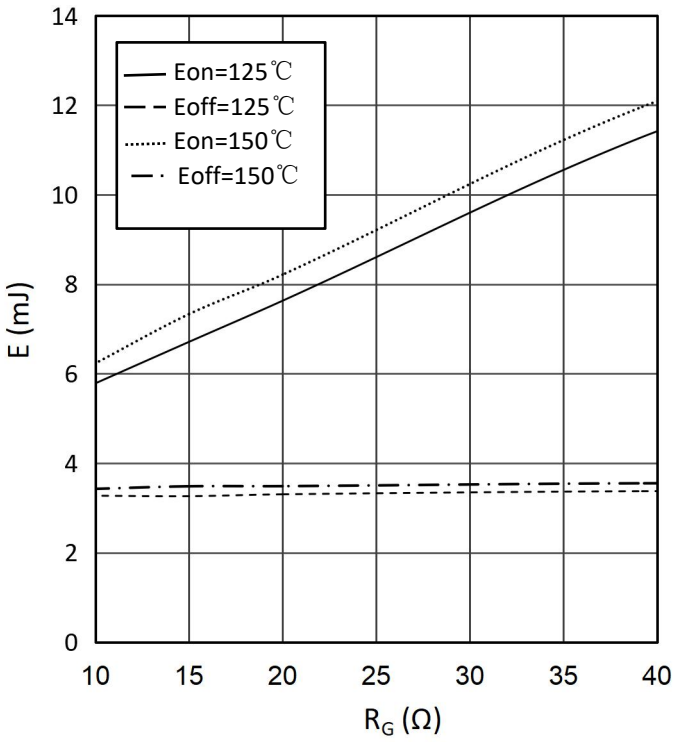
$V_{GE} = \pm 15V$, $R_{Gon} = 51\Omega$, $R_{Goff} = 51\Omega$, $V_{CE} = 600V$



switching losses IGBT,Inverter (typical)

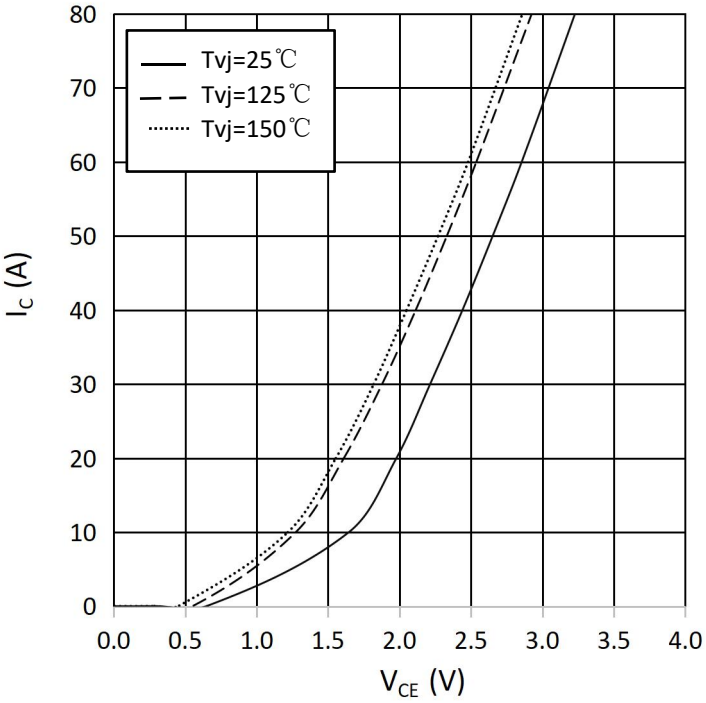
$E_{on} = f(R_G)$, $E_{off} = f(R_G)$

$V_{GE} = \pm 15V$, $I_C = 40A$, $V_{CE} = 600V$



forward characteristic of Diode, Inverter (typical)

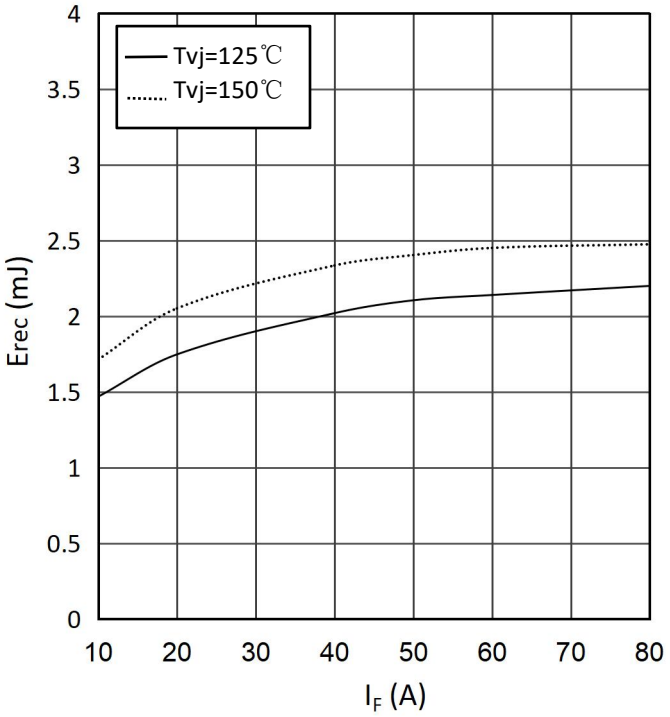
$I_F = f(V_F)$



switching losses Diode, Inverter (typical)

$E_{rec} = f(I_F)$

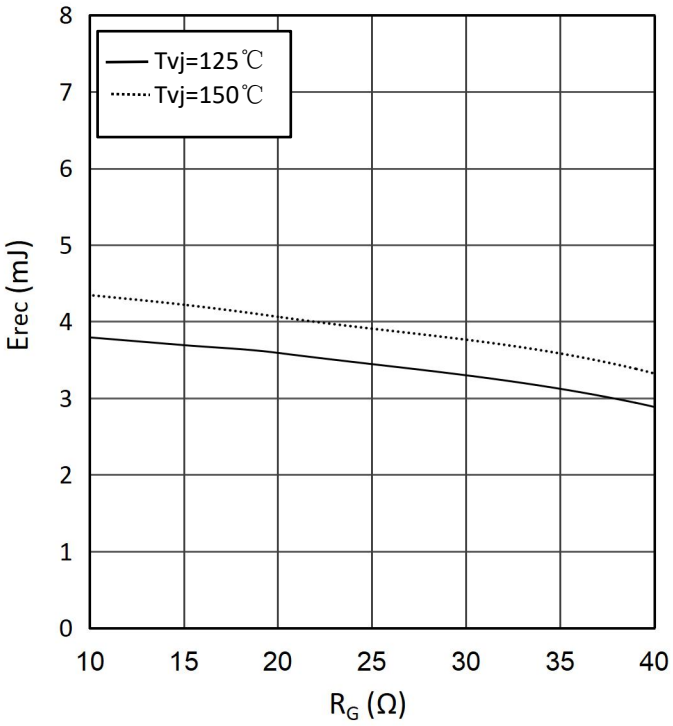
$R_{Gon} = 51\Omega$, $V_{CE} = 600$ V



switching losses Diode, Inverter (typical)

$E_{rec} = f(R_G)$

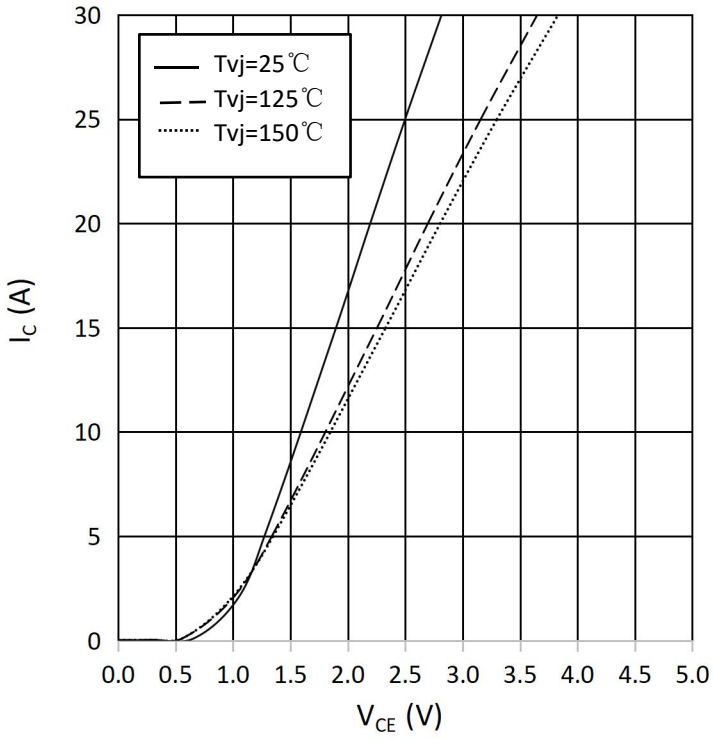
$I_F = 40A$, $V_{CE} = 600V$



output characteristic IGBT, Brake-Chopper (typical)

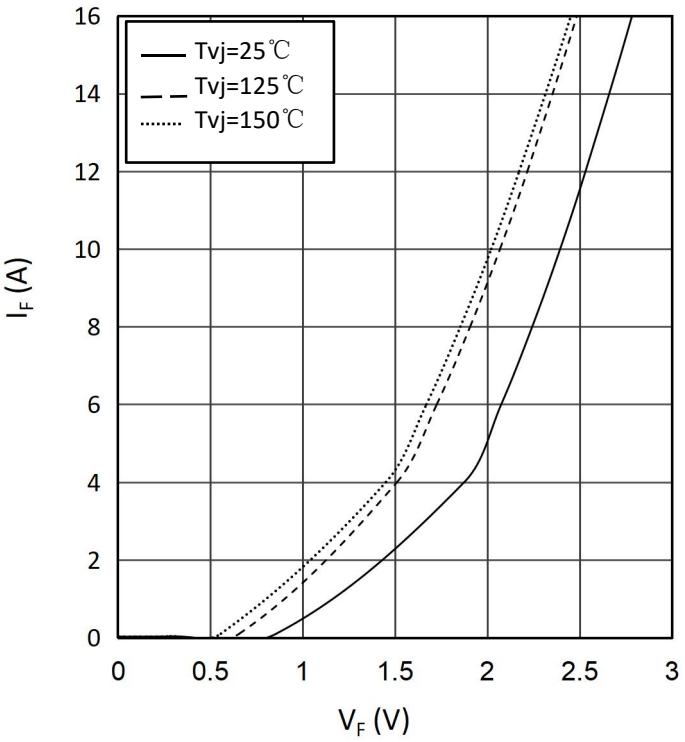
$I_C = f(V_{CE})$

$V_{GE} = 15V$



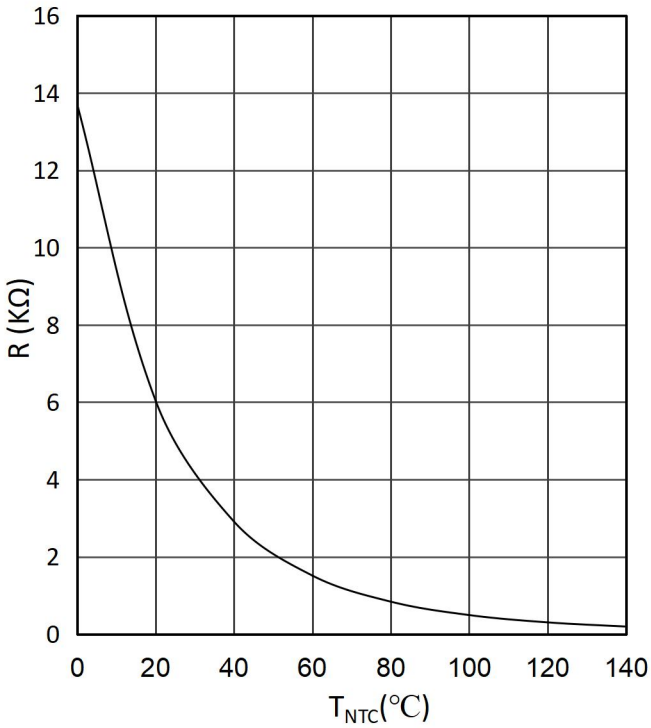
forward characteristic of Diode, Brake-Chopper (typical)

$I_F = f(V_F)$



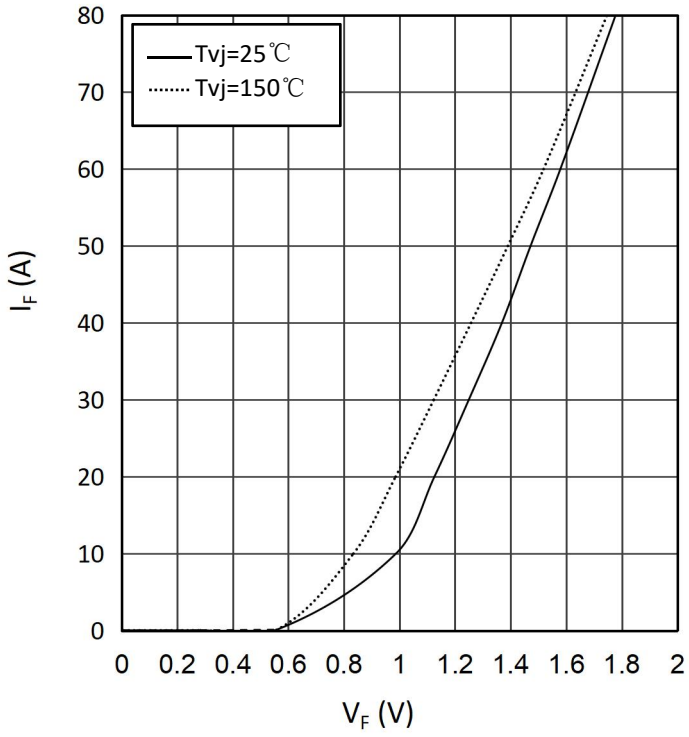
NTC- Thermistor- temperature characteristic(typical)

R=f (T)

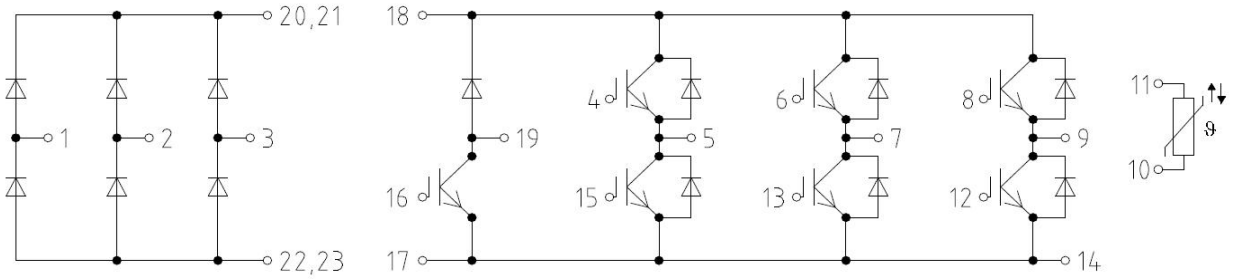


Forward characteristic of Diode, Rectifier(typical)

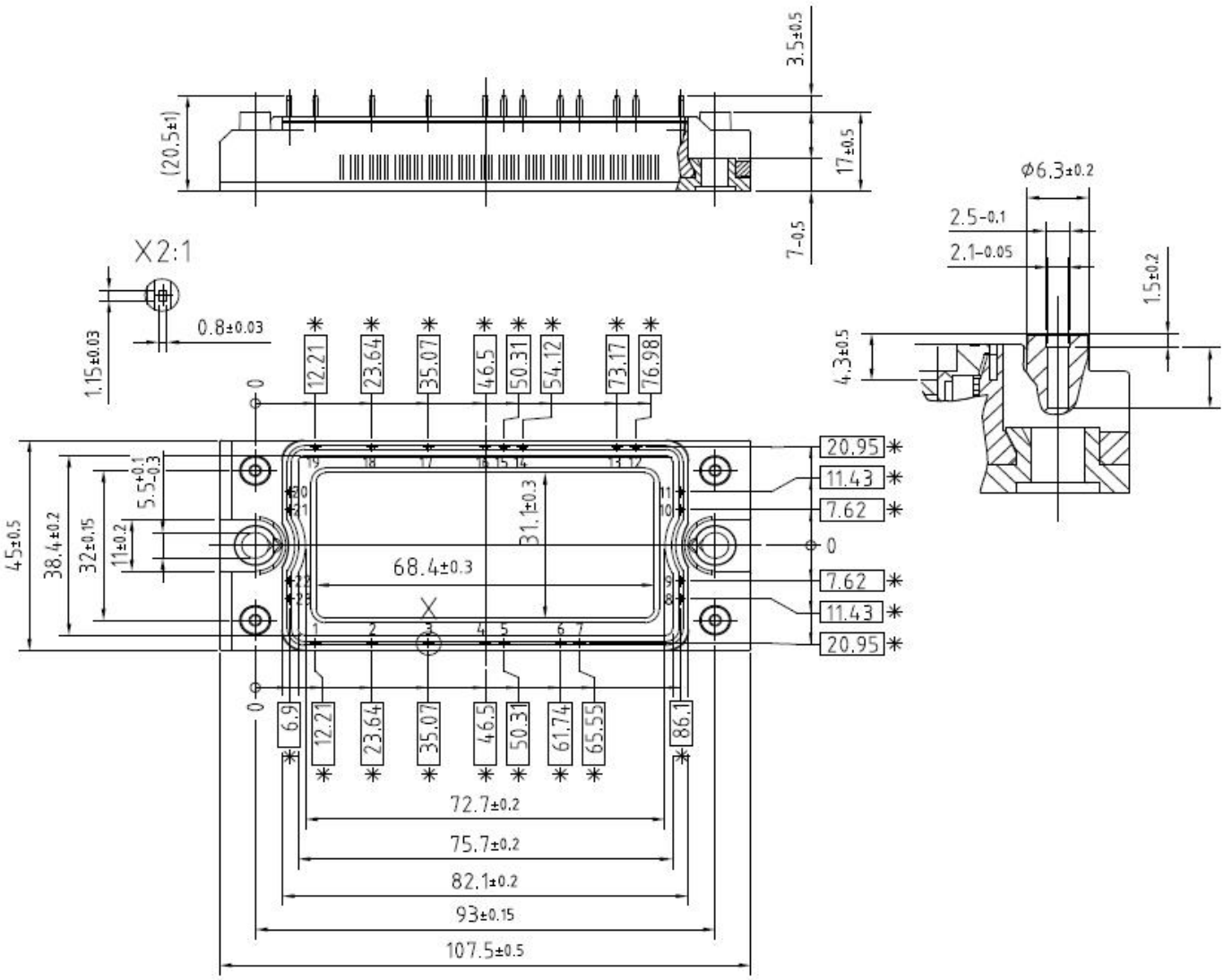
$I_F = f(V_F)$



Cricuit Diagram



Package Outlines



Terms & Conditions of usage

1. The product specifications, characteristics, data, materials and structures given in this datasheet are subject to change without notice.

2. The information given in this datasheet shall in no event be regarded as a guarantee of conditions or characteristics. Qinxin Microelectronics Technology Co., Ltd. does not warrant or assume any legal liability or responsibility for the accuracy and completeness of any examples, hints or any typical values stated herein and/or any information regarding the application of the product.

3. This datasheet is only used as a reference for customers to apply our products，Qinxin Microelectronics Technology Co., Ltd. does not undertake to permit the use of intellectual property rights or any third-party property rights related to the product information described in this datasheet.

4. Although Qinxin Microelectronics Technology Co., Ltd. is committed to enhancing product quality and reliability, all semiconductor products still have a probability of failure. When using Qinxin Microelectronics semiconductor products in your equipment, you are requested to take adequate safety measures to prevent the equipment from causing accidents or events including but not limited to physical injury, fire or damage to other property if any of the products become faulty.

5. The products introduced in this datasheet are electrostatic sensitive devices and must be protected against static electricity during device installation, testing, packaging, storage and transportation.

6. Due to technical requirements our product may contain dangerous substances. For information on the types in question please contact the sales office, which is responsible for you.

7. Do not use the products introduced in this datasheet in equipment or systems that requiring strict reliability or/and may directly endanger human life such as medical, life-saving, life-sustaining, space equipment, aeronautic equipment, nuclear equipment submarine repeater equipment and equivalents to strategic equipment (without limitation).

8.No part of this datasheet may be disseminated and reproduced in any form or by any means without prior written permission from Qinxin Microelectronics Technology Co., Ltd.

9. The data contained in this datasheet is exclusively intended for use by professional technicians only. It is the responsibility of the customer's own technical departments to evaluate the suitability of the product for the intended application and the completeness of the product information given in this document with respect to corresponding application. If you have any question about any portion in this datasheet, contact Qinxin Microelectronics Technology Co., Ltd. before using the product. Qinxin Microelectronics Technology Co., Ltd. shall not be liable for any injury caused by any use of the products not in accordance with instructions set forth herein.