QMFP40R12LFF

1200V 40A IGBT Module

Electrical Features

- Trench/Fieldstop IGBT
- Half-bridge
- Low inductance
- Standard package
- High short circuit capability
- Including anti-parallel FWD

Typical Applications

- Motor Drives
- Servo Drives
- Auxiliary Inverters

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= 100℃ ,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	5.58	6.6	V
V_{CEsat}	Collector-emitter saturation voltage	I_C=40A V_{GE}= 15V	T_{vj}=25℃	-	1.98	-	V
			T_{vj}= 125℃	-	2.31	-	
			T_{vj}= 150℃	-	2.37	-	
C_{ies}	Input capacitance	V_{CE}=25V,V_{GE}=0V f=1MHz,T_{vj}=25℃		-	3.13	-	nF
C_{oes}	Output capacitance			-	0.17	-	
C_{res}	Reverse transfer capacitance			-	0.09	-	
Q_G	Gate charge	V_{CC}=600V,I_C=40A V_{GE}=- 15...+ 15V,T_{vj}=25℃		-	0.24	-	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 $R_{G(on)}$=30Ω $R_{G(off)}$=30Ω	T_{vj}=25℃	-	136	-	ns
			T_{vj}= 125℃	-	116	-	
			T_{vj}= 150℃	-	99	-	
t_r	Rise time		T_{vj}=25℃	-	55	-	
			T_{vj}= 125℃	-	58	-	
			T_{vj}= 150℃	-	61	-	
$t_{d(off)}$	Turn-off delay time		T_{vj}=25℃	-	294	-	
			T_{vj}= 125℃	-	328	-	
			T_{vj}= 150℃	-	371	-	
t_f	Fall time		T_{vj}=25℃	-	273	-	
			T_{vj}= 125℃	-	408	-	
			T_{vj}= 150℃	-	521	-	
E_{on}	Turn-on energy (per pulse)		T_{vj}=25℃	-	6.4	-	mJ
			T_{vj}= 125℃	-	8.2	-	
			T_{vj}= 150℃	-	10.9	-	
E_{off}	Turn-off energy (per pulse)		T_{vj}=25℃	-	2.8	-	
			T_{vj}= 125℃	-	3.6	-	
			T_{vj}= 150℃	-	4.1	-	
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
Tvjop	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		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℃	-	2.22	2.4	V
			T_{vj}= 125℃	-	1.86	2.2	
			T_{vj}= 150℃	-	1.78	-	
I_{RM}	Peak reverse recovery current	V_R=600V I_F=40A V_{GE}=- 15V	T_{vj}=25℃	-	29	-	A
			T_{vj}= 125℃	-	36	-	
			T_{vj}= 150℃	-	34	-	
t_{rr}	Reverse recovery time		T_{vj}=25℃	-	125	-	ns
			T_{vj}= 125℃	-	526	-	
			T_{vj}= 150℃	-	591	-	
Q_r	Recovered charge		T_{vj}=25℃	-	2.51	-	μC
			T_{vj}= 125℃	-	7.08	-	
			T_{vj}= 150℃	-	7.5	-	

E_{rec}	Reverse recovery energy		T_{vj}=25℃	-	0 56	-	mJ
			T_{vj}= 125℃	-	1.99	-	
			T_{vj}= 150℃	-	-	-	
R_{thJC}	Thermal resistance,junction to case	Per IGBT		-	-	0.95	K/W
Tvjop	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℃		1600			V
I_F	Forward current, DC	T_C= 100℃		50			A
I_{FRM}	Repetitive peak forward current	t_p= 1ms		60			A
I^2t	I^2t-value	V_R=0V,t_p= 10ms,T_{vj}= 150℃		340			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℃	-	1.21	2.3	V
			T_{vj}= 125℃	-	-	-	
			T_{vj}= 150℃	-	-	-	
I_R	Reverse current	V_R= 1600V	T_{vj}=25℃	-	-	10	uA
			T_{vj}= 125℃	-	-	-	
			T_{vj}= 150℃	-	-	-	
R_{thJC}	Thermal resistance,junction to case	Per IGBT		-	-	1	K/W
Tvjop	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℃		5.2	5.87	6.6	V
V_{CEsat}	Collector-emitter saturation voltage	I_C= 15A V_{GE}= 15V	T_{vj}=25℃	-	1.94	2.25	
			T_{vj}= 125℃	-	2.1	-	
			T_{vj}= 150℃	-	2.4	-	
C_{ies}	Input capacitance	V_{CE}=25V,V_{GE}=0V f=1MHz,T_{vj}=25℃		-	1.12	-	nF
C_{oes}	Output capacitance			-	0.081	-	

C_{res}	Reverse transfer capacitance			-	0.035	-	
Q_G	Gate charge	V_{CC}=600V,I_C= 15A V_{GE}=- 15...+ 15V,T_{vj}=25℃		-	94	-	nC
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 $R_{G(on)}$=30Ω $R_{G(off)}$=30Ω	T_{vj}=25℃	-	105	-	ns
			T_{vj}= 125℃	-	86	-	
			T_{vj}= 150℃	-	78	-	
t_r	Rise time		T_{vj}=25℃	-	28	-	
			T_{vj}= 125℃	-	33	-	
			T_{vj}= 150℃	-	41	-	
$t_{d(off)}$	Turn-off delay time		T_{vj}=25℃	-	223	-	
			T_{vj}= 125℃	-	245	-	
			T_{vj}= 150℃	-	312	-	
t_f	Fall time		T_{vj}=25℃	-	396	-	
			T_{vj}= 125℃	-	540	-	
			T_{vj}= 150℃	-	681	-	
E_{on}	Turn-on energy (per pulse)		T_{vj}=25℃	-	1.9	-	mJ
			T_{vj}= 125℃	-	2.6	-	
			T_{vj}= 150℃	-	3.8	-	
E_{off}	Turn-off energy (per pulse)		T_{vj}=25℃	-	1.4	-	
			T_{vj}= 125℃	-	1.7	-	
			T_{vj}= 150℃	-	1.9	-	
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
Tvjop	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			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℃	-	2.2	2.3	V
			T_{vj}= 125℃	-	1.9	-	
			T_{vj}= 150℃	-	1.7	-	
I_{RM}	Peak reverse recovery current	V_R=600V I_F= 10A V_{GE}=- 15V	T_{vj}=25℃	-	28	-	A
			T_{vj}= 125℃	-	36	-	
			T_{vj}= 150℃	-	33	-	
t_{rr}	Reverse recovery time		T_{vj}=25℃	-	82	-	ns
			T_{vj}= 125℃	-	282	-	

Q_r	Recovered charge		T_{vj}=25℃	-	1 03	-	μC
			T_{vj}= 125℃	-	3.33	-	
E_{rec}	Reverse recovery energy		T_{vj}=25℃	-	0. 12	-	mJ
			T_{vj}= 125℃	-	0.89	-	
R_{thJC}	Thermal resistance,junction to case	Per IGBT		-	-	2.3	K/W
Tvjop	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
$T_{vj\ max}$	Maximum junction temperature	-	175			℃
$T_{vj\ op}$	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	-	-	175	-	g

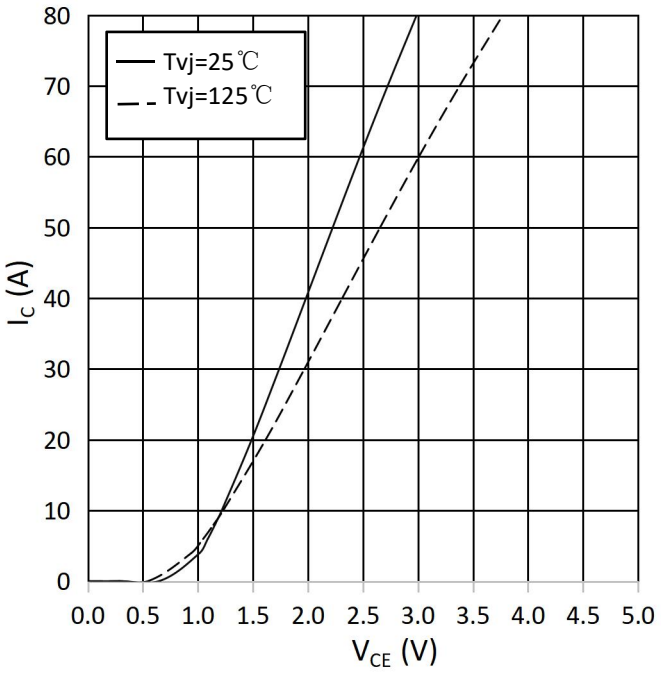
NTC Thermistor Characteristics

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
$B_{25/50}$	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	-	
$B_{25/100}$	B-constant	$R_2=R_{25}exp[B_{25/100}(1/T_2- 1/(298.15K))$	-	3433	-	

output characteristic IGBT,Inverter (typical)

$I_C = f(V_{CE})$

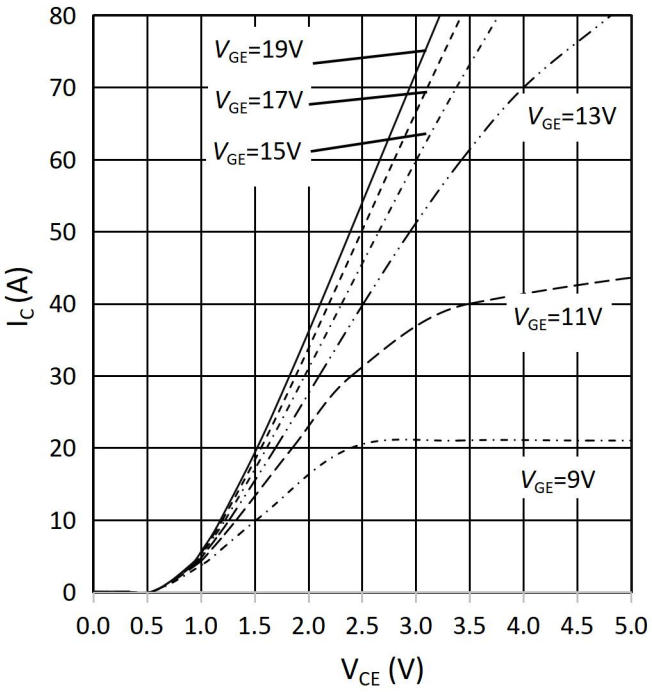
$V_{GE} = 15V$



output characteristic IGBT,Inverter (typical)

$I_C = f(V_{CE})$

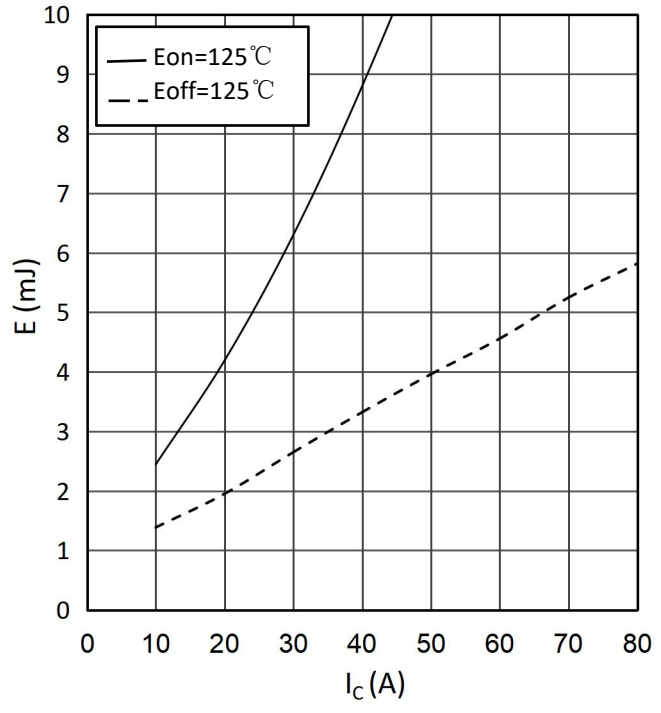
$T_{vj} = 125°C$



switching losses IGBT,Inverter (typical)

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

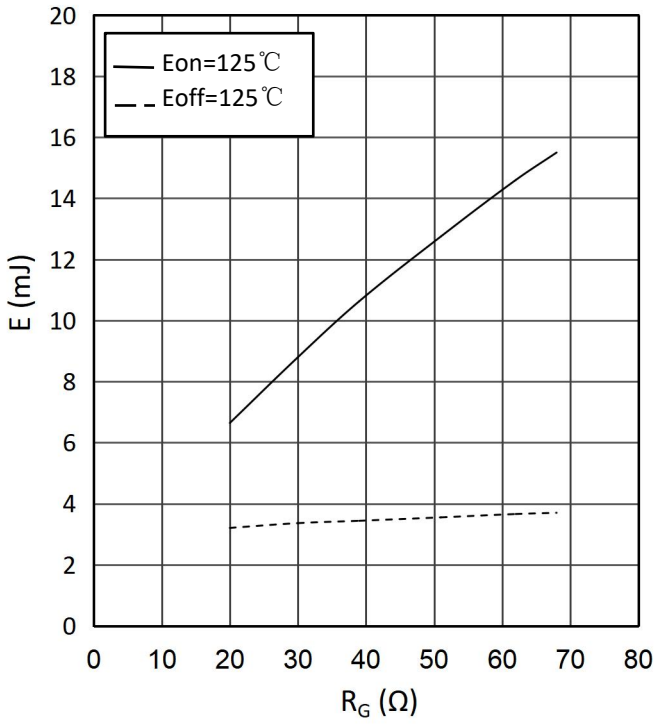
$V_{GE} = \pm 15V$, $R_{Gon} = 30\Omega$, $R_{Goff} = 30\Omega$, $V_{CE} = 600V$



switching losses IGBT,Inverter (typical)

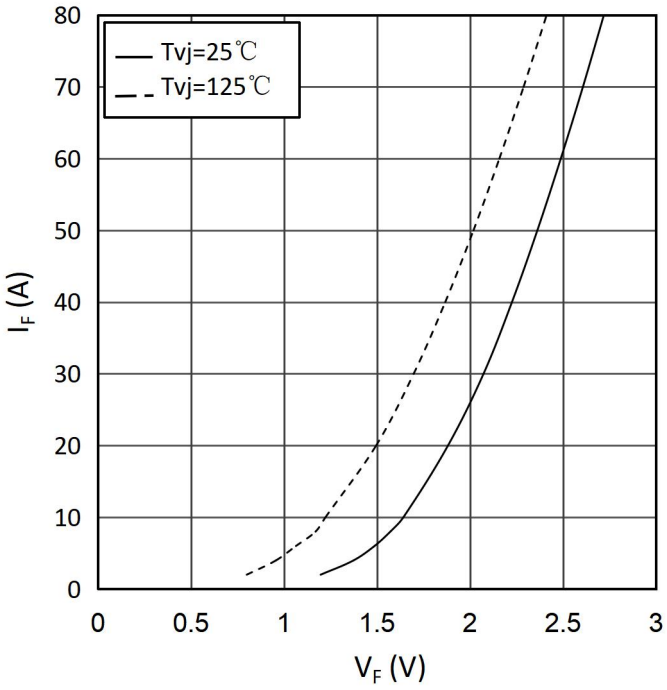
$E_{on} = f(R_G)$, $E_{off} = f(R_G)$

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



forward characteristic of Diode, Inverter (typical)

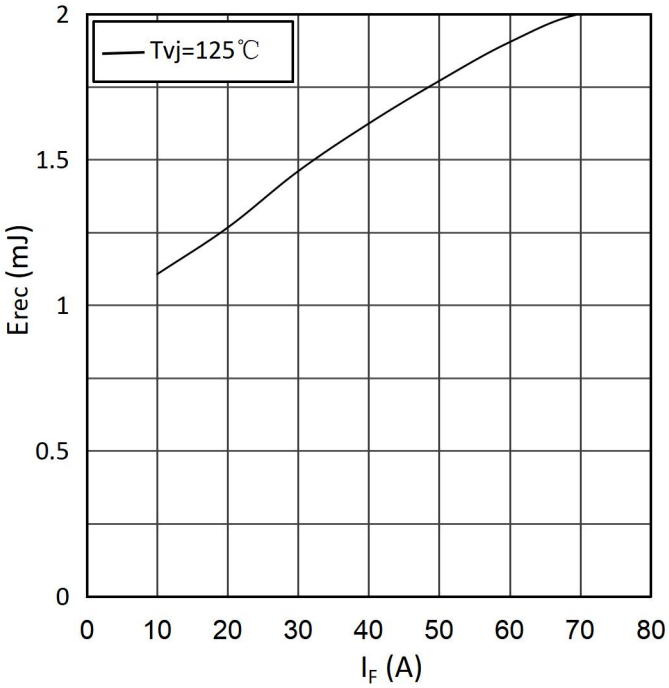
$I_F = f(V_F)$



switching losses Diode, Inverter (typical)

$E_{rec} = f(I_F)$

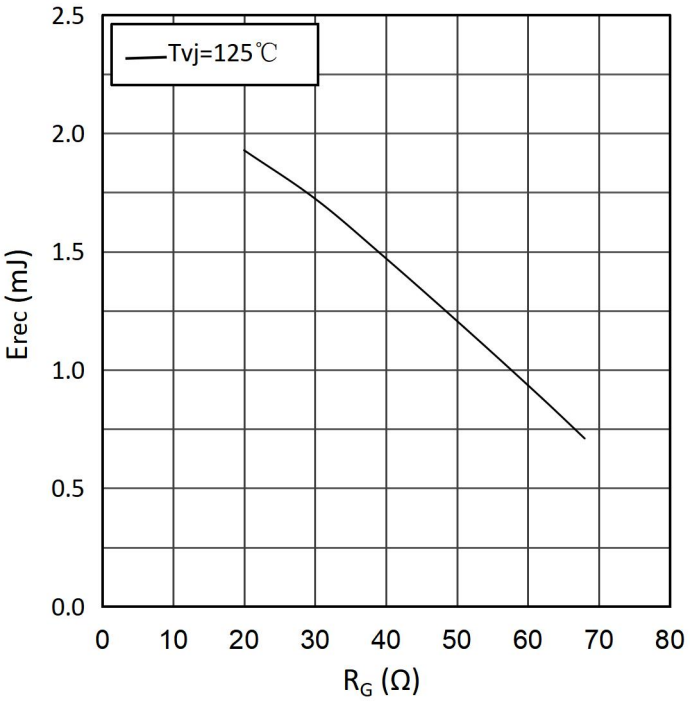
$R_{Gon} = 30\Omega$, $V_{CE} = 600$ V



switching losses Diode, Inverter (typical)

$E_{rec} = f(R_G)$

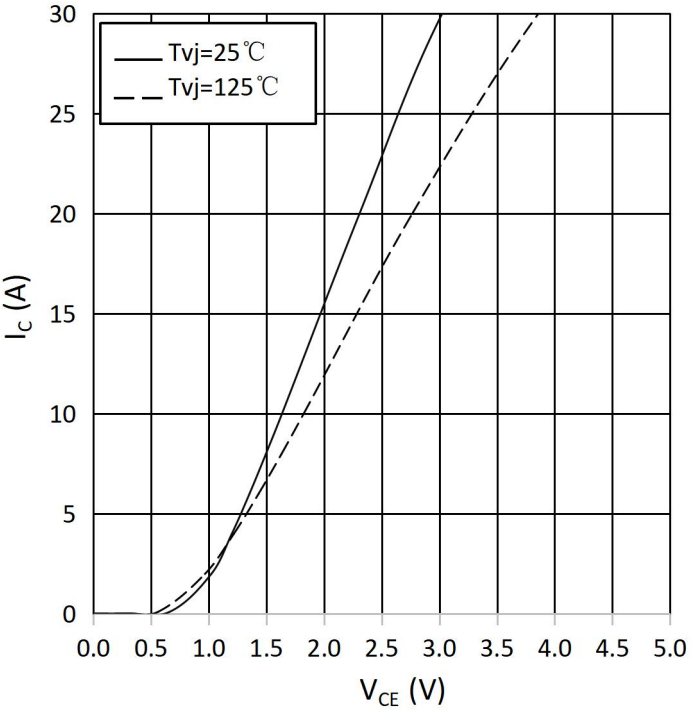
$I_F = 40A$, $V_{CE} = 600V$



output characteristic IGBT, Brake-Chopper (typical)

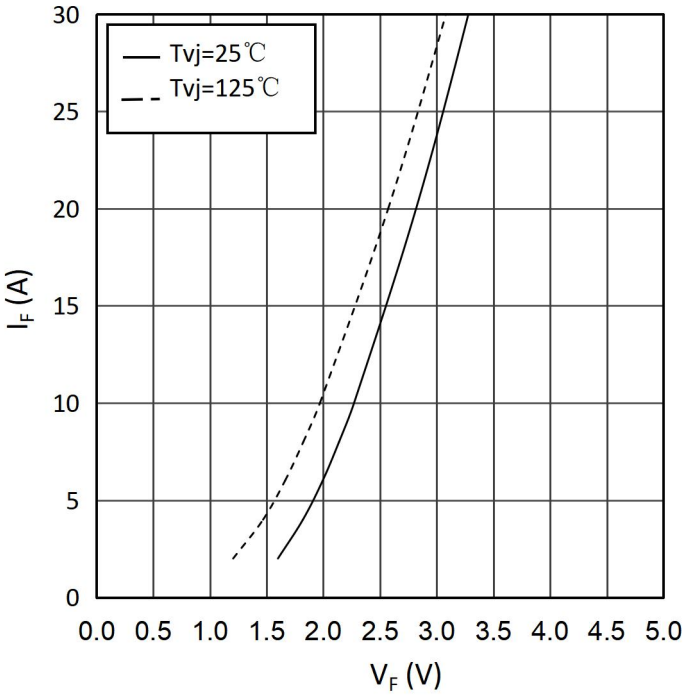
$I_C = f(V_{CE})$

$V_{GE} = 15V$



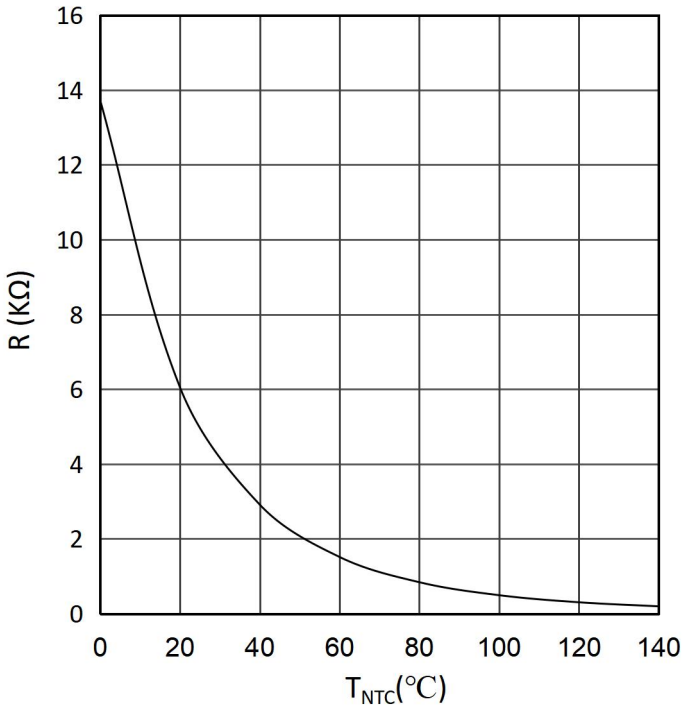
forward characteristic of Diode, Brake-Chopper (typical)

$I_F = f(V_F)$

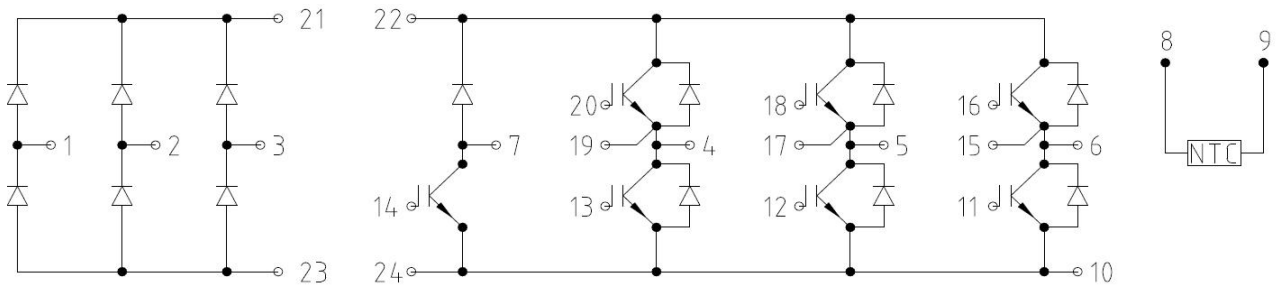


NTC- Thermistor- temperature characteristic(typical)

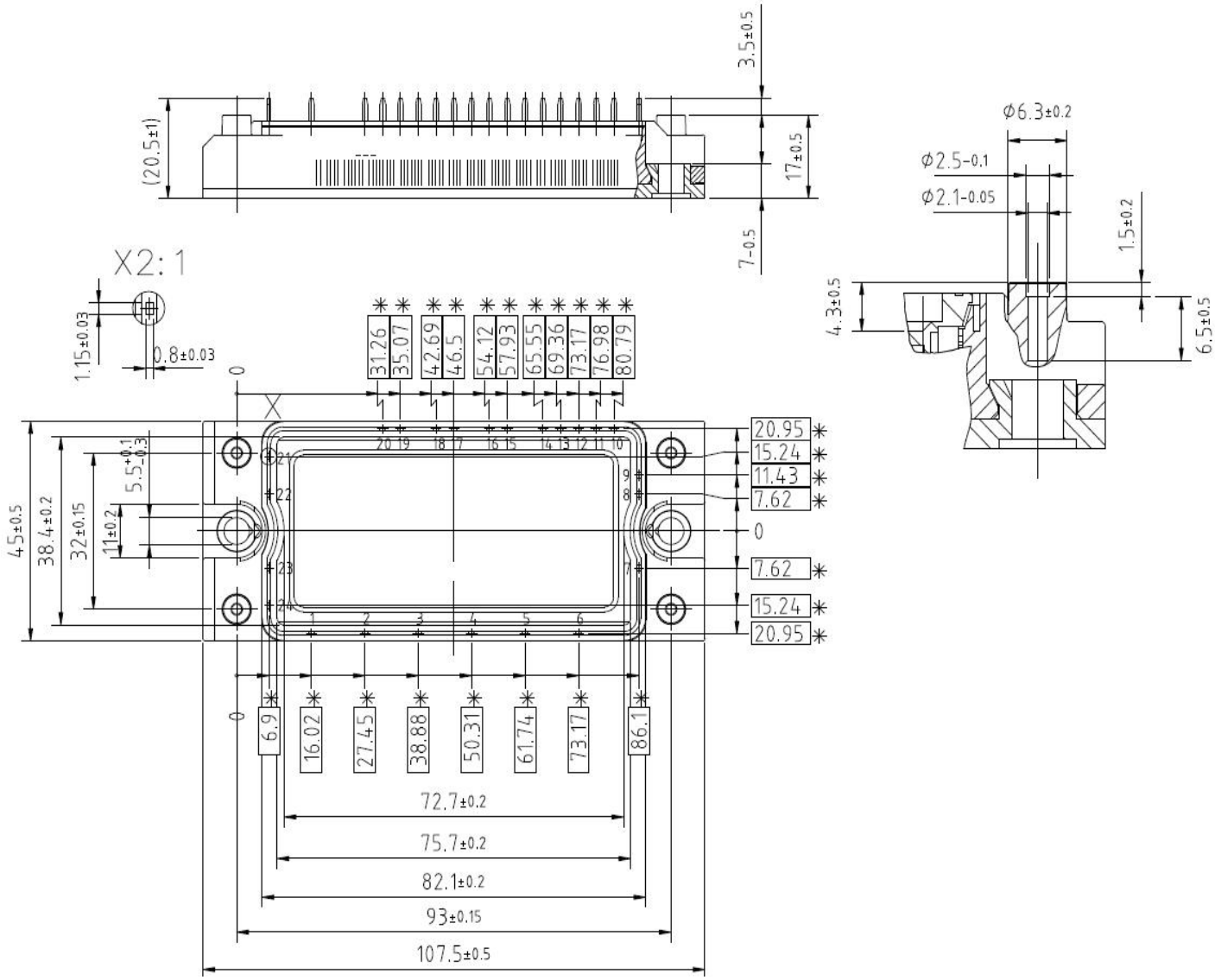
R=f (T)



Cricuit Diagram



Package Outlines



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