QMFP25R12HFF

1200V 25A IGBT Module

Electrical Features

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

Typical Applications

- Auxiliary Inverters
- Air Conditioning
- Motor Drives

Mechanical Features

- Al_2O_3 Substrate with Low Thermal Resistance
- Compact design
- Solder Contact Technology
- Rugged mounting due to integrated mounting clamps

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℃	25	A
I_{CRM}	Repetitive peak collector current	t_p= 1ms	50	A
P_{tot}	Total power dissipation	T_C=25℃ ,T_{vj}= 175℃	176	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℃		-	-	500	nA
$V_{GE(th)}$	Gate-emitter threshold voltage	I_C=0.8mA,V_{CE}=V_{GE},T_{vj}=25℃		5.2	5.77	6.5	V
V_{CEsat}	Collector-emitter saturation voltage	I_C=25A V_{GE}= 15V	T_{vj}=25℃	-	2.04	-	V
			T_{vj}= 125℃	-	2.43	-	
			T_{vj}= 150℃	-	2.53	-	
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=25A 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=25A V_{GE}=±15V $R_{G(on)}$=20Ω $R_{G(off)}$=20Ω	T_{vj}=25℃	-	56.5	-	ns
			T_{vj}= 125℃	-	43.2	-	
			T_{vj}= 150℃	-	40.5	-	
t_r	Rise time		T_{vj}=25℃	-	60.0	-	
			T_{vj}= 125℃	-	63.4	-	
			T_{vj}= 150℃	-	64.8	-	
$t_{d(off)}$	Turn-off delay time		T_{vj}=25℃	-	129.0	-	
			T_{vj}= 125℃	-	145.3	-	
			T_{vj}= 150℃	-	150.4	-	
t_f	Fall time		T_{vj}=25℃	-	196.5	-	
			T_{vj}= 125℃	-	320.2	-	
			T_{vj}= 150℃	-	329.3	-	
E_{on}	Turn-on energy (per pulse)		T_{vj}=25℃	-	3.21	-	mJ
			T_{vj}= 125℃	-	4.31	-	
			T_{vj}= 150℃	-	4.77	-	
E_{off}	Turn-off energy (per pulse)		T_{vj}=25℃	-	1.32	-	
			T_{vj}= 125℃	-	1.84	-	
			T_{vj}= 150℃	-	1.98	-	
SC data	Short-circuit current	V_{CC}=600V,V_{GE}≤ 15V,T_{vj}= 125℃ V_{CES}≤ 1200V,t_P≤ 10μs		-	107	-	A
R_{thJC}	Thermal resistance,junction to case	Per IGBT		-	0.75	0.85	K/W
R_{thCH}	Thermalresistance,case to heatsink	Per IGBT λgrease= 1W/(m·K)		-	0.7	-	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		25	A
I_{FRM}	Repetitive peak forward current	t_p= 1ms	50	A
I^2t	I^2t-value	V_R=0V,t_p= 10ms,T_{vj}= 150℃	75	A^2s

Characteristic Values

V_F	Continuous forward voltage	I_F=25A V_{GE}=0V	T_{vj}=25℃	-	2. 12	-	V
			T_{vj}= 125℃	-	1.85	-	
			T_{vj}= 150℃	-	1.79	-	
I_{RM}	Peak reverse recovery current	V_R=600V I_F=25A V_{GE}=- 15V	T_{vj}=25℃	-	21.9	-	A
			T_{vj}= 125℃	-	24.7	-	
			T_{vj}= 150℃	-	26.5	-	
t_{rr}	Reverse recovery time		T_{vj}=25℃	-	62.8	-	ns
			T_{vj}= 125℃	-	574	-	
			T_{vj}= 150℃	-	690	-	
Q_r	Recovered charge		T_{vj}=25℃	-	1.78	-	μC
			T_{vj}= 125℃	-	5.61	-	
			T_{vj}= 150℃	-	6.51	-	

E_{rec}	Reverse recovery energy		T_{vj}=25℃	-	1 82	-	mJ
			T_{vj}= 125℃	-	2.48	-	
			T_{vj}= 150℃	-	2.86	-	
R_{thJC}	Thermal resistance, junction to case	per diode		-	1.10	1.20	K/W
R_{thCH}	Thermal resistance, case to heatsink	per diode， λ_{grease}= 1 W/(m • K)		-	0.9	-	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℃	1800		V
I_{FRMSM}	Maximum RMS forward current per chip	T_C=80℃,T_{vj}= 175℃	60		A
I_{RMSM}	Maximum RMS current at rectifier output	T_C= 80℃	60		A
I_{FSM}	Surge forward current	tp = 10 ms, T_{vj} = 150℃	370		A
I^2t	I^2t-value	V_R=0V,t_p= 10ms,T_{vj}= 150℃	685		A^2s

Characteristic Values							
Symbol	Item	Conditions		Values			Unit
				Min.	Typ.	Max.	
V_F	Continuous forward voltage	I_F=25A V_{GE}=0V	T_{vj}=25℃	-	1.12	-	V
			T_{vj}= 125℃	-	-	-	
			T_{vj}= 150℃	-	-	-	
I_R	Reverse current	V_R= 1800V	T_{vj}=25℃	-	-	10	μA
			T_{vj}= 125℃	-	-	-	
			T_{vj}= 150℃	-	-	-	
R_{thJC}	Thermal resistance, junction to case	per diode		-	1.05	1.15	K/W
R_{thCH}	Thermal resistance, case to heatsink	per diode， λ_{grease}= 1 W/(m • K)		-	0.95	-	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℃	25		A
I_{CRM}	Repetitive peak collector current	t_p= 1ms	50		A
P_{tot}	Total power dissipation	T_C=25℃,T_{vj}= 175℃	175		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℃	-	-	500	nA
$V_{GE(th)}$	Gate-emitter threshold voltage	I_C=0.8mA,V_{CE}=V_{GE},T_{vj}=25℃	5.2	5.7	6.5	V

V_{CEsat}	Collector-emitter saturation voltage	I_C=25A V_{GE}= 15V	T_{vj}=25℃	-	2.24	-	V
			T_{vj}= 125℃	-	2.41	-	
			T_{vj}= 150℃	-	2.83	-	
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=25A 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=25A V_{GE}=±15V $R_{G(on)}$=20Ω $R_{G(off)}$=20Ω	T_{vj}=25℃	-	51.2	-	ns
			T_{vj}= 125℃	-	45.6	-	
			T_{vj}= 150℃	-	43.2	-	
t_r	Rise time		T_{vj}=25℃	-	88.8	-	
			T_{vj}= 125℃	-	84.8	-	
			T_{vj}= 150℃	-	85.6	-	
$t_{d(off)}$	Turn-off delay time		T_{vj}=25℃	-	133.6	-	
			T_{vj}= 125℃	-	150.4	-	
			T_{vj}= 150℃	-	156.0	-	
t_f	Fall time		T_{vj}=25℃	-	200. 1	-	
			T_{vj}= 125℃	-	262.4	-	
			T_{vj}= 150℃	-	339.2	-	
E_{on}	Turn-on energy (per pulse)		T_{vj}=25℃	-	3.46	-	mJ
			T_{vj}= 125℃	-	4.06	-	
			T_{vj}= 150℃	-	4.20	-	
E_{off}	Turn-off energy (per pulse)		T_{vj}=25℃	-	1.42	-	
			T_{vj}= 125℃	-	2.01	-	
			T_{vj}= 150℃	-	2. 11	-	
SC data	Short-circuit current	V_{CC}=600V,V_{GE}≤ 15V,T_{vj}= 125℃ V_{CES}≤ 1200V,t_P≤ 10μs		-	100	-	A
R_{thJC}	Thermal resistance,junction to case	Per IGBT		-	0.75	0.85	K/W
R_{thCH}	Thermalresistance,case to heatsink	Per IGBT λgrease= 1W/(m·K)		-	0.70	-	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℃		16			A^2s
Characteristic Values							
V_F	Continuous forward voltage	I_F= 10A V_{GE}=0V	T_{vj}=25℃	-	2.31	-	V
			T_{vj}= 125℃	-	2. 13	-	
			T_{vj}= 150℃	-	2.03	-	

I_{RM}	Peak reverse recovery current	V_R=600V I_F= 10A V_{GE}=- 15V	T_{vj}=25℃	-	22 74	-	A
			T_{vj}= 125℃	-	24.8	-	
			T_{vj}= 150℃	-	25.2	-	
t_{rr}	Reverse recovery time		T_{vj}=25℃	-	42.5	-	ns
			T_{vj}= 125℃	-	105. 1	-	
			T_{vj}= 150℃	-	199.6	-	
Q_r	Recovered charge		T_{vj}=25℃	-	0.68	-	μC
			T_{vj}= 125℃	-	4.23	-	
			T_{vj}= 150℃	-	4.95	-	
E_{rec}	Reverse recovery energy		T_{vj}=25℃	-	0.02	-	mJ
			T_{vj}= 125℃	-	1.85	-	
			T_{vj}= 150℃	-	2 23	-	
R_{thJC}	Thermal resistance, junction to case	per diode		-	1.75	1.90	K/W
R_{thCH}	Thermal resistance, case to heatsink	per diode， λ_{grease}= 1 W/(m • K)		-	1.30	-	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(underswitching)	-40~ 150			℃
T_{stg}	Storage temperature	-	-40~ 125			℃
Symbol	Item	Conditions	Values			Unit
			Min.	Typ.	Max.	
F	mountig force per clamp	-	40	-	80	N
ds	Creepage distance	Terminal to terminal	-	6.3	-	mm
		Terminal to base plate	-	11 5	-	
da	Clearance	Terminal to terminal	-	5	-	mm
		Terminal to base plate	-	10	-	
m	Weight	-	-	38	-	g

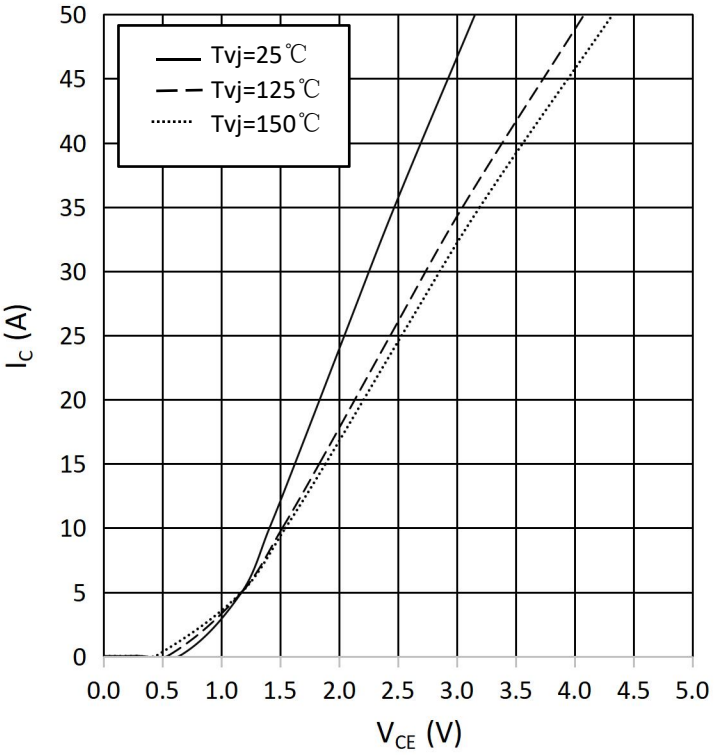
NTC Thermistor Characteristics

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)

$I_C = f(V_{CE})$

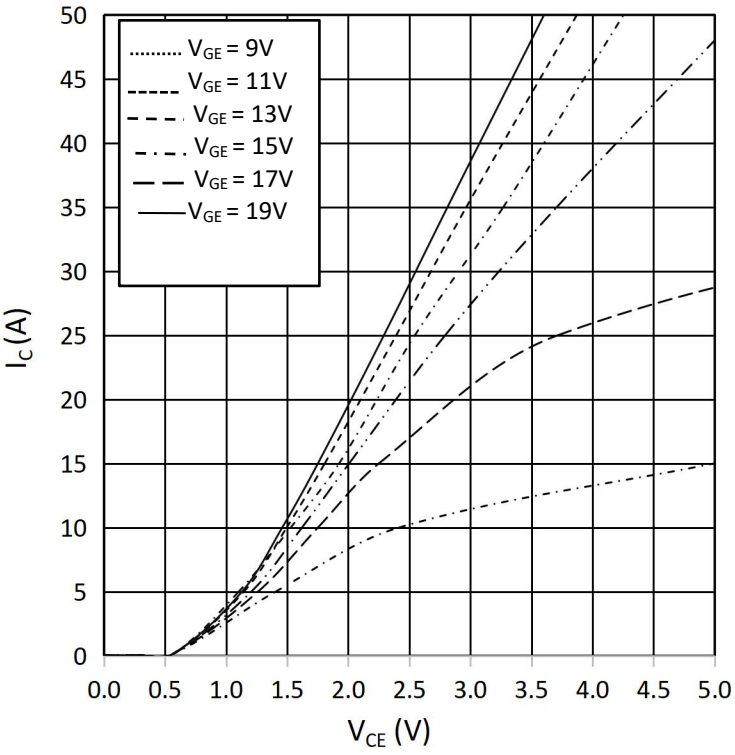
$V_{GE} = 15V$



output characteristic IGBT,Inverter (typical)

$I_C = f(V_{CE})$

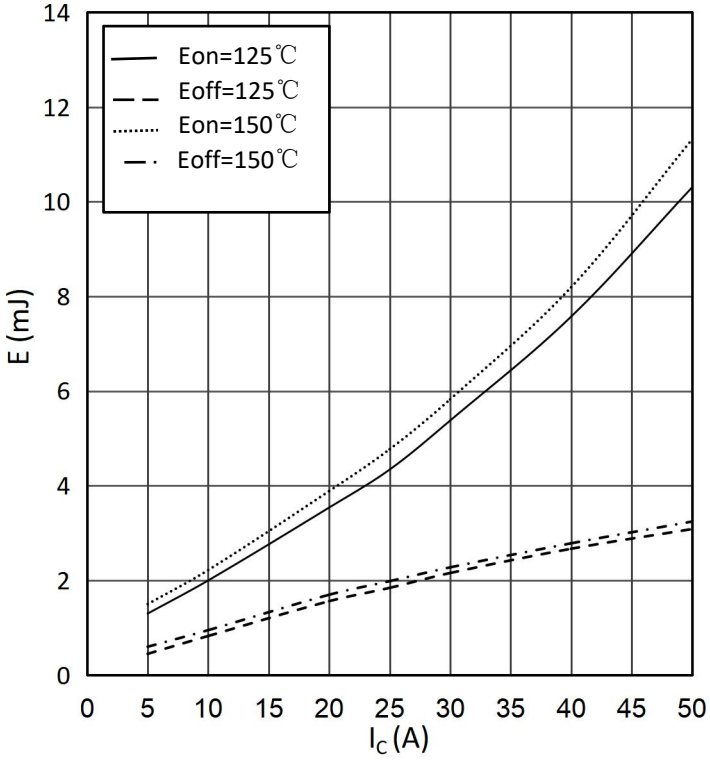
$T_{vj} = 150°C$



switching losses IGBT,Inverter (typical)

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

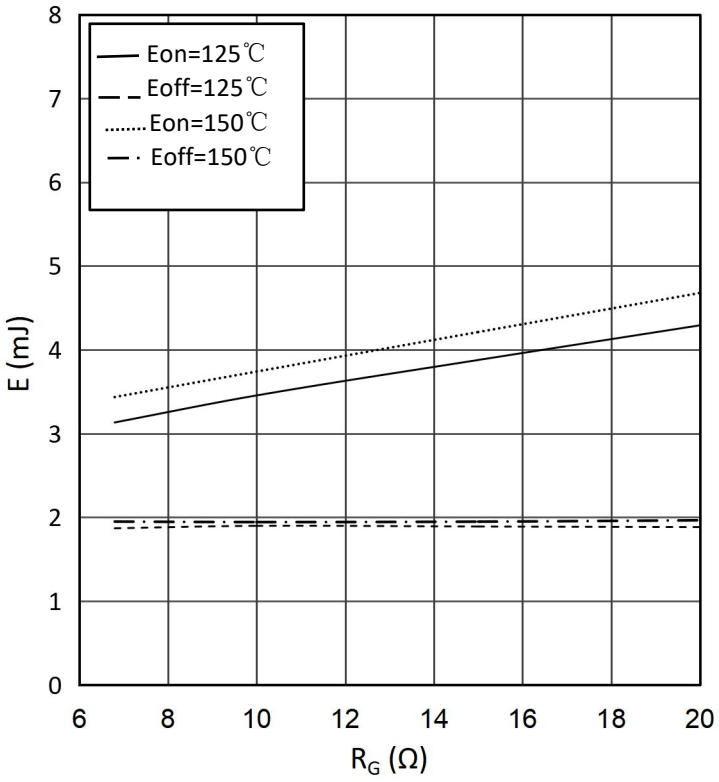
$V_{GE} = \pm 15V$, $R_{Gon} = 20\Omega$, $R_{Goff} = 20\Omega$, $V_{CE} = 600V$



switching losses IGBT,Inverter (typical)

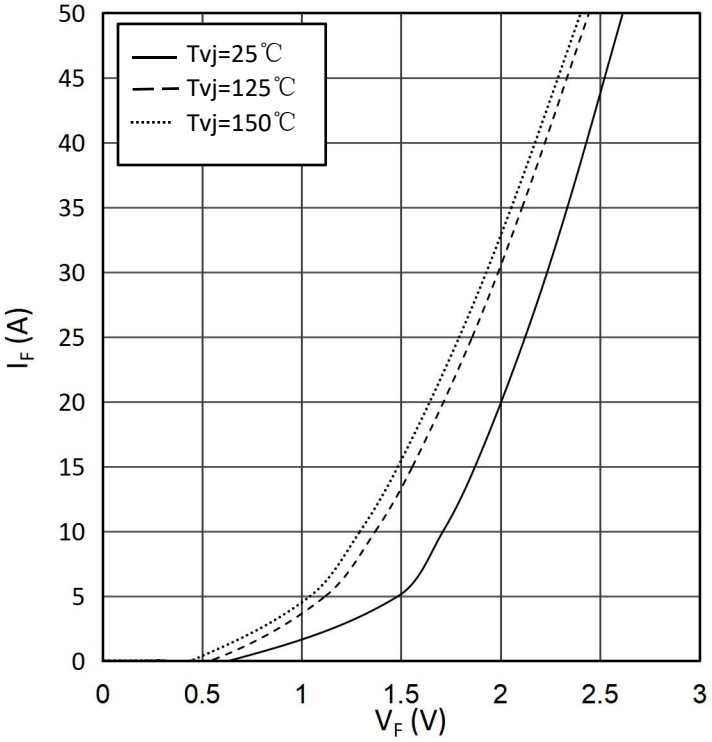
$E_{on} = f(R_G)$, $E_{off} = f(R_G)$

$V_{GE} = \pm 15V$, $I_C = 25A$, $V_{CE} = 600V$



forward characteristic of Diode, Inverter (typical)

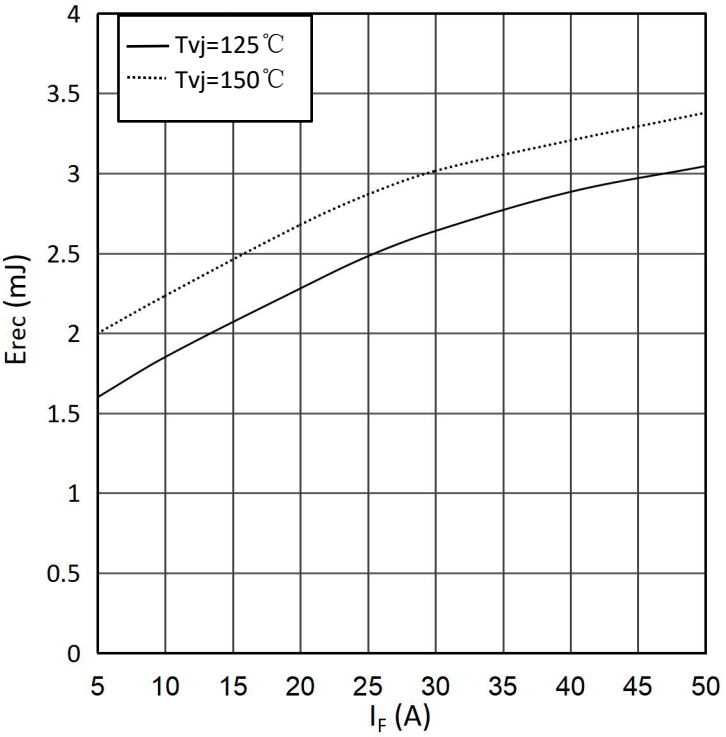
$I_F = f(V_F)$



switching losses Diode, Inverter (typical)

$E_{rec} = f(I_F)$

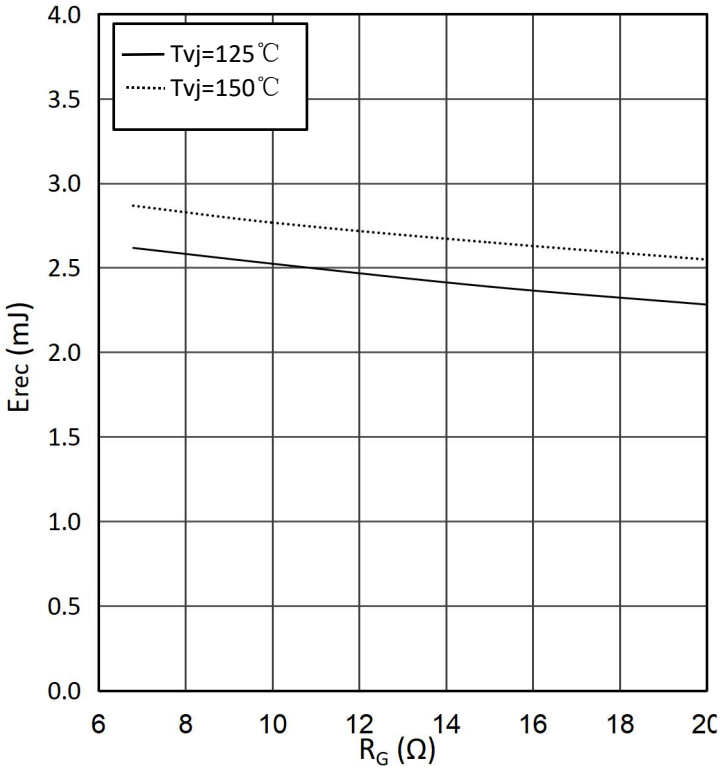
$R_{Gon} = 20\Omega$, $V_{CE} = 600$



switching losses Diode, Inverter (typical)

$E_{rec} = f(R_G)$

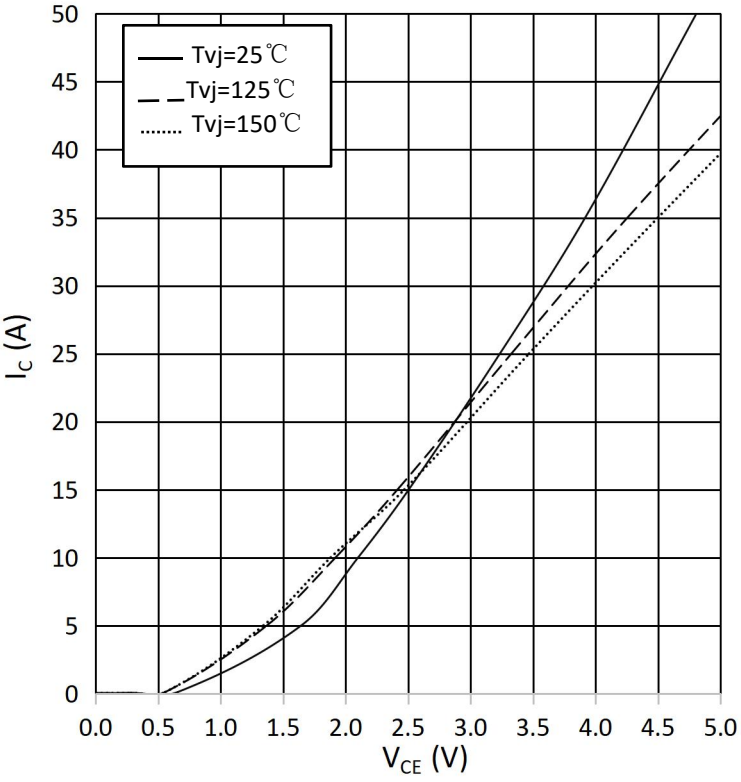
$I_F = 25A$, $V_{CE} = 600V$



output characteristic IGBT, Brake-Chopper (typical)

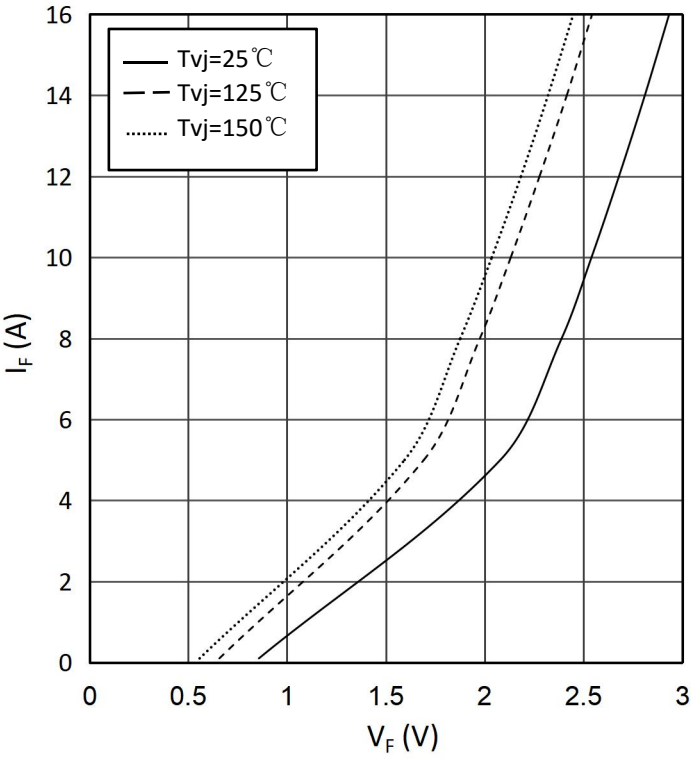
$I_C = f(V_{CE})$

$V_{GE} = 15V$



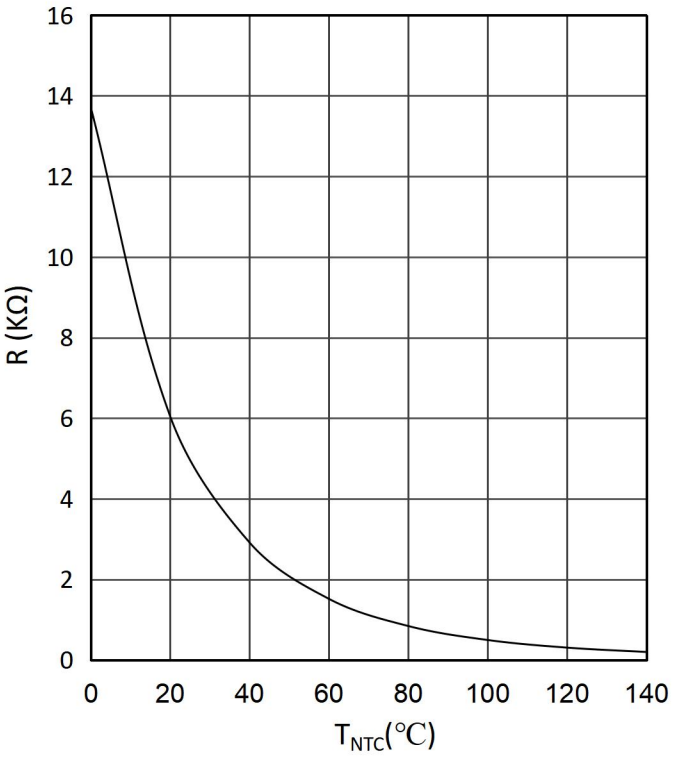
forward characteristic of Diode, Brake-Chopper (typical)

$I_F = f(V_F)$

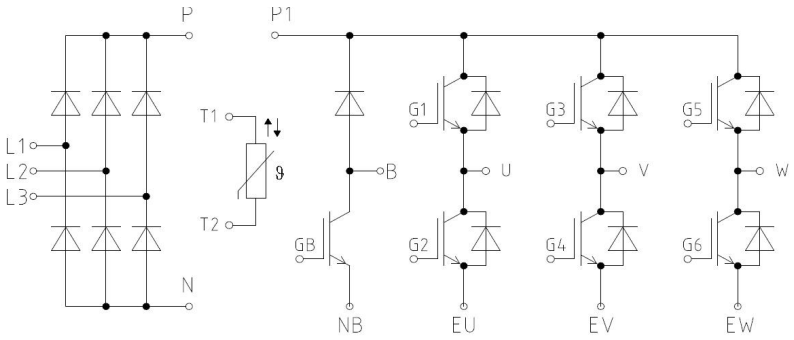


NTC- Thermistor- temperature characteristic(typical)

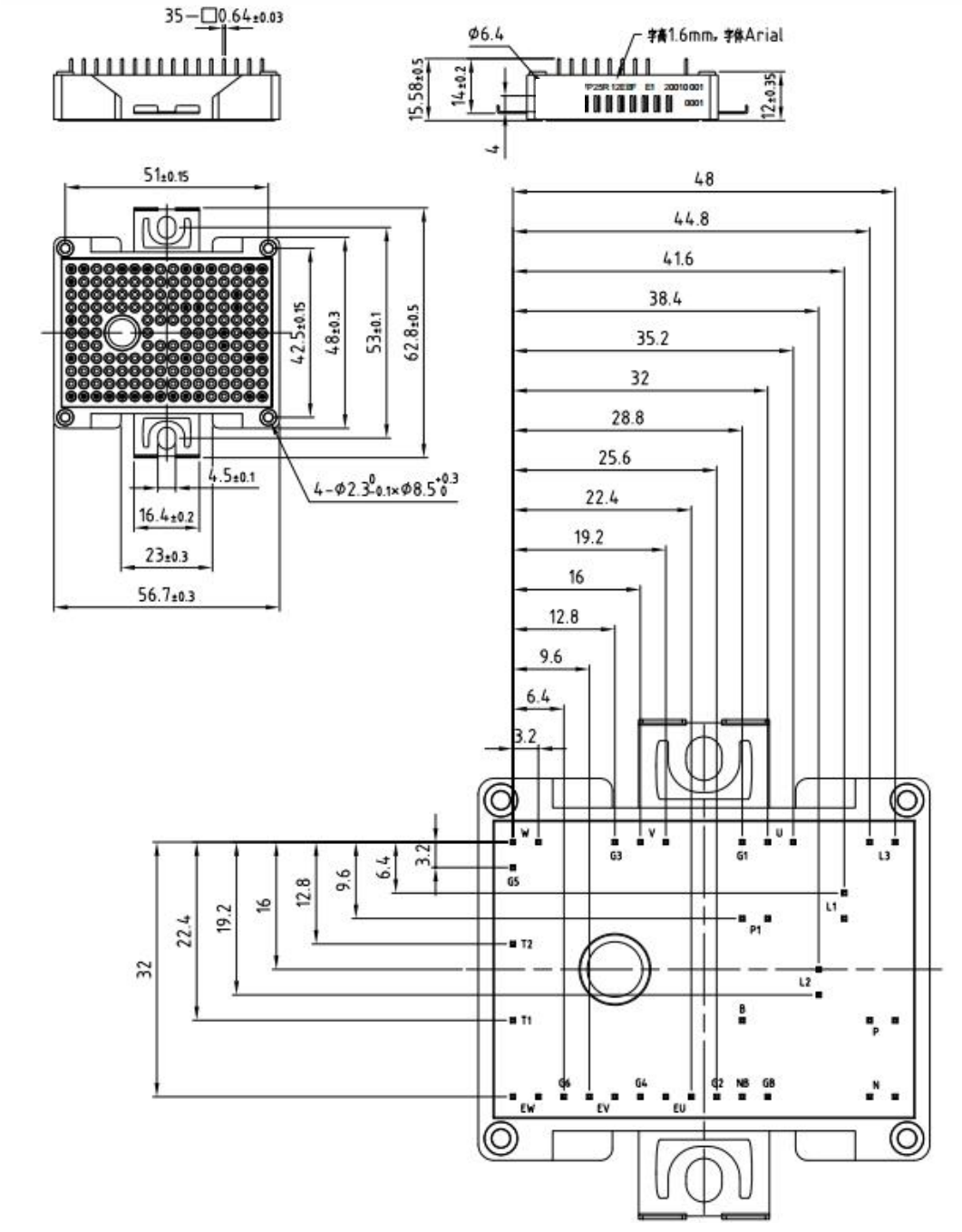
R=f (T)



Cricuit Diagram



Package Outlines



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