MPFP25R12FBF

1200V 25A 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℃		25	A
I_{CRM}	Repetitive peak collector current	t_p=1ms		50	A
P_{tot}	Total power dissipation	T_C=25℃,T_{vj}=175℃		158	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=0.8mA,V_{CE}=V_{GE},T_{vj}=25℃		5.2	5.6	6.6	V
V_{CEsat}	Collector-emitter saturation voltage	I_C=25A V_{GE}=15V	T_{vj}=25℃	-	2.10	-	V
			T_{vj}=125℃	-	2.40	-	
			T_{vj}=150℃	-	2.49	-	
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 $R_{G(on)}$=33Ω $R_{G(off)}$=33Ω	T_{vj}=25°C	-	88.1	-	ns
			T_{vj}=125°C	-	96.0	-	
			T_{vj}=150°C	-	98.1	-	
t_r	Rise time		T_{vj}=25°C	-	60.4	-	
			T_{vj}=125°C	-	67.2	-	
			T_{vj}=150°C	-	68.6	-	
$t_{d(off)}$	Turn-off delay time		T_{vj}=25°C	-	173.4	-	
			T_{vj}=125°C	-	224.0	-	
			T_{vj}=150°C	-	225.6	-	
t_f	Fall time		T_{vj}=25°C	-	246.2	-	
			T_{vj}=125°C	-	289.6	-	
			T_{vj}=150°C	-	319.2	-	
E_{on}	Turn-on energy (per pulse)	V_{CC}=600V，I_C=25A V_{GE}=±15V，$R_{G(on)}$=33Ω di/dt=900A/μs(T_{vj}=150°C)	T_{vj}=25°C	-	4.94	-	mJ
			T_{vj}=125°C	-	5.65	-	
			T_{vj}=150°C	-	5.90	-	
E_{off}	Turn-off energy (per pulse)	V_{CC}=600V，I_C=25A V_{GE}=±15V，$R_{G(off)}$=33Ω du/dt=4600V/μs(T_{vj}=150°C)	T_{vj}=25°C	-	1.50	-	
			T_{vj}=125°C	-	1.89	-	
			T_{vj}=150°C	-	1.97	-	
SC data	Short-circuit current	V_{CC}=600V,V_{GE}≤15V,T_{vj}=125°C V_{CES}≤1200V,t_P≤10μs		-	90	-	A
R_{thJC}	Thermal resistance,junction to case	Per IGBT		-	-	0.95	K/W
R_{thCH}	Thermalresistance,case to heatsink	Per IGBT λgrease=1W/(m·K)		-	0.36	-	K/W
T_{vjop}	Temperature under switching conditions			-40		150	°C

Diode，Inverter

Maximum Rated Values

Symbol	Item	Conditions	Rating	Unit
V_{RRM}	Repetitive peak reverse voltage	T_{vj}=25°C	1200	V
I_F	Forward current,DC	T_C=80°C,T_{vj}=175°C	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}=125°C	170	A^2s

Characteristic Values

				Min.	Typ.	Max.	
V_F	Continuous forward voltage	I_F=25A V_{GE}=0V	T_{vj}=25°C	-	1.86	-	V
			T_{vj}=125°C	-	1.83	-	
			T_{vj}=150°C	-	1.80	-	
I_{RM}	Peak reverse recovery current	V_R=600V I_F=25A V_{GE}=-15V -di_F/dt=900A/μs (T_{vj}=150°C)	T_{vj}=25°C	-	22.5	-	A
			T_{vj}=125°C	-	24.0	-	
			T_{vj}=150°C	-	26.2	-	
t_{rr}	Reverse recovery time		T_{vj}=25°C	-	263	-	ns
			T_{vj}=125°C	-	619.7	-	
			T_{vj}=150°C	-	639.4	-	
Q_r	Recovered charge		T_{vj}=25°C	-	2.06	-	μC
			T_{vj}=125°C	-	5.32	-	
			T_{vj}=150°C	-	5.95	-	

E_{rec}	Reverse recovery energy		T_{vj}=25℃	-	1.38	-	mJ
			T_{vj}=125℃	-	2.12	-	
			T_{vj}=150℃	-	2.29	-	
R_{thJC}	Thermal resistance, junction to case	per diode		-	-	1.35	K/W
R_{thCH}	Thermal resistance, case to heatsink	Per diode，λ_{grease}=1 W/(m • K)		-	0.51	-	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℃	80		A
I^2t	I^2t-value	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=25A V_{GE}=0V	T_{vj}=25℃	-	1.22	-	V
			T_{vj}=125℃	-	1.07	-	
			T_{vj}=150℃	-	1.05	-	
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℃	108	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	5.85	6.6	V
V_{CEsat}	Collector-emitter saturation voltage	I_C=15A V_{GE}=15V	T_{vj}=25℃	-	1.91	-	
			T_{vj}=125℃	-	2.25	-	
			T_{vj}=150℃	-	2.33	-	

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 $R_{G(on)}$=33Ω $R_{G(off)}$=33Ω	T_{vj}=25℃	-	33.0	-	ns
			T_{vj}=125℃	-	84.8	-	
			T_{vj}=150℃	-	88.1	-	
t_r	Rise time		T_{vj}=25℃	-	290.0	-	
			T_{vj}=125℃	-	417.6	-	
			T_{vj}=150℃	-	423.1	-	
$t_{d(off)}$	Turn-off delay time		T_{vj}=25℃	-	120.4	-	
			T_{vj}=125℃	-	145.6	-	
			T_{vj}=150℃	-	158.1	-	
t_f	Fall time		T_{vj}=25℃	-	339.8	-	
			T_{vj}=125℃	-	418.4	-	
			T_{vj}=150℃	-	460.8	-	
E_{on}	Turn-on energy (per pulse)		T_{vj}=25℃	-	1.61	-	mJ
			T_{vj}=125℃	-	1.96	-	
			T_{vj}=150℃	-	2.03	-	
E_{off}	Turn-off energy (per pulse)		T_{vj}=25℃	-	0.85	-	
			T_{vj}=125℃	-	0.93	-	
			T_{vj}=150℃	-	0.98	-	
SC data	Short-circuit current	V_{CC}=600V,V_{GE}≤15V,T_{vj}=125℃ V_{CES}≤1200V,t_P≤10μs		-	55	-	A
R_{thJC}	Thermal resistance,junction to case	Per IGBT		-	-	1.4	K/W
R_{thCH}	Thermalresistance,case to heatsink	Per IGBT λgrease=1W/(m·K)		-	0.53	-	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℃	-	1.22		V
			T_{vj}=125℃	-	1.07	-	
			T_{vj}=150℃	-	1.05	-	

I_{RM}	Peak reverse recovery current	V_R=600V I_F=10A V_{GE}=-15V -di$_F$/dt=730A/μs (T_{vj}=150°C)	T_{vj}=25°C	-	11.25	-	A
			T_{vj}=125°C	-	12.1	-	
			T_{vj}=150°C	-	12.4	-	
t_{rr}	Reverse recovery time		T_{vj}=25°C	-	101.8	-	ns
			T_{vj}=125°C	-	622.1	-	
			T_{vj}=150°C	-	665.3	-	
Q_r	Recovered charge		T_{vj}=25°C	-	2.21	-	μC
			T_{vj}=125°C	-	3.48	-	
			T_{vj}=150°C	-	3.82	-	
E_{rec}	Reverse recovery energy		T_{vj}=25°C	-	1.26	-	mJ
			T_{vj}=125°C	-	1.49	-	
			T_{vj}=150°C	-	1.72	-	
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)		-	0.875	-	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

NTC Thermistor Characteristics

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

Module

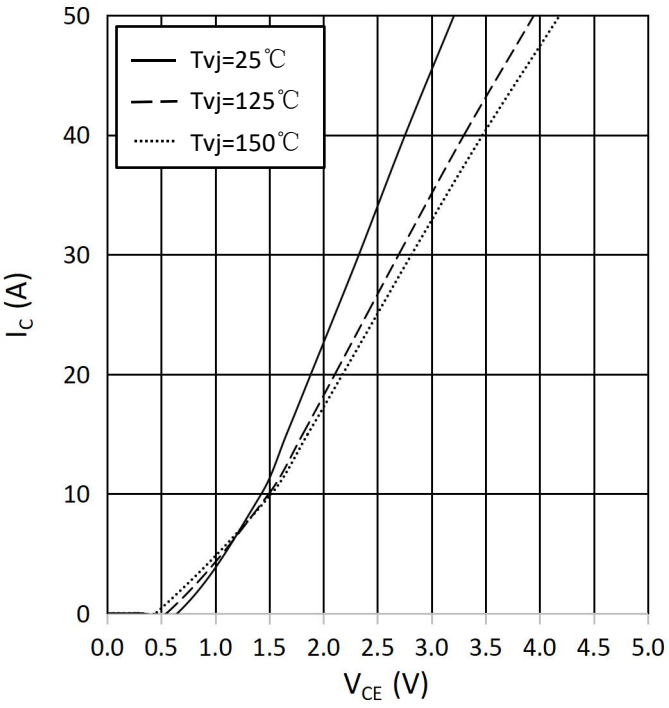
Symbol	Item	Conditions	Rating	Unit
V_{ISOL}	Isolation voltage	Terminals to baseplate，RMS,f=50Hz,t=1min	2500	V
T_{vjmax}	Maximum junction temperature	-	175	℃
T_{vjop}	Operating junction temperature	Continuous operationg(under switching)	-40~150	℃
T_{stg}	Storage temperature	-	-40~125	℃

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

output characteristic IGBT,Inverter (typical)

$I_C = f(V_{CE})$

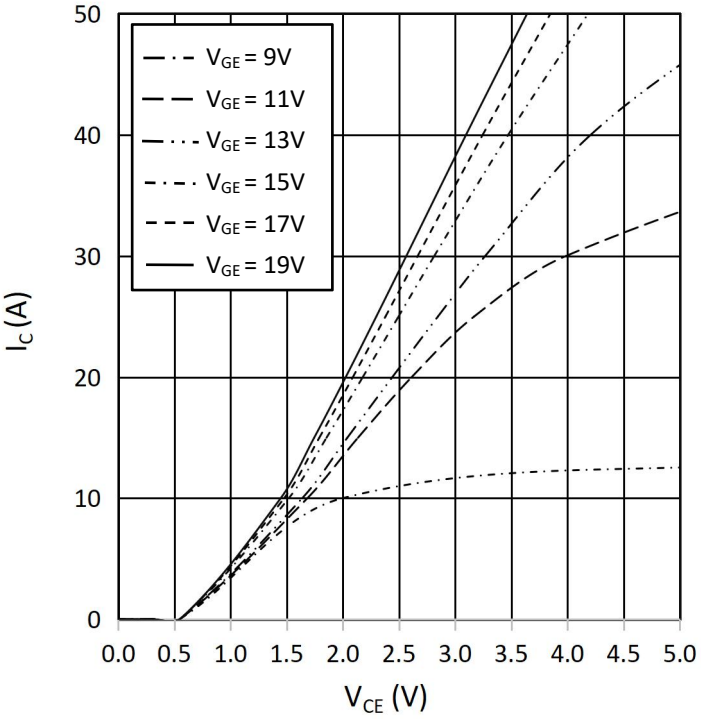
$V_{GE} = 15V$



output characteristic IGBT,Inverter (typical)

$I_C = f(V_{CE})$

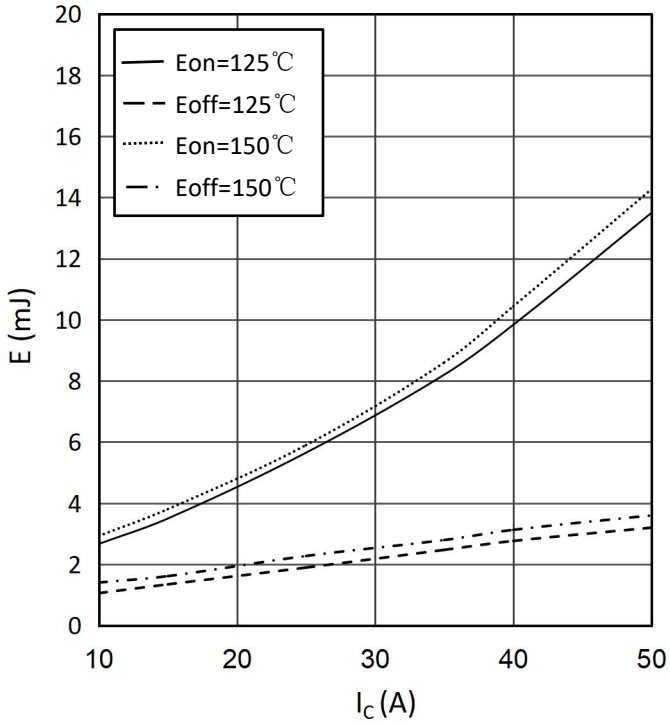
$T_{vj} = 150°C$



switching losses IGBT,Inverter (typical)

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

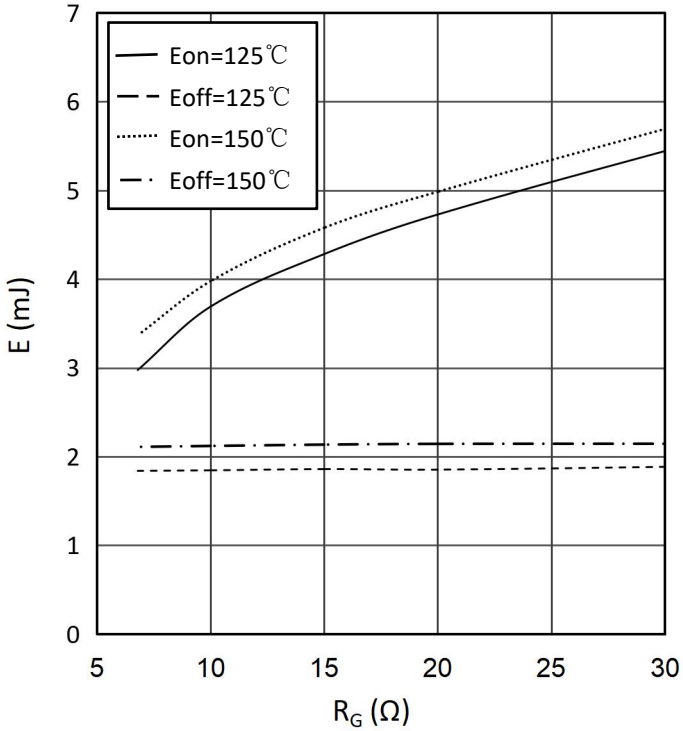
$V_{GE} = \pm 15V$, $R_{Gon} = 33\Omega$, $R_{Goff} = 33\Omega$, $V_{CE} = 600V$



switching losses IGBT,Inverter (typical)

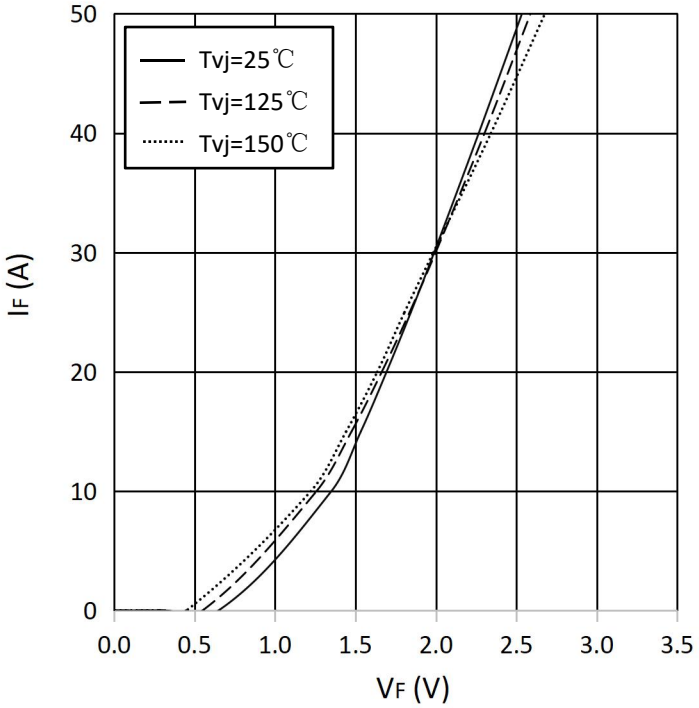
$E_{on} = f(R_G)$, $E_{off} = f(R_G)$

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



forward characteristic of Diode, Inverter (typical)

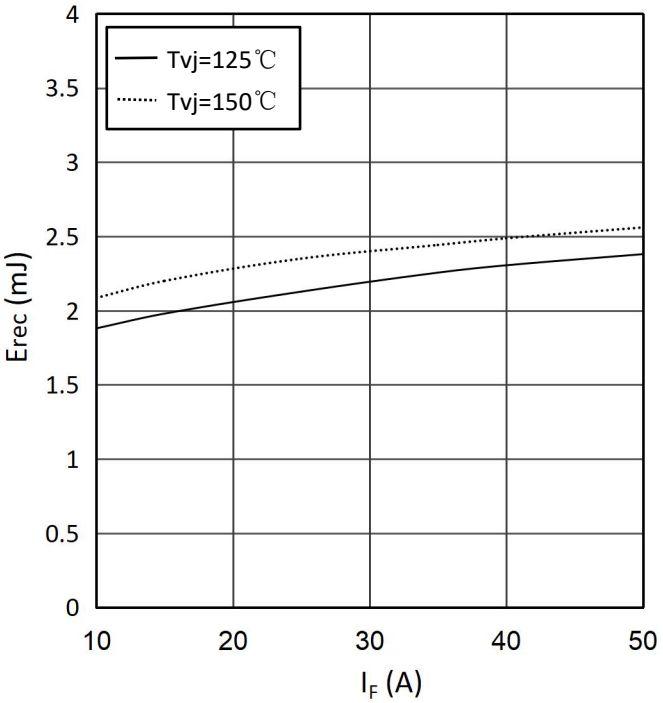
$I_F = f(V_F)$



switching losses Diode, Inverter (typical)

$E_{rec} = f(I_F)$

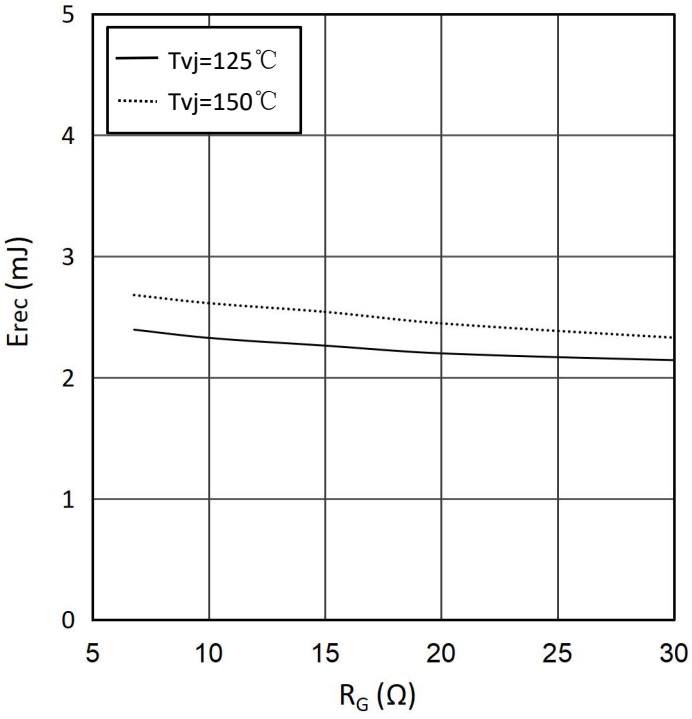
$R_{Gon} = 33\Omega$, $V_{CE} = 600$ V



switching losses Diode, Inverter (typical)

$E_{rec} = f(R_G)$

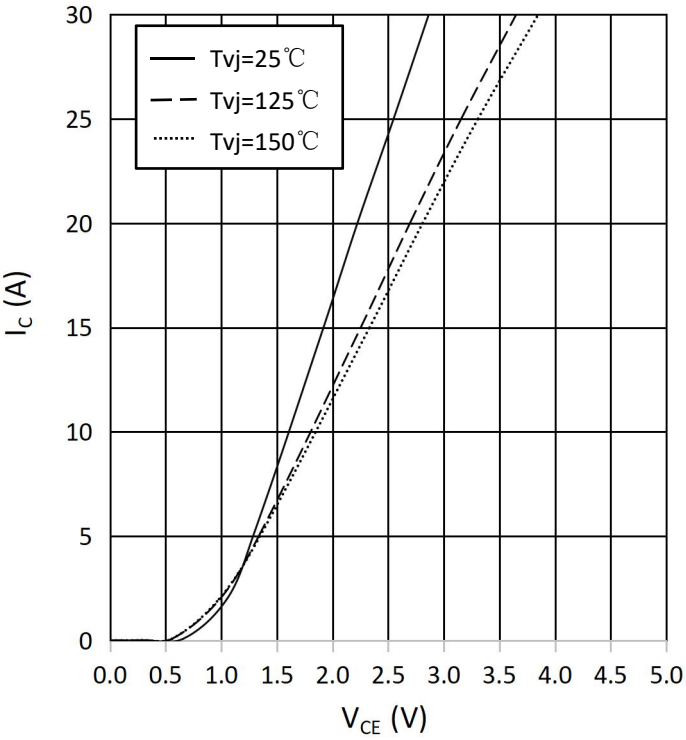
$I_F = 25A$, $V_{CE} = 600V$



output characteristic IGBT, Brake-Chopper (typical)

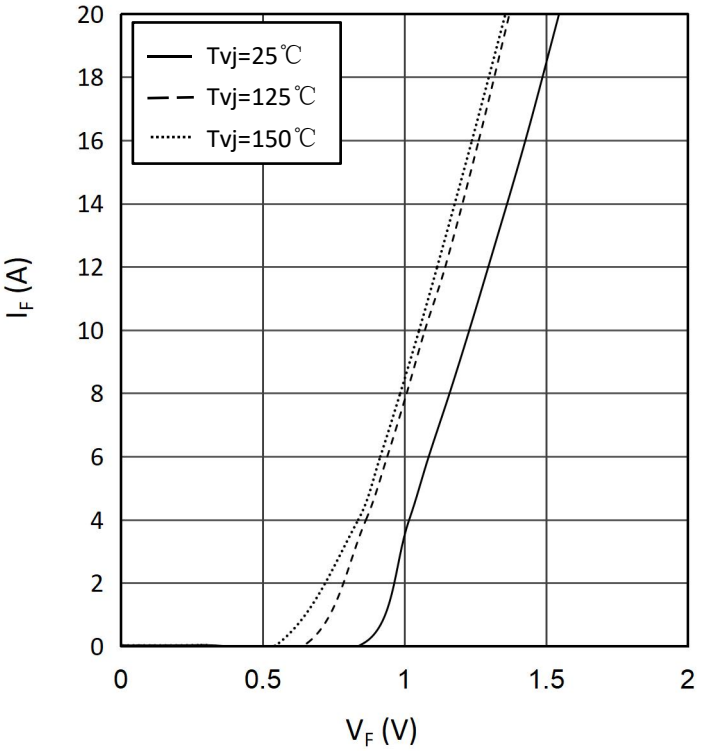
$I_C = f(V_{CE})$

$V_{GE} = 15V$



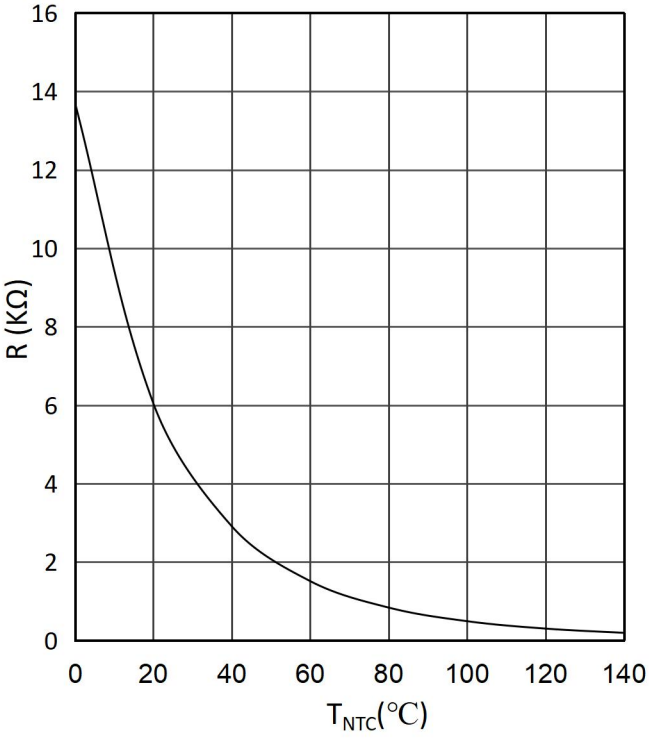
forward characteristic of Diode, Brake-Chopper (typical)

$I_F = f(V_F)$



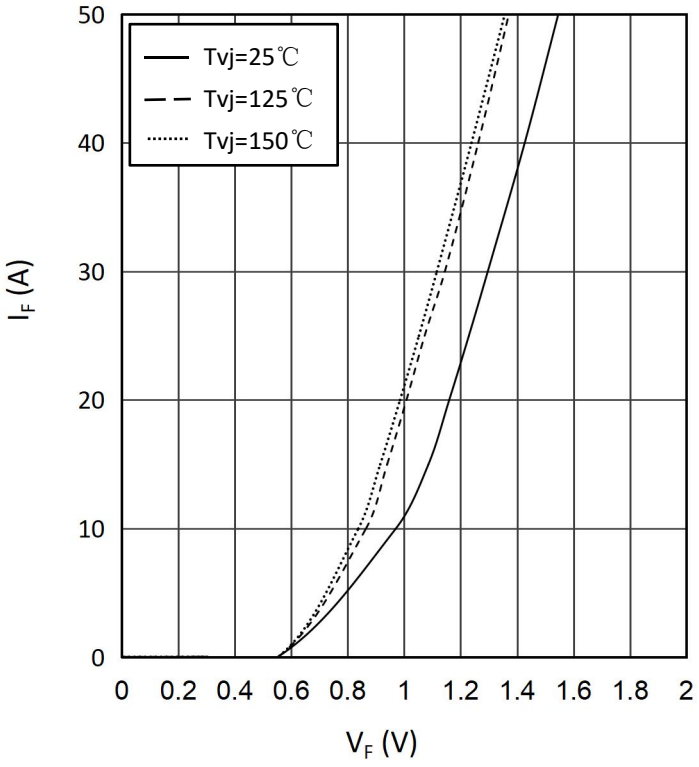
NTC-Thermistor-temperature characteristic(typical)

R=f (T)

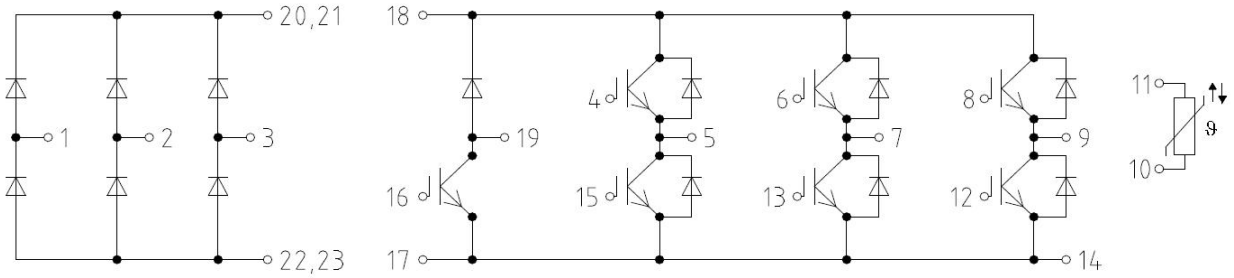


Forward characteristic of Diode, Rectifier(typical)

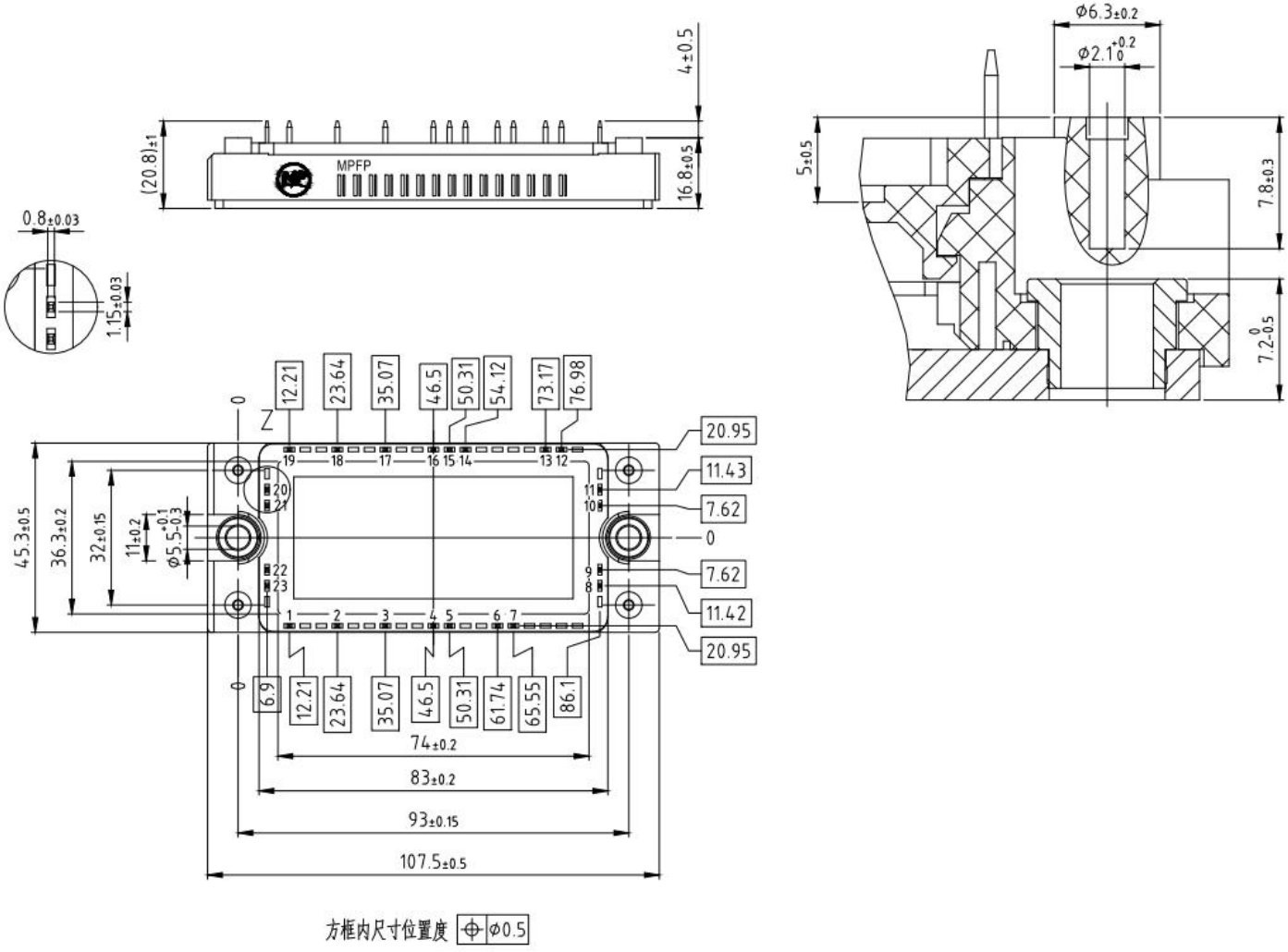
$I_F = f(V_F)$



Cricuit Diagram



Package Outlines



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