Electrical Features

- Trench/Fieldstop IGBT6
- V_{CEsat} with positive Temperature Coefficient
- Low V_{CEsat}

Typical Applications

- Auxiliary inverters
- Motor drives
- Servo drives

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°C		1200		V
V_{GES}	Gate-emitter voltage	-		±20		V
I_C	Collector current,DC	T_C=100°C,T_{vj}=175°C		40		A
I_{CRM}	Repetitive peak collector current	t_p=1ms		80		A
P_{tot}	Total power dissipation	T_C=25°C,T_{vj}=175°C		183		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°C		-	- 1	mA
I_{GES}	Gate leakage current	V_{CE}=0V,V_{GE}=20V,T_{vj}=25°C		-	- 100	nA
$V_{GE(th)}$	Gate-emitter threshold voltage	I_C=1.5mA,V_{CE}=V_{GE},T_{vj}=25°C		5.2	6.0 6.6	
V_{CEsat}	Collector-emitter saturation voltage	I_C=40A V_{GE}=15V	T_{vj}=25°C	-	1.78 2.3	V
			T_{vj}=125°C	-	2.07 -	
			T_{vj}=150°C	-	2.13 -	
C_{ies}	Input capacitance	V_{CE}=25V,V_{GE}=0V f=1MHz,T_{vj}=25°C		-	5.95 -	nF
C_{oes}	Output capacitance			-	0.335 -	
C_{res}	Reverse transfer capacitance			-	0.064 -	
Q_G	Gate charge	V_{CC}=600V,I_C=40A V_{GE}=-15...+15V,T_{vj}=25°C		-	0.24 -	µC
R_g	Internal gate resistance	T_{vj}=25°C		-	- -	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℃	-	108	-	ns
			T_{vj}=125℃	-	147	-	
			T_{vj}=150℃	-	153	-	
t_r	Rise time		T_{vj}=25℃	-	103	-	
			T_{vj}=125℃	-	123	-	
			T_{vj}=150℃	-	163	-	
$t_{d(off)}$	Turn-off delay time		T_{vj}=25℃	-	141	-	
			T_{vj}=125℃	-	168	-	
			T_{vj}=150℃	-	188	-	
t_f	Fall time		T_{vj}=25℃	-	168	-	
			T_{vj}=125℃	-	228	-	
			T_{vj}=150℃	-	243	-	
E_{on}	Turn-on energy (per pulse)	V_{CC}=600V, I_C=40A V_{GE}=±15V, $R_{G(on)}$=30Ω di/dt=1520A/μs(T_{vj}=150℃)	T_{vj}=25℃	-	5.21	-	mJ
			T_{vj}=125℃	-	8.44	-	
			T_{vj}=150℃	-	9.11	-	
E_{off}	Turn-off energy (per pulse)	V_{CC}=600V, I_C=40A V_{GE}=±15V, $R_{G(off)}$=30Ω du/dt=4700V/μs(T_{vj}=150℃)	T_{vj}=25℃	-	1.32	-	
			T_{vj}=125℃	-	2.53	-	
			T_{vj}=150℃	-	2.98	-	
SC data	Short-circuit current	V_{CC}=600V,V_{GE}≤15V,T_{vj}=25℃ V_{CES}≤1200V,t_P≤10μs		-	240	-	A
R_{thJC}	Thermal resistance,junction to case	Per IGBT		-	-	0.82	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		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℃	-	2.06	2.4	V
			T_{vj}=125℃	-	1.73	-	
			T_{vj}=150℃	-	1.70	-	
I_{RM}	Peak reverse recovery current	V_R=600V I_F=40A V_{GE}=-15V -di$_F$/dt=590A/μs (T_{vj}=150℃)	T_{vj}=25℃	-	25	-	A
			T_{vj}=125℃	-	27	-	
			T_{vj}=150℃	-	28	-	
t_{rr}	Reverse recovery time		T_{vj}=25℃	-	621	-	ns
			T_{vj}=125℃	-	855	-	
			T_{vj}=150℃	-	872	-	
Q_r	Recovered charge		T_{vj}=25℃	-	1.8	-	μC
			T_{vj}=125℃	-	5.9	-	
			T_{vj}=150℃	-	6.5	-	

E_{rec}	Reverse recovery energy		T_{vj}=25℃	-	0.5	-	mJ
			T_{vj}=125℃	-	1.3	-	
			T_{vj}=150℃	-	1.8	-	
R_{thJC}	Thermal resistance,junction to case	Per diode		-	-	1.0	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_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℃	-	1.76	2.2	V
			T_{vj}=125℃	-	1.55	-	
			T_{vj}=150℃	-	1.50	-	
I_R	Reverse current	V_R=1800V	T_{vj}=25℃	-	-	10	uA
			T_{vj}=125℃	-	-	-	
			T_{vj}=150℃	-	-	-	
R_{thJC}	Thermal resistance,junction to case	Per diode		-	-	1	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	℃

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℃		123			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℃	-	2.10	-	
			T_{vj}=150℃	-	2.40	-	

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℃		-	0.094	-	μC
R_g	Internal gate resistance	T_{vj}=25℃		-	-	-	Ω
$t_{d(on)}$	Turn-on delay time	V_{CC}=600V I_C=20A V_{GE}=±15V $R_{G(on)}$=30Ω $R_{G(off)}$=30Ω	T_{vj}=25℃	-	63	-	ns
			T_{vj}=125℃	-	96	-	
			T_{vj}=150℃	-	97	-	
t_r	Rise time		T_{vj}=25℃	-	48	-	
			T_{vj}=125℃	-	65	-	
			T_{vj}=150℃	-	66	-	
$t_{d(off)}$	Turn-off delay time		T_{vj}=25℃	-	151	-	
			T_{vj}=125℃	-	179	-	
			T_{vj}=150℃	-	191	-	
t_f	Fall time		T_{vj}=25℃	-	421	-	
			T_{vj}=125℃	-	601	-	
			T_{vj}=150℃	-	802	-	
E_{on}	Turn-on energy (per pulse)	V_{CC}=600V, I_C=20A V_{GE}=±15V, $R_{G(on)}$=30Ω di/dt=1085A/μs(T_{vj}=150℃)	T_{vj}=25℃	-	1.35	-	mJ
			T_{vj}=125℃	-	3.94	-	
			T_{vj}=150℃	-	4.21	-	
E_{off}	Turn-off energy (per pulse)	V_{CC}=600V, I_C=20A V_{GE}=±15V, $R_{G(off)}$=30Ω du/dt=5180V/μs(T_{vj}=150℃)	T_{vj}=25℃	-	0.45	-	
			T_{vj}=125℃	-	1.34	-	
			T_{vj}=150℃	-	1.40	-	
SC data	Short-circuit current	V_{CC}=600V,V_{GE}≤15V,T_{vj}=25℃ V_{CES}≤1200V,t_P≤10μs		-	93	-	A
R_{thJC}	Thermal resistance,junction to case	Per IGBT		-	-	1.22	K/W
R_{thCH}	Thermalresistance,case to heatsink	Per IGBT / λgrease=1W/(m·K)		-	-	-	K/W
Tv_{jop}	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℃	-	2.20	2.5	V
			T_{vj}=125℃	-	1.90	-	
			T_{vj}=150℃	-	1.70	-	
I_{RM}	Peak reverse recovery current	V_R=600V I_F=20A V_{GE}=-15V	T_{vj}=25℃	-	14	-	A
			T_{vj}=125℃	-	16	-	
			T_{vj}=150℃	-	17	-	

Trr	Reverse recovery time	V_R=600V I_F=20A V_{GE}=-15V -di$_F$/dt=660A/μs (T_{vj}=150℃)	T_{vj}=25℃	-	101	-	ns
			T_{vj}=125℃	-	169	-	
			T_{vj}=150℃	-	210	-	
Q_r	Recovered charge		T_{vj}=25℃	-	3.1	-	μC
			T_{vj}=125℃	-	5.5	-	
			T_{vj}=150℃	-	6.0	-	
E_{rec}	Reverse recovery energy		T_{vj}=25℃	-	1.01	-	mJ
			T_{vj}=125℃	-	2.68	-	
			T_{vj}=150℃	-	2.70	-	
R_{thJC}	Thermal resistance, junction to case	per diode		-	-	2.87	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

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	-	

Module

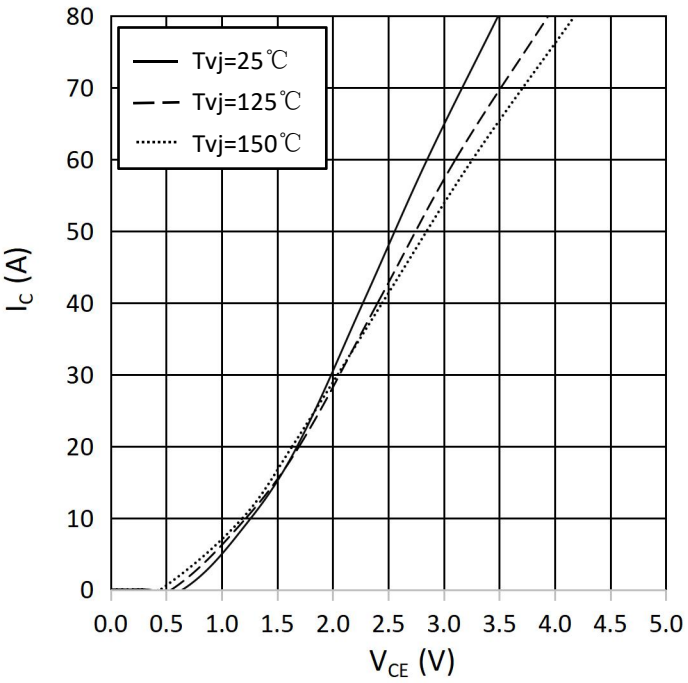
Symbol	Item	Conditions	Rating	Unit
V_{ISOL}	Isolation voltage	Terminals to baseplate，RMS,f=50Hz,t=1min	2500	V
$T_{vj\ max}$	Maximum junction temperature	-	175	℃
$T_{vj\ op}$	Operating junction temperature	Continuous operationg(under switching)	-40~150	℃
T_{stg}	Storage temperature	-	-40~125	℃

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	-	-	175	-	g

output characteristic IGBT,Inverter (typical)

$I_C = f(V_{CE})$

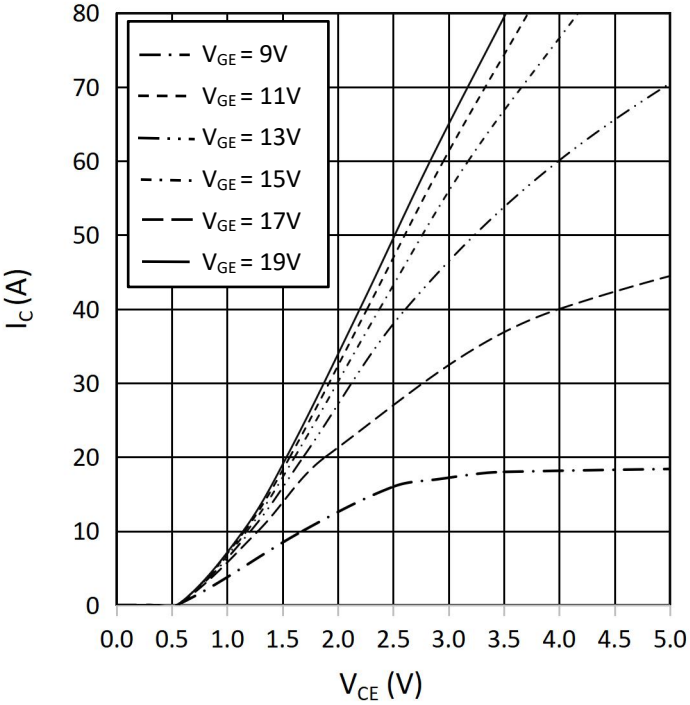
$V_{GE} = 15V$



output characteristic IGBT,Inverter (typical)

$I_C = f(V_{CE})$

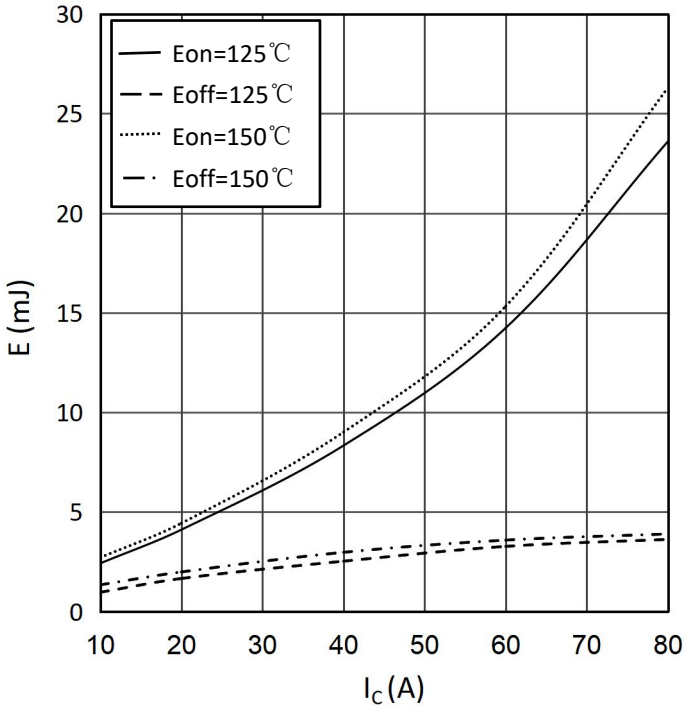
$T_{vj} = 150°C$



switching losses IGBT,Inverter (typical)

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

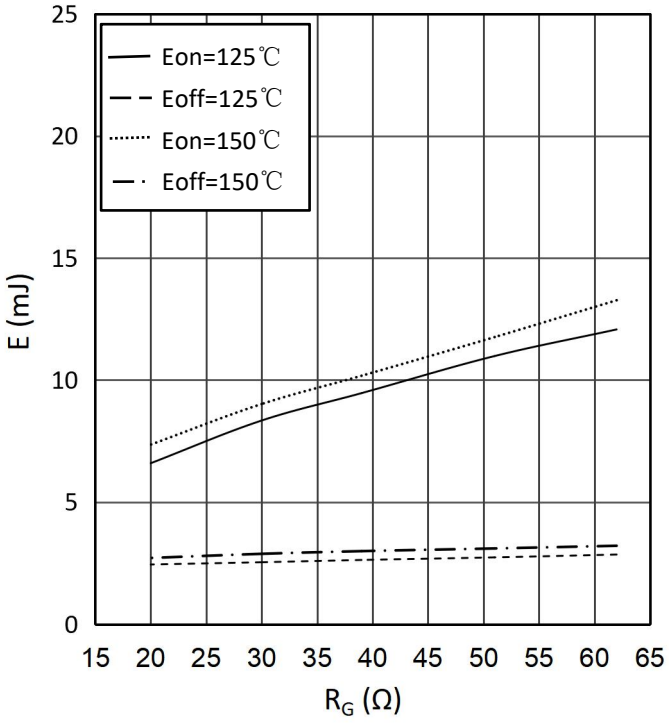
$V_{GE} = \pm 15V$, $R_{Gon} = 30\Omega$, $R_{Goff} = 30\Omega$, $V_{CE} = 600V$



switching losses IGBT,Inverter (typical)

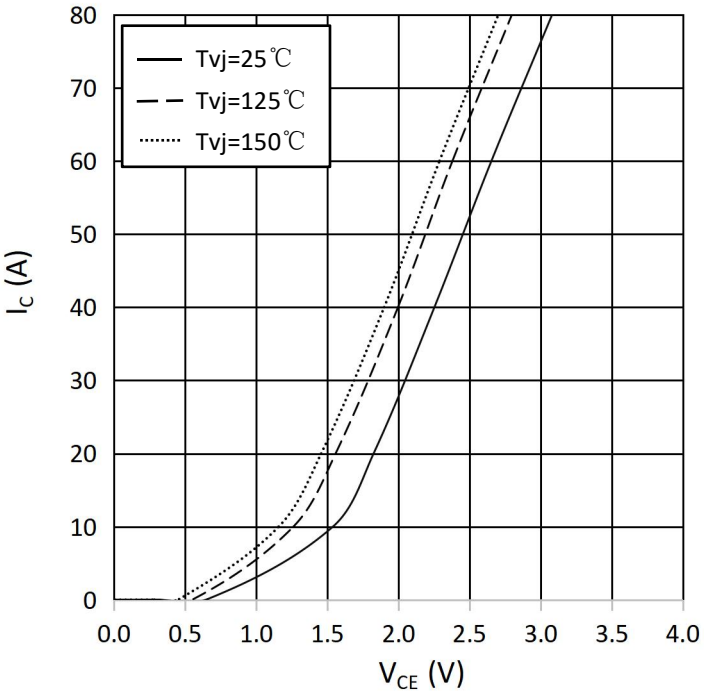
$E_{on} = f(R_G)$, $E_{off} = f(R_G)$

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



forward characteristic of Diode, Inverter (typical)

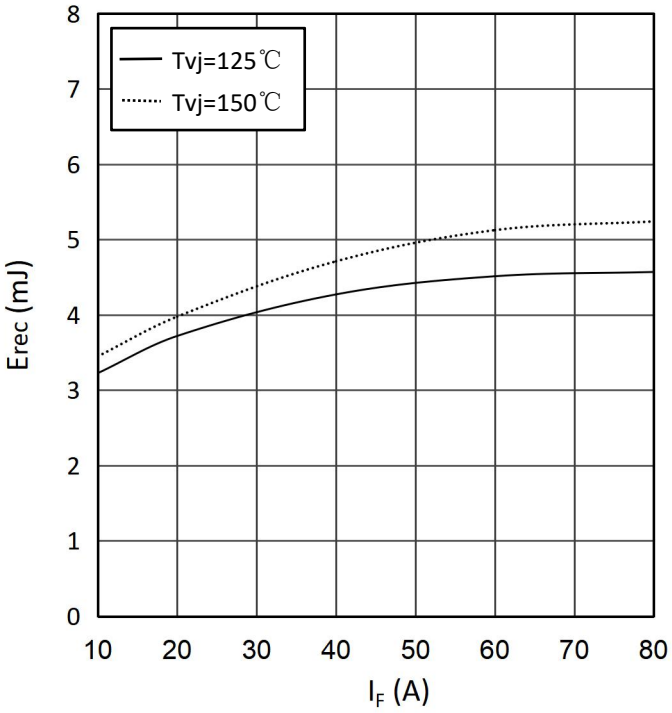
$I_F = f(V_F)$



switching losses Diode, Inverter (typical)

$E_{rec} = f(I_F)$

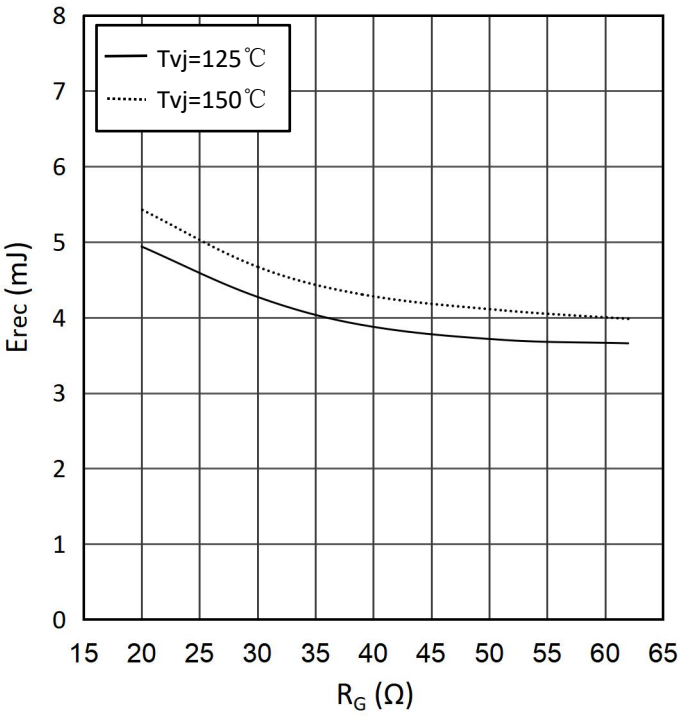
$R_{Gon} = 30\Omega$, $V_{CE} = 600$ V



switching losses Diode, Inverter (typical)

$E_{rec} = f(R_G)$

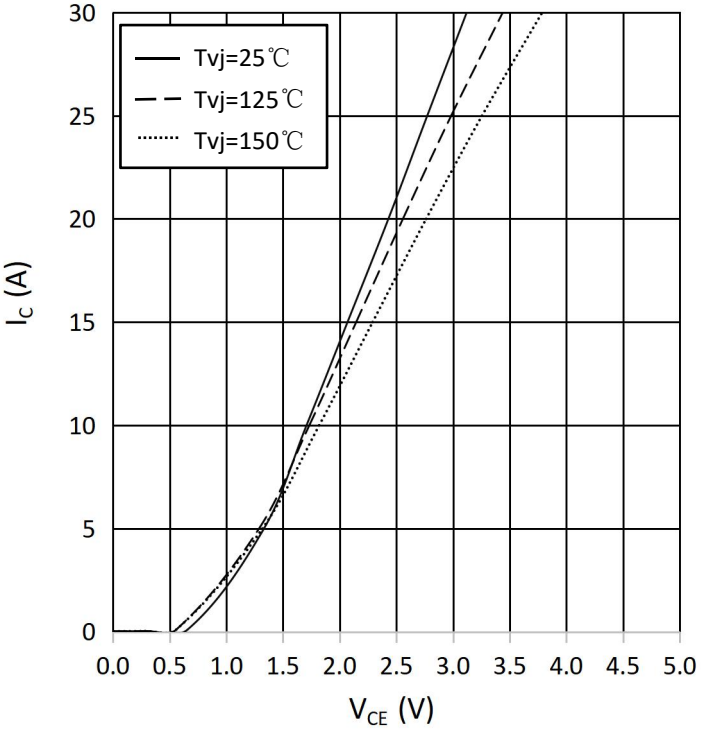
$I_F = 40A$, $V_{CE} = 600V$



output characteristic IGBT, Brake-Chopper (typical)

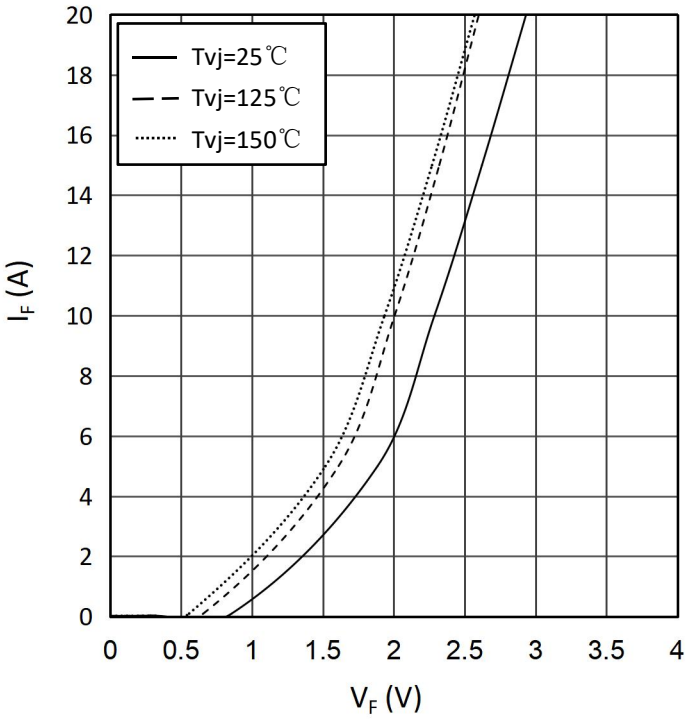
$I_C = f(V_{CE})$

$V_{GE} = 15V$



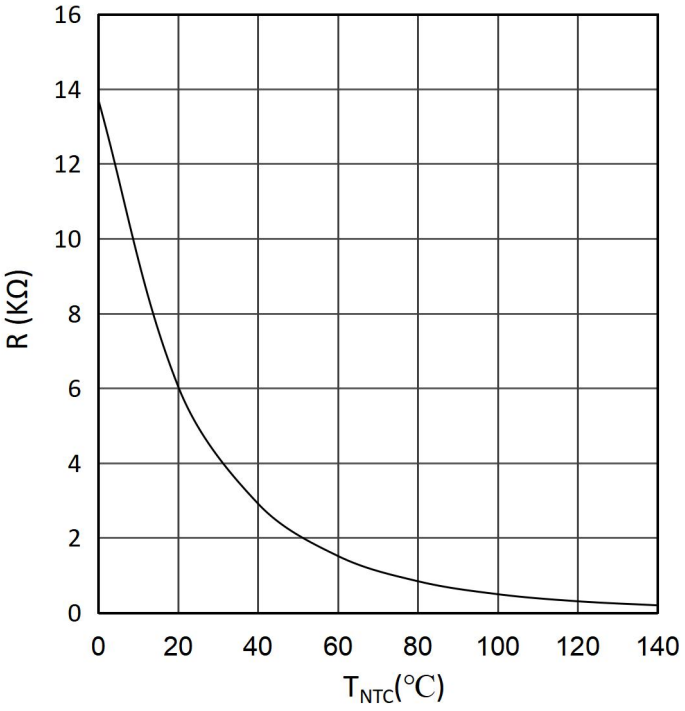
forward characteristic of Diode, Brake-Chopper (typical)

$I_F = f(V_F)$



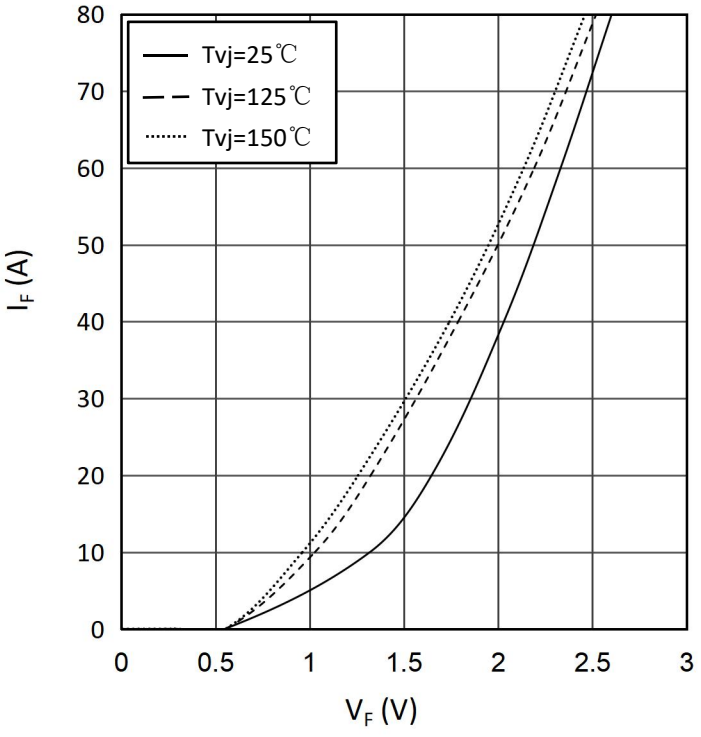
NTC-Thermistor-temperature characteristic(typical)

R=f (T)

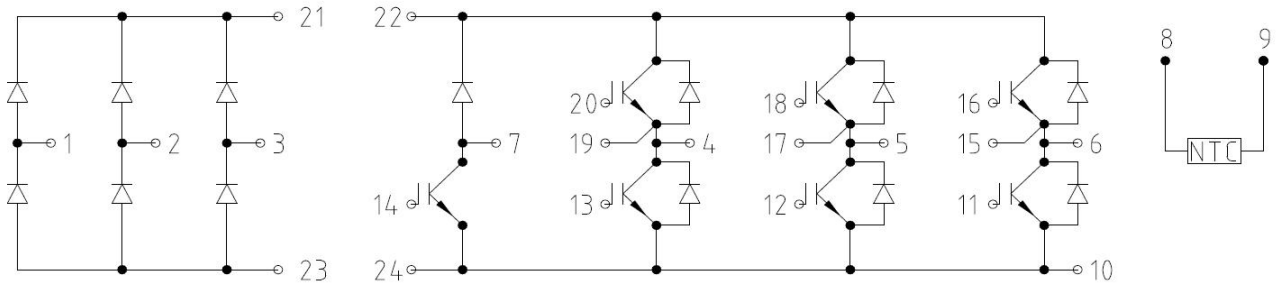


Forward characteristic of Diode, Rectifier(typical)

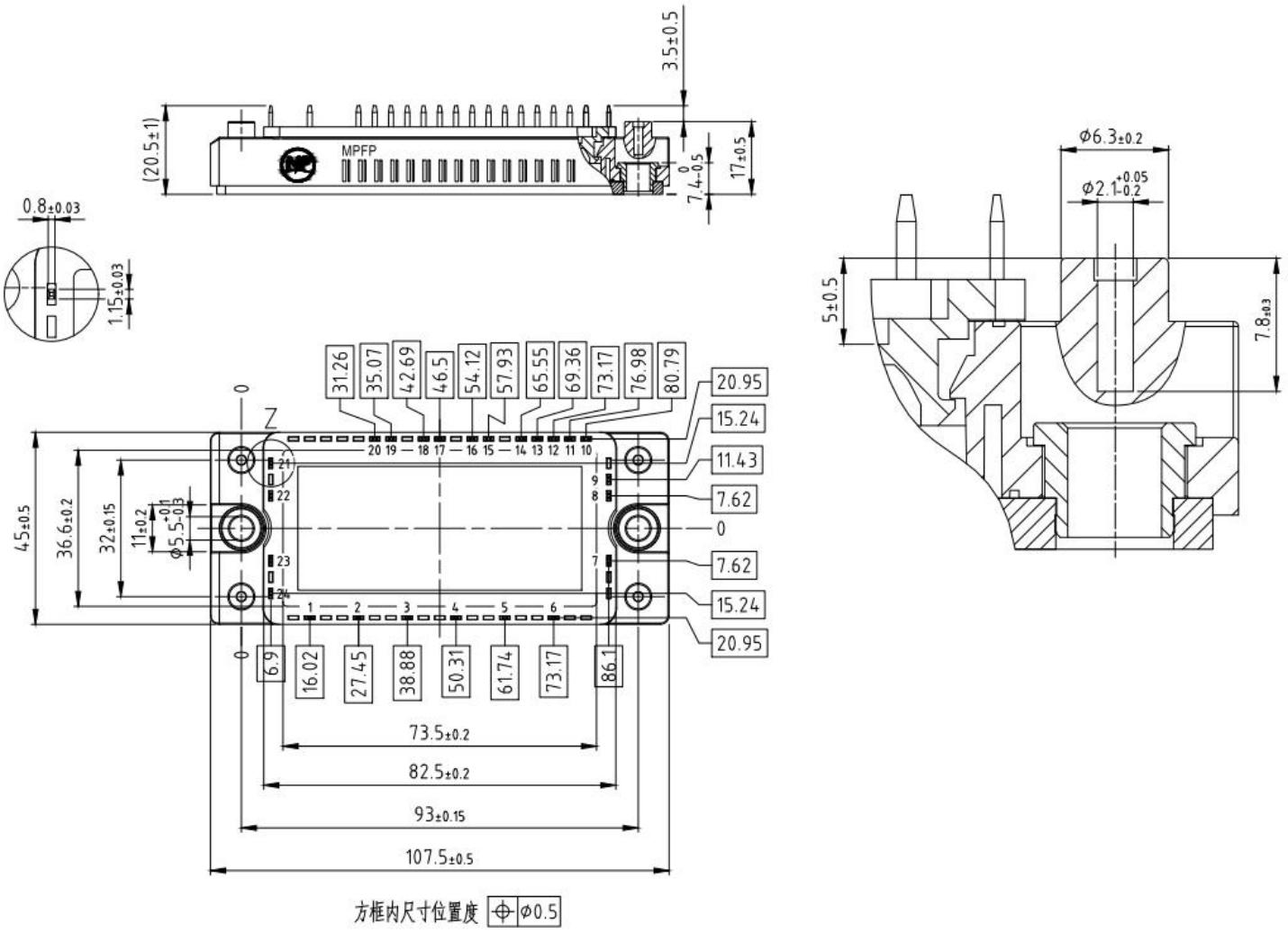
$I_F = f(V_F)$



Cricuit Diagram



Package Outlines



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