

Electrical Features

- Trench/Fieldstop IGBT
- 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		100		A
I _{CRM}	Repetitive peak collector current	t _p =1ms		200		A
P _{tot}	Total power dissipation	T _C =25°C,T _{vj} =175°C		517		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
I _{GES}	Gate leakage current	V _{CE} =0V,V _{GE} =20V,T _{vj} =25°C		-	-	500
V _{GE(th)}	Gate-emitter threshold voltage	I _C =3.8mA,V _{CE} =V _{GE} ,T _{vj} =25°C		5.2	5.48	6.2
V _{CESat}	Collector-emitter saturation voltage	I _C =100A V _{GE} =15V	T _{vj} =25°C	-	1.93	-
			T _{vj} =125°C	-	2.41	-
			T _{vj} =150°C	-	2.50	-
C _{ies}	Input capacitance	V _{CE} =25V,V _{GE} =0V f=1MHz,T _{vj} =25°C		-	7.07	-
C _{oes}	Output capacitance			-	0.46	-
C _{res}	Reverse transfer capacitance			-	0.24	-
Q _G	Gate charge	V _{CC} =600V, I _C =100A V _{GE} =-15...+15V,T _{vj} =25°C		-	640	-
R _g	Internal gate resistance	T _{vj} =25°C		-	1.8	-
						Ω

t _{d(on)}	Turn-on delay time	V _{CC} =600V I _C =100A V _{GE} =±15V R _{G(on)} =30Ω R _{G(off)} =30Ω	T _{vj} =25°C	-	240	-	ns	
			T _{vj} =125°C	-	211	-		
			T _{vj} =150°C	-	203	-		
t _r	Rise time		T _{vj} =25°C	-	103	-		
			T _{vj} =125°C	-	134	-		
			T _{vj} =150°C	-	139	-		
t _{d(off)}	Turn-off delay time		T _{vj} =25°C	-	782	-		
			T _{vj} =125°C	-	830	-		
			T _{vj} =150°C	-	742	-		
t _f	Fall time		T _{vj} =25°C	-	140	-		
			T _{vj} =125°C	-	244	-		
			T _{vj} =150°C	-	345	-		
E _{on}	Turn-on energy (per pulse)		T _{vj} =25°C	-	26.2	-	mJ	
			T _{vj} =125°C	-	39.0	-		
			T _{vj} =150°C	-	41.6	-		
E _{off}	Turn-off energy (per pulse)		T _{vj} =25°C	-	8.1	-		
			T _{vj} =125°C	-	10.6	-		
			T _{vj} =150°C	-	10.9	-		
SC data	Short-circuit current		V _{CC} =600V,V _{GE} ≤15V,T _{vj} =125°C V _{CES} ≤1200V,t _p ≤10μs		-	273	-	A
R _{thJC}	Thermal resistance,junction to case		Per IGBT		-	-	0.29	K/W
R _{thCH}	Thermalresistance,case to heatsink		Per IGBT λgrease=1 W/(m·K)		-	0.13	-	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	$T_{vj}=25^{\circ}C$	1200	V
I_F	Forward current, DC		100	A
I_{FRM}	Repetitive peak forward current	$t_p=1ms$	200	A
I^2t	I^2t -value	$V_R=0V, t_p=10ms, T_{vj}=150^{\circ}C$	1500	A ² s

Characteristic Values

V _F	Continuous forward voltage	I _F =100A V _{GE} =0V	T _{vj} =25°C	-	1.96	-	V
			T _{vj} =125°C	-	1.77	-	
			T _{vj} =150°C	-	1.72	-	
I _{RM}	Peak reverse recovery current	V _R =600V I _F =100A V _{GE} =-15V	T _{vj} =25°C	-	49.3	-	A
			T _{vj} =125°C	-	68.8	-	
			T _{vj} =150°C	-	72.7	-	
t _{rr}	Reverse recovery time		T _{vj} =25°C	-	113.6	-	ns
			T _{vj} =125°C	-	800	-	
			T _{vj} =150°C	-	952	-	
Q _r	Recovered charge		T _{vj} =25°C	-	4.01	-	μC
			T _{vj} =125°C	-	15.57	-	
			T _{vi} =150°C	-	22.76	-	

E _{rec}	Reverse recovery energy		T _{vj} =25°C	-	0.6	-	mJ
			T _{vj} =125°C	-	3.4	-	
			T _{vj} =150°C	-	5.1	-	
R _{thJC}	Thermal resistance, junction to case	per diode		-	-	0.5	K/W
R _{thCH}	Thermal resistance, case to heatsink	per diode, $\lambda_{grease}=1 \text{ W/(m} \cdot \text{K)}$		-	0.225	-	K/W
T _{vjop}	Temperature under switching conditions			-40		150	°C

Diode, Rectifier

Maximum Rated Values							
Symbol	Item	Conditions		Rating			Unit
V _{RRM}	Repetitive peak reverse voltage	T _{vj} =25°C		1600			V
I _{FRMSM}	Maximum RMS forward current per chip	T _C =80°C,T _{vj} =175°C		100			A
I _{RMSM}	Maximum RMS current at rectifier output	T _C = 80°C		150			A
I _{FSM}	Surge forward current	tp = 10 ms, Tvj = 150°C		880			A
I ² t	I ² t-value	V _R =0V,t _p =10ms,T _{vj} =150°C		3850			A ² s
Characteristic Values							
Symbol	Item	Conditions		Values			Unit
				Min.	Typ.	Max.	
V _F	Continuous forward voltage	I _F =100A V _{GE} =0V	T _{vj} =25°C	-	1.24	-	V
			T _{vj} =125°C	-	-	-	
			T _{vj} =150°C	-	-	-	
I _R	Reverse current	V _R =1600V	T _{vj} =25°C	-	-	10	uA
			T _{vj} =125°C	-	-	-	
			T _{vj} =150°C	-	-	-	
T _{vjop}	Temperature under switching conditions			-40		150	°C

IGBT, Brake-Chopper

Maximum Rated Values							
Symbol	Item	Conditions		Values		Unit	
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		50		A	
I _{CRM}	Repetitive peak collector current	t _p =1ms		100		A	
P _{tot}	Total power dissipation	T _C =25°C,T _{vj} =175°C		280		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°C		-	-	1	mA
I _{GES}	Gate leakage current	V _{CE} =0V,V _{GE} =20V,T _{vj} =25°C		-	-	500	nA
V _{GE(th)}	Gate-emitter threshold voltage	I _C =3.8mA,V _{CE} =V _{GE} ,T _{vj} =25°C		5.2	5.66	6.2	V
V _{CEsat}	Collector-emitter saturation voltage	I _C =50A	T _{vj} =25°C	-	2.2	-	
		V _{GE} =15V	T _{vj} =125°C	-	2.7	-	

			T _{vj} =150°C	-	2.8	-	
C _{ies}	Input capacitance	V _{CE} =25V,V _{GE} =0V f=1MHz,T _{vj} =25°C		-	3.15	-	nF
C _{oes}	Output capacitance			-	0.18	-	
C _{res}	Reverse transfer capacitance			-	0.103	-	
Q _G	Gate charge	V _{CC} =600V,I _C =50A V _{GE} =-15...+15V,T _{vj} =25°C		-	316	-	nC
R _g	Internal gate resistance	T _{vj} =25°C		-	-	-	Ω
t _{d(on)}	Turn-on delay time	V _{CC} =600V I _C =50A V _{GE} =±15V R _{G(on)} =30Ω R _{G(off)} =30Ω	T _{vj} =25°C	-	-	-	ns
			T _{vj} =125°C	-	153	-	
			T _{vj} =150°C	-	141	-	
t _r	Rise time		T _{vj} =25°C	-	-	-	
			T _{vj} =125°C	-	44	-	
			T _{vj} =150°C	-	49	-	
t _{d(off)}	Turn-off delay time		T _{vj} =25°C	-	-	-	
			T _{vj} =125°C	-	628	-	
			T _{vj} =150°C	-	612	-	
t _f	Fall time		T _{vj} =25°C	-	-	-	
			T _{vj} =125°C	-	319	-	
			T _{vj} =150°C	-	369	-	
E _{on}	Turn-on energy (per pulse)		T _{vj} =25°C	-	-	-	mJ
			T _{vj} =125°C	-	9.6	-	
			T _{vj} =150°C	-	10.9	-	
E _{off}	Turn-off energy (per pulse)		T _{vj} =25°C	-	-	-	
			T _{vj} =125°C	-	4.4	-	
			T _{vj} =150°C	-	4.7	-	
SC data	Short-circuit current	V _{CC} =600V,V _{GE} ≤15V,T _{vj} =125°C V _{CES} ≤1200V,t _p ≤10μs		-	78	-	A
R _{thJC}	Thermal resistance,junction to case	Per IGBT		-	-	0.54	K/W
R _{thCH}	Thermalresistance,case to heatsink	Per IGBT λgrease=1W/(m·K)		-	0.245	-	K/W
T _{vjop}	Temperature under switching conditions			-40		150	°C

Diode, Brake-Chopper
Maximum Rated Values

Symbol	Item	Conditions	Rating	Unit
V_{RRM}	Repetitive peak reverse voltage	$T_{vj}=25^{\circ}\text{C}$	1200	V
I_F	Forward current, DC		25	A
I_{FRM}	Repetitive peak forward current	$t_p=1\text{ms}$	50	A
I^2t	I^2t -value	$V_R=0\text{V}, t_p=10\text{ms}, T_{vj}=125^{\circ}\text{C}$	90	A^2s

Characteristic Values

V_F	Continuous forward voltage	$I_F=25\text{A}$ $V_{GE}=0\text{V}$	$T_{vj}=25^{\circ}\text{C}$	-	2.08	-	V
			$T_{vj}=125^{\circ}\text{C}$	-	1.65	-	
			$T_{vj}=150^{\circ}\text{C}$	-	1.56	-	

I _{RM}	Peak reverse recovery current	V _R =600V I _F =25A V _{GE} =-15V	T _{vj} =25°C	-	-	-	A
			T _{vj} =125°C	-	53.9	-	
			T _{vj} =150°C	-	53.9	-	
t _{rr}	Reverse recovery time		T _{vj} =25°C	-	-	-	ns
			T _{vj} =125°C	-	388	-	
Q _r	Recovered charge		T _{vj} =25°C	-	-	-	μC
			T _{vj} =125°C	-	7.69	-	
E _{rec}	Reverse recovery energy		T _{vj} =25°C	-	-	-	mJ
			T _{vj} =125°C	-	1.74	-	
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)		-	0.61	-	K/W
T _{vjop}	Temperature under switching conditions			-40		150	°C

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	$T_C=25^{\circ}C$	-	5	-	k Ω
$\Delta R/R$	Deviation of resistance	$T_C=100^{\circ}C, R_{100}=493\Omega$	-5	-	5	%
P_{25}	Power dissipation	$T_C=25^{\circ}C$	-	-	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	-	

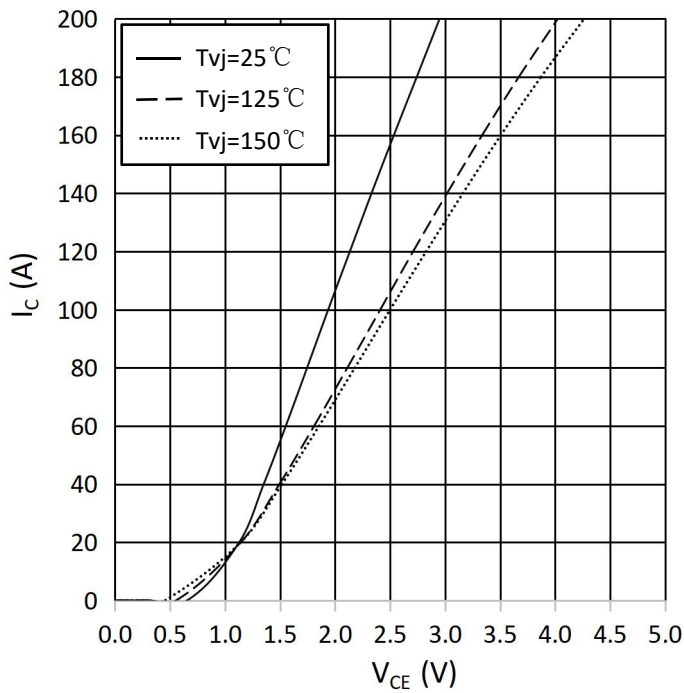
Module

Symbol	Item	Conditions	Rating			Unit
V_{ISOL}	Isolation voltage	Terminals to baseplate, RMS, $f=50Hz, t=1min$	2500			V
$T_{vj\ max}$	Maximum junction temperature	-	175			$^{\circ}C$
$T_{vj\ op}$	Operating junction temperature	Continuous operationg(underswitching)	-40~150			$^{\circ}C$
T_{stg}	Storage temperature	-	-40~125			$^{\circ}C$
Symbol	Item	Conditions	Values			Unit
			Min.	Typ.	Max.	
M	Mounting torque for module mounting	-	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	-	-	290	-	g

output characteristic IGBT, Inverter (typical)

$$I_C = f(V_{CE})$$

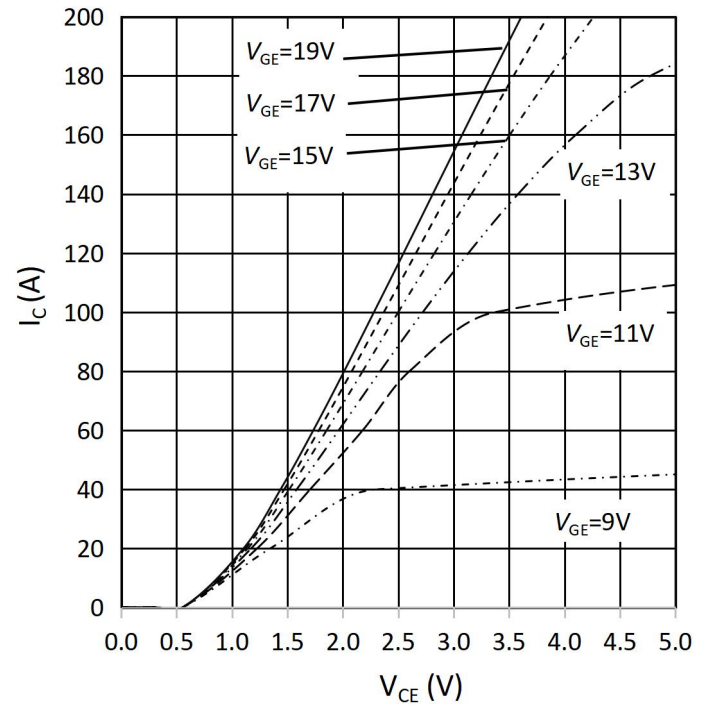
$$V_{GE} = 15V$$



output characteristic IGBT, Inverter (typical)

$$I_C = f(V_{CE})$$

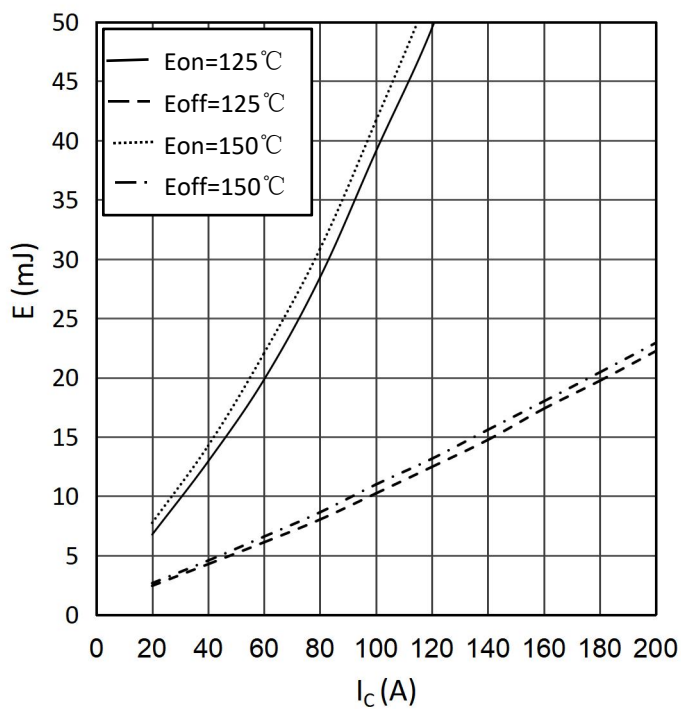
$$T_{vj} = 150^{\circ}C$$



switching losses IGBT, Inverter (typical)

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

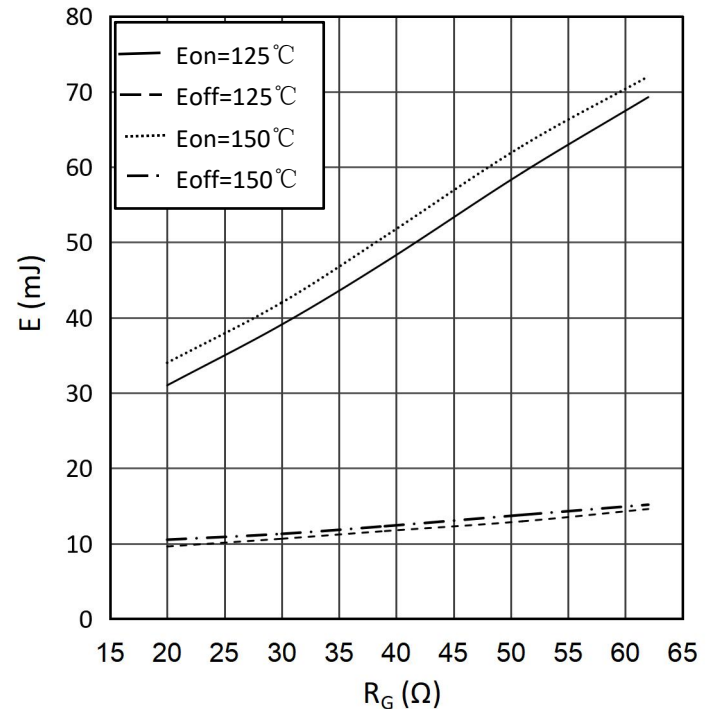
$$V_{GE} = \pm 15V, R_{Gon} = 30\Omega, R_{Goff} = 30\Omega, V_{CE} = 600V$$



switching losses IGBT, Inverter (typical)

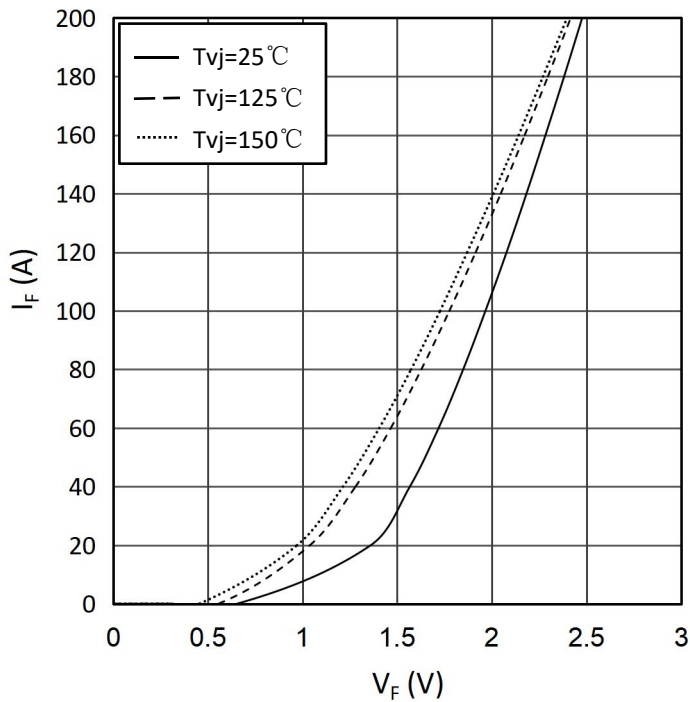
$$E_{on} = f(R_G), E_{off} = f(R_G)$$

$$V_{GE} = \pm 15V, I_C = 100A, V_{CE} = 600V$$



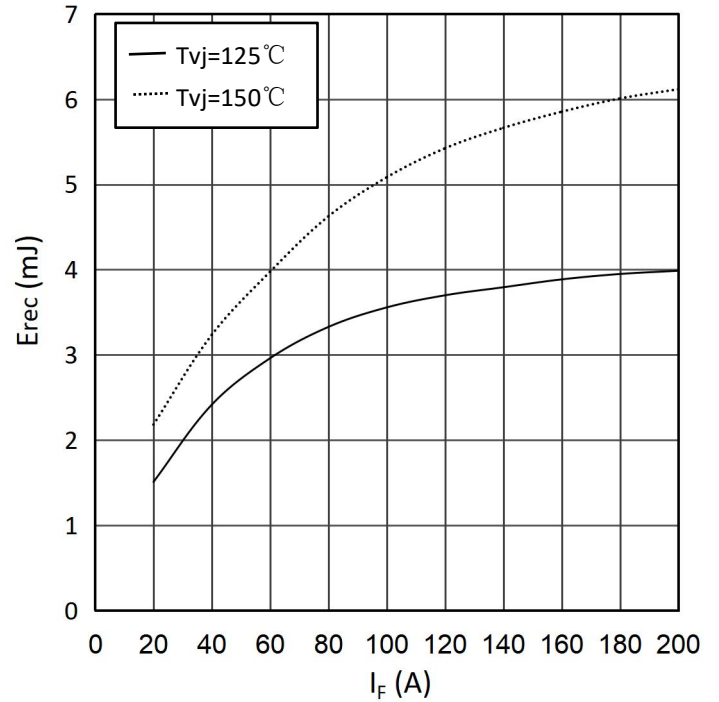
forward characteristic of Diode, Inverter (typical)

$$I_F = f(V_F)$$


switching losses Diode, Inverter (typical)

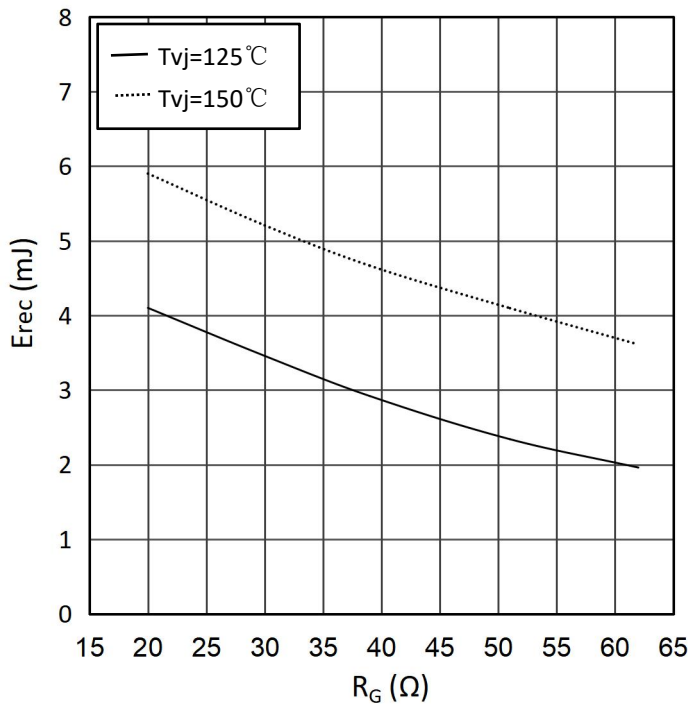
$$E_{\text{rec}} = f(I_F)$$

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


switching losses Diode, Inverter (typical)

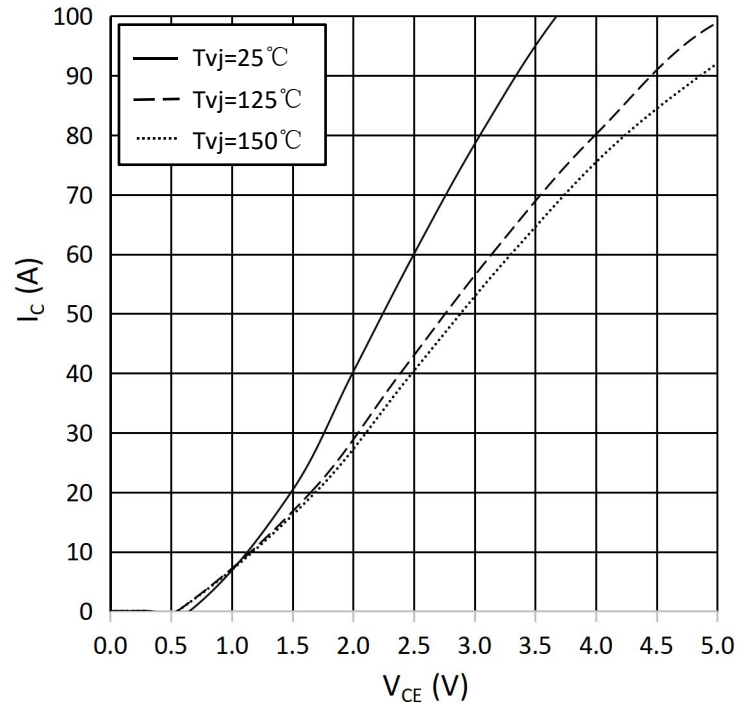
$$E_{\text{rec}} = f(R_G)$$

$$I_F = 100\text{ A}, V_{\text{CE}} = 600\text{ V}$$


output characteristic IGBT, Brake-Chopper (typical)

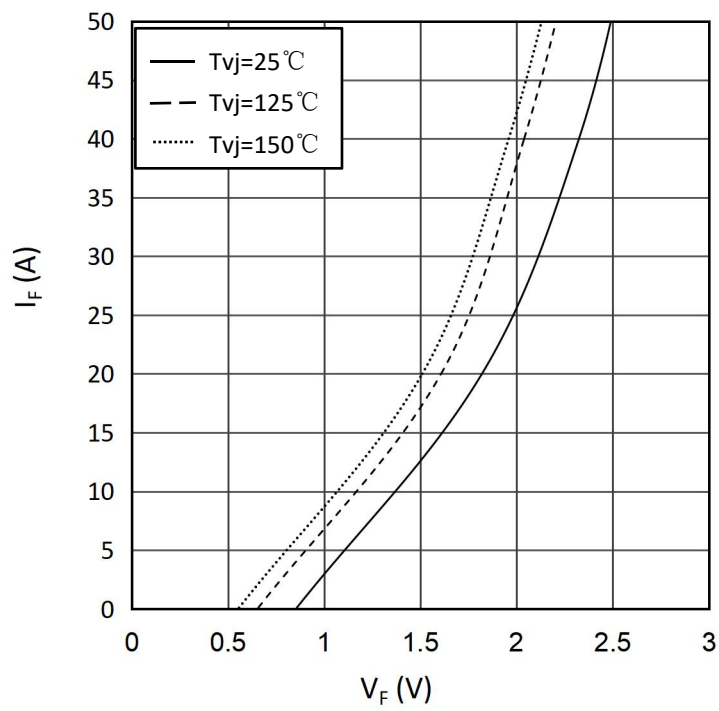
$$I_C = f(V_{\text{CE}})$$

$$V_{\text{GE}} = 15\text{ V}$$



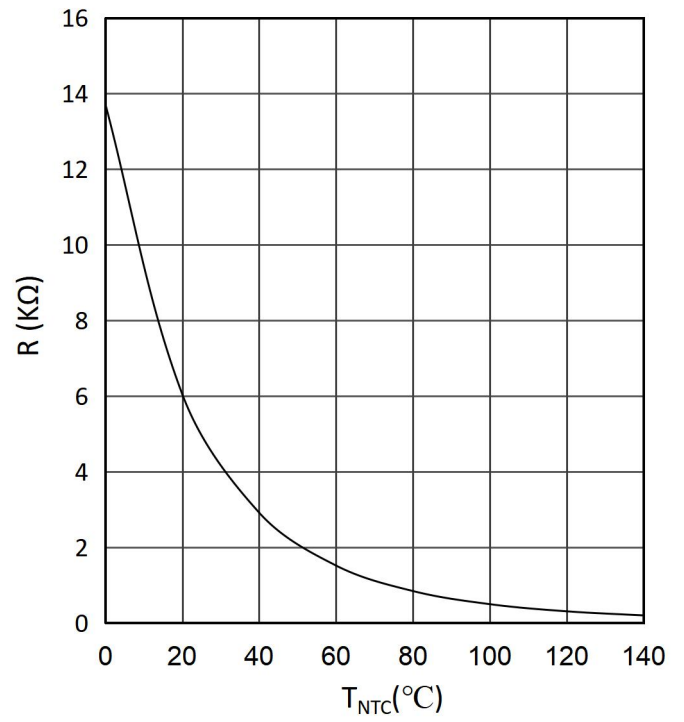
forward characteristic of Diode, Brake-Chopper (typical)

$$I_F = f(V_F)$$

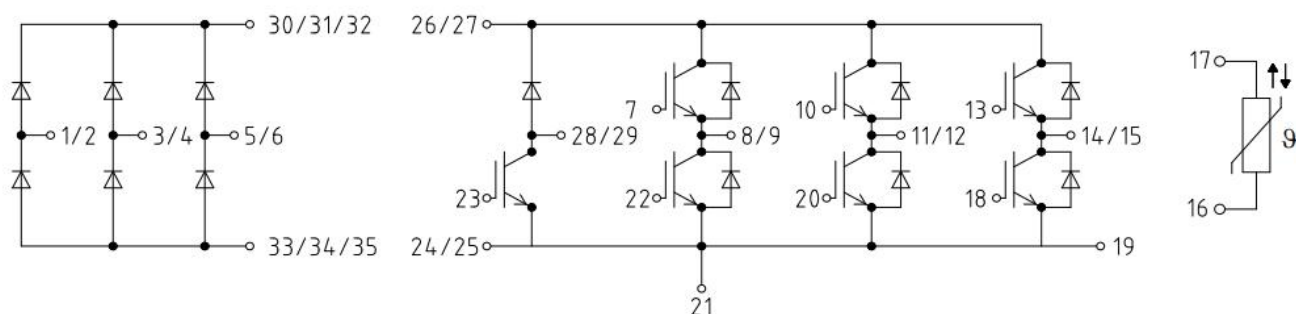


NTC-Thermistor-temperature characteristic(typical)

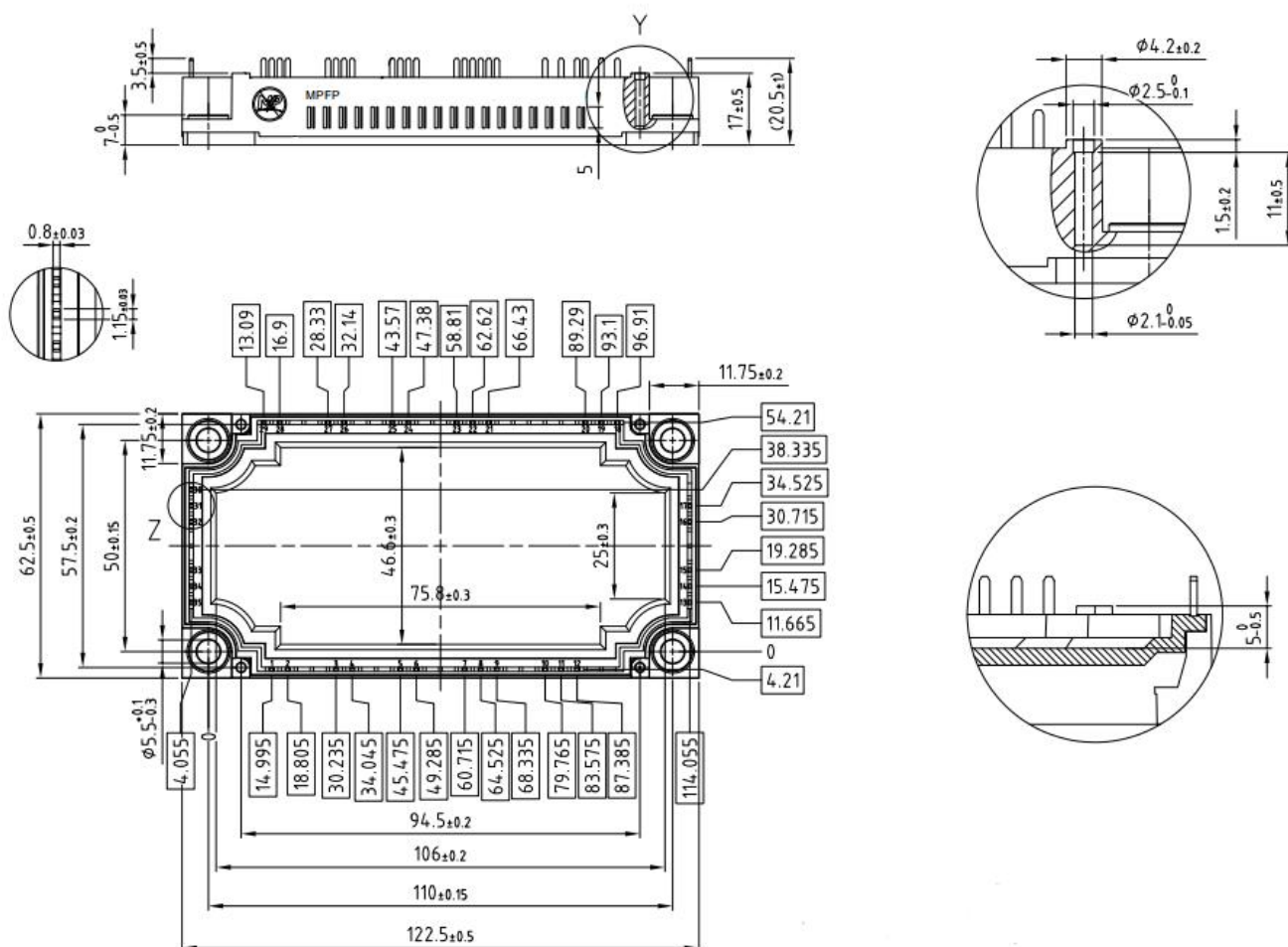
$$R=f(T)$$



Circuit Diagram



Package Outlines



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