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°C	1200	V
V_{GES}	Gate-emitter voltage	-	±20	V
I_C	Collector current,DC	T_C=100°C,T_{vj}=175°C	15	A
I_{CRM}	Repetitive peak collector current	t_p=1ms	30	A
P_{tot}	Total power dissipation	T_C=25°C,T_{vj}=175°C	130	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		-	-	500	nA
$V_{GE(th)}$	Gate-emitter threshold voltage	I_C=0.5mA,V_{CE}=V_{GE},T_{vj}=25°C		5.2	5.7	6.5	V
V_{CEsat}	Collector-emitter saturation voltage	I_C=15A V_{GE}=15V	T_{vj}=25°C	-	2.0	-	V
			T_{vj}=125°C	-	2.4	-	
			T_{vj}=150°C	-	2.6	-	
C_{ies}	Input capacitance	V_{CE}=25V,V_{GE}=0V f=1MHz,T_{vj}=25°C		-	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°C		-	0.094	-	µC
R_g	Internal gate resistance	T_{vj}=25°C		-	-	-	Ω

$t_{d(on)}$	Turn-on delay time	V_{CC}=600V I_C=15A V_{GE}=±15V $R_{G(on)}$=10Ω $R_{G(off)}$=10Ω	T_{vj}=25℃	-	4.0	-	ns
			T_{vj}=125℃	-	5.9	-	
			T_{vj}=150℃	-	2.6	-	
t_r	Rise time		T_{vj}=25℃	-	48.0	-	
			T_{vj}=125℃	-	46.4	-	
			T_{vj}=150℃	-	49.0	-	
$t_{d(off)}$	Turn-off delay time		T_{vj}=25℃	-	75.2	-	
			T_{vj}=125℃	-	76.26	-	
			T_{vj}=150℃	-	76.8	-	
t_f	Fall time		T_{vj}=25℃	-	238.6	-	
			T_{vj}=125℃	-	283.2	-	
			T_{vj}=150℃	-	295.7	-	
E_{on}	Turn-on energy (per pulse)		T_{vj}=25℃	-	1.74	-	mJ
			T_{vj}=125℃	-	2.45	-	
			T_{vj}=150℃	-	2.74	-	
E_{off}	Turn-off energy (per pulse)		T_{vj}=25℃	-	0.86	-	
			T_{vj}=125℃	-	1.01	-	
			T_{vj}=150℃	-	1.07	-	
SC data	Short-circuit current	V_{CC}=600V,V_{GE}≤15V,T_{vj}=125℃ V_{CES}≤1200V,t_P≤10μs		-	99	-	A
R_{thJC}	Thermal resistance,junction to case	Per IGBT		-	1.05	1.15	K/W
R_{thCH}	Thermalresistance,case to heatsink	Per IGBT λgrease=1W/(m·K)		-	1.05	-	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		15	A
I_{FRM}	Repetitive peak forward current	t_p=1ms	30	A
I^2t	I^2t-value	V_R=0V,t_p=10ms,T_{vj}=150℃	14	A^2s

Characteristic Values

V_F	Continuous forward voltage	I_F=15A V_{GE}=0V	T_{vj}=25℃	-	2.4	-	V
			T_{vj}=125℃	-	2.2	-	
			T_{vj}=150℃	-	2.1	-	
I_{RM}	Peak reverse recovery current	V_R=600V I_F=15A V_{GE}=-15V	T_{vj}=25℃	-	18	-	A
			T_{vj}=125℃	-	22	-	
			T_{vj}=150℃	-	25	-	
t_{rr}	Reverse recovery time		T_{vj}=25℃	-	97.5	-	ns
			T_{vj}=125℃	-	373.5	-	
			T_{vj}=150℃	-	442.1	-	
Q_r	Recovered charge		T_{vj}=25℃	-	1.11	-	μC
			T_{vj}=125℃	-	5.19	-	
			T_{vj}=150℃	-	6.12	-	

E_{rec}	Reverse recovery energy		T_{vj}=25℃	-	0.87	-	mJ
			T_{vj}=125℃	-	2.57	-	
			T_{vj}=150℃	-	2.84	-	
R_{thJC}	Thermal resistance, junction to case	per diode		-	1.75	1.9	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	℃

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℃		30			A
I_{RMSM}	Maximum RMS current at rectifier output	T_C= 80℃		30			A
I_{FSM}	Surge forward current	tp = 10 ms, Tvj =150℃		245			A
I^2t	I^2t-value	V_R=0V,t_p=10ms,T_{vj}=150℃		300			A^2s
Characteristic Values							
Symbol	Item	Conditions		Values			Unit
				Min.	Typ.	Max.	
V_F	Continuous forward voltage	I_F=15A V_{GE}=0V	T_{vj}=25℃	-	1.13	-	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℃	-	-	-	
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℃		130			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=0.5mA,V_{CE}=V_{GE},T_{vj}=25℃		5.2	5.7	6.5	V
V_{CEsat}	Collector-emitter saturation voltage	I_C=15A V_{GE}=15V	T_{vj}=25℃	-	2.0	-	
			T_{vj}=125℃	-	2.4	-	
			T_{vj}=150℃	-	2.8	-	

C_{ies}	Input capacitance	V_{CE}=25V,V_{GE}=0V f=1MHz,T_{vj}=25°C		-	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°C		-	0.094	-	µC
R_g	Internal gate resistance	T_{vj}=25°C		-	-	-	Ω
$t_{d(on)}$	Turn-on delay time	V_{CC}=600V I_C=15A V_{GE}=±15V $R_{G(on)}$=10Ω $R_{G(off)}$=10Ω	T_{vj}=25°C	-	7.2	-	ns
			T_{vj}=125°C	-	2.4	-	
			T_{vj}=150°C	-	2.0	-	
t_r	Rise time		T_{vj}=25°C	-	48	-	
			T_{vj}=125°C	-	52.8	-	
			T_{vj}=150°C	-	55.6	-	
$t_{d(off)}$	Turn-off delay time		T_{vj}=25°C	-	77.6	-	
			T_{vj}=125°C	-	86.4	-	
			T_{vj}=150°C	-	90.4	-	
t_f	Fall time		T_{vj}=25°C	-	236.8	-	
			T_{vj}=125°C	-	274.4	-	
			T_{vj}=150°C	-	288.8	-	
E_{on}	Turn-on energy (per pulse)		T_{vj}=25°C	-	1.54	-	mJ
			T_{vj}=125°C	-	1.95	-	
			T_{vj}=150°C	-	2.12	-	
E_{off}	Turn-off energy (per pulse)		T_{vj}=25°C	-	0.87	-	
			T_{vj}=125°C	-	1.04	-	
			T_{vj}=150°C	-	1.09	-	
SC data	Short-circuit current	V_{CC}=600V,V_{GE}≤15V,T_{vj}=125°C V_{CES}≤1200V,t_P≤10µs		-	128	-	A
R_{thJC}	Thermal resistance,junction to case	Per IGBT		-	1.05	1.15	K/W
R_{thCH}	Thermalresistance,case to heatsink	Per IGBT λgrease=1W/(m·K)		-	1.05	-	K/W
Tvjop	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°C	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°C	16	A^2s

Characteristic Values

V_F	Continuous forward voltage	I_F=10A V_{GE}=0V	T_{vj}=25°C	-	2.6	-	V
			T_{vj}=125°C	-	2.2	-	
			T_{vj}=150°C	-	2.1	-	
I_{RM}	Peak reverse recovery current	V_R=600V I_F=15A V_{GE}=-15V	T_{vj}=25°C	-	15.4	-	A
			T_{vj}=125°C	-	18.4	-	
			T_{vj}=150°C	-	20.7	-	

t_{rr}	Reverse recovery time	V_R=600V I_F=15A V_{GE}=-15V	T_{vj}=25℃	-	466.8	-	ns
			T_{vj}=125℃	-	128.9	-	
			T_{vj}=150℃	-	126.4	-	
Q_r	Recovered charge		T_{vj}=25℃	-	2.35	-	μC
			T_{vj}=125℃	-	2.09	-	
			T_{vj}=150℃	-	1.3	-	
E_{rec}	Reverse recovery energy		T_{vj}=25℃	-	1.11	-	mJ
			T_{vj}=125℃	-	0.70	-	
			T_{vj}=150℃	-	0.79	-	
R_{thJC}	Thermal resistance, junction to case	per diode		-	1.75	1.9	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

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	-	

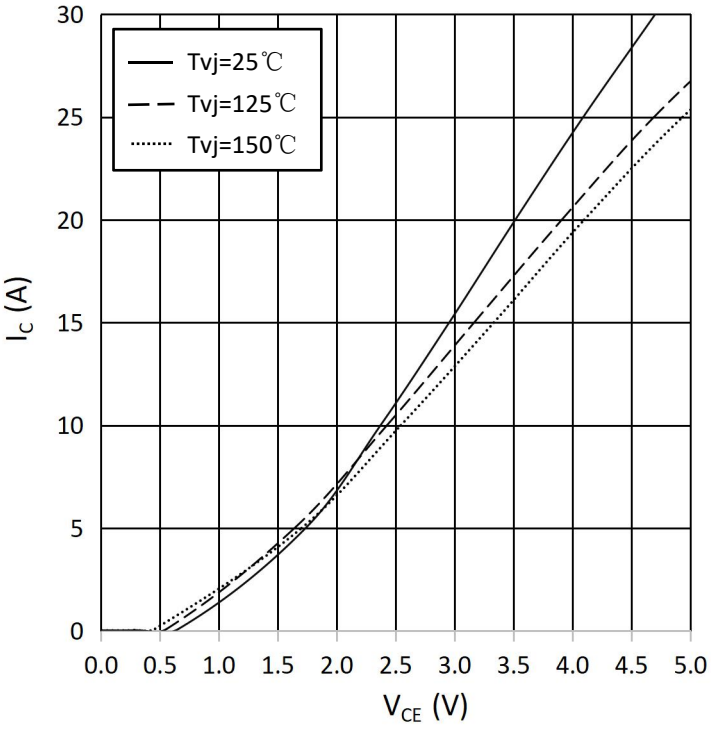
Module

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(underswitching)	-40~150			℃
T_{stg}	Storage temperature	-	-40~125			℃
Symbol	Item	Conditions	Values			Unit
			Min.	Typ.	Max.	
F	mountig force per clamp	-	20	-	50	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	-	-	24	-	g

output characteristic IGBT,Inverter (typical)

$I_C = f(V_{CE})$

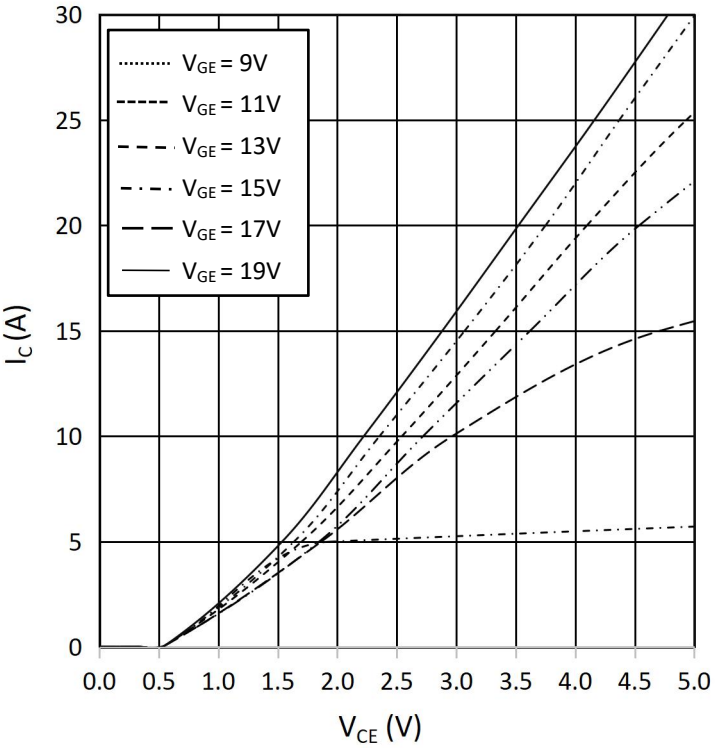
$V_{GE} = 15V$



output characteristic IGBT,Inverter (typical)

$I_C = f(V_{CE})$

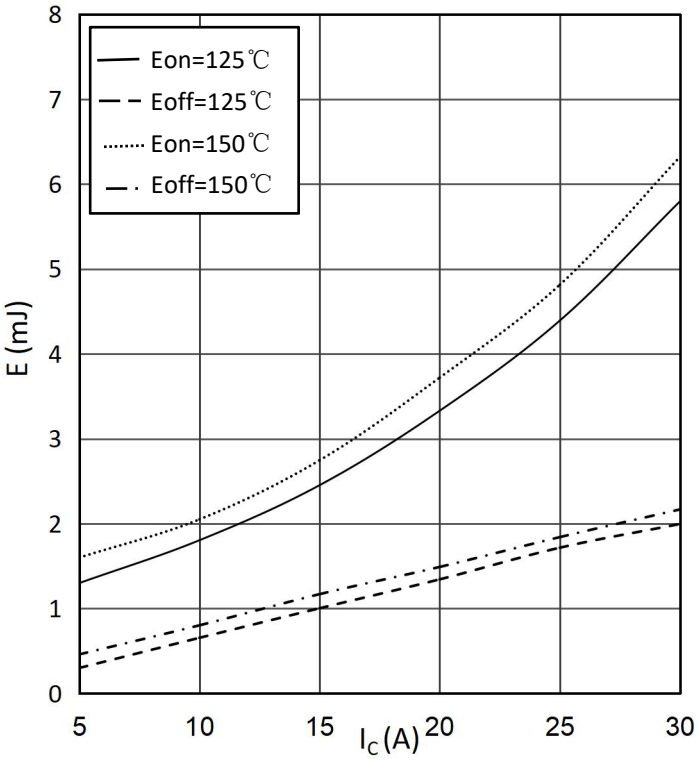
$T_{vj} = 150°C$



switching losses IGBT,Inverter (typical)

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

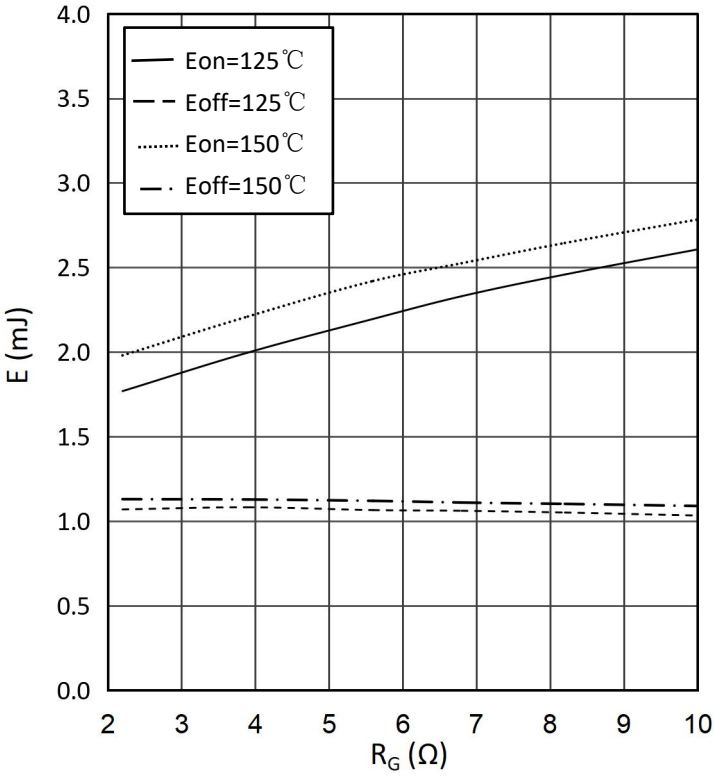
$V_{GE} = \pm 15V$, $R_{Gon} = 10\Omega$, $R_{Goff} = 10\Omega$, $V_{CE} = 600V$



switching losses IGBT,Inverter (typical)

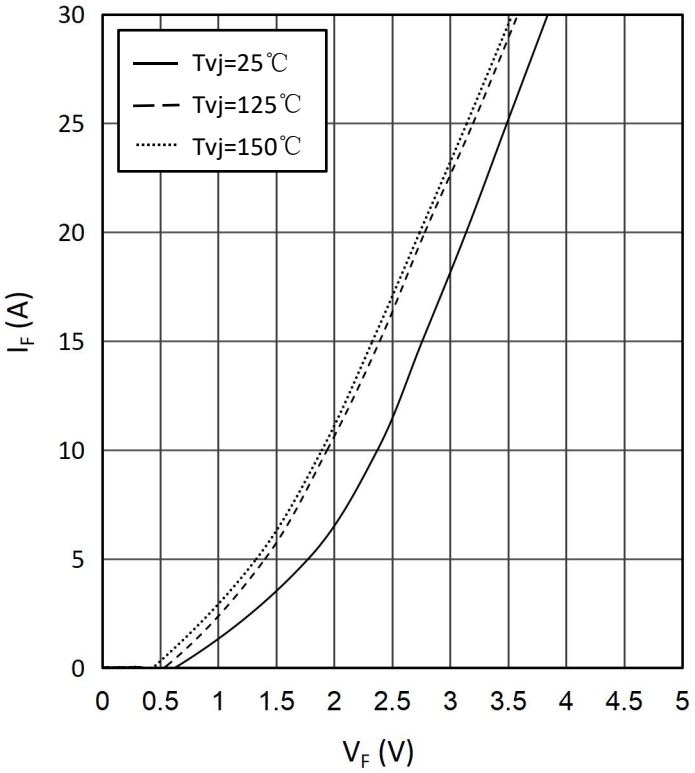
$E_{on} = f(R_G)$, $E_{off} = f(R_G)$

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



forward characteristic of Diode, Inverter (typical)

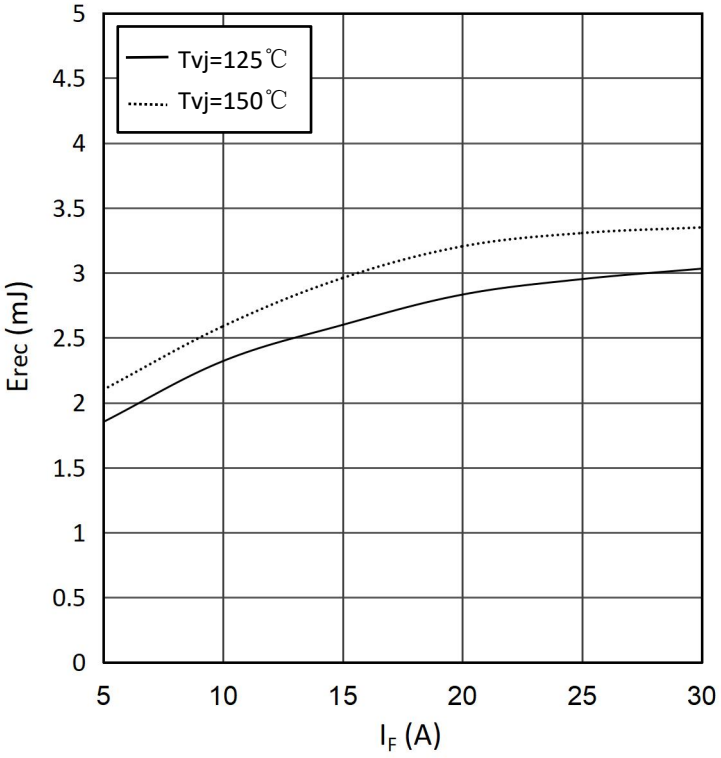
$I_F = f(V_F)$



switching losses Diode, Inverter (typical)

$E_{rec} = f(I_F)$

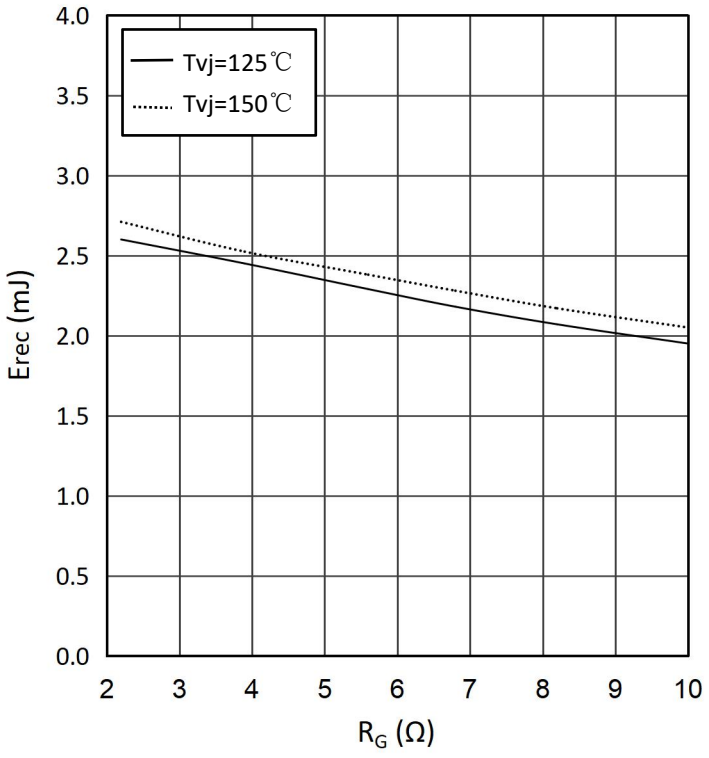
$R_{Gon} = 10\Omega$, $V_{CE} = 600$ V



switching losses Diode, Inverter (typical)

$E_{rec} = f(R_G)$

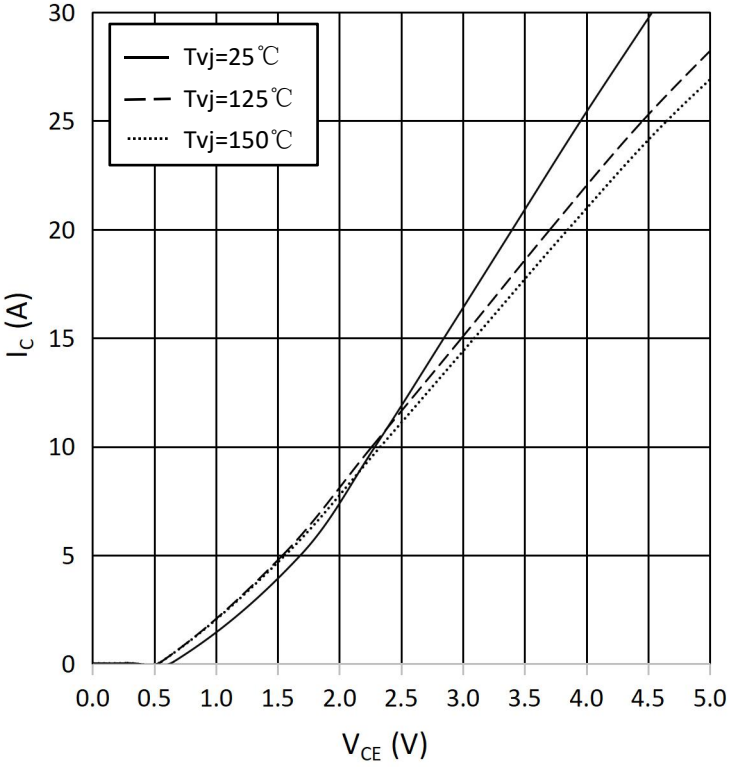
$I_F = 15A$, $V_{CE} = 600V$



output characteristic IGBT, Brake-Chopper (typical)

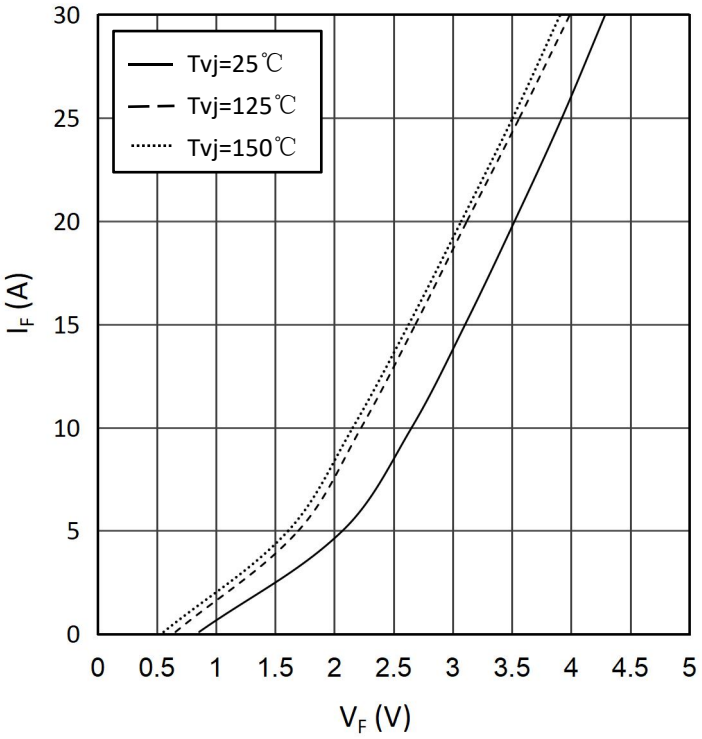
$I_C = f(V_{CE})$

$V_{GE} = 15V$



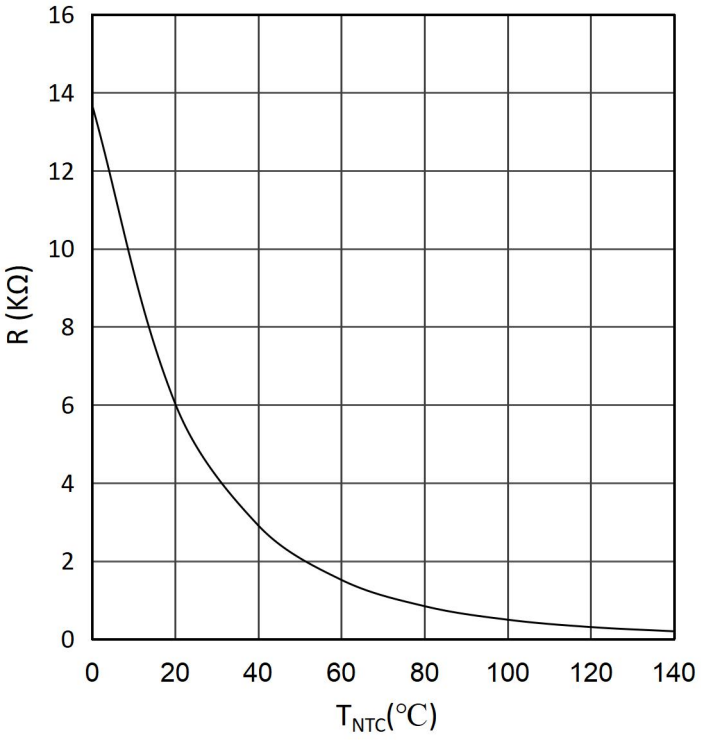
forward characteristic of Diode, Brake-Chopper (typical)

$I_F = f(V_F)$

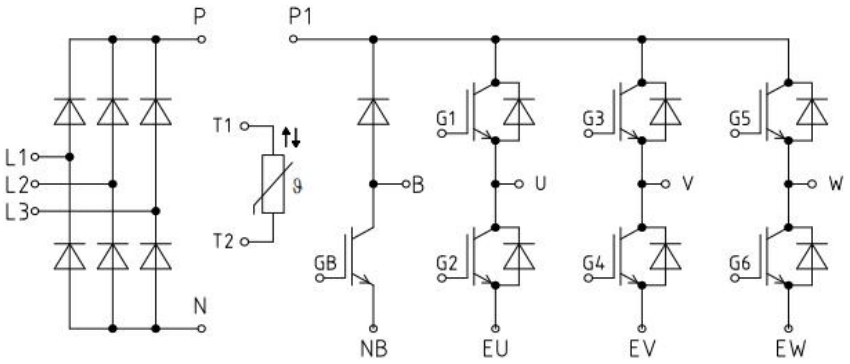


NTC-Thermistor-temperature characteristic(typical)

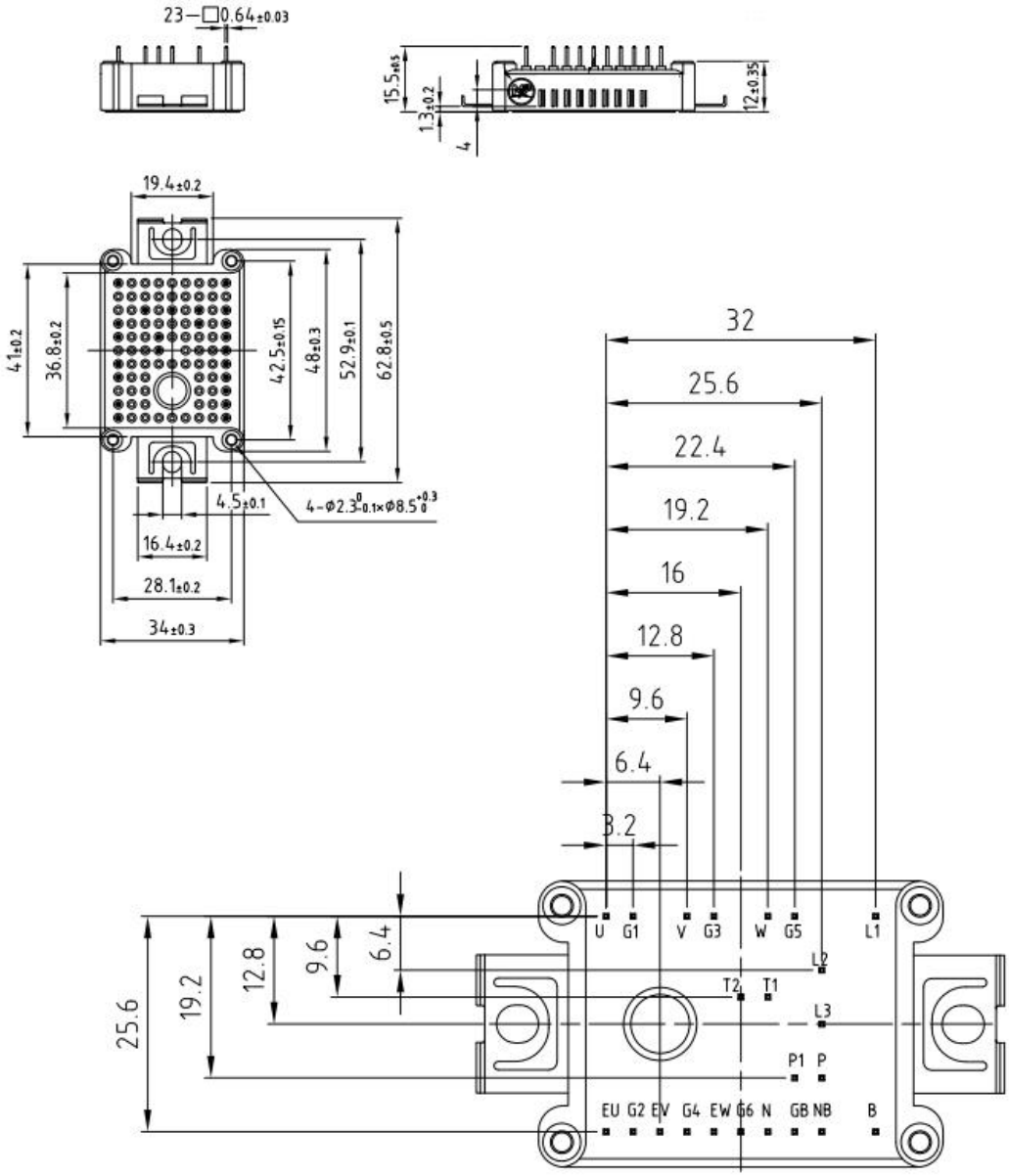
R=f (T)



Cricuit Diagram



Package Outlines



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