

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	$T_{vj}=25^{\circ}C$	1200			V	
V_{GES}	Gate-emitter voltage	-	± 20			V	
I_C	Collector current,DC	$T_C=100^{\circ}C, T_{vj}=175^{\circ}C$	15			A	
I_{CRM}	Repetitive peak collector current	$t_p=1ms$	30			A	
P_{tot}	Total power dissipation	$T_C=25^{\circ}C, T_{vj}=175^{\circ}C$	130			W	
Characteristics Values							
Symbol	Item	Conditions	Values			Unit	
			Min.	Typ.	Max.		
I_{CES}	Collector-emitter cut-off current	$V_{CE}=1200V, V_{GE}=0V, T_{vj}=25^{\circ}C$	-	-	1	mA	
I_{GES}	Gate leakage current	$V_{CE}=0V, V_{GE}=20V, T_{vj}=25^{\circ}C$	-	-	500	nA	
$V_{GE(th)}$	Gate-emitter threshold voltage	$I_C=0.5mA, V_{CE}=V_{GE}, T_{vj}=25^{\circ}C$	5.2	5.7	6.5	V	
V_{CEsat}	Collector-emitter saturation voltage	$I_C=15A$ $V_{GE}=15V$	$T_{vj}=25^{\circ}C$	-	2.0		-
			$T_{vj}=125^{\circ}C$	-	2.4		-
			$T_{vj}=150^{\circ}C$	-	2.6	-	
C_{ies}	Input capacitance	$V_{CE}=25V, V_{GE}=0V$ $f=1MHz, T_{vj}=25^{\circ}C$	-	1.19	-	nF	
C_{oes}	Output capacitance		-	0.08	-		
C_{res}	Reverse transfer capacitance		-	0.04	-		
Q_G	Gate charge	$V_{CC}=600V, I_C=15A$ $V_{GE}=-15...+15V, T_{vj}=25^{\circ}C$	-	0.094	-	μC	
R_g	Internal gate resistance	$T_{vj}=25^{\circ}C$	-	-	-	Ω	

$t_{d(on)}$	Turn-on delay time	$V_{CC}=600V$ $I_C=15A$ $V_{GE}=\pm 15V$ $R_{G(on)}=10\Omega$ $R_{G(off)}=10\Omega$	$T_{vj}=25^\circ C$	-	4.0	-	ns
			$T_{vj}=125^\circ C$	-	5.9	-	
			$T_{vj}=150^\circ C$	-	2.6	-	
t_r	Rise time		$T_{vj}=25^\circ C$	-	48.0	-	
			$T_{vj}=125^\circ C$	-	46.4	-	
			$T_{vj}=150^\circ C$	-	49.0	-	
$t_{d(off)}$	Turn-off delay time		$T_{vj}=25^\circ C$	-	75.2	-	
			$T_{vj}=125^\circ C$	-	76.26	-	
			$T_{vj}=150^\circ C$	-	76.8	-	
t_f	Fall time		$T_{vj}=25^\circ C$	-	238.6	-	
			$T_{vj}=125^\circ C$	-	283.2	-	
			$T_{vj}=150^\circ C$	-	295.7	-	
E_{on}	Turn-on energy (per pulse)	$T_{vj}=25^\circ C$	-	1.74	-	mJ	
		$T_{vj}=125^\circ C$	-	2.45	-		
		$T_{vj}=150^\circ C$	-	2.74	-		
E_{off}	Turn-off energy (per pulse)	$T_{vj}=25^\circ C$	-	0.86	-		
		$T_{vj}=125^\circ C$	-	1.01	-		
		$T_{vj}=150^\circ C$	-	1.07	-		
SC data	Short-circuit current	$V_{CC}=600V, V_{GE}\leq 15V, T_{vj}=125^\circ C$ $V_{CES}\leq 1200V, t_p\leq 10\mu s$	-	99	-	A	
R_{thJC}	Thermal resistance, junction to case	Per IGBT	-	1.05	1.15	K/W	
R_{thCH}	Thermal resistance, case to heatsink	Per IGBT $\lambda_{grease}=1W/(m\cdot K)$	-	1.05	-	K/W	
T_{vjop}	Temperature under switching conditions		-40		150	$^\circ C$	

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		15	A
I_{FRM}	Repetitive peak forward current	$t_p=1ms$	30	A
I^2t	I^2t -value	$V_R=0V, t_p=10ms, T_{vj}=150^\circ C$	14	A^2s

Characteristic Values

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

E _{rec}	Reverse recovery energy		T _{vj} =25°C	-	0.87	-	mJ
			T _{vj} =125°C	-	2.57	-	
			T _{vj} =150°C	-	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
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	1800	V
I _{FRMSM}	Maximum RMS forward current per chip	T _C =80°C, T _{vj} =175°C	30	A
I _{RMSM}	Maximum RMS current at rectifier output	T _C = 80°C	30	A
I _{FSM}	Surge forward current	tp = 10 ms, T _{vj} =150°C	245	A
I ² t	I ² t-value	V _R =0V, t _p =10ms, T _{vj} =150°C	300	A ² s

Characteristic Values

Symbol	Item	Conditions	Values			Unit	
			Min.	Typ.	Max.		
V _F	Continuous forward voltage	I _F =15A V _{GE} =0V	T _{vj} =25°C	-	1.13	-	V
			T _{vj} =125°C	-	-	-	
			T _{vj} =150°C	-	-	-	
I _R	Reverse current	V _R =1800V	T _{vj} =25°C	-	-	10	μA
			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	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

Characteristic Values

Symbol	Item	Conditions	Values			Unit	
			Min.	Typ.	Max.		
IGBT							
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		-
			T _{vj} =125°C	-	2.4		-
			T _{vj} =150°C	-	2.8	-	

C_{ies}	Input capacitance	$V_{CE}=25V, V_{GE}=0V$ $f=1MHz, T_{vj}=25^{\circ}C$	-	1.19	-	nF	
C_{oes}	Output capacitance		-	0.08	-		
C_{res}	Reverse transfer capacitance		-	0.04	-		
Q_G	Gate charge	$V_{CC}=600V, I_C=15A$ $V_{GE}=-15...+15V, T_{vj}=25^{\circ}C$	-	0.094	-	μC	
R_g	Internal gate resistance	$T_{vj}=25^{\circ}C$	-	-	-	Ω	
$t_{d(on)}$	Turn-on delay time	$V_{CC}=600V$ $I_C=15A$ $V_{GE}=\pm 15V$ $R_{G(on)}=10\Omega$ $R_{G(off)}=10\Omega$	$T_{vj}=25^{\circ}C$	-	7.2	-	ns
			$T_{vj}=125^{\circ}C$	-	2.4	-	
			$T_{vj}=150^{\circ}C$	-	2.0	-	
t_r	Rise time		$T_{vj}=25^{\circ}C$	-	48	-	
			$T_{vj}=125^{\circ}C$	-	52.8	-	
			$T_{vj}=150^{\circ}C$	-	55.6	-	
$t_{d(off)}$	Turn-off delay time		$T_{vj}=25^{\circ}C$	-	77.6	-	
			$T_{vj}=125^{\circ}C$	-	86.4	-	
			$T_{vj}=150^{\circ}C$	-	90.4	-	
t_f	Fall time		$T_{vj}=25^{\circ}C$	-	236.8	-	
			$T_{vj}=125^{\circ}C$	-	274.4	-	
			$T_{vj}=150^{\circ}C$	-	288.8	-	
E_{on}	Turn-on energy (per pulse)	$T_{vj}=25^{\circ}C$	-	1.54	-	mJ	
		$T_{vj}=125^{\circ}C$	-	1.95	-		
		$T_{vj}=150^{\circ}C$	-	2.12	-		
E_{off}	Turn-off energy (per pulse)	$T_{vj}=25^{\circ}C$	-	0.87	-		
		$T_{vj}=125^{\circ}C$	-	1.04	-		
		$T_{vj}=150^{\circ}C$	-	1.09	-		
SC data	Short-circuit current	$V_{CC}=600V, V_{GE}\leq 15V, T_{vj}=125^{\circ}C$ $V_{CES}\leq 1200V, t_p\leq 10\mu s$	-	128	-	A	
R_{thJC}	Thermal resistance, junction to case	Per IGBT	-	1.05	1.15	K/W	
R_{thCH}	Thermal resistance, case to heatsink	Per IGBT $\lambda_{grease}=1W/(m\cdot K)$	-	1.05	-	K/W	
T_{vjop}	Temperature under switching conditions		-40		150	$^{\circ}C$	

Diode, Brake-Chopper
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		10	A
I_{FRM}	Repetitive peak forward current	$t_p=1ms$	20	A
I^2t	I^2t -value	$V_R=0V, t_p=10ms, T_{vj}=125^{\circ}C$	16	A^2s

Characteristic Values

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

t _{rr}	Reverse recovery time	V _R =600V I _F =15A V _{GE} =-15V	T _{vj} =25°C	-	466.8	-	ns
			T _{vj} =125°C	-	128.9	-	
			T _{vj} =150°C	-	126.4	-	
Q _r	Recovered charge	V _R =600V I _F =15A V _{GE} =-15V	T _{vj} =25°C	-	2.35	-	μC
			T _{vj} =125°C	-	2.09	-	
			T _{vj} =150°C	-	1.3	-	
E _{rec}	Reverse recovery energy	V _R =600V I _F =15A V _{GE} =-15V	T _{vj} =25°C	-	1.11	-	mJ
			T _{vj} =125°C	-	0.70	-	
			T _{vj} =150°C	-	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	
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°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	-	

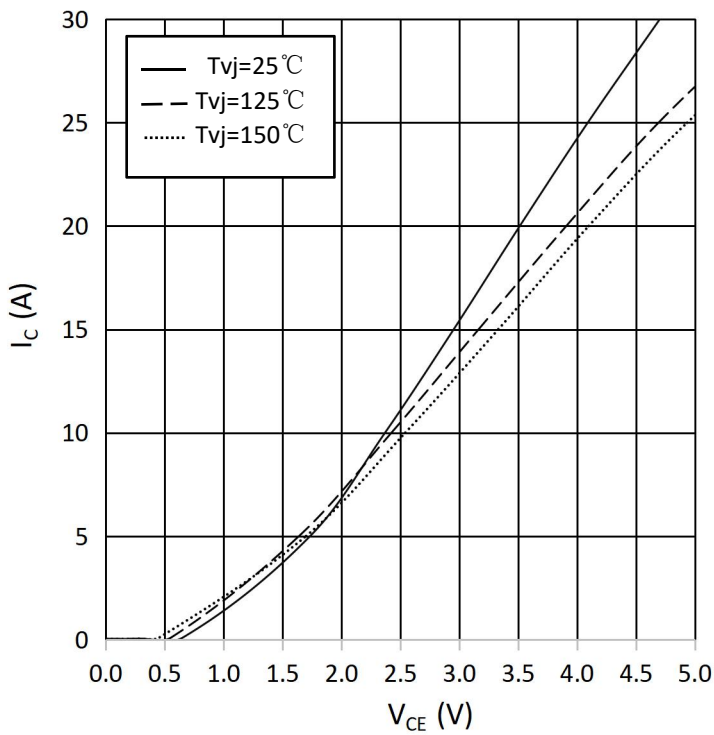
Module

Symbol	Item	Conditions	Rating			Unit
V _{ISOL}	Isolation voltage	Terminals to baseplate, RMS, f=50Hz, t=1min	2500			V
T _{vj max}	Maximum junction temperature	-	175			°C
T _{vj op}	Operating junction temperature	Continuous operation(underswitching)	-40~150			°C
T _{stg}	Storage temperature	-	-40~125			°C
Symbol	Item	Conditions	Values			Unit
			Min.	Typ.	Max.	
F	mounting 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)

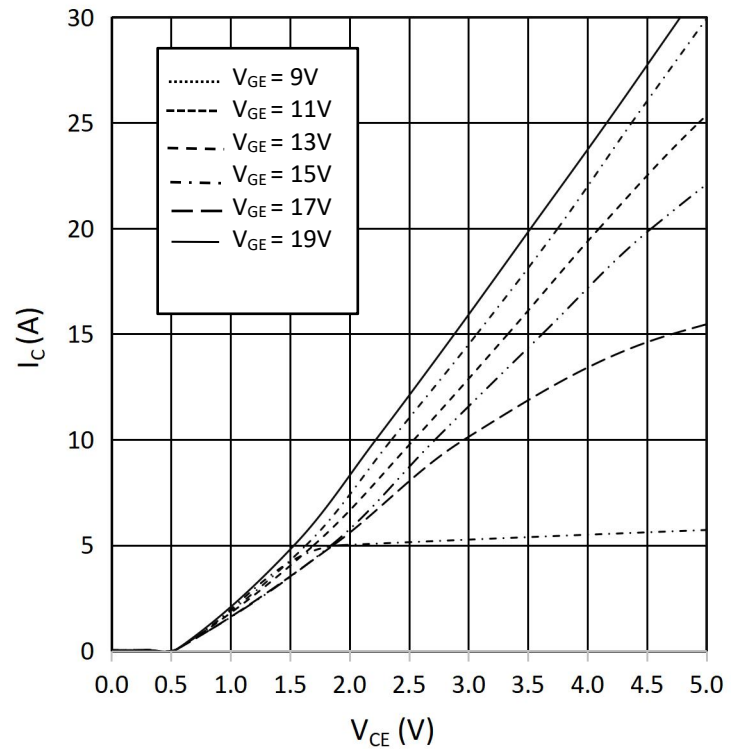
$$I_C = f(V_{CE})$$

$$V_{GE} = 15V$$


output characteristic IGBT, Inverter (typical)

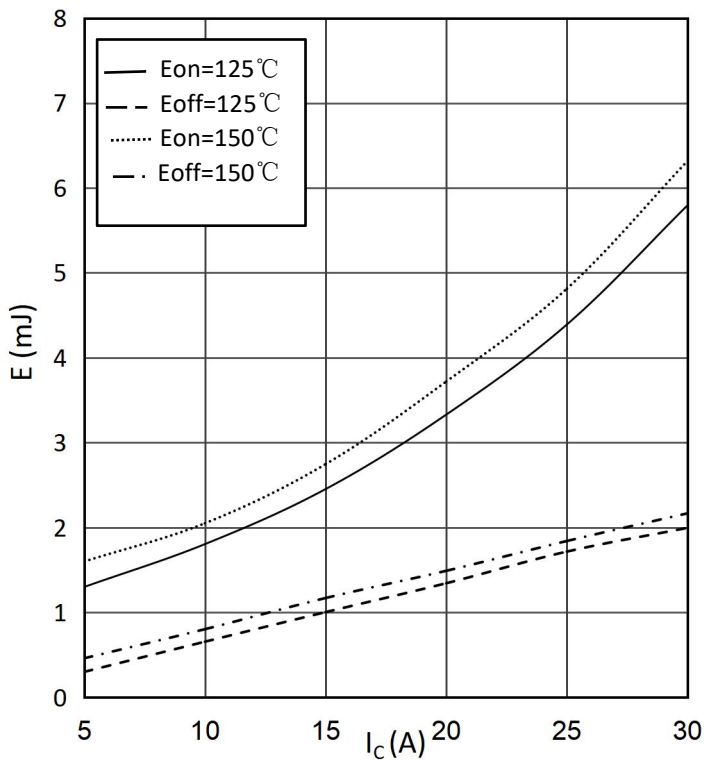
$$I_C = f(V_{CE})$$

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


switching losses IGBT, Inverter (typical)

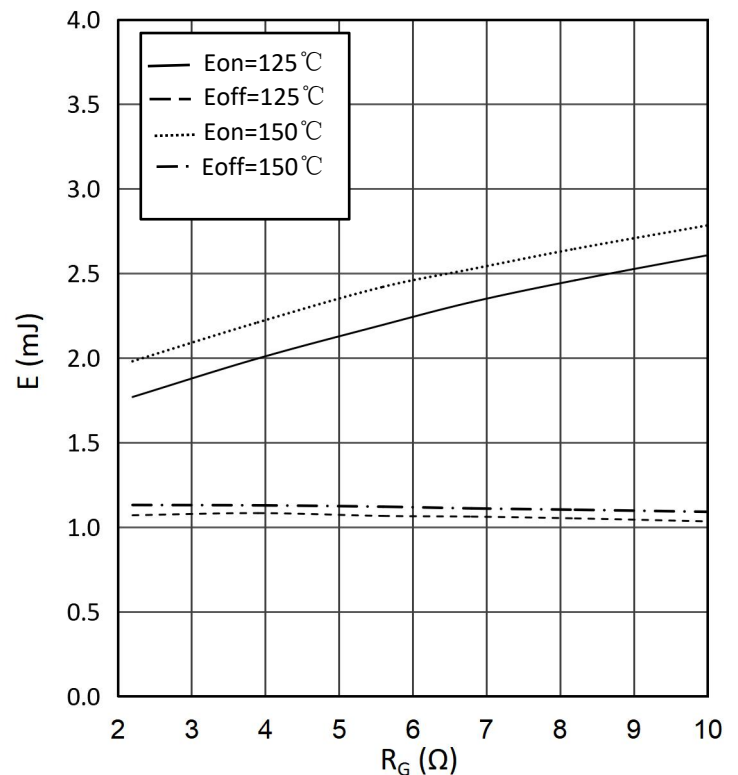
$$E_{on} = f(I_C), E_{off} = f(I_C)$$

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


switching losses IGBT, Inverter (typical)

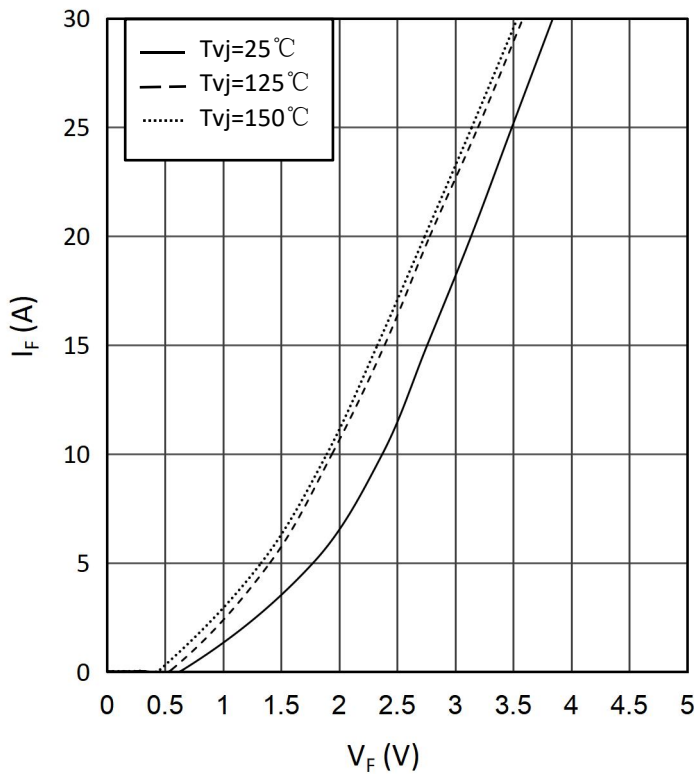
$$E_{on} = f(R_G), E_{off} = f(R_G)$$

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



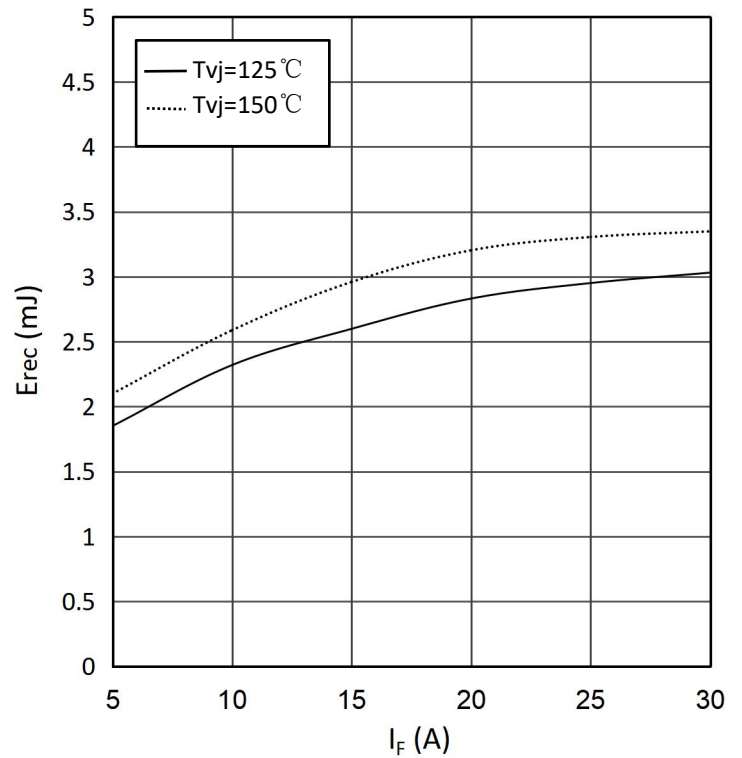
forward characteristic of Diode, Inverter (typical)

$$I_F = f(V_F)$$


switching losses Diode, Inverter (typical)

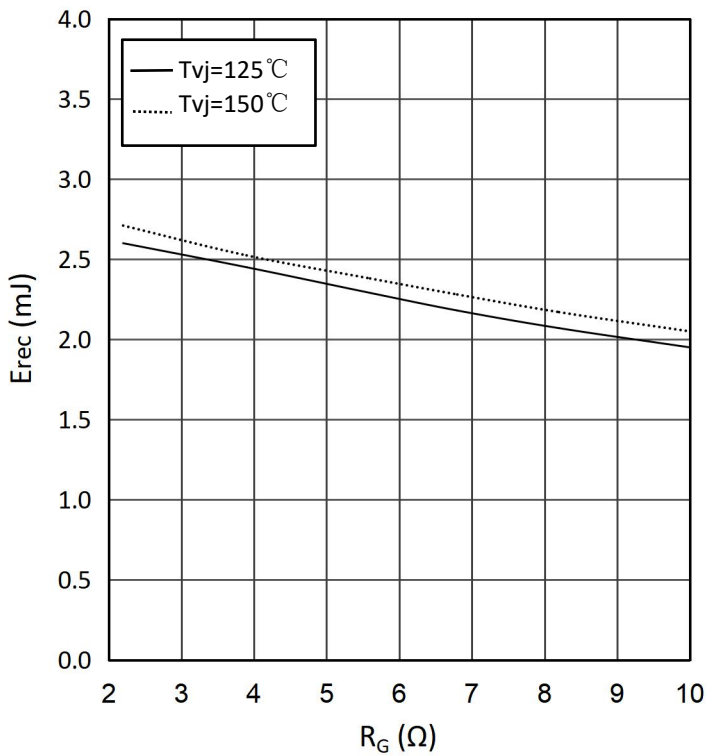
$$E_{rec} = f(I_F)$$

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


switching losses Diode, Inverter (typical)

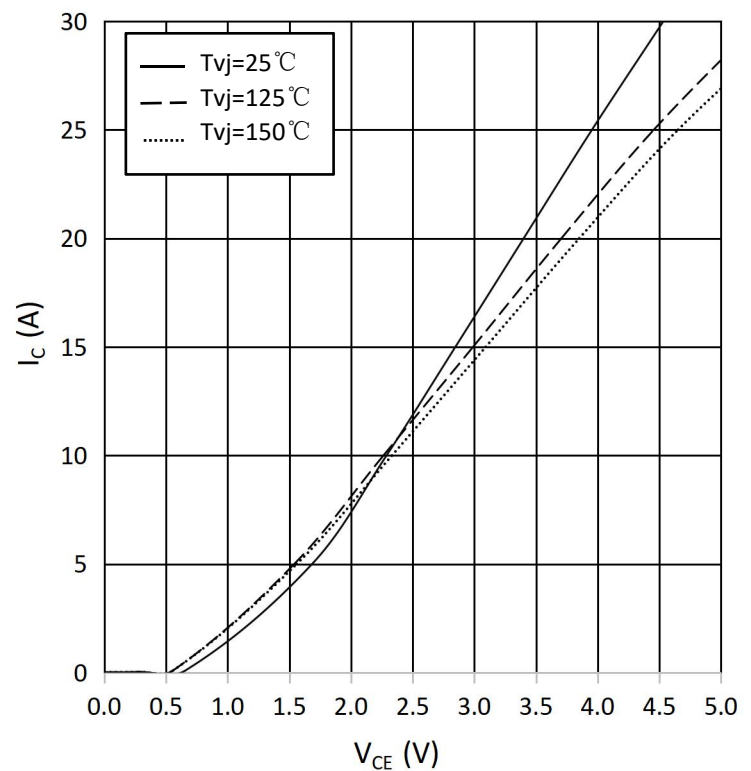
$$E_{rec} = f(R_G)$$

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


output characteristic IGBT, Brake-Chopper (typical)

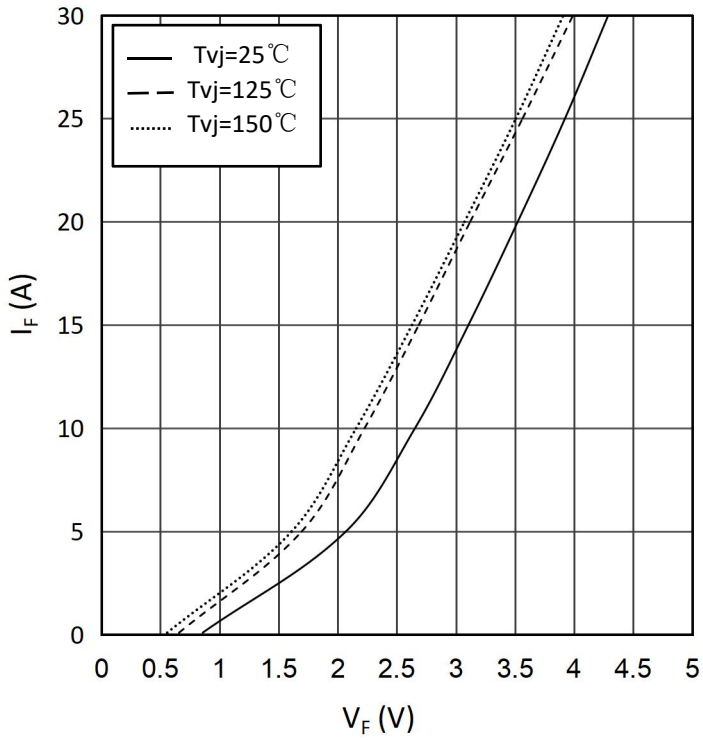
$$I_C = f(V_{CE})$$

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



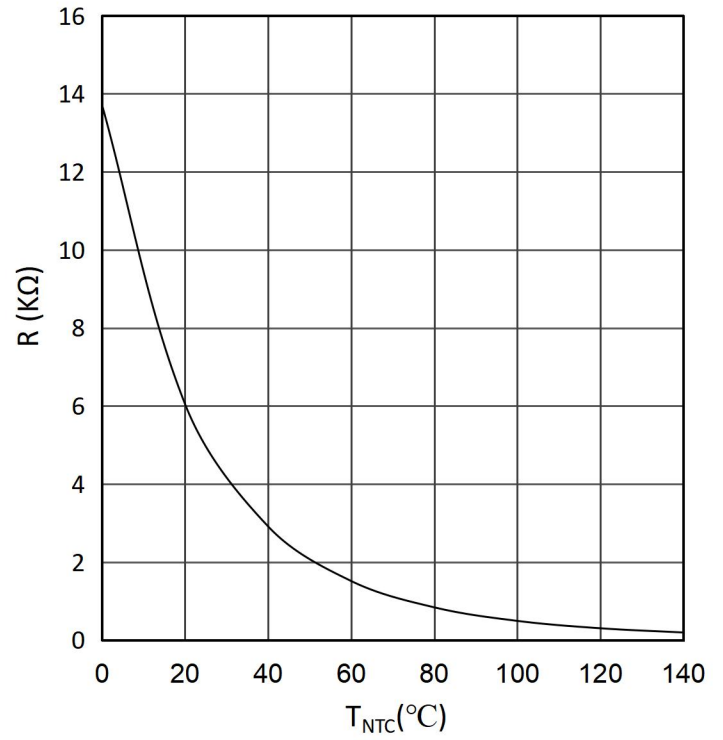
forward characteristic of Diode, Brake-Chopper (typical)

$I_F = f(V_F)$

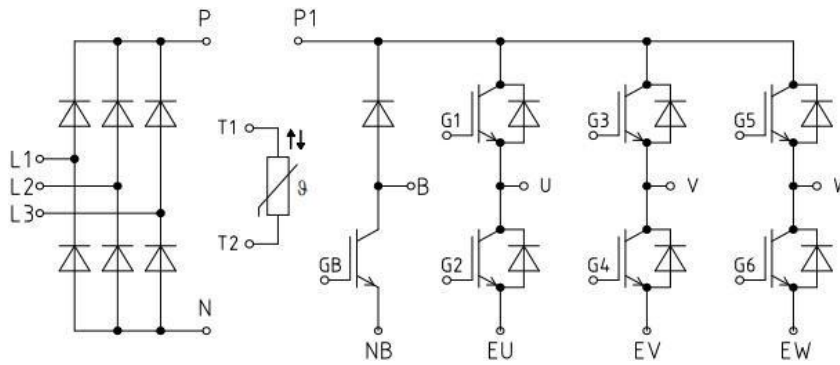


NTC-Thermistor-temperature characteristic(typical)

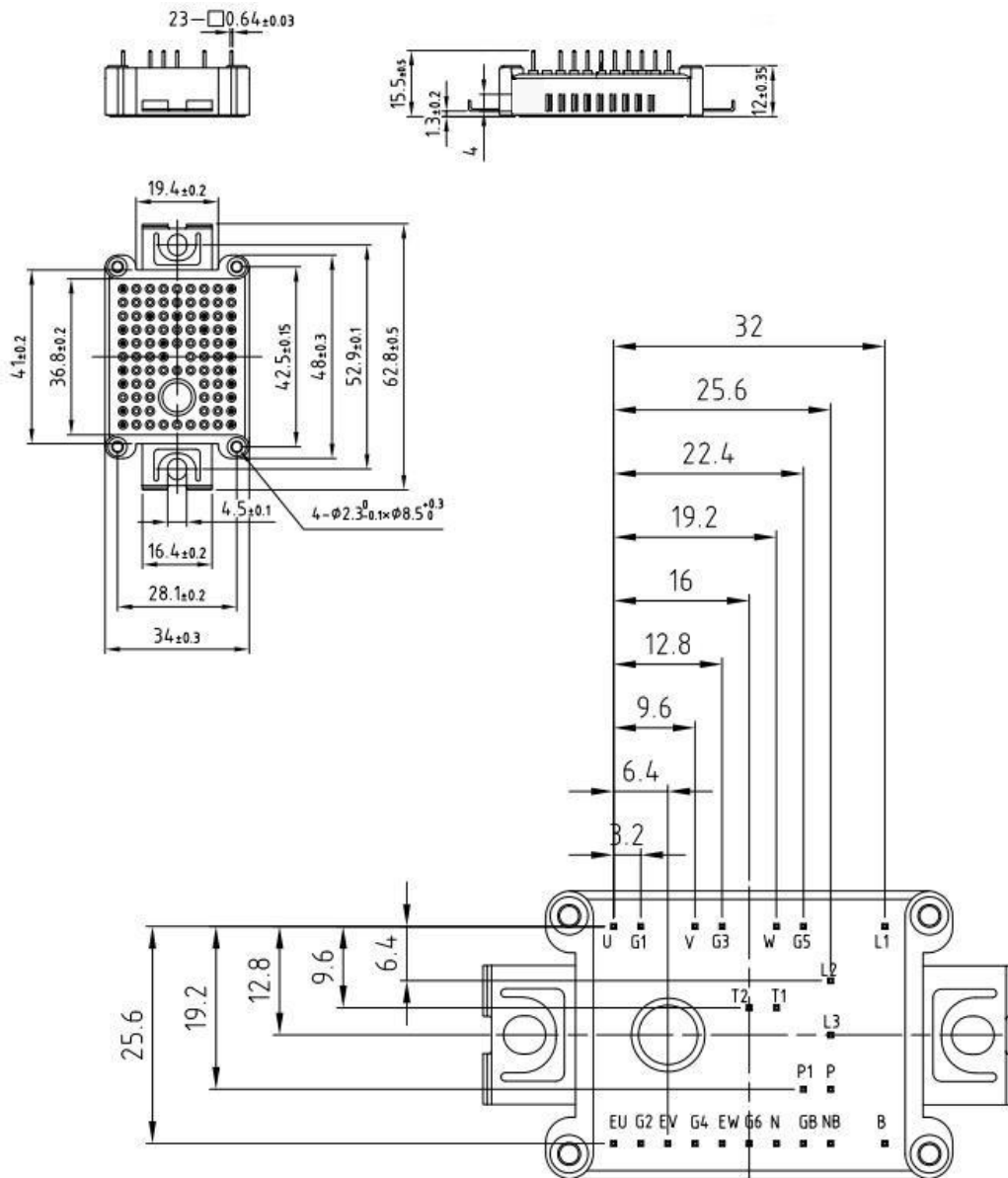
$R=f(T)$



Circuit Diagram



Package Outlines



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