

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	$T_C=100^{\circ}C, T_{vj}=175^{\circ}C$	40	A			
I_{CRM}	Repetitive peak collector current	$t_p=1ms$	80	A			
P_{tot}	Total power dissipation	$T_C=25^{\circ}C, T_{vj}=175^{\circ}C$	214	W			
Characteristics Values							
Symbol	Item	Conditions	Values			Unit	
			Min.	Typ.	Max.		
IGBT							
I_{CES}	Collector-emitter cut-off current	$V_{CE}=1200V, V_{GE}=0V, T_{vj}=25^{\circ}C$	-	-	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	$I_C=1.5mA, V_{CE}=V_{GE}, T_{vj}=25^{\circ}C$	5.2	6.08	6.5	V	
V_{CEsat}	Collector-emitter saturation voltage	$I_C=40A$ $V_{GE}=15V$	$T_{vj}=25^{\circ}C$	-	1.94	-	V
			$T_{vj}=125^{\circ}C$	-	2.33	-	
			$T_{vj}=150^{\circ}C$	-	2.43	-	
C_{ies}	Input capacitance	$V_{CE}=25V, V_{GE}=0V$ $f=1MHz, T_{vj}=25^{\circ}C$	-	3.13	-	nF	
C_{oes}	Output capacitance		-	0.17	-		
C_{res}	Reverse transfer capacitance		-	0.09	-		
Q_G	Gate charge	$V_{CC}=600V, I_C=40A$ $V_{GE}=-15...+15V, T_{vj}=25^{\circ}C$	-	0.24	-	μC	
R_g	Internal gate resistance	$T_{vj}=25^{\circ}C$	-	-	-	Ω	

$t_{d(on)}$	Turn-on delay time	$V_{CC}=600V$ $I_C=40A$ $V_{GE}=\pm 15V$ $R_{G(on)}=12\Omega$ $R_{G(off)}=12\Omega$	$T_{vj}=25^\circ C$	-	45.6	-	ns	
			$T_{vj}=125^\circ C$	-	28.5	-		
			$T_{vj}=150^\circ C$	-	28.8	-		
t_r	Rise time		$T_{vj}=25^\circ C$	-	44.2	-		
			$T_{vj}=125^\circ C$	-	54.1	-		
			$T_{vj}=150^\circ C$	-	54.9	-		
$t_{d(off)}$	Turn-off delay time		$T_{vj}=25^\circ C$	-	139.4	-		
			$T_{vj}=125^\circ C$	-	169.8	-		
			$T_{vj}=150^\circ C$	-	173.0	-		
t_f	Fall time		$T_{vj}=25^\circ C$	-	234.1	-		
			$T_{vj}=125^\circ C$	-	293.8	-		
			$T_{vj}=150^\circ C$	-	278.6	-		
E_{on}	Turn-on energy (per pulse)		$T_{vj}=25^\circ C$	-	4.61	-		mJ
			$T_{vj}=125^\circ C$	-	6.56	-		
			$T_{vj}=150^\circ C$	-	7.01	-		
E_{off}	Turn-off energy (per pulse)	$T_{vj}=25^\circ C$	-	2.19	-			
		$T_{vj}=125^\circ C$	-	3.28	-			
		$T_{vj}=150^\circ C$	-	2.93	-			
SC data	Short-circuit current	$V_{CC}=600V, V_{GE}\leq 15V, T_{vj}=125^\circ C$ $V_{CES}\leq 1200V, t_p\leq 10\mu s$	-	243	-	A		
R_{thJC}	Thermal resistance, junction to case	Per IGBT	-	-	0.7	K/W		
R_{thCH}	Thermal resistance, case to heatsink	Per IGBT $\lambda_{grease}=1W/(m\cdot K)$	-	0.6	-	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		35			A		
I_{FRM}	Repetitive peak forward current	$t_p=1ms$	70			A		
I^2t	I^2t -value	$V_R=0V, t_p=10ms, T_{vj}=150^\circ C$	220			A^2s		
Characteristic Values								
V_F	Continuous forward voltage	$I_F=40A$ $V_{GE}=0V$	$T_{vj}=25^\circ C$	-	2.08	-	V	
			$T_{vj}=125^\circ C$	-	1.78	-		
			$T_{vj}=150^\circ C$	-	1.71	-		
I_{RM}	Peak reverse recovery current		$T_{vj}=25^\circ C$	-	35.6	-	A	
			$T_{vj}=125^\circ C$	-	40.7	-		
			$T_{vj}=150^\circ C$	-	41.6	-		
t_{rr}	Reverse recovery time	$V_R=600V$ $I_F=40A$ $V_{GE}=-15V$	$T_{vj}=25^\circ C$	-	72.7	-	ns	
			$T_{vj}=125^\circ C$	-	500.3	-		
			$T_{vj}=150^\circ C$	-	624.1	-		
Q_r	Recovered charge		$T_{vj}=25^\circ C$	-	1.36	-	μC	
			$T_{vj}=125^\circ C$	-	8.54	-		
			$T_{vj}=150^\circ C$	-	10.43	-		

E _{rec}	Reverse recovery energy		T _{vj} =25°C	-	0.47	-	mJ
			T _{vj} =125°C	-	3.56	-	
			T _{vj} =150°C	-	4.43	-	
R _{thJC}	Thermal resistance, junction to case	per diode	-	-	0.90	-	K/W
R _{thCH}	Thermal resistance, case to heatsink	per diode, λ _{grease} =1 W/(m·K)	-	0.75	-	-	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	60	A
I _{RMSM}	Maximum RMS current at rectifier output	T _C =80°C	60	A
I _{FSM}	Surge forward current	t _p = 10 ms, T _{vj} = 150°C	370	A
I ² t	I ² t-value	V _R =0V, t _p =10ms, T _{vj} =150°C	685	A ² s

Characteristic Values							
Symbol	Item	Conditions	Values			Unit	
			Min.	Typ.	Max.		
V _F	Continuous forward voltage	I _F =35A V _{GE} =0V	T _{vj} =25°C	-	1.57	-	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	-	-	-	
R _{thJC}	Thermal resistance, junction to case	per diode	-	1.05	1.15	-	K/W
R _{thCH}	Thermal resistance, case to heatsink	per diode, λ _{grease} =1 W/(m·K)	-	0.95	-	-	K/W
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	35	A
I _{CRM}	Repetitive peak collector current	t _p =1ms	70	A
P _{tot}	Total power dissipation	T _C =25°C, T _{vj} =175°C	214	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 =0.8mA, V _{CE} =V _{GE} , T _{vj} =25°C	5.2	5.7	6.5	V

V _{CEsat}	Collector-emitter saturation voltage	I _C =35A V _{GE} = 15V	T _{vj} =25°C	-	2.1	-	V
			T _{vj} = 125°C	-	2.3	-	
			T _{vj} = 150°C	-	2.7	-	
C _{ies}	Input capacitance	V _{CE} =25V,V _{GE} =0V f=1MHz,T _{vj} =25°C	-	1767	-	pF	
C _{oes}	Output capacitance		-	116	-		
C _{res}	Reverse transfer capacitance		-	62	-		
Q _G	Gate charge	V _{CC} =600V,I _C =35A V _{GE} =- 15...+ 15V,T _{vj} =25°C	-	0.22	-	μC	
R _g	Internal gate resistance	T _{vj} =25°C	-	-	-	Ω	
t _{d(on)}	Turn-on delay time	V _{CC} =600V I _C =35A V _{GE} =±15V R _{G(on)} = 12Ω R _{G(off)} = 12Ω	T _{vj} =25°C	-	20.8	-	ns
			T _{vj} = 125°C	-	17.6	-	
			T _{vj} = 150°C	-	28.8	-	
t _r	Rise time		T _{vj} =25°C	-	112.8	-	
			T _{vj} = 125°C	-	107.2	-	
			T _{vj} = 150°C	-	54.9	-	
t _{d(off)}	Turn-off delay time		T _{vj} =25°C	-	109.6	-	
			T _{vj} = 125°C	-	120.8	-	
			T _{vj} = 150°C	-	173.1	-	
t _f	Fall time		T _{vj} =25°C	-	152	-	
			T _{vj} = 125°C	-	180.8	-	
			T _{vj} = 150°C	-	278.6	-	
E _{on}	Turn-on energy (per pulse)	T _{vj} =25°C	-	4.97	-	mJ	
		T _{vj} = 125°C	-	5.93	-		
		T _{vj} = 150°C	-	6.13	-		
E _{off}	Turn-off energy (per pulse)	T _{vj} =25°C	-	1.87	-		
		T _{vj} = 125°C	-	2.30	-		
		T _{vj} = 150°C	-	2.68	-		
SC data	Short-circuit current	V _{CC} =600V,V _{GE} ≤ 15V,T _{vj} = 125°C V _{CEs} ≤ 1200V,t _p ≤ 10μs	-	160	-	A	
R _{thJC}	Thermal resistance,junction to case	Per IGBT	-	0.6	0.7	K/W	
R _{thCH}	Thermalresistance,case to heatsink	Per IGBT λgrease= 1W/(m·K)	-	0.6	-	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°C	1200			V	
I _F	Forward current,DC		10			A	
I _{FRM}	Repetitive peak forward current	t _p = 1ms	20			A	
I ² t	I ² t-value	V _R =0V,t _p = 10ms,T _{vj} = 150°C	14			A ² s	
Characteristic Values							
V _F	Continuous forward voltage	I _F = 10A V _{GE} =0V	T _{vj} =25°C	-	1.98	-	V
			T _{vj} = 125°C	-	1.84	-	
			T _{vj} = 150°C	-	1.81	-	

I _{RM}	Peak reverse recovery current	V _R =600V I _F =10A V _{GE} =-15V	T _{vj} =25°C	-	21	-	A
			T _{vj} =125°C	-	19	-	
			T _{vj} =150°C	-	20.8	-	
t _{rr}	Reverse recovery time		T _{vj} =25°C	-	45.2	-	ns
			T _{vj} =125°C	-	101.9	-	
			T _{vj} =150°C	-	283.4	-	
Q _r	Recovered charge		T _{vj} =25°C	-	1.06	-	μC
			T _{vj} =125°C	-	3.58	-	
			T _{vj} =150°C	-	3.86	-	
E _{rec}	Reverse recovery energy	T _{vj} =25°C	-	0.73	-	mJ	
		T _{vj} =125°C	-	1.87	-		
		T _{vj} =150°C	-	1.89	-		
R _{thJC}	Thermal resistance, junction to case	per diode	-	1.75	1.90	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

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	-	40	-	80	N
d _s	Creepage distance	Terminal to terminal	-	6.3	-	mm
		Terminal to base plate	-	11.5	-	
d _a	Clearance	Terminal to terminal	-	5	-	mm
		Terminal to base plate	-	10	-	
m	Weight	-	-	41	-	g

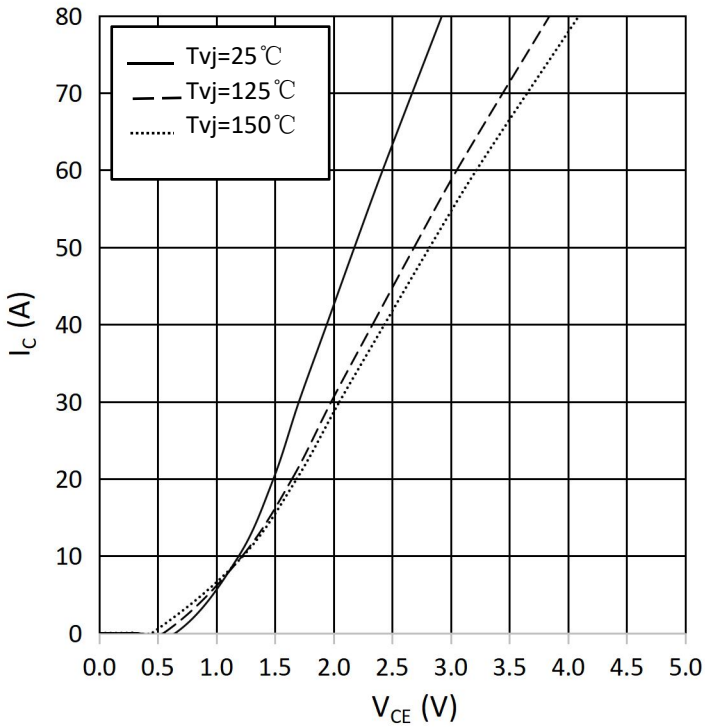
NTC Thermistor Characteristics

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	-	

output characteristic IGBT, Inverter (typical)

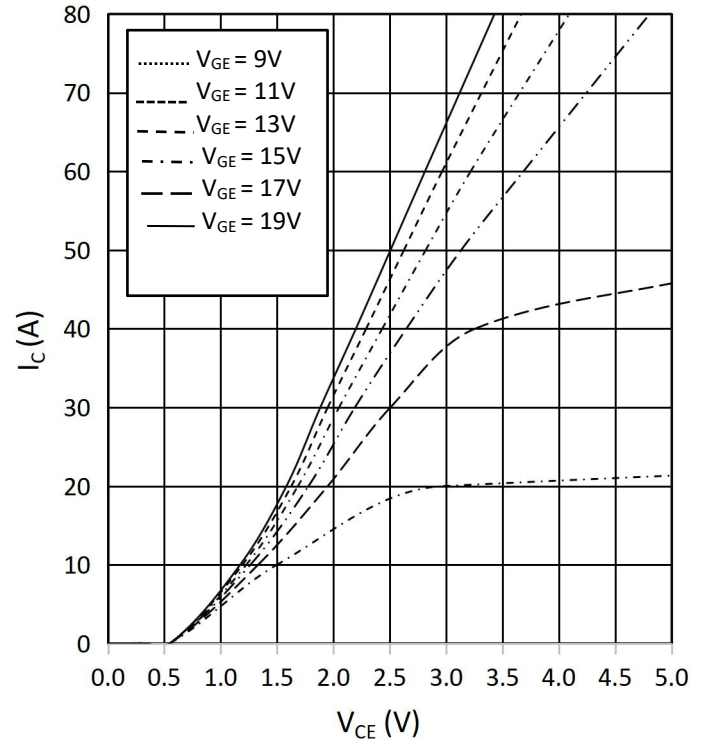
$I_C = f(V_{CE})$

$V_{GE} = 15V$


output characteristic IGBT, Inverter (typical)

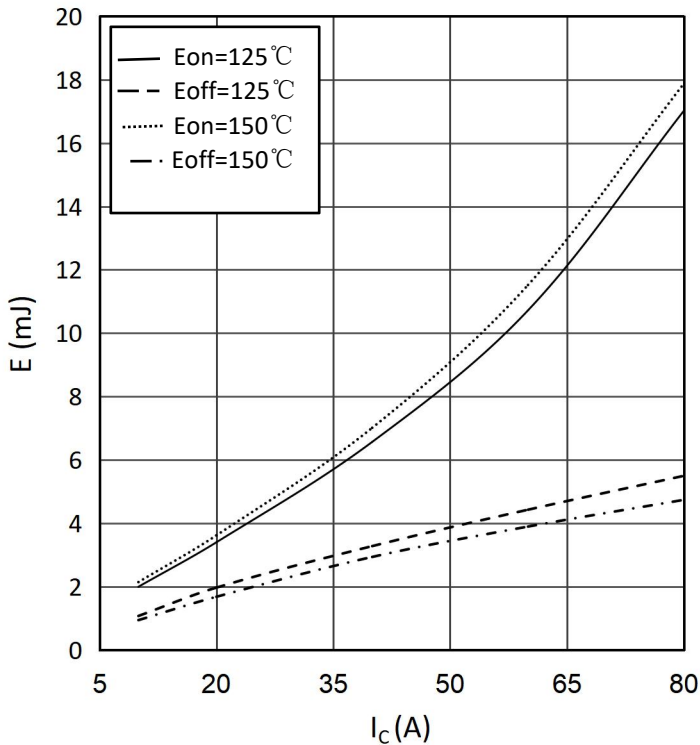
$I_C = f(V_{CE})$

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


switching losses IGBT, Inverter (typical)

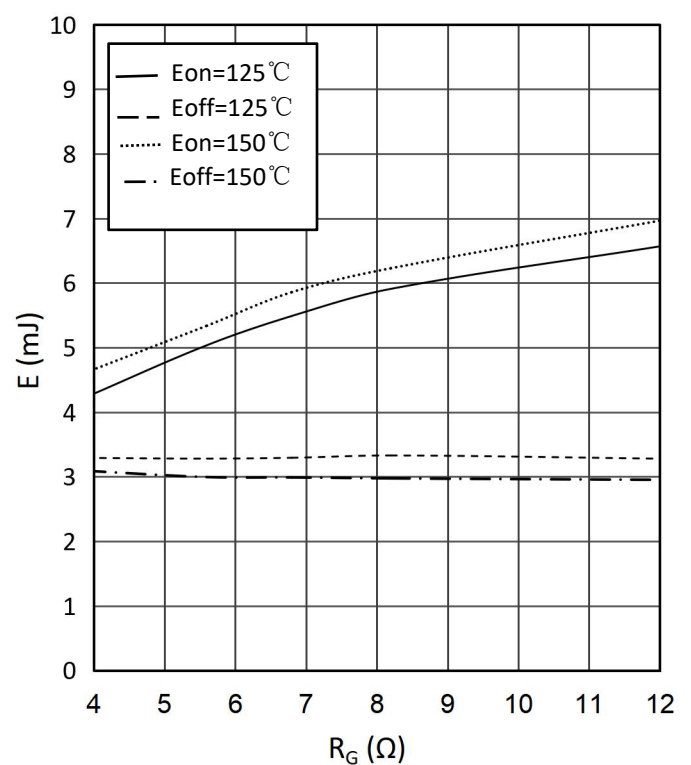
$E_{on} = f(I_C), E_{off} = f(I_C)$

$V_{GE} = \pm 15V, R_{Gon} = 12\Omega, R_{Goff} = 12\Omega, V_{CE} = 600V$


switching losses IGBT, Inverter (typical)

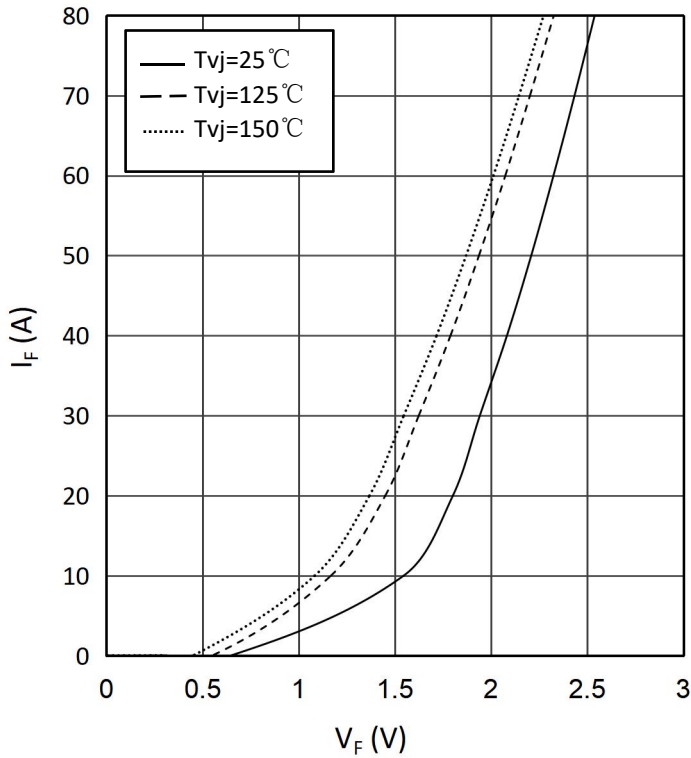
$E_{on} = f(R_G), E_{off} = f(R_G)$

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



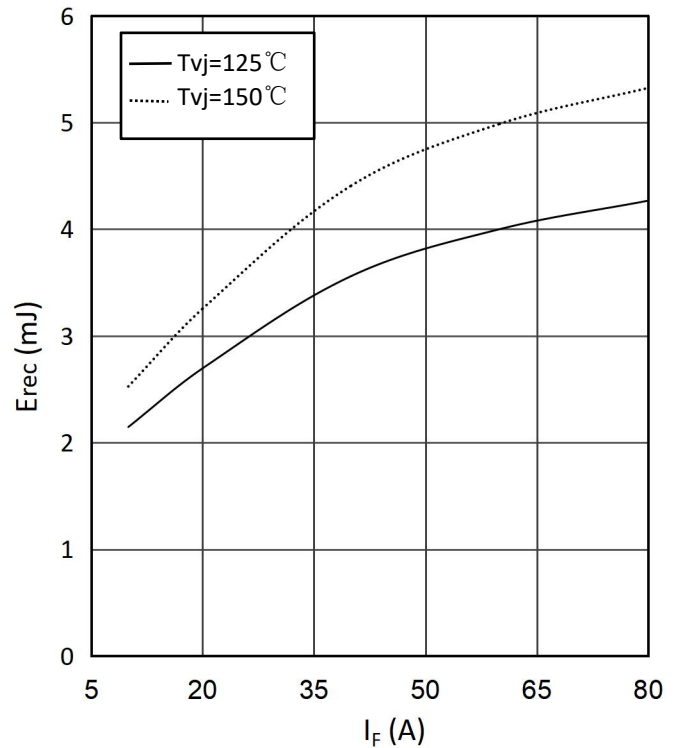
forward characteristic of Diode, Inverter (typical)

$$I_F = f(V_F)$$


switching losses Diode, Inverter (typical)

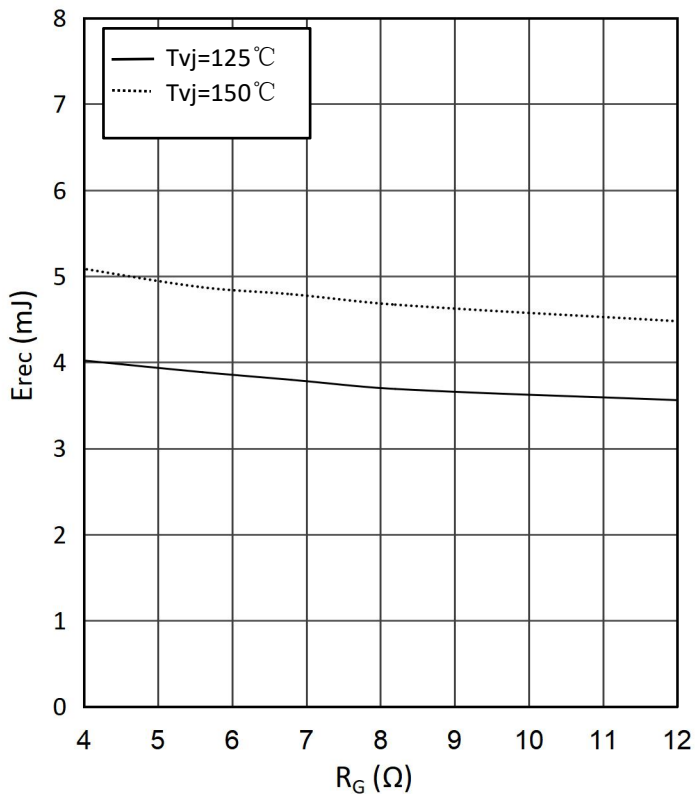
$$E_{rec} = f(I_F)$$

$$R_{Gon} = 12\Omega, V_{CE} = 600\text{ V}$$


switching losses Diode, Inverter (typical)

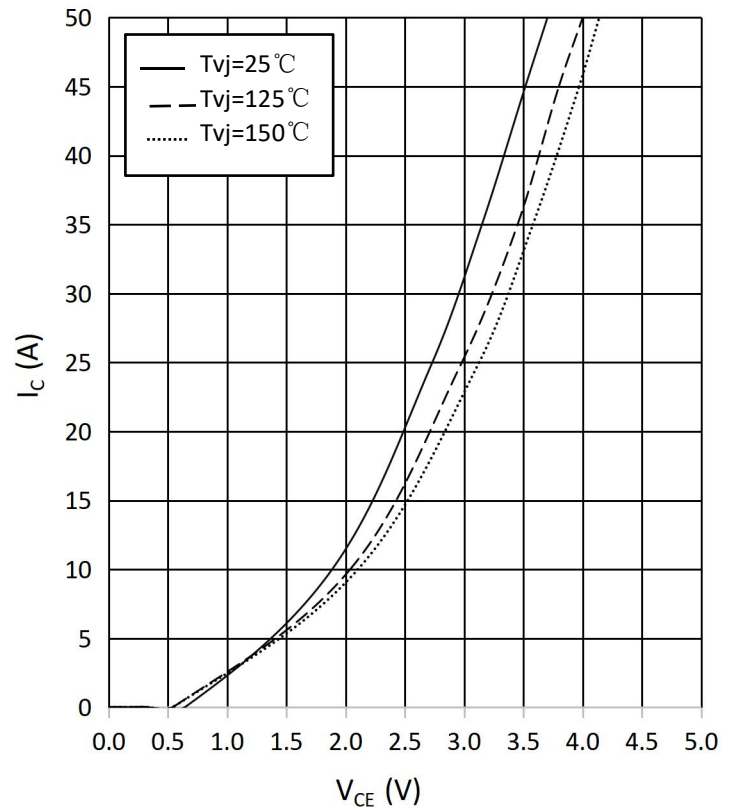
$$E_{rec} = f(R_G)$$

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


output characteristic IGBT, Brake-Chopper (typical)

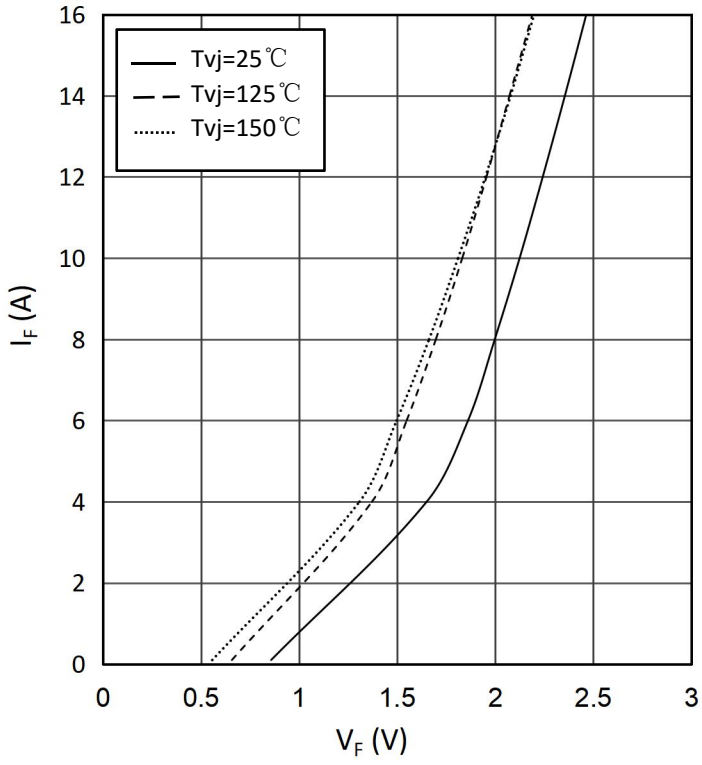
$$I_C = f(V_{CE})$$

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



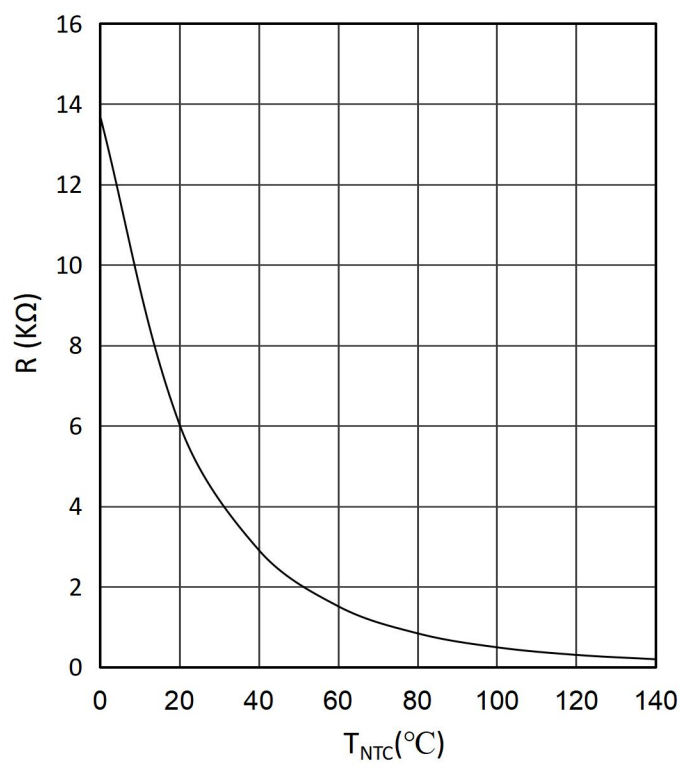
forward characteristic of Diode, Brake-Chopper (typical)

$I_F = f(V_F)$

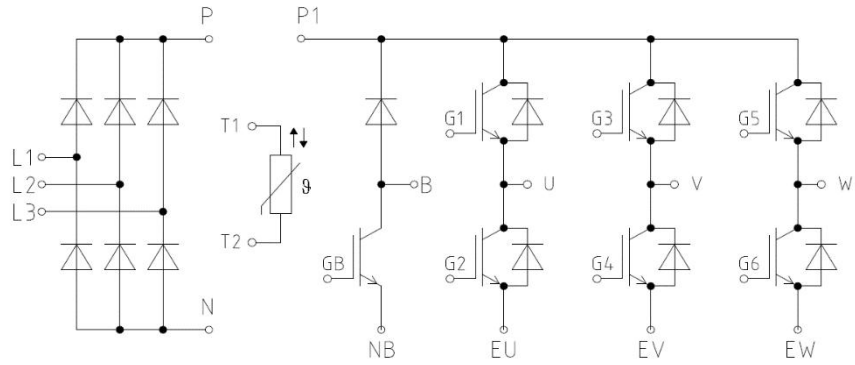


NTC- Thermistor- temperature characteristic(typical)

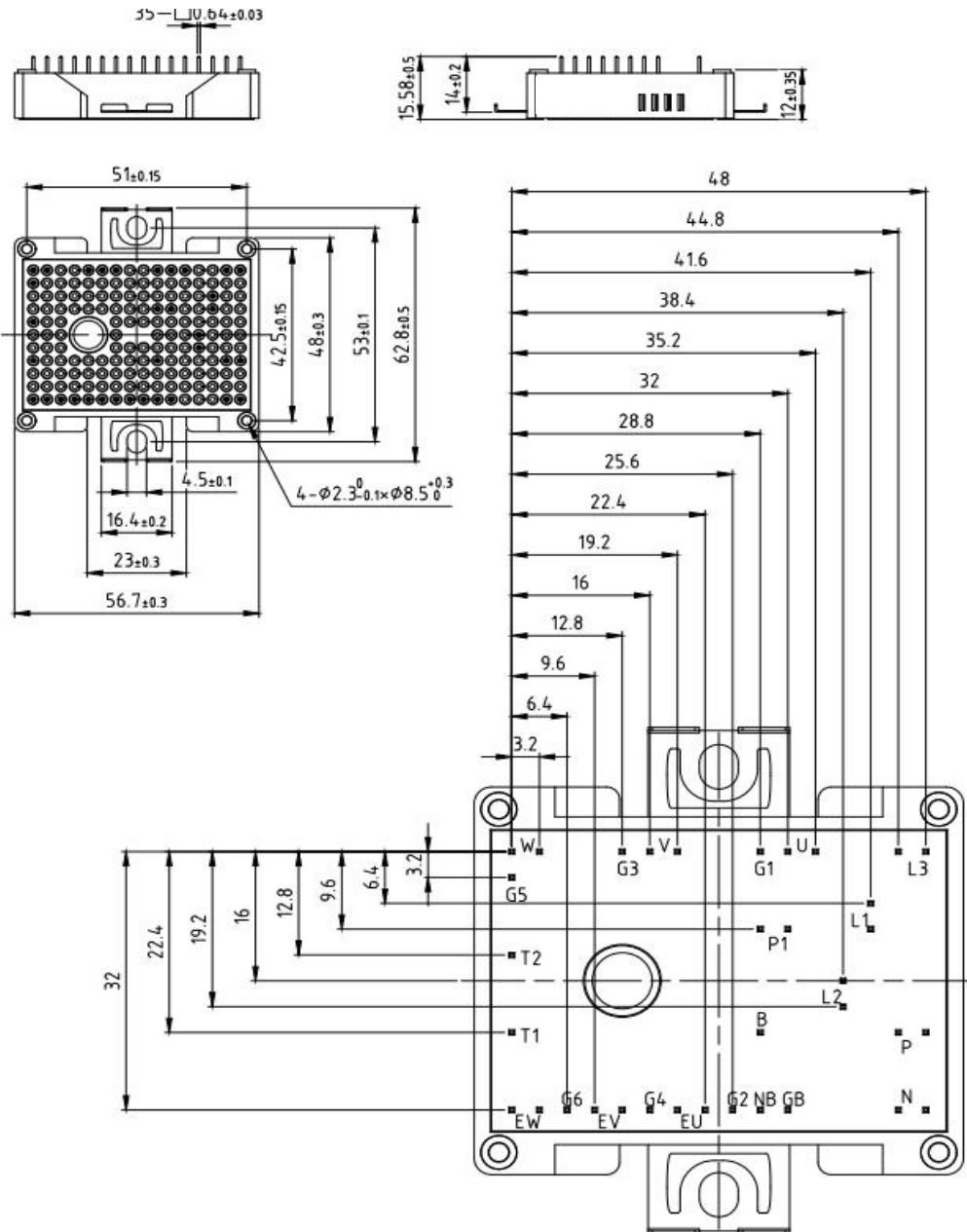
$R=f(T)$



Circuit Diagram



Package Outlines



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