LEGM35BE120E5HZ

IGBT Power Module

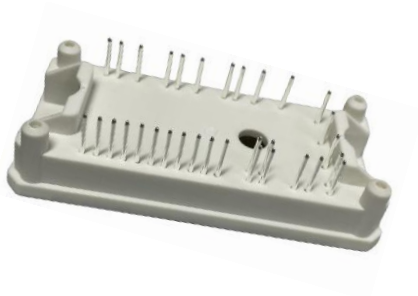
Features:

- V_{CE}=1200V I_C=35A
- Low $V_{CE(sat)}$
- V_{CEsat} with positive temperature coefficient
- Maximum junction temperature 175℃
- Isolation Type Package

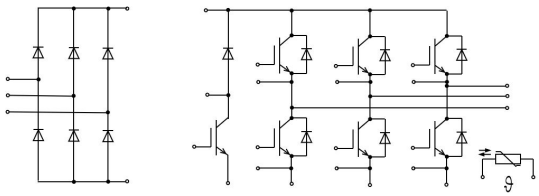
Applications:

- The inverter
- Motor control and drives

Package Type & Internal Circuit



E5



Internal Circuit

Maximum Rated Values (IGBT,Inverter)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CES}	Collector-emitter voltage	V_{EC}=0 V,I_C=1mA,T_{vj}=25 ℃	1200	V
I_C	Continuous Collector Current	T_C=80℃	35	A
I_{CRM}	Peak Collector Current	I_{CRM}=2I_C	70	A
V_{GES}	Gate-Emitter Voltage	T_{vj}=25 ℃	±30	V
P_{tot}	Total Power Dissipation	T_C=25 ℃,T_{vjmax}=175 ℃	217	W

Characteristics Values (IGBT Inverter)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C=35 A, V_{GE}=15 V, T_{vj}=25 ℃		1.9		V
		I_C=35 A, V_{GE}=15 V, T_{vj}=150 ℃		2.4		V
$V_{GE(th)}$	Gate Threshold Voltage	I_C=6.0 mA,V_{CE}=V_{GE},T_{vj}= 25 ℃	5.8	6.3	6.8	V
I_{CES}	Collector-Emitter Cut-off Current	V_{CE}=1200 V, V_{GE}=0 V, T_{vj}=25 ℃			1.2	mA
I_{GES}	Gate-Emitter Leakage Current	V_{CE}=0 V, V_{GE}=20V, T_{vj}=25 ℃			410	nA
C_{ies}	Input capacitance	f = 1 MHz, T_{vj}= 25°C, V_{CE} = 25 V, V_{GE}= 0 V		3459		pF
C_{res}	Reverse transfer capacitance			102		pF
$t_{d(on)}$	Turn-on Delay Time, Inductive Load	I_C=35 A,V_{CE}=600 V V_{GE}=±15 V R_G=25Ω T_{vj}=25 ℃		43		ns
t_r	Rise Time, Inductive Load			29		ns
$t_{d(off)}$	Turn-off Delay Time, Inductive Load			200		ns
t_f	Fall Time, Inductive Load			230		ns
E_{on}	Turn-on Energy Loss per Pulse			2.74		mJ
E_{off}	Turn-off Energy Loss per Pulse			2.47		mJ
$t_{d(on)}$	Turn-on Delay Time, Inductive Load	I_C=35 A,V_{CE}=600 V V_{GE}=±15 V R_G=25Ω T_{vj}=150 ℃		43		ns
t_r	Rise Time, Inductive Load			31		ns
$t_{d(off)}$	Turn-off Delay Time, Inductive Load			287		ns
t_f	Fall Time, Inductive Load			300		ns
E_{on}	Turn-on Energy Loss per Pulse			4.82		mJ
E_{off}	Turn-off Energy Loss per Pulse			3.54		mJ
R_{thJC}	Thermal resistance, junction to case	per IGBT			0.69	K/W
$T_{vj\ op}$	Temperature under switching conditions		-40		150	℃
I_{sc}	SC	V_{GE}≤15V, V_{CE}=600V, t_p≤10μS, T_{vj}=150℃, V_{CEmax}=V_{CES}-L_{sCE} ·di/dt		160		A

Maximum Rated Values (Diode Inverter)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	T_{vj}= 25 ℃		1200		V
I_F	Continuous DC Forward Current			35		A
I_{FRM}	Repetitive Peak Forward Current	t_P=1 ms		70		A

Characteristic Values (Diode Inverter)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_F	Forward Voltage	I_F=35 A, V_{CE}=0 V,T_{vj}= 25 ℃		1.9		V
		I_F=35 A, V_{CE}=0 V,T_{vj}=150 ℃		1.6		V
I_{rr}	Peak reverse recovery current	I_F=35 A,V_R=600 V -di/dt=1000A/us T_{vj}=25 ℃, V_{GE}=-15V		45		A
Q_r	Recovered Charge			3.25		uC
E_{rec}	Reverse Recovery Energy			1.03		mJ
I_{rr}	Peak reverse recovery current	I_F=35A,V_R=600 V -di/dt=1000A/us T_{vj}=150 ℃ V_{GE}=-15V		64		A
Q_r	Recovered Charge			6.86		uC
E_{rec}	Reverse Recovery Energy			2.06		mJ
R_{thJC}	Thermal resistance, junction to case	per Diode			1.08	K/W
$T_{vj\ op}$	Temperature under switching conditions		-40		150	℃

Maximum Rated Values (Diode Rectifier)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{RRM}	Repetitive peak reverse voltage	T_{vj}=25 ℃		1800		V
I_{FRMSM}	Maximum RMS forward current per chip	T_c=80 ℃		70		A
I_{RMSM}	Maximum RMS current at rectifier chip	T_c=80 ℃		70		A
I_{FSM}	Surge forward current	t_p=10ms T_{vj}=25 ℃		420		A
I^2t	I^2t-value	t_p=10ms T_{vj}=25 ℃		880		A^2S
I_{FSM}	Surge forward current	t_p=10ms T_{vj}=150 ℃		360		A
I^2t	I^2t-value	t_p=10ms T_{vj}=150 ℃		600		A^2S

Characteristic Values (Diode Rectifier)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_F	Forward voltage	T_c=25 ℃		0.9		V
I_R	Reverse current	T_{vj}=150 ℃ V_R=1800V		1.1		mA
R_{thjc}	Thermal resistance junction to case	T_c=25 ℃			1.5	K/W
T_{vjop}	Temperature under switching conditions		-40		150	℃

Maximum Rated Values (IGBT Brake-Chopper)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{CES}	Collector-emitter voltage	T_{vj}=25℃		1200		V
I_C	Continuous Collector Current	T_C = 100℃, $T_{vj\,max}$ = 175℃		25		A
I_{CRM}	Peak Collector Current	I_{CRM}=2I_C		50		A
V_{GES}	Gate-Emitter Voltage	T_{vj}=25℃	-20		20	V

Characteristic Values (IGBT Brake-Chopper)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C=25 A, V_{GE}=15 V, T_{vj}=25 ℃		1.8		V
		I_C=25 A, V_{GE}=15 V, T_{vj}=150 ℃		2.1		V
$V_{GE(th)}$	Gate Threshold Voltage	I_C=6.0 mA,V_{CE}=V_{GE},T_{vj}= 25 ℃	6.0	6.5	7.0	V
I_{CES}	Collector-Emitter Cut-off Current	V_{CE}=1200 V, V_{GE}=0 V, T_{vj}=25 ℃			20	uA
I_{GES}	Gate-Emitter Leakage Current	V_{CE}=0 V, V_{GE}=15 V, T_{vj}=25 ℃			200	nA
C_{ies}	Input capacitance	f = 1 MHz, T_{vj}= 25°C, V_{CE} = 25 V, V_{GE}= 0 V		2.15		nF
C_{res}	Reverse transfer capacitance			101.5		pF
$t_{d(on)}$	Turn-on Delay Time, Inductive Load	I_C=25 A,V_{CE}=600 V V_{GE}=±15 V R_G=20Ω T_{vj}=25 ℃		29.8		ns
t_r	Rise Time, Inductive Load			15.2		ns
$t_{d(off)}$	Turn-off Delay Time, Inductive Load			223		ns
t_f	Fall Time, Inductive Load			192		ns
E_{on}	Turn-on Energy Loss per Pulse			0.92		mJ
E_{off}	Turn-off Energy Loss per Pulse			1.73		mJ
$t_{d(on)}$	Turn-on Delay Time, Inductive Load	I_C=25 A,V_{CE}=600 V V_{GE}=±15 V R_G=20Ω T_{vj}=150 ℃		30		ns
t_r	Rise Time, Inductive Load			16		ns
$t_{d(off)}$	Turn-off Delay Time, Inductive Load			279		ns
t_f	Fall Time, Inductive Load			344		ns
E_{on}	Turn-on Energy Loss per Pulse			1.71		mJ
E_{off}	Turn-off Energy Loss per Pulse			2.71		mJ
R_{thJC}	Thermal resistance, junction to case	per IGBT			0.893	K/W
$T_{vj\,op}$	Temperature under switching conditions		-40		150	°C
I_{sc}	SC	V_{GE}≤15V, V_{CE}=600V, tp≤10μS,T_{vj}=150℃, VCE_{max}=V_{CES}-L_{sCE} ·di/dt		100		A

Maximum Rated Values (Diode Brake-Chopper)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	T_{vj}= 25 ℃		1200		V
I_F	Continuous DC Forward Current			15		A
I_{FRM}	Repetitive Peak Forward Current	t_P=1 ms		30		A

Characteristics (Diode Brake-Chopper)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_F	Forward Voltage	I_F=15 A, V_{CE}=0 V, T_{vj}=25 ℃		2.1		V
		I_F=15 A, V_{CE}=0 V, T_{vj}=150 ℃		1.6		V
t_{rr}	Reverse Recovery time	I_F=15 A,V_R=600 V -di/dt=300A/us T_{vj}=25 ℃		42.2		ns
Q_r	Recovered Charge			0.88		μC
E_{rec}	Reverse Recovery Energy			0.09		mJ
t_{rr}	Reverse Recovery time	I_F=15A,V_R=600 V -di/dt=300A/us T_{vj}=150 ℃		270		ns
Q_r	Recovered Charge			2.06		μC
E_{rec}	Reverse Recovery Energy			0.43		mJ
R_{thJC}	Thermal resistance, junction to case	Per diode			1.44	K/W
$T_{vj\ op}$	Temperature under switching conditions		-40		150	℃

NTC-Thermistor (Characteristic Values)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
R_{25}	Rated resistance	T_c=25 ℃		22		KΩ
ΔR/R	Deviation of R100	T_c=100 ℃	-5		5	%
P_{25}	Power dissipation	T_c=25 ℃		210		mW
$B_{25/50}$	B-value	$R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298,15K))]$		3950		K
$B_{25/100}$	B-value	$R_2=R_{25}\exp[B_{25/100}(1/T_2-1/(298,15K))]$		3998		K

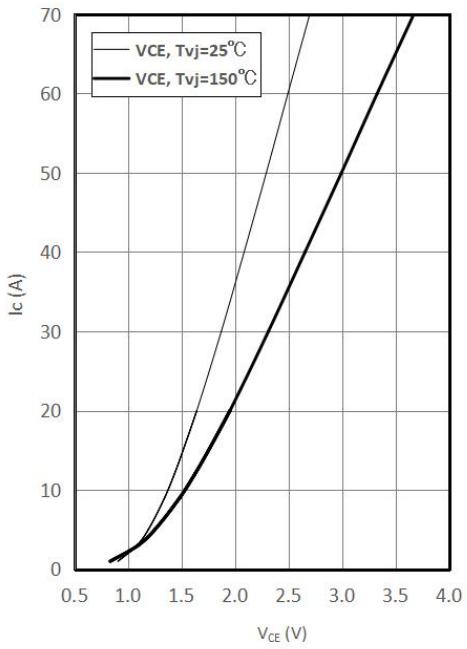
Module Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{isol}	Isolation voltage	t=1min,f=50Hz	2500			V
T_{stg}	Storage Temperature		-40		125	℃
F	Mountig Force per Clamp		40		80	N
G	Weight of Module			40		g

Output characteristic of IGBT,Inverter (typical)

$I_c = f(V_{CE})$

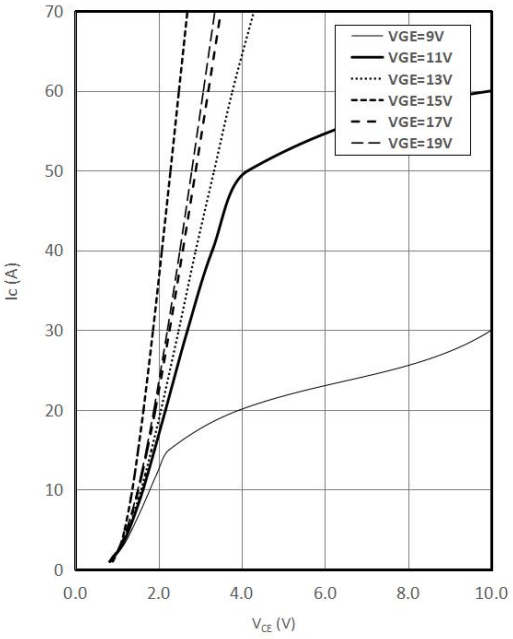
$V_{GE} = 15V$



Output characteristic IGBT , Inverter (typical)

$I_C = f(V_{CE})$

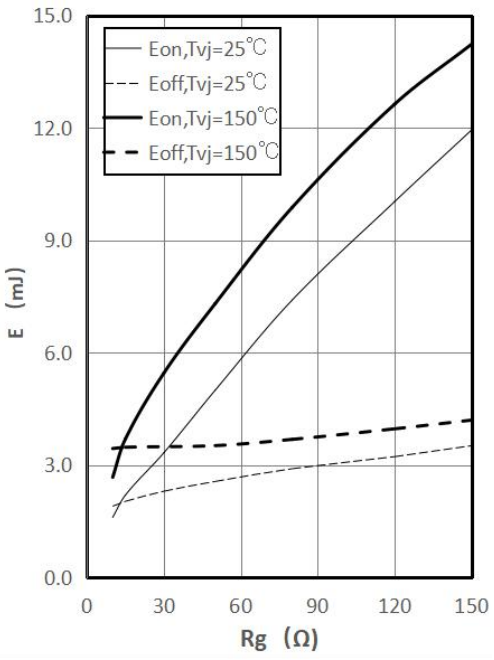
T_{vj}=150°C



Switching losses of IGBT,Inverter (typical)

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

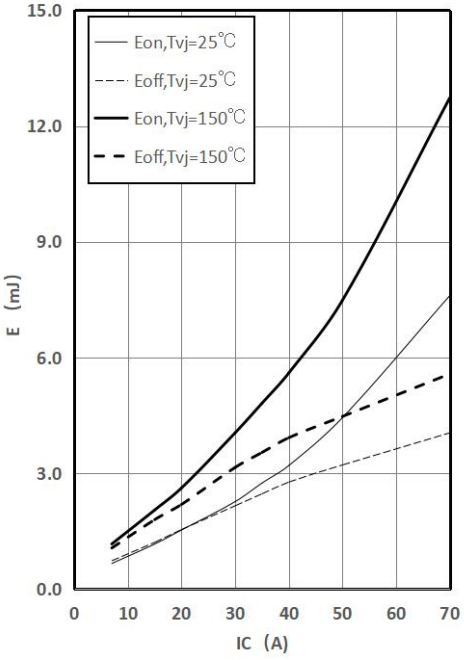
$V_{GE} = \pm 15V$, $R_G = 25\ \Omega$, $V_{CE} = 600V$



Switching losses of IGBT,Inverter (typical)

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

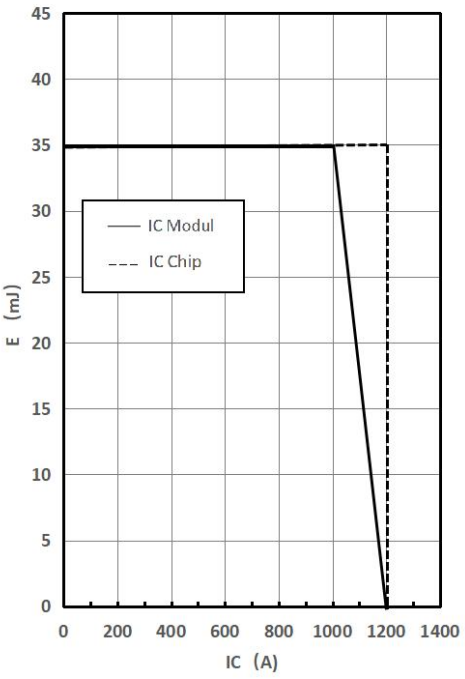
$V_{GE} = \pm 15V$, $I_C = 35$ A, $V_{CE} = 600V$



RBSOA IGBT,Inverter (typical)

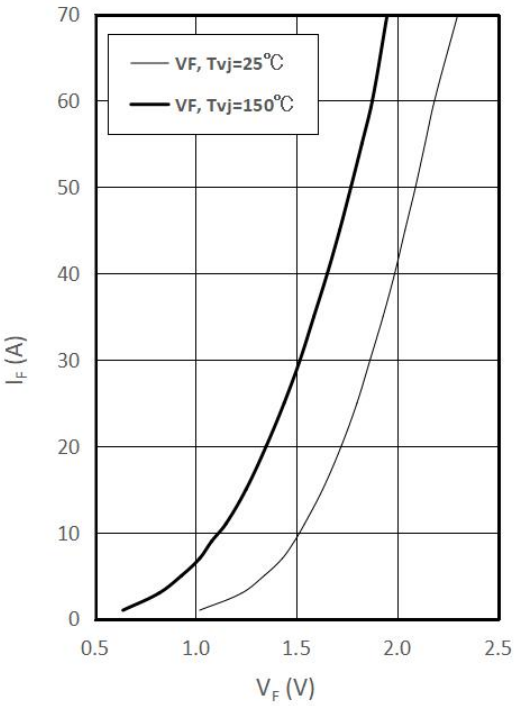
I_C= f (V_{CE})

V_{GE} = ±15V, R_G =25 Ω, T_{vj} =150 ℃



Forward characteristic of Diode,Inverter (typical)

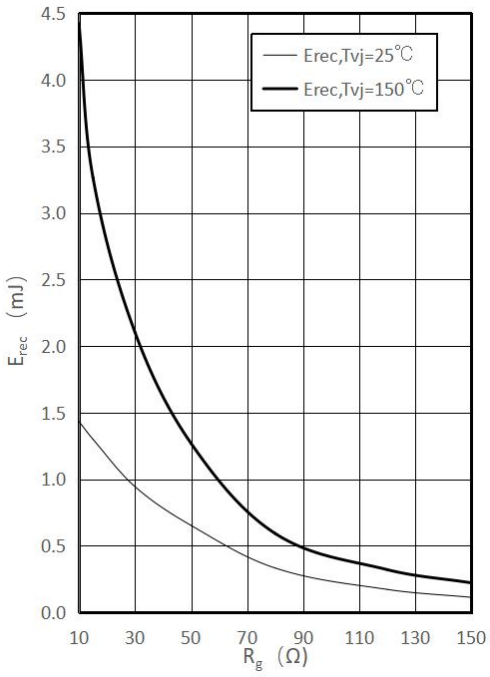
I_F = f(V_F)



Switching losses of Diode, Inverter (typical)

E_{rec} = f(R_G),

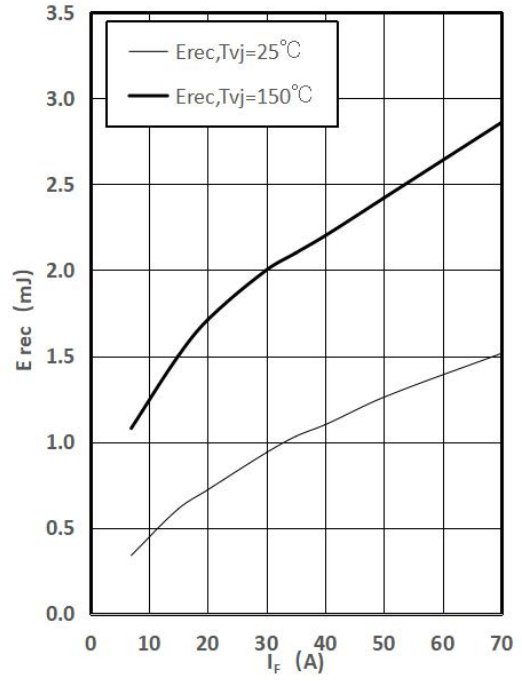
I_F =35 A，V_{CE} = 600V



Switching losses of Diode, Inverter (typical)

E_{rec} = f(I_F),

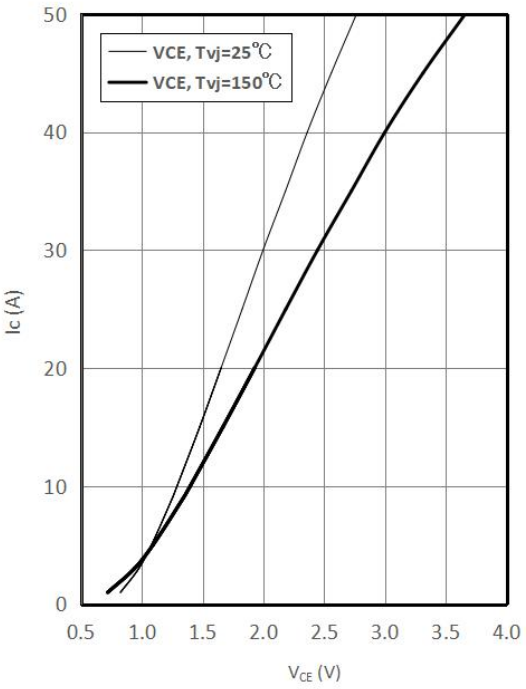
R_G =25 Ω，V_{CE} = 600V



Output characteristic of IGBT,Brake-Chopper, (typical)

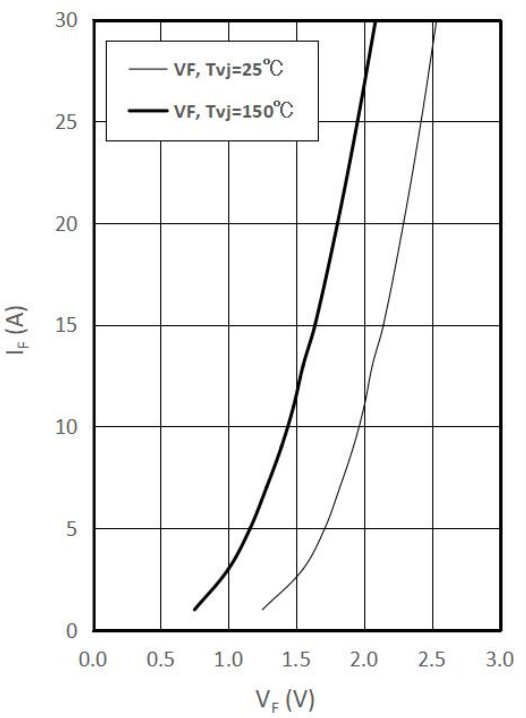
$I_c = f(V_{CE})$

$V_{GE} = 15V$



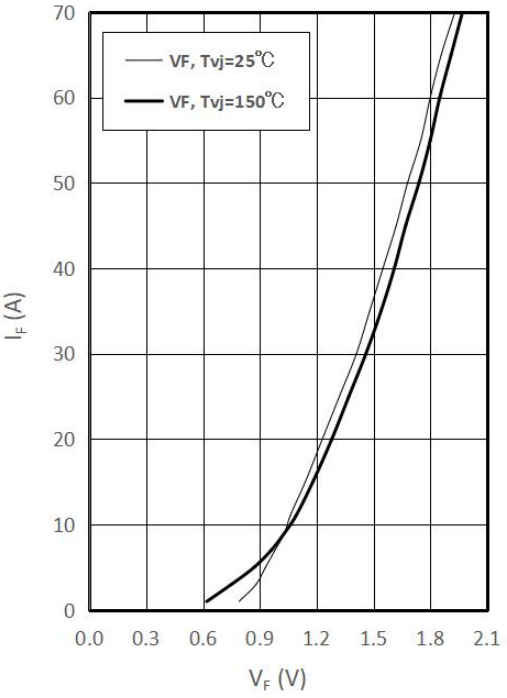
Forward characteristic of Diode,Brake-Chopper (typical)

$I_F = f(V_F)$



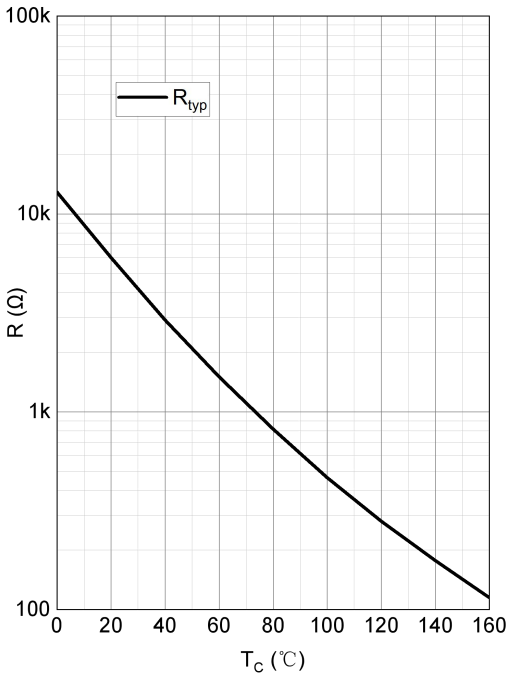
Forward characteristic of Diode, Rectifier(typical)

$I_F = f(V_F)$

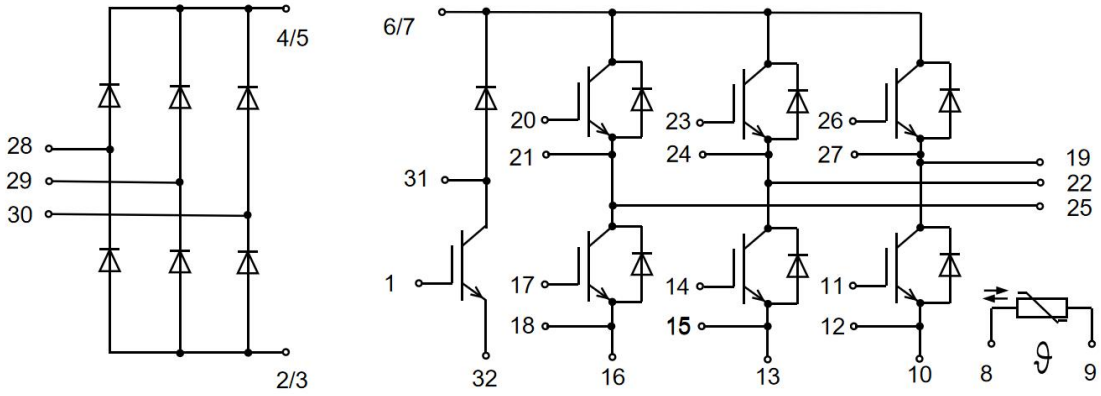


NTC-thermistor-temperature characteristic (typical)

$R = f(T_{NTC})$,



Circuit Diagram



Package Dimensions

(Dimensions in Millimeters)

Pin table		
Pin	X	Y
1	52, 55	0
2	47, 7	0
3	44, 8	0
4	37, 8	0
5	37, 8	2, 8
6	35	0
7	35	2, 8
8	28	0
9	25, 2	0
10	22, 4	0
11	19, 6	0
12	16, 8	0
13	14	0
14	11, 2	0
15	8, 4	0
16	5, 6	0
17	2, 8	0
18	0	0
19	0	28, 5
20	2, 8	28, 5
21	7, 5	28, 5
22	14, 5	28, 5
23	17, 3	28, 5
24	22	28, 5
25	29	28, 5
26	31, 8	28, 5
27	36, 5	28, 5
28	43, 5	28, 5
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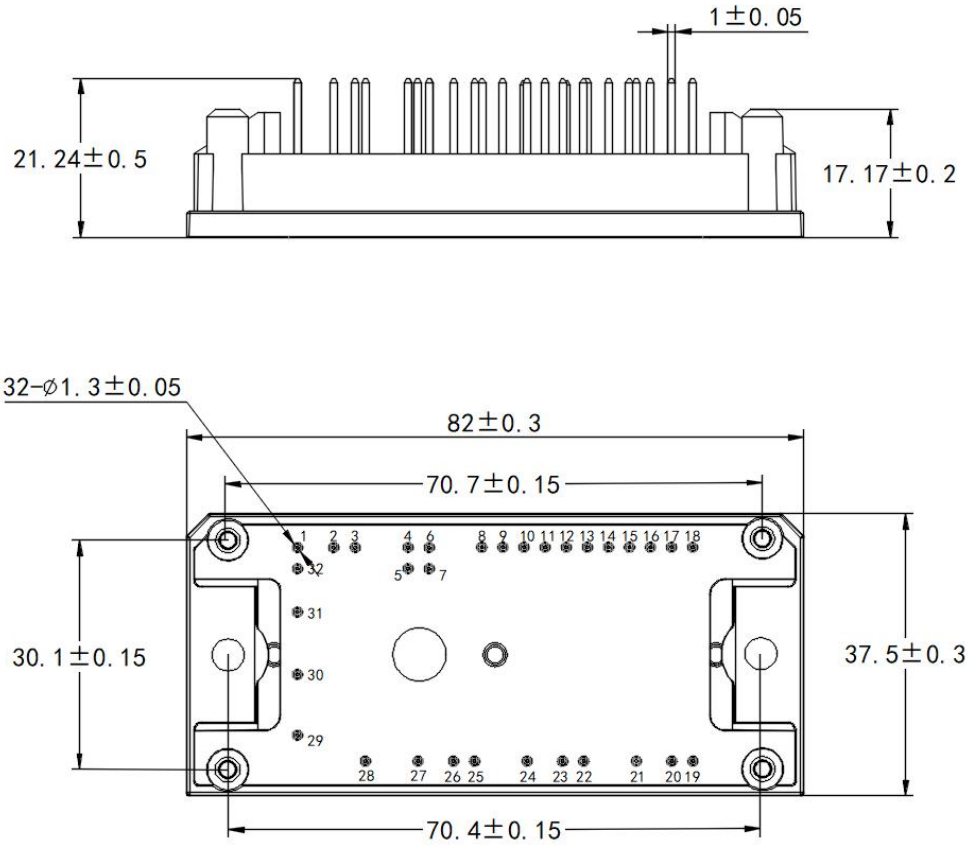
30	52, 55	16, 9
31	52, 55	8, 6
32	52, 55	2, 8



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