

LEGM25BE120E5HZ

IGBT Power Module

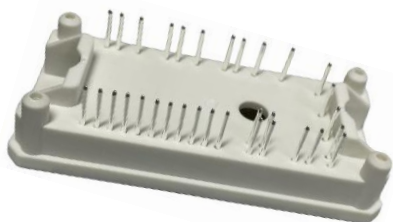
Features:

- $V_{CE}=1200V$ $I_C=25A$
- Low $V_{CE(sat)}$
- V_{CEsat} with positive temperature coefficient
- Maximum junction temperature $150^{\circ}C$
- Isolation Type Package

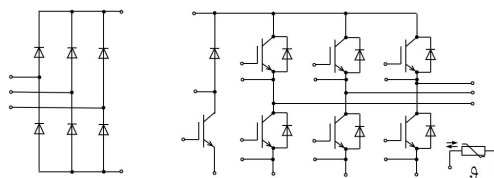
Applications:

- 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	$V_{EC}=0V, I_C=1mA, T_{vj}=25^{\circ}C$	1200	V
I_C	Continuous Collector Current	$T_C=100^{\circ}C$	25	A
I_{CRM}	Peak Collector Current	$I_{CRM}=2I_C$	50	A
V_{GES}	Gate-Emitter Voltage	$T_{vj}=25^{\circ}C$	± 30	V
P_{tot}	Total Power Dissipation	$T_C=25^{\circ}C, T_{vjmax}=150^{\circ}C$	87	W

Maximum Rated Values (IGBT Inverter)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$I_C=25\text{ A}, V_{GE}=15\text{ V}, T_{vj}=25\text{ }^{\circ}\text{C}$	1.7	1.85	2.5	V
		$I_C=25\text{ A}, V_{GE}=15\text{ V}, T_{vj}=125\text{ }^{\circ}\text{C}$		2.53	2.7	V
$V_{GE(th)}$	Gate Threshold Voltage	$I_C=5.0\text{ mA}, V_{CE}=V_{GE}, T_{vj}=25\text{ }^{\circ}\text{C}$	5.2	6.0	6.5	V
I_{CES}	Collector-Emitter Cut-off Current	$V_{CE}=1200\text{ V}, V_{GE}=0\text{ V}, T_{vj}=25\text{ }^{\circ}\text{C}$			20	μA
I_{GES}	Gate-Emitter Leakage Current	$V_{CE}=0\text{ V}, V_{GE}=15\text{ V}, T_{vj}=25\text{ }^{\circ}\text{C}$			200	nA
C_{ies}	Input capacitance	$f = 1\text{ MHz}, T_{vj} = 25^{\circ}\text{C},$ $V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}$		2.15		nF
C_{res}	Reverse transfer capacitance			72.3		pF
$t_{d(on)}$	Turn-on Delay Time, Inductive Load	$I_C=25\text{ A}, V_{CE}=600\text{ V}$ $V_{GE}=\pm 15\text{ V}$ $R_G=20\Omega$ $T_{vj}=25\text{ }^{\circ}\text{C}$		138		ns
t_r	Rise Time, Inductive Load			94		ns
$t_{d(off)}$	Turn-off Delay Time, Inductive Load			220		ns
t_f	Fall Time, Inductive Load			152		ns
E_{on}	Turn-on Energy Loss per Pulse			3.53		mJ
E_{off}	Turn-off Energy Loss per Pulse			1.23		mJ
$t_{d(on)}$	Turn-on Delay Time, Inductive Load	$I_C=25\text{ A}, V_{CE}=600\text{ V}$ $V_{GE}=\pm 15\text{ V}$ $R_G=20\Omega$ $T_{vj}=125\text{ }^{\circ}\text{C}$		116		ns
t_r	Rise Time, Inductive Load			114		ns
$t_{d(off)}$	Turn-off Delay Time, Inductive Load			264		ns
t_f	Fall Time, Inductive Load			244		ns
E_{on}	Turn-on Energy Loss per Pulse			4.41		mJ
E_{off}	Turn-off Energy Loss per Pulse			1.81		mJ
R_{thJC}	Thermal resistance, junction to case	per IGBT			1.45	K/W
$T_{vj\text{ op}}$	Temperature under switching conditions		-40		125	$^{\circ}\text{C}$
I_{sc}	SC	$V_{GE}\leq 15\text{ V}, V_{CE}=600\text{ V},$ $t_p\leq 10\mu\text{S}, T_{vj}=125^{\circ}\text{C},$ $V_{CE_{max}}=V_{CES}-L_{sCE}\cdot di/dt$		100		A

Maximum Rated Values (Diode Inverter)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	$T_{vj}=25\text{ }^{\circ}\text{C}$		1200		V
I_F	Continuous DC Forward Current			25		A
I_{FRM}	Repetitive Peak Forward Current	$t_p=1\text{ ms}$		50		A
I^2t	I^2t Value	$V_R=0\text{ V}$, $t_p=10\text{ ms}$, $T_{vj}=125\text{ }^{\circ}\text{C}$		220		A^2s

Characteristic Values (Diode Inverter)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_F	Forward Voltage	$I_F=25\text{ A}$, $V_{CE}=0\text{ V}$, $T_{vj}=25\text{ }^{\circ}\text{C}$		1.85	2.5	V
		$I_F=25\text{ A}$, $V_{CE}=0\text{ V}$, $T_{vj}=125\text{ }^{\circ}\text{C}$		1.85	2.5	V
t_{rr}	Reverse Recovery time	$I_F=25\text{ A}$, $V_R=600\text{ V}$ -di/dt=100A/us $T_{vj}=25\text{ }^{\circ}\text{C}$ $V_{GE}=-15\text{ V}$		170		ns
Q_r	Recovered Charge			0.98		uC
E_{rec}	Reverse Recovery Energy			0.35		mJ
t_{rr}	Reverse Recovery time	$I_F=25\text{ A}$, $V_R=600\text{ V}$ -di/dt=100A/us $T_{vj}=125\text{ }^{\circ}\text{C}$ $V_{GE}=-15\text{ V}$		205		ns
Q_r	Recovered Charge			1.09		uC
E_{rec}	Reverse Recovery Energy			0.36		mJ
R_{thJC}	Thermal resistance, junction to case	per Diode			1.0	K/W
$T_{vj\text{ op}}$	Temperature under switching conditions		-40		125	$^{\circ}\text{C}$

Maximum Rated Values (Diode Rectifier)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{RRM}	Repetitive peak reverse voltage	$T_{vj}=25\text{ }^{\circ}\text{C}$		1600		V
I_{FRMSM}	Maximum RMS forward current per chip	$T_c=80\text{ }^{\circ}\text{C}$		50		A
I_{RMSM}	Maximum RMS current at rectifier chip	$T_c=80\text{ }^{\circ}\text{C}$		50		A
I_{FSM}	Surge forward current	$t_p=10\text{ms}$ $T_{vj}=25\text{ }^{\circ}\text{C}$		300		A
I^2t	I^2t -value			450		A ² S
I_{FSM}	Surge forward current	$t_p=10\text{ms}$ $T_{vj}=125\text{ }^{\circ}\text{C}$		230		A
I^2t	I^2t -value			310		A ² S

Characteristic Values (Diode Rectifier)

V_F	Forward voltage	$T_{vj}=125\text{ }^{\circ}\text{C}$ $I_F=25\text{A}$		1.1		V
I_R	Reverse current	$T_{vj}=125\text{ }^{\circ}\text{C}$ $V_R=1600\text{V}$		1.1		mA
R_{thjc}	Thermal resistance junction to case	per diode			1.1	K/W
T_{vjop}	Temperature under switching conditions		-40		125	$^{\circ}\text{C}$

Maximum Rated Values (IGBT Brake-Chopper)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{CES}	Collector-emitter voltage	$T_{vj}=25^{\circ}\text{C}$		1200		V
I_C	Continuous Collector Current	$T_C = 100^{\circ}\text{C}, T_{vj\max} = 150^{\circ}\text{C}$		25		A
I_{CRM}	Peak Collector Current	$I_{CRM}=2I_C$		50		A
V_{GES}	Gate-Emitter Voltage	$T_{vj}=25^{\circ}\text{C}$	-20		20	V

Characteristic Values (IGBT Brake-Chopper)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$I_C=25\text{ A}, V_{GE}=15\text{ V}, T_{vj}=25^{\circ}\text{C}$	1.7	1.85	2.5	V
		$I_C=25\text{ A}, V_{GE}=15\text{ V}, T_{vj}=125^{\circ}\text{C}$		2.53	2.9	V
$V_{GE(th)}$	Gate Threshold Voltage	$I_C=5.0\text{ mA}, V_{CE}=V_{GE}, T_{vj}=25^{\circ}\text{C}$	5.2	6.0	6.5	V
I_{CES}	Collector-Emitter Cut-off Current	$V_{CE}=1200\text{ V}, V_{GE}=0\text{ V}, T_{vj}=25^{\circ}\text{C}$			20	μA
I_{GES}	Gate-Emitter Leakage Current	$V_{CE}=0\text{ V}, V_{GE}=15\text{ V}, T_{vj}=25^{\circ}\text{C}$			200	nA
C_{ies}	Input capacitance	$f = 1\text{ MHz}, T_{vj}=25^{\circ}\text{C}, V_{CE}=25\text{ V},$ $V_{GE}=0\text{ V}$		2.15		nF
C_{res}	Reverse transfer capacitance			72.3		pF
$t_{d(on)}$	Turn-on Delay Time, Inductive Load	$I_C=25\text{ A}, V_{CE}=600\text{ V}$ $V_{GE}=\pm 15\text{ V}$ $R_G=20\Omega$ $T_{vj}=25^{\circ}\text{C}$		138		ns
t_r	Rise Time, Inductive Load			94		ns
$t_{d(off)}$	Turn-off Delay Time, Inductive Load			220		ns
t_f	Fall Time, Inductive Load			152		ns
E_{on}	Turn-on Energy Loss per Pulse			3.53		mJ
E_{off}	Turn-off Energy Loss per Pulse			1.23		mJ
$t_{d(on)}$	Turn-on Delay Time, Inductive Load			116		ns
t_r	Rise Time, Inductive Load			114		ns
$t_{d(off)}$	Turn-off Delay Time, Inductive Load			264		ns
t_f	Fall Time, Inductive Load			244		ns
E_{on}	Turn-on Energy Loss per Pulse	$I_C=25\text{ A}, V_{CE}=600\text{ V}$ $V_{GE}=\pm 15\text{ V}$ $R_G=20\Omega$ $T_{vj}=125^{\circ}\text{C}$		4.41		mJ
E_{off}	Turn-off Energy Loss per Pulse			1.81		mJ
R_{thJC}	Thermal resistance, junction to case	per IGBT			0.9	K/W
$T_{vj\text{ op}}$	Temperature under switching conditions		-40		125	$^{\circ}\text{C}$
I_{sc}	SC	$V_{GE}\leq 15\text{ V}, V_{CE}=600\text{ V}, t_p\leq 10\mu\text{S},$ $T_{vj}=150^{\circ}\text{C},$ $V_{CE\max}=V_{CES}-L_{SCE}\cdot di/dt$		100		A

Maximum Rated Values (Diode Brake-Chopper)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	$T_{vj} = 25\text{ }^{\circ}\text{C}$		1200		V
I_F	Continuous DC Forward Current	$T_C = 100\text{ }^{\circ}\text{C}$		15		A
I_{FRM}	Repetitive Peak Forward Current	$t_p = 1\text{ ms}$		30		A
I^2t	I^2t Value	$V_R = 0\text{ V}$, $t_p = 10\text{ ms}$, $T_{vj} = 150\text{ }^{\circ}\text{C}$		15		A^2s

Characteristics (Diode Brake-Chopper)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_F	Forward Voltage	$I_F = 15\text{ A}$, $V_{CE} = 0\text{ V}$, $T_{vj} = 25\text{ }^{\circ}\text{C}$		1.9	2.5	V
		$I_F = 15\text{ A}$, $V_{CE} = 0\text{ V}$, $T_{vj} = 125\text{ }^{\circ}\text{C}$		1.90	2.5	V
t_{rr}	Reverse Recovery time	$I_F = 15\text{ A}$, $V_R = 600\text{ V}$ $-di/dt = 300\text{ A/us}$ $T_{vj} = 25\text{ }^{\circ}\text{C}$		220		ns
Q_r	Recovered Charge			0.8		μC
E_{rec}	Reverse Recovery Energy			0.2		mJ
t_{rr}	Reverse Recovery time	$I_F = 15\text{ A}$, $V_R = 600\text{ V}$ $-di/dt = 300\text{ A/us}$ $T_{vj} = 125\text{ }^{\circ}\text{C}$		370		ns
Q_r	Recovered Charge			1.4		μC
E_{rec}	Reverse Recovery Energy			0.4		mJ
R_{thJC}	Thermal resistance, junction to case	per Diode			1.45	K/W
$T_{vj\text{ op}}$	Temperature under switching conditions		-40		125	$^{\circ}\text{C}$

NTC-Thermistor (Characteristic Values)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
R_{25}	Rated resistance	$T_c=25\text{ }^{\circ}\text{C}$		22		K Ω
$\Delta R/R$	Deviation of R100	$T_c=100\text{ }^{\circ}\text{C}$	-5		5	%
P_{25}	Power dissipation	$T_c=25\text{ }^{\circ}\text{C}$		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

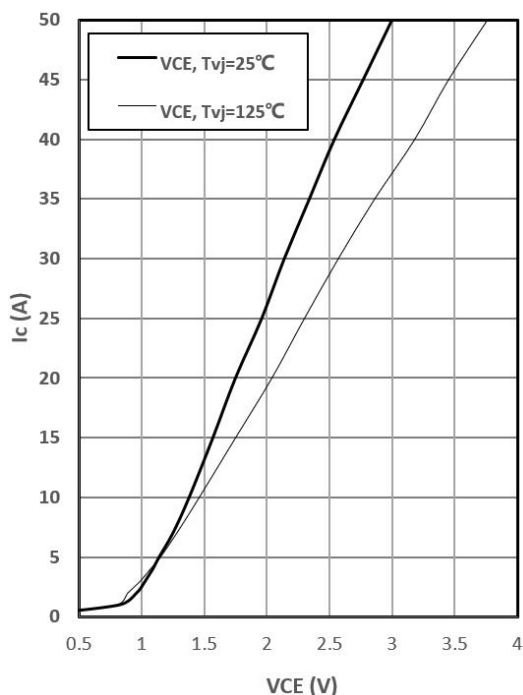
Module Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{isol}	Isolation voltage	$t=1\text{ min}, f=50\text{ Hz}$	2500			V
T_{stg}	Storage Temperature		-40		150	$^{\circ}\text{C}$
M_s	Module-to-Sink Torque	Recommended(M5)	3.0		6.0	N·m
G	Weight of Module			180		g

Output characteristic of IGBT, Inverter (typical)

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

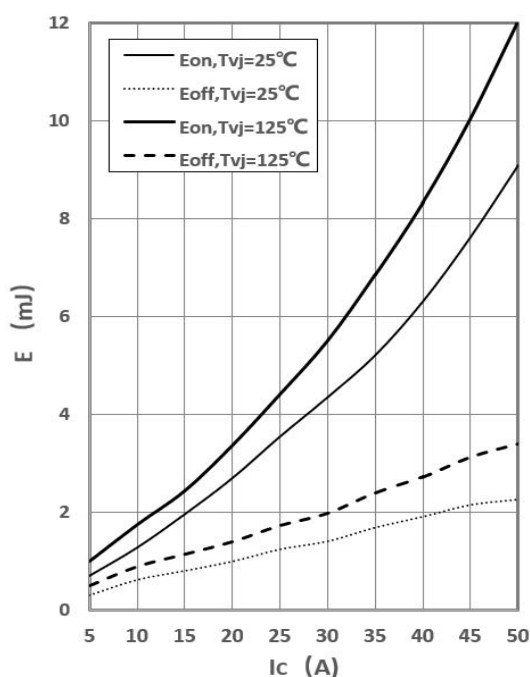
$$V_{GE} = 15V$$



Switching losses of IGBT, Inverter (typical)

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

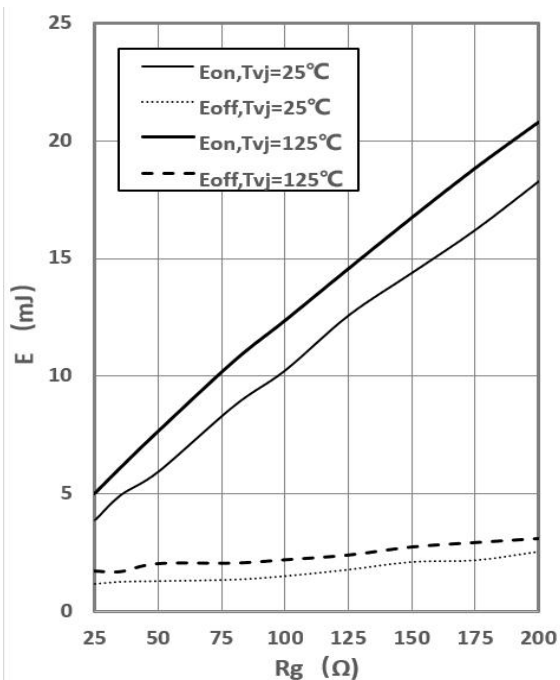
$$V_{GE} = \pm 15V, R_G = 20\Omega, V_{CE} = 600V$$



Switching losses of IGBT, Inverter (typical)

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

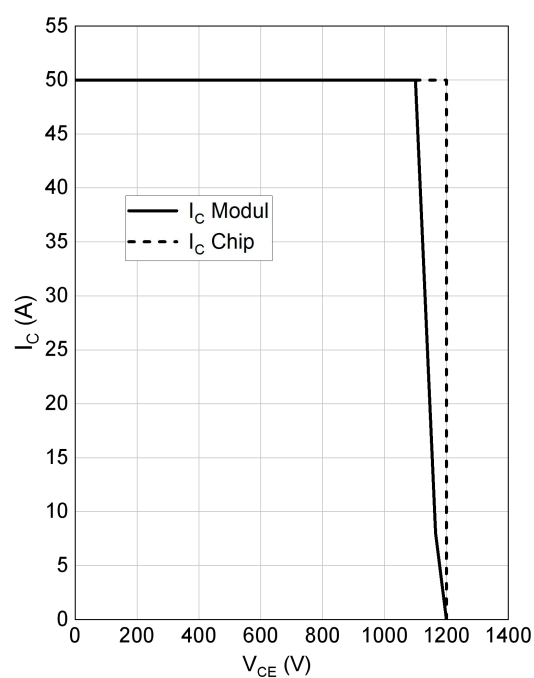
$$V_{GE} = \pm 15V, I_c = 25A, V_{CE} = 600V$$



RBSOA IGBT, Inverter (typical)

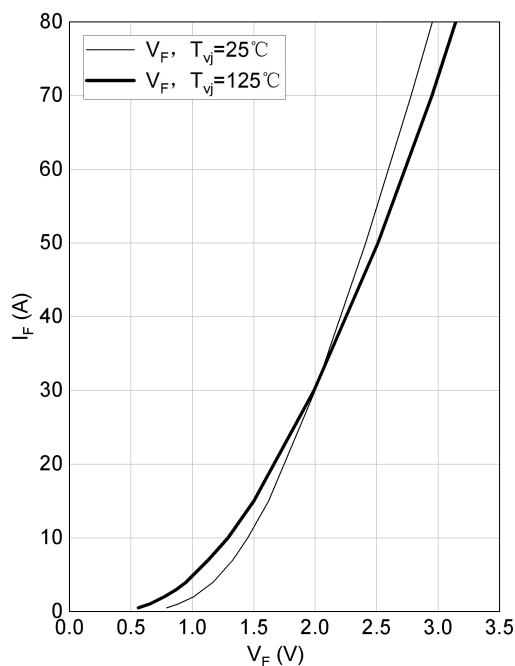
$$I_c = f(V_{CE})$$

$$V_{GE} = \pm 15V, R_G = 20\Omega, T_{vj} = 125^\circ C$$



Forward characteristic of Diode, Inverter
(typical)

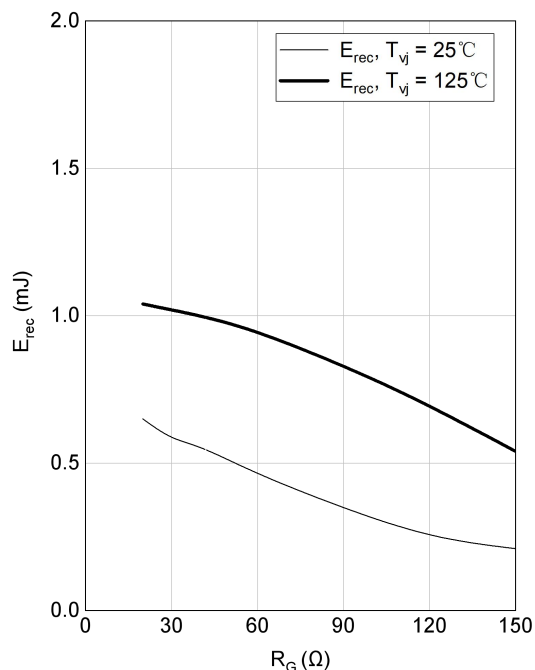
$$I_F = f(V_F)$$



Switching losses of Diode, Inverter (typical)

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

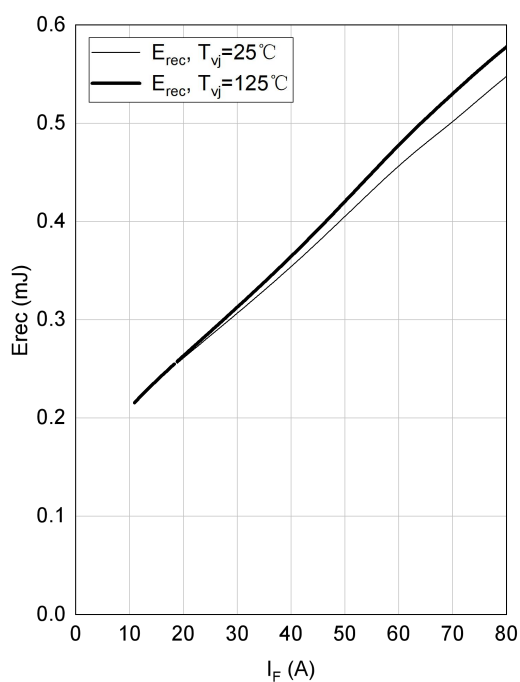
$$I_F = 25\text{A}, V_{CE} = 600\text{V}$$



Switching losses of Diode, Inverter (typical)

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

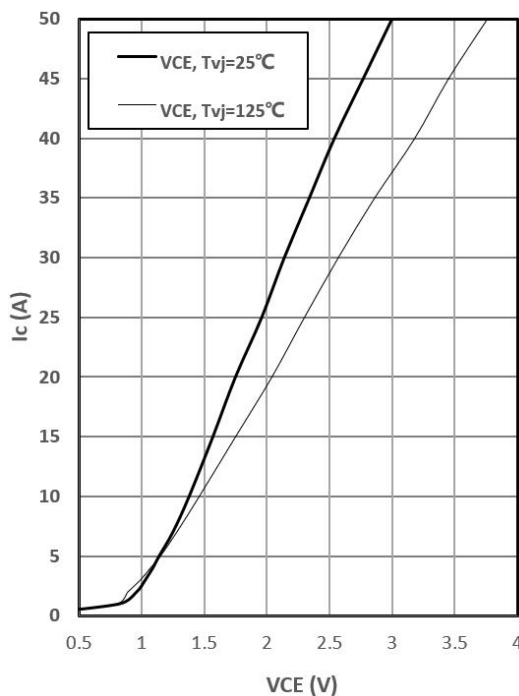
$$R_G = 20\ \Omega, V_{CE} = 600\text{V}$$



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

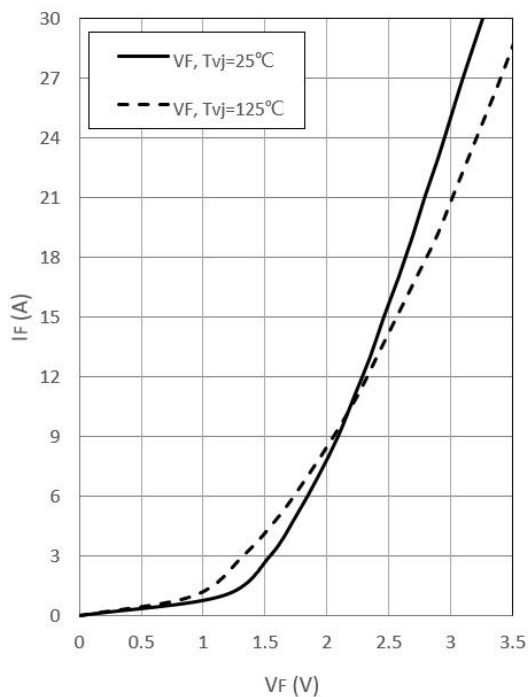
$$I_c = f(V_{CE})$$

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



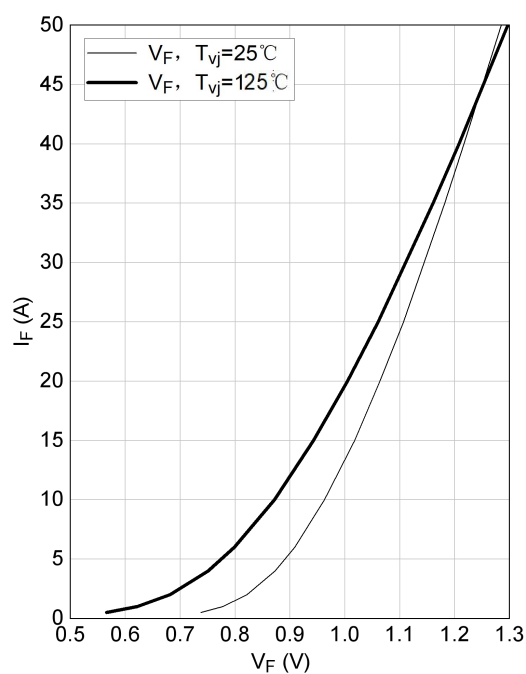
Forward characteristic of Diode,Brake-Chopper (typical)

$$I_F = f(V_F)$$



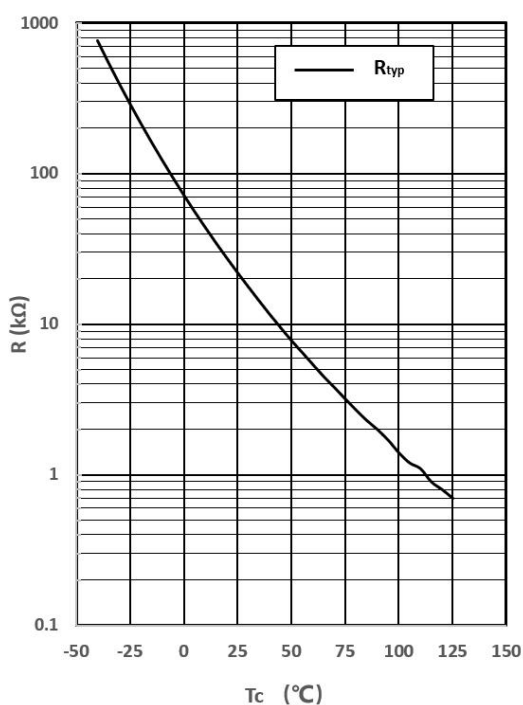
Forward characteristic of Diode, Rectifier(typical)

$$I_F = f(V_F)$$

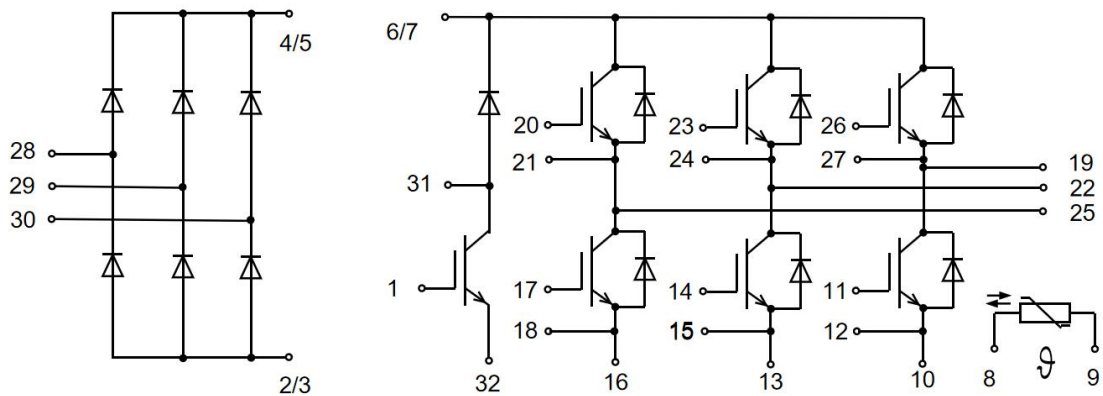


NTC-thermistor-temperature characteristic (typical)

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



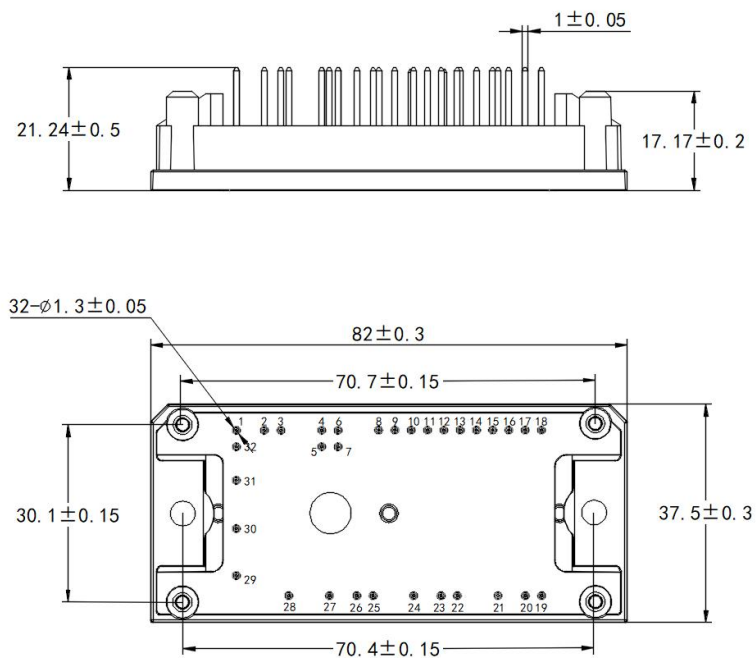
Circuit Diagram



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
29	52,55	25
30	52,55	16,9
31	52,55	8,6
32	52,55	2,8



DISCLAIMER

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE
TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE