

LEGM35BE120E2HZ

IGBT Power Module

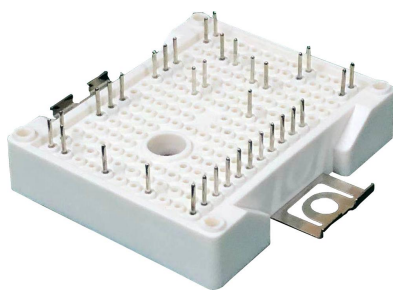
Features:

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

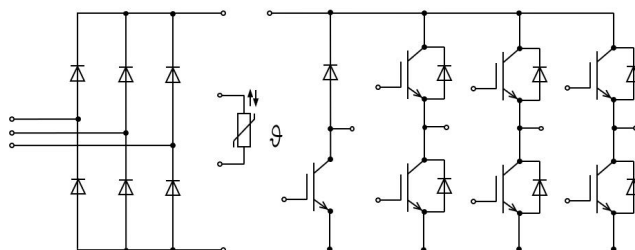
Applications:

- The inverter
- Motor control and drives

Package Type & Internal Circuit



E2



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	$T_C=80^{\circ}C$	35	A
I_{CRM}	Peak Collector Current	$I_{CRM}=2I_C$	70	A
V_{GES}	Gate-Emitter Voltage	$T_{vj}=25^{\circ}C$	± 30	V
P_{tot}	Total Power Dissipation	$T_C=25^{\circ}C, T_{vjmax}=175^{\circ}C$	217	W

Characteristics Values (IGBT Inverter)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$I_C=35\text{ A}, V_{GE}=15\text{ V}, T_{vj}=25\text{ }^{\circ}\text{C}$		1.9		V
		$I_C=35\text{ A}, V_{GE}=15\text{ V}, T_{vj}=150\text{ }^{\circ}\text{C}$		2.4		V
$V_{GE(th)}$	Gate Threshold Voltage	$I_C=6.0\text{ mA}, V_{CE}=V_{GE}, T_{vj}=25\text{ }^{\circ}\text{C}$	5.8	6.3	6.8	V
I_{CES}	Collector-Emitter Cut-off Current	$V_{CE}=1200\text{ V}, V_{GE}=0\text{ V}, T_{vj}=25\text{ }^{\circ}\text{C}$			1.2	mA
I_{GES}	Gate-Emitter Leakage Current	$V_{CE}=0\text{ V}, V_{GE}=20\text{ V}, T_{vj}=25\text{ }^{\circ}\text{C}$			410	nA
C_{ies}	Input capacitance	$f = 1\text{ MHz}, T_{vj}=25\text{ }^{\circ}\text{C},$ $V_{CE}=25\text{ V}, V_{GE}=0\text{ V}$		3459		pF
C_{res}	Reverse transfer capacitance			102		pF
$t_{d(on)}$	Turn-on Delay Time, Inductive Load	$I_C=35\text{ A}, V_{CE}=600\text{ V}$ $V_{GE}=\pm 15\text{ V}$ $R_G=25\Omega$ $T_{vj}=25\text{ }^{\circ}\text{C}$		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	$I_C=35\text{ A}, V_{CE}=600\text{ V}$ $V_{GE}=\pm 15\text{ V}$ $R_G=25\Omega$ $T_{vj}=150\text{ }^{\circ}\text{C}$		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
$T_{vj\text{ op}}$	Temperature under switching conditions		-40		150	$^{\circ}\text{C}$
I_{sc}	SC	$V_{GE}\leq 15\text{ V}, V_{CE}=600\text{ V},$ $t_p\leq 10\mu\text{S}, T_{vj}=150\text{ }^{\circ}\text{C},$ $V_{CEmax}=V_{CES}-L_{sCE}\cdot di/dt$		160		A

Maximum Rated Values (Diode Inverter)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	$T_{vj}=25\text{ }^{\circ}\text{C}$		1200		V
I_F	Continuous DC Forward Current			35		A
I_{FRM}	Repetitive Peak Forward Current	$t_p=1\text{ ms}$		70		A

Characteristic Values (Diode Inverter)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_F	Forward Voltage	$I_F=35\text{ A}, V_{CE}=0\text{ V}, T_{vj}=25\text{ }^{\circ}\text{C}$		1.9		V
		$I_F=35\text{ A}, V_{CE}=0\text{ V}, T_{vj}=150\text{ }^{\circ}\text{C}$		1.6		V
I_{rr}	Peak reverse recovery current	$I_F=35\text{ A}, V_R=600\text{ V}$ $-di/dt=1000\text{ A/us}$ $T_{vj}=25\text{ }^{\circ}\text{C},$ $V_{GE}=-15\text{ V}$		45		A
Q_r	Recovered Charge			3.25		uC
E_{rec}	Reverse Recovery Energy			1.03		mJ
I_{rr}	Peak reverse recovery current	$I_F=35\text{ A}, V_R=600\text{ V}$ $-di/dt=1000\text{ A/us}$ $T_{vj}=150\text{ }^{\circ}\text{C}$ $V_{GE}=-15\text{ V}$		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
$T_{vj\text{ op}}$	Temperature under switching conditions		-40		150	$^{\circ}\text{C}$

Maximum Rated Values (Diode Rectifier)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{RRM}	Repetitive peak reverse voltage	$T_{vj}=25\text{ }^{\circ}\text{C}$		1800		V
I_{FRMSM}	Maximum RMS forward current per chip	$T_c=80\text{ }^{\circ}\text{C}$		70		A
I_{RMSM}	Maximum RMS current at rectifier chip	$T_c=80\text{ }^{\circ}\text{C}$		70		A
I_{FSM}	Surge forward current	$t_p=10\text{ms}$ $T_{vj}=25\text{ }^{\circ}\text{C}$		420		A
I^2t	I^2t -value	$t_p=10\text{ms}$ $T_{vj}=25\text{ }^{\circ}\text{C}$		880		A ² S
I_{FSM}	Surge forward current	$t_p=10\text{ms}$ $T_{vj}=125\text{ }^{\circ}\text{C}$		360		A
I^2t	I^2t -value	$t_p=10\text{ms}$ $T_{vj}=125\text{ }^{\circ}\text{C}$		600		A ² S

Characteristic Values (Diode Rectifier)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_F	Forward voltage	$T_c=25\text{ }^{\circ}\text{C}$		0.9		V
I_R	Reverse current	$T_{vj}=125\text{ }^{\circ}\text{C}$ $V_R=1800\text{V}$		1.1		mA
R_{thjc}	Thermal resistance junction to case	$T_c=25\text{ }^{\circ}\text{C}$			1.5	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	$T_C = 100^{\circ}\text{C}, T_{vj\max} = 175^{\circ}\text{C}$		35		A
I_{CRM}	Peak Collector Current	$I_{CRM}=2I_C$		70		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	$I_C=35\text{ A}, V_{GE}=15\text{ V}, T_{vj}=25^{\circ}\text{C}$		1.9		V
		$I_C=35\text{ A}, V_{GE}=15\text{ V}, T_{vj}=150^{\circ}\text{C}$		2.4		V
$V_{GE(th)}$	Gate Threshold Voltage	$I_C=6.0\text{ mA}, V_{CE}=V_{GE}, T_{vj}=25^{\circ}\text{C}$	5.8	6.3	6.8	V
I_{CES}	Collector-Emitter Cut-off Current	$V_{CE}=1200\text{ V}, V_{GE}=0\text{ V}, T_{vj}=25^{\circ}\text{C}$			1.2	mA
I_{GES}	Gate-Emitter Leakage Current	$V_{CE}=0\text{ V}, V_{GE}=20\text{ V}, T_{vj}=25^{\circ}\text{C}$			410	nA
C_{ies}	Input capacitance	$f = 1\text{ MHz}, T_{vj}=25^{\circ}\text{C},$ $V_{CE}=25\text{ V}, V_{GE}=0\text{ V}$		3459		pF
C_{res}	Reverse transfer capacitance			102		pF
$t_{d(on)}$	Turn-on Delay Time, Inductive Load	$I_C=35\text{ A}, V_{CE}=600\text{ V}$ $V_{GE}=\pm 15\text{ V}$ $R_G=15\Omega$ $T_{vj}=25^{\circ}\text{C}$		20		ns
t_r	Rise Time, Inductive Load			30		ns
$t_{d(off)}$	Turn-off Delay Time, Inductive Load			215		ns
t_f	Fall Time, Inductive Load			169		ns
E_{on}	Turn-on Energy Loss per Pulse			1.25		mJ
E_{off}	Turn-off Energy Loss per Pulse			2.30		mJ
$t_{d(on)}$	Turn-on Delay Time, Inductive Load	$I_C=35\text{ A}, V_{CE}=600\text{ V}$ $V_{GE}=\pm 15\text{ V}$ $R_G=15\Omega$ $T_{vj}=150^{\circ}\text{C}$		34		ns
t_r	Rise Time, Inductive Load			26		ns
$t_{d(off)}$	Turn-off Delay Time, Inductive Load			280		ns
t_f	Fall Time, Inductive Load			277		ns
E_{on}	Turn-on Energy Loss per Pulse			2.74		mJ
E_{off}	Turn-off Energy Loss per Pulse			3.82		mJ

Characteristic Values (IGBT Brake-Chopper)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
R_{thJC}	Thermal resistance, junction to case	per IGBT			0.69	K/W
$T_{vj\ op}$	Temperature under switching conditions		-40		150	°C
I_{sc}	SC	$V_{GE} \leq 15V$, $V_{CE} = 600V$, $t_p \leq 10\mu S$, $T_{vj} = 150^\circ C$, $V_{CEmax} = V_{CES} - L_{sCE} \cdot di/dt$		160		A

Maximum Rated Values (Diode Brake-Chopper)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	$T_{vj} = 25^\circ C$		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	$I_F = 15\ A$, $V_{CE} = 0\ V$, $T_{vj} = 25^\circ C$		2.1		V
		$I_F = 15\ A$, $V_{CE} = 0\ V$, $T_{vj} = 150^\circ C$		1.6		V
I_{rr}	Peak reverse recovery current	$I_F = 15\ A$, $V_R = 600\ V$ $-di/dt = 300A/\mu s$ $T_{vj} = 25^\circ C$		45		A
Q_r	Recovered Charge			0.17		μC
E_{rec}	Reverse Recovery Energy			1.06		mJ
I_{rr}	Peak reverse recovery current	$I_F = 15A$, $V_R = 600\ V$ $-di/dt = 300A/\mu s$ $T_{vj} = 150^\circ C$		56		A
Q_r	Recovered Charge			0.69		μC
E_{rec}	Reverse Recovery Energy			2.64		mJ
R_{thJC}	Thermal resistance, junction to case	Per diode		2.1	2.28	K/W
$T_{vj\ op}$	Temperature under switching conditions		-40		150	°C

NTC-Thermistor (Characteristic Values)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
R ₂₅	Rated resistance	T _c =25 °C		5		KΩ
ΔR/R	Deviation of R100	T _c =100 °C	-5		5	%
P ₂₅	Power dissipation	T _c =25 °C		20		mW
B _{25/50}	B-value	$R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298,15K))]$		3380		K
B _{25/100}	B-value	$R_2=R_{25}\exp[B_{25/100}(1/T_2-1/(298,15K))]$		3450		K

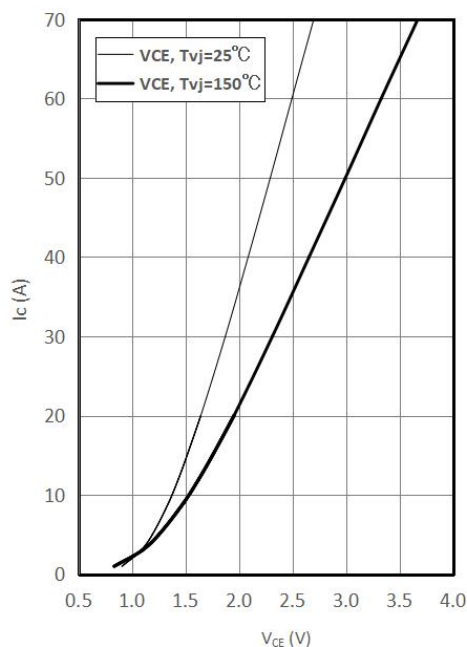
Module Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V _{isol}	Isolation voltage	t=1min,f=50Hz	2500			V
T _{stg}	Storage Temperature		-40		125	°C
F	Mountig Force per Clamp		40		80	N
G	Weight of Module			44		g

Output characteristic of IGBT, Inverter (typical)

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

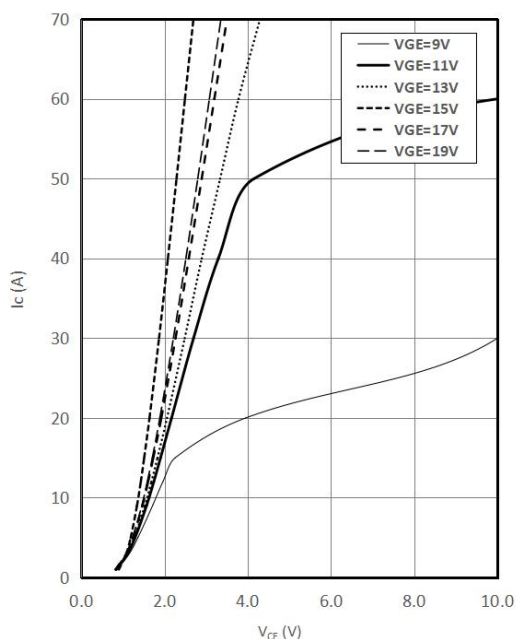
$$V_{GE} = 15V$$



Output characteristic IGBT , Inverter (typical)

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

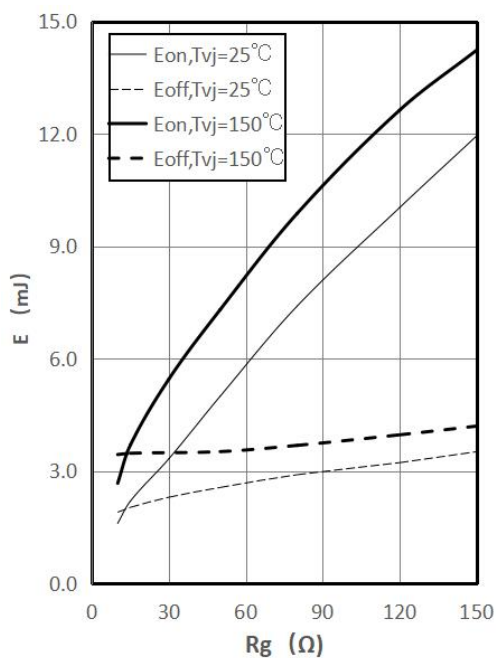
$$T_{vj} = 150^{\circ}C$$



Switching losses of IGBT, Inverter (typical)

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

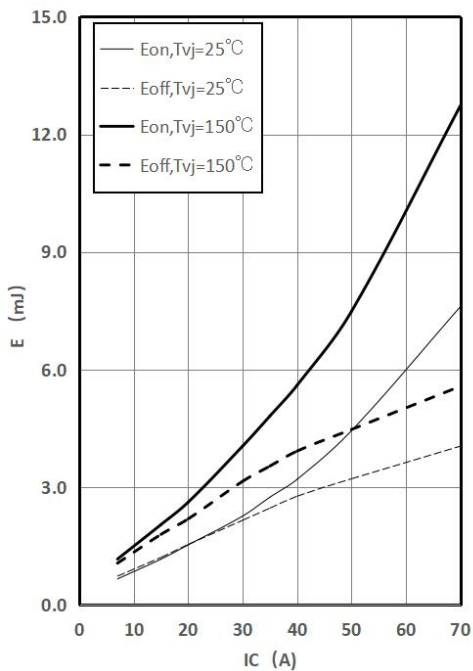
$$V_{GE} = \pm 15V, R_G = 25 \Omega, V_{CE} = 600V$$



Switching losses of IGBT, Inverter (typical)

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

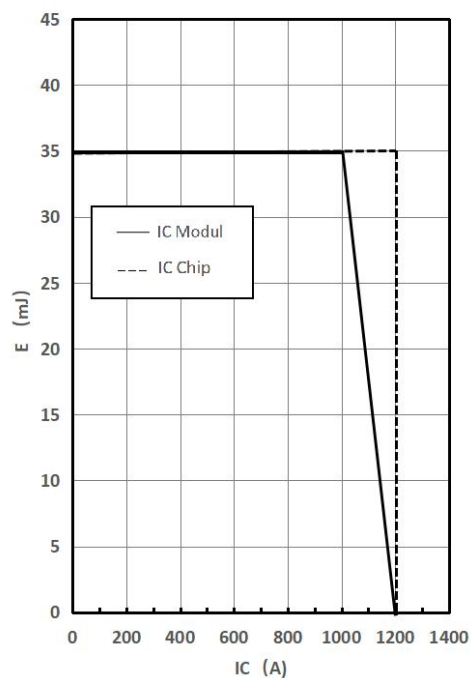
$$V_{GE} = \pm 15V, I_C = 35 A, V_{CE} = 600V$$



RBSOA IGBT, Inverter (typical)

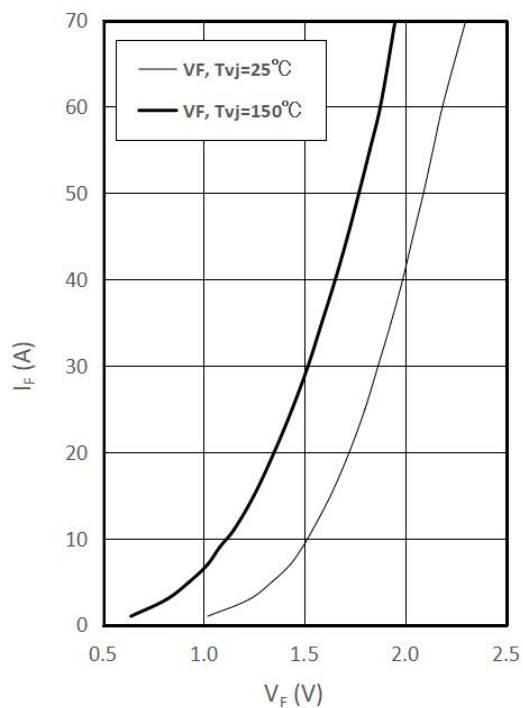
$$I_C = f(V_{CE})$$

$$V_{GE} = \pm 15V, R_G = 25 \Omega, T_{vj} = 150^\circ C$$


Forward characteristic of Diode, Inverter

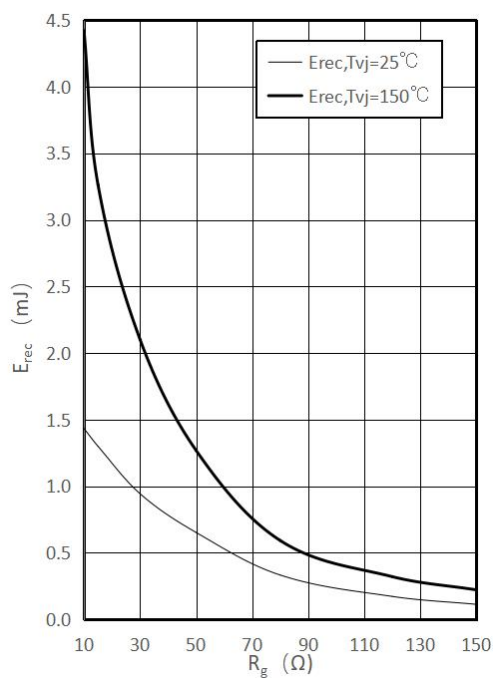
(typical)

$$I_F = f(V_F)$$


Switching losses of Diode, Inverter (typical)

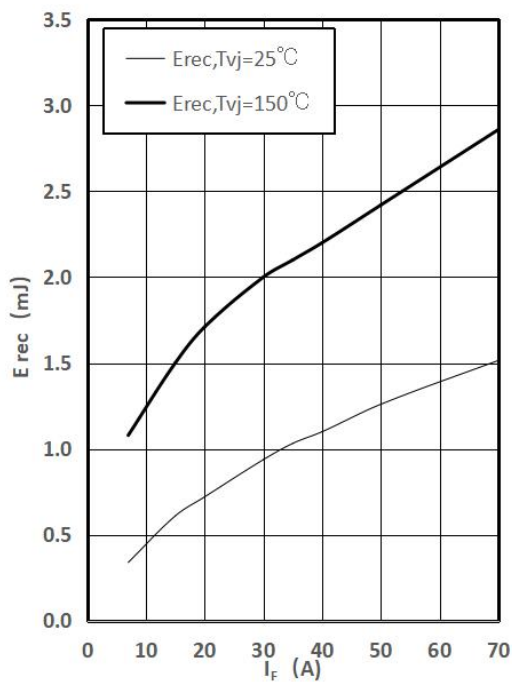
$$E_{rec} = f(R_G)$$

$$I_F = 35 A, V_{CE} = 600V$$


Switching losses of Diode, Inverter (typical)

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

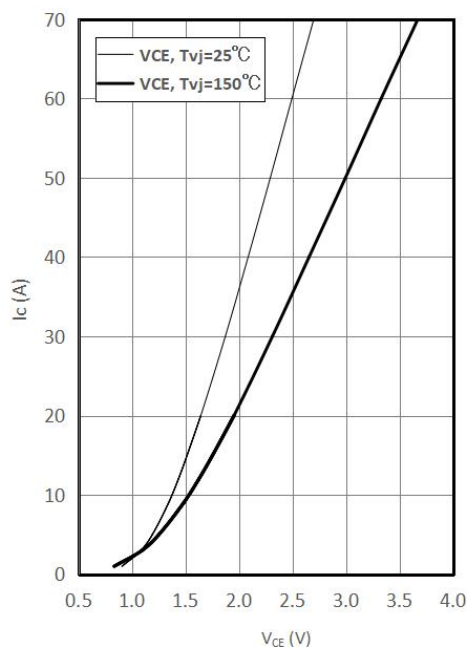
$$R_G = 25 \Omega, V_{CE} = 600V$$



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

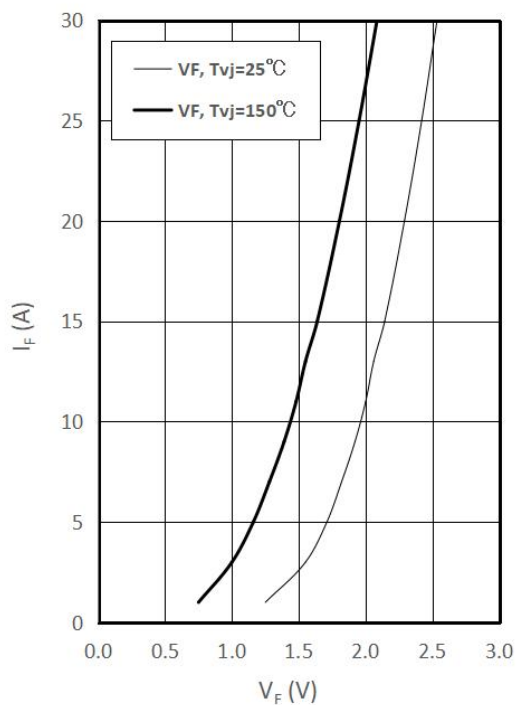
$$I_c = f(V_{CE})$$

$$V_{GE} = 15V$$



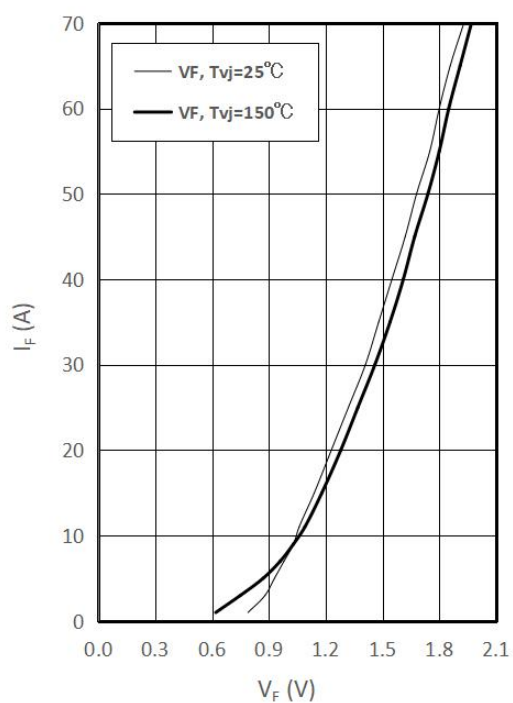
Forward characteristic of Diode, Brake-Chopper (typical)

$$I_F = f(V_F)$$



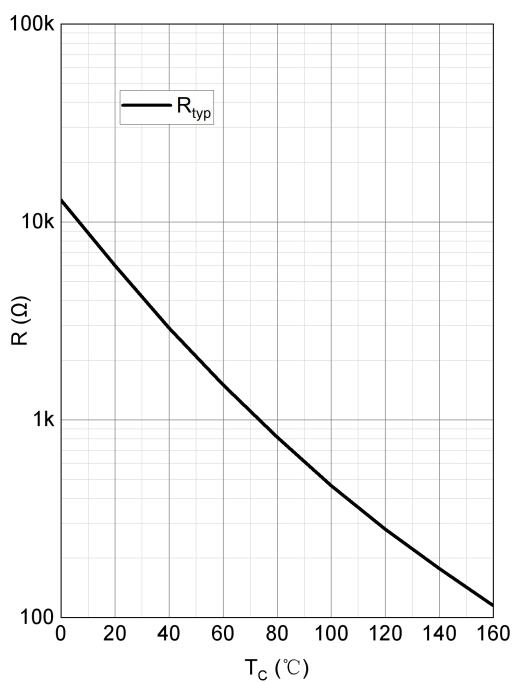
Forward characteristic of Diode, Rectifier (typical)

$$I_F = f(V_F)$$

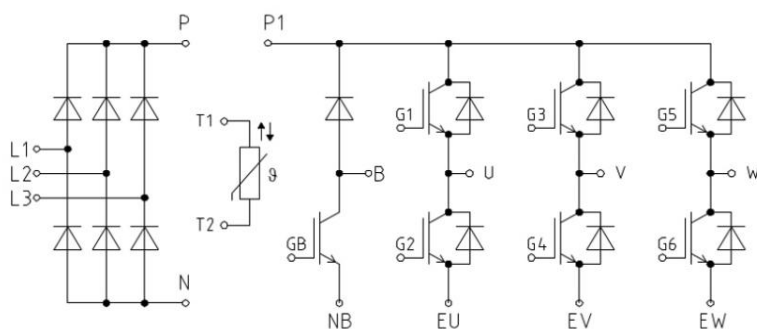


NTC-thermistor-temperature characteristic (typical)

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

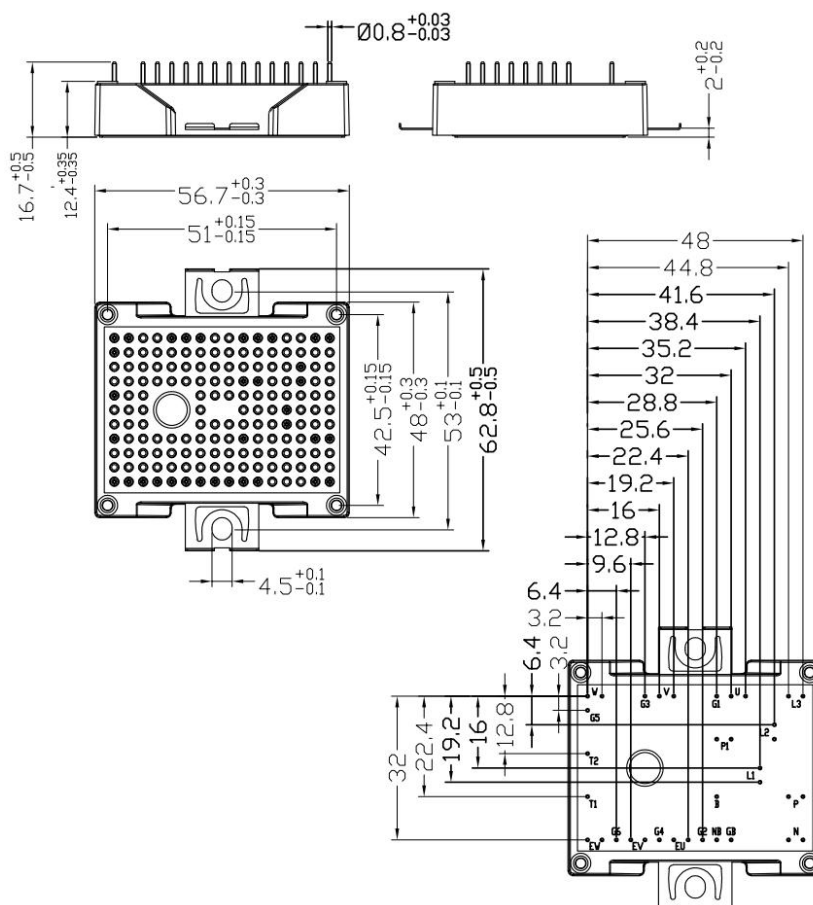


Circuit Diagram



Package Dimensions

(Dimensions in Millimeters)



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