

LEGM25BE120E2HZ

IGBT Power Module

Features:

- $V_{CE}=1200V$ $I_C=25A$
- Low $V_{CE(sat)}$
- V_{CEsat} with positive temperature coefficient
- Maximum junction temperature $175^{\circ}C$
- Isolation Type Package

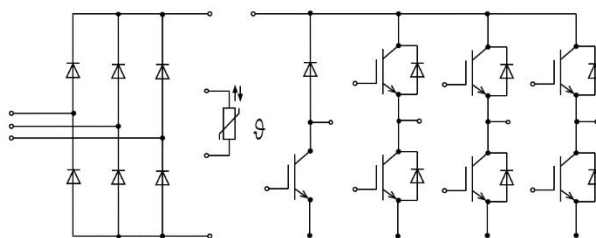
Applications:

- 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	$T_C=100^{\circ}C$	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	$T_C=25^{\circ}C, T_{vjmax}=175^{\circ}C$	190	W

Maximum Rated Values (IGBT Inverter)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$I_C=25\text{ A}, V_{GE}=15\text{ V}, T_{vj}=25\text{ }^{\circ}\text{C}$		1.8		V
		$I_C=25\text{ A}, V_{GE}=15\text{ V}, T_{vj}=150\text{ }^{\circ}\text{C}$		2.1		V
$V_{GE(th)}$	Gate Threshold Voltage	$I_C=6.0\text{ mA}, V_{CE}=V_{GE}, T_{vj}=25\text{ }^{\circ}\text{C}$	6.0	6.5	7.0	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
R_{Gint}	Internal gate resistor	$T_{vj}=25\text{ }^{\circ}\text{C}$		1.47		Ω
C_{ies}	Input Capacitance	$f=1\text{ MHz}, T_{vj}=25\text{ }^{\circ}\text{C},$ $V_{CE}=25\text{ V}, V_{GE}=0\text{ V}$		2146		pF
C_{oes}	Output Capacitance			72.5		pF
C_{res}	Reverse Transfer Capacitance			101.5		pF
$t_{d(on)}$	Turn-on Delay Time, Inductive Load	$I_C=25\text{ A}, V_{CE}=600\text{ V}$ $V_{GE}=\pm 15\text{ V}$ $R_{Gon}=20\Omega$ $T_{vj}=25\text{ }^{\circ}\text{C}$		29		ns
t_r	Rise Time, Inductive Load			14.2		ns
$t_{d(off)}$	Turn-off Delay Time, Inductive Load			213		ns
t_f	Fall Time, Inductive Load			214		ns
E_{on}	Turn-on Energy Loss per Pulse			1.14		mJ
E_{off}	Energy Loss per Pulse			1.81		mJ
$t_{d(on)}$	Turn-on Delay Time, Inductive Load	$I_C=25\text{ A}, V_{CE}=600\text{ V}$ $V_{GE}=\pm 15\text{ V}$ $R_{Gon}=20\Omega$ $T_{vj}=150\text{ }^{\circ}\text{C}$		29.2		ns
t_r	Rise Time, Inductive Load			16		ns
$t_{d(off)}$	Turn-off Delay Time, Inductive Load			277		ns
t_f	Fall Time, Inductive Load			340		ns
E_{on}	Turn-on Energy Loss per Pulse			2.33		mJ
E_{off}	Energy Loss per Pulse			2.77		mJ
R_{thJC}	Thermal resistance, junction to case	per IGBT		0.788		K/W
$T_{vj\text{ op}}$	Temperature under switching conditions		-40		150	$^{\circ}\text{C}$
I_{sc}	SC	$V_{GE}\leq 15\text{ V}, V_{CE}=600\text{ V},$ $t_p\leq 10\mu\text{S}, T_{vj}=150\text{ }^{\circ}\text{C},$ $V_{CEmax}=V_{CES}-L_{sCE}\cdot di/dt$		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	$T_C=100\text{ }^{\circ}\text{C}$		25		A
I_{FRM}	Repetitive Peak Forward Current	$t_p=1\text{ ms}$		50		A
I^2t	I^2t Value	$V_R=0\text{ V}$, $t_p=10\text{ ms}$, $T_{vj}=150\text{ }^{\circ}\text{C}$		220		A ² s

Characteristic Values (Diode Inverter)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_F	Forward Voltage	$I_F=25\text{ A}$, $V_{CE}=0\text{ V}$, $T_{vj}=25\text{ }^{\circ}\text{C}$		1.9		V
		$I_F=25\text{ A}$, $V_{CE}=0\text{ V}$, $T_{vj}=150\text{ }^{\circ}\text{C}$		1.6		V
t_{rr}	Reverse Recovery time	$I_F=25\text{ A}$, $V_R=600\text{ V}$ -di/dt=1200A/us $T_{vj}=25\text{ }^{\circ}\text{C}$		86.3		ns
Q_r	Recovered Charge			2.1		uC
E_{rec}	Reverse Recovery Energy			0.6		mJ
t_{rr}	Reverse Recovery time	$I_F=25\text{ A}$, $V_R=600\text{ V}$ -di/dt=1200A/us $T_{vj}=150\text{ }^{\circ}\text{C}$		346		ns
Q_r	Recovered Charge			4.68		uC
E_{rec}	Reverse Recovery Energy			1.51		mJ
R_{thJC}	Thermal resistance, junction to case	per Diode		1.2		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		150	$^{\circ}\text{C}$

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	$I_C=25\text{ A}, V_{GE}=15\text{ V}, T_{vj}=25^{\circ}\text{C}$		1.8		V
		$I_C=25\text{ A}, V_{GE}=15\text{ V}, T_{vj}=150^{\circ}\text{C}$		2.1		V
$V_{GE(th)}$	Gate Threshold Voltage	$I_C=6.0\text{ mA}, V_{CE}=V_{GE}, T_{vj}=25^{\circ}\text{C}$	6.0	6.5	7.0	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	uA
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			101.5		pF
$t_{d(on)}$	Turn-on Delay Time, Inductive Load	$I_C=25\text{ A}, V_{CE}=600\text{ V}$ $V_{GE}=\pm 15\text{ V}$ $R_G=20\Omega$ $T_{vj}=25^{\circ}\text{C}$		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	$I_C=25\text{ A}, V_{CE}=600\text{ V}$ $V_{GE}=\pm 15\text{ V}$ $R_G=20\Omega$ $T_{vj}=150^{\circ}\text{C}$		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		0.788		K/W
$T_{vj\text{ op}}$	Temperature under switching conditions		-40		150	$^{\circ}\text{C}$
I_{sc}	SC	$V_{GE}\leq 15\text{ V}, V_{CE}=600\text{ V}, tp\leq 10\mu\text{S}, T_{vj}=150^{\circ}\text{C},$ $V_{CE\max}=V_{CES}-L_{sCE}\cdot di/dt$		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			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	$I_F = 15\text{ A}$, $V_{CE} = 0\text{ V}$, $T_{vj} = 25\text{ }^{\circ}\text{C}$		2.1		V
		$I_F = 15\text{ A}$, $V_{CE} = 0\text{ V}$, $T_{vj} = 150\text{ }^{\circ}\text{C}$		1.6		V
t_{rr}	Reverse Recovery time	$I_F = 15\text{ A}$, $V_R = 600\text{ V}$ $-di/dt = 300\text{ A}/\mu\text{s}$ $T_{vj} = 25\text{ }^{\circ}\text{C}$		42.2		ns
Q_r	Recovered Charge			0.88		μC
E_{rec}	Reverse Recovery Energy			0.09		mJ
t_{rr}	Reverse Recovery time	$I_F = 15\text{ A}$, $V_R = 600\text{ V}$ $-di/dt = 300\text{ A}/\mu\text{s}$ $T_{vj} = 150\text{ }^{\circ}\text{C}$		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		1.56		K/W
$T_{vj\text{ op}}$	Temperature under switching conditions		-40		150	$^{\circ}\text{C}$

NTC-Thermistor (Characteristic Values)

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

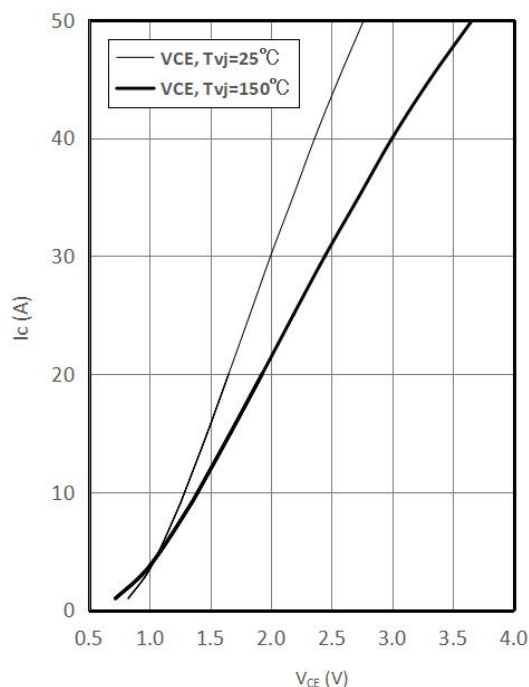
Module Characteristics

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

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

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

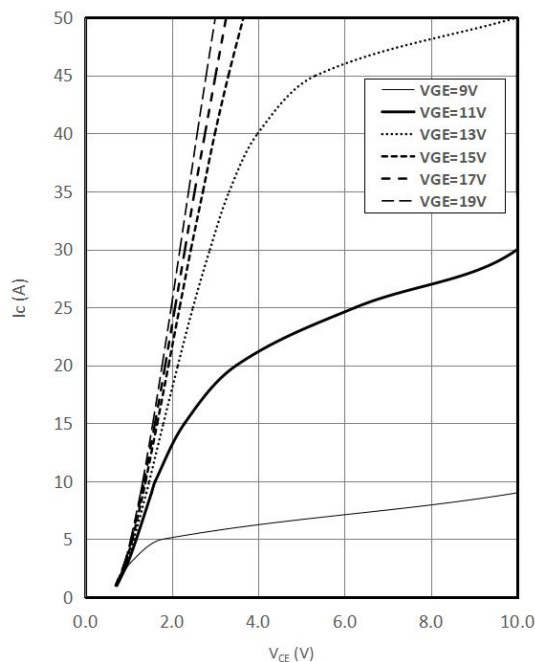
$$V_{GE} = \pm 15V, R_G = 20 \Omega, V_{CE} = 600V$$



Output characteristic IGBT, Inverter (typical)

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

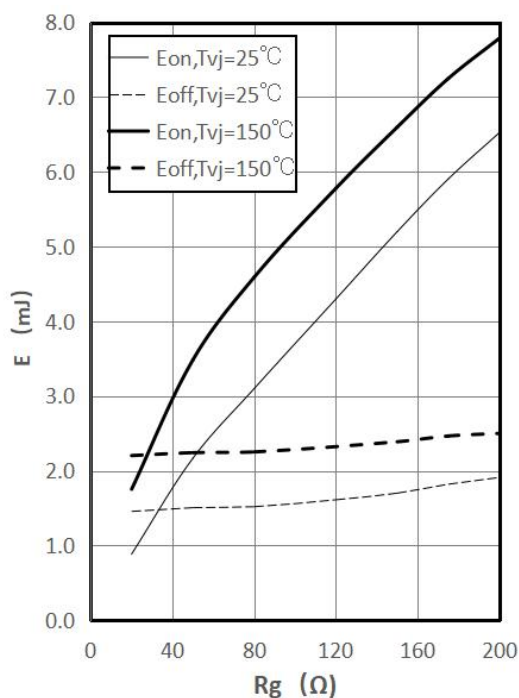
$$T_{vj}=150^{\circ}C$$



Switching losses IGBT, Inverter (typical)

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

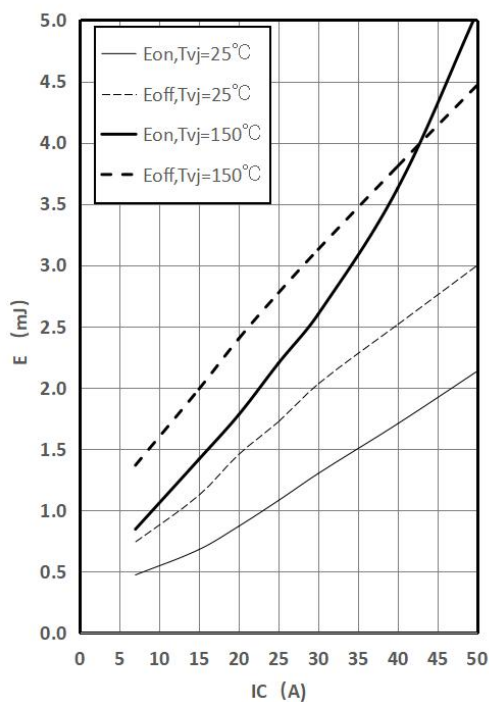
$$V_{GE} = \pm 15V, I_C = 25 A, V_{CE} = 600V$$



Switching losses IGBT, Inverter (typical)

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

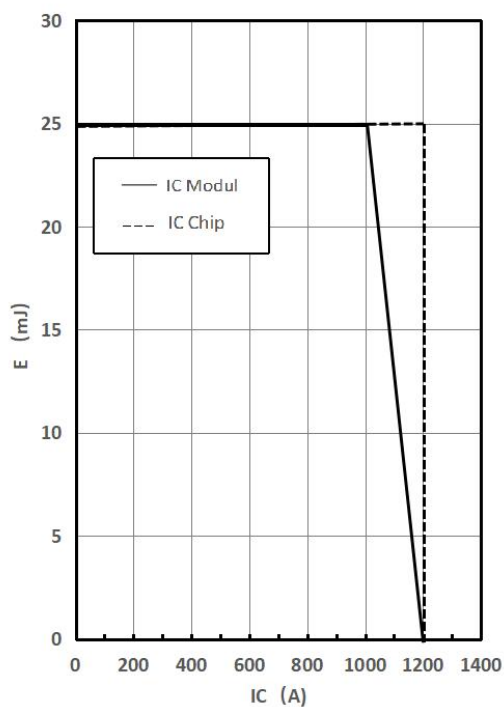
$$V_{GE} = \pm 15V, R_G = 20 \Omega, V_{CE} = 600V$$



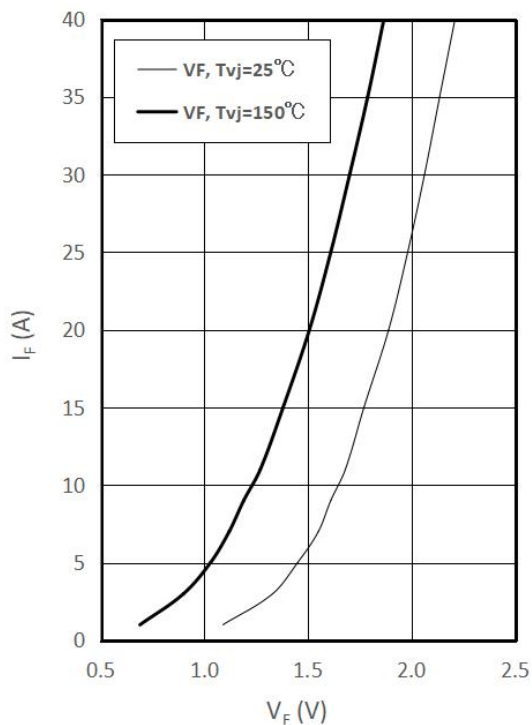
RBSOA IGBT, Inverter (typical)

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

$$V_{GE} = \pm 15V, R_G = 20 \Omega, T_{vj} = 150^\circ C$$

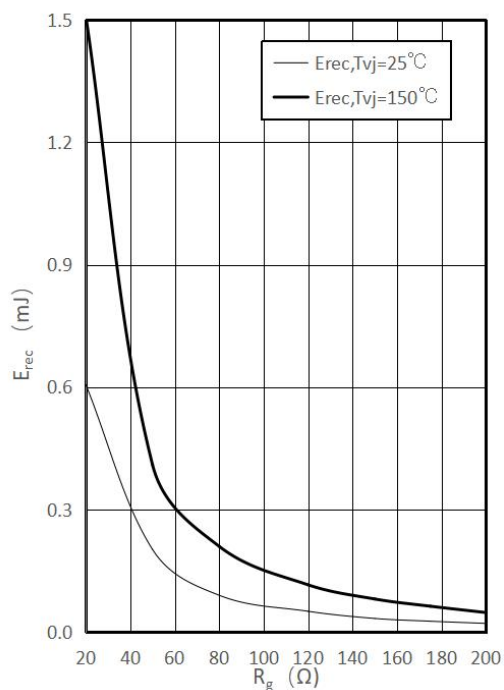

Forward characteristic of Diode, Inverter (typical)

$$I_F = f(V_F)$$


Switching losses Diode, Inverter (typical)

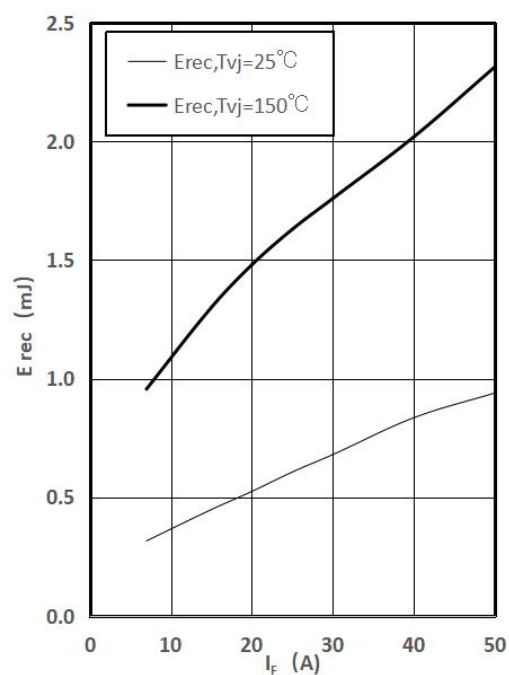
$$E_{rec} = f(R_G)$$

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


Switching losses Diode, Inverter (typical)

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

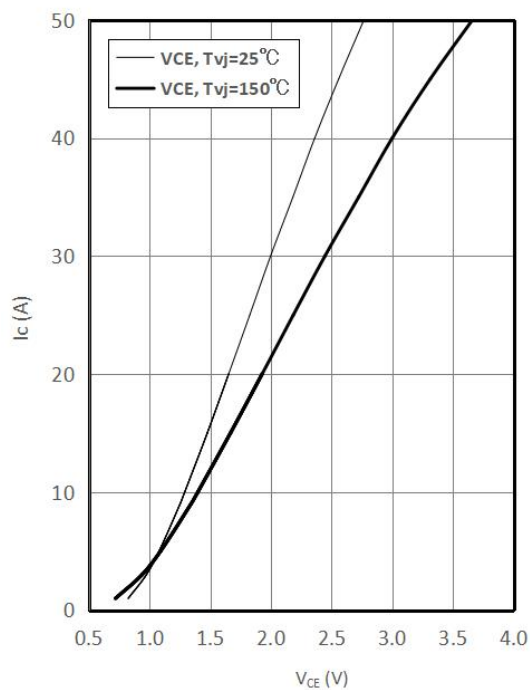
$$R_G = 20 \Omega, V_{CE} = 600 V$$



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

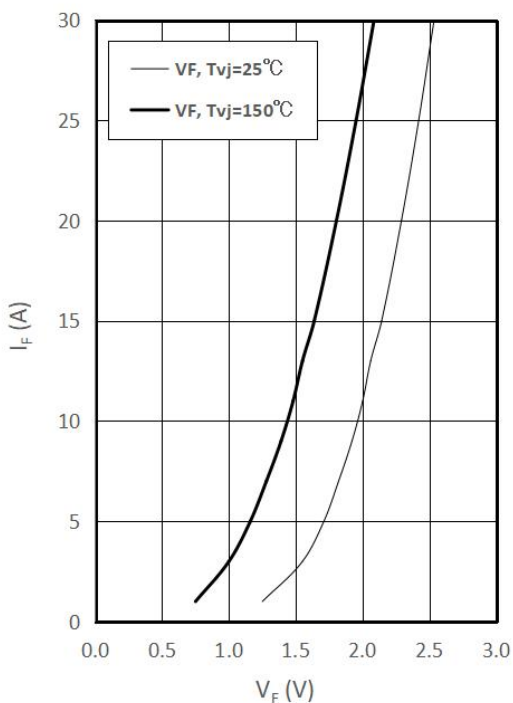
$$I_c = f(V_{CE})$$

$$V_{GE} = 15V$$



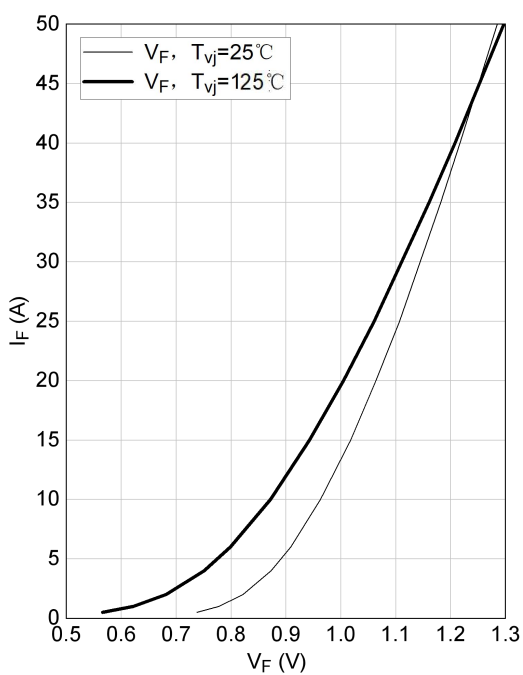
Forward characteristic of Diode, Brake-Chopper (typical)

$$I_F = f(V_F)$$



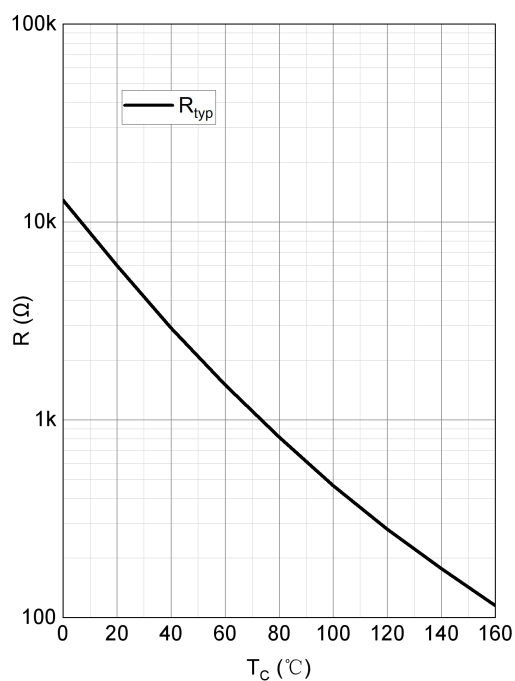
Forward characteristic of Diode, Rectifier (typical)

$$I_F = f(V_F)$$

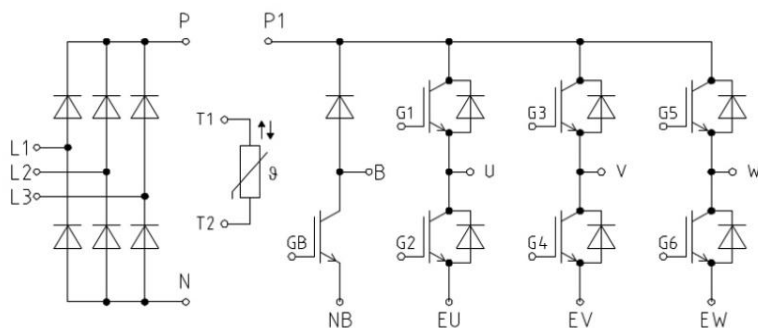


NTC-thermistor-temperature characteristic (typical)

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

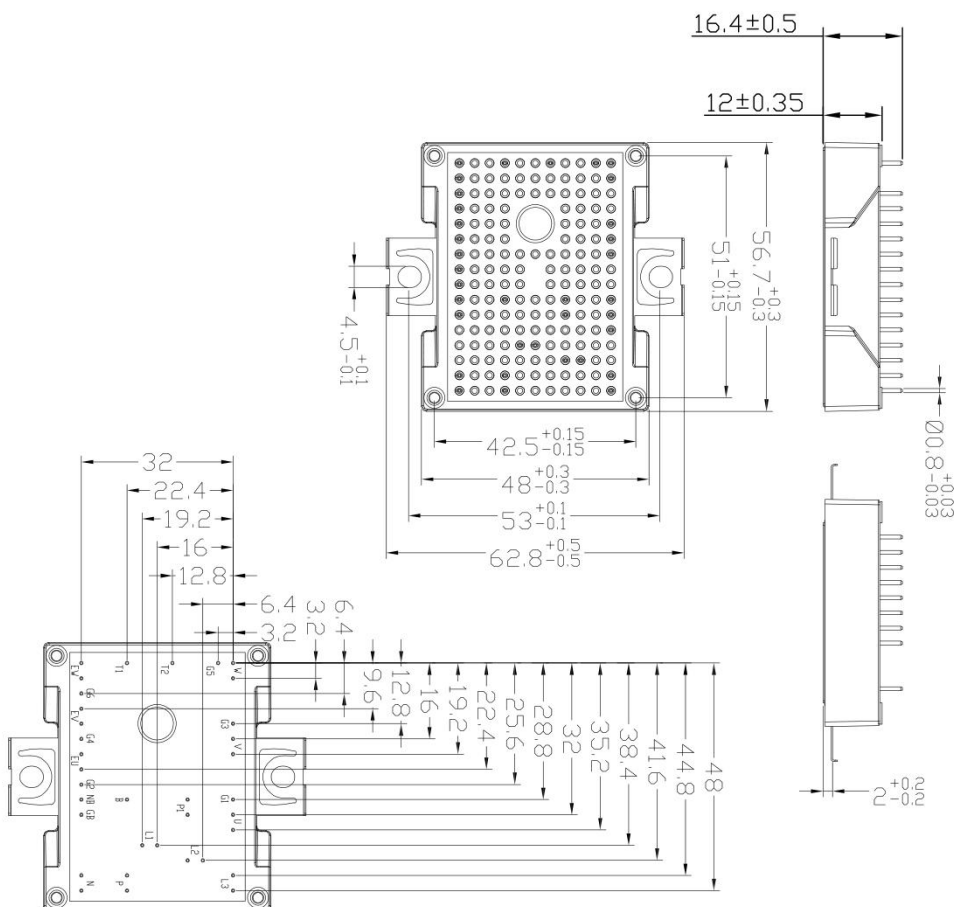


Circuit Diagram



Package Dimensions

(Dimensions in Millimeters)



DISCLAIMER

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