

LEGM50BE120L4HZ

IGBT Power Module

Features:

- $V_{CE}=1200V$ $I_C=50A$
- Low $V_{CE(sat)}$
- $V_{CE(sat)}$ with positive temperature coefficient
- Maximum junction temperature 150°C
- Isolation Type Package

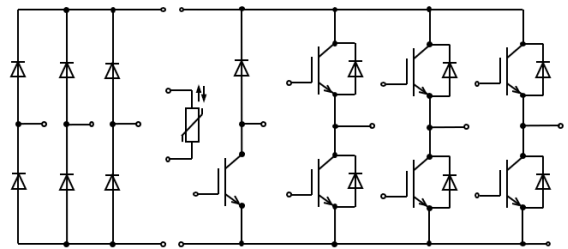
Applications:

- The inverter
- Motor control and drives

Package Type & Internal Circuit



L4



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	$T_C=100^\circ C$	50	A
I_{CRM}	Peak Collector Current	$I_{CRM}=2I_C$	100	A
V_{GES}	Gate-Emitter Voltage	$T_{vj}=25^\circ C$	± 20	V
P_{tot}	Total Power Dissipation	$T_C=25^\circ C, T_{vjmax}=150^\circ C$	270	W

Characteristics Values (IGBT Inverter)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$I_C=50\text{ A}, V_{GE}=15\text{ V}, T_{vj}=25\text{ }^\circ\text{C}$		1.80	2.25	V
		$I_C=50\text{ A}, V_{GE}=15\text{ V}, T_{vj}=125\text{ }^\circ\text{C}$		2.05	2.7	V
$V_{GE(th)}$	Gate Threshold Voltage	$I_C=2\text{ mA}, V_{CE}=V_{GE}, T_{vj}=25\text{ }^\circ\text{C}$	5	6	6.5	V
I_{CES}	Collector-Emitter Cut-off Current	$V_{CE}=1200\text{ V}, V_{GE}=0\text{ V}, T_{vj}=25\text{ }^\circ\text{C}$			4.0	mA
I_{GES}	Gate-Emitter Leakage Current	$V_{CE}=0\text{ V}, V_{GE}=15\text{ V}, T_{vj}=25\text{ }^\circ\text{C}$			450	nA
C_{ies}	Input Capacitance		-	5.19	-	nF
C_{oes}	Output Capacitance	$V_{CE}=25\text{ V}, V_{GE}=0\text{ V},$ $f=1\text{ MHz}$	-	225	-	pF
C_{res}	Reverse Transfer Capacitance		-	189	-	pF
$t_{d(on)}$	Turn-on Delay Time, Inductive Load			76		ns
t_r	Rise Time, Inductive Load			62		ns
$t_{d(off)}$	Turn-off Delay Time, Inductive Load	$I_C=50\text{ A}, V_{CE}=600\text{ V}$ $V_{GE}=\pm 15\text{ V}$		278		ns
t_f	Fall Time, Inductive Load	$R_{Gon}=15\ \Omega$ $T_{vj}=25\text{ }^\circ\text{C}$		196		ns
E_{on}	Turn-on Energy Loss per Pulse			5.2		mJ
E_{off}	Energy Loss per Pulse			3.1		mJ
$t_{d(on)}$	Turn-on Delay Time, Inductive Load			80		ns
t_r	Rise Time, Inductive Load			64		ns
$t_{d(off)}$	Turn-off Delay Time, Inductive Load	$I_C=50\text{ A}, V_{CE}=600\text{ V}$ $V_{GE}=\pm 15\text{ V}$		326		ns
t_f	Fall Time, Inductive Load	$R_{Gon}=15\ \Omega$ $T_{vj}=125\text{ }^\circ\text{C}$		284		ns
E_{on}	Turn-on Energy Loss per Pulse			5.4		mJ
E_{off}	Energy Loss per Pulse			4.5		mJ
R_{thJC}	Thermal resistance, junction to case	pro IGBT / per IGBT			0.47	K/W
$T_{vj\ op}$	Temperature under switching conditions		-40		125	$^\circ\text{C}$
I_{SC}	SC data	$V_{GE}\leq 15\text{ V}, V_{CC}=600\text{ V}$ $V_{CEmax}=V_{CES}-L_{sCE}\cdot di/dt$ $t_p\leq 10\ \mu\text{s}, T_{vj}=125\text{ }^\circ\text{C}$		250		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	$T_C=100\text{ }^{\circ}\text{C}$		50		A
I_{FRM}	Repetitive Peak Forward Current	$t_p=1\text{ ms}$		100		A
I^2t	I^2t Value	$V_R=0\text{ V}$, $t_p=10\text{ ms}$, $T_{vj}=125\text{ }^{\circ}\text{C}$		550		A^2s

Characteristic Values (Diode Inverter)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit	
V_F	Forward Voltage	$I_F=50\text{ A}$, $V_{CE}=0\text{ V}$, $T_{vj}=25\text{ }^{\circ}\text{C}$		1.9	2.2	V	
		$I_F=50\text{ A}$, $V_{CE}=0\text{ V}$, $T_{vj}=125\text{ }^{\circ}\text{C}$		1.8	2.1	V	
t_{rr}	Reverse Recovery time	$I_F=50\text{ A}$, $V_R=600\text{ V}$ $-di/dt=3000\text{ A/us}$		43		ns	
Q_r	Recovered Charge			2.10		μC	
E_{rec}	Reverse Recovery Energy		$T_{vj}=25\text{ }^{\circ}\text{C}$		0.43		mJ
t_{rr}	Reverse Recovery time	$I_F=50\text{ A}$, $V_R=600\text{ V}$ $-di/dt=3000\text{ A/us}$		45		ns	
Q_r	Recovered Charge		$T_{vj}=125\text{ }^{\circ}\text{C}$		1.86		μC
E_{rec}	Reverse Recovery Energy				0.47		mJ
R_{thJC}	Thermal resistance, junction to case	per Diode			0.85	K/W	
$T_{vj\text{ op}}$	Operating Junction Temperature		-40		125	$^{\circ}\text{C}$	

Maximum Rated Values (Diode Rectifier)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{RRM}	Repetitive peak reverse voltage	$T_{vj}=25\text{ }^{\circ}\text{C}$		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	$t_p=10\text{ms}$ $T_{vj}=150\text{ }^{\circ}\text{C}$		880		A^2S
I_{FSM}	Surge forward current	$t_p=10\text{ms}$ $T_{vj}=25\text{ }^{\circ}\text{C}$		360		A
I^2t	I^2t -value	$t_p=10\text{ms}$ $T_{vj}=150\text{ }^{\circ}\text{C}$		600		A^2S

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	$T_{vj}=150\text{ }^{\circ}\text{C}$ $V_R=1800\text{V}$		1.1		mA
R_{thjc}	Thermal resistance junction to case	$T_c=25\text{ }^{\circ}\text{C}$		0.76		K/W
T_{vjop}	Temperature under switching conditions	per diode	-40		150	$^{\circ}\text{C}$

Maximum Rated Values (IGBT Brake-Chopper)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{CES}	Collector-emitter voltage	$T_{vj}=25\text{ }^{\circ}\text{C}$		1200		V
I_C	Continuous Collector Current	$T_C = 100^{\circ}\text{C}, T_{vj\text{ max}} = 150^{\circ}\text{C}$		35		A
I_{CRM}	Peak Collector Current	$I_{CRM}=2I_C$		70		A
V_{GES}	Gate-Emitter Voltage	$T_{vj}=25\text{ }^{\circ}\text{C}$	-20		20	V

Characteristic Values (IGBT Brake-Chopper)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$I_C=35\text{ A}, V_{GE}=15\text{ V}, T_{vj}=25\text{ }^{\circ}\text{C}$		2.15	2.5	V	
		$I_C=35\text{ A}, V_{GE}=15\text{ V}, T_{vj}=150\text{ }^{\circ}\text{C}$		2.13	2.4	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	5.8	6.5	V	
I_{CES}	Collector-Emitter Cut-off Current	$V_{CE}=1200\text{ V}, V_{GE}=0\text{ V}, T_{vj}=25\text{ }^{\circ}\text{C}$			1.2	mA	
I_{GES}	Gate-Emitter Leakage Current	$V_{CE}=0\text{ V}, V_{GE}=15\text{ V}, T_{vj}=25\text{ }^{\circ}\text{C}$			410	nA	
$t_{d(on)}$	Turn-on Delay Time, Inductive Load	$I_C=35\text{ A}, V_{CE}=600\text{ V}$ $V_{GE}=\pm 15\text{ V}$ $R_{Gon}=15\Omega$ $T_{vj}=25\text{ }^{\circ}\text{C}$		170		ns	
t_r	Rise Time, Inductive Load			160		ns	
$t_{d(off)}$	Turn-on Delay Time, Inductive Load			310		ns	
t_f	Fall Time, Inductive Load			100		ns	
E_{on}	Turn-on Energy Loss per Pulse				4.6	mJ	
E_{off}	Energy Loss per Pulse				2.2	mJ	
$t_{d(on)}$	Turn-on Delay Time, Inductive Load		$I_C=35\text{ A}, V_{CE}=600\text{ V}$ $V_{GE}=\pm 15\text{ V}$ $R_{Gon}=15\Omega$ $T_{vj}=150\text{ }^{\circ}\text{C}$		210		ns
t_r	Rise Time, Inductive Load				180		ns
$t_{d(off)}$	Turn-on Delay Time, Inductive Load				350		ns
t_f	Fall Time, Inductive Load				180		ns
E_{on}	Turn-on Energy Loss per Pulse				4.9	mJ	
E_{off}	Energy Loss per Pulse				3.0	mJ	
R_{thJC}	Thermal resistance, junction to case	per IGBT				0.75	K/W
$T_{vj\text{ op}}$	Temperature under switching conditions		-40		150	$^{\circ}\text{C}$	

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	$T_C=100\text{ }^{\circ}\text{C}$		25		A
I_{FRM}	Repetitive Peak Forward Current	$t_p=1\text{ ms}$		50		A
I^2t	I^2t Value	$V_R=0\text{ V}$, $t_p=10\text{ ms}$, $T_{vj}=150\text{ }^{\circ}\text{C}$		100		A^2s

Characteristics (Diode Brake-Chopper)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit	
V_F	Forward Voltage	$T_{vj}=25\text{ }^{\circ}\text{C}$		2.03	2.5	V	
		$T_{vj}=150\text{ }^{\circ}\text{C}$		2.05	2.45	V	
t_{rr}	Reverse Recovery time	$I_F=25\text{ A}$, $V_R=600\text{ V}$ $-di/dt=250\text{ A/us}$		220		ns	
Q_r	Recovered Charge			0.8		μC	
E_{rec}	Reverse Recovery Energy		$T_{vj}=25\text{ }^{\circ}\text{C}$		0.2		mJ
t_{rr}	Reverse Recovery time	$I_F=25\text{ A}$, $V_R=600\text{ V}$ $-di/dt=250\text{ A/us}$		340		ns	
Q_r	Recovered Charge		$T_{vj}=150\text{ }^{\circ}\text{C}$		1.6		μC
E_{rec}	Reverse Recovery Energy				0.5		mJ
R_{thJC}	Thermal resistance, junction to case	$I_F=25\text{ A}$, $V_{CE}=0\text{ V}$, $T_{vj}=25\text{ }^{\circ}\text{C}$			1.24	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 °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

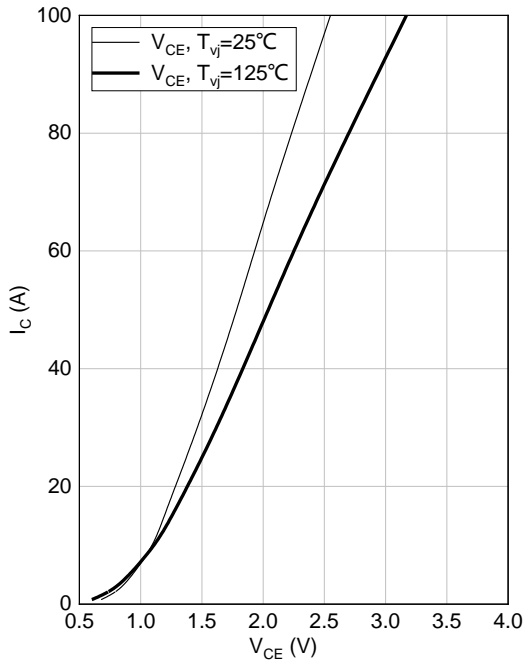
Module Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V _{isol}	Isolation voltage	t=1min,f=50Hz	2500			V
T _{stg}	Storage Temperature		-40		125	°C
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)

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

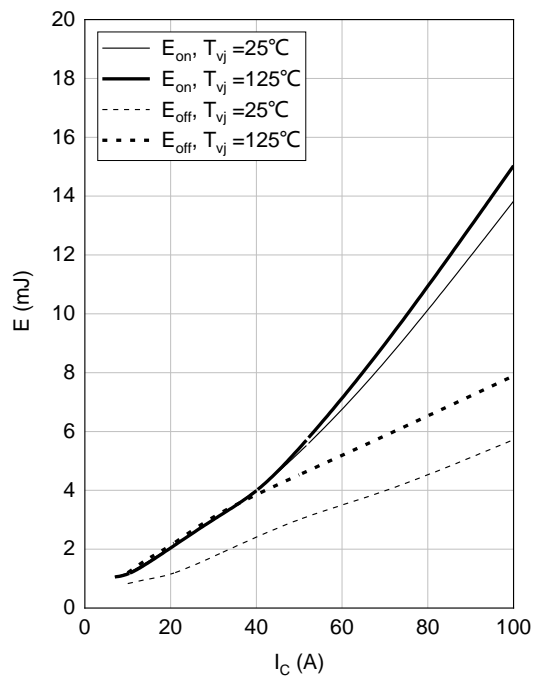
$$V_{GE} = 15V$$



Switching losses of IGBT, Inverter (typical)

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

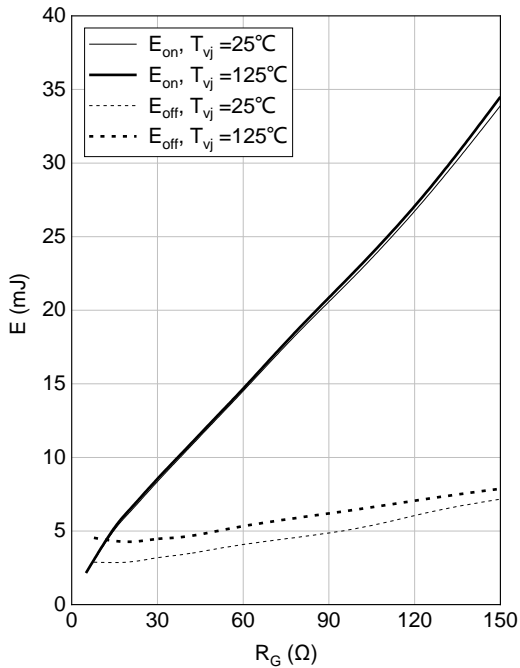
$$V_{GE} = \pm 15V, R_{Gon} = 15\Omega, V_{CE} = 600V$$



Switching losses of IGBT, Inverter (typical)

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

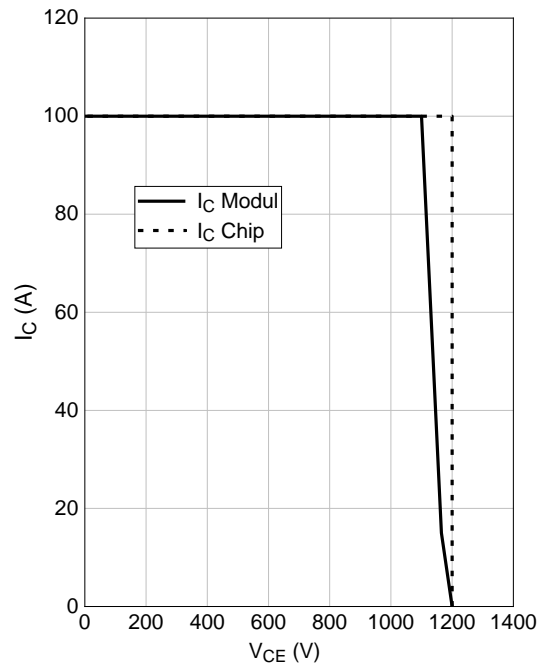
$$V_{GE} = \pm 15V, I_c = 50A, V_{CE} = 600V$$



RBSOA IGBT, Inverter (typical)

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

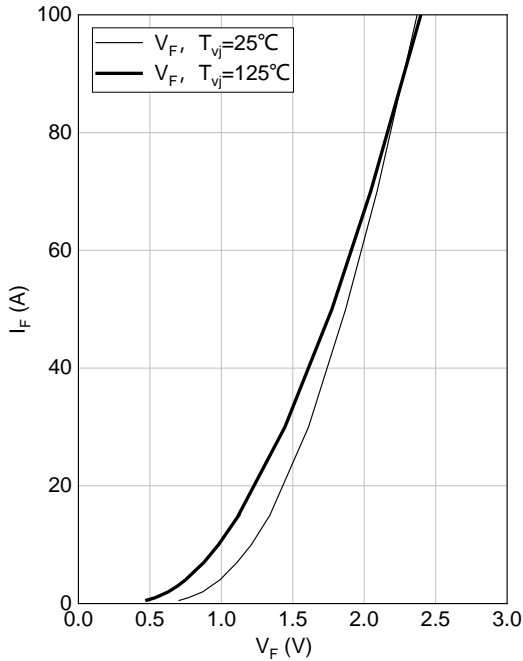
$$V_{GE} = \pm 15V, R_{Goff} = 15\Omega, T_{vj} = 150^\circ C$$



Forward characteristic of Diode, Inverter (typical)

$$I_F = f(V_F)$$

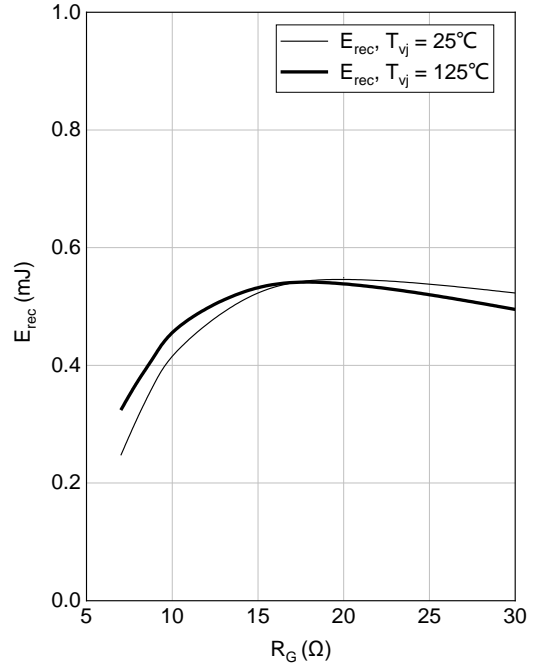
$$V_{GE} = \pm 15V$$



Switching losses of Diode, Inverter (typical)

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

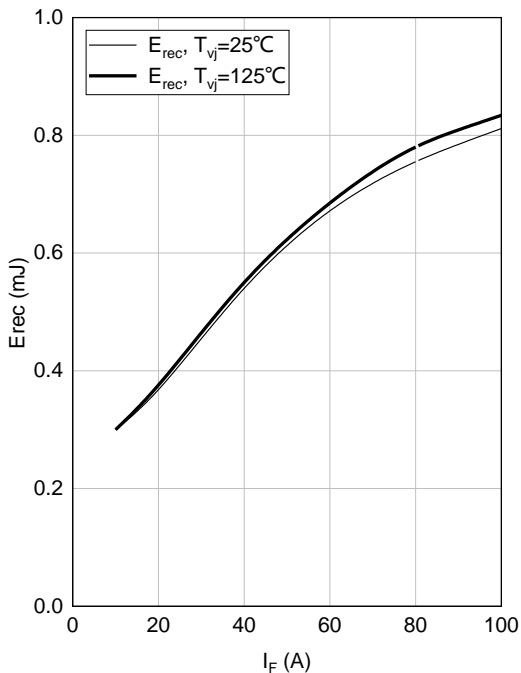
$$I_F = 50 A, V_{CE} = 600 V$$



switching losses of Diode, Inverter (typical)

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

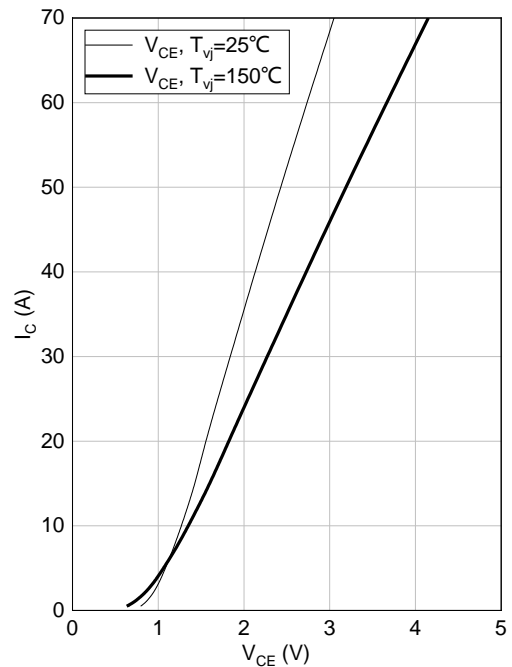
$$R_{Gon} = 15 \Omega, V_{CE} = 600V$$



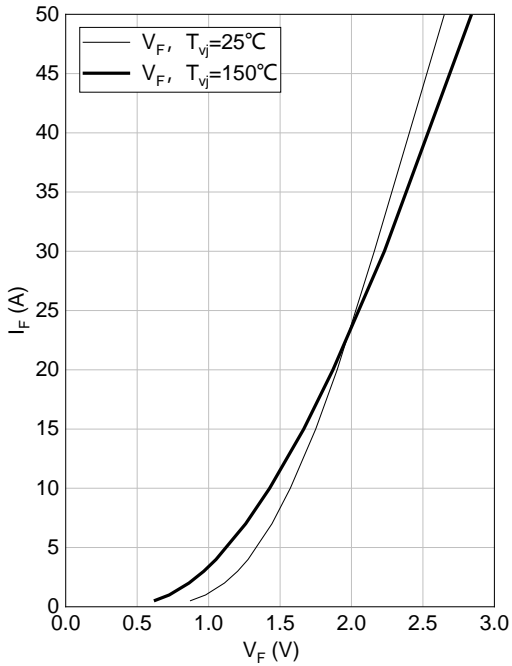
Output characteristic IGBT, Brake-Chopper (typical)

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

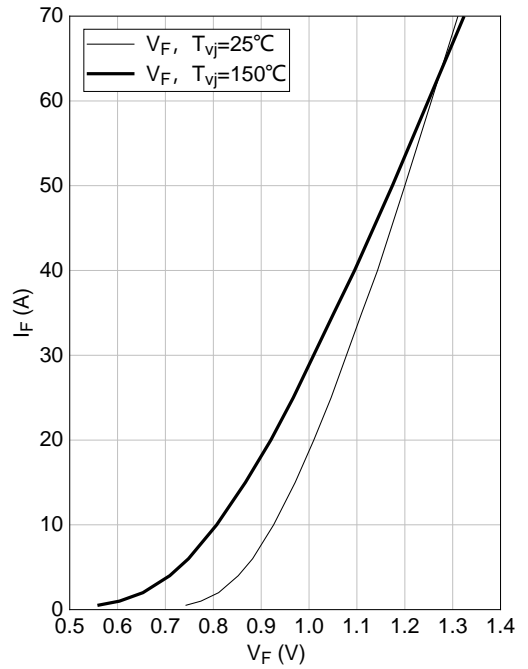
$$V_{GE} = 15 V$$



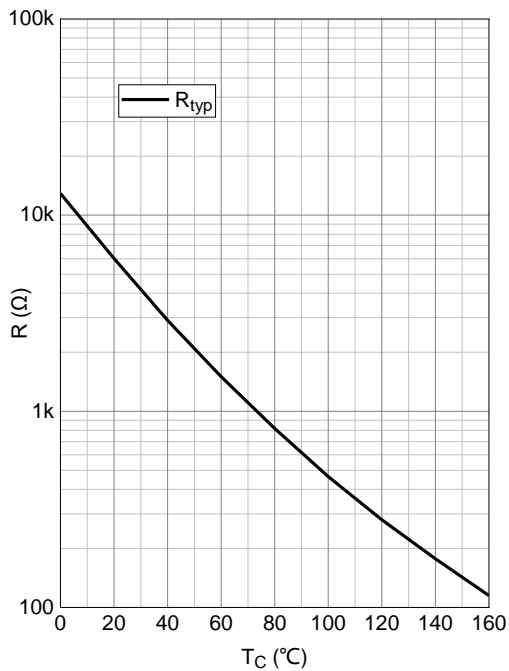
Forward characteristic of Diode, Brake-Chopper (typical)
 $I_F = f(V_F)$



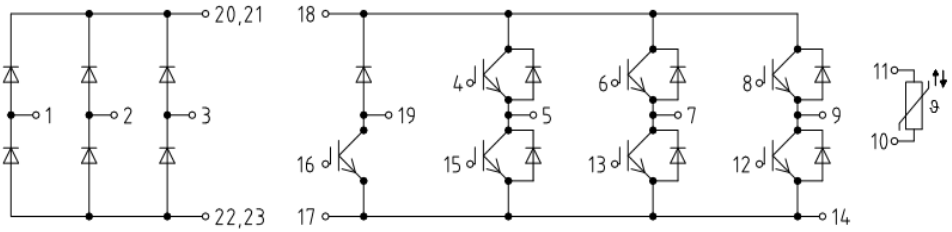
Forward characteristic of Diode, Rectifier (typical)
 $I_F = f(V_F)$



NTC-Thermistor-temperature characteristic (typical)
 $R = f(T)$

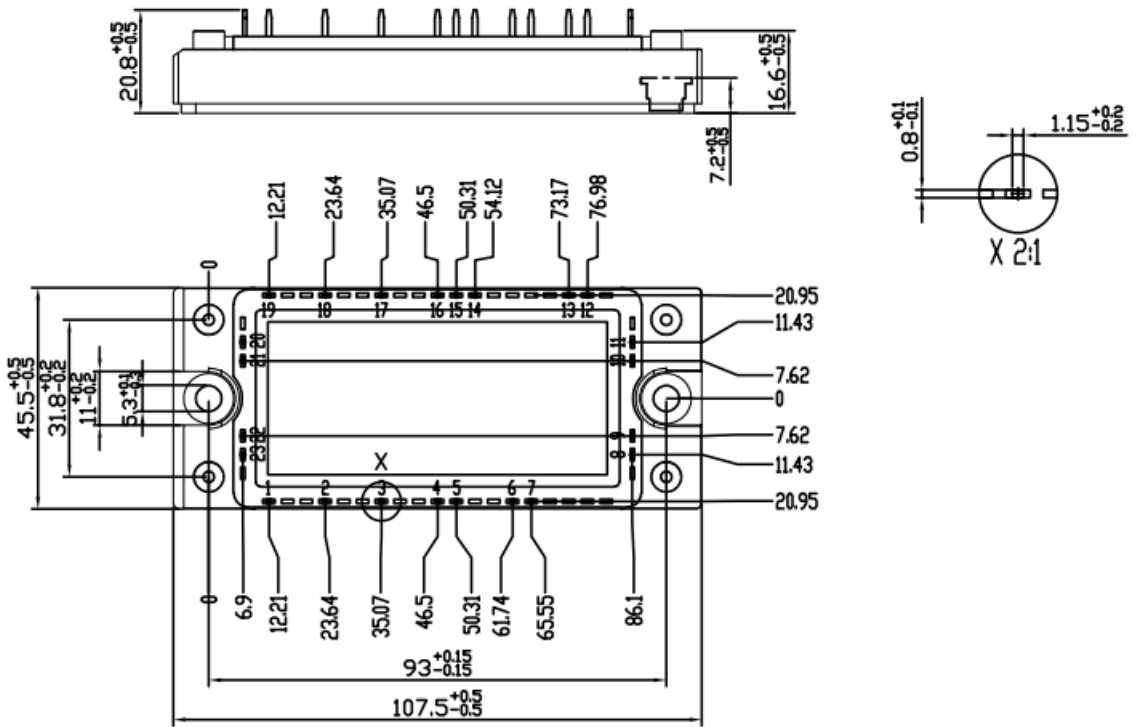


Circuit Diagram



Package Dimensions

(Dimensions in Millimeters)



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