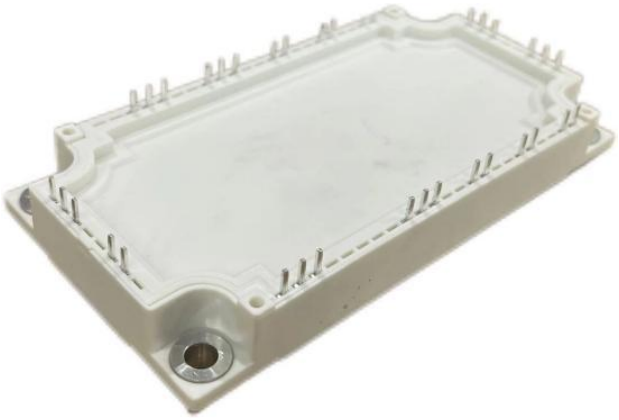
1200V 100A CoolFAST™ IGBT7 Power Module

Electrical Features:

- 1200V 100A, $V_{CE(sat)}$ =1.7V@25°C
- High RBSOA Capability
- Trench/FS Technology
- Low Reverse-recovery Losses
- High SC Capability



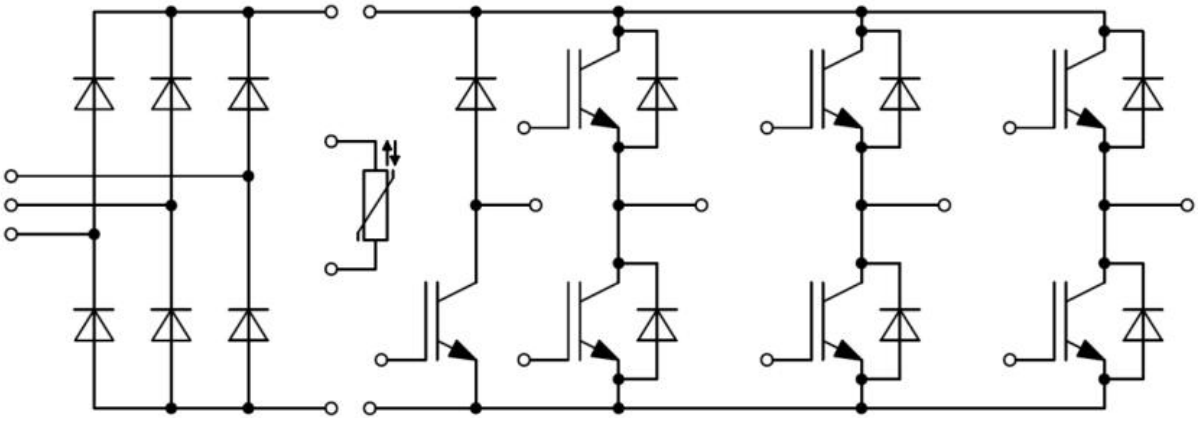
Applications:

- Motor Drives
- Servo Drives
- Auxiliary Inverters
- Uniterruptible Power Supply

Mechanical Features:

- High Power and Thermal Cycling Capability
- Maximum Junction Temperature 175℃
- High Power Density
- PressFIT Contact Technology
- Isolated Base Plate

Equivalent circuit:



Maximum Ratings and Characteristics

Absolute Maximum Ratings at T_c= 25°C (unless otherwise specified)

IGBT/FRD, Inverter

Items	Symbols	Values	Units	Remarks
Collector-Emitter voltage	V_{CES}	1200	V	
Gate-Emitter voltage	V_{GES}	±30	V	
DC Collector Current	I_C	100	A	T_C= 100°C
Pulsed Collector Current	I_{CP}	200	A	t_p=1ms
Diode Forward Current	I_F	100	A	
Repetitive Peak Forward Current	I_{FRM}	200	A	

Diode, Rectifier

Items	Symbols	Values	Units	Remarks
Repetitive Peak Reverse Voltage	V_{RRM}	1600	V	
Average Output Current 50Hz/60Hz, sine wave	I_O	100	A	
Surge Forward Current	I_{FSM}	900	A	V_R=0V, t_p=10ms, T_{vj}=45℃
I^2t-Value	I^2t	5000	A^2s	V_R=0V, t_p=10ms, T_{vj}=45℃

IGBT, Brake

Items	Symbols	Values	Units	Remarks
Collector-Emitter voltage	V_{CES}	1200	V	
Gate-Emitter voltage	V_{GES}	±30	V	
DC Collector Current	I_C	50	A	T_C= 100°C
Pulsed Collector Current	I_{CP}	100	A	t_p=1ms

Diode, Brake

Items	Symbols	Values	Units	Remarks
Repetitive Peak Reverse Voltage	V_{RRM}	1200	V	
Diode Continuous Forward Current	I_F	30	A	
Repetitive Peak Forward Current	I_{FRM}	60	A	t_p=1ms

Module

Items	Symbols	Values	Units	Remarks
Maximum Junction Temperature(inverter, brake) Maximum Junction Temperature(rectifier)	T_{vjmax}	175 150	°C	
Operating Junction Temperature	T_{vj}	-40 ~ +150	°C	
Storage Temperature	T_{stg}	-40 ~ +125	°C	
Isolation Voltage RMS,f=50Hz,t=1min	V_{ISO}	2500	V	

Electrical Characteristics (unless otherwise specified)

IGBT, Inverter

Description	Symbols	Conditions		Values			Unit
				Min	Typ	Max	
Zero Gate Voltage Collector Current	I_{CES}	V_{CE}= 1200V, V_{GE}= 0V T_{vj}= 25°C				200	μA
Gate-Emitter Leakage Current	I_{GES}	V_{CE}= 0V, V= 20V, T_{vj}= 25°C				±300	nA
Gate-Emitter Threshold Voltage	$V_{GE(th)}$	V_{CE}= V_{GE}, I_C= 100mA		5.5	6.1	6.7	V
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	V_{GE}= 15V I_C= 100A	T_{vj}= 25°C		1.7	2.2	V
			T_{vj}= 125°C		2.08		
			T_{vj}= 150°C		2.23		
Input Capacitance	C_{ies}	V_{CE}= 25V, V_{GE}= 0V f= 1MHz			21.20		nF
Reverse Transfer Capacitance	C_{res}				0.12		nF
Gate Charge	Q_G	V_{CC}= 600V, V_{GE}= 15V			1.80		μC
Internal Gate Resistor	R_{Gint}	T_{vj}= 25°C			3.88		Ω
Turn-On Delay Time, Inductive load	$t_{d(on)}$	V_{CC}= 600V I_C= 100A V_{GE}= 15V R_G= 10Ω	T_{vj}= 25°C		0.36		μs
			T_{vj}= 125°C		0.34		
			T_{vj}= 150°C		0.33		
Rise Time, Inductive load	t_r		T_{vj}= 25°C		0.09		μs
			T_{vj}= 125°C		0.10		
			T_{vj}= 150°C		0.11		
Turn-Off Delay Time, Inductive load	$t_{d(off)}$		T_{vj}= 25°C		0.39		μs
			T_{vj}= 125°C		0.41		
			T_{vj}= 150°C		0.44		
Fall Time, Inductive load	t_f		T_{vj}= 25°C		0.08		μs
			T_{vj}= 125°C		0.10		
			T_{vj}= 150°C		0.15		
Turn-On Energy	E_{on}		T_{vj}= 25°C		12.92		mJ
			T_{vj}= 125°C		16.08		
			T_{vj}= 150°C		21.09		
Turn-Off Energy	E_{off}		T_{vj}= 25°C		5.35		mJ
			T_{vj}= 125°C		6.19		
			T_{vj}= 150°C		7.34		
SC Data	I_{SC}	V_{CC}= 600V R_G= 20Ω V_{GE}≤ 15V V_{CEmax}=V_{CE}-L_{SCE}*di/dt	t_P≤ 10μs T_{vj}= 150°C		400		A

Diode,Inverter

Description	Symbols	Conditions		Values			Unit
				Min	Typ	Max	
Forward Voltage	V_F	I_F= 100A V_{GE}= 0V	T_{vj}= 25°C		1.49	2.0	V
			T_{vj}= 125°C		1.38		
			T_{vj}= 150°C		1.36		
Recovery Charge	Q_r	I_F= 100A,V_R= 600V -di_F/d_t= 1100A/us V_{GE}= -15V	T_{vj}= 25°C		7.90		µC
			T_{vj}= 125°C		16.77		
			T_{vj}= 150°C		22.31		
Reverse Recovery Energy	E_{rec}	I_F= 100A, V_R= 600V -di_F/d_t=1100A/us V_{GE}= -15V	T_{vj}= 25°C		3.17		mJ
			T_{vj}= 125°C		6.41		
			T_{vj}= 150°C		8.91		
Peak reverse recovery current	I_{RM}	I_F= 100A, V_R= 600V -di_F/d_t=1100A/us V_{GE}= -15V	T_{vj}= 25°C		60.81		A
			T_{vj}= 125°C		71.25		
			T_{vj}= 150°C		89.43		

Diode,Rectifier

Description	Symbols	Conditions		Values			Unit
				Min	Typ	Max	
Forward Voltage	V_F	I_F= 100A, V_{GE}= 0V	T_{vj}= 25°C		1.20		V
Reverse Current	I_R	V_R=1600V, V_{GE}=0V	T_{vj}= 25°C		3.34		µA

IGBT, Brake

Description	Symbols	Conditions		Values			Unit
				Min	Typ	Max	
Zero Gate Voltage Collector Current	I_{CES}	V_{CE}= 1200V, V_{GE}= 0V T_{vj}= 25°C				200	µA
Gate-Emitter Leakage Current	I_{GES}	V_{CE}= 0V, V= 20V, T_{vj}= 25°C				±300	nA
Gate-Emitter Threshold Voltage	$V_{GE(th)}$	V_{CE}= V_{GE}, I_C= 1.6mA			5.9		V
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	V_{GE}= 15V I_C= 50A	T_{vj}= 25°C		2.1		V
Turn-On Delay Time, Inductive load	$t_{d(on)}$	V_{CC}= 600V I_C= 50A V_{GE}= 15V R_G= 15Ω	T_{vj}= 25°C		0.23		µs
Rise Time, Inductive load	t_r		T_{vj}= 25°C		0.04		µs
Turn-Off Delay Time, Inductive load	$t_{d(off)}$		T_{vj}= 25°C		0.36		µs
Fall Time, Inductive load	t_f		T_{vj}= 25°C		0.12		µs
Turn-On Energy	E_{on}		T_{vj}= 25°C		5.49		mJ
Turn-Off Energy	E_{off}		T_{vj}= 25°C		3.83		mJ
SC Data	I_{SC}	V_{CC}= 600V R_G= 20Ω V_{GE}≤ 15V V_{CEmax}=V_{CE}-L_{SCE}*di/dt	t_P≤ 10µs T_{vj}= 150°C		200		A

Diode,Brake

Description	Symbols	Conditions		Values			Unit
				Min	Typ	Max	
Forward Voltage	V_F	I_F= 30A V_{GE}= 0V	T_{vj}= 25°C		1.97		V
Recovery Charge	Q_r	I_F= 30A,V_R= 600V -di_F/d_t= 357A/us V_{GE}= -15V	T_{vj}= 25°C		0.25		μC
Reverse Recovery Energy	E_{rec}	I_F= 30A, V_R= 600V -di_F/d_t=357A/us V_{GE}= -15V	T_{vj}= 25°C		0.01		mJ
Peak reverse recovery current	I_{RM}	I_F= 30A, V_R= 600V -di_F/d_t=357A/us V_{GE}= -15V	T_{vj}= 25°C		13.78		A

NTC Characteristics

Description	Symbols	Conditions	Values			Unit
			Min	Typ	Max	
Rated Resistance	R_{25}	T_{NTC}=25°C		5.0		KΩ
Deviation of R_{100}	ΔR/R	T_{NTC}=100°C, R_{100}=493Ω	-5		5	%
Power Dissipation	P_{25}				20	mW
B-value	$B_{25/50}$	$R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298.15K))]$		3388		K
B-value	$B_{25/80}$	$R_2=R_{25}\exp[B_{25/80}(1/T_2-1/(298.15K))]$		3454		K
B-value	$B_{25/100}$	$R_2=R_{25}\exp[B_{25/100}(1/T_2-1/(298.15K))]$		3485		K

Module

Description	Symbols	Conditions	Values	Unit
Material of Module Base plat			Cu	
Internal Isolation			Al_2O_3	
Creepage Distance	d_{Creep}	Terminal to terminal	10.0	mm
Clearance	d_{Clear}	Terminal to terminal	7.5	mm
Comparative Tracking Index	CTI		200	

Description	Symbols	Conditions	Values			Unit
			Min	Typ	Max	
Stray Inductance Module	L_{sCE}			35.2		nH
Module Lead Resistance，Terminals-Chip	$R_{CC'+EE'}$	T_C= 25°C，Per switch		4.3		mΩ
Mounting Torque for Module Mounting	M	Screw M5	3.0		6.0	Nm
Weight	G			300		g

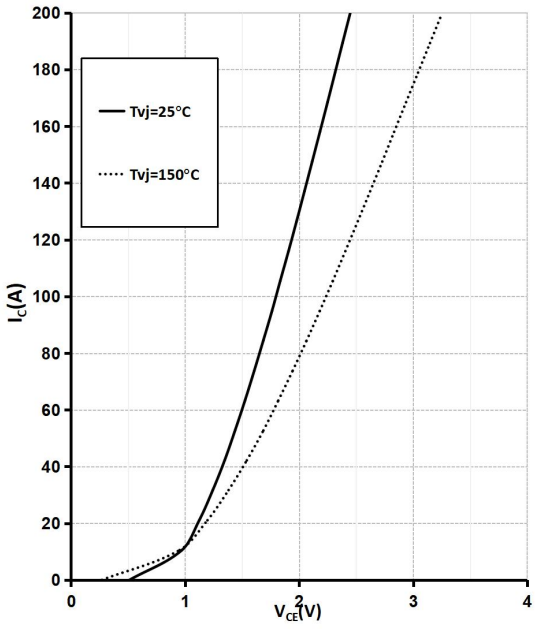
Thermal resistance

Description	Symbols	Conditions	Values			Unit
			Min	Typ	Max	
Thermal Resistance, junction to case	$R_{th(j-c)}$	Inverter IGBT			0.23	K/W
		Inverter FRD			0.44	

Output characteristic (typical), IGBT, Inverter

$I_C = f(V_{CE})$

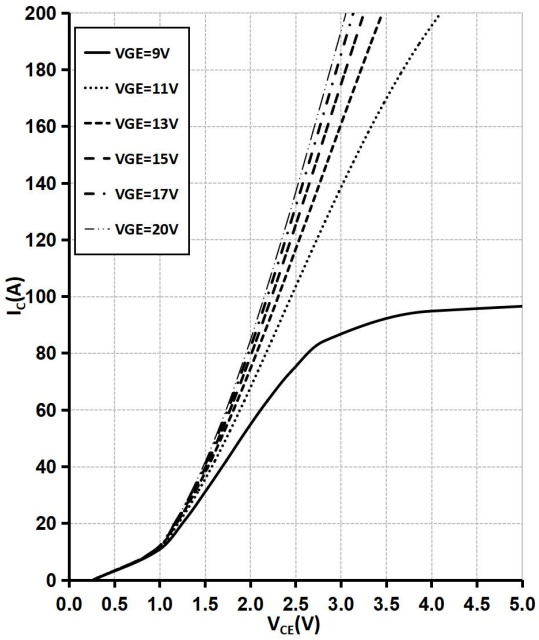
V_{GE}= 15V



Output characteristic (typical), IGBT, Inverter

$I_C = f(V_{CE})$

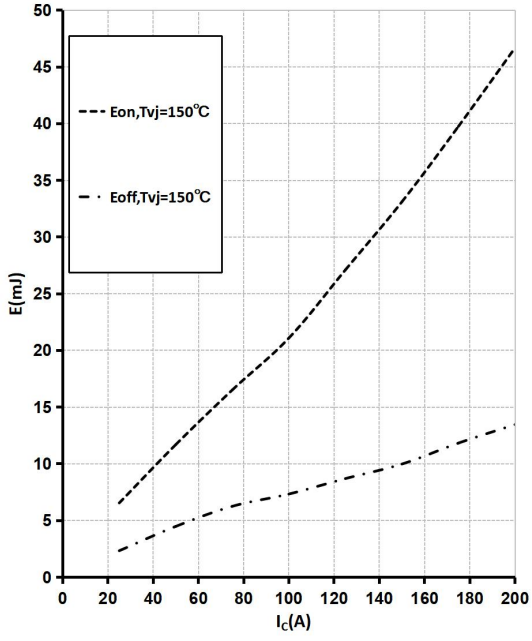
T_{vj}= 150°C



Switching losses (typical), IGBT, Inverter

$E = f(I_C)$

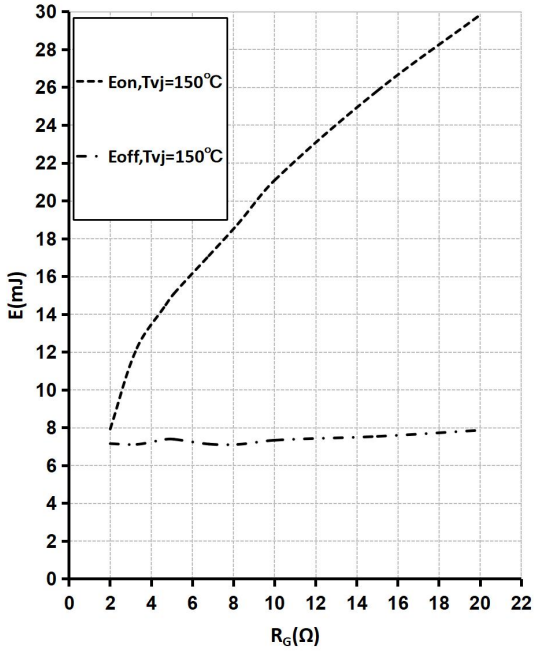
R_{Goff}= 10Ω, R_{Gon}=10Ω, V_{GE}= ±15V, V_{CC}= 600V



Switching losses (typical), IGBT, Inverter

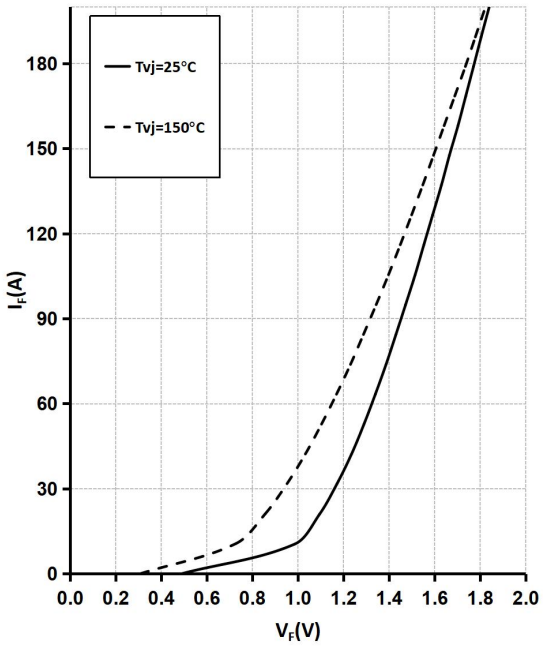
$E = f(R_G)$

V_{GE}= 15V, I_C= 100A, V_{CC}= 600V



Forward characteristic (typical), Diode, Inverter

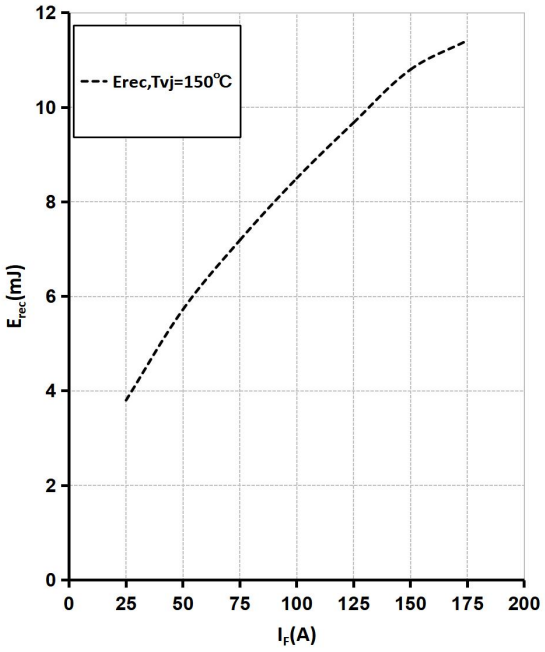
$I_F = f(V_f)$



Switching losses (typical), Diode, Inverter

$E_{rec} = f(I_F)$

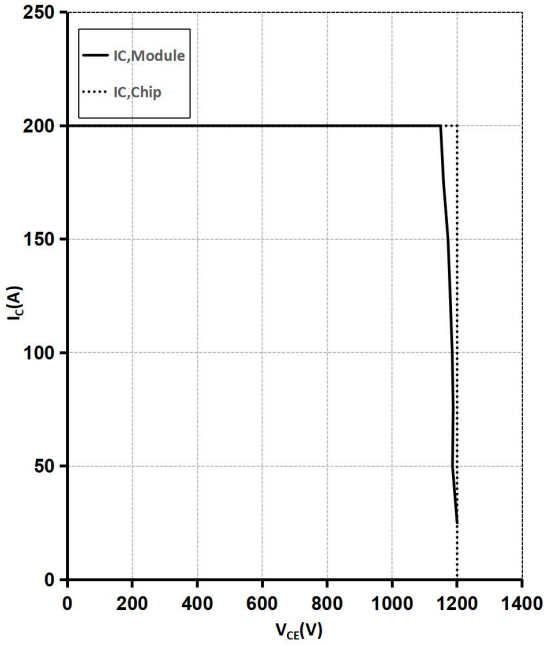
R_{Gon}= 10Ω, V_{CC}= 600V



Reverse bias safe operating area (RBSOA), IGBT, Inverter

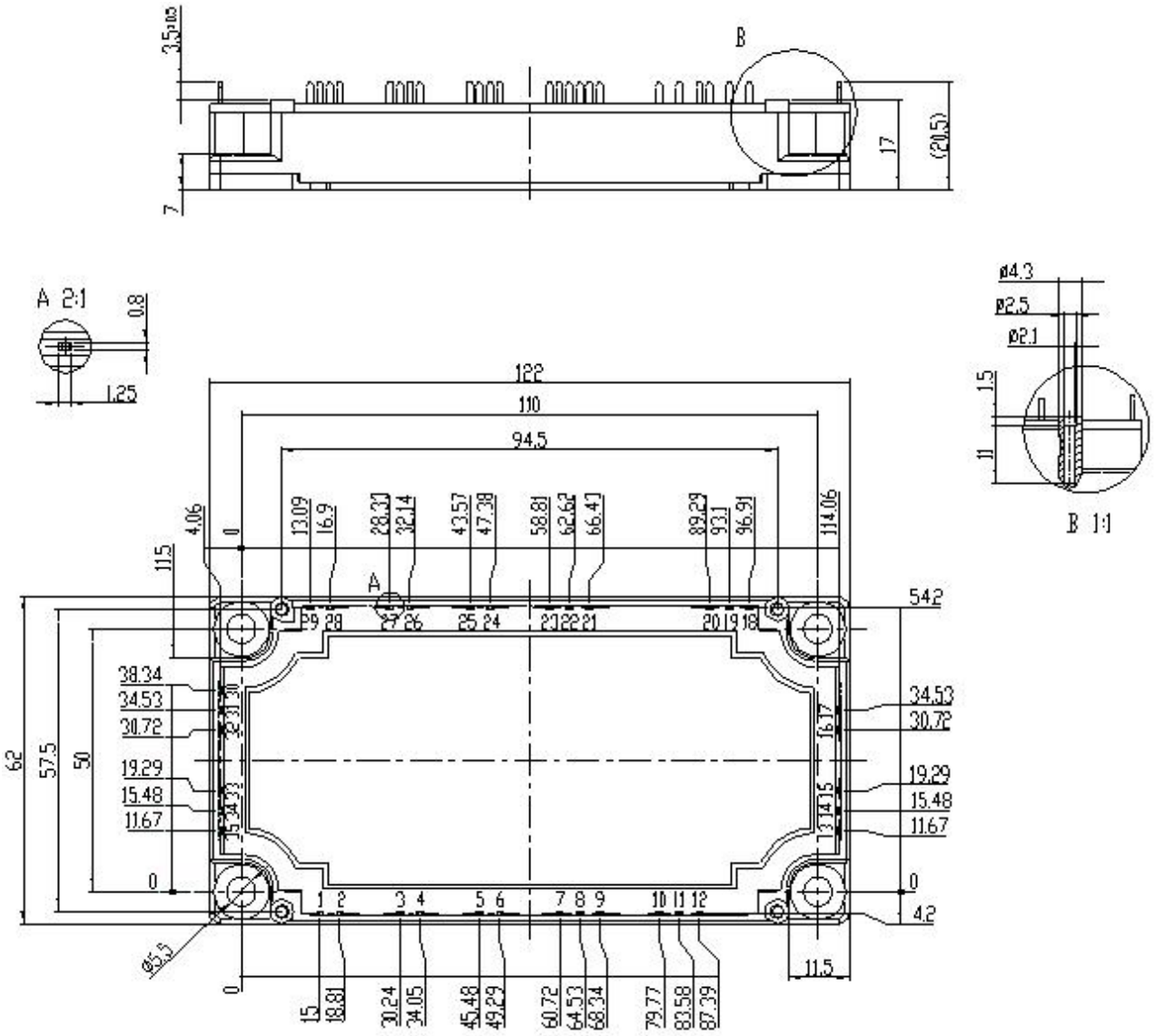
$I_C = f(V_{CE})$

R_{Goff}= 10Ω, V_{GE}= ±15V, T_{vj}= 150°C

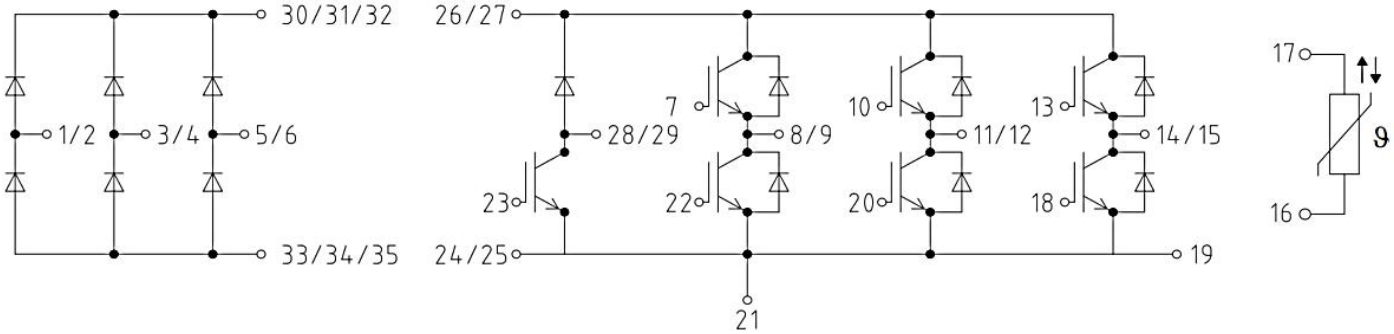


Package Dimension

Dimensions in Millimeters



Internal Circuit



Revision History

Revision	Date	Subjects (major changes since last revision)
0.1	2023-05-23	Preliminary version
1.0	2023-06-05	MP version

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