MMG450WQ120PD6T7H

1200V 450A Three Level Inverter Module

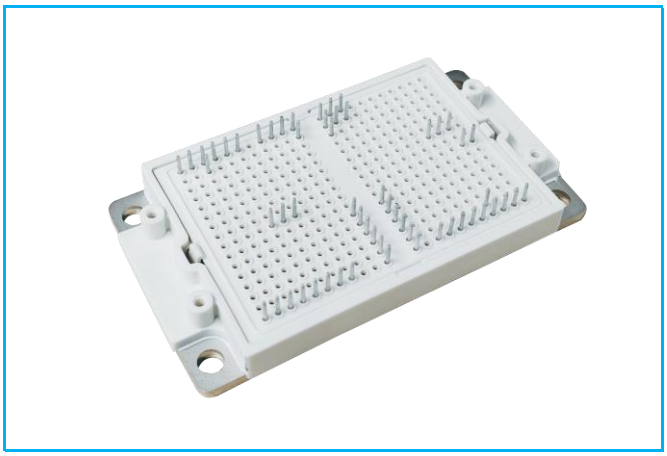
April 2025 | Preliminary | RoHS Compliant

PRODUCT FEATURES

☐ 1200V IGBT CHIP

☐ Low VCE(sat) and Low switching losses

☐ Free wheeling diodes with fast and soft reverse recovery



APPLICATIONS

☐ 3-Level-Applications

☐ Solar Applications

☐ PCS

MODULE CHARACTERISTICS *(T_C=25°C unless otherwise specified)*

Symbol	Parameter/Test Conditions		Values	Unit
T_{Jop}	Operating Temperature		-40~150	℃
T_{stg}	Storage Temperature		-40~125	
V_{isol}	Isolation Breakdown Voltage	AC, 50Hz(R.M.S), t=1minute	3200	V
RTI	RTI Elec.	housing	140	℃
CTI	Comparative Tracking Index		>400	
Md	Mounting Torque	Recommended（M5）	2.5~5	Nm

MacMic Science & Technology Co., Ltd.

Add：#18, Hua Shan Zhong Lu, New District, Changzhou City, Jiangsu Province, P. R .of China

Tel.：+86-519-85163708 Fax：+86-519-85162291 Post Code：213022 Website：www.macmicst.com

IGBT(T1、T4)

ABSOLUTE MAXIMUM RATINGS(T_C =25°C unless otherwise specified)

Symbol	Parameter/Test Conditions		Values	Unit
V_{CES}	Collector Emitter Voltage	T_J=25℃	1200	V
V_{GES}	Gate Emitter Voltage		±20	
I_{CN}	Implemented Collector Current		450	A
I_{CDC}	Continuous DC Collector Current	T_C=100℃,T_{Jmax}=175℃	325	
I_{CM}	Repetitive Peak Collector Current	tp=1ms	900	
T_{Jmax}	Max. Junction Temperature		175	℃
P_{tot}	Power Dissipation Per IGBT	T_C=25℃,T_{Jmax}=175℃	1400	W

ELECTRICAL CHARACTERISTICS (T_C =25°C unless otherwise specified)

Symbol	Parameter/Test Conditions			Min.	Typ.	Max.	Unit
$V_{GE(th)}$	Gate Emitter Threshold Voltage	V_{CE}=V_{GE}, I_C=6mA		4.60	5.40	6.10	V
$V_{CE(sat)}$	Collector Emitter Saturation Voltage	I_C=450A, V_{GE}=15V, T_J=25℃			1.53		
		I_C=450A, V_{GE}=15V, T_J=125℃			1.85		
		I_C=450A, V_{GE}=15V, T_J=150℃			1.92		
I_{CES}	Collector Leakage Current	V_{CE}=1200V, V_{GE}=0V, T_J=25℃				100	μA
I_{GES}	Gate Leakage Current	V_{CE}=0V,V_{GE}=±20V, T_J=25℃		-400		400	nA
R_{Gint}	Integrated Gate Resistor				0.33		Ω
Q_G	Gate Charge	V_{CE}=650V, I_C=200A , V_{GE}=15V			2		μC
C_{ies}	Input Capacitance	V_{CE}=25V, V_{GE}=0V, f =100kHz			63.6		nF
C_{oes}	Output Capacitance				1.15		nF
C_{res}	Reverse Transfer Capacitance				0.281		nF
$t_{d(on)}$	Turn on Delay Time	V_{CC}=650V,I_C=200A R_{Gon} =5Ω, V_{GE}=±15V, Inductive Load di/dt=4500A/μs （T_J=150℃）	T_J=25℃		129		ns
			T_J=125℃		113		ns
			T_J=150℃		110		ns
t_r	Rise Time		T_J=25℃		39		ns
			T_J=125℃		41		ns
			T_J=150℃		44		ns
E_{on}	Turn on Energy		T_J=25℃		8.5		mJ
			T_J=125℃		10.7		mJ
			T_J=150℃		11.5		mJ
$t_{d(off)}$	Turn off Delay Time	V_{CC}=650V,I_C=200A R_{Goff} =15Ω, V_{GE}=±15V, Inductive Load dv/dt=5100V/μs （T_J=150℃）	T_J=25℃		1190		ns
			T_J=125℃		1290		ns
			T_J=150℃		1320		ns
t_f	Fall Time		T_J=25℃		60		ns
			T_J=125℃		92		ns
			T_J=150℃		115		ns
E_{off}	Turn off Energy		T_J=25℃		9.7		mJ
			T_J=125℃		13.7		mJ
			T_J=150℃		14.9		mJ
R_{thJC}	Junction to Case Thermal Resistance					0.107	K /W

IGBT(T2、T3)

ABSOLUTE MAXIMUM RATINGS(T_C =25°C unless otherwise specified)

Symbol	Parameter/Test Conditions		Values	Unit
V_{CES}	Collector Emitter Voltage	T_J=25℃	1200	V
V_{GES}	Gate Emitter Voltage		±20	
I_{CN}	Implemented Collector Current		450	A
I_{CDC}	Continuous DC Collector Current	T_C=100℃,T_{Jmax}=175℃	325	
I_{CM}	Repetitive Peak Collector Current	tp=1ms	900	
T_{Jmax}	Max. Junction Temperature		175	℃
P_{tot}	Power Dissipation Per IGBT	T_C=25℃,T_{Jmax}=175℃	1400	W

ELECTRICAL CHARACTERISTICS (T_C =25°C unless otherwise specified)

Symbol	Parameter/Test Conditions			Min.	Typ.	Max.	Unit
$V_{GE(th)}$	Gate Emitter Threshold Voltage	V_{CE}=V_{GE}, I_C=6mA		4.60	5.40	6.10	V
$V_{CE(sat)}$	Collector Emitter Saturation Voltage	I_C=450A, V_{GE}=15V, T_J=25℃			1.55		
		I_C=450A, V_{GE}=15V, T_J=125℃			1.88		
		I_C=450A, V_{GE}=15V, T_J=150℃			1.95		
I_{CES}	Collector Leakage Current	V_{CE}=1200V, V_{GE}=0V, T_J=25℃				100	μA
I_{GES}	Gate Leakage Current	V_{CE}=0V,V_{GE}=±20V, T_J=25℃		-400		400	nA
R_{Gint}	Integrated Gate Resistor				0.33		Ω
Q_G	Gate Charge	V_{CE}=650V, I_C=200A , V_{GE}=15V			2		μC
C_{ies}	Input Capacitance	V_{CE}=25V, V_{GE}=0V, f =100kHz			63.6		nF
C_{oes}	Output Capacitance				1.15		nF
C_{res}	Reverse Transfer Capacitance				0.281		nF
$t_{d(on)}$	Turn on Delay Time	V_{CC}=650V,I_C=200A R_{Gon} =5Ω, V_{GE}=±15V, Inductive Load di/dt=4500A/μs （T_J=150℃）	T_J=25℃		129		ns
			T_J=125℃		113		ns
			T_J=150℃		110		ns
t_r	Rise Time		T_J=25℃		39		ns
			T_J=125℃		41		ns
			T_J=150℃		44		ns
E_{on}	Turn on Energy		T_J=25℃		8.4		mJ
			T_J=125℃		9.6		mJ
			T_J=150℃		10.5		mJ
$t_{d(off)}$	Turn off Delay Time	V_{CC}=650V,I_C=200A R_{Goff} =15Ω, V_{GE}=±15V, Inductive Load dv/dt=5100V/μs （T_J=150℃）	T_J=25℃		1190		ns
			T_J=125℃		1290		ns
			T_J=150℃		1320		ns
t_f	Fall Time		T_J=25℃		60		ns
			T_J=125℃		92		ns
			T_J=150℃		115		ns
E_{off}	Turn off Energy		T_J=25℃		10.3		mJ
			T_J=125℃		14.1		mJ
			T_J=150℃		15.7		mJ
R_{thJC}	Junction to Case Thermal Resistance					0.107	K /W

Diode(D2、D3)

ABSOLUTE MAXIMUM RATINGS (*T_C=25°C unless otherwise specified)*

Symbol	Parameter/Test Conditions		Values	Unit
V_{RRM}	Repetitive Reverse Voltage	T_J=25℃	1200	V
I_{FN}	Implemented Forward Current		280	A
I_{FRM}	Repetitive Peak Forward Current	tp=1ms	560	
I^2t		T_{vj}=25℃, t=10ms, 50Hz	9100	A^2s
T_{Jmax}	Max. Junction Temperature		175	℃

ELECTRICAL CHARACTERISTICS *(T_C=25°C unless otherwise specified)*

Symbol	Parameter/Test Conditions		Min.	Typ.	Max.	Unit
V_F	Forward Voltage	I_F=280A , V_{GE}=0V, T_J=25℃		2.80		V
		I_F=280A , V_{GE}=0V, T_J=125℃		2.30		
		I_F=280A , V_{GE}=0V, T_J=150℃		2.15		
R_{thJC}	Junction to Case Thermal Resistance				0.277	K /W

Diode(D1、D4、D5、D6)

ABSOLUTE MAXIMUM RATINGS (*T_C=25°C unless otherwise specified)*

Symbol	Parameter/Test Conditions		Values	Unit
V_{RRM}	Repetitive Reverse Voltage	T_J=25℃	1200	V
I_{FN}	Implemented Forward Current		250	A
I_{FRM}	Repetitive Peak Forward Current	tp=1ms	500	
I^2t		T_{vj}=25℃, t=10ms, 50Hz	16200	A^2s
T_{Jmax}	Max. Junction Temperature		175	℃

ELECTRICAL CHARACTERISTICS *(T_C=25°C unless otherwise specified)*

Symbol	Parameter/Test Conditions		Min.	Typ.	Max.	Unit
V_F	Forward Voltage	I_F=250A , V_{GE}=0V, T_J=25℃		1.34	1.65	V
		I_F=250A , V_{GE}=0V, T_J=125℃		1.6		
		I_F=250A , V_{GE}=0V, T_J=150℃		1.66		
R_{thJC}	Junction to Case Thermal Resistance				0.152	K /W

NTC CHARACTERISTICS *(T_C=25°C unless otherwise specified)*

Symbol	Parameter/Test Conditions		Min.	Typ.	Max.	Unit
R_{25}	Resistance	T_{NTC} =25℃		5		kΩ
△R/R	T_{NTC}=100℃， R_{100}=0.484kΩ		-5		5	%
$B_{25/50}$	$R_2 = R_{25} \exp [B_{25/50}(1/T_2 - 1/(298.15\ K))]$			3375		K

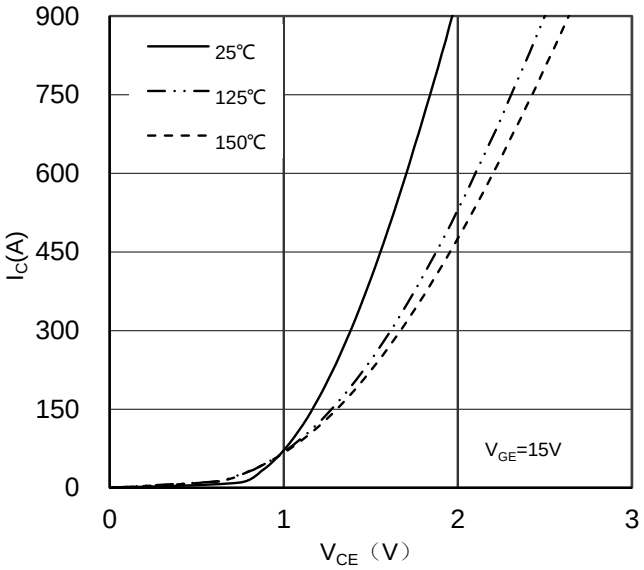


Figure 1. Typical Output Characteristics IGBT

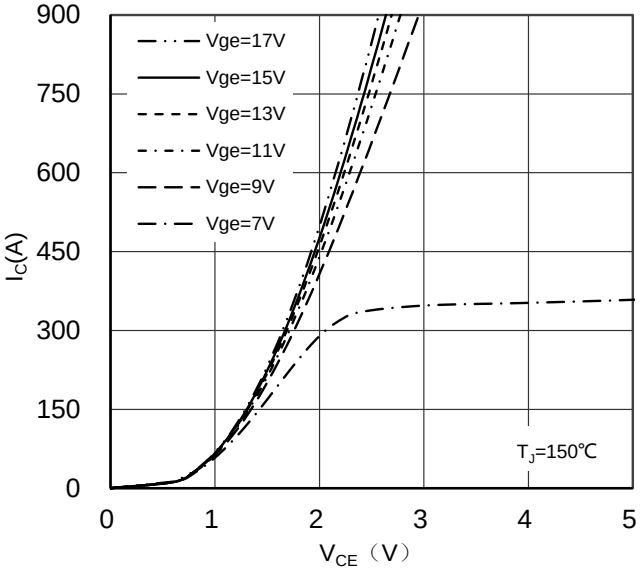


Figure 2. Typical Output Characteristics IGBT

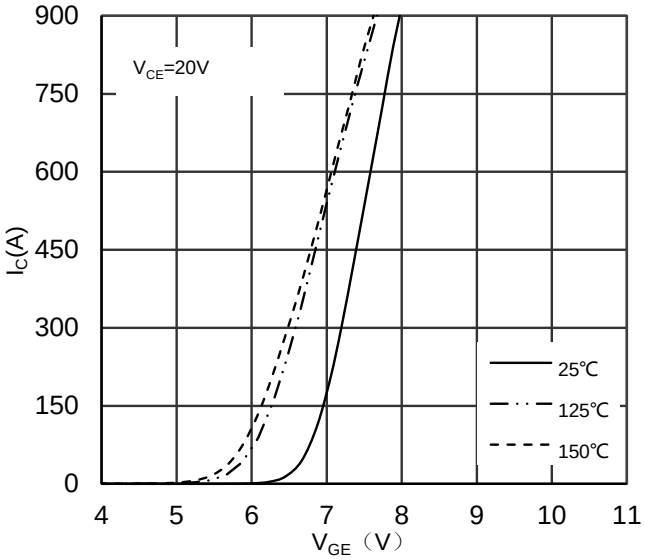


Figure 3. Typical Transfer characteristics IGBT

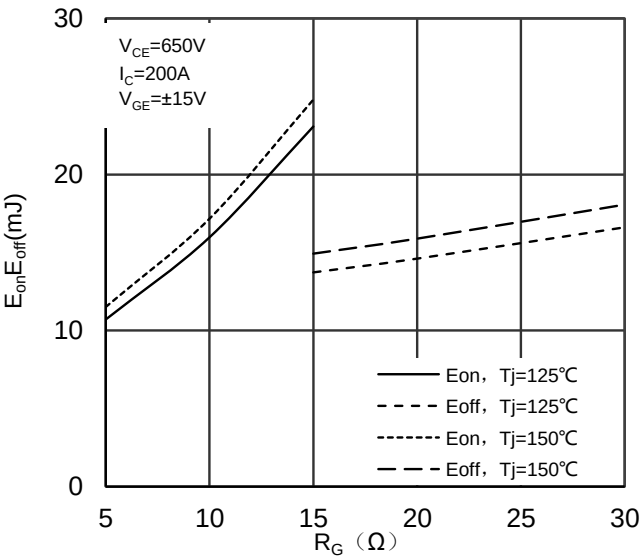


Figure 4. Switching Energy vs Gate Resistor IGBT
（T1、T4）

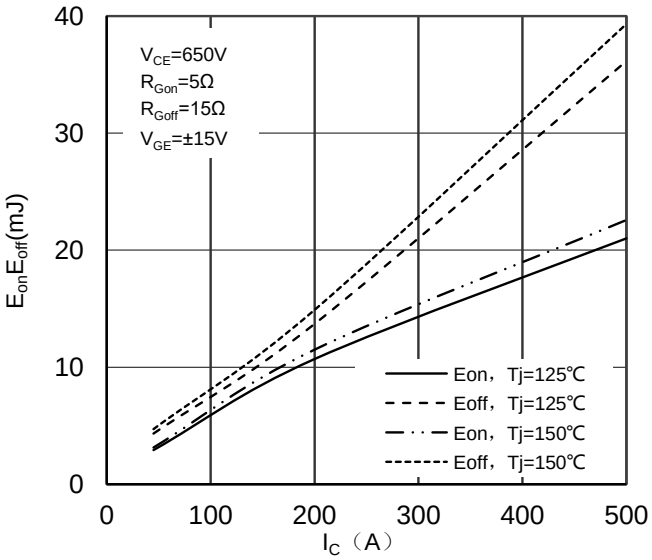


Figure 5. Switching Energy vs Collector Current IGBT
（T1、T4）

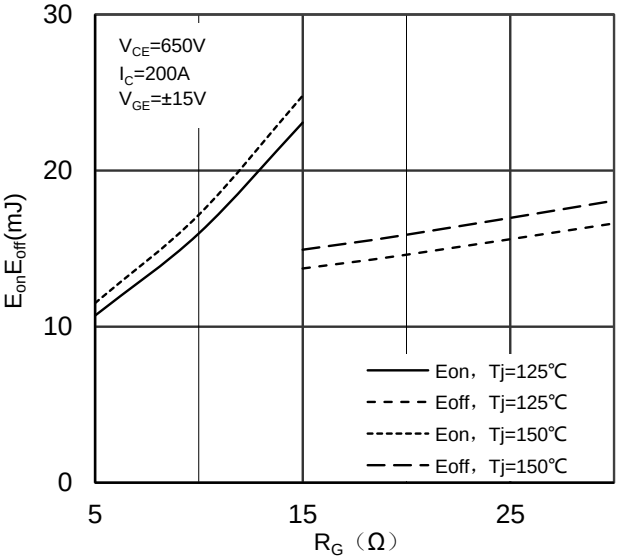


Figure 6. Switching Energy vs Gate Resistor IGBT
（T2、T3）

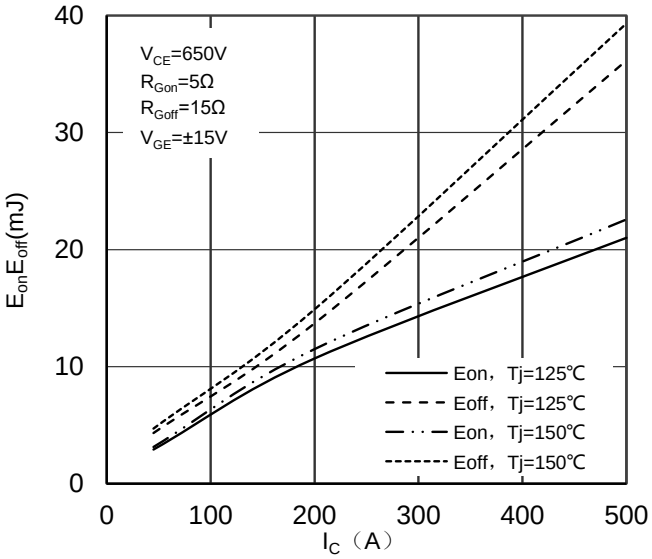


Figure 7. Switching Energy vs Collector Current IGBT （T2、T3）

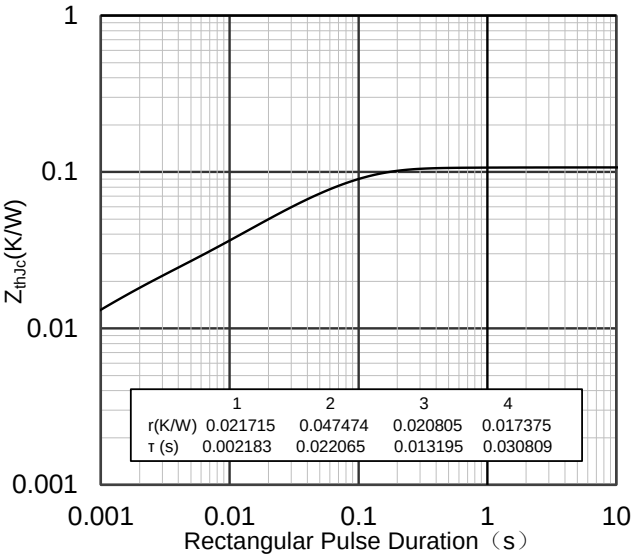


Figure 8. Transient Thermal Impedance of IGBT

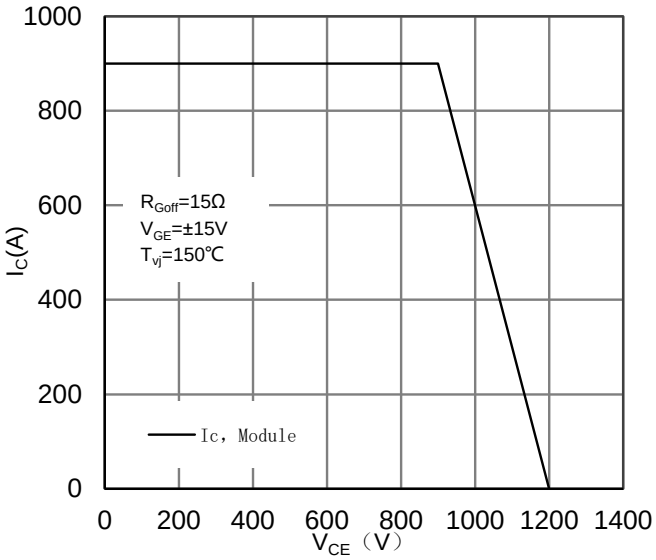


Figure 9. Reverse Bias Safe Operating Area IGBT

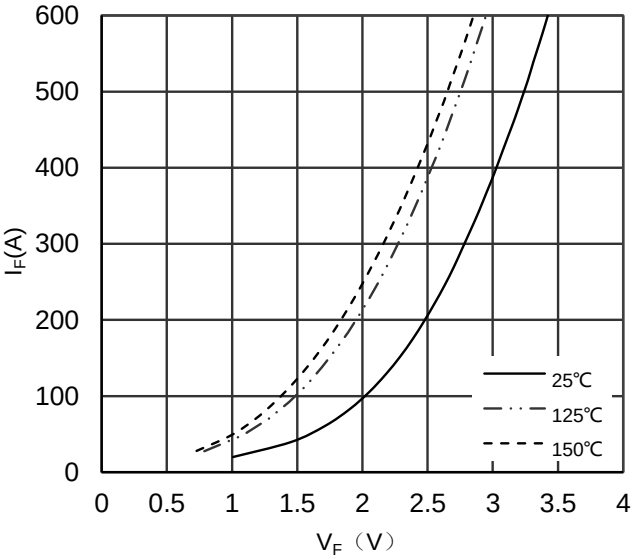


Figure 10. Diode Forward Characteristics Diode （D2、D3）

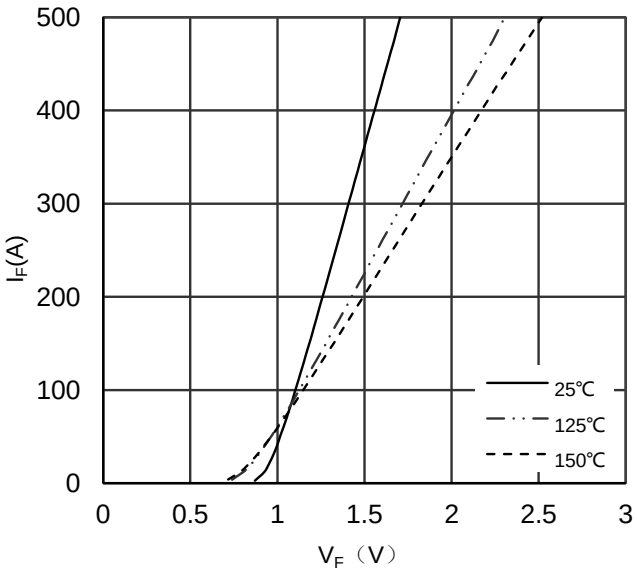


Figure 11. Diode Forward Characteristics Diode （D1、D4、D5、D6）

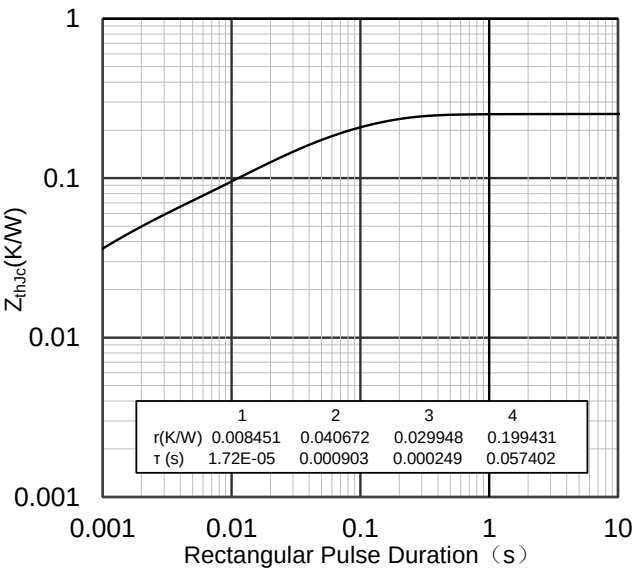


Figure 12. Transient Thermal Impedance of Diode （D2、D3）

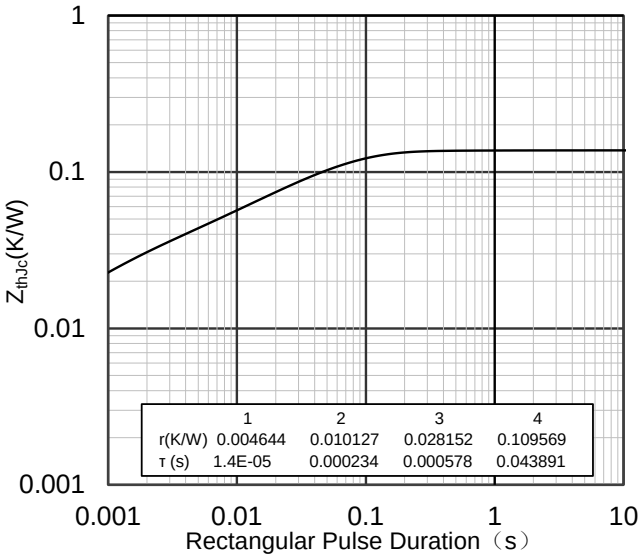


Figure 13. Transient Thermal Impedance of Diode （D1、D4、D5、D6）

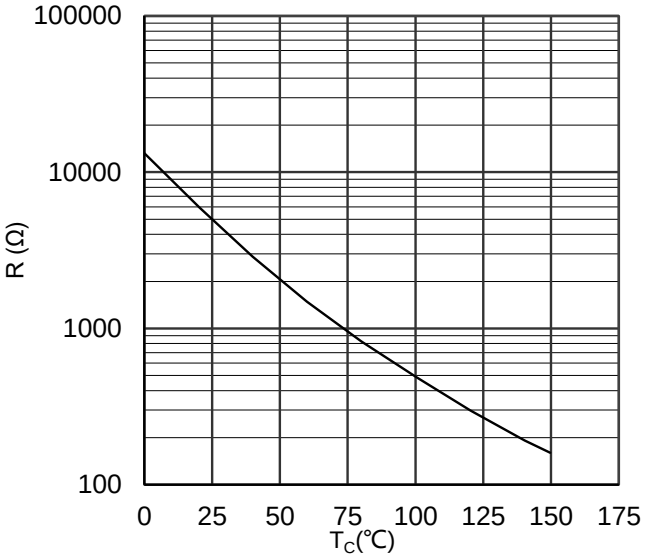


Figure 14. NTC Characteristics

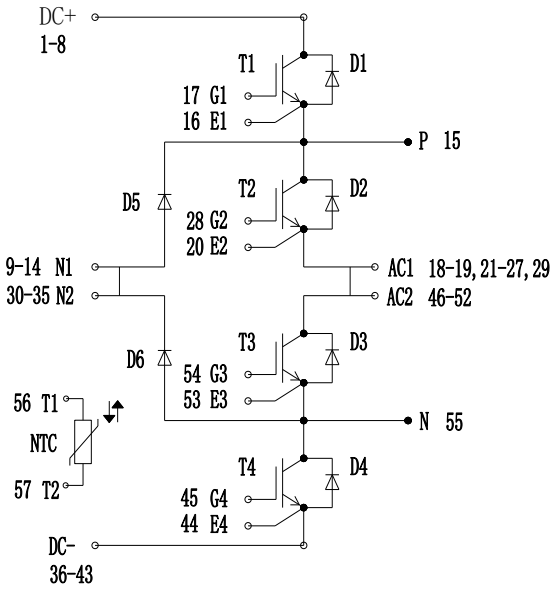
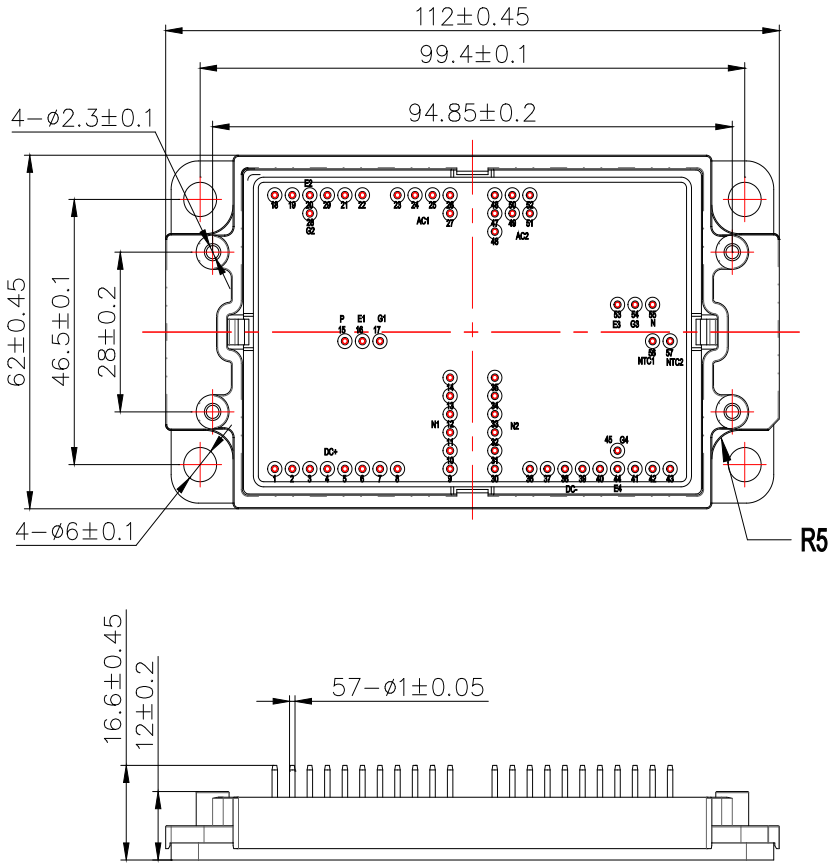


Figure 15. Circuit Diagram



Dimensions in (mm)

Figure 16. Package Outline

Pin table(mm)							
Pin Num	X	Y	端子定义	Pin Num	X	Y	端子定义
1	0	0	DC+	30	40.16	0	N2
2	3.2	0	DC+	31	40.16	3.2	N2
3	6.4	0	DC+	32	40.16	6.4	N2
4	9.6	0	DC+	33	40.16	9.6	N2
5	12.8	0	DC+	34	40.16	12.8	N2
6	16	0	DC+	35	40.16	16	N2
7	19.2	0	DC+	36	46.56	0	DC-
8	22.4	0	DC+	37	49.76	0	DC-
9	32	0	N1	38	52.96	0	DC-
10	32	3.2	N1	39	56.16	0	DC-
11	32	6.4	N1	40	59.36	0	DC-
12	32	9.6	N1	41	65.76	0	DC-
13	32	12.8	N1	42	68.96	0	DC-
14	32	16	N1	43	72.16	0	DC-
15	12.8	22.4	P	44	62.56	0	E4
16	16	22.4	E1	45	62.56	3.2	G4
17	19.2	22.4	G1	46	40.16	41.6	AC2
18	0	48	AC1	47	40.16	44.8	AC2
19	3.2	48	AC1	48	40.16	48	AC2
20	6.4	48	E2	49	43.36	44.8	AC2
21	12.8	48	AC1	50	43.36	48	AC2
22	16	48	AC1	51	46.56	44.8	AC2
23	22.4	48	AC1	52	46.56	48	AC2
24	25.6	48	AC1	53	62.56	28.8	E3
25	28.8	48	AC1	54	65.76	28.8	G3
26	32	48	AC1	55	68.96	28.8	N
27	32	44.8	AC1	56	68.96	22.4	T1
28	6.4	44.8	G2	57	72.16	22.4	T2
29	9.6	48	AC1				

Figure 17. Coordinates