

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 ($T_c=25^{\circ}\text{C}$ unless otherwise specified)

Symbol	Parameter/Test Conditions		Values	Unit
T_{Jop}	Operating Temperature		-40~150	°C
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	°C
CTI	Comparative Tracking Index		>400	
Md	Mounting Torque	Recommended (M5)	2.5~5	Nm

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MMG450WQ120PD6T7

IGBT(T1、T4)

ABSOLUTE MAXIMUM RATINGS($T_C=25^\circ\text{C}$ unless otherwise specified)

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

ELECTRICAL CHARACTERISTICS ($T_C=25^\circ\text{C}$ unless otherwise specified)

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

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IGBT(T2、T3)

ABSOLUTE MAXIMUM RATINGS($T_C=25^{\circ}\text{C}$ unless otherwise specified)

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

ELECTRICAL CHARACTERISTICS ($T_C=25^{\circ}\text{C}$ unless otherwise specified)

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

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Diode(D2、D3)

ABSOLUTE MAXIMUM RATINGS ($T_C=25^\circ\text{C}$ unless otherwise specified)

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

ELECTRICAL CHARACTERISTICS ($T_C=25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter/Test Conditions		Min.	Typ.	Max.	Unit
V_F	Forward Voltage	$I_F=280\text{A}$, $V_{GE}=0\text{V}$, $T_J=25^\circ\text{C}$		2.80		V
		$I_F=280\text{A}$, $V_{GE}=0\text{V}$, $T_J=125^\circ\text{C}$		2.30		
		$I_F=280\text{A}$, $V_{GE}=0\text{V}$, $T_J=150^\circ\text{C}$		2.15		
R_{thJC}	Junction to Case Thermal Resistance				0.250	K/W

Diode(D1、D4、D5、D6)

ABSOLUTE MAXIMUM RATINGS ($T_C=25^\circ\text{C}$ unless otherwise specified)

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

ELECTRICAL CHARACTERISTICS ($T_C=25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter/Test Conditions		Min.	Typ.	Max.	Unit
V_F	Forward Voltage	$I_F=250\text{A}$, $V_{GE}=0\text{V}$, $T_J=25^\circ\text{C}$		1.34	1.65	V
		$I_F=250\text{A}$, $V_{GE}=0\text{V}$, $T_J=125^\circ\text{C}$		1.6		
		$I_F=250\text{A}$, $V_{GE}=0\text{V}$, $T_J=150^\circ\text{C}$		1.66		
R_{thJC}	Junction to Case Thermal Resistance				0.163	K/W

NTC CHARACTERISTICS ($T_C=25^\circ\text{C}$ unless otherwise specified)

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

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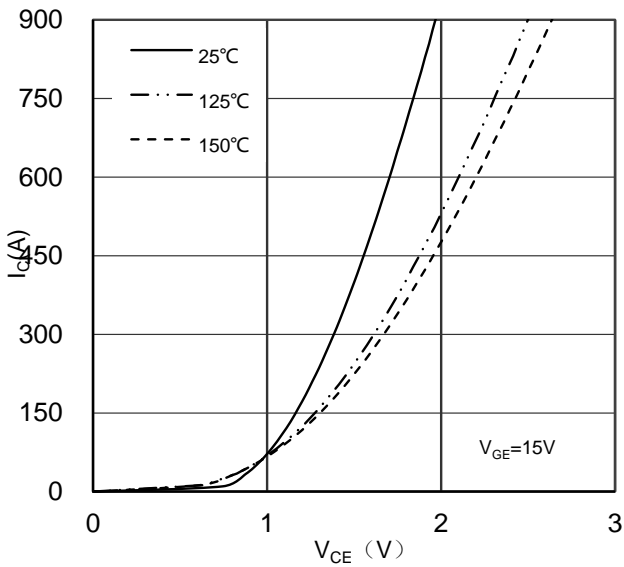


Figure 1. Typical Output Characteristics IGBT

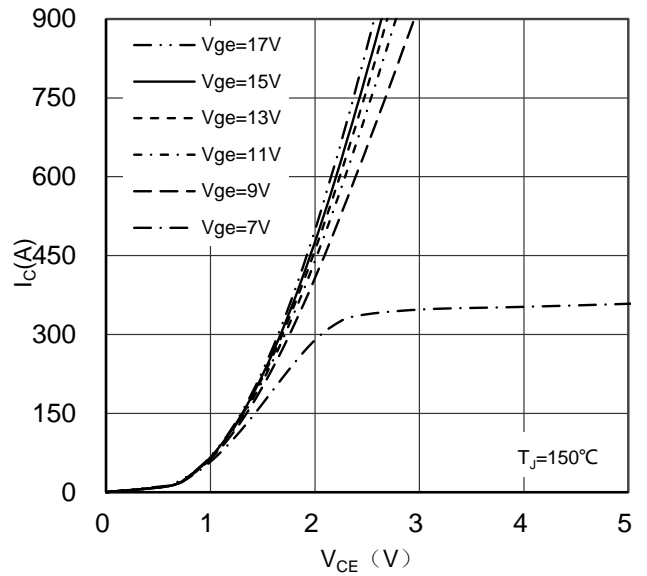


Figure 2. Typical Output Characteristics IGBT

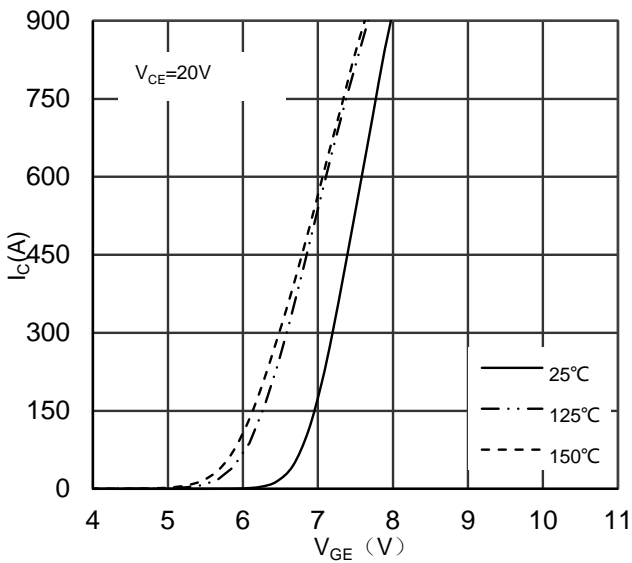


Figure 3. Typical Transfer characteristics IGBT

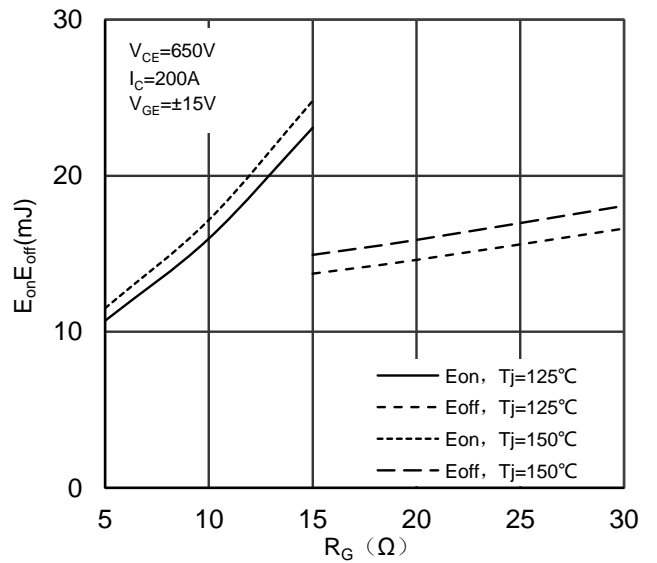


Figure 4. Switching Energy vs Gate Resistor IGBT (T1, T4)

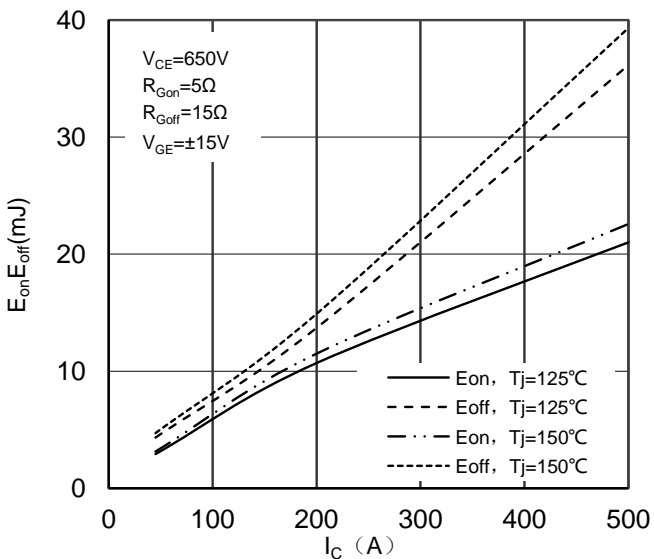


Figure 5. Switching Energy vs Collector Current IGBT (T1, T4)

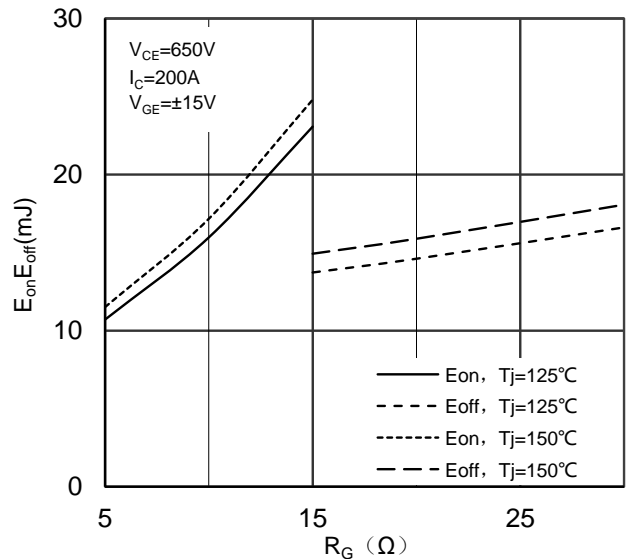


Figure 6. Switching Energy vs Gate Resistor IGBT (T2, T3)

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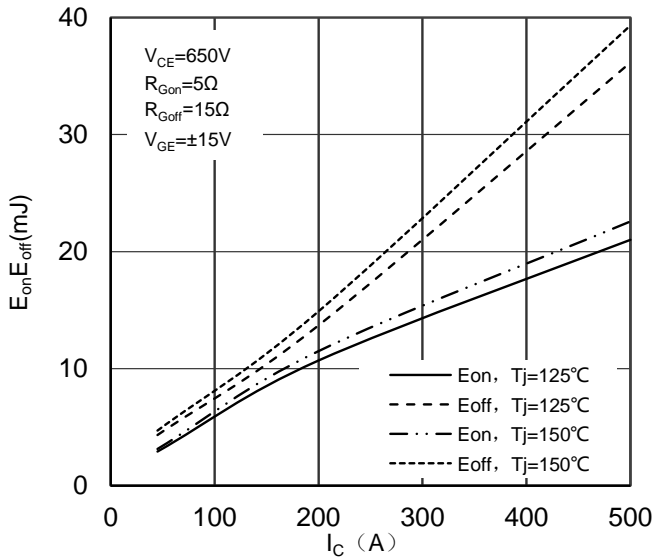


Figure 7. Switching Energy vs Collector Current IGBT (T2, T3)

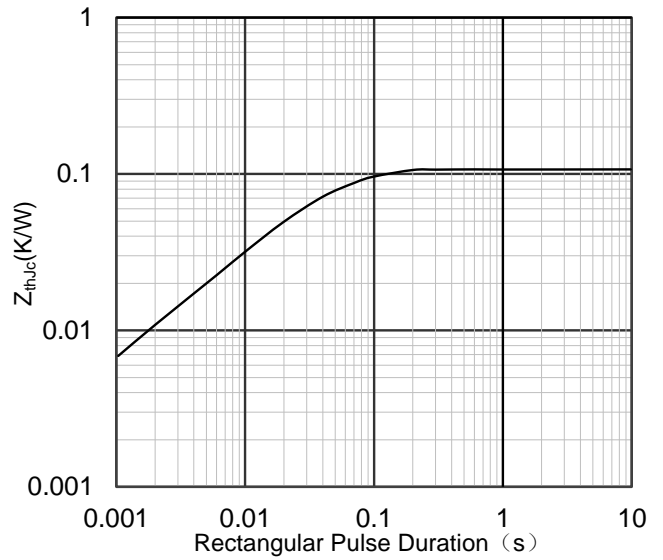


Figure 8. Transient Thermal Impedance of IGBT

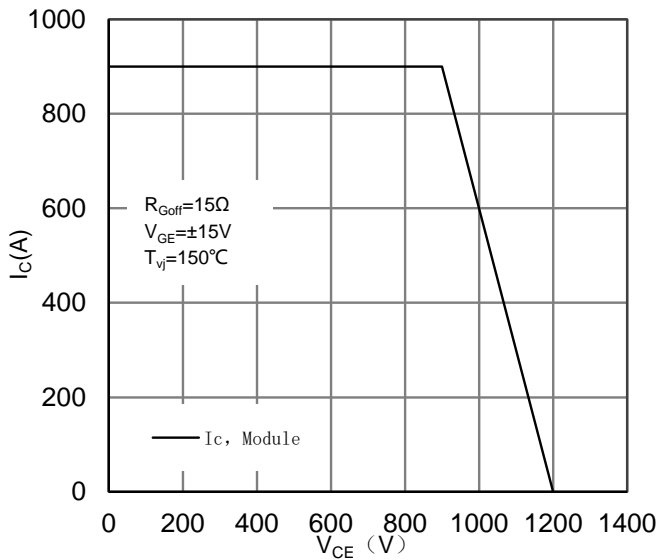


Figure 9. Reverse Bias Safe Operating Area IGBT

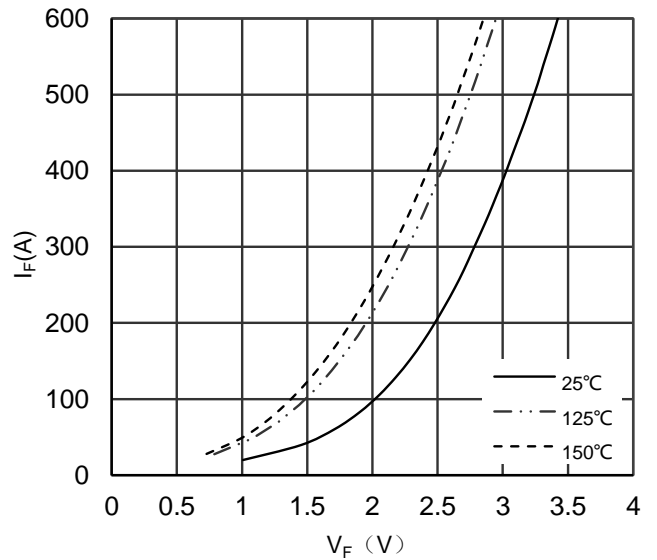


Figure 10. Diode Forward Characteristics Diode (D2, D3)

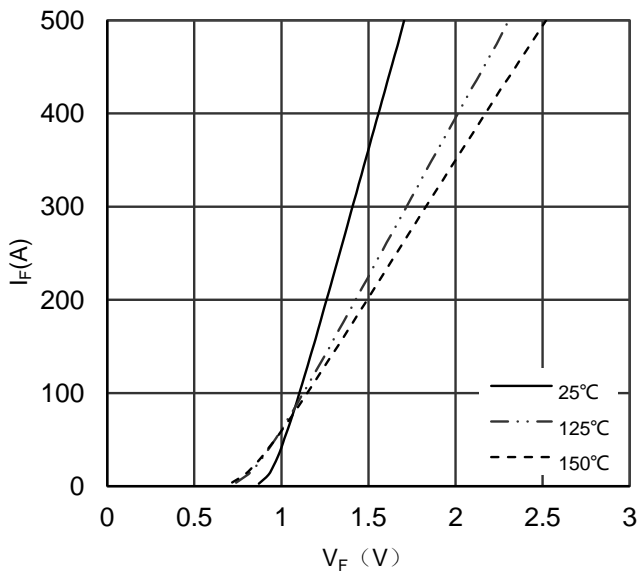


Figure 11. Diode Forward Characteristics Diode (D1, D4, D5, D6)

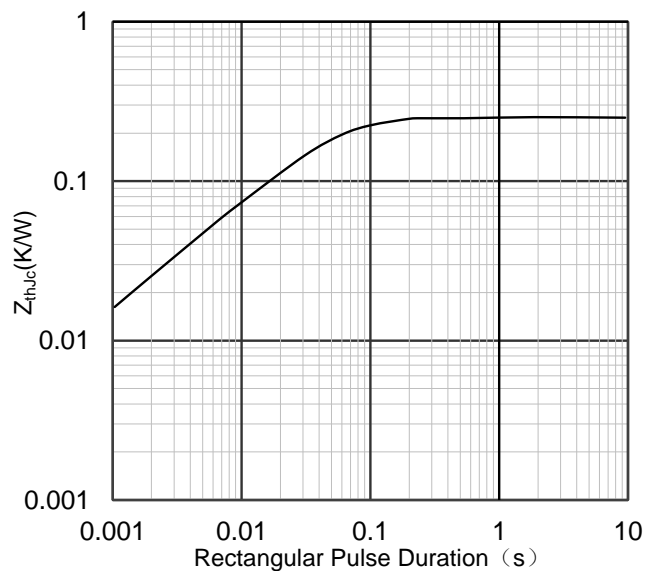


Figure 12. Transient Thermal Impedance of Diode (D2, D3)

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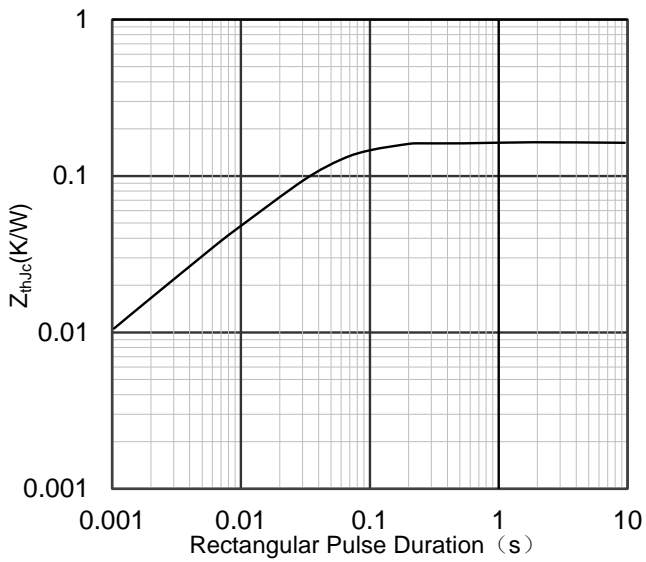


Figure 13. Transient Thermal Impedance of Diode (D1、D4、D5、D6)

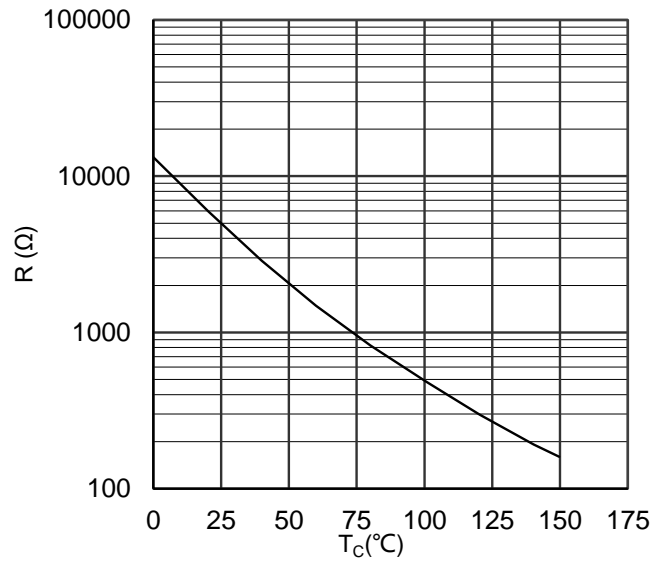


Figure 14. NTC Characteristics

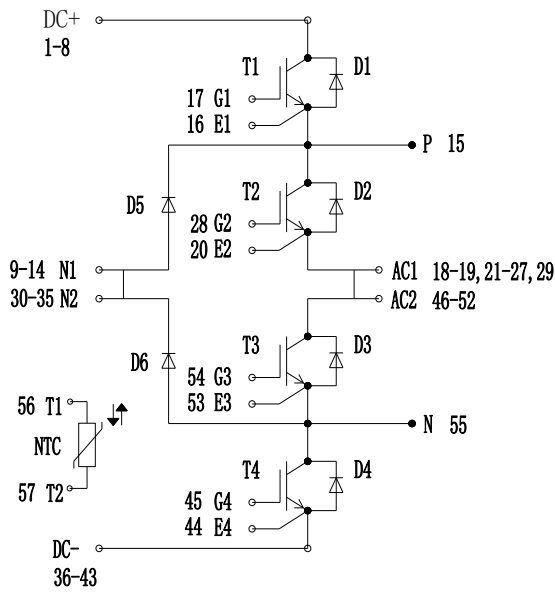
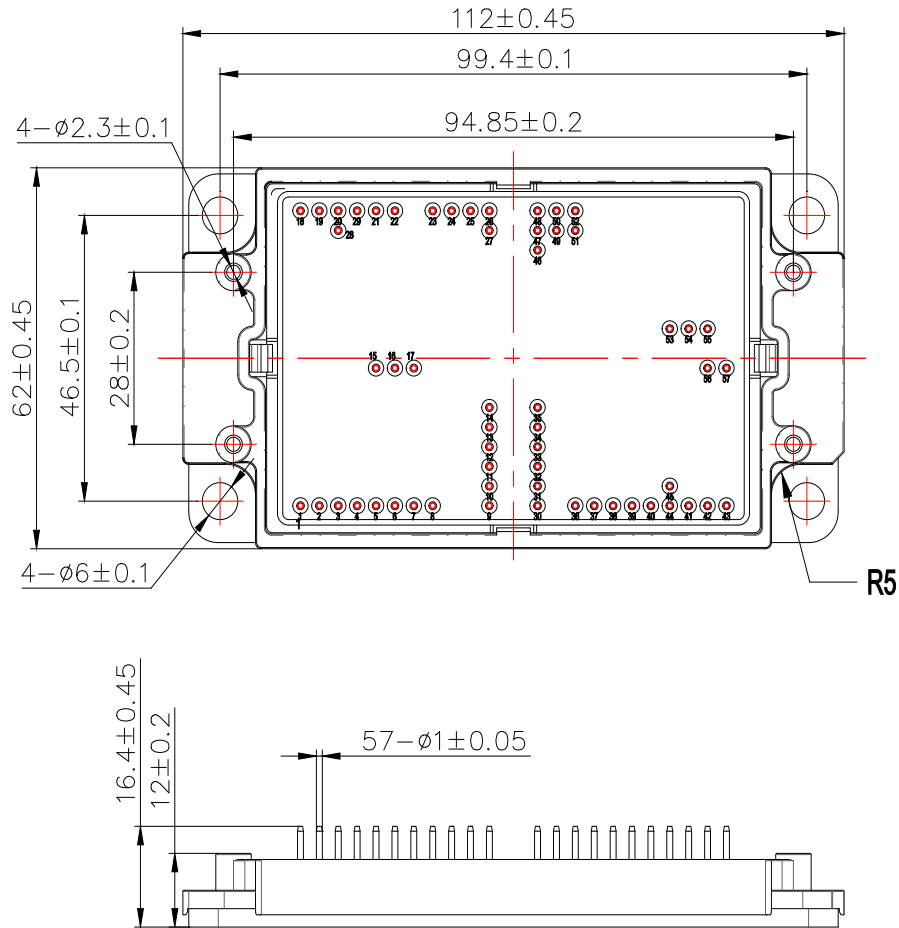


Figure 15. Circuit Diagram

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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	9.3	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	6.5	44.8	G2	57	72.16	22.4	T2
29	9.6	48	AC1				

Figure 17. Coordinates