MMG200CE065PD6T5

650V 200A Three Level Inverter Module

October 2024 Version 01 RoHS Compliant

PRODUCT FEATURES

☐ 650V IGBT CHIP(Trench+Field Stop technology)

☐ Low saturation voltage and positive temperature coefficient

☐ Low switching losses and short tail current

☐ Free wheeling diodes with fast and soft reverse recovery

☐ Temperature sense included

APPLICATIONS

☐ 3-Level-Applications

☐ Solar Applications

☐ UPS Systems

IGBT(T1、T2、T3、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℃	650	V
V_{GES}	Gate Emitter Voltage		±20	
I_C	DC Collector Current	T_C=65℃,T_{Jmax}=175℃	200	A
I_{CM}	Repetitive Peak Collector Current	tp=1ms	400	
P_{tot}	Power Dissipation Per IGBT	T_C=25℃,T_{Jmax}=175℃	468	W

Diode(D1、D2、D3、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℃	650	V
$I_{F(AV)}$	Average Forward Current		150	A
I_{FRM}	Repetitive Peak Forward Current	tp=1ms	300	
I^2t		T_J=125℃, t=10ms, 50Hz	800	A^2s

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IGBT(T1、T4)

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=2.4mA		3.30	4.00	4.70	V
$V_{CE(sat)}$	Collector Emitter Saturation Voltage	I_C=200A, V_{GE}=15V, T_J=25℃			1.50		
		I_C=200A, V_{GE}=15V, T_J=125℃			1.63		
		I_C=200A, V_{GE}=15V, T_J=150℃			1.68		
I_{CES}	Collector Leakage Current	V_{CE}=650V, V_{GE}=0V, T_J=25℃				0.1	mA
I_{GES}	Gate Leakage Current	V_{CE}=0V,V_{GE}=±20V, T_J=25℃		-400		400	nA
R_{Gint}	Integrated Gate Resistor				0.9		Ω
Q_G	Gate Charge	V_{CE}=400V, I_C=200A , V_{GE}=15V			0.5		μC
C_{ies}	Input Capacitance	V_{CE}=25V, V_{GE}=0V, f =1MHz			14		nF
C_{oes}	Output Capacitance				630		pF
C_{res}	Reverse Transfer Capacitance				90		pF
$t_{d(on)}$	Turn on Delay Time	V_{CC}=400V,I_C=200A R_{Gon} =5.1Ω, V_{GE}=±15V	T_J=25℃		24		ns
			T_J=125℃		26		ns
			T_J=150℃		26		ns
t_r	Rise Time		T_J=25℃		22		ns
			T_J=125℃		24		ns
			T_J=150℃		24		ns
$t_{d(off)}$	Turn off Delay Time	V_{CC}=400V,I_C=200A R_{Goff} =39Ω, V_{GE}=±15V	T_J=25℃		550		ns
			T_J=125℃		600		ns
			T_J=150℃		630		ns
t_f	Fall Time		T_J=25℃		40		ns
			T_J=125℃		45		ns
			T_J=150℃		48		ns
E_{on}	Turn on Energy	V_{CC}=400V,I_C=200A R_{Gon} =5.1Ω R_{Goff} =39Ω V_{GE}=±15V	T_J=25℃		1.82		mJ
			T_J=125℃		2.88		mJ
			T_J=150℃		3.34		mJ
E_{off}	Turn off Energy		T_J=25℃		5.17		mJ
			T_J=125℃		6.03		mJ
			T_J=150℃		6.36		mJ
R_{thJC}	Junction to Case Thermal Resistance （ Per IGBT）					0.32	K /W
T_J	Junction Temperature			-40		175	℃

IGBT(T2、T3)

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=2.4mA		3.30	4.00	4.70	V
$V_{CE(sat)}$	Collector Emitter Saturation Voltage	I_C=200A, V_{GE}=15V, T_J=25℃			1.50		
		I_C=200A, V_{GE}=15V, T_J=125℃			1.63		
		I_C=200A, V_{GE}=15V, T_J=150℃			1.68		
I_{CES}	Collector Leakage Current	V_{CE}=650V, V_{GE}=0V, T_J=25℃				0.1	mA
I_{GES}	Gate Leakage Current	V_{CE}=0V,V_{GE}=±20V, T_J=25℃		-400		400	nA
R_{Gint}	Integrated Gate Resistor				0.9		Ω
Q_G	Gate Charge	V_{CE}=400V, I_C=200A , V_{GE}=15V			0.5		μC
C_{ies}	Input Capacitance	V_{CE}=25V, V_{GE}=0V, f =1MHz			14		nF
C_{oes}	Output Capacitance				630		pF
C_{res}	Reverse Transfer Capacitance				90		pF
$t_{d(on)}$	Turn on Delay Time	V_{CC}=400V,I_C=200A R_{Gon} =5.1Ω, V_{GE}=±15V	T_J=25℃		24		ns
			T_J=125℃		26		ns
			T_J=150℃		26		ns
t_r	Rise Time		T_J=25℃		22		ns
			T_J=125℃		24		ns
			T_J=150℃		24		ns
$t_{d(off)}$	Turn off Delay Time	V_{CC}=400V,I_C=200A R_{Goff} =39Ω, V_{GE}=±15V	T_J=25℃		550		ns
			T_J=125℃		600		ns
			T_J=150℃		630		ns
t_f	Fall Time		T_J=25℃		40		ns
			T_J=125℃		45		ns
			T_J=150℃		48		ns
E_{on}	Turn on Energy	V_{CC}=400V,I_C=200A R_{Gon} =5.1Ω R_{Goff} =39Ω V_{GE}=±15V	T_J=25℃		1.76		mJ
			T_J=125℃		2.43		mJ
			T_J=150℃		2.67		mJ
E_{off}	Turn off Energy		T_J=25℃		5.56		mJ
			T_J=125℃		6.56		mJ
			T_J=150℃		6.62		mJ
R_{thJC}	Junction to Case Thermal Resistance （ Per IGBT）					0.32	K /W
T_J	Junction Temperature			-40		175	℃

Diode(D1、D2、D3、D4、D5、D6)

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

Symbol	Parameter/Test Conditions		Min.	Typ.	Max.	Unit
V_F	Forward Voltage	I_F=200A , V_{GE}=0V, T_J=25℃		2.00	2.50	V
		I_F=200A , V_{GE}=0V, T_J=125℃		1.75		
		I_F=200A , V_{GE}=0V, T_J=150℃		1.70		
t_{rr}	Reverse Recovery Time	I_F=200A , V_R=400V dI_F/dt=-6700A/μs T_J =150℃		100		ns
I_{RRM}	Max. Reverse Recovery Current			220		A
Q_{RR}	Reverse Recovery Charge			11		μC
E_{rec}	Reverse Recovery Energy			4.7		mJ
R_{thJCD}	Junction to Case Thermal Resistance （Per Diode）				0.45	K /W
T_J	Junction Temperature		-40		175	℃

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

Symbol	Parameter/Test Conditions		Min.	Typ.	Max.	Unit
R_{25}	Resistance	T_C =25℃		5		kΩ
ΔR/R	T_C = 100 °C, R_{100} = 493 Ω		5		5	%
$B_{25/50}$	$R_2 = R_{25} \exp [B_{25/50}(1/T_2 - 1/(298.15\ K))]$			3375		K

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	3000	V
CTI	Comparative Tracking Index		＞200	
F	Mounting Force Per Clamp		40~80	N
Weight			41.9	g

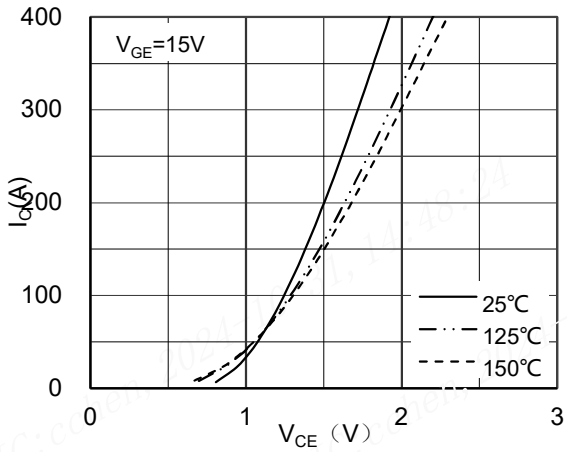


Figure 1. Typical Output Characteristics IGBT

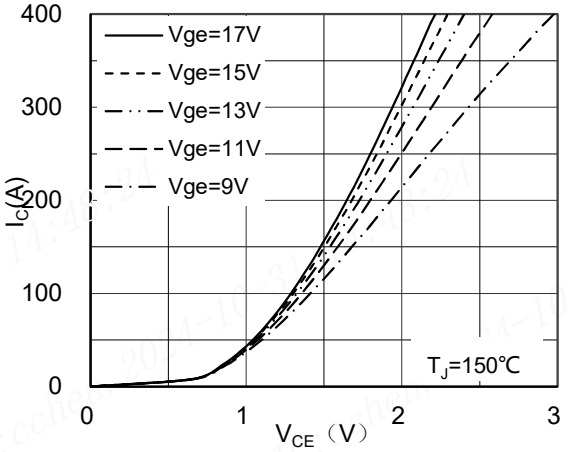


Figure 2. Typical Output Characteristics IGBT

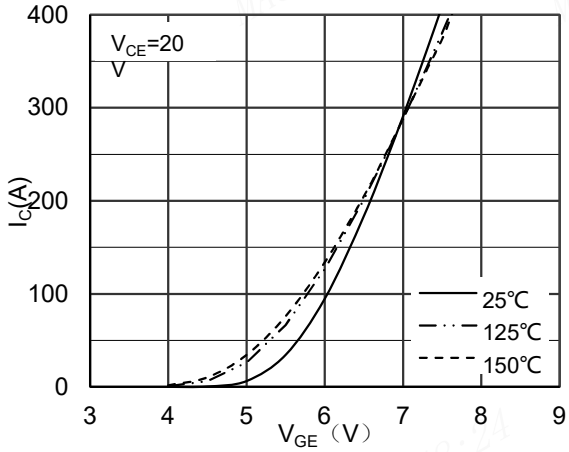


Figure 3. Typical Transfer characteristics IGBT

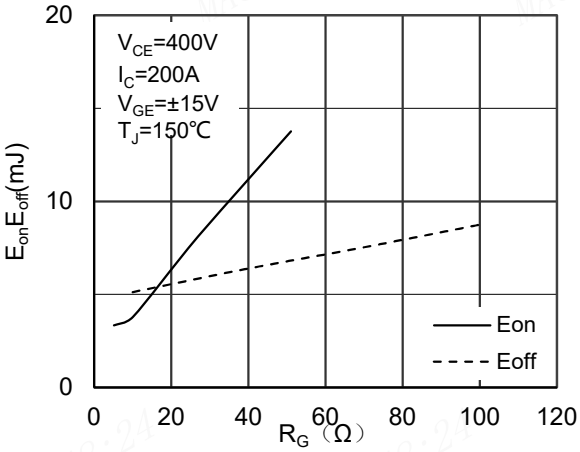


Figure 4. Switching Energy vs Gate Resistor IGBT （T1、T4）

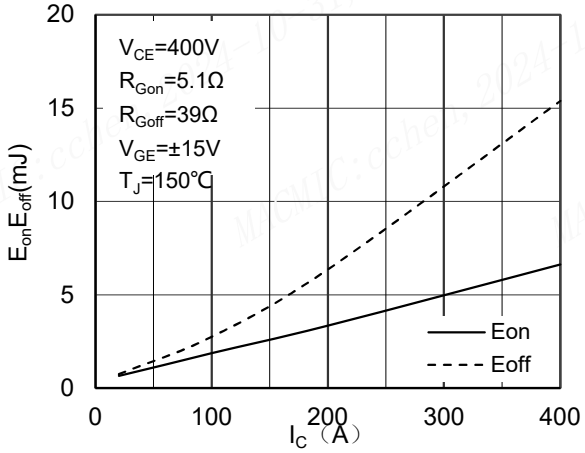


Figure 5. Switching Energy vs Collector Current IGBT （T1、T4）

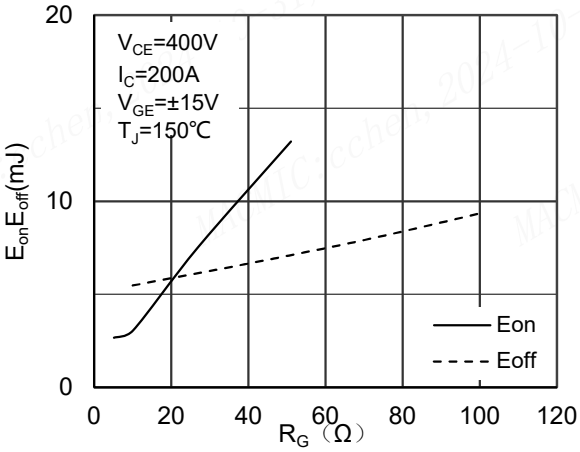


Figure 6. Switching Energy vs Gate Resistor IGBT （T2、T3）

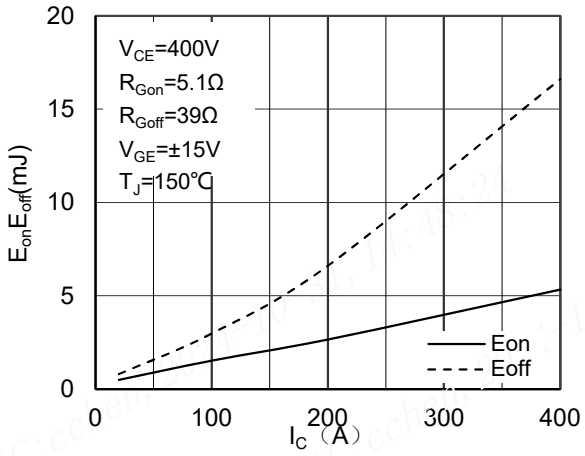


Figure 7. Switching Energy vs Collector Current IGBT

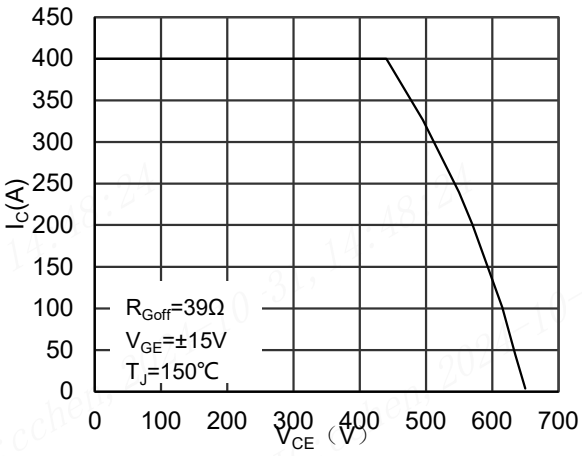


Figure 8. Reverse Biased Safe Operating Area IGBT

（T2、T3）

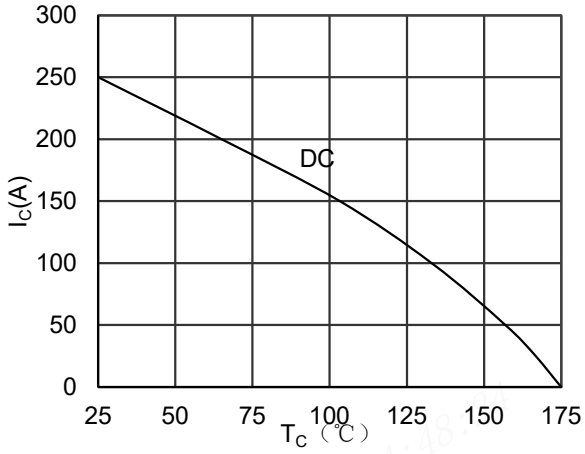


Figure 9. Collector Current vs Case temperature IGBT

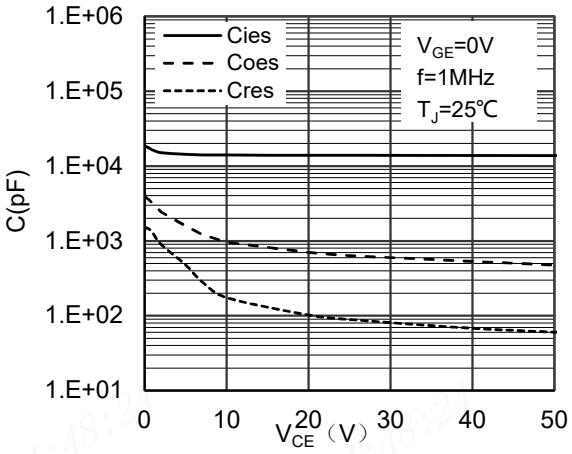


Figure 10. Typical capacitance

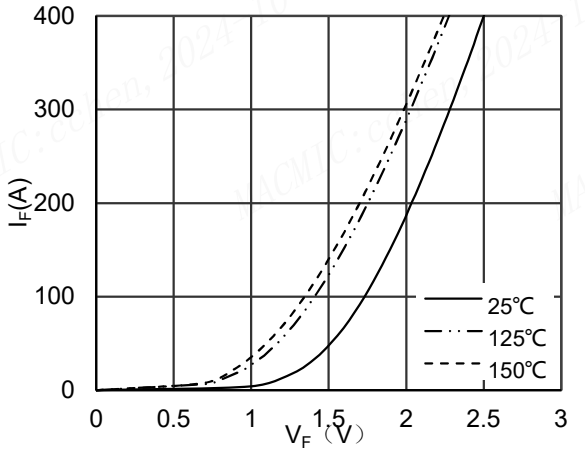


Figure 11. Diode Forward Characteristics Diode

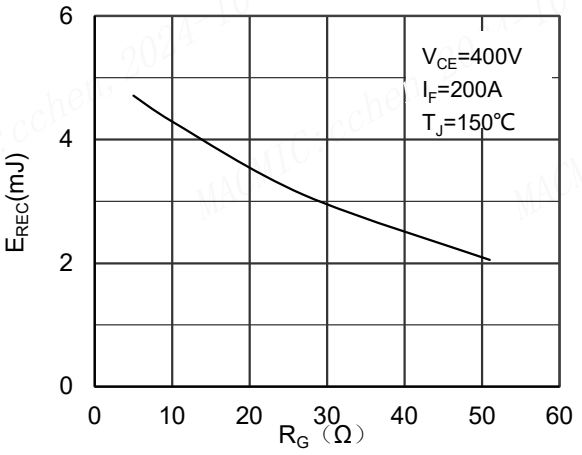


Figure 12. Switching Energy vs Gate Resistor Diode

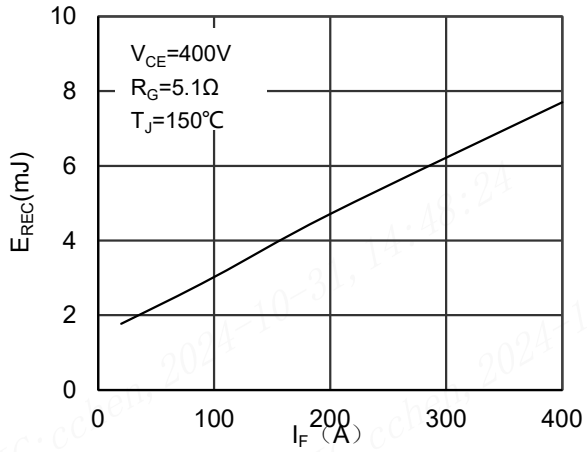


Figure 13. Switching Energy vs Forward Current Diode

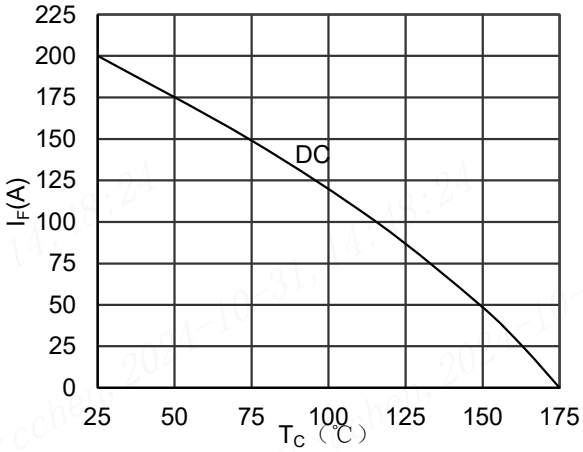


Figure 14. Forward current vs Case temperature Diode

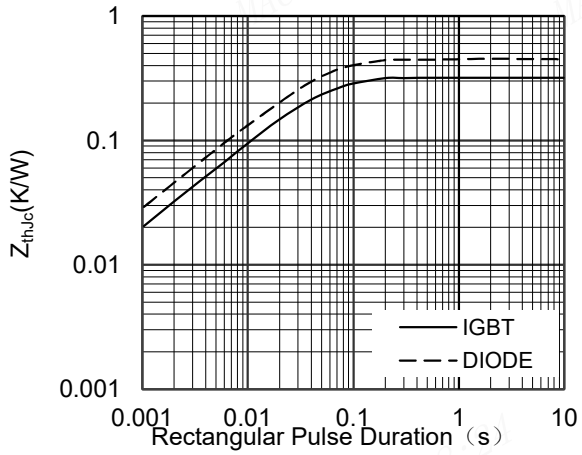


Figure 15. Transient Thermal Impedance of Diode and IGBT

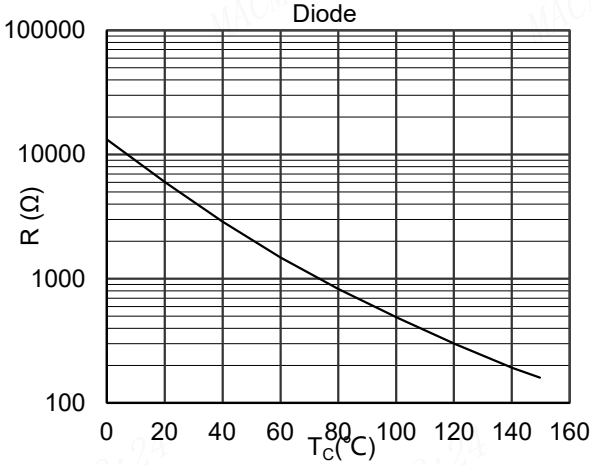
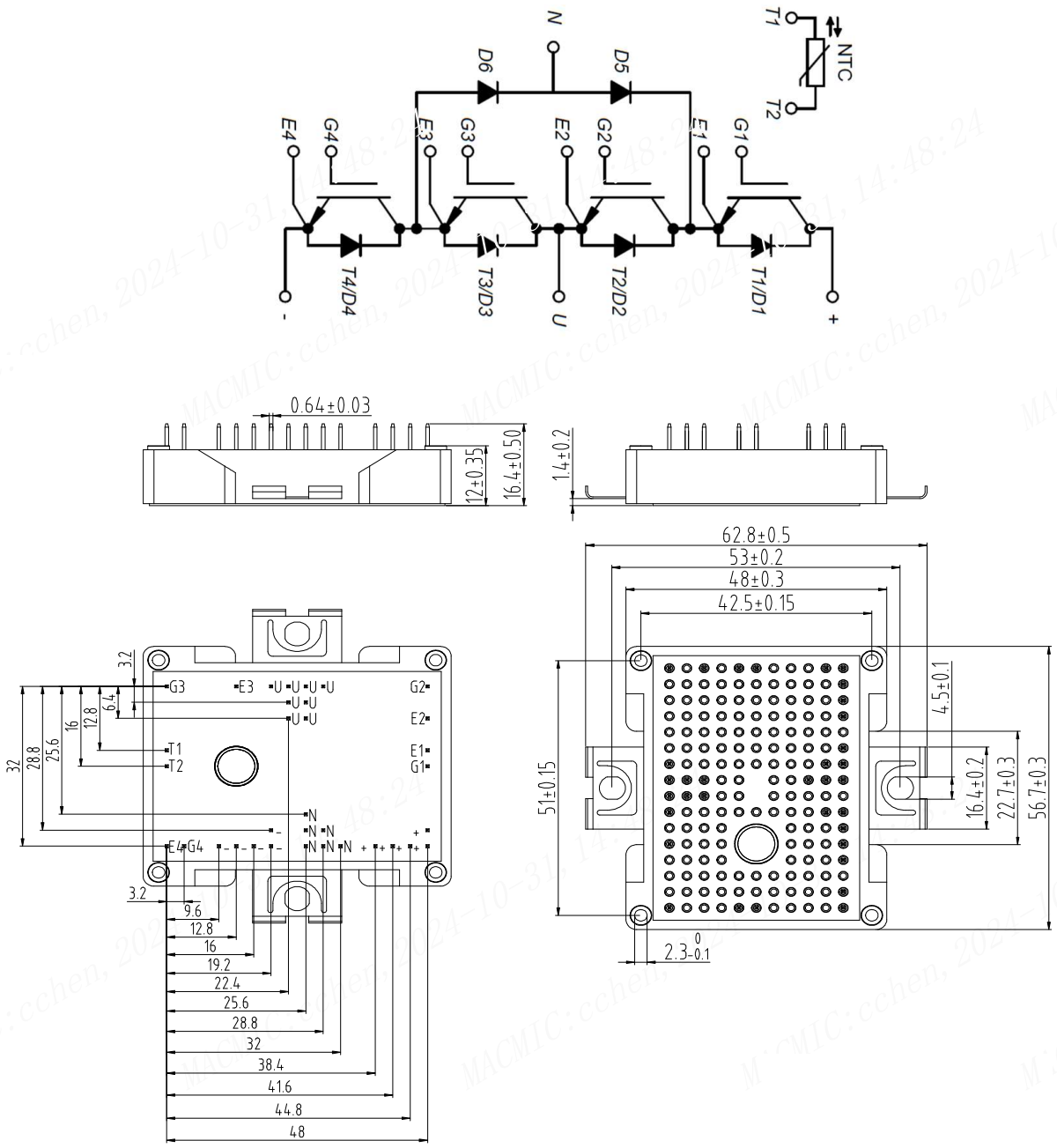


Figure 16. NTC Characteristics



Dimensions in (mm)
Figure 18. Package Outline