MMG300HP065PG6T5

650V 300A Module

April 2024 | Preliminary | RoHS Compliant

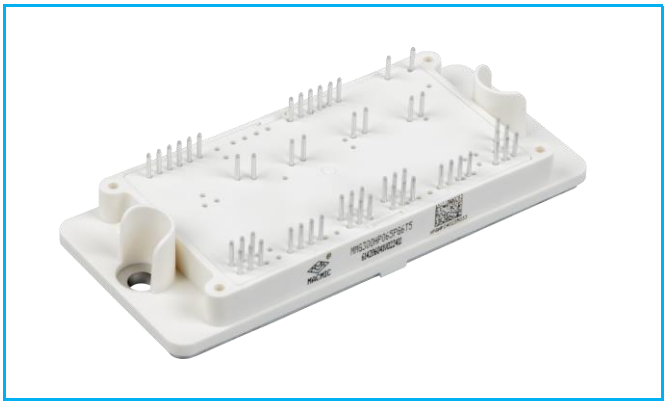
PRODUCT FEATURES

☐ High efficient and compact symmetric booster

☐ High switching frequency and low inductive design

☐ Low losses with TRENCHSTOP™ 5 IGBT

☐ Integrated temperature sensor



APPLICATIONS

☐ UPS Systems

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	2500	V
Creepage distance			min. 12.7	mm
Clearance			10.43	mm
CTI	Comparative Tracking Index		> 600	
Md	Mounting Torque	Recommended（M5）	1.3~1.5	Nm
Weight			176	g

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Absolute Maximum Ratings (T_C *=25°C unless otherwise specified)*

IGBT(T11、T12、T13、T14)

Symbol	Parameter/Test Conditions		Values	Unit
V_{CES}	Collector Emitter Voltage	T_{vj}=25℃	650	V
V_{GES}	Gate Emitter Voltage		±20	
I_C	DC Collector Current	T_C=25℃,T_{vjmax}=175℃	345	A
I_{Cpulse}	Pulsed Collector Current	tp limited by Tvjmax	900	
P_{tot}	Power Dissipation	T_C=25℃,T_{vjmax}=175℃	600	W
T_{vjmax}	Max. Virtual Junction Temperature		175	℃

SIC(D11、D12)

Symbol	Parameter/Test Conditions		Values	Unit
V_{RRM}	Repetitive Reverse Voltage	T_{vj}=25℃	650	V
I_F	Continue Forward Current		200	A
I_{FRM}	Repetitive Peak Forward Current	tp limited by Tvjmax	800	
T_{vjmax}	Max. Virtual Junction Temperature		175	℃

FRED(D14、D15)

Symbol	Parameter/Test Conditions		Values	Unit
V_{RRM}	Repetitive Reverse Voltage	T_{vj}=25℃	1200	V
I_F	Continue Forward Current		300	A
I_{FRM}	Repetitive Peak Forward Current	tp limited by Tvjmax	600	
T_{vjmax}	Max. Virtual Junction Temperature		175	℃

FRED(D41、D42、D43、D44)

Symbol	Parameter/Test Conditions		Values	Unit
V_{RRM}	Repetitive Reverse Voltage	T_{vj}=25℃	650	V
I_F	Continue Forward Current		30	A
I_{FRM}	Repetitive Peak Forward Current	tp limited by Tvjmax	60	
T_{vjmax}	Max. Virtual Junction Temperature		175	℃

Electrical Characteristics *(T_C=25°C unless otherwise specified)*

IGBT(T11、T12)

Symbol	Parameter/Test Conditions			Min.	Typ.	Max.	Unit
$V_{GE(th)}$	Gate Emitter Threshold Voltage	$V_{CE}=V_{GE}$, I_C=3mA		3.2	4.0	4.8	V
$V_{CE(sat)}$	Collector Emitter Saturation Voltage	I_C=300A, V_{GE}=15V, T_{vj}=25℃			1.40		
		I_C=300A, V_{GE}=15V, T_{vj}=125℃			1.51		
		I_C=300A, V_{GE}=15V, T_{vj}=150℃			1.55		
I_{CES}	Collector Leakage Current	V_{CE}=650V, V_{GE}=0V, T_{vj}=25℃				100	μA
I_{GES}	Gate Leakage Current	V_{CE}=0V,V_{GE}=±20V, T_{vj}=25℃		-400		400	nA
R_{Gint}	Integrated Gate Resistor				0.5		Ω
Q_G	Gate Charge	V_{CE}=350V, I_C=300A , V_{GE}=15V			0.61		μC
C_{ies}	Input Capacitance	V_{CE}=25V, V_{GE}=0V, f =1MHz			22		nF
C_{oes}	Output Capacitance				630		pF
C_{res}	Reverse Transfer Capacitance				110		pF
$t_{d(on)}$	Turn on Delay Time	V_{CC}=350V,I_C=300A R_{Gon} =5Ω, R_{Goff} =20Ω, V_{GE}=±15V, Inductive Load	T_{vj}=25℃		65		ns
			T_{vj}=125℃		60		ns
			T_{vj}=150℃		60		ns
t_r	Rise Time		T_{vj}=25℃		53		ns
			T_{vj}=125℃		58		ns
			T_{vj}=150℃		60		ns
$t_{d(off)}$	Turn off Delay Time	V_{CC}=350V,I_C=300A R_{Gon} =5Ω, R_{Goff} =20Ω, V_{GE}=±15V, Inductive Load	T_{vj}=25℃		495		ns
			T_{vj}=125℃		530		ns
			T_{vj}=150℃		540		ns
t_f	Fall Time		T_{vj}=25℃		62		ns
			T_{vj}=125℃		80		ns
			T_{vj}=150℃		86		ns
E_{on}	Turn on Energy	V_{CC}=350V,I_C=300A R_{Gon} =5Ω, R_{Goff} =20Ω, V_{GE}=±15V, Inductive Load	T_{vj}=25℃		1.75		mJ
			T_{vj}=125℃		2.30		mJ
			T_{vj}=150℃		2.50		mJ
E_{off}	Turn off Energy		T_{vj}=25℃		8.40		mJ
			T_{vj}=125℃		8.70		mJ
			T_{vj}=150℃		8.90		mJ
R_{thJC}	Junction to Case Thermal Resistance					0.25	K /W

Electrical Characteristics *(T_C=25°C unless otherwise specified)*

IGBT(T13、T14)

Symbol	Parameter/Test Conditions			Min.	Typ.	Max.	Unit
$V_{GE(th)}$	Gate Emitter Threshold Voltage	$V_{CE}=V_{GE}$, I_C=3mA		3.2	4.0	4.8	V
$V_{CE(sat)}$	Collector Emitter Saturation Voltage	I_C=300A, V_{GE}=15V, T_{vj}=25℃			1.40		
		I_C=300A, V_{GE}=15V, T_{vj}=125℃			1.51		
		I_C=300A, V_{GE}=15V, T_{vj}=150℃			1.55		
I_{CES}	Collector Leakage Current	V_{CE}=650V, V_{GE}=0V, T_{vj}=25℃				100	μA
I_{GES}	Gate Leakage Current	V_{CE}=0V,V_{GE}=±20V, T_{vj}=25℃		-400		400	nA
R_{Gint}	Integrated Gate Resistor				0.5		Ω
Q_G	Gate Charge	V_{CE}=350V, I_C=300A , V_{GE}=15V			0.61		μC
C_{ies}	Input Capacitance	V_{CE}=25V, V_{GE}=0V, f =1MHz			22		nF
C_{oes}	Output Capacitance				630		pF
C_{res}	Reverse Transfer Capacitance				110		pF
$t_{d(on)}$	Turn on Delay Time	V_{CC}=350V,I_C=300A R_{Gon} =5Ω, R_{Goff} =20Ω, V_{GE}=±15V, Inductive Load	T_{vj}=25℃		64		ns
			T_{vj}=125℃		60		ns
			T_{vj}=150℃		58		ns
t_r	Rise Time		T_{vj}=25℃		53		ns
			T_{vj}=125℃		60		ns
			T_{vj}=150℃		62		ns
$t_{d(off)}$	Turn off Delay Time	V_{CC}=350V,I_C=300A R_{Gon} =5Ω, R_{Goff} =20Ω, V_{GE}=±15V, Inductive Load	T_{vj}=25℃		510		ns
			T_{vj}=125℃		530		ns
			T_{vj}=150℃		540		ns
t_f	Fall Time		T_{vj}=25℃		62		ns
			T_{vj}=125℃		80		ns
			T_{vj}=150℃		84		ns
E_{on}	Turn on Energy	V_{CC}=350V,I_C=300A R_{Gon} =5Ω, R_{Goff} =20Ω, V_{GE}=±15V, Inductive Load	T_{vj}=25℃		2.63		mJ
			T_{vj}=125℃		5.00		mJ
			T_{vj}=150℃		5.50		mJ
E_{off}	Turn off Energy		T_{vj}=25℃		8.50		mJ
			T_{vj}=125℃		9.30		mJ
			T_{vj}=150℃		9.60		mJ
R_{thJC}	Junction to Case Thermal Resistance					0.25	K /W

SIC(D11、D12)

Symbol	Parameter/Test Conditions		Min.	Typ.	Max.	Unit
V_F	Forward Voltage	I_F=200A , V_{GE}=0V, T_{vj}=25℃		1.46	1.75	V
		I_F=200A , V_{GE}=0V, T_{vj}=125℃		1.65		
		I_F=200A , V_{GE}=0V, T_{vj}=150℃		1.7		
R_{thJC}	Junction to Case Thermal Resistance				0.45	K /W

FRED(D14、D15)

Symbol	Parameter/Test Conditions			Min.	Typ.	Max.	Unit
V_F	Forward Voltage	I_F=300A , V_{GE}=0V, T_{vj}=25℃			1.8	2.3	V
		I_F=300A , V_{GE}=0V, T_{vj}=125℃			1.55		
		I_F=300A , V_{GE}=0V, T_{vj}=150℃			1.45		
t_{rr}	Reverse Recovery Time	I_F=300A , V_R=350V Tvj =25℃, dI_F/dt=-5900A/μs; Tvj =125℃, dI_F/dt=-5300A/μs; Tvj =150℃, dI_F/dt=-5000A/μs;	T_{vj}=25℃		110		ns
			T_{vj}=125℃		180		ns
			T_{vj}=150℃		200		ns
I_{RRM}	Max. Reverse Recovery Current		T_{vj}=25℃		235		A
			T_{vj}=125℃		340		A
			T_{vj}=150℃		386		A
Q_{RR}	Reverse Recovery Charge		T_{vj}=25℃		12.7		μC
			T_{vj}=125℃		29.6		μC
			T_{vj}=150℃		37.8		μC
E_{rec}	Reverse Recovery Energy		T_{vj}=25℃		7.3		mJ
			T_{vj}=125℃		16.6		mJ
			T_{vj}=150℃		18.3		mJ
R_{thJC}	Junction to Case Thermal Resistance					0.153	K /W

FRED(D41、D42、D43、D44)

Symbol	Parameter/Test Conditions		Min.	Typ.	Max.	Unit
V_F	Forward Voltage	I_F=30A,V_{GE}=0V, T_{vj}=25℃		1.8	2.3	V
		I_F=30A,V_{GE}=0V, T_{vj}=125℃		1.55		
		I_F=30A,V_{GE}=0V, T_{vj}=150℃		1.45		
R_{thJC}	Junction to Case Thermal Resistance				2.2	K /W

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

Symbol	Parameter/Test Conditions		Min.	Typ.	Max.	Unit
R_{25}	Resistance	T_C =25℃		22		kΩ
△R/R	T_{NTC}=100℃，R_{100}=1.486kΩ		-5		5	%
$B_{25/50}$	$R_2 = R_{25} \exp [B_{25/50}(1/T_2 - 1/(298.15\ K))]$			3950		K

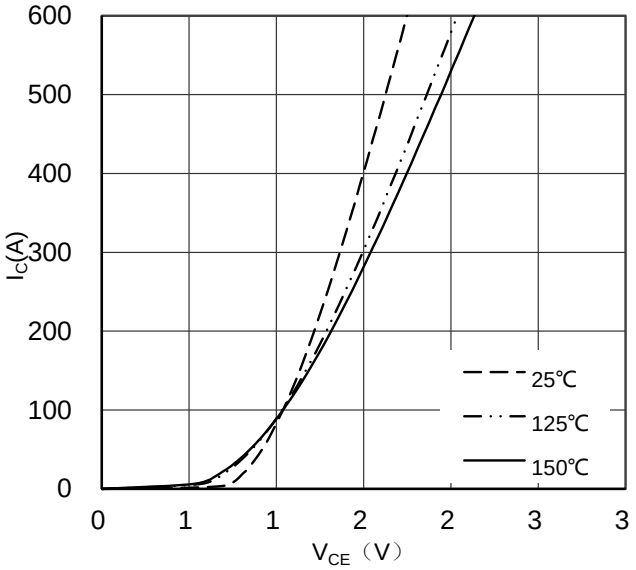


Figure 1. Typical Output Characteristics IGBT
(T11、T12、T13、T14)

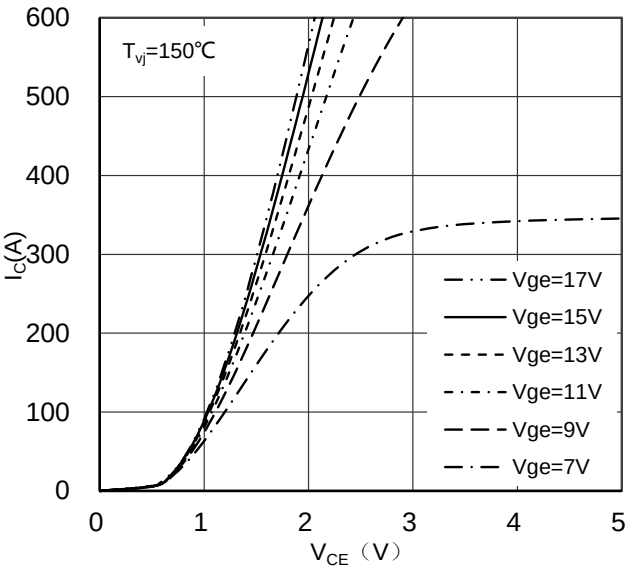


Figure 2. Typical Output Characteristics IGBT
(T11、T12、T13、T14)

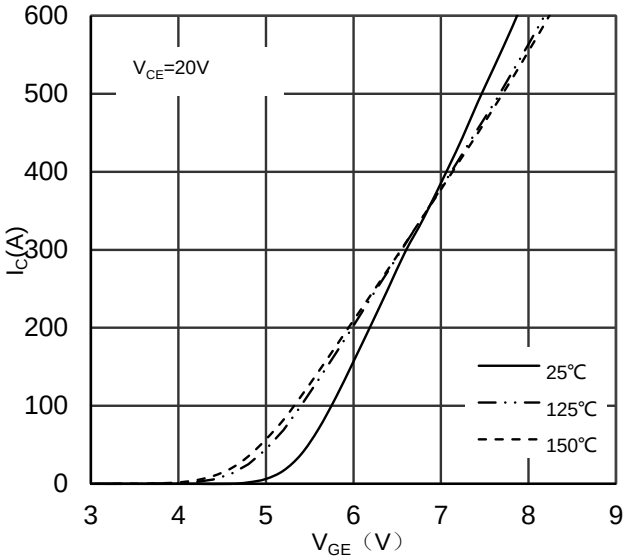


Figure 3. Typical Transfer characteristics IGBT
(T11、T12、T13、T14)

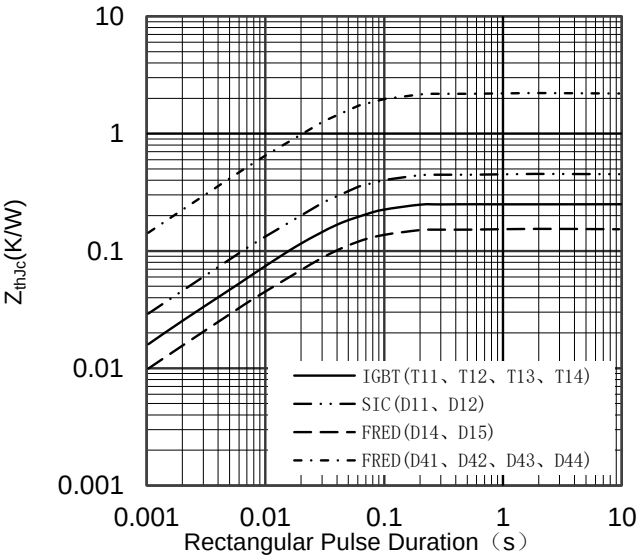


Figure 4. Transient Thermal Impedance

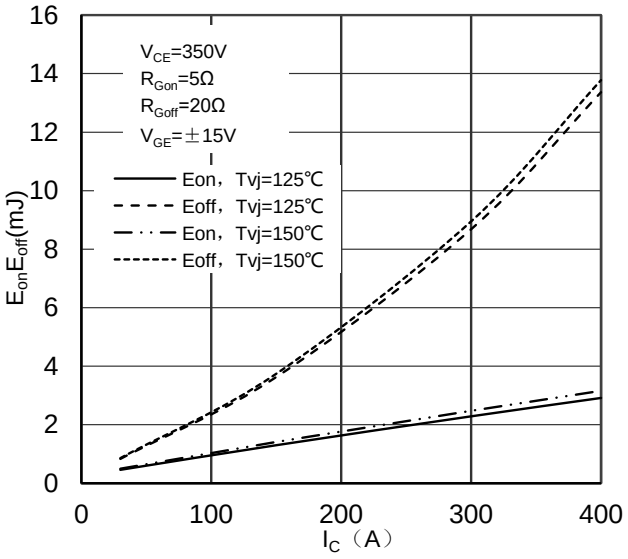


Figure 5. Switching Energy vs Collector Current IGBT
（T11、T12）

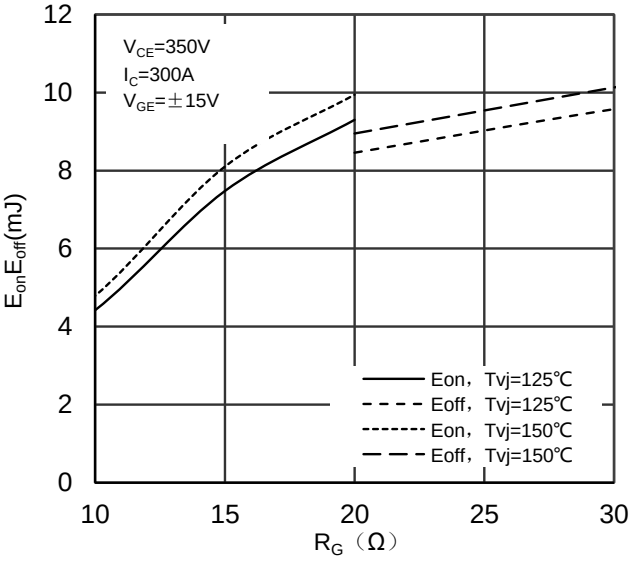


Figure 6. Switching Energy vs Gate Resistor IGBT
（T11、T12）

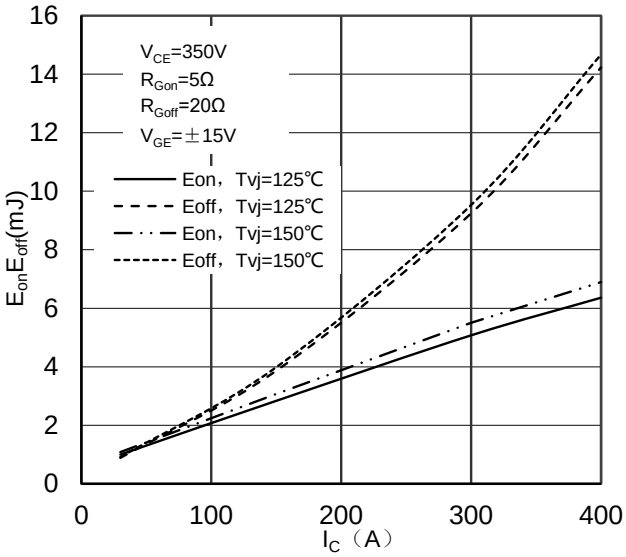


Figure 7. Switching Energy vs Collector Current IGBT
（T13、T14）

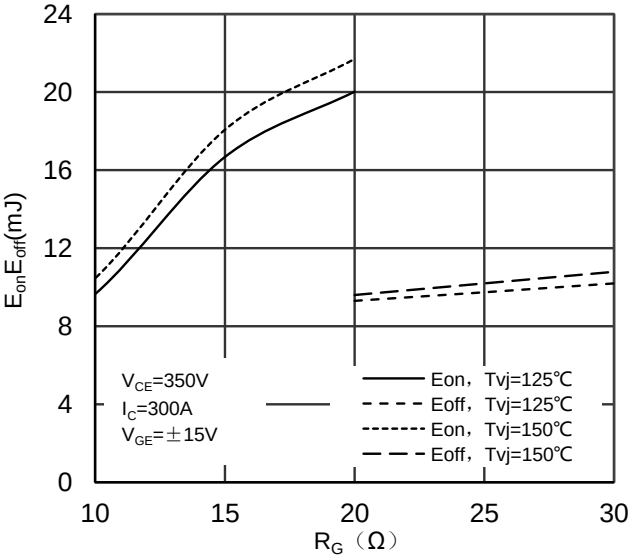


Figure 8. Switching Energy vs Gate Resistor IGBT
（T13、T14）

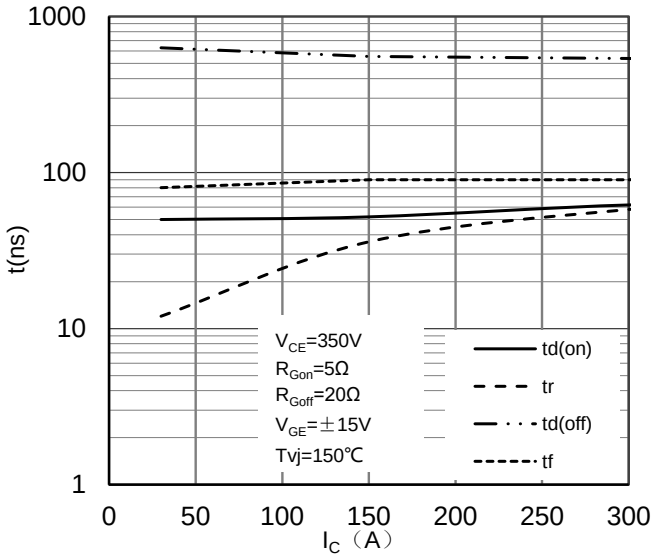


Figure 9. Switching Times vs Collector Current IGBT
(T11、T12、T13、T14)

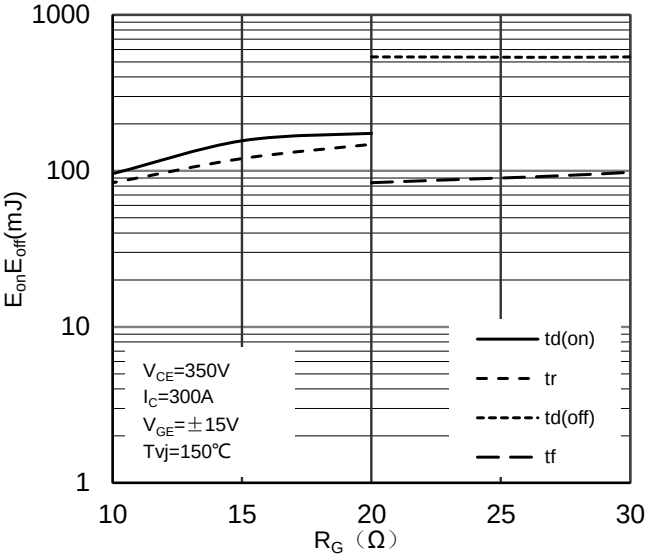


Figure 10. Switching Times vs Gate Resistor IGBT
(T11、T12、T13、T14)

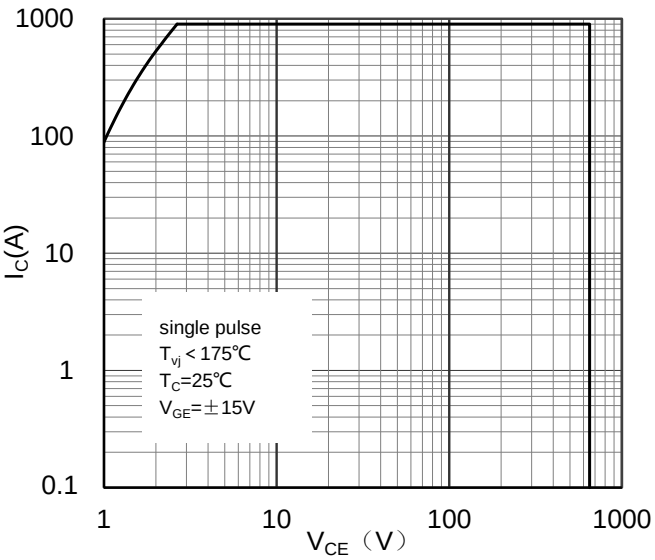


Figure 11. Forward Biased Safe Operating Area
(T11、T12、T13、T14)

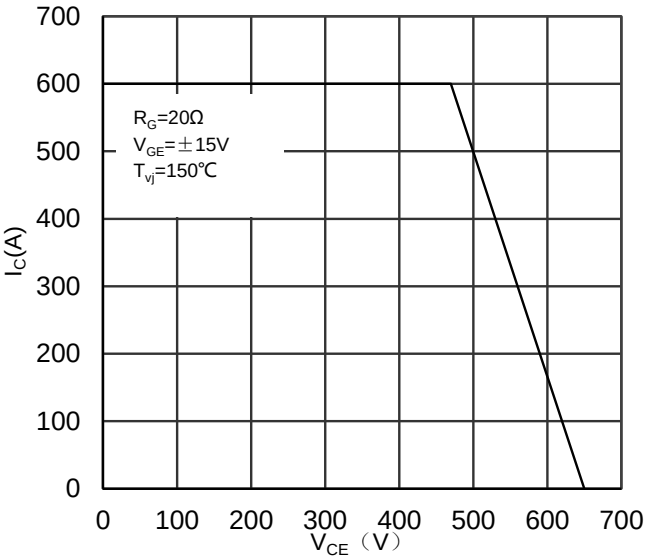


Figure 12. Reverse Biased Safe Operating Area IGBT
（T11、T12）

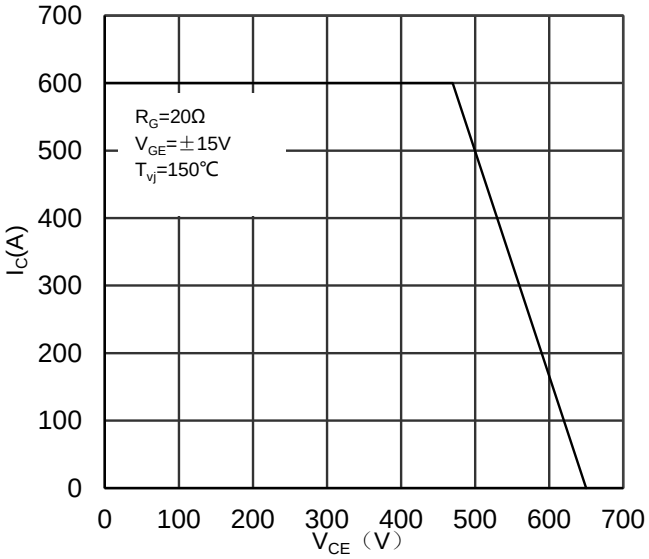


Figure 13. Reverse Biased Safe Operating Area IGBT
（T13、T14）

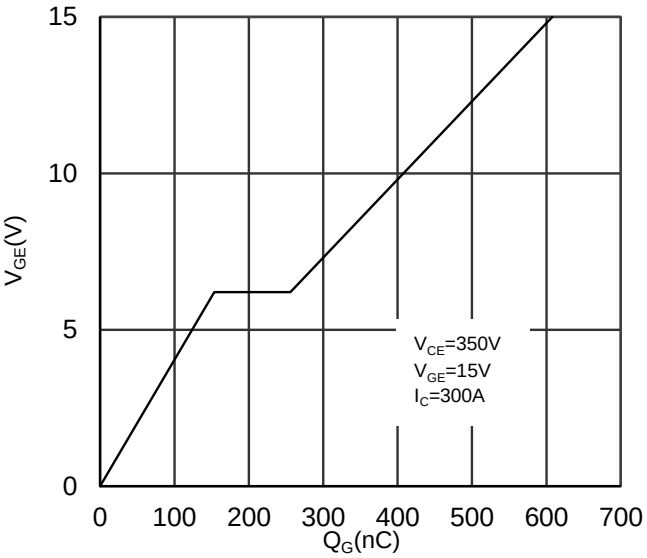


Figure 14. Typical Gate Charge
(T11、T12、T13、T14)

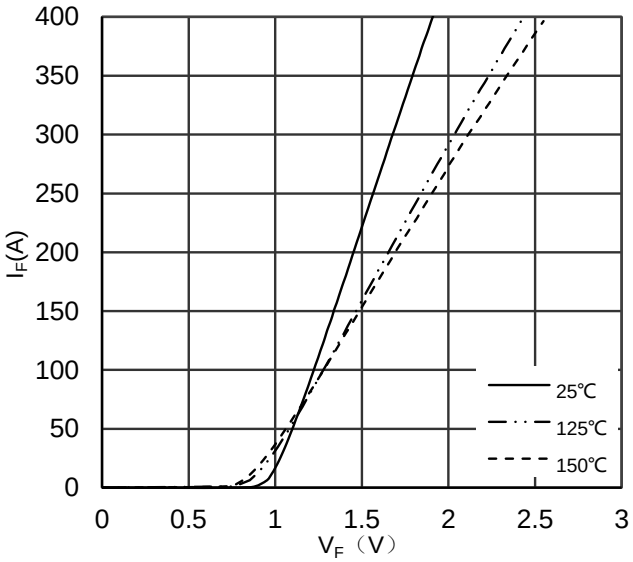


Figure 15. Diode Forward Characteristics Diode
（D11、D12）

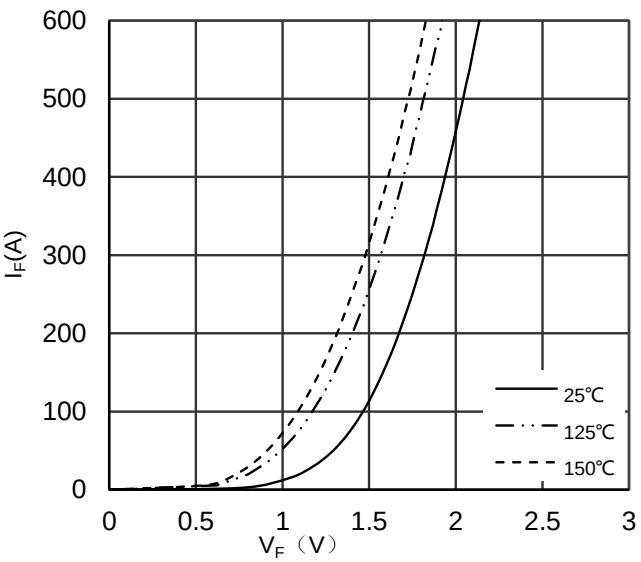


Figure 16. Diode Forward Characteristics Diode
（D14、D15）

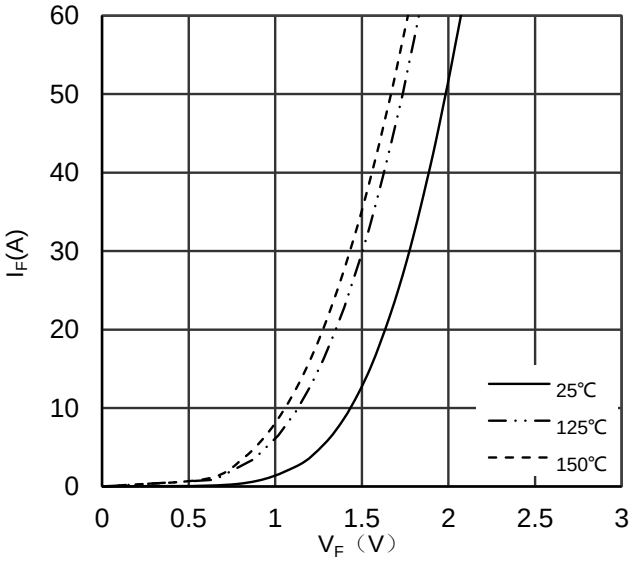


Figure 17. Diode Forward Characteristics Diode
(D41、D42、D43、D44)

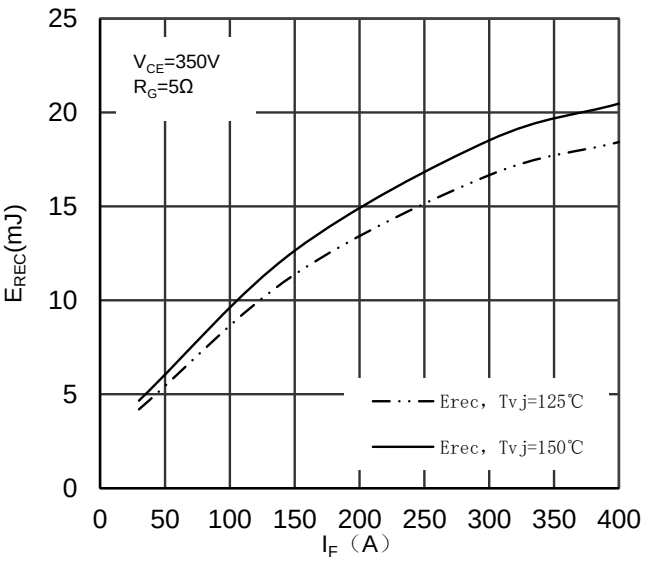


Figure 18. Switching Energy vs Forward Current Diode
（D14、D15）

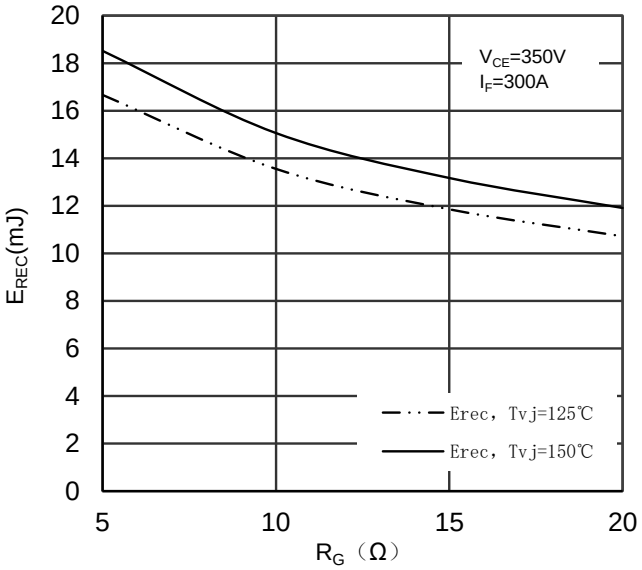


Figure 19. Switching Energy vs Gate Resistor Diode （D14、D15）

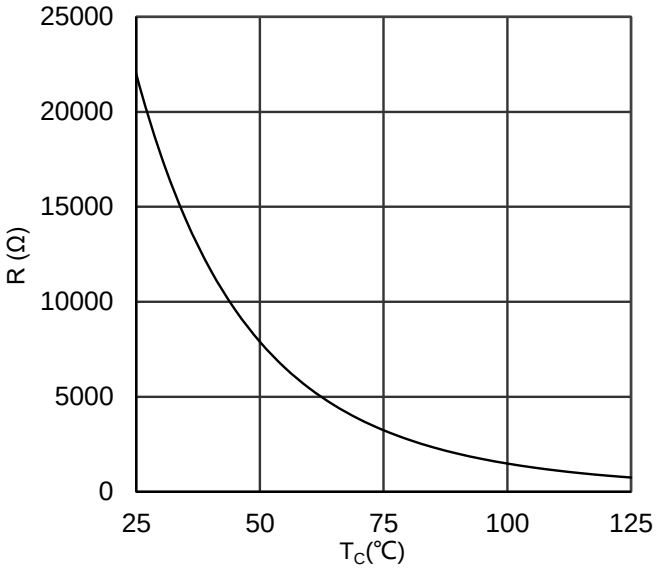


Figure 20. NTC Characteristics

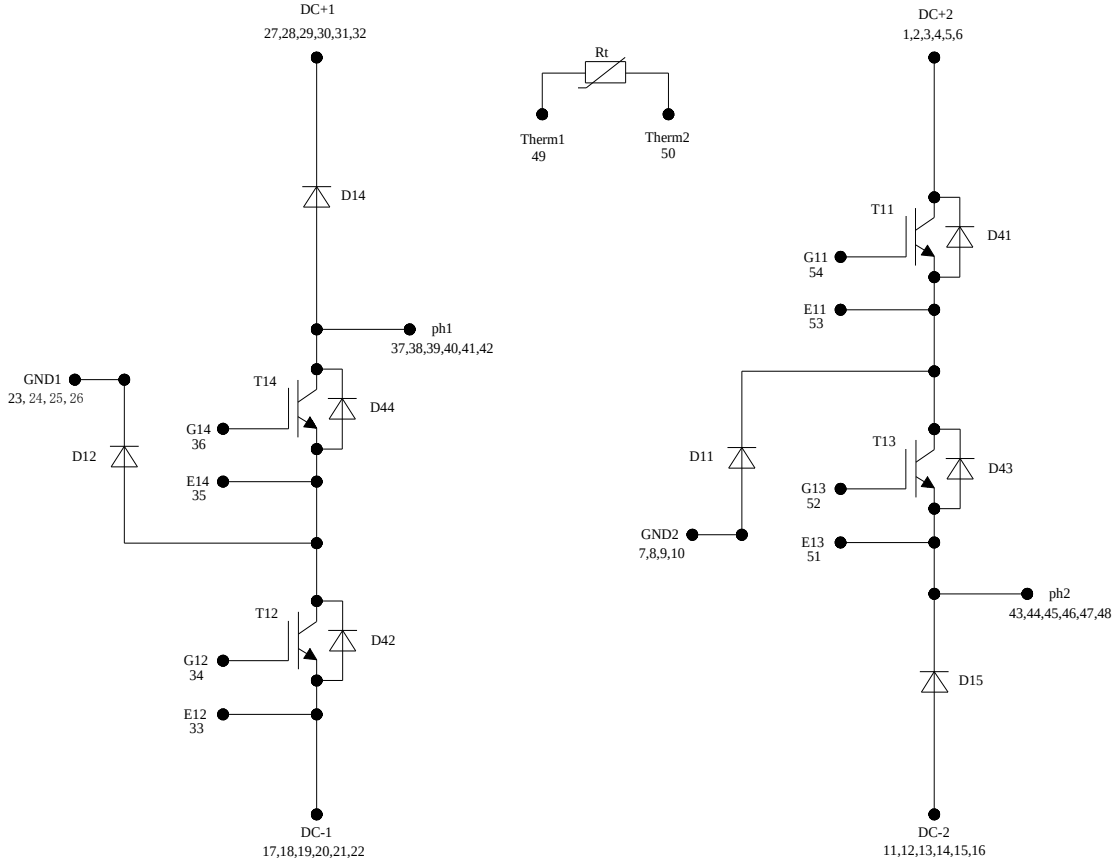
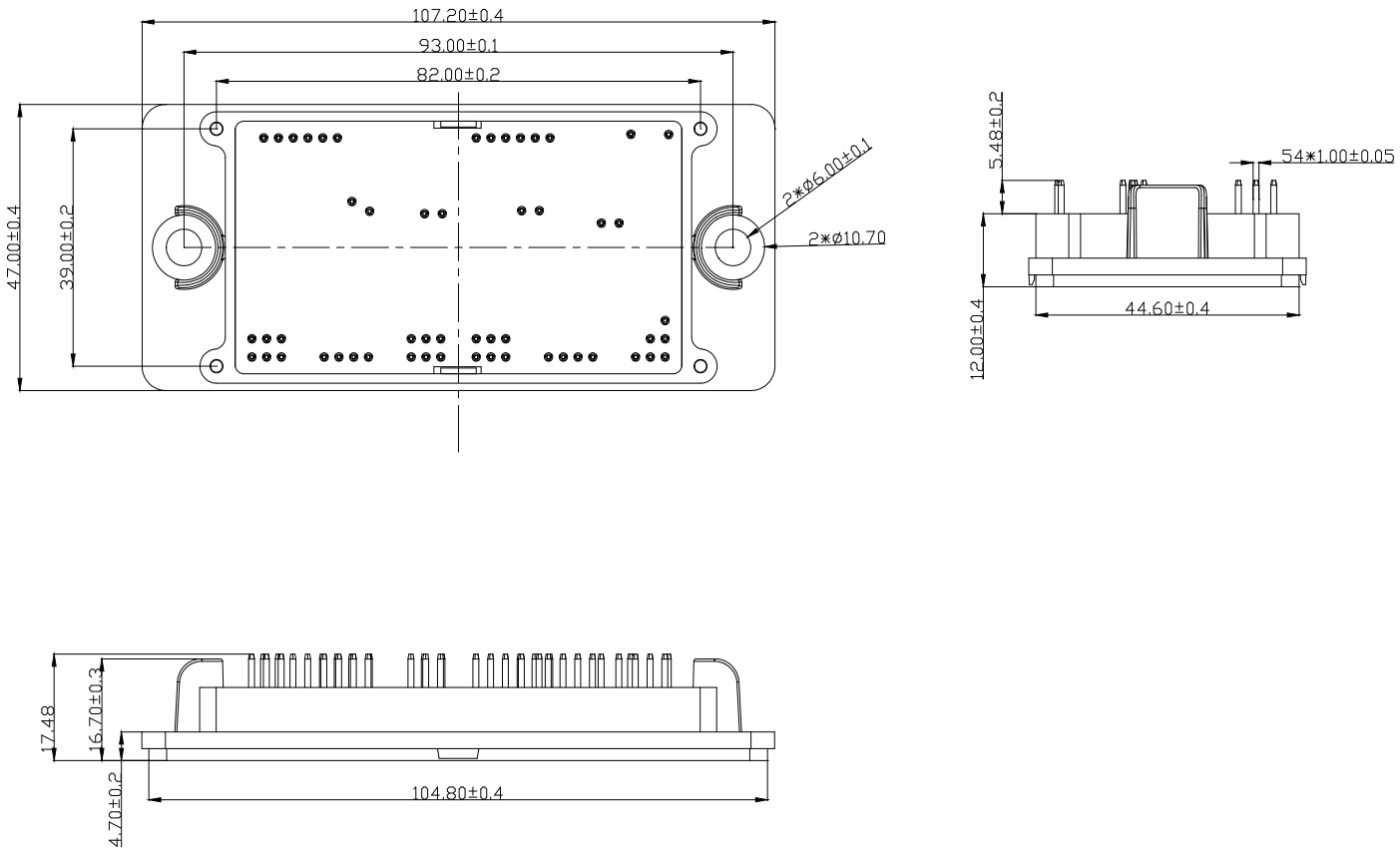


Figure 21. Circuit Diagram



Dimensions in (mm)

Figure 22. Package Outline

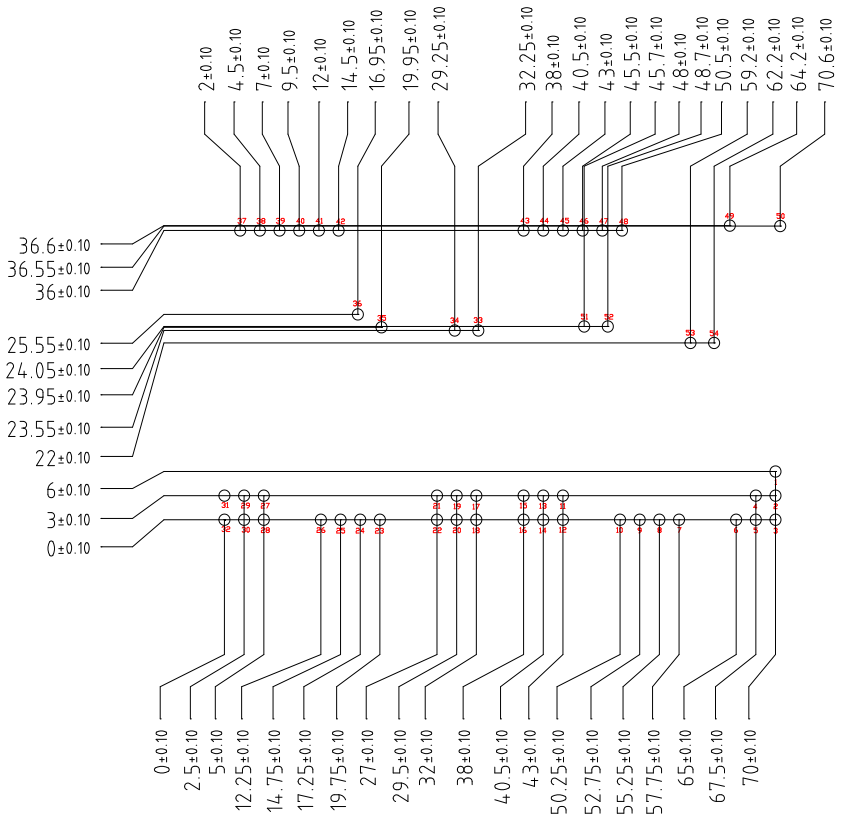


Figure 23. Pin Position（mm）