MMG400D120UA6TC

1200V 400A IGBT Module

August 2020 Version 01 RoHS Compliant

PRODUCT FEATURES

☐ IGBT CHIP(Trench+Field Stop technology)

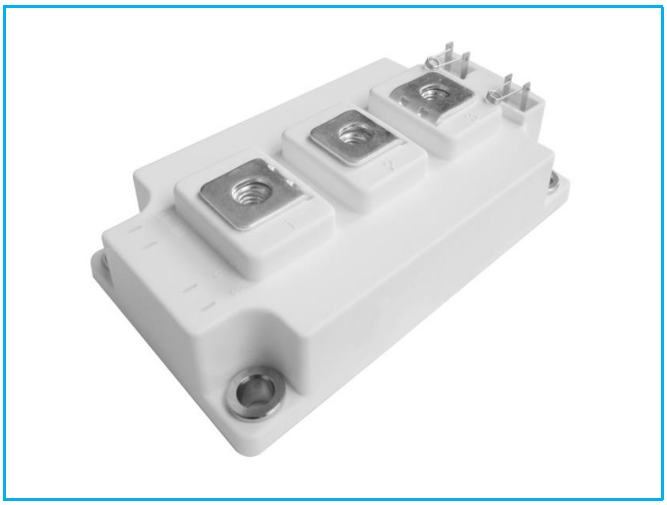
☐ $V_{CE(sat)}$ with positive temperature coefficient

☐ High short circuit capability

☐ Fast switching and short tail current

☐ Free wheeling diodes with fast and soft reverse recovery

☐ Low switching losses



APPLICATIONS

☐ High frequency switching application

☐ Medical applications

☐ Motion/servo control

☐ UPS systems

IGBT

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_C	DC Collector Current	T_C=25℃, T_{Jmax}=175℃	568	A
		T_C=92℃, T_{Jmax}=175℃	400	
I_{CM}	Repetitive Peak Collector Current	tp=1ms	800	
P_{tot}	Power Dissipation Per IGBT	T_C=25℃, T_{Jmax}=175℃	1973	W

Diode

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
$I_{F(AV)}$	Average Forward Current		400	A
I_{FRM}	Repetitive Peak Forward Current	tp=1ms	800	
I^2t		T_J=125℃, t=10ms, V_R=0V	39.2	KA^2S

IGBT

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=16mA		5.0	5.8	6.5	V
$V_{CE(sat)}$	Collector - Emitter Saturation Voltage	I_C=400A, V_{GE}=15V, T_J=25℃			1.85	2.25	
		I_C=400A, V_{GE}=15V, T_J=125℃			2.15		
		I_C=400A, V_{GE}=15V, T_J=150℃			2.2		
I_{CES}	Collector Leakage Current	V_{CE}=1200V, V_{GE}=0V, T_J=25℃				1	mA
		V_{CE}=1200V, V_{GE}=0V, T_J=150℃				10	
I_{GES}	Gate Leakage Current	V_{CE}=0V,V_{GE}=±20V, T_J=25℃		-400		400	nA
R_{gint}	Integrated Gate Resistor				1.1		Ω
Q_g	Gate Charge	V_{CE}=600V, I_C=400A , V_{GE}=15V			2.15		μC
C_{ies}	Input Capacitance	V_{CE}=25V, V_{GE}=0V, f =1MHz			30.5		nF
C_{res}	Reverse Transfer Capacitance				1.35		nF
$t_{d(on)}$	Turn on Delay Time	V_{CC}=600V,I_C=400A R_G =2.0Ω, V_{GE}=±15V, Inductive Load	T_J=25℃		90		ns
			T_J=125℃		108		ns
			T_J=150℃		114		ns
t_r	Rise Time		T_J=25℃		68		ns
			T_J=125℃		74		ns
			T_J=150℃		76		ns
$t_{d(off)}$	Turn off Delay Time	V_{CC}=600V,I_C=400A R_G =2.0Ω, V_{GE}=±15V, Inductive Load	T_J=25℃		510		ns
			T_J=125℃		550		ns
			T_J=150℃		560		ns
t_f	Fall Time		T_J=25℃		120		ns
			T_J=125℃		200		ns
			T_J=150℃		220		ns
E_{on}	Turn on Energy	V_{CC}=600V,I_C=400A R_G =2.0Ω, V_{GE}=±15V, Inductive Load	T_J=125℃		34.5		mJ
			T_J=150℃		38		mJ
E_{off}	Turn off Energy		T_J=125℃		42.4		mJ
			T_J=150℃		45		mJ
I_{SC}	Short Circuit Current	tpsc≤10μS , V_{GE}=15V T_J=125℃,V_{CC}=800V			1500		A
R_{thJC}	Junction to Case Thermal Resistance (Per IGBT)					0.076	K /W

Diode

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

Symbol	Parameter/Test Conditions		Min.	Typ.	Max.	Unit
V_F	Forward Voltage	I_F=400A , V_{GE}=0V, T_J=25℃		1.75	2.3	V
		I_F=400A , V_{GE}=0V, T_J=125℃		1.5		
		I_F=400A , V_{GE}=0V, T_J=150℃		1.45		
t_{rr}	Reverse Recovery Time	I_F=400A , V_R=600V dI_F/dt=-5600A/μs T_J =150℃		460		ns
I_{RRM}	Max. Reverse Recovery Current			626		A
Q_{RR}	Reverse Recovery Charge			160		μC
E_{rec}	Reverse Recovery Energy			72.5		mJ
R_{thJCD}	Junction to Case Thermal Resistance （Per Diode）				0.12	K /W

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

Symbol	Parameter/Test Conditions		Values	Unit
T_{Jmax}	Max. Junction Temperature		175	℃
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		> 225	
Torque	to heatsink	Recommended（M6）	3~5	Nm
	to terminal	Recommended（M6）	2.5~5	Nm
Weight			300	g

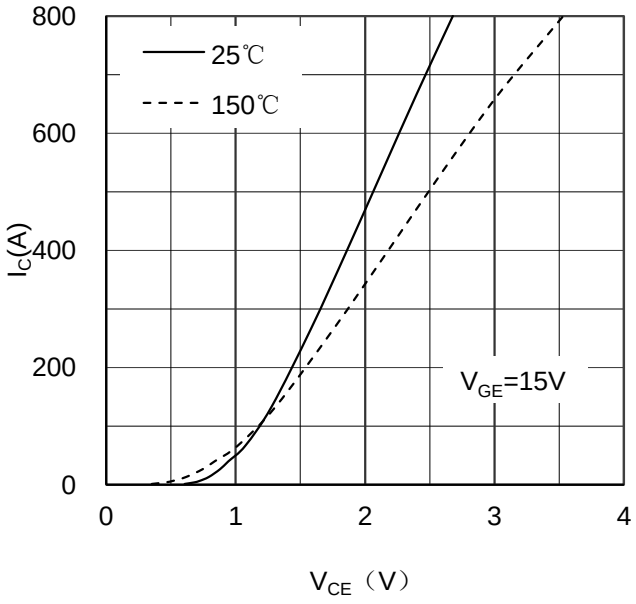


Figure 1. Typical Output Characteristics IGBT

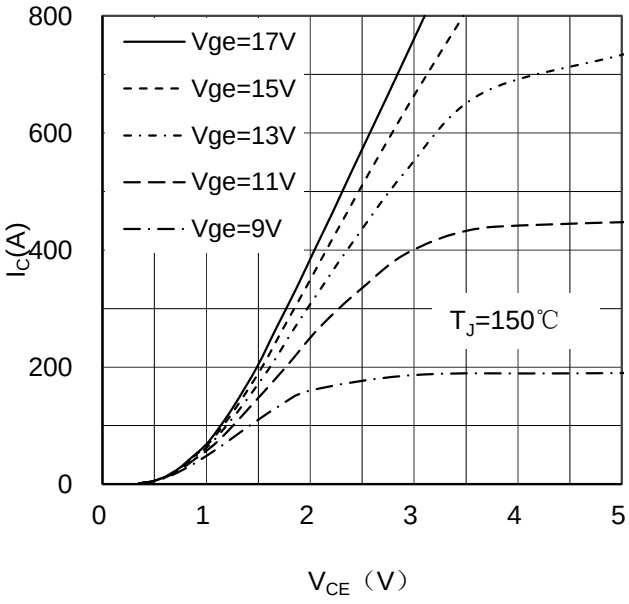


Figure 2. Typical Output Characteristics IGBT

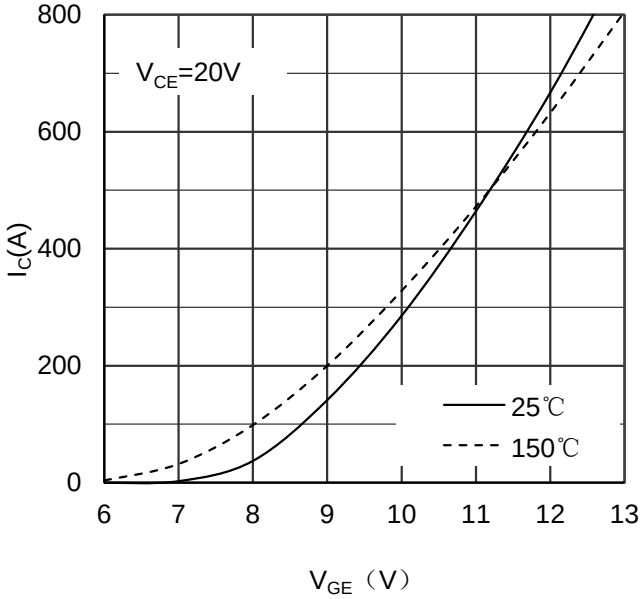


Figure 3. Typical Transfer characteristics IGBT

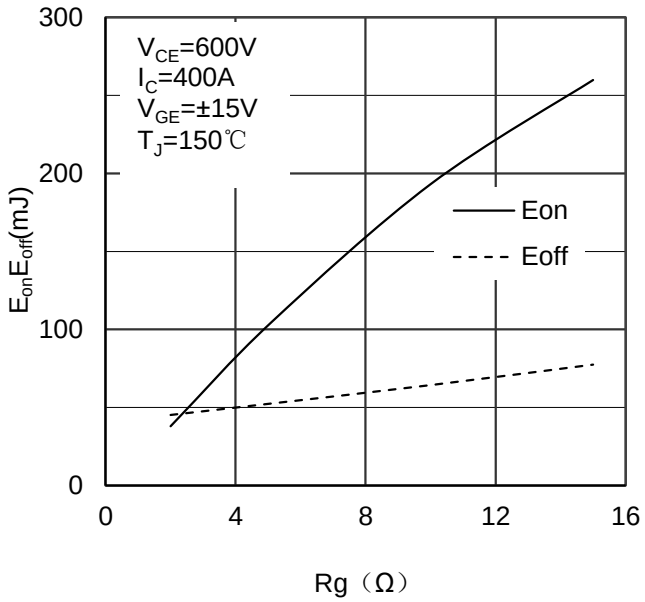


Figure 4. Switching Energy vs Gate Resistor IGBT

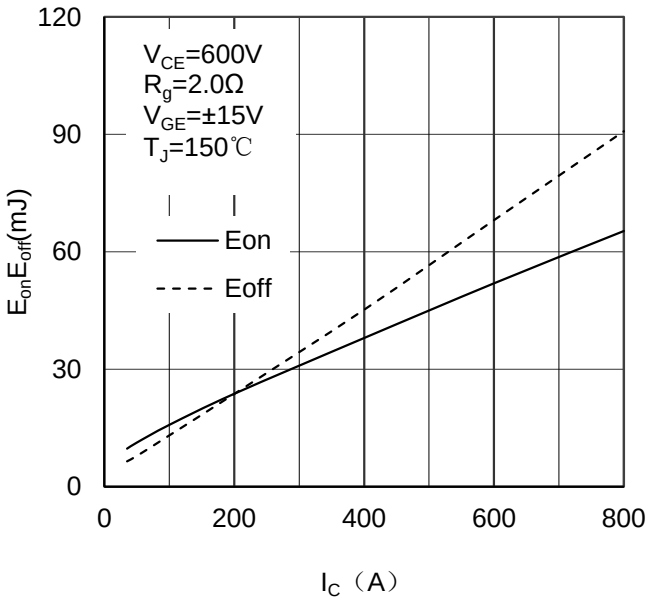


Figure 5. Switching Energy vs Collector Current IGBT

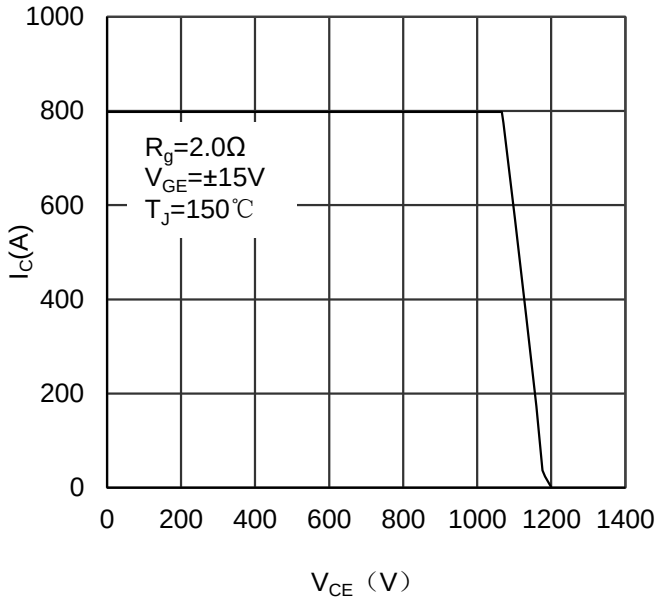


Figure 6. Reverse Biased Safe Operating Area IGBT

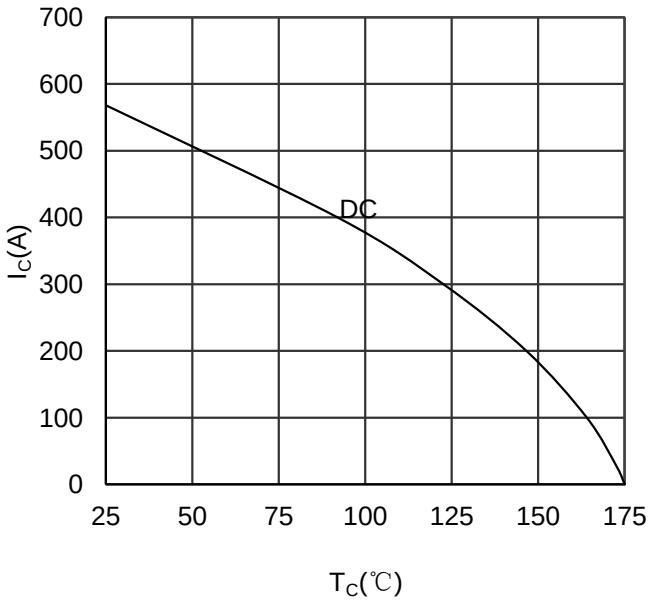


Figure 7. Collector Current vs Case temperature IGBT

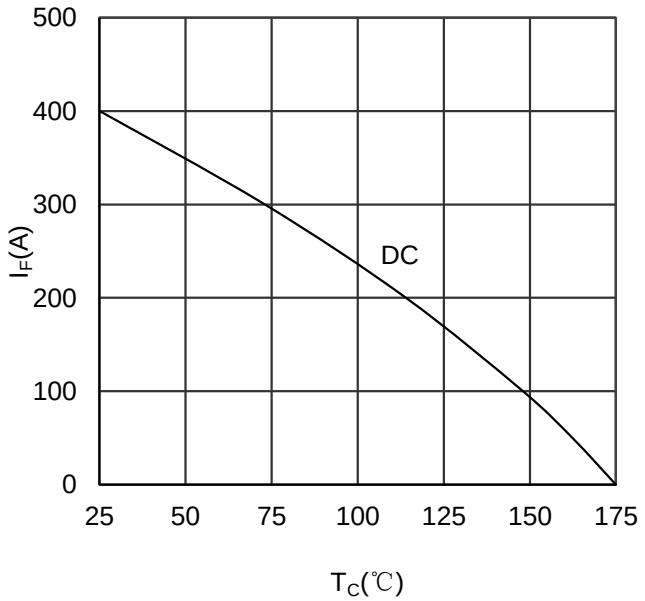


Figure 8. Forward current vs Case temperature Diode

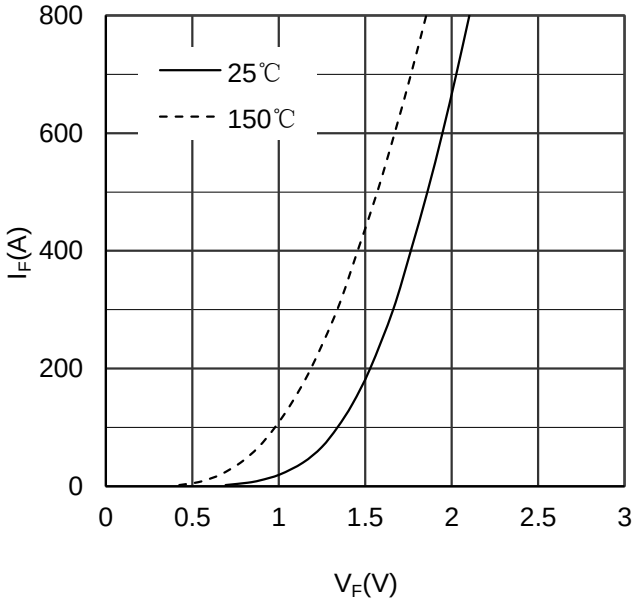


Figure 9. Diode Forward Characteristics Diode

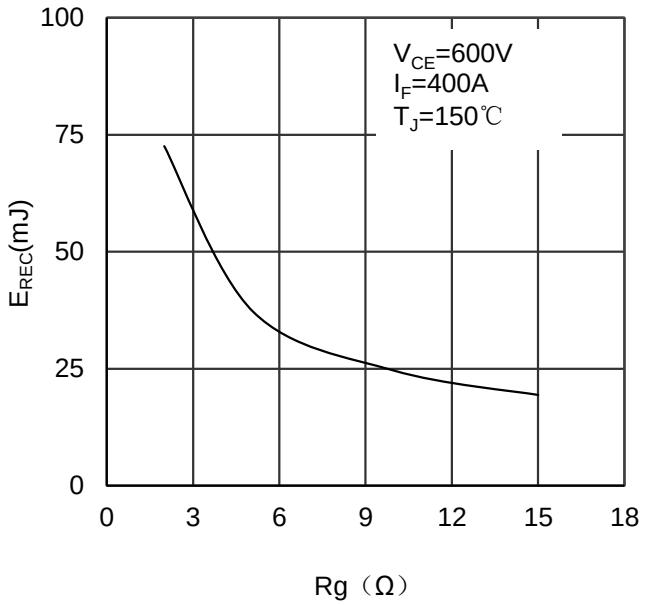


Figure 10. Switching Energy vs Gate Resistor Diode

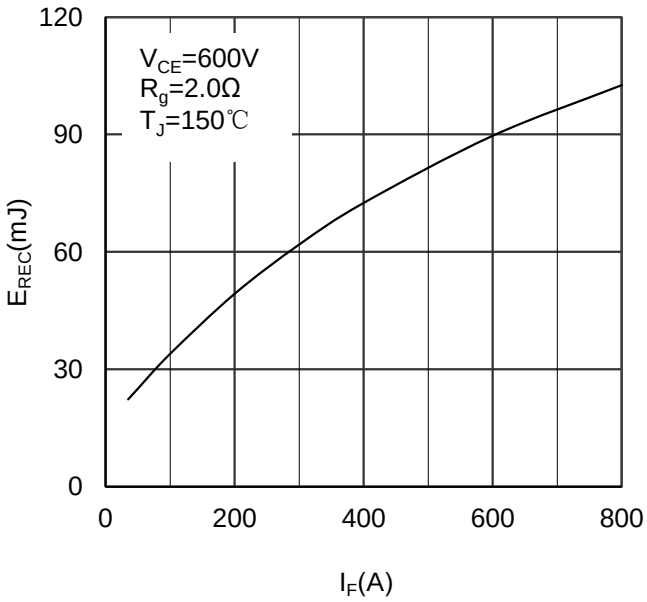


Figure 11. Switching Energy vs Forward Current Diode

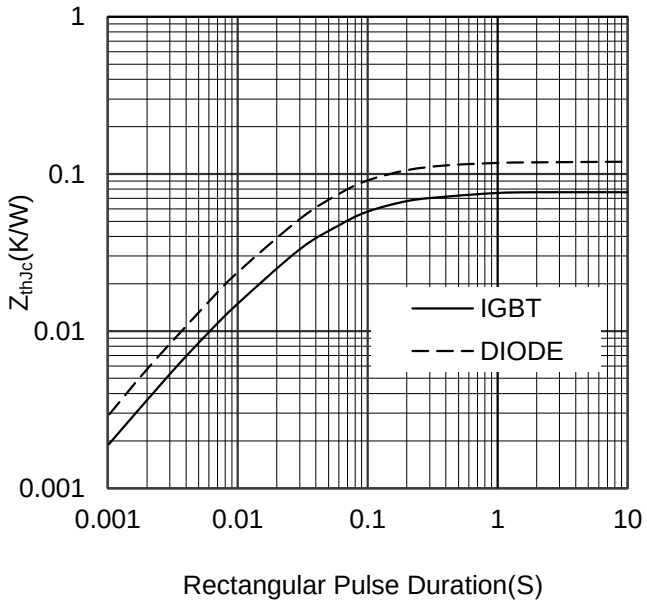


Figure 12. Transient Thermal Impedance of Diode and IGBT

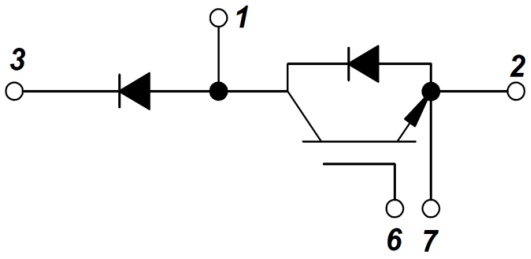
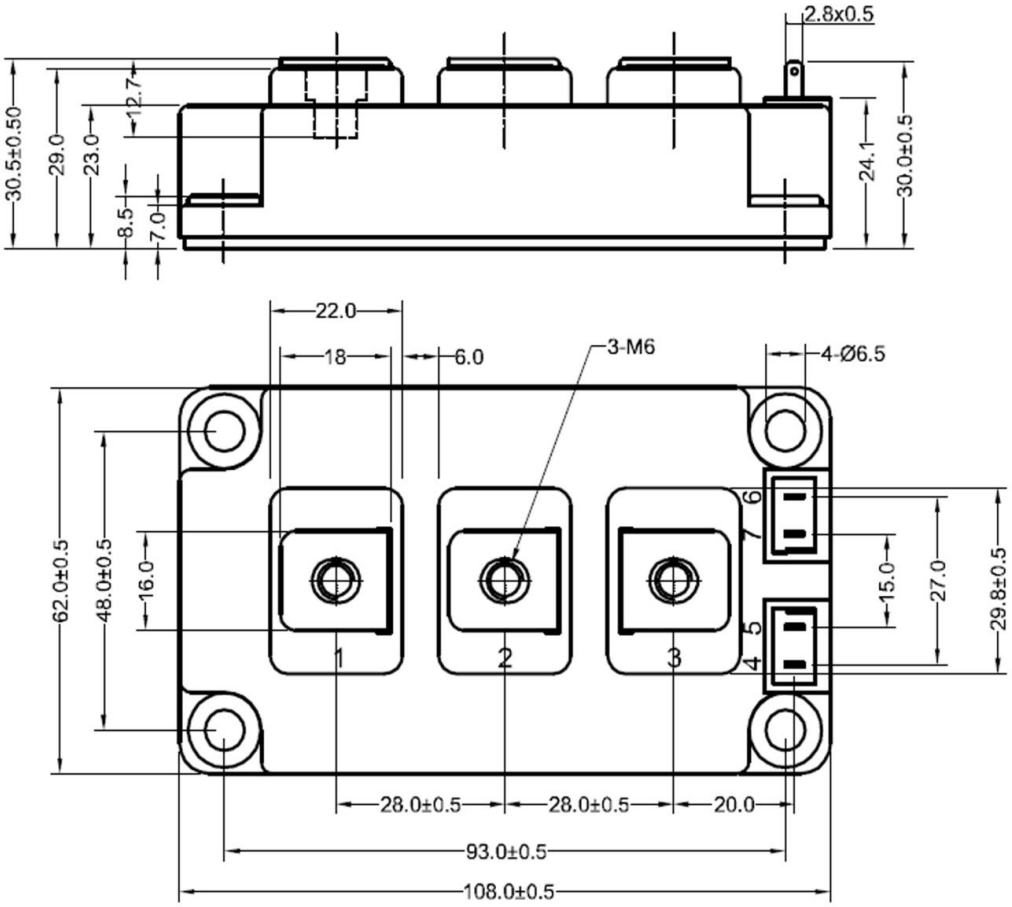


Figure 13. Circuit Diagram



Dimensions in (mm)

Figure 14. Package Outline