MMG400VC075X6TC

750V 400A IGBT Module

December 2022 Version 01 RoHS Compliant

PRODUCT FEATURES

- ☐ 750V Field Stop Trench IGBT
- ☐ $V_{CE(sat)}$ with positive temperature coefficient
- ☐ Fast switching and short tail current
- ☐ Free wheeling diodes with fast and soft reverse recovery
- ☐ Temperature sense included

APPLICATIONS

- ☐ Automotive Traction Modules
- ☐ General Power Modules

IGBT-inverter

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

Symbol	Parameter/Test Conditions		Values	Unit
V_{CES}	Collector Emitter Voltage	T_J=25℃	750	V
V_{GES}	Gate Emitter Voltage		±20	
I_C	DC Collector Current	T_C=25℃, T_{Jmax}=175℃	535	A
		T_C=75℃, 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℃	1071	W

Diode-inverter

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

Symbol	Parameter/Test Conditions		Values	Unit
V_{RRM}	Repetitive Reverse Voltage	T_J=25℃	750	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	12.8	KA^2s

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IGBT-inverter

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=6.4mA		5.1	5.9	6.7	V
$V_{CE(sat)}$	Collector Emitter Saturation Voltage	I_C=400A, V_{GE}=15V, T_J=25℃			1.21	1.6	
		I_C=400A, V_{GE}=15V, T_J=125℃			1.27		
		I_C=400A, V_{GE}=15V, T_J=150℃			1.29		
I_{CES}	Collector Leakage Current	V_{CE}=750V, V_{GE}=0V, T_J=25℃				1	mA
		V_{CE}=750V, V_{GE}=0V, T_J=150℃				5	mA
I_{GES}	Gate Leakage Current	V_{CE}=0V,V_{GE}=±20V, T_J=25℃		-400		400	nA
R_{gint}	Integrated Gate Resistor				0.8		Ω
Q_g	Gate Charge	V_{CE}=400V, I_C=400A , V_{GE}=15V			1.6		μC
C_{ies}	Input Capacitance	V_{CE}=25V, V_{GE}=0V, f =1MHz			52		nF
C_{res}	Reverse Transfer Capacitance				0.44		nF
$t_{d(on)}$	Turn on Delay Time	V_{CC}=400V,I_C=400A R_G =1.8Ω, V_{GE}=±15V, Inductive Load	T_J=25℃		130		ns
			T_J=150℃		130		ns
t_r	Rise Time		T_J=25℃		55		ns
			T_J=150℃		55		ns
$t_{d(off)}$	Turn off Delay Time	V_{CC}=400V,I_C=400A R_G =1.8Ω, V_{GE}=±15V, Inductive Load	T_J=25℃		360		ns
			T_J=150℃		400		ns
t_f	Fall Time		T_J=25℃		140		ns
			T_J=150℃		210		ns
E_{on}	Turn on Energy	V_{CC}=400V,I_C=400A R_G =1.8Ω, V_{GE}=±15V, Inductive Load	T_J=25℃		7.2		mJ
			T_J=125℃		9.4		mJ
			T_J=150℃		10		mJ
E_{off}	Turn off Energy		T_J=25℃		16.4		mJ
			T_J=125℃		21.7		mJ
			T_J=150℃		22.3		mJ
I_{SC}	Short Circuit Current	tpsc≤6μs , V_{GE}=15V T_J=150℃,V_{CC}=360V			2600		A
R_{thJF}	Junction to cooling fluid, △V/△t = 10 dm³/min, T_F = 25°C （Per IGBT）					0.14	K /W

Diode-inverter

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℃		1.85	2.1	V
		I_F=400A , V_{GE}=0V, T_J=125℃		1.70		
		I_F=400A , V_{GE}=0V, T_J=150℃		1.65		
t_{rr}	Reverse Recovery Time	I_F=400A , V_R=400V dI_F/dt=-5200A/μs T_J =150℃		320		ns
I_{RRM}	Max. Reverse Recovery Current			260		A
Q_{RR}	Reverse Recovery Charge			36		μC
E_{rec}	Reverse Recovery Energy			12.3		mJ
R_{thJFD}	Junction to cooling fluid, △V/△t = 10 dm³/min, TF = 25°C （Per Diode）				0.2	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℃		5		kΩ
$B_{25/50}$	$R_2 = R_{25} \exp [B_{25/50}(1/T_2 - 1/(298.15\ K))]$			3375		K

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

Symbol	Parameter/Test Conditions		Values	Unit
T_{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		> 200	
Torque	to heatsink	Recommended（M5）	2.5~5	Nm
	to terminal	Recommended（M6）	3~5	Nm
Weight			700	g

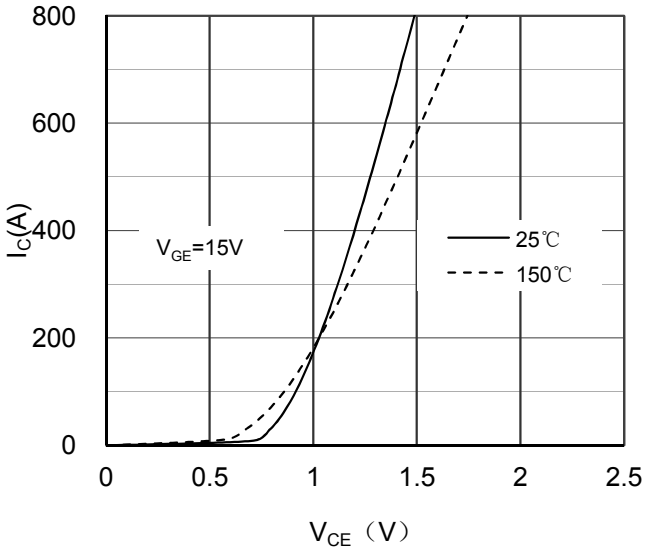


Figure 1. Typical Output Characteristics IGBT-inverter

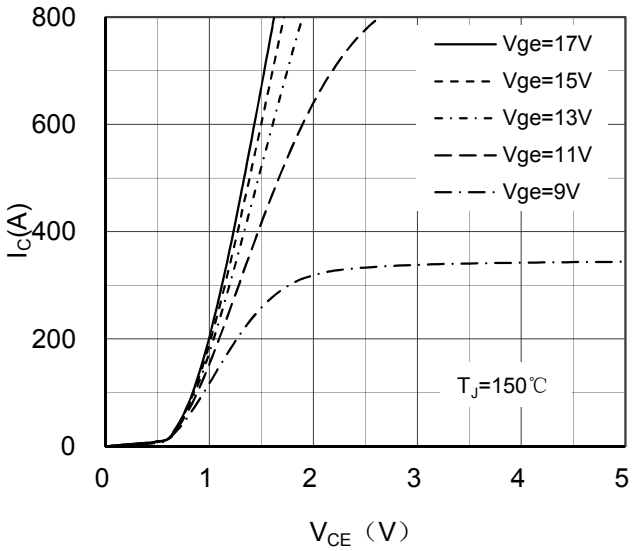


Figure 2. Typical Output Characteristics IGBT-inverter

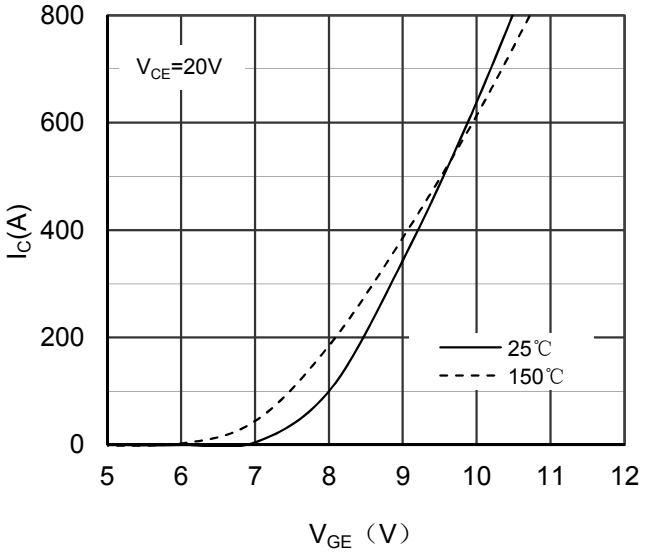


Figure 3. Typical Transfer characteristics IGBT-inverter

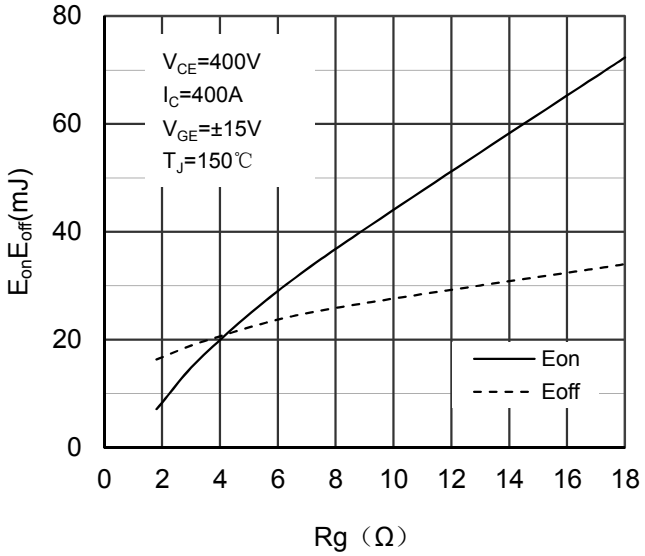


Figure 4. Switching Energy vs Gate Resistor IGBT-inverter

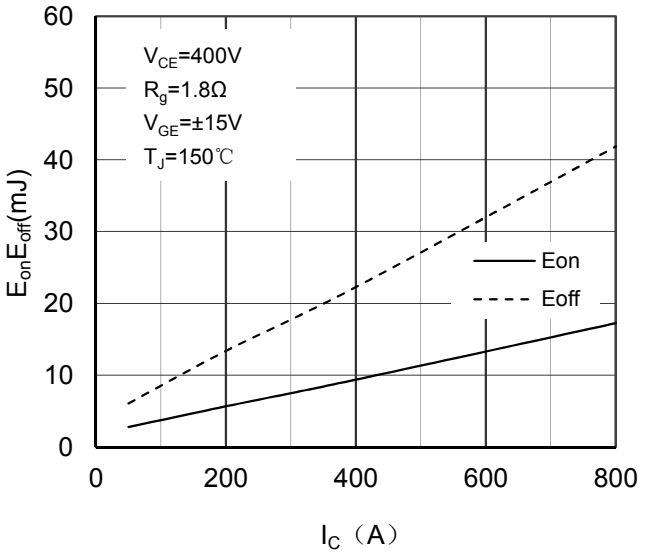


Figure 5. Switching Energy vs Collector Current IGBT-inverter

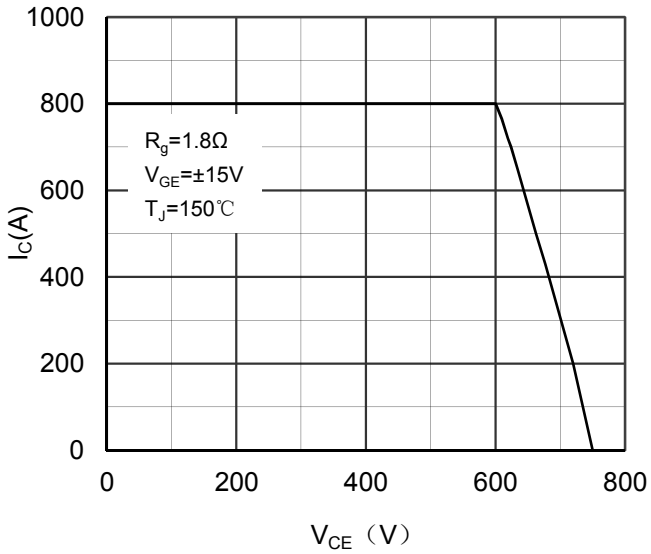


Figure 6. Reverse Biased Safe Operating Area IGBT-inverter

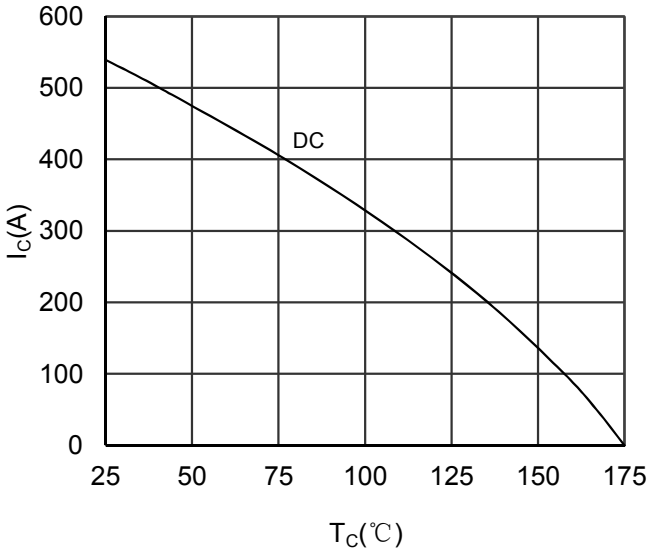


Figure 7. Collector Current vs Case temperature IGBT-inverter

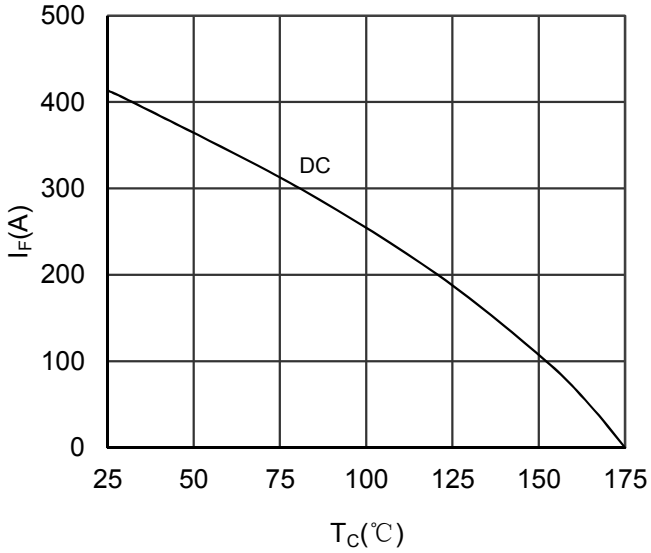


Figure 8. Forward current vs Case temperature Diode-inverter

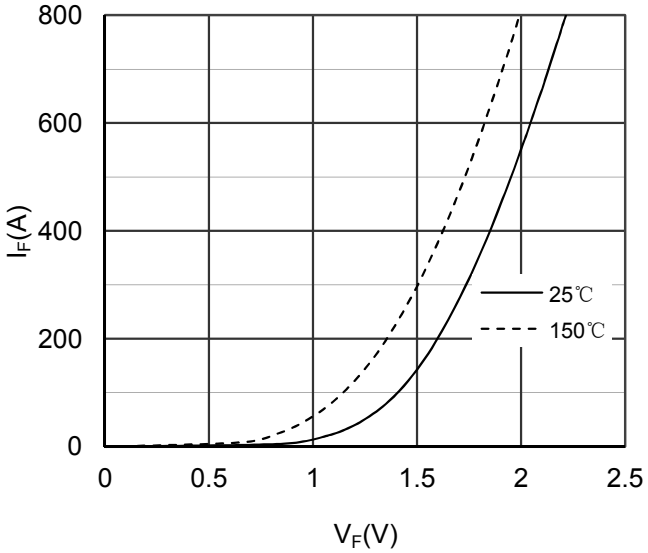


Figure 9. Diode Forward Characteristics Diode-inverter

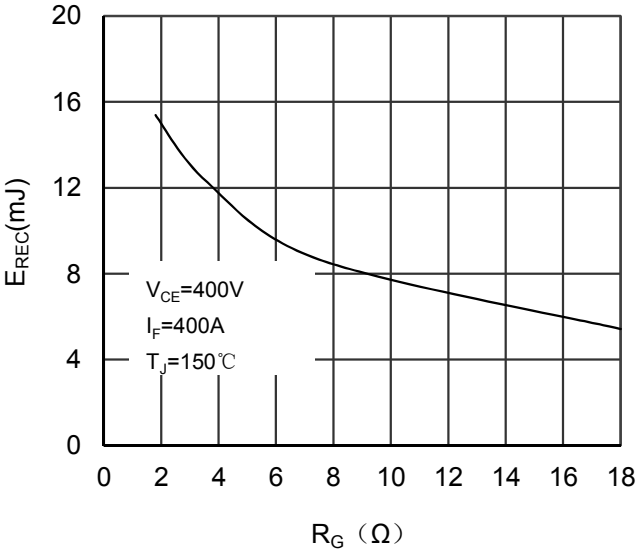


Figure 10. Switching Energy vs Gate Resistor Diode-inverter

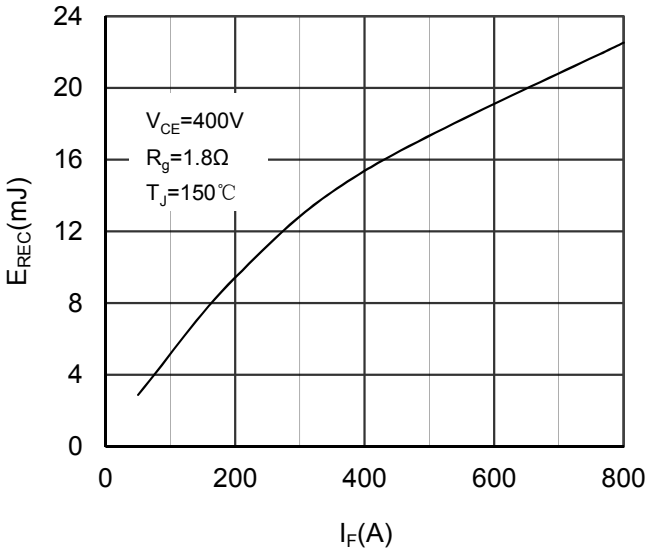


Figure 11. Switching Energy vs Forward Current Diode-inverter

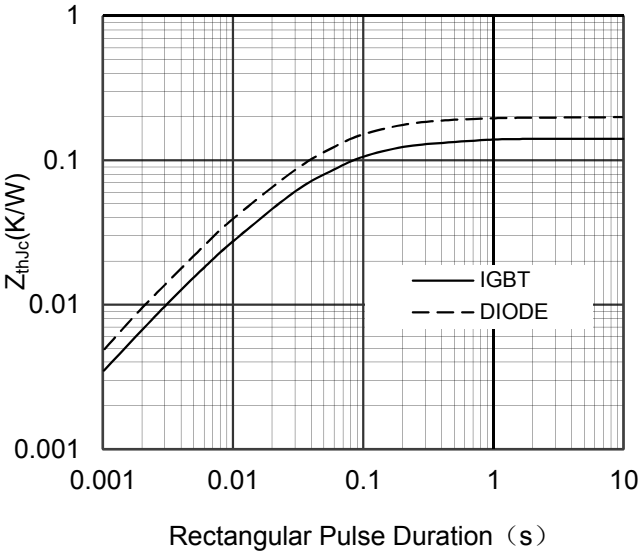


Figure 12. Transient Thermal Impedance of Diode and IGBT-inverter

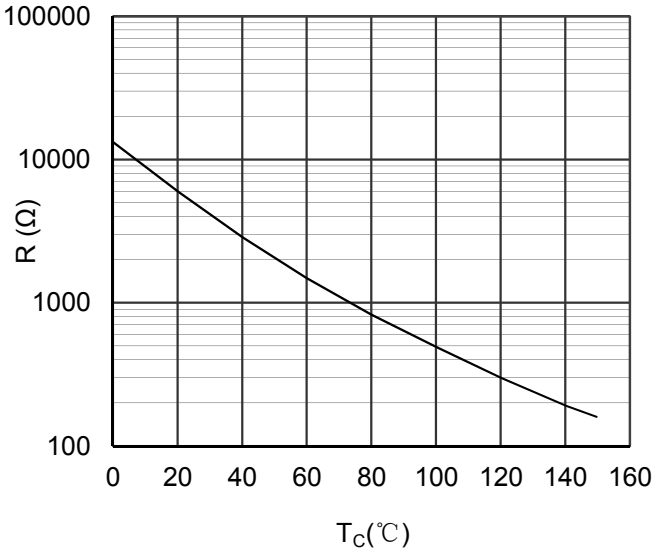


Figure 13. NTC Characteristics

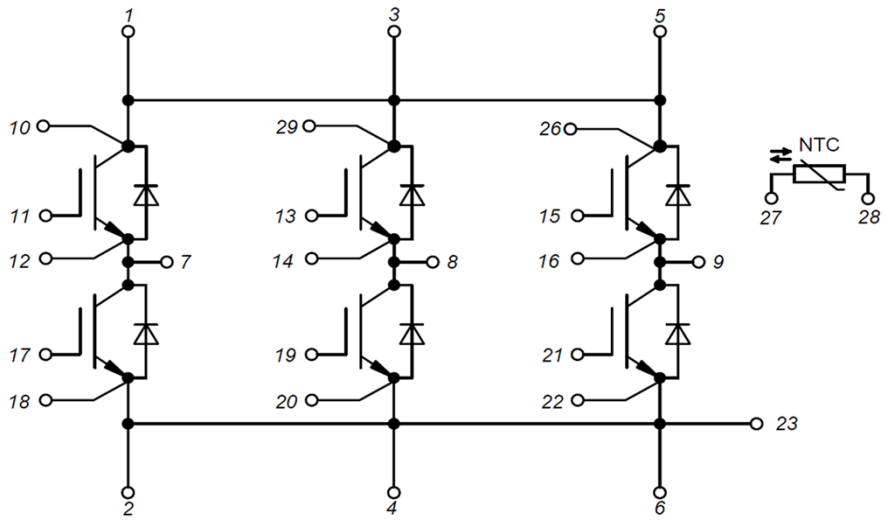
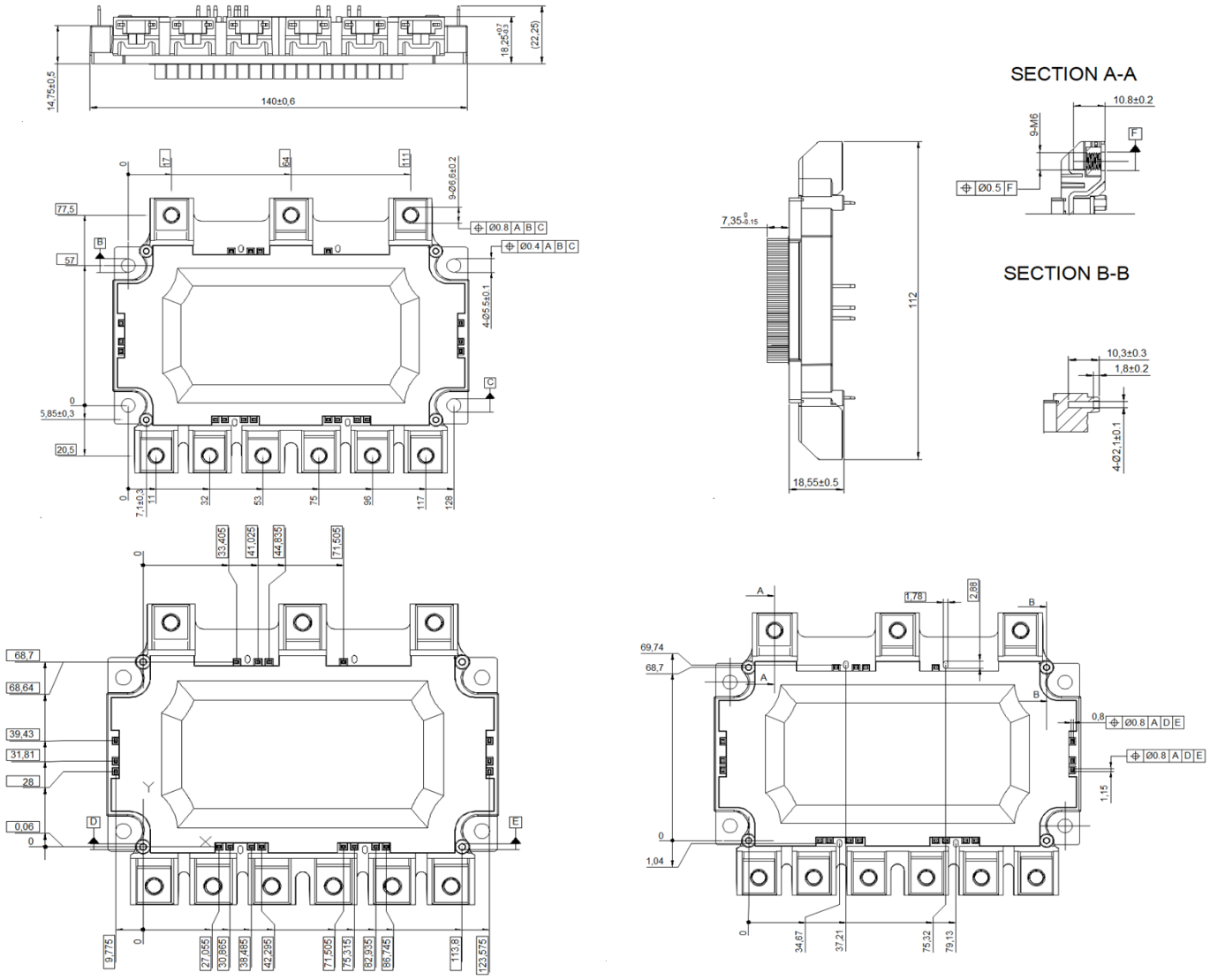


Figure 14. Circuit Diagram



Dimensions in (mm)

Figure 15. Package Outline