MMG40H120XB6TN

1200V 40A PIM Module

March 2011 **PRELIMINARY** **RoHS Compliant**

FEATURES

- ☐ High level of integration—only one power semiconductor module required for the whole drive
- ☐ Low saturation voltage and positive temperature coefficient
- ☐ Fast switching and short tail current
- ☐ Free wheeling diodes with fast and soft reverse recovery
- ☐ Industry standard package with insulated copper base plate and soldering pins for PCB mounting
- ☐ Temperature sense included

PIM Three Phase Input Rectifier

APPLICATIONS

- ☐ AC motor control
- ☐ Motion/servo control
- ☐ Inverter and power supplies

INVERTER SECTOR

ABSOLUTE MAXIMUM RATINGS

T_C=25°C unless otherwise specified

Symbol	Parameter	Test Conditions	Values	Unit
IGBT				
V_{CES}	Collector - Emitter Voltage	T_{vj}=25°C	1200	V
V_{GES}	Gate - Emitter Voltage		±20	V
I_C	DC Collector Current	T_C=25°C	55	A
		T_C=80°C	40	A
I_{CM}	Repetitive Peak Collector Current	t_p=1ms	80	A
P_{tot}	Power Dissipation Per IGBT		195	W
Diode				
V_{RRM}	Repetitive Reverse Voltage	T_{vj}=25°C	1200	V
$I_{F(AV)}$	Average Forward Current	T_C=25°C	55	A
		T_C=80°C	40	A
I_{FRM}	Repetitive Peak Forward Current	t_p=1ms	80	A
I^2t		T_{vj} =125°C, t=10ms, V_R=0V	300	A^2s

INVERTER SECTOR

ELECTRICAL AND THERMAL CHARACTERISTICS *T_C=25°C unless otherwise specified*

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
IGBT						
$V_{GE(th)}$	Gate - Emitter Threshold Voltage	V_{CE}=V_{GE}, I_C=1.5mA	5.0	5.8	6.5	V
$V_{CE(sat)}$	Collector - Emitter Saturation Voltage	I_C=40A, V_{GE}=15V, T_{vj}=25°C		1.8		V
		I_C=40A, V_{GE}=15V, T_{vj}=125°C		2.05		V
I_{CES}	Collector Leakage Current	V_{CE}=1200V, V_{GE}=0V, T_{vj}=25°C			0.25	mA
		V_{CE}=1200V, V_{GE}=0V, T_{vj}=125°C			2	mA
I_{GES}	Gate Leakage Current	V_{CE}=0V,V_{GE}±15V, T_{vj}=125°C	-400		400	nA
R_{Gint}	Integrated Gate Resistor			6.0		Ω
Q_{ge}	Gate Charge	V_{CE}=600V, I_C=40A , V_{GE}=±15V		0.33		μC
C_{ies}	Input Capacitance	V_{CE}=25V, V_{GE}=0V, f =1MHz		2.5		nF
C_{res}	Reverse Transfer Capacitance			0.11		nF
$t_{d(on)}$	Turn - on Delay Time	V_{CC}=600V,I_C=40A, R_G =27Ω , V_{GE}=±15V, Inductive Load, T_{vj} =25°C		90		ns
		T_{vj} =125°C		90		ns
t_r	Rise Time	T_{vj} =25°C		30		ns
		T_{vj} =125°C		50		ns
$t_{d(off)}$	Turn - off Delay Time	V_{CC}=600V,I_C=40A, R_G =27Ω , V_{GE}=±15V, Inductive Load, T_{vj} =25°C		420		ns
		T_{vj} =125°C		520		ns
t_f	Fall Time	T_{vj} =25°C		70		ns
		T_{vj} =125°C		90		ns
E_{on}	Turn - on Energy	V_{CC}=600V,I_C=40A, R_G =27Ω , V_{GE}=±15V, Inductive Load, T_{vj} =25°C		4.1		mJ
		T_{vj} =125°C		5.8		mJ
E_{off}	Turn - off Energy	T_{vj} =25°C		3.6		mJ
		T_{vj} =125°C		4.2		mJ
I_{SC}	Short Circuit Current	t_{psc}≤10μS , V_{GE}=15V T_{vj}=125°C,V_{CC}=900V		160		A
R_{thJC}	Junction-to-Case Thermal Resistance （ **Per IGBT**）				0.64	K /W
Diode						
V_F	Forward Voltage	I_F=40A , V_{GE}=0V, T_{vj} =25°C		1.80		V
		I_F=40A , V_{GE}=0V, T_{vj} =125°C		1.85		V
t_{rr}	Reverse Recovery Time	I_F=40A , V_R=600V		240		ns
I_{RRM}	Max. Reverse Recovery Current	di_F/dt=-400A/μs		35		A
E_{rec}	Reverse Recovery Energy	T_{vj} =125°C		2.8		mJ
R_{thJCD}	Junction-to-Case Thermal Resistance （ **Per Diode**）				1.0	K /W

DIODE-RECTIFIER SECTOR

ABSOLUTE MAXIMUM RATINGS

T_C=25°C unless otherwise specified

Symbol	Parameter	Test Conditions	Values	Unit
V_{RRM}	Repetitive Reverse Voltage	T_{vj}=25°C	1600	V
$I_{F(AV)}$	Average Forward Current	T_C=80°C	40	A
I_{FSM}	Non-Repetitive Surge Forward Current	T_{vj} =45°C, t=10ms, 50Hz	320	A
		T_{vj} =45°C, t=8.3ms, 60Hz	350	A
I^2t		T_{vj} =45°C, t=10ms, 50Hz	512	A^2s
		T_{vj} =45°C, t=8.3ms, 60Hz	612	A^2s

DIODE-RECTIFIER SECTOR

ELECTRICAL AND THERMAL CHARACTERISTICS

T_C=25°C unless otherwise specified

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Forward Voltage	I_F=40A , T_{vj} =25°C		1.2		V
		I_F=40A , T_{vj} =125°C		1.15		V
I_R	Reverse Leakage Current	V_R=1600V, T_{vj}=25°C			50	μA
		V_R=1600V, T_{vj}=125°C			1	mA
R_{thJCD}	Junction-to-Case Thermal Resistance （ **Per Diode**）				1.0	K /W

BRAKE-CHOPPER SECTOR

ABSOLUTE MAXIMUM RATINGS

T_C=25°C unless otherwise specified

Symbol	Parameter	Test Conditions	Values	Unit
IGBT				
V_{CES}	Collector - Emitter Voltage	T_{vj}=25°C	1200	V
V_{GES}	Gate - Emitter Voltage		±20	V
I_C	DC Collector Current	T_C=25°C	25	A
		T_C=80°C	15	A
I_{CM}	Repetitive Peak Collector Current	t_p=1ms	30	A
P_{tot}	Power Dissipation Per IGBT		105	W
Diode				
V_{RRM}	Repetitive Reverse Voltage	T_{vj}=25°C	1200	V
$I_{F(AV)}$	Average Forward Current	T_C=25°C	25	A
		T_C=80°C	15	A
I_{FRM}	Repetitive Peak Forward Current	t_p=1ms	30	A
I^2t		T_{vj} =125°C, t=10ms, V_R=0V	60	A^2s

BRAKE-CHOPPER SECTOR

ELECTRICAL AND THERMAL CHARACTERISTICS *T_C=25°C unless otherwise specified*

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
IGBT						
$V_{GE(th)}$	Gate - Emitter Threshold Voltage	V_{CE}=V_{GE}, I_C=0.5mA	5.0	5.8	6.5	V
$V_{CE(sat)}$	Collector - Emitter Saturation Voltage	I_C=15A, V_{GE}=15V, T_{vj}=25°C		1.7		V
		I_C=15A, V_{GE}=15V, T_{vj}=125°C		1.9		V
I_{CES}	Collector Leakage Current	V_{CE}=1200V, V_{GE}=0V, T_{vj}=25°C			50	μA
		V_{CE}=1200V, V_{GE}=0V, T_{vj}=125°C			1	mA
I_{GES}	Gate Leakage Current	V_{CE}=0V,V_{GE}±15V, T_{vj}=125°C	-400		400	nA
R_{Gint}	Integrated Gate Resistor			0		Ω
Q_{ge}	Gate Charge	V_{CE}=600V, I_C=15A , V_{GE}=±15V		0.15		μC
C_{ies}	Input Capacitance	V_{CE}=25V, V_{GE}=0V, f =1MHz		1.1		nF
C_{res}	Reverse Transfer Capacitance			0.05		nF
$t_{d(on)}$	Turn - on Delay Time	V_{CC}=600V,I_C=15A, R_G =62Ω , V_{GE}=±15V, Inductive Load — T_{vj} =25°C		90		ns
		T_{vj} =125°C		90		ns
t_r	Rise Time	T_{vj} =25°C		25		ns
		T_{vj} =125°C		30		ns
$t_{d(off)}$	Turn - off Delay Time	V_{CC}=600V,I_C=15A, R_G =62Ω , V_{GE}=±15V, Inductive Load — T_{vj} =25°C		420		ns
		T_{vj} =125°C		520		ns
t_f	Fall Time	T_{vj} =25°C		90		ns
		T_{vj} =125°C		120		ns
E_{on}	Turn - on Energy	V_{CC}=600V,I_C=15A, R_G =62Ω , V_{GE}=±15V, Inductive Load — T_{vj} =25°C		1.4		mJ
		T_{vj} =125°C		2.0		mJ
E_{off}	Turn - off Energy	T_{vj} =25°C		1.0		mJ
		T_{vj} =125°C		1.2		mJ
I_{SC}	Short Circuit Current	t_{psc}≤10μS , V_{GE}=15V T_{vj}=125°C,V_{CC}=900V		55		A
R_{thJC}	Junction-to-Case Thermal Resistance （ **Per IGBT**）				1.2	K /W
Diode						
V_F	Forward Voltage	I_F=15A , V_{GE}=0V, T_{vj} =25°C		1.65		V
		I_F=15A , V_{GE}=0V, T_{vj} =125°C		1.75		V
t_{rr}	Reverse Recovery Time	I_F=15A , V_R=600V		150		ns
I_{RRM}	Max. Reverse Recovery Current	di_F/dt=-400A/μs		15		A
E_{rec}	Reverse Recovery Energy	T_{vj} =125°C		0.6		mJ
R_{thJCD}	Junction-to-Case Thermal Resistance （ **Per Diode**）				2.1	K /W

NTC SECTOR

CHARACTERISTIC VALUES

T_C=25°C unless otherwise specified

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
R_{25}	Resistance	T_C =25°C		5		KΩ
$B_{25/50}$				3375		K

MODULE CHARACTERISTICS

T_C=25°C unless otherwise specified

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$T_{Vj\ max}$	Max. Junction Temperature				150	°C
$T_{Vj\ op}$	Operating Temperature		-40		125	°C
T_{stg}	Storage Temperature		-40		125	°C
V_{isol}	Insulation Test Voltage	AC, t=1min		3000		V
CTI	Comparative Tracking Index		250			
M_d	Mounting Torque	Recommended（M5）	2.5		5	N · m
Weight				180		g

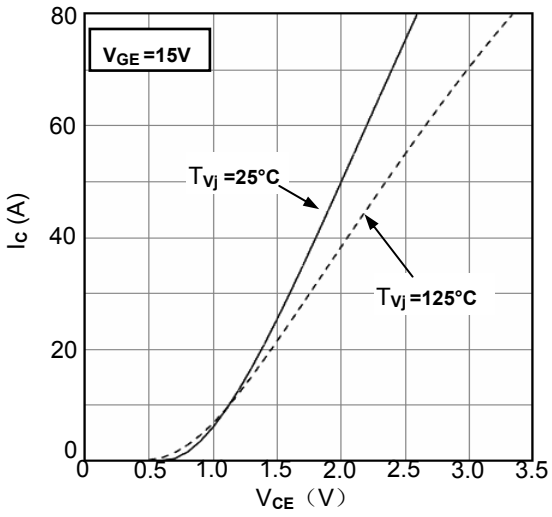


Figure1. Typical Output Characteristics
IGBT-inverter

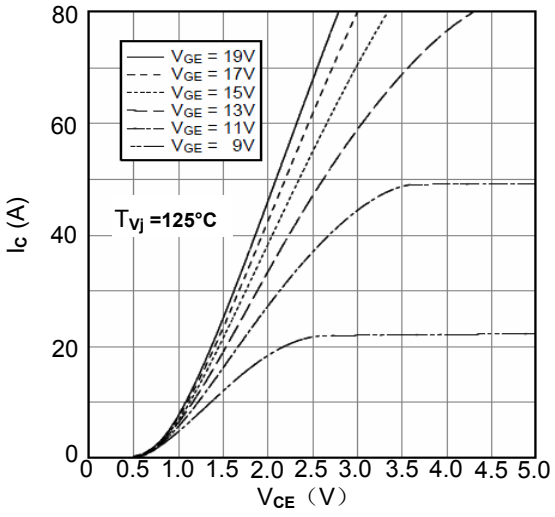


Figure2. Typical Output Characteristics
IGBT-inverter

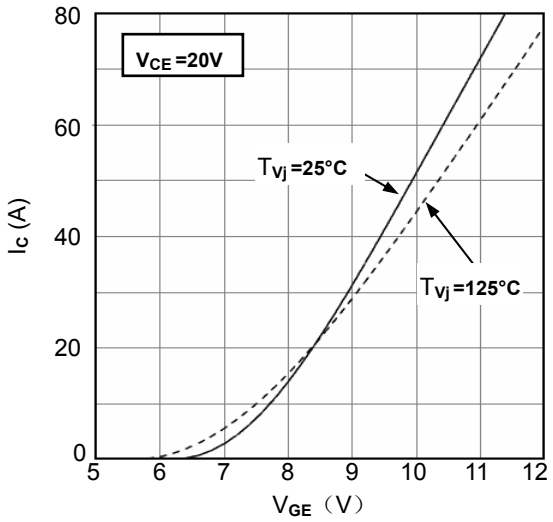


Figure3. Typical Transfer characteristics
IGBT-inverter

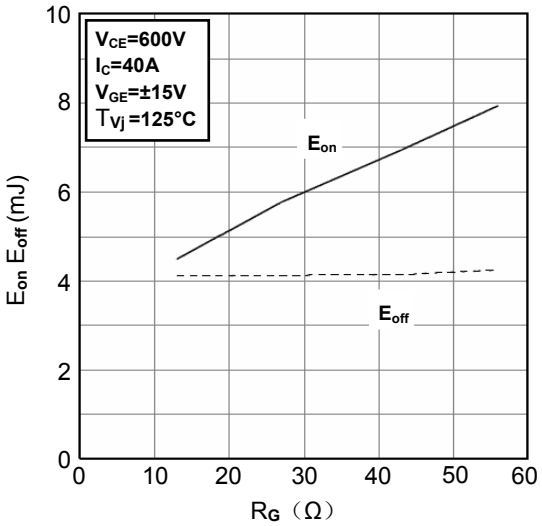


Figure4. Switching Energy vs. Gate Resistor
IGBT-inverter

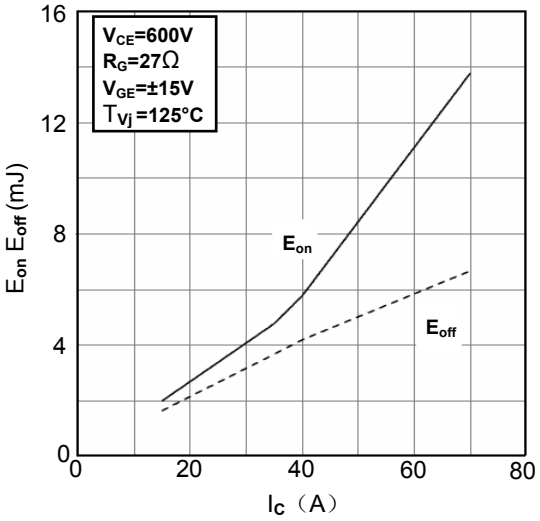


Figure5. Switching Energy vs. Collector Current
IGBT-inverter

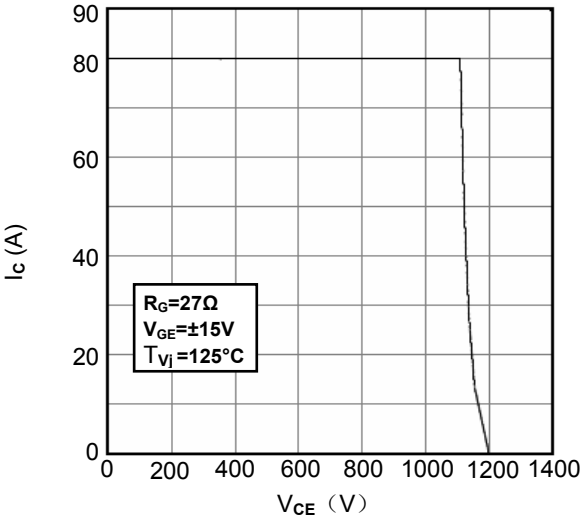


Figure6. Reverse Biased Safe Operating Area
IGBT-inverter

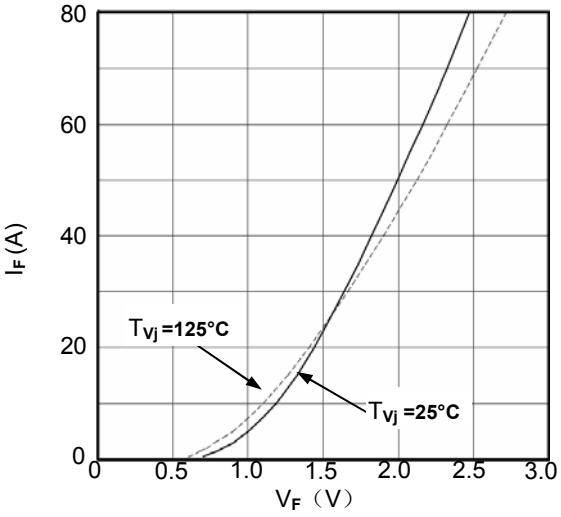


Figure7. Diode Forward Characteristics
Diode -inverter

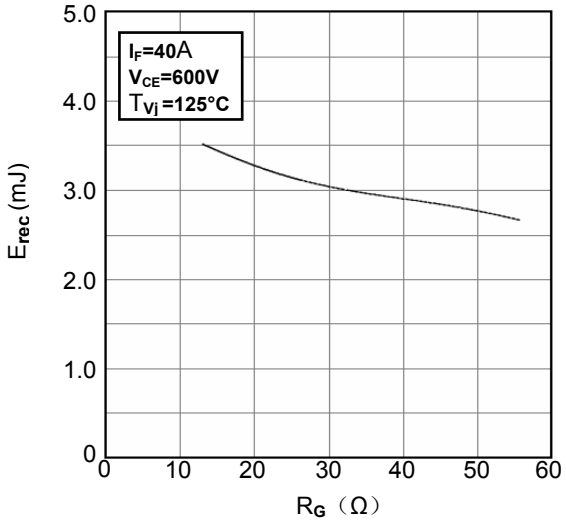


Figure8. Switching Energy vs. Gate Resistor
Diode -inverter

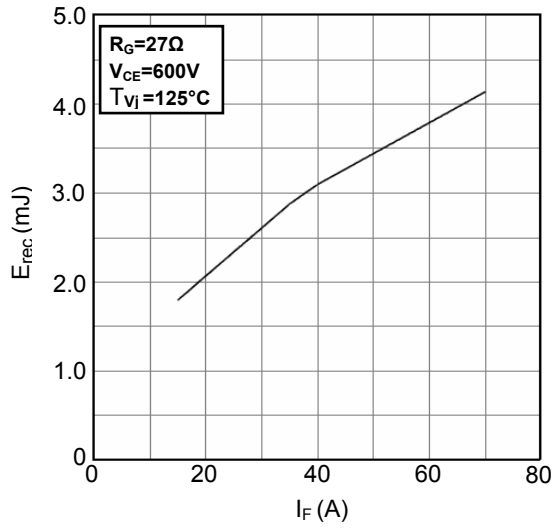


Figure9. Switching Energy vs. Forward Current
Diode-inverter

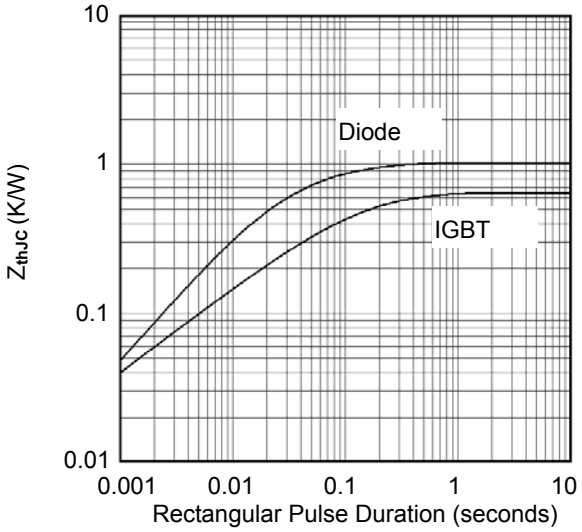


Figure10. Transient Thermal Impedance of
Diode and IGBT-inverter

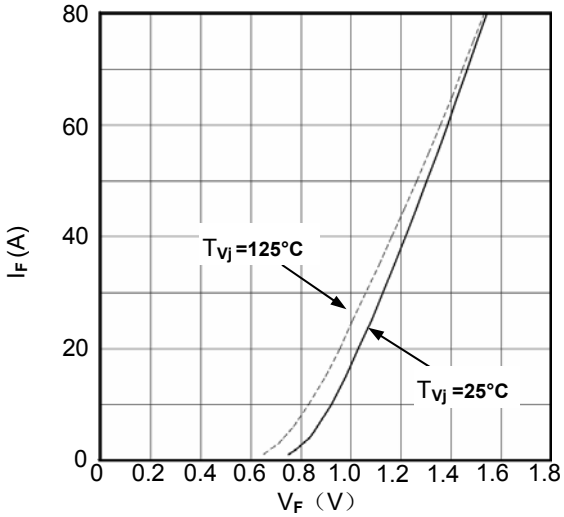


Figure11. Diode Forward Characteristics
Diode- rectifier

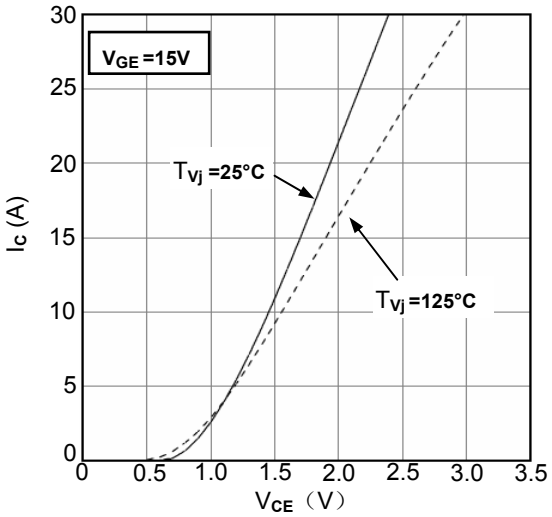


Figure12. Typical Output Characteristics
IGBT- brake chopper

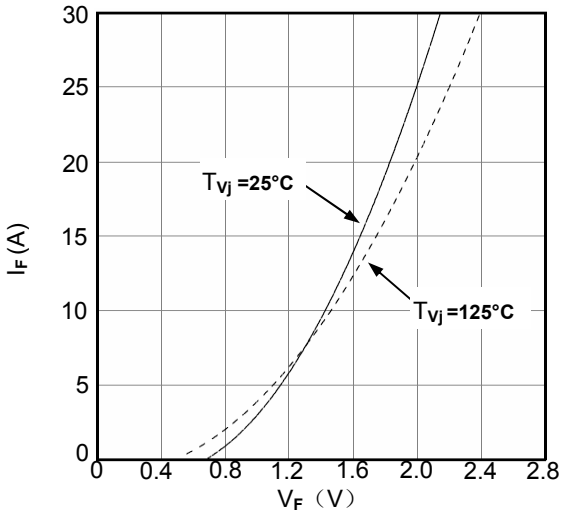


Figure13. Diode Forward Characteristics
Diode - brake chopper

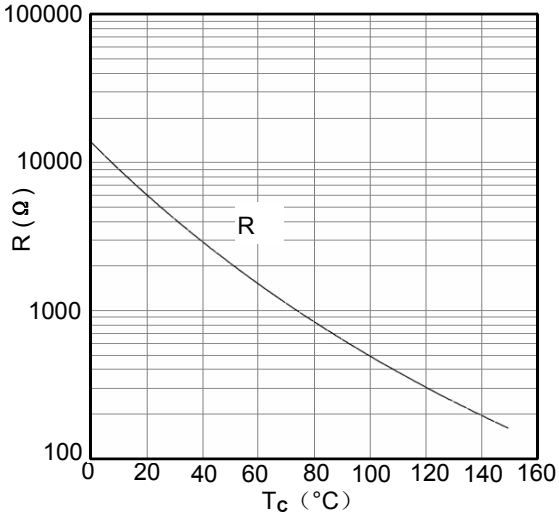


Figure14. NTC Characteristics

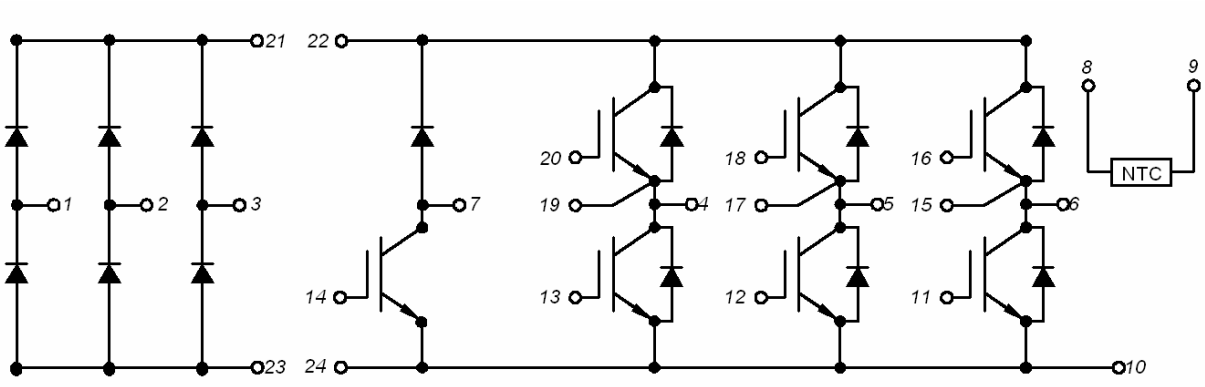
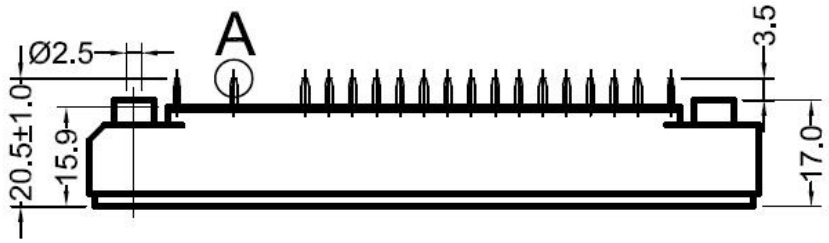
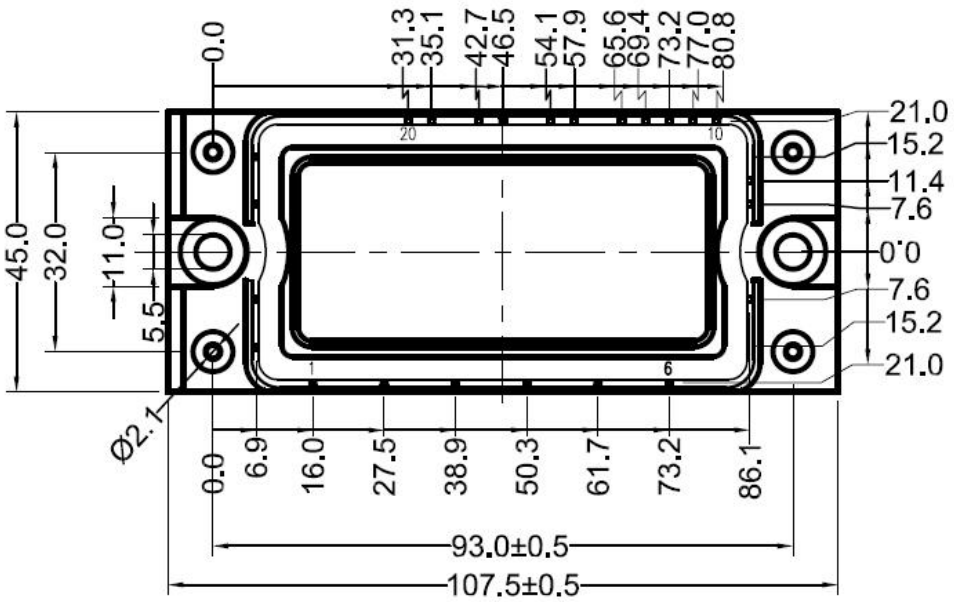


Figure15. Circuit Diagram





Dimensions (mm)
Figure16. Package Outline