MMG400VD075X6TC

750V 400A IGBT Module

May 2024 Version 04 RoHS Compliant

PRODUCT FEATURES

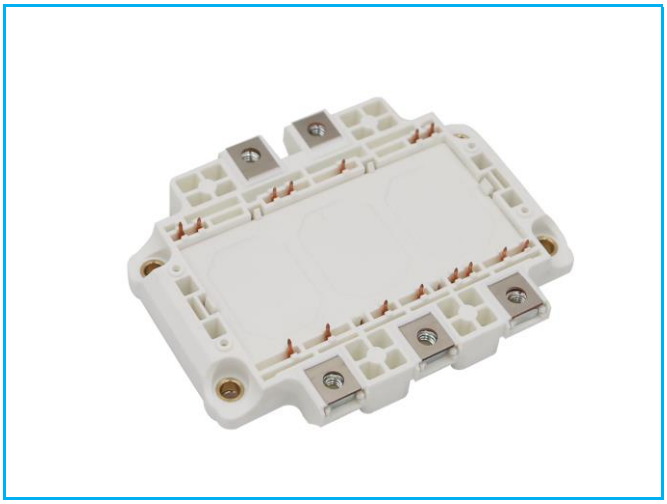
☐ IGBT CHIP(Trench+FS)

☐ Low saturation voltage and positive temperature coefficient

☐ Fast switching and short tail current

☐ Free wheeling diodes with fast and soft reverse recovery

☐ Temperature sense included



APPLICATIONS

☐ Automotive application

☐ Hybrid and electric vehicle

☐ Inverter for motor drive

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℃	750	V
V_{GES}	Gate Emitter Voltage		±20	
I_C	DC Collector Current	T_C=25℃, T_{Jmax}=175℃	555	A
		T_C=85℃, 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℃	1064	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℃	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	19.6	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=5.72mA			5.35		V
$V_{CE(sat)}$	Collector Emitter Saturation Voltage	I_C=400A, V_{GE}=15V, T_J=25℃			1.35		
		I_C=400A, V_{GE}=15V, T_J=125℃			1.45		
		I_C=400A, V_{GE}=15V, T_J=175℃			1.55		
I_{CES}	Collector Leakage Current	V_{CE}=750V, V_{GE}=0V, T_J=25℃				1	mA
		V_{CE}=750V, V_{GE}=0V, T_J=175℃				10	
I_{GES}	Gate Leakage Current	V_{CE}=0V,V_{GE}=±20V, T_J=25℃		-400		400	nA
R_{Gint}	Integrated Gate Resistor				1.17		Ω
Q_g	Gate Charge	V_{CE}=400V, I_C=400A , V_{GE}=15V			1.3		μC
C_{ies}	Input Capacitance	V_{CE}=25V, V_{GE}=0V, f =1MHz			60		nF
C_{res}	Reverse Transfer Capacitance				0.55		nF
$t_{d(on)}$	Turn on Delay Time	V_{CC}=400V, I_C=400A, R_{Gon} =2.5Ω, V_{GE}=±15V, Inductive Load	T_J=25℃		170		ns
			T_J=175℃		185		ns
t_r	Rise Time		T_J=25℃		90		ns
			T_J=175℃		105		ns
E_{on}	Turn on Energy		T_J=25℃		9.5		mJ
			T_J=125℃		16.5		mJ
			T_J=175℃		20.3		mJ
$t_{d(off)}$	Turn off Delay Time	V_{CC}=400V, I_C=400A, R_{Goff} =12Ω, V_{GE}=±15V, Inductive Load	T_J=25℃		800		ns
			T_J=175℃		850		ns
t_f	Fall Time		T_J=25℃		155		ns
			T_J=175℃		195		ns
E_{off}	Turn off Energy		T_J=25℃		29.6		mJ
			T_J=125℃		33.2		mJ
			T_J=175℃		35.2		mJ
I_{SC}	Short Circuit Current	tpsc≤5μs , V_{GE}=15V T_J=150℃,V_{CC}=400V			3075		A
R_{thJC}	Junction to Case Thermal Resistance （Per IGBT）					0.141	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℃		1.60		V
		I_F=400A , V_{GE}=0V, T_J=125℃		1.49		
		I_F=400A , V_{GE}=0V, T_J=175℃		1.42		
t_{rr}	Reverse Recovery Time	I_F=400A , V_R=400V dI_F/dt=-4000A/μs T_J =175℃		380		ns
I_{RRM}	Max. Reverse Recovery Current			310		A
Q_{RR}	Reverse Recovery Charge			55		μC
E_{rec}	Reverse Recovery Energy			20		mJ
R_{thJCD}	Junction to Case Thermal Resistance （Per Diode）				0.164	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		-40~175	
T_{stg}	Storage Temperature		-40~125	
V_{isol}	Isolation Breakdown Voltage	AC, 50Hz(R.M.S), t=1minute	3300	V
CTI	Comparative Tracking Index		› 100	
Torque	to heatsink	Recommended（M5）	3~5	Nm
	to terminal	Recommended（M6）	3~5	Nm
Weight			450	g

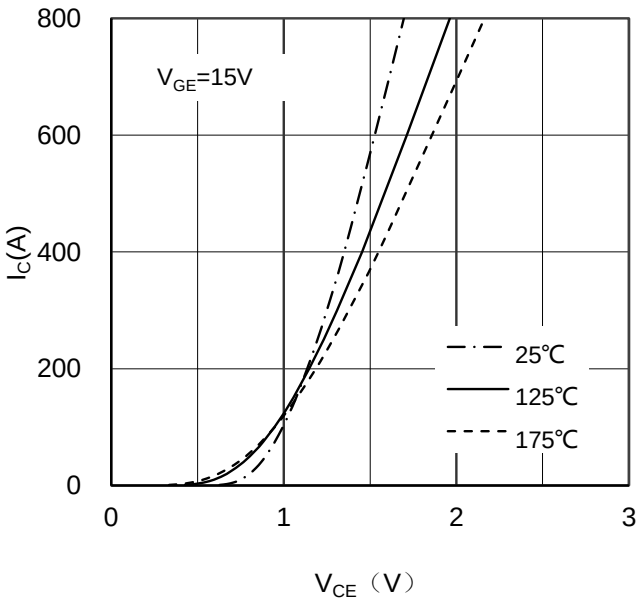


Figure 1. Typical Output Characteristics IGBT

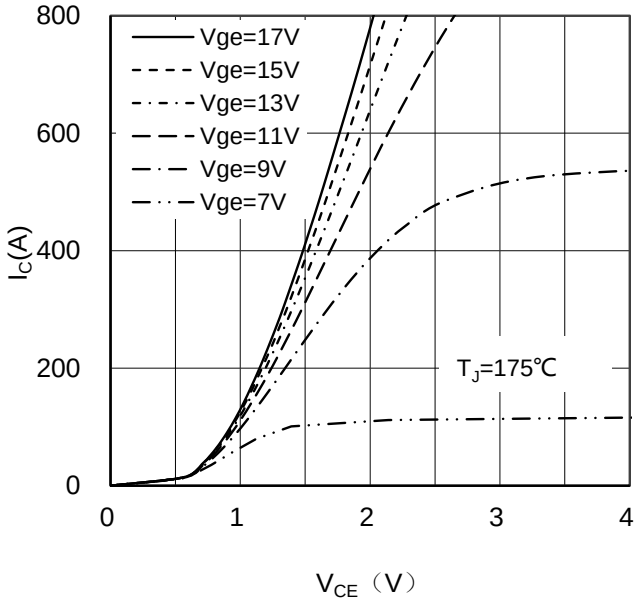


Figure 2. Typical Output Characteristics IGBT

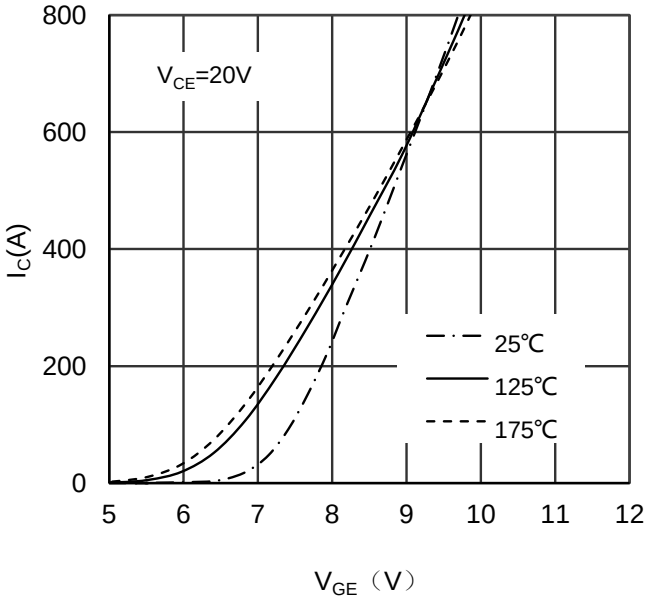


Figure 3. Typical Transfer characteristics IGBT

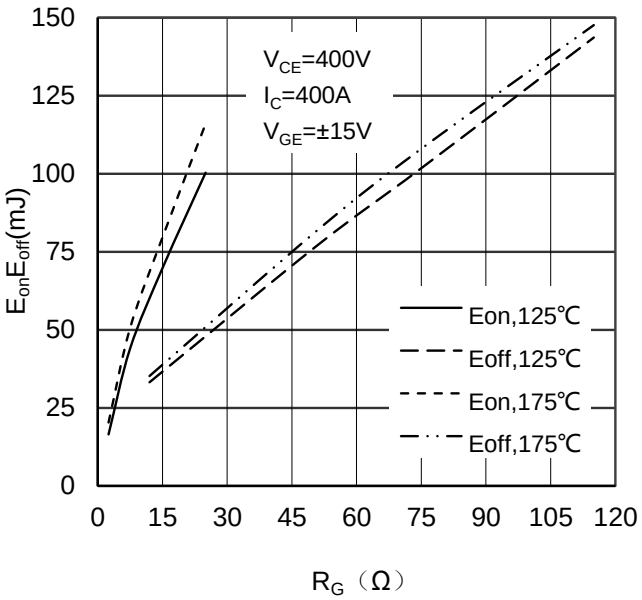


Figure 4. Switching Energy vs Gate Resistor IGBT

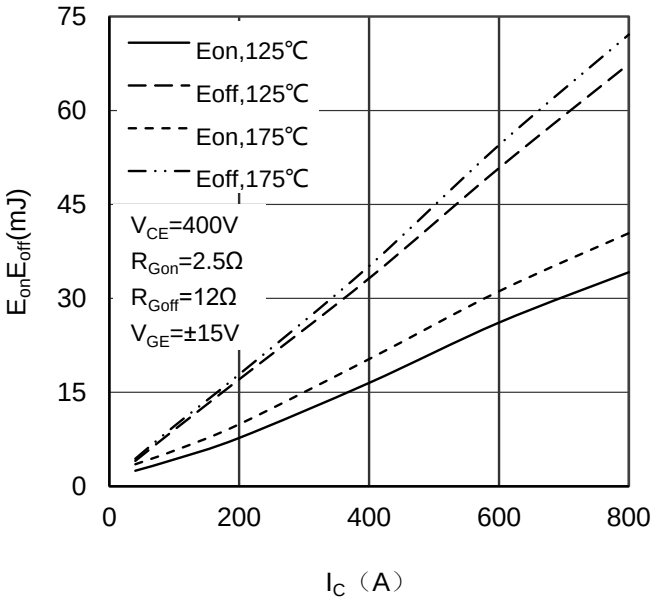


Figure 5. Switching Energy vs Collector Current IGBT

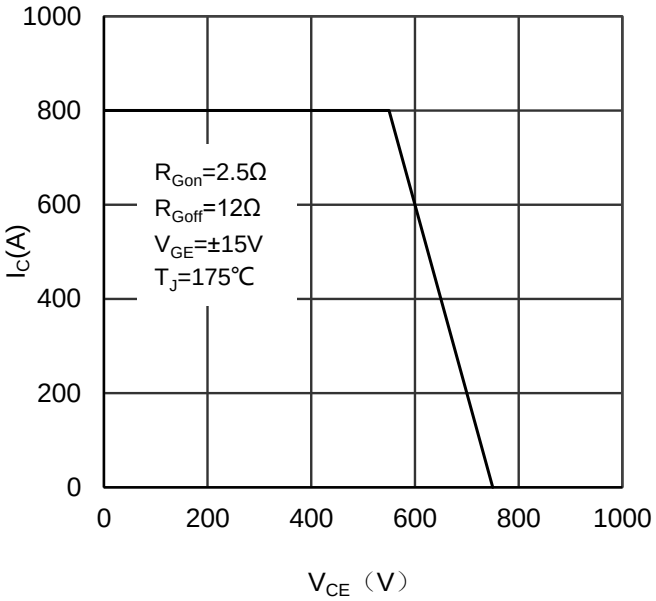


Figure 6. Reverse Biased Safe Operating Area IGBT

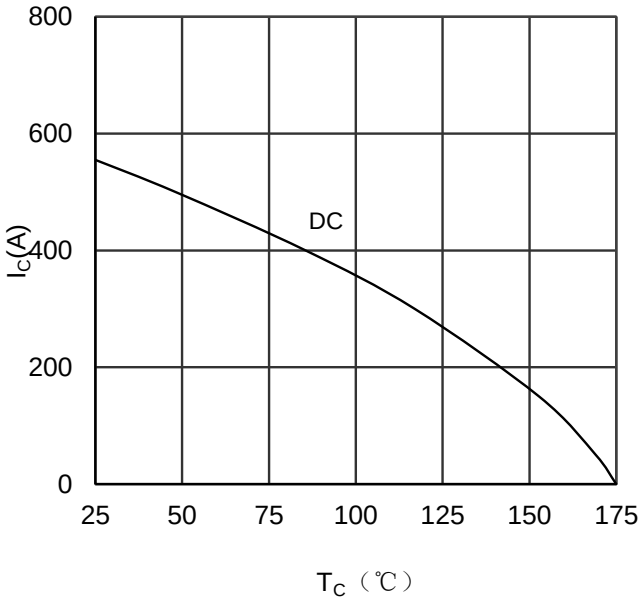


Figure 7. Collector Current vs Case temperature IGBT

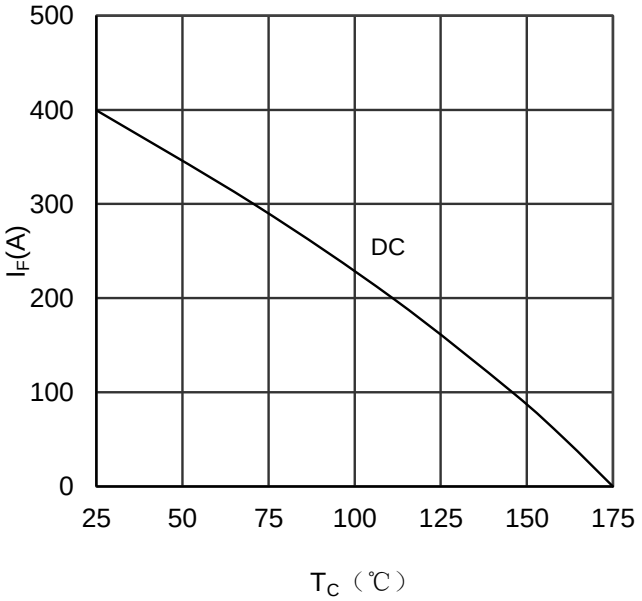


Figure 8. Forward current vs Case temperature Diode

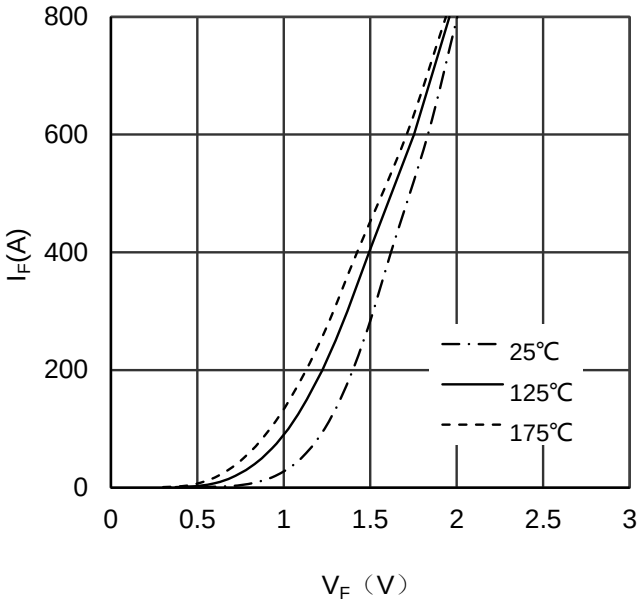


Figure 9. Diode Forward Characteristics Diode

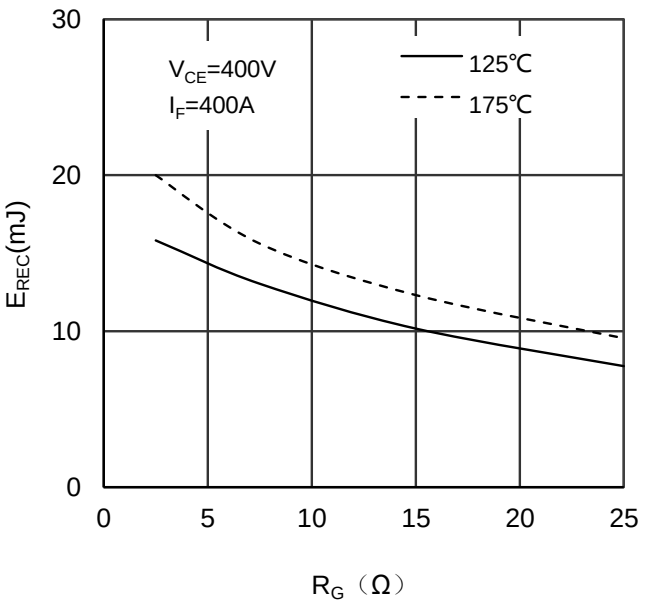


Figure 10. Switching Energy vs Gate Resistor Diode

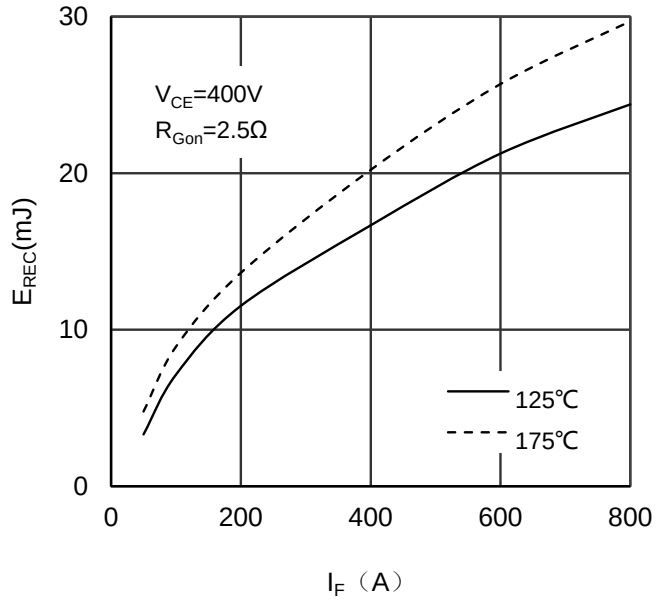


Figure 11. Switching Energy vs Forward Current Diode

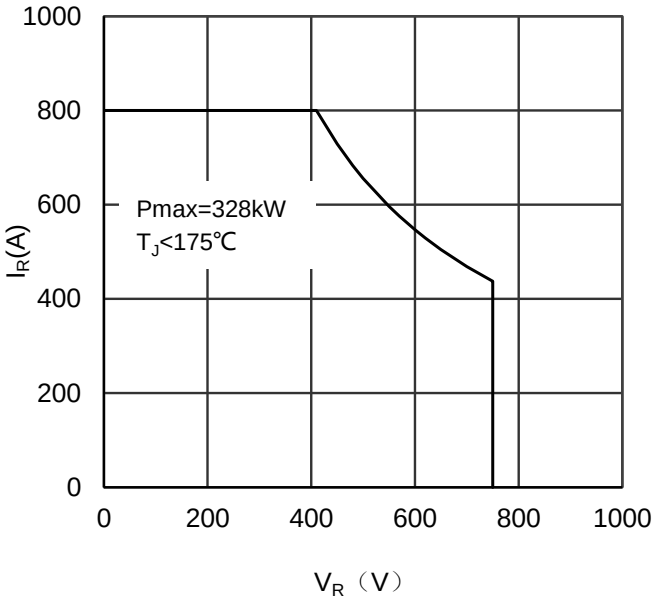


Figure 12. Safe Operating Area Diode

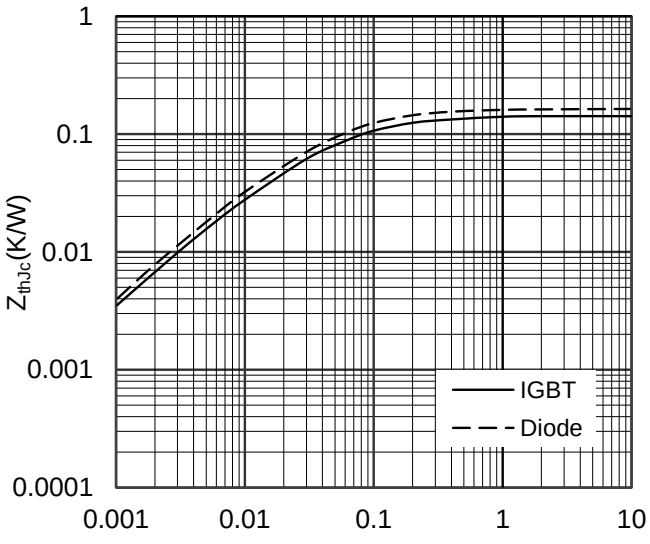


Figure 13. Transient Thermal Impedance of Diode and IGBT

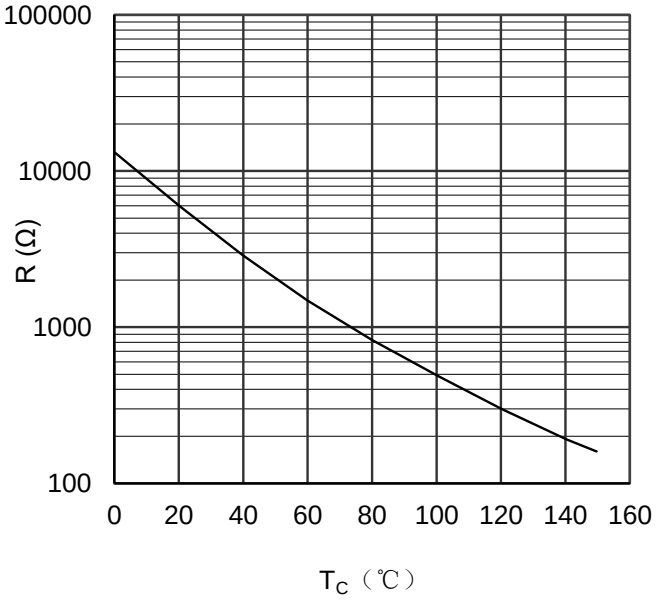


Figure 14. NTC Characteristics

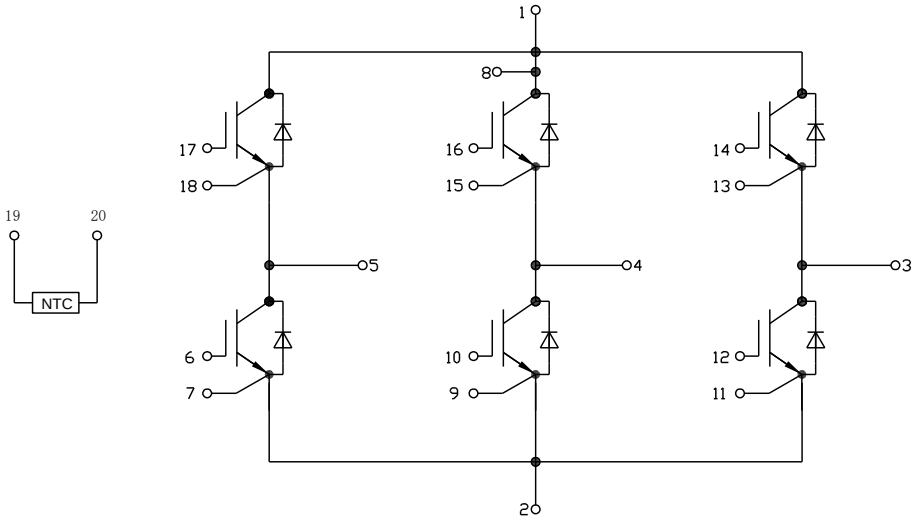
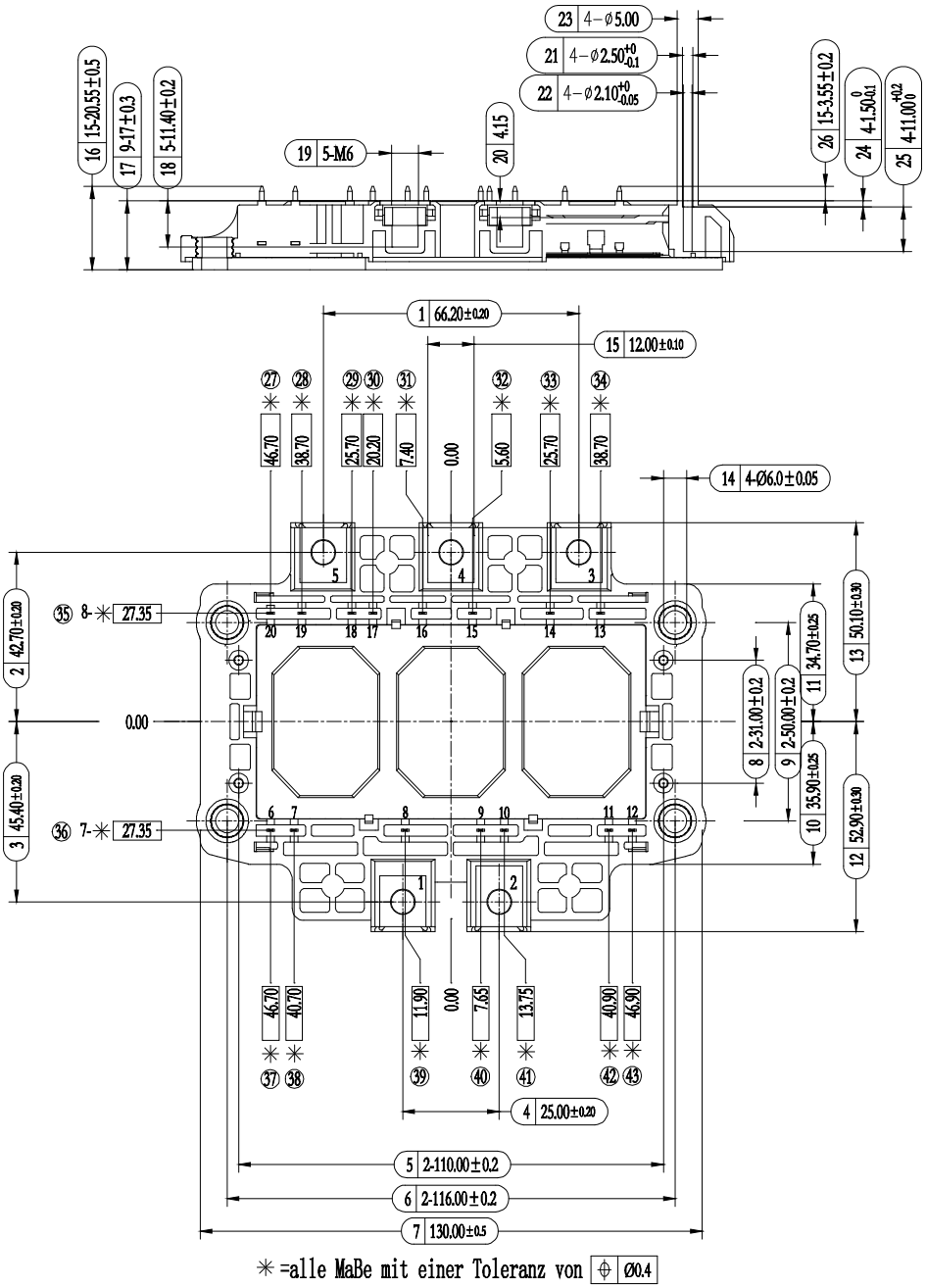


Figure 15. Circuit Diagram



Dimensions in (mm)

Figure 16. Package Outline