# MMG600V075X6T7

750V IGBT Module

September 2024 Version 01 RoHS Compliant

## PRODUCT FEATURES

☐ 750V Field Stop Trench IGBT

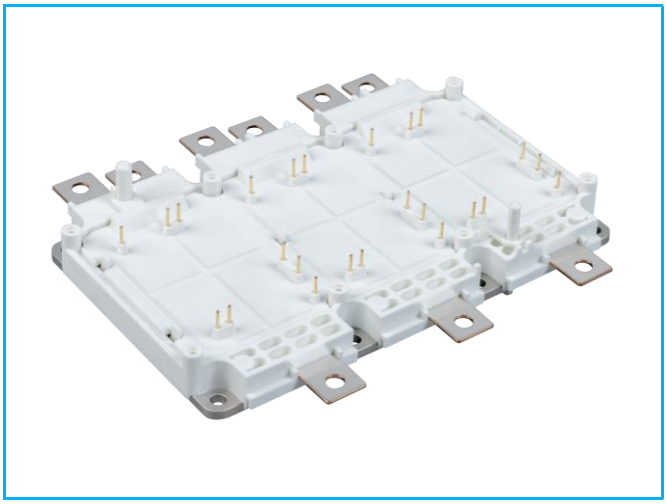
☐ $V_{CE(sat)}$ with positive temperature coefficient

☐ Fast switching and short tail current

☐ Free wheeling diodes with fast and soft reverse recovery

☐ Max Junction Temperature 175°C

☐ Temperature sense included



## APPLICATIONS

☐ Automotive Traction Modules

☐ General Power Modules

IGBT-inverter

ABSOLUTE MAXIMUM RATINGS($T_F$ *=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 | |
| $I_{CN}$ | Implemented Collector Current | | 600 | A |
| $I_C$ | DC Collector Current | $T_F$=80℃, $T_{Jmax}$=175℃ | 300 | |
| $I_{CM}$ | Repetitive Peak Collector Current | tp=1ms | 1200 | |
| $T_{Jmax}$ | Max. Junction Temperature | | 175 | ℃ |
| $P_{tot}$ | Power Dissipation Per IGBT | $T_F$=25℃, $T_{Jmax}$=175℃ | 937 | W |

Diode-inverter

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

| Symbol | Parameter/Test Conditions | | Values | Unit |
|---|---|---|---|---|
| $V_{RRM}$ | Repetitive Reverse Voltage | $T_J$=25℃ | 750 | V |
| $I_{FN}$ | Implemented Forward Current | | 600 | A |
| $I_{F(AV)}$ | Average Forward Current | $T_F$=50℃, $T_{Jmax}$=175℃ | 300 | |
| $I_{FRM}$ | Repetitive Peak Forward Current | tp=1ms | 1200 | |
| $I^2t$ | | $T_J$=125℃, t=10ms, $V_R$=0V | 12.8 | $kA^2s$ |
| $T_{Jmax}$ | Max. Junction Temperature | | 175 | ℃ |

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IGBT-inverter

ELECTRICAL CHARACTERISTICS *($T_F$=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 | | 5.0 | 5.9 | 6.5 | V |
| $V_{CE(sat)}$ | Collector Emitter Saturation Voltage | $I_C$=300A, $V_{GE}$=15V, $T_J$=25℃ | | | 1.11 | 1.4 | |
| | | $I_C$=300A, $V_{GE}$=15V, $T_J$=125℃ | | | 1.11 | | |
| | | $I_C$=300A, $V_{GE}$=15V, $T_J$=150℃ | | | 1.11 | | |
| | | $I_C$=600A, $V_{GE}$=15V, $T_J$=25℃ | | | 1.4 | | |
| | | $I_C$=600A, $V_{GE}$=15V, $T_J$=125℃ | | | 1.51 | | |
| | | $I_C$=600A, $V_{GE}$=15V, $T_J$=150℃ | | | 1.55 | | |
| $I_{CES}$ | Collector Leakage Current | $V_{CE}$=750V, $V_{GE}$=0V, $T_J$=25℃ | | | | 20 | μA |
| $I_{GES}$ | Gate Leakage Current | $V_{CE}$=0V,$V_{GE}$=±20V, $T_J$=25℃ | | -400 | | 400 | nA |
| $R_{Gint}$ | Integrated Gate Resistor | | | | 1.2 | | Ω |
| $Q_G$ | Gate Charge | $V_{CE}$=400V, $I_C$=300A , $V_{GE}$=15V | | | 1.6 | | μC |
| $C_{ies}$ | Input Capacitance | $V_{CE}$=25V, $V_{GE}$=0V, f =100kHz | | | 56 | | nF |
| $C_{oes}$ | Output Capacitance | | | | 3 | | nF |
| $C_{res}$ | Reverse Transfer Capacitance | | | | 0.27 | | nF |
| $t_{d(on)}$ | Turn on Delay Time | $V_{CC}$=400V,$I_C$=300A $R_G$ =5.1Ω, $V_{GE}$=±15V, Inductive Load | $T_J$=25℃ | | 225 | | ns |
| | | | $T_J$=150℃ | | 235 | | ns |
| $t_r$ | Rise Time | | $T_J$=25℃ | | 65 | | ns |
| | | | $T_J$=150℃ | | 80 | | ns |
| $t_{d(off)}$ | Turn off Delay Time | $V_{CC}$=400V,$I_C$=300A $R_G$ =5.1Ω, $V_{GE}$=±15V, Inductive Load | $T_J$=25℃ | | 570 | | ns |
| | | | $T_J$=150℃ | | 680 | | ns |
| $t_f$ | Fall Time | | $T_J$=25℃ | | 80 | | ns |
| | | | $T_J$=150℃ | | 150 | | ns |
| $E_{on}$ | Turn on Energy | $V_{CC}$=400V,$I_C$=300A $R_G$ =5.1Ω, $V_{GE}$=±15V, Inductive Load | $T_J$=25℃ | | 11 | | mJ |
| | | | $T_J$=125℃ | | 15.3 | | mJ |
| | | | $T_J$=150℃ | | 16.6 | | mJ |
| $E_{off}$ | Turn off Energy | | $T_J$=25℃ | | 13.2 | | mJ |
| | | | $T_J$=125℃ | | 19.3 | | mJ |
| | | | $T_J$=150℃ | | 21 | | mJ |
| $I_{SC}$ | Short Circuit Current | tpsc≤5μs , $V_{GE}$=15V $T_J$=150℃,$V_{CC}$=400V | | | 2400 | | A |
| $R_{thJF}$ | Junction to cooling fluid, △V/△t = 10 dm³/min, $T_F$ = 60°C | | | | | 0.16 | K /W |

Diode-inverter

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

| Symbol | Parameter/Test Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_F$ | Forward Voltage | $I_F$=300A , $V_{GE}$=0V, $T_J$=25℃ | | 1.42 | 1.7 | V |
| | | $I_F$=300A , $V_{GE}$=0V, $T_J$=125℃ | | 1.42 | | |
| | | $I_F$=300A , $V_{GE}$=0V, $T_J$=150℃ | | 1.42 | | |
| | | $I_F$=600A , $V_{GE}$=0V, $T_J$=25℃ | | 1.78 | 2.05 | |
| | | $I_F$=600A , $V_{GE}$=0V, $T_J$=125℃ | | 1.86 | | |
| | | $I_F$=600A , $V_{GE}$=0V, $T_J$=150℃ | | 1.86 | | |
| $t_{rr}$ | Reverse Recovery Time | $I_F$=300A , $V_R$=400V<br>$dI_F/dt$=-4500A/μs<br>$T_J$ =150℃ | | 320 | | ns |
| $I_{RRM}$ | Max. Reverse Recovery Current | | | 250 | | A |
| $Q_{RR}$ | Reverse Recovery Charge | | | 37.6 | | μC |
| $E_{rec}$ | Reverse Recovery Energy | | | 12.7 | | mJ |
| $R_{thJF}$ | Junction to cooling fluid, △V/△t = 10 dm³/min, $T_F$ = 60°C | | | | 0.25 | K /W |

NTC CHARACTERISTICS *($T_F$=25°C unless otherwise specified)*

| Symbol | Parameter/Test Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $R_{25}$ | Resistance | $T_F$ =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 *($T_F$=25°C unless otherwise specified)*

| Symbol | Parameter/Test Conditions | | Values | Unit |
|---|---|---|---|---|
| $T_{Jop}$ | Operating Temperature | | -40~150 | ℃ |
| $T_{stg}$ | Storage Temperature | | -40~125 | |
| $L_{sCE}$ | Stray Inductance Module | | 8 | nH |
| $R_{CC'+EE'}$ | Module Lead Resistance, terminals - chip | $T_F$=25℃ , per switch | 0.7 | mΩ |
| $V_{isol}$ | Isolation Breakdown Voltage | RMS, f = 0 Hz, t = 1 sec | 4200 | V |
| CTI | Comparative Tracking Index | | > 200 | |
| Torque | baseplate to heatsink | Recommended（M4） | 1.8~2.2 | Nm |
| | PCB to frame | Recommended（M3） | 0.4~0.6 | Nm |
| Weight | | | 775 | g |

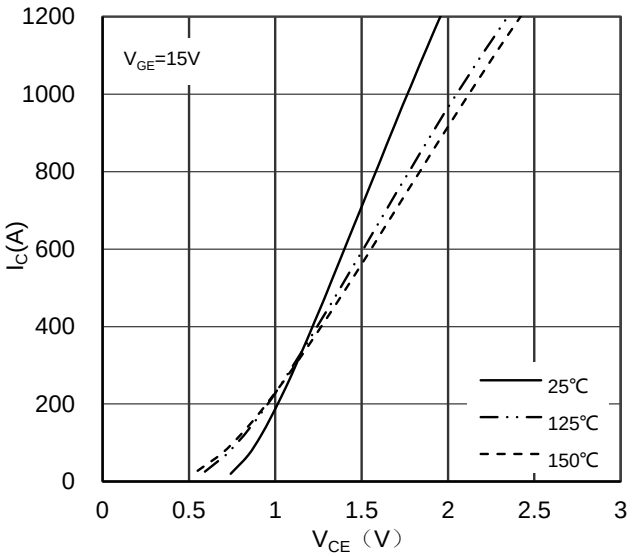



Figure 1. Typical Output Characteristics IGBT-inverter

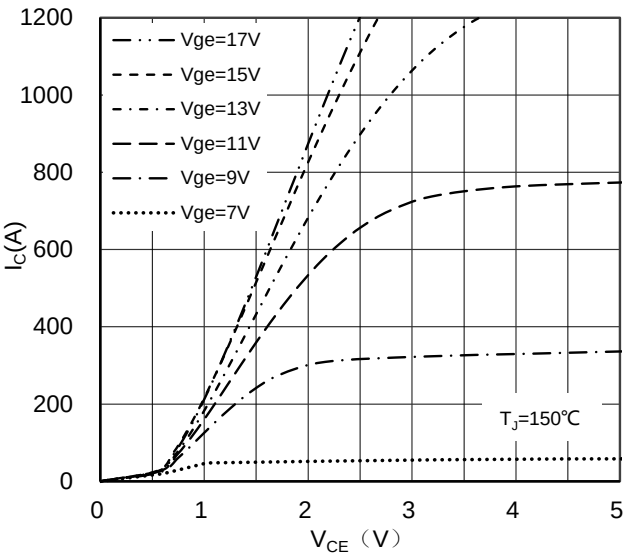



Figure 2. Typical Output Characteristics IGBT-inverter

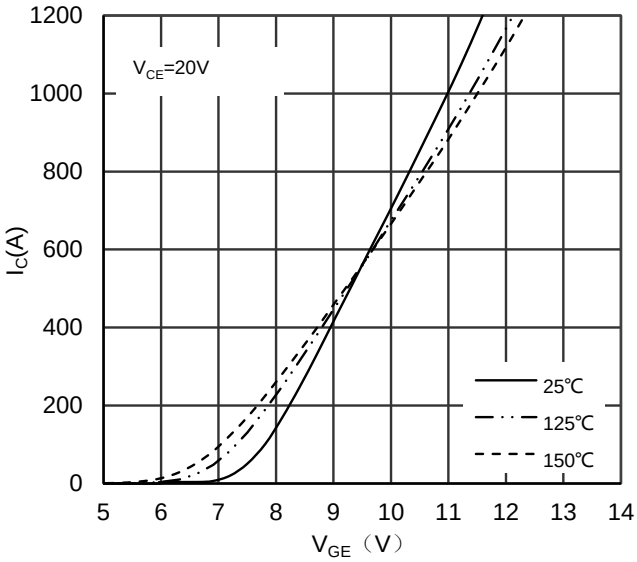



Figure 3. Typical Transfer characteristics IGBT-inverter

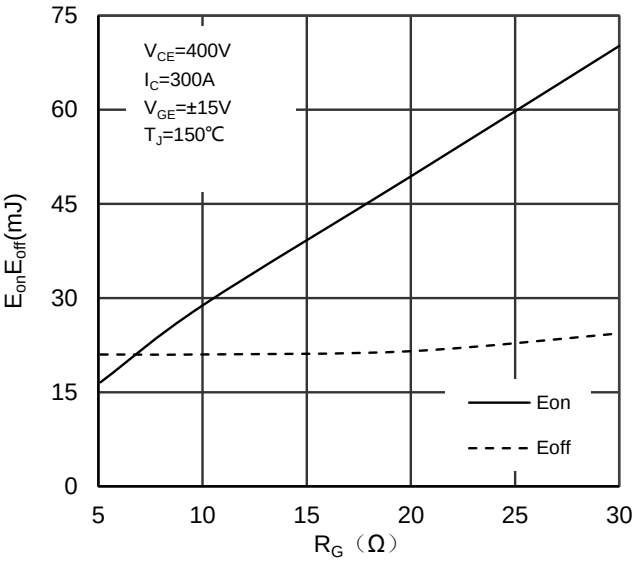



Figure 4. Switching Energy vs Gate Resistor IGBT-inverter

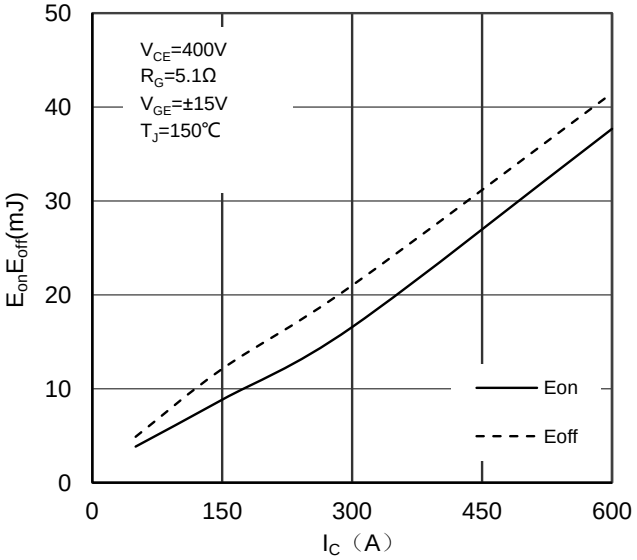



Figure 5. Switching Energy vs Collector Current IGBT-inverter

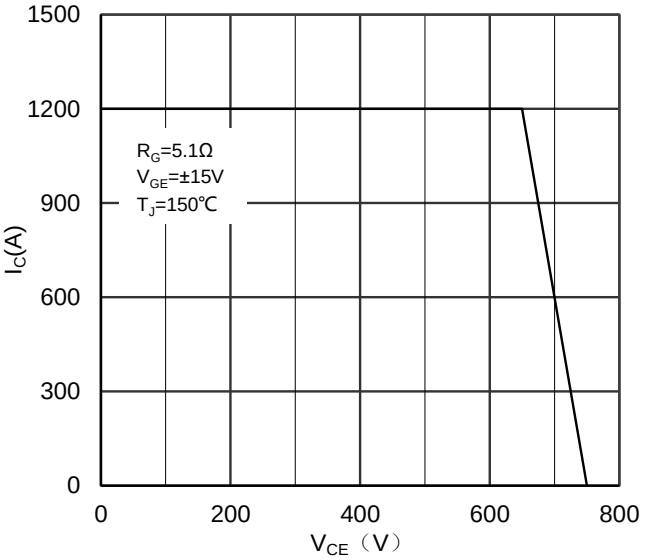



Figure 6. Reverse Biased Safe Operating Area IGBT-inverter

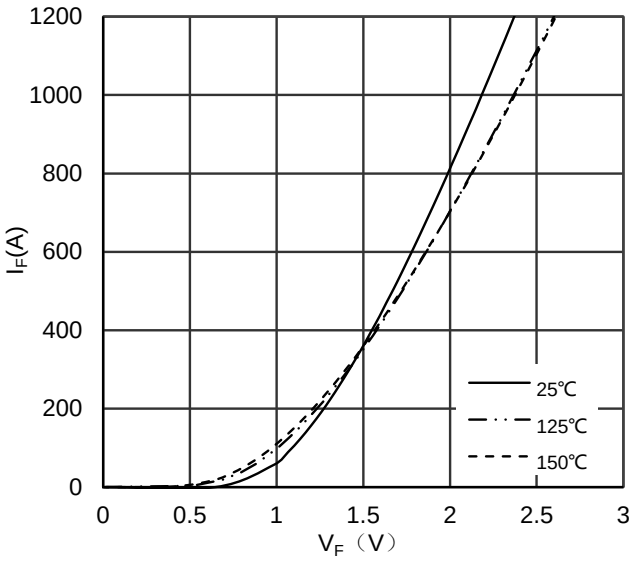



Figure 7. Diode Forward Characteristics Diode-inverter

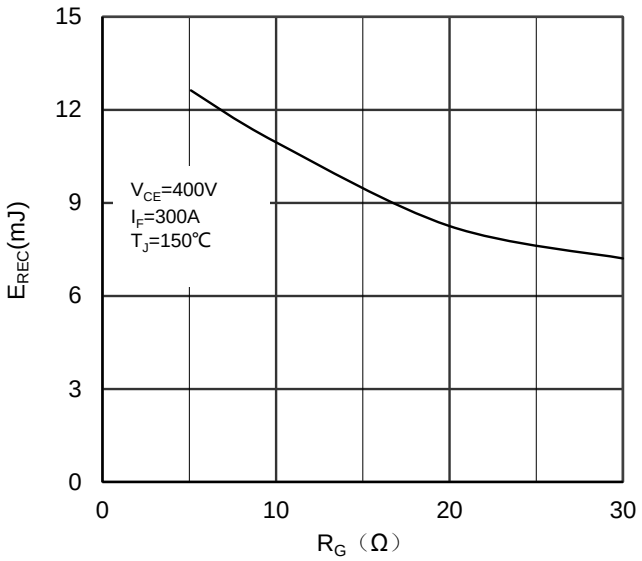



Figure 8. Switching Energy vs Gate Resistor Diode-inverter

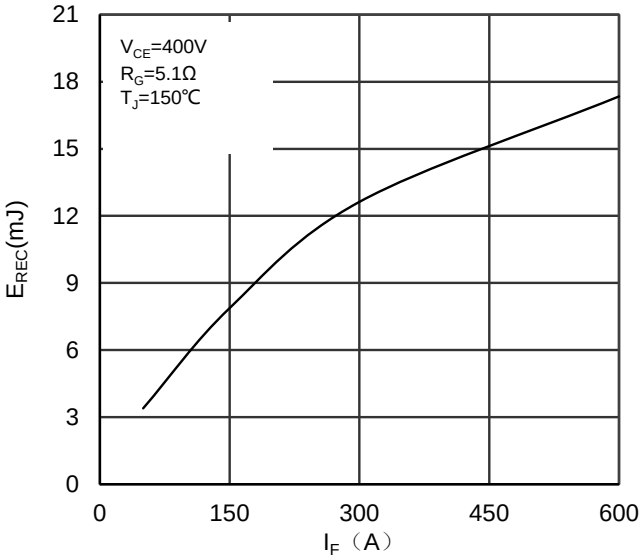



Figure 9. Switching Energy vs Forward Current Diode-inverter

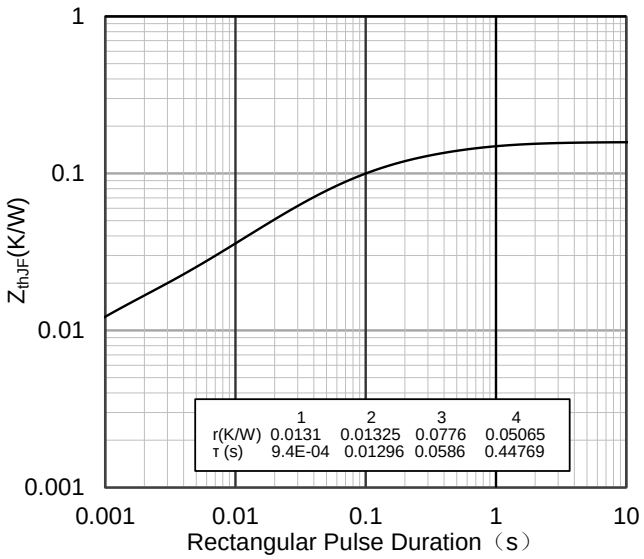



Figure 10. Transient Thermal Impedance of IGBT-inverter

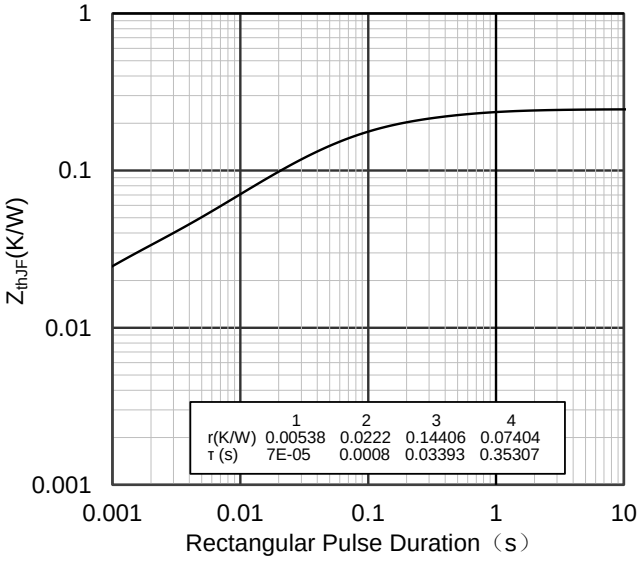



Figure 11. Transient Thermal Impedance of Diode-inverter

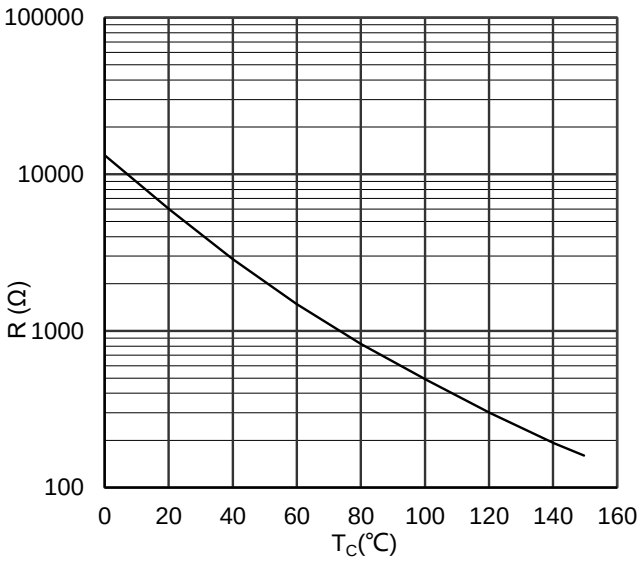



Figure 12. NTC Characteristics

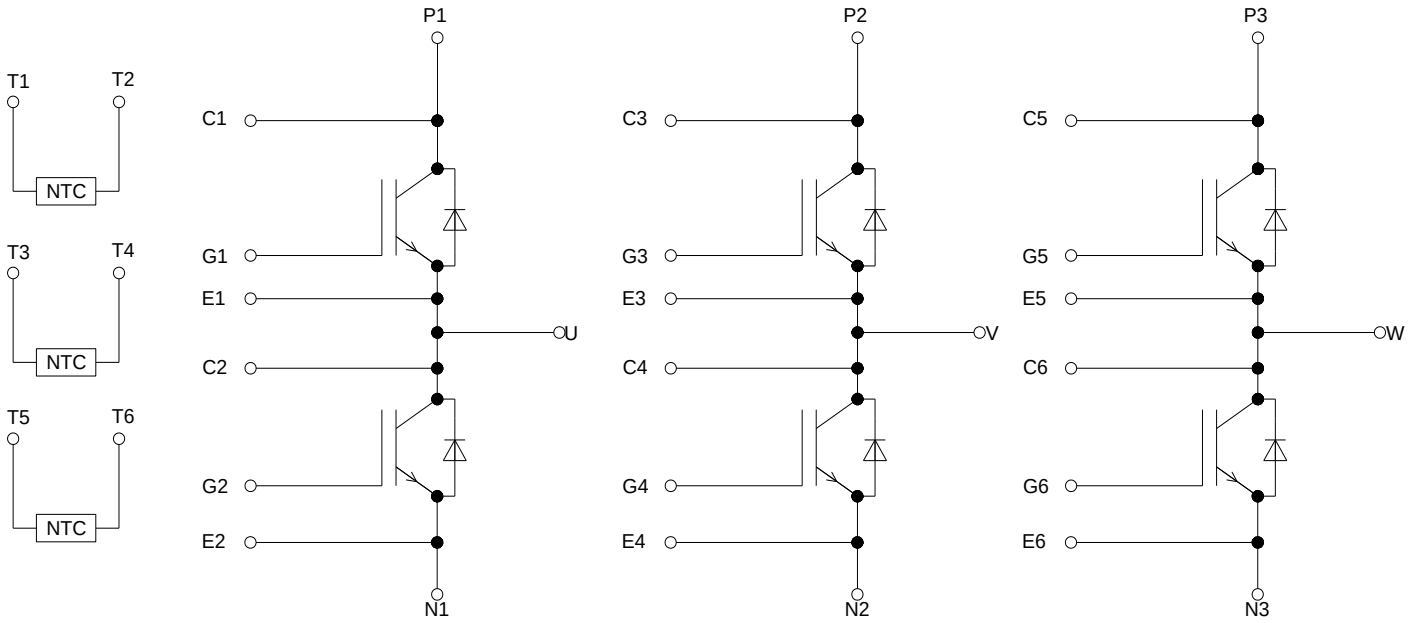
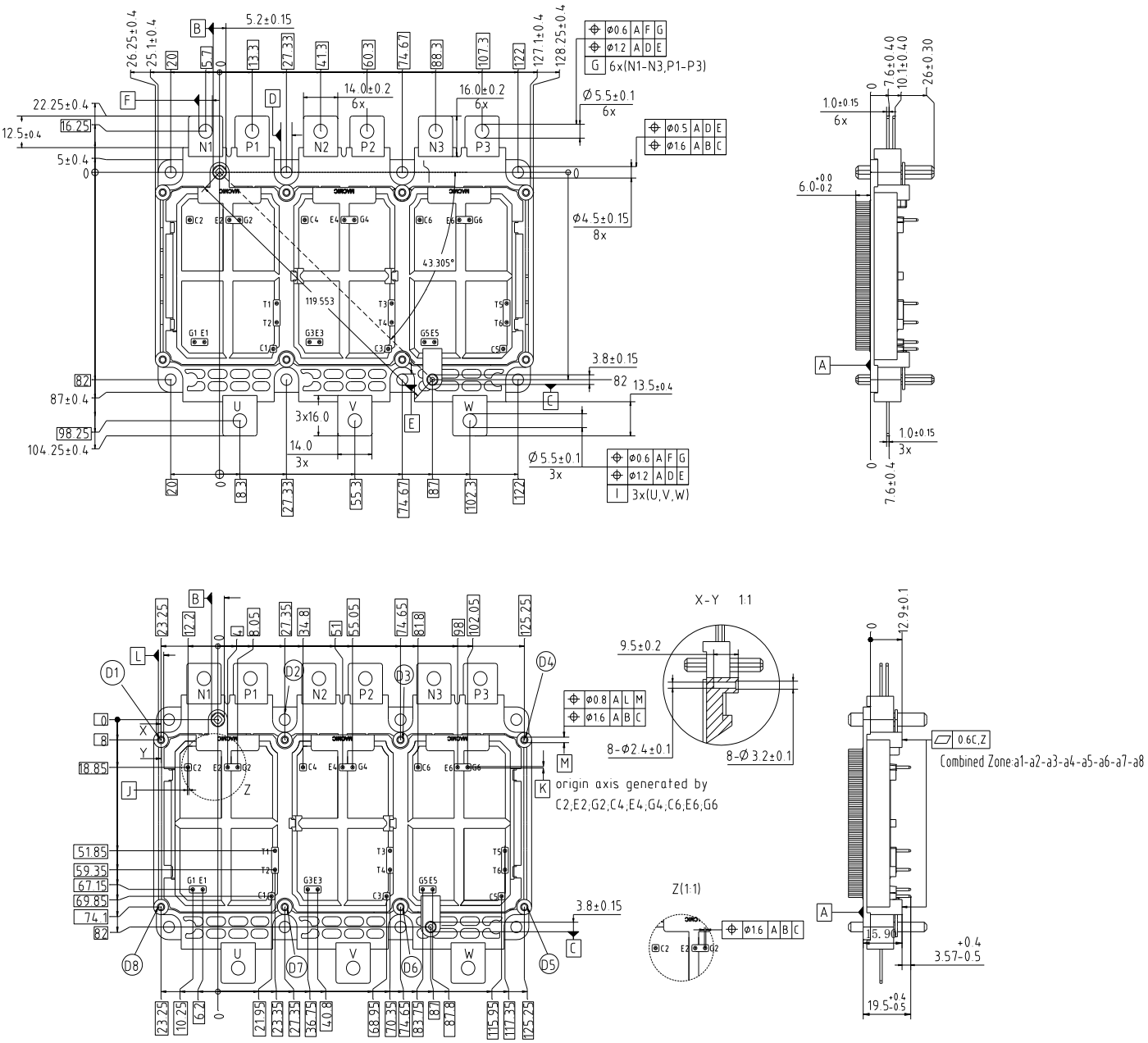



Figure 13. Circuit Diagram




Dimensions in (mm)

Figure 14. Package Outline