

FMM7G30US60N

Compact & Complex Module

General Description

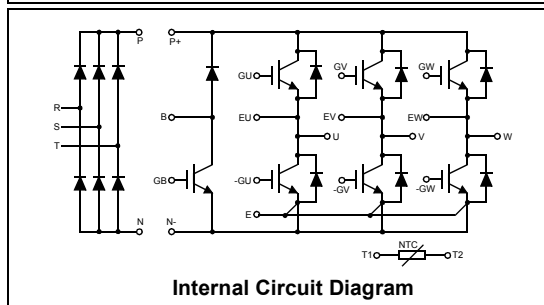
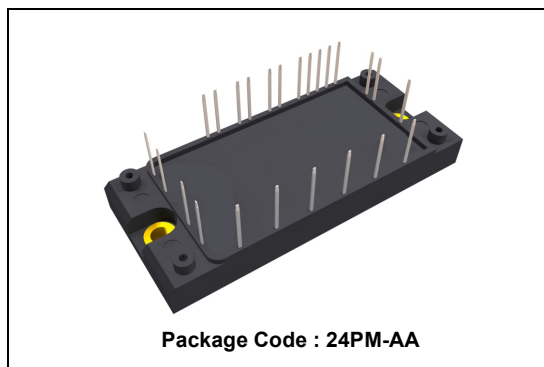
Fairchild IGBT Power Module provides low conduction and switching losses as well as short circuit ruggedness. It's designed for the applications such as motor control and general inverters where short-circuit ruggedness is required.

Features

- Short Circuit rated Time ; 10us @ $T_C = 100^\circ\text{C}$, $V_{GE} = 15\text{V}$
- High Speed Switching
- Low Saturation Voltage : $V_{CE(sat)} = 2.1\text{V}$ @ $I_C = 30\text{A}$
- High Input Impedance
- Built in Brake & 3 Phase Rectifier Circuit
- Fast & Soft Anti-Parallel FWD
- Built-in NTC Thermistor
- UL Certified No. E209204

Application

- AC & DC Motor Controls
- General Purpose Inverters
- Robotics
- Servo Controls



Absolute Maximum Ratings $T_C = 25^\circ\text{C}$ unless otherwise noted

| | Symbol | Description | FMM7G30US60N | Units |
|------------------|-------------|---|--------------|----------------------|
| Inverter & Brake | V_{CES} | Collector-Emitter Voltage | 600 | V |
| | V_{GES} | Gate-Emitter Voltage | ± 20 | V |
| | I_C | Collector Current @ $T_C = 80^\circ\text{C}$ | 30 | A |
| | $I_{CM(1)}$ | Pulsed Collector Current | 60 | A |
| | I_F | Diode Continuous Forward Current @ $T_C = 80^\circ\text{C}$ | 30 | A |
| | I_{FM} | Diode Maximum Forward Current | 60 | A |
| | P_D | Maximum Power Dissipation @ $T_C = 25^\circ\text{C}$ | 104 | W |
| Converter | T_{SC} | Short Circuit Withstand Time @ $T_C = 100^\circ\text{C}$ | 10 | us |
| | V_{RRM} | Repetitive Peak Reverse Voltage | 1600 | V |
| | I_O | Average Output Rectified Current | 30 | A |
| | I_{FSM} | Surge Forward Current @ 1Cycle at 60Hz, Peak value Non-Repetitive | 300 | A |
| Common | i^2t | Energy pulse @ 1Cycle at 60Hz | 369 | A^2s |
| | T_J | Operating Junction Temperature | -40 to +150 | $^\circ\text{C}$ |
| | T_{STG} | Storage Temperature Range | -40 to +125 | $^\circ\text{C}$ |
| | V_{ISO} | Isolation Voltage @ AC 1minute | 2500 | V |
| Mounting Torque | | Mounting part Screw @ M4 | 4.0 | N.m |

Notes :

(1) Repetitive rating : Pulse width limited by max. junction temperature

Electrical Characteristics of IGBT @ Inverter & Brake $T_C = 25^\circ\text{C}$ unless otherwise noted

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Units |
|------------------------------|---|---------------------------------|------|------|-----------|--------------|
| Off Characteristics | | | | | | |
| BV_{CES} | Collector-Emitter Breakdown Voltage | $V_{GE} = 0V, I_C = 250\mu A$ | 600 | -- | -- | V |
| $\Delta BV_{CES}/\Delta T_J$ | Temperature Coeff. of Breakdown Voltage | $V_{GE} = 0V, I_C = 1mA$ | -- | 0.6 | -- | $V/^\circ C$ |
| I_{CES} | Collector Cut-Off Current | $V_{CE} = V_{CES}, V_{GE} = 0V$ | -- | -- | 250 | μA |
| I_{GES} | Gate - Emitter Leakage Current | $V_{GE} = V_{GES}, V_{CE} = 0V$ | -- | -- | ± 100 | nA |

On Characteristics

| | | | | | | |
|---------------|---|-------------------------------|-----|-----|-----|---|
| $V_{GE(th)}$ | Gate - Emitter Threshold Voltage | $I_C = 30mA, V_{CE} = V_{GE}$ | 5.0 | 6.5 | 8.5 | V |
| $V_{CE(sat)}$ | Collector to Emitter Saturation Voltage | $I_C = 30A, V_{GE} = 15V$ | -- | 2.1 | 2.7 | V |

Dynamic Characteristics

| | | | | | | |
|-----------|------------------------------|--|----|------|----|----|
| C_{ies} | Input Capacitance | $V_{CE} = 30V, V_{GE} = 0V,$ $f = 1MHz$ | -- | 2100 | -- | pF |
| C_{oes} | Output Capacitance | | -- | 270 | -- | pF |
| C_{res} | Reverse Transfer Capacitance | | -- | 36 | -- | pF |

Switching Characteristics

| | | | | | | |
|--------------|------------------------------|---|----|------|-----|----|
| $t_{d(on)}$ | Turn-On Delay Time | $V_{CC} = 300V, I_C = 30A,$ $R_G = 15\Omega, V_{GE} = 15V,$ Inductive Load, $T_C = 25^\circ C$ | -- | 110 | 150 | ns |
| t_r | Rise Time | | -- | 90 | 200 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | -- | 150 | 200 | ns |
| t_f | Fall Time | | -- | 130 | 250 | ns |
| E_{on} | Turn-On Switching Loss | | -- | 0.9 | -- | mJ |
| E_{off} | Turn-Off Switching Loss | | -- | 0.58 | -- | mJ |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{CC} = 300V, I_C = 30A,$ $R_G = 15\Omega, V_{GE} = 15V,$ Inductive Load, $T_C = 125^\circ C$ | -- | 100 | 150 | ns |
| t_r | Rise Time | | -- | 90 | 200 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | -- | 150 | 200 | ns |
| t_f | Fall Time | | -- | 200 | 400 | ns |
| E_{on} | Turn-On Switching Loss | | -- | 0.98 | -- | mJ |
| E_{off} | Turn-Off Switching Loss | | -- | 0.9 | -- | mJ |
| T_{sc} | Short Circuit Withstand Time | $V_{CC} = 300V, V_{GE} = 15V$ @ $T_C = 100^\circ C$ | 10 | -- | -- | us |
| Q_g | Total Gate Charge | $V_{CE} = 300V, I_C = 30A,$ $V_{GE} = 15V$ | -- | 90 | 150 | nC |
| Q_{ge} | Gate-Emitter Charge | | -- | 20 | 40 | nC |
| Q_{gc} | Gate-Collector Charge | | -- | 35 | 70 | nC |

Electrical Characteristics of DIODE @ Inverter & Brake $T_C = 25^\circ\text{C}$ unless otherwise noted

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Units | |
|----------|-------------------------------------|---|---------------------------|------|------|-------|----|
| V_{FM} | Diode Forward Voltage | $I_F = 30\text{A}$ | $T_C = 25^\circ\text{C}$ | -- | 2.0 | 2.8 | V |
| | | | $T_C = 100^\circ\text{C}$ | -- | 2.0 | -- | |
| t_{rr} | Diode Reverse Recovery Time | | $T_C = 25^\circ\text{C}$ | -- | 90 | 180 | ns |
| | | | $T_C = 100^\circ\text{C}$ | -- | 130 | -- | |
| I_{rr} | Diode Peak Reverse Recovery Current | $I_F = 30\text{A}$ $di / dt = 60 \text{ A/us}$ | $T_C = 25^\circ\text{C}$ | -- | 2.2 | 3.4 | A |
| | | | $T_C = 100^\circ\text{C}$ | -- | 3.4 | -- | |
| Q_{rr} | Diode Reverse Recovery Charge | | $T_C = 25^\circ\text{C}$ | -- | 400 | 600 | nC |
| | | | $T_C = 100^\circ\text{C}$ | -- | 880 | -- | |

Electrical Characteristics of DIODE @ Converter $T_C = 25^\circ\text{C}$ unless otherwise noted

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Units | |
|-----------|----------------------------|--------------------|---------------------------|------|------|-------|----|
| V_{FM} | Diode Forward Voltage | $I_F = 30\text{A}$ | $T_C = 25^\circ\text{C}$ | -- | 1.1 | 1.5 | V |
| | | | $T_C = 100^\circ\text{C}$ | -- | 1.0 | -- | |
| I_{RRM} | Repetitive Reverse Current | $V_R = V_{RRM}$ | $T_C = 25^\circ\text{C}$ | -- | -- | 8 | mA |
| | | | $T_C = 100^\circ\text{C}$ | -- | 5 | -- | |

Thermal Characteristics

| | Symbol | Parameter | Typ. | Max. | Units |
|-----------|-----------------|---|------|------|--------------------|
| Inverter | $R_{\theta JC}$ | Junction-to-Case (IGBT Part, per 1/6 Module) | -- | 1.2 | $^\circ\text{C/W}$ |
| | $R_{\theta JC}$ | Junction-to-Case (DIODE Part, per 1/6 Module) | -- | 1.5 | $^\circ\text{C/W}$ |
| Brake | $R_{\theta JC}$ | Junction-to-Case (IGBT Part) | -- | 1.2 | $^\circ\text{C/W}$ |
| | $R_{\theta JC}$ | Junction-to-Case (DIODE Part) | -- | 1.5 | $^\circ\text{C/W}$ |
| Converter | $R_{\theta JC}$ | Junction-to-Case (DIODE Part, per 1/6 Module) | -- | 1.3 | $^\circ\text{C/W}$ |
| Weight | | Weight of Module | 210 | -- | g |

NTC Thermistor Characteristics

| | Symbol | Parameter | Tol. | Typ. | Units |
|------------|----------------|--|---------|-------|------------------|
| Thermistor | R_{25} | Rated Resistance @ $T_C = 25^\circ\text{C}$ | +/- 5 % | 5.0 | $\text{K}\Omega$ |
| | R_{100} | Rated Resistance @ $T_C = 100^\circ\text{C}$ | +/- 5 % | 0.415 | $\text{K}\Omega$ |
| | $B_{(25/100)}$ | B - Value | +/- 3 % | 3692 | |

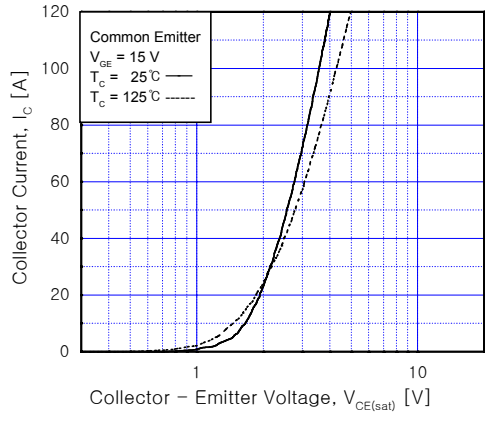


Fig 1. Typical Output Characteristics

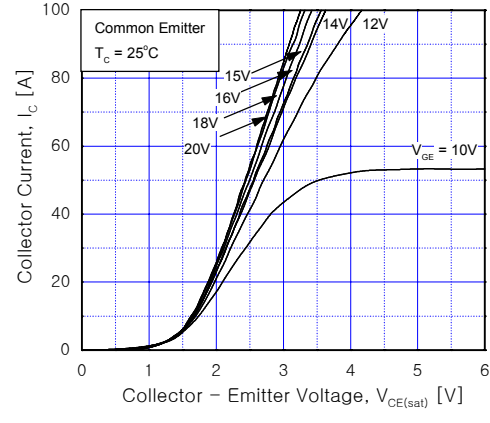


Fig 2. Typical Saturation Voltage Characteristics

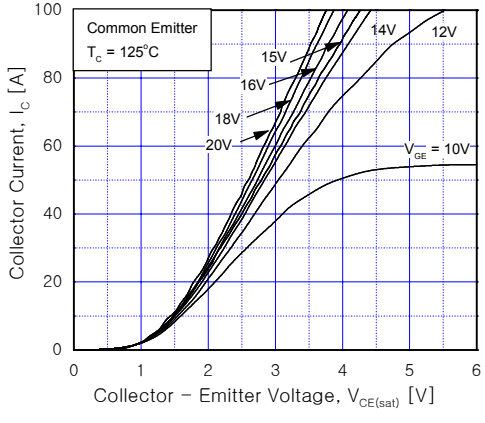


Fig 3. Typical Saturation Voltage Characteristics

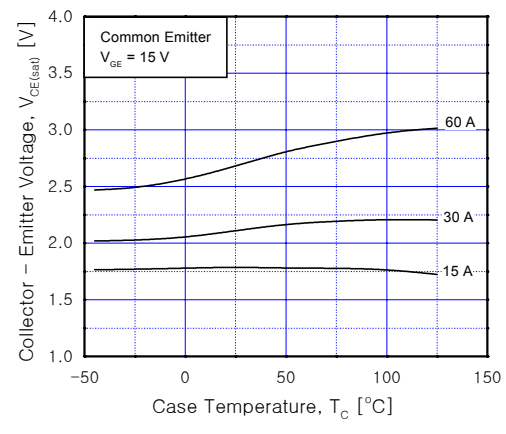


Fig 4. Saturation Voltage vs. Case Temperature at Variant Current Level

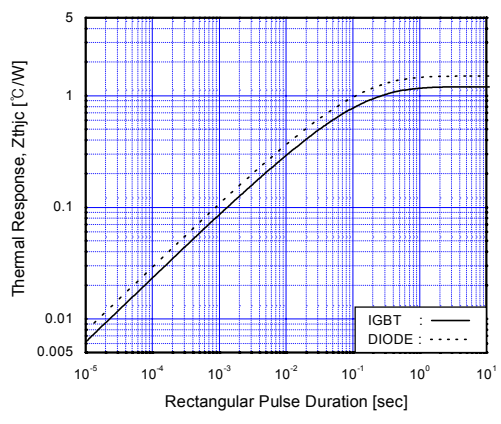


Fig 5. Transient Thermal Impedance

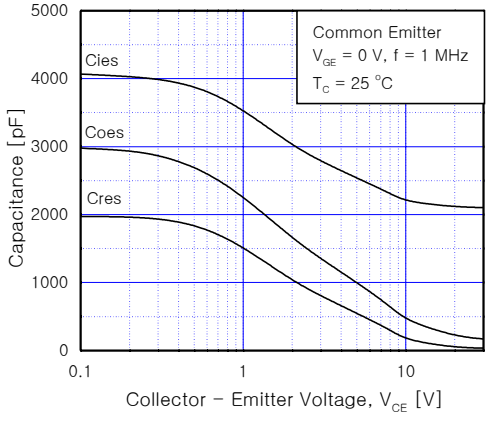


Fig 6. Capacitance Characteristics

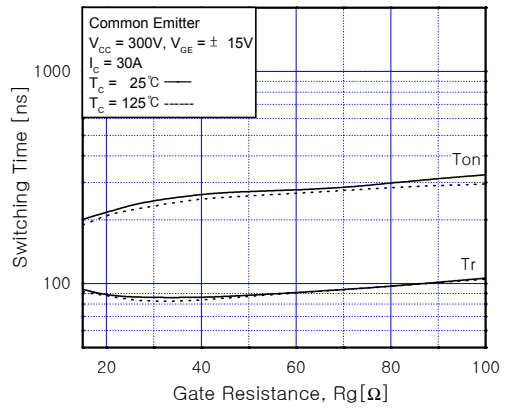


Fig 7. Turn-On Characteristics vs. Gate Resistance

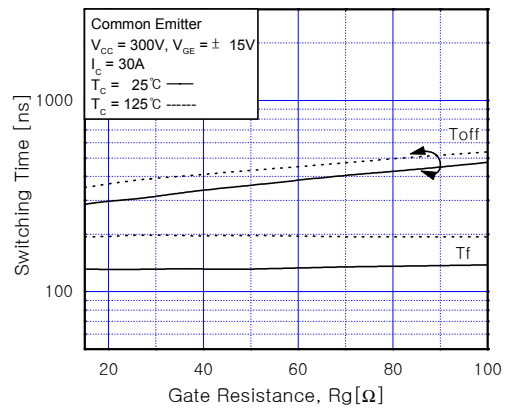


Fig 8. Turn-Off Characteristics vs. Gate Resistance

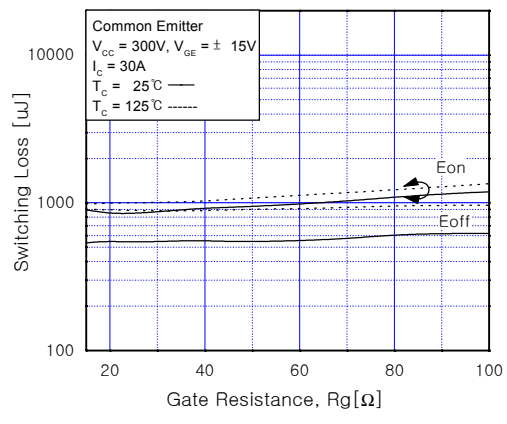


Fig 9. Switching Loss vs. Gate Resistance

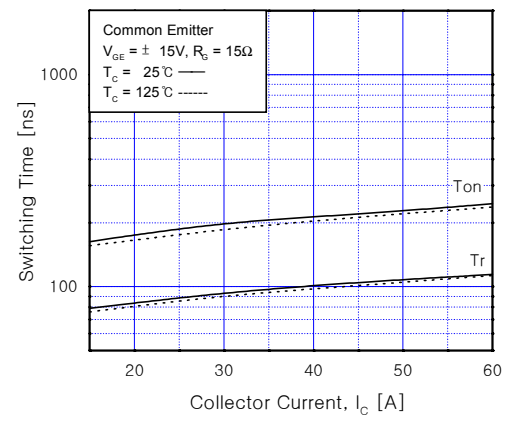


Fig 10. Turn-On Characteristics vs. Collector Current

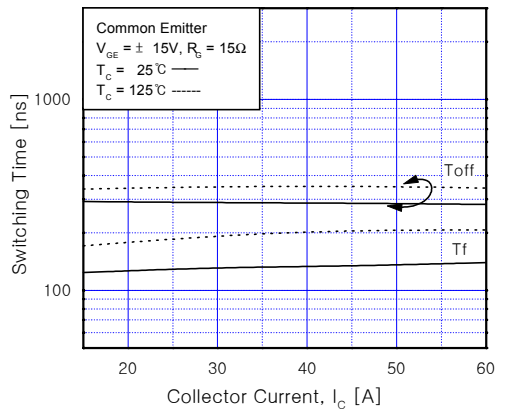


Fig 11. Turn-Off Characteristics vs. Collector Current

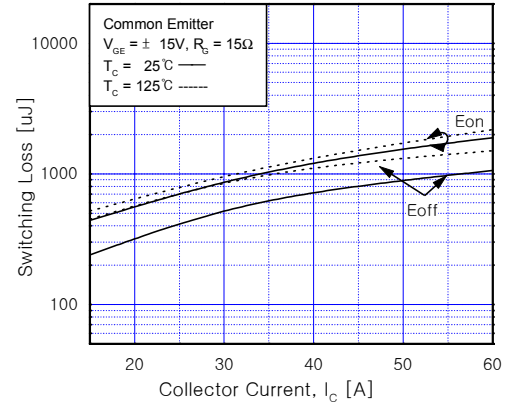


Fig 12. Switching Loss vs. Collector Current

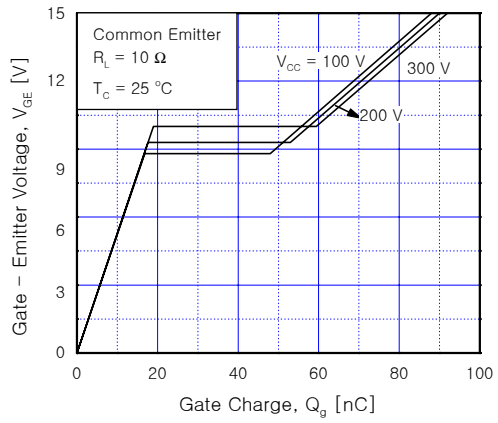


Fig 13. Gate Charge Characteristics

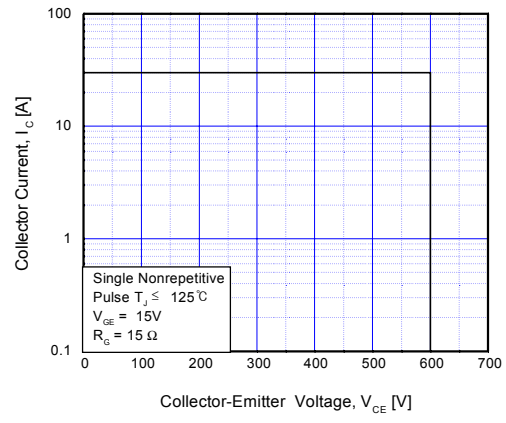


Fig 14. RBSOA Characteristics

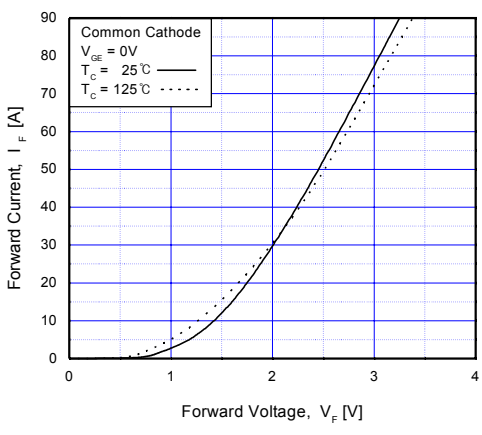


Fig 15. Forward Characteristics

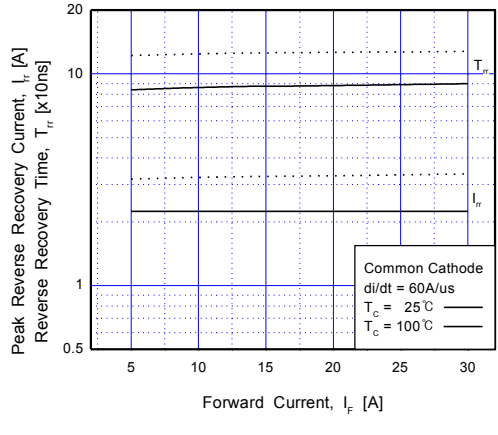


Fig 16. Reverse Recovery Characteristics

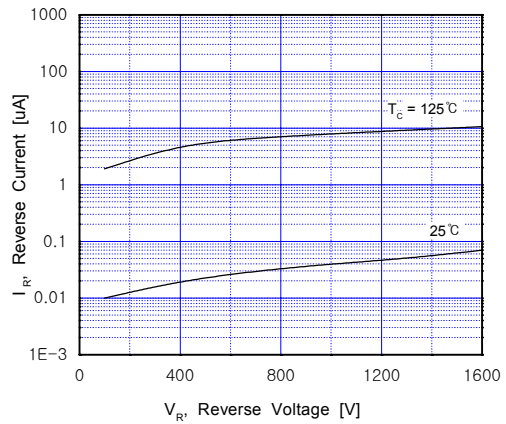


Fig 17. Rectifier (Converter) Characteristics

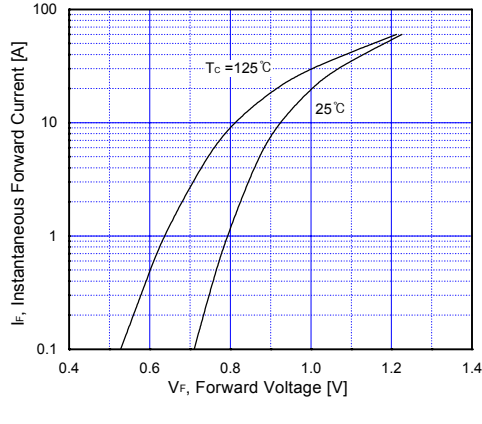


Fig 18. Rectifier (Converter) Characteristics

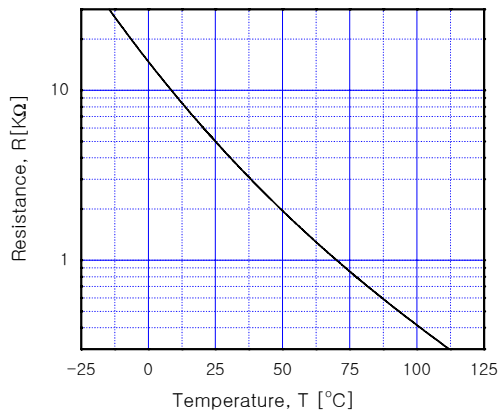


Fig 19. NTC Characteristics

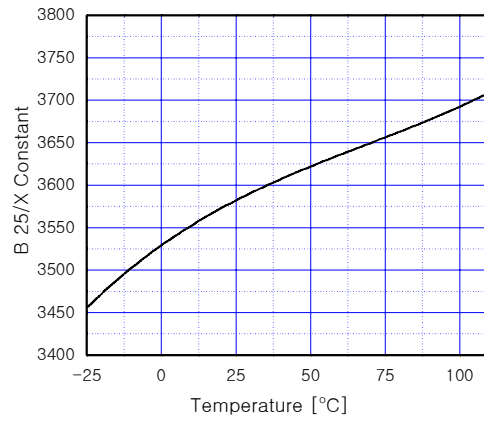
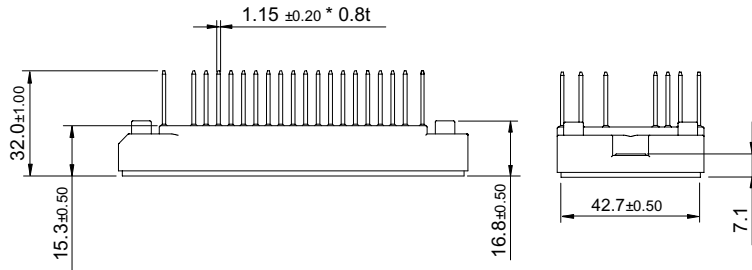
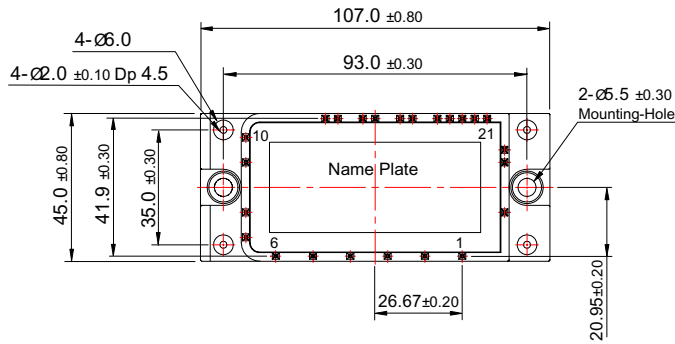


Fig 20. NTC Characteristics

Package Dimension

24PM-AA



-. Pin Coordinate

| Pin #No | Coordinate | |
|---------|------------|-------|
| | x | y |
| 1 | 0.0 | 0.0 |
| 2 | -11.43 | 0.0 |
| 3 | -22.86 | 0.0 |
| 4 | -34.29 | 0.0 |
| 5 | -45.72 | 0.0 |
| 6 | -57.15 | 0.0 |
| 7 | -66.27 | 5.71 |
| 8 | -66.27 | 13.33 |
| 9 | -66.27 | 28.57 |
| 10 | -66.27 | 36.19 |
| 11 | -41.91 | 41.90 |
| 12 | -38.10 | 41.90 |
| 13 | -30.48 | 41.90 |
| 14 | -26.67 | 41.90 |
| 15 | -19.05 | 41.90 |
| 16 | -15.24 | 41.90 |
| 17 | -7.62 | 41.90 |
| 18 | -3.81 | 41.90 |
| 19 | 0.0 | 41.90 |
| 20 | 3.81 | 41.90 |
| 21 | 7.62 | 41.90 |
| 22 | 12.93 | 32.38 |
| 23 | 12.93 | 28.57 |
| 24 | 12.93 | 13.33 |

- datum pin : #1
- Pin Tilt : ±0.20

Dimensions in Millimeters

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