TOSHIBA INTELLIGENT GTR MODULE SILICON N CHANNEL IGBT

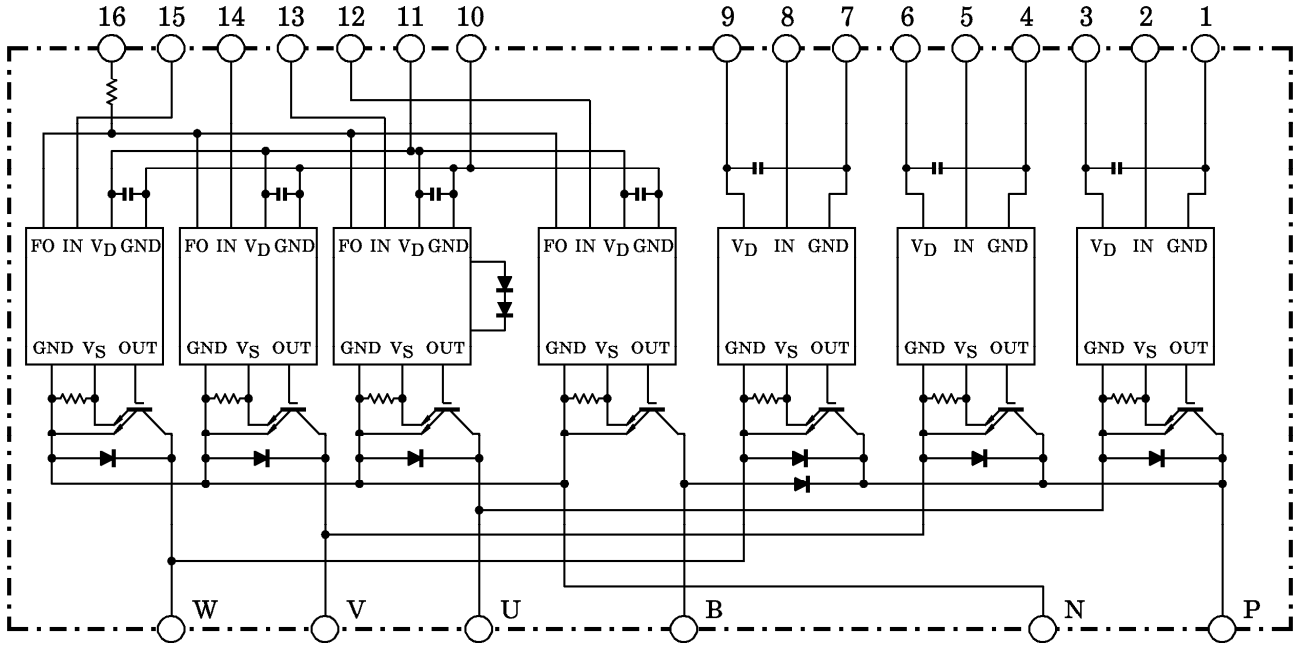
# MIG75J201H

HIGH POWER SWITCHING APPLICATIONS

MOTOR CONTROL APPLICATIONS

- Integrates Inverter, Brake Power Circuits & Control Circuits (IGBT drive units, Protection units for Over-Current, Under-Voltage & Over-Temperature) in One Package.
- The Electrodes are Isolated from Case.
- High Speed Type IGBT : $V_{CE\,(sat)}$ = 2.5V (Max.)
  $t_{off}$ = 3.0 $\mu$s (Max.)
  $t_{rr}$ = 0.30 $\mu$s (Max.)
- Outline : TOSHIBA 2-110A1A
- Weight : 520g

EQUIVALENT CIRCUIT




| | | | | | |
|---|---|---|---|---|---|
| 1. GND (U) | 2. IN (U) | 3. $V_D$ (U) | 4. GND (V) | 5. IN (V) | 6. $V_D$ (V) |
| 7. GND (W) | 8. IN (W) | 9. $V_D$ (W) | 10.GND (L) | 11.$V_D$ (L) | 12.IN (B) |
| 13.IN (X) | 14.IN (Y) | 15.IN (Z) | 16.FO | | |

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MAXIMUM RATINGS ($T_j$ = 25°C)

| STAGE | CHARACTERISTIC | CONDITION | SYMBOL | RATINGS | UNIT |
|---|---|---|---|---|---|
| Inverter | Supply Voltage | P-N power terminal | $V_{CC}$ | 450 | V |
| | Collector-Emitter Voltage | — | $V_{CES}$ | 600 | V |
| | Collector Current | Tc = 25°C, DC | $I_C$ | 75 | A |
| | Forward Current | Tc = 25°C, DC | $I_F$ | 75 | A |
| | Collector Power Dissipation | Tc = 25°C | $P_C$ | 195 | W |
| | Junction Temperature | — | $T_j$ | 150 | °C |
| Brake | Supply Voltage | P-N power terminal | $V_{CC}$ | 450 | V |
| | Collector-Emitter Voltage | — | $V_{CES}$ | 600 | V |
| | Collector Current | Tc = 25°C, DC | $I_C$ | 30 | A |
| | Reverse Voltage | — | $V_R$ | 600 | V |
| | Forward Current | Tc = 25°C, DC | $I_F$ | 30 | A |
| | Collector Power Dissipation | Tc = 25°C | $P_C$ | 80 | W |
| | Junction Temperature | — | $T_j$ | 150 | °C |
| Control | Control Supply Voltage | $V_D$-GND terminal | $V_D$ | 20 | V |
| | Input Voltage | IN-GND terminal | $V_{IN}$ | 20 | V |
| | Fault Output Voltage | FO-GND (L) terminal | $V_{FO}$ | 20 | V |
| | Fault Output Current | FO sink current | $I_{FO}$ | 14 | mA |
| Module | Operating Temperature | — | TC | −20 ~ +100 | °C |
| | Storage Temperature Range | — | $T_{stg}$ | −40 ~ +125 | °C |
| | Isolation Voltage | AC 1 minute | $V_{ISO}$ | 2500 | V |
| | Screw Torque | M5 | — | 3 | Nm |

ELECTRICAL CHARACTERISTICS ($T_j$ = 25°C)

a. Inverter stage

| CHARACTERISTIC | SYMBOL | TEST CONDITION | | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|---|
| Collector Cut-Off Current | $I_{CEX}$ | $V_{CEX}$ = 600V | $T_j$ = 25°C | — | — | 1 | mA |
| | | | $T_j$ = 125°C | — | — | 20 | |
| Collector-Emitter Saturation Voltage | $V_{CE\ (sat)}$ | $V_D$ = 15V, $I_C$ = 75A<br>$V_{IN}$ = 15V→0V | $T_j$ = 25°C | — | 2.0 | 2.5 | V |
| | | | $T_j$ = 125°C | — | 2.0 | — | |
| Forward Voltage | $V_F$ | $I_F$ = 75A | | — | 2.1 | 3.0 | V |
| Switching Time | $t_{on}$ | $V_{CC}$ = 300V, $I_C$ = 75A<br>$V_D$ = 15V, $V_{IN}$ = 15V↔0V<br>Inductive load<br>(Note 1) | | — | 1.0 | 2.0 | μs |
| | $t_{off}$ | | | — | 1.2 | 3.0 | |
| | $t_f$ | | | — | 0.2 | 0.5 | |
| | $t_{rr}$ | | | — | 0.1 | 0.3 | |

b. Brake stage

| CHARACTERISTIC | SYMBOL | TEST CONDITION | | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|---|
| Collector Cut-Off Current | $I_{CEX}$ | $V_{CEX}$ = 600V | $T_j$ = 25°C | — | — | 1 | mA |
| | | | $T_j$ = 125°C | — | — | 20 | |
| Collector-Emitter Saturation Voltage | $V_{CE\ (sat)}$ | $V_D$ = 15V, $I_C$ = 30A<br>$V_{IN}$ = 15V→0V | $T_j$ = 25°C | — | 1.7 | 2.7 | V |
| | | | $T_j$ = 125°C | — | 1.6 | — | |
| Reverse Current | $I_R$ | $V_R$ = 600V | $T_j$ = 25°C | — | — | 1 | mA |
| | | | $T_j$ = 125°C | — | — | 20 | |
| Forward Voltage | $V_F$ | $I_F$ = 30A | | — | 2.0 | 2.5 | V |
| Switching Time | $t_{on}$ | $V_{CC}$ = 300V, $I_C$ = 30A<br>$V_D$ = 15V, $V_{IN}$ = 15V↔0V<br>Inductive load<br>(Note 1) | | — | 0.9 | 2.0 | μs |
| | $t_{off}$ | | | — | 1.7 | 3.0 | |
| | $t_f$ | | | — | 0.25 | 0.5 | |
| | $t_{rr}$ | | | — | 0.15 | 0.3 | |

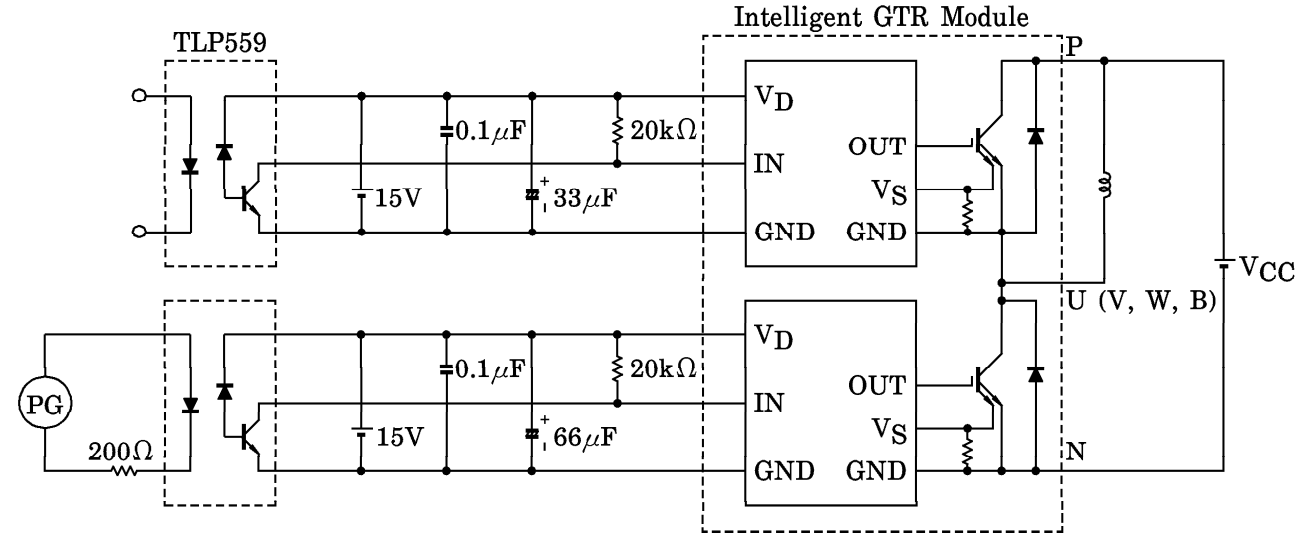
c. Control stage ($T_j$ = 25°C)

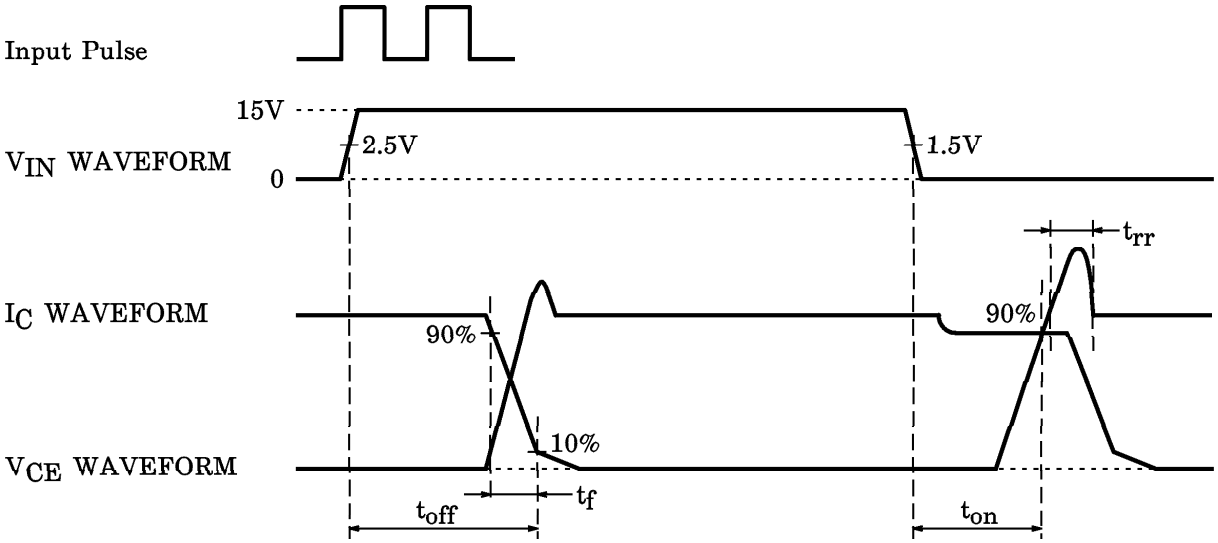
| CHARACTERISTIC | | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|---|
| Control Circuit Current | High Side | $I_{D\ (H)}$ | $V_D$ = 15V | — | 8 | — | mA |
| | Low Side | $I_{D\ (L)}$ | | — | 32 | — | |
| Input-On Signal Voltage | | $V_{IN\ (on)}$ | $V_D$ = 15V, $I_C$ = 75mA | 1.3 | 1.5 | 1.7 | V |
| Input-Off Signal Voltage | | $V_{IN\ (off)}$ | $V_D$ = 15V, $I_C$ = 75mA | 2.2 | 2.5 | 2.8 | V |
| Fault Output Current | Protection | $I_{FO\ (on)}$ | $V_D$ = 15V | 8 | 10 | 12 | mA |
| | Normal | $I_{FO\ (off)}$ | | — | — | 1 | |
| Over Current Protection Trip Level | Inverter | OC | $V_D$ = 15V, $T_j$ = 125°C | 105 | 150 | — | A |
| | Brake | | | 40 | — | — | |
| Short Circuit Protection Trip Level | Inverter | SC | $V_D$ = 15V, $T_j$ = 125°C | 157 | 225 | — | A |
| | Brake | | | 60 | — | — | |
| Over Current Cut-Off Time | | $t_{off}$ (OC) | $V_D$ = 15V | — | 5 | — | μs |
| Over Temperature Protection | Trip Level | OT | Case temperature | 110 | 118 | 125 | °C |
| | Reset Level | OTr | | — | 98 | — | |
| Control Supply Under Voltage Protection | Trip Level | UV | — | 11.0 | 12.0 | 12.5 | V |
| | Reset Level | UVr | | — | 12.5 | — | |
| Fault Output Pulse Width | | $t_{FO}$ | $V_D$ = 15V | 1 | 2 | 3 | ms |

d. Thermal resistance ($T_j$ = 25°C)

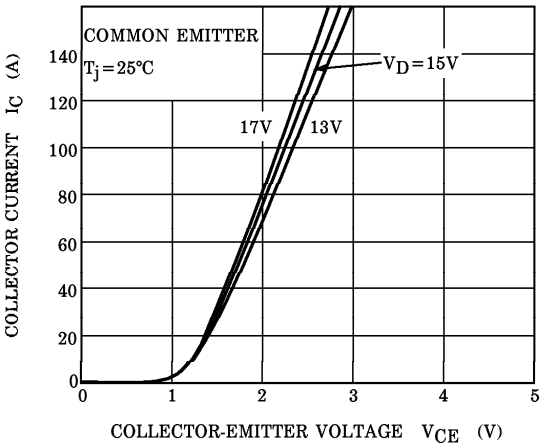
| CHARACTERISTIC | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| Junction to Case Thermal Resistance | $R_{th\ (j\text{-}c)}$ | Inverter IGBT stage | — | — | 0.553 | °C / W |
| | | Inverter FRD stage | — | — | 1.000 | |
| | | Brake IGBT stage | — | — | 1.562 | |
| | | Brake FRD stage | — | — | 2.000 | |
| Case to Fin Thermal Resistance | $R_{th\ (c\text{-}f)}$ | Compound is applied | — | 0.05 | — | °C / W |

Note 1 : Switching time test circuit & timing chart

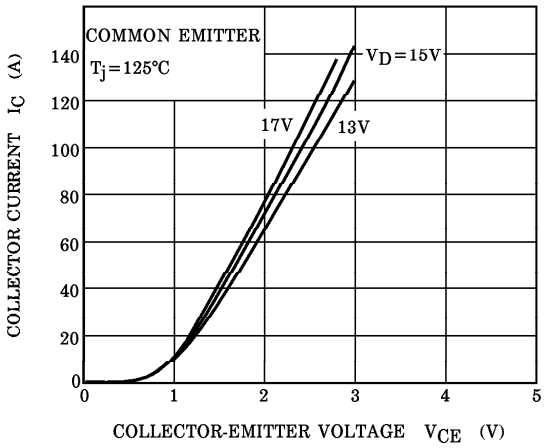


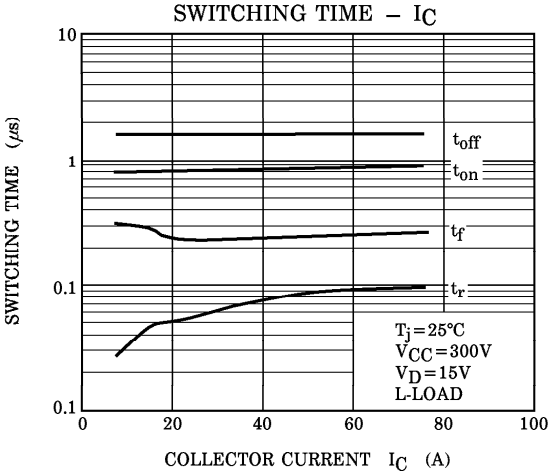
$I_C$ – $V_{CE}$



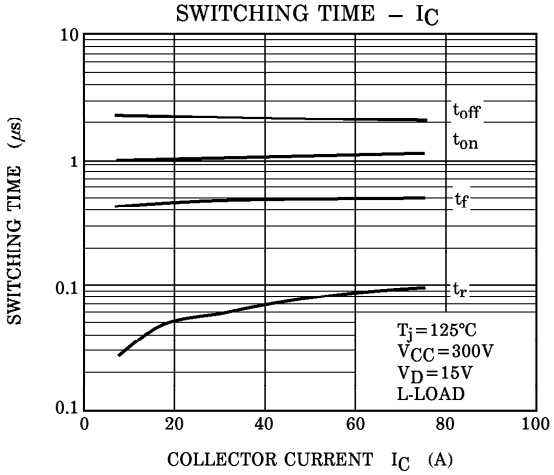

$I_C$ – $V_{CE}$



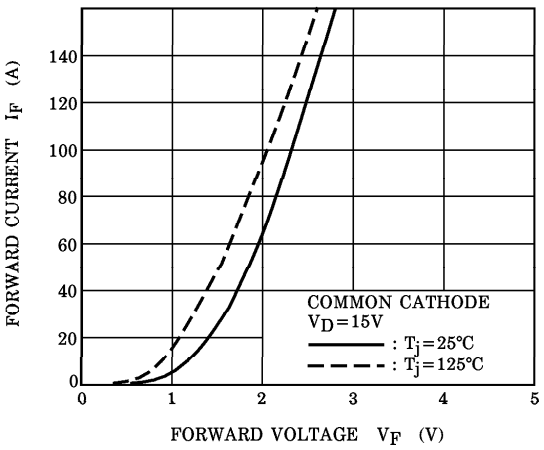

SWITCHING TIME – $I_C$



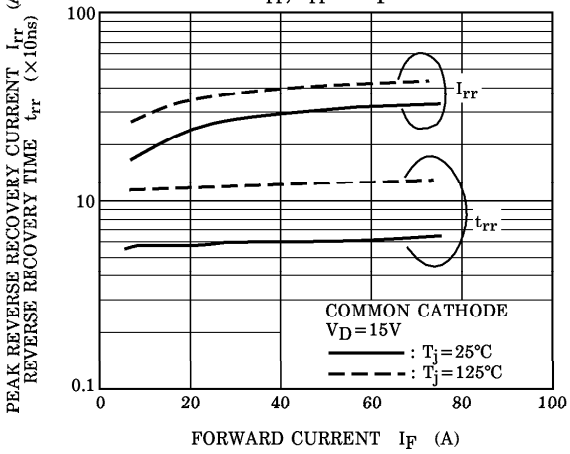

SWITCHING TIME – $I_C$



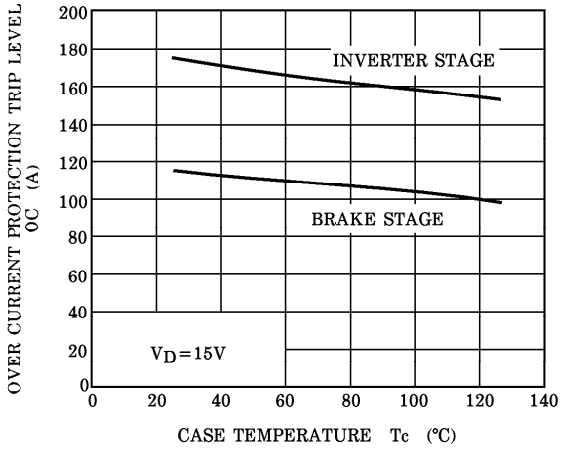

$I_F$ – $V_F$



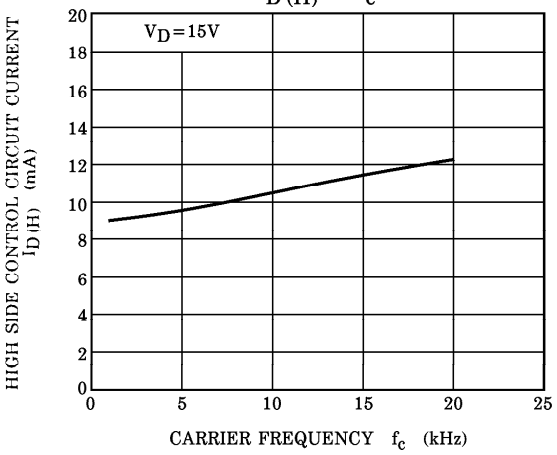

$t_{rr}$, $I_{rr}$ – $I_F$



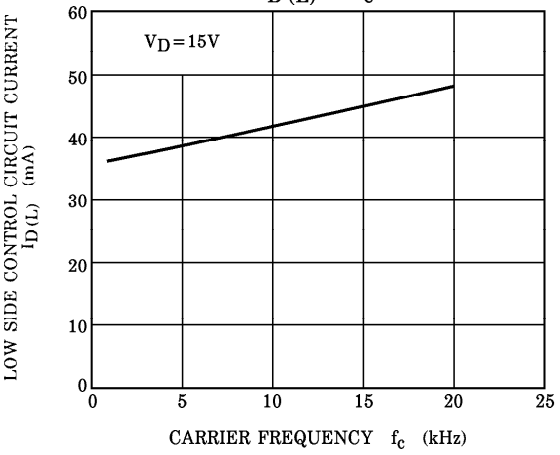
OC – Tc



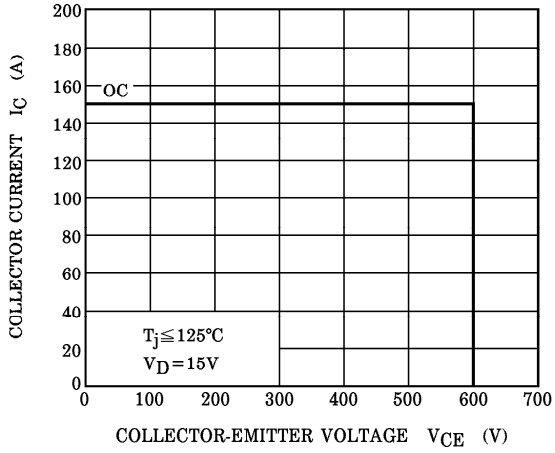

$I_{D(H)}$ – $f_c$



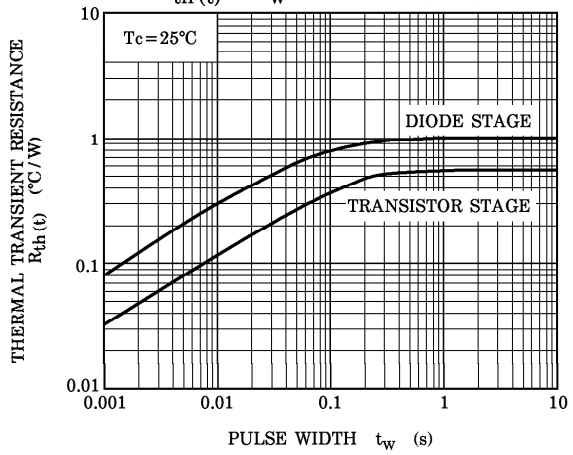

$I_{D(L)}$ – $f_c$



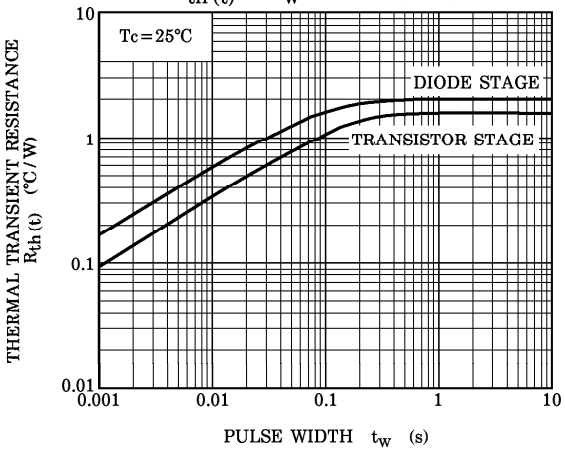

REVERSE BIAS SOA




$R_{th(t)}$ – $t_w$ INVERTER STAGE

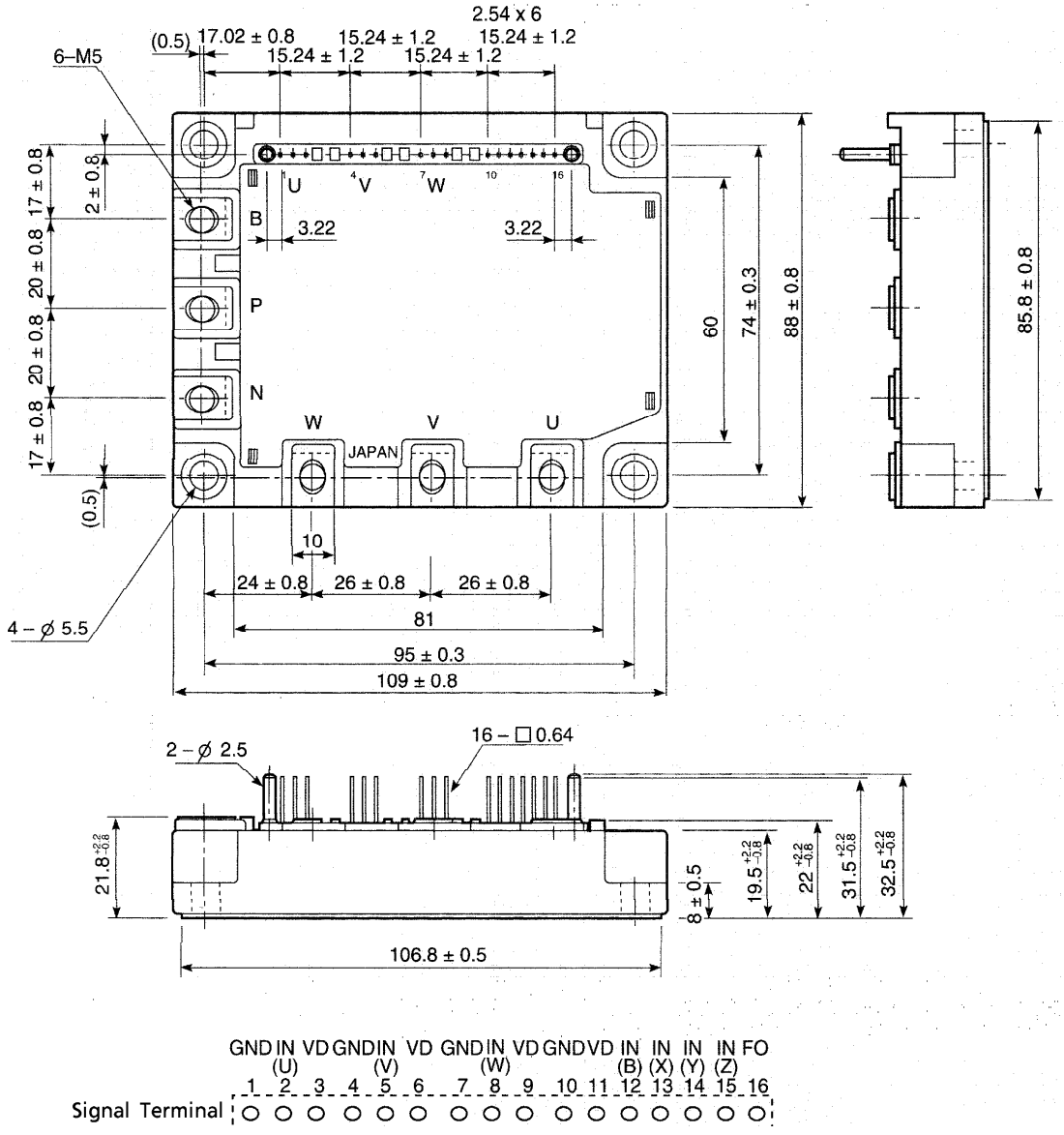



$R_{th(t)}$ – $t_w$ BRAKE STAGE



OUTLINE

Unit : mm




| | GND | IN (U) | VD | GND | IN (V) | VD | GND | IN (W) | VD | GND | VD | IN (B) | IN (X) | IN (Y) | IN (Z) | FO |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Signal Terminal | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |