

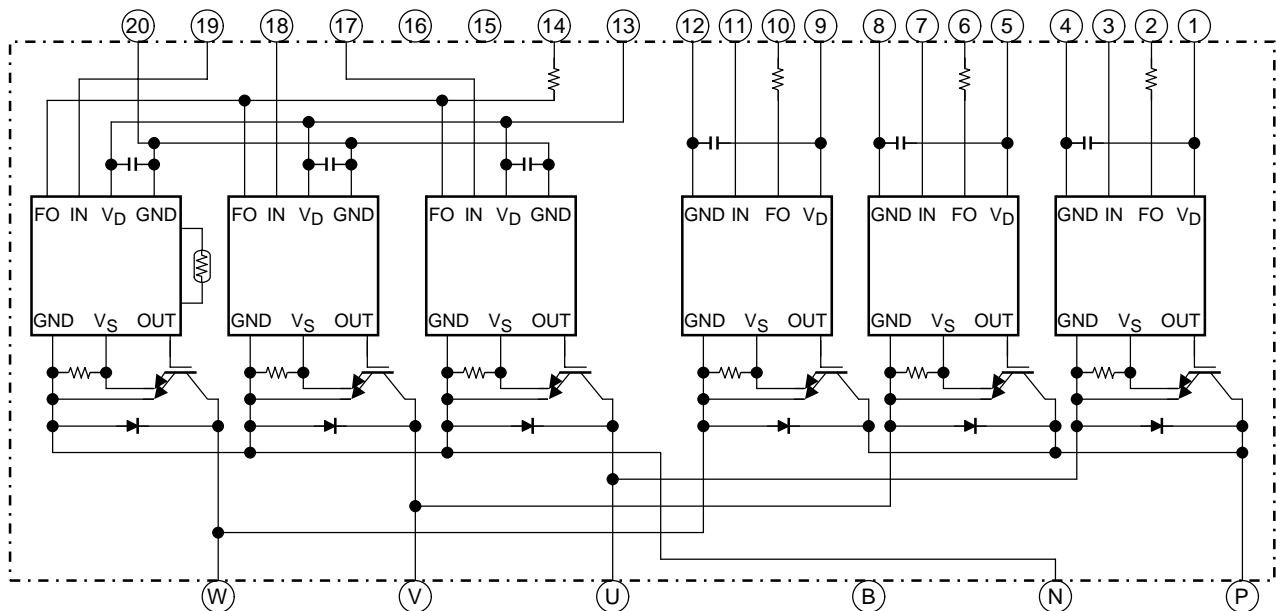
TOSHIBA Intelligent Power Module Silicon N Channel IGBT

# MIG75J6CSB1W (600V/75A 6in1)

High Power Switching Applications  
 Motor Control Applications

- Integrates inverter and control circuits (IGBT drive units, and units for protection against short-circuit current, overcurrent, undervoltage and overtemperature) into a single package.
- The electrodes are isolated from case.
- Low thermal resistance
- $V_{CE(sat)} = 1.8\text{ V (typ.)}$
- UL recognized: File No. E87989

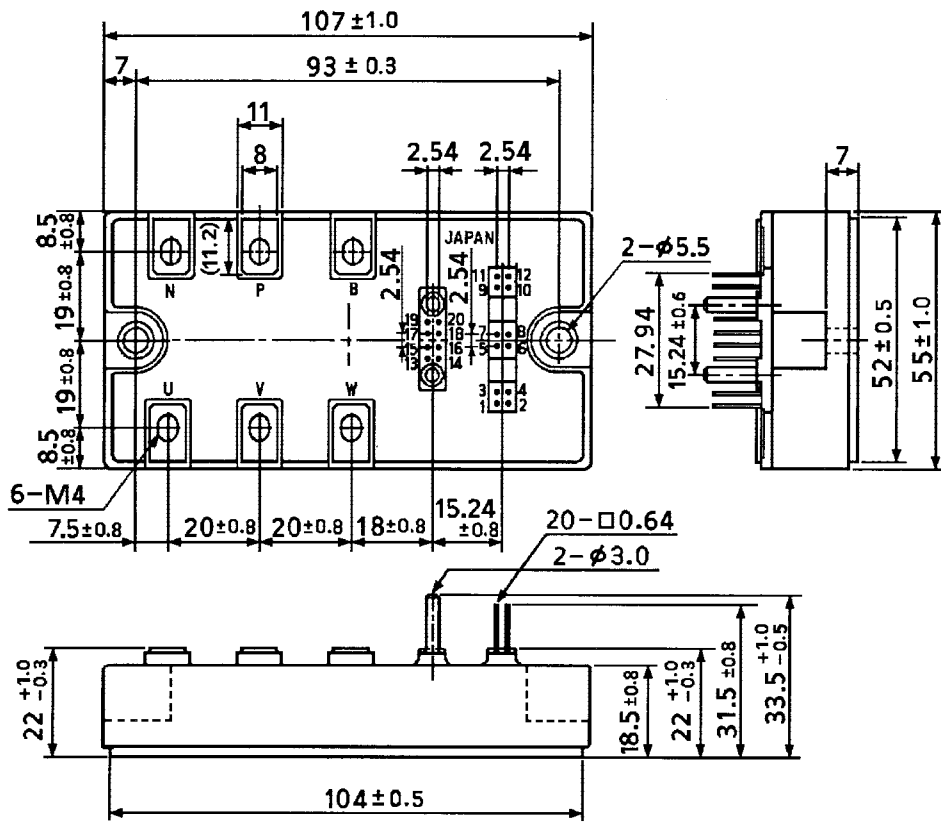
## Equivalent Circuit



|              |              |            |            |              |               |            |
|--------------|--------------|------------|------------|--------------|---------------|------------|
| 1. $V_D$ (U) | 2. FO (U)    | 3. IN (U)  | 4. GND (U) | 5. $V_D$ (V) | 6. FO (V)     | 7. IN (V)  |
| 8. GND (V)   | 9. $V_D$ (W) | 10. FO (W) | 11. IN (W) | 12. GND (W)  | 13. $V_D$ (L) | 14. FO (L) |
| 15. Open     | 16. Open     | 17. IN (X) | 18. IN (Y) | 19. IN (Z)   | 20. GND (L)   |            |

## Package Dimensions: TOSHIBA 2-108G1D

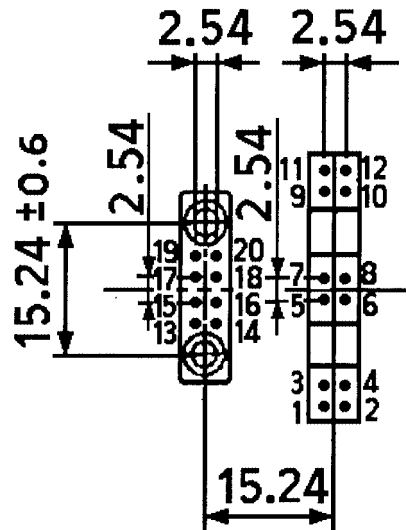
Unit : mm



- |                        |             |                       |            |                       |             |
|------------------------|-------------|-----------------------|------------|-----------------------|-------------|
| 1. V <sub>D</sub> (U)  | 2. FO (U)   | 3. IN (U)             | 4. GND (U) | 5. V <sub>D</sub> (V) | 6. FO (V)   |
| 7. IN (V)              | 8. GND (V)  | 9. V <sub>D</sub> (W) | 10. FO (W) | 11. IN (W)            | 12. GND (W) |
| 13. V <sub>D</sub> (L) | 14. FO (L)  | 15. Open              | 16. Open   | 17. IN (X)            | 18. IN (Y)  |
| 19. IN (Z)             | 20. GND (L) |                       |            |                       |             |

## Signal Terminal Layout

Unit : mm



- |     |                    |     |         |     |                    |     |         |     |                    |     |         |
|-----|--------------------|-----|---------|-----|--------------------|-----|---------|-----|--------------------|-----|---------|
| 1.  | V <sub>D</sub> (U) | 2.  | FO (U)  | 3.  | IN (U)             | 4.  | GND (U) | 5.  | V <sub>D</sub> (V) | 6.  | FO (V)  |
| 7.  | IN (V)             | 8.  | GND (V) | 9.  | V <sub>D</sub> (W) | 10. | FO (W)  | 11. | IN (W)             | 12. | GND (W) |
| 13. | V <sub>D</sub> (L) | 14. | FO (L)  | 15. | Open               | 16. | Open    | 17. | IN (X)             | 18. | IN (Y)  |
| 19. | IN (Z)             | 20. | GND (L) |     |                    |     |         |     |                    |     |         |

## Maximum Ratings ( $T_j = 25^\circ\text{C}$ )

| Stage    | Characteristics             | Condition                     | Symbol    | Ratings     | Unit             |
|----------|-----------------------------|-------------------------------|-----------|-------------|------------------|
| Inverter | Supply voltage              | P-N power terminal            | $V_{CC}$  | 450         | V                |
|          | Collector-emitter voltage   | —                             | $V_{CES}$ | 600         | V                |
|          | Collector current           | $T_c = 25^\circ\text{C}$ , DC | $I_C$     | 75          | A                |
|          | Forward current             | $T_c = 25^\circ\text{C}$ , DC | $I_F$     | 75          | A                |
|          | Collector power dissipation | $T_c = 25^\circ\text{C}$ , DC | $P_C$     | 460         | W                |
|          | Junction temperature        | —                             | $T_j$     | 150         | $^\circ\text{C}$ |
| 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 Terminal               | $V_{FO}$  | 20          | V                |
|          | Fault output current        | FO sink current               | $I_{FO}$  | 14          | mA               |
| Module   | Operating temperature       | —                             | $T_c$     | -20 to +100 | $^\circ\text{C}$ |
|          | Storage temperature range   | —                             | $T_{stg}$ | -40 to +125 | $^\circ\text{C}$ |
|          | Isolation voltage           | AC 1 min                      | $V_{ISO}$ | 2500        | V                |
|          | Screw torque (terminal)     | M4                            | —         | 2           | N·m              |
|          | Screw torque (mounting)     | M5                            | —         | 3           | N·m              |

## Electrical Characteristics

### 1. Inverter Stage

| Characteristics                      | Symbol        | Test Condition  | Min                       | Typ. | Max | Unit          |    |
|--------------------------------------|---------------|---|---------------------------|------|-----|---------------|----|
| Collector cut-off current            | $I_{CEX}$     | $V_{CE} = 600\text{ V}$   | $T_j = 25^\circ\text{C}$  | —    | —   | 1             | mA |
|                                      |               |   | $T_j = 125^\circ\text{C}$ | —    | —   | 10            |    |
| Collector-emitter saturation voltage | $V_{CE(sat)}$ | $V_D = 15\text{ V}$<br>$I_C = 75\text{ A}$<br>$V_{IN} = 15\text{ V} \rightarrow 0\text{ V}$   | $T_j = 25^\circ\text{C}$  | 1.5  | 1.8 | 2.2           | V  |
|                                      |               |   | $T_j = 125^\circ\text{C}$ | —    | 2.0 | —             |    |
| Forward voltage                      | $V_F$         | $I_F = 75\text{ A}$ , $T_j = 25^\circ\text{C}$  | —                         | 1.8  | 2.2 | V             |    |
| Switching time                       | $t_{on}$      | $V_{CC} = 300\text{ V}$ , $I_C = 75\text{ A}$<br>$V_D = 15\text{ V}$ , $V_{IN} = 15\text{ V} \leftrightarrow 0\text{ V}$<br>$T_j = 25^\circ\text{C}$ , Inductive load<br>(Note 1) | —                         | 1.3  | 2.2 | $\mu\text{s}$ |    |
|                                      | $t_c(on)$     |   | —                         | 0.25 | —   |               |    |
|                                      | $t_{rr}$      |   | —                         | 0.2  | —   |               |    |
|                                      | $t_{off}$     |   | —                         | 1.1  | 2.1 |               |    |
|                                      | $t_c(off)$    |   | —                         | 0.2  | —   |               |    |

Note 1: Switching time test circuit and timing chart

## 2. Control Stage ( $T_j = 25^\circ\text{C}$ )

| Characteristics                         |             | Symbol         | Test Condition                                  | Min  | Typ. | Max  | Unit             |
|---|-------------|----------------|---|------|------|------|------------------|
| Control circuit current                 | High side   | $I_D$ (H)      | $V_D = 15\text{ V}$                             | —    | 13   | 17   | mA               |
|   | Low side    | $I_D$ (L)      |   | —    | 39   | 51   |                  |
| Input on signal voltage                 |             | $V_{IN}$ (on)  | $V_D = 15\text{ V}$                             | 1.4  | 1.6  | 1.8  | V                |
| Input off signal voltage                |             | $V_{IN}$ (off) |   | 2.2  | 2.5  | 2.8  | V                |
| Fault output current                    | Protection  | $I_{FO}$ (on)  | $V_D = 15\text{ V}$                             | —    | 10   | 12   | mA               |
|   | Normal      | $I_{FO}$ (off) |   | —    | —    | 0.1  |                  |
| Over current protection trip level      | Inverter    | OC             | $V_D = 15\text{ V}, T_j \leq 125^\circ\text{C}$ | 120  | —    | —    | A                |
| Short circuit protection trip level     | Inverter    | SC             | $V_D = 15\text{ V}, T_j \leq 125^\circ\text{C}$ | 120  | —    | —    | A                |
| Over current cut-off time               |             | $t_{off}$ (OC) | $V_D = 15\text{ V}$                             | —    | 5    | —    | $\mu\text{s}$    |
| Over temperature protection             | Trip level  | OT             | Case temperature                                | 110  | 118  | 125  | $^\circ\text{C}$ |
|   | Reset level | OTr            |   | —    | 98   | —    |                  |
| Control supply under voltage protection | Trip level  | UV             | —   | 11.0 | 12.0 | 12.5 | V                |
|   | Reset level | UVr            |   | 12.0 | 12.5 | 13.0 |                  |
| Fault output pulse width                |             | $t_{FO}$       | $V_D = 15\text{ V}$                             | 1    | 2    | 3    | ms               |

## 3. Thermal Resistance ( $T_c = 25^\circ\text{C}$ )

| Characteristics                     | Symbol         | Test Condition      | Min | Typ.  | Max   | Unit               |
|-------------------------------------|----------------|---------------------|-----|-------|-------|--------------------|
| Junction to case thermal resistance | $R_{th}$ (j-c) | Inverter IGBT       | —   | —     | 0.270 | $^\circ\text{C/W}$ |
|                                     |                | Inverter FRD        | —   | —     | 0.313 |                    |
| Case to fin thermal resistance      | $R_{th}$ (c-f) | Compound is applied | —   | 0.017 | —     | $^\circ\text{C/W}$ |