

TOSHIBA Intelligent Power Module Silicon N Channel IGBT

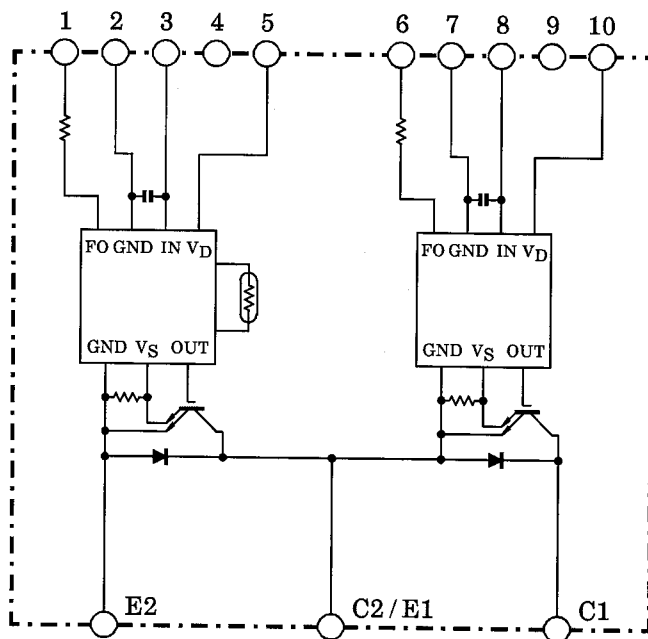
MIG150Q101H

High Power Switching Applications

Motor Control Applications

- Integrates inverter power & 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 : $V_{CE(sat)} = 3.5 \text{ V (Max.)}$
 $t_{off} = 3.8 \mu\text{s (Max.)}$
 $t_{rr} = 0.24 \mu\text{s (Max.)}$
- Package Dimensions : TOSHIBA 2-121A1A
- Weight : 510 g

Equivalent Circuit



- | | | | | |
|-----------|------------|-----------|---------|---------------|
| 1. FO (L) | 2. GND (L) | 3. IN (L) | 4. Open | 5. V_D (L) |
| 6. FO (H) | 7. GND (H) | 8. IN (H) | 9. Open | 10. V_D (H) |

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

| Stage | Characteristic | Condition | Symbol | Ratings | Unit |
|----------|-----------------------------|-------------------------------|-----------|------------|------------------|
| Inverter | Supply voltage | P-N power terminal | V_{CC} | 900 | V |
| | Collector-emitter voltage | — | V_{CES} | 1200 | V |
| | Collector current | $T_c = 25^\circ\text{C}$, DC | I_C | 150 | A |
| | Forward current | $T_c = 25^\circ\text{C}$, DC | I_F | 150 | A |
| | Collector power dissipation | $T_c = 25^\circ\text{C}$ | P_C | 1200 | 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 (L) terminal | V_{FO} | 20 | V |
| | Fault output current | FO sink current | I_{FO} | 14 | mA |
| Module | Operating temperature | — | T_C | -20 ~ +100 | $^\circ\text{C}$ |
| | Storage temperature range | — | T_{stg} | -40 ~ +125 | $^\circ\text{C}$ |
| | Isolation voltage | AC 1 minute | V_{ISO} | 2500 | V |
| | Screw torque | M6 | — | 3 | N·m |

Electrical Characteristics ($T_j = 25^\circ\text{C}$)

a. Inverter Stage

| Characteristic | Symbol | Test Condition | Min | Typ. | Max | Unit | |
|--------------------------------------|---------------|--|---------------------------|------|------|---------------|----|
| Collector cut-off current | I_{CE} | $V_{CE} = 1200\text{ V}$ | $T_j = 25^\circ\text{C}$ | — | — | 2 | mA |
| | | | $T_j = 125^\circ\text{C}$ | — | — | 40 | |
| Collector-emitter saturation voltage | $V_{CE(sat)}$ | $V_D = 15\text{ V}$, $I_C = 150\text{ A}$ $V_{IN} = 3\text{ V} \rightarrow 0\text{ V}$ | $T_j = 25^\circ\text{C}$ | — | 2.7 | 3.5 | V |
| | | | $T_j = 125^\circ\text{C}$ | — | 2.6 | — | |
| Forward voltage | V_F | $I_F = 150\text{ A}$ | — | 2.0 | 2.5 | V | |
| Switching time | t_{on} | $V_{CC} = 600\text{ V}$, $I_C = 150\text{ A}$ $V_D = 15\text{ V}$, $V_{IN} = 3\text{ V} \leftrightarrow 0\text{ V}$ Inductive load (Attached 1) | 0.8 | 1.5 | 2.2 | μs | |
| | $t_{c(on)}$ | | — | 0.5 | 1.0 | | |
| | t_{rr} | | — | 0.16 | 0.24 | | |
| | t_{off} | | — | 3.3 | 3.8 | | |
| | $t_{c(off)}$ | | — | 0.4 | 0.8 | | |

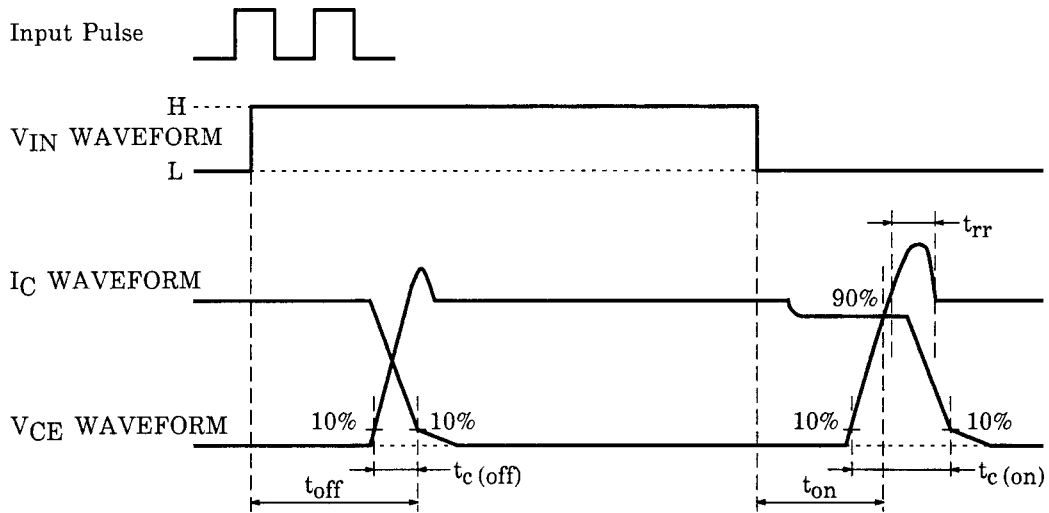
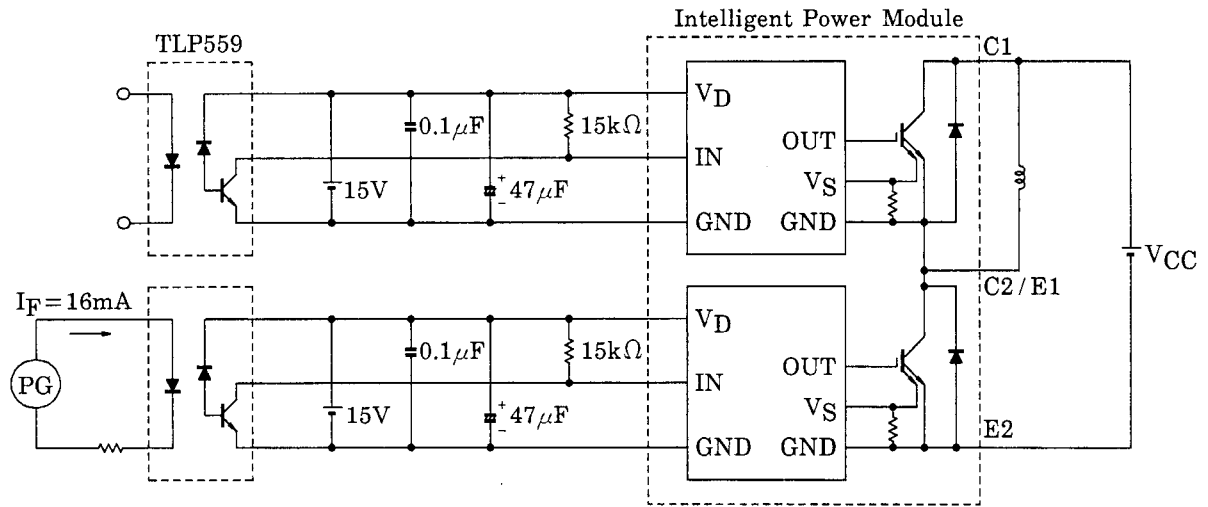
b. Control Stage ($T_j = 25^\circ\text{C}$)

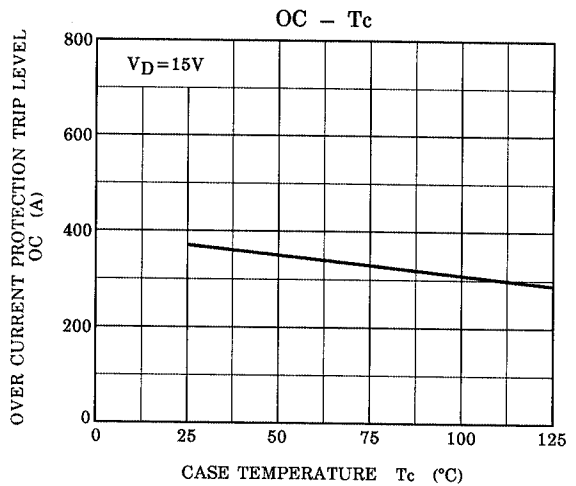
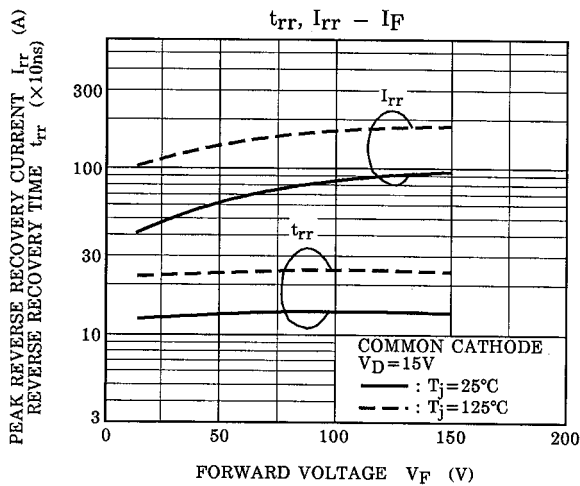
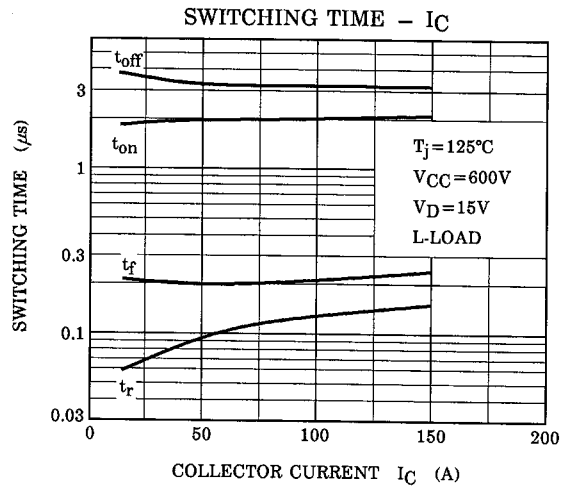
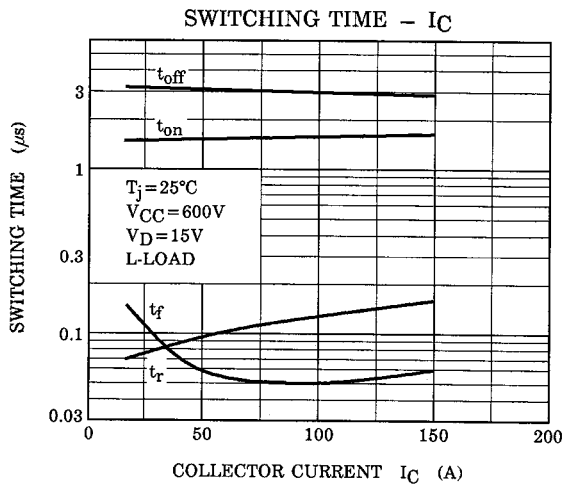
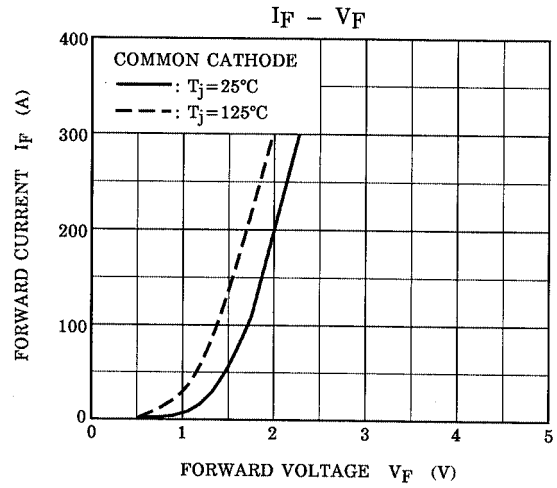
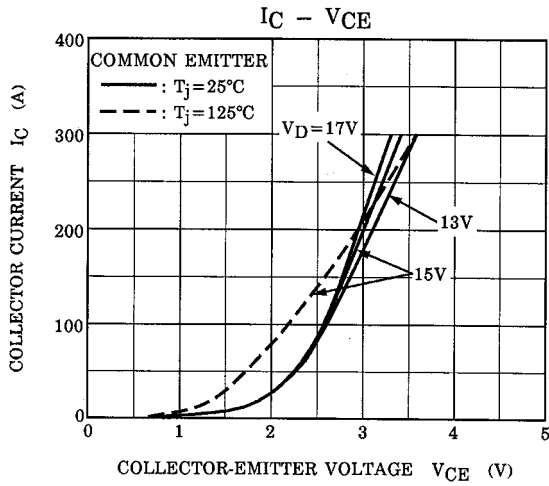
| Characteristic | | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|-------------|----------------|--|------|------|------|------------------|
| Control circuit current | | I_D | $V_D = 15\text{ V}$ | — | 20 | 30 | mA |
| Input-on signal voltage | | $V_{IN (on)}$ | $V_D = 15\text{ V}, I_C = 150\text{ mA}$ | 0.9 | 1.1 | 1.3 | V |
| Fault output current | Protection | $I_{FO (on)}$ | $V_D = 15\text{ V}$ | 8 | 10 | 12 | mA |
| | Normal | $I_{FO (off)}$ | | — | — | 1 | |
| Over current protection trip level | | OC | $V_D = 15\text{ V}, T_j = 125^\circ\text{C}$ | 210 | 300 | — | A |
| Short current protection trip level | | SC | $V_D = 15\text{ V}, T_j = 125^\circ\text{C}$ | 315 | 450 | — | A |
| Over current cut-off time | | $t_{off (OC)}$ | $V_D = 15\text{ V}$ | — | 10 | — | μs |
| Over temperature protection | Trip level | OT | Case temperature | 111 | 118 | 125 | $^\circ\text{C}$ |
| | Reset level | OTr | | 93 | 100 | 107 | |
| Control supply under voltage protection | Trip level | UV | — | 11.3 | 12.0 | 12.7 | V |
| | Reset level | UVr | | 11.8 | 12.5 | 13.2 | |
| Fault output pulse width | | t_{FO} | $V_D = 15\text{ V}$ | 1 | 2 | 3 | ms |

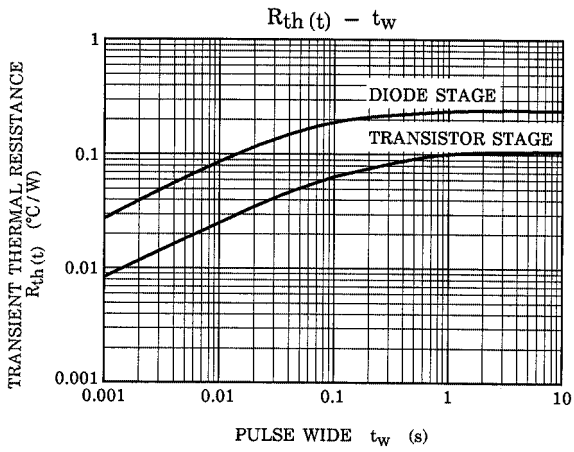
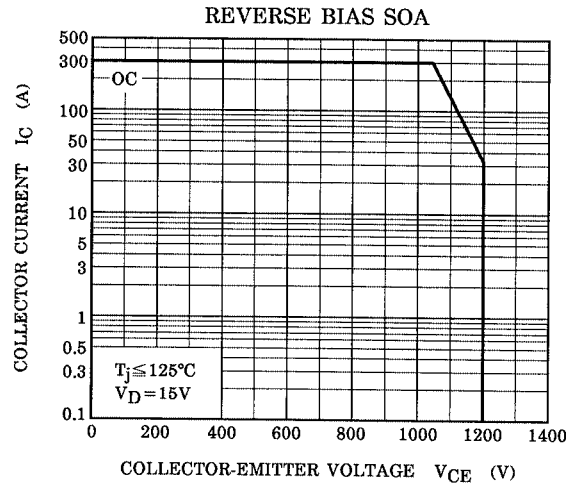
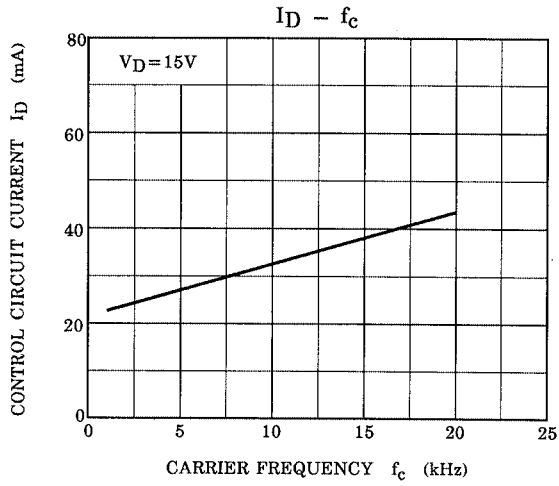
c. Thermal Resistance ($T_j = 25^\circ\text{C}$)

| Characteristic | | Symbol | Test Condition | Min | Typ. | Max | Unit |
|-------------------------------------|--|----------------|---------------------|-----|------|-------|-----------------------------|
| Junction to case thermal resistance | | $R_{th (j-c)}$ | IGBT | — | — | 0.104 | $^\circ\text{C} / \text{W}$ |
| | | | FRD | — | — | 0.25 | |
| Case to fin thermal resistance | | $R_{th (c-f)}$ | Compound is applied | — | 0.05 | — | $^\circ\text{C} / \text{W}$ |

Note 1: Switching time test circuit & timing chart







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