

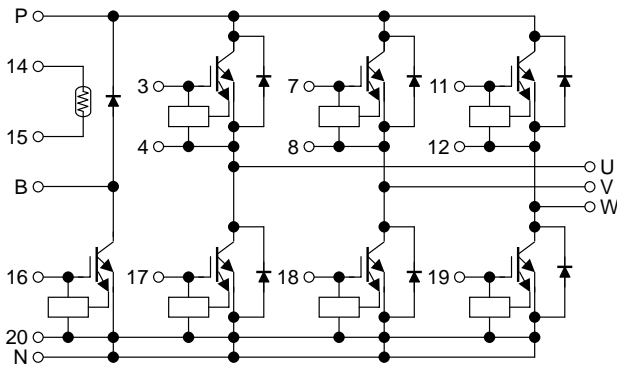
# MG150J7KS60 (600V/150A 7in1)

High Power Switching Applications

Motor Control Applications

- Integrates inverter and brake power circuit into a single package
- The electrodes are isolated from case.
- Low thermal resistance
- $V_{CE(sat)} = 1.6\text{ V (typ.)}$

## Equivalent Circuit

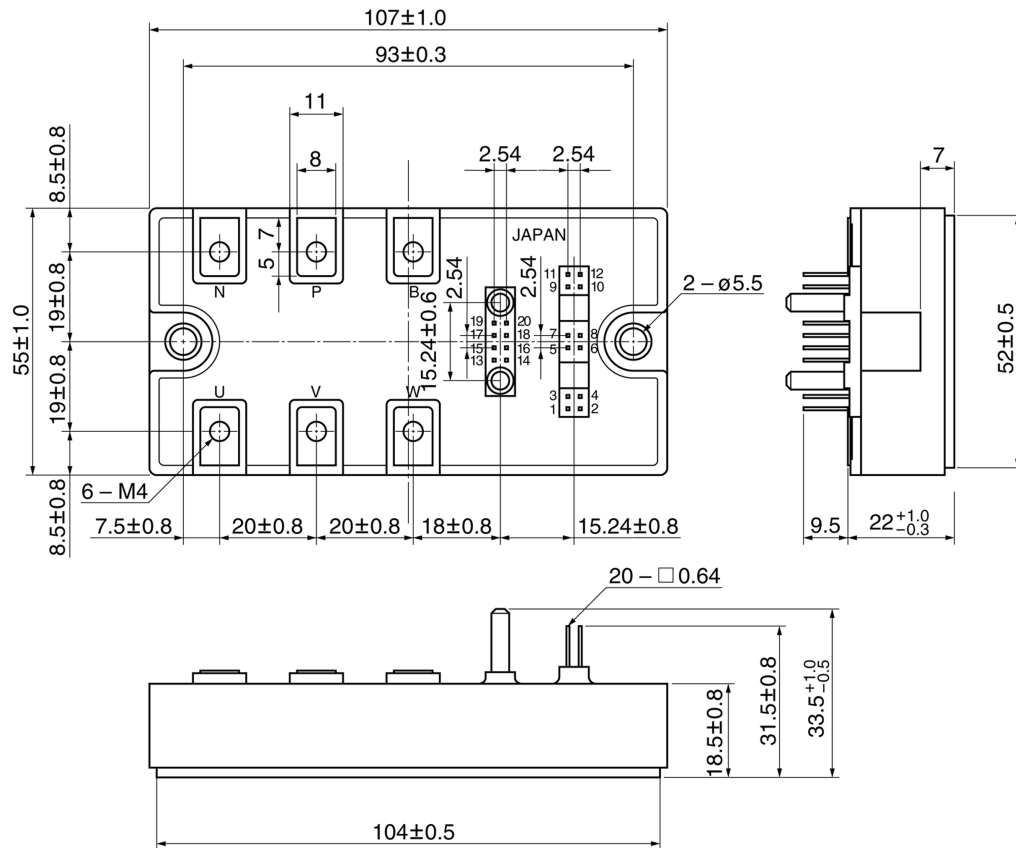


## Signal Terminal

|           |           |           |           |
|-----------|-----------|-----------|-----------|
| 1. Open   | 2. Open   | 3. G (U)  | 4. E (U)  |
| 5. Open   | 6. Open   | 7. G (V)  | 8. E (V)  |
| 9. Open   | 10. Open  | 11. G (W) | 12. E (W) |
| 13. Open  | 14. TH1   | 15. TH2   | 16. G (B) |
| 17. G (X) | 18. G (Y) | 19. G (Z) | 20. E (L) |

## Package Dimensions: 2-108G1B

Unit: mm



|           |           |           |           |
|-----------|-----------|-----------|-----------|
| 1. Open   | 2. Open   | 3. G (U)  | 4. E (U)  |
| 5. Open   | 6. Open   | 7. G (V)  | 8. E (V)  |
| 9. Open   | 10. Open  | 11. G (W) | 12. E (W) |
| 13. Open  | 14. TH1   | 15. TH2   | 16. G (B) |
| 17. G (X) | 18. G (Y) | 19. G (Z) | 20. E (L) |

## Maximum Ratings (Ta = 25°C)

| Stage                                   | Characteristics                         | Symbol    | Rating     | Unit            |     |
|---|---|-----------|------------|-----------------|-----|
| Inverter                                | Collector-emitter voltage               | $V_{CES}$ | 600        | V               |     |
|   | Gate-emitter voltage                    | $V_{GES}$ | $\pm 20$   | V               |     |
|   | Collector current                       | DC        | $I_C$      | 150             | A   |
|   |   | 1 ms      | $I_{CP}$   | 300             |     |
|   | Forward current                         | DC        | $I_F$      | 150             | A   |
|   |   | 1 ms      | $I_{FM}$   | 300             |     |
| Collector power dissipation (Tc = 25°C) |   | $P_C$     | 750        | W               |     |
| Brake                                   | Collector-emitter voltage               | $V_{CES}$ | 600        | V               |     |
|   | Gate-emitter voltage                    | $V_{GES}$ | $\pm 20$   | V               |     |
|   | Collector current                       | DC        | $I_C$      | 75              | A   |
|   |   | 1 ms      | $I_{CP}$   | 150             |     |
|   | Collector power dissipation (Tc = 25°C) |           | $P_C$      | 375             | W   |
|   | Reverse voltage                         |           | $V_R$      | 600             | V   |
|   | Forward current                         | DC        | $I_F$      | 75              | A   |
|   |   | 1 ms      | $I_{FM}$   | 150             |     |
| Module                                  | Junction temperature                    |           | $T_j$      | 150             | °C  |
|   | Storage temperature range               |           | $T_{stg}$  | -40~125         | °C  |
|   | Isolation voltage                       |           | $V_{isol}$ | 2500 (AC 1 min) | V   |
|   | Screw torque                            | Terminal  | —          | 2 (M4)          | N·m |
|   |   | Mounting  | —          | 3 (M5)          |     |

## Electrical Characteristics (Tj = 25°C)

### 1. Inverter stage

| Characteristics                      |                    | Symbol         | Test Condition  | Min                       | Typ.  | Max       | Unit          |   |
|--------------------------------------|--------------------|----------------|---|---------------------------|-------|-----------|---------------|---|
| Gate leakage current                 |                    | $I_{GES}$      | $V_{GE} = \pm 20 \text{ V}, V_{CE} = 0$   | —                         | —     | $\pm 500$ | nA            |   |
| Collector cut-off current            |                    | $I_{CES}$      | $V_{CE} = 600 \text{ V}, V_{GE} = 0$  | —                         | —     | 1.0       | mA            |   |
| Gate-emitter cut-off voltage         |                    | $V_{GE (off)}$ | $V_{CE} = 5 \text{ V}, I_C = 150 \text{ mA}$  | 5.0                       | 6.5   | 8.0       | V             |   |
| Collector-emitter saturation voltage |                    | $V_{CE (sat)}$ | $V_{GE} = 15 \text{ V}, I_C = 150 \text{ A}$  | $T_j = 25^\circ\text{C}$  | —     | 1.6       | 2.2           | V |
|                                      |                    |                |   | $T_j = 125^\circ\text{C}$ | —     | —         | 2.2           |   |
| Input capacitance                    |                    | $C_{ies}$      | $V_{CE} = 10 \text{ V}, V_{GE} = 0, f = 1 \text{ MHz}$  | —                         | 25000 | —         | pF            |   |
| Switching time                       | Turn-on delay time | $t_{d (on)}$   | $V_{CC} = 300 \text{ V}, I_C = 150 \text{ A}$<br>$V_{GE} = \pm 15 \text{ V}, R_G = 15 \Omega$<br>(Note 1) | —                         | —     | 1.00      | $\mu\text{s}$ |   |
|                                      | Turn-off time      | $t_{off}$      |   | —                         | —     | 1.20      |               |   |
|                                      | Fall time          | $t_f$          |   | —                         | —     | 0.50      |               |   |
| Reverse recovery time                | $t_{rr}$           | —              |   | —                         | 0.30  |           |               |   |
| Forward voltage                      |                    | $V_F$          | $I_F = 150 \text{ A}$   | —                         | 2.0   | 2.2       | V             |   |

Note 1: Switching time test circuit & timing chart

## 2. Brake stage

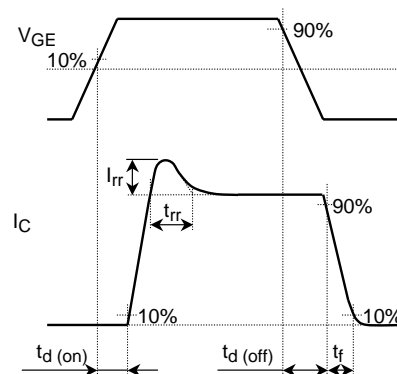
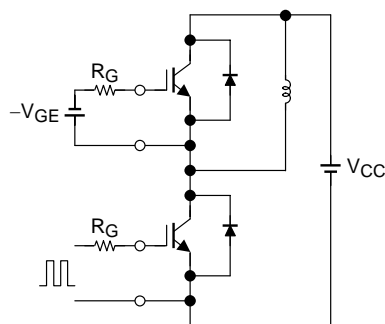
| Characteristics                      |                    | Symbol         | Test Condition   | Min                       | Typ.  | Max       | Unit          |   |
|--------------------------------------|--------------------|----------------|--|---------------------------|-------|-----------|---------------|---|
| Gate leakage current                 |                    | $I_{GES}$      | $V_{GE} = \pm 20\text{ V}, V_{CE} = 0$   | —                         | —     | $\pm 500$ | nA            |   |
| Collector cut-off current            |                    | $I_{CES}$      | $V_{CE} = 600\text{ V}, V_{GE} = 0$  | —                         | —     | 1.0       | mA            |   |
| Gate-emitter cut-off voltage         |                    | $V_{GE (off)}$ | $V_{CE} = 5\text{ V}, I_C = 75\text{ mA}$  | 5.0                       | 6.5   | 8.0       | V             |   |
| Collector-emitter saturation voltage |                    | $V_{CE (sat)}$ | $V_{GE} = 15\text{ V}, I_C = 75\text{ A}$  | $T_j = 25^\circ\text{C}$  | —     | 1.6       | 2.2           | V |
|                                      |                    |                |  | $T_j = 125^\circ\text{C}$ | —     | —         | 2.2           |   |
| Input capacitance                    |                    | $C_{ies}$      | $V_{CE} = 10\text{ V}, V_{GE} = 0, f = 1\text{ MHz}$   | —                         | 12000 | —         | pF            |   |
| Switching time                       | Turn-on delay time | $t_d (on)$     | $V_{CC} = 300\text{ V}, I_C = 75\text{ A}$<br>$V_{GE} = \pm 15\text{ V}, R_G = 24\ \Omega$<br>(Note 1) | —                         | —     | 1.00      | $\mu\text{s}$ |   |
|                                      | Turn-off time      | $t_{off}$      |  | —                         | —     | 1.20      |               |   |
|                                      | Fall time          | $t_f$          |  | —                         | —     | 0.50      |               |   |
| Reverse current                      |                    | $I_R$          | $V_R = 600\text{ V}$   | —                         | —     | 1.0       | mA            |   |
| Forward voltage                      |                    | $V_F$          | $I_F = 75\text{ A}$  | —                         | 2.1   | 2.6       | V             |   |

Note 1: Switching time test circuit & timing chart

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

| Characteristics                     |  | Symbol         | Test Condition                                  | Min | Typ. | Max   | Unit               |
|-------------------------------------|--|----------------|---|-----|------|-------|--------------------|
| Zero-power resistance               |  | $R_{25}$       | $ITM = 0.2\text{ mA}$                           | —   | 100  | —     | $k\Omega$          |
| B value                             |  | B25/85         | $T_c = 25^\circ\text{C}/T_c = 85^\circ\text{C}$ | —   | 4390 | —     | K                  |
| Junction to case thermal resistance |  | $R_{th (j-c)}$ | Inverter IGBT stage                             | —   | —    | 0.167 | $^\circ\text{C/W}$ |
|                                     |  |                | Inverter FRD stage                              | —   | —    | 0.313 |                    |
|                                     |  |                | Brake IGBT stage                                | —   | —    | 0.333 |                    |
|                                     |  |                | Brake FRD stage                                 | —   | —    | 1.000 |                    |
| Case to fin thermal resistance      |  | $R_{th (c-f)}$ | —   | —   | 0.05 | —     | $^\circ\text{C/W}$ |

## Switching Time Test Circuit & Timing Chart



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