



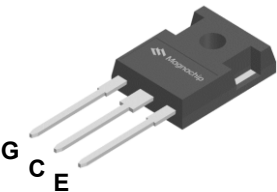
# MBQ50T120RFSTH

1200V Field Stop IGBT

### FEATURES

- Low switching loss,  $V_{CE(sat)} = 1.80V @ I_c = 50A$
- $V_{CE(sat)}$  positive temperature coefficient
- Very soft, fast recovery anti-parallel diode
- Low EMI
- Maximum junction temperature 175°C

TO247-3L



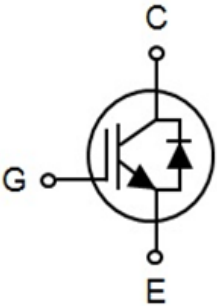
Top View

### APPLICATIONS

- PV Inverter
- UPS
- ESS

### KEY PERFORMANCE PARAMETERS

|                                     |      |    |
|-------------------------------------|------|----|
| $V_{CE}$                            | 1200 | V  |
| $V_{CE(sat)}$                       | 1.80 | V  |
| $V_F$                               | 1.90 | V  |
| Junction temperature <sub>max</sub> | 175  | °C |
|                                     |      |    |



RoHS Compliant  
HALOGEN-FREE

### ORDERING INFORMATION

| Type / Ordering Code | Marking   | Temp. Range | Package  | Packing | RoHS Status |
|----------------------|-----------|-------------|----------|---------|-------------|
| MBQ50T120RFSTH       | 50T120RFS | -55~175°C   | TO247-3L | Tube    | Compliant   |

<http://www.magnachip.com/>

**ABSOLUTE MAXIMUM RATINGS**, at  $T_J = 25^\circ\text{C}$ , unless otherwise specified

| PARAMETER                                                                    |                         | SYMBOL      | RATING   | UNIT             |
|------------------------------------------------------------------------------|-------------------------|-------------|----------|------------------|
| Collector-emitter voltage                                                    |                         | $V_{CE}$    | 1200     | V                |
| DC collector current, limited by $T_{vjmax}$                                 | $T_C=25^\circ\text{C}$  | $I_C$       | 127      | A                |
|                                                                              | $T_C=100^\circ\text{C}$ |             | 80       | A                |
| Pulsed collector current, $t_p$ limited by $T_{vjmax}$                       |                         | $I_{Cpuls}$ | 150      | A                |
| Diode forward current, limited by $T_{vjmax}$                                | $T_C=25^\circ\text{C}$  | $I_F$       | 111      | A                |
|                                                                              | $T_C=100^\circ\text{C}$ |             | 72       | A                |
| Diode pulsed current, $t_p$ limited by $T_{vjmax}$                           |                         | $I_{Fpuls}$ | 150      | A                |
| Gate-emitter voltage                                                         |                         | $V_{GE}$    | $\pm 20$ | V                |
| Transient gate-emitter voltage ( $t_p \leq 10\mu\text{s}$ , $D \leq 0.010$ ) |                         |             | $\pm 30$ | V                |
| Power dissipation                                                            | $T_C=25^\circ\text{C}$  | $P_D$       | 577      | W                |
|                                                                              | $T_C=100^\circ\text{C}$ |             | 289      |                  |
| Operating Junction temperature range                                         |                         | $T_{vj}$    | -40~175  | $^\circ\text{C}$ |
| Storage temperature range                                                    |                         | $T_{stg}$   | -55~150  | $^\circ\text{C}$ |

**THERMAL RESISTANCE RATINGS**

| PARAMETER                                     | SYMBOL        | RATING | UNIT               |
|-----------------------------------------------|---------------|--------|--------------------|
| Thermal resistance junction-to-ambient        | $R_{th(j-a)}$ | 40     | $^\circ\text{C/W}$ |
| Thermal resistance junction-to-case for IGBT  | $R_{th(j-c)}$ | 0.26   | $^\circ\text{C/W}$ |
| Thermal resistance junction-to-case for Diode | $R_{th(j-c)}$ | 0.43   | $^\circ\text{C/W}$ |

**ELECTRICAL CHARACTERISTICS ( $T_{vj} = 25^{\circ}\text{C}$  unless otherwise specified)****Static Characteristics**

| PARAMETER                            | SYMBOL               | TEST CONDITIONS                                                                 |                                | MIN. | TYP. | MAX.      | UNIT          |
|--------------------------------------|----------------------|---------------------------------------------------------------------------------|--------------------------------|------|------|-----------|---------------|
| Collector-emitter breakdown voltage  | $BV_{CES}$           | $I_C = 1\text{mA}$ , $V_{GE} = 0\text{ V}$                                      |                                | 1200 | -    | -         | V             |
| Collector-emitter saturation voltage | $V_{CE(\text{sat})}$ | $I_C = 50\text{A}$ , $V_{GE} = 15\text{ V}$                                     | $T_{vj} = 25^{\circ}\text{C}$  | -    | 1.80 | 1.65      | V             |
|                                      |                      |                                                                                 | $T_{vj} = 175^{\circ}\text{C}$ | -    | 2.4  | -         |               |
| Diode forward voltage                | $V_F$                | $V_{GE} = 0\text{ V}$ , $I_F = 50\text{ A}$                                     | $T_{vj} = 25^{\circ}\text{C}$  | -    | 1.90 |           | V             |
|                                      |                      |                                                                                 | $T_{vj} = 175^{\circ}\text{C}$ | -    | 2.05 | -         |               |
| Gate-emitter threshold voltage       | $V_{GE(\text{th})}$  | $V_{CE} = V_{GE}$ , $I_C = 50\text{ mA}$                                        |                                | 5.0  | 6.0  | 7.0       | V             |
| Zero gate voltage collector current  | $I_{CES}$            | $V_{CE} = 1200\text{ V}$ , $V_{GE} = 0\text{V}$ , $T_{vj} = 25^{\circ}\text{C}$ |                                | -    | -    | 250       | $\mu\text{A}$ |
| Gate-emitter leakage current         | $I_{GES}$            | $V_{GE} = 20\text{ V}$ , $V_{CE} = 0\text{V}$                                   |                                | -    | -    | $\pm 250$ | nA            |

**Dynamic Characteristics**

| PARAMETER                    | SYMBOL    | TEST CONDITIONS                                                        | MIN. | TYP. | MAX. | UNIT |
|------------------------------|-----------|------------------------------------------------------------------------|------|------|------|------|
| Total gate charge            | $Q_G$     | $V_{CE} = 960\text{V}$ , $I_C = 50\text{A}$ ,<br>$V_{GE} = 15\text{V}$ | -    | 236  | -    | nC   |
| Gate-emitter charge          | $Q_{GE}$  |                                                                        | -    | 46   | -    |      |
| Gate-collector charge        | $Q_{GC}$  |                                                                        | -    | 79   | -    |      |
| Input capacitance            | $C_{ies}$ | $V_{CE} = 25\text{V}$ , $V_{GE} = 0\text{V}$ ,<br>$f = 800\text{kHz}$  | -    | 6677 | -    | pF   |
| Output capacitance           | $C_{oes}$ |                                                                        | -    | 223  | -    |      |
| Reverse transfer capacitance | $C_{res}$ |                                                                        | -    | 63   | -    |      |

**Switching Characteristics**

| PARAMETER                 | SYMBOL       | TEST CONDITIONS                                                                                                                                | MIN. | TYP. | MAX. | UNIT          |
|---------------------------|--------------|------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|---------------|
| Turn-on delay time        | $t_{d(on)}$  | $V_{GE} = 0/15\text{V}$ , $V_{CC} = 600\text{V}$<br>$I_C = 50\text{A}$ , $R_G = 2.2\Omega$ ,<br>Inductive Load, $T_{vj} = 25^{\circ}\text{C}$  | -    | 43.2 | -    | ns            |
| Rise time                 | $t_r$        |                                                                                                                                                | -    | 40.8 | -    |               |
| Turn-off delay time       | $t_{d(off)}$ |                                                                                                                                                | -    | 167  | -    |               |
| Fall time                 | $t_f$        |                                                                                                                                                | -    | 76   | -    |               |
| Turn-on switching energy  | $E_{on}$     |                                                                                                                                                | -    | 3.48 | -    | mJ            |
| Turn-off switching energy | $E_{off}$    | $V_{GE} = 0/15\text{V}$ , $V_{CC} = 600\text{V}$<br>$I_C = 50\text{A}$ , $R_G = 2.2\Omega$ ,<br>Inductive Load, $T_{vj} = 175^{\circ}\text{C}$ | -    | 1.23 | -    |               |
| Total switching energy    | $E_{ts}$     |                                                                                                                                                | -    | 4.71 | -    |               |
| Turn-on delay time        | $t_{d(on)}$  |                                                                                                                                                | -    | 44.8 | -    | ns            |
| Rise time                 | $t_r$        |                                                                                                                                                | -    | 42.5 | -    |               |
| Turn-off delay time       | $t_{d(off)}$ |                                                                                                                                                | -    | 182  | -    |               |
| Fall time                 | $t_f$        |                                                                                                                                                | -    | 123  | -    |               |
| Turn-on switching energy  | $E_{on}$     |                                                                                                                                                | -    | 5.17 | -    | $\mu\text{J}$ |
| Turn-off switching energy | $E_{off}$    |                                                                                                                                                | -    | 1.94 | -    |               |
| Total switching energy    | $E_{ts}$     |                                                                                                                                                | -    | 7.11 | -    |               |
| Reverse recovery time     | $t_{rr}$     | $I_F = 50\text{A}$ , $di_F/dt = 800\text{A}/\mu\text{s}$ ,<br>$T_{vj} = 25^{\circ}\text{C}$                                                    | -    | 150  | -    | ns            |
| Reverse recovery current  | $I_{rr}$     |                                                                                                                                                | -    | 27.3 | -    | A             |
| Reverse recovery charge   | $Q_{rr}$     |                                                                                                                                                | -    | 2.07 | -    | $\mu\text{C}$ |
| Reverse recovery time     | $t_{rr}$     | $I_F = 50\text{A}$ , $di_F/dt = 800\text{A}/\mu\text{s}$ ,<br>$T_{vj} = 175^{\circ}\text{C}$                                                   | -    | 290  | -    | ns            |
| Reverse recovery current  | $I_{rr}$     |                                                                                                                                                | -    | 39   | -    | A             |
| Reverse recovery charge   | $Q_{rr}$     |                                                                                                                                                | -    | 6.03 | -    | $\mu\text{C}$ |

Electrical Characteristics Diagrams (25 °C, unless otherwise noted)

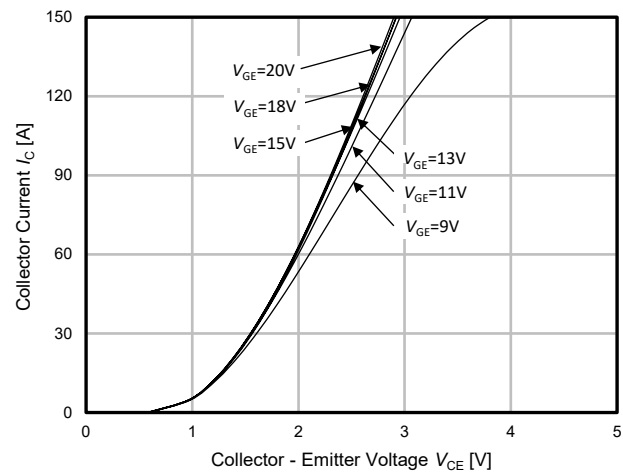


Fig.1. Typical output characteristics( $T_{vj}$ =25°C)

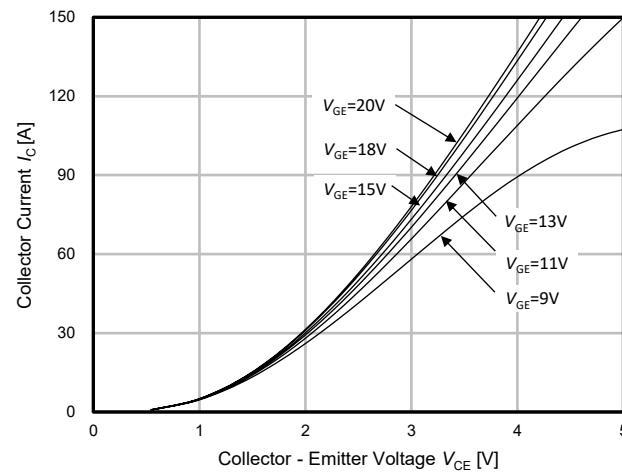


Fig.2. Typical output characteristics( $T_{vj}$ =175°C)

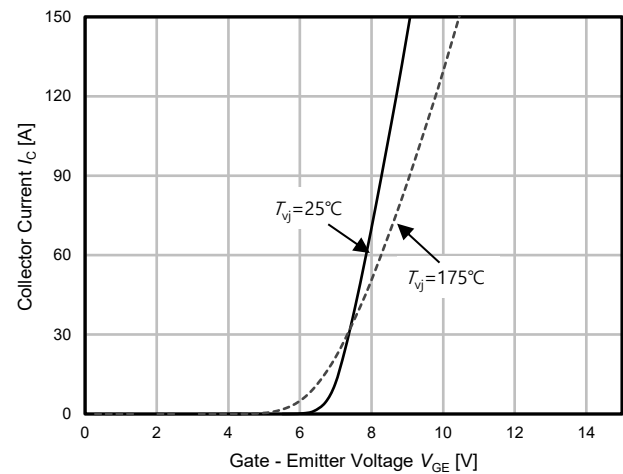


Fig.3. Typical transfer characteristics

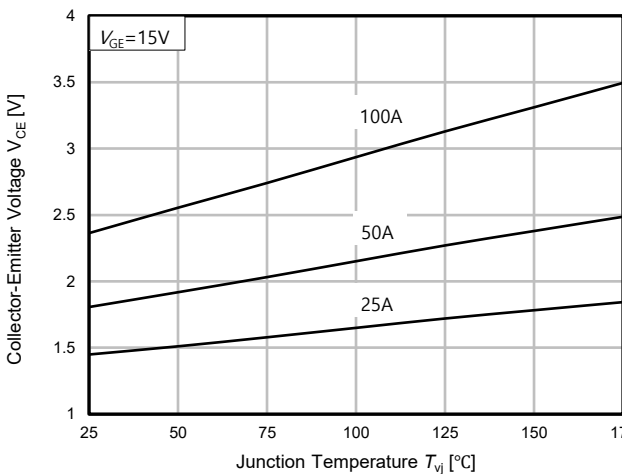


Fig.4. Typical collector emitter saturation voltage-junction temperature

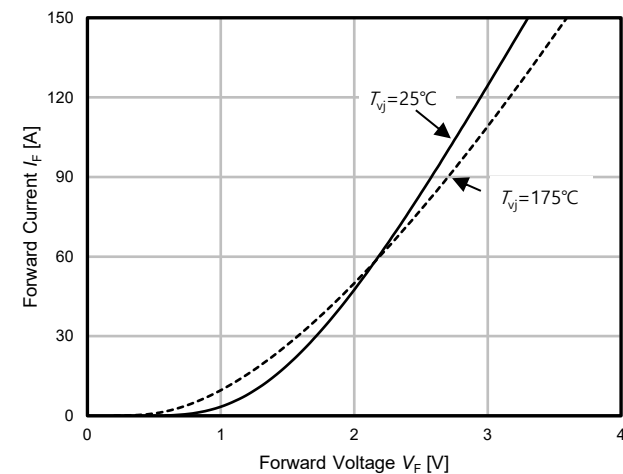


Fig. 5. Diode forward characteristics

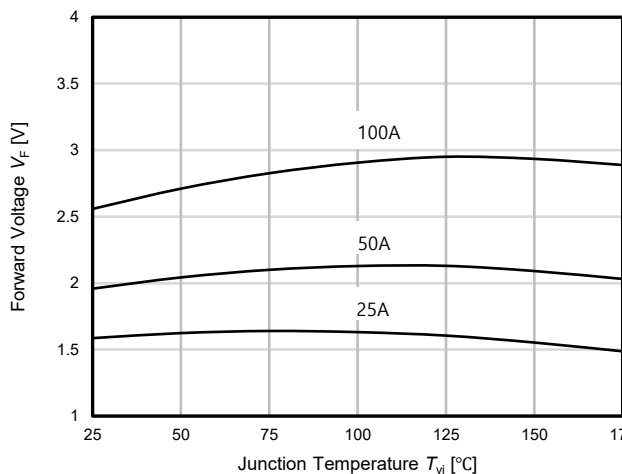


Fig. 6. Diode forward-junction temperature

## Electrical Characteristics Diagrams (25 °C, unless otherwise noted)

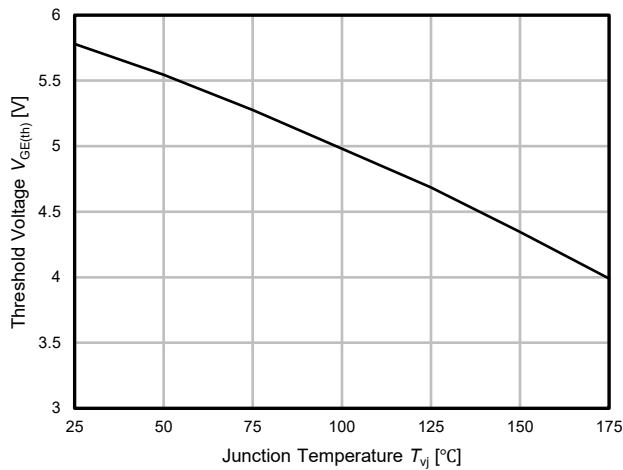


Fig.7. Threshold voltage-junction temperature

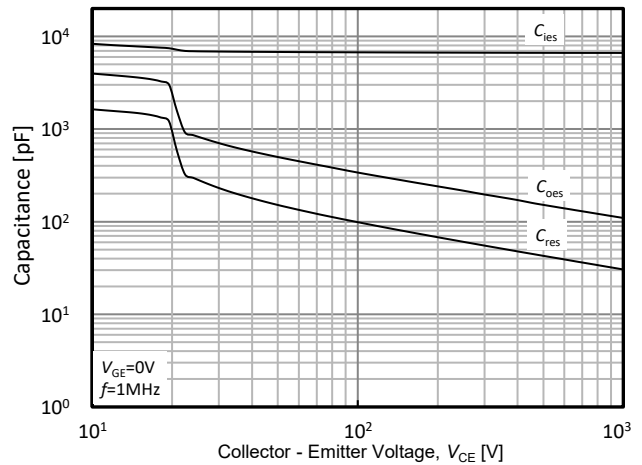


Fig.8. Typical capacitance

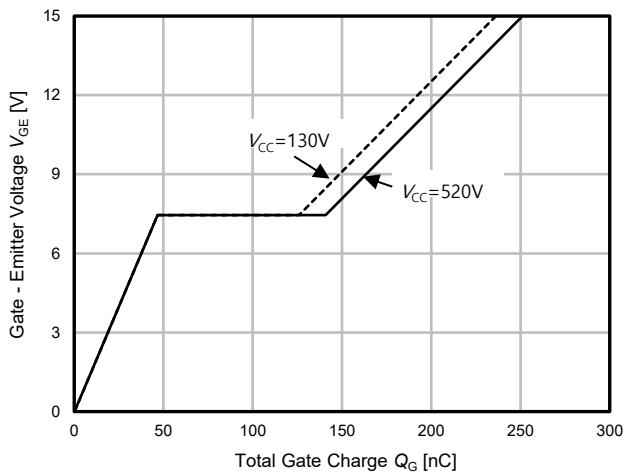


Fig.9. Typical gate charge

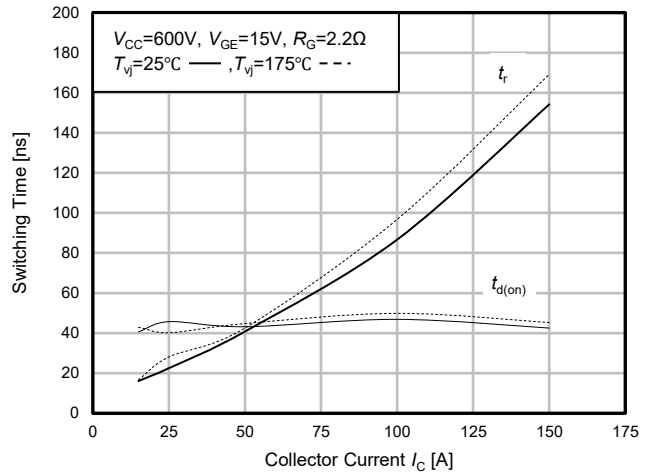


Fig.10. Typical turn on times-collector current

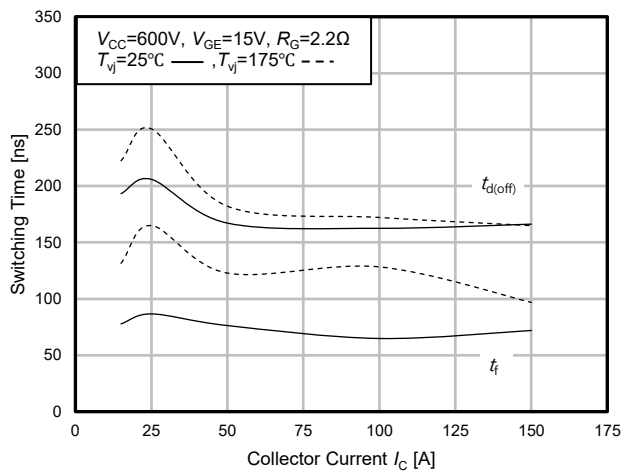


Fig.11. Typical turn off times-collector current

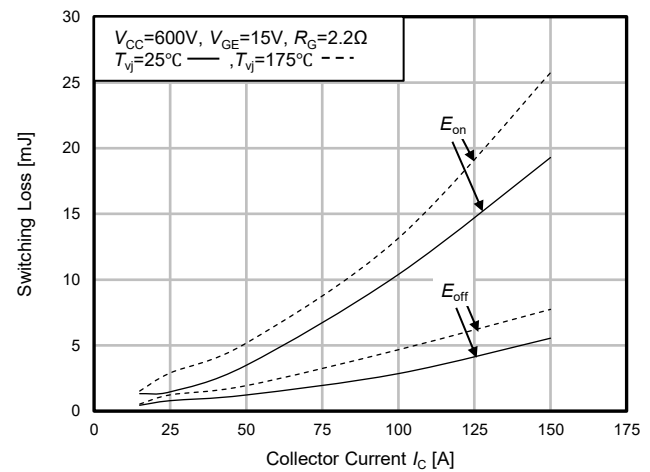
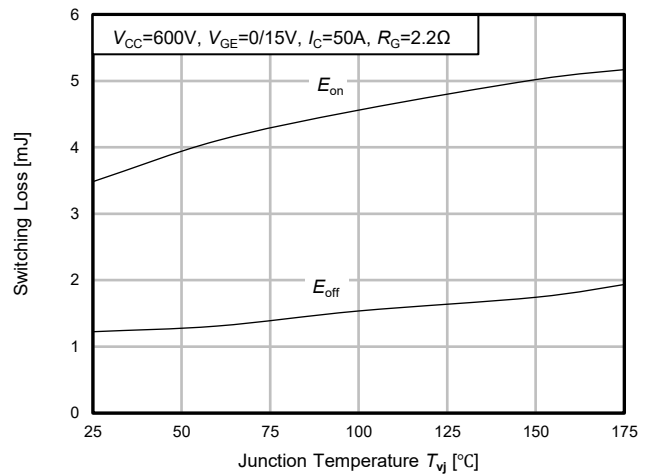
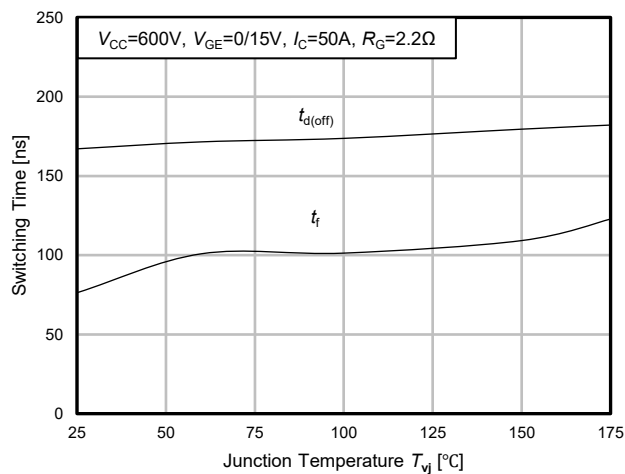
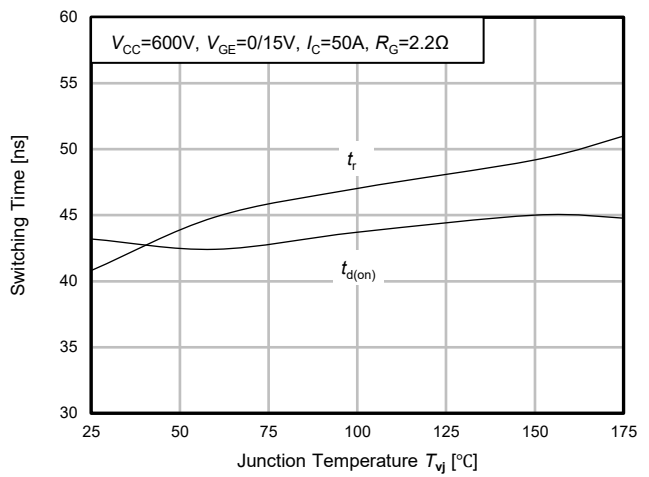
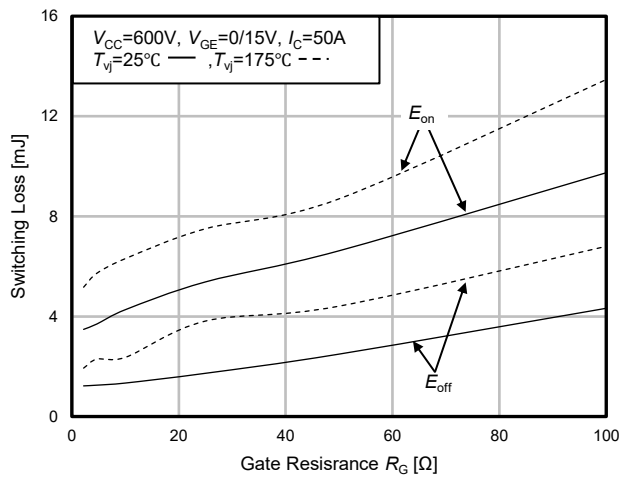
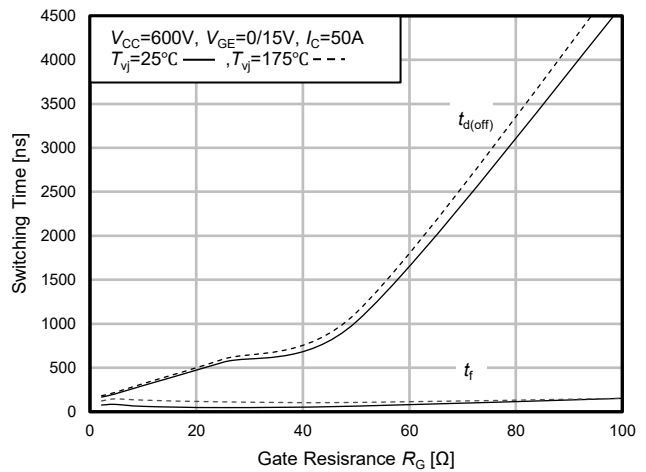
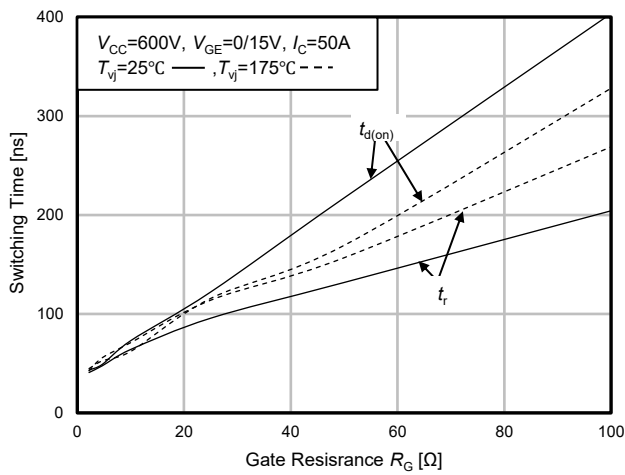
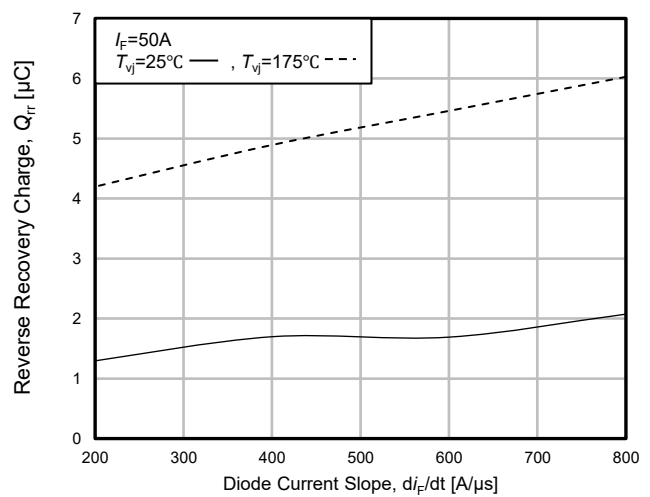
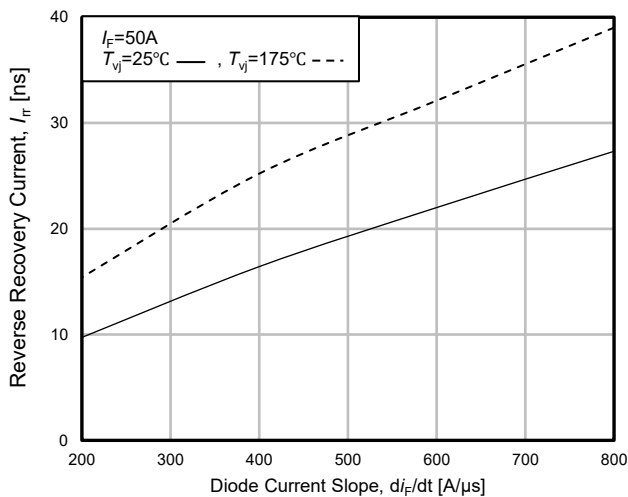
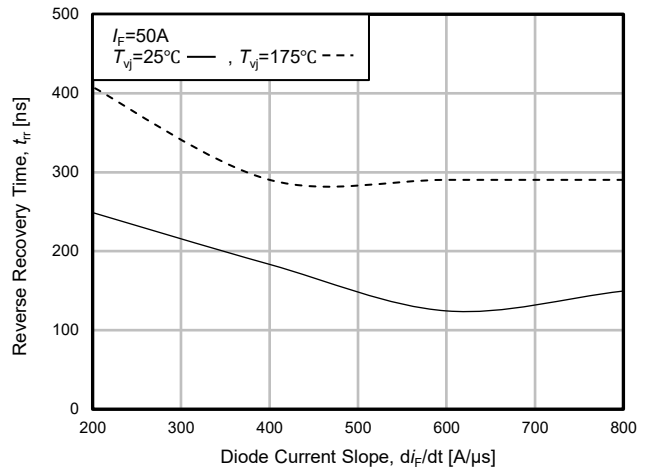
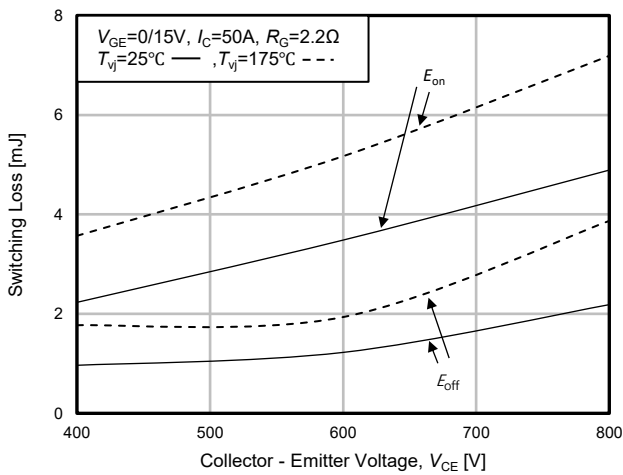
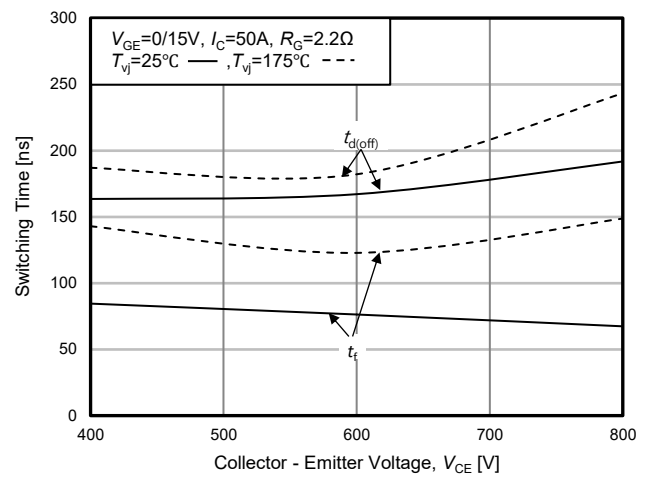
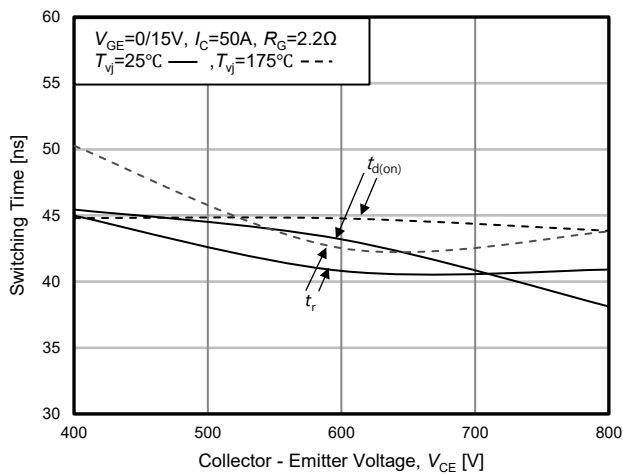


Fig.12. Switching losses-collector current

## Electrical Characteristics Diagrams (25 °C, unless otherwise noted)



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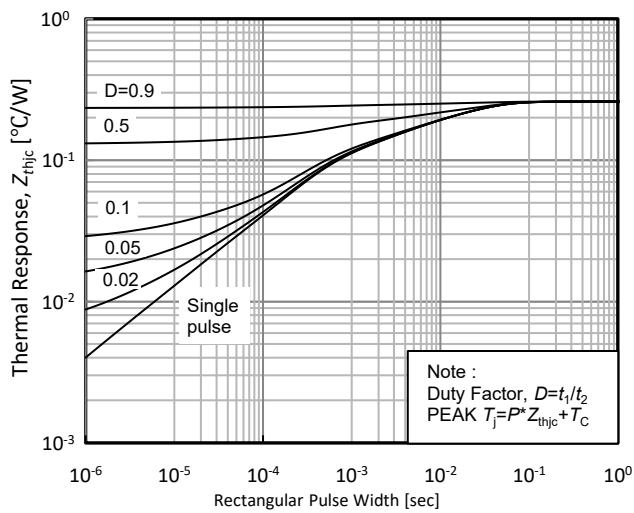


Fig.25. IGBT transient thermal impedance

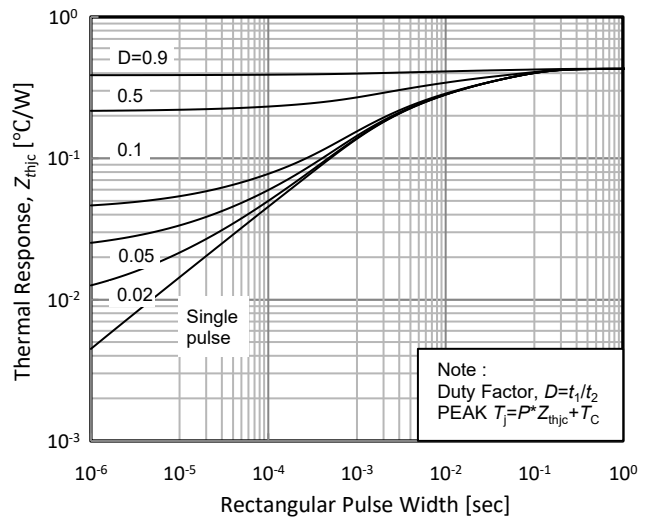


Fig.26. FRD transient thermal impedance

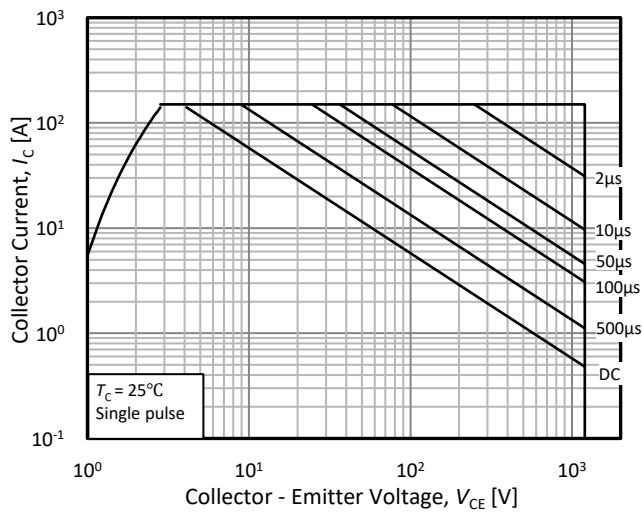


Fig.27. FBSOA

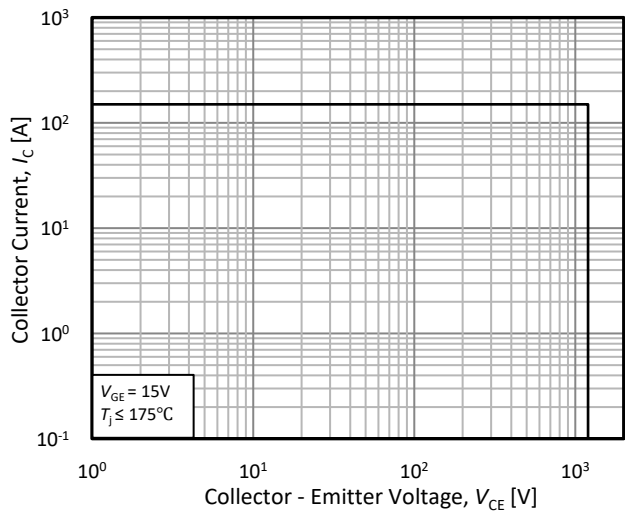
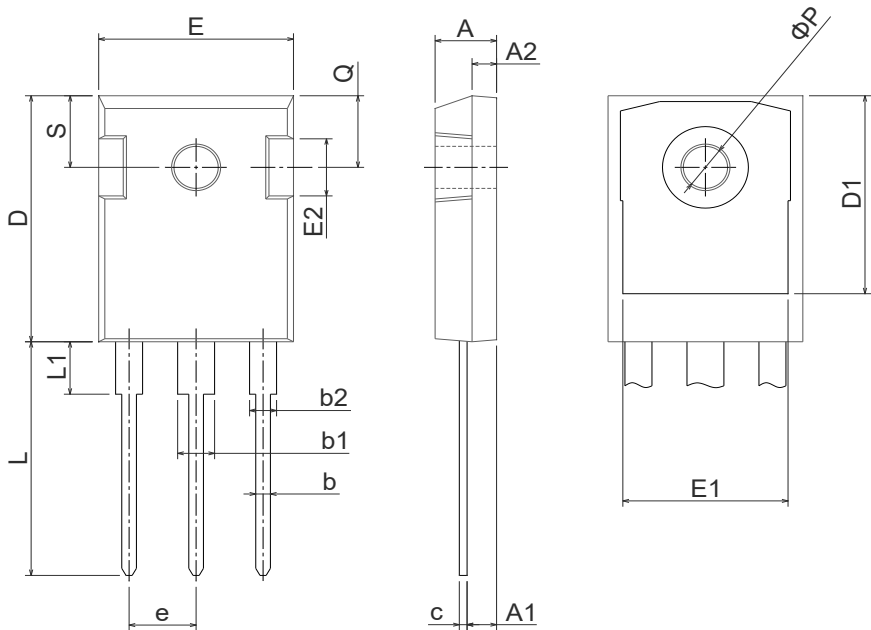


Fig.28. RBSOA

# Physical Dimension

## 50T120RFS



| Dimension | Min(mm) | Max(mm) |
|-----------|---------|---------|
| A         | 4.70    | 5.31    |
| A1        | 2.20    | 2.60    |
| A2        | 1.50    | 2.49    |
| b         | 0.99    | 1.40    |
| b1        | 2.59    | 3.43    |
| b2        | 1.65    | 2.39    |
| c         | 0.38    | 0.89    |
| D         | 20.30   | 21.46   |
| D1        | 13.08   | -       |
| E         | 15.45   | 16.26   |
| E1        | 13.06   | 14.02   |
| E2        | 4.32    | 5.49    |
| e         | 5.45BSC |         |
| L         | 19.81   | 20.57   |
| L1        | -       | 4.50    |
| ΦP        | 3.50    | 3.70    |
| Q         | 5.38    | 6.20    |
| S         | 6.15BSC |         |

**Notes**

Package body size, length and width do not include mold flash, protrusions and gate burrs.

**DISCLAIMER :**

The Products are not designed for use in hostile environments, including, without limitation, aircraft, nuclear power generation, medical appliances, and devices or systems in which malfunction of any Product can reasonably be expected to result in a personal injury. Seller's customers using or selling Seller's products for use in such applications do so at their own risk and agree to fully defend and indemnify Seller.

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