

7MBR10XKC120-50

IGBT Modules

Power Module(X series)
1200V / 10A / PIM

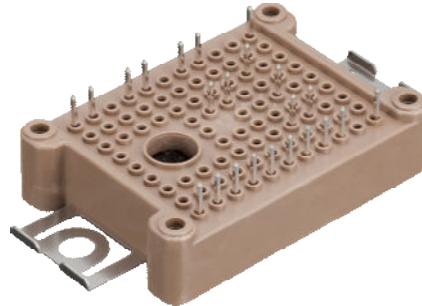
■ **Features**

- Low $V_{CE(sat)}$
- Compact Package
- P.C.Board Mount Module
- Converter Diode Bridge Dynamic Brake Circuit
- RoHS compliant Product

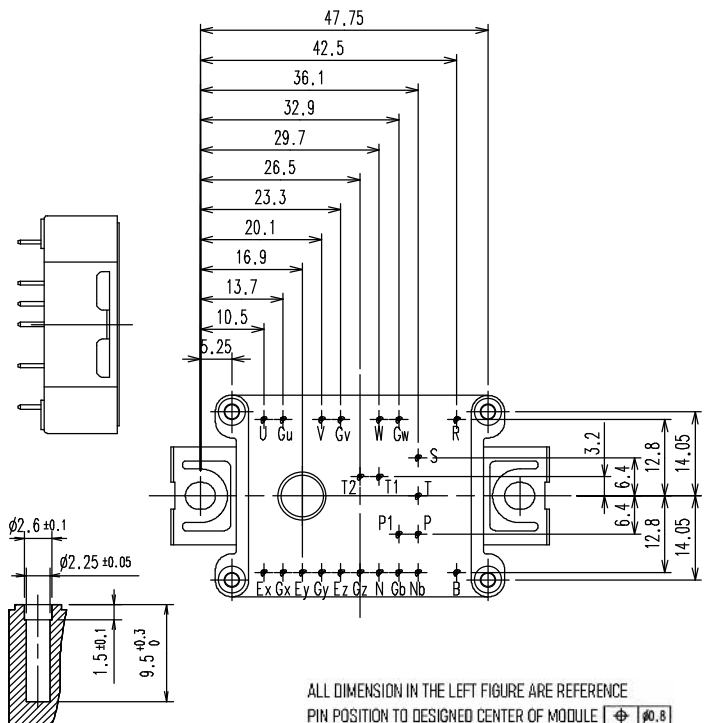
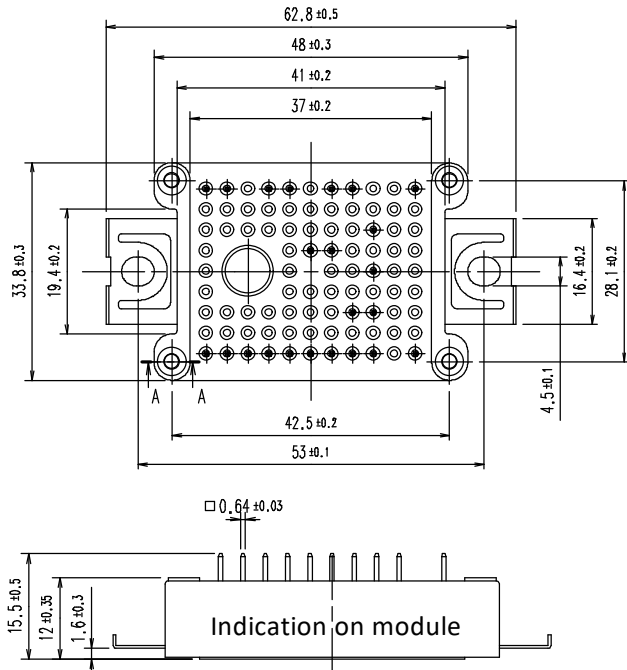
■ **Applications**

- Inverter for Motor Drive
- AC and DC Servo Drive Amplifier
- Uninterruptible Power Supply

■ **Typical appearance**



■ **Outline drawing (Unit : mm)**

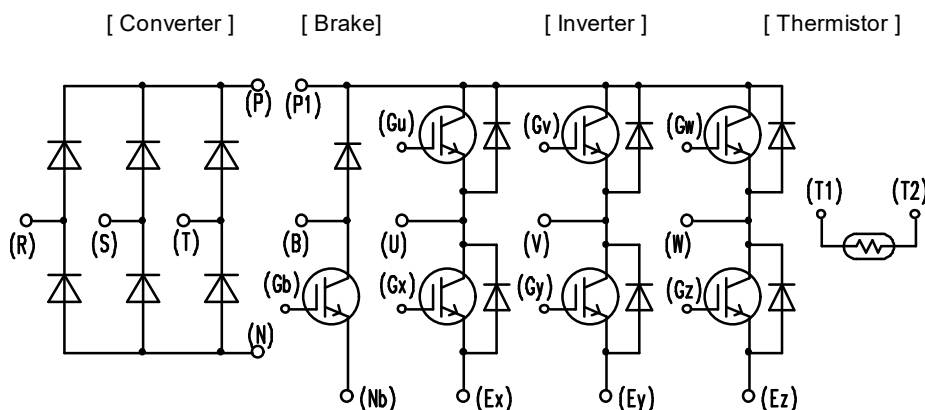


ALL DIMENSION IN THE LEFT FIGURE ARE REFERENCE
PIN POSITION TO DESIGNED CENTER OF MODULE $\square \oplus \phi 0.8$
PIN-GRID SPACING 3.2mm

断面 A-A (1.5:1)
SECTION A-A

Weight: 25 g (typ.)

■ **Equivalent circuit**



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■ Maximum ratings (at $T_c = 25^\circ\text{C}$ unless otherwise specified)

| Items | | Symbols | Conditions | | Maximum ratings | Units |
|---|--|----------------------------|---|----------------------------|-----------------|------------------|
| Inverter | Collector-Emitter voltage, Gate-Emitter short-circuited | V_{CES} | | | 1200 | V |
| | Gate-Emitter voltage, Collector-Emitter short-circuited | V_{GES} | | | ± 20 | V |
| | Collector current | I_C | Continuous | $T_c=100^\circ\text{C}$ | 10 | A |
| | Repetitive peak collector current | I_{CRM} | 1ms | | 20 | |
| | Forward current | I_F | Continuous | | 10 | |
| | Repetitive peak forward current | I_{FRM} | 1ms | | 20 | |
| | Total power dissipation | P_{tot} | 1 device | | 105 | W |
| Brake IGBT | Collector-Emitter voltage, Gate-Emitter short-circuited | V_{CES} | | | 1200 | V |
| | Gate-Emitter voltage, Collector-Emitter short-circuited | V_{GES} | | | ± 20 | V |
| | Collector current | I_C | Continuous | $T_c=100^\circ\text{C}$ | 10 | A |
| | Repetitive peak collector current | I_{CRM} | 1ms | | 20 | |
| | Total power dissipation | P_{tot} | 1 device | | 105 | W |
| Brake FWD | Forward current | I_F | Continuous | | 10 | A |
| | Repetitive peak forward current | I_{FRM} | 1ms | | 20 | |
| | Repetitive peak reverse voltage | V_{RRM} | | | 1200 | V |
| | Repetitive peak reverse voltage | V_{RRM} | | | 1600 | V |
| Converter | Average output current | I_O | Three-phase full wave rectified current | $T_c=80^\circ\text{C}$ | 10 | A |
| | Surge current (Non-Repetitive) (*1) | I_{FSM} | $t=10\text{ms}$, Half sine wave form | $T_{vj}=25^\circ\text{C}$ | 350 | A |
| | | | | $T_{vj}=150^\circ\text{C}$ | 300 | |
| | I^2t (Non-Repetitive) (*1) | I^2t | | $T_{vj}=25^\circ\text{C}$ | 615 | A ² s |
| | | $T_{vj}=150^\circ\text{C}$ | 450 | | | |
| Virtual junction temperature | | T_{vj} | Inverter, Brake | | 175 | °C |
| | | | Converter | | 150 | |
| Operating junction temperature (under switching conditions) | | T_{vjop} | Inverter, Brake | | 175 | |
| | | | Converter | | 150 | |
| Case temperature | | T_c | | | 125 | |
| Storage temperature | | T_{stg} | | | -40 ~ 125 | |
| Isolation voltage | between terminals and copper base (*2) between thermistor and others (*3) | V_{isol} | A.C. : 1min. | | 2500 | Vrms |
| Screw torque | Mounting torque of screws to heat sink | M_s | M4 | | 1.3~1.7 | N·m |

(*1) T_{vj} : Temperature at test start.

(*2) All terminals should be connected together during the test.

(*3) Two thermistor terminals should be connected together, other terminals should be connected together and shorted to base plate during the test.

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■ Electrical characteristics (at $T_{vj} = 25^{\circ}\text{C}$ unless otherwise specified)

| Items | Symbols | Conditions | Characteristics | | | Units | |
|---|---|---|------------------------------|------|------|---------------|---------------|
| | | | min. | typ. | max. | | |
| Collector-Emitter cut-off current, Gate-Emitter short-circuited | I_{CES} | $V_{GE} = 0\text{V}$ $V_{CE} = 1200\text{V}$ | - | - | 50 | μA | |
| Gate leakage current, Collector-Emitter short-circuited | I_{GES} | $V_{CE} = 0\text{V}$ $V_{GE} = +20/-20\text{V}$ | - | - | 100 | nA | |
| Gate-Emitter threshold voltage | $V_{GE(th)}$ | $V_{CE} = 20\text{V}$ $I_C = 10\text{mA}$ | 6.0 | 6.5 | 7.0 | V | |
| Collector-Emitter saturation voltage | $V_{CE(sat)}$ (terminal) | $V_{GE} = 15\text{V}$ $I_C = 10\text{A}$ | $T_{vj}=25^{\circ}\text{C}$ | - | 1.55 | 2.00 | V |
| | | | $T_{vj}=25^{\circ}\text{C}$ | - | 1.50 | 1.95 | |
| | $T_{vj}=125^{\circ}\text{C}$ | | - | 1.85 | - | | |
| | $T_{vj}=150^{\circ}\text{C}$ | | - | 1.95 | - | | |
| | $T_{vj}=175^{\circ}\text{C}$ | | - | 2.00 | - | | |
| Internal gate resistance | r_g | - | - | 0 | - | Ω | |
| | | | - | 1.1 | - | nF | |
| Capacitance | C_{ies} | $V_{CE} = 10\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$ | - | 0.04 | - | | |
| | C_{oes} | | - | 0.01 | - | | |
| | C_{res} | | - | 0.01 | - | | |
| Gate charge | Q_G | $V_{CC} = 600\text{V}$ $V_{GE} = -15 \rightarrow +15\text{V}$ $I_C = 10\text{A}$ | - | 68 | - | nC | |
| Forward voltage | V_F | $I_F = 10\text{A}$ | $T_{vj}=25^{\circ}\text{C}$ | - | 1.95 | 2.40 | V |
| | | | $T_{vj}=25^{\circ}\text{C}$ | - | 1.90 | 2.35 | |
| | $T_{vj}=125^{\circ}\text{C}$ | | - | 1.95 | - | | |
| | $T_{vj}=150^{\circ}\text{C}$ | | - | 1.90 | - | | |
| | $T_{vj}=175^{\circ}\text{C}$ | | - | 1.85 | - | | |
| Switching time (*1) | $t_{d(on)}$ | $V_{CC} = 600\text{V}$ $I_C, I_F = 10\text{A}$ $L_s = 30\text{nH}$ $V_{GE} = +15/-15\text{V}$ $R_G = 47\ \Omega$ | $T_{vj}=25^{\circ}\text{C}$ | - | 0.05 | - | μs |
| | | | $T_{vj}=125^{\circ}\text{C}$ | - | 0.05 | - | |
| | | | $T_{vj}=150^{\circ}\text{C}$ | - | 0.05 | - | |
| | | | $T_{vj}=175^{\circ}\text{C}$ | - | 0.05 | - | |
| | t_r | $V_{CC} = 600\text{V}$ $I_C, I_F = 10\text{A}$ $L_s = 30\text{nH}$ $V_{GE} = +15/-15\text{V}$ $R_G = 47\ \Omega$ | $T_{vj}=25^{\circ}\text{C}$ | - | 0.03 | - | |
| | | | $T_{vj}=125^{\circ}\text{C}$ | - | 0.03 | - | |
| | | | $T_{vj}=150^{\circ}\text{C}$ | - | 0.03 | - | |
| | | | $T_{vj}=175^{\circ}\text{C}$ | - | 0.03 | - | |
| | $t_{d(off)}$ | $V_{CC} = 600\text{V}$ $I_C, I_F = 10\text{A}$ $L_s = 30\text{nH}$ $V_{GE} = +15/-15\text{V}$ $R_G = 47\ \Omega$ | $T_{vj}=25^{\circ}\text{C}$ | - | 0.19 | - | |
| | | | $T_{vj}=125^{\circ}\text{C}$ | - | 0.22 | - | |
| | | | $T_{vj}=150^{\circ}\text{C}$ | - | 0.22 | - | |
| | | | $T_{vj}=175^{\circ}\text{C}$ | - | 0.23 | - | |
| t_f | $V_{CC} = 600\text{V}$ $I_C, I_F = 10\text{A}$ $L_s = 30\text{nH}$ $V_{GE} = +15/-15\text{V}$ $R_G = 47\ \Omega$ | $T_{vj}=25^{\circ}\text{C}$ | - | 0.12 | - | | |
| | | $T_{vj}=125^{\circ}\text{C}$ | - | 0.18 | - | | |
| | | $T_{vj}=150^{\circ}\text{C}$ | - | 0.20 | - | | |
| | | $T_{vj}=175^{\circ}\text{C}$ | - | 0.22 | - | | |
| Reverse recovery time | t_{rr} | $V_{CC} = 600\text{V}$ $I_C, I_F = 10\text{A}$ $L_s = 30\text{nH}$ $V_{GE} = +15/-15\text{V}$ $R_G = 47\ \Omega$ | $T_{vj}=25^{\circ}\text{C}$ | - | 0.06 | - | |
| | | | $T_{vj}=125^{\circ}\text{C}$ | - | 0.09 | - | |
| | | | $T_{vj}=150^{\circ}\text{C}$ | - | 0.15 | - | |
| | | | $T_{vj}=175^{\circ}\text{C}$ | - | 0.20 | - | |

(*1) Turn on time (t_{on}) = $t_{d(on)} + t_r$, Turn off time (t_{off}) = $t_{d(off)} + t_f$

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| Items | Symbols | Conditions | Characteristics | | | Units | |
|---|-----------------------------|---|----------------------|------|------|----------|---------|
| | | | min. | typ. | max. | | |
| Inverter Switching loss (per pulse) | E_{on} | $V_{CC} = 600V$ $I_C, I_F = 10A \quad L_s = 30nH$ $V_{GE} = +15/-15V$ $R_G = 47\Omega$ | $T_{vj}=25^\circ C$ | - | 0.72 | - | mJ |
| | | | $T_{vj}=125^\circ C$ | - | 0.96 | - | |
| | | | $T_{vj}=150^\circ C$ | - | 1.06 | - | |
| | | | $T_{vj}=175^\circ C$ | - | 1.15 | - | |
| | E_{off} | $V_{CC} = 600V$ $I_C, I_F = 10A \quad L_s = 30nH$ $V_{GE} = +15/-15V$ $R_G = 47\Omega$ | $T_{vj}=25^\circ C$ | - | 0.76 | - | |
| | | | $T_{vj}=125^\circ C$ | - | 0.98 | - | |
| | | | $T_{vj}=150^\circ C$ | - | 1.03 | - | |
| | | | $T_{vj}=175^\circ C$ | - | 1.08 | - | |
| | E_{rr} | $V_{CC} = 600V$ $I_C, I_F = 10A \quad L_s = 30nH$ $V_{GE} = +15/-15V$ $R_G = 47\Omega$ | $T_{vj}=25^\circ C$ | - | 0.51 | - | |
| | | | $T_{vj}=125^\circ C$ | - | 0.72 | - | |
| | | | $T_{vj}=150^\circ C$ | - | 0.85 | - | |
| | | | $T_{vj}=175^\circ C$ | - | 0.97 | - | |
| Collector-Emitter cut-off current, Gate-Emitter short-circuited | I_{CES} | $V_{GE} = 0V$ $V_{CE} = 1200V$ | - | - | 50 | μA | |
| Gate leakage current, Collector-Emitter short-circuited | I_{GES} | $V_{CE} = 0V, \quad V_{GE} = +20/-20V$ | - | - | 100 | nA | |
| Collector-Emitter saturation voltage | $V_{CE(sat)}$ (terminal) | $V_{GE} = 15V$ $I_C = 10A$ | $T_{vj}=25^\circ C$ | - | 1.55 | 2.00 | V |
| | | | $T_{vj}=125^\circ C$ | - | 1.50 | 1.95 | |
| | $V_{CE(sat)}$ (chip) | | $T_{vj}=150^\circ C$ | - | 1.95 | - | |
| | | | $T_{vj}=175^\circ C$ | - | 2.00 | - | |
| Internal gate resistance | r_g | - | - | 0 | - | Ω | |
| Brake Switching time (*1) | $t_{d(on)}$ | $V_{CC} = 600V$ $I_C = 10A \quad L_s = 30nH$ $V_{GE} = +15/-15V$ $R_G = 47\Omega$ | $T_{vj}=25^\circ C$ | - | 0.05 | - | μs |
| | | | $T_{vj}=125^\circ C$ | - | 0.05 | - | |
| | | | $T_{vj}=150^\circ C$ | - | 0.05 | - | |
| | | | $T_{vj}=175^\circ C$ | - | 0.05 | - | |
| | t_r | $V_{CC} = 600V$ $I_C = 10A \quad L_s = 30nH$ $V_{GE} = +15/-15V$ $R_G = 47\Omega$ | $T_{vj}=25^\circ C$ | - | 0.03 | - | |
| | | | $T_{vj}=125^\circ C$ | - | 0.03 | - | |
| | | | $T_{vj}=150^\circ C$ | - | 0.03 | - | |
| | | | $T_{vj}=175^\circ C$ | - | 0.03 | - | |
| | $t_{d(off)}$ | $V_{CC} = 600V$ $I_C = 10A \quad L_s = 30nH$ $V_{GE} = +15/-15V$ $R_G = 47\Omega$ | $T_{vj}=25^\circ C$ | - | 0.19 | - | |
| | | | $T_{vj}=125^\circ C$ | - | 0.22 | - | |
| | | | $T_{vj}=150^\circ C$ | - | 0.22 | - | |
| | | | $T_{vj}=175^\circ C$ | - | 0.23 | - | |
| | t_f | $V_{CC} = 600V$ $I_C = 10A \quad L_s = 30nH$ $V_{GE} = +15/-15V$ $R_G = 47\Omega$ | $T_{vj}=25^\circ C$ | - | 0.12 | - | |
| | | | $T_{vj}=125^\circ C$ | - | 0.18 | - | |
| | | | $T_{vj}=150^\circ C$ | - | 0.20 | - | |
| | | | $T_{vj}=175^\circ C$ | - | 0.22 | - | |
| Reverse current | I_{RRM} | $V_R = 1200V$ | - | - | 50 | μA | |
| Forward voltage | V_F (terminal) | $I_F = 10A$ | $T_{vj}=25^\circ C$ | - | 1.95 | 2.40 | V |
| | | | $T_{vj}=125^\circ C$ | - | 1.90 | 2.35 | |
| | V_F (chip) | | $T_{vj}=150^\circ C$ | - | 1.90 | - | |
| | | | $T_{vj}=175^\circ C$ | - | 1.85 | - | |
| Reverse current | I_{RRM} | $V_R = 1600V$ | - | - | 50 | μA | |
| Forward voltage | V_{FM} | $I_F = 10A$ | terminal | - | 1.00 | 1.45 | V |
| | | | chip | - | 0.95 | 1.40 | |
| Resistance | R | $T = 25^\circ C$ | - | 5000 | - | Ω | |
| | | $T = 100^\circ C$ | 465 | 495 | 520 | | |
| B value | B | $T = 25/50^\circ C$ | 3305 | 3375 | 3450 | K | |

(*1) Turn on time (t_{on}) = $t_{d(on)} + t_r$, Turn off time (t_{off}) = $t_{d(off)} + t_f$

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NOTICE:

The external gate resistance (R_G) shown above is one of our recommended value for the purpose of minimum switching loss. However the optimum R_G depends on circuit configuration and/or environment. We recommend that the R_G has to be carefully chosen based on consideration if IGBT module matches design criteria, for example, switching loss, EMC/EMI, spike voltage, surge current and no unexpected oscillation and so on.

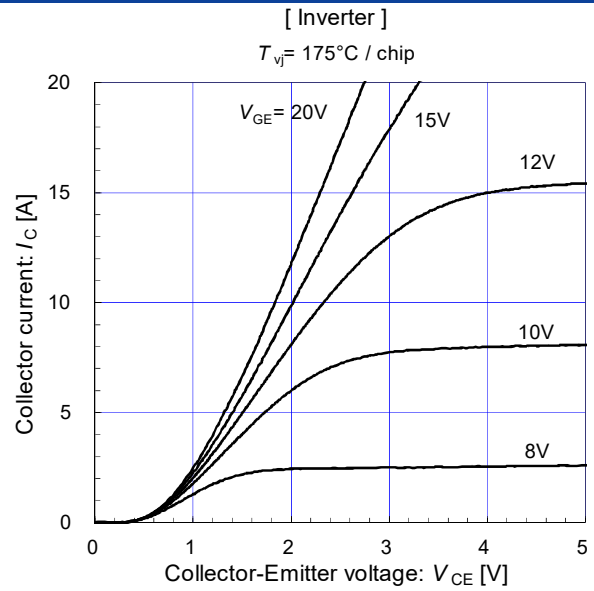
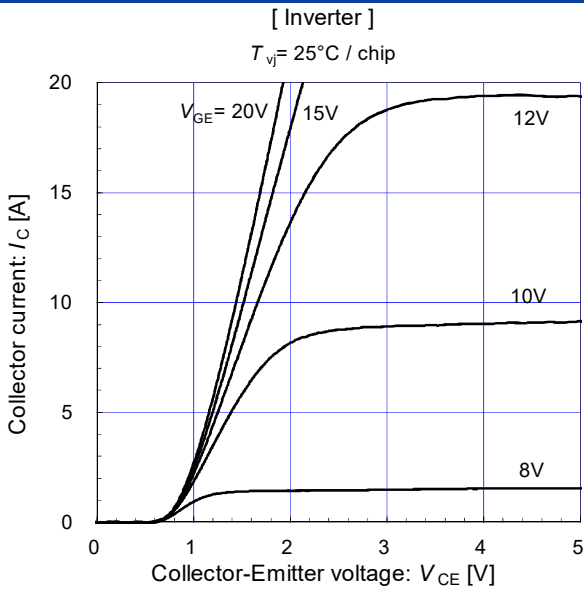
■ Thermal resistance characteristics

| Items | Symbols | Conditions | Characteristics | | | Units |
|--|---------------|-----------------|-----------------|------|------|-------|
| | | | min. | typ. | max. | |
| Thermal resistance junction to case (1 device) | $R_{th(j-c)}$ | Inverter IGBT | - | - | 1.40 | K/W |
| | | Inverter FWD | - | - | 1.75 | |
| | | Brake IGBT | - | - | 1.40 | |
| | | Brake FWD | - | - | 1.75 | |
| | | Converter Diode | - | - | 0.97 | |
| Thermal resistance case to heat sink(*1) (1 device) | $R_{th(c-f)}$ | Inverter IGBT | - | 0.79 | - | |
| | | Inverter FWD | - | 0.92 | - | |
| | | Brake IGBT | - | 0.82 | - | |
| | | Brake FWD | - | 0.76 | - | |
| | | Converter Diode | - | 0.78 | - | |

(*1) This is the value which is defined mounting on the additional cooling fin with 1W/(m·K) thermal grease.

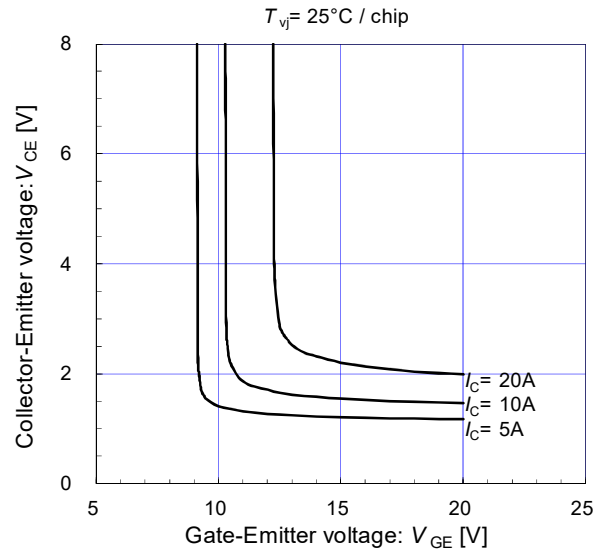
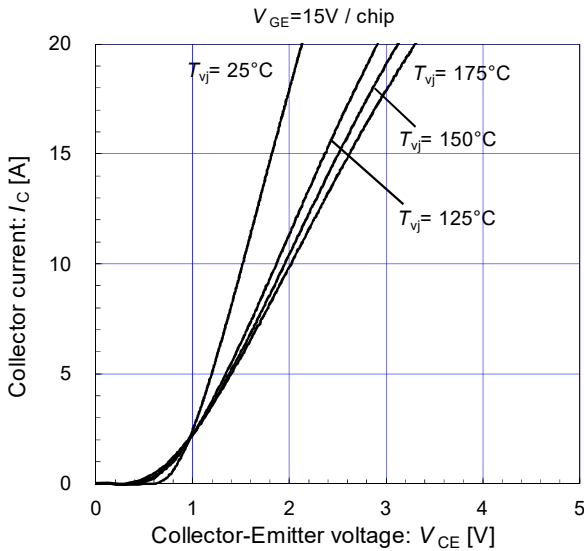
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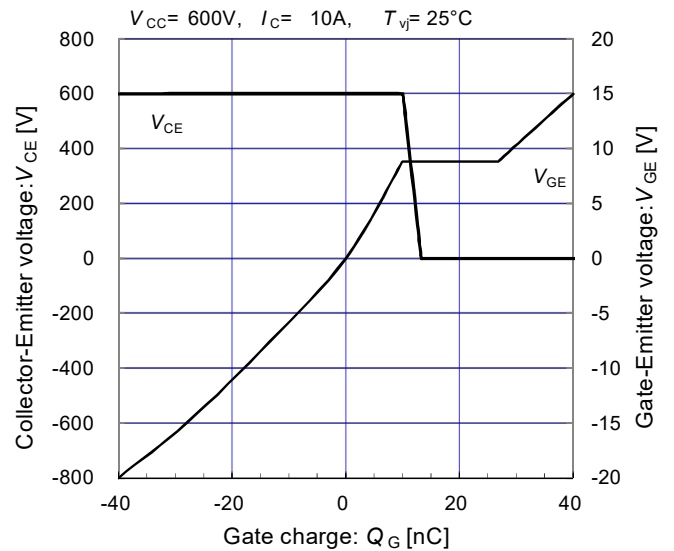
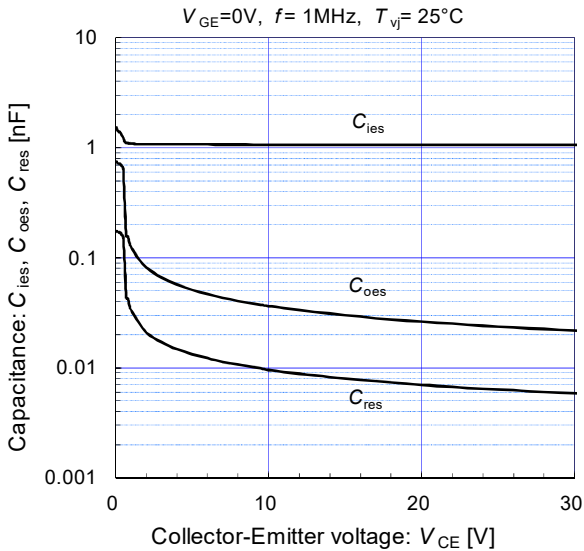
[Inverter]
 Collector current vs. Collector-Emitter voltage (typ.)

[Inverter]
 Collector-Emitter voltage vs. Gate-Emitter voltage (typ.)



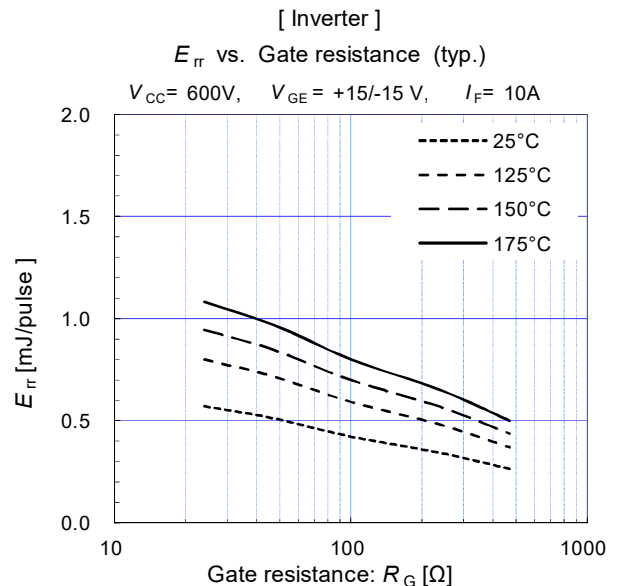
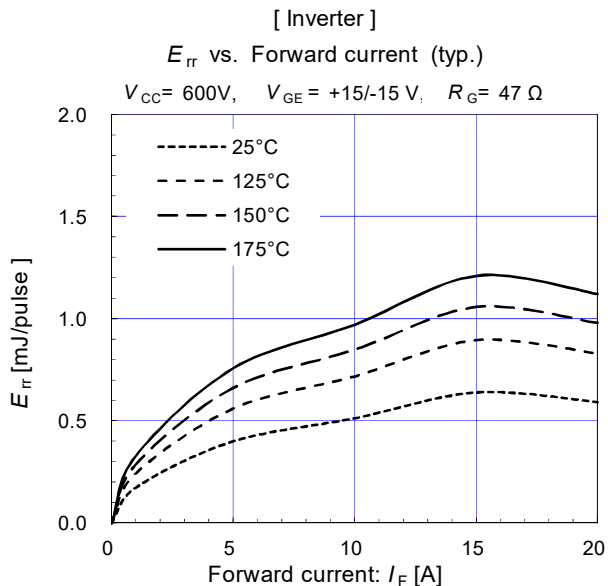
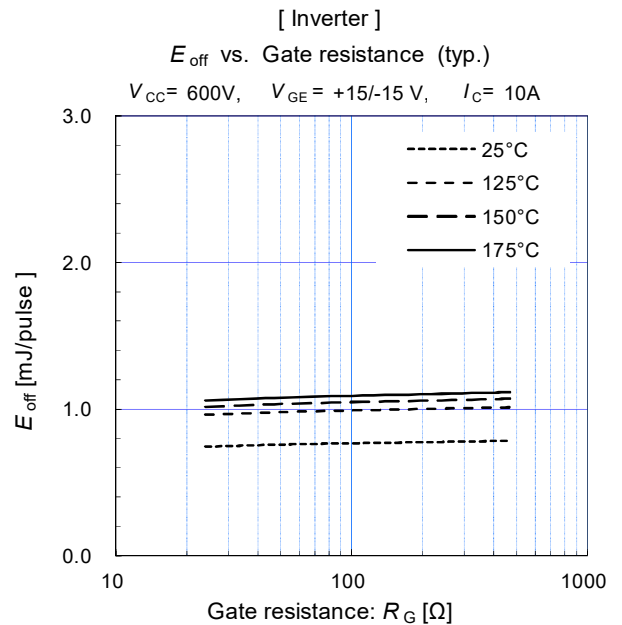
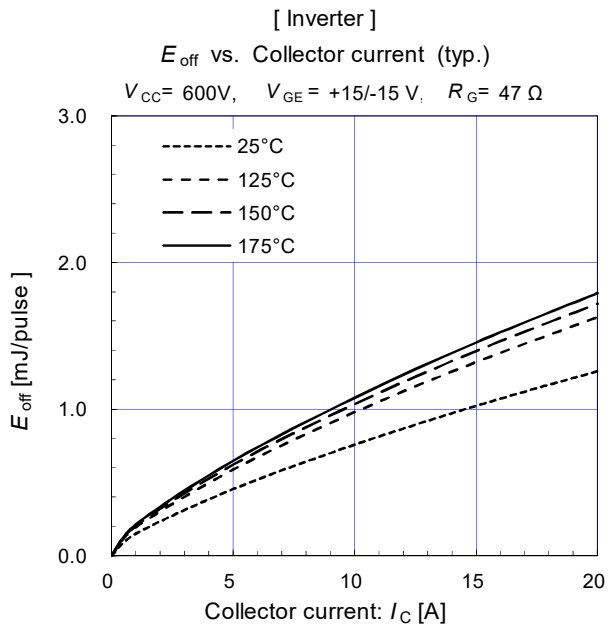
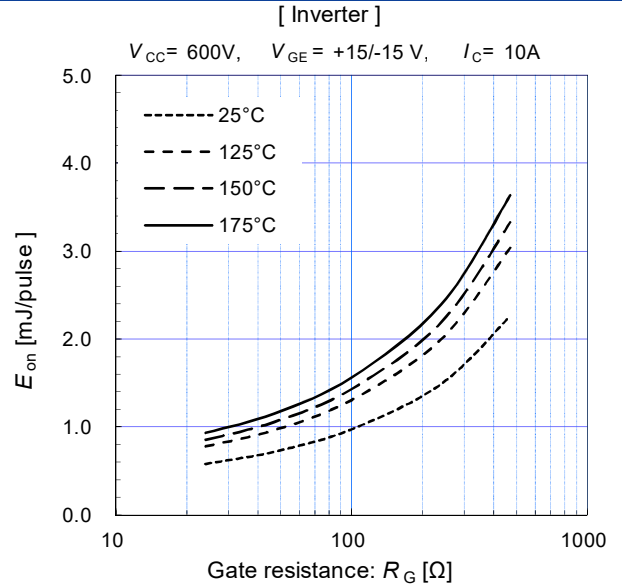
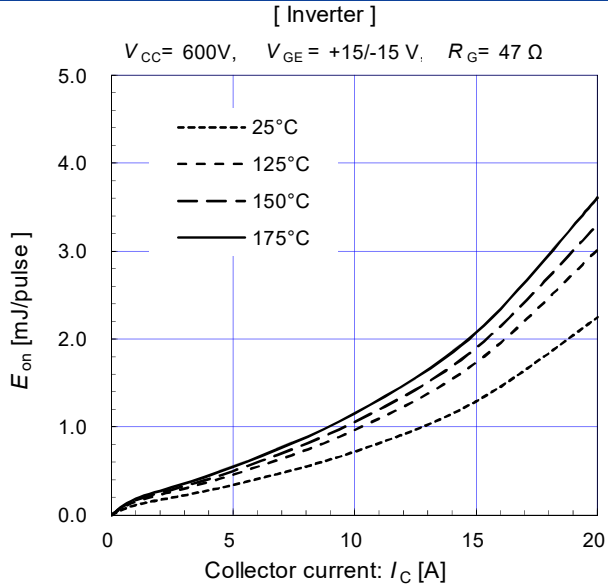
[Inverter]
 Capacitance vs. Collector-Emitter voltage (typ.)

[Inverter]
 Dynamic gate charge (typ.)



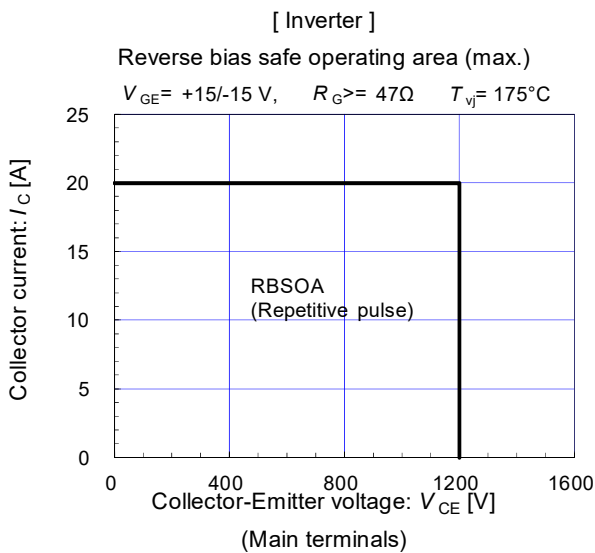
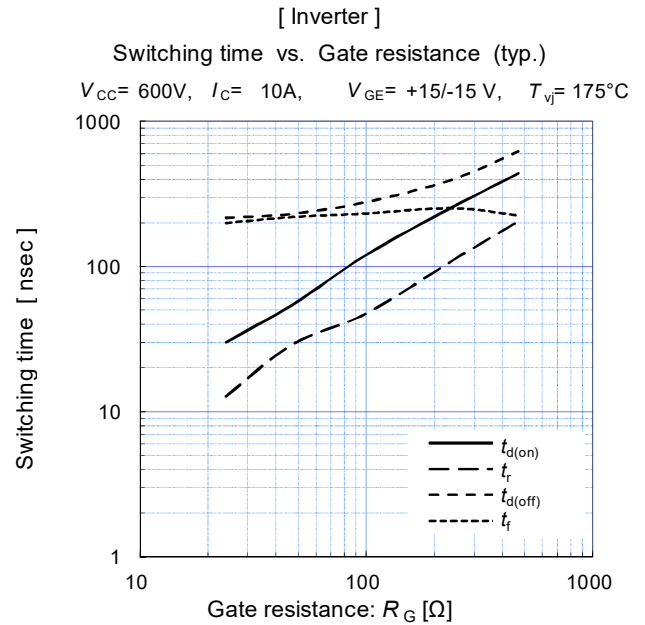
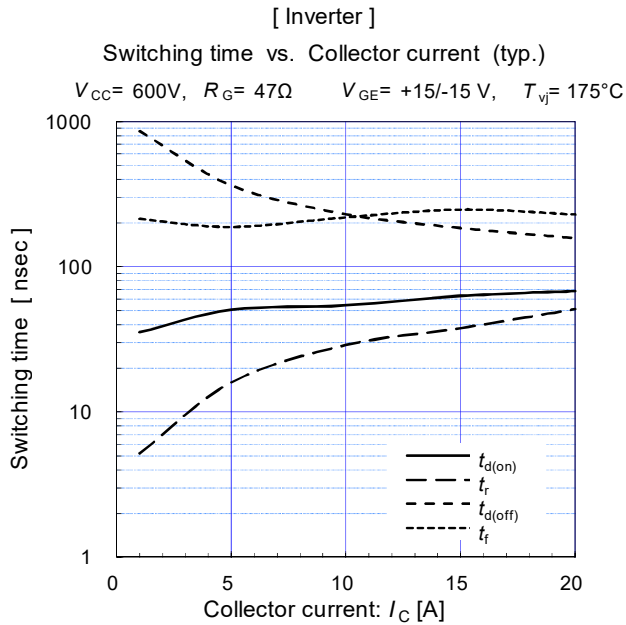
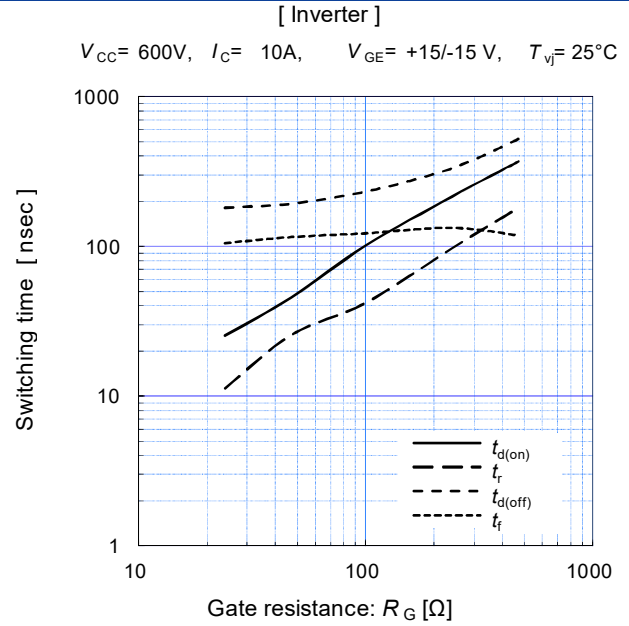
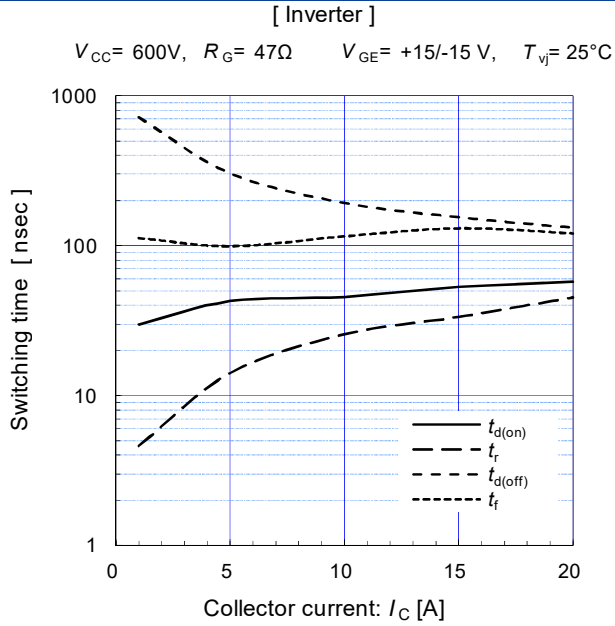
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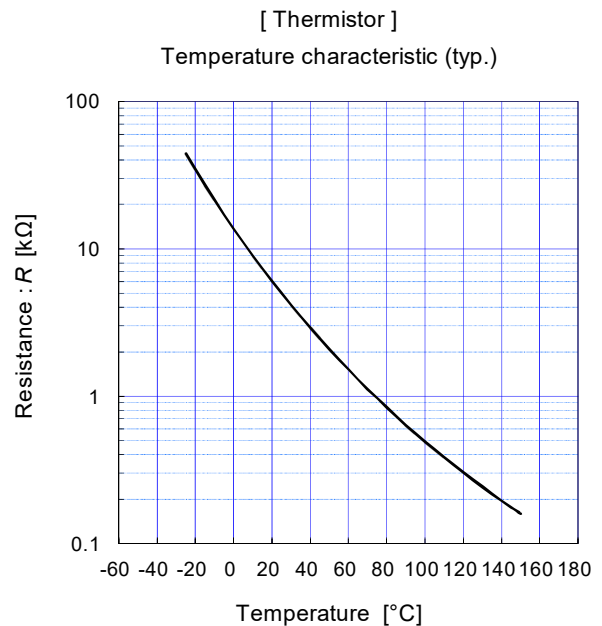
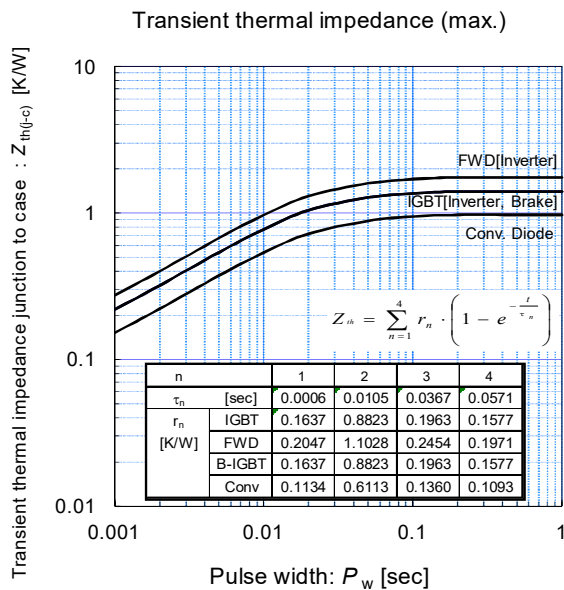
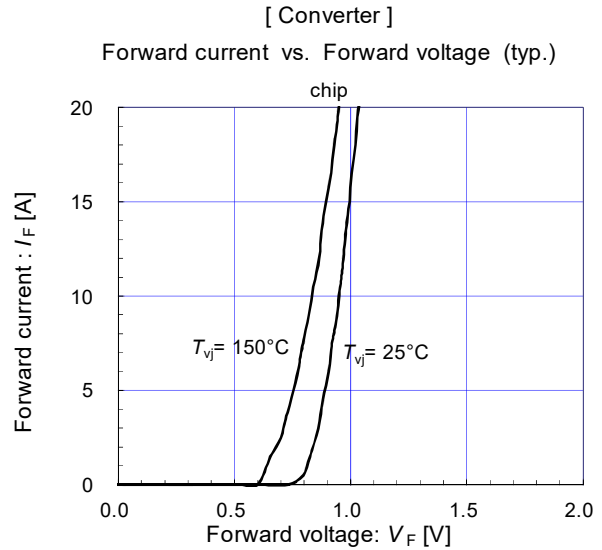
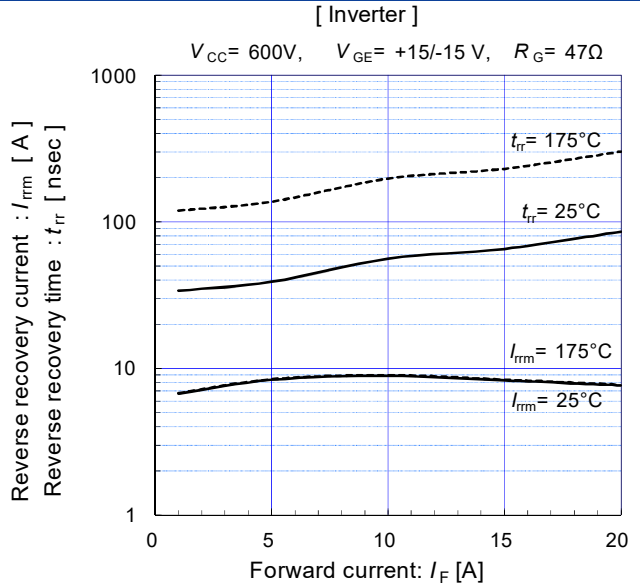
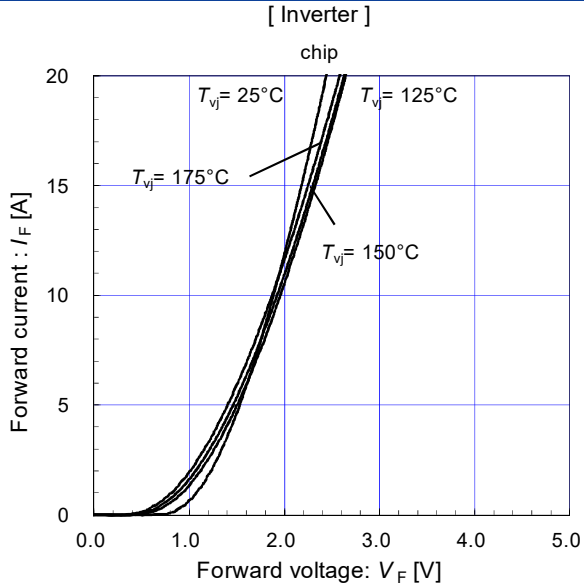
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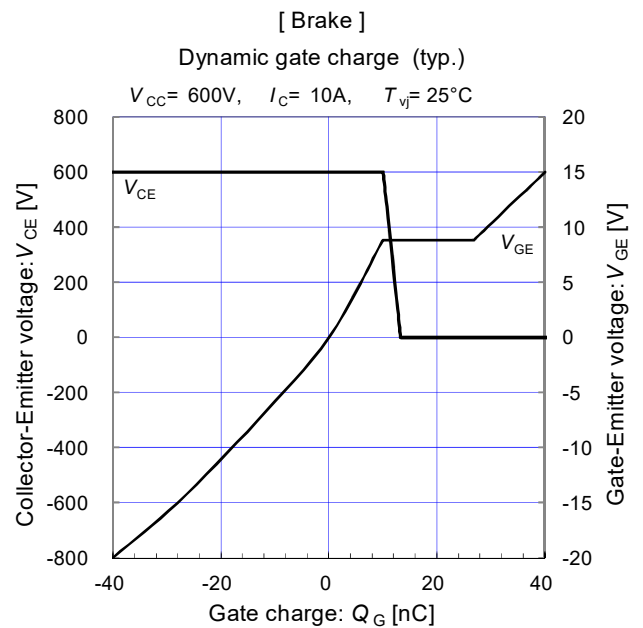
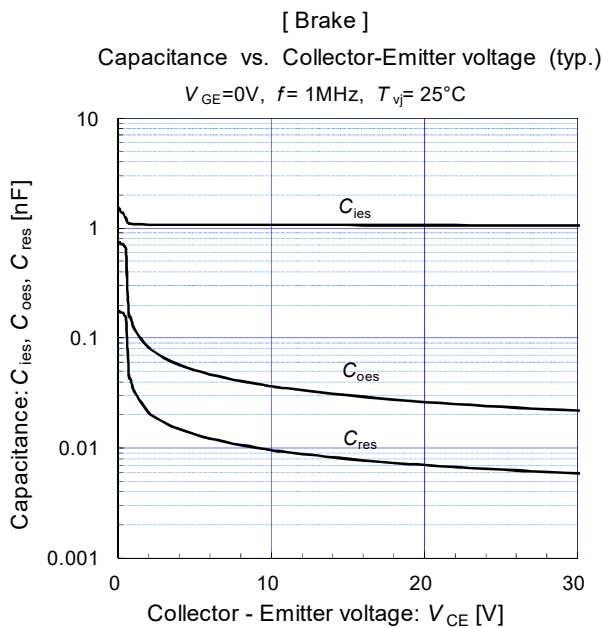
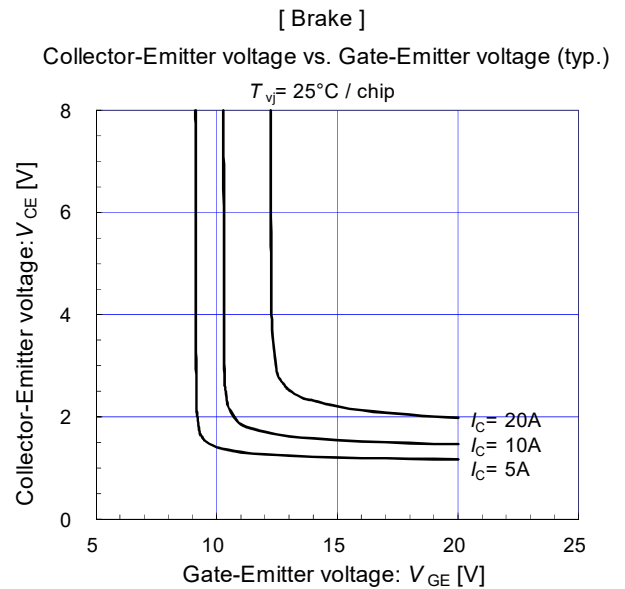
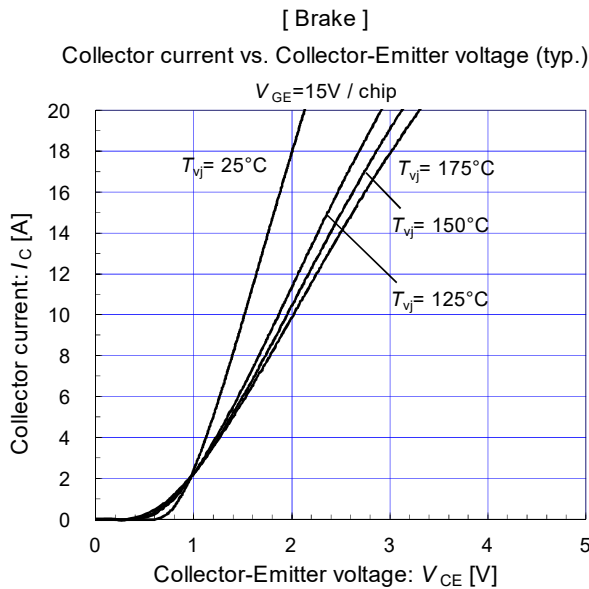
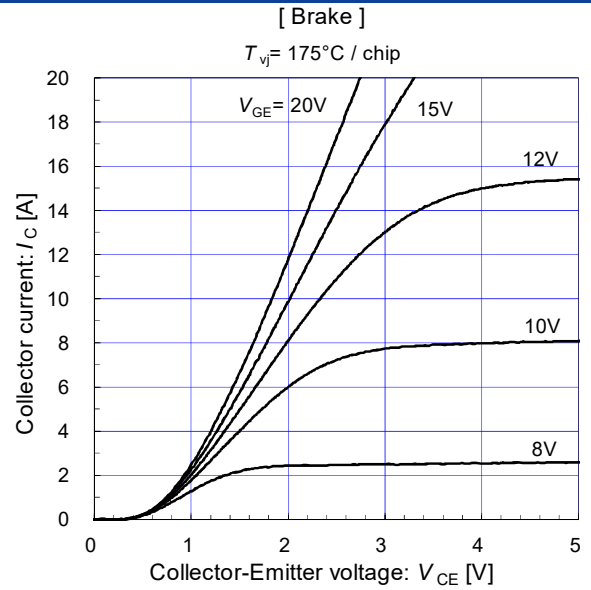
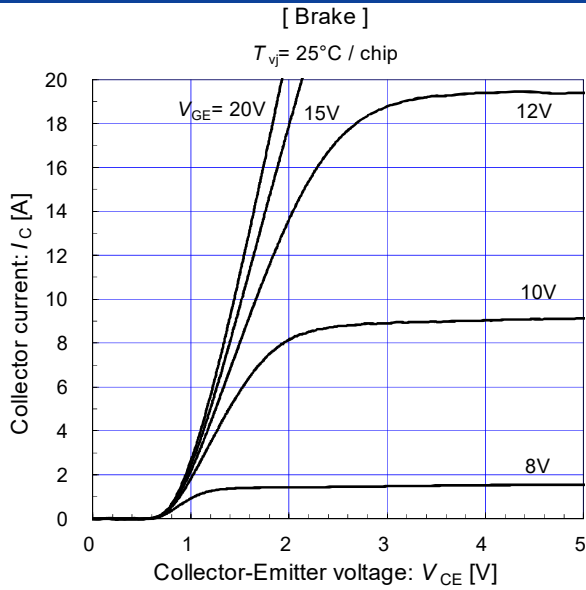
7MBR10XKC120-50

IGBT Modules



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