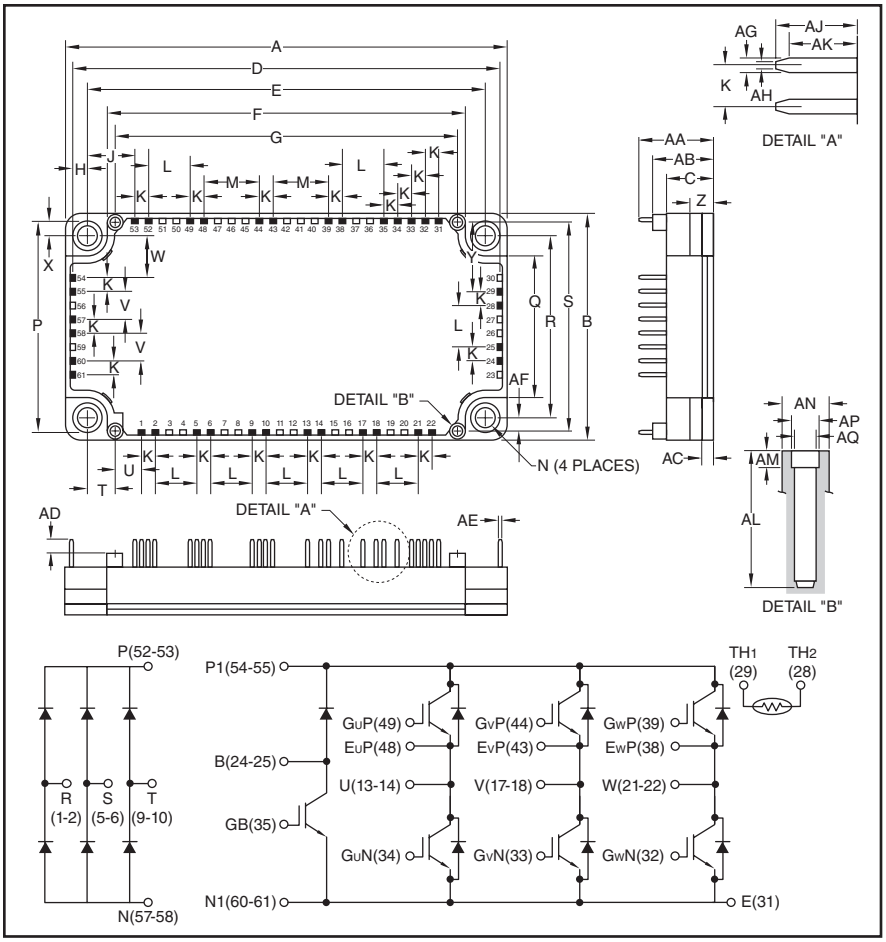
Powerex, Inc., 173 Pavilion Lane, Youngwood, Pennsylvania 15697 (724) 925-7272

# CM100MX-12A

## NX-Series CIB Module

***(3Ø Converter + 3Ø Inverter + Brake)***

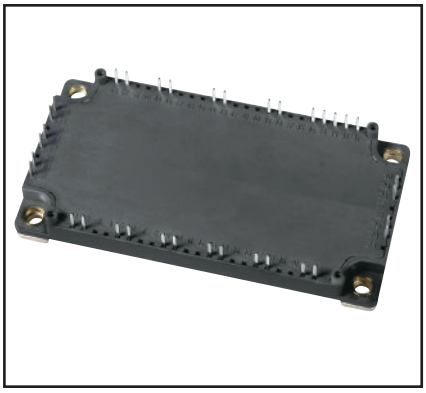
***100 Amperes/600 Volts***




**Outline Drawing and Circuit Diagram**

| Dimensions | Inches | Millimeters |
|---|---|---|
| A | 4.79 | 121.7 |
| B | 2.44 | 62.0 |
| C | 0.51 | 13.0 |
| D | 4.65 | 118.1 |
| E | 4.33±0.02 | 110.0±0.5 |
| F | 3.89 | 99.0 |
| G | 3.72 | 94.5 |
| H | 0.16 | 4.06 |
| J | 0.51 | 13.09 |
| K | 0.15 | 3.81 |
| L | 0.45 | 11.43 |
| M | 0.6 | 15.24 |
| N | 0.22 Dia. | 5.5 Dia. |
| P | 2.30 | 58.4 |
| Q | 1.53 | 39.0 |
| R | 1.97±0.02 | 50.0±0.5 |
| S | 2.26 | 57.5 |
| T | 0.30 | 7.75 |
| U | 0.28 | 7.25 |
| V | 0.3 | 7.62 |

| Dimensions | Inches | Millimeters |
|---|---|---|
| W | 0.46 | 11.66 |
| X | 0.16 | 4.2 |
| Y | 0.61 | 15.48 |
| Z | 0.27 | 7.0 |
| AA | 0.81 | 20.5 |
| AB | 0.67 | 17.0 |
| AC | 0.12 | 3.0 |
| AD | 0.14 | 3.5 |
| AE | 0.03 | 0.8 |
| AF | 0.15 | 3.75 |
| AG | 0.05 | 1.15 |
| AH | 0.025 | 0.65 |
| AJ | 0.29 | 7.4 |
| AK | 0.24 | 6.2 |
| AL | 0.49 | 12.5 |
| AM | 0.06 | 1.5 |
| AN | 0.17 Dia. | 4.3 Dia. |
| AP | 0.10 Dia. | 2.5 Dia. |
| AQ | 0.08 Dia. | 2.1 Dia. |



**Description:**

CIBs are low profile and thermally efficient. Each module consists of a three-phase diode converter section, a three-phase inverter section and a brake circuit. A thermistor is included in the package for sensing the baseplate temperature. 5th Generation CSTBT chips yield low loss.

**Features:**

- ☐ Low Drive Power
- ☐ Low $V_{CE(sat)}$
- ☐ Discrete Super-Fast Recovery Free-Wheel Diode
- ☐ Isolated Baseplate for Easy Heat Sinking

**Applications:**

- ☐ AC Motor Control
- ☐ Motion/Servo Control
- ☐ Photovoltaic/Fuel Cell

**Ordering Information:**

Example: Select the complete module number you desire from the table below -i.e. CM100MX-12A is a 600V ($V_{CES}$), 100 Ampere CIB Power Module.

| Type | Current Rating Amperes | $V_{CES}$ Volts (x 50) |
|---|---|---|
| CM | 100 | 12 |

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*100 Amperes/600 Volts*

## Absolute Maximum Ratings, $T_j$ = 25°C unless otherwise specified

| Characteristics | Symbol | CM100MX-12A | Units |
|---|---|---|---|
| Power Device Junction Temperature | $T_j$ | -40 to 150 | °C |
| Storage Temperature | $T_{stg}$ | -40 to 125 | °C |
| Mounting Torque, M5 Mounting Screws | — | 31 | in-lb |
| Module Weight (Typical) | — | 270 | Grams |
| Isolation Voltage, AC 1 minute, 60Hz Sinusoidal | $V_{ISO}$ | 2500 | Volts |

### Inverter Sector

| | | | |
|---|---|---|---|
| Collector-Emitter Voltage (G-E Short) | $V_{CES}$ | 600 | Volts |
| Gate-Emitter Voltage (C-E Short) | $V_{GES}$ | ±20 | Volts |
| Collector Current ($T_C$ = 75°C)* | $I_C$ | 100 | Amperes |
| Peak Collector Current** | $I_{CM}$ | 200 | Amperes |
| Emitter Current ($T_C$ = 25°C, $T_j$ < 150°C)* | $I_E$*** | 100 | Amperes |
| Peak Emitter Current ($T_j$ < 150°C)** | $I_{EM}$*** | 200 | Amperes |
| Maximum Collector Dissipation ($T_C$ = 25°C, $T_j$ < 150°C)* | $P_C$ | 400 | Watts |

### Brake Sector

| | | | |
|---|---|---|---|
| Collector-Emitter Voltage (G-E Short) | $V_{CES}$ | 600 | Volts |
| Gate-Emitter Voltage (C-E Short) | $V_{GES}$ | ±20 | Volts |
| Collector Current ($T_C$ = 97°C)* | $I_C$ | 50 | Amperes |
| Peak Collector Current** | $I_{CM}$ | 100 | Amperes |
| Maximum Collector Dissipation ($T_C$ = 25°C, $T_j$ < 150°C)* | $P_C$ | 280 | Watts |
| Repetitive Peak Reverse Voltage (Clamp Diode Part) | $V_{RRM}$*** | 600 | Volts |
| Forward Current ($T_C$ = 25°C)* | $I_F$*** | 50 | Amperes |
| Forward Current (Clamp Diode Part)** | $I_{FM}$*** | 100 | Amperes |

### Converter Sector

| | | | |
|---|---|---|---|
| Repetitive Peak Reverse Voltage | $V_{RRM}$ | 800 | Volts |
| Recommended Input Voltage | $E_a$ | 220 | Volts RMS |
| DC Output Current (3-Phase Full Wave Rectifying, $T_C$ = 137°C)* | $I_O$ | 100 | Amperes |
| Surge Forward Current (sine Half-wave 1 Cycle Peak Value, F = 60Hz, Non-repetitive) | $I_{FSM}$ | 1000 | Amperes |
| Current Square Time (Value for One Cycle of Surge Current) | $I^2t$ | 4160 | $A^2s$ |

*$T_C$, $T_f$ measured point is just under the chips.
**Pulse width and repetition rate should be such that device junction temperature ($T_j$) does not exceed $T_{j(max)}$ rating.
***Represents characteristics of the anti-parallel, emitter-to-collector free-wheel diode (FWDi).

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## Electrical and Mechanical Characteristics, $T_j$ = 25°C unless otherwise specified

### Inverter Sector

| Characteristics | | Symbol | Test Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|---|
| Collector Cutoff Current | | $I_{CES}$ | $V_{CE} = V_{CES}$, $V_{GE}$ = 0V | — | — | 1.0 | mA |
| Gate-Emitter Threshold Voltage | | $V_{GE(th)}$ | $I_C$ = 10mA, $V_{CE}$ = 10V | 5 | 6 | 7 | Volts |
| Gate Leakage Current | | $I_{GES}$ | $V_{GE} = V_{GES}$, $V_{CE}$ = 0V | — | — | 0.5 | µA |
| Collector-Emitter Saturation Voltage | | $V_{CE(sat)}$ | $I_C$ = 100A, $V_{GE}$ = 15V, $T_j$ = 25°C | — | 1.7 | 2.1 | Volts |
| | | | $I_C$ = 100A, $V_{GE}$ = 15V, $T_j$ = 125°C | — | 1.9 | — | Volts |
| | | | $I_C$ = 100A, $V_{GE}$ = 15V, Chip | — | 1.6 | — | Volts |
| Input Capacitance | | $C_{ies}$ | $V_{CE}$ = 10V, $V_{GE}$ = 0V | — | — | 11.3 | nF |
| Output Capacitance | | $C_{oes}$ | | — | — | 1.4 | nF |
| Reverse Transfer Capacitance | | $C_{res}$ | | — | — | 0.45 | nF |
| Total Gate Charge | | $Q_G$ | $V_{CC}$ = 300V, $I_C$ = 100A, $V_{GE}$ = 15V | — | 270 | — | nC |
| Inductive | Turn-on Delay Time | $t_{d(on)}$ | $V_{CC}$ = 300V, $I_C$ = 100A, $V_{GE}$ = ±15V, $R_G$ = 6.2Ω, $I_E$ = 100A, Inductive Load Switching Operation | — | — | 100 | ns |
| Load | Turn-on Rise Time | $t_r$ | | — | — | 100 | ns |
| Switch | Turn-off Delay Time | $t_{d(off)}$ | | — | — | 300 | ns |
| Time | Turn-off Fall Time | $t_f$ | | — | — | 600 | ns |
| Reverse Recovery Time* | | $t_{rr}$ | | — | — | 200 | ns |
| Reverse Recovery Charge* | | Qrr | | — | 3.6 | — | µC |
| Emitter-Collector Voltage* | | $V_{EC}$ | $I_E$ = 100A, $V_{GE}$ = 0V | — | 2.0 | 2.8 | Volts |
| | | | $I_E$ = 100A, $V_{GE}$ = 0V, Chip | — | 1.9 | — | Volts |

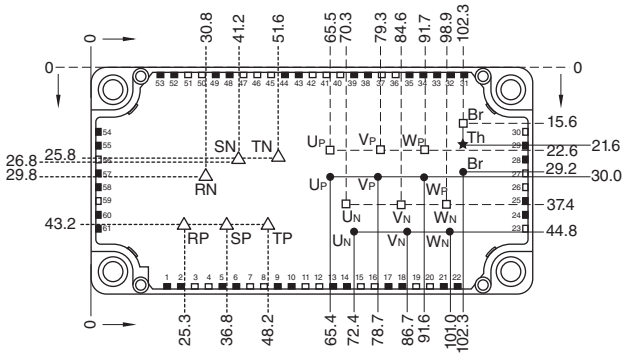
## Thermal and Mechanical Characteristics, $T_j$ = 25°C unless otherwise specified

| Characteristics | Symbol | Test Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| Thermal Resistance, Junction to Case** | $R_{th(j-c)}Q$ | Per IGBT | — | — | 0.31 | °C/W |
| Thermal Resistance, Junction to Case** | $R_{th(j-c)}D$ | Per FWDi | — | — | 0.59 | °C/W |
| Contact Thermal Resistance** | $R_{th(c-f)}$ | Thermal Grease Applied | — | 0.015 | — | °C/W |
| Internal Gate Resistance | $R_{Gint}$ | $T_C$ = 25°C | — | 0 | — | Ω |
| External Gate Resistance | $R_G$ | | 6.0 | — | 63 | Ω |

*Represents characteristics of the anti-parallel, emitter-to-collector free-wheel diode (FWDi).
**$T_C$, $T_f$ measured point is just under the chips.

CHIP LOCATION (TOP VIEW)

□ IGBT ● FWDi △ Converter Diode ★ NTC Thermistor




Dimensions in mm (Tolerance: ±1mm)

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*100 Amperes/600 Volts*

## Electrical and Mechanical Characteristics, $T_j$ = 25°C unless otherwise specified

### Brake Sector

| Characteristics | Symbol | Test Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| Collector Cutoff Current | $I_{CES}$ | $V_{CE} = V_{CES}$, $V_{GE}$ = 0V | — | — | 1.0 | mA |
| Gate-Emitter Threshold Voltage | $V_{GE(th)}$ | $I_C$ = 5mA | 5 | 6 | 7 | Volts |
| Gate Leakage Current | $I_{GES}$ | $V_{GE} = V_{GES}$, $V_{CE}$ = 0V | — | — | 0.5 | µA |
| Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | $I_C$ = 50A, $V_{GE}$ = 15V, $T_j$ = 25°C | — | 1.7 | 2.1 | Volts |
| | | $I_C$ = 50A, $V_{GE}$ = 15V, $T_j$ = 125°C | — | 1.9 | — | Volts |
| | | $I_C$ = 50A, $V_{GE}$ = 15V, Chip | — | 1.6 | — | Volts |
| Input Capacitance | $C_{ies}$ | $V_{CE}$ = 10V, $V_{GE}$ = 0V | — | — | 7.5 | nF |
| Output Capacitance | $C_{oes}$ | | — | — | 1.0 | nF |
| Reverse Transfer Capacitance | $C_{res}$ | | — | — | 0.3 | nF |
| Total Gate Charge | $Q_G$ | $V_{CC}$ = 300V, $I_C$ = 50A, $V_{GE}$ = 15V | — | 200 | — | nC |
| Repetitive Reverse Current* | $I_{RRM}$ | $V_R = V_{RRM}$ | — | — | 1.0 | mA |
| Forward Voltage Drop * | $V_F$ | $I_F$ = 50A | — | 2.3 | 3.2 | Volts |
| | | $I_F$ = 50A, Chip | — | 2.2 | — | Volts |

## Thermal and Mechanical Characteristics, $T_j$ = 25°C unless otherwise specified

| Characteristics | Symbol | Test Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| Thermal Resistance, Junction to Case** | $R_{th(j-c)}Q$ | Per IGBT | — | — | 0.44 | °C/W |
| Thermal Resistance, Junction to Case** | $R_{th(j-c)}D$ | Per FWDi | — | — | 0.85 | °C/W |
| Contact Thermal Resistance** | $R_{th(c-f)}$ | Thermal Grease Applied | — | 0.015 | — | °C/W |
| Internal Gate Resistance | $R_{Gint}$ | $T_C$ = 25°C | — | 0 | — | Ω |
| External Gate Resistance | $R_G$ | | 13 | — | 125 | Ω |

## Converter Sector, $T_j$ = 25°C unless otherwise specified

| Characteristics | Symbol | Test Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| Repetitive Peak Reverse Current | $I_{RRM}$ | $V_R = V_{RRM}$, $T_j$ = 150°C | — | — | 20 | mA |
| Forward Voltage Drop | $V_F$ | $I_F$ = 100A | — | 1.2 | 1.6 | Volts |
| Thermal Resistance, Junction to Case** | $R_{th(j-c)}$ | Per FWDi | — | — | 0.24 | K/W |
| Contact Thermal Resistance** | $R_{th(c-f)}$ | Thermal Grease Applied | — | 0.015 | — | °C/W |

## NTC Thermistor Sector, $T_j$ = 25°C unless otherwise specified

| Characteristics | Symbol | Test Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| Zero Power Resistance | R | $T_C$ = 25°C | 4.85 | 5.00 | 5.15 | kΩ |
| Deviation of Resistance | ΔR/R | $T_C$ = 100°C, $R_{100}$ = 493Ω | –7.3 | — | +7.8 | % |
| B Constant | $B_{(25/50)}$ | $B = (\ln R_1 - \ln R_2) / (1/T_1 - 1/T_2)$*** | — | 3375 | — | K |
| Power Dissipation | $P_{25}$ | $T_C$ = 25°C | — | — | 10 | mW |

*Represents characteristics of the anti-parallel, emitter-to-collector free-wheel diode (FWDi).
**$T_C$, $T_f$ measured point is just under the chips.
***R1: Resistance at Absolute Temperature $T_1$(K), $R_2$: Resistance at Absolute Temperature $T_2$(K), T(K) = t(°C) + 273.15

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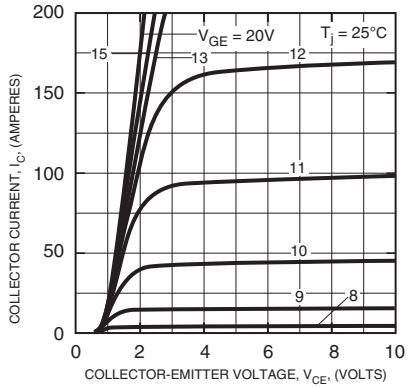
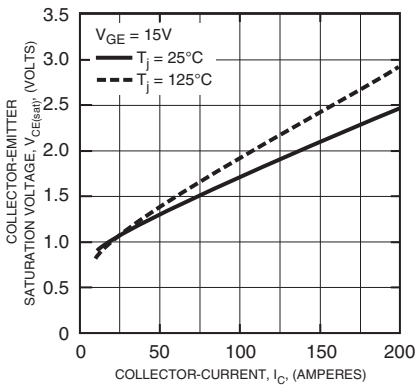
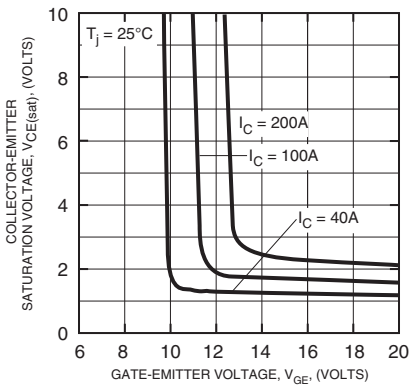
**OUTPUT CHARACTERISTICS (INVERTER PART - TYPICAL)**



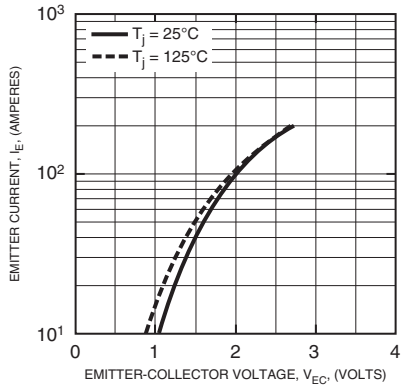

**COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (INVERTER PART - TYPICAL)**



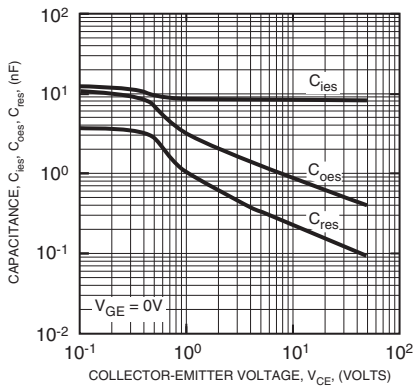

**COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (INVERTER PART - TYPICAL)**



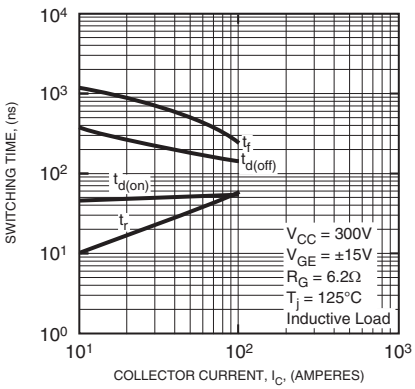

**FREE-WHEEL DIODE FORWARD CHARACTERISTICS (INVERTER PART - TYPICAL)**



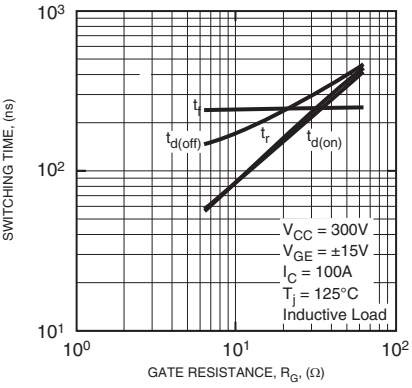

**CAPACITANCE VS. $V_{CE}$ (INVERTER PART - TYPICAL)**



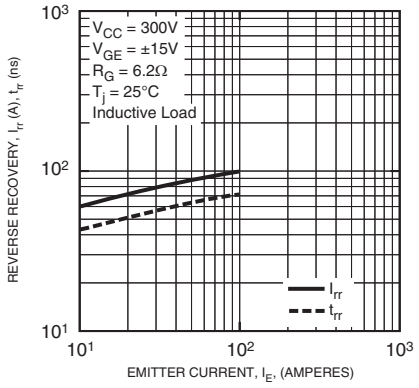

**HALF-BRIDGE SWITCHING CHARACTERISTICS (INVERTER PART - TYPICAL)**



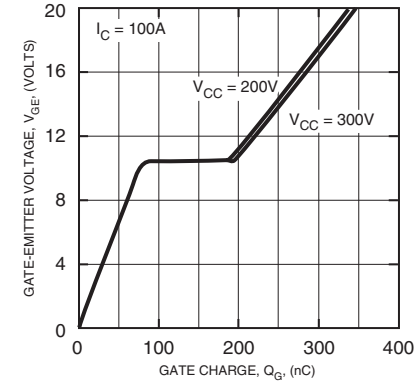

**SWITCHING TIME VS. GATE RESISTANCE (INVERTER PART - TYPICAL)**




**REVERSE RECOVERY CHARACTERISTICS (INVERTER PART - TYPICAL)**




**GATE CHARGE VS. $V_{GE}$ (INVERTER PART)**



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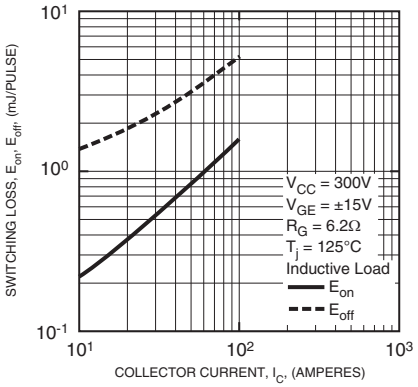
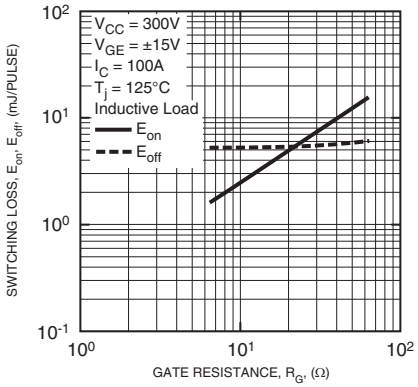
*100 Amperes/600 Volts*

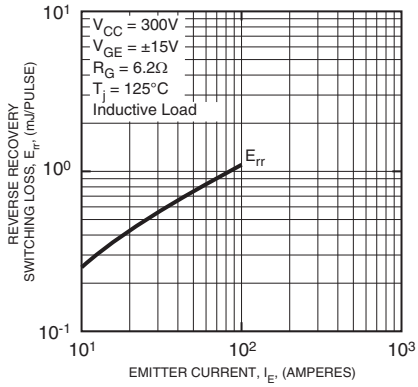
**SWITCHING LOSS VS. COLLECTOR CURRENT (INVERTER PART - TYPICAL)**



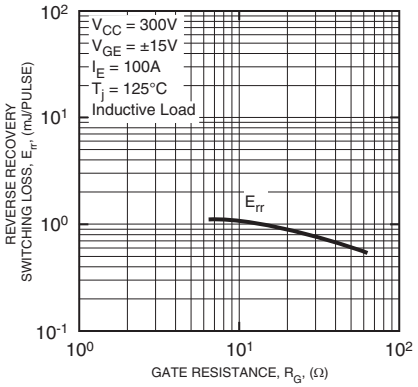

**SWITCHING LOSS VS. GATE RESISTANCE (INVERTER PART - TYPICAL)**



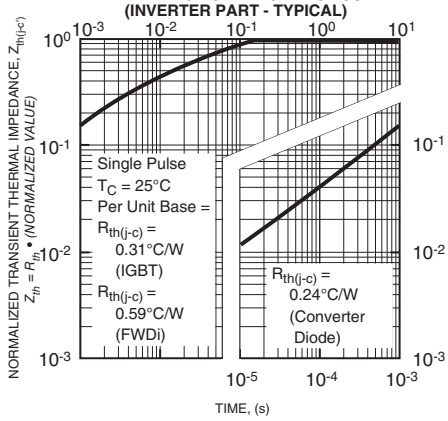

**REVERSE RECOVERY SWITCHING LOSS VS. EMITTER CURRENT (INVERTER PART - TYPICAL)**



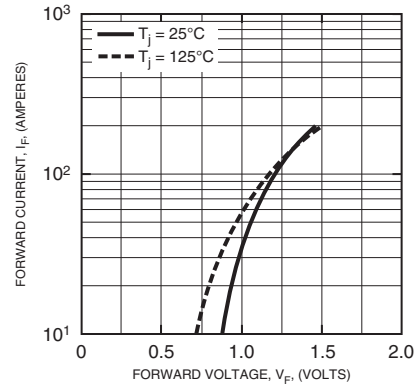

**REVERSE RECOVERY SWITCHING LOSS VS. GATE RESISTANCE (INVERTER PART - TYPICAL)**



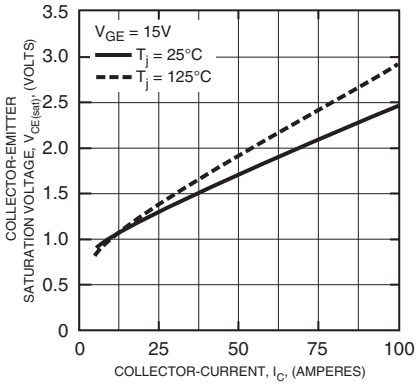

**TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (INVERTER PART - TYPICAL)**



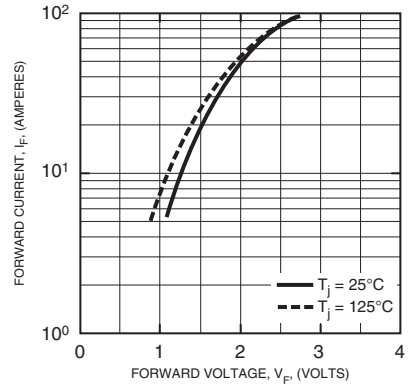

**FREE-WHEEL DIODE FORWARD CHARACTERISTICS (CONVERTER PART - TYPICAL)**




**COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (BRAKE PART - TYPICAL)**




**FREE-WHEEL DIODE FORWARD CHARACTERISTICS (BRAKE PART - TYPICAL)**




**TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (BRAKE PART - TYPICAL)**