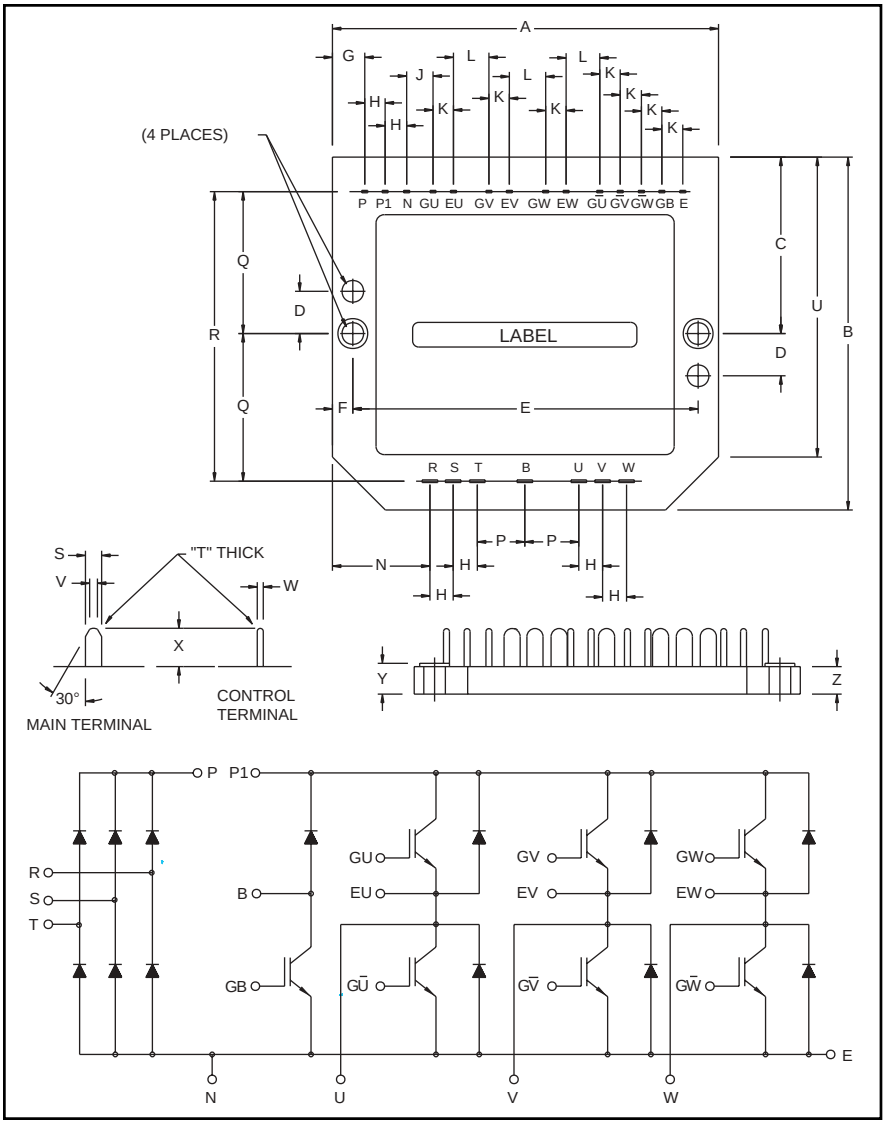
Powerex, Inc., 200 Hillis Street, Youngwood, Pennsylvania 15697-1800 (724) 925-7272

# CIB Module

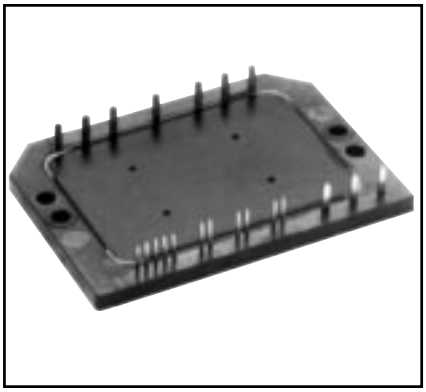
***Three Phase Converter + Three Phase Inverter + Brake***
***10 Amperes/1200 Volts***




**Outline Drawing and Circuit Diagram**

| Dimensions | Inches | Millimeters |
|---|---|---|
| A | 3.54 | 90.0 |
| B | 2.52 | 64.0 |
| C | 1.26 | 32.0 |
| D | 0.35 | 9.0 |
| E | 3.15 | 80.0 |
| F | 0.20 | 5.0 |
| G | 0.30 | 7.5 |
| H | 0.32 | 8.0 |
| J | 0.48 | 12.28 |
| K | 0.10 | 2.54 |
| L | 0.30 | 7.62 |
| M | 0.19 | 4.8 |

| Dimensions | Inches | Millimeters |
|---|---|---|
| N | 0.65 | 16.5 |
| P | 0.49 | 12.5 |
| Q | 1.04 | 26.5 |
| R | 2.09 | 53.0 |
| S | 0.08 | 2.0 |
| T | 0.02 | 0.5 |
| U | 2.13 | 54.0 |
| V | 0.04 | 1.0 |
| W | 0.03 | 0.8 |
| X | 0.32 | 8.0 |
| Y | 0.21 | 5.3 |
| Z | 0.20 | 5.0 |



**Description:**
Powerex CIB Modules are designed for use in switching applications. Each module consists of a three phase diode converter section, a three phase IGBT inverter section and a brake section. All components and interconnects are isolated from the heat sinking baseplate, offering simplified system assembly and thermal management.

**Features:**
- ☐ Low Drive Power
- ☐ Low $V_{CE(sat)}$
- ☐ Discrete Super-Fast Recovery (70ns) Free-Wheel Diodes
- ☐ High Frequency Operation (20-25 kHz)
- ☐ Isolated Baseplate for Easy Heat Sinking

**Applications:**
- ☐ AC Motor Control
- ☐ Motion/Servo Control
- ☐ General Purpose Inverters
- ☐ Robotics

**Ordering Information:**
Example: Select the complete nine digit module part number you desire from the table below - i.e. CM10MD-24H is a 1200V ($V_{CES}$), 10 Ampere CIB Power Module.

| Type | Current Rating Amperes | $V_{CES}$ Volts (x 50) |
|---|---|---|
| CM | 10 | 24 |

***CM10MD-24H***
***CIB Module***
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## Absolute Maximum Ratings, $T_j$ = 25°C unless otherwise specified

| Characteristics | Symbol | CM10MD-24H | Units |
|---|---|---|---|
| Power Device Junction Temperature | $T_j$ | -40 to 150 | °C |
| Storage Temperature | $T_{stg}$ | -40 to 125 | °C |
| Mounting Torque, M4 Mounting Screws | — | 13 | in-lb |
| Module Weight (Typical) | — | 60 | Grams |
| Isolation Voltage, AC 1 minute, 60Hz | $V_{RMS}$ | 2500 | Volts |

### Converter Sector

| | | | |
|---|---|---|---|
| Repetitive Peak Reverse Voltage | $V_{RRM}$ | 1600 | Volts |
| Recommended AC Input Voltage | $E_a$ | 440 | Volts |
| DC Output Current | $I_O$ | 10 | Amperes |
| Surge (Non-repetitive) Forward Current | $I_{FSM}$ | 100 | Amperes |
| $I^2t$ for Fusing | $I^2t$ | 42 | $A^2s$ |

### IGBT Inverter Sector

| | | | |
|---|---|---|---|
| Collector-Emitter Voltage (G-E Short) | $V_{CES}$ | 1200 | Volts |
| Gate-Emitter Voltage (C-E Short) | $V_{GES}$ | ±20 | Volts |
| Collector Current | $I_C$ | 10 | Amperes |
| Collector Current (Pulse)* | $I_{CM}$ | 20 | Amperes |
| Emitter Current** | $I_E$ | 10 | Amperes |
| Emitter Current** (Pulse)* | $I_{EM}$ | 20 | Amperes |
| Maximum Collector Dissipation | $P_C$ | 57 | Watts |

### Brake Sector

| | | | |
|---|---|---|---|
| Collector-Emitter Voltage (G-E Short) | $V_{CES}$ | 1200 | Volts |
| Gate-Emitter Voltage (C-E Short) | $V_{GES}$ | ±20 | Volts |
| Collector Current | $I_C$ | 10 | Amperes |
| Collector Current (Pulse)* | $I_{CM}$ | 20 | Amperes |
| Collector Dissipation | $P_C$ | 57 | Watts |
| Repetitive Peak Reverse Voltage (Clamp Diode Part) | $V_{RRM}$ | 1200 | Volts |
| Forward Current (Clamp Diode Part) | $I_{FM}$ | 10 | Amperes |

* Pulse width and repetition rate should be such that device junction temperature does not exceed maximum rating.
** Characteristics of the anti-parallel emitter-collector free-wheel diode.

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

| Characteristics | Symbol | Test Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| **Converter Sector** | | | | | | |
| Repetitive Reverse Current | $I_{RRM}$ | $V_R = V_{RRM}$, $T_j$ = 150°C | — | — | 8 | mA |
| Forward Voltage Drop | $V_{FM}$ | $I_F$ = 10A | — | — | 1.7 | Volts |
| Thermal Resistance (Junction-to-Fin) | $R_{th(j-f)}$ | Per Diode | — | — | 2.7 | °C/W |
| **Brake Sector** | | | | | | |
| Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | $V_{GE}$ = 15V, $I_C$ = 10A, $T_j$ = 25°C | — | 2.7 | 3.4 | Volts |
| | | $V_{GE}$ = 15V, $I_C$ = 10A, $T_j$ = 150°C | — | 2.45 | — | Volts |
| Collector Cutoff Current | $I_{CES}$ | $V_{CE} = V_{CES}$, $V_{GE}$ = 0V | — | — | 1 | mA |
| Gate-Emitter Threshold Voltage | $V_{GE(th)}$ | $I_C$ = 1mA, $V_{CE}$ = 10V | 4.5 | 6.0 | 7.5 | Volts |
| Gate-Emitter Cutoff Current | $I_{GES}$ | $V_{GE} = V_{GES}$, $V_{CE}$ = 0V | — | — | 0.5 | μA |
| Input Capacitance | $C_{ies}$ | $V_{GE}$ = 0V, $V_{CE}$ = 10V | — | — | 2.0 | nF |
| Output Capacitance | $C_{oes}$ | | — | — | 1.5 | nF |
| Reverse Transfer Capacitance | $C_{res}$ | | — | — | 0.4 | nF |
| Total Gate Charge | $Q_G$ | $V_{CC}$ = 600V, $I_C$ = 10A, $V_{GE}$ = 15V | — | 50 | — | nC |
| Forward Voltage Drop | $V_{FM}$ | $I_F$ = 10A | — | — | 1.7 | Volts |
| Thermal Resistance (Junction-to-Fin) | $R_{th(j-f)}$ | Per IGBT | — | — | 2.2 | °C/W |
| | | Per Clamp Diode | — | — | 2.7 | °C/W |

***CM10MD-24H***
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*10 Amperes/1200 Volts*

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

| Characteristics | | Symbol | Test Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|---|
| **IGBT Inverter Sector** | | | | | | | |
| Collector Cutoff Current | | $I_{CES}$ | $V_{CE} = V_{CES}$, $V_{GE}$ = 0V | — | — | 1 | mA |
| Gate-Emitter Threshold Voltage | | $V_{GE(th)}$ | $V_{CE}$ = 10V, $I_C$ = 1mA | 4.5 | 6.0 | 7.5 | Volts |
| Gate-Emitter Cutoff Current | | $I_{GES}$ | $V_{GE} = V_{GES}$, $V_{CE}$ = 0V | — | — | 0.5 | μA |
| Collector-Emitter Saturation Voltage | | $V_{CE(sat)}$ | $V_{GE}$ = 15V, $I_C$ = 10A, $T_j$ = 25°C | — | 2.7 | 3.4 | Volts |
| | | | $V_{GE}$ = 15V, $I_C$ = 10A, $T_j$ = 150°C | — | 2.45 | — | Volts |
| Input Capacitance | | $C_{ies}$ | $V_{GE}$ = 0V, $V_{CE}$ = 10V | — | — | 2.0 | nF |
| Output Capacitance | | $C_{oes}$ | | — | — | 1.5 | nF |
| Reverse Transfer Capacitance | | $C_{res}$ | | — | — | 0.4 | nF |
| Total Gate Charge | | $Q_G$ | $V_{CC}$ = 600V, $I_C$ = 10A, $V_{GE}$ = 15V | — | 50 | — | nC |
| Resistive | Turn-on Delay Time | $t_{d(on)}$ | $V_{GE1} = V_{GE2}$ = 15V, | — | — | 100 | nS |
| Load | Rise Time | $t_r$ | $V_{CC}$ = 600V, $I_C$ = 10A, | — | — | 200 | nS |
| Switching | Turn-off Delay Time | $t_{d(off)}$ | $R_g$ = 31Ω, | — | — | 150 | nS |
| Times | Fall Time | $t_f$ | Resistive Load | — | — | 350 | nS |
| Emitter-Collector Voltage | | $V_{EC}$ | $I_E$ = 10A, $V_{GE}$ = 0V | — | — | 3.5 | Volts |
| Reverse Recovery Time | | $t_{rr}$ | $I_E$ = 10A, $V_{GE}$ = 0V, | — | — | 250 | nS |
| Reverse Recovery Charge | | $Q_{rr}$ | $di_E/dt$ = -20A/ms | — | 0.08 | — | μC |
| Thermal Resistance (Junction-to-Fin) | | $R_{th(j-f)}$ | Per IGBT | — | — | 2.2 | °C/W |
| | | | Per FWDi | — | — | 3.1 | °C/W |

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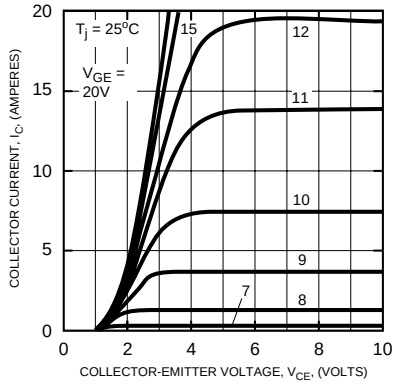
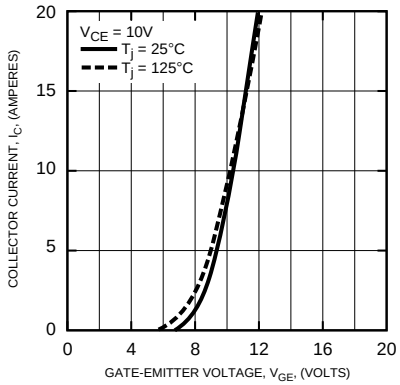
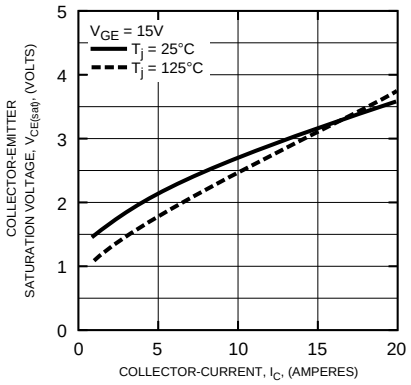
**OUTPUT CHARACTERISTICS (TYPICAL)**



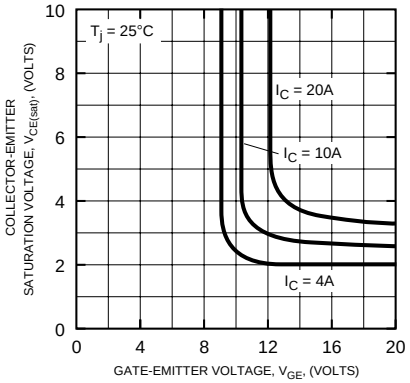

**TRANSFER CHARACTERISTICS (TYPICAL)**



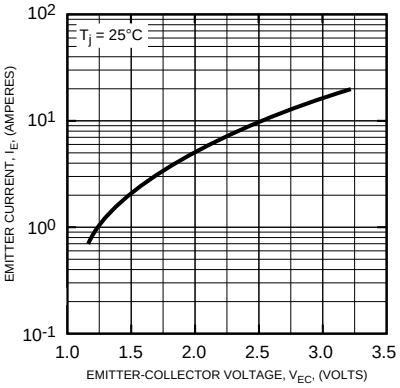

**COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)**



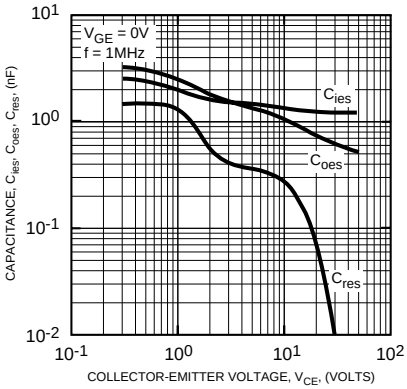

**COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)**



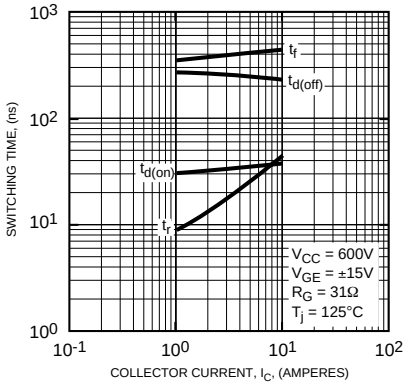

**FREE-WHEEL DIODE FORWARD CHARACTERISTICS (TYPICAL)**



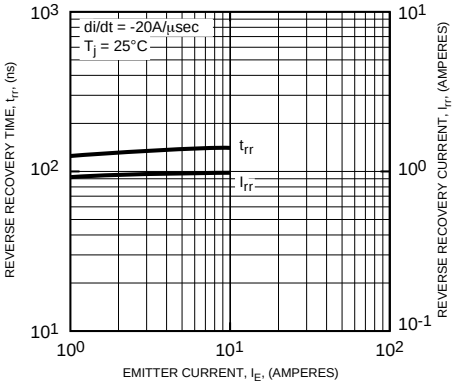

**CAPACITANCE VS. $V_{CE}$ (TYPICAL)**



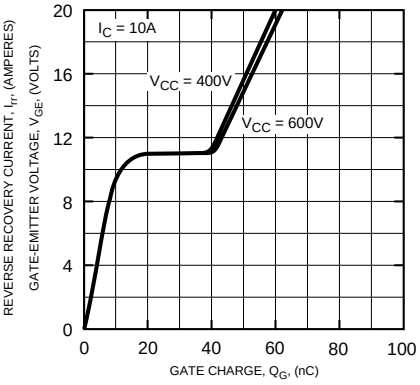

**HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)**




**REVERSE RECOVERY CHARACTERISTICS (TYPICAL)**




**GATE CHARGE, $V_{GE}$**



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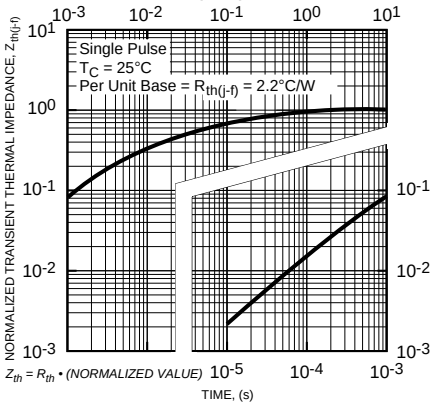
**TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (IGBT)**




**TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (FWDi)**