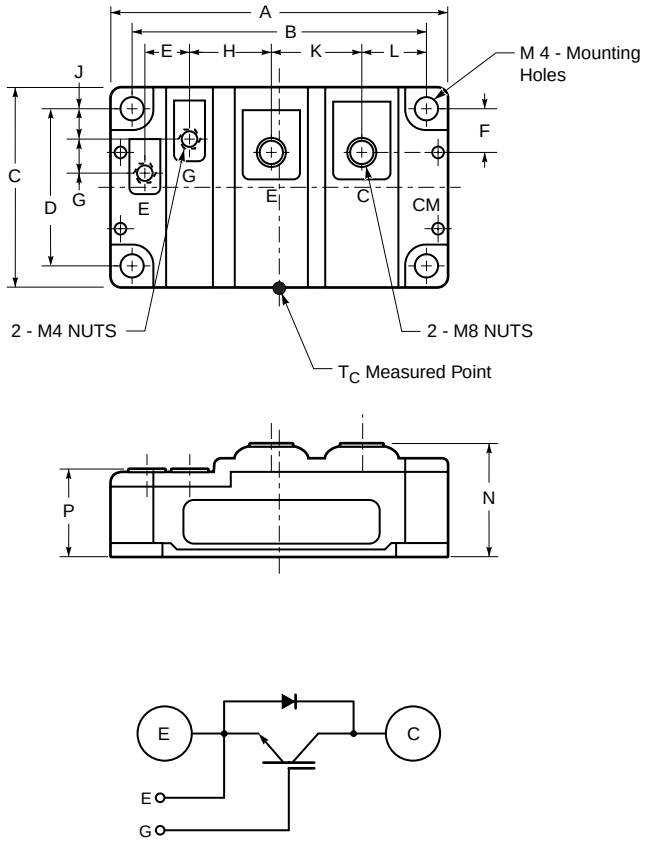
Powerex, Inc., 200 Hillis Street, Youngwood, Pennsylvania 15697-1800 (724) 925-7272

# Single IGBTMOD™ U-Series Module

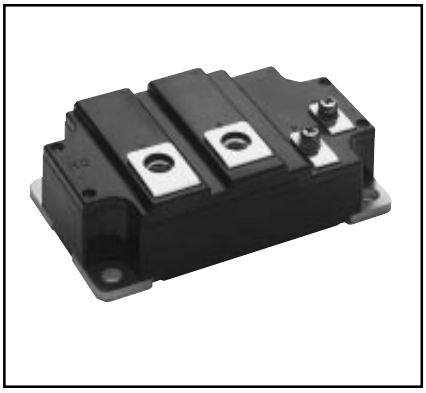
## 600 Amperes/600 Volts




Outline Drawing and Circuit Diagram

| Dimensions | Inches | Millimeters |
|---|---|---|
| A | 4.21 | 107.0 |
| B | 3.66±0.01 | 93.0±0.25 |
| C | 2.44 | 62.0 |
| D | 1.89±0.01 | 48.0±0.25 |
| E | 0.53 | 13.5 |
| F | 0.49 | 12.55 |
| G | 0.39 | 10.0 |

| Dimensions | Inches | Millimeters |
|---|---|---|
| H | 1.02 | 26.0 |
| J | 0.37 | 9.5 |
| K | 1.14 | 29.0 |
| L | 0.81 | 20.5 |
| M | 0.26 Dia. | 6.5 Dia. |
| N | 1.34 +0.04/-0.02 | 34 +1.0/-0.5 |
| P | 1.02 +0.04/-0.02 | 26 +1.0/-0.5 |



**Description:**
Powerex IGBTMOD™ Modules are designed for use in switching applications. Each module consists of one IGBT Transistor in a single configuration with a reverse-connected super-fast recovery free-wheel diode. 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 Free-Wheel Diode
- ☐ Isolated Baseplate for Easy Heat Sinking

**Applications:**
- ☐ AC Motor Control
- ☐ Motion/Servo Control
- ☐ UPS
- ☐ Welding Power Supplies
- ☐ Laser Power Supplies

**Ordering Information:**
Example: Select the complete module number you desire from the table - i.e. CM600HU-12H is a 600V ($V_{CES}$), 600 Ampere Single IGBTMOD™ Power Module.

| Type | Current Rating Amperes | $V_{CES}$ Volts (x 50) |
|---|---|---|
| CM | 600 | 12 |

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

| Ratings | Symbol | CM600HU-12H | Units |
|---|---|---|---|
| Junction Temperature | $T_j$ | -40 to 150 | °C |
| Storage Temperature | $T_{stg}$ | -40 to 125 | °C |
| Collector-Emitter Voltage (G-E SHORT) | $V_{CES}$ | 600 | Volts |
| Gate-Emitter Voltage (C-E SHORT) | $V_{GES}$ | ±20 | Volts |
| Collector Current ($T_c$ = 25°C) | $I_C$ | 600 | Amperes |
| Peak Collector Current ($T_j \leq$ 150°C) | $I_{CM}$ | 1200* | Amperes |
| Emitter Current** ($T_c$ = 25°C) | $I_E$ | 600 | Amperes |
| Peak Emitter Current** | $I_{EM}$ | 1200* | Amperes |
| Maximum Collector Dissipation ($T_c$ = 25°C) | $P_c$ | 1560 | Watts |
| Mounting Torque, M8 Main Terminal | – | 95 | in-lb |
| Mounting Torque, M6 Mounting | – | 40 | in-lb |
| Mounting Torque, M4 Terminal | – | 15 | in-lb |
| Weight | – | 450 | Grams |
| Isolation Voltage (Main Terminal to Baseplate, AC 1 min.) | $V_{iso}$ | 2500 | Volts |

* Pulse width and repetition rate should be such that the 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).

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

| Characteristics | Symbol | Test Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| Collector-Cutoff Current | $I_{CES}$ | $V_{CE} = V_{CES}$, $V_{GE}$ = 0V | – | – | 1 | mA |
| Gate Leakage Voltage | $I_{GES}$ | $V_{GE} = V_{GES}$, $V_{CE}$ = 0V | – | – | 0.5 | µA |
| Gate-Emitter Threshold Voltage | $V_{GE(th)}$ | $I_C$ = 60mA, $V_{CE}$ = 10V | 4.5 | 6 | 7.5 | Volts |
| Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | $I_C$ = 600A, $V_{GE}$ = 15V, $T_j$ = 25°C | – | 2.4 | 3.0 | Volts |
| | | $I_C$ = 600A, $V_{GE}$ = 15V, $T_j$ = 125°C | – | 2.6 | – | Volts |
| Total Gate Charge | $Q_G$ | $V_{CC}$ = 300V, $I_C$ = 600A, $V_{GE}$ = 15V | – | 1200 | – | nC |
| Emitter-Collector Voltage* | $V_{EC}$ | $I_E$ = 600A, $V_{GE}$ = 0V | – | – | 2.6 | Volts |

* Pulse width and repetition rate should be such that the device junction temperature ($T_j$) does not exceed $T_{j(max)}$ rating.

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

| Characteristics | | Symbol | Test Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|---|
| Input Capacitance | | $C_{ies}$ | $V_{CE}$ = 10V, $V_{GE}$ = 0V | – | – | 52.8 | nf |
| Output Capacitance | | $C_{oes}$ | | – | – | 28.8 | nf |
| Reverse Transfer Capacitance | | $C_{res}$ | | – | – | 7.8 | nf |
| Resistive | Turn-on Delay Time | $t_{d(on)}$ | $V_{CC}$ = 300V, $I_C$ = 600A, | – | – | 300 | ns |
| Load | Rise Time | $t_r$ | $V_{GE1} = V_{GE2}$ = 15V, | – | – | 600 | ns |
| Switch | Turn-off Delay Time | $t_{d(off)}$ | $R_G$ = 1.0Ω, Resistive | – | – | 350 | ns |
| Times | Fall Time | $t_f$ | Load Switching Operation | – | – | 350 | ns |
| Diode Reverse Recovery Time | | $t_{rr}$ | $I_E$ = 600A, $di_E/dt$ = -1200A/µs | – | – | 160 | ns |
| Diode Reverse Recovery Charge | | $Q_{rr}$ | $I_E$ = 600A, $di_E/dt$ = -1200A/µs | – | 1.44 | – | µC |

## 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 Module | – | – | 0.08 | °C/ W |
| Thermal Resistance, Junction to Case | $R_{th(j-c)}D$ | Per FWDi Module | – | – | 0.12 | °C/W |
| Contact Thermal Resistance | $R_{th(c-f)}$ | Per Module, Thermal Grease Applied | – | 0.02 | – | °C/W |

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***CM600HU-12H***
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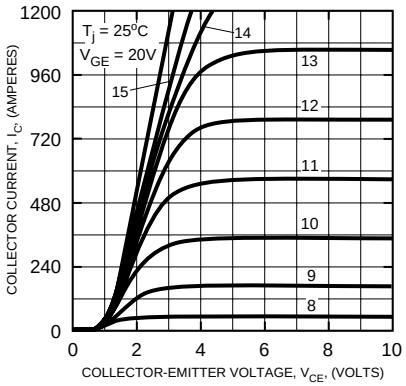
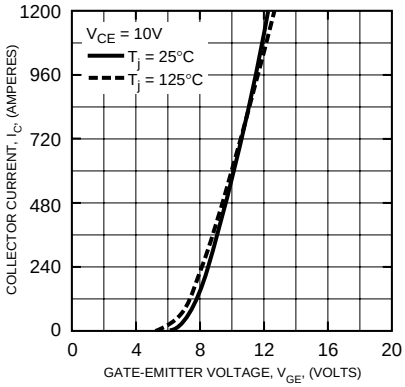
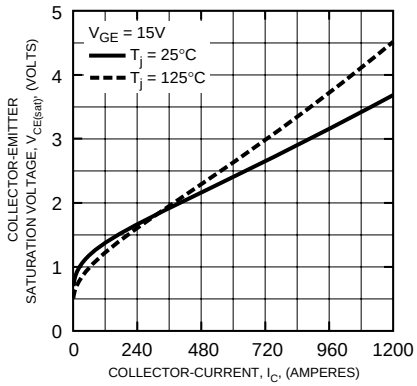
**OUTPUT CHARACTERISTICS (TYPICAL)**




**TRANSFER CHARACTERISTICS (TYPICAL)**




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

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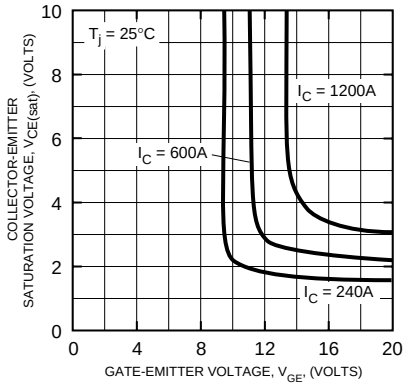
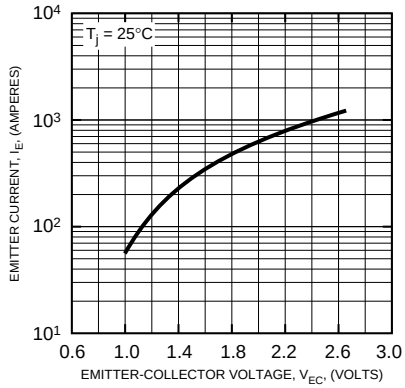
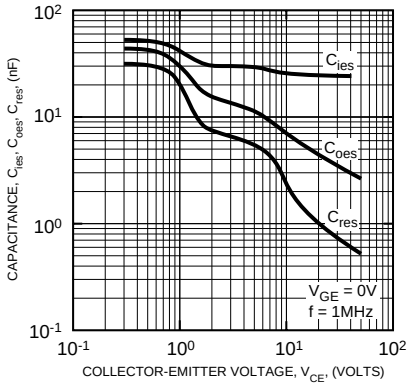


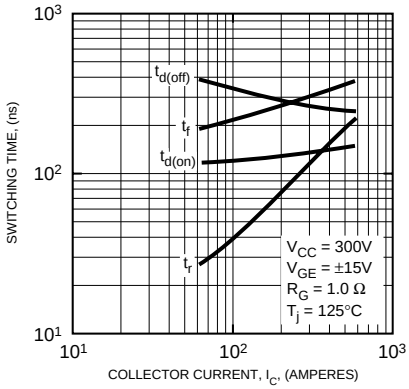

**FREE-WHEEL DIODE FORWARD CHARACTERISTICS (TYPICAL)**



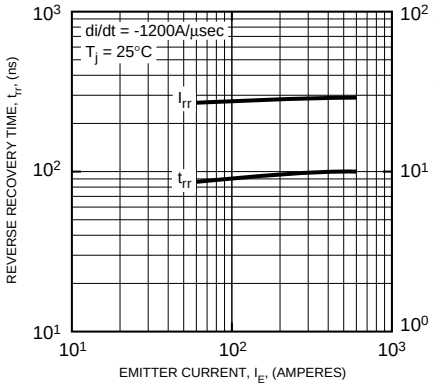

**CAPACITANCE VS. $V_{CE}$ (TYPICAL)**



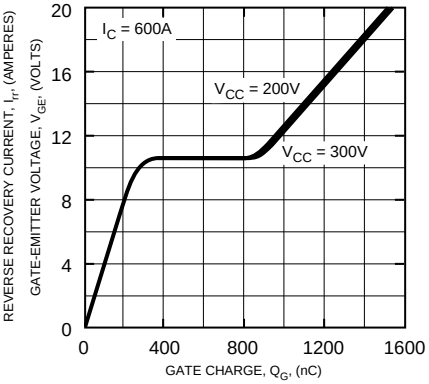

**HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)**




**REVERSE RECOVERY CHARACTERISTICS (TYPICAL)**




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



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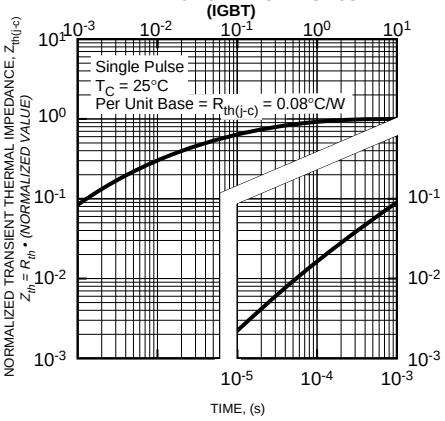
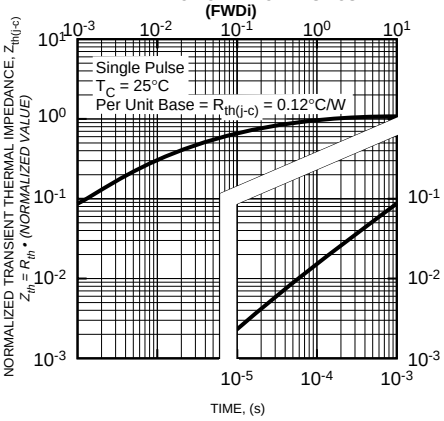
**TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (IGBT)**




**TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (FWDi)**