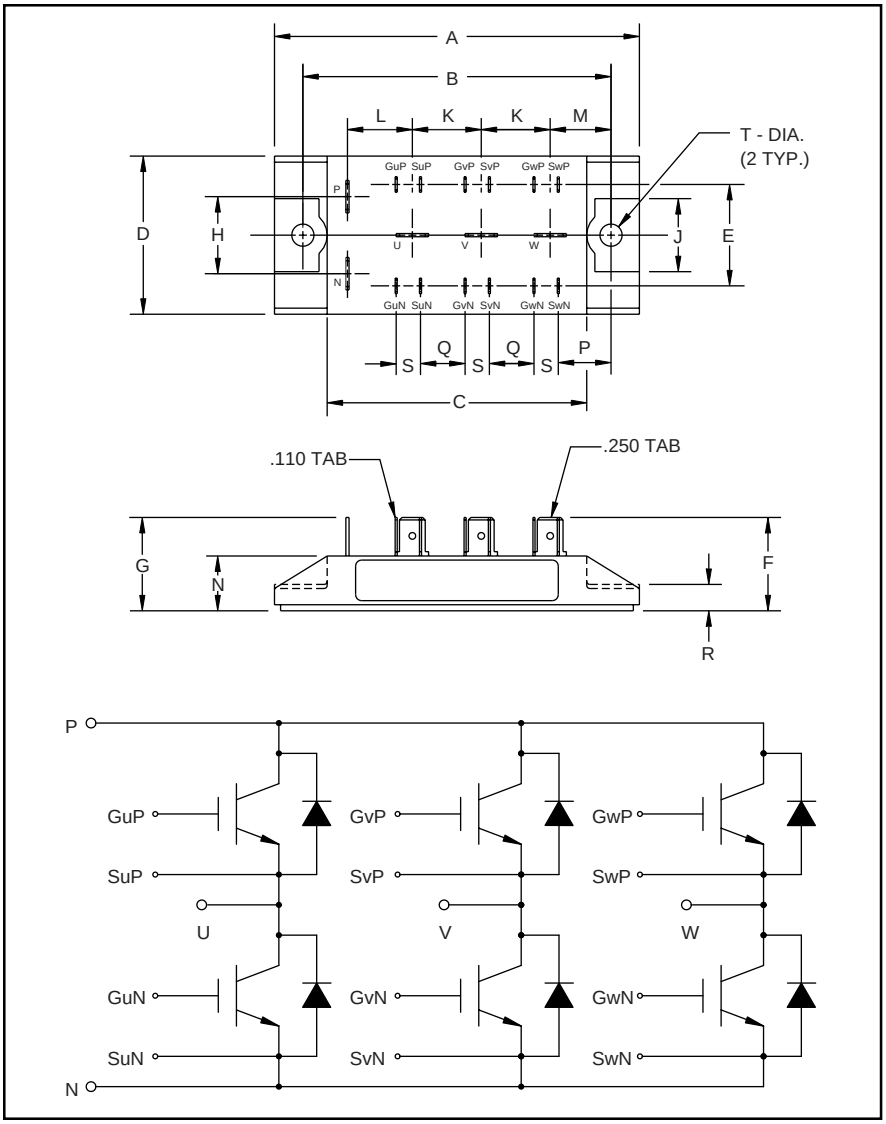
Powerex, Inc., 200 Hillis Street, Youngwood, Pennsylvania 15697-1800 (724) 925-7272

# Six-IGBT IGBTMOD™ H-Series Module
## 20 Amperes/600 Volts




**Outline Drawing and Circuit Diagram**

| Dimensions | Inches | Millimeters |
|---|---|---|
| A | 3.54 | 90.0 |
| B | 2.99±0.01 | 76.0±0.2 |
| C | 2.52 | 64.0 |
| D | 1.54 | 39.0 |
| E | 0.98 | 25.0 |
| F | 0.90 | 23.0 |
| G | 0.87 | 22.0 |
| H | 0.75 | 19.0 |
| J | 0.71 | 18.0 |

| Dimensions | Inches | Millimeters |
|---|---|---|
| K | 0.67 | 17.0 |
| L | 0.63 | 16.0 |
| M | 0.59 | 15.0 |
| N | 0.56 | 14.1 |
| P | 0.51 | 13.0 |
| Q | 0.43 | 11.0 |
| R | 0.26 | 6.5 |
| S | 0.24 | 6.0 |
| T | 0.22 Dia. | Dia. 5.5 |

**Description:**
Powerex IGBTMOD™ Modules are designed for use in switching applications. Each module consists of six IGBT Transistors in a three phase bridge configuration, with each transistor having 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 (70ns) Free-Wheel Diode
- ☐ High Frequency Operation (20-25kHz)
- ☐ 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 part module number you desire from the table below -i.e. CM20TF-12H is a 600V ($V_{CES}$), 20 Ampere Six-IGBT IGBTMOD™ Power Module.

| Type | Current Rating Amperes | $V_{CES}$ Volts (x 50) |
|---|---|---|
| CM | 20 | 12 |

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

| Ratings | Symbol | CM20TF-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 | $V_{GES}$ | ±20 | Volts |
| Collector Current | $I_C$ | 20 | Amperes |
| Peak Collector Current | $I_{CM}$ | 40* | Amperes |
| Diode Forward Current | $I_F$ | 20 | Amperes |
| Diode Forward Surge Current | $I_{FM}$ | 40* | Amperes |
| Power Dissipation | $P_d$ | 125 | Watts |
| Max. Mounting Torque M5 Mounting Screws | – | 17 | in-lb |
| Module Weight (Typical) | – | 150 | Grams |
| V Isolation | $V_{RMS}$ | 2500 | Volts |

* Pulse width and repetition rate should be such that device junction temperature does not exceed the device rating.

## 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 | – | – | 1.0 | mA |
| Gate Leakage Current | $I_{GES}$ | $V_{GE} = V_{GES}$, $V_{CE}$ = 0V | – | – | 0.5 | μA |
| Gate-Emitter Threshold Voltage | $V_{GE(th)}$ | $I_C$ = 2mA, $V_{CE}$ = 10V | 4.5 | 6.0 | 7.5 | Volts |
| Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | $I_C$ = 20A, $V_{GE}$ = 15V | – | 2.1 | 2.8** | Volts |
| | | $I_C$ = 20A, $V_{GE}$ = 15V, $T_j$ = 150°C | – | 2.15 | – | Volts |
| Total Gate Charge | $Q_G$ | $V_{CC}$ = 300V, $I_C$ = 20A, $V_{GS}$ = 15V | – | 60 | – | nC |
| Diode Forward Voltage | $V_{FM}$ | $I_E$ = 20A, $V_{GS}$ = 0V | – | – | 2.8 | Volts |

** Pulse width and repetition rate should be such that device junction temperature rise is negligible.

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

| Characteristics | | Symbol | Test Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|---|
| Input Capacitance | | $C_{ies}$ | $V_{GE}$ = 0V, $V_{CE}$ = 10V, f = 1MHz | – | – | 2.0 | nF |
| Output Capacitance | | $C_{oes}$ | | – | – | 0.7 | nF |
| Reverse Transfer Capacitance | | $C_{res}$ | | – | – | 0.4 | nF |
| Resistive | Turn-on Delay Time | $t_{d(on)}$ | $V_{CC}$ = 300V, $I_C$ = 20A, $V_{GE1} = V_{GE2}$ = 15V, $R_G$ = 31Ω | – | – | 120 | ns |
| Load | Rise Time | $t_r$ | | – | – | 300 | ns |
| Switching | Turn-off Delay Time | $t_{d(off)}$ | | – | – | 200 | ns |
| Times | Fall Time | $t_f$ | | – | – | 300 | ns |
| Diode Reverse Recovery Time | | $t_{rr}$ | $I_E$ = 20A, $di_E/dt$ = –40A/μs | – | – | 110 | ns |
| Diode Reverse Recovery Charge | | $Q_{rr}$ | $I_E$ = 20A, $di_E/dt$ = –40A/μs | – | 0.05 | – | 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 | $R_{th(j-c)}$ | Per IGBT | – | – | 1.00 | °C/W |
| Thermal Resistance, Junction to Case | $R_{th(j-c)}$ | Per FWDi | – | – | 3.50 | °C/W |
| Contact Thermal Resistance | $R_{th(c-f)}$ | Per Module, Thermal Grease Applied | – | – | 0.092 | °C/W |

**CM20TF-12H**
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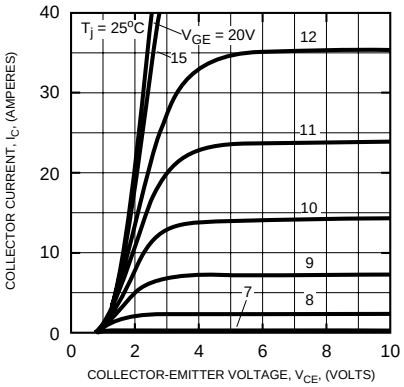
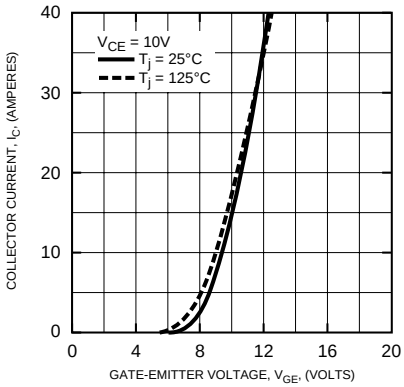
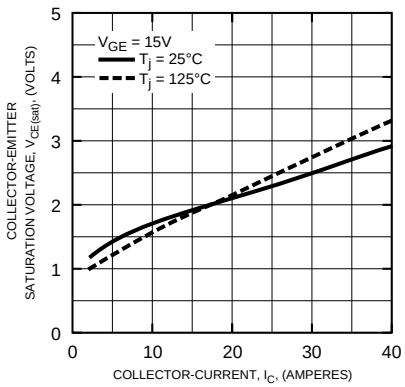
**OUTPUT CHARACTERISTICS (TYPICAL)**




**TRANSFER CHARACTERISTICS (TYPICAL)**




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

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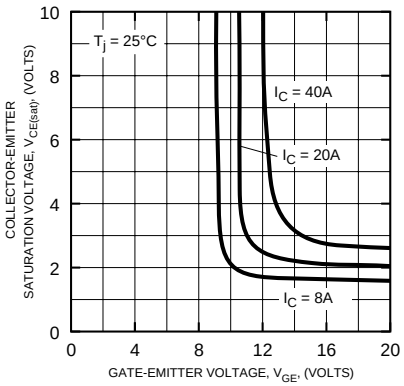
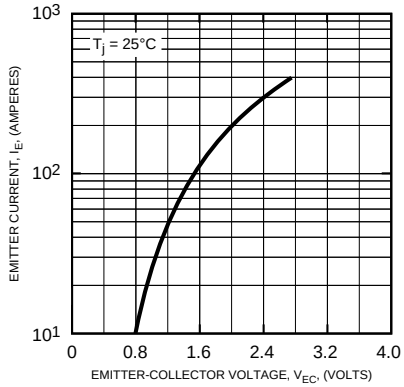
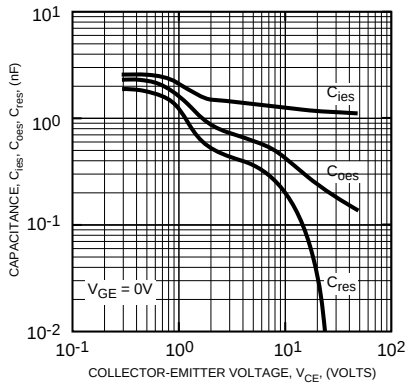


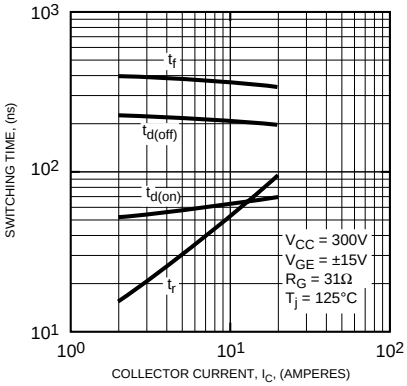

**FREE-WHEEL DIODE FORWARD CHARACTERISTICS (TYPICAL)**



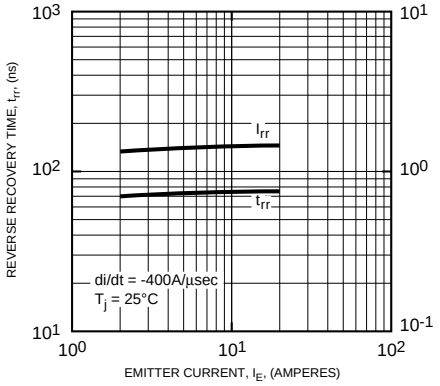

**CAPACITANCE VS. $V_{CE}$ (TYPICAL)**



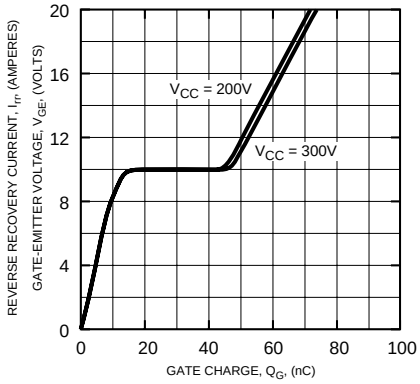

**HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)**




**REVERSE RECOVERY CHARACTERISTICS (TYPICAL)**




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



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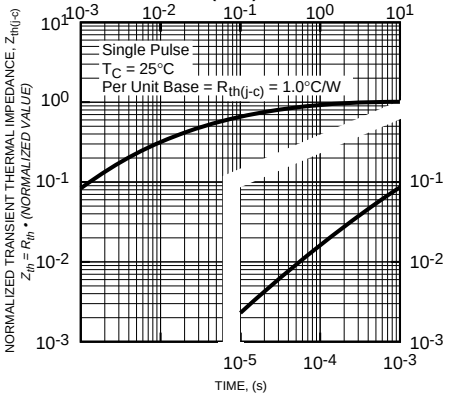
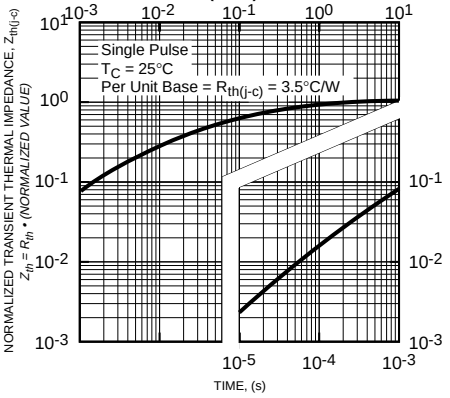
**TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (IGBT)**




**TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (FWDi)**