# Molding Type Module IGBT, 1-in-1 Package, 1200 V and 600 A

Dual INT-A-PAK

## FEATURES

- High short circuit capability, self limiting to 6 x $I_C$
- 10 µs short circuit capability
- $V_{CE(on)}$ with positive temperature coefficient
- Low inductance case
- Fast and soft reverse recovery antiparallel FWD
- Isolated copper baseplate using DCB (Direct Copper Bonding) technology
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

RoHS COMPLIANT

## TYPICAL APPLICATIONS

- AC inverter drives
- Switching mode power supplies
- Electronic welder at $f_{sw}$ up to 20 kHz

## DESCRIPTION

Vishay's IGBT power module provides ultralow conduction loss as well as short circuit ruggedness. It is designed for applications such as inverters and UPS.

| PRIMARY CHARACTERISTICS | |
|---|---|
| $V_{CES}$ | 1200 V |
| $I_C$ at $T_C$ = 80 °C | 600 A |
| $V_{CE(on)}$ (typical) at $I_C$ = 600 A, 25 °C | 1.9 V |
| Speed | 8 kHz to 30 kHz |
| Package | Dual INT-A-PAK |
| Circuit configuration | Single switch with AP diode |

**ABSOLUTE MAXIMUM RATINGS** ($T_C$ = 25 °C unless otherwise noted)

| PARAMETER | SYMBOL | TEST CONDITIONS | MAX. | UNITS |
|---|---|---|---|---|
| Collector to emitter voltage | $V_{CES}$ | | 1200 | V |
| Gate to emitter voltage | $V_{GES}$ | | ± 20 | |
| Collector current at $T_J$ = 150 °C | $I_C$ | $T_C$ = 25 °C | 910 | A |
| | | $T_C$ = 80 °C | 600 | |
| Pulsed collector current | $I_{CM}$ (1) | $T_C$ = 80 °C | 1200 | |
| Diode continuous forward current | $I_F$ | | 600 | |
| Diode maximum forward current | $I_{FM}$ | | 1200 | |
| Maximum power dissipation | $P_D$ | $T_J$ = 150 °C | 3125 | W |
| Short circuit withstand time | $t_{SC}$ | $T_J$ = 125 °C | 10 | µs |
| RMS isolation voltage | $V_{ISOL}$ | f = 50 Hz, t = 1 min | 2500 | V |
| $I^2t$-value, diode | $I^2t$ | $V_R$ = 0 V, t = 10 ms, $T_J$ = 125 °C | 74 000 | $A^2s$ |

**Note**

(1) Repetitive rating: pulse width limited by maximum junction temperature.

**IGBT ELECTRICAL SPECIFICATIONS** ($T_C$ = 25 °C unless otherwise noted)

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNITS |
|---|---|---|---|---|---|---|
| Collector to emitter breakdown voltage | $V_{(BR)CES}$ | $T_J$ = 25 °C | 1200 | - | - | V |
| Collector to emitter voltage | $V_{CE(on)}$ | $V_{GE}$ = 15 V, $I_C$ = 600 A, $T_J$ = 25 °C | - | 1.9 | - | |
| | | $V_{GE}$ = 15 V, $I_C$ = 600 A, $T_J$ = 125 °C | - | 2.1 | - | |
| Gate to emitter threshold voltage | $V_{GE(th)}$ | $V_{CE}$ = $V_{GE}$, $I_C$ = 24 mA, $T_J$ = 25 °C | 5.0 | 6.2 | 7.0 | |
| Collector cut-off current | $I_{CES}$ | $V_{CE}$ = $V_{CES}$, $V_{GE}$ = 0 V, $T_J$ = 25 °C | - | - | 5.0 | mA |
| Gate to emitter leakage current | $I_{GES}$ | $V_{GE}$ = $V_{GES}$, $V_{CE}$ = 0 V, $T_J$ = 25 °C | - | - | 400 | nA |

## SWITCHING CHARACTERISTICS

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNITS |
|---|---|---|---|---|---|---|
| Turn-on delay time | $t_{d(on)}$ | $V_{CC}$ = 600 V, $I_C$ = 600 A, $R_g$ = 3 Ω, $V_{GE}$ = ± 15 V, $T_J$ = 25 °C | - | 200 | - | ns |
| Rise time | $t_r$ | | - | 62 | - | |
| Turn-off delay time | $t_{d(off)}$ | | - | 510 | - | |
| Fall time | $t_f$ | | - | 60 | - | |
| Turn-on switching loss | $E_{on}$ | | - | 39 | - | mJ |
| Turn-off switching loss | $E_{off}$ | | - | 48 | - | |
| Turn-on delay time | $t_{d(on)}$ | $V_{CC}$ = 600 V, $I_C$ = 600 A, $R_g$ = 3 Ω, $V_{GE}$ = ± 15 V, $T_J$ = 125 °C | - | 210 | - | ns |
| Rise time | $t_r$ | | - | 65 | - | |
| Turn-off delay time | $t_{d(off)}$ | | - | 600 | - | |
| Fall time | $t_f$ | | - | 75 | - | |
| Turn-on switching loss | $E_{on}$ | | - | 45 | - | mJ |
| Turn-off switching loss | $E_{off}$ | | - | 60 | - | |
| Input capacitance | $C_{ies}$ | $V_{GE}$ = 0 V, $V_{CE}$ = 25 V, f = 1.0 MHz | - | 41.0 | - | nF |
| Output capacitance | $C_{oes}$ | | - | 3.1 | - | |
| Reverse transfer capacitance | $C_{res}$ | | - | 2.0 | - | |
| SC data | $I_{SC}$ | $t_{SC}$ ≤ 10 µs, $V_{GE}$ = 15 V, $T_J$ = 25 °C, $V_{CC}$ = 900 V, $V_{CEM}$ ≤ 1200 V | - | 2600 | - | A |
| Stray inductance | $L_{CE}$ | | - | - | 20 | nH |
| Module lead resistance, terminal to chip | $R_{CC'+EE'}$ | $T_C$ = 25 °C | - | 0.18 | - | mΩ |

## DIODE ELECTRICAL SPECIFICATIONS ($T_C$ = 25 °C unless otherwise noted)

| PARAMETER | SYMBOL | TEST CONDITIONS | | MIN. | TYP. | MAX. | UNITS |
|---|---|---|---|---|---|---|---|
| Diode forward voltage | $V_F$ | $I_F$ = 600 A | $T_J$ = 25 °C | - | 1.8 | 2.4 | V |
| | | | $T_J$ = 125 °C | - | 1.9 | - | |
| Diode reverse recovery charge | $Q_{rr}$ | $I_F$ = 600 A, $V_R$ = 600 V, $dI_F/dt$ = -6000 A/µs, $V_{GE}$ = -15 V | $T_J$ = 25 °C | - | 65 | - | µC |
| | | | $T_J$ = 125 °C | - | 100 | - | |
| Diode peak reverse recovery current | $I_{rr}$ | | $T_J$ = 25 °C | - | 450 | - | A |
| | | | $T_J$ = 125 °C | - | 510 | - | |
| Diode reverse recovery energy | $E_{rec}$ | | $T_J$ = 25 °C | - | 35 | - | mJ |
| | | | $T_J$ = 125 °C | - | 42 | - | |

## THERMAL AND MECHANICAL SPECIFICATIONS

| PARAMETER | | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNITS |
|---|---|---|---|---|---|---|---|
| Operating temperature range | | $T_J$ | | -40 | - | 150 | °C |
| Storage temperature range | | $T_{Stg}$ | | -40 | - | 125 | °C |
| Junction to case per module | IGBT | $R_{thJC}$ | | - | - | 0.04 | K/W |
| | Diode | | | - | - | 0.09 | |
| Case to sink | | $R_{thCS}$ | Conductive grease applied | - | 0.035 | - | |
| Mounting torque | | | Power terminal screw: M6 | 2.5 to 5.0 | | | Nm |
| | | | Mounting screw: M6 | 3.0 to 6.0 | | | |
| Weight | | | | 310 | | | g |

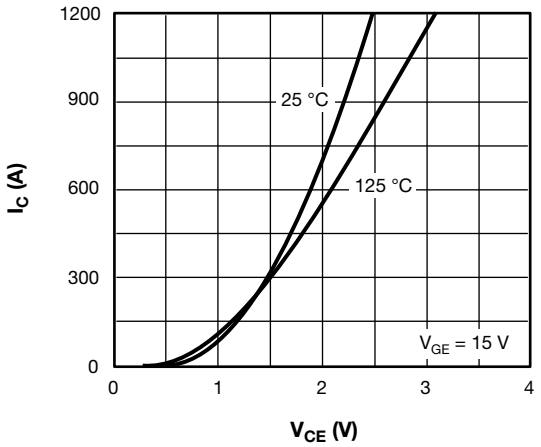



Fig. 1 - Typical Output Characteristics

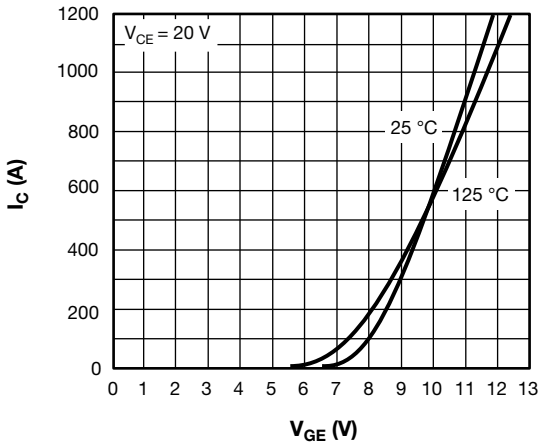



Fig. 2 - Typical Transfer Characteristics

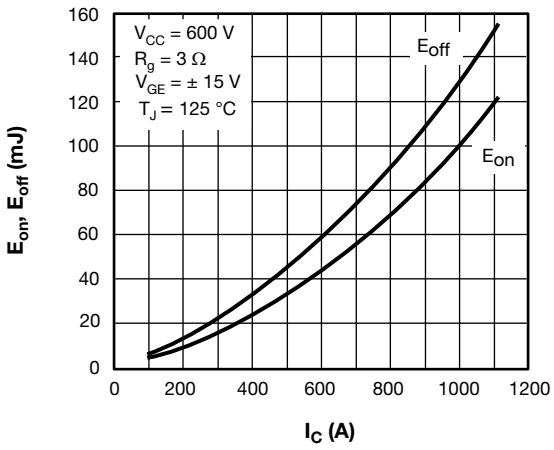



Fig. 3 - Switching Loss vs. Collector Current

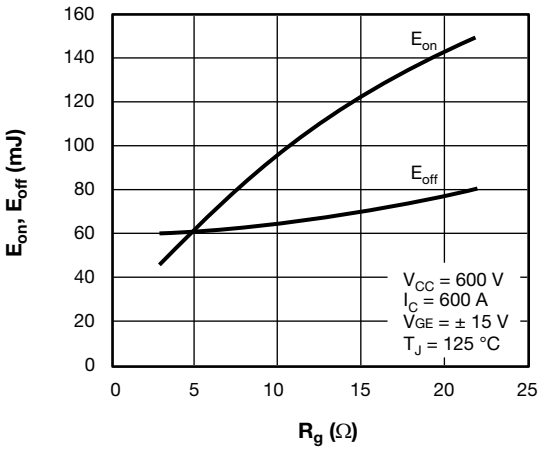



Fig. 4 - Switching Loss vs. Gate Resistor

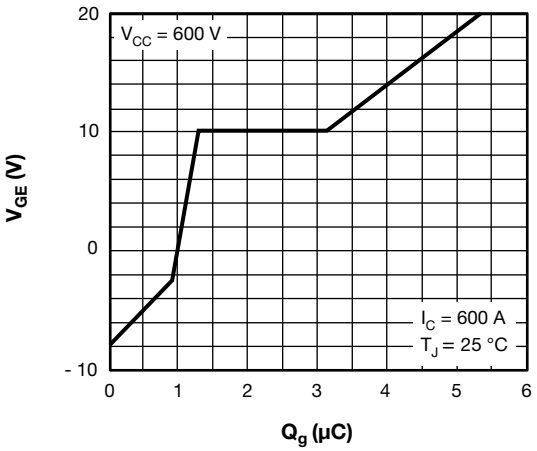



Fig. 5 - Gate Charge Characteristics

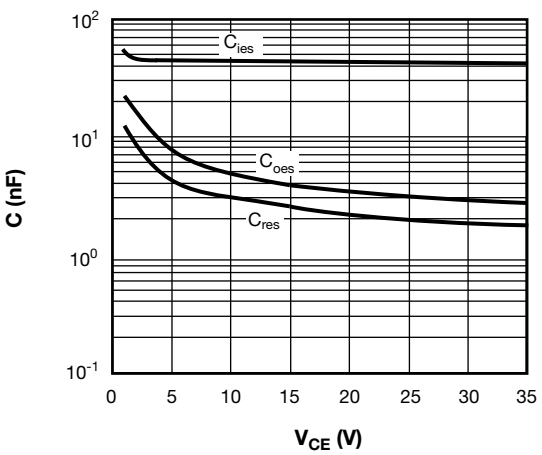



Fig. 6 - Typical Capacitance vs. Collector-Emitter Voltage

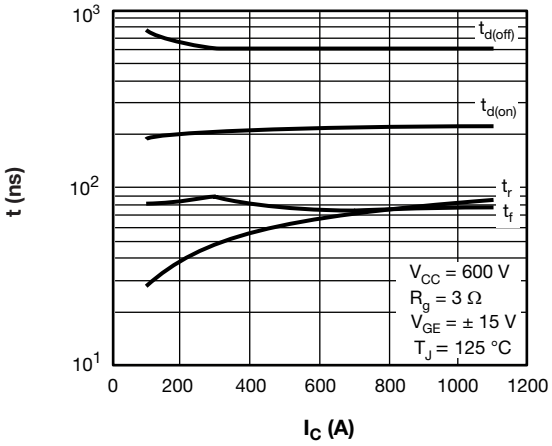



Fig. 7 - Typical Switching Times

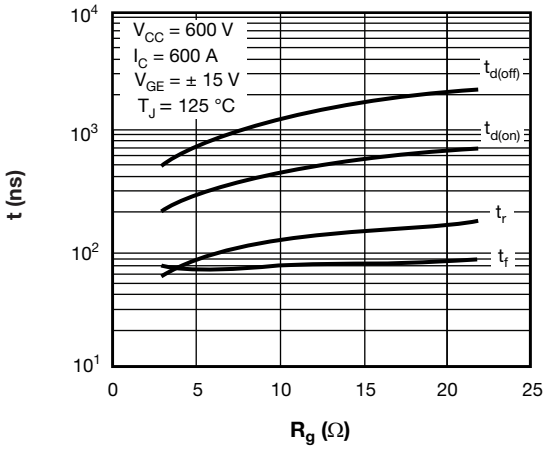



Fig. 8 - Typical Switching Times vs. Gate Resistance $R_g$

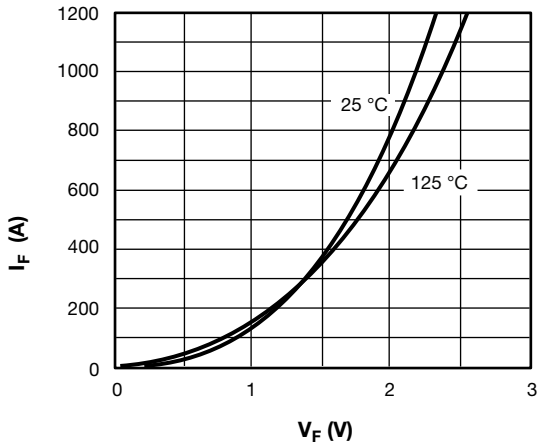



Fig. 9 - Typical forward Characteristics (Diode)

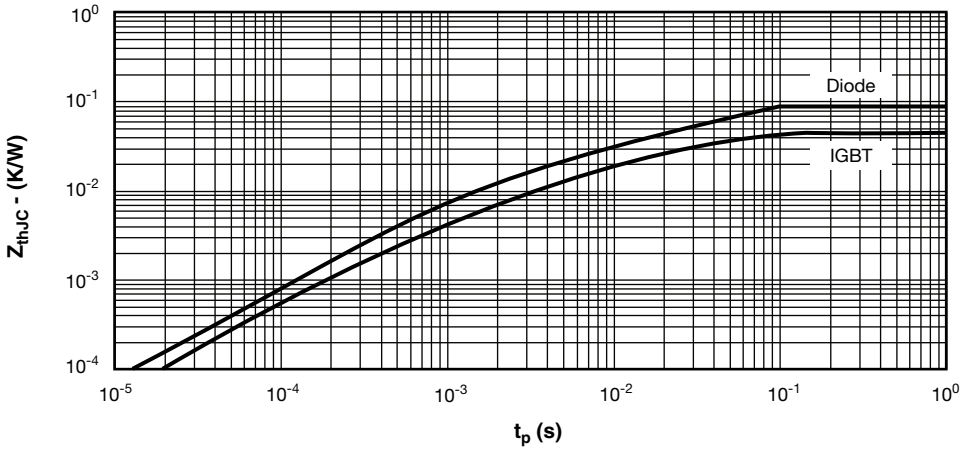
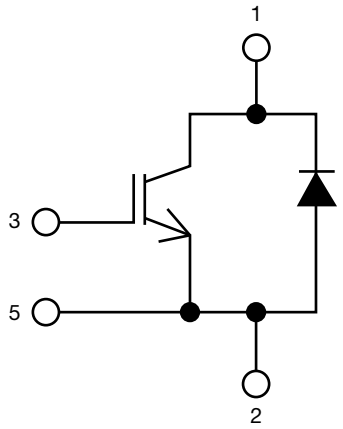



Fig. 10 - Transient Thermal Impedance

## CIRCUIT CONFIGURATION




| LINKS TO RELATED DOCUMENTS | |
|---|---|
| Dimensions | www.vishay.com/doc?95526 |

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