International
IOR Rectifier

# HiRel™ INT-A-Pak 2, PLASTIC HALF-BRIDGE IGBT MODULE

# G300HHCK12P2



HiRel™ INT-A-Pak 2

## Product Summary

| Part Number | $V_{CE}$ | $I_C$ | $V_{CE(SAT)}$ |
|---|---|---|---|
| G300HHCK12P2 | 1200V | 300A | 2.2 |

The HiRel™ INT-A-Pak series are isolated near hermetic power modules which combine the latest IGBT and Soft Recovery Rectifier Technology. The module uses both high-speed and low Vce(sat) IGBT's packaged for ultra low thermal resistance junction to case. The G300HHCK12P2 power module consists of six IGBT's and six FRED's in a Phase- Leg or Half-Bridge configuration.

## Features:

- Rugged, Lightweight near Hermetic Package with Integrated Power Terminal Cap
- Gen IV IGBT Technology
- Soft Recovery Rectifiers
- Ultra-Low Thermal Resistance
- Zener Gate Protection
- Very Low Conduction and Switching Loss
- -55°C to +125°C Operating Temperature
- Screening to meet the intent of MIL-PRF-38534 Class H
- Short Circuit Capability
- 2.0 Ohms Series Gate Resistor
- High Altitude Operation, 85,000 Feet Above Sea Level at Rated Voltage

## Absolute Maximum Ratings @ Tj=25°C (unless otherwise specified)

| Parameter | Symbol | Value | Units |
|---|---|---|---|
| Collector-to-Emitter Voltage | $V_{CES}$ | 1200 | V |
| Gate-to-Emitter Voltage | $V_{GE}$ | ±20 | |
| Continuous Collector Current @ Tc = 25°C | $I_C$ | 450 | A |
| Continuous Collector Current @ Tc = 100°C | | 300 | |
| Isolation Voltage | $V_{ISOL}$ | 2500 | $V_{RMS}$ |

## Electrical Characteristics @ Tj = 25°C (unless otherwise specified)

| Parameter | Symbol | Test Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| **Off Characteristics** | | | | | | |
| Collector Emitter Breakdown Voltage | $V_{CES}$ | $V_{GE}$ = 0V | 1200 | - | - | V |
| Zero Gate Voltage Collector Current | $I_{CES}$ | $V_{GE}$ =0V, $V_{CE}$ = 1200V | - | - | 1.0 | mA |
| Gate Emitter Leakage Current | $I_{GES}$ | $V_{GE}$ = ±15V, $V_{CE}$ = 0V | - | - | 10 | µA |
| | | | | | | |
| **On Characteristics** | | | | | | |
| Gate Threshold Voltage | $V_{GE(TH)}$ | $V_{CE}$ = $V_{GE}$, $I_C$ = 1.0mA | 3.5 | - | 7.5 | V |
| Collector Emitter Saturation Voltage | $V_{CE(SAT)}$ | $V_{GE}$ = 15V, $I_C$ = 300A | - | 2.2 | 2.7 | |
| | | | | | | |
| **Dynamic Characteristics** | | | | | | |
| Total Gate Charge | Qg | $V_{CE}$ = 600V, $I_C$ = 300A, $V_{GE}$ = 15V | - | 2300 | - | nC |
| Input Capacitance | $C_{IES}$ | $V_{GE}$ = 0V, $V_{CE}$ = 25V, f = 1.0MHz | - | 44 | - | nF |
| Output Capacitance | $C_{OES}$ | | - | 3.0 | - | |
| Reverse Transfer Capacitance | $C_{RES}$ | | - | 0.3 | - | |
| | | | | | | |
| **Switching Inductive Load Characteristics** | | | | | | |
| Turn-On Delay Time | td(on) | $V_{CC}$ = 600V, $I_C$ = 300A, $V_{GE}$ =15V<br>$R_{G(on)}$ = 20Ω, $R_{G(off)}$ =10Ω, L=100µH | - | 830 | 1000 | ns |
| Rise Time | tr | | | 300 | 400 | |
| Turn-On Losses | $E_{on}$ | | - | 100 | - | mJ |
| Turn-Off Delay Time | td(off) | | | 1900 | 2200 | ns |
| Fall Time | tf | | - | 300 | 400 | |
| Turn-Off Losses | $E_{off}$ | | - | 55 | - | mJ |
| | | | | | | |
| **Diode Characteristics** | | | | | | |
| Forward Voltage | $V_F$ | $I_F$ = 300A | - | 1.9 | 2.2 | V |
| Reverse Recovery Charge | Qrr | $V_R$ =600V, $I_C$ =300A, di/dt =-800A/µs | - | 15 | 20 | µC |
| Peak Reverse Recovery Current | Irr | | - | 90 | - | A |
| Reverse Recovery Time | trr | | - | 500 | 800 | ns |

## Electrical Characteristics @ Tj = 125°C (unless otherwise specified)

| Parameter | Symbol | Test Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| **Off Characteristics** | | | | | | |
| Collector Emitter Breakdown Voltage | $V_{CES}$ | $V_{GE}$ = 0V | 1200 | - | - | V |
| Zero Gate Voltage Collector Current | $I_{CES}$ | $V_{GE}$ =0V, $V_{CE}$ = 1200V | - | - | 3.0 | mA |
| Gate Emitter Leakage Current | $I_{GES}$ | $V_{GE}$ = ±15V, $V_{CE}$ = 0V | - | - | 10 | µA |
| | | | | | | |
| **On Characteristics** | | | | | | |
| Gate Threshold Voltage | $V_{GE(TH)}$ | $V_{CE}$ = $V_{GE}$, $I_C$ = 1.0mA | 3.5 | - | 7.5 | V |
| Collector Emitter Saturation Voltage | $V_{CE(SAT)}$ | $V_{GE}$ = 15V, $I_C$ = 300A | - | 2.2 | 2.7 | |
| | | | | | | |
| **Diode Characteristics** | | | | | | |
| Forward Voltage | $V_F$ | $I_F$ = 300A | - | 1.9 | 2.2 | V |

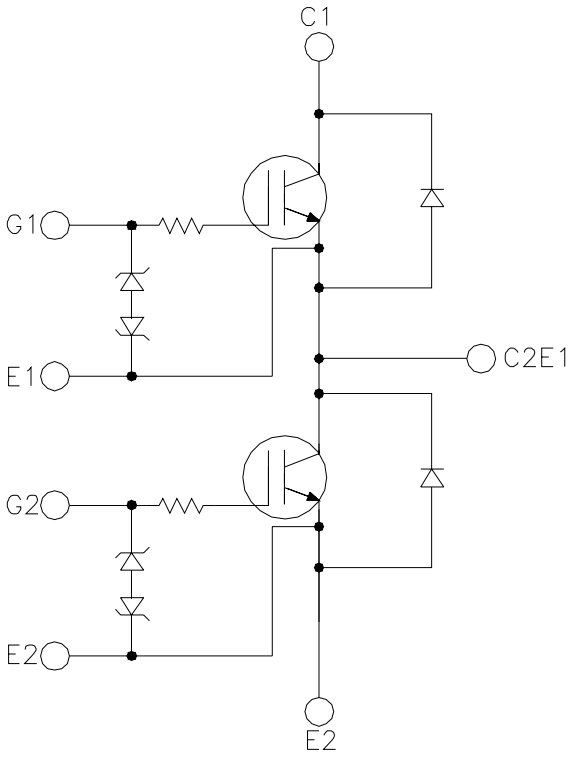
## Thermal-Mechanical Specifications

| Parameter | Symbol | Min | Max | Units |
|---|---|---|---|---|
| IGBT Thermal Resistance, Junction to Case, per Switch | $R_{thJC}$ | - | 0.06 | °C/W |
| Diode Thermal Resistance, Junction to Case, per Switch | | - | 0.10 | |
| Operating Junction Temperature Range | $T_J$ | -55 | 150 | °C |
| Storage Temperature Range | $T_{STG}$ | -55 | 125 | |
| Screw Torque - Mounting | T | - | 26 | in-lbs |
| Screw Torque - Terminals | | | | |
| Module Weight | | - | 270 | g |

## Module Screening

| Test or Inspection | MIL-STD-883 | | Comments |
|---|---|---|---|
| | Method | Condition | |
| Internal Visual | 2017 | | |
| Temperature Cycle | 1010 | B | 10 Cycles, -55°C to +125°C |
| Mechanical Shock | 2002 | B | 1500G, 0.5ms, 5 Times (Y1 direction only) |
| Burn-in | 1015 | A | 160 Hrs @ +125°C |
| Final Electrical Test | | | Group A, -55°C, +25°C, +125°C |
| External Visual | 2009 | | |

## Schematic



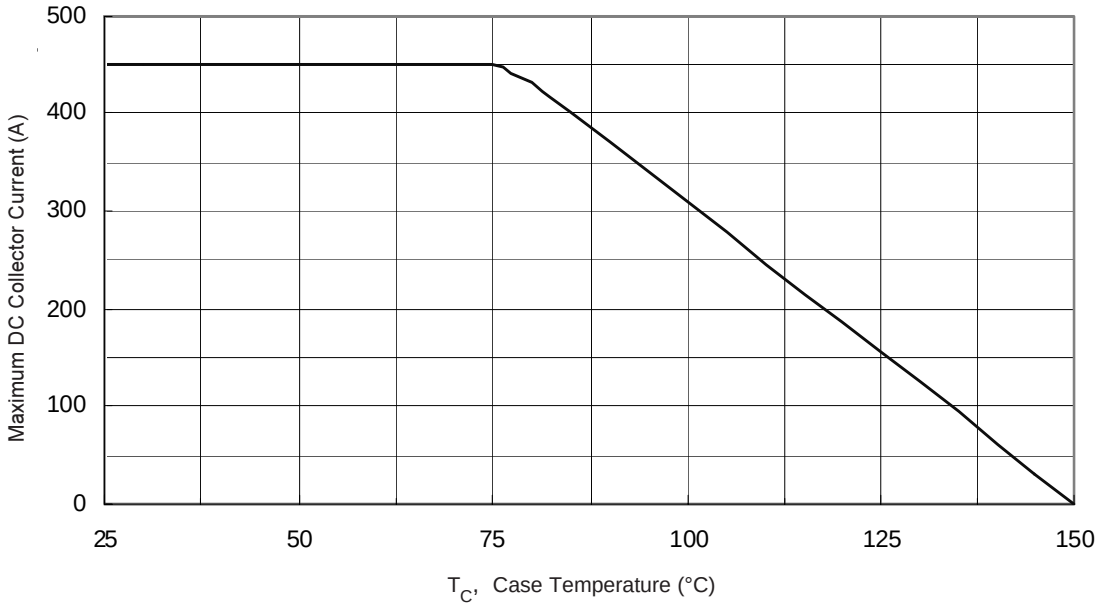




**Fig 1:** Maximum Collector Current Vs Case Temperature

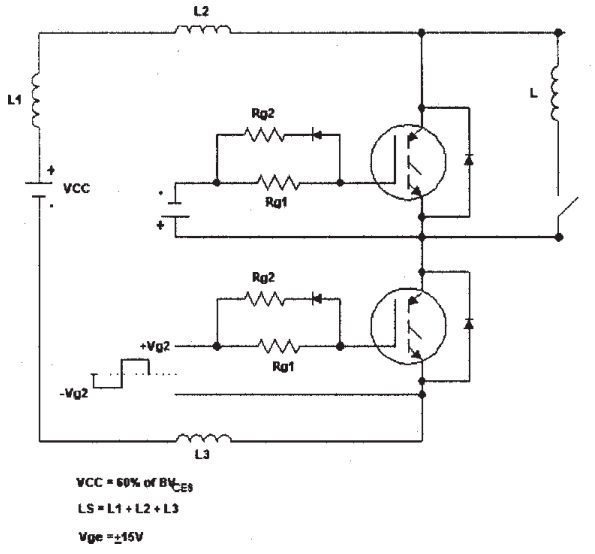



**Fig. 2** - Test Circuit for Measurement of $E_{on}$, $E_{off}$, $t_{rr}$, $Q_{rr}$, $I_{rr}$, $t_{d(on)}$, $t_r$, $t_{d(off)}$, $t_f$

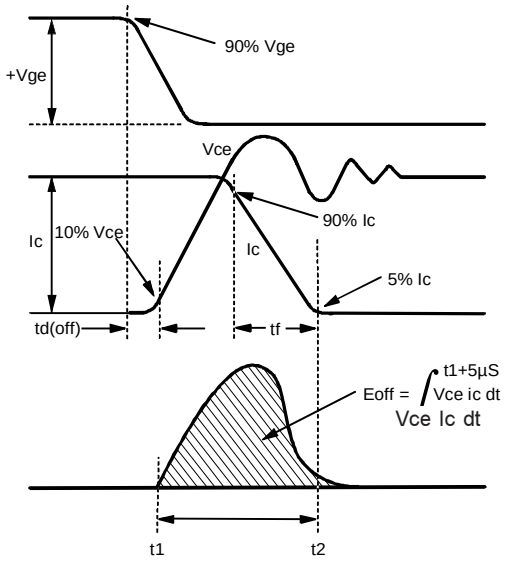



**Fig. 3** - Test Waveforms for Circuit of Fig. 2, Defining $E_{off}$, $t_{d(off)}$, $t_f$

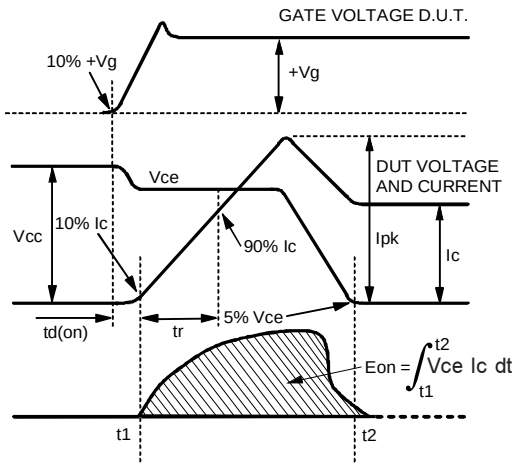



**Fig. 3** - Test Waveforms for Circuit of Fig. 2, Defining $E_{on}$, $t_{d(on)}$, $t_r$

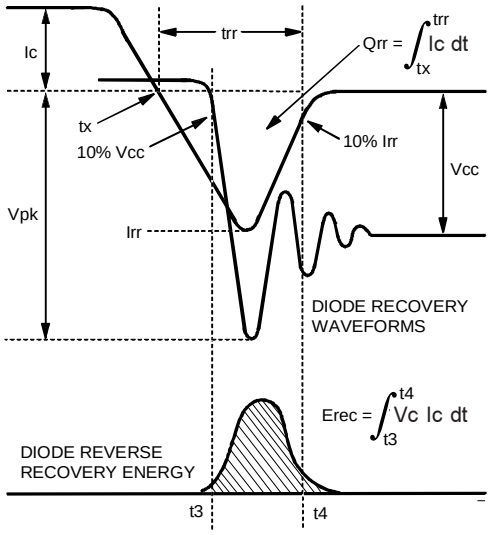
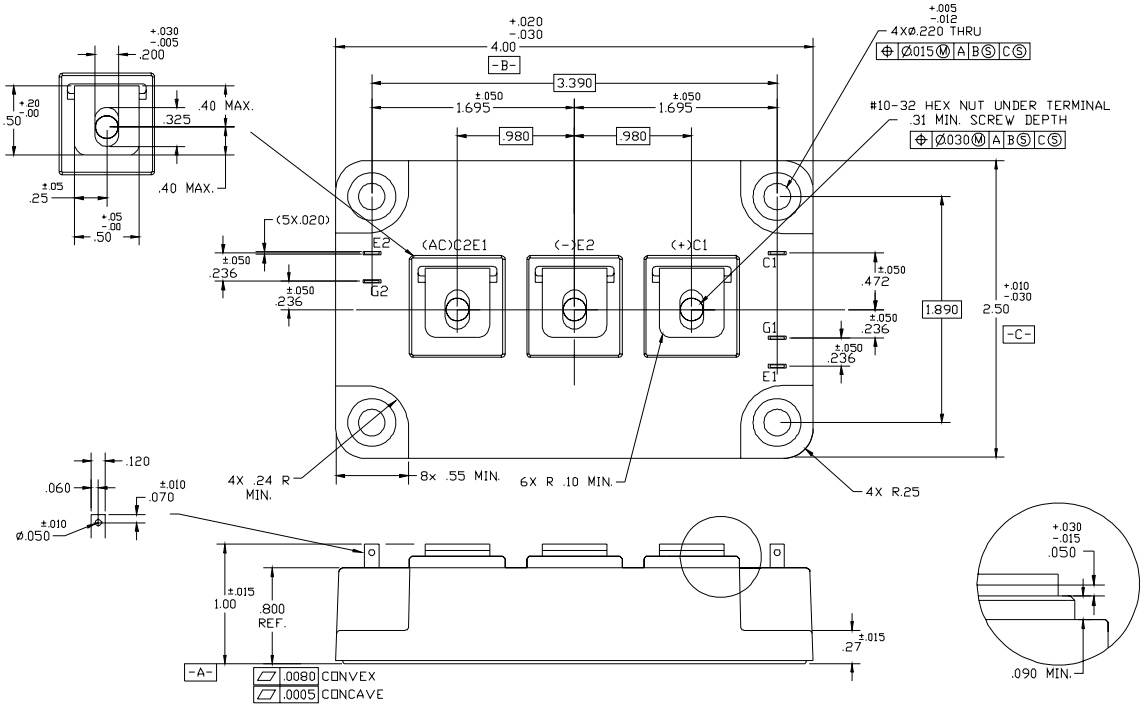



**Fig. 4** - Test Waveforms for Circuit of Fig. 2, Defining $E_{rec}$, $t_{rr}$, $Q_{rr}$, $I_{rr}$

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## Case Outline and Dimensions - HiRel™ INT-A-Pak 2




Notes: 1) All dimensions are in inches
2) Unless otherwise specified,
Tolerances .XX = ±0.01, .XXX = ±0.005

## Part numbering Nomenclature

**G 300 HH C K 12 P2 H**

**IGBT Module - Hirel**

**Current Capability**
300 = 300 Amps

**Circuit Configuration**
HH = Half Bridge

**Generation**
**IGBT / FWD Configuration**
C = GEN 5 (NPT) / GEN 3

**Screening Level**
P = Unscreened, 25°C Electrical Test
( Not intended for Qualification)
H = Screened per MIL-PRF-38534

**Package Type**
P2 = HiRel™ INT-A-Pak 2,
2.5" X 4.0" X 1.0"

**Voltage**
12 = 1200V

**IGBT Speed / SC Capability**
K = Fast, SC Capable

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