DACO®

# DAHF600G120SB2

## IGBT Power Module
## 1200V / 600A

Preliminary

### Features

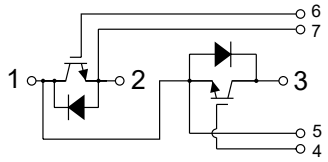
- 62mm Fast Switching / Trench Field Stop IGBT Technology
- Low Switching Losses
- Super Fast Diodes
- High Short Circuit Capability

### Applications

- Welder / Power Supply
- UPS / Inverter
- Industrial Motor Drive

**HDA-10662**

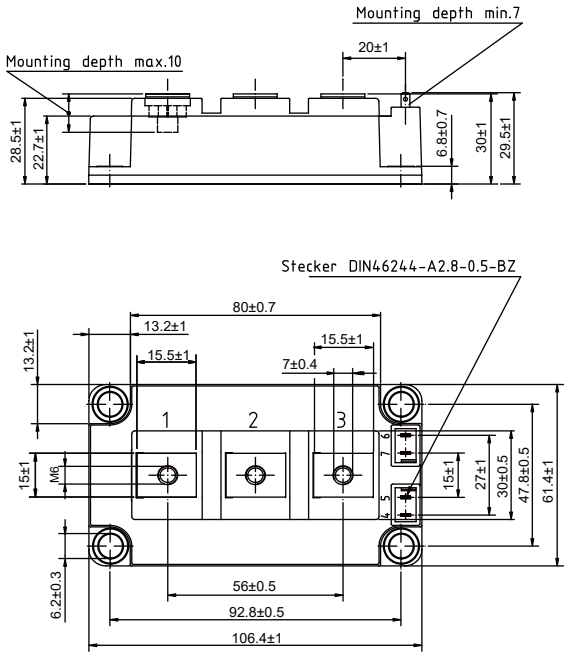
### Circuit Diagram Headline




### Maximum Ratings ( $T_C$= 25℃ )

| Item | | Symbol | Rated Value | Unit |
|---|---|---|---|---|
| Collector-Emitter Voltage | $T_{VJ}$ = 25℃ | $V_{CES}$ | 1200 | V |
| Gate-Emitter Peak Voltage | | $V_{GES}$ | ±20 | V |
| Continuous DC Collector Current | Tc = 100℃<br>$T_{VJ\ max.}$ = 175℃ | $I_{C,nom.}$ | 600 | A |
| Repetitive Peak Collector Current | tp =1ms | $I_{CRM}$ | 1200 | A |
| Total Power Dissipation | | $P_{tot}$ | 3260 | W |
| Isolation Voltage | RMS, f=50Hz, t=1min | $V_{iso}$ | 3000 | V |
| Max. Junction Temperature | | $T_{VJ\ max.}$ | 175 | ℃ |
| Temperature Under Switching Conditions | | $T_{VJ\ op}$ | −40～+150 | ℃ |
| Storage Temperature | | $T_{stg}$ | −40～+125 | ℃ |
| Mounting Torque | Module Base to Heatsink (M6) | | 3～6 | N.m |
| | Busbar to Terminal (M6) | | 2.5～5 | |

### Package Outlines




Dimensions in mm (1 mm = 0.0394")

## ■ Electrical Characteristics

| Characteristics | Symbol | Test Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| Collector-emitter saturation voltage | $V_{CE\ sat}$ | $I_C$ =600A, $V_{GE}$ =15V | $T_{vj}$ =25℃ | | 1.9 | 2.2 | V |
| | | $I_C$ =600A, $V_{GE}$ =15V | $T_{vj}$ =125℃ | | 2.30 | | |
| Gate threshold voltage | $V_{GEth}$ | $I_C$ =5.3mA, $V_{CE}$ =$V_{GE}$, $T_{vj}$ =25℃ | | 5.3 | 5.8 | 6.4 | V |
| Gate charge | $Q_G$ | Ic =600A, $V_{CE}$ =600V,$V_{GE}$ =15V | | | 29.6 | | uC |
| Internal gate resistor | $R_{Gint}$ | $T_{vj}$ =25°C | | | 0.1 | | Ω |
| Input capacitance | $C_{ies}$ | f = 100KHz, $T_{vj}$ =25℃, $V_{CE}$ =25V, $V_{GE}$ =0V | | | 54.4 | | nF |
| Output capacitance | $C_{oes}$ | f = 100KHz, $T_{vj}$ =25℃, $V_{CE}$ =25V, $V_{GE}$ =0V | | | 2.49 | | nF |
| Reverse transfer capacitance | $C_{res}$ | f = 100KHz, $T_{vj}$ =25℃, $V_{CE}$ =25V, $V_{GE}$ =0V | | | 0.517 | | nF |
| Collector-emitter cut-off current | $I_{CES}$ | $V_{CE}$ =1200V, $V_{GE}$ =0V, $T_{vj}$ =25℃ | | | | 5 | mA |
| Gate-emitter leakage current | $I_{GES}$ | $V_{CE}$ =0V, $V_{GE}$ =20V, $T_{vj}$ =25℃ | | | | 400 | nA |
| Turn-on delay time, inductive load | $t_{d\ on}$ | $I_C$ =600A, $V_{CE}$ =600V | $T_{vj}$ =25℃ | | 327 | | ns |
| | | $V_{GE}$ = ±15V | $T_{vj}$ =125℃ | | 341 | | |
| | | $R_{G(on)}$ =0.5Ω, $R_{G(off)}$ =0.5Ω | $T_{vj}$ =150℃ | | 346 | | |
| Rise time, inductive load | $t_r$ | $I_C$ =600A, $V_{CE}$ =600V | $T_{vj}$ =25℃ | | 91 | | ns |
| | | $V_{GE}$ = ±15V | $T_{vj}$ =125℃ | | 101 | | |
| | | $R_{G(on)}$ =0.5Ω, $R_{G(off)}$ =0.5Ω | $T_{vj}$ =150℃ | | 106 | | |
| Turn-off delay time, inductive load | $t_{d\ off}$ | $I_C$ =600A, $V_{CE}$ =600V | $T_{vj}$ =25℃ | | 461 | | ns |
| | | $V_{GE}$ = ±15V | $T_{vj}$ =125℃ | | 511 | | |
| | | $R_{G(on)}$ =0.5Ω, $R_{G(off)}$ =0.5Ω | $T_{vj}$ =150℃ | | 534 | | |
| Fall time, inductive load | $t_f$ | $I_C$ =600A, $V_{CE}$ =600V | $T_{vj}$ =25℃ | | 57 | | ns |
| | | $V_{GE}$ = ±15V | $T_{vj}$ =125℃ | | 69 | | |
| | | $R_{G(on)}$ =0.5Ω, $R_{G(off)}$ =0.5Ω | $T_{vj}$ =150℃ | | 78 | | |
| Turn-on energy loss per pulse | $E_{on}$ | $I_C$ =600A, $V_{CE}$ =600V | $T_{vj}$ =25℃ | | 15 | | mJ |
| | | $V_{GE}$ = ±15V | $T_{vj}$ =125℃ | | 28 | | |
| | | $R_{G(on)}$ =0.5Ω, $R_{G(off)}$ =0.5Ω | $T_{vj}$ =150℃ | | 32 | | |
| Turn-off energy loss per pulse | $E_{off}$ | $I_C$ =600A, $V_{CE}$ =600V | $T_{vj}$ =25℃ | | 50 | | mJ |
| | | $V_{GE}$ = ±15V | $T_{vj}$ =125℃ | | 59 | | |
| | | $R_{G(on)}$ =0.5Ω, $R_{G(off)}$ =0.5Ω | $T_{vj}$ =150℃ | | 62 | | |
| SC data | $I_{SC}$ | $V_{GE}$ ≤15V, $V_{CC}$ =800V | $t_P$ ≤10μs, $T_{vj}$ =150℃ | | 2600 | | A |
| | | $V_{CEmax}$ =$V_{CES}$ - $L_{sCE}$ ·di/dt | | | | | |
| Thermal resistance, junction to case | $R_{thJC}$ | per IGBT | | | | 0.046 | ℃/W |
| Thermal resistance, case to heatsink | $R_{thCH}$ | per IGBT | | | 0.0226 | | ℃/W |

## ■ Diode Ratings & Characteristics

| Characteristics | Symbol | Test Conditions | Value | Unit |
|---|---|---|---|---|
| Repetitive peak reverse voltage | $V_{RRM}$ | $T_{vj}$ =25°C | 1200 | V |
| Continuous DC forward current | $I_F$ | | 600 | A |
| Repetitive peak forward current | $I_{FRM}$ | $t_P$ =1ms | 1200 | A |
| $I^2t$ - value | $I^2t$ | $V_R$ =0V, $t_P$ =10ms, $T_{vj}$ =125°C | 35000 | $A^2s$ |
| | | $V_R$ =0V, $t_P$ =10ms, $T_{vj}$ =150°C | 33000 | |

| Characteristics | Symbol | Test Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| Forward voltage | $V_F$ | $I_F$ =600A, $V_{GE}$ =0V | $T_{vj}$ =25°C | | 2.7 | 2.9 | V |
| | | $I_F$ =600A, $V_{GE}$ =0V | $T_{vj}$ =125°C | | 2.45 | | |
| Peak reverse recovery current | $I_{RRM}$ | $I_F$ =600A, -$di_F/dt$ =5200A/µs | $T_{vj}$ =25°C | | 340 | | A |
| | | $V_R$ =600V | $T_{vj}$ =125°C | | 540 | | |
| | | $V_{GE}$ = ±15V | $T_{vj}$ =150°C | | 580 | | |
| Recovered charge | Qrr | $I_F$ =600A, -$di_F/dt$ =5200A/µs | $T_{vj}$ =25°C | | 38190 | | nC |
| | | $V_R$ =600V | $T_{vj}$ =125°C | | 86180 | | |
| | | $V_{GE}$ = ±15V | $T_{vj}$ =150°C | | 101600 | | |
| Reverse recovery energy | Erec | $I_F$ =600A, -$di_F/dt$ =5200A/µs | $T_{vj}$ =25°C | | 21.4 | | mJ |
| | | $V_R$ =600V | $T_{vj}$ =125°C | | 44.3 | | |
| | | $V_{GE}$ = ±15V | $T_{vj}$ =150°C | | 50.7 | | |
| Reverse Recovery Time | Trr | $I_F$ =600A, -$di_F/dt$ =5200A/µs, $V_R$ =600V, $V_{GE}$ = ±15V $T_{vj}$=25°C | | | 174 | | ns |
| Thermal resistance, junction to case | $R_{thJC}$ | per diode | | | | 0.0929 | °C/W |
| Thermal resistance, case to heatsink | $R_{thCH}$ | per diode | | | 0.0303 | | °C/W |
| Temperature under switching conditions | $T_{vj\ op}$ | | | -40 | | 150 | °C |

## ■ Module Ratings & Characteristics

| Characteristics | Symbol | Test Conditions | Value | Unit |
|---|---|---|---|---|
| Material of module baseplate | | | Cu | |
| Internal isolation | | basic insulation (class 1, IEC 61140) | $Al_2O_3$ | |
| Creepage distance | | terminal to heatsink | 29 | mm |
| | | terminal to terminal | 23 | |
| Clearance | | terminal to heatsink | 23 | mm |
| | | terminal to terminal | 11 | |
| Comperative tracking index | CTI | | >400 | |

## Typical Characteristics

Preliminary Data

**Fig.1 Output characteristic IGBT,Inverter (typical)**

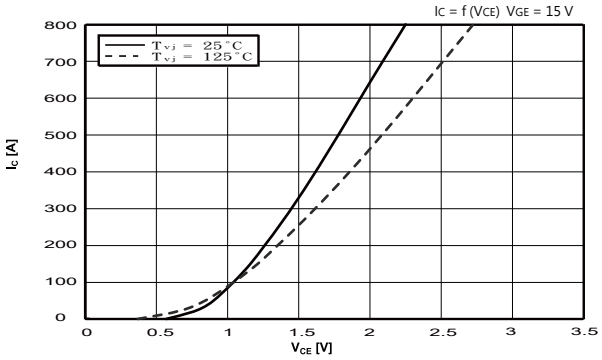



**Fig.2 Output characteristic IGBT,Inverter (typical)**

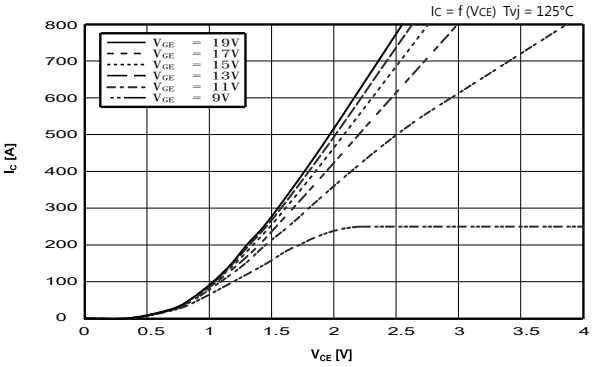



**Fig.3 Transfer characteristic IGBT,Inverter (typical)**

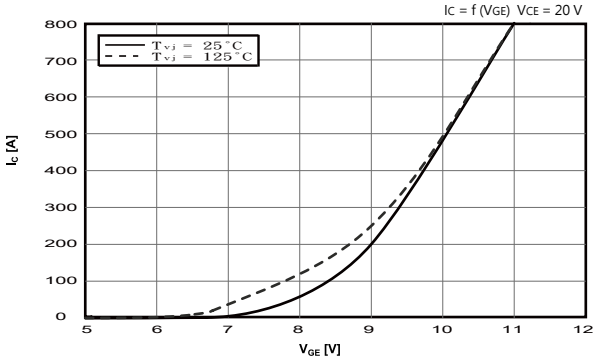



**Fig.4 Switching losses IGBT,Inverter (typical)**

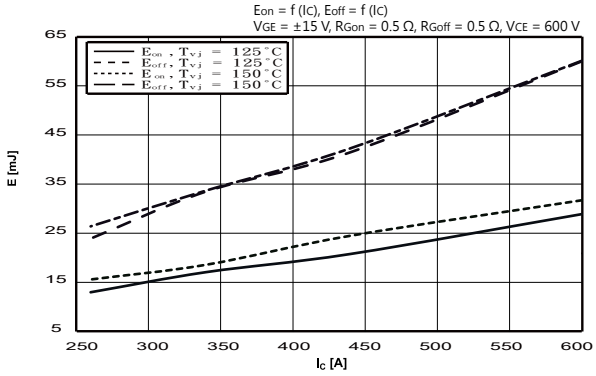



**Fig.5 Switching losses IGBT,Inverter (typical)**

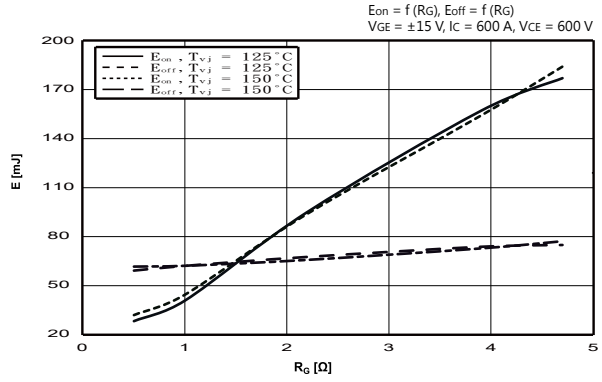



**Fig.6 Transient thermal impedance IGBT,Inverter**

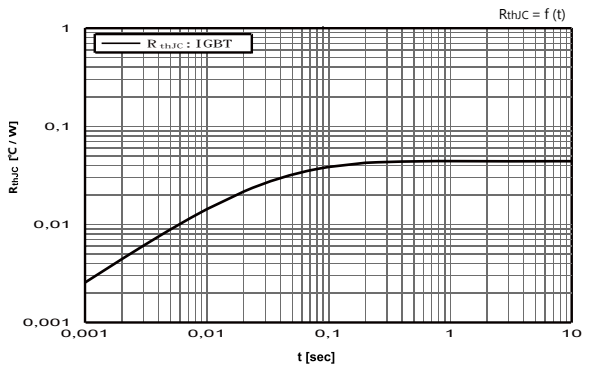



**Fig.7 Reverse bias safe operating area IGBT,Inverter (RBSOA)**

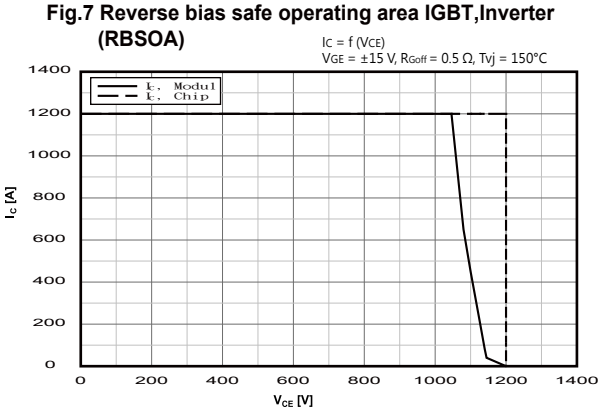
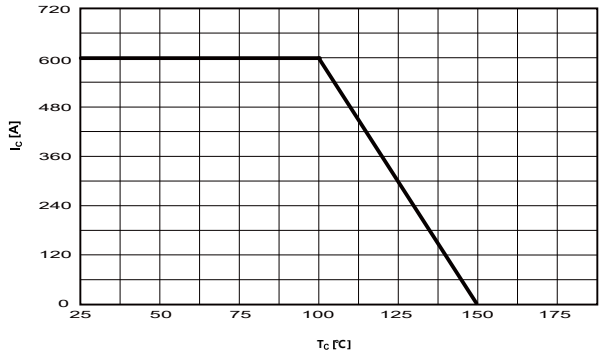



**Fig.8 Output characteristic IGBT,Inverter (typical)**



## Typical Characteristics

Preliminary Data

**Fig.9 Gate Charge Characteristics(typical)**

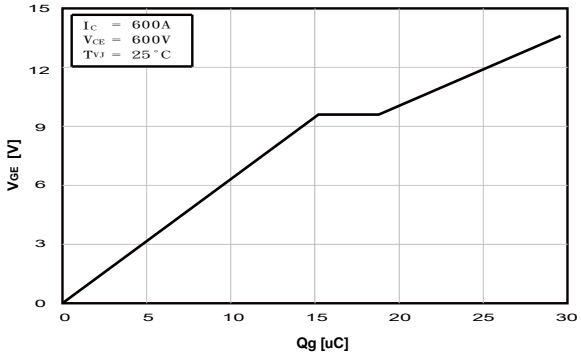



**Fig.10 Forward characteristic of Diode, Inverter (typical)**

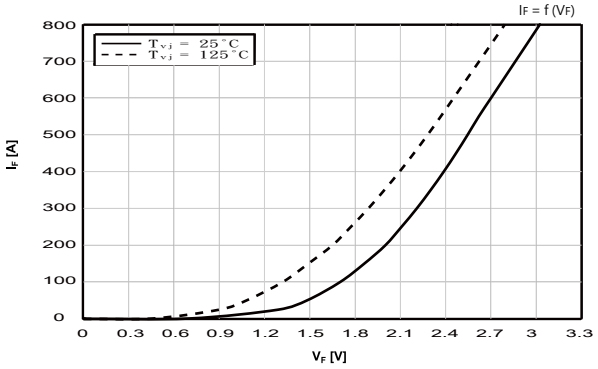



**Fig.11 Switching losses Diode, Inverter (typical)**

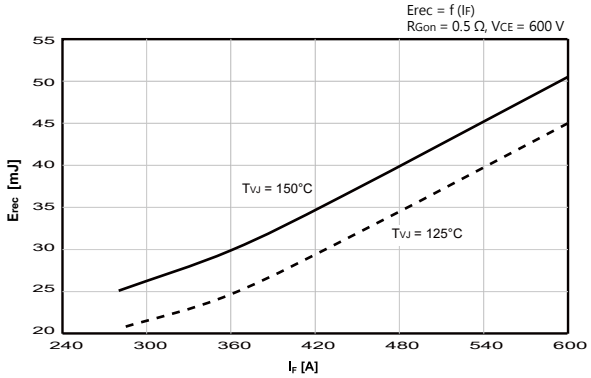



**Fig.12 Switching losses Diode, Inverter (typical)**

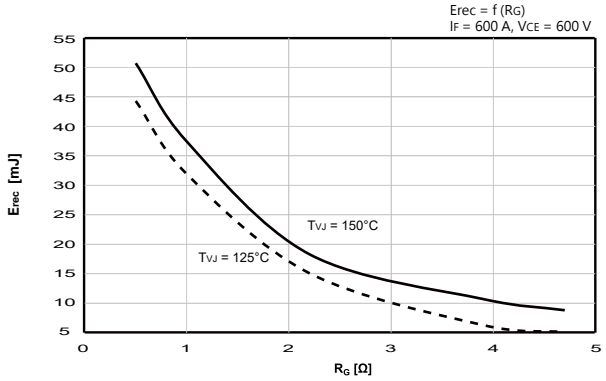
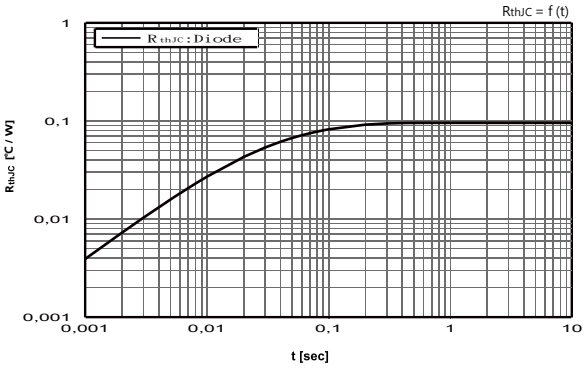



**Fig.13 Transient thermal impedance Diode, Inverter**



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