

FEATURES

- Low $V_{CE(SAT)}$
- Non Punch Through Silicon
- Isolated Copper Baseplate
- Low Inductance Internal Construction
- 1600A Per module

APPLICATIONS

- High Reliability Inverters
- Motor Controllers
- Traction Drives
- Resonant Converters

The Powerline range of high power modules includes dual and single switch configurations covering voltages from 600V to 3300V and currents up to 4800A.

The GP1601FSS18 is a single switch 1800V, n channel enhancement mode, insulated gate bipolar transistor (IGBT) module. Designed with low $V_{CE(SAT)}$ to minimise conduction losses, the module is of particular relevance in low to medium frequency applications. The IGBT has a wide reverse bias safe operating area (RBSOA) ensuring reliability in demanding applications.

The module incorporates an electrically isolated base plate and low inductance construction enabling circuit designers to optimise circuit layouts and utilise earthed heat sinks for safety.

ORDERING INFORMATION

Order As:

GP1601FSS18

Note: When ordering, please use the whole part number.

KEY PARAMETERS

| | | |
|---------------|--------------|--------------|
| V_{CES} | | 1800V |
| $V_{CE(sat)}$ | (typ) | 2.6V |
| I_C | (max) | 1600A |
| $I_{C(PK)}$ | (max) | 3200A |

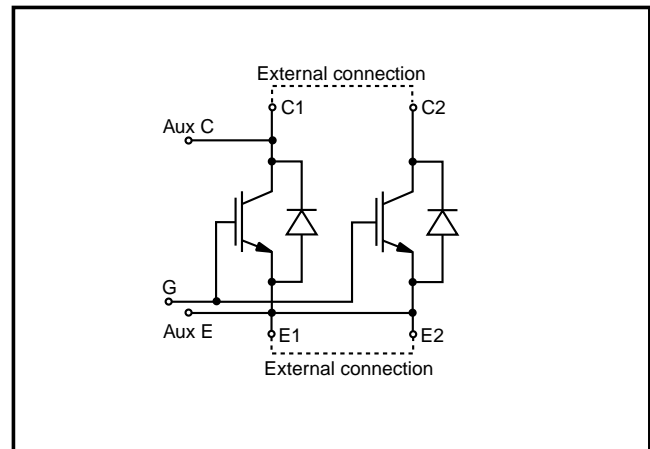


Fig. 1 Single switch circuit diagram

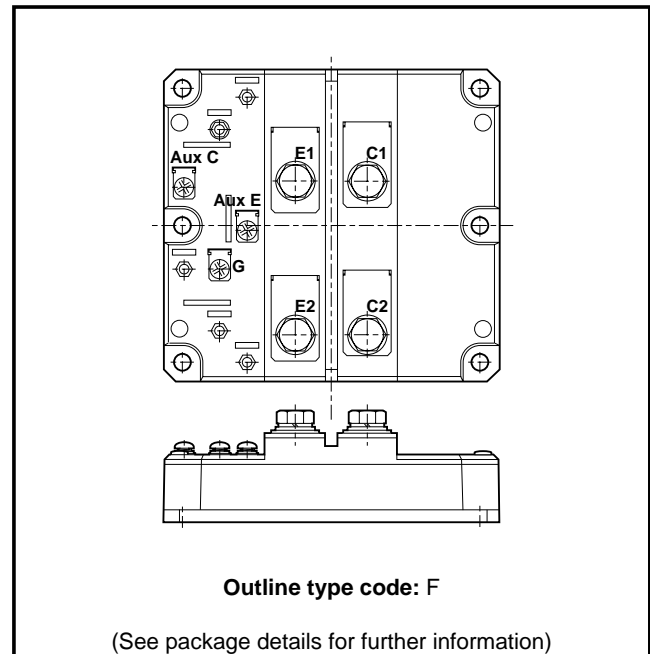


Fig. 2 Electrical connections - (not to scale)

ABSOLUTE MAXIMUM RATINGS

Stresses above those listed under 'Absolute Maximum Ratings' may cause permanent damage to the device. In extreme conditions, as with all semiconductors, this may include potentially hazardous rupture of the package. Appropriate safety precautions should always be followed. Exposure to Absolute Maximum Ratings may affect device reliability.

$T_{case} = 25^{\circ}\text{C}$ unless stated otherwise

| Symbol | Parameter | Test Conditions | Max. | Units |
|-------------|-----------------------------------|---|----------|-------|
| V_{CES} | Collector-emitter voltage | $V_{GE} = 0V$ | 1800 | V |
| V_{GES} | Gate-emitter voltage | - | ± 20 | V |
| I_C | Continuous collector current | $T_{case} = 70^{\circ}\text{C}$ for $T_j = 125^{\circ}\text{C}$ | 1600 | A |
| $I_{C(PK)}$ | Peak collector current | 1ms, $T_{case} = 115^{\circ}\text{C}$ | 3200 | A |
| P_{max} | Max. transistor power dissipation | $T_{case} = 25^{\circ}\text{C}$, $T_j = 150^{\circ}\text{C}$ | 11.4 | kW |
| V_{isol} | Isolation voltage | Commoned terminals to base plate. AC RMS, 1 min, 50Hz | 4000 | V |

THERMAL AND MECHANICAL RATINGS

| Symbol | Parameter | Test Conditions | Min. | Max. | Units |
|---------------|--|---|------|------|------------------------------|
| $R_{th(j-c)}$ | Thermal resistance - transistor | Continuous dissipation - junction to case | - | 11 | $^{\circ}\text{C}/\text{kW}$ |
| $R_{th(j-c)}$ | Thermal resistance - diode | Continuous dissipation - junction to case | - | 20 | $^{\circ}\text{C}/\text{kW}$ |
| $R_{th(c-h)}$ | Thermal resistance - case to heatsink (per module) | Mounting torque 5Nm (with mounting grease) | - | 8 | $^{\circ}\text{C}/\text{kW}$ |
| T_j | Junction temperature | Transistor | - | 150 | $^{\circ}\text{C}$ |
| | | Diode | - | 125 | $^{\circ}\text{C}$ |
| T_{stg} | Storage temperature range | - | -40 | 125 | $^{\circ}\text{C}$ |
| - | Screw torque | Mounting - M6 | - | 5 | Nm |
| | | Electrical connections - M4 | - | 2 | Nm |
| | | Electrical connections - M8 | - | 10 | Nm |

ELECTRICAL CHARACTERISTICS
 $T_{\text{case}} = 25^{\circ}\text{C}$ unless stated otherwise.

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Units |
|----------------------|--------------------------------------|--|------|------|------|---------------|
| I_{CES} | Collector cut-off current | $V_{\text{GE}} = 0\text{V}, V_{\text{CE}} = V_{\text{CES}}$ | - | - | 2 | mA |
| | | $V_{\text{GE}} = 0\text{V}, V_{\text{CE}} = V_{\text{CES}}, T_{\text{case}} = 125^{\circ}\text{C}$ | - | - | 50 | mA |
| I_{GES} | Gate leakage current | $V_{\text{GE}} = \pm 20\text{V}, V_{\text{CE}} = 0\text{V}$ | - | - | 8 | μA |
| $V_{\text{GE(TH)}}$ | Gate threshold voltage | $I_{\text{C}} = 80\text{mA}, V_{\text{GE}} = V_{\text{CE}}$ | 4.5 | 5.5 | 6.5 | V |
| $V_{\text{CE(sat)}}$ | Collector-emitter saturation voltage | $V_{\text{GE}} = 15\text{V}, I_{\text{C}} = 1600\text{A}$ | - | 2.6 | 3.2 | V |
| | | $V_{\text{GE}} = 15\text{V}, I_{\text{C}} = 1600\text{A}, T_{\text{case}} = 125^{\circ}\text{C}$ | - | 3.3 | 4 | V |
| I_{F} | Diode forward current | DC | - | - | 1600 | A |
| I_{FM} | Diode maximum forward current | $t_{\text{p}} = 1\text{ms}$ | - | - | 3200 | A |
| V_{F} | Diode forward voltage | $I_{\text{F}} = 1600\text{A}$ | - | 2.2 | 2.5 | V |
| | | $I_{\text{F}} = 1600\text{A}, T_{\text{case}} = 125^{\circ}\text{C}$ | - | 2.3 | 2.6 | V |
| C_{ies} | Input capacitance | $V_{\text{CE}} = 25\text{V}, V_{\text{GE}} = 0\text{V}, f = 1\text{MHz}$ | - | 180 | - | nF |
| L_{M} | Module inductance | - | - | 15 | - | nH |

ELECTRICAL CHARACTERISTICS

 $T_{\text{case}} = 25^{\circ}\text{C}$ unless stated otherwise

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Units |
|---------------------|-------------------------------|---|--|------|------|-------|
| $t_{d(\text{off})}$ | Turn-off delay time | $I_C = 1600\text{A}$ $V_{GE} = \pm 15\text{V}$ $V_{CE} = 900\text{V}$ $R_{G(\text{ON})} = R_{G(\text{OFF})} = 2.2\Omega$ $L \sim 50\text{nH}$ | - | 1500 | 1650 | ns |
| t_f | Fall time | | - | 300 | 350 | ns |
| E_{OFF} | Turn-off energy loss | | - | 850 | 1050 | mJ |
| $t_{d(\text{on})}$ | Turn-on delay time | | - | 400 | 550 | ns |
| t_r | Rise time | | - | 300 | 450 | ns |
| E_{ON} | Turn-on energy loss | | - | 500 | 700 | mJ |
| Q_{rr} | Diode reverse recovery charge | | $I_F = 1600\text{A}, V_R = 50\% V_{CES}$ $di_F/dt = 6000\text{A}/\mu\text{s}$ | - | 300 | 400 |
| I_{rr} | Diode reverse current | - | | 750 | - | A |
| E_{REC} | Diode reverse recovery energy | - | | 200 | - | mJ |

 $T_{\text{case}} = 125^{\circ}\text{C}$ unless stated otherwise

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Units |
|---------------------|-------------------------------|---|--|------|------|-------|
| $t_{d(\text{off})}$ | Turn-off delay time | $I_C = 1600\text{A}$ $V_{GE} = \pm 15\text{V}$ $V_{CE} = 900\text{V}$ $R_{G(\text{ON})} = R_{G(\text{OFF})} = 2.2\Omega$ $L \sim 50\text{nH}$ | - | 1700 | 1900 | ns |
| t_f | Fall time | | - | 300 | 380 | ns |
| E_{OFF} | Turn-off energy loss | | - | 1100 | 1300 | mJ |
| $t_{d(\text{on})}$ | Turn-on delay time | | - | 500 | 700 | ns |
| t_r | Rise time | | - | 350 | 500 | ns |
| E_{ON} | Turn-on energy loss | | - | 700 | 900 | mJ |
| Q_{rr} | Diode reverse recovery charge | | $I_F = 1600\text{A}, V_R = 50\% V_{CES}$ $di_F/dt = 5000\text{A}/\mu\text{s}$ | - | 550 | 650 |
| I_{rr} | Diode reverse current | - | | 850 | - | A |
| E_{REC} | Diode reverse recovery energy | - | | 320 | - | mJ |

TYPICAL CHARACTERISTICS

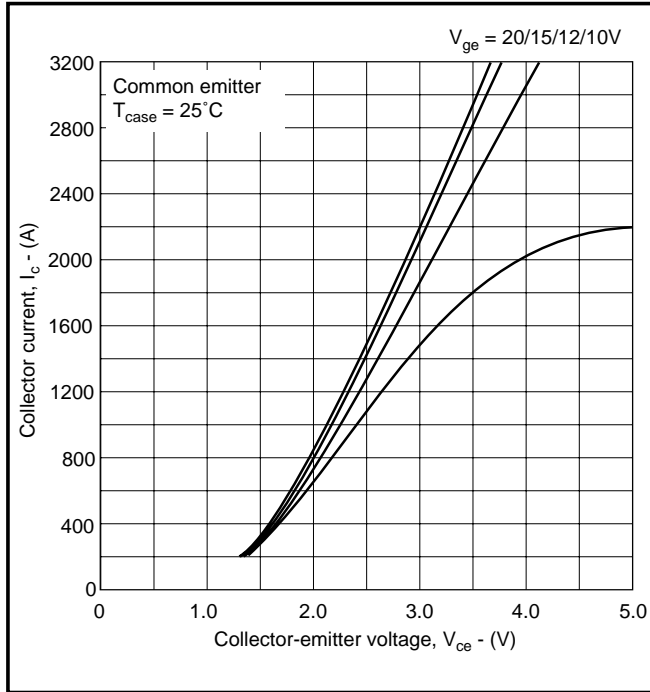


Fig. 3 Typical output characteristics

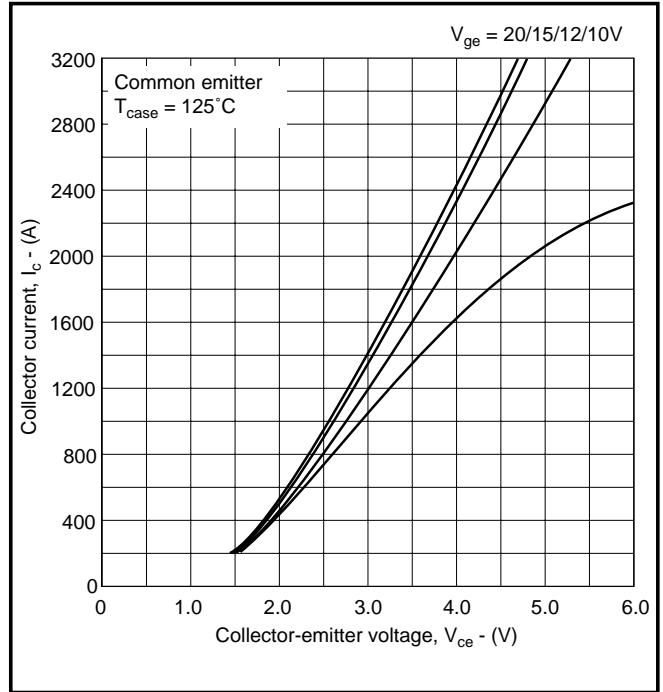


Fig. 4 Typical output characteristics

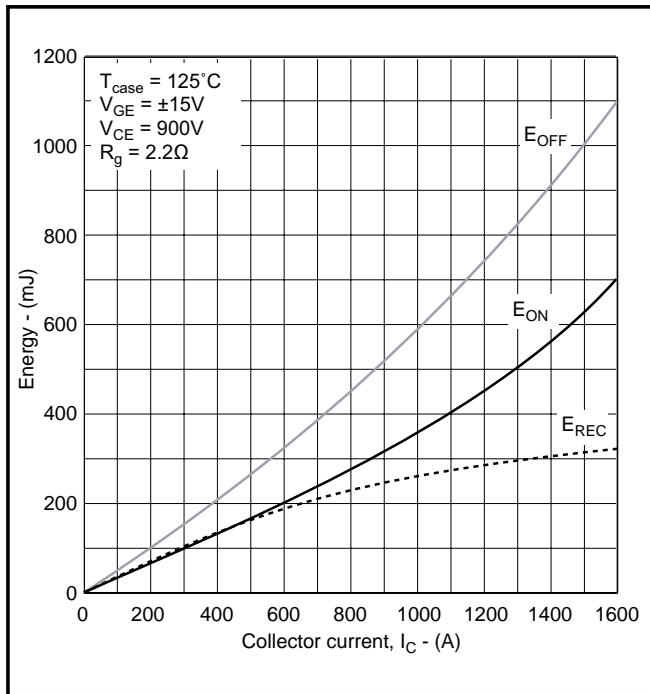


Fig. 5 Typical turn-on energy vs collector current

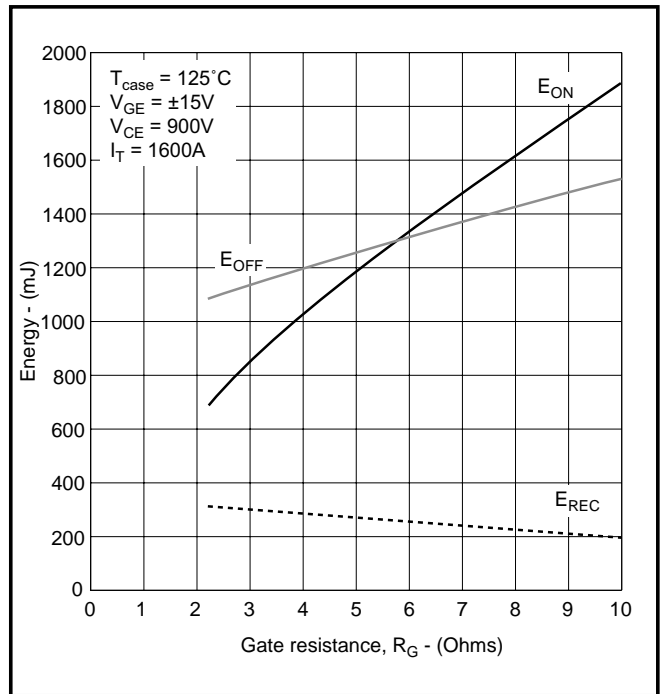


Fig. 6 Typical turn-off energy vs collector current

Caution: This device is sensitive to electrostatic discharge. Users should follow ESD handling procedures.

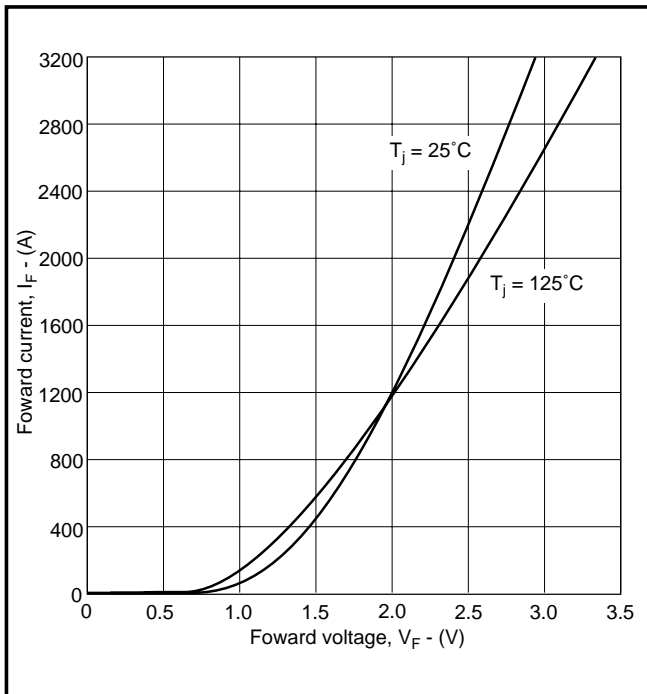


Fig. 7 Diode typical forward characteristics

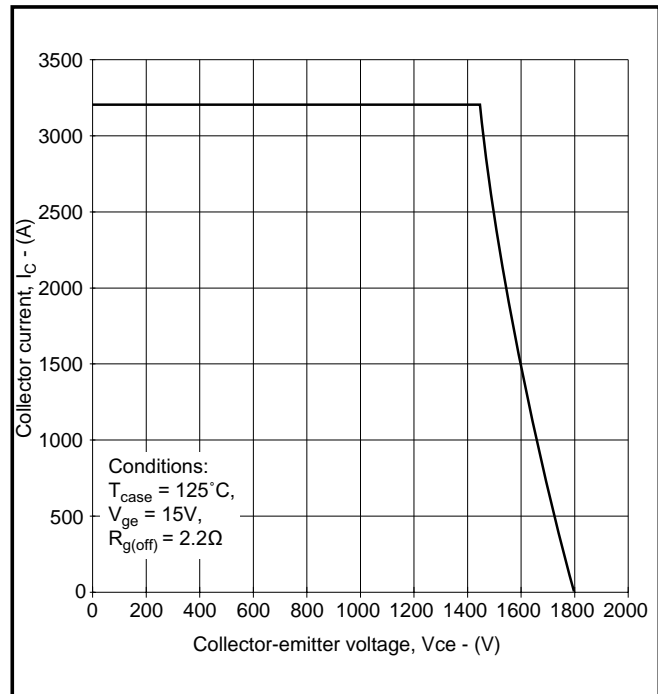


Fig. 8 Reverse bias safe operating area

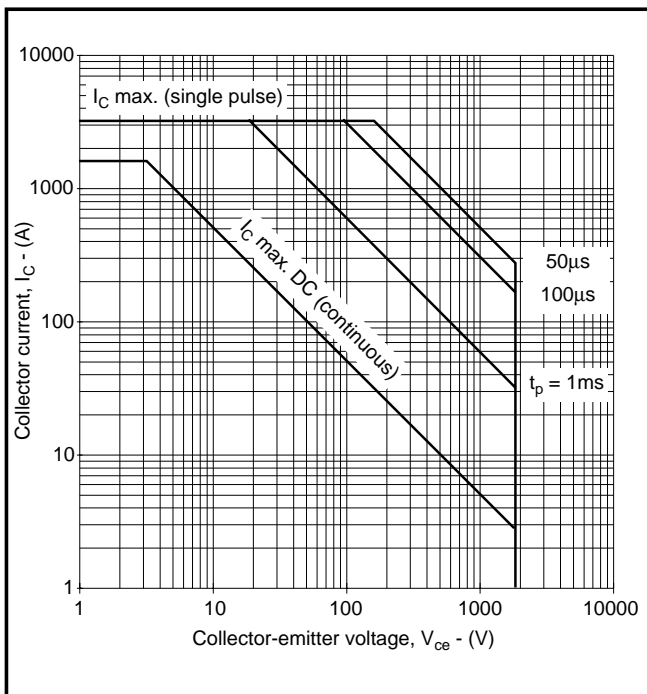


Fig. 9 Forward bias safe operating area

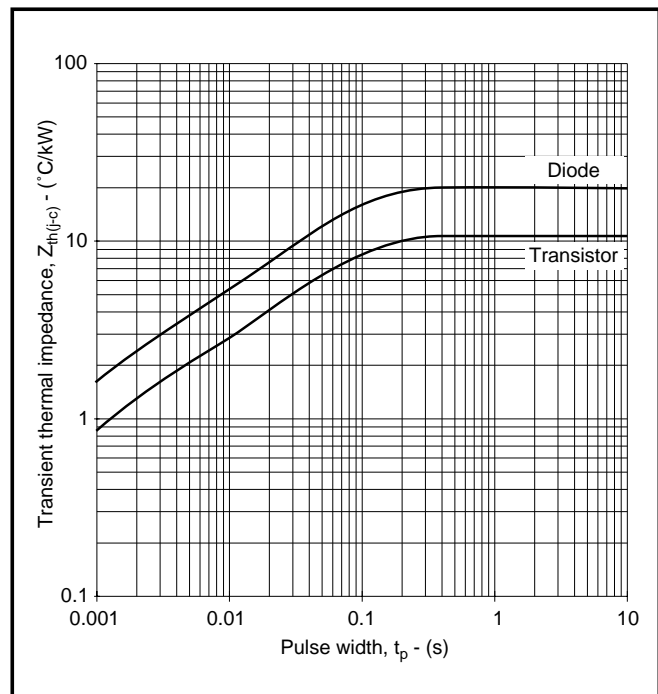


Fig. 10 Transient thermal impedance

ASSOCIATED PUBLICATIONS

| Title | Application Note Number |
|--|----------------------------|
| Electrostatic handling precautions | AN4502 |
| An introduction to IGBTs | AN4503 |
| IGBT ratings and characteristics | AN4504 |
| Heatsink requirements for IGBT modules | AN4505 |
| Calculating the junction temperature of power semiconductors | AN4506 |
| Gate drive considerations to maximise IGBT efficiency | AN4507 |
| Parallel operation of IGBTs – punch through vs non-punch through characteristics | AN4508 |
| Guidance notes for formulating technical enquiries | AN4869 |
| Principle of rating parallel connected IGBT modules | AN5000 |
| Short circuit withstand capability in IGBTs | AN5167 |
| Driving Dynex Semiconductor IGBT modules with Concept gate drivers | AN5384 |

POWER ASSEMBLY CAPABILITY

The Power Assembly group was set up to provide a support service for those customers requiring more than the basic semiconductor, and has developed a flexible range of heatsink and clamping systems in line with advances in device voltages and current capability of our semiconductors.

We offer an extensive range of air and liquid cooled assemblies covering the full range of circuit designs in general use today. The Assembly group continues to offer high quality engineering support dedicated to designing new units to satisfy the growing needs of our customers.

Using the latest CAD methods our team of design and applications engineers aim to provide the Power Assembly Complete Solution (PACs).

HEATSINKS

The Power Assembly group has its own proprietary range of extruded aluminium heatsinks. They have been designed to optimise the performance of Dynex semiconductors. Data with respect to air natural, forced air and liquid cooling (with flow rates) is available on request.

For further information on device clamps, heatsinks and assemblies, please contact your nearest sales representative or customer service office.



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Preliminary Information: The product is in design and development. The datasheet represents the product as it is understood but details may change.

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