GP1601FSS18

Single Switch Low $V_{CE(SAT)}$ IGBT Module

Replaces January 2000 version, DS5248-3.0

DS5248-4.2 January 2001

FEATURES

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

KEY PARAMETERS

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

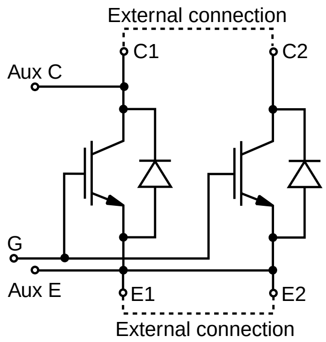


Fig. 1 Single switch circuit diagram

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.

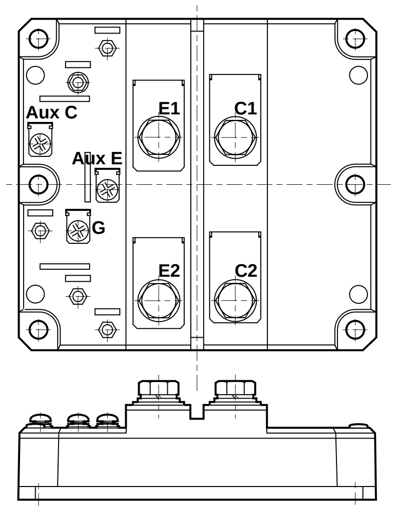
The module incorporates an electrically isolated base plate and low inductance construction enabling circuit designers to optimise circuit layouts and utilise earthed heat sinks for safety.

ORDERING INFORMATION

Order As:

GP1601FSS18

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



Outline type code: F

(See package details for further information)

Fig. 2 Electrical connections - (not to scale)

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

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˚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˚C for T_j = 125˚C	1600	A
$I_{C(PK)}$	Peak collector current	1ms, T_{case} = 115˚C	3200	A
P_{max}	Max. transistor power dissipation	T_{case} = 25˚C, T_j = 150˚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	˚C/kW
$R_{th(j-c)}$	Thermal resistance - diode	Continuous dissipation - junction to case	-	20	˚C/kW
$R_{th(c-h)}$	Thermal resistance - case to heatsink (per module)	Mounting torque 5Nm (with mounting grease)	-	8	˚C/kW
T_j	Junction temperature	Transistor	-	150	˚C
		Diode	-	125	˚C
T_{stg}	Storage temperature range	-	–40	125	˚C
-	Screw torque	Mounting - M6	-	5	Nm
		Electrical connections - M4	-	2	Nm
		Electrical connections - M8	-	10	Nm

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

ELECTRICAL CHARACTERISTICS

T_{case} = 25˚C unless stated otherwise.

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

ELECTRICAL CHARACTERISTICS

T_{case} = 25°C unless stated otherwise

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

T_{case} = 125°C unless stated otherwise

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

TYPICAL CHARACTERISTICS

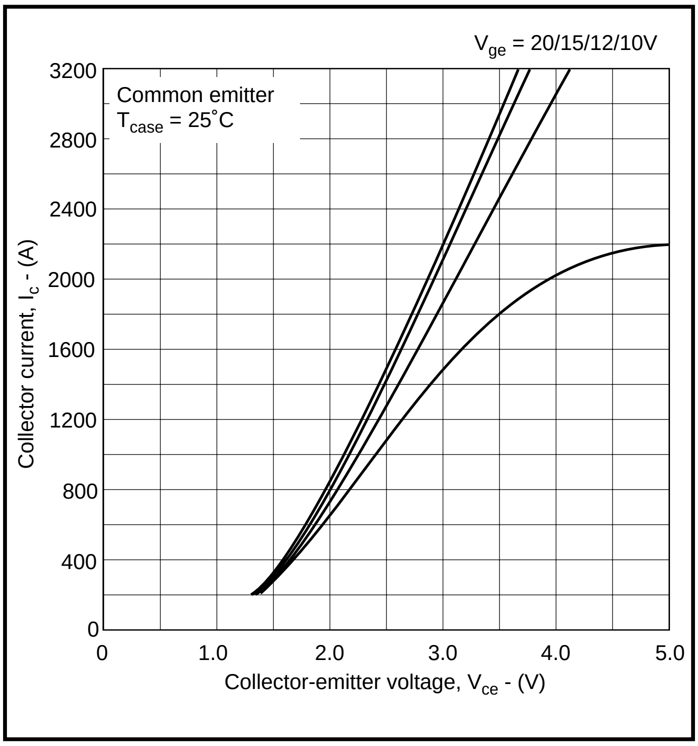


Fig. 3 Typical output characteristics

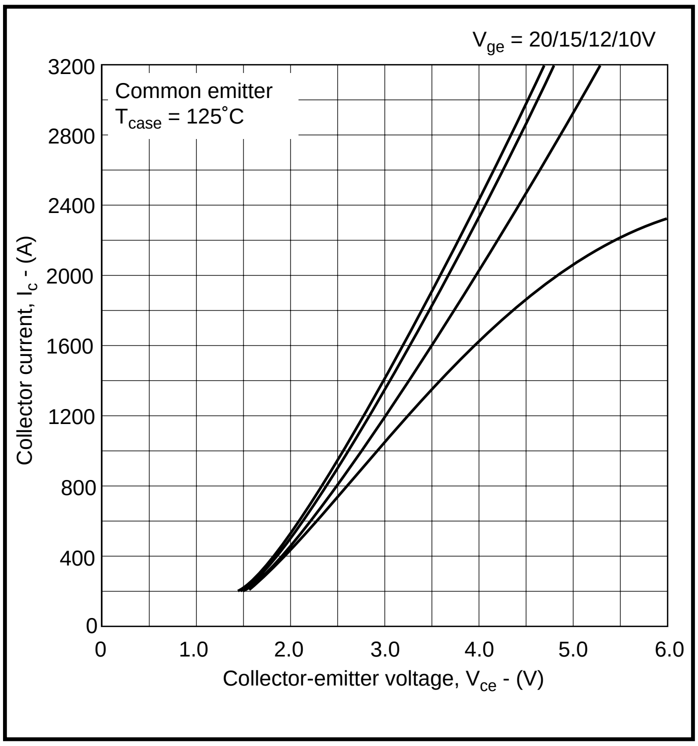


Fig. 4 Typical output characteristics

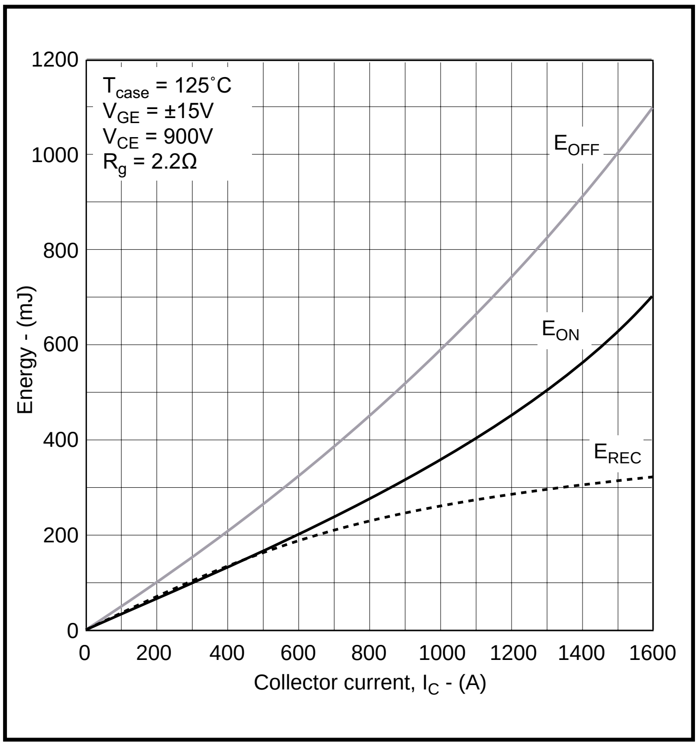


Fig. 5 Typical turn-on energy vs collector current

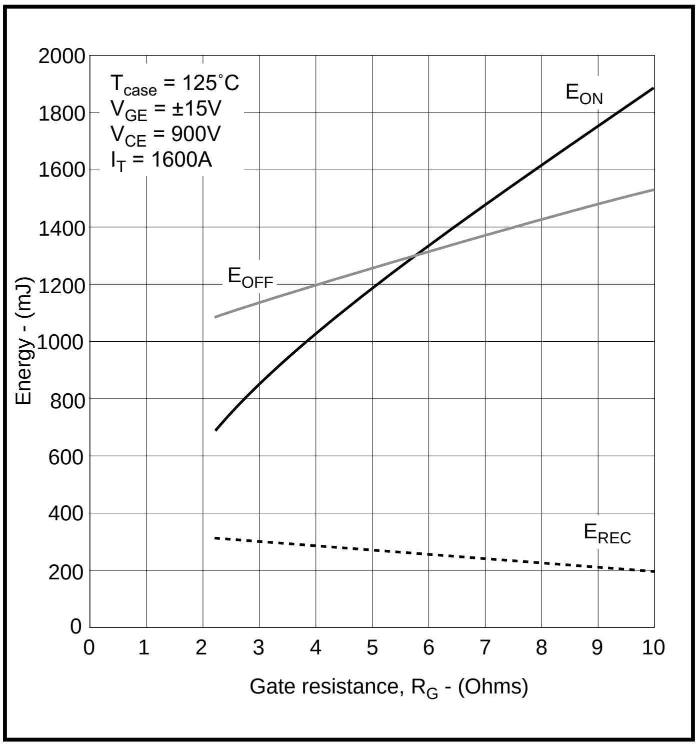


Fig. 6 Typical turn-off energy vs collector current

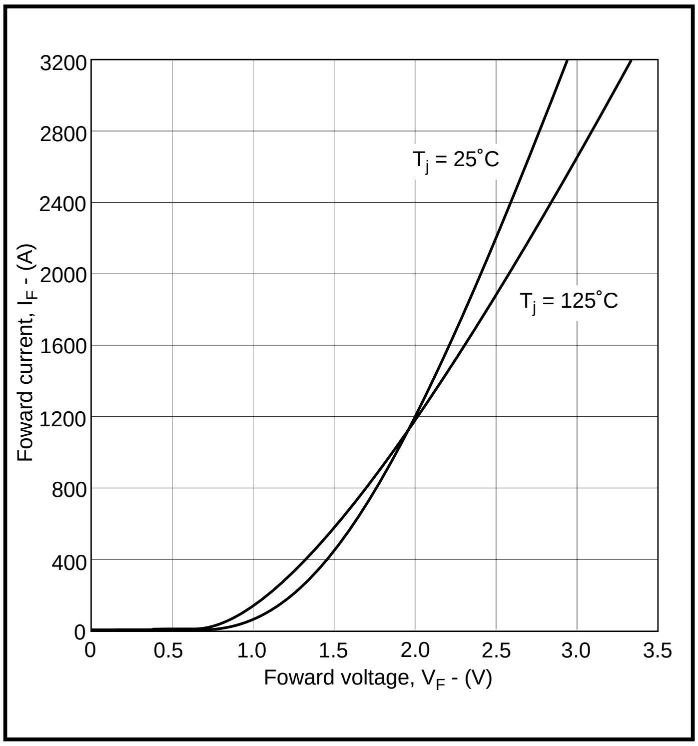


Fig. 7 Diode typical forward characteristics

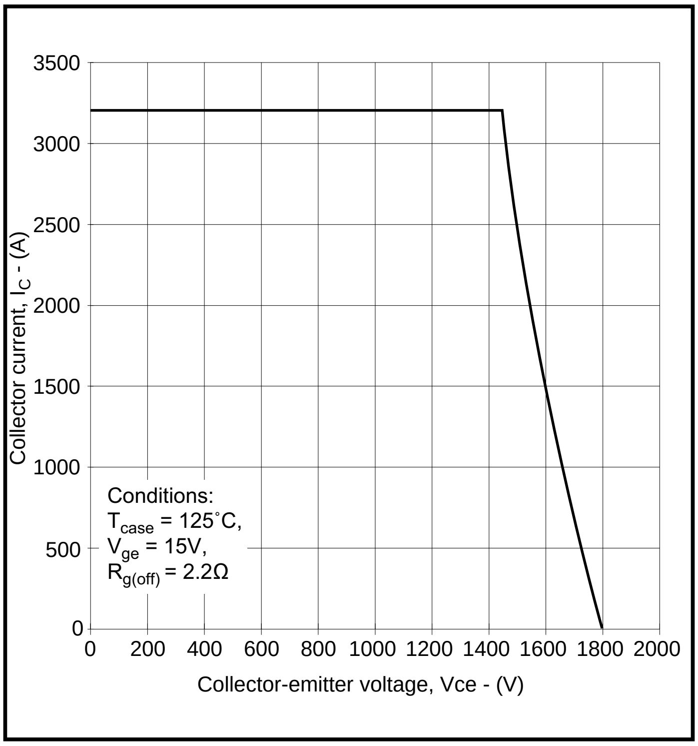


Fig. 8 Reverse bias safe operating area

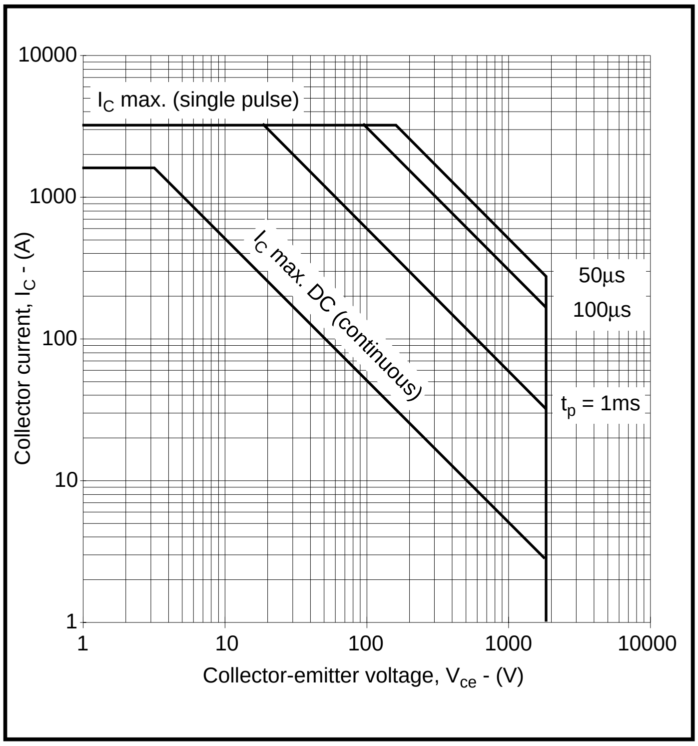


Fig. 9 Forward bias safe operating area

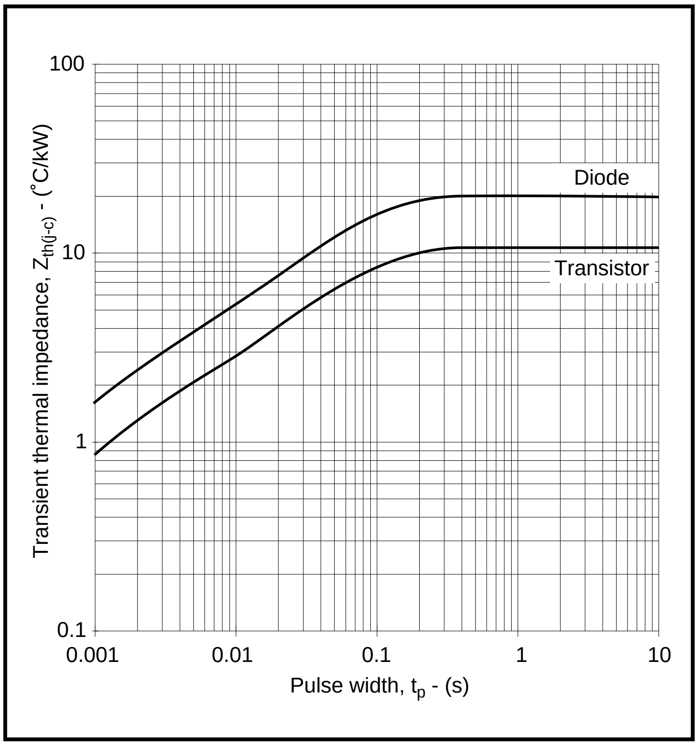
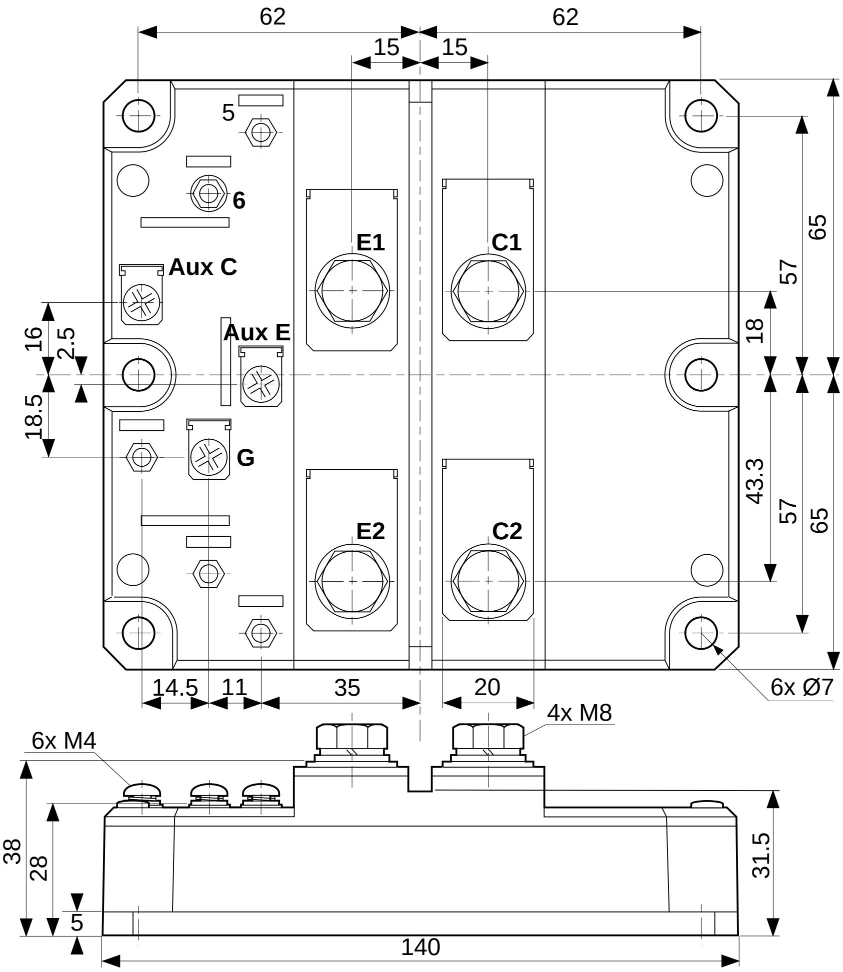


Fig. 10 Transient thermal impedance

PACKAGE DETAILS

For further package information, please visit our website or contact your nearest Customer Service Centre. All dimensions in mm, unless stated otherwise. DO NOT SCALE.



Nominal weight: 1600g

Module outline type code: F

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 Semincoductor 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.

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

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Target Information: This is the most tentative form of information and represents a very preliminary specification. No actual design work on the product has been started.

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

Advance Information: The product design is complete and final characterisation for volume production is well in hand.

No Annotation: The product parameters are fixed and the product is available to datasheet specification.