



GP400DDS18

Dual Switch IGBT Module

Preliminary Information

DS5359-2.0 January 2001

FEATURES

- Non Punch Through Silicon
- Isolated Copper Baseplate
- Low Inductance Internal Construction

APPLICATIONS

- High Power Inverters
- Motor Controllers
- Induction Heating
- 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 GP400DDS18 is a dual switch 1800V, n channel enhancement mode, insulated gate bipolar transistor (IGBT) module. 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:

GP400DDS18

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

KEY PARAMETERS

V_{CES}		1800V
$V_{CE(sat)}$	(typ)	3.5V
I_C	(max)	400A
$I_{C(PK)}$	(max)	1600A

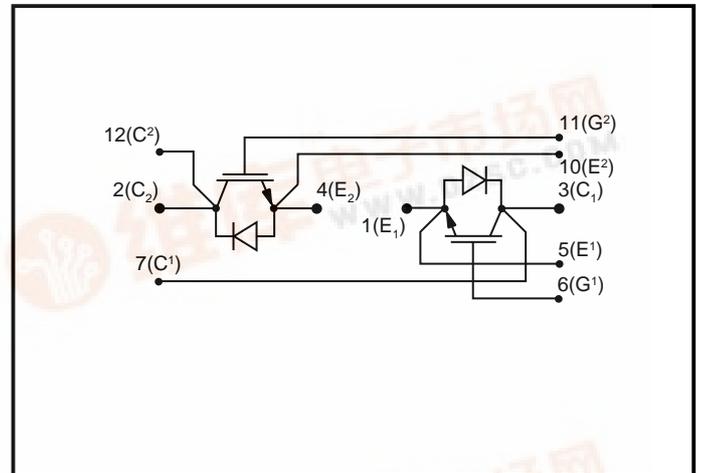


Fig. 1 Dual switch circuit diagram

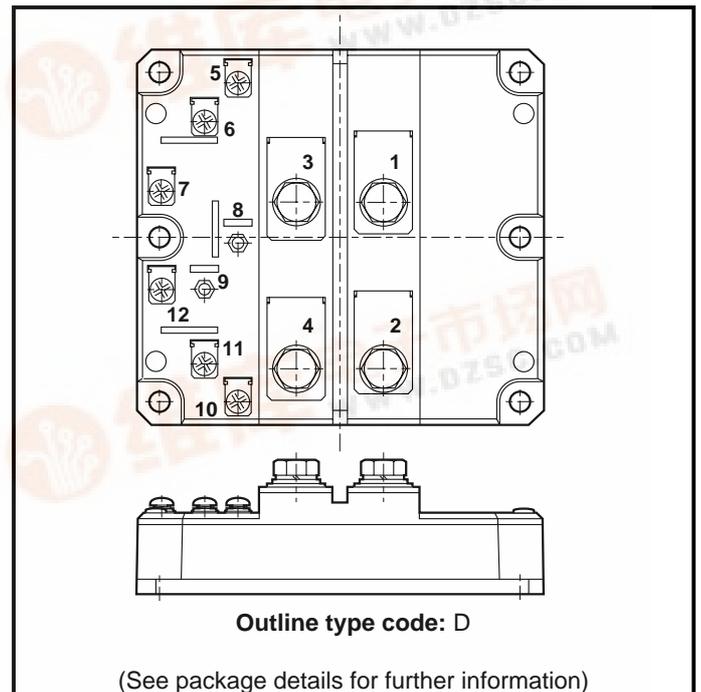


Fig. 2 Electrical connections - (not to scale)

ABSOLUTE MAXIMUM RATINGS - PER ARM

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	$T_{case} = 65^{\circ}\text{C}$	400	A
$I_{C(PK)}$	Peak collector current	1ms, $T_{case} = 105^{\circ}\text{C}$	800	A
P_{max}	Max. transistor power dissipation	$T_{case} = 25^{\circ}\text{C}$, $T_j = 150^{\circ}\text{C}$	3000	W
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 (per arm)	Continuous dissipation - junction to case	-	42	$^{\circ}\text{C}/\text{kW}$
$R_{th(j-d)}$	Thermal resistance - diode (per arm)	Continuous dissipation - junction to case	-	80	$^{\circ}\text{C}/\text{kW}$
$R_{th(c-h)}$	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	$V_{\text{GE}} = 0\text{V}, V_{\text{CE}} = V_{\text{CES}}$	-	-	1	mA
		$V_{\text{GE}} = 0\text{V}, V_{\text{CE}} = V_{\text{CES}}, T_{\text{case}} = 125^{\circ}\text{C}$	-	-	12	mA
I_{GES}	Gate leakage current	$V_{\text{GE}} = \pm 20\text{V}, V_{\text{CE}} = 0\text{V}$	-	-	2	μA
$V_{\text{GE(TH)}}$	Gate threshold voltage	$I_{\text{C}} = 20\text{mA}, V_{\text{GE}} = V_{\text{CE}}$	4.5	5.5	6.5	V
$V_{\text{CE(sat)}}$	Collector-emitter saturation voltage	$V_{\text{GE}} = 15\text{V}, I_{\text{C}} = 400\text{A}$	-	3.5	4	V
		$V_{\text{GE}} = 15\text{V}, I_{\text{C}} = 400\text{A}, T_{\text{case}} = 125^{\circ}\text{C}$	-	4.3	5	V
I_{F}	Diode forward current	DC	-	400	-	A
I_{FM}	Diode maximum forward current	$t_{\text{p}} = 1\text{ms}$	-	800	-	A
V_{F}	Diode forward voltage	$I_{\text{F}} = 400\text{A}$	-	2.2	2.5	V
		$I_{\text{F}} = 400\text{A}, T_{\text{case}} = 125^{\circ}\text{C}$	-	2.3	2.6	V
C_{ies}	Input capacitance	$V_{\text{CE}} = 25\text{V}, V_{\text{GE}} = 0\text{V}, f = 1\text{MHz}$	-	45	-	nF
L_{M}	Module inductance	-	-	20	-	nH

ELECTRICAL CHARACTERISTICS

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$t_{\text{d(off)}}$	Turn-off delay time	$I_{\text{C}} = 400\text{A}$	-	900	1100	ns
t_{f}	Fall time	$V_{\text{GE}} = \pm 15\text{V}$	-	280	350	ns
E_{OFF}	Turn-off energy loss	$V_{\text{CE}} = 900\text{V}$	-	80	100	mJ
$t_{\text{d(on)}}$	Turn-on delay time	$R_{\text{G(ON)}} = R_{\text{G(OFF)}} = 2.2\Omega$	-	500	650	ns
t_{r}	Rise time	$L \sim 100\text{nH}$	-	200	400	ns
E_{ON}	Turn-on energy loss		-	140	180	mJ
Q_{rr}	Diode reverse recovery charge	$I_{\text{F}} = 400\text{A}, V_{\text{R}} = 50\% V_{\text{CES}}$	-	80	100	μC
I_{rr}	Diode reverse current	$di_{\text{F}}/dt = 3000\text{A}/\mu\text{s}$	-	250	-	A
E_{REC}	Diode reverse recovery energy		-	70	-	mJ

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$t_{\text{d(off)}}$	Turn-off delay time	$I_{\text{C}} = 400\text{A}$	-	1010	1200	ns
t_{f}	Fall time	$V_{\text{GE}} = \pm 15\text{V}$	-	390	500	ns
E_{OFF}	Turn-off energy loss	$V_{\text{CE}} = 900\text{V}$	-	100	150	mJ
$t_{\text{d(on)}}$	Turn-on delay time	$R_{\text{G(ON)}} = R_{\text{G(OFF)}} = 2.2\Omega$	-	660	800	ns
t_{r}	Rise time	$L \sim 100\text{nH}$	-	310	400	ns
E_{ON}	Turn-on energy loss		-	200	270	mJ
Q_{rr}	Diode reverse recovery charge	$I_{\text{F}} = 400\text{A}, V_{\text{R}} = 50\% V_{\text{CES}}$	-	110	150	μC
I_{rr}	Diode reverse current	$di_{\text{F}}/dt = 2500\text{A}/\mu\text{s}$	-	300	-	A
E_{REC}	Diode reverse recovery energy		-	70	-	mJ

TYPICAL CHARACTERISTICS

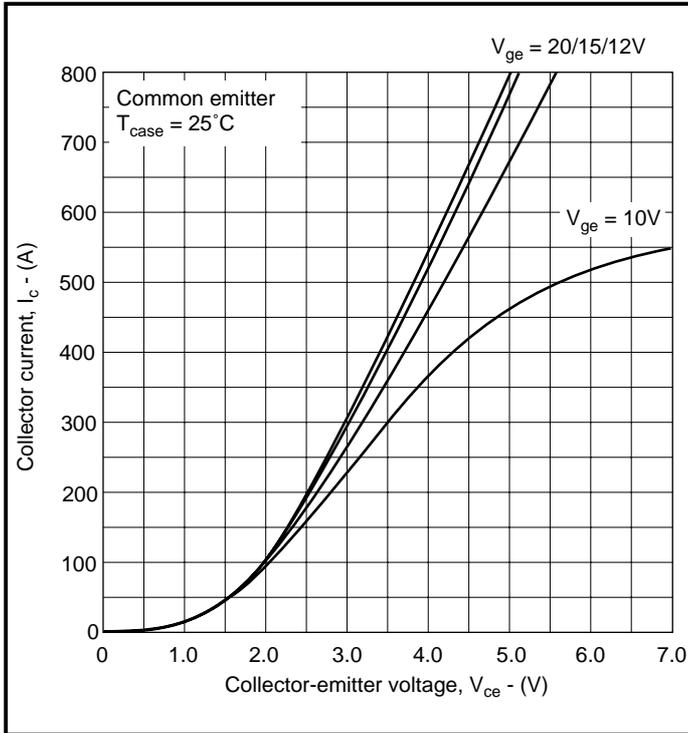


Fig. 3 Typical output characteristics

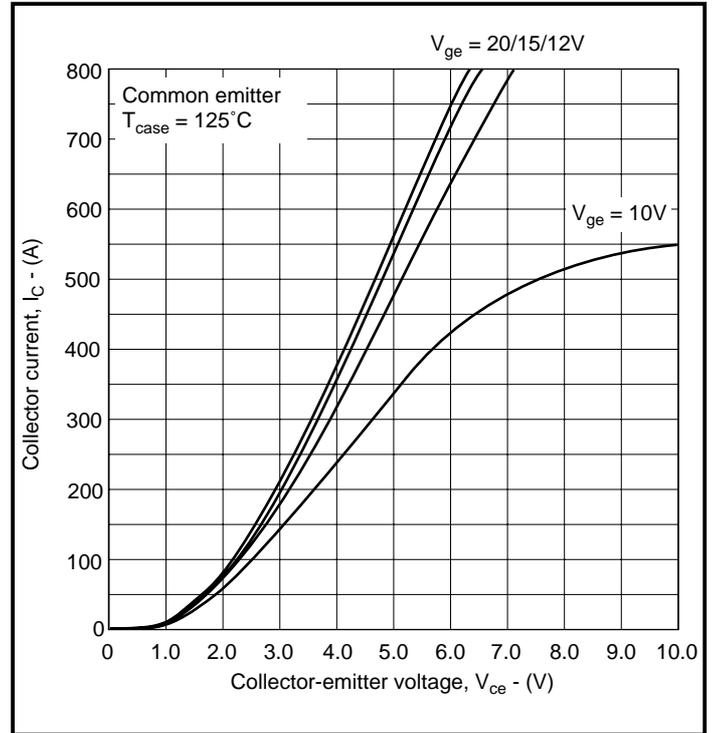


Fig. 4 Typical output characteristics

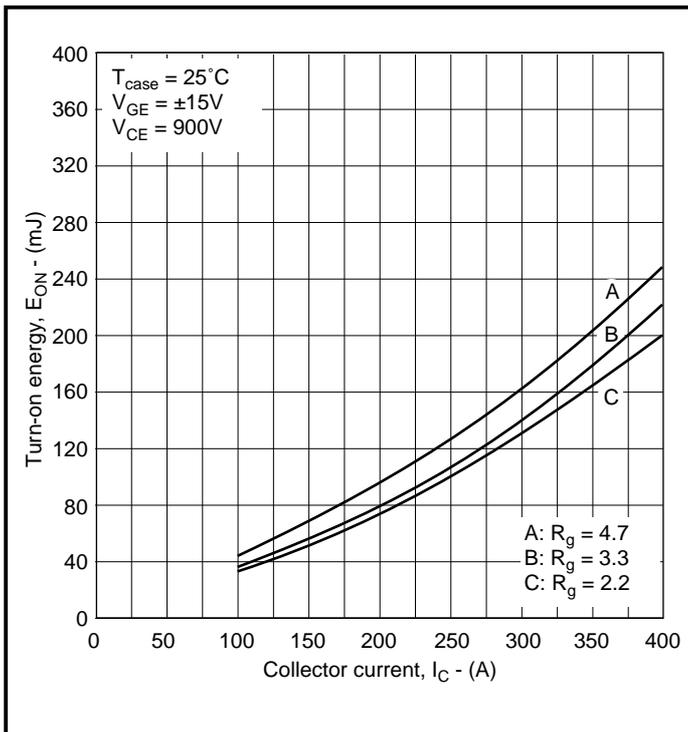


Fig. 5 Typical turn-off energy vs collector current

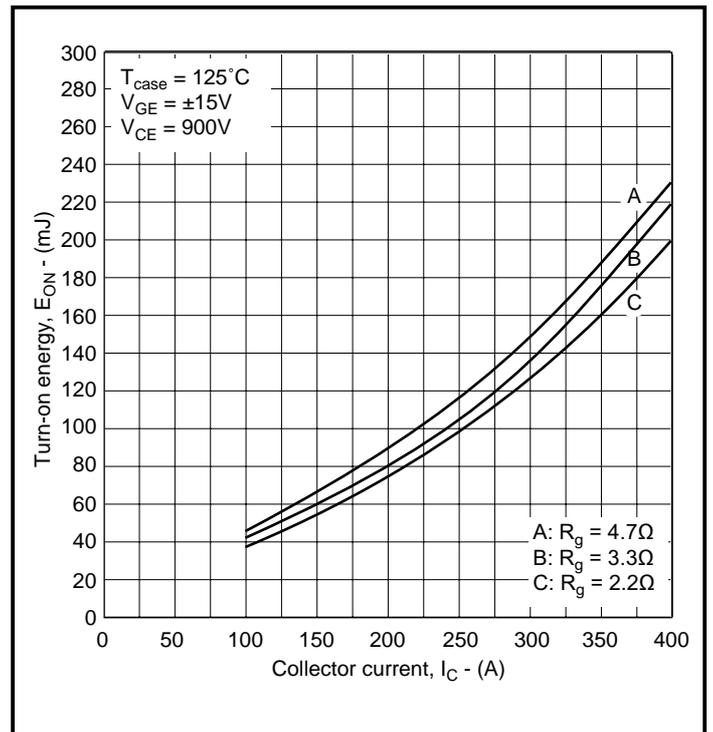


Fig. 6 Typical turn-off energy vs collector current

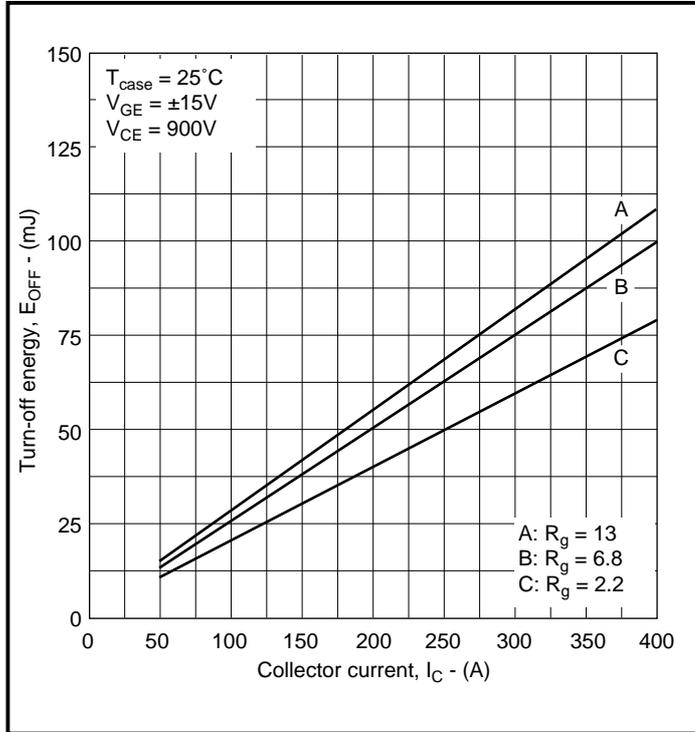


Fig. 7 Typical turn-off energy vs collector current

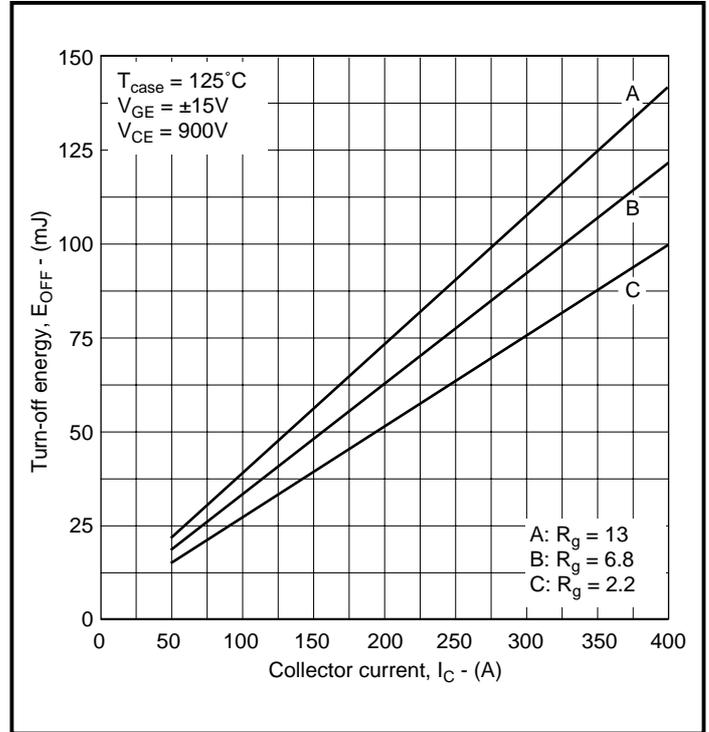


Fig. 8 Typical turn-off energy vs collector current

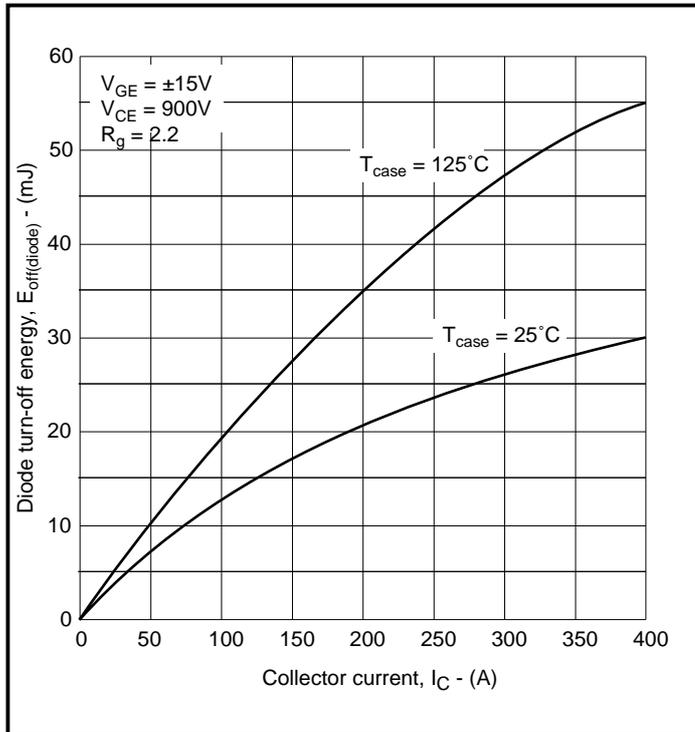


Fig. 9 Typical diode turn-off energy vs collector current

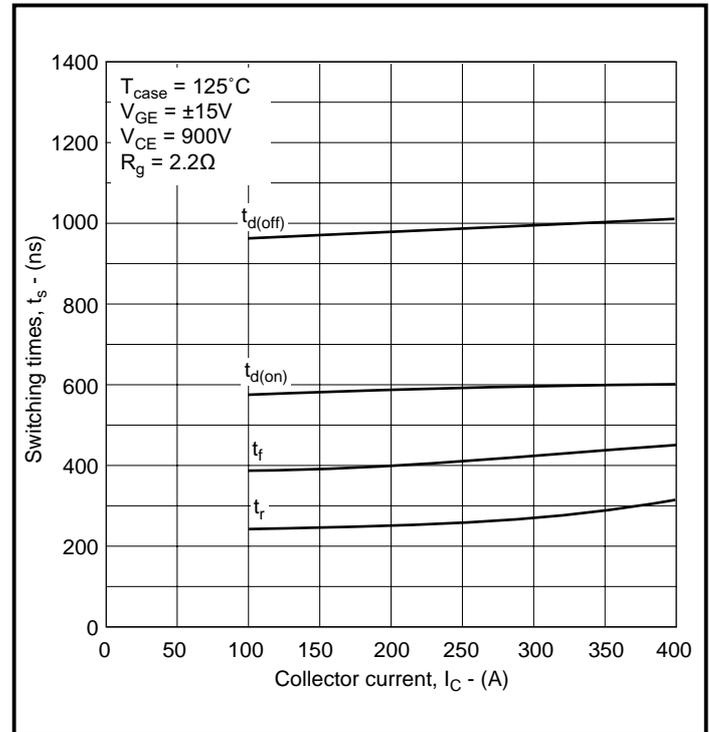


Fig. 10 Typical switching times

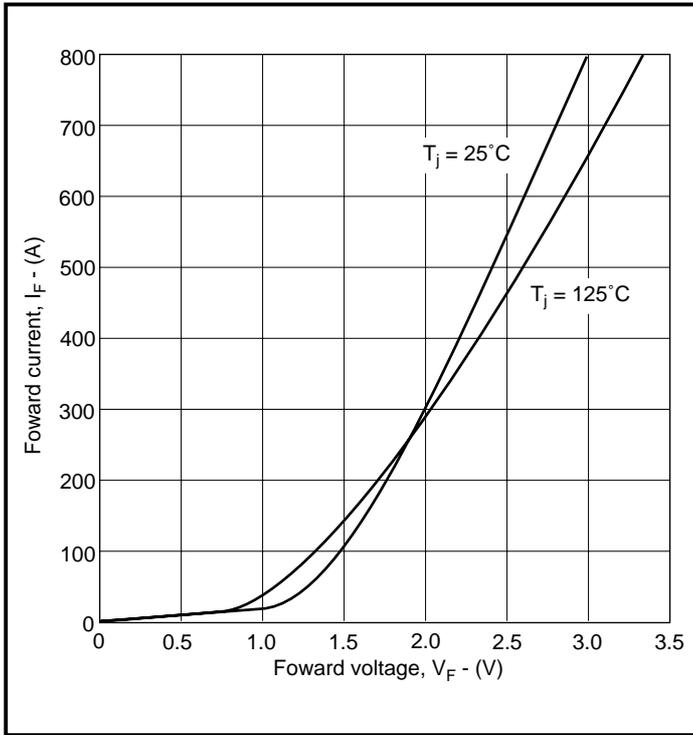


Fig. 11 Diode typical forward characteristics

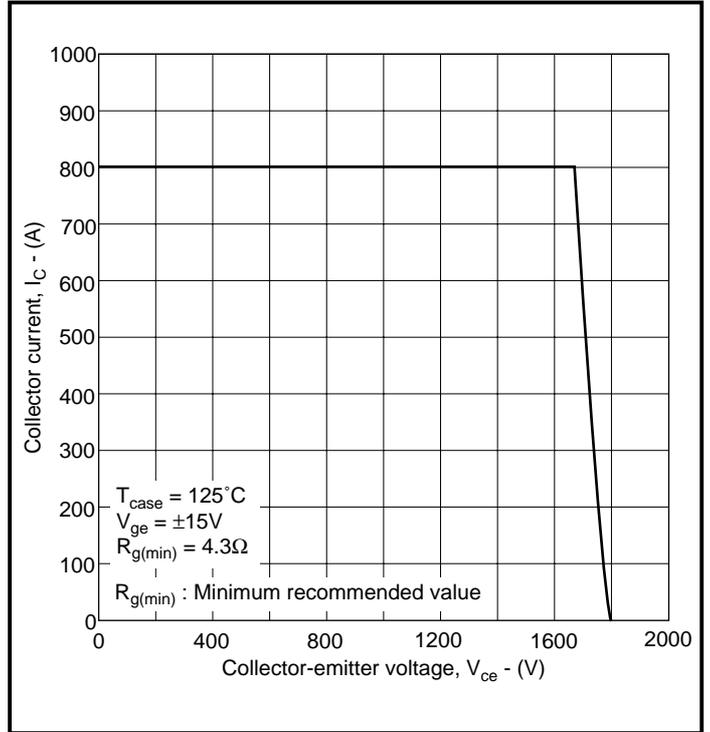


Fig. 12 Reverse bias safe operating area

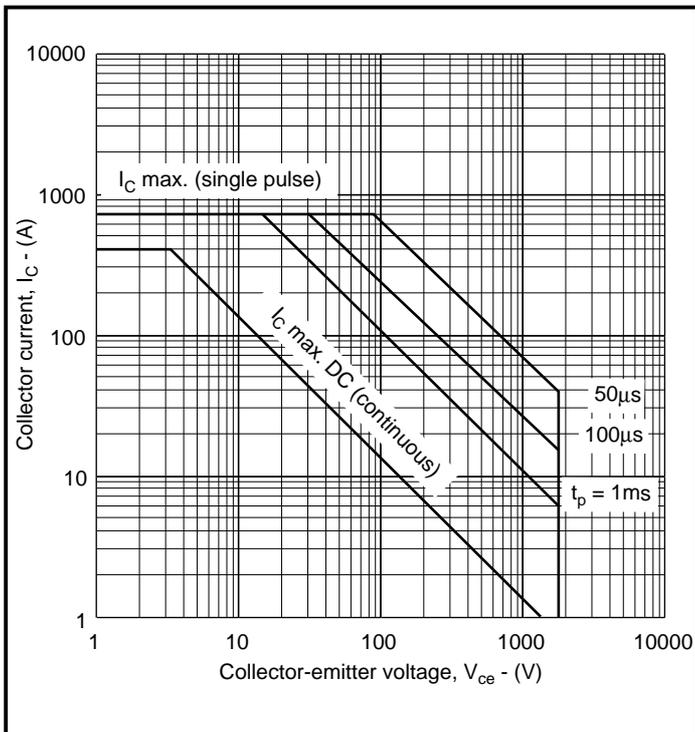


Fig. 13 Forward bias safe operating area

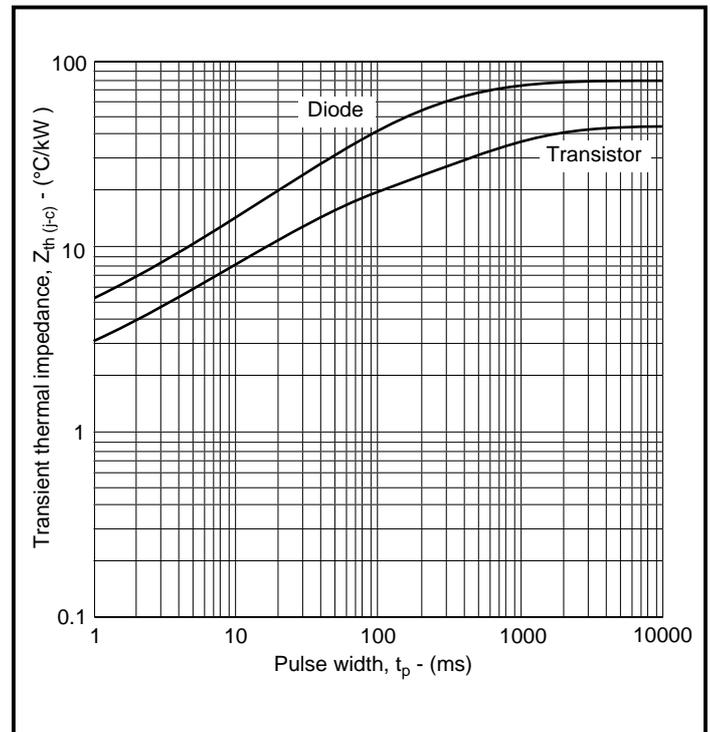


Fig. 14 Transient thermal impedance

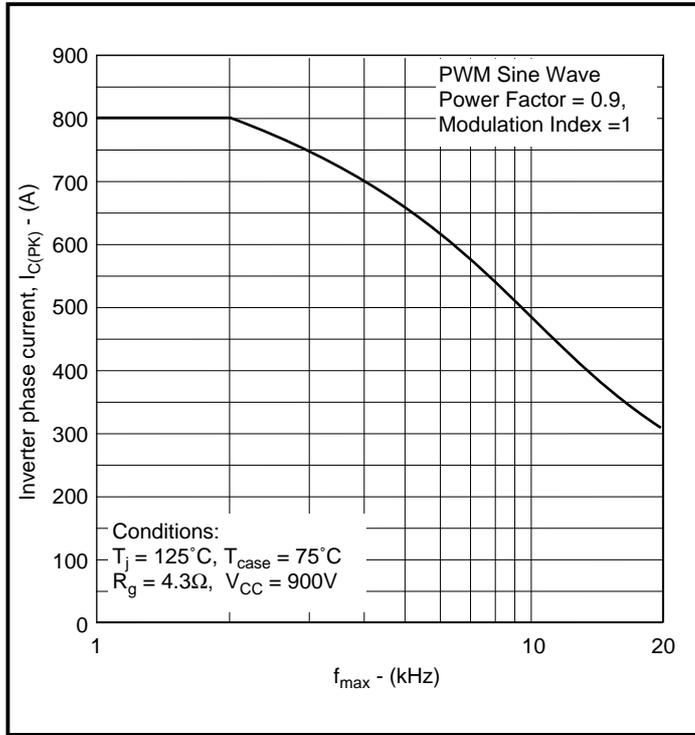


Fig.15 3-Phase inverter operating frequency

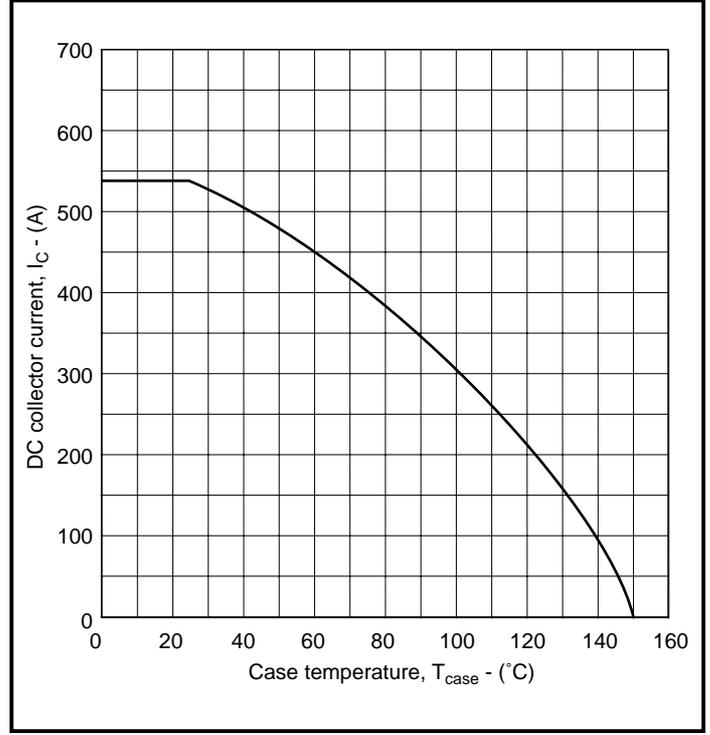
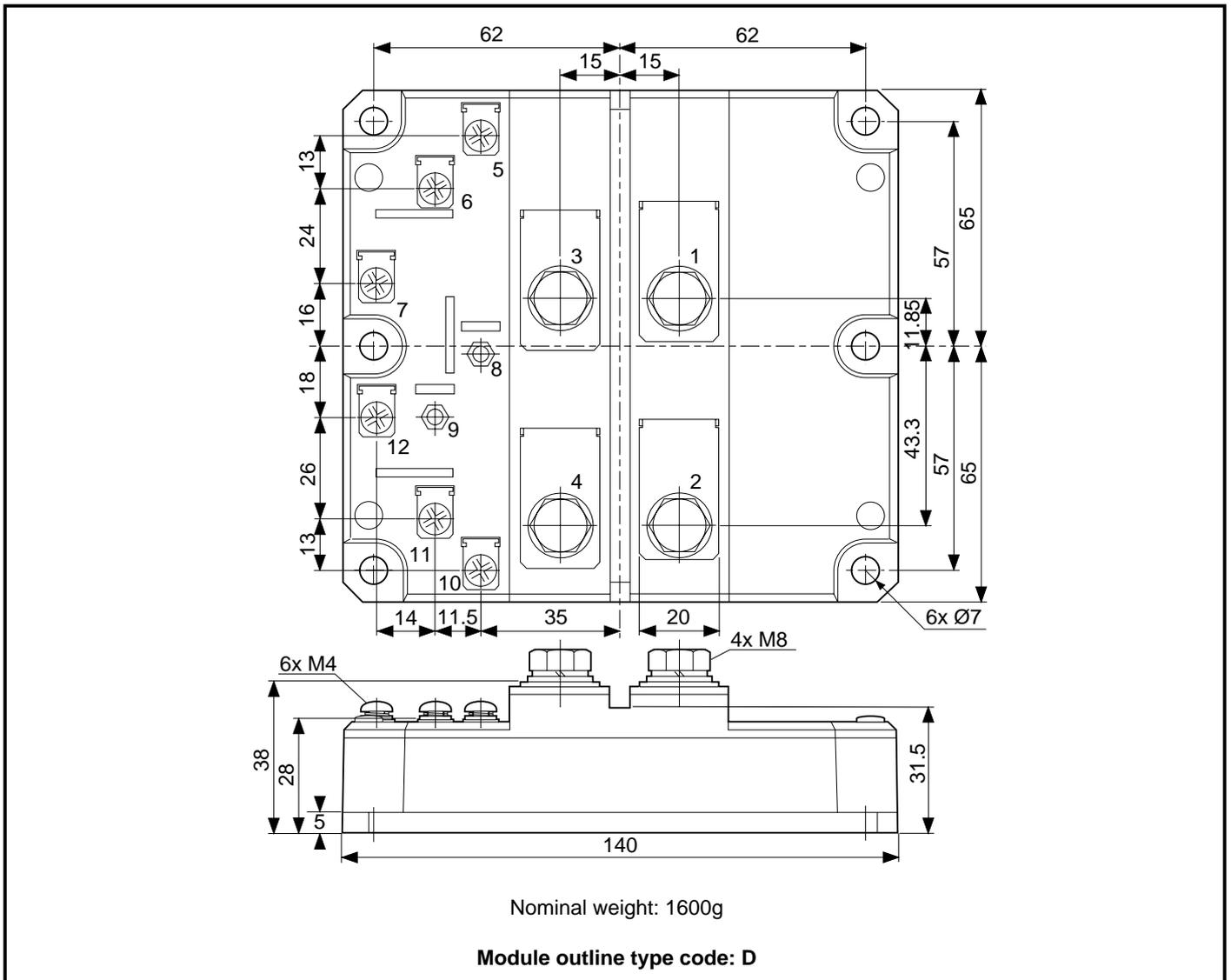


Fig.16 DC current rating vs case temperature

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.



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 high power IGBTs with Concept gate drivers	AN5190

POWER ASSEMBLY CAPABILITY

The Power Assembly group provides support for those customers requiring more than the basic semiconductor switch. Using CAD design tools the group has developed a flexible range of heatsink / clamping systems in line with advances in device types and the voltage and current capability of Dynex semiconductors.

An extensive range of air and liquid cooled assemblies is available covering the range of circuit designs in general use today.

HEATSINKS

The Power Assembly group has a proprietary range of extruded aluminium heatsinks. These were 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.



<http://www.dynexsemi.com>

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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.

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