

The GP400LSS12S is a single switch 1200 volt, robust n channel enhancement mode insulated gate bipolar transistor (IGBT) module. Designed for low power loss, the module is suitable for a variety of medium voltage applications in motor drives and power conversion. The high impedance gate simplifies gate drive considerations enabling operation directly from low power control circuitry.

Fast switching times allow high frequency operation making the device suitable for the latest drive designs employing pwm and high frequency switching. The IGBT is fully short circuit rated and has a wide reverse bias safe operating area (RBSOA) for ultimate reliability in demanding applications.

These modules incorporate electrically isolated base plates and low inductance construction enabling circuit designers to optimise circuit layouts and utilise earthed heat sinks for safety.

The powerline range of high power modules includes dual and single switch configurations with a range of current and voltage capabilities to match customer system demands.

Typical applications include dc motor drives, ac pwm drives, traction auxiliaries, ups systems and resonant inverters.

FEATURES

- n - Channel.
- High Input Impedance.
- High Switching Speed.
- Low Forward Voltage Drop.
- Isolated Base.
- Short Circuit Capability (10µs).

APPLICATIONS

- High Power Switching.
- Motor Control.
- UPS.
- AC And DC Servo Drive Amplifiers.

KEY PARAMETERS

V_{CES}		1200V
$V_{CE(sat)}$	(typ)	3.2V
I_{C25}	(max)	560A
I_{C75}	(max)	400A
$I_{C(PK)}$	(max)	1120A
t_{sc}	(max)	10µs

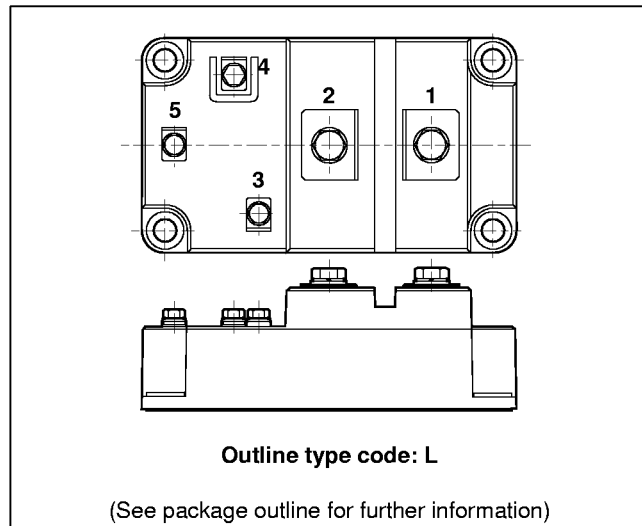


Fig. 1 Electrical connections - (not to scale)

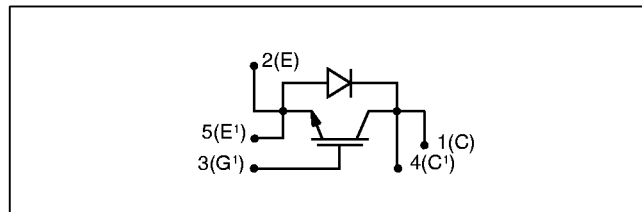


Fig.2 Single switch circuit diagram

ORDERING INFORMATION

GP400LSS12S

Note: When ordering, use complete part number.

GP400LSS12S

ABSOLUTE MAXIMUM RATINGS

Stresses above those listed under 'Absolute Maximum Ratings' may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to Absolute Maximum Ratings for extended periods may affect device reliability.

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

Symbol	Parameter	Test Conditions	Max.	Units
V_{CES}	Collector-emitter voltage	$V_{GE} = 0\text{V}$	1200	V
V_{GES}	Gate-emitter voltage	-	± 20	V
I_C	Collector current	DC, $T_{case} = 25^{\circ}\text{C}$	560	A
		DC, $T_{case} = 75^{\circ}\text{C}$	400	A
$I_{C(PK)}$		1ms, $T_{case} = 25^{\circ}\text{C}$	1120	A
		1ms, $T_{case} = 75^{\circ}\text{C}$	800	A
P_{max}	Maximum power dissipation	(Transistor)	2500	W
V_{isol}	Isolation voltage	Commoned terminals to base plate. AC RMS, 1 min, 50Hz	2500	V

THERMAL AND MECHANICAL RATINGS

Symbol	Parameter	Conditions	Min.	Max.	Units
$R_{th(j-c)}$	Thermal resistance - transistor	DC junction to case	-	50	$^{\circ}\text{C}/\text{kW}$
$R_{th(j-d)}$	Thermal resistance - diode	DC junction to case	-	125	$^{\circ}\text{C}/\text{kW}$
$R_{th(c-h)}$	Thermal resistance - Case to heatsink	Mounting torque 5Nm (with mounting grease)	-	15	$^{\circ}\text{C}/\text{kW}$
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 - M6	-	5	Nm

ELECTRICAL CHARACTERISTICS

$T_j = 25^\circ\text{C}$ unless stated otherwise.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
I_{CES}	Collector cut-off current	$V_{GE} = 0V, V_{CE} = V_{CES}$	-	-	19	mA
		$V_{GE} = 0V, V_{CE} = V_{CES}, T_j = 125^\circ\text{C}$	-	-	90	mA
I_{GES}	Gate leakage current	$V_{GE} = \pm 20V, V_{CE} = 0V$	-	-	2	μA
$V_{GE(TH)}$	Gate threshold voltage	$I_C = 20\text{mA}, V_{GE} = V_{CE}$	4	-	7.5	V
$V_{CE(SAT)}$	Collector-emitter saturation voltage	$V_{GE} = 15V, I_C = 400A$	-	3.2	3.8	V
		$V_{GE} = 15V, I_C = 400A, T_j = 125^\circ\text{C}$	-	3.4	3.8	V
I_F	Diode forward current	DC	-	-	400	A
I_{FM}	Diode maximum forward current	$t_p = 1\text{ms}$	-	-	800	A
V_F	Diode forward voltage	$I_F = 400A,$	-	1.6	2.2	V
		$I_F = 400A, T_j = 125^\circ\text{C}$	-	1.5	2.1	V
C_{ies}	Input capacitance	$V_{CE} = 25V, V_{GE} = 0V, f = 1\text{MHz}$	-	54000	-	pF
L_M	Module inductance	-	-	15	-	nH

GP400LSS12S

INDUCTIVE SWITCHING CHARACTERISTICS

For definition of switching waveforms, refer to figure 3 and 4.

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

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
$t_{d(\text{off})}$	Turn-off delay time	$I_C = 400\text{A}$ $V_{GE} = \pm 15\text{V}$ $V_{CE} = 50\% V_{CES}$ $R_{G(\text{ON})} = R_{G(\text{OFF})} = 5\Omega$ $L \sim 100\text{nH}$	-	1200	-	ns
t_f	Fall time		-	800	-	ns
E_{OFF}	Turn-off energy loss		-	70	-	mJ
$t_{d(\text{on})}$	Turn-on delay time		-	560	-	ns
t_r	Rise time		-	150	-	ns
E_{ON}	Turn-on energy loss		-	60	-	mJ
t_{rr}	Diode reverse recovery time	$I_F = 400\text{A}$	-	250	-	ns
Q_{rr}	Diode reverse recovery charge	$V_R = 50\% V_{CES}$, $di_F/dt = 1500\text{A}/\mu\text{s}$	-	45	-	μC

$T_J = 125^\circ\text{C}$ unless stated otherwise.

$t_{d(\text{off})}$	Turn-off delay time	$I_C = 400\text{A}$ $V_{GE} = \pm 15\text{V}$ $V_{CE} = 50\% V_{CES}$ $R_{G(\text{ON})} = R_{G(\text{OFF})} = 5\Omega$ $L \sim 100\text{nH}$	-	1400	-	ns
t_f	Fall time		-	1000	-	ns
E_{OFF}	Turn-off energy loss		-	125	-	mJ
$t_{d(\text{on})}$	Turn-on delay time		-	700	-	ns
t_r	Rise time		-	180	-	ns
E_{ON}	Turn-on energy loss		-	90	-	mJ
t_{rr}	Diode reverse recovery time	$I_F = 400\text{A}$	-	360	-	ns
Q_{rr}	Diode reverse recovery charge	$V_R = 50\% V_{CES}$, $di_F/dt = 1500\text{A}/\mu\text{s}$	-	60	-	μC

SHORT CIRCUIT RATING

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
t_{sc}	Short circuit withstand time	$T_c = 125^\circ\text{C}$, $V_{GE} = 15\text{V}$, $V_{CE} = 50\% V_{CES}$	-	-	10	μs

SWITCHING DEFINITIONS

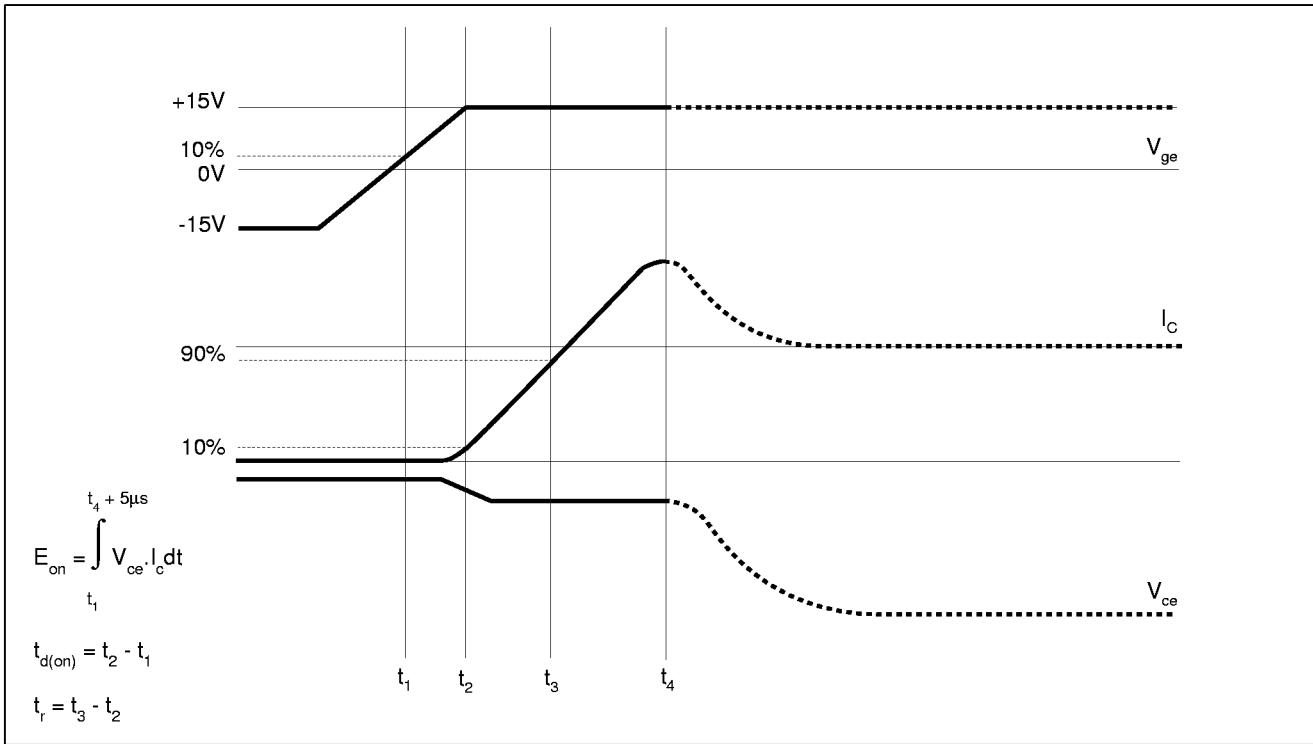


Fig.3 Definition of turn-on switching times

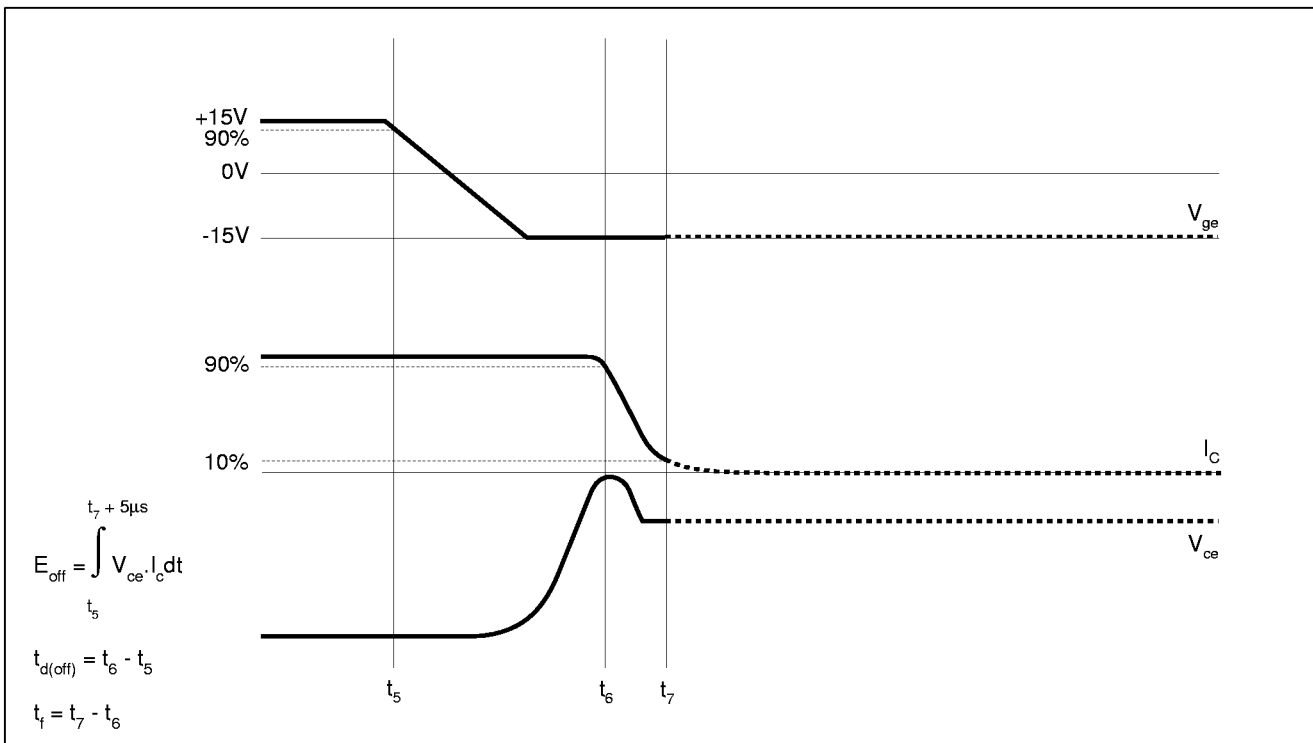


Fig.4 Definition of turn-off switching times

TYPICAL CHARACTERISTICS

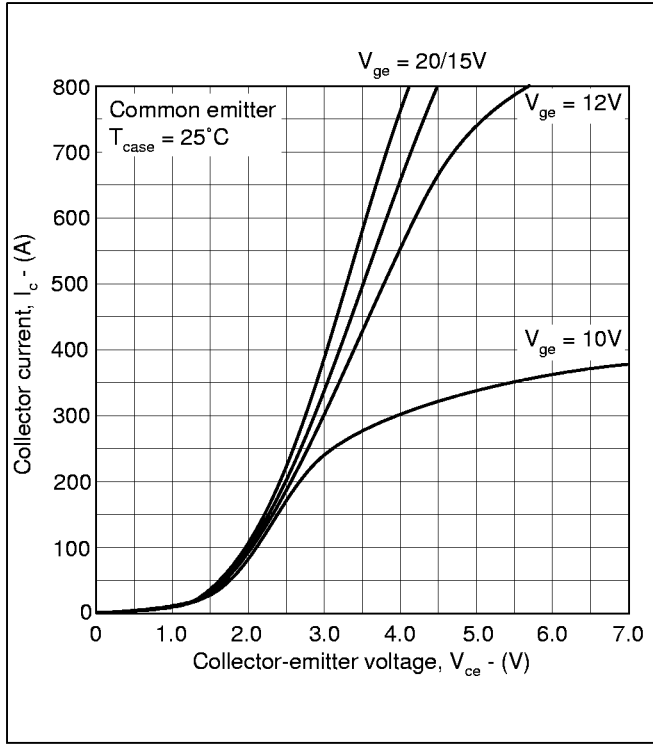


Fig.5 Typical output characteristics

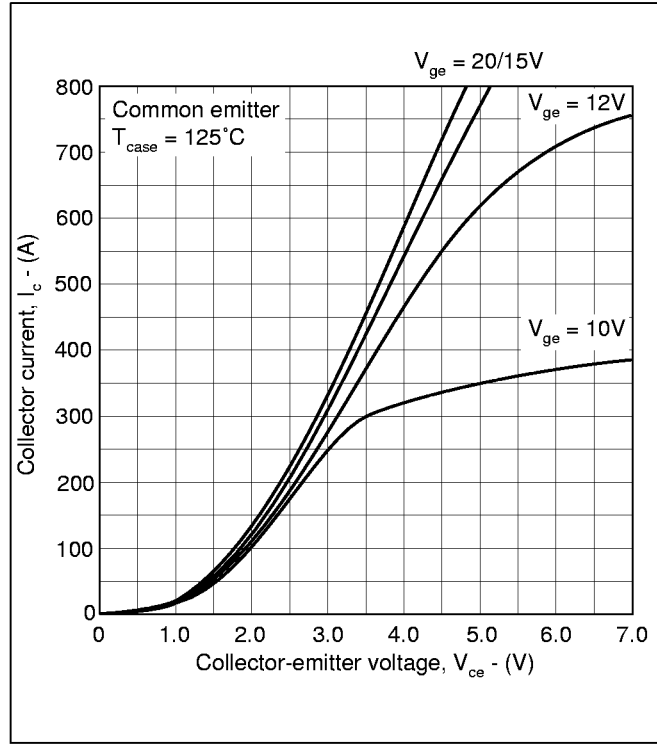


Fig.6 Typical output characteristics

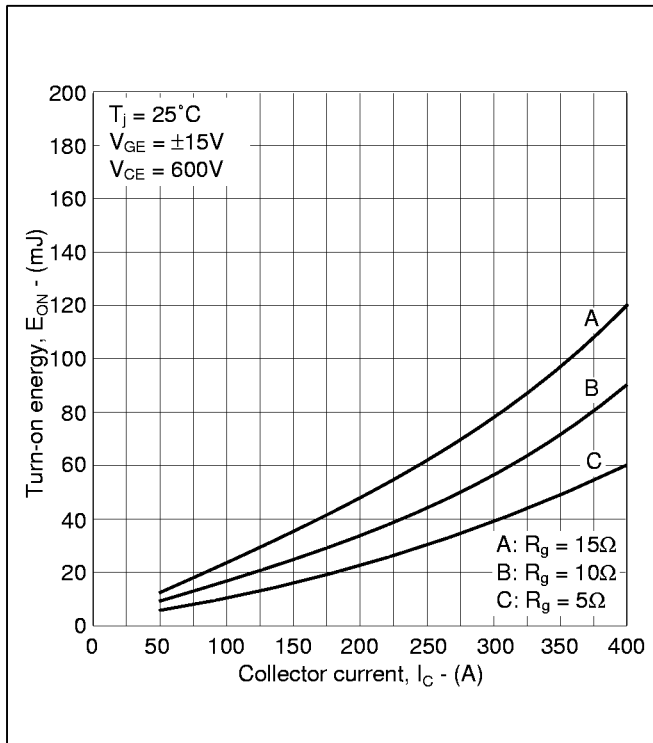


Fig.7 Typical turn-on energy vs collector current

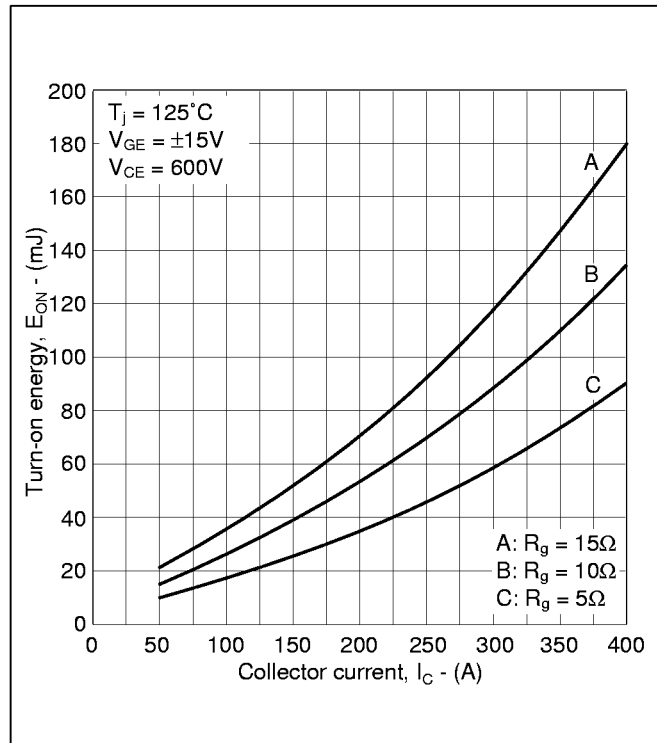


Fig.8 Typical turn-on energy vs collector current

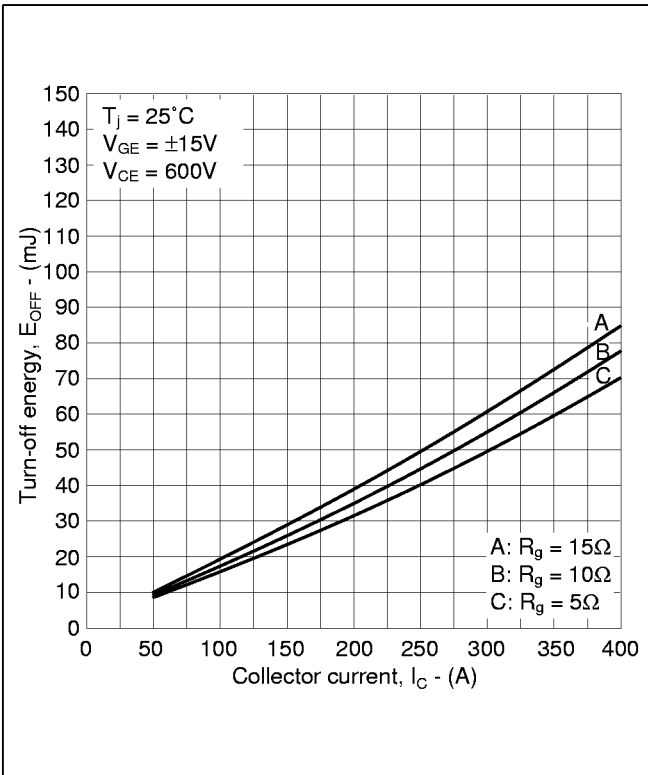


Fig.10 Typical turn-off energy vs collector current

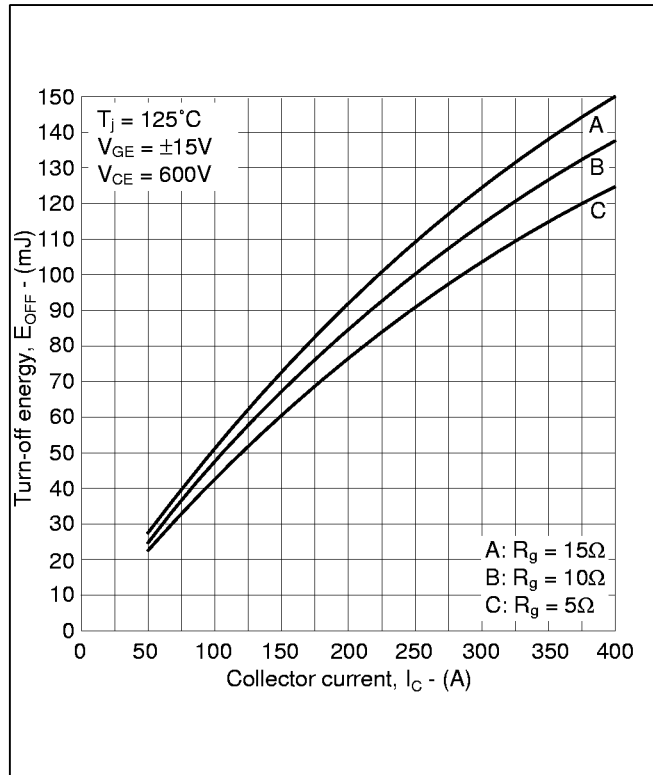


Fig.11 Typical turn-off energy vs collector current

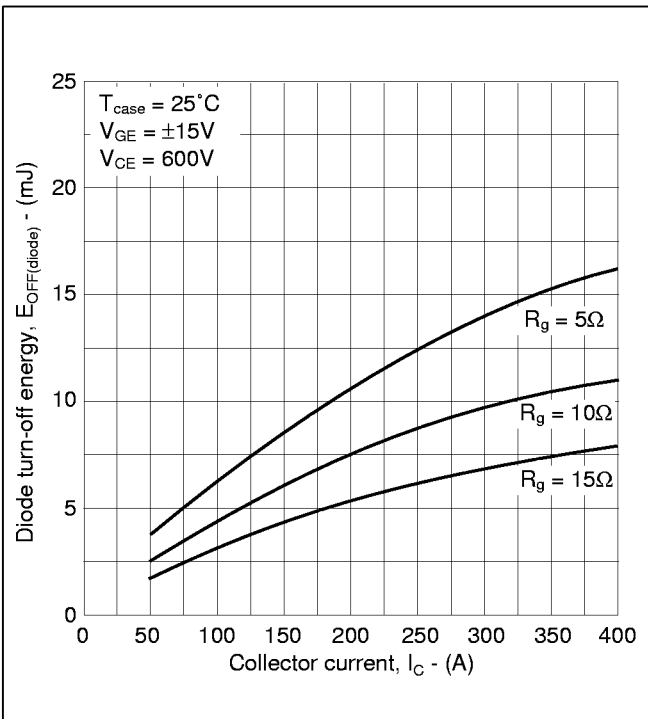


Fig.12 Typical diode turn-off energy vs collector current

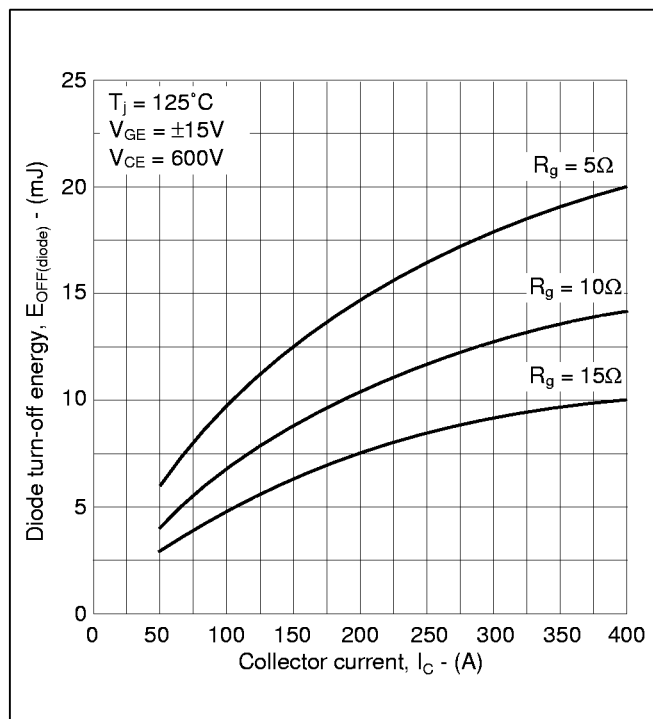


Fig.13 Typical diode turn-off energy vs collector current

GP400LSS12S

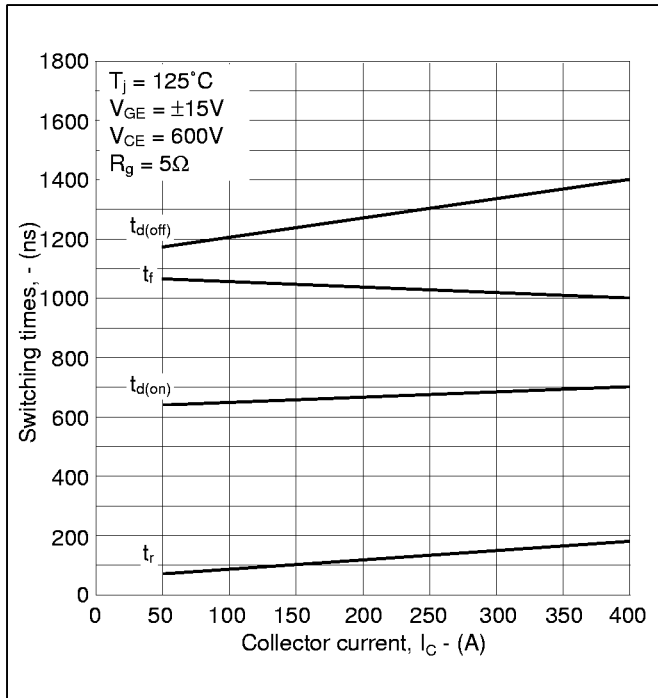


Fig. 14 Typical switching characteristics

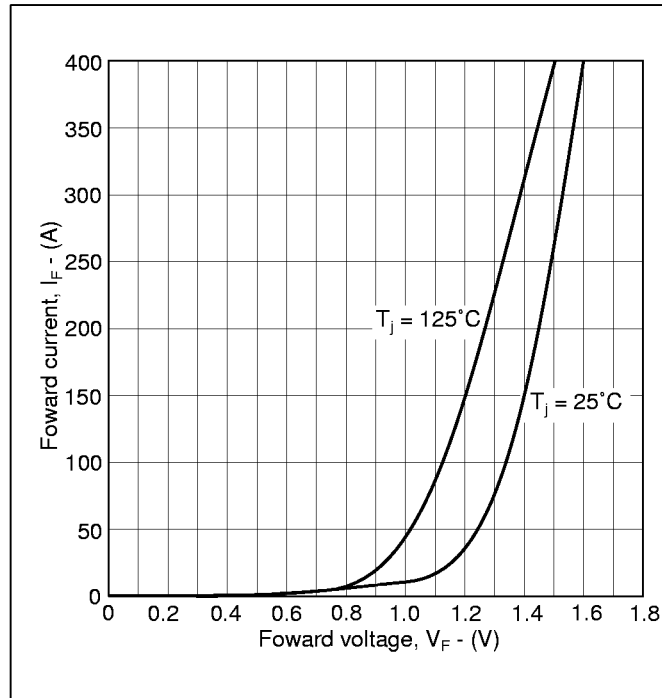


Fig. 15 Diode typical forward characteristics

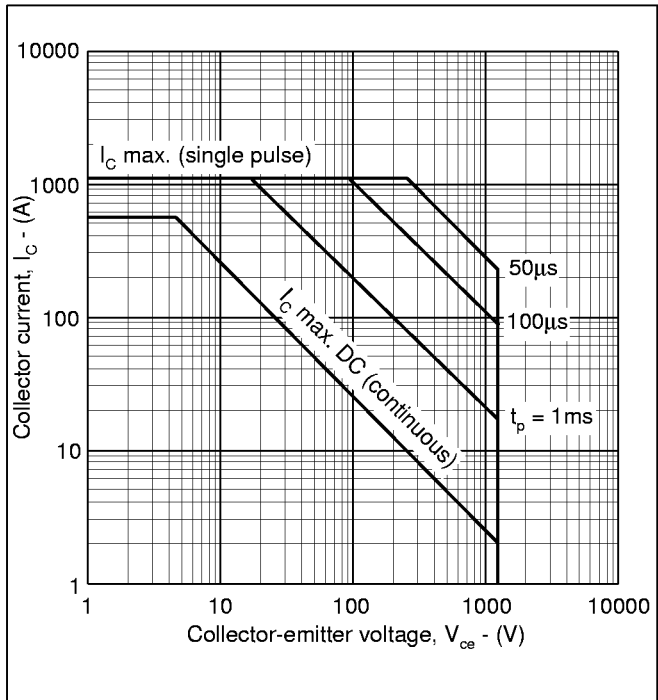


Fig. 16 Forward bias safe operating area (DC and single pulse)

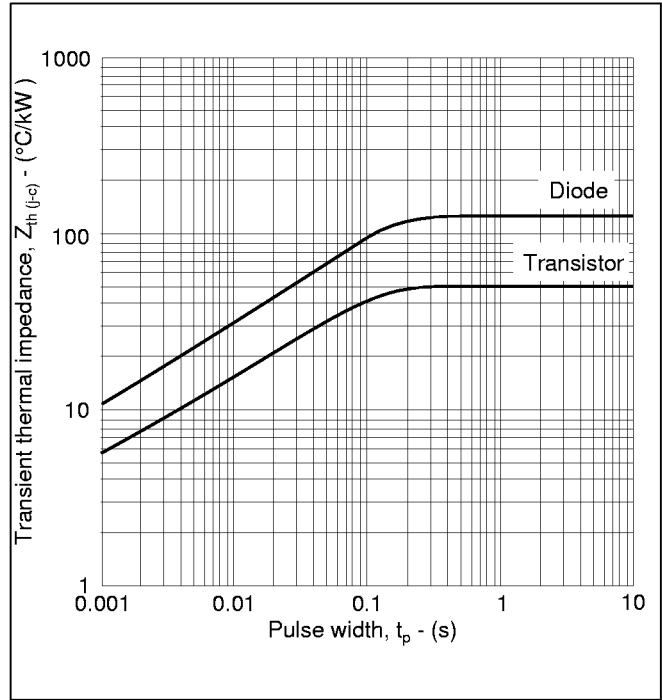
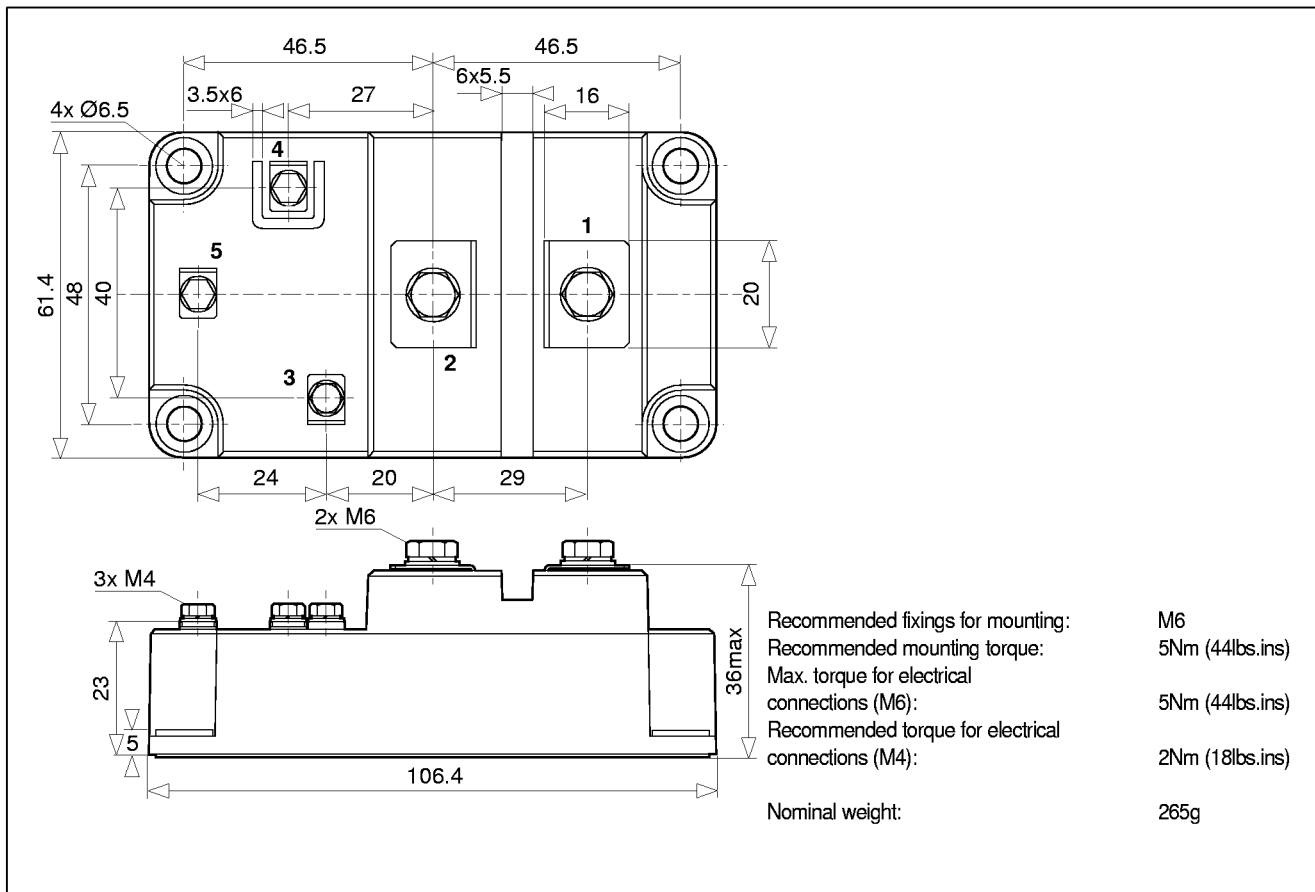


Fig. 17 Transient thermal impedance

PACKAGE DETAILS - L

For further package information, please contact your local Customer Service Centre. All dimensions in mm, unless stated otherwise. DO NOT SCALE.



HEADQUARTERS POWER OPERATIONS
MITEL SEMICONDUCTOR
 Doddington Road, Lincoln,
 LN6 3LF, United Kingdom.
 Tel: + 44 (0)1522 500500
 Fax: + 44 (0)1522 500550

Internet: <http://www.mitelsemi.com>
 e-mail: power_solutions@mitel.com
 POWER PRODUCT CUSTOMER SERVICE CENTRES
 ● **FRANCE, BENELUX & SPAIN** Tel: + 33 (0)1 69 18 90 00 Fax : +33 (0)1 64 46 54 50
 ● **NORTH AMERICA** Tel: 011-800-5554-5554 Fax: 011-800-5444-5444
 ● **UK, GERMANY, REST OF WORLD** Tel: + 44 (0)1522 500500 Fax : + 44 (0)1522 500020

These are supported by agents and distributors in major countries world-wide.
 © Mitel 1998 Publication No. DS4137-7 Issue No. 7.4 December 1998
 TECHNICAL DOCUMENTATION – NOT FOR RESALE. PRINTED IN UNITED KINGDOM

This publication is issued to provide information only which (unless agreed by the Company in writing) may not be used, applied or reproduced for any purpose nor form part of any order or contract nor to be regarded as a representation relating to the products or services concerned. No warranty or guarantee express or implied is made regarding the capability, performance or suitability of any product or service. The Company reserves the right to alter without prior notice the specification, design or price of any product or service. Information concerning possible methods of use is provided as a guide only and does not constitute any guarantee that such methods of use will be satisfactory in a specific piece of equipment. It is the user's responsibility to fully determine the performance and suitability of any equipment using such information and to ensure that any publication or data used is up to date and has not been superseded. These products are not suitable for use in any medical products whose failure to perform may result in significant injury or death to the user. All products and materials are sold and services provided subject to the Company's conditions of sale, which are available on request.

All brand names and product names used in this publication are trademarks, registered trademarks or trade names of their respective owners.

Caution: These devices are sensitive to electrostatic discharge. Users should observe proper ESD handling precautions.