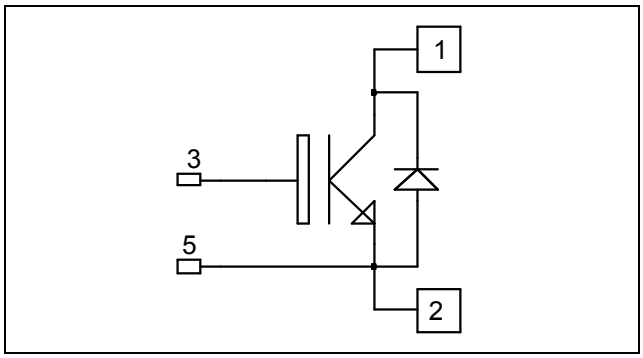
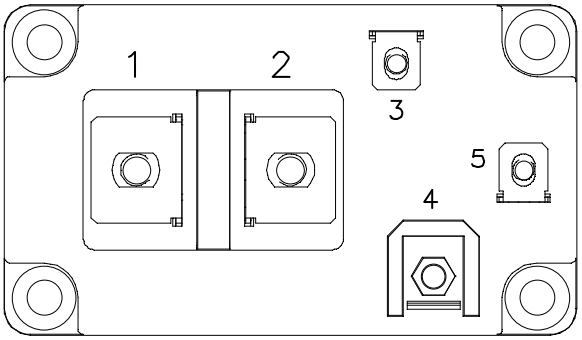
Single switch
NPT IGBT Power Module

V_{CES} = 600V
I_C = 360A @ Tc = 80°C





Application

- Welding converters
- Switched Mode Power Supplies
- Uninterruptible Power Supplies
- Motor control

Features

- Non Punch Through (NPT) IGBT
  - Low voltage drop
  - Low tail current
  - Switching frequency up to 50 kHz
  - Soft recovery parallel diodes
  - Low diode VF
  - Low leakage current
  - RBSOA and SCSOA rated
- Kelvin emitter for easy drive
- M6 connectors for power
- M4 connectors for signal
- High level of integration

Benefits

- Outstanding performance at high frequency operation
- Stable temperature behavior
- Very rugged
- Direct mounting to heatsink (isolated package)
- Low junction to case thermal resistance
- Easy paralleling due to positive T_C of V_{CEsat}
- RoHS Compliant

Absolute maximum ratings

Symbol	*Parameter*		*Max ratings*	*Unit*
V_{CES}	Collector - Emitter Breakdown Voltage		600	V
I_C	Continuous Collector Current	T_C = 25°C	450	A
		T_C = 80°C	360	
I_{CM}	Pulsed Collector Current	T_C = 25°C	720	
V_{GE}	Gate – Emitter Voltage		±20	V
P_D	Maximum Power Dissipation	T_C = 25°C	1560	W
RBSOA	Reverse Bias Safe Operating Area	T_j = 125°C	800A@520V	

CAUTION: These Devices are sensitive to Electrostatic Discharge. Proper Handling Procedures Should Be Followed. See application note APT0502 on www.microsemi.com

All ratings @ T_j = 25°C unless otherwise specified

Electrical Characteristics

Symbol	*Characteristic*	*Test Conditions*		*Min*	*Typ*	*Max*	*Unit*
I_{CES}	Zero Gate Voltage Collector Current	V_{GE} = 0V, V_{CE} = 600V	T_j = 25°C			500	µA
			T_j = 125°C			1	mA
$V_{CE(sat)}$	Collector Emitter saturation Voltage	V_{GE} = 15V, I_C = 400A	T_j = 25°C		1.95	2.45	V
			T_j = 125°C		2.2		
$V_{GE(th)}$	Gate Threshold Voltage	$V_{GE} = V_{CE}$, I_C = 6mA		4.5	5.5	6.5	V
I_{GES}	Gate – Emitter Leakage Current	V_{GE} = 20V, V_{CE} = 0V				1200	nA

Dynamic Characteristics

Symbol	*Characteristic*	*Test Conditions*		*Min*	*Typ*	*Max*	*Unit*
C_{ies}	Input Capacitance	V_{GE} = 0V, V_{CE} = 25V f = 1MHz			17		nF
C_{res}	Reverse Transfer Capacitance				1.6		
Q_G	Gate charge	V_{GE}=15V, I_C=400A V_{CE}=300V			1		µC
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching (25°C) V_{GE} = ±15V V_{Bus} = 300V I_C = 400A R_G = 8Ω			150		ns
T_r	Rise Time				72		
$T_{d(off)}$	Turn-off Delay Time				530		
T_f	Fall Time				40		
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching (125°C) V_{GE} = ±15V V_{Bus} = 300V I_C = 400A R_G = 8Ω			160		ns
T_r	Rise Time				75		
$T_{d(off)}$	Turn-off Delay Time				550		
T_f	Fall Time				50		
E_{on}	Turn on Energy	V_{GE} = ±15V V_{Bus} = 300V I_C = 400A R_G = 8Ω	T_j = 125°C		18.6		mJ
E_{off}	Turn off Energy		T_j = 125°C		17.3		mJ
I_{sc}	Short Circuit data	V_{GE} ≤15V ; V_{Bus} = 360V t_p ≤ 10µs ; T_j = 125°C			1800		A

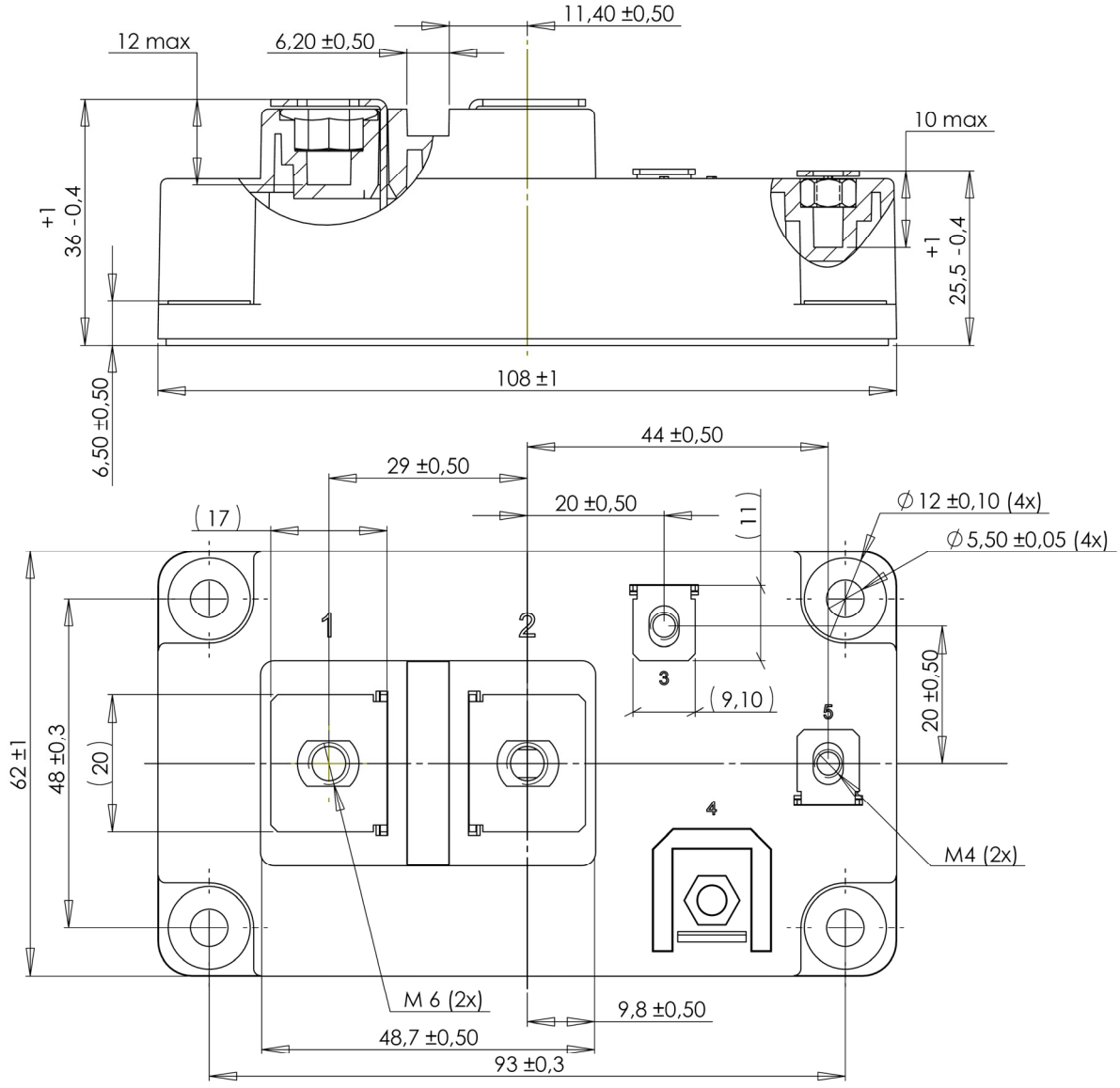
Reverse diode ratings and characteristics

Symbol	*Characteristic*	*Test Conditions*		*Min*	*Typ*	*Max*	*Unit*
V_{RRM}	Maximum Peak Repetitive Reverse Voltage			600			V
I_{RRM}	Maximum Reverse Leakage Current	V_R = 600V	T_j = 25°C			750	µA
			T_j = 125°C			1000	
I_F	DC Forward Current		Tc = 80°C		400		A
V_F	Diode Forward Voltage	I_F = 400A V_{GE} = 0V	T_j = 25°C		1.25	1.6	V
			T_j = 125°C		1.2		
t_{rr}	Reverse Recovery Time	I_F = 400A V_R = 300V di/dt =4400A/µs	T_j = 25°C		150		ns
			T_j = 125°C		250		
Q_{rr}	Reverse Recovery Charge		T_j = 25°C		27		µC
			T_j = 125°C		44		
E_{rr}	Reverse Recovery Energy		T_j = 25°C		5.6		mJ
			T_j = 125°C		9.2		

Thermal and package characteristics

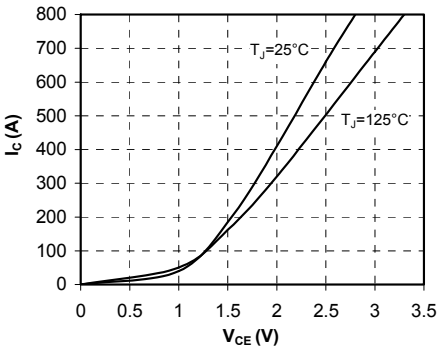
Symbol	*Characteristic*		*Min*	*Typ*	*Max*	*Unit*
R_{thJC}	Junction to Case Thermal Resistance	IGBT			0.08	°C/W
		Diode			0.15	
V_{ISOL}	RMS Isolation Voltage, any terminal to case t =1 min, 50/60Hz		4000			V
T_J	Operating junction temperature range		-40		150	°C
T_{STG}	Storage Temperature Range		-40		125	
T_C	Operating Case Temperature		-40		125	
Torque	Mounting torque	M6	3		5	N.m
		M4	1		2	
Wt	Package Weight				350	g

D4 Package outline (dimensions in mm)

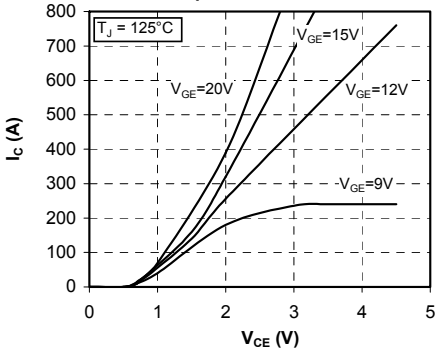


Typical Performance Curve

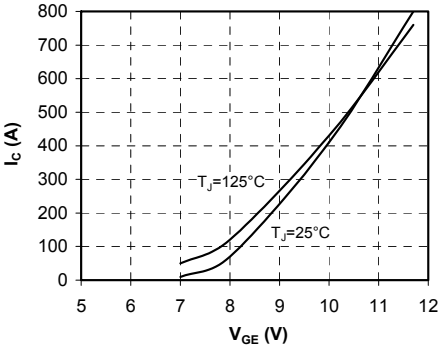
Output Characteristics (V_{GE}=15V)



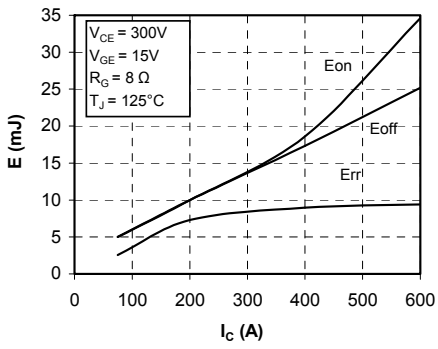
Output Characteristics



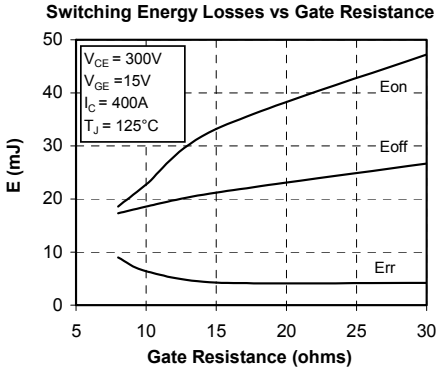
Transfert Characteristics



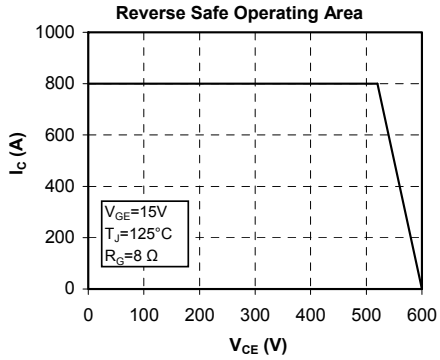
Energy losses vs Collector Current



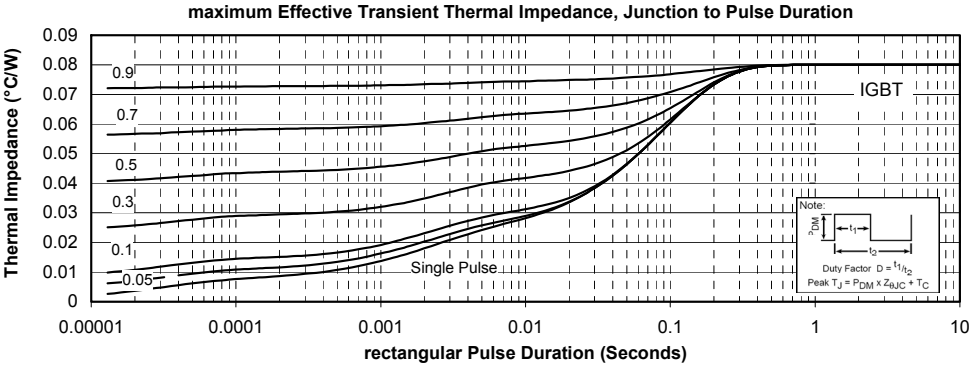
Switching Energy Losses vs Gate Resistance

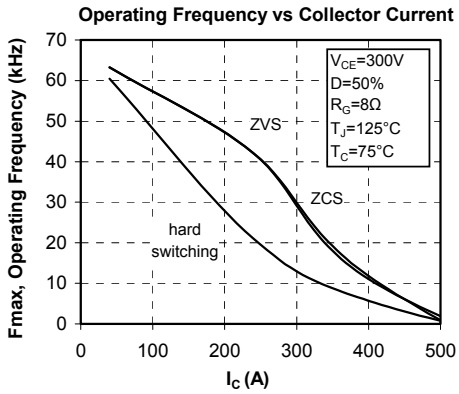


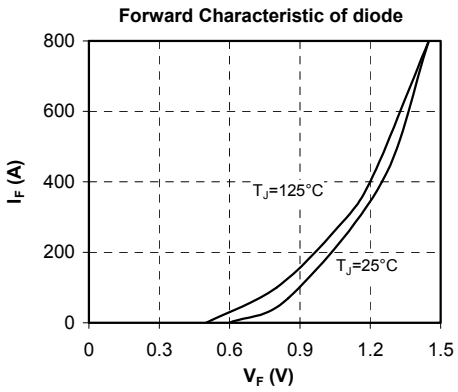
Reverse Safe Operating Area

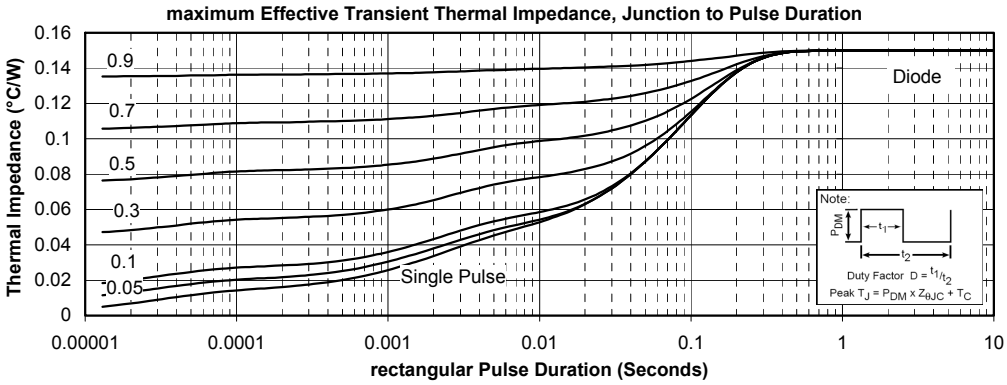


maximum Effective Transient Thermal Impedance, Junction to Pulse Duration




Operating Frequency vs Collector Current
Fmax, Operating Frequency (kHz)
70
60
50
40
30
20
10
0
0
100
200
300
400
500
I_C (A)
V_{CE}=300V
D=50%
R_G=8Ω
T_J=125°C
T_C=75°C
ZVS
ZCS
hard
switching


Forward Characteristic of diode
I_F (A)
800
600
400
200
0
0
0.3
0.6
0.9
1.2
1.5
V_F (V)
T_J=125°C
T_J=25°C


maximum Effective Transient Thermal Impedance, Junction to Pulse Duration
Thermal Impedance (°C/W)
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
0.00001
0.0001
0.001
0.01
0.1
1
10
rectangular Pulse Duration (Seconds)
0.9
0.7
0.5
0.3
0.1
0.05
Single Pulse
Diode
Note:
P_{DM}
t_1
t_2
Duty Factor $D = t_1/t_2$
Peak $T_J = P_{DM} \times Z_{\theta JC} + T_C$

DISCLAIMER

The information contained in the document (unless it is publicly available on the Web without access restrictions) is PROPRIETARY AND CONFIDENTIAL information of Microsemi and cannot be copied, published, uploaded, posted, transmitted, distributed or disclosed or used without the express duly signed written consent of Microsemi. If the recipient of this document has entered into a disclosure agreement with Microsemi, then the terms of such Agreement will also apply. This document and the information contained herein may not be modified, by any person other than authorized personnel of Microsemi. No license under any patent, copyright, trade secret or other intellectual property right is granted to or conferred upon you by disclosure or delivery of the information, either expressly, by implication, inducement, estoppels or otherwise. Any license under such intellectual property rights must be approved by Microsemi in writing signed by an officer of Microsemi.

Microsemi reserves the right to change the configuration, functionality and performance of its products at anytime without any notice. This product has been subject to limited testing and should not be used in conjunction with life-support or other mission-critical equipment or applications. Microsemi assumes no liability whatsoever, and Microsemi disclaims any express or implied warranty, relating to sale and/or use of Microsemi products including liability or warranties relating to fitness for a particular purpose, merchantability, or infringement of any patent, copyright or other intellectual property right. Any performance specifications believed to be reliable but are not verified and customer or user must conduct and complete all performance and other testing of this product as well as any user or customers final application. User or customer shall not rely on any data and performance specifications or parameters provided by Microsemi. It is the customer's and user's responsibility to independently determine suitability of any Microsemi product and to test and verify the same. The information contained herein is provided "AS IS, WHERE IS" and with all faults, and the entire risk associated with such information is entirely with the User. Microsemi specifically disclaims any liability of any kind including for consequential, incidental and punitive damages as well as lost profit. The product is subject to other terms and conditions which can be located on the web at http://www.microsemi.com/legal/tnc.asp

Life Support Application

Seller's Products are not designed, intended, or authorized for use as components in systems intended for space, aviation, surgical implant into the body, in other applications intended to support or sustain life, or for any other application in which the failure of the Seller's Product could create a situation where personal injury, death or property damage or loss may occur (collectively "Life Support Applications").
Buyer agrees not to use Products in any Life Support Applications and to the extent it does it shall conduct extensive testing of the Product in such applications and further agrees to indemnify and hold Seller, and its officers, employees, subsidiaries, affiliates, agents, sales representatives and distributors harmless against all claims, costs, damages and expenses, and attorneys' fees and costs arising, directly or directly, out of any claims of personal injury, death, damage or otherwise associated with the use of the goods in Life Support Applications, even if such claim includes allegations that Seller was negligent regarding the design or manufacture of the goods.

Buyer must notify Seller in writing before using Seller's Products in Life Support Applications. Seller will study with Buyer alternative solutions to meet Buyer application specification based on Sellers sales conditions applicable for the new proposed specific part.