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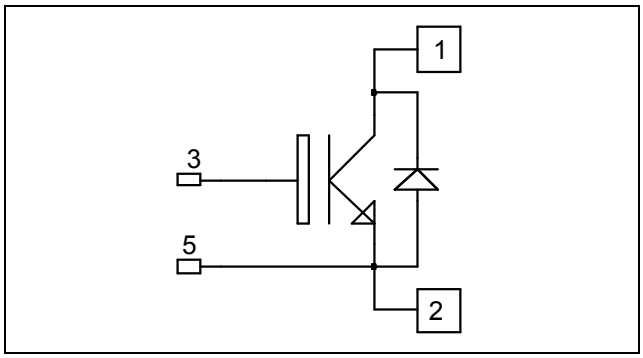
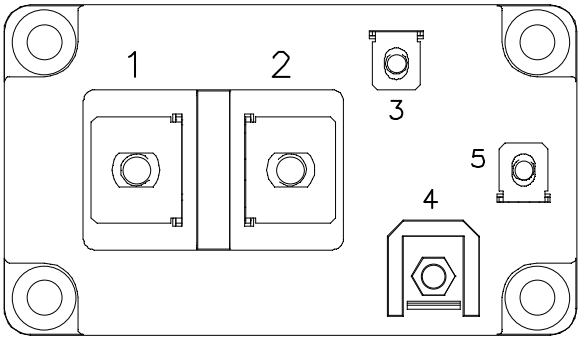
Single switch
NPT IGBT Power Module

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

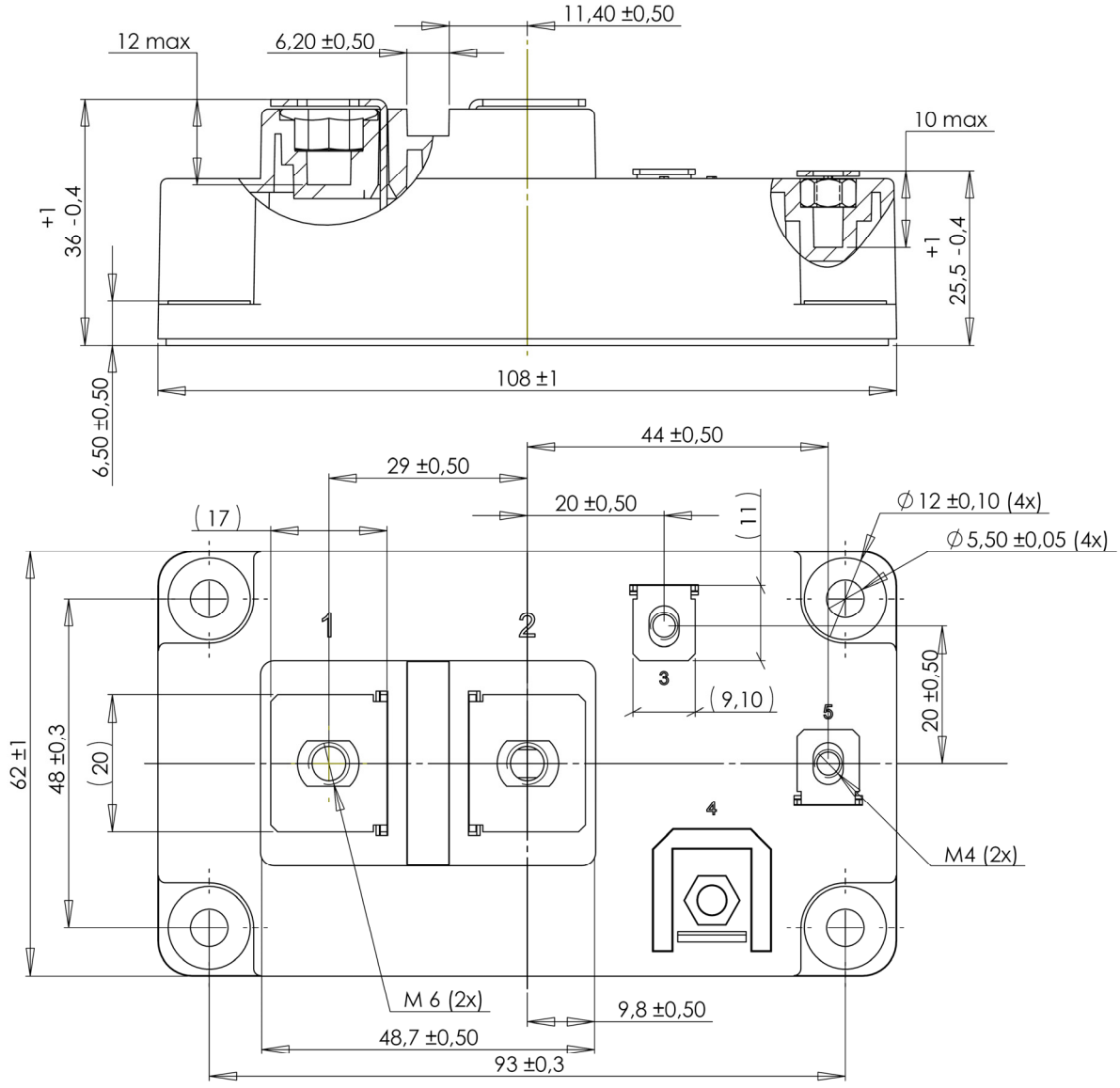
Reverse diode ratings and characteristics

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		

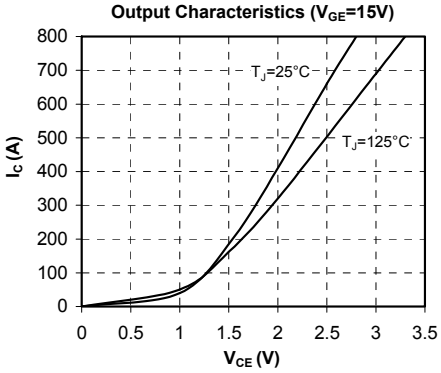
Thermal and package characteristics

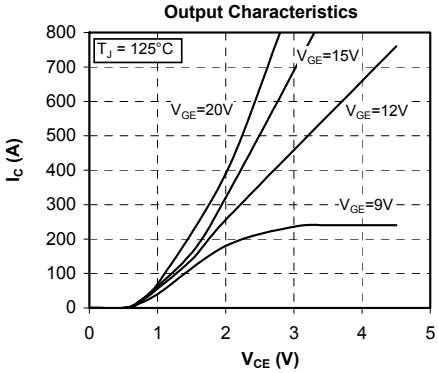
Symbol	*Characteristic*		*Min*	*Typ*	*Max*	*Unit*
R_{thJC}	Junction to Case Thermal Resistance	IGBT			0.08	°C/W
		Diode			0.15	
V_{ISOL}	RMS Isolation Voltage, any terminal to case t =1 min, 50/60Hz		4000			V
T_J	Operating junction temperature range		-40		150	°C
T_{STG}	Storage Temperature Range		-40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

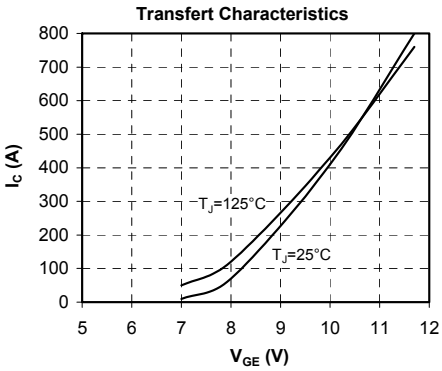
D4 Package outline (dimensions in mm)

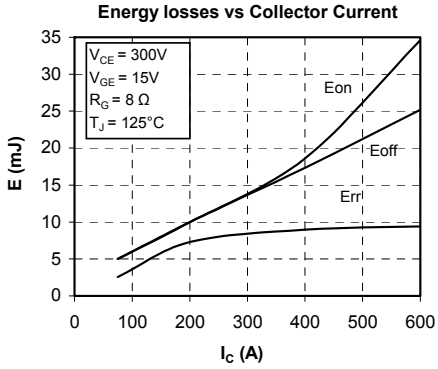


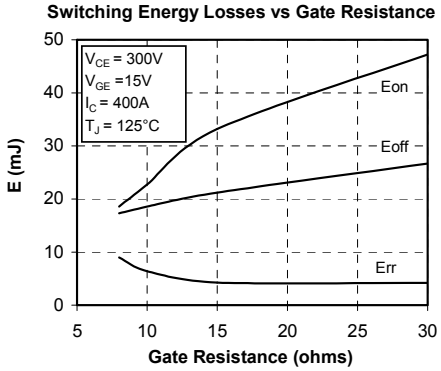
Typical Performance Curve

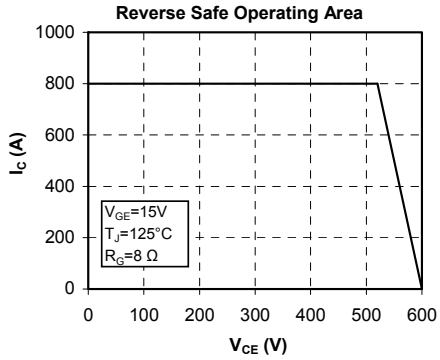


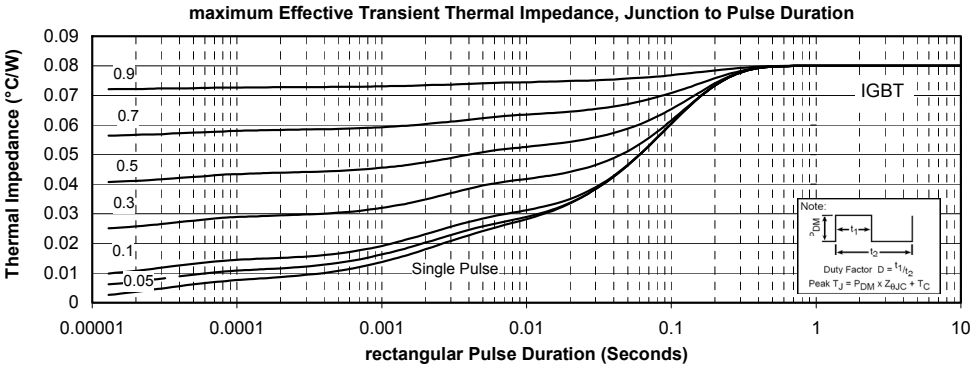


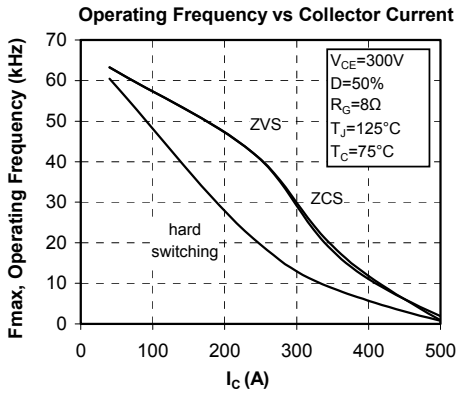


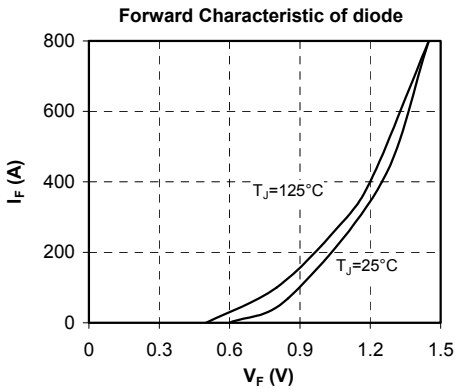


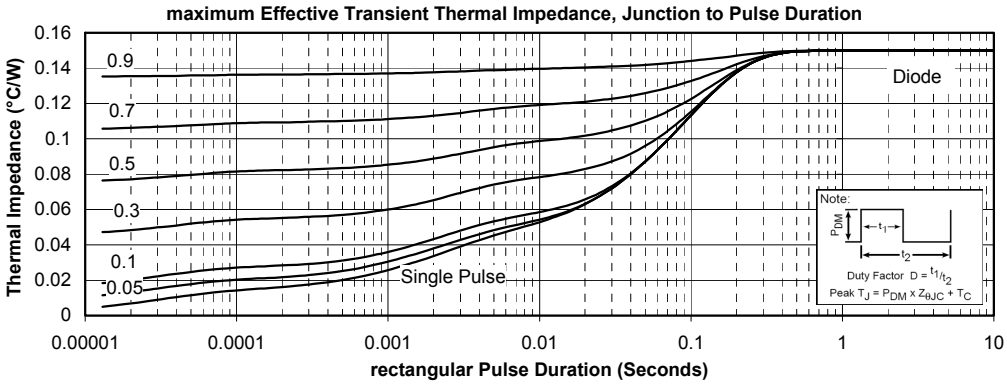







Operating Frequency vs Collector Current
Fmax, Operating Frequency (kHz)
70
60
50
40
30
20
10
0
0
100
200
300
400
500
I_C (A)
V_{CE}=300V
D=50%
R_G=8Ω
T_J=125°C
T_C=75°C
ZVS
ZCS
hard
switching


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 $T_J = P_{DM} \times Z_{\theta JC} + T_C$

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