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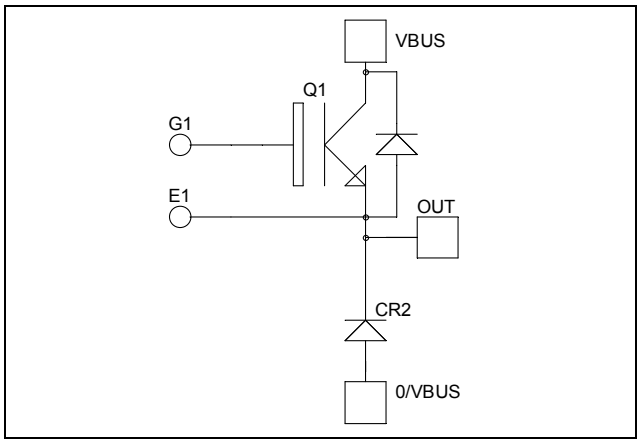
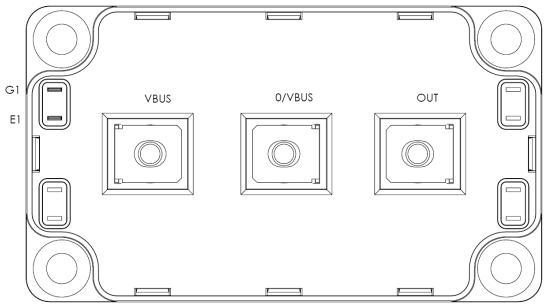
Buck chopper
NPT IGBT Power Module

V_{CES} = 1200V
I_C = 300A @ Tc = 80°C





Application

- AC and DC motor control
- Switched Mode Power Supplies

Features

- Non Punch Through (NPT) FAST 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
- Very low stray inductance
  - Symmetrical design
  - M5 power connectors
- 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}
- Low profile
- RoHS compliant

Absolute maximum ratings

Symbol	*Parameter*		*Max ratings*	*Unit*
V_{CES}	Collector - Emitter Breakdown Voltage		1200	V
I_C	Continuous Collector Current	T_c = 25°C	400	A
		T_c = 80°C	300	
I_{CM}	Pulsed Collector Current	T_c = 25°C	600	
V_{GE}	Gate – Emitter Voltage		±20	V
P_D	Maximum Power Dissipation	T_c = 25°C	1780	W
RBSOA	Reverse Bias Safe Operating Area	T_j = 150°C	600A @ 1200V	

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} = 1200V	T_j = 25°C			500	µA
			T_j = 125°C			750	
$V_{CE(sat)}$	Collector Emitter saturation Voltage	V_{GE} =15V, I_C = 300A	T_j = 25°C		3.3	3.9	V
			T_j = 125°C		4		
$V_{GE(th)}$	Gate Threshold Voltage	V_{GE} = V_{CE}, I_C = 12mA		4.5		6.5	V
I_{GES}	Gate – Emitter Leakage Current	V_{GE} = ±20V, V_{CE} = 0V				±1	µA

Dynamic Characteristics

Symbol	*Characteristic*	*Test Conditions*	*Min*	*Typ*	*Max*	*Unit*
C_{ies}	Input Capacitance	V_{GE} = 0V V_{CE} = 25V f = 1MHz		21		nF
C_{oes}	Output Capacitance			2.9		
C_{res}	Reverse Transfer Capacitance			1.52		
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching (25°C) V_{GE} = 15V V_{Bus} = 600V I_C = 300A R_G = 3Ω		120		ns
T_r	Rise Time			50		
$T_{d(off)}$	Turn-off Delay Time			310		
T_f	Fall Time			30		
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching (125°C) V_{GE} = 15V V_{Bus} = 600V I_C = 300A R_G = 3Ω		130		ns
T_r	Rise Time			60		
$T_{d(off)}$	Turn-off Delay Time			360		
T_f	Fall Time			40		
E_{on}	Turn-on Switching Energy	V_{GE} = 15V, V_{Bus} = 600V, I_C = 300A, R_G = 3Ω, T_j = 125°C		25		mJ
E_{off}	Turn-off Switching Energy	V_{GE} = 15V, V_{Bus} = 600V, I_C = 300A, R_G = 3Ω, T_j = 125°C		15		

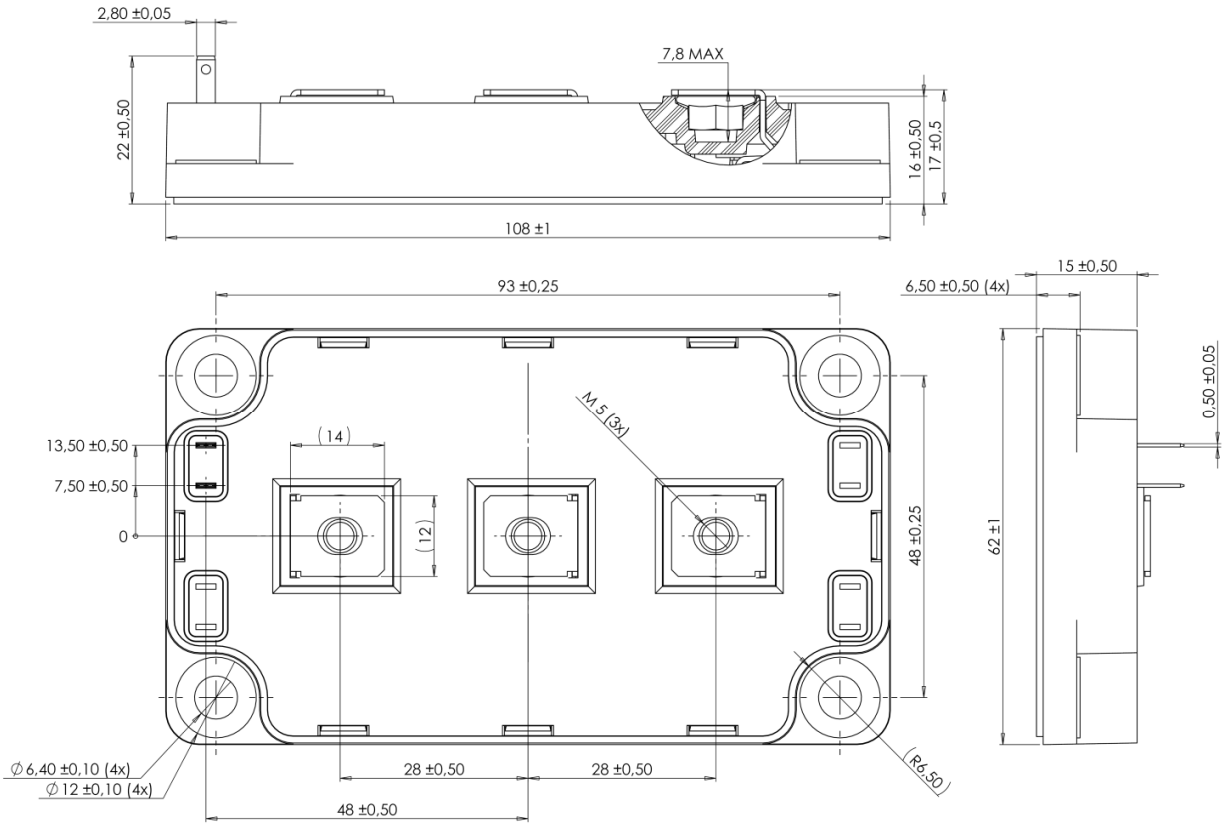
Chopper diode ratings and characteristics

Symbol	*Characteristic*	*Test Conditions*		*Min*	*Typ*	*Max*	*Unit*
V_{RRM}	Maximum Peak Repetitive Reverse Voltage			1200			V
I_{RM}	Maximum Reverse Leakage Current	V_R=1200V	T_j = 25°C			750	µA
			T_j = 125°C			1000	
I_F	DC Forward Current		Tc = 70°C		400		A
V_F	Diode Forward Voltage	I_F = 400A			2.0	2.5	V
		I_F = 800A			2.5		
		I_F = 400A	T_j = 125°C		1.8		
t_{rr}	Reverse Recovery Time	I_F = 400A, V_R = 800V, di/dt =800A/µs	T_j = 25°C		420		ns
			T_j = 125°C		580		
Q_{rr}	Reverse Recovery Charge		T_j = 25°C		5		µC
			T_j = 125°C		21.4		

Thermal and package characteristics

Symbol	*Characteristic*			*Min*	*Typ*	*Max*	*Unit*
R_{thJC}	Junction to Case Thermal Resistance		IGBT			0.07	°C/W
			Diode			0.16	
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		100	
Torque	Mounting torque	To heatsink	M6	3		5	N.m
		For terminals	M5	2		3.5	
Wt	Package Weight					300	g

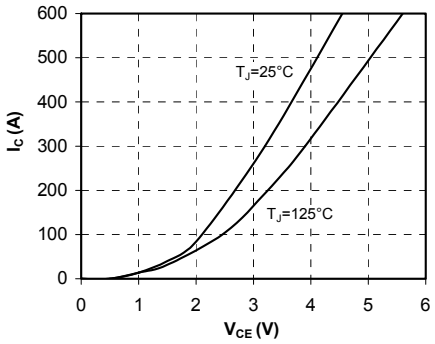
SP6 Package outline (dimensions in mm)



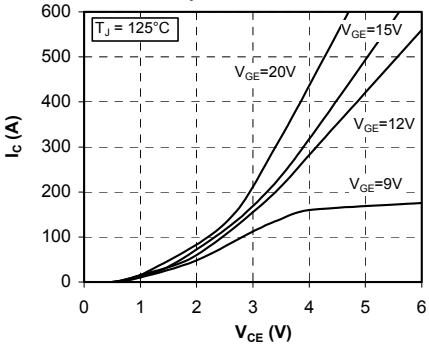
See application note APT0601 - Mounting Instructions for SP6 Power Modules on www.microsemi.com

Typical Performance Curve

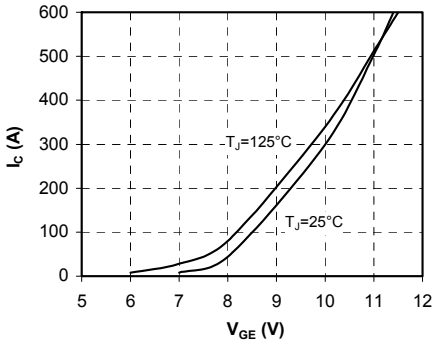
Output Characteristics (V_{GE}=15V)



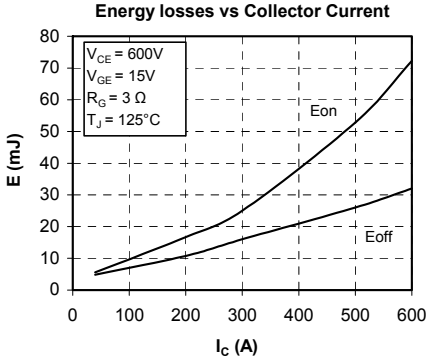
Output Characteristics



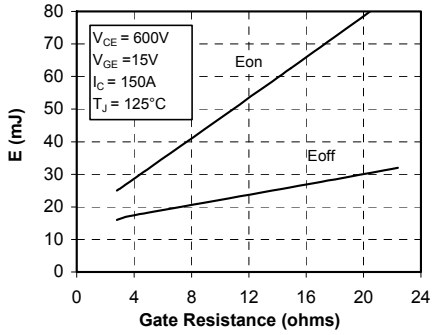
Transfert Characteristics



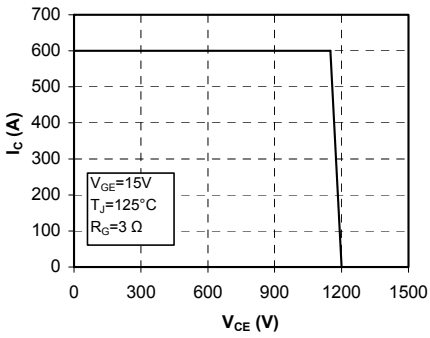
Energy losses vs Collector Current



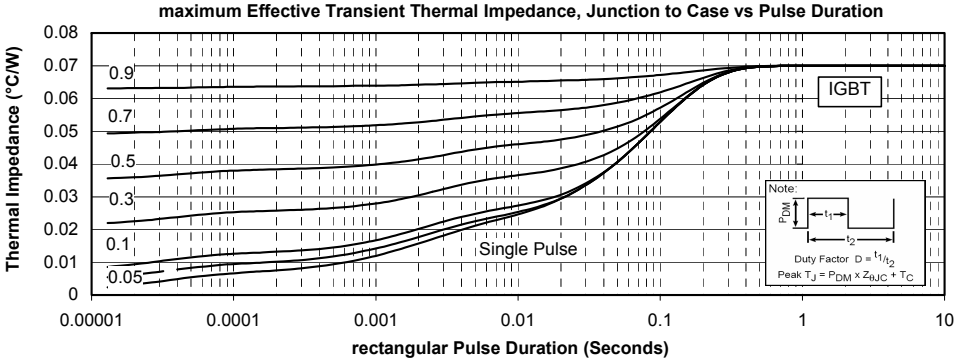
Switching Energy Losses vs Gate Resistance

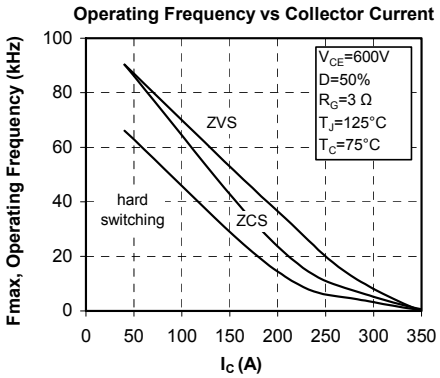


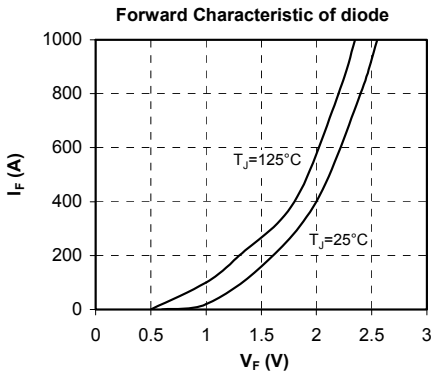
Reverse Bias Safe Operating Area

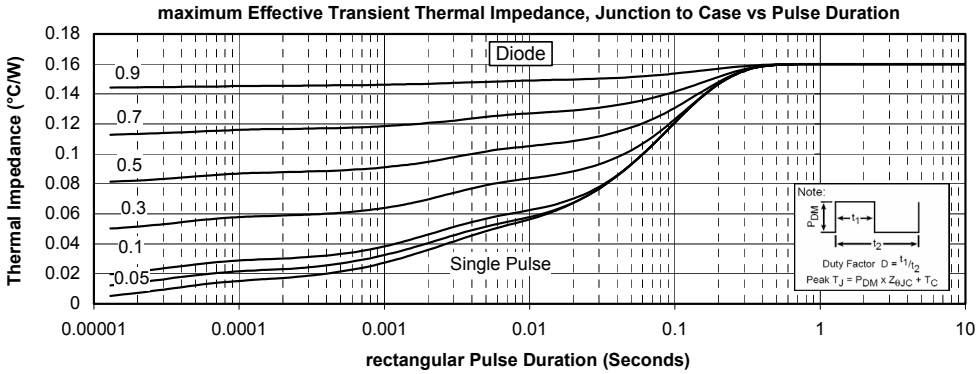


maximum Effective Transient Thermal Impedance, Junction to Case vs Pulse Duration




Operating Frequency vs Collector Current
Fmax, Operating Frequency (kHz)
100
80
60
40
20
0
0
50
100
150
200
250
300
350
I_C (A)
V_{CE}=600V
D=50%
R_G=3 Ω
T_J=125°C
T_C=75°C
ZVS
ZCS
hard
switching


Forward Characteristic of diode
I_F (A)
1000
800
600
400
200
0
0
0.5
1
1.5
2
2.5
3
V_F (V)
T_J=125°C
T_J=25°C


maximum Effective Transient Thermal Impedance, Junction to Case vs Pulse Duration
Thermal Impedance (°C/W)
0.18
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)
Diode
0.9
0.7
0.5
0.3
0.1
0.05
Single Pulse
Note:
P_{DM}
t_1
t_2
Duty Factor D = t_1/t_2
Peak T_J = P_{DM} x $Z_{\theta JC}$ + T_C

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