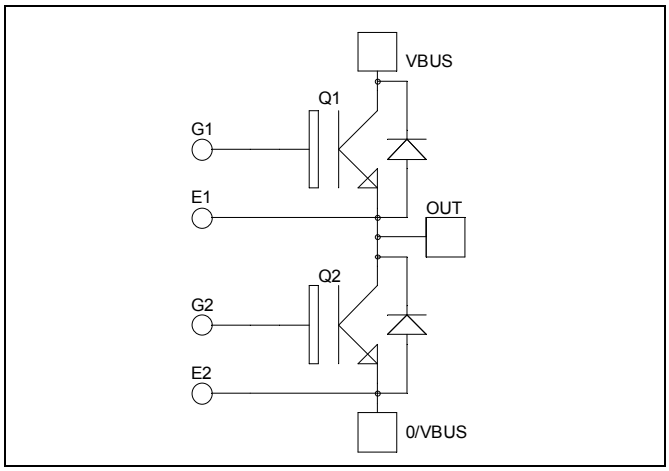
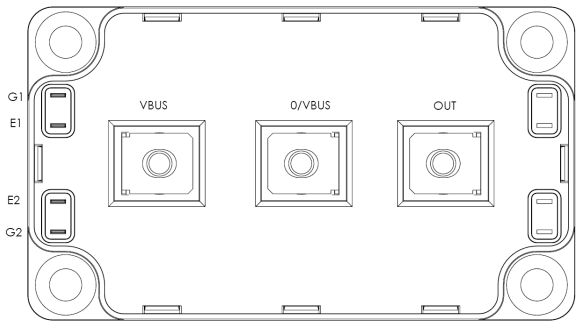
APTGT400A120G

Phase leg
Fast Trench + Field Stop IGBT3
Power Module

V_{CES} = 1200V
I_C = 400A @ Tc = 80°C





Application

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

Features

- Fast Trench + Field Stop IGBT3 Technology
  - Low voltage drop
  - Low tail current
  - Switching frequency up to 20 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

- Stable temperature behavior
- Very rugged
- Direct mounting to heatsink (isolated package)
- Low junction to case thermal resistance
- Easy paralleling due to positive TC of VCEsat
- 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	560 *	A
		T_C = 80°C	400	
I_{CM}	Pulsed Collector Current	T_C = 25°C	800	
V_{GE}	Gate – Emitter Voltage		±20	V
P_D	Maximum Power Dissipation	T_C = 25°C	1785	W
RBSOA	Reverse Bias Safe Operating Area	T_j = 125°C	800A @ 1100V	

* Specification of IGBT device but output current must be limited to 500A to not exceed a delta of temperature greater than 100°C for the connectors.

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				750	µA
$V_{CE(sat)}$	Collector Emitter Saturation Voltage	V_{GE} =15V I_C = 400A	T_j = 25°C	1.4	1.7	2.1	V
			T_j = 125°C		2.0		
$V_{GE(th)}$	Gate Threshold Voltage	V_{GE} = V_{CE} , I_C = 4 mA		5.0	5.8	6.5	V
I_{GES}	Gate – Emitter Leakage Current	V_{GE} = 20V, V_{CE} = 0V				600	nA

Dynamic Characteristics

Symbol	*Characteristic*	*Test Conditions*		*Min*	*Typ*	*Max*	*Unit*
C_{ies}	Input Capacitance	V_{GE} = 0V V_{CE} = 25V f = 1MHz			28		nF
C_{oes}	Output Capacitance				1.6		
C_{res}	Reverse Transfer Capacitance				1.2		
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching (25°C) V_{GE} = ±15V V_{Bus} = 600V I_C = 400A R_G = 1.2Ω			260		ns
T_r	Rise Time				30		
$T_{d(off)}$	Turn-off Delay Time				420		
T_f	Fall Time				80		
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching (125°C) V_{GE} = ±15V V_{Bus} = 600V I_C = 400A R_G = 1.2Ω			290		ns
T_r	Rise Time				50		
$T_{d(off)}$	Turn-off Delay Time				520		
T_f	Fall Time				100		
E_{on}	Turn on Energy	V_{GE} = ±15V V_{Bus} = 600V I_C = 400A R_G = 1.2Ω	T_j = 125°C		40		mJ
E_{off}	Turn off Energy		T_j = 125°C		40		

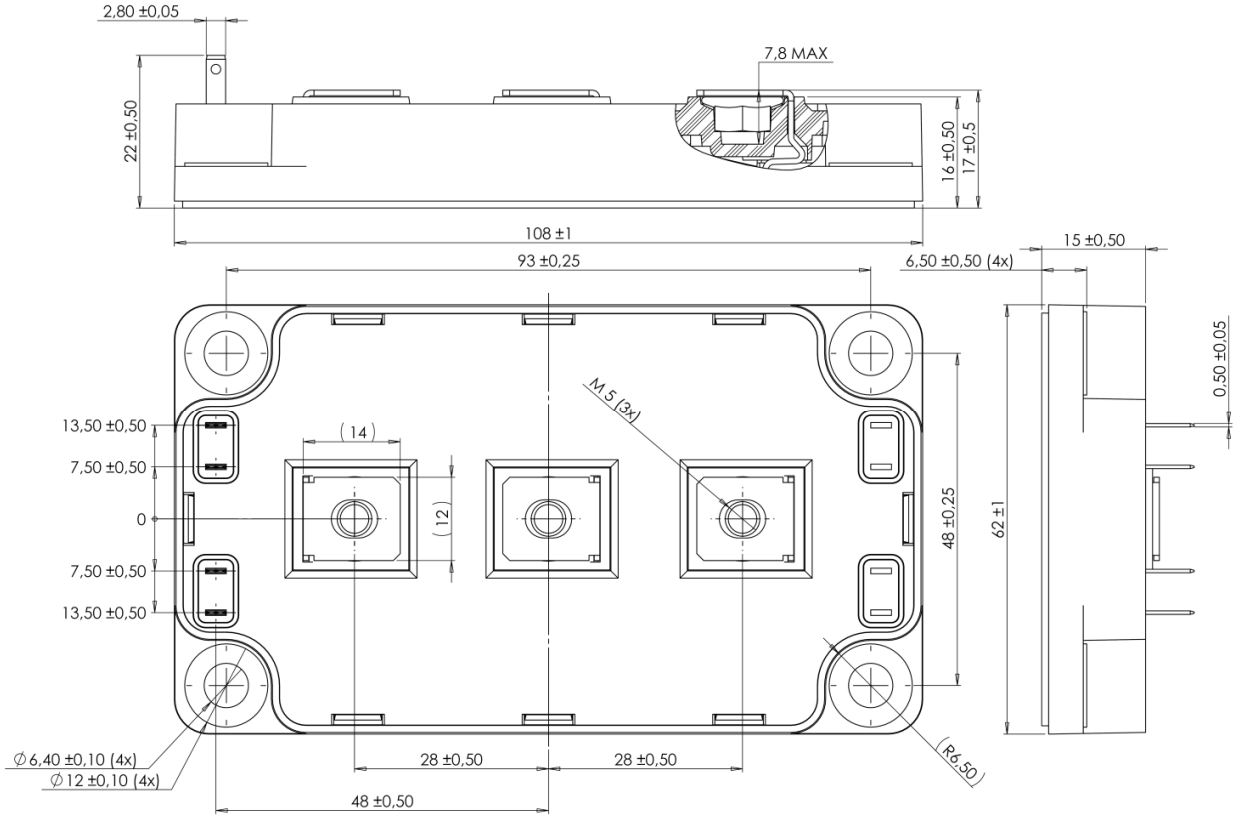
Reverse diode ratings and characteristics

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			700	µA
			T_j = 125°C			900	
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		1.6	2.1	V
			T_j = 125°C		1.6		
t_{rr}	Reverse Recovery Time	I_F = 400A V_R = 600V di/dt =4000A/µs	T_j = 25°C		170		ns
			T_j = 125°C		280		
Q_{rr}	Reverse Recovery Charge		T_j = 25°C		36		µC
			T_j = 125°C		72		
E_r	Reverse Recovery Energy		T_j = 25°C		20		mJ
			T_j = 125°C		36		

Thermal and package characteristics

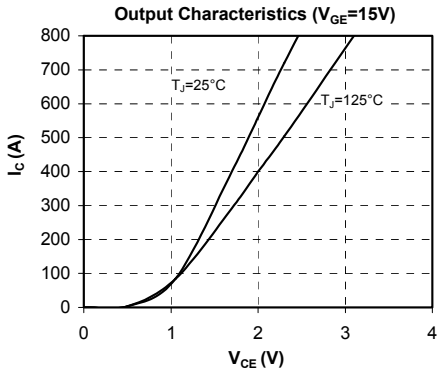
Symbol	*Characteristic*			*Min*	*Typ*	*Max*	*Unit*
R_{thJC}	Junction to Case Thermal Resistance		IGBT			0.07	°C/W
			Diode			0.13	
V_{ISOL}	RMS Isolation Voltage, any terminal to case t =1 min, 50/60Hz			4000			V
T_J	Operating junction temperature range			-40		150	°C
T_{STG}	Storage Temperature Range			-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

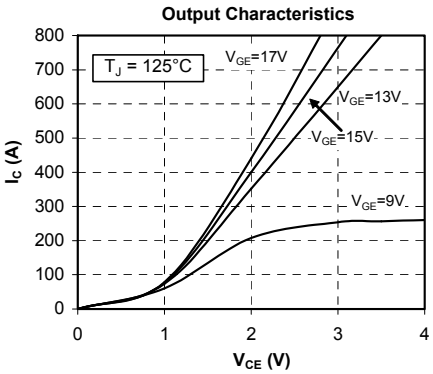
SP6 Package outline (dimensions in mm)

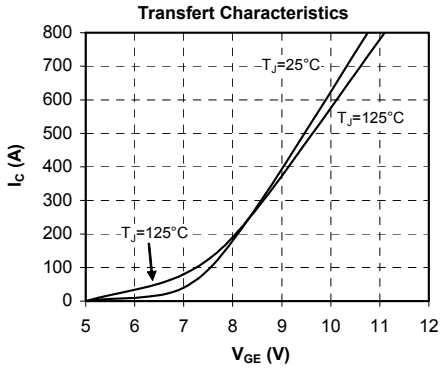


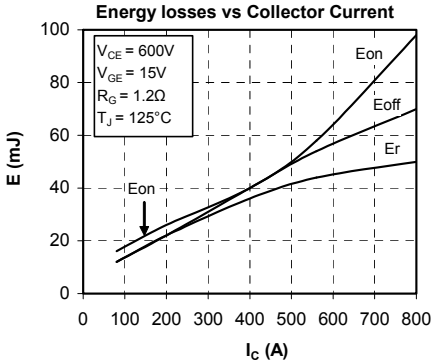
See application note APT0601 - Mounting Instructions for SP6 Power Modules on www.microsemi.com

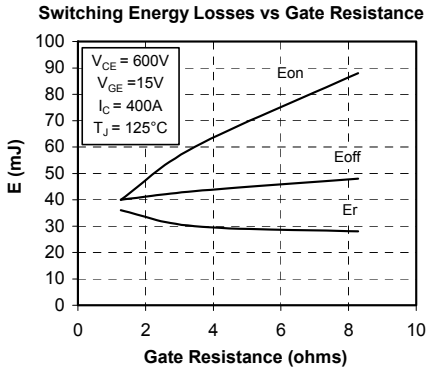
Typical Performance Curve

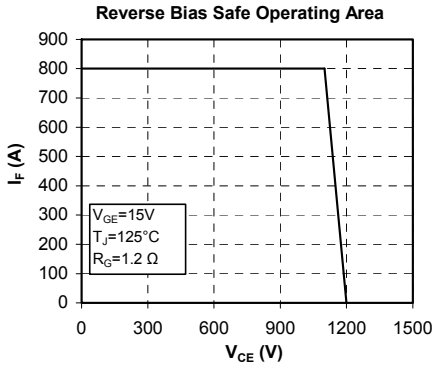


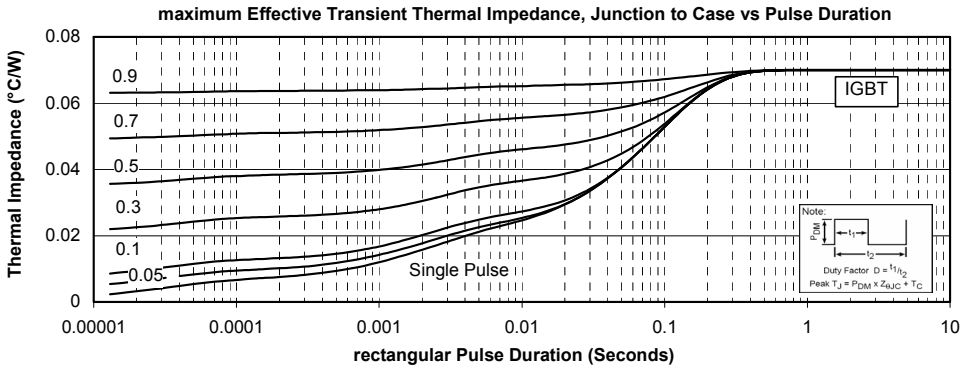


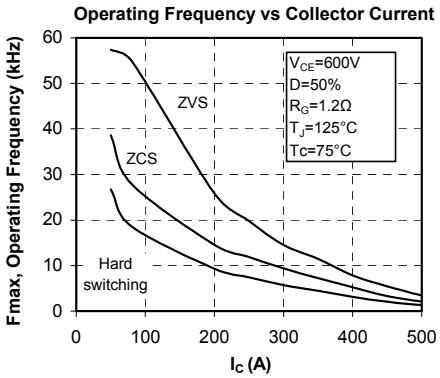


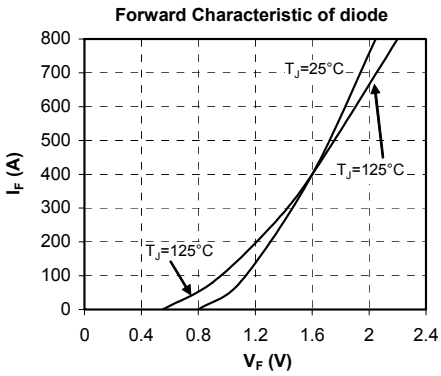


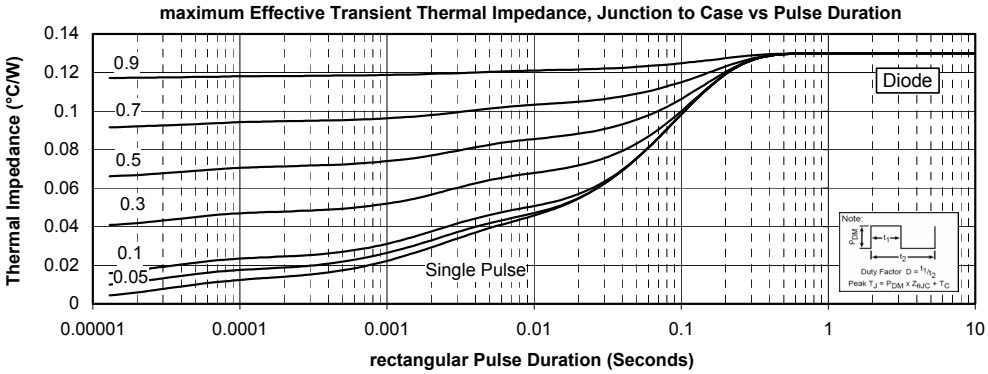







Operating Frequency vs Collector Current
Fmax, Operating Frequency (kHz)
60
50
40
30
20
10
0
0
100
200
300
400
500
I_C (A)
V_{CE}=600V
D=50%
R_G=1.2Ω
T_J=125°C
Tc=75°C
ZVS
ZCS
Hard
switching


Forward Characteristic of diode
I_F (A)
800
700
600
500
400
300
200
100
0
0
0.4
0.8
1.2
1.6
2
2.4
V_F (V)
T_J=25°C
T_J=125°C
T_J=125°C


maximum Effective Transient Thermal Impedance, Junction to Case vs Pulse Duration
Thermal Impedance (°C/W)
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:
Duty Factor D = t_1/t_2
Peak $T_J = P_{DM} \times Z_{\theta JC} + T_C$

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