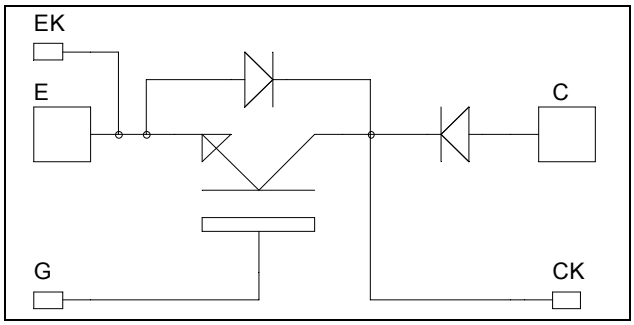
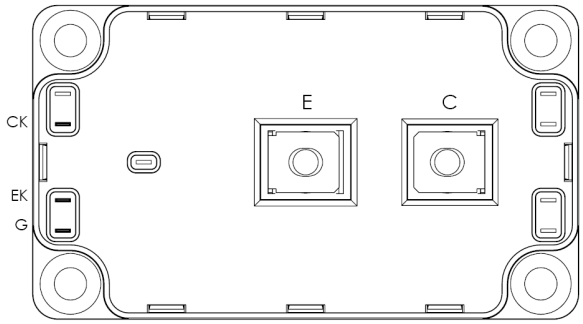
APTGF200U120DG

Single Switch with Series diodes NPT IGBT Power Module

V_{CES} = 1200V
I_C = 200A @ Tc = 80°C





Application

- Zero Current Switching resonant mode

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 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	275	A
		T_c = 80°C	200	
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	1136	W
RBSOA	Reverse Bias Safe Operating Area	T_j = 150°C	400A @ 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 = 200A	T_j = 25°C		3.2	3.7	V
			T_j = 125°C		4.0		
$V_{GE(th)}$	Gate Threshold Voltage	V_{GE} = V_{CE}, I_C = 4mA		4.5		6.5	V
I_{GES}	Gate – Emitter Leakage Current	V_{GE} = ±20V, V_{CE} = 0V				±300	nA

Dynamic Characteristics

Symbol	*Characteristic*	*Test Conditions*		*Min*	*Typ*	*Max*	*Unit*
C_{ies}	Input Capacitance	V_{GE} = 0V, V_{CE} = 25V, f = 1MHz			13.8		nF
C_{oes}	Output Capacitance				1.32		
C_{res}	Reverse Transfer Capacitance				0.88		
Q_g	Total gate Charge	V_{GS} = 15V, V_{Bus} = 600V, I_C = 200A			1320		nC
Q_{ge}	Gate – Emitter Charge				140		
Q_{gc}	Gate – Collector Charge				800		
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching (125°C) V_{GE} = 15V, V_{Bus} = 600V, I_C = 200A, R_G = 1.2Ω			35		ns
T_r	Rise Time				65		
$T_{d(off)}$	Turn-off Delay Time				320		
T_f	Fall Time				30		
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching (125°C) V_{GE} = 15V, V_{Bus} = 600V, I_C = 200A, R_G = 1.2Ω			35		ns
T_r	Rise Time				65		
$T_{d(off)}$	Turn-off Delay Time				360		
T_f	Fall Time				40		
E_{on}	Turn-on Switching Energy	V_{GE} = 15V, V_{Bus} = 600V, I_C = 200A, R_G = 1.2Ω	T_j = 125°C		22		mJ
E_{off}	Turn-off Switching Energy		T_j = 125°C		12.2		

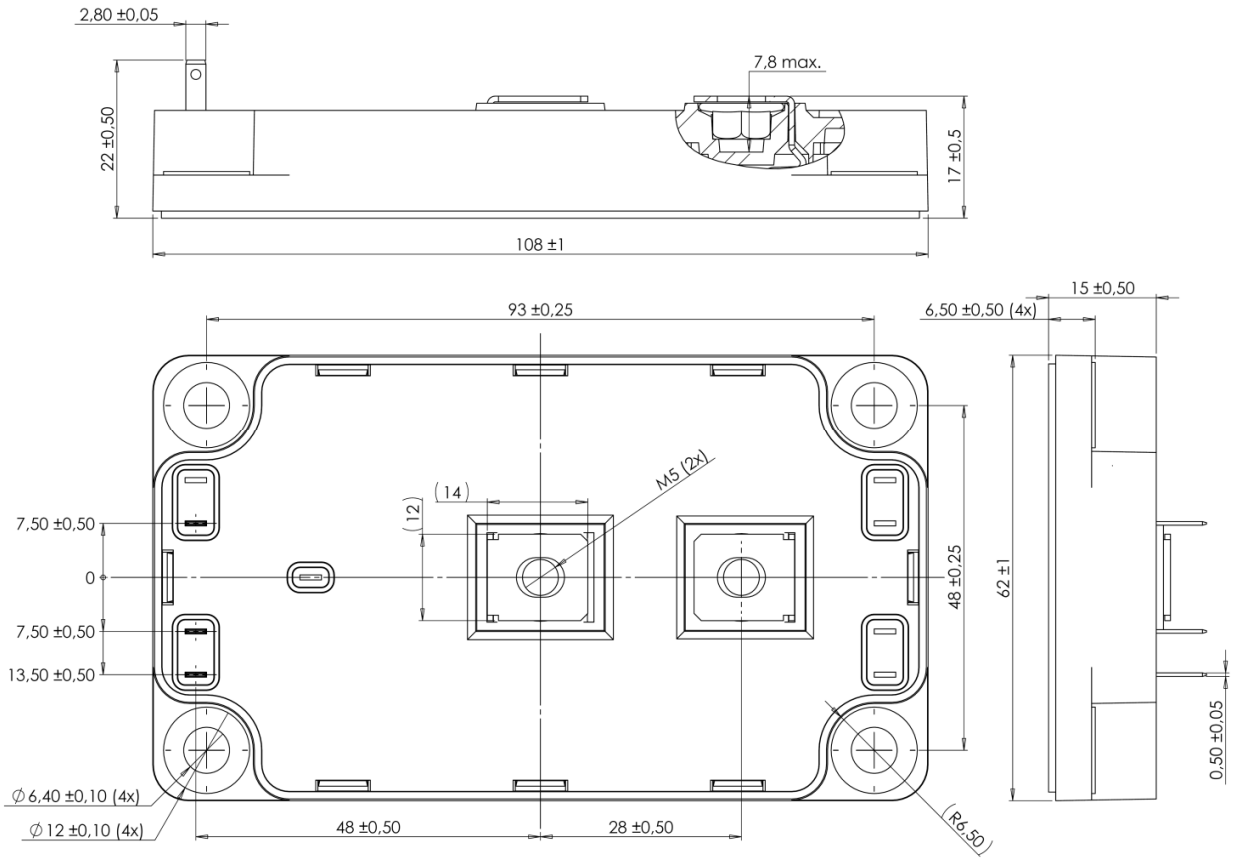
Series diode ratings and characteristics

Symbol	*Characteristic*	*Test Conditions*		*Min*	*Typ*	*Max*	*Unit*
V_{RRM}	Maximum 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		240		A
V_F	Diode Forward Voltage	I_F = 240A			2	2.5	V
		I_F = 480A			2.3		
		I_F = 240A	T_j = 125°C		1.8		
t_{rr}	Reverse Recovery Time	I_F = 240A, V_R = 800V, di/dt =800A/µs	T_j = 25°C		400		ns
			T_j = 125°C		470		
Q_{rr}	Reverse Recovery Charge		T_j = 25°C		4.8		µC
			T_j = 125°C		16		

Thermal and package characteristics

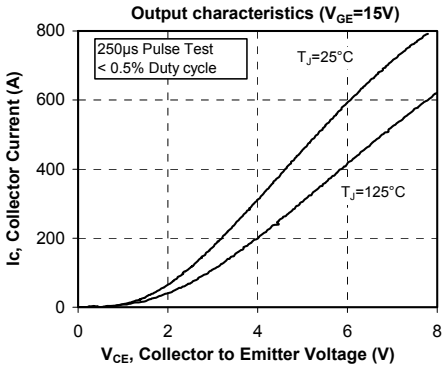
Symbol	*Characteristic*			*Min*	*Typ*	*Max*	*Unit*
R_{thJC}	Junction to Case Thermal Resistance		IGBT			0.11	°C/W
			Diode			0.23	
V_{ISOL}	RMS Isolation Voltage, any terminal to case t =1 min, 50/60Hz			4000			V
T_J	Operating junction temperature range			-40		150	°C
T_{STG}	Storage Temperature Range			-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

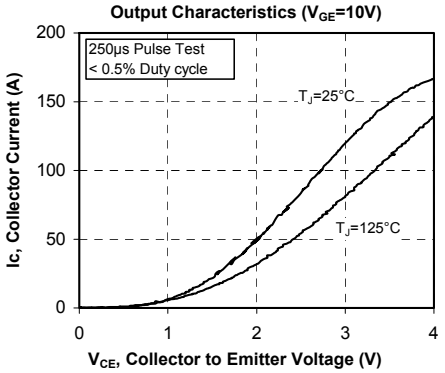
SP6 Package outline (dimensions in mm)

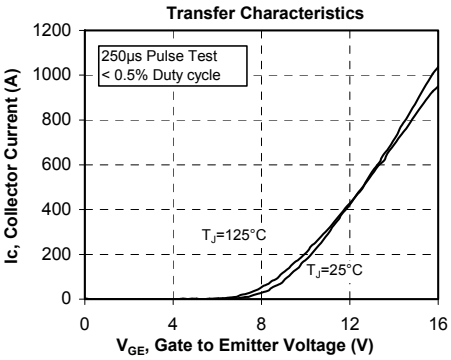


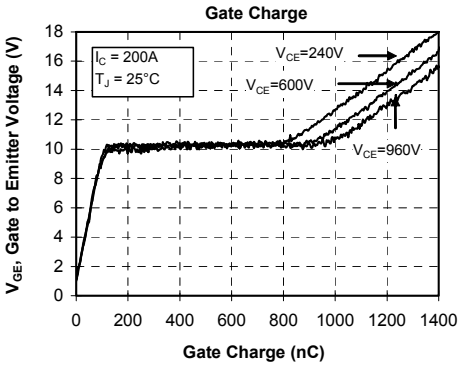
See application note APT0601 - Mounting Instructions for SP6 Power Modules on www.microsemi.com

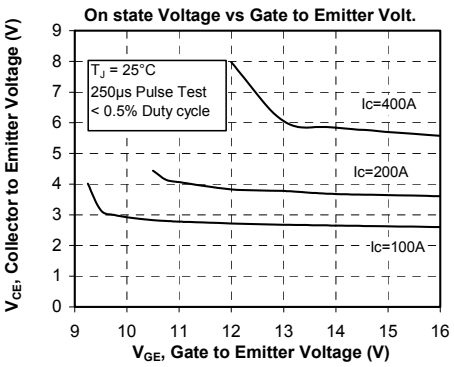
Typical Performance Curve

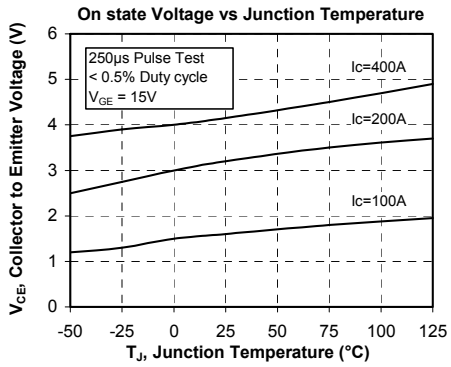


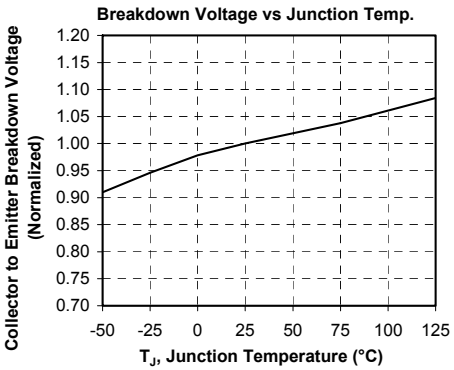


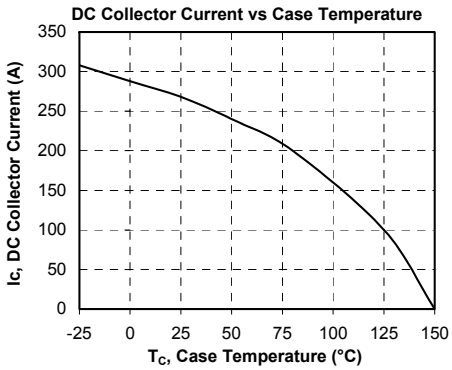




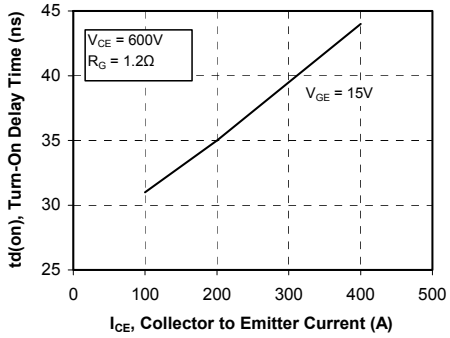




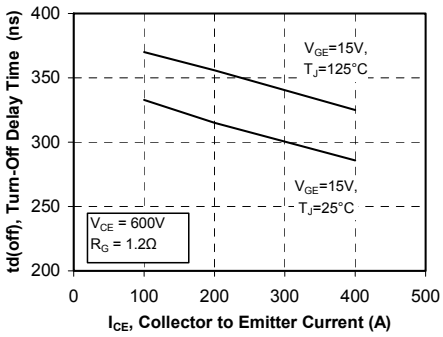




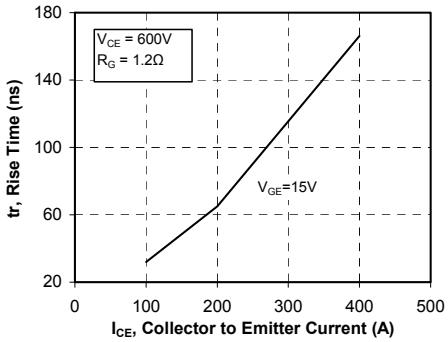
Turn-On Delay Time vs Collector Current



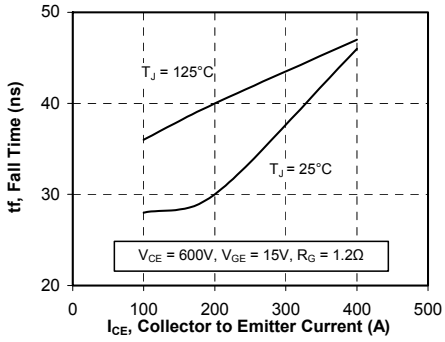
Turn-Off Delay Time vs Collector Current



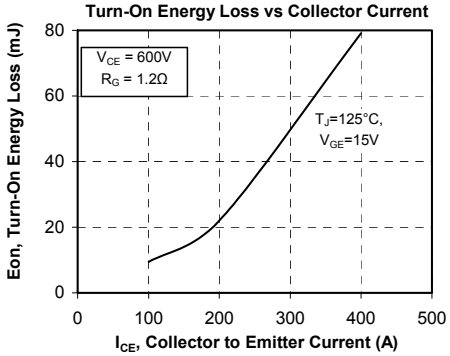
Current Rise Time vs Collector Current



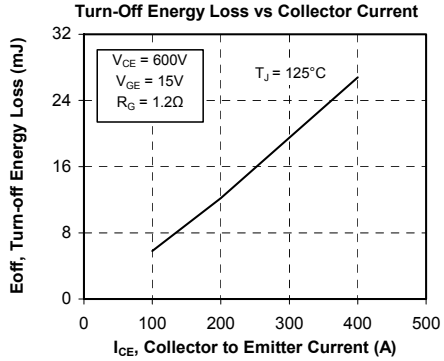
Current Fall Time vs Collector Current



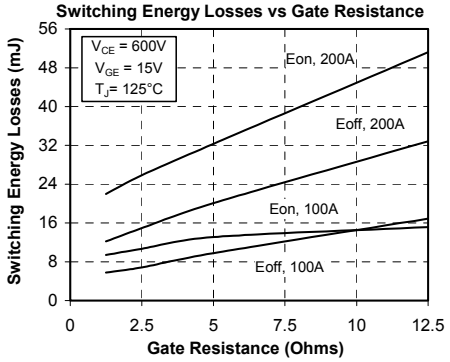
Turn-On Energy Loss vs Collector Current



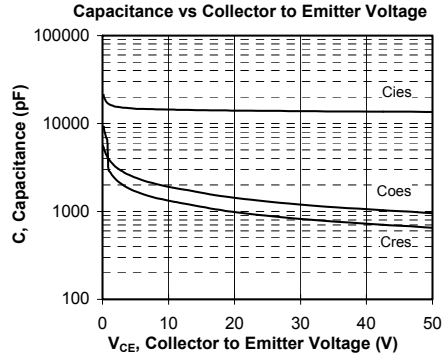
Turn-Off Energy Loss vs Collector Current

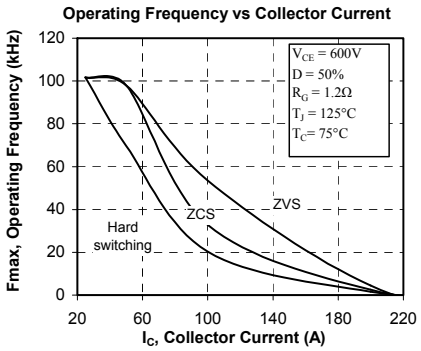


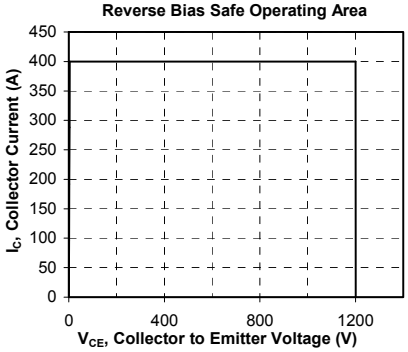
Switching Energy Losses vs Gate Resistance

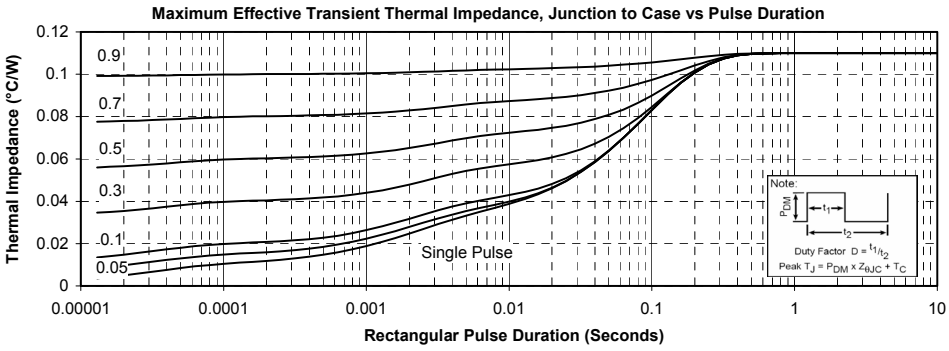


Capacitance vs Collector to Emitter Voltage




Operating Frequency vs Collector Current
Fmax, Operating Frequency (kHz)
120
100
80
60
40
20
0
20
60
100
140
180
220
I_C, Collector Current (A)
V_{CE} = 600V
D = 50%
R_G = 1.2Ω
T_J = 125°C
T_C= 75°C
ZVS
ZCS
Hard
switching


Reverse Bias Safe Operating Area
I_C, Collector Current (A)
450
400
350
300
250
200
150
100
50
0
0
400
800
1200
V_{CE}, Collector to Emitter Voltage (V)


Maximum Effective Transient Thermal Impedance, Junction to Case vs Pulse Duration
Thermal Impedance (°C/W)
0.12
0.1
0.08
0.06
0.04
0.02
0
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
0.00001
0.0001
0.001
0.01
0.1
1
10
Rectangular Pulse Duration (Seconds)

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