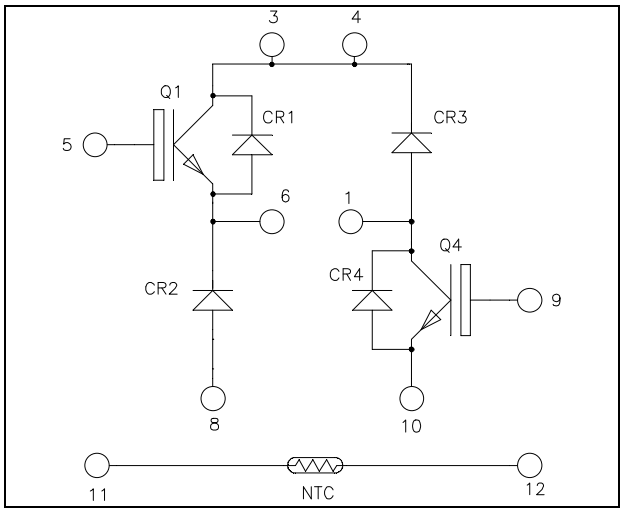
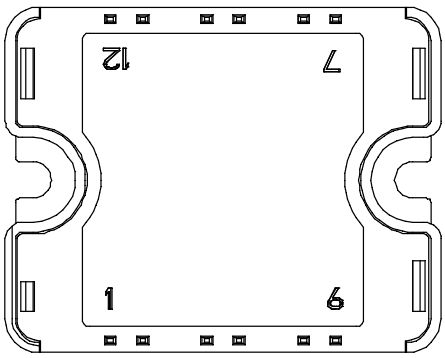
APTGT50DH60T1G

Asymmetrical - Bridge Trench + Field Stop IGBT3 Power Module

V_{CES} = 600V
I_C = 50A* @ Tc = 80°C





Pins 3/4 must be shorted together

Application

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

Features

- 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
- Very low stray inductance
  - Symmetrical design
- Internal thermistor for temperature monitoring
- High level of integration

Benefits

- Outstanding performance at high frequency operation
- Direct mounting to heatsink (isolated package)
- Low junction to case thermal resistance
- Solderable terminals both for power and signal for easy PCB mounting
- Low profile
- 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	80*	A
		T_C = 80°C	50*	
I_{CM}	Pulsed Collector Current	T_C = 25°C	100	
V_{GE}	Gate – Emitter Voltage		±20	V
P_D	Maximum Power Dissipation	T_C = 25°C	176	W
RBSOA	Reverse Bias Safe Operating Area	T_J = 150°C	100A @ 550V	

* Specification of IGBT device but output current must be limited to 40A to not exceed a delta of temperature greater than 35°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} = 600V				250	µA
$V_{CE(sat)}$	Collector Emitter Saturation Voltage	V_{GE} =15V I_C = 50A	T_j = 25°C		1.5	1.9	V
			T_j = 150°C		1.7		
$V_{GE(th)}$	Gate Threshold Voltage	V_{GE} = V_{CE} , I_C = 600µA		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			3150		pF
C_{oes}	Output Capacitance				200		
C_{res}	Reverse Transfer Capacitance				95		
Q_G	Gate charge	V_{GE}=±15V, I_C=50A V_{CE}=300V			0.5		µC
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching (25°C) V_{GE} = ±15V V_{Bus} = 300V I_C = 50A R_G = 8.2Ω			110		ns
T_r	Rise Time				45		
$T_{d(off)}$	Turn-off Delay Time				200		
T_f	Fall Time				40		
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching (150°C) V_{GE} = ±15V V_{Bus} = 300V I_C = 50A R_G = 8.2Ω			120		ns
T_r	Rise Time				50		
$T_{d(off)}$	Turn-off Delay Time				250		
T_f	Fall Time				60		
E_{on}	Turn-on Switching Energy	V_{GE} = ±15V V_{Bus} = 300V I_C = 50A R_G = 8.2Ω	T_j = 25°C		0.3		mJ
			T_j = 150°C		0.43		
E_{off}	Turn-off Switching Energy		T_j = 25°C		1.35		mJ
			T_j = 150°C		1.75		
I_{sc}	Short Circuit data	V_{GE} ≤15V ; V_{Bus} = 360V t_p ≤ 6µs ; T_j = 150°C			250		A

Diode ratings and characteristics (CR2 & CR3)

Symbol	*Characteristic*	*Test Conditions*		*Min*	*Typ*	*Max*	*Unit*
V_{RRM}	Maximum Peak Repetitive Reverse Voltage			600			V
I_{RM}	Maximum Reverse Leakage Current	V_R=600V	T_j = 25°C			250	µA
			T_j = 150°C			500	
I_F	DC Forward Current		Tc = 80°C		50		A
V_F	Diode Forward Voltage	I_F = 50A V_{GE} = 0V	T_j = 25°C		1.6	2	V
			T_j = 150°C		1.5		
t_{rr}	Reverse Recovery Time	I_F = 50A V_R = 300V di/dt =1800A/µs	T_j = 25°C		100		ns
			T_j = 150°C		150		
Q_{rr}	Reverse Recovery Charge		T_j = 25°C		2.6		µC
			T_j = 150°C		5.4		
E_r	Reverse Recovery Energy		T_j = 25°C		0.6		mJ
			T_j = 150°C		1.2		

CR1 & CR4 are IGBT protection diodes only

Thermal and package characteristics

Symbol	*Characteristic*			*Min*	*Typ*	*Max*	*Unit*
R_{thJC}	Junction to Case Thermal Resistance		IGBT			0.85	°C/W
			Diode			1.42	
V_{ISOL}	RMS Isolation Voltage, any terminal to case t =1 min, 50/60Hz			4000			V
T_J	Operating junction temperature range			-40		175	°C
T_{STG}	Storage Temperature Range			-40		125	
T_C	Operating Case Temperature			-40		100	
Torque	Mounting torque	To heatsink	M4	2		3	N.m
Wt	Package Weight					80	g

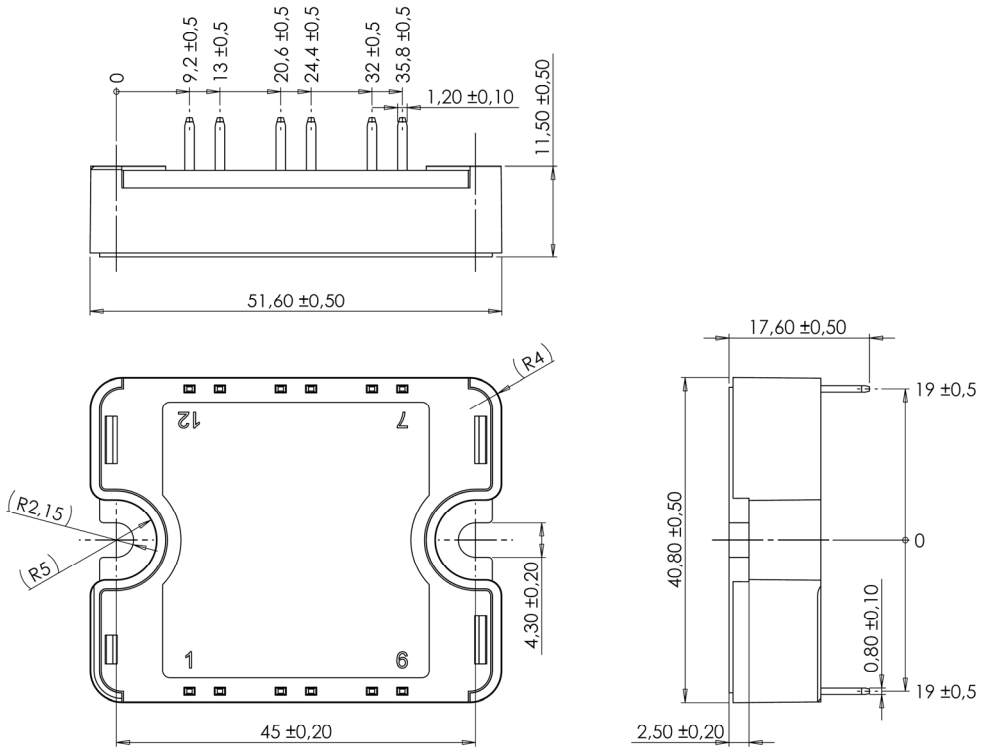
Temperature sensor NTC (see application note APT0406 on www.microsemi.com for more information).

Symbol	*Characteristic*		*Min*	*Typ*	*Max*	*Unit*
R_{25}	Resistance @ 25°C			50		kΩ
$\Delta R_{25}/R_{25}$				5		%
$B_{25/85}$	T_{25} = 298.15 K			3952		K
$\Delta B/B$		T_C=100°C		4		%

$$R_T = \frac{R_{25}}{\exp\left[B_{25/85}\left(\frac{1}{T_{25}} - \frac{1}{T}\right)\right]}$$

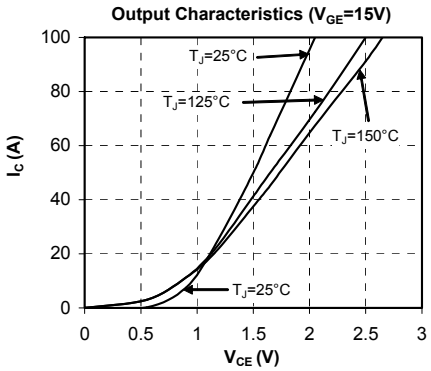
T: Thermistor temperature
R_T: Thermistor value at T

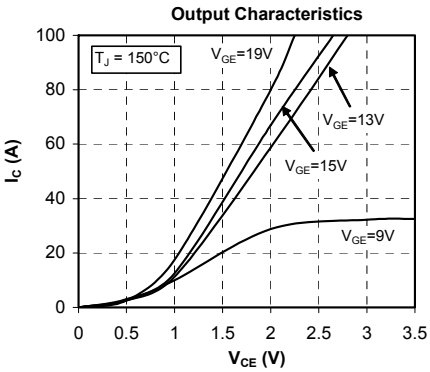
SP1 Package outline (dimensions in mm)

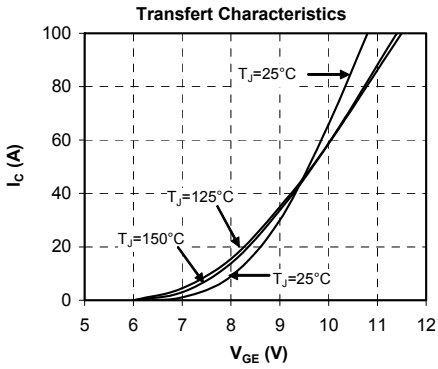


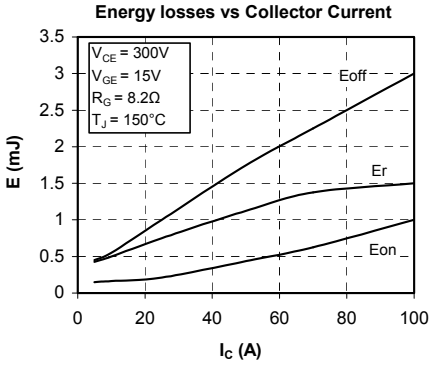
See application note 1904 - Mounting Instructions for SP1 Power Modules on www.microsemi.com

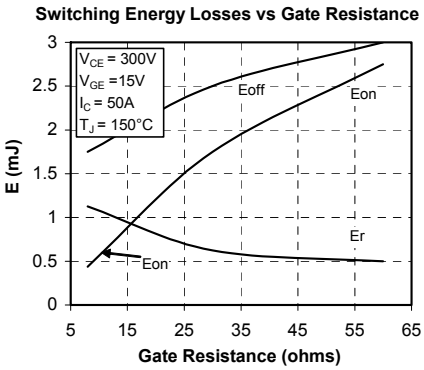
Typical Performance Curve

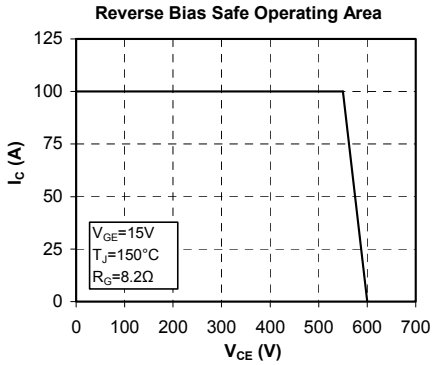


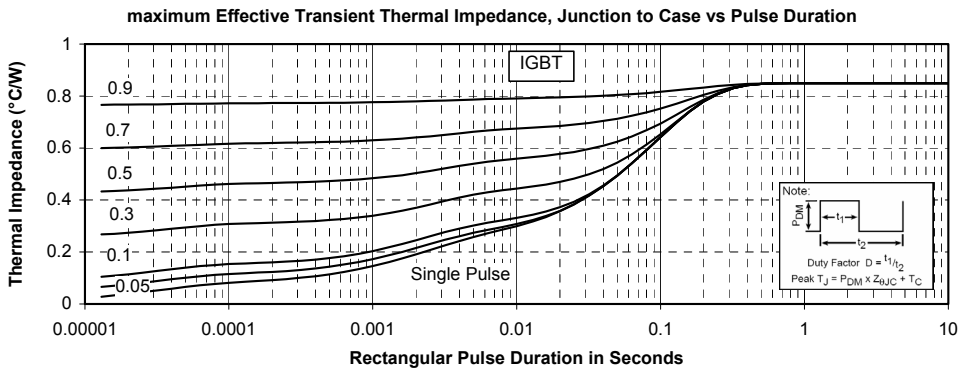


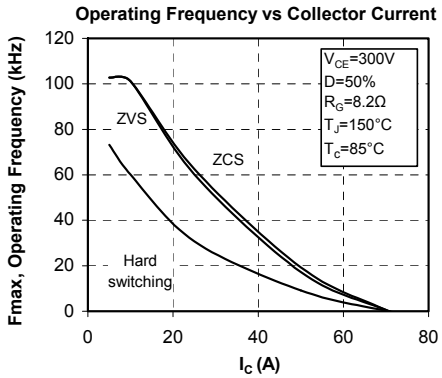


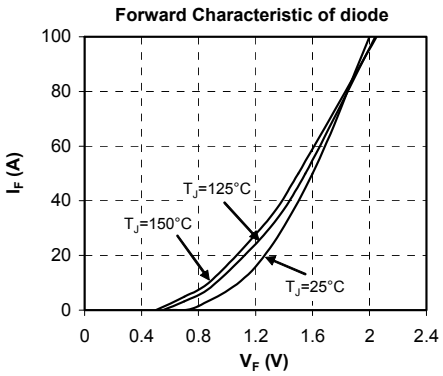


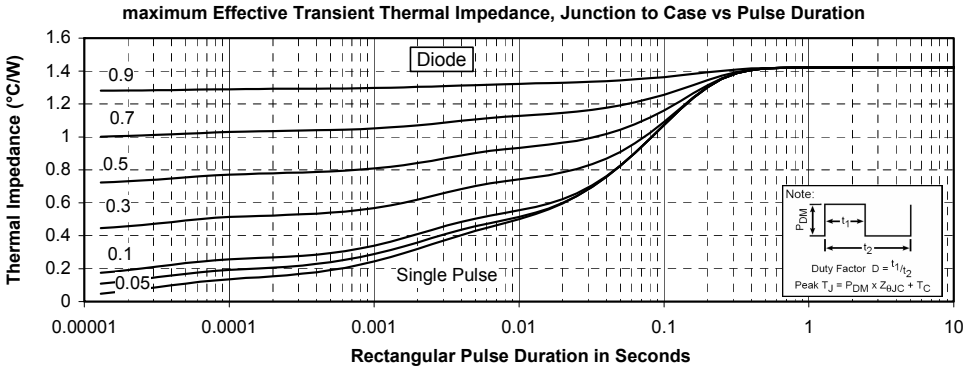







Operating Frequency vs Collector Current
Fmax, Operating Frequency (kHz)
I_C (A)
V_{CE}=300V
D=50%
R_G=8.2Ω
T_J=150°C
T_c=85°C
ZVS
ZCS
Hard switching
120
100
80
60
40
20
0
0
20
40
60
80


Forward Characteristic of diode
I_F (A)
V_F (V)
T_J=125°C
T_J=150°C
T_J=25°C
100
80
60
40
20
0
0
0.4
0.8
1.2
1.6
2
2.4


maximum Effective Transient Thermal Impedance, Junction to Case vs Pulse Duration
Thermal Impedance (°C/W)
Rectangular Pulse Duration in Seconds
Diode
Single Pulse
0.9
0.7
0.5
0.3
0.1
0.05
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
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0.00001
0.0001
0.001
0.01
0.1
1
10

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