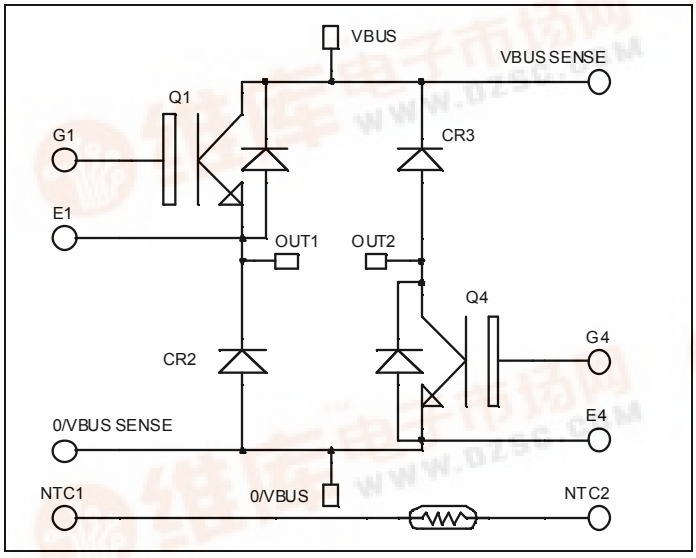
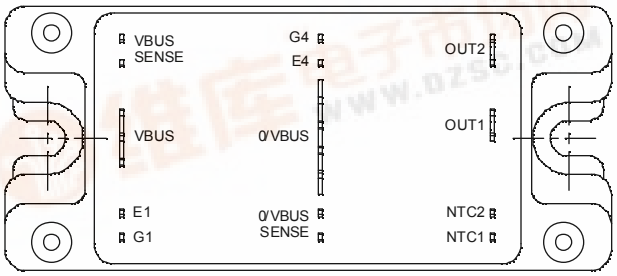
Microsemi
POWER PRODUCTS GROUP

APTGF50DH60TG

Asymmetrical - Bridge NPT IGBT Power Module

V_{CES} = 600V
I_C = 50A @ Tc = 80°C





Application

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

Features

- Non Punch Through (NPT) Fast IGBT®
  - Low voltage drop
  - Low tail current
  - Switching frequency up to 100 kHz
  - Soft recovery parallel diodes
  - Low diode VF
  - Low leakage current
  - Avalanche energy rated
  - RBSOA and SCSOA rated
- Kelvin emitter for easy drive
- Very low stray inductance
  - Symmetrical design
  - Lead frames for power connections
- Internal thermistor for temperature monitoring
- 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
- Solderable terminals both for power and signal for easy PCB mounting
- 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		600	V
I_C	Continuous Collector Current	T_C = 25°C	65	A
		T_C = 80°C	50	
I_{CM}	Pulsed Collector Current	T_C = 25°C	230	
V_{GE}	Gate – Emitter Voltage		±20	V
P_D	Maximum Power Dissipation	T_C = 25°C	250	W
RBSOA	Reverse Bias Safe Operating Area	T_j = 125°C	100A@500V	

CAUTION: These Devices are sensitive to Electrostatic Discharge. Proper Handing 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			250	µA
			T_j = 125°C			500	
$V_{CE(sat)}$	Collector Emitter Saturation Voltage	V_{GE} =15V, I_C = 50A	T_j = 25°C	1.7	2.0	2.45	V
			T_j = 125°C		2.2		
$V_{GE(th)}$	Gate Threshold Voltage	V_{GE} = V_{CE}, I_C = 1mA		4		6	V
I_{GES}	Gate – Emitter Leakage Current	V_{GE} = 20V, V_{CE} = 0V				400	nA

Dynamic Characteristics

Symbol	*Characteristic*	*Test Conditions*		*Min*	*Typ*	*Max*	*Unit*
C_{ies}	Input Capacitance	V_{GE} = 0V V_{CE} = 25V f = 1MHz			2200		pF
C_{oes}	Output Capacitance				323		
C_{res}	Reverse Transfer Capacitance				200		
Q_g	Total gate Charge	V_{GE} = 15V V_{Bus} = 300V I_C = 50A			166		nC
Q_{ge}	Gate – Emitter Charge				20		
Q_{gc}	Gate – Collector Charge				100		
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching (25°C) V_{GE} = 15V V_{Bus} = 400V I_C = 50A R_G = 2.7Ω			40		ns
T_r	Rise Time				9		
$T_{d(off)}$	Turn-off Delay Time				120		
T_f	Fall Time				12		
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching (125°C) V_{GE} = 15V V_{Bus} = 400V I_C = 50A R_G = 2.7Ω			42		ns
T_r	Rise Time				10		
$T_{d(off)}$	Turn-off Delay Time				130		
T_f	Fall Time				21		
E_{on}	Turn-on Switching Energy	V_{GE} = 15V V_{Bus} = 400V I_C = 50A R_G = 2.7Ω	T_j = 125°C		0.5		mJ
E_{off}	Turn-off Switching Energy		T_j = 125°C		1		

Diode ratings and characteristics

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 = 125°C			500	
I_F	DC Forward Current		Tc = 70°C		60		A
V_F	Diode Forward Voltage	I_F = 60A			1.6	1.8	V
		I_F = 120A			1.9		
		I_F = 60A	T_j = 125°C		1.4		
t_{rr}	Reverse Recovery Time	I_F = 60A V_R = 400V di/dt =200A/µs	T_j = 25°C		130		ns
			T_j = 125°C		170		
Q_{rr}	Reverse Recovery Charge		T_j = 25°C		220		nC
			T_j = 125°C		920		

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
$B_{25/85}$	T_{25} = 298.15 K		3952		K

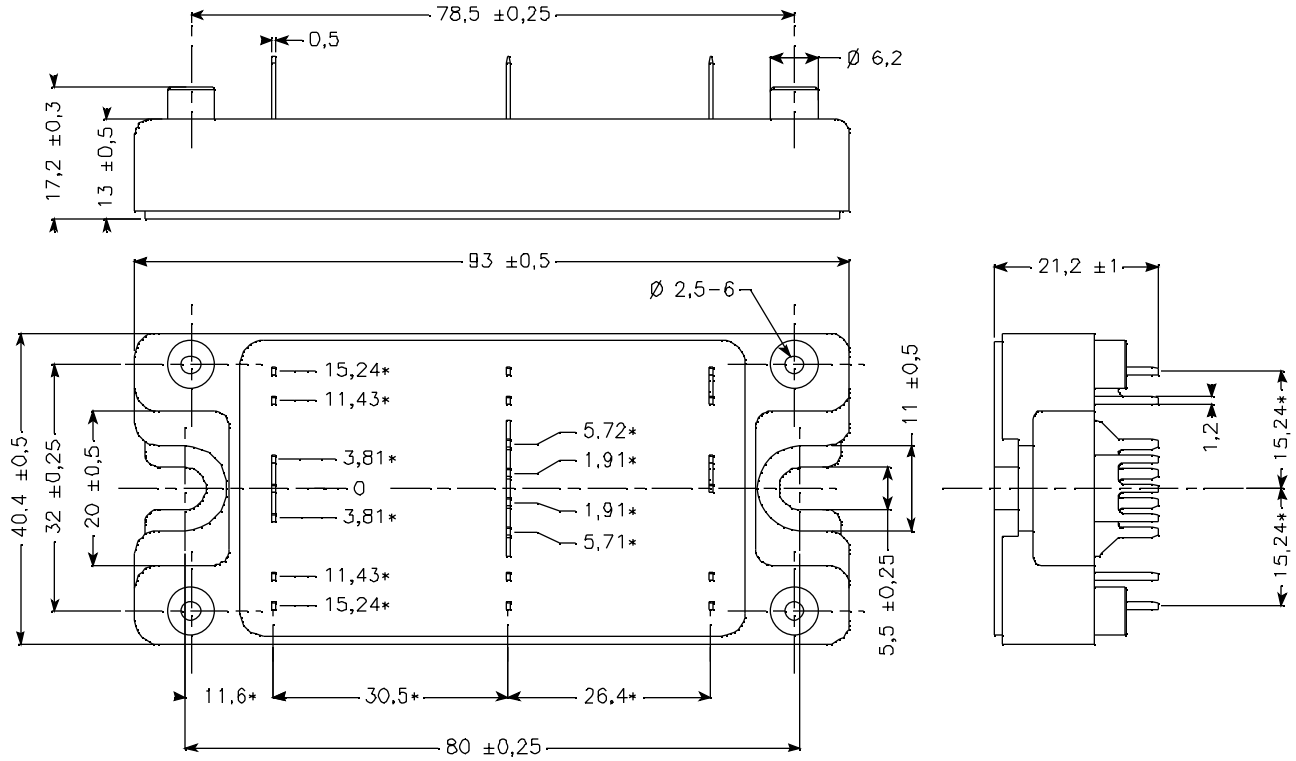
$$R_T = \frac{R_{25}}{\exp\left[B_{25/85}\left(\frac{1}{T_{25}} - \frac{1}{T}\right)\right]}$$

T: Thermistor temperature
R_T: Thermistor value at T

Thermal and package characteristics

Symbol	Characteristic			Min	Typ	Max	Unit
R_{thJC}	Junction to Case Thermal Resistance		IGBT			0.5	°C/W
			Diode			0.9	
V_{ISOL}	RMS Isolation Voltage, any terminal to case t =1 min, I isol<1mA, 50/60Hz			2500			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	M5	2.5		4.7	N.m
Wt	Package Weight					160	g

SP4 Package outline (dimensions in mm)

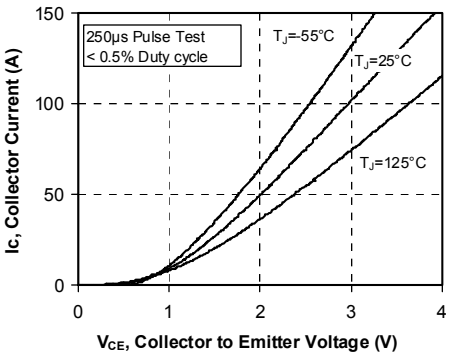


ALL DIMENSIONS MARKED " * " ARE TOLERENCED AS : ⌖Ø1

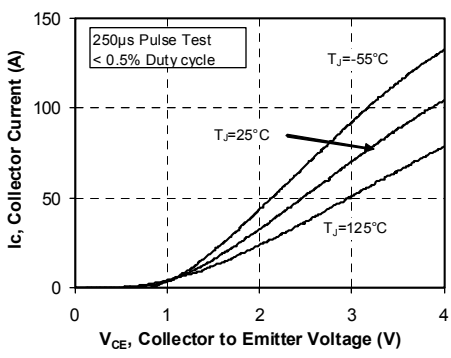
See application note APT0501 - Mounting Instructions for SP4 Power Modules on www.microsemi.com

Typical Performance Curve

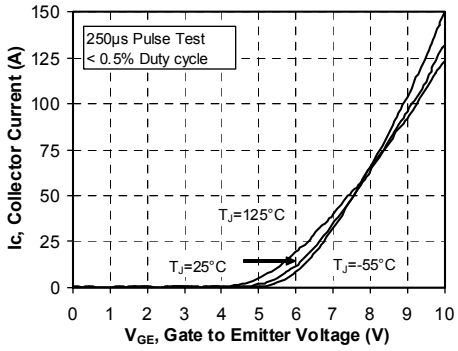
Output characteristics (V_{GE}=15V)



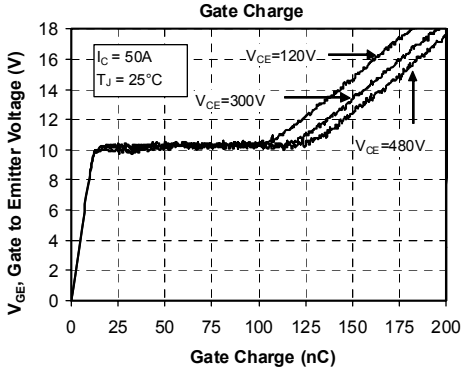
Output Characteristics (V_{GE}=10V)



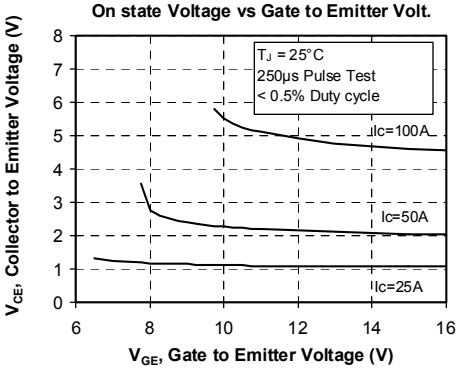
Transfer Characteristics



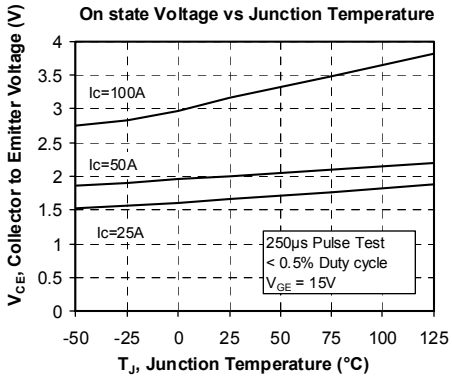
Gate Charge



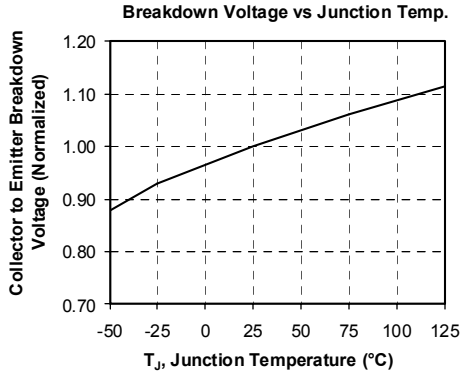
On state Voltage vs Gate to Emitter Volt.



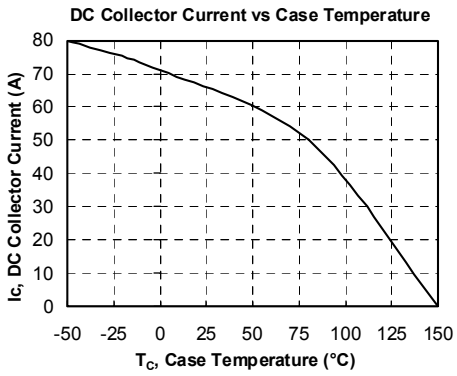
On state Voltage vs Junction Temperature



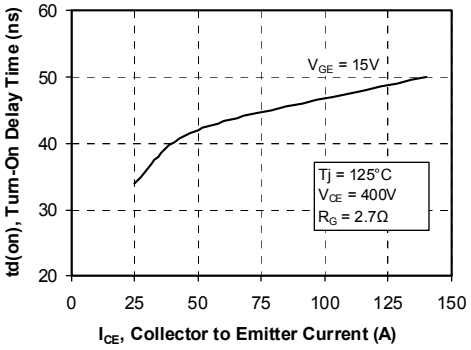
Breakdown Voltage vs Junction Temp.



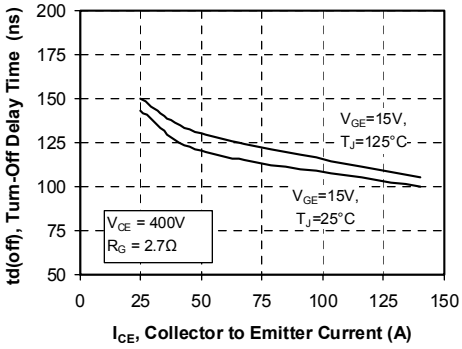
DC Collector Current vs Case Temperature



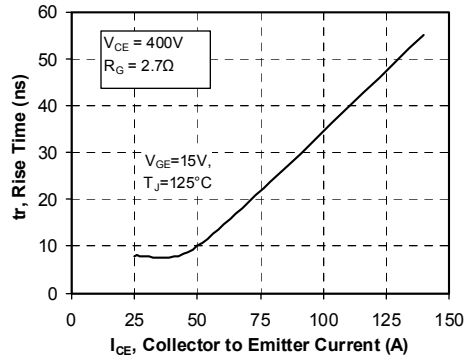
Turn-On Delay Time vs Collector Current



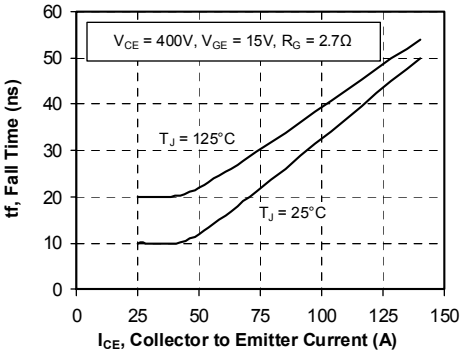
Turn-Off Delay Time vs Collector Current



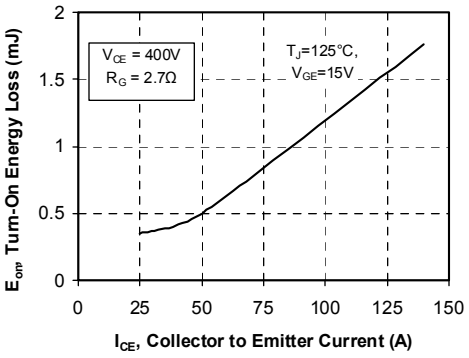
Current Rise Time vs Collector Current



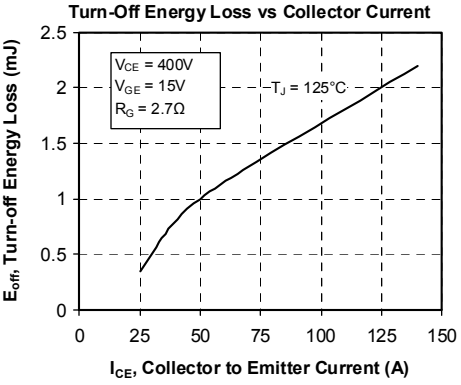
Current Fall Time vs Collector Current



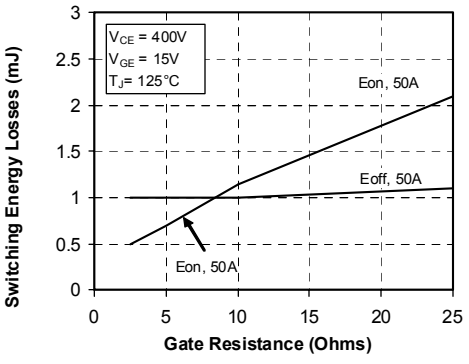
Turn-On Energy Loss vs Collector Current



Turn-Off Energy Loss vs Collector Current



Switching Energy Losses vs Gate Resistance



Reverse Bias Safe Operating Area