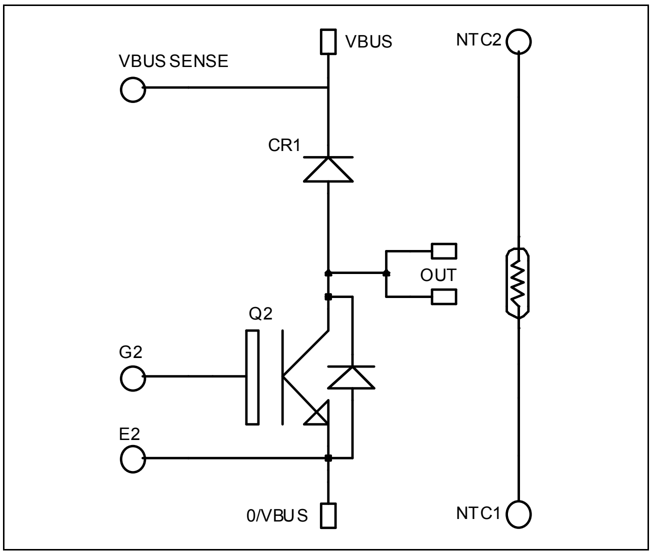
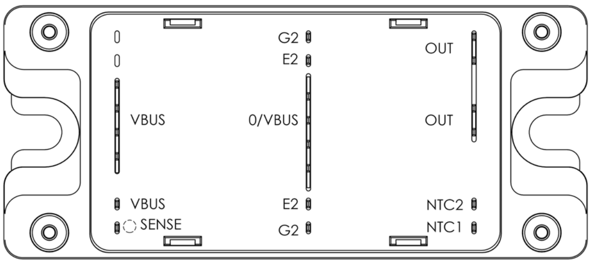
APTGF180DA60TG

Boost chopper NPT IGBT Power Module

V_{CES} = 600V
I_C = 180A @ Tc = 80°C





Application

- AC and DC motor control
- Switched Mode Power Supplies
- Power Factor Correction

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
  - 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 T_C of V_{CEsat}
- 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	220	A
		T_c = 80°C	180	
I_{CM}	Pulsed Collector Current	T_c = 25°C	630	
V_{GE}	Gate – Emitter Voltage		±20	V
P_D	Maximum Power Dissipation	T_c = 25°C	833	W
RBSOA	Reverse Bias Safe Operating Area	T_j = 150°C	400A @ 600V	

CAUTION: These Devices are sensitive to Electrostatic Discharge. Proper Handling Procedures Should Be Followed. See application note APT0502 on www.microsemi.com

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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			300	µA
			T_j = 125°C			1000	
$V_{CE(sat)}$	Collector Emitter saturation Voltage	V_{GE} =15V I_C = 180A	T_j = 25°C		2.0	2.5	V
			T_j = 125°C		2.2		
$V_{GE(th)}$	Gate Threshold Voltage	V_{GE} = V_{CE}, I_C = 2mA		3		5	V
I_{GES}	Gate – Emitter Leakage Current	V_{GE} = 20 V, V_{CE} = 0V				±200	nA

Dynamic Characteristics

Symbol	*Characteristic*	*Test Conditions*		*Min*	*Typ*	*Max*	*Unit*
C_{ies}	Input Capacitance	V_{GE} = 0V V_{CE} = 25V f = 1MHz			8.6		nF
C_{oes}	Output Capacitance				0.94		
C_{res}	Reverse Transfer Capacitance				0.8		
Q_g	Total gate Charge	V_{GS} = 15V V_{Bus} = 300V I_C = 180A			660		nC
Q_{ge}	Gate – Emitter Charge				580		
Q_{gc}	Gate – Collector Charge				400		
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching (25°C) V_{GE} = 15V V_{Bus} = 400V I_C = 180A R_G = 2.5 Ω			26		ns
T_r	Rise Time				25		
$T_{d(off)}$	Turn-off Delay Time				150		
T_f	Fall Time				30		
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching (125°C) V_{GE} = 15V V_{Bus} = 400V I_C = 180A R_G = 2.5 Ω			26		ns
T_r	Rise Time				25		
$T_{d(off)}$	Turn-off Delay Time				170		
T_f	Fall Time				40		
E_{on}	Turn-on Switching Energy	V_{GE} = 15V V_{Bus} = 400V I_C = 180A R_G = 2.5 Ω	T_j = 125°C		8.6		mJ
E_{off}	Turn-off Switching Energy		T_j = 125°C		7		

Chopper 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			350	µA
			T_j = 125°C			750	
I_F	DC Forward Current		T_c = 80°C		200		A
V_F	Diode Forward Voltage	I_F = 200A			1.6	1.8	V
		I_F = 400A			1.9		
		I_F = 200A	T_j = 125°C		1.4		
t_{rr}	Reverse Recovery Time	I_F = 200A V_R = 400V di/dt =400A/µs	T_j = 25°C		180		ns
			T_j = 125°C		220		
Q_{rr}	Reverse Recovery Charge		T_j = 25°C		780		nC
			T_j = 125°C		2900		

Thermal and package characteristics

Symbol	Characteristic			Min	Typ	Max	Unit
R_{thJC}	Junction to Case Thermal Resistance		IGBT			0.15	°C/W
			Diode			0.32	
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	M5	2.5		4.7	N.m
Wt	Package Weight					160	g

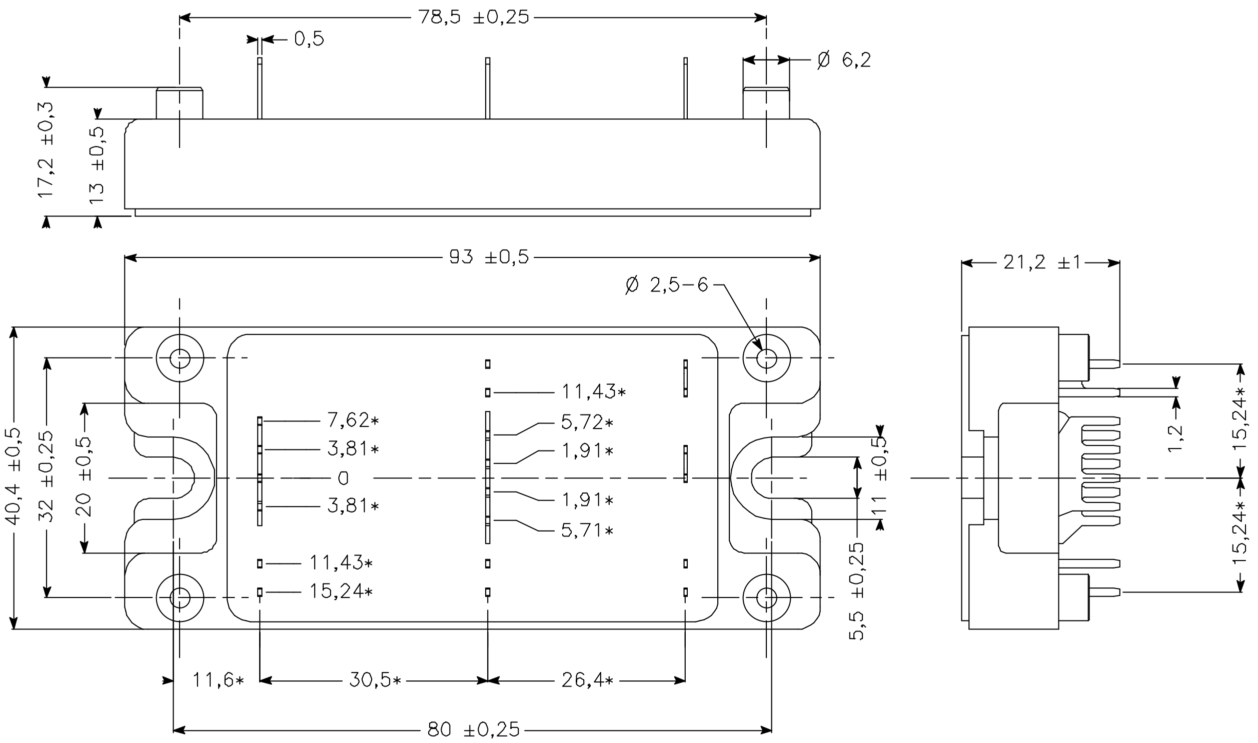
Temperature sensor NTC (see application note APT0406 on www.microsemi.com for more information).

Symbol	Characteristic	Min	Typ	Max	Unit
R_{25}	Resistance @ 25°C		50		kΩ
$B_{25/85}$	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

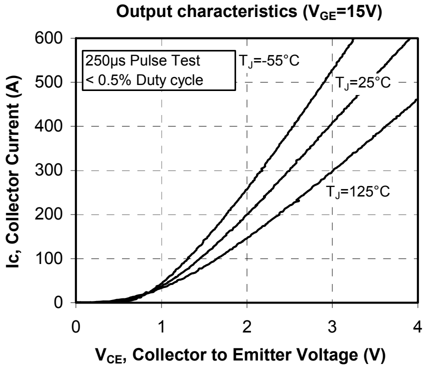
SP4 Package outline (dimensions in mm)

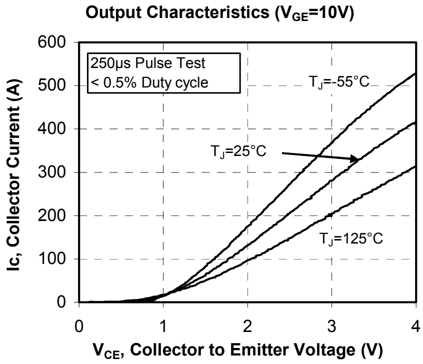


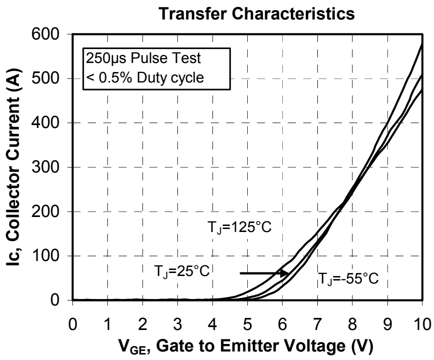
ALL DIMENSIONS MARKED " * " ARE TOLERENCED AS : ⊕ Ø1

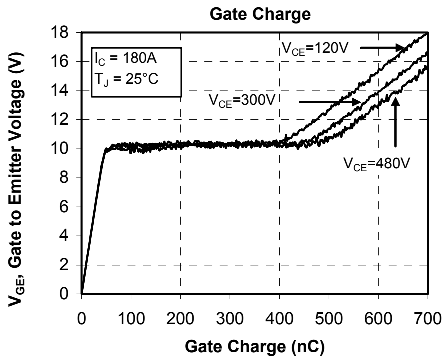
See application note APT0501 - Mounting Instructions for SP4 Power Modules on www.microsemi.com

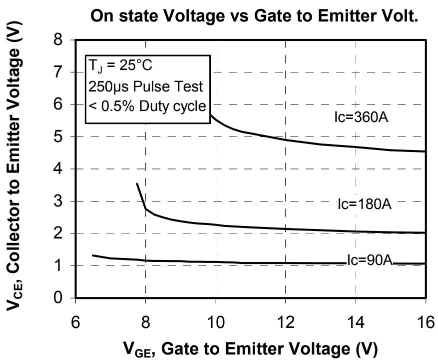
Typical Performance Curve

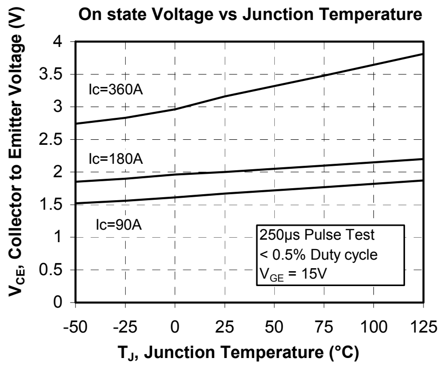


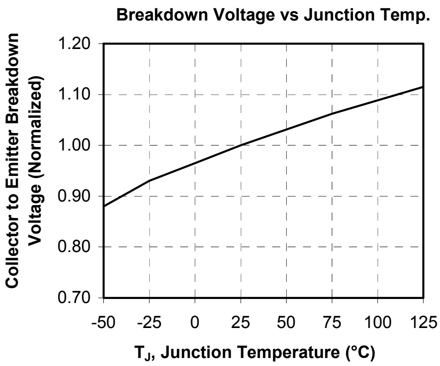


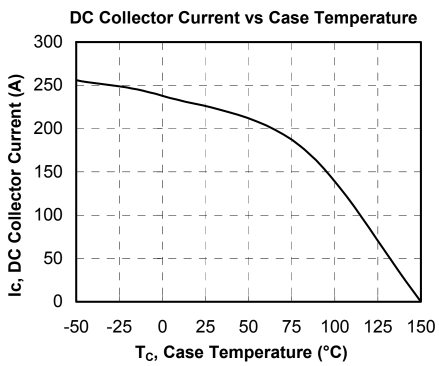




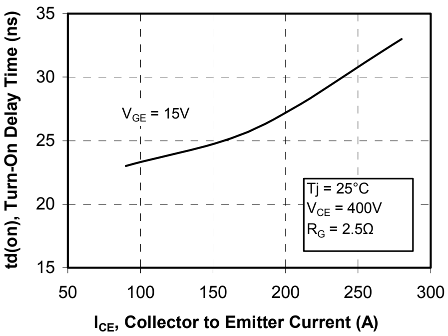




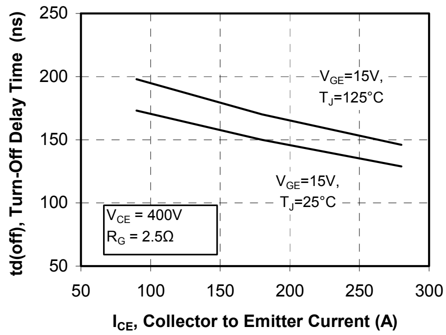




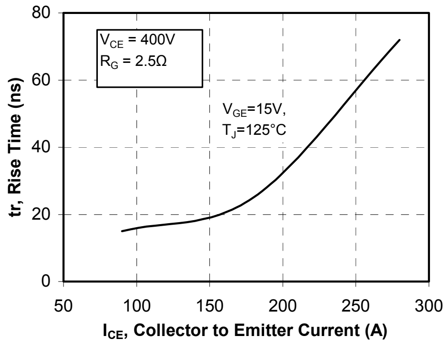
Turn-On Delay Time vs Collector Current



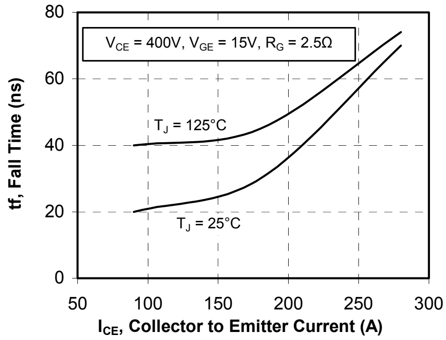
Turn-Off Delay Time vs Collector Current



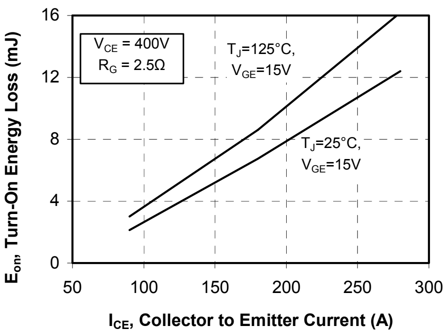
Current Rise Time vs Collector Current



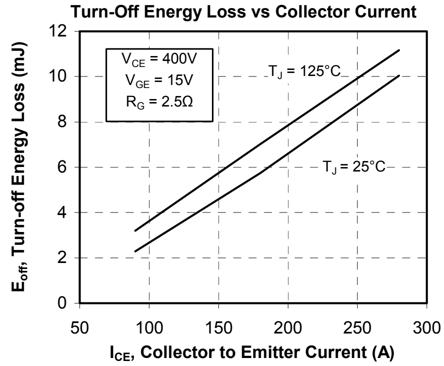
Current Fall Time vs Collector Current



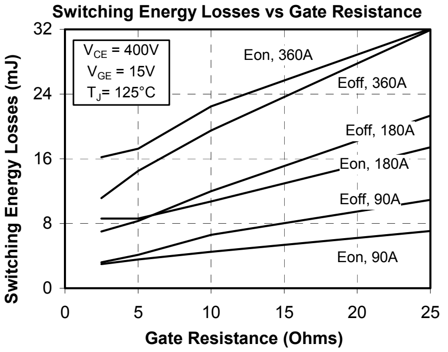
Turn-On Energy Loss vs Collector Current



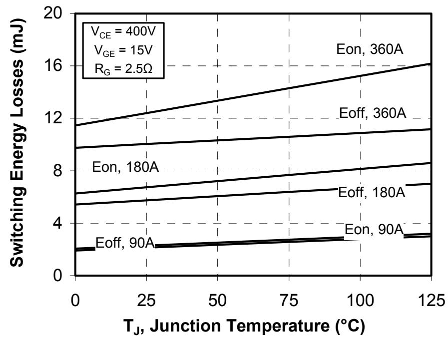
Turn-Off Energy Loss vs Collector Current

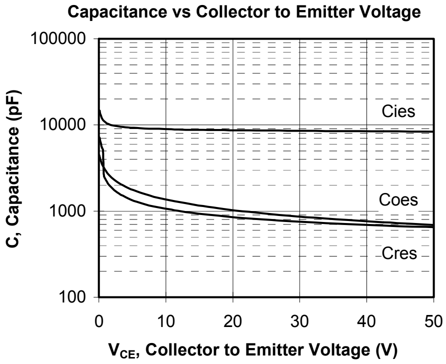


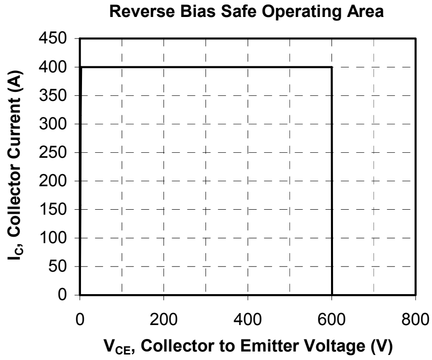
Switching Energy Losses vs Gate Resistance

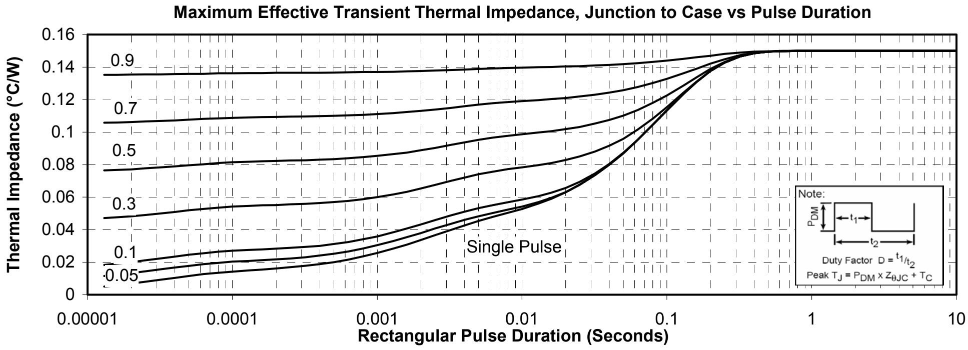


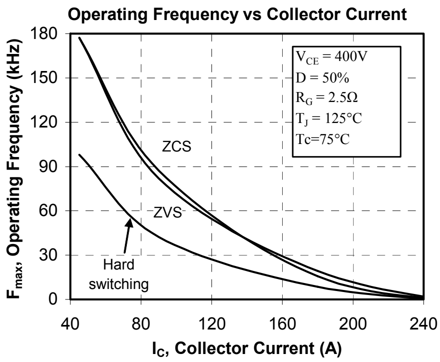
Switching Energy Losses vs Junction Temp.




Capacitance vs Collector to Emitter Voltage
C, Capacitance (pF)
100000
10000
1000
100
Cies
Coes
Cres
0
10
20
30
40
50
V_{CE}, Collector to Emitter Voltage (V)


Reverse Bias Safe Operating Area
I_C, Collector Current (A)
450
400
350
300
250
200
150
100
50
0
0
200
400
600
800
V_{CE}, Collector to Emitter Voltage (V)


Maximum Effective Transient Thermal Impedance, Junction to Case vs Pulse Duration
Thermal Impedance (°C/W)
0.16
0.14
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 $T_J = P_{DM} \times Z_{\theta JC} + T_C$
0.00001
0.0001
0.001
0.01
0.1
1
10
Rectangular Pulse Duration (Seconds)


Operating Frequency vs Collector Current
F_{max}, Operating Frequency (kHz)
180
150
120
90
60
30
0
V_{CE} = 400V
D = 50%
R_G = 2.5Ω
T_J = 125°C
Tc=75°C
ZCS
ZVS
Hard
switching
40
80
120
160
200
240
I_C, Collector Current (A)

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