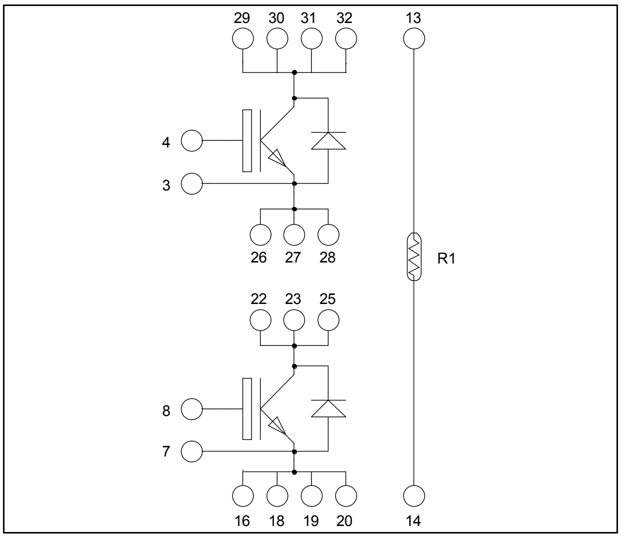
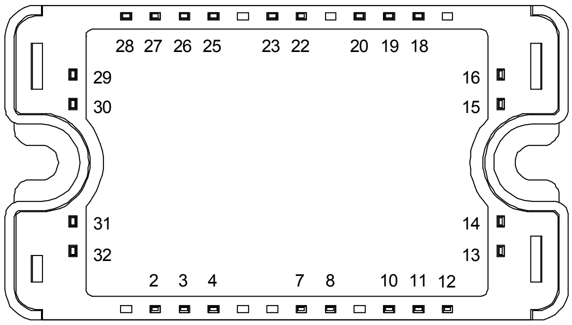
APTGF150A60T3AG

Phase leg
NPT IGBT Power Module
Power Module

V_{CES} = 600V
I_C = 150A @ Tc = 100°C





Pins 29/30/31/32 must be shorted together
Pins 26/27/28/22/23/25 must be shorted together to achieve a phase leg
Pins 16/18/19/20 must be shorted together

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 50 kHz
  - Soft recovery parallel diodes
  - Low diode VF
  - Low leakage current
  - RBSOA and SCSOA rated
- Very low stray inductance
- Kelvin emitter for easy drive
- Internal thermistor for temperature monitoring
- High level of integration
- AlN substrate for improved thermal performance

Benefits
- 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	230	A
		T_C = 100°C	150	
I_{CM}	Pulsed Collector Current	T_C = 25°C	400	
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 @ 480V	

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 = 200A	T_j = 25°C		2	2.5	V
			T_j = 125°C		2.2		
$V_{GE(th)}$	Gate Threshold Voltage	V_{GE} = V_{CE}, I_C = 1.5mA		4.5	5.5	6.5	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			9		nF
C_{res}	Reverse Transfer Capacitance				0.8		
Q_G	Gate charge	V_{GE}= 15V ; V_{CE}=300V, I_C=200A			480		nC
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching (25°C), V_{GE} = ±15V, V_{Bus} = 300V, I_C = 200A, R_G = 1.5Ω			25		ns
T_r	Rise Time				10		
$T_{d(off)}$	Turn-off Delay Time				130		
T_f	Fall Time				20		
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching (125°C), V_{GE} = ±15V, V_{Bus} = 300V, I_C = 200A, R_G = 1.5Ω			25		ns
T_r	Rise Time				11		
$T_{d(off)}$	Turn-off Delay Time				150		
T_f	Fall Time				30		
E_{on}	Turn-on Switching Energy	V_{GE} = ±15V, V_{Bus} = 300V, I_C = 200A, R_G = 1.5Ω	T_j = 125°C		2		mJ
E_{off}	Turn-off Switching Energy		T_j = 125°C		6		
I_{sc}	Short Circuit data	V_{GE} ≤15V ; V_{Bus} = 360V, t_p ≤ 10µs ; T_j = 125°C			900		A

Reverse 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			35	µA
			T_j = 125°C			600	
I_F	DC Forward Current		Tc = 100°C		120		A
V_F	Diode Forward Voltage	I_F = 120A			1.7	2.3	V
		I_F = 240A			2		
		I_F = 120A	T_j = 125°C		1.4		
t_{rr}	Reverse Recovery Time	I_F = 120A, V_R = 400V, di/dt =200A/µs	T_j = 25°C		70		ns
			T_j = 125°C		140		
Q_{rr}	Reverse Recovery Charge		T_j = 25°C		200		nC
			T_j = 125°C		1380		

Thermal and package characteristics

Symbol	Characteristic			Min	Typ	Max	Unit
R_{thJC}	Junction to Case Thermal Resistance		IGBT			0.15	°C/W
			Diode			0.36	
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	M4	2		3	N.m
Wt	Package Weight					110	g

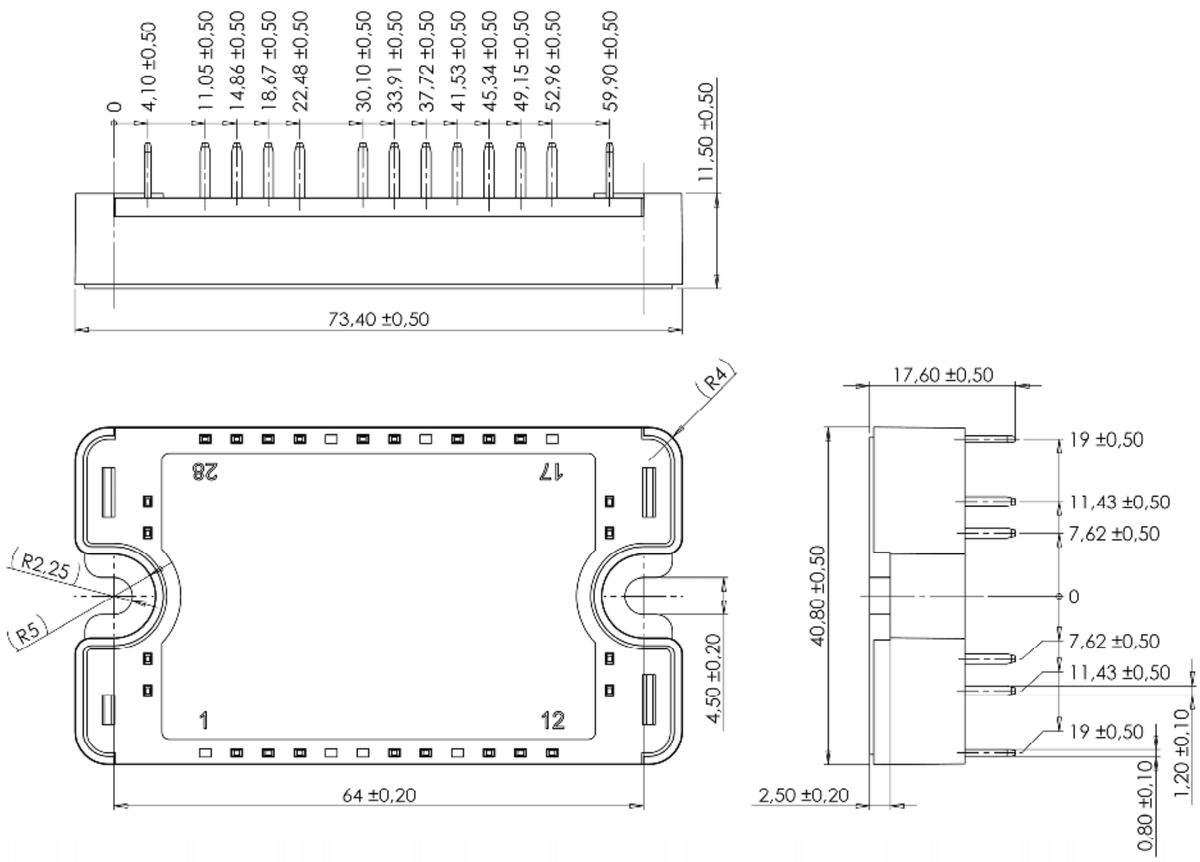
Temperature sensor NTC (see application note APT0406 on www.microsemi.com for more information).

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

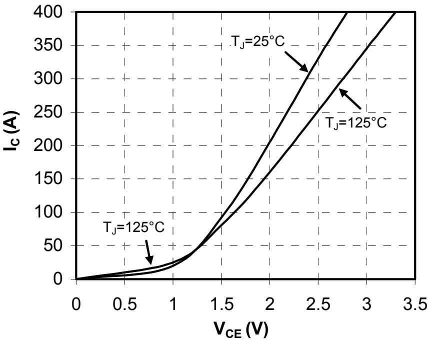
SP3 Package outline (dimensions in mm)



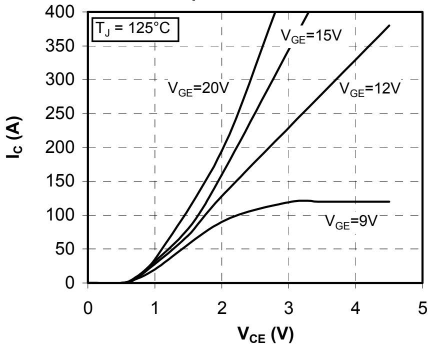
See application note 1901 - Mounting Instructions for SP3 Power Modules on www.microsemi.com

Typical Performance Curve

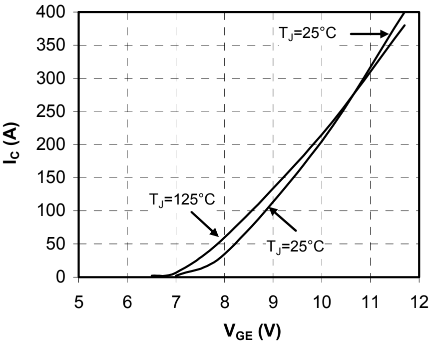
Output Characteristics (V_{GE}=15V)



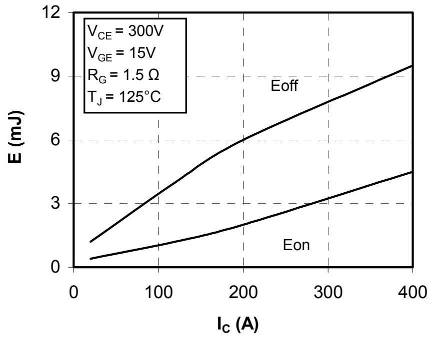
Output Characteristics



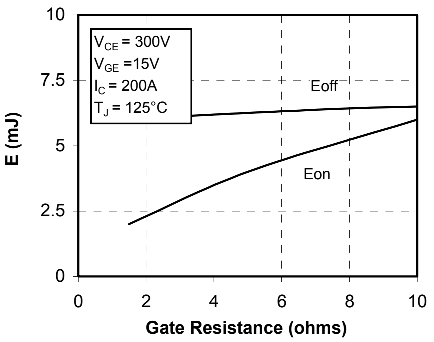
Transfert Characteristics



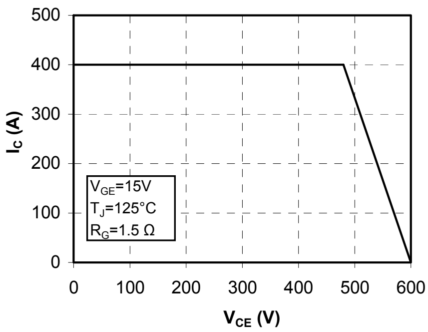
Energy losses vs Collector Current



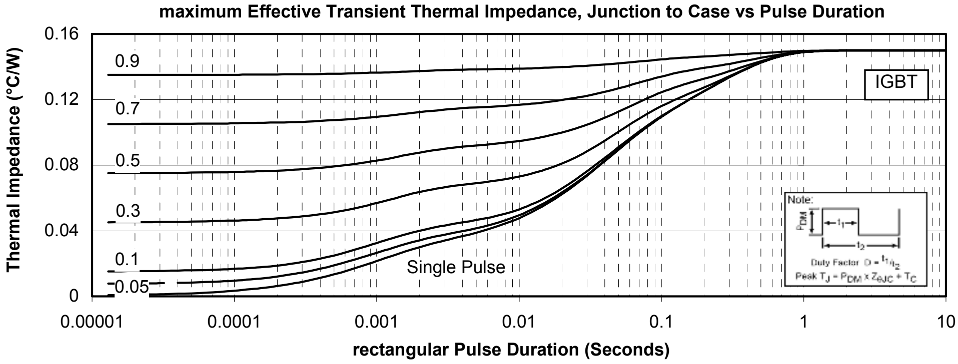
Switching Energy Losses vs Gate Resistance

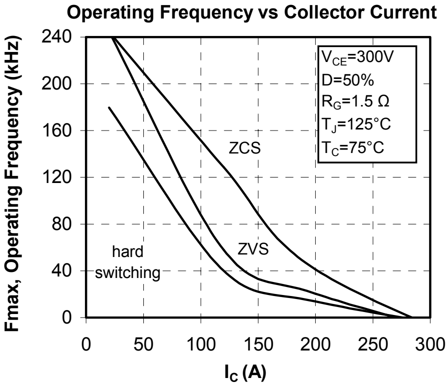


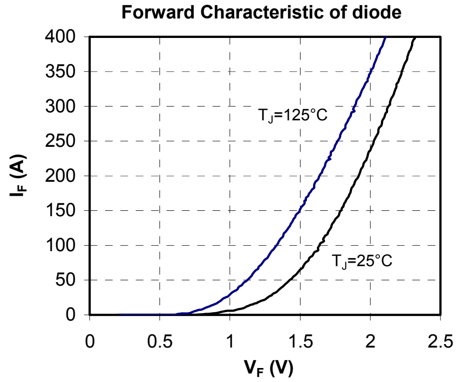
Reverse Bias Safe Operating Area

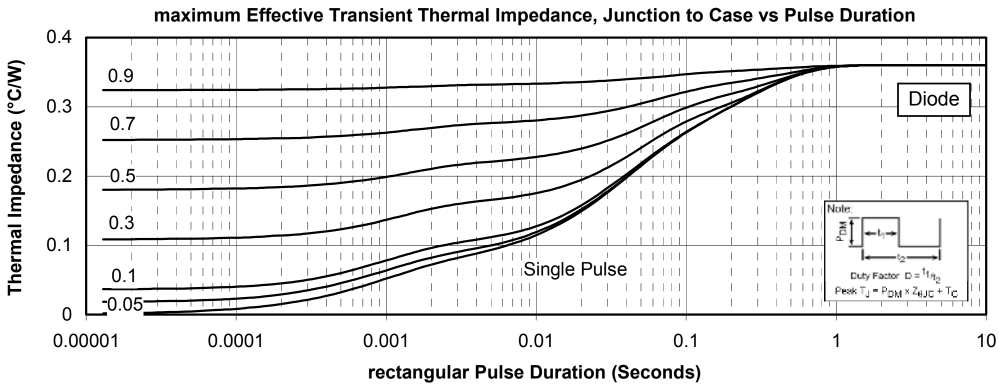


maximum Effective Transient Thermal Impedance, Junction to Case vs Pulse Duration




Operating Frequency vs Collector Current
Fmax, Operating Frequency (kHz)
240
200
160
120
80
40
0
0
50
100
150
200
250
300
IC (A)
VCE=300V
D=50%
RG=1.5 Ω
TJ=125°C
TC=75°C
ZCS
ZVS
hard
switching


Forward Characteristic of diode
IF (A)
400
350
300
250
200
150
100
50
0
0
0.5
1
1.5
2
2.5
VF (V)
TJ=125°C
TJ=25°C


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

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