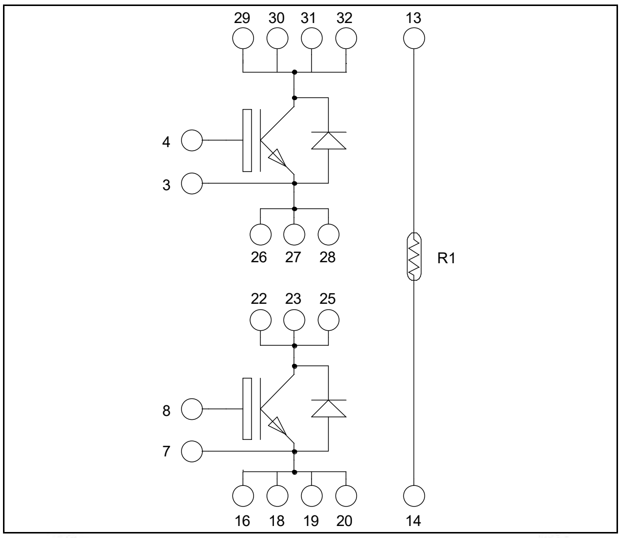
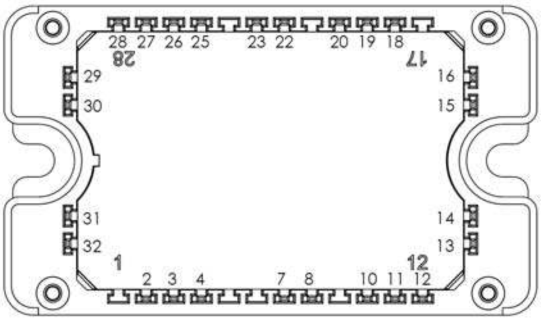
APTGT150A120T3AG

Phase leg
Trench + Field Stop IGBT3
Power Module

V_{CES} = 1200V
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

- **Trench + Field Stop IGBT3**
  - Low voltage drop
  - Low tail current
  - Switching frequency up to 20 kHz
  - Low leakage current
  - RBSOA and SCSOA rated
- Very low stray inductance
- Kelvin emitter for easy drive
- Internal thermistor for temperature monitoring
- 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

All ratings @ T_j = 25°C unless otherwise specified

Absolute maximum ratings (Per IGBT)

Symbol	*Parameter*		*Max ratings*	*Unit*
V_{CES}	Collector - Emitter Voltage		1200	V
I_C	Continuous Collector Current	T_C = 25°C	220	A
		T_C = 100°C	150	
I_{CM}	Pulsed Collector Current	T_C = 25°C	300	
V_{GE}	Gate – Emitter Voltage		±20	V
P_D	Power Dissipation	T_C = 25°C	833	W
RBSOA	Reverse Bias Safe Operating Area	T_j = 125°C	300A @ 1150V	

CAUTION: These Devices are sensitive to Electrostatic Discharge. Proper Handling Procedures Should Be Followed.

Electrical Characteristics (Per IGBT)

Symbol	Characteristic	Test Conditions		Min	Typ	Max	Unit
I_{CES}	Zero Gate Voltage Collector Current	$V_{GE} = 0V$, $V_{CE} = 1200V$				250	µA
$V_{CE(sat)}$	Collector Emitter Saturation Voltage	$V_{GE} = 15V$, $I_C = 150A$	$T_j = 25°C$		1.7	2.1	V
			$T_j = 125°C$		2.0		
$V_{GE(th)}$	Gate Threshold Voltage	$V_{GE} = V_{CE}$, $I_C = 3$ mA		5.0	5.8	6.5	V
I_{GES}	Gate – Emitter Leakage Current	$V_{GE} = 20V$, $V_{CE} = 0V$				400	nA

Dynamic Characteristics (Per IGBT)

Symbol	Characteristic	Test Conditions		Min	Typ	Max	Unit
C_{ies}	Input Capacitance	$V_{GE} = 0V$, $V_{CE} = 25V$, f = 1MHz			10.7		nF
C_{oes}	Output Capacitance				0.56		
C_{res}	Reverse Transfer Capacitance				0.48		
Q_G	Gate charge	$V_{GE}= \pm15V$; $V_{CE}=600V$, $I_C=150A$			1.4		µC
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching (25°C), $V_{GE} = \pm15V$, $V_{Bus} = 600V$, $I_C = 150A$, $R_G = 2.2\Omega$			280		ns
T_r	Rise Time				40		
$T_{d(off)}$	Turn-off Delay Time				420		
T_f	Fall Time				75		
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching (125°C), $V_{GE} = \pm15V$, $V_{Bus} = 600V$, $I_C = 150A$, $R_G = 2.2\Omega$			290		ns
T_r	Rise Time				45		
$T_{d(off)}$	Turn-off Delay Time				520		
T_f	Fall Time				90		
E_{on}	Turn-on Switching Energy	$V_{GE} = \pm15V$, $V_{Bus} = 600V$, $I_C = 150A$, $R_G = 2.2\Omega$	$T_j = 125°C$		14		mJ
E_{off}	Turn-off Switching Energy		$T_j = 125°C$		16		
I_{sc}	Short Circuit data	$V_{GE} \leq 15V$; $V_{Bus} = 900V$, $t_p \leq 10\mu s$; $T_j = 125°C$			600		A
R_{thJC}	Junction to Case Thermal Resistance					0.15	°C/W

Reverse diode ratings and characteristics (Per diode)

Symbol	Characteristic	Test Conditions		Min	Typ	Max	Unit
V_{RRM}	Peak Repetitive Reverse Voltage					1200	V
I_{RM}	Reverse Leakage Current	$V_R=1200V$				350	µA
I_F	DC Forward Current		Tc = 80°C		150		A
V_F	Diode Forward Voltage	$I_F = 150A$, $V_{GE} = 0V$	$T_j = 25°C$		1.6	2.1	V
			$T_j = 125°C$		1.6		
t_{rr}	Reverse Recovery Time	$I_F = 150A$, $V_R = 600V$, di/dt =2500A/µs	$T_j = 25°C$		170		ns
			$T_j = 125°C$		280		
Q_{rr}	Reverse Recovery Charge		$T_j = 25°C$		14		µC
			$T_j = 125°C$		28		
E_r	Reverse Recovery Energy		$T_j = 25°C$		6		mJ
			$T_j = 125°C$		11		
R_{thJC}	Junction to Case Thermal Resistance					0.25	°C/W

Thermal and package characteristics

Symbol	Characteristic			Min	Max	Unit
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_{JOP}	Recommended junction temperature under switching conditions			-40	$T_J$max -25	°C
T_{STG}	Storage Temperature Range			-40	125	°C
T_C	Operating Case Temperature			-40	125	°C
Torque	Mounting torque	To heatsink	M4	2	3	N.m
Wt	Package Weight				110	g

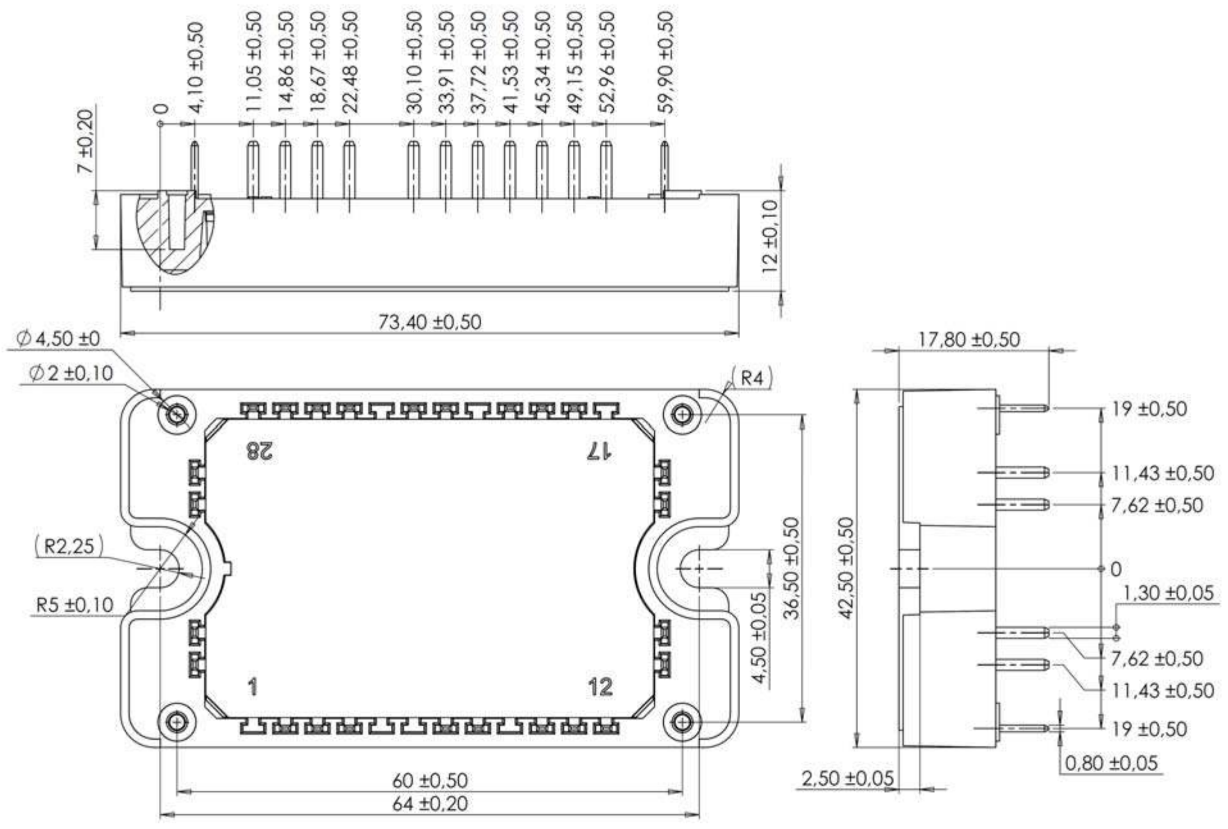
Temperature sensor NTC (see application note APT0406 on www.microsemi.com for more information).

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

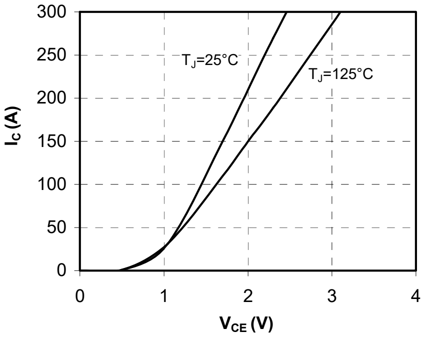
Package outline (dimensions in mm)



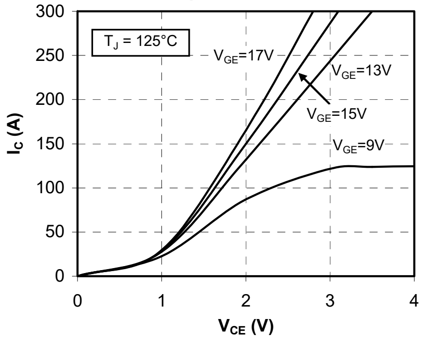
See application note 1906 - Mounting Instructions for SP3F Power Modules on www.microsemi.com

Typical Performance Curve

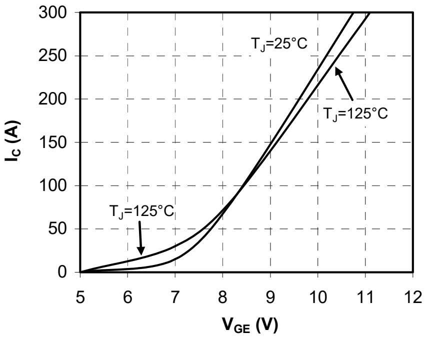
Output Characteristics (V_{GE}=15V)



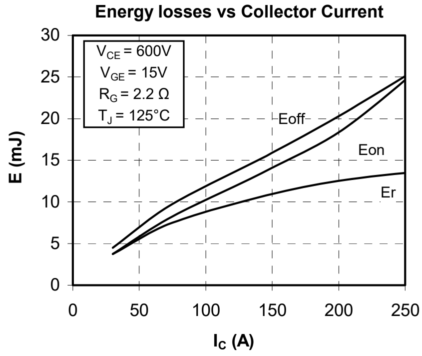
Output Characteristics



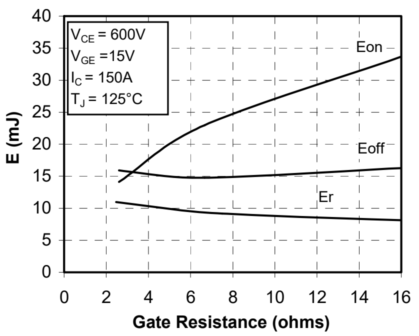
Transfert Characteristics



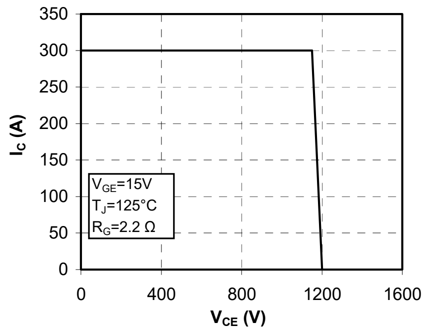
Energy losses vs Collector Current



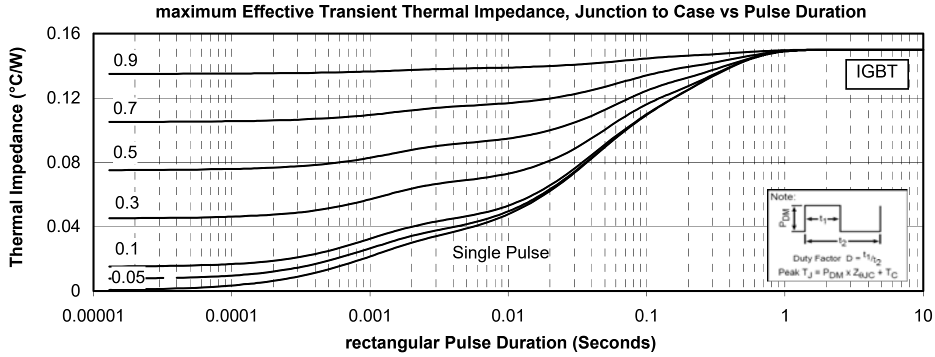
Switching Energy Losses vs Gate Resistance

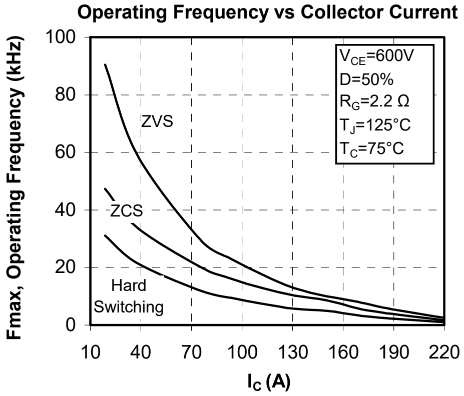


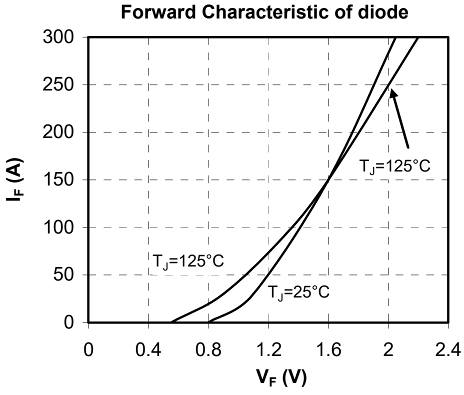
Reverse Bias Safe Operating Area

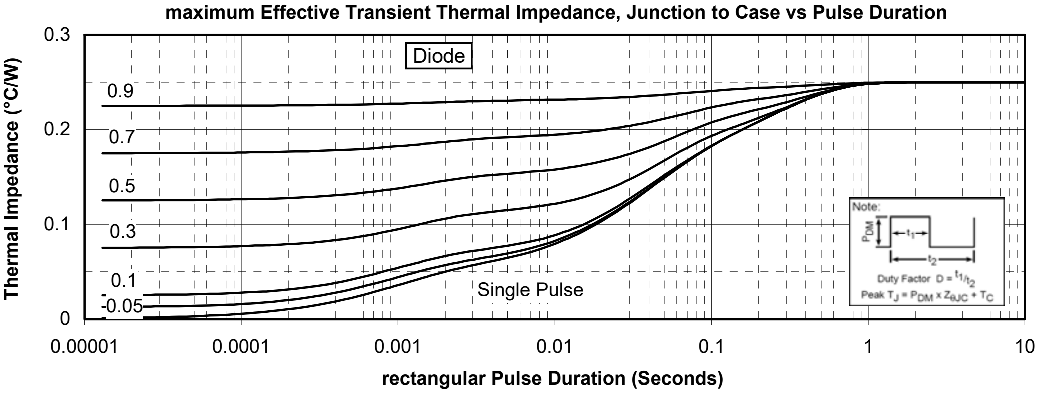


maximum Effective Transient Thermal Impedance, Junction to Case vs Pulse Duration




Operating Frequency vs Collector Current
V_{CE}=600V
D=50%
R_G=2.2 Ω
T_J=125°C
T_C=75°C
ZVS
ZCS
Hard
Switching
Fmax, Operating Frequency (kHz)
I_C (A)


Forward Characteristic of diode
T_J=125°C
T_J=125°C
T_J=25°C
I_F (A)
V_F (V)


maximum Effective Transient Thermal Impedance, Junction to Case vs Pulse Duration
Diode
0.9
0.7
0.5
0.3
0.1
0.05
Single Pulse
Thermal Impedance (°C/W)
rectangular Pulse Duration (Seconds)

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