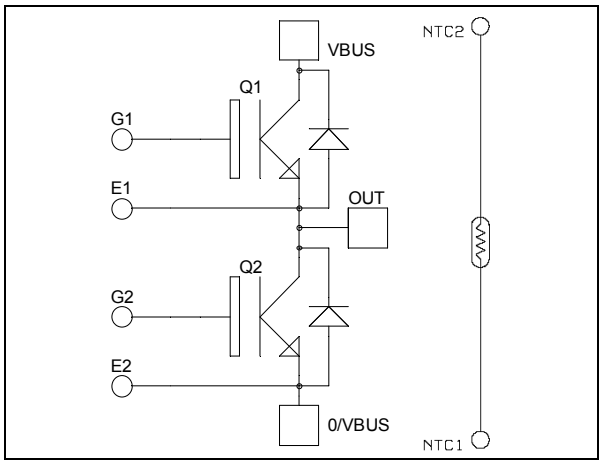
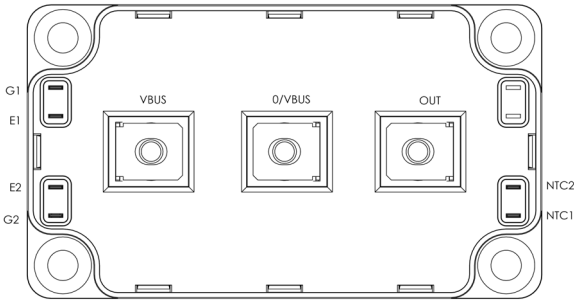
APTGLQ600A65T6G

Phase leg
High speed Trench + Field Stop IGBT4
Power module

V_{CES} = 650V
I_C = 600A* @ Tc = 60°C





Application

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

Features

- High speed Trench + Field Stop IGBT 4 Technology
  - Low voltage drop
  - Low leakage current
  - Low switching losses
  - Soft recovery parallel diodes
  - Low diode VF
  - RBSOA and SCSOA rated
- Kelvin source for easy drive
- Very low stray inductance
- M5 power connectors
- High level of integration
- Internal thermistor for temperature monitoring

Benefits

- Stable temperature behavior
- Very rugged
- Direct mounting to heatsink (isolated package)
- Low junction to case thermal resistance
- Easy paralleling due to positive TC of VCEsat
- 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		650	V
I_C	Continuous Collector Current	T_C = 25°C	770*	A
		T_C = 60°C	600*	
I_{CM}	Pulsed Collector Current	T_C = 25°C	1500	
V_{GE}	Gate – Emitter Voltage		±20	V
P_D	Maximum Power Dissipation	T_C = 25°C	2000	W
RBSOA	Reverse Bias Safe Operating Area	T_j = 125°C	1200A @ 600V	

* Specification of device but current must be limited due to size of power connectors.

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

Electrical Characteristics (per IGBT)

Symbol	Characteristic	Test Conditions		Min	Typ	Max	Unit
I_{CES}	Zero Gate Voltage Collector Current	V_{GE} = 0V, V_{CE} = 650V				600	µA
$V_{CE(sat)}$	Collector Emitter saturation Voltage	V_{GE} = 15V I_C = 600A	T_j = 25°C		1.85	2.3	V
			T_j = 150°C		2.2		
$V_{GE(th)}$	Gate Threshold Voltage	V_{GE} = V_{CE} , I_C = 3.2 mA		4.2	5.1	5.6	V
I_{GES}	Gate – Emitter Leakage Current	V_{GE} = 20V, V_{CE} = 0V				1	µA

Dynamic Characteristics (per IGBT)

Symbol	Characteristic	Test Conditions		Min	Typ	Max	Unit
C_{ies}	Input Capacitance	V_{GE} = 0V V_{CE} = 25V f = 1MHz			36.6		nF
C_{oes}	Output Capacitance				1.3		
C_{res}	Reverse Transfer Capacitance				1.08		
Q_G	Gate charge	V_{GE} = 15V ; V_{CE} = 480V I_C = 600A			3500		nC
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching (25°C) V_{GE} = ±15V V_{CE} = 400V I_C = 600A R_G = 0.6Ω			19		ns
T_r	Rise Time				33		
$T_{d(off)}$	Turn-off Delay Time				197		
T_f	Fall Time				21		
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching (150°C) V_{GE} = ±15V V_{CE} = 400V I_C = 600A R_G = 0.6Ω			19		ns
T_r	Rise Time				29		
$T_{d(off)}$	Turn-off Delay Time				227		
T_f	Fall Time				22		
E_{on}	Turn-on Switching Energy	V_{GE} = ±15V V_{CE} = 400V I_C = 600A R_G = 0.6Ω	T_J = 25°C		12		mJ
			T_J = 150°C		14.7		
E_{off}	Turn-off Switching Energy		T_J = 25°C		11.2		mJ
			T_J = 150°C		12		
I_{sc}	Short Circuit data	V_{GE} ≤15V ; V_{Bus} = 600V t_p ≤10µs ; T_j = 150°C			3900		A
R_{thJC}	Junction to Case Thermal Resistance					0.075	°C/W

Diode ratings and characteristics (per diode)

Symbol	Characteristic	Test Conditions		Min	Typ	Max	Unit
V_{RRM}	Repetitive Reverse Voltage					650	V
I_{RM}	Reverse Leakage Current	V_R = 650V				300	µA
I_F	DC Forward Current		T_c = 25°C		600		A
V_F	Diode Forward Voltage	I_F = 600A V_{GE} = 0V	T_j = 25°C		1.6	2	V
			T_j = 150°C		1.5		
t_{rr}	Reverse Recovery Time	I_F = 600A V_R = 400V di/dt = 7000A/µs	T_j = 25°C		125		ns
			T_j = 150°C		220		
Q_{rr}	Reverse Recovery Charge		T_j = 25°C		28.1		µC
			T_j = 150°C		59.3		
E_r	Reverse Recovery Energy		T_j = 25°C		6.6		mJ
			T_j = 150°C		14.4		
R_{thJC}	Junction to Case Thermal Resistance					0.13	°C/W

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

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		%

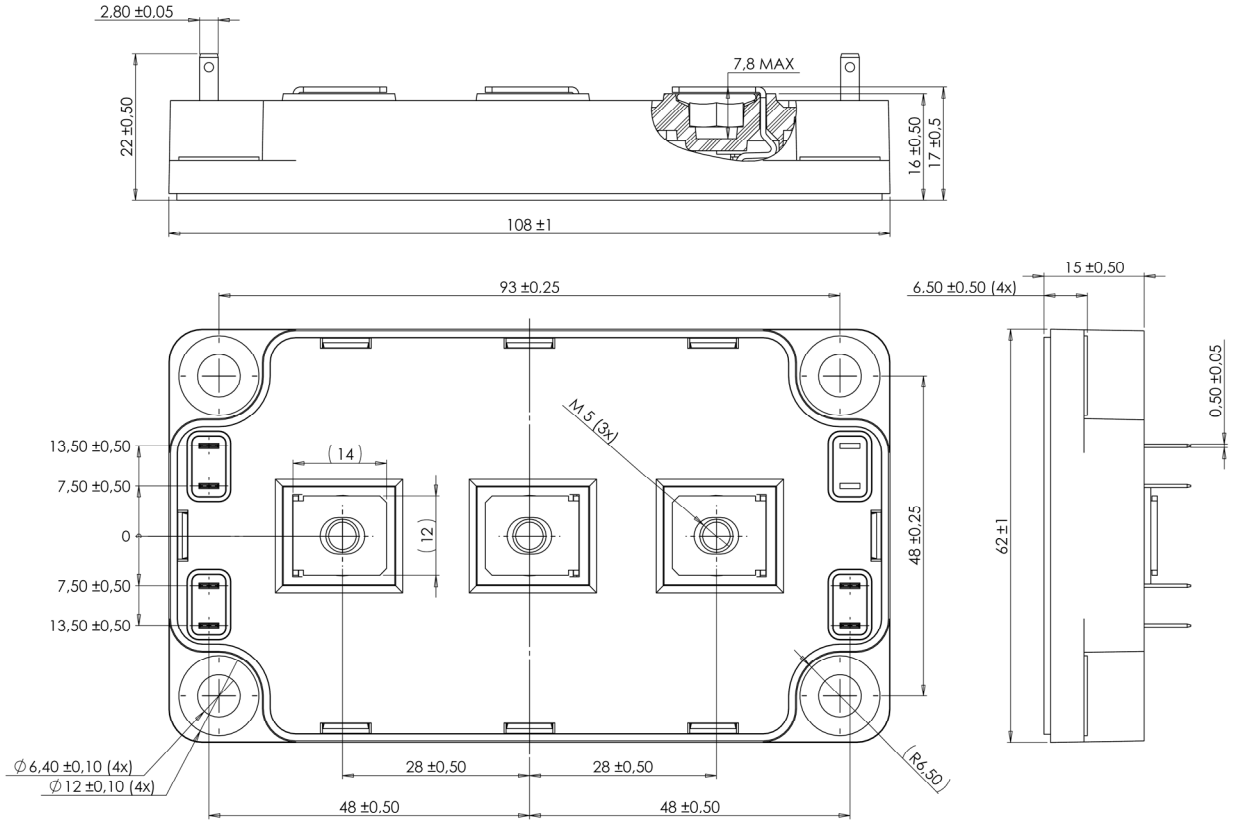
$$R_T = \frac{R_{25}}{\exp\left[B_{25/85}\left(\frac{1}{T_{25}} - \frac{1}{T}\right)\right]}$$

T: Thermistor temperature
R_T: Thermistor value at T

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	175	°C
T_{JOP}	Recommended junction temperature under switching conditions			-40	$T_J$max -25	
T_{STG}	Storage Temperature Range			-40	125	
T_C	Operating Case Temperature			-40	100	
Torque	Mounting torque	To Heatsink	M6	3	5	N.m
		For teminals	M5	2	3.5	
Wt	Package Weight				300	g

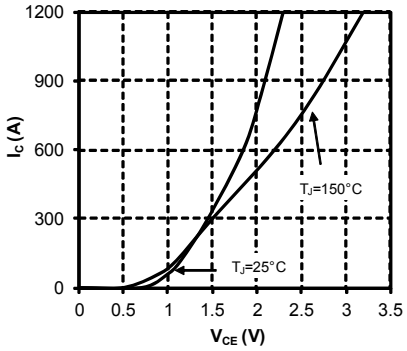
SP6 Package outline (dimensions in mm)



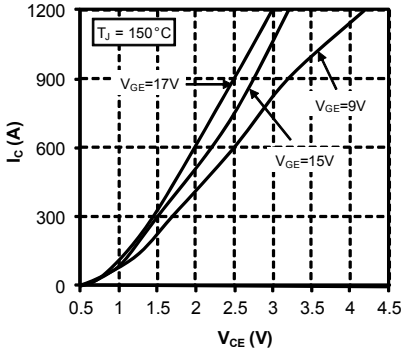
See application note APT0601 - Mounting Instructions for SP6 Power Modules on www.microsemi.com

Typical Performance Curve

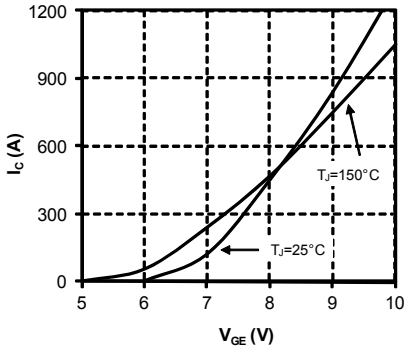
Output Characteristics (V_{GE}=15V)



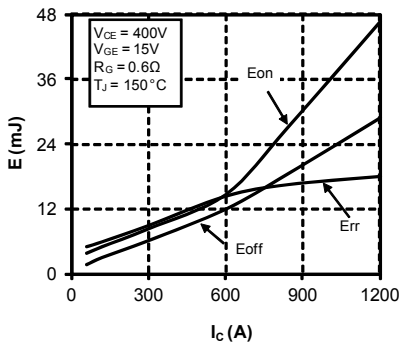
Output Characteristics



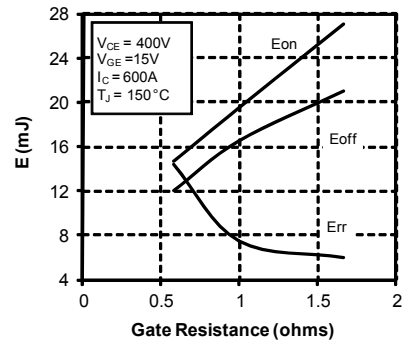
Transfert Characteristics



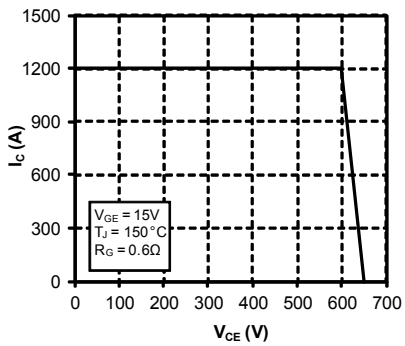
Energy losses vs Collector Current



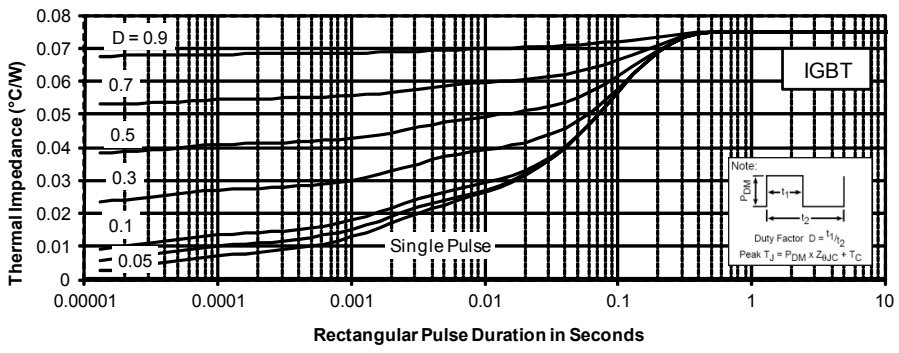
Switching Energy Losses vs Gate Resistance

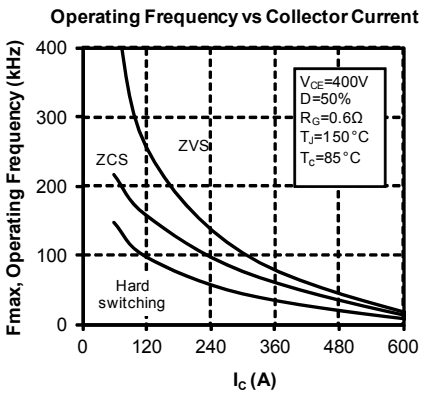


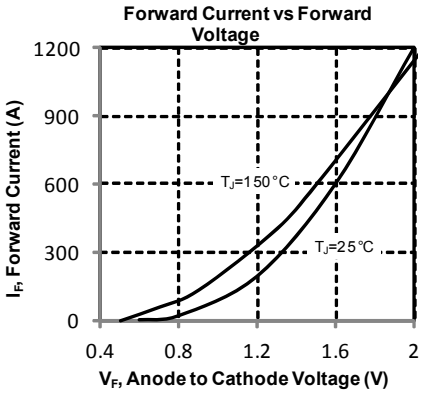
Reverse Bias Safe Operating Area

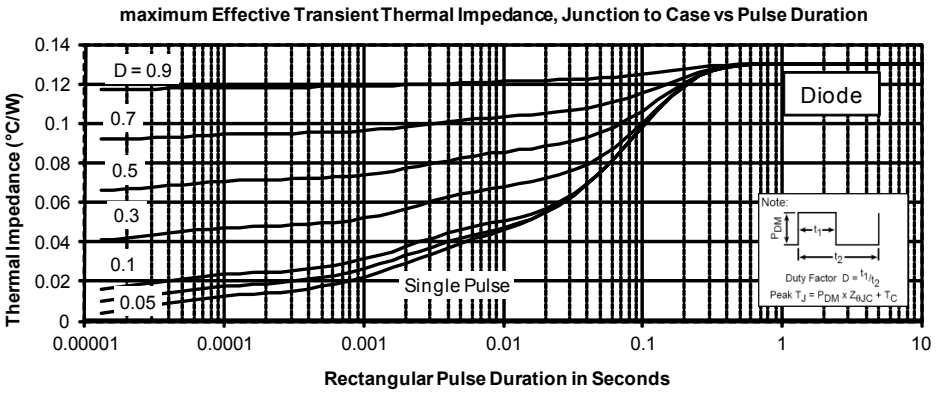


maximum Effective Transient Thermal Impedance, Junction to Case vs Pulse Duration




Operating Frequency vs Collector Current
Fmax, Operating Frequency (kHz)
400
300
200
100
0
0
120
240
360
480
600
I_C (A)
V_{CE}=400V
D=50%
R_G=0.6Ω
T_J=150°C
T_C=85°C
ZCS
ZVS
Hard switching


Forward Current vs Forward Voltage
I_F, Forward Current (A)
1200
900
600
300
0
0.4
0.8
1.2
1.6
2
V_F, Anode to Cathode Voltage (V)
T_J=150°C
T_J=25°C


maximum Effective Transient Thermal Impedance, Junction to Case vs Pulse Duration
Thermal Impedance (°C/W)
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
0.00001
0.0001
0.001
0.01
0.1
1
10
Rectangular Pulse Duration in Seconds
D = 0.9
0.7
0.5
0.3
0.1
0.05
Single Pulse
Diode
Note:
Duty Factor D = t_1/t_2
Peak T_J = P_{DM} x $Z_{\theta JC}$ + T_C

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