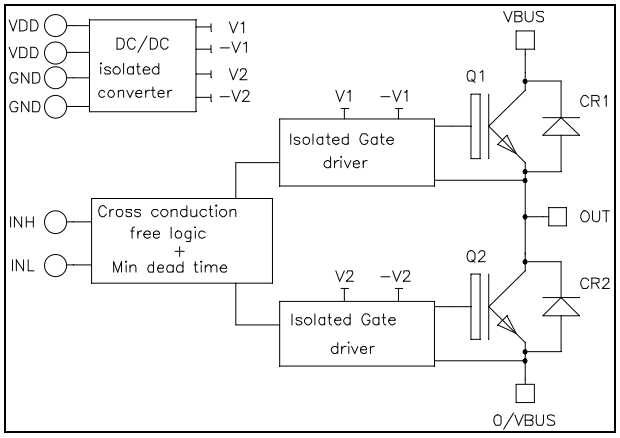
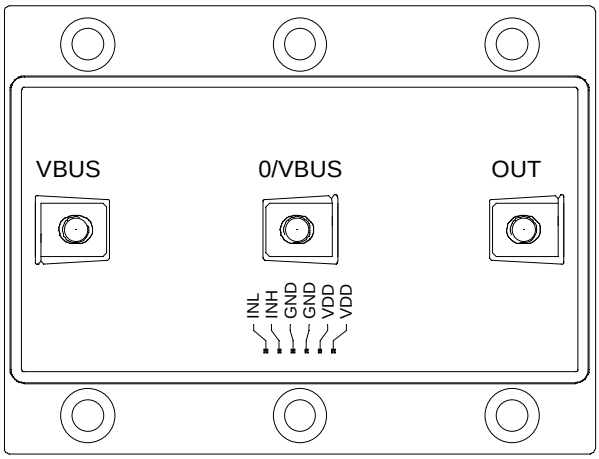
APTLGT400A608G

Phase leg Intelligent Power Module

V_{CES} = 600V
I_C = 400A @ Tc = 80°C





Application

- Motor control
- Uninterruptible Power Supplies
- Switched Mode Power Supplies
- Amplifier

Features

- ***Non Punch Through (NPT) FAST IGBT***
  - Low voltage drop
  - Low tail current
  - Soft recovery parallel diodes
  - Low diode VF
  - Low leakage current
  - RBSOA & SCSOA rated

- ***Integrated Fail Safe IGBT Protection (Driver)***
  - Top Bottom input signals Interlock
  - Isolated DC/DC Converter

- Low stray inductance
- M5 power connectors
- 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
- Very high noise immunity
  (common mode rejection > 25kV/µs)
- Galvanic Isolation: 3750V for the optocoupler
  2500V for the transformer
- 5V logic level with Schmitt-trigger Input
- Single V_{DD}=5V supply required
- Secondary auxiliary power supplies internally generated (15V, -6V)
- Optocoupler qualified to AEC-Q100 test quidelines
- RoHS compliant

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

1. Inverter Power Module

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	600	A
		T_C = 80°C	400	
I_{CM}	Pulsed Collector Current	T_C = 25°C	800	
P_D	Maximum Power Dissipation	T_C = 25°C	1250	W
RBSOA	Reverse Bias Safe Operating Area	T_j = 150°C	800A@550V	

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			0.3	mA
			T_j = 150°C			1	
$V_{CE(sat)}$	Collector Emitter Saturation Voltage	V_{DD} = V_{IN} = 5V I_C = 400A	T_j = 25°C		1.5	1.9	V
			T_j = 150°C		1.7		

Dynamic Characteristics

Symbol	*Characteristic*	*Test Conditions*	*Min*	*Typ*	*Max*	*Unit*
C_{ies}	Input Capacitance	V_{GE} = 0V V_{CE} = 25V f = 1MHz		24		nF
C_{oes}	Output Capacitance			1.6		
C_{res}	Reverse Transfer Capacitance			0.8		
T_r	Rise Time	Inductive Switching (25°C) V_{DD} = V_{IN} = 5V V_{Bus} = 300V ; I_C = 400A		45		ns
T_f	Fall Time			55		
T_r	Rise Time	Inductive Switching (125°C) V_{DD} = V_{IN} = 5V V_{Bus} = 300V I_C = 400A		25		ns
T_f	Fall Time			70		
E_{on}	Turn-on Switching Energy			3.5		mJ
E_{off}	Turn-off Switching Energy			14		
I_{sc}	Short Circuit data	V_{DD} = V_{IN} = 5V; V_{Bus} =360V $t_p \leq 6\mu s$; T_j = 150°C		2000		A
R_{thJC}	Junction to Case thermal resistance				0.12	°C/W

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			350	µA
			T_j = 150°C			500	
I_F	DC Forward Current		Tc = 80°C		400		A
V_F	Diode Forward Voltage	I_F = 400A	T_j = 25°C		1.6	2	V
			T_j = 150°C		1.5		
t_{rr}	Reverse Recovery Time	I_F = 400A V_R = 300V di/dt =4800A/µs	T_j = 25°C		125		ns
			T_j = 150°C		220		
Q_{rr}	Reverse Recovery Charge		T_j = 25°C		19		µC
			T_j = 150°C		40		
E_{rr}	Reverse Recovery Energy		T_j = 25°C		4.4		mJ
			T_j = 150°C		9.6		
R_{thJC}	Junction to Case thermal resistance					0.20	°C/W

2. Driver

Absolute maximum ratings

Symbol	Parameter		Max ratings	Unit
V_{DD}	Supply Voltage		5.5	V
V_{INi}	Input signal voltage i=L, H		5.5	
I_{VDDmax}	Maximum Supply current	V_{INi} = 0V, i =L & H	0.35	A
		V_{DD}=5V, V_{INH} = /V_{INL} ; F_{out} = 45kHz	2	
f_{max}	Maximum Switching Frequency		45	kHz

Driver Electrical Characteristics

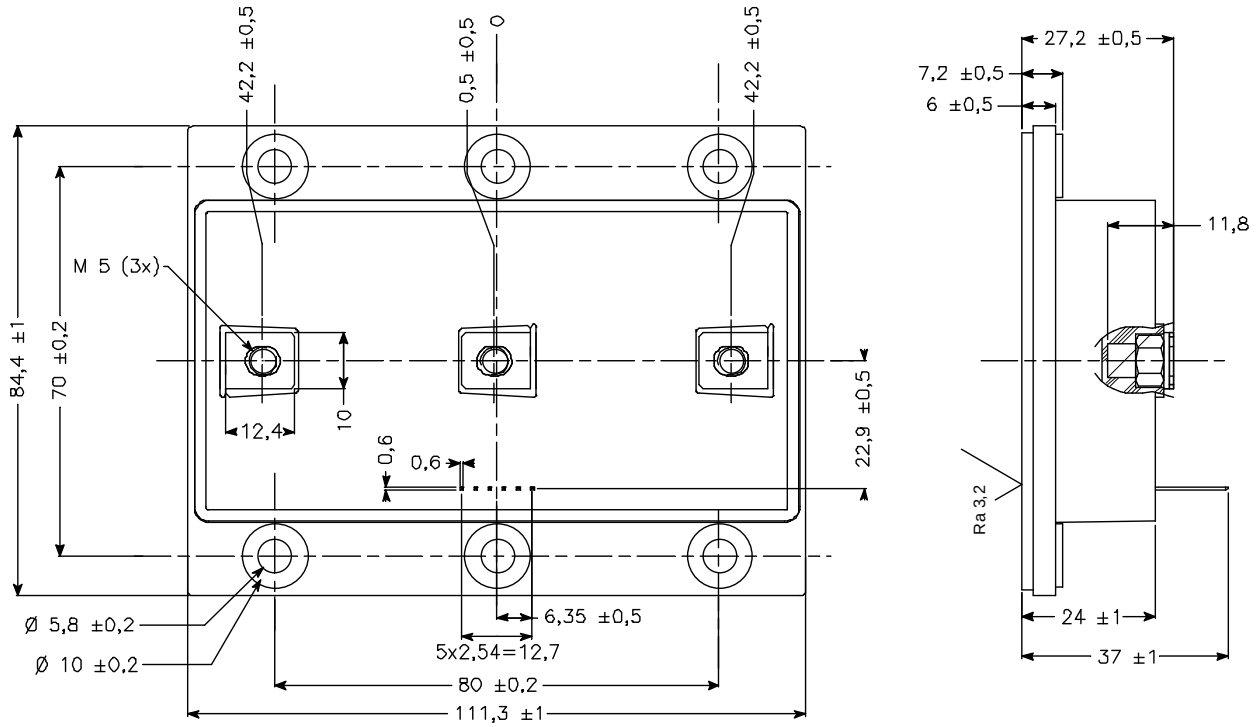
Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
V_{DD}	Operating Supply Voltage		4.5	5	5.5	V
$V_{INi(max)}$	Maximum Input Voltage	i = L, H	-0.5	5	5.5	V
$V_{INi\ (th+)}$	Positive Going Threshold Voltage			3.2		
$V_{INi(th-)}$	Negative Going Threshold Voltage			1		
R_{INi}	Input Resistance *			1		kΩ
$T_{d(on)}$	Turn On delay time	Driver + IGBT		1100❶		ns
D_T	Built in dead time			600		
$T_{d(off)}$	Turn Off delay time	Driver + IGBT		750		
PWD	Pulse Width Distortion				300	ns
PDD	Propagation Delay Difference between any two driver	$T_{d(on)}$ - $T_{d(off)}$	-350		350	
V_{ISOL}	Primary to Secondary Isolation		2500			V_{RMS}

* Low impedance guarantees good noise immunity.

3. Package characteristics

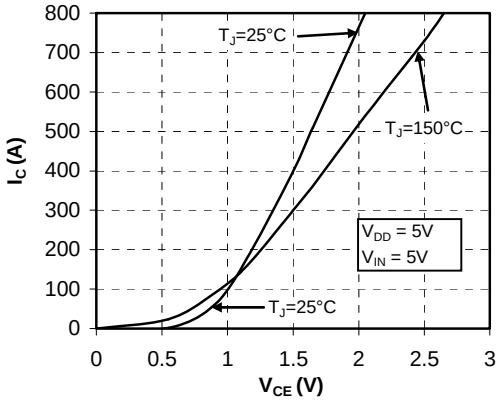
Symbol	*Characteristic*			*Min*	*Typ*	*Max*	*Unit*
V_{ISOL}	RMS Isolation Voltage, any terminal to case t =1 min, I isol<1mA, 50/60Hz			2500			V
T_J	Operating junction temperature range			-40		150	°C
T_{OP}	Operating Ambient Temperature			-40		85	
T_{STG}	Storage Temperature Range			-40		100	
T_C	Operating Case Temperature			-40		100	
Torque	Mounting torque	To heatsink	M5	2		4.7	N.m
		For terminals	M5	2		4	
Wt	Package Weight				550		g

4. LP8 Package outline (dimensions in mm)

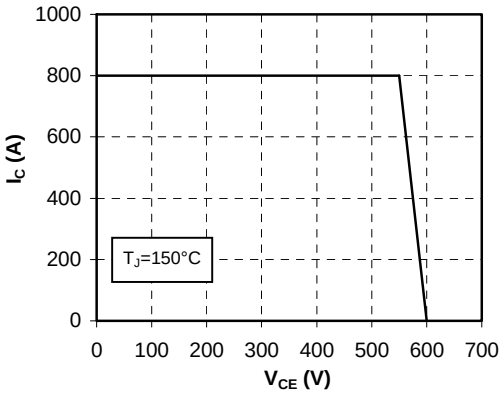


Typical IGBT Performance Curve

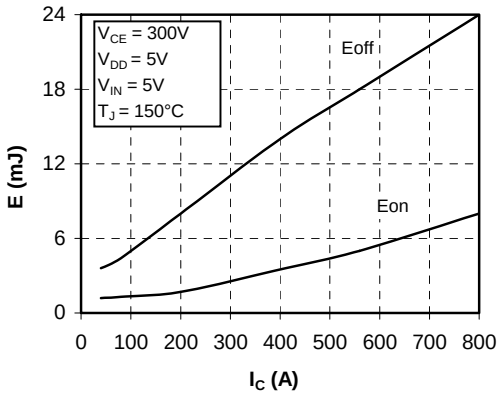
Output Characteristics (V_{GE}=15V)



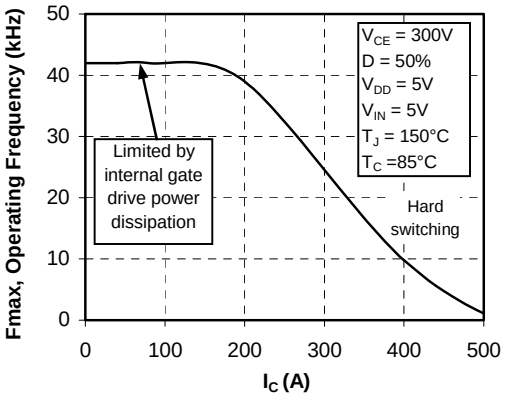
Reverse Bias Safe Operating Area



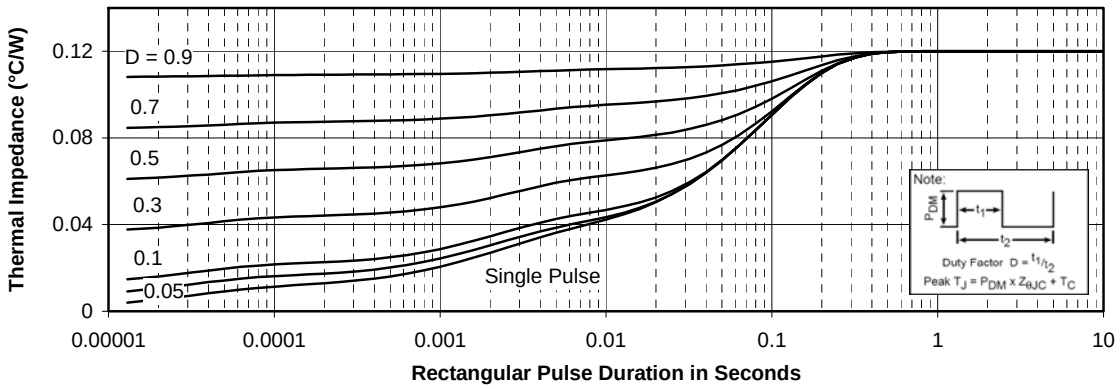
Energy losses vs Collector Current



Operating Frequency vs Collector Current



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



Typical diode Performance Curve