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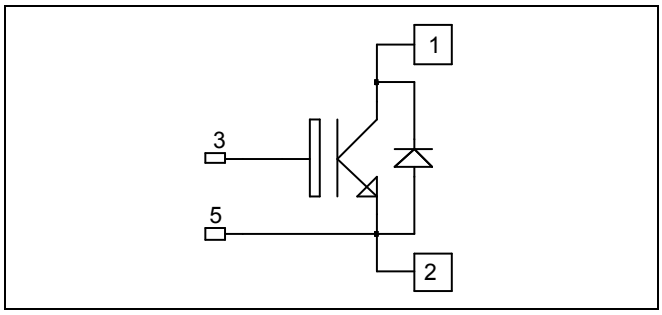
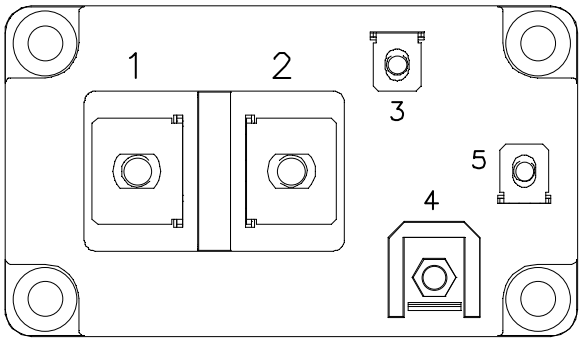
APTGT400U170D4G

Single switch
Trench + Field Stop IGBT3
Power Module

V_{CES} = 1700V
I_C = 400A @ Tc = 80°C





Application

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

Features

- Trench + Field Stop IGBT3 Technology
  - Low voltage drop
  - Low tail current
  - Switching frequency up to 20 kHz
  - Soft recovery parallel diodes
  - Low diode VF
  - Low leakage current
  - RBSOA and SCSOA rated
- Kelvin emitter for easy drive
- M6 connectors for power
- M4 connectors for signal
- High level of integration

Benefits

- Stable temperature behavior
- Very rugged
- Direct mounting to heatsink (isolated package)
- Low junction to case thermal resistance
- Easy paralleling due to positive T_C of V_{CEsat}
- RoHS Compliant

Absolute maximum ratings

Symbol	*Parameter*		*Max ratings*	*Unit*
V_{CES}	Collector - Emitter Breakdown Voltage		1700	V
I_C	Continuous Collector Current	T_C = 25°C	800	A
		T_C = 80°C	400	
I_{CM}	Pulsed Collector Current	T_C = 25°C	800	
V_{GE}	Gate – Emitter Voltage		±20	V
P_D	Maximum Power Dissipation	T_C = 25°C	2080	W
RBSOA	Reverse Bias Safe Operating Area	T_j = 125°C	800A@1650V	

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} = 1700V				5	mA
$V_{CE(sat)}$	Collector Emitter saturation Voltage	V_{GE} = 15V I_C = 400A	T_j = 25°C		2.0	2.4	V
			T_j = 125°C		2.4		
$V_{GE(th)}$	Gate Threshold Voltage	V_{GE} = V_{CE} , I_C = 16 mA		5.2	5.8	6.4	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			33		nF
C_{res}	Reverse Transfer Capacitance				1.2		
Q_G	Gate charge	V_{GE}=±15V, I_C=400A V_{CE}=900V			4.6		µC
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching (25°C) V_{GE} = ±15V V_{Bus} = 900V I_C = 400A R_G = 3.6Ω			250		ns
T_r	Rise Time				100		
$T_{d(off)}$	Turn-off Delay Time				850		
T_f	Fall Time				120		
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching (125°C) V_{GE} = ±15V V_{Bus} = 900V I_C = 400A R_G = 3.6Ω			300		ns
T_r	Rise Time				100		
$T_{d(off)}$	Turn-off Delay Time				1000		
T_f	Fall Time				200		
E_{on}	Turn On Energy	V_{GE} = ±15V V_{Bus} = 900V I_C = 400A R_G = 3.6Ω	T_j = 125°C		135		mJ
E_{off}	Turn Off Energy		T_j = 125°C		125		
I_{sc}	Short Circuit data	V_{GE} ≤15V ; V_{Bus} = 1000V t_p ≤ 10µs ; T_j = 125°C			1600		A

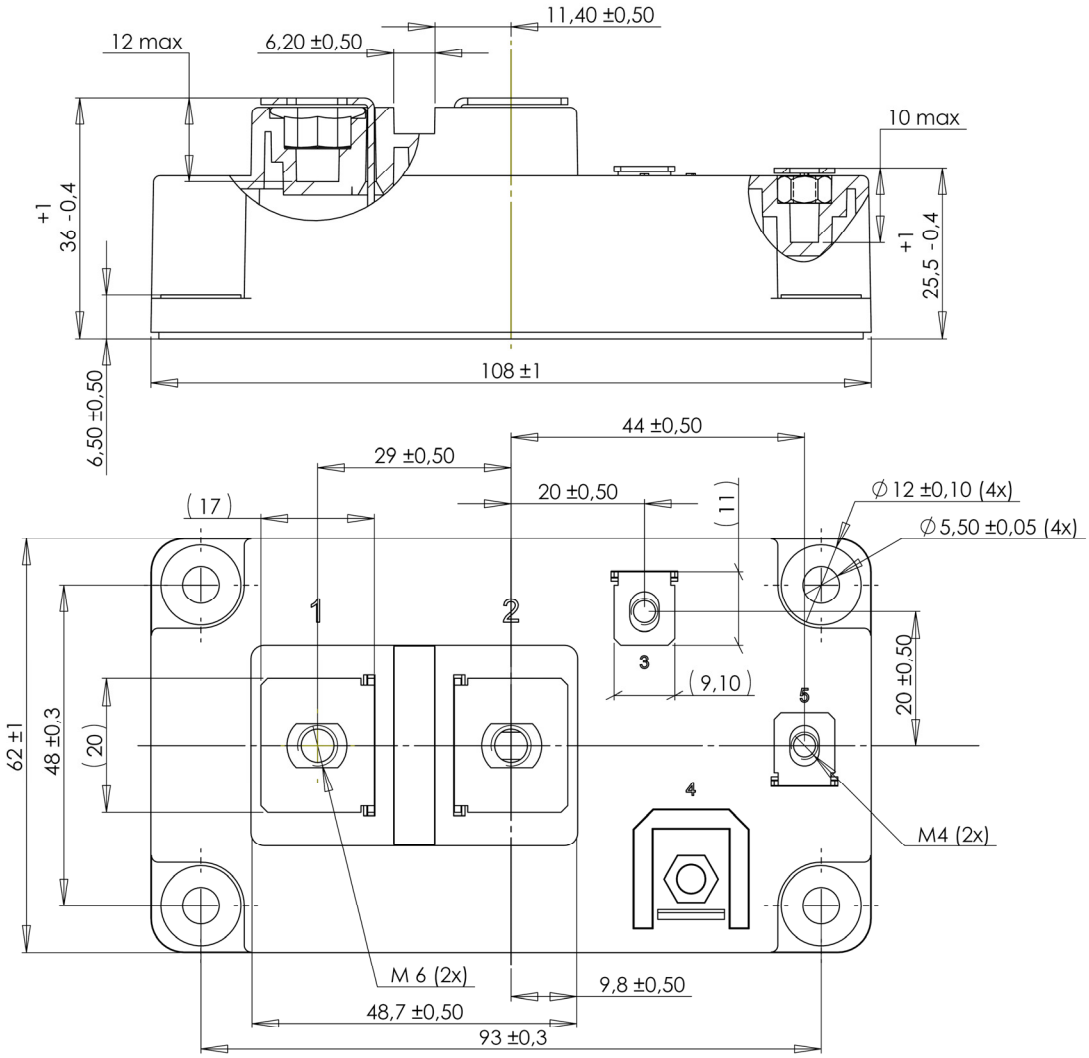
Reverse diode ratings and characteristics

Symbol	*Characteristic*	*Test Conditions*		*Min*	*Typ*	*Max*	*Unit*
V_{RRM}	Maximum Peak Repetitive Reverse Voltage			1700			V
I_{RRM}	Maximum Reverse Leakage Current	V_R=1700V	T_j = 25°C			750	µA
			T_j = 125°C			1000	
I_F	DC forward current		Tc=80°C		400		A
V_F	Diode Forward Voltage	I_F = 400A V_{GE} = 0V	T_j = 25°C		1.8	2.2	V
			T_j = 125°C		1.9		
E_{rr}	Reverse Recovery Energy	I_F = 400A V_R = 900V di/dt =4200A/µs	T_j = 25°C		50		mJ
			T_j = 125°C		96		
t_{rr}	Reverse Recovery Time		T_j = 25°C		420		ns
			T_j = 125°C		525		
Q_{rr}	Reverse Recovery Charge		T_j = 25°C		100		µC
			T_j = 125°C		170		

Thermal and package characteristics

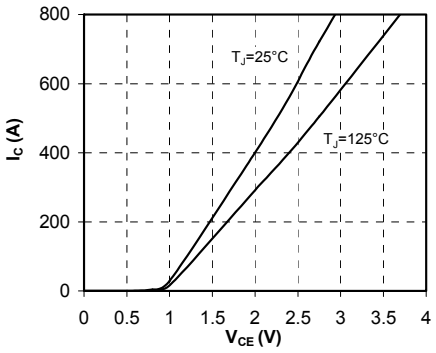
Symbol	*Characteristic*		*Min*	*Typ*	*Max*	*Unit*
R_{thJC}	Junction to Case Thermal Resistance	IGBT			0.06	°C/W
		Diode			0.08	
V_{ISOL}	RMS Isolation Voltage, any terminal to case t =1 min, 50/60Hz		4000			V
T_J	Operating junction temperature range		-40		150	°C
T_{STG}	Storage Temperature Range		-40		125	
T_C	Operating Case Temperature		-40		125	
Torque	Mounting torque	M6	3		5	N.m
		M4	1		2	
Wt	Package Weight				350	g

D4 Package outline (dimensions in mm)

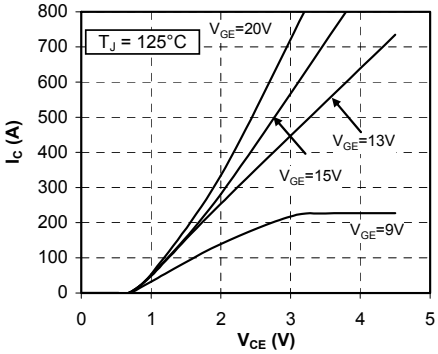


Typical Performance Curve

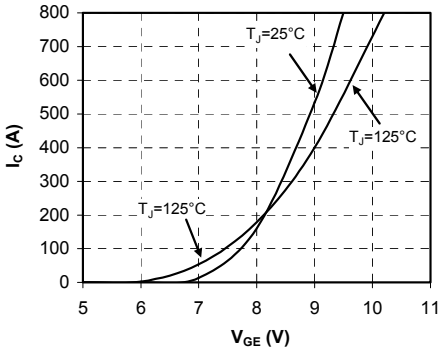
Output Characteristics (V_{GE}=15V)



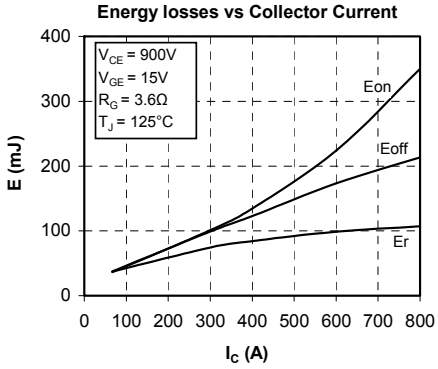
Output Characteristics



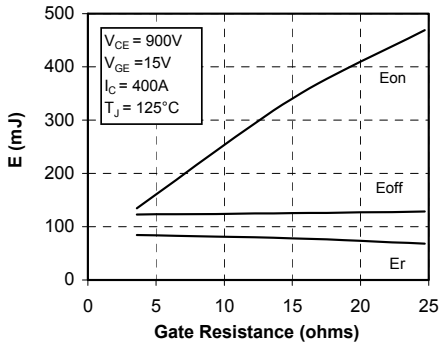
Transfert Characteristics



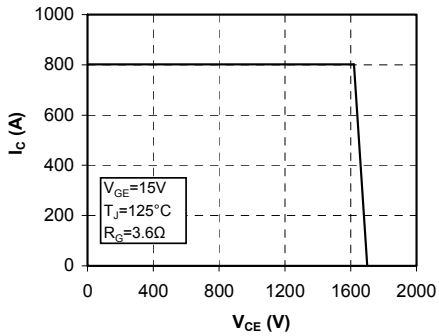
Energy losses vs Collector Current



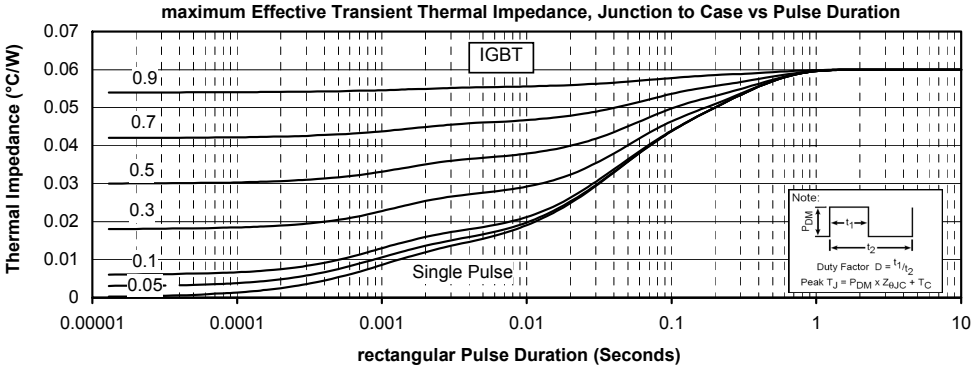
Switching Energy Losses vs Gate Resistance

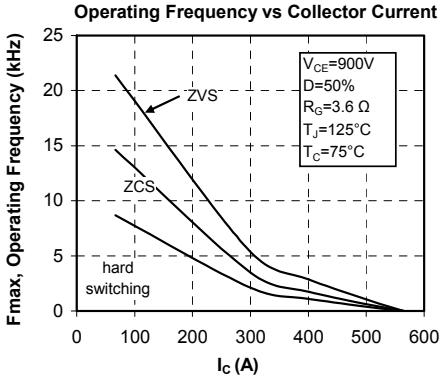


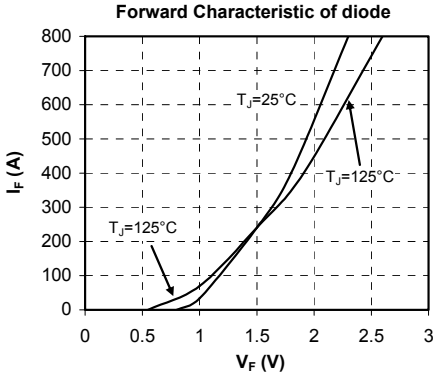
Reverse Bias Safe Operating Area

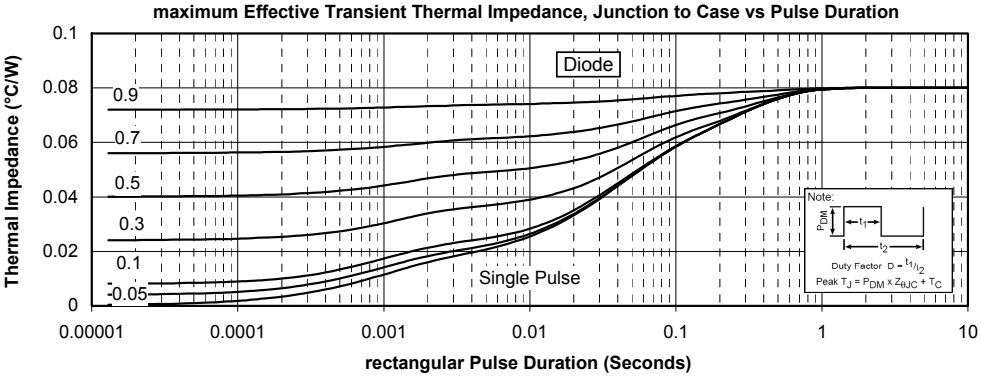


maximum Effective Transient Thermal Impedance, Junction to Case vs Pulse Duration




Operating Frequency vs Collector Current
Fmax, Operating Frequency (kHz)
25
20
15
10
5
0
0
100
200
300
400
500
600
I_C (A)
V_{CE}=900V
D=50%
R_G=3.6 Ω
T_J=125°C
T_C=75°C
ZVS
ZCS
hard
switching


Forward Characteristic of diode
I_F (A)
800
700
600
500
400
300
200
100
0
0
0.5
1
1.5
2
2.5
3
V_F (V)
T_J=25°C
T_J=125°C
T_J=125°C


maximum Effective Transient Thermal Impedance, Junction to Case vs Pulse Duration
Thermal Impedance (°C/W)
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 (Seconds)
Diode
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} x $Z_{\theta JC}$ + T_C

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