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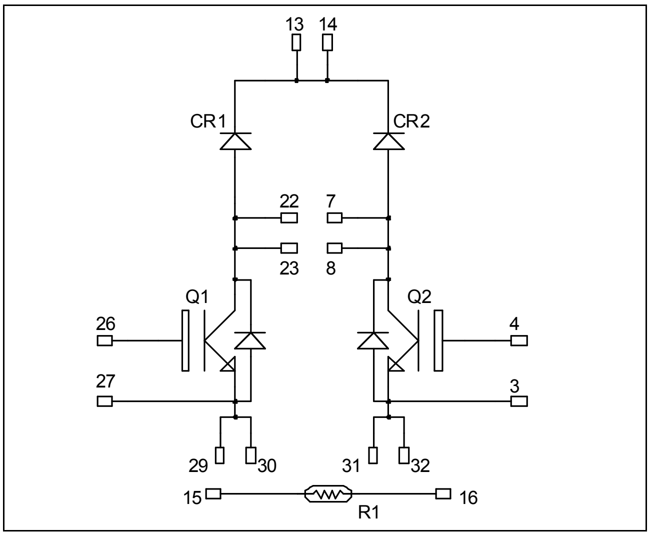
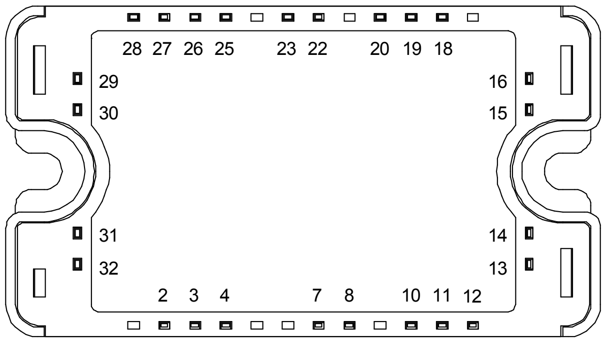
Microsemi POWER PRODUCTS GROUP

APTGF25DDA120T3G

Dual Boost Chopper NPT IGBT Power Module

V_{CES} = 1200V
I_C = 25A @ Tc = 80°C





All multiple inputs and outputs must be shorted together
Example: 13/14 ; 29/30 ; 22/23 …

Application
- AC and DC motor control
- Switched Mode Power Supplies
- Power Factor Correction

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
  - Symmetrical design
- Kelvin emitter for easy drive
- Very low stray inductance
- High level of integration
- Internal thermistor for temperature monitoring

Benefits
- Outstanding performance at high frequency operation
- 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
- Easy paralleling due to positive TC of VCEsat
- Each leg can be easily paralleled to achieve a single boost of twice the current capability.
- RoHS compliant

Absolute maximum ratings

Symbol	*Parameter*		*Max ratings*	*Unit*
V_{CES}	Collector - Emitter Breakdown Voltage		1200	V
I_C	Continuous Collector Current	T_C = 25°C	40	A
		T_C = 80°C	25	
I_{CM}	Pulsed Collector Current	T_C = 25°C	100	
V_{GE}	Gate – Emitter Voltage		±20	V
P_D	Maximum Power Dissipation	T_C = 25°C	208	W
RBSOA	Reverse Bias Safe Operating Area	T_j = 125°C	50A@1150V	

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} = 1200V	T_j = 25°C			250	µA
			T_j = 125°C			500	
$V_{CE(sat)}$	Collector Emitter saturation Voltage	V_{GE} =15V, I_C = 25A	T_j = 25°C	2.5	3.2	3.7	V
			T_j = 125°C		4.0		
$V_{GE(th)}$	Gate Threshold Voltage	$V_{GE} = V_{CE}$, I_C = 1mA		4		6	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			1650		pF
C_{oes}	Output Capacitance				250		
C_{res}	Reverse Transfer Capacitance				110		
Q_g	Total gate Charge	V_{GE} = 15V, V_{Bus} = 600V, I_C =25A			160		nC
Q_{ge}	Gate – Emitter Charge				10		
Q_{gc}	Gate – Collector Charge				70		
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching (25°C), V_{GE} = 15V, V_{Bus} = 600V, I_C = 25A, R_G = 22Ω			60		ns
T_r	Rise Time				50		
$T_{d(off)}$	Turn-off Delay Time				305		
T_f	Fall Time				30		
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching (125°C), V_{GE} = 15V, V_{Bus} = 600V, I_C = 25A, R_G = 22Ω			60		ns
T_r	Rise Time				50		
$T_{d(off)}$	Turn-off Delay Time				346		
T_f	Fall Time				40		
E_{on}	Turn-on Switching Energy	V_{GE} = 15V, V_{Bus} = 600V, I_C = 25A, R_G = 22Ω	T_j = 125°C		3.5		mJ
E_{off}	Turn-off Switching Energy		T_j = 125°C		1.5		

Chopper diode ratings and characteristics

Symbol	*Characteristic*	*Test Conditions*		*Min*	*Typ*	*Max*	*Unit*
V_{RRM}	Maximum Peak Repetitive Reverse Voltage			1200			V
I_{RM}	Maximum Reverse Leakage Current	V_R=1200V	T_j = 25°C			250	µA
			T_j = 125°C			500	
I_F	Forward Current		Tc = 70°C		60		A
V_F	Diode Forward Voltage	I_F = 60A			2	2.5	V
		I_F = 120A			2.3		
		I_F = 60A	T_j = 125°C		1.8		
t_{rr}	Reverse Recovery Time	I_F = 60A, V_R = 800V, di/dt =200A/µs	T_j = 25°C		400		ns
			T_j = 125°C		470		
Q_{rr}	Reverse Recovery Charge		T_j = 25°C		1.2		µC
			T_j = 125°C		4		

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

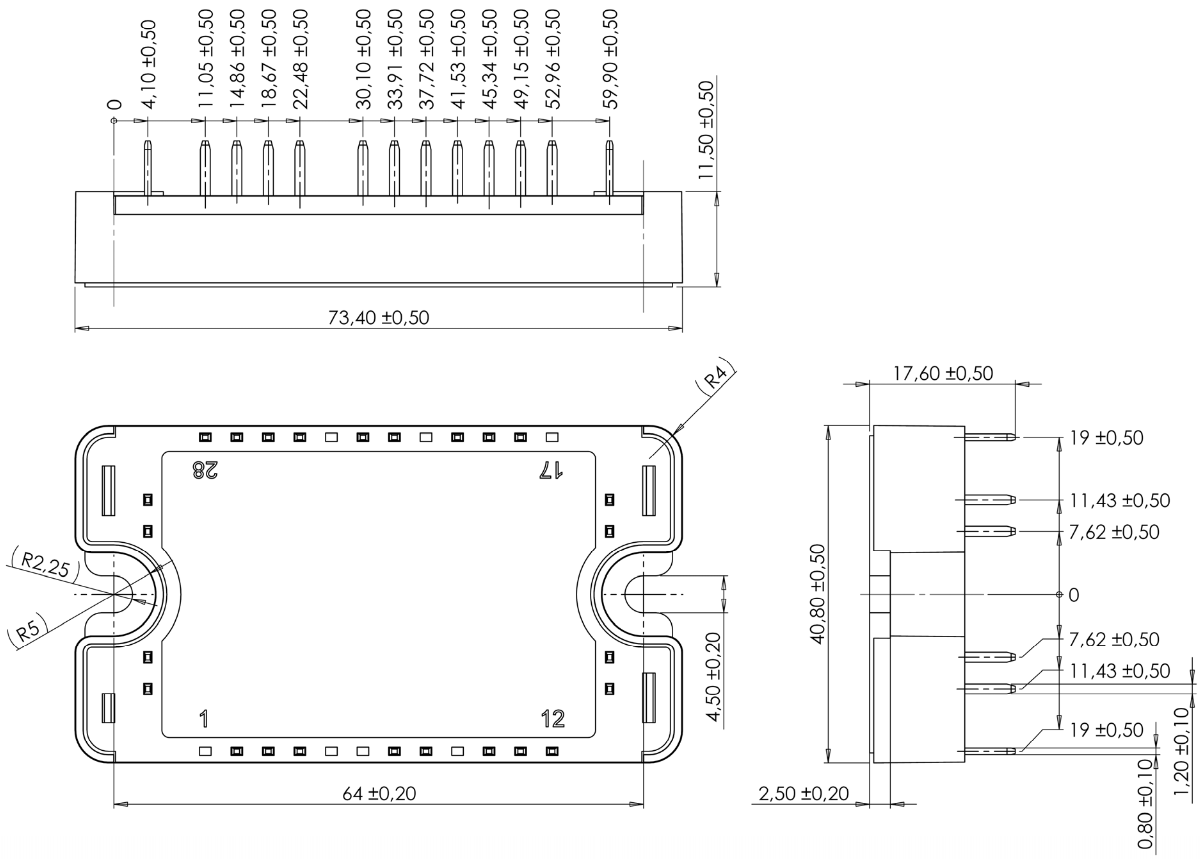
$$R_T = \frac{R_{25}}{\exp\left[B_{25/85}\left(\frac{1}{T_{25}} - \frac{1}{T}\right)\right]}$$

T: Thermistor temperature
R_T: Thermistor value at T

Thermal and package characteristics

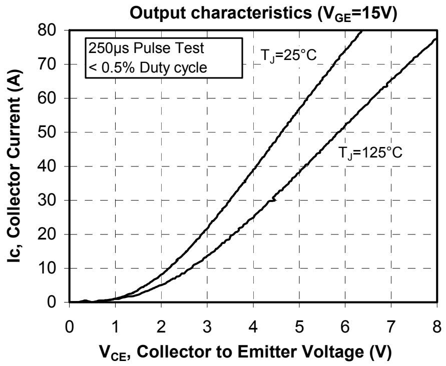
Symbol	*Characteristic*			*Min*	*Typ*	*Max*	*Unit*
R_{thJC}	Junction to Case Thermal Resistance		IGBT			0.6	°C/W
			Diode			0.9	
V_{ISOL}	RMS Isolation Voltage, any terminal to case t =1 min, 50/60Hz			4000			V
T_J	Operating junction temperature range			-40		150	°C
T_{STG}	Storage Temperature Range			-40		125	
T_C	Operating Case Temperature			-40		100	
Torque	Mounting torque	To heatsink	M4	2		3	N.m
Wt	Package Weight					110	g

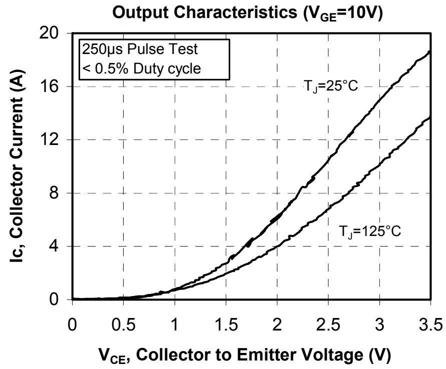
SP3 Package outline (dimensions in mm)

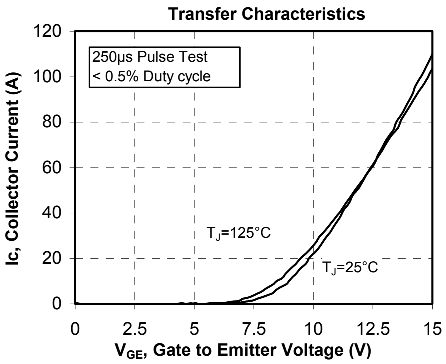


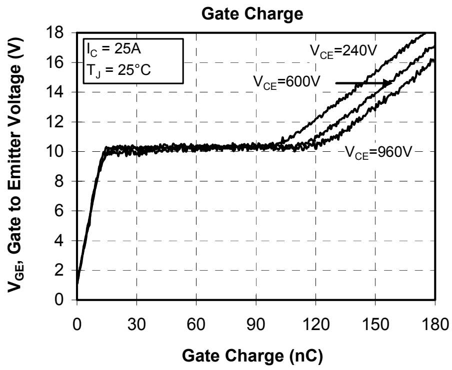
See application note 1901 - Mounting Instructions for SP3 Power Modules on www.microsemi.com

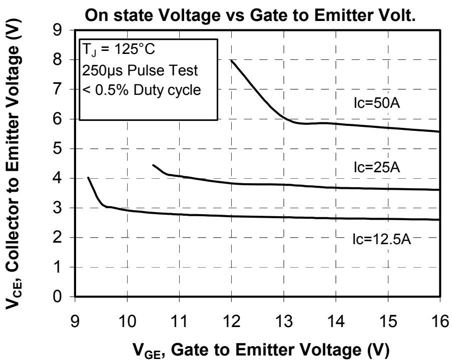
Typical Performance Curve

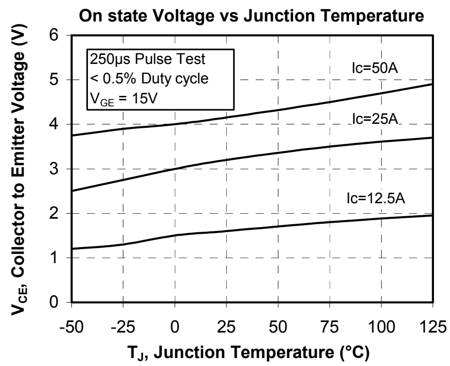


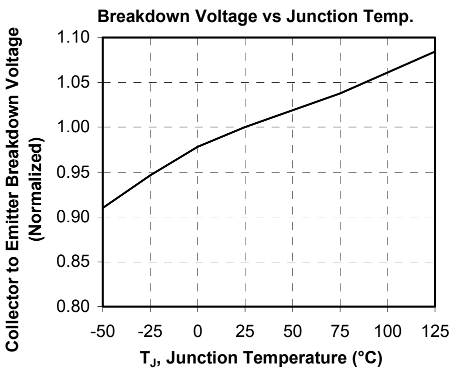


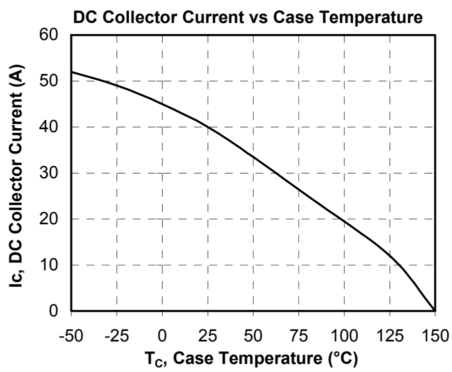


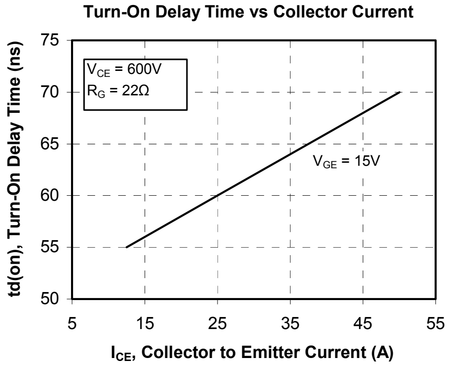


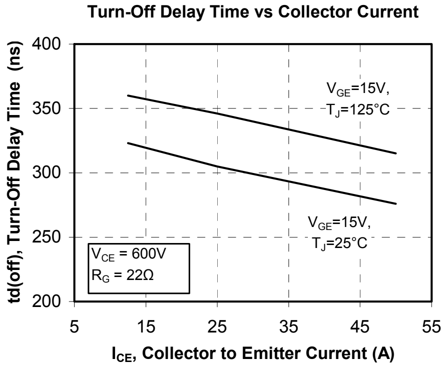


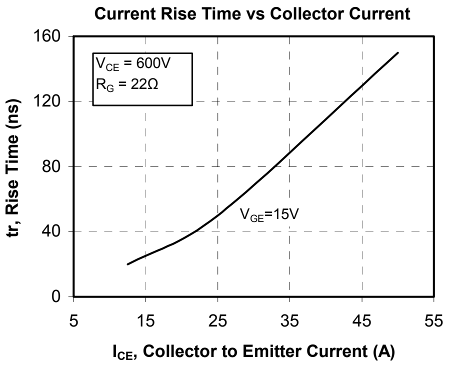


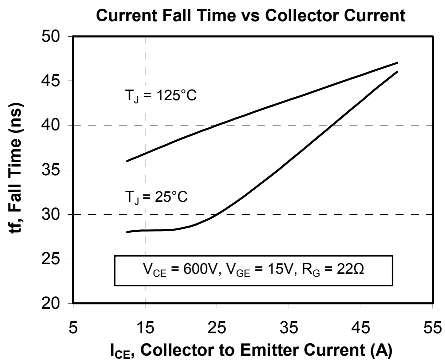


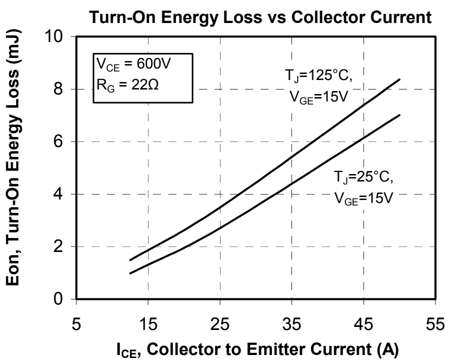


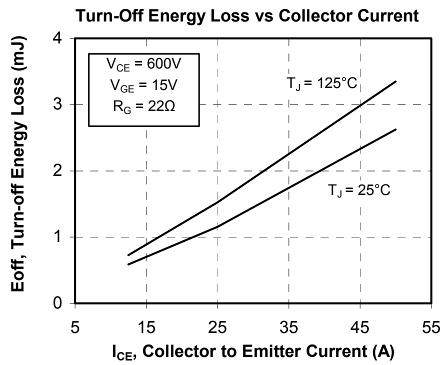

Turn-On Delay Time vs Collector Current
VCE = 600V
RG = 22Ω
VGE = 15V
td(on), Turn-On Delay Time (ns)
ICE, Collector to Emitter Current (A)

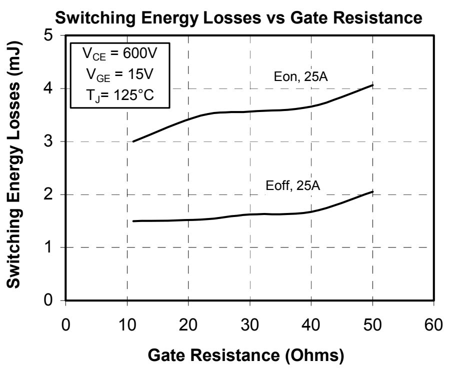

Turn-Off Delay Time vs Collector Current
VGE=15V, TJ=125°C
VGE=15V, TJ=25°C
VCE = 600V
RG = 22Ω
td(off), Turn-Off Delay Time (ns)
ICE, Collector to Emitter Current (A)

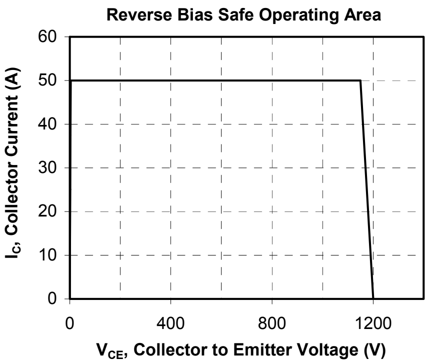

Current Rise Time vs Collector Current
VCE = 600V
RG = 22Ω
VGE=15V
tr, Rise Time (ns)
ICE, Collector to Emitter Current (A)

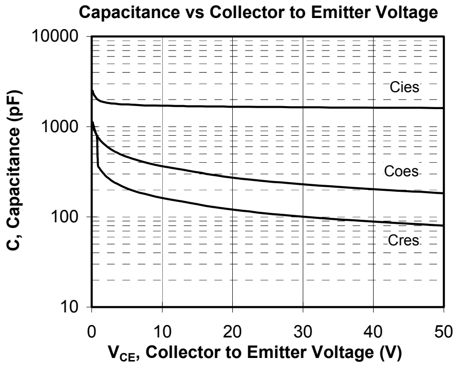

Current Fall Time vs Collector Current
TJ = 125°C
TJ = 25°C
VCE = 600V, VGE = 15V, RG = 22Ω
tf, Fall Time (ns)
ICE, Collector to Emitter Current (A)

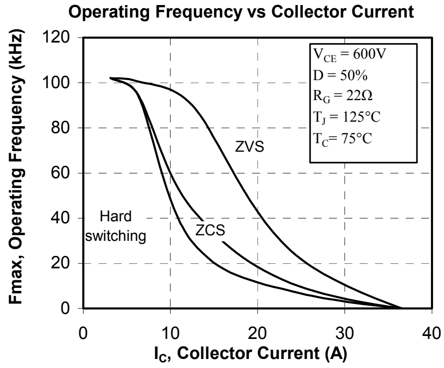

Turn-On Energy Loss vs Collector Current
VCE = 600V
RG = 22Ω
TJ=125°C, VGE=15V
TJ=25°C, VGE=15V
Eon, Turn-On Energy Loss (mJ)
ICE, Collector to Emitter Current (A)

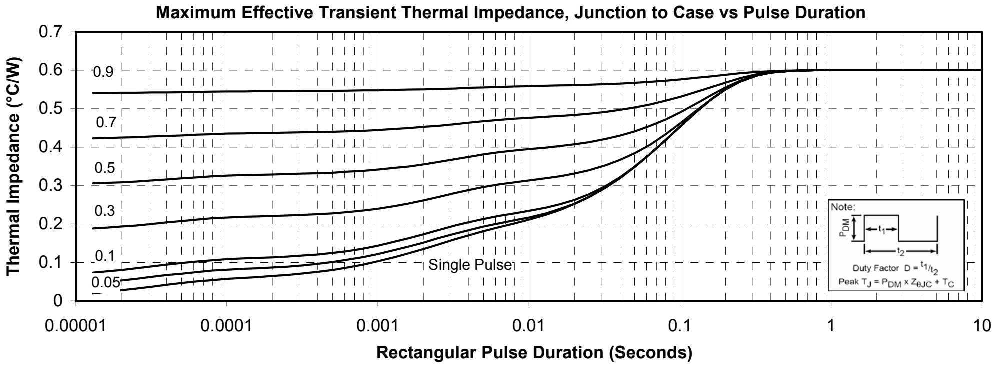

Turn-Off Energy Loss vs Collector Current
VCE = 600V
VGE = 15V
RG = 22Ω
TJ = 125°C
TJ = 25°C
Eoff, Turn-off Energy Loss (mJ)
ICE, Collector to Emitter Current (A)


Switching Energy Losses vs Gate Resistance
VCE = 600V
VGE = 15V
TJ= 125°C
Eon, 25A
Eoff, 25A
Switching Energy Losses (mJ)
Gate Resistance (Ohms)


Reverse Bias Safe Operating Area
IC, Collector Current (A)
VCE, Collector to Emitter Voltage (V)


Capacitance vs Collector to Emitter Voltage
10000
1000
100
10
C, Capacitance (pF)
Cies
Coes
Cres
0
10
20
30
40
50
V_{CE}, Collector to Emitter Voltage (V)


Operating Frequency vs Collector Current
120
100
80
60
40
20
0
Fmax, Operating Frequency (kHz)
V_{CE} = 600V
D = 50%
R_G = 22Ω
T_J = 125°C
T_C= 75°C
ZVS
ZCS
Hard
switching
0
10
20
30
40
I_C, Collector Current (A)


Maximum Effective Transient Thermal Impedance, Junction to Case vs Pulse Duration
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Thermal Impedance (°C/W)
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 $Z_{θJC}$ + T_C
0.00001
0.0001
0.001
0.01
0.1
1
10
Rectangular Pulse Duration (Seconds)

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