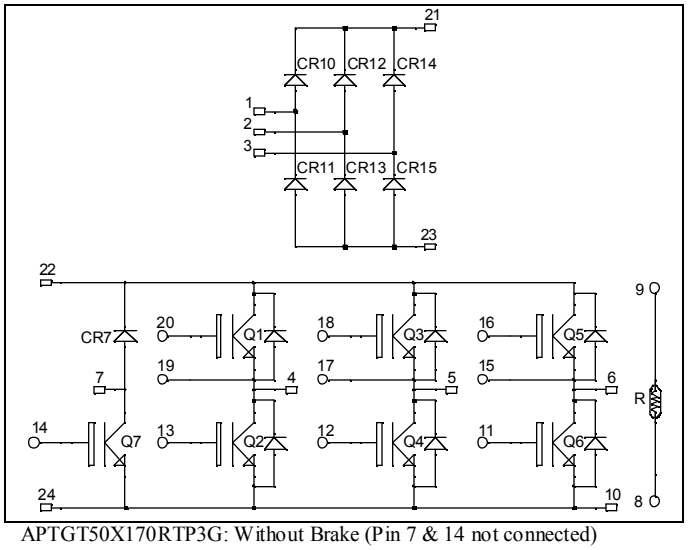
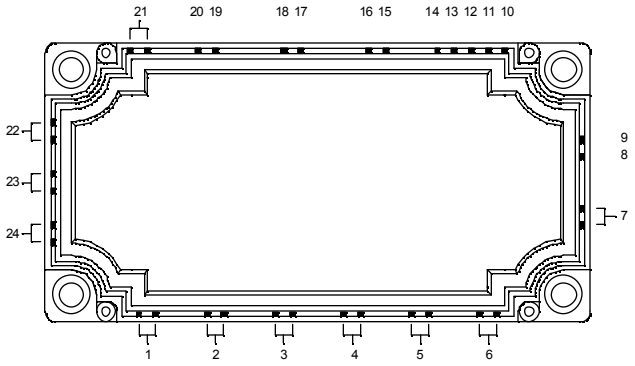
APTGT50X170RTP3G
APTGT50X170BTP3G

Input rectifier bridge + Brake + 3 Phase Bridge
Trench + Field Stop IGBT®
Power Module

V_{CES} = 1700V
I_C = 50A @ Tc = 80°C



APTGT50X170RTP3G: Without Brake (Pin 7 & 14 not connected)



Application

- AC Motor control

Features

- Trench + Field Stop IGBT® Technology
  - Low voltage drop
  - Low tail current
  - Switching frequency up to 20 kHz
  - Soft recovery parallel diodes
  - Low diode VF
  - Low leakage current
  - Avalanche energy rated
  - RBSOA and SCSOA rated
- Kelvin emitter for easy drive
- Low stray inductance
- High level of integration
- Kelvin emitter for easy drive
- Low stray inductance
- Internal thermistor for temperature monitoring

Benefits

- Low conduction losses
- Stable temperature behavior
- Very rugged
- Solderable terminals for easy PCB mounting
- 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

1. Absolute maximum ratings

Diode rectifier Absolute maximum ratings

Symbol	*Parameter*			*Max ratings*	*Unit*
V_{RRM}	Repetitive Peak Reverse Voltage			1600	V
I_D	DC Forward Current		T_C = 80°C	80	A
I_{FSM}	Surge Forward Current	t_p = 10ms	T_j = 25°C	500	
			T_j = 150°C	400	

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

IGBT & Diode Brake (only for APTGT50X170BTP3G) Absolute maximum ratings

Symbol	*Parameter*		*Max ratings*	*Unit*
V_{CES}	Collector - Emitter Breakdown Voltage		1700	V
I_C	Continuous Collector Current	$T_C = 25°C$	45	A
		$T_C = 80°C$	30	
I_{CM}	Pulsed Collector Current	$T_C = 25°C$	70	
V_{GE}	Gate – Emitter Voltage		±20	V
P_D	Maximum Power Dissipation	$T_C = 25°C$	210	W
I_F	DC Forward Current	$T_C = 80°C$	50	A

IGBT & Diode Inverter Absolute maximum ratings

Symbol	*Parameter*		*Max ratings*	*Unit*
V_{CES}	Collector - Emitter Breakdown Voltage		1200	V
I_C	Continuous Collector Current	$T_C = 25°C$	70	A
		$T_C = 80°C$	50	
I_{CM}	Pulsed Collector Current	$T_C = 25°C$	100	
V_{GE}	Gate – Emitter Voltage		±20	V
P_D	Maximum Power Dissipation	$T_C = 25°C$	310	W
RBSOA	Reverse Bias Safe Operating Area	$T_j = 125°C$	100A @ 1700V	
I_F	DC Forward Current	$T_C = 80°C$	50	A
I_{FRM}	Repetitive Peak Forward Current	$t_p = 1ms$	100	

2. Electrical Characteristics

Diodes Rectifier Electrical Characteristics

Symbol	*Characteristic*	*Test Conditions*		*Min*	*Typ*	*Max*	*Unit*
I_R	Reverse Current	$V_R = 1600V$	$T_j = 150°C$		3		mA
V_F	Forward Voltage	$I_F = 50A$	$T_j = 150°C$		1.0		V
R_{thJC}	Junction to Case Thermal Resistance					0.65	°C/W

IGBT Brake & Diode (only for APTGT50X170BTP3G) Electrical Characteristics

Symbol	*Characteristic*	*Test Conditions*		*Min*	*Typ*	*Max*	*Unit*
I_{CES}	Zero Gate Voltage Collector Current	$V_{GE} = 0V, V_{CE} = 1700V$				250	µA
$V_{CE(on)}$	Collector Emitter on Voltage	$V_{GE} = 15V$ $I_C = 30A$	$T_j = 25°C$		2.0	2.4	V
			$T_j = 125°C$		2.4		
$V_{GE(th)}$	Gate Threshold Voltage	$V_{GE} = V_{CE}$, $I_C = 1.5mA$		5.0	5.8	6.5	V
I_{GES}	Gate – Emitter Leakage Current	$V_{GE} = 20V, V_{CE} = 0V$				600	nA
C_{ies}	Input Capacitance	$V_{GE} = 0V, V_{CE} = 25V$ f = 1MHz			2500		pF
C_{res}	Reverse Transfer Capacitance				90		
V_F	Forward Voltage	$V_{GE} = 0V$ $I_F = 50A$	$T_j = 25°C$		1.8	2.2	V
			$T_j = 125°C$		1.9		
R_{thJC}	Junction to Case Thermal Resistance		IGBT			0.6	°C/W
			Diode			0.7	

IGBT & Diode Inverter Electrical Characteristics

Symbol	Characteristic	Test Conditions		Min	Typ	Max	Unit
I_{CES}	Zero Gate Voltage Collector Current	V_{GE} = 0V, V_{CE} = 1700V				250	µA
$V_{CE(on)}$	Collector Emitter on Voltage	V_{GE} =15V, I_C = 50A	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 = 2.5mA		5.0	5.8	6.5	V
I_{GES}	Gate – Emitter Leakage Current	V_{GE} = 20V, V_{CE} = 0V				600	nA
C_{ies}	Input Capacitance	V_{GE} = 0V ;V_{CE} = 25V f = 1MHz			4400		pF
C_{rss}	Reverse Transfer Capacitance				150		
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching (25°C) V_{GE} = ±15V V_{Bus} = 900V I_C = 50A R_G = 10Ω			370		ns
T_r	Rise Time				40		
$T_{d(off)}$	Turn-off Delay Time				700		
T_f	Fall Time				180		
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching (125°C) V_{GE} = ±15V V_{Bus} = 900V I_C = 50A R_G = 10Ω			400		ns
T_r	Rise Time				50		
$T_{d(off)}$	Turn-off Delay Time				850		
T_f	Fall Time				300		
E_{off}	Turn off Energy				15		mJ
V_F	Forward Voltage	V_{GE} = 0V, I_F = 50A	T_j = 25°C		1.8	2.2	V
			T_j = 125°C		1.9		
Q_{rr}	Reverse Recovery Charge	I_F = 50A V_R = 900V di/dt=990A/µs	T_j = 25°C		19		µC
			T_j = 125°C		30		
R_{thJC}	Junction to Case Thermal Resistance		IGBT			0.4	°C/W
			Diode			0.7	

Temperature sensor NTC

Symbol	Characteristic	Min	Typ	Max	Unit
R_{25}	Resistance @ 25°C		5		kΩ
$B_{25/50}$	T_{25} = 298.16 K		3375		K

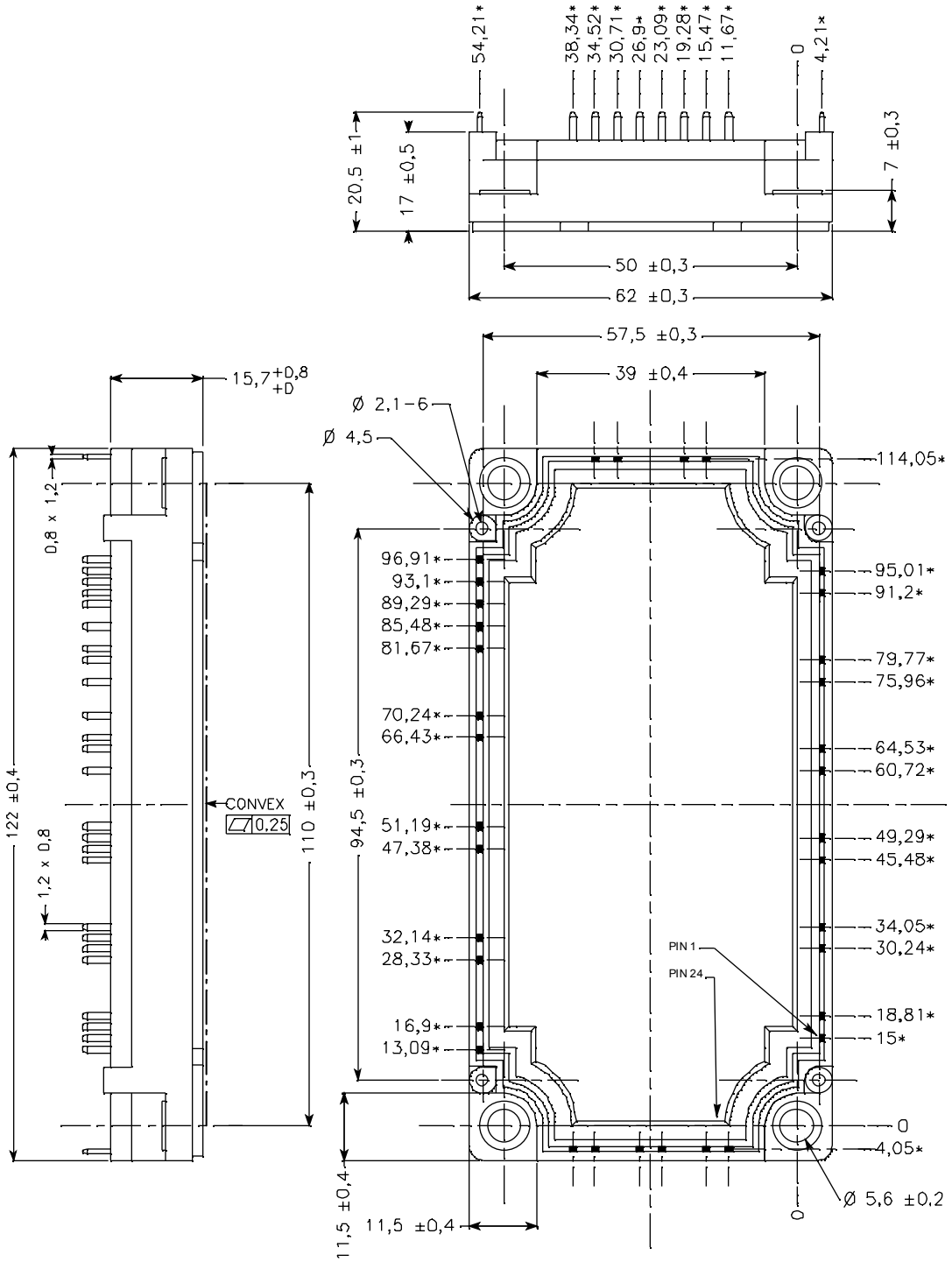
$$R_T = \frac{R_{25}}{\exp\left[B_{25/50}\left(\frac{1}{T_{25}} - \frac{1}{T}\right)\right]}$$

T: Thermistor temperature
R_T: Thermistor value at T

3. Thermal and 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			3500			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	To Heatsink	M5	2.5		4.7	N.m
Wt	Package Weight					300	g

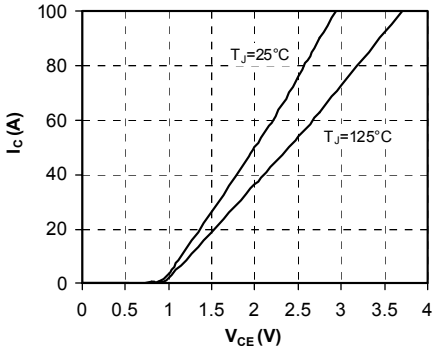
4. P3 Package outline (dimensions in mm)



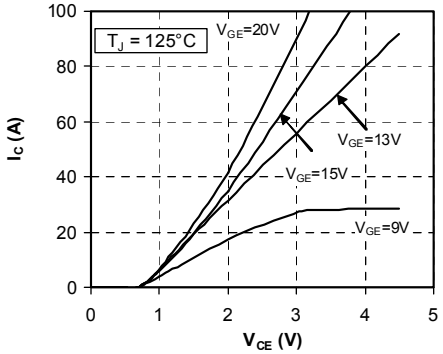
ALL DIMENSIONS MARKED " * " ARE TOLERENCED AS : ⌖ Ø0,4

Inverter Typical Performance Curve

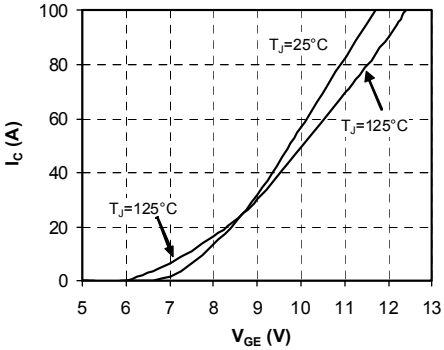
Output Characteristics (V_{GE}=15V)



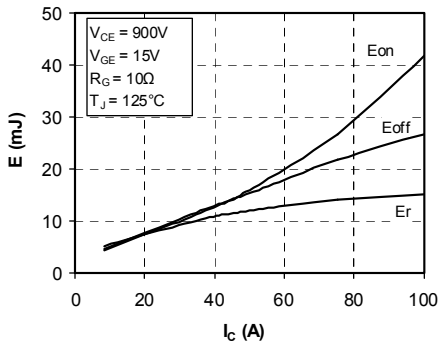
Output Characteristics



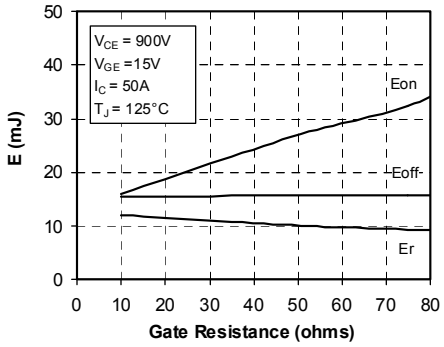
Transfert Characteristics



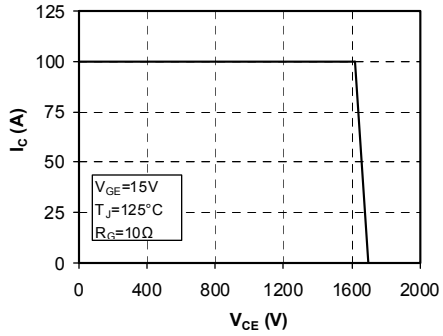
Energy losses vs Collector Current



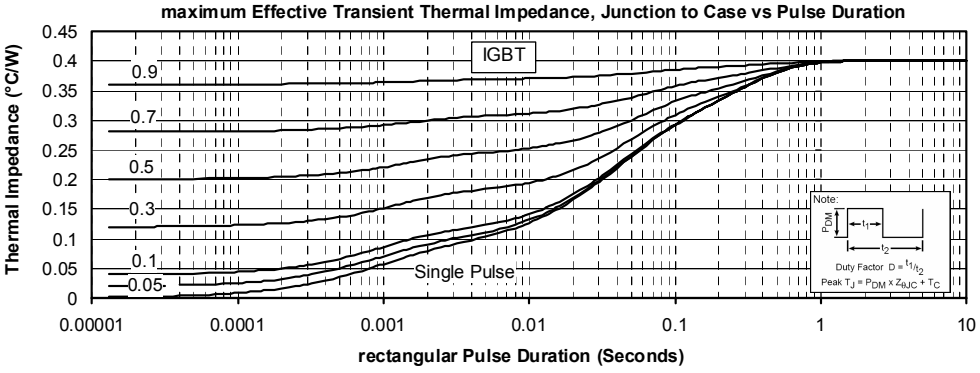
Switching Energy Losses vs Gate Resistance

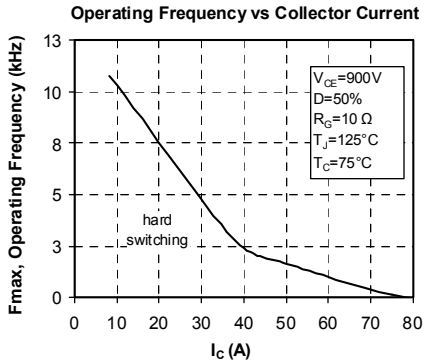


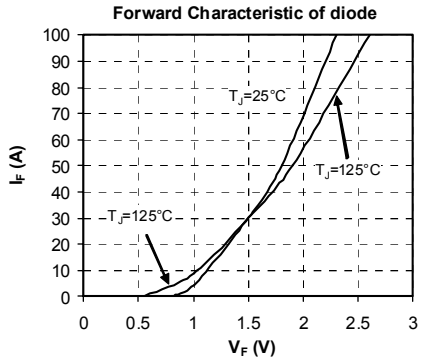
Reverse Bias Safe Operating Area

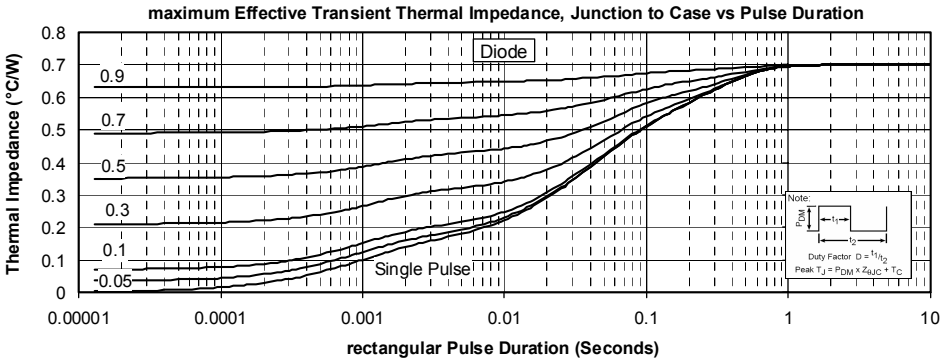


maximum Effective Transient Thermal Impedance, Junction to Case vs Pulse Duration



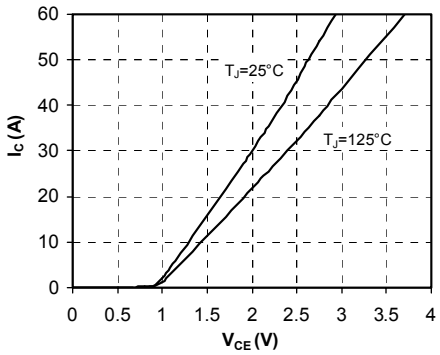

Operating Frequency vs Collector Current
Fmax, Operating Frequency (kHz)
13
10
8
5
3
0
0 10 20 30 40 50 60 70 80
I_C (A)
V_{CE}=900V
D=50%
R_G=10 Ω
T_J=125°C
T_C=75°C
hard
switching


Forward Characteristic of diode
I_F (A)
100
90
80
70
60
50
40
30
20
10
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

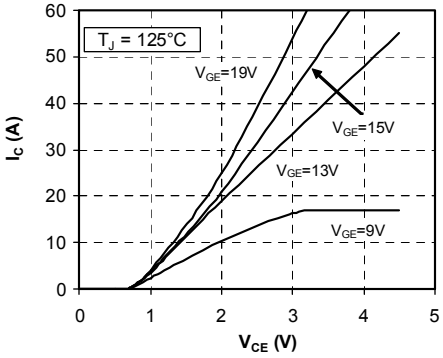

maximum Effective Transient Thermal Impedance, Junction to Case vs Pulse Duration
Thermal Impedance (°C/W)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0.00001 0.0001 0.001 0.01 0.1 1 10
rectangular Pulse Duration (Seconds)
Diode
0.9
0.7
0.5
0.3
0.1
0.05
Single Pulse
Note:
P_{DM}
t_1
t_2
Duty Factor D = t_1/t_2
Peak T_J = P_{DM} x $Z_{\theta JC}$ + T_C

Brake Typical Performance Curve (only for APTGT50X170BTP3G)

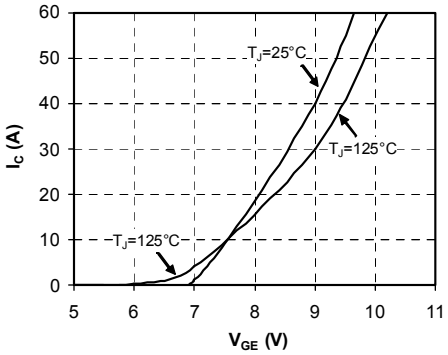
Output Characteristics (V_{GE}=15V)



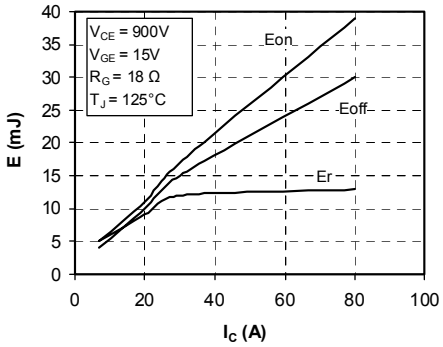
Output Characteristics



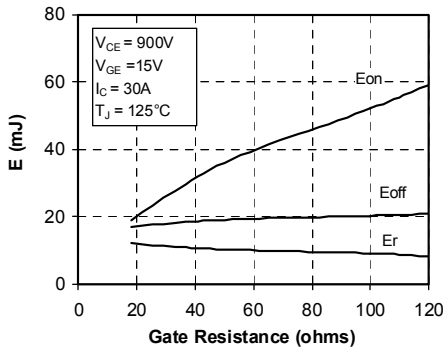
Transfert Characteristics



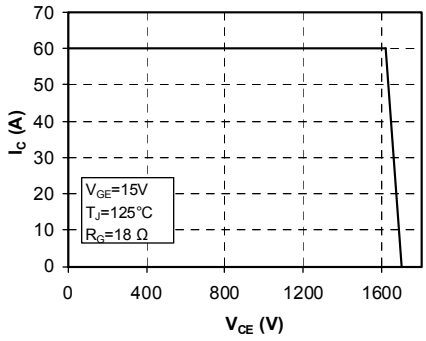
Energy losses vs Collector Current



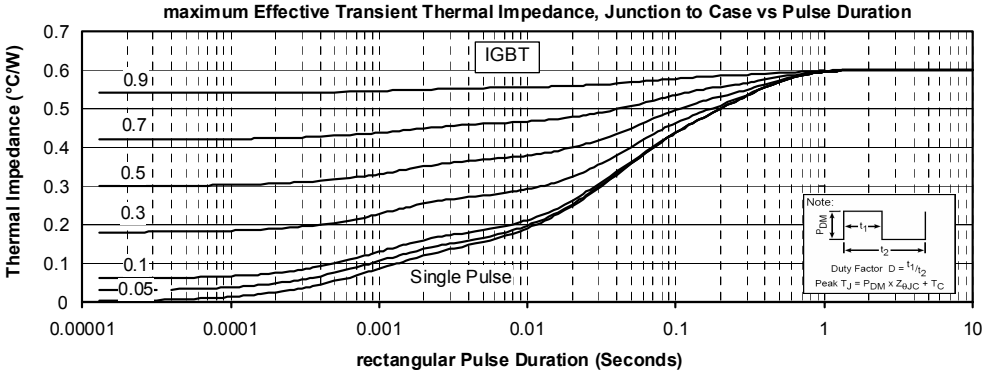
Switching Energy Losses vs Gate Resistance



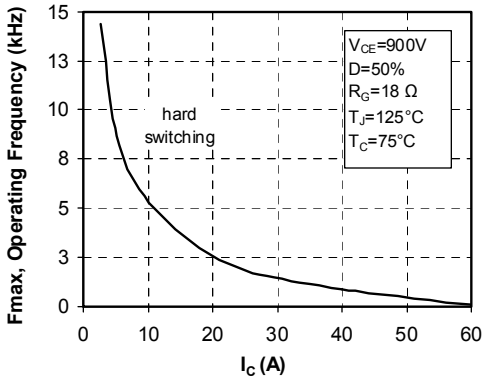
Reverse Bias Safe Operating Area



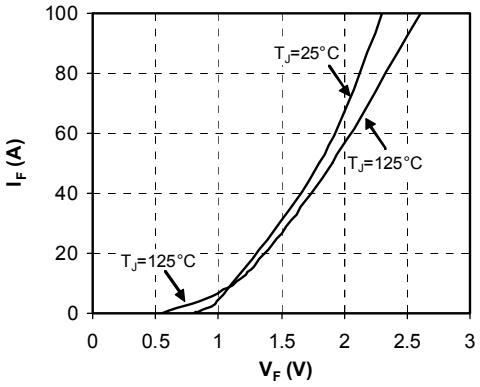
maximum Effective Transient Thermal Impedance, Junction to Case vs Pulse Duration



Operating Frequency vs Collector Current



Forward Characteristic of diode



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