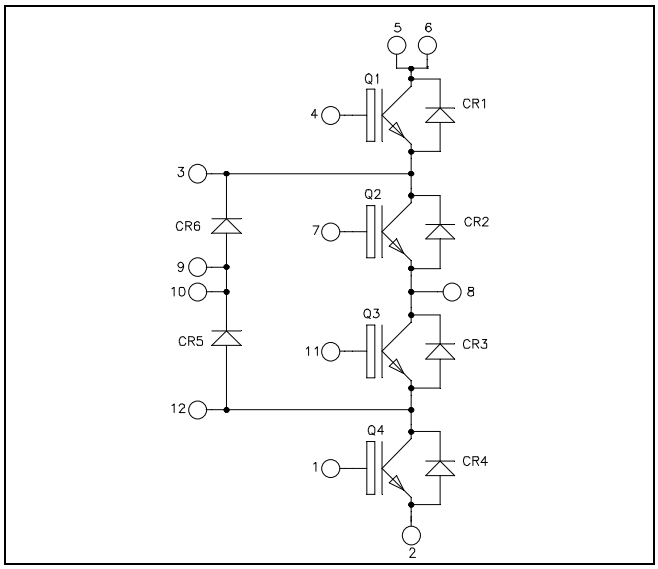
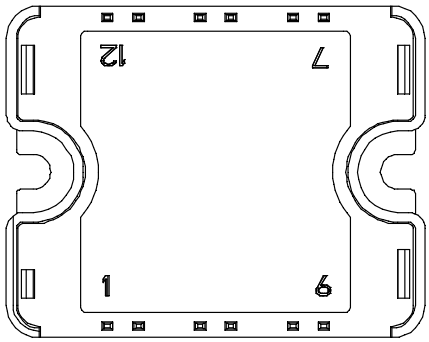
APTGF30TL601G

Three level inverter NPT IGBT Power Module

V_{CES} = 600V
I_C = 30A @ Tc = 80°C





All multiple inputs and outputs must be shorted together
5/6 ; 9/10

Application

- Solar converter
- Uninterruptible Power Supplies

Features

- Non Punch Through (NPT) Fast IGBT
  - Low voltage drop
  - Low tail current
  - Switching frequency up to 100 kHz
  - Soft recovery parallel diodes
  - Low diode VF
  - Low leakage current
  - RBSOA and SCSOA rated
- Kelvin emitter for easy drive
- Very low stray inductance
- 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 TC of VCEsat
- Low profile
- RoHS Compliant

Q1 to Q4 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	42	A
		T_C = 80°C	30	
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	140	W
RBSOA	Reverse Bias Safe Operating Area	T_j = 125°C	60A@500V	

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

Q1 to Q4 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			250	µA
			T_j = 125°C			500	
$V_{CE(on)}$	Collector Emitter on Voltage	V_{GE} =15V I_C = 30A	T_j = 25°C	1.7	2.0	2.45	V
			T_j = 125°C		2.2		
$V_{GE(th)}$	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

Q1 to Q4 Dynamic Characteristics

Symbol	*Characteristic*	*Test Conditions*		*Min*	*Typ*	*Max*	*Unit*
C_{ies}	Input Capacitance	V_{GE} = 0V V_{CE} = 25V f = 1MHz			1350		pF
C_{oes}	Output Capacitance				193		
C_{res}	Reverse Transfer Capacitance				120		
Q_g	Total gate Charge	V_{GE} = 15V V_{Bus} = 300V I_C =30A			99		nC
Q_{ge}	Gate – Emitter Charge				10		
Q_{gc}	Gate – Collector Charge				60		
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching (25°C) V_{GE} = 15V V_{Bus} = 400V I_C = 30A R_G = 6.8Ω			30		ns
T_r	Rise Time				12		
$T_{d(off)}$	Turn-off Delay Time				80		
T_f	Fall Time				15		
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching (125°C) V_{GE} = 15V V_{Bus} = 400V I_C = 30A R_G = 6.8Ω			32		ns
T_r	Rise Time				12		
$T_{d(off)}$	Turn-off Delay Time				90		
T_f	Fall Time				21		
E_{on}	Turn-on Switching Energy	V_{GE} = 15V V_{Bus} = 400V I_C = 30A R_G = 6.8Ω	T_j = 125°C		0.3		mJ
E_{off}	Turn-off Switching Energy		T_j = 125°C		0.8		
I_{sc}	Short Circuit data	V_{GE} ≤15V ; V_{Bus} = 360V t_p ≤ 10µs ; T_j = 125°C			135		A
R_{thJC}	Junction to Case Thermal Resistance					0.9	°C/W

CR1 to CR4 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			25	µA
			T_j = 150°C			500	
I_F	DC Forward Current		Tc = 80°C		15		A
		I_F = 15A			2	2.4	
V_F	Diode Forward Voltage	I_F = 30A			2.5		V
		I_F = 15A	T_j = 125°C		1.6		
t_{rr}	Reverse Recovery Time	I_F = 15A V_R = 400V di/dt =200A/µs	T_j = 25°C		20		ns
			T_j = 125°C		105		
Q_{rr}	Reverse Recovery Charge		T_j = 25°C		21		nC
			T_j = 125°C		250		
E_{rr}	Reverse Recovery Energy	I_F = 15A V_R = 400V di/dt =1000A/µs	T_j = 125°C		0.24		mJ
R_{thJC}	Junction to Case Thermal Resistance					2	°C/W

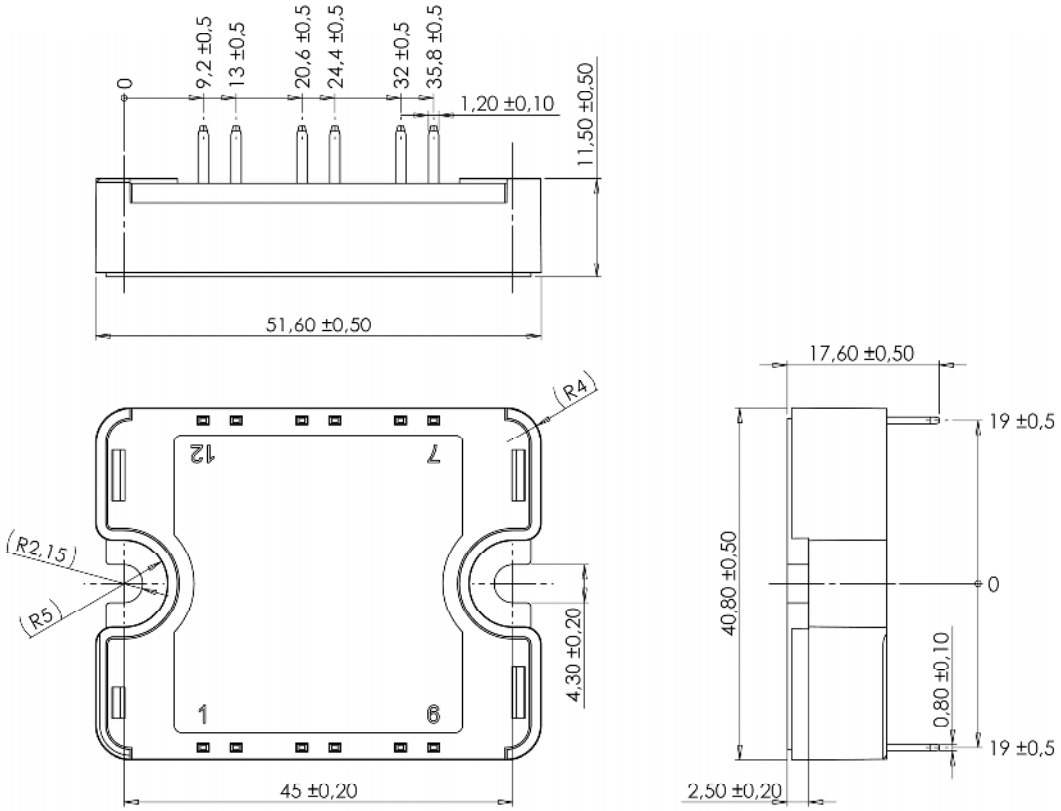
CR5 & CR6 diode ratings and characteristics

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			25	µA
			T_j = 150°C			500	
I_F	DC Forward Current		Tc = 80°C		30		A
		I_F = 30A			1.8	2.2	
V_F	Diode Forward Voltage	I_F = 60A			2.2		V
		I_F = 30A	T_j = 125°C		1.5		
t_{rr}	Reverse Recovery Time	I_F = 30A V_R = 400V di/dt =200A/µs	T_j = 25°C		25		ns
			T_j = 125°C		160		
Q_{rr}	Reverse Recovery Charge		T_j = 25°C		35		nC
			T_j = 125°C		480		
E_{rr}	Reverse Recovery Energy	I_F = 30A V_R = 400V di/dt =1000A/µs	T_j = 125°C		0.6		mJ
R_{thJC}	Junction to Case Thermal Resistance					1.2	°C/W

Thermal and package characteristics

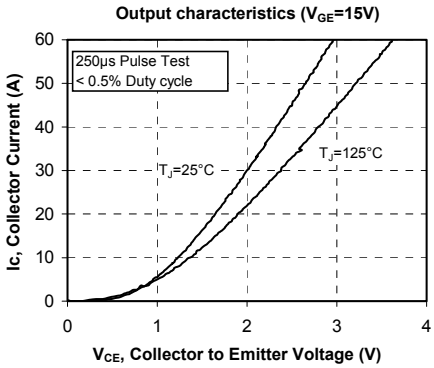
Symbol	Characteristic			Min	Typ	Max	Unit
V_{ISOL}	RMS Isolation Voltage, any terminal to case t =1 min, 50/60Hz			4000			V
T_J	Operating junction temperature range			-40		150	°C
T_{STG}	Storage Temperature Range			-40		125	
T_C	Operating Case Temperature			-40		100	
Torque	Mounting torque	To heatsink	M4	2		3	N.m
Wt	Package Weight					80	g

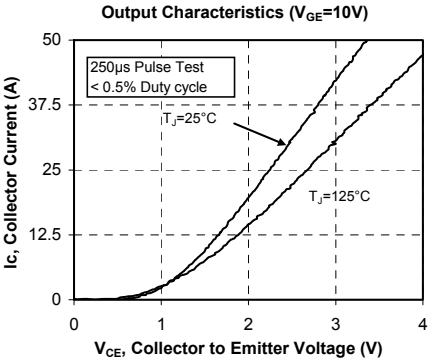
SP1 Package outline (dimensions in mm)

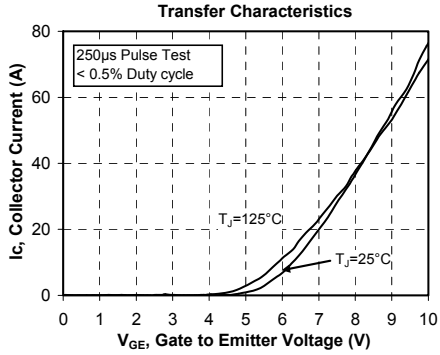


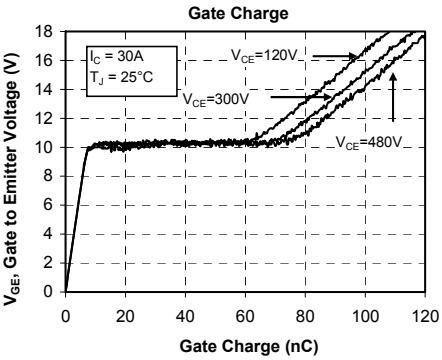
See application note 1904 - Mounting Instructions for SP1 Power Modules on www.microsemi.com

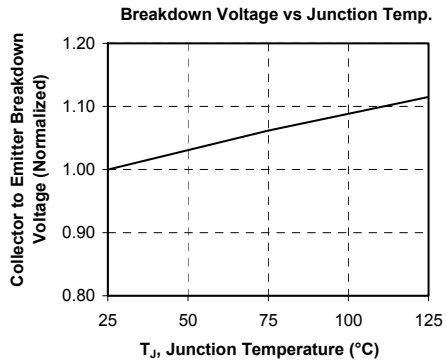
Q1 to Q4 Typical performance curve

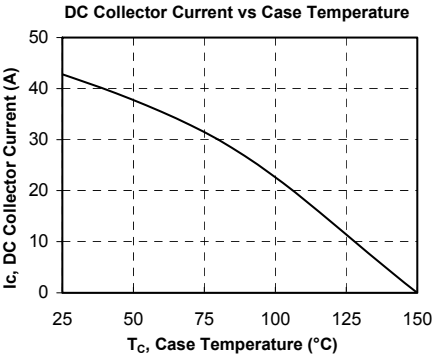




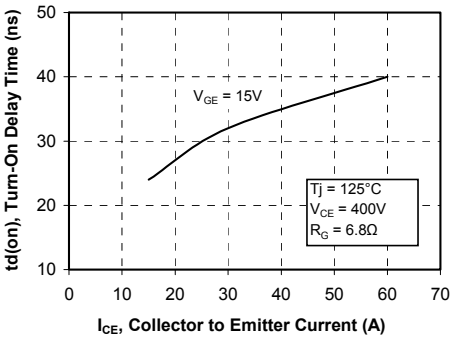




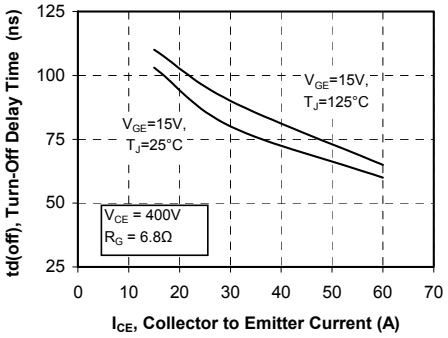




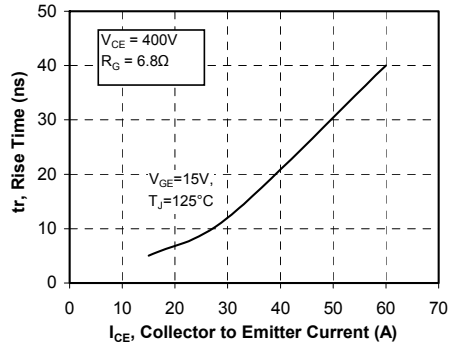
Turn-On Delay Time vs Collector Current



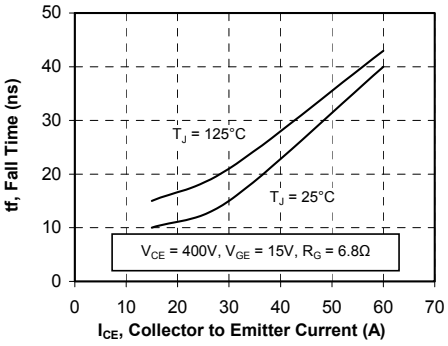
Turn-Off Delay Time vs Collector Current



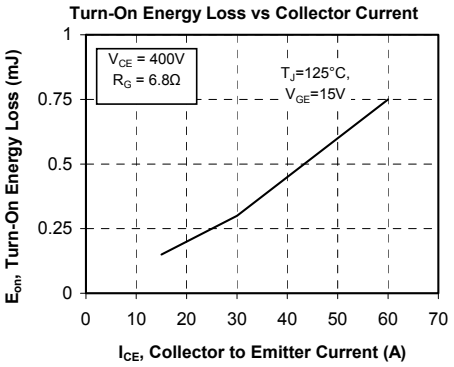
Current Rise Time vs Collector Current



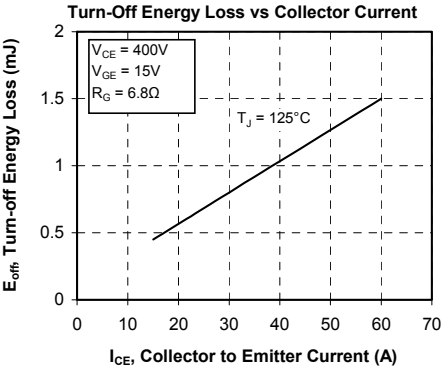
Current Fall Time vs Collector Current



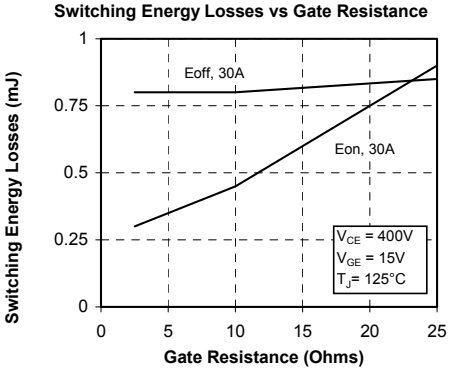
Turn-On Energy Loss vs Collector Current



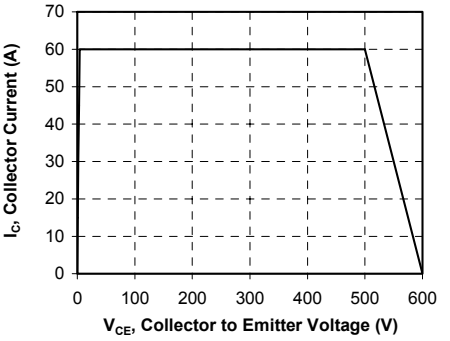
Turn-Off Energy Loss vs Collector Current

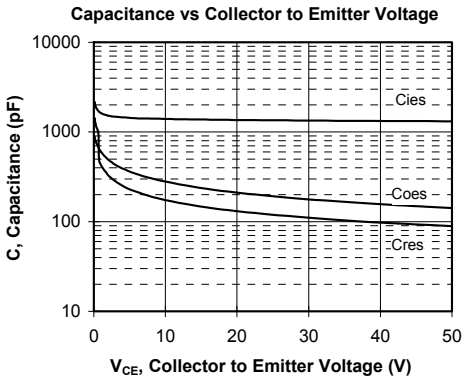


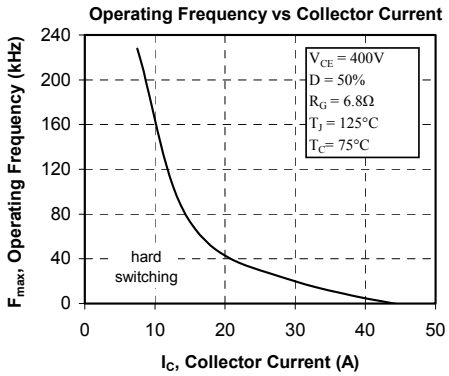
Switching Energy Losses vs Gate Resistance

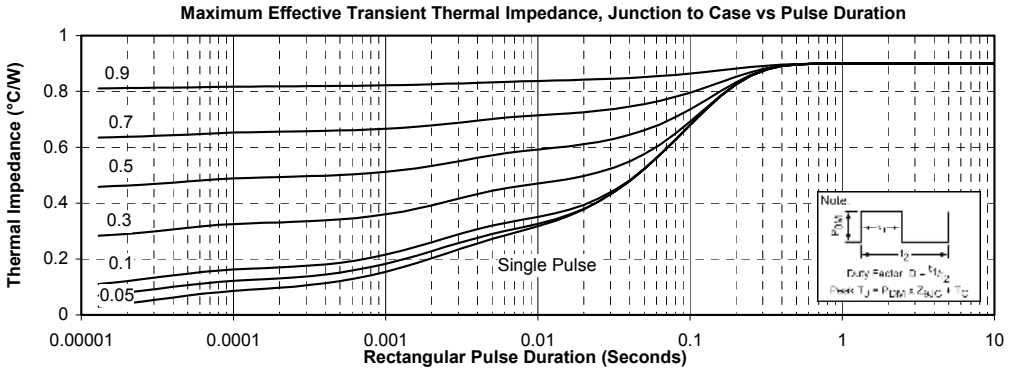


Reverse Bias Safe Operating Area



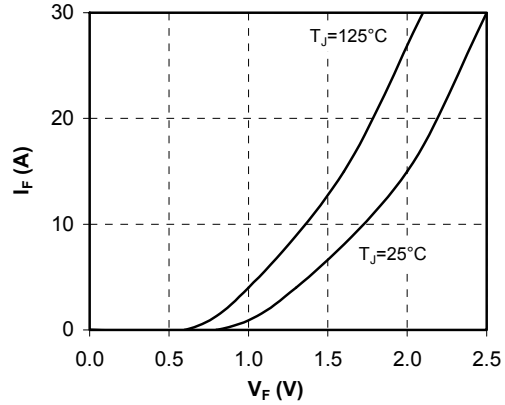

Capacitance vs Collector to Emitter Voltage
C, Capacitance (pF)
10000
1000
100
10
Cies
Coes
Cres
0
10
20
30
40
50
VCE, Collector to Emitter Voltage (V)


Operating Frequency vs Collector Current
Fmax, Operating Frequency (kHz)
240
200
160
120
80
40
0
VCE = 400V
D = 50%
RG = 6.8Ω
TJ = 125°C
TC = 75°C
hard
switching
0
10
20
30
40
50
IC, Collector Current (A)

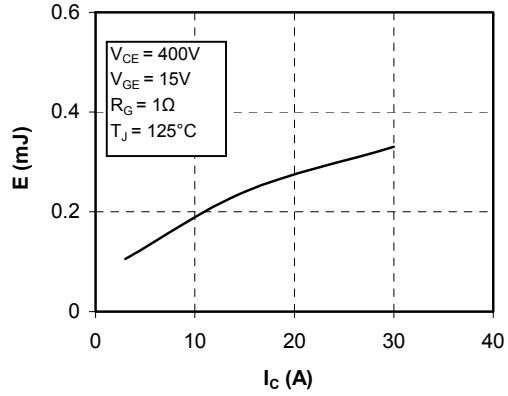

Maximum Effective Transient Thermal Impedance, Junction to Case vs Pulse Duration
Thermal Impedance (°C/W)
1
0.8
0.6
0.4
0.2
0
0.9
0.7
0.5
0.3
0.1
0.05
Single Pulse
Note
0.00001
0.0001
0.001
0.01
0.1
1
10
Rectangular Pulse Duration (Seconds)

CR1 to CR4 Typical performance curve

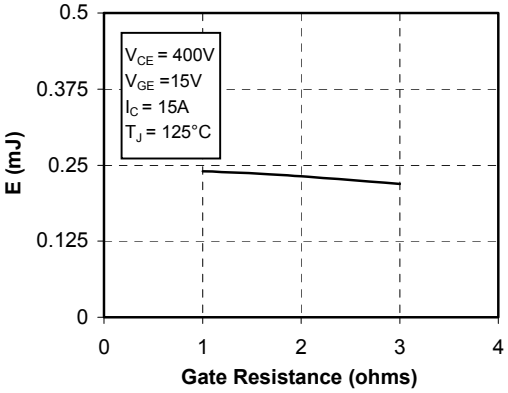
Forward Characteristic of diode



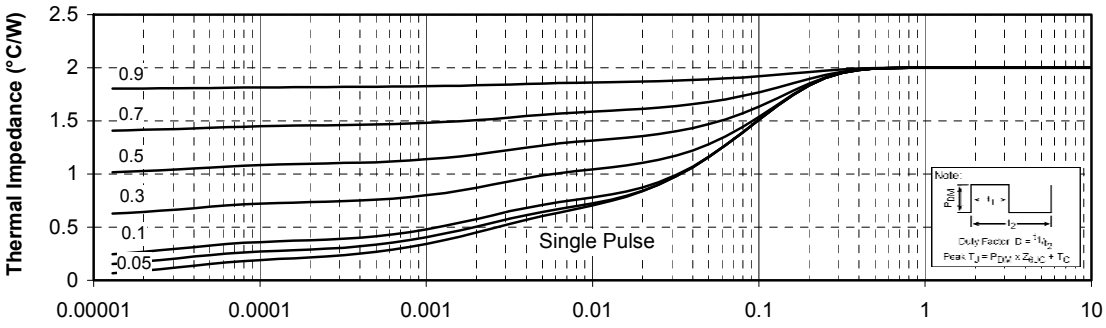
Energy losses vs Collector Current



Switching Energy Losses vs Gate Resistance

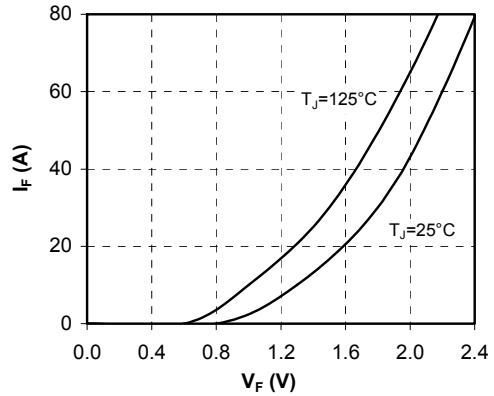


Maximum Effective Transient Thermal Impedance, Junction to Case vs Pulse Duration

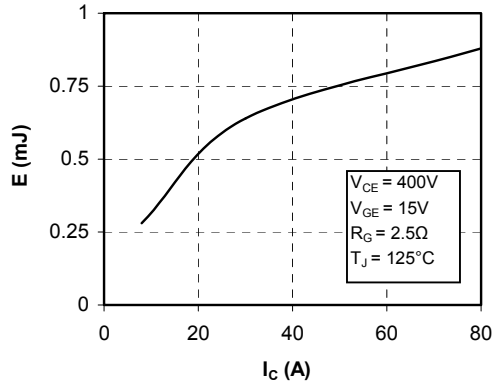


CR5 & CR6 Typical performance curve

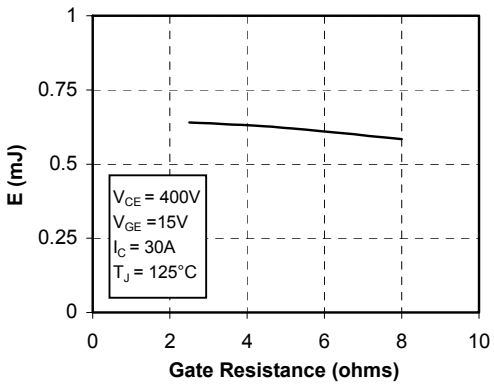
Forward Characteristic of diode



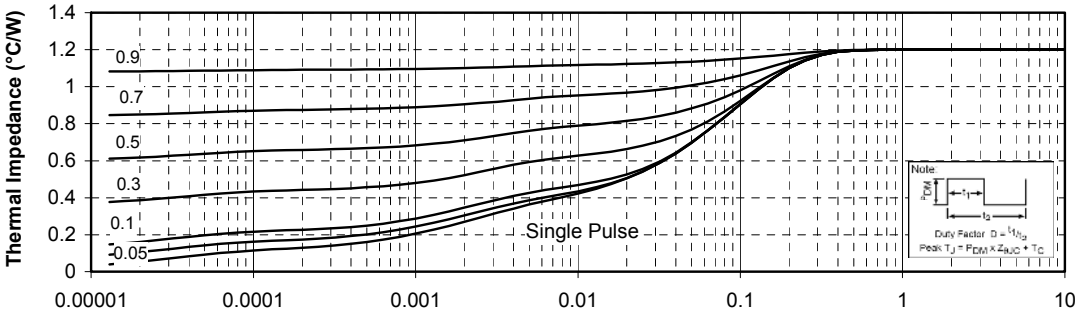
Energy losses vs Collector Current



Switching Energy Losses vs Gate Resistance



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



DISCLAIMER

The information contained in the document (unless it is publicly available on the Web without access restrictions) is PROPRIETARY AND CONFIDENTIAL information of Microsemi and cannot be copied, published, uploaded, posted, transmitted, distributed or disclosed or used without the express duly signed written consent of Microsemi. If the recipient of this document has entered into a disclosure agreement with Microsemi, then the terms of such Agreement will also apply. This document and the information contained herein may not be modified, by any person other than authorized personnel of Microsemi. No license under any patent, copyright, trade secret or other intellectual property right is granted to or conferred upon you by disclosure or delivery of the information, either expressly, by implication, inducement, estoppels or otherwise. Any license under such intellectual property rights must be approved by Microsemi in writing signed by an officer of Microsemi.

Microsemi reserves the right to change the configuration, functionality and performance of its products at anytime without any notice. This product has been subject to limited testing and should not be used in conjunction with life-support or other mission-critical equipment or applications. Microsemi assumes no liability whatsoever, and Microsemi disclaims any express or implied warranty, relating to sale and/or use of Microsemi products including liability or warranties relating to fitness for a particular purpose, merchantability, or infringement of any patent, copyright or other intellectual property right. Any performance specifications believed to be reliable but are not verified and customer or user must conduct and complete all performance and other testing of this product as well as any user or customers final application. User or customer shall not rely on any data and performance specifications or parameters provided by Microsemi. It is the customer's and user's responsibility to independently determine suitability of any Microsemi product and to test and verify the same. The information contained herein is provided "AS IS, WHERE IS" and with all faults, and the entire risk associated with such information is entirely with the User. Microsemi specifically disclaims any liability of any kind including for consequential, incidental and punitive damages as well as lost profit. The product is subject to other terms and conditions which can be located on the web at http://www.microsemi.com/legal/tnc.asp

Life Support Application

Seller's Products are not designed, intended, or authorized for use as components in systems intended for space, aviation, surgical implant into the body, in other applications intended to support or sustain life, or for any other application in which the failure of the Seller's Product could create a situation where personal injury, death or property damage or loss may occur (collectively "Life Support Applications").

Buyer agrees not to use Products in any Life Support Applications and to the extent it does it shall conduct extensive testing of the Product in such applications and further agrees to indemnify and hold Seller, and its officers, employees, subsidiaries, affiliates, agents, sales representatives and distributors harmless against all claims, costs, damages and expenses, and attorneys' fees and costs arising, directly or directly, out of any claims of personal injury, death, damage or otherwise associated with the use of the goods in Life Support Applications, even if such claim includes allegations that Seller was negligent regarding the design or manufacture of the goods.

Buyer must notify Seller in writing before using Seller's Products in Life Support Applications. Seller will study with Buyer alternative solutions to meet Buyer application specification based on Sellers sales conditions applicable for the new proposed specific part.