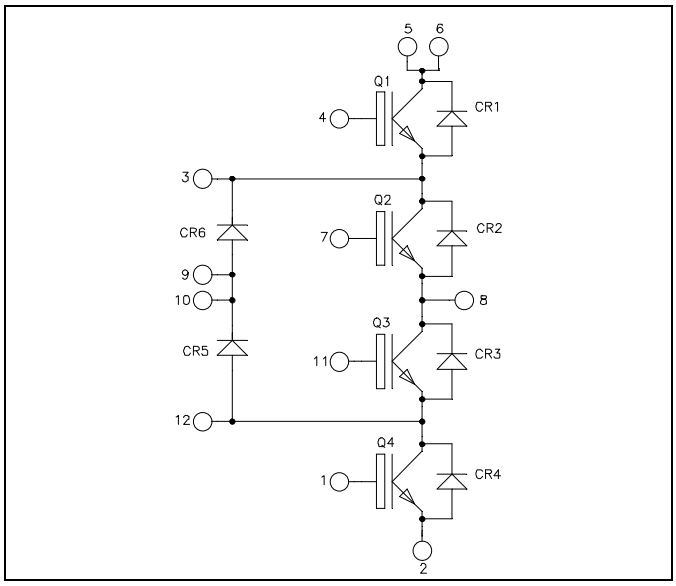
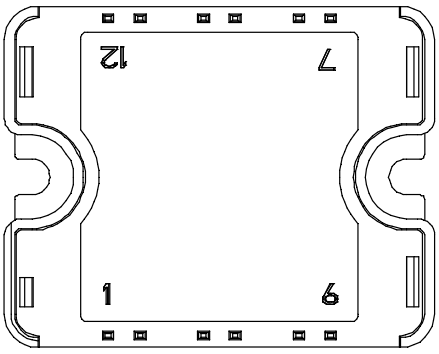
Three level inverter
NPT IGBT Power Module

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

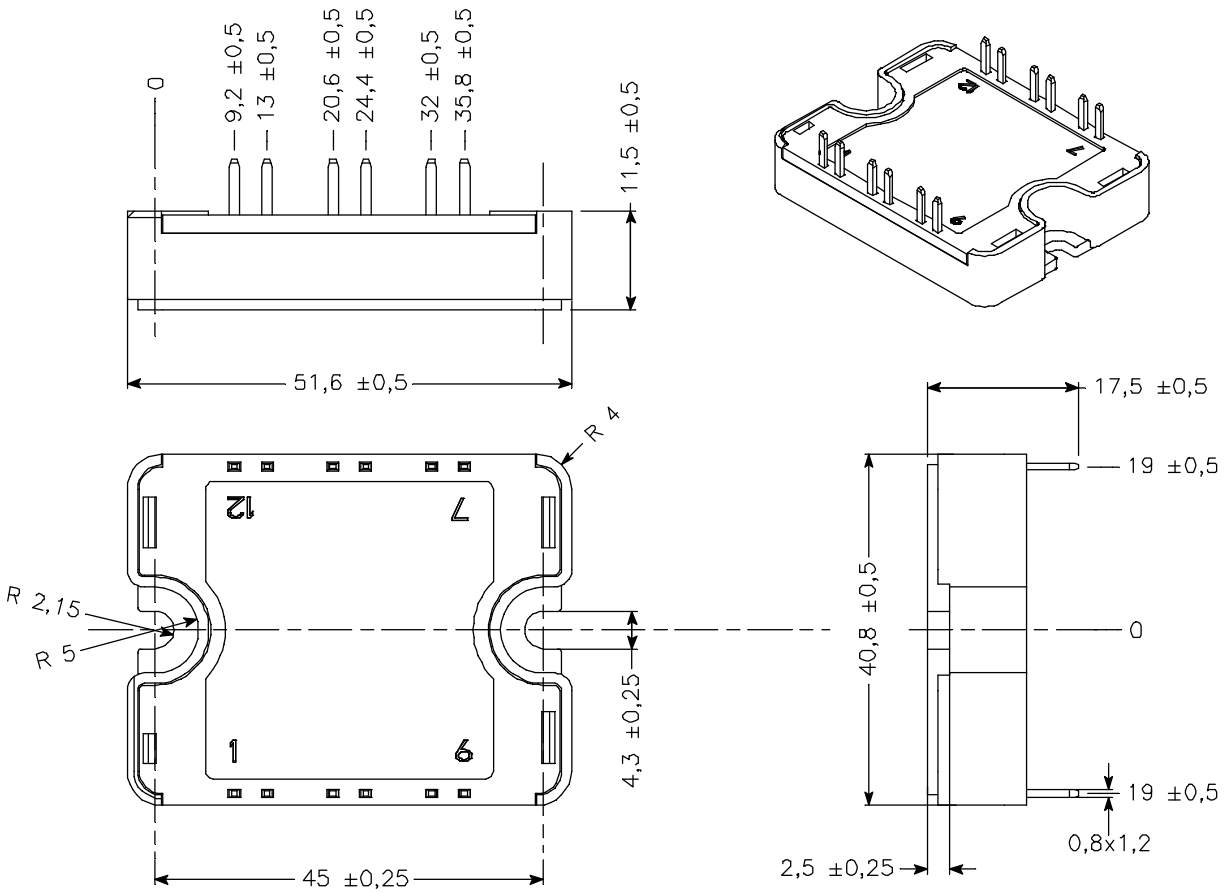
CR5 & CR6 diode ratings and characteristics

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, I isol<1mA, 50/60Hz			2500			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	2.5		4.7	N.m
Wt	Package Weight					80	g

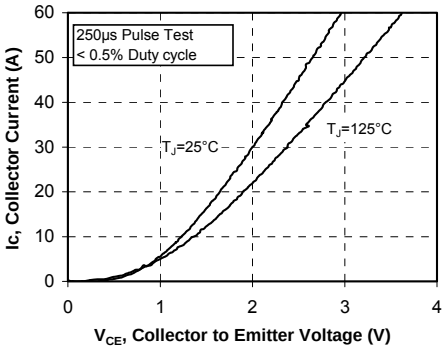
SP1 Package outline (dimensions in mm)



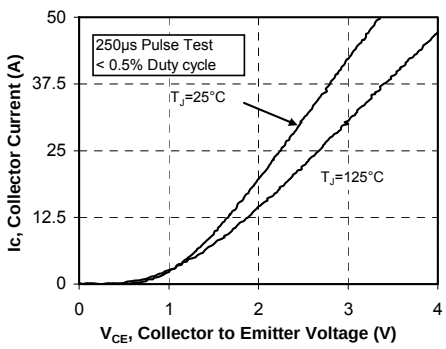
See application note 1904 - Mounting Instructions for SP1 Power Modules on www.microsemi.com

Q1 to Q4 Typical performance curve

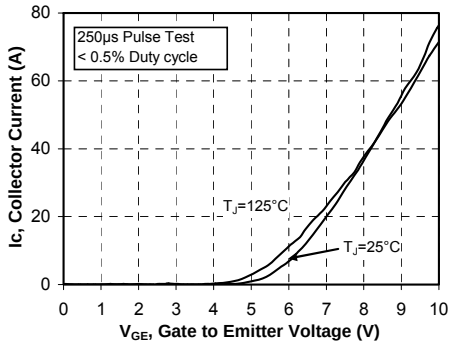
Output characteristics (V_{GE}=15V)



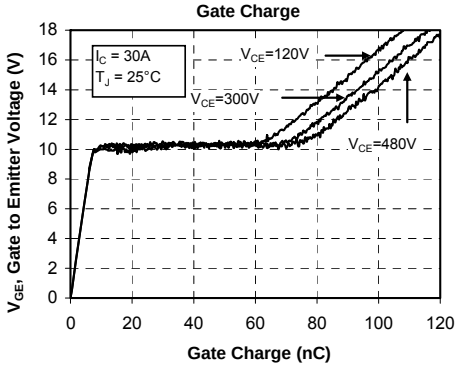
Output Characteristics (V_{GE}=10V)



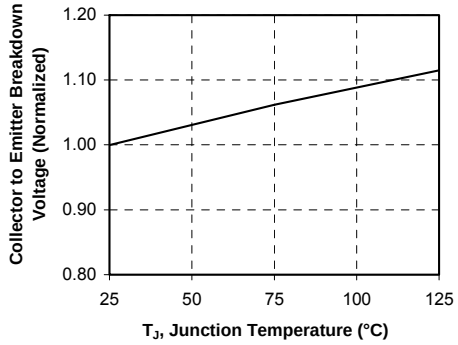
Transfer Characteristics



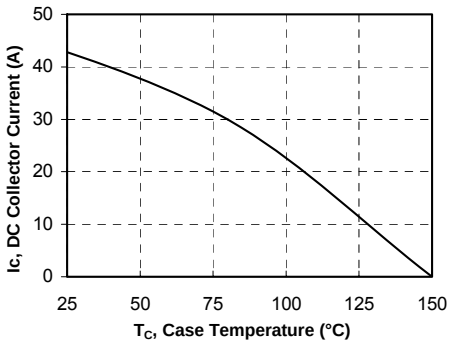
Gate Charge



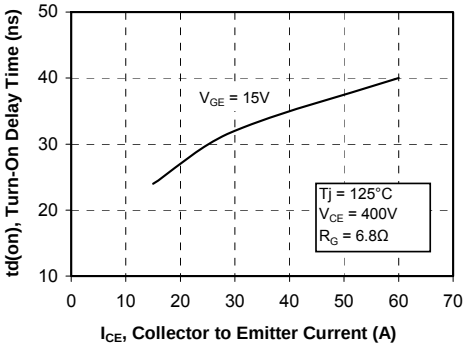
Breakdown Voltage vs Junction Temp.



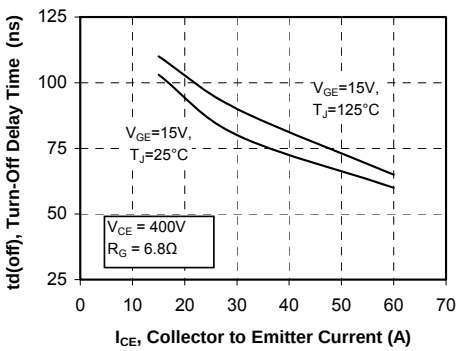
DC Collector Current vs Case Temperature



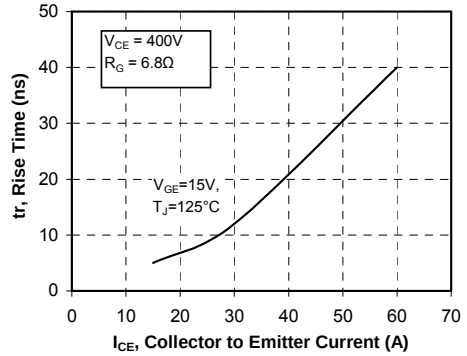
Turn-On Delay Time vs Collector Current



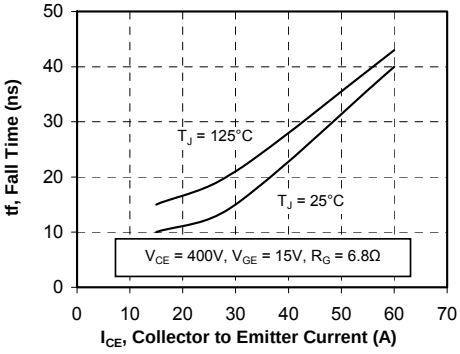
Turn-Off Delay Time vs Collector Current



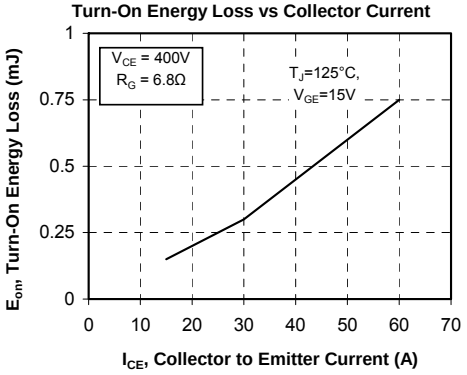
Current Rise Time vs Collector Current



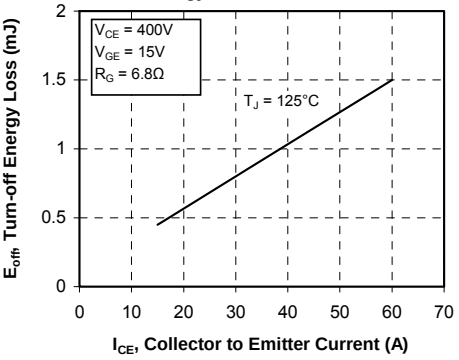
Current Fall Time vs Collector Current



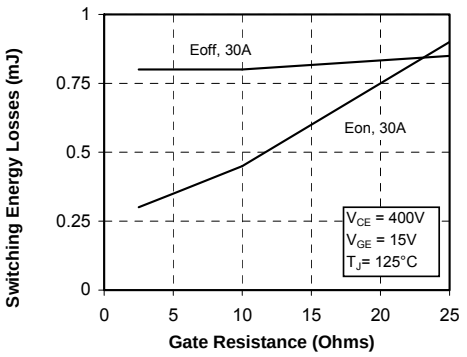
Turn-On Energy Loss vs Collector Current



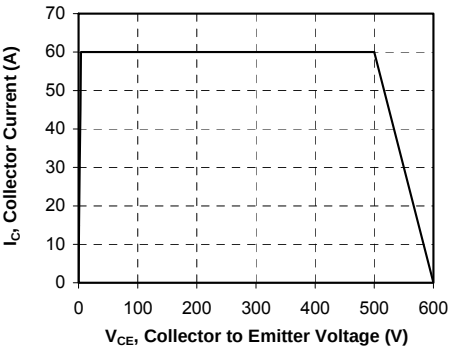
Turn-Off Energy Loss vs Collector Current



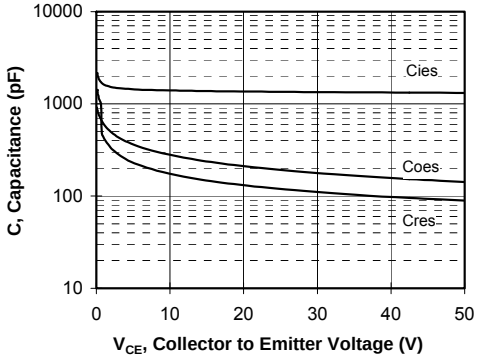
Switching Energy Losses vs Gate Resistance



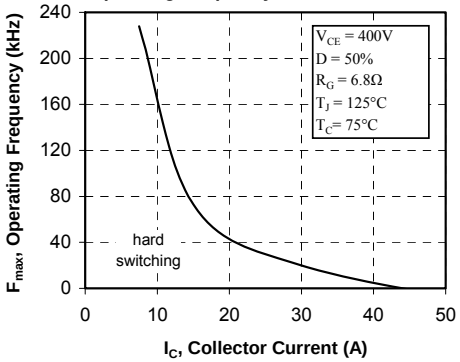
Reverse Bias Safe Operating Area



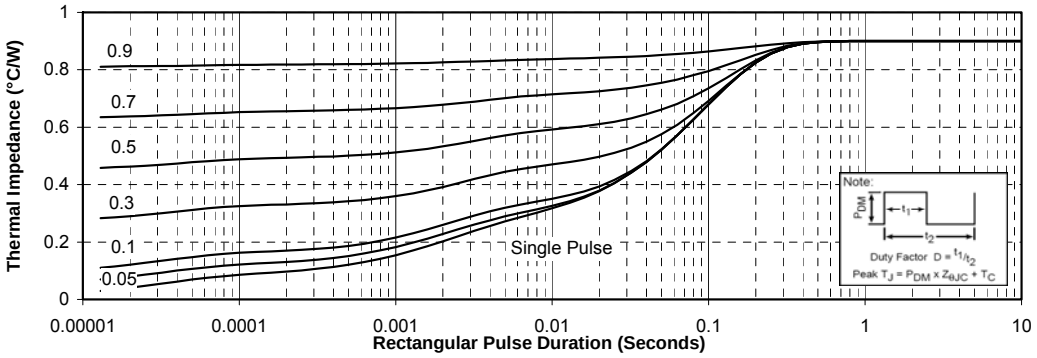
Capacitance vs Collector to Emitter Voltage



Operating Frequency vs Collector Current

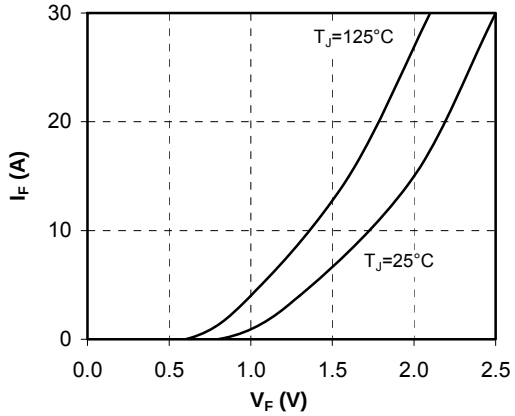


Maximum Effective Transient Thermal Impedance, Junction to Case vs Pulse Duration

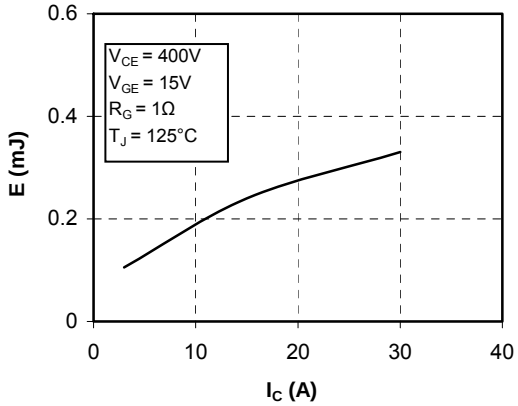


CR1 to CR4 Typical performance curve

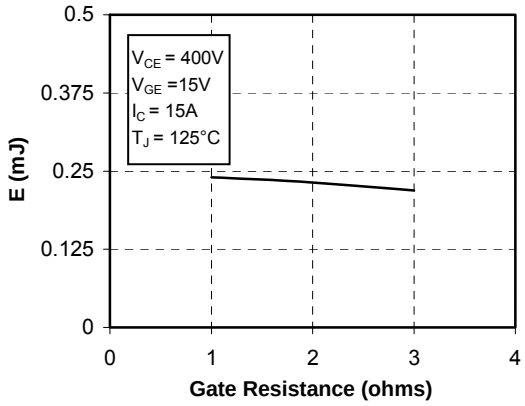
Forward Characteristic of diode



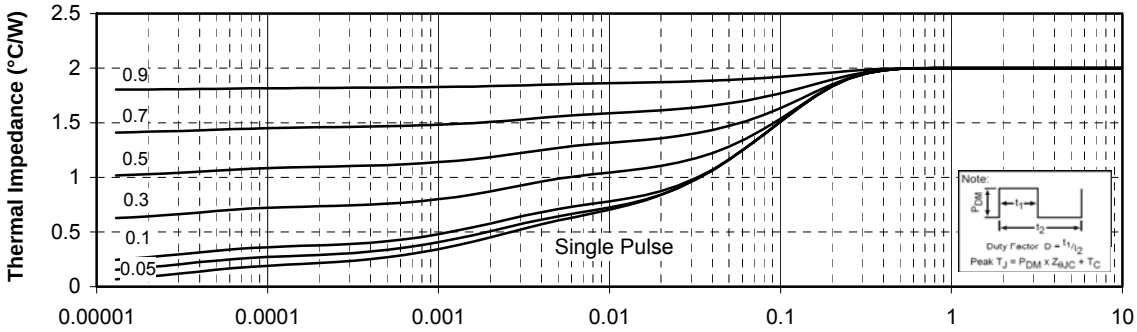
Energy losses vs Collector Current



Switching Energy Losses vs Gate Resistance



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



CR5 & CR6 Typical performance curve