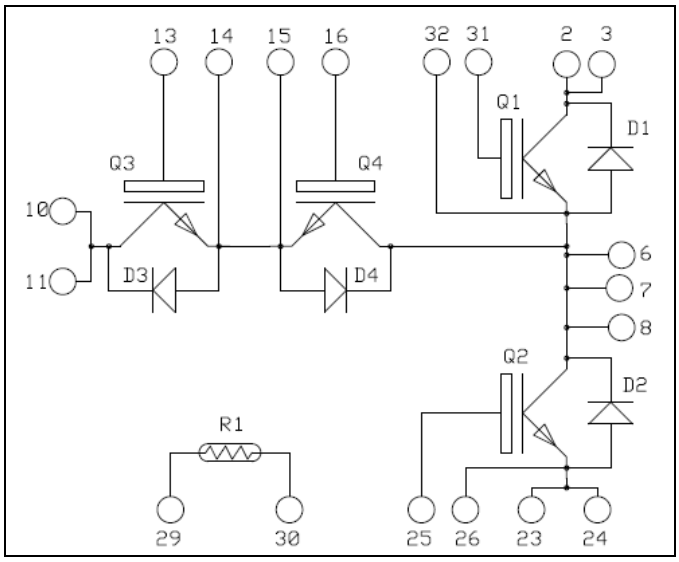
APTGLQ80HR120CT3G

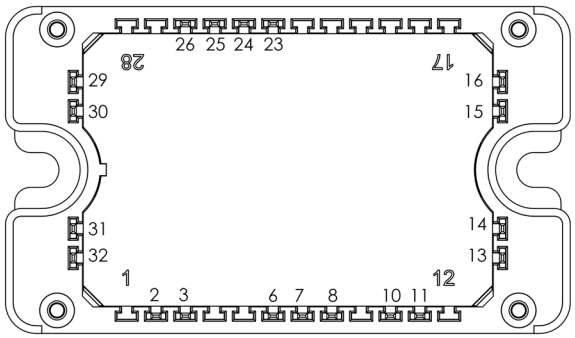
Microsemi POWER PRODUCTS GROUP

Phase Leg & Dual Common Emitter Power Module

High speed Trench & Field Stop IGBT4 (Q1, Q2):
V_{CES} = 1200V ; I_C = 80A @ Tc = 80°C

Trench & Field Stop IGBT3 (Q3, Q4):





All multiple inputs and outputs must be shorted together
10/11 ; 23/24 ; 2/3 ; …

Application

- Uninterruptible Power Supplies

Features

- ***Q1, Q2 High speed Trench + field Stop IGBT4***
  - Low voltage drop
  - Low tail current
- ***Q3, Q4 Trench + field Stop IGBT3***
  - Low voltage drop
  - Low tail current
  - Switching frequency up to 20 kHz
- ***SiC Schottky Diode (D3, D4)***
  - Zero reverse recovery
  - Zero forward recovery
  - Temperature Independent switching behavior
  - Positive temperature coefficient on VF
- Kelvin emitter for easy drive
- Very low stray inductance
- High level of integration
- Internal thermistor for temperature monitoring

Benefits

- 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 T_C of V_{CEsat}
- Low profile
- RoHS Compliant

All ratings @ T_j = 25°C unless otherwise specified

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

1. High speed Trench & Field Stop IGBT4 Phase Leg Q1&Q2 (per IGBT)

Absolute maximum ratings

Symbol	*Parameter*		*Max ratings*	*Unit*
V_{CES}	Collector - Emitter Breakdown Voltage		1200	V
I_C	Continuous Collector Current	$T_C = 25°C$	150	A
		$T_C = 80°C$	80	
I_{CM}	Pulsed Collector Current	$T_C = 25°C$	320	
V_{GE}	Gate – Emitter Voltage		±20	V
P_D	Maximum Power Dissipation		500	W
RBSOA	Reverse Bias Safe Operating Area	$T_j = 150°C$	160A @ 1100V	

Electrical Characteristics

Symbol	*Characteristic*	*Test Conditions*		*Min*	*Typ*	*Max*	*Unit*
I_{CES}	Zero Gate Voltage Collector Current	$V_{GE} = 0V$, $V_{CE} = 1200V$				150	µA
$V_{CE(sat)}$	Collector Emitter Saturation Voltage	$V_{GE} = 15V$ $I_C = 80A$	$T_j = 25°C$	1.7	2.05	2.4	V
			$T_j = 150°C$		2.6		
$V_{GE(th)}$	Gate Threshold Voltage	$V_{GE} = V_{CE}$, $I_C = 2$ mA		5.0	5.8	6.5	V
I_{GES}	Gate – Emitter Leakage Current	$V_{GE} = 20V$, $V_{CE} = 0V$				240	nA

Dynamic Characteristics

Symbol	*Characteristic*	*Test Conditions*		*Min*	*Typ*	*Max*	*Unit*
C_{ies}	Input Capacitance	$V_{GE} = 0V$ $V_{CE} = 25V$ $f = 1MHz$			4600		pF
C_{oes}	Output Capacitance				300		
C_{res}	Reverse Transfer Capacitance				270		
Q_G	Gate charge	$V_{GE} = 15V$, $I_C = 80A$ $V_{CE} = 960V$			370		nC
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching (25°C) $V_{GE} = ±15V$ $V_{Bus} = 600V$ $I_C = 80A$ $R_G = 6Ω$			30		ns
T_r	Rise Time				57		
$T_{d(off)}$	Turn-off Delay Time				290		
T_f	Fall Time				16		
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching (150°C) $V_{GE} = ±15V$ $V_{Bus} = 600V$ $I_C = 80A$ $R_G = 6Ω$			30		ns
T_r	Rise Time				49		
$T_{d(off)}$	Turn-off Delay Time				366		
T_f	Fall Time				48		
E_{on}	Turn on Energy	$V_{GE} = ±15V$ $V_{Bus} = 600V$ $I_C = 80A$ $R_G = 6Ω$	$T_j = 25°C$		6.4		mJ
			$T_j = 150°C$		7.5		
E_{off}	Turn off Energy		$T_j = 25°C$		2.4		
			$T_j = 150°C$		4.5		
I_{sc}	Short Circuit data	$V_{GE} ≤ 15V$; $V_{Bus} = 600V$ $t_p ≤ 10µs$; $T_j = 150°C$			300		A
R_{thJC}	Junction to Case Thermal Resistance					0.3	°C/W

Diode ratings and characteristics (D1 & D2) (per diode)

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				100	µA
I_F	DC Forward Current		Tc =80°C		30		A
V_F	Diode Forward Voltage	I_F = 30A			2.6	3.1	V
		I_F = 60A			3.2		
		I_F = 30A	T_j = 125°C		1.8		
t_{rr}	Reverse Recovery Time	I_F = 30A V_R = 800V di/dt =200A/µs	T_j = 25°C		300		ns
			T_j = 125°C		380		
Q_{rr}	Reverse Recovery Charge		T_j = 25°C		360		nC
			T_j = 125°C		1700		
R_{thJC}	Junction to Case Thermal Resistance					1.2	°C/W

2. Trench & Field Stop IGBT3 Dual common emitter Q3&Q4 (per IGBT)

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	100	A
		T_C = 80°C	75	
I_{CM}	Pulsed Collector Current	T_C = 25°C	140	
V_{GE}	Gate – Emitter Voltage		±20	V
P_D	Maximum Power Dissipation	T_C = 25°C	250	W
RBSOA	Reverse Bias Safe Operating Area	T_J = 150°C	150A @ 550V	

Electrical Characteristics

Symbol	*Characteristic*	*Test Conditions*		*Min*	*Typ*	*Max*	*Unit*
I_{CES}	Zero Gate Voltage Collector Current	V_{GE} = 0V, V_{CE} = 600V				250	µA
$V_{CE(sat)}$	Collector Emitter Saturation Voltage	V_{GE} =15V I_C = 75A	T_j = 25°C		1.5	1.9	V
			T_j = 150°C		1.7		
$V_{GE(th)}$	Gate Threshold Voltage	V_{GE} = V_{CE}, I_C = 600µA		5.0	5.8	6.5	V
I_{GES}	Gate – Emitter Leakage Current	V_{GE} = 20V, V_{CE} = 0V				600	nA

Dynamic Characteristics

Symbol	Characteristic	Test Conditions		Min	Typ	Max	Unit
C_{ies}	Input Capacitance	V_{GE} = 0V V_{CE} = 25V f = 1MHz			4620		pF
C_{oes}	Output Capacitance				300		
C_{res}	Reverse Transfer Capacitance				140		
Q_G	Gate charge	V_{GE}=±15V, I_C=75A V_{CE}=300V			0.8		µC
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching (25°C) V_{GE} = ±15V V_{Bus} = 300V I_C = 75A R_G = 4.7Ω			110		ns
T_r	Rise Time				45		
$T_{d(off)}$	Turn-off Delay Time				200		
T_f	Fall Time				40		
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching (150°C) V_{GE} = ±15V V_{Bus} = 300V I_C = 75A R_G = 4.7Ω			120		ns
T_r	Rise Time				50		
$T_{d(off)}$	Turn-off Delay Time				250		
T_f	Fall Time				60		
E_{on}	Turn-on Switching Energy	V_{GE} = ±15V V_{Bus} = 300V I_C = 75A R_G = 4.7Ω	T_j = 25°C		0.21		mJ
			T_j = 150°C		0.36		
E_{off}	Turn-off Switching Energy		T_j = 25°C		2.2		mJ
			T_j = 150°C		2.6		
I_{sc}	Short Circuit data	V_{GE} ≤15V ; V_{Bus} = 360V t_p ≤ 6µs ; T_j = 150°C			380		A
R_{thJC}	Junction to Case Thermal Resistance					0.60	°C/W

SiC diode ratings and characteristics (D3 & D4) (per diode)

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		30	180	µA
			T_j = 175°C		60	900	
I_F	DC Forward Current		Tc = 100°C		30		A
V_F	Diode Forward Voltage	I_F = 30A	T_j = 25°C		1.6	1.8	V
			T_j = 175°C		2	2.4	
Q_C	Total Capacitive Charge	I_F = 30A, V_R = 600V di/dt =1000A/µs			84		nC
C	Total Capacitance	f = 1MHz, V_R = 200V			195		pF
		f = 1MHz, V_R = 400V			150		
R_{thJC}	Junction to Case Thermal Resistance					1	°C/W

3. Thermal & Package characteristics

Temperature sensor NTC (see application note APT0406 on www.microsemi.com).

Symbol	*Characteristic*	*Min*	*Typ*	*Max*	*Unit*
R_{25}	Resistance @ 25°C		22		kΩ
$\Delta R_{25}/R_{25}$				5	%
$B_{25/100}$	T_{25} = 298.15 K		3980		K
$\Delta B/B$				3	%

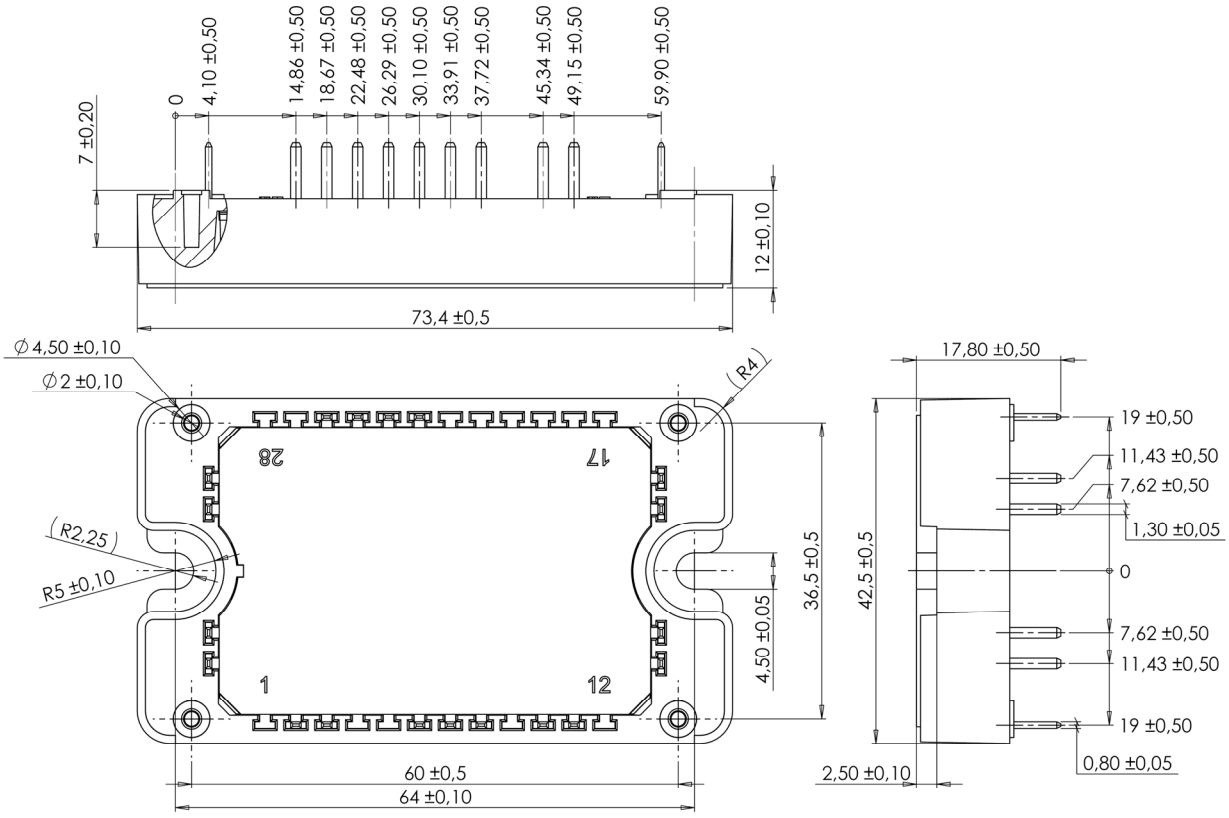
$$R_T = \frac{R_{25}}{\exp\left[B_{25/85}\left(\frac{1}{T_{25}} - \frac{1}{T}\right)\right]}$$

T: Thermistor temperature
R_T: Thermistor value at T

Thermal and package characteristics

Symbol	*Characteristic*			*Min*	*Typ*	*Max*	*Unit*
V_{ISOL}	RMS Isolation Voltage, any terminal to case t =1 min, 50/60Hz			4000			V
T_J	Operating junction temperature range			-40		175	°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

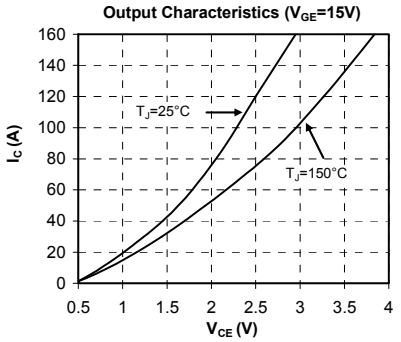
SP3F Package outline (dimensions in mm)

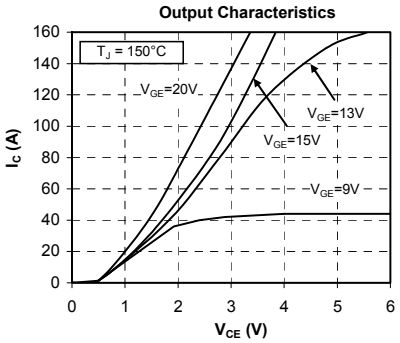


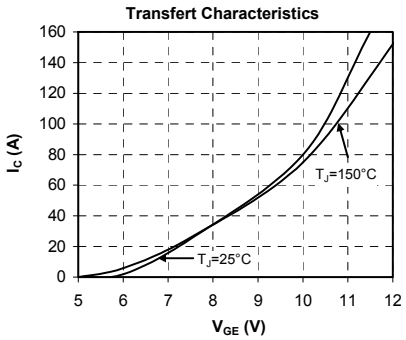
See application note 1906 - Mounting Instructions for SP3F Power Modules on www.microsemi.com

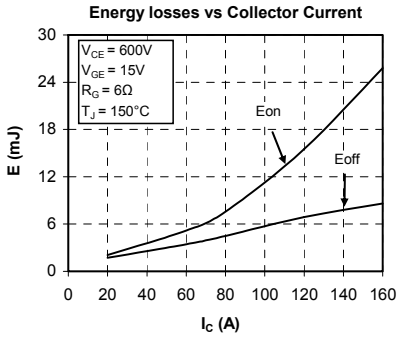
4. Typical performance curve

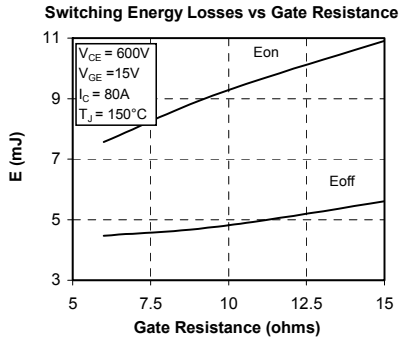
Q1, Q2 High speed Trench + field stop IGBT4 + CR1 & CR2 diode characteristics

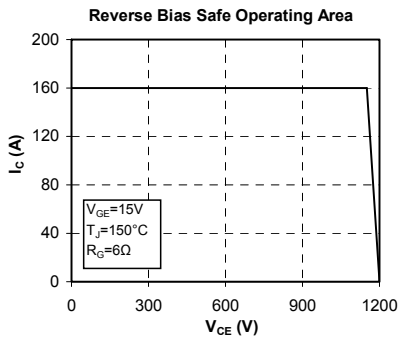


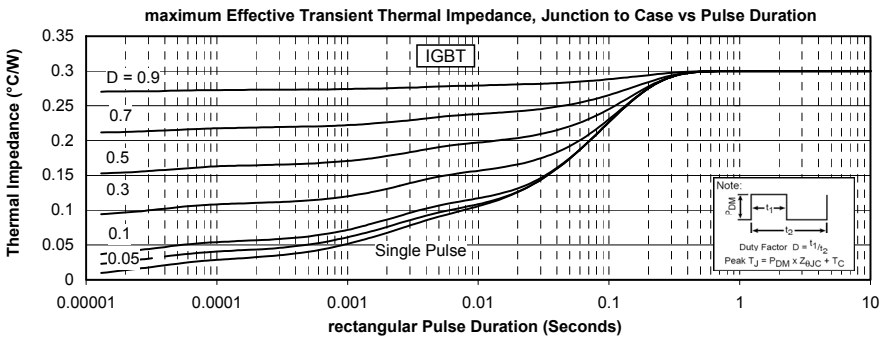


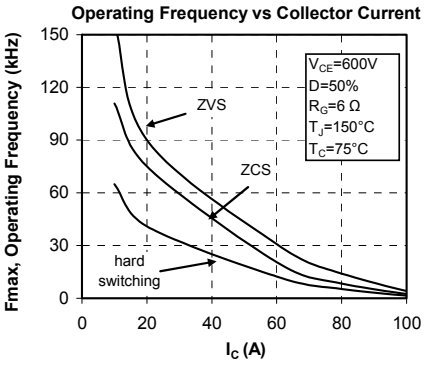


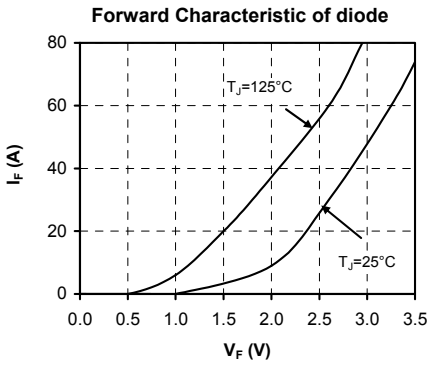


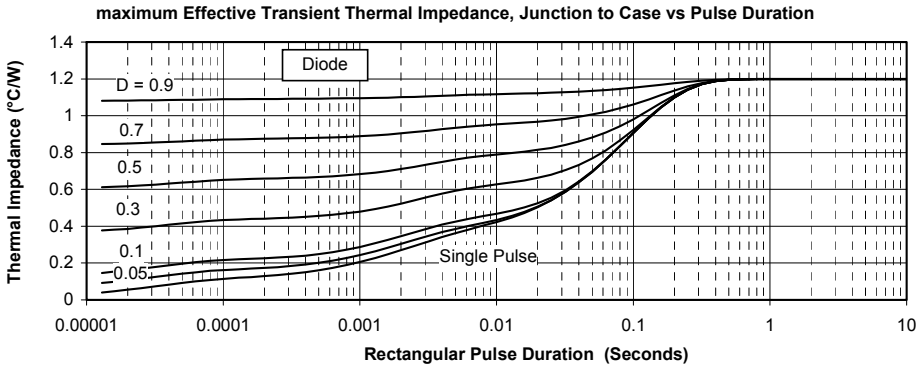




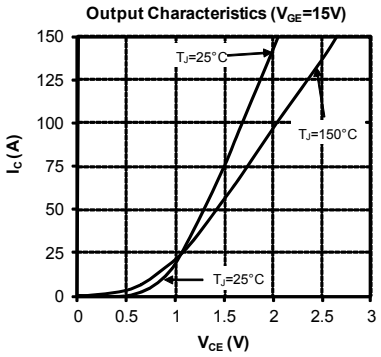


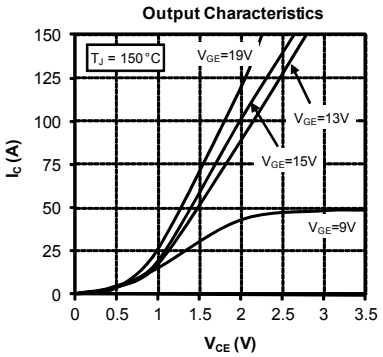


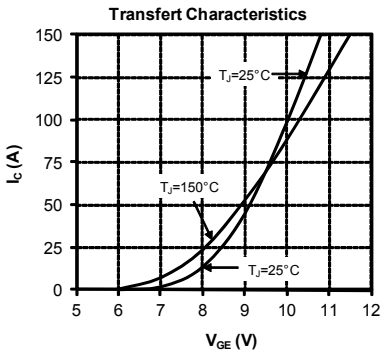


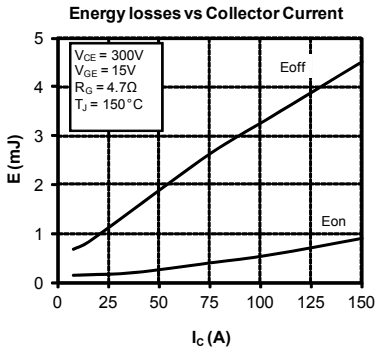


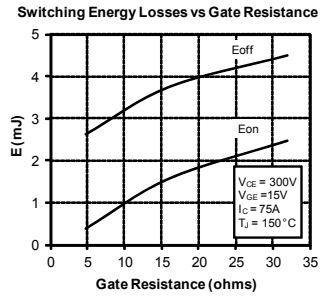
Q3, Q4 Trench + field stop IGBT3

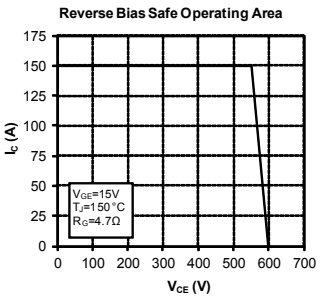


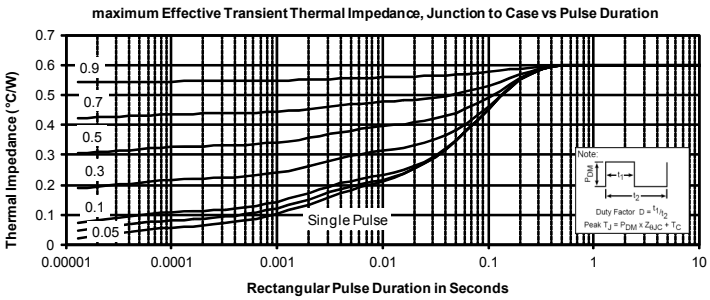




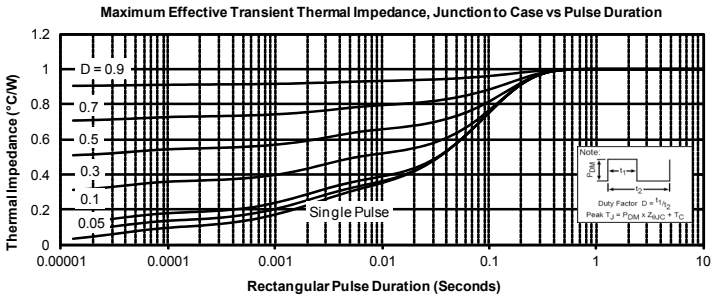


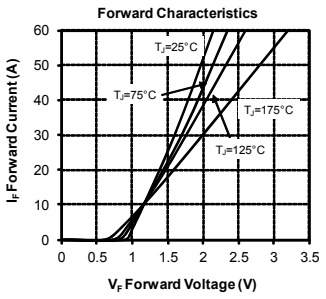


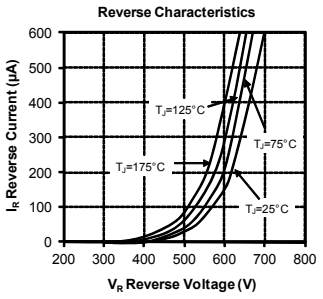


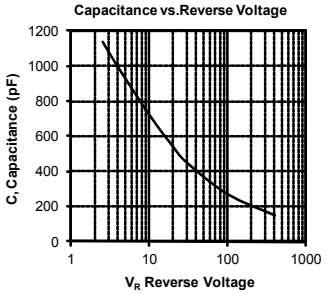


CR3 & CR4 SiC diode characteristics









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