

Phase leg Series & SiC parallel diodes MOSFET Power Module

$$V_{DSS} = 1000V$$

$$R_{DSon} = 230m\Omega \text{ typ @ } T_j = 25^\circ C$$

$$I_D = 36A \text{ @ } T_c = 25^\circ C$$

Application

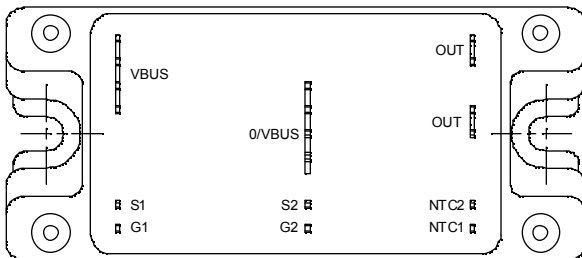
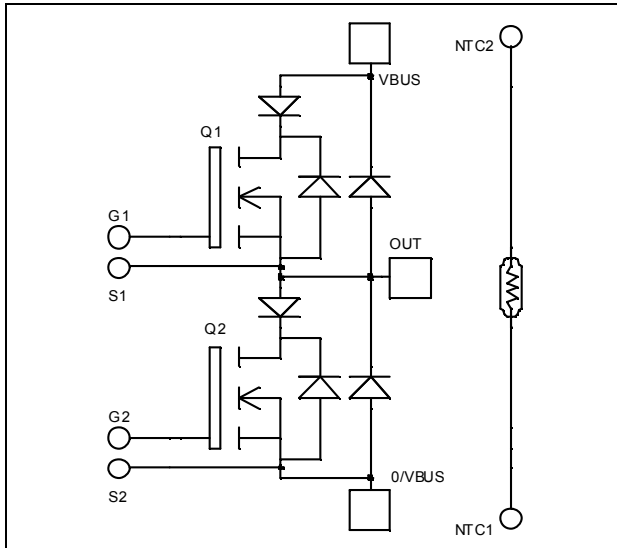
- Motor control
- Switched Mode Power Supplies
- Uninterruptible Power Supplies

Features

- **Power MOS 7[®] MOSFETs**
 - Low R_{DSon}
 - Low input and Miller capacitance
 - Low gate charge
 - Avalanche energy rated
- **Parallel SiC Schottky Diode**
 - Zero reverse recovery
 - Zero forward recovery
 - Temperature Independent switching behavior
 - Positive temperature coefficient on VF
- Kelvin source for easy drive
- Very low stray inductance
 - Symmetrical design
 - Lead frames for power connections
- Internal thermistor for temperature monitoring
- High level of integration

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
- RoHS Compliant



Absolute maximum ratings

Symbol	Parameter	Max ratings	Unit
V_{DSS}	Drain - Source Breakdown Voltage	1000	V
I_D	Continuous Drain Current	$T_c = 25^\circ C$	36
		$T_c = 80^\circ C$	27
I_{DM}	Pulsed Drain current	144	A
V_{GS}	Gate - Source Voltage	± 30	V
R_{DSon}	Drain - Source ON Resistance	270	m Ω
P_D	Maximum Power Dissipation	$T_c = 25^\circ C$	694
I_{AR}	Avalanche current (repetitive and non repetitive)	18	A
E_{AR}	Repetitive Avalanche Energy	50	mJ
E_{AS}	Single Pulse Avalanche Energy	2500	



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

All ratings @ $T_j = 25^\circ\text{C}$ unless otherwise specified

Electrical Characteristics

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
I_{DSS}	Zero Gate Voltage Drain Current	$V_{GS} = 0V, V_{DS} = 1000V$ $T_j = 25^\circ\text{C}$			200	μA
		$V_{GS} = 0V, V_{DS} = 800V$ $T_j = 125^\circ\text{C}$			1000	
$R_{DS(on)}$	Drain – Source on Resistance	$V_{GS} = 10V, I_D = 18A$		230	270	$\text{m}\Omega$
$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 5\text{mA}$	3		5	V
I_{GSS}	Gate – Source Leakage Current	$V_{GS} = \pm 30V, V_{DS} = 0V$			± 150	nA

Dynamic Characteristics

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
C_{iss}	Input Capacitance	$V_{GS} = 0V$		8700		pF
C_{oss}	Output Capacitance	$V_{DS} = 25V$		1430		
C_{rss}	Reverse Transfer Capacitance	$f = 1\text{MHz}$		240		
Q_g	Total gate Charge	$V_{GS} = 10V$		308		nC
Q_{gs}	Gate – Source Charge	$V_{Bus} = 500V$		52		
Q_{gd}	Gate – Drain Charge	$I_D = 36A$		194		
$T_{d(on)}$	Turn-on Delay Time	Inductive switching @ 125°C $V_{GS} = 15V$ $V_{Bus} = 667V$ $I_D = 36A$ $R_G = 2.5\Omega$		10		ns
T_r	Rise Time			12		
$T_{d(off)}$	Turn-off Delay Time			121		
T_f	Fall Time			35		
E_{on}	Turn-on Switching Energy	Inductive switching @ 25°C $V_{GS} = 15V, V_{Bus} = 667V$ $I_D = 36A, R_G = 2.5\Omega$		767		μJ
E_{off}	Turn-off Switching Energy			760		
E_{on}	Turn-on Switching Energy	Inductive switching @ 125°C $V_{GS} = 15V, V_{Bus} = 667V$ $I_D = 36A, R_G = 2.5\Omega$		1255		μJ
E_{off}	Turn-off Switching Energy			902		

Series diode ratings and characteristics

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
V_{RRM}	Maximum Peak Repetitive Reverse Voltage		200			V
I_{RM}	Maximum Reverse Leakage Current	$V_R = 200V$	$T_j = 25^\circ\text{C}$		350	μA
			$T_j = 125^\circ\text{C}$		600	
I_F	DC Forward Current	$T_c = 85^\circ\text{C}$		60		A
V_F	Diode Forward Voltage	$I_F = 60A$		1.1	1.15	V
		$I_F = 120A$		1.4		
		$I_F = 60A$ $T_j = 125^\circ\text{C}$		0.9		
t_{rr}	Reverse Recovery Time	$I_F = 60A$ $V_R = 133V$ $di/dt = 400A/\mu\text{s}$	$T_j = 25^\circ\text{C}$	24		ns
			$T_j = 125^\circ\text{C}$	48		
Q_{rr}	Reverse Recovery Charge	$T_j = 25^\circ\text{C}$		66		nC
			$T_j = 125^\circ\text{C}$	300		

Parallel SiC 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		200	800	μA
			T _j = 150°C		400	4000	
I _F	DC Forward Current	T _c = 125°C			20		A
V _F	Diode Forward Voltage	I _F = 20A	T _j = 25°C		1.6	1.8	V
			T _j = 175°C		2.6	3.0	
Q _C	Total Capacitive Charge	I _F = 20A, V _R = 600V di/dt = 1200A/μs			56		nC
Q	Total Capacitance	f = 1MHz, V _R = 200V			180		pF
		f = 1MHz, V _R = 400V			132		

Thermal and package characteristics

Symbol	Characteristic	Min		Typ	Max	Unit
R _{thJC}	Junction to Case Thermal Resistance	Transistor			0.18	°C/W
		Series diode			0.65	
		Parallel diode			0.8	
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	M5	2.5	4.7	N.m
Wt	Package Weight				160	g

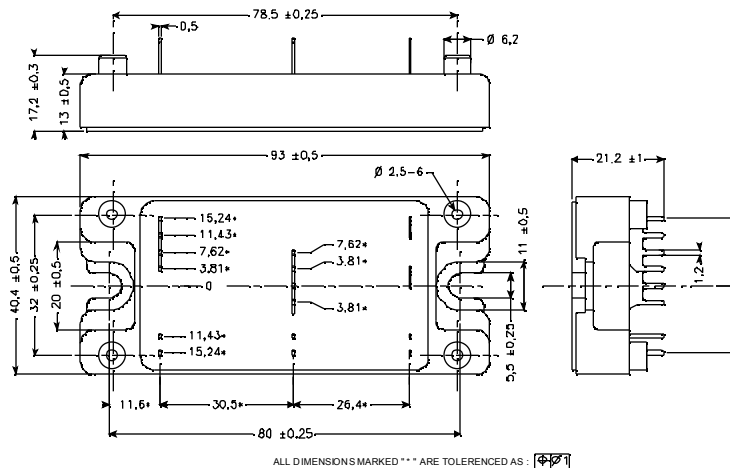
Temperature sensor NTC (see application note APT0406 on www.microsemi.com for more information).

Symbol	Characteristic	Min	Typ	Max	Unit
R ₂₅	Resistance @ 25°C		50		kΩ
B _{25/85}	T ₂₅ = 298.15 K		3952		K

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

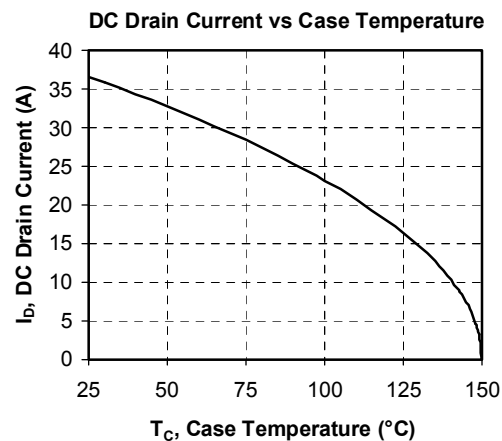
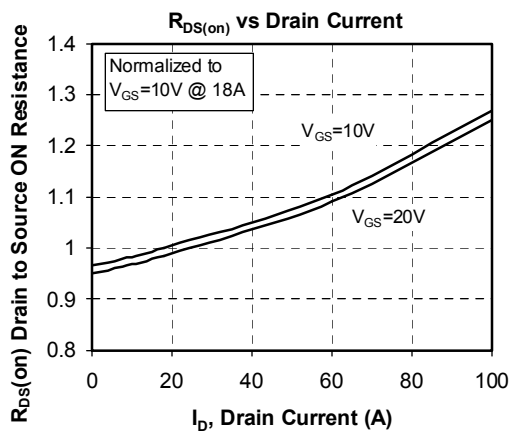
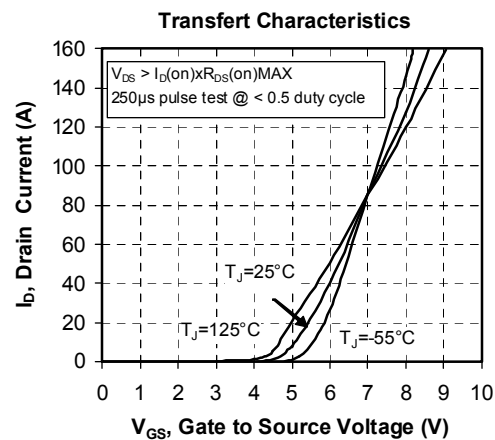
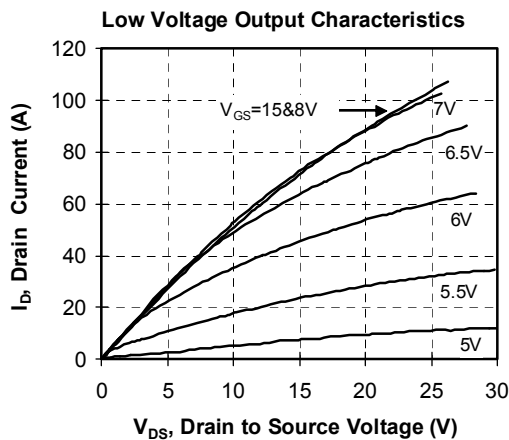
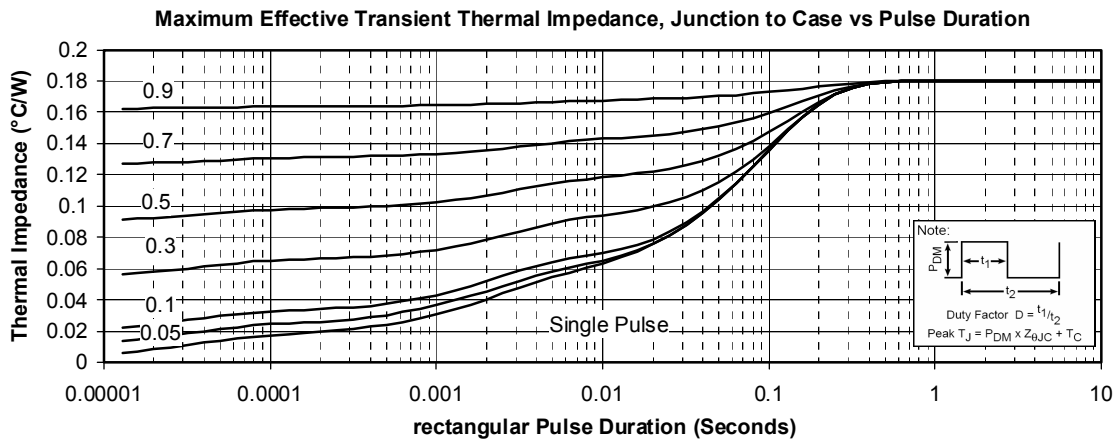
T: Thermistor temperature
R_T: Thermistor value at T

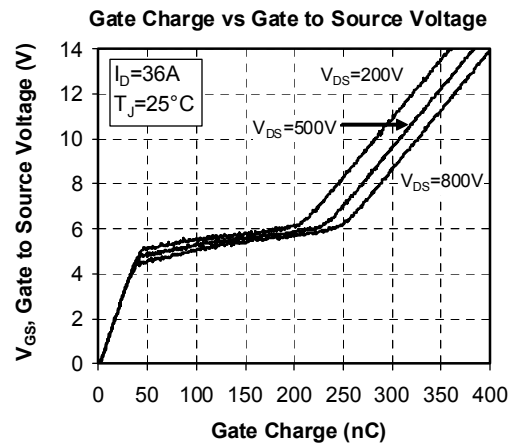
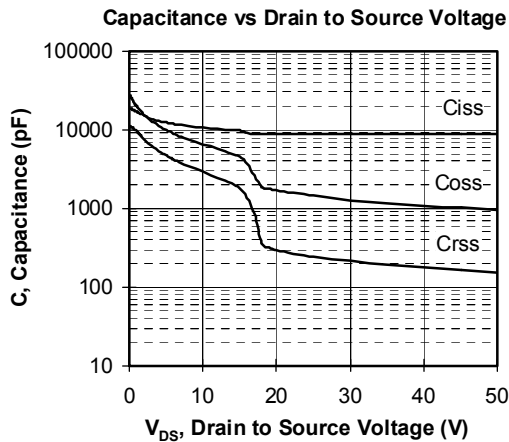
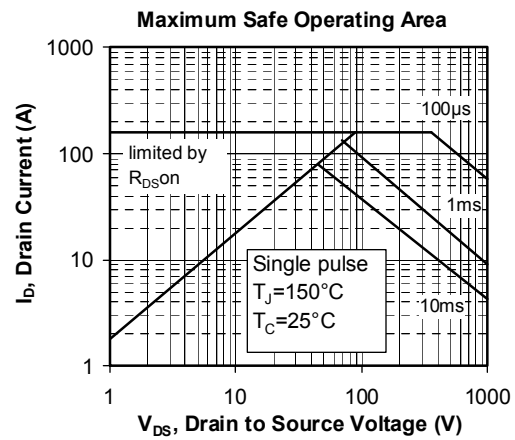
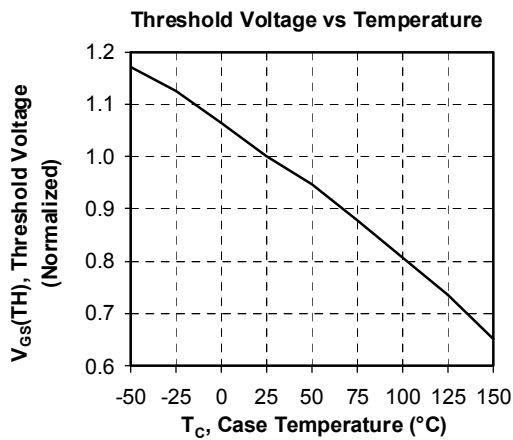
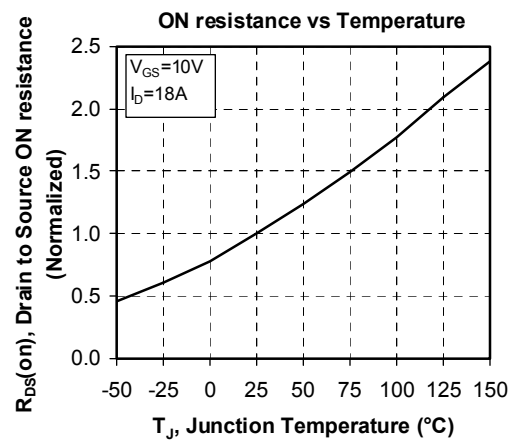
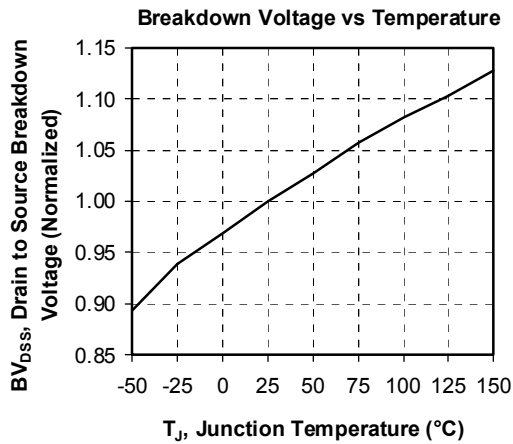
SP4 Package outline (dimensions in mm)

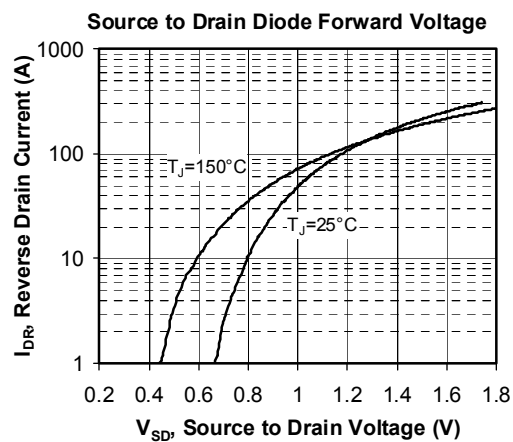
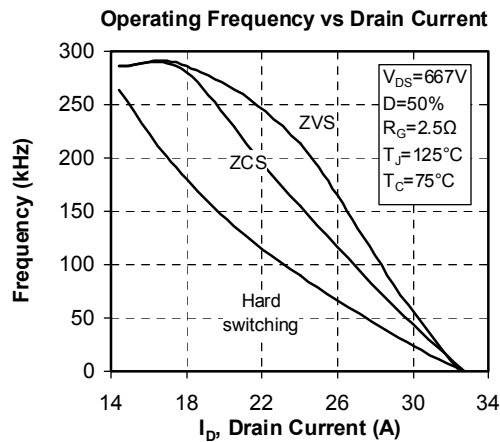
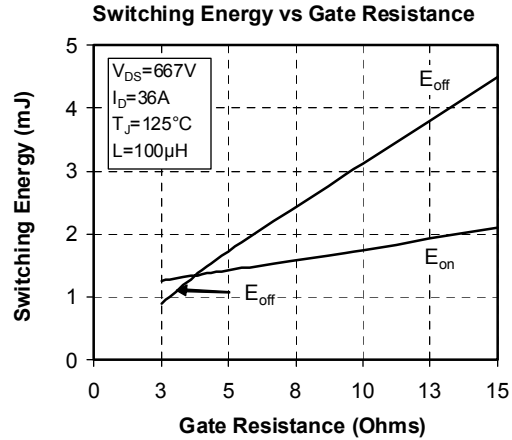
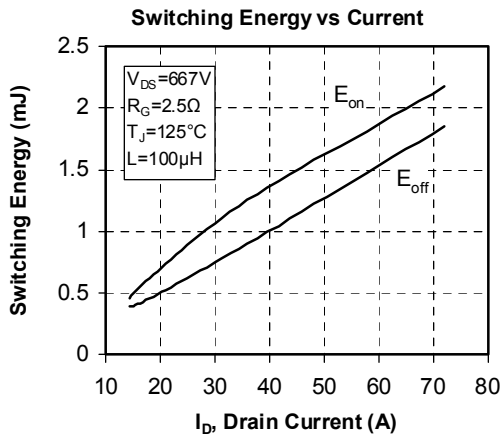
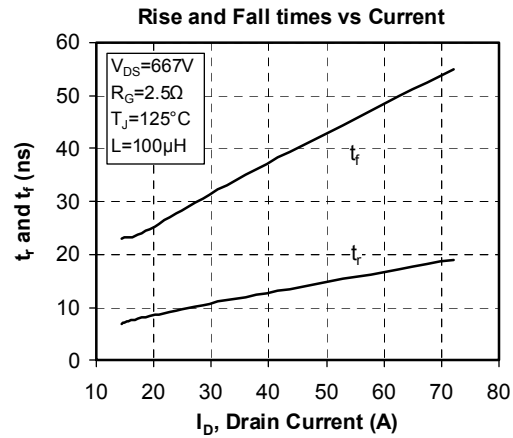
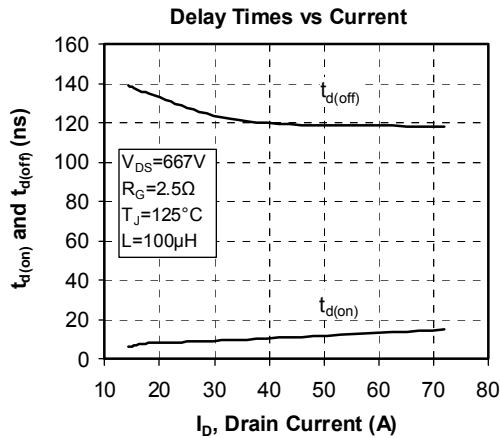


See application note APT0501 - Mounting Instructions for SP4 Power Modules on www.microsemi.com

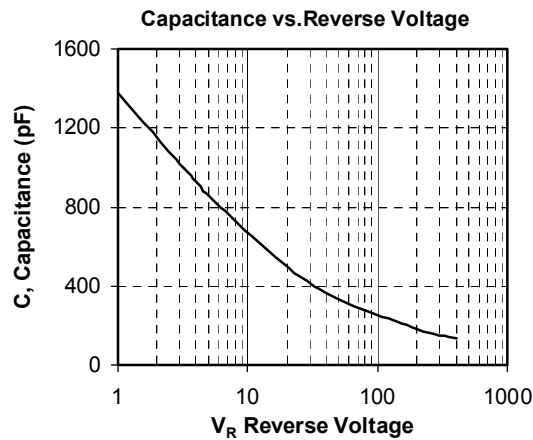
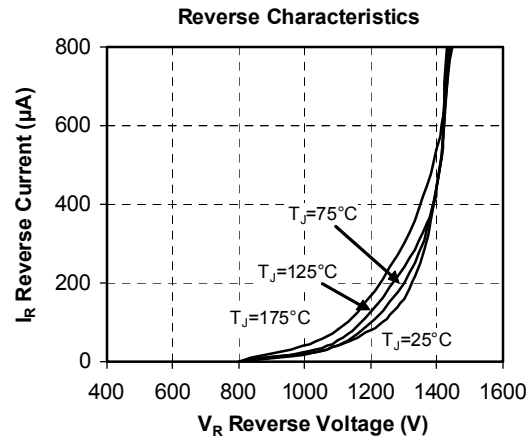
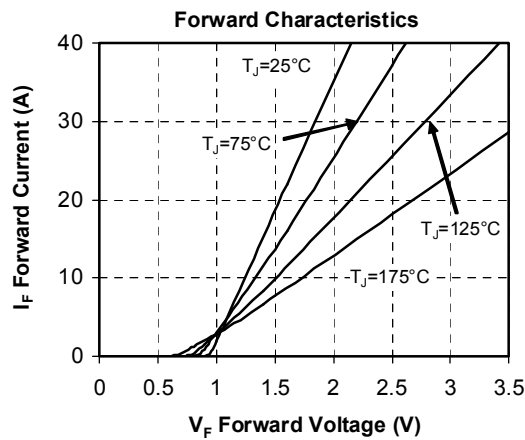
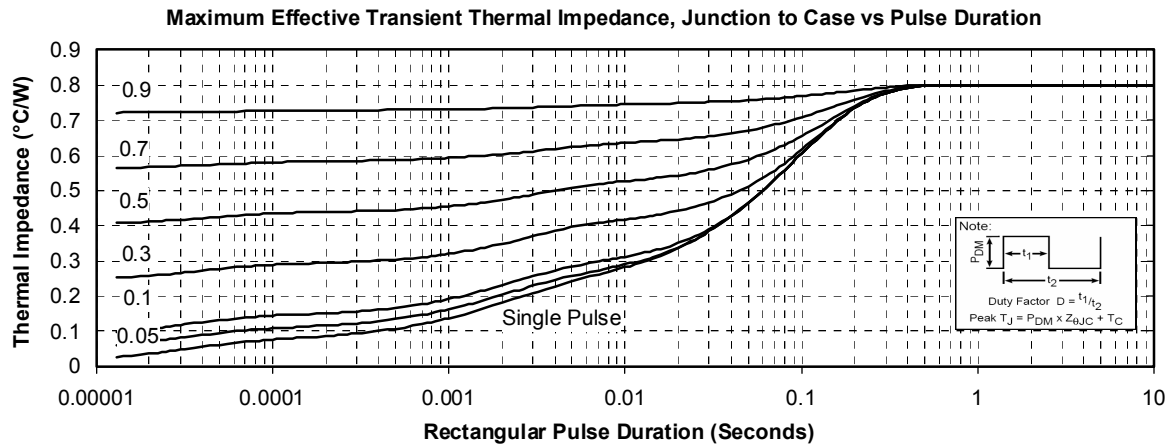
Typical MOSFET Performance Curve







Typical SiC Diode Performance Curve



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