

Phase leg Series & SiC parallel diodes MOSFET Power Module

$$V_{DSS} = 500V$$

$$R_{DSon} = 38m\Omega \text{ typ @ } T_j = 25^\circ C$$

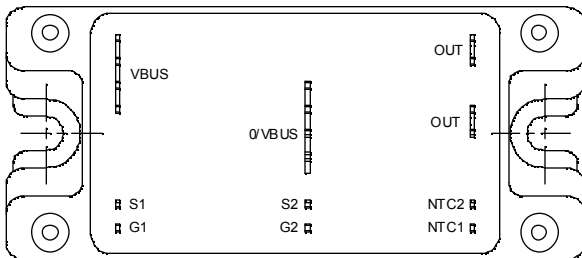
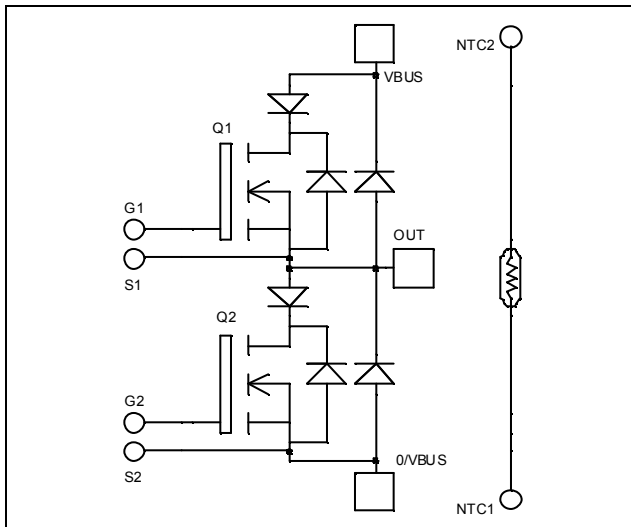
$$I_D = 90A \text{ @ } T_c = 25^\circ C$$

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	500	V
I_D	Continuous Drain Current	$T_c = 25^\circ C$	90
		$T_c = 80^\circ C$	67
I_{DM}	Pulsed Drain current	360	A
V_{GS}	Gate - Source Voltage	± 30	V
R_{DSon}	Drain - Source ON Resistance	45	$m\Omega$
P_D	Maximum Power Dissipation	$T_c = 25^\circ C$	694
I_{AR}	Avalanche current (repetitive and non repetitive)	46	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	$V_{GS} = 0V, V_{DS} = 500V$			200	μA
		$V_{GS} = 0V, V_{DS} = 400V$			1000	
$R_{DS(on)}$	Drain – Source on Resistance	$V_{GS} = 10V, I_D = 45A$		38	45	$\text{m}\Omega$
$V_{GS(th)}$	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	$V_{GS} = 0V$		11.2		nF
C_{oss}	Output Capacitance	$V_{DS} = 25V$		2.36		
C_{rss}	Reverse Transfer Capacitance	$f = 1\text{MHz}$		0.18		
Q_g	Total gate Charge	$V_{GS} = 10V$		246		nC
Q_{gs}	Gate – Source Charge	$V_{Bus} = 250V$		66		
Q_{gd}	Gate – Drain Charge	$I_D = 90A$		130		
$T_{d(on)}$	Turn-on Delay Time	Inductive switching @ 125°C $V_{GS} = 15V$ $V_{Bus} = 333V$ $I_D = 90A$ $R_G = 2\Omega$		18		ns
T_r	Rise Time			35		
$T_{d(off)}$	Turn-off Delay Time			87		
T_f	Fall Time			77		
E_{on}	Turn-on Switching Energy	Inductive switching @ 25°C $V_{GS} = 15V, V_{Bus} = 333V$ $I_D = 90A, R_G = 2\Omega$		906		μJ
E_{off}	Turn-off Switching Energy			1452		
E_{on}	Turn-on Switching Energy	Inductive switching @ 125°C $V_{GS} = 15V, V_{Bus} = 333V$ $I_D = 90A, R_G = 2\Omega$		1490		μJ
E_{off}	Turn-off Switching Energy			1692		

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	$V_R = 200V$	$T_j = 25^\circ\text{C}$		500	μA
			$T_j = 125^\circ\text{C}$		750	
I_F	DC Forward Current	$T_c = 85^\circ\text{C}$		90		A
V_F	Diode Forward Voltage	$I_F = 90A$		1.1	1.15	V
		$I_F = 180A$		1.4		
		$I_F = 90A$	$T_j = 125^\circ\text{C}$	0.9		
t_{rr}	Reverse Recovery Time	$I_F = 90A$ $V_R = 133V$ $di/dt = 600A/\mu\text{s}$	$T_j = 25^\circ\text{C}$	24		ns
			$T_j = 125^\circ\text{C}$	48		
Q_{rr}	Reverse Recovery Charge	$I_F = 90A$ $V_R = 133V$ $di/dt = 600A/\mu\text{s}$	$T_j = 25^\circ\text{C}$	99		nC
			$T_j = 125^\circ\text{C}$	450		

Parallel 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		250	1000	μA
			T _j = 175°C		500	5000	
I _F	DC Forward Current		T _c = 125°C		50		A
V _F	Diode Forward Voltage	I _F = 50A	T _j = 25°C		1.6	1.8	V
			T _j = 175°C		2.0	2.4	
Q _C	Total Capacitive Charge	I _F = 50A, V _R = 300V di/dt = 1400A/μs			70		nC
Q	Total Capacitance	f = 1 MHz, V _R = 200V			325		pF
		f = 1 MHz, V _R = 400V			250		

Thermal and package characteristics

Symbol	Characteristic				Min	Typ	Max	Unit
R _{thJC}	Junction to Case Thermal Resistance			Transistor			0.18	°C/W
				Series diode			0.45	
				Parallel diode			0.5	
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

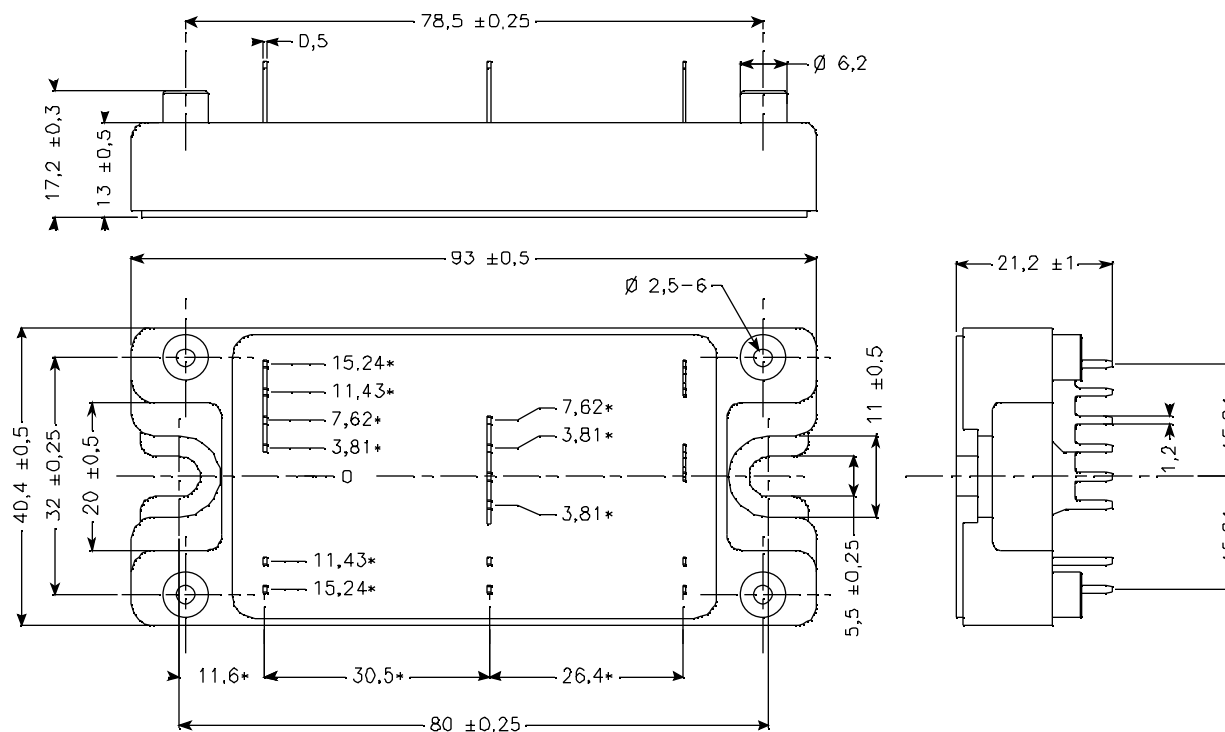
Temperature sensor NTC (see application note APT0406 on www.microsemi.com for more information).

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

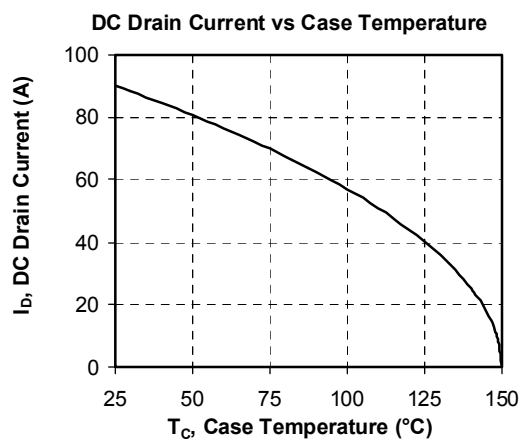
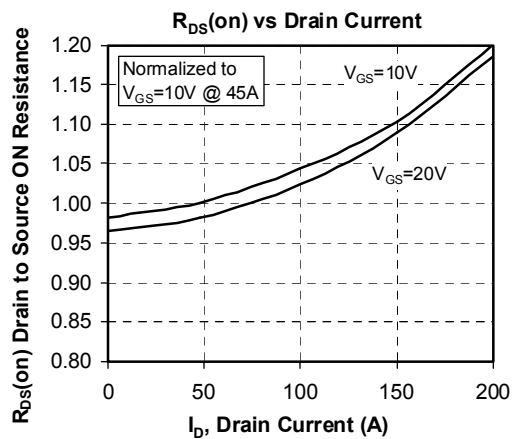
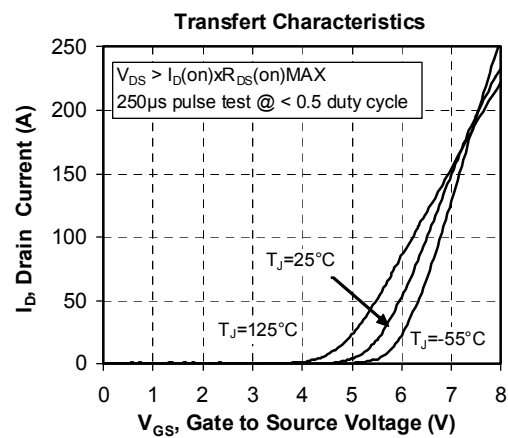
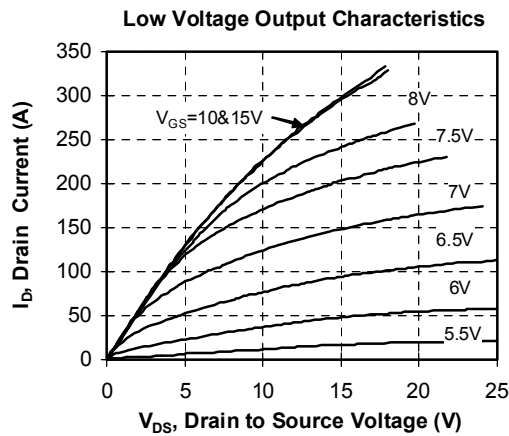
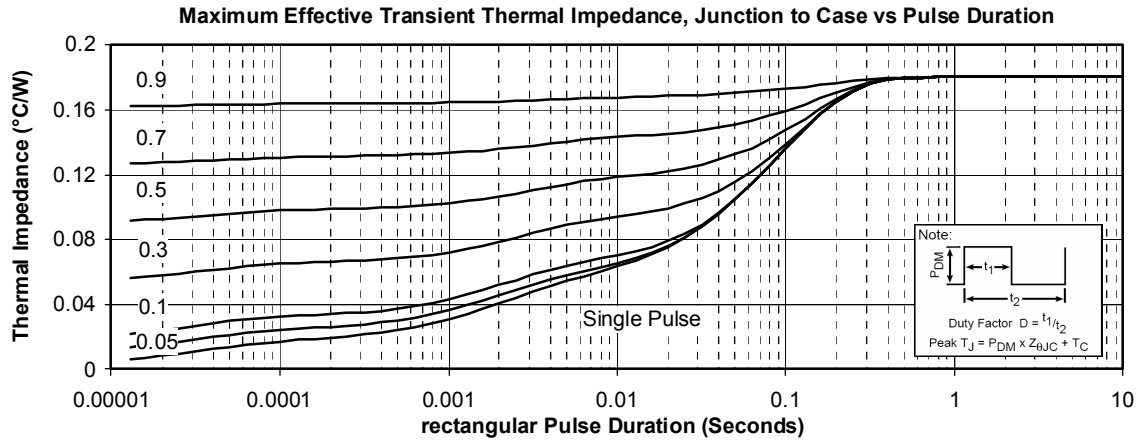
SP4 Package outline (dimensions in mm)

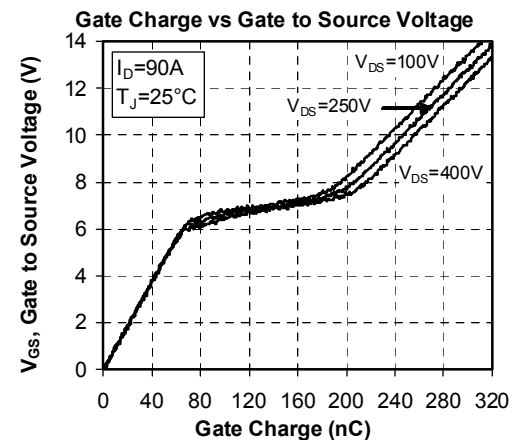
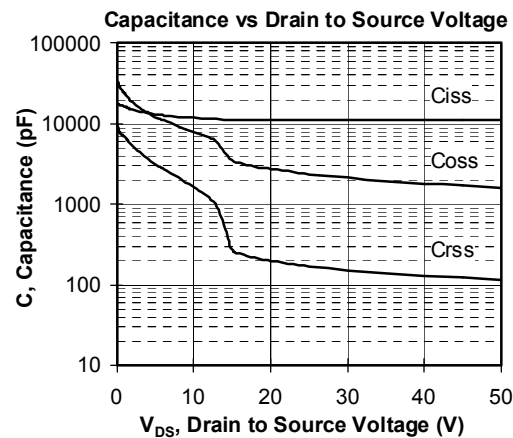
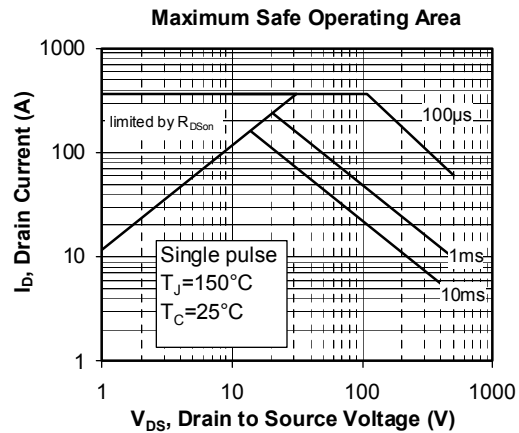
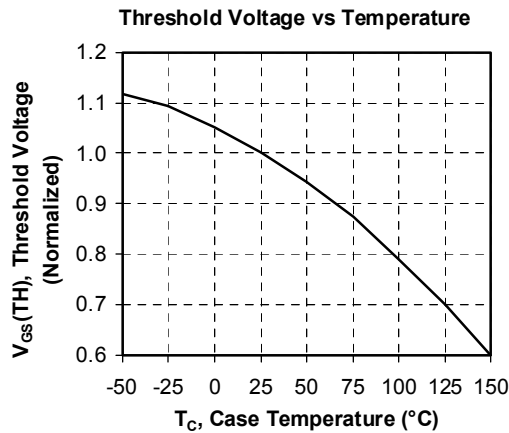
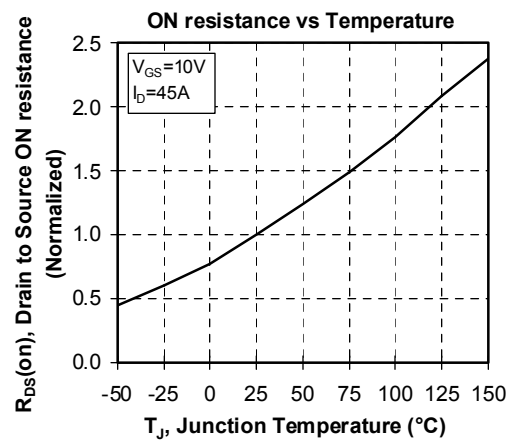
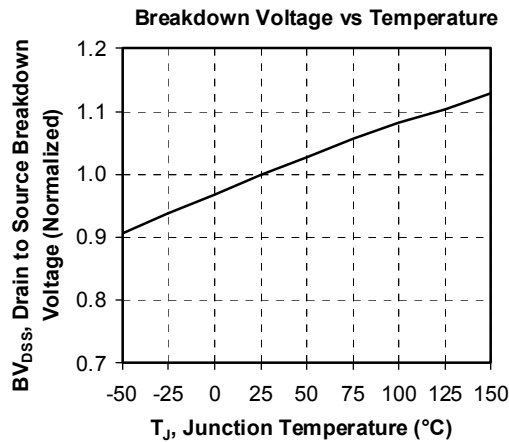


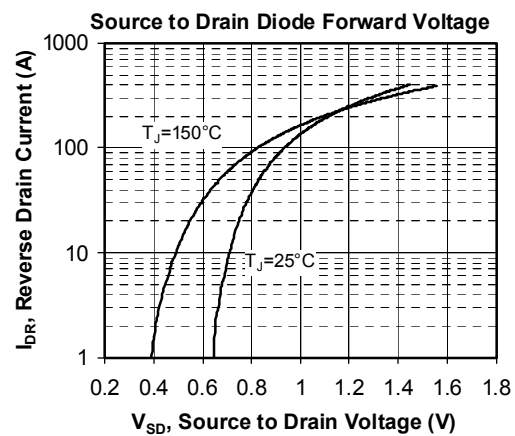
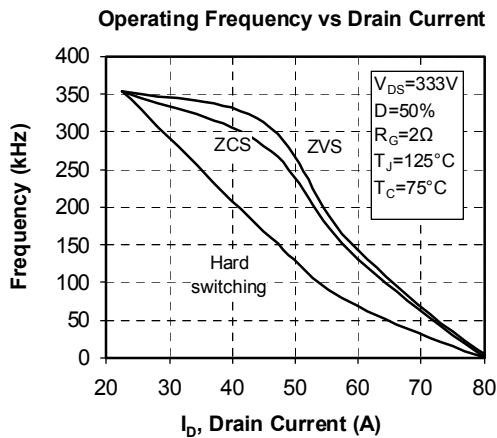
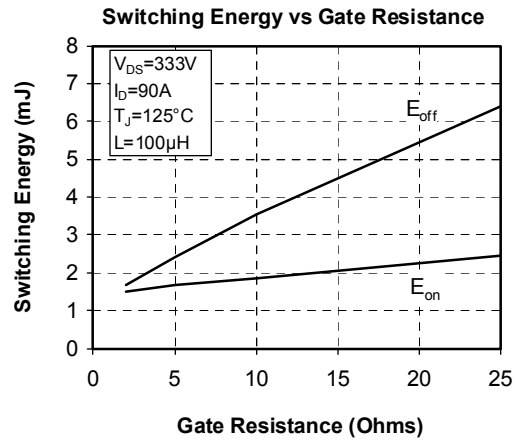
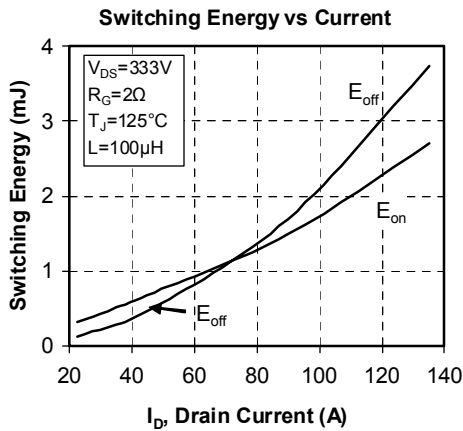
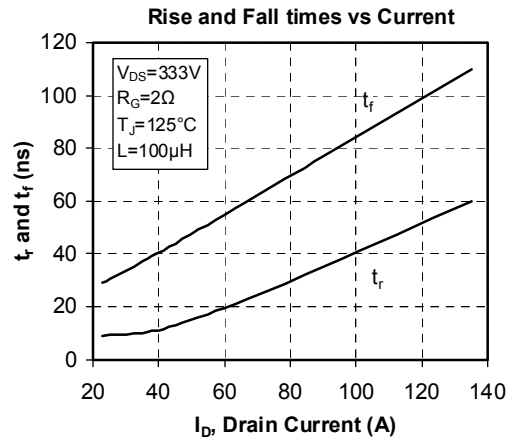
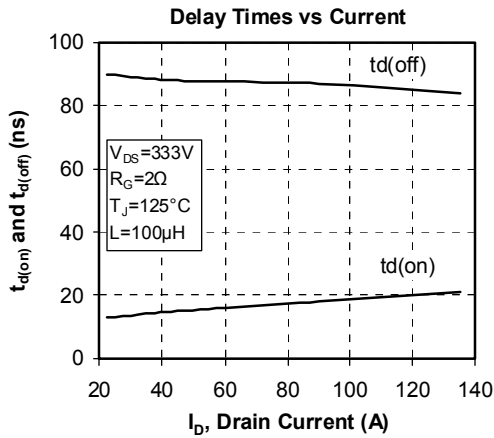
ALL DIMENSIONS MARKED "*" ARE TOLERENCED AS : $\begin{array}{|c|c|} \hline \phi & \phi 1 \\ \hline \end{array}$

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

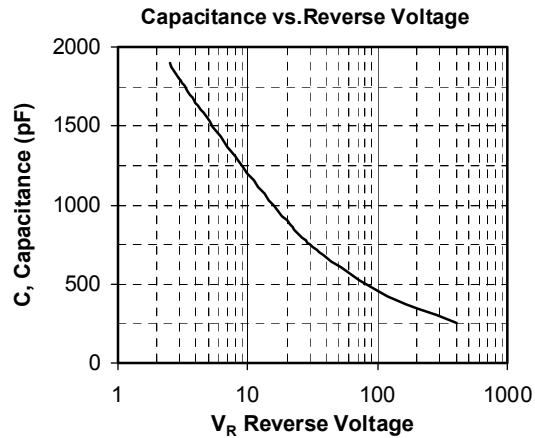
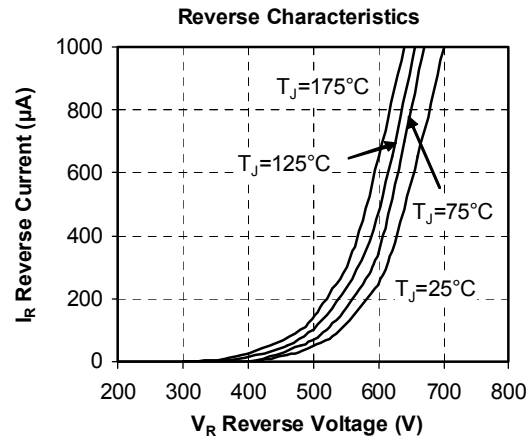
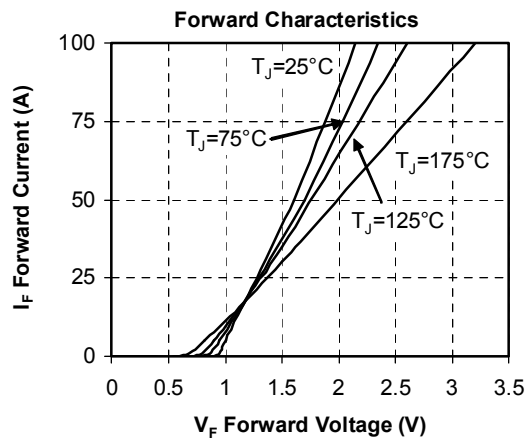
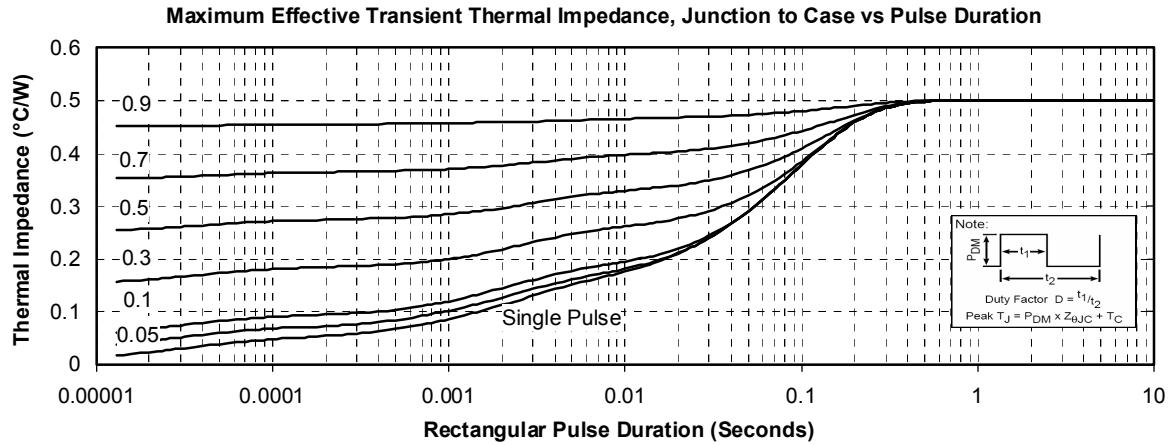
Typical MOSFET Performance Curve







Typical SiC Diode Performance Curve



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