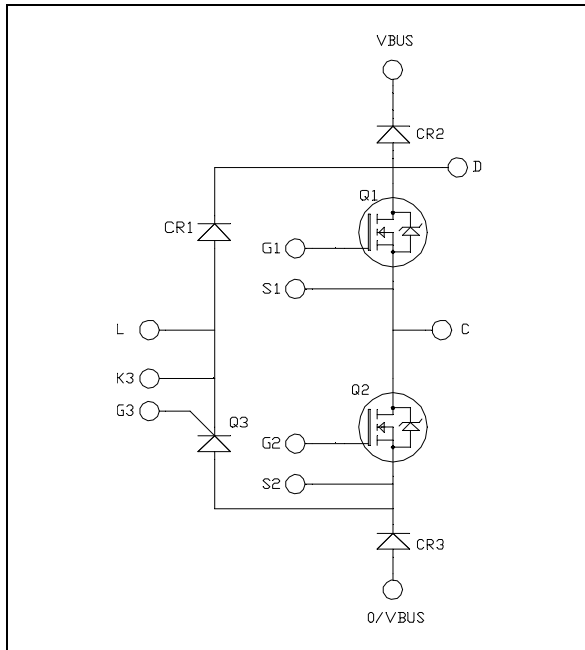


Phase leg Power Module

Super junction MOSFET Q1 & Q2:
 $V_{DS} = 600V$; $I_D = 108A$ @ $T_J = 25^\circ C$



Application

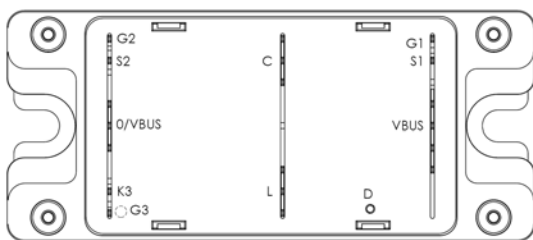
- Plasma & Induction heating
- Uninterruptible Power Supplies

Features

- **Super junction MOSFET**
 - Ultra low $R_{DS(on)}$
 - Low Miller capacitance
 - Ultra low gate charge
 - Avalanche energy rated
 - Very rugged
- **SiC Schottky Diode (CR2, CR3)**
 - 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
- AlN substrate for improved thermal performance

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



All ratings @ $T_J = 25^\circ C$ unless otherwise specified

 **CAUTION:** These Devices are sensitive to Electrostatic Discharge. Proper Handling Procedures Should Be Followed.

1. Absolute maximum ratings

Diode (CR1)

Symbol	Parameter	Max ratings	Unit
V_{RRM}	Peak Repetitive Reverse Voltage	1600	V
I_F	DC Forward Current	$T_C = 80^\circ\text{C}$ 200	A
I_{FSM}	Non-Repetitive Forward Surge Current	$t = 10\text{ms}$ $T_J = 25^\circ\text{C}$ 1600	
P_D	Power Dissipation	$T_C = 25^\circ\text{C}$ 390	W

Thyristor (Q3)

Symbol	Parameter	Max ratings	Unit
V_{DRM}	Repetitive Peak Reverse Voltage	1600	V
I_{DRM}	Repetitive Peak Reverse Current	3	mA
I_{TRMS}	RMS on – state current	$T_J = 100^\circ\text{C}$ 60	A
I_{TSM}	Surge on – state current	$t = 10\text{ms}$ $T_C = 45^\circ\text{C}$ 520	A
V_{RGM}	Peak Reverse Gate Voltage	10	V
P_D	Power Dissipation	$T_C = 25^\circ\text{C}$ 357	W

Super junction MOSFET (Q1 & Q2)

Symbol	Parameter	Max ratings	Unit
V_{DSS}	Drain - Source Voltage	600	V
I_D	Continuous Drain Current	$T_c = 25^\circ\text{C}$ 108	A
		$T_c = 80^\circ\text{C}$ 81	
I_{DM}	Pulsed Drain current	260	
V_{GS}	Gate - Source Voltage	± 20	V
$R_{DS(on)}$	Drain - Source ON Resistance	24	m Ω
P_D	Power Dissipation	$T_c = 25^\circ\text{C}$ 647	W
I_{AR}	Avalanche current (repetitive and non repetitive)	15	A
E_{AR}	Repetitive Avalanche Energy	3	mJ
E_{AS}	Single Pulse Avalanche Energy	1900	

SiC Diodes (CR2 & CR3)

Symbol	Parameter	Max ratings	Unit
V_{RRM}	Peak Repetitive Reverse Voltage	650	V
I_F	DC Forward Current	$T_C = 70^\circ\text{C}$ 50	A
P_D	Power Dissipation	$T_C = 25^\circ\text{C}$ 170	W

2. Electrical Characteristics

Diode (CR1)

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
I_R	Reverse Current	$V_R = 1600\text{V}$			50	μA
V_F	Forward Voltage	$I_F = 77\text{A}$		$T_J = 25^\circ\text{C}$ 1	1.21	V
				$T_J = 125^\circ\text{C}$ 0.9	1.1	
V_T	On – state Voltage				0.83	V
r_T	On – state Slope resistance				2.2	m Ω
R_{thJC}	Junction to Case Thermal Resistance				0.32	$^\circ\text{C/W}$

Thyristor (Q3)

Symbol	Characteristic	Test Conditions		Min	Typ	Max	Unit
V_T	On – state Voltage	$I_T = 60A$	$T_J = 25^\circ C$		1.41		V
V_{TO}	Direct On state threshold Voltage		$T_J = 125^\circ C$		0.85		
r_T	On – state Slope resistance		$T_J = 125^\circ C$		10		m Ω
V_{GT}	Gate Trigger Voltage		$T_J = 25^\circ C$		1.5		V
I_{GT}	Gate Trigger Current				50		mA
R_{thJC}	Junction to Case Thermal Resistance					0.35	$^\circ C/W$

Super junction MOSFET (Q1 & Q2)

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
I_{DSS}	Zero Gate Voltage Drain Current	$V_{GS} = 0V, V_{DS} = 600V$			350	μA
$R_{DS(on)}$	Drain – Source on Resistance	$V_{GS} = 10V, I_D = 47.5A$			24	m Ω
$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 5mA$	2.1	3	3.9	V
I_{GSS}	Gate – Source Leakage Current	$V_{GS} = \pm 20V, V_{DS} = 0V$			200	nA
C_{iss}	Input Capacitance	$V_{GS} = 0V ; V_{DS} = 25V$		14.4		nF
C_{oss}	Output Capacitance	$f = 1MHz$		17		
Q_g	Total gate Charge	$V_{GS} = 10V$ $V_{Bus} = 300V$ $I_D = 95A$		300		nC
Q_{gs}	Gate – Source Charge			68		
Q_{gd}	Gate – Drain Charge			102		
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching (125$^\circ C$) $V_{GS} = 10V$ $V_{Bus} = 400V$ $I_D = 95A$ $R_G = 2.5\Omega$		21		ns
T_r	Rise Time			30		
$T_{d(off)}$	Turn-off Delay Time			100		
T_f	Fall Time			45		
E_{on}	Turn-on Switching Energy	Inductive switching @ 125$^\circ C$ $V_{GS} = 10V ; V_{Bus} = 400V$ $I_D = 95A ; R_G = 2.5\Omega$		2200		μJ
E_{off}	Turn-off Switching Energy			1270		
R_{Gint}	Internal gate resistance			2.5		Ω
R_{thJC}	Junction to Case Thermal Resistance				0.193	$^\circ C/W$

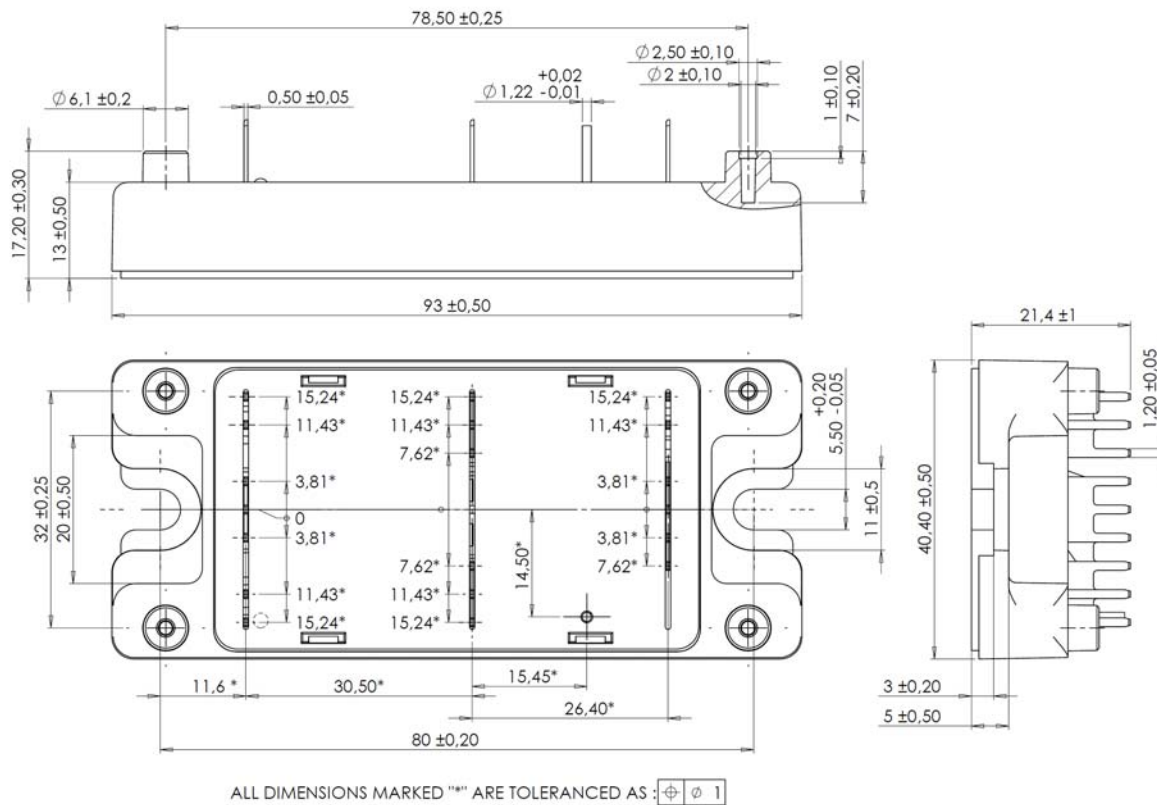
SiC Diodes (CR2 & CR3)

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
I_{RM}	Reverse Leakage Current	$V_R = 650V$	$T_J = 25^\circ C$	50	500	μA
			$T_J = 175^\circ C$	200	1000	
V_F	Diode Forward Voltage	$I_F = 50A$	$T_J = 25^\circ C$	1.5	1.8	V
			$T_J = 175^\circ C$	1.8	2.2	
Q_C	Total Capacitive Charge	$I_F = 50A, V_R = 400V$		110		nC
C	Total Capacitance	$f = 1MHz, V_R = 200V$		200		pF
		$f = 1MHz, V_R = 400V$		180		
R_{thJC}	Junction to Case Thermal Resistance				0.94	$^\circ C/W$

3. Package characteristics

Symbol	Characteristic			Min	Max	Unit
V _{ISOL}	RMS Isolation Voltage, any terminal to case t =1 min, 50/60Hz			4000		V
T _J	Operating junction temperature range		Q1, Q2, Q3, CR1	-40	150	°C
			CR2, CR3	-40	175	
T _{JOP}	Recommended junction temperature under switching conditions			-40	T _{Jmax} -25	
T _{STG}	Storage Temperature Range			-40	125	
T _C	Operating Case Temperature			-40	125	
Torque	Mounting torque	To Heatsink	M5	2.5	4.7	N.m
Wt	Package Weight				160	g

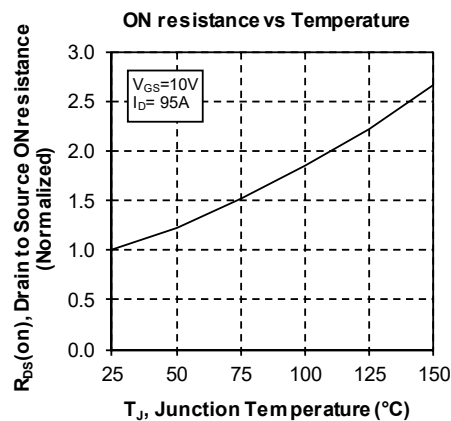
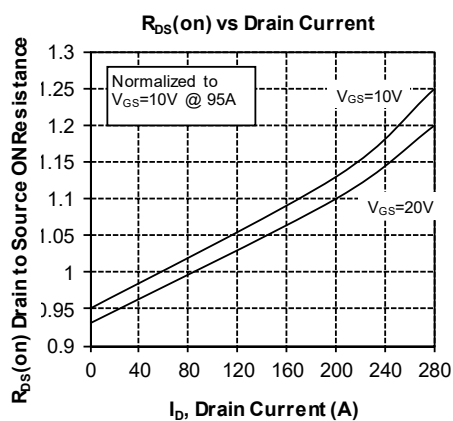
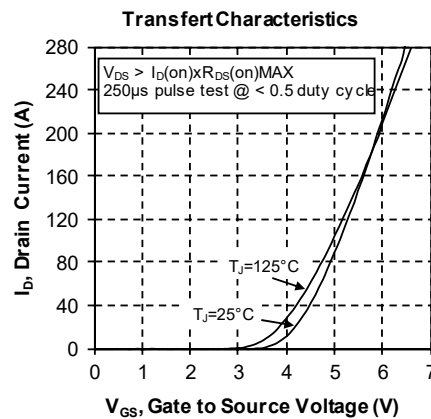
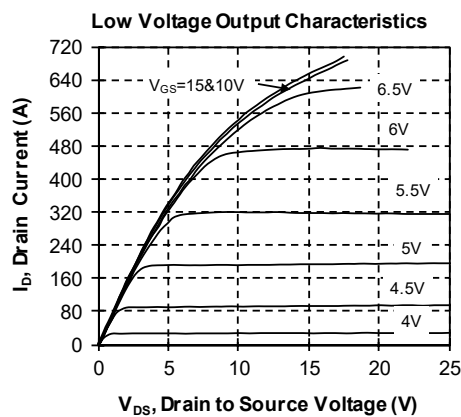
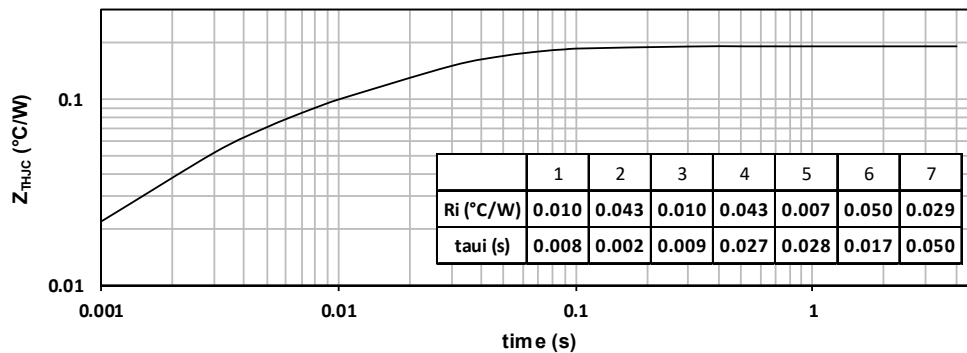
Package outline (dimensions in mm)

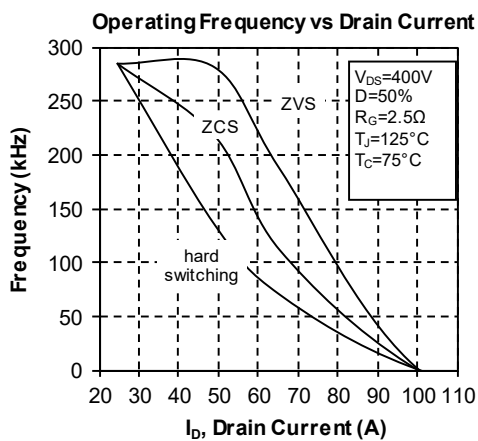
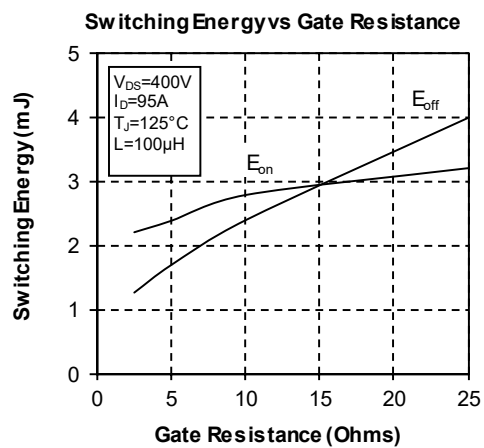
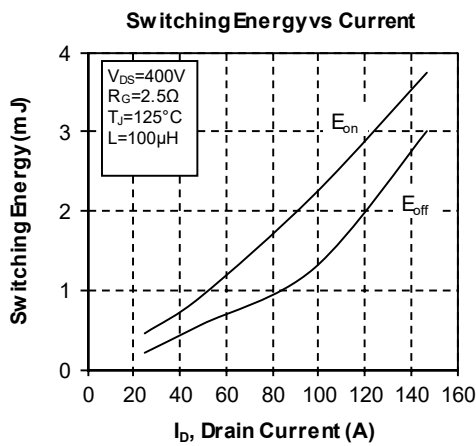
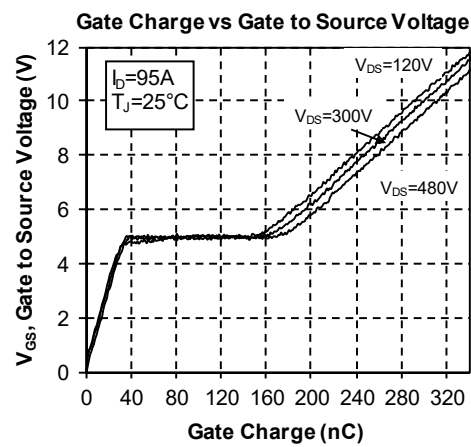
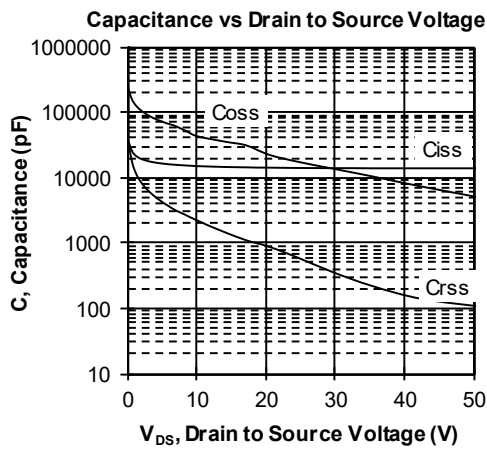


See application note APT0501 - Mounting Instructions for SP4 Power Modules on www.microsemi.com

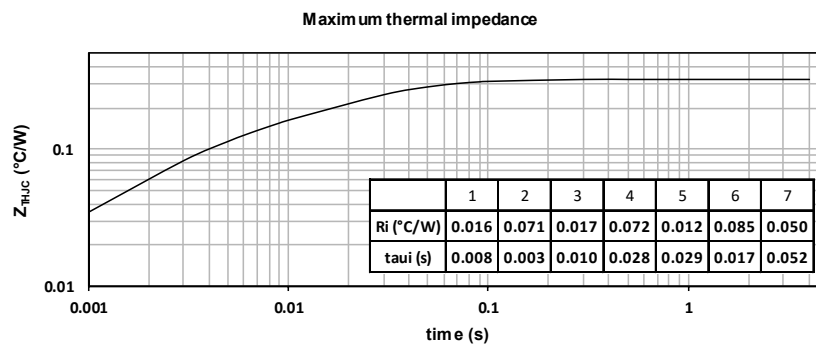
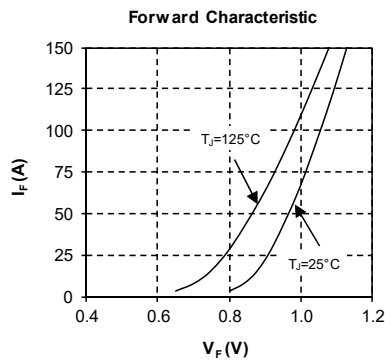
4. Typical performance curves Super junction MOSFET (Q1 & Q2)

Maximum thermal impedance

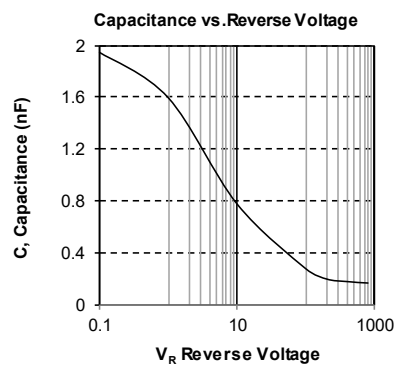
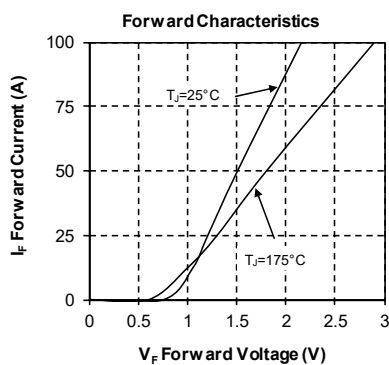
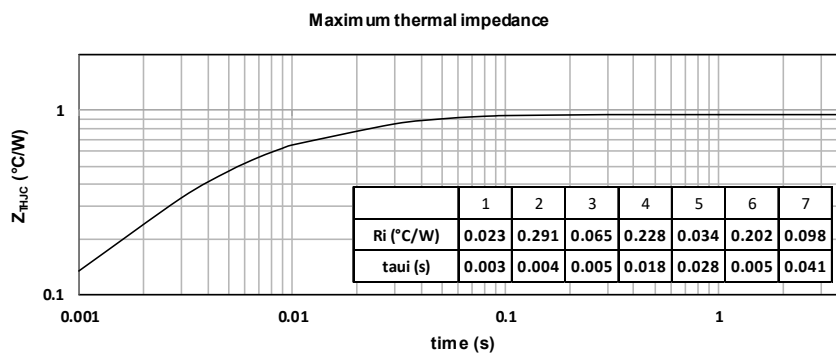




Diode (CR1)



SiC diode (CR2 & CR3)



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