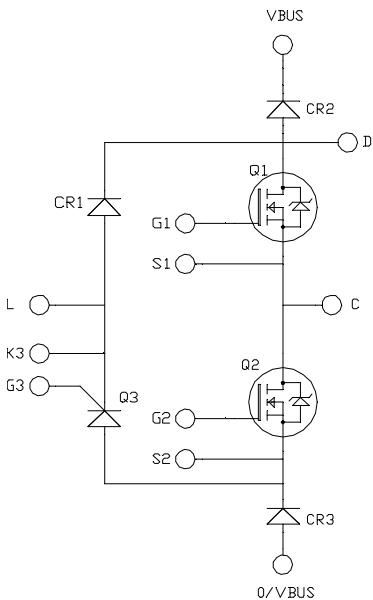


**Phase leg
Power Module**
**Super junction MOSFET Q1 & Q2:
V_{DSS} = 600V ; I_D = 108A @ T_J = 25°C**

Application

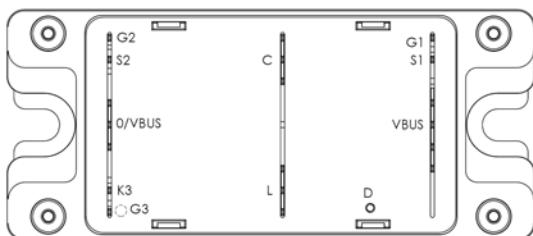
- Plasma & Induction heating
- Uninterruptible Power Supplies

Features

- **Super junction MOSFET**
 - Ultra low R_{DSon}
 - 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°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	$T_J = 25^\circ\text{C}$	1600	
$t = 10\text{ms}$				
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	$t = 10\text{ms}$	$T_C = 45^\circ\text{C}$	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_{DSon}	Drain - Source ON Resistance		24	$\text{m}\Omega$
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
					2.2	$\text{m}\Omega$
r_T	On – state Slope resistance				0.32	$^\circ\text{C}/\text{W}$
R_{thJC}	Junction to Case Thermal Resistance					

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		$m\Omega$
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	$m\Omega$
$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 5mA$		2.1	3	3.9	V
I_{GSS}	Gate – Source Leakage Current	$V_{GS} = \pm 20 V, V_{DS} = 0V$				200	nA
C_{iss}	Input Capacitance	$V_{GS} = 0V ; V_{DS} = 25V$ $f = 1MHz$				14.4	nF
C_{oss}	Output Capacitance					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°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°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	$^\circ C/W$

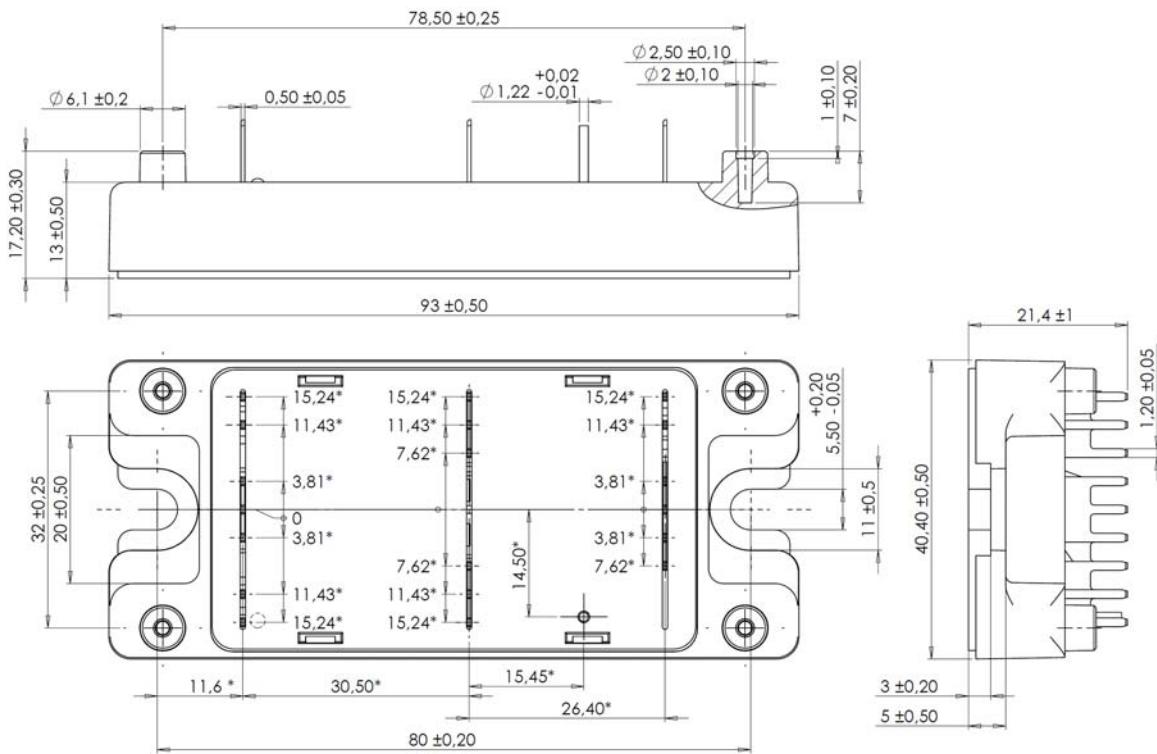
SiC Diodes (CR2 & CR3)

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	$f = 1MHz, V_R = 200V$ $f = 1MHz, V_R = 400V$		200			pF
				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)

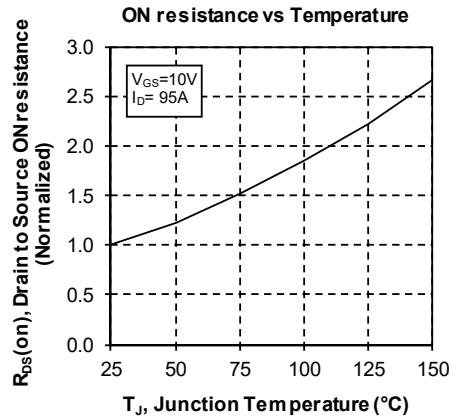
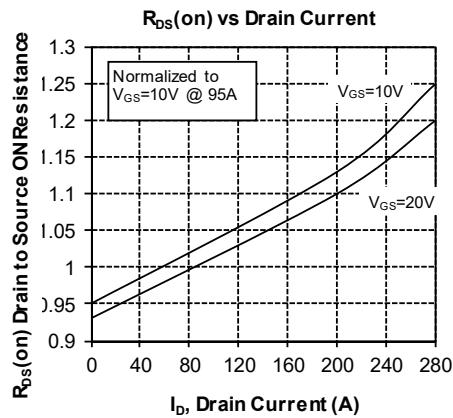
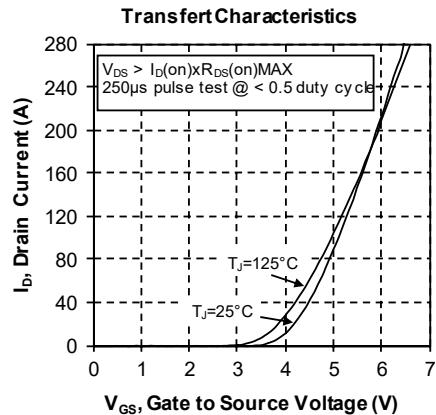
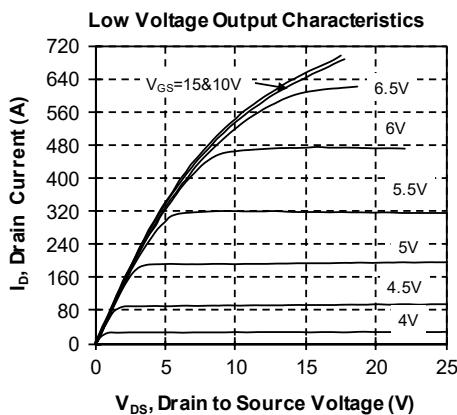
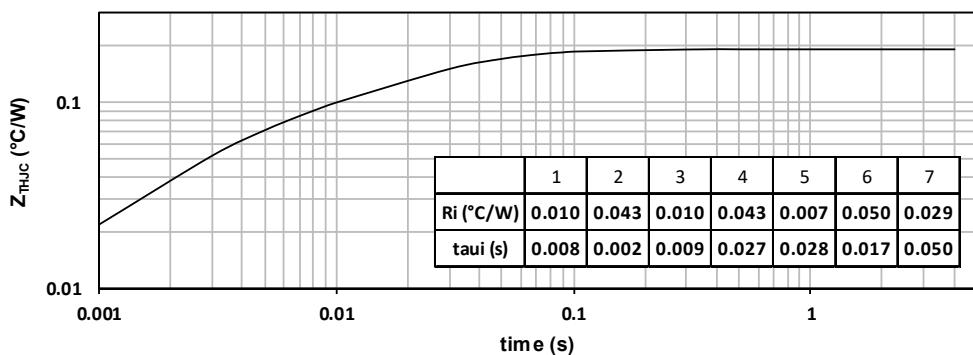


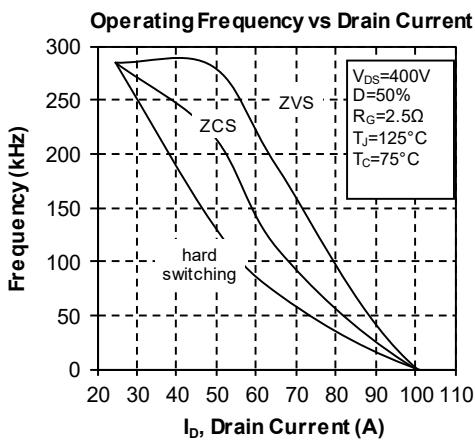
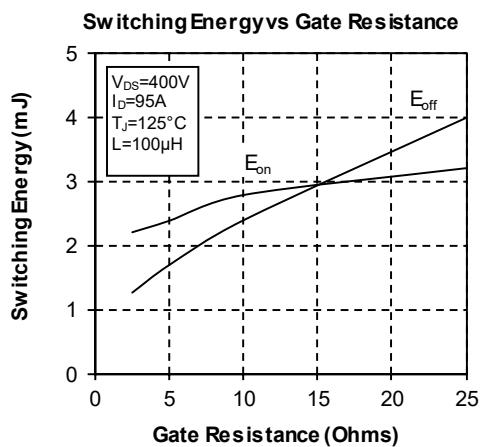
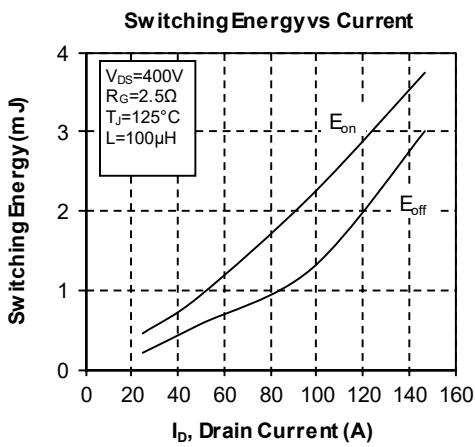
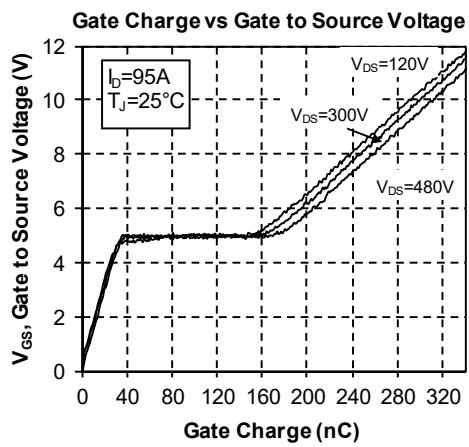
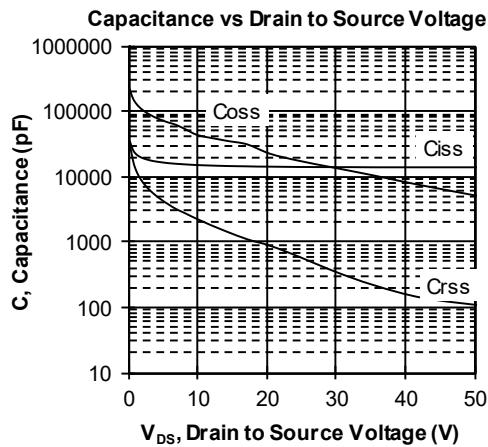
ALL DIMENSIONS MARKED "*" ARE TOLERANCED AS ± 0.10 mm

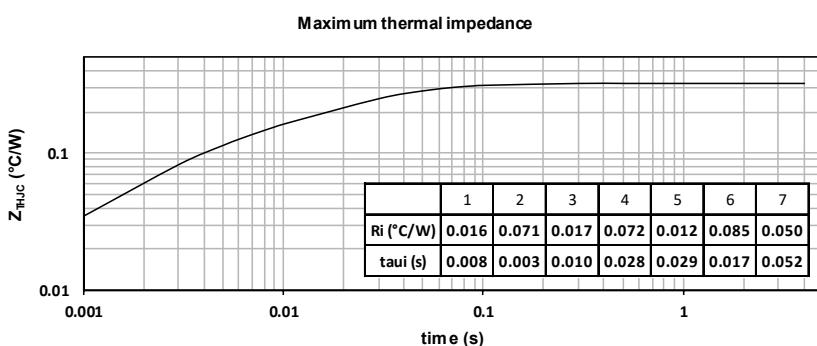
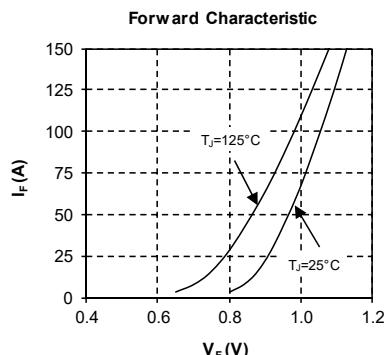
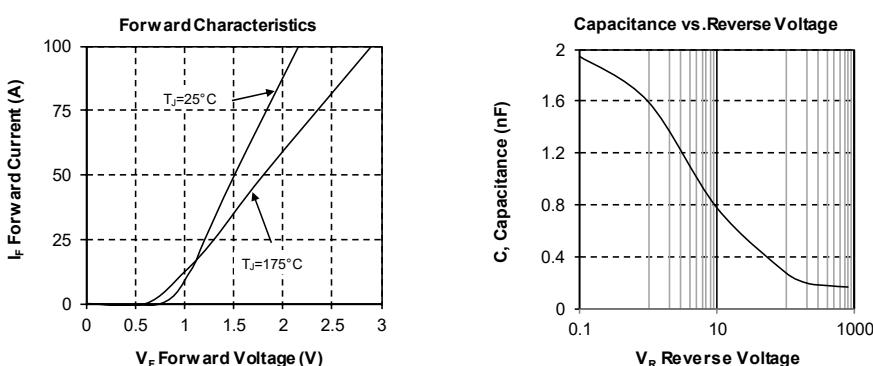
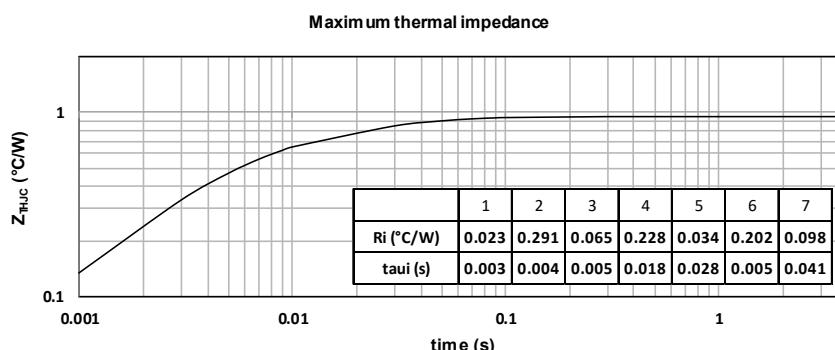
See application note APT0501 - Mounting Instructions for SP4 Power Modules on www.microsemi.com

4. Typical performance curves

Super junction MOSFET (Q1 & Q2)

Maximum thermal impedance




Diode (CR1)

SiC diode (CR2 & CR3)


DISCLAIMER

The information contained in the document (unless it is publicly available on the Web without access restrictions) is PROPRIETARY AND CONFIDENTIAL information of Microsemi and cannot be copied, published, uploaded, posted, transmitted, distributed or disclosed or used without the express duly signed written consent of Microsemi. If the recipient of this document has entered into a disclosure agreement with Microsemi, then the terms of such Agreement will also apply. This document and the information contained herein may not be modified, by any person other than authorized personnel of Microsemi. No license under any patent, copyright, trade secret or other intellectual property right is granted to or conferred upon you by disclosure or delivery of the information, either expressly, by implication, inducement, estoppels or otherwise. Any license under such intellectual property rights must be approved by Microsemi in writing signed by an officer of Microsemi.

Life Support Application

Seller's Products are not designed, intended, or authorized for use as components in systems intended for space, aviation, surgical implant into the body, in other applications intended to support or sustain life, or for any other application in which the failure of the Seller's Product could create a situation where personal injury, death or property damage or loss may occur (collectively "Life Support Applications").

Buyer agrees not to use Products in any Life Support Applications and to the extent it does it shall conduct extensive testing of the Product in such applications and further agrees to indemnify and hold Seller, and its officers, employees, subsidiaries, affiliates, agents, sales representatives and distributors harmless against all claims, costs, damages and expenses, and attorneys' fees and costs arising, directly or indirectly, out of any claims of personal injury, death, damage or otherwise associated with the use of the goods in Life Support Applications, even if such claim includes allegations that Seller was negligent regarding the design or manufacture of the goods.

Buyer must notify Seller in writing before using Seller's Products in Life Support Applications. Seller will study with Buyer alternative solutions to meet Buyer application specification based on Sellers sales conditions applicable for the new proposed specific part.