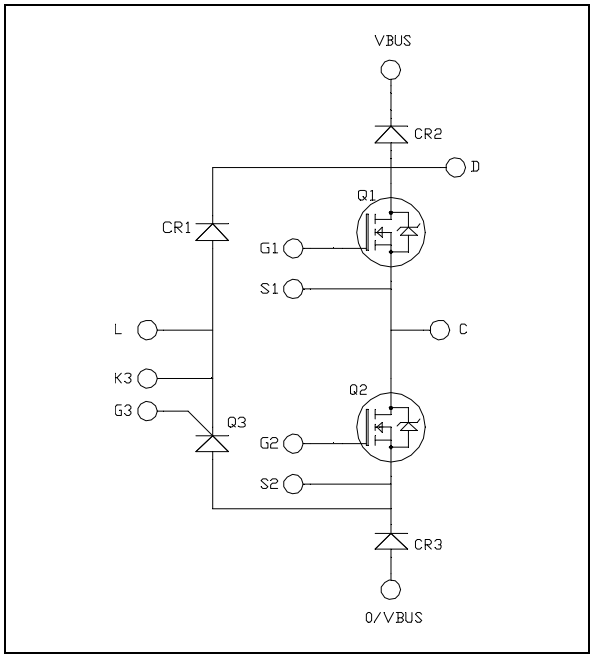
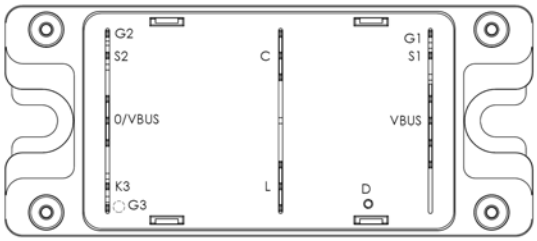
MSCC60AM23C4AG

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°C	200	A
I_{FSM}	Non-Repetitive Forward Surge Current	t =10ms	T_J = 25°C	1600	
P_D	Power Dissipation		T_C = 25°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°C	60	A
I_{TSM}	Surge on – state current	t = 10ms	T_C = 45°C	520	A
V_{RGM}	Peak Reverse Gate Voltage			10	V
P_D	Power Dissipation		T_C = 25°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°C	108	A
		T_c = 80°C	81	
I_{DM}	Pulsed Drain current		260	
V_{GS}	Gate - Source Voltage		±20	V
R_{DSon}	Drain - Source ON Resistance		24	mΩ
P_D	Power Dissipation	T_c = 25°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°C	50	A
P_D	Power Dissipation	T_C = 25°C	170	W

2. Electrical Characteristics

Diode (CR1)

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

Thyristor (Q3)

Symbol	Characteristic	Test Conditions		Min	Typ	Max	Unit
V_T	On – state Voltage	I_T = 60A	T_J = 25°C		1.41		V
V_{TO}	Direct On state threshold Voltage		T_J = 125°C		0.85		
r_T	On – state Slope resistance		T_J = 125°C		10		mΩ
V_{GT}	Gate Trigger Voltage		T_J = 25°C		1.5		V
I_{GT}	Gate Trigger Current				50		mA
R_{thJC}	Junction to Case Thermal Resistance					0.35	°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	mΩ
$V_{GS(th)}$	Gate Threshold Voltage	V_{GS} = V_{DS}, I_D = 5mA	2.1	3	3.9	V
I_{GSS}	Gate – Source Leakage Current	V_{GS} = ±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 = 2.5Ω		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 = 2.5Ω		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	°C/W

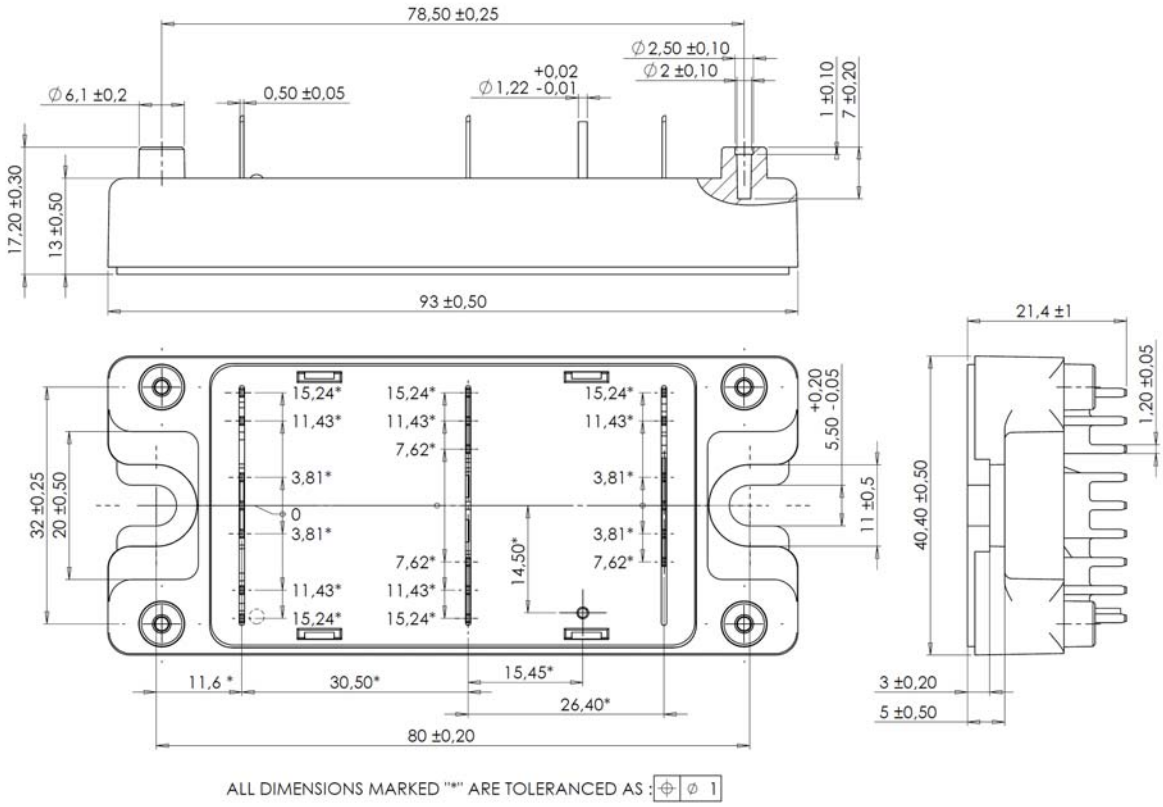
SiC Diodes (CR2 & CR3)

Symbol	Characteristic	Test Conditions		Min	Typ	Max	Unit
I_{RM}	Reverse Leakage Current	V_R=650V	T_j = 25°C		50	500	µA
			T_j = 175°C		200	1000	
V_F	Diode Forward Voltage	I_F = 50A	T_j = 25°C		1.5	1.8	V
			T_j = 175°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	°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	$T_J$max -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)

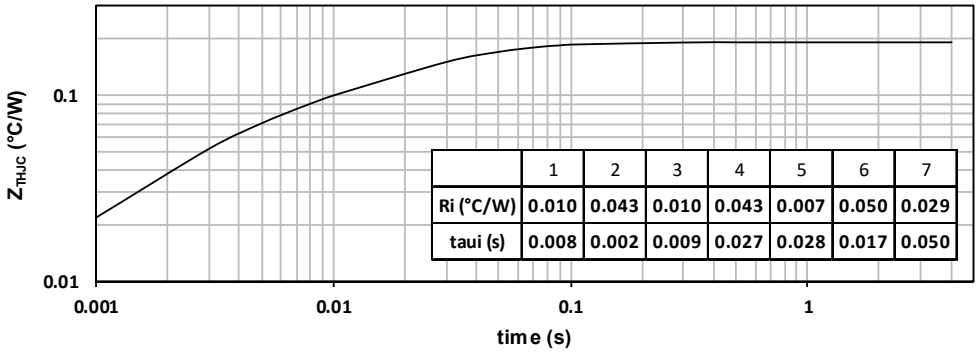


See application note APT0501 - Mounting Instructions for SP4 Power Modules on www.microsemi.com

4. Typical performance curves

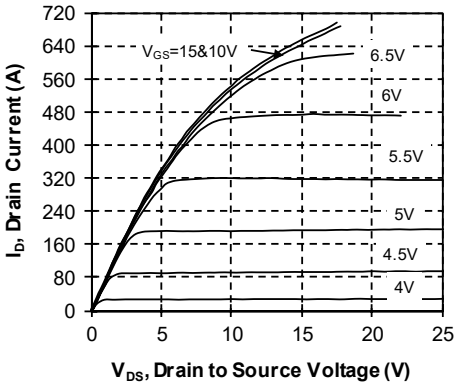
Super junction MOSFET (Q1 & Q2)

Maximum thermal impedance

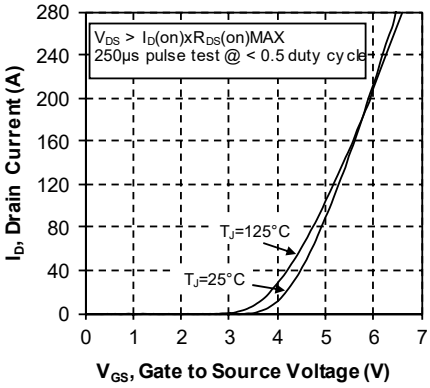


	1	2	3	4	5	6	7
Ri (°C/W)	0.010	0.043	0.010	0.043	0.007	0.050	0.029
taui (s)	0.008	0.002	0.009	0.027	0.028	0.017	0.050

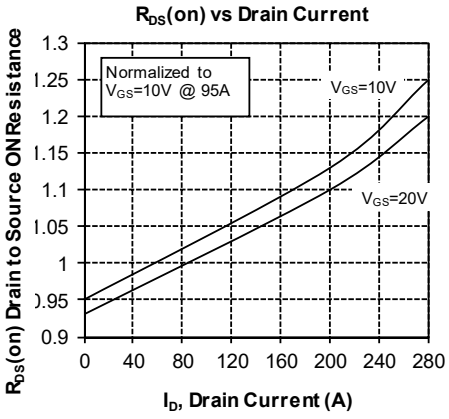
Low Voltage Output Characteristics



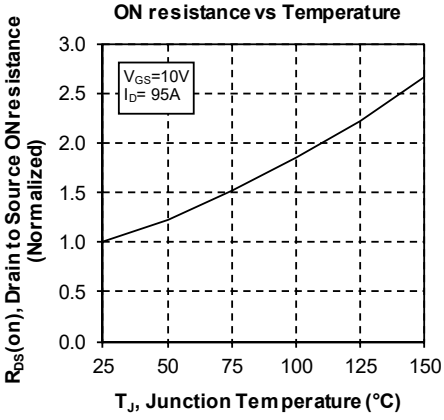
Transfert Characteristics



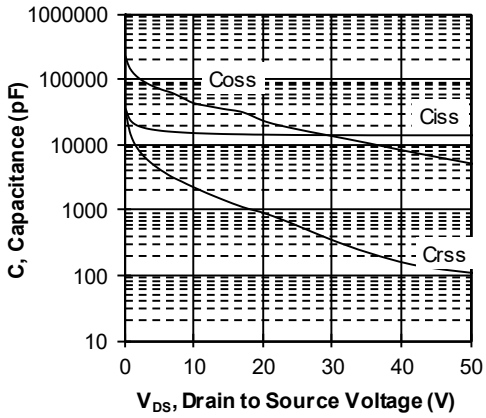
R_{DS}(on) vs Drain Current



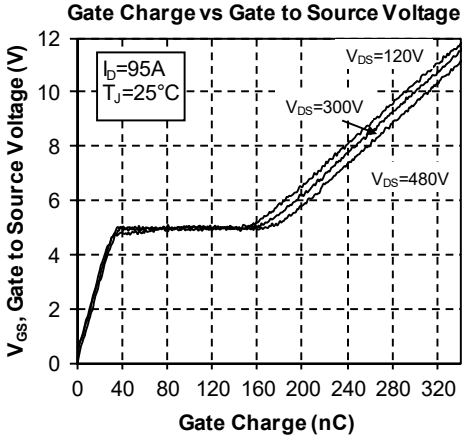
ON resistance vs Temperature



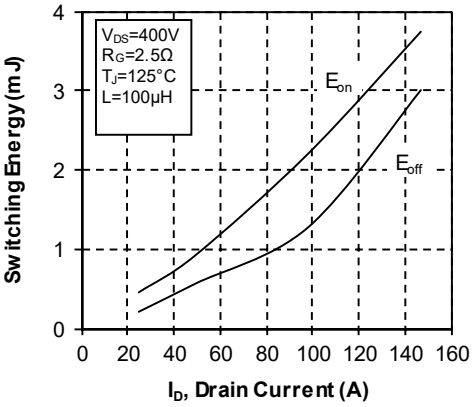
Capacitance vs Drain to Source Voltage



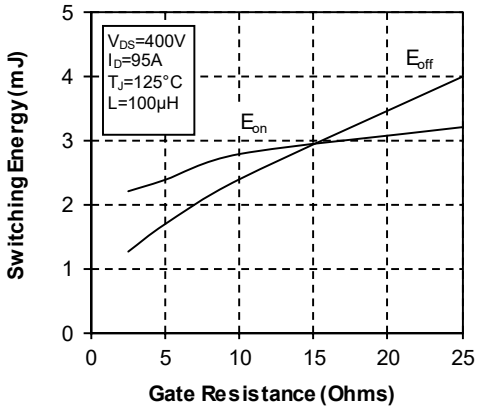
Gate Charge vs Gate to Source Voltage



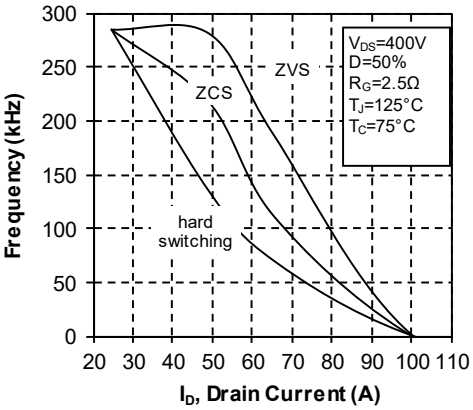
Switching Energy vs Current



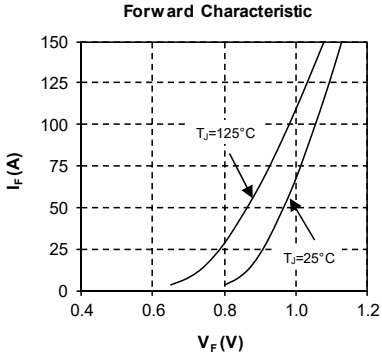
Switching Energy vs Gate Resistance

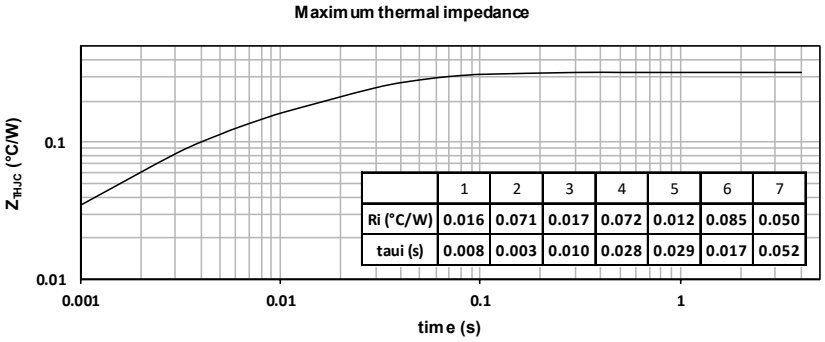


Operating Frequency vs Drain Current



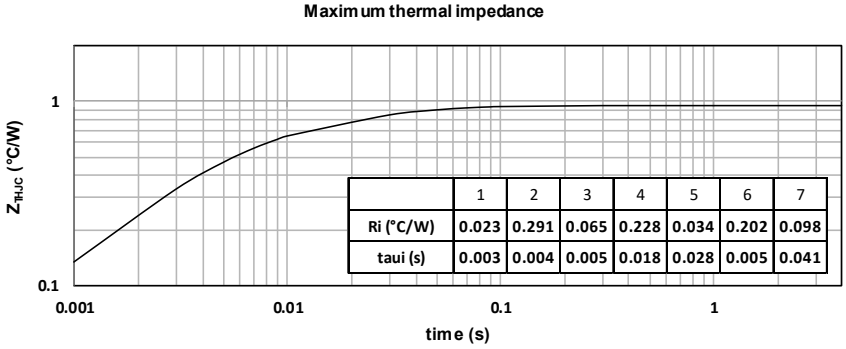
Diode (CR1)



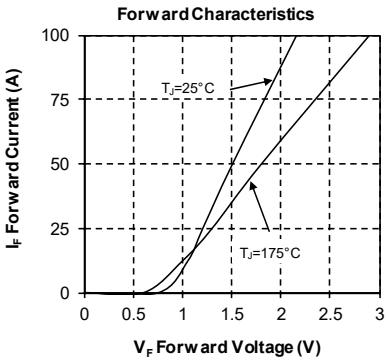


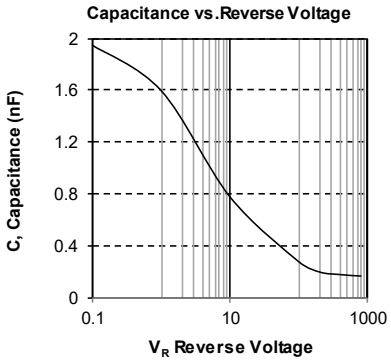
	1	2	3	4	5	6	7
Ri (°C/W)	0.016	0.071	0.017	0.072	0.012	0.085	0.050
taui (s)	0.008	0.003	0.010	0.028	0.029	0.017	0.052

SiC diode (CR2 & CR3)



	1	2	3	4	5	6	7
Ri (°C/W)	0.023	0.291	0.065	0.228	0.034	0.202	0.098
taui (s)	0.003	0.004	0.005	0.018	0.028	0.005	0.041





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