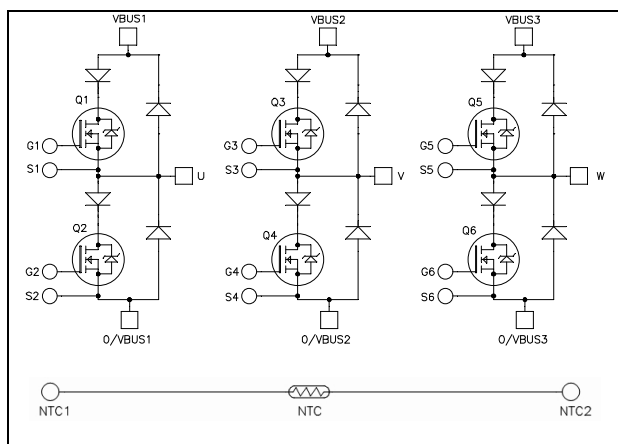


Triple phase leg CoolMOS™ Power Module

$V_{DSS} = 600V$

$R_{DS(on)} = 21m\Omega$ typ @ $T_j = 25^\circ C$

$I_D = 116A$ @ $T_c = 25^\circ C$

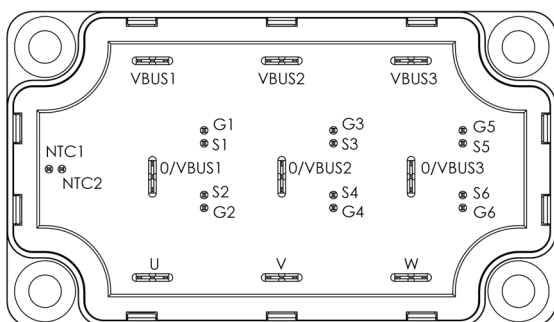


Application

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

Features

- **CoolMOS™**
 - Ultra low $R_{DS(on)}$
 - Low Miller capacitance
 - Ultra low gate charge
 - Avalanche energy rated
 - Very rugged
- **SiC Parallel 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
- High level of integration
- Internal thermistor for temperature monitoring
- 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
- Very low (12mm) profile
- Each leg can be easily paralleled to achieve a phase leg of three times the current capability
- Module can be configured as a three phase bridge
- 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. See application note APT0502 on www.microsemi.com

Absolute maximum ratings (Per CoolMOS™)

Symbol	Parameter	Max ratings	Unit
V_{DSS}	Drain - Source Breakdown Voltage	600	V
I_D	Continuous Drain Current	$T_c = 25^\circ\text{C}$ 116	A
		$T_c = 80^\circ\text{C}$ 87	
I_{DM}	Pulsed Drain current	400	
V_{GS}	Gate - Source Voltage	± 20	V
$R_{DS(on)}$	Drain - Source ON Resistance	21	m Ω
P_D	Maximum Power Dissipation	$T_c = 25^\circ\text{C}$ 625	W
I_{AR}	Avalanche current (repetitive and non repetitive)	13	A
E_{AR}	Repetitive Avalanche Energy	3	mJ
E_{AS}	Single Pulse Avalanche Energy	1950	

Electrical Characteristics (Per CoolMOS™)

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
I_{DSS}	Zero Gate Voltage Drain Current	$V_{GS} = 0V, V_{DS} = 600V$			200	μA
$R_{DS(on)}$	Drain – Source on Resistance	$V_{GS} = 10V, I_D = 88A$		18.5	21	m Ω
$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 6mA$	2.4	3	3.6	V
I_{GSS}	Gate – Source Leakage Current	$V_{GS} = \pm 20V, V_{DS} = 0V$			200	nA

Dynamic Characteristics (Per CoolMOS™)

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
C_{iss}	Input Capacitance	$V_{GS} = 0V ; V_{DS} = 100V$		13		nF
C_{oss}	Output Capacitance	$f = 1MHz$		0.72		
Q_g	Total gate Charge	$V_{GS} = 10V$ $V_{Bus} = 480V$ $I_D = 88A$		580		nC
Q_{gs}	Gate – Source Charge			72		
Q_{gd}	Gate – Drain Charge			300		
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching @ 25°C $V_{GS} = 13V$ $V_{Bus} = 400V$ $I_D = 88A$ $R_G = 0.8\Omega$		23		ns
T_r	Rise Time			10		
$T_{d(off)}$	Turn-off Delay Time			130		
T_f	Fall Time			7		
E_{on}	Turn-on Switching Energy	Inductive switching @ 125°C $V_{GS} = 13V, V_{Bus} = 400V$ $I_D = 88A, R_G = 0.8\Omega$		1.2		mJ
E_{off}	Turn-off Switching Energy			2.8		
R_{thJC}	Junction to Case Thermal Resistance				0.20	°C/W

Series diode ratings and characteristics (Per series diode)

Symbol	Characteristic	Test Conditions		Min	Typ	Max	Unit
V _{RRM}	Maximum Repetitive Reverse Voltage			600			V
I _{RM}	Maximum Reverse Leakage Current	V _R = 600V				100	μA
I _F	DC Forward Current		T _c = 80°C		75		A
V _F	Diode Forward Voltage	I _F = 75A	T _j = 25°C		1.6	2	V
			T _j = 150°C		1.5		
t _{rr}	Reverse Recovery Time	I _F = 75A V _R = 300V di/dt = 2000A/μs	T _j = 25°C		100		ns
			T _j = 150°C		150		
Q _{rr}	Reverse Recovery Charge		T _j = 25°C		3.6		nC
			T _j = 150°C		7.6		
R _{thJC}	Junction to Case Thermal Resistance					0.80	°C/W

SiC Parallel diode ratings and characteristics (Per parallel diode)

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		30	180	μA
			T _j = 175°C		60	900	
I _F	DC Forward Current		T _c = 100°C		30		A
V _F	Diode Forward Voltage	I _F = 30A	T _j = 25°C		1.6	1.8	V
			T _j = 175°C		2	2.4	
Q _C	Total Capacitive Charge	I _F = 30A, V _R = 600V di/dt = 1000A/μs			84		nC
C	Total Capacitance	f = 1MHz, V _R = 200V			195		pF
		f = 1MHz, V _R = 400V			150		
R _{thJC}	Junction to Case Thermal Resistance					0.80	°C/W

Thermal and package characteristics

Symbol	Characteristic	Min		Typ	Max	Unit
V _{ISOL}	RMS Isolation Voltage, any terminal to case t = 1 min, 50/60Hz	4000				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	M6	3	5	N.m
Wt	Package Weight				250	g

* T_j = 175°C for series and parallel diodes

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

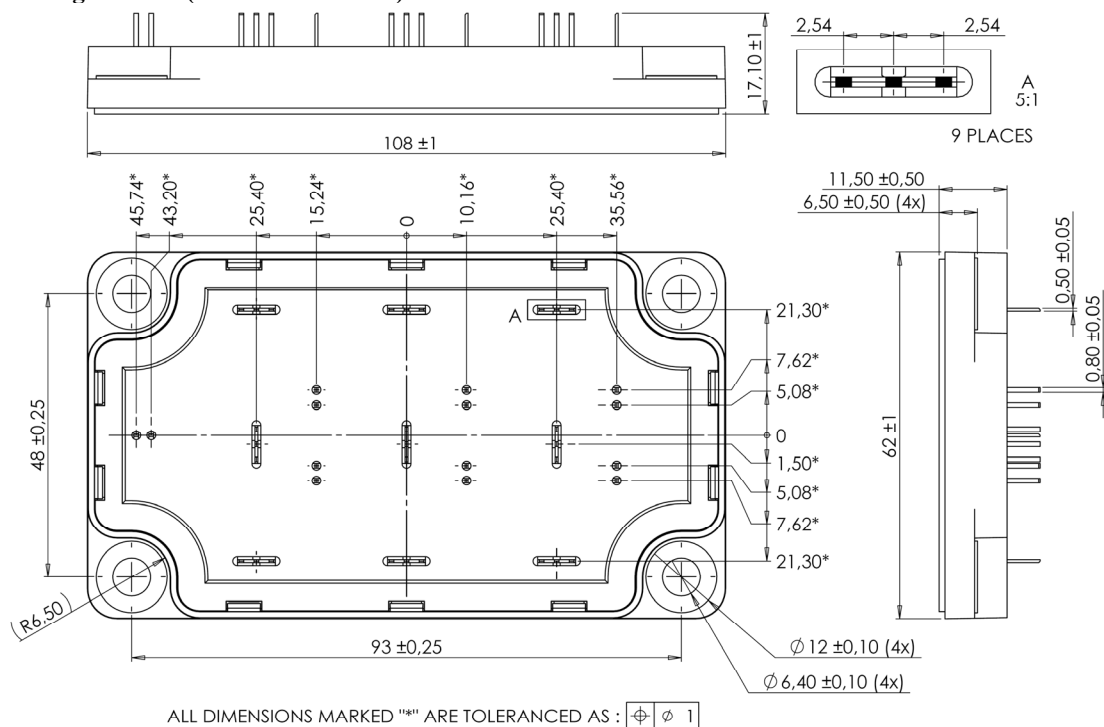
Pins NTC1 & NTC2 are only mounted on APTM100TA35SCTPG power module.

Symbol	Characteristic	Min	Typ	Max	Unit
R ₂₅	Resistance @ 25°C		50		kΩ
ΔR ₂₅ /R ₂₅			5		%
B _{25/85}	T ₂₅ = 298.15 K		3952		K
ΔB/B			4		%

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

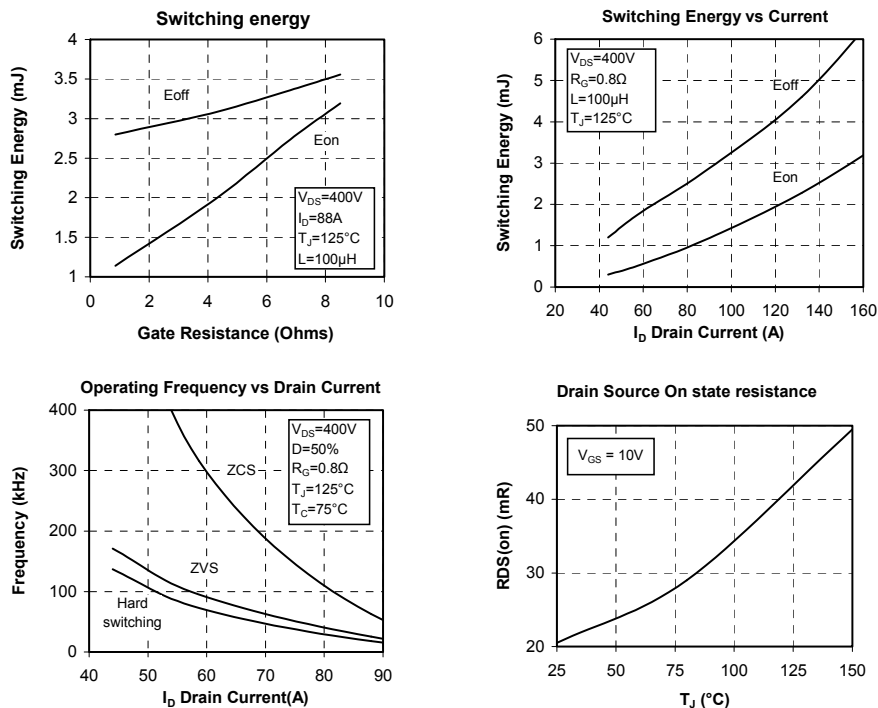
T: Thermistor temperature
 R_T: Thermistor value at T

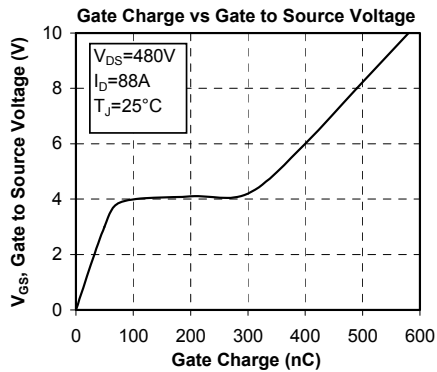
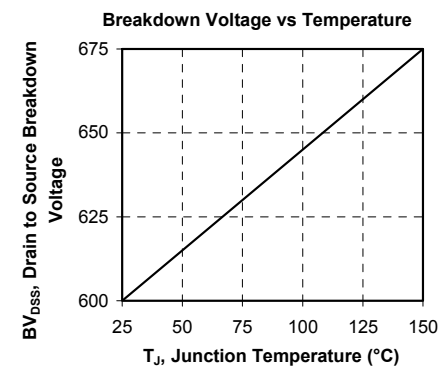
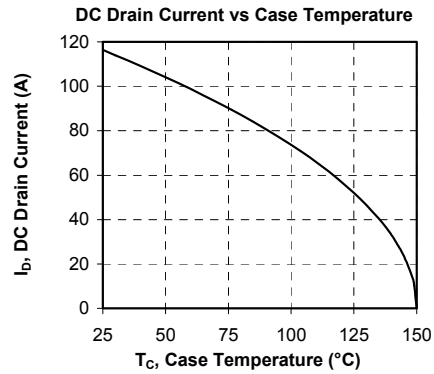
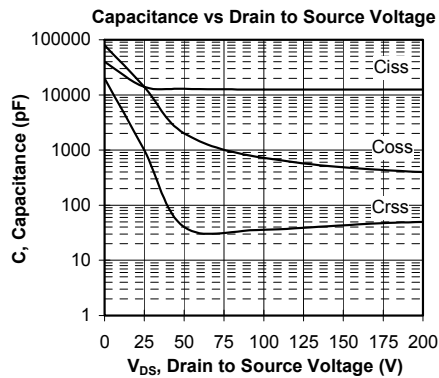
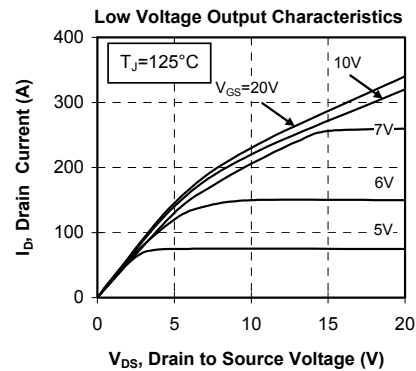
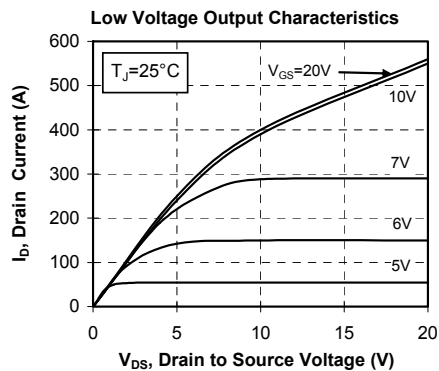
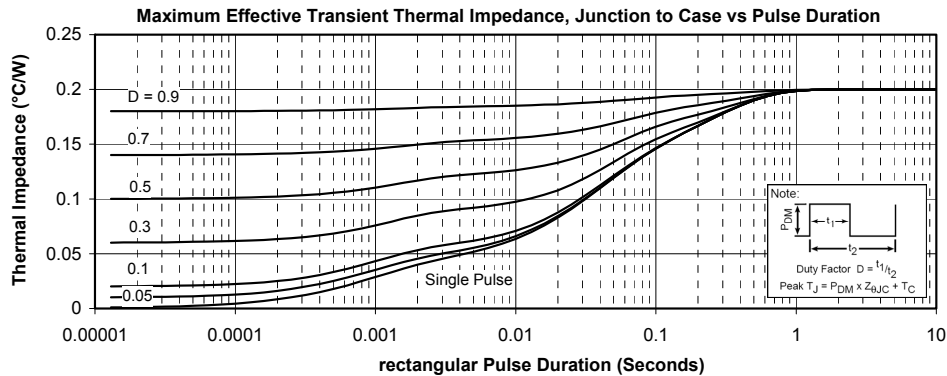
SP6-P Package outline (dimensions in mm)



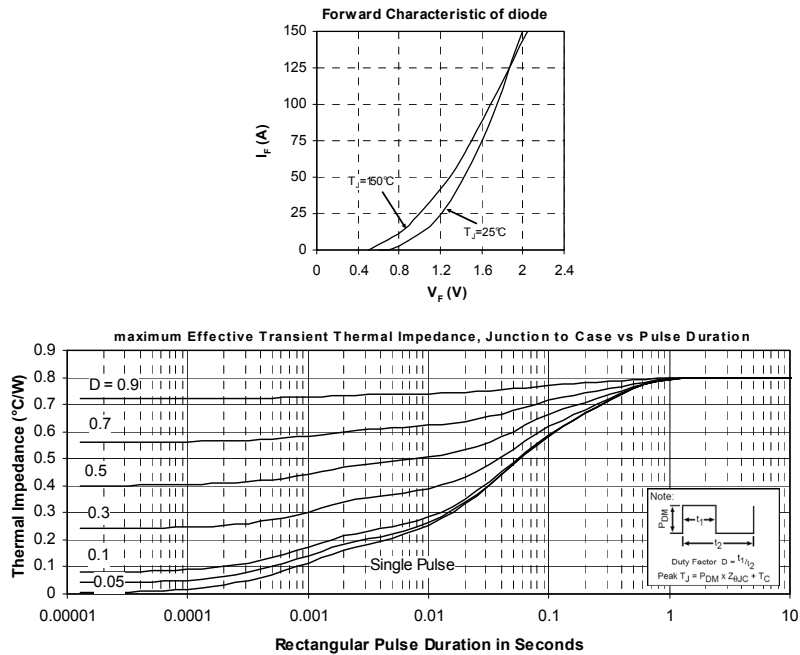
See application note 1902 - Mounting Instructions for SP6-P (12mm) Power Modules on www.microsemi.com

Typical CoolMOS™ Performance Curve

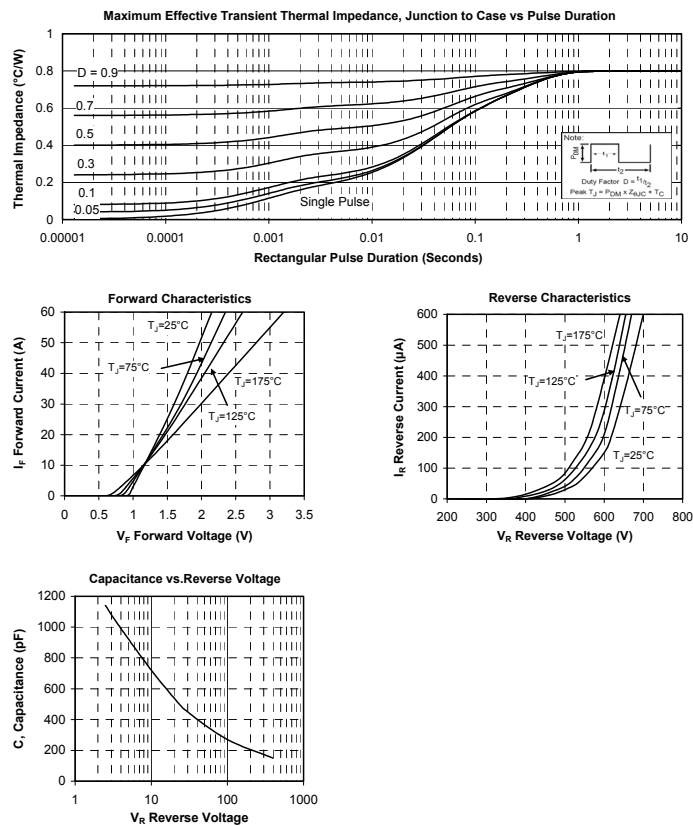




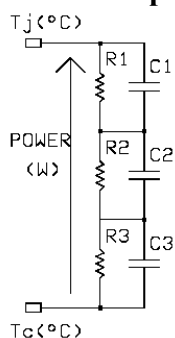
Typical series diode Performance Curve



Typical SiC parallel diode Performance Curve



Thermal impedance ; CoolMOS™



RC Final Model

$$R1 = 0.044 \, \Omega$$

$$R2 = 0.103 \, \Omega$$

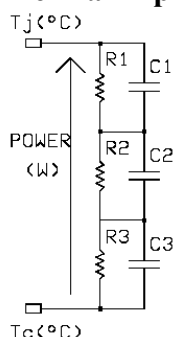
$$R3 = 0.053 \, \Omega$$

$$C1 = 0.022 \, \text{F}$$

$$C2 = 0.347 \, \text{F}$$

$$C3 = 4.31 \, \text{F}$$

Thermal impedance ; Series diode



RC Final Model

$$R1 = 0.176 \, \Omega$$

$$R2 = 0.413 \, \Omega$$

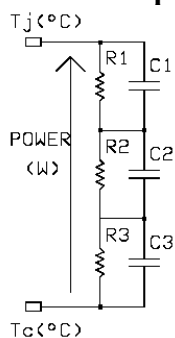
$$R3 = 0.211 \, \Omega$$

$$C1 = 0.0055 \, \text{F}$$

$$C2 = 0.086 \, \text{F}$$

$$C3 = 1.07 \, \text{F}$$

Thermal impedance ; SiC Parallel diode



RC Final Model

$$R1 = 0.176 \, \Omega$$

$$R2 = 0.413 \, \Omega$$

$$R3 = 0.211 \, \Omega$$

$$C1 = 0.0055 \, \text{F}$$

$$C2 = 0.086 \, \text{F}$$

$$C3 = 1.07 \, \text{F}$$

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