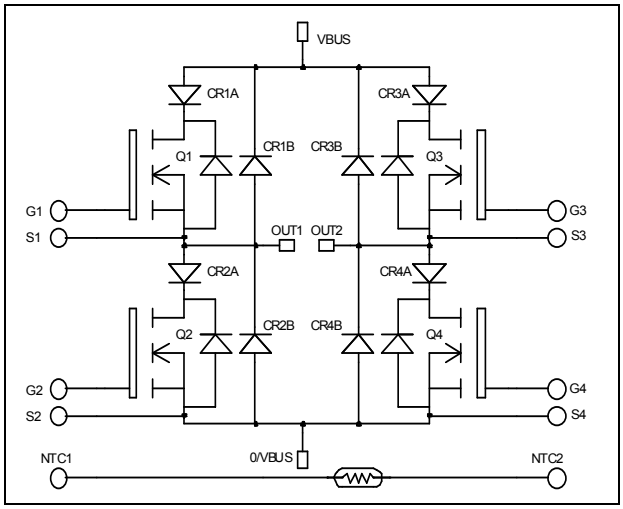
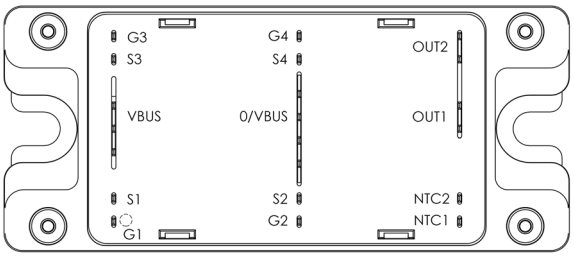
APTC90H12SCTG

Full – Bridge Series & SiC parallel diodes
Super Junction MOSFET Power Module

V_{DSS} = 900V
R_{DSon} = 120mΩ max @ Tj = 25°C
I_D = 30A @ Tc = 25°C





Application

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

Features

- ***CoolMOS™***
  - Ultra low R_{DSon}
  - Low Miller capacitance
  - Ultra 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

All ratings @ T_j = 25°C unless otherwise specified

Absolute maximum ratings

Symbol	*Parameter*		*Max ratings*	*Unit*
V_{DSS}	Drain - Source Breakdown Voltage		900	V
I_D	Continuous Drain Current	T_c = 25°C	30	A
		T_c = 80°C	23	
I_{DM}	Pulsed Drain current		75	
V_{GS}	Gate - Source Voltage		±20	V
R_{DSon}	Drain - Source ON Resistance		120	mΩ
P_D	Maximum Power Dissipation	T_c = 25°C	250	W
I_{AR}	Avalanche current (repetitive and non repetitive)		8.8	A
E_{AR}	Repetitive Avalanche Energy		2.9	mJ
E_{AS}	Single Pulse Avalanche Energy		1940	

CAUTION: These Devices are sensitive to Electrostatic Discharge. Proper Handling Procedures Should Be Followed. See application note APT0502 on www.microsemi.com

Electrical Characteristics

Symbol	Characteristic	Test Conditions		Min	Typ	Max	Unit
I_{DSS}	Zero Gate Voltage Drain Current	V_{GS} = 0V, V_{DS} = 900V	T_j = 25°C			100	µA
		V_{GS} = 0V, V_{DS} = 900V	T_j = 125°C		500		
$R_{DS(on)}$	Drain – Source on Resistance	V_{GS} = 10V, I_D = 26A			100	120	mΩ
$V_{GS(th)}$	Gate Threshold Voltage	V_{GS} = V_{DS}, I_D = 3mA		2.5	3	3.5	V
I_{GSS}	Gate – Source Leakage Current	V_{GS} = ±20 V, V_{DS} = 0V				100	nA

Dynamic Characteristics

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
C_{iss}	Input Capacitance	V_{GS} = 0V ; V_{DS} = 100V f = 1MHz		6800		pF
C_{oss}	Output Capacitance			330		
Q_g	Total gate Charge	V_{GS} = 10V V_{Bus} = 400V I_D = 26A		270		nC
Q_{gs}	Gate – Source Charge			32		
Q_{gd}	Gate – Drain Charge			115		
$T_{d(on)}$	Turn-on Delay Time	**Inductive Switching (125°C)** V_{GS} = 10V V_{Bus} = 600V I_D = 26A R_G = 7.5Ω		70		ns
T_r	Rise Time			20		
$T_{d(off)}$	Turn-off Delay Time			400		
T_f	Fall Time			25		
E_{on}	Turn-on Switching Energy	**Inductive switching @ 25°C** V_{GS} = 10V ; V_{Bus} = 600V I_D = 26A ; R_G = 7.5Ω		900		µJ
E_{off}	Turn-off Switching Energy			750		
E_{on}	Turn-on Switching Energy	**Inductive switching @ 125°C** V_{GS} = 10V ; V_{Bus} = 600V I_D = 26A ; R_G = 7.5Ω		1278		µJ
E_{off}	Turn-off Switching Energy			867		
R_{thJC}	Junction to Case Thermal Resistance				0.5	°C/W

Series diode ratings and characteristics

Symbol	Characteristic	Test Conditions		Min	Typ	Max	Unit
V_{RRM}	Maximum Peak Repetitive Reverse Voltage			1000			V
I_{RM}	Maximum Reverse Leakage Current	V_R = 1000V				250	µA
I_F	DC Forward Current		Tc = 80°C		30		A
V_F	Diode Forward Voltage	I_F = 30A			1.9	2.3	V
		I_F = 60A			2.2		
		I_F = 30A	T_j = 125°C		1.7		
t_{rr}	Reverse Recovery Time	I_F = 30A V_R = 667V di/dt = 200A/µs	T_j = 25°C		290		ns
			T_j = 125°C		390		
Q_{rr}	Reverse Recovery Charge		T_j = 25°C		670		nC
			T_j = 125°C		2350		
R_{thJC}	Junction to Case Thermal Resistance					1.2	°C/W

Parallel diode ratings and characteristics

Symbol	Characteristic	Test Conditions		Min	Typ	Max	Unit
V_{RRM}	Maximum Peak Repetitive Reverse Voltage			1200			V
I_{RM}	Maximum Reverse Leakage Current	V_R=1200V	T_j = 25°C		32	200	µA
			T_j = 175°C		56	1000	
I_F	DC Forward Current		Tc = 100°C		10		A
V_F	Diode Forward Voltage	I_F = 10A	T_j = 25°C		1.6	1.8	V
			T_j = 175°C		2.3	3	
Q_C	Total Capacitive Charge	I_F = 10A, V_R = 1200V di/dt =500A/µs			80		nC
Q	Total Capacitance	f = 1MHz, V_R = 200V			96		pF
		f = 1MHz, V_R = 400V			69		
R_{thJC}	Junction to Case Thermal Resistance					1.8	°C/W

Thermal and 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			-40	150	°C
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	100	
Torque	Mounting torque	To Heatsink	M5	2.5	4.7	N.m
Wt	Package Weight				160	g

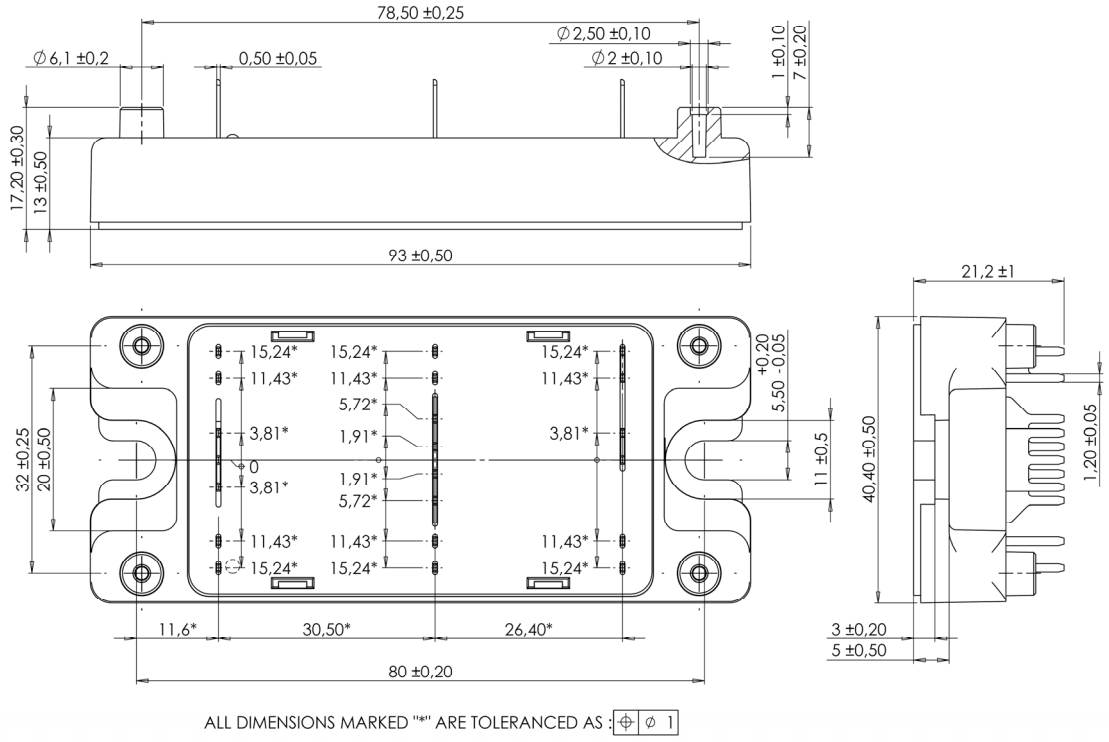
Temperature sensor NTC (see application note APT0406 on www.microsemi.com).

Symbol	Characteristic		Min	Typ	Max	Unit
R_{25}	Resistance @ 25°C			50		kΩ
$\Delta R_{25}/R_{25}$				5		%
$B_{25/85}$	T_{25} = 298.15 K			3952		K
ΔB/B		T_C=100°C		4		%

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

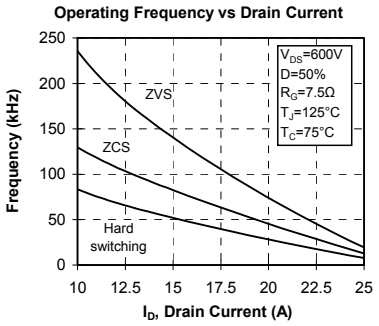
T: Thermistor temperature
R_T: Thermistor value at T

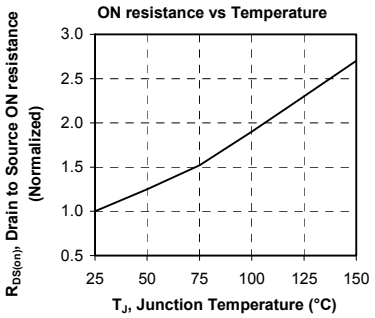
SP4 Package outline (dimensions in mm)

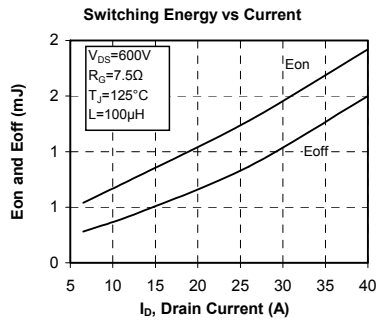


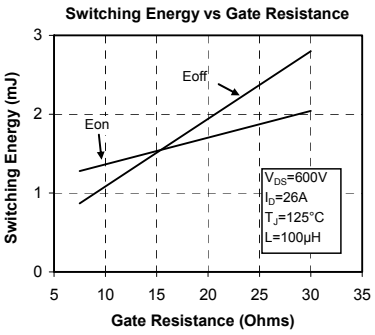
See application note APT0501 - Mounting Instructions for SP4 Power Modules on www.microsemi.com

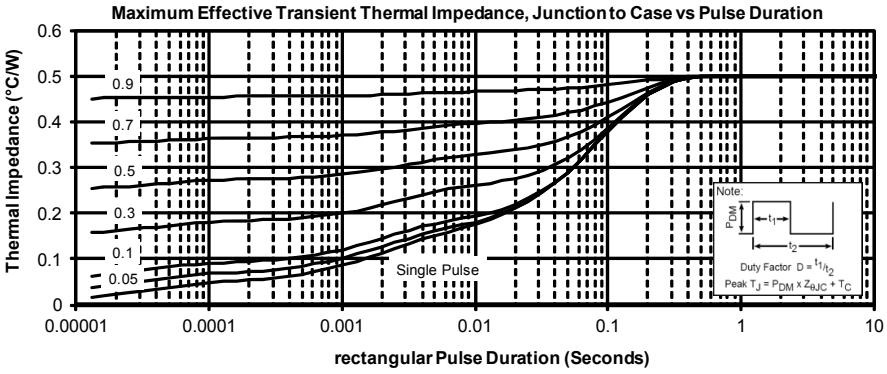
Typical CoolMOS Performance Curve

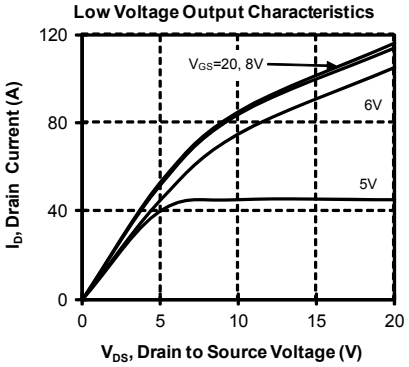


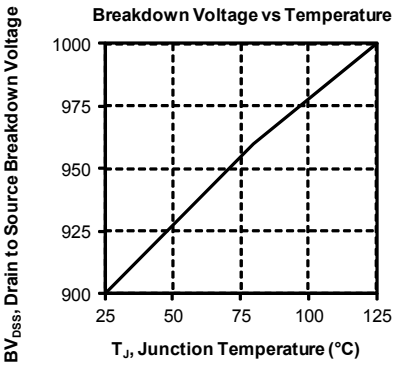


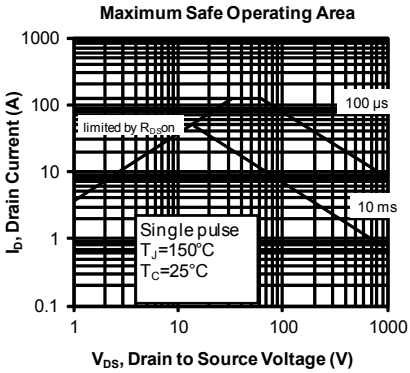


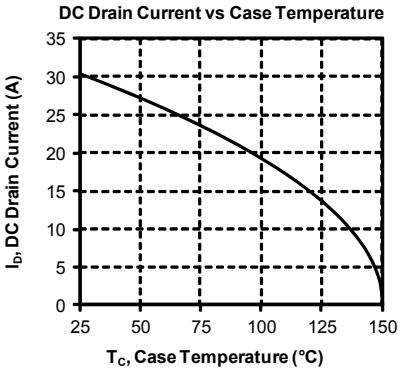


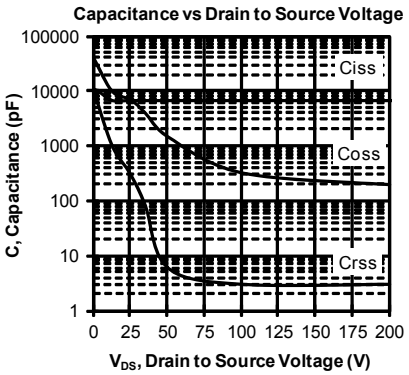

Maximum Effective Transient Thermal Impedance, Junction to Case vs Pulse Duration
Thermal Impedance (°C/W)
0.6
0.5
0.4
0.3
0.2
0.1
0
0.9
0.7
0.5
0.3
0.1
0.05
Single Pulse
Note:
PDM
t1
t2
Duty Factor D = t1/t2
Peak TJ = PDM x ZθJC + TC
0.00001
0.0001
0.001
0.01
0.1
1
10
rectangular Pulse Duration (Seconds)

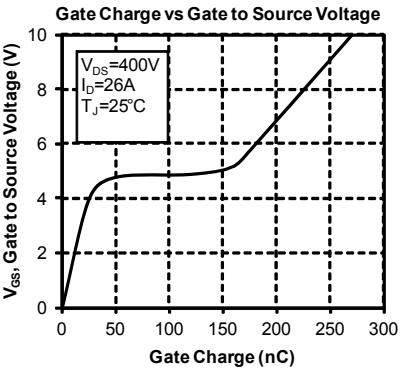

Low Voltage Output Characteristics
ID, Drain Current (A)
120
80
40
0
VGS=20, 8V
6V
5V
0
5
10
15
20
VDS, Drain to Source Voltage (V)


Breakdown Voltage vs Temperature
BVDSS, Drain to Source Breakdown Voltage
1000
975
950
925
900
25
50
75
100
125
TJ, Junction Temperature (°C)

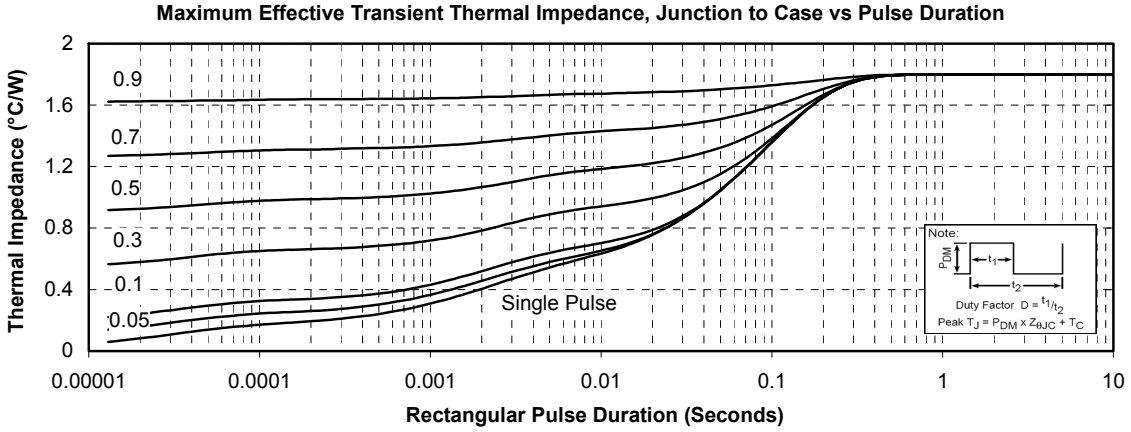

Maximum Safe Operating Area
ID, Drain Current (A)
1000
100
10
1
0.1
100 µs
limited by RDSon
10 ms
Single pulse
TJ=150°C
TC=25°C
1
10
100
1000
VDS, Drain to Source Voltage (V)

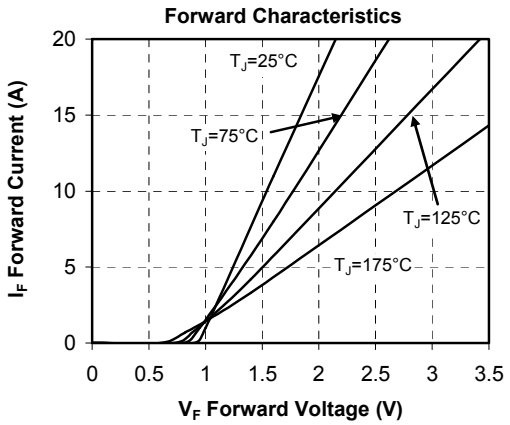

DC Drain Current vs Case Temperature
ID, DC Drain Current (A)
35
30
25
20
15
10
5
0
25
50
75
100
125
150
TC, Case Temperature (°C)

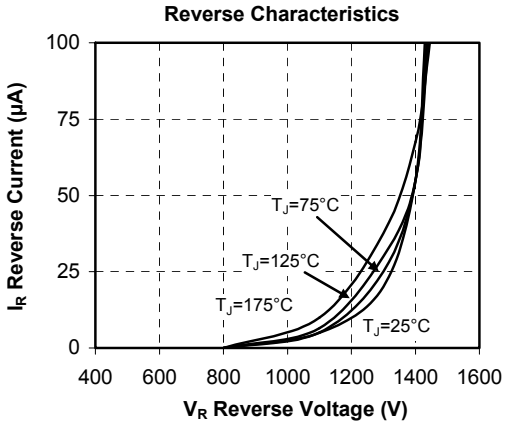

Capacitance vs Drain to Source Voltage
C, Capacitance (pF)
100000
10000
1000
100
10
1
Ciss
Coss
Crss
0
25
50
75
100
125
150
175
200
VDS, Drain to Source Voltage (V)

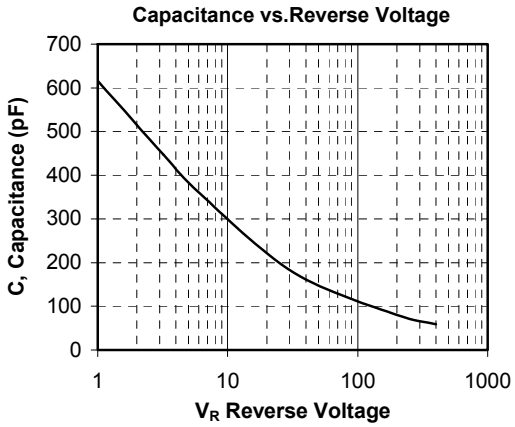

Gate Charge vs Gate to Source Voltage
VGS, Gate to Source Voltage (V)
10
8
6
4
2
0
VDS=400V
ID=26A
TJ=25°C
0
50
100
150
200
250
300
Gate Charge (nC)

Typical SiC Diode Performance Curve









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