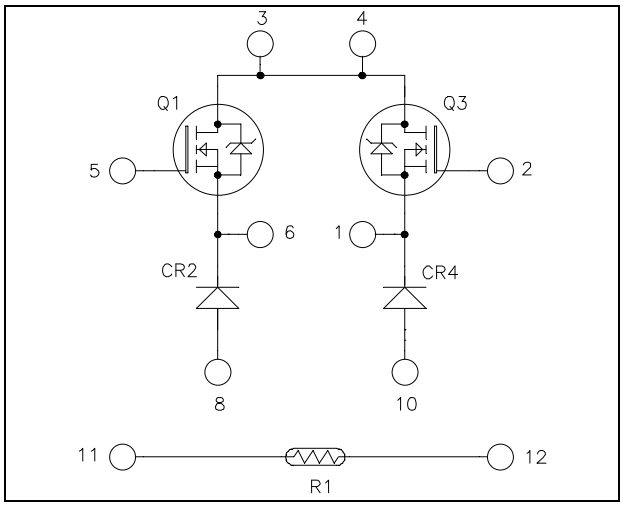
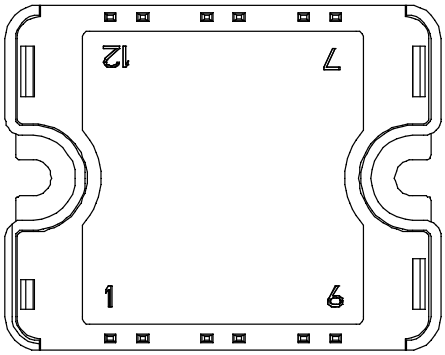
APTC90DSK12T1G

Dual Buck chopper Super Junction MOSFET Power Module

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





Pins 3/4 must be shorted together

Application

- AC and DC motor control
- Switched Mode Power Supplies

Features

- COOLMOS Power Semiconductors
  - Ultra low R_{DSon}
  - Low Miller capacitance
  - Ultra low gate charge
  - Avalanche energy rated
  - Very rugged
- Very low stray inductance
  - Symmetrical design
- 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
- Each leg can be easily paralleled to achieve a single buck of twice the current capability
- RoHS Compliant

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

All ratings @ T_j = 25°C unless otherwise specified

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		6.8		nF
C_{oss}	Output Capacitance			0.33		
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		1.5		mJ
E_{off}	Turn-off Switching Energy			0.75		
E_{on}	Turn-on Switching Energy	**Inductive switching @ 125°C** V_{GS} = 10V ; V_{Bus} = 600V I_D = 26A ; R_G = 7.5Ω		2.1		mJ
E_{off}	Turn-off Switching Energy			0.85		

Chopper 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			100	µA
			T_j = 125°C			500	
I_F	DC Forward Current		T_c = 80°C		30		A
V_F	Diode Forward Voltage	I_F = 30A			2.6	3.1	V
		I_F = 60A			3.2		
		I_F = 30A	T_j = 125°C		1.8		
t_{rr}	Reverse Recovery Time	I_F = 30A V_R = 800V di/dt=200A/µs	T_j = 25°C		300		ns
			T_j = 125°C		380		
Q_{rr}	Reverse Recovery Charge		T_j = 25°C		360		nC
			T_j = 125°C		1700		

Thermal and package characteristics

Symbol	Characteristic			Min	Typ	Max	Unit
R_{thJC}	Junction to Case Thermal Resistance		CoolMOS			0.50	°C/W
			diode			1.2	
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	M4	2		3	N.m
Wt	Package Weight					80	g

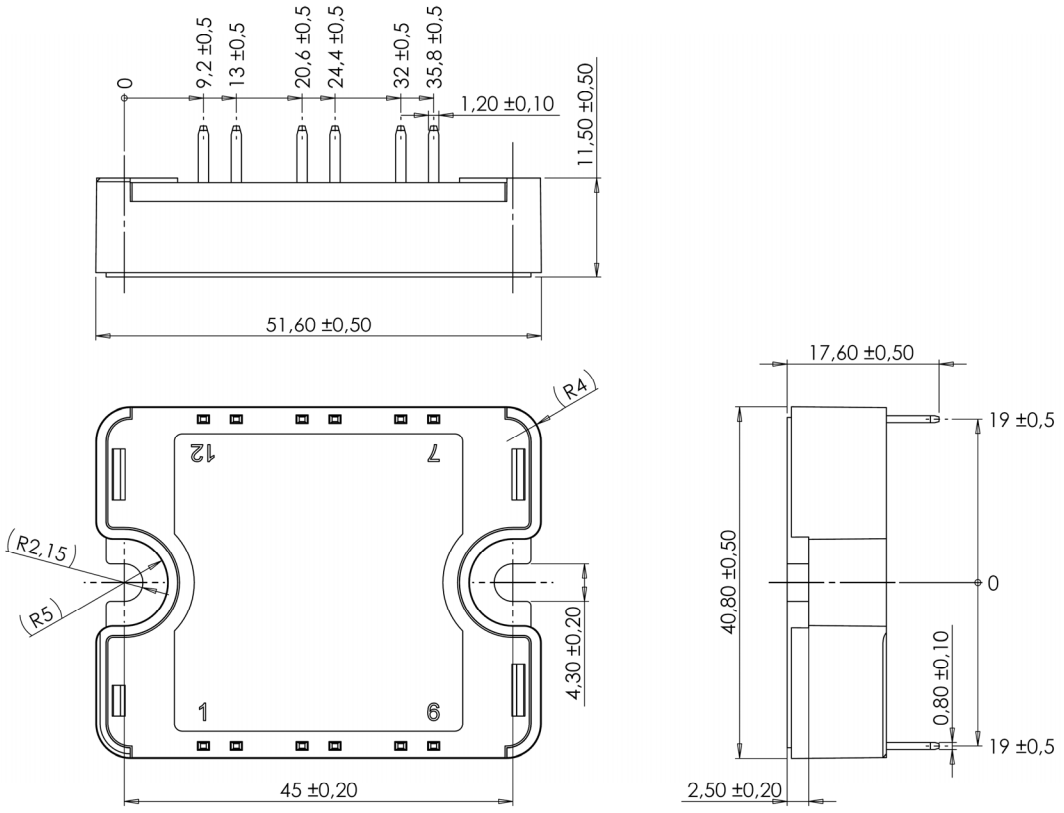
Temperature sensor NTC (see application note APT0406 on www.microsemi.com for more information).

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
$\Delta B/B$		T_C=100°C		4		%

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

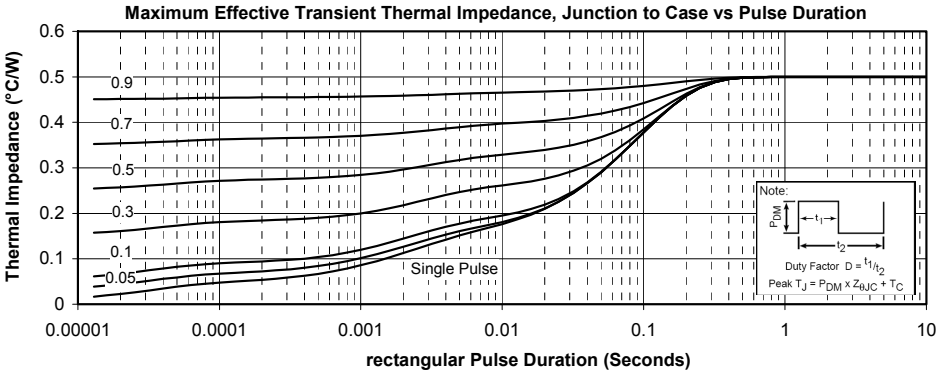
T: Thermistor temperature
R_T: Thermistor value at T

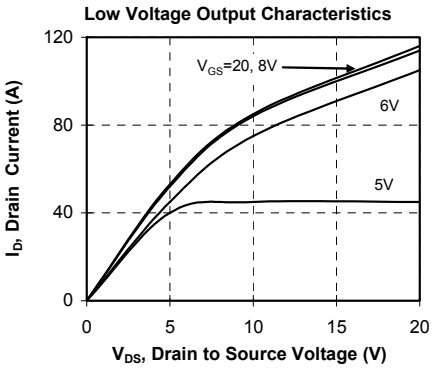
SP1 Package outline (dimensions in mm)

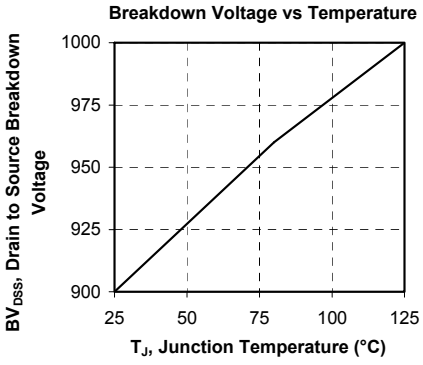


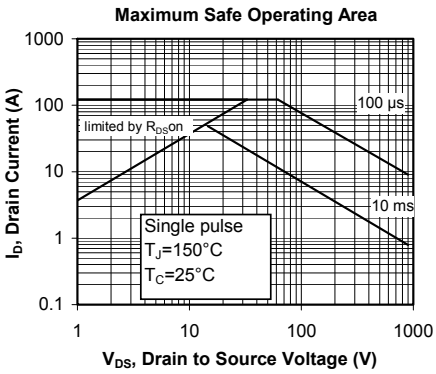
See application note 1904 - Mounting Instructions for SP1 Power Modules on www.microsemi.com

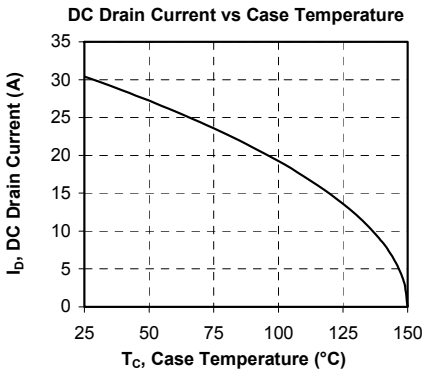
Typical CoolMOS performance Curve

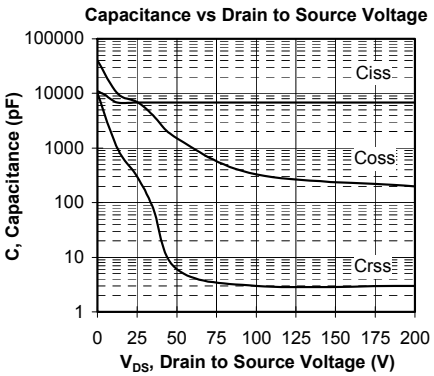


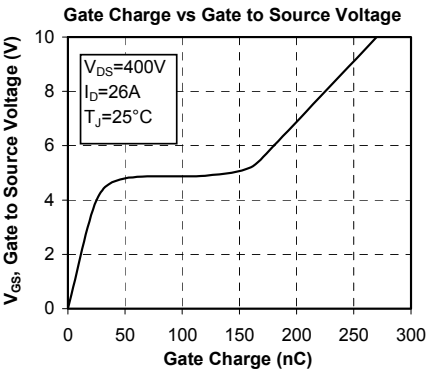


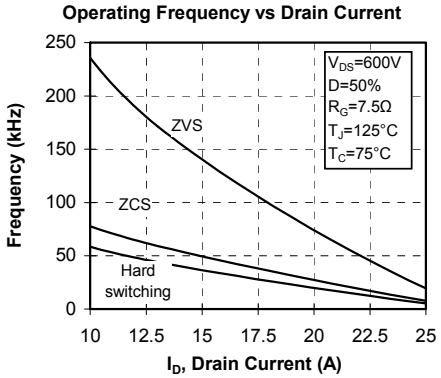


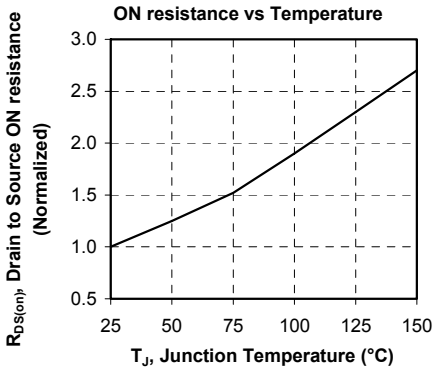


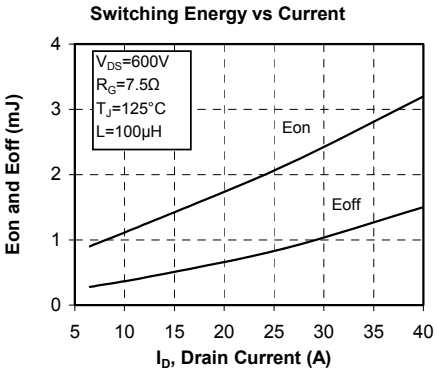


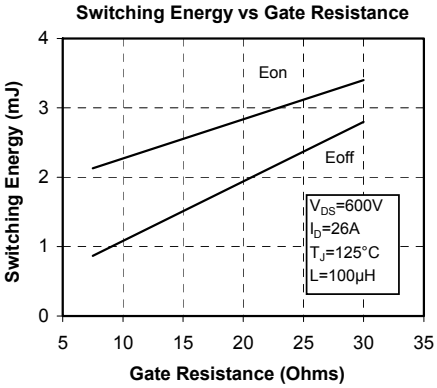




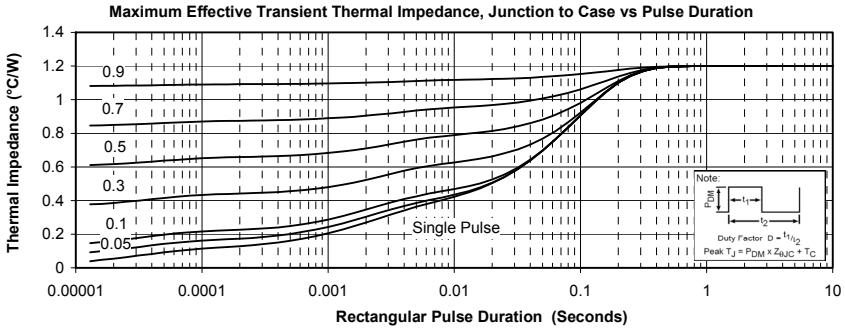

Operating Frequency vs Drain Current
Frequency (kHz)
250
200
150
100
50
0
10
12.5
15
17.5
20
22.5
25
I_D, Drain Current (A)
V_{DS}=600V
D=50%
R_G=7.5Ω
T_J=125°C
T_C=75°C
ZVS
ZCS
Hard
switching

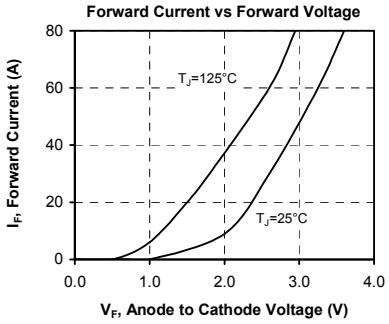

ON resistance vs Temperature
$R_{DS(on)}$, Drain to Source ON resistance (Normalized)
3.0
2.5
2.0
1.5
1.0
0.5
25
50
75
100
125
150
T_J, Junction Temperature (°C)

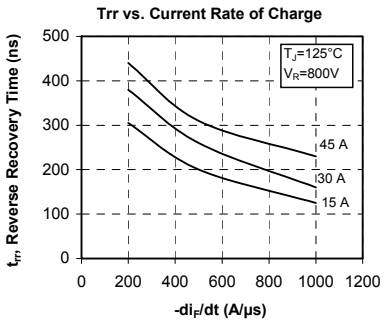

Switching Energy vs Current
Eon and Eoff (mJ)
4
3
2
1
0
5
10
15
20
25
30
35
40
I_D, Drain Current (A)
V_{DS}=600V
R_G=7.5Ω
T_J=125°C
L=100µH
Eon
Eoff

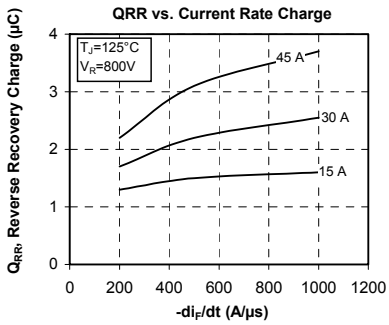

Switching Energy vs Gate Resistance
Switching Energy (mJ)
4
3
2
1
0
5
10
15
20
25
30
35
Gate Resistance (Ohms)
Eon
Eoff
V_{DS}=600V
I_D=26A
T_J=125°C
L=100µH

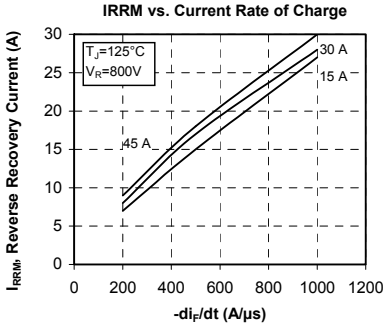
Typical Chopper diode performance Curve

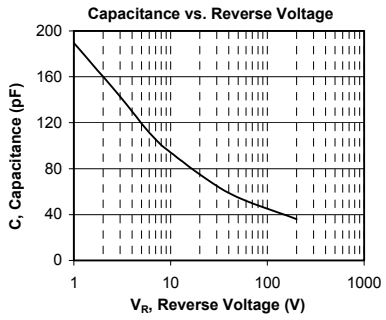


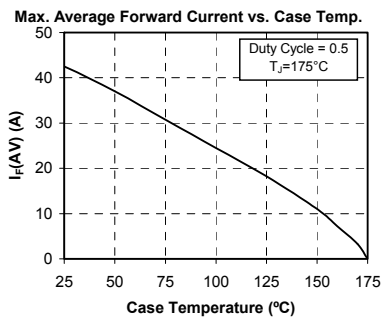












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