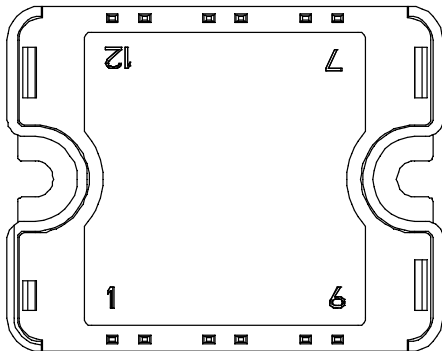
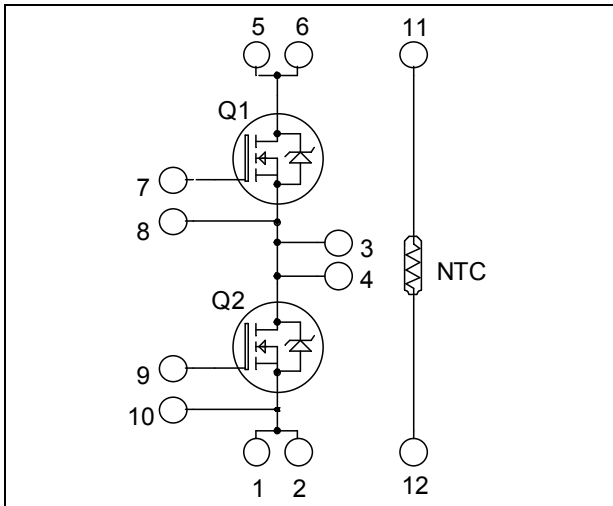


## Phase leg Super Junction MOSFET Power Module

$V_{DSS} = 600V$   
 $R_{DSon} = 45m\Omega \text{ max @ } T_j = 25^\circ C$   
 $I_D = 49A \text{ @ } T_c = 25^\circ C$



Pins 1/2 ; 3/4 ; 5/6 must be shorted together

### Application

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

### 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
- RoHS Compliant

### Absolute maximum ratings

Symbol	Parameter	Max ratings	Unit
$V_{DSS}$	Drain - Source Breakdown Voltage	600	V
$I_D$	Continuous Drain Current	$T_c = 25^\circ C$	49
		$T_c = 80^\circ C$	38
$I_{DM}$	Pulsed Drain current	130	A
$V_{GS}$	Gate - Source Voltage	$\pm 20$	V
$R_{DSon}$	Drain - Source ON Resistance	45	$m\Omega$
$P_D$	Maximum Power Dissipation	$T_c = 25^\circ C$	250
$I_{AR}$	Avalanche current (repetitive and non repetitive)	15	A
$E_{AR}$	Repetitive Avalanche Energy	3	mJ
$E_{AS}$	Single Pulse Avalanche Energy	1900	

**CAUTION:** These Devices are sensitive to Electrostatic Discharge. Proper Handling Procedures Should Be Followed. See application note APT0502 on [www.microsemi.com](http://www.microsemi.com)

All ratings @  $T_j = 25^\circ\text{C}$  unless otherwise specified

**Electrical Characteristics**

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{GS} = 0V, V_{DS} = 600V$			250	$\mu\text{A}$
		$T_j = 25^\circ\text{C}$				
		$V_{GS} = 0V, V_{DS} = 600V$			500	
$R_{DS(on)}$	Drain – Source on Resistance	$V_{GS} = 10V, I_D = 24.5A$		40	45	$\text{m}\Omega$
$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 3\text{mA}$	2.1	3	3.9	V
$I_{GSS}$	Gate – Source Leakage Current	$V_{GS} = \pm 20V, V_{DS} = 0V$			100	$\text{nA}$

**Dynamic Characteristics**

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
$C_{iss}$	Input Capacitance	$V_{GS} = 0V ; V_{DS} = 25V$ $f = 1\text{MHz}$		7.2		nF
$C_{oss}$	Output Capacitance			8.5		
$Q_g$	Total gate Charge	$V_{GS} = 10V$ $V_{Bus} = 300V$ $I_D = 49A$		150		nC
$Q_{gs}$	Gate – Source Charge			34		
$Q_{gd}$	Gate – Drain Charge			51		
$T_{d(on)}$	Turn-on Delay Time	<b>Inductive Switching (<math>125^\circ\text{C}</math>)</b> $V_{GS} = 10V$ $V_{Bus} = 400V$ $I_D = 49A$ $R_G = 5\Omega$		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	<b>Inductive switching @ <math>25^\circ\text{C}</math></b> $V_{GS} = 10V ; V_{Bus} = 400V$ $I_D = 49A ; R_G = 5\Omega$		675		$\mu\text{J}$
$E_{off}$	Turn-off Switching Energy			520		
$E_{on}$	Turn-on Switching Energy	<b>Inductive switching @ <math>125^\circ\text{C}</math></b> $V_{GS} = 10V ; V_{Bus} = 400V$ $I_D = 49A ; R_G = 5\Omega$		1100		$\mu\text{J}$
$E_{off}$	Turn-off Switching Energy			635		

**Source - Drain diode ratings and characteristics**

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
$I_S$	Continuous Source current (Body diode)		$T_c = 25^\circ\text{C}$		49	A
			$T_c = 80^\circ\text{C}$		38	
$V_{SD}$	Diode Forward Voltage	$V_{GS} = 0V, I_S = -49A$			1.2	V
$dv/dt$	Peak Diode Recovery ❶				4	V/ns
$t_{rr}$	Reverse Recovery Time	$I_S = -49A$ $V_R = 350V$ $di_S/dt = 100A/\mu\text{s}$	$T_j = 25^\circ\text{C}$		600	ns
$Q_{rr}$	Reverse Recovery Charge		$T_j = 25^\circ\text{C}$		17	$\mu\text{C}$

 ❶  $dv/dt$  numbers reflect the limitations of the circuit rather than the device itself.

$$I_S \leq -49A \quad di/dt \leq 100A/\mu\text{s} \quad V_R \leq V_{DSS} \quad T_j \leq 150^\circ\text{C}$$

## Thermal and package characteristics

Symbol	Characteristic	Min	Typ	Max	Unit	
R <sub>thJC</sub>	Junction to Case Thermal Resistance			0.5	°C/W	
V <sub>ISOL</sub>	RMS Isolation Voltage, any terminal to case t=1 min, I <sub>isol</sub> <1mA, 50/60Hz	2500			V	
T <sub>J</sub>	Operating junction temperature range	-40		150	°C	
T <sub>STG</sub>	Storage Temperature Range	-40		125		
T <sub>C</sub>	Operating Case Temperature	-40		100		
Torque	Mounting torque	To heatsink	M4	2.5	4.7	N.m
Wt	Package Weight			80		g

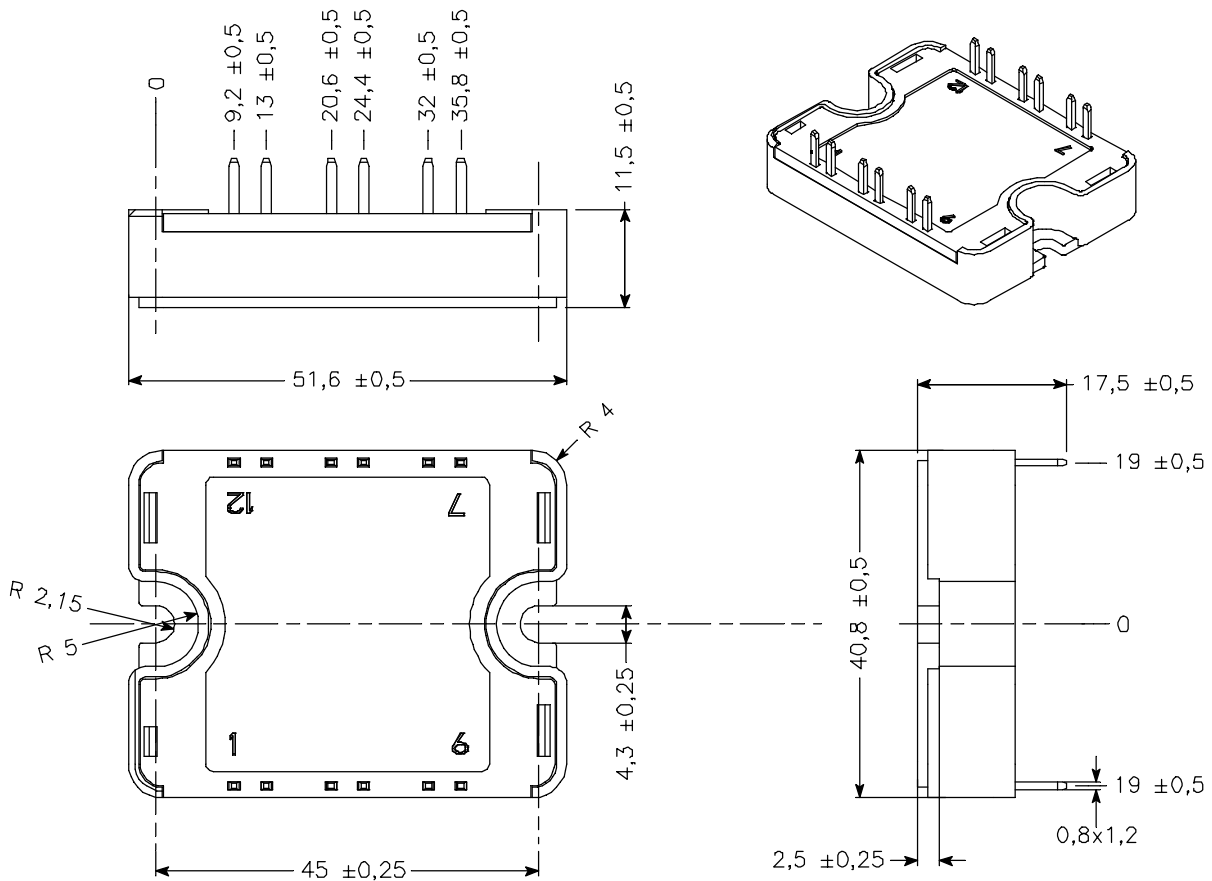
## Temperature sensor NTC (see application note APT0406 on www.microsemi.com for more information).

Symbol	Characteristic	Min	Typ	Max	Unit
R <sub>25</sub>	Resistance @ 25°C		50		kΩ
B <sub>25/85</sub>	T <sub>25</sub> = 298.15 K		3952		K

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

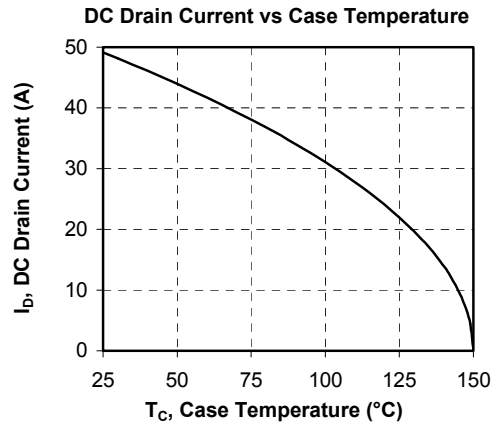
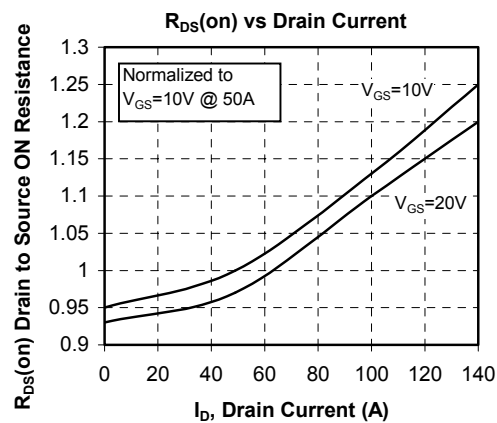
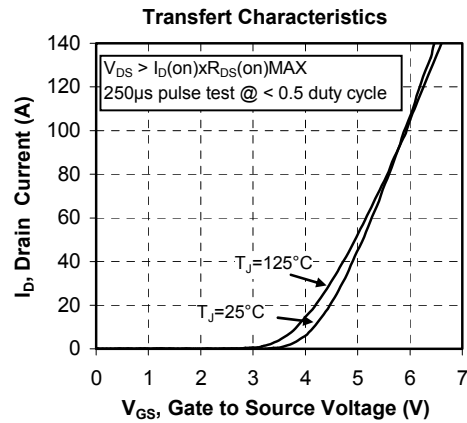
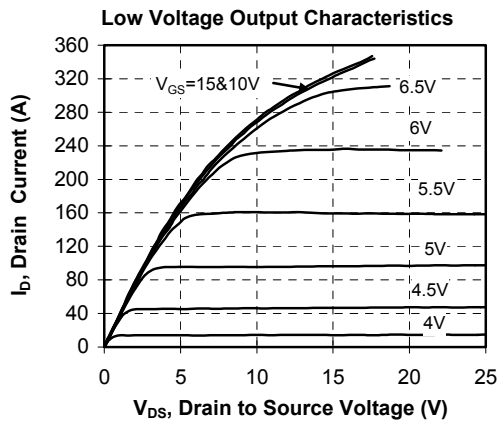
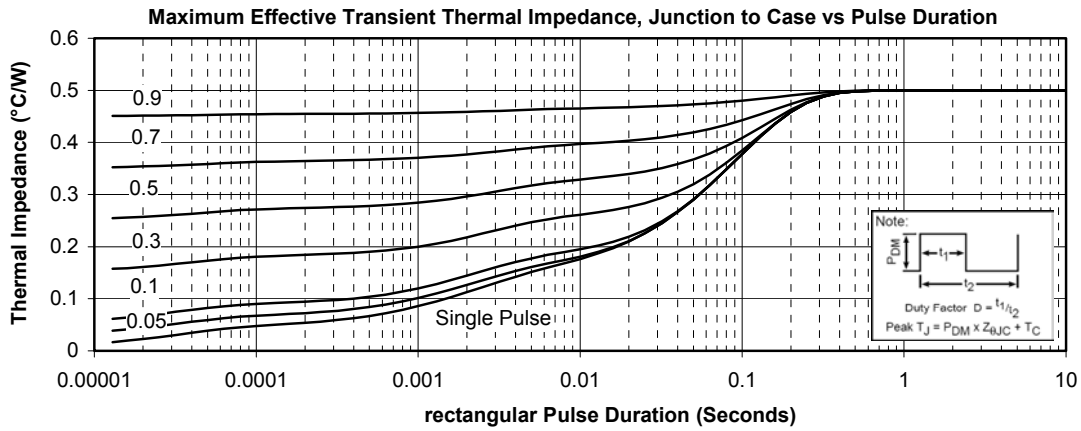
T: Thermistor temperature  
 R<sub>T</sub>: Thermistor value at T

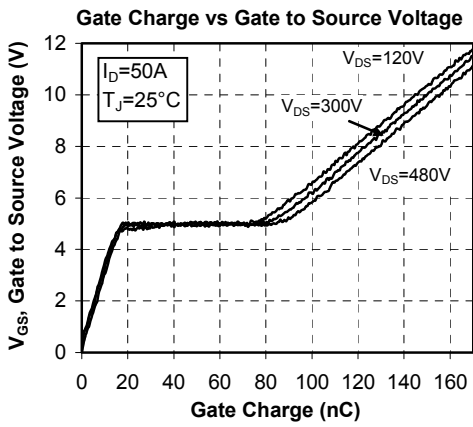
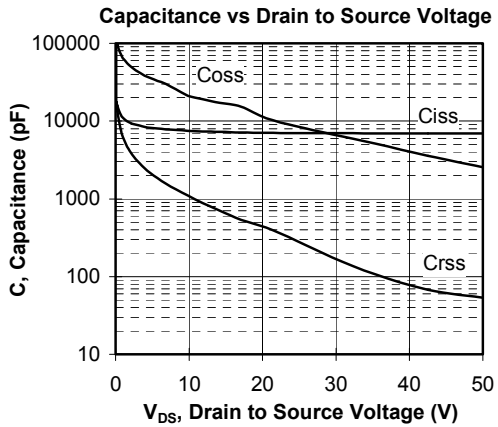
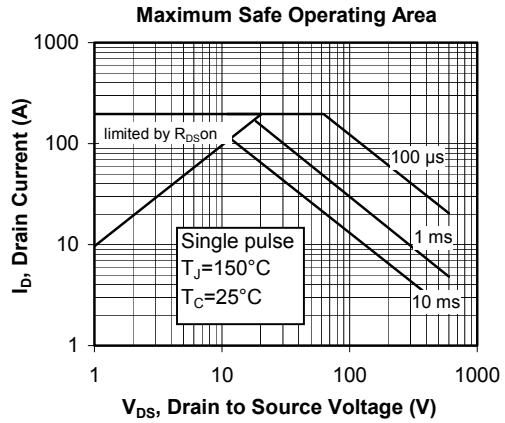
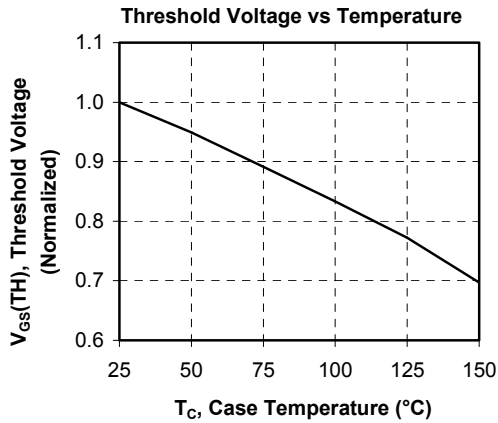
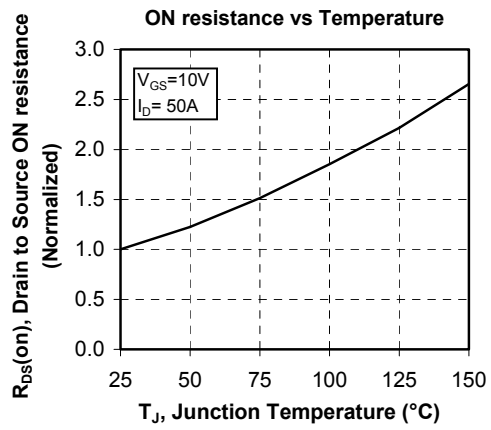
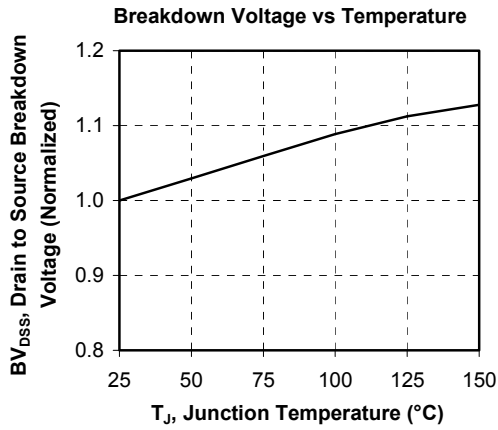
## SP1 Package outline (dimensions in mm)

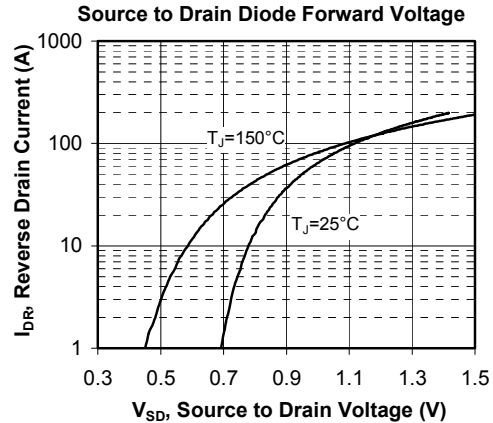
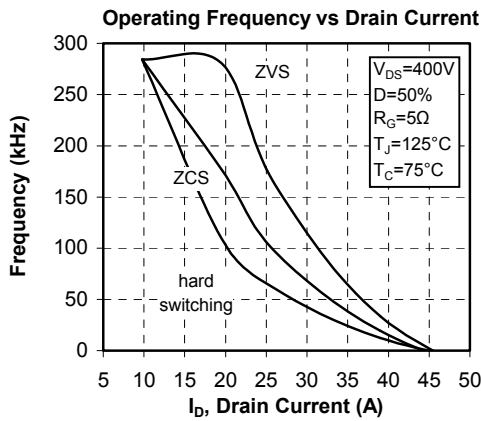
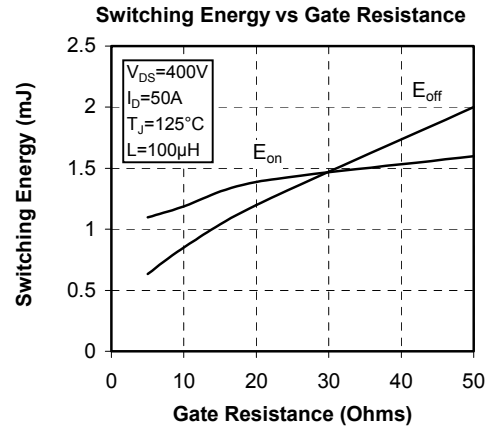
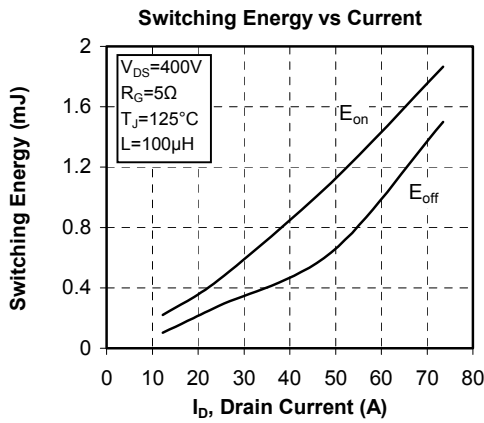
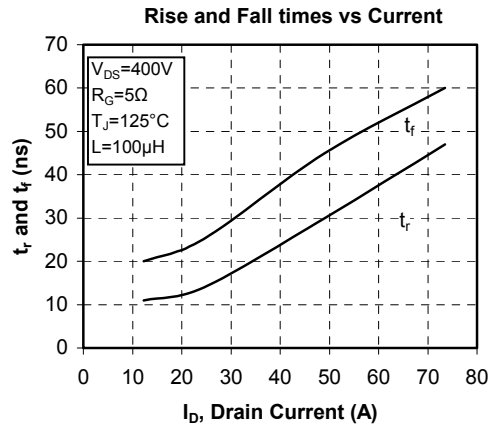
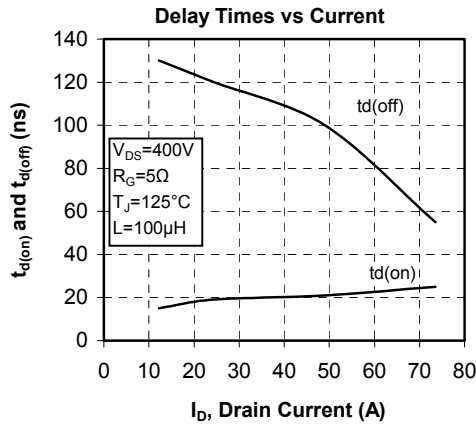


See application note 1904 - Mounting Instructions for SP1 Power Modules on [www.microsemi.com](http://www.microsemi.com)

## Typical Performance Curve







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