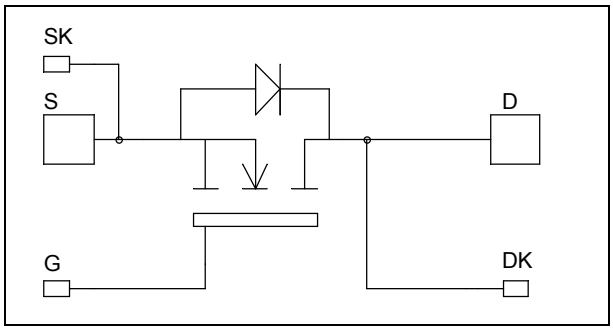
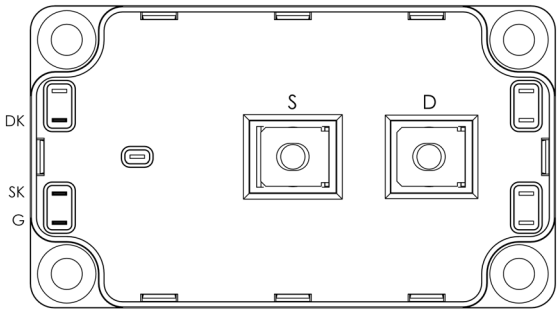
Single Switch MOSFET Power Module

V_{DSS} = 100V
R_{DSon} = 1.5mΩ typ @ Tj = 25°C
I_D = 860A* @ Tc = 25°C





Application

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

Features

- Power MOS V® FREDFETs
  - Low R_{DSon}
  - Low input and Miller capacitance
  - Low gate charge
  - Avalanche energy rated
  - Fast intrinsic diode
  - Very rugged
- Kelvin source for easy drive
- Very low stray inductance
  - Symmetrical design
  - M5 power connectors
- 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
- Low profile
- RoHS Compliant

Absolute maximum ratings

Symbol	*Parameter*		*Max ratings*	*Unit*
V_{DSS}	Drain - Source Breakdown Voltage		100	V
I_D	Continuous Drain Current	T_c = 25°C	860 *	A
		T_c = 80°C	640 *	
I_{DM}	Pulsed Drain current		2200	
V_{GS}	Gate - Source Voltage		±30	V
R_{DSon}	Drain - Source ON Resistance		1.6	mΩ
P_D	Maximum Power Dissipation	T_c = 25°C	2500	W
I_{AR}	Avalanche current (repetitive and non repetitive)		100	A
E_{AR}	Repetitive Avalanche Energy		50	mJ
E_{AS}	Single Pulse Avalanche Energy		3000	

* Specification of MOSFET device but output current must be limited to 500A to not exceed a delta of temperature greater than 100°C for the connectors.

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} = 100V	T_j = 25°C			500	µA
		V_{GS} = 0V, V_{DS} = 80V	T_j = 125°C			2000	
$R_{DS(on)}$	Drain – Source on Resistance	V_{GS} = 10V, I_D = 275A			1.5	1.6	mΩ
$V_{GS(th)}$	Gate Threshold Voltage	V_{GS} = V_{DS}, I_D = 12mA		2		4	V
I_{GSS}	Gate – Source Leakage Current	V_{GS} = ±30 V, V_{DS} = 0V				±450	nA

Dynamic Characteristics

Symbol	*Characteristic*	*Test Conditions*	*Min*	*Typ*	*Max*	*Unit*
C_{iss}	Input Capacitance	V_{GS} = 0V V_{DS} = 25V f = 1MHz		60		nF
C_{oss}	Output Capacitance			23		
C_{rss}	Reverse Transfer Capacitance			8.8		
Q_g	Total gate Charge	V_{GS} = 10V V_{Bus} = 50V I_D =550A		2100		nC
Q_{gs}	Gate – Source Charge			360		
Q_{gd}	Gate – Drain Charge			1080		
$T_{d(on)}$	Turn-on Delay Time	**Inductive switching** V_{GS} = 15V V_{Bus} = 66V I_D = 550A R_G = 1Ω		185		ns
T_r	Rise Time			270		
$T_{d(off)}$	Turn-off Delay Time			600		
T_f	Fall Time			175		
E_{on}	Turn-on Switching Energy	**Inductive switching @ 25°C** V_{GS} = 15V, V_{Bus} = 66V I_D = 550A, R_G =1Ω		3.3		mJ
E_{off}	Turn-off Switching Energy			3.6		
E_{on}	Turn-on Switching Energy	**Inductive switching @ 125°C** V_{GS} = 15V, V_{Bus} = 66V I_D = 550A, R_G = 1Ω		3.65		mJ
E_{off}	Turn-off Switching Energy			3.85		

Source - Drain diode ratings and characteristics

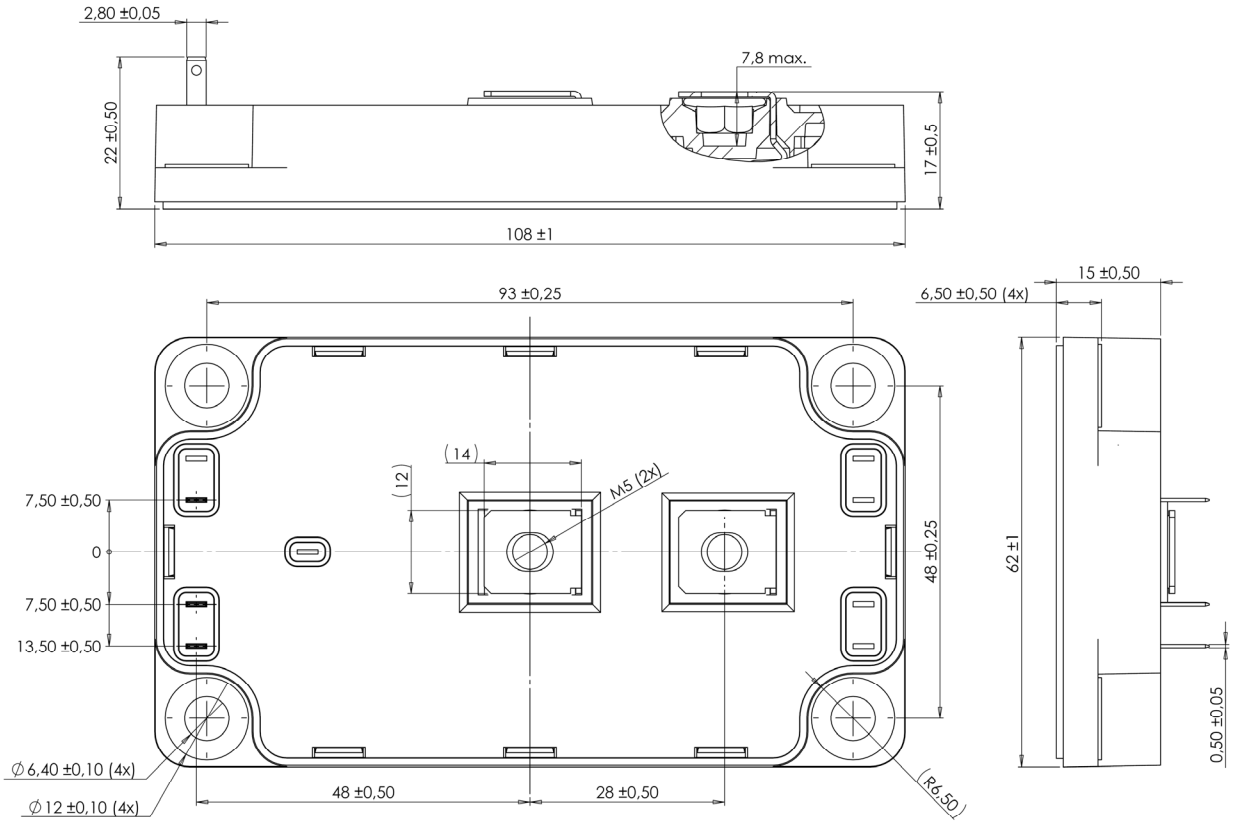
Symbol	*Characteristic*	*Test Conditions*		*Min*	*Typ*	*Max*	*Unit*
I_S	Continuous Source current (Body diode)		Tc = 25°C			860*	A
			Tc = 80°C			640*	
V_{SD}	Diode Forward Voltage	V_{GS} = 0V, I_S = - 550A				1.3	V
dv/dt	Peak Diode Recovery ❶					5	V/ns
t_{rr}	Reverse Recovery Time	I_S = - 550A V_R = 66V di_S/dt = 600A/µs	T_j = 25°C			190	ns
			T_j = 125°C			370	
Q_{rr}	Reverse Recovery Charge		T_j = 25°C		2.4		µC
			T_j = 125°C		10.2		

❶ dv/dt numbers reflect the limitations of the circuit rather than the device itself.
$I_S \le$ - 860A di/dt ≤ 600A/µs $V_R \le V_{DSS}$ $T_j \le$ 150°C

Thermal and package characteristics

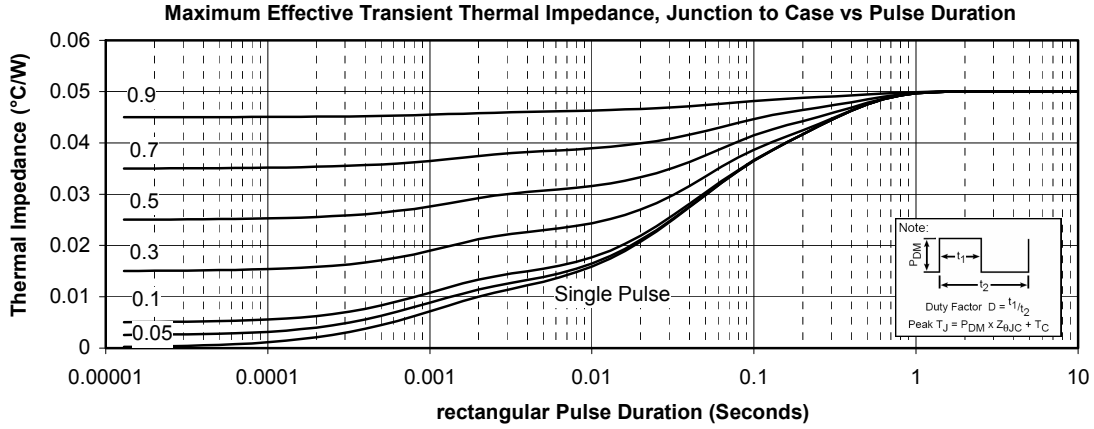
Symbol	*Characteristic*			*Min*	*Typ*	*Max*	*Unit*
R_{thJC}	Junction to Case Thermal Resistance					0.05	°C/W
V_{ISOL}	RMS Isolation Voltage, any terminal to case t =1 min, 50/60Hz			4000			V
T_J	Operating junction temperature range			-40		150	°C
T_{STG}	Storage Temperature Range			-40		125	
T_C	Operating Case Temperature			-40		100	
Torque	Mounting torque	To heatsink	M6	3		5	N.m
		For terminals	M5	2		3.5	
Wt	Package Weight					300	g

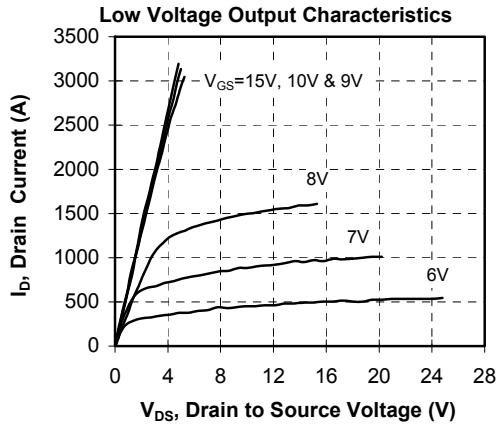
SP6 Package outline (dimensions in mm)

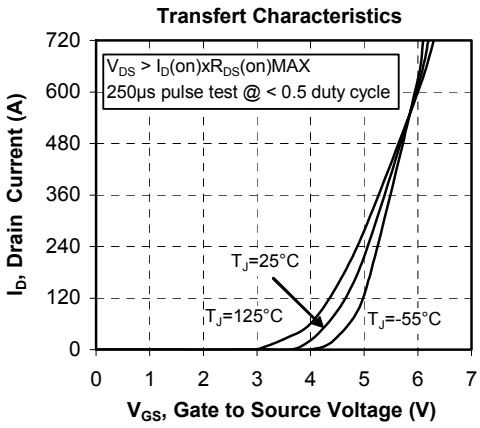


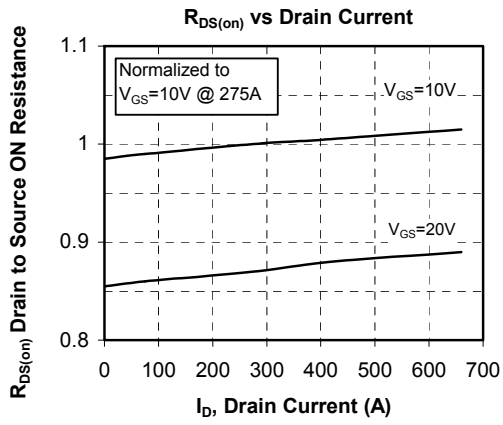
See application note APT0601 - Mounting Instructions for SP6 Power Modules on www.microsemi.com

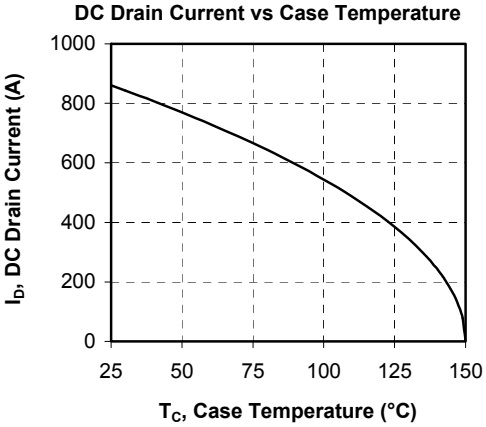
Typical Performance Curve

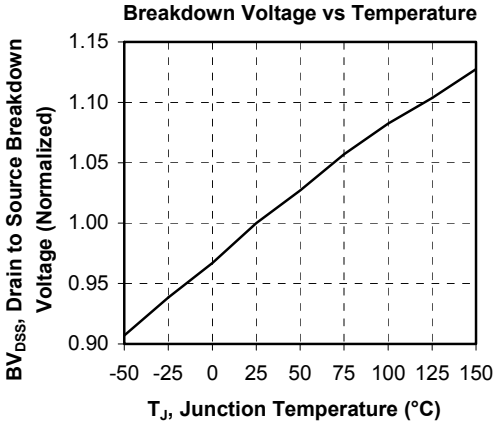


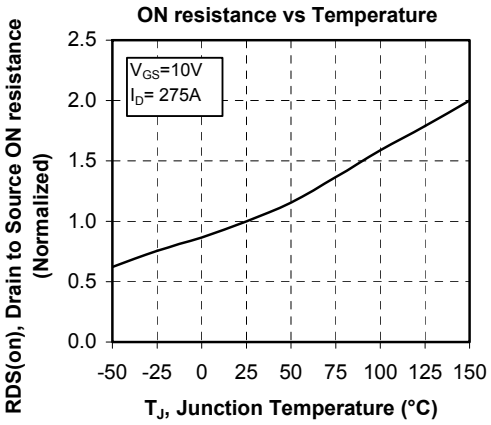


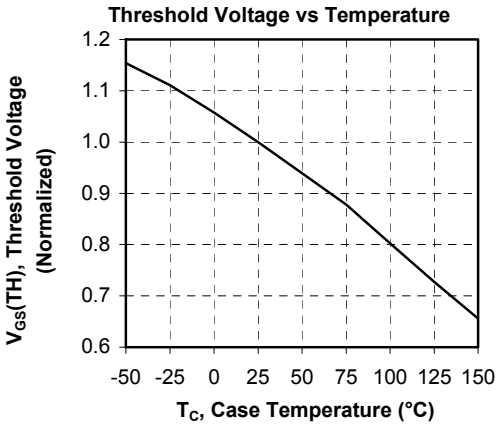


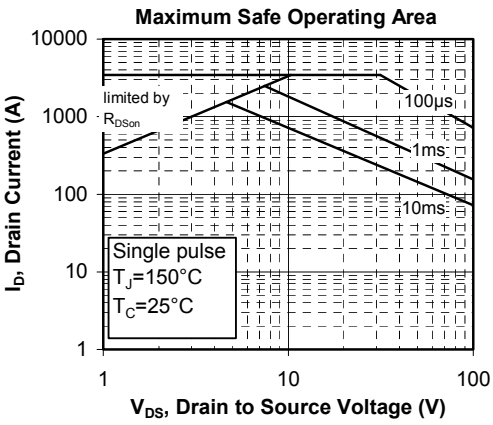


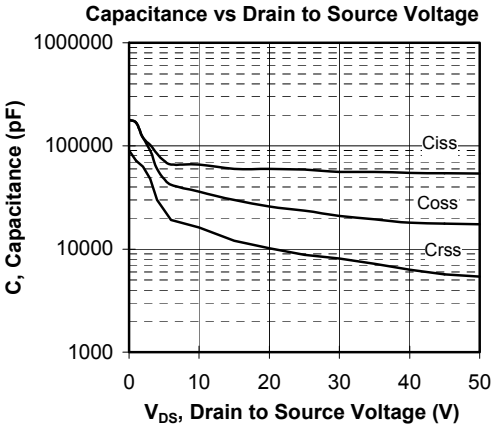


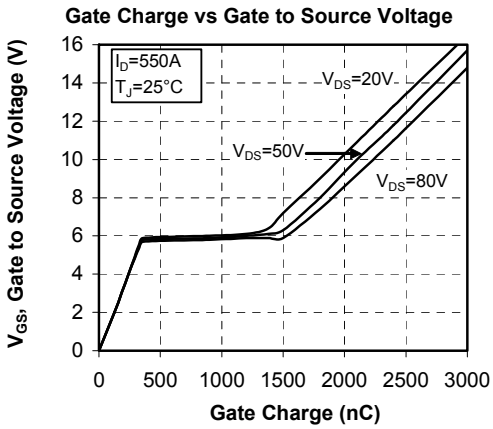

Breakdown Voltage vs Temperature
BVDSS, Drain to Source Breakdown Voltage (Normalized)
1.15
1.10
1.05
1.00
0.95
0.90
-50 -25 0 25 50 75 100 125 150
TJ, Junction Temperature (°C)


ON resistance vs Temperature
RDS(on), Drain to Source ON resistance (Normalized)
VGS=10V
ID= 275A
2.5
2.0
1.5
1.0
0.5
0.0
-50 -25 0 25 50 75 100 125 150
TJ, Junction Temperature (°C)

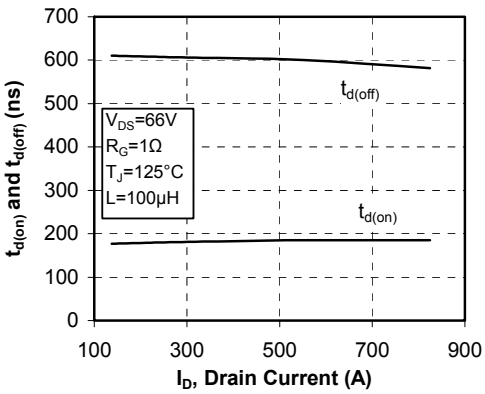

Threshold Voltage vs Temperature
VGS(TH), Threshold Voltage (Normalized)
1.2
1.1
1.0
0.9
0.8
0.7
0.6
-50 -25 0 25 50 75 100 125 150
TC, Case Temperature (°C)


Maximum Safe Operating Area
ID, Drain Current (A)
10000
1000
100
10
1
limited by RDSon
100µs
1ms
10ms
Single pulse
TJ=150°C
TC=25°C
1
10
100
VDS, Drain to Source Voltage (V)

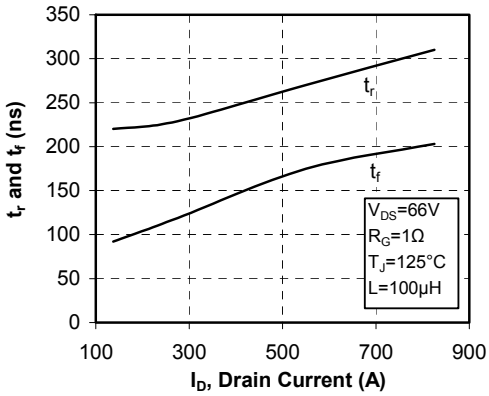

Capacitance vs Drain to Source Voltage
C, Capacitance (pF)
1000000
100000
10000
1000
Ciss
Coss
Crss
0 10 20 30 40 50
VDS, Drain to Source Voltage (V)


Gate Charge vs Gate to Source Voltage
VGS, Gate to Source Voltage (V)
16
14
12
10
8
6
4
2
0
ID=550A
TJ=25°C
VDS=20V
VDS=50V
VDS=80V
0 500 1000 1500 2000 2500 3000
Gate Charge (nC)

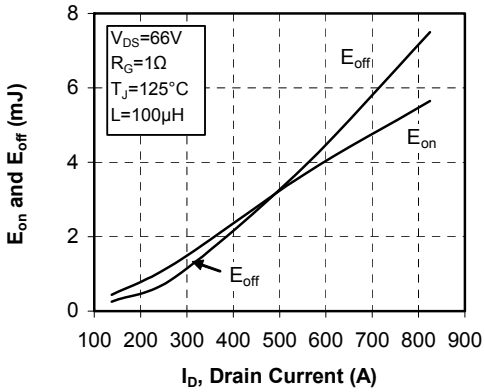
Delay Times vs Current



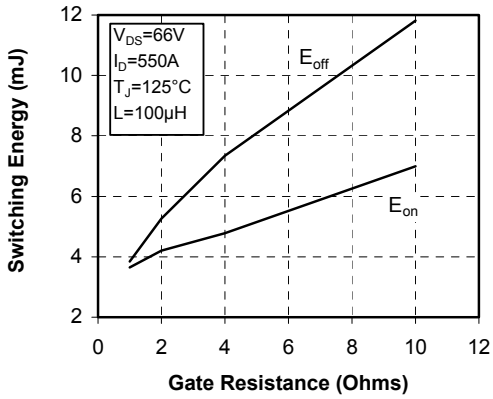
Rise and Fall times vs Current



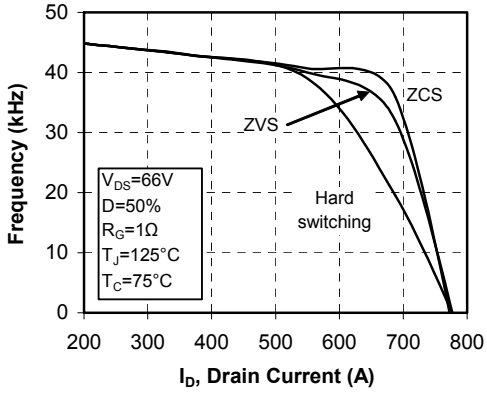
Switching Energy vs Current



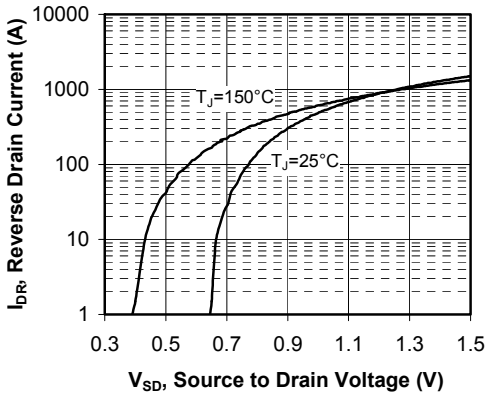
Switching Energy vs Gate Resistance



Operating Frequency vs Drain Current



Source to Drain Diode Forward Voltage



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