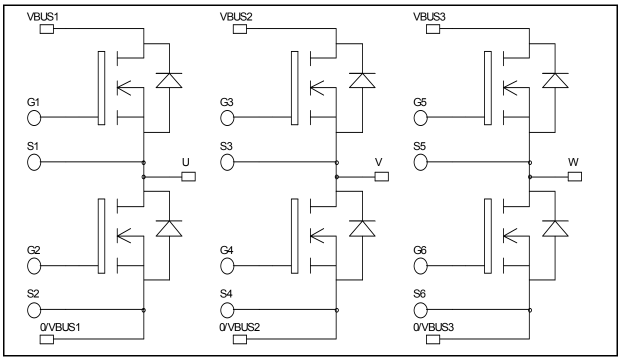
APTM10TAM09FPG

Triple phase leg MOSFET Power Module

V_{DSS} = 100V
R_{DSon} = 09mΩ typ @ Tj = 25°C
I_D = 139A @ Tc = 25°C

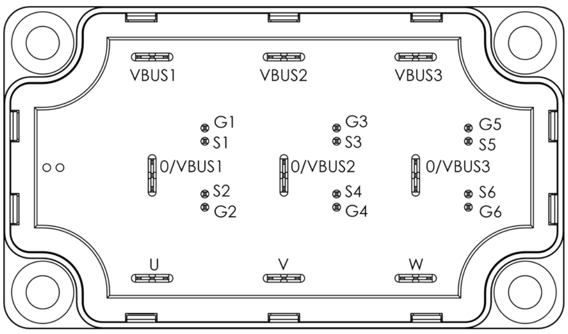


Application

- 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
  - Fast intrinsic diode
  - Avalanche energy rated
  - Very rugged
- Kelvin source for easy drive
- Very low stray inductance
  - Symmetrical design
  - Lead frames for power connections
- 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
- 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
- Module can be configured as a boost followed by a full bridge
- 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	139	A
		T_c = 80°C	100	
I_{DM}	Pulsed Drain current		430	
V_{GS}	Gate - Source Voltage		±30	V
R_{DSon}	Drain - Source ON Resistance		10	mΩ
P_D	Maximum Power Dissipation	T_c = 25°C	390	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	

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

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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			100	µA
		V_{GS} = 0V,V_{DS} = 80V	T_j = 125°C			500	
$R_{DS(on)}$	Drain – Source on Resistance	V_{GS} = 10V, I_D = 69.5A			9	10	mΩ
$V_{GS(th)}$	Gate Threshold Voltage	V_{GS} = V_{DS}, I_D = 2.5mA		2		4	V
I_{GSS}	Gate – Source Leakage Current	V_{GS} = ±30 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} = 25V f = 1MHz		9875		pF
C_{oss}	Output Capacitance			3940		
C_{rss}	Reverse Transfer Capacitance			1470		
Q_g	Total gate Charge	V_{GS} = 10V V_{Bus} = 50V I_D =139A		350		nC
Q_{gs}	Gate – Source Charge			60		
Q_{gd}	Gate – Drain Charge			180		
$T_{d(on)}$	Turn-on Delay Time	**Inductive switching @ 125°C** V_{GS} = 15V V_{Bus} = 66V I_D = 139A R_G = 5Ω		35		ns
T_r	Rise Time			70		
$T_{d(off)}$	Turn-off Delay Time			95		
T_f	Fall Time			125		
E_{on}	Turn-on Switching Energy	**Inductive switching @ 25°C** V_{GS} = 15V, V_{Bus} = 66V I_D = 139A, R_G = 5Ω		552		µJ
E_{off}	Turn-off Switching Energy			604		
E_{on}	Turn-on Switching Energy	**Inductive switching @ 125°C** V_{GS} = 15V, V_{Bus} = 66V I_D = 139A, R_G = 5Ω		608		µJ
E_{off}	Turn-off Switching Energy			641		

Source - Drain diode ratings and characteristics

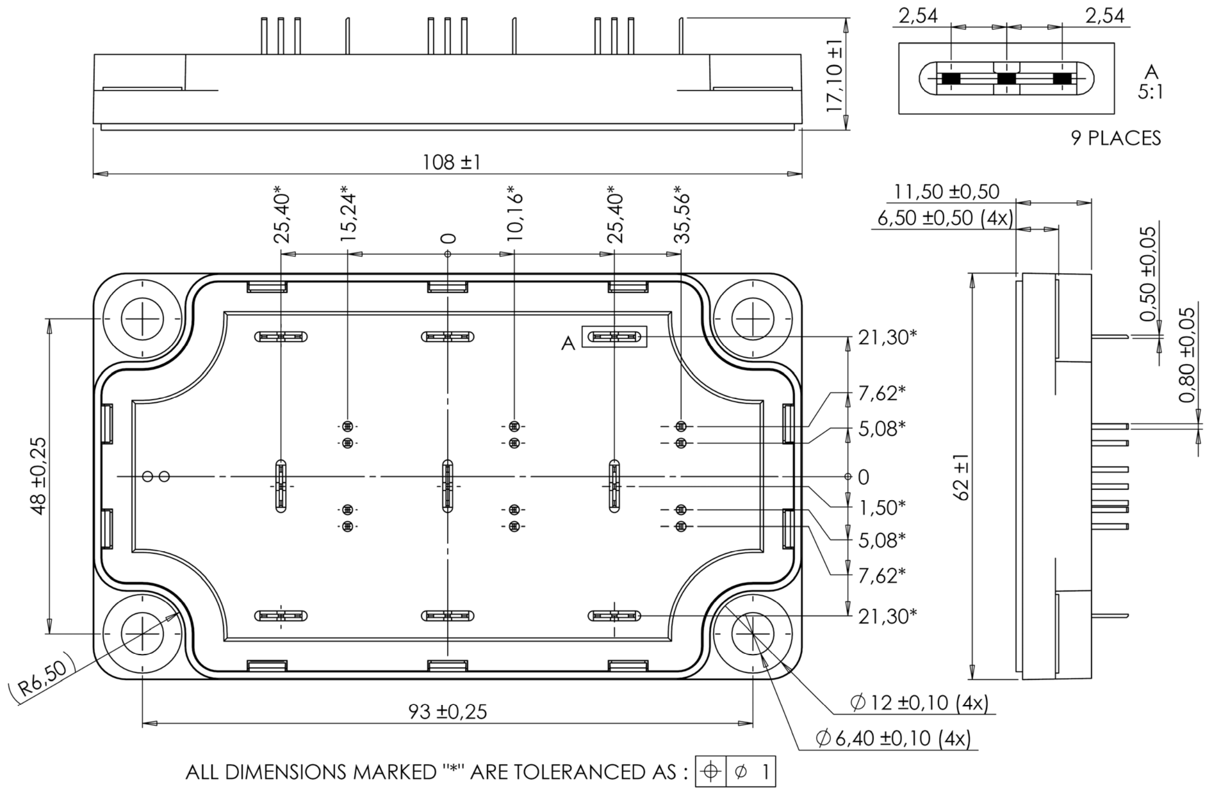
Symbol	*Characteristic*	*Test Conditions*		*Min*	*Typ*	*Max*	*Unit*
I_S	Continuous Source current (Body diode)		Tc = 25°C			139	A
			Tc = 80°C			100	
V_{SD}	Diode Forward Voltage	V_{GS} = 0V, I_S = - 139A				1.3	V
dv/dt	Peak Diode Recovery ❶					8	V/ns
t_{rr}	Reverse Recovery Time	I_S = - 139A V_R = 66V di_S/dt = 100A/µs	T_j = 25°C			190	ns
			T_j = 125°C			370	
Q_{rr}	Reverse Recovery Charge		T_j = 25°C		0.4		µC
			T_j = 125°C		1.7		

❶ dv/dt numbers reflect the limitations of the circuit rather than the device itself.
$I_S \leq$ - 139A $di/dt \leq$ 700A/µs $V_R \leq V_{DSS}$ $T_j \leq$ 150°C

Thermal and package characteristics

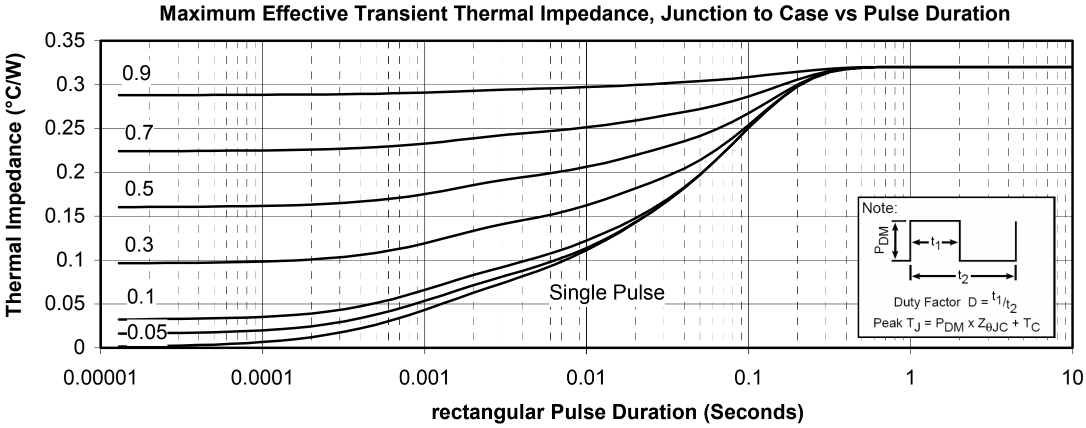
Symbol	*Characteristic*			*Min*	*Typ*	*Max*	*Unit*
R_{thJC}	Junction to Case Thermal Resistance					0.32	°C/W
V_{ISOL}	RMS Isolation Voltage, any terminal to case t =1 min, 50/60Hz			4000			V
T_J	Operating junction temperature range			-40		150	°C
T_{STG}	Storage Temperature Range			-40		125	
T_C	Operating Case Temperature			-40		100	
Torque	Mounting torque	To heatsink	M6	3		5	N.m
Wt	Package Weight					250	g

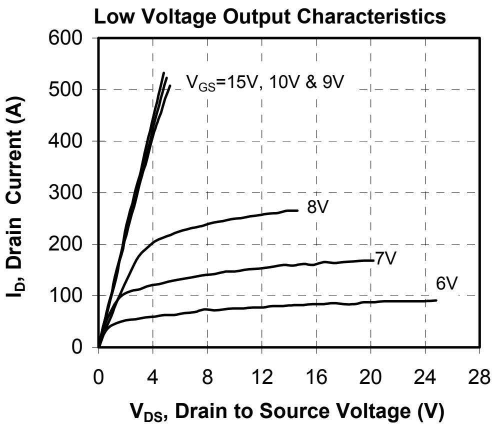
SP6-P Package outline (dimensions in mm)

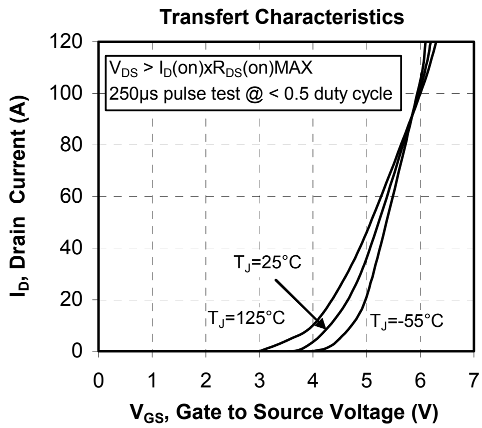


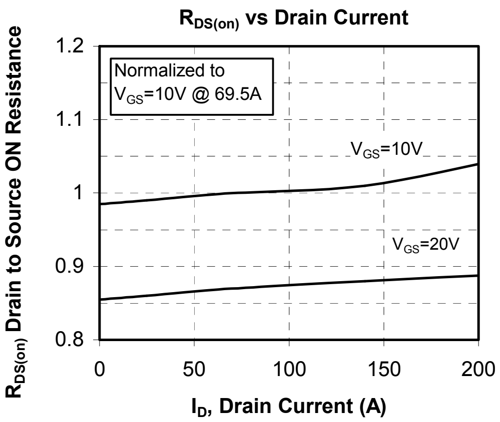
See application note 1902 - Mounting Instructions for SP6-P (12mm) Power Modules on www.microsemi.com

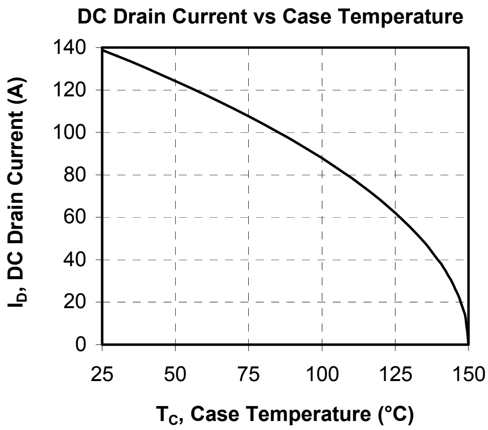
Typical Performance Curve

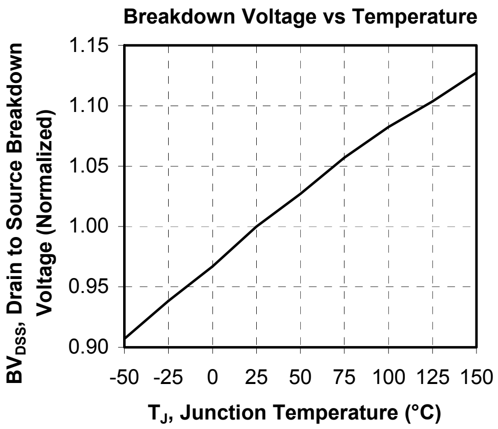


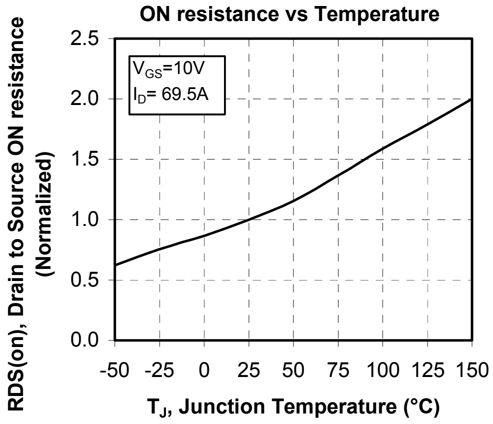


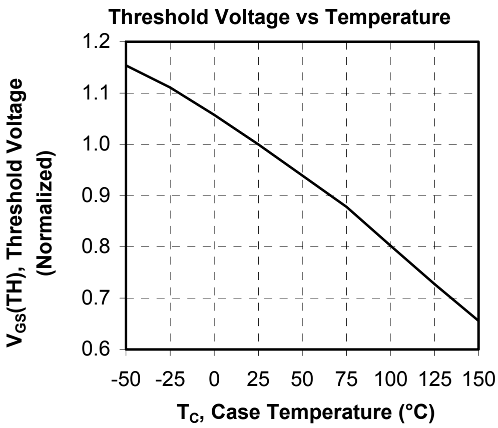


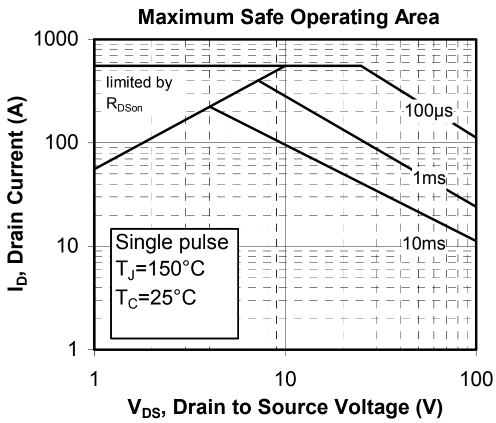


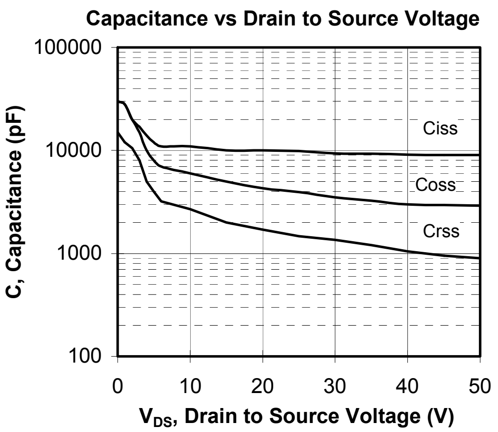


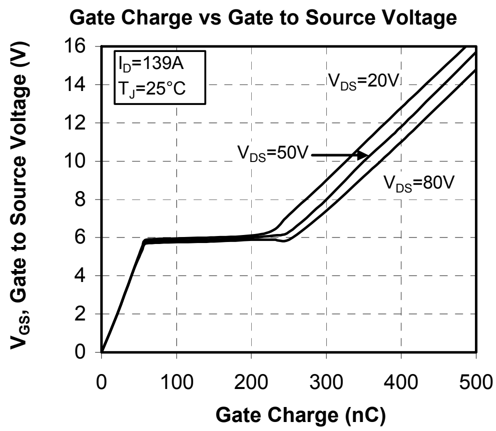

Breakdown Voltage vs Temperature
BVDSS, Drain to Source Breakdown Voltage (Normalized)
TJ, Junction Temperature (°C)


ON resistance vs Temperature
VGS=10V
ID= 69.5A
RDS(on), Drain to Source ON resistance (Normalized)
TJ, Junction Temperature (°C)

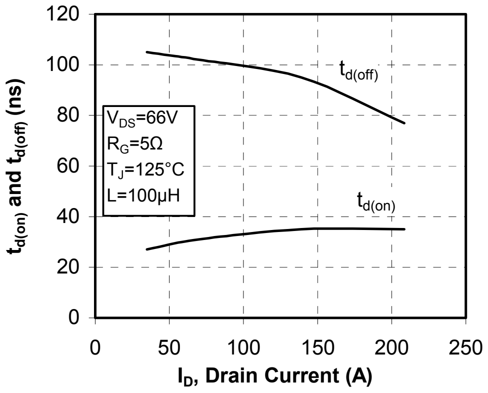

Threshold Voltage vs Temperature
VGS(TH), Threshold Voltage (Normalized)
TC, Case Temperature (°C)


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

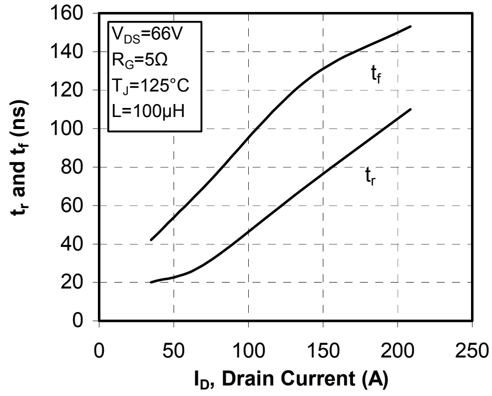

Capacitance vs Drain to Source Voltage
Ciss
Coss
Crss
C, Capacitance (pF)
VDS, Drain to Source Voltage (V)


Gate Charge vs Gate to Source Voltage
ID=139A
TJ=25°C
VDS=20V
VDS=50V
VDS=80V
VGS, Gate to Source Voltage (V)
Gate Charge (nC)

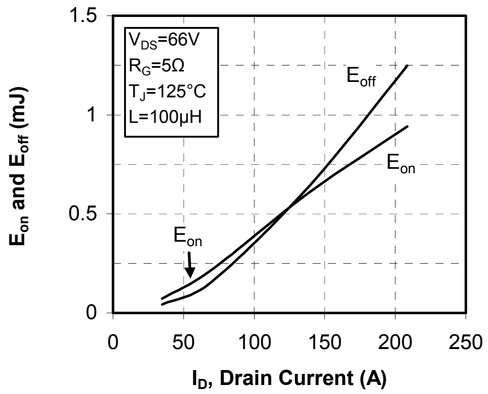
Delay Times vs Current



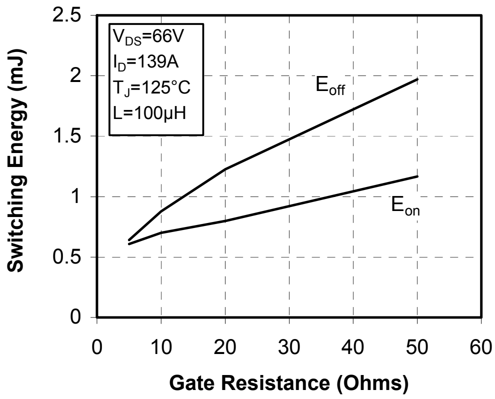
Rise and Fall times vs Current



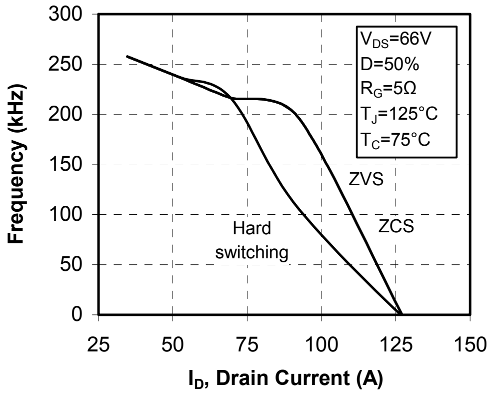
Switching Energy vs Current



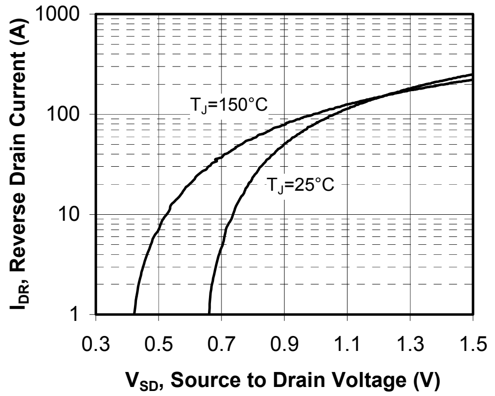
Switching Energy vs Gate Resistance



Operating Frequency vs Drain Current



Source to Drain Diode Forward Voltage



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