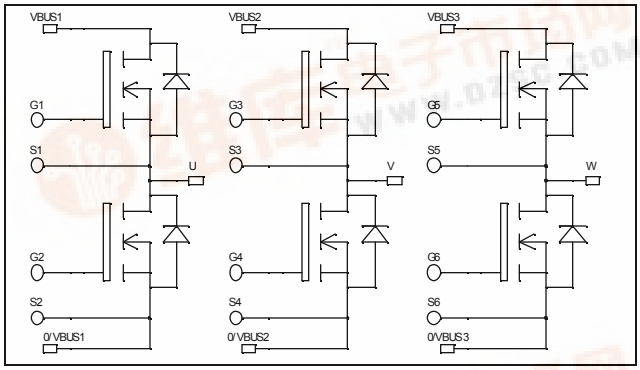
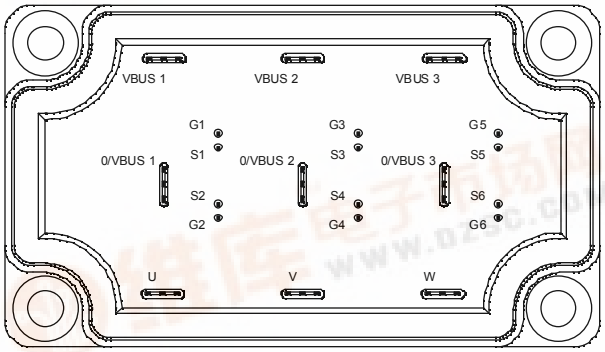
Microsemi
POWER PRODUCTS GROUP

APTM20TAM16FPG

Triple phase leg MOSFET Power Module

V_{DSS} = 200V
R_{DSon} = 16mΩ typ @ Tj = 25°C
I_D = 104A @ Tc = 25°C





Application

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

Features

- Power MOS 7® FREDFETs
  - Low R_{DSon}
  - Low input and Miller capacitance
  - Low gate charge
  - Fast intrinsic reverse 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		200	V
I_D	Continuous Drain Current	T_c = 25°C	104	A
		T_c = 80°C	77	
I_{DM}	Pulsed Drain current		416	
V_{GS}	Gate - Source Voltage		±30	V
R_{DSon}	Drain - Source ON Resistance		19	mΩ
P_D	Maximum Power Dissipation	T_c = 25°C	390	W
I_{AR}	Avalanche current (repetitive and non repetitive)		104	A
E_{AR}	Repetitive Avalanche Energy		50	mJ
E_{AS}	Single Pulse Avalanche Energy		3000	

CAUTION: These Devices are sensitive to Electrostatic Discharge. Proper Handing 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} = 200V	T_j = 25°C			250	µA
		V_{GS} = 0V, V_{DS} = 160V	T_j = 125°C			1000	
$R_{DS(on)}$	Drain – Source on Resistance	V_{GS} = 10V, I_D = 52A			16	19	mΩ
$V_{GS(th)}$	Gate Threshold Voltage	V_{GS} = V_{DS}, I_D = 2.5mA		3		5	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		7220		pF
C_{oss}	Output Capacitance			2330		
C_{rss}	Reverse Transfer Capacitance			146		
Q_g	Total gate Charge	V_{GS} = 10V V_{Bus} = 100V I_D =104A		140		nC
Q_{gs}	Gate – Source Charge			53		
Q_{gd}	Gate – Drain Charge			67		
$T_{d(on)}$	Turn-on Delay Time	**Inductive switching @ 125°C** V_{GS} = 15V V_{Bus} = 133V I_D = 104A R_G = 5Ω		32		ns
T_r	Rise Time			64		
$T_{d(off)}$	Turn-off Delay Time			88		
T_f	Fall Time			116		
E_{on}	Turn-on Switching Energy	**Inductive switching @ 25°C** V_{GS} = 15V, V_{Bus} = 133V I_D = 104A, R_G = 5Ω		849		µJ
E_{off}	Turn-off Switching Energy			929		
E_{on}	Turn-on Switching Energy	**Inductive switching @ 125°C** V_{GS} = 15V, V_{Bus} = 133V I_D = 104A, R_G = 5Ω		936		µJ
E_{off}	Turn-off Switching Energy			986		

Source - Drain diode ratings and characteristics

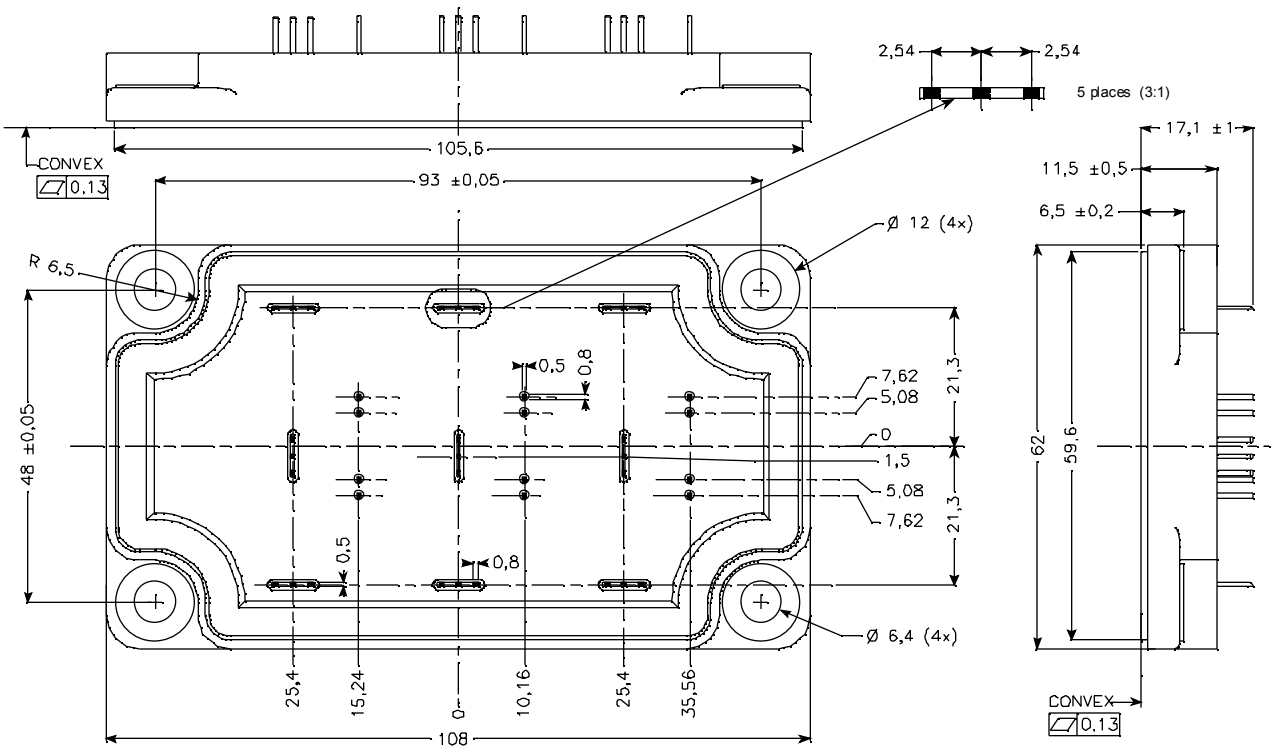
Symbol	*Characteristic*	*Test Conditions*		*Min*	*Typ*	*Max*	*Unit*
I_S	Continuous Source current (Body diode)		Tc = 25°C			104	A
			Tc = 80°C			77	
V_{SD}	Diode Forward Voltage	V_{GS} = 0V, I_S = - 104A				1.3	V
dv/dt	Peak Diode Recovery ❶					5	V/ns
t_{rr}	Reverse Recovery Time	I_S = - 104A V_R = 133V di_S/dt = 100A/µs	T_j = 25°C			230	ns
			T_j = 125°C			450	
Q_{rr}	Reverse Recovery Charge		T_j = 25°C		0.9		µC
			T_j = 125°C		3.4		

❶ dv/dt numbers reflect the limitations of the circuit rather than the device itself.
$I_S \le$ - 104A di/dt ≤ 700A/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					0.32	°C/W
V_{ISOL}	RMS Isolation Voltage, any terminal to case t =1 min, I isol<1mA, 50/60Hz			2500			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

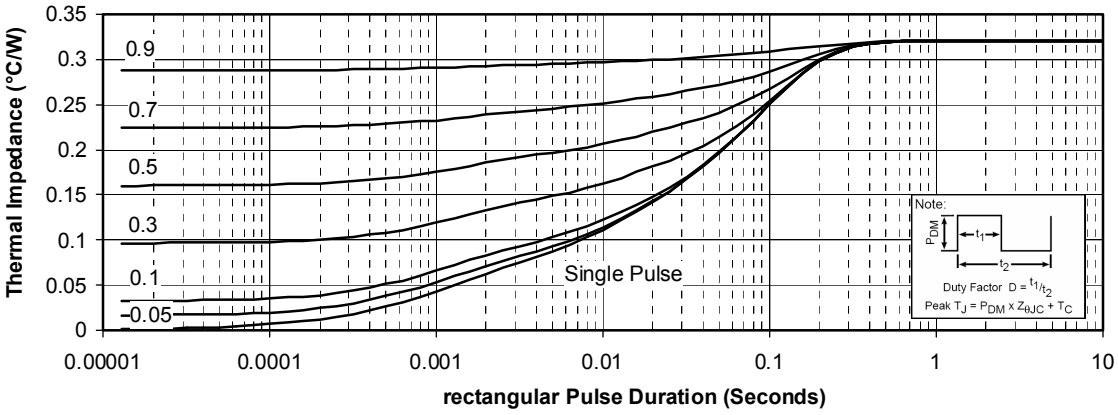
SP6-P Package outline (dimensions in mm)



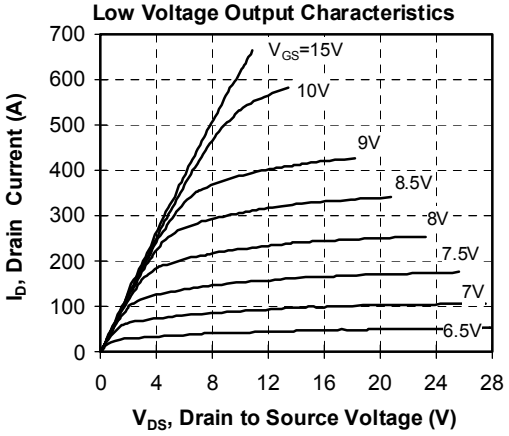
See application note 1902 - Mounting Instructions for SP6-P (12mm) Power Modules on www.microsemi.com

Typical Performance Curve

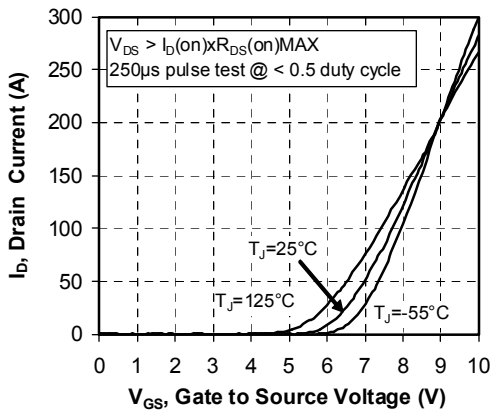
Maximum Effective Transient Thermal Impedance, Junction to Case vs Pulse Duration



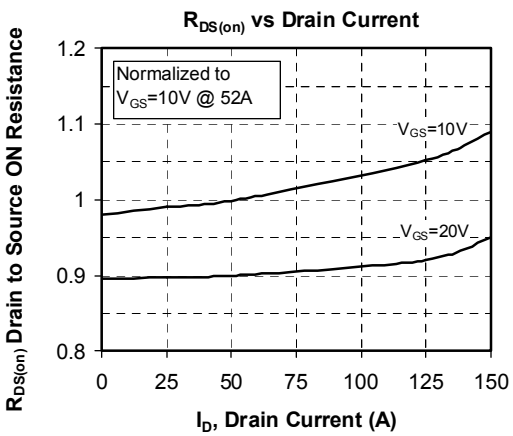
Low Voltage Output Characteristics



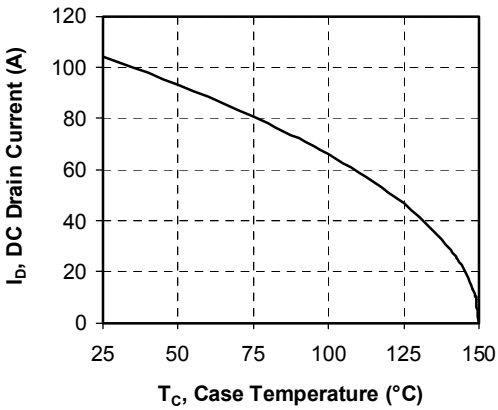
Transfert Characteristics



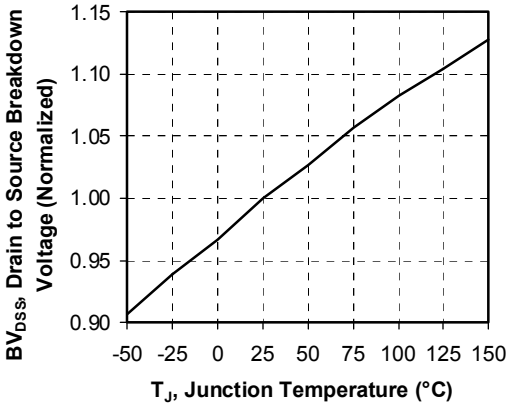
$R_{DS(on)}$ vs Drain Current



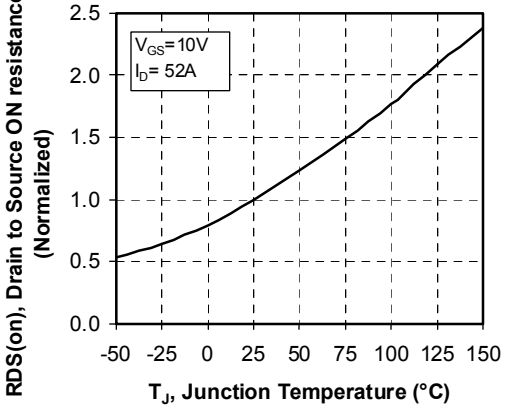
DC Drain Current vs Case Temperature



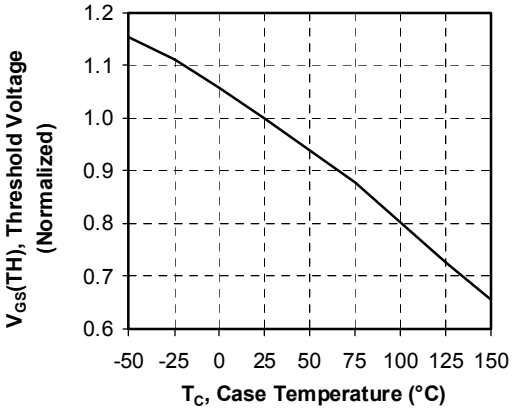
Breakdown Voltage vs Temperature



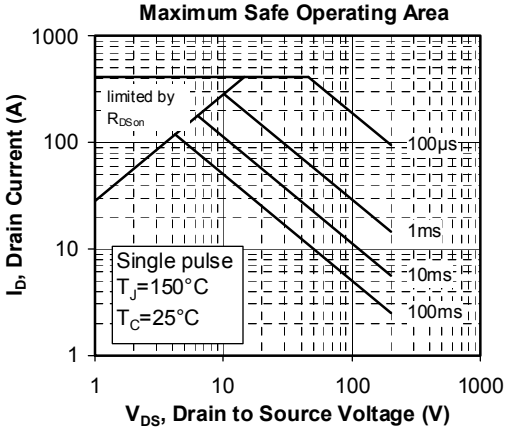
ON resistance vs Temperature



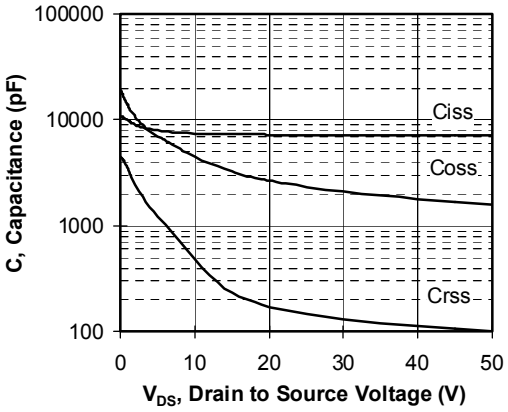
Threshold Voltage vs Temperature



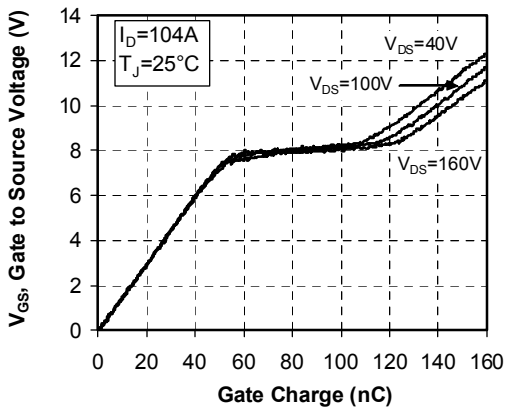
Maximum Safe Operating Area



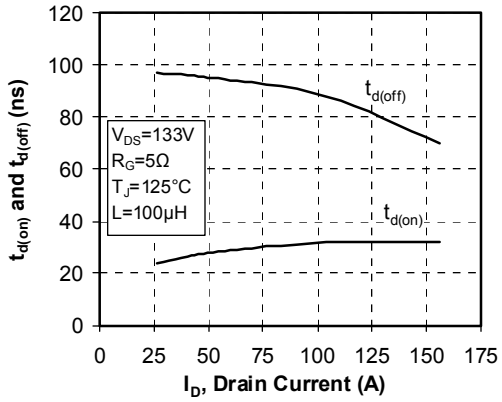
Capacitance vs Drain to Source Voltage



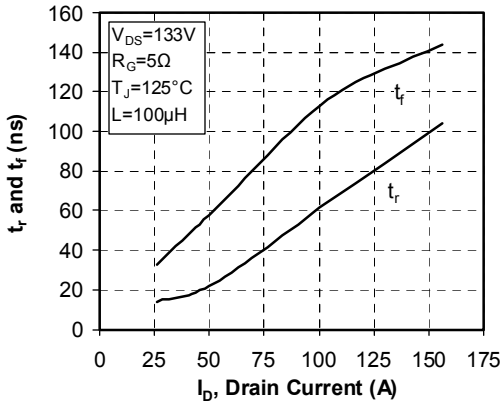
Gate Charge vs Gate to Source Voltage



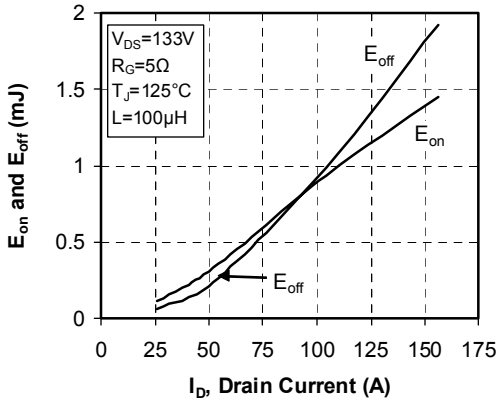
Delay Times vs Current



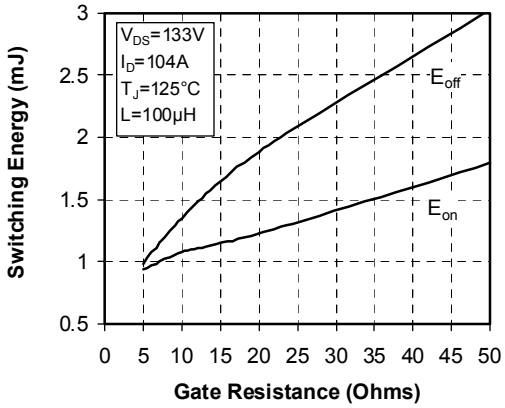
Rise and Fall times vs Current



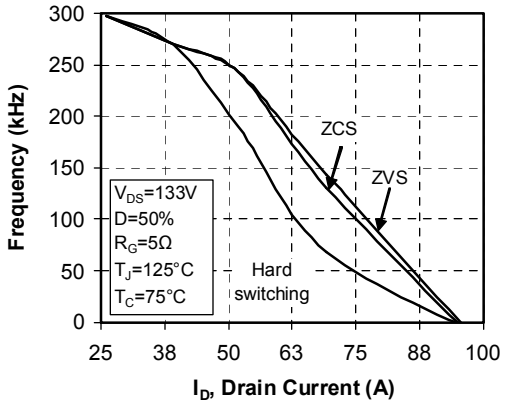
Switching Energy vs Current



Switching Energy vs Gate Resistance



Operating Frequency vs Drain Current



Source to Drain Diode Forward Voltage