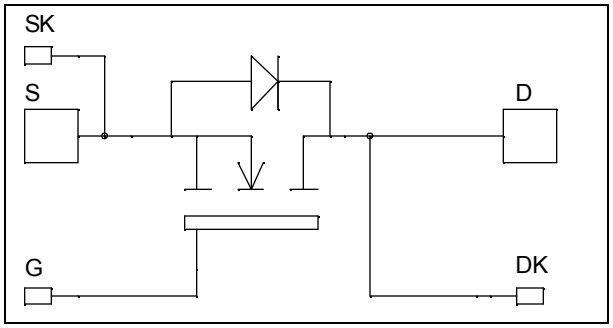
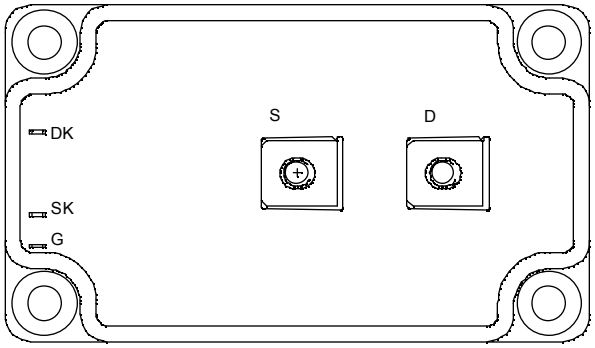
APTM50UM09F-AlN

Single Switch MOSFET Power Module

V_{DSS} = 500V
R_{DSon} = 9 mΩ max @ Tj = 25°C
I_D = 497A @ 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
  - 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

Absolute maximum ratings

Symbol	*Parameter*		*Max ratings*	*Unit*
V_{DSS}	Drain - Source Breakdown Voltage		500	V
I_D	Continuous Drain Current	T_c = 25°C	497	A
		T_c = 80°C	371	
I_{DM}	Pulsed Drain current		1988	
V_{GS}	Gate - Source Voltage		±30	V
R_{DSon}	Drain - Source ON Resistance		9	mΩ
P_D	Maximum Power Dissipation	T_c = 25°C	5000	W
I_{AR}	Avalanche current (repetitive and non repetitive)		71	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.

All ratings @ T_j = 25°C unless otherwise specified

Electrical Characteristics

Symbol	*Characteristic*	*Test Conditions*		*Min*	*Typ*	*Max*	*Unit*
BV_{DSS}	Drain - Source Breakdown Voltage	V_{GS} = 0V, I_D = 1.5mA		500			V
I_{DSS}	Zero Gate Voltage Drain Current	V_{GS} = 0V, V_{DS} = 500V	T_j = 25°C			600	µA
		V_{GS} = 0V, V_{DS} = 400V	T_j = 125°C			2500	
$R_{DS(on)}$	Drain – Source on Resistance	V_{GS} = 10V, I_D = 248.5A				9	mΩ
$V_{GS(th)}$	Gate Threshold Voltage	V_{GS} = V_{DS}, I_D = 30mA		3		5	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		63.3		nF
C_{oss}	Output Capacitance			12.4		
C_{rss}	Reverse Transfer Capacitance			0.63		
Q_g	Total gate Charge	V_{GS} = 10V V_{Bus} = 250V I_D =497A		1200		nC
Q_{gs}	Gate – Source Charge			300		
Q_{gd}	Gate – Drain Charge			630		
$T_{d(on)}$	Turn-on Delay Time	**Inductive switching @ 125°C** V_{GS} = 15V V_{Bus} = 333V I_D = 497A R_G = 0.5Ω		21		ns
T_r	Rise Time			42		
$T_{d(off)}$	Turn-off Delay Time			96		
T_f	Fall Time			100		
E_{on}	Turn-on Switching Energy ❶	**Inductive switching @ 25°C** V_{GS} = 15V, V_{Bus} = 333V I_D = 497A, R_G = 0.5Ω		6		mJ
E_{off}	Turn-off Switching Energy ❷			6.2		
E_{on}	Turn-on Switching Energy ❶	**Inductive switching @ 125°C** V_{GS} = 15V, V_{Bus} = 333V I_D = 497A, R_G =0.5Ω		9.48		mJ
E_{off}	Turn-off Switching Energy ❷			6.96		

Source - Drain diode ratings and characteristics

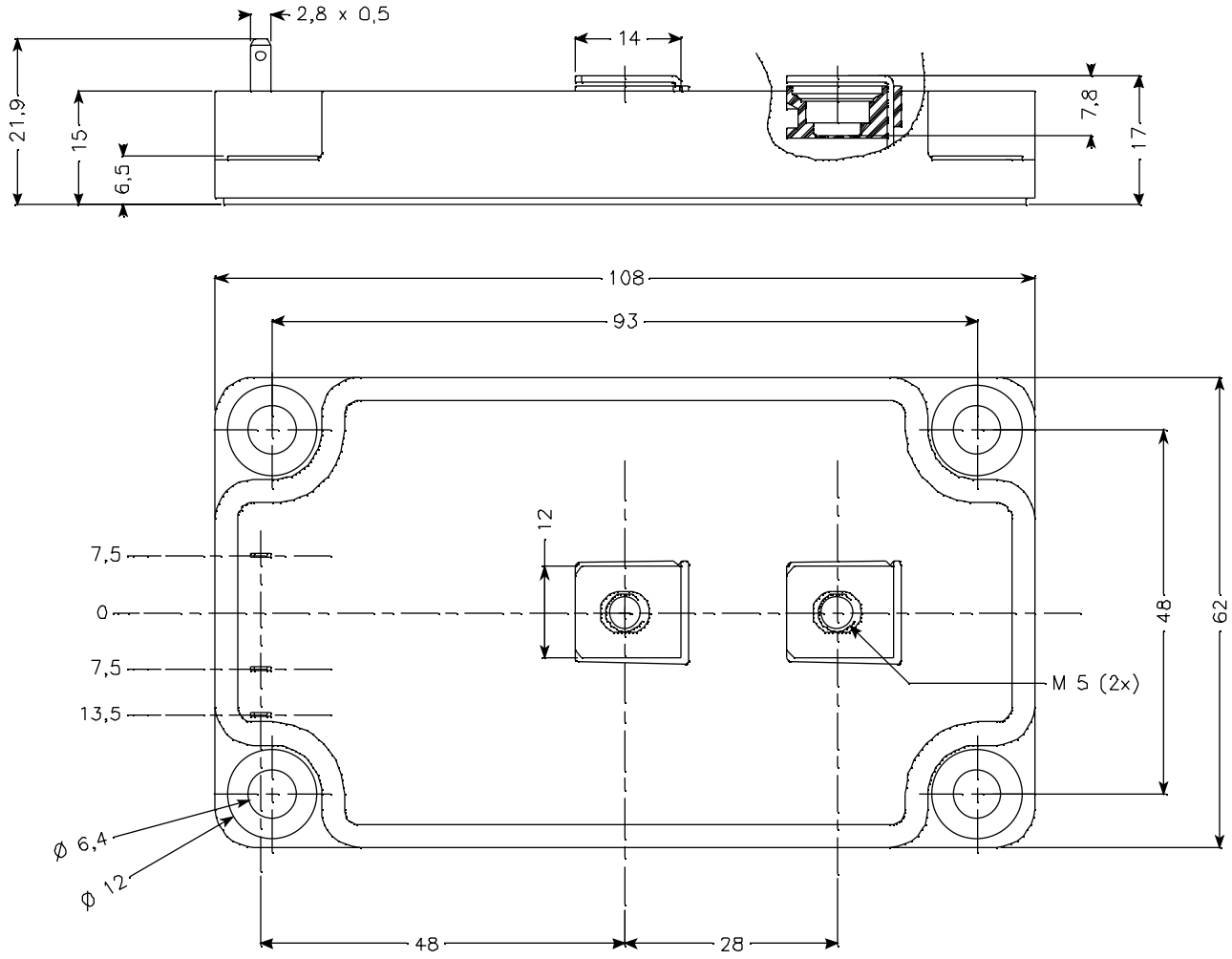
Symbol	*Characteristic*	*Test Conditions*		*Min*	*Typ*	*Max*	*Unit*
I_S	Continuous Source current (Body diode)		Tc = 25°C			497	A
			Tc = 80°C			371	
V_{SD}	Diode Forward Voltage	V_{GS} = 0V, I_S = - 497A				1.3	V
dv/dt	Peak Diode Recovery ❸					18	V/ns
t_{rr}	Reverse Recovery Time	I_S = - 497A V_R = 250V di_S/dt = 600A/µs	T_j = 25°C			300	ns
			T_j = 125°C			600	
Q_{rr}	Reverse Recovery Charge	I_S = - 497A V_R = 250V di_S/dt = 600A/µs	T_j = 25°C		15.6		µC
			T_j = 125°C		60		

❶ E_{on} includes diode reverse recovery.
❷ In accordance with JEDEC standard JESD24-1.
❸ dv/dt numbers reflect the limitations of the circuit rather than the device itself.
$I_S \le$ - 497A di/dt ≤ 700A/µs $V_R \le V_{DSS}$ $T_j \le$ 150°C

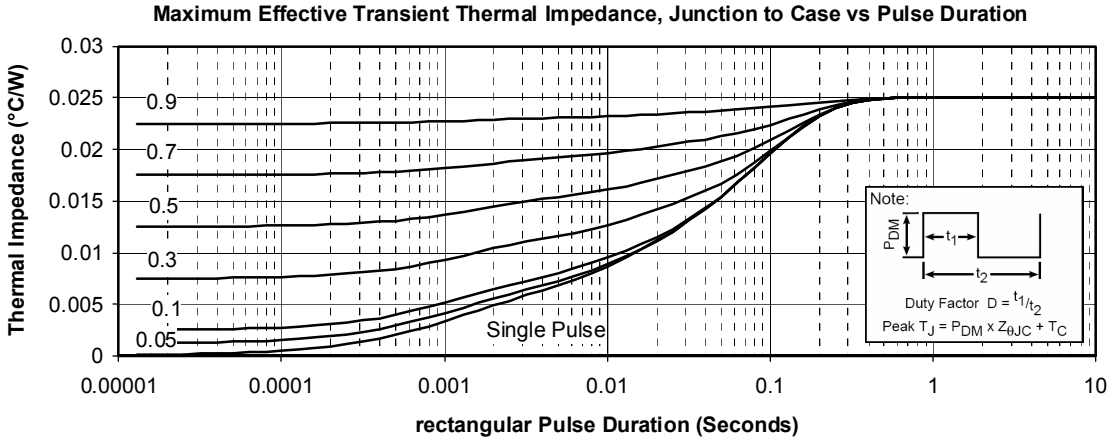
Thermal and package characteristics

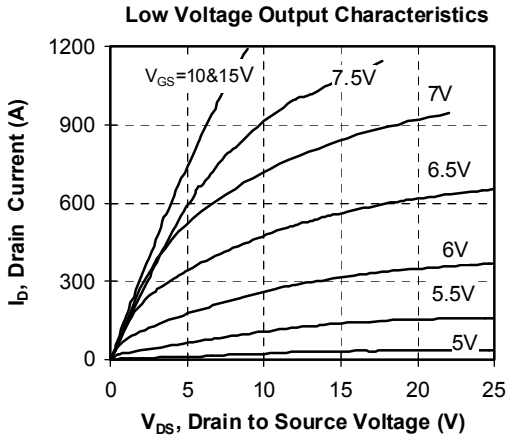
Symbol	*Characteristic*			*Min*	*Typ*	*Max*	*Unit*
R_{thJC}	Junction to Case		Transistor			0.025	°C/W
V_{ISOL}	RMS Isolation Voltage, any terminal to case t =1 min, I isol<1mA, 50/60Hz			2500			V
T_J	Operating junction temperature range			-40		150	°C
T_{STG}	Storage Temperature Range			-40		125	
T_C	Operating Case Temperature			-40		100	
Torque	Mounting torque	To Heatsink	M6	3		5	N.m
		For teminals	M5	2		3.5	
Wt	Package Weight					280	g

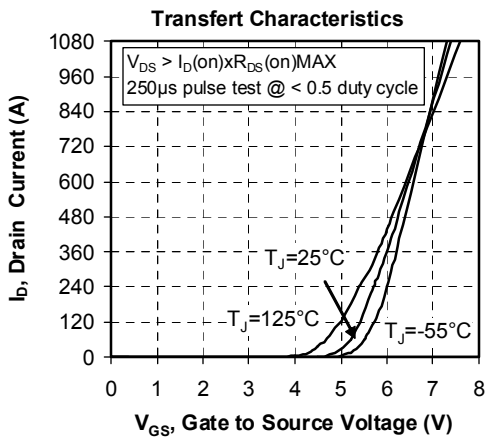
Package outline

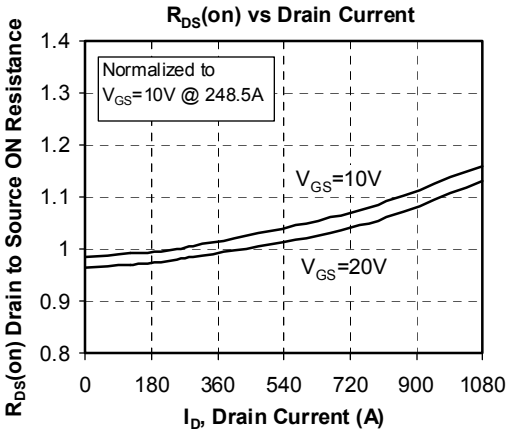


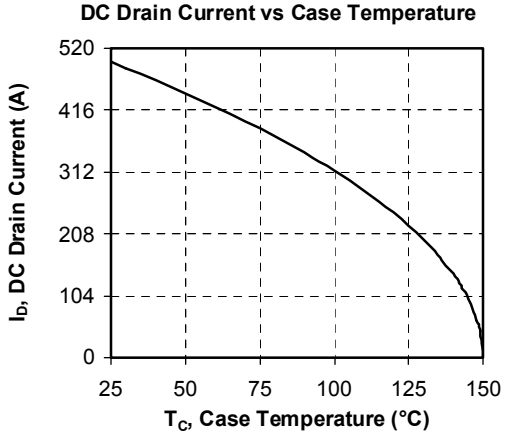
Typical Performance Curve



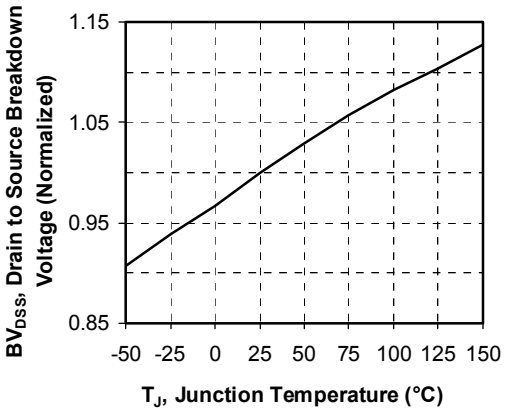




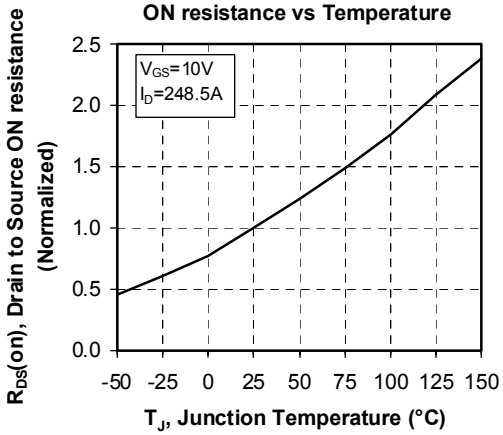




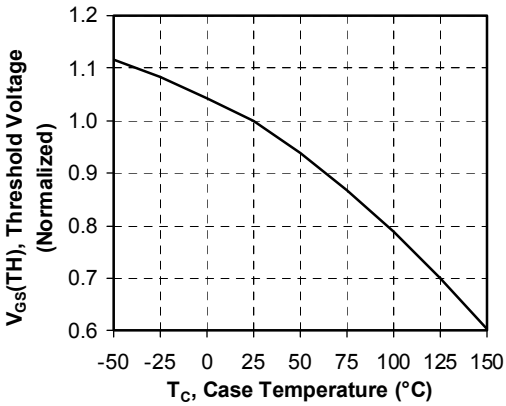
Breakdown Voltage vs Temperature



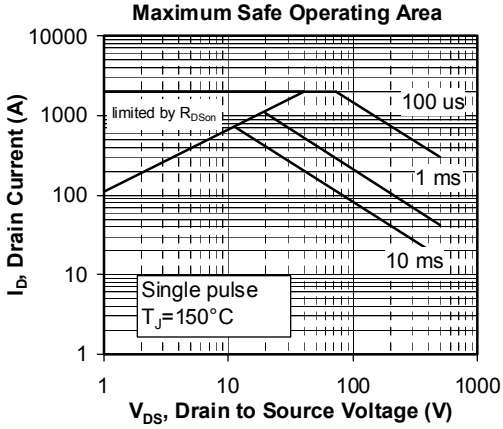
ON resistance vs Temperature



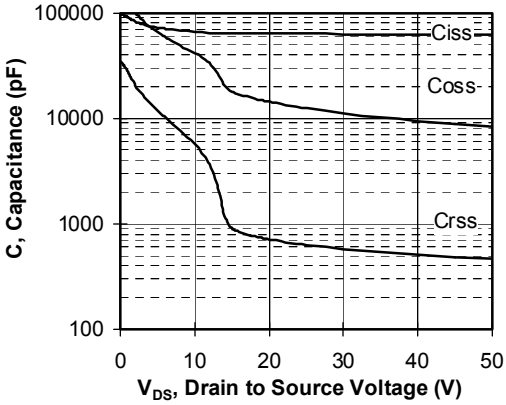
Threshold Voltage vs Temperature



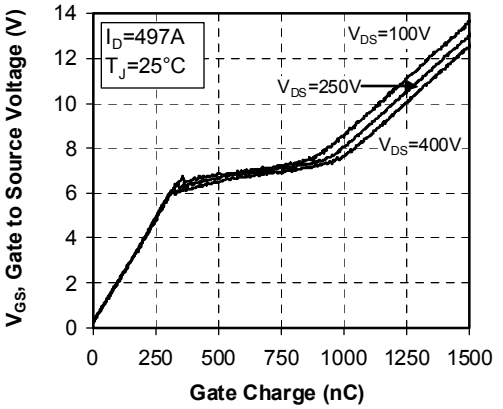
Maximum Safe Operating Area



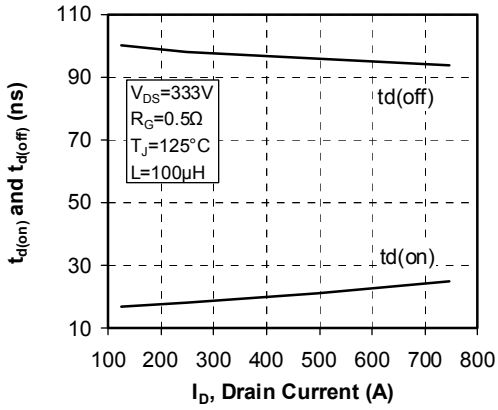
Capacitance vs Drain to Source Voltage



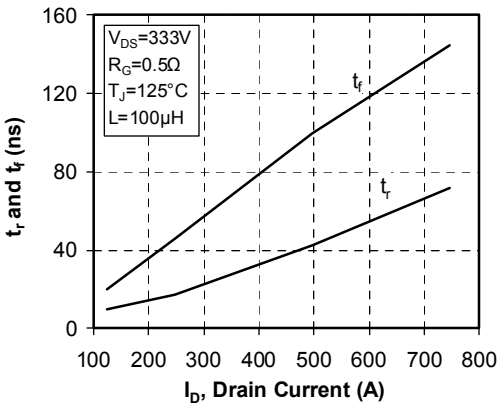
Gate Charge vs Gate to Source Voltage



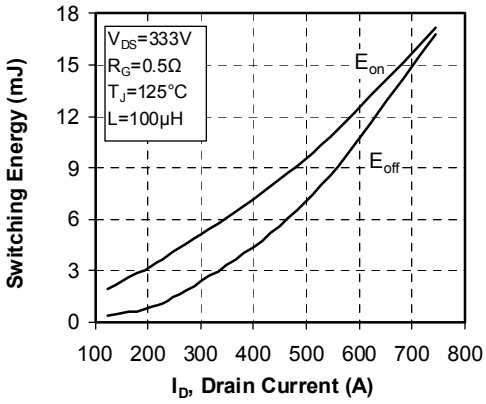
Delay Times vs Current



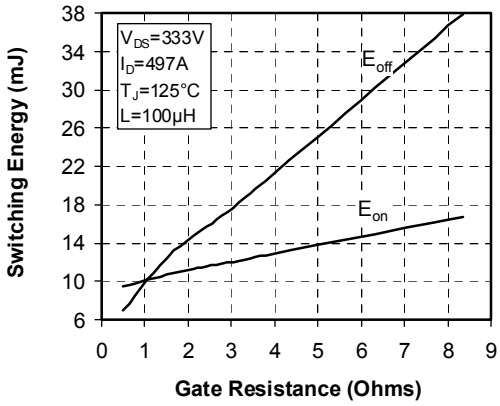
Rise and Fall times vs Current



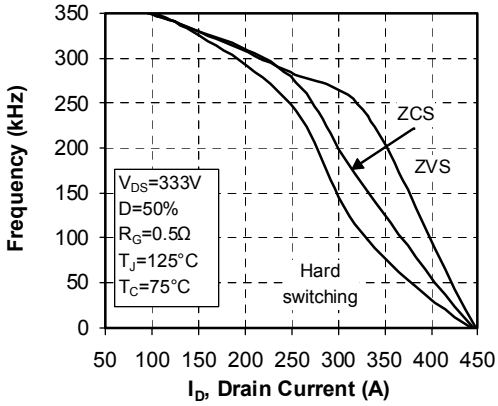
Switching Energy vs Current



Switching Energy vs Gate Resistance



Operating Frequency vs Drain Current



Source to Drain Diode Forward Voltage