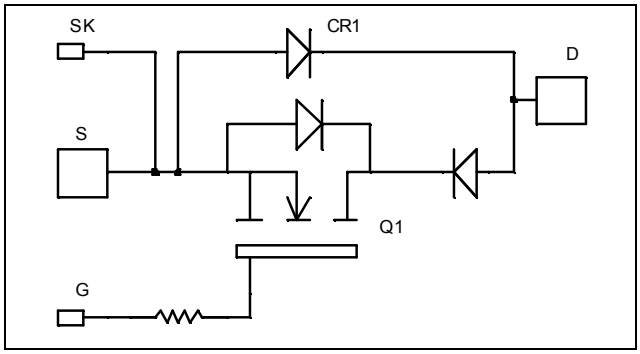
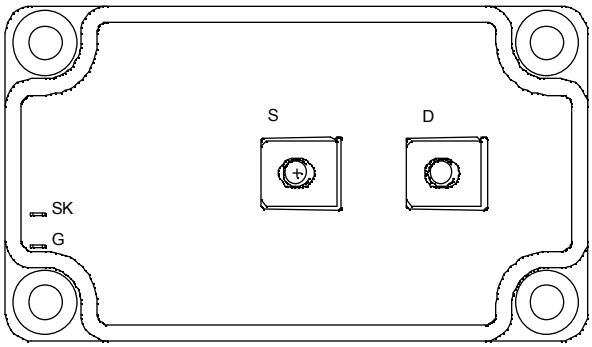
APTM20UM04S-AIN

Single switch
Series & parallel diodes
MOSFET Power Module

V_{DSS} = 200V
R_{DSon} = 4mΩ max @ Tj = 25°C
I_D = 417A @ Tc = 25°C





Application

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

Features

- Power MOS 7® MOSFETs
  - Low R_{DSon}
  - Low input and Miller capacitance
  - Low gate charge
  - 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		200	V
I_D	Continuous Drain Current	T_c = 25°C	417	A
		T_c = 80°C	310	
I_{DM}	Pulsed Drain current		1670	
V_{GS}	Gate - Source Voltage		±30	V
R_{DSon}	Drain - Source ON Resistance		4	mΩ
P_D	Maximum Power Dissipation	T_c = 25°C	1560	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 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 = 500µA		200			V
I_{DSS}	Zero Gate Voltage Drain Current	V_{GS} = 0V, V_{DS} = 200V	T_j = 25°C			500	µA
		V_{GS} = 0V, V_{DS} = 160V	T_j = 125°C			2000	
$R_{DS(on)}$	Drain – Source on Resistance	V_{GS} = 10V, I_D = 208.5A				4	mΩ
$V_{GS(th)}$	Gate Threshold Voltage	V_{GS} = V_{DS}, I_D = 10mA		3		5	V
I_{GSS}	Gate – Source Leakage Current	V_{GS} = ±30 V, V_{DS} = 0V				±200	nA

Dynamic Characteristics

Symbol	*Characteristic*	*Test Conditions*	*Min*	*Typ*	*Max*	*Unit*
C_{iss}	Input Capacitance	V_{GS} = 0V V_{DS} = 25V f = 1MHz		28.8		nF
C_{oss}	Output Capacitance			9.32		
C_{rss}	Reverse Transfer Capacitance			0.58		
Q_g	Total gate Charge	V_{GS} = 10V V_{Bus} = 100V I_D = 417A		560		nC
Q_{gs}	Gate – Source Charge			212		
Q_{gd}	Gate – Drain Charge			268		
$T_{d(on)}$	Turn-on Delay Time	**Inductive switching @ 125°C** V_{GS} = 15V V_{Bus} = 133V I_D = 417A R_G = 1.2Ω		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 ❶	**Inductive switching @ 25°C** V_{GS} = 15V, V_{Bus} = 133V I_D = 417A, R_G = 1.2Ω		3396		µJ
E_{off}	Turn-off Switching Energy ❷			3716		
E_{on}	Turn-on Switching Energy ❶	**Inductive switching @ 125°C** V_{GS} = 15V, V_{Bus} = 133V I_D = 417A, R_G = 1.2Ω		3744		µJ
E_{off}	Turn-off Switching Energy ❷			3944		

❶ E_{on} includes diode reverse recovery.
❷ In accordance with JEDEC standard JESD24-1.

Series diode ratings and characteristics

Symbol	*Characteristic*	*Test Conditions*		*Min*	*Typ*	*Max*	*Unit*
$I_{F(AV)}$	Maximum Average Forward Current	50% duty cycle	T_c = 85°C		360		A
V_F	Diode Forward Voltage	I_F = 360A			1.1	1.15	V
		I_F = 720A			1.4		
		I_F = 360A	T_j = 125°C		0.9		
t_{rr}	Reverse Recovery Time	I_F = 360A V_R = 133V di/dt = 1000A/µs	T_j = 25°C		31		ns
			T_j = 125°C		60		
Q_{rr}	Reverse Recovery Charge	I_F = 360A V_R = 133V di/dt = 1000A/µs	T_j = 25°C		360		nC
			T_j = 125°C		1500		

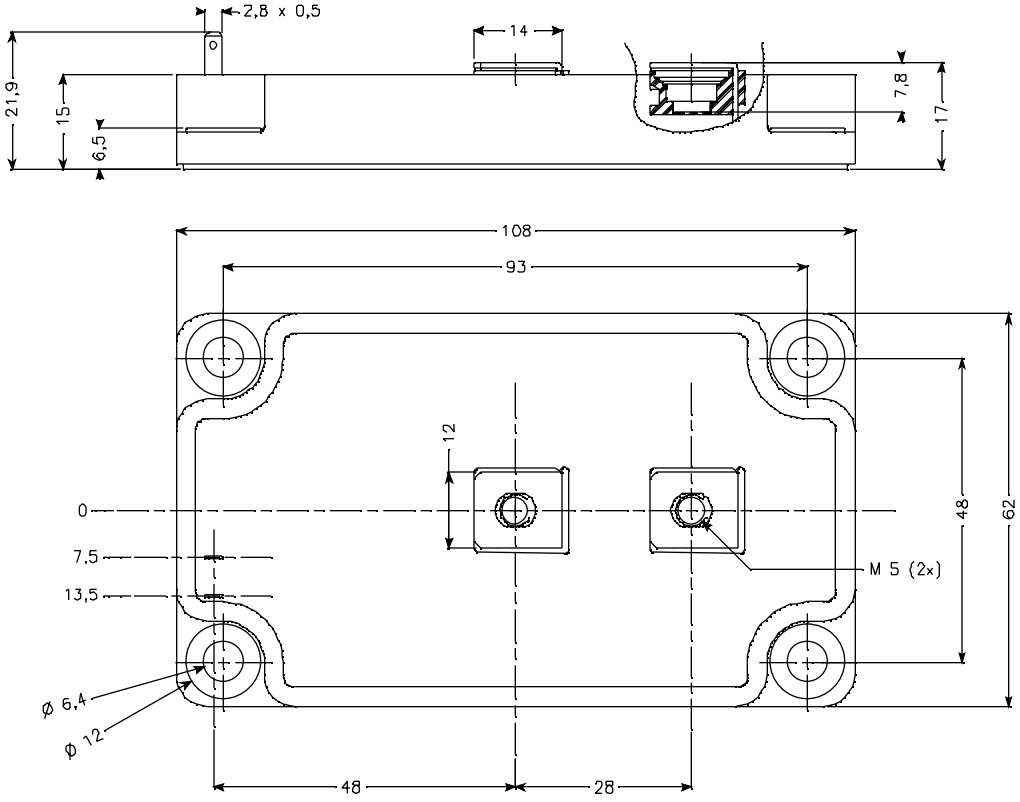
Parallel diode ratings and characteristics

Symbol	Characteristic	Test Conditions		Min	Typ	Max	Unit
$I_{F(AV)}$	Maximum Average Forward Current	50% duty cycle	T_c = 85°C		360		A
V_F	Diode Forward Voltage	I_F = 360A			1.1	1.15	V
		I_F = 720A			1.4		
		I_F = 360A	T_j = 125°C		0.9		
t_{rr}	Reverse Recovery Time	I_F = 360A V_R = 133V di/dt = 1000A/µs	T_j = 25°C		31		ns
			T_j = 125°C		60		
Q_{rr}	Reverse Recovery Charge	I_F = 360A V_R = 133V di/dt = 1000A/µs	T_j = 25°C		360		nC
			T_j = 125°C		1500		

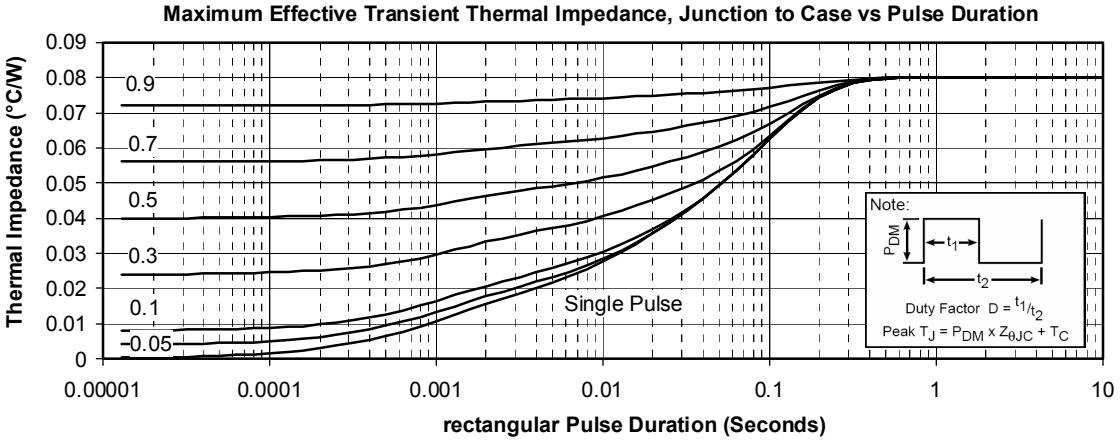
Thermal and package characteristics

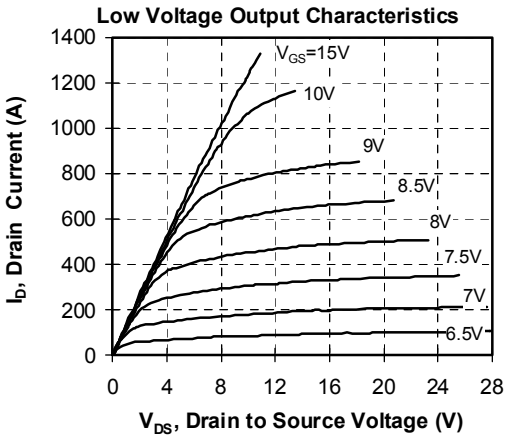
Symbol	Characteristic			Min	Typ	Max	Unit
R_{thJC}	Junction to Case	Transistor				0.08	°C/W
		Series Diode				0.12	
		Parallel Diode				0.12	
V_{ISOL}	RMS Isolation Voltage, any terminal to case t =1 min, Isol<1mA, 50/60Hz			2500			V
T_J	Operating junction temperature range			-40		150	°C
T_{STG}	Storage Temperature Range			-40		125	
T_C	Operating Case Temperature			-40		100	
Torque	Mounting torque	To heatsink	M6	3		5	N.m
		For terminals	M5	2		3.5	
Wt	Package Weight					280	g

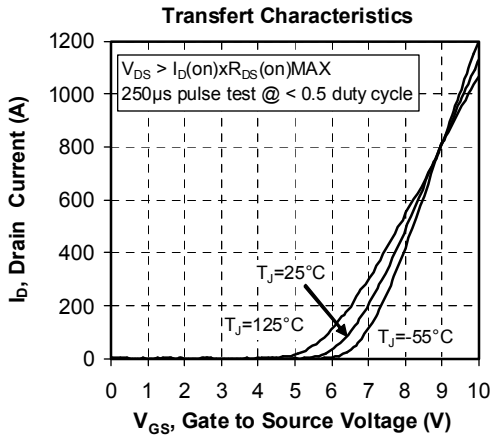
Package outline

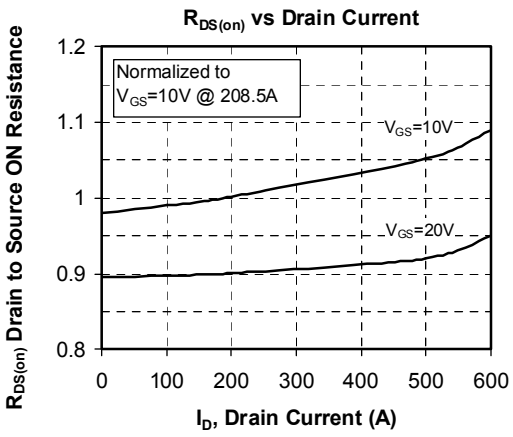


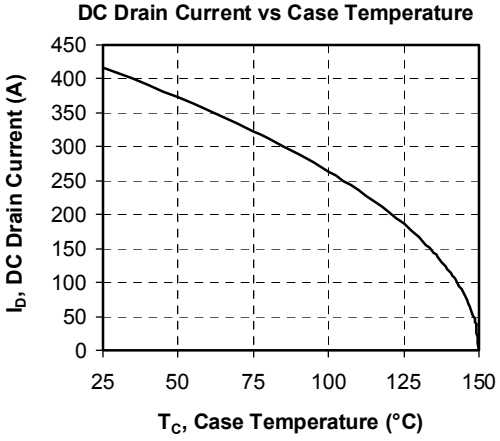
Typical Performance Curve



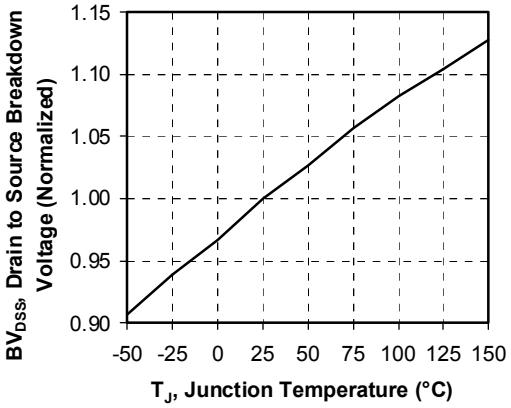




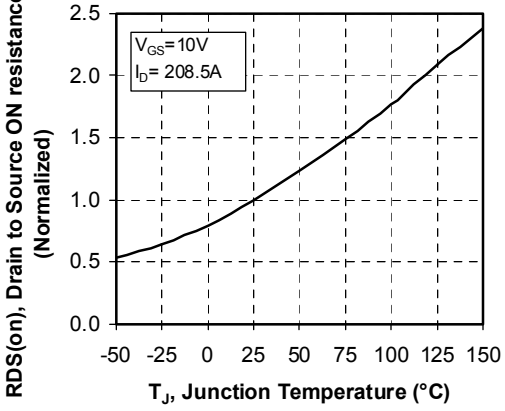




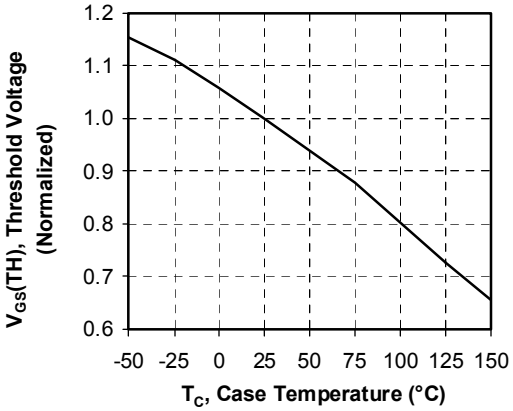
Breakdown Voltage vs Temperature



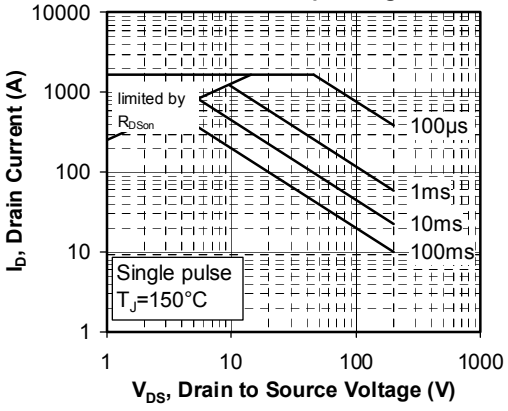
ON resistance vs Temperature



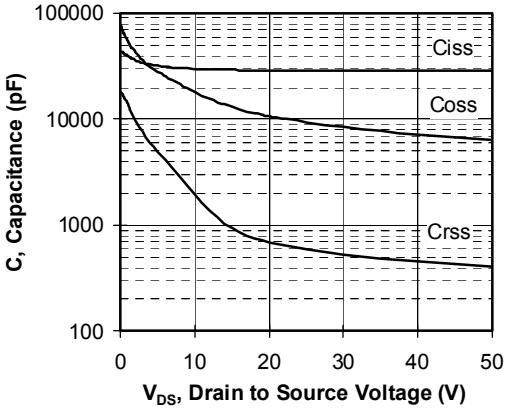
Threshold Voltage vs Temperature



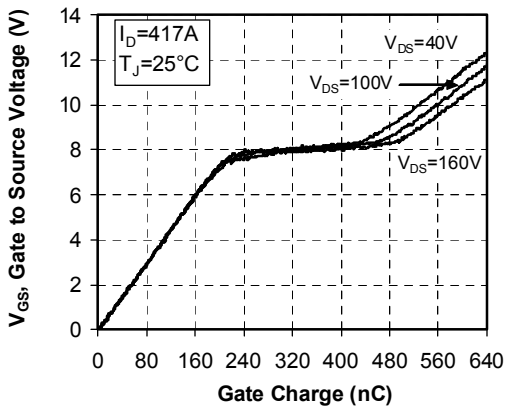
Maximum Safe Operating Area



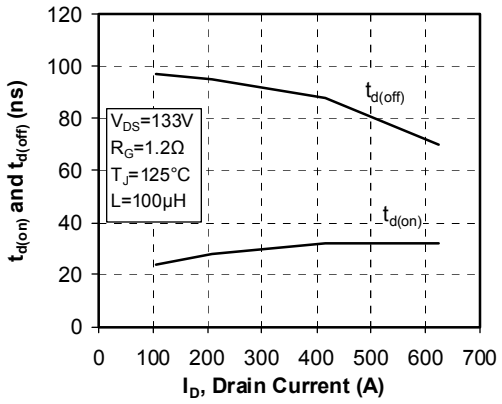
Capacitance vs Drain to Source Voltage



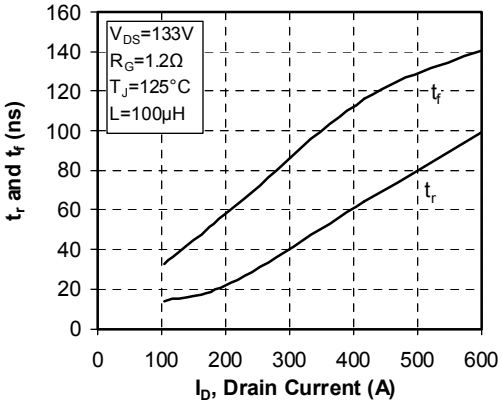
Gate Charge vs Gate to Source Voltage



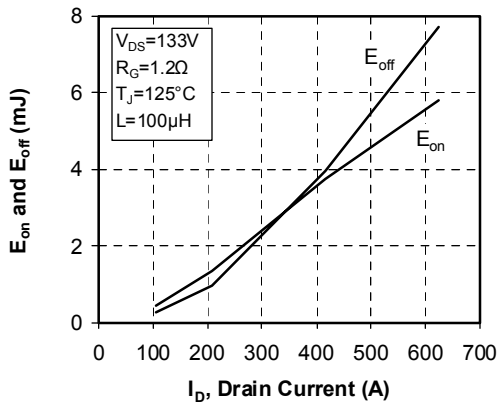
Delay Times vs Current



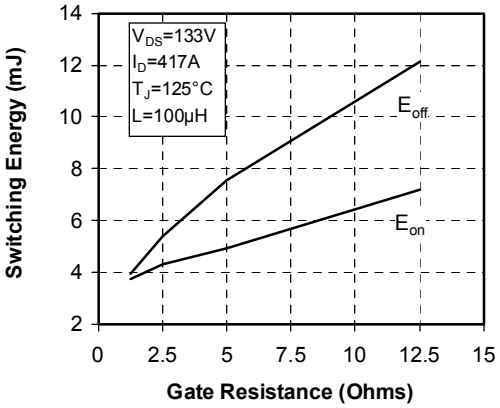
Rise and Fall times vs Current



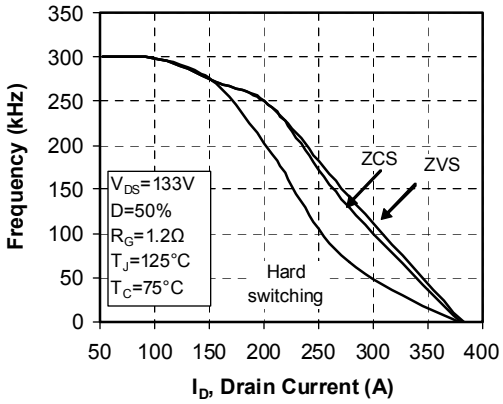
Switching Energy vs Current



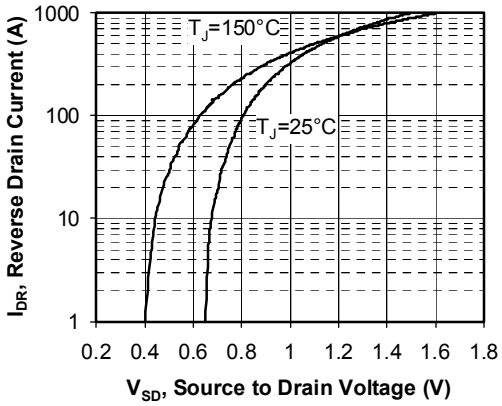
Switching Energy vs Gate Resistance



Operating Frequency vs Drain Current



Source to Drain Diode Forward Voltage



APT reserves the right to change, without notice, the specifications and information contained herein

APT's products are covered by one or more of U.S patents 4,895,810 5,045,903 5,089,434 5,182,234 5,019,522 5,262,336 6,503,786 5,256,583 4,748,103 5,283,202 5,231,474 5,434,095 5,528,058 and foreign patents. U.S and Foreign patents pending. All Rights Reserved.