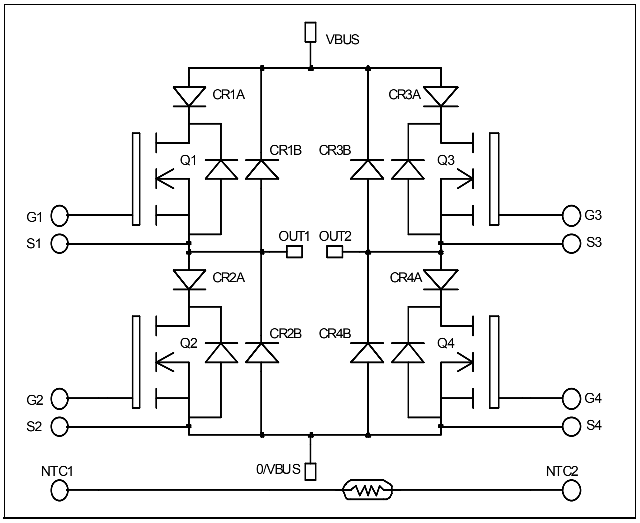
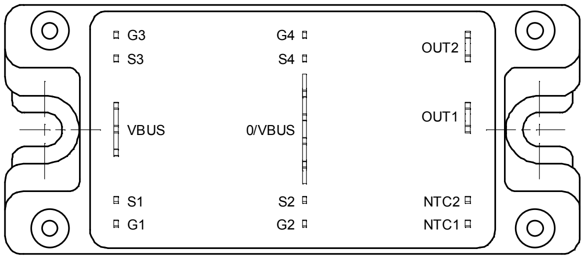
APTM50HM75SCT

Full bridge
Series & SiC parallel diodes
MOSFET Power Module

V_{DSS} = 500V
R_{DSon} = 75mΩ max @ Tj = 25°C
I_D = 46A @ Tc = 25°C





Application

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

Features

- *Power MOS 7® MOSFETs*
  - Low R_{DSon}
  - Low input and Miller capacitance
  - Low gate charge
  - Avalanche energy rated
- *Parallel SiC Schottky Diode*
  - Zero reverse recovery
  - Zero forward recovery
  - Temperature Independent switching behavior
  - Positive temperature coefficient on VF
- Kelvin source for easy drive
- Very low stray inductance
  - Symmetrical design
  - Lead frames for power connections
- Internal thermistor for temperature monitoring
- 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
- 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	46	A
		T_c = 80°C	34	
I_{DM}	Pulsed Drain current		184	
V_{GS}	Gate - Source Voltage		±30	V
R_{DSon}	Drain - Source ON Resistance		75	mΩ
P_D	Maximum Power Dissipation	T_c = 25°C	357	W
I_{AR}	Avalanche current (repetitive and non repetitive)		46	A
E_{AR}	Repetitive Avalanche Energy		50	mJ
E_{AS}	Single Pulse Avalanche Energy		2500	

CAUTION: These Devices are sensitive to Electrostatic Discharge. Proper Handing Procedures Should Be Followed

APT website – http://www.advancedpower.com

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 = 250µA		500			V
I_{DSS}	Zero Gate Voltage Drain Current	V_{GS} = 0V,V_{DS} = 500V	T_j = 25°C			100	µA
		V_{GS} = 0V,V_{DS} = 400V	T_j = 125°C			500	
$R_{DS(on)}$	Drain – Source on Resistance	V_{GS} = 10V, I_D = 23A				75	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		5590		pF
C_{oss}	Output Capacitance			1180		
C_{rss}	Reverse Transfer Capacitance			85		
Q_g	Total gate Charge	V_{GS} = 10V V_{Bus} = 250V I_D = 46A		123		nC
Q_{gs}	Gate – Source Charge			33		
Q_{gd}	Gate – Drain Charge			65		
$T_{d(on)}$	Turn-on Delay Time	**Inductive switching @ 125°C** V_{GS} = 15V V_{Bus} = 333V I_D = 46A R_G = 5Ω		18		ns
T_r	Rise Time			35		
$T_{d(off)}$	Turn-off Delay Time			87		
T_f	Fall Time			77		
E_{on}	Turn-on Switching Energy	**Inductive switching @ 25°C** V_{GS} = 15V, V_{Bus} = 333V I_D = 46A, R_G = 5Ω		453		µJ
E_{off}	Turn-off Switching Energy ❶			726		
E_{on}	Turn-on Switching Energy	**Inductive switching @ 125°C** V_{GS} = 15V, V_{Bus} = 333V I_D = 46A, R_G = 5Ω		745		µJ
E_{off}	Turn-off Switching Energy ❶			846		

❶ 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		30		A
V_F	Diode Forward Voltage	I_F = 30A			1.1	1.15	V
		I_F = 60A			1.4		
		I_F = 30A	T_j = 125°C		0.9		
t_{rr}	Reverse Recovery Time	I_F = 30A V_R = 133V di/dt = 200A/µs	T_j = 25°C		24		ns
			T_j = 125°C		48		
Q_{rr}	Reverse Recovery Charge	I_F = 30A V_R = 133V di/dt = 200A/µs	T_j = 25°C		33		nC
			T_j = 125°C		150		

Parallel diode ratings and characteristics

Symbol	Characteristic	Test Conditions		Min	Typ	Max	Unit
$I_{F(AV)}$	Maximum Average Forward Current	50% duty cycle	Tc = 125°C		20		A
V_F	Diode Forward Voltage	$I_F = 20A$	$T_j = 25°C$		1.6	1.8	V
			$T_j = 175°C$		2.0	2.4	
Q_C	Total Capacitive Charge	$I_F = 20A$, $V_R = 300V$ di/dt =800A/µs			28		nC
Q	Total Capacitance	f = 1MHz, $V_R = 200V$			130		pF
		f = 1MHz, $V_R = 400V$			100		

Thermal and package characteristics

Symbol	Characteristic			Min	Typ	Max	Unit
R_{thJC}	Junction to Case		Transistor			0.35	°C/W
			Series diode			1.2	
			Parallel diode			1.5	
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	M5			4.7	N.m
Wt	Package Weight					160	g

Temperature sensor NTC

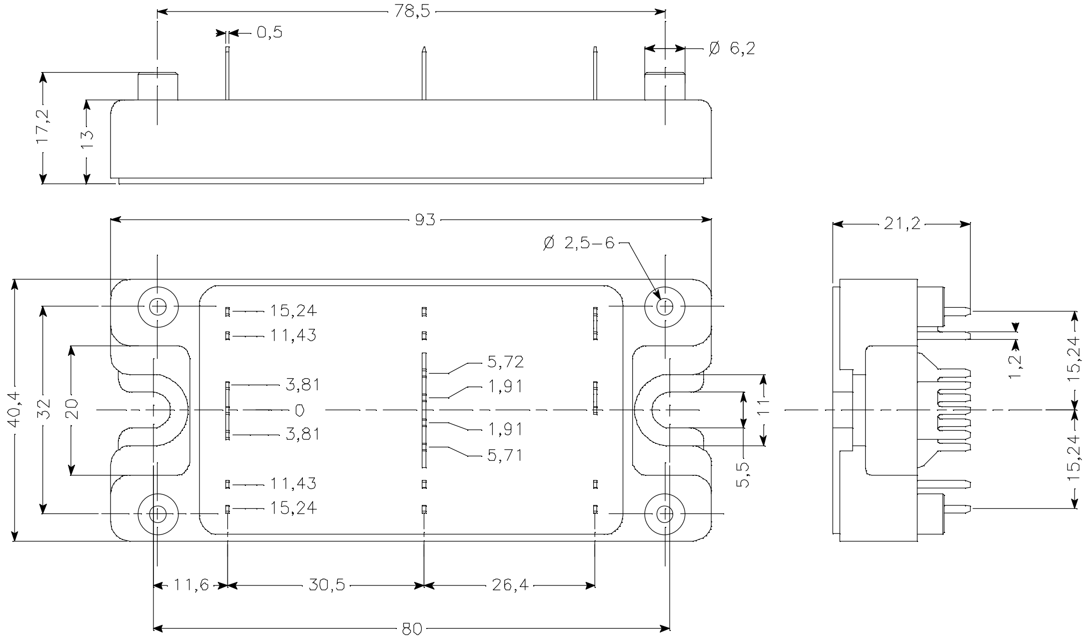
Symbol	Characteristic	Min	Typ	Max	Unit
R_{25}	Resistance @ 25°C		68		kΩ
$B_{25/85}$	$T_{25} = 298.16$ K		4080		K

$$R_T = \frac{R_{25}}{\exp\left[B_{25/85}\left(\frac{1}{T_{25}} - \frac{1}{T}\right)\right]}$$

T: Thermistor temperature

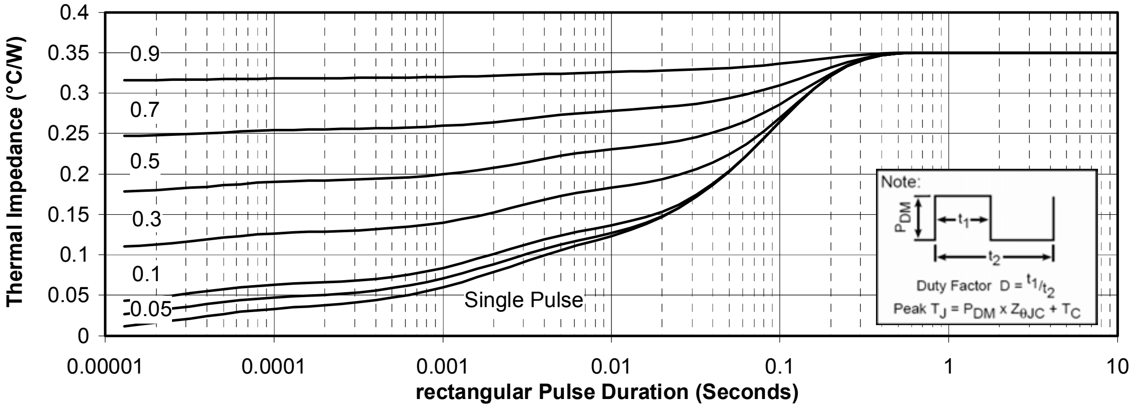
R_T: Thermistor value at T

Package outline

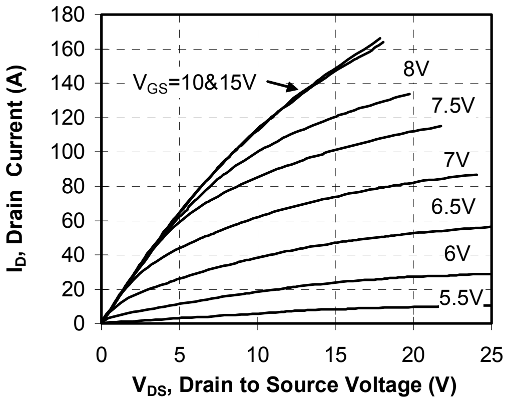


Typical MOSFET Performance Curve

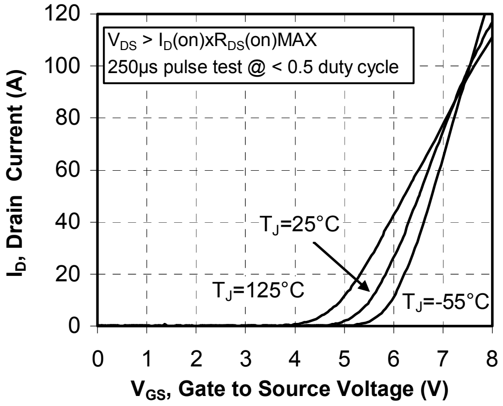
Maximum Effective Transient Thermal Impedance, Junction to Case vs Pulse Duration



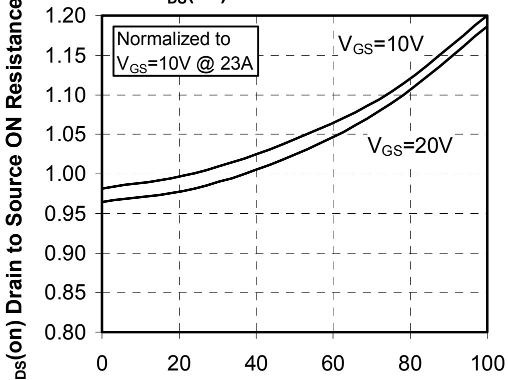
Low Voltage Output Characteristics



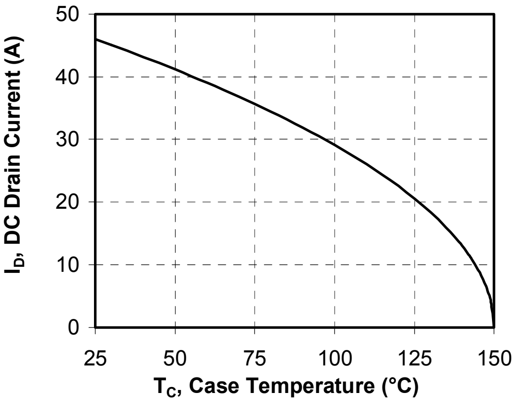
Transfert Characteristics

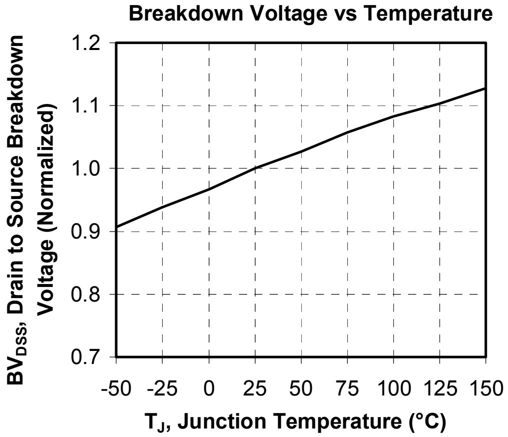


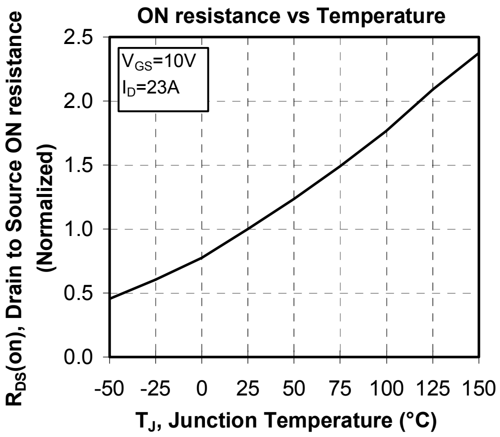
R_{DS}(on) vs Drain Current

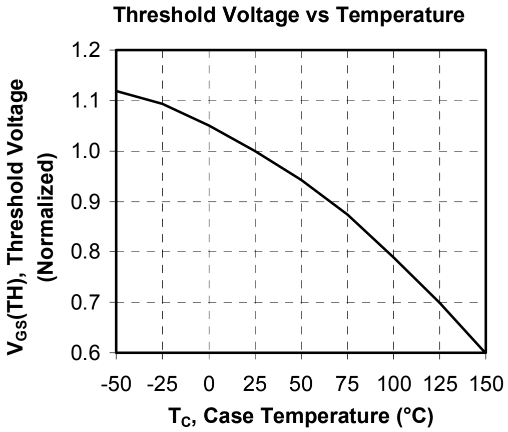


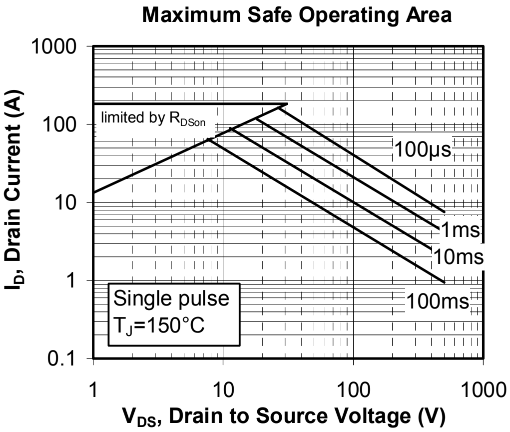
DC Drain Current vs Case Temperature

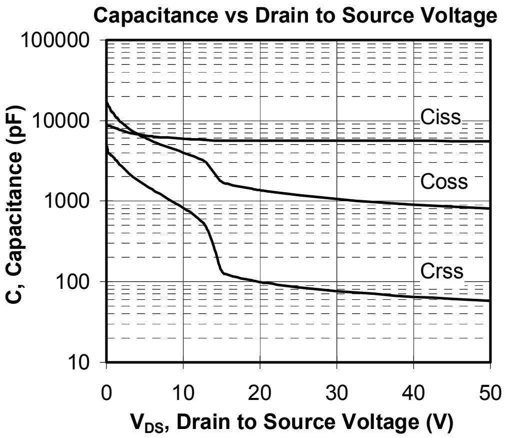


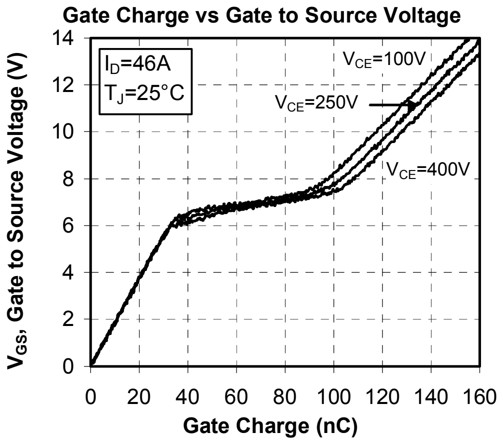

Breakdown Voltage vs Temperature


ON resistance vs Temperature

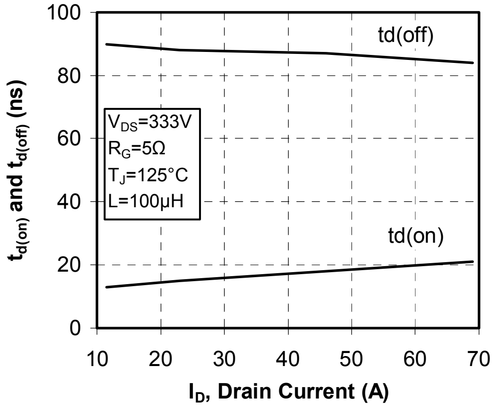

Threshold Voltage vs Temperature


Maximum Safe Operating Area

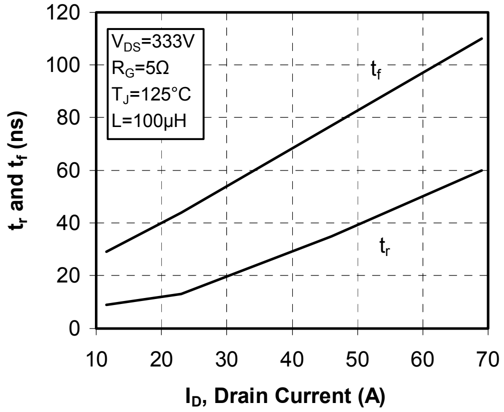

Capacitance vs Drain to Source Voltage


Gate Charge vs Gate to Source Voltage

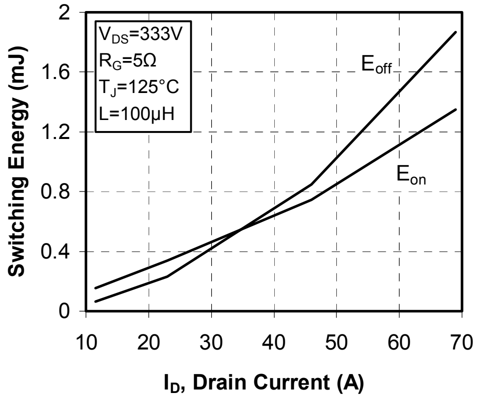
Delay Times vs Current



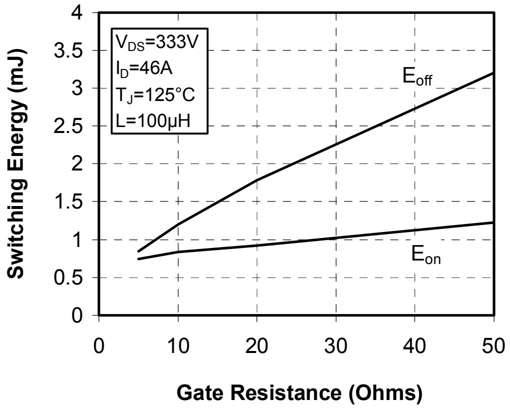
Rise and Fall times vs Current



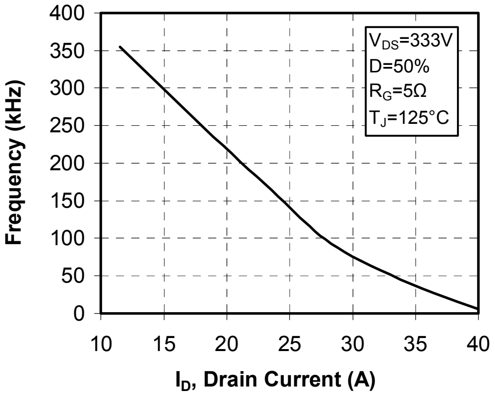
Switching Energy vs Current



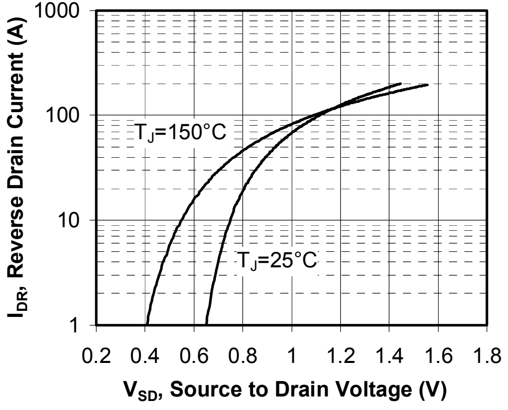
Switching Energy vs Gate Resistance



Operating Frequency vs Drain Current



Source to Drain Diode Forward Voltage



Typical SiC Diode Performance Curve