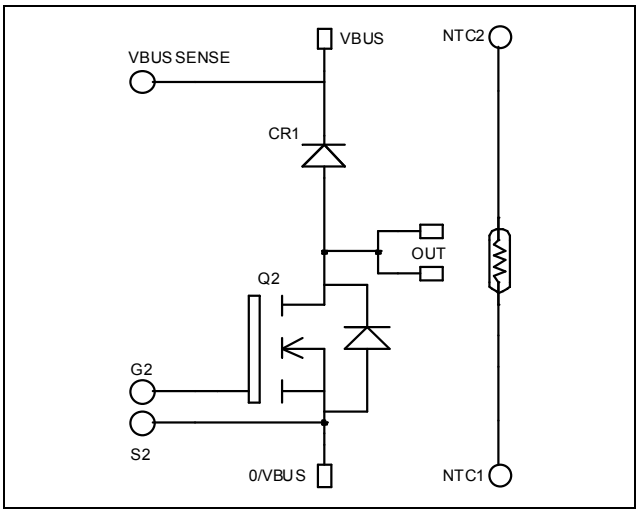
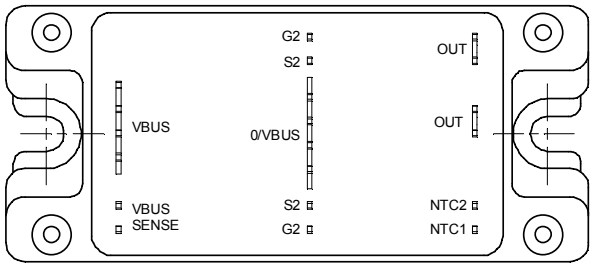
APTM50DAM38CT

Boost chopper
SiC FWD diode
MOSFET Power Module

V_{DSS} = 500V
R_{DSon} = 38mΩ max @ Tj = 25°C
I_D = 90A @ Tc = 25°C





Application

- AC and DC motor control
- Switched Mode Power Supplies
- Power Factor Correction

Features

- ***Power MOS 7® MOSFETs***
  - Low R_{DSon}
  - Low input and Miller capacitance
  - Low gate charge
  - Avalanche energy rated
- ***FWD 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 inductance²
  - 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	90	A
		T_c = 80°C	67	
I_{DM}	Pulsed Drain current		360	
V_{GS}	Gate - Source Voltage		±30	V
R_{DSon}	Drain - Source ON Resistance		38	mΩ
P_D	Maximum Power Dissipation	T_c = 25°C	694	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.

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 = 375µA		500			V
I_{DSS}	Zero Gate Voltage Drain Current	V_{GS} = 0V, V_{DS} = 500V	T_j = 25°C			150	µA
		V_{GS} = 0V, V_{DS} = 400V	T_j = 125°C			750	
$R_{DS(on)}$	Drain – Source on Resistance	V_{GS} = 10V, I_D = 45A				38	mΩ
$V_{GS(th)}$	Gate Threshold Voltage	V_{GS} = V_{DS}, I_D = 5mA		3		5	V
I_{GSS}	Gate – Source Leakage Current	V_{GS} = ±30 V, V_{DS} = 0V				±150	nA

Dynamic Characteristics

Symbol	*Characteristic*	*Test Conditions*	*Min*	*Typ*	*Max*	*Unit*
C_{iss}	Input Capacitance	V_{GS} = 0V V_{DS} = 25V f = 1MHz		11.2		nF
C_{oss}	Output Capacitance			2.36		
C_{rss}	Reverse Transfer Capacitance			0.18		
Q_g	Total gate Charge	V_{GS} = 10V V_{Bus} = 250V I_D = 90A		246		nC
Q_{gs}	Gate – Source Charge			66		
Q_{gd}	Gate – Drain Charge			130		
$T_{d(on)}$	Turn-on Delay Time	**Inductive switching @ 125°C** V_{GS} = 15V V_{Bus} = 333V I_D = 90A R_G = 2Ω		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 = 90A, R_G = 2Ω		906		µJ
E_{off}	Turn-off Switching Energy ❶			1452		
E_{on}	Turn-on Switching Energy	**Inductive switching @ 125°C** V_{GS} = 15V, V_{Bus} = 333V I_D = 90A, R_G = 2Ω		1490		µJ
E_{off}	Turn-off Switching Energy ❶			1692		

❶ In accordance with JEDEC standard JESD24-1.

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		60		A
V_F	Diode Forward Voltage	I_F = 60A	T_j = 25°C		1.6	1.8	V
			T_j = 175°C		2.0	2.4	
Q_C	Total Capacitive Charge	I_F = 60A, V_R = 300V di/dt =1600A/µs			84		nC
Q	Total Capacitance	f = 1MHz, V_R = 200V			390		pF
		f = 1MHz, V_R = 400V			300		

Thermal and package characteristics

Symbol	Characteristic			Min	Typ	Max	Unit
R_{thJC}	Junction to Case		Transistor			0.18	°C/W
			Diode			0.45	
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	M5			4.7	N.m
Wt	Package Weight					160	g

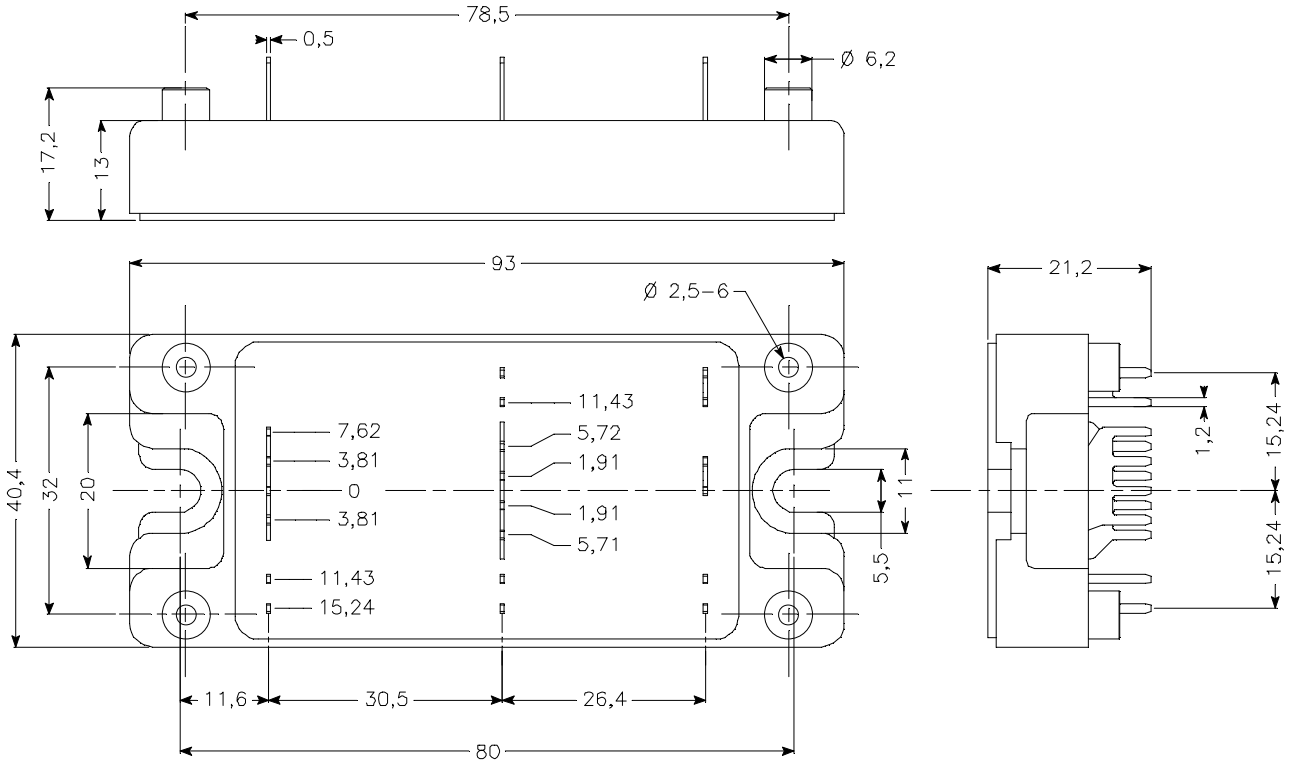
Temperature sensor NTC

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

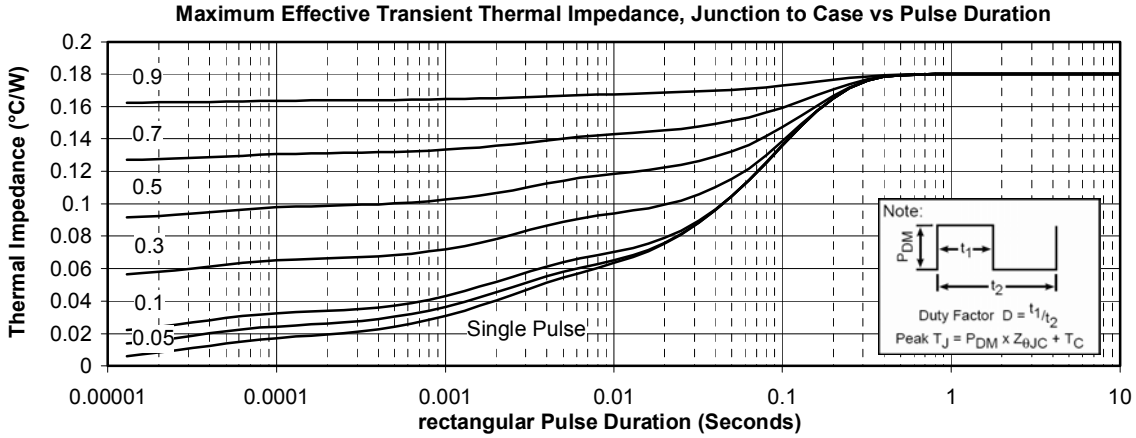
$$R_T = \frac{R_{25}}{\exp\left[B_{25/85}\left(\frac{1}{T_{25}} - \frac{1}{T}\right)\right]}$$

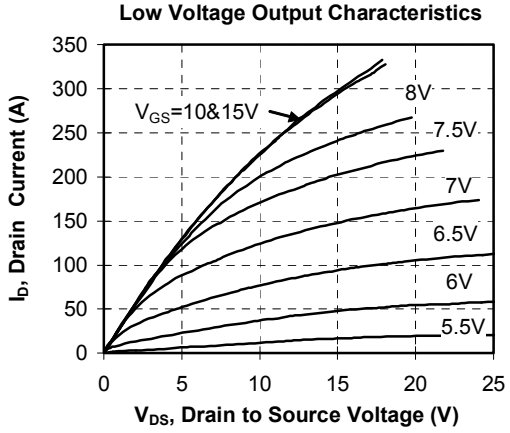
T: Thermistor temperature
R_T: Thermistor value at T

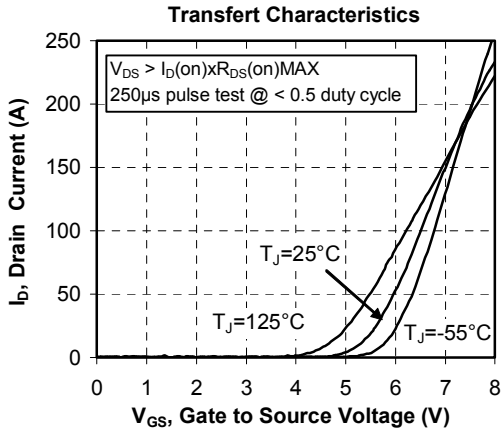
Package outline

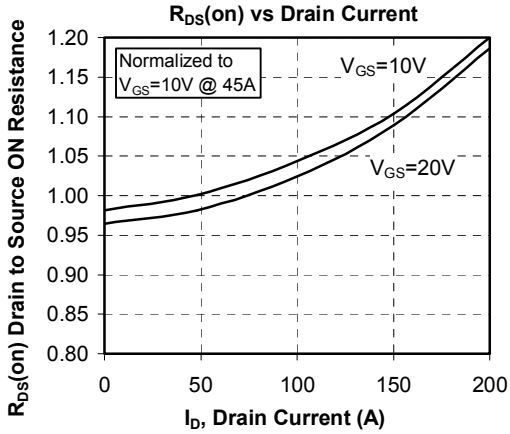


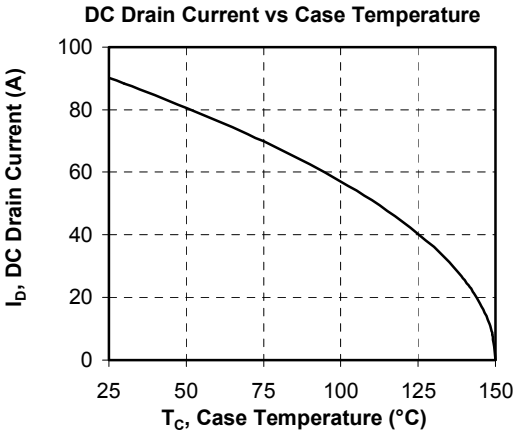
Typical MOSFET Performance Curve



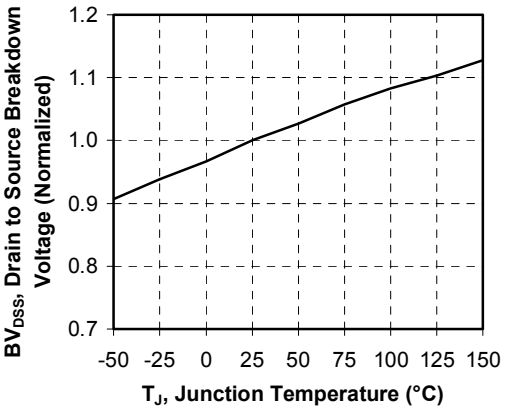




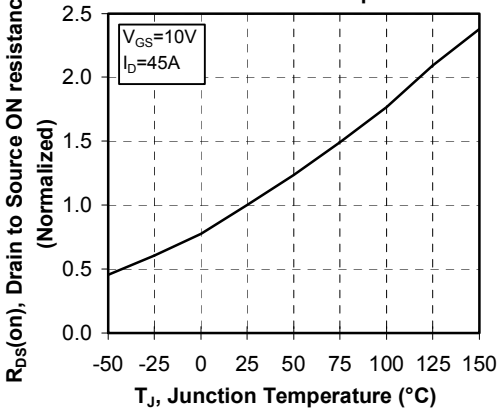




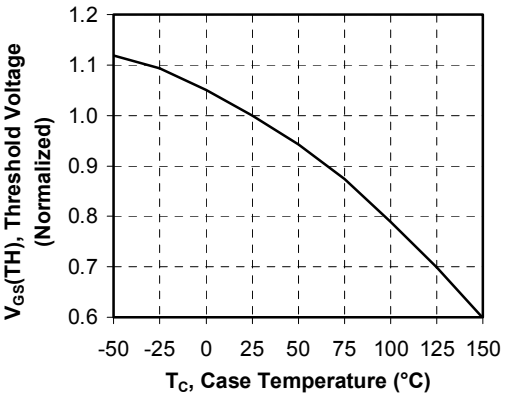
Breakdown Voltage vs Temperature



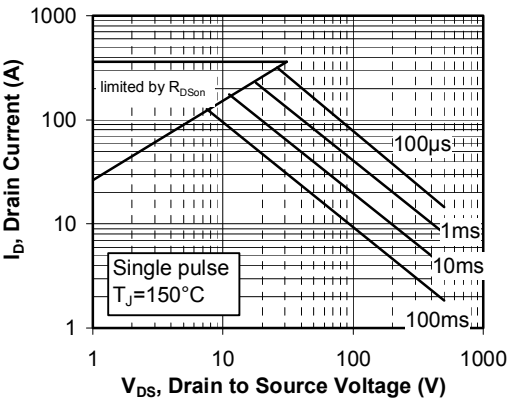
ON resistance vs Temperature



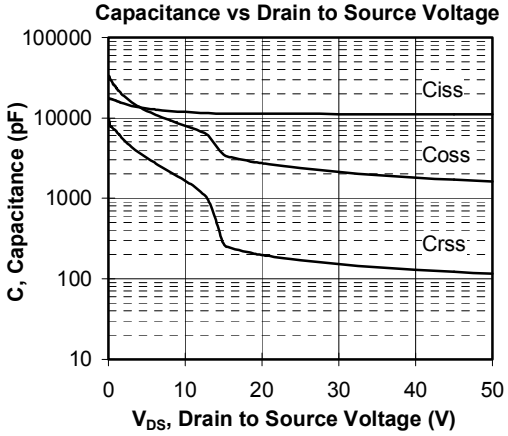
Threshold Voltage vs Temperature



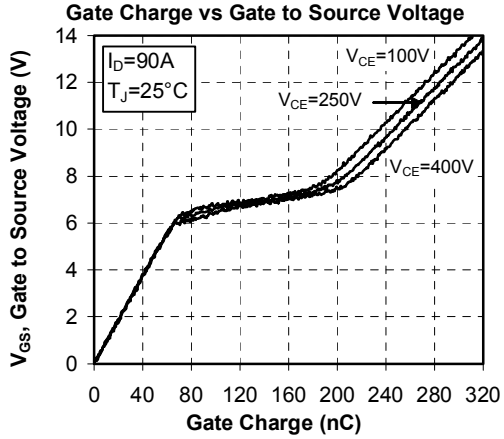
Maximum Safe Operating Area



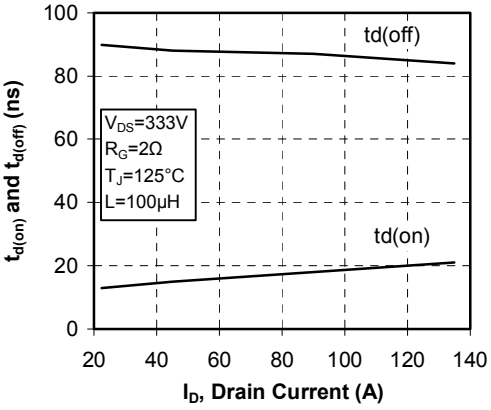
Capacitance vs Drain to Source Voltage



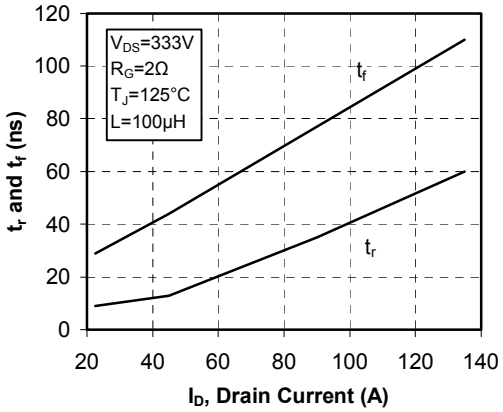
Gate Charge vs Gate to Source Voltage



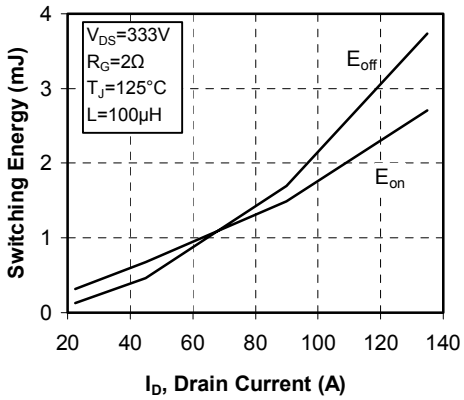
Delay Times vs Current



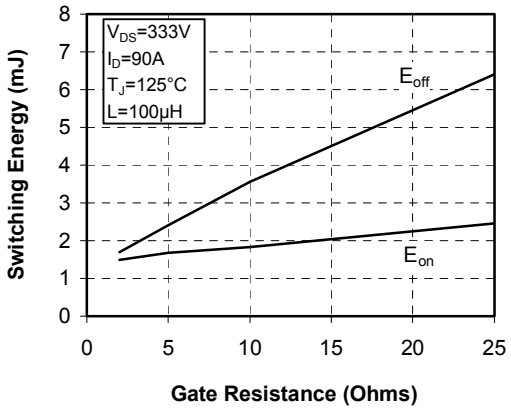
Rise and Fall times vs Current



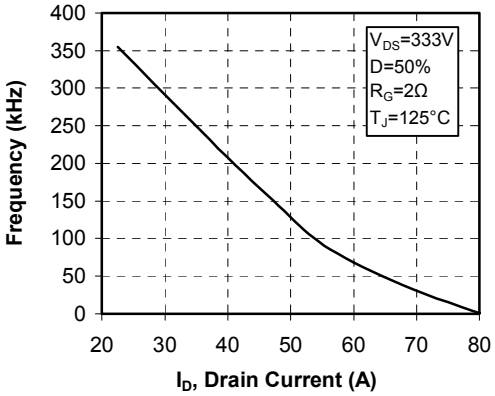
Switching Energy vs Current



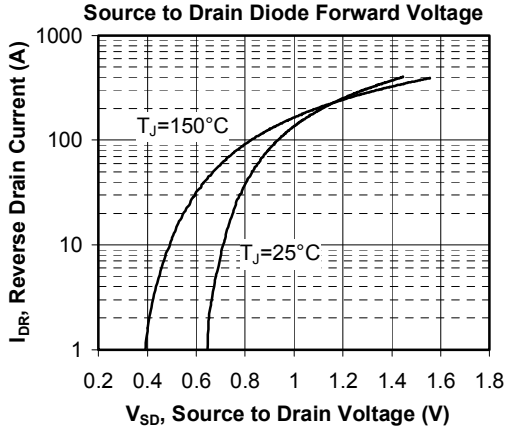
Switching Energy vs Gate Resistance



Operating Frequency vs Drain Current



Source to Drain Diode Forward Voltage



Typical SiC Diode Performance Curve