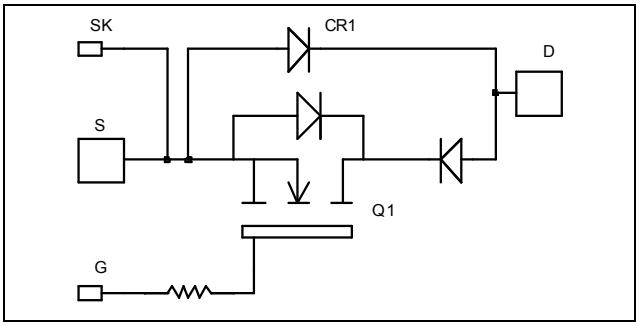
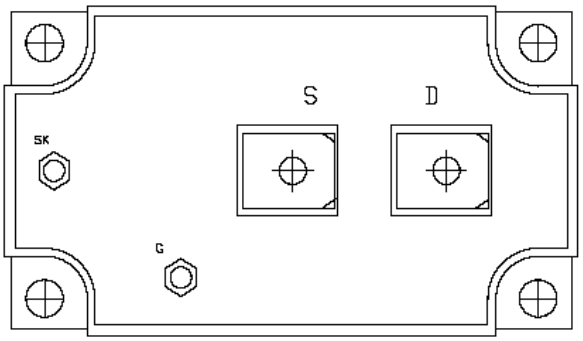
APTM20UM05S

Single switch
Series & parallel diodes
MOSFET Power Module

V_{DSS} = 200V
R_{DSon} = 5mΩ max @ Tj = 25°C
I_D = 317A @ 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
  - Very rugged
- Kelvin source for easy drive
- Low stray inductance
  - M6 power connectors
  - M4 signal connectors
- High level of integration

Benefits

- Outstanding performance at high frequency operation
- Direct mounting to heatsink (isolated package)
- Low junction to case thermal resistance

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	317	A
		T_c = 80°C	237	
I_{DM}	Pulsed Drain current		1268	
V_{GS}	Gate - Source Voltage		±30	V
R_{DSon}	Drain - Source ON Resistance		5	mΩ
P_D	Maximum Power Dissipation	T_c = 25°C	1136	W
I_{AR}	Avalanche current (repetitive and non repetitive)		89	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 = 500µA		200			V
I_{DSS}	Zero Gate Voltage Drain Current	V_{GS} = 0V, V_{DS}= 200V	T_j = 25°C			200	µA
		V_{GS} = 0V, V_{DS}= 160V	T_j = 125°C			1000	
$R_{DS(on)}$	Drain – Source on Resistance	V_{GS} = 10V, I_D = 158.5A				5	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		27.4		nF
C_{oss}	Output Capacitance			8.7		
C_{rss}	Reverse Transfer Capacitance			0.4		
Q_g	Total gate Charge	V_{GS} = 10V V_{Bus} = 100V I_D = 300A		448		nC
Q_{gs}	Gate – Source Charge			172		
Q_{gd}	Gate – Drain Charge			188		
$T_{d(on)}$	Turn-on Delay Time	**Inductive switching @ 125°C** V_{GS} = 15V V_{Bus} = 133V I_D = 300A R_G = 1.2Ω		28		ns
T_r	Rise Time			56		
$T_{d(off)}$	Turn-off Delay Time			81		
T_f	Fall Time			99		
E_{on}	Turn-on Switching Energy ❶	**Inductive switching @ 25°C** V_{GS} = 15V, V_{Bus} = 133V I_D = 300A, R_G = 1.2Ω		1852		µJ
E_{off}	Turn-off Switching Energy ❷			1820		
E_{on}	Turn-on Switching Energy ❶	**Inductive switching @ 125°C** V_{GS} = 15V, V_{Bus} = 133V I_D = 300A, R_G = 1.2Ω		2432		µJ
E_{off}	Turn-off Switching Energy ❷			2124		

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		120		A
V_F	Diode Forward Voltage	I_F = 120A			1.1	1.15	V
		I_F = 240A			1.4		
		I_F = 120A	T_j = 125°C		0.9		
t_{rr}	Reverse Recovery Time	I_F = 120A V_R = 133V di/dt = 400A/µs	T_j = 25°C		31		ns
			T_j = 125°C		60		
Q_{rr}	Reverse Recovery Charge	I_F = 120A V_R = 133V di/dt = 400A/µs	T_j = 25°C		120		nC
			T_j = 125°C		500		

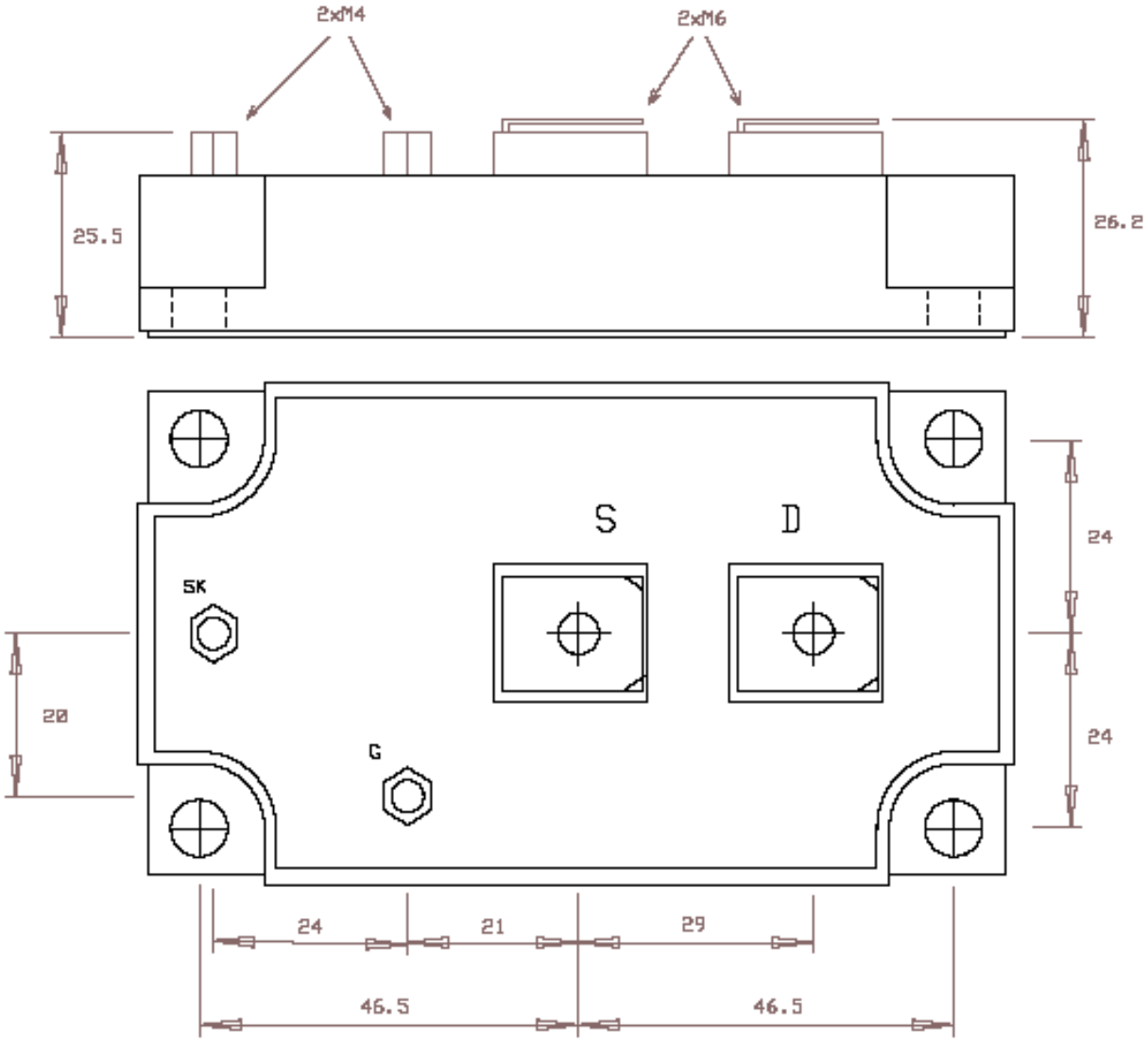
Parallel diode ratings and characteristics

Symbol	*Characteristic*	*Test Conditions*		*Min*	*Typ*	*Max*	*Unit*
$I_{F(AV)}$	Maximum Average Forward Current	50% duty cycle	T_c = 90°C		100		A
V_F	Diode Forward Voltage	I_F = 100A			1	1.1	V
		I_F = 200A			1.4		
		I_F = 100A	T_j = 125°C		0.9		
t_{rr}	Reverse Recovery Time	I_F = 100A V_R = 133V di/dt = 200A/µs	T_j = 25°C		60		ns
			T_j = 125°C		110		
Q_{rr}	Reverse Recovery Charge	I_F = 100A V_R = 133V di/dt = 200A/µs	T_j = 25°C		200		nC
			T_j = 125°C		840		

Thermal and package characteristics

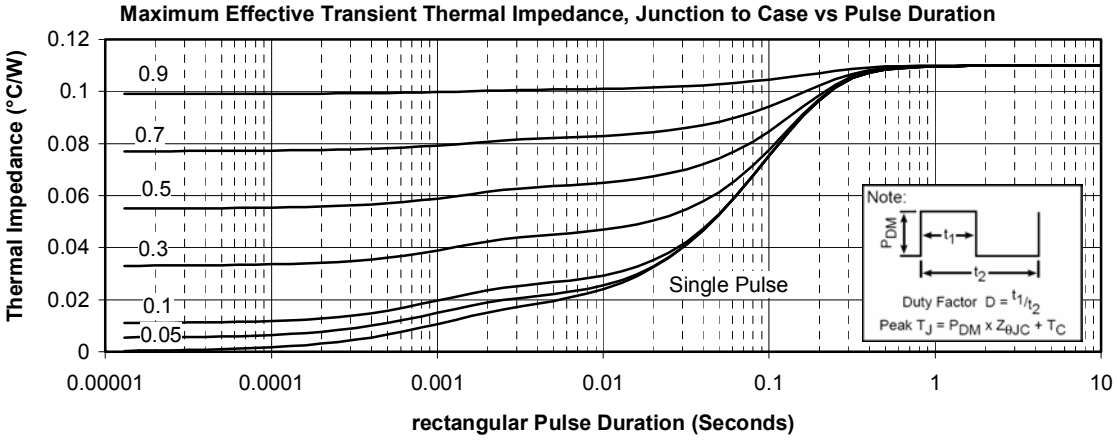
Symbol	*Characteristic*		*Min*	*Typ*	*Max*	*Unit*
R_{thJC}	Junction to Case	Transistor			0.11	°C/W
		Series diode			0.46	
		Parallel diode			0.6	
V_{ISOL}	RMS Isolation Voltage, any terminal to case t =1 min, I isol<1mA, 50/60Hz		2500			V
T_J	Operating junction temperature range		-40		150	°C
T_{STG}	Storage Temperature Range		-40		125	
T_C	Operating Case Temperature		-40		100	
Torque	Mounting torque	M4			1.2	N.m
		M6	3		5	
Wt	Package Weight				400	g

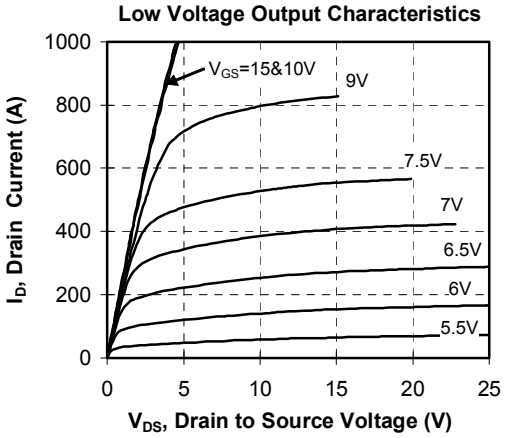
Package outline

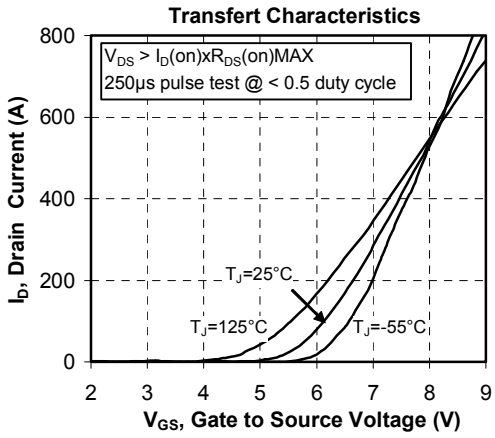


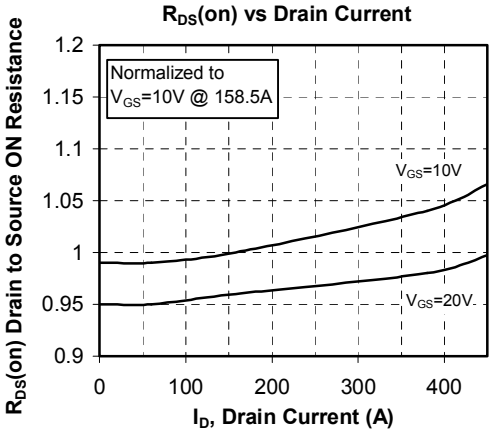
Mounting holes: 4x∅6.5 mm

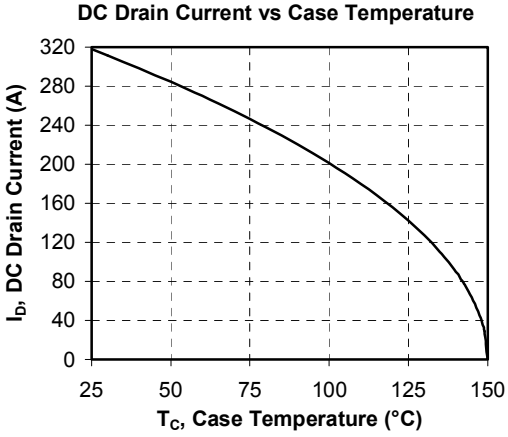
Typical Performance Curve

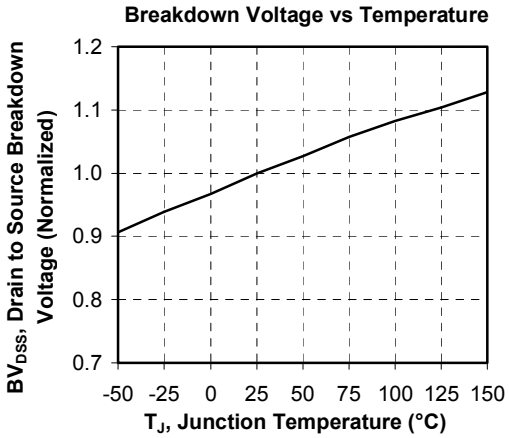


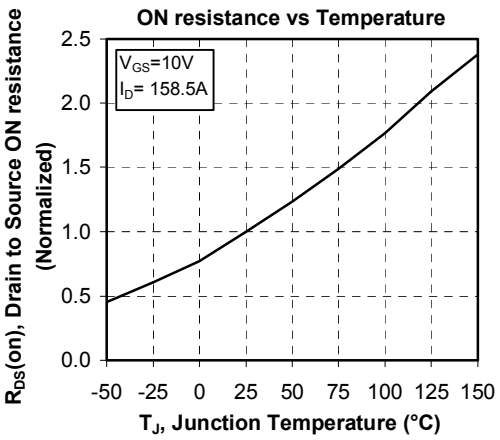


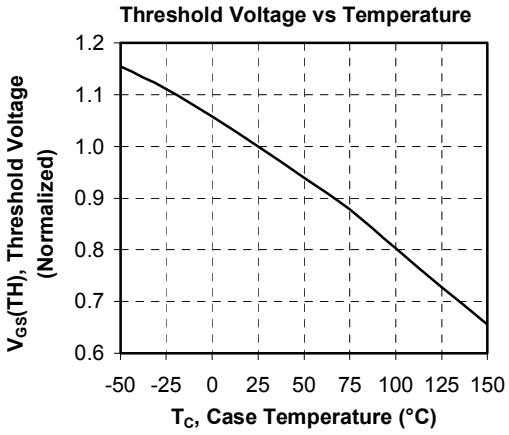


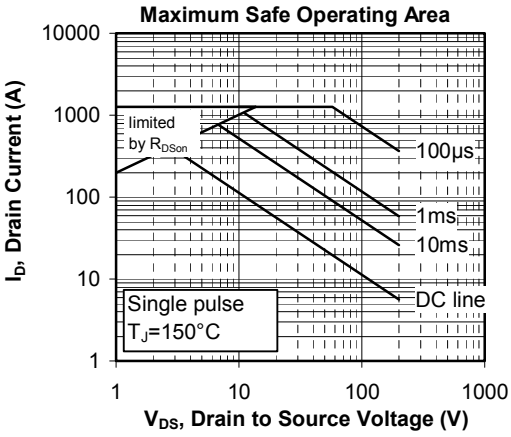


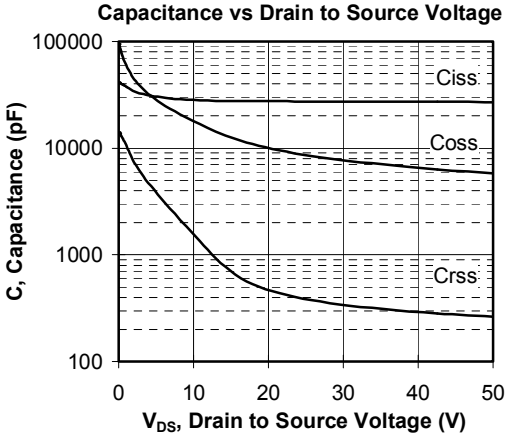


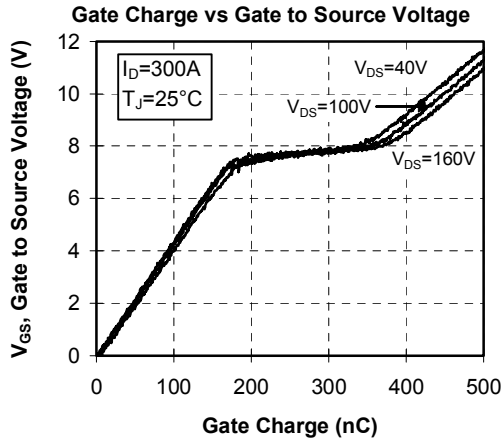

Breakdown Voltage vs Temperature
BVDSS, Drain to Source Breakdown Voltage (Normalized)
1.2
1.1
1.0
0.9
0.8
0.7
-50 -25 0 25 50 75 100 125 150
TJ, Junction Temperature (°C)


ON resistance vs Temperature
RDS(on), Drain to Source ON resistance (Normalized)
VGS=10V
ID= 158.5A
2.5
2.0
1.5
1.0
0.5
0.0
-50 -25 0 25 50 75 100 125 150
TJ, Junction Temperature (°C)

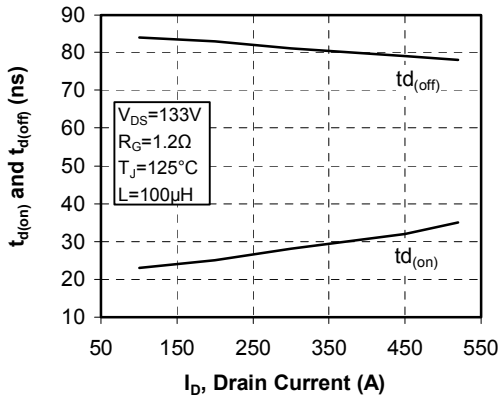

Threshold Voltage vs Temperature
VGS(TH), Threshold Voltage (Normalized)
1.2
1.1
1.0
0.9
0.8
0.7
0.6
-50 -25 0 25 50 75 100 125 150
TC, Case Temperature (°C)


Maximum Safe Operating Area
ID, Drain Current (A)
10000
1000
100
10
1
limited by RDSon
100µs
1ms
10ms
DC line
Single pulse
TJ=150°C
1
10
100
1000
VDS, Drain to Source Voltage (V)

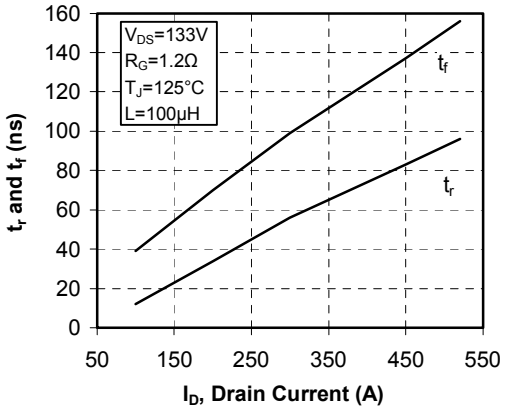

Capacitance vs Drain to Source Voltage
C, Capacitance (pF)
100000
10000
1000
100
Ciss
Coss
Crss
0 10 20 30 40 50
VDS, Drain to Source Voltage (V)


Gate Charge vs Gate to Source Voltage
VGS, Gate to Source Voltage (V)
12
10
8
6
4
2
0
ID=300A
TJ=25°C
VDS=40V
VDS=100V
VDS=160V
0 100 200 300 400 500
Gate Charge (nC)

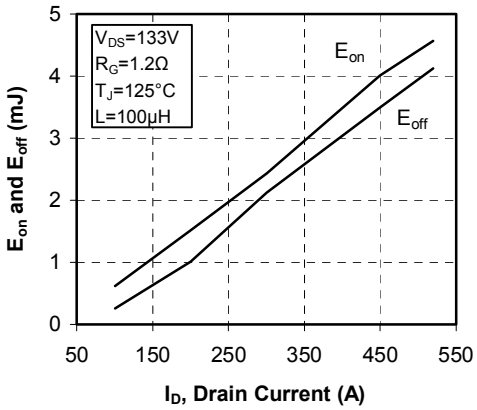
Delay Times vs Current



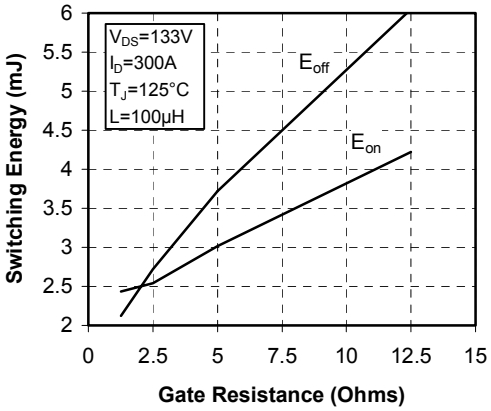
Rise and Fall times vs Current



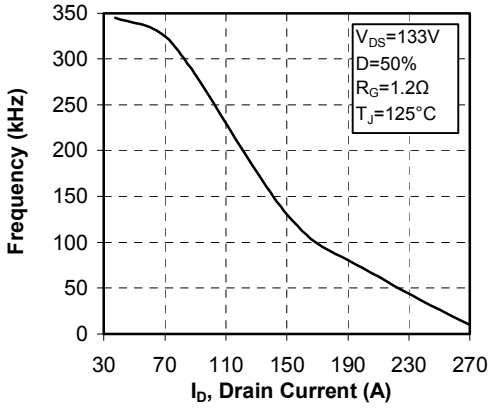
Switching Energy vs Current



Switching Energy vs Gate Resistance



Operating Frequency vs Drain Current



Source to Drain Diode Forward Voltage