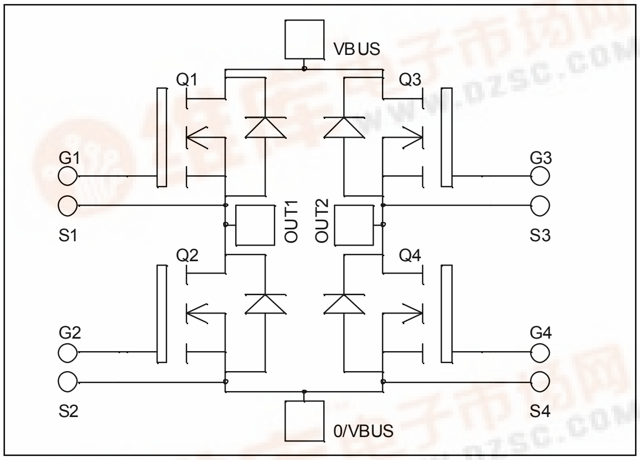
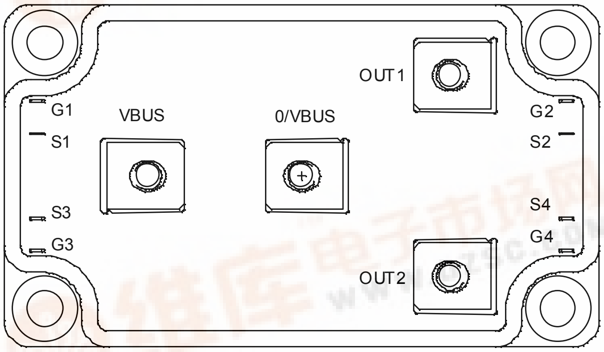
Microsemi POWER PRODUCTS GROUP

APTM20HM10FG

Full - Bridge MOSFET Power Module

V_{DSS} = 200V
R_{DSon} = 10mΩ typ @ Tj = 25°C
I_D = 175A @ 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

Benefits

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

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	175	A
		T_c = 80°C	131	
I_{DM}	Pulsed Drain current		700	
V_{GS}	Gate - Source Voltage		±30	V
R_{DSon}	Drain - Source ON Resistance		12	mΩ
P_D	Maximum Power Dissipation	T_c = 25°C	694	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. See application note APT0502 on www.microsemi.com

All ratings @ T_j = 25°C unless otherwise specified

Electrical Characteristics

Symbol	*Characteristic*	*Test Conditions*		*Min*	*Typ*	*Max*	*Unit*
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 = 87.5A			10	12	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		13.7		nF
C_{oss}	Output Capacitance			4.36		
C_{rss}	Reverse Transfer Capacitance			0.19		
Q_g	Total gate Charge	V_{GS} = 10V V_{Bus} = 100V I_D = 150A		224		nC
Q_{gs}	Gate – Source Charge			86		
Q_{gd}	Gate – Drain Charge			94		
$T_{d(on)}$	Turn-on Delay Time	**Inductive switching @ 125°C** V_{GS} = 15V V_{Bus} = 133V I_D = 150A R_G = 2.5Ω		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	**Inductive switching @ 25°C** V_{GS} = 15V, V_{Bus} = 133V I_D = 150A, R_G = 2.5Ω		926		µJ
E_{off}	Turn-off Switching Energy			910		
E_{on}	Turn-on Switching Energy	**Inductive switching @ 125°C** V_{GS} = 15V, V_{Bus} = 133V I_D = 150A, R_G = 2.5Ω		1216		µJ
E_{off}	Turn-off Switching Energy			1062		

Source - Drain diode ratings and characteristics

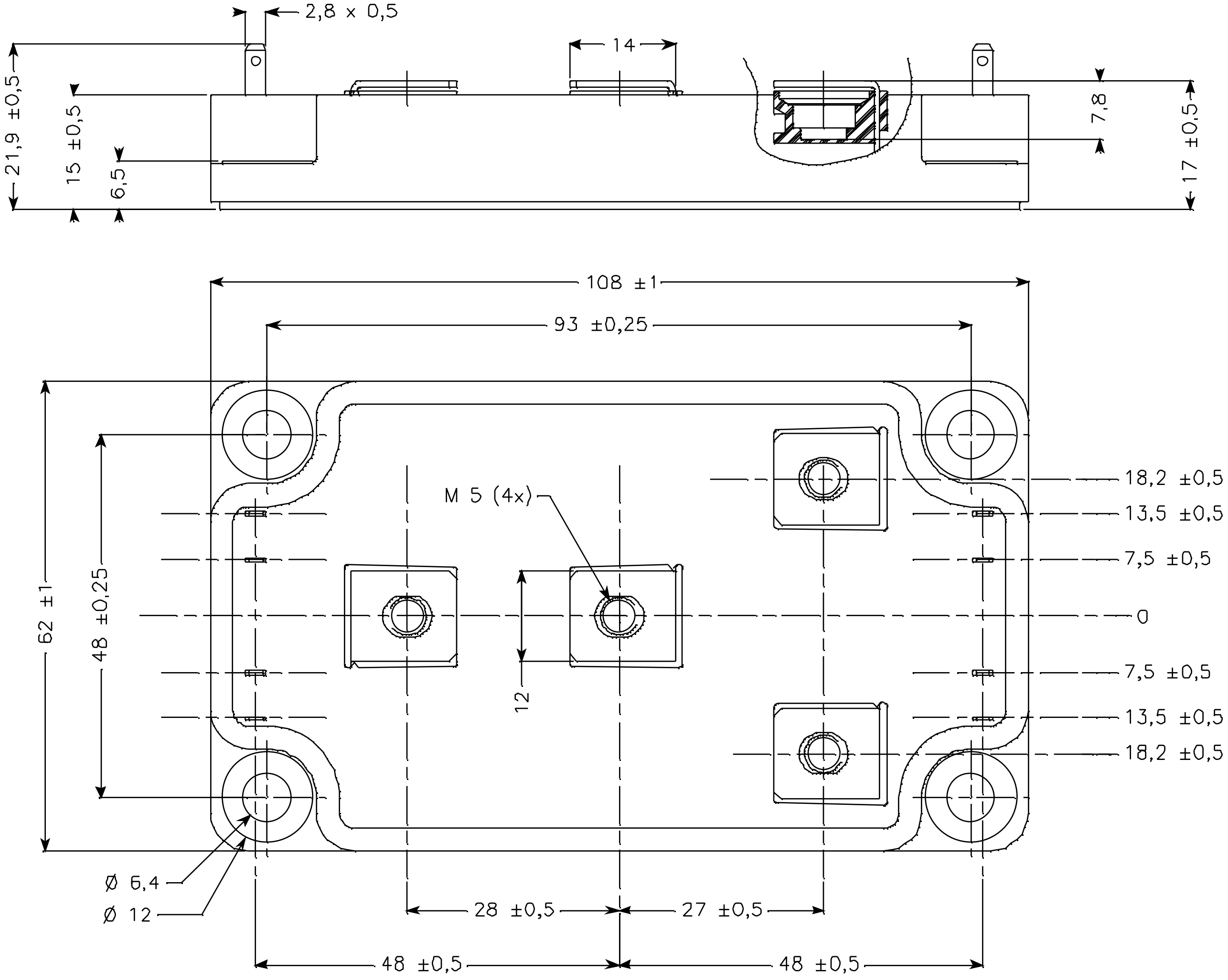
Symbol	*Characteristic*	*Test Conditions*		*Min*	*Typ*	*Max*	*Unit*
I_S	Continuous Source current (Body diode)		Tc = 25°C			175	A
			Tc = 80°C			131	
V_{SD}	Diode Forward Voltage	V_{GS} = 0V, I_S = - 150A				1.3	V
dv/dt	Peak Diode Recovery ❶					8	V/ns
t_{rr}	Reverse Recovery Time	I_S = -150A V_R = 133V di_S/dt = 200A/µs	T_j = 25°C			220	ns
			T_j = 125°C			420	
Q_{rr}	Reverse Recovery Charge		T_j = 25°C		2.14		µC
			T_j = 125°C		5.8		

❶ dv/dt numbers reflect the limitations of the circuit rather than the device itself.
$I_S \le$ - 150A 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 Thermal Resistance					0.18	°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 terminals	M5	2		3.5	
Wt	Package Weight					280	g

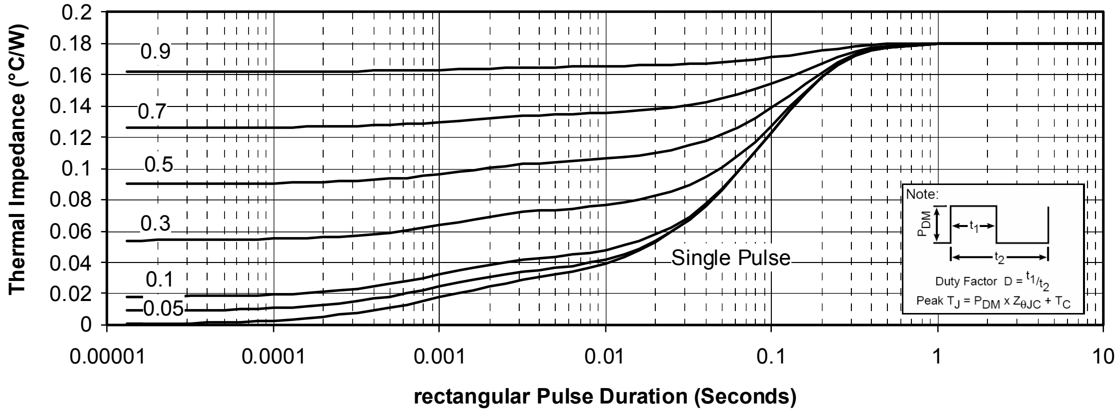
SP6 Package outline (dimensions in mm)



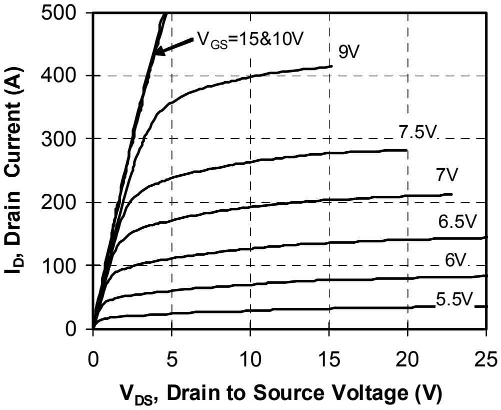
See application note APT0601 - Mounting Instructions for SP6 Power Modules on www.microsemi.com

Typical Performance Curve

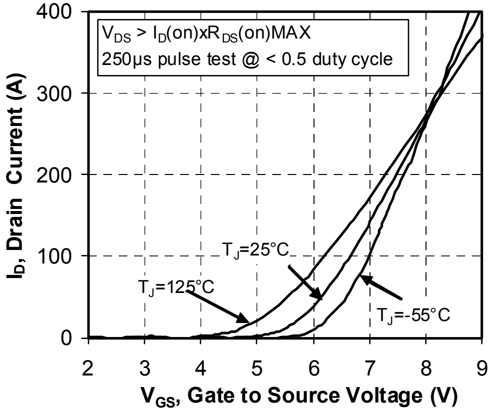
Maximum Effective Transient Thermal Impedance, Junction to Case vs Pulse Duration



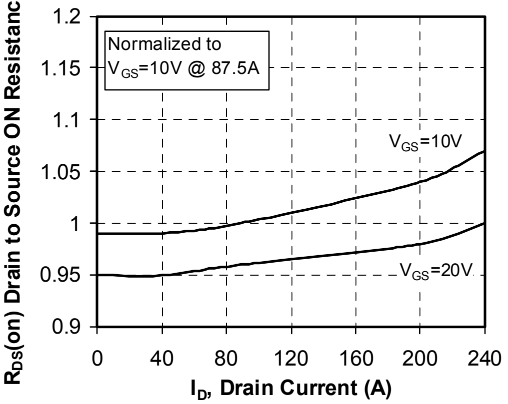
Low Voltage Output Characteristics



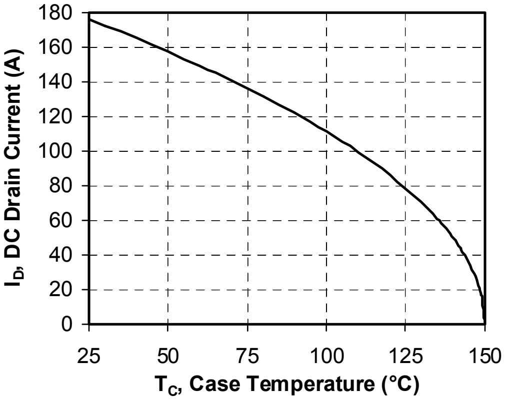
Transfert Characteristics

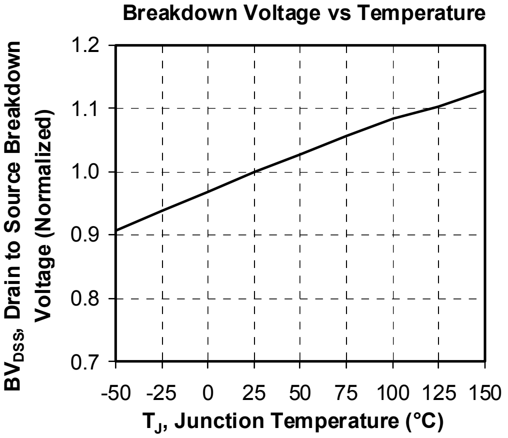


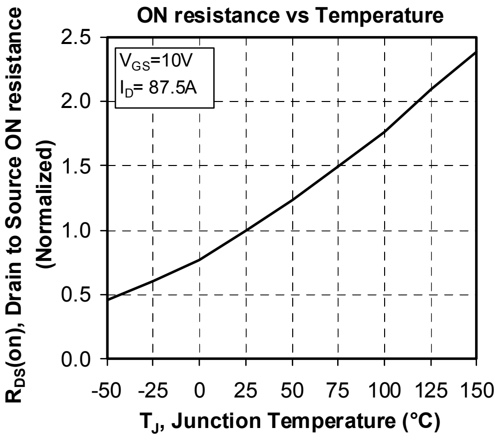
R_{DS}(on) vs Drain Current

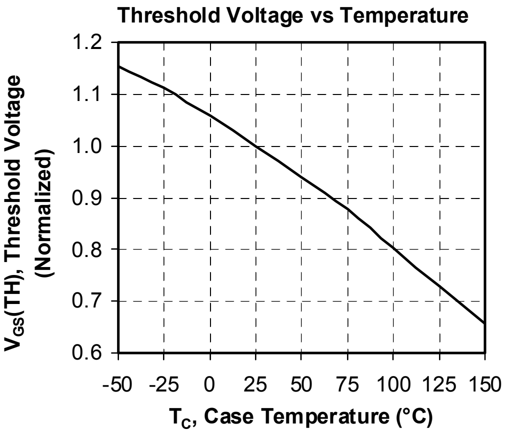


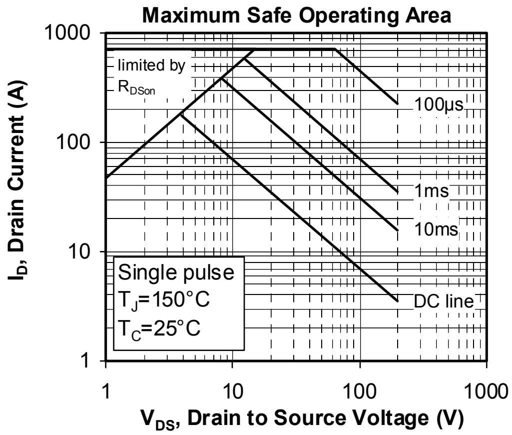
DC Drain Current vs Case Temperature

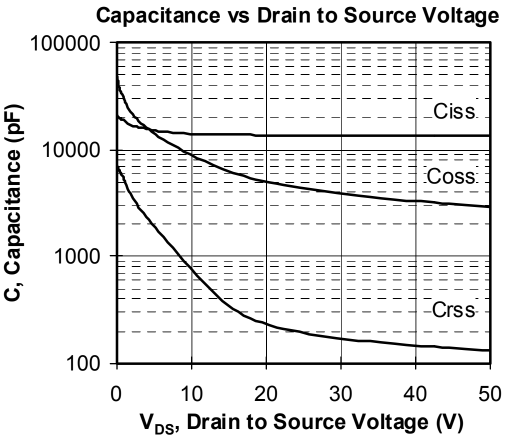


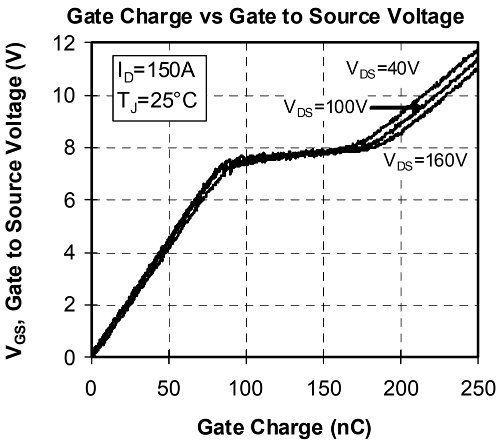

Breakdown Voltage vs Temperature
BV$_{DSS}$, Drain to Source Breakdown Voltage (Normalized)
1.2
1.1
1.0
0.9
0.8
0.7
-50 -25 0 25 50 75 100 125 150
T$_J$, Junction Temperature (°C)


ON resistance vs Temperature
R$_{DS}$(on), Drain to Source ON resistance (Normalized)
V$_{GS}$=10V
I$_D$= 87.5A
2.5
2.0
1.5
1.0
0.5
0.0
-50 -25 0 25 50 75 100 125 150
T$_J$, Junction Temperature (°C)

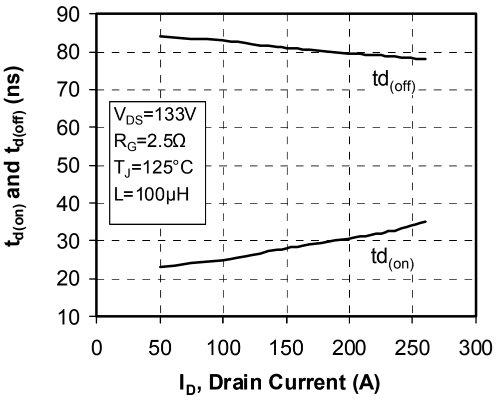

Threshold Voltage vs Temperature
V$_{GS}$(TH), Threshold Voltage (Normalized)
1.2
1.1
1.0
0.9
0.8
0.7
0.6
-50 -25 0 25 50 75 100 125 150
T$_C$, Case Temperature (°C)


Maximum Safe Operating Area
I$_D$, Drain Current (A)
limited by R$_{DSon}$
100µs
1ms
10ms
DC line
Single pulse
T$_J$=150°C
T$_C$=25°C
1000
100
10
1
1 10 100 1000
V$_{DS}$, Drain to Source Voltage (V)

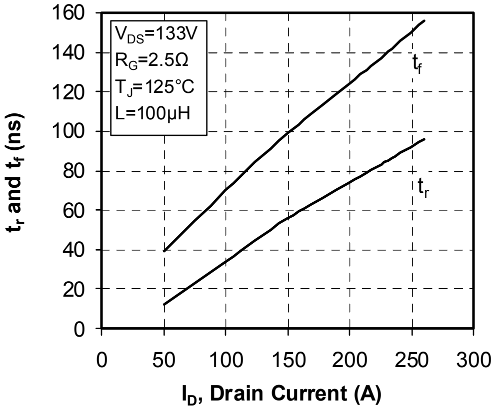

Capacitance vs Drain to Source Voltage
C, Capacitance (pF)
Ciss
Coss
Crss
100000
10000
1000
100
0 10 20 30 40 50
V$_{DS}$, Drain to Source Voltage (V)


Gate Charge vs Gate to Source Voltage
V$_{GS}$, Gate to Source Voltage (V)
I$_D$=150A
T$_J$=25°C
V$_{DS}$=40V
V$_{DS}$=100V
V$_{DS}$=160V
12
10
8
6
4
2
0
0 50 100 150 200 250
Gate Charge (nC)

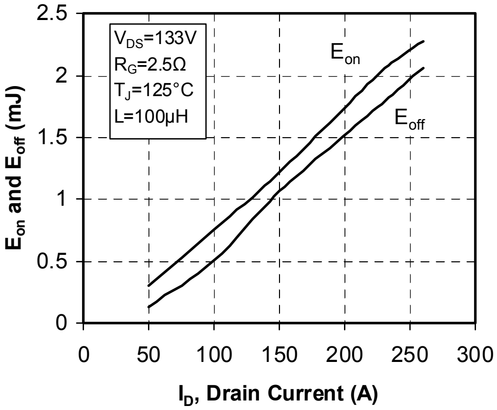
Delay Times vs Current



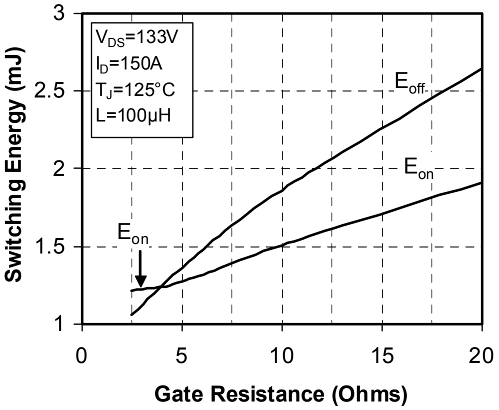
Rise and Fall times vs Current



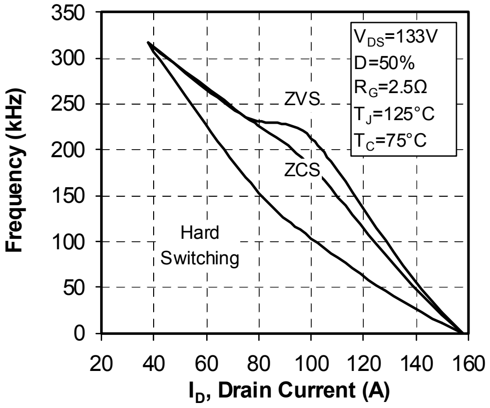
Switching Energy vs Current



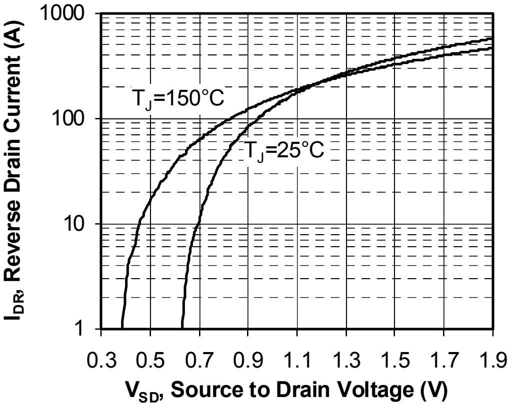
Switching Energy vs Gate Resistance



Operating Frequency vs Drain Current



Source to Drain Diode Forward Voltage



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