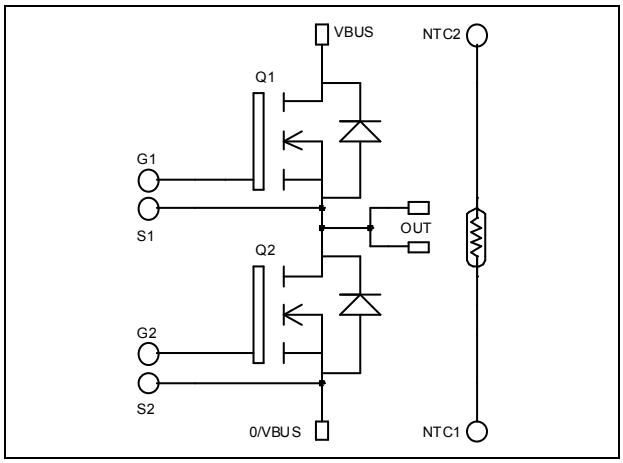
APTM50AM35FTG

Phase leg MOSFET Power Module

V_{DSS} = 500V
R_{DSon} = 35mΩ typ @ Tj = 25°C
I_D = 99A @ Tc = 25°C

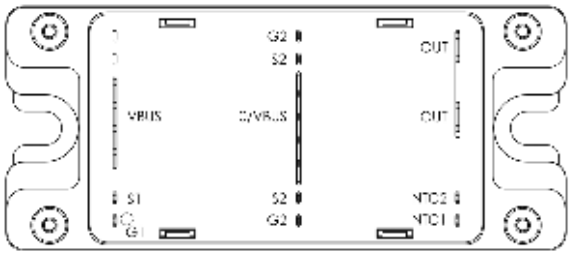


Application

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

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
  - 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
- RoHS Compliant

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	99	A
		T_c = 80°C	74	
I_{DM}	Pulsed Drain current		396	
V_{GS}	Gate - Source Voltage		±30	V
R_{DSon}	Drain - Source ON Resistance		39	mΩ
P_D	Maximum Power Dissipation	T_c = 25°C	781	W
I_{AR}	Avalanche current (repetitive and non repetitive)		51	A
E_{AR}	Repetitive Avalanche Energy		50	mJ
E_{AS}	Single Pulse Avalanche Energy		3000	

CAUTION: These Devices are sensitive to Electrostatic Discharge. Proper Handling 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} = 500V	T_j = 25°C			200	µA
		V_{GS} = 0V, V_{DS} = 400V	T_j = 125°C			1000	
$R_{DS(on)}$	Drain – Source on Resistance	V_{GS} = 10V, I_D = 49.5A			35	39	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		14		nF
C_{oss}	Output Capacitance			2.8		
C_{rss}	Reverse Transfer Capacitance			0.2		
Q_g	Total gate Charge	V_{GS} = 10V V_{Bus} = 250V I_D = 99A		280		nC
Q_{gs}	Gate – Source Charge			80		
Q_{gd}	Gate – Drain Charge			140		
$T_{d(on)}$	Turn-on Delay Time	**Inductive switching @ 125°C** V_{GS} = 15V V_{Bus} = 333V I_D = 99A R_G = 1Ω		21		ns
T_r	Rise Time			38		
$T_{d(off)}$	Turn-off Delay Time			75		
T_f	Fall Time			93		
E_{on}	Turn-on Switching Energy	**Inductive switching @ 25°C** V_{GS} = 15V, V_{Bus} = 333V I_D = 99A, R_G = 1Ω		2070		µJ
E_{off}	Turn-off Switching Energy			1690		
E_{on}	Turn-on Switching Energy	**Inductive switching @ 125°C** V_{GS} = 15V, V_{Bus} = 333V I_D = 99A, R_G = 1Ω		3112		µJ
E_{off}	Turn-off Switching Energy			2026		

Source - Drain diode ratings and characteristics

Symbol	Characteristic	Test Conditions		Min	Typ	Max	Unit
I_S	Continuous Source current (Body diode)		Tc = 25°C			99	A
			Tc = 80°C			74	
V_{SD}	Diode Forward Voltage	V_{GS} = 0V, I_S = - 99A				1.3	V
dv/dt	Peak Diode Recovery ❶					15	V/ns
t_{rr}	Reverse Recovery Time	I_S = - 99A V_R = 333V di_S/dt = 200A/µs	T_j = 25°C			270	ns
			T_j = 125°C			540	
Q_{rr}	Reverse Recovery Charge		T_j = 25°C		5.2		µC
			T_j = 125°C		19.2		

❶ dv/dt numbers reflect the limitations of the circuit rather than the device itself.
I_S ≤ - 99A di/dt ≤ 700A/µs V_R ≤ V_{DSS} T_j ≤ 150°C

Thermal and package characteristics

Symbol	Characteristic			Min	Typ	Max	Unit
R_{thJC}	Junction to Case Thermal Resistance					0.16	°C/W
V_{ISOL}	RMS Isolation Voltage, any terminal to case t =1 min, 50/60Hz			4000			V
T_J	Operating junction temperature range			-40		150	°C
T_{STG}	Storage Temperature Range			-40		125	°C
T_C	Operating Case Temperature			-40		100	°C
Torque	Mounting torque	To Heatsink	M5	2.5		4.7	N.m
Wt	Package Weight					160	g

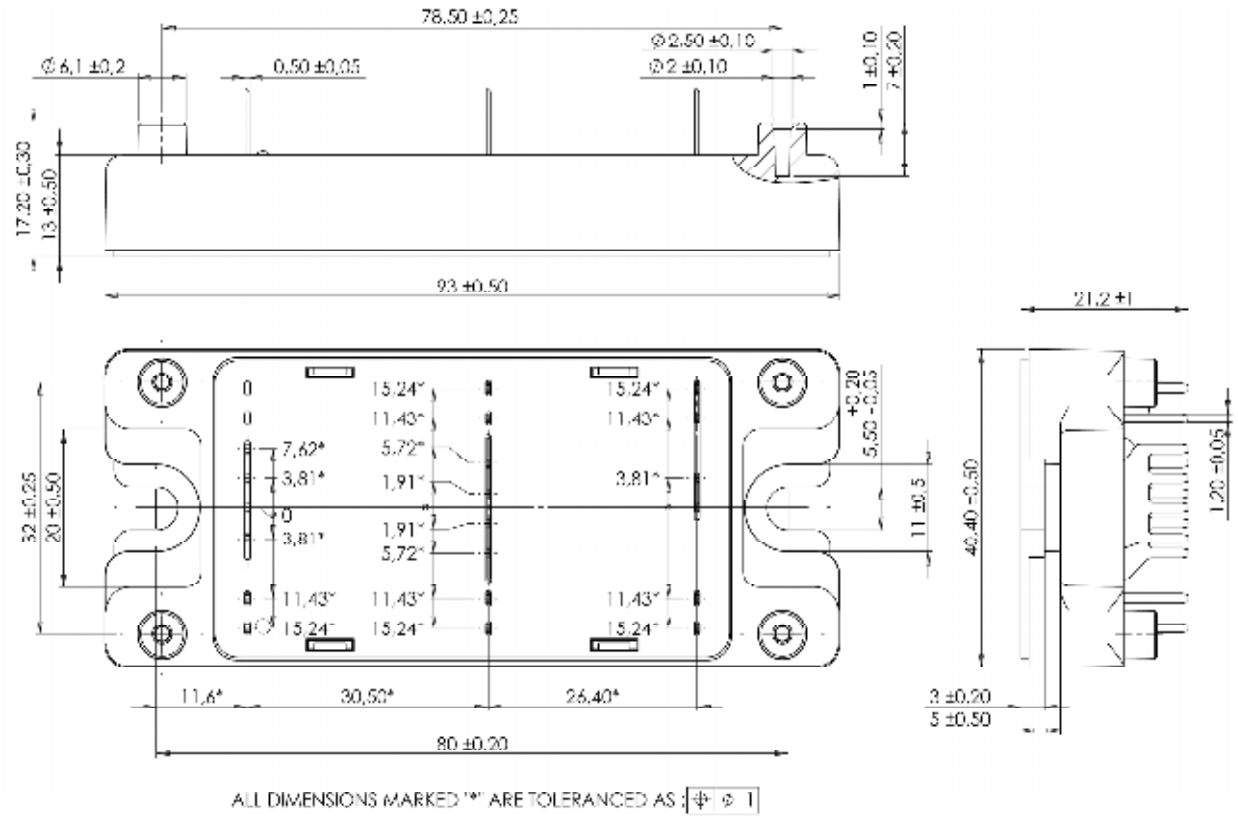
Temperature sensor NTC (see application note APT0406 on www.microsemi.com for more information).

Symbol	Characteristic	Min	Typ	Max	Unit
R_{25}	Resistance @ 25°C		50		kΩ
$B_{25/85}$	T_{25} = 298.15 K		3952		K

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

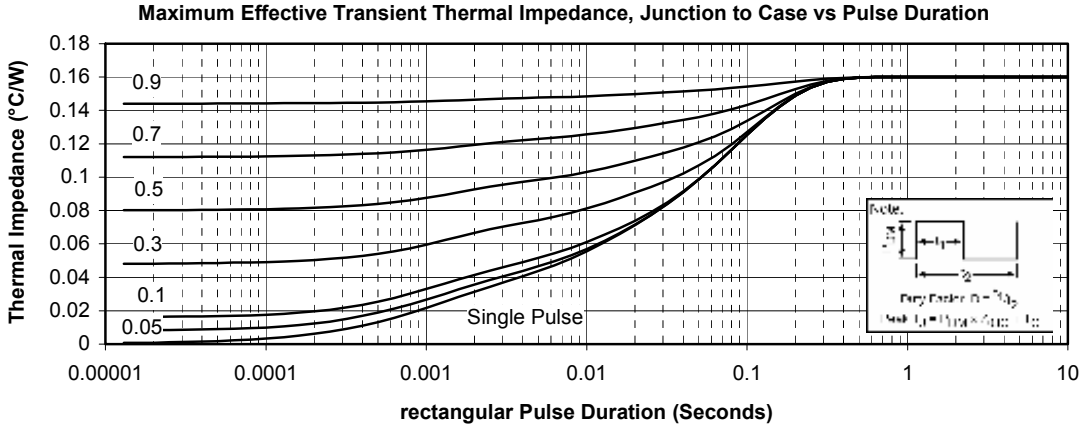
T: Thermistor temperature
R_T: Thermistor value at T

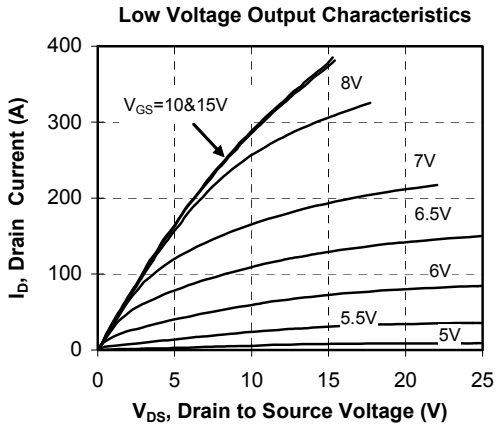
SP4 Package outline (dimensions in mm)

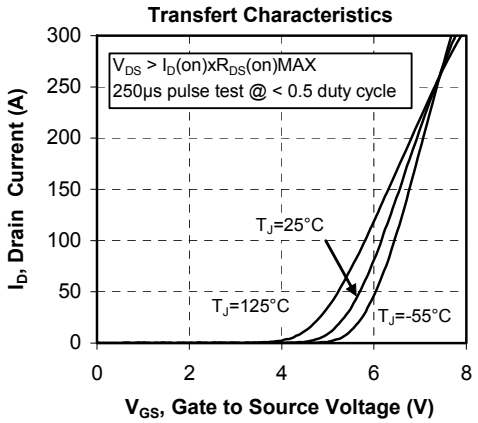


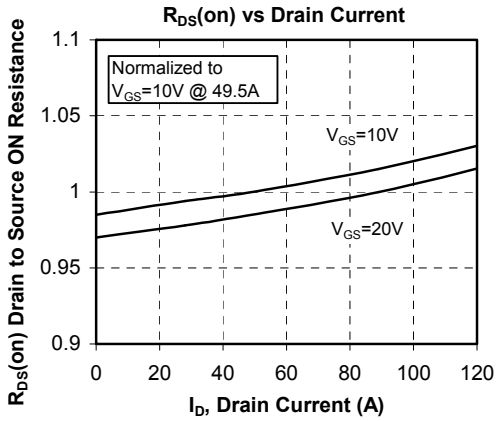
See application note APT0501 - Mounting Instructions for SP4 Power Modules on www.microsemi.com

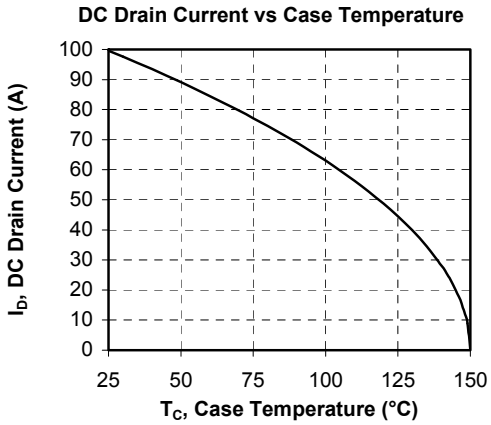
Typical Performance Curve

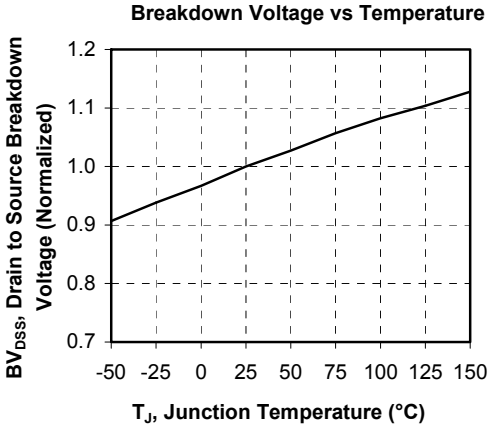


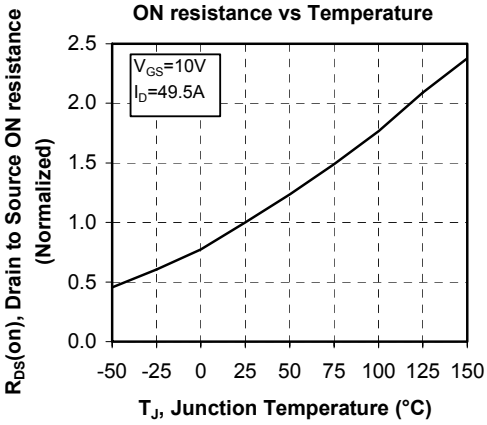


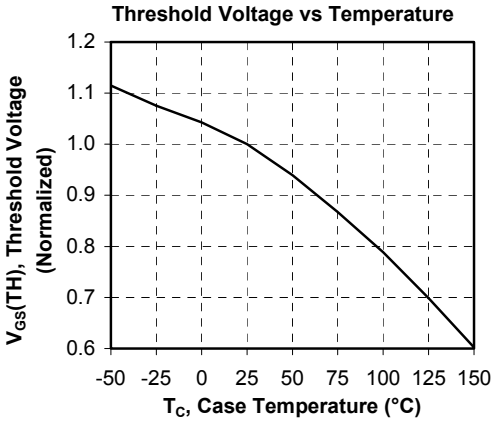


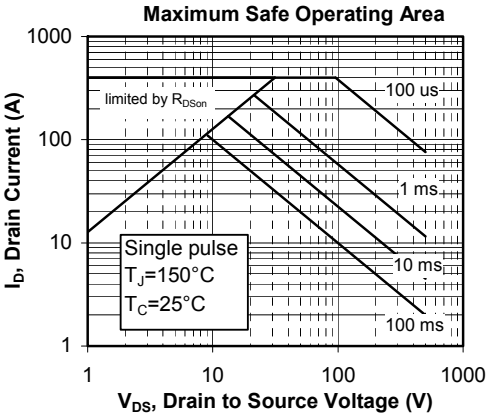


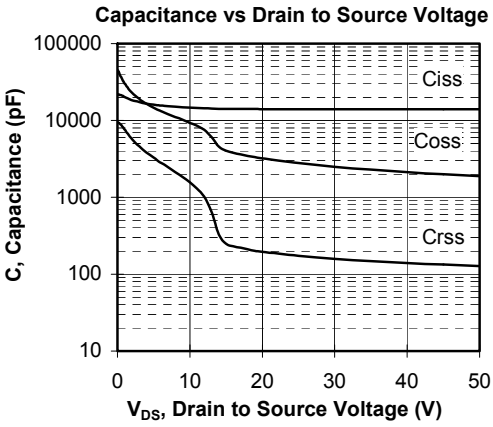


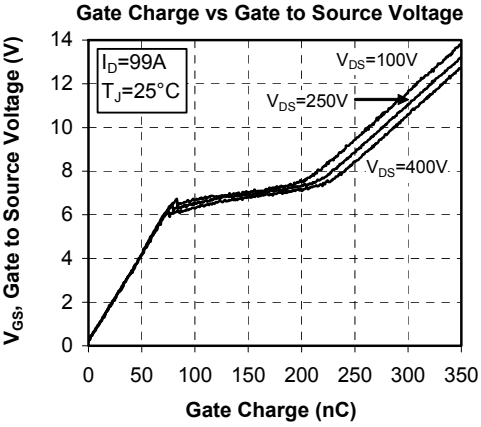

Breakdown Voltage vs Temperature
BVDSS, Drain to Source Breakdown Voltage (Normalized)
1.2
1.1
1.0
0.9
0.8
0.7
-50 -25 0 25 50 75 100 125 150
TJ, Junction Temperature (°C)

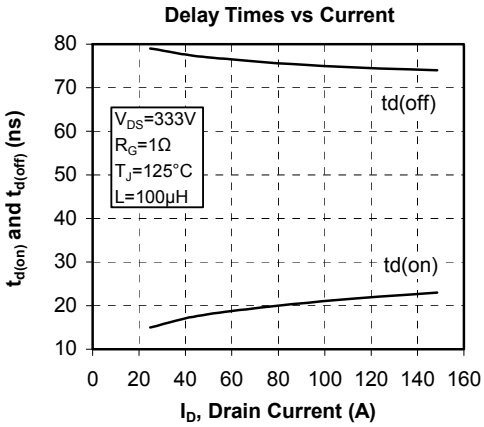

ON resistance vs Temperature
RDS(on), Drain to Source ON resistance (Normalized)
VGS=10V
ID=49.5A
2.5
2.0
1.5
1.0
0.5
0.0
-50 -25 0 25 50 75 100 125 150
TJ, Junction Temperature (°C)

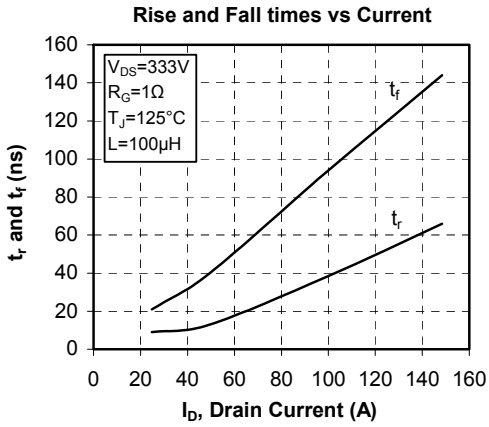

Threshold Voltage vs Temperature
VGS(TH), Threshold Voltage (Normalized)
1.2
1.1
1.0
0.9
0.8
0.7
0.6
-50 -25 0 25 50 75 100 125 150
TC, Case Temperature (°C)

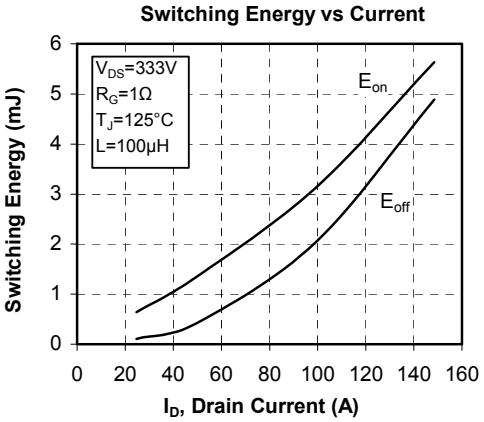

Maximum Safe Operating Area
ID, Drain Current (A)
1000
100
10
1
limited by RDSon
100 us
1 ms
10 ms
100 ms
Single pulse
TJ=150°C
TC=25°C
1 10 100 1000
VDS, Drain to Source Voltage (V)

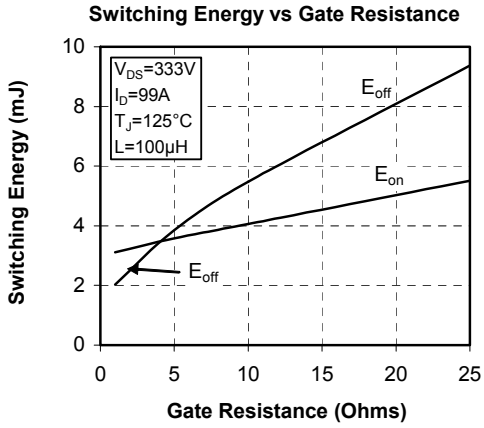

Capacitance vs Drain to Source Voltage
C, Capacitance (pF)
100000
10000
1000
100
10
Ciss
Coss
Crss
0 10 20 30 40 50
VDS, Drain to Source Voltage (V)

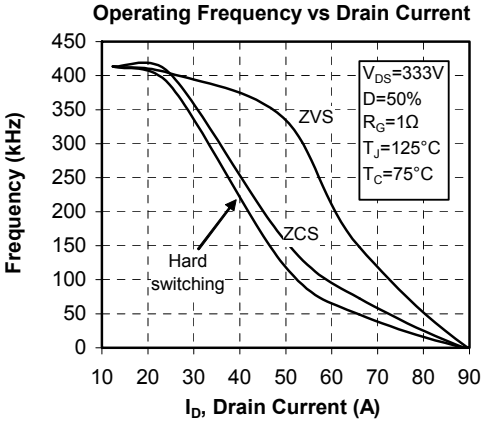

Gate Charge vs Gate to Source Voltage
VGS, Gate to Source Voltage (V)
ID=99A
TJ=25°C
VDS=100V
VDS=250V
VDS=400V
14
12
10
8
6
4
2
0
0 50 100 150 200 250 300 350
Gate Charge (nC)

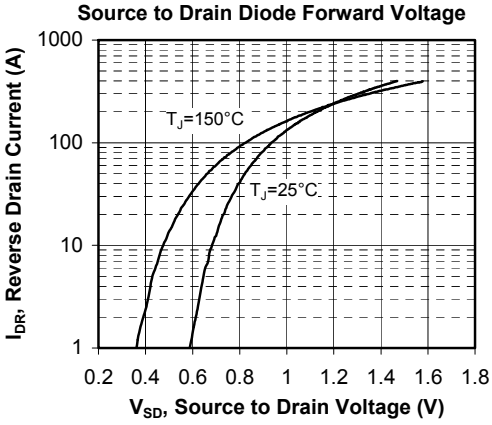

Delay Times vs Current
V_{DS}=333V
R_G=1Ω
T_J=125°C
L=100µH
td(off)
td(on)
$t_{d(on)}$ and $t_{d(off)}$ (ns)
I_D, Drain Current (A)


Rise and Fall times vs Current
V_{DS}=333V
R_G=1Ω
T_J=125°C
L=100µH
t_f
t_r
t_r and t_f (ns)
I_D, Drain Current (A)


Switching Energy vs Current
V_{DS}=333V
R_G=1Ω
T_J=125°C
L=100µH
E_{on}
E_{off}
Switching Energy (mJ)
I_D, Drain Current (A)


Switching Energy vs Gate Resistance
V_{DS}=333V
I_D=99A
T_J=125°C
L=100µH
E_{off}
E_{on}
E_{off}
Switching Energy (mJ)
Gate Resistance (Ohms)


Operating Frequency vs Drain Current
V_{DS}=333V
D=50%
R_G=1Ω
T_J=125°C
T_C=75°C
ZVS
ZCS
Hard
switching
Frequency (kHz)
I_D, Drain Current (A)


Source to Drain Diode Forward Voltage
T_J=150°C
T_J=25°C
I_{DR}, Reverse Drain Current (A)
V_{SD}, Source to Drain Voltage (V)

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