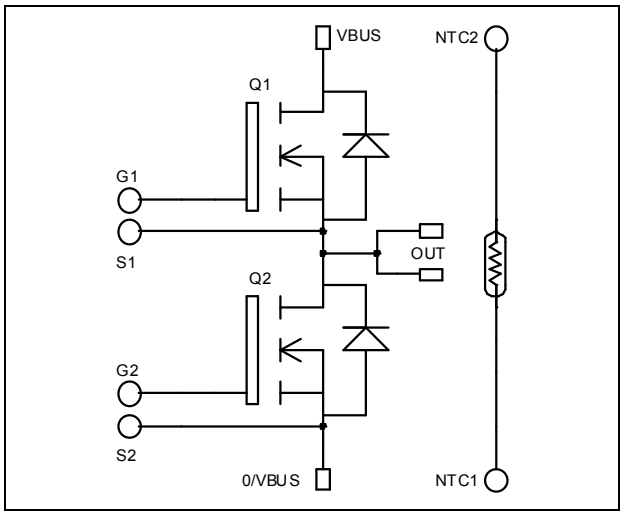
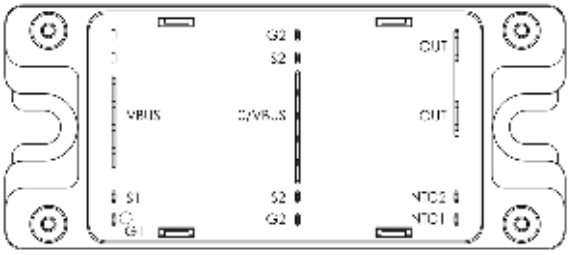
APTM100A18FTG

Phase leg MOSFET Power Module

V_{DSS} = 1000V
R_{DSon} = 180mΩ typ @ Tj = 25°C
I_D = 43A @ 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
  - 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		1000	V
I_D	Continuous Drain Current	T_c = 25°C	43	A
		T_c = 80°C	33	
I_{DM}	Pulsed Drain current		172	
V_{GS}	Gate - Source Voltage		±30	V
R_{DSon}	Drain - Source ON Resistance		210	mΩ
P_D	Maximum Power Dissipation	T_c = 25°C	780	W
I_{AR}	Avalanche current (repetitive and non repetitive)		25	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} = 1000V	T_j = 25°C			200	µA
		V_{GS} = 0V, V_{DS} = 800V	T_j = 125°C			1000	
$R_{DS(on)}$	Drain – Source on Resistance	V_{GS} = 10V, I_D = 21.5A			180	210	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		10.4		nF
C_{oss}	Output Capacitance			1.76		
C_{rss}	Reverse Transfer Capacitance			0.32		
Q_g	Total gate Charge	V_{GS} = 10V V_{Bus} = 500V I_D = 43A		372		nC
Q_{gs}	Gate – Source Charge			48		
Q_{gd}	Gate – Drain Charge			244		
$T_{d(on)}$	Turn-on Delay Time	**Inductive switching @ 125°C** V_{GS} = 15V V_{Bus} = 670V I_D = 43A R_G = 2.5Ω		18		ns
T_r	Rise Time			12		
$T_{d(off)}$	Turn-off Delay Time			155		
T_f	Fall Time			40		
E_{on}	Turn-on Switching Energy	**Inductive switching @ 25°C** V_{GS} = 15V, V_{Bus} = 670V I_D = 43A, R_G = 2.5Ω		1800		µJ
E_{off}	Turn-off Switching Energy			1246		
E_{on}	Turn-on Switching Energy	**Inductive switching @ 125°C** V_{GS} = 15V, V_{Bus} = 670V I_D = 43A, R_G = 2.5Ω		2846		µJ
E_{off}	Turn-off Switching Energy			1558		

Source - Drain diode ratings and characteristics

Symbol	Characteristic	Test Conditions		Min	Typ	Max	Unit
I_S	Continuous Source current (Body diode)		Tc = 25°C			43	A
			Tc = 80°C			33	
V_{SD}	Diode Forward Voltage	V_{GS} = 0V, I_S = - 43A				1.3	V
dv/dt	Peak Diode Recovery ❶					18	V/ns
t_{rr}	Reverse Recovery Time	I_S = - 43A V_R = 670V di_S/dt = 200A/µs	T_j = 25°C			320	ns
			T_j = 125°C			650	
Q_{rr}	Reverse Recovery Charge		T_j = 25°C		7.2		µC
			T_j = 125°C		19.5		

❶ dv/dt numbers reflect the limitations of the circuit rather than the device itself.
$I_S \leq$ - 43A di/dt ≤ 700A/µs $V_R \leq V_{DSS}$ $T_j \leq$ 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	
T_C	Operating Case Temperature			-40		100	
Torque	Mounting torque	To Heatsink	M5	2.5		4.7	N.m
Wt	Package Weight					160	g

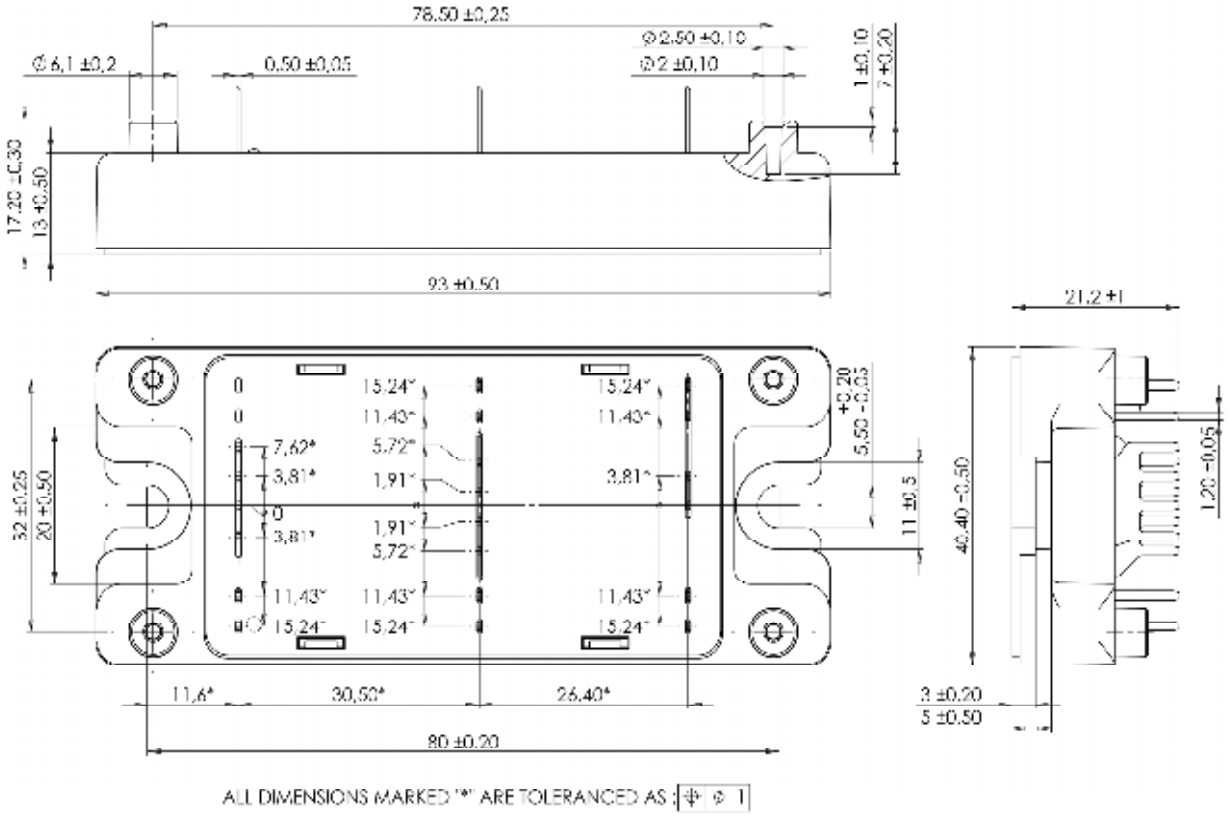
Temperature sensor NTC (see application note APT0406 on www.microsemi.com for more information).

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

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

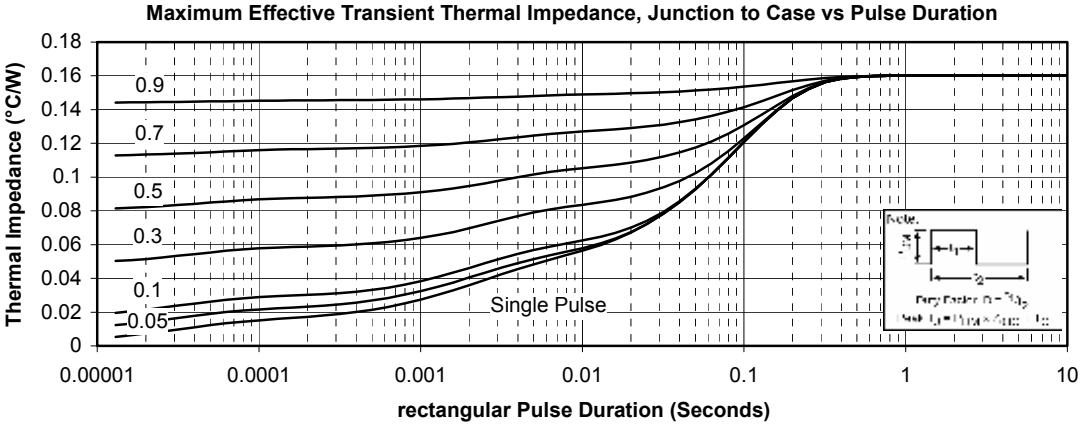
T: Thermistor temperature
R_T: Thermistor value at T

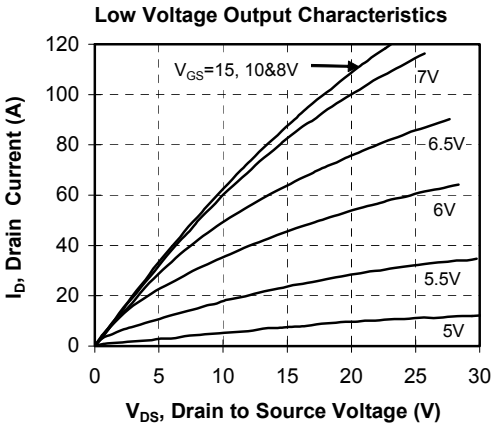
SP4 Package outline (dimensions in mm)

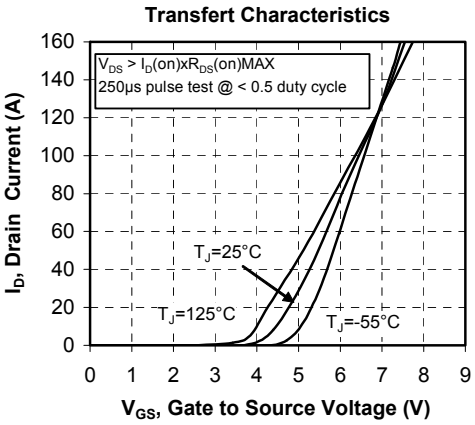


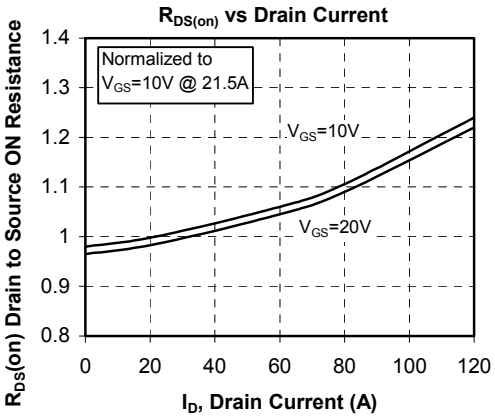
See application note APT0501 - Mounting Instructions for SP4 Power Modules on www.microsemi.com

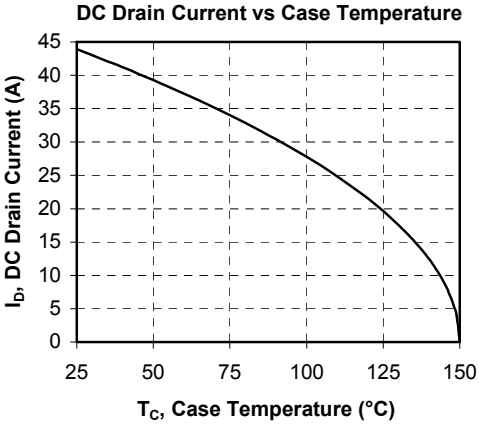
Typical Performance Curve

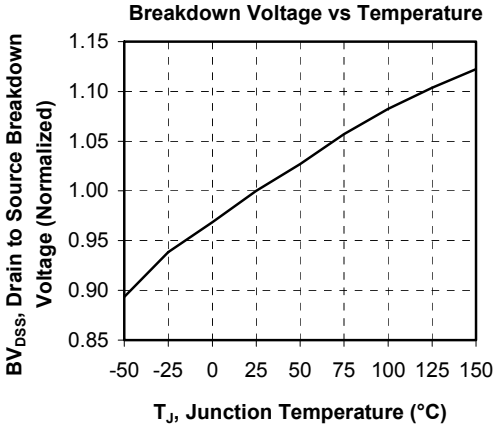


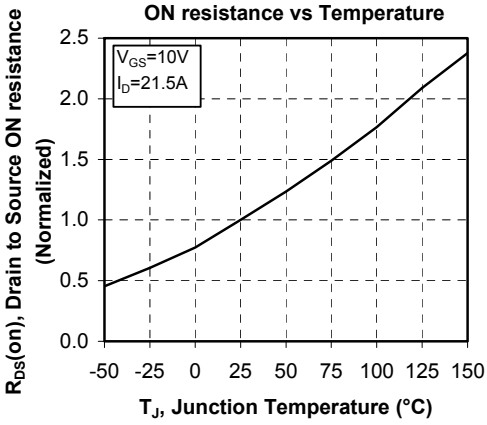


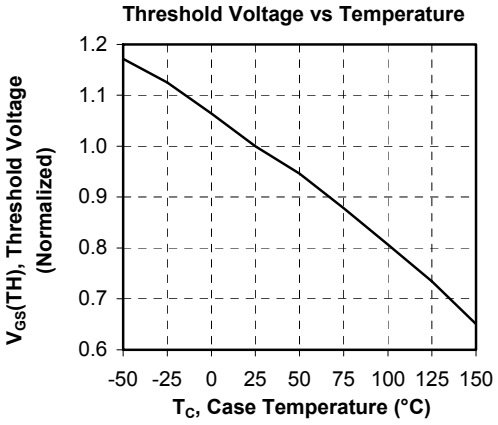


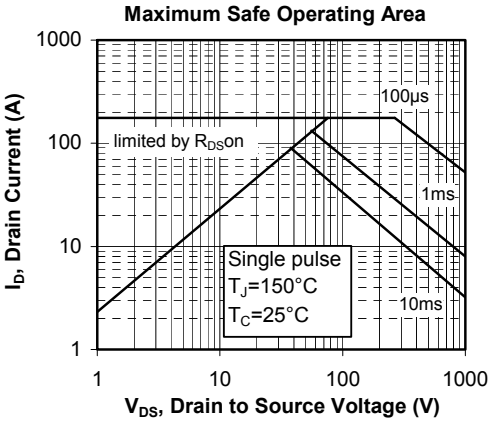


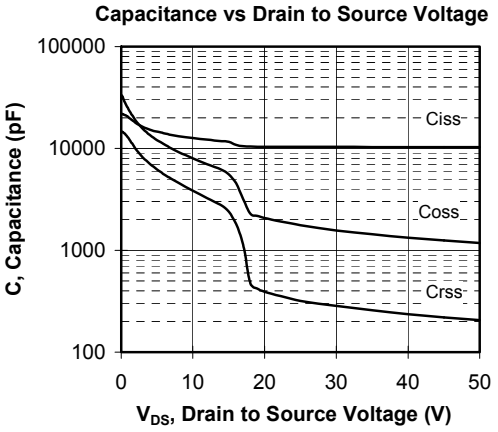


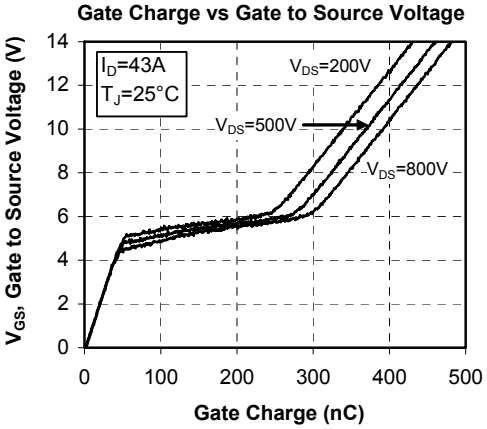

Breakdown Voltage vs Temperature
BVDSS, Drain to Source Breakdown Voltage (Normalized)
1.15
1.10
1.05
1.00
0.95
0.90
0.85
-50 -25 0 25 50 75 100 125 150
TJ, Junction Temperature (°C)

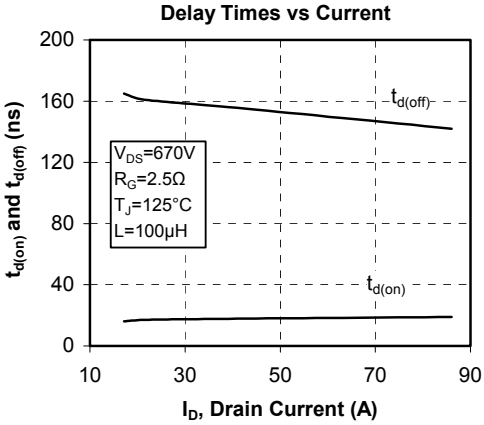

ON resistance vs Temperature
VGS=10V
ID=21.5A
RDS(on), Drain to Source ON resistance (Normalized)
2.5
2.0
1.5
1.0
0.5
0.0
-50 -25 0 25 50 75 100 125 150
TJ, Junction Temperature (°C)

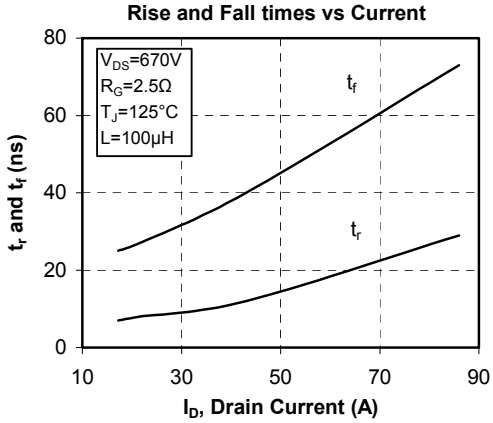

Threshold Voltage vs Temperature
VGS(TH), Threshold Voltage (Normalized)
1.2
1.1
1.0
0.9
0.8
0.7
0.6
-50 -25 0 25 50 75 100 125 150
TC, Case Temperature (°C)

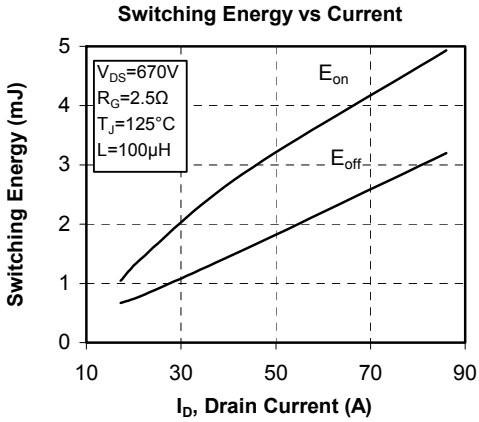

Maximum Safe Operating Area
ID, Drain Current (A)
1000
100
10
1
100µs
limited by RDSon
1ms
Single pulse
TJ=150°C
TC=25°C
10ms
1 10 100 1000
VDS, Drain to Source Voltage (V)

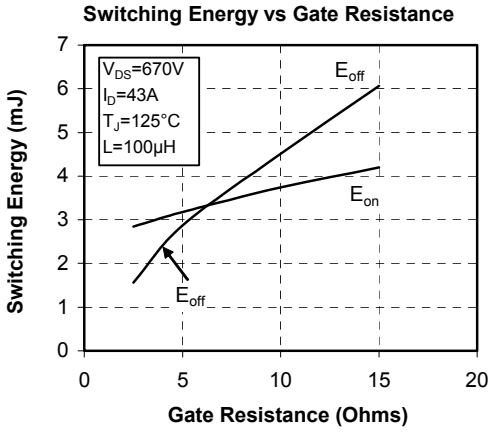

Capacitance vs Drain to Source Voltage
C, Capacitance (pF)
100000
10000
1000
100
Ciss
Coss
Crss
0 10 20 30 40 50
VDS, Drain to Source Voltage (V)

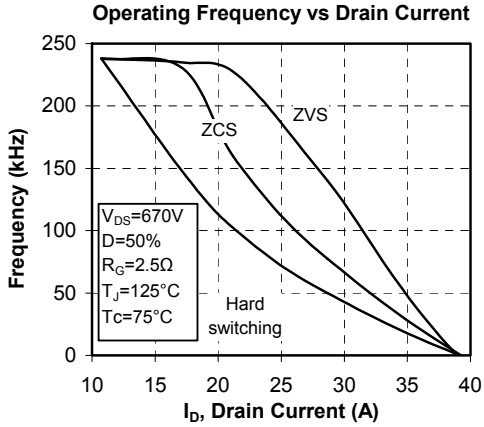

Gate Charge vs Gate to Source Voltage
ID=43A
TJ=25°C
VDS=200V
VDS=500V
VDS=800V
VGS, Gate to Source Voltage (V)
14
12
10
8
6
4
2
0
0 100 200 300 400 500
Gate Charge (nC)

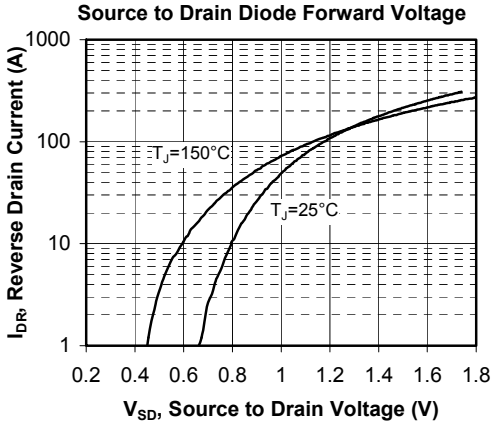

Delay Times vs Current
$t_{d(on)}$ and $t_{d(off)}$ (ns)
I_D, Drain Current (A)
$t_{d(off)}$
$t_{d(on)}$
V_{DS}=670V
R_G=2.5Ω
T_J=125°C
L=100µH


Rise and Fall times vs Current
t_r and t_f (ns)
I_D, Drain Current (A)
t_f
t_r
V_{DS}=670V
R_G=2.5Ω
T_J=125°C
L=100µH


Switching Energy vs Current
Switching Energy (mJ)
I_D, Drain Current (A)
E_{on}
E_{off}
V_{DS}=670V
R_G=2.5Ω
T_J=125°C
L=100µH


Switching Energy vs Gate Resistance
Switching Energy (mJ)
Gate Resistance (Ohms)
E_{off}
E_{on}
E_{off}
V_{DS}=670V
I_D=43A
T_J=125°C
L=100µH


Operating Frequency vs Drain Current
Frequency (kHz)
I_D, Drain Current (A)
ZVS
ZCS
Hard switching
V_{DS}=670V
D=50%
R_G=2.5Ω
T_J=125°C
Tc=75°C


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

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