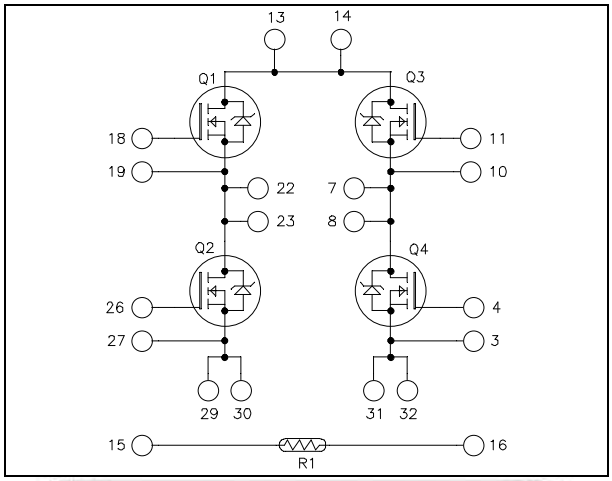
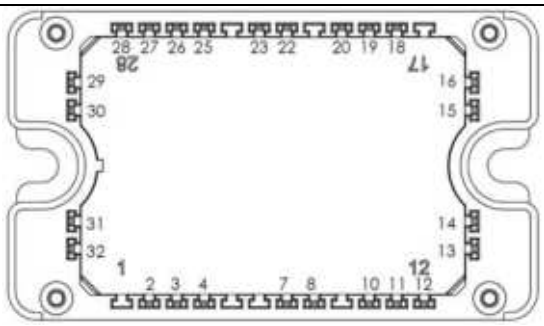
APTM50H14FT3G

Full - Bridge MOSFET Power Module

V_{DSS} = 500V
R_{DSon} = 140mΩ typ @ Tj = 25°C
I_D = 26A @ Tc = 25°C





All multiple inputs and outputs must be shorted together
Example: 13/14 ; 29/30 ; 22/23 …

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
- Internal thermistor for temperature monitoring

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
- Each leg can be easily paralleled to achieve a phase leg of twice the current capability
- RoHS Compliant

All ratings @ T_j = 25°C unless otherwise specified

Absolute maximum ratings (Per MOSFET)

Symbol	*Parameter*		*Max ratings*	*Unit*
V_{DSS}	Drain - Source Voltage		500	V
I_D	Continuous Drain Current	T_c = 25°C	26	A
		T_c = 80°C	18	
I_{DM}	Pulsed Drain current		105	
V_{GS}	Gate - Source Voltage		±30	V
R_{DSon}	Drain - Source ON Resistance		168	mΩ
P_D	Power Dissipation	T_c = 25°C	208	W
I_{AR}	Avalanche current (repetitive and non repetitive)		35	A
E_{AR}	Repetitive Avalanche Energy		30	mJ
E_{AS}	Single Pulse Avalanche Energy		1300	

CAUTION: These Devices are sensitive to Electrostatic Discharge. Proper Handling Procedures Should Be Followed.

Electrical Characteristics (Per MOSFET)

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
I_{DSS}	Zero Gate Voltage Drain Current	V_{GS} = 0V,V_{DS} = 500V			100	µA
$R_{DS(on)}$	Drain – Source on Resistance	V_{GS} = 10V, I_D = 13A		140	168	mΩ
$V_{GS(th)}$	Gate Threshold Voltage	V_{GS} = V_{DS}, I_D = 1mA	3		5	V
I_{GSS}	Gate – Source Leakage Current	V_{GS} = ±30 V, V_{DS} = 0V			±100	nA

Dynamic Characteristics (Per MOSFET)

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
C_{iss}	Input Capacitance	V_{GS} = 0V V_{DS} = 25V f = 1MHz		3259		pF
C_{oss}	Output Capacitance			709		
C_{rss}	Reverse Transfer Capacitance			51		
Q_g	Total gate Charge	V_{GS} = 10V V_{Bus} = 250V I_D = 26A		72		nC
Q_{gs}	Gate – Source Charge			20		
Q_{gd}	Gate – Drain Charge			36		
$T_{d(on)}$	Turn-on Delay Time	**Inductive switching @ 125°C** V_{GS} = 15V V_{Bus} = 333V I_D = 26A R_G = 5Ω		10		ns
T_r	Rise Time			17		
$T_{d(off)}$	Turn-off Delay Time			50		
T_f	Fall Time			41		
E_{on}	Turn-on Switching Energy	**Inductive switching @ 25°C** V_{GS} = 15V, V_{Bus} = 333V I_D = 26A, R_G = 5Ω		326		µJ
E_{off}	Turn-off Switching Energy			250		
E_{on}	Turn-on Switching Energy	**Inductive switching @ 125°C** V_{GS} = 15V, V_{Bus} = 333V I_D = 26A, R_G = 5Ω		548		µJ
E_{off}	Turn-off Switching Energy			288		
R_{thJC}	Junction to Case Thermal Resistance				0.6	°C/W

Source - Drain diode ratings and characteristics (Per MOSFET)

Symbol	Characteristic	Test Conditions		Min	Typ	Max	Unit
I_S	Continuous Source current (Body diode)		Tc = 25°C		26		A
			Tc = 80°C		18		
V_{SD}	Diode Forward Voltage	V_{GS} = 0V, I_S = - 26A				1.3	V
dv/dt	Peak Diode Recovery ❶					15	V/ns
t_{rr}	Reverse Recovery Time	I_S = - 26A V_R = 333V di_S/dt = 100A/µs	T_j = 25°C			250	ns
			T_j = 125°C			525	
Q_{rr}	Reverse Recovery Charge		T_j = 25°C		1.6		µC
			T_j = 125°C		6		

❶ dv/dt numbers reflect the limitations of the circuit rather than the device itself.
$I_S \leq$ - 26A di/dt ≤ 700A/µs $V_R \leq V_{DSS}$ $T_j \leq$ 150°C

Thermal and package characteristics

Symbol	Characteristic			Min	Max	Unit
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_{JOP}	Recommended junction temperature under switching conditions			-40	$T_J$max - 25	
T_{STG}	Storage Temperature Range			-40	125	
T_C	Operating Case Temperature			-40	125	
Torque	Mounting torque	To heatsink	M4	2	3	N.m
Wt	Package Weight				110	g

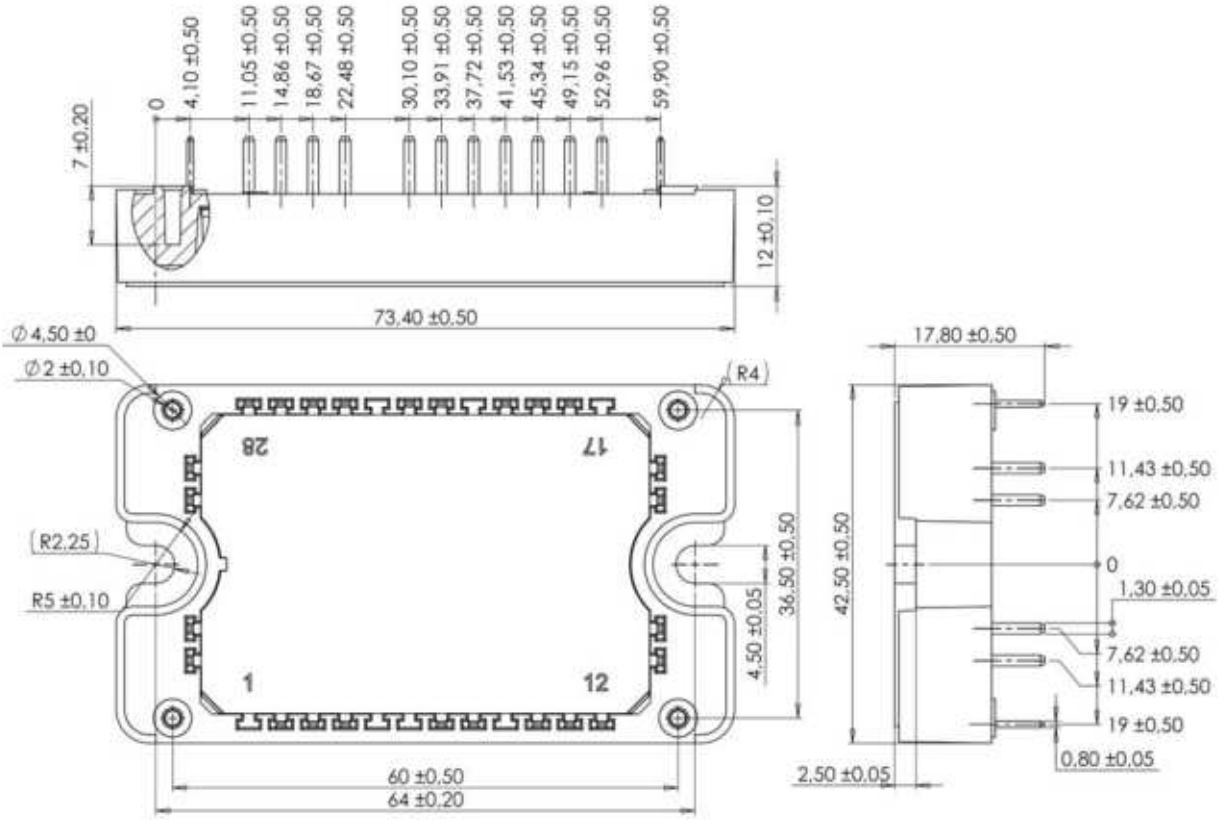
Temperature sensor NTC (see application note APT0406 on www.microsemi.com for more information).

Symbol	Characteristic		Min	Typ	Max	Unit
R_{25}	Resistance @ 25°C			50		kΩ
$\Delta R_{25}/R_{25}$				5		%
$B_{25/85}$	T_{25} = 298.15 K			3952		K
ΔB/B		T_C=100°C		4		%

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

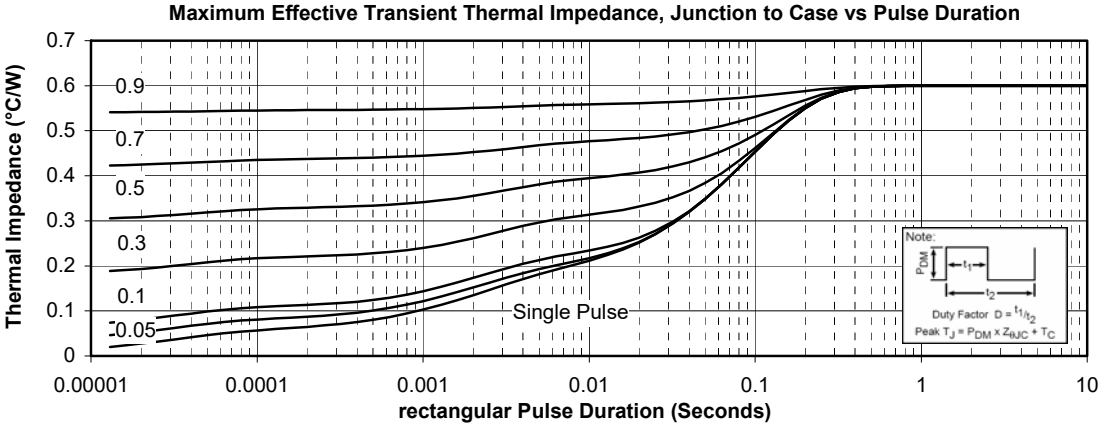
T: Thermistor temperature
R_T: Thermistor value at T

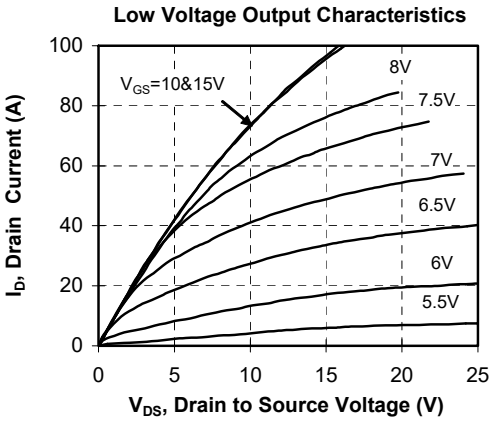
Package outline (dimensions in mm)

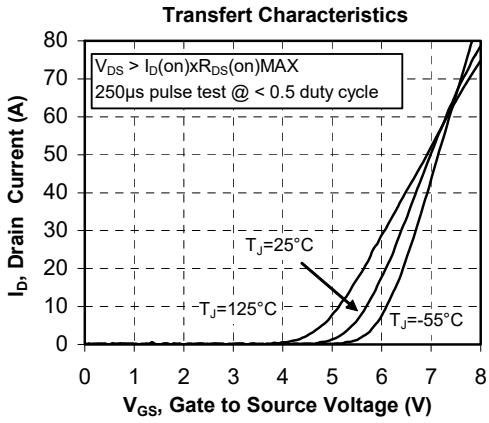


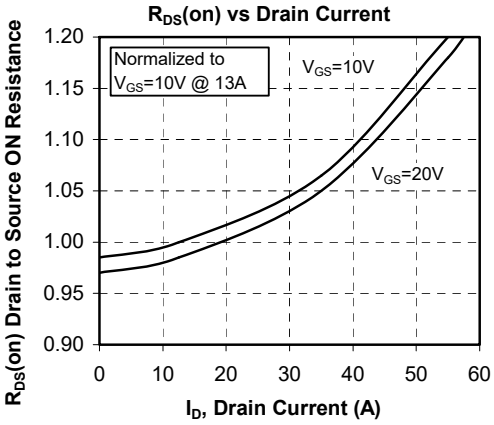
See application note 1906 - Mounting Instructions for SP3F Power Modules on www.microsemi.com

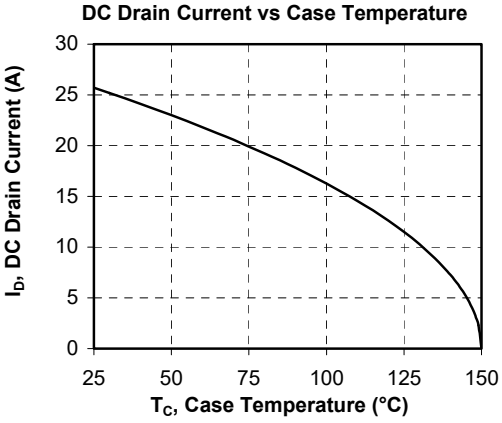
Typical Performance Curve

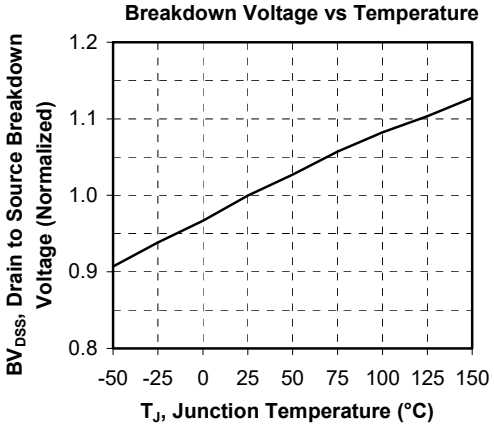


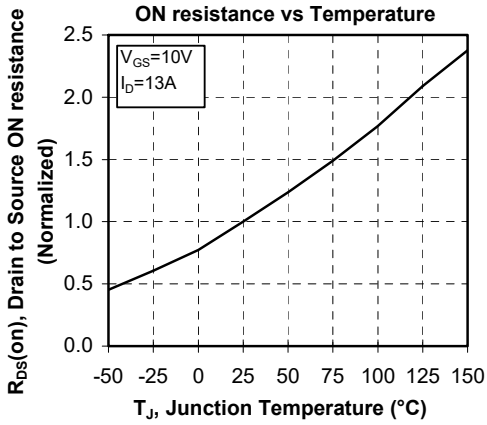


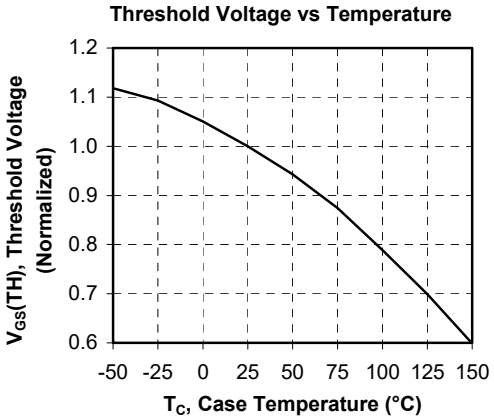


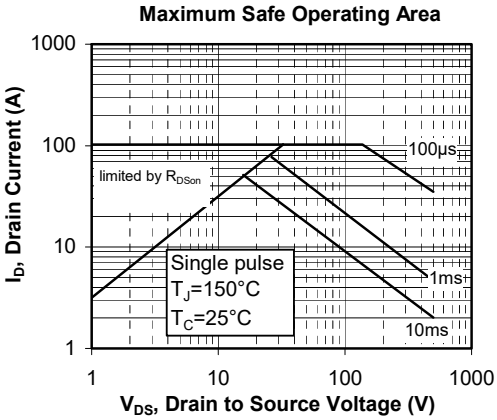


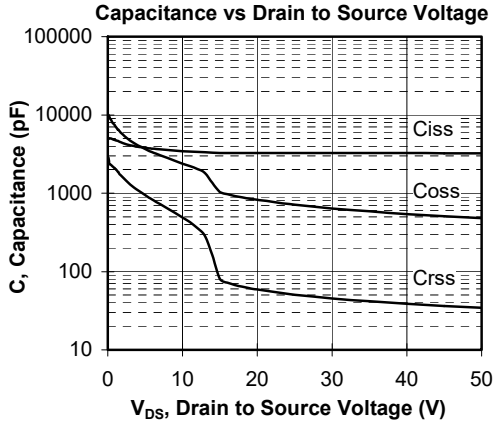


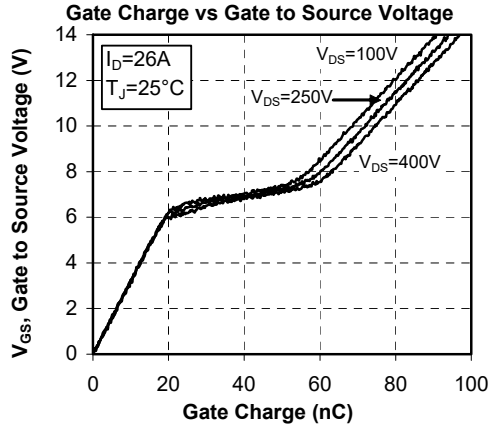

Breakdown Voltage vs Temperature
BVDSS, Drain to Source Breakdown Voltage (Normalized)
1.2
1.1
1.0
0.9
0.8
-50 -25 0 25 50 75 100 125 150
TJ, Junction Temperature (°C)

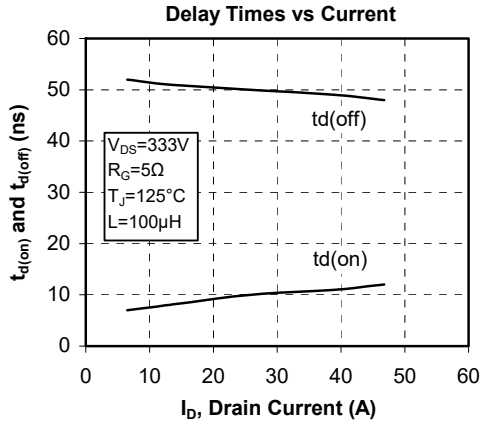

ON resistance vs Temperature
VGS=10V
ID=13A
RDS(on), Drain to Source ON resistance (Normalized)
2.5
2.0
1.5
1.0
0.5
0.0
-50 -25 0 25 50 75 100 125 150
TJ, Junction Temperature (°C)

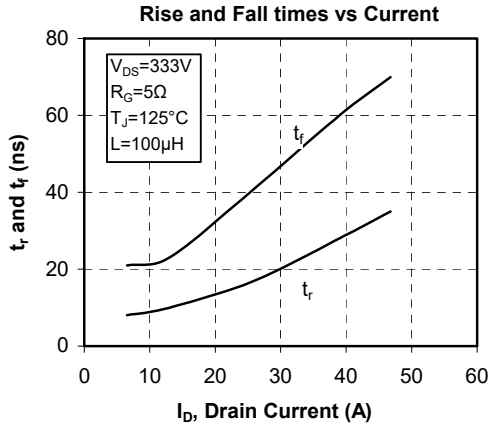

Threshold Voltage vs Temperature
VGS(TH), Threshold Voltage (Normalized)
1.2
1.1
1.0
0.9
0.8
0.7
0.6
-50 -25 0 25 50 75 100 125 150
TC, Case Temperature (°C)

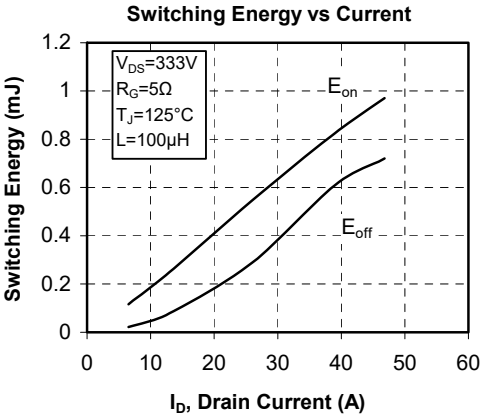

Maximum Safe Operating Area
ID, Drain Current (A)
1000
100
10
1
limited by RDSon
100µs
1ms
10ms
Single pulse
TJ=150°C
TC=25°C
1 10 100 1000
VDS, Drain to Source Voltage (V)

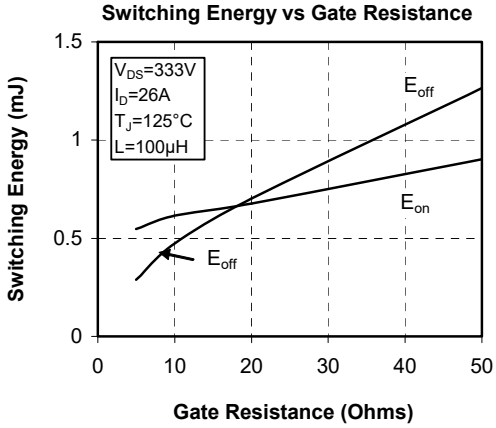

Capacitance vs Drain to Source Voltage
C, Capacitance (pF)
100000
10000
1000
100
10
Ciss
Coss
Crss
0 10 20 30 40 50
VDS, Drain to Source Voltage (V)

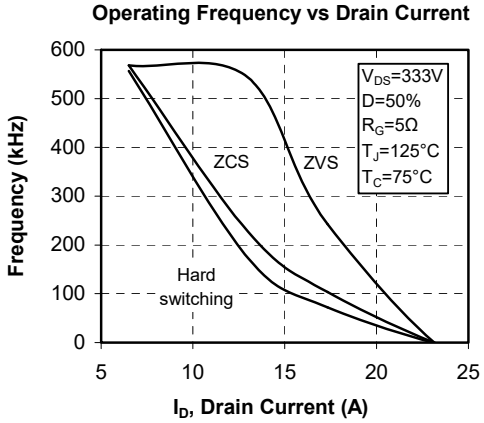

Gate Charge vs Gate to Source Voltage
ID=26A
TJ=25°C
VDS=100V
VDS=250V
VDS=400V
VGS, Gate to Source Voltage (V)
14
12
10
8
6
4
2
0
0 20 40 60 80 100
Gate Charge (nC)

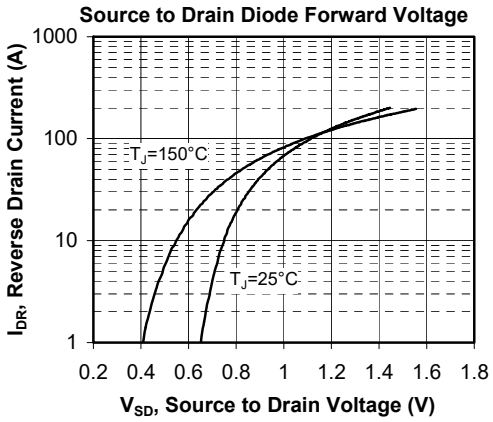

Delay Times vs Current
td(off)
td(on)
VDS=333V
RG=5Ω
TJ=125°C
L=100µH
td(on) and td(off) (ns)
ID, Drain Current (A)


Rise and Fall times vs Current
VDS=333V
RG=5Ω
TJ=125°C
L=100µH
tf
tr
tr and tf (ns)
ID, Drain Current (A)


Switching Energy vs Current
VDS=333V
RG=5Ω
TJ=125°C
L=100µH
Eon
Eoff
Switching Energy (mJ)
ID, Drain Current (A)


Switching Energy vs Gate Resistance
VDS=333V
ID=26A
TJ=125°C
L=100µH
Eoff
Eon
Eoff
Switching Energy (mJ)
Gate Resistance (Ohms)


Operating Frequency vs Drain Current
VDS=333V
D=50%
RG=5Ω
TJ=125°C
TC=75°C
ZCS
ZVS
Hard
switching
Frequency (kHz)
ID, Drain Current (A)


Source to Drain Diode Forward Voltage
TJ=150°C
TJ=25°C
IDR, Reverse Drain Current (A)
VSD, Source to Drain Voltage (V)

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