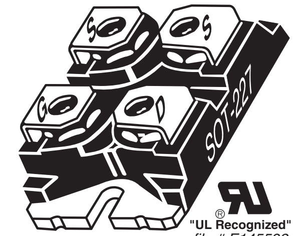
APT22F100J

1000V, 23A, 0.38Ω Max, t_{rr} ≤300ns

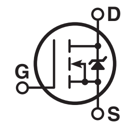
N-Channel FREDFET

Power MOS 8™ is a high speed, high voltage N-channel switch-mode power MOSFET. This 'FREDFET' version has a drain-source (body) diode that has been optimized for high reliability in ZVS phase shifted bridge and other circuits through reduced t_{rr}, soft recovery, and high recovery dv/dt capability. Low gate charge, high gain, and a greatly reduced ratio of C_{rss}/C_{iss} result in excellent noise immunity and low switching loss. The intrinsic gate resistance and capacitance of the poly-silicon gate structure help control di/dt during switching, resulting in low EMI and reliable paralleling, even when switching at very high frequency.



ISOTOP®
APT22F100J

Single die FREDFET



FEATURES

- Fast switching with low EMI
- Low t_{rr} for high reliability
- Ultra low C_{rss} for improved noise immunity
- Low gate charge
- Avalanche energy rated
- RoHS compliant

TYPICAL APPLICATIONS

- ZVS phase shifted and other full bridge
- Half bridge
- PFC and other boost converter
- Buck converter
- Single and two switch forward
- Flyback

Absolute Maximum Ratings

Symbol	Parameter	Ratings	Unit
I_D	Continuous Drain Current @ T_C = 25°C	23	A
	Continuous Drain Current @ T_C = 100°C	15	
I_{DM}	Pulsed Drain Current ①	140	
V_{GS}	Gate-Source Voltage	±30	V
E_{AS}	Single Pulse Avalanche Energy ②	2165	mJ
I_{AR}	Avalanche Current, Repetitive or Non-Repetitive	18	A

Thermal and Mechanical Characteristics

Symbol	Characteristic	Min	Typ	Max	Unit
P_D	Total Power Dissipation @ T_C = 25°C			545	W
$R_{\theta JC}$	Junction to Case Thermal Resistance			0.23	°C/W
$R_{\theta CS}$	Case to Sink Thermal Resistance, Flat, Greased Surface		0.11		
T_J,T_{STG}	Operating and Storage Junction Temperature Range	-55		150	°C
$V_{Isolation}$	RMS Voltage (50-60hHz Sinusoidal Waveform from Terminals to Mounting Base for 1 Min.)	2500			V
W_T	Package Weight		1.03		oz
			29.2		g
Torque	Terminals and Mounting Screws.			10	in·lbf
				1.1	N·m

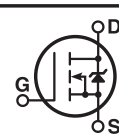
Static Characteristics T_J = 25°C unless otherwise specified   APT22F100J

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
$V_{BR(DSS)}$	Drain-Source Breakdown Voltage	V_{GS} = 0V, I_D = 250µA	1000			V
$\Delta V_{BR(DSS)}/\Delta T_J$	Breakdown Voltage Temperature Coefficient	Reference to 25°C, I_D = 250µA		1.15		V/°C
$R_{DS(on)}$	Drain-Source On Resistance ③	V_{GS} = 10V, I_D = 18A		0.32	0.38	Ω
$V_{GS(th)}$	Gate-Source Threshold Voltage	V_{GS} = V_{DS}, I_D = 2.5mA	2.5	4	5	V
$\Delta V_{GS(th)}/\Delta T_J$	Threshold Voltage Temperature Coefficient			-10		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 1000V, V_{GS} = 0V; T_J = 25°C			250	µA
		T_J = 125°C			1000	
I_{GSS}	Gate-Source Leakage Current	V_{GS} = ±30V			±100	nA

Dynamic Characteristics T_J = 25°C unless otherwise specified

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
g_{fs}	Forward Transconductance	V_{DS} = 50V, I_D = 18A		39		S
C_{iss}	Input Capacitance	V_{GS} = 0V, V_{DS} = 25V f = 1MHz		9835		pF
C_{rss}	Reverse Transfer Capacitance			130		
C_{oss}	Output Capacitance			825		
$C_{o(cr)}$ ④	Effective Output Capacitance, Charge Related	V_{GS} = 0V, V_{DS} = 0V to 667V		335		
$C_{o(er)}$ ⑤	Effective Output Capacitance, Energy Related			170		
Q_g	Total Gate Charge	V_{GS} = 0 to 10V, I_D = 18A, V_{DS} = 500V		305		nC
Q_{gs}	Gate-Source Charge			55		
Q_{gd}	Gate-Drain Charge			145		
$t_{d(on)}$	Turn-On Delay Time	**Resistive Switching** V_{DD} = 667V, I_D = 18A R_G = 2.2Ω ⑥, V_{GG} = 15V		44		ns
t_r	Current Rise Time			40		
$t_{d(off)}$	Turn-Off Delay Time			150		
t_f	Current Fall Time			38		

Source-Drain Diode Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
I_S	Continuous Source Current (Body Diode)	MOSFET symbol showing the integral reverse p-n junction diode (body diode) 			23	A
I_{SM}	Pulsed Source Current (Body Diode) ①				140	
V_{SD}	Diode Forward Voltage	I_{SD} = 18A, T_J = 25°C, V_{GS} = 0V			1.1	V
t_{rr}	Reverse Recovery Time	I_{SD} = 18A ③, V_{DD} = 100V, di_{SD}/dt = 100A/µs; T_J = 25°C			300	ns
		T_J = 125°C			650	
Q_{rr}	Reverse Recovery Charge	T_J = 25°C		1.61		µC
		T_J = 125°C		4.21		
I_{rrm}	Reverse Recovery Current	T_J = 25°C		11.6		A
		T_J = 125°C		15.8		
dv/dt	Peak Recovery dv/dt	I_{SD} ≤ 18A, di/dt ≤1000A/µs, V_{DD} = 667V, T_J = 125°C			25	V/ns

① Repetitive Rating: Pulse width and case temperature limited by maximum junction temperature.

② Starting at T_J = 25°C, L = 13.36mH, R_G = 25Ω, I_{AS} = 18A.

③ Pulse test: Pulse Width < 380µs, duty cycle < 2%.

④ $C_{o(cr)}$ is defined as a fixed capacitance with the same stored charge as C_{OSS} with V_{DS} = 67% of $V_{(BR)DSS}$.

⑤ $C_{o(er)}$ is defined as a fixed capacitance with the same stored energy as C_{OSS} with V_{DS} = 67% of $V_{(BR)DSS}$. To calculate $C_{o(er)}$ for any value of V_{DS} less than $V_{(BR)DSS,}$ use this equation: $C_{o(er)}$ = -2.85E-7/V_{DS}^2 + 5.04E-8/V_{DS} + 9.75E-11.

⑥ R_G is external gate resistance, not including internal gate resistance or gate driver impedance. (MIC4452)

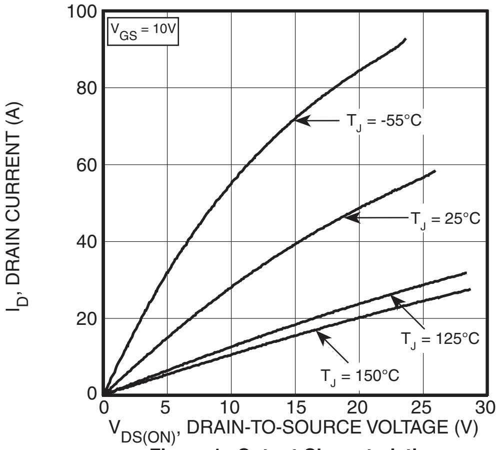


Figure 1, Output Characteristics

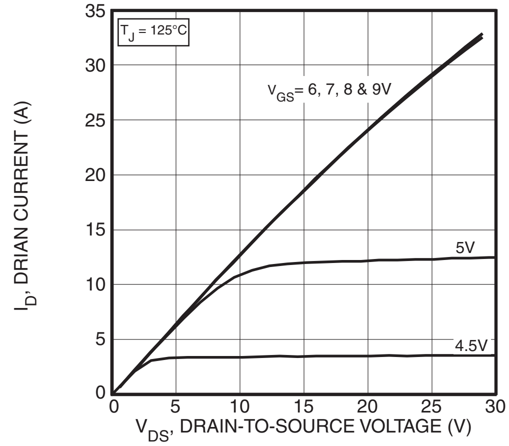


Figure 2, Output Characteristics

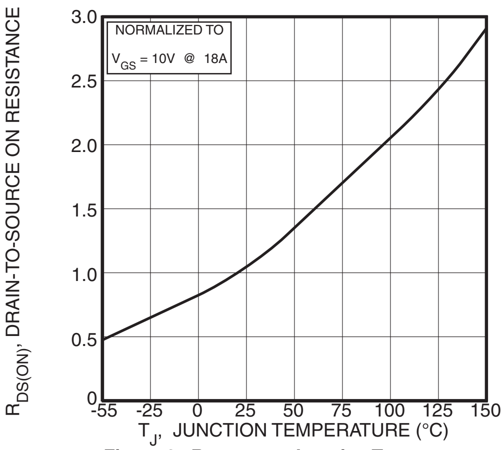


Figure 3, $R_{DS(ON)}$ vs Junction Temperature

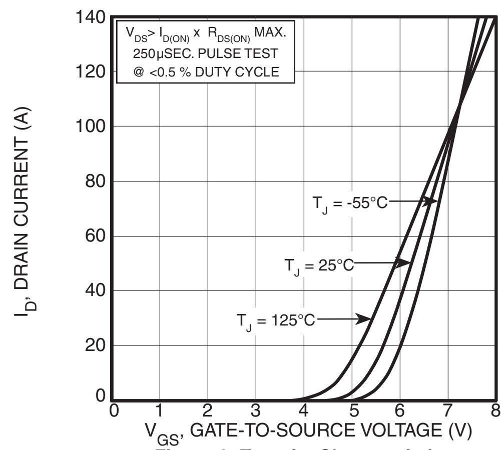


Figure 4, Transfer Characteristics

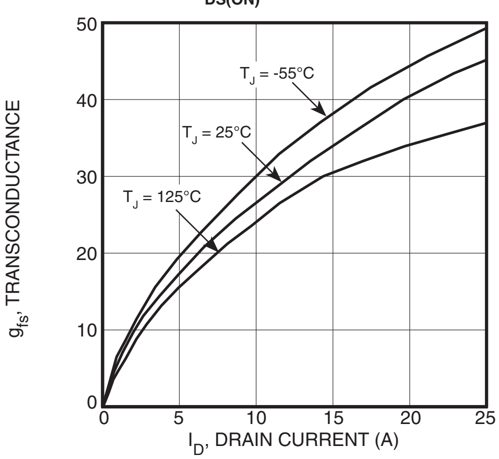


Figure 5, Gain vs Drain Current

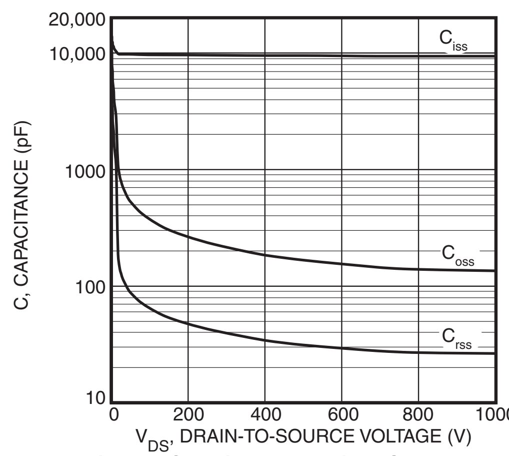


Figure 6, Capacitance vs Drain-to-Source Voltage

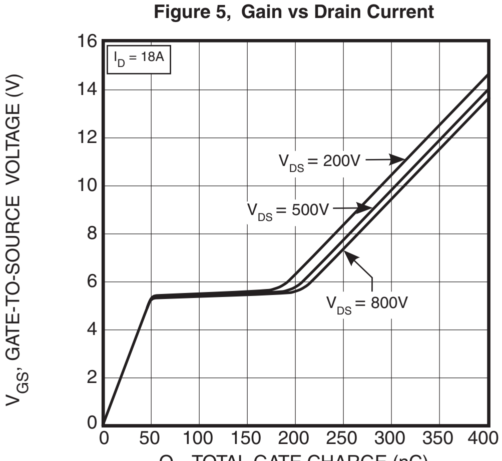


Figure 7, Gate Charge vs Gate-to-Source Voltage

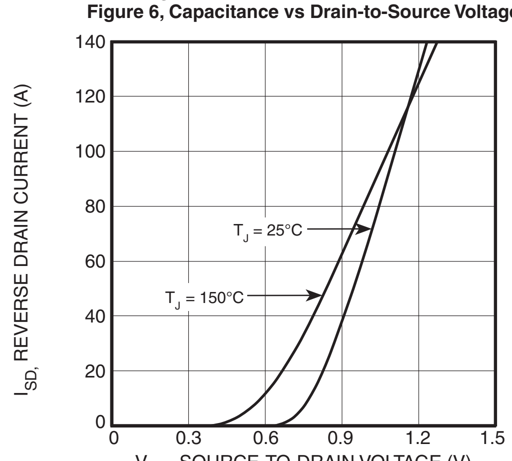


Figure 8, Reverse Drain Current vs Source-to-Drain Voltage

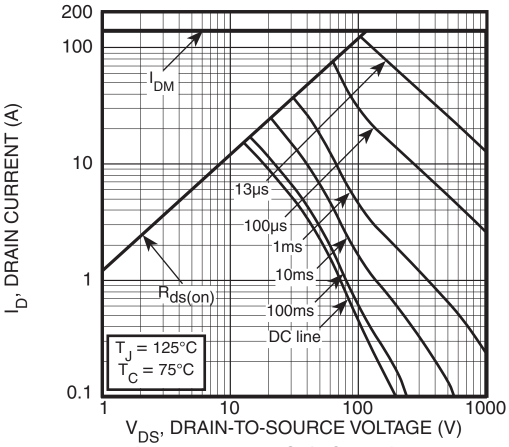


Figure 9, Forward Safe Operating Area

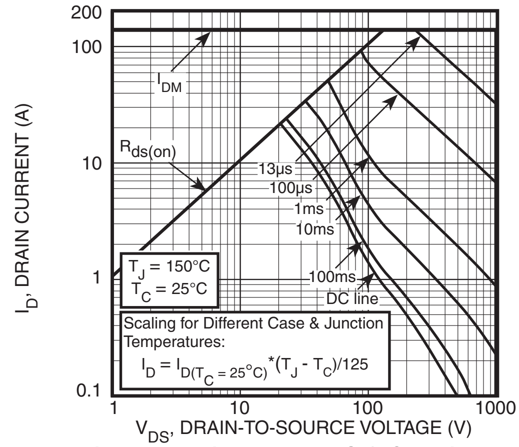


Figure 10, Maximum Forward Safe Operating Area

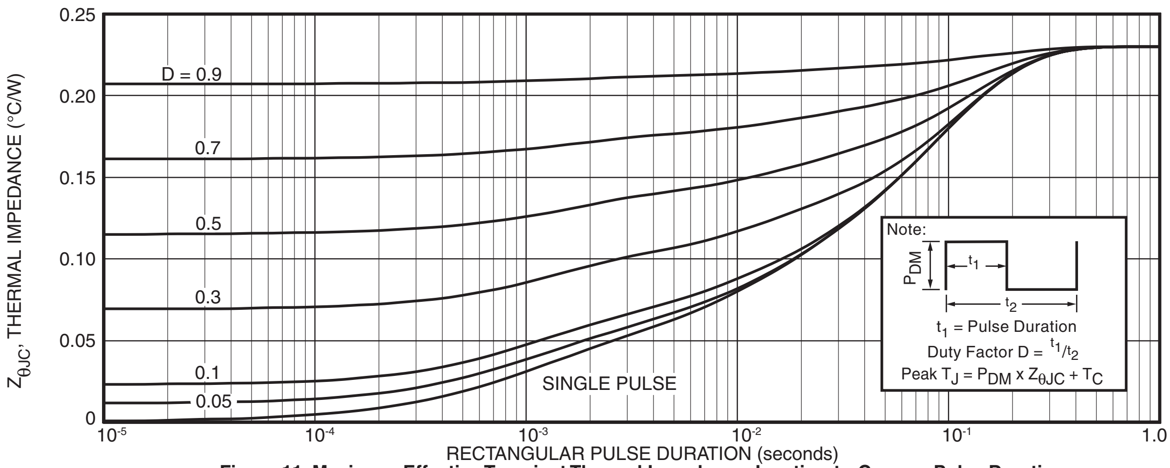
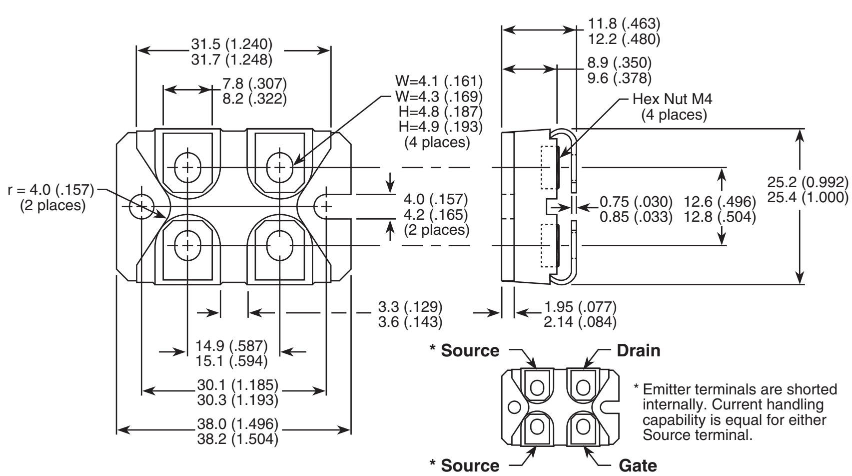


Figure 11. Maximum Effective Transient Thermal Impedance Junction-to-Case vs Pulse Duration

SOT-227 (ISOTOP®) Package Outline



Dimensions in Millimeters and (Inches)