Microsemi
POWER PRODUCTS GROUP

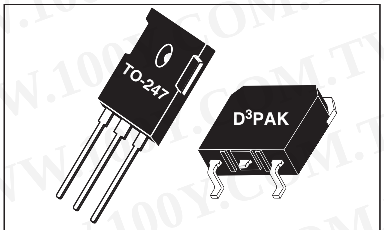
Power MOS 8™ Cooler!

APT42F50B
APT42F50S

600V, 42A, 0.14Ω Max, t_{rr}, ≤250ns

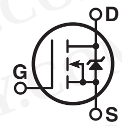
N-Channel FREDFET

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 niose 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.



APT42F50B APT42F50S

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 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	42	A
	Continuous Drain Current @ T_C = 100°C	27	
I_{DM}	Pulsed Drain Current ①	135	
V_{GS}	Gate-Source Voltage	±30	V
E_{AS}	Single Pulse Avalanche Energy ②	930	mJ
I_{AR}	Avalanche Current, Repetitive or Non-Repetitive	21	A

Thermal and Mechanical Characteristics

Symbol	Characteristic	Min	Typ	Max	Unit
P_D	Total Power Dissipation @ T_C = 25°C			624	W
$R_{\theta JC}$	Junction to Case Thermal Resistance			0.20	°C/W
$R_{\theta CS}$	Case to Sink Thermal Resistance, Flat, Greased Surface		0.15		
T_J,T_{STG}	Operating and Storage Junction Temperature Range	-55		150	°C
T_L	Soldering Temperature for 10 Seconds (1.6mm from case)			300	
W_T	Package Weight		0.22		oz
			6.2		g
Torque	Mounting Torque (TO-247 Package), 6-32 or M3 screw			10	in·lbf
				1.1	N·m

050-8084 Rev A 9-2006

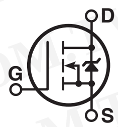
Static Characteristics — $T_J = 25°C$ unless otherwise specified

Symbol	Parameter	Test Conditions		Min	Typ	Max	Unit
$V_{BR(DSS)}$	Drain-Source Breakdown Voltage	$V_{GS} = 0V$, $I_D = 250μA$		500			V
$ΔV_{BR(DSS)}/ΔT_J$	Breakdown Voltage Temperature Coefficient	Reference to 25°C, $I_D = 250μA$			0.60		V/°C
$R_{DS(on)}$	Drain-Source On Resistance ③	$V_{GS} = 10V$, $I_D = 21A$			0.11	0.14	Ω
$V_{GS(th)}$	Gate-Source Threshold Voltage	$V_{GS} = V_{DS}$, $I_D = 1mA$		3	4	5	V
$ΔV_{GS(th)}/ΔT_J$	Threshold Voltage Temperature Coefficient	$V_{GS} = V_{DS}$, $I_D = 1mA$			-10		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 500V$, $V_{GS} = 0V$	$T_J = 25°C$			100	μA
			$T_J = 125°C$			500	μA
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	$V_{DS} = 50V$, $I_D = 21A$		32		S
C_{iss}	Input Capacitance	$V_{GS} = 0V$, $V_{DS} = 25V$, f = 1MHz		6810		pF
C_{rss}	Reverse Transfer Capacitance			90		pF
C_{oss}	Output Capacitance			735		pF
$C_{o(cr)}$ ④	Effective Output Capacitance, Charge Related	$V_{GS} = 0V$, $V_{DS} = 0V$ to 333V		425		pF
$C_{o(er)}$ ⑤	Effective Output Capacitance, Energy Related			215		pF
Q_g	Total Gate Charge	$V_{GS} = 0$ to 10V, $I_D = 21A$, $V_{DS} = 250V$		170		nC
Q_{gs}	Gate-Source Charge			38		nC
Q_{gd}	Gate-Drain Charge			80		nC
$t_{d(on)}$	Turn-On Delay Time	**Resistive Switching** $V_{DD} = 333V$, $I_D = 21A$, $R_G = 4.7Ω$ ⑥, $V_{GG} = 15V$		29		ns
t_r	Current Rise Time			35		ns
$t_{d(off)}$	Turn-Off Delay Time			80		ns
t_f	Current Fall Time			26		ns

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) 				42	A
I_{SM}	Pulsed Source Current (Body Diode) ①					135	A
V_{SD}	Diode Forward Voltage	$I_{SD} = 21A$, $T_J = 25°C$, $V_{GS} = 0V$				1.0	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 21A$ ③, $di_{SD}/dt = 100A/μs$	$T_J = 25°C$			250	ns
			$T_J = 125°C$			525	ns
Q_{rr}	Reverse Recovery Charge		$T_J = 25°C$		10		μC
			$T_J = 125°C$		25		μC
I_{rrm}	Reverse Recovery Current		$T_J = 25°C$		9		A
			$T_J = 125°C$		12		A
dv/dt	Peak Recovery dv/dt	$I_{SD} \le 21A$, $di/dt \le 1000A/μs$, $V_{DD} = 400V$, $T_J = 125°C$				20	V/ns

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

② Starting at $T_J = 25°C$, L = 4.22mH, $R_G = 4.7Ω$, $I_{AS} = 21A$.

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 $C_{o(cr)}$ for any value of V_{DS} less than $V_{(BR)DSS}$, use this equation: $C_{o(er)} = -1.84E-7/V_{DS}$^2 + $3.75E-8/V_{DS}$ + 1.05E-10.

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

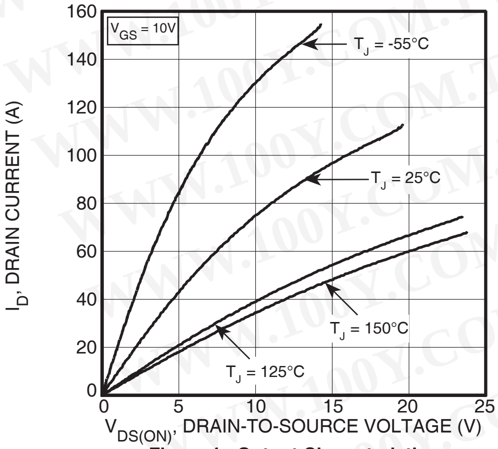


Figure 1, Output Characteristics

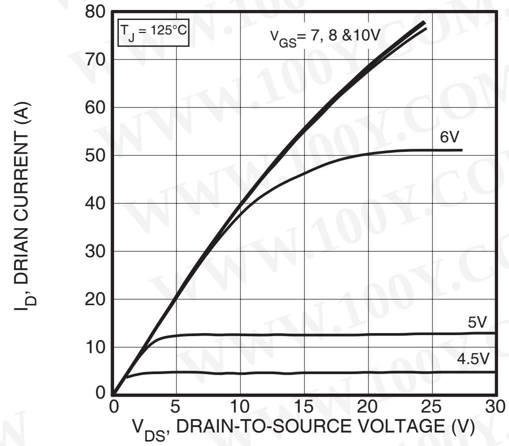


Figure 2, Output Characteristics

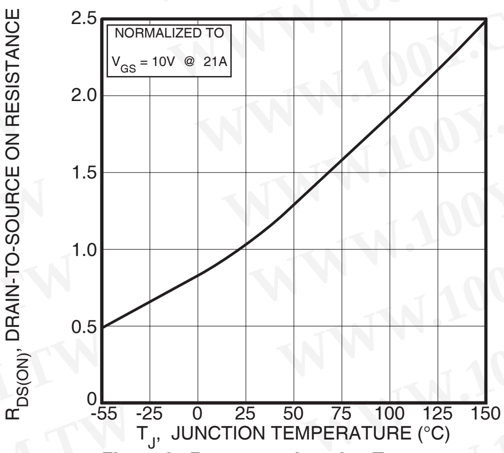


Figure 3, $R_{DS(ON)}$ vs Junction Temperature

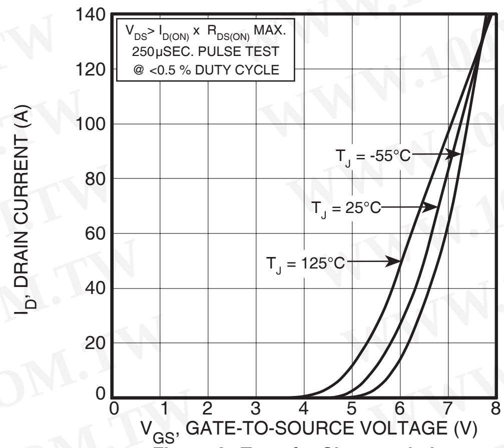


Figure 4, Transfer Characteristics

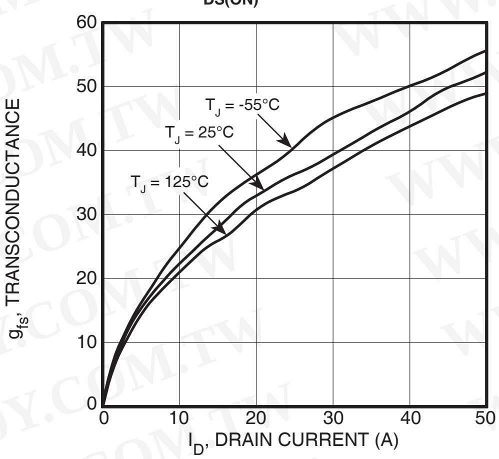


Figure 5, Gain vs Drain Current

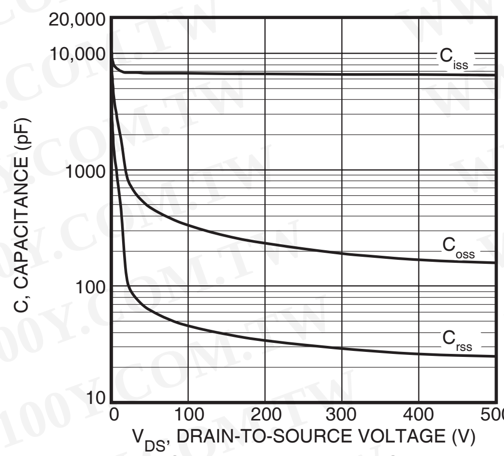


Figure 6, Capacitance vs Drain-to-Source Voltage

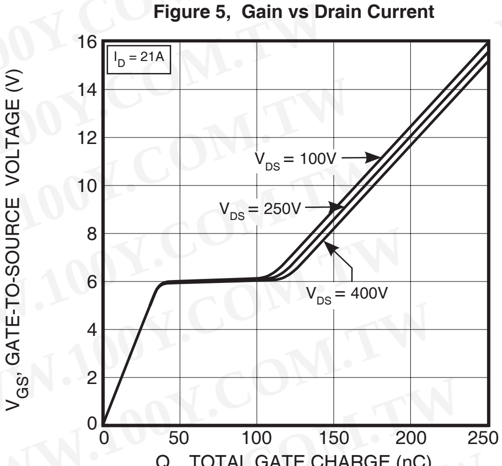


Figure 7, Gate Charge vs Gate-to-Source Voltage

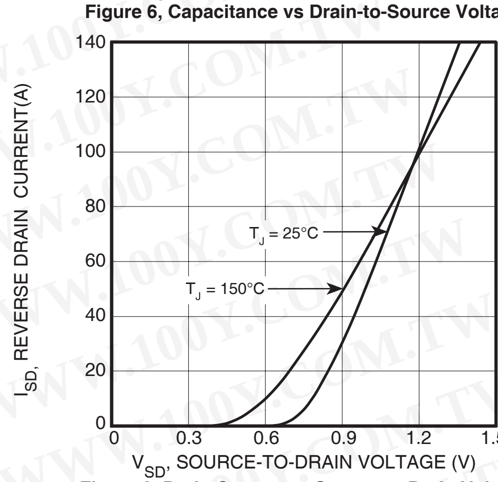


Figure 8, Drain Current vs Source-to-Drain Voltage

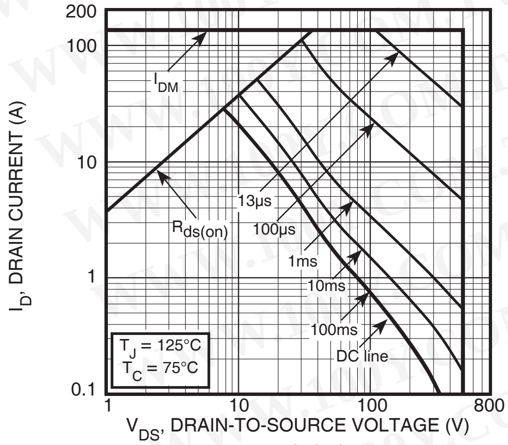


Figure 9, Forward Safe Operating Area

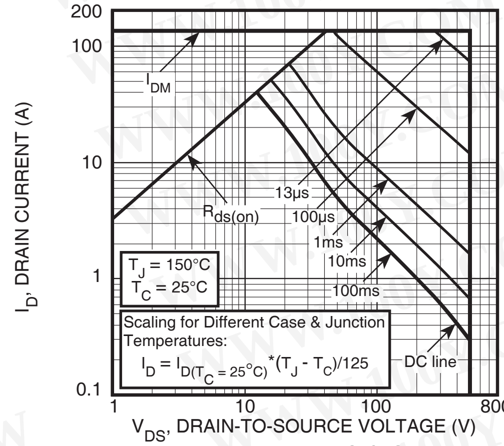


Figure 10, Maximum Forward Safe Operating Area

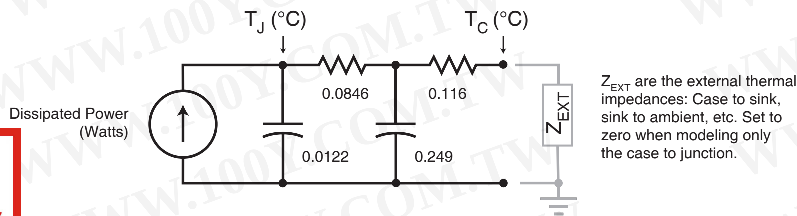


Figure 11, Transient Thermal Impedance Model

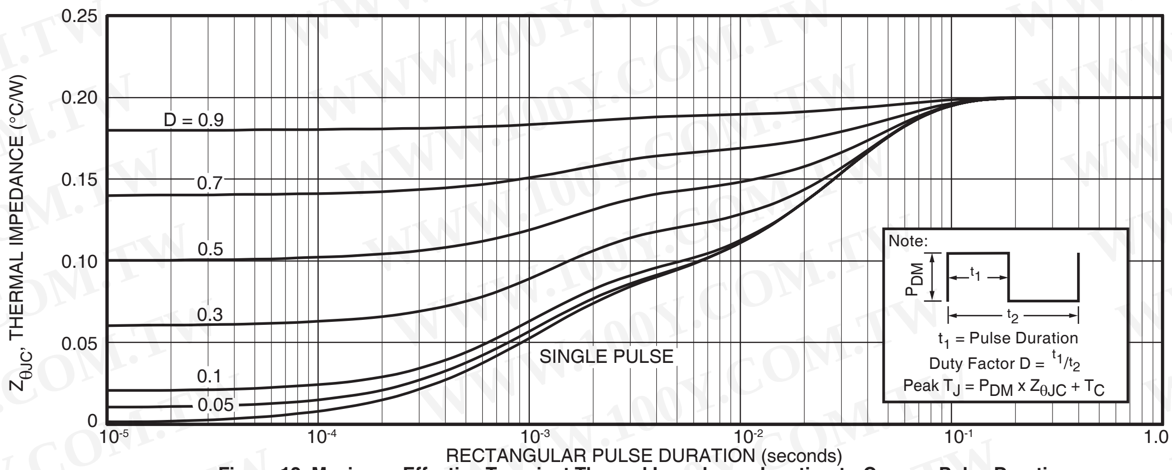
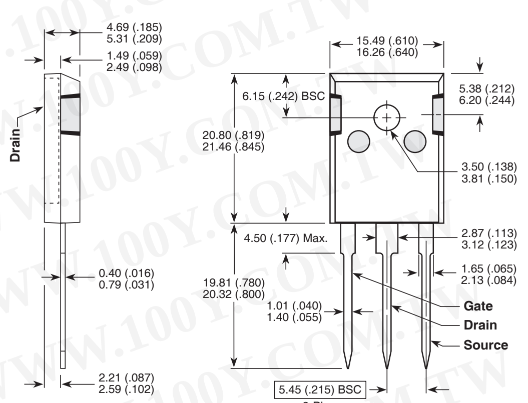


Figure 12. Maximum Effective Transient Thermal Impedance Junction-to-Case vs Pulse Duration

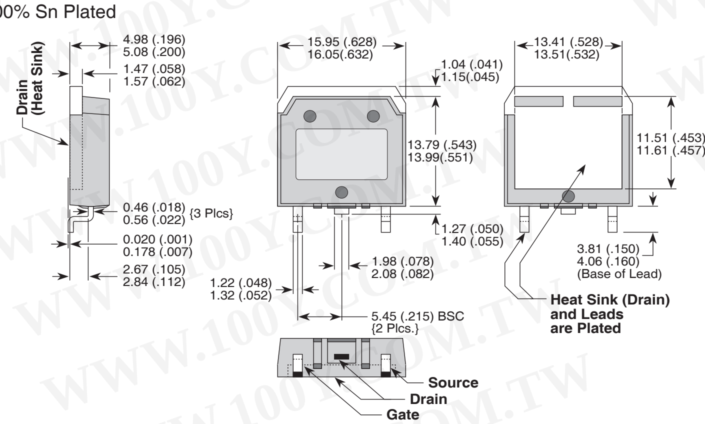
TO-247 (B) Package Outline

D^{3}PAK Package Outline

(e3) 100% Sn Plated



Dimensions in Millimeters and (Inches)



Dimensions in Millimeters (Inches)