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August 2012

FPF1003A / FPF1004 IntelliMAX™ Advanced Load Management Products

Features

- 1.2 V to 5.5 V Input Voltage Operating Range
- Typical R_{DS(ON)}:
 - 30 m Ω at V_{IN} =5.5 V
 - 35 mΩ at V_{IN}=3.3 V
- ESD Protected: Above 8000 V HBM
- ROHS Compliant

Applications

- PDA's
- Cell Phones
- GPS Devices
- MP3 Players
- Digital Cameras
- Peripheral PortsHot Swap Supplies

Description

The FPF1003A and FPF1004 are low $R_{\rm DS}$ P-channel MOSFET load switches with controlled turn-on. The input voltage range operates from 1.2 V to 5.5 V to fulfill today's ultra-portable device supply requirements. Switch control is accomplished with a logic input (ON) capable of interfacing directly with low-voltage control signal. In FPF1004, a 120 Ω on-chip load resistor is added for output quick discharge when the switch is turned off.

Both FPF1003A and FPF1004 are available in a space-saving 1.0x1.5 mm² wafer-level chip-scale package.

Ordering Information

Part Number	Top Mark	Switch	Input Buffer	Output Discharge	ON Pin Activity	Package
FPF1003A	Q2	30 mΩ, Schmitt	NA	Active HIGH	1.0 x 1.5 mm ² Wafer-Level	
FPF1004	Q3	PMOS	Schille	120Ω	Active HIGH	Chip-Scale Package (WLCSP),

Application Diagram

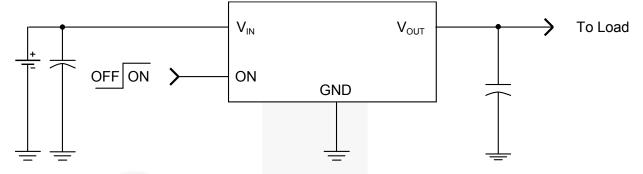


Figure 1. Typical Application

Block Diagram

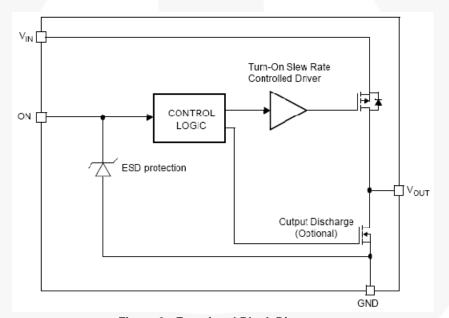


Figure 2. Functional Block Diagram

Pin Configurations

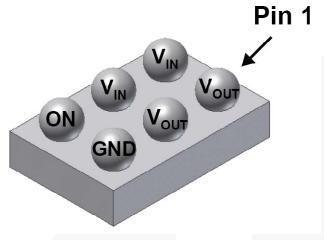


Figure 3. WLCSP Bumps Facing UP

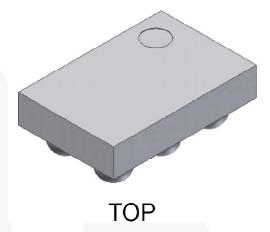


Figure 4. WLCSP Bumps Facing Down

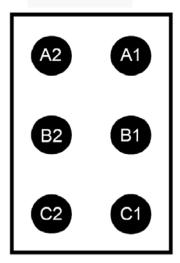


Figure 5. 1.0mm x 1.5mm WLCSP Pin Assignments (Bottom View)

Pin Definitions

Pin#	Name	Description		
A2, B2	V _{IN}	Input to the power switch and the supply voltage for the IC		
C2	ON	N Control Input		
A1, B1	V _{OUT}	Output of the power switch		
C1	GND	Ground		

Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Symbol	P	Min.	Max.	Unit	
V _{IN}	V _{IN} , V _{OUT} , ON to GND			6.0	V
I _{SW}	Maximum Continuous Switch Curre	Maximum Continuous Switch Current			Α
P _D	Power Dissipation at T _A =25°C ⁽¹⁾			1.2	W
T _{STG}	Storage Junction Temperature			+150	°C
T _A	Operating Temperature Range			+125	°C
Θ_{JA}	Thermal Resistance, Junction-to-Ambient			85	°C/W
ESD	Electrostatic Discharge Capability	Human Body Model, JESD22-A114	5500		V
ESD		Charged Device Model, JESD22-C101	1500		

Note:

1. Package power dissipation on one square inch pad, 2 oz.

Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. Fairchild does not recommend exceeding them or designing to Absolute Maximum Ratings.

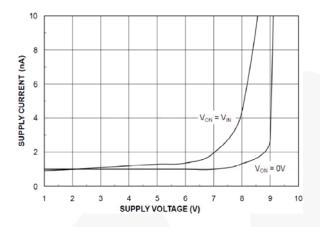
Symbol	Parameter	Min.	Max.	Unit
V_{IN}	Supply Voltage	1.2	5.5	V
T _A	Ambient Operating Temperature	-40	+85	°C

Electrical Characteristics

Unless otherwise noted, V_{IN} =1.2 to 5.0V, T_A =-40 to +85°C; typical values are at V_{IN} =3.3V and T_A =25°C.

Symbol	Parameter	Conditions	Min.	Тур.	Max.	Units	
Basic Oper	ration			•			
V_{IN}	Supply Voltage		1.2		5.5	V	
I _{Q(OFF)}	Off Supply Current	V _{ON} =GND, OUT=Open			1	μA	
	Shutdown Current	V _{ON} =GND, V _{OUT} =0 at V _{IN} =5.5, T _A =85°C			1	μA	
I _{SD}	Shuldown Current	V _{ON} =GND, V _{OUT} =0 at V _{IN} =3.3, T _A =85°C		10	100	nA	
ΙQ	Quiescent Current	I _{OUT} =0 mA, V _{IN} =V _{ON}			1	μA	
		V _{IN} =5.5 V, I _{OUT} =1 A, T _A =25°C		20	30		
		V _{IN} =3.3 V, I _{OUT} =1 A, T _A =25°C		25	35		
Б	On Desistance	V _{IN} =1.5 V, I _{OUT} =1 A, T _A =25°C		50	75	0	
R_{ON}	On-Resistance	V _{IN} =1.2 V, I _{OUT} =1 A, T _A =25°C		95	150	mΩ	
		V _{IN} =3.3 V, I _{OUT} =1 A, T _A =85°C		30	42		
		V _{IN} =3.3 V, I _{OUT} =1 A, T _A =40°C to 85°C	12		42		
R_{PD}	Output Pull-Down Resistance	V _{IN} =3.3 V, V _{ON} =0 V, T _A =25°C, FPF1004		75	120	Ω	
	ON Input Logic High Voltage	V _{IN} =1.2 V to 5.5 V	2				
V _{IH}		V _{IN} =1.2 V	0.8			V	
	ON Input Logic Low	V _{IN} =2.7 V to 5.5 V			0.8	,,	
VIL	Voltage	V _{IN} =1.2 V			0.35	V	
I _{ON}	ON Input Leakage	V _{ON} =V _{IN} or GND			1	μΑ	
Dynamic C	haracteristics						
t _{ON}	Turn-On Time	V_{IN} =3.3 V, R_L =500 Ω , C_L =0.1 μ F, T_A =25°C		13		μs	
	Turn-Off Time	V_{IN} =3.3 V, R _L =500 Ω , C _L =0.1 μ F, T _A =25°C, FPF1003A		45			
toff		V_{IN} =3.3 V, R _L =500 Ω , C _L =0.1 μ F, R _{L_CHIP} =120 Ω , T _A =25°C, FPF1004		15		μs	
t _R	V _{OUT} Rise Time	V_{IN} =3.3 V, R _L =500 Ω , C _L =0.1 μ F, T _A =25°C		13		μs	
	V _{OUT} Fall Time	V_{IN} =3.3 V, R _L =500 Ω , C _L =0.1 μ F, T _A =25°C, FPF1003A		113			
t⊧		V_{IN} =3.3 V, R _L =500 Ω , C _L =0.1 μ F, R _{L_CHIP} =120 Ω , T _A =25°C, FPF1004		10		μs	

Typical Performance Characteristics



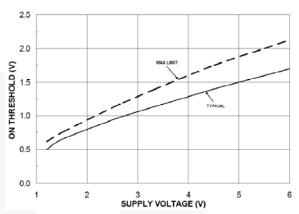
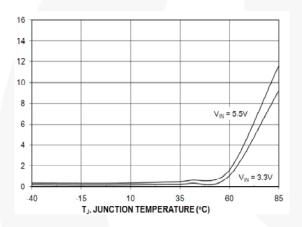


Figure 6. Quiescent Current vs. VIN





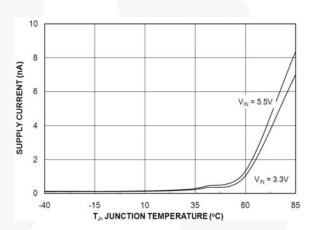
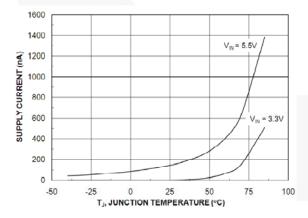


Figure 8. Quiescent Current vs. Temperature

Figure 9. Quiescent Current (OFF) vs. Temperature



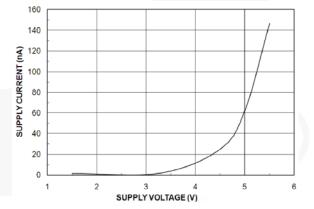
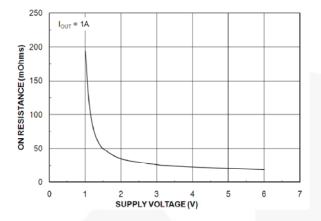


Figure 10. I_{SWITCH-OFF} Current vs. Temperature

Figure 11. $I_{SWITCH-OFF}$ Current vs. V_{IN}

Typical Performance Characteristics



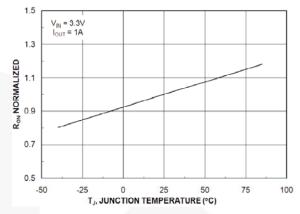
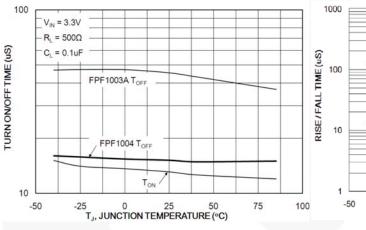


Figure 12. Ron vs. V_{IN}

Figure 13. Ron vs. Temperature



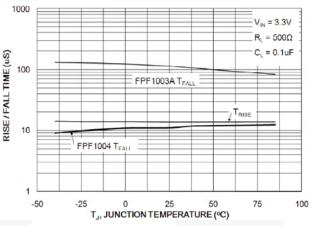
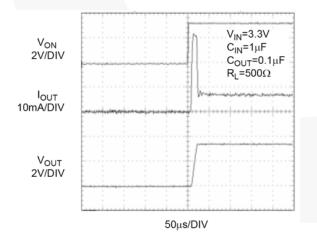


Figure 14. ton/toff vs. Temperature

Figure 15. t_R/t_F vs. Temperature



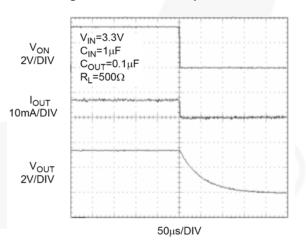
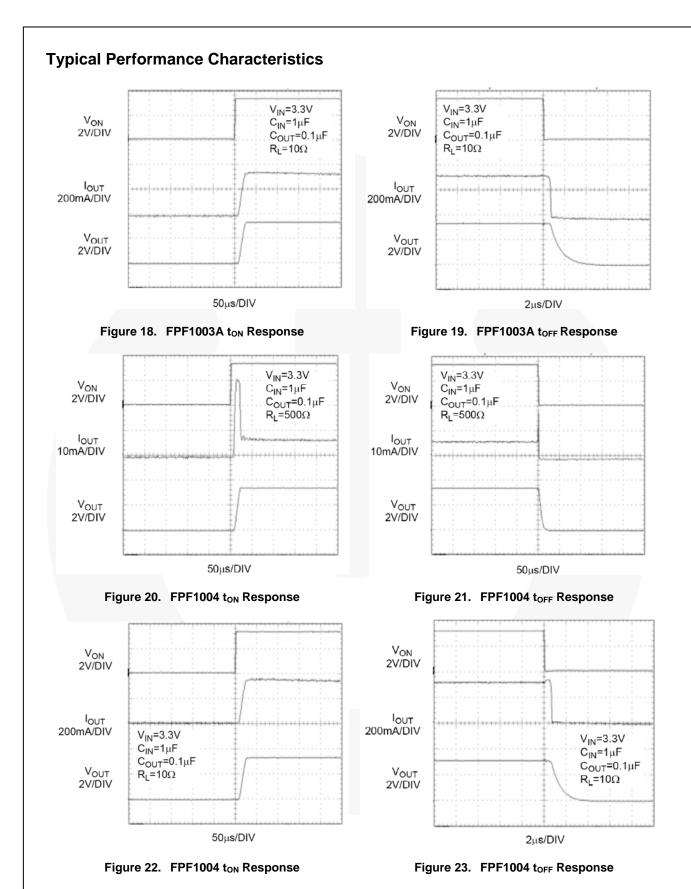


Figure 16. FPF1003A ton Response

Figure 17. FPF1003A t_{OFF} Response



Description of Operation

Input Capacitor

FPF1003A and FPF1004 are low-RDS(ON) P-channel load switches with controlled turn-on. The core of each device is a 30 m Ω P-Channel MOSFET and a controller capable of functioning over an input operating range of

1.2 to 5.5 V. Switch control is accomplished with a logic input (ON) capable of interfacing directly with low-voltage control signal. In FPF1004, a 120 Ω on-chip load resistor is added for output quick discharge when the switch is turned off.

Application Information

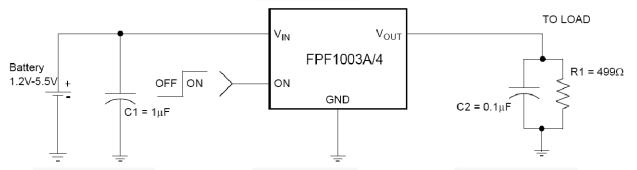


Figure 24. Typical Application

Input Capacitor

To limit the voltage drop on the input supply caused by transient inrush currents when the switch turns on into a discharged load capacitor or short-circuit, a capacitor needs to be placed between $V_{\rm IN}$ and GND. A 0.1 μF ceramic capacitor, $C_{\rm IN}$, must be placed close to the $V_{\rm IN}$ pin. A higher value of $C_{\rm IN}$ can be used to further reduce the voltage drop experienced as the switch is turned on into a large capacitive load.

Output Capacitor

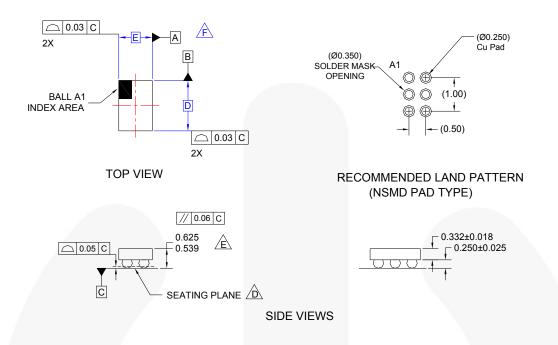
A 0.1 μ F capacitor, C_{OUT} , should be placed between VOUT and GND. This capacitor prevents parasitic board inductance from forcing V_{OUT} below GND when the switch turns off. Due to the integral body diode in the

PMOS switch, a C_{IN} greater than C_{OUT} is recommended. A C_{OUT} greater than C_{IN} can cause V_{OUT} to exceed V_{IN} when the system supply is removed. This could result in current flow through the body diode from V_{OUT} to V_{IN} .

Board Layout

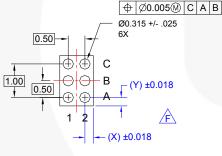
For best performance, all traces should be as short as possible. To be most effective, the input and output capacitors should be placed close to the device to minimize the effects that parasitic trace inductances may have on normal and short-circuit operation. Using wide traces for $V_{\text{IN}},\ V_{\text{OUT}},\$ and GND minimizes the parasitic electrical effects and case-to-ambient thermal impedance.

Physical Dimensions



NOTES:

- A. NO JEDEC REGISTRATION APPLIES.
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS AND TOLERANCE PER ASMEY14.5M. 1994.
- DATUM C IS DEFINED BY THE SPHERICAL CROWNS OF THE BALLS.
- E PACKAGE NOMINAL HEIGHT IS 582 MICRONS ±43 MICRONS (539-625 MICRONS).
- F. FOR DIMENSIONS D, E, X, AND Y SEE PRODUCT DATASHEET.
 - G. DRAWING FILNAME: MKT-UC006AFrev2.



BOTTOM VIEW

Figure 25. 1.0 x 1.5 mm² Wafer-Level Chip-Scale Package (WLCSP)

Product-Specific Dimensions

Product	D	E	X	Y
FPF1003A	1480 μm ± 30 μm	980 μm ± 30 μm	240 μm	240 µm
FPF1004	1480 μm ± 30 μm	980 μm ± 30 μm	240 µm	240 µm

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