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 mΩ 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 Ports
- Hot Swap Supplies

Description

The FPF1003A and FPF1004 are low R_{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 mm^2 wafer-level chip-scale package.

Ordering Information

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

Application Diagram

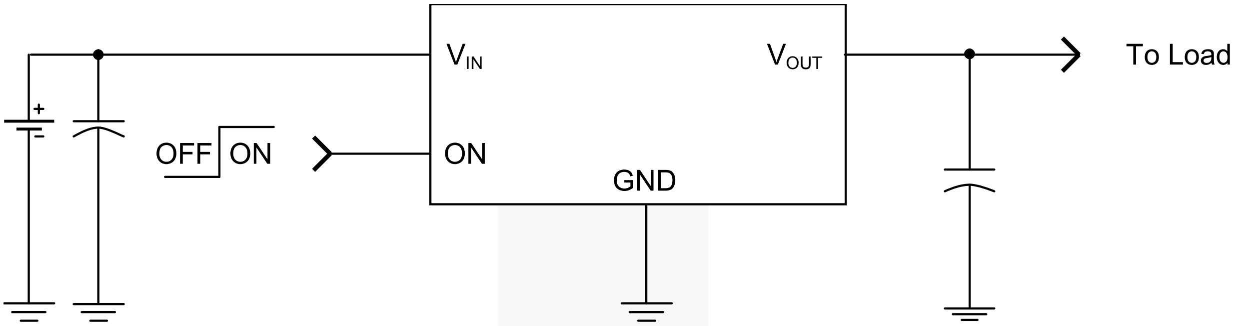


Figure 1. Typical Application

Block Diagram

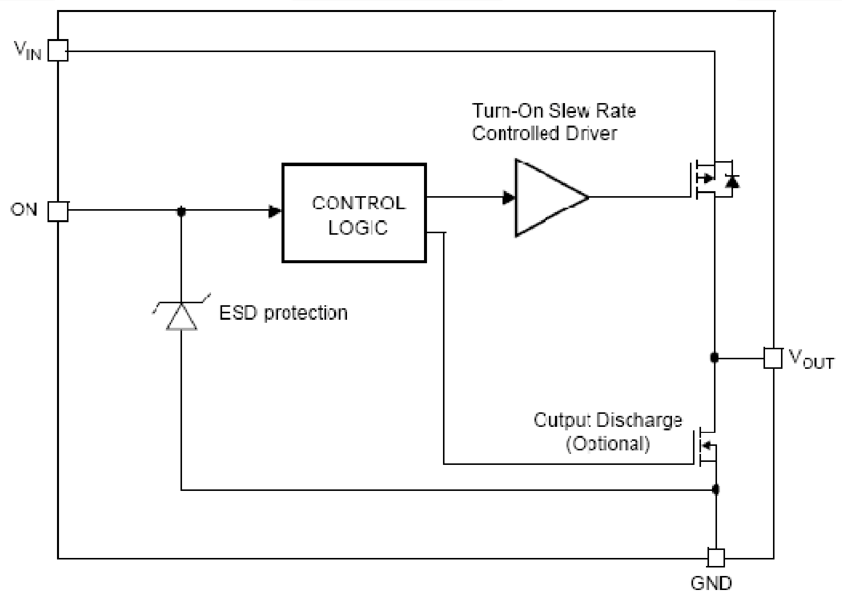


Figure 2. Functional Block Diagram

Pin Configurations

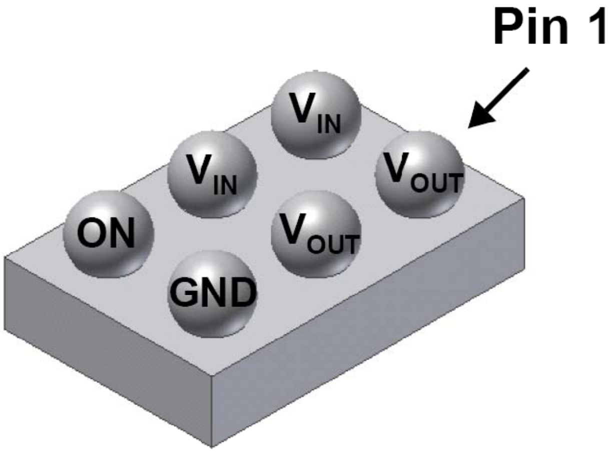


Figure 3. WLCSP Bumps Facing UP

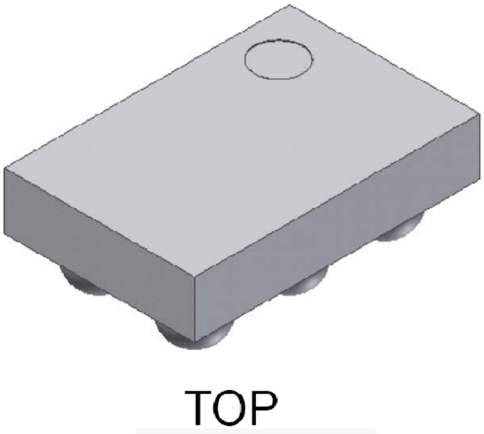


Figure 4. WLCSP Bumps Facing Down

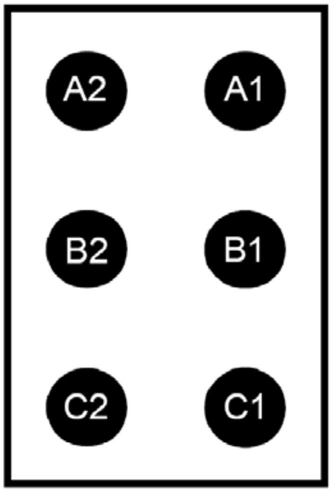


Figure 5. 1.0mm x 1.5mm WLCSP Pin Assignments (Bottom View)

Pin Definitions

Pin #	Name	Description
A2, B2	V_{IN}	Input to the power switch and the supply voltage for the IC
C2	ON	ON 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	Parameter		Min.	Max.	Unit
V_{IN}	V_{IN}, V_{OUT}, ON to GND		-0.3	6.0	V
I_{SW}	Maximum Continuous Switch Current			2.0	A
P_D	Power Dissipation at T_A=25°C[1]			1.2	W
T_{STG}	Storage Junction Temperature		-65	+150	°C
T_A	Operating Temperature Range		-40	+125	°C
Θ_{JA}	Thermal Resistance, Junction-to-Ambient			85	°C/W
ESD	Electrostatic Discharge Capability	Human Body Model, JESD22-A114	5500		V
		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.	Typ.	Max.	Units
Basic Operation						
V_{IN}	Supply Voltage		1.2		5.5	V
$I_{Q(OFF)}$	Off Supply Current	V_{ON}=GND, OUT=Open			1	µA
I_{SD}	Shutdown Current	V_{ON}=GND, V_{OUT}=0 at V_{IN}=5.5, T_A=85°C			1	µA
		V_{ON}=GND, V_{OUT}=0 at V_{IN}=3.3, T_A=85°C		10	100	nA
I_Q	Quiescent Current	I_{OUT}=0 mA, V_{IN}=V_{ON}			1	µA
R_{ON}	On-Resistance	V_{IN}=5.5 V, I_{OUT}=1 A, T_A=25°C		20	30	mΩ
		V_{IN}=3.3 V, I_{OUT}=1 A, T_A=25°C		25	35	
		V_{IN}=1.5 V, I_{OUT}=1 A, T_A=25°C		50	75	
		V_{IN}=1.2 V, I_{OUT}=1 A, T_A=25°C		95	150	
		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
V_{IH}	ON Input Logic High Voltage	V_{IN}=1.2 V to 5.5 V	2			V
		V_{IN}=1.2 V	0.8			
V_{IL}	ON Input Logic Low Voltage	V_{IN}=2.7 V to 5.5 V			0.8	V
		V_{IN}=1.2 V			0.35	
I_{ON}	ON Input Leakage	V_{ON}=V_{IN} or GND			1	µA
Dynamic Characteristics						
t_{ON}	Turn-On Time	V_{IN}=3.3 V, R_L=500 Ω, C_L=0.1 µF, T_A=25°C		13		µs
t_{OFF}	Turn-Off Time	V_{IN}=3.3 V, R_L=500 Ω, C_L=0.1 µF, T_A=25°C, FPF1003A		45		µs
		V_{IN}=3.3 V, R_L=500 Ω, C_L=0.1 µF, R_{L_CHIP}=120 Ω, T_A=25°C, FPF1004		15		
t_R	V_{OUT} Rise Time	V_{IN}=3.3 V, R_L=500 Ω, C_L=0.1 µF, T_A=25°C		13		µs
t_F	V_{OUT} Fall Time	V_{IN}=3.3 V, R_L=500 Ω, C_L=0.1 µF, T_A=25°C, FPF1003A		113		µs
		V_{IN}=3.3 V, R_L=500 Ω, C_L=0.1 µF, R_{L_CHIP}=120 Ω, T_A=25°C, FPF1004		10		

Typical Performance Characteristics

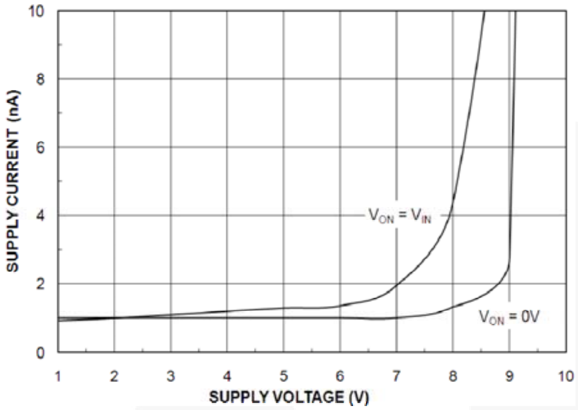


Figure 6. Quiescent Current vs. V_{IN}

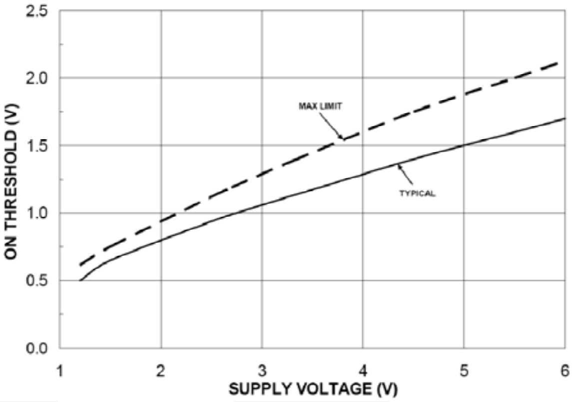


Figure 7. ON Threshold vs. V_{IN}

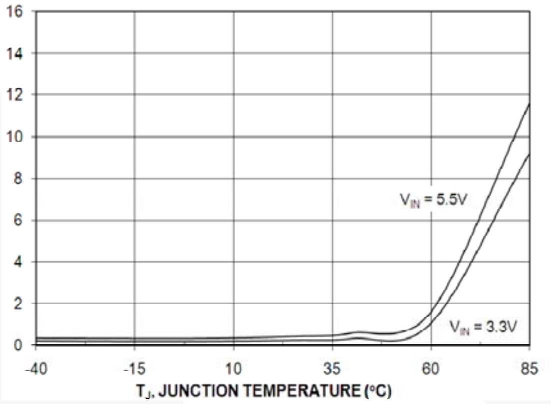


Figure 8. Quiescent Current vs. Temperature

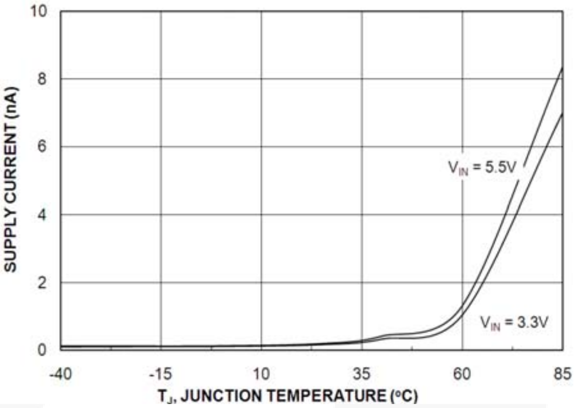


Figure 9. Quiescent Current (OFF) vs. Temperature

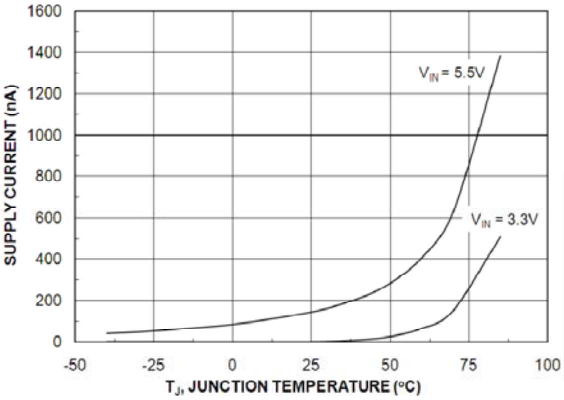


Figure 10. $I_{SWITCH-OFF}$ Current vs. Temperature

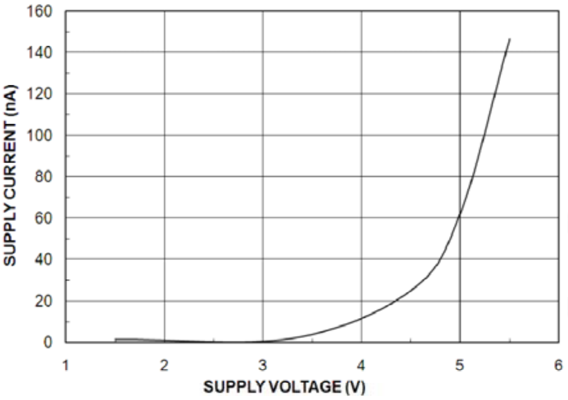


Figure 11. $I_{SWITCH-OFF}$ Current vs. V_{IN}

Typical Performance Characteristics

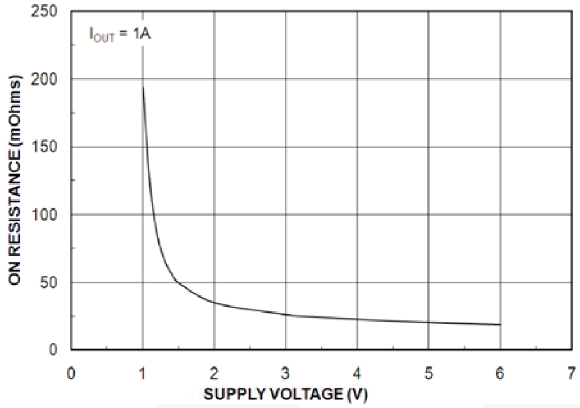


Figure 12. R_{ON} vs. V_{IN}

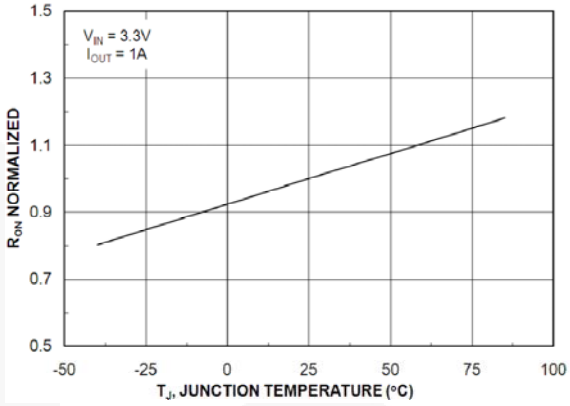


Figure 13. R_{ON} vs. Temperature

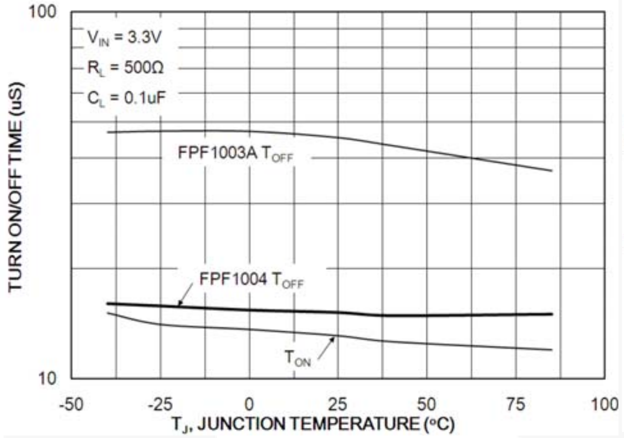


Figure 14. t_{ON}/t_{OFF} vs. Temperature

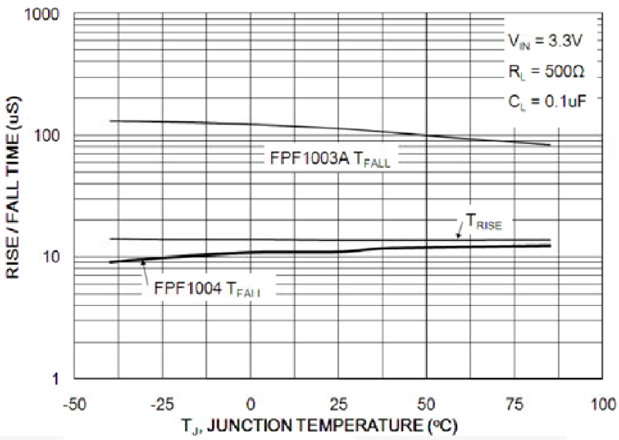


Figure 15. t_R/t_F vs. Temperature

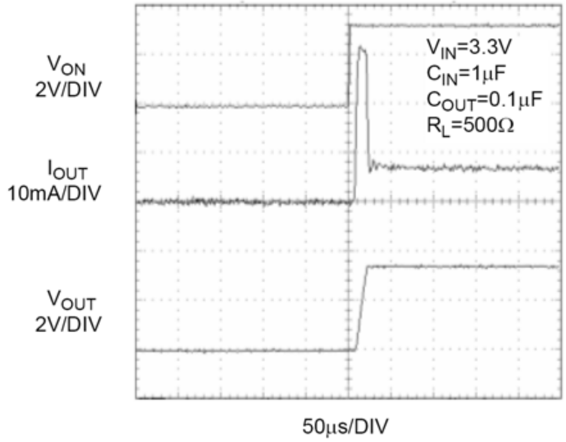


Figure 16. FPF1003A t_{ON} Response

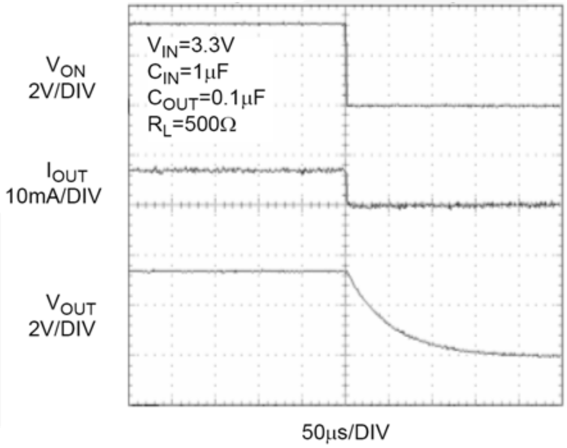


Figure 17. FPF1003A t_{OFF} Response

Typical Performance Characteristics

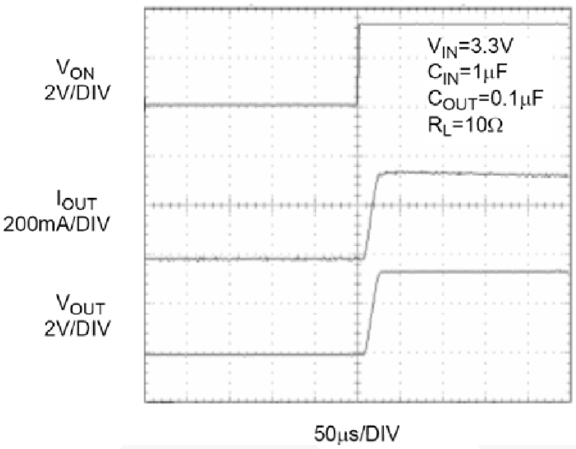


Figure 18. FPF1003A t_{ON} Response

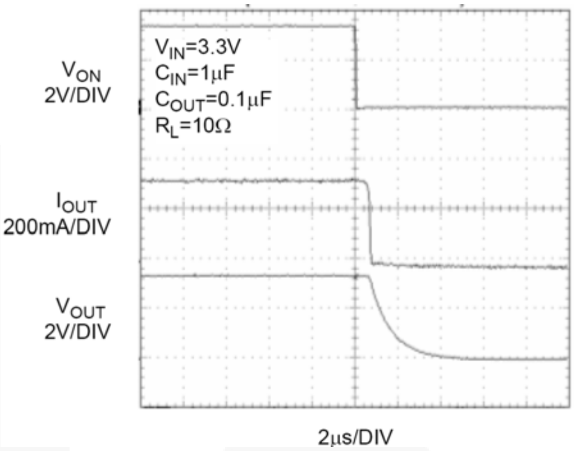


Figure 19. FPF1003A t_{OFF} Response

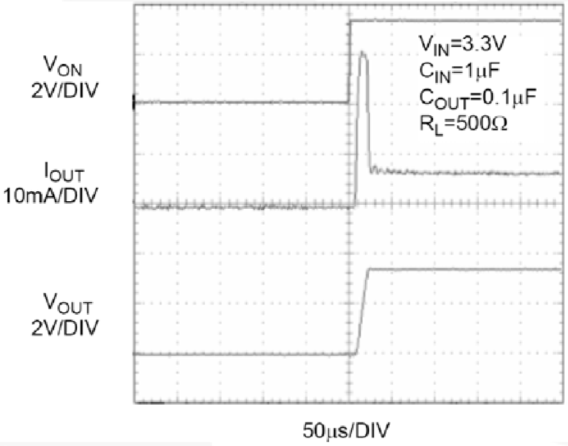


Figure 20. FPF1004 t_{ON} Response

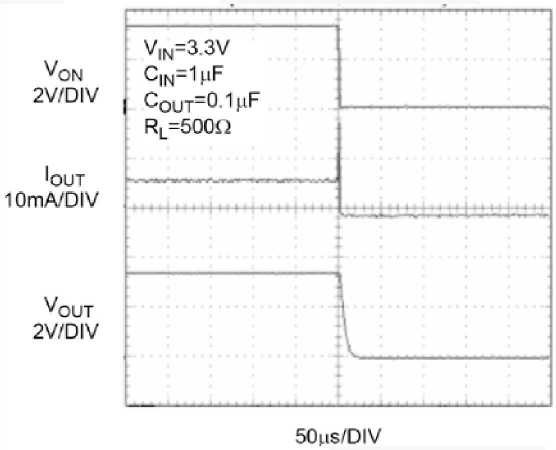


Figure 21. FPF1004 t_{OFF} Response

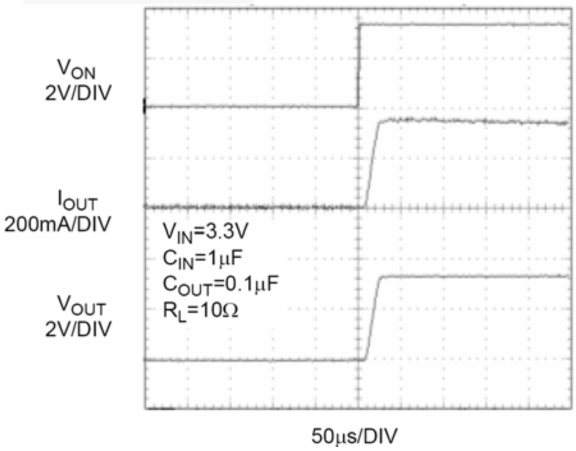


Figure 22. FPF1004 t_{ON} Response

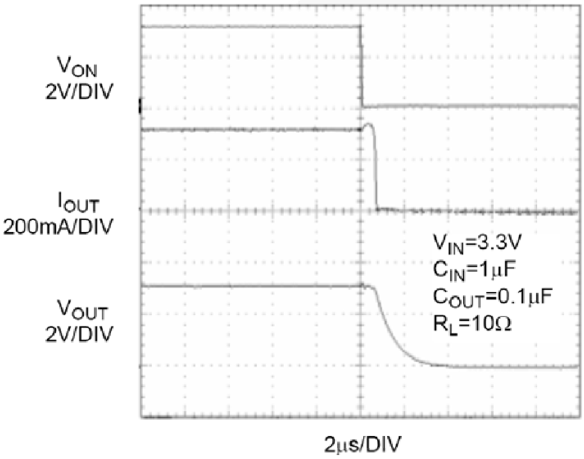


Figure 23. FPF1004 t_{OFF} Response

Description of Operation

Input Capacitor

FPF1003A and FPF1004 are low-$R_{DS(ON)}$ P-channel load switches with controlled turn-on. The core of each device is a 30 mΩ 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

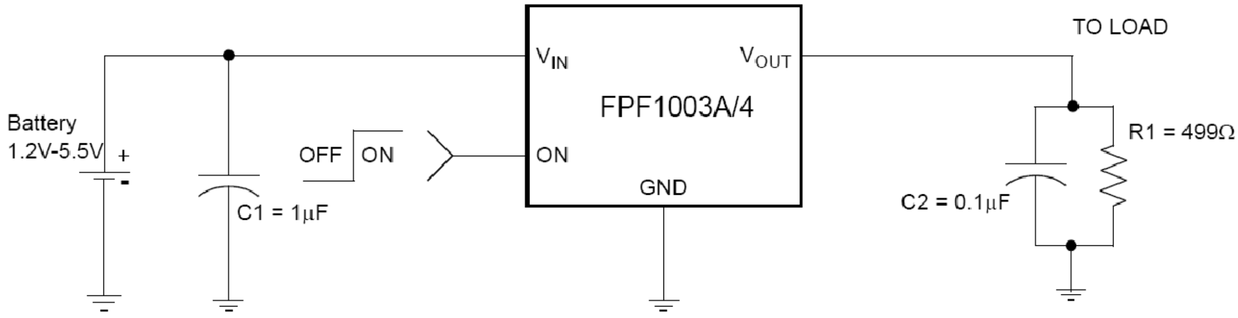


Figure 24. Typical Application

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_{IN} and GND. A 0.1 µF ceramic capacitor, C_{IN}, must be placed close to the V_{IN} pin. A higher value of C_{IN} can be used to further reduce the voltage drop experienced as the switch is turned on into a large capacitive load.

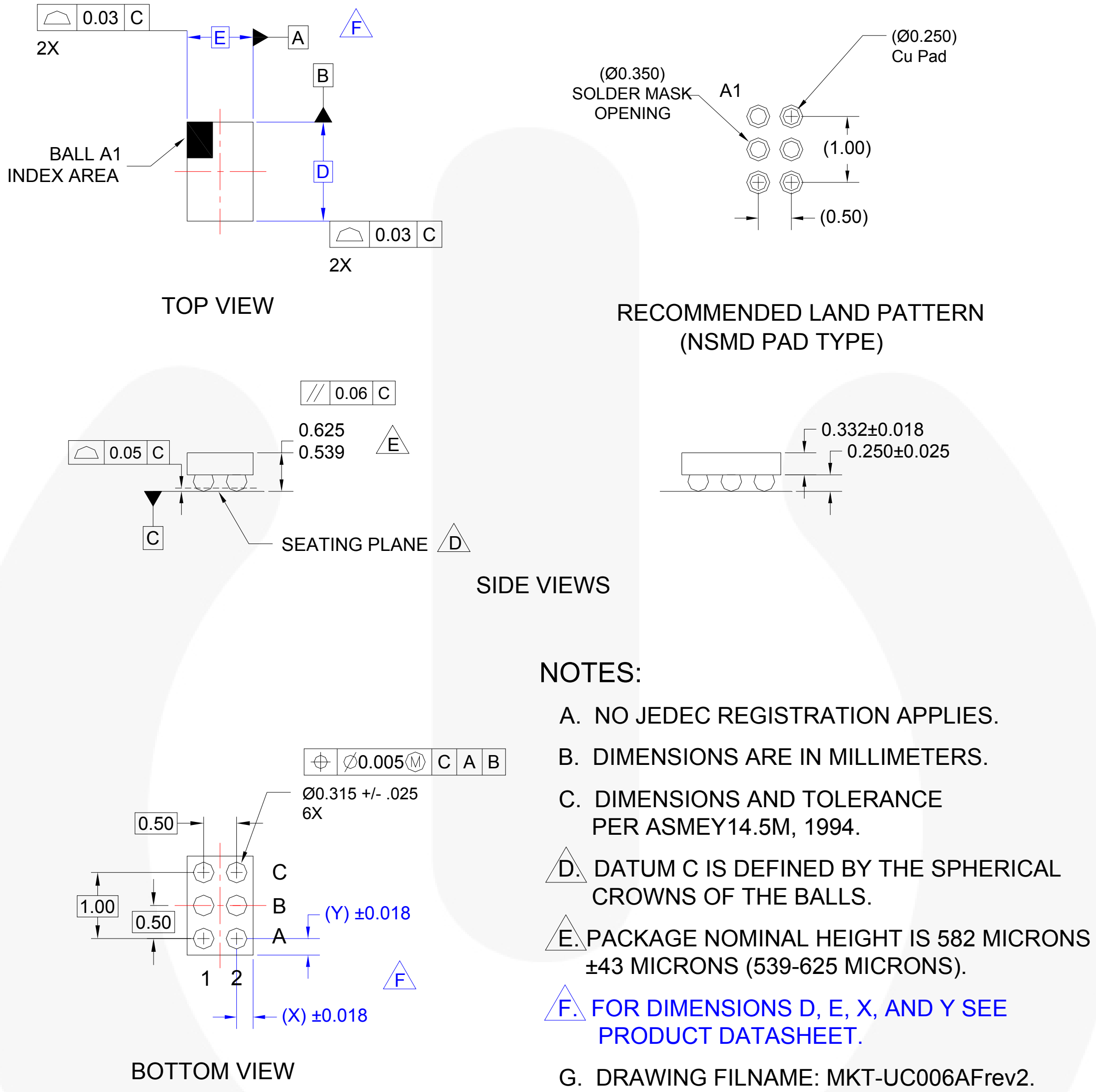
Output Capacitor

A 0.1 µF 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_{IN}, V_{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.

D. 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.

Figure 25. 1.0 x 1.5 mm^2 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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Preliminary	First Production	Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
No Identification Needed	Full Production	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
Obsolete	Not In Production	Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.

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