

# FPF1003-FPF1004 IntelliMAX™ Advanced Load Management Products

## Features

- 1.2 to 5.5V Input Voltage Range
- $R_{DS(ON)} = 30\text{ m}\Omega$  @  $V_{IN} = 5.5\text{V}$
- $R_{DS(ON)} = 35\text{ m}\Omega$  @  $V_{IN} = 3.3\text{V}$
- ESD Protected, above 2000V HBM

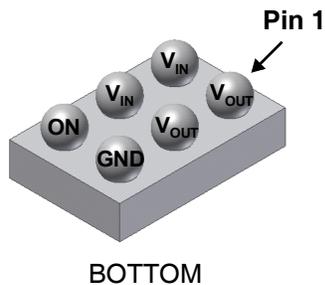
## Applications

- PDAs
- Cell Phones
- GPS Devices
- MP3 Players
- Digital Cameras
- Peripheral Ports
- Hot Swap Supplies
- RoHS Compliant

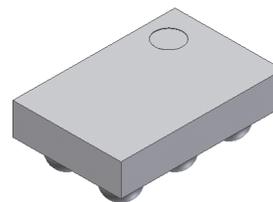
## General Description

The FPF1003 & FPF1004 are low RDS P-Channel MOSFET load switches with controlled turn-on. The input voltage range operates from 1.2V to 5.5V to fulfill today's Ultra Portable Device's supply requirement. Switch control is by a logic input (ON) capable of interfacing directly with low voltage control signal. In FPF1004, 120Ω on-chip load resistor is added for output quick discharge when switch is turned off.

Both FPF1003 & FPF1004 are available in a space-saving 1.0x1.5 mm<sup>2</sup> chip scale package, 1.0X1.5CSP-6.

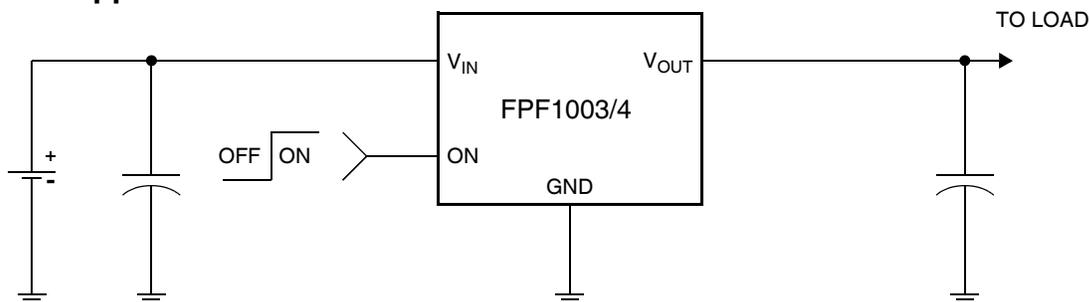


BOTTOM



TOP

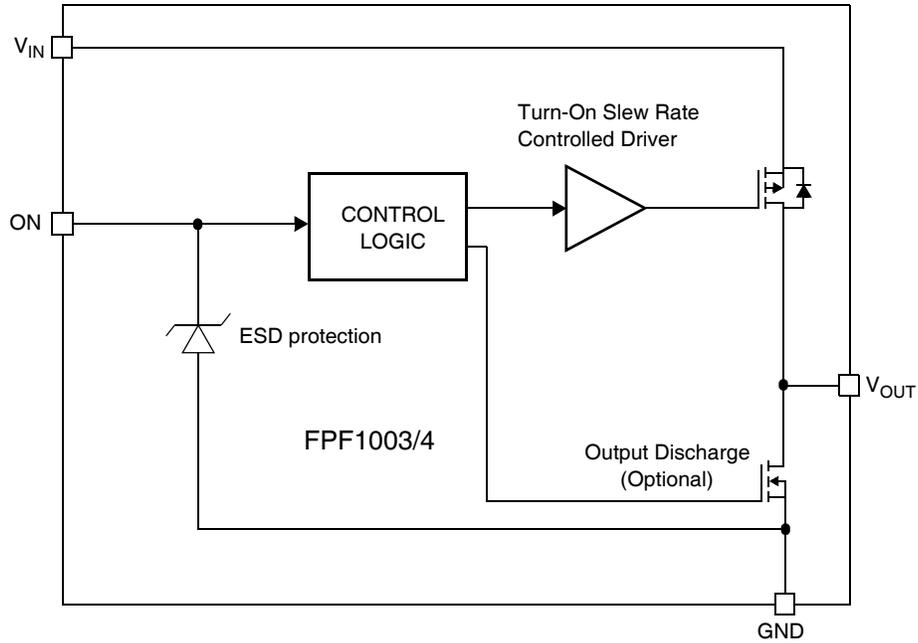
## Typical Application Circuit



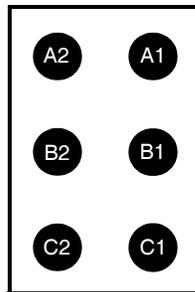
## Ordering Information

Part	Switch	Input buffer	Output Discharge	ON Pin Activity	Top Mark
FPF1003	30mΩ, PMOS	Schmitt	NA	Active HI	3
FPF1004	30mΩ, PMOS	Schmitt	120Ω	Active HI	4

## Functional Block Diagram



## Pin Configuration



1.0 x 1.5 CSP Bottom View

## Pin Description

Pin	Name	Function
A2, B2	$V_{IN}$	Supply Input: Input to the power switch and the supply voltage for the IC
C2	ON	ON Control Input
A1, B1	$V_{OUT}$	Switch Output: Output of the power switch
C1	GND	Ground

## Absolute Maximum Ratings

Parameter		Min	Max	Unit
$V_{IN}$ , $V_{OUT}$ , ON to GND		-0.3	6	V
Power Dissipation @ $T_A = 25^\circ\text{C}$ (Note 1)			1.2	W
Maximum Continuous Switch Current			2.0	A
Operating Temperature Range		-40	125	$^\circ\text{C}$
Storage Temperature		-65	150	$^\circ\text{C}$
Thermal Resistance, Junction to Ambient			85	$^\circ\text{C/W}$
Electrostatic Discharge Protection	HBM	2000		V
	MM	200		V

## Recommended Operating Range

Parameter		Min	Max	Unit
$V_{IN}$		1.2	5.5	V
Ambient Operating Temperature, $T_A$		-40	85	$^\circ\text{C}$

## Electrical Characteristics

$V_{IN} = 1.2$  to  $5.5\text{V}$ ,  $T_A = -40$  to  $+85^\circ\text{C}$  unless otherwise noted. Typical values are at  $V_{IN} = 3.3\text{V}$  and  $T_A = 25^\circ\text{C}$ .

Parameter	Symbol	Conditions	Min	Typ	Max	Units
<b>Basic Operation</b>						
Operating Voltage	$V_{IN}$		1.2		5.5	V
Quiescent Current	$I_Q$	$I_{OUT} = 0\text{mA}$ , $V_{IN} = V_{ON}$			1	$\mu\text{A}$
Off Supply Current	$I_{Q(off)}$	$V_{ON} = \text{GND}$ , $\text{OUT} = \text{open}$			1	$\mu\text{A}$
Off Switch Current	$I_{SD(off)}$	$V_{ON} = \text{GND}$ , $V_{OUT} = 0$			1	$\mu\text{A}$
On-Resistance	$R_{ON}$	$V_{IN} = 5.5\text{V}$ , $T_A = 25^\circ\text{C}$		20	30	m $\Omega$
		$V_{IN} = 3.3\text{V}$ , $T_A = 25^\circ\text{C}$		25	35	
		$V_{IN} = 1.5\text{V}$ , $T_A = 25^\circ\text{C}$		50	75	
		$V_{IN} = 1.2\text{V}$ , $T_A = 25^\circ\text{C}$		95	150	
Output Pull Down Resistance	$R_{PD}$	$V_{IN} = 3.3\text{V}$ , $V_{ON} = 0\text{V}$ , $T_A = 25^\circ\text{C}$ , FPF1004		75	120	$\Omega$
ON Input Logic High Voltage	$V_{IH}$	$V_{IN} = 2.7\text{V}$ to $5.5\text{V}$	2			V
		$V_{IN} = 1.2\text{V}$	0.8			
ON Input Logic Low Voltage	$V_{IL}$	$V_{IN} = 2.7\text{V}$ to $5.5\text{V}$			0.8	V
		$V_{IN} = 1.2\text{V}$			0.35	
ON Input Leakage		$V_{ON} = V_{IN}$ or GND			1	$\mu\text{A}$
<b>Dynamic</b>						
Turn on delay	$t_{ON}$	$V_{IN} = 3.3\text{V}$ , $R_L = 500\Omega$ , $C_L = 0.1\mu\text{F}$ , $T_A = 25^\circ\text{C}$		13		$\mu\text{s}$
Turn off delay	$t_{OFF}$	$V_{IN} = 3.3\text{V}$ , $R_L = 500\Omega$ , $C_L = 0.1\mu\text{F}$ , $T_A = 25^\circ\text{C}$ , FPF1003		45		$\mu\text{s}$
		$V_{IN} = 3.3\text{V}$ , $R_L = 500\Omega$ , $C_L = 0.1\mu\text{F}$ , $R_{L\_CHIP} = 120\Omega$ , $T_A = 25^\circ\text{C}$ , FPF1004		15		$\mu\text{s}$
$V_{OUT}$ Rise Time	$t_R$	$V_{IN} = 3.3\text{V}$ , $R_L = 500\Omega$ , $C_L = 0.1\mu\text{F}$ , $T_A = 25^\circ\text{C}$		13		$\mu\text{s}$
$V_{OUT}$ Fall Time	$t_F$	$V_{IN} = 3.3\text{V}$ , $R_L = 500\Omega$ , $C_L = 0.1\mu\text{F}$ , $T_A = 25^\circ\text{C}$ , FPF1003		113		$\mu\text{s}$
		$V_{IN} = 3.3\text{V}$ , $R_L = 500\Omega$ , $C_L = 0.1\mu\text{F}$ , $R_{L\_CHIP} = 120\Omega$ , $T_A = 25^\circ\text{C}$ , FPF1004		10		$\mu\text{s}$

**Note 1:** Package power dissipation on 1square inch pad, 2 oz. copper board.

### Typical Characteristics

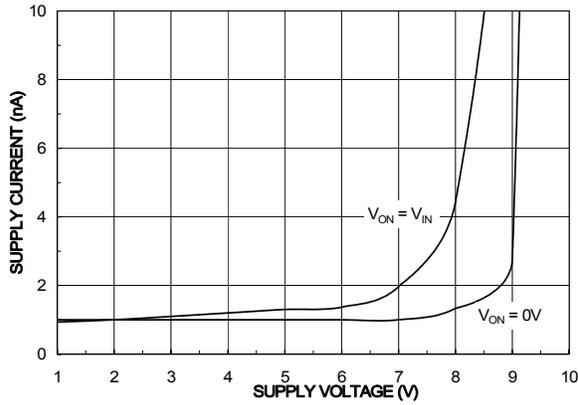


Figure 1. Quiescent Current vs.  $V_{IN}$

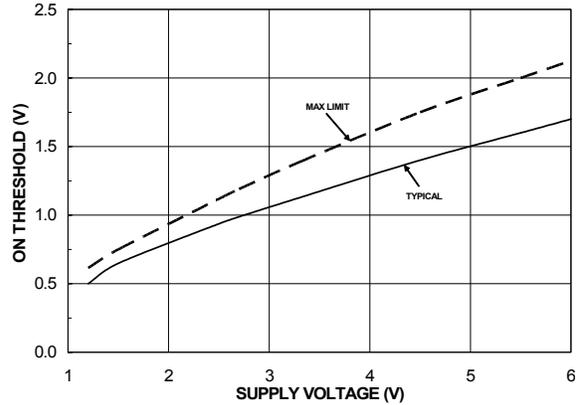


Figure 2. ON Threshold vs.  $V_{IN}$

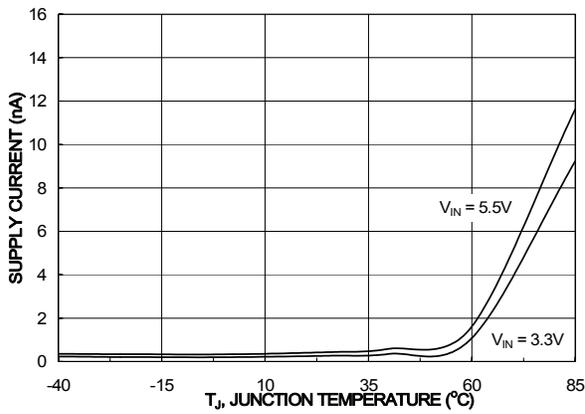


Figure 3. Quiescent Current vs. Temperature

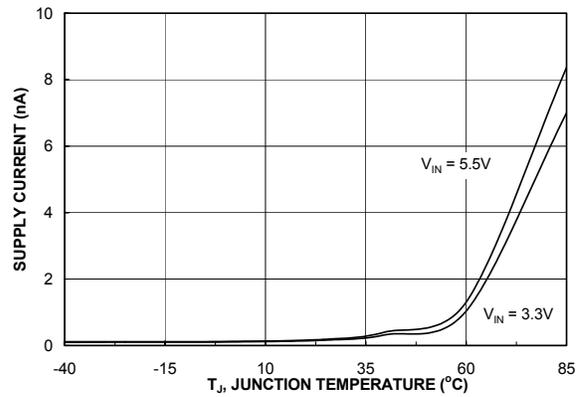


Figure 4. Quiescent Current (off) vs. Temperature

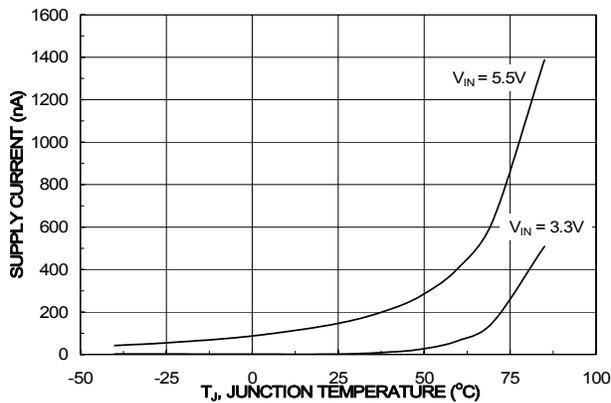


Figure 5.  $I_{SWITCH-OFF}$  Current vs. Temperature

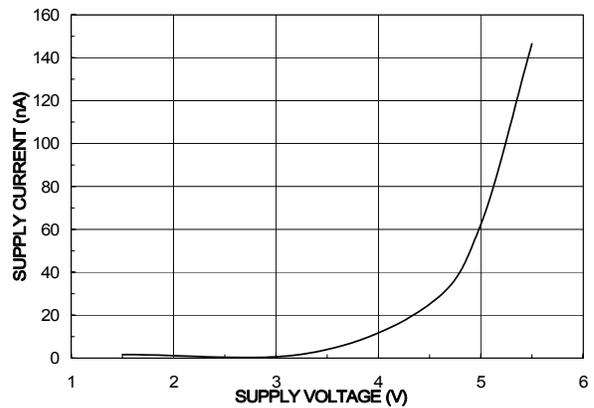


Figure 6.  $I_{SWITCH-OFF}$  Current vs.  $V_{IN}$

## Typical Characteristics

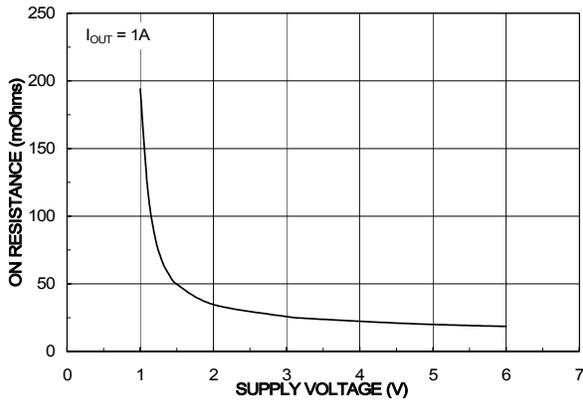


Figure 7.  $R_{ON}$  vs.  $V_{IN}$

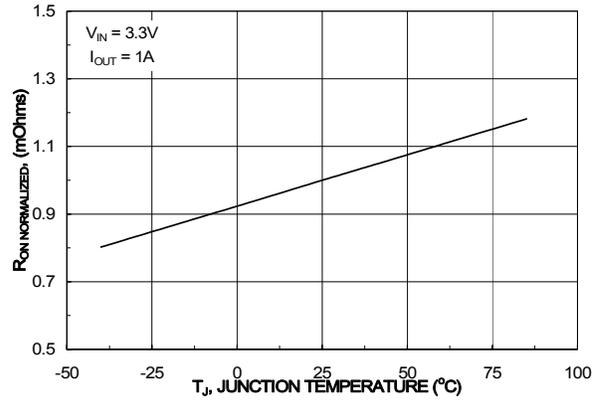


Figure 8.  $R_{ON}$  vs. Temperature

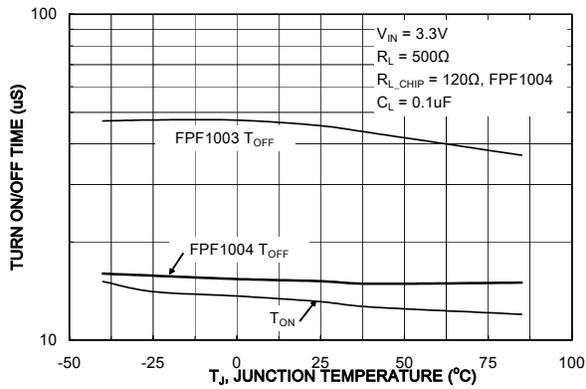


Figure 9.  $T_{ON}/T_{OFF}$  vs. Temperature

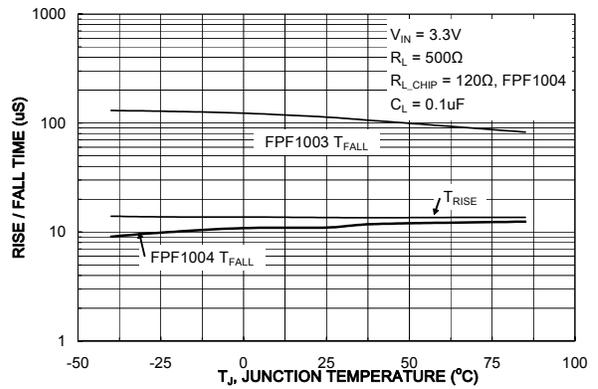


Figure 10.  $T_{RISE}/T_{FALL}$  vs. Temperature

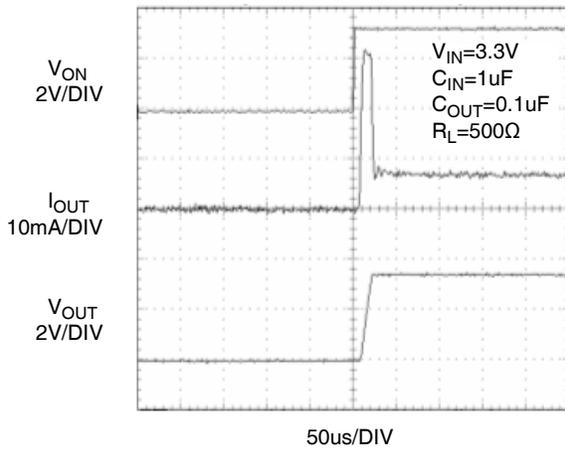


Figure 11. FPF1003  $T_{ON}$  Response

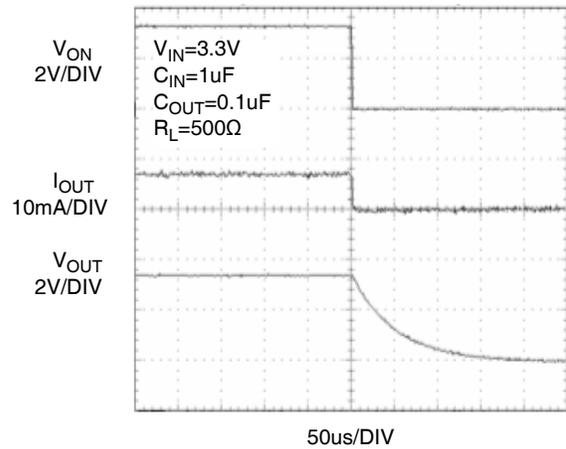


Figure 12. FPF1003  $T_{OFF}$  Response

## Typical Characteristics

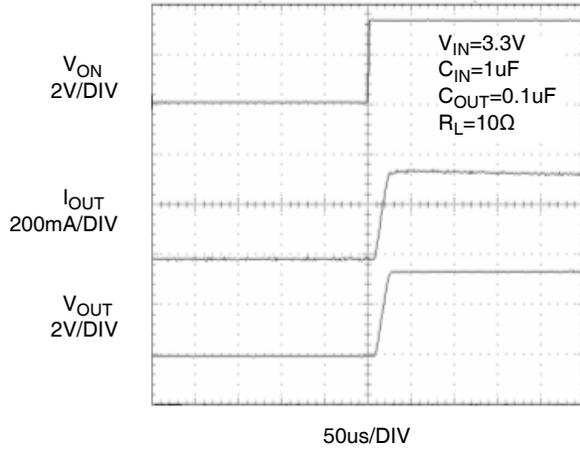


Figure 13. FPF1003  $T_{ON}$  Response

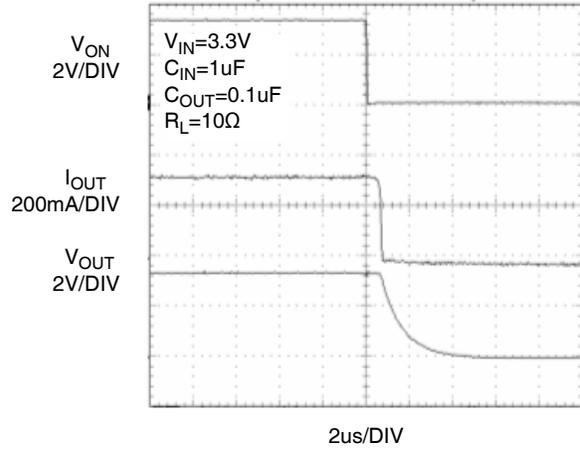


Figure 14. FPF1003  $T_{OFF}$  Response

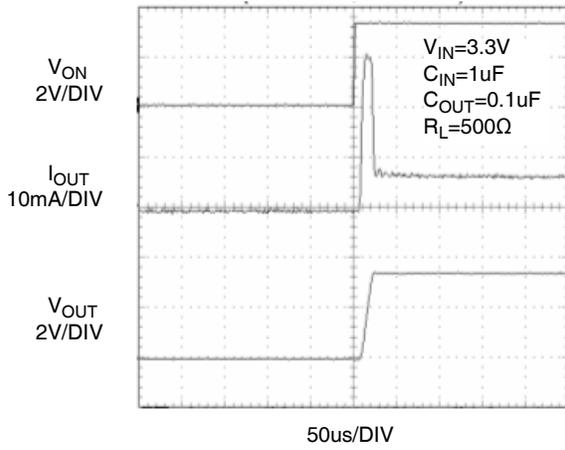


Figure 15. FPF1004  $T_{ON}$  Response

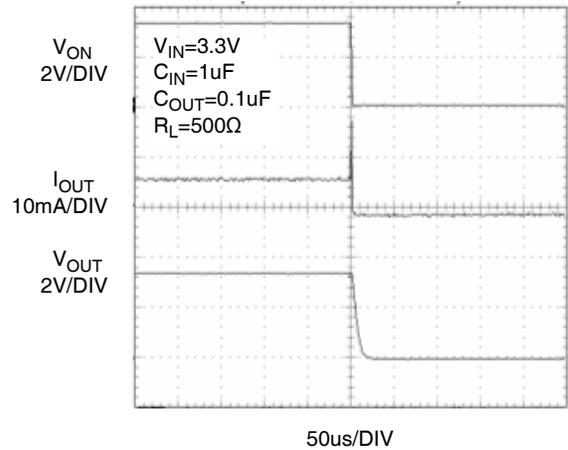


Figure 16. FPF1004  $T_{OFF}$  Response

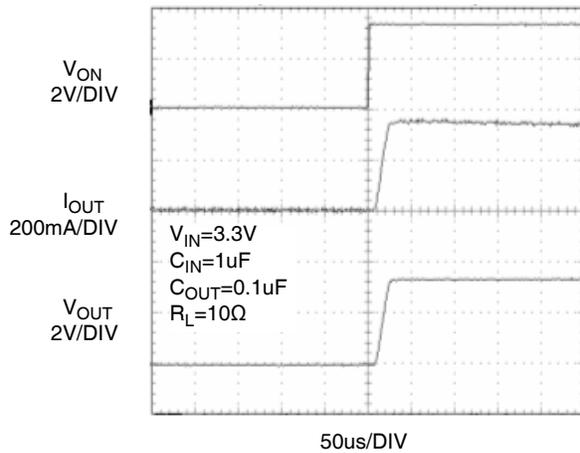


Figure 17. FPF1004  $T_{ON}$  Response

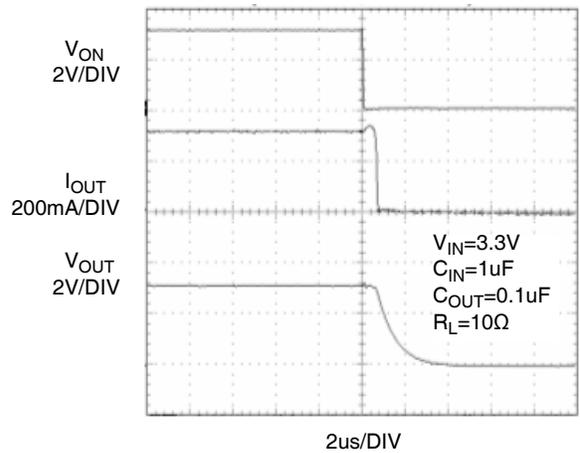


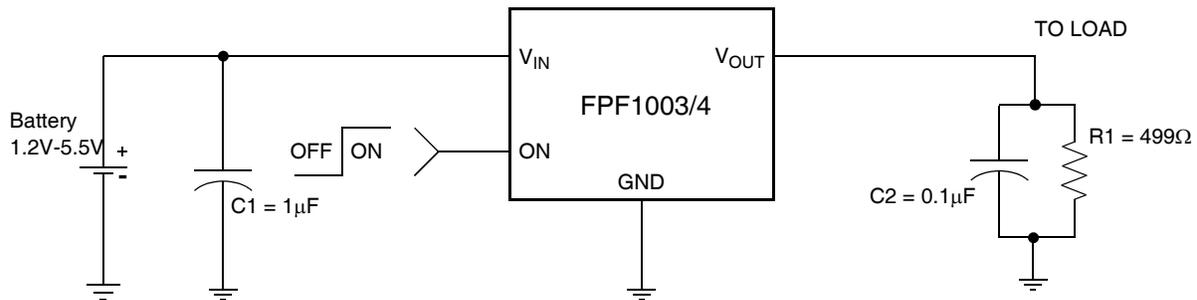
Figure 18. FPF1004  $T_{OFF}$  Response

## Description of Operation

The FPF1003 & FPF1004 are low  $R_{DS(ON)}$  P-Channel load switches with controlled turn-on. The core of each device is a 30mΩ P-Channel MOSFET and a controller capable of functioning over a wide input operating range of 1.2-5.5V. Switch control is by a logic input (ON) capable of interfacing directly with low voltage control signal. In FPF1004, 120Ω on-chip load resistor is added for output quick discharge when switch is turned off.

## Application Information

### Typical Application



### Input Capacitor

To limit the voltage drop on the input supply caused by transient in-rush 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 1µF ceramic capacitor,  $C_{IN}$ , placed close to the pins is usually sufficient. Higher values of  $C_{IN}$  can be used to further reduce the voltage drop.

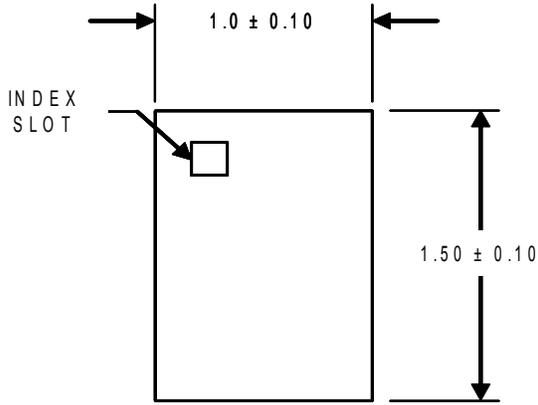
### Board Layout

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 will help minimize the parasitic electrical effects along with minimizing the case to ambient thermal impedance.

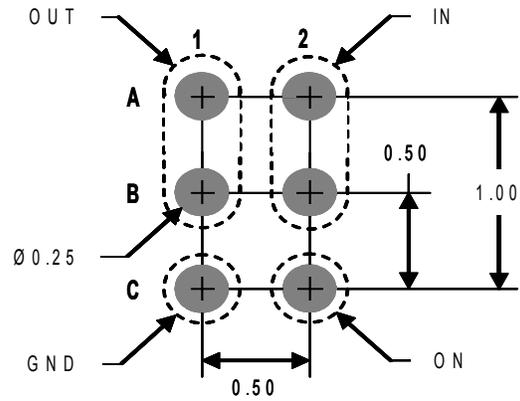
### Output Capacitor

A 0.1µF capacitor,  $C_{OUT}$ , should be placed between  $V_{OUT}$  and GND. This capacitor will prevent 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 highly 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  $V_{IN}$ .

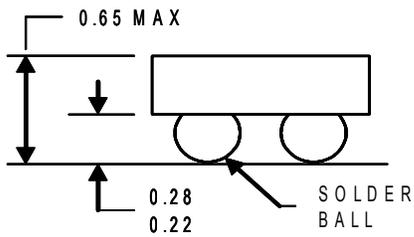
### Dimensional Outline and Pad Layout



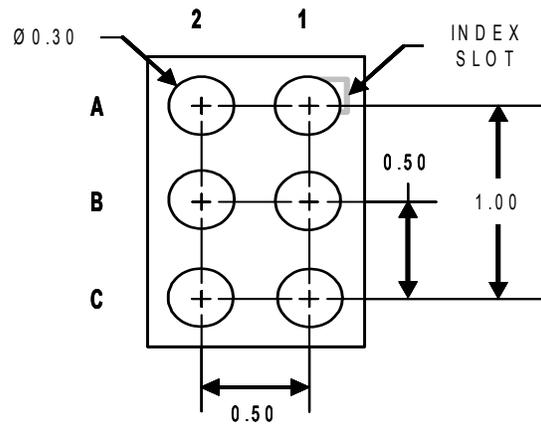
TOP VIEW



RECOMMENDED LAND PATTERN



SIDE VIEW



BOTTOM VIEW

NOTES:

A) ALL DIMENSIONS ARE IN MILLIMETERS.

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#### Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative or In Design	This datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
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Rev. I22