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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

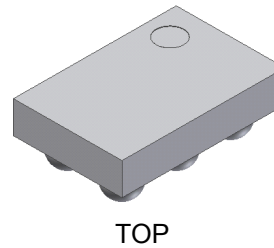
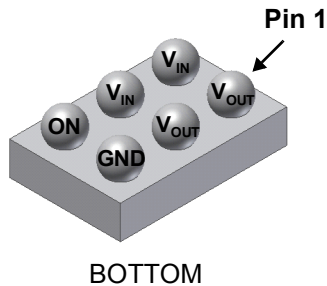
Applications

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

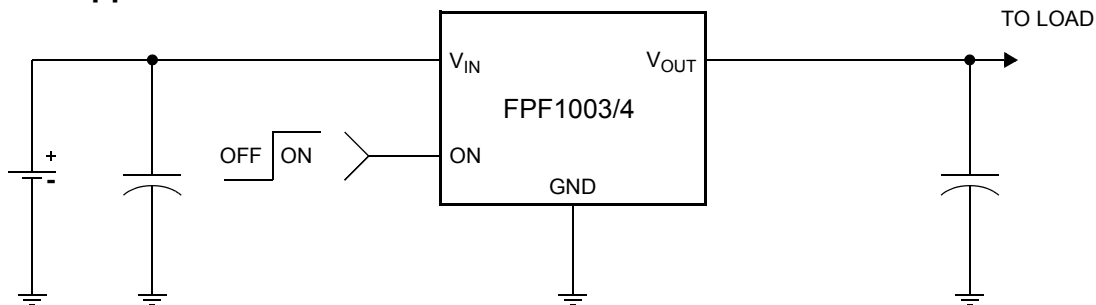
General Description

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 mm² chip scale package, 1.0X1.5CSP-6.



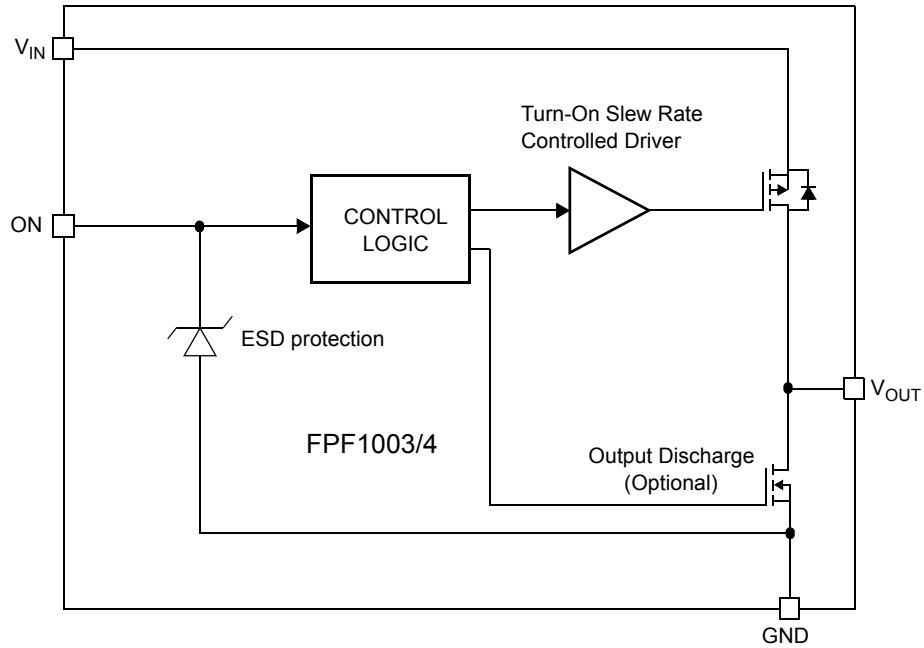
Typical Application Circuit



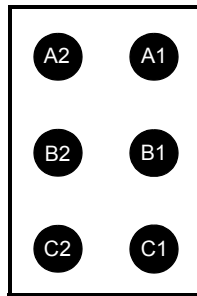
Ordering Information

| 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 5.5V , $T_A = -40$ 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 |
|-----------------------------|---------------|--|-----|-----|------|---------------|
| Basic Operation | | | | | | |
| Operating Voltage | V_{IN} | | 1.2 | | 5.5 | V |
| Quiescent Current | I_Q | $I_{OUT} = 0\text{mA}$, $V_{IN} = V_{ON}$ | | | 1 | μA |
| Off Supply Current | $I_{Q(off)}$ | $V_{ON} = \text{GND}$, $\text{OUT} = \text{open}$ | | | 1 | μA |
| Off Switch Current | $I_{SD(off)}$ | $V_{ON} = \text{GND}$, $V_{OUT} = 0$ @ $V_{IN} = 5.5\text{V}$, $T_A = 85^\circ\text{C}$ | | | 1 | μA |
| | | $V_{ON} = \text{GND}$, $V_{OUT} = 0$ @ $V_{IN} = 3.3\text{V}$, $T_A = 25^\circ\text{C}$ | | 10 | 100 | nA |
| On-Resistance | R_{ON} | $V_{IN} = 5.5\text{V}$, $T_A = 25^\circ\text{C}$ | | 20 | 30 | m Ω |
| | | $V_{IN} = 3.3\text{V}$, $T_A = 25^\circ\text{C}$ | | 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 | Ω |
| ON Input Logic High Voltage | V_{IH} | $V_{IN} = 2.7\text{V}$ to 5.5V | 2 | | | V |
| | | $V_{IN} = 1.2\text{V}$ | 0.8 | | | |
| ON Input Logic Low Voltage | V_{IL} | $V_{IN} = 2.7\text{V}$ to 5.5V | | | 0.8 | V |
| | | $V_{IN} = 1.2\text{V}$ | | | 0.35 | |
| ON Input Leakage | | $V_{ON} = V_{IN}$ or GND | | | 1 | μA |
| Dynamic | | | | | | |
| 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 | | μs |
| 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 | | μs |
| | | $V_{IN} = 3.3\text{V}$, $R_L = 500\Omega$, $C_L = 0.1\mu\text{F}$, $R_{L_CHIP} = 120\Omega$, $T_A = 25^\circ\text{C}$, FPF1004 | | 15 | | μs |
| 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 | | μs |
| 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 | | μs |
| | | $V_{IN} = 3.3\text{V}$, $R_L = 500\Omega$, $C_L = 0.1\mu\text{F}$, $R_{L_CHIP} = 120\Omega$, $T_A = 25^\circ\text{C}$, FPF1004 | | 10 | | μs |

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

Typical Characteristics

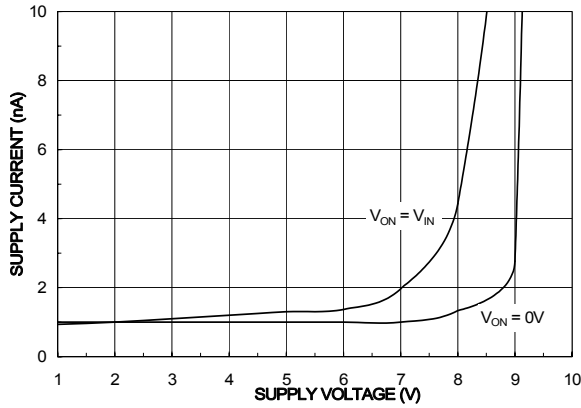


Figure 1. Quiescent Current vs. V_{IN}

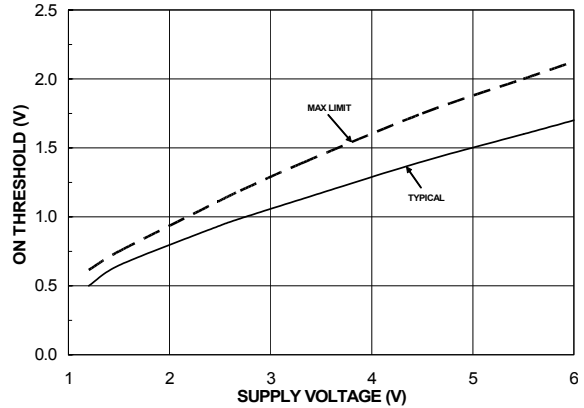


Figure 2. ON Threshold vs. V_{IN}

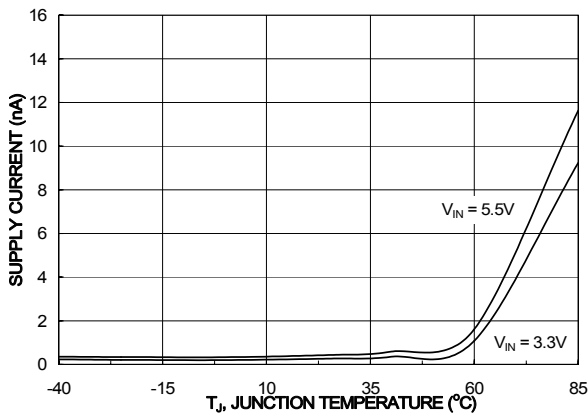


Figure 3. Quiescent Current vs. Temperature

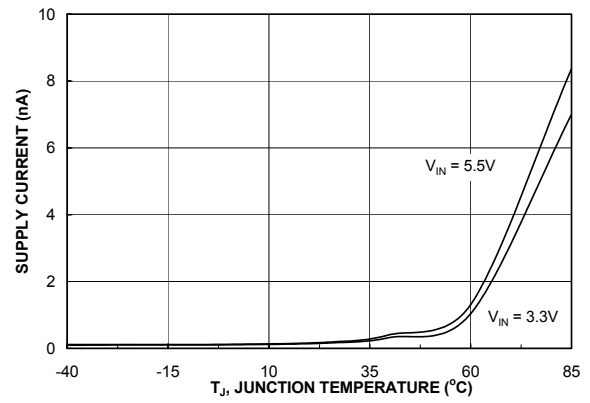


Figure 4. Quiescent Current (off) vs. Temperature

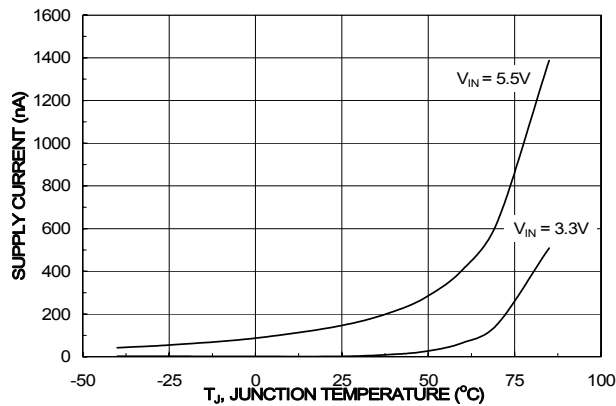


Figure 5. $I_{\text{SWITCH-OFF}}$ Current vs. Temperature

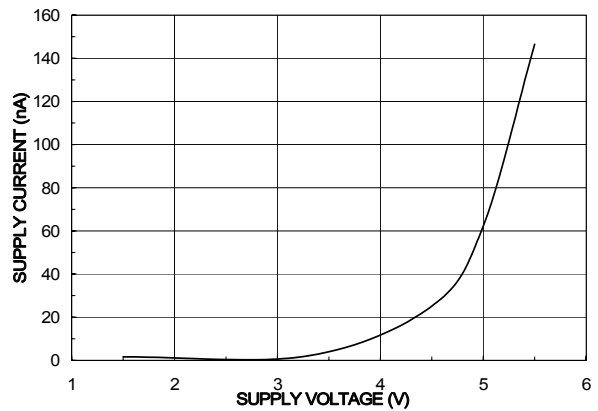


Figure 6. $I_{\text{SWITCH-OFF}}$ Current vs. V_{IN}

Typical Characteristics

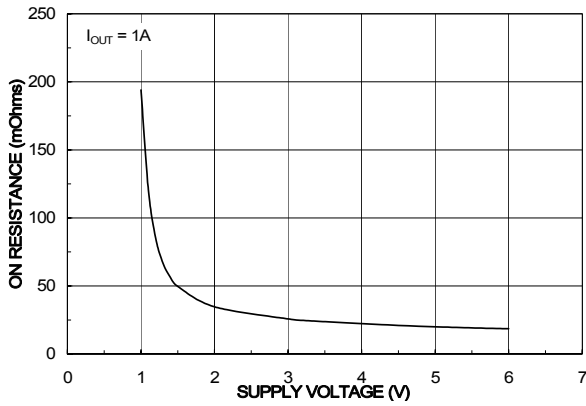


Figure 7. R_{ON} vs. V_{IN}

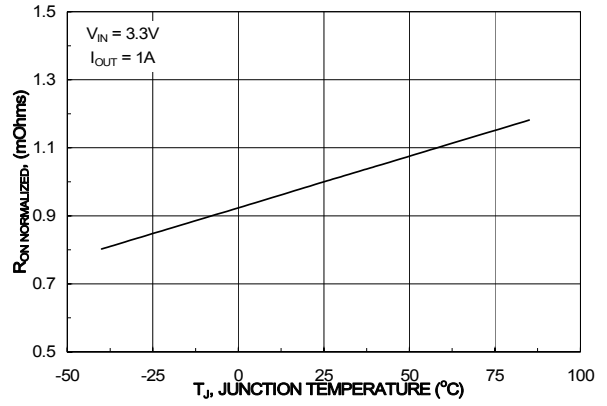


Figure 8. R_{ON} vs. Temperature

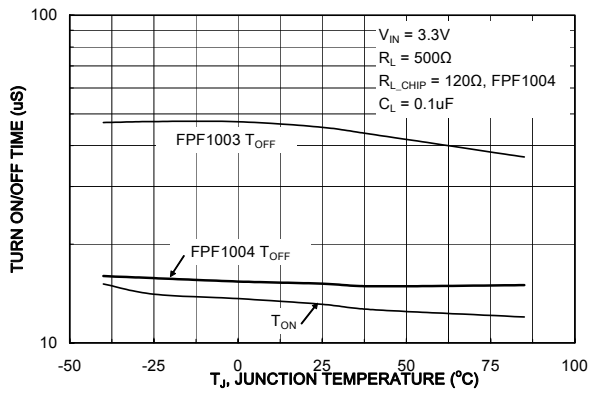


Figure 9. T_{ON}/T_{OFF} vs. Temperature

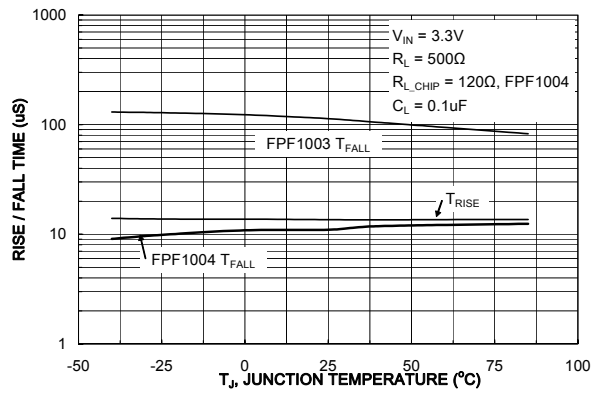


Figure 10. T_{RISE}/T_{FALL} vs. Temperature

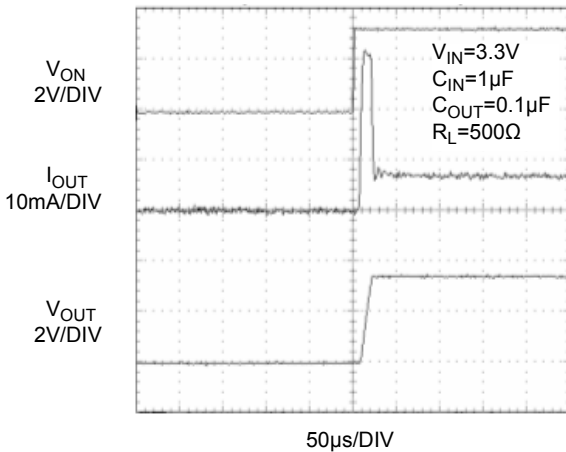


Figure 11. FPF1003 T_{ON} Response

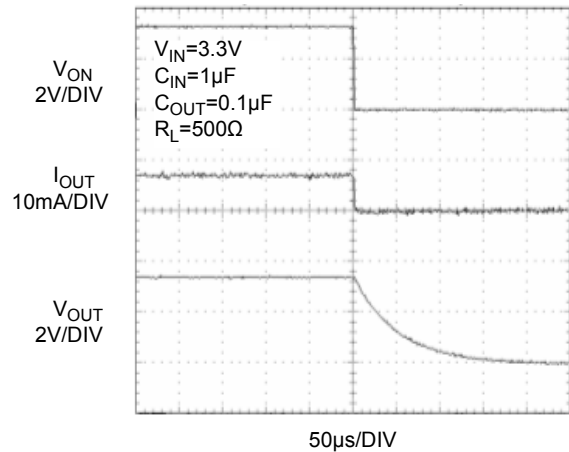


Figure 12. FPF1003 T_{OFF} Response

Typical Characteristics

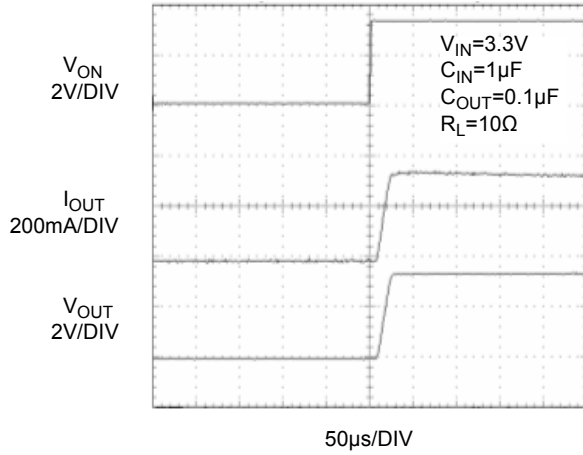


Figure 13. FPF1003 T_{ON} Response

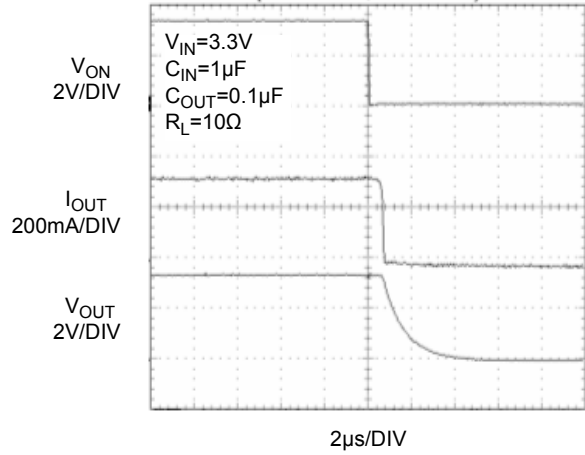


Figure 14. FPF1003 T_{OFF} Response

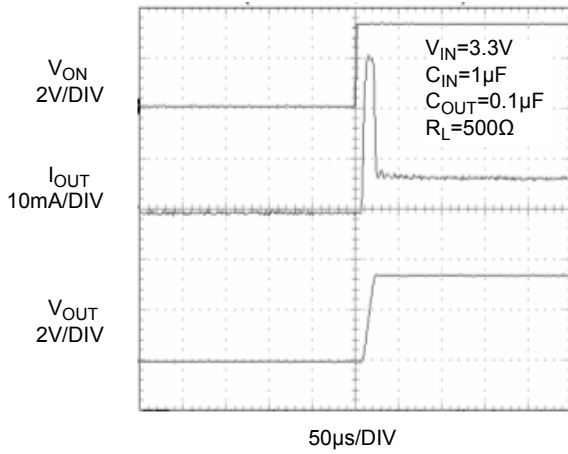


Figure 15. FPF1004 T_{ON} Response

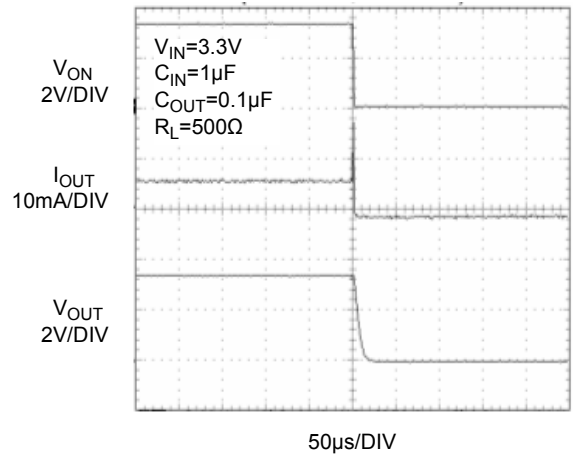


Figure 16. FPF1004 T_{OFF} Response

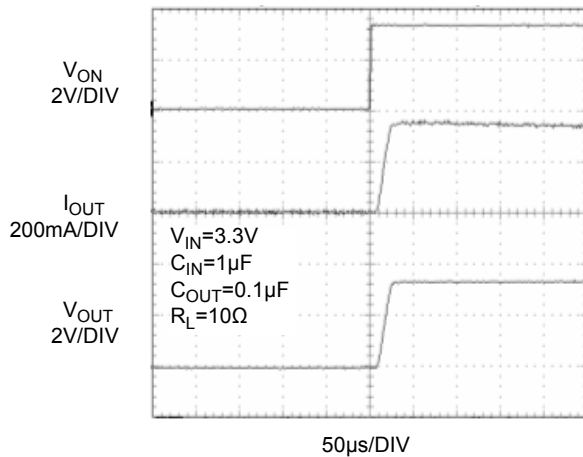


Figure 17. FPF1004 T_{ON} Response

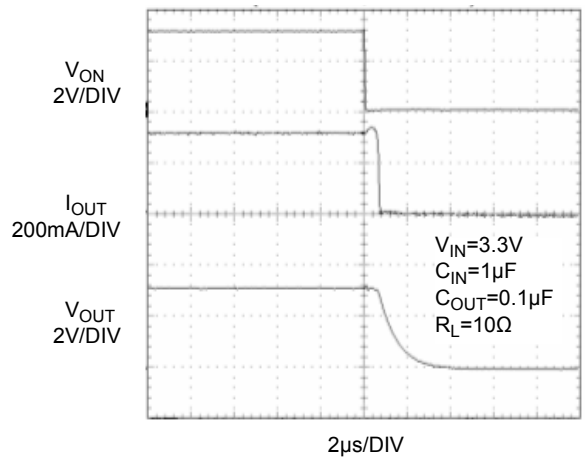


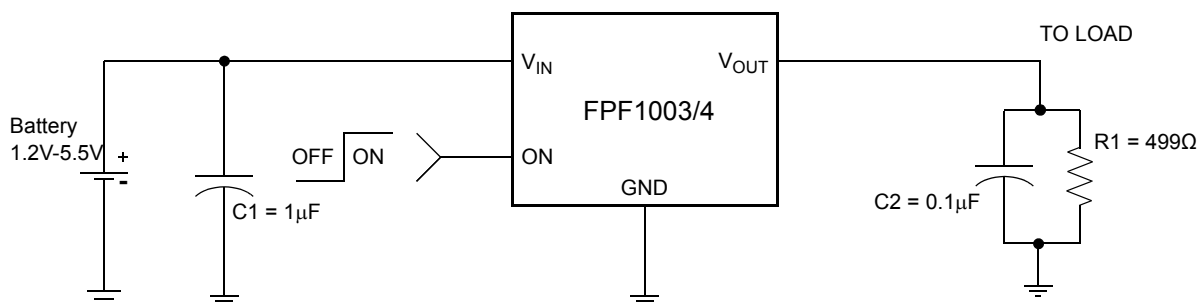
Figure 18. FPF1004 T_{OFF} Response

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.

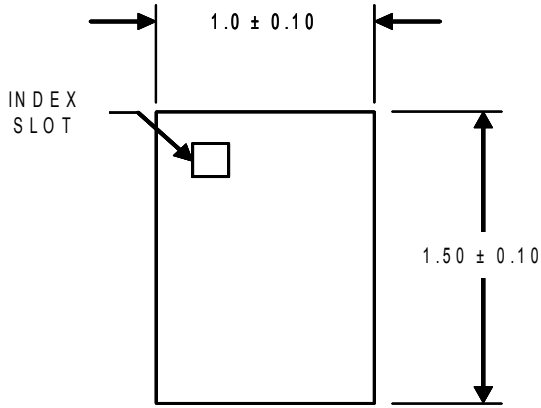
Board Layout

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.

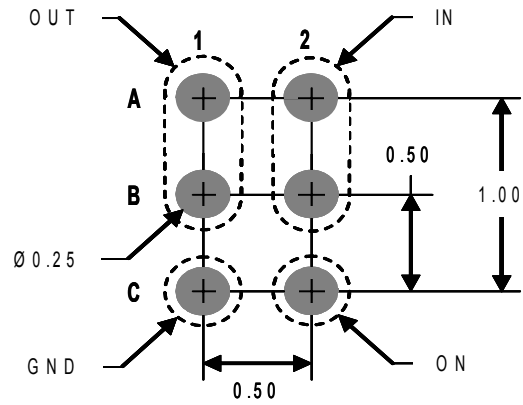
Output Capacitor

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} .

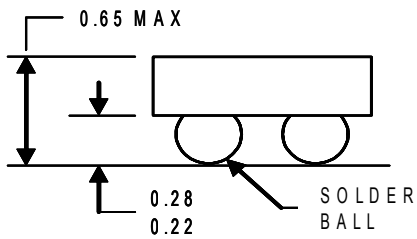
Dimensional Outline and Pad Layout



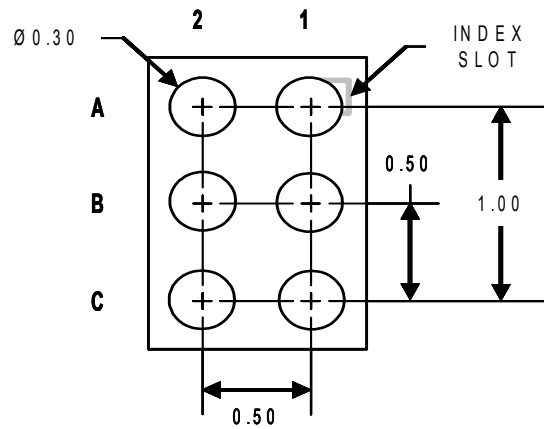
TOP VIEW



RECOMMENDED LAND PATTERN



SIDE VIEW



BOTTOM VIEW


NOTES:

A) ALL DIMENSIONS ARE IN MILLIMETERS.



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