FAIRCHILD SEMICONDUCTOR®

August 2007

FPF1005-FPF1006
IntelliMAX™ Advanced Load Management Products

Features

- 1.2 to 5.5V Input Voltage Range
- Typical $R_{DS(ON)}$ = 50mΩ @ V_{IN} = 5.5V
- Typical $R_{DS(ON)}$ = 55mΩ @ V_{IN} = 3.3V
- ESD Protected, above 2000V HBM

Applications

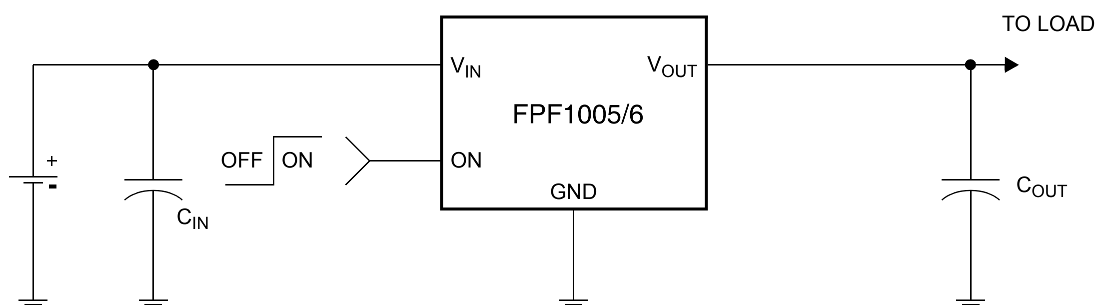
- PDAs
- Cell Phones
- GPS Devices
- MP3 Players
- Digital Cameras
- Peripheral Ports
- Hot Swap Supplies
- RoHS Compliant

General Description

The FPF1005 & FPF1006 are low R_{DS} P-Channel MOSFET load switches with CMOS controlled turn-on targeting small package load switch applications. The input voltage range operates from 1.2V to 5.5V. Switch control is by a logic input (ON) capable of interfacing directly with low voltage control signals. In FPF1006, 120Ω on-chip load resistor is added for output quick discharge when switch is turned off.

Both FPF1005 & FPF1006 are available in a small 2X2 MicroFET-6 pin plastic package.

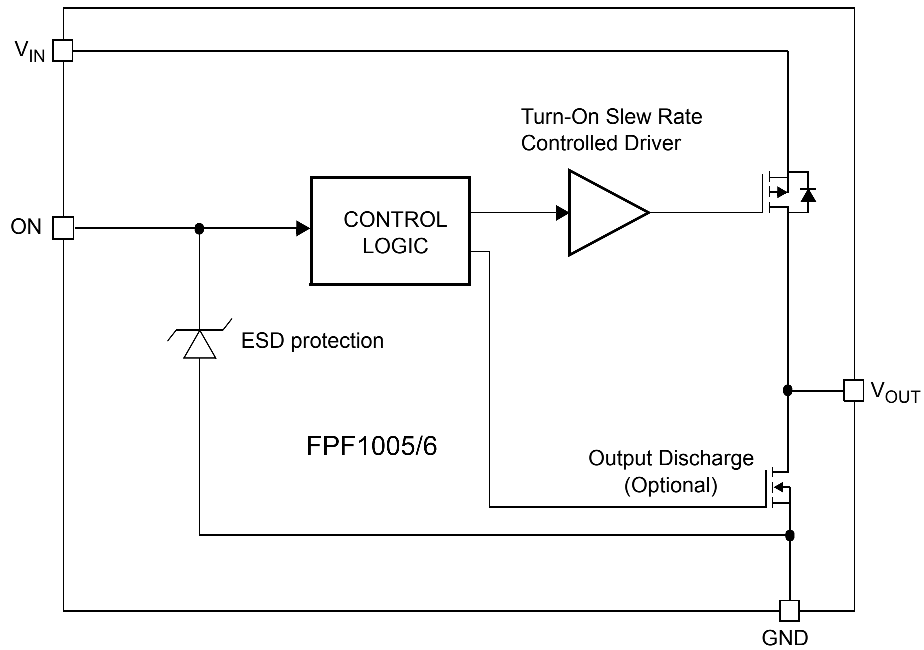
Typical Application Circuit



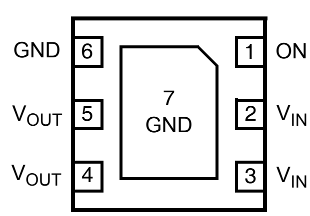
Ordering Information

Part	Switch	Input Buffer	Output Discharge	ON Pin Activity
FPF1005	55mΩ, PMOS	Schmitt	NA	Active HI
FPF1006	55mΩ, PMOS	Schmitt	120Ω	Active HI

Functional Block Diagram



Pin Configuration



MicroFET 2x2 6L BOTTOM

Pin Description

Pin	Name	Function
4, 5	V_{OUT}	Switch Output: Output of the power switch
2, 3	V_{IN}	Supply Input: Input to the power switch and the supply voltage for the IC
6, 7	GND	Ground
1	ON	ON/OFF Control Input

Absolute Maximum Ratings

Parameter		Min	Max	Unit
V_{IN}, V_{OUT}, ON to GND		-0.3	6	V
Maximum Continuous Switch Current			1.5	A
Power Dissipation @ T_A = 25°C (Note 1)			1.2	W
Operating Temperature Range		-40	85	°C
Storage Temperature		-65	150	°C
Thermal Resistance, Junction to Ambient			86	°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	°C

Electrical Characteristics

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

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Basic Operation						
Operating Voltage	V_{IN}		1.2		5.5	V
Quiescent Current	I_Q	I_{OUT} = 0mA, V_{IN} = V_{ON}			1	µA
Off Supply Current	$I_{Q(off)}$	V_{ON} = GND, OUT = open			1	µA
Off Switch Current	$I_{SD(off)}$	V_{ON} = GND, V_{OUT} = 0V @ V_{IN} = 5.5V, T_A = 85°C			1	µA
		V_{ON} = GND, V_{OUT} = 0V @ V_{IN} = 3.3V, T_A = 25°C		10	100	nA
On-Resistance	R_{ON}	V_{IN} = 5.5V, T_A = 25°C		50	70	mΩ
		V_{IN} = 3.3V, T_A = 25°C		55	80	
		V_{IN} = 1.5V, T_A = 25°C		95	135	
		V_{IN} = 1.2V, T_A = 25°C		165	250	
Output Pull Down Resistance	R_{PD}	V_{IN} = 3.3V, V_{ON} = 0V, T_A = 25°C, FPF1006		75	120	Ω
ON Input Logic Low Voltage	V_{IL}	V_{IN} = 5.5V			1.25	V
		V_{IN} = 4.5V			1.10	
		V_{IN} = 1.5V			0.50	
ON Input Logic High Voltage	V_{IH}	V_{IN} = 5.5V	2.00			V
		V_{IN} = 4.5V	1.75			
		V_{IN} = 1.5V	0.75			
ON Input Leakage		V_{ON} = V_{IN} or GND	-1		1	µA
Dynamic						
Turn on delay	t_{ON}	V_{IN} = 3.3V, R_L = 500Ω, C_L = 0.1µF, T_A = 25°C		10		µs
Turn off delay	t_{OFF}	V_{IN} = 3.3V, R_L = 500Ω, C_L = 0.1µF, T_A = 25°C, FPF1005		50		µs
		V_{IN} = 3.3V, R_L = 500Ω, C_L = 0.1µF, R_{L_CHIP} = 120Ω, T_A = 25°C, FPF1006		10		µs
V_{OUT} Rise Time	t_R	V_{IN} = 3.3V, R_L = 500Ω, C_L = 0.1µF, T_A = 25°C		10		µs
V_{OUT} Fall Time	t_F	V_{IN} = 3.3V, R_L = 500Ω, C_L = 0.1µF, T_A = 25°C, FPF1005		100		µs
		V_{IN} = 3.3V, R_L = 500Ω, C_L = 0.1µF, R_{L_CHIP} = 120Ω, T_A = 25°C, FPF1006		10		µs

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

Typical Characteristics

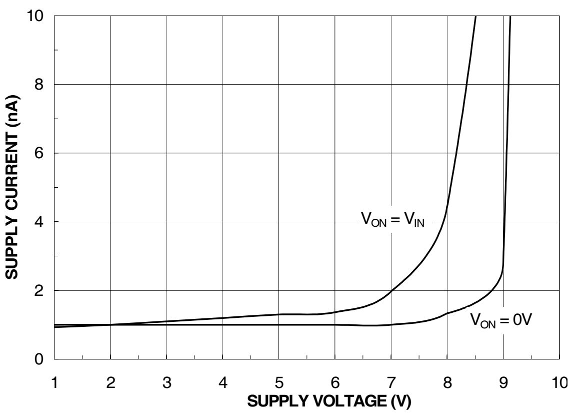


Figure 1. Quiescent Current vs.V_{IN}

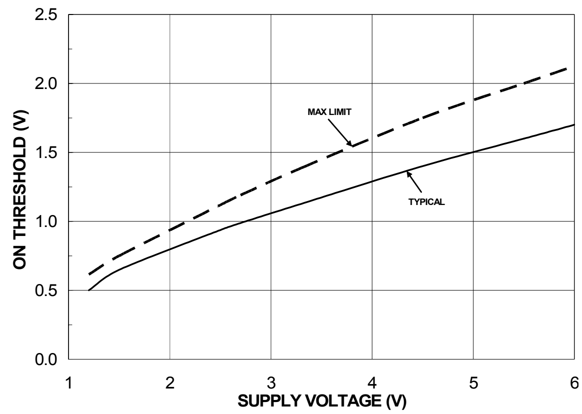


Figure 2. ON Threshold vs. V_{IN}

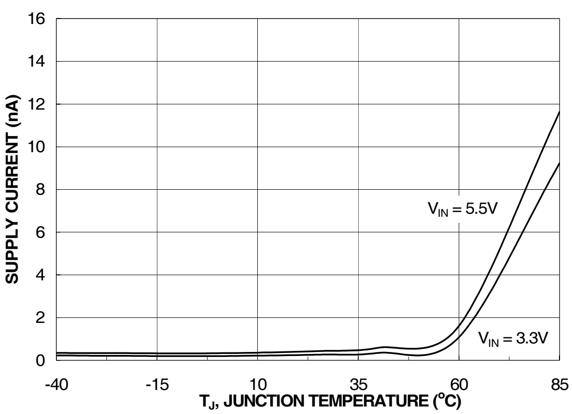


Figure 3. Quiescent Current vs. Temperature

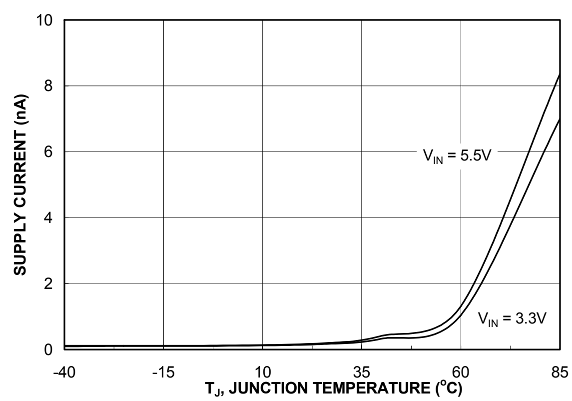


Figure 4. Quiescent Current (off) vs. Temperature

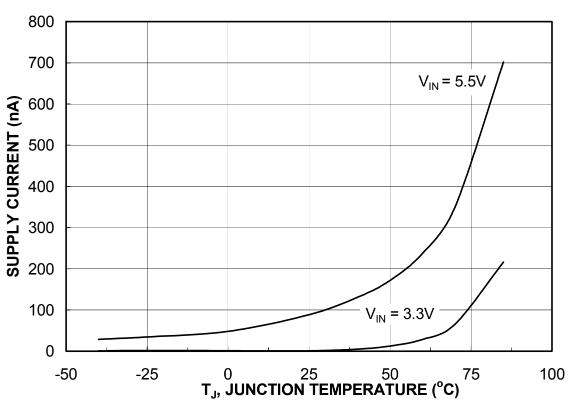


Figure 5. $I_{SWITCH-OFF}$ Current vs. Temperature

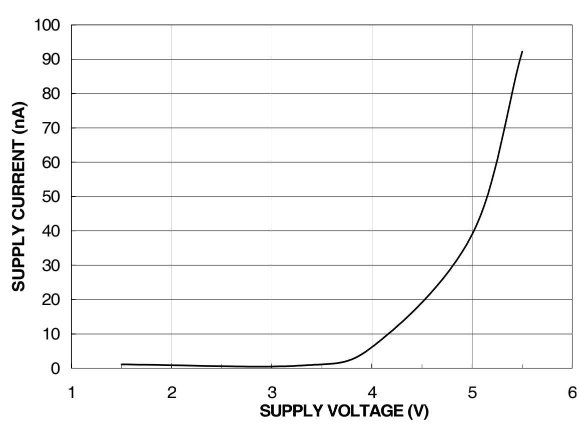


Figure 6. $I_{SWITCH-OFF}$ Current vs. V_{IN}

Typical Characteristics

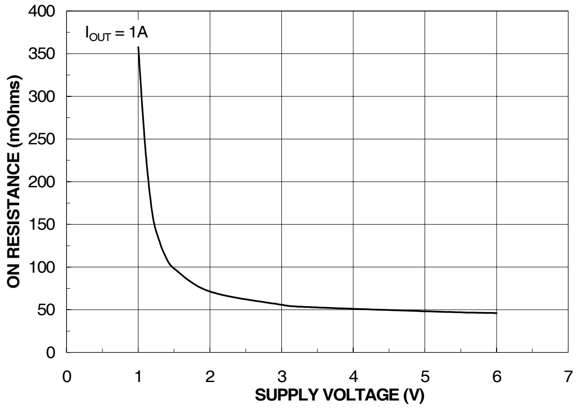


Figure 7. R_{ON} vs. V_{IN}

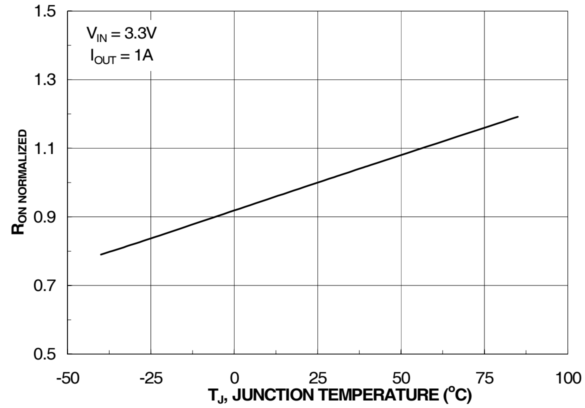


Figure 8. R_{ON} vs. Temperature

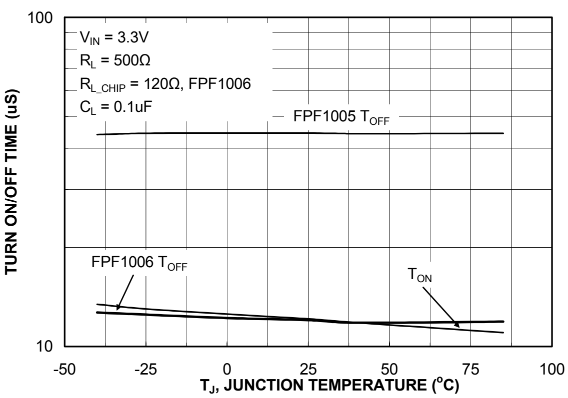


Figure 9. T_{ON}/T_{Off} vs. Temperature

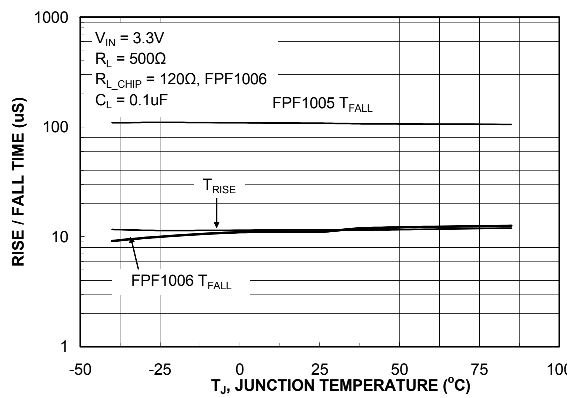


Figure 10. T_{RISE}/T_{FALL} vs. Temperature

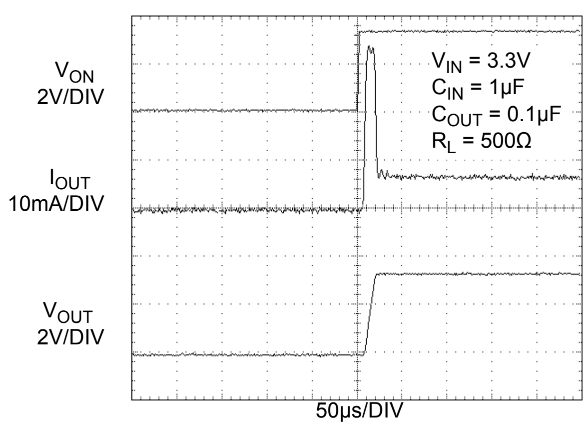


Figure 11. FPF1005 T_{ON} Response

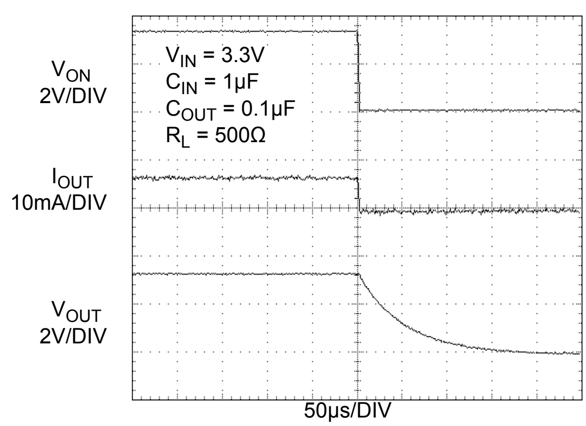


Figure 12. FPF1005 T_{OFF} Response

Typical Characteristics

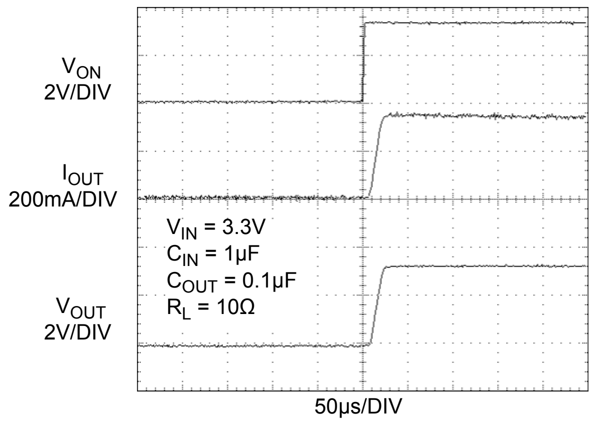


Figure 13. FPF1005 T_{ON} Response

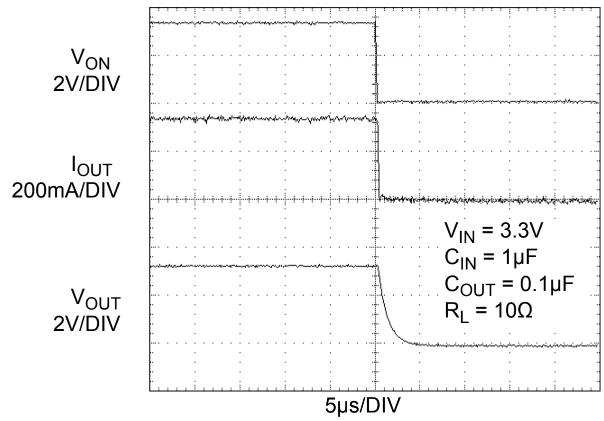


Figure 14. FPF1005 T_{OFF} Response

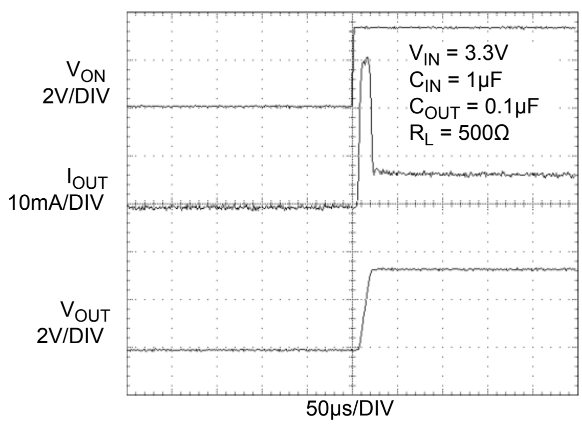


Figure 15. FPF1006 T_{ON} Response

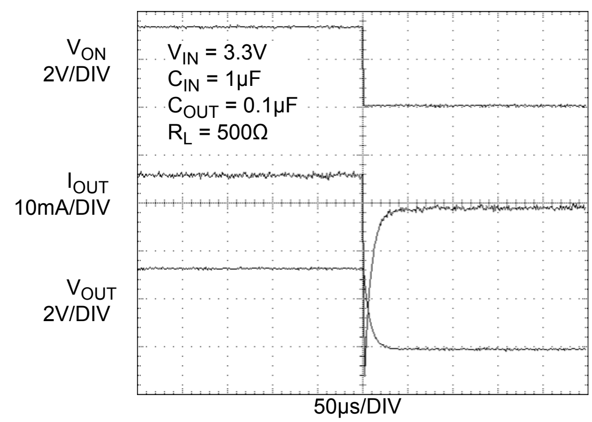


Figure 16. FPF1006 T_{OFF} Response

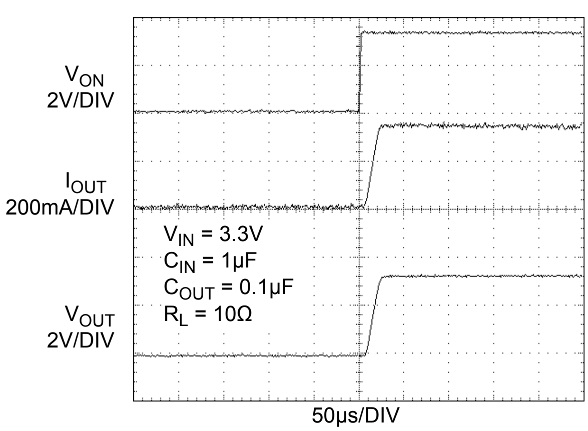


Figure 17. FPF1006 T_{ON} Response

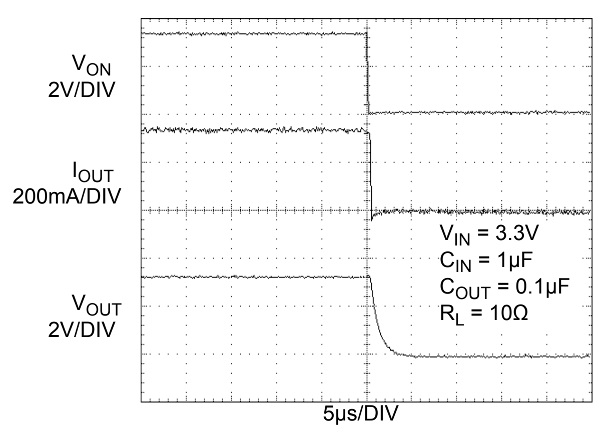


Figure 18. FPF1006 T_{OFF} Response

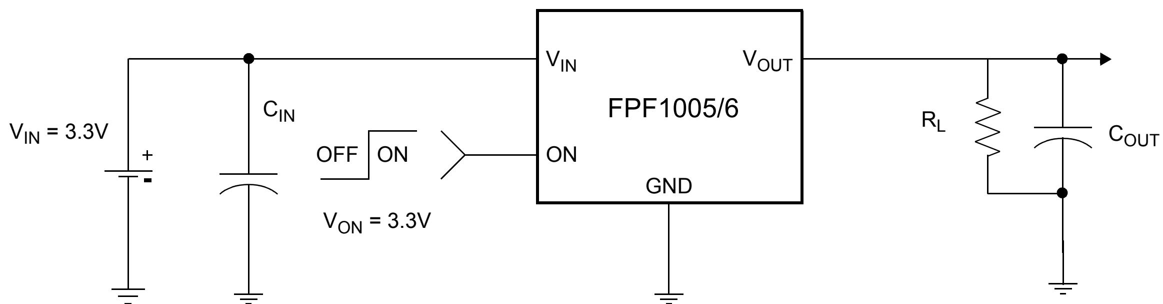
Description of Operation

The FPF1005 & FPF1006 are low $R_{DS(ON)}$ P-Channel load switches with controlled turn-on. The core of each device is a 55mΩ P-Channel MOSFET and a controller capable of functioning over a wide input operating range of 1.2-5.5V. The ON pin, an active HI TTL compatible input, controls the state of the switch. The FPF1006 contains a 120Ω on-chip load resistor for quick output discharge when the switch is turned off.

However, V_{OUT} pin of FPF1006 should not be connected directly to the battery source due to the discharge mechanism of the load switch.

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 during higher current application.

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}.

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 or large copper planes for all pins (V_{IN}, V_{OUT}, ON and GND) will help minimize the parasitic electrical effects along with minimizing the case to ambient thermal impedance.

Evaluation Board Layout

FPF1005/6 Demo board has the components and circuitry to demonstrate the load switch functions. Thermal performance of the load switch can be improved significantly by connecting the middle pad (pin 7) to the GND area of the PCB.

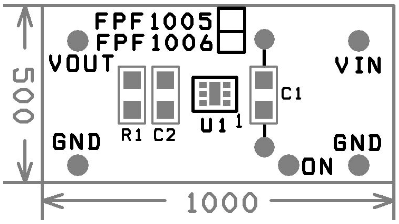


Figure 19. Demo board silk screen top and component assembly drawing.

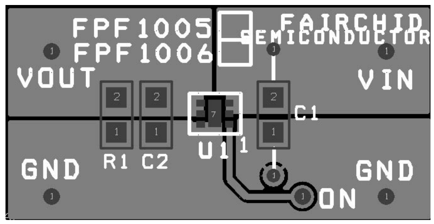


Figure 20. Demo board top and surface mount top layers view.(Pin 7 is connected to GND).

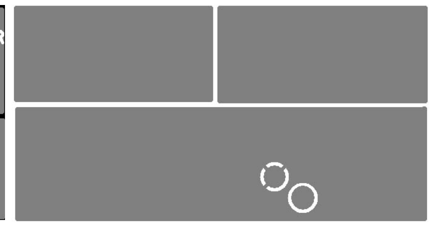
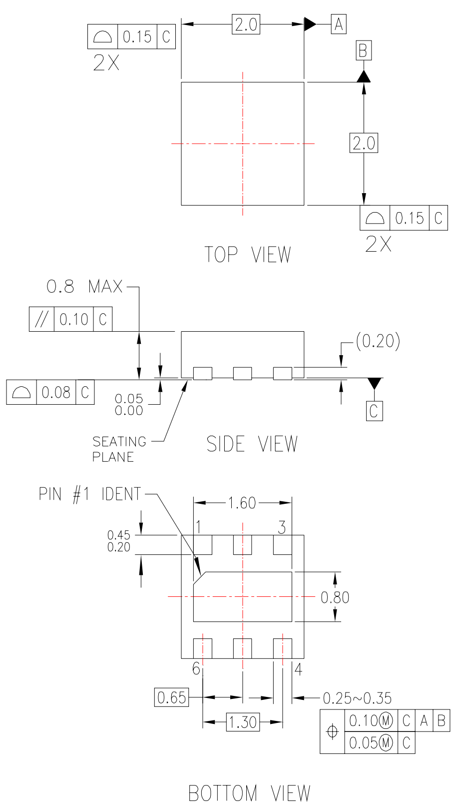
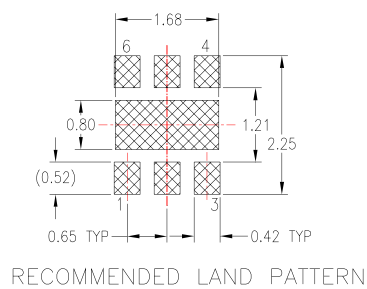


Figure 21. Demo board bottom layer view.

Dimensional Outline and Pad Layout





NOTES:

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B. DIMENSIONS ARE IN MILLIMETERS.
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SuperSOT™-3
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