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# FPF1007-FPF1009 IntelliMAX™ Advanced Load Products

## Features

- 1.2 to 5.5 V Input Voltage Range
- Typical  $R_{ON} = 30\text{ m}\Omega$  at  $V_{IN} = 5.5\text{ V}$
- Typical  $R_{ON} = 40\text{ m}\Omega$  at  $V_{IN} = 3.3\text{ V}$
- Fixed Three Different Turn-on Rise Time  $10\text{ }\mu\text{s} / 80\text{ }\mu\text{s} / 1\text{ ms}$
- Low  $< 10\text{ }\mu\text{A}$  at  $V_{IN} = 3.3\text{ V}$  Quiescent Current
- Internal ON Pin Pull Down
- Output Discharge Function
- ESD Protection above 8000 V HBM and 2000 V CDM
- RoHS Compliant

## Applications

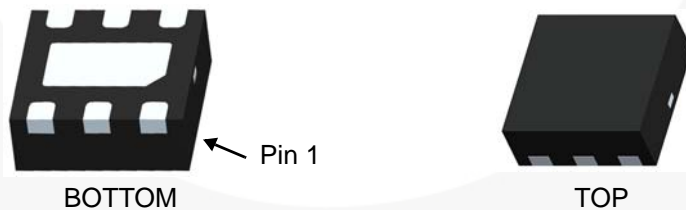
- PDAs
- Cell Phones
- GPS Devices
- MP3 Players
- Digital Cameras
- Peripheral Ports
- Hot-Swap Supplies
- Notebook Computers



## General Description

The FPF1007/8/9 are low  $R_{DS}$  P-Channel MOSFET load switches offered in a selection of  $10\text{ }\mu\text{s}$ ,  $80\text{ }\mu\text{s}$ , and  $1\text{ ms}$  slew rate turn-on options for transient / in-rush current control. To support trends in mobile application requirements, the minimum operating input voltage has been reduced down to  $1.2\text{ V}$ , the input current leakage has been minimized to extend battery life, and the ESD-protection has been designed to withstand a minimum of  $8\text{ kV}$  (HBM) and  $2\text{ kV}$  (CDM).

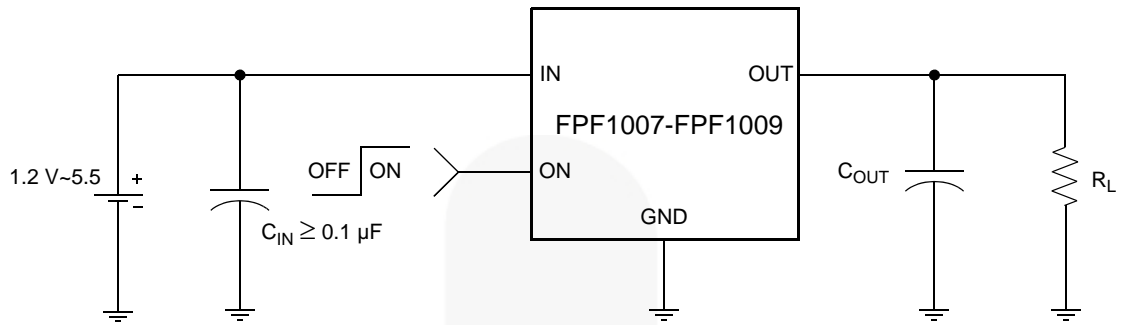
The switch is controlled by an active-high logic input (ON pin), allowing direct interface with a low-voltage control signal. An internal ON pin pull-down resistor protects against unintentional device turn-on in the initial state. An on-chip pull-down resistor on the output is enabled when the switch is turned-off and provides quick, robust discharge of the output load.



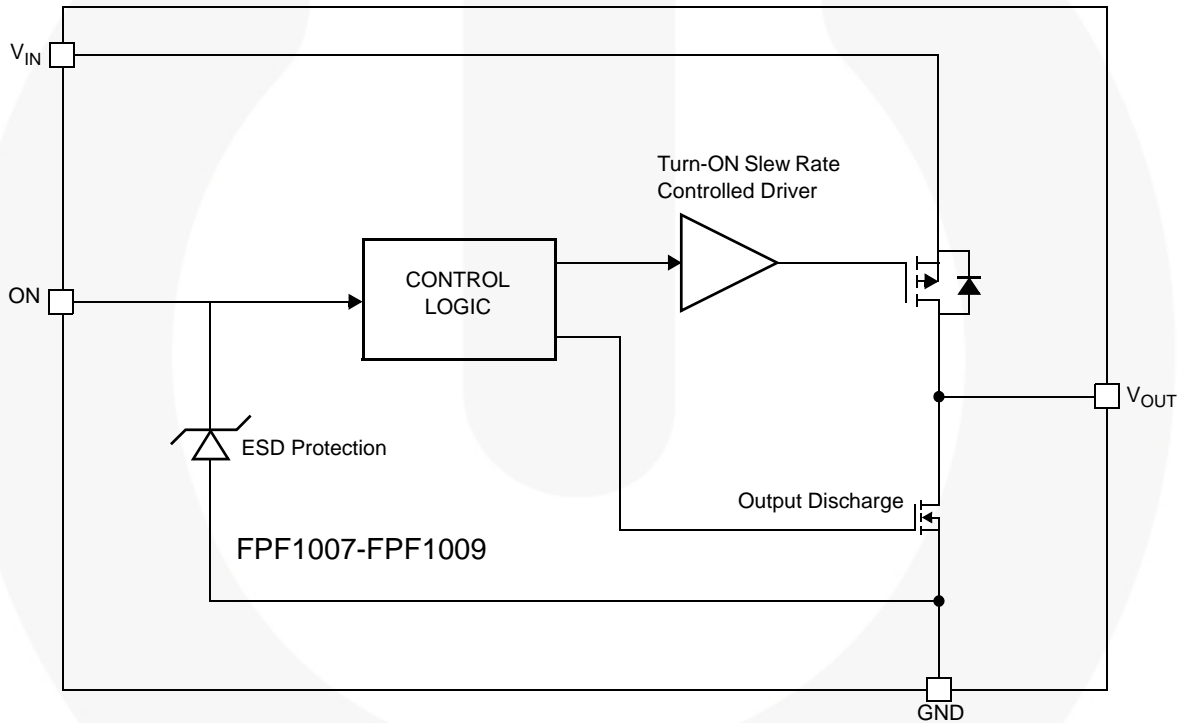
## Ordering Information

Part	Switch $R_{ON}$ at 5.5 V [Typ.]	Rise Time [Typ.]	Output Discharge [Typ.]	ON Pin Activity
FPF1007	$30\text{ m}\Omega$ , PMOS	$10\text{ }\mu\text{s}$	$60\text{ }\Omega$	Active HIGH
FPF1008	$30\text{ m}\Omega$ , PMOS	$80\text{ }\mu\text{s}$	$60\text{ }\Omega$	Active HIGH
FPF1009	$30\text{ m}\Omega$ , PMOS	$1\text{ ms}$	$60\text{ }\Omega$	Active HIGH

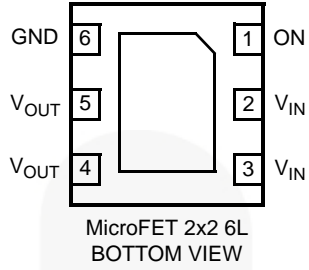
### Typical Application Circuit



### Functional Block Diagram



## Pin Configuration



## Pin Description

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

## Absolute Maximum Ratings

Parameter	Min.	Max.	Unit
$V_{IN}$ , $V_{OUT}$ , ON to GND	-0.3	6.0	V
Maximum Continuous Switch Current		1.5	A
Power Dissipation at $T_A = 25^\circ\text{C}^{(1)}$		1.2	W
Storage Junction Temperature	-65	+150	$^\circ\text{C}$
Operating Temperature Range	-40	+85	$^\circ\text{C}$
Thermal Resistance, Junction to Ambient		86	$^\circ\text{C/W}$
Electrostatic Discharge Protection	HBM	8000	V
	CDM	2000	V

**Note:**

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

## 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

$V_{IN} = 1.2\text{ V to } 5.5\text{ V}$ ,  $T_A = -40\text{ to } +85^\circ\text{C}$  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	$I_Q$	$I_{OUT} = 0\text{ mA}$ , $V_{IN} = 3.3\text{ V}$ , $V_{ON} = \text{Enabled}$		8		$\mu\text{A}$
		$I_{OUT} = 0\text{ mA}$ , $V_{IN} = 5.5\text{ V}$ , $V_{ON} = \text{Enabled}$			15	
Off Supply Current	$I_{Q(\text{off})}$	$V_{ON} = \text{GND}$ , $V_{OUT} = \text{OPEN}$			1	$\mu\text{A}$
Off Switch Current	$I_{SD(\text{off})}$	$V_{ON} = \text{GND}$ , $V_{OUT} = \text{GND}$		0.1	1.0	$\mu\text{A}$
On-Resistance	$R_{ON}$	$V_{IN} = 5.5\text{ V}$ , $I_{OUT} = 200\text{ mA}$ , $T_A = 25^\circ\text{C}$		30	40	$\text{m}\Omega$
		$V_{IN} = 3.3\text{ V}$ , $I_{OUT} = 200\text{ mA}$ , $T_A = 25^\circ\text{C}$		40	55	
		$V_{IN} = 1.5\text{ V}$ , $I_{OUT} = 200\text{ mA}$ , $T_A = 25^\circ\text{C}$		100	130	
		$V_{IN} = 1.2\text{ V}$ , $I_{OUT} = 200\text{ mA}$ , $T_A = 25^\circ\text{C}$		175	250	
		$V_{IN} = 3.3\text{ V}$ , $I_{OUT} = 200\text{ mA}$ , $T_A = -40^\circ\text{C to } +85^\circ\text{C}$	20		65	
Output Pull Down Resistance	$R_{PD}$	$V_{IN} = 3.3\text{ V}$ , $V_{ON} = 0\text{ V}$ , $T_A = 25^\circ\text{C}$		60		$\Omega$
ON Input Logic Low Voltage	$V_{IL}$	$V_{IN} = 1.2\text{ V to } 5.5\text{ V}$			0.4	V
ON Input Logic High Voltage	$V_{IH}$	$V_{IN} = 1.2\text{ V to } 5.5\text{ V}$	1			V
ON Input Leakage (On)		$V_{ON} = V_{IN} = 5.5\text{ V}$			10	$\mu\text{A}$
ON Input Leakage (Off)		$V_{ON} = \text{GND}$			1	$\mu\text{A}$
<b>Dynamic</b>						
<b>FPF1007</b>						
Turn On	$t_{ON}$	$V_{IN} = 3.3\text{ V}$ , $R_L = 500\ \Omega$ , $R_{L\_CHIP} = 60\ \Omega$ , $C_{OUT} = 0.1\ \mu\text{F}$ , $T_A = 25^\circ\text{C}$		12		$\mu\text{s}$
Rise Time	$t_R$			10		$\mu\text{s}$
Turn Off	$t_{OFF}$			40		$\mu\text{s}$
Fall Time	$t_F$			15		$\mu\text{s}$
<b>FPF1008</b>						
Turn On	$t_{ON}$	$V_{IN} = 3.3\text{ V}$ , $R_L = 500\ \Omega$ , $R_{L\_CHIP} = 60\ \Omega$ , $C_{OUT} = 0.1\ \mu\text{F}$ , $T_A = 25^\circ\text{C}$		125		$\mu\text{s}$
Rise Time	$t_R$			80		$\mu\text{s}$
Turn Off	$t_{OFF}$			40		$\mu\text{s}$
Fall Time	$t_F$			15		$\mu\text{s}$
<b>FPF1009</b>						
Turn On	$t_{ON}$	$V_{IN} = 3.3\text{ V}$ , $R_L = 500\ \Omega$ , $R_{L\_CHIP} = 60\ \Omega$ , $C_{OUT} = 0.1\ \mu\text{F}$ , $T_A = 25^\circ\text{C}$		2		ms
Rise Time	$t_R$			1		ms
Turn Off	$t_{OFF}$			40		$\mu\text{s}$
Fall Time	$t_F$			15		$\mu\text{s}$

## Typical Characteristics

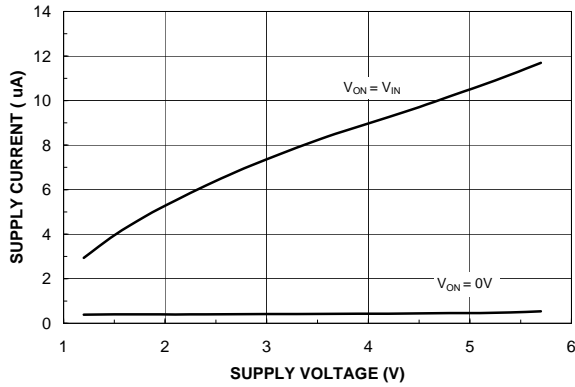


Figure 1. Quiescent Current vs. Input Voltage

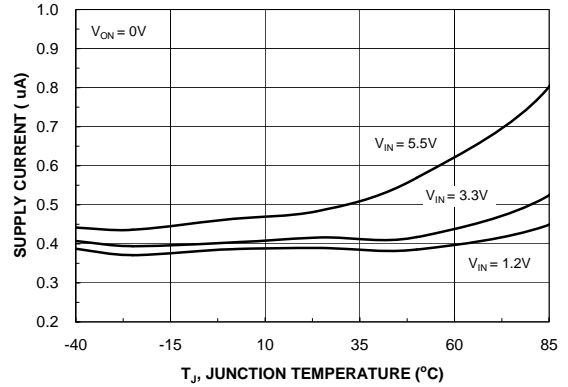


Figure 2. Quiescent Current vs. Temperature

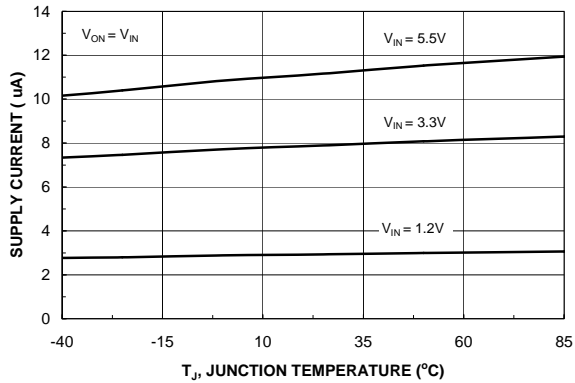


Figure 3. Quiescent Current vs. Temperature

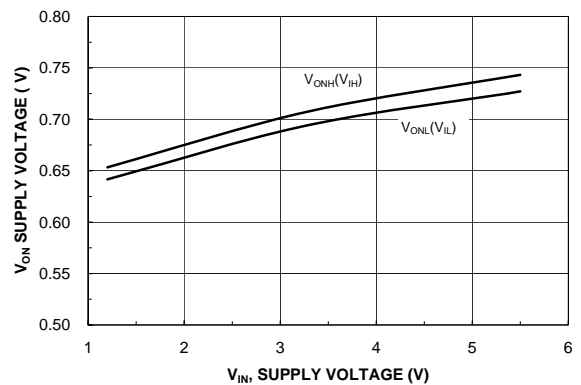


Figure 4.  $V_{ON}$  Voltage vs. Input Voltage

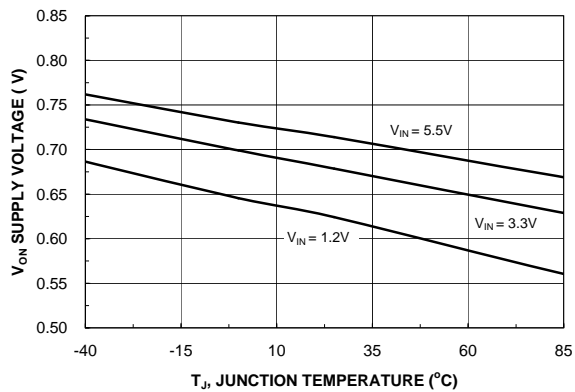


Figure 5.  $V_{ON}$  Low Voltage vs. Temperature

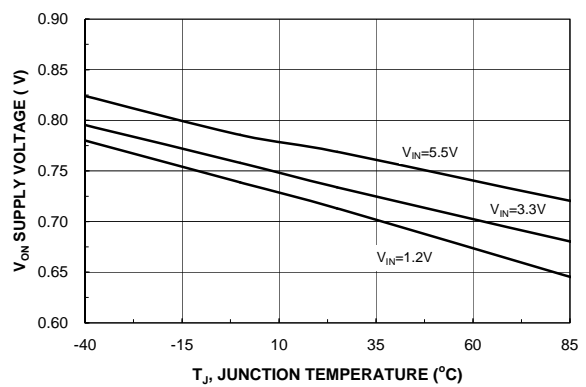


Figure 6.  $V_{ON}$  High Voltage vs. Temperature

## Typical Characteristics

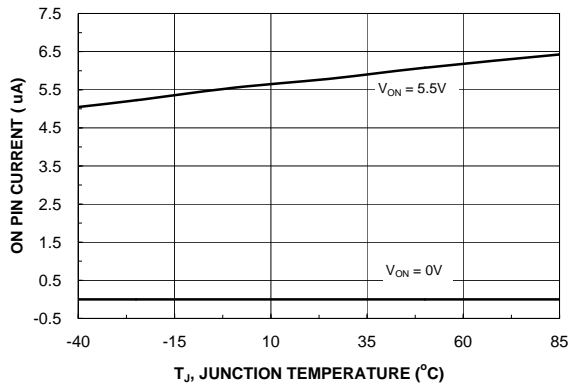


Figure 7. On Pin Current vs. Temperature

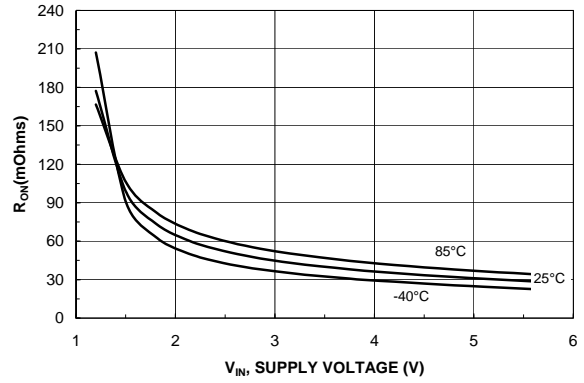


Figure 8.  $R_{ON}$  vs.  $V_{IN}$

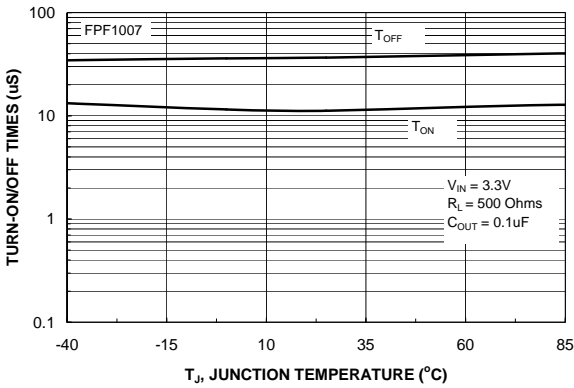


Figure 9. FPF1007  $t_{ON}$  /  $t_{OFF}$  vs. Temperature

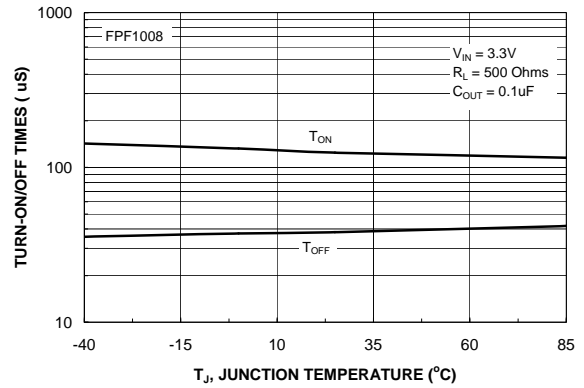


Figure 10. FPF1008  $t_{ON}$  /  $t_{OFF}$  vs. Temperature

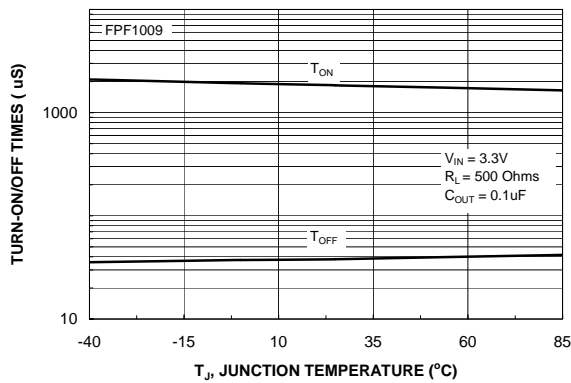


Figure 11. FPF1009  $t_{ON}$  /  $t_{OFF}$  vs. Temperature

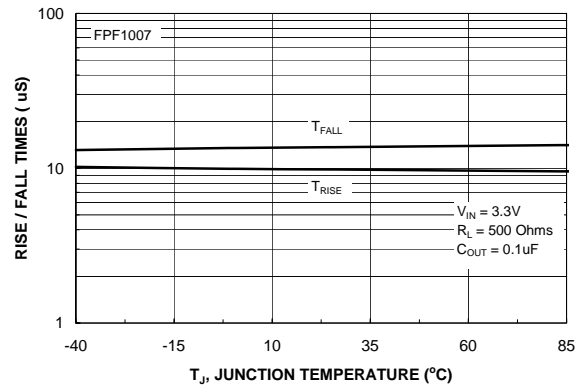


Figure 12. FPF1007  $t_{RISE}$  /  $t_{FALL}$  vs. Temperature



## Typical Characteristics

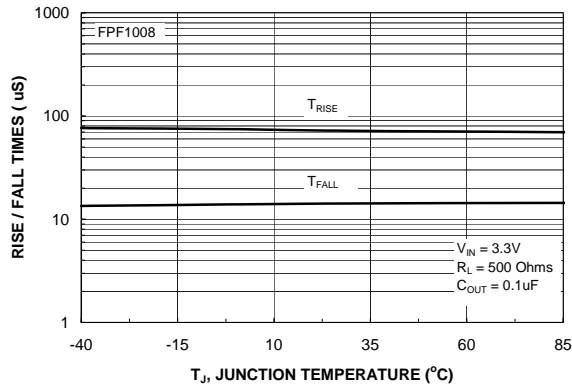


Figure 13. FPF1008  $t_{RISE}$  /  $t_{FALL}$  vs. Temperature

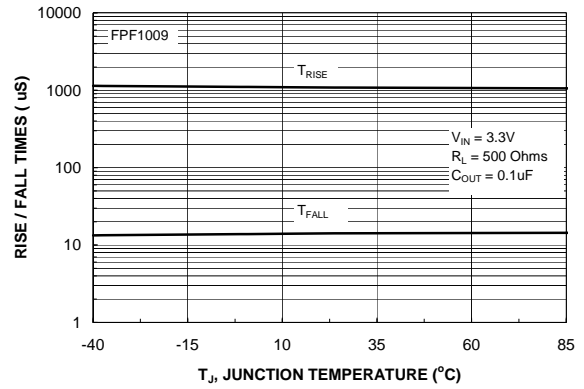


Figure 14. FPF1009  $t_{RISE}$  /  $t_{FALL}$  vs. Temperature

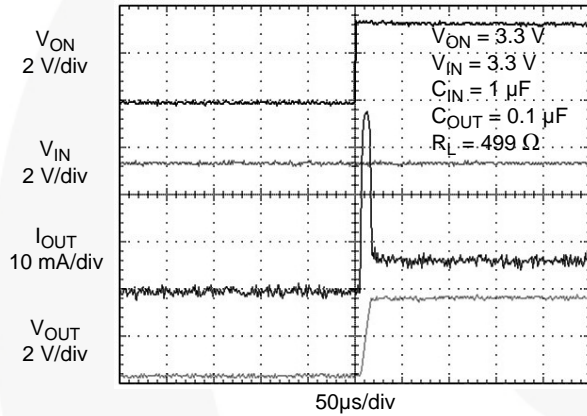


Figure 15. FPF1007 Turn-On Response

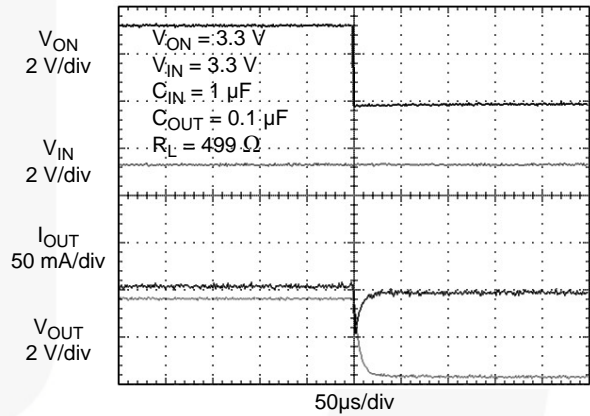


Figure 16. FPF1007 Turn-Off Response  
Load current discharged through on-chip output discharge resistor

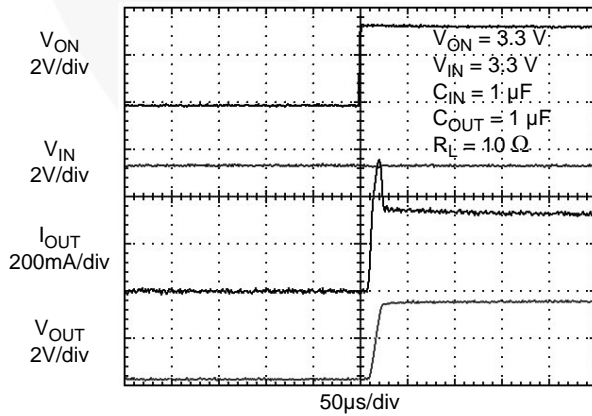


Figure 17. FPF1007 Turn-On Response ( $C_{OUT} = 1 \mu F$ )

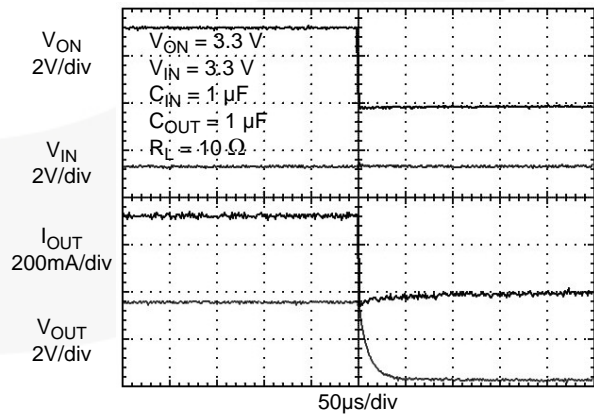


Figure 18. FPF1007 Turn-Off Response

## Typical Characteristics

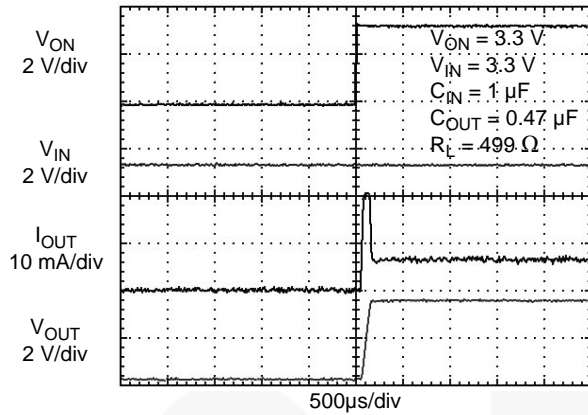


Figure 19. FPF1008 Turn-On Response

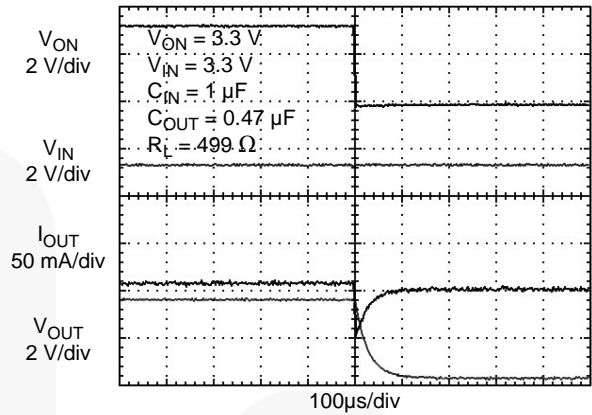


Figure 20. FPF1008 Turn-Off Response  
Load current discharged through on-chip output discharge resistor

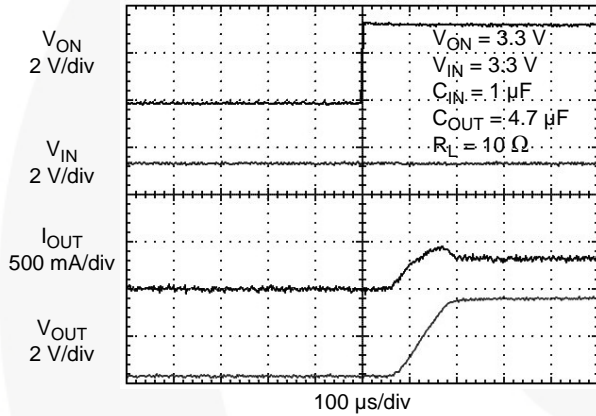


Figure 21. FPF1008 Turn-On Response ( $C_{OUT} = 4.7\text{ }\mu\text{F}$ )

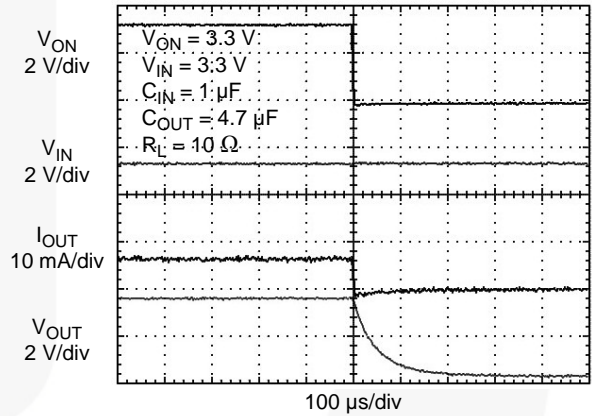


Figure 22. FPF1008 Turn-Off Response

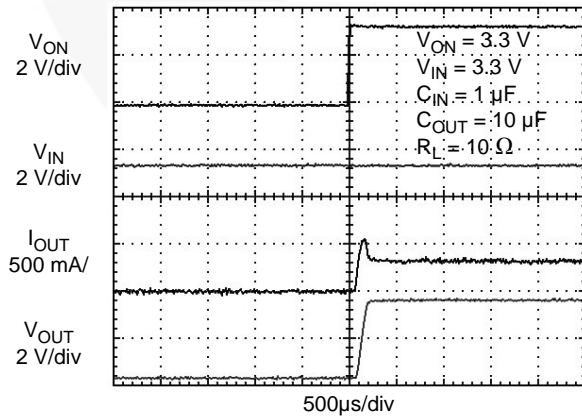


Figure 23. FPF1008 Turn-On Response ( $C_{OUT} = 10\text{ }\mu\text{F}$ )

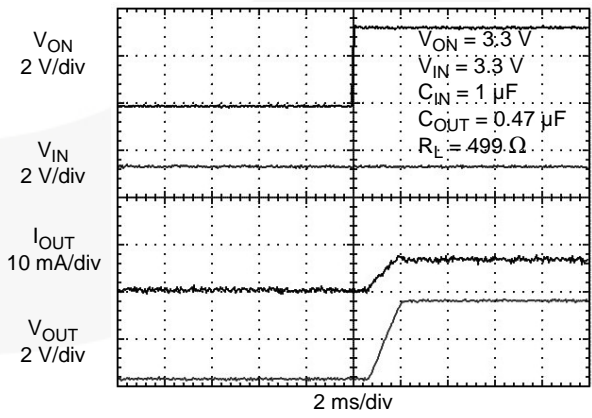


Figure 24. FPF1009 Turn-On Response

## Typical Characteristics

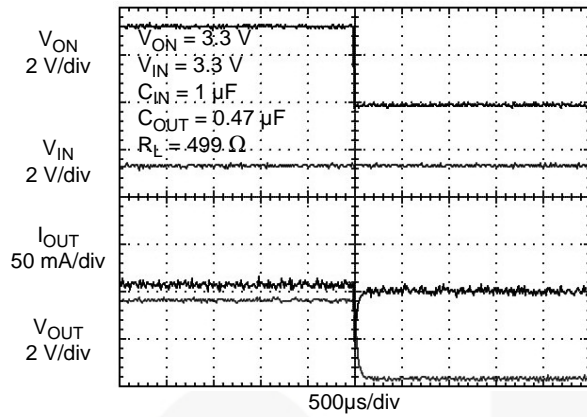


Figure 25. FPF1009 Turn-Off Response  
Load current discharged through on-chip output discharge resistor

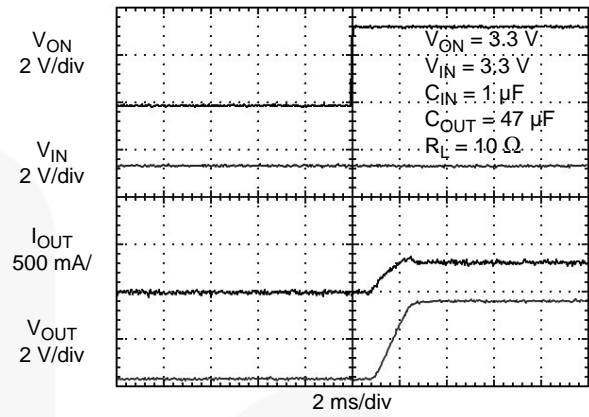


Figure 26. FPF1009 Turn-On Response ( $C_{OUT} = 47$   $\mu$ F)

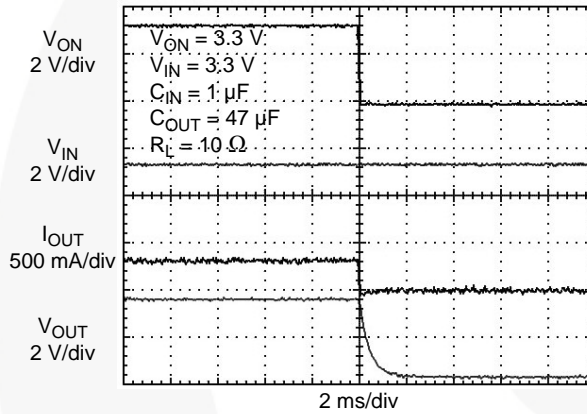


Figure 27. FPF1009 Turn-Off Response

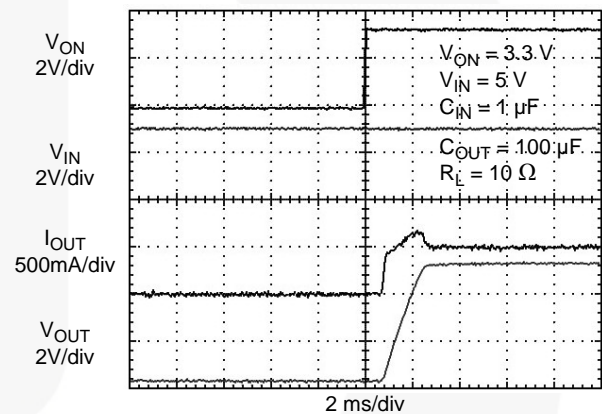
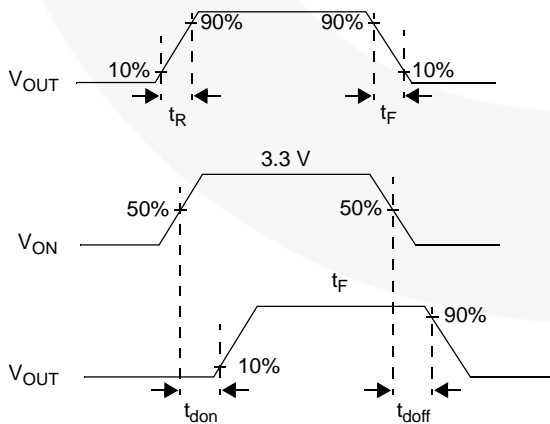


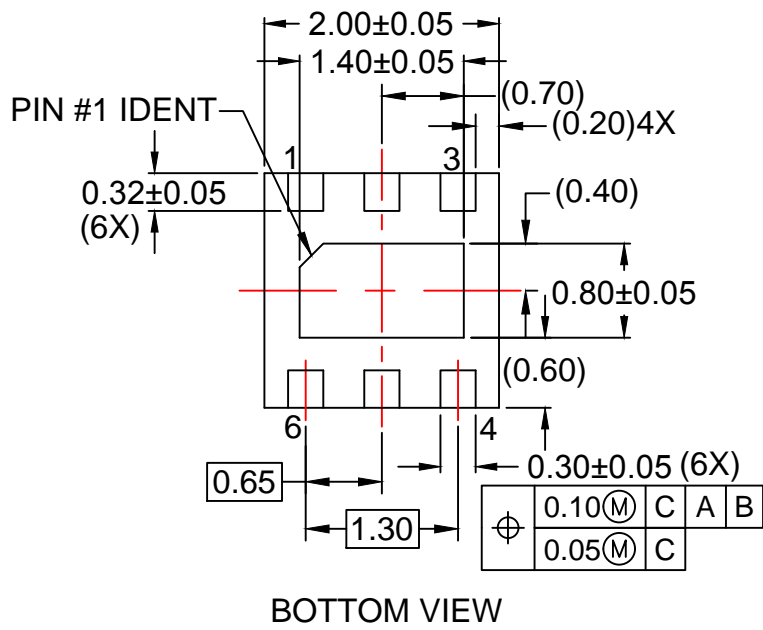
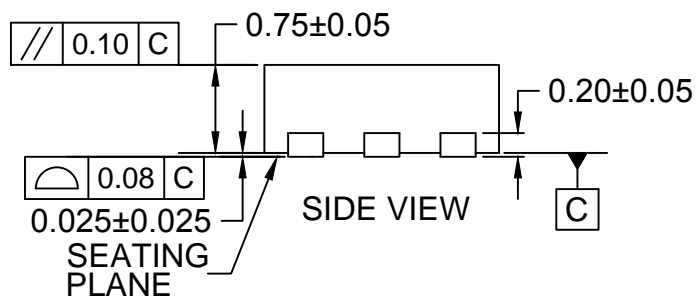
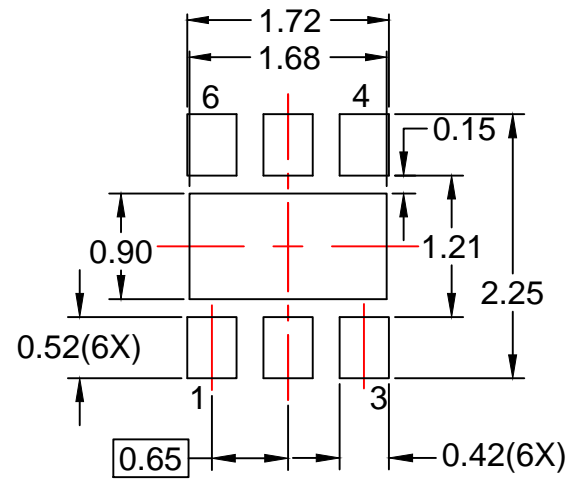
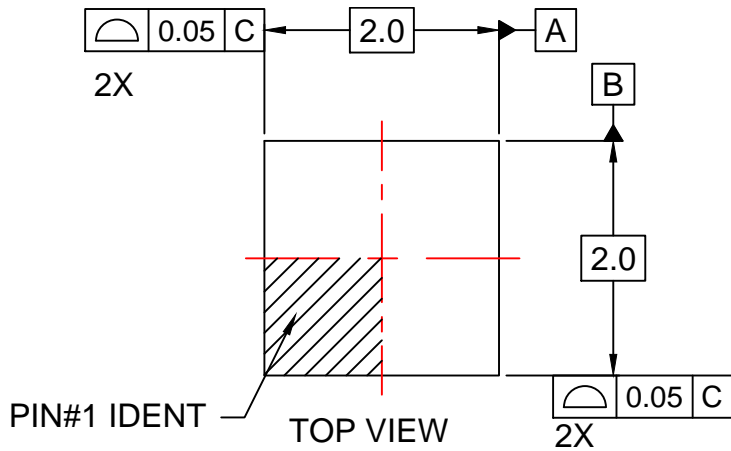
Figure 28. FPF1009 Turn-On Response  
( $C_{OUT} = 100$   $\mu$ F,  $V_{IN} = 5$  V)

## Timing Diagram



where:

- $t_{ON}$  = Turn-On Time
- $t_{OFF}$  = Turn-Off Time
- $t_{don}$  = Turn-On Delay Time
- $t_{doff}$  = Turn-Off Delay Time
- $t_R$  = Rise Time
- $t_F$  =  $V_{OUT}$  Fall Time
- $t_{ON} = t_R + t_{don}$
- $t_{OFF} = t_F + t_{doff}$



NOTES:

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- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 2009.
- D. LAND PATTERN RECOMMENDATION IS EXISTING INDUSTRY LAND PATTERN.
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