

1.5 A Ideal Diode with Ultra-Low IQ and Small Package

FPF1903UCX

Description

FPF1903 is a single load switch with P-type MOSFET integrated. The device can perfectly block reverse current from OUT to IN in both enabled and disabled status.

The input voltage from 1.2 V to 5.5 V. The supply current is relatively constant with load current 1.5 A, when disabled (EN = low), the power consumption is typically 250 nA, it is suitable for use in most low-voltage, portable electronic devices.

FPF1903 is in ultra-small WLCSP-4 package with 0.35 mm pin pitch.

Features

- P-type Power Switch with Ideal Diode Feature
- IN Voltage Range: 1.2 V ~ 5.5 V
- Max Continuous Current Capability: 1.5 A
- Low Supply Quiescent Current 250 nA (Typ)
- ESD Performance: 2 kV HBM and 1.5 kV CDM
- Over-Temperature Protection (OTP)
- This is a Pb-Free Device

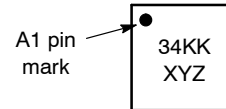
Applications

- Mobile Handsets and Tablets
- Dual Power Source
- Dual Battery



WLCSP4 0.70x0.70x0.454
CASE 567ZV

MARKING DIAGRAMS



34	= 2-digit Device Identifier
KK	= 2-digit Lot Run Traceability Code
XY	= 2-digit Date Code Format (X: Year and Y: Week)
Z	= 1-digit Assembly Plant Code

ORDERING INFORMATION

See detailed ordering and shipping information on page 5 of this data sheet.

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APPLICATION DIAGRAM

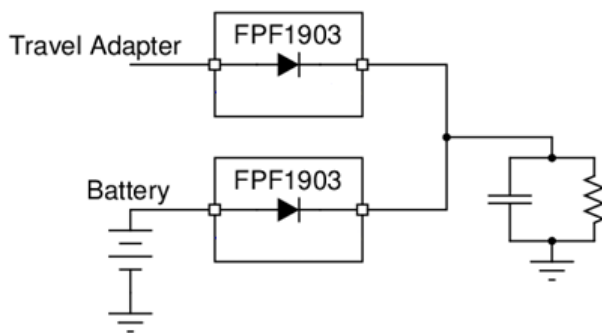


Figure 1. Application in Dual Power Source

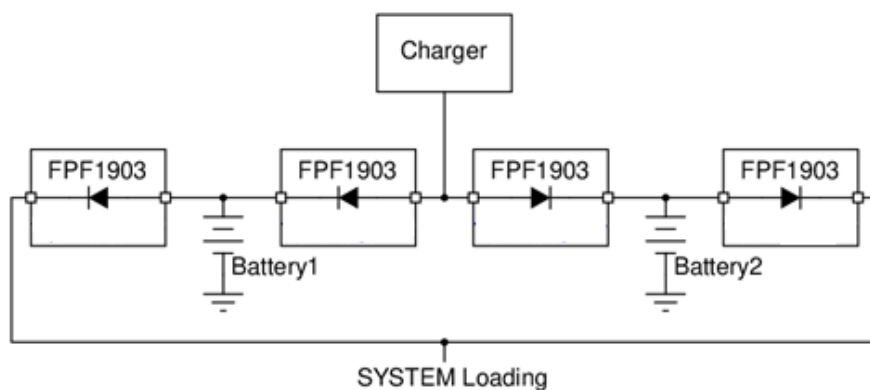


Figure 2. Application in Dual Battery

BLOCK DIAGRAM

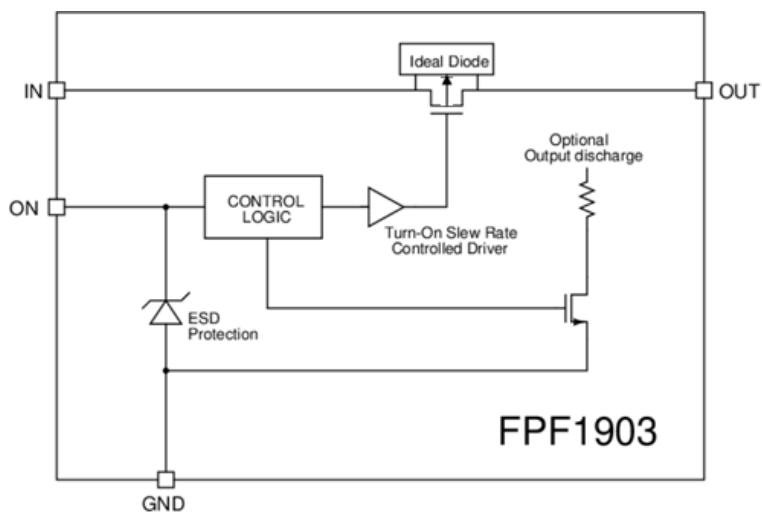


Figure 3. Functional Block Diagram

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PIN CONFIGURATION

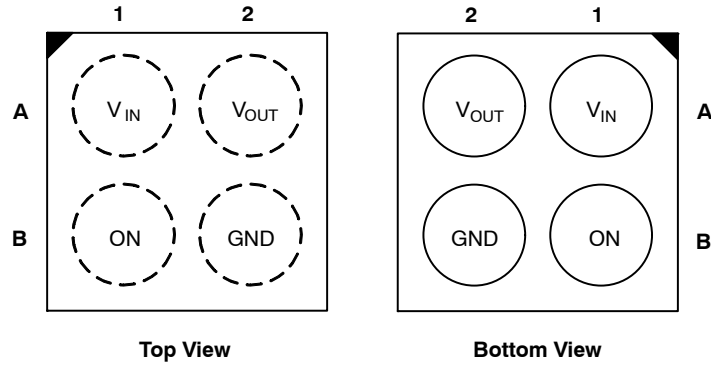


Figure 4. Pin Configuration

PIN DEFINITIONS

Name	Bump	Type	Description
V_{IN}	A1	Input/Output	Switch Input/Output and Power Paths Block Power Supply
V_{OUT}	A2	Input/Output	Switch Output/Input to Load
ON	B1	Input	Active HIGH for Power Path
GND	B2	GND	Ground

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameters		Min.	Max.	Unit
V_{IN}	IN to GND & IN to OUT = GND or Float		-0.3	6	V
V_{OUT}	OUT to GND		-0.3	6	V
ON	ON to GND		-0.3	6	V
I_{IN_VOUT}	Continuous IN to OUT Current			1.5	A
	Peak IN to OUT Current (5 ms)			3.0	A
T_{STG}	Storage Junction Temperature		-65	+150	°C
T_J	Operating Junction Temperature			+150	°C
T_L	Lead Temperature (Soldering, 10 seconds)			+260	°C
ESD	Electrostatic Discharge Capability	Human Body Model, ANSI/ESDA/JEDEC JS-001	2		kV
		Charged Device Model, JESD22-C101	1.5		

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameters	Min.	Max.	Unit
V_{IN}	IN Operating Voltage	1.2	5.5	V
C_{IN}	Input Capacitance for IN	0.01		μF
C_{OUT}	Output Capacitance for V_{OUT}	0.01	100	μF
T_A	Ambient Operating Temperature	-40	85	°C

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

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ELECTRICAL CHARACTERISTICS

Unless otherwise noted, $V_{IN} = 1.2 \text{ V to } 5.5 \text{ V}$, $T_A = -40^\circ\text{C to } 85^\circ\text{C}$; typical values are at $V_{IN} = 5 \text{ V}$, $I_{IN} \leq 1 \text{ A}$, $C_{IN} = 1 \mu\text{F}$ and $T_A = 25^\circ\text{C}$.

Symbol	Parameters	Conditions	Min	Typ	Max	Unit
BASIC OPERATION						
I_{Q_IN}	Power Input Quiescent Current	$V_{IN} = 5.5 \text{ V}$, OUT floating, $V_{ON} = 5.5 \text{ V or } 1.8 \text{ V}$, $T_A = 25^\circ\text{C}$		250	500	nA
		$V_{IN} = 5.5 \text{ V}$, OUT floating, $V_{ON} = 1.8 \text{ V or } 5.5 \text{ V}$, $T_A = -40^\circ\text{C to } 85^\circ\text{C}$			600	nA
I_{SD_IN}	Shutdown Current	$V_{IN} = 5 \text{ V}$, $V_{OUT} = 0 \text{ V}$, Disabled, $T_A = -40^\circ\text{C to } +85^\circ\text{C}$		180	400	nA
I_{GND}	Ground Current (Note 1)	$V_{IN} = 0 \text{ V}$, $V_{OUT} = 5.5 \text{ V}$, $V_{ON} = 0 \text{ V}$, $T_A = 25^\circ\text{C}$		180		nA
		$V_{IN} = 0 \text{ V}$, $V_{OUT} = 5.5 \text{ V}$, $V_{ON} = 0 \text{ V}$, $T_A = -40^\circ\text{C to } +85^\circ\text{C}$		200		
		$V_{IN} = 5.5 \text{ V}$, $V_{OUT} = 5.5 \text{ V}$, $V_{ON} = 5.5 \text{ V}$, $T_A = -40^\circ\text{C to } +85^\circ\text{C}$		200		
T_{SDN}	Thermal Shutdown (Note 1)			150		$^\circ\text{C}$
T_{SDN_HYS}	Thermal Shutdown Hysteresis (Note 1)			20		$^\circ\text{C}$

POWER SWITCH

I_{REV}	Reverse Current from OUT to IN	IN grounded, $V_{OUT} = 5.5 \text{ V}$, $T_A = -40 \text{ to } 85^\circ\text{C}$		15	200	nA
V_{DROP}	Voltage Drop from IN to OUT	$I_{OUT} = 1 \text{ mA}$, $V_{IN} = 5 \text{ V}$, $T_A = 25^\circ\text{C}$	10	20	40	mV
		$I_{OUT} = 1 \text{ mA}$, $V_{IN} = 5 \text{ V}$, $T_A = -40 \text{ to } 85^\circ\text{C}$			50	
		$I_{OUT} = 0.1 \text{ A}$, $V_{IN} = 5 \text{ V}$, $T_A = 25^\circ\text{C}$	12	25	45	
		$I_{OUT} = 0.1 \text{ A}$, $V_{IN} = 5 \text{ V}$, $T_A = -40 \text{ to } 85^\circ\text{C}$			55	
		$I_{OUT} = 0.2 \text{ A}$, $V_{IN} = 5 \text{ V}$, $T_A = 25^\circ\text{C}$	15	30	55	
		$I_{OUT} = 0.2 \text{ A}$, $V_{IN} = 1.5 \text{ V}$, $T_A = 25^\circ\text{C}$		90		
		$I_{OUT} = 0.5 \text{ A}$, $V_{IN} = 5 \text{ V}$, $T_A = 25^\circ\text{C}$ (Note 1)		90		
		$I_{OUT} = 1 \text{ A}$, $V_{IN} = 5 \text{ V}$, $T_A = 25^\circ\text{C}$ (Note 1)		100		
		$I_{OUT} = 1.5 \text{ A}$, $V_{IN} = 5 \text{ V}$, $T_A = 25^\circ\text{C}$ (Note 1)		150		
t_{DON}	Switch Turn-On Delay Time	Time from $V_{ON} > V_{IH}$ to $V_{OUT} = 0.1 \times V_{IN}$, $V_{IN} = 5 \text{ V}$, $R_L = 100 \Omega$, $C_L = 0.1 \mu\text{F}$		10		μs
t_R	Switch Turn-On Rising Time	Time from $V_{OUT} = 0.1 \times V_{IN}$ to $0.9 \times V_{IN}$, $V_{IN} = 5 \text{ V}$, $R_L = 100 \Omega$, $C_L = 0.1 \mu\text{F}$		20		μs
t_{DOFF}	Switch Turn-Off Delay Time	Time from $V_{ON} < V_{IL}$ to $V_{OUT} = 0.9 \times V_{IN}$, $V_{IN} = 5 \text{ V}$, $R_L = 100 \Omega$, $C_L = 0.1 \mu\text{F}$		5		μs
t_F	Switch Turn-Off Falling Time	Time from $V_{OUT} = 0.9 \times V_{IN}$ to $0.1 \times V_{IN}$, $V_{IN} = 5 \text{ V}$, $R_L = 100 \Omega$, $C_L = 0.1 \mu\text{F}$		40		μs

DIGITAL SIGNALS

V_{IH}	Logic Enable HIGH Voltage	ON/ONB input operating range	0.78			V
V_{IL}	Logic Enable LOW Voltage	ON/ONB input operating range			0.4	V

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

1. This parameter is guaranteed by design and characterization; not production tested.



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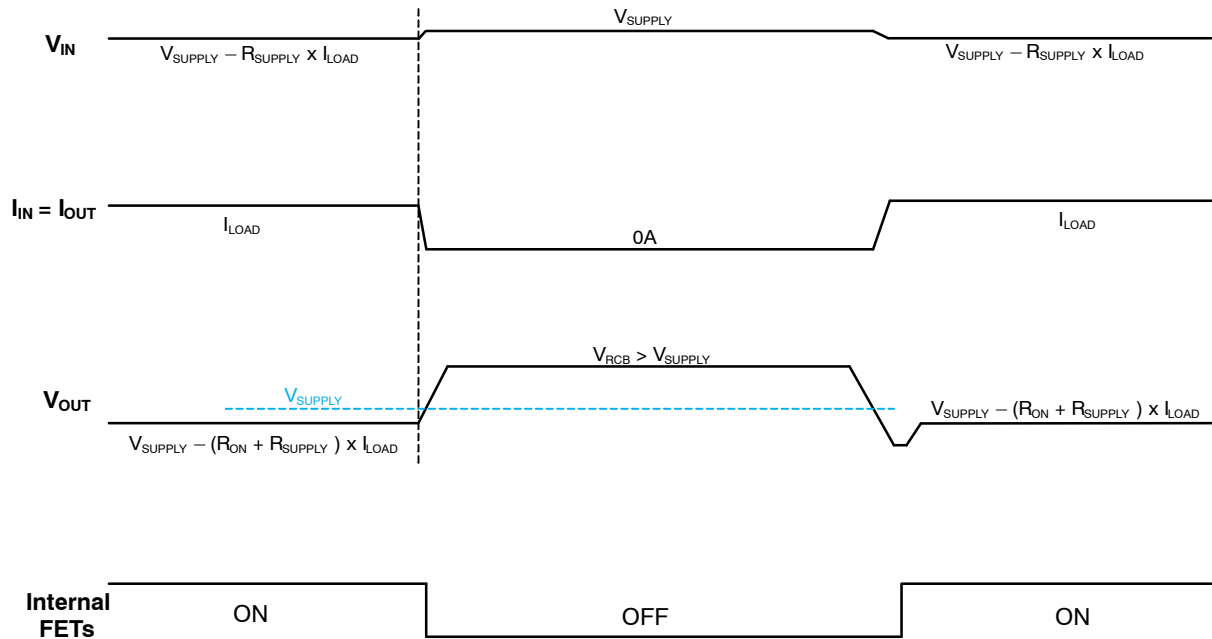


Figure 5. Ideal Diode Behavior

Ideal Diode

When ON is high or floating, the device is in enable status:

- The on-resistance of the device will be regulated in light loading condition. There will be voltage drop from IN to OUT even with very low loading current. The drop depends on loading current.
- When V_{OUT} is higher than V_{IN} , the internal MOSFET will be turned off entirely. Moreover, the body diode of the MOSFET is removed accordingly.

- When loading current is large enough, the MOSFET will be fully turned on and regulation on gate will not be implemented.

When ON is low, power FET will keep off and ideal diode function is disabled too. However, the reverse current from OUT to IN still be blocked.

ORDERING INFORMATION

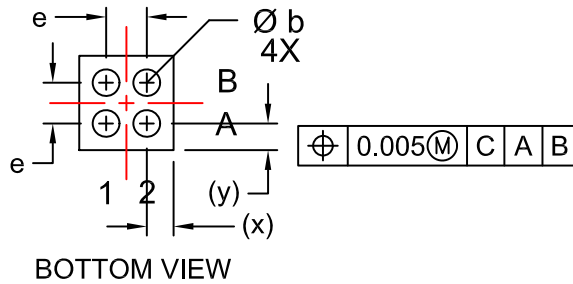
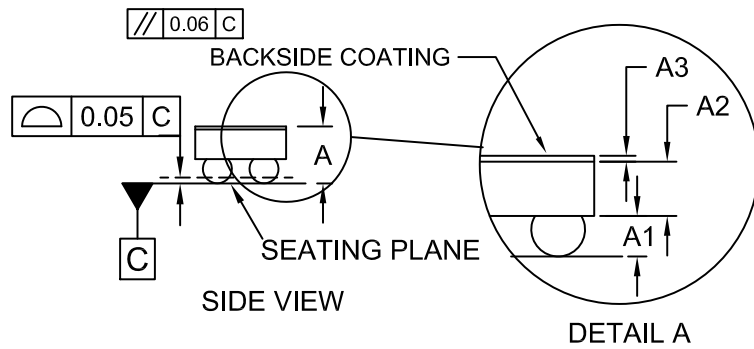
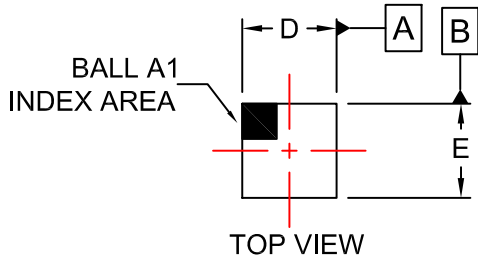
Part Number	Marking	Operating Temperature Range	Package	Shipping [†]
FPF1903UCX	34	-40°C to +85°C	4-Ball, 0.35 mm Pitch WLCSP (WLCSP4) (Pb-Free)	Tape & Reel

[†]For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

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PACKAGE DIMENSIONS

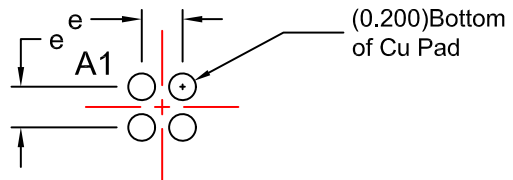
WLCSP4 0.70x0.70x0.454
CASE 567ZV
ISSUE O



NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DATUM C APPLIES TO THE SPHERICAL CROWN OF THE SOLDER BALLS

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.413	0.454	0.495
A1	0.154	0.174	0.194
A2	0.237	0.255	0.273
A3	0.022	0.025	0.028
b	0.210	0.230	0.250
D	0.67	0.7	0.73
E	0.67	0.7	0.73
e	0.35 BSC		
x	0.160	0.175	0.190
y	0.160	0.175	0.190



*FOR ADDITIONAL INFORMATION ON OUR Pb-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ON SEMICONDUCTOR SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERRM/D.

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