DATA SHEET
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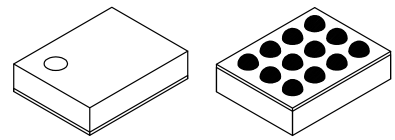
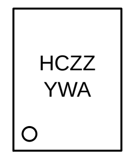
Surge and Over-Voltage Protection Switch for VBUS

FPF2280



WLCSP12 1.288x1.828x0.586
CASE 567QX

MARKING DIAGRAM



HC	=	Specific Device Code
ZZ	=	Assembly Lot Code
Y	=	Year
W	=	Work Week
A	=	Assembly Location

Description

The FPF2280 features a low−R_{ON} internal FET and an operating range of 2.5 V_{DC} to 5.5 V_{DC} (absolute maximum of 29 V_{DC}). An internal clamp is capable of shunting surge voltages > 100 V, protecting downstream components and enhancing system robustness. The FPF2280 features over−voltage protection that powers down the internal FET if the input voltage exceeds the OVP threshold. The OVP threshold is adjustable with optional external resistors. Over−temperature protection also powers down the device at 130°C (typical). Exceptionally low off−state current (< 1 μA maximum) facilitates compliance with standby power requirements.

The FPF2280 is available in a fully “green” compliant 1.3 mm × 1.8 mm Wafer−Level Chip−Scale Package (WLCSP) with backside laminate.

Features

- Surge Protection
  - IEC 61000−4−5: > 100 V
- Over−Voltage Protection (OVP)
- Over−Temperature Protection (OTP)
- ESD Protection
  - Human Body Model (HBM): > 3.5 kV
  - Charged Device Model (CDM): > 2 kV
  - IEC 61000−4−2 Air Discharge: > 15 kV
  - IEC 61000−4−2 Contact Discharge: > 8 kV
- This is a Pb−Free Device

Typical Applications

- Mobile Handsets and Tablets
- Portable Media Players
- MP3 Players

ORDERING INFORMATION

Part Number	Top Marking	Operating Temperature Range	Package	Shipping†
FPF2280BUCX−F130	HC	−40°C to +105°C	WLCSP12 (Pb−Free)	3000 / 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.

Block Diagram

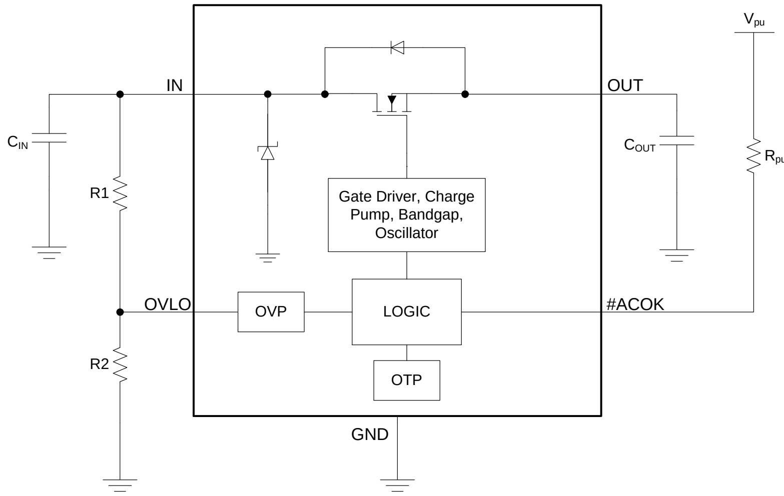
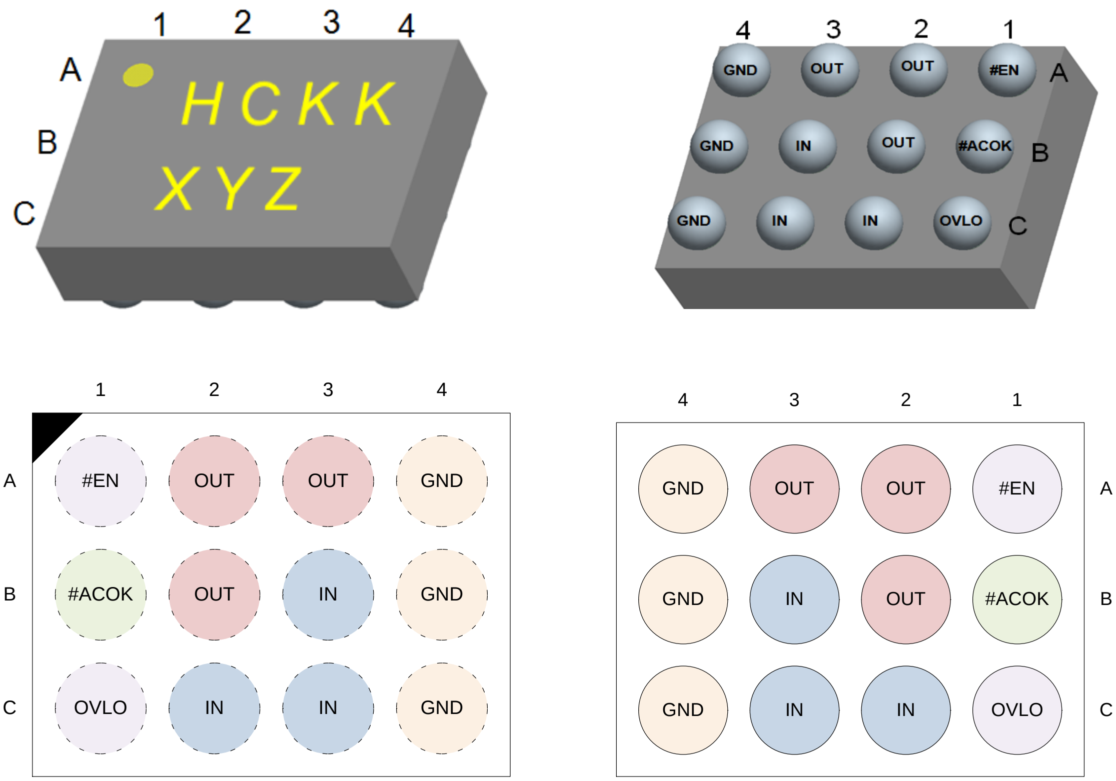


Figure 1. Functional Block Diagram

Pin Configuration



(Top View) (Bottom View)

Figure 2. Pin Configuration

PIN DEFINITIONS

<table>
<tr><th>Name</th><th>Bump</th><th>Type</th><th colspan="3">Description</th></tr>
<tr><td>IN</td><td>B3, C2, C3</td><td>Input/Supply</td><td colspan="3">Switch Input and Device Supply</td></tr>
<tr><td>OUT</td><td>A2, A3, B2</td><td>Output</td><td colspan="3">Switch Output to Load</td></tr>
<tr><td rowspan="2">#ACOK</td><td rowspan="2">B1</td><td rowspan="2">Output (Open Drain)</td><td rowspan="2">Power Good</td><td>1</td><td>$V_{IN} < V_{IN\_min}$ or $V_{IN} \geq V_{OVLO}$</td></tr>
<tr><td>0</td><td>Voltage Stable</td></tr>
<tr><td>#EN</td><td>A1</td><td>Input</td><td colspan="3">Device Enable (Active LOW)</td></tr>
<tr><td>OVLO</td><td>C1</td><td>Input</td><td colspan="3">Over−Voltage Lockout Adjustment Pin</td></tr>
<tr><td>GND</td><td>A4, B4, C4</td><td>Supply</td><td colspan="3">Device Ground</td></tr>
</table>

Over−Voltage Lockout (OVLO) Calculation

OVLO can be set externally and override default OVP. By connecting an external resistor−driver to the OVLO pin. Equation (1) can produce the desired trip voltage and resistor values.

$$V_{IN\_OVLO} = V_{OVLO\_TH} \times [1 + R1/R2] \quad \text{(eq. 1)}$$

Recommended minimum R1 = 1 MΩ

On−The−Go (OTG) Functionality

During OTG operation, the FPF2280 is initially disabled and the power FET's bulk diode is forward biased. The bulk diode represents ~0.7 V drop across the device, which remains until the V_IN voltage increases past 2.5 V, when the device is fully enabled. While the device is disabled and the body diode is forward biased, the max DC current through the diode is 1.8 A. This current is limited by the thermal performance of the device (0.7 V x 1.8 A = 1.36 W). This current should be transient; the #EN pin must be pulled LOW to ensure the device fully enables. The transient should not exceed the RC time constant of the C_IN and C_OUT capacitors. At the system level, over−voltage and current protection should be provided outside the FPF2280.

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter		Min.	Max.	Unit
V_{IN}	V_IN to GND & V_IN to V_OUT = GND or Float		−0.3	29.0	V
V_{OUT}	V_OUT to GND		−0.3	V_{IN} + 0.3	V
V_{OVLO}	OVLO to GND		−0.3	24.0	V
$V_{\#EN\_ACOK}$	Maximum DC Voltage Allowed on #EN or ACOK Pin			6	V
I_{IN}	Switch I/O Current (Continuous)			4.5	A
t_{PD}	Total Power Dissipation at T_A = 25°C			1.48	W
T_{STG}	Storage Temperature Range		−65	150	°C
T_J	Maximum Junction Temperature			150	°C
T_L	Lead Temperature (Soldering, 10 Seconds)			260	°C
Θ_{JA}	Thermal Resistance, Junction−to−Ambient(1) (1−in.^{2} Pad of 2−oz. Copper)			84.1	°C/W
ESD	IEC 61000−4−2 System ESD	Air Gap	15.0		kV
		Contact	8.0		
	Human Body Model, ANSI/ESDA/JEDEC JS−001−2012	All Pins	3.5		
	Charged Device Model, JESD22−C101	All Pins	2.0		
Surge	IEC 61000−4−5, Surge Protection	V_{IN}	100		V

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.

1. Measured using 2S2P JEDEC std. PCB

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min.	Max.	Unit
V_{IN}	Supply Voltage	2.5	20.0	V
T_A	Operating Temperature	−40	105	°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.

ELECTRICAL CHARACTERISTICS

(T_A = −40°C to 105°C unless otherwise indicated. Typical values are V_{IN} = 5.0 V, I_{IN} ≤ 3 A, C_{IN} = 0.1 μF and T_A = 25°C.)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{IN_CLAMP}	Input Clamping Voltage	I_{IN} = 10 mA		35		V
I_Q	Input Quiescent Current	V_{IN} = 5 V, #EN = 0 V		58	100	μA
I_{IN_Q}	OVLO Supply Current	V_{OVLO} = 3 V, V_{IN} = 5 V, V_{OUT} = 0 V		63	100	μA
V_{IN_OVLO}	Internal Over−Voltage Trip Level	V_{IN} Rising, OVLO = GND	6.6	6.8	7.0	V
		V_{IN} Falling	6.2			V
V_{OVLO_TH}	OVLO Set Threshold	V_{IN} = 2.5 V to V_{OVLO}	1.12	1.20	1.24	V
V_{OVLO_RNG}	Adjustable OVLO Threshold Range	V_{IN} = 2.5 V to V_{OVLO}	4		20	V
VOVLO_SELECT	External OVLO Select Threshold			0.30	0.28	V
R_{ON}	Resistance from V_{IN} to V_{OUT}	V_{IN} = 5 V, I_{OUT} = 1 A, T_A = 25°C		30	39	mΩ
C_{OUT}	OUT Load Capacitance(2)	V_{IN} = 5 V			1000	μF
I_{OLVO}	OVLO Input Leakage Current	VOVLO = VOVLO_TH	−100		100	nA
T_{SDN}	Thermal Shutdown(2)			130		°C
T_{SDN_HYS}	Thermal Shutdown Hysteresis(2)			20		°C

Digital Signals

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{OL}	#ACOK Output Low Voltage	$V_{I/O}$ = 3.3 V, I_{SINK} = 1 mA			0.4	V
VIH_#EN	Enable HIGH Voltage	V_{IN} = 2.5 V to V_{OVLO}	1.2			V
VIL_#EN	Enable LOW Voltage	V_{IN} = 2.5 V to V_{OVLO}			0.5	V
IACOK_LEAK	#ACOK Leakage Current	$V_{I/O}$ = 3.3 V, #ACOK Deasserted, #EN = 0 V	−0.5		0.5	μA
#EN_Leak	#EN Leakage Current	V_{IN} = 5.0 V, V_{OUT} = Float	−1.0		1.0	μA

Timing Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
t_{DEB}	Debounce Time	Time from 2.5 V < V_{IN} < V_{IN_OVLO} to V_{OUT} = 0.1 × V_{IN}		15		ms
t_{START}	Soft−Start Time	Time from V_{IN} = V_{IN_min} to 0.2 × #ACOK, V_{IO} = 1.8 V with 10 kΩ Pull−up Resistor		30		ms
t_{ON}	Switch Turn−On Time	V_{IN} = 5 V, R_L = 100 Ω, V_{OUT} from 0.1 × V_{IN} to 0.9 × V_{IN}, C_{LOAD} = 100 μF		2		ms
t_{OFF}	Switch Turn−Off Time(2)	R_L = 100 Ω, C_L = 0 μF, V_{IN} > V_{OVLO} to V_{OUT} = 0.8 × V_{IN}		125		ns

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.

2. Guaranteed by characterization and design.

Timing Diagrams

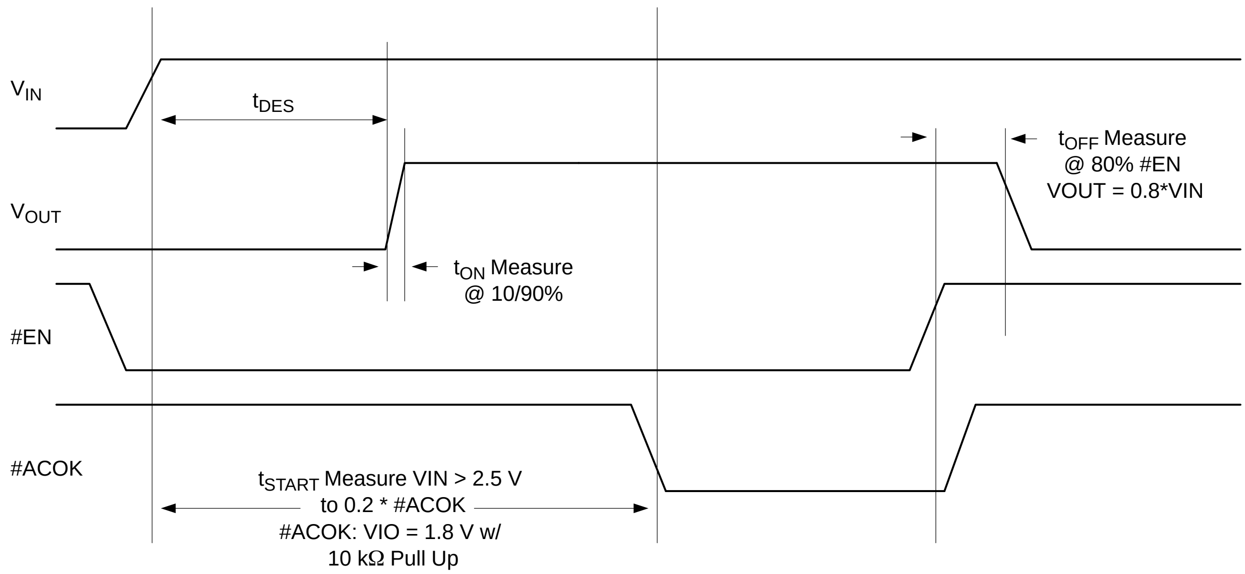


Figure 3. Timing for Power Up and Normal Operation

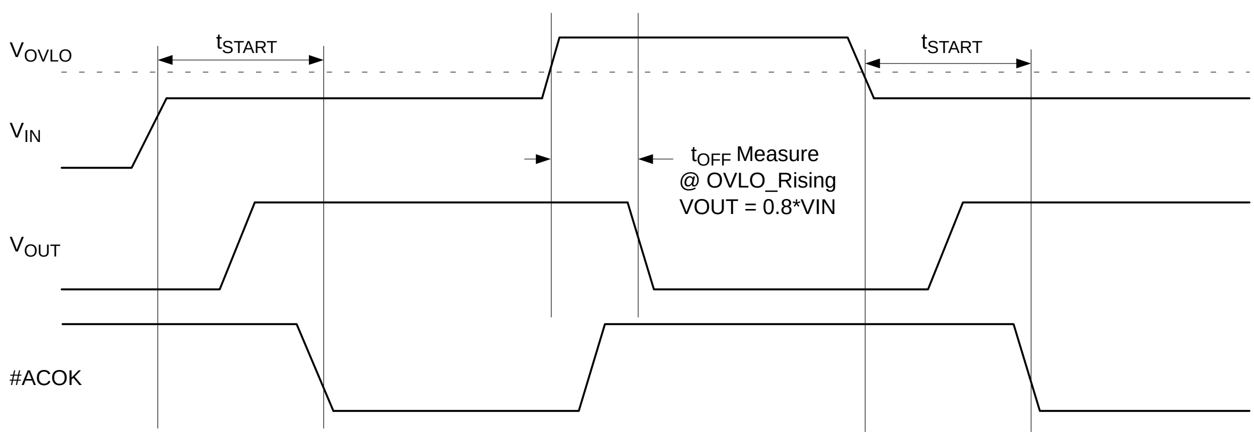


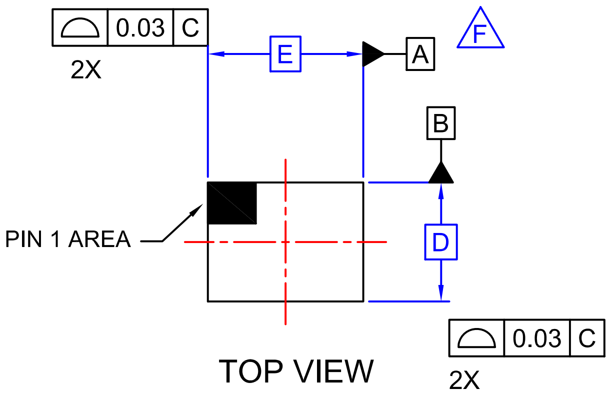
Figure 4. Timing for OVLO Trip

PRODUCT−SPECIFIC PACKAGE DIMENSIONS

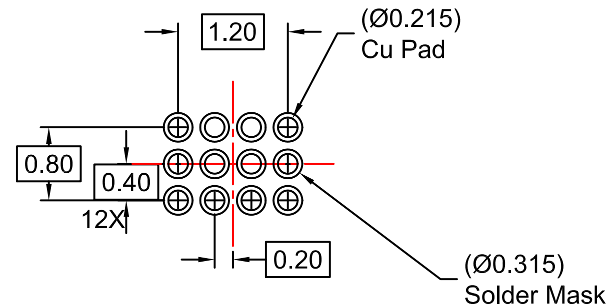
D	E	X	Y
1288 µm ±30 µm	1828 µm ±30 µm	314 µm ±18 µm	244 µm ±18 µm

WLCSP12 1.288x1.828x0.586
CASE 567QX
ISSUE O

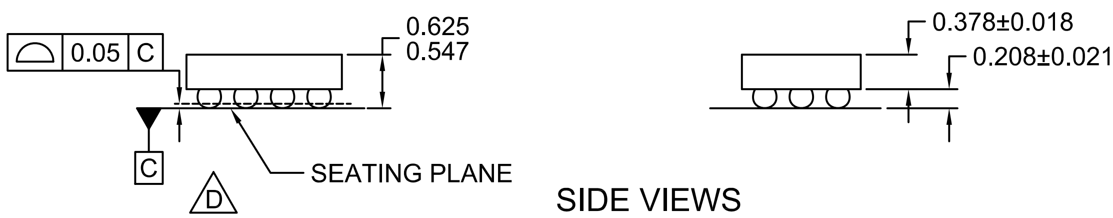
DATE 31 OCT 2016



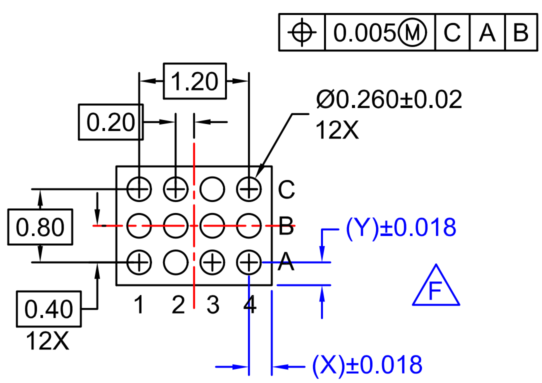
TOP VIEW



RECOMMENDED LAND PATTERN
(NSMD PAD TYPE)



SIDE VIEWS



BOTTOM VIEW

NOTES:

A. NO JEDEC REGISTRATION APPLIES.

B. DIMENSIONS ARE IN MILLIMETERS.

C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 2009.

D. DATUM C IS DEFINED BY THE SPHERICAL CROWNS OF THE BALLS.

E. PACKAGE NOMINAL HEIGHT IS 586 MICRONS ±39 MICRONS (547-625 MICRONS).

F. FOR DIMENSIONS D, E, X, AND Y SEE PRODUCT DATASHEET.

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DESCRIPTION:	**WLCSP12 1.288x1.828x0.586**	**PAGE 1 OF 1**

PUBLICATION ORDERING INFORMATION

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