

Over-Voltage Protection Load Switch

FPF2290



WLCSP12
CASE 567QX

General Description

The FPF2290 features a low- R_{ON} internal FET and an operating voltage range of 2.5 V to 23 V. An internal clamping circuit is capable of shunting surge voltages of ± 100 V, protecting downstream components and enhancing system robustness. The FPF2290 features over-voltage protection that powers down the internal FET if the input voltage exceeds the OVP threshold. The OVP threshold is selectable via Logic select pins (OV1 and OV2). Over-temperature protection also powers down the device at 130°C (typical).

The FPF2290 is available in a fully “green” compliant 1.3×1.8 mm Wafer-Level Chip-Scale Package (WLCSP) with backside laminate.

Features

- Surge Protection
 - ◆ IEC 61000-4-5: ± 100 V
- Selectable Over-Voltage Protection (OVP) with OV1 and OV2 Logic Inputs
 - ◆ 5.9 V ± 100 mV
 - ◆ 10 V ± 100 mV
 - ◆ 14 V ± 280 mV
 - ◆ 23 V ± 460 mV
- Over-Temperature Protection (OTP)
- Ultra-Low On-Resistance: Typ. 33 m Ω
- ESD Protection
 - ◆ Human Body Model (HBM): > 2 kV
 - ◆ Charged Device Model (CDM): > 1 kV
 - ◆ IEC 61000-4-2 Air Discharge: > 15 kV
- This is a Pb-Free and Halide Free Device

Applications

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

MARKING DIAGRAM



- HR = Specific Device Code
- KK = 2-Digits Lot Run Traceability Code
- XY = 2-Digit Date Code
- Z = Assembly Plant Code

ORDERING INFORMATION

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

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BLOCK DIAGRAM

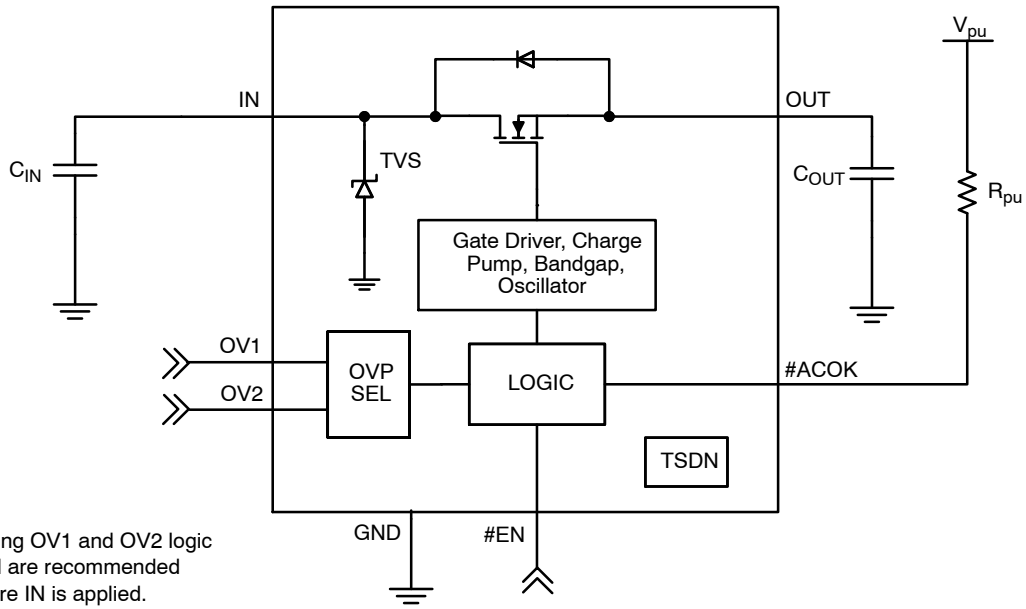


Figure 1. Functional Block Diagram

PIN CONFIGURATION

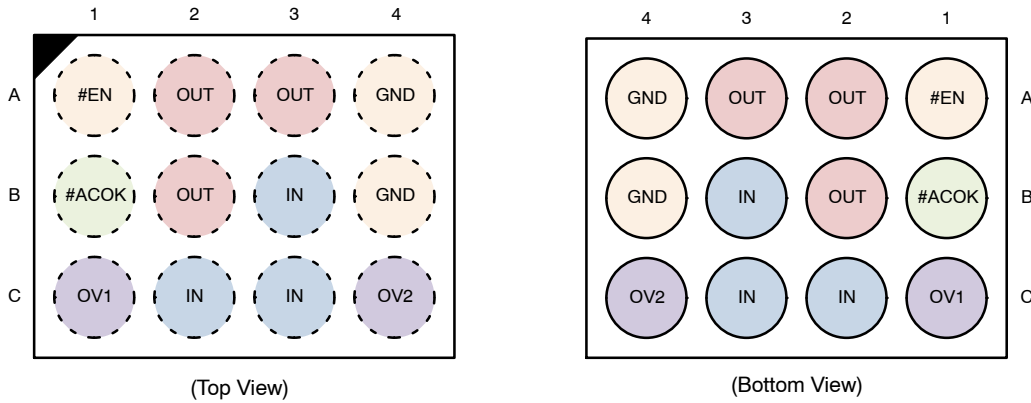


Figure 2. Pin Configuration

PIN DESCRIPTION

| Name | Bump | Type | Description | | |
|-------|------------|--------------|---|---|---|
| IN | B3, C2, C3 | Input/Supply | Switch Input and Device Supply | | |
| OUT | A2, A3, B2 | Output | Switch Output to Load | | |
| #ACOK | B1 | Output | Power Good (Open-Drain Output) | 1 | Hi-Z: $V_{IN} < V_{IN_MIN}$ OR $V_{IN} > V_{OVLO}$ |
| | | | | 0 | LOW: Voltage Stable |
| #EN | A1 | Input | Device Enable (Active LOW) | | |
| OV1/2 | C1, C4 | Input | OVLO Selection Input (see Table 1) Note: Apply OV1 and OV2 Logic levels before VIN is applied. | | |
| GND | A4, B4 | Supply | Device Ground | | |

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Table 1. OVLO SELECTION

| OV1 | OV2 | OVP Trip Level |
|------|------|----------------|
| LOW | LOW | 5.9 V ±100 mV |
| HIGH | LOW | 10 V ±100 mV |
| LOW | HIGH | 14 V ±280 mV |
| HIGH | HIGH | 23 V ±460 mV |

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 _{OVn} | OV1 and OV2 to GND | -0.3 | 6.0 | 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-in. ² Pad of 2-oz. Copper) (Note 1) | - | 84.1 | °C/W | |
| ESD | IEC 61000-4-2 System Level ESD | Air Discharge | 15 | - | kV |
| | | Contact Discharge | 8 | - | |
| | Human Body Model, ANSI/ESDA/JEDEC JS-001-2012 | All Pins | 2 | - | |
| | Charged Device Model, JESD22-C101 | All Pins | 1 | - | |
| 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 | 23.0 | V |
| T _A | 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

($T_A = -40^{\circ}\text{C}$ to 85°C , $V_{IN} = 2.5$ to 23 V, unless otherwise indicated. Typical values are $V_{IN} = 5.0$ V, $I_{IN} \leq 3$ A, $C_{IN} = 0.1$ μF and $T_A = 25^{\circ}\text{C}$.)

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Unit | |
|------------------------|---------------------------------------|---|---------------------------|-------|--------|--------------------|---|
| BASIC OPERATION | | | | | | | |
| V_{IN_CLAMP} | Input Clamping Voltage | $I_{IN} = 10$ mA | - | 35 | - | V | |
| I_Q | Input Quiescent Current | $V_{IN} = 5$ V, #EN = 0 V | - | 80 | 115 | μA | |
| I_{IN_Q} | OVLO Supply Current | OV1 = LOW, OV2 = LOW $V_{IN} = 6.5$ V, $V_{OUT} = 0$ V | - | 63 | 90 | μA | |
| V_{IN_OVLO} | Over-Voltage Trip Level | V_{IN} Rising | OV1 = LOW, OV2 = LOW | 5.80 | 5.90 | 6.00 | V |
| | | V_{IN} Falling | | 5.75 | | | |
| | | V_{IN} Rising | OV1 = HIGH, OV2 = LOW | 9.90 | 10.00 | 10.10 | |
| | | V_{IN} Falling | | 9.85 | | | |
| | | V_{IN} Rising | OV1 = LOW, OV2 = HIGH | 13.72 | 14.0 | 14.28 | |
| | | V_{IN} Falling | | 13.52 | | | |
| | | V_{IN} Rising | OV1 = HIGH, OV2 = HIGH | 22.54 | 23.0 | 23.46 | |
| | | V_{IN} Falling | | 22.34 | | | |
| R_{ON} | Resistance from V_{IN} to V_{OUT} | $V_{IN} = 5$ V, $I_{OUT} = 1$ A, $T_A = 25^{\circ}\text{C}$ | - | 33 | 40 | m Ω | |
| C_{OUT} | OUT Load Capacitance (Note 2) | $V_{IN} = 5$ V | 0.1 | - | 1000.0 | μF | |
| T_{SDN} | Thermal Shutdown (Note 2) | | - | 130 | - | $^{\circ}\text{C}$ | |
| T_{SDN_HYS} | Thermal Shutdown Hysteresis (Note 2) | | - | 20 | - | $^{\circ}\text{C}$ | |

DIGITAL SIGNALS

| | | | | | | |
|------------|----------------------------------|--|-----|---|-----|---------------|
| V_{OL} | #ACOK Output Low Voltage | $I_{SINK} = 1$ mA | - | - | 0.4 | V |
| I_{ACOK} | #ACOK Leakage Current | $V_{I/O} = 3.0$ V, #ACOK Deasserted | - | - | 0.5 | μA |
| V_{IH} | Input HIGH Voltage (#EN, OVx) | $V_{IN} = 2.5$ V to V_{OVLO} | 1.2 | - | - | V |
| V_{IL} | Input LOW Voltage (#EN, OVx) | $V_{IN} = 2.5$ V to V_{OVLO} | - | - | 0.5 | V |
| I_{IN} | Input Leakage Current (#EN, OVx) | $V_{IN} = 5.0$ V, $V_{OUT} = \text{Float}$ | - | - | 1.0 | μA |

TIMING CHARACTERISTICS

| | | | | | | |
|-------------|------------------------------|--|----|----|-----|----|
| t_{DEB} | Debounce Time | Time from 2.5 V < V_{IN} < V_{IN_OVLO} to $V_{OUT} = 0.1 \times V_{IN}$ | 10 | 15 | 20 | ms |
| t_{START} | Soft-Start Time | Time from $V_{IN} = V_{IN_min}$ to $0.2 \times \#ACOK$, $V_{IO} = 1.8$ V with 10 k Ω Pull-up Resistor | 20 | 30 | 40 | ms |
| t_{ON} | Switch Turn-On Time | $R_L = 100$ Ω , $C_L = 22$ μF , V_{OUT} from $0.1 \times V_{IN}$ to $0.9 \times V_{IN}$ | 1 | 3 | 5 | ms |
| t_{OFF} | Switch Turn-Off Tim (Note 2) | $R_L = 100$ Ω , $C_L = 0$ μF , $V_{IN} > V_{OVLO}$ to $V_{OUT} = 0.8 \times V_{IN}$ | - | - | 150 | 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.

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TIMING DIAGRAMS

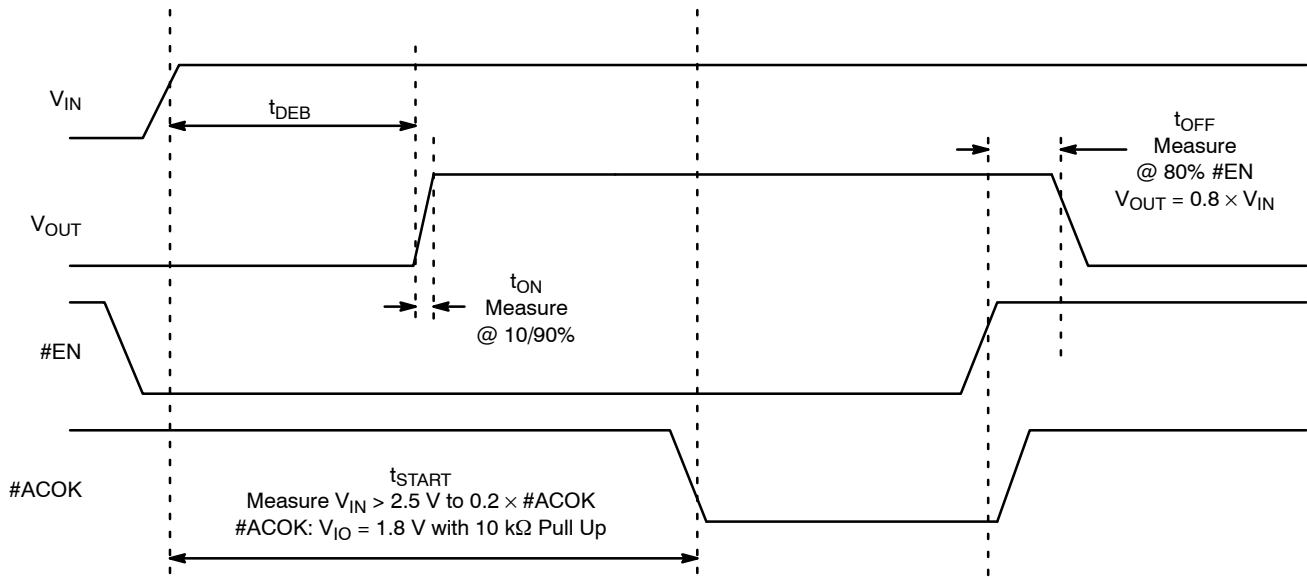


Figure 3. Timing for Power Up and Normal Operation

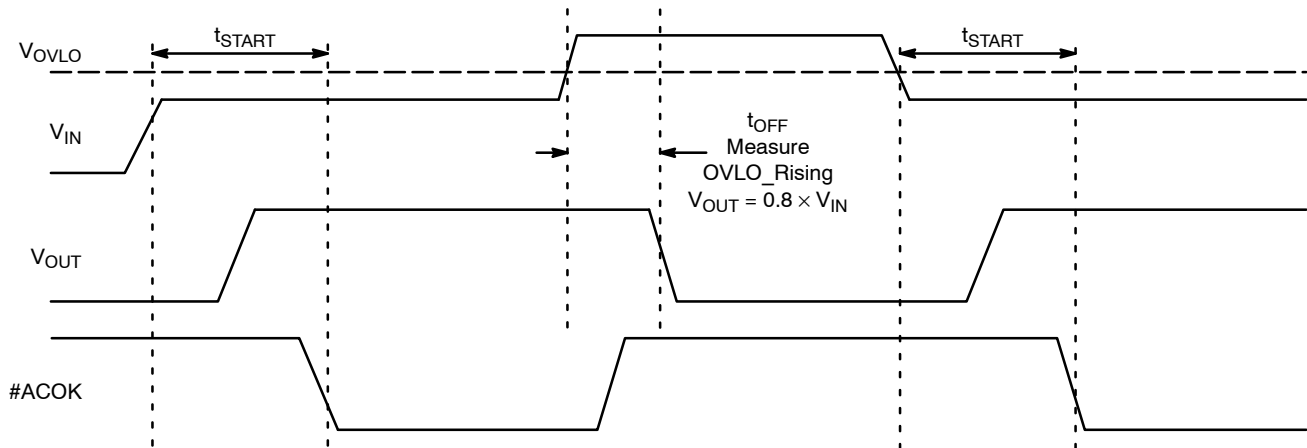


Figure 4. Timing for OVLO Trip

ORDERING INFORMATION

| Part Number | Operating Temperature Range | Top Mark | Package | Shipping† |
|------------------|-----------------------------|----------|----------------------------------|--------------------|
| FPF2290BUCX-F130 | -40°C to +85°C | HR | WLCSP12 (Pb-Free/Halide 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](#).

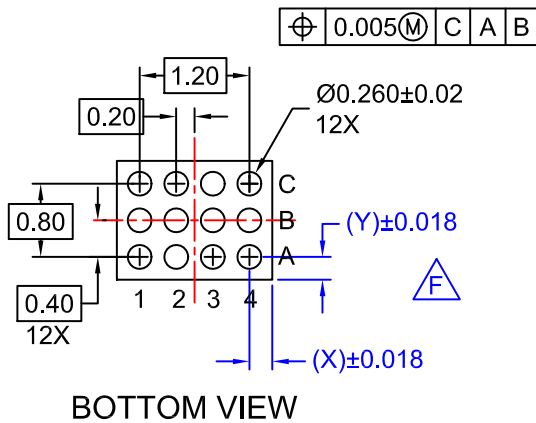
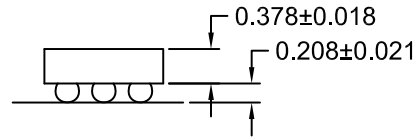
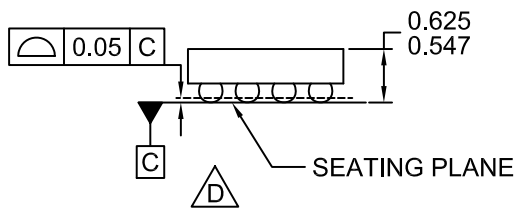
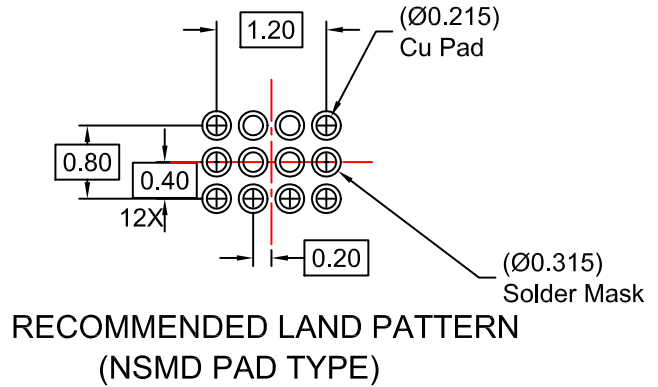
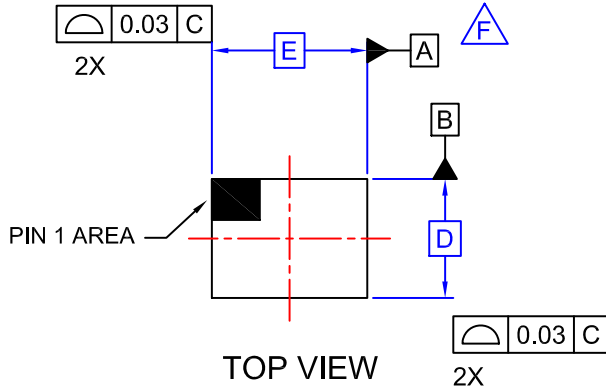
PRODUCT-SPECIFIC DIMENSIONS

| D | E | X | Y |
|---------------------------------------|---------------------------------------|--------------------------------------|--------------------------------------|
| 1288 $\mu\text{m} \pm 30 \mu\text{m}$ | 1828 $\mu\text{m} \pm 30 \mu\text{m}$ | 314 $\mu\text{m} \pm 18 \mu\text{m}$ | 244 $\mu\text{m} \pm 18 \mu\text{m}$ |



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

DATE 31 OCT 2016



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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