UPD1001

Programmable USB Power Delivery Controller

Highlights

- Integrated USB Power Delivery (PD) PHY
- Support for Power Delivery Message Protocol
- Integrated Voltage and Current ADC Inputs
- Configuration Profile Selection
- On-chip Microcontroller
- SPI Interface
- Commercial, Industrial, and Automotive Grade Temperature Support
- Available in 28-TSSOP and 32-SQFN Packages

Target Applications

- AC Adapters & Chargers
  - Type-A
  - Type-B
  - Micro-A
  - Micro-B
  - Captive cable

Key Benefits

- Integrated USB Power Delivery (PD) PHY
  - Integrated receive termination
  - Requires minimal external components
- Support for Power Delivery Message Protocol
  - Message Generation/Consumption
  - Retry Generation
  - Error Handling
  - State Behavior
- Cable Detect Logic
  - Cable attachment type
- CFG_SEL pins allow selection of multiple profiles
  - Provider
  - Consumer/Provider
- Integrated Voltage (VMON) and Current (IMON) ADC Inputs
- Dead Battery Support
- On-chip Microcontroller
  - Manages I/Os and other signals
  - Implements power delivery policy engine and device policy manager
- Configuration Programming via OTP, or Vendor Defined Messaging
- Supports Low Power Modes
- Serial Peripheral Interface (SPI) Bus
- Internal 3.3 V and 1.8 V Voltage Regulators
- Integrated Oscillator Reduces BOM Costs
- Package
  - 28-pin TSSOP (9.7 x 6.1 mm)
  - 32-pin SQFN (5 x 5 mm)
- Environmental
  - Commercial temperature range (0°C to +70°C)
  - Industrial temperature range (-40°C to +85°C)
  - Automotive temperature range (-40°C to +105°C)

UPD1001

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1.0 INTRODUCTION

1.1 General Description

The UPD1001 is a programmable USB Power Delivery (PD) controller designed to adhere to the *USB Power Delivery Specification.* USB Power Delivery allows a host (or device) to provide or consume up to 5 Amps and/or up to 20 Volts of power from a USB PD capable partner device on the other end of the USB cable. USB PD capable standard and custom cables/connectors are supported, which in most cases are backward compatible with standard USB connections.

The UPD1001 provides a complete USB Power Delivery solution for all charger and adapter solutions. The functionality of the UPD1001 is selected via two configuration selection pins, **CFG_SEL0** and **CFG_SEL1**, which can be used to select unique PD and system configurations. Designing the UPD1001 into a system can be as simple as selecting a configuration, with no external EEPROM required. Advanced programmability options exist with an external EEPROM installed.

The integrated USB Power Delivery MAC and PHY support provider and consumer operation via the PD communication protocol, as specified in Revision 1.0 (Version 1.2) of the *USB Power Delivery Specification.* Monitoring of VBUS and battery charging is accomplished via the integrated voltage and current ADC inputs. The PHY supports cable ID detection/identification and loopback modes. The PHY includes a 24MHz FSK modulator/demodulator and provides integrated terminations. The USB PD MAC supports both USB PD insertion detection (cold socket) and dead battery cases.

The on-chip microcontroller manages the IOs and implements the power delivery local policy engine and device manager. The SPI ROM controller is used by the microcontroller for optional external code execution from ROM. A One Time Programmable (OTP) ROM is integrated in the UPD1001. Integrated 3.3 V and 1.8 V regulators allow device operation from a single power supply. The UPD1001 is available in commercial (0°C to +70°C), industrial (-40°C to +85°C), and automotive (-40°C to +105°C) temperature ranges. An internal block diagram of the UPD1001 is shown in Figure 1-1.

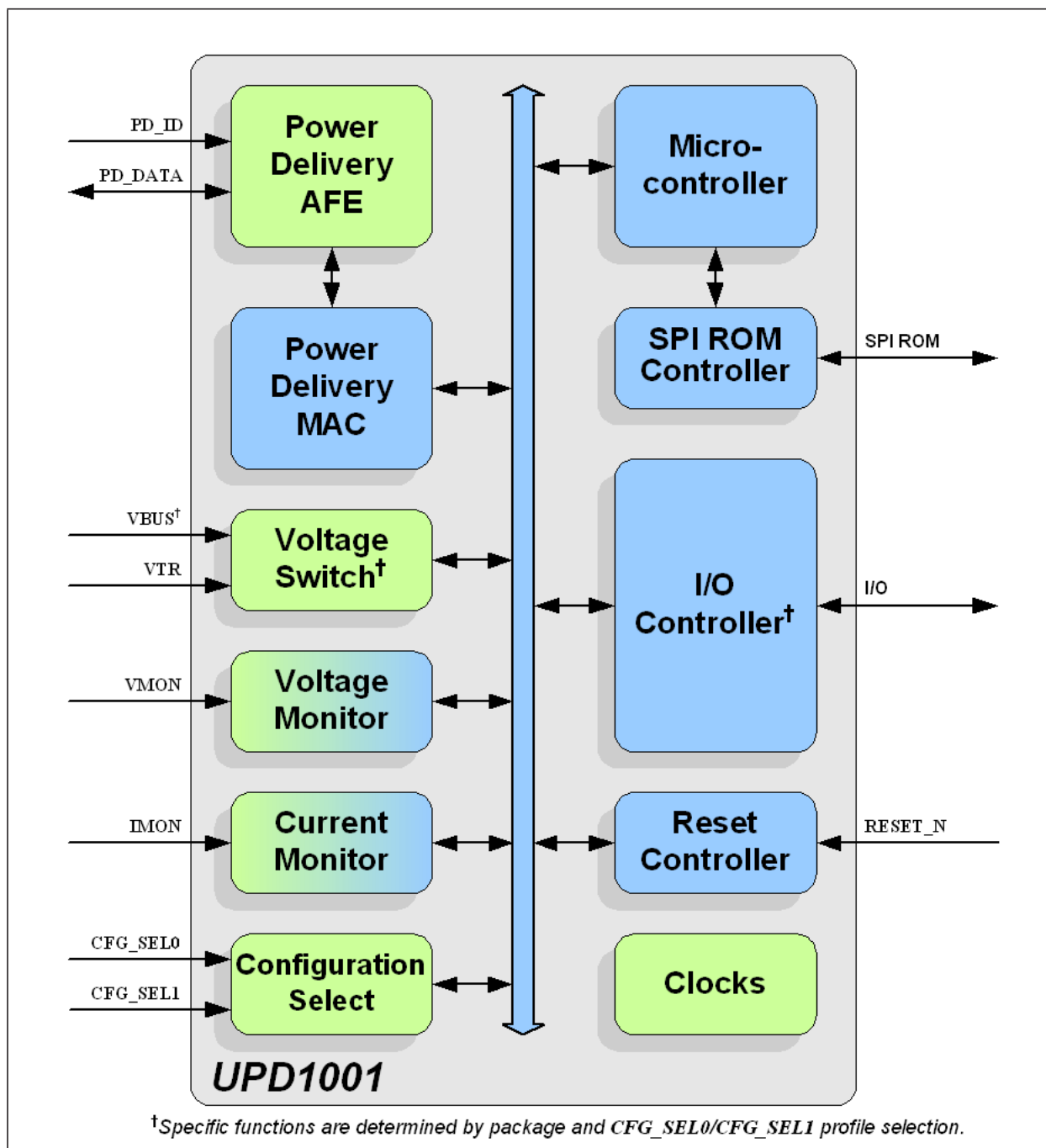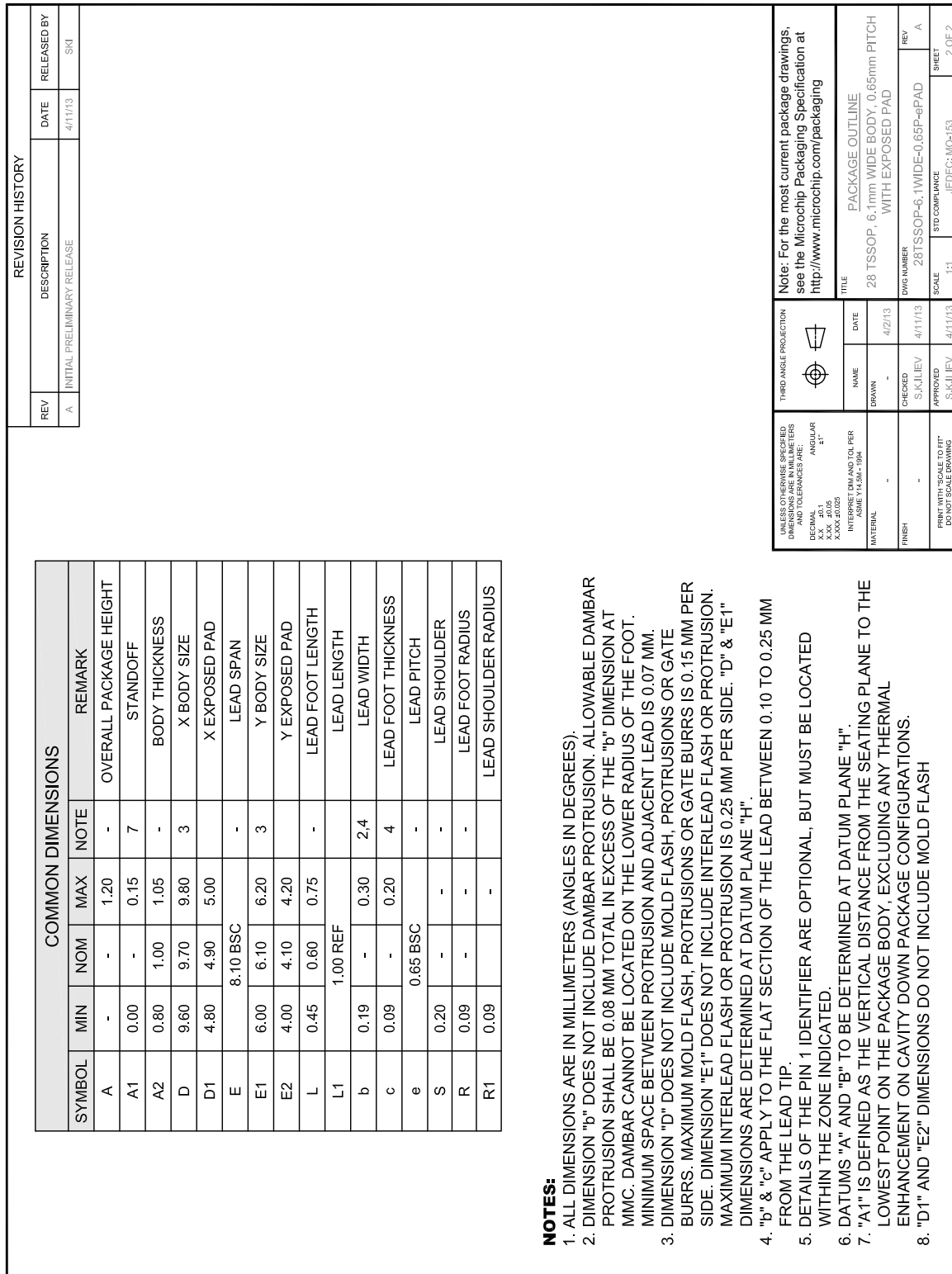# UPD1001

FIGURE 1-1: **INTERNAL BLOCK DIAGRAM**

†Specific functions are determined by package and CFG_SEL0/CFG_SEL1 profile selection.

2.0   PACKAGE OUTLINES

2.1   28-TSSOP

FIGURE 2-1:   **28-TSSOP PACKAGE (DRAWING)**

FIGURE 2-2: 28-TSSOP PACKAGE (DIMENSIONS)

COMMON DIMENSIONS

SYMBOL	MIN	NOM	MAX	NOTE	REMARK
A	-	-	1.20	-	OVERALL PACKAGE HEIGHT
A1	0.00	-	0.15	7	STANDOFF
A2	0.80	1.00	1.05	-	BODY THICKNESS
D	9.60	9.70	9.80	3	X BODY SIZE
D1	4.80	4.90	5.00	-	X EXPOSED PAD
E	8.10 BSC			-	LEAD SPAN
E1	6.00	6.10	6.20	3	Y BODY SIZE
E2	4.00	4.10	4.20	-	Y EXPOSED PAD
L	0.45	0.60	0.75	-	LEAD FOOT LENGTH
L1	1.00 REF			-	LEAD LENGTH
b	0.19	-	0.30	2,4	LEAD WIDTH
c	0.09	-	0.20	4	LEAD FOOT THICKNESS
e	0.65 BSC			-	LEAD PITCH
S	0.20	-	-	-	LEAD SHOULDER
R	0.09	-	-	-	LEAD FOOT RADIUS
R1	0.09	-	-	-	LEAD SHOULDER RADIUS

NOTES:
1. ALL DIMENSIONS ARE IN MILLIMETERS (ANGLES IN DEGREES).
2. DIMENSION "b" DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 MM TOTAL IN EXCESS OF THE "b" DIMENSION AT MMC. DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OF THE FOOT. MINIMUM SPACE BETWEEN PROTRUSION AND ADJACENT LEAD IS 0.07 MM.
3. DIMENSION "D" DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MAXIMUM MOLD FLASH, PROTRUSIONS OR GATE BURRS IS 0.15 MM PER SIDE. DIMENSION "E1" DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. MAXIMUM INTERLEAD FLASH OR PROTRUSION IS 0.25 MM PER SIDE. "D" & "E1" DIMENSIONS ARE DETERMINED AT DATUM PLANE "H".
4. "b" & "c" APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN 0.10 TO 0.25 MM FROM THE LEAD TIP.
5. DETAILS OF THE PIN 1 IDENTIFIER ARE OPTIONAL, BUT MUST BE LOCATED WITHIN THE ZONE INDICATED.
6. DATUMS "A" AND "B" TO BE DETERMINED AT DATUM PLANE "H".
7. "A1" IS DEFINED AS THE VERTICAL DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT ON THE PACKAGE BODY, EXCLUDING ANY THERMAL ENHANCEMENT ON CAVITY DOWN PACKAGE CONFIGURATIONS.
8. "D1" AND "E2" DIMENSIONS DO NOT INCLUDE MOLD FLASH

REVISION HISTORY

REV	DESCRIPTION	DATE	RELEASED BY
A	INITIAL PRELIMINARY RELEASE	4/11/13	SKI

THIRD ANGLE PROJECTION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MILLIMETERS AND TOLERANCES ARE:
DECIMAL   ANGULAR
X.X   ±0.1   ±1°
X.XX   ±0.05
X.XXX ±0.025
INTERPRET DIM AND TOL PER ASME Y14.5M – 1994

	NAME	DATE
DRAWN	-	4/2/13
CHECKED	S.K.ILIEV	4/11/13
APPROVED	S.K.ILIEV	4/11/13

MATERIAL -
FINISH -

PRINT WITH "SCALE TO FIT"
DO NOT SCALE DRAWING

Note: For the most current package drawings, see the Microchip Packaging Specification at http://www.microchip.com/packaging

TITLE   PACKAGE OUTLINE
28 TSSOP, 6.1mm WIDE BODY, 0.65mm PITCH WITH EXPOSED PAD

DWG NUMBER 28TSSOP-6.1WIDE-0.65P-ePAD   REV A
STD COMPLIANCE JEDEC: MO-153
SCALE 1:1   SHEET 2 OF 2

2.2   32-SQFN

FIGURE 2-3:   **32-SQFN PACKAGE**

REVISION HISTORY

REV	DESCRIPTION	DATE	RELEASED BY
A	INITIAL PRELIMINARY RELEASE	4/2/13	S.K.ILIEV

COMMON DIMENSIONS

SYMBOL	MIN	NOM	MAX	NOTE	REMARK
A	0.80	0.90	1.00	-	OVERALL PACKAGE HEIGHT
A1	0	0.02	0.05	-	STANDOFF
D/E	4.90	5.00	5.10	-	X/Y BODY SIZE
D2/E2	3.40	3.50	3.60	-	X/Y EXPOSED PAD SIZE
L	0.35	0.40	0.45	-	TERMINAL LENGTH
b	0.18	0.25	0.30	2	TERMINAL WIDTH
K	0.35	0.45	-	-	PIN TO ePAD CLEARANCE
e		0.50 BSC		-	TERMINAL PITCH

NOTES:
1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. DIMENSIONS "b" APPLIES TO PLATED TERMINALS AND IT IS MEASURED BETWEEN 0.15 AND 0.30 mm FROM THE TERMINAL TIP.
3. DETAILS OF TERMINAL #1 IDENTIFIER ARE OPTIONAL BUT MUST BE LOCATED WITHIN THE AREA INDICATED.

Note: For the most current package drawings, see the Microchip Packaging Specification at http://www.microchip.com/packaging

PACKAGE OUTLINE

32 PINS SQFN, 5x5mm BODY, 0.5mm PITCH
(SAWN QFN, FULL LEAD TERMINATION)

TITLE		
DWG NUMBER	32-SQFN-3504-5x5B-0.5P	REV A
STD COMPLIANCE	JEDEC: MO-220	
SCALE 1:1		SHEET 1 OF 1

THIRD ANGLE PROJECTION

	NAME	DATE
DRAWN	-	4/1/13
CHECKED	S.K.ILIEV	4/2/13
APPROVED	S.K.ILIEV	4/2/13

MATERIAL -

FINISH -

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MILLIMETERS AND TOLERANCES ARE:
DECIMAL   ANGULAR
X.X   ±0.1   ±1°
X.XX   ±0.05
X.XXX   ±0.025
INTERPRET DIM AND TOL PER ASME Y14.5M – 1994

PRINT WITH "SCALE TO FIT"
DO NOT SCALE DRAWING

BOTTOM VIEW

TERMINAL #1 IDENTIFIER AREA (D/2 X E/2)

EXPOSED PAD (ePAD)

32X L

32X b

32X K

(DATUM B)
(DATUM A)

TOP VIEW

TERMINAL #1 IDENTIFIER AREA (D/2 X E/2)

SIDE VIEW

32X + ePAD

A1

PCB LAND PATTERN

0.2 (MIN)

SEE NOTE 2

NOTES:
1. THE USER MAY MODIFY THE PCB LAND PATTERN DESIGN AND DIMENSIONS BASED ON THEIR EXPERIENCE AND/OR PROCESS CAPABILITY
2. EXPOSED SOLDERABLE COPPER AREA OF THE CENTER PAD CAN BE EITHER SOLID OR SEGMENTED
3. MAXIMUM THERMAL AND ELECTRICAL PACKAGE PERFORMANCE IS ACHIEVED WHEN AN ARRAY OF SOLID VIAS IS INCORPORATED IN THE CENTER LAND PATTERN

LAND PATTERN DIMENSIONS

SYMBOL	MIN	NOM	MAX
GD/GE	4.00	-	4.10
D2'/E2'	-	3.50	3.5000
X	-	0.28	0.28
Y	-	0.69	-
e		0.50	

UPD1001

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<u>PART NO.</u>   [X]   -   XX   /   XX

Device   **Tape and Reel Option**   **Temperature Range**   **Package**

Device:	UPD1001
Tape and Reel Option:	Blank = Standard packaging (tray) T = Tape and Reel (Note 1)
Temperature Range:	A = 0°C to +70°C (Commercial) AI = -40°C to +85°C (Industrial) AV = -40°C to +105°C (Automotive)
Package:	ST = 28-pin TSSOP MQ = 32-pin SQFN

Examples:

a) UPD1001-A/ST
   Tray, Commercial temp., 28-pin TSSOP

b) UPD1001T-AI/MQ
   Tape & reel, Industrial temp., 32-pin SQFN

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