



# AP1400

## 2 cell, Multi-channel System Power Control IC

### 1. General Description

The AP1400 is a multichannel system power supply IC that has a 4ch DC-DC converter and a 2ch LDO, supporting input voltage up to 12V. It integrates a start sequence circuit, a current sense circuit, an external load switch control circuit, and various protection functions. A power supply system can be simply designed with the AP1400. In addition, the standby current is very low at 19  $\mu$ A. The AP1400 is housed in a small 65-pin WLCSP package, making it ideal for portable equipment such as digital single lens reflex cameras and mirrorless cameras.

### 2. Features

- Operation Input Voltage 4.0 to 12.0 V
- Startup Sequence The AP1400 can set the startup sequence and start time of each regulator by register settings.
- Protection Function Pre-start Abnormal Voltage Detection, Short-circuit Protection, Overvoltage Protection, Thermal Protection, Undervoltage Protection.
- Standby Current 19  $\mu$ A (max)
- Operation Current 10 mA (max)
- DC-DC Converter
  - Soft Start, Output Discharge Function
  - Buck-boost 1ch DDC1: 5.3V / 700mA(max), Built-in FET
  - Buck 3ch DDC2: 4.25V / 2300mA(max), Built-in FET
  - DDC3: 3.3V / 4000mA(max), External FET
  - DDC4: 4.0V / 600mA(max), Built-in FET
  - Switching Frequency Selectable from 1 to 2.57 MHz
  - Recommended Frequency DDC1/2/4: 2 MHz, DDC3: 1 MHz
  - External CLK Synchronization From 1.5 to 2.5 MHz
- Internal Oscillation  $\pm 3\%$  (max)  $T_a=25^\circ\text{C}$ ,  $\pm 7\%$  (max)  $-20$  to  $60^\circ\text{C}$
- Frequency Accuracy
- Load Switch 2ch
  - LDSW1:  $R_{onmax}=200\text{m}\Omega$
  - Constant Current Control, Output Discharge Function
  - LDSW2:  $R_{onmax}=200\text{m}\Omega$
- LDO 2ch
  - Always-On
  - LDO5: 5.0V / 50mA(max)  $EN= "L"$ , 250mA(max)  $EN= "H"$
  - LDO3: 3.3V / 50mA(max)
- Current Sense 3ch
  - Sense Current Range: 0 to 6.4A
  - External Load Switch Control (with latch function)
  - CS1: Gain x20, x40, x100 Analog Output
  - (Maximum Output Voltage: 3.2V, Settling Time: 20 $\mu$ s)
  - CS2: Gain x20, x40
  - CS3: Gain x20, x40
- Power Good Output Start Detection Function for 4ch DC-DC Converter and External 2ch LDO

- External Power Supply Voltage for Communication 3.3 V or 1.8 V
- Interface I<sup>2</sup>C Interface (400kHz max)
- Operating Temperature -30 to 70 °C
- Package 65-pin WLCSP (0.4 mm pitch, 2.9 mm x 4.1 mm)

### 3. Block Diagram

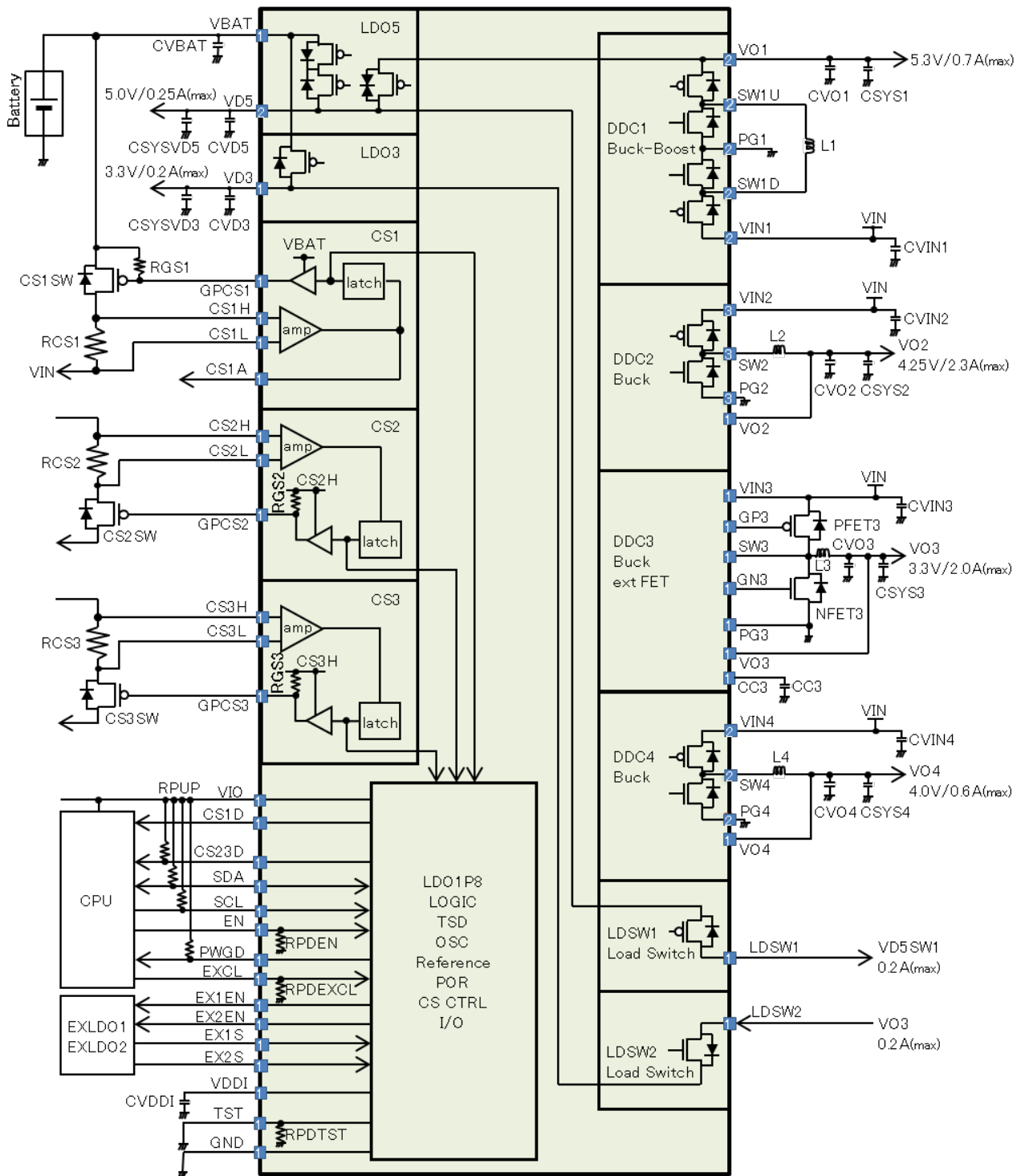


Figure 1. Block Diagram

#### 4. Pin Configurations

• Top View

VIN2	SW2	PG2	CS3H	PG4	SW4	VIN4
(1A)	(2A)	(3A)	(4A)	(5A)	(6A)	(7A)
VIN2	SW2	PG2	CS3L	PG4	SW4	VIN4
(1B)	(2B)	(3B)	(4B)	(5B)	(6B)	(7B)
VIN2	SW2	PG2	GPCS3		VO4	EX2EN
(1C)	(2C)	(3C)	(4C)		(6C)	(7C)
VIN3	VO2		CS1H	CS1L	EX2S	EX1EN
(1D)	(2D)		(4D)	(5D)	(6D)	(7D)
GP3	GPCS1	CS2L	CS2H	CS1A	EX1S	GND
(1E)	(2E)	(3E)	(4E)	(5E)	(6E)	(7E)
SW3	GPCS2	SDA	SCL	TST	EN	VDDI
(1F)	(2F)	(3F)	(4F)	(5F)	(6F)	(7F)
PG3	CC3	CS23D	EXCL		LDSW2	VD3
(1G)	(2G)	(3G)	(4G)		(6G)	(7G)
GN3	VO3		CS1D	PWGD		VIO
(1H)	(2H)		(4H)	(5H)		(7H)
VIN1	SW1D	PG1	SW1U	VO1	VD5	VBAT
(1J)	(2J)	(3J)	(4J)	(5J)	(6J)	(7J)
VIN1	SW1D	PG1	SW1U	VO1	VD5	LDSW1
(1K)	(2K)	(3K)	(4K)	(5K)	(6K)	(7K)

Figure 2. Pin Configurations

## 5. Package

### ■ Outline Dimensions

- 65-pin WLCSP (0.4mm pitch)

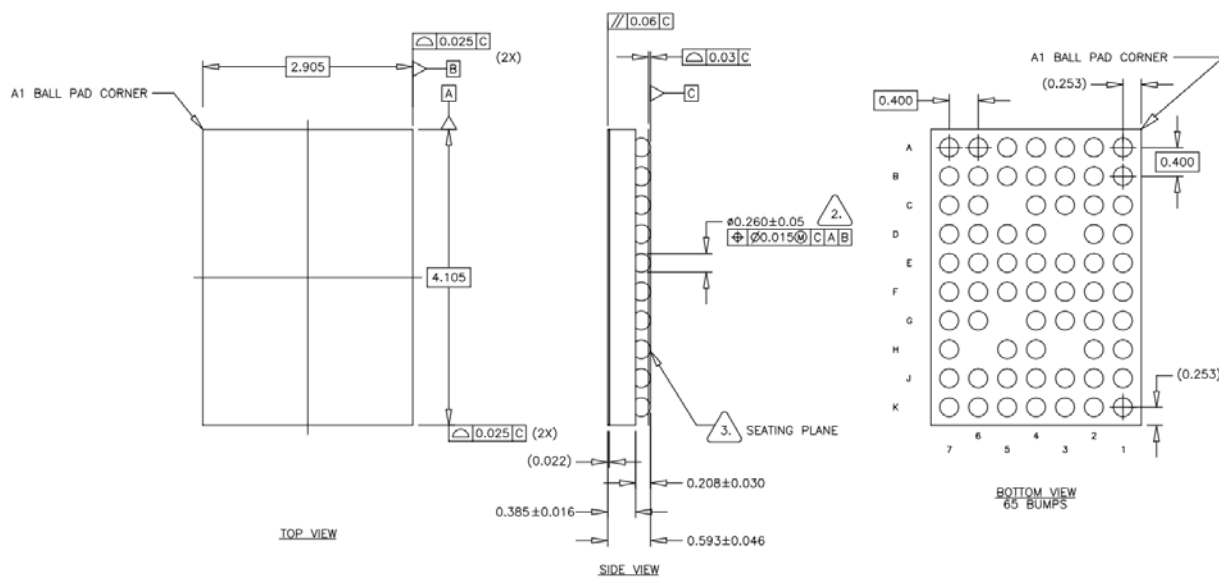
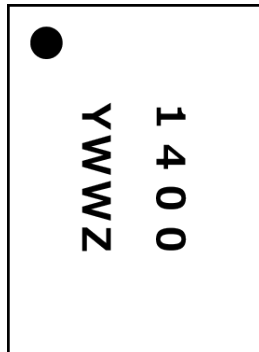


Figure 3. Outline Dimensions

### ■ Marking



1400 : Product name (number part only)  
 Y : Year of manufacture  
 WW : Production week  
 Z : Management code

Figure 4. Marking

<b>6. Revision History</b>
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Date (Y/M/D)	Revision	Page	Contents
2016/09/01	00	-	First Edition

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