



# 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 Frequency Accuracy  $\pm 3\%$  (max)  $T_a=25^\circ\text{C}$ ,  $\pm 7\%$  (max)  $-20$  to  $60^\circ\text{C}$
- Load Switch 2ch LDSW1: Ronmax=200m $\Omega$   
Constant Current Control, Output Discharge Function  
LDSW2: Ronmax=200m $\Omega$
- 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 3.3 V or 1.8 V for Communication
- 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

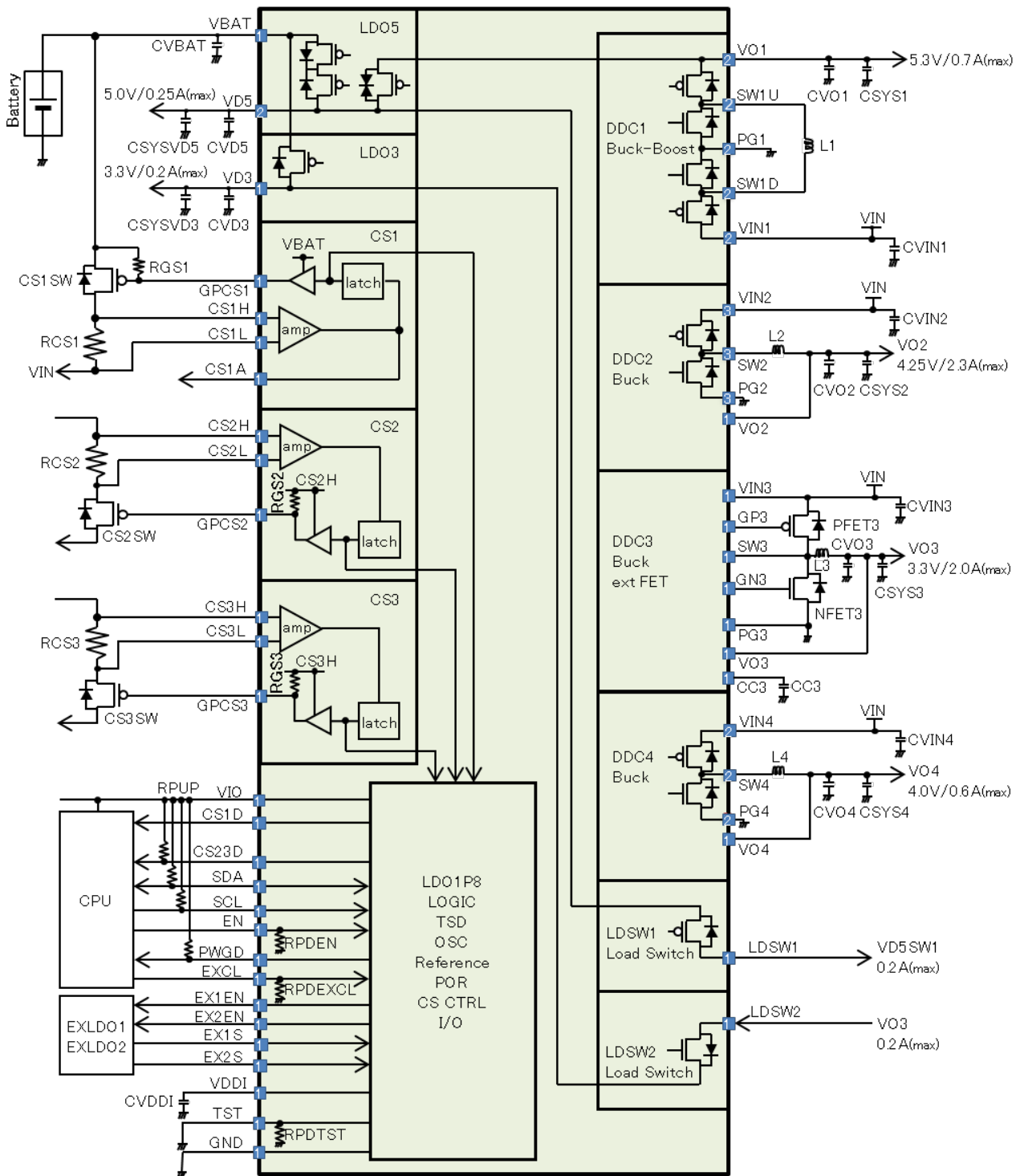


Figure 1. Block Diagram

**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)

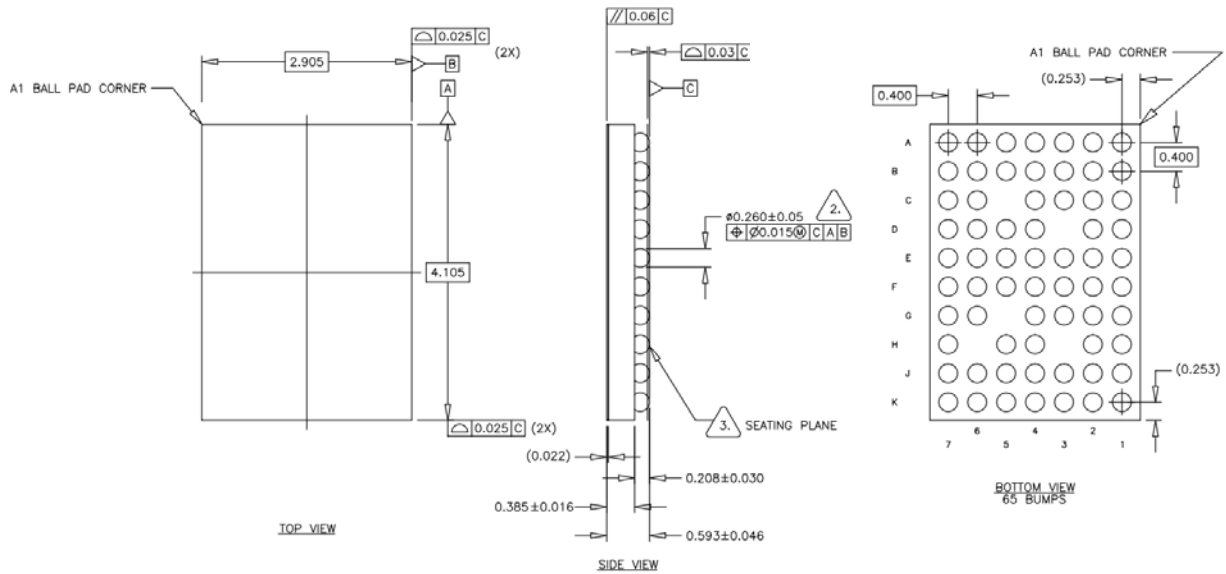
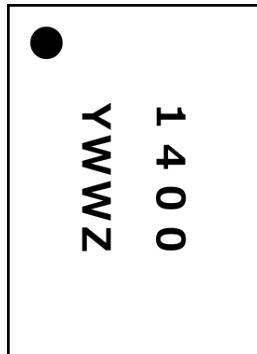


Figure 3. Outline Dimensions

■ **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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