

# AN8083S

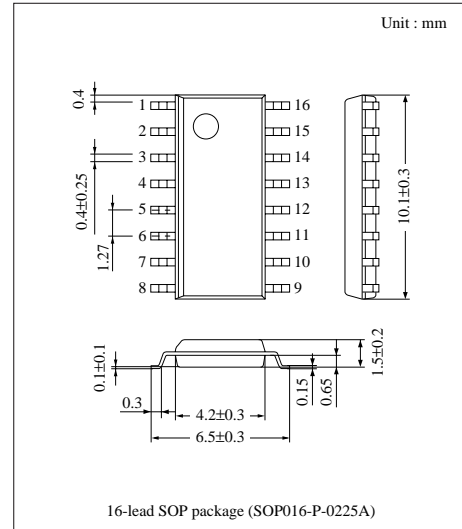
## Low Voltage Operation IC for DC-DC Converter

### ■ Overview

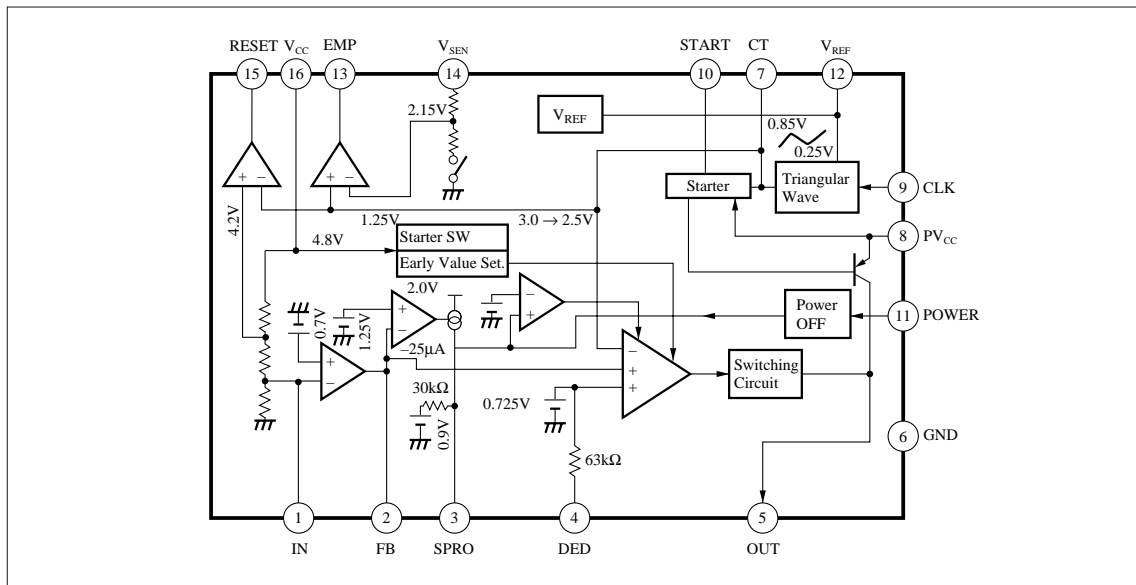
The AN8083S is an IC for controlling a DC-DC converter suitable for the switching power supply of various portable equipments. It can operate with input voltage 1.1V or more.

### ■ Features

- Operatable with low voltage input ( $PV_{CC} > 1.1V$ )
- Decreased voltage detection circuit built-in
- Short-circuit protection feature built-in
- Provided with reset output
- Synchronizable with outside clock
- Low consumption current in stand-by mode
- Output voltage in secondary side;  $4.8V \pm 0.3V$  (Variable by using external resistance)



### ■ Block Diagram



### ■ Absolute Maximum Ratings (Ta=25°C)

Parameter	Symbol	Rating	Unit
Supply Voltage	V <sub>CC</sub>	14.4	V
	PV <sub>CC</sub>	14.4	
Power Dissipation	P <sub>D</sub>	380	mW
Operating Ambient Temperature	T <sub>opr</sub>	-20 ~ +75	°C
Storage Temperature	T <sub>stg</sub>	-55 ~ +125	°C

### ■ Recommended Operating Range (Ta=25°C)

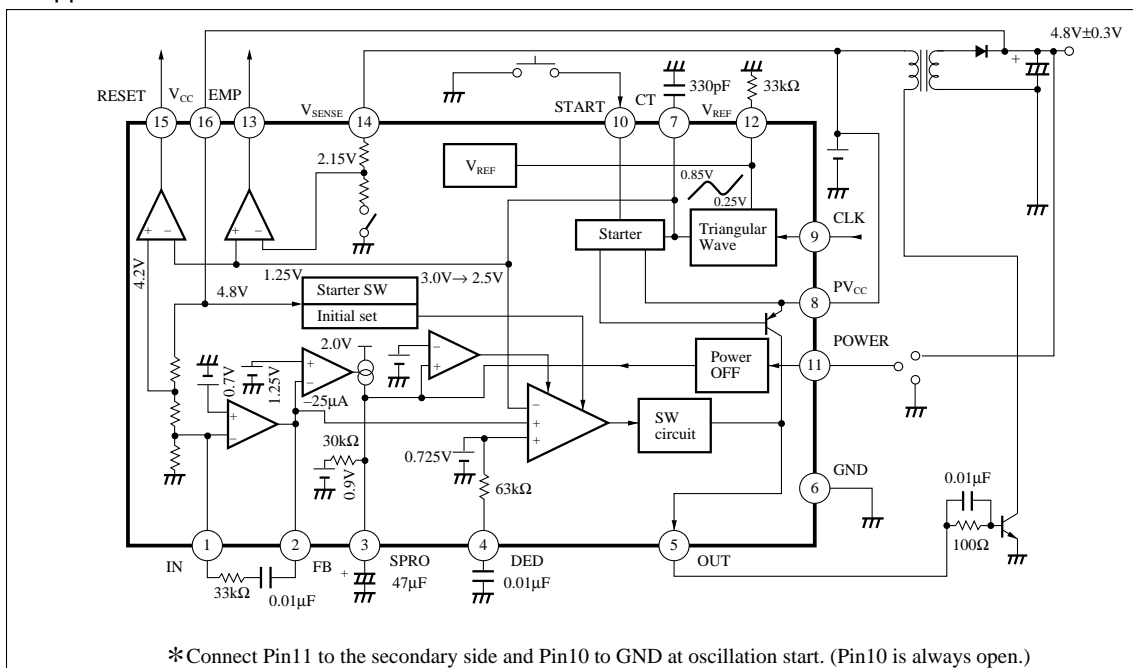
Parameter	Symbol	Range
Operating Supply Voltage Range	V <sub>CC</sub>	1.8V ~ 12V
	PV <sub>CC</sub>	1.1V ~ 12V

### ■ Electrical Characteristics (Ta=25°C)

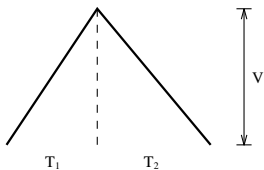
Parameter	Symbol	Condition	min.	typ.	max.	Unit
Power V <sub>CC</sub> Stand-by Mode Supply Current	I <sub>PVCC</sub>	V <sub>CC</sub> =0V, PV <sub>CC</sub> =3V	—	—	2	μA
Power V <sub>CC</sub> Operating Mode Supply Current	I <sub>PVCC</sub>	V <sub>CC</sub> =3.1V, PV <sub>CC</sub> =3V	—	1.2	3	mA
Output Voltage	V <sub>O</sub>		—	4.8	—	V
Reset Output Threshold Voltage	V <sub>TH (RESET)</sub>	PV <sub>CC</sub> =3V	4	4.2	4.4	V
Decreased Voltage Detection Threshold Voltage	V <sub>TH (VSEN)</sub>	PV <sub>CC</sub> =3V	2.05	2.15	2.25	V
Short-Circuit Protection Operating Voltage	V <sub>O (SPRO)</sub>	V <sub>IN</sub> =0V, V <sub>POWER</sub> =2V	1.35	—	2.1	V
Short-Circuit Protection Operating Voltage	V <sub>O (SPRO)</sub>	V <sub>IN</sub> =1V, V <sub>POWER</sub> =0V	1.7	—	3.2	V
Oscillation Frequency in Normal Operation	f <sub>OSC1</sub>	R <sub>REF</sub> =33kΩ, C <sub>T</sub> =330pF	60	70	80	kHz
Oscillation Frequency at Start	f <sub>OSC2</sub>	R <sub>REF</sub> =33kΩ, C <sub>T</sub> =330pF V <sub>CC</sub> =1.9V, PV <sub>CC</sub> =3V	80	100	120	kHz
Output Voltage (Normal)	V <sub>OH (OUT)</sub>	I <sub>O</sub> =-20mA, V <sub>CT</sub> =0V	1.2	—	1.6	V
Output Voltage (Normal)	V <sub>OL (OUT)</sub>	I <sub>O</sub> =20mA, V <sub>CT</sub> =1V	—	—	0.4	V

Note) Unless otherwise specified, V<sub>CC</sub>=4.8V, PV<sub>CC</sub>=3V

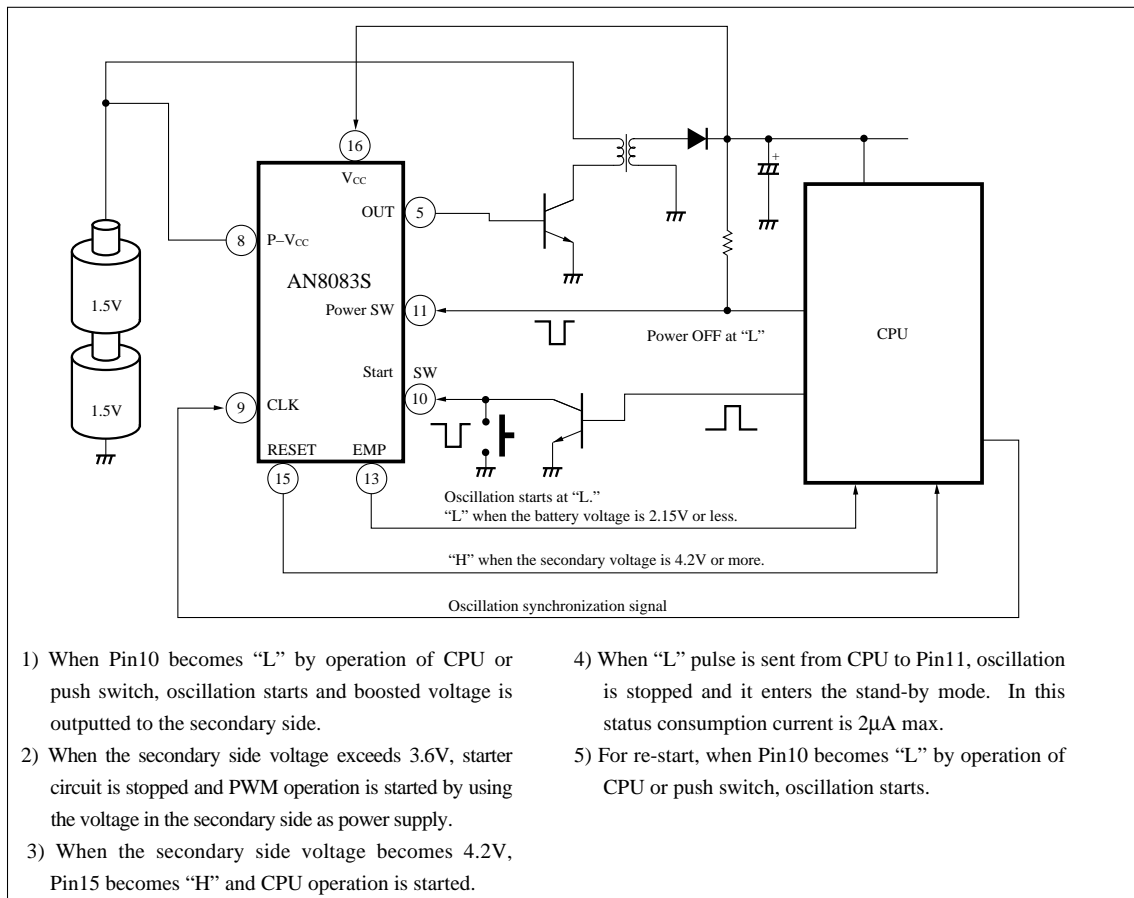
### ■ Application Circuit



### ■ Pin Description

Pin No.	Symbol	Pin Description
1	IN	<ul style="list-style-type: none"> <li>• Input pin for error amplifier</li> <li>• Threshold voltage ; 0.7V</li> </ul>
2	FB	<ul style="list-style-type: none"> <li>• Output pin for error amplifier</li> </ul>
3	SPRO	<ul style="list-style-type: none"> <li>• Short-circuit protection input pin. If output of error amplifier does not become "L" when <math>t=CV_{th}/I_{SPRO}</math> output of IC is not switched.</li> <li><math>I_{SPRO}=25\mu A</math></li> <li><math>V_{th}=0.9V</math></li> </ul>
4	DED	<ul style="list-style-type: none"> <li>• Dead time control input. Maximum duty ratio set to 85%. (Maximum duty ratio can be changed by installing external resistance between Pins 12 and 4.)</li> </ul>
5	OUT	<ul style="list-style-type: none"> <li>• Switching output pin Output current ; <math>I_o=20mA</math> (max.)</li> </ul>
6	GND	<ul style="list-style-type: none"> <li>• GND pin</li> </ul>
7	CT	<ul style="list-style-type: none"> <li>• Triangular oscillating capacitor pin</li> </ul> <div style="display: flex; align-items: center;">  <div style="margin-left: 20px;"> <math display="block">T_1 = \frac{CV}{I(\text{Discharged})}</math> <math display="block">T_2 = \frac{CV}{I(\text{Charged})}</math> <math display="block">f = \frac{1}{T_1 + T_2}</math> </div> <div style="border: 1px solid black; padding: 5px; margin-left: 20px; text-align: center;"> <math>I(\text{Discharged})=52\mu A</math>  <math>I(\text{Charged})=30\mu A</math>  <math>V=0.58V</math> </div> </div> <p style="text-align: right; margin-right: 50px;">In normal mode</p>
8	PV <sub>CC</sub>	<ul style="list-style-type: none"> <li>• DC voltage input pin Operates with 1.2V or more.</li> </ul>
9	CLK	<ul style="list-style-type: none"> <li>• Clock input <ul style="list-style-type: none"> <li>· It is used to synchronize triangular oscillation with clock input and operates at rise edge of clock.</li> <li>· The threshold level is TTL level.</li> <li>· It is open when not used.</li> </ul> </li> </ul>
10	START	<ul style="list-style-type: none"> <li>• Start pin <ul style="list-style-type: none"> <li>· Starts switching of starter</li> <li>· Threshold voltage, PV<sub>CC</sub> - 0.9V</li> </ul> </li> </ul>
11	POWER	<ul style="list-style-type: none"> <li>• Power ON/OFF pin Output ON/OFF switching pin (Output is off at "L.")</li> </ul>
12	V <sub>REF</sub>	<ul style="list-style-type: none"> <li>• Reference voltage pin <ul style="list-style-type: none"> <li>· 1.25V output</li> <li>· Charged and discharged current of triangular oscillation is determined by external R.</li> </ul> <math display="block">I(\text{Charged}) = \frac{V_{REF} - 0.7}{R_{REF} + 1k\Omega}</math> <math display="block">I(\text{Discharged}) = 1.40 \times I(\text{Charged})</math> </li> </ul>
13	EMP	<ul style="list-style-type: none"> <li>• Decreased voltage detection output pin "H" when detected by open collector output form</li> </ul>
14	V <sub>SEN</sub>	<ul style="list-style-type: none"> <li>• Decreased voltage detection input pin · Threshold voltage ; 2.15V</li> </ul>
15	Reset	<ul style="list-style-type: none"> <li>• Reset output pin <ul style="list-style-type: none"> <li>· "H" when V<sub>CC</sub> becomes 4.2V or more</li> <li>· Open collector output form</li> </ul> </li> </ul>
16	V <sub>CC</sub>	<ul style="list-style-type: none"> <li>• DC voltage input pin Operates with 1.8V or more.</li> </ul>

## ■ System Block Diagram



## ■ Supplementary Explanation

### • Operational Description

When power  $V_{CC}$  pin (Pin8) is connected to the supply output and start pin (Pin10) is set to "Low," the triangular oscillation is outputted to CT pin (Pin7) and the rectangular wave to OUT pin (Pin5). In this condition, called start condition, PWM control is not obtained and only oscillation is repeated. By this oscillation at start, supply output is increased. This supply output voltage is inputted to  $V_{CC}$  pin (Pin16) of the AN8083S. When the voltage of  $V_{CC}$  pin becomes 3V or more, start oscillation is stopped and oscillation in normal operation is outputted. PWM control is started only after entering normal mode. The voltage switching between start and normal operation has 0.5V hysteresis. When power pin (Pin11) is set to "High" in normal operation, normal mode oscillation is started. In this status, output of the supply is 4.8V fixed.

### • Other features

#### 1. Short-circuit protection feature

For normal mode oscillation, when output/FB pin (Pin2) of error amplifier is in "High" condition, oscillation is stopped, since the power supply system is judged to be in an abnormal condition. With the time constant of discharged current  $I_{SPRO}$  of SPRO pin (Pin3) and capacitor  $C_{SPRO}$ , pin voltage is increased, and oscillation is stopped when it becomes 1.25V or more. During this time, when the error amplifier becomes "Low," charged current no longer exits and SPRO is maintained to 0.9V.

#### 2. Decreased voltage detection circuit

When  $V_{SEN}$  pin (Pin14) gets 2.15V or less, EMS pin (Pin13) gets "High."

#### 3. Reset output

When  $V_{CC}$  pin voltage is 4.2V or more, RST pin (Pin15) gets "High."

• Miscellaneous

1. Method for making output voltage variable

$$V_{CC} = 0.7V \times (R_1 + R_2) / R_2$$

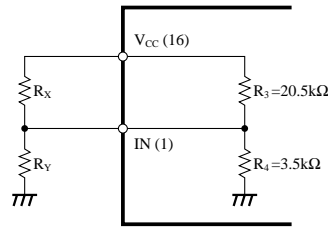
$$R_1 = R_X // R_3$$

$$R_2 = R_Y // R_4$$

ex) Where  $V_{CC} = 5V$ ,

$$R_X = 51k\Omega$$

$$R_Y = 7.5k\Omega$$



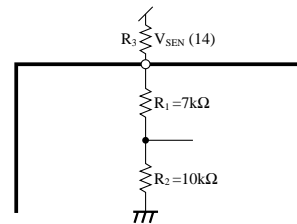
2. Method for making decreased voltage detection variable

$$V_{SEN} = \frac{R_1 + R_2}{R_2} \times 1.25V$$

ex)  $V_{SEN} = 3V$

$$V_{SEN} = \frac{R_1 + R_2 + R_3}{R_2} \times 1.25V$$

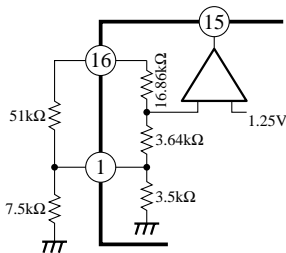
$$R_3 = 7k\Omega$$



However, take care that an external resistance causes different temperature characteristics.

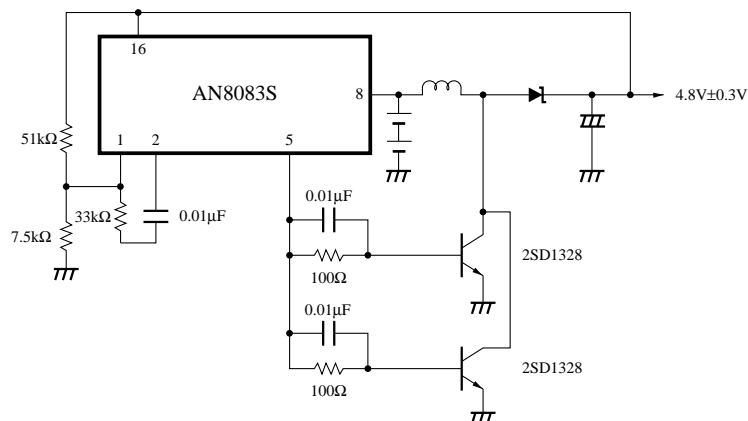
3. Reset output

When the output voltage is made variable, detection voltage changes.



$V_{CC} = 4.8V \rightarrow 4.2V$  (No changes)  
 $V_{CC} = 5V \rightarrow 4.27V$

• Chopper type application



## Request for your special attention and precautions in using the technical information and semiconductors described in this material

- (1) An export permit needs to be obtained from the competent authorities of the Japanese Government if any of the products or technologies described in this material and controlled under the "Foreign Exchange and Foreign Trade Law" is to be exported or taken out of Japan.
- (2) The technical information described in this material is limited to showing representative characteristics and applied circuit examples of the products. It does not constitute the warranting of industrial property, the granting of relative rights, or the granting of any license.
- (3) The products described in this material are intended to be used for standard applications or general electronic equipment (such as office equipment, communications equipment, measuring instruments and household appliances).  
Consult our sales staff in advance for information on the following applications:
  - Special applications (such as for airplanes, aerospace, automobiles, traffic control equipment, combustion equipment, life support systems and safety devices) in which exceptional quality and reliability are required, or if the failure or malfunction of the products may directly jeopardize life or harm the human body.
  - Any applications other than the standard applications intended.
- (4) The products and product specifications described in this material are subject to change without notice for reasons of modification and/or improvement. At the final stage of your design, purchasing, or use of the products, therefore, ask for the most up-to-date Product Standards in advance to make sure that the latest specifications satisfy your requirements.
- (5) When designing your equipment, comply with the guaranteed values, in particular those of maximum rating, the range of operating power supply voltage and heat radiation characteristics. Otherwise, we will not be liable for any defect which may arise later in your equipment.  
Even when the products are used within the guaranteed values, redundant design is recommended, so that such equipment may not violate relevant laws or regulations because of the function of our products.
- (6) When using products for which dry packing is required, observe the conditions (including shelf life and after-unpacking standby time) agreed upon when specification sheets are individually exchanged.
- (7) No part of this material may be reprinted or reproduced by any means without written permission from our company.

## Please read the following notes before using the datasheets

- A. These materials are intended as a reference to assist customers with the selection of Panasonic semiconductor products best suited to their applications.  
Due to modification or other reasons, any information contained in this material, such as available product types, technical data, and so on, is subject to change without notice.  
Customers are advised to contact our semiconductor sales office and obtain the latest information before starting precise technical research and/or purchasing activities.
- B. Panasonic is endeavoring to continually improve the quality and reliability of these materials but there is always the possibility that further rectifications will be required in the future. Therefore, Panasonic will not assume any liability for any damages arising from any errors etc. that may appear in this material.
- C. These materials are solely intended for a customer's individual use.  
Therefore, without the prior written approval of Panasonic, any other use such as reproducing, selling, or distributing this material to a third party, via the Internet or in any other way, is prohibited.