

# AN8083S

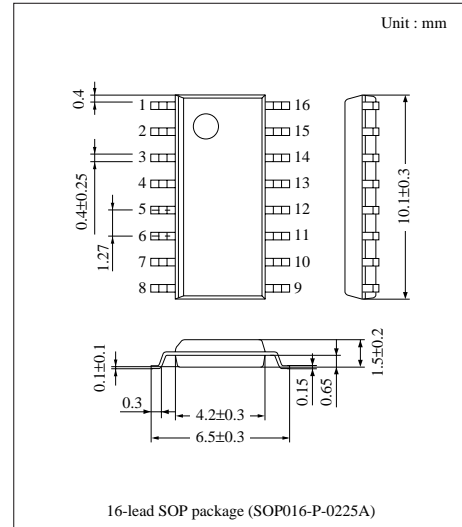
## Low Voltage Operation IC for DC-DC Converter

### ■ Overview

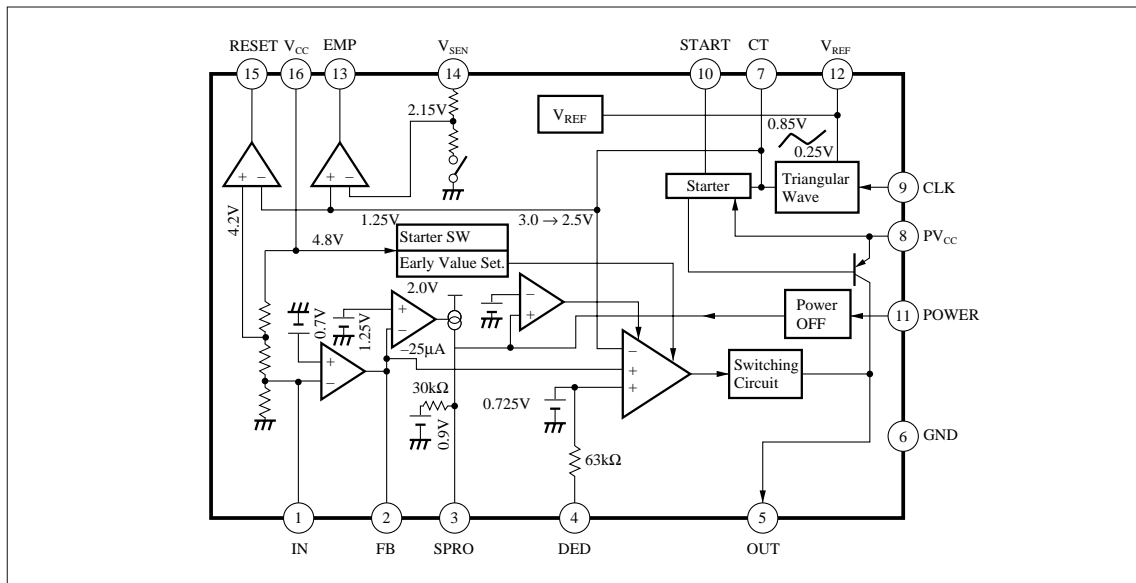
The AN8083S is an IC for controlling a DC-DC converter suitable for the switching power supply of various portable equipments. It can operate with input voltage 1.1V or more.

### ■ 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)

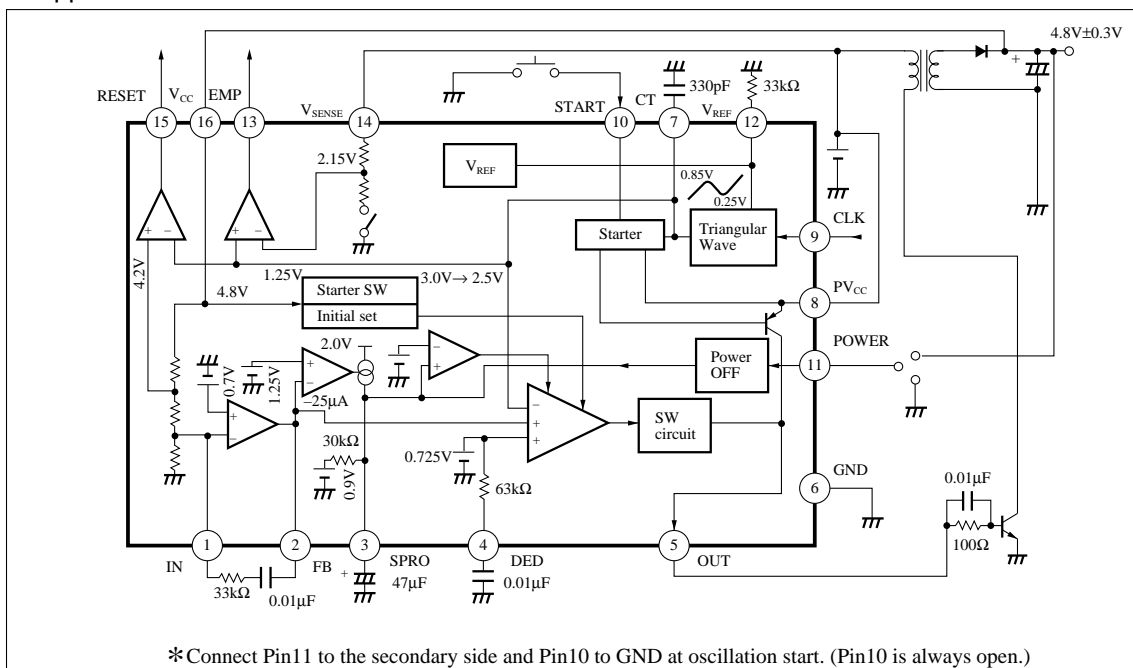
Parameter	Symbol	Range
Operating Supply Voltage Range	V <sub>CC</sub>	1.8V ~ 12V
	PV <sub>CC</sub>	1.1V ~ 12V

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

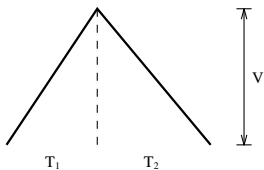
Parameter	Symbol	Condition	min.	typ.	max.	Unit
Power V <sub>CC</sub> Stand-by Mode Supply Current	I <sub>PVCC</sub>	V <sub>CC</sub> =0V, PV <sub>CC</sub> =3V	—	—	2	μA
Power V <sub>CC</sub> Operating Mode Supply Current	I <sub>PVCC</sub>	V <sub>CC</sub> =3.1V, PV <sub>CC</sub> =3V	—	1.2	3	mA
Output Voltage	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

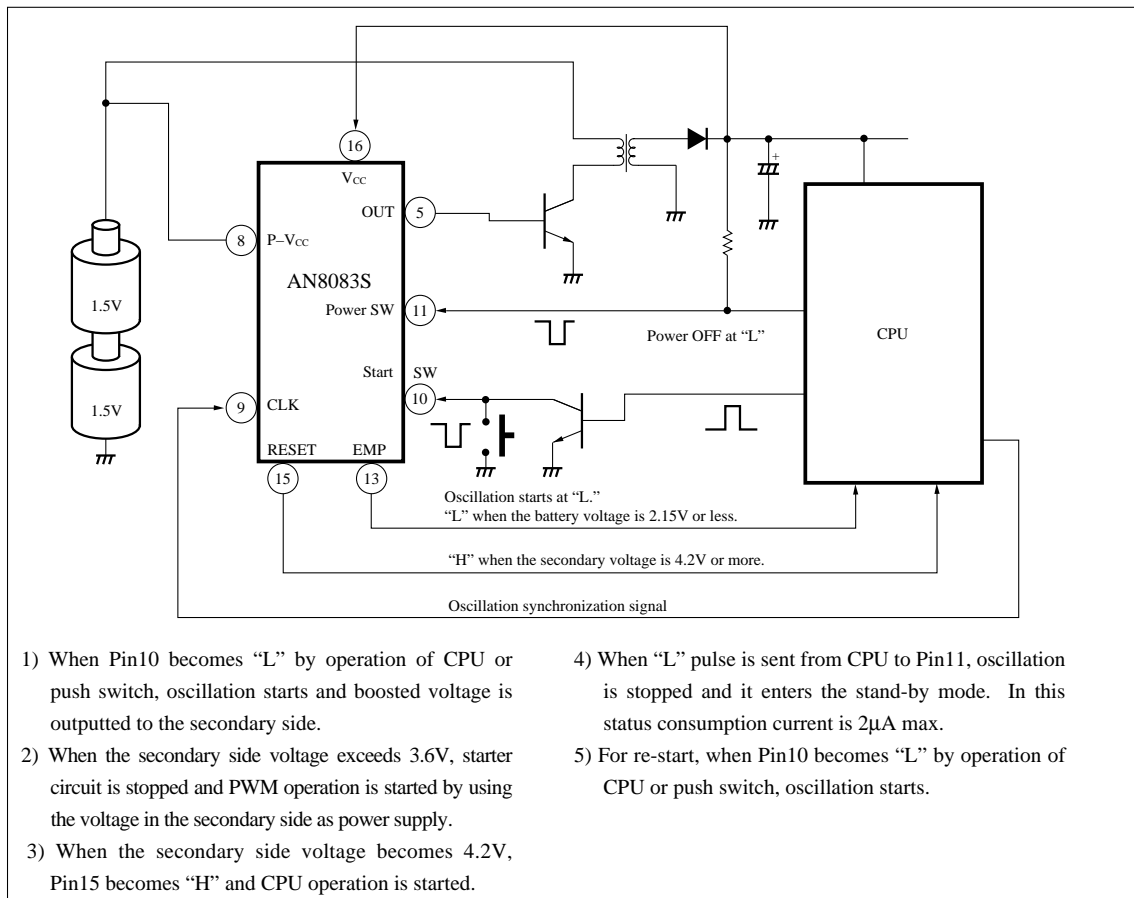
### ■ Application Circuit



### ■ 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, <math>PV_{CC} - 0.9V</math></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 <math>V_{CC}</math> 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

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

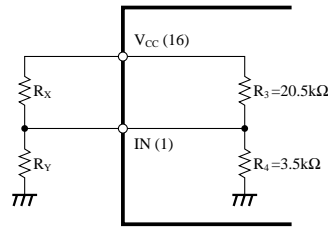
$$R_1 = R_X // R_3$$

$$R_2 = R_Y // R_4$$

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

$$R_X = 51k\Omega$$

$$R_Y = 7.5k\Omega$$



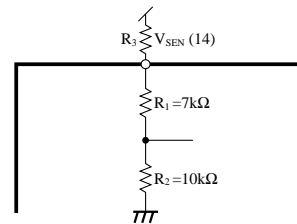
2. Method for making decreased voltage detection variable

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

ex)  $V_{SEN} = 3V$

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

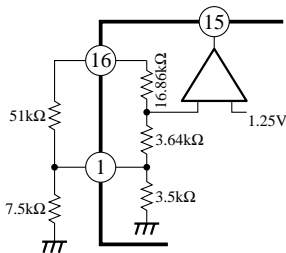
$$R_3 = 7k\Omega$$



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

