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Product Standards

Part No.	AN8015SH
Package Code No.	SSOP010-P-0225A

Analogue LSI Business Unit
Semiconductor Company
Matsushita Electric Industrial Co., Ltd.

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AN8015SH

Single-channel step-down, step-up, or inverting use DC-DC converter control IC

■ Overview

AN8015SH is a single-channel DC-DC converter control IC using the PWM method.

This IC can provide any one output type from among step-down, step-up and inverting output.

Its operating supply voltage range is wide and its consumption current is small. In addition, since it uses the 10-pin surface mounting type package with 0.5 mm pitch, it is suitable for highly efficient miniature portable power supply, especially for a negative output power supply.

■ Features

- Wide operating supply voltage range (3.6 V to 34 V)
- Small consumption current (1.8 mA typical)
- Converter control in a wide output frequency range is possible (2 kHz to 500 kHz).
- Built-in timer latch short-circuit protection circuit (charge current : 1.1 μ A typical)
- Incorporating the under-voltage lock-out (U.V.L.O) circuit
- Incorporating a high precision reference voltage circuit (2.46 V (allowance: \pm 3%))
- Output block is open-collector (darlington) type.
- High absolute maximum rating of output current (100 mA)
- Maximum duty ratio is fixed and has small sample-to-sample variations (90% \pm 5%)

■ Applications

- LCD displays, digital still cameras, and PDAs

■ Package

- 10 pin Plastic Shrink Small Outline Package (SSOP Type)

■ Type

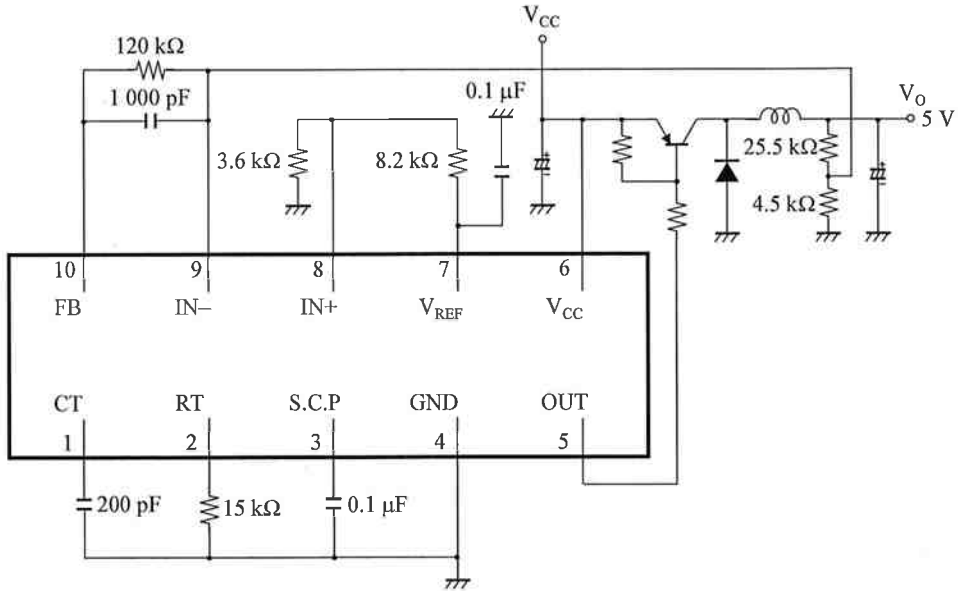
- Silicon Monolithic Bipolar IC

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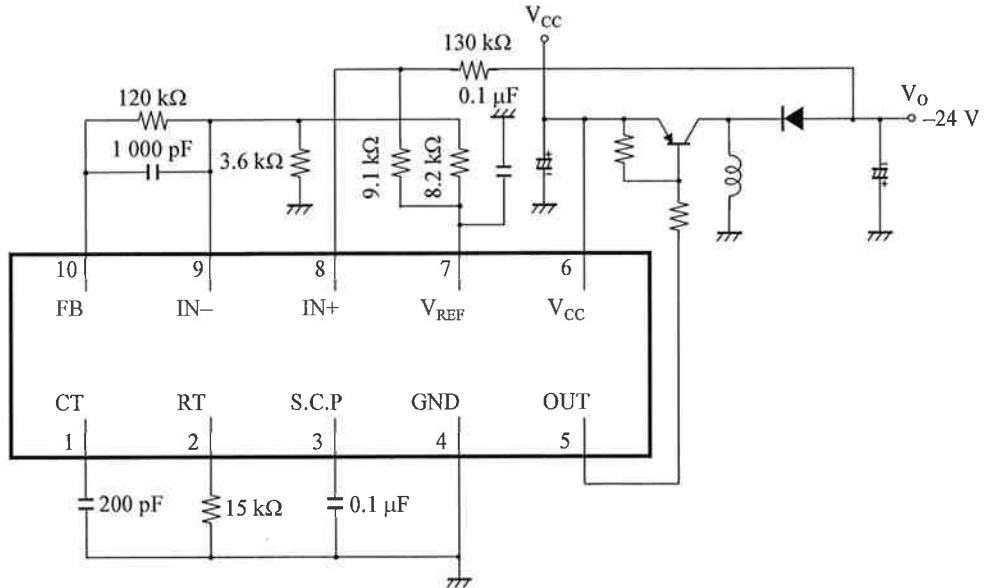
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■ Application Circuit Example

1. Chopper method step-down type



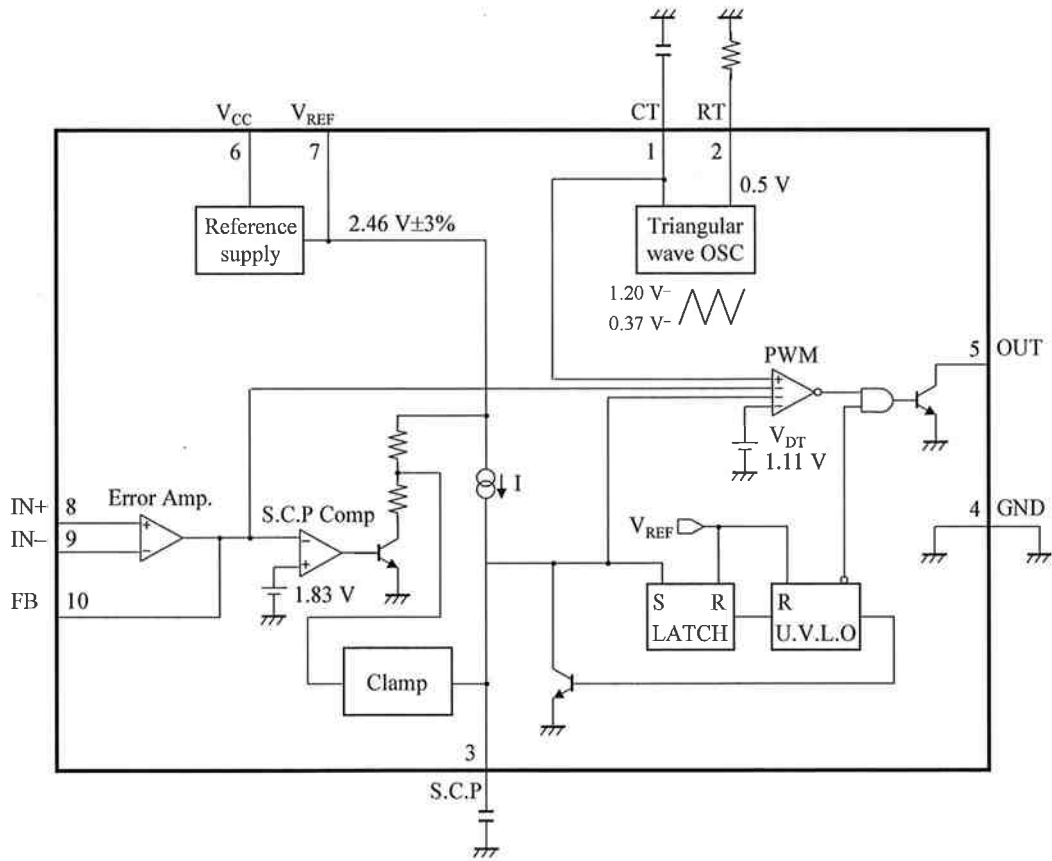
2. Chopper method inverting type



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■ Block Diagram



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■ Pin Descriptions

Pin No.	Pin name	Type	Description
1	CT	—	Pin for connecting oscillator timing capacitor
2	RT	—	Pin for connecting oscillator timing resistor
3	S.C.P	—	Pin for connection the time constant setting capacitor for short-circuit protection
4	GND	Ground	Grounding pin
5	OUT	Output	Open collector type output pin
6	V _{CC}	Power supply	Power supply voltage application pin
7	V _{REF}	Output	Reference voltage output pin
8	IN+	Input	Error amplifier non-inverted input pin
9	IN-	Input	Error amplifier inverted input pin
10	FB	Output	Output pin of error amplifier

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■ Absolute Maximum Ratings

A No.	Parameter	Symbol	Rating	Unit	Notes
1	Supply voltage	V_{CC}	35	V	*1
2	Supply current	I_{CC}	—	mA	—
3	Power dissipation	P_D	115	mW	*2
4	Operating ambient temperature	T_{opr}	-30 to +85	°C	*3
5	Storage temperature	T_{stg}	-55 to +150	°C	*3
6	IN- pin allowable application voltage	V_{IN-}	-0.3 to V_{REF}	V	—
7	IN+ pin allowable application voltage	V_{IN+}	-0.3 to V_{REF}	V	—
8	Output pin allowable application voltage	V_{OUT}	35	V	—
9	Collector output current	I_{OUT}	100	mA	—

Notes) *1 : The values under the condition not exceeding the above absolute maximum ratings and the power dissipation.

*2 : The power dissipation shown is the value at $T_a = 85^\circ\text{C}$ for the independent (unmounted) IC package.

When using this IC, refer to the P_D - T_a diagram of the package standard page 4 and use under the condition not exceeding the allowable value.

*3 : Except for the power dissipation, operating ambient temperature, and storage temperature, all ratings are for $T_a = 25^\circ\text{C}$.

■ Operating supply voltage range

Parameter	Symbol	Range	Unit	Notes
Supply voltage range	V_{CC}	3.6 to 34	V	*

Note) *: The values under the condition not exceeding the above absolute maximum ratings and the power dissipation.

■ Recommended Operating Conditions

Parameter	Symbol	Min	Max	Unit	Notes
Error amplifier input voltage	V_{IN}	-0.1	0.8	V	*
Collector output voltage	V_{OUT}	—	34	V	*
Collector output current	I_{OUT}	—	50	mA	*
Timing capacitance	C_T	100	27 000	pF	*
Timing resistance	R_T	5.6	15	k Ω	*
Oscillation frequency	f_{OUT}	2	500	kHz	*
Reference voltage output current	I_{REF}	-3	0	mA	*
Time constant setting capacitance for soft start short-circuit protection	C_{SCP}	1 000	—	pF	*

Note) *: Do not apply current or voltage from external source to any pin not listed above.

In the circuit current, (+) means the current flowing into IC and (-) means the current flowing out of IC.

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■ Electrical Characteristics at $V_{CC} = 12\text{ V}$, $R_T = 15\text{ k}\Omega$, $C_T = 200\text{ pF}$

Note) $T_a = 25^\circ\text{C} \pm 2^\circ\text{C}$ unless otherwise specified.

B No.	Parameter	Symbol	Test circuits	Conditions	Limits			Unit	Notes
					Min	Typ	Max		
Reference Voltage Block									
1	Reference voltage	V_{REF}	1	$I_{REF} = -1\text{ mA}$	2.386	2.46	2.534	V	
2	Input regulation with input fluctuation	Line	1	$V_{CC} = 3.6\text{ to }34\text{ V}$ $I_{REF} = -1\text{ mA}$	—	5	20	mV	
3	Load regulation	Load	1	$I_{REF} = -0.1\text{ to }-1\text{ mA}$	—	2	10	mV	
U.V.L.O. Block									
4	Circuit operation start voltage	V_{UON}	2	—	2.8	3.1	3.4	V	
5	Hysteresis width	V_{HYS}	2	—	100	200	300	mV	
Error Amplifier Block									
6	Input offset voltage	V_{IO}	3	—	-6	—	6	mV	
7	Input bias current	I_B	3	—	-500	-25	—	nA	
8	Common-mode input voltage range	V_{ICR}	3	—	-0.1	—	0.8	V	
9	High-level output voltage	V_{EH}	4	—	$V_{REF} - 0.3$	$V_{REF} - 0.1$	—	V	
10	Low-level output voltage	V_{EL}	4	—	—	0.1	0.3	V	
Output Block									
11	Oscillation frequency	f_{OUT}	5	$R_T = 15\text{ k}\Omega$, $C_T = 200\text{ pF}$	175	195	215	kHz	
12	Maximum duty ratio	D_{MAX}	5	$R_T = 15\text{ k}\Omega$, $C_T = 200\text{ pF}$	85	90	95	%	
13	Output saturation voltage	V_{OL}	5	$I_O = 50\text{ mA}$, $R_T = 15\text{ k}\Omega$	—	0.9	1.2	V	
14	Output leak current	I_{LEAK}	5	$V_{CC} = 34\text{ V}$, when output transistor is off	—	—	10	μA	
Short-circuit Protection Circuit Block									
15	Input threshold voltage	V_{THPC}	6	—	1.73	1.83	1.93	V	
16	Input standby voltage	V_{STBY}	6	—	1.15	1.25	1.35	V	
17	Input latch voltage	V_{IN}	6	—	—	30	120	mV	
18	Charge current	I_{CHG}	6	$V_{SCP} = 0\text{ V}$	-1.32	-1.1	-0.88	μA	
Whole Device									
19	Total consumption current	I_{CC}	1	$R_T = 15\text{ k}\Omega$	—	1.8	2.8	mA	

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■ Electrical Characteristics (Reference values for design) at $V_{CC} = 12\text{ V}$, $R_T = 15\text{ k}\Omega$, $C_T = 200\text{ pF}$

Note) $T_a = 25^\circ\text{C} \pm 2^\circ\text{C}$ unless otherwise specified.

B No.	Parameter	Symbol	Test circuits	Conditions	Reference values			Unit	Notes
					Min	Typ	Max		
Reference Voltage Block									
20	Input regulation with input fluctuation 2	L_{INE2}	1	$V_{CC} = 3.6\text{ V to }20\text{ V}$	—	10 (max)	—	mV	*1
21	Output voltage temperature characteristics 1	V_{TC1}	1	$T_a = -30\text{ to }25^\circ\text{C}$	—	± 0.5	—	%	*1
22	Output voltage temperature characteristics 2	V_{TC2}	1	$T_a = 25\text{ to }85^\circ\text{C}$	—	± 0.5	—	%	*1
23	Reference short-circuit current	I_{RS}	1	—	—	-20	—	mA	*1
Error Amplifier Block									
24	Output sink current	I_{SINK}	4	$V_{FB} = 0.8\text{ V}$	—	8	—	mA	*1
25	Output source current	I_{SOURCE}	4	$V_{FB} = 0.8\text{ V}$	—	-120	—	μA	*1
26	Open-loop gain	A_V	4	—	—	70	—	dB	*1
27	Common-mode ripple rejection ratio	CMRR	3	—	—	50	—	dB	*1
Output Block									
28	RT pin voltage	V_{RT}	5	—	—	0.5	—	V	*1
29	Maximum oscillation frequency	$f_{OUT(MAX)}$	5	$R_T = 5.6\text{ k}\Omega$, $C_T = 150\text{ pF}$	—	500	—	kHz	*1
30	Frequency supply voltage characteristics	f_{dV}	5	$f_{OUT} = 200\text{ kHz}$, $V_{CC} = 3.6\text{ V to }34\text{ V}$	—	± 2	—	%	*1
31	Frequency temperature characteristics 1	f_{dT1}	5	$f_{OUT} = 200\text{ kHz}$, $T_a = -30\text{ to }25^\circ\text{C}$	—	± 3	—	%	*1
32	Frequency temperature characteristics 2	f_{dT2}	5	$f_{OUT} = 200\text{ kHz}$, $T_a = 25\text{ to }85^\circ\text{C}$	—	± 3	—	%	*1
Short-circuit Protection Circuit Block									
33	Comparator threshold voltage	V_{THL}	6	—	—	1.83	—	V	*1
Whole Device									
34	Total consumption current 2	I_{CC2}	1	$R_T = 5.6\text{ k}\Omega$, $C_T = 150\text{ pF}$	—	2.5	—	mA	*1

Note) *1: The above characteristics are reference values for design of the IC and are not guaranteed by inspection.

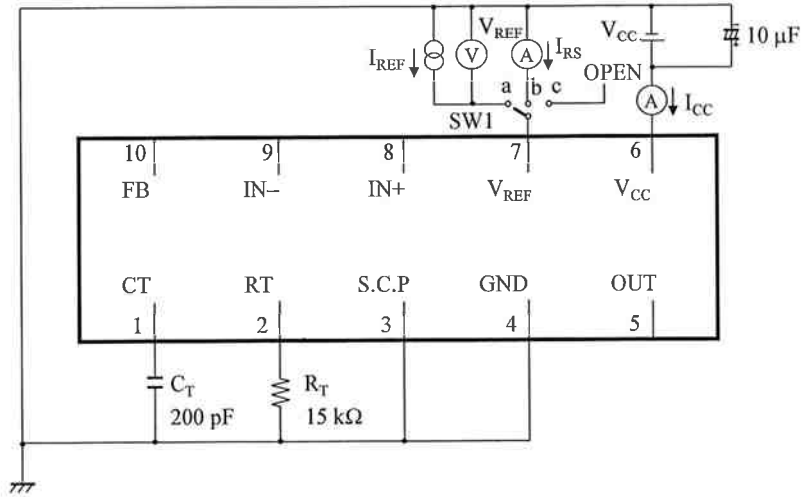
If a problem does occur related to these characteristics, Matsushita will respond in good faith to user concerns.

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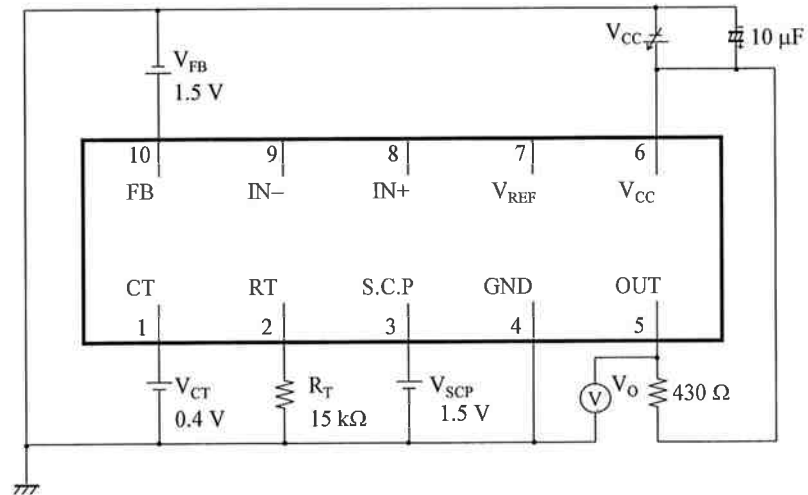
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■ Test Circuit Diagram

1. Test Circuit 1



2. Test Circuit 2

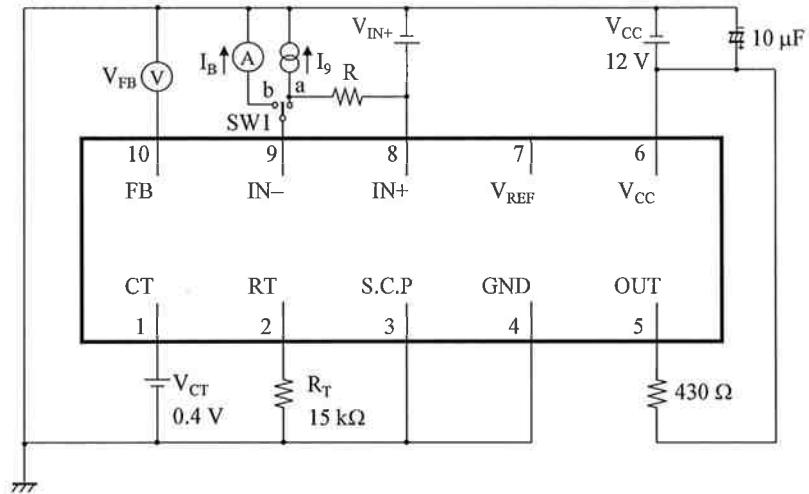


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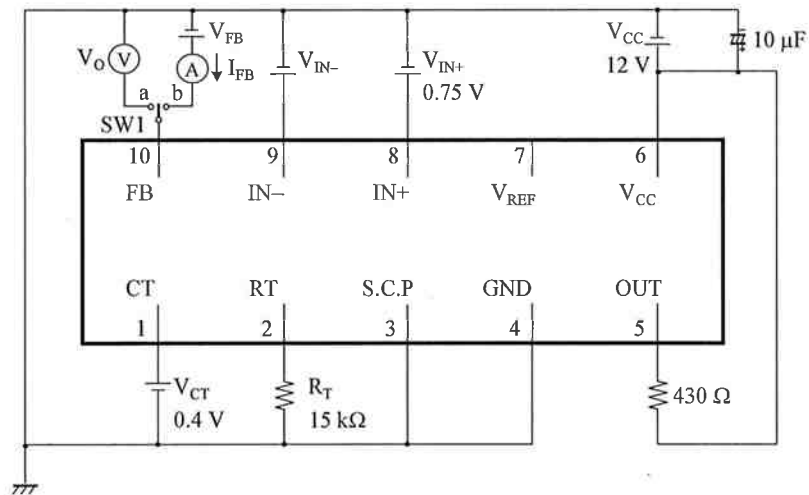
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■ Test Circuit Diagram (continued)

3. Test Circuit 3



4. Test Circuit 4



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