TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC
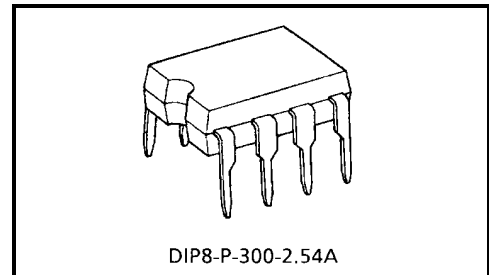
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Integrated Circuit For Standby Power-Supply Control

TA1307P is a switching power-supply IC used as a standby power-supply control such as small power-supply.

This IC, Slight power-supply can do that a MOSFET is controlled in intermittent, and this IC is optimum IC as objects for power-supply control, such as color TV, monitor, VCR, DVD, FAX, printer, etc.

Main Characteristics

- Burst mode PWM pulse output
- The over current protection circuits to power MOSFET for a drive are built in.
- UVLO (Under Voltage Lock Out), OVLO (Over Voltage Lock Out) with Latch, OVLO on/off function
  OCL (Over Current Limmiter),
  Select SW for IC active/IC not active are built in.
- The starting current until UVLO is canceled about 100 μA.
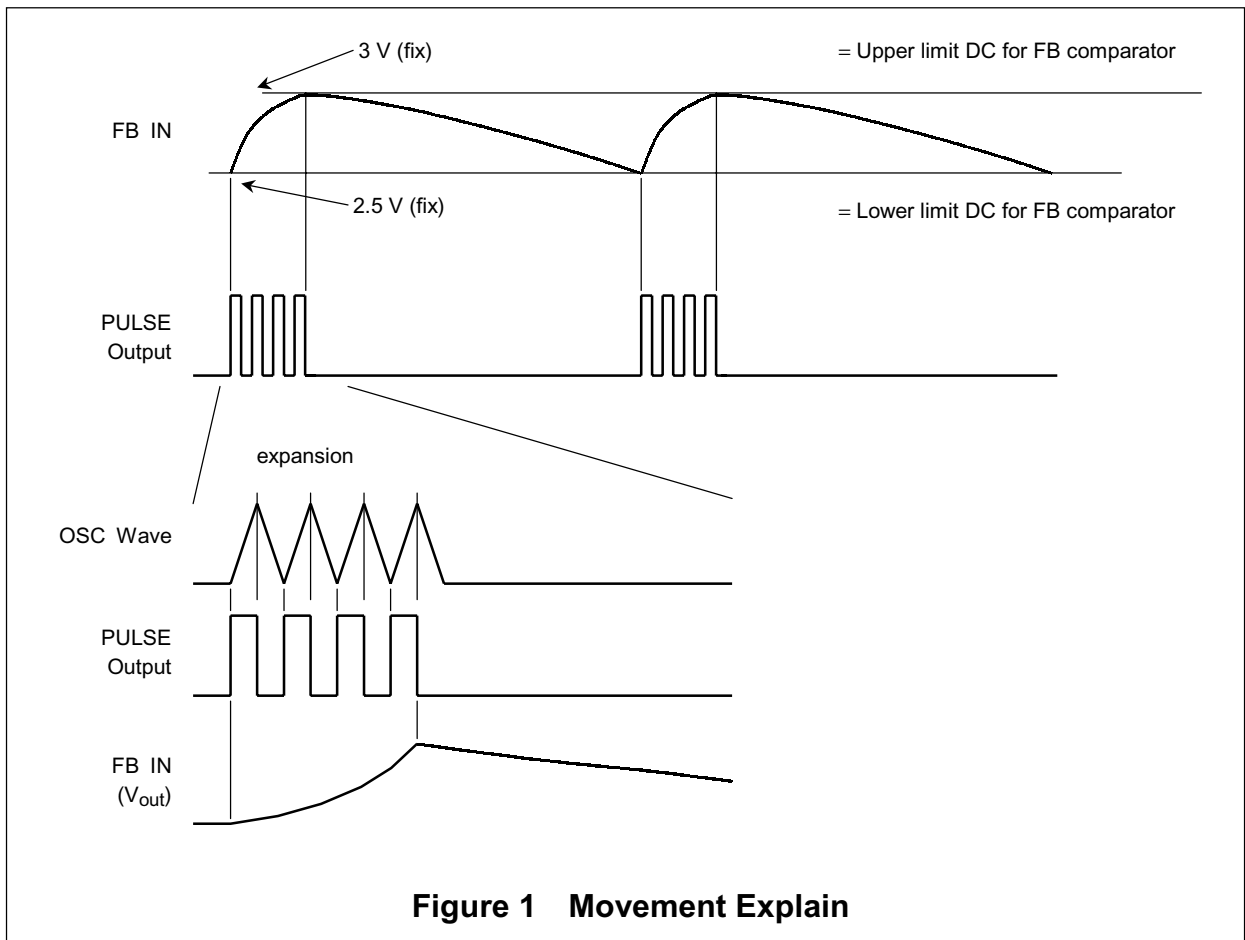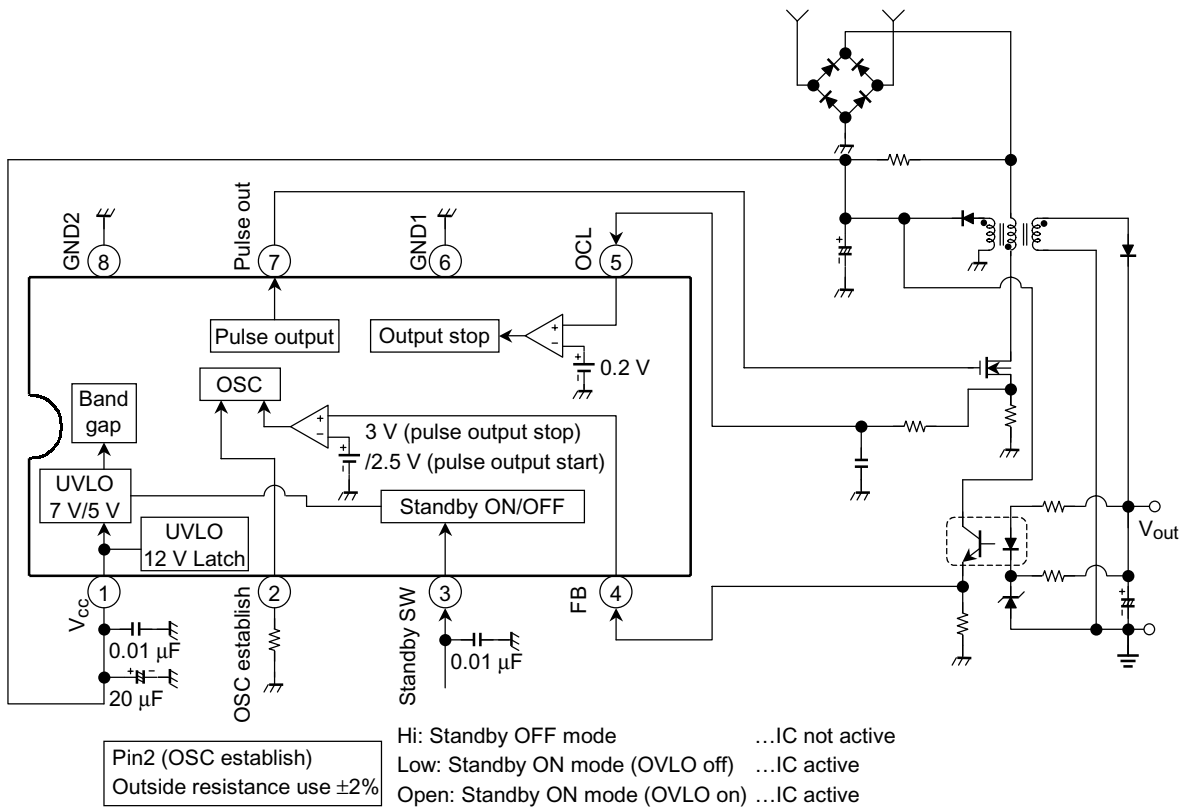- Wide range input voltage: (85 V to 264 V).

DIP8-P-300-2.54A

Weight: 0.5 g (typ.)

980910EBA1

Stand Power Supply Application Circuit Example (voltage detection by 2nd side)

Pin2 (OSC establish)
Outside resistance use ±2%

Hi: Standby OFF mode ...IC not active
Low: Standby ON mode (OVLO off) ...IC active
Open: Standby ON mode (OVLO on) ...IC active

Figure 1   Movement Explain

With outputting burst switching control pulse from IC, burst enegize of the TRANS is carried out.

Voltage stabilized also at the time of a light load can be supplied.

It is the optimum IC for constituting the power-supply system for minute electric-power supply.

By this IC, the burst time of switching control pulse is decided by level of output ripple of a power-supply system.

As for the terminal 4 which is carrying out the monitor of the power-supply output-voltage value, another side is connected to the comparator.

The standard voltage value of this comparator has hysterisis, 2.5 V and 3 V fixation. (inside IC)

Since output DC voltage of a power supply is stabilized, power-supply output voltage is detected and it feedbacks for the terminal 4 (FB IN terminal).

When the voltage value of a terminal 4 tends to become more than 3 V, switching control pulse of a terminal 7 (pulse out) is stopped.

If pulse is stooped, in order not to control power-supply TRANS, it will stop supplying energy supplied to the output of a power supply, and the output DC voltage of a power-supply will descend.

If output DC voltage tends to become less than (V/2.5), switching control pulse of a terminal 7 (pulse out) will be outputted.

Power-supply TRANS is made to drive and PULSE supplies energy to a power-supply output.

Then, output DC voltage rises.

Burst electric supply is realized by repeating the above-mentioned operation.
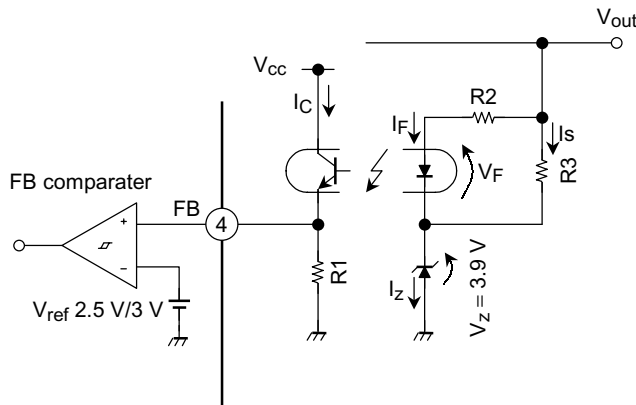
Figure 2   Ripple Voltage Establish (example)

Hereafter, calculation using ripple level as an example

Voltage of V_{out} and the terminal 2 is set output DC voltage to V_{ref}.

$V_{out} = V_Z + V_F + 1/CTR \times R2/R1 \times V_{ref}$

*CTR $= I_C/I_F$

*$I_Z = I_F + I_S$, R3 is set up.

For example, R1 = 10 kΩ, R2 = R3 = 1 kΩ, CTR = about 1, V_Z = 3.9 V, V_F = 0.7 V

V_{ref} (minimum) = 2.5 V fixation and V_{ref} (maximum) = 3 V fixation.

Calculation

V_{out} (minimum) = 4.85 V

V_{out} (maximum) = 4.9 V.

Ripple in an output is 0.05 V.

Internal oscillation circuit for obtaining output PULSE is built in.

Oscillation frequency of output PULSE can be set up by outside attachment resistance to a terminal 2.

Duty about 50% of output PULSE has been obtained.

Oscillation frequency is calculation from f = i/2 CV (Hz), I = 1 (V) /R/10, and it will be set to 25 kHz, if 20 kΩ is attached to a terminal 2 outside.

Terminal voltage and R are outside attachment resistance in 1 (V).

10 is a current ratio, sets current of a terminal 2 to 1/10, and makes it the charge/discharge current of a internal 50 pF capacitor. C = 50 (pF) (built-in capacitor value) V = 2 (V) (oscillation amplitude)

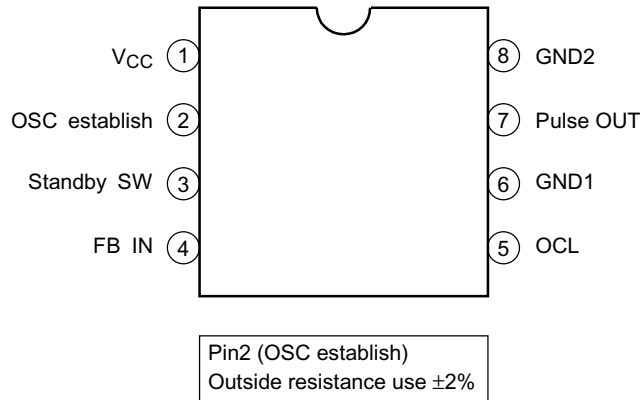In addition, there is a function below as a PROTECT circuits.

A terminal 5 (OCL) detects the overcurrent of MOSFET connected to the terminal 7 (pulse out), and output Pulse is made to compulsion low at the time of an overcurrent.

Output pulse will be made to compulsion low, if it flows into a terminal 7 (pulse out) and there is always 40 mA or more of current.

Output pulse will be made to compulsion low, if the supply voltage of a terminal 1 (V_{CC}) becomes more than 12 V.(OVLO)

Circuit operation start of the UVLO function is carried out more than by 7 V, and it carries out a circuit operation stop less than 5 V.

Pin Connection (top view)

```
        V_CC   (1)  ┌───────  ───────┐  (8)  GND2
                    │        \/       │
  OSC  establish (2) │                 │  (7)  Pulse OUT
                    │                 │
     Standby  SW (3) │                 │  (6)  GND1
                    │                 │
          FB  IN (4) │                 │  (5)  OCL
                    └─────────────────┘
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┌─────────────────────────────┐
│ Pin2 (OSC establish)   │
│ Outside resistance use ±2% │
└─────────────────────────────┘

Maximum Ratings (Ta = 25°C)

Characteristics		Symbol	Rating	Unit
Supply Voltage		V_{CC} max	14	V
Maximum Input Voltage		V_{IN} max	$V_{CC} + 0.3$	V
Minimun Input Voltage		V_{IN} min	$GND - 0.3$	V
Power Dissipation	(Note1)	P_D max	817	mW
Operating Temperature		T_{opr}	−25~85	°C
Storage Temperature		T_{stg}	−55~150	°C

Note1:   Derated above Ta = 25°C in the proportion of 6.5 mW/°C
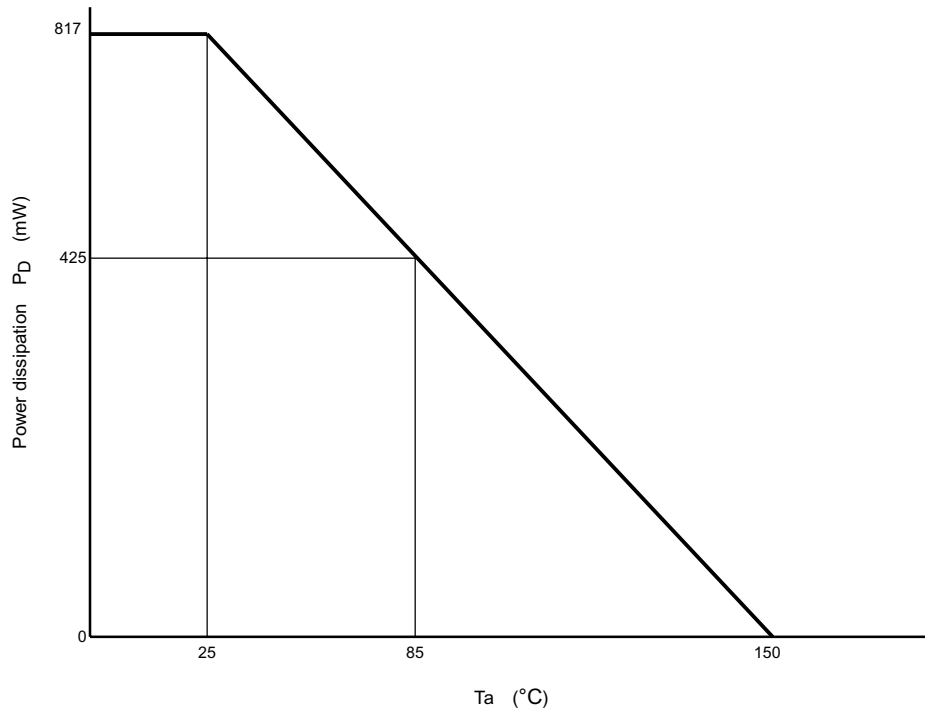
Figure 3   P$_D$ – Ta Curve

Recommended Operating Condition

Characteristics	Pin No.	Min	Typ.	Max	Unit
Power Supply Voltage	1	7.5	—	11.5	V

Electrical Characteristics

DC Characteristics (There is no designation V$_{cc}$ = 9 V, Ta = 25°C)
(reference: a measurement circuit is figure 4)

Characteristics	Symbol	Pin No.	Test Condition	Min	Typ.	Max	Unit
Power Current (9 V)	I1Load	1	Load of 100 pF is connected with Pin7. SW1 = ON, SW2 = b, SW3 = a	0.8	1.2	1.6	mA
Power Current (9 V)	I1on	1	Pin3 = Low voltage input (standby ON mode) SW1 = ON, SW2 = b, SW3 = b	0.39	0.55	0.72	mA
Power Current (9 V)	I1off	1	Pin3 = Hi voltage input (standby OFF mode) SW1 = Open, SW2 = a, SW3 = b	0.05	0.09	0.13	mA
Pin3 Threshold Voltage	V3th L	3	(Note2)	—	0.7	0.5	V
	V3th H		(Note3)	0.9	0.7	—	

Note2:   V3 th L is threshold voltage "Standby ON (IC active) mode"

Note3:   V3 th H is threshold voltage "Standby OFF (IC not active) mode"
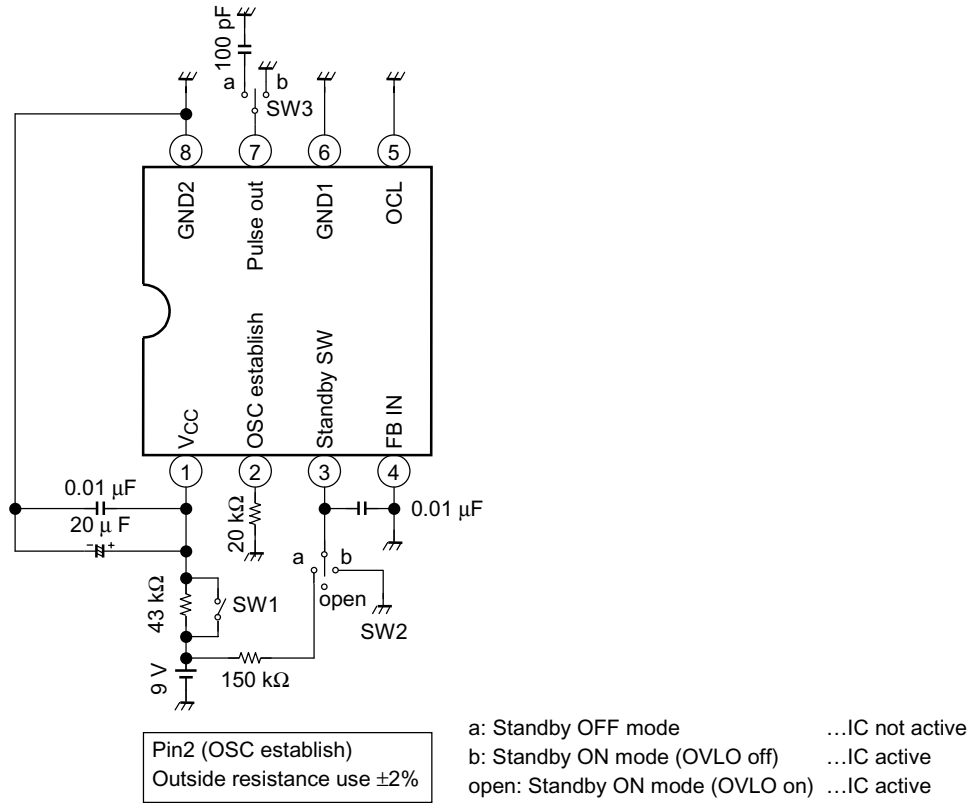
Figure 4   DC Terminal Voltage Measurement Circuit

Pin2 (OSC establish)
Outside resistance use ±2%

a: Standby OFF mode   …IC not active
b: Standby ON mode (OVLO off)   …IC active
open: Standby ON mode (OVLO on) …IC active

AC Characteristics (there is no designation V_{CC} = 9 V, Ta = 25°C)

AC Characteristics (there is no designation V_{CC} = 9 V, Ta = 25°C)
(refer: Next page AC characteristic measurement, Figure 5 AC characteristic measurement circuit)

Characteristics	Symbol	Measurement Method No.	Min	Typ.	Max	Unit
UVLO Movement Voltage	VUL	1	4.6	5.0	5.5	V
	VUH		6.6	7.0	7.4	
Start Up Current	Istrt	2	30	55	90	μA
Triangle Wave Oscillate Frequency (temperature margin −0.016% is contained)	FOSC	3	20.2	25.0	29.8	kHz
Output Pulse Rise Time (reference data)	TRPF	4	50	100	160	ns
Output Pulse Fall Time (reference data)	TSPF	5	50	100	160	ns
Output Pulse Max. Voltage	VOPFMX	6	7.0	7.5	8.0	V
Output Pulse Min. Voltage	VOPFMN	7	−0.1	0.1	0.65	V
Output Current (source, sink) (reference data)	IOPFC	8	27.0	40.0	53.0	mA
Output Terminal (pin7) PROTECT Movement Current V7pt	V7pt	9	30.0	40.0	—	mA
FB IN Terminal (pin4) FB Comparator THRESHOLD Hi Voltage	Vth4H	10	2.9	3.0	3.1	V
FB IN Terminal (pin4) FB Comparator THRESHOLD Low Voltage	Vth4L	11	2.4	2.5	2.6	V
OCL Terminal (pin5) PROTECT Movement Current	V5pt	12	0.18	0.2	0.22	V
V_{CC} Terminal (pin1) OVLO Movement Voltage	V1ovlo	13	11.5	12.0	12.5	V
Standby SW Terminal (pin3) Movement Voltage	I StSW	14	0.5	0.7	0.9	V
FB IN Terminal (pin4) Input Current	I FBIN	15	0.08	0.15	0.30	μA

AC Characteristics Measurement (there is no designation V_{CC} = 9 V, Ta = 25°C)
(refer: Figure 5 AC characteristic measurement circuit)

No.	Characteristics	SW mode				Test Condition
		1	2	3	4	
1	UVLO movement voltage (VUL/VUH)	b	b	a	a	Pin4 (FB IN) = GND Confirm pin7 (pulse out) pulse is output. Vcc voltage is lowered, and measure V_{CC} voltage when pin7 output pulse disappears.(VUL) And Vcc voltage is upped, and measure V_{CC} voltage when pin7 output pulse appears.(VUH)
2	Start Up Current	b	b	a	a	Pin4 (FB IN) = GND Input voltage Vcc < 5.0 V (= pin7 pulse is not outputted) And Vcc voltage is upped (V_{CC} = 9V) Measure source current through V_{CC} (I strt).
3	Triangle Wave Oscillate Frequency	b	b	a	a	Pin4 (FB IN) = GND Confirm pin7 (pulse out) pulse is output. Measure pulse period, look for frequency. (F_{osc})
4	Output Pulse Rise Time (reference data)	b	b	a	a	Above condition, measure pulse rise time :pulse amplitude 10% to 90% (TRPF)
5	Output Pulse Fall Time (reference data)	b	b	a	a	Above condition, measure pulse fall time :pulse amplitude 10% to 90% (TSPF)
6	Output Pulse Max. Voltage	b	b	a	a	Above condition, measure pulse Max. voltage. (VOPMX)
7	Output Pulse Min. Voltage	b	b	a	a	Above condition, measure pulse Min. voltage. (VOPMN)

AC Characteristics Measurement (there is no designation V_{CC} = 9 V, Ta = 25°C)
(refer: Figure 5 AC characteristic measurement)

No.	Characteristics	SW mode				Test Condition
		1	2	3	4	
8	Output Current (source, sink) (reference data)	b	b	a	b	Measure pin7 (pulse out) current for using current probe.
9	Output Terminal (pin7) PROTECT Movement Current	b	b	a	c	Increase DC voltage for pin7 (FB IN) through resistance (100 Ω), pin7 pulse is made to output. pin7 DC voltage is upped, and measure pulse highest level voltage and increase DC voltage (V6) when pin7 pulse duty is began to become short. i7 pt is calculated by bottom type. $$I7pt = (\text{pulse highest level voltage} - V6 \text{ DC voltage}) /100\ \Omega$$
10	FB IN Terminal (pin4) FB Comparator THRESHOLD Hi Voltage	b	a	a	a	Increase DC voltage for pin4 (FB IN) (early value is 2.0 V) pin7 pulse is made to output. Pin4 DC voltage is upped, and measure pin4 voltage when pin7 pulse disappears. (Vth4H)
11	FB IN Terminal (pin4) FB Comparator THRESHOLD Low Voltage	b	a	a	a	And Pin4 DC voltage is lowered, and measure pin4 voltage when pin7 pulse appears.(Vth4L)
12	OCL Terminal (pin5) PROTECT Movement Current	b	b	a	a	Pin4 (FB IN) = GND. Confirm pin7 (pulse out) pulse is output. Pin5 (OCL) connect outside power supply. Pin5 DC voltage is upped, and measure pin5 voltage when pulse disappears.
13	Vcc Terminal (pin1) OVLO Movement Voltage	d	b	a	a	Pin4 (FB IN) = GND Confirm pin7 (pulse out) pulse is output. Pin1 (Vcc) DC voltage is upped, and measure Vcc voltage when pulse disappears.(V1OVLO)
14	Standby SW Terminal (pin3) Movement Voltage	c	b	a	a	Pin4 (FB IN) = GND Confirm pin7 (pulse out) pulse is output. Pin3 (standby SW) connect outside power supply. Pin3 DC voltage is upped (early value is 0 V), and measure pin3 voltage when pulse disappears.
15	FB IN Terminal (pin4) Input Current	b	c	a	a	Pin4 (FB IN) connect outside power supply (3.5 V). Measure pin4 current.

Figure 5   AC Characteristics Measurement Circuit

Pin2 (OSC establish)
Outside resistance use ±2%

a: Standby OFF mode …IC not active
b: Standby ON mode (OVLO off) …IC active
open: Standby ON mode (OVLO on) …IC active

Package Dimensions
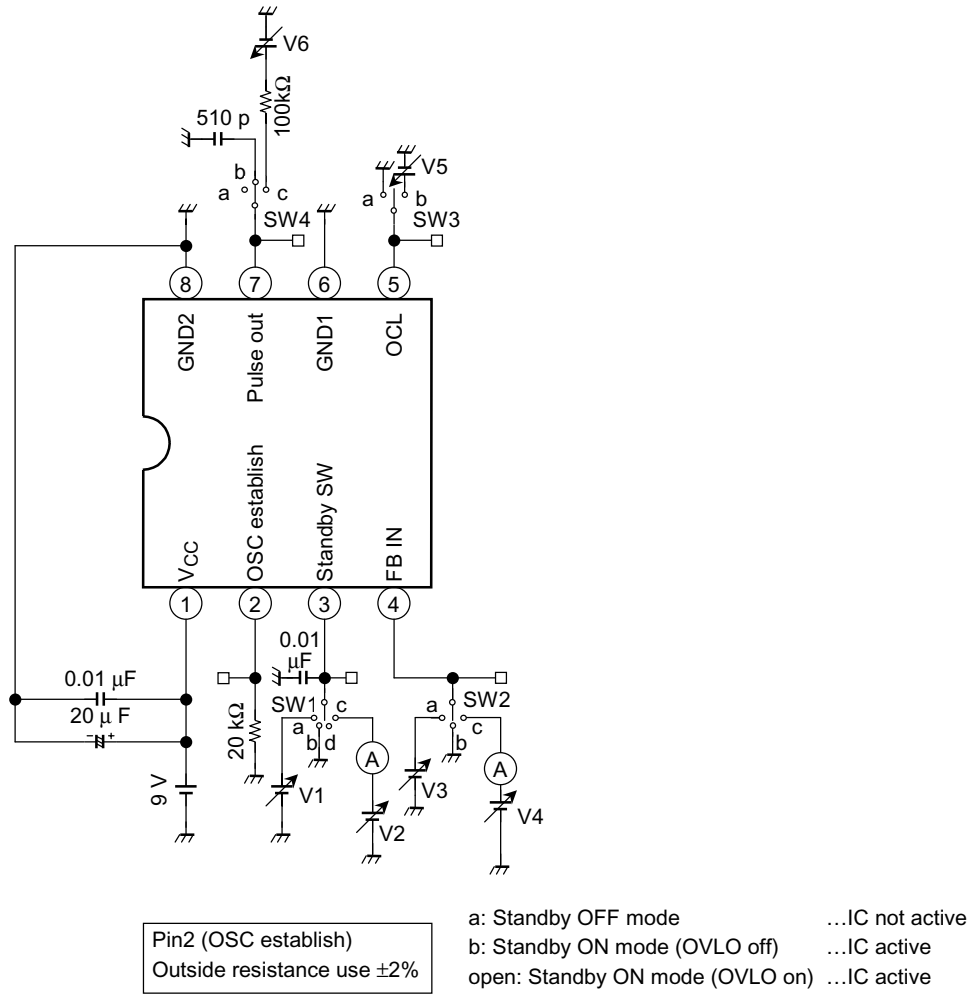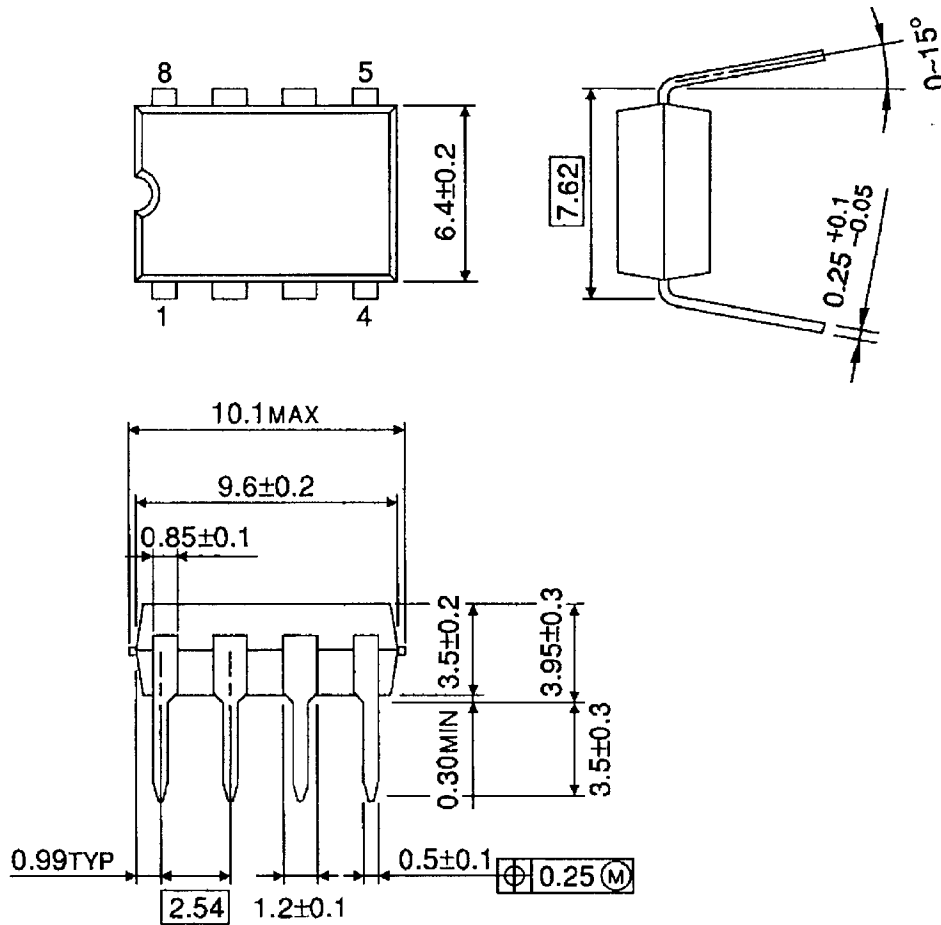
DIP8-P-300-2.54A   Unit : mm

Weight: 0.5 g (typ.)