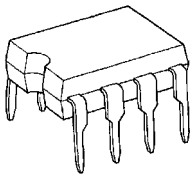
Toshiba Bipolar Linear IC - Silicon Monolithic

TA1307P/PG

Standby Power Controller IC



DIP8-P-300-2.54A

Weight: 0.5g (standard)

The TA1307P/PG is a switching power controller IC that is designed for standby power control in low power systems

The TA1307P/PG makes it possible to build of a low power supply system that provides power using intermittent pulse control of the external FET (switching element).

The TA1307P/PG is optimal for low power consumption standby power control applications such as in televisions, computer monitors, video cassette recorders and fax machines.

Notes : TA1307PG is lead free

Features

- Intermittent mode PWM output
- Overcurrent protection for power MOSFET driver
- UVLO (Under Voltage Lock Out)
- OVLO (Over Voltage Lock Out) latch function equipped

  OVLO On/Off toggle

  OCL (Over Current Limiter)
- IC active/IC inactive toggle
- Compatible with wide range of voltage (85 to 264 V)

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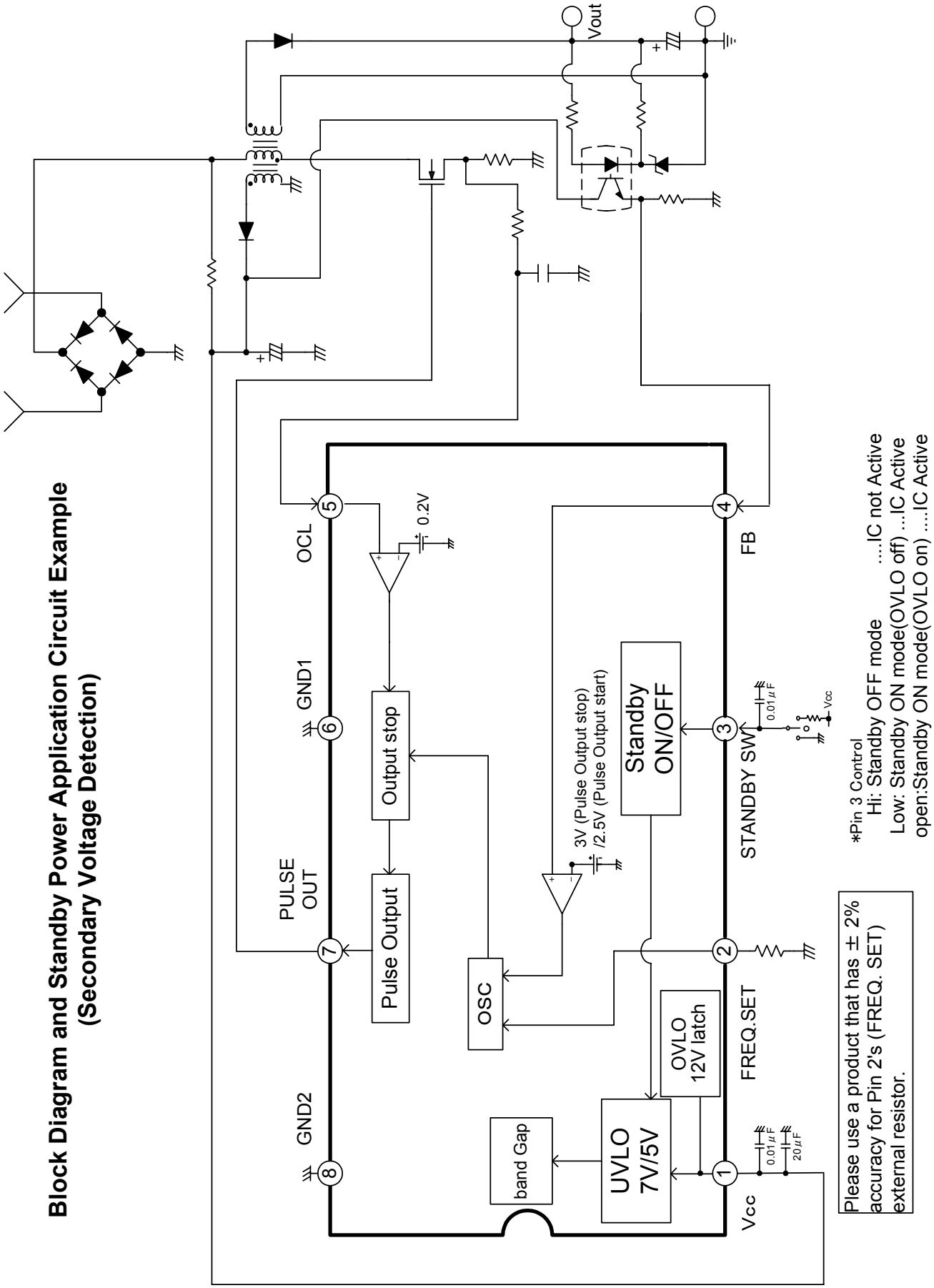
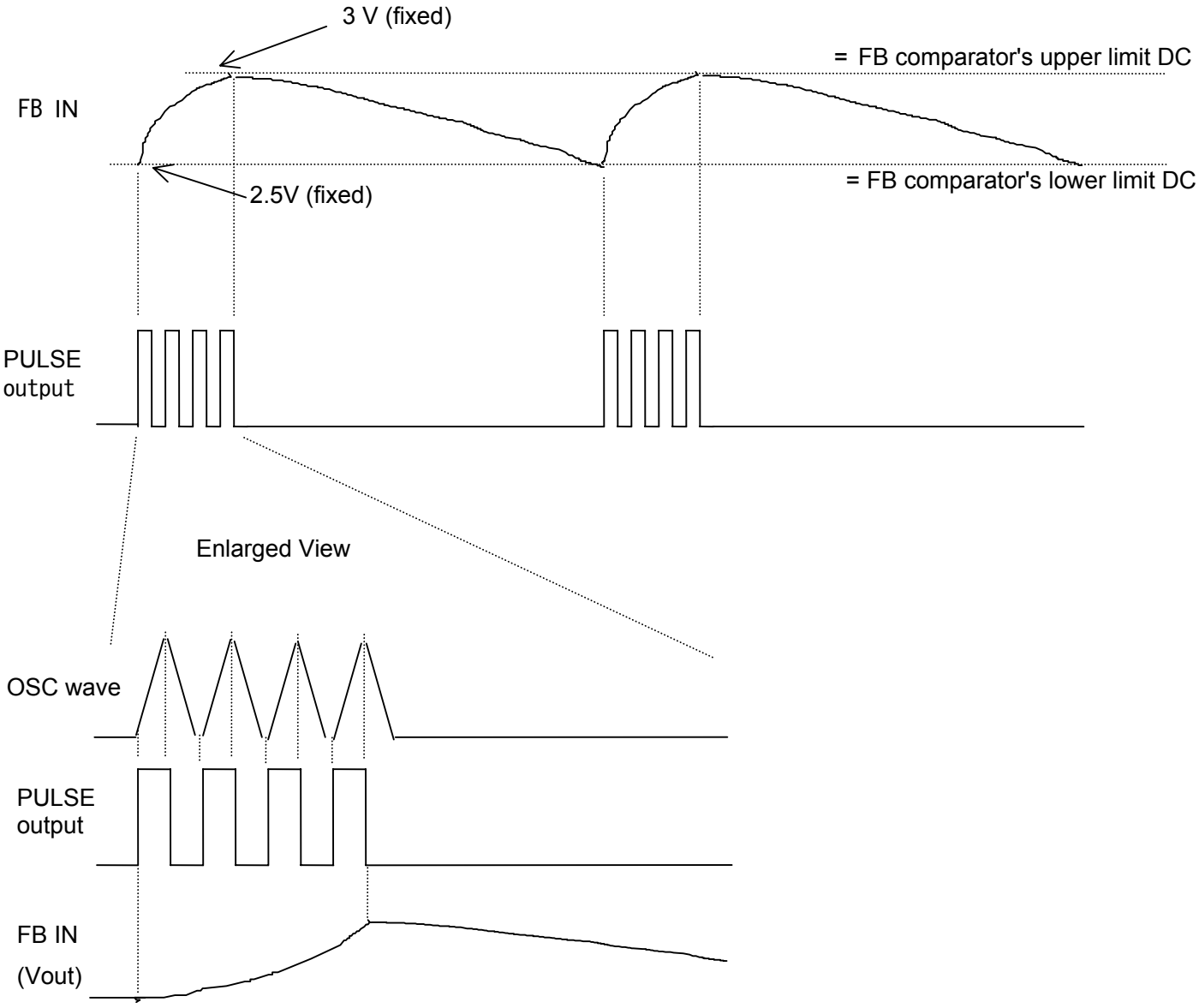
Block Diagram and Standby Power Application Circuit Example (Secondary Voltage Detection)



* Operation Diagram (Figure 1)



The TA1307P/PG is optimally designed for building low power supply systems that can intermittently feed power to the power transformer in order to supply a stable voltage feed (even during low load conditions) by intermittently outputting the IC's switching control pulses.

The TA1307P/PG's switching control pulse's intermittent timing is determined by the power system's output ripple level. Pin 4, which monitors the power output voltage, is connected to a comparator. The comparator's reference voltage contains hysteresis. The IC's internal reference voltage is fixed at 3 V/2.5 V.

In order to stabilize the output power's DC voltage, the output voltage is detected and feedbacked to the IC's Pin 4 (FB IN pin). When Pin 4's voltage starts to rise above the voltage generated internally by the IC (3 V), Pin 7's (Pulse Out) switching control pulse is terminated and intermittent pulsing is commenced. Since the power transformer is not controlled during intermittent pulsing, energy is no longer supplied to the power output, which results in the power output DC voltage dropping.

When the output DC voltage drops below the voltage generated internally by the IC (2.5 V), Pin 7's (Pulse Out) switching control pulse is output (which in turn ends the intermittent pulsing cycle), the power transformer kicks in, energy is supplied to the power output, and the output DC voltage rises. Through repeating the above, the TA1307P is able to achieve intermittent power supply.

The following is an example of a ripple level calculation.

With the output DC voltage as Vout and Pin 2's voltage as Vref:

$$Vout = Vz + VF + 1/CTR \times R2/R1 \times Vref$$

*CTR = Ic/IF

*IZ = IF + IS

For example, R1 =10 kΩ, R2 = R3 = 1 kΩ, CTR≒1, Vz = 3.9V, VF = 0.7V

However, if Vref (lower limit) = 2.5 V (fixed), Vref (upper limit) = 3 V (fixed),

Vout will be as follows:

Vout (lower limit) = 4.85 v

Vout (upper limit) = 4.9 v

Thus, the ripple will come to 0.05 V.

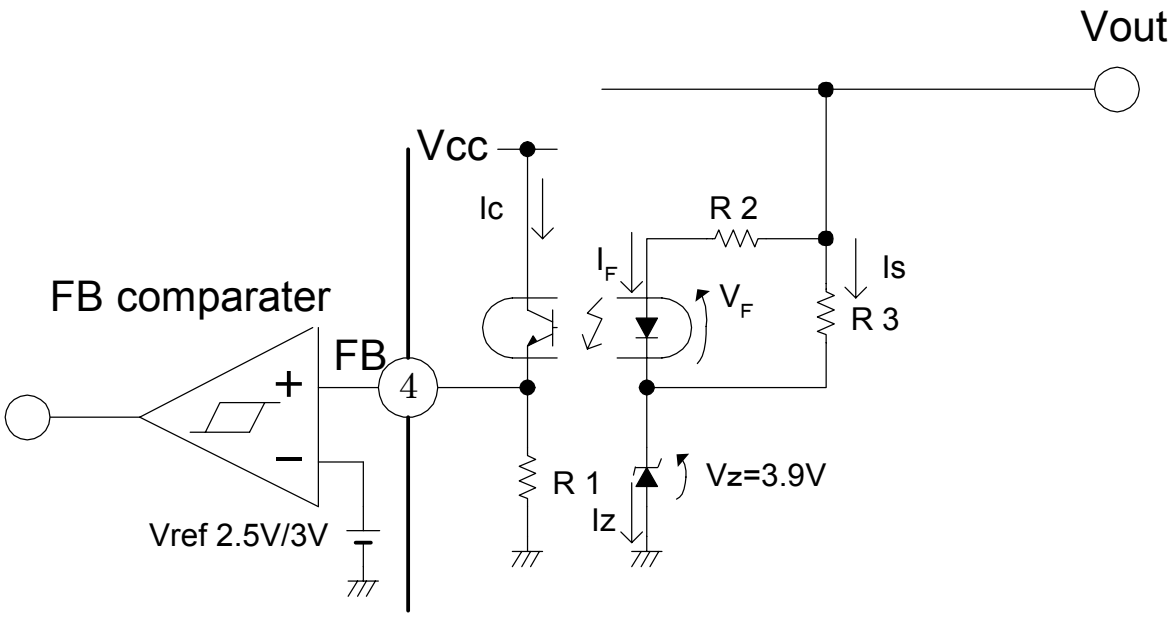


Figure 2 - Output Ripple Voltage Configuration Schematic Diagram

The TA1307P/PG is equipped with an internal oscillator to obtain output pulses. The output pulse's oscillation frequency can be configured by the external resistor connected to Pin 2 (FREQ. SET), and obtains approximately 50% the duty of pulses output from the circuit.

The oscillation frequency can be extrapolated as follows:

f =i/2CV [Hz], I = 1[V] ÷ R ÷ 10

(*1[V]* is the pin current, *R* is the external resistor. *10* is the current ratio, which shows the relationship of reducing Pin 2's current to one tenth to produce the 50 pF capacitor's charge/discharge current.)

C = 50 [pF] (internal capacitor tolerance)

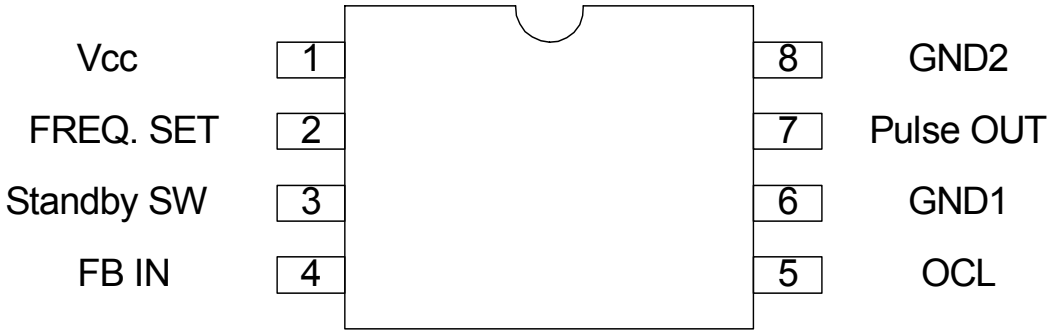
V = 2 [V] (oscillation amplitude)

Thus, when an external resistor of 20 kΩ is applied to Pin 2, the frequency will be 25 kHz.

In addition, TA1307P/PG has the following the protection circuit functions:

- Uses Pin 5 (OCL) to detect any overcurrent in the MOSFET connected to Pin 7 (Pulse Out). In an overcurrent state, the output pulse will be forced low.
- If an sink current of the normal 40 mA or higher is fed to Pin 7 (Pulse Out), the output pulse will be forced low.
- If Pin 1's (Vcc) power voltage goes higher than 12 V, the output pulse will be forced low.
- The UVLO function starts the circuit when the voltage goes over 7 V and stops the circuit if voltage drops below 5 V.

PIN CONNECTION (TOP VIEW)



Please use a product that has ± 2% accuracy for Pin 2's (FREQ. SET) external resistor.

Maximum Ratings (Ta = 25%)

Characteristics	Symbol	Rating	Unit
Power supply voltage	Vccmax	14	V
Maximum supply voltage of each pin	Vinmax	Vcc+0.3	V
Minimum supply voltage of each pin	Vinmin	GND-0.3	V
Power dissipation (*Note 1)	PDmax	817	mW
Operating temperature (*Note 2)	Topr	-25 ～ 85	℃
Storage temperature	Tstg	-55 ～ 150	℃

(*Note 1) 11.2 mW is derated for each degree Celsius when Ta = 25℃ or above.

(*Note 2) The temperature range in which the IC is designed to run without problem related to temperature.

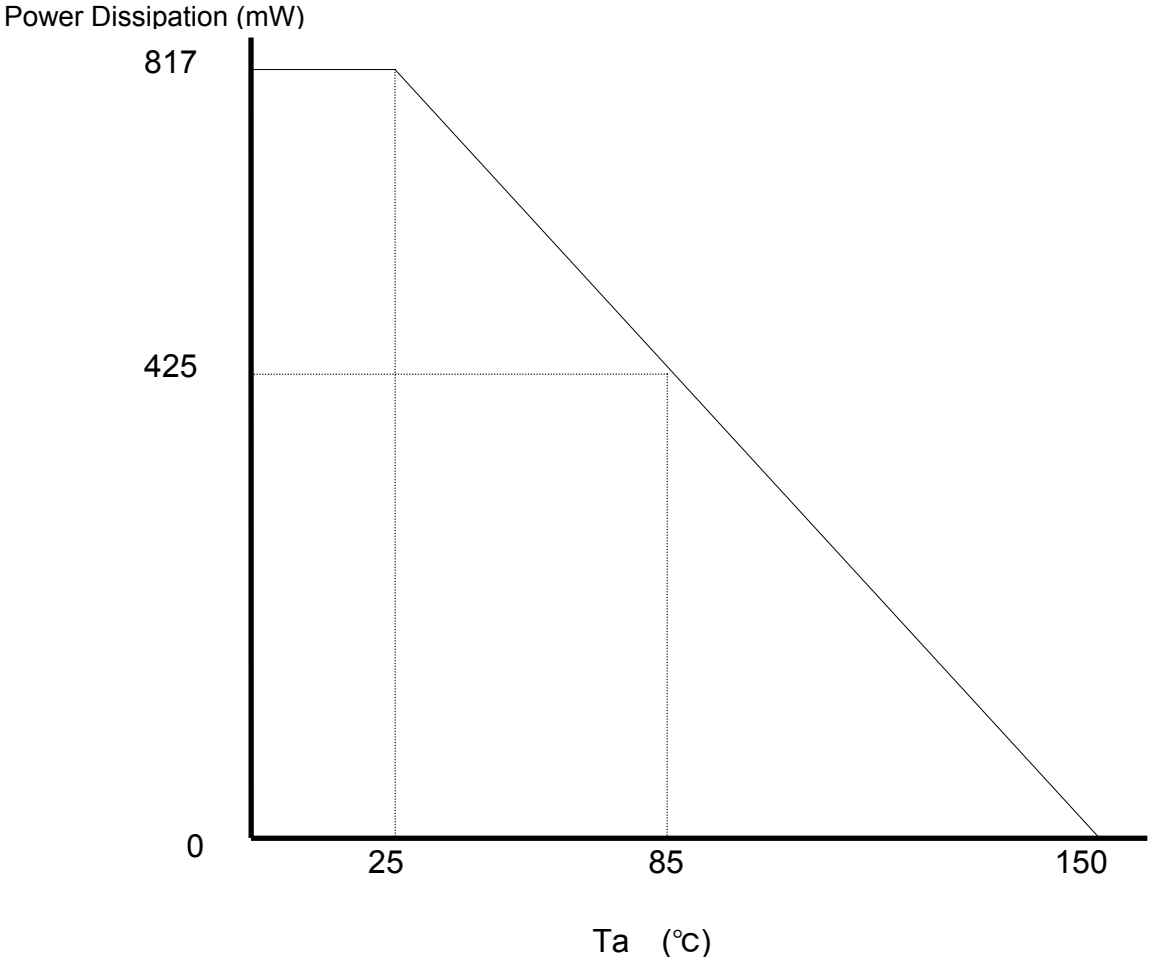


Figure 3 PD – Ta Curve

Recommended Operating Conditions

Characteristics	Pin No.	Min	Typ.	Max	Unit
Power supply voltage (*Note 3)	Pin 1	7.5	—	11.5	V

(*Note 3) The power supply voltage range for which the IC is designed for stable operation.

DC Characteristics

Unless otherwise specified: Vcc = 9V and Ta = 25ºC

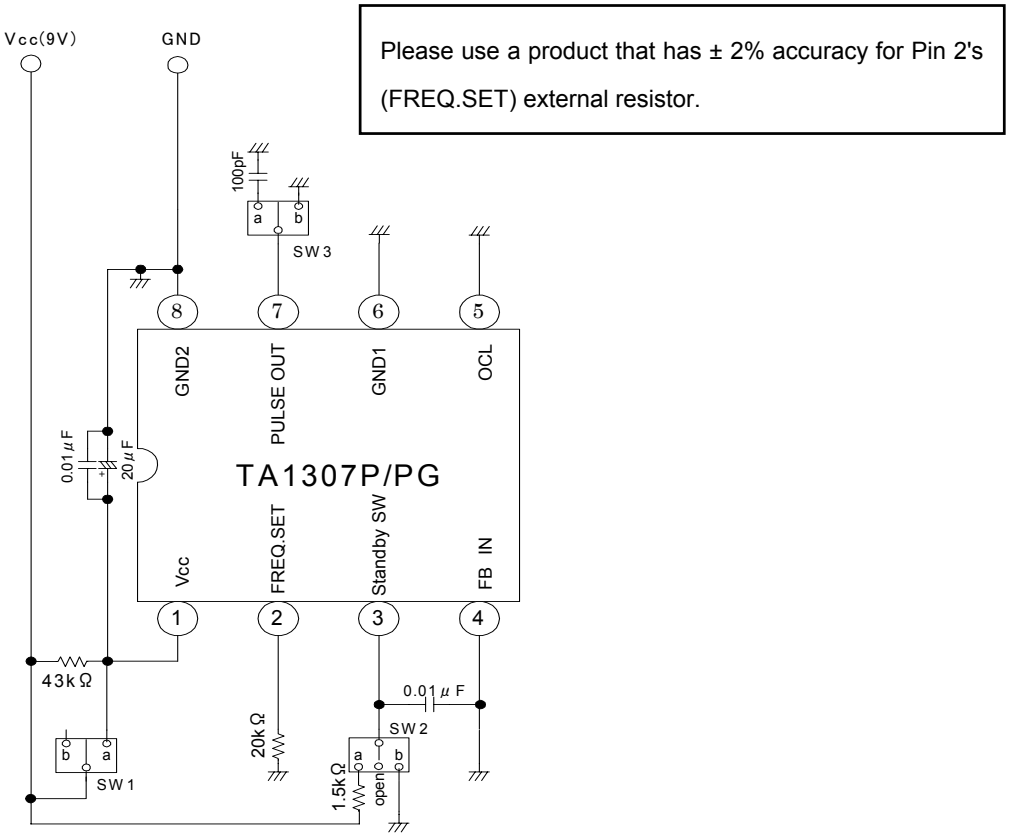
Characteristics	Pin No.	Symbol	Min	Typ.	Max	Unit
Power current	Pin 1	I1Load	0.8	1.2	1.6	mA
(The above is for when Pin 7 is connected to a load of 100pF) SW1 = ON, SW2 = b, SW3 = a						
Power current	Pin 1	I1Load	0.39	0.55	0.72	mA
(The above is for when Pin 3 is supplied Low level DC voltage (Standby ON mode)) SW1 = ON, SW2 = b, SW3 = a						
Power current	Pin 1	I1Load	0.05	0.09	0.13	mA
(The above is for when Pin 3 is supplied High level DC voltage (Standby OFF mode)) SW1 = open, SW2 = a, SW3 = b						
Pin 3 threshold voltage	Pin 3	V3 th L (*Note 4)	-	0.7	0.5	V
		V3 th H (*Note 5)	0.9	0.7	–	

(*Note 4) V3 th L is the threshold voltage for Standby ON mode

This IC can be set to Standby ON mode when Pin 3 is supplied a DC voltage lower than this threshold voltage.

(*Note 5) V3 th H is the threshold voltage for Standby OFF mode

This IC can be set to Standby OFF mode when Pin 3 is supplied a DC voltage higher than this threshold voltage.



a: Standby OFF mode ....IC not Active

b: Standby ON mode(OVLO off) ....IC Active

open:Standby ON mode(OVLO on) ...IC Active

Figure 4 Direct Current Pin Voltage Measurement

AC Characteristics (Unless otherwise specified: Vcc = 9V, Ta = 25°C)

also refer to AC Characteristics Measuring Method on pages 11-12

and Figure 5 AC Characteristics Measuring Circuit on page 13.

Characteristics	Symbol	Test Conditions	Min	Typ.	Max	Unit
UVLO operating voltage	VUL	No.1	4.6	5.0	5.5	V
	VUH		6.6	7.0	7.4	
Startup current	I strt	No.2	30	55	90	μA
Triangula roscillation frequency (including IC's temperature margin temperature = -0.016%/°C)	f OSC	No.3	20.2	25.0	29.8	KHz
Output pulse rise time (reference data)	T RPF	No.4	50	100	160	ns
Output pulse fall time (reference data)	T SPF	No.5	50	100	160	ns
Output pulse maximum voltage	VOMAX	No.6	7.0	7.5	8.0	V
Output pulse minimum voltage	VOMIN	No.7	-0.1	0.1	0.65	V
Output current (SOURCE, SINK) (reference data)	I OC	No.8	27.0	40.0	53.0	mA
Output pulse pin (#7) protect operation current	V 7 pt	No.9	30.0	40.0	-	mA
FB IN pin (#4) FB comparator threshold Hi voltage	Vth 4H	No.10	2.9	3.0	3.1	V
FB IN pin (#4) FB comparator threshold Low voltage	Vth 4L	No.11	2.4	2.5	2.6	V
OCL pin (#5) protect operation voltage	V5pt	No.12	0.18	0.2	0.22	V
Vcc pin (#1) OVLO operation voltage	V1ovlo	No.13	11.5	12.0	12.5	V
Standby SW pin (#3) operation voltage	I StSW	No.14	0.5	0.7	0.9	V
FB IN pin (#4) sink current	I FBIN	No.15	0.08	0.15	0.30	μA

AC Characteristics

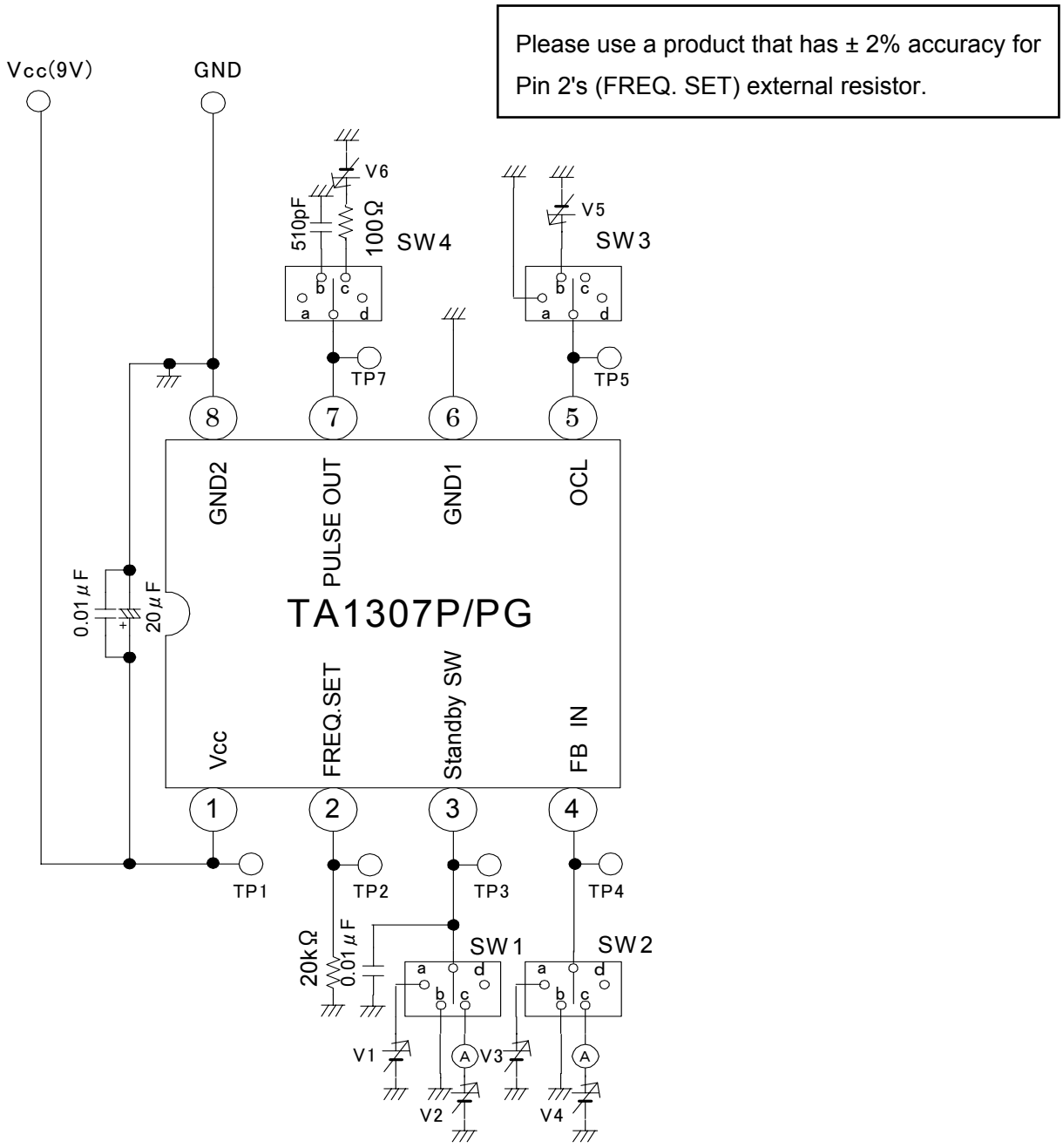
(Unless otherwise specified: Vcc = 9V, Ta = 25°C also refer to Figure 5 - AC Characteristics Measuring Circuit.)

No.	Characteristics	SW Mode				Measuring Circuit
		1	2	3	4	
1	UVLO Operating voltage (VUL/VUH)	b	b	a	a	Connect Pin 4 (FB IN) to GND. Lower Vcc's voltage while Pin 7 (PULSE OUT) is outputting pulses, and measure the power source voltage (VUL) when Pin 7 starts running out of pulses. Raise the power voltage when Pin 7 runs out of output pulses and measure the power supply voltage (VUH) when Pin 7 starts outputting pulses.
2	Startup current	b	b	a	a	Connect Pin 4 (FB IN) to GND. Measure Vcc's sink current (I strt) when Vcc goes to 9 V from a state of Pin 7 outputting no voltage (Vcc = less than 5 V).
3	Triangular oscillation frequency	b	b	a	a	Connect Pin 4 (FB IN) to GND. Have Pin 7 output pulses. Measure the pulse cycle and seek out the frequency (Fosc).
4	Output pulse rise time (reference data)	b	b	a	a	In the above state, seek out the rise time difference (TRPF) when the output pulse's amplitude is raised from a 10% level to a 90% level.
5	Output pulse fall time (reference data)	b	b	a	a	In the above state, seek out the fall time difference (TRPF) when the output pulse's amplitude is lowered from a 90% level to a 10% level.
6	Output Pulse maximum voltage	b	b	a	a	In the above state, measure the output pulse's maximum voltage (VOMAX).
7	Output pulse minimum voltage	b	b	a	a	In the above state, measure the output pulse's minimum voltage (VOMIN).

AC Characteristics

(Unless otherwise specified: Vcc = 9V, Ta = 25°C; also refer to Figure 5 - AC Characteristics Measuring Circuit.)

No.	Characteristics	SW Mode				Measuring Circuit
		1	2	3	4	
8	Pulse output current (SOURCE, SINK)	b	b	a	b	Use a current probe to measure the current (IOC) flowing to Pin 7.
9	Output pulse pin (#7) protect operation current	b	b	a	c	External voltage is applied to Pin 7 via the resistor (100 Ω). When the external voltage drops and the Pin 7's output pulse duty begins to narrow, measure the peak pulse frequency and the externally applied voltage (V6 voltage) to seek out the difference (ΔV). Use the following formula to calculate the protect operation current (I7pt) of the output pulse pin (#7): I7pt =ΔV(V)/100 Ω
10	FB IN pin (#4) FB comparator threshold High voltage	b	a	a	a	Apply external voltage to Pin 4 (default = 2.0 V) and then make sure the output voltage is outputting to Pin 7. Increase the external voltage and then measure the voltage when the output pulses run out (Vth4H).
11	FB IN pin (#4) FB comparator threshold Low voltage	b	a	a	a	From the point that the pulses run out, lower the external voltage, and then, when the output pulse reaches its maximum duty, measure the voltage (Vth4L).
12	OCL pin (#5) protect operation voltage	b	b	a	a	Apply external voltage to Pin 5 (OCL) and then measure Pin 5's voltage (V5pt) as the external voltage increases and the output pulse stops outputting.
13	Vcc pin (#1) OVLO operation voltage	d	b	a	a	Raise the power voltage of Pin 1 (Vcc) and then measure Pin 1's voltage (V1OVLO) when the output pulse stops outputting (latching has started).
14	Standby SW pin (#3) sink current	c	b	a	a	Connect external power (default = 0 V) to Pin 3 (Standby SW), gradually increase the voltage and then measure Pin 3's sink current when the output pulse stops outputting.
15	FB IN pin (#4) sink current	b	c	a	a	Connect external voltage (3.5 V) to Pin 4 (FB IN) and measure the sink current which flows into the pin.



Pin3 Control explanation

a: Standby OFF mode ....IC not Active

b: Standby ON mode(OVLO off) ....IC Active

open:Standby ON mode(OVLO on) ...IC Active

Figure 5 - AC Characteristics Test Circuit Circuit

TA1307P/PG Application Example (Secondary Voltage Detection)

1. NTSC System Television Circuits (Input: 100 VAC, Output: 5 VDC)

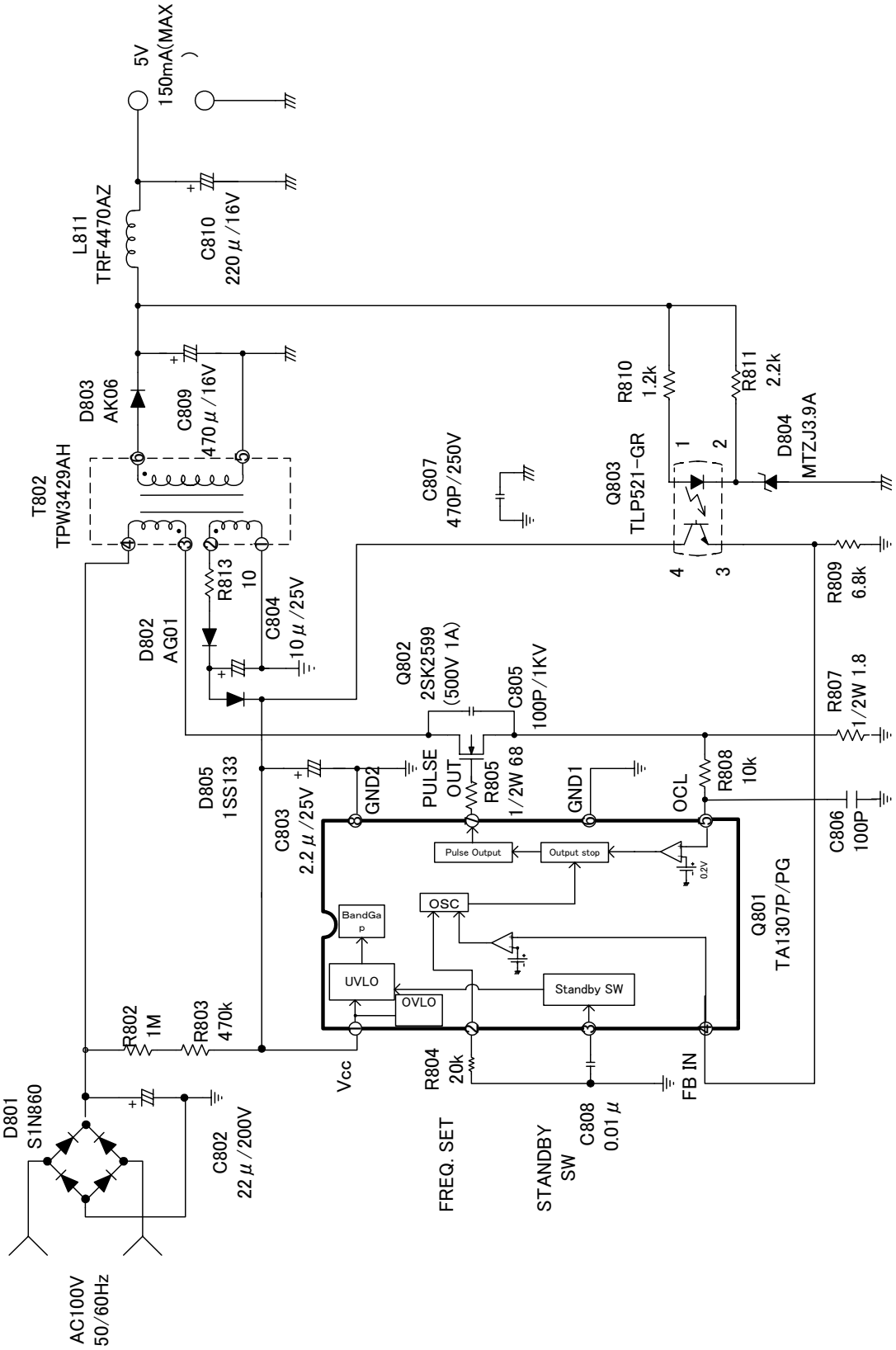


Figure 6

Converter Transformer T802 Specifications

1. Input Voltage Range: 90 to 110 V (AC)
2. Output Voltage: 5 VDC 200mA (max)
3. Oscillation Frequency: 25 kHz
4. Inductance Lp: 10 mH
5. Wiring NP1: 285t 0.1Φ
   NP2: 285t 0.1Φ
   Nd: 47t 0.14Φ
   Ns: 28t 0.2Φ
6. Bobbin: DATO161
7. Ferrite Core: 2E6EE16SG0.2
8. Gap: 0.2 mm
9. Connection

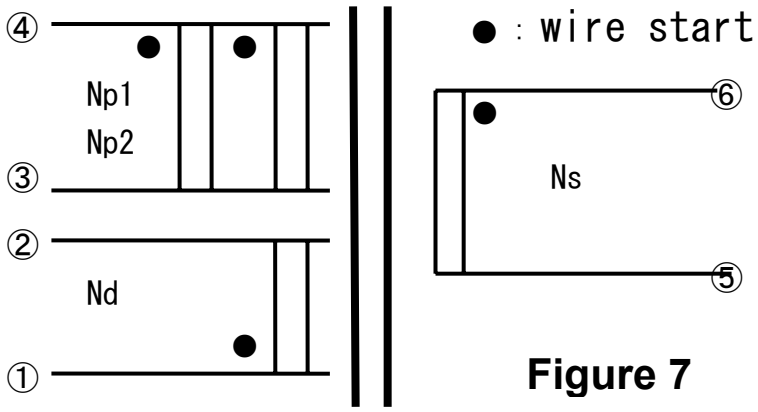


Figure 7

2. Application Circuit　Printed Circuit Board Layout

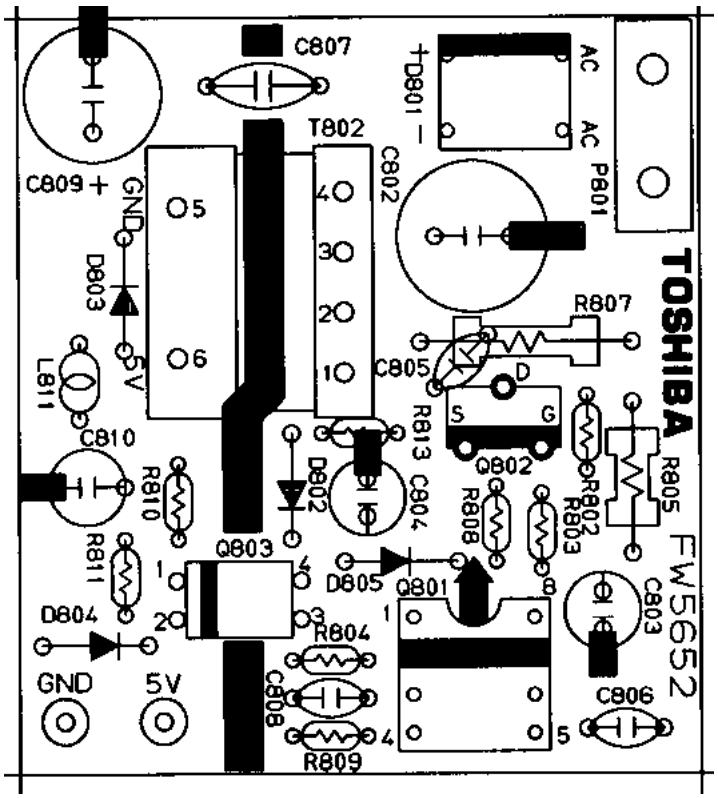


Figure 5 - Front Silkscreen
(2/1 scale)
View from mounted side

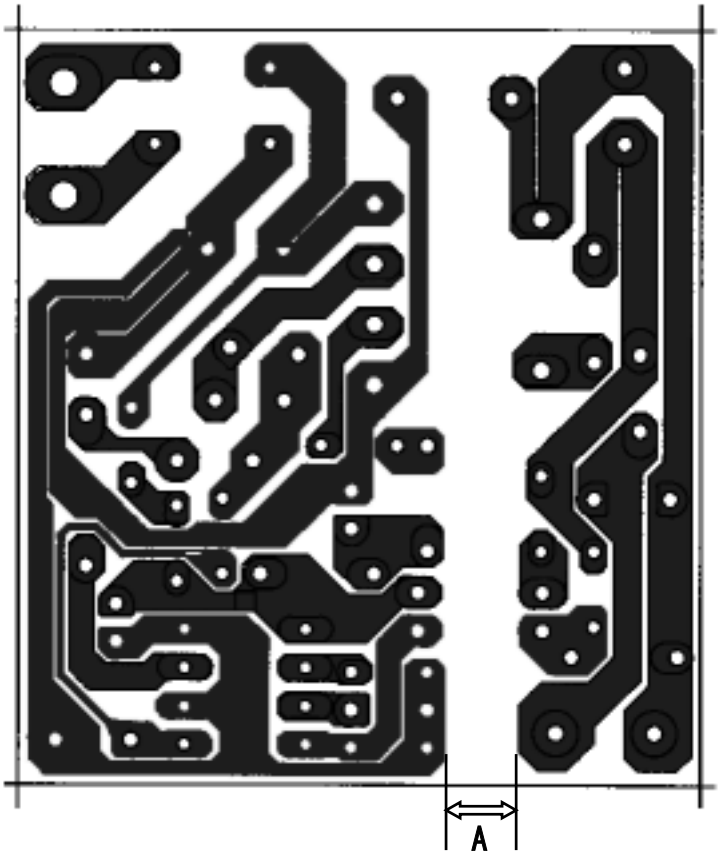


Figure 6 - Back Pattern
(2/1 scale)
View from pattern side

Layout Highlights

A represents the creepage distance for insulation established by safety standards.

The SW loop is designed extremely small (short).

--C802-T802-Q802-R807--

--T802－D803-C809--

3. AC Wide range Compatible Application Circuit Example (Input: 90 to 264 V AC, Output: 5 V DC)

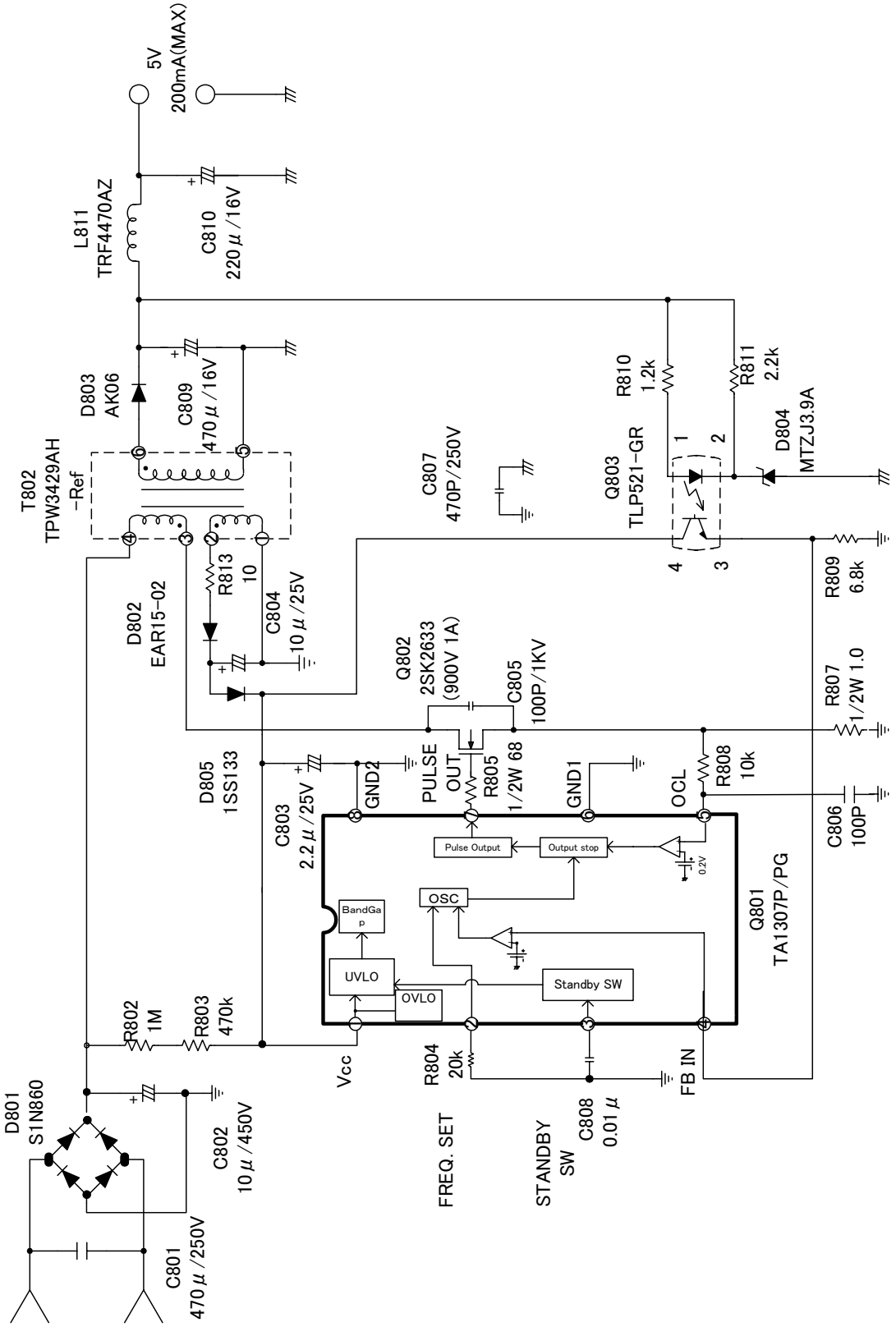


Figure 8

Converter Transformer T802 Specifications

1. Input Voltage Range: 90 to 110 V (AC)
2. Output Voltage: 5 VDC 200mA (max)
3. Oscillation Frequency: 25 kHz
4. Inductance Lp: 10 mH
5. Wiring NP1: 295t 0.1Φ
   NP2: 295t 0.1Φ
   Nd: 49t 0.14Φ
   Ns: 29t 0.2Φ
6. Bobbin: DATO161
7. Ferrite Core: 2E6EE16SG0.3
8. Gap: 0.3 mm
9. Connection

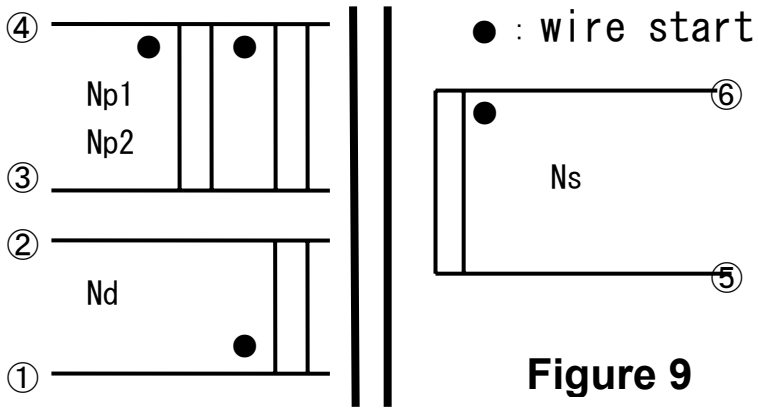


Figure 9

Package Dimensions

DIPS-P-300-2.5AA