

# FA5310P(S)/FA5311P(S)

Bipolar IC  
For Switching Power Supply Control

## ■ Description

The FA5310P(S) and FA5311P(S) are bipolar ICs for switching power supply control that can directly drive a power MOSFET.

These ICs contain many functions in a small 8-pin package. With these ICs, a high-performance and compact power supply can be created because not many external discrete components are needed.

## ■ Features

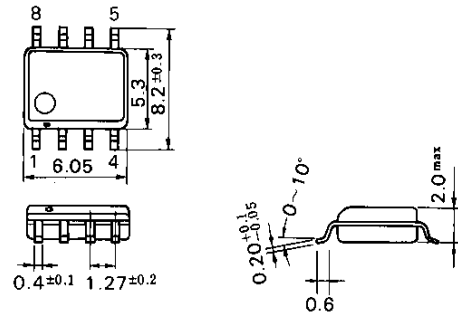
- Drive circuit for connecting a power MOS-FET ( $I_o = \pm 1.5A$ )
- Wide operating frequency range (5 to 600kHz)
- Pulse-by-pulse overcurrent limiting function
- Overload cutoff function (Latch or non-protection mode selectable)
- Output ON/OFF control function by external signals
- Overvoltage cutoff function in latch mode
- Undervoltage malfunction prevention function (ON at 16V and OFF at 8.7V)
- Low standby current (90 $\mu$ A typical)
- Exclusive choices by circuits  
Forward type: FA5310 ( $D_{max} = 46\%$ )  
Flyback type: FA5311 ( $D_{max} = 70\%$ )
- 8-pin package (DIP/SOP)

## ■ Applications

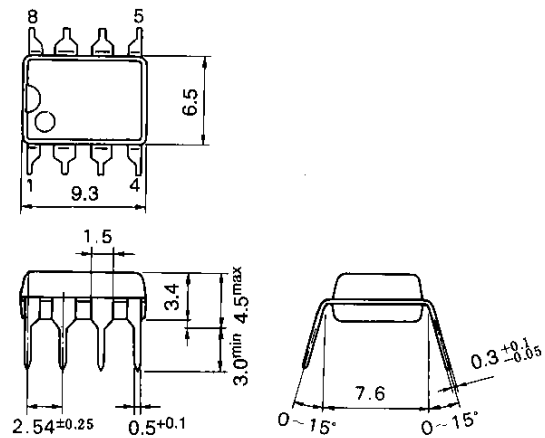
- Switching power supply for general equipment

## ■ Dimensions, mm

### ● SOP-8

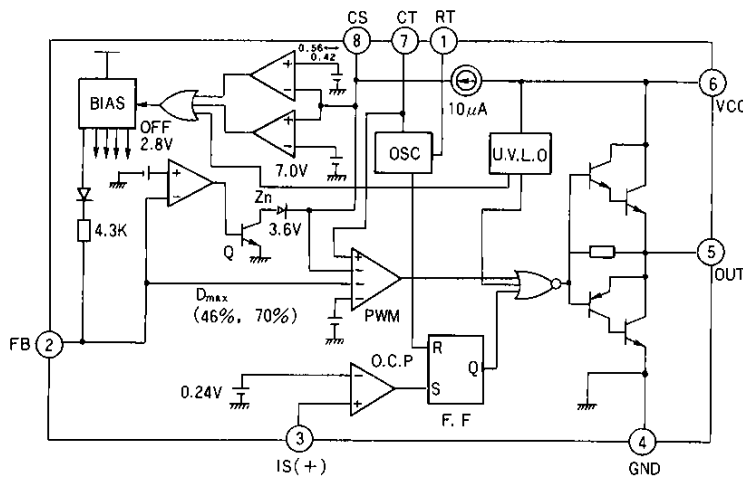


### ● DIP-8



## ■ Block diagram

### ● FA5310P(S)/FA5311P(S)



Pin No.	Pin symbol	Description
1	RT	Oscillator timing resistor
2	FB	Feedback
3	IS (+)	Overcurrent (+) detection
4	GND	Ground
5	OUT	Output
6	VCC	Power supply
7	CT	Oscillator timing capacitor
8	CS	Soft-start and ON/OFF control

### ■ Absolute maximum ratings

Common to FA5310P(S) and FA5311P(S)

Item	Symbol	Rating	Unit
Supply voltage	V <sub>CC</sub>	31	V
Output current	I <sub>O</sub>	±1.5	A
Error amplifier input voltage	V <sub>I</sub>	4	V
Feedback terminal input voltage	V <sub>FB</sub>	4	V
Overcurrent detection terminal input voltage	V <sub>IS</sub>	-0.3 to +4	V
CS terminal input current	I <sub>CS</sub>	2	mA
Total power dissipation (T <sub>a</sub> =25°C)	P <sub>d</sub>	800 (DIP-8) *1 550 (SOP-8) *2	mW
Operating temperature	T <sub>opr</sub>	-30 to +85	°C
Storage temperature	T <sub>stg</sub>	-40 to +150	°C

### ■ Recommended operating conditions

Common to FA5310P(S) and FA5311P(S)

Item	Symbol	Min.	Max.	Unit
Supply voltage	V <sub>CC</sub>	10	30	V
Oscillator timing resistance	R <sub>T</sub>	3.3	10	kΩ
Soft-start capacitor	C <sub>S</sub>	0.1	1	μF
Oscillation frequency	f <sub>osc</sub>	5	600	kHz

Notes:

\*1 Derating factor T<sub>a</sub> > 25°C : 8.0mW/°C (on PC board)\*2 Derating factor T<sub>a</sub> > 25°C : 5.5mW/°C (on PC board)

### ■ Electrical characteristics (T<sub>a</sub> = 25°C, V<sub>CC</sub> = 18V, f<sub>osc</sub> = 135kHz)

#### Oscillator section Common to FA5310P(S) and FA5311P(S)

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Oscillation frequency	f <sub>osc</sub>	C <sub>T</sub> = 330pF	125	135	145	kHz
Frequency variation 1 (due to supply voltage change)	f <sub>ΔV</sub>	V <sub>CC</sub> = 10 to 30V		±1		%
Frequency variation 2 (due to temperature change)	f <sub>ΔT</sub>	T <sub>a</sub> = -30 to +85°C		±1.5		%

#### Pulse width modulation circuit section

Item	Symbol	Test condition	FA5310P(S)			FA5311P(S)			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	
Feedback terminal source current	I <sub>FB</sub>	V <sub>FB</sub> = 0	-660	-800	-960	-660	-800	-900	μA
Input threshold voltage (Pin 2)	V <sub>TH FBO</sub>	Duty cycle = 0%		0.75			0.75		V
	V <sub>TH FBM</sub>	Duty cycle = D <sub>MAX</sub>		1.80			2.30		V
Maximum duty cycle	D <sub>MAX</sub>		43	46	49	66	70	74	%

#### Soft-start circuit section

Item	Symbol	Test condition	FA5310P(S)			FA5311P(S)			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	
Charge current (Pin 8)	I <sub>CHG</sub>	Pin 8 = 0V	-15	-10	-5	-15	-10	-5	μA
Input threshold voltage (Pin 8)	V <sub>TH CSO</sub>	Duty cycle = 0%		0.90			0.90		V
	V <sub>TH CSM</sub>	Duty cycle = D <sub>MAX</sub>		1.90			2.40		V

#### Overcurrent limiting circuit section Common to FA5310P(S) and FA5311P(S)

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Input threshold voltage (Pin 3)	V <sub>TH IS</sub>		0.21	0.24	0.27	V
Overcurrent detection terminal source current	I <sub>IS</sub>	Pin 3 = 0V	-300	-200	-100	μA
Delay time	T <sub>PD IS</sub>			150		ns

## FA5310P(S)/FA5311P(S)

### Latch-mode cutoff circuit section Common to FA5310P(S) and FA5311P(S)

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
CS terminal sink current	ISINK CS	Pin 8 = 6V, Pin 2 = 1V	25	45	65	$\mu$ A
Cutoff threshold voltage (Pin 8)	V <sub>TH CS</sub>		6.5	7.0	7.5	V

### Overload cutoff circuit section Common to FA5310P(S) and FA5311P(S)

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Cutoff-state supply voltage (Pin 2)	V <sub>TH FB</sub>		2.6	2.8	3.1	V

### Undervoltage lockout circuit Common to FA5310P(S) and FA5311P(S)

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
OFF-to-ON threshold voltage	V <sub>TH ON</sub>		15.5	16.0	16.5	V
ON-to-OFF threshold voltage	V <sub>TH OFF</sub>		8.20	8.70	9.20	V
Voltage hysteresis	V <sub>HYS</sub>			7.30		V

### Output section Common to FA5310P(S) and FA5311P(S)

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
L-level output voltage	V <sub>OL</sub>	I <sub>O</sub> = 100mA		1.30	1.80	V
H-level output voltage	V <sub>OH</sub>	I <sub>O</sub> = -100mA, V <sub>CC</sub> = 18V	16.0	16.5		V
Rise time	t <sub>r</sub>	No load		50		ns
Fall time	t <sub>f</sub>	No load		50		ns

### Output ON/OFF circuit section Common to FA5310P(S) and FA5311P(S)

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
CS terminal source current	ISOURCE CS	Pin 8 = 0V	-15	-10	-5	$\mu$ A
OFF-to-ON threshold voltage (Pin 8)	V <sub>TH ON</sub>	CS terminal voltage OFF→ON		0.56		V
ON-to-OFF threshold voltage (Pin 8)	V <sub>TH OFF</sub>	CS terminal voltage ON→OFF		0.42		V

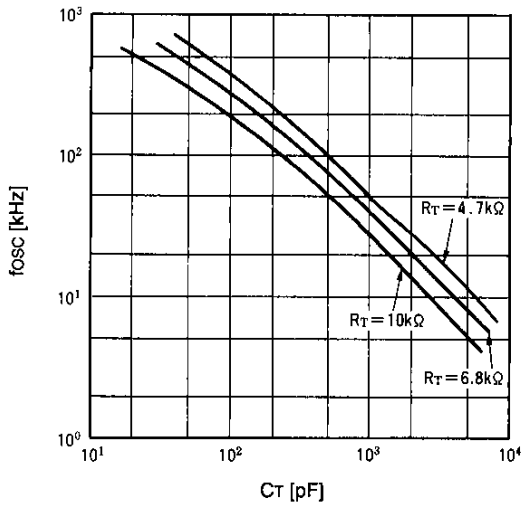
### Overall device Common to FA5310P(S) and FA5311P(S)

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Standby current	I <sub>CC ST</sub>	V <sub>CC</sub> = 14V		90	150	$\mu$ A
Operating-state supply current	I <sub>CC OP</sub>			9	15	mA
OFF-state supply current	I <sub>CC OFF</sub>			1.1	1.8	mA
Cutoff-state supply current	I <sub>CC L</sub>			1.1	1.8	mA

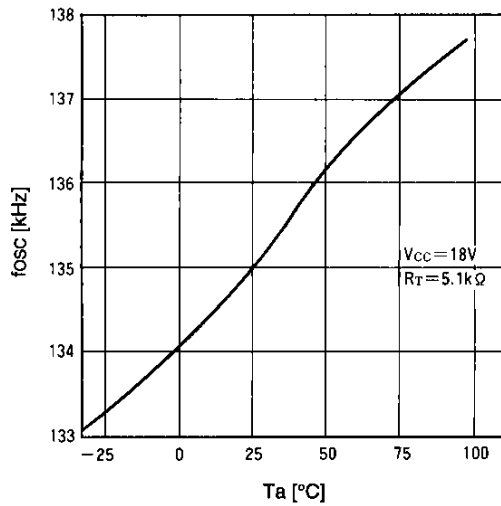
The ratings and pin numbers given in the tables are applicable for DIP-8 and SOP-8 packages.

■ Characteristic curves (Ta = 25°C)

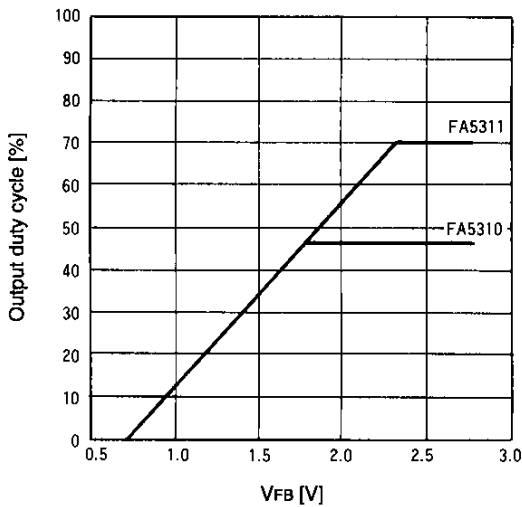
Oscillation frequency (fosc) vs. timing capacitor capacitance (CT)



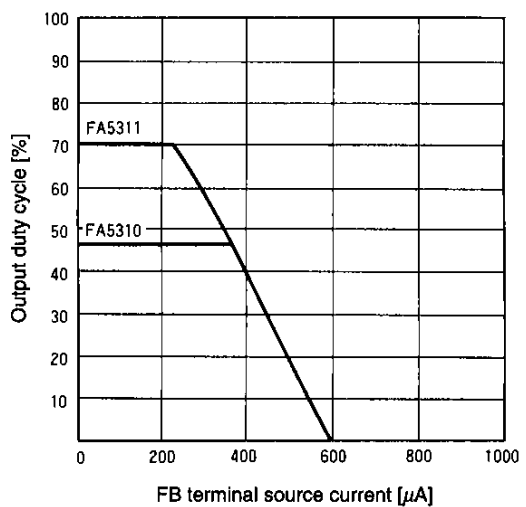
Oscillation frequency (fosc) vs. ambient temperature (Ta)



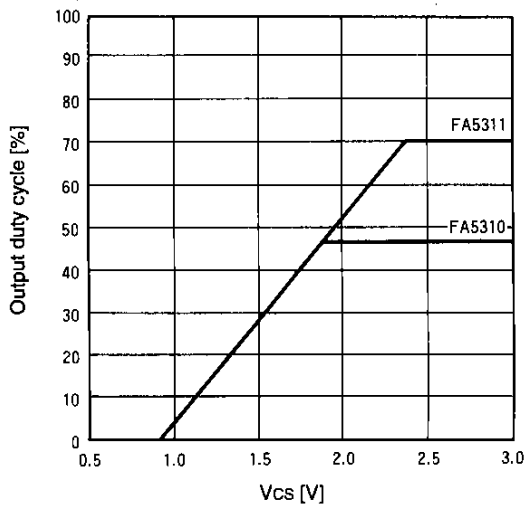
Output duty cycle vs. FB terminal voltage (VFB)



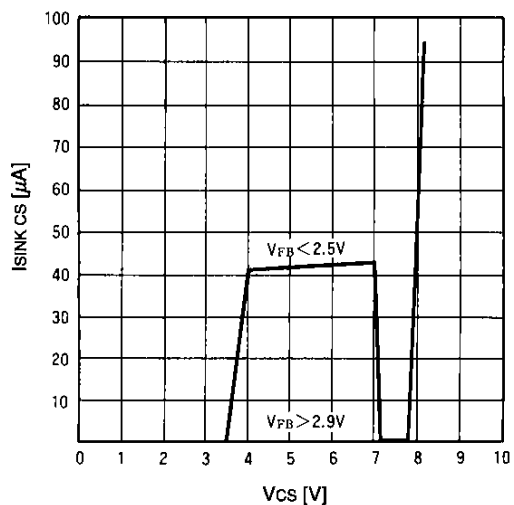
Output duty cycle vs. FB terminal source current (ISOURCE)



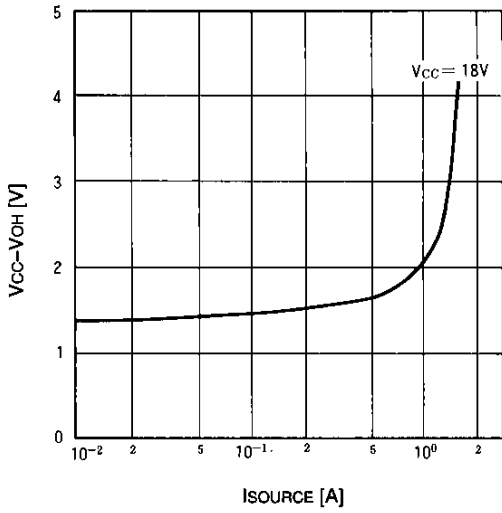
Output duty cycle vs. CS terminal voltage (Vcs)



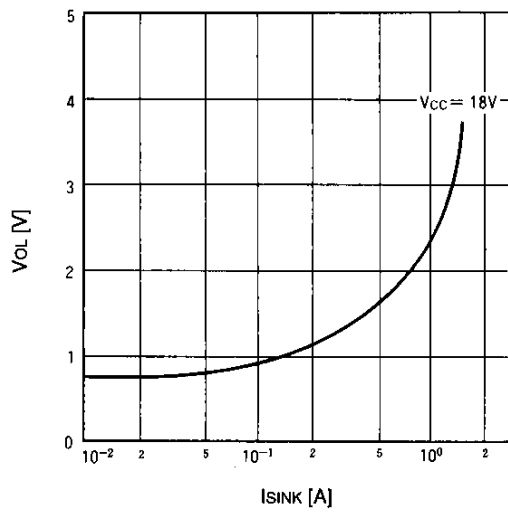
CS terminal sink current (ISINK CS) vs. CS terminal voltage (Vcs)



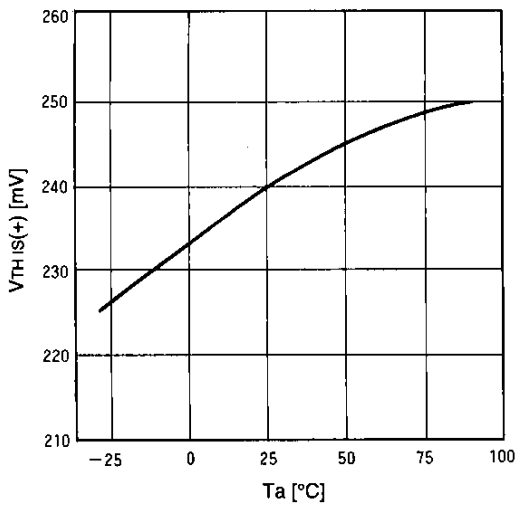
H-level output voltage (V<sub>OH</sub>) vs. output source current (I<sub>SOURCE</sub>)



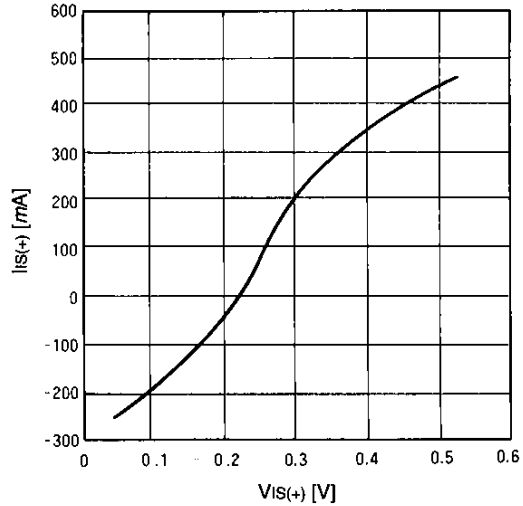
L-level output voltage (V<sub>OL</sub>) vs. output sink current (I<sub>SINK</sub>)



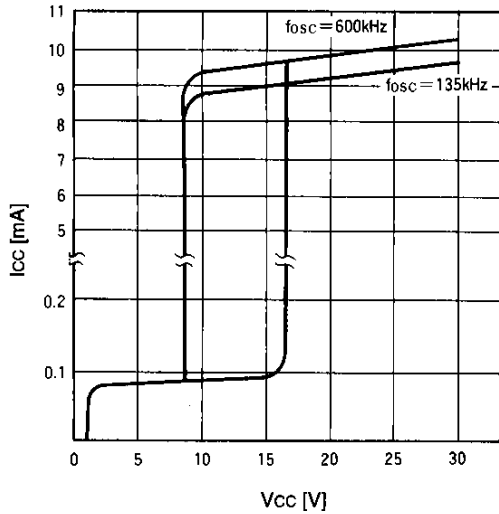
IS (+) terminal threshold voltage (V<sub>TH IS(+)</sub>) vs. ambient temperature (Ta)



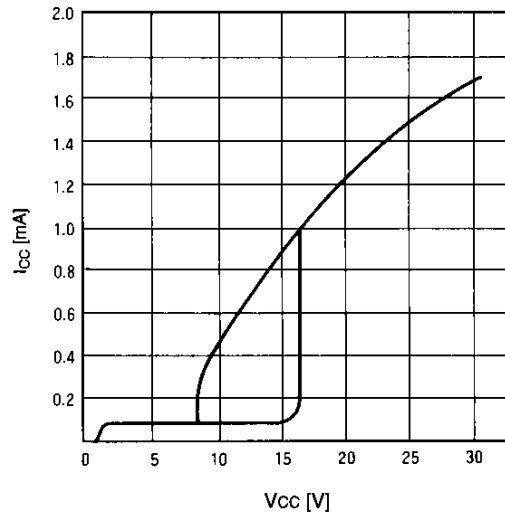
IS (+) terminal current (I<sub>IS(+)</sub>) vs. IS (+) terminal voltage (V<sub>IS(+)</sub>)



Supply current (I<sub>CC</sub>) vs. supply voltage (V<sub>CC</sub>) Ordinary operation

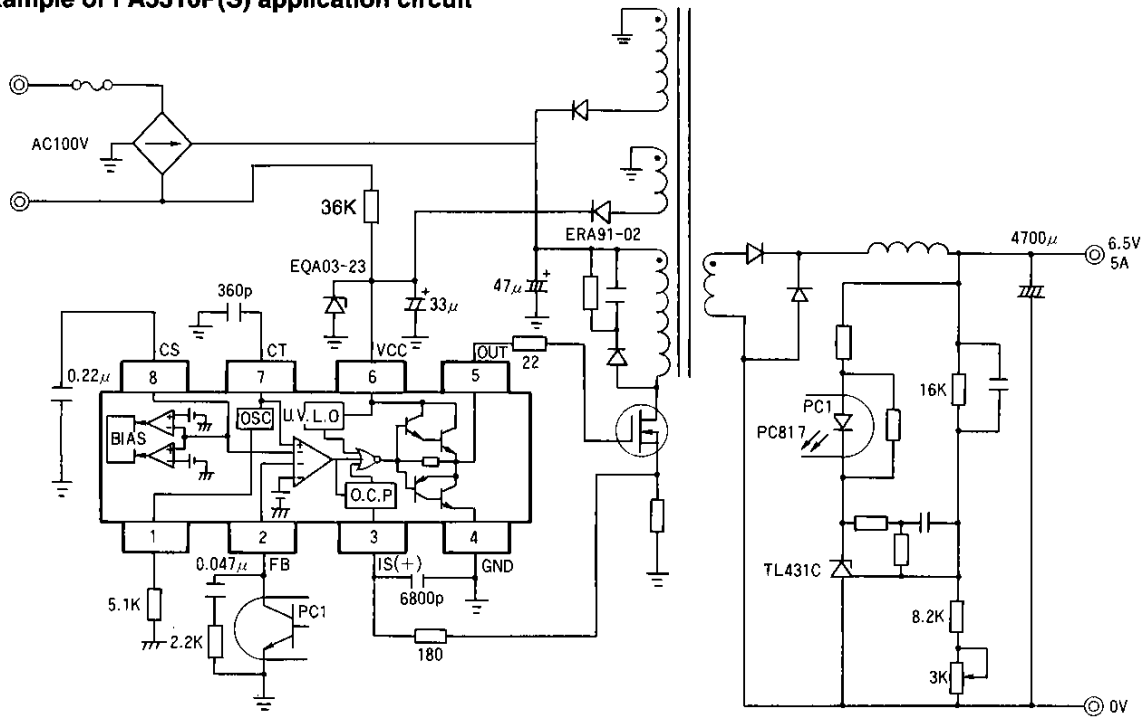


Supply current (I<sub>CC</sub>) vs. supply voltage (V<sub>CC</sub>) OFF or OFF latch mode

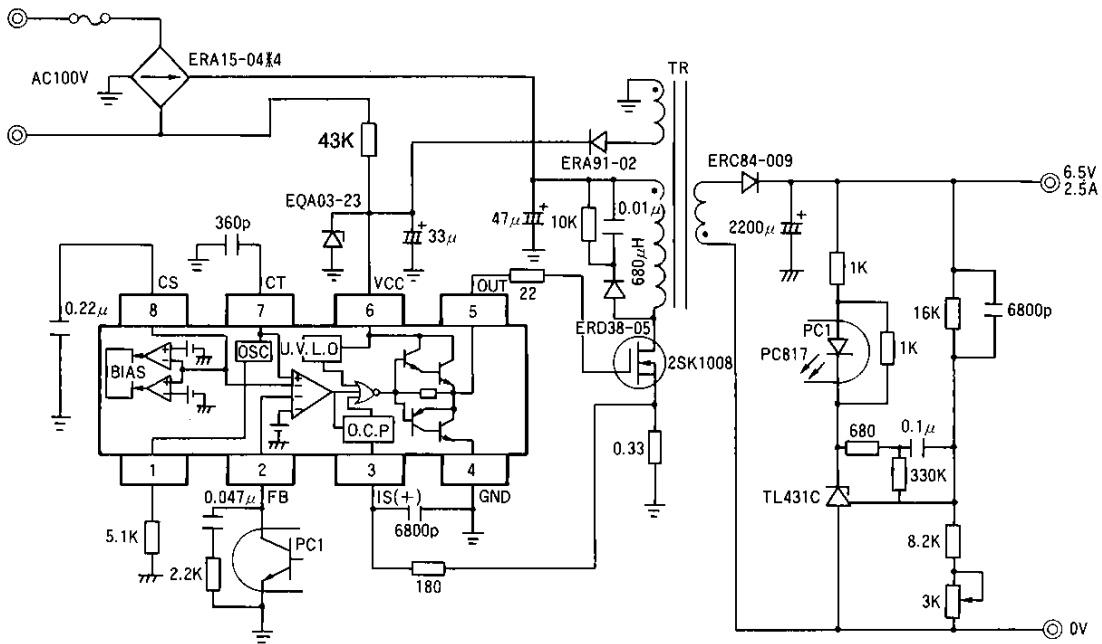


■ Application circuit

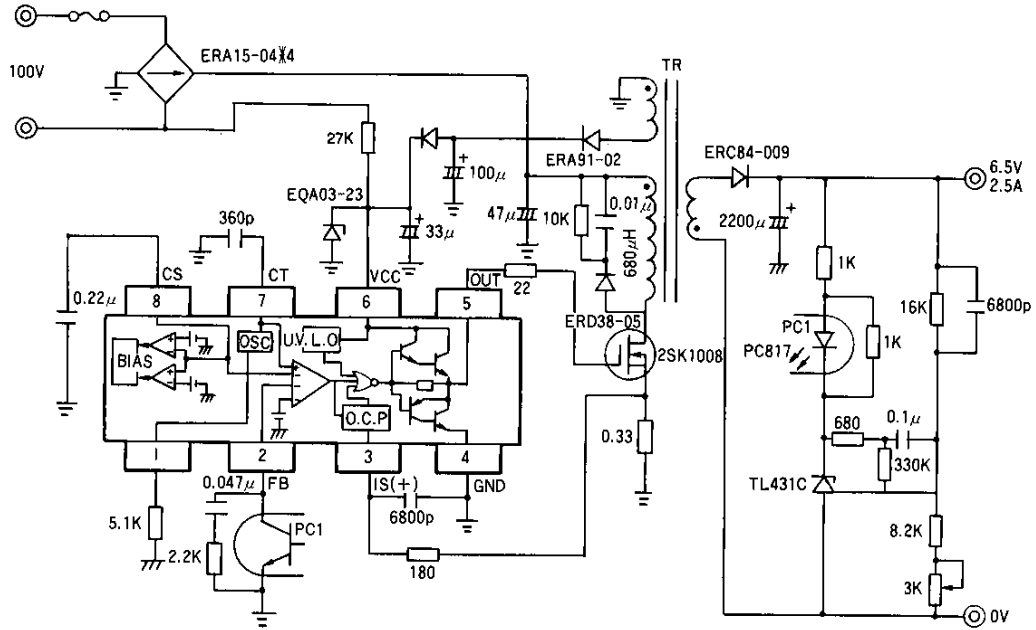
● Example of FA5310P(S) application circuit



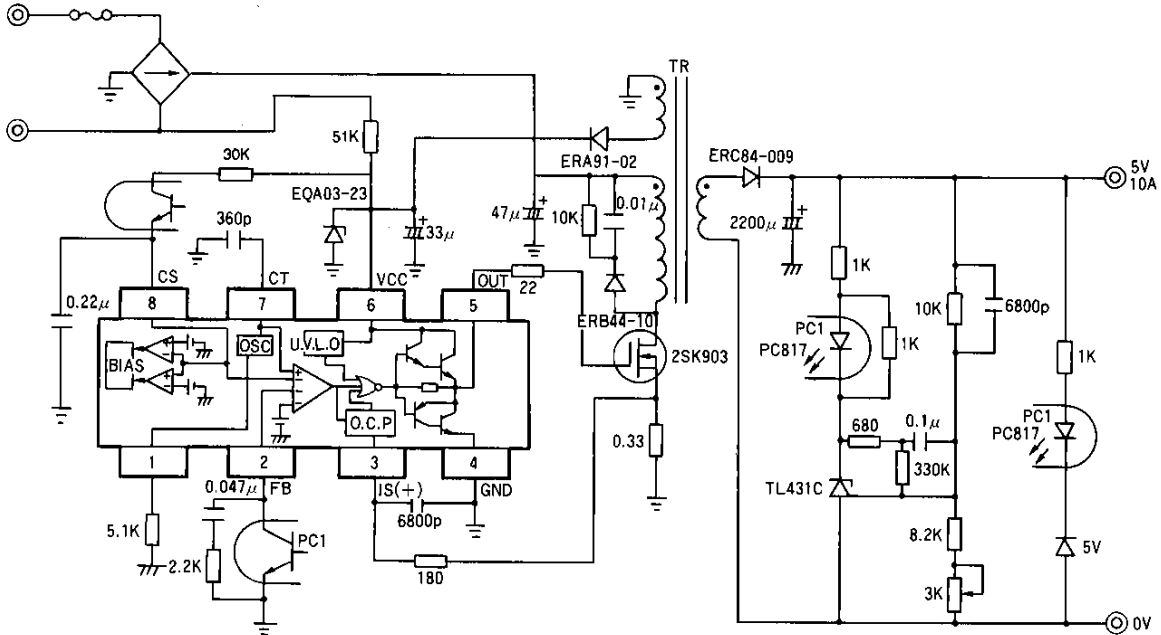
● Example of FA5310P(S) / FA5311P(S) application circuit (1)



• Example of FA5310P(S) / FA5311P(S) application circuit (2)



• Example of FA5310P(S) / FA5311P(S) application circuit (3)



Parts tolerances characteristics are not defined in the circuit design sample shown above. When designing an actual circuit for a product, you must determine parts tolerances and characteristics for safe and economical operation.

## CAUTION

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