

■ Description

The FA7610CP(N), 7612CP(N) and 7617CP(N) are bipolar ICs containing basic circuits necessary for PWM-type switching power supply control.

To minimize the number of external discrete components, the FA7610CP(N) is provided for a flyback or step-up power-supply circuit, the FA7612CP(N) for a step-down power-supply circuit and FA7617CP(N) for a flyback power supply circuit.

■ Features

FA7610CP(N)

- For flyback transformer-type or step-up power-supply circuit (maximum output duty = 64% typical)
- Totem-pole predriver
- PWM-type switching power supply control
- Low-voltage operation ($V_{CC} = 3.6$ to $22V$)
- Latch-mode short-circuit protection function (no malfunction by noise)
- Soft-start function
- Undervoltage lockout function
- One capacitor shared for short circuit protection and for soft-start to minimize the number of external discrete components

FA7612CP(N)

- For step-down power-supply circuit (maximum output duty = up to 100%)
- Open collector output
- PWM-type switching power supply control
- Low-voltage operation ($V_{CC} = 3.6$ to $22V$)
- Latch-mode short-circuit protection function (no malfunction by noise)
- Soft-start function
- Undervoltage lockout function
- One capacitor shared for short circuit protection and for soft-start to minimize the number of external discrete components

FA7617CP(N)

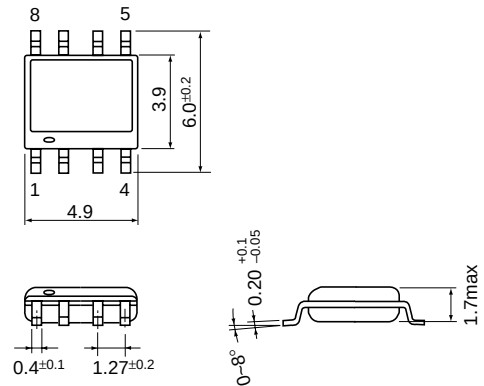
- For flyback transformer-type power-supply circuit (maximum output duty = 67% typical)
- Open collector output
- PWM-type switching power supply control
- Low-voltage operation ($V_{CC} = 3.6$ to $22V$)
- Latch-mode short-circuit protection function (no malfunction by noise)
- Soft-start function
- Undervoltage lockout function
- One capacitor shared for short circuit protection and for soft-start to minimize the number of external discrete components

■ Applications

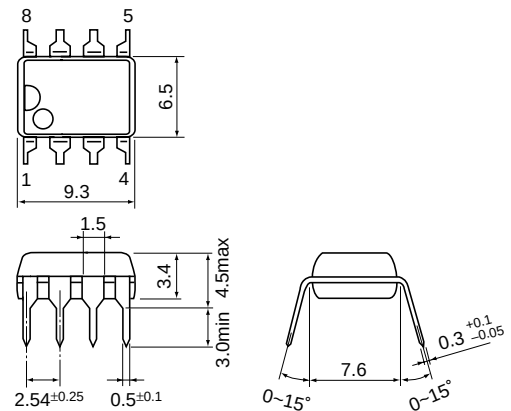
- Battery power supply for portable equipment

■ Dimensions, mm

● SOP-8

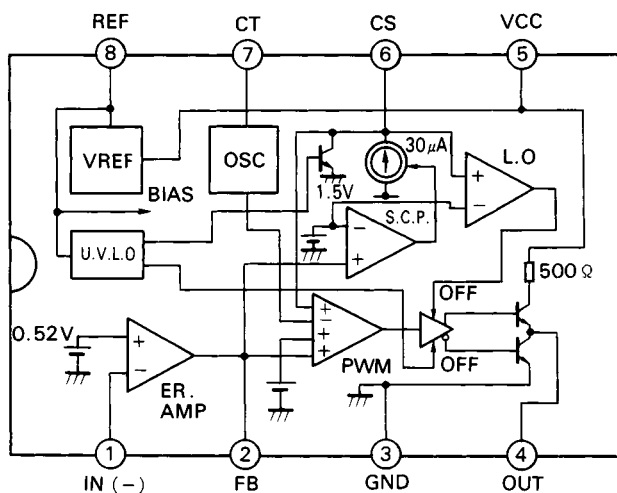


● DIP-8



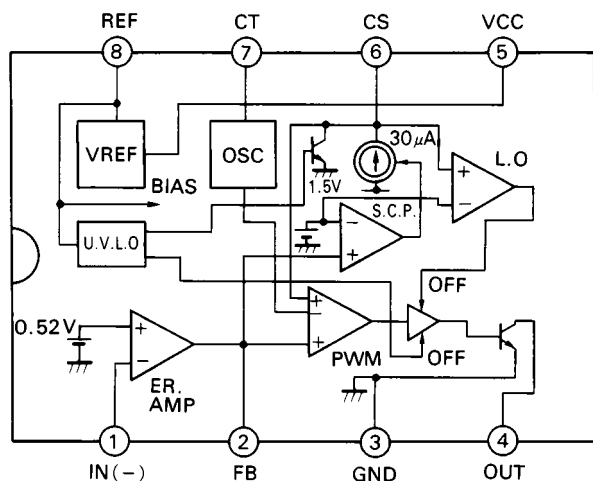
■ Block diagram

● FA7610CP(N)



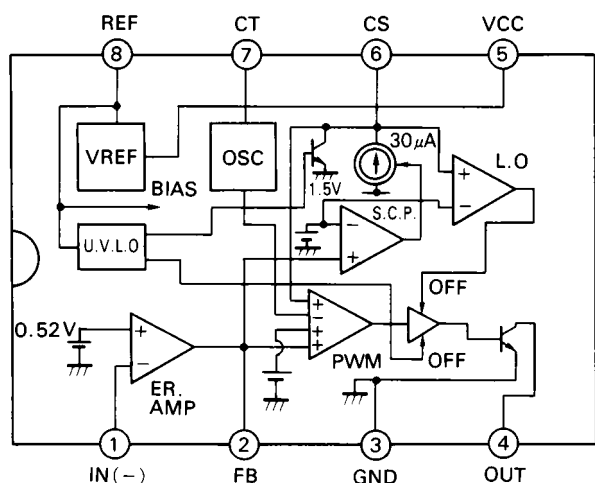
Pin No.	Pin symbol	Description
1	IN (-)	Inverting input to error amplifier
2	FB	Error amplifier output
3	GND	Ground
4	OUT	Output
5	VCC	Power supply
6	CS	Capacitor for soft-start, short-circuit protection and delay
7	CT	Oscillator timing capacitor
8	REF	Reference voltage output (2.5V)

● FA7612CP(N)



Pin No.	Pin symbol	Description
1	IN (-)	Inverting input to error amplifier
2	FB	Error amplifier output
3	GND	Ground
4	OUT	Output
5	VCC	Power supply
6	CS	Capacitor for soft-start, short-circuit protection and delay
7	CT	Oscillator timing capacitor
8	REF	Reference voltage output (2.5V)

● FA7617CP(N)



Pin No.	Pin symbol	Description
1	IN (-)	Inverting input to error amplifier
2	FB	Error amplifier output
3	GND	Ground
4	OUT	Output
5	VCC	Power supply
6	CS	Capacitor for soft-start, short-circuit protection and delay
7	CT	Oscillator timing capacitor
8	REF	Reference voltage output (2.5V)

■ Absolute maximum ratings (Ta = 25°C)

Item	Symbol	Rating		Unit
		FA7610C	FA7612C/17C	
Supply voltage	V _{CC}	22	22	V
Reference voltage output current	I _{OR}	5	5	mA
Output current	I _O	±50	80	mA
Total power dissipation	P _d	400	400	mW
Operating temperature	T _{opr}	−20 to +85	−20 to +85	°C
Storage temperature	T _{stg}	−40 to +150	−40 to +150	°C

■ Recommended operating conditions

Item	Symbol	FA7610C		FA7612/17C		Unit
		Min.	Max.	Min.	Max.	
Supply voltage	V _{CC}	3.6	20	3.6	20	V
Feedback resistance	R _{NF}	100		100		kΩ
Oscillator timing capacitor	C _T	220	22,000	220	22,000	pF
Oscillator timing resistance	R _T	10	100	10	100	kΩ
Oscillation frequency	f _{osc}	5	200	5	500	kHz

■ Electrical characteristics (Ta = 25°C, V_{CC} = 6V, R_T = 33kΩ, C_T = 1000pF)

Reference voltage section Common to FA7610C/12C/17C

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Output voltage	V _{REF}	I _{OR} = 1mA	2.528	2.580	2.632	V
Line regulation	LINE	V _{CC} = 3.6 to 20V, I _{OR} = 1mA		4	12	mV
Load regulation	LOAD	I _{OR} = 0.1 to 1mA		1	6	mV
Output voltage variation due to temperature change	V _{TC1}	Ta = −20 to +25°C	−1		1	%
	V _{TC2}	Ta = +25 to +85°C	−1		1	%

Oscillator section Common to FA7610C/12C/17C

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Oscillation frequency	f _{osc}	C _T = 1000pF, R _T = 33kΩ	100	111	122	kHz
Frequency variation 1 (due to supply voltage change)	f _{dV}	V _{CC} = 3.6 to 20V		1		%
Frequency variation 2 (due to temperature change)	f _{dT}	Ta = −20 to +85°C		5		%

Error amplifier section Common to FA7610C/12C/17C

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Reference voltage	V _B		0.515	0.525	0.535	V
Input bias current	I _B			5	100	nA
Open-loop voltage gain	A _v		70			dB
Unity-gain bandwidth	G _B			0.6		MHz
Maximum output voltage (Pin 2)	V _{OM+}	R _{NF} = 100kΩ	V _{REF} −0.2			V
	V _{OM−}	R _{NF} = 100kΩ			200	mV
Output source current (Pin 2)	I _{OM+}	V _{OM} = 1V	40	85	200	μA

PWM comparator section

Item	Symbol	Test condition	FA7610C			FA7612C			FA7617C			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	
Input threshold voltage (pin 2)	V _{TH0}	Duty cycle = 0%		0.85	0.95		0.85	0.95		0.85	0.95	V
Input threshold voltage (pin 2)	V _{TH50}	Duty cycle = 50%		1.1			1.1			1.1		V
Maximum duty cycle	α _M	(Pin 2 = 1.2V)	58	64	75		100		63	67	71	%

Soft-start circuit section Common to FA7610C/12C/17C

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Input bias current (Pin 6)	I _{BCS}			80	300	nA
Input threshold voltage (Pin 6)	V _{TH CS0}	Duty cycle = 0%		0.22	0.32	V
Input threshold voltage (Pin 6)	V _{TH CS50}	Duty cycle = 50%		0.46		V

Short-circuit protection circuit section Common to FA7610C/12C/17C

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Input threshold voltage (Pin 2)	V _{TH PC}		1.20	1.50	1.80	V
Charge current (Pin 6)	I _{CHG}	Pin 6 = 0V, Pin 2 = 2V	20	30	40	μA
Latch-mode threshold voltage (Pin 6)	V _{TH LA}		1.20	1.50	1.80	V

Undervoltage lockout circuit section Common to FA7610C/12C/17C

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
OFF-to-ON threshold voltage	V _{TH ON}			2.70		V
ON-to-OFF threshold voltage	V _{TH OFF}			2.52		V
Voltage hysteresis	V _{HYS}		60	180		mV

Output section

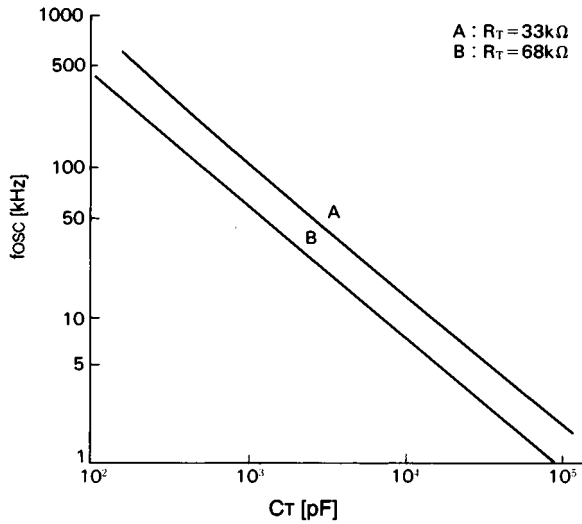
Item	Symbol	Test condition	FA7610C			FA7612C/17C			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	
H-level output voltage (Pin 4)	V _{OH}	R _L = 10kΩ	3.5	4.0		—	—	—	V
L-level output voltage (Pin 4)	V _{OL}	Output sink current = 20mA		0.25	0.65		0.9	1.5	V
Output source current (Pin 4)	I _{SOURCE}	Pin 4 = 0V	8	11	14	—	—	—	mA

Overall device

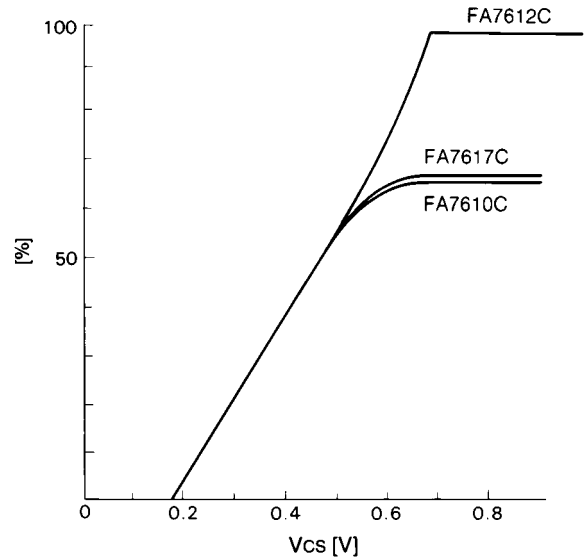
Item	Symbol	Test condition	FA7610C			FA7612C/17C			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	
Supply current	I _{CC LA}	Latch mode		1.6	2.2		1.5	2.2	mA
Operating-state supply current	I _{CC AV}	R _L = ∞ Duty cycle = 50%		2.6	3.8		1.8	3.0	mA

■ Characteristic curves ($T_a = 25^\circ\text{C}$)

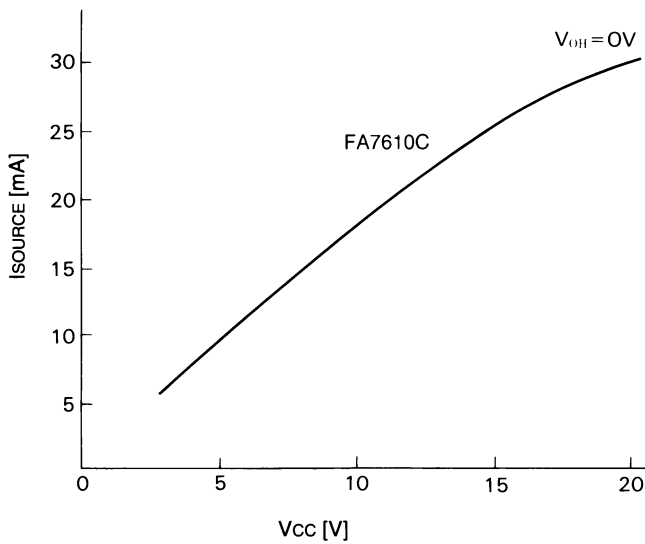
Oscillation frequency(f_{osc}) vs.
timing capacitor capacitance(C_T)



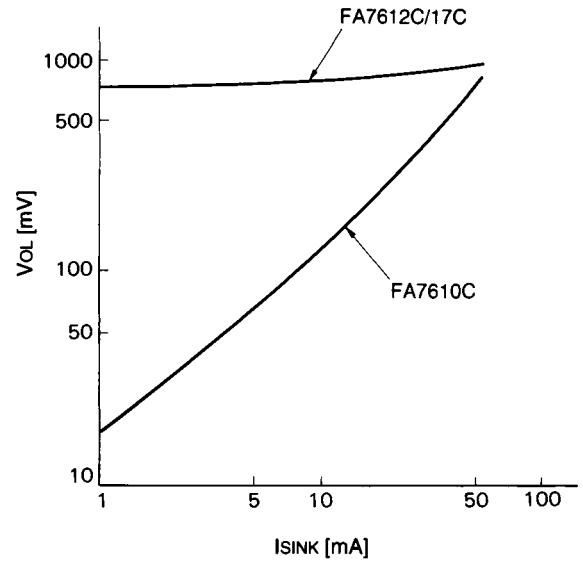
Output duty cycle vs. CS terminal voltage(V_{cs})



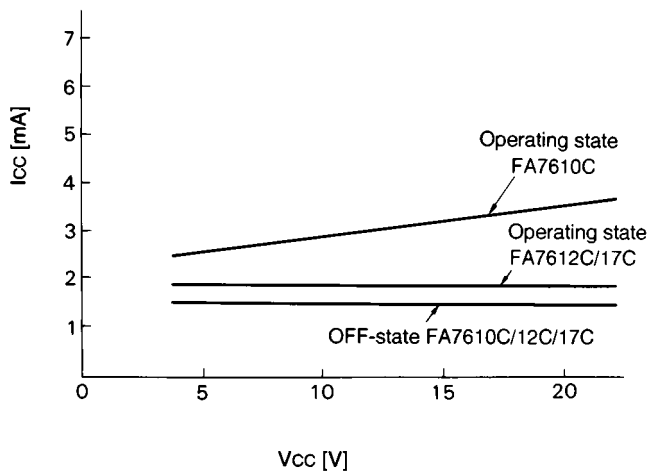
Output source current (I_{source}) vs.
supply voltage(V_{cc})



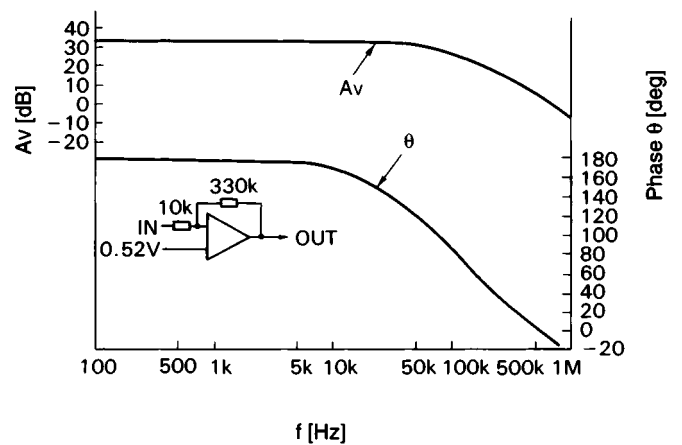
L-level output voltage(V_{OL}) vs. output sink current
(I_{sink})



Supply current(I_{cc}) vs. supply voltage(V_{cc})



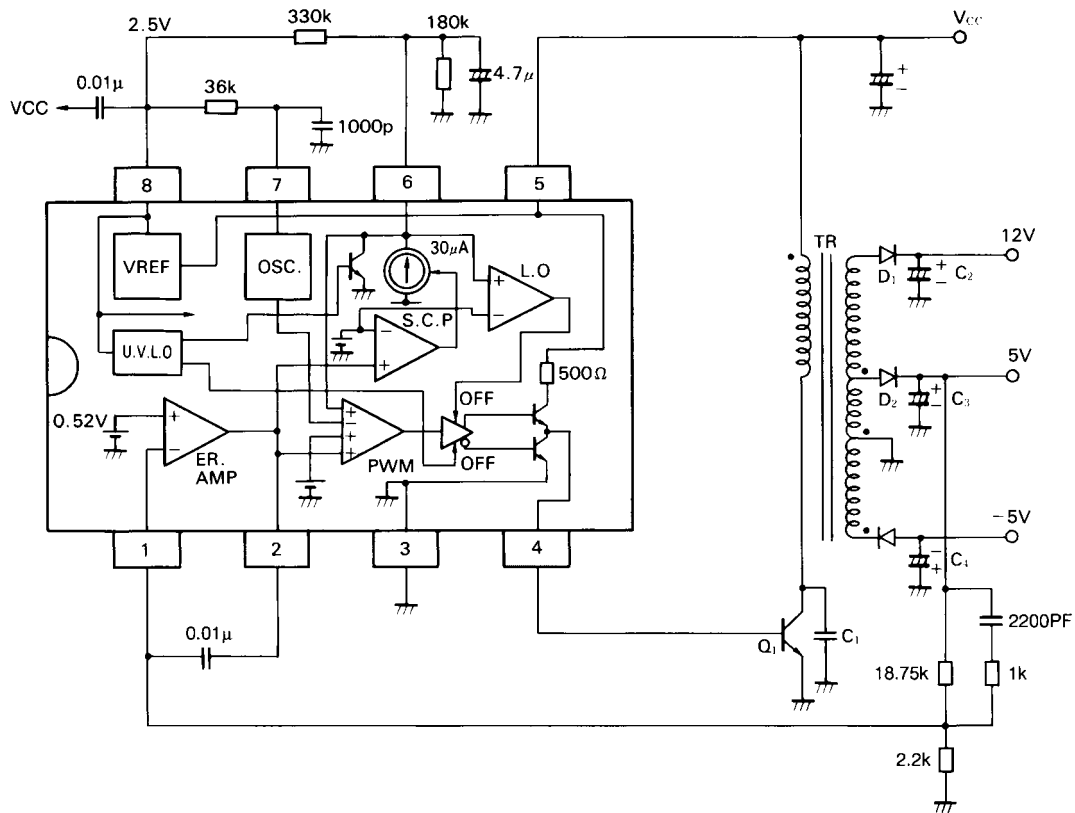
Error amplifier frequency(f) vs. voltage gain(A_v) / phase (θ)



■ Application circuit

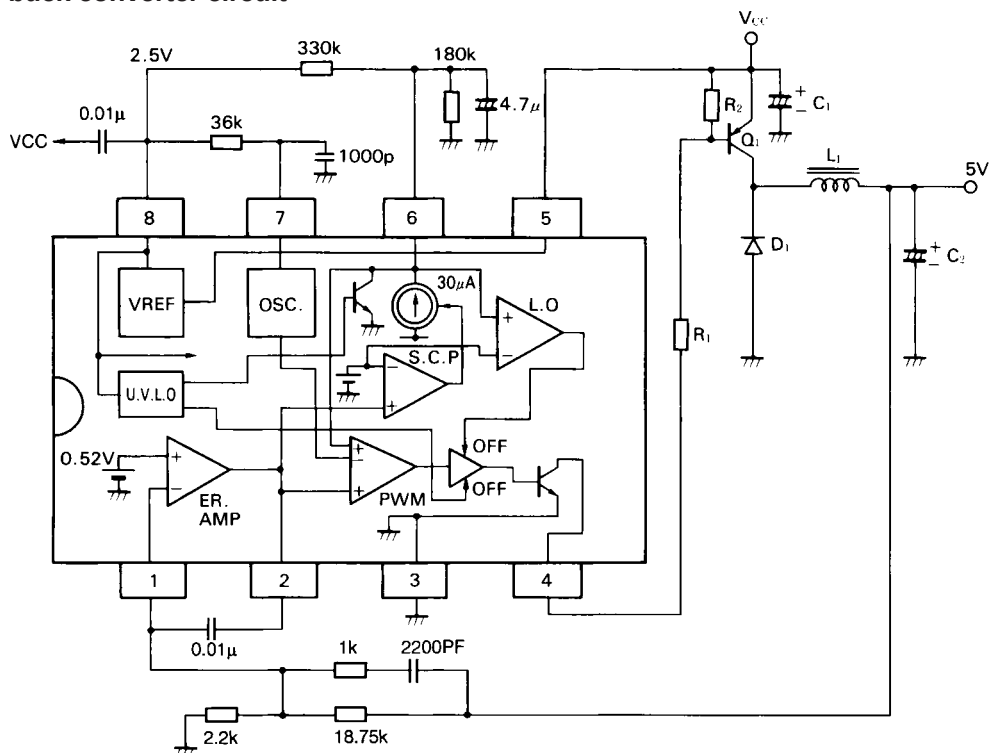
● FA7610CP(N)

Flyback-transformer type converter circuit



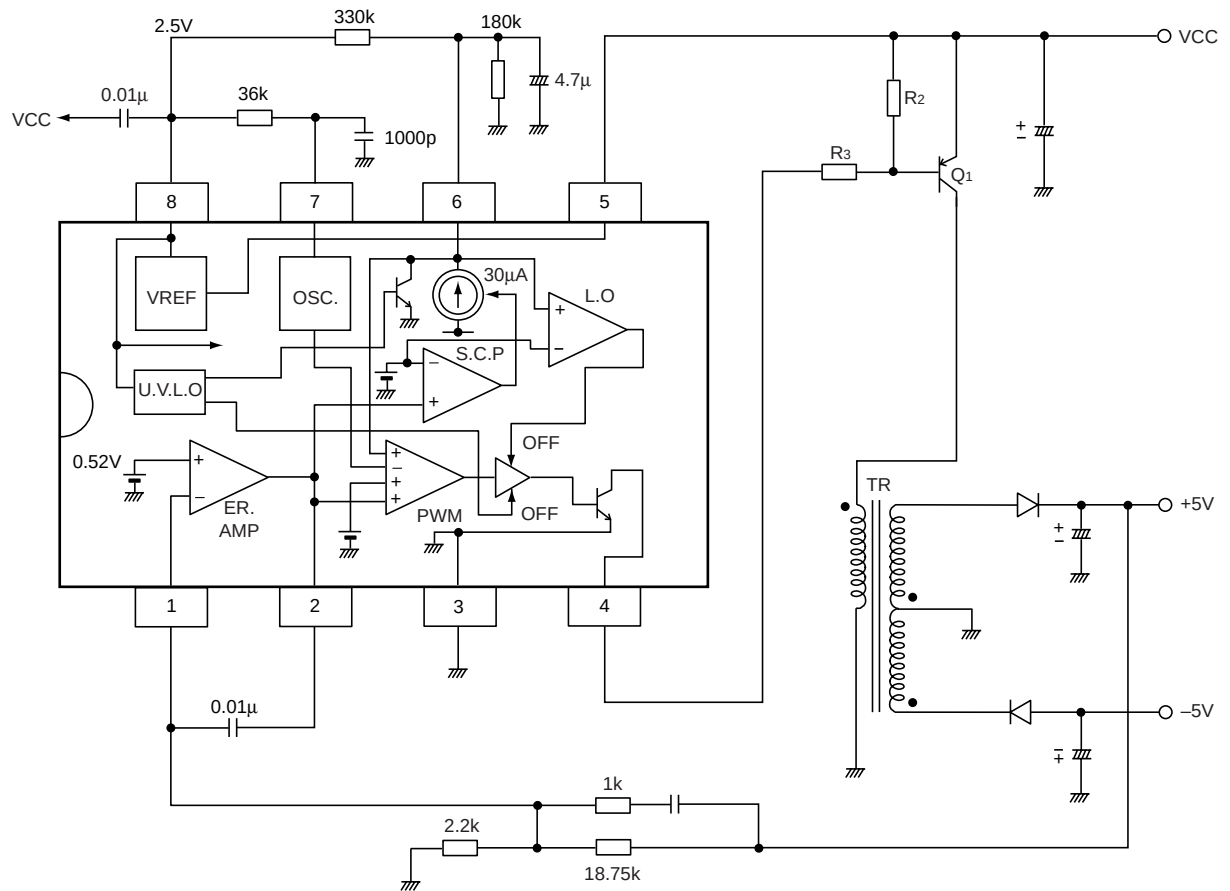
● FA7612CP(N)

Chopper type buck converter circuit



● FA7617CP(N)

Flyback-transformer type converter circuit



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.

Please connect a capacitor, which the value is about $0.01\mu\text{F}$ to $0.1\mu\text{F}$, between VCC and REF terminals in order to prevent from irregular output pulse at start up.