

# FA7615CP(E)

Bipolar IC  
For Switching Power Supply Control

## ■ Description

The FA7615CP(E) is a bipolar IC containing basic circuit necessary for PWM-type switching power supply control. This IC can be operated by external synchronizing pulses.

## ■ Features

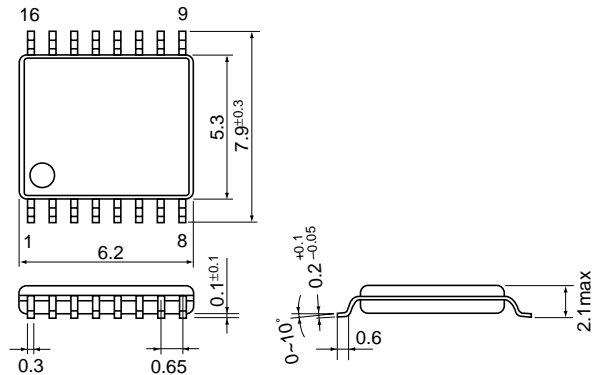
- External synchronization input terminal
- Low-voltage operation ( $V_{CC} = 3.6$  to  $22V$ )
- Totem-pole predriver
- Latch-mode short-circuit protection function (no malfunction due to electrical noise)
- One capacitor shared for short-circuit protection and for soft-start to minimize the number of external discrete components

## ■ Applications

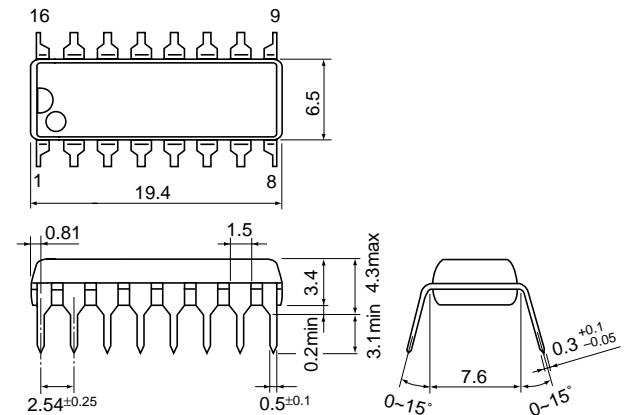
- Battery power supply for portable equipment

## ■ Dimensions, mm

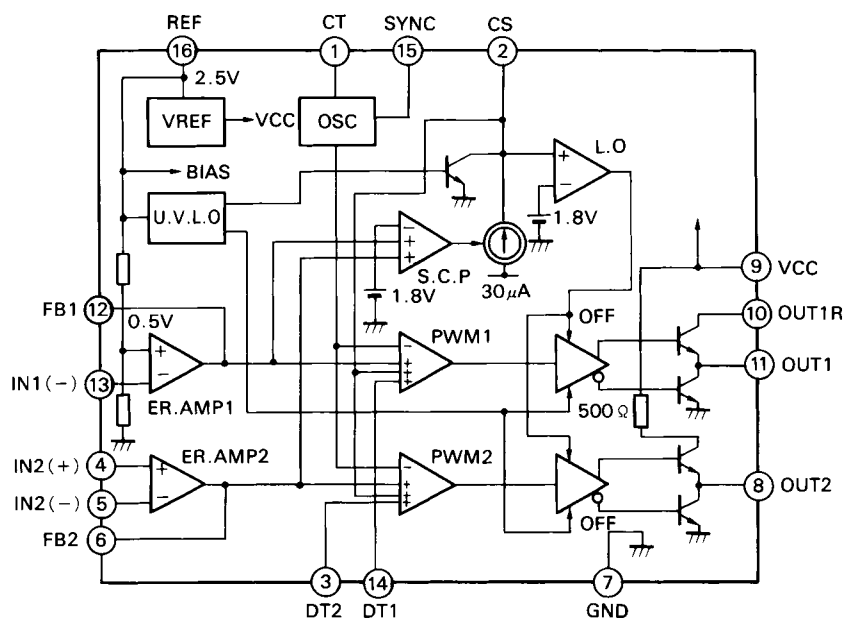
### ● SSOP-16



### ● DIP-16



## ■ Block diagram



Pin No.	Pin symbol	Description
1	CT	Oscillator timing capacitor
2	CS	Capacitor for soft-start, short-circuit protection and delay
3	DT2	Dead time adjustment
4	IN2 (+)	Non-inverting input to error amplifier
5	IN2 (-)	Inverting input to error amplifier
6	FB2	Error amplifier output
7	GND	Ground
8	OUT2	CH. 2 Output
9	VCC	Power supply
10	OUT1R	CH. 1 Current limiting resistor
11	OUT1	CH. 1 Output
12	FB1	Error amplifier output
13	IN1 (-)	Inverting input to error amplifier
14	DT1	Dead time adjustment
15	SYNC	External synchronization input
16	REF	Reference voltage output (2.5V)

### ■ Absolute maximum ratings

Item	Symbol	Rating	Unit
Supply voltage	V <sub>CC</sub>	22	V
Reference voltage output current	I <sub>OR</sub>	5	mA
Output current	I <sub>O</sub>	±50	mA
Total power dissipation	P <sub>d</sub>	400	mW
Operating temperature	T <sub>opr</sub>	-20 to +85	°C
Storage temperature	T <sub>stg</sub>	-40 to +150	°C

### ■ Recommended operating conditions

Item	Symbol	Min.	Max.	Unit
Supply voltage	V <sub>CC</sub>	3.6	20	V
Feedback resistance	R <sub>NF</sub>	100		kΩ
Oscillator timing capacitor	C <sub>T</sub>	220	22,000	pF
Oscillator timing resistance	R <sub>T</sub>	10	100	kΩ
Oscillation frequency	f <sub>osc</sub>	5	200	kHz

### ■ Electrical characteristics (T<sub>a</sub> = 25°C, V<sub>CC</sub> = 6V, R<sub>T</sub> = 47kΩ, C<sub>T</sub> = 1000pF)

#### Reference voltage section

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Output voltage	V <sub>REF</sub>	I <sub>OR</sub> = 1mA	2.383	2.432	2.481	V
Line regulation	LINE	V <sub>CC</sub> = 3.6 to 20V, I <sub>OR</sub> = 1mA		4	12	mV
Load regulation	LOAD	I <sub>OR</sub> = 0.1 to 1mA		1	6	mV
Output voltage variation due to temperature change	V <sub>TC1</sub>	T <sub>a</sub> = -20 to +25°C	-1		1	%
	V <sub>TC2</sub>	T <sub>a</sub> = +25 to +85°C	-1		1	%

#### Oscillator section

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Oscillation frequency	f <sub>OSC</sub>	C <sub>T</sub> = 1000pF, R <sub>T</sub> = 47kΩ	17	20	23	kHz
Frequency variation 1 (due to supply voltage change)	f <sub>ΔV</sub>	V <sub>CC</sub> = 3.6 to 20V		1		%
Frequency variation 2 (due to temperature change)	f <sub>ΔT</sub>	T <sub>a</sub> = -20 to +85°C		5		%
Synchronizing terminal input current	I <sub>SYNC</sub>	V <sub>SYNC</sub> = 2V		0.4	1.0	mA
Synchronizing terminal input voltage	V <sub>SYNC</sub>		1		2.5	V

#### Error amplifier section

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Reference voltage	V <sub>B</sub>		0.484	0.494	0.504	V
Input bias current	I <sub>B</sub>			5	100	nA
Open-loop voltage gain	A <sub>V</sub>		70			dB
Unity-gain bandwidth	G <sub>B</sub>			1.0		MHz
Maximum output voltage (Pin 6 and Pin 12)	V <sub>OM+</sub>	R <sub>NF</sub> = 100kΩ	V <sub>REF</sub> -0.2			V
	V <sub>OM-</sub>	R <sub>NF</sub> = 100kΩ			200	mV
Output source current (Pin 6 and Pin 12)	I <sub>OM+</sub>	V <sub>OM</sub> = 1V	40	85	200	μA

#### PWM comparator section

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Input threshold voltage (Pin 6 and Pin 12)	V <sub>TH0</sub>	Duty cycle = 0%		0.38	0.48	V
Input threshold voltage (Pin 6 and Pin 12)	V <sub>TH50</sub>	Duty cycle = 50%		0.6		V

**Dead time adjustment circuit section**

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Input bias current (Pin 3 and Pin 14)	IBDT			80	300	nA
Input threshold voltage (Pin 3 and Pin 14)	V <sub>TH DT0</sub>	Duty cycle = 0%		0.38	0.48	V
Input threshold voltage (Pin 3 and Pin 14)	V <sub>TH DT50</sub>	Duty cycle = 50%		0.60		V

**Short-circuit protection circuit section**

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Input threshold voltage (Pin 6 and Pin 12)	V <sub>TH PC</sub>		1.60	1.80	2.00	V
Charge current (Pin 2)	I <sub>CHG</sub>	Pin 2 = 0V, Pin 6, Pin 12 = 2V	18	30	42	μA
Latch-mode threshold voltage (Pin 2)	V <sub>TH LA</sub>		1.60	1.80	2.00	V

**Undervoltage lockout section**

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
OFF-to-ON threshold voltage	V <sub>TH ON</sub>			2.65		V
ON-to-OFF threshold voltage	V <sub>TH OFF</sub>			2.60		V
Voltage hysteresis	V <sub>HYS</sub>			50		mV

**Output section**

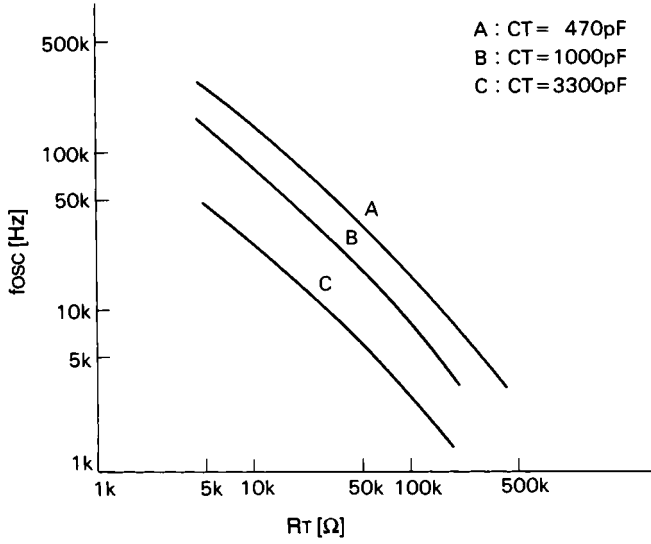
Item	Symbol	Test condition	Min.	Typ.	Max.	Unit	
Output saturation voltage	H-level (CH.1)	VO1H	Output source current = 20mA		0.3	0.8	V
	L-level (Common to CH.1 and CH.2)	VO1L/2L	Output sink current = 20mA		0.3	0.8	V
CH. 1 Output source current (Pin 11)	ISOURCE1	Pin 11 = 0V	6	11	15	mA	
CH. 2 Output source current (Pin 8)	ISOURCE2	V <sub>CC</sub> = 16V, Pin 8 = 0V	19	27	36	mA	

**Overall device**

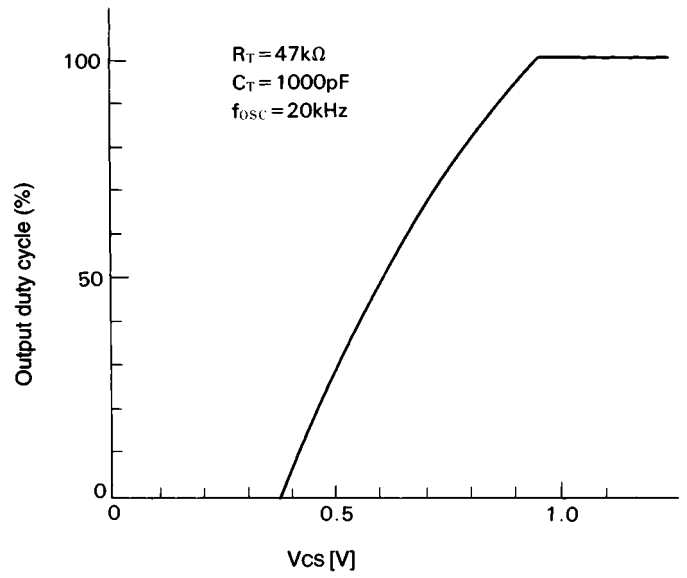
Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Supply current	I <sub>CC LA</sub>	Latch mode		2.0	3.0	mA
Operating-state supply current	I <sub>CC AV</sub>	R <sub>L</sub> = ∞ Duty cycle = 50%		3.5	6.0	mA

■ Characteristic curves (Ta = 25°C)

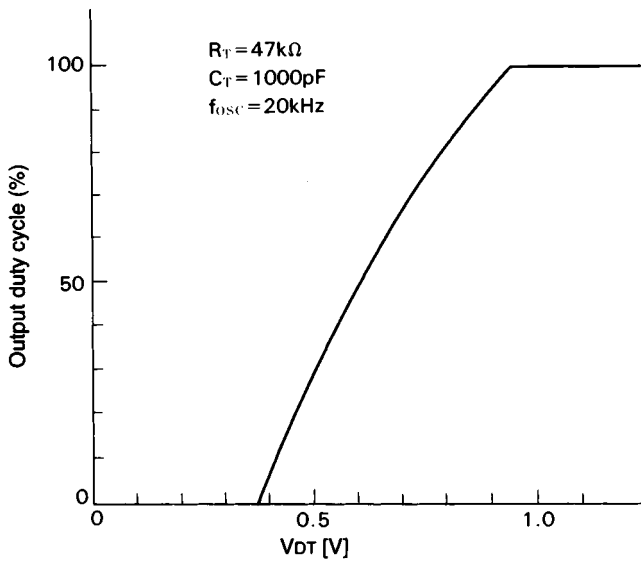
Oscillation frequency (fosc) vs. timing resistor resistance (RT)



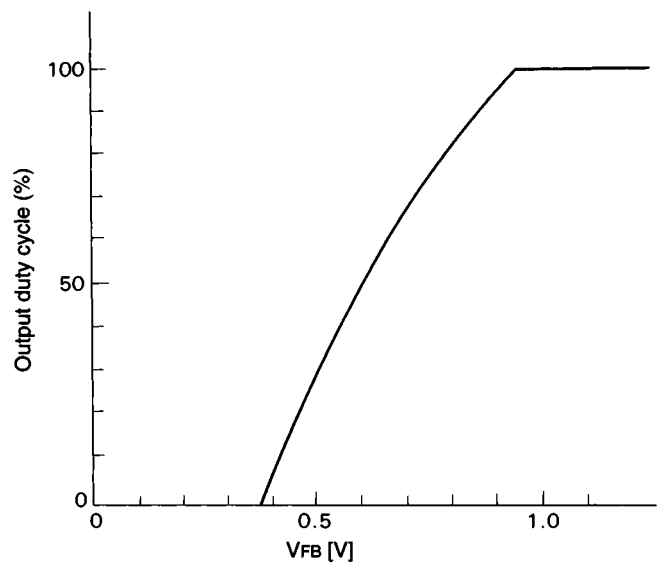
Output duty cycle vs. CS terminal voltage (Vcs)



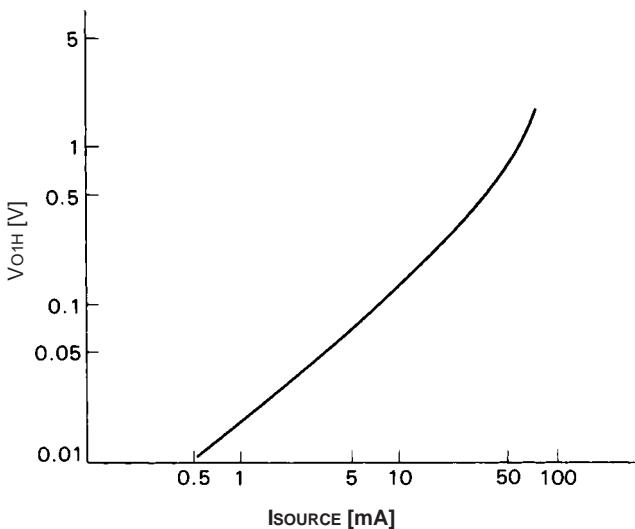
Output duty cycle vs. DT terminal voltage (VDT)



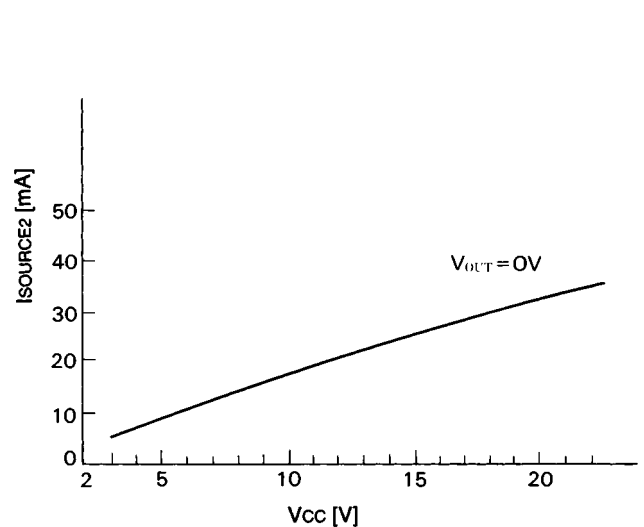
Output duty cycle vs. FB terminal voltage (VFB)



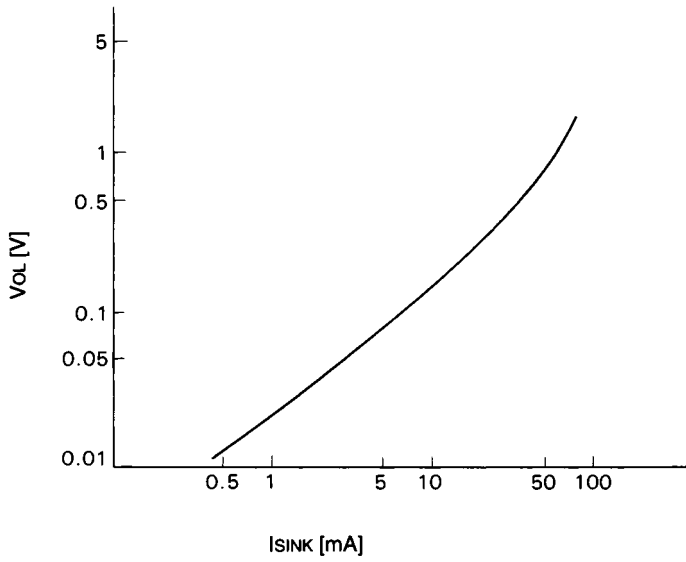
H-level output saturation voltage (VO1H) vs. CH. 1 output source current (ISOURCE1)



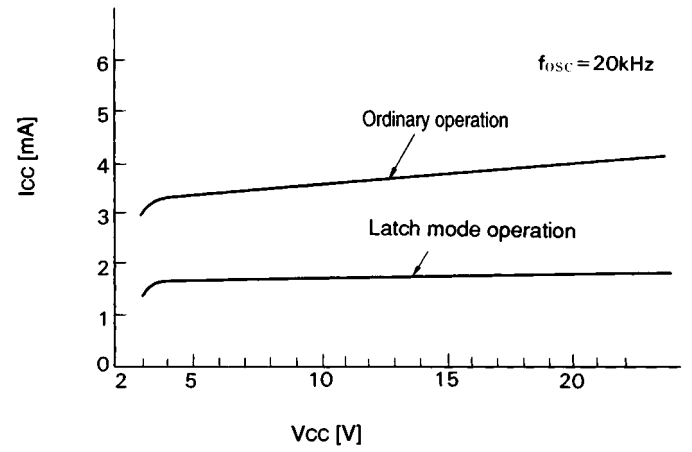
CH-2 output source current (ISOURCE2) vs. supply voltage (VCC)



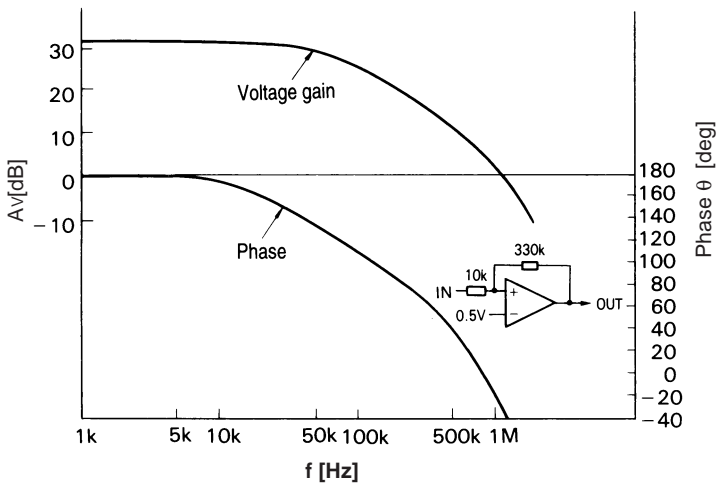
L-level output voltage (VoL) vs. output sink current (ISINK)



Supply current (Icc) vs. supply voltage (Vcc)

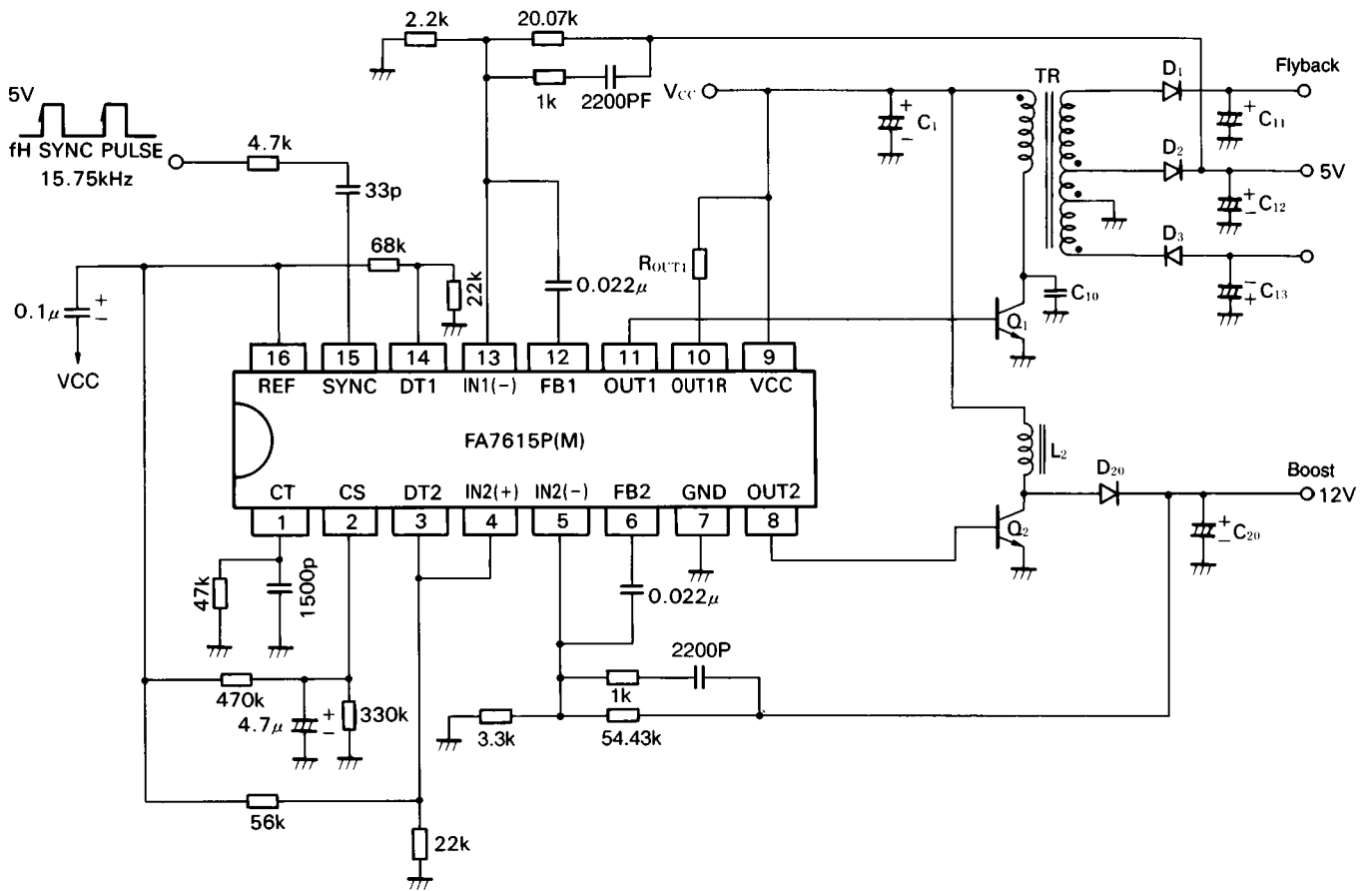


Error amplifier frequency (f) vs. voltage gain (AV)/phase (θ)



■ Application circuit

● Flyback-transformer type and chopper type boost 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.