FA7611P(M)

Bipolar IC
For Switching Power Supply Control

■ Description

The FA7611P(M) is a bipolar IC containing basic circuit necessary for PWM-type switching power supply control.

■ Features

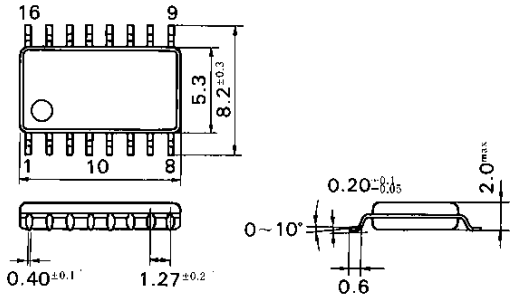
- Low-voltage operation (Vcc = 3.6 to 22V)
- Predrivers: Totem-pole output or open-collector for CH1 and open-collector output for CH2
- Latch-mode short-circuit protection function (no malfunction due to electrical noise)
- soft-start function
- Undervoltage lock-out function
- One capacitor shared for short circuit protection and for soft start to minimize the number of external discrete components

■ Applications

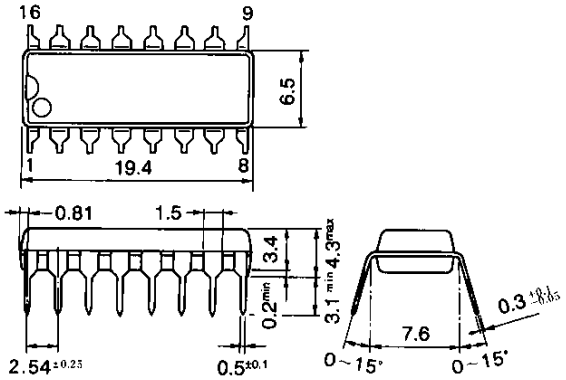
- Battery power supply for portable equipment

■ Dimensions, mm

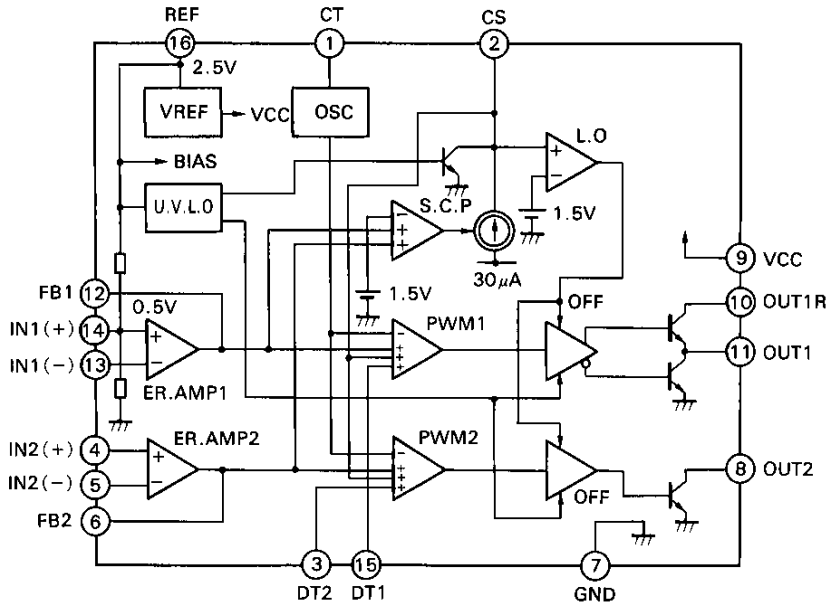
• SOP-16



• DIP-16



■ Block diagram



Pin No.	Pin symbol	Description
1	CT	Oscillator timing capacitor
2	CS	Capacitor for soft-start, short-circuit protection and deray
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	IN1 (+)	Non-inverting input to error amplifier Reference voltage (0.5V)
15	DT1	Dead time adjustment
16	REF	Reference voltage output (2.5V)

■ Absolute maximum ratings

Item	Symbol	Rating	Unit
Supply voltage	V_{CC}	22	V
Reference voltage output	I_{OR}	5	mA
Output current	Io	±50	mA
Total power dissipation	P_d	400	mW
Operating temperature	T_{opr}	–20 to +85	°C
Storage temperature	T_{stg}	–40 to +150	°C

■ Recommended operating conditions

Item	Symbol	Min.	Max.	Unit
Supply voltage	V_{CC}	3.6	20	V
Feedback resistance	R_{NF}	100		kΩ
Oscillator timing capacitor	C_T	220	22,000	pF
Oscillator timing resistance	R_T	10	100	kΩ
Oscillation frequency	fosc	5	200	kHz

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

Reference voltage section

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Output voltage	V_{REF}	I_{OR} = 1mA	2.38	2.50	2.62	V
Line regulation	L_{INE}	V_{CC} = 3.6 to 20V		4	12	mV
Load regulation	L_{OAD}	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

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Oscillation frequency	fosc	C_T = 1000pF, R_T = 33kΩ	95	115	135	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

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Reference voltage	V_B		0.45	0.50	0.55	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 6 and Pin 12)	V_{OM+}	R_{NF} = 100kΩ	V_{REF}–0.2			V
	V_{OM-}	R_{NF} = 100kΩ			200	mV
Output source current (Pin 6 and Pin 12)	I_{OM+}	V_{OM} = 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_{TH0}	Duty cycle = 0%		0.85	0.95	V
Input threshold voltage (Pin 6 and Pin 12)	V_{TH50}	Duty cycle = 50%		1.1		V

Dead time adjustment circuit section

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Input bias current (Pin 3 and Pin 15)	I_{BDT}			80	300	nA
Input threshold voltage (Pin 3 and Pin 15)	$V_{TH\ DT0}$	Duty cycle = 0%		0.22	0.32	V
Input threshold voltage (Pin 3 and Pin 15)	$V_{TH\ DT50}$	Duty cycle = 50%		0.46		V

Short-circuit protection circuit section

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Input threshold voltage (Pin 6 and Pin 12)	$V_{TH\ PC}$		1.20	1.50	1.80	V
Charge current (Pin 2)	I_{CHG}	Pin 2 = 0V, Pin 6, Pin 12 = 2V	10	30	50	μA
Latch-mode threshold voltage (Pin 2)	$V_{TH\ LA}$		1.20	1.50	1.80	V

Undervoltage lockout circuit section

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
OFF-to-ON threshold voltage	$V_{TH\ ON}$			2.65		V
ON-to-OFF threshold voltage	$V_{TH\ OFF}$			2.60		V
Voltage hysteresis	V_{HYS}			50		mV

Output section

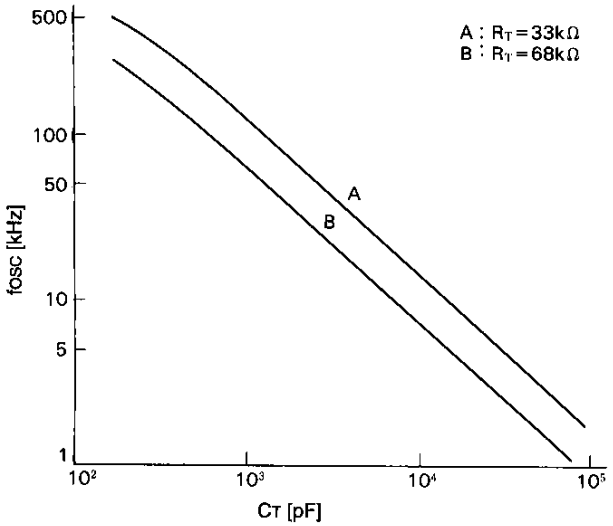
Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
CH. 1 H-level output voltage (Pin 11)	V_{O1H}	R_L = 10kΩ	3.5	4.0		V
CH. 1 L-level output voltage (Pin 11)	V_{O1L}	Output sink current = 20mA		0.25	0.65	V
CH. 1 Output source current (Pin11)	$I_{SOURCE1}$	R_{OUT1} = 680 Ω (Pin 11) = 0V	6.5	9		mA
CH. 2 L-level output voltage (Pin 8)	V_{O2L}	Output sink current = 20mA		1.0	1.5	V

Overall device

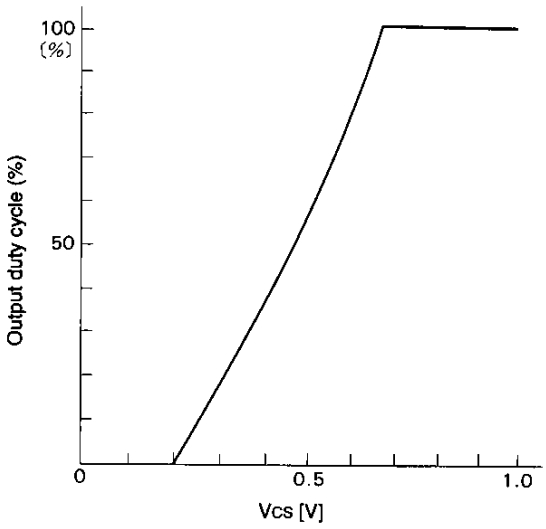
Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Supply current	$I_{CC\ LA}$	Latch mode		2.0	3.0	mA
Operating-state supply current	$I_{CC\ AV}$	R_L = ∞ Duty cycle = 50%		3.5	6.0	mA

■ Characteristic curves (Ta = 25°C)

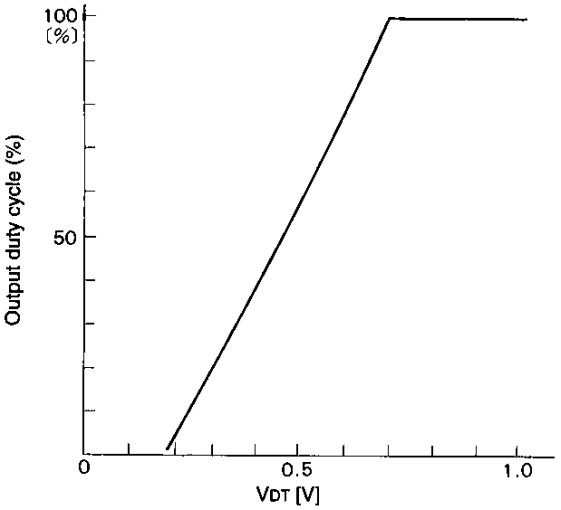
Oscillation frequency (fosc) vs. timing capacitor capacitance (C_T)



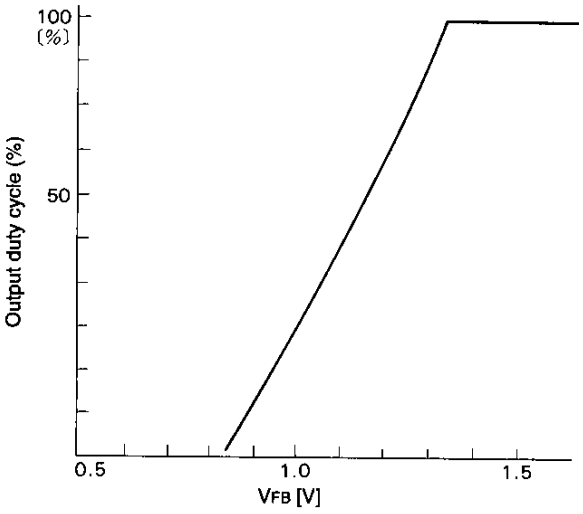
Output duty cycle vs. CS terminal voltage (V_{CS})



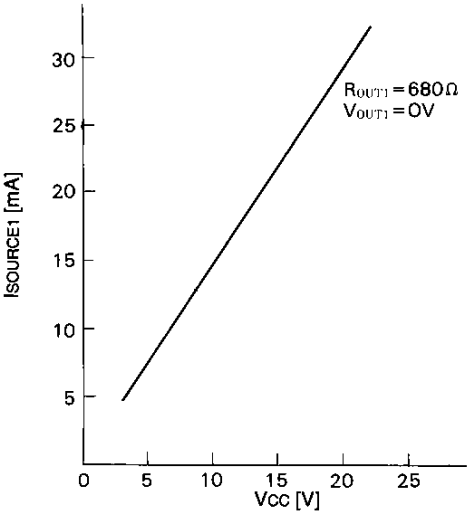
Output duty cycle vs. DT terminal voltage (V_{DT})



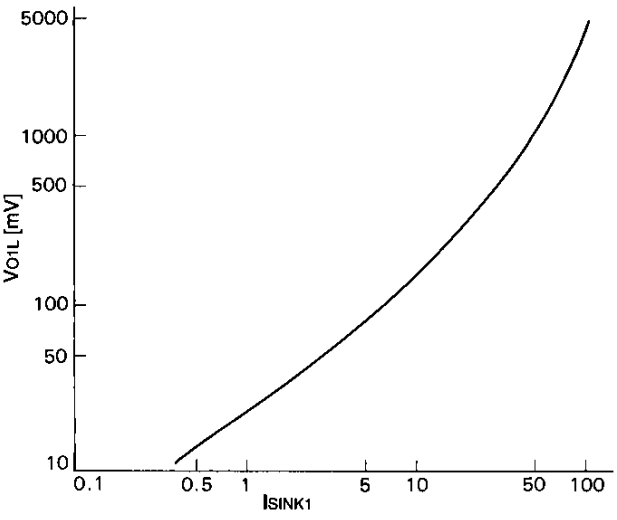
Output duty cycle vs. FB terminal voltage (V_{FB})



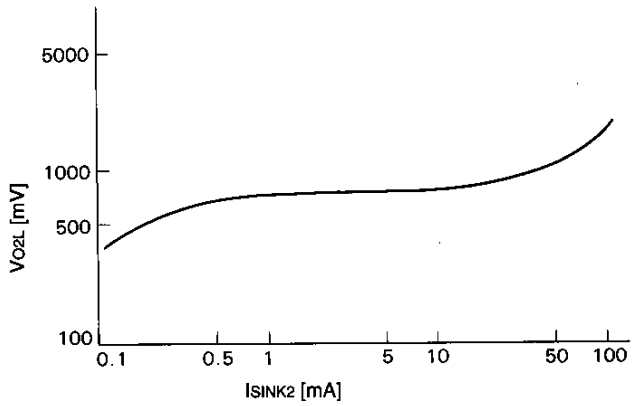
CH-1 output source current ($I_{SOURCE1}$) vs. supply voltage (V_{CC})



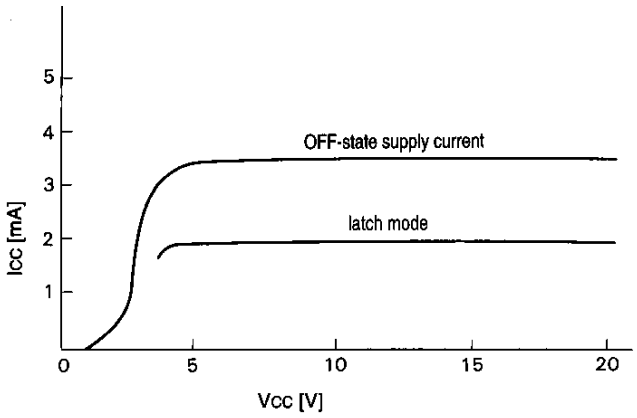
L-level output voltage (V_{O1L}) vs. CH. 1 output sink current (I_{SINK1})



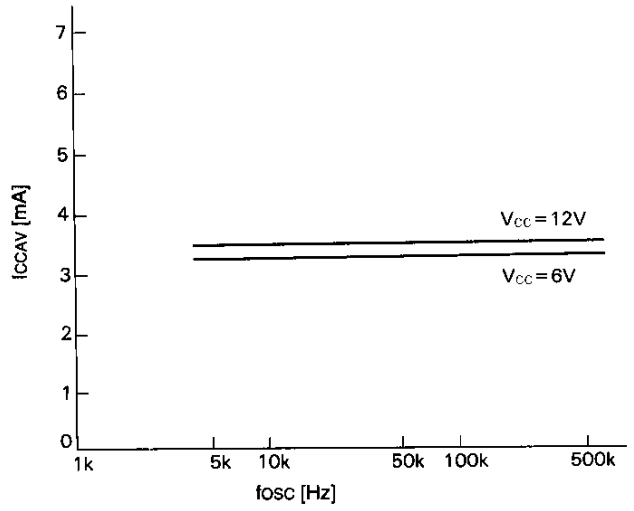
L-level output voltage (V_{O2L}) vs. CH. 2 output sink current (I_{SINK2})



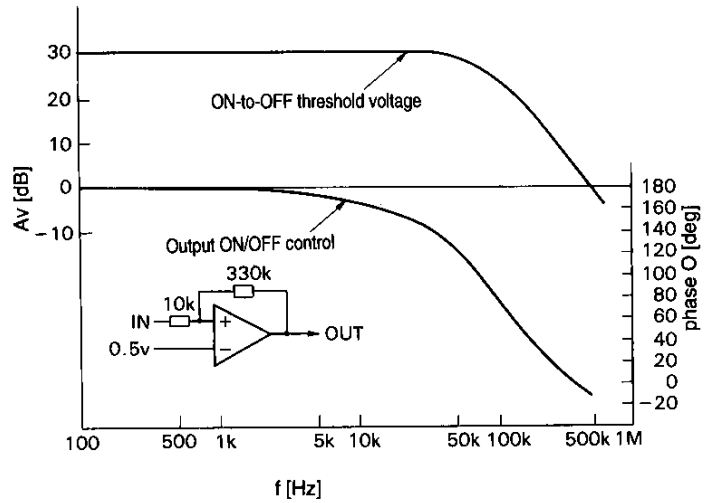
Supply current (I_{CC}) vs. supply voltage(V_{CC})



Operating-state supply current (I_{CCAV}) vs. oscillation frequency (fosc)

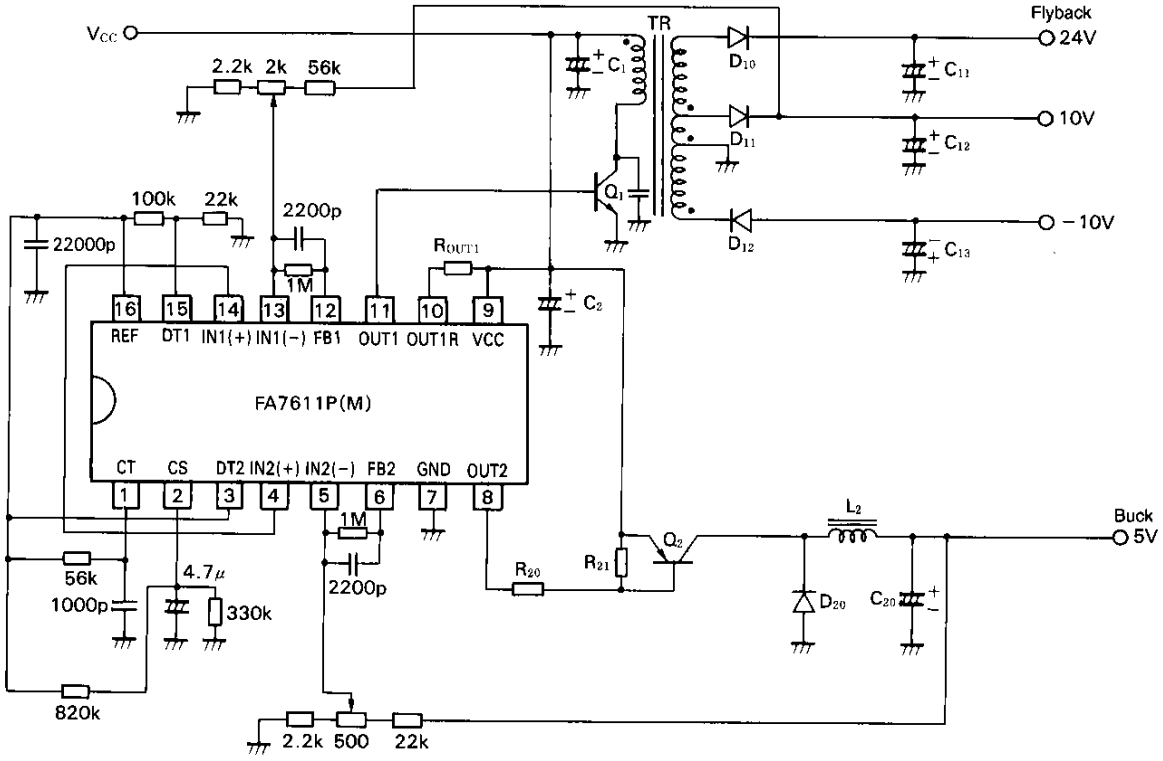


Error amplifie frequency (f) vs. valtage gain (A_V) / phase

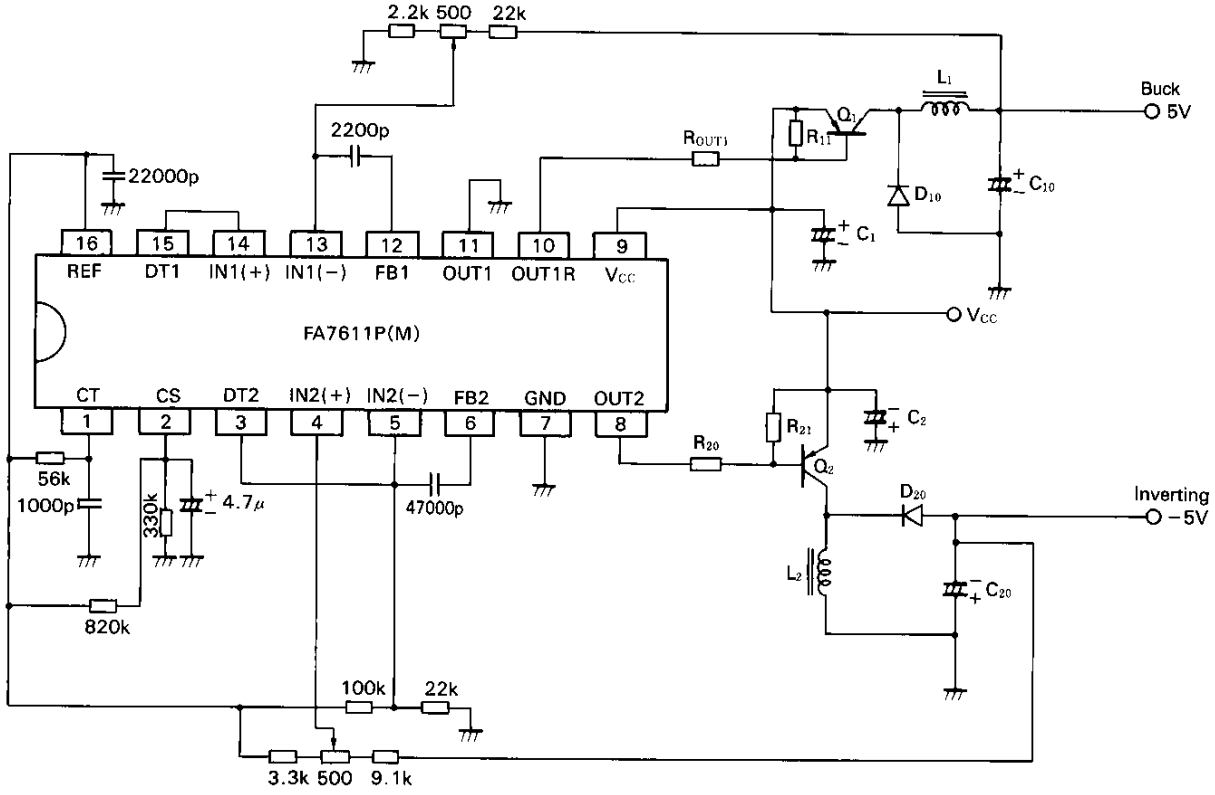


■ Application circuit

• Flyback-transformer type and chopper type buck converter circuit



• Chopper type buck converter and inverting 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.

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   - Computers
   - OA equipment
   - Communications equipment (terminal devices)
   - Measurement equipment
   - Machine tools
   - Audiovisual equipment
   - Electrical home appliances
   - Personal equipment
   - Industrial robots

   etc.

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   - Trunk communications equipment
   - Traffic-signal control equipment
   - Gas leakage detectors with an auto-shut-off feature
   - Emergency equipment for responding to disasters and anti-burglary devices
   - Safety devices

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   - Aeronautic equipment
   - Atomic control equipment
   - Submarine repeater equipment
   - Medical equipment

7.

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