

■ Description

The FA7613P(N) is a bipolar IC containing basic circuit necessary for PWM-type switching power supply control. The supply voltage range is from 2.5V.

■ Features

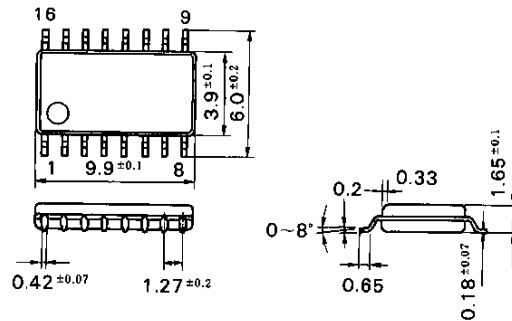
- Low-voltage operation ($V_{CC} = 2.5$ to $22V$)
- Open collector output
- Latch-mode short-circuit protection function (no malfunction due to electrical noise)
- Soft-strat function
- Output ON/OFF control function
- Low standby current (Max. $10\mu A$)
- Not many external discrete components needed

■ Applications

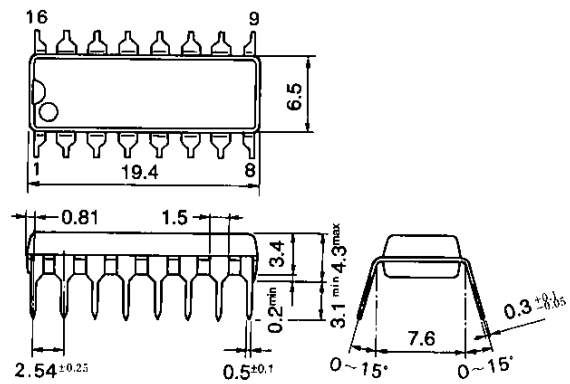
- Battery power supply for portable equipment

■ Dimensions, mm

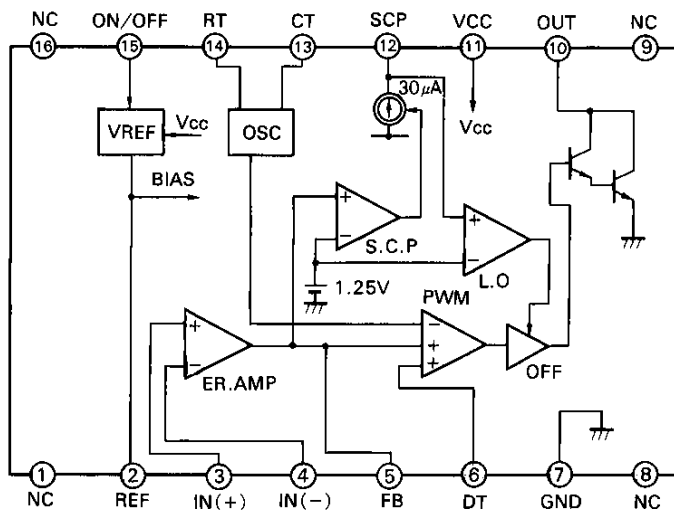
• SOP-16



• DIP-16



■ Block diagram



| Pin No. | Pin symbol | Description |
|---------|------------|--|
| 1 | NC | — |
| 2 | REF | Reference voltage output(1.25V) |
| 3 | IN (+) | Non-inverting input to error amplifier |
| 4 | IN (-) | Inverting input to error amplifier |
| 5 | FB | Error amplifier output |
| 6 | DT | Dead time adjustment |
| 7 | GND | Ground |
| 8 | NC | — |
| 9 | NC | — |
| 10 | OUT | Output |
| 11 | VCC | Power supply |
| 12 | SCP | Capacitor for short-circuit protection and delay |
| 13 | CT | Oscillator timing capacitor |
| 14 | RT | Oscillator timing resistance |
| 15 | ON/OFF | Output ON/OFF control |
| 16 | NC | — |

■ Absolute maximum ratings

| Item | Symbol | Rating | Unit |
|----------------------------------|-------------------|-------------|------|
| Supply voltage | V _{CC} | 22 | V |
| Reference voltage output current | I _{OR} | 5 | mA |
| Output sink current | I _{SINK} | 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} | 2.5 | 20 | V |
| Feedback resistance | R _{NF} | 100 | | kΩ |
| Oscillator timing capacitor | C _T | 220 | 22,000 | pF |
| Oscillator timing resistance | R _T | 4.7 | 100 | kΩ |
| Oscillation frequency | f _{osc} | 10 | 500 | kHz |

■ Electrical characteristics (T_a = 25°C, V_{CC} = 5V, f_{osc} = 100kHz)

Reference voltage section

| Item | Symbol | Test condition | Min. | Typ. | Max. | Unit |
|--|------------------|-------------------------------|------|------|------|------|
| Output voltage | V _{REF} | I _{OR} = 1mA | 1.19 | 1.25 | 1.31 | V |
| Line regulation | LINE | V _{CC} = 2.2 to 20V | | 1 | 5 | mV |
| Load regulation | LOAD | I _{OR} = 0.1 to 1mA | | 5 | 10 | mV |
| Output voltage variation due to temperature change | V _{TC1} | T _a = −20 to +25°C | −1 | | 1 | % |
| | V _{TC2} | T _a = +25 to +85°C | −1 | | 1 | % |

Oscillator section

| Item | Symbol | Test condition | Min. | Typ. | Max. | Unit |
|--|------------------|---|------|------|------|------|
| Oscillation frequency | f _{osc} | C _T = 1000pF, R _T = 4.7kΩ | 120 | 140 | 160 | kHz |
| Frequency variation 1 (due to supply voltage change) | f _{dV} | V _{CC} = 2.5 to 20V | | 2 | | % |
| Frequency variation 2 (due to temperature change) | f _{dT} | T _a = −20 to +85°C | | 4 | | % |

Error amplifier section

| Item | Symbol | Test condition | Min. | Typ. | Max. | Unit |
|--------------------------------|------------------|-------------------------|------|------|------|------|
| Input bias current | I _{B+} | Pin 3 = 1.25V | | 0.1 | 1.0 | μA |
| | I _{B−} | Pin 4 = 1.25V | | 0.1 | 1.0 | μA |
| Open-loop voltage gain | A _v | | 70 | | | dB |
| Unity-gain bandwidth | G _B | | | 1.0 | | MHz |
| Maximum output voltage (Pin 5) | V _{OM+} | R _{NF} = 200kΩ | 4.8 | | | V |
| | V _{OM−} | R _{NF} = 200kΩ | | | 200 | mV |
| Output source current (Pin 5) | I _{OM+} | V _{OM} = 1V | 25 | 50 | 100 | μA |

PWM comparator section

| Item | Symbol | Test condition | Min. | Typ. | Max. | Unit |
|---------------------------------|-------------------|------------------|------|------|------|------|
| Input threshold voltage (Pin 5) | V _{TH0} | Duty cycle = 0% | | 0.80 | 0.90 | V |
| Input threshold voltage (Pin 5) | V _{TH50} | Duty cycle = 50% | | 1.13 | | V |

Dead time adjustment circuit section

| Item | Symbol | Test condition | Min. | Typ. | Max. | Unit |
|---------------------------------|----------------------|------------------|------|------|------|------|
| Input bias current (Pin 6) | I _{BDT} | | | 0.3 | 1.0 | μA |
| Input threshold voltage (Pin 6) | V _{TH DT0} | Duty cycle = 0% | | 0.10 | 0.20 | V |
| Input threshold voltage (Pin 6) | V _{TH DT50} | Duty cycle = 50% | | 0.47 | | V |

Short-circuit protection circuit section

| Item | Symbol | Test condition | Min. | Typ. | Max. | Unit |
|---------------------------------------|--------------------|--------------------------------|------|------|------|------|
| Input threshold voltage (Pin 5) | V _{TH PC} | | 2.05 | 2.35 | 2.65 | V |
| Charge current (Pin 12) | I _{CHG} | Pin 12 = 0V, Pin 6, Pin 5 = 2V | 15 | 35 | 55 | μA |
| Latch-mode threshold voltage (Pin 12) | V _{TH LA} | | 0.90 | 1.20 | 1.50 | V |

Output section

| Item | Symbol | Test condition | Min. | Typ. | Max. | Unit |
|---------------------------------|-----------------|----------------------------|------|------|------|------|
| L-level output voltage (Pin 10) | V _{OL} | Output sink current = 20mA | | 1.0 | 1.5 | V |

Output ON/OFF circuit section

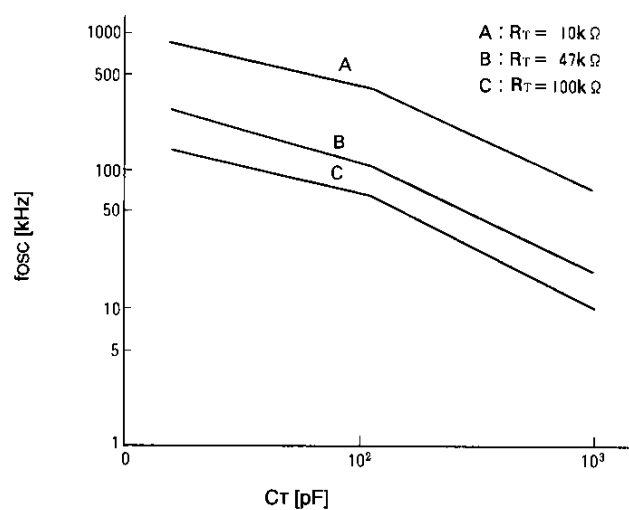
| Item | Symbol | Test condition | Min. | Typ. | Max. | Unit |
|--------------------------------------|---------------------|----------------|------|------|------|------|
| Input current (Pin 15) | I _{ON/OFF} | Pin 15 = 5V | 0.5 | 1.0 | 2.0 | mA |
| OFF-to-ON threshold voltage (Pin 15) | V _{TH ON} | | 0.6 | 0.8 | 1.0 | V |

Overall device

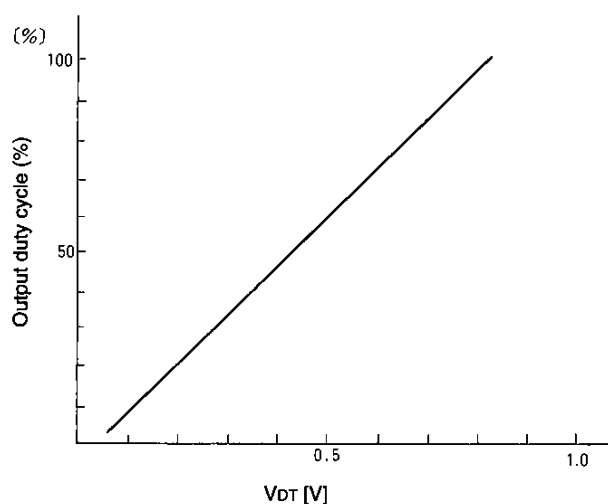
| Item | Symbol | Test condition | Min. | Typ. | Max. | Unit |
|--------------------------------|--------------------|-------------------------------------|------|------|------|------|
| Standby current | I _{CC ST} | Pin 15 = 0V | | 0.5 | 10 | μA |
| Supply current | I _{CC LA} | Latch mode | | 1.5 | 2.5 | mA |
| Operating-state supply current | I _{CC AV} | R _L = ∞ Duty cycle = 50% | | 1.8 | 4.0 | mA |

■ Characteristic curves (T_a = 25°C)

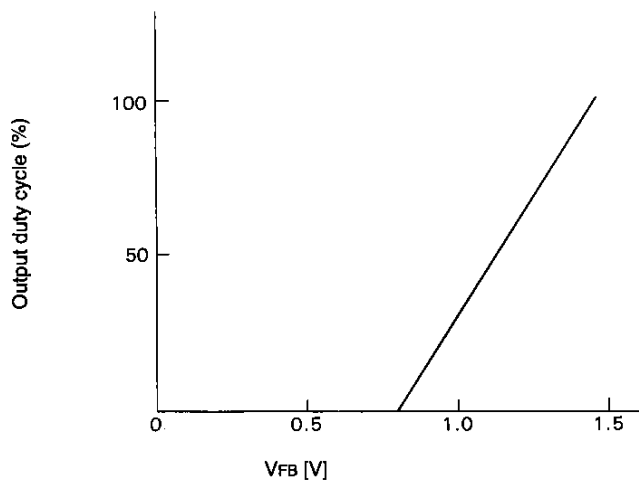
**Oscillation frequency (f_{osc}) vs.
timing capacitor capacitance (C_T)**



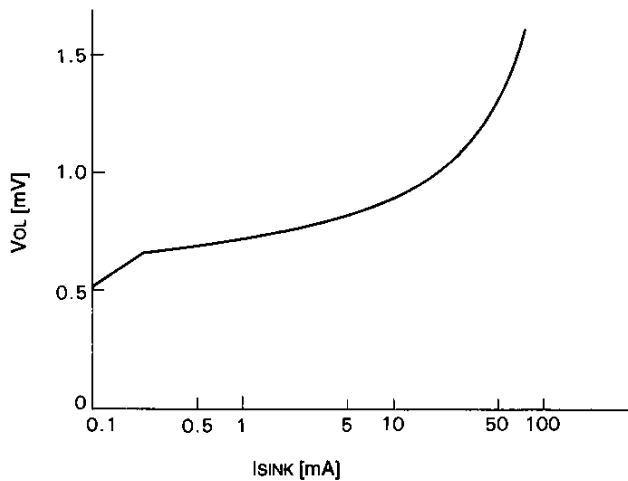
Output duty cycle vs. DT terminal voltage (V_{DT})



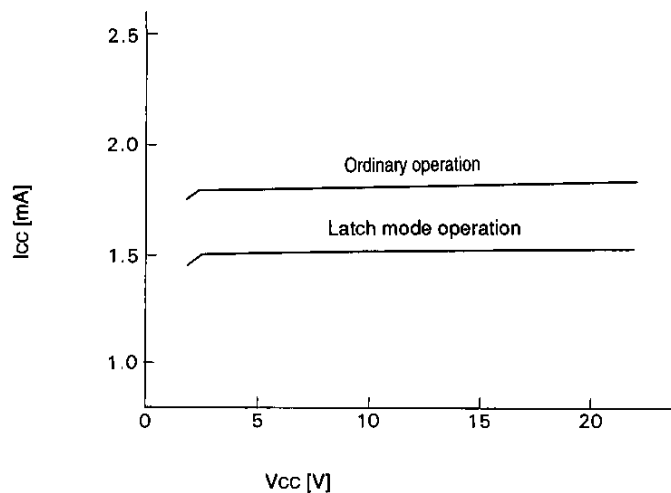
Output duty cycle vs. FB terminal voltage (V_{FB})



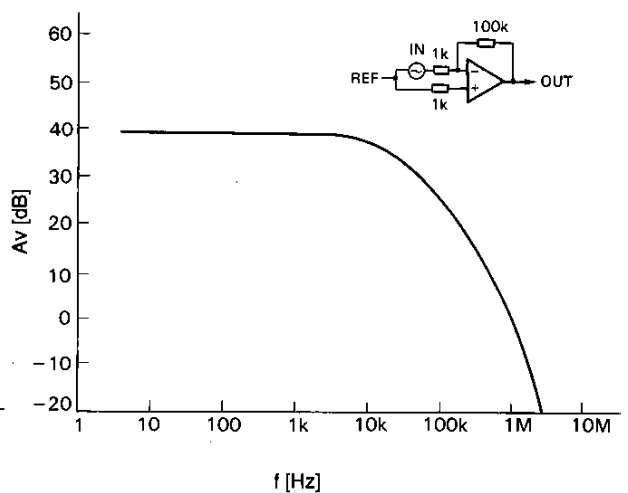
L-level output voltage (V_{OL}) vs. output sink current (I_{SINK})



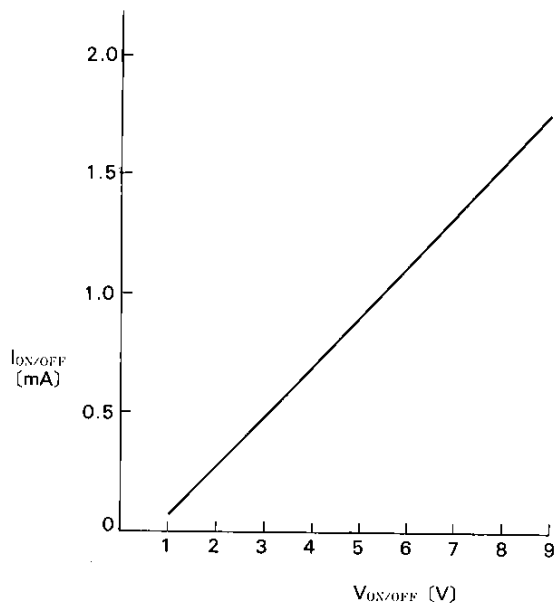
Supply current (I_{CC}) vs. supply voltage (V_{CC})



Error amplifier frequency (f) vs. voltage gain (A_v)

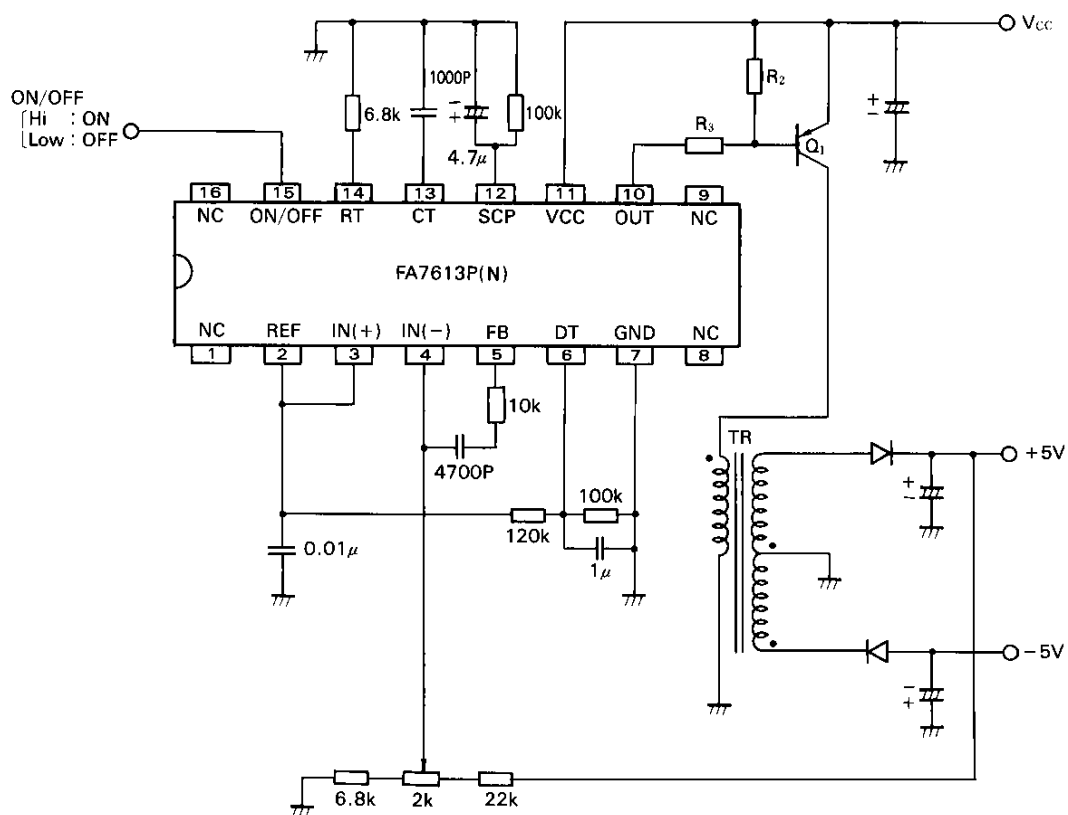


Output ON/OFF control terminal input current ($I_{ON/OFF}$) vs. voltage ($V_{ON/OFF}$)



■ Application circuit

● 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.

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