



Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

With the principle of “Quality Parts,Customers Priority,Honest Operation,and Considerate Service”,our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

We are looking forward to setting up business relationship with you and hope to provide you with the best service and solution. Let us make a better world for our industry!



## Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832

Email & Skype: info@chipsmall.com Web: www.chipsmall.com

Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China



# PQ1CZ21H2Z

## Low Dissipation Current at OFF-state Chopper Regulator

### ■ Features

1. Maximum switching current:1.5A
2. Low dissipation current at OFF-state ( $I_{qs}$ =Max. 1 $\mu$ A)
3. Built-in oscillation circuit  
(Oscillation frequency:TYP.100kHz)
4. Built-in overheat/overcurrent protection function
5. Variable output voltage  
(Output variable range: $V_{ref}$  to 35V/ $-V_{ref}$  to  $-30$ V)  
[Possible to select step-down output/inversing output according to external connection circuit]  
**PQ1CZ21H2ZZ**:sleeve-packaged product  
**PQ1CZ21H2ZP**:tape-packaged product

### ■ Applications

1. Facsimiles
2. Printers
3. Switching power supplies

### ■ Absolute Maximum Ratings (Ta=25°C)

| Parameter                          | Symbol    | Rating      | Unit |
|------------------------------------|-----------|-------------|------|
| *1 Input voltage                   | $V_{IN}$  | 40          | V    |
| Output adjustment terminal voltage | $V_{ADJ}$ | 7           | V    |
| Dropout voltage                    | $V_{I-O}$ | 41          | V    |
| *2 Output-COM voltage              | $V_{OUT}$ | -1          | V    |
| *3 ON/OFF control voltage          | $V_C$     | -0.3 to +40 | V    |
| Switching current                  | $I_{SW}$  | 1.5         | A    |
| *4 Power dissipation               | $P_D$     | 8           | W    |
| *5 Junction temperature            | $T_j$     | 150         | °C   |
| Operating temperature              | $T_{opr}$ | -40 to +85  | °C   |
| Storage temperature                | $T_{stg}$ | -40 to +150 | °C   |
| *6 Soldering temperature           | $T_{sol}$ | 260         | °C   |

\*1 Voltage between  $V_{IN}$  terminal and COM terminal

\*2 Voltage between  $V_{OUT}$  terminal and COM terminal

\*3 Voltage between ON/OFF control and COM terminal

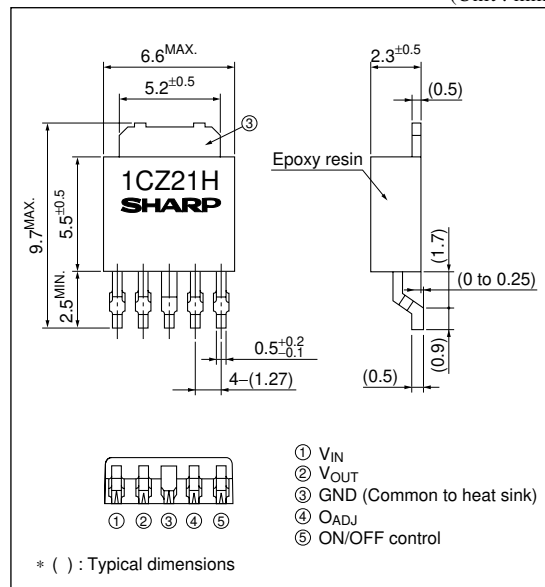
\*4  $P_D$ :With infinite heat sink

\*5 Overheat protection may operate at the condition  $T_j$ :125°C to 150°C

\*6 For 10s

### ■ Outline Dimensions

(Unit : mm)

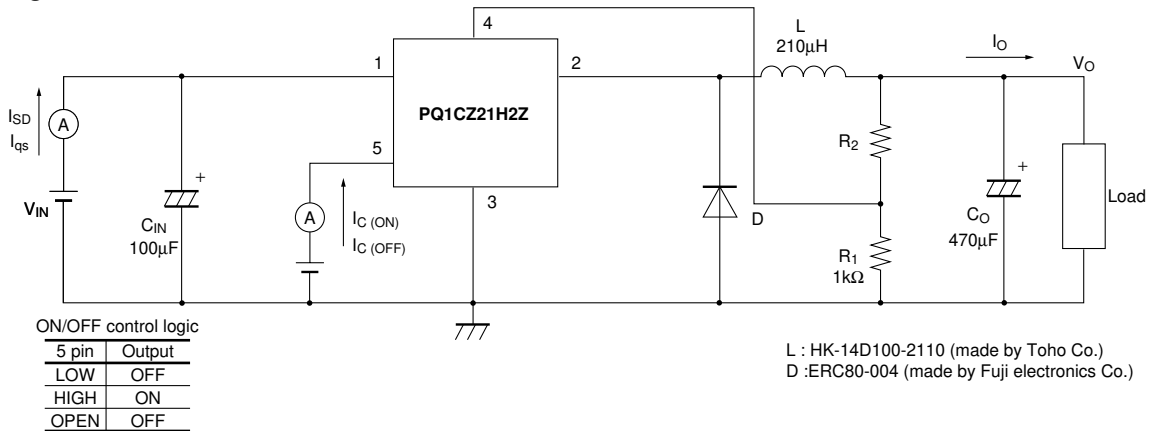


**Electrical Characteristics**

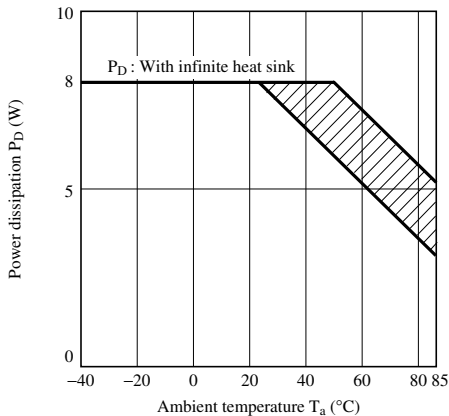
(Unless otherwise specified, condition shall be  $V_{IN}=12V$ ,  $I_o=0.2A$ ,  $V_o=5V$ , ON-OFF terminal=2.7V,  $T_a=25^\circ C$ )

| Parameter                                     | Symbol           | Conditions                   | MIN.  | TYP.      | MAX.  | Unit    |
|---|------------------|------------------------------|-------|-----------|-------|---------|
| Output saturation voltage                     | $V_{SAT}$        | $I_{sw}=1A$                  | —     | 0.9       | 1.5   | V       |
| Reference voltage                             | $V_{ref}$        | —                            | 1.235 | 1.26      | 1.285 | V       |
| Reference voltage temperature fluctuation     | $\Delta V_{ref}$ | $T_j=0$ to $125^\circ C$     | —     | $\pm 0.5$ | —     | %       |
| Load regulation                               | $ R_{egL} $      | $I_o=0.2$ to $1A$            | —     | 0.1       | 1.5   | %       |
| Line regulation                               | $ R_{egI} $      | $V_{IN}=8$ to $35V$          | —     | 0.5       | 2.5   | %       |
| Efficiency                                    | $\eta$           | $I_o=1A$                     | —     | 82        | —     | %       |
| Oscillation frequency                         | $f_o$            | —                            | 80    | 100       | 120   | kHz     |
| Oscillation frequency temperature fluctuation | $\Delta f_o$     | $T_j=0$ to $125^\circ C$     | —     | $\pm 3$   | —     | %       |
| Overcurrent detecting level                   | $I_L$            | No L, C, D                   | 1.55  | 2         | 2.6   | A       |
| ON threshold voltage                          | $V_{TH(ON)}$     | ④ terminal=0V, ⑤ terminal    | 0.8   | 1.5       | 2     | V       |
| Output ON control current                     | $I_C(ON)$        | ⑤ terminal=2.7V              | —     | —         | 200   | $\mu A$ |
| Output OFF control current                    | $I_C(OFF)$       | ⑤ terminal=0.4V              | —     | —         | 2     | $\mu A$ |
| Stand-by current                              | $I_{SD}$         | $V_{IN}=40V$ , ⑤ terminal=0V | —     | —         | 1     | $\mu A$ |
| Output OFF-state consumption current          | $I_{QS}$         | $V_{IN}=40V$ , ④ terminal=3V | —     | 8         | 12    | mA      |

**Fig.1 Standard Test Circuit**



**Fig.2 Power Dissipation vs. Ambient Temperature**



**Fig.3 Overcurrent Protection Characteristics (Typical value)**

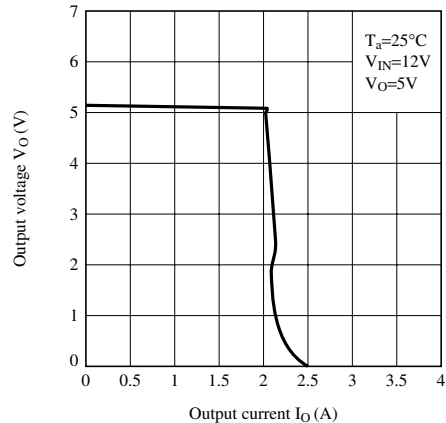


Fig.4 Efficiency vs. Input Current

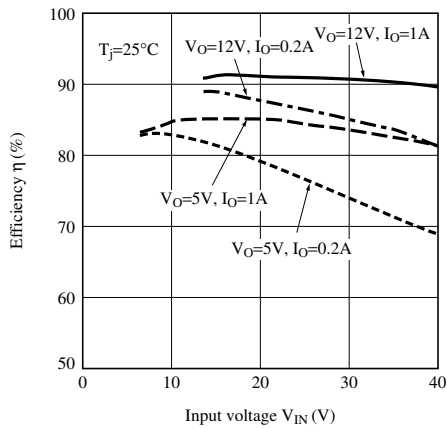


Fig.5 Switching Current vs. Output Saturation Voltage

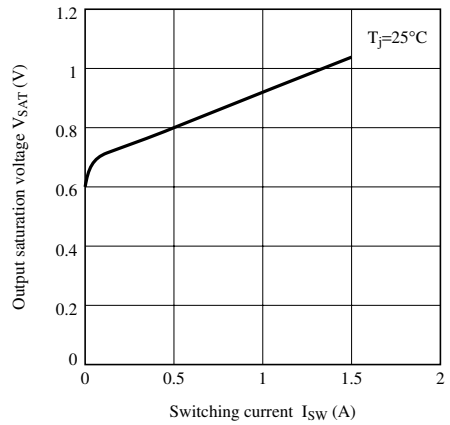


Fig.6 Reference Voltage Fluctuation vs. Junction Temperature

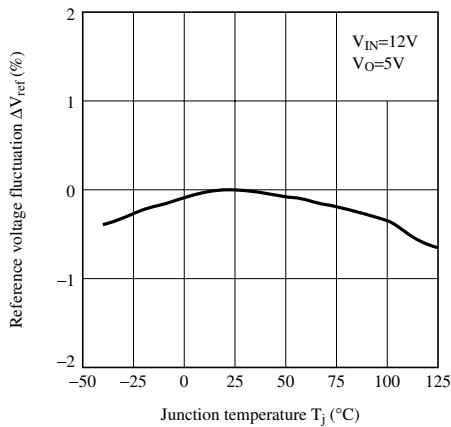


Fig.7 Load Regulation vs. Output Current

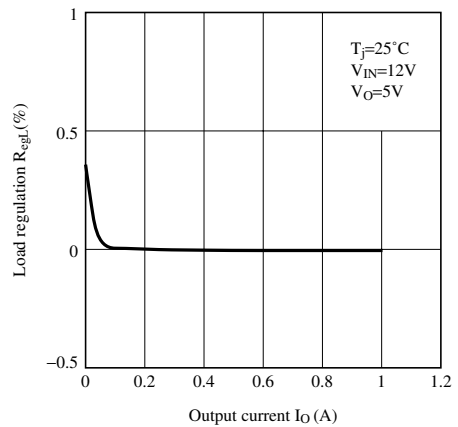


Fig.8 Line Regulation vs. Input Voltage

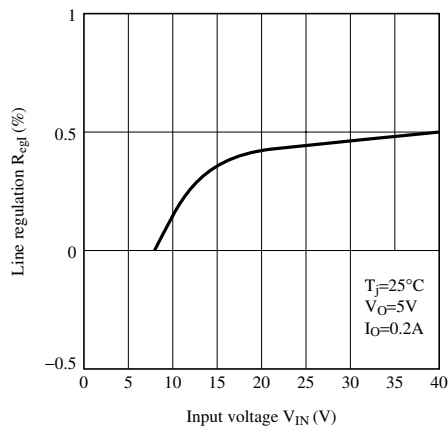
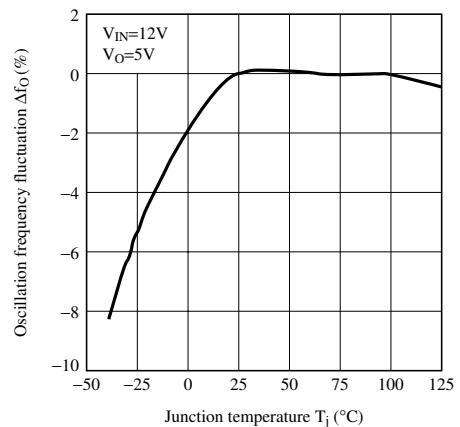
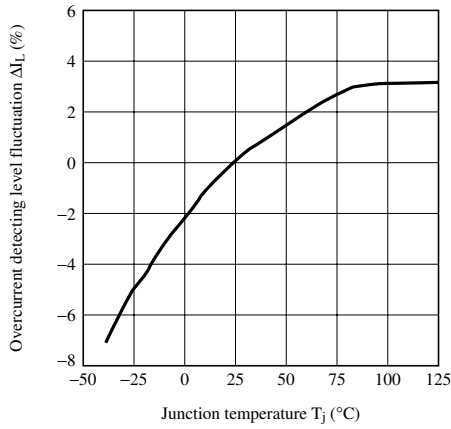


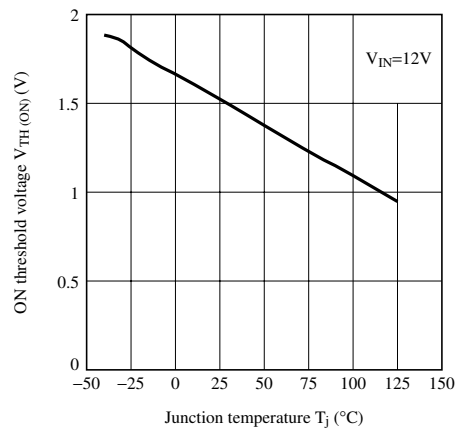
Fig.9 Oscillation Frequency Fluctuation vs. Junction Temperature



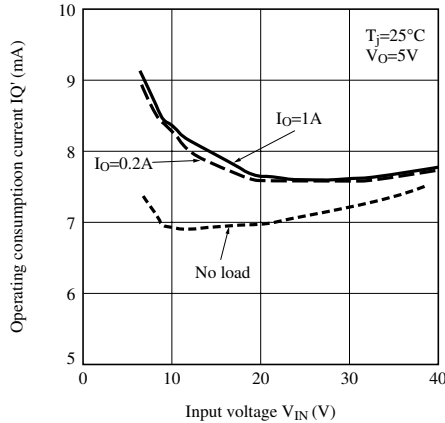
**Fig.10 Overcurrent Detection Level Fluctuation vs. Junction Temperature**



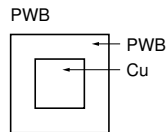
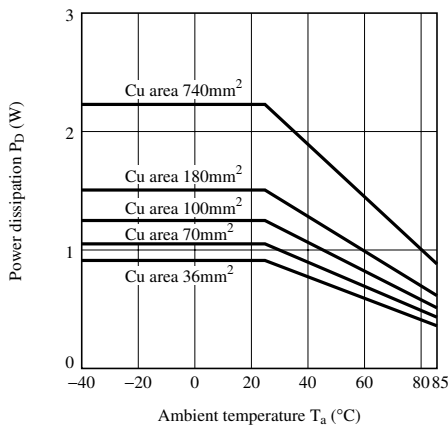
**Fig.11 ON Threshold Voltage vs. Junction Temperature**



**Fig.12 Operating Consumption Current vs. Input Voltage**



**Fig.13 Power Dissipation vs. Ambient Temperature (Typical Value)**



Material : Glass-cloth epoxy resin  
 Size : 50×50×1.6mm  
 Cu thickness : 35μm

Fig.14 Block Diagram

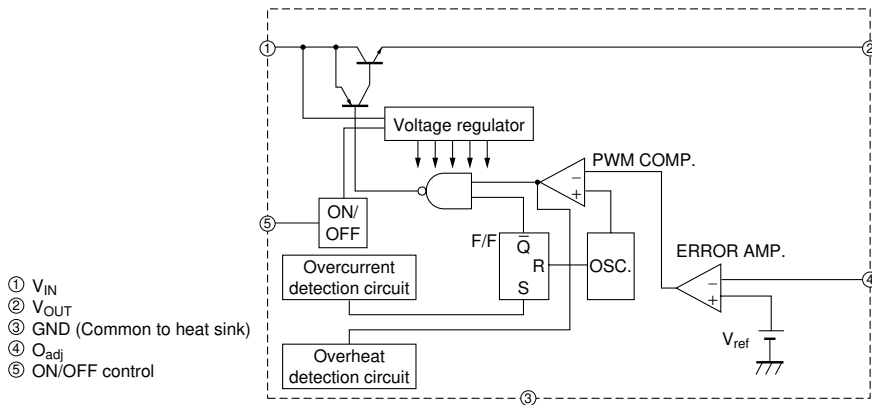


Fig.15 Step Down Type Circuit Diagram (5V output)

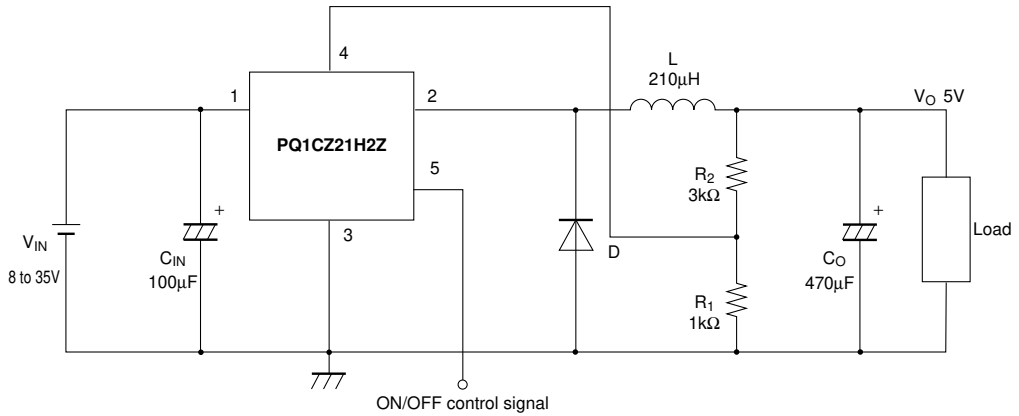
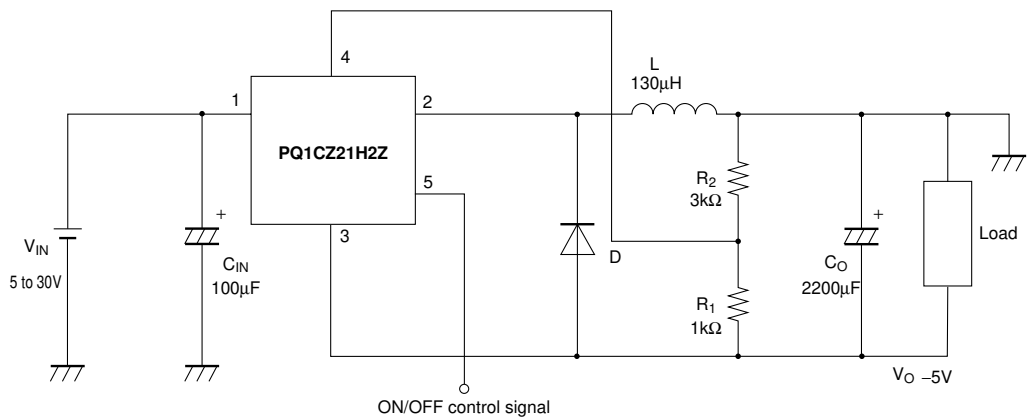


Fig.16 Polarity Inversion Type Circuit Diagram (-5V output)



## ■ Precautions for Use

### 1. External connection

- (1) Wiring condition is very important. Noise associated with wiring inductance may cause problems.

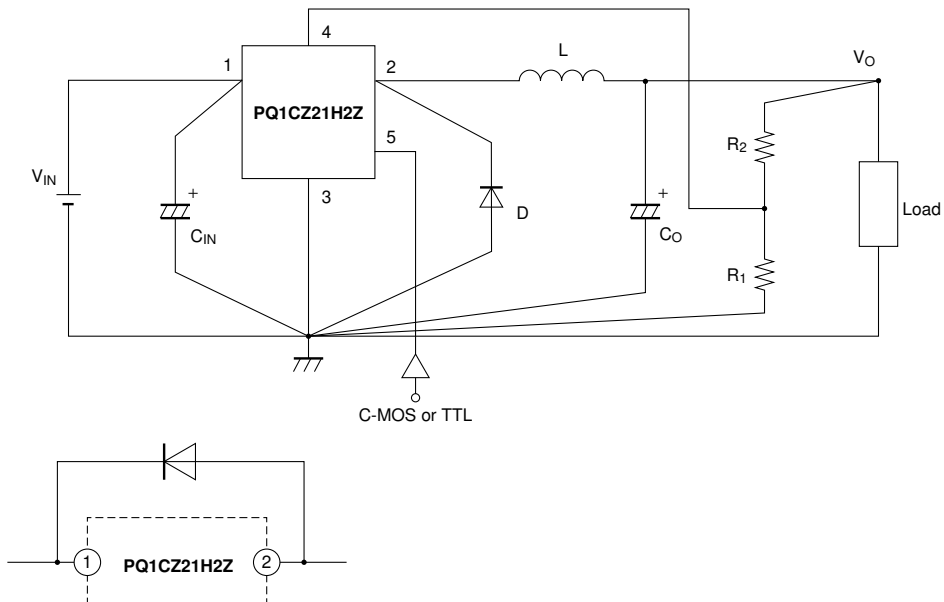
For minimizing inductance, it is recommended to design the thick and short pattern (between large current diodes, input/output capacitors, and terminal 1,2.) Single-point grounding (as indicated) should be used for best results.

- (2) High switching speed and low forward voltage type schottky barrier diode should be recommended for the catch-diode D because it affects the efficiency. Please select the diode which the current rating is at least 1.2 times greater than maximum switching current.

- (3) The output ripple voltage is highly influenced by ESR(Equivalent Series Resistor)of output capacitor, and can be minimized by selecting Low ESR capacitor.

- (4) An inductor should not be operated beyond its maximum rated current so that it may not saturate.

- (5) When voltage that is higher than  $V_{IN}$  ①, is applied to  $V_{OUT}$  ②, there is the case that the device is broken. Especially, in case  $V_{IN}$  ① is shorted to GND in normal condition, there is the case that the device is broken since the charged electric charge in output capacitor ( $C_o$ ) flows into input side. In such case a schottky barrier diode or a silicon diode shall be recommended to connect as the following circuit.



## ■ Thermal Protection Design

Internal power dissipation(P)of device is generally obtained by the following equation.

$$P=I_{sw}(\text{Average.}) \times V_{SAT} \times D' + V_{IN}(\text{voltage between } V_{IN} \text{ to COM terminal}) \times I_Q'(\text{consumption current})$$

Step down type

$$D'(\text{Duty}) = \frac{T_{on}}{T(\text{period})} = \frac{V_O + V_F}{V_{IN} - V_{SAT} + V_F}$$

$$I_{sw}(\text{Average}) = I_O(\text{Output current.})$$

Polarity inversion type

$$D'(\text{Duty}) = \frac{T_{on}}{T(\text{period})} = \frac{|V_O| + V_F}{V_{IN} + |V_O| - V_{SAT} + V_F}$$

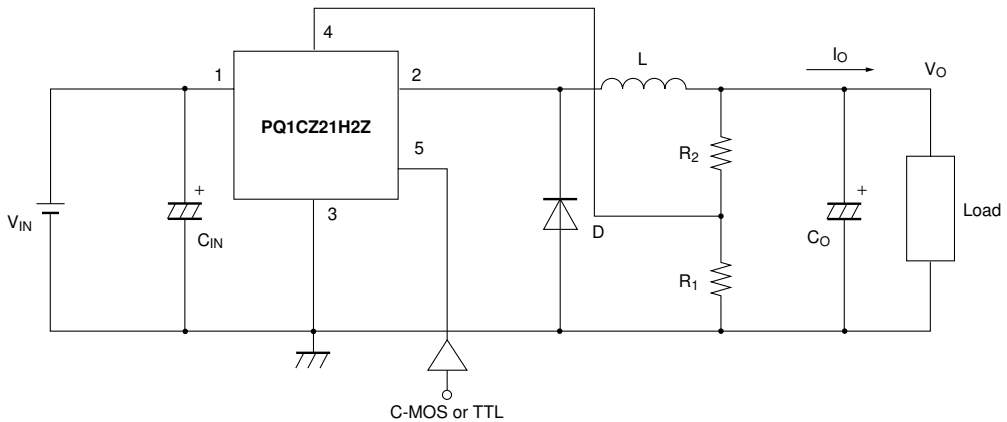
$$I_{sw}(\text{Average}) = \frac{1}{1-D'} \times I_O(\text{Output current.})$$

$V_F$  : Forward voltage of the diode

When ambient temperature  $T_a$  and power dissipation  $P_D(\text{MAX})$  during operation are determined, use Cu plate which allows the element to operate within the safety operation area specified by the derating curve. Insufficient radiation gives an unfavorable influence to the normal operation and reliability of the device.

## ■ ON/OFF Control Terminal

1. In the following circuit, when ON/OFF control terminal ⑤ becomes low by switching transistor  $T_r$  on, output voltage may be turned OFF and the device becomes stand-by mode. Dissipation current at stand-by mode becomes Max.  $1\mu\text{A}$ .
2. ON/OFF control terminal ⑤ is compatible with LS-TTL. It enables to be directly drive by TTL or C-MOS standard logic (RCA4000 series). If ON/OFF control terminal is not used, it is recommended to directly connect applicable terminals with input terminal.





### NOTICE

- The circuit application examples in this publication are provided to explain representative applications of SHARP devices and are not intended to guarantee any circuit design or license any intellectual property rights. SHARP takes no responsibility for any problems related to any intellectual property right of a third party resulting from the use of SHARP's devices.
- Contact SHARP in order to obtain the latest device specification sheets before using any SHARP device. SHARP reserves the right to make changes in the specifications, characteristics, data, materials, structure, and other contents described herein at any time without notice in order to improve design or reliability. Manufacturing locations are also subject to change without notice.
- Observe the following points when using any devices in this publication. SHARP takes no responsibility for damage caused by improper use of the devices which does not meet the conditions and absolute maximum ratings to be used specified in the relevant specification sheet nor meet the following conditions:
  - (i) The devices in this publication are designed for use in general electronic equipment designs such as:
    - Personal computers
    - Office automation equipment
    - Telecommunication equipment [terminal]
    - Test and measurement equipment
    - Industrial control
    - Audio visual equipment
    - Consumer electronics
  - (ii) Measures such as fail-safe function and redundant design should be taken to ensure reliability and safety when SHARP devices are used for or in connection with equipment that requires higher reliability such as:
    - Transportation control and safety equipment (i.e., aircraft, trains, automobiles, etc.)
    - Traffic signals
    - Gas leakage sensor breakers
    - Alarm equipment
    - Various safety devices, etc.
  - (iii) SHARP devices shall not be used for or in connection with equipment that requires an extremely high level of reliability and safety such as:
    - Space applications
    - Telecommunication equipment [trunk lines]
    - Nuclear power control equipment
    - Medical and other life support equipment (e.g., scuba).
- Contact a SHARP representative in advance when intending to use SHARP devices for any "specific" applications other than those recommended by SHARP or when it is unclear which category mentioned above controls the intended use.
- If the SHARP devices listed in this publication fall within the scope of strategic products described in the Foreign Exchange and Foreign Trade Control Law of Japan, it is necessary to obtain approval to export such SHARP devices.
- This publication is the proprietary product of SHARP and is copyrighted, with all rights reserved. Under the copyright laws, no part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, for any purpose, in whole or in part, without the express written permission of SHARP. Express written permission is also required before any use of this publication may be made by a third party.
- Contact and consult with a SHARP representative if there are any questions about the contents of this publication.