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. 1μA)
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 –30V)
   [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

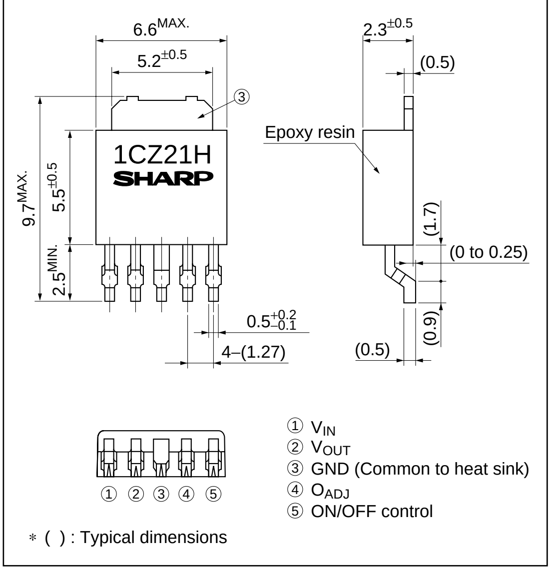
(Ta=25°C)

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)

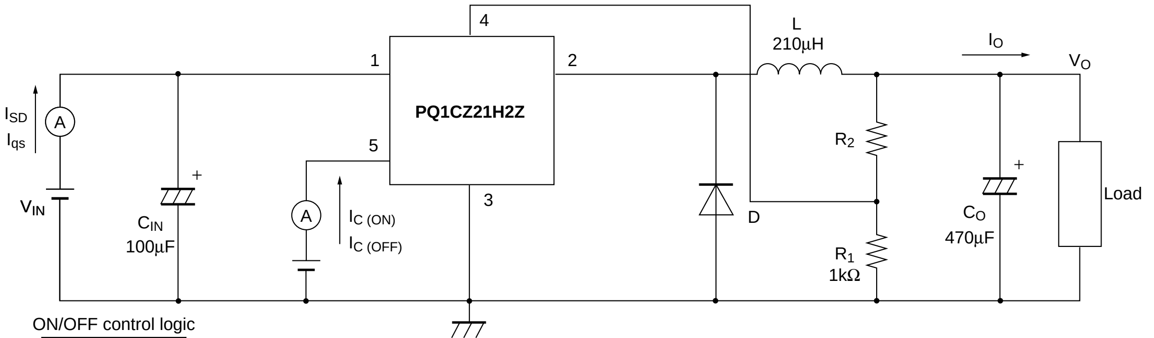


■ Electrical Characteristics

(Unless otherwise specified, condition shall be V_{IN}=12V, I_O=0.2A, V_O=5V, ON-OFF terminal=2.7V, Ta=25˚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	ΔV_{ref}	T_j=0 to 125˚C	–	±0.5	–	%
Load regulation	$\|R_{eg}L\|$	I_O=0.2 to 1A	–	0.1	1.5	%
Line regulation	$\|R_{eg}I\|$	V_{IN}=8 to 35V	–	0.5	2.5	%
Efficiency	η	I_O=1A	–	82	–	%
Oscillation frequency	f_O	–	80	100	120	kHz
Oscillation frequency temperature fluctuation	Δf_O	T_j=0 to 125˚C	–	±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, ⑤terminal	0.8	1.5	2	V
Output ON control current	$I_{C\,(ON)}$	⑤ terminal=2.7V	–	–	200	μA
Output OFF control current	$I_{C\,(OFF)}$	⑤ terminal=0.4V	–	–	2	μA
Stand-by current	I_{SD}	V_{IN}=40V, ⑤ terminal=0V	–	–	1	μA
Output OFF-state consumption current	I_{QS}	V_{IN}=40V, ④ terminal=3V	–	8	12	mA

Fig.1 Standard Test Circuit

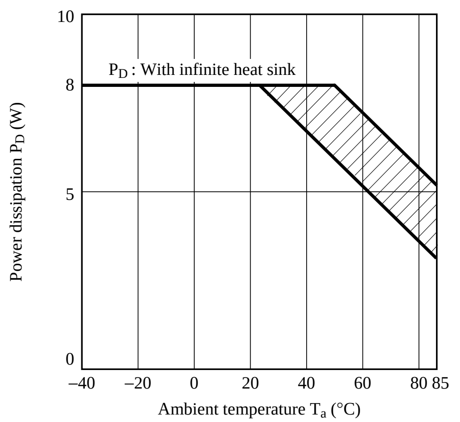


ON/OFF control logic

5 pin	Output
LOW	OFF
HIGH	ON
OPEN	OFF

L : HK-14D100-2110 (made by Toho Co.)
D :ERC80-004 (made by Fuji electronics Co.)

Fig.2 Power Dissipation vs. Ambient Temperature



Note) Oblique line prtion:Overheat protection may operate in this area

Fig.3 Overcurrent Protection Characteristics (Typical value)

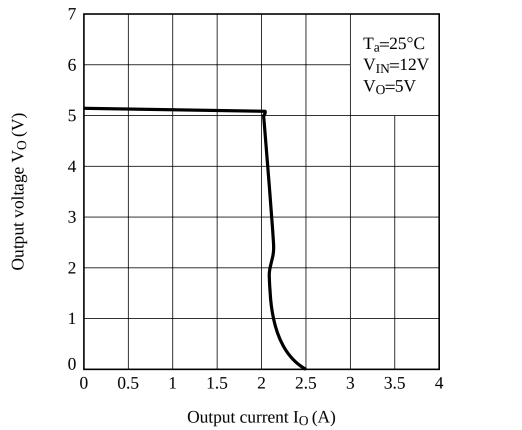


Fig.4 Efficiency vs. Input Current

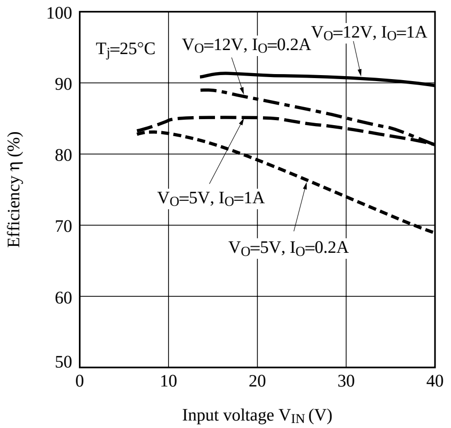


Fig.5 Switching Current vs. Output Saturation Voltage

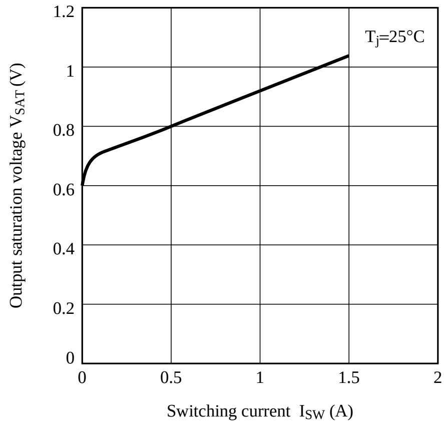


Fig.6 Reference Voltage Fluctuation vs. Junction Temperature

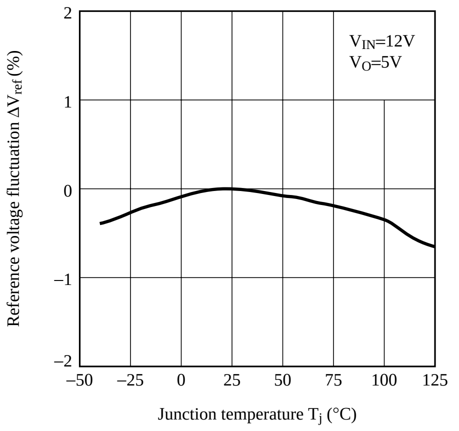


Fig.7 Load Regulation vs. Output Current

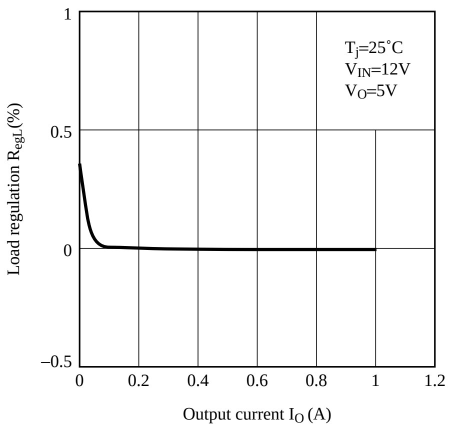


Fig.8 Line Regulation vs. Input Voltage

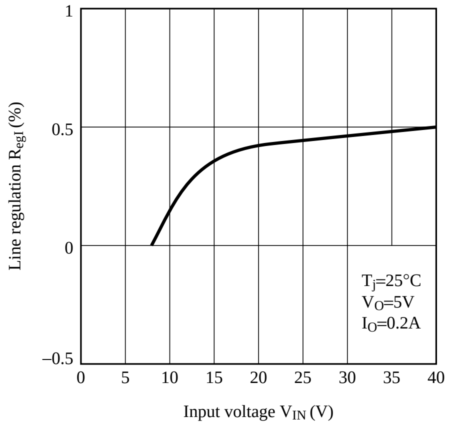


Fig.9 Oscillation Frequency Fluctuation vs. Junction Temperature

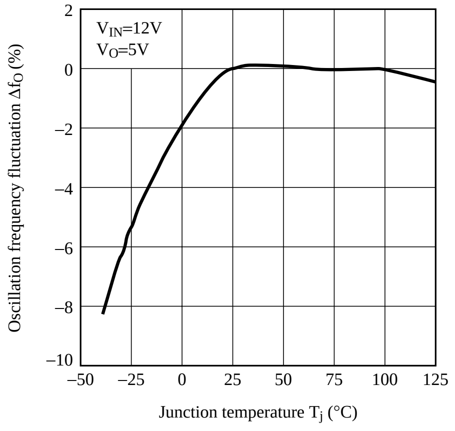


Fig.10 Overcurrent Detection Level Fluctuation vs. Junction Temperature

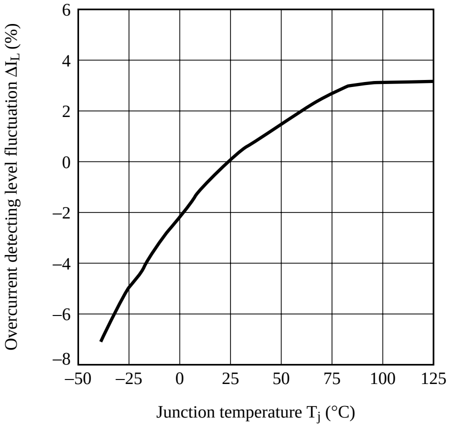


Fig.11 ON Threshold Voltage vs. Junction Temperature

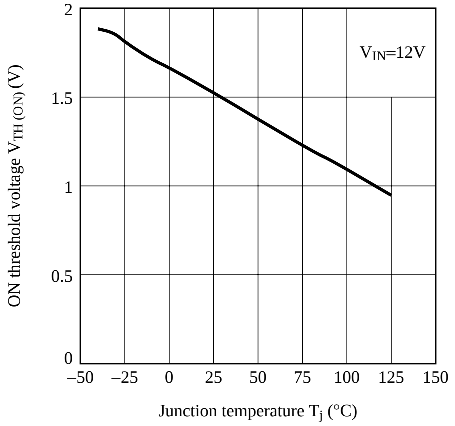


Fig.12 Operating Consumption Current vs. Input Voltage

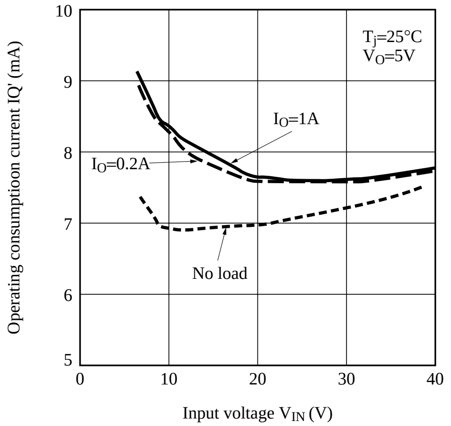
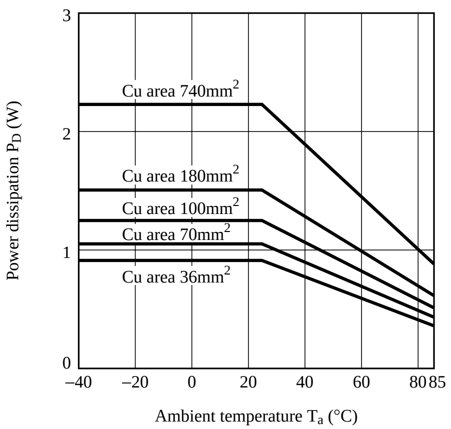
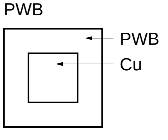


Fig.13 Power Dissipation vs. Ambient Temperature (Typical Value)





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

Fig.14 Block Diagram

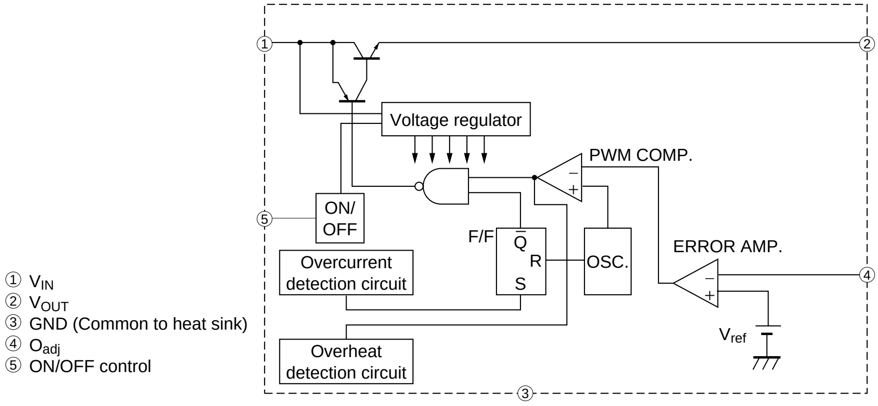


Fig.15 Step Down Type Circuit Diagram (5V output)

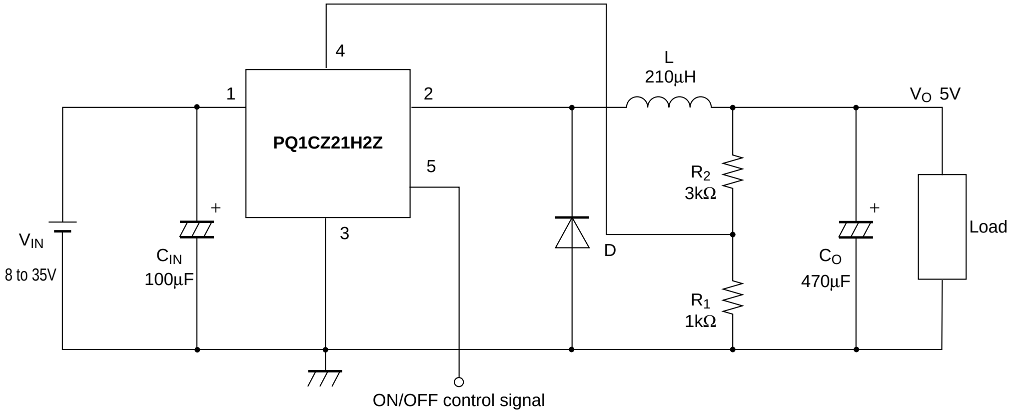
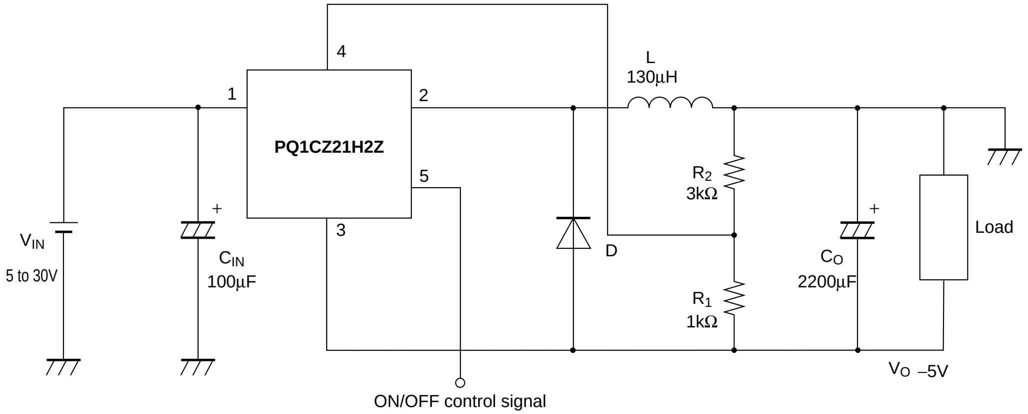


Fig.16 Polarity Inversion Type Circuit Diagram (-5V output)



■ Precautions for Use

1. External connection

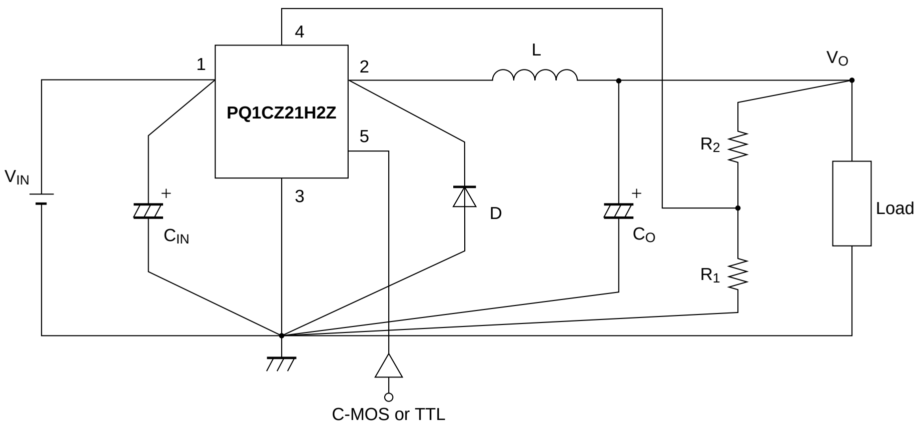
(1) Wiring condition is very important. Noise associated with wiring inductance may cause problems. For minimizing inductance, it is recommended to design the thick and short pattern (between large current diodos, input/output capacitors, and terminal 1,2.) Single-point grounding (as indicated) should be used for best results.

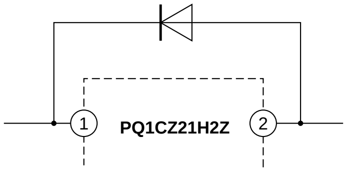
(2) High switching speed and low forward voltage type schottky barrier diode should be recommended for the catch-diode D because it affects the efficiency. Please select the diode which the current rating is at least 1.2 times greater than maximum swiching current.

(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} ①is 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 schottly 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

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

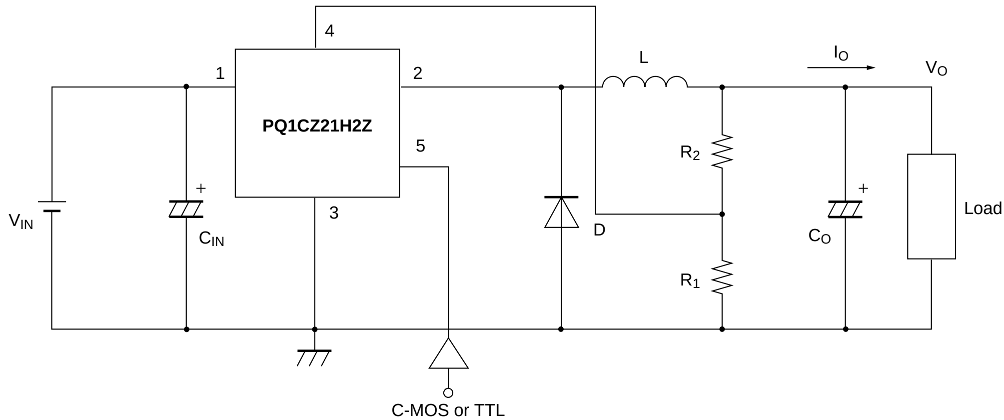
$$I_{SW}(\text{Average}) = \frac{1}{1 - D'} \times I_O(\text{Output current.})$$

V_F : Forward voltage of the diode

When ambient temperature Ta and power dissipation P_D(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.1µA.
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.



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  - Office automation equipment
  - Telecommunication equipment [terminal]
  - Test and measurement equipment
  - Industrial control
  - Audio visual equipment
  - Consumer electronics

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  - Traffic signals
  - Gas leakage sensor breakers
  - Alarm equipment
  - Various safety devices, etc.

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