PQ05RF1/11/1V 1A/1B Series

1A Output, Low Power-Loss Voltage Regulators

■ General Description

The sharp's PQ05RF1/PQ05RF11/PQ05RF1V series 4-terminal low power-loss voltage regulators provide 1A output and employ the compact full-mold package. They are multi-function regulators with overcurrent protection function and overheat protection function. They are best suited to constant voltage power supply for various electronic equipment, such as VCRs and electronic musical instruments.

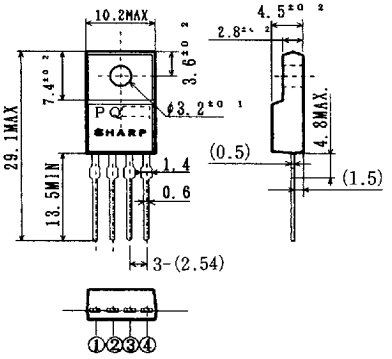
■ Features

(1) Compact resin full-mold package.
(2) Low power-loss (voltage difference between input and output : MAX. 0.5V)
(3) With ON/OFF control terminal (PQ05RF1/PQ05RF11 series)
(4) With output voltage minute adjustment terminal (Critical rate of ripple rejection is improved.) (PQ05RF1V series)
(5) Lead forming type (PQ05RF1A/1B series) is also available.

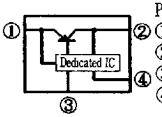
■ Model Line-ups

	5Voutput	9Voutput	12Voutput
Output voltage precision : ±5%	PQ05RF1	PQ09RF1	PQ12RF1
Output voltage precision : ±2.5%	PQ05RF11	PQ09RF11	PQ12RF11
Minute adjustment (Output voltage adjustment range : ±10%)	PQ05RF1V	PQ09RF1V	PQ12RF1V

■ Outline Dimensions (Unit : mm)



Internal terminal connection



PQ05RF1/PQ05RF11 series
① ② ① DC input (V_{in})
② DC output (V_o)
③ GND
④ ③ GND
④ ON/OFF control terminal (V_c)

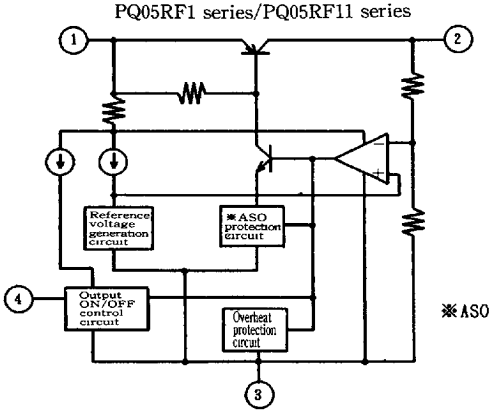
PQ05RF1V series
① DC input (V_{in})
② DC output (V_o)
③ GND
④ Output voltage minute adjustment terminal

■ Applications

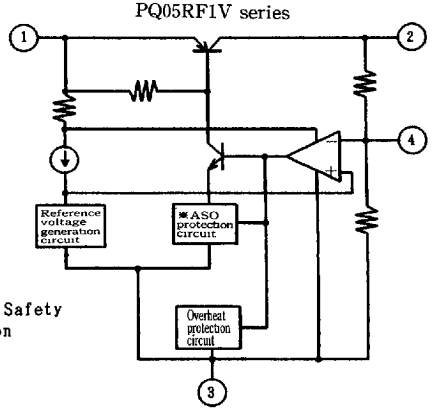
Series power supply for various electronic equipment such as VCRs and musical instruments

■ Equivalent Circuit Diagram

PQ05RF1 series/PQ05RF11 series



PQ05RF1V series



※ASO: Area of Safety Operation

■ Absolute Maximum Ratings (T_a=25°C)

Parameter		Symbol	Rating	Unit
*1Input voltage		V_{in}	35	V
*1ON/OFF control terminal voltage	PQ05RF1 series	V_c	35	V
	PQ05RF11 series			
Output current		I_o	1	A
Power dissipation (no heat sink)		Pd1	1.5	W
Power dissipation (with infinite heat sink)		Pd2	15	W
*2Junction temperature		Tj	150	°C
Operating temperature		T_{opr}	−20 to +80	°C
Storage temperature		T_{stg}	−40 to +150	°C
*3Soldering temperature		T_{sol}	260	°C

*1 All are open except GND and applicable terminals.
*2 Overheat protection operates at Tj>125°C
*3 For 10 s.

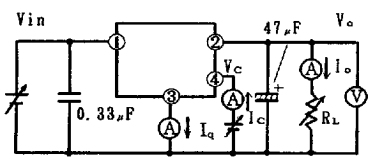
■ Electrical Characteristics (Unless otherwise specified condition shall be I_o=0.5A, T_a=25°C, *4)

Parameter		Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Output voltage	PQ05RF1/PQ05RF1V	V_o	−	4.75	5.0	5.25	V
	PQ09RF1/PQ09RF1V			8.55	9.0	9.45	
	PQ12RF1/PQ12RF1V			11.4	12.0	12.6	
	PQ05RF11			4.88	5.0	5.12	
	PQ09RF11			8.78	9.0	9.22	
	PQ12RF11			11.7	12.0	12.3	
Load regulation		$R_{eg}L$	I_o=5mA to 1A	−	0.1	2.0	%
Line regulation		$R_{eg}I$	*5	−	0.5	2.5	%
Temperature coefficient of output voltage		T_cV_o	Tj=0 to 125°C	−	±0.02	−	%/°C
Ripple rejection	PQ05RF1/PQ05RF11 series	RR	−	45	55	−	dB
	PQ05RF1V series			55	−	−	
Dropout voltage		V_{i-o}	*6	−	−	0.5	V
ON-state voltage for control	PQ05RF1/PQ05RF11series	$V_{c(on)}$	−	2.0*7	−	−	V
ON-state current for control	PQ05RF1/PQ05RF11series	$I_{c(on)}$	V_c=2.7V	−	−	20	μA
OFF-state voltage for control	PQ05RF1/PQ05RF11series	$V_{c(off)}$	−	−	−	0.8	V
OFF-state current for control	PQ05RF1/PQ05RF11series	$I_{c(off)}$	V_c=0.4V	−	−	−0.4	mA
Quiescent current		I_q	I_o=0	−	−	10	mA
Output voltage Adjustment Characteristics	PQ05RF1V	V_o(adj)	−	4.5	5.0	5.5	V
	PQ09RF1V			8.1	9.0	9.9	
	PQ12RF1V			10.8	12.0	13.2	

*4 PQ05RF1 series : V_{in}=7V, PQ09RF1 series : V_{in}=15V, PQ12RF1 series : Vin=18V
*5 PQ05RF1/PQ05RF11/PQ05RF1V : V_{in}=6 to 12V
PQ09RF1/PQ09RF11/PQ09RF1V : V_{in}=10 to 25V
PQ12RF1/PQ12RF11/PQ12RF1V : V_{in}=13 to 29V
*6 Input voltage shall be the value when output voltage is 95% in comparison with the initial value.
*7 In case of opening control terminal, output voltage turns on. (PQ05RF1/PQ05RF11 series)

Fig. 1 Test Circuit

PQ05RF1/PQ05F11 series



PQ05RF1V series

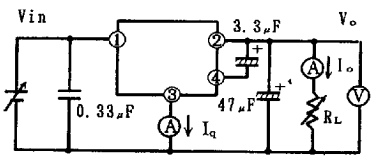
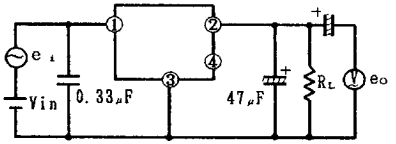


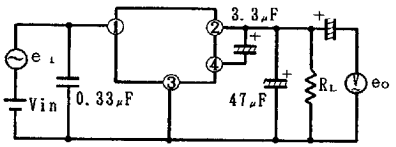
Fig. 2 Test Circuit of Ripple Rejection

PQ05RF1/PQ05RF11 series



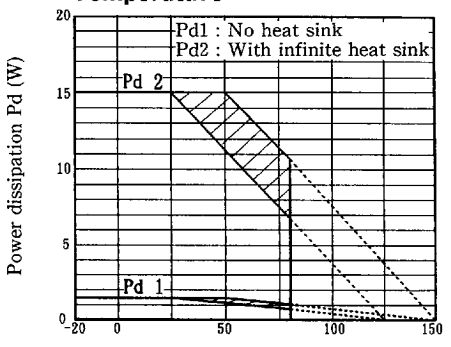
f=120Hz(sine wave)
ei=0.5V_{rms}
RR=20log(ei/eo)

PQ05RF1V series



f=120Hz(sine wave)
ei=0.5V_{rms}
RR=20log(ei/eo)

Fig. 3 Power Dissipation vs. Ambient Temperature



Note) Oblique line portion : Operating area of overheat protection

Fig. 4 Overcurrent Protection Characteristics (Typical value)

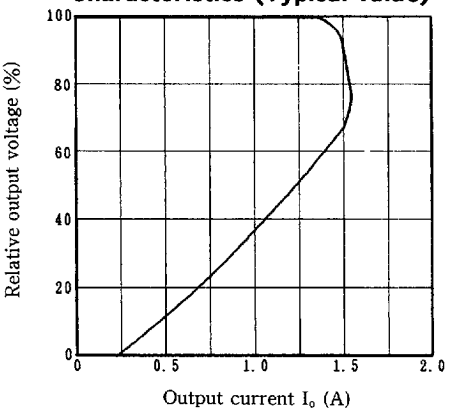


Fig. 5 Output Voltage Minute Adjustment Characteristics (PQ05RF1V)

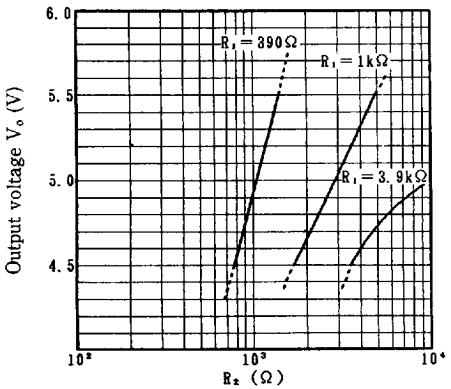


Fig. 6 Output Voltage Minute Adjustment Characteristics (PQ09RF1V)

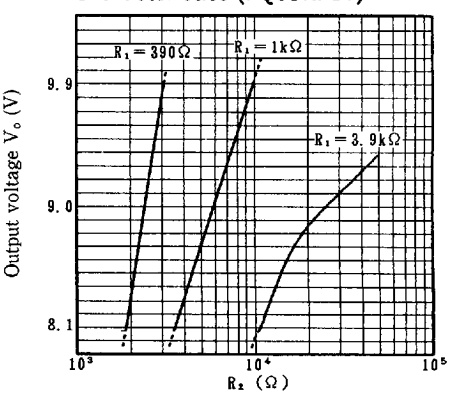


Fig. 7 Output Voltage Minute Adjustment Characteristics (PQ12RF1V)

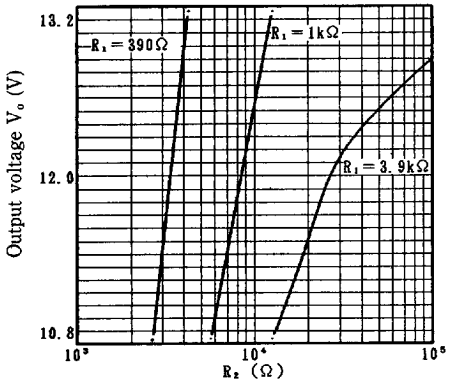


Fig. 8 Output Voltage Deviation vs. Junction Temperature (PQ05RF1/PQ05RF11/PQ05RF1V)

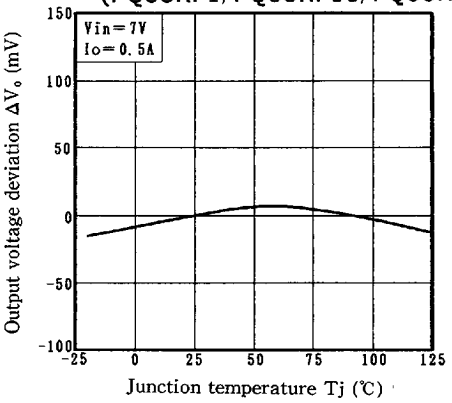


Fig. 9 Output Voltage Deviation vs. Junction Temperature (PQ09RF1/PQ09RF11/PQ09RF1V)

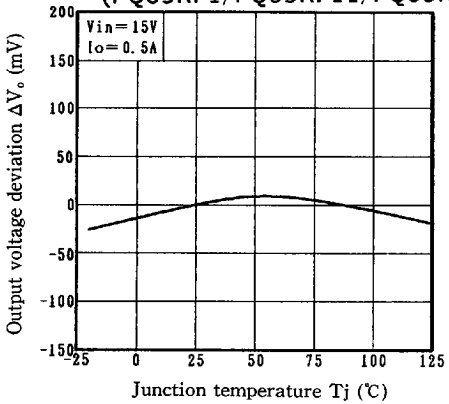


Fig. 10 Output Voltage Deviation vs. Junction Temperature (PQ12RF1/PQ12RF11/PQ12RF1V)

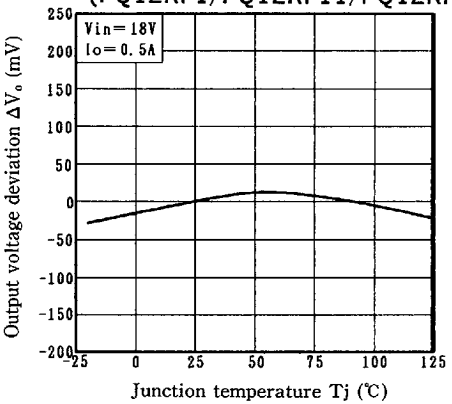


Fig. 11 Output Voltage vs. Input Voltage (PQ05RF1/PQ05RF11/PQ05RF1V)

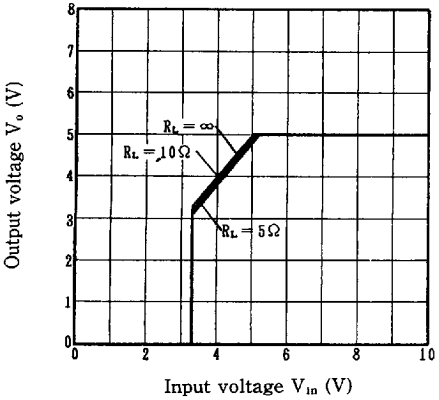


Fig. 12 Output Voltage vs. Input Voltage (PQ09RF1/PQ09RF11/PQ09RF1V)

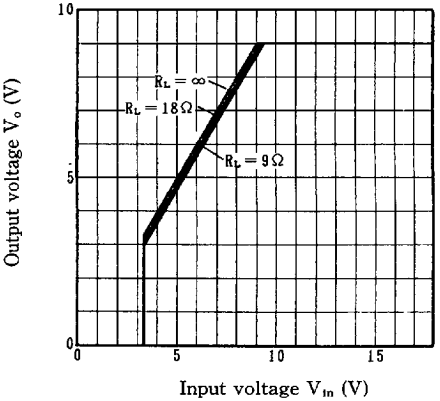


Fig. 13 Output Voltage vs. Input Voltage (PQ12RF1/PQ12RF11/PQ12RF1V)

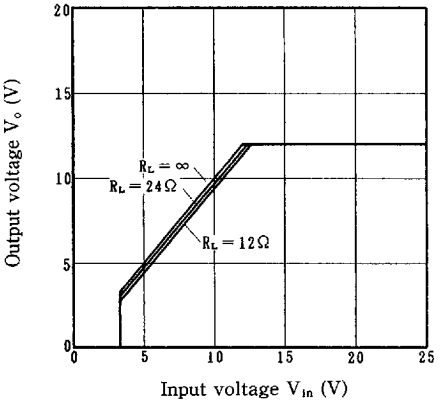


Fig. 14 Circuit Operating Current vs. Input Voltage (PQ05RF1/PQ05RF11/PQ05RF1V)

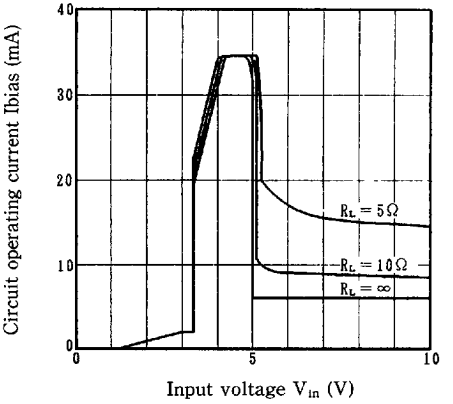


Fig. 15 Circuit Operating Current vs. Input Voltage (PQ09RF1/PQ09RF11/PQ09RF1V)

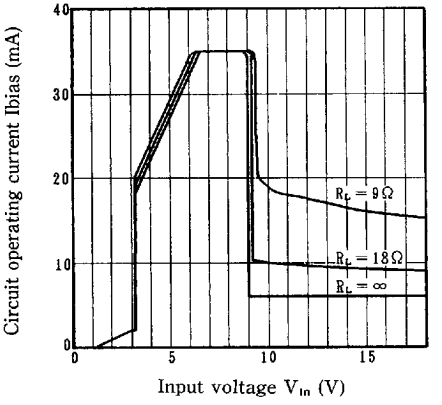


Fig. 16 Circuit Operating Current vs. Input Voltage (PQ12RF1/PQ12RF11/PQ12RF1V)

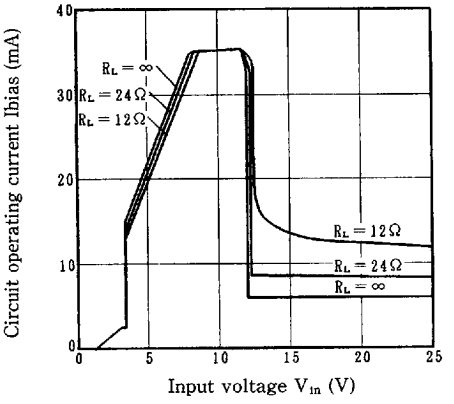


Fig. 17 Dropout Voltage vs. Junction Temperature

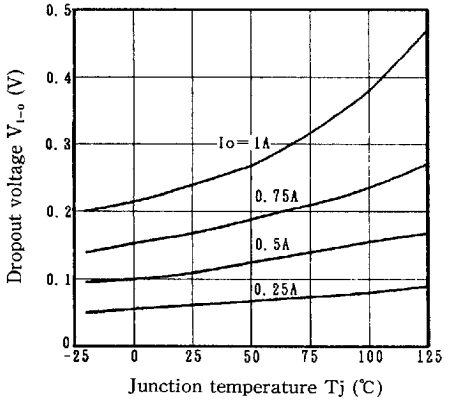


Fig. 18 Quiescent Current vs. Junction Temperature

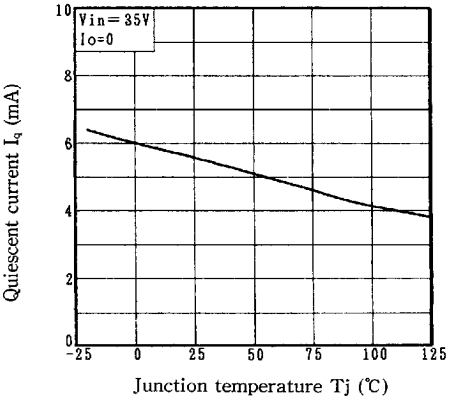


Fig. 19 Ripple Rejection vs. Input Ripple Frequency
(PQ05RF1/PQ05RF11/PQ09RF1/PQ09RF11/PQ12RF1/PQ12RF11)

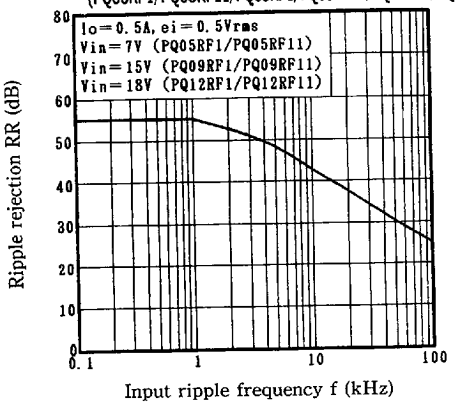


Fig. 20 Ripple Rejection vs. Input Ripple Frequency
(PQ05RF1V/PQ09RF1V/PQ12RF1V)

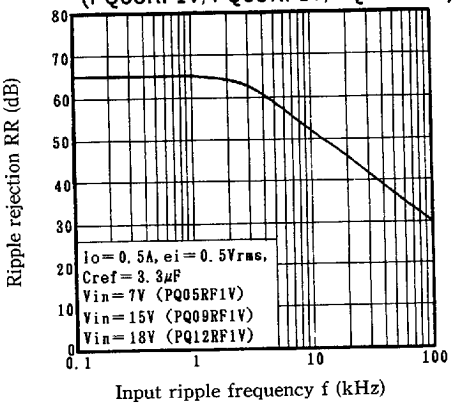
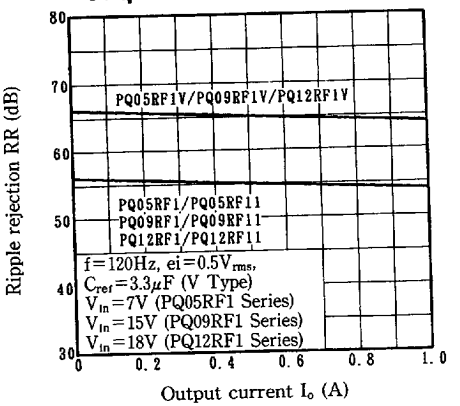
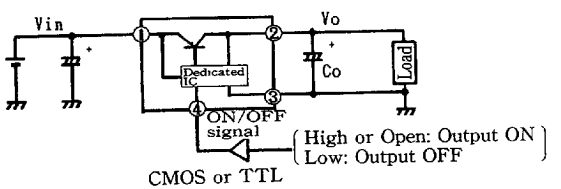


Fig. 21 Ripple Rejection vs. Output Current

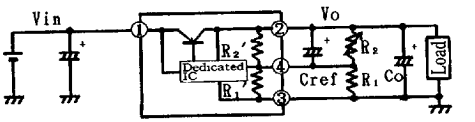


■ Typical Application

PQ05RF1/PQ05RF11 series



PQ05RF1V series



$$V_o = V_{ref} \times \left(1 + \frac{R_2' \times R_2}{R_2' + R_2} \bullet \frac{R_1' + R_1}{R_1' \times R_1}\right)$$

$V_{ref} \fallingdotseq 1.26V$, $R_1' \fallingdotseq 390\Omega$
PQ05RF1V : $R_2' \fallingdotseq 1.16k\Omega$
PQ09RF1V : $R_2' \fallingdotseq 2.40k\Omega$
PQ12RF1V : $R_2' \fallingdotseq 3.32k\Omega$

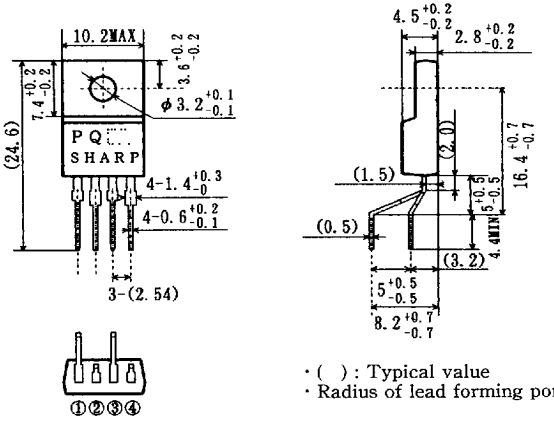
(Note) R1' and R2' are built in a dedicated IC.

■ Model Line-ups for Lead Forming Type

Output voltage	5V output	9V output	12V output
Output voltage precision : ±5%	PQ05RF1A	PQ09RF1A	PQ12RF1A
Output voltage precision : ±2.5%	PQ05RF1B	PQ09RF1B	PQ12RF1B

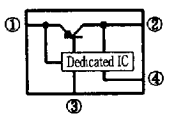
■ Outline Dimensions (PQ05RF1A/PQ05RF1B)

(Unit : mm)



・( ) : Typical value
・Radius of lead forming portion : R=0.5 to 1.5mm

Internal connection diagram

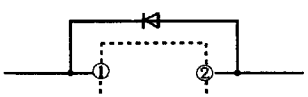


① DC input (V_{in})
② DC output (V_o)
③ GND
④ ON/OFF control terminal (V_c)

Note) The value of absolute maximum ratings and electrical characteristics is same as ones of PQ05RF1/11 series.

■ Precautions for Use

(1) If voltage exceeding the voltage of DC input terminal ① is applied to the output terminal ②, the element may be damaged, especially when the DC input terminal ① is short-circuited to GND in ordinary operating state, the output terminal voltage rises above the voltage of DC input terminal, charges accumulated in the output capacitor Co flow to the input side, causing damage to the element. In this case connect the ordinary silicon diode as shown in the figure.



(2) Minute adjustment of output voltage (PQ05RF1V series)
If the external resistor is attached to the terminals ②, ③, and ④, minute adjustment of output voltage is possible.
(Refer to the example of basic circuit (PQ05RF1V series) and Fig. 5 to 7.)

Note:
The specification is subject to change for improvement.
Cares when handling:
Be sure to observe the requirements described in the specification and data book.