

PQ05RF2/21/2V Series

2A Output, Low Power-Loss Voltage Regulators

■ Features

- Low power-loss (Dropout voltage : MAX. 0.5V)
- Compact resin full-mold package.
- Built-in ON/OFF control terminal (PQ05RF2/PQ05RF21 series)
- Built-in output voltage minute adjustment terminal (ripple rejection is improved) (PQ05RF2V series)

■ Model Line-ups

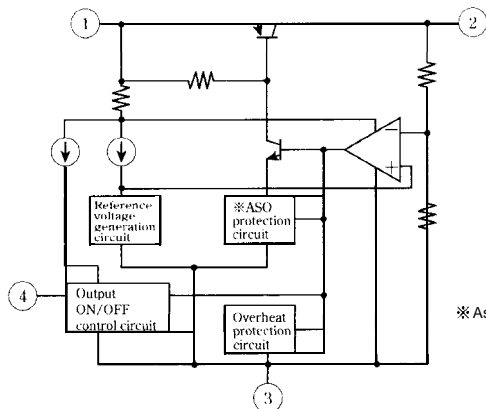
Output voltage	5V output	9V output	12V output	15V output
Output voltage precision: $\pm 5\%$	PQ05RF2	PQ09RF2	PQ12RF2	PQ15RF2
Output voltage precision: $\pm 2.5\%$	PQ05RF21	PQ09RF21	PQ12RF21	PQ15RF21
Minute adjustment Output voltage adjustment range: $\pm 10\%$	PQ05RF2V	PQ09RF2V	PQ12RF2V	PQ15RF2V

■ Applications

- Series power supply for various electronic equipment such as VCRs, electronic music instruments

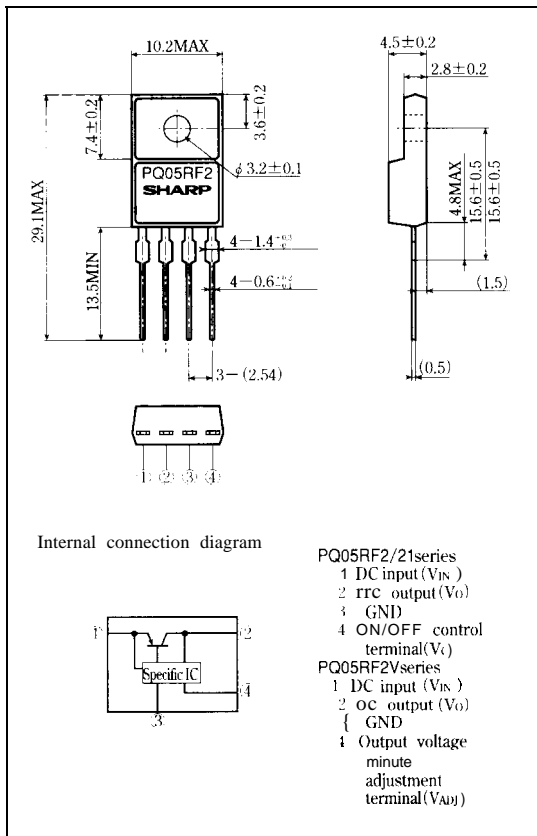
■ Equivalent Circuit Diagram

PQ05RF2series/PQ05RF21series



■ Outline Dimensions

(Unit: mm)



Internal connection diagram

- PQ05RF2/21series
- DC input (V_{IN})
 - OC output (V_O)
 - GND
 - ON/OFF control terminal (V_C)
- PQ05RF2Vseries
- DC input (V_{IN})
 - OC output (V_O)
 - GND
 - Output voltage minute adjustment terminal (V_{ADJ})

PQ05RF2Vseries

※ As() : Area of Safety Operation

· Please refer to the chapter "Handling Precautions".

■ Absolute Maximum Ratings

(T_a=25°C)

Parameter	Symbol	Rating	Unit
*1 Input voltage	V _{IN}	35	V
*1ON/OFF control terminal voltage	PQ05RF2 series	35	v
	PQ05RF21 series		
Output current	I _o	2	A
Power dissipation (No heat sink)	P _{D1}	1.5	W
Power dissipation (With infinite heat sink)	P _{D2}	18	W
*2 Junction temperature	T _j	150	°C
operating temperature	T _{opr}	-20 to +80	°C
Storage temperature	T _{stg}	-40 to +150	°C
Soldering temperature	T _{sol}	260 (For 10s)	°C

*1 All are open except GND and applicable terminals

*2 Overheat protection may operate at 125 ≤ T_j ≤ 150°C.

■ Electrical Characteristics

(Unless otherwise specified, condition shall be I_o = 1A, T_a = 25°C, *3)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit	
output voltage	V _o	—	PQ05RF2/PQ05RF2V	4.75	5.0	5.25	V
			PQ09RF2/PQ09RF2V	8.55	9.0	9.45	
			PQ12RF2/PQ12RF2V	11.4	12.0	12.6	
			PQ15RF2/PQ15RF2V	14.25	15.0	15.75	
			PQ05RF21	4.88	5.0	5.12	
			PQ09RF21				
			PQ12RF21				
Load regulation	R _{regL}						
Line regulation	R _{regI}	*4		0.5	2.5	%	
Temperature coefficient of output voltage	T _c V _o	T _j = 0 to 125°C	—	±0.02	—	%/°C	
Ripple rejection	RR	I _o = 0.5A Refer to Fig.2	PQ05RF2/PQ05RF21Series	45	55	—	dB
			PQ05RF2VSeries	55	—	—	dB
Dropout voltage	V _{i-o}	*5, I _o = 2A	—	—	0.5	V	
ON-state voltage for control	V _c (ON)	—	2.0	*6	—	V	
ON-state current for current	I _c (ON)	V _c = 2.7V			20	μA	
OFF-state voltage for control	V _c (OFF)				0.8	v	
OFF-state current for control	I _c (OFF)	V _c = 0.4V			-0.4	mA	
Quiescent current	I _q	I _o = 0			10	mA	
Output voltage minute adjustment range	V _o (Adj)	—	PQ05RF2V	4.5	5.0	5.5	V
			PQ09RF2V	8.1	9.0	9.9	
			PQ12RF2V	10.8	12.0	13.2	
			PQ15RF2V	13.5	15.0	16.5	

*3 PQ05RF2 Series: V_{IN} = 7V, PQ09RF2 Series: V_{IN} = 15V, PQ12RF2 Series: V_{IN} = 18V, PQ15RF2 Series: V_{IN} = 23V

*4 PQ05RF2/PQ05RF21/PQ05RF2V: V_{IN} = 6 to 12V PQ09RF2/PQ09RF21/PQ09RF2V: V_{IN} = 10 to 25V

PQ12RF2/PQ12RF21/PQ12RF2V: V_{IN} = 13 to 29V PQ15RF2/PQ15RF21/PQ15RF2V: V_{IN} = 16 to 32V

*5 Input voltage shall be the value when output voltage is 95% in comparison with the initial value.

*6 in case of opening control terminal 4, output voltage turns on. (PQ05RF2/PQ05RF21Series)

Fig. 1 Test Circuit

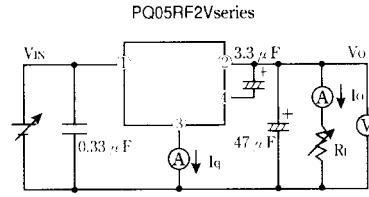
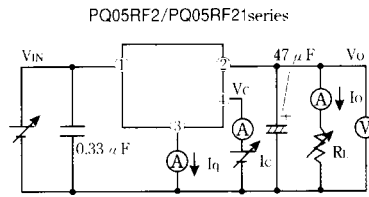


Fig. 2 Test Circuit of Ripple Rejection

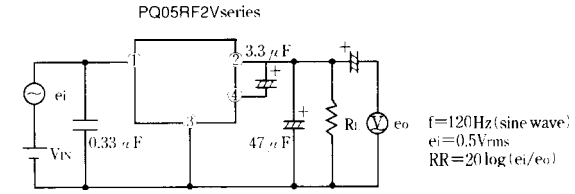
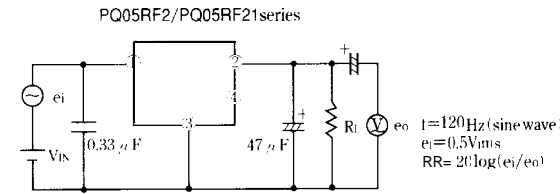


Fig. 3 Power Dissipation vs. Ambient Temperature

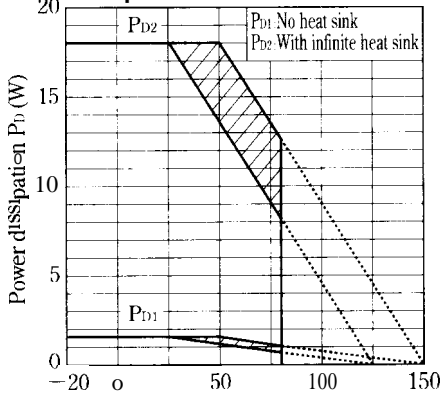
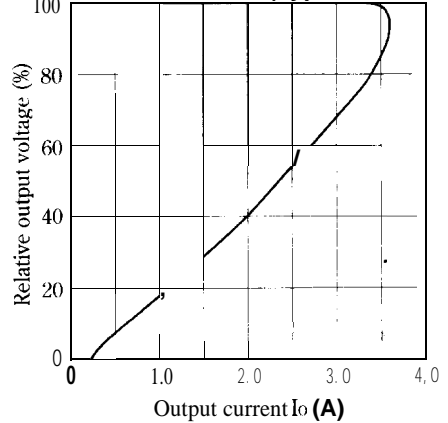


Fig. 4 Overcurrent Protection Characteristics (Typical value)



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

Fig. 5 Output Voltage Minute Adjustment Characteristics (PQ05RF2V)

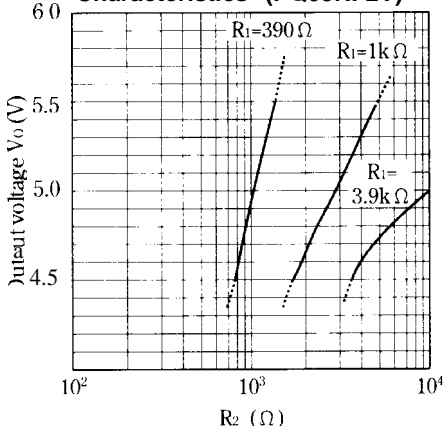


Fig. 6 Output Voltage Minute Adjustment Characteristics (PQ09RF2V)

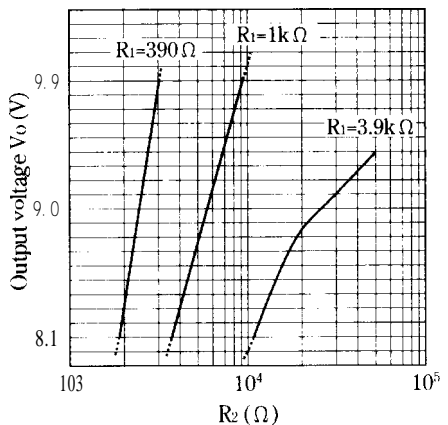


Fig. 7 Output Voltage Minute Adjustment Characteristics (PQ12RF2V)

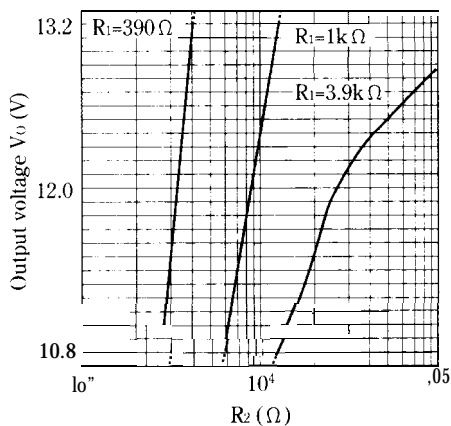


Fig. 8 Output Voltage Minute Adjustment Characteristics (PQ15RF2V)

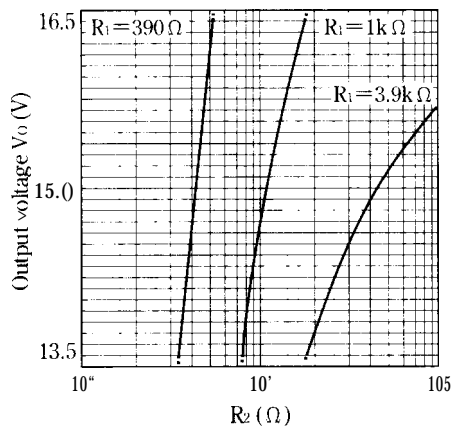


Fig. 9 Output Voltage Deviation vs. Junction Temperature (PQ05RF2/PQ05RF21/PQ05RF2V)

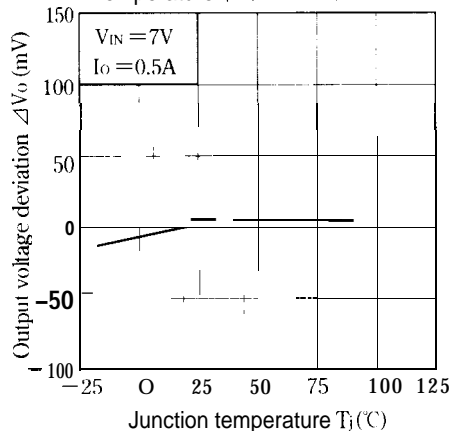


Fig.10 Output Voltage Deviation vs. Junction Temperature (PQ09RF2/PQ09RF21/PQ09RF2V)

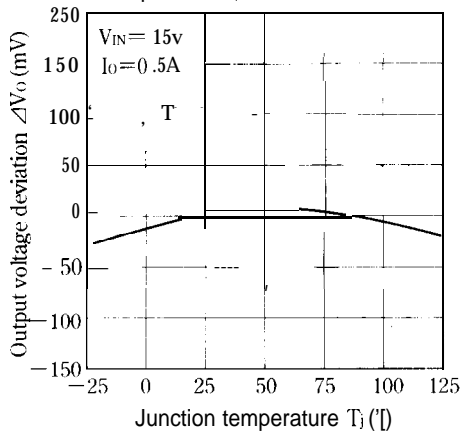


Fig.11 Output Voltage Deviation vs. Junction Temperature (PQ12RF2/PQ12RF21/PQ12RF2V)

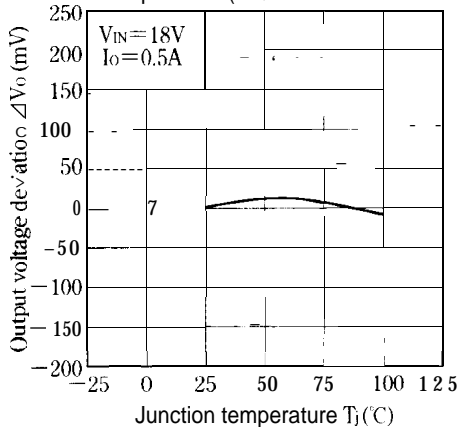


Fig.12 Output Voltage Deviation vs. Junction Temperature (PQ15RF2/PQ15RF21/PQ15RF2V)

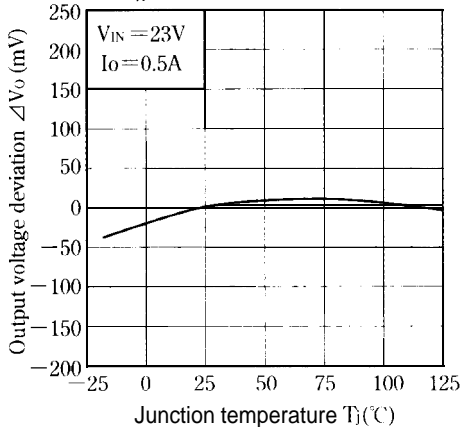


Fig.13 Output Voltage vs. Input Voltage (PQ05RF2/PQ05RF21/PQ05RF2V)

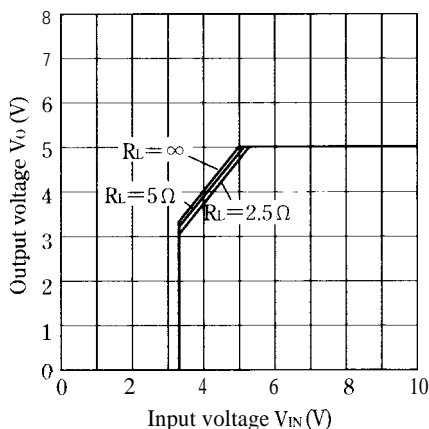


Fig.14 Output Voltage vs. Input Voltage (PQ09RF2/PQ09RF21/PQ09RF2V)

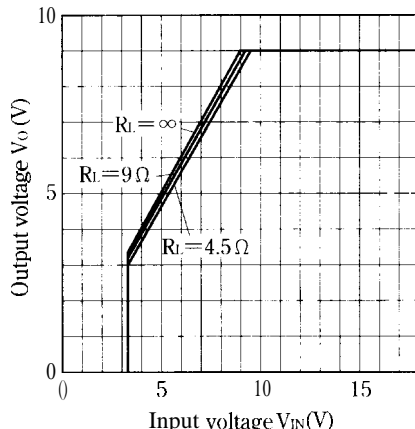


Fig.15 Output Voltage vs. Input Voltage (PQ12RF2/PQ12RF21/PQ12RF2V)

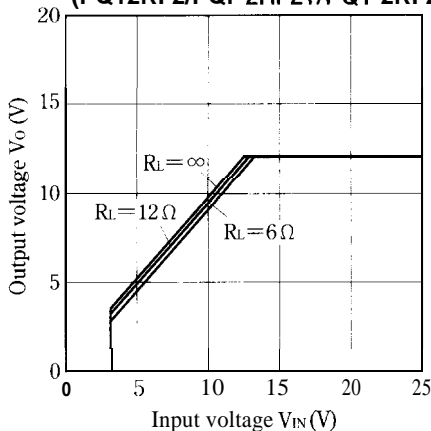


Fig.16 Output Voltage vs. Input Voltage (PQ15RF2/PQ15RF21/PQ15RF2V)

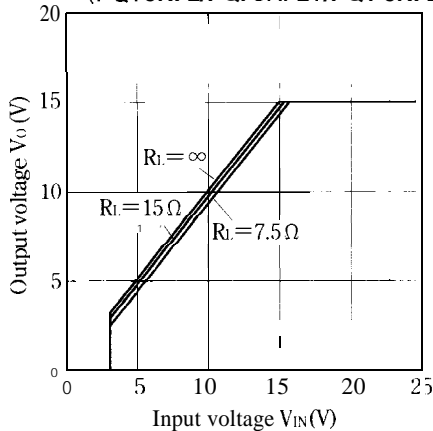


Fig.17 Circuit Operating Current vs. Input Voltage (PQ05RF2/PQ05RF21 /PQ05RF2V)

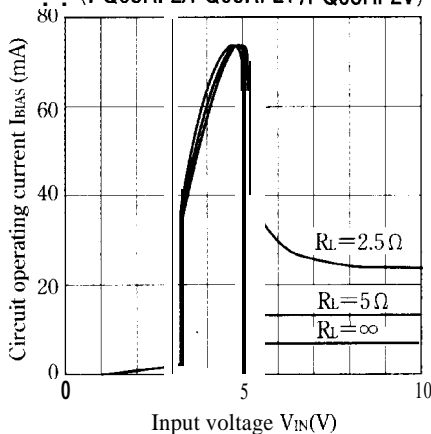


Fig.18 Circuit Operating Current vs. Input Voltage (PQ09RF2/PQ09RF21/PQ09RF2V)

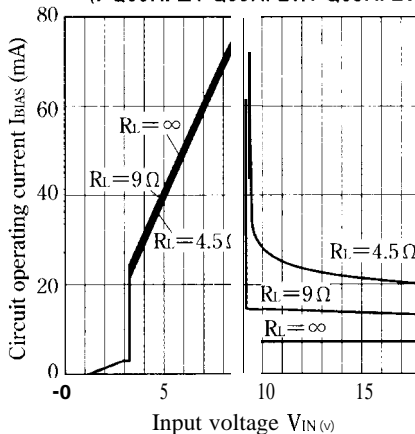


Fig.19 Circuit Operating Current vs. Input Voltage (PQ12RF2/PQ12RF21/PQ12RF2V)

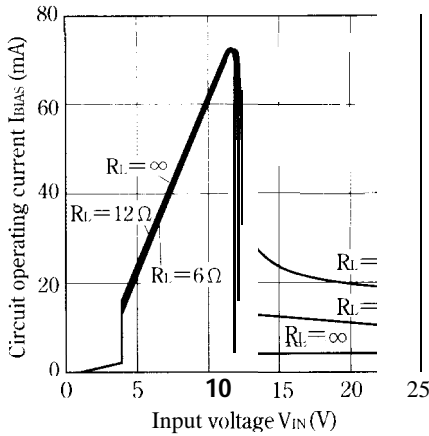


Fig.20 Circuit Operating Current vs. Input Voltage (PQ15RF2/PQ15RF21/PQ15RF2V)

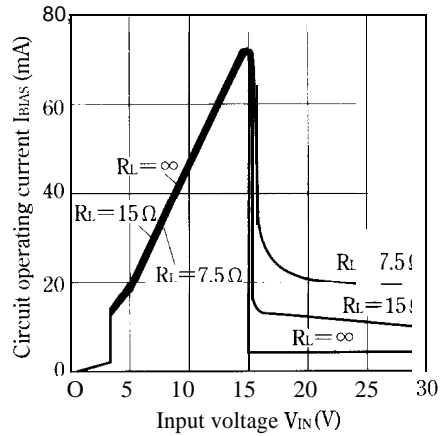


Fig.21 Dropout Voltage vs. Junction Temperature

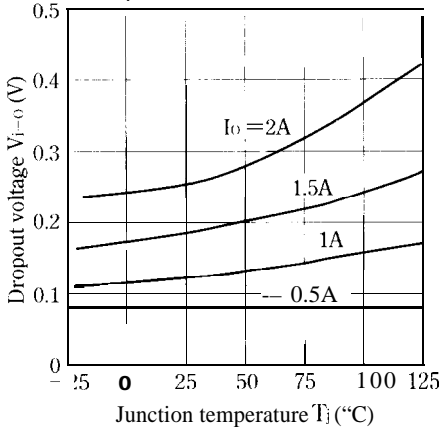


Fig.22 Quiescent Current vs. Junction Temperature

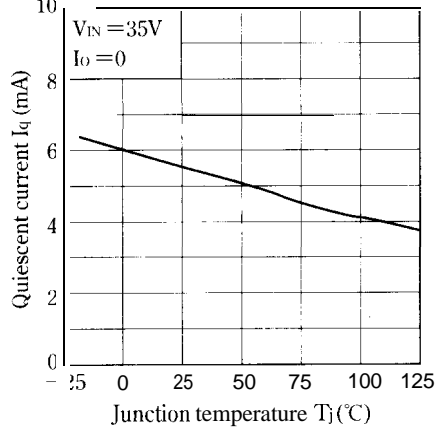


Fig.23 Ripple Rejection vs. Input Ripple Frequency (PQ05RF2/PQ05RF21/PQ09RF2/PQ09RF21/PQ12RF2/PQ12RF21/PQ15RF2/PQ15RF21)

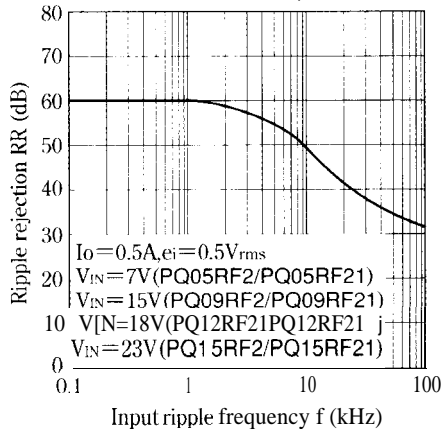


Fig.24 Ripple Rejection vs. Input Ripple Frequency (PQ05RF2V/PQ09RF2V/PQ12RF2v/PQ15RF2v)

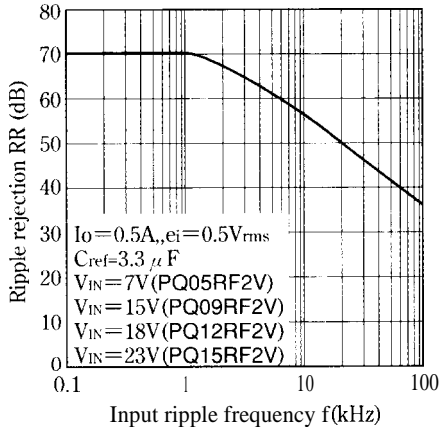
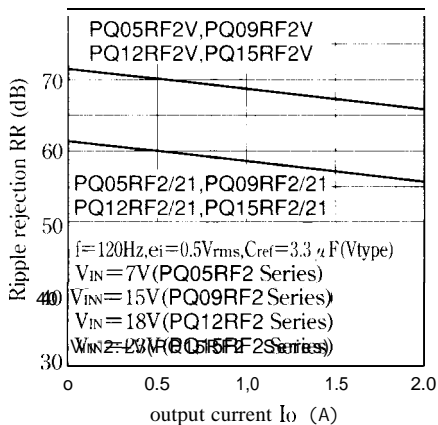
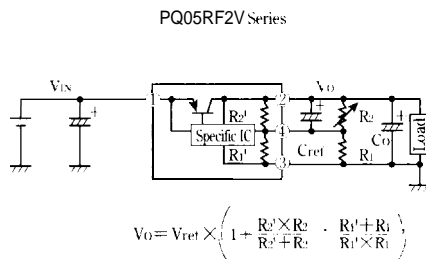
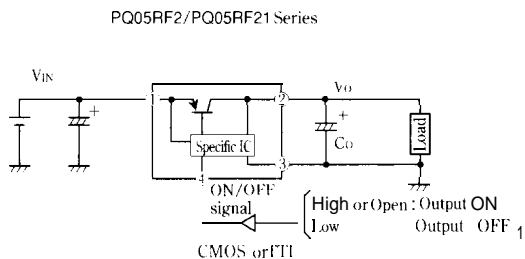


Fig.25 Ripple Rejection vs. Output Current



■ Typical Application



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

$V_{ref} \approx 1.26V, R_1' \approx 390 \Omega$
 PQ05RF2V : $R_2' \approx 116k \Omega$
 PQ09RF2V : $R_2' \approx 2.40k \Omega$
 PQ12RF2V : $R_2' \approx 3.32k \Omega$
 PQ15RF2V : $R_2' \approx 4.45k \Omega$

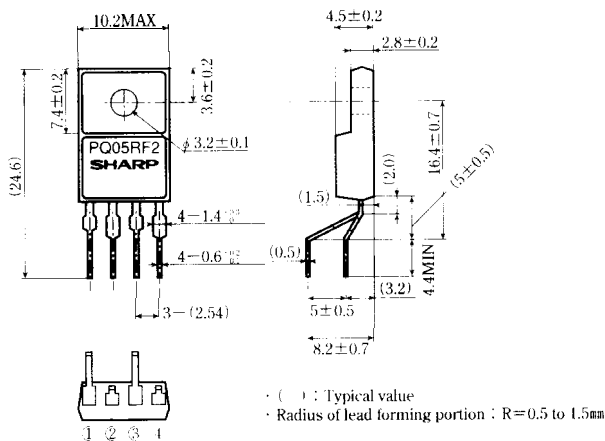
(Note) R_1 and R_2 are built into a specific IC

■ Model Line-ups for Lead Forming Type

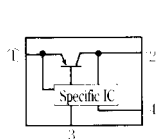
Output voltage	5V output	9V output	12V output	15V output
Output voltage precision: +5%	PQ05RF2A	PQ09RF2A	PQ12RF2A	PQ15RF2A
Output voltage precision: ±2.5%	PQ05RF2B	PQ09RF2B	PQ12RF2B	PQ15RF2B

■ Outline Dimensions (PQ05RF2A/PQ05RF2B Series)

(Unit: mm)



Internal connection diagram



PQ05RF2/21series	PQ05RF2Vseries
① DC input (V _{IN})	① DC input (V _{IN})
② DC output (V _O)	② DC output (V _O)
③ GND	③ GND
④ ON/OFF control terminal (V _c)	④ Output voltage minute adjustment terminal (V _{ADJ})

Note) The value of absolute maximum ratings and electrical characteristics is same as ones 01 PQ05HF2/21 series.

■ Precautions for Use

(1) Minute adjustment of output voltage (PQ05RF2V 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 (PQ05RF2V series) and Fig.5 to 8.)