PQ30RVI/PQ30RVI 1/PQ30RV2/PQ30RV21

Variable output Low Power-Loss Voltage Regulators

Features

- Compact resin full-mold package
- Low power-loss (Dropout voltage MAX.0.5V)
- Variable output voltage (setting range :1.5 to 30V)
- Built-in output ON/OFF control function

Applications

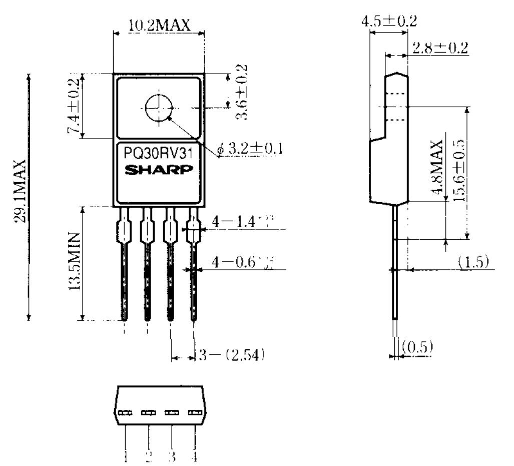
- Power supply for print concentration control of electronic typewriters with display
- Series power supply for motor drives
- Series power supply for VCRs and TVs

Model Line-ups

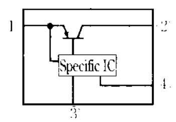
output voltage	1A output	2A output
Reference voltage precision: ±4%	PQ30RVI	PQ30RV2
Reference voltage precision: ±2%	PQ30RV11	PQ30RV21

Outline Dimensions

(Unit: mm)

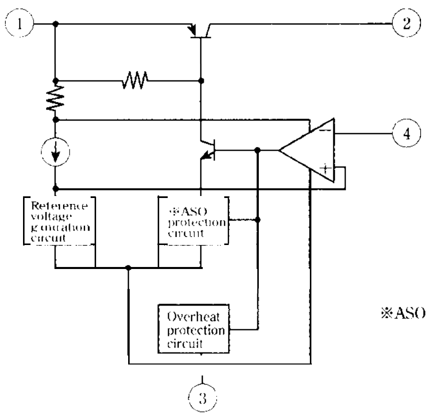


Internal connection diagram



1 DC input (V_{IN})
2 DC output (V_O)
3 GND
4 Output voltage minute adjustment terminal (V_{ADJ})

Equivalent Circuit Diagram



※ASO : 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
*1 output voltage adjustment voltage		V_{ADJ}	7	V
output current	PQ30RV1/PQ30RV11	I_O	1	A
	PQ30RV2/PQ30RV21		2	
Power dissipation (No heat sink)		P_{D1}	1.5	W
Power dissipation (With infinite heat sink)	PQ30RV1/PQ30RV11	P_{D2}	15	W
	PQ30RV2/PQ30RV21		18	
*2 Junction temperature		T_j	150	°C
operating temperature		T_{opr}	-20~+80	°C
Storage temperature		T_{stg}	-40~+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 $T_j \geqq 125$°C.

■ Electrical Characteristics

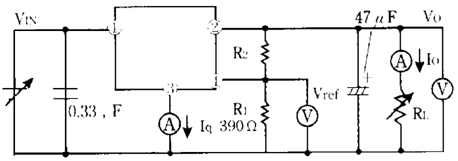
Unless otherwise specified, condition shall be
V_{IN}=15V, V_O=10V, I_O=0.5A, R_1=390Ω (PQ30RV1/PQ30RV11)
V_{IN}= 15V, V_O=10V, I_O=1.0A, R_1=390Ω (PQ30RV2/PQ30RV21)

(T_a=25°C)

Parameter		Symbol	Conditions		MIN.	TYP.	MAX.	Unit
Input voltage		V_{IN}			4.5		35	V
output voltage	PQ30RV1/PQ30RV2	V_O	R_2=94Ω to 8.5kΩ		1.5		30	V
	PQ30RV11/PQ30RV21		R_2=84Ω to 8.7kΩ					
Load regulation	PQ30RV1/PQ30RV11	R_{egL}	I_O=5mA to 1A			0.3	1.0	%
	PQ30RV2/PQ30RV21		I_O=5mA to 2A			0.5	1.0	
Line regulation		R_{egI}	V_{IN}=11 to 28V			0.5	2.5	%
Ripple rejection		RR	C_{ref}=0	Fefer to Fig. 2	45	55		dB
			C_{ref}=3.3μF		55	65		
Reference voltage	PQ30RV1/PQ30RV2	V_{ref}			1.20	1.25	1.30	V
	PQ30RV11/PQ30RV21				1.225	1.25	1.275	
Temperature coefficient of reference voltage		T_cV_{ref}	T_j=0 to 125°C			±1.0		%
Dropout voltage	PQ30RV1/PQ30RV11	V_{i-o}	*3, I_O=0.5A				0.5	V
	PQ30RV2/PQ30RV21		*3, I_O=2A					
Quiescent current		I_q	I_O=0				7	mA

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

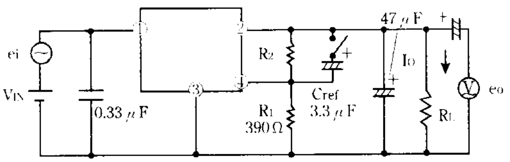
Fig. 1 Test Circuit



$$V_O = V_{ref} \times \left(1+\frac{R_2}{R_1}\right) \fallingdotseq 1.25 \times \left(1+\frac{R_2}{R_1}\right)$$

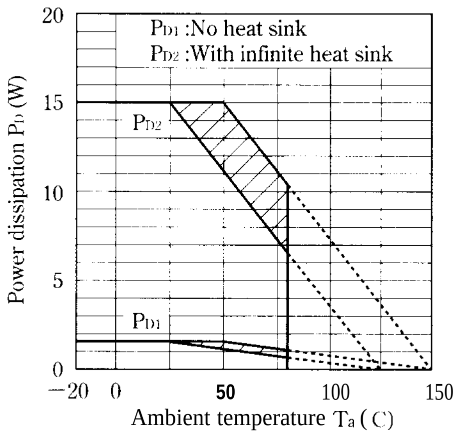
[R_1=390Ω, $V_{ref} \fallingdotseq$ 1.25V]

Fig. 2 Test Circuit of Ripple Rejection



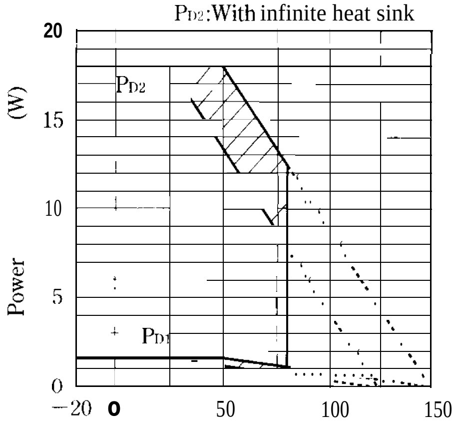
I_O=0.5A
f=120Hz (sine wave)
ei=0.5Vrms
RR=20 log(ei/eo)

Fig. 3 Power Dissipation vs. Ambient Temperature (PQ30RV1/PQ30RV11)



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

Fig. 4 Power Dissipation vs. Ambient Temperature (PQ30RV2/PQ30RV21)



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

Fig. 5 Overcurrent Protection Characteristics (PQ30RV1/PQ30RV11)

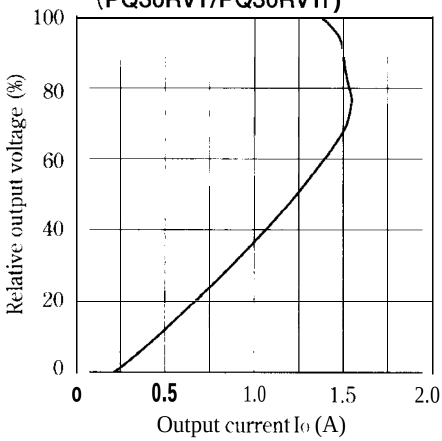


Fig. 6 Overcurrent Protection Characteristics (PQ30RV2/PQ30RV21)

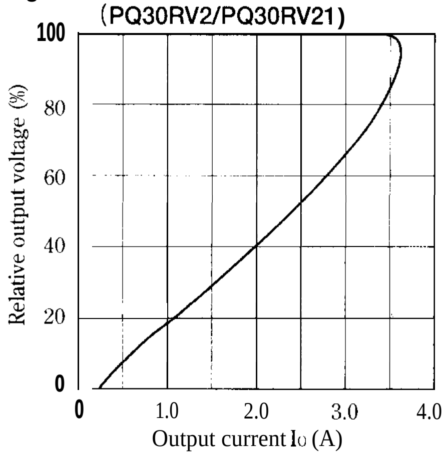


Fig. 7 Output Voltage Adjustment Characteristics

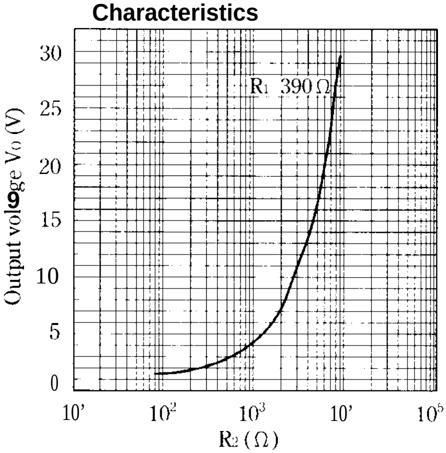


Fig. 8 Reference Voltage Deviation vs. Junction Temperature

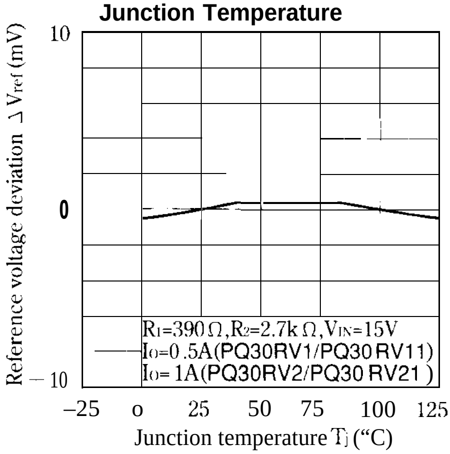


Fig. 9 Output Voltage vs. Input Voltage (PQ30RV1/PQ30RV11)

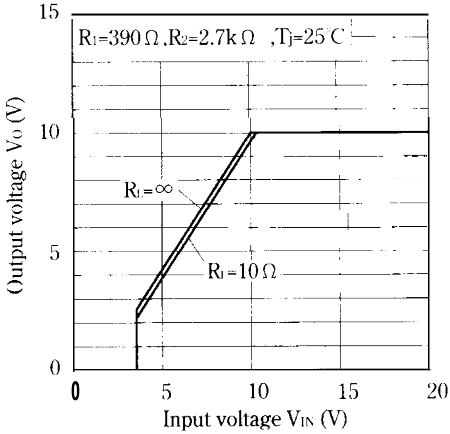


Fig.10 Output Voltage vs. Input Voltage (PQ30RV2/PQ30RV21)

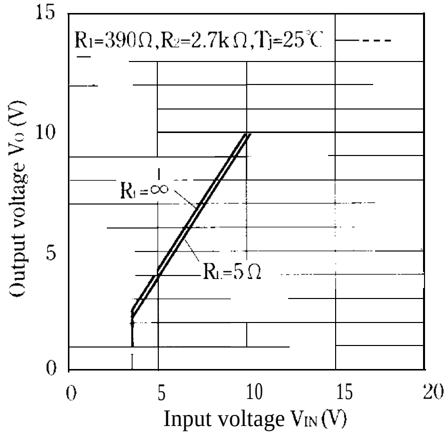


Fig.11 Dropout Voltage vs. Junction Temperature (PQ30RV1/PQ30RV11)

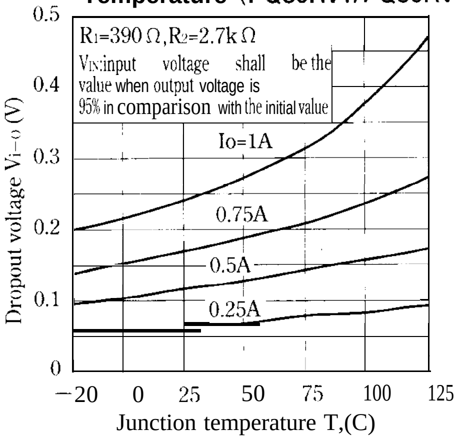


Fig.12 Dropout Voltage vs. Junction Temperature (PQ30RV2/PQ30RV21)

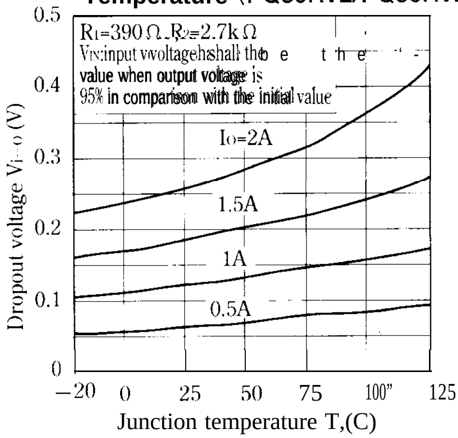


Fig.13 Quiescent Current vs. Junction Temperature

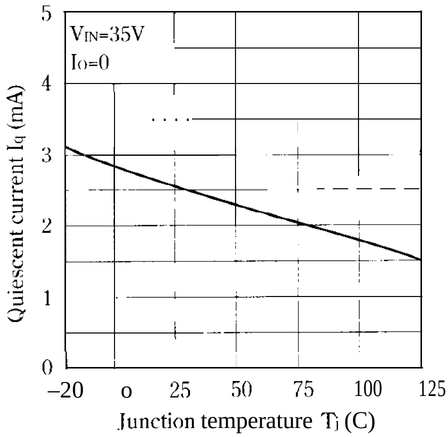


Fig.14 Ripple Rejection vs. Input Ripple Frequency (PQ30RV1/PQ30RV11)

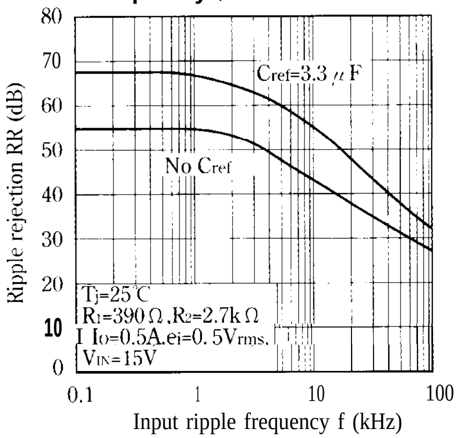


Fig.15 Ripple Rejection vs. Input Ripple Frequency (PQ30RV2/PQ30RV21)

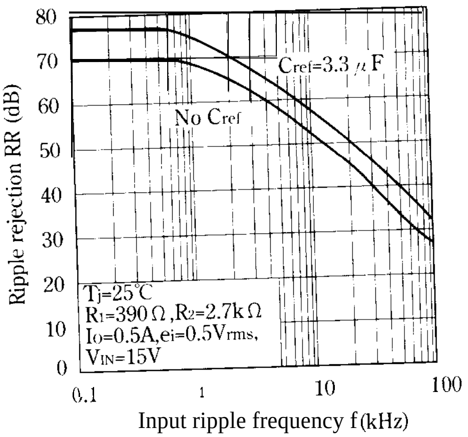


Fig.16 Ripple Rejection vs. Output Current (PQ30RV1/PQ30RV11)

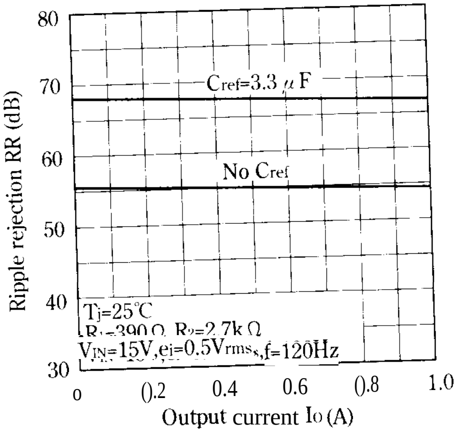


Fig.17 Ripple Rejection vs. Output Current (PQ30RV2/PQ30RV21)

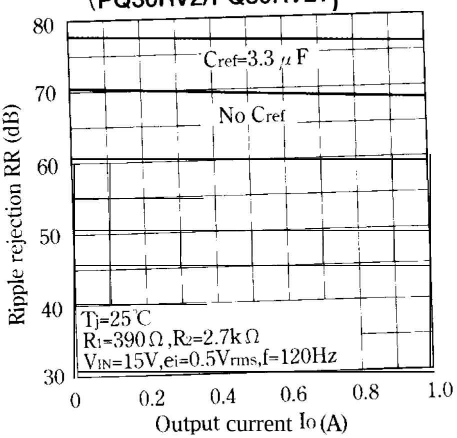


Fig.18 Output Peak Current vs. Dropout Voltage (PQ30RV1/PQ30RV11)

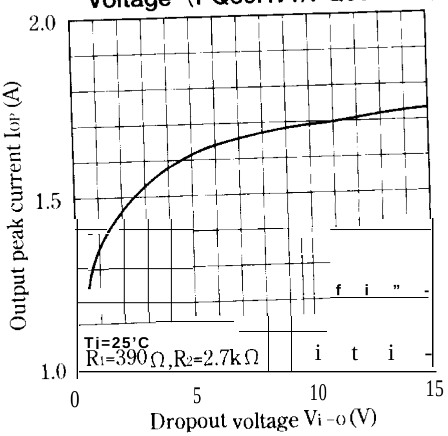


Fig.19 Output Peak Current vs. Dropout Voltage (PQ30RV2/PQ30RV21)

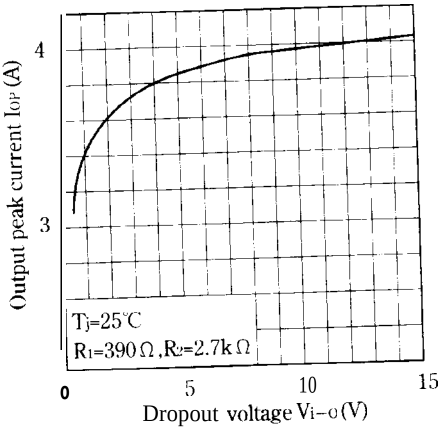


Fig.20 Output Peak Current vs. Junction Temperature (PQ30RV1/PQ30RV11)

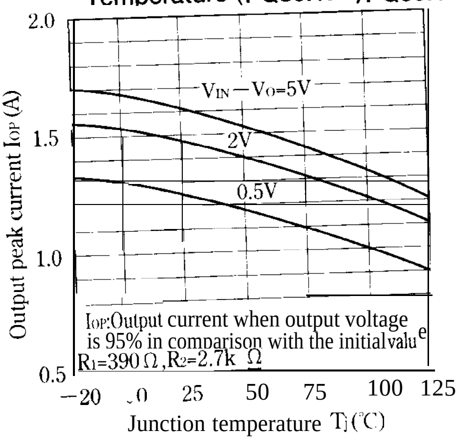
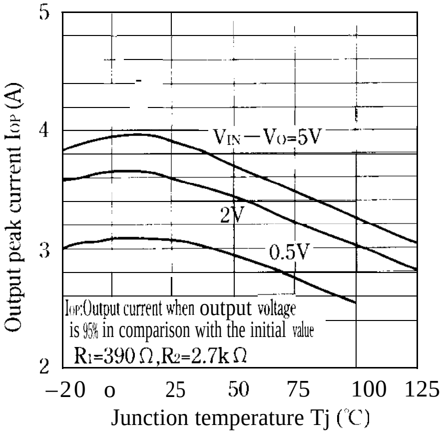
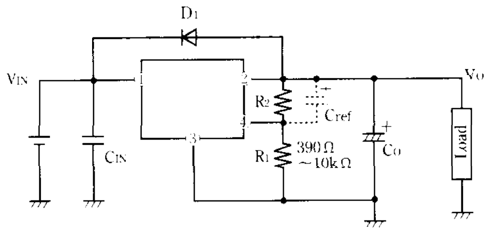


Fig.21 Output Peak Current vs. Junction Temperature (PQ30RV2/PQ30RV21)



■ Standard Connection



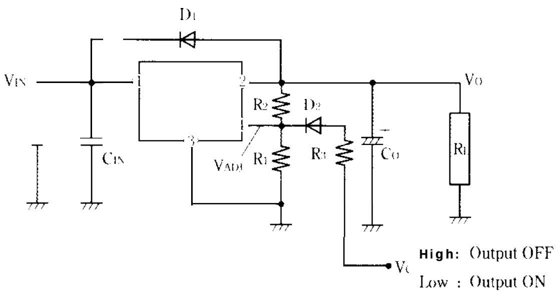
1)1 : This device is necessary to protect the element from damage when reverse voltage maybe applied to the regulator in case of input short-circuiting.

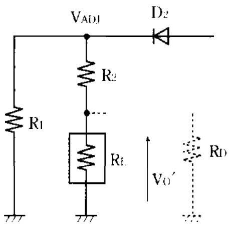
C_{ref} : This device is necessary when it is required to enhance the ripple rejection or to delay the output start-up time(* 1). (* 1)Otherwise, it is not necessary.
(Care must be taken since C_{ref} may raise the gain, facilitating oscillation.)
(* 1) The output start-up time is proportional to C_{ref} X R_2.

C_{IN}、C_O : Be sure to mount the devices C_{IN} and C_O as close to the device terminal as possible so as to prevent oscillation.
The standard specification of C_{IN} and Co is 0.33 μF and 47 μ F, respectively. However, ajust them as necessary after checking.

R_1. R_2 : These devices are necessary to set the output voltage. The output voltage Vo is given by the following formula:
$V_O = V_{ref}$ X $(1 + R_2/R_1)$
(V_{ref} is 1.25V TYP)
The standard value of R_1 is 390 Ω.But value up 10k Ω does not cause any trouble.

■ ON/OFF Operation





Equivalent Circuit in OFF-state

- ON/OFF operation is available by mounting externally D_2 and R_3.
- When V_{ADJ} is forcibly raised above V_{ref} (1.25V TYP) by applying the external signal, the output is turned off (pass transistor of regulator is turned off). When the output is OFF, V_{ADJ} must be higher then V_{ref} MAX., and at the same time must be lower than maximum rating 7V.

  In OFF-state, the load current flows to R_L from V_{ADJ} through R_2. Therefore the value of R_2 must be as high as possible.
- vo'=v,kIIJ X R_L/ ($R_I + R_2$)

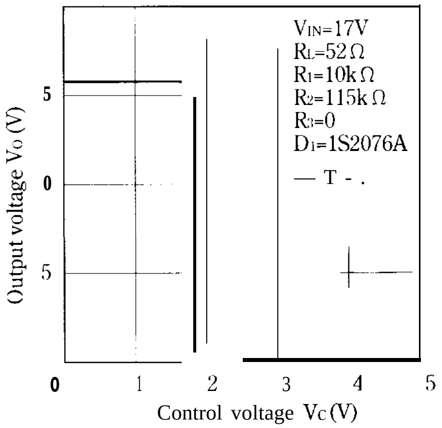
  occurs at the load. OFF-state equivalent circuit R_1 up to 10kΩ is allowed, Select as high value of R_1 and R_2 as possible in this range. In some case, as output voltage is getting lower (V_O < 1V), impedance of load resistance rises. In such condition, it is sometime impossible to obtain the minimum value of V_O'. So add the dummy resistance indicated by R_D in the figure to the circuit parallel to the load,

■ An Example of ON/OFF Circuit Using the 1 -chip Microcomputer Output Port (PQ30RV1)

(Specification)
output port of microcomputer
  V_{OH} (max) = ().5 V
  V_{OH} (rein) = 2.41 (I_{OH} = 0.2mA)
  MAX, rating of I_{OH} = 0.5mA
Output should be set as follows
  15.6V R_L = 52 Ω (1[) = 0.3A)

Fmm $V_O = 1.25V (1 + R_2/R_1)$ we get V_O = 15.6V.
R_2/R_1 = 11.48
Assuming that V_F(max) = 0.8V for D_2 in case of V_{OH}(min) = 2.4V, we get V_{ADJ} = V_{OH}(min) – V_F(max) = 2,4V – 0.8V = 1.6V. From V_{ref}(max) = 1.3V we get R_3 = O Ω
If R_1 = 10k Ω, we get R_2 = 11.48X R_1 = 114.8kΩ and IOH as follows, ingnoring R_L (52 Ω) :
IOH = 1.6V X ($R_1 + R_2$) /R] X R_2
= 1.6V X (lOk Ω+114.8kΩ) /lOk Ω X 114.8kΩ = 0.17mA
Hence, I_{OH} < 0.2mA. Therefore V_{OH}(min) is ensured,
Next, assuming that V_F(min) = 0.5V for D_2 in case of V_{OH}(max), we get :
I_{OH} = (5V – 0.5V) ($R_1 + R_2$) / R_1 X R_2 = 0.49mA which is less than the rating.
Figure 1 shows the Vo – V_C characteristics when R_1 = 10kΩ, R_2 = 115kΩ, R_3 = 0Ω, V_{IN} = 17V, RI. = 52Ω, and D_1 ⁻1S2076A (Hitachi).

Output Voltage vs. Control Voltage (PQ30RV1)

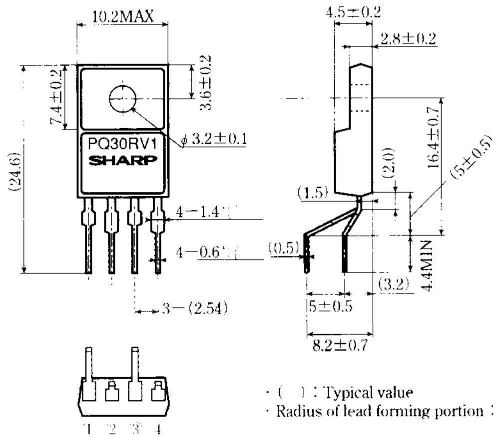


■ Model Line-ups for Lead Forming Type

Output voltage	5V output	2A output
Output voltage precision: ±2.5%	PQ30RVI B	PQ30RV2B

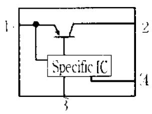
■ Outline Dimensions (PQ30RV1B/PQ30RV2B)

(Unit : mm)



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

Internal connection diagram



1 DC input (VIN)
2 DC output (v,!)
3 GND
4 Output voltage minute adjustment terminal (VADJ)

Note) The value of absolute maximum ratings and electrical characteristics is same as ones of PQ30RV1 /2 series