

PQ30RV1/PQ30RV11/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

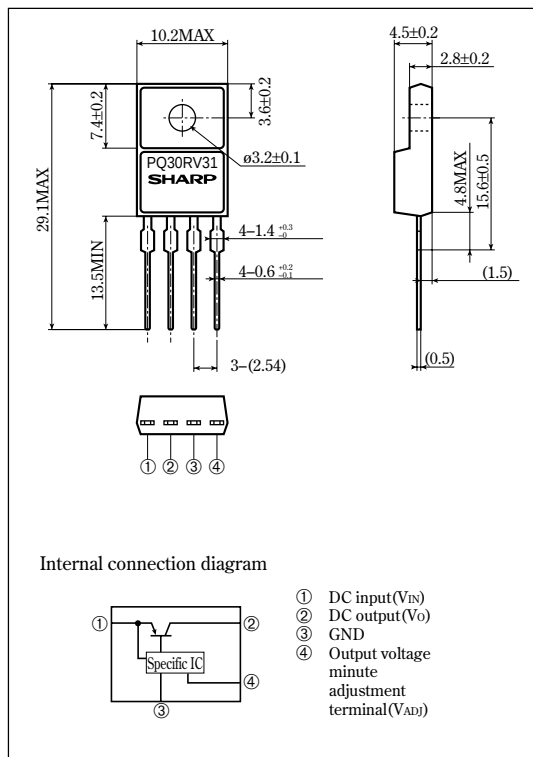
- Power supply for print concentration control of electronic typewriters with display
- Series power supply for motor drives
- Series power supply for VCRs and TVs

Model Line-ups

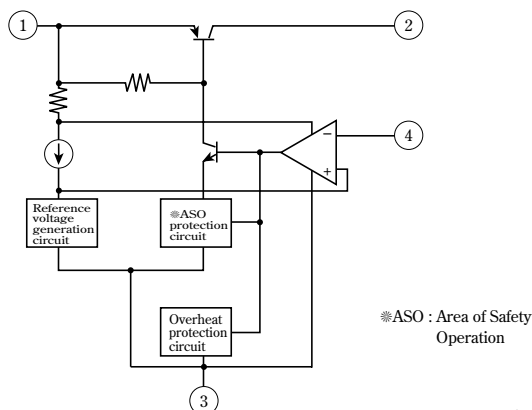
Output voltage	1A output	2A output
Reference voltage precision:±4%	PQ30RV1	PQ30RV2
Reference voltage precision:±2%	PQ30RV11	PQ30RV21

Outline Dimensions

(Unit : mm)



Equivalent Circuit Diagram



•Please refer to the chapter " Handling Precautions ".

SHARP

Absolute Maximum Ratings

(Ta=25°C)

Parameter		Symbol	Rating	Unit
① Input voltage		VIN	35	V
① Output voltage adjustment voltage		VADJ	7	V
Output current	PQ30RV1/PQ30RV11	Io	1	A
	PQ30RV2/PQ30RV21		2	
Power dissipation(No heat sink)		PD1	1.5	W
Power dissipation (With infinite heat sink)	PQ30RV1/PQ30RV11	PD2	15	W
	PQ30RV2/PQ30RV21		18	
② Junction temperature		Tj	150	°C
Operating temperature		Topr	-20 to +80	°C
Storage temperature		Tstg	-40 to +150	°C
Soldering temperature		Tsol	260(For 10s)	°C

① All are open except GND and applicable terminals.

② Overheat protection may operate at Tj>=125°C.

Electrical Characteristics

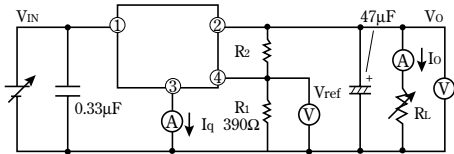
Unless otherwise specified, condition shall be
VIN=15V, Vo=10V, Io=0.5A, Ri=390Ω(PQ30RV1/PQ30RV11)
VIN=15V, Vo=10V, Io=1.0A, Ri=390Ω(PQ30RV2/PQ30RV21)

(Ta=25°C)

Parameter		Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Input voltage		VIN	—	4.5	—	35	V
Output voltage	PQ30RV1/PQ30RV2	Vo	R2=94Ω to 8.5kΩ	1.5	—	30	V
	PQ30RV11/PQ30RV21		R2=84Ω to 8.7kΩ				
Load regulation	PQ30RV1/PQ30RV11	RegL	Io=5mA to 1A	—	0.3	1.0	%
	PQ30RV2/PQ30RV21		Io=5mA to 2A	—	0.5	1.0	
Line regulation		RegI	VIN=11 to 28V	—	0.5	2.5	%
Ripple rejection		RR	Cref=0	45	55	—	dB
			Cref=3.3μF	55	65	—	
Reference voltage	PQ30RV1/PQ30RV2	Vref	—	1.20	1.25	1.30	V
	PQ30RV11/PQ30RV21			1.225	1.25	1.275	
Temperature coefficient of reference voltage		TcVref	Tj=0 to 125°C	—	±1.0	—	%
Dropout voltage	PQ30RV1/PQ30RV11	Vi-O	③, Io=0.5A	—	—	0.5	V
	PQ30RV2/PQ30RV21		③, Io=2A				
Quiescent current		Iq	Io=0	—	—	7	mA

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

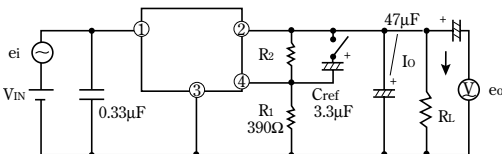
Fig. 1 Test Circuit



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

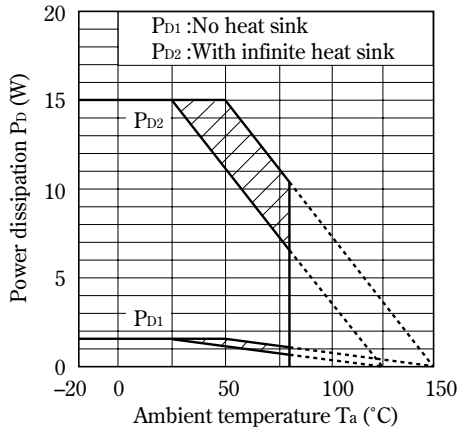
[R1=390Ω, Vref Nearly=1.25V]

Fig. 2 Test Circuit of Ripple Rejection



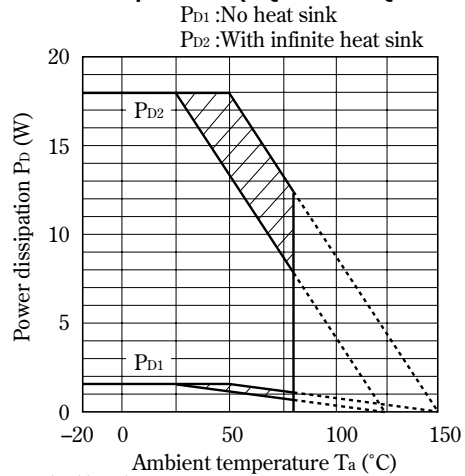
Io=0.5A
f=120Hz(sine wave)
ei(rms)=0.5V
RR=20 log(ei(rms)/eo(rms))

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)

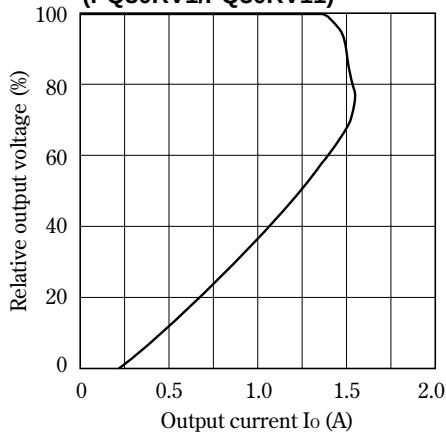


Fig. 6 Overcurrent Protection Characteristics (PQ30RV2/PQ30RV21)

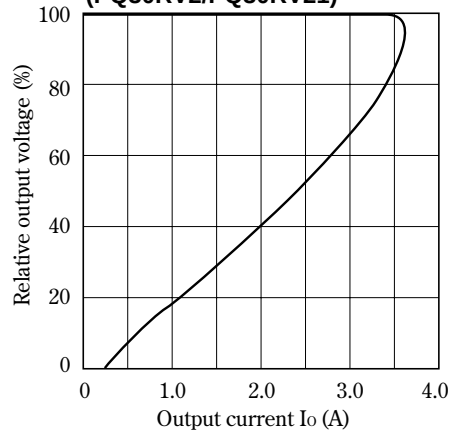


Fig. 7 Output Voltage Adjustment Characteristics

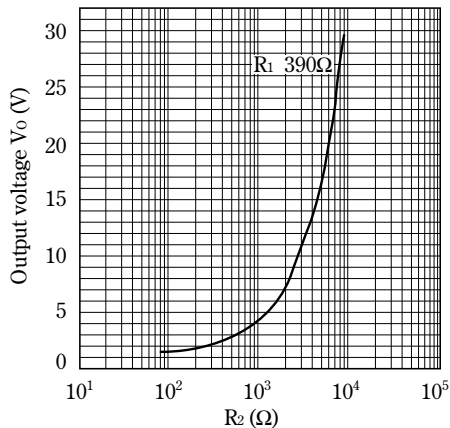


Fig. 8 Reference Voltage Deviation vs. Junction Temperature

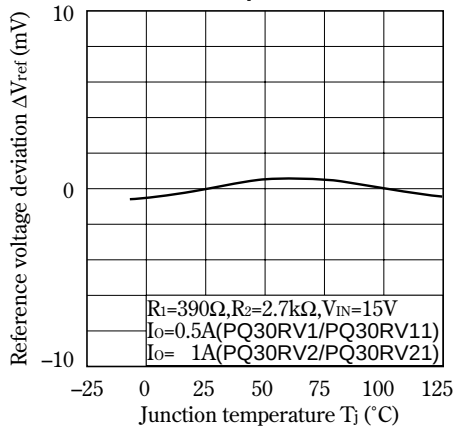


Fig. 9 Output Voltage vs. Input Voltage (PQ30RV1/PQ30RV11)

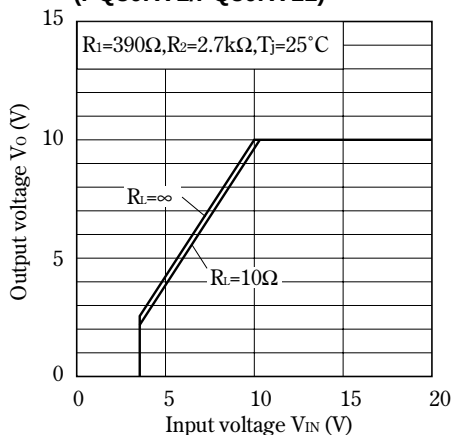


Fig.10 Output Voltage vs. Input Voltage (PQ30RV2/PQ30RV21)

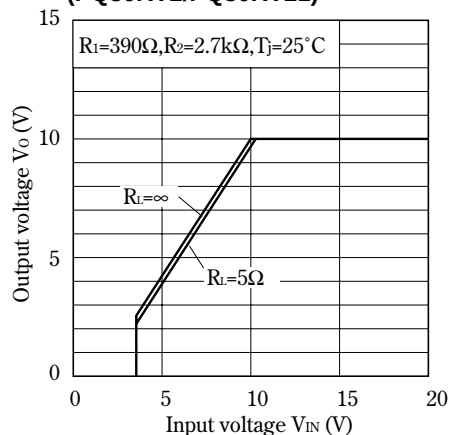


Fig.11 Dropout Voltage vs. Junction Temperature (PQ30RV1/PQ30RV11)

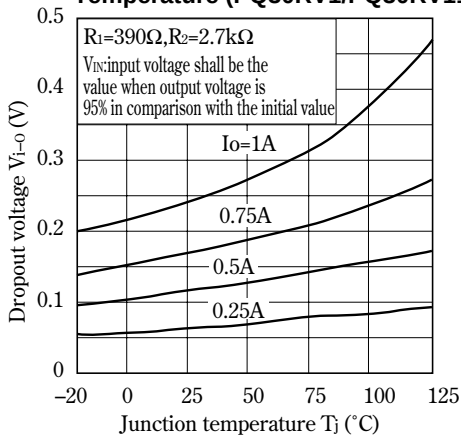


Fig.12 Dropout Voltage vs. Junction Temperature (PQ30RV2/PQ30RV21)

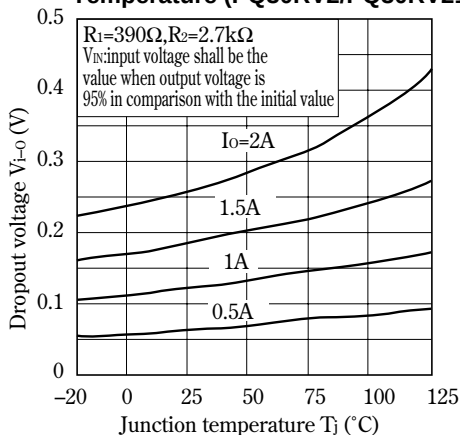


Fig.13 Quiescent Current vs. Junction Temperature

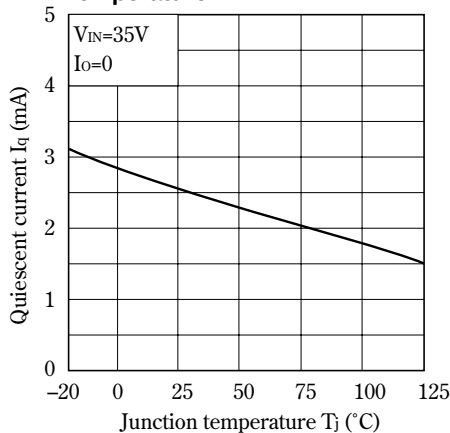


Fig.14 Ripple Rejection vs. Input Ripple Frequency (PQ30RV1/PQ30RV11)

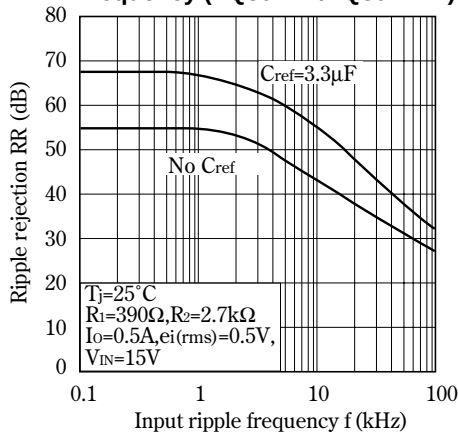


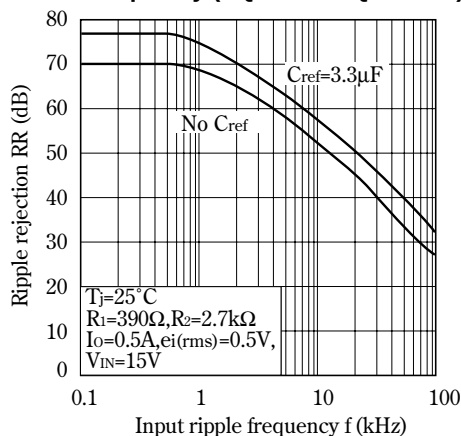
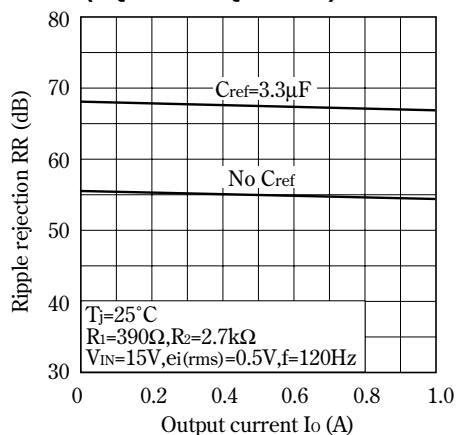
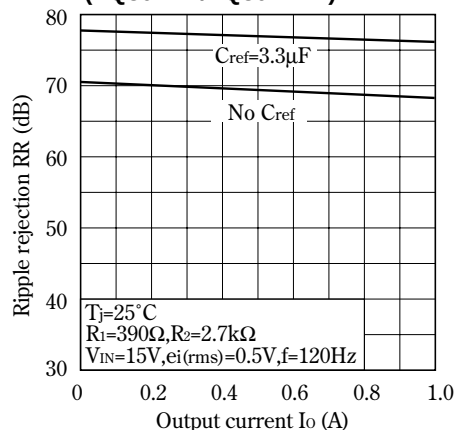
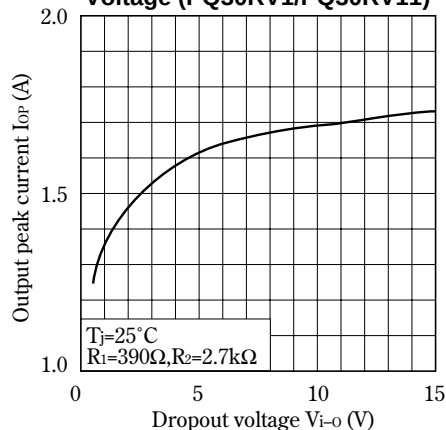
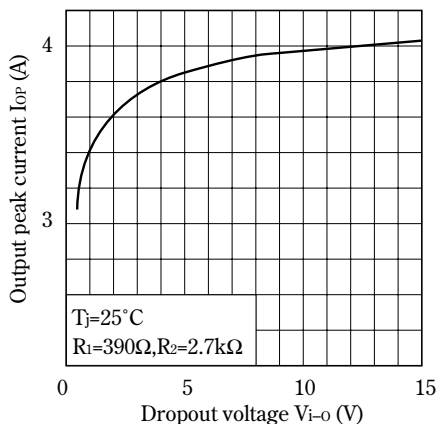
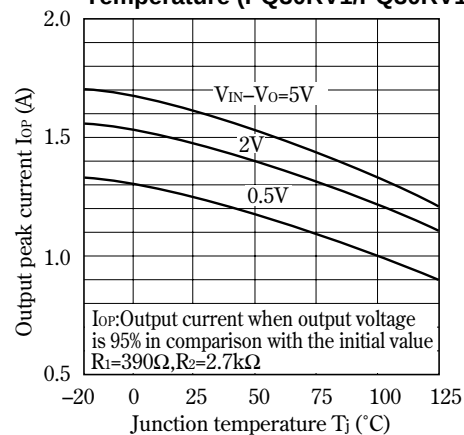
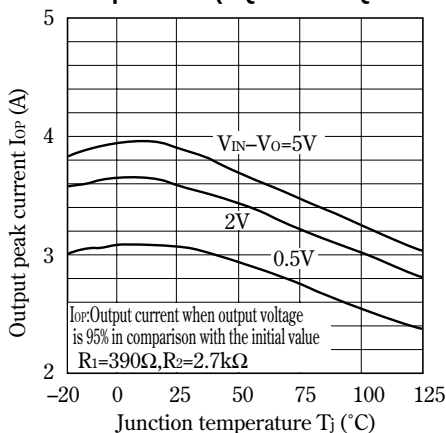
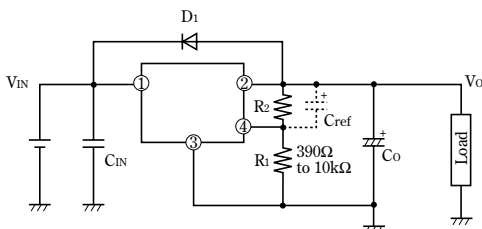
Fig.15 Ripple Rejection vs. Input Ripple Frequency (PQ30RV2/PQ30RV21)**Fig.16 Ripple Rejection vs. Output Current (PQ30RV1/PQ30RV11)****Fig.17 Ripple Rejection vs. Output Current (PQ30RV2/PQ30RV21)****Fig.18 Output Peak Current vs. Dropout Voltage (PQ30RV1/PQ30RV11)****Fig.19 Output Peak Current vs. 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

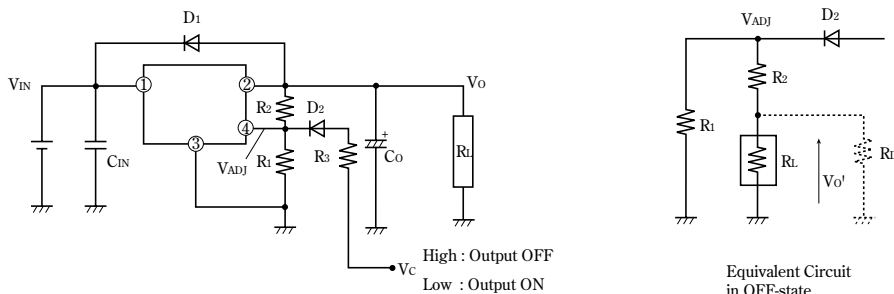


- D_1 : This device is necessary to protect the element from damage when reverse voltage may be applied to the regulator in case of input short-circuiting.
- C_{ref} : This device is necessary when it is required to enhance the ripple rejection or to delay the output start-up time(※1).
 (※1) Otherwise, 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 $C_{ref} \times R_2$.
- 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 C_O is $0.33\mu\text{F}$ and $47\mu\text{F}$, respectively. However, adjust them as necessary after checking.
- R_1, R_2 : These devices are necessary to set the output voltage. The output voltage V_O is given by the following formula:

$$V_O = V_{ref} \times (1 + R_2/R_1)$$

$$(V_{ref} \text{ is } 1.25\text{V TYP})$$
 The standard value of R_1 is 390Ω . But value up to $10\text{k}\Omega$ does not cause any trouble.

ON/OFF Operation



- ON/OFF operation is available by mounting externally D₂ and R₃.
- 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 than 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 R₂. Therefore the value of R₂ must be as high as possible.

- $V_o' = V_{ADJ} \times R_L / (R_L + R_2)$

occurs at the load. OFF-state equivalent circuit R₁ up to 10kΩ is allowed. Select as high value of R₁ and R₂ 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)=0.5 V

V_{OH}(min)=2.4 V (I_{OH}=0.2mA)

MAX. rating of I_{OH}=0.5mA

Output should be set as follows.

15.6V R_L=52Ω(I_O=0.3A)

From V_o=1.25V(1+R₂/R₁) we get V_o=15.6V.

R₂/R₁=11.48

Assuming that V_F(max)=0.8V for D₂ 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 R₃=0Ω

If R₁=10kΩ, we get R₂=11.48×R₁=114.8kΩ and I_{OH} as follows, ignoring R_L (52Ω):

I_{OH}=1.6V×(R₁+R₂)/R₁×R₂

=1.6V×(10kΩ+114.8kΩ)/10kΩ×114.8kΩ=0.17mA

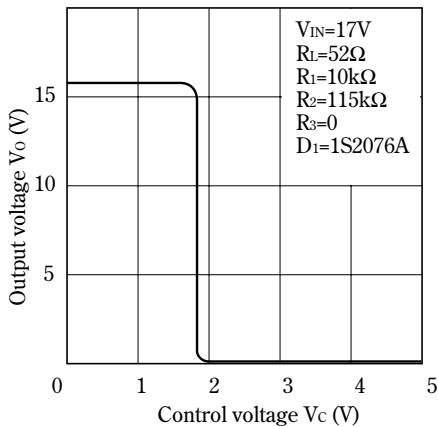
Hence, I_{OH}<0.2mA. Therefore V_{OH}(min) is ensured.

Next, assuming that V_F(min)=0.5V for D₂ in case of V_{OH}(max), we get:

I_{OH}=(5V-0.5V)(R₁+R₂)/R₁×R₂=0.49mA which is less than the rating.

Figure 1 shows the V_o-V_c characteristics when R₁=10kΩ, R₂=115kΩ, R₃=0Ω, V_{IN}=17V, R_L=52Ω, and D₁=1S2076A(Hitachi).

Output Voltage vs. Control Voltage(PQ30RV1)

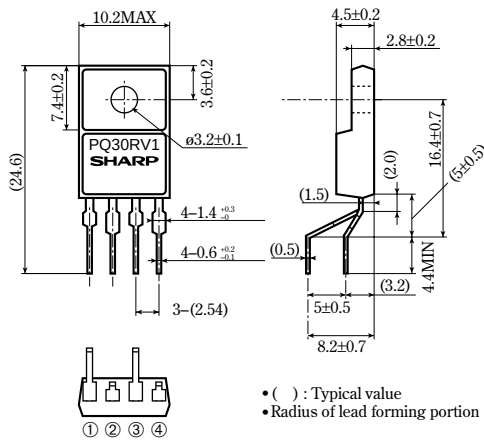


Model Line-ups for Lead Forming Type

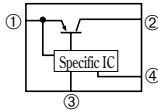
Output current	1A output	2A output
Output voltage precision:±2.5%	PQ30RV1B	PQ30RV2B

Outline Dimensions(PQ30RV1B/PQ30RV2B)

(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})

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

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