# PQxxxEF02SZH Series

TO-220 Type,Low Voltage Operation
Low Power-Loss Voltage Regulators

## ■ Features

1. Low voltage operation
   (Minimum operating voltage: 2.35V)
2. Low dissipation current
   (Dissipation current at no load: MAX. 2mA
    Output OFF-state dissipation current: MAX.5μA)
3. Low power-loss
   Dropout voltage: MAX.0.5V
4. Built-in overcurrent and overheat protection functions
5. RoHS directive compliant

## ■ Applications

1. AV equipment
   (Digital TV/STB/PDP/DVD recorder)
2. OA equipment
   (Printer/LCD monitor/Copier/LC projector)

## ■ Model Line-up

| Output voltage | Model No. | Output voltage | Model No. |
|---|---|---|---|
| 1.5V | PQ015EF02SZH | 2.5V | PQ025EF02SZH |
| 1.8V | PQ018EF02SZH | 3.3V | PQ033EF02SZH |

## ■ Absolute Maximum Ratings

(Ta=25°C)

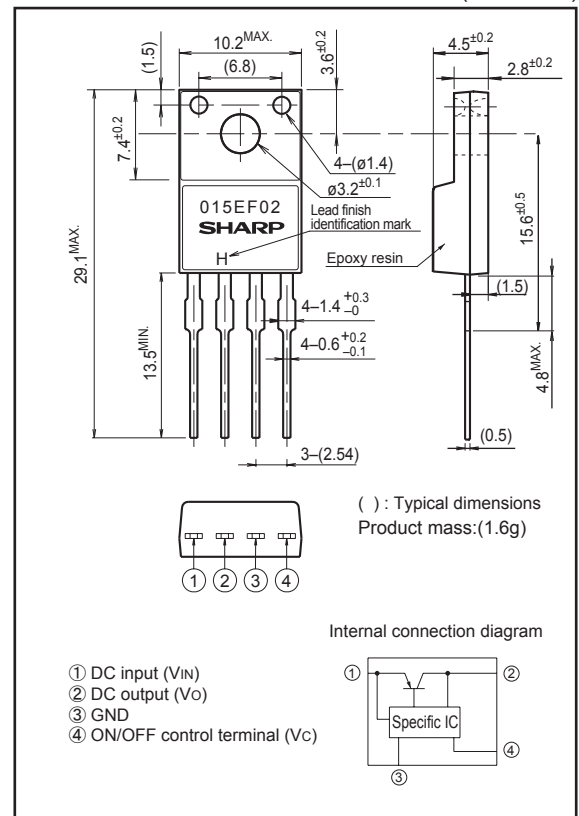| Parameter | Symbol | Rating | Unit |
|---|---|---|---|
| [*1] Input voltage | $V_{IN}$ | 10 | V |
| [*1] ON/OFF control terminal voltage | $V_C$ | 10 | V |
| Output current | $I_O$ | 2.0 | A |
| [*2] Power dissipation | $P_{D1}$ | 1.4 | W |
|  | $P_{D2}$ | 15 |  |
| [*3] Junction temperature | $T_j$ | 150 | °C |
| Operating temperature | $T_{opr}$ | -40 to +85 | °C |
| Storage temperature | $T_{stg}$ | -40 to +150 | °C |
| Soldering temperature | $T_{sol}$ | 260(10s) | °C |

*1 All are open except GND and applicable terminals.
*2 $P_{D1}$: No heat sink,$P_{D2}$: With infinite heat sink.
*3 Overheat protection may operate at Tj=125°C to 150°C

## ■ Outline Dimensions

(Unit : mm)



( ) : Typical dimensions
Product mass:(1.6g)

Internal connection diagram

① DC input ($V_{IN}$)
② DC output ($V_O$)
③ GND
④ ON/OFF control terminal ($V_C$)

Lead finish:Lead-free solder plating
(Composition:  Sn2Cu)

Sheet No.: OP06067

■ Electrical Characteristics

(Unless otherwise specified,condition shall be $V_{IN}=V_O$(TYP.)+1V,$I_O$=1A,$V_C$=2.7V,$T_a$=25°C)

| Parameter | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
|---|---|---|---|---|---|---|
| Input voltage | $V_{IN}$ | – | Refer to the table below | | | V |
| Output voltage | $V_O$ | – | Refer to the table below | | | V |
| Load regulation | $R_{egL}$ | $I_O$=5mA to 2.0A | – | 0.2 | 2.0 | % |
| Line regulation | $R_{eg}I$ | $V_{IN}=V_O$(TYP.)+1V to $V_O$(TYP.)+6V , $I_O$=5mA | – | 0.1 | 1.0 | % |
| Temperature coefficient of output voltage | $T_CV_O$ | $T_j$=0 to +125°C, $I_O$=5mA | – | ±0.01 | – | %/°C |
| Ripple rejection | RR | – | 45 | 60 | – | dB |
| ※4 Dropout voltage | $V_{I-O}$ | $I_O$=2A ※5 | – | – | 0.5 | V |
| ※6 ON-state voltage for control | $V_{C(ON)}$ | – | 2.0 | – | – | V |
| ON-state current for control | $I_{C(ON)}$ | – | – | – | 200 | μA |
| OFF-state voltage for control | $V_{C(OFF)}$ | – | – | – | 0.8 | V |
| OFF-state current for control | $I_{C(OFF)}$ | $V_C$=0.4V | – | – | 2 | μA |
| Quiescent current | $I_q$ | $I_O$=0A | – | 1 | 2 | mA |
| Output OFF-state dissipation current | $I_{qs}$ | $I_O$=0A, $V_C$=0.4V | – | – | 5 | μA |

※4 Applied to **PQ033EF02SZH**.
※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 off.

Table.1  Input Voltage Range

| Model No. | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
|---|---|---|---|---|---|---|
| **PQ015EF02SZH** | $V_{IN}$ | $I_O$=1A, $V_C$=2.7V, $T_a$=25°C | 2.35 | – | 10 | V |
| **PQ018EF02SZH** | | | 2.35 | – | 10 | |
| **PQ025EF02SZH** | | | 3.0 | – | 10 | |
| **PQ033EF02SZH** | | | 3.8 | – | 10 | |

Table.2  Output Voltage

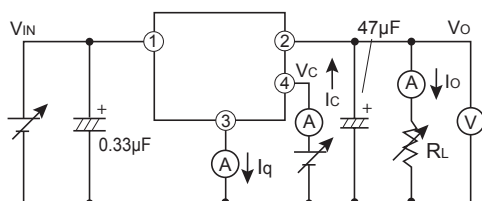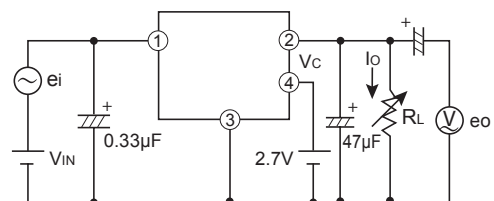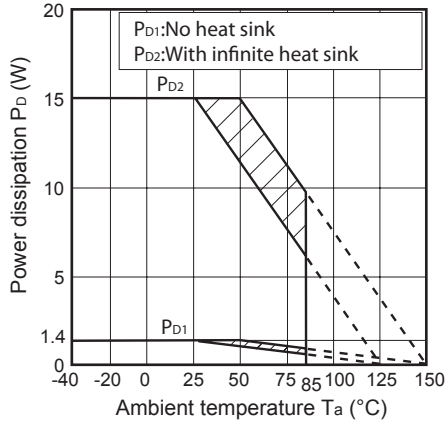| Model No. | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
|---|---|---|---|---|---|---|
| **PQ015EF02SZH** | $V_O$ | $V_{IN}=V_O$ (TYP.)+1V, $I_O$=1A, $V_C$=2.7V, $T_a$=25°C | 1.45 | 1.5 | 1.55 | V |
| **PQ018EF02SZH** | | | 1.75 | 1.8 | 1.85 | |
| **PQ025EF02SZH** | | | 2.438 | 2.5 | 2.562 | |
| **PQ033EF02SZH** | | | 3.218 | 3.3 | 3.382 | |

Fig.1  Test Circuit



Fig.2  Test Circuit of Ripple Rejection



f=120Hz (sine wave)
ei(rms)=0.5V
$V_{IN}=V_O$(TYP)+2V
$I_O$=0.3A
RR=20 log(ei(rms)/eo(rms))

Fig.3 Power Dissipation vs. Ambient Temperature



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

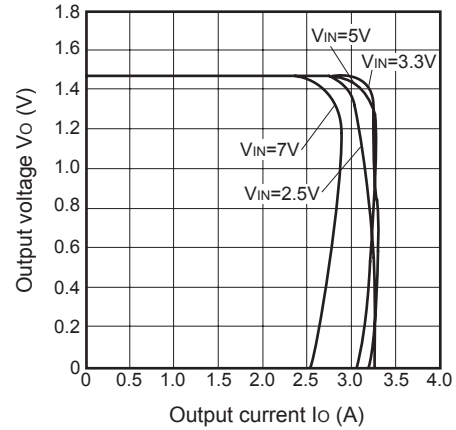Fig.4 Overcurrent Protection Characteristics (**PQ015EF02SZH**)



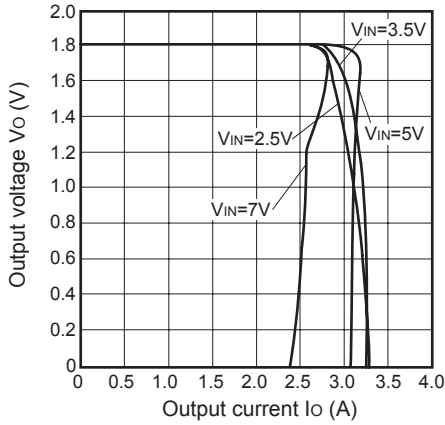Fig.5 Overcurrent Protection Characteristics (**PQ018EF02SZH**)



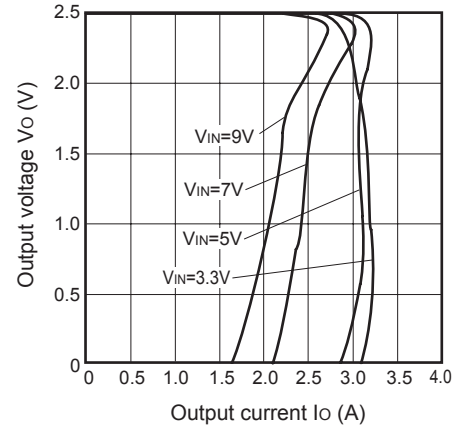Fig.6 Overcurrent Protection Characteristics (**PQ025EF02SZH**)



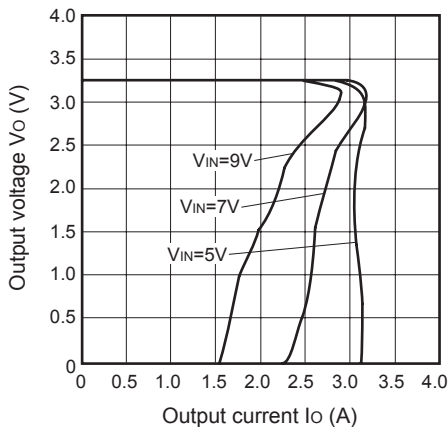Fig.7 Overcurrent Protection Characteristics (**PQ033EF02SZH**)
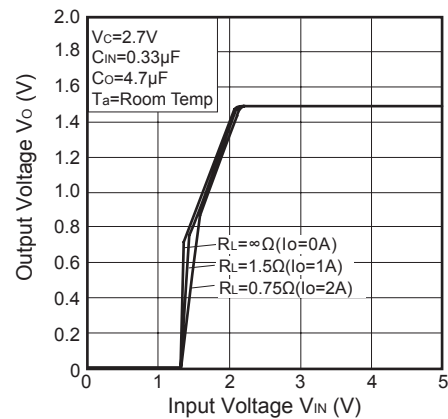


Fig.8 Output Voltage vs. Input Voltage (**PQ015EF02SZH)**

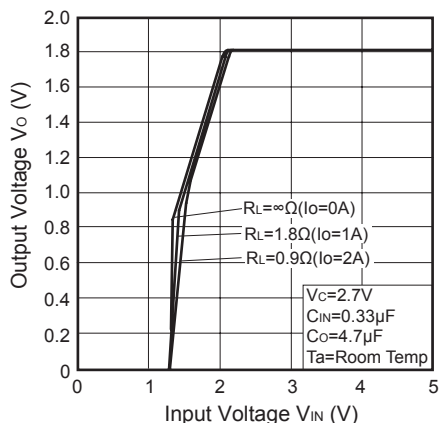Fig.9　Output Voltage vs. Input Voltage
(**PQ018EF02SZH)**



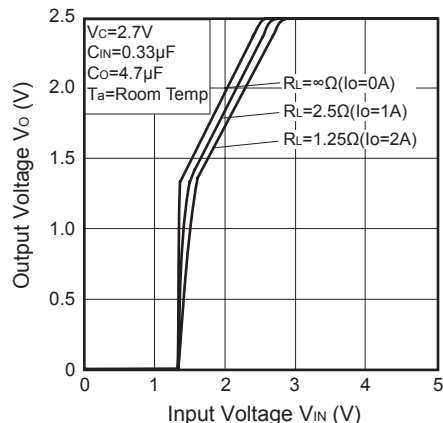Fig.10　Output Voltage vs. Input Voltage
(**PQ025EF02SZH)**



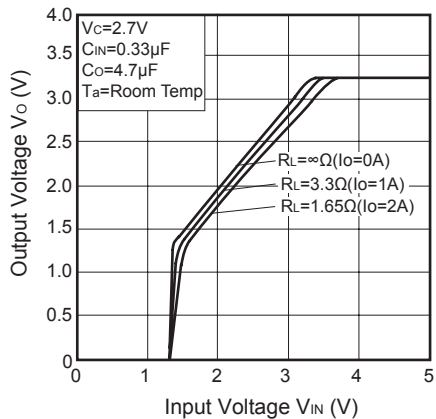Fig.11　Output Voltage vs. Input Voltage
(**PQ033EF02SZH)**



Fig.12　Circuit Operating Current vs. Input
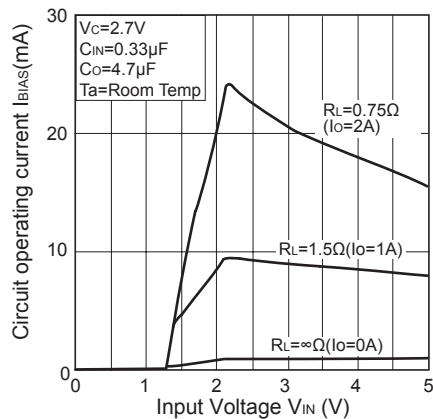Voltage (**PQ015EF02SZH**)



Fig.13　Circuit Operating Current vs. Input
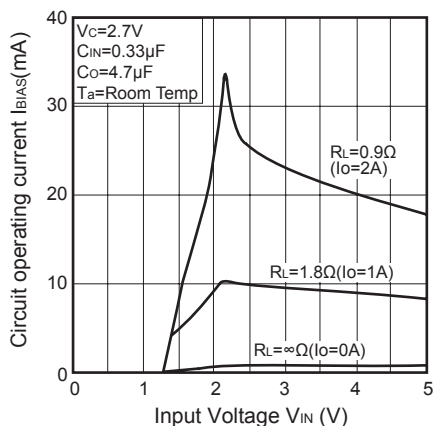Voltage (**PQ018EF02SZH**)



Fig.14　Circuit Operating Current vs. Input
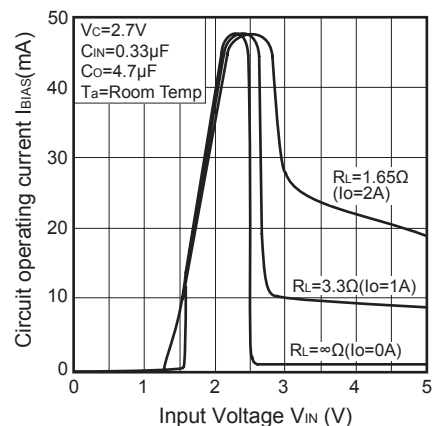Voltage (**PQ025EF02SZH**)

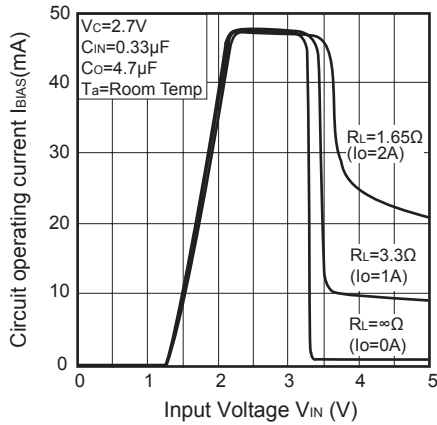Fig.15 Circuit Operating Current vs. Input Voltage (**PQ033EF02SZH**)

$V_C$=2.7V
$C_{IN}$=0.33µF
$C_O$=4.7µF
$T_a$=Room Temp

$R_L$=1.65Ω (Io=2A)

$R_L$=3.3Ω (Io=1A)

$R_L$=∞Ω (Io=0A)

Circuit operating current $I_{BIAS}$(mA)

Input Voltage $V_{IN}$ (V)

Fig.16 Dropout Voltage vs. Output Current (**PQ033EF02SZH**)

$V_{IN}$=2.35V
$V_C$=2.7V
$C_{IN}$=0.33µF
$C_O$=4.7µF

Dropout voltage $V_{i-o}$(V)

Output current Io(A)

Fig.17 Output Voltage vs. Ambient Temperature (**PQ018EF02SZH**)

$V_{IN}$=2.35V
$V_C$=2.7V
$I_O$=0A
$C_{IN}$=0.33µF
$C_O$=4.7µF

Output voltage $V_O$(V)

Ambient temperature $T_a$ (°C)

Fig.18 Quiescent Current vs. Ambient Temperature (**PQ018EF02SZH**)

$V_{IN}$=2.8V
$V_C$=2.7V
$I_O$=0A
$C_{IN}$=0.33µF
$C_O$=4.7µF

Quiescent current $I_q$(mA)

Ambient temperature $T_a$ (°C)
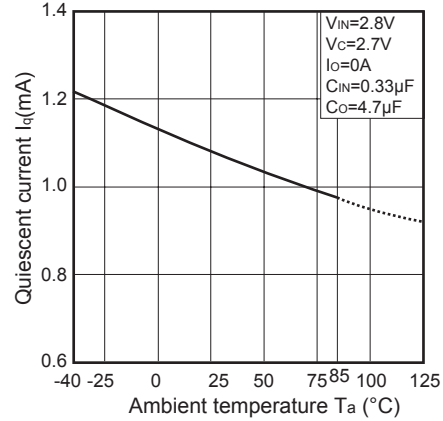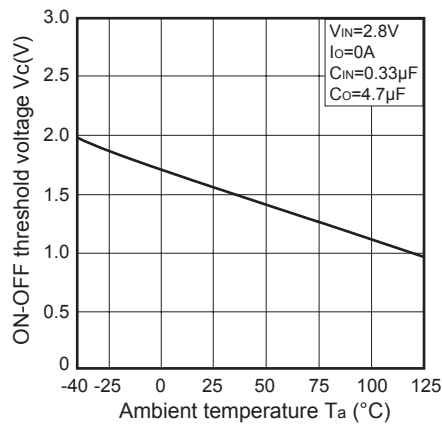
Fig.19 ON/OFF Threshold Voltage vs. Ambient Temperature (**PQ018EF02SZH**)

$V_{IN}$=2.8V
$I_O$=0A
$C_{IN}$=0.33µF
$C_O$=4.7µF

ON-OFF threshold voltage Vc(V)

Ambient temperature $T_a$ (°C)

■ Typical Application

$V_{IN}$
$C_{IN}$
Vo
$C_O$
Load

ON/OFF signal
 High : Output ON
 Low or Open : Output OFF