PQ25VB8M2FZ/ PQ25VB012FZ

Variable Output Type, built-in Overheat Shut-Down Function Low Power-Loss Voltage Regulator

■ Features

1. Compact resin full mold package
   (Equivalent to TO-220)
2. Low power-loss
   (Dropout voltage: MAX. 0.5V at I_O=0.5A)
3. Overheat shut-down function (keep shut-down output until power-on again)
4. Variable output voltage (setting range:1.5 to 25V)
5. With built-in overcurrent protection
6. Reference voltage precision:±2.0%
7. With built-in ON/OFF control function

■ Applications

1. Series power supply for TVs and VCRs
2. Power supplies for equipment
3. CRT displays

■ Outline Dimensions

(Unit : mm)

① DC input (V_{IN})
② ON/OFF control (V_C)
③ DC output (V_O)
④ Output voltage adjustment (V_{ADJ})
⑤ GND

■ Absolute Maximum Ratings

(Ta=25°C)

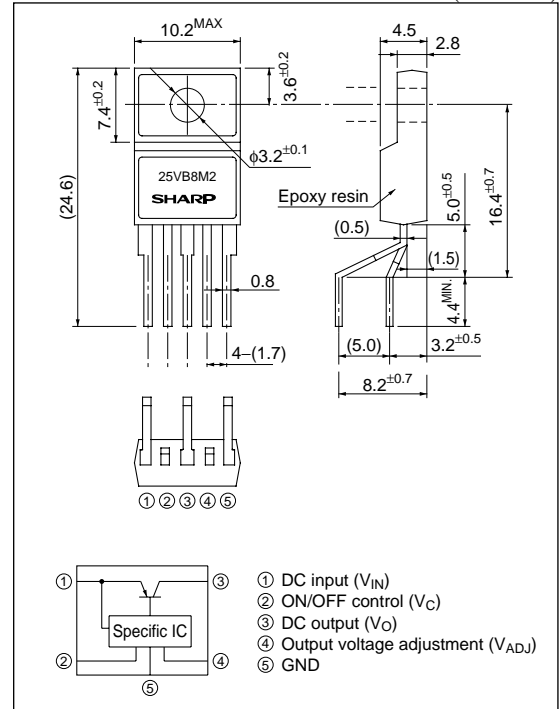| Parameter	Symbol	Rating	Unit
[*1]Input voltage	V_{IN}	27	V
[*1]ON/OFF control voltage	V_C	27	V
[*1]Output adjustment terminal voltage	V_{ADJ}	7	V
Output current PQ25VB8M2FZ	I_O	0.8	A
Output current PQ25VB012FZ	I_O	1	A
[*2]Power dissipation	P_{D1}	1.25	W
[*2]Power dissipation	P_{D2}	12.5	W
[*3]Junction 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 (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 shut-down function operates at Tj≥110°C

## ■ Electrical Characteristics (Unless otherwise specified, condition shall be V_{IN}=12V, V_O=10V (R_1=390Ω), I_O=0.5A, V_O=2.7V, Ta=25°C)

| Parameter		Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Minimum operating supply voltag		$V_{IN(MIN.)}$	–	4.5	–	27	V
Output voltage range		V_O	–	1.5	–	25	V
Load regulation	**PQ25VB8M2FZ**	$R_{eg}L$	I_O=5mA to 0.8A	–	0.3	1.0	%
	PQ25VB012FZ		I_O=5mA to 1A				
Line regulation		$R_{eg}I$	V_{IN}=11 to 20V, I_O=5mA	–	0.5	1.0	%
Ripple rejection		RR	Refer to Fig.2	45	55	–	dB
Reference voltage		V_{ref}	–	1.225	1.25	1.275	V
Reference voltage temperature coefficient		$T_C V_O$	T_j=0 to 110°C, I_O=5mA	–	±1.0	–	%
Dropout voltage		V_{I-O}	*4 I_O=0.5A	–	–	0.5	V
*5 Output on control voltage		$V_{C(ON)}$	*5	2.0	–	–	V
Output on control current		$I_{C(ON)}$	V_C=2.7V	–	–	20	μA
Output off control voltage		$V_{C(OFF)}$	–	–	–	0.8	V
Output off control current		$I_{C(OFF)}$	V_C=0.4V	–	–	–0.4	mA
Quiescent current		I_q	I_O=0A	–	–	7	mA
Overheating shutdown temperature		T_{SD}	–	110	130	150	°C

*4 Input voltage shall be the value when output voltage is 95% in comparison with the initial value
*5 In case of opening ON/OFF control terminal ②, output voltage turns on
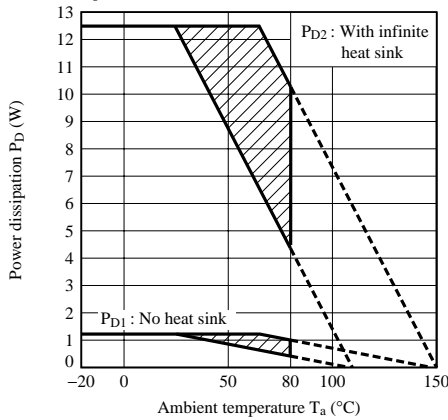
Fig.1 Standard Test Circuit
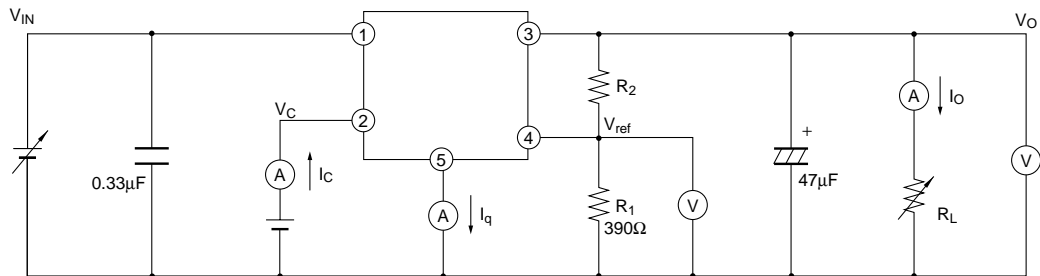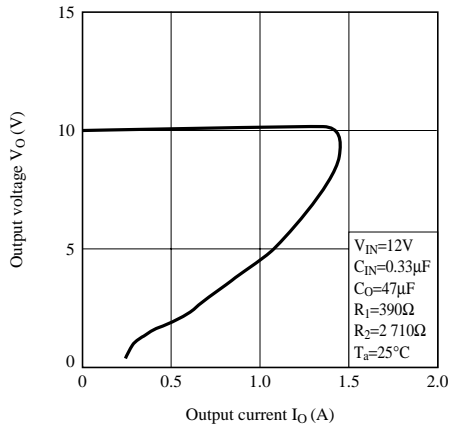

Fig.2 Test Circuit for Ripple Rejection
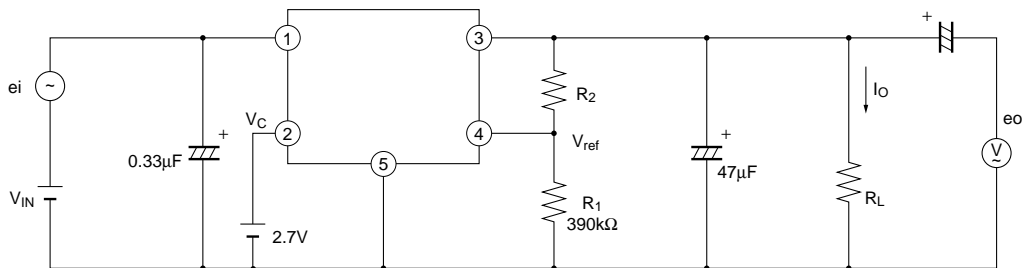
f=120Hz(sine wave)
ei(rms)=0.5V
V_O=10V(R_1=390Ω)
V_{IN}=12V
I_O=0.5A
RR=20log(ei(rms)/eo(rms))

Fig.3 Power Dissipation vs. Ambient Temperature

Power dissipation P_D (W)

P_{D2} : With infinite heat sink
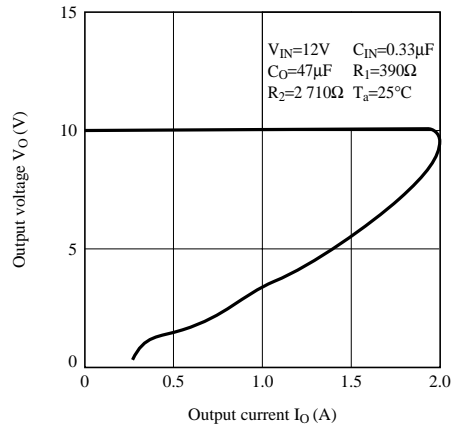
P_{D1} : No heat sink

Ambient temperature T_a (°C)

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

Fig.4 Overcurrent Protection Characteristics (PQ25VB8M2FZ)

Output voltage V_O (V)

V_{IN}=12V
C_{IN}=0.33μF
C_O=47μF
R_1=390Ω
R_2=2 710Ω
T_a=25°C

Output current I_O (A)

Fig.5 Overcurrent Protection Characteristics (PQ25VB012FZ)

Output voltage V_O (V)

V_{IN}=12V C_{IN}=0.33μF
C_O=47μF R_1=390Ω
R_2=2 710Ω T_a=25°C

Output current I_O (A)

Fig.6 Reference Voltage Fluctuation vs. Junction Temperature (PQ25VB8M2FZ)

Reference voltage fluctuation V_{ref} (V)

V_{IN}=12V
R_1=390Ω,
R_2=2 710Ω

V_{ref} (I_O=0.5A)

V_{ref} (I_O=0A)

Junction temperature T_j (°C)
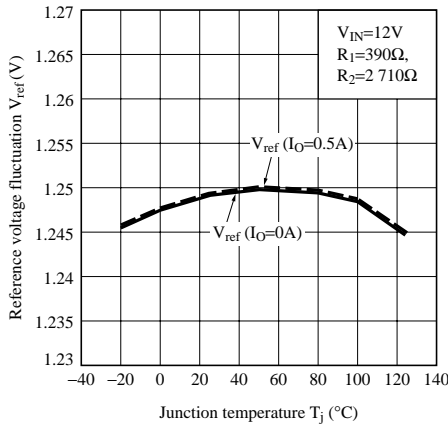
Fig.7 Reference Voltage Fluctuation vs. Junction Temperature (PQ25VB012FZ)

Reference voltage fluctuation V_{ref} (V)

V_{IN}=12V
R_1=390Ω,
R_2=2 710Ω

V_{ref} (I_O=0.5A)

V_{ref} (I_O=0A)
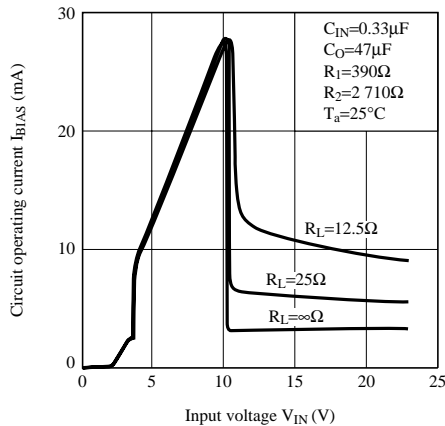
Junction temperature T_j (°C)
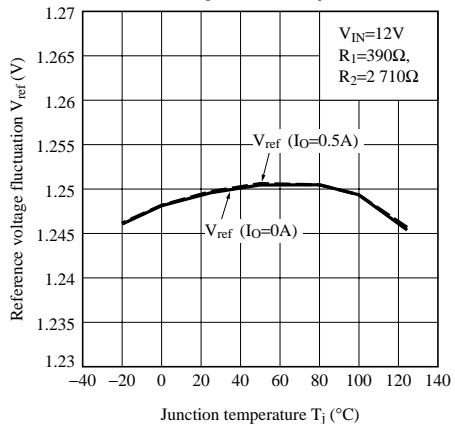
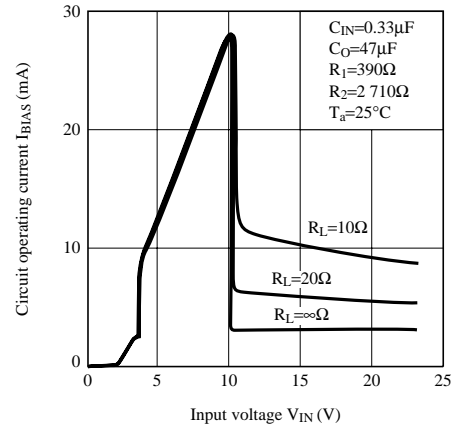**Fig.8 Output Voltage vs. Input Voltage
(PQ25VB8M2FZ)**

**Fig.9 Output Voltage vs. Input Voltage
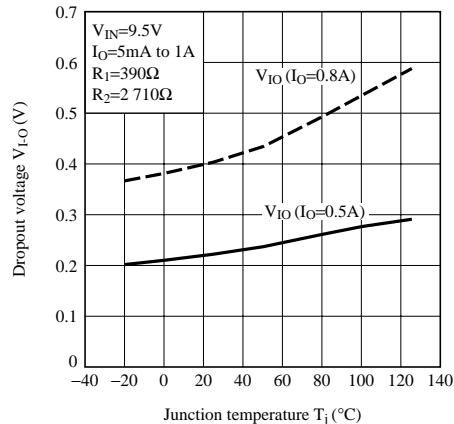(PQ25VB012FZ)**
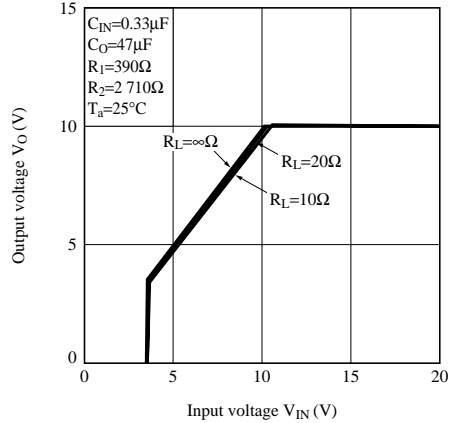
**Fig.10 Circuit Operating Current vs. Input
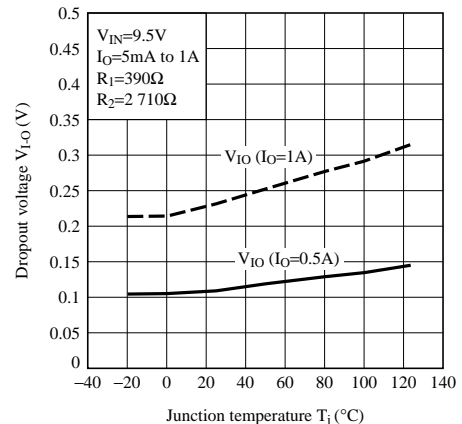Voltage (PQ25VB8M2FZ)**

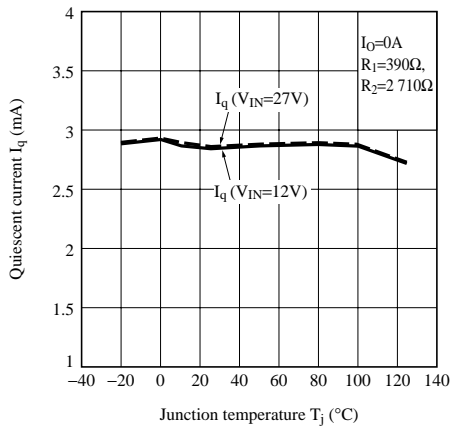**Fig.11 Circuit Operating Current vs. Input
Voltage (PQ25VB012FZ)**

**Fig.12 Dropout voltage vs. Junction
Temperature (PQ25VB8M2FZ)**

**Fig.13 Dropout voltage vs. Junction
Temperature (PQ25VB012FZ)**

**Fig.14 Quiescent Current vs. Junction Temperature (PQ25VB8M2FZ)**

$I_O=0A$
$R_1=390\Omega,$
$R_2=2\,710\Omega$

$I_q\,(V_{IN}=27V)$

$I_q\,(V_{IN}=12V)$

Quiescent current I_q (mA)

Junction temperature T_j (°C)

Fig.15 Quiescent Current vs. Junction Temperature (PQ25VB012FZ)

$I_O=0A$
$R_1=390\Omega,$
$R_2=2\,710\Omega$

$I_q\,(V_{IN}=27V)$

$I_q\,(V_{IN}=12V)$

Quiescent current I_q (mA)

Junction temperature T_j (°C)
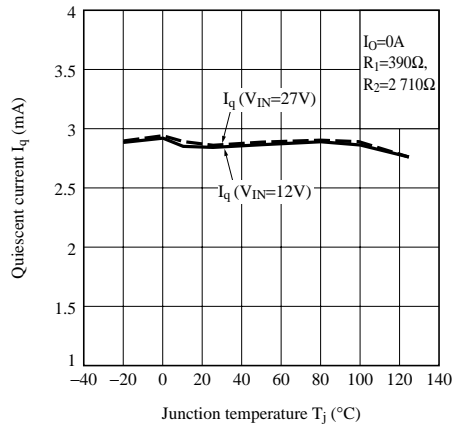
Fig.16 Ripple Rejection vs. Input Ripple Frequency (PQ25VB8M2FZ)

$V_{IN}=12V$
$V_O=10V$
$I_O=0.5A$

Ripple rejection RR (dB)

Input ripple frequency f (kHz)
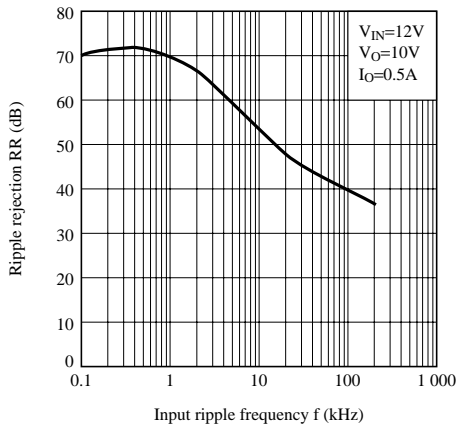
Fig.17 Ripple Rejection vs. Input Ripple Frequency (PQ25VB012FZ)

$V_{IN}=12V$
$V_O=10V$
$I_O=0.5A$

Ripple rejection RR (dB)

Input ripple frequency f (kHz)
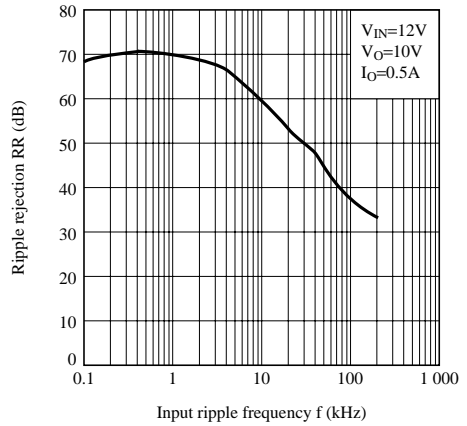
Fig.18 Output Voltage Adjustment Characteristics

$R_1=390\Omega$

Output voltage V_O (V)

$R_2\,(\Omega)$
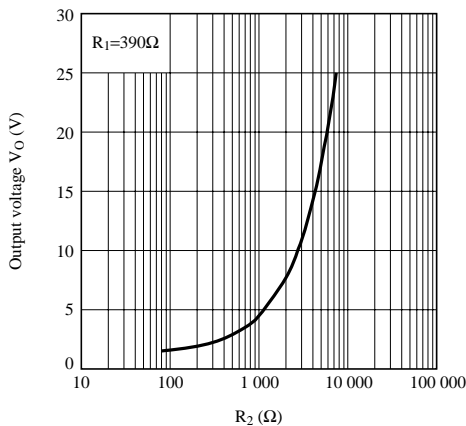
■ Precautions for Use
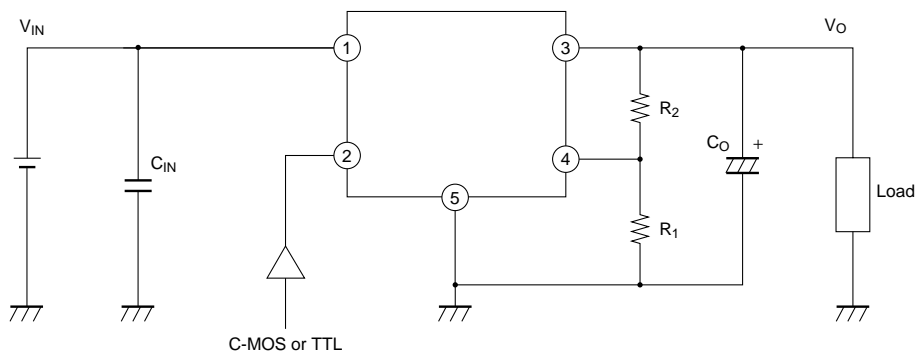
1. External connection

   (1) The connecting wiring of C_O and each terminal must be as short as possible. Owing to type, value and wiring condition of capacitor, it may oscillate. Confirm the output waveform under the actual condition before using.

   (2) ON/OFF control terminal ② is compatible with LS-TTL. It enables to be directly drive by TTL or C-MOS standard logic (RCA4000 series).

   (3) If voltage is applied under the conditions that the device pin is connected divergently or reversely, the deterioration of characteristics or damage may occur. Never allow improper mounting.

   (4) If voltage exceeding the voltage of DC input terminal ① is applied to the output terminal ③, the element may be damaged. Especially when the DC input terminal ① is short-circuited to the GND in ordinary operating state, charges accumulated in the output capacitor C_O flow to the input side, causing damage to the element. In this case, connect the ordinary silicon diode as shown in the figure.

2. Thermal protection design

   Power dissipation of devices is obtained by the following equation.

   $$P_D = I_O \times (V_{IN} - V_O) + V_{IN} \times I_q$$

   When ambient temperature T_a and power dissipation P_D during operation are determined, operate element within the safety operation area specified by the derating curve. Insufficient radiation gives an unfavorable influence to the normal operation and reliability of the device.

   In the external area of the safety operation area shown by the derating curve, the overheat protection circuit may operate to shut-down output. However please avoid keeping such condition for a long time.

3. ESD (Electrostatic Sensitivity Discharge)

   Be careful not to apply electrostatic discharge to the device since this device employs a bipolar IC and may be damaged by electro static discharge. Followings are some methods against excessive voltage caused by electro static discharge.

   (1) Human body must be grounded to discharge the electro charge which is charged in the body or cloth.

   (2) Anything that is in contact with the device such as workbench, inserter, or measuring instrument must be grounded.

   (3) Use a soldering dip basin with a minimum leak current (isolation resistance 10MΩ or more) from the AC power supply line. Also the soldering dip basin must be grounded.
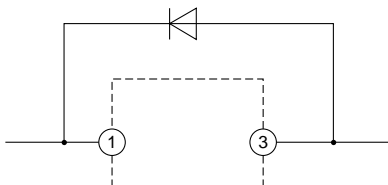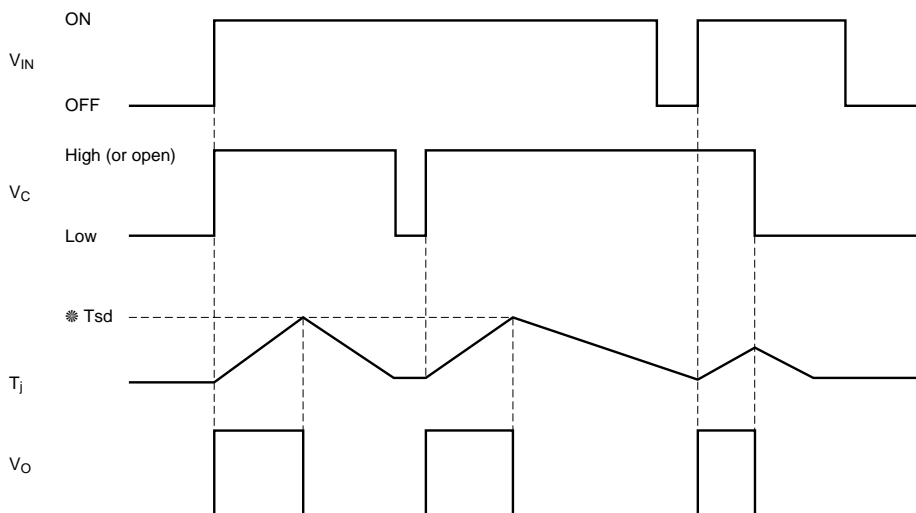
■ **Output Voltage Fine Tuning**

1. Connecting external resistors R_1 and R_2 to terminals ③, ④, ⑤ allows the output voltage to be fine tuned from 1.5V to 25V. Refer to the figure below and Fig.18 when connecting external resistors for fine tuning output voltage.

$$V_O = V_{ref} \times (1 + R_2/R_1)$$
$$\fallingdotseq 1.25 \times (1 + R_2/390)$$
$$[R_1 = 390\Omega, V_{ref} = 1.25V]$$
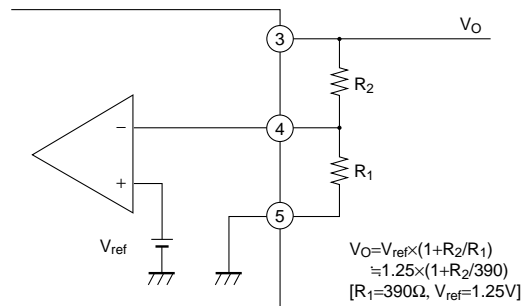
■ **Overheat Shut-down Characteristics**

❋ Tsd:Overheat shut-down temperature (Tj≥110℃)

    (1) Overheat shut-down operates at T_j=Tsd and output OFF-state is maintained.

    (2) OFF-state is kept untill V_{IN} is once turned off or V_C is turned down to the "L" level.

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