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April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (<http://www.renesas.com>)

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M5291P/FP

DC/DC Converter

REJ03D0841-0201

Rev.2.01

Nov 14, 2007

Description

M5291 is a semiconductor integrated circuit which is designed for switching regulator control. The device consists of a comparator, controlled pulse width oscillator (with peak current protection circuit), temperature compensated reference, and high current output switch.

Especially, this IC was designed for Step-Down and Step-Up and Voltage-Inverting applications.

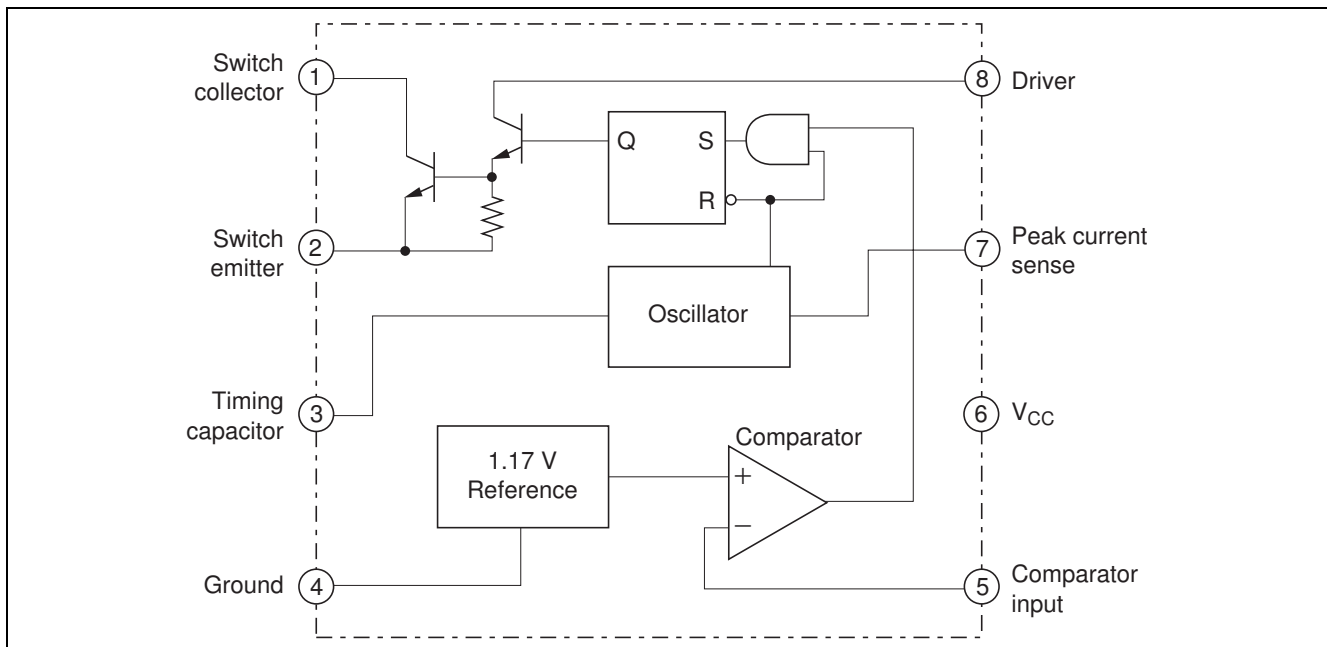
Features

- Wide supply voltage range.....2.5 to 40 V
- Low dissipation current.....1.4 mA
- Wide range of output
Voltage adjust.....1.17 to 40 V
- Output switch current.....200 mA
- Wide range of switching frequency..... 100 Hz to 100 kHz
- Built-in peak current protection circuit

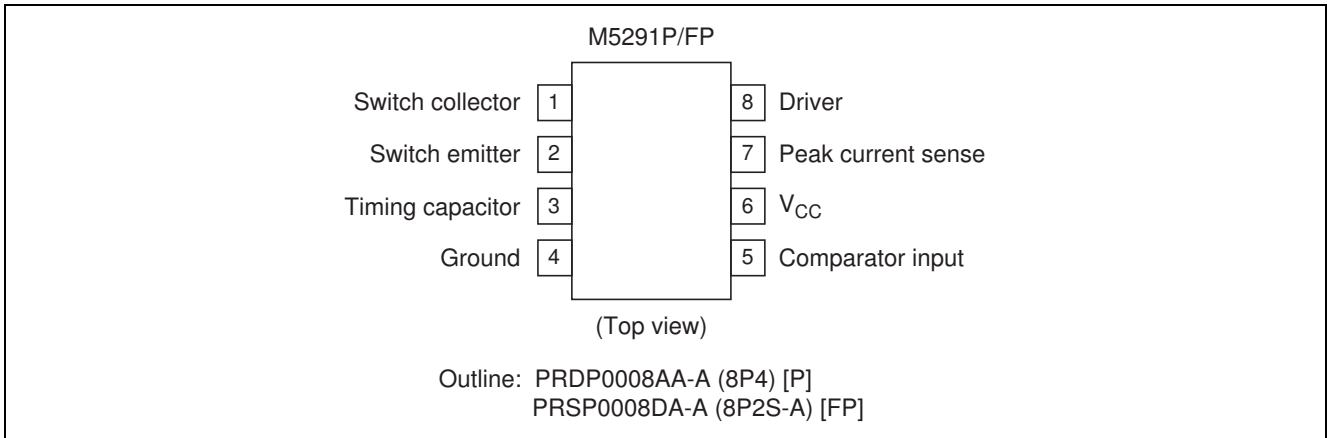
Application

General power supply system

Block Diagram



Pin Arrangement



Absolute Maximum Ratings

(Ta = 25°C, unless otherwise noted)

| Item | Symbol | Ratings | Unit | Conditions |
|-------------------------------|--------------------|-------------|-------|------------------|
| Power supply voltage | V _{CC} | 40 | V | |
| Input voltage | V _{IN} | -0.3 to 40 | V | Comparator input |
| Switch collector voltage | V _{C(S)} | 40 | V | |
| Switch emitter voltage | V _{E(S)} | 40 | V | |
| Collector emitter voltage | V _{CE(S)} | 40 | V | |
| Driver collector voltage | V _{C(D)} | 40 | V | |
| Switch current | I _{SW} | 200 | mA | |
| Internal power dissipation | Pd | 625 | mW | 8-pin DIP |
| | | 440 | | 8-pin FLAT |
| Thermal derating | Kθ | 6.25 | mW/°C | 8-pin DIP |
| | | 4.5 | | 8-pin FLAT |
| Operating ambient temperature | T _{opr} | -20 to +75 | °C | |
| Storage temperature | T _{stg} | -55 to +125 | °C | |

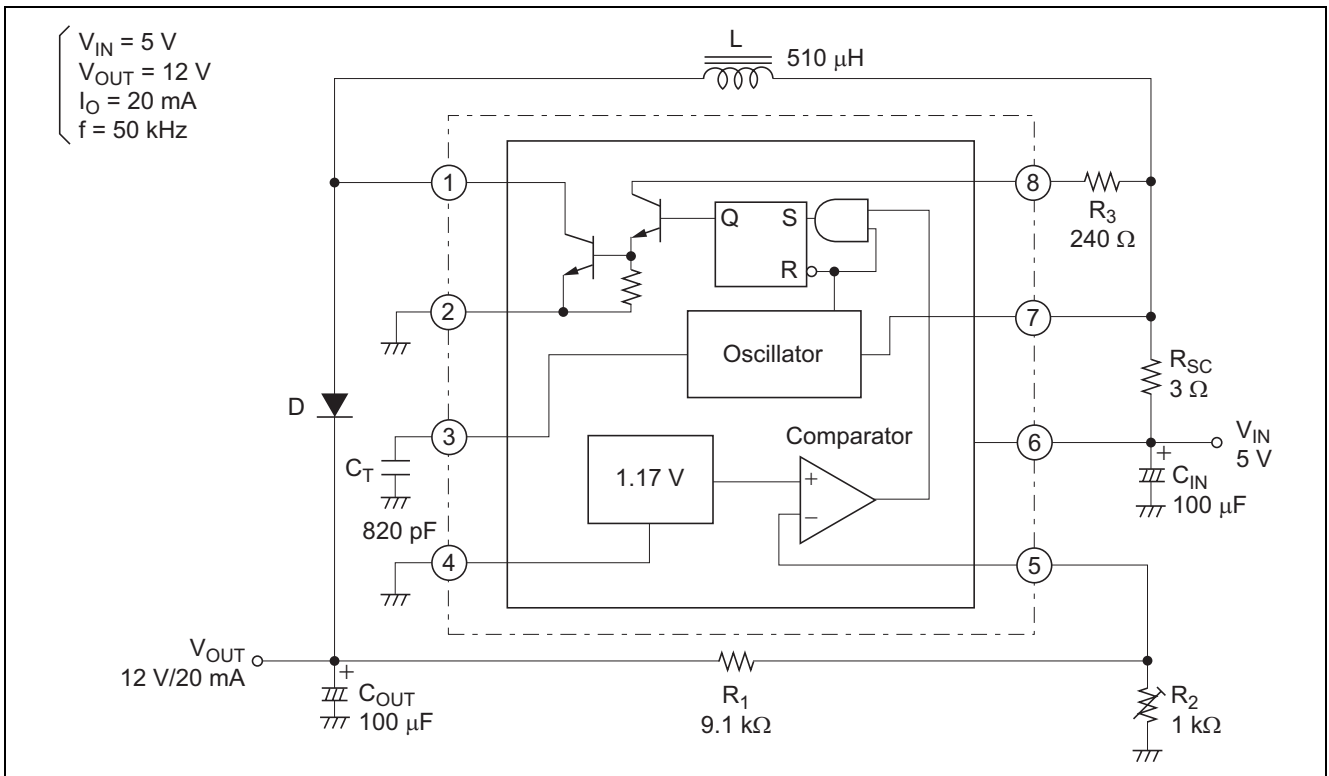
Electrical Characteristics

(Ta = 25°C, V_{CC} = 5 V)

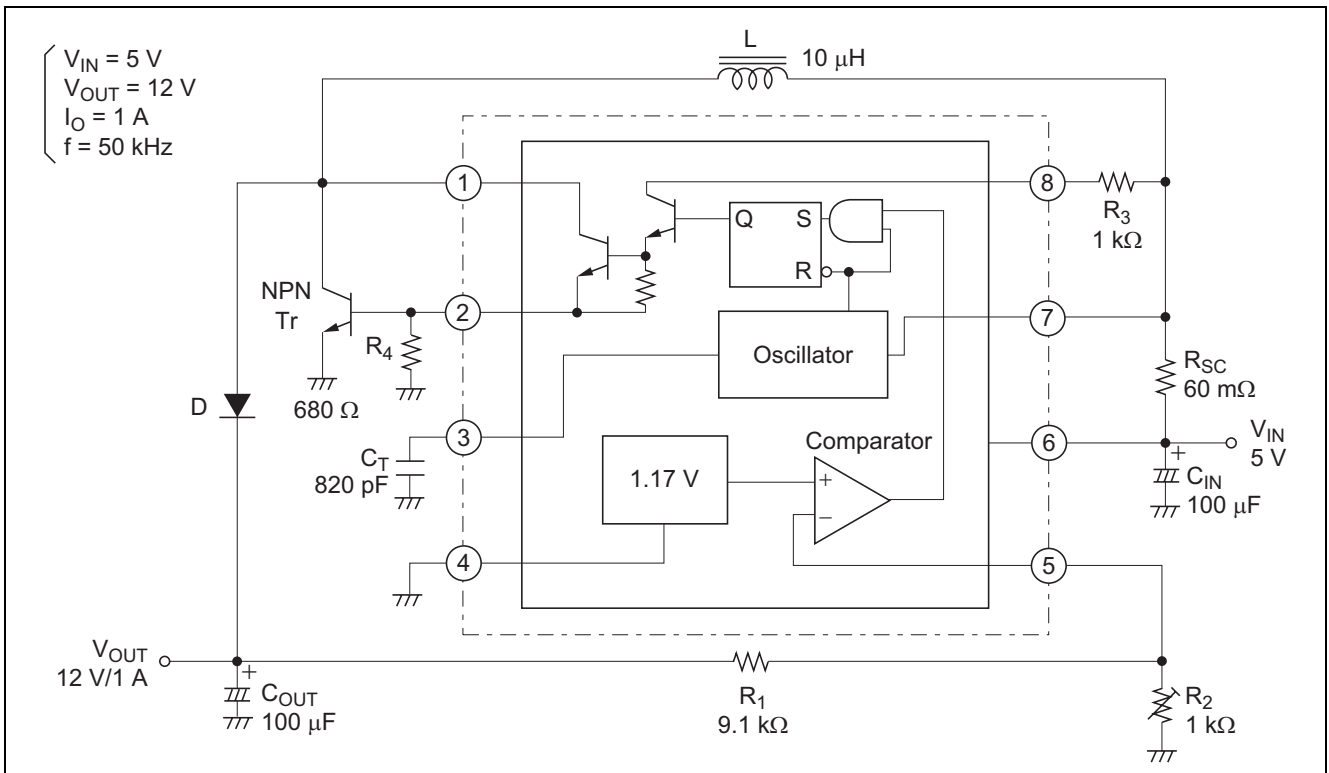
| Item | Symbol | Limits | | | Unit | Test Conditions | |
|-----------------|---------------------------------------|--------------------------------|------|------|------|------------------|--|
| | | Min | Typ | Max | | | |
| Oscillator | Charge current | I _C | 20 | 35 | 50 | μA | |
| | Discharge current | I _D | 150 | 200 | 250 | μA | |
| | Oscillator voltage | V _{OSC} | — | 0.6 | — | V _{P-P} | |
| | Charge, discharge current ratio | I _D /I _C | — | 6 | — | — | |
| | Current protection, detecting voltage | V _{IPK} | 270 | 330 | 390 | mV | |
| Output | Saturation voltage | V _{sat1} | — | 1.5 | 2.0 | V | Darlington connection I _{SW} = 50 mA |
| | Saturation voltage | V _{sat2} | — | 0.3 | 0.6 | V | I _{SW} = 50 mA I _{C(D)} = 10 mA |
| | Collector leak current | I _L | — | 10 | — | nA | V _{CE} = 40 V |
| Comparator | Threshold voltage | V _{TH} | 1.11 | 1.17 | 1.23 | V | |
| | Threshold voltage regulation | V _{THREG} | — | 0.03 | 0.2 | mV/V | 3.0 ≤ V _{CC} ≤ 40 V |
| | Input bias current | I _B | — | 40 | 200 | nA | V _{IN} = 0 V |
| Circuit current | I _{CC} | — | 1.4 | 2.5 | mA | | |

Application Circuits

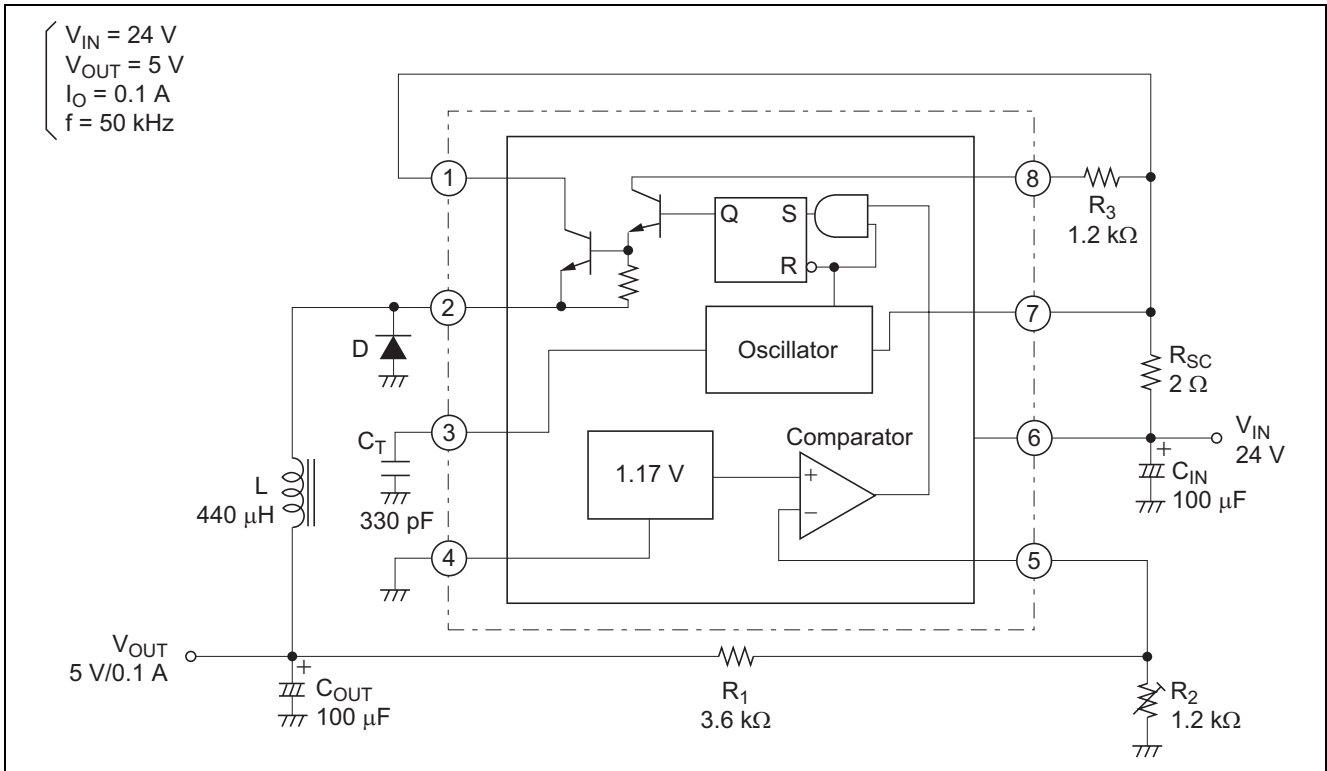
1. Step-up Circuit



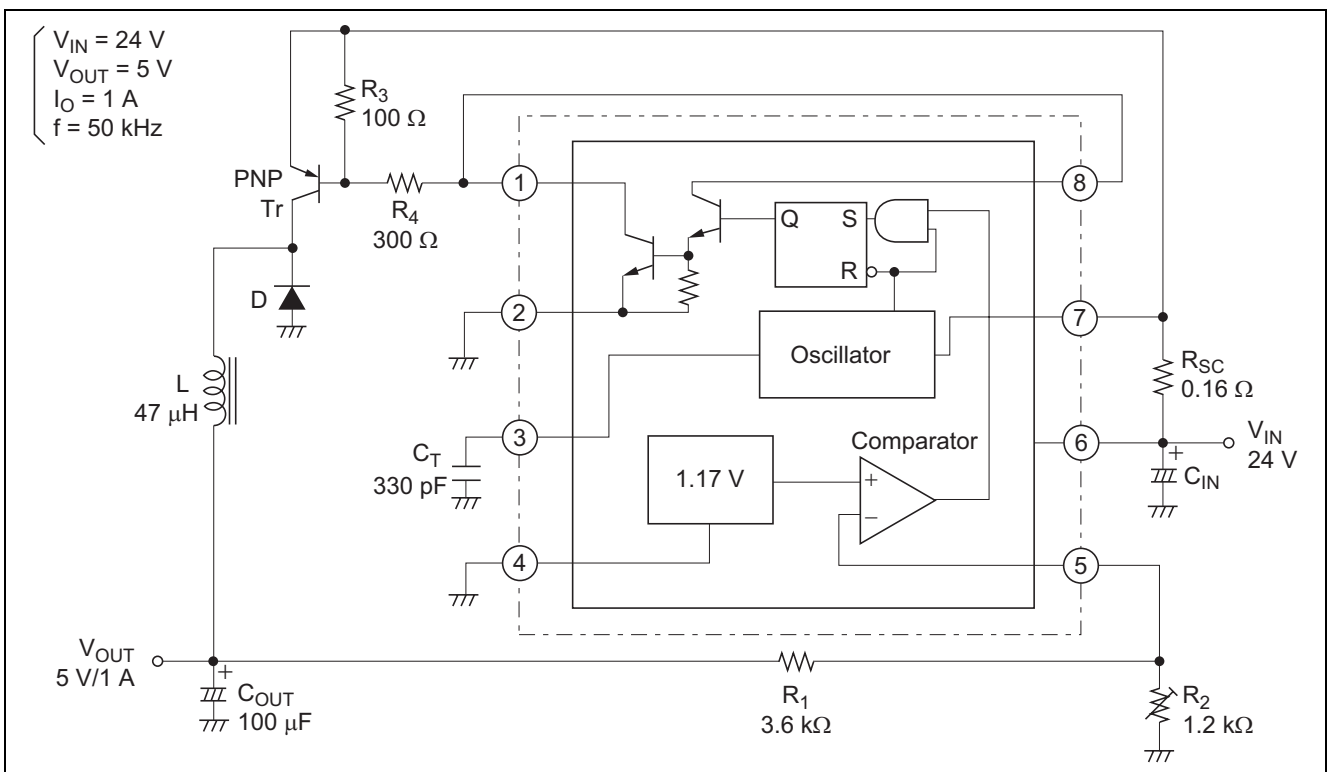
2. Step-up Circuit with Transistor



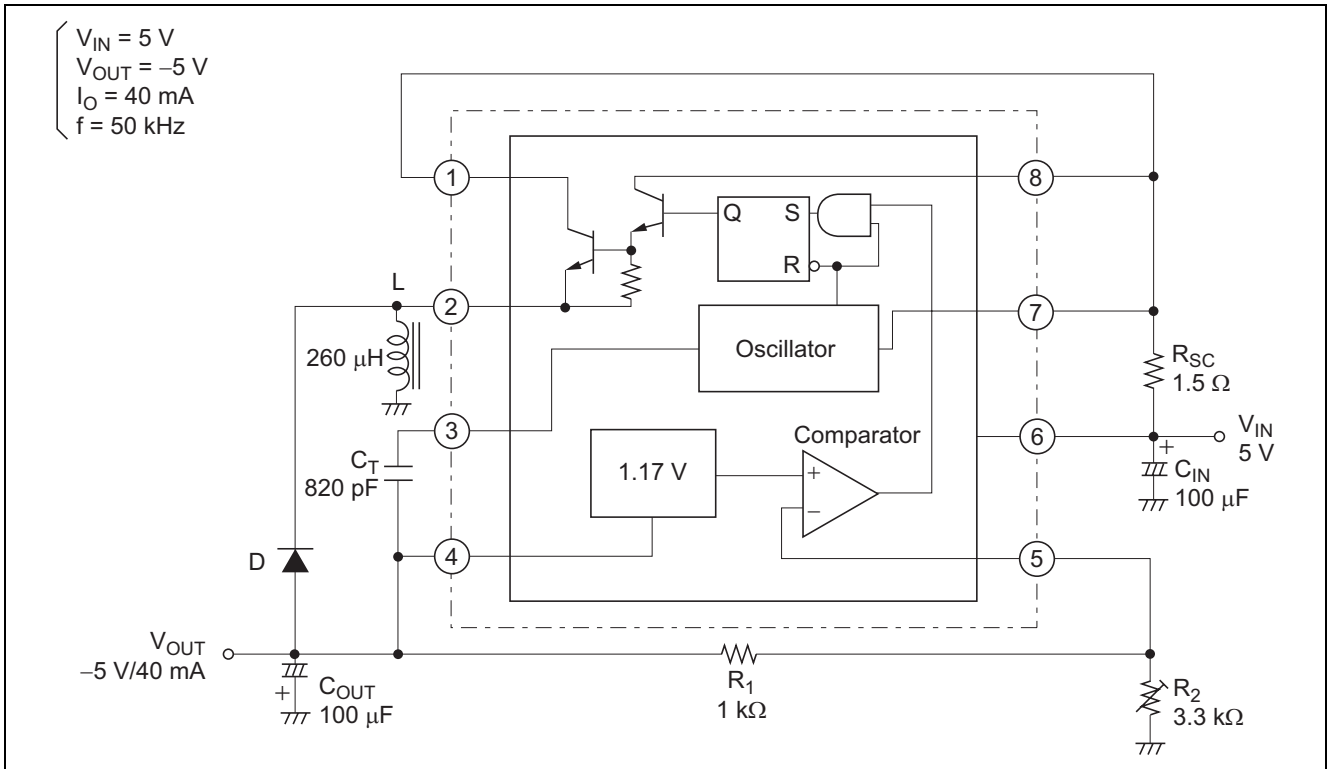
3. Step-down Circuit



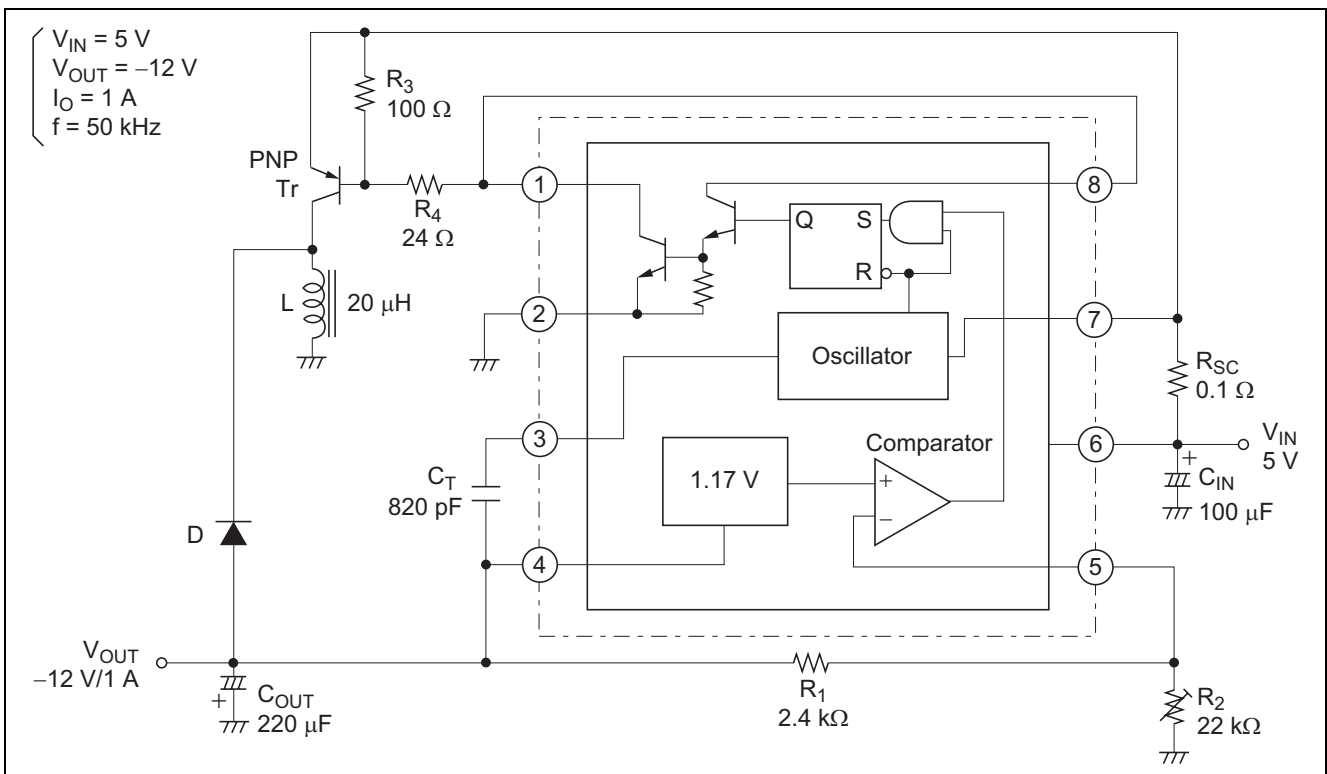
4. Step-down Circuit with Transistor



5. Inverse Polarity Circuit



6. Inverse Polarity Circuit with Transistor



Constant Definition

| Constant | Step-down Circuit | Step-up Circuit | Inverse Polarity Circuit |
|----------------------------|--|---|--|
| $\frac{T_{ON}}{T_{OFF}}$ | $\frac{V_{OUT} + V_F}{V_{IN(MIN)} - V_{sat} - V_{OUT}}$ | $\frac{V_{OUT} + V_F - V_{IN(MIN)}}{V_{IN(MIN)} - V_{sat}}$ | $\frac{ V_{OUT} + V_F}{V_{IN} - V_{sat}}$ |
| $(T_{ON} + T_{OFF})_{MAX}$ | $\frac{1}{f_{MIN}}$ | $\frac{1}{f_{MIN}}$ | $\frac{1}{f_{MIN}}$ |
| T_{OFF} | $\frac{T_{ON} + T_{OFF}}{1 + \frac{T_{ON}}{T_{OFF}}}$ | $\frac{T_{ON} + T_{OFF}}{1 + \frac{T_{ON}}{T_{OFF}}}$ | $\frac{T_{ON} + T_{OFF}}{1 + \frac{T_{ON}}{T_{OFF}}}$ |
| T_{ON} | $\frac{1}{f_{MIN}} - T_{OFF}$ | $\frac{1}{f_{MIN}} - T_{OFF}$ | $\frac{1}{f_{MIN}} - T_{OFF}$ |
| C_T | $6 \times 10^{-5} \cdot T_{ON}$ | $6 \times 10^{-5} \cdot T_{ON}$ | $6 \times 10^{-5} \cdot T_{ON}$ |
| I_{PK} | $2 \cdot I_{OUT(MAX)}$ | $2 \cdot I_{OUT(MAX)} \cdot (1 + \frac{T_{ON}}{T_{OFF}})$ | $2 \cdot I_{OUT(MAX)} \cdot (1 + \frac{T_{ON}}{T_{OFF}})$ |
| $L_{(MIN)}$ | $(\frac{V_{IN(MIN)} - V_{sat} - V_{OUT}}{I_{PK}}) \cdot T_{ON(MAX)}$ | $(\frac{V_{IN(MIN)} - V_{sat}}{I_{PK}}) \cdot T_{ON(MAX)}$ | $(\frac{V_{IN(MIN)} - V_{sat}}{I_{PK}}) \cdot T_{ON(MAX)}$ |
| R_{SC} | $\frac{0.33}{I_{PK}}$ | $\frac{0.33}{I_{PK}}$ | $\frac{0.33}{I_{PK}}$ |
| V_O | $1.17 \times (1 + \frac{R_1}{R_2})$ | $1.17 \times (1 + \frac{R_1}{R_2})$ | $1.17 \times (1 + \frac{R_2}{R_1})$ |

Note: V_F : Forward Voltage of Diode

V_{sat} : Output saturation voltage of M5291 (0.6 Vmax at single output, 2.0 Vmax at Darlington output)

Setting switching frequency first and calculate each constant value.

Notes:

1. Peak current sense

In overcurrent function, oscillator is stop, when voltage descend of external detecting resistance is more than 330 mV.

2. ON/OFF Control

If you need stop the action, connected resistance (5 to 10 kΩ) between supply voltage terminal and timing capacitor terminal.

3. $\frac{T_{ON}}{T_{ON} + T_{OFF}}$ is not established more than 0.857, because charge and discharge current ratio fixed 1 : 6.

Package Dimensions

| | | | |
|--|-------------------------------|----------------------|--------------------|
| JEITA Package Code P-DIP8-6.3x8.84-2.54 | RENEASAS Code PRDP0008AA-A | Previous Code 8P4 | MASS[Typ.] 0.5g |
|--|-------------------------------|----------------------|--------------------|

NOTE)
 1. DIMENSIONS **1* AND **2*
 DO NOT INCLUDE MOLD FLASH.
 2. DIMENSION **3* DOES NOT
 INCLUDE TRIM OFFSET.

| Reference Symbol | Dimension in Millimeters | | |
|------------------|--------------------------|------|------|
| | Min | Nom | Max |
| e ₁ | 7.32 | 7.62 | 7.92 |
| D | 8.7 | 8.9 | 9.1 |
| E | 6.15 | 6.3 | 6.45 |
| A | — | — | 4.5 |
| A ₁ | 0.51 | — | — |
| A ₂ | — | 3.3 | — |
| b _p | 0.4 | 0.5 | 0.6 |
| b ₂ | 0.9 | 1.0 | 1.3 |
| b ₃ | 1.4 | 1.5 | 1.8 |
| c | 0.22 | 0.27 | 0.34 |
| θ | 0° | — | 15° |
| e | 2.29 | 2.54 | 2.79 |
| L | 3.0 | — | — |

| | | | |
|---|-------------------------------|-------------------------|---------------------|
| JEITA Package Code P-SOP8-4.4x5-1.27 | RENEASAS Code PRSP0008DA-A | Previous Code 8P2S-A | MASS[Typ.] 0.07g |
|---|-------------------------------|-------------------------|---------------------|

NOTE)
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 2. DIMENSION **3* DOES NOT
 INCLUDE TRIM OFFSET.

| Reference Symbol | Dimension in Millimeters | | |
|------------------|--------------------------|------|------|
| | Min | Nom | Max |
| D | 4.8 | 5.0 | 5.2 |
| E | 4.2 | 4.4 | 4.6 |
| A ₂ | — | 1.5 | — |
| A ₁ | 0.05 | — | — |
| A | — | — | 1.9 |
| b _p | 0.35 | 0.4 | 0.5 |
| c | 0.13 | 0.15 | 0.2 |
| θ | 0° | — | 10° |
| H _E | 5.9 | 6.2 | 6.5 |
| e | 1.12 | 1.27 | 1.42 |
| y | — | — | 0.1 |
| L | 0.2 | 0.4 | 0.6 |

Notes:

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