

M5291P/FP

DC/DC Converter

REJ03D0841-0300

Rev.3.00

Jun 15, 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.

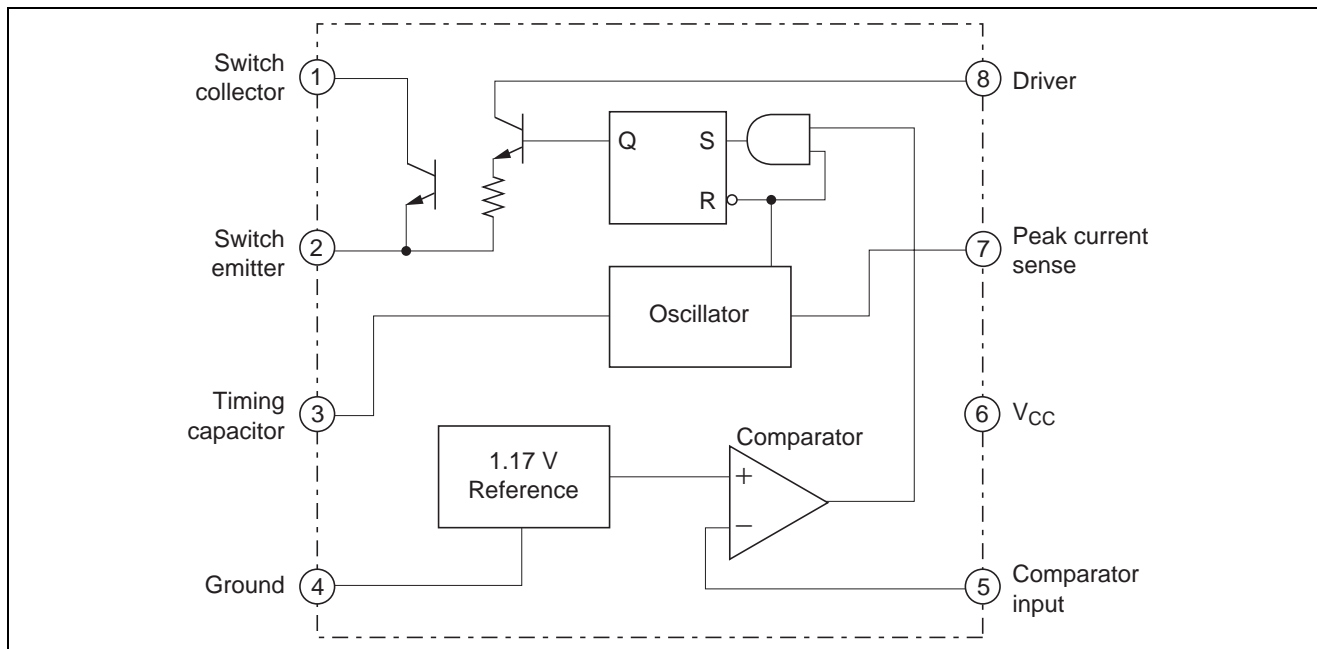
Features

- 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

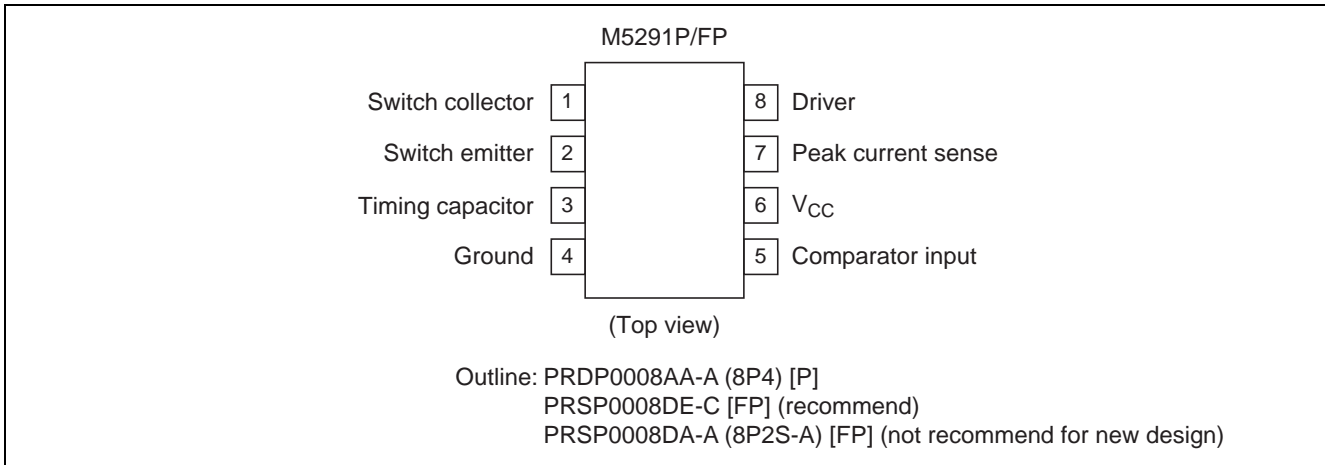
Application

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	

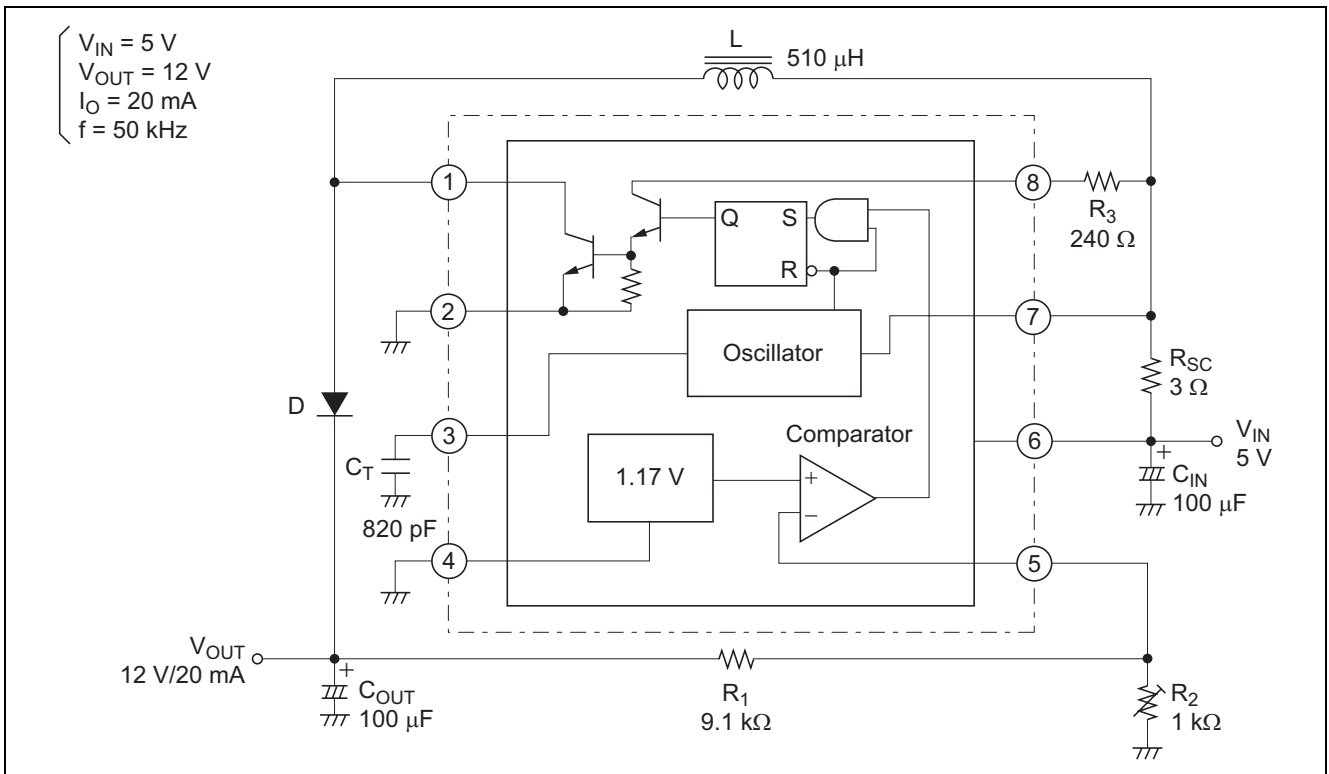
Electrical Characteristics

(Ta = 25°C, V_{CC} = 5 V)

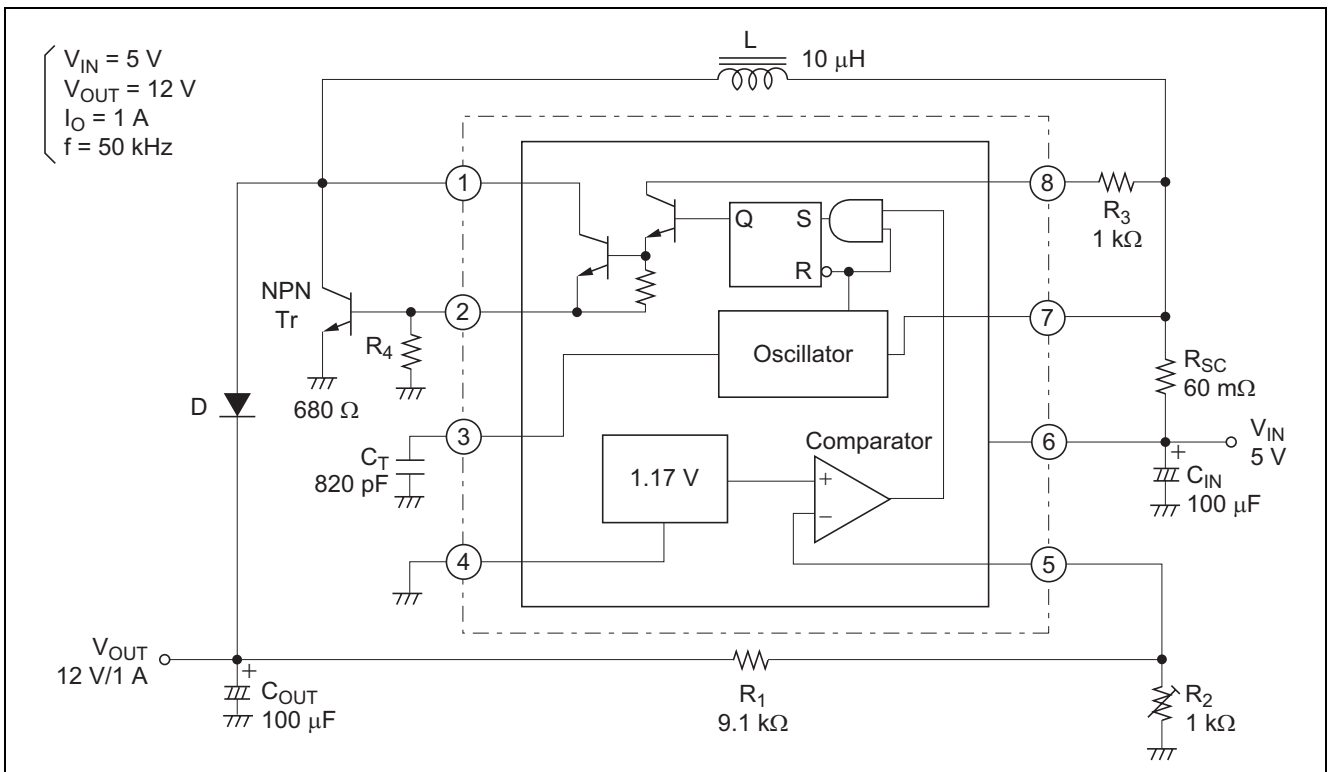
Item	Symbol	Limits			Unit	Test Conditions	
		Min	Typ	Max			
Oscillator	Charge current	I _C	20	35	50	μA	
	Discharge current	I _D	150	200	250	μA	
	Oscillator voltage	V _{OSC}	—	0.6	—	V _{P-P}	
	Charge, discharge current ratio	I _D /I _C	—	6	—	—	
	Current protection, detecting voltage	V _{IPK}	270	330	390	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

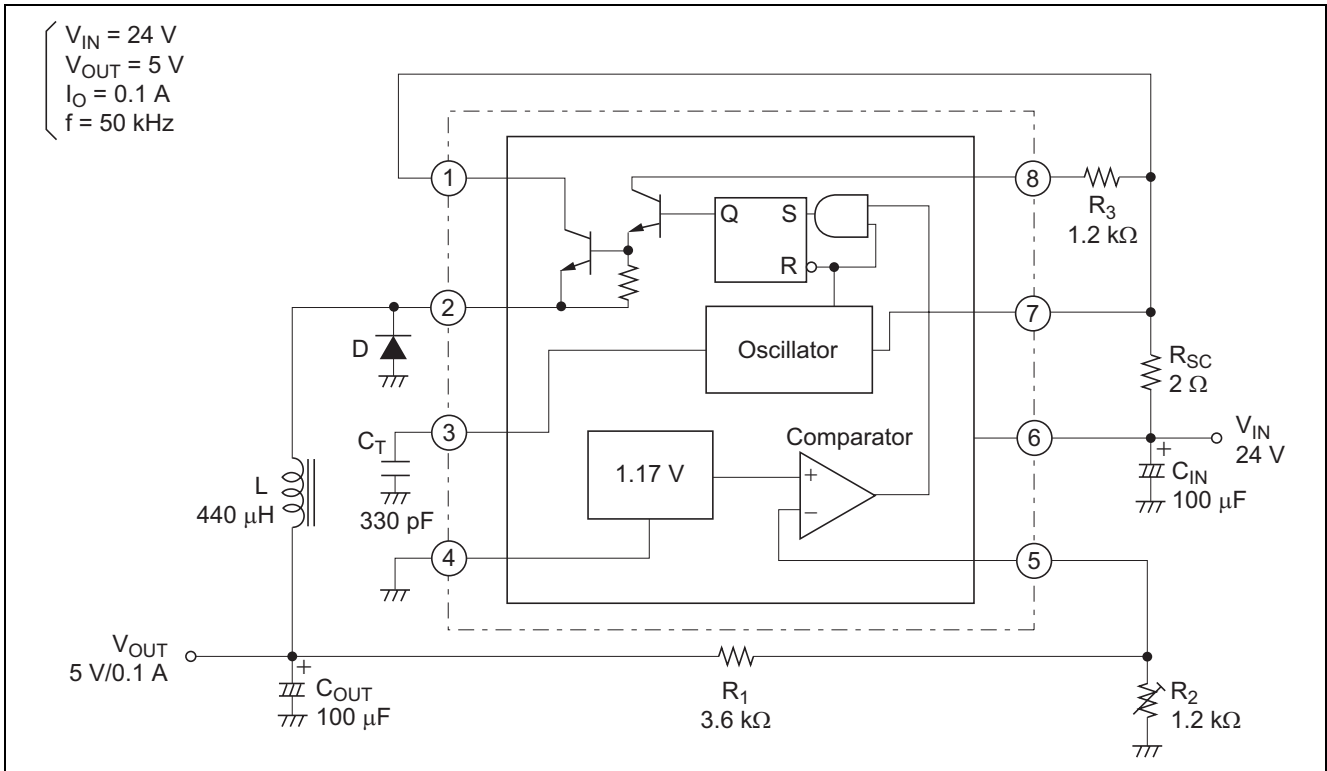
1. Step-up Circuit



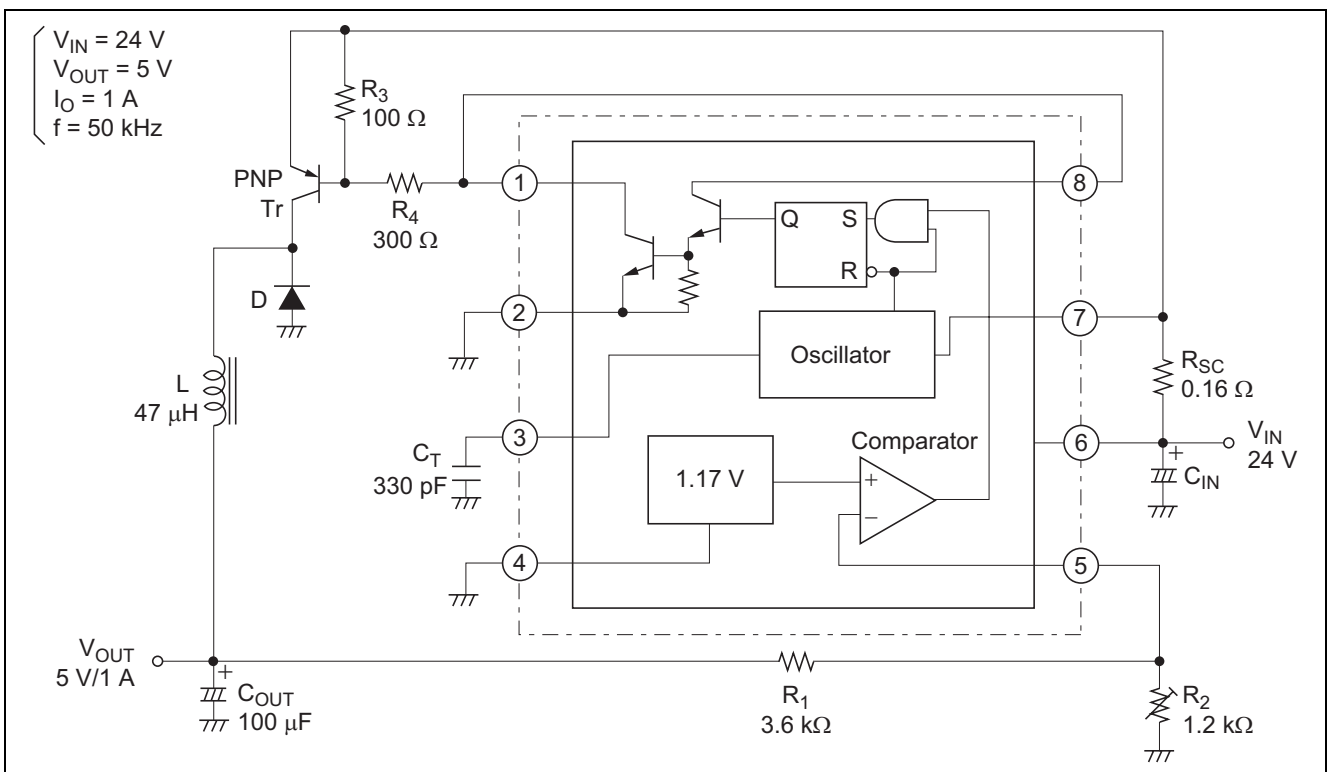
2. Step-up Circuit with Transistor



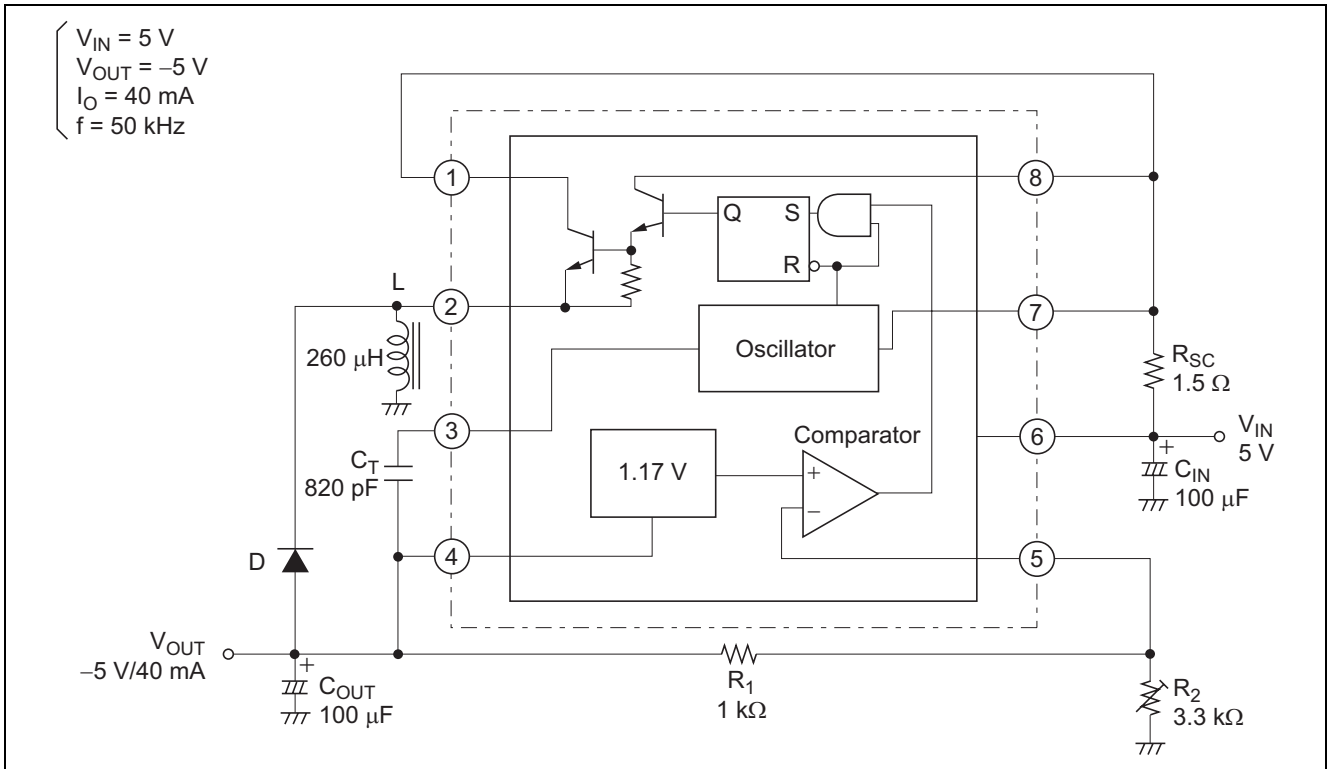
3. Step-down Circuit



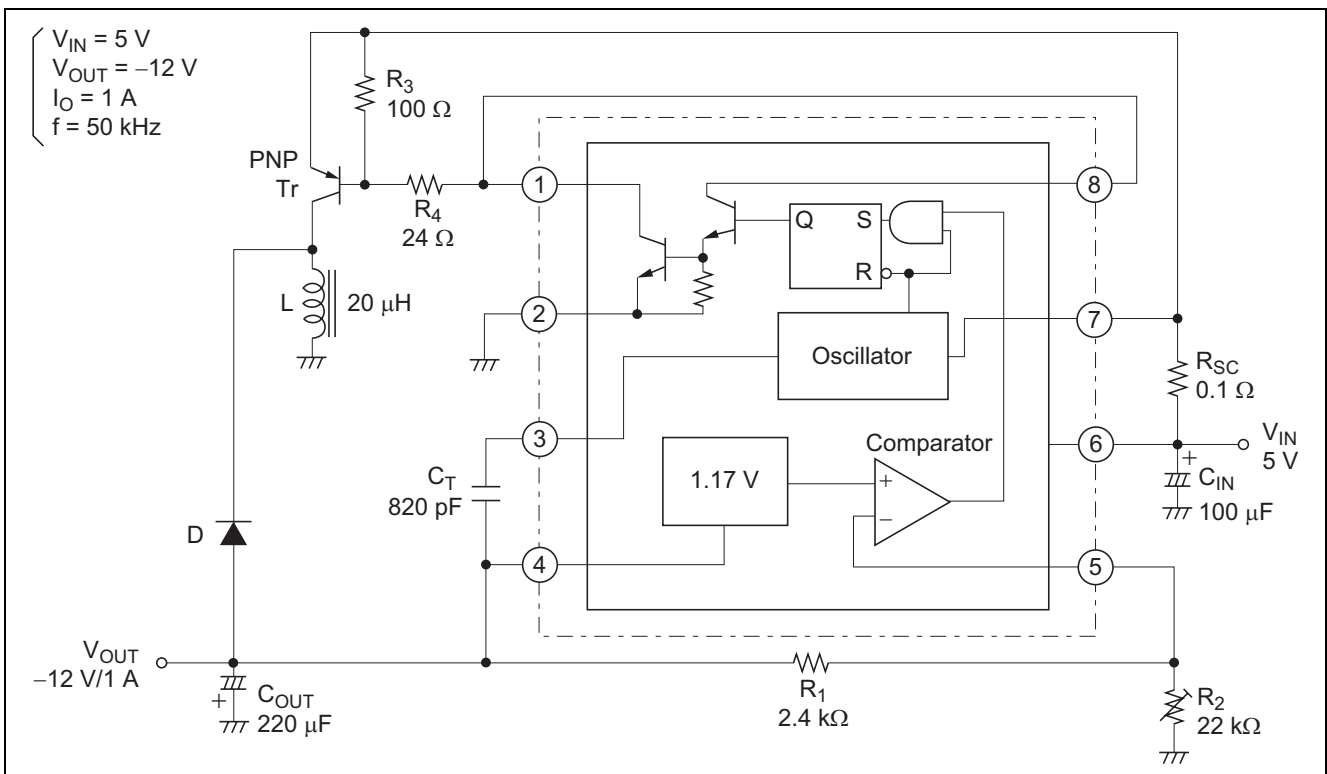
4. Step-down Circuit with Transistor



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	$1.17 \times (1 + \frac{R_1}{R_2})$	$1.17 \times (1 + \frac{R_1}{R_2})$	$1.17 \times (1 + \frac{R_1}{R_2})$

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.

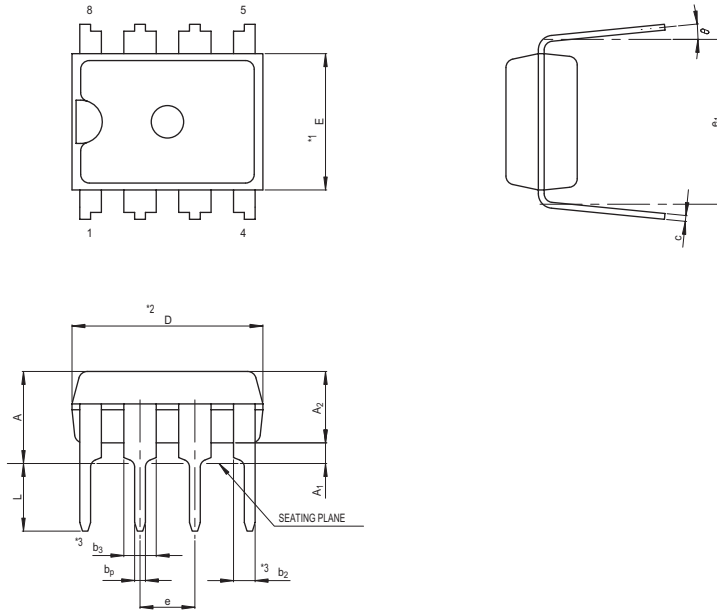
2. ON/OFF Control

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

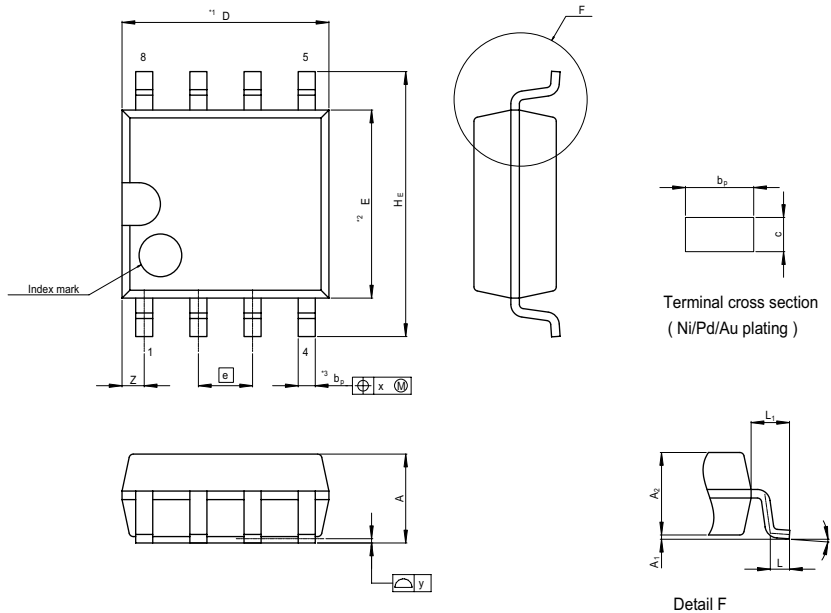
JEITA Package Code	RENEASAS Code	Previous Code	MASS[Typ.]
P-DIP8-6.3x8.84-2.54	PRDP008AA-A	8P4	0.5g



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	—	—

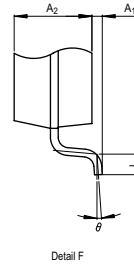
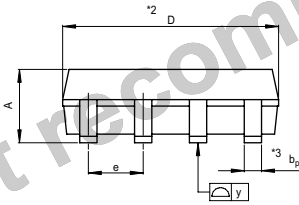
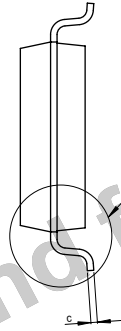
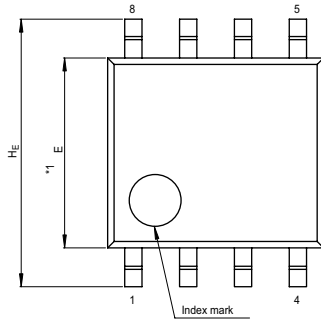
JEITA Package Code	RENEASAS Code	Previous Code	MASS[Typ.]
P-SOP8-4.4x4.85-1.27	PRSP008DE-C	—	0.1g



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

Reference Symbol	Dimension in Millimeters		
	Min	Nom	Max
D	4.65	4.85	5.05
E	4.2	4.4	4.6
A ₂	—	1.85	—
A ₁	0.00	0.1	0.20
A	—	—	2.03
b _p	0.34	0.4	0.46
b ₁	—	—	—
c	0.15	0.20	0.25
c ₁	—	—	—
θ	0°	—	8°
H _E	5.7	6.2	6.5
Ⓧ	1.12	1.27	1.42
x	—	—	0.12
y	—	—	0.10
Z	—	—	0.75
L	0.25	0.45	0.65
L ₁	—	0.90	—

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



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
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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