To all our customers

Regarding the change of names mentioned in the document, such as Mitsubishi Electric and Mitsubishi XX, to Renesas Technology Corp.

The semiconductor operations of Hitachi and Mitsubishi Electric were transferred to Renesas Technology Corporation on April 1st 2003. These operations include microcomputer, logic, analog and discrete devices, and memory chips other than DRAMs (flash memory, SRAMs etc.) Accordingly, although Mitsubishi Electric, Mitsubishi Electric Corporation, Mitsubishi Semiconductors, and other Mitsubishi brand names are mentioned in the document, these names have in fact all been changed to Renesas Technology Corp. Thank you for your understanding. Except for our corporate trademark, logo and corporate statement, no changes whatsoever have been made to the contents of the document, and these changes do not constitute any alteration to the contents of the document itself.

Note : Mitsubishi Electric will continue the business operations of high frequency & optical devices and power devices.

Renesas Technology Corp.
Customer Support Dept.
April 1, 2003

RENESAS
Renesas Technology Corp.

M5291P,FP

DC-DC CONVERTER

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.

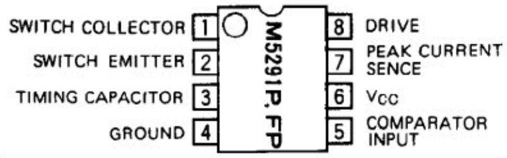
FEATURES

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

APPLICATION

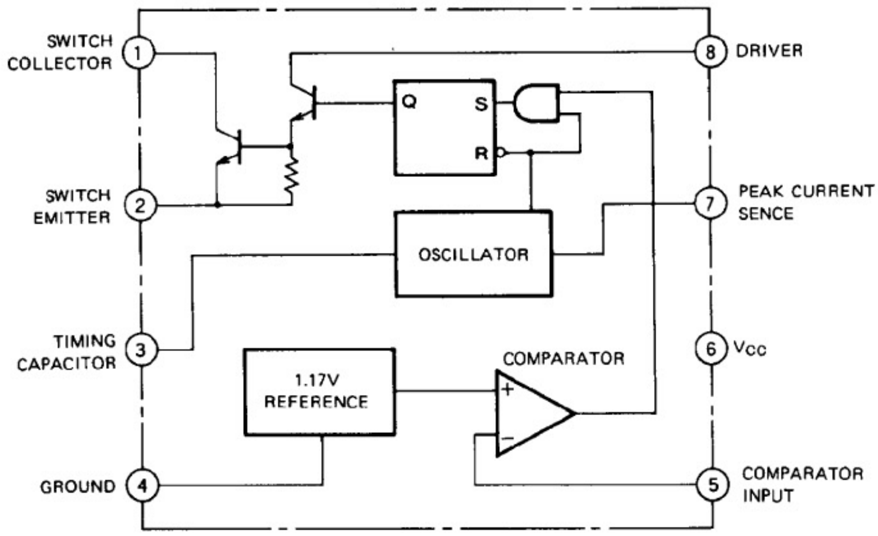
General power supply system

PIN CONFIGURATION (TOP VIEW)



Outline 8P4(P)
8P2S-A(FP)

BLOCK DIAGRAM



RENESAS

ABUSOLUTE MAXIMUM RATINGS (Ta = 25℃, unless otherwise noted)

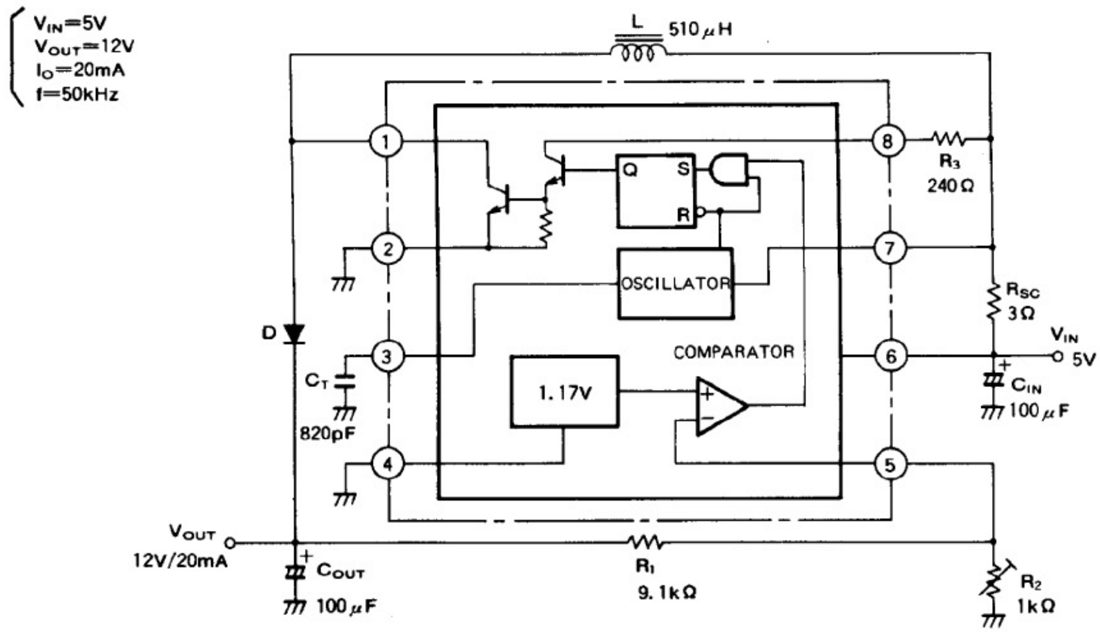
Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	Power supply voltage		40	V
V_{IN}	Input voltage	Comparator input	−0.3~40	V
$V_{C(S)}$	Switch collector voltage		40	V
$V_{E(S)}$	Switch emitter voltage		40	V
$V_{CE(S)}$	Collector emitter voltage		40	V
$V_{C(D)}$	Driver collector voltage		40	V
I_{SW}	Switch current		200	mA
P_d	Internal power disspation	8 pin DIP	625	mW
		8 pin FLAT	440	
K	Thermal derating	8 pin DIP	6.25	mW/℃
		8 pin FLAT	4.5	
T_{opr}	Operating ambient temperature		−20~+75	℃
T_{stg}	Storage temperature		−55~+125	℃

ELECTRICAL CHARACTERISTICS (Ta = 25℃, V_{CC} = 5V)

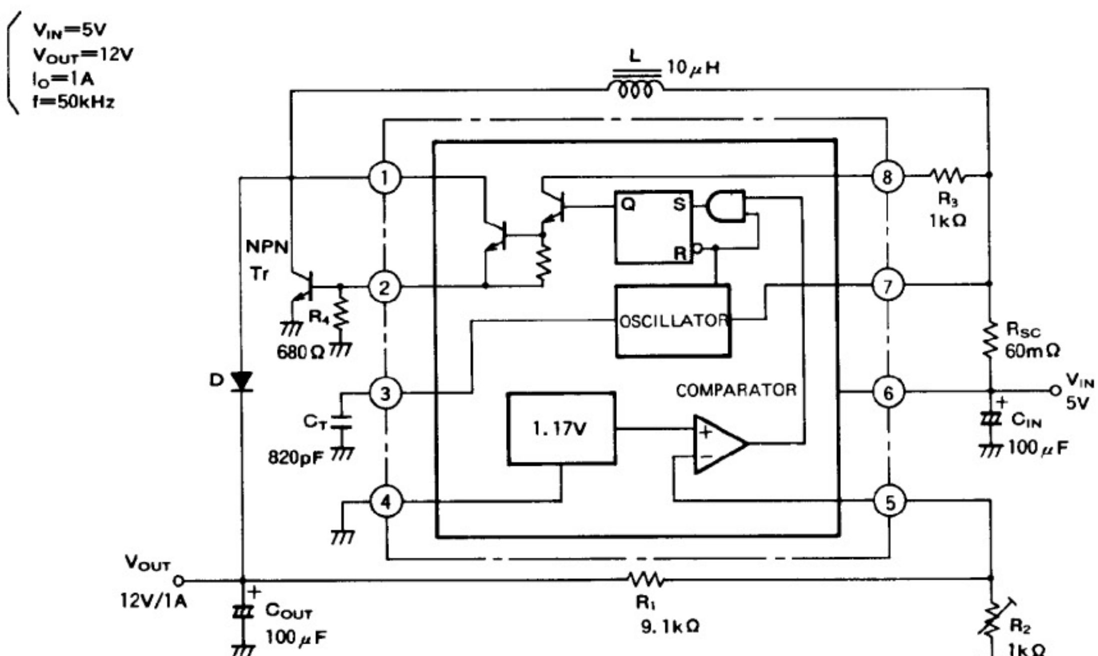
Symbol		Parameter	Test conditions	Limits Min	Limits Typ	Limits Max	Unit
I_C	Oscillator	Charge current		20	35	50	μA
I_D	Oscillator	Discharge current		150	200	250	μA
V_{OSC}	Oscillator	Oscillator voltage			0.6		V_{P-P}
I_D/I_C	Oscillator	Charge, discharge current ratio			6		—
V_{IPK}		Current protection, detecting voltage		270	330	390	mV
V_{sat1}	Output	Saturation voltage	Darlington connection I_{SW} = 50mA		1.5	2.0	V
V_{sat2}	Output	Saturation voltage	I_{SW} = 50mA $I_{C(D)}$ = 10mA		0.3	0.6	V
I_L	Output	Collector leak current	V_{CE} = 40V		10		nA
V_{TH}	Comparator	Threshold voltage		1.11	1.17	1.23	V
V_{THREG}	Comparator	Threshold voltage regulation	$3.0 \leq V_{CC} \leq 40V$		0.03	0.2	mV/V
I_B	Comparator	Input bias current	V_{IN} = 0V		40	200	nA
I_{CC}		Circuit current			1.4	2.5	mA

APPLICATION CIRCUITS

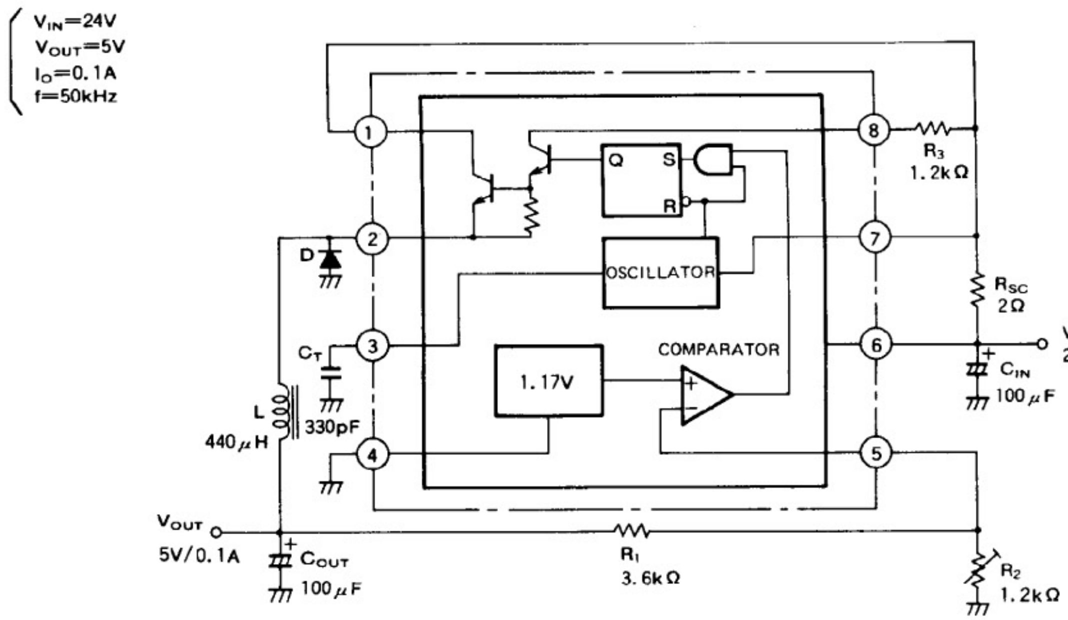
(1) Step-Up Circuit



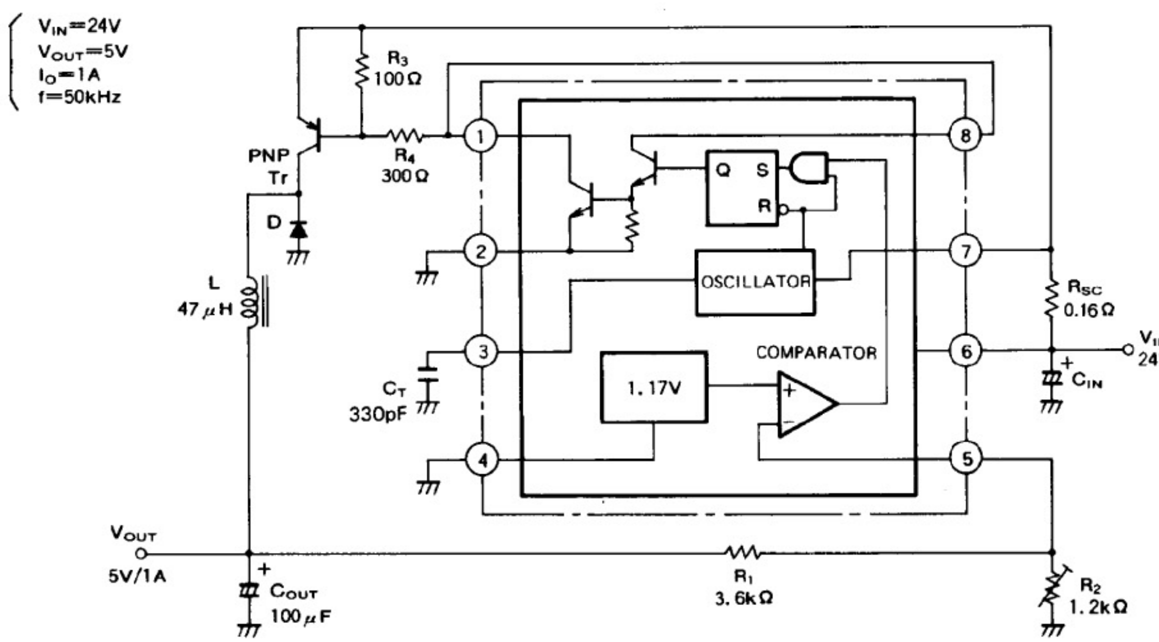
(2) Step-Up circuit with Transistor



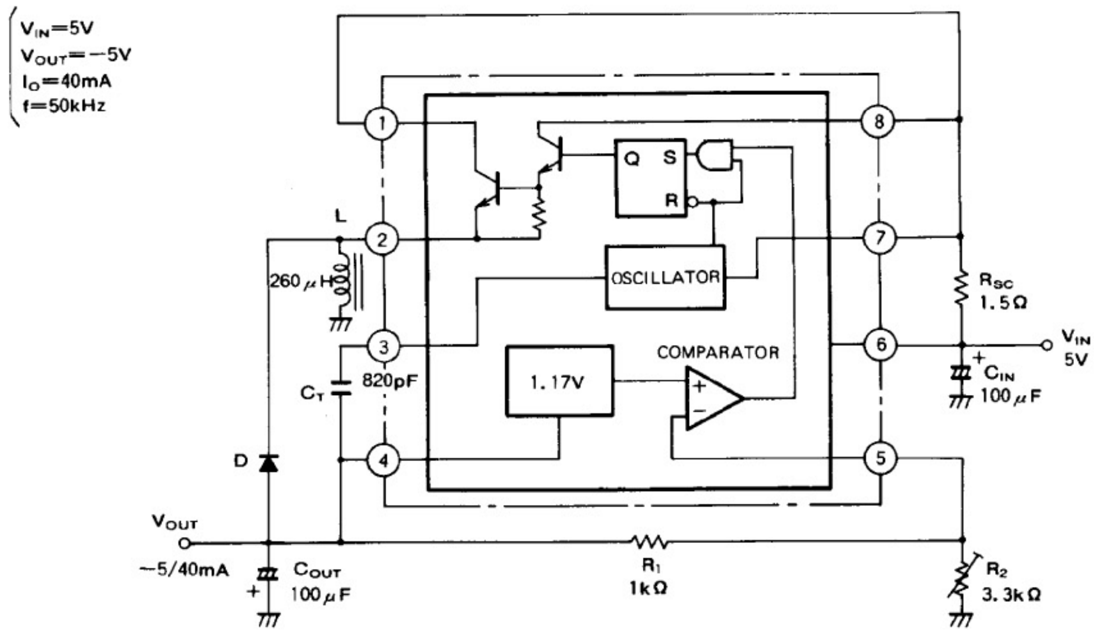
(3) Step-Down Circuit



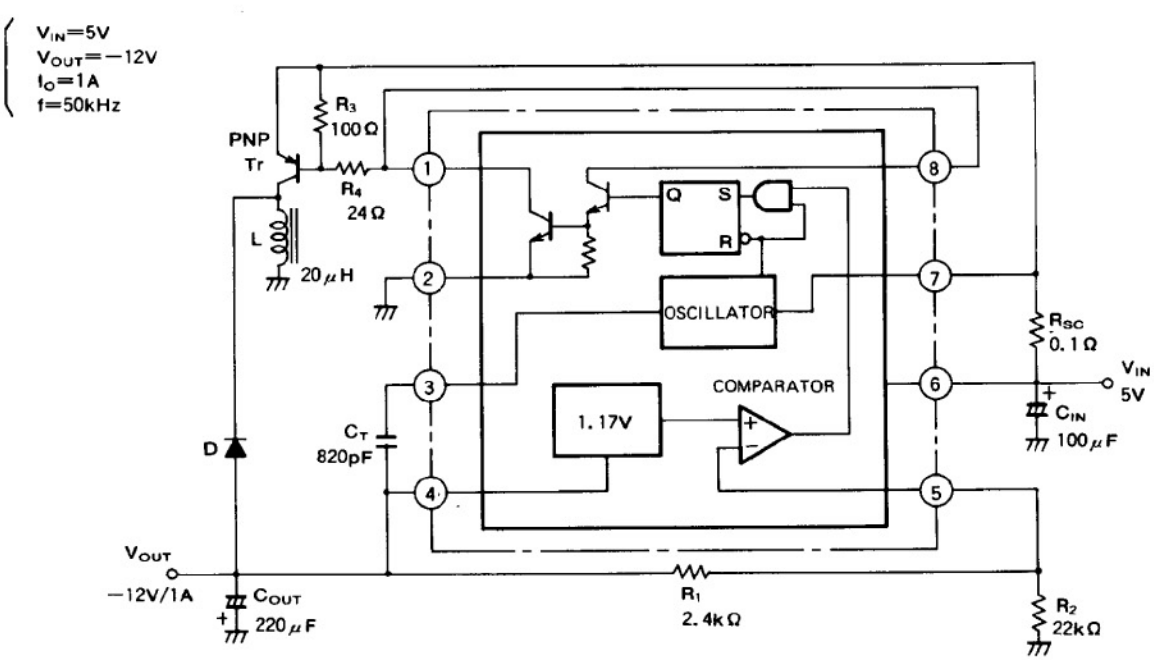
(4) Step-Down Circuit with Transistor



(5) Inverse Polarity Circuit



(6) Inverse Polarity Circuit with Transistor



CONSTANT DEFINITION

Constant	Step-up circuit	Step-down circuit	Inverse polarity circuit
$\frac{T_{ON}}{T_{OFF}}$	$\frac{V_{OUT}+V_F-V_{IN(MIN)}}{V_{IN(MIN)}-Vsat}$	$\frac{V_{OUT}+V_F}{V_{IN(MIN)}-Vsat-V_{OUT}}$	$\frac{\lvert V_{OUT}\rvert+V_F}{V_{IN}-Vsat}$
$(T_{ON}+T_{OFF})_{MAX}$	$\frac{1}{f_{MIN}}$	$\frac{1}{f_{MIN}}$	$\frac{1}{f_{MIN}}$
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	$6\times10^{-5}\cdot T_{ON}$	$6\times10^{-5}\cdot T_{ON}$	$6\times10^{-5}\cdot T_{ON}$
I_{PK}	$2\cdot I_{OUT(MAX)}\cdot(1+\frac{T_{ON}}{T_{OFF}})$	$2\cdot I_{OUT(MAX)}$	$2\cdot I_{OUT(MAX)}\cdot(1+\frac{T_{ON}}{T_{OFF}})$
$L_{(MIN)}$	$\left(\frac{V_{IN(MIN)}-Vsat}{I_{PK}}\right)\cdot T_{ON(MAX)}$	$\left(\frac{V_{IN(MIN)}-Vsat-V_{OUT}}{I_{PK}}\right)\cdot T_{ON(MAX)}$	$\left(\frac{V_{IN(MIN)}-Vsat}{I_P}\right)\cdot T_{ON(MAX)}$
R_{SC}	$\frac{0.33}{I_{PK}}$	$\frac{0.33}{I_{PK}}$	$\frac{0.33}{I_{PK}}$
V_O	$1.17\times(1+\frac{R_1}{R_2})$	$1.17\times(1+\frac{R_1}{R_2})$	$1.17\times(1+\frac{R_2}{R_1})$

VF: Forward Voltage of Diode
Vsat: Output saturation voltage of M5291 (0.6V_{max} at single output, 2.0V_{max} at Darlington output)
* : Setting switching frequency first and calicurate each constant value.

NOTE:

1) Peak current sence
   In overcurrent function, oscillator is stop, when voltage descend of external detecting resistance is more than 330mV.
2) ON/OFF Control
   If you need stop the action, connected resistance (5 ~ 10kΩ) between supply voltage terminal and timing capacitor 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.