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.

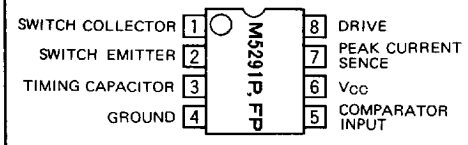
FEATURES

- 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

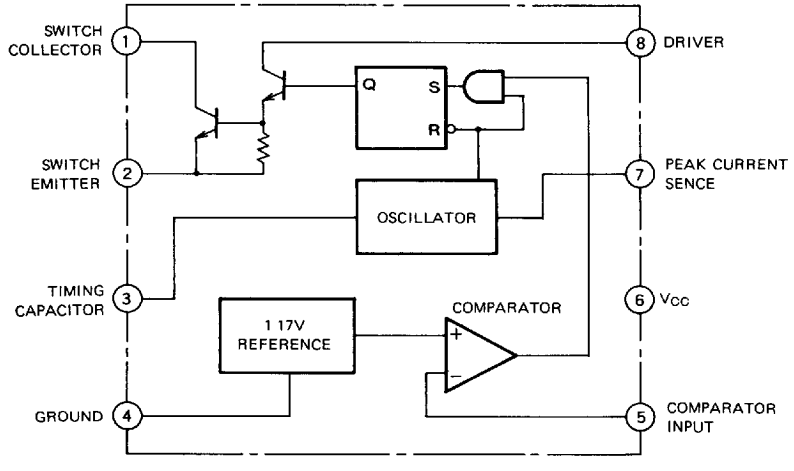
General power supply system

PIN CONFIGURATION (TOP VIEW)



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

BLOCK DIAGRAM



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

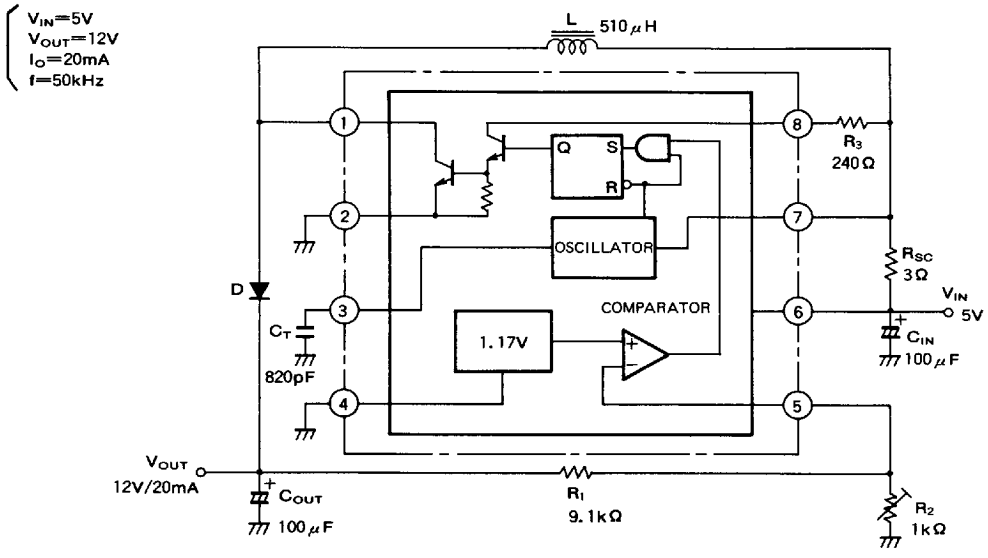
Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	Power supply voltage		40	V
V_{IN}	Input voltage	Comparator input	−0.3∼40	V
$V_{C(S)}$	Switch collector voltage		40	V
$V_{E(S)}$	Switch emitter voltage		40	V
$V_{CE(S)}$	Collector-emitter voltage		40	V
$V_{C(D)}$	Driver collector voltage		40	V
I_{SW}	Switch 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 (T_a=25℃, V_{CC}=5V)

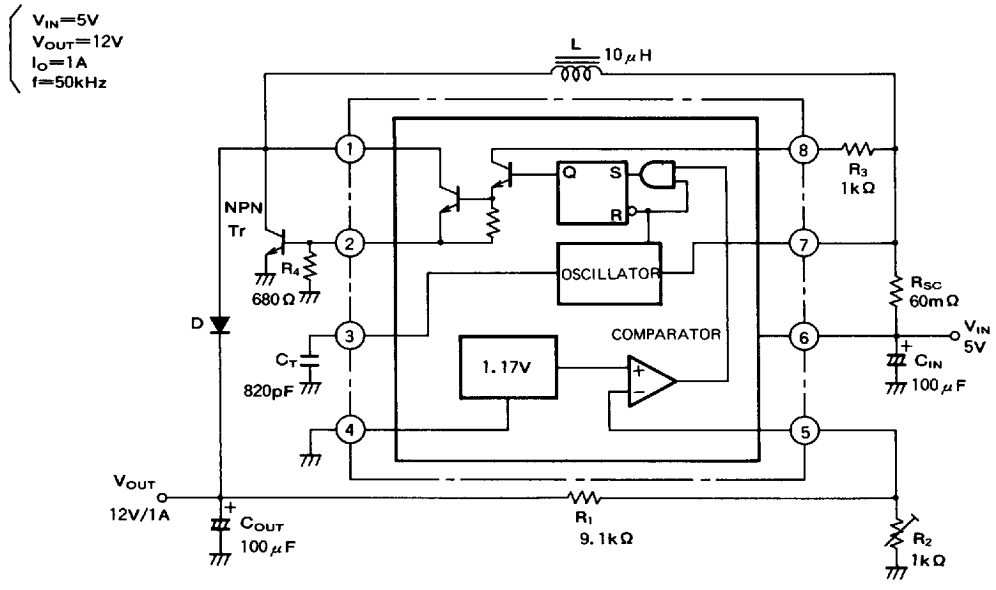
Symbol		Parameter	Test conditions	Limits			Unit
				Min	Typ	Max	
I_C	Oscillator	Charge current		20	35	50	μA
I_D		Discharge current		150	200	250	μA
V_{OSC}		Oscillator voltage			0.6		V_{P-P}
I_D/I_C		Charge, discharge current ratio			6		—
V_{IPK}		Current protection, detecting voltage		270	330	390	mV
Vsat1	Output	Saturation voltage	Darlington connection I_{SW}=50mA		1.5	2.0	V
Vsat2		Saturation voltage	I_{SW}=50mA $I_{C(D)}$=10mA		0.3	0.6	V
I_L		Collector leak current	V_{CE}=40V		10		nA
V_{TH}	Comparator	Threshold voltage		1.11	1.17	1.23	V
V_{THREG}		Threshold voltage regulation	3.0≦V_{CC}≦40V		0.03	0.2	mV/V
I_B		Input bias current	V_{IN}=0V		40	200	nA
I_{CC}		Circuit current			1.4	2.5	mA

APPLICATION CIRCUITS

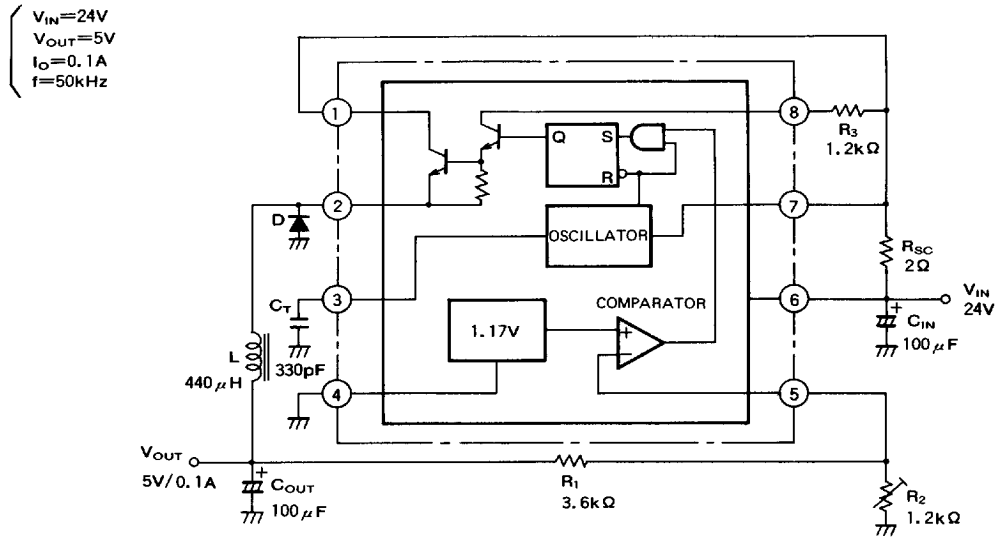
(1) Step-Up Circuit



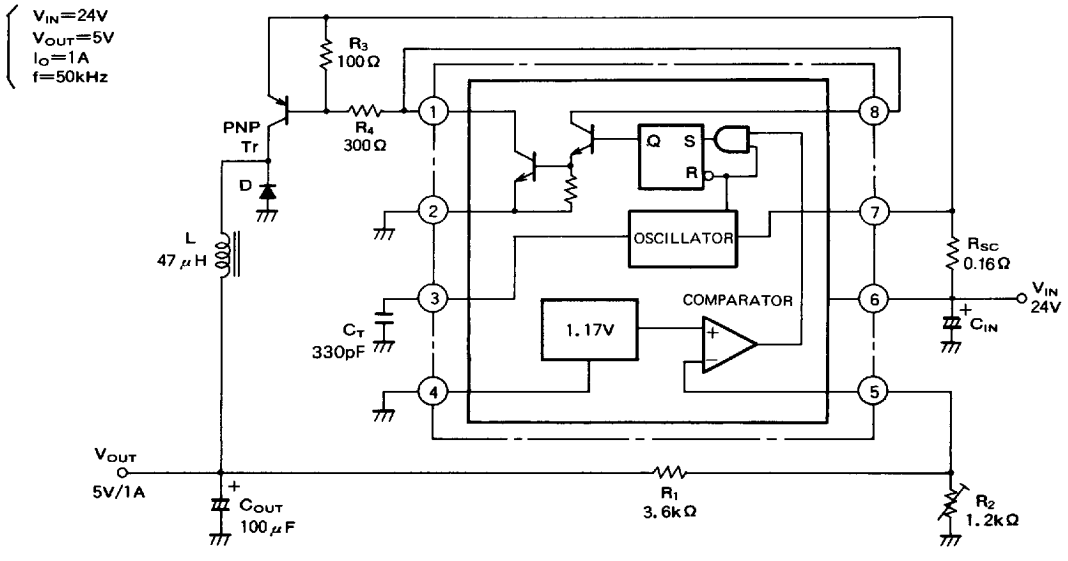
(2) Step-Up circuit with Transistor



(3) Step-Down Circuit

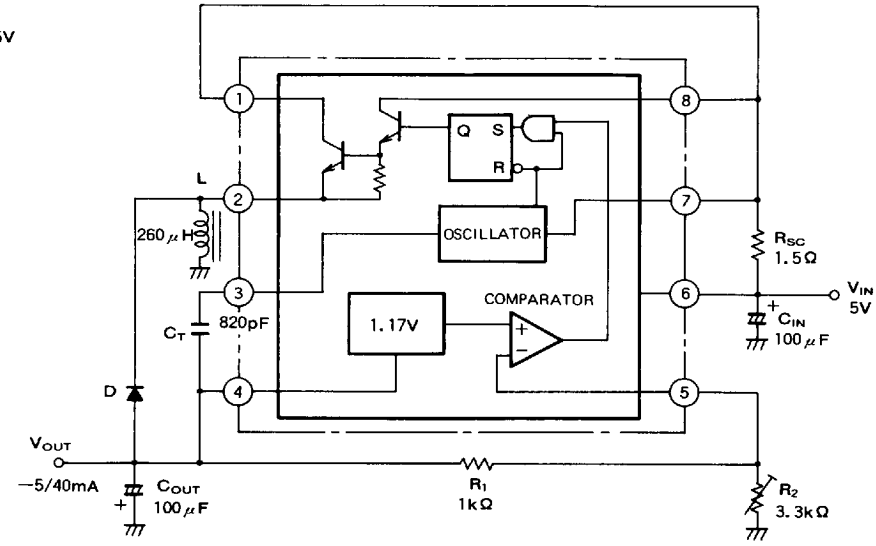


(4) Step-Down Circuit with Transistor



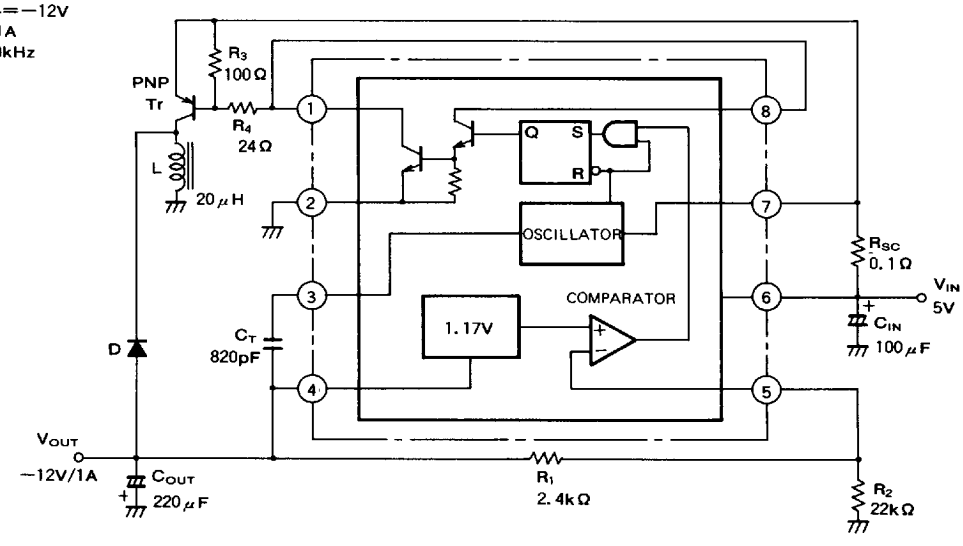
(5) Inverse Polarity Circuit

V_{IN}=5V
V_{OUT}=−5V
I_O=40mA
f=50kHz



(6) Inverse Polarity Circuit with Transistor

V_{IN}=5V
V_{OUT}=−12V
I_O=1A
f=50kHz



CONSTANT DEFINITION

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

V_F: Forward Voltage of Diode
V_{sat} 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.