

To all our customers

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

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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

# M51998P/FP

## Switching Regulator Control

### Description

M51998 is a primary side switching regulator control IC suitable for converting AC power supply to stabilized DC voltage. Basic functions provided are from M51995A and limited to the indispensable. This device is housed in 10pin SOP, 14pin DIP.

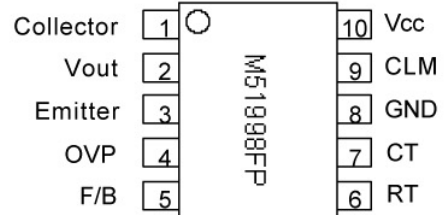
### Features

- Output current(Io peak)----- ±1A
- Totempole output
- Small start-up current-----100mA(typ.)
- Start-up threshold 16V .Stop voltage 10V
- Output duty-----51%(internally fixed)
- Pulse-by-pulse current limit
- 10 pin SOP,14 pin DIP package

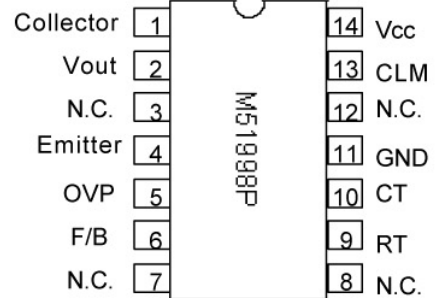
### Application

Flyback regulator

### PIN CONFIGURATION(TOP VIEW)

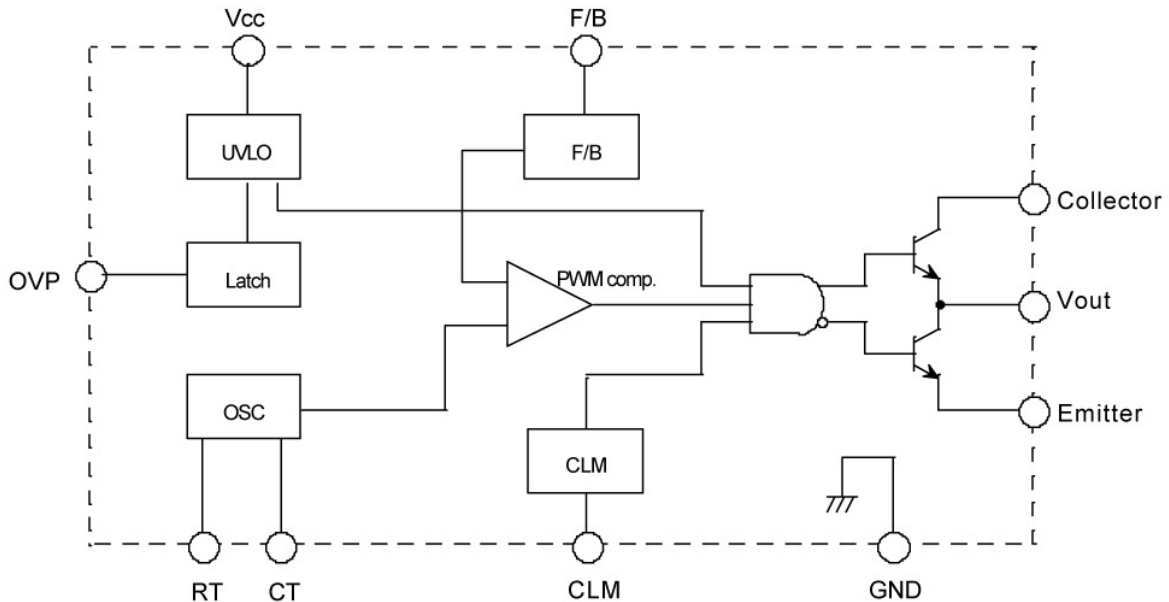


### Outline 10P2N-A



### Outline 14P4

### BLOCK DIAGRAM



# M51998P/FP

## Switching Regulator Control

ABSOLUTE MAXIMUM RATINGS(Ta=25°C, unless otherwise noted.)

Symbol	Parameter	Condition	Ratings	Unit
Vcc	Supply voltage		36	V
Vc	Collector terminal voltage		36	V
Io	Output current	Peak	±1	A
		Continuous	±0.15	A
VCLM	CLM terminal voltage		-0.3~+4.0	V
IOVP	OVP terminal voltage		10	mA
VFB	F/B terminal voltage		0~10	V
Pd	Power dissipation		440	mW
Kθ	Thermal derating ratio		3.52	mW/°C
Topr	Operating temperature		-20~85	°C
Tstg	Storage temperature		-40~125	°C

ELECTRICAL CHARACTERISTICS(Ta=25°C, Vcc=5V, unless otherwise noted.)

BLOCK	Symbol	Parameter	Test conditions	Limits			Unit
				Min.	Typ.	Max.	
BLOCK	Vcc	Operating voltage range		Vcc(STOP)		35	V
	Vcc(START)	Operation start voltage		15.2	16.2	17.2	V
	Vcc(STOP)	Operation stop voltage		9.0	9.9	10.9	V
	ΔVcc	Start/stop differential	DVcc=Vcc(START)-Vcc(STOP)	5.0	6.3	7.6	V
	IccL	Start-up current	Vcc=14.5V, Ta=25°C	50	100	150	□A
			Vcc=14.5V, -20<Ta<85°C	40	100	200	□A
	Icco	Circuit current	Vcc=30V	8	12	21	mA
Icc OVP	Circuit current in OVP state	Vcc=25V	1.3	2.0	3.0	mA	
		Vcc=9.5V	125	210	320	□A	
F / B	IFBMIND	Current at 0% duty		-2.10	-1.54	-1.00	mA
	IFBMAXD	Current at maximum duty		-0.90	-0.55	-0.40	mA
	ΔIFB	Max./0% differential	DIFB=IFBMIND-IFBMAXD	-1.35	-0.99	-0.70	mA
	VFB	F/B terminal voltage		4.9	5.9	7.1	V
	RFB	F/B terminal resistance		420	600	780	Ω
OVP	VTHOVPH	OVP term. H threshold volt.		540	750	960	mV
	ΔVTHOVPH	OVP term. hysteresis volt.	ΔVTHOVPH=VTHOVPH-VTHOVPL	-	30	-	mV
	ITHOVP	OVP term. threshold current		80	150	250	□A
	IINOVP	OVP term. input current		80	150	250	□A

# M51998P/FP

## Switching Regulator Control

BLOCK	Symbol	Parameter	Test conditions	Limits			Unit
				Min.	Typ.	Max.	
P V O	V <sub>cc</sub> OVP	OVP reset supply voltage		7.5	9.0	10.0	V
	V <sub>cc</sub> (STOP) -V <sub>cc</sub> OVP	Operation stop volt. -OVP reset supply voltage		0.55	1.20	-	V
	I <sub>THO</sub> VPC	Current from OVP terminal for OVP reset	V <sub>cc</sub> =30V V <sub>cc</sub> =18V	-480 -210	-320 -140	-213 -93	□A
C L M	V <sub>TH</sub> CLM	CLM terminal threshold volt.		180	200	220	mV
	I <sub>IN</sub> CLM	CLM terminal current		-280	-200	-140	□A
	T <sub>P</sub> DCLM	Delay time from CLM to V <sub>out</sub>		-	90	-	ns
	f <sub>osc</sub>	Oscillation frequency	RT=27kΩ, CT=470pF	68	75	82	kHz
	T <sub>DUTY</sub>	Maximum ON duty		48	51	54	%
	V <sub>OSCH</sub>	Upper limit volt.of OSC waveform		3.97	4.37	4.77	V
	V <sub>OSCL</sub>	Lower limit volt.of OSC waveform		1.76	1.96	2.16	V
	ΔV <sub>osc</sub>	Upper/lower limit volt.difference		2.11	2.41	2.71	V
	V <sub>RT</sub>	RT terminal voltage	RT=27kΩ	3.80	4.50	5.40	V
	V <sub>OL1</sub>	Output low voltage	V <sub>cc</sub> =18V, I <sub>o</sub> =10mA	-	0.04	0.4	V
	V <sub>OL2</sub>		V <sub>cc</sub> =18V, I <sub>o</sub> =100mA	-	0.7	1.4	V
	V <sub>OL3</sub>		V <sub>cc</sub> =5V, I <sub>o</sub> =1mA	-	0.85	1.0	V
	V <sub>OL4</sub>		V <sub>cc</sub> =5V, I <sub>o</sub> =100mA	-	1.3	2.0	V
	V <sub>OH1</sub>	Output high voltage	V <sub>cc</sub> =18V, I <sub>o</sub> =-10mA	16.0	16.7	-	V
	V <sub>OH2</sub>		V <sub>cc</sub> =18V, I <sub>o</sub> =-100mA	15.5	16.5	-	V
	T <sub>RISE</sub>	Output voltage rise time		-	50	-	ns
	T <sub>FALL</sub>	Output voltage fall time		-	35	-	ns

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## Switching Regulator Control

M51998 example application circuit

