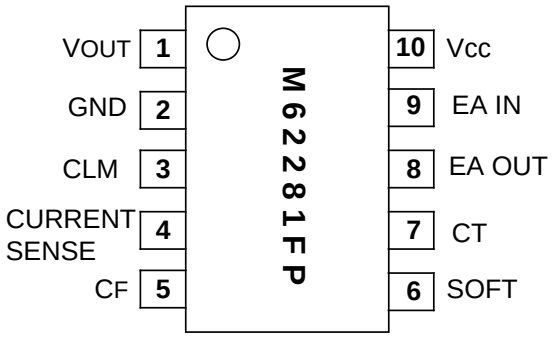
M62281FP

GENERAL PURPOSE CURRENT MODE PWM CONTROL IC

GENERAL DESCRIPTION

The M62281FP is a high speed current mode PWM control IC.
This IC, housed in small10-pin package contains many functions and protection circuits which allow to simplify peripheral circuits and design a compact set.
It can be operated with high speed switching (700kHz Max) in a high speed PWM comparator and current limiting circuit.

PIN CONFIGURATION (TOP VIEW)



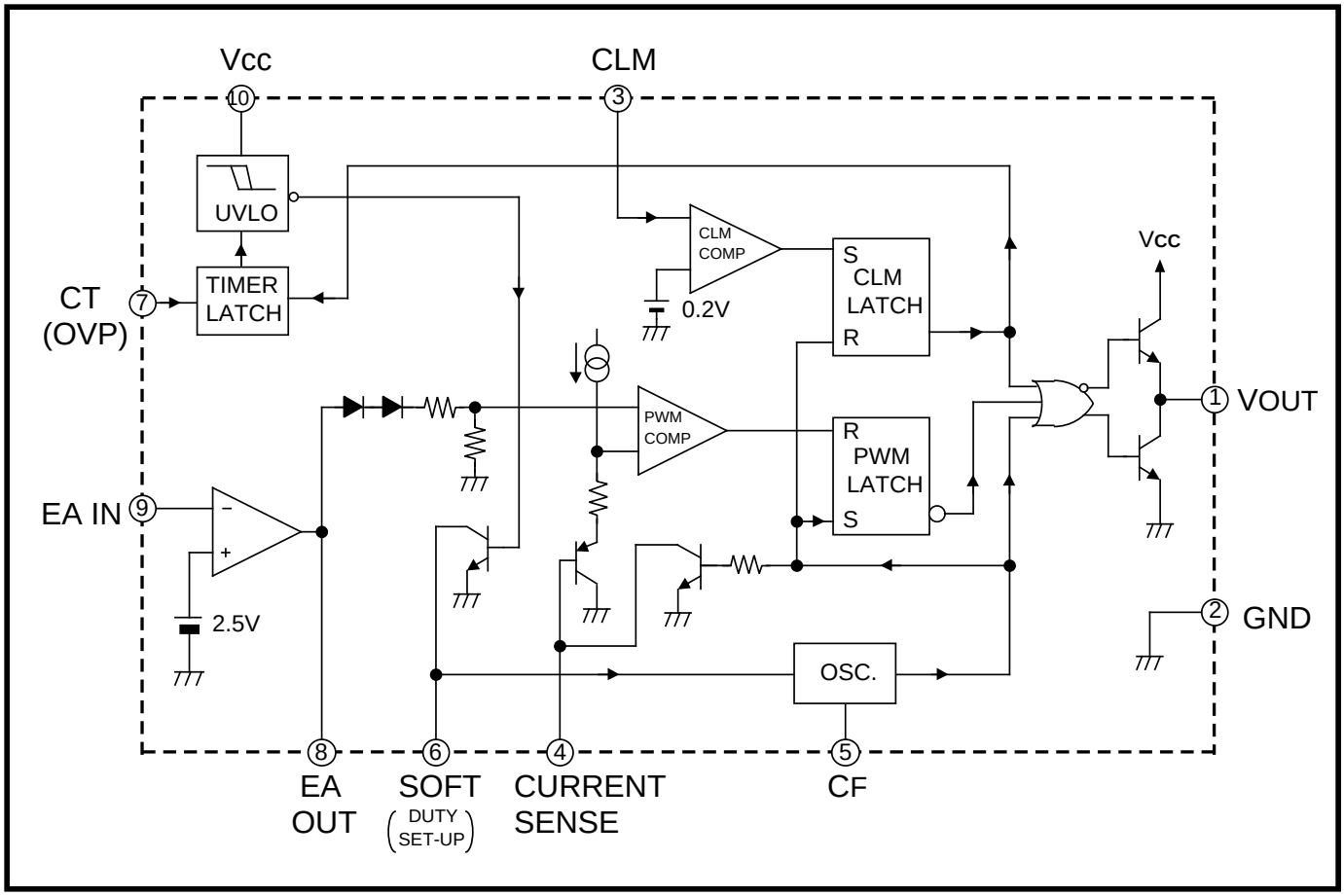
OUTLINE 10P2N-A

FEATURES

- 700kHz-operation to MOS-FET
  - Output current Io(peak) = ±1A
  - Totem pole output circuit
- High noise immunity SW power supply by the separated CURRENT SENSE terminal
- High speed pulse-by-pulse current limiting
- Timer type latch protection circuit with OVP
- Soft start operation (with dead time control)
- Built-in Op-Amp for feedback control
  (photo coupler can be driven)
- Small start-up current 180µ A
- Start-up voltage 12.5V Stop voltage 8.3V

APPLICATION

- Switching Regulator
- DC-DC converter



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

Symbol	Parameter	Condition		Rating	Unit
Vcc	Supply voltage			36	V
IOUT	Output current		Continuous	150	mA
			Peak	1.0	A
VCT	CT terminal supply voltage			36	V
VEA IN	EA IN terminal supply voltage			10	V
VCLM	CLM terminal supply voltage			-0.3 to +4.0	V
VCS	CURRENT SENSE terminal supply voltage			-0.3 to +5.8	V
Pd	Power dissipation	Ta = 25 °C		440	mW
K_θ	Thermal derating	Ta ≥ 25 °C		3.52	mW/°C
Topr	Operating temperature			–20 to +85	°C
Tstg	Storage temperature			–40 to +150	°C
Tj	Junction temperature			150	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C, Vcc=14V, unless otherwise noted)

Block	Symbol	Parameter	Test condition	Limits			Unit
				Min	Typ	Max	
All device	Vcc	Supply voltage range		V_{cc} (STOP)	——	35	V
	Vcc(START)	Operation start-up voltage		11.5	12.5	13.5	V
	Vcc(STOP)	Operation stop voltage		7.6	8.3	9.0	V
	ΔVcc	Start-up and stop voltage difference		3.5	4.2	5.1	V
	IccL	Stand-by current	Vcc=Vcc(START)-0.5V	90	180	270	µA
	Icco	Operating current		7.5	13	19	mA
CT	VTHCTH	CT term. "H" threshold voltage		3.5	4.0	4.5	V
	VTHCTL	CT term. "L" threshold voltage		0.4	0.7	1.0	V
	ITIMEOFFIN	CT term. input current (timer off mode)		70	110	165	µA
	ITIMEOFFOUT	CT term. output current (timer off mode)		-33	-14	-5	µA
Error Amp	VB	Reference voltage		2.4	2.5	2.6	V
	IB	Input bias current		-300	-100	0	nA
	AVO	Open loop gain			70		dB
	fT	Unity gain bandwidth			1		MHz
	IOS	Output source current		-460	-370	-240	µA
	Vom+	Output voltage range(High condition)		5.30	5.80	6.25	V
	Vom-	Output voltage range(Low condition)		0.00	0.20	0.35	V
CURRENT SENSE	AVCS	CS term. input voltage gain			3.0		V/V
	IB	Input bias current		-5.0	-1.0		µA
	TPDCS	CS term. delay time	Delay time to output		150		nS

ELECTRICAL CHARACTERISTICS (Ta=25°C, Vcc=14V, unless otherwise noted)

Block	Symbol	Parameter	Test condition	Limits			Unit
				Min	Typ	Max	
CLM	VTHCLM	CLM term. threshold voltage		180	200	220	mV
	IOUTCLM	CLM term. output current	V_{CLM}=0V	-270	-200	-140	µA
	TPDCLM	CLM term. delay time	Delay time to output		100		nS
SOFT	VSOFT(0%)	Input.voltage range at 0% duty	Soft term. input voltage range to set 0% duty	0		1.0	V
	VSOFT(50%)	Input.voltage at 50% duty	Soft term. voltage when 50% duty		2.7		V
	Duty Max	Maximum duty		83	90	97	%
	ISOFT	Soft term. input current		-50	-43	-36	µA
OSC	fOSCmax	Maximum oscillation frequency				700	KHz
	fOSC	Oscillation frequency	CF= 270pF	130	180	230	KHz
	V_{OSCH}	Upper limit voltage of oscillation waveform	CF= 270pF	3.2	3.6	4.0	V
	V_{OSCL}	Low limit voltage of oscillation waveform	CF= 270pF	1.2	1.4	1.6	V
	ΔV_{OSC}	Voltage difference between upper limit and lower limit of OSC waveform	CF= 270pF	1.9	2.2	2.5	V
OUTPUT	VOL1	Output low voltage	Vcc=14V,Io=10mA	0.04		0.4	V
	VOL2		Vcc=14V,Io=100mA		0.3	1.4	V
	VOH1	Output high voltage	Vcc=14V,Io=-10mA	12.0	12.7		V
	VOH2		Vcc=14V,Io=-100mA	11.5	12.5		V
	TRISE	Output voltage rise time	No load		50		nS
	TFALL	Output voltage fall time	No load		35		nS

FUNCTION DESCRIPTION AND APPLICATION

(1) EA IN, EA OUT TERMINALS

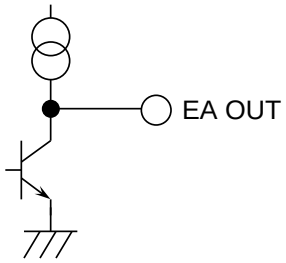
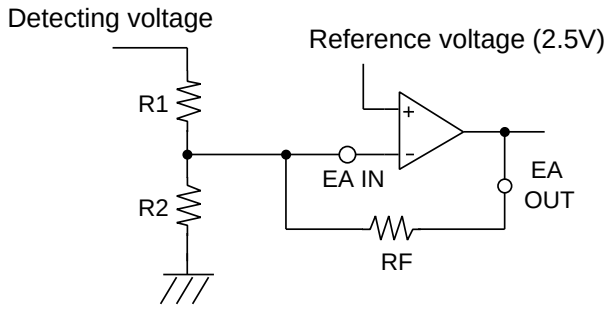


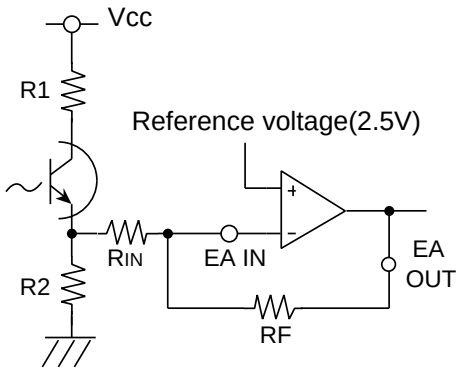
Fig.1 Circuit diagram of EAOUT terminal

Peripheral circuit of Error Amp



An operating point is set by R1 and R2 and a voltage gain is set by a ratio among R1, R2 and RF.

Fig.2-1 Method to detect the primary side voltage



An operating point is set by R1 and R2 and a voltage gain is set by a ratio among RIN and RF.

Fig.2-2 Method to use photo-coupler

(2) CT TERMINAL

The constant charge current to the capacitor flows out from the CT terminal when CLM is active in the timer type latch circuit. When the voltage level of CT terminal is over "H" threshold, the latch will start to operate and then the function of this IC will be stopped.
Without the timer type latch function, this IC will stop to operate when the voltage level of CT terminal is over "H" threshold. So, CT terminal can use the OVP function.
Only use the OVP function, to connect resister between CT terminal and GND.
In this case, voltage level of CT terminal can't reach "H" threshold level, and only charge current of the capacitor flows out.

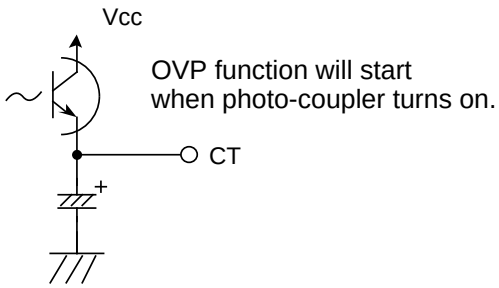


Fig.3-1 Method to use timer type latch and OVP

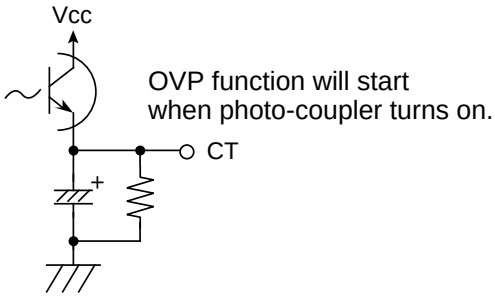


Fig.2-2 Method to use only OVP

(3) SOFT(DUTY SET-UP) TERMINAL

The voltage of SOFT terminal sets the maximum duty. And it can easily set-up the maximum duty by connecting the resister between the SOFT terminal and GND (shown in Fig 4), because the constant current that is assured in a temperature characteristics flows out from the terminal.
And it can operate SOFT start function as increase the duty step by step when start-up, by connecting the capacitor between SOFT terminal and GND.
This including circuit of SOFT start terminal has a discharge circuit that operates when star-up mode. It can operate SOFT start function certainly.

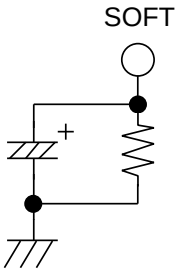


Fig.4
Method to set-up duty
and SOFT start function.

(4) CLM TERMINAL

This terminal detect the over-current using pulse-by-pulse current limiting.
This current limiting circuit is the same as that of M51995.

(5) CURRENT SENSE TERMINAL

This terminal is supplied the voltage that is proportional to the switching current from the current sense resister Rcs. PWM function is active from the result of a comparison between this terminal voltage and the output voltage of the error amp.
The CURRENT SENSE terminal is separate from CLM terminal, which makes free setting according to the applications.

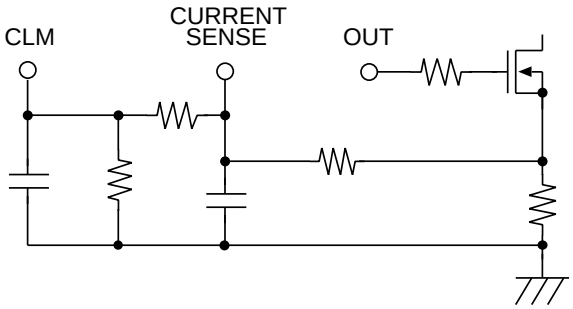


Fig.5 Peripheral circuit of CURRENT SENSE terminal and CLM terminal.

(5) CF TERMINAL

The oscillation frequency is set by a capacitor that is connected to the CF terminal.
The waveform of the CF terminal is a triangle wave that the ratio between a charge and discharge period is 9:1.
And the maximum duty is set by the voltage of the SOFT terminal (the maximum duty is 90%).

(6) Attention for heat generation

The maximum ambient temperature of type M62281 is +85°C, however, the ambient temperature in vicinity of the IC is not uniform and varies place by place, as the amount of power dissipation is fairly large and a heat generation is concentrated locally in the switching regulator.
So, it is one of the good idea to check the IC package temperature. The temperature difference between the IC junction and the surface if IC package is 30°C or less, when the IC junction temperature is measured by temperature dependency of forward voltage of pn junction, and IC package temperature is measured by "thermo-viewer", and also the IC is mounted on the "phenol-base" PC board in normal atmosphere.
So it is concluded that the maximum case temperature (surface temperature of IC) rating is 100°C with adequate margin.

M62281 APPLICATION CIRCUIT (FEED-FORWARD)