

M62501P/FP

PWM IC for the Synchronized Deflection System Control

REJ03D0857-0200

Rev.2.00

Jun 14, 2006

General Description

The M62501P/FP is a controller for a deflection system of CRT display monitors. It performs a stable PWM control over a wide fluctuation of external signals, thanks to the built-in trigger mode oscillator. The IC is suitable for an application to a high voltage drive of monitors because of its following circuits and functions;

- low voltage malfunction protection circuit,
- over or under voltage protection circuit for a control line,
- soft-start function.

It is also applicable to a horizontal output correction.

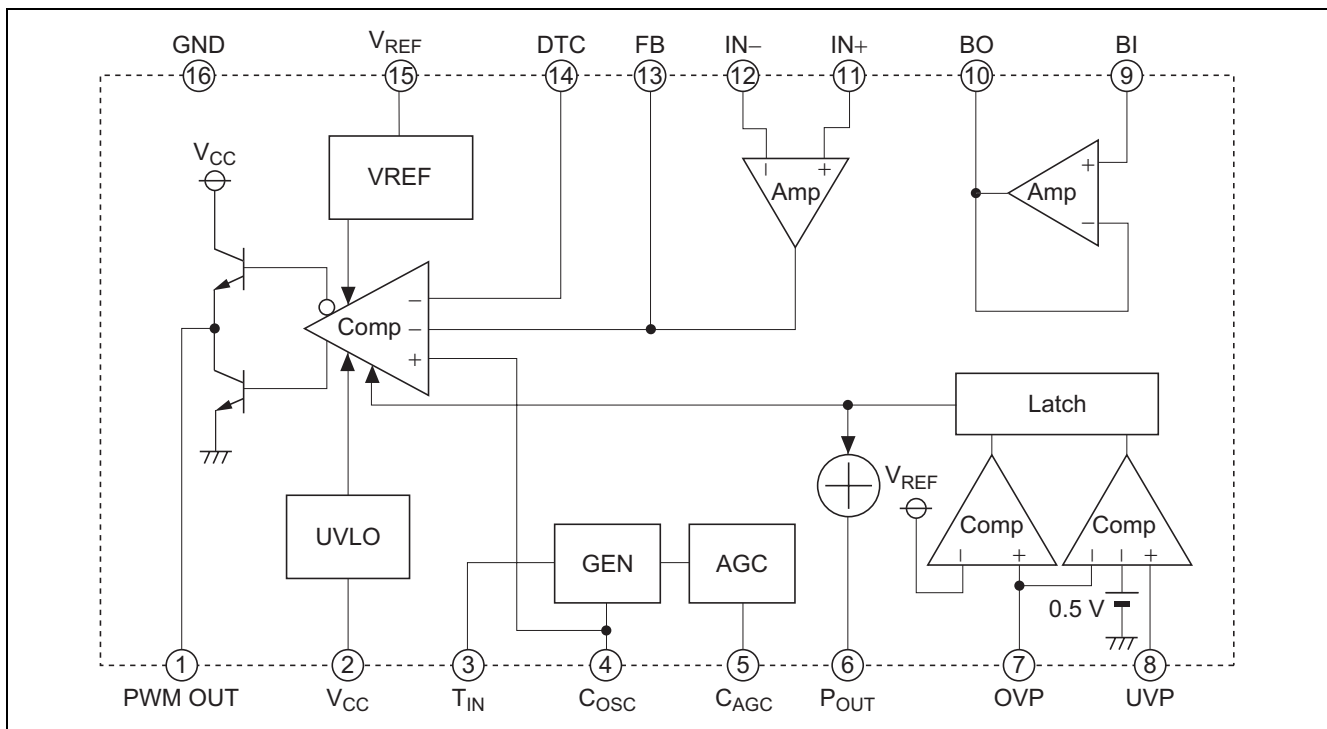
Features

- PWM output synchronized with external signals
- Wide pulse width modulation control frequency
15 kHz to 150 kHz
- Soft start function
- The under voltage output malfunction protection circuit
start $V_{CC} > 9\text{ V}$
stop $V_{CC} < 6\text{ V}$
- Built-in over voltage protection (OVP) and under voltage protection (UVP) control

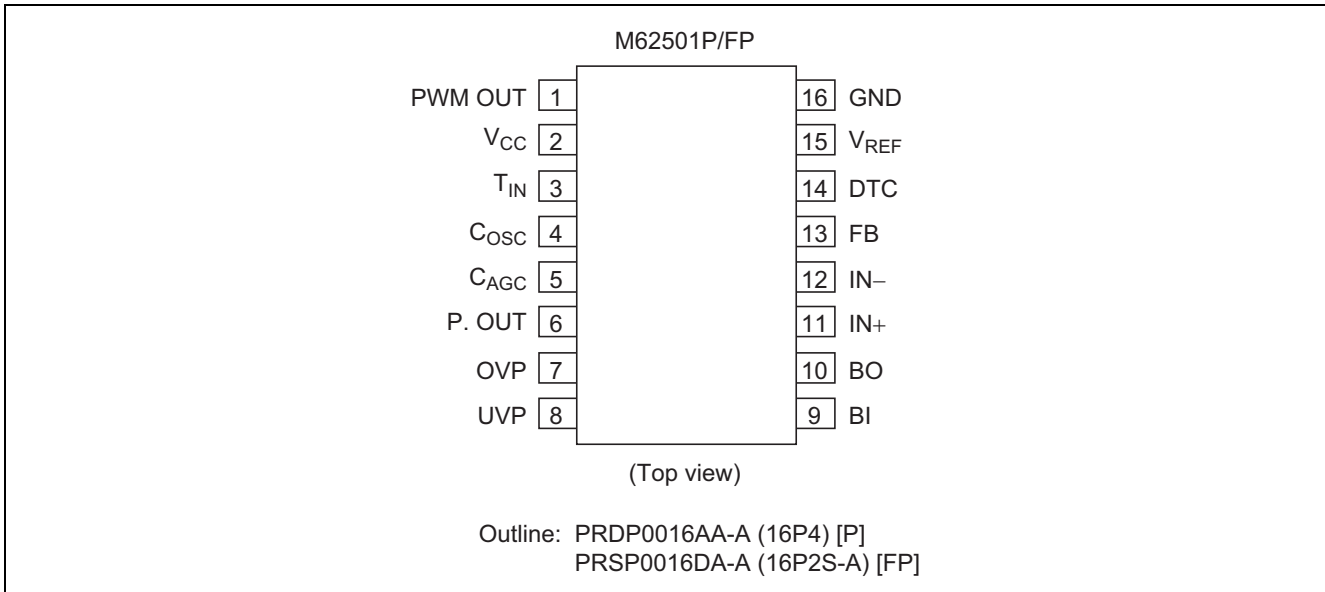
Application

CRT display monitor

Block Diagram



Pin Arrangement



Terminal Number and The Facility

PIN No.	Symbol	Functional Description
1	PWM OUT	PWM output
2	V _{CC}	Power supply
3	T _{IN}	Trigger input
4	C _{OSC}	Setting oscillating frequency
5	C _{AGC}	AGC setting
6	P.OUT	Error signal output
7	OVP	Input of over voltage protection
8	UVP	Input of under voltage protection
9	BI	Positive input of buffer Amp.
10	BO	Output of buffer Amp.
11	IN+	Positive input of Op-Amp.
12	IN-	Negative input of Op-Amp.
13	FB	Output of Op-Amp.
14	DTC	Dead time control (Soft start function)
15	V _{REF}	Output of reference voltage (5 V)
16	GND	Ground

Absolute Maximum Ratings

(T_a = 25°C, unless otherwise noted)

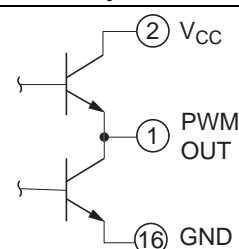
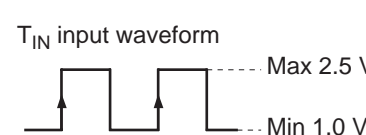
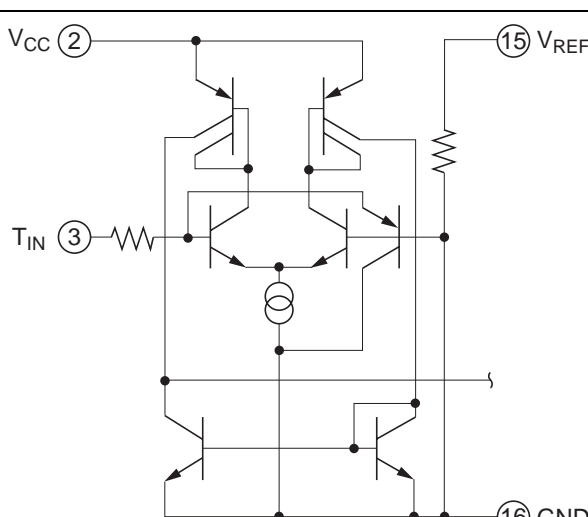
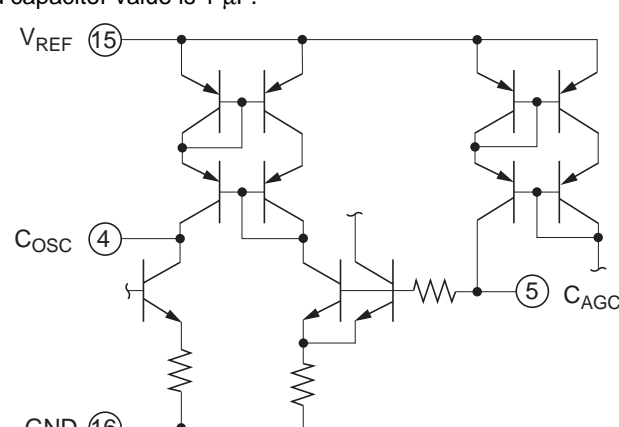
Item	Symbol	Ratings		Unit	Conditions
Supply voltage	V _{CC}	15		V	
Output voltage	V _{OUT}	15		V	
Output current	I _{OUT}	±100		mA	
Error amplifier input common mode voltage	V _{ICM}	-0.3 to V _{CC}		V	
Error amplifier differential input voltage	V _{ID}	V _{CC}		V	
Power dissipation	P _d	P	FP	mW	
		1200	650		
Thermal derating	K _θ	P	FP	mW/°C	T _a ≥ 25°C
		9.6	5.2		
Operating temperature	T _{opr}	-20 to +75		°C	
Storage temperature	T _{stg}	-40 to +150		°C	

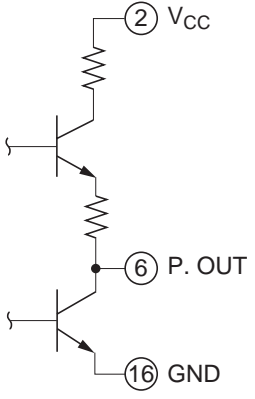
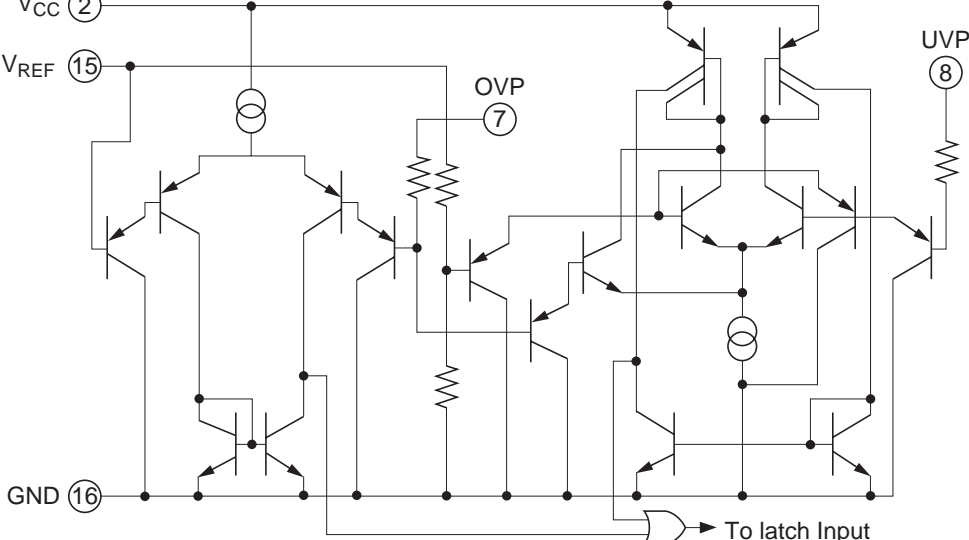
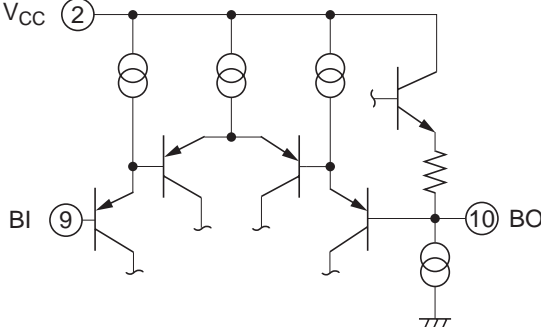
Electrical Characteristics

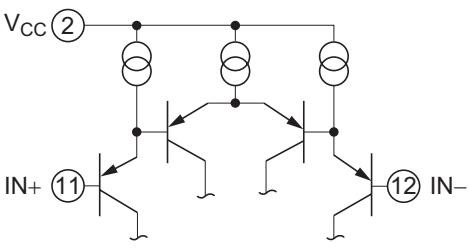
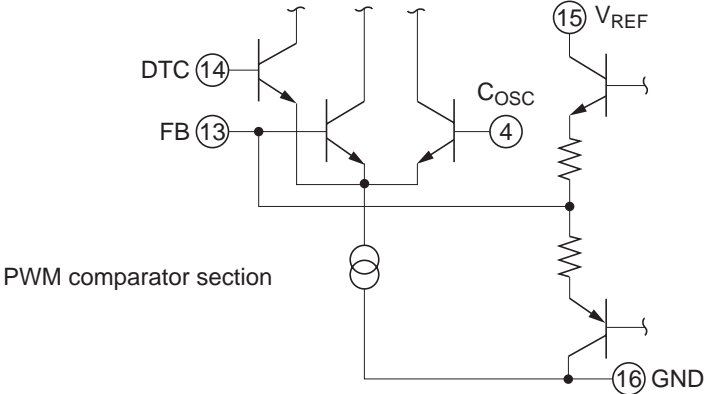
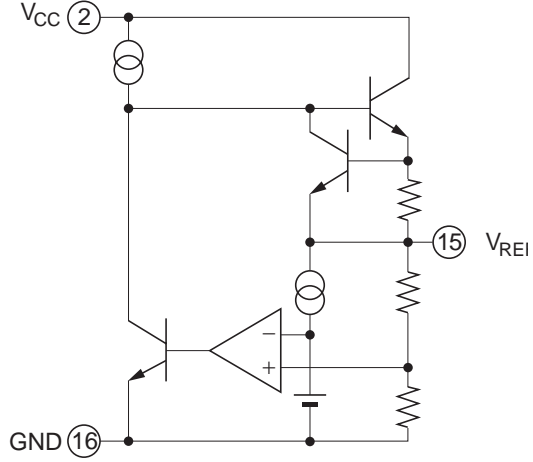
(V_{CC} = 12 V, T_{IN} = 40 kHz, T_a = 25°C, unless otherwise noted)

Block	Item	Symbol	Limits			Unit	Test Conditions
			Min	Typ	Max		
All device	Range of power supply	V _{CC}	V _{CC OFF}		14	V	
	Circuit current	I _{CC}	—	20	—	mA	Output off mode
Reference voltage section	Reference voltage	V _{REF}	4.80	5.00	5.20	V	I _{REF} = -5 mA
	Input regulation	Reg-in	—	1.0	10	mV	V _{CC} = 7 to 14 V I _{REF} = -5 mA
	Load regulation	Reg-L	—	2.0	20	mV	I _{REF} = 0 to -5 mA
	Reference voltage thermal coefficient	TC _{VREF}	—	0.01	—	%/°C	
	Maximum reference current	I _{REF MAX}	—	-30	—	mA	
	Short-circuit current	I _S	—	-30	—	mA	
Error Amp.	Input offset voltage	V _{IO}	—	—	7	mV	
	Input bias current	I _{ib}	-100	—	—	nA	
	Input offset current	I _{IO}	-100	—	100	nA	
	Common mode input voltage range	V _{ICM}	-0.3	—	V _{CC} - 2	V	
	Open loop transmission gain	AV	70	110	—	dB	
	Slew rate	SR	—	4	—	V/μs	
	Output voltage range	V _{OR}	0.3	—	V _{REF} - 1.5	V	
	Output sink current	I _{sink}	10	—	—	mA	
	Output source current	I _{source}	—	—	-10	mA	
Buffer Amp.	Input bias current	I _b	-20	—	—	nA	
	Slew rate	SR	—	4	—	V/μs	
	Output voltage	V _{OR}	0.3	—	V _{CC} - 2.5	V	
	Output sink current	I _{sink}	2	—	—	mA	
	Output source current	I _{source}	—	—	-10	mA	
Oscillator	Oscillation frequency	f _{OSC}	15	—	150	kHz	
	The oscillator waveform bound voltage	V _{OSC H}	—	3.5	—	V	
	The oscillator waveform lower limit voltage	V _{OSC L}	—	1.5	—	V	
	High level of T _{IN}	V _{TIN H}	2.5	—	V _{CC}	V	
	Low level of T _{IN}	V _{TIN L}	—	—	1.0	V	
PWM output section	Output saturation voltage L	V _{sat L}	—	0.7	1.4	V	I _O = 100 mA
	Output saturation voltage H	V _{sat H}	9.5	10.5	—	V	I _O = -100 mA
UVLO section	ON threshold voltage	V _{TH ON}	8.0	9.0	10.0	V	
	OFF threshold voltage	V _{TH OFF}	5.4	6.0	6.6	V	
OVP section	OVP terminal threshold voltage	V _{TH OVP}	4.75	5.00	5.25	V	
	OVP terminal input current	I _{IN OVP}	—	—	1.0	μA	
UVP section	Input offset voltage	V _{UVPO}	—	—	7	mV	
	UVP terminal input current	I _{IN UVP}	—	—	1.0	μA	
P.OUT section	Output saturation voltage	V _{sat}	—	—	0.4	V	I _{PO} = 10 mA
	Output leakage current	I _L	—	—	1.0	μA	V _{PO} = 12 V

Terminal Functional Description and Equivalent Circuit

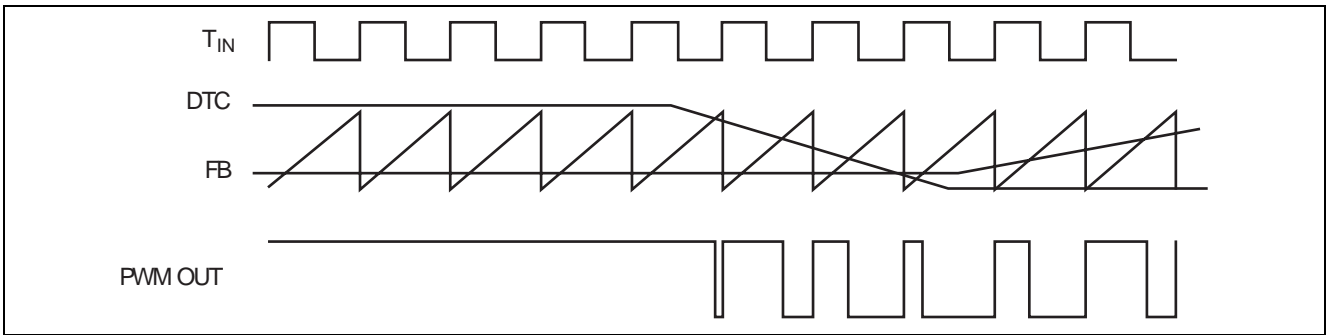
Terminal No.	Symbol	Function and Terminal Circumscription Circuitry
1	PWM OUT	<p>PWM output terminal</p> <ul style="list-style-type: none"> The PWM output synchronized with the T_{IN} input. Output "H" level = 10.5 V typ (The output load current: -100 mA, $V_{CC} = 12$ V) Output "L" level = 0.7 V typ (The output load current: +100 mA, $V_{CC} = 12$ V) 
2	V_{CC}	Power supply terminal
3	T_{IN}	<p>Trigger input terminal</p> <ul style="list-style-type: none"> Frequency range 15 kHz to 150 kHz It takes in a start edge.  
4	C_{OSC}	<p>Cosc terminal</p> <ul style="list-style-type: none"> It generates a saw wave by connecting capacitor between 4-pin and GND. Recommended capacitor value is 1000 pF.
5	C_{AGC}	<p>C_{AGC} terminal</p> <ul style="list-style-type: none"> It sets up sensitivity of AGC by connecting capacitor between 5-pin and GND. Recommended capacitor value is 1 μF. 

Terminal No.	Symbol	Function and Terminal Circumscription Circuitry
6	P.OUT	<p>The abnormal state detection output terminal</p> <ul style="list-style-type: none"> The output becomes "H" from "L" when an abnormality is detected in the OVP or UVP terminal. Then the PWM output terminal becomes "H" settlement, too. Do OFF of power supply (V_{CC}) to remove latch of abnormal state. In abnormal state detection; <ul style="list-style-type: none"> Output "H" level = 10.5 V typ (The output load current: no-load, $V_{CC} = 12\text{ V}$) Output "L" level = 1.5 V typ (The output load current: -1 mA, $V_{CC} = 12\text{ V}$) In normal state ; <ul style="list-style-type: none"> Output "L" level = 0.4 V typ (The output load current: $+10\text{ mA}$, $V_{CC} = 12\text{ V}$) 
7 8	OVP UVP	<p>Over voltage protection of the control line (OVP)</p> <ul style="list-style-type: none"> Setting terminal voltage; $GND \leq V_{OVP} < V_{REF}$ <p>Under voltage protection of the control line (UVP)</p> <ul style="list-style-type: none"> Setting terminal voltage; $GND \leq V_{UVP} < V_{OVP}$  <p>Note: It is connected to GND when the abnormal detection terminal is not used.</p>
9 10	BI BO	<p>The input terminal of a buffer Amp. (BI)</p> <p>The output terminal of a buffer Amp. (BO)</p> 

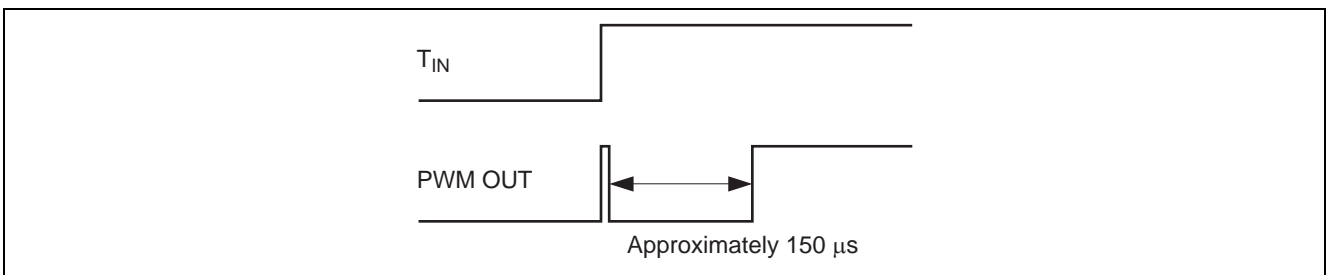
Terminal No.	Symbol	Function and Terminal Circumscription Circuitry
11 12	IN+ IN-	<p>Positive input terminal of an Op-Amp. (IN+) Negative input terminal of an Op-Amp. (IN-)</p> 
13 14	FB DTC	<p>Output terminal of an Op-Amp. (FB) Dead time control terminal (DTC)</p> <ul style="list-style-type: none"> It can do soft start during power-on under keeping time constant.  <p>PWM comparator section</p>
15	V _{REF}	<p>Reference voltage terminal</p> <ul style="list-style-type: none"> 5 V output voltage (The terminal can begin to take outside connected load 5 mA.) 
16	GND	Ground terminal

Timing Chart

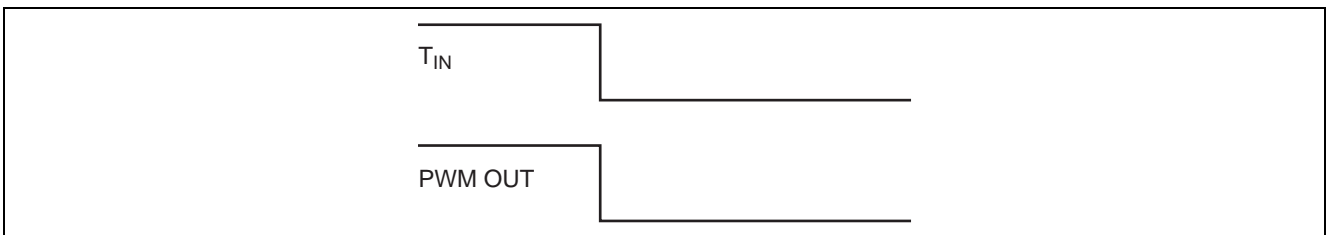
PWM OUT ON Duty is fixed in the voltage of higher one between DTC terminal and FB terminal voltage.



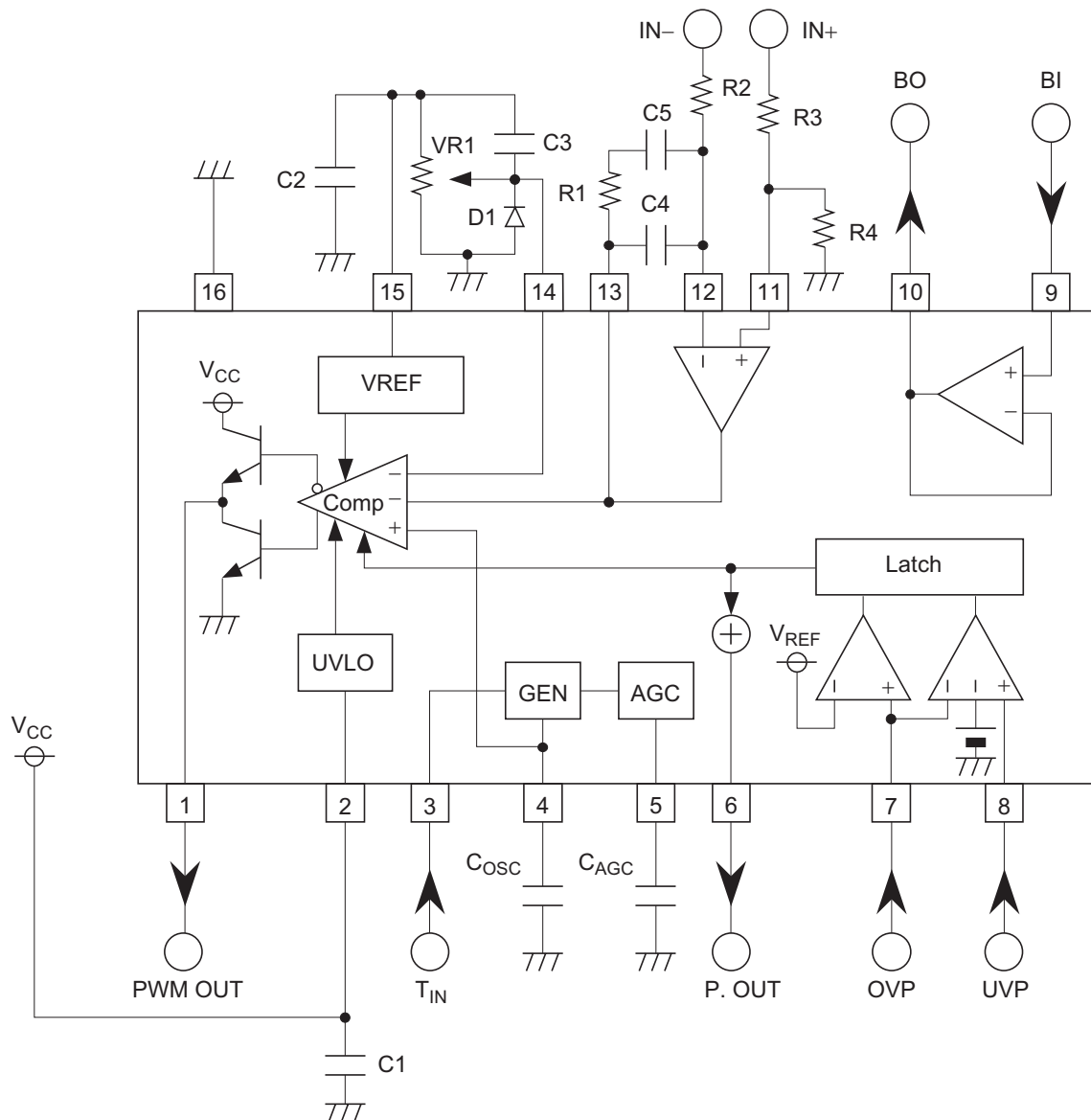
- Waveform at "H" was taken from "L", and having put T_{IN} up.
(PWM output is fixed in "H", too when fix T_{IN} terminal in "H")



- Waveform at "L" was taken from "H", and having put T_{IN} up.
(PWM output is fixed in "L", too when fix T_{IN} terminal in "L")



M62501 Application



C1, C2: Stabilization capacitors of V_{CC} and V_{REF} .

VR1: It is decided considering a load capacity of V_{REF} .
(A load capacity is approximately 5 mA.)
Recommended value is around 10 k Ω .

C3, D1: They are for the soft start function. A time constant is decided considering VR1.

C_{AGC} : This capacitor is for stabilization of AGC. A larger capacitor improves a stability of the system, however a system response is degraded.
Recommended value is around 1 μ F.

C_{OSC} : This capacitor is for a saw wave generation. Recommended value is around 1000 pF.

R1, R2, R3, R4, C4, C5:

They are for a gain setting of the error Amp. R2 should be several k Ω to dozens of k Ω to set a voltage gain 20 dB to 40 dB at $f = 1$ kHz, so that the feed back loop is stable.

When the voltage gain is too low, it causes jitter.

Recommended values of C4, C5 and R1 are ;

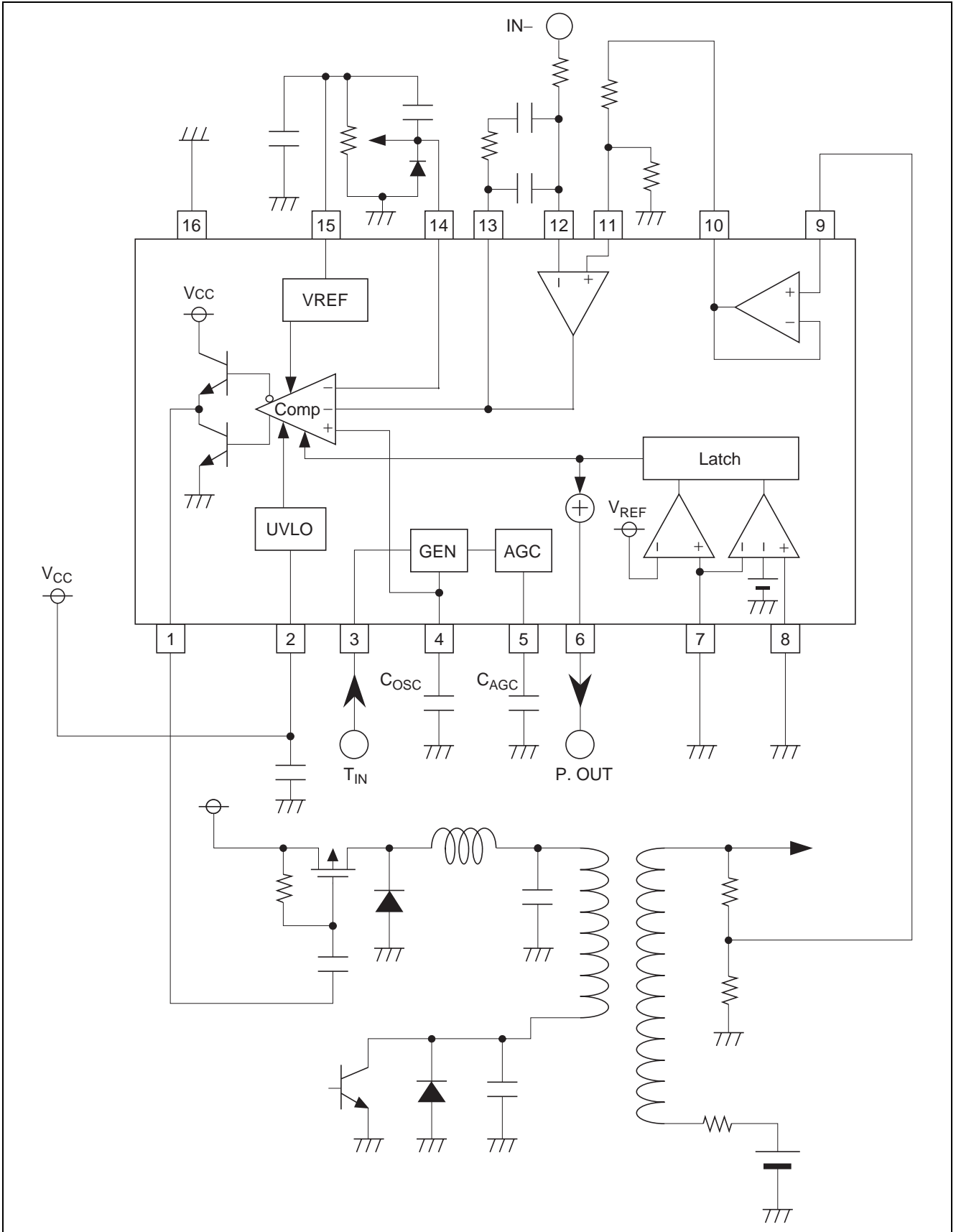
C4 = dozens of pF to several hundreds pF

C5 = several thousands pF to tens of thousands pF

R1 = dozens of k Ω to several hundreds k Ω .

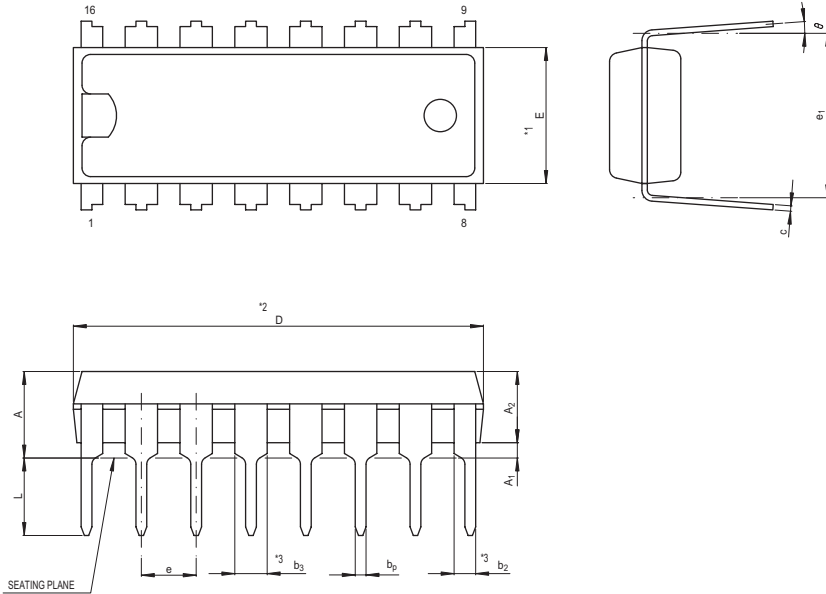
Note: Connect 7-pin and 8-pin terminal to GND when don't use under voltage protection. (UVP)

Example of Application Circuit



Package Dimensions

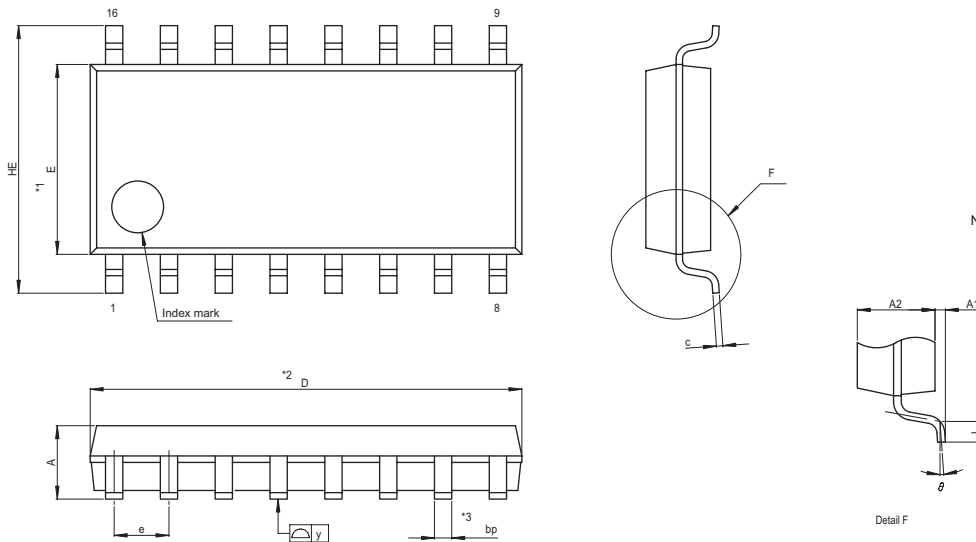
JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-DIP16-6.3x19-2.54	PRDP0016AA-A	16P4	1.0g



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	18.8	19.0	19.2
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	RENESAS Code	Previous Code	MASS[Typ.]
P-SOP16-4.4x10-1.27	PRSP0016DA-A	16P2S-A	0.15g



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	9.8	10.0	10.2
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	1.07	1.27	1.47
y	—	—	0.1
L	0.2	0.4	0.6

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