

# 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.

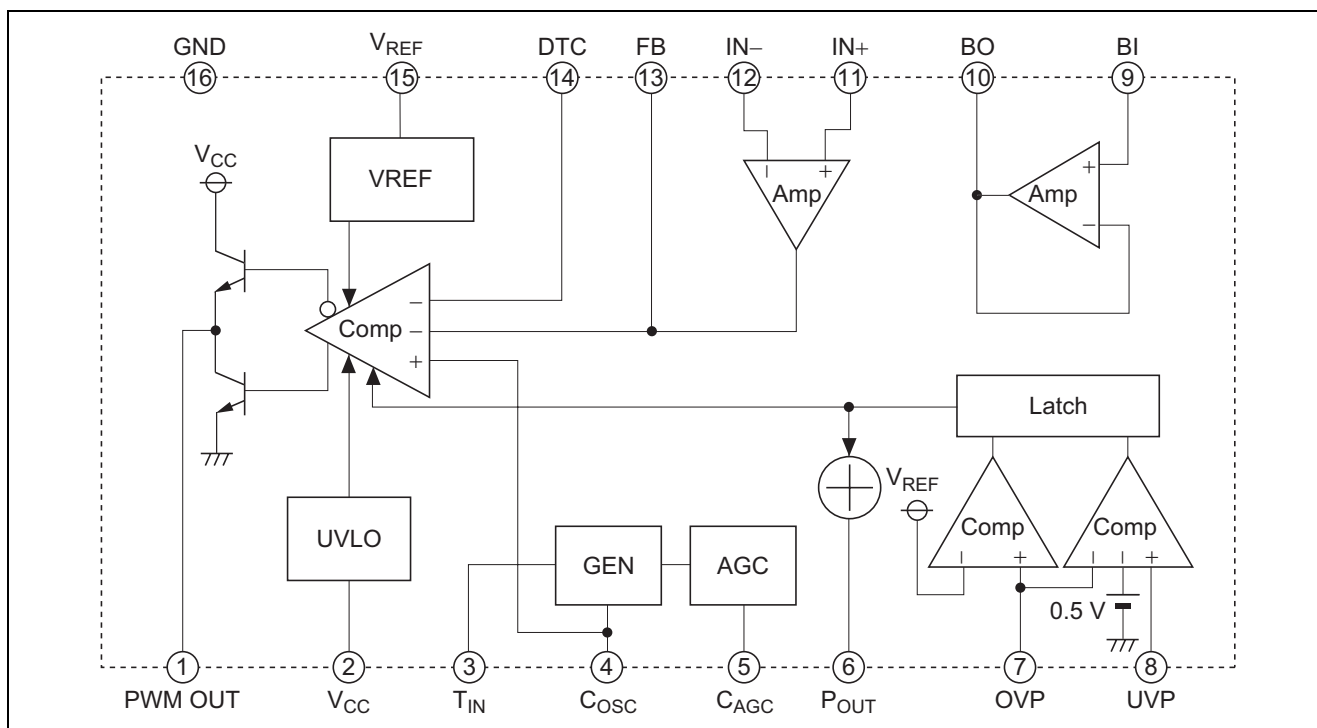
### Features

- 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

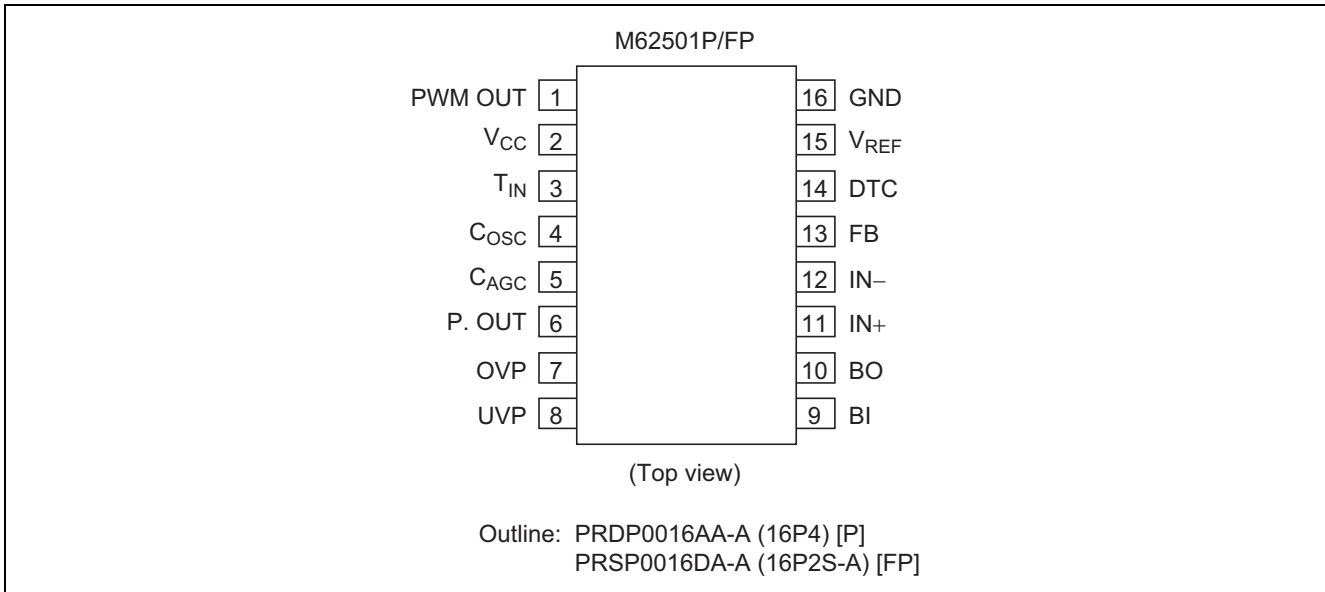
### Application

CRT display monitor

### Block Diagram



## Pin Arrangement



## Terminal Number and The Facility

PIN No.	Symbol	Functional Description
1	PWM OUT	PWM output
2	V <sub>CC</sub>	Power supply
3	T <sub>IN</sub>	Trigger input
4	C <sub>OSC</sub>	Setting oscillating frequency
5	C <sub>AGC</sub>	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 <sub>REF</sub>	Output of reference voltage (5 V)
16	GND	Ground

## Absolute Maximum Ratings

(T<sub>a</sub> = 25°C, unless otherwise noted)

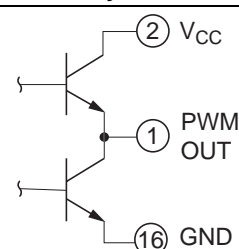
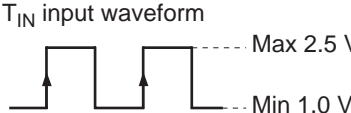
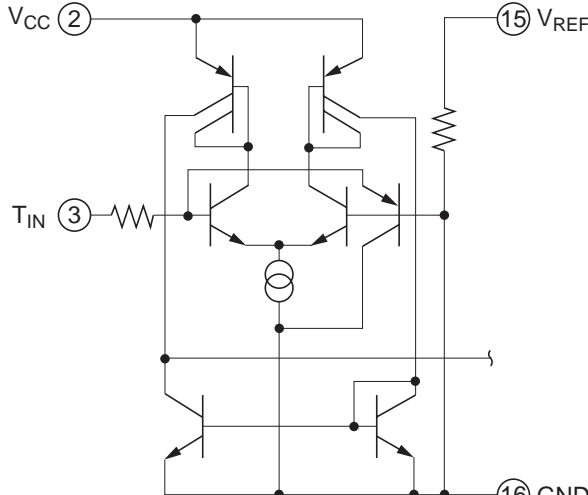
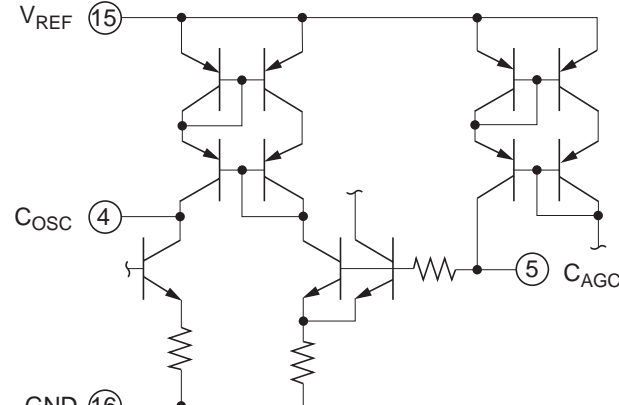
Item	Symbol	Ratings		Unit	Conditions
Supply voltage	V <sub>CC</sub>	15		V	
Output voltage	V <sub>OUT</sub>	15		V	
Output current	I <sub>OUT</sub>	±100		mA	
Error amplifier input common mode voltage	V <sub>ICM</sub>	-0.3 to V <sub>CC</sub>		V	
Error amplifier differential input voltage	V <sub>ID</sub>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

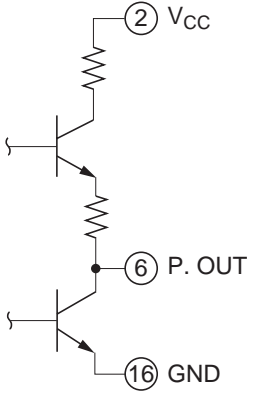
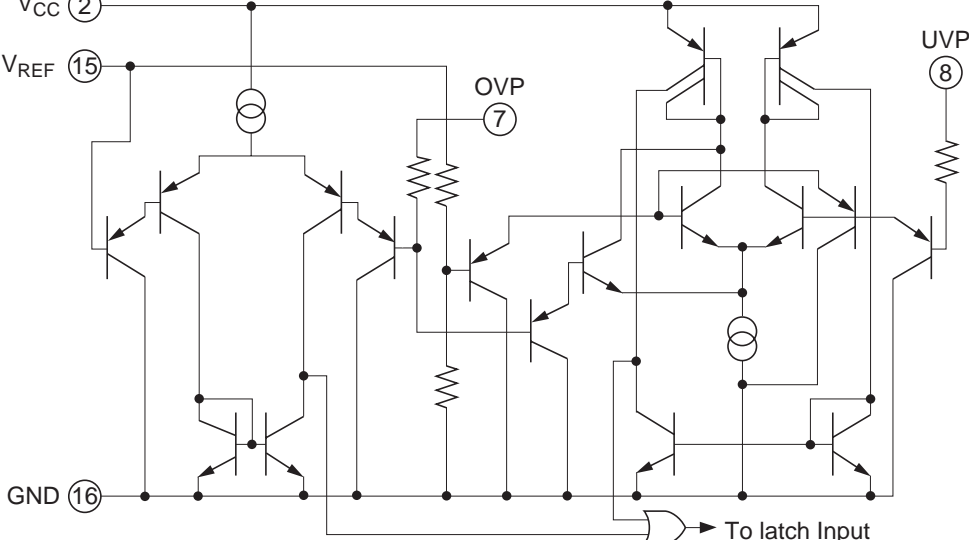
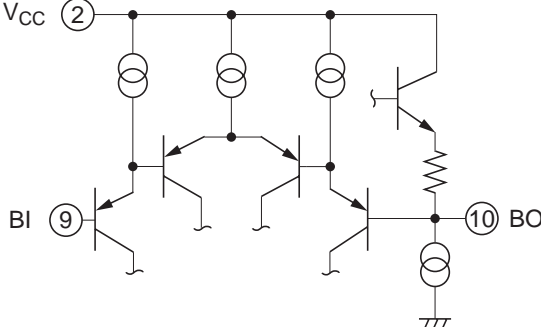
## Electrical Characteristics

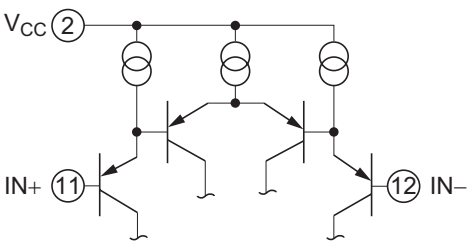
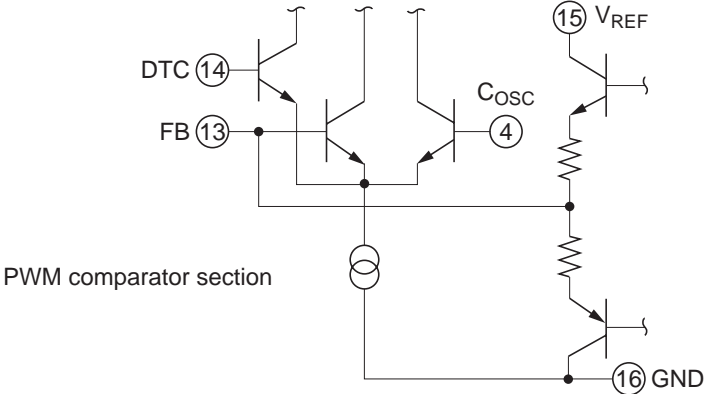
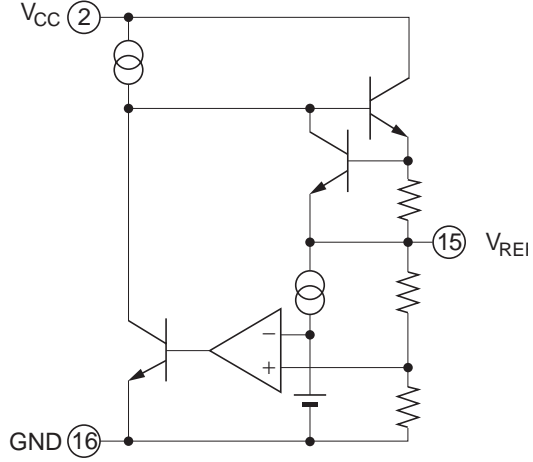
(V<sub>CC</sub> = 12 V, T<sub>IN</sub> = 40 kHz, T<sub>a</sub> = 25°C, unless otherwise noted)

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

**Terminal Functional Description and Equivalent Circuit**

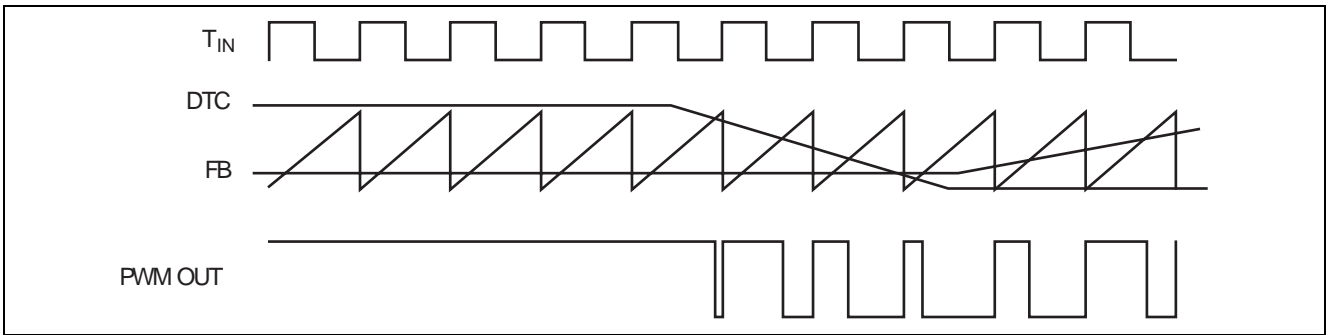
Terminal No.	Symbol	Function and Terminal Circumscription Circuitry
1	PWM OUT	<p>PWM output terminal</p> <ul style="list-style-type: none"> <li>The PWM output synchronized with the <math>T_{IN}</math> input.</li> <li>Output "H" level = 10.5 V typ (The output load current: -100 mA, <math>V_{CC} = 12</math>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

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"> <li>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.</li> <li>Do OFF of power supply (<math>V_{CC}</math>) to remove latch of abnormal state.</li> <li>In abnormal state detection;                     <ul style="list-style-type: none"> <li>Output "H" level = 10.5 V typ (The output load current: no-load, <math>V_{CC} = 12\text{ V}</math>)</li> <li>Output "L" level = 1.5 V typ (The output load current: <math>-1\text{ mA}</math>, <math>V_{CC} = 12\text{ V}</math>)</li> </ul> </li> <li>In normal state ;                     <ul style="list-style-type: none"> <li>Output "L" level = 0.4 V typ (The output load current: <math>+10\text{ mA}</math>, <math>V_{CC} = 12\text{ V}</math>)</li> </ul> </li> </ul> 
7 8	OVP UVP	<p>Over voltage protection of the control line (OVP)</p> <ul style="list-style-type: none"> <li>Setting terminal voltage; <math>GND \leq V_{OVP} &lt; V_{REF}</math></li> </ul> <p>Under voltage protection of the control line (UVP)</p> <ul style="list-style-type: none"> <li>Setting terminal voltage; <math>GND \leq V_{UVP} &lt; V_{OVP}</math></li> </ul>  <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> 

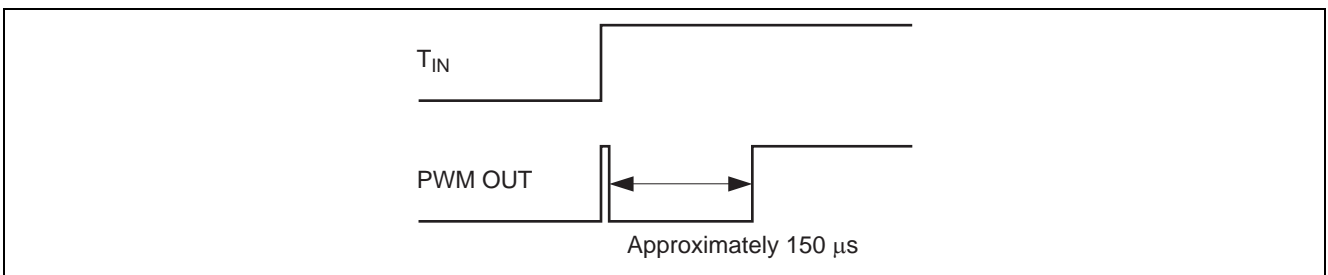
Terminal No.	Symbol	Function and Terminal Circumscription Circuitry
11 12	IN+ IN-	<p>Positive input terminal of an Op-Amp. (IN+) Negative input terminal of an Op-Amp. (IN-)</p> 
13 14	FB DTC	<p>Output terminal of an Op-Amp. (FB) Dead time control terminal (DTC)</p> <ul style="list-style-type: none">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

## Timing Chart

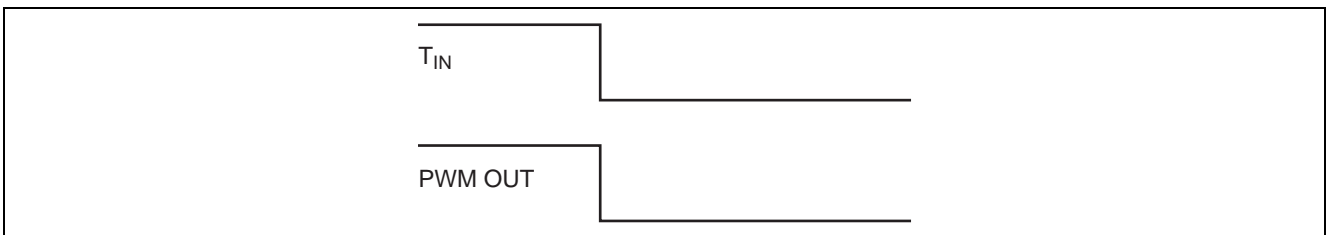
PWM OUT ON Duty is fixed in the voltage of higher one between DTC terminal and FB terminal voltage.



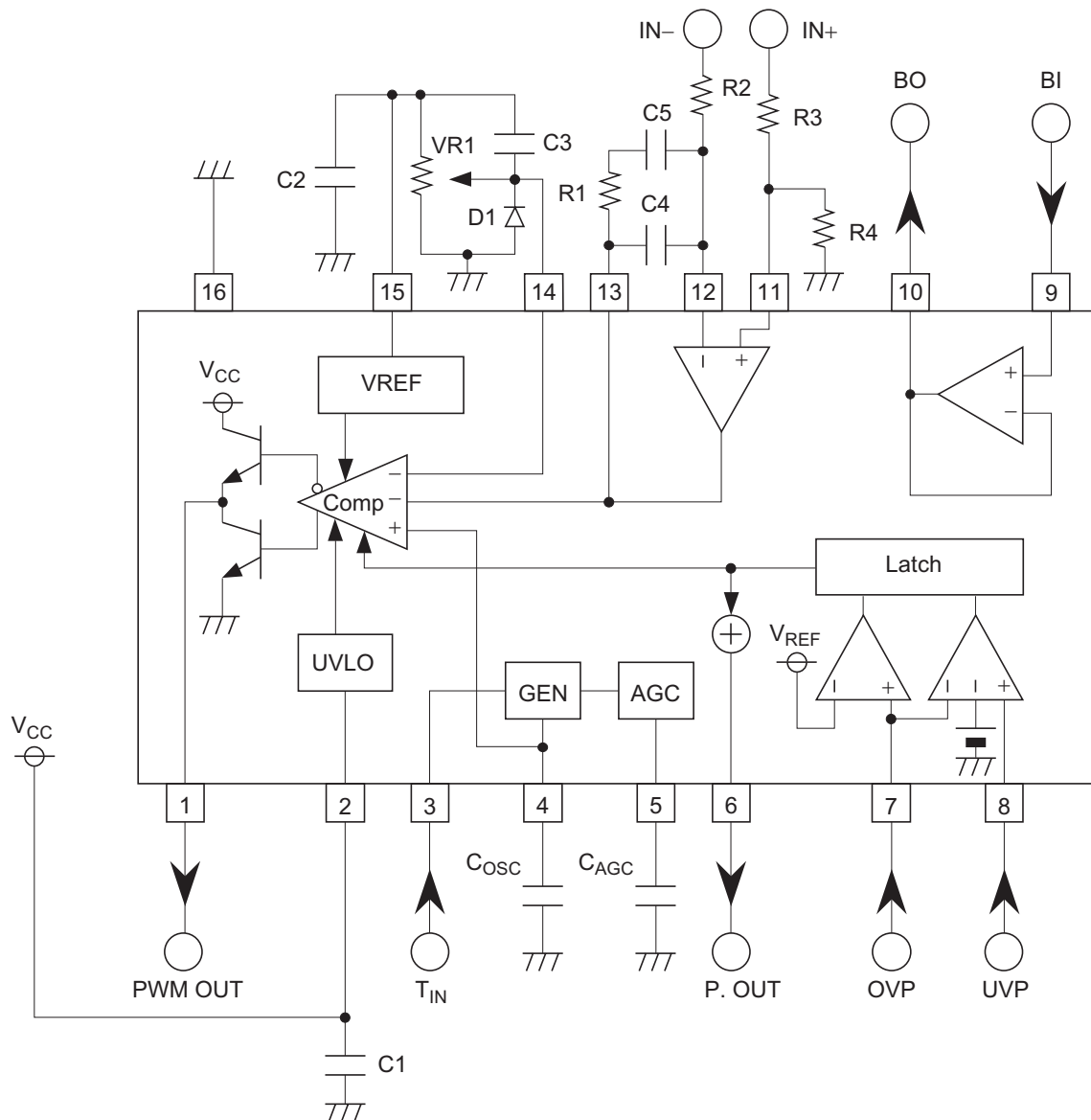
- Waveform at "H" was taken from "L", and having put T<sub>IN</sub> up.  
(PWM output is fixed in "H", too when fix T<sub>IN</sub> terminal in "H")



- Waveform at "L" was taken from "H", and having put T<sub>IN</sub> up.  
(PWM output is fixed in "L", too when fix T<sub>IN</sub> 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 $\Omega$ .

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

C<sub>AGC</sub>: 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  $\mu$ F.

C<sub>OSC</sub>: 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 $\Omega$  to dozens of k $\Omega$  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

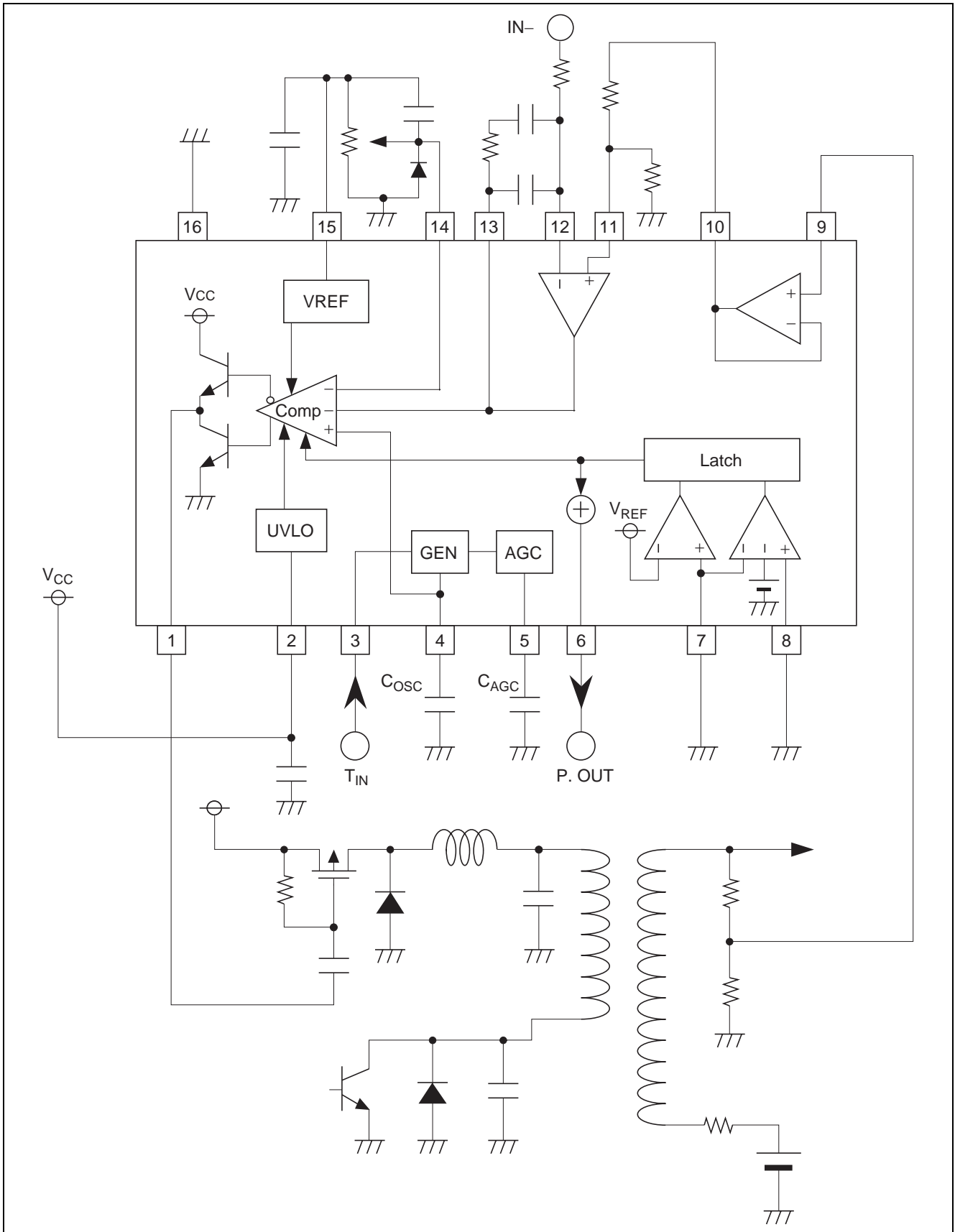
C5 = several thousands pF to tens of thousands pF

R1 = dozens of k $\Omega$  to several hundreds k $\Omega$ .

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

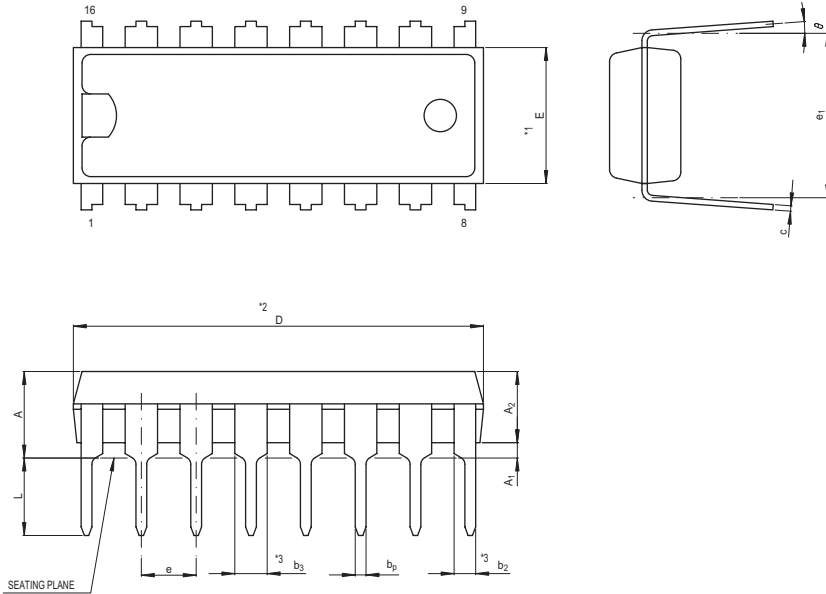


Example of Application Circuit



### Package Dimensions

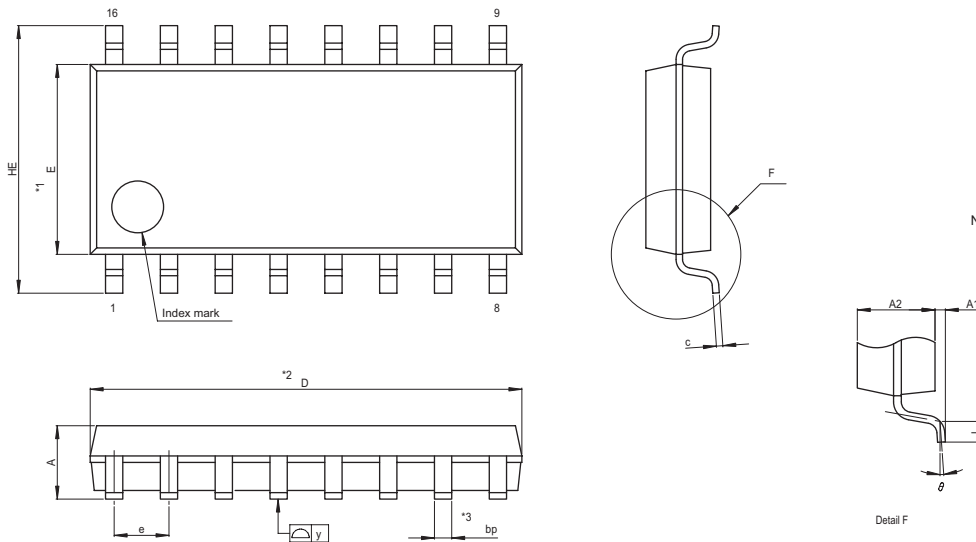
JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-DIP16-6.3x19-2.54	PRDP0016AA-A	16P4	1.0g



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 <sub>1</sub>	7.32	7.62	7.92
D	18.8	19.0	19.2
E	6.15	6.3	6.45
A	—	—	4.5
A <sub>1</sub>	0.51	—	—
A <sub>2</sub>	—	3.3	—
b <sub>p</sub>	0.4	0.5	0.6
b <sub>2</sub>	0.9	1.0	1.3
b <sub>3</sub>	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 <sub>2</sub>	—	1.5	—
A <sub>1</sub>	0.05	—	—
A	—	—	1.9
b <sub>p</sub>	0.35	0.4	0.5
c	0.13	0.15	0.2
θ	0°	—	10°
H <sub>E</sub>	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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**Renesas Technology (Shanghai) Co., Ltd.**

Unit 204, 205, AZIACenter, No.1233 Lujiazui Ring Rd, Pudong District, Shanghai, China 200120  
Tel: <86> (21) 5877-1818, Fax: <86> (21) 6887-7898

**Renesas Technology Hong Kong Ltd.**

7th Floor, North Tower, World Finance Centre, Harbour City, 1 Canton Road, Tsimshatsui, Kowloon, Hong Kong  
Tel: <852> 2265-6688, Fax: <852> 2730-6071

**Renesas Technology Taiwan Co., Ltd.**

10th Floor, No.99, Fushing North Road, Taipei, Taiwan  
Tel: <886> (2) 2715-2888, Fax: <886> (2) 2713-2999

**Renesas Technology Singapore Pte. Ltd.**

1 Harbour Front Avenue, #06-10, Keppel Bay Tower, Singapore 098632  
Tel: <65> 6213-0200, Fax: <65> 6278-8001

**Renesas Technology Korea Co., Ltd.**

Kukje Center Bldg. 18th Fl., 191, 2-ka, Hangang-ro, Yongsan-ku, Seoul 140-702, Korea  
Tel: <82> (2) 796-3115, Fax: <82> (2) 796-2145

**Renesas Technology Malaysia Sdn. Bhd**

Unit 906, Block B, Menara Amcorp, Amcorp Trade Centre, No.18, Jalan Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia  
Tel: <603> 7955-9390, Fax: <603> 7955-9510