

# BIPOLAR ANALOG INTEGRATED CIRCUIT

## $\mu$ PC1905

### SWITCHING REGULATOR CONTROL CIRCUIT FOR 500 kHz OPERATION

$\mu$ PC1905 is a control IC for the high performance switching power supply equipped with high speed/high sensitivity protection circuit. Control ICs for the high performance switching power supply have 3 series of  $\mu$ PC1099, 1905, 1906. The features of  $\mu$ PC1905 are as follows:

- ① Supply voltage is as high as 31 V.  
→ It is possible to drive output power MOS FET with high voltage.
- ② Hysteresis voltage of under voltage lockout circuit is 6.5 V.  
→ The ripple allowance of input capacitor is wide and a smaller capacitor can be used.

#### CONTROL IC FAMILY FOR THE HIGH PERFORMANCE SWITCHING POWER SUPPLY

PART NUMBER	SUPPLY VOLTAGE	START-UP THRESHOLD VOLTAGE	THRESHOLD HYSTERESIS	OVER CURRENT LATCH PROTECTION MODE
$\mu$ PC1099	26 V	11 V	3 V	Pulse by pulse current limiting
$\mu$ PC1905	31 V	16.5 V	6.5 V	Pulse by pulse current limiting
$\mu$ PC1906	31 V	16.5 V	6.5 V	Shut down and $V_{CC}$ reset

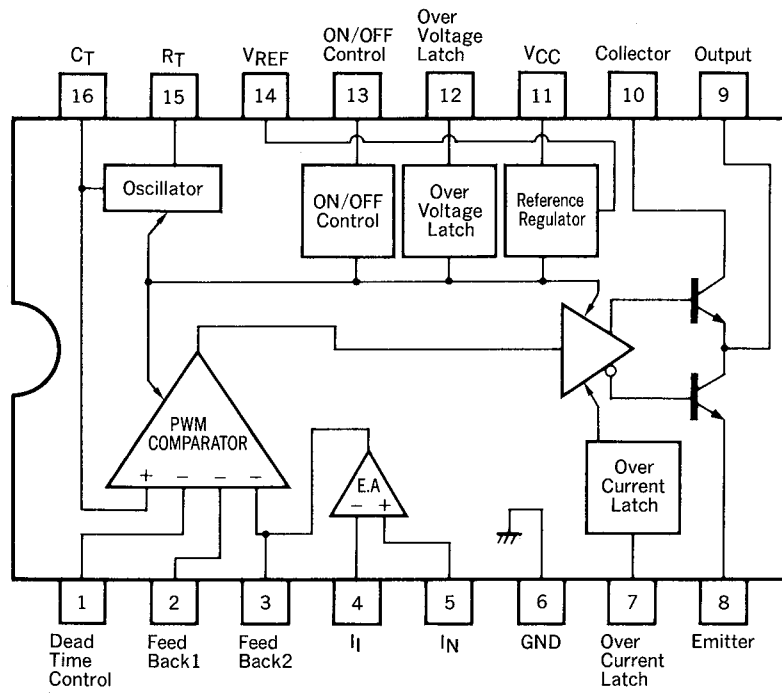
#### FEATURES

- Directly drive power MOS FET (totem pole circuit adopted)
- Pulse by pulse over current latch circuit incorporated
- Over voltage latch circuit incorporated
- Under voltage lockout circuit incorporated
- Remote control circuit incorporated
- Error amplifier incorporated

PART NUMBER	PACKAGE	QUALITY GRADE
$\mu$ PC1905CX	16 pin plastic DIP (300 mil)	Standard
$\mu$ PC1905GS	16 pin plastic SOP (300 mil)	

Please refer to "Quality grade on NEC Semiconductor Devices" (Document number IEI-1209) published by NEC Corporation to know the specification of quality grade on the devices and its recommended applications.

PIN CONNECTION DIAGRAM (Top View)



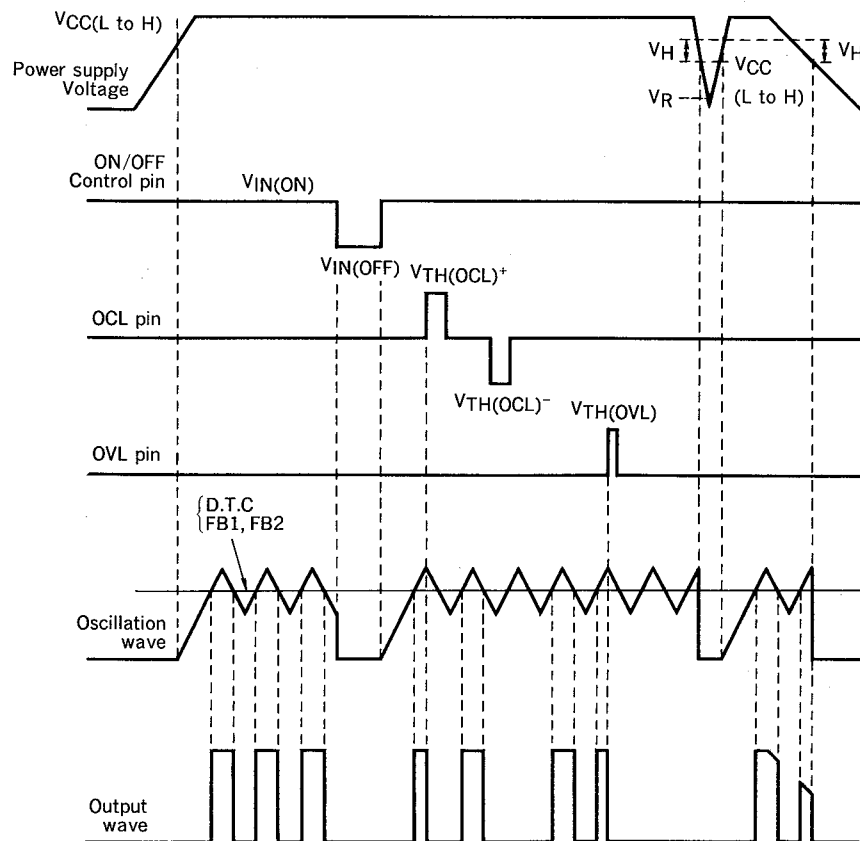
ABSOLUTE MAXIMUM RATING ( $T_a = 25^\circ\text{C}$ )

PARAMETER	SYMBOL	RATING	UNIT	
Supply Voltage	$V_{CC}$	31	V	
Output Voltage	$V_C$	31	V	
Output Current	$I_C(\text{DC})$	100	mA	
Peak Output Current	$I_C(\text{peak})$	1.2	A	
Total Power Dissipation	μPC1905CX	$P_T(T_a = 25^\circ\text{C})$	1 000	mW
	μPC1905GS	$P_T(T_a = 25^\circ\text{C})$	694	mW
Operation Temperature	$T_{\text{opt}}$	-20 to +85	$^\circ\text{C}$	
Storage Temperature	$T_{\text{stg}}$	-55 to +150	$^\circ\text{C}$	

RECOMMENDED OPERATION REQUIREMENTS

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
Supply Voltage	$V_{CC}$	12	18	30	V
Oscillation Frequency	$f_{\text{OSC}}$	50	200	500	kHz
Output Load Capacitance	$C_L$	-	2 200	3 000	pF

OPERATION WAVES

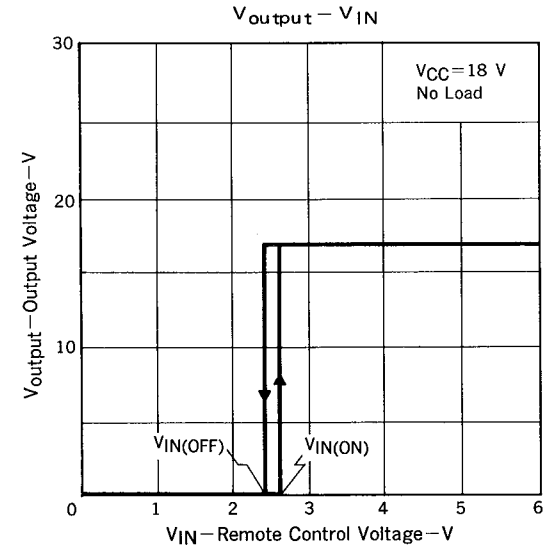
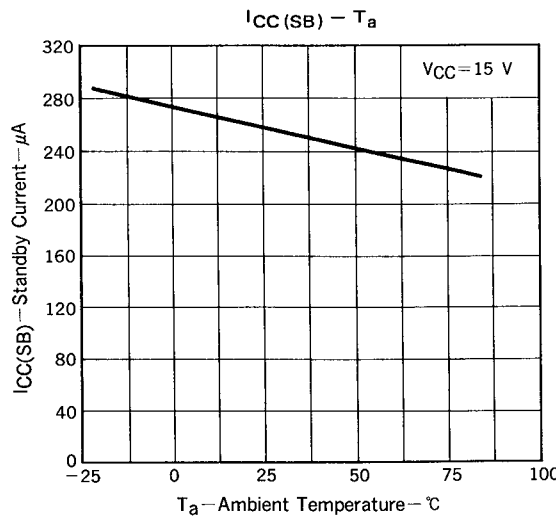
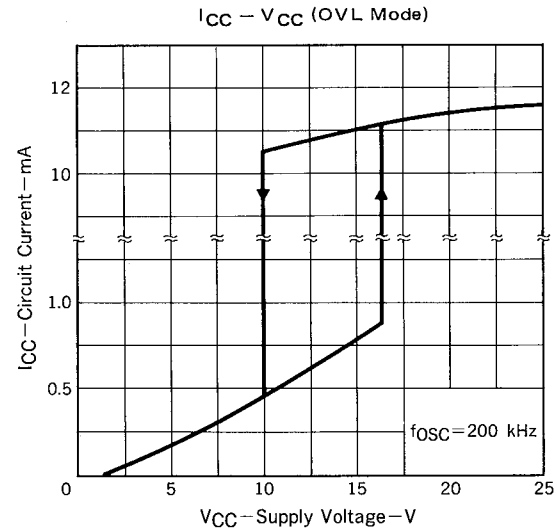
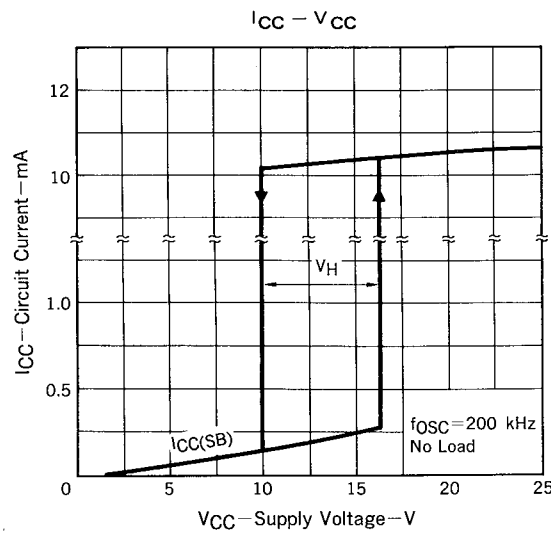
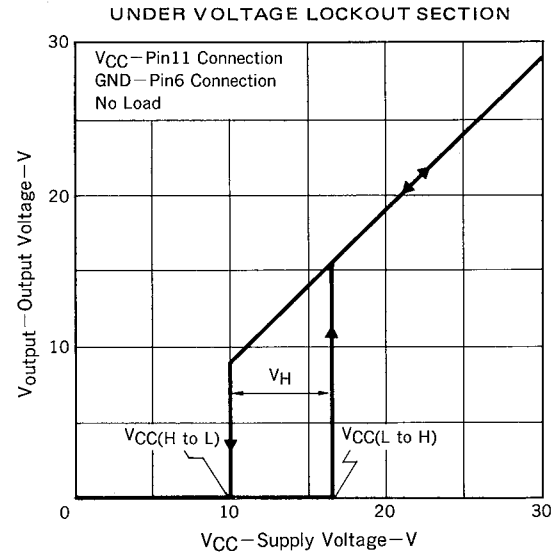
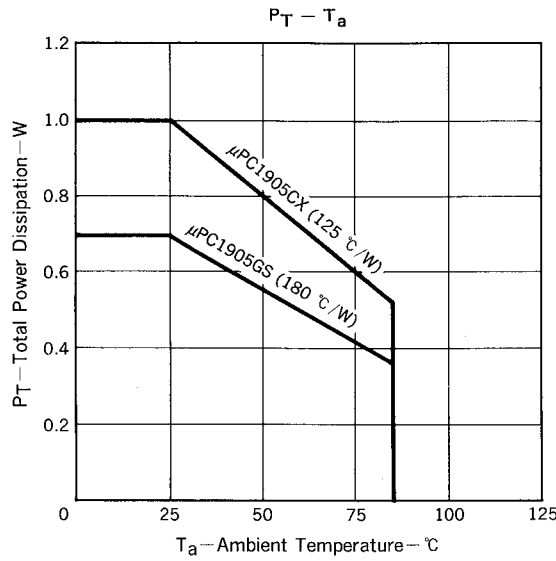


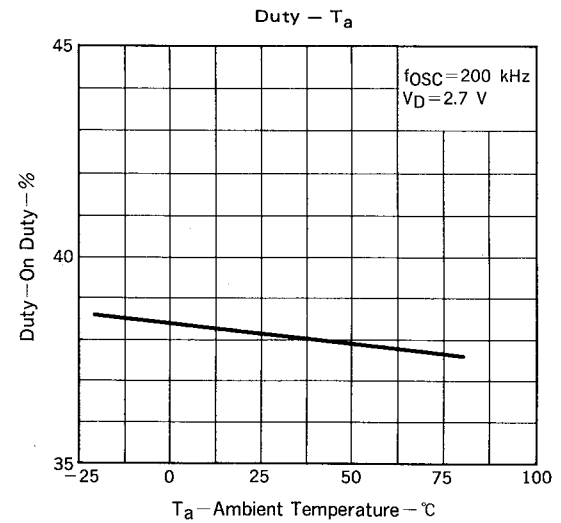
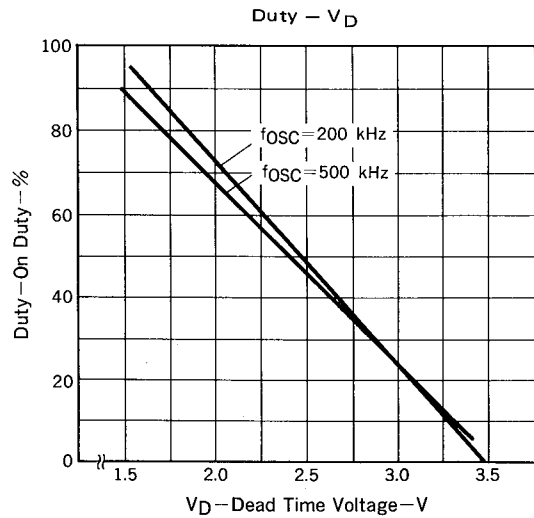
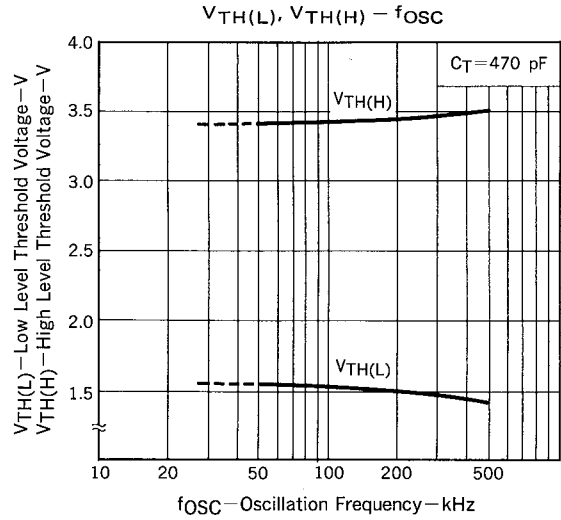
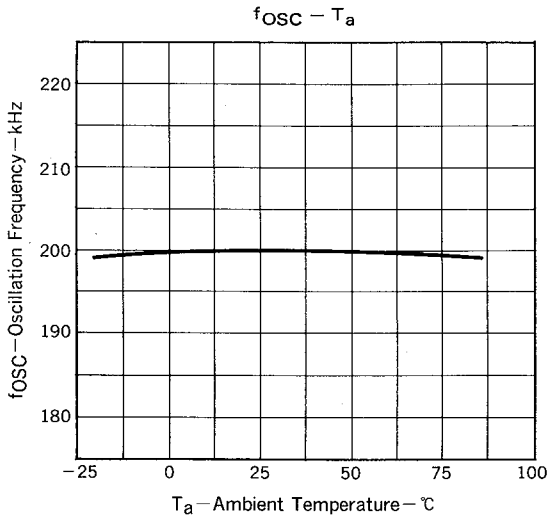
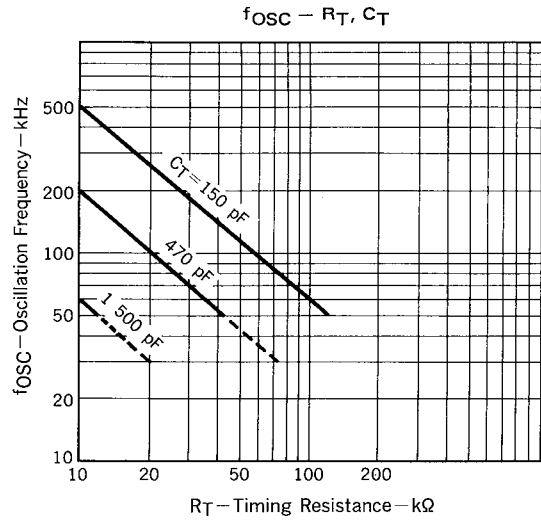
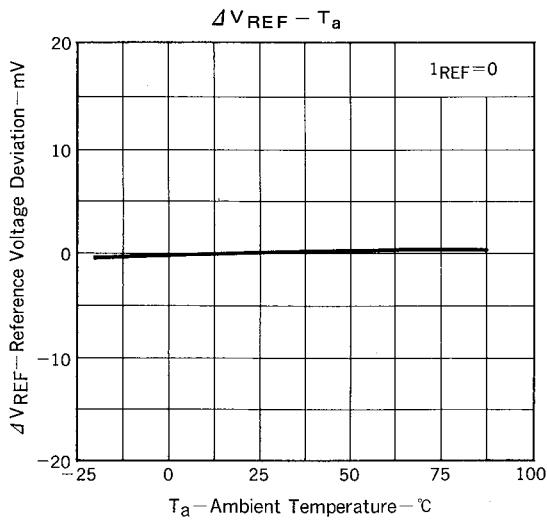
ELECTRICAL CHARACTERISTICS (T<sub>a</sub> = 25 °C, V<sub>CC</sub> = 18 V, C<sub>T</sub> = 470 pF, R<sub>T</sub> = 10 kΩ, f<sub>OSC</sub> = 200 kHz)

BLOCK	PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	CONDITIONS
Total	Standby Current	I <sub>CC(SB)</sub>	0.1	0.25	0.4	mA	V <sub>CC</sub> = 15 V, -10 °C ≤ T <sub>a</sub> ≤ 85 °C
	Circuit Current at OVL Operation Mode	I <sub>CC(OVL)</sub>		10		mA	
	Circuit Current at Off Mode	I <sub>CC(OFF)</sub>		10		mA	
	Circuit Current	I <sub>CC</sub>		10	15	mA	V <sub>CC</sub> = V <sub>C</sub> = 24 V, V <sub>D</sub> = 2.7 V, no load
Under Voltage Lockout Section	Start-Up Threshold Voltage	V <sub>CC(L to H)</sub>	15.5	16.5	17.5	V	
	Threshold Hysteresis	V <sub>H</sub>	5.5	6.5	7.5	V	
Reference Voltage Section	Output Voltage	V <sub>REF</sub>	4.8	5	5.2	V	I <sub>REF</sub> = 0
	Line Regulation	REG <sub>IN</sub>		4	10	mV	12 V ≤ V <sub>CC</sub> ≤ 30 V, I <sub>REF</sub> = 0
	Load Regulation	REG <sub>L</sub>		2	12	mV	0 ≤ I <sub>REF</sub> ≤ 3 mA
	Output Voltage Temperature Coefficient	V <sub>REF/ΔT</sub>		100	700	μV/°C	I <sub>REF</sub> = 0, -10 °C ≤ T <sub>a</sub> ≤ +85 °C
	Short Circuit Current	I <sub>O short</sub>		15		mA	V <sub>REF</sub> = 0
PWM Section	Input Bias Current	I <sub>B</sub>			10	μA	
	Low Level Threshold Voltage	V <sub>TH(L)</sub>		1.5		V	
	High Level Threshold Voltage	V <sub>TH(H)</sub>		3.5		V	
	Dead Time Temperature Coefficient	ΔDT/ΔT		1	5	%	V <sub>D</sub> = 0.54 V <sub>REF</sub> , -10 °C ≤ T <sub>a</sub> ≤ +85 °C
Oscillator Section	Oscillation Frequency	f <sub>OSC</sub>	180	200	220	kHz	
	Frequency Line Regulation	Δf/ΔV <sub>CC</sub>		0.6		%	12 V ≤ V <sub>CC</sub> ≤ 30 V
	Frequency Temperature Coefficient	Δf/ΔT		1	5	%	-10 °C ≤ T <sub>a</sub> ≤ +85 °C
Output Section	Low Level Output Voltage	V <sub>OL</sub>			0.5	V	I <sub>SINK</sub> = 3 mA, V <sub>CC</sub> = V <sub>C</sub>
	High Level Output Voltage	V <sub>OH</sub>		V <sub>CC</sub> -1.6		V	I <sub>SOURCE</sub> = 30 mA, V <sub>CC</sub> = V <sub>C</sub>
	Output Voltage Rise Time	t <sub>r</sub>		80		ns	R <sub>L</sub> = 15 Ω, C <sub>L</sub> = 2 200 pF
	Output Voltage Fall Time	t <sub>f</sub>		30		ns	V <sub>CC</sub> = V <sub>C</sub>
Remote Control Section	Input Voltage at Output ON	V <sub>IN(ON)</sub>	2.3	2.5	2.7	V	
	Input Voltage at Output OFF	V <sub>IN(OFF)</sub>	2.1	2.3	2.5	V	
	Hysteresis Width	V <sub>H</sub>	0.1	0.2	0.3	V	
Over Voltage Latch Section	Over Voltage Threshold Voltage	V <sub>TH(OVL)</sub>	2.0	2.4	2.8	V	-10 °C ≤ T <sub>a</sub> ≤ +85 °C
	Input Bias Current	I <sub>B(OVL)</sub>			4	μA	OVL pin voltage = V <sub>TH(OVL)</sub>
	OVL Reset Voltage	V <sub>R(OVL)</sub>		2		V	
	Delay to Output	t <sub>d(OVL)</sub>		600		ns	
Over Current Latch Section	Over Current Threshold Voltage	V <sub>TH(OCL)</sub> <sup>+</sup>	200	220	240	mV	-10 °C ≤ T <sub>a</sub> ≤ +85 °C
	Over Current Threshold Voltage	V <sub>TH(OCL)</sub> <sup>-</sup>	-230	-210	-190	mV	-10 °C ≤ T <sub>a</sub> ≤ +85 °C
	OCL Pin Output Current	I <sub>B(OCL)</sub>		250		μA	
	Delay to Output	t <sub>d(OCL)</sub> <sup>+</sup>		120		ns	
	Delay to Output	t <sub>d(OCL)</sub> <sup>-</sup>		190		ns	

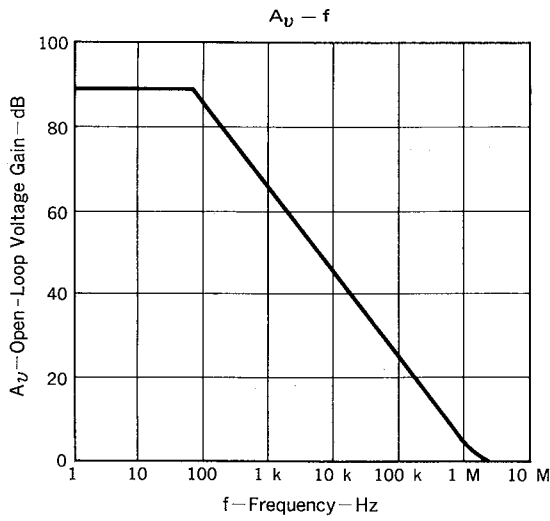
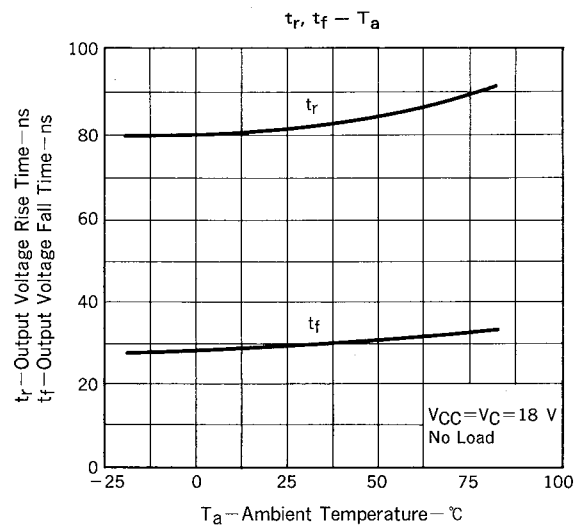
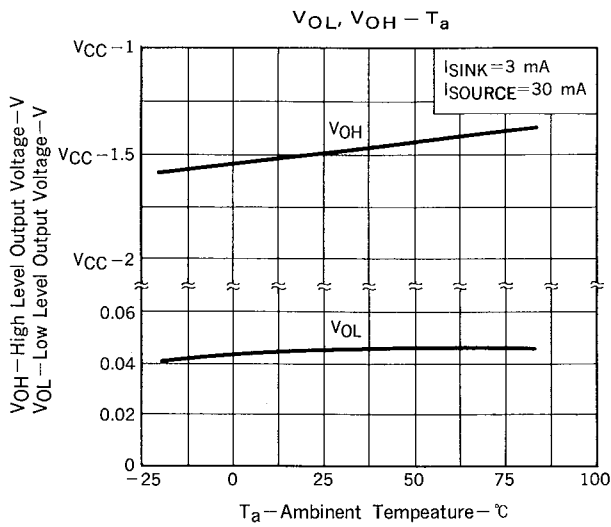
BLOCK	PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	CONDITIONS
Error Amplification Section	Input Bias Current	$I_B$ (AMP)			1	μA	$V_{IN} = 2.5 V$
	Open-Loop Voltage Gain	$A_v$	60	90		dB	$V_{FB} = 2.9 V$
	Unit Gain Bandwidth	$f_{unity}$	1	1.6		MHz	
	High Level Output Voltage	$V_{om}^+$	3.0			V	
	Low Level Output Voltage	$V_{om}^-$			1.0	V	
	Common Mode Input Voltage Range	$V_{ICM}^+$	3			V	$12 V \leq V_{CC} \leq 30 V,$
	Common Mode Input Voltage Range	$V_{ICM}^-$			-0.3	V	$-10^\circ C \leq T_a \leq +85^\circ C$

TYPICAL CHARACTERISTICS (T<sub>a</sub> = 25 °C)









**NOTE:** When under-shoot voltage at pin 9 occur, it must be cramped to prevent from wrong operation. See Fig. 1.

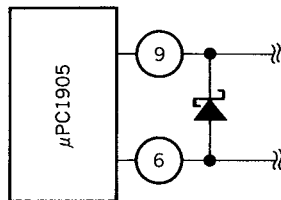
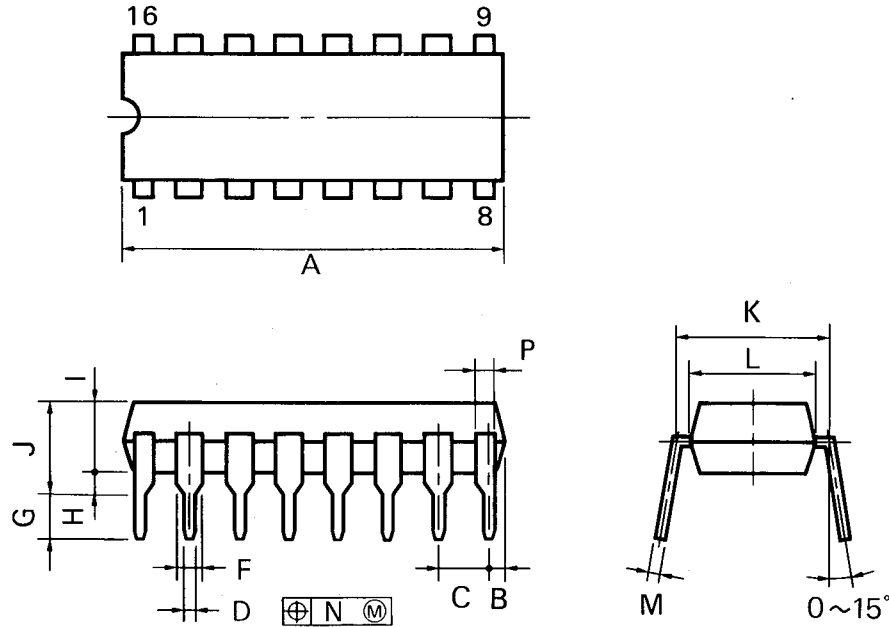


Fig.1



16PIN PLASTIC DIP (300 mil)

μPC1905CX



P16C-100-300B

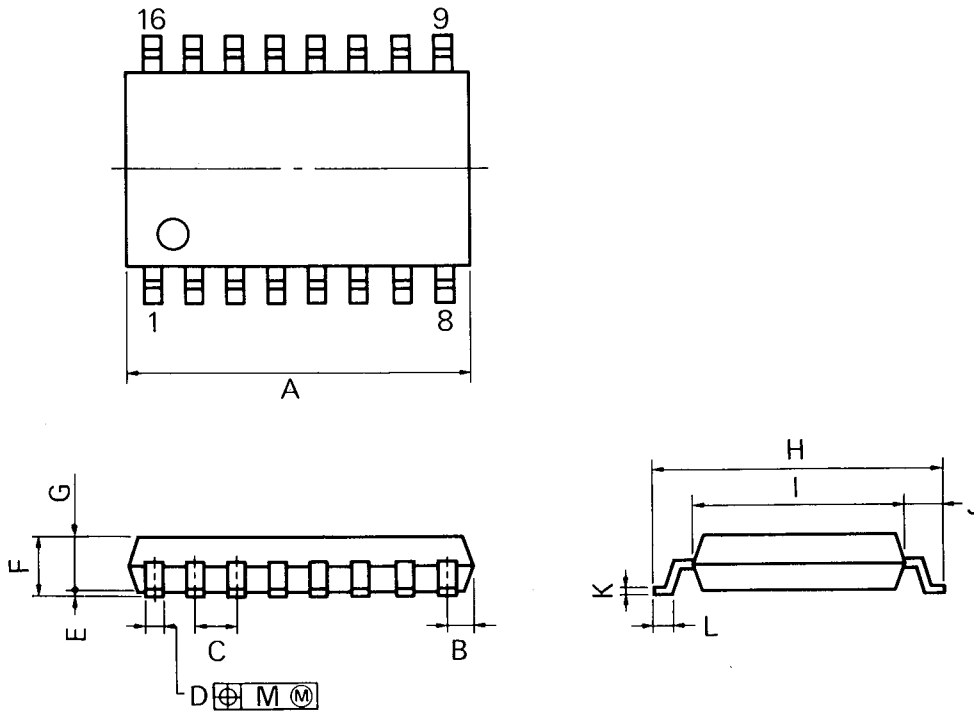
NOTES

- 1) Each lead centerline is located within 0.25 mm (0.01 inch) of its true position (T.P.) at maximum material condition.
- 2) Item "K" to center of leads when formed parallel.

ITEM	MILLIMETERS	INCHES
A	20.32 MAX.	0.800 MAX.
B	1.27 MAX.	0.050 MAX.
C	2.54 (T.P.)	0.100 (T.P.)
D	0.50 ±0.10	0.020 <sup>+0.004</sup> / <sub>-0.005</sub>
F	1.1 MIN.	0.043 MIN.
G	3.5 ±0.3	0.138 ±0.012
H	0.51 MIN.	0.020 MIN.
I	4.31 MAX.	0.170 MAX.
J	5.08 MAX.	0.200 MAX.
K	7.62 (T.P.)	0.300 (T.P.)
L	6.5	0.256
M	0.25 <sup>+0.10</sup> / <sub>-0.05</sub>	0.010 <sup>+0.004</sup> / <sub>-0.003</sub>
N	0.25	0.01
P	1.1 MIN.	0.043 MIN.

16PIN PLASTIC SOP (300 mil)

μPC1905GS



NOTE

Each lead centerline is located within 0.12 mm (0.005 inch) of its true position (T.P.) at maximum material condition.

P16GM-50-300B-1

ITEM	MILLIMETERS	INCHES
A	10.46 MAX.	0.412 MAX.
B	0.78 MAX.	0.031 MAX.
C	1.27 (T.P.)	0.050 (T.P.)
D	0.40 <sup>+0.10</sup> <sub>-0.05</sub>	0.016 <sup>+0.004</sup> <sub>-0.003</sub>
E	0.1 <sup>±0.1</sup>	0.004 <sup>±0.004</sup>
F	1.8 MAX.	0.071 MAX.
G	1.55	0.061
H	7.7 <sup>±0.3</sup>	0.303 <sup>±0.012</sup>
I	5.6	0.220
J	1.1	0.043
K	0.20 <sup>+0.10</sup> <sub>-0.05</sub>	0.008 <sup>+0.004</sup> <sub>-0.002</sub>
L	0.6 <sup>±0.2</sup>	0.024 <sup>+0.008</sup> <sub>-0.009</sub>
M	0.12	0.005



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