

# 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

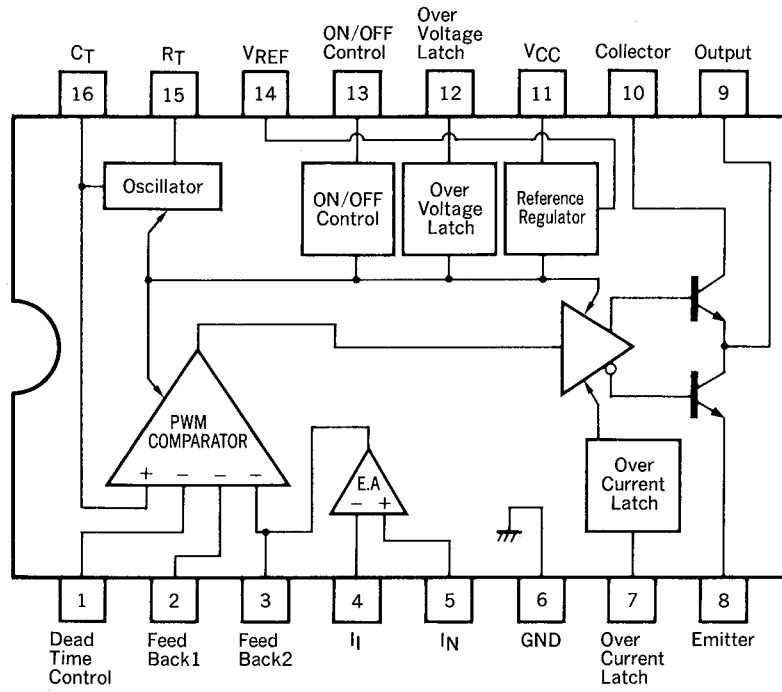
#### FEATURES

- 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)



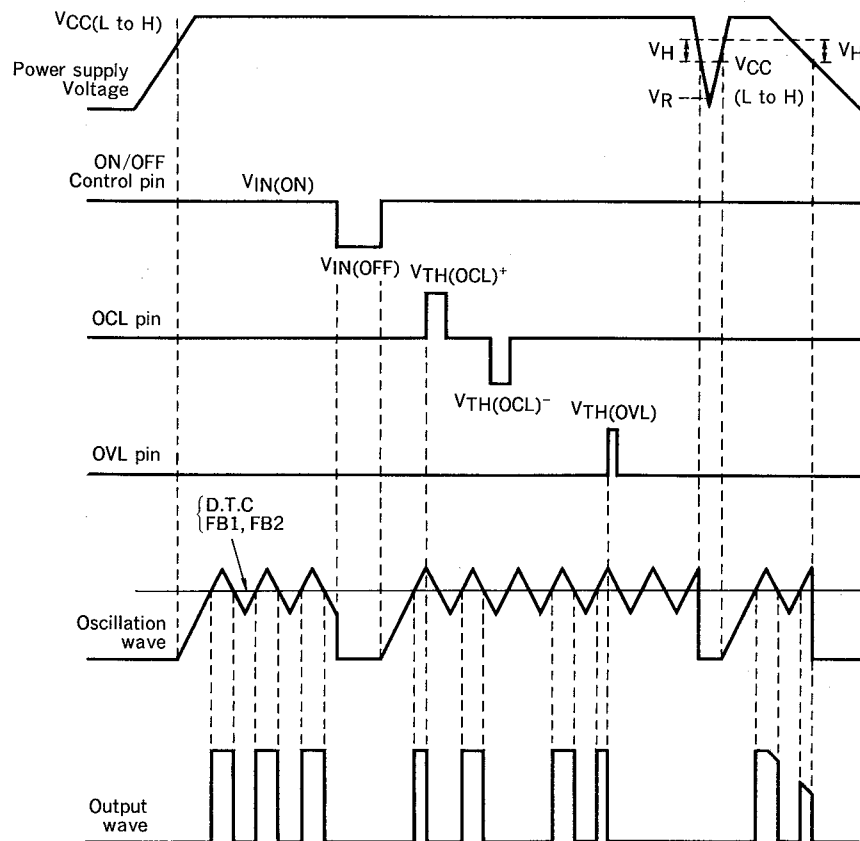
ABSOLUTE MAXIMUM RATING ( $T_a = 25^\circ\text{C}$ )

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	°C
Storage Temperature		$T_{\text{stg}}$	-55 to +150	°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

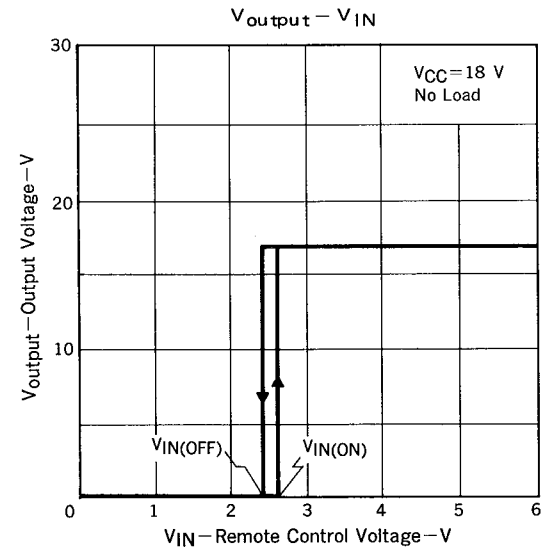
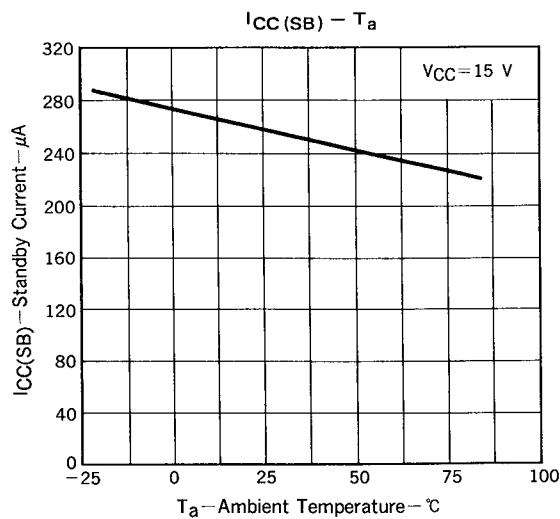
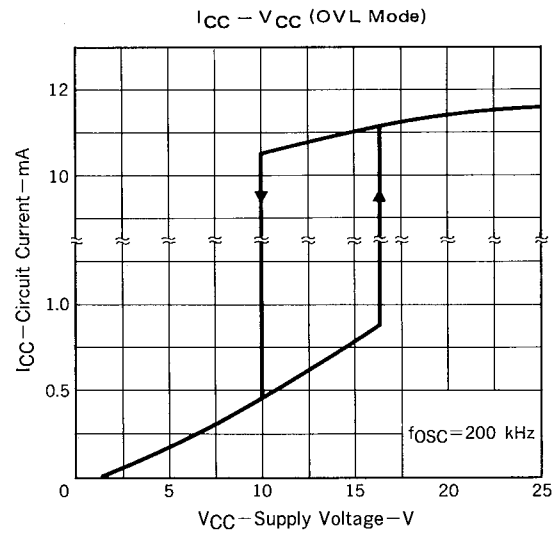
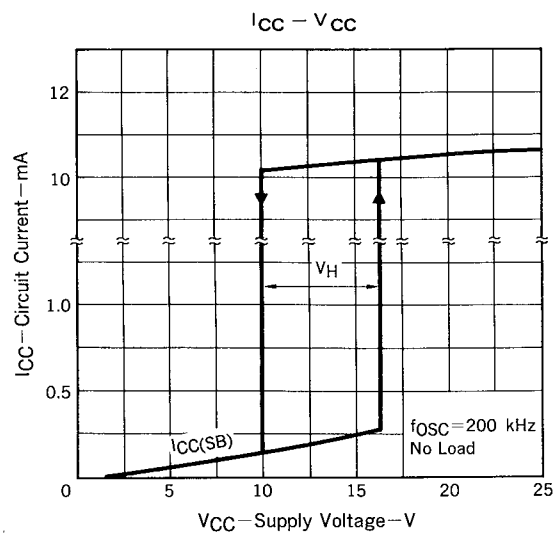
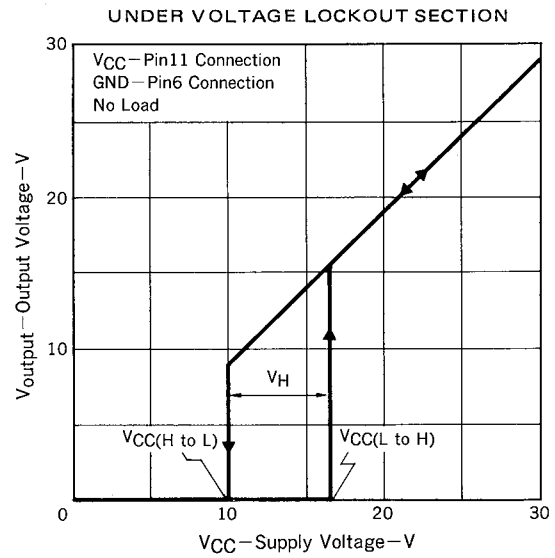
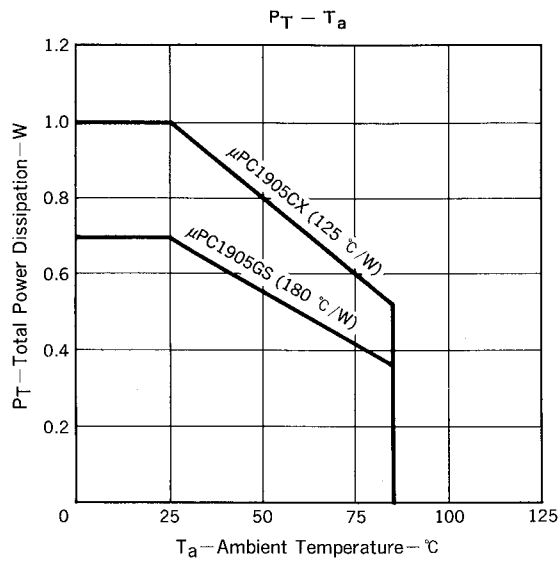


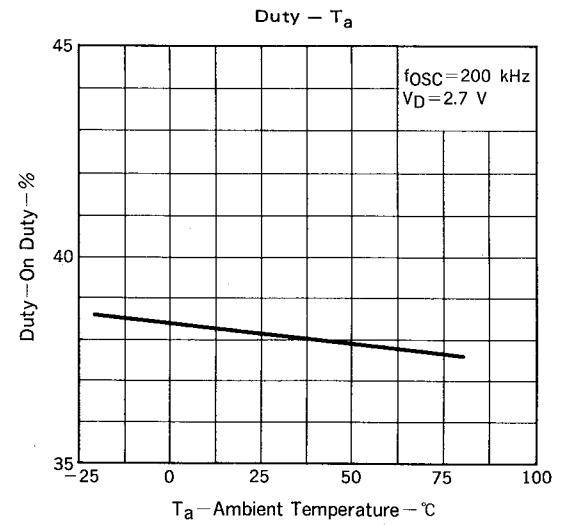
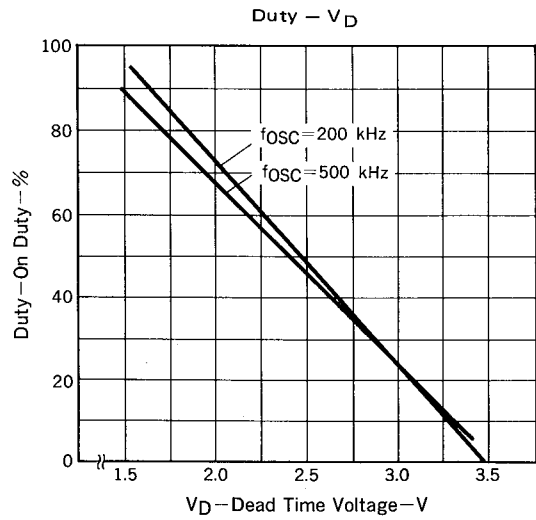
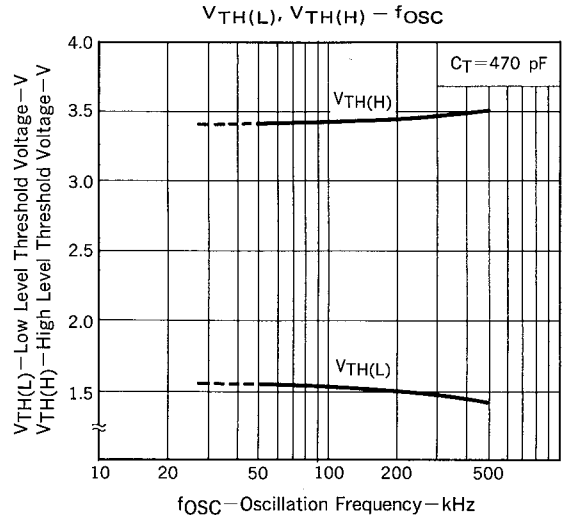
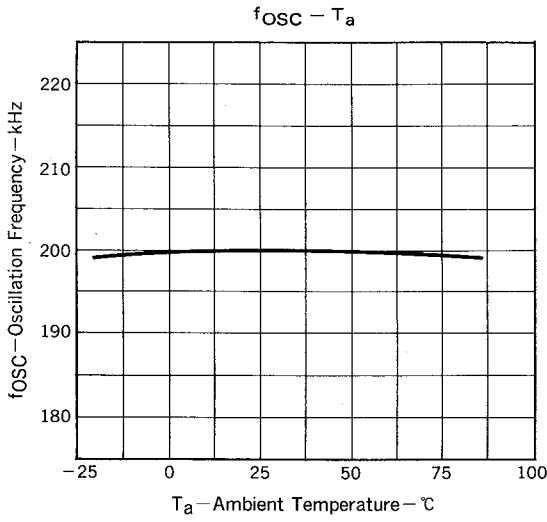
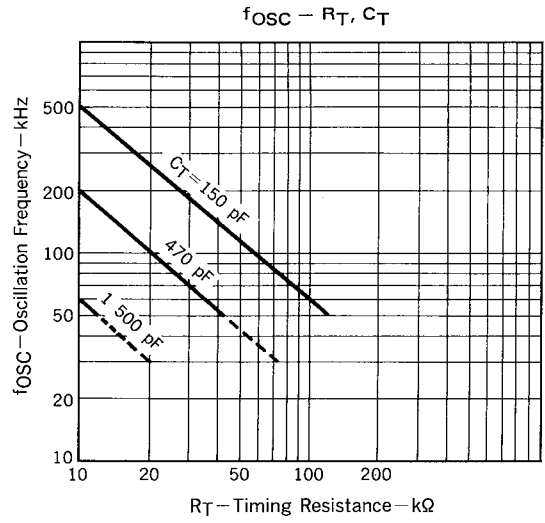
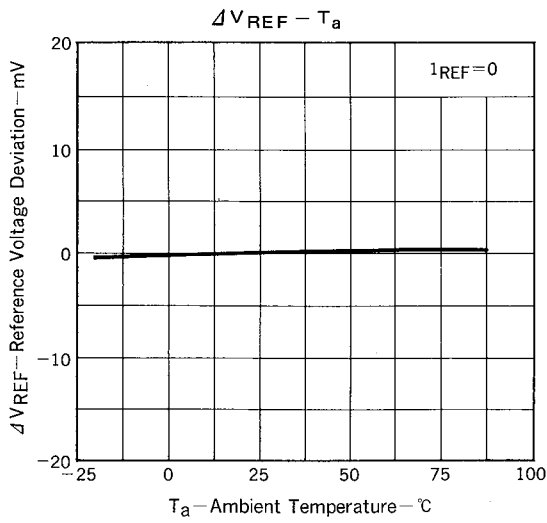
ELECTRICAL CHARACTERISTICS ( $T_a = 25\text{ }^\circ\text{C}$ ,  $V_{CC} = 18\text{ V}$ ,  $C_T = 470\text{ pF}$ ,  $R_T \approx 10\text{ k}\Omega$ ,  $f_{OSC} = 200\text{ kHz}$ )

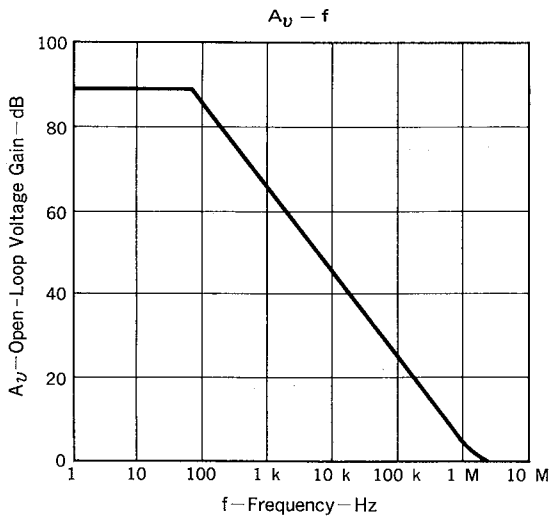
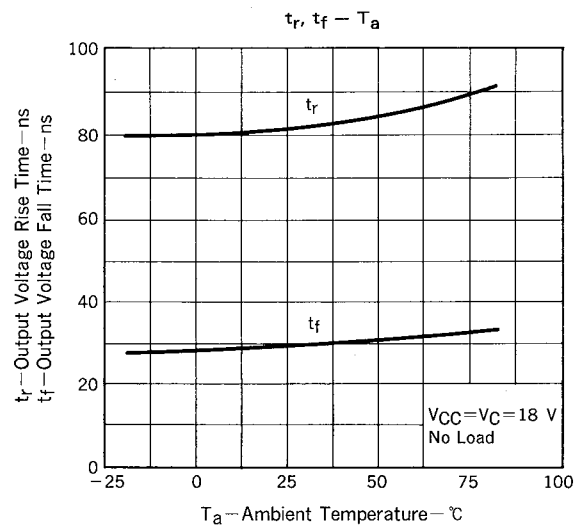
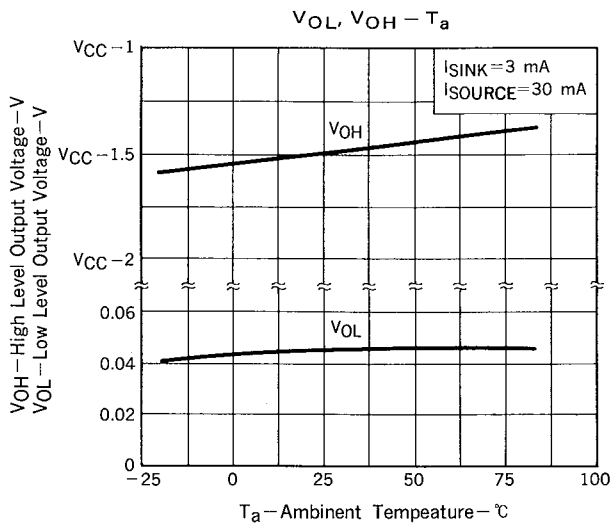
BLOCK	PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	CONDITIONS
Total	Standby Current	$I_{CC(SB)}$	0.1	0.25	0.4	mA	$V_{CC} = 15\text{ V}$ , $-10\text{ }^\circ\text{C} \leq T_a \leq 85\text{ }^\circ\text{C}$
	Circuit Current at OVL Operation Mode	$I_{CC(OVL)}$		10		mA	
	Circuit Current at Off Mode	$I_{CC(OFF)}$		10		mA	
	Circuit Current	$I_{CC}$		10	15	mA	$V_{CC} = V_C = 24\text{ V}$ , $V_D = 2.7\text{ V}$ , no load
Under Voltage Lockout Section	Start-Up Threshold Voltage	$V_{CC(L\text{ to }H)}$	15.5	16.5	17.5	V	
	Threshold Hysteresis	$V_H$	5.5	6.5	7.5	V	
Reference Voltage Section	Output Voltage	$V_{REF}$	4.8	5	5.2	V	$I_{REF} = 0$
	Line Regulation	$REG_{IN}$		4	10	mV	$12\text{ V} \leq V_{CC} \leq 30\text{ V}$ , $I_{REF} = 0$
	Load Regulation	$REG_L$		2	12	mV	$0 \leq I_{REF} \leq 3\text{ mA}$
	Output Voltage Temperature Coefficient	$V_{REF}/\Delta T$		100	700	$\mu\text{V}/^\circ\text{C}$	$I_{REF} = 0$ , $-10\text{ }^\circ\text{C} \leq T_a \leq +85\text{ }^\circ\text{C}$
	Short Circuit Current	$I_{O\text{ short}}$		15		mA	$V_{REF} = 0$
PWM Section	Input Bias Current	$I_B$			10	$\mu\text{A}$	
	Low Level Threshold Voltage	$V_{TH(L)}$		1.5		V	
	High Level Threshold Voltage	$V_{TH(H)}$		3.5		V	
	Dead Time Temperature Coefficient	$\Delta DT/\Delta T$		1	5	%	$V_D = 0.54 V_{REF}$ , $-10\text{ }^\circ\text{C} \leq T_a \leq +85\text{ }^\circ\text{C}$
Oscillator Section	Oscillation Frequency	$f_{OSC}$	180	200	220	kHz	
	Frequency Line Regulation	$\Delta f/\Delta V_{CC}$		0.6		%	$12\text{ V} \leq V_{CC} \leq 30\text{ V}$
	Frequency Temperature Coefficient	$\Delta f/\Delta T$		1	5	%	$-10\text{ }^\circ\text{C} \leq T_a \leq +85\text{ }^\circ\text{C}$
Output Section	Low Level Output Voltage	$V_{OL}$			0.5	V	$I_{SINK} = 3\text{ mA}$ , $V_{CC} = V_C$
	High Level Output Voltage	$V_{OH}$		$V_{CC}-1.6$		V	$I_{SOURCE} = 30\text{ mA}$ , $V_{CC} = V_C$
	Output Voltage Rise Time	$t_r$		80		ns	$R_L = 15\text{ }\Omega$ , $C_L = 2\text{ }200\text{ pF}$
	Output Voltage Fall Time	$t_f$		30		ns	$V_{CC} = V_C$
Remote Control Section	Input Voltage at Output ON	$V_{IN(ON)}$	2.3	2.5	2.7	V	
	Input Voltage at Output OFF	$V_{IN(OFF)}$	2.1	2.3	2.5	V	
	Hysteresis Width	$V_H$	0.1	0.2	0.3	V	
Over Voltage Latch Section	Over Voltage Threshold Voltage	$V_{TH(OVL)}$	2.0	2.4	2.8	V	$-10\text{ }^\circ\text{C} \leq T_a \leq +85\text{ }^\circ\text{C}$
	Input Bias Current	$I_B(OVL)$			4	$\mu\text{A}$	OVL pin voltage = $V_{TH(OVL)}$
	OVL Reset Voltage	$V_R(OVL)$		2		V	
	Delay to Output	$t_d(OVL)$		600		ns	
Over Current Latch Section	Over Current Threshold Voltage	$V_{TH(OCL)}^+$	200	220	240	mV	$-10\text{ }^\circ\text{C} \leq T_a \leq +85\text{ }^\circ\text{C}$
	Over Current Threshold Voltage	$V_{TH(OCL)}^-$	-230	-210	-190	mV	$-10\text{ }^\circ\text{C} \leq T_a \leq +85\text{ }^\circ\text{C}$
	OCL Pin Output Current	$I_B(OCL)$		250		$\mu\text{A}$	
	Delay to Output	$t_d(OCL)^+$		120		ns	
	Delay to Output	$t_d(OCL)^-$		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 ( $T_a = 25^\circ\text{C}$ )







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

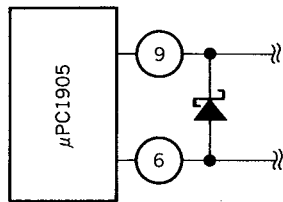
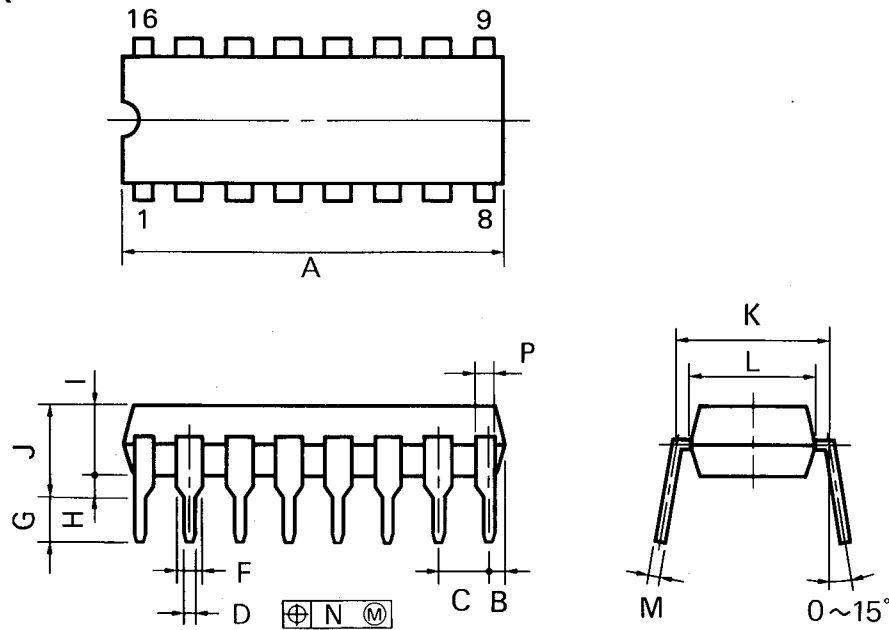


Fig.1



16PIN PLASTIC DIP (300 mil)

μPC1905CX



P16C-100-300B

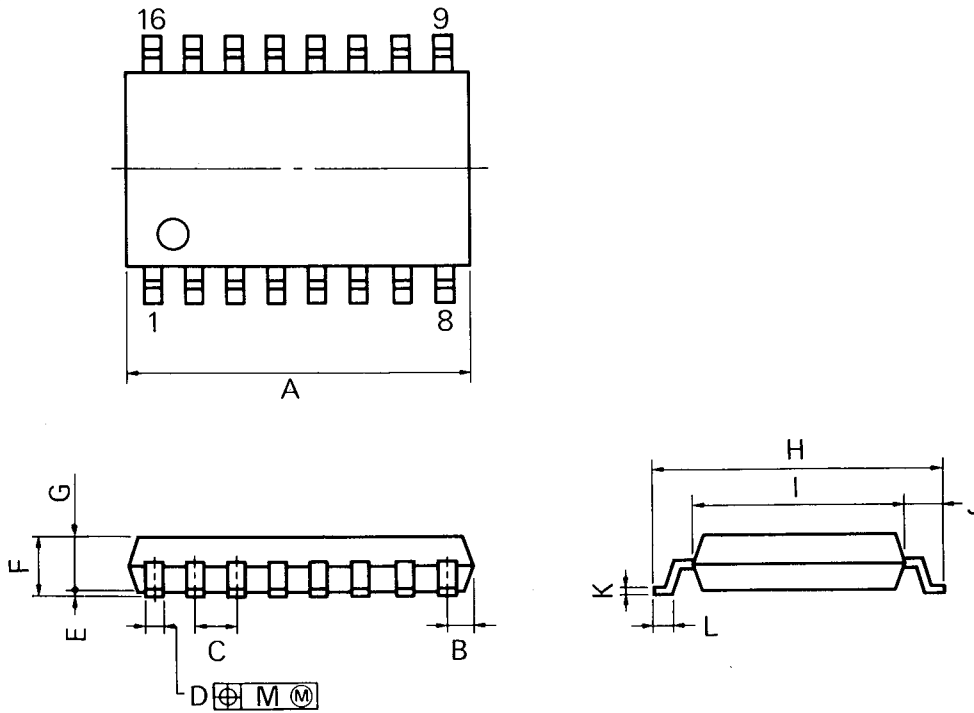
NOTES

- 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



P16GM-50-300B-1

NOTE

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

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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Special: Automotive and Transportation equipment, Communication equipment (trunk line), Train and Traffic control devices, Burning control systems, antidisaster systems, anticrime systems etc.