

BIPOLAR ANALOG INTEGRATED CIRCUIT

μ PC1905

SWITCHING REGULATOR CONTROL CIRCUIT FOR 500 kHz OPERATION

μ 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 μ PC1099, 1905, 1906. The features of μ 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 |
|--------------|----------------|----------------------------|----------------------|------------------------------------|
| μ PC1099 | 26 V | 11 V | 3 V | Pulse by pulse current limiting |
| μ PC1905 | 31 V | 16.5 V | 6.5 V | Pulse by pulse current limiting |
| μ PC1906 | 31 V | 16.5 V | 6.5 V | Shut down and V_{CC} reset |

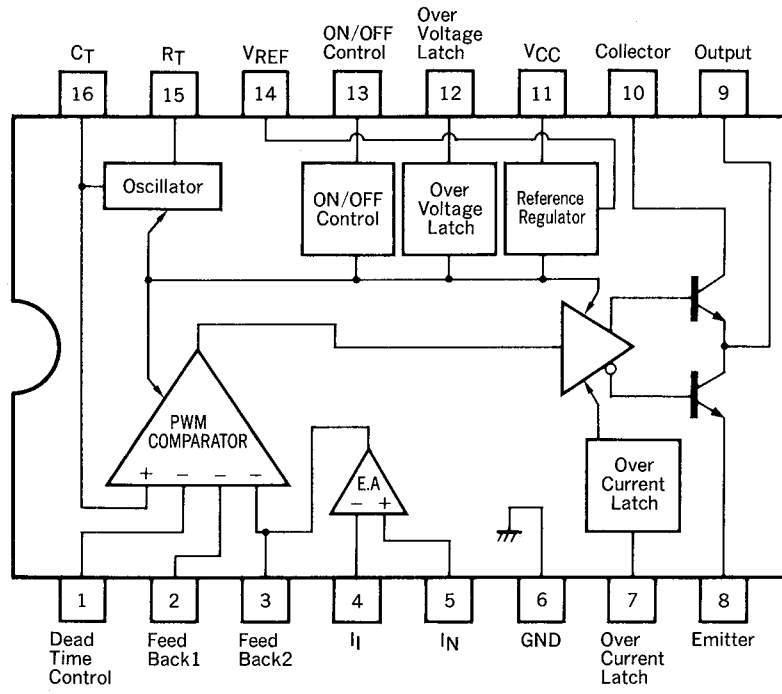
FEATURES

- 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 |
|----------------|------------------------------|---------------|
| μ PC1905CX | 16 pin plastic DIP (300 mil) | Standard |
| μ 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)



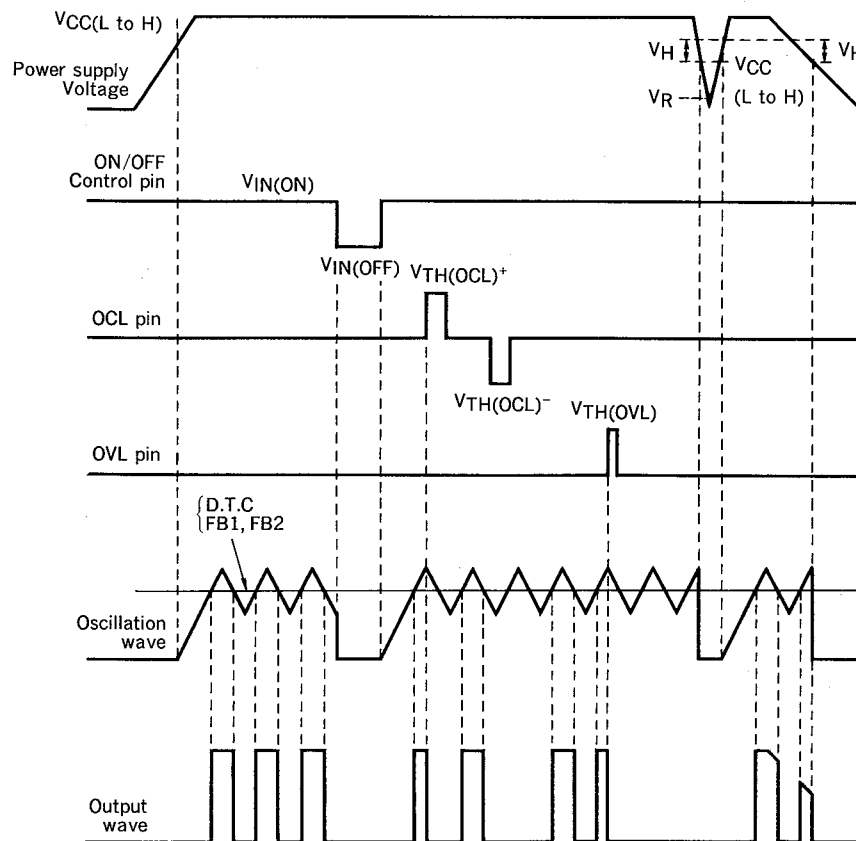
ABSOLUTE MAXIMUM RATING ($T_a = 25^\circ\text{C}$)

| 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_{opt} | -20 to +85 | $^\circ\text{C}$ |
| Storage Temperature | | T_{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_{OSC} | 50 | 200 | 500 | kHz |
| Output Load Capacitance | C_L | - | 2 200 | 3 000 | pF |

OPERATION WAVES

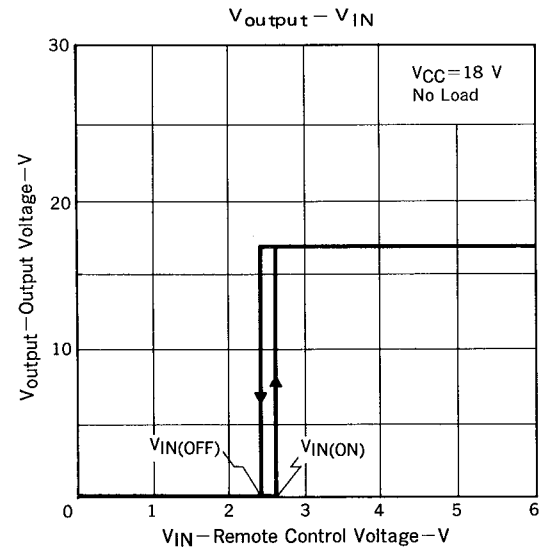
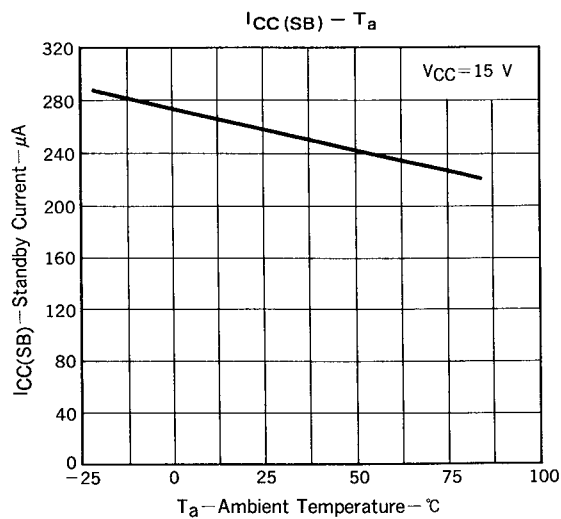
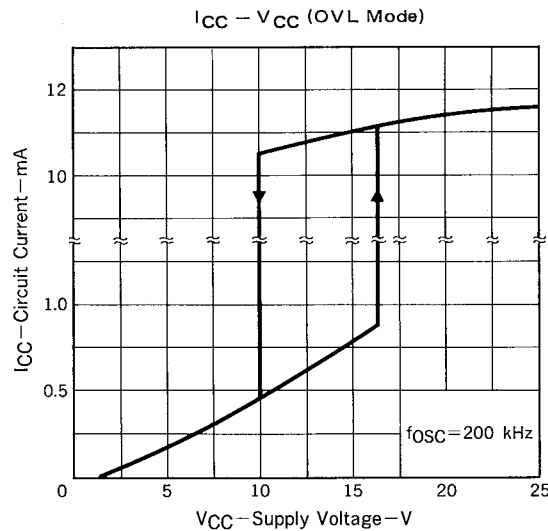
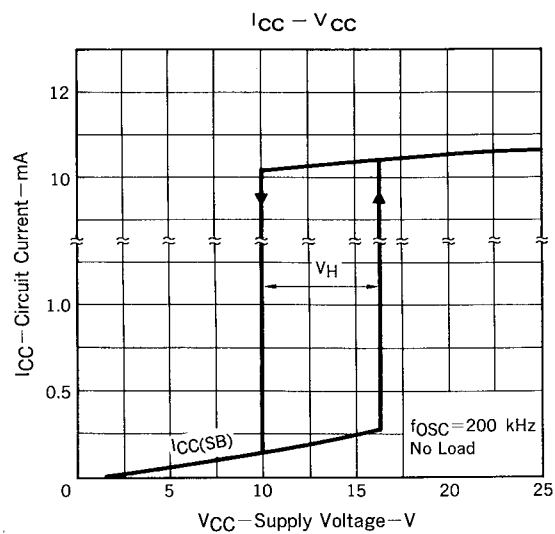
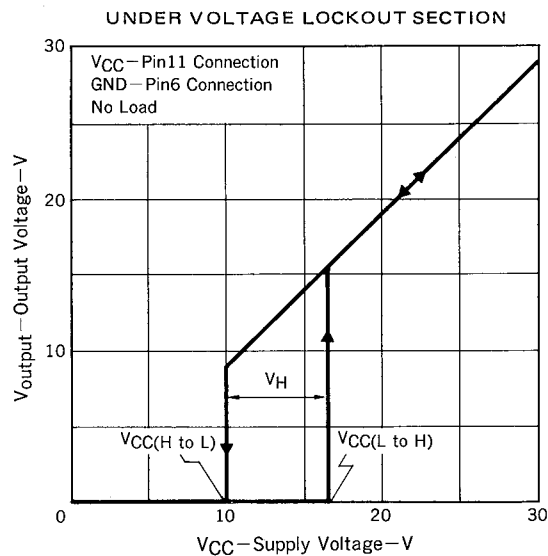
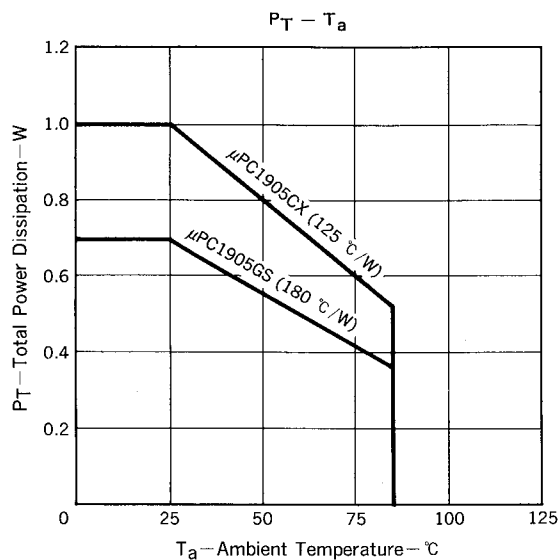


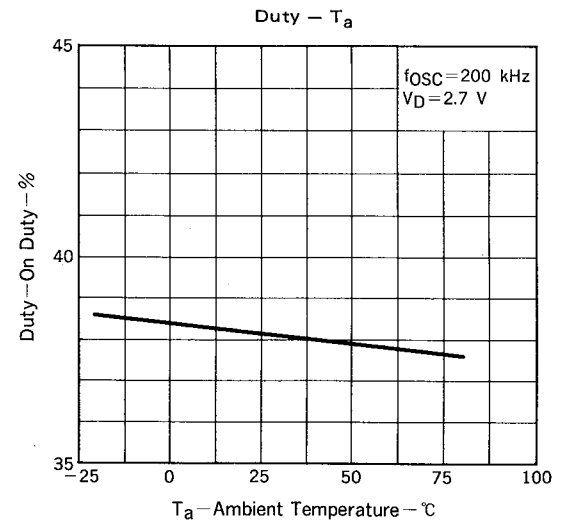
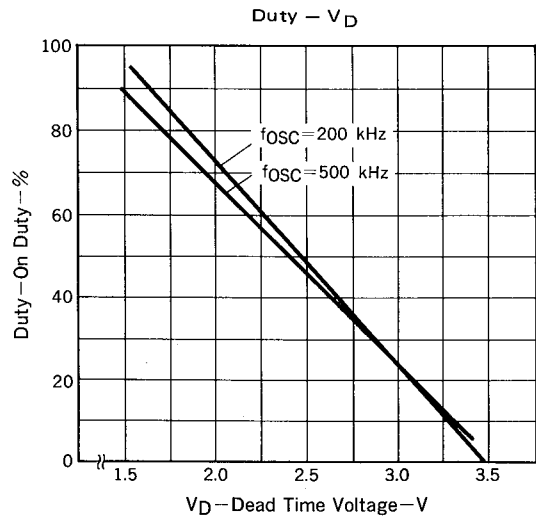
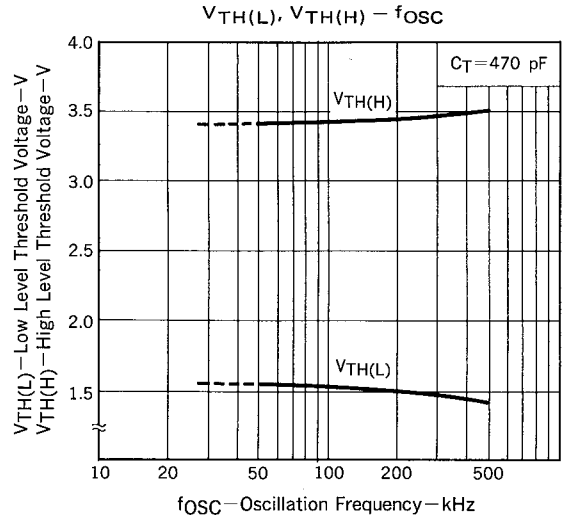
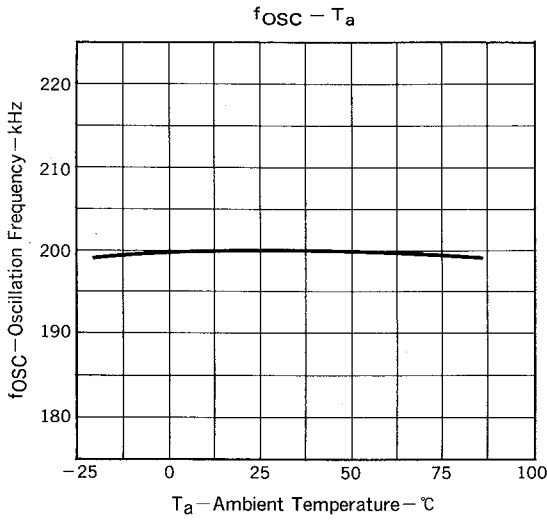
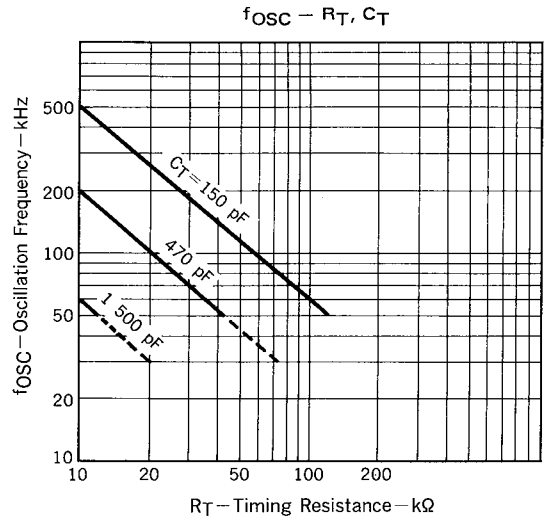
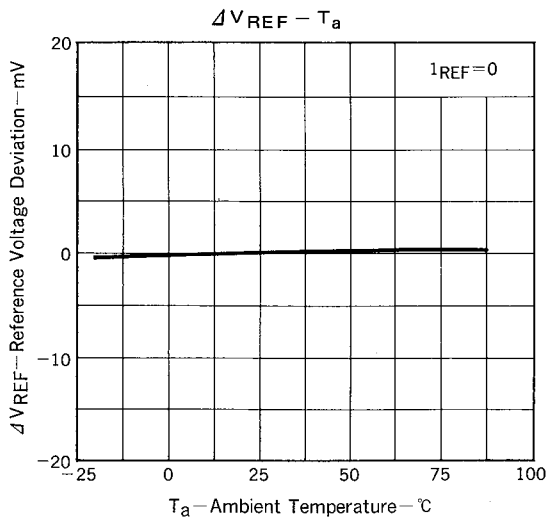
ELECTRICAL CHARACTERISTICS ($T_a = 25\text{ }^\circ\text{C}$, $V_{CC} = 18\text{ V}$, $C_T = 470\text{ pF}$, $R_T \approx 10\text{ k}\Omega$, $f_{OSC} = 200\text{ kHz}$)

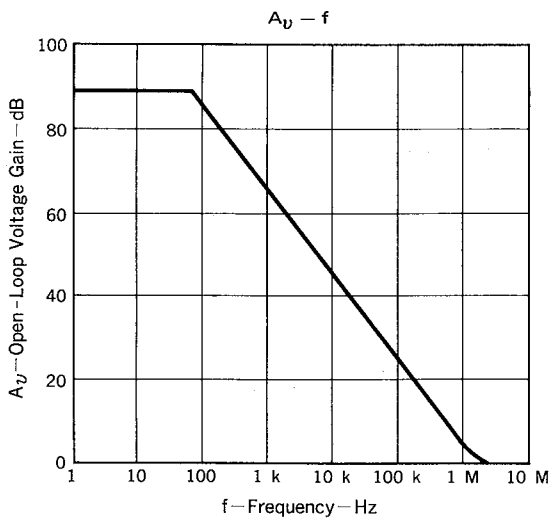
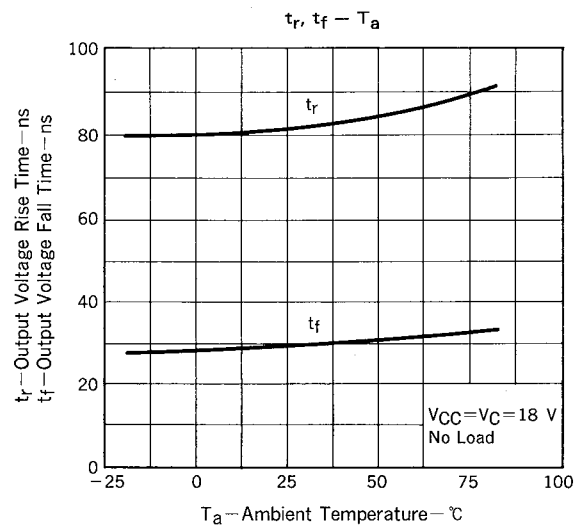
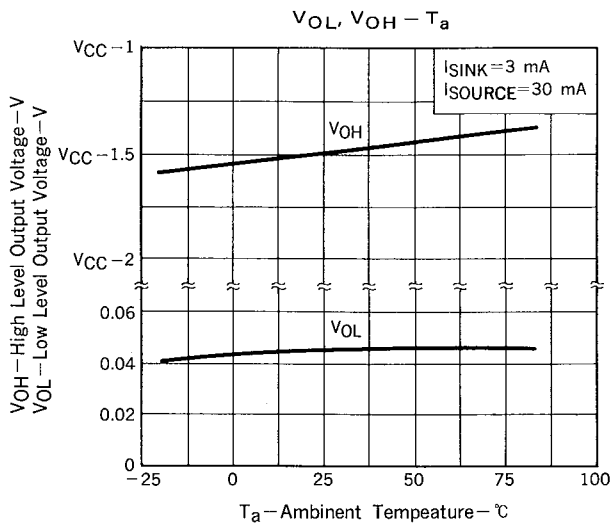
| BLOCK | PARAMETER | SYMBOL | MIN. | TYP. | MAX. | UNIT | CONDITIONS |
|-------------------------------|--|--------------------------|------|--------------|------|------------------------------|---|
| Total | Standby Current | $I_{CC(SB)}$ | 0.1 | 0.25 | 0.4 | mA | $V_{CC} = 15\text{ V}$, $-10\text{ }^\circ\text{C} \leq T_a \leq 85\text{ }^\circ\text{C}$ |
| | 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 | μA | |
| | 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 | μA | 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 | | μA | |
| | 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.

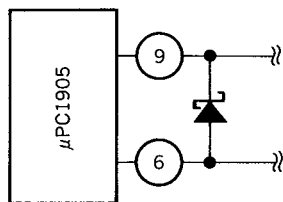
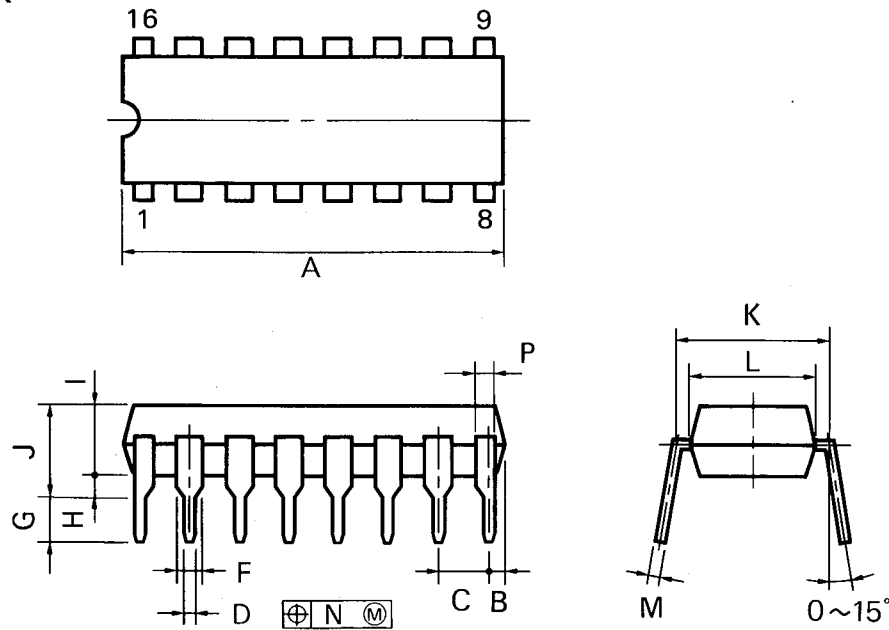


Fig.1

16PIN PLASTIC DIP (300 mil)

μPC1905CX



P16C-100-300B

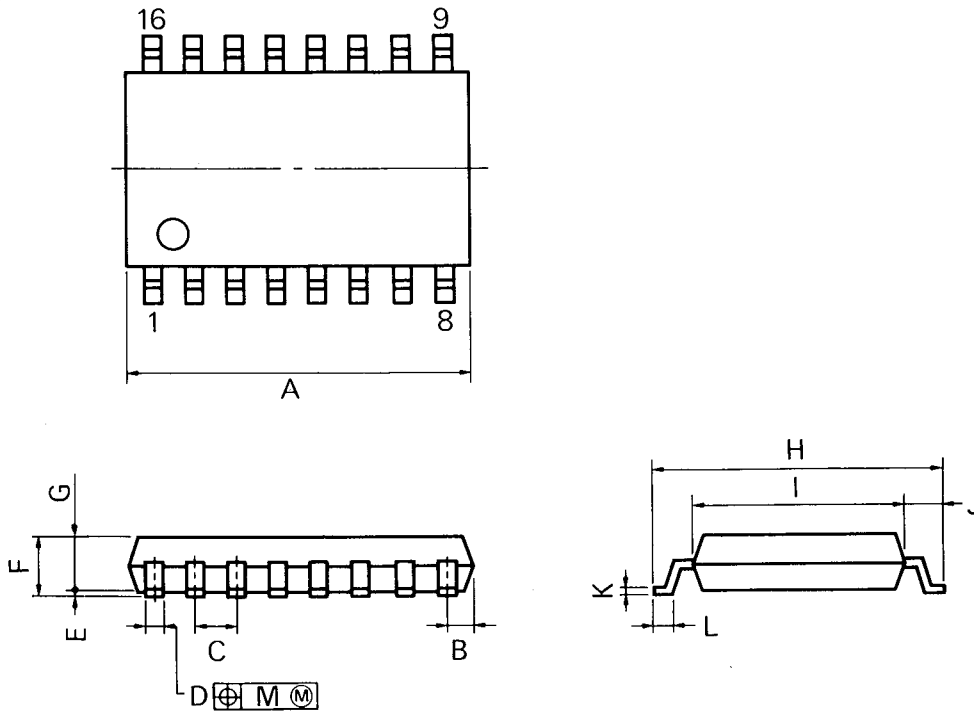
NOTES

- 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 ^{+0.004} / _{-0.005} |
| 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 ^{+0.10} / _{-0.05} | 0.010 ^{+0.004} / _{-0.003} |
| 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 ^{+0.10} _{-0.05} | 0.016 ^{+0.004} _{-0.003} |
| E | 0.1 ^{±0.1} | 0.004 ^{±0.004} |
| F | 1.8 MAX. | 0.071 MAX. |
| G | 1.55 | 0.061 |
| H | 7.7 ^{±0.3} | 0.303 ^{±0.012} |
| I | 5.6 | 0.220 |
| J | 1.1 | 0.043 |
| K | 0.20 ^{+0.10} _{-0.05} | 0.008 ^{+0.004} _{-0.002} |
| L | 0.6 ^{±0.2} | 0.024 ^{+0.008} _{-0.009} |
| M | 0.12 | 0.005 |

[MEMO]

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Application examples recommended by NEC Corporation

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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.