

**DUAL SWITCHING REGULATOR CONTROL CIRCUIT**

**DESCRIPTION**

The  $\mu$ PC1100,  $\mu$ PC1150 are PWM type dual switching regulator control circuits which incorporate 2.5 V voltage reference, variable frequency oscillator, two sets of synchronized switching control circuits, timer latch short protection circuit and ON/OFF control circuit on a single monolithic chip. The  $\mu$ PC1100,  $\mu$ PC1150 feature low supply voltage operation, low stand-by current and low supply current therefore, these ICs are the optimum choice for battery operated portable equipments power supply and other DC-DC converter applications. Two ICs are available in accordance with short protection method.

**FEATURES**

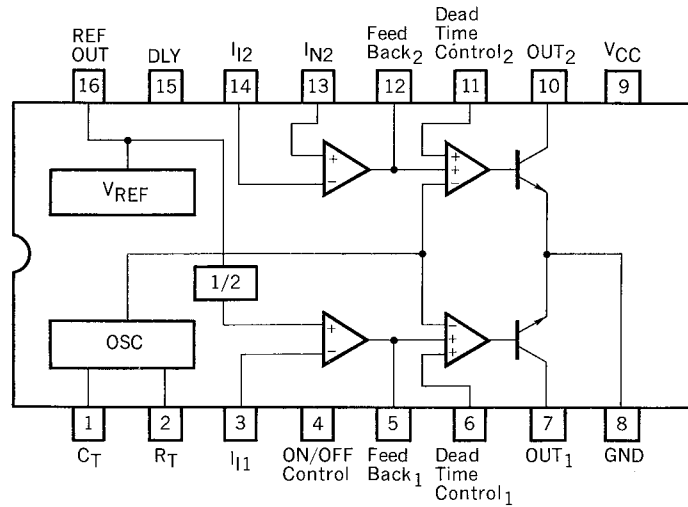
- Two outputs synchronized operation
- Wide supply voltage range  $3.6\text{ V} \leq V_{CC} \leq 40\text{ V}$
- Low stand-by and supply current stand-by mode; 2.2 mA, operation mode; 2.5 mA
- Timer latch short protection circuit
- $\mu$ PC1100 – Two outputs cut off when one channel becomes short state.
- $\mu$ PC1150 – Only short channel cuts off.
- Internal ON/OFF control circuit

**ORDERING INFORMATION**

PART NUMBER	PACKAGE	QUALITY GRADE
$\mu$ PC1100C	16 pin Plastic DIP (300 mil)	Standard
$\mu$ PC1100GS	16 pin Plastic SOP (300 mil)	
$\mu$ PC1150C	16 pin Plastic DIP (300 mil)	
$\mu$ PC1150GS	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.

CONNECTION DIAGRAM (Top View)



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

PARAMETER	SYMBOL	RATING	UNIT
Supply Voltage	$V_{CC}$	41	V
Error Amplifier Input Voltage	$V_I$	20	V
Output Voltage	$V_O$	41	V
Output Current	$I_O$	25	mA
Total Power Dissipation C Package	$P_{T1}$	1 000	mW
Total Power Dissipation GS Package	$P_{T2}$	694	mW
Operating Temperature Range	$T_{opt}$	-20 to +85	$^\circ\text{C}$
Storage Temperature Range	$T_{stg}$	-55 to +150	$^\circ\text{C}$

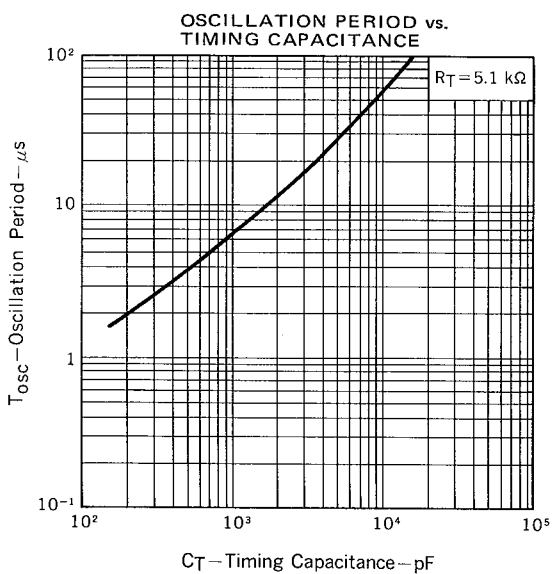
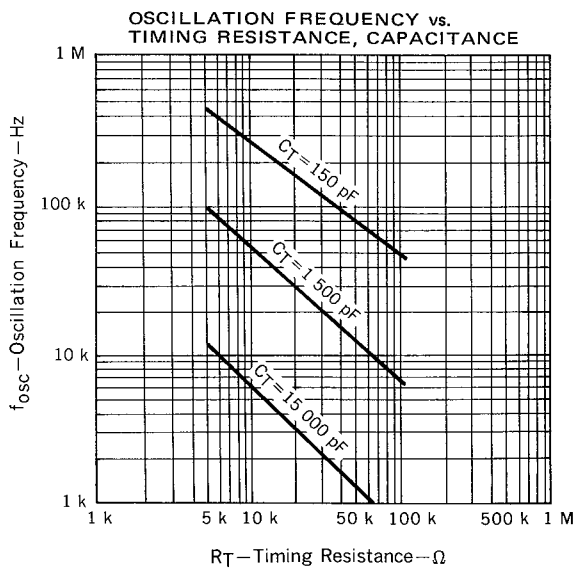
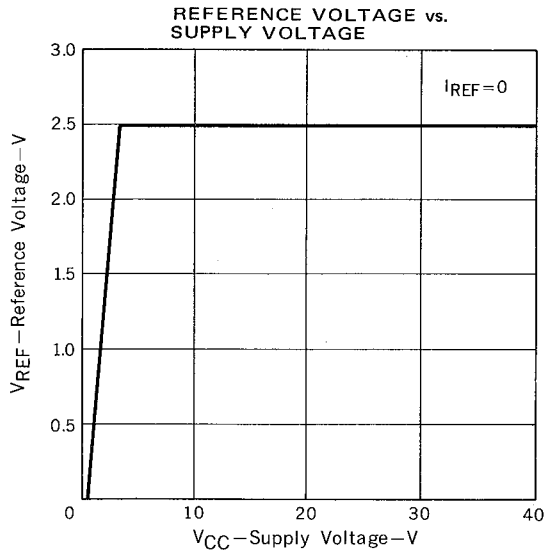
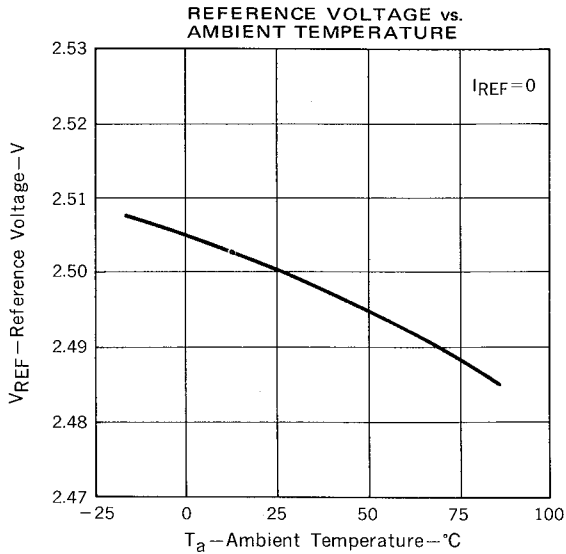
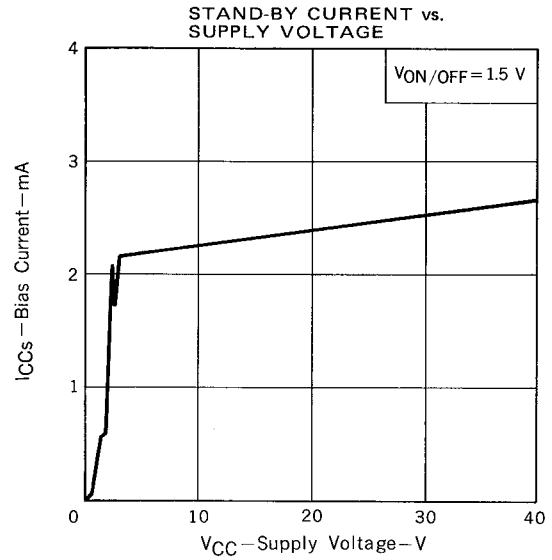
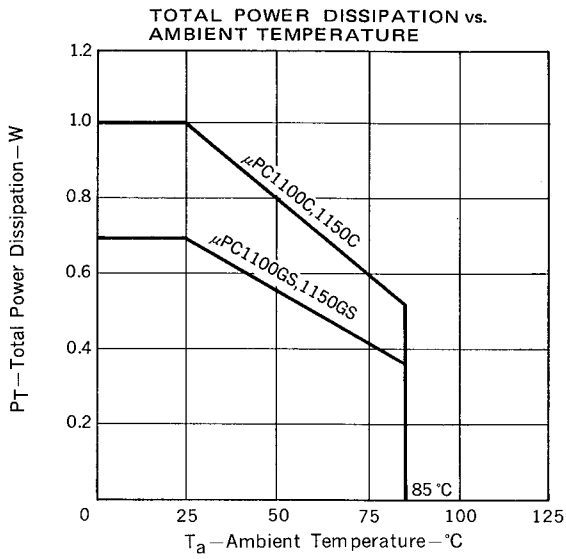
RECOMMENDED OPERATING CONDITIONS

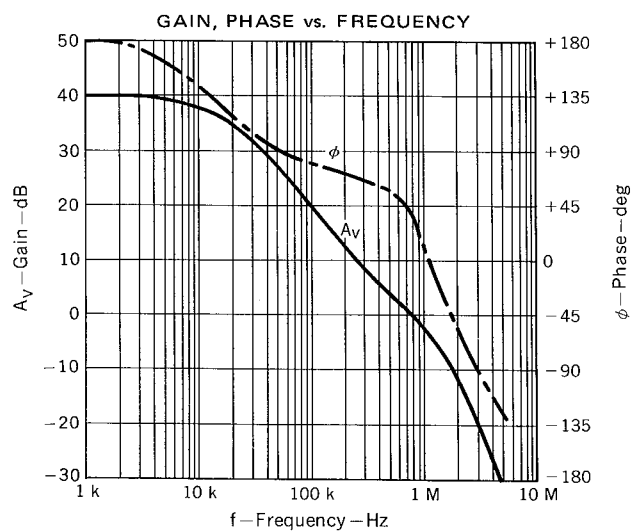
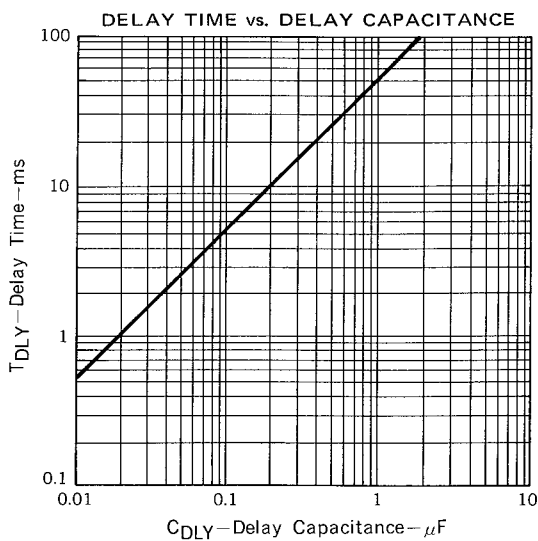
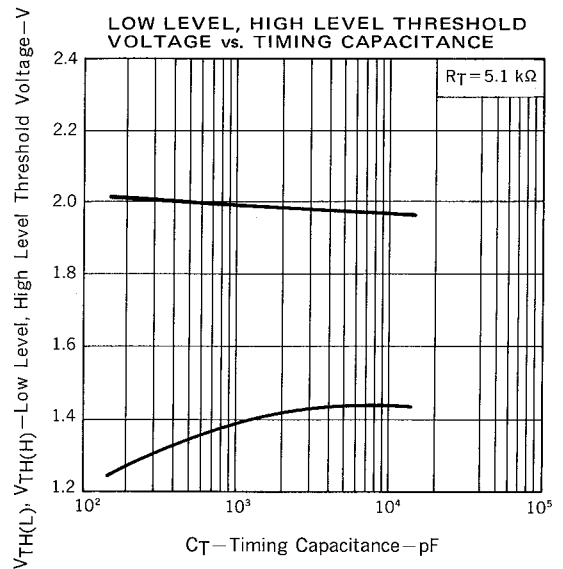
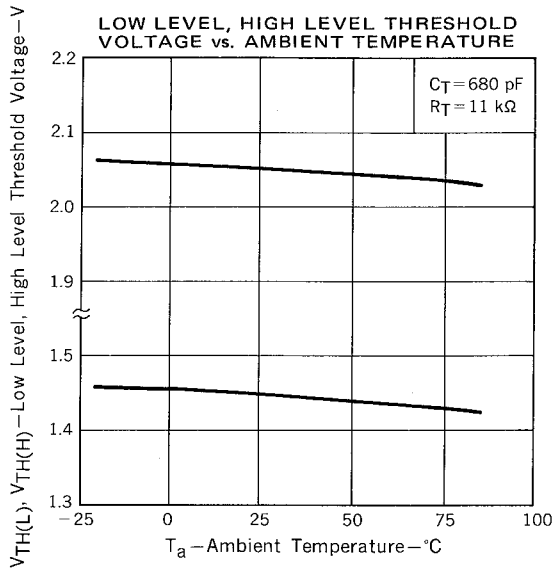
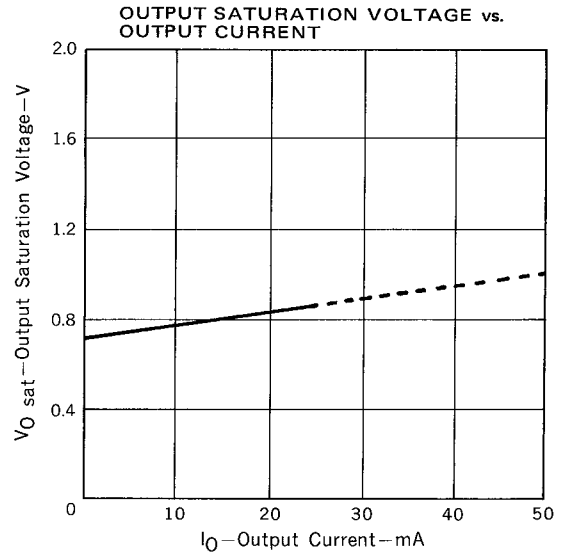
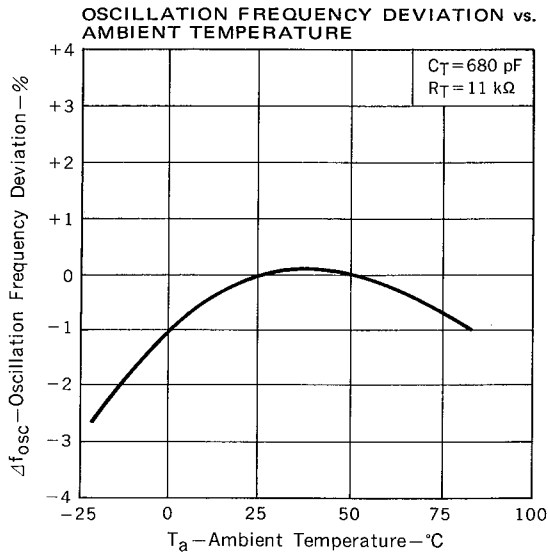
PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
Supply Voltage	$V_{CC}$	3.6		40	V
Error Amplifier Input Voltage	$V_I$	1.05		1.45	V
Output Voltage	$V_O$			40	V
Output Current	$I_O$			20	mA
Current into Feed-back Terminal	$I_{FT}$			45	$\mu\text{A}$
Timing Capacitor	$C_T$	150		15 000	pF
Timing Resistor	$R_T$	5.1		100	$k\Omega$
Oscillator Frequency	$f_{osc}$	1		500	kHz

ELECTRICAL CHARACTERISTICS (T<sub>a</sub> = -20 °C to +85 °C, V<sub>CC</sub> = 6 V, f<sub>osc</sub> = 100 kHz)

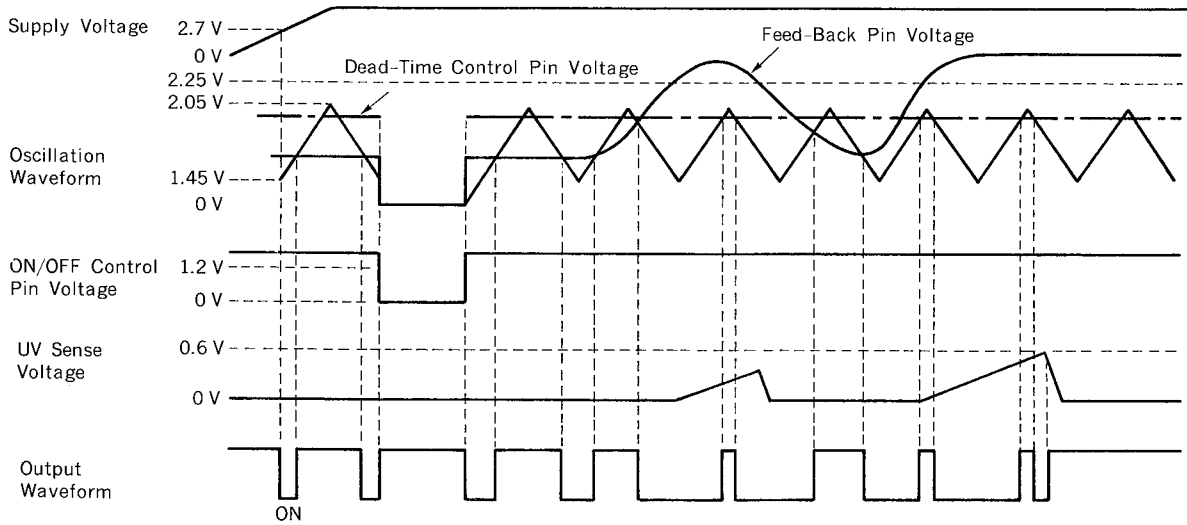
BLOCK	PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITIONS	
Under Voltage Lock-out Section	Start-up Voltage	V <sub>CC(L to H)</sub>		2.72		V	T <sub>a</sub> =25 °C, I <sub>REF</sub> =0.1 mA	
	Stop Voltage	V <sub>CC(H to L)</sub>		2.60		V	T <sub>a</sub> =25 °C, I <sub>REF</sub> =0.1 mA	
	Hysteresis Voltage	V <sub>H</sub>	80	120		mV	T <sub>a</sub> =25 °C, I <sub>REF</sub> =0.1 mA	
	Reset Voltage (V <sub>CC</sub> )	V <sub>R</sub>	2.3	2.7		V	T <sub>a</sub> =25 °C, I <sub>REF</sub> =0.1 mA	
Reference Voltage Section	Reference Voltage	V <sub>REF</sub>	2.40	2.50	2.60	V	I <sub>REF</sub> = 1 mA	
	Line Regulation	REG <sub>LN</sub>		2	12.5	mV	3.6 V ≤ V <sub>CC</sub> ≤ 40 V	
	Load Regulation	REG <sub>L</sub>		1	7.5	mV	0.1 mA ≤ I <sub>REF</sub> ≤ 1 mA	
	Temperature Coefficient	ΔV <sub>REF</sub> /ΔT	-1	-0.1	1	%	-20 °C ≤ T <sub>a</sub> ≤ +25 °C, I <sub>REF</sub> =0	
			-1	-0.2	1	%	+25 °C ≤ T <sub>a</sub> ≤ +85 °C, I <sub>REF</sub> =0	
Short Circuit Current	I <sub>o short</sub>	2.5	10	30	mA	V <sub>REF</sub> =0		
Oscillator Section	Oscillation Frequency	f <sub>osc</sub>	80	100	120	kHz	C <sub>T</sub> =680 pF, R <sub>T</sub> =11 kΩ	
	Frequency Line Regulation	Δf/ΔV <sub>CC</sub>		0.1		%	T <sub>a</sub> =25 °C, 3.6 V ≤ V <sub>CC</sub> ≤ 40 V	
	Frequency Temperature Coefficient	Δf/ΔT	-5	2	5	%	-20 °C ≤ T <sub>a</sub> ≤ +25 °C	
-5			-2	5	%	+25 °C ≤ T <sub>a</sub> ≤ +85 °C		
Dead-Time Control Section	Input Bias Current	I <sub>BD</sub>			1	μA		
	Low Level Threshold Voltage	V <sub>TH(L)</sub>	1.20	1.45		V	On-duty 0 %	
	High Level Threshold Voltage	V <sub>TH(H)</sub>		2.05	2.25	V	On-duty 100 %	
Error Amplifier Section	Input Offset Voltage	V <sub>IO</sub>	-10		10	mV	V <sub>O Amp</sub> =1.25 V	
	Input Offset Current	I <sub>IO</sub>	-100		100	nA	V <sub>O Amp</sub> =1.25 V	
	Input Bias Current	I <sub>B</sub>		160	500	nA	V <sub>O Amp</sub> =1.25 V	
	Common Mode Input Voltage	V <sub>ICR</sub>	1.05		1.45	V	3.6 V ≤ V <sub>CC</sub> ≤ 40 V	
	Open Loop Voltage Gain	A <sub>V</sub>	70	80		dB	R <sub>NF</sub> =200 kΩ	
	Unity Gain Bandwidth	f <sub>unity</sub>		1.5		MHz		
	Common Mode Rejection Ratio	CMR	60	80		dB		
	Maximum Output Voltage	V <sub>om+</sub>	V <sub>REF</sub> -0.1				V	
		V <sub>om-</sub>				1.0	V	
	Output Sink Current	I <sub>OSINK</sub>	0.5	1.6		mA	V <sub>ID</sub> =-0.1 V, V <sub>OAMP</sub> =1.15 V	
Output Source Current	I <sub>OSOURCE</sub>	-45	-70		μA	V <sub>ID</sub> =0.1 V, V <sub>OAMP</sub> =2.3 V		
Output Section	Collector Cutoff Current	I <sub>LEAK</sub>			100	μA	V <sub>O</sub> =40 V	
		I <sub>LEAK(OFF)</sub>			10	μA	V <sub>CC</sub> =0, V <sub>O</sub> =40 V	
	Collector Saturation Voltage	V <sub>OSAT</sub>		0.95	1.3	V	I <sub>O</sub> =20 mA	
	Output Voltage Rise Time	t <sub>r</sub>			150	ns	R <sub>O</sub> =500 Ω	
Output Voltage Fall Time	t <sub>f</sub>			180	ns	R <sub>O</sub> =500 Ω		
Short Circuit Protection Section	Input Sense Voltage	V <sub>TH</sub>	2.05	2.25	2.45	V	T <sub>a</sub> =25 °C	
	UV Sense Voltage (15 pin)	V <sub>UV</sub>	0.5	0.6	0.8	V	T <sub>a</sub> =25 °C	
	Source Current	I <sub>OUV</sub>	10	15	25	μA	T <sub>a</sub> =25 °C, V <sub>DLY</sub> =0	
	Delay Time	t <sub>DLY</sub>		55		ms	C <sub>DLY</sub> =1 μF	
ON/OFF Control Section	ON/OFF Threshold Voltage	V <sub>CTL</sub>	0.6	1.0	1.2	V	V <sub>REF</sub> =0	
	Stand-by Current	I <sub>CCi</sub>			10	μA	V <sub>ON/OFF</sub> (4 pin)=0	
Total	Stand-by Current	I <sub>CCs</sub>		2.2	3.1	mA	V <sub>ON/OFF</sub> (4 pin)=1.5 V, No Output Voltage	
	Bias Current	I <sub>CCa</sub>		2.5	3.4	mA	C <sub>T</sub> =680 pF, R <sub>T</sub> =11 kΩ, V <sub>ON/OFF</sub> (4 pin)=1.5 V	

TYPICAL CHARACTERISTICS ( $T_a = 25^\circ\text{C}$ ,  $V_{CC} = 6\text{V}$ )



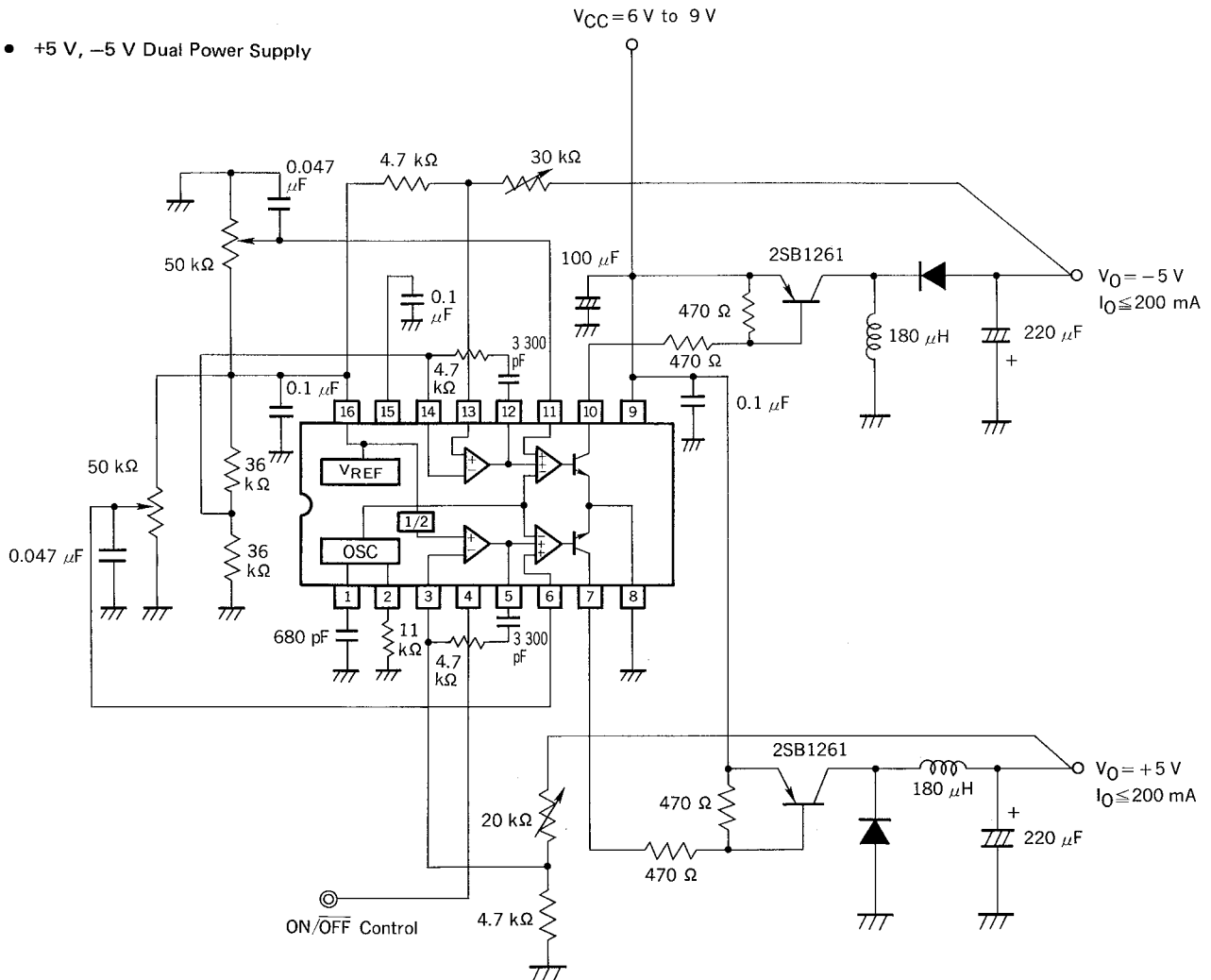


OPERATING WAVEFORMS



TYPICAL APPLICATION CIRCUIT

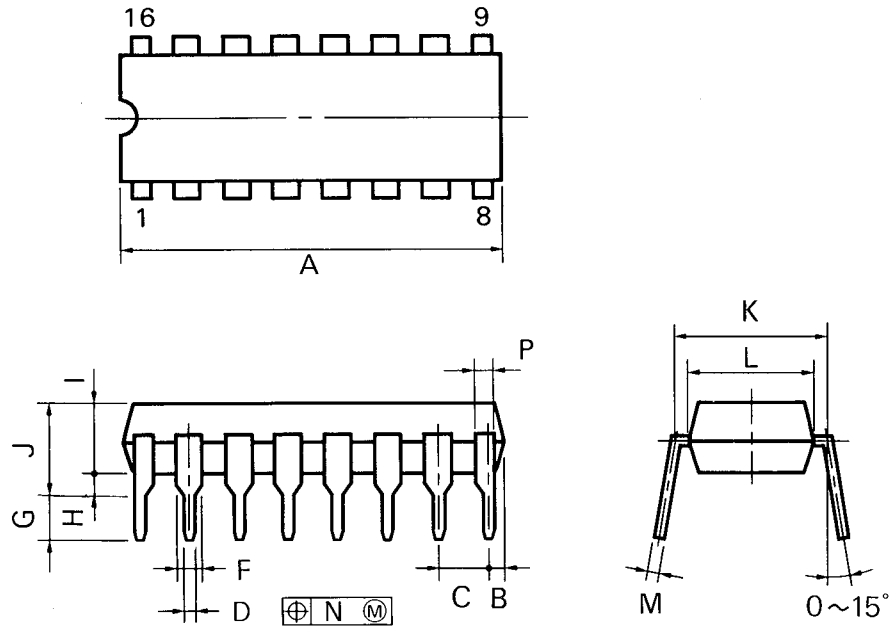
- +5 V, -5 V Dual Power Supply



PACKAGE DIMENSIONS

16 PIN PLASTIC DIP (300 mil)

$\mu$ PC1100C,  $\mu$ PC1150C



P16C-100-300B

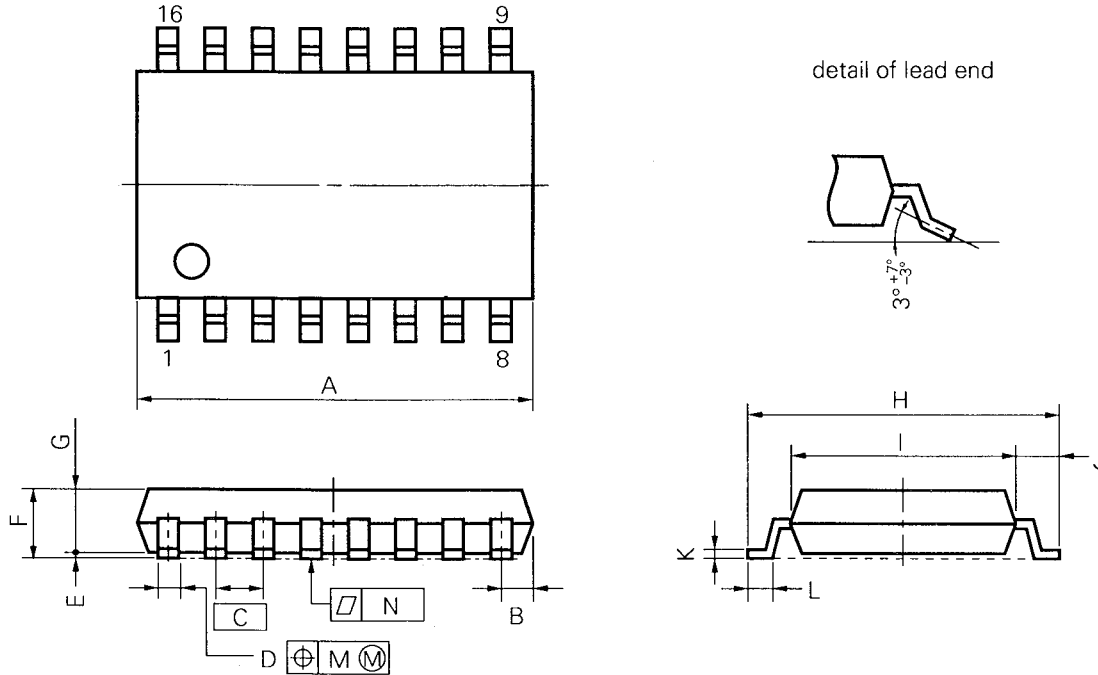
NOTES

- 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 <sup>+0.10</sup>	0.020 <sup>+0.004</sup> <sub>-0.005</sub>
F	1.1 MIN.	0.043 MIN.
G	3.5 <sup>+0.3</sup>	0.138 <sup>+0.012</sup>
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.

16 PIN PLASTIC SOP (300 mil)

μPC1100GS, μPC1150GS



P16GM-50-300B-3

**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±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 <sup>+0.10</sup> <sub>-0.05</sub>	0.008 <sup>+0.004</sup> <sub>-0.002</sub>
L	0.6±0.2	0.024 <sup>+0.008</sup> <sub>-0.009</sub>
M	0.12	0.005
N	0.10	0.004



**RECOMMENDED SOLDERING CONDITIONS**

The following conditions (see table below) must be set when soldering this product.

Please consult with our sales offices in case other soldering process is used, or in case soldering is done under different conditions.

**TYPES OF SURFACE MOUNT DEVICE**

For more details, refer to our document "SEMICONDUCTOR DEVICE MOUNTING TECHNOLOGY MANUAL" (IEI-1207).

μPC1100GS, μPC1150GS

Soldering process	Soldering conditions	Symbol
Infrared ray reflow	Peak package's surface temperature: 230 °C or below, Reflow time: 30 seconds or below (210 °C or higher), Number of reflow process: 1, Exposure limit*: None	IR30-00-1
VPS	Peak package's surface temperature: 215 °C or below, Reflow time: 40 seconds or below (200 °C or higher), Number of reflow process: 1, Exposure limit*: None	VP15-00-1

\*: Exposure limit before soldering after dry-pack package is opened.

Storage conditions: 25 °C and relative humidity at 65 % or less.

**Note:** Do not apply more than a single process at once, except for "Partial heating method".

**TYPES OF THROUGH HOLE MOUNT DEVICE**

μPC1100C, μPC1150C

Soldering process	Soldering conditions	Symbol
Wave soldering	Solder temperature: 260 °C or below, Flow time: 10 seconds or below	

**REFERENCE**

Document Name	Document No.
Quality control of NEC semiconductor devices	TEM-1202
Quality control guide of semiconductor devices	MEI-1202
Assembly manual of semiconductor devices	IEI-1207
NEC semiconductor device reliability/quality control system	IEI-1212

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Application examples recommended by NEC Corporation

Standard: Computer, Office equipment, Communication equipment, Test and Measurement equipment, Machine tools, Industrial robots, Audio and Visual equipment, Other consumer products, etc.

Special: Automotive and Transportation equipment, Traffic control systems, Antidisaster systems, Anticrime systems, etc.