

# BIPOLAR ANALOG INTEGRATED CIRCUIT

# $\mu$ PC3033,3005

### LOW-SATURATION STABILIZED POWER SUPPLY WITH ON/OFF FUNCTION (OUTPUT CURRENT: 1 A)

#### DESCRIPTION

The  $\mu$ PC3033 and 3005 are low-saturation type regulators with an output current of 1 A at respective output voltages of 3.3 V and 5 V. These regulators are also provided with an ON/OFF function, which reduces the dissipation when there is no load, making them ideal for systems requiring low power consumption. Since output voltage accuracy is as high as  $\pm 1\%$ , it can respond also to the application of which high precision is required.

#### FEATURES

- ON/OFF pin for output control (active-high)
- Output voltage accuracy:  $V_o = \pm 1\%$  (when  $T_A = 25^\circ\text{C}$ )
- Output current capacitance: 1 A
- Low minimum voltage difference between input and output:  $V_{\text{DIF}} = 0.6 \text{ V TYP.}$  (at  $I_o = 0.5 \text{ A}$ )
- On-chip inrush current protection circuit for when input voltage rises (when input voltage is low level)
- On-chip overcurrent and thermal protection circuit

#### APPLICATIONS

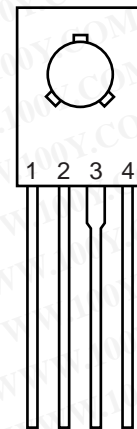
Digital TV, Audio, Air conditioner, etc.

#### ORDERING INFORMATION

Part Number	Package	Marking	Output Voltage
$\mu$ PC3033H	4-pin plastic SIP (TO-126)	C3033	3.3 V
$\mu$ PC3033H-AZ <sup>Note</sup>	4-pin plastic SIP (TO-126)	C3033	3.3 V
$\mu$ PC3005H	4-pin plastic SIP (TO-126)	C3005	5 V
$\mu$ PC3005H-AZ <sup>Note</sup>	4-pin plastic SIP (TO-126)	C3005	5 V

**Note** Pb-free (This product does not contain Pb in external electrode.)

#### PIN CONFIGURATION (Marking Side)

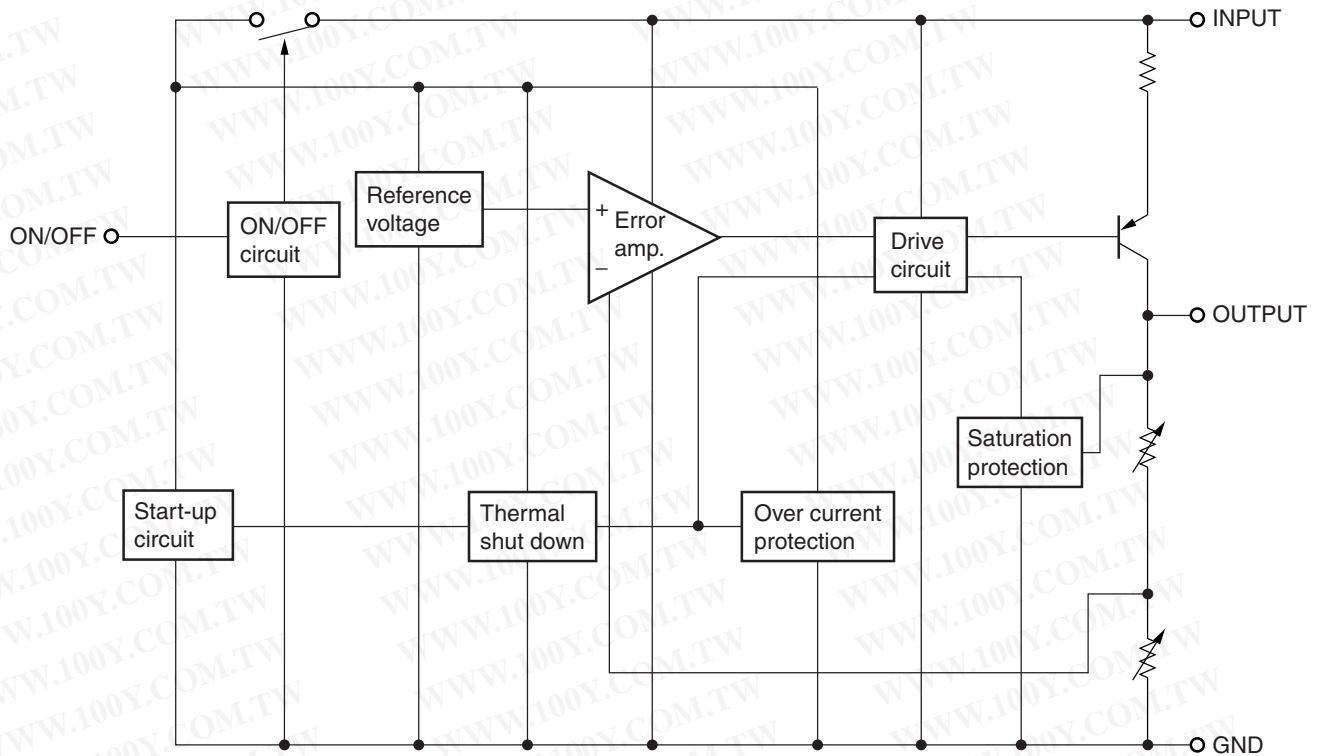


- 1: INPUT
- 2: ON/OFF
- 3: GND
- 4: OUTPUT

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BLOCK DIAGRAM



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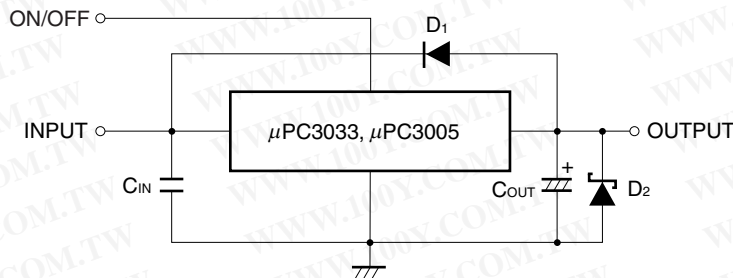
**ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub> = 25°C, unless otherwise specified.)**

Parameter	Symbol	Rating	Unit
Input Voltage	V <sub>IN</sub>	-0.3 to +8.0	V
ON/OFF Pin Voltage	V <sub>ON/OFF</sub>	-0.3 to +8.0	V
Internal Power Dissipation (T <sub>c</sub> = 25°C) <sup>Note</sup>	P <sub>T</sub>	12.5	W
Operating Ambient Temperature	T <sub>A</sub>	-40 to +85	°C
Operating Junction Temperature	T <sub>J</sub>	-40 to +150	°C
Storage Temperature	T <sub>stg</sub>	-55 to +150	°C
Thermal Resistance (Junction to Ambient)	R <sub>th(J-A)</sub>	110	°C/W
Thermal Resistance (Junction to Case)	R <sub>th(J-C)</sub>	10	°C/W

**Note** Internally limited. When the operating junction temperature rises over 150°C, the internal circuit shuts down the output voltage.

**Caution** Product quality may suffer if the absolute maximum rating is exceeded even momentarily for any parameter. That is, the absolute maximum ratings are rated values at which the product is on the verge of suffering physical damage, and therefore the product must be used under conditions that ensure that the absolute maximum ratings are not exceeded.

**TYPICAL CONNECTION**



C<sub>IN</sub>: 0.1 μF or higher. Set this value according to the length of the line between the regulator and INPUT pin. Be sure to connect C<sub>IN</sub> to prevent parasitic oscillation. Use of a film capacitor or other capacitor with excellent voltage and temperature characteristics is recommended. If using a laminated ceramic capacitor, it is necessary to ensure that C<sub>IN</sub> is 0.1 μF or higher for the voltage and temperature range to be used.

C<sub>OUT</sub>: 10 μF or higher. Be sure to connect C<sub>OUT</sub> to prevent oscillation and improve excessive load regulation. Place C<sub>IN</sub> and C<sub>OUT</sub> as close as possible to the IC pins (within 1 to 2 cm). Also, use an electrolytic capacitor with low impedance characteristics if considering use at sub-zero temperatures.

D1: If the OUTPUT pin has a higher voltage than the INPUT pin, connect a diode.

D2: If the OUTPUT pin has a lower voltage than the GND pin, connect a Schottky barrier diode.

**Caution** Ensure that voltage is not applied to the OUTPUT pin externally.

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**RECOMMENDED OPERATING CONDITIONS**

Parameter	Symbol	Corresponding Model	MIN.	TYP.	MAX.	Unit
Input Voltage	V <sub>IN</sub>	μPC3033	4.3		5.5	V
		μPC3005	6.0		7.0	V
ON/OFF Pin Voltage	V <sub>ON/OFF</sub>	All	0		V <sub>IN</sub>	V
Output Current	I <sub>o</sub>	All	0		1.0	A
Operating Ambient Temperature	T <sub>A</sub>	All	-40		+85	°C
Operating Junction Temperature	T <sub>J</sub>	All	-40		+125	°C

**Caution** Use of conditions other than the above-listed recommended operating conditions is not a problem as long as the absolute maximum ratings are not exceeded. However, since the use of such conditions diminishes the margin of safety, careful evaluation is required before such conditions are used. Moreover, using the MAX. value for all the recommended operating conditions is not guaranteed to be safe.

**ELECTRICAL CHARACTERISTICS**

**μPC3033** (T<sub>J</sub> = 25°C, V<sub>IN</sub> = 5 V, V<sub>ON/OFF</sub> = 5 V, I<sub>o</sub> = 0.5 A, C<sub>IN</sub> = 0.1 μF, C<sub>OUT</sub> = 10 μF, unless otherwise specified.)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Output Voltage	V <sub>O1</sub>		3.267	3.3	3.333	V
	V <sub>O2</sub>	-20°C ≤ T <sub>J</sub> ≤ +70°C, I <sub>o</sub> = 50 mA	(3.234)		(3.366)	V
Line Regulation	REG <sub>IN</sub>	4.3 V ≤ V <sub>IN</sub> ≤ 6 V		2.0	9.0	mV
Load Regulation	REG <sub>L</sub>	5 mA ≤ I <sub>o</sub> ≤ 1 A		10.0	66.0	mV
Quiescent Current	I <sub>BIAS1</sub>	I <sub>o</sub> = 0 A		2.0	4.0	mA
	I <sub>BIAS2</sub>	I <sub>o</sub> = 0.5 A		15.0	30.0	mA
Startup Quiescent Current	I <sub>BIAS(S)</sub>	V <sub>IN</sub> = 3.1 V, I <sub>o</sub> = 0 A		9.0	25.0	mA
Output Noise Voltage	V <sub>n</sub>	10 Hz ≤ f ≤ 100 kHz		80		μV <sub>r.m.s.</sub>
Ripple Rejection	R-R	f = 120 Hz, 4.3 V ≤ V <sub>IN</sub> ≤ 6 V		57		dB
Dropout Voltage	V <sub>DIF</sub>	I <sub>o</sub> = 0.5 A		0.4	0.6	V
Short Circuit Current	I <sub>short</sub>			0.6		A
Peak Output Current	I <sub>opeak</sub>		1.0	1.5		A
Temperature Coefficient of Output Voltage	ΔV <sub>o</sub> /ΔT	0°C ≤ T <sub>J</sub> ≤ 125°C		-0.4		mV/°C
ON Voltage	V <sub>ON</sub>	V <sub>IN</sub> = 7 V, I <sub>o</sub> = 0 A	2.0			V
OFF Voltage	V <sub>OFF</sub>	V <sub>IN</sub> = 7 V, I <sub>o</sub> = 0 A			0.8	V
ON/OFF Pin Current (ON state)	I <sub>ON/OFF</sub>	V <sub>ON/OFF</sub> = 5 V		85	200	μA
Standby Current	I <sub>BIAS(OFF)</sub>	V <sub>ON/OFF</sub> = 0 V			10	μA

**Remark** Values in parentheses have been measured during product design and are provided as reference values.

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μPC3005 (T<sub>J</sub> = 25°C, V<sub>IN</sub> = 6 V, V<sub>ON/OFF</sub> = 6 V, I<sub>o</sub> = 0.5 A, C<sub>IN</sub> = 0.1 μF, C<sub>OUT</sub> = 10 μF, unless otherwise specified.)

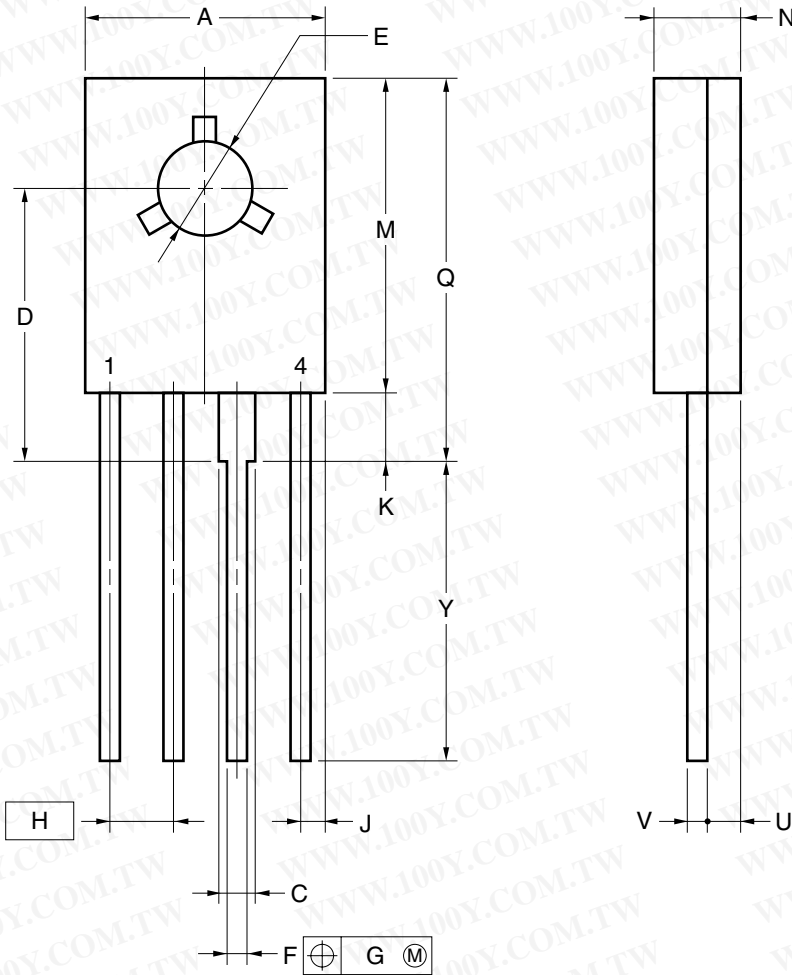
Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Output Voltage	V <sub>O1</sub>		4.95	5.0	5.05	V
	V <sub>O2</sub>	-20°C ≤ T <sub>J</sub> ≤ +70°C, I <sub>o</sub> = 50 mA	(4.90)		(5.10)	V
Line Regulation	REG <sub>IN</sub>	6 V ≤ V <sub>IN</sub> ≤ 7 V		2.0	9.0	mV
Load Regulation	REG <sub>L</sub>	5 mA ≤ I <sub>o</sub> ≤ 1 A		20.0	66.0	mV
Quiescent Current	I <sub>BIAS1</sub>	I <sub>o</sub> = 0 A		2.0	4.0	mA
	I <sub>BIAS2</sub>	I <sub>o</sub> = 0.5 A		15.0	30.0	mA
Startup Quiescent Current	I <sub>BIAS(S)</sub>	V <sub>IN</sub> = 4.8 V, I <sub>o</sub> = 0 A		9.0	30.0	mA
Output Noise Voltage	V <sub>n</sub>	10 Hz ≤ f ≤ 100 kHz		120		μV <sub>r.m.s.</sub>
Ripple Rejection	R-R	f = 120 Hz, 6 V ≤ V <sub>IN</sub> ≤ 7 V		54		dB
Dropout Voltage	V <sub>DIF</sub>	I <sub>o</sub> = 0.5 A		0.4	0.6	V
Short Circuit Current	I <sub>short</sub>			0.6		A
Peak Output Current	I <sub>opeak</sub>		1.0	1.4		A
Temperature Coefficient of Output Voltage	ΔV <sub>o</sub> /ΔT	0°C ≤ T <sub>J</sub> ≤ 125°C		-0.4		mV/°C
ON Voltage	V <sub>ON</sub>	V <sub>IN</sub> = 7 V, I <sub>o</sub> = 0 A	2.0			V
OFF Voltage	V <sub>OFF</sub>	V <sub>IN</sub> = 7 V, I <sub>o</sub> = 0 A			0.8	V
ON/OFF Pin Current (ON state)	I <sub>ON/OFF</sub>	V <sub>ON/OFF</sub> = 7 V		130	200	μA
Standby Current	I <sub>BIAS(OFF)</sub>	V <sub>ON/OFF</sub> = 0 V			10	μA

**Remark** Values in parentheses have been measured during product design and are provided as reference values.

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PACKAGE DRAWING (Unit: mm)

4-PIN PLASTIC SIP (TO-126)



NOTE

Each lead centerline is located within 0.2 mm of its true position (T.P.) at maximum material condition.

ITEM	MILLIMETERS
A	8.5 MAX.
C	1.1 MIN.
D	9.7±0.3
E	φ3.2±0.1
F	0.65±0.1
G	0.2
H	2.0
J	1.25 MAX.
K	2.3 MIN.
M	11.5 MAX.
N	2.7±0.2
Q	14.5 MAX.
U	1.7 MAX.
V	0.55±0.1
Y	13.5±0.7

P4HP-200B-2

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**RECOMMENDED SOLDERING CONDITIONS**

The μPC3033,3005 should be soldered and mounted under the following recommended conditions.

For soldering methods and conditions other than those recommended below, contact an NEC Electronics sales representative.

For technical information, see the following website.

**Semiconductor Device Mount Manual (<http://www.necel.com/pkg/en/mount/index.html>)**

**Through-hole devices**

μPC3033H, μPC3005H: 4-pin plastic SIP (TO-126)

Process	Conditions	Recommend
Wave soldering (only to leads)	Solder temperature: 260°C or below, Flow time: 10 seconds or less.	WS60-00
Partial heating method	Pin temperature: 300°C or below, Heat time: 3 seconds or less (Per each pin).	P300-1

μPC3033H-AZ, μPC3005H-AZ: 4-pin plastic SIP (TO-126) <sup>Note</sup>

Process	Conditions	Recommend
Wave soldering (only to leads)	Solder temperature: 260°C or below, Flow time: 10 seconds or less.	WS60-00
Partial heating method	Pin temperature: 300°C or below, Heat time: 3 seconds or less (Per each pin).	P300-1

**Note** Pb-free (This product does not contain Pb in external electrode.)

**Caution** For through-hole device, the wave soldering process must be applied only to leads, and make sure that the package body does not get jet soldered.

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**NOTES ON USE**

When the μPC3033 or μPC3005 is used with an input voltage that is lower than the value prescribed in the recommended operating conditions, a large quiescent current flows through the device due to saturation at the transistor of the output stage. The specifications of these characteristics are prescribed by the item “Startup Quiescent Current (I<sub>BIAS(S)</sub>)”.

These products have a saturation protector, but a current of up to 80 mA MAX. may flow through the device. Thus the power supply on the input side must have sufficient capacity to allow this quiescent current to pass through when the device is started up.

**REFERENCE DOCUMENTS**

Document Name	Document No.
Usage of Three-Terminal Regulators User's Manual	G12702E
Semiconductor Device Mount Manual	<a href="http://www.necel.com/pkg/en/mount/index.html">http://www.necel.com/pkg/en/mount/index.html</a>
SEMICONDUCTOR SELECTION GUIDE - Products and Packages -	X13769X

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