To our customers,

Old Company Name in Catalogs and Other Documents

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Renesas Electronics website: http://www.renesas.com

April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (http://www.renesas.com)

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RENESAS

BIPOLAR ANALOG INTEGRATED CIRCUIT
μPC24A00 Series

THREE TERMINAL LOW DROPOUT VOLTAGE REGULATOR

DESCRIPTION

The μPC24A00 series is a low dropout voltage three terminal regulator that has realized a minimum voltage differential between the I/O of no more than 1 V when the output current is 2 A through the employment of a PNP transistor at the output stage.

Due to its ability to achieve a greater reduction in the power loss compared with conventional three-terminal regulators, the μPC24A00 series is ideal for use as the secondary side smoothing circuit of a power supply.

FEATURES

- Output current in excess of 2 A
- High accuracy output voltage: ΔV_O = ±2% MAX. (T_J = 25°C, I_O = 1 A)
- Low dropout voltage: V_{DIF} = 1 V MAX. (I_O = 2 A)
- On-chip thermal shut down circuit, over-current protection circuit and safe operating area protection circuit

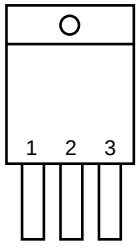
ORDERING INFORMATION

Part Number	Package	Output Voltage
μPC24A05HF	3-pin plastic SIP (MP-45G) (Isolated TO-220)	5 V
μPC24A12HF	3-pin plastic SIP (MP-45G) (Isolated TO-220)	12 V
μPC24A15HF	3-pin plastic SIP (MP-45G) (Isolated TO-220)	15 V

PIN CONFIGURATION (Marking Side)

3-pin plastic SIP (MP-45G)

μPC24A05HF, 24A12HF, 24A15HF



1: INPUT
2: GND
3: OUTPUT

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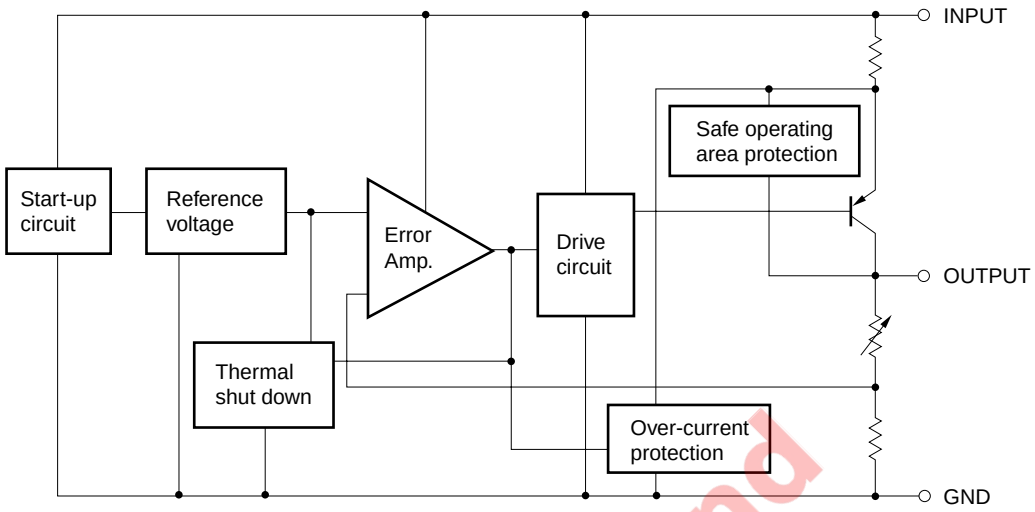
Date Published March 2003 NS CP(K)
Printed in Japan

The mark ★ shows major revised points.

BLOCK DIAGRAM



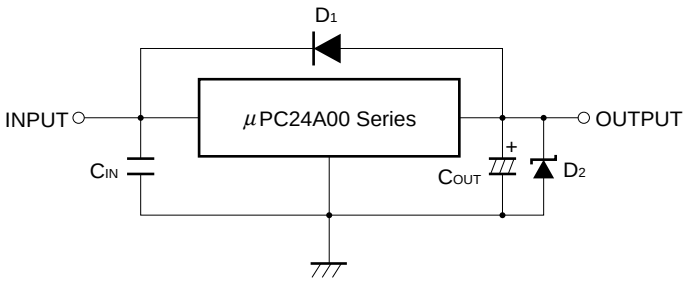
ABSOLUTE MAXIMUM RATINGS (T_A = 25°C, unless otherwise specified)

Parameter	Symbol	Rating	Unit
Input Voltage	V_{IN}	–0.3 to +36	V
Internal Power Dissipation	P_T	20 Note	W
Operating Ambient Temperature	T_A	–20 to +85	°C
Operating Junction Temperature	T_J	–20 to +150	°C
Storage Temperature	T_{stg}	–55 to +150	°C
Thermal Resistance (Junction to Case)	$R_{th(J-C)}$	5	°C/W
Thermal Resistance (Junction to Ambient)	$R_{th(J-A)}$	65	°C/W

Note Internally limited. When the operating junction temperature rises up to 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_{IN}: 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_{IN} 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_{IN} is 0.1 μF or higher for the voltage and temperature range to be used.

★ C_{OUT}: 47 μF or higher. Be sure to connect C_{OUT} to prevent oscillation and improve excessive load regulation. Place C_{IN} and C_{OUT} as close as possible to the IC pins (within 2 cm). Also, use an electrolytic capacitor with low impedance characteristics if considering use at sub-zero temperatures.

D_1: If the OUTPUT pin has a higher voltage than the INPUT pin, connect a diode.

D_2: If the OUTPUT pin has a lower voltage than the GND pin, connect a Schottky barrier diode.

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Condition	MIN.	TYP.	MAX.	Unit
Input Voltage	V_{IN}	μPC24A05HF	6	9	15	V
		μPC24A12HF	13	18	22	V
		μPC24A15HF	16	22	25	V
Output Current	I_O	All	0		2	A
Operating Junction Temperature	T_J	All	−20		+125	°C

Caution The recommended operating range may be exceeded without causing any problems provided that the absolute maximum ratings are not exceeded. However, if the device is operated in a way that exceeds the recommended operating conditions, the margin between the actual conditions of use and the absolute maximum ratings is small, and therefore thorough evaluation is necessary. The recommended operating conditions do not imply that the device can be used with all values at their maximum values.

ELECTRICAL CHARACTERISTICS

μPC24A05 (T_J = 25°C, V_{IN} = 9 V, I_O = 1 A, unless otherwise specified)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Output Voltage	V_O		4.9	5.0	5.1	V
		0°C ≤ T_J ≤ 125°C, 6 V ≤ V_{IN} ≤ 15 V, 5 mA ≤ I_O ≤ 2 A	4.85		5.15	V
Line Regulation	REG_{IN}	6 V ≤ V_{IN} ≤ 15 V		6	50	mV
Load Regulation	REG_L	5 mA ≤ I_O ≤ 2 A		3	50	mV
Quiescent Current	I_{BIAS}	I_O = 0 A		3	5.0	mA
		I_O = 2 A		15	30	mA
Quiescent Current Change	ΔI_{BIAS}	6 V ≤ V_{IN} ≤ 15 V, I_O = 2 A			20	mA
Output Noise Voltage	V_n	10 Hz ≤ f ≤ 100 kHz		150		μVr.m.s.
Ripple Rejection	R•R	f = 120 Hz, 6.5 V ≤ V_{IN} ≤ 16.5 V	50	60		dB
Dropout Voltage	V_{DIF}	0°C ≤ T_J ≤ 125°C, I_O = 2 A			1.0	V
Peak Output Current	I_{Opeak}	V_{IN} = 9 V	2.8	3.5	4.2	A
Short Circuit Current	I_{Oshort}	V_{IN} = 15 V		1.3		A
Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	0°C ≤ T_J ≤ 125°C, I_O = 5 mA		0.5		mV/°C

μPC24A12 (T_J = 25°C, V_{IN} = 18 V, I_O = 1 A, unless otherwise specified)

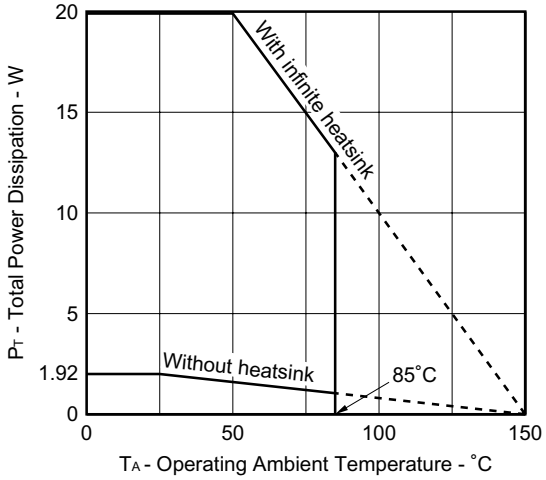
Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Output Voltage	V_O		11.75	12.0	12.25	V
		0°C ≤ T_J ≤ 125°C, 13 V ≤ V_{IN} ≤ 22 V, 5 mA ≤ I_O ≤ 2 A	11.65		12.35	V
Line Regulation	REG_{IN}	13 V ≤ V_{IN} ≤ 22 V		12	100	mV
Load Regulation	REG_L	5 mA ≤ I_O ≤ 2 A		6	100	mV
Quiescent Current	I_{BIAS}	I_O = 0 A		3	5.0	mA
		I_O = 2 A		15	30	mA
Quiescent Current Change	ΔI_{BIAS}	13 V ≤ V_{IN} ≤ 22 V, I_O = 2 A			20	mA
Output Noise Voltage	V_n	10 Hz ≤ f ≤ 100 kHz		220		μVr.m.s.
Ripple Rejection	R•R	f = 120 Hz, 13.5 V ≤ V_{IN} ≤ 23.5 V	43	50		dB
Dropout Voltage	V_{DIF}	0°C ≤ T_J ≤ 125°C, I_O = 2 A			1.0	V
Peak Output Current	I_{Opeak}	V_{IN} = 18 V	2.8	3.5	4.2	A
Short Circuit Current	I_{Oshort}	V_{IN} = 15 V		1.4		A
Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	0°C ≤ T_J ≤ 125°C, I_O = 5 mA		1.0		mV/°C

μPC24A15 (T_J = 25°C, V_{IN} = 22 V, I_O = 1 A, unless otherwise specified)

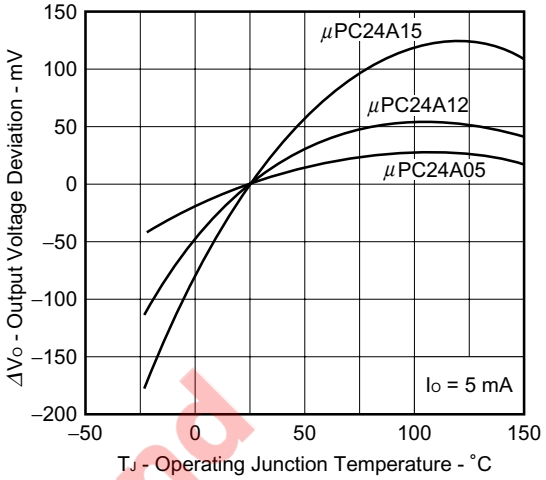
Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Output Voltage	V_O		14.7	15.0	15.3	V
		0°C ≤ T_J ≤ 125°C, 16 V ≤ V_{IN} ≤ 25 V, 5 mA ≤ I_O ≤ 2 A	14.55		15.45	V
Line Regulation	REG_{IN}	17 V ≤ V_{IN} ≤ 25 V		18	150	mV
Load Regulation	REG_L	5 mA ≤ I_O ≤ 2 A		10	150	mV
Quiescent Current	I_{BIAS}	I_O = 0 A		3	5.0	mA
		I_O = 2 A		15	30	mA
Quiescent Current Change	ΔI_{BIAS}	17 V ≤ V_{IN} ≤ 25 V, I_O = 2 A			20	mA
Output Noise Voltage	V_n	10 Hz ≤ f ≤ 100 kHz		260		μVr.m.s.
Ripple Rejection	R•R	f = 120 Hz, 17 V ≤ V_{IN} ≤ 27 V	40	48		dB
Dropout Voltage	V_{DIF}	0°C ≤ T_J ≤ 125°C, I_O = 2 A			1.0	V
Peak Output Current	I_{Opeak}	V_{IN} = 22 V	2.8	3.5	4.2	A
Short Circuit Current	I_{Oshort}	V_{IN} = 16 V		1.4		A
Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	0°C ≤ T_J ≤ 125°C, I_O = 5 mA		1.6		mV/°C

TYPICAL CHARACTERISTICS (Reference Values)

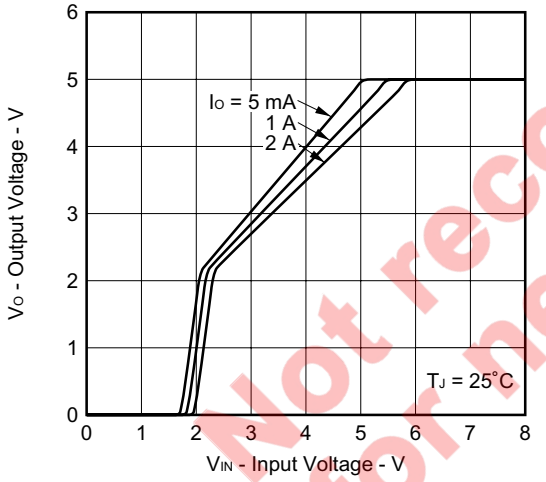
P_T vs. T_A



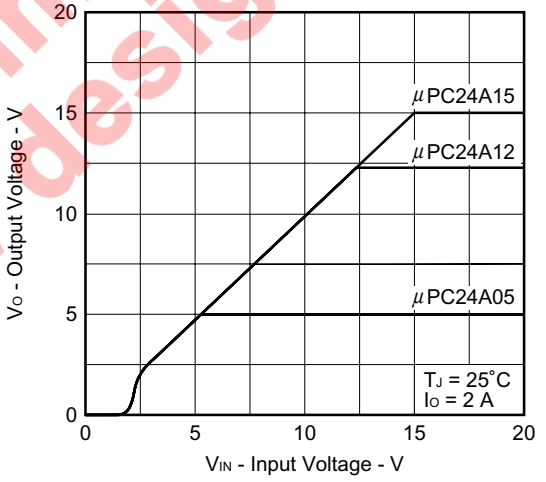
ΔV_O vs. T_J



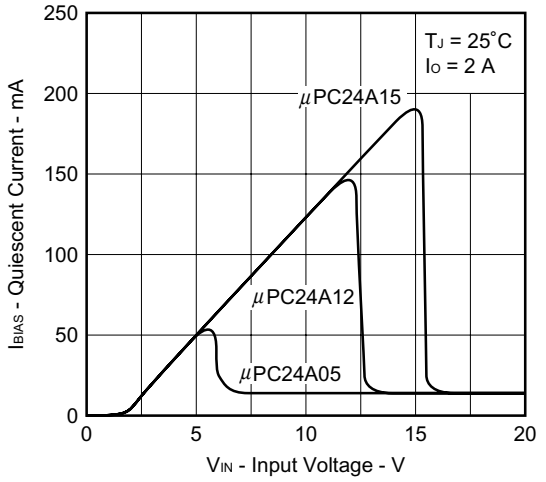
V_O vs. V_{IN} (μPC24A05)



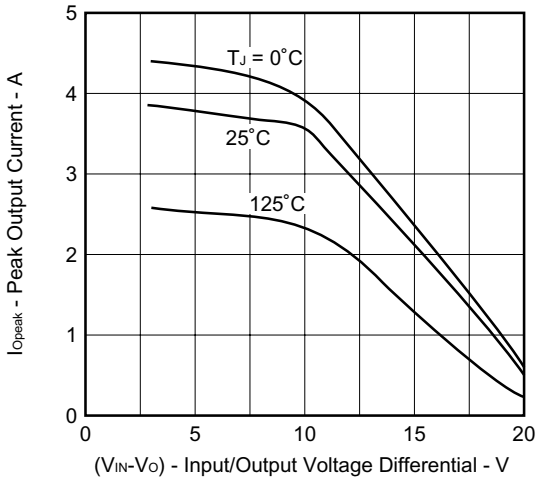
V_O vs. V_{IN}



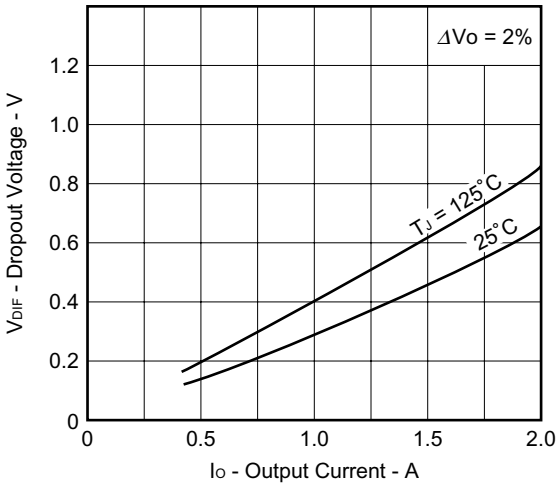
I_{BIAS} vs. V_{IN}



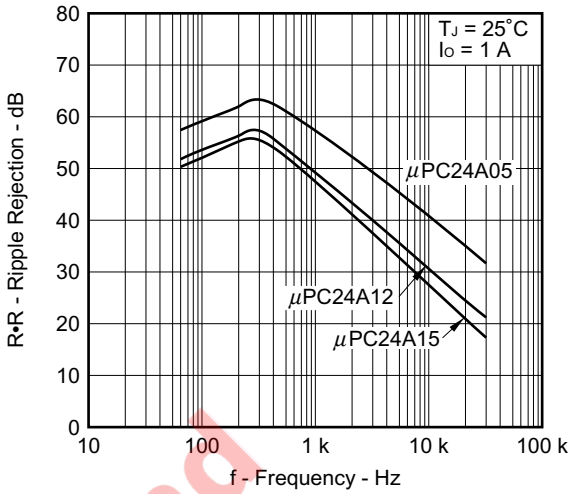
I_{Opeak} vs. (V_{IN}-V_O)



V_{DIF} vs. I_O

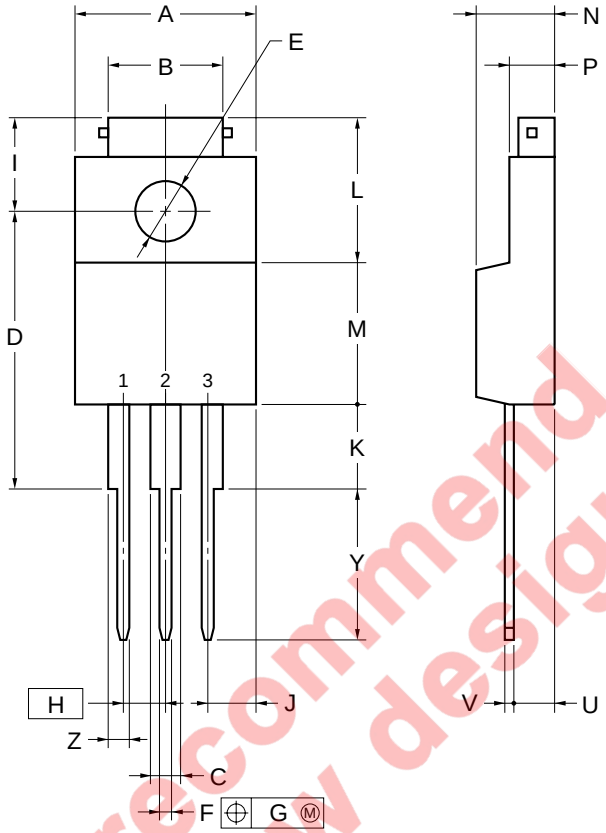


R•R vs. f



PACKAGE DRAWING (Unit: mm)

3PIN PLASTIC SIP (MP-45G)



NOTE

Each lead centerline is located within 0.25 mm of its true position (T.P.) at maximum material condition.

ITEM	MILLIMETERS
A	10.0±0.2
B	7.0±0.2
C	1.50±0.2
D	17.0±0.3
E	φ3.3±0.2
F	0.75±0.10
G	0.25
H	2.54 (T.P.)
I	5.0±0.3
J	2.46±0.2
K	5.0±0.2
L	8.5±0.2
M	8.5±0.2
N	4.5±0.2
P	2.8±0.2
U	2.4±0.5
V	0.65±0.10
Y	8.9±0.7
Z	1.30±0.2

P3HF-254B-4

RECOMMENDED SOLDERING CONDITIONS

When soldering this product, it is highly recommended to observe the conditions as shown below. If other soldering processes are used, of if the soldering is performed under different conditions, please make sure to consult with our sales offices.

For more details, refer to below our document.

"Semiconductor Device Mounting Technology Manual (C10535E)"

Type of Through-Hole Device

μPC24A05HF, μPC24A12HF, μPC24A15HF: 3-PIN PLASTIC SIP (MP-45G) (Isolated TO-220)

Process	Conditions
Wave Soldering (Only to leads)	Solder temperature: 260°C or below, Flow time: 10 seconds or less.

Caution Apply wave soldering only to the pins and be careful not to bring solder into direct contact with the package.

CAUTION ON USE

- The μPC24A00 series, if the output is short-circuited at $V_{IN} \geq 20$ V, the output may not be restored after the short-circuit is cancelled. In this case, restore the output by lowering and then reapplying V_{IN}.
- If a lower than recommended input voltage is used in the μPC24A00 series, a large circuit current will flow due to the saturation of the output stage transistor (refer to the I_{BIAS} vs. V_{IN} curves in TYPICAL CHARACTERISTICS). The capacitance for the input side power supply therefore needs to be only enough to enable the current to flow in this circuit at startup. Note also that a resistor cannot be inserted at the GND pin to adjust the output voltage.

REFERENCE DOCUMENTS

Quality Grades on NEC Semiconductor Devices (C11531E)

Semiconductor Device Mounting Technology Manual (C10535E)

Semiconductors Selection Guide (X10679E)

Semiconductor Selection Guide -Products and Packages- (X13769X)

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