μPC2933A, 2905A

THREE-TERMINAL LOW DROPOUT VOLTAGE REGULATOR

R03DS0029EJ0400
Rev.4.00
Mar 16, 2011

Description

The μPC2933A, 2905A of low dropout voltage three terminal positive regulators is constructed with PNP output transistor. The μPC2933A, 2905A feature the ability to source 1 A of output current with a low dropout voltage of typically 0.7 V.

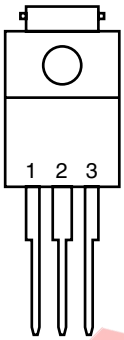
The power dissipation of the μPC2933A, 2905A can be drastically reduced compared with the conventional three terminal positive voltage regulators that is constructed with NPN output transistor. Also, this series corresponds to the low voltage output (3.3 V) which is not in the conventional low dropout regulators (μPC24xxA series).

Features

- Output current in excess of 1.0 A
- Low dropout voltage
  V_{DIF} = 0.7 V TYP. (I_O = 1 A)
- On-chip over-current and thermal protection circuit
- On-chip output transistor safe operating area protection circuit

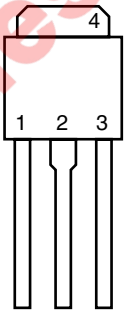
Pin Configurations (Marking Side)

μPC2933AHF,
μPC2905AHF: Isolated TO-220 (MP-45G)



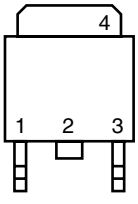
1: INPUT
2: GND
3: OUTPUT

μPC2933AHB,
μPC2905AHB: SC-64 (MP-3)



1: INPUT
2: GND[Note1]
3: OUTPUT
4: GND (Fin)

μPC2933AT,
μPC2905AT: SC-63 (MP-3Z)



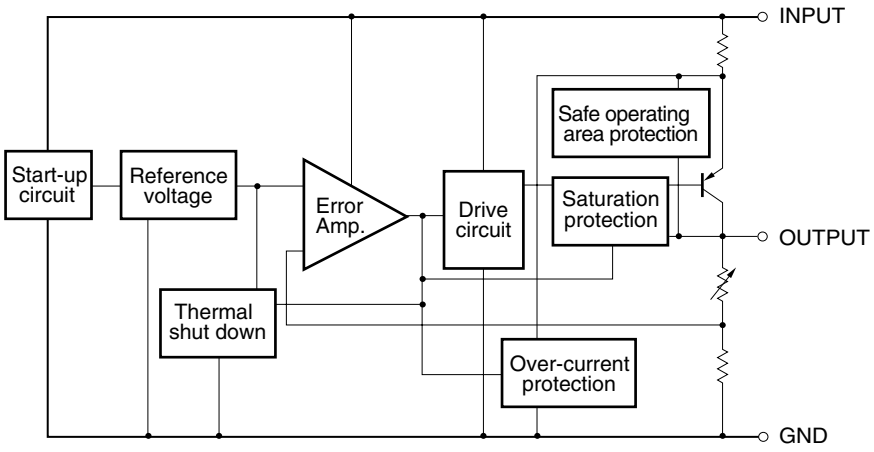
1: INPUT
2: GND[Note2]
3: OUTPUT
4: GND (Fin)

Notes 1. No.2 pin and No.4 fin are common GND.

2. No.2 pin is cut. No.2 pin and No.4 fin are common GND.

The mark <R> shows major revised points.
The revised points can be easily searched by copying an "<R>" in the PDF file and specifying it in the "Find what:" field.

Block Diagram



Ordering Information

Part Number	Package	Output Voltage	Marking
μPC2933AHF	Isolated TO-220 (MP-45G)	3.3 V	2933A
μPC2933AHB	SC-64 (MP-3)	3.3 V	2933A
μPC2933AT	SC-63 (MP-3Z)	3.3 V	2933A
μPC2905AHF	Isolated TO-220 (MP-45G)	5.0 V	2905A
μPC2905AHB	SC-64 (MP-3)	5.0 V	2905A
μPC2905AT	SC-63 (MP-3Z)	5.0 V	2905A

Remark Tape-packaged products have the symbol -E1, or -E2 suffixed to the part number. Pb-free products have the symbol -AZ, or -AY suffixed to the part number. Refer to the following table for details.

<R>

Part Number Note1	Package	Package Type
μPC29xxAHF-AZ Note2	Isolated TO-220 (MP-45G)	• Packed in envelop
μPC29xxAHB-AZ Note2	SC-64 (MP-3)	• Packed in envelop
μPC29xxAHB-AY Note3	SC-64 (MP-3)	• Packed in envelop
μPC29xxAT-E1-AZ Note2	SC-63 (MP-3Z)	• 16 mm wide embossed taping • Pin 1 on draw-out side • 2000 pcs/reel
μPC29xxAT-E1-AY Note3	SC-63 (MP-3Z)	• 16 mm wide embossed taping • Pin 1 on draw-out side • 2000 pcs/reel
μPC29xxAT-E2-AZ Note2	SC-63 (MP-3Z)	• 16 mm wide embossed taping • Pin 1 at take-up side • 2000 pcs/reel
μPC29xxAT-E2-AY Note3	SC-63 (MP-3Z)	• 16 mm wide embossed taping • Pin 1 at take-up side • 2000 pcs/reel

Notes 1. xx stands for symbols that indicate the output voltage.

2. Pb-free (This product does not contain Pb in the external electrode.)

3. Pb-free (This product does not contain Pb in the external electrode, Sn100% plating.)

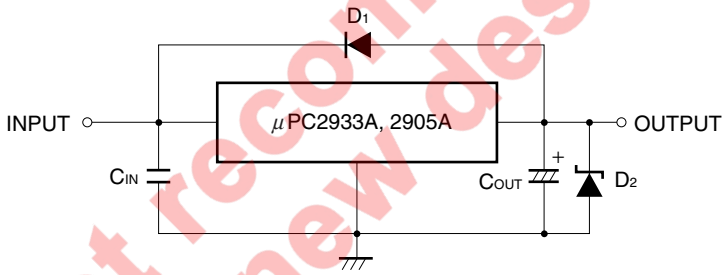
Absolute Maximum Ratings (T_A = 25°C)

Parameter	Symbol	Rating		Unit
		μPC2933AHF, 2905AHF	μPC2933AHB, 2905AHB μPC2933AT, 2905AT	
Input Voltage	V_{IN}	20		V
Internal Power Dissipation (T_C = 25°C) Note	P_T	15	10	W
Operating Ambient Temperature	T_A	–30 to +85		°C
Operating Junction Temperature	T_J	–30 to +150		°C
Storage Temperature	T_{stg}	–55 to +150		°C
Thermal Resistance (junction to case)	$R_{th(J-C)}$	7	12.5	°C/W
Thermal Resistance (junction to ambient)	$R_{th(J-A)}$	65	125	°C/W

Note Internally limited. When the operating junction temperature rises above 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. Be sure to connect C_{IN} to prevent parasitic oscillation. Set this value according to the length of the line between the regulator and the INPUT pin. Use of a film capacitor or other capacitor with first-rate 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 1 to 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.

Caution Make sure that no voltage is applied to the OUTPUT pin from external.

Recommended Conditions

Parameter	Symbol	Type Number	MIN.	TYP.	MAX.	Unit
Input Voltage	V_{IN}	μPC2933A	4.3		16	V
		μPC2905A	6		16	
Output Current	I_O	All	0		1.0	A
Operating Ambient Temperature	T_A	All	–30		+85	°C
Operating Junction Temperature	T_J	All	–30		+125	°C

Electrical Characteristics

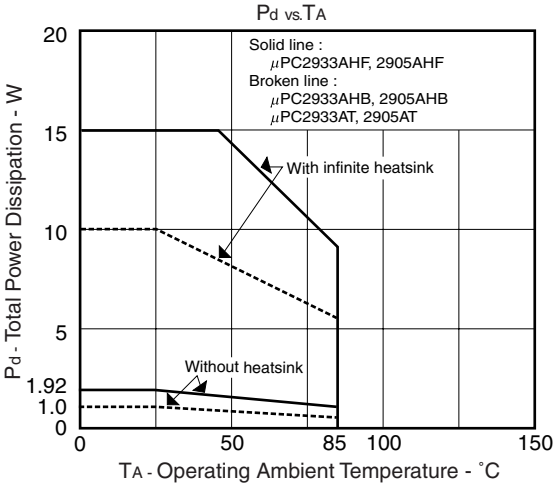
μPC2933A (T_J = 25°C, V_{IN} = 5 V, I_O = 500 mA, C_{IN} = 0.22 μF, C_{OUT} = 47 μF, unless otherwise specified)

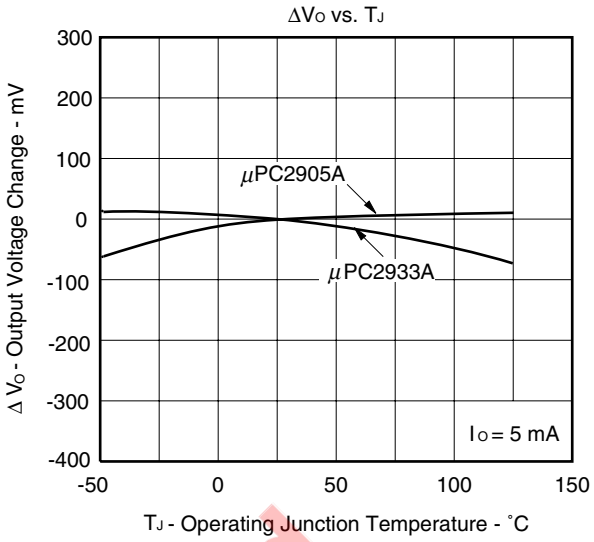
Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Output Voltage	V_O		3.18	3.3	3.42	V
		0°C ≤ T_J ≤ 125°C, 4.3 V ≤ V_{IN} ≤ 16 V, 0 A ≤ I_O ≤ 500 mA	3.14		3.46	
		0°C ≤ T_J ≤ 125°C, 0 A ≤ I_O ≤ 1 A				
Line Regulation	REG_{IN}	4.3 V ≤ V_{IN} ≤ 16 V		12	33	mV
Load Regulation	REG_L	0 A ≤ I_O ≤ 1 A		23	33	mV
Quiescent Current	I_{BIAS}	I_O = 0 A		2.0	3.0	mA
		I_O = 1 A		20	40	
<R> Startup Quiescent Current	$I_{BIAS\ (s)}$	V_{IN} = 3.1 V, I_O = 0 A		10	30	mA
		V_{IN} = 3.1 V, I_O = 1 A			50	
Quiescent Current Change	ΔI_{BIAS}	0°C ≤ T_J ≤ 125°C, 4.3 V ≤ V_{IN} ≤ 16 V		3.0	15	mA
Output Noise Voltage	V_n	10 Hz ≤ f ≤ 100 kHz		55		$\mu V_{r.m.s.}$
Ripple Rejection	R•R	f = 120 Hz, 4.3 V ≤ V_{IN} ≤ 16 V	48	64		dB
Dropout Voltage	V_{DIF}	0°C ≤ T_J ≤ 125°C, I_O = 1 A		0.7	1.0	V
Short Circuit Current	I_{Oshort}	V_{IN} = 4.5 V	1.2	1.6	3.0	A
		V_{IN} = 16 V		1.2		
Peak Output Current	I_{Opeak}	V_{IN} = 4.5 V	1.0	1.4	3.0	A
		V_{IN} = 16 V	1.3	1.7	2.8	
Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	0°C ≤ T_J ≤ 125°C, I_O = 5 mA		–0.4		mV/°C

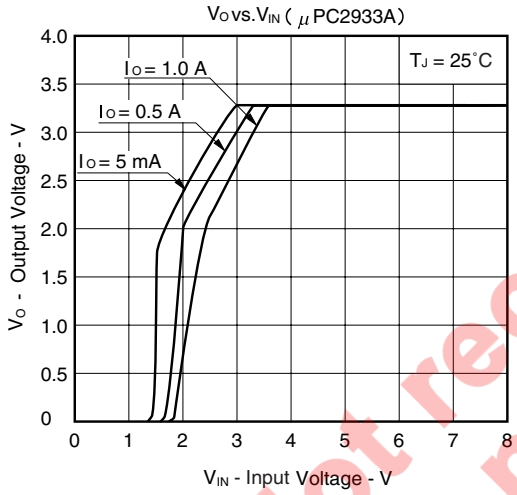
μPC2905A (T_J = 25°C, V_{IN} = 8 V, I_O = 500 mA, C_{IN} = 0.22 μF, C_{OUT} = 47 μF, unless otherwise specified)

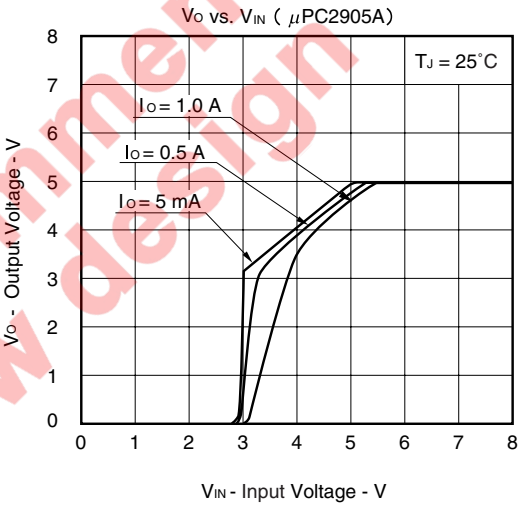
Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Output Voltage	V_O		4.83	5.0	5.18	V
		0°C ≤ T_J ≤ 125°C, 6 V ≤ V_{IN} ≤ 16 V, 0 A ≤ I_O ≤ 500 mA	4.75		5.25	
		0°C ≤ T_J ≤ 125°C, 0 A ≤ I_O ≤ 1 A				
Line Regulation	REG_{IN}	6 V ≤ V_{IN} ≤ 16 V		23	50	mV
Load Regulation	REG_L	0 A ≤ I_O ≤ 1 A		28	50	mV
Quiescent Current	I_{BIAS}	I_O = 0 A		2.2	3.5	mA
		I_O = 1 A		28	50	
Startup Quiescent Current	$I_{BIAS\ (s)}$	V_{IN} = 4.5 V, I_O = 0 A		10	30	mA
		V_{IN} = 4.5 V, I_O = 1 A			50	
Quiescent Current Change	ΔI_{BIAS}	0°C ≤ T_J ≤ 125°C, 6 V ≤ V_{IN} ≤ 16 V		2.9	15	mA
Output Noise Voltage	V_n	10 Hz ≤ f ≤ 100 kHz		90		$\mu V_{r.m.s.}$
Ripple Rejection	R•R	f = 120 Hz, 6 V ≤ V_{IN} ≤ 16 V	46	61		dB
Dropout Voltage	V_{DIF}	0°C ≤ T_J ≤ 125°C, I_O = 1 A		0.7	1.0	V
Short Circuit Current	I_{Oshort}	V_{IN} = 6.5 V	1.15	1.8	3.0	A
		V_{IN} = 16 V		1.1		
Peak Output Current	I_{Opeak}	V_{IN} = 6.5 V	1.1	1.5	3.0	A
		V_{IN} = 16 V	1.4	2.0	2.8	
Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	0°C ≤ T_J ≤ 125°C, I_O = 5 mA		0.6		mV/°C

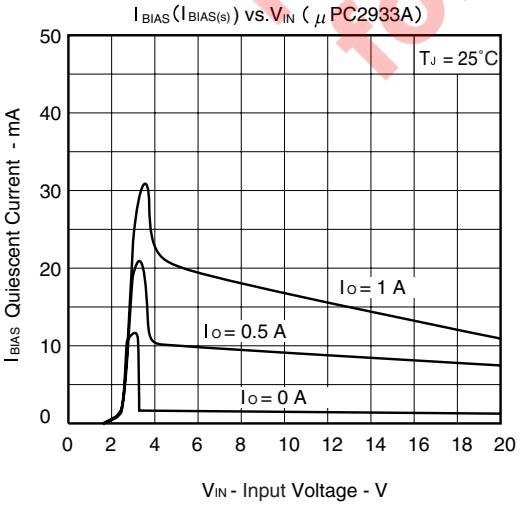
Typical Characteristics

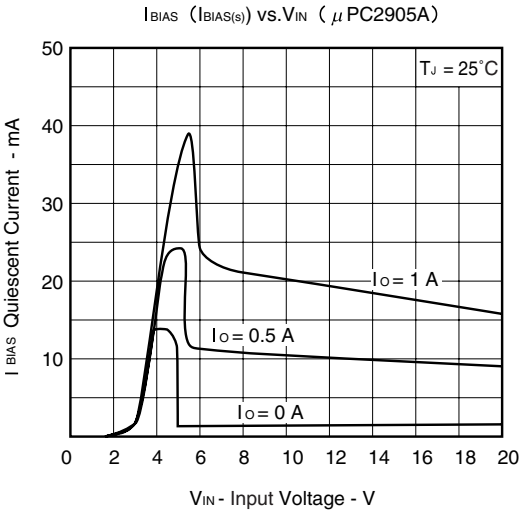


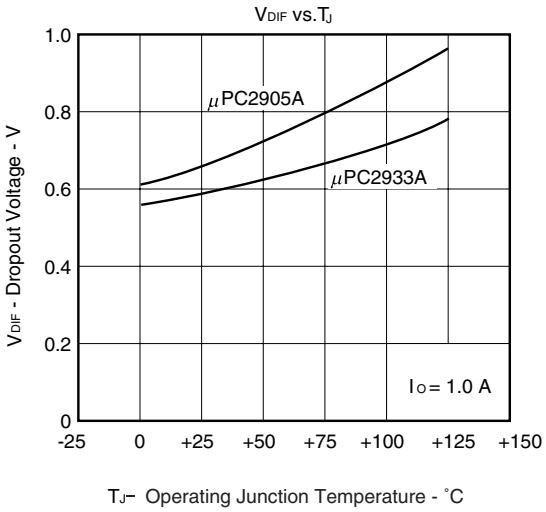


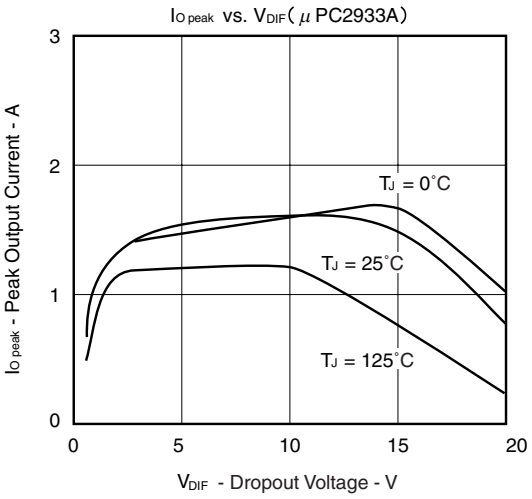


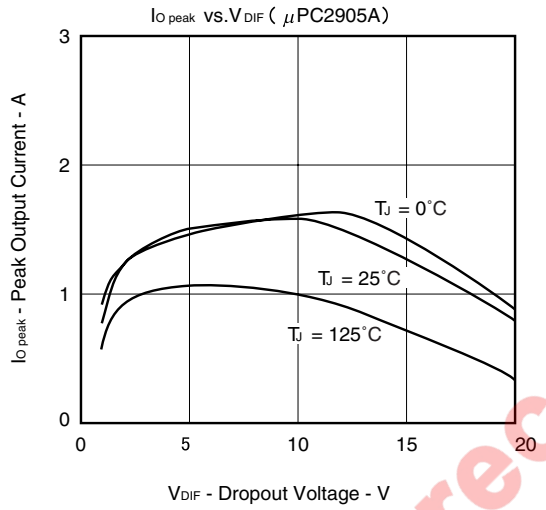


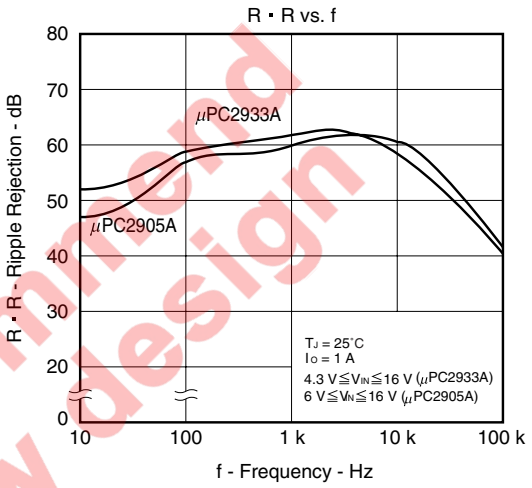


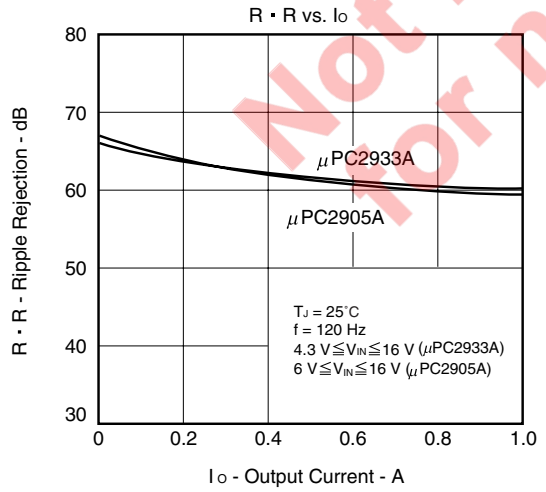


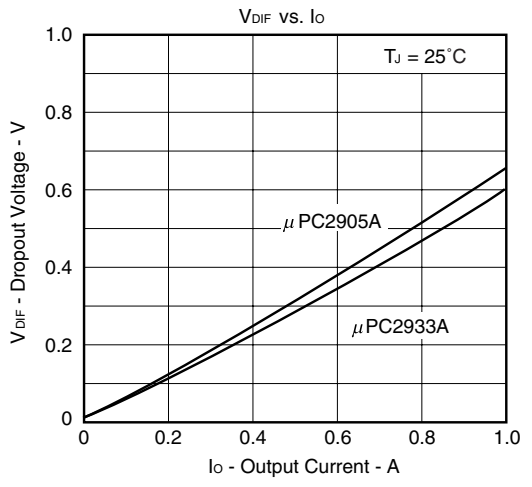


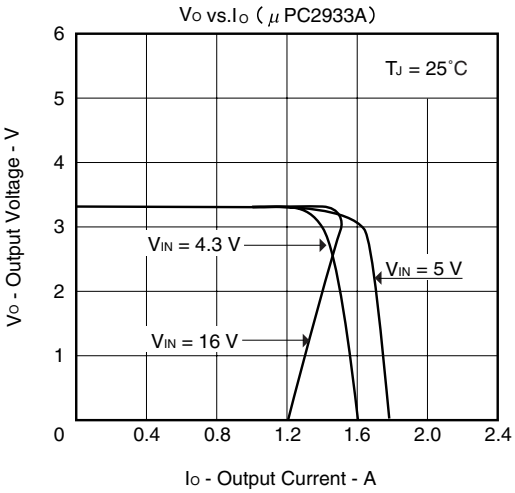


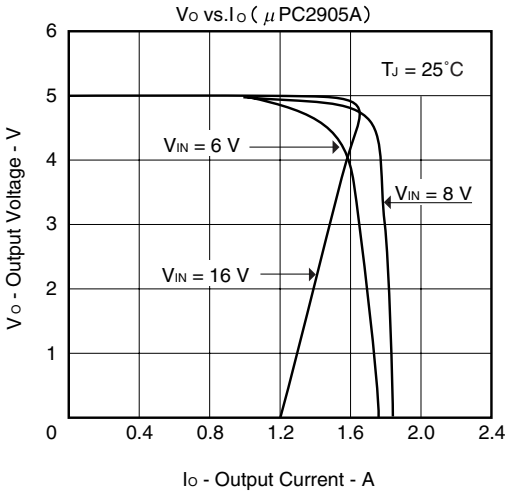








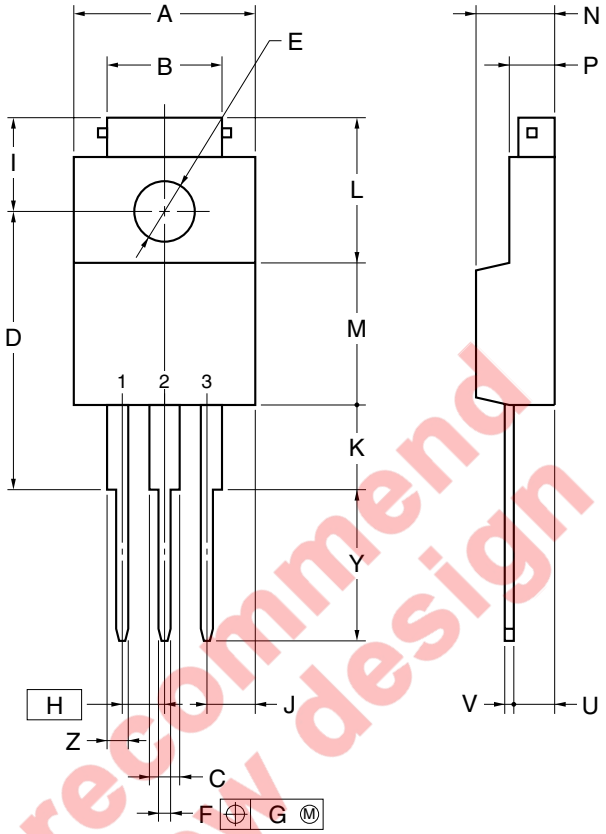




Package Drawings (Unit: mm)

μPC2933AHF, μPC2905AHF

3PIN PLASTIC SIP (MP-45G)



NOTE

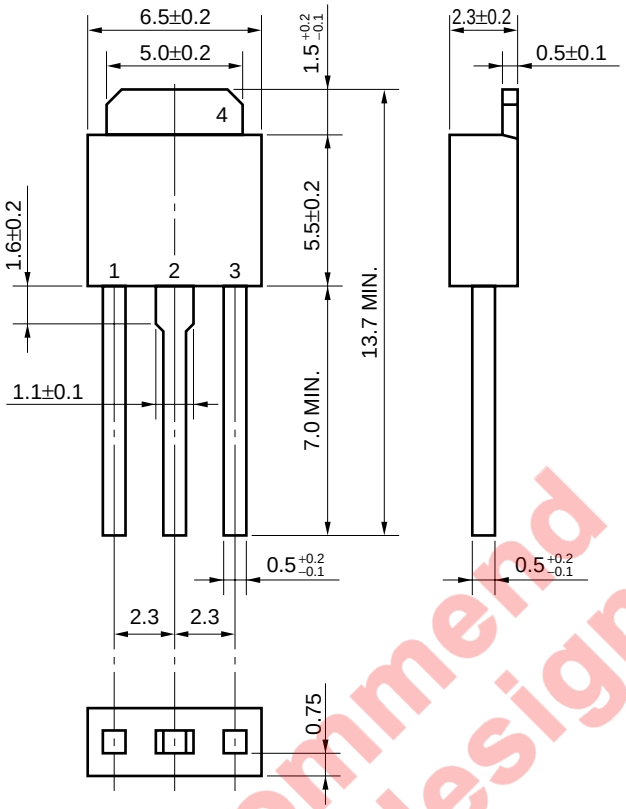
Each lead centerline is located within 0.25 mm of its true position (T.P.) at maximum material condition.

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

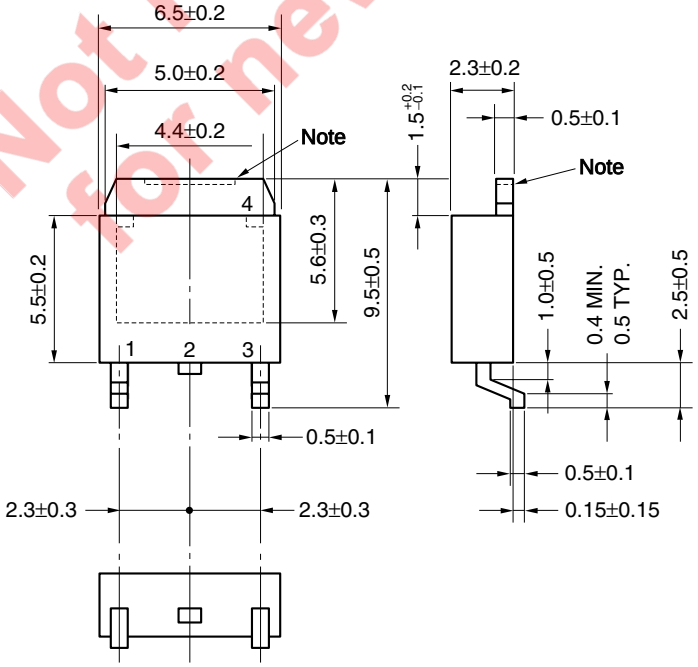
μPC2933AHB, μPC2905AHB

SC-64 (MP-3) (Unit: mm)



μPC2933AT, μPC2905AT

SC-63 (MP-3Z) (Unit: mm)



Note The depth of notch at the top of the fin is from 0 to 0.2 mm.

<R> ## RECOMMENDED SOLDERING CONDITIONS

The μPC2933A, 2905A should be soldered and mounted under the following recommended conditions.
For soldering methods and conditions other than those recommended below, contact your nearby sales representative.
For technical information, see the following website.

Semiconductor Device Mount Manual (http://www.renesas.com/prod/package/manual/)

Surface Mount Device

μPC29xxAT-AZ Series[Note1], μPC29xxAT-AY Series[Note2]: SC-63 (MP-3Z)

Process	Conditions	Symbol
Infrared Ray Reflow	Peak temperature: 260°C or below (Package surface temperature), Reflow time: 60 seconds or less (at 220°C or higher), Maximum number of reflow processes: 3 times or less.	IR60-00-3
Partial Heating Method	Pin temperature: 350°C or below, Heat time: 3 seconds or less (Per each side of the device).	P350

Notes 1. Pb-free (This product does not contain Pb in the external electrode.)

2. Pb-free (This product does not contain Pb in the external electrode, Sn100% plating.)

Caution Apply only one kind of soldering condition to a device, except for "partial heating method", or the device will be damaged by heat stress.

Remark Flux: Rosin-based flux with low chlorine content (chlorine 0.2 Wt% or below) is recommended.

Through-hole devices

μPC29xxAHF-AZ Series[Note1]: Isolated TO-220 (MP-45G)
μPC29xxAHB-AZ Series[Note1], μPC29xxAHB-AY Series[Note2]: SC-64 (MP-3)

Process	Conditions	Symbol
Wave soldering (only to leads)	Solder temperature: 260°C or below, Flow time: 10 seconds or less.	WS60-00-1
Partial heating method	Pin temperature: 350°C or below, Heat time: 3 seconds or less (Per each pin).	P350

Notes 1. Pb-free (This product does not contain Pb in the external electrode.)

2. Pb-free (This product does not contain Pb in the external electrode, Sn100% plating.)

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.

Notes On Use

When the μPC2933A, 2905A are used with an input voltage that is lower than the value indicated in the recommended operating conditions, a high quiescent current flows through the device due to saturation of the transistor of the output stage. (Refer to the "**I_{BIAS} ($I_{BIAS(S)}$) vs. V_{IN} curves in Typical Characteristics**").

These products have 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 when the device starts up.

Reference Documents

USER'S MANUAL USAGE OF THREE TERMINAL REGULATORS	Document No.G12702E Note
REVIEW OF QUALITY AND RELIABILITY HANDBOOK	Document No.C12769E Note
INFORMATION VOLTAGE REGULATOR OF SMD	Document No.G11872E Note
SEMICONDUCTOR DEVICE PACKAGE MANUAL	

http://www.renesas.com/prod/package/index.html

Note Published by the former NEC Electronics Corporation.

Revision History	μPC2933A,2905A Data Sheet

Rev.	Date	Description	
		Page	Summary
–	Aug 2007	–	Previous No. : G15374EJ3V0DS00
4.00	Mar 16, 2011	Throughout	Deletion of leaded products
		p.4	μPC2933A Startup Quiescent Current $I_{BIAS\,(s)}$ 80 mA -> 50 mA @V_{IN} = 3.1 V, I_O = 1 A

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