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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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BIPOLAR ANALOG INTEGRATED CIRCUIT

μ PC2933A, 2905A

THREE-TERMINAL LOW DROPOUT VOLTAGE REGULATOR

DESCRIPTION

The μ PC2933A, 2905A of low dropout voltage three terminal positive regulators is constructed with PNP output transistor. The μ PC2933A, 2905A feature the ability to source 1 A of output current with a low dropout voltage of typically 0.7 V.

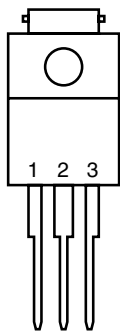
The power dissipation of the μ PC2933A, 2905A can be drastically reduced compared with the conventional three terminal positive voltage regulators that is constructed with NPN output transistor. Also, this series corresponds to the low voltage output (3.3 V) which is not in the conventional low dropout regulators (μ PC24xxA series).

FEATURES

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

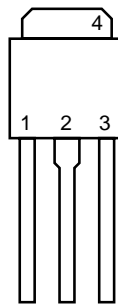
<R> PIN CONFIGURATIONS (Marking Side)

μ PC2933AHF,
 μ PC2905AHF: Isolated TO-220 (MP-45G)



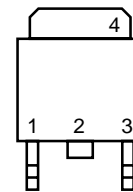
1: INPUT
 2: GND
 3: OUTPUT

μ PC2933AHB,
 μ PC2905AHB: SC-64 (MP-3)



1: INPUT
 2: GND^{Note1}
 3: OUTPUT
 4: GND (Fin)

μ PC2933AT,
 μ PC2905AT: SC-63 (MP-3Z)



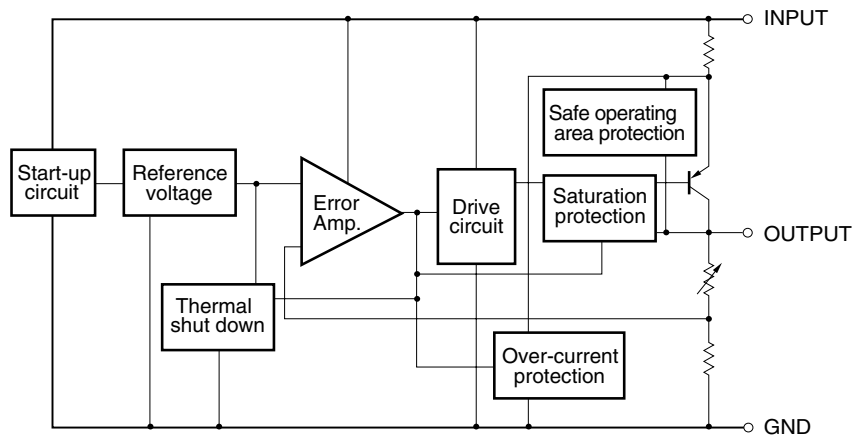
1: INPUT
 2: GND^{Note2}
 3: OUTPUT
 4: GND (Fin)

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.

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BLOCK DIAGRAM



<R> 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.

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

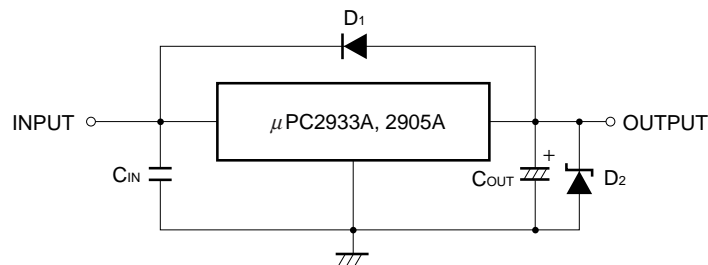
ABSOLUTE MAXIMUM RATINGS (T_A = 25°C)

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.

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

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Type Number	MIN.	TYP.	MAX.	Unit
Input Voltage	V_{IN}	μ PC2933A	4.3		16	V
		μ PC2905A	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

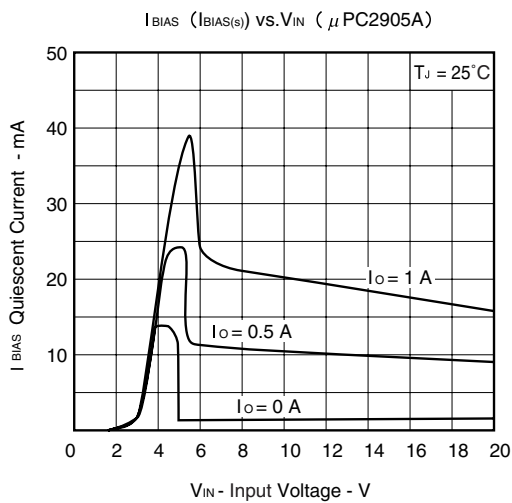
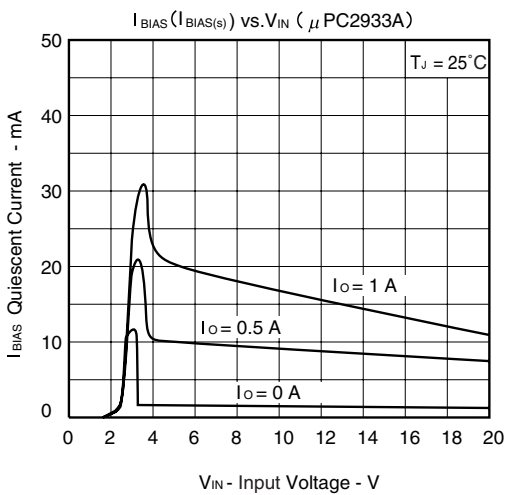
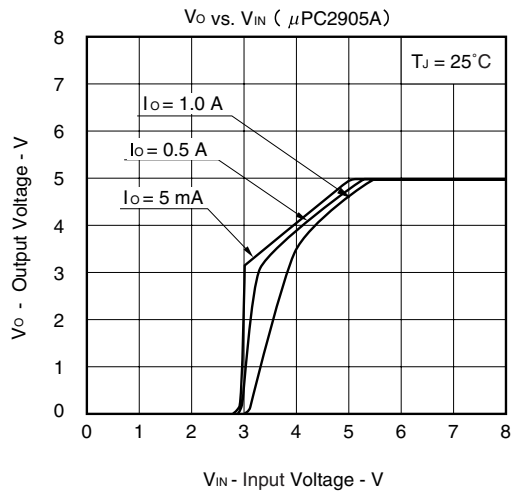
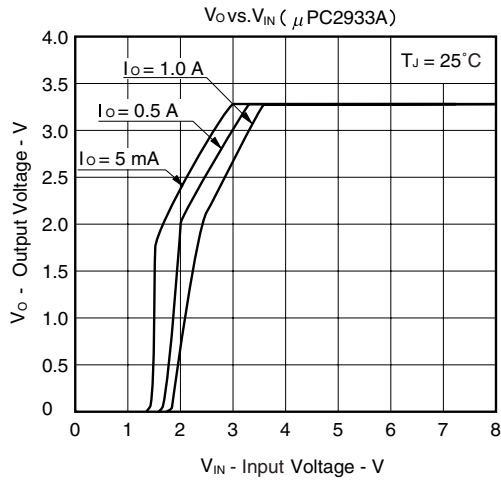
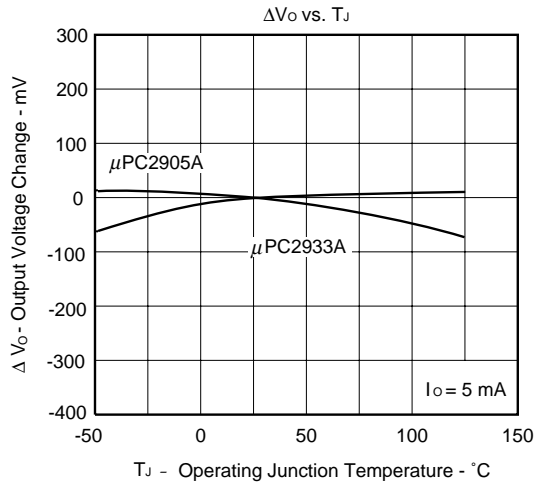
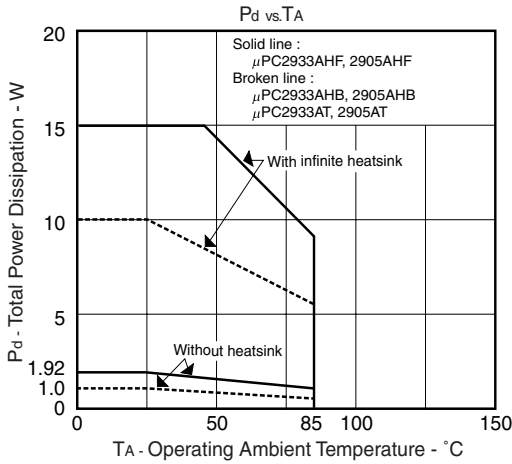
μ PC2933A ($T_J = 25^\circ\text{C}$, $V_{IN} = 5\text{ V}$, $I_o = 500\text{ mA}$, $C_{IN} = 0.22\ \mu\text{F}$, $C_{OUT} = 47\ \mu\text{F}$, unless otherwise specified)

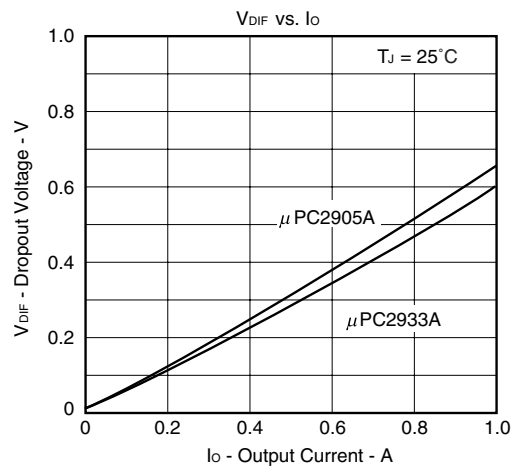
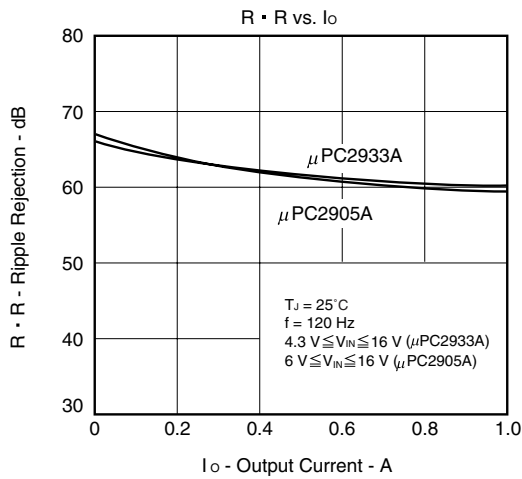
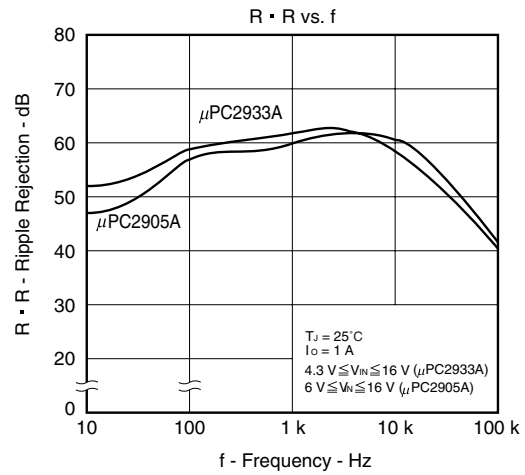
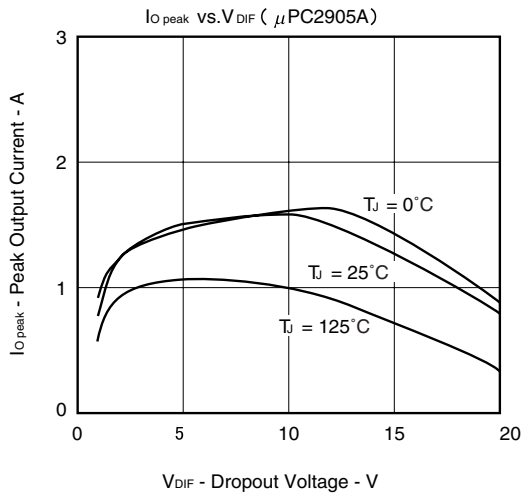
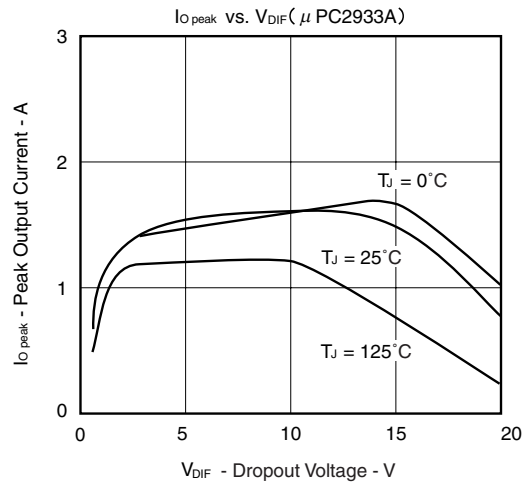
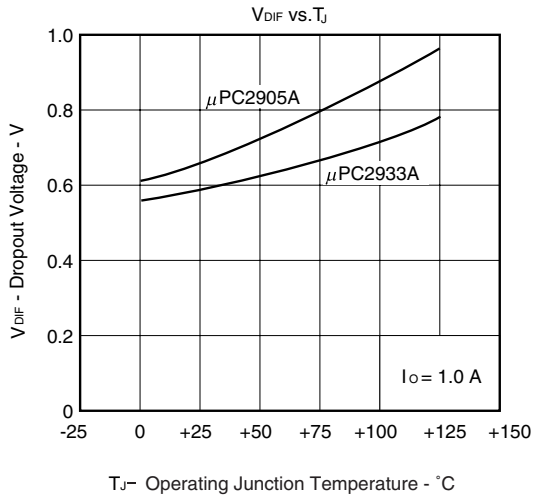
Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Output Voltage	V_o		3.18	3.3	3.42	V
		$0^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$, $4.3\text{ V} \leq V_{IN} \leq 16\text{ V}$, $0\text{ A} \leq I_o \leq 500\text{ mA}$	3.14		3.46	
		$0^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$, $0\text{ A} \leq I_o \leq 1\text{ A}$				
Line Regulation	REG_{IN}	$4.3\text{ V} \leq V_{IN} \leq 16\text{ V}$		12	33	mV
Load Regulation	REG_L	$0\text{ A} \leq I_o \leq 1\text{ A}$		23	33	mV
Quiescent Current	I_{BIAS}	$I_o = 0\text{ A}$		2.0	3.0	mA
		$I_o = 1\text{ A}$		20	40	
Startup Quiescent Current	$I_{BIAS(s)}$	$V_{IN} = 3.1\text{ V}$, $I_o = 0\text{ A}$		10	30	mA
		$V_{IN} = 3.1\text{ V}$, $I_o = 1\text{ A}$			80	
Quiescent Current Change	ΔI_{BIAS}	$0^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$, $4.3\text{ V} \leq V_{IN} \leq 16\text{ V}$		3.0	15	mA
Output Noise Voltage	V_n	$10\text{ Hz} \leq f \leq 100\text{ kHz}$		55		$\mu\text{V}_{r.m.s.}$
Ripple Rejection	$R \cdot R$	$f = 120\text{ Hz}$, $4.3\text{ V} \leq V_{IN} \leq 16\text{ V}$	48	64		dB
Dropout Voltage	V_{DIF}	$0^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$, $I_o = 1\text{ A}$		0.7	1.0	V
Short Circuit Current	I_{Oshort}	$V_{IN} = 4.5\text{ V}$	1.2	1.6	3.0	A
		$V_{IN} = 16\text{ V}$		1.2		
Peak Output Current	I_{Opeak}	$V_{IN} = 4.5\text{ V}$	1.0	1.4	3.0	A
		$V_{IN} = 16\text{ V}$	1.3	1.7	2.8	
Temperature Coefficient of Output Voltage	$\Delta V_o / \Delta T$	$0^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$, $I_o = 5\text{ mA}$		-0.4		mV/°C

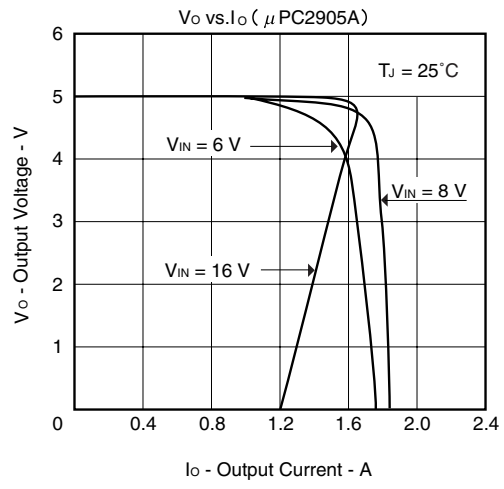
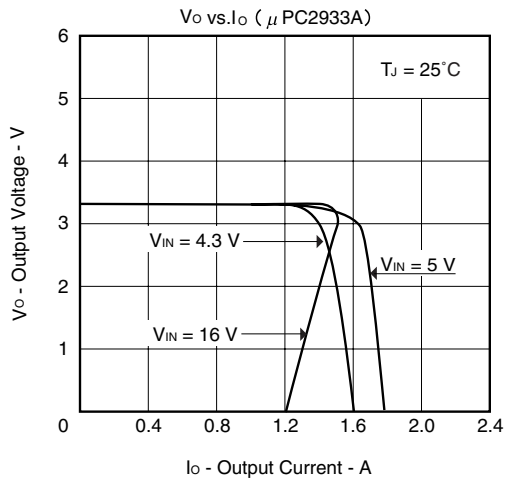
μPC2905A (T_J = 25°C, V_{IN} = 8 V, I_o = 500 mA, C_{IN} = 0.22 μF, C_{OUT} = 47 μF, unless otherwise specified)

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		μV _{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	ΔV _O /ΔT	0°C ≤ T _J ≤ 125°C, I _o = 5 mA		0.6		mV/°C

TYPICAL CHARACTERISTICS



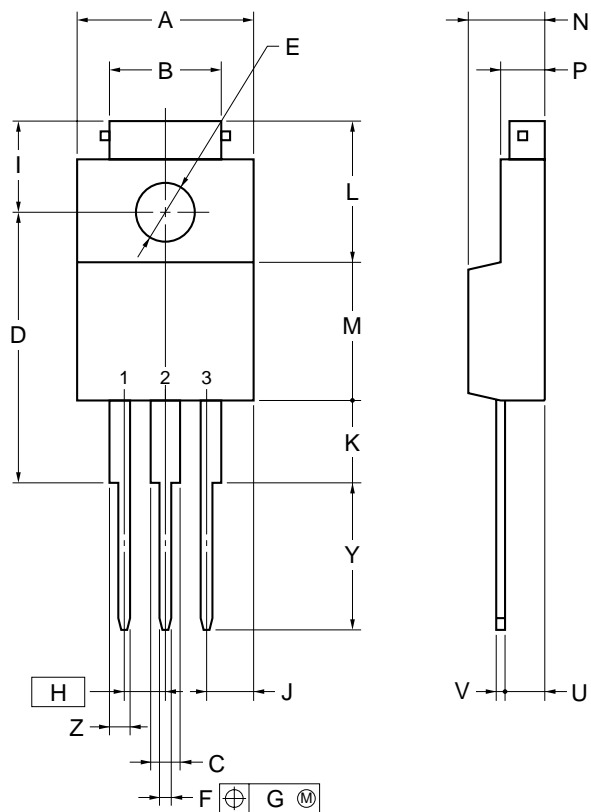




PACKAGE DRAWINGS

μPC2933AHF, μPC2905AHF

3PIN PLASTIC SIP (MP-45G)



NOTE

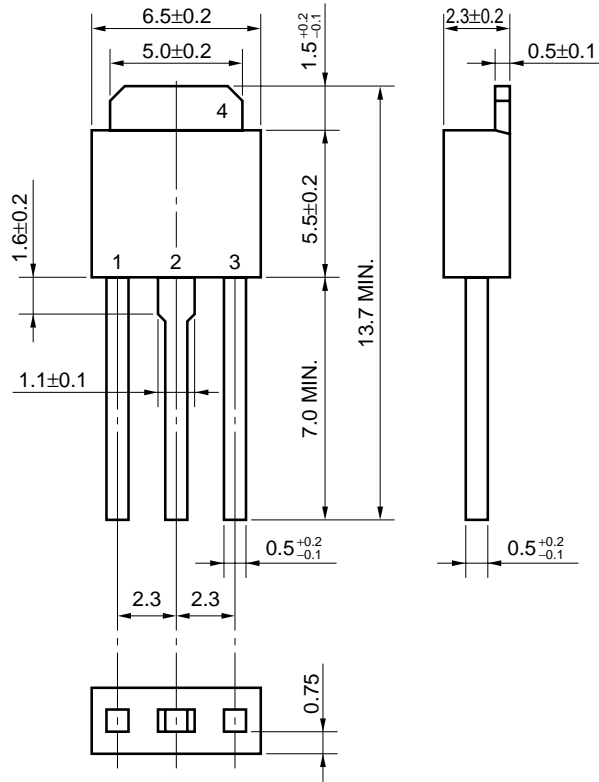
Each lead centerline is located within 0.25 mm of its true position (T.P.) at maximum material condition.

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

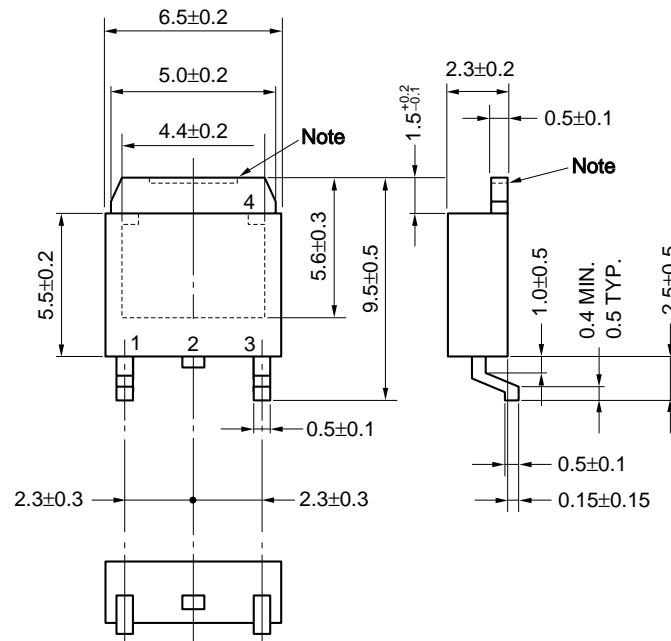
μPC2933AHB, μPC2905AHB

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



μPC2933AT, μPC2905AT

<R> 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 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>)

Surface Mount Device

μPC29xxAT Series: SC-63 (MP-3Z)

Process	Conditions	Symbol
Infrared Ray Reflow	Peak temperature: 235°C or below (Package surface temperature), Reflow time: 30 seconds or less (at 210°C or higher), Maximum number of reflow processes: 3 times or less.	IR35-00-3
Vapor Phase Soldering	Peak temperature: 215°C or below (Package surface temperature), Reflow time: 40 seconds or less (at 200°C or higher), Maximum number of reflow processes: 3 times or less.	VP15-00-3
Partial Heating Method	Pin temperature: 350°C or below, Heat time: 3 seconds or less (Per each side of the device).	P350

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 Series, μPC29xxAHF-AZ Series ^{Note1}: Isolated TO-220 (MP-45G)

μPC29xxAHB Series, 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
REVIEW OF QUALITY AND RELIABILITY HANDBOOK	Document No.C12769E
INFORMATION VOLTAGE REGULATOR OF SMD	Document No.G11872E
SEMICONDUCTOR DEVICE MOUNT MANUAL	http://www.necel.com/pkg/en/mount/index.html

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