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

PC29xx Series

THREE TERMINAL LOW DROPOUT VOLTAGE REGULATOR

The PC29xx series of low dropout voltage three terminal positive regulators is constructed with PNP output transistor. The PC29xx series feature the ability to source 1 A of output current with a low dropout voltage of typically 0.7 V.

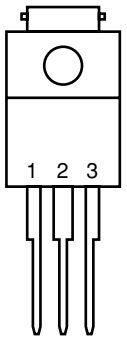
The power dissipation of the PC29xx series can be drastically reduced compared with the conventional three terminal positive voltage regulators that is constructed with NPN output transistor. Also, this series corresponds to the low voltage output (3.0 V, 3.3 V) which is not in the conventional low dropout regulators (PC24xxA 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

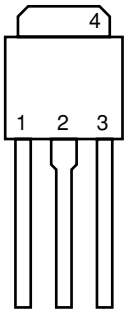
<R> **PIN CONFIGURATIONS (Marking Side)**

PC29xxHF Series: Isolated TO-220 (MP-45G)



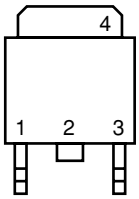
1: INPUT
2: GND
3: OUTPUT

PC29xxHB Series: SC-64 (MP-3)



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

PC29xxT Series: 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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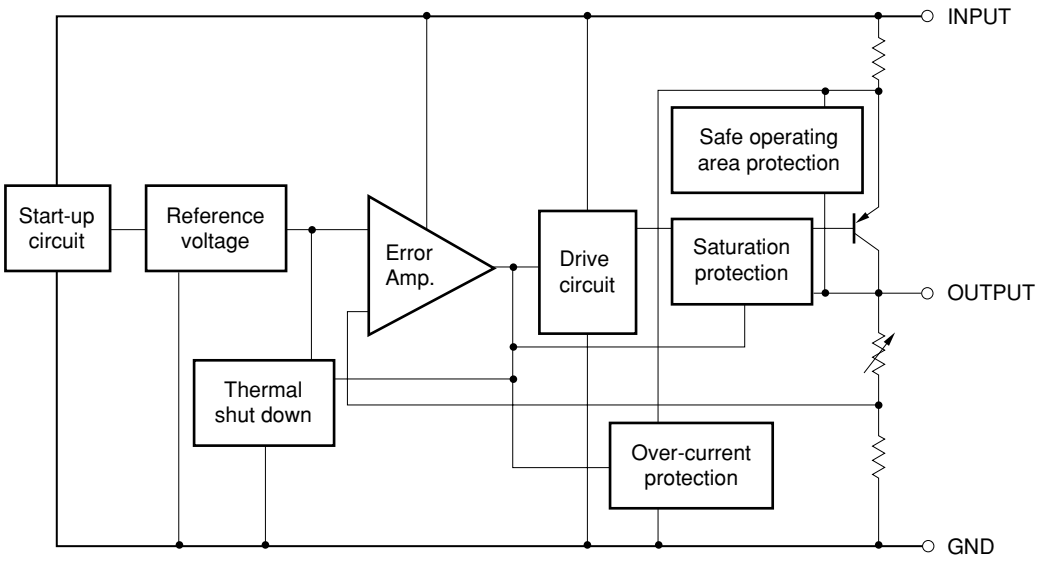
The mark <R> shows major revised points.
The revised points can be easily searched by copying an "<R>" in the PDF file and specifying it in the "Find what." field.

BLOCK DIAGRAM



<R> **ORDERING INFORMATION**

Part Number	Package	Output Voltage	Marking
μPC2903HF	Isolated TO-220 (MP-45G)	3.0 V	2903
μPC2903HB	SC-64 (MP-3)	3.0 V	2903
μPC2903T	SC-63 (MP-3Z)	3.0 V	2903
μPC2933HF	Isolated TO-220 (MP-45G)	3.3 V	2933
μPC2933HB	SC-64 (MP-3)	3.3 V	2933
μPC2933T	SC-63 (MP-3Z)	3.3 V	2933
μPC2905HF	Isolated TO-220 (MP-45G)	5.0 V	2905
μPC2905HB	SC-64 (MP-3)	5.0 V	2905
μPC2905T	SC-63 (MP-3Z)	5.0 V	2905
μPC2906HF	Isolated TO-220 (MP-45G)	6.0 V	2906
μPC2906HB	SC-64 (MP-3)	6.0 V	2906
μPC2906T	SC-63 (MP-3Z)	6.0 V	2906
μPC2907HF	Isolated TO-220 (MP-45G)	7.0 V	2907
μPC2907HB	SC-64 (MP-3)	7.0 V	2907
μPC2907T	SC-63 (MP-3Z)	7.0 V	2907
μPC2908HF	Isolated TO-220 (MP-45G)	8.0 V	2908
μPC2908HB	SC-64 (MP-3)	8.0 V	2908
μPC2908T	SC-63 (MP-3Z)	8.0 V	2908
μPC2909HF	Isolated TO-220 (MP-45G)	9.0 V	2909
μPC2909HB	SC-64 (MP-3)	9.0 V	2909
μPC2909T	SC-63 (MP-3Z)	9.0 V	2909
μPC2910HF	Isolated TO-220 (MP-45G)	10.0 V	2910
μPC2910HB	SC-64 (MP-3)	10.0 V	2910
μPC2910T	SC-63 (MP-3Z)	10.0 V	2910
μPC2912HF	Isolated TO-220 (MP-45G)	12.0 V	2912
μPC2912HB	SC-64 (MP-3)	12.0 V	2912
μPC2912T	SC-63 (MP-3Z)	12.0 V	2912

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	Packege Type
μPC29xxHF	Isolated TO-220 (MP-45G)	• Packed in envelop
μPC29xxHF-AZ Note2	Isolated TO-220 (MP-45G)	• Packed in envelop
μPC29xxHB	SC-64 (MP-3)	• Packed in envelop
μPC29xxHB-AZ Note2	SC-64 (MP-3)	• Packed in envelop
μPC29xxHB-AY Note3	SC-64 (MP-3)	• Packed in envelop
μPC29xxT-E1	SC-63 (MP-3Z)	• 16 mm wide embossed taping • Pin 1 on draw-out side • 2000 pcs/reel
μPC29xxT-E1-AZ Note2	SC-63 (MP-3Z)	• 16 mm wide embossed taping • Pin 1 on draw-out side • 2000 pcs/reel
μPC29xxT-E1-AY Note3	SC-63 (MP-3Z)	• 16 mm wide embossed taping • Pin 1 on draw-out side • 2000 pcs/reel
μPC29xxT-E2	SC-63 (MP-3Z)	• 16 mm wide embossed taping • Pin 1 at take-up side • 2000 pcs/reel
μPC29xxT-E2-AZ Note2	SC-63 (MP-3Z)	• 16 mm wide embossed taping • Pin 1 at take-up side • 2000 pcs/reel
μPC29xxT-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.)

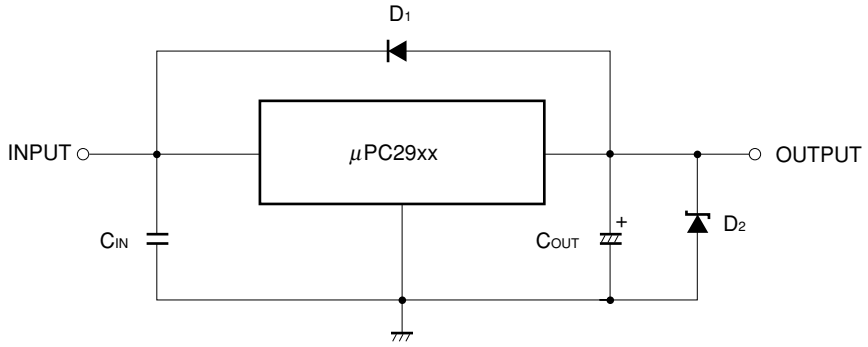
ABSOLUTE MAXIMUM RATINGS (T_A = 25°C, Unless otherwise specified.)

Parameter	Symbol	Rating		Unit
		μPC29xxHF	μPC29xxHB, μPC29xxT	
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 OPERATING CONDITIONS

Parameter	Symbol	Type Number	MIN.	TYP.	MAX.	Unit
Input Voltage	V_{IN}	μPC2903	4.0		16	V
		μPC2933	4.3		16	
		μPC2905	6		16	
		μPC2906	7		16	
		μPC2907	8		16	
		μPC2908	9		18	
		μPC2909	10		18	
		μPC2910	11		18	
		μPC2912	13		18	
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

μPC2903 (T_J = 25°C, V_{IN} = 5 V, I_O = 500 mA, C_{IN} = 0.22 μF, C_{OUT} = 47 μF, unless otherwise specified.)

Parameters	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Output Voltage	V_O		2.88	3.0	3.12	V
		0°C ≤ T_J ≤ 125°C, 4.0 V ≤ V_{IN} ≤ 16 V, 0 A ≤ I_O ≤ 500 mA	2.85		3.15	
		0°C ≤ T_J ≤ 125°C, 0 A ≤ I_O ≤ 1 A				
Line Regulation	REG_{IN}	4.0 V ≤ V_{IN} ≤ 16 V		11	30	mV
Load Regulation	REG_L	0 A ≤ I_O ≤ 1 A		9	30	mV
Quiescent Current	I_{BIAS}	I_O = 0 A		1.9	4.0	mA
		I_O = 1 A		23	60	
Startup Quiescent Current	$I_{BIAS\ (s)}$	V_{IN} = 2.95 V, I_O = 0 A		12	30	mA
		V_{IN} = 2.95 V, I_O = 1 A			80	
Quiescent Current Change	ΔI_{BIAS}	0°C ≤ T_J ≤ 125°C, 4.0 V ≤ V_{IN} ≤ 16 V		3.2	20	mA
Output Noise Voltage	V_n	10 Hz ≤ f ≤ 100 kHz		52		$\mu V_{r.m.s.}$
Ripple Rejection	R·R	f = 120 Hz, 4.0 V ≤ V_{IN} ≤ 16 V	48	63		dB
Dropout Voltage	V_{DIF}	0°C ≤ T_J ≤ 125°C, I_O = 1 A		0.7	1.0	V
Short Circuit Current	$I_{O\ short}$	V_{IN} = 4.5 V	1.2	1.7	3.0	A
		V_{IN} = 16 V		1.2		
Peak Output Current	$I_{O\ peak}$	V_{IN} = 4.5 V	1.0	1.5	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		–0.5		mV/°C

μPC2933 (T_J = 25°C, V_{IN} = 5 V, I_O = 500 mA, C_{IN} = 0.22 μF, C_{OUT} = 47 μF, unless otherwise specified.)

Parameters	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Output Voltage	V_O		3.17	3.3	3.43	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	4.0	mA
		I_O = 1 A		30	60	
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			80	
Quiescent Current Change	ΔI_{BIAS}	0°C ≤ T_J ≤ 125°C, 4.3 V ≤ V_{IN} ≤ 16 V		3.0	20	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	$I_{O\ short}$	V_{IN} = 4.5 V	1.2	1.6	3.0	A
		V_{IN} = 16 V		1.2		
Peak Output Current	$I_{O\ peak}$	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

μPC2905 (T_J = 25°C, V_{IN} = 8 V, I_O = 500 mA, C_{IN} = 0.22 μF, C_{OUT} = 47 μF, unless otherwise specified.)

Parameters	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Output Voltage	V_O		4.8	5.0	5.2	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	4.0	mA
		I_O = 1 A		30	60	
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			80	
Quiescent Current Change	ΔI_{BIAS}	0°C ≤ T_J ≤ 125°C, 6 V ≤ V_{IN} ≤ 16 V		2.9	20	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	$I_{O\ short}$	V_{IN} = 6.5 V	1.15	1.8	3.0	A
		V_{IN} = 16 V		1.1		
Peak Output Current	$I_{O\ peak}$	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

μPC2906 (T_J = 25°C, V_{IN} = 9 V, I_O = 500 mA, C_{IN} = 0.22 μF, C_{OUT} = 47 μF, unless otherwise specified.)

Parameters	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Output Voltage	V_O		5.76	6.0	6.24	V
		0°C ≤ T_J ≤ 125°C, 7 V ≤ V_{IN} ≤ 16 V, 0 A ≤ I_O ≤ 500 mA	5.70		6.30	
		0°C ≤ T_J ≤ 125°C, 0 A ≤ I_O ≤ 1 A				
Line Regulation	REG_{IN}	7 V ≤ V_{IN} ≤ 16 V		25	60	mV
Load Regulation	REG_L	0 A ≤ I_O ≤ 1 A		29	60	mV
Quiescent Current	I_{BIAS}	I_O = 0 A		2.0	4.0	mA
		I_O = 1 A		23	60	
Startup Quiescent Current	$I_{BIAS\ (s)}$	V_{IN} = 5.5 V, I_O = 0 A		10	30	mA
		V_{IN} = 5.5 V, I_O = 1 A			80	
Quiescent Current Change	ΔI_{BIAS}	0°C ≤ T_J ≤ 125°C, 7 V ≤ V_{IN} ≤ 16 V		2.2	20	mA
Output Noise Voltage	V_n	10 Hz ≤ f ≤ 100 kHz		108		$\mu V_{r.m.s.}$
Ripple Rejection	R·R	f = 120 Hz, 7 V ≤ V_{IN} ≤ 16 V	44	60		dB
Dropout Voltage	V_{DIF}	0°C ≤ T_J ≤ 125°C, I_O = 1 A		0.7	1.0	V
Short Circuit Current	$I_{O\ short}$	V_{IN} = 7.5 V		1.8		A
		V_{IN} = 16 V		1.1		
Peak Output Current	$I_{O\ peak}$	V_{IN} = 7.5 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

μPC2907 (T_J = 25°C, V_{IN} = 10 V, I_O = 500 mA, C_{IN} = 0.22 μF, C_{OUT} = 47 μF, unless otherwise specified.)

Parameters	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Output Voltage	V_O		6.72	7.0	7.28	V
		0°C ≤ T_J ≤ 125°C, 8 V ≤ V_{IN} ≤ 16 V, 0 A ≤ I_O ≤ 500 mA	6.65		7.35	
		0°C ≤ T_J ≤ 125°C, 0 A ≤ I_O ≤ 1 A				
Line Regulation	REG_{IN}	8 V ≤ V_{IN} ≤ 16 V		27	70	mV
Load Regulation	REG_L	0 A ≤ I_O ≤ 1 A		30	70	mV
Quiescent Current	I_{BIAS}	I_O = 0 A		2.0	4.0	mA
		I_O = 1 A		24	60	
Startup Quiescent Current	$I_{BIAS\ (s)}$	V_{IN} = 6.5 V, I_O = 0 A		10	30	mA
		V_{IN} = 6.5 V, I_O = 1 A			80	
Quiescent Current Change	ΔI_{BIAS}	0°C ≤ T_J ≤ 125°C, 8 V ≤ V_{IN} ≤ 16 V		2.3	20	mA
Output Noise Voltage	V_n	10 Hz ≤ f ≤ 100 kHz		126		$\mu V_{r.m.s.}$
Ripple Rejection	R·R	f = 120 Hz, 8 V ≤ V_{IN} ≤ 16 V	43	59		dB
Dropout Voltage	V_{DIF}	0°C ≤ T_J ≤ 125°C, I_O = 1 A		0.7	1.0	V
Short Circuit Current	$I_{O\ short}$	V_{IN} = 8.5 V		1.8		A
		V_{IN} = 16 V		1.1		
Peak Output Current	$I_{O\ peak}$	V_{IN} = 8.5 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

μPC2908 (T_J = 25°C, V_{IN} = 11 V, I_O = 500 mA, C_{IN} = 0.22 μF, C_{OUT} = 47 μF, unless otherwise specified.)

Parameters	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Output Voltage	V_O		7.68	8.0	8.32	V
		0°C ≤ T_J ≤ 125°C, 9 V ≤ V_{IN} ≤ 18 V, 0 A ≤ I_O ≤ 500 mA	7.6		8.4	
		0°C ≤ T_J ≤ 125°C, 0 A ≤ I_O ≤ 1 A				
Line Regulation	REG_{IN}	9 V ≤ V_{IN} ≤ 18 V		31	80	mV
Load Regulation	REG_L	0 A ≤ I_O ≤ 1 A		30	80	mV
Quiescent Current	I_{BIAS}	I_O = 0 A		1.9	4.0	mA
		I_O = 1 A		25	60	
Startup Quiescent Current	$I_{BIAS\ (s)}$	V_{IN} = 7.5 V, I_O = 0 A		10	30	mA
		V_{IN} = 7.5 V, I_O = 1 A			80	
Quiescent Current Change	ΔI_{BIAS}	0°C ≤ T_J ≤ 125°C, 9 V ≤ V_{IN} ≤ 18 V		2.4	20	mA
Output Noise Voltage	V_n	10 Hz ≤ f ≤ 100 kHz		145		$\mu V_{r.m.s.}$
Ripple Rejection	R·R	f = 120 Hz, 9 V ≤ V_{IN} ≤ 18 V	42	58		dB
Dropout Voltage	V_{DIF}	0°C ≤ T_J ≤ 125°C, I_O = 1 A		0.7	1.0	V
Short Circuit Current	$I_{O\ short}$	V_{IN} = 9.5 V		1.9		A
		V_{IN} = 18 V		1.0		
Peak Output Current	$I_{O\ peak}$	V_{IN} = 9.5 V	1.1	1.5	3.0	A
		V_{IN} = 18 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

μPC2909 (T_J = 25°C, V_{IN} = 12 V, I_O = 500 mA, C_{IN} = 0.22 μF, C_{OUT} = 47 μF, unless otherwise specified.)

Parameters	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Output Voltage	V_O		8.64	9.0	9.36	V
		0°C ≤ T_J ≤ 125°C, 10 V ≤ V_{IN} ≤ 18 V, 0 A ≤ I_O ≤ 500 mA	8.55		9.45	
		0°C ≤ T_J ≤ 125°C, 0 A ≤ I_O ≤ 1 A				
Line Regulation	REG_{IN}	10 V ≤ V_{IN} ≤ 18 V		31	90	mV
Load Regulation	REG_L	0 A ≤ I_O ≤ 1 A		32	90	mV
Quiescent Current	I_{BIAS}	I_O = 0 A		1.9	4.0	mA
		I_O = 1 A		27	60	
Startup Quiescent Current	$I_{BIAS\ (s)}$	V_{IN} = 8.5 V, I_O = 0 A		11	30	mA
		V_{IN} = 8.5 V, I_O = 1 A			80	
Quiescent Current Change	ΔI_{BIAS}	0°C ≤ T_J ≤ 125°C, 10 V ≤ V_{IN} ≤ 18 V		3.0	20	mA
Output Noise Voltage	V_n	10 Hz ≤ f ≤ 100 kHz		155		$\mu V_{r.m.s.}$
Ripple Rejection	R·R	f = 120 Hz, 10 V ≤ V_{IN} ≤ 18 V	41	58		dB
Dropout Voltage	V_{DIF}	0°C ≤ T_J ≤ 125°C, I_O = 1 A		0.7	1.0	V
Short Circuit Current	$I_{O\ short}$	V_{IN} = 10.5 V		1.9		A
		V_{IN} = 18 V		1.0		
Peak Output Current	$I_{O\ peak}$	V_{IN} = 10.5 V	1.1	1.5	3.0	A
		V_{IN} = 18 V	1.4	2.0	3.0	
Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	0°C ≤ T_J ≤ 125°C, I_O = 5 mA		1.0		mV/°C

μPC2910 (T_J = 25°C, V_{IN} = 13 V, I_O = 500 mA, C_{IN} = 0.22 μF, C_{OUT} = 47 μF, unless otherwise specified.)

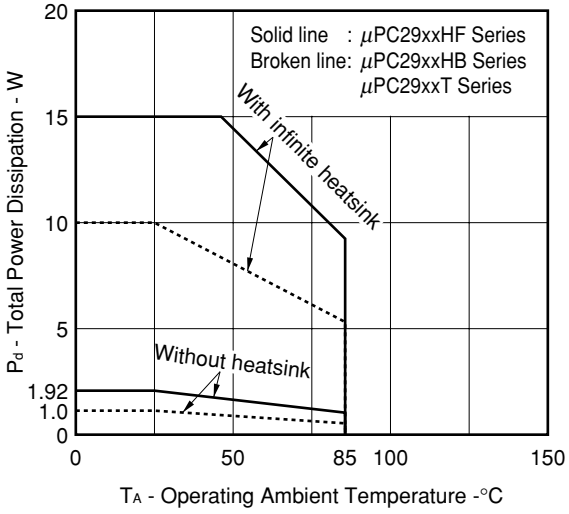
Parameters	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Output Voltage	V_O		9.6	10.0	10.4	V
		0°C ≤ T_J ≤ 125°C, 11 V ≤ V_{IN} ≤ 18 V, 0 A ≤ I_O ≤ 500 mA	9.5		10.5	
		0°C ≤ T_J ≤ 125°C, 0 A ≤ I_O ≤ 1 A				
Line Regulation	REG_{IN}	11 V ≤ V_{IN} ≤ 18 V		35	100	mV
Load Regulation	REG_L	0 A ≤ I_O ≤ 1 A		33	100	mV
Quiescent Current	I_{BIAS}	I_O = 0 A		2.0	4.0	mA
		I_O = 1 A		25	60	
Startup Quiescent Current	$I_{BIAS\ (s)}$	V_{IN} = 9.5 V, I_O = 0 A		10	30	mA
		V_{IN} = 9.5 V, I_O = 1 A			80	
Quiescent Current Change	ΔI_{BIAS}	0°C ≤ T_J ≤ 125°C, 11 V ≤ V_{IN} ≤ 18 V		1.9	20	mA
Output Noise Voltage	V_n	10 Hz ≤ f ≤ 100 kHz		180		$\mu V_{r.m.s.}$
Ripple Rejection	R·R	f = 120 Hz, 11 V ≤ V_{IN} ≤ 18 V	40	56		dB
Dropout Voltage	V_{DIF}	0°C ≤ T_J ≤ 125°C, I_O = 1 A		0.7	1.0	V
Short Circuit Current	$I_{O\ short}$	V_{IN} = 11.5 V		1.7		A
		V_{IN} = 18 V		1.0		
Peak Output Current	$I_{O\ peak}$	V_{IN} = 11.5 V	1.1	1.6	3.0	A
		V_{IN} = 18 V	1.4	2.0	3.0	
Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	0°C ≤ T_J ≤ 125°C, I_O = 5 mA		2.1		mV/°C

μPC2912 (T_J = 25°C, V_{IN} = 15 V, I_O = 500 mA, C_{IN} = 0.22 μF, C_{OUT} = 47 μF, unless otherwise specified.)

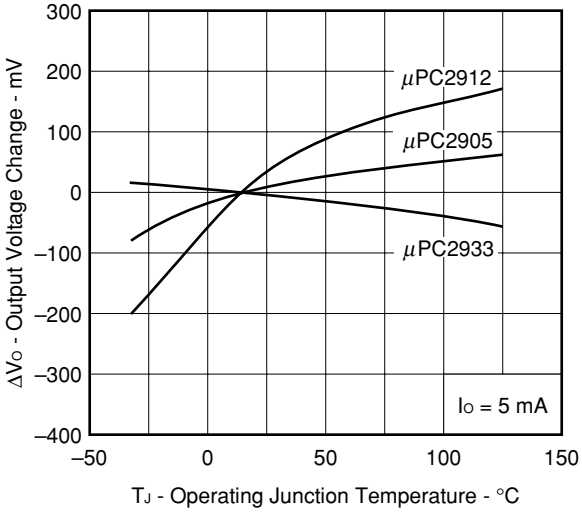
Parameters	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Output Voltage	V_O		11.52	12	12.48	V
		0°C ≤ T_J ≤ 125°C, 13 V ≤ V_{IN} ≤ 18 V, 0 A ≤ I_O ≤ 500 mA	11.4		12.6	
		0°C ≤ T_J ≤ 125°C, 0 A ≤ I_O ≤ 1 A				
Line Regulation	REG_{IN}	13 V ≤ V_{IN} ≤ 18 V		38	120	mV
Load Regulation	REG_L	0 A ≤ I_O ≤ 1 A		35	120	mV
Quiescent Current	I_{BIAS}	I_O = 0 A		2.1	4.0	mA
		I_O = 1 A		26	60	
Startup Quiescent Current	$I_{BIAS\ (s)}$	V_{IN} = 11.5 V, I_O = 0 A		10	30	mA
		V_{IN} = 11.5 V, I_O = 1 A			80	
Quiescent Current Change	ΔI_{BIAS}	0°C ≤ T_J ≤ 125°C, 13 V ≤ V_{IN} ≤ 18 V		1.5	20	mA
Output Noise Voltage	V_n	10 Hz ≤ f ≤ 100 kHz		210		$\mu V_{r.m.s.}$
Ripple Rejection	R·R	f = 120 Hz, 13 V ≤ V_{IN} ≤ 18 V	40	52		dB
Dropout Voltage	V_{DIF}	0°C ≤ T_J ≤ 125°C, I_O = 1 A		0.7	1.0	V
Short Circuit Current	$I_{O\ short}$	V_{IN} = 14 V		1.7		A
		V_{IN} = 18 V		1.0		
Peak Output Current	$I_{O\ peak}$	V_{IN} = 14 V	1.1	1.6	3.0	A
		V_{IN} = 18 V	1.4	2.0	3.0	
Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	0°C ≤ T_J ≤ 125°C, I_O = 5 mA		2.1		mV/°C

TYPICAL CHARACTERISTICS

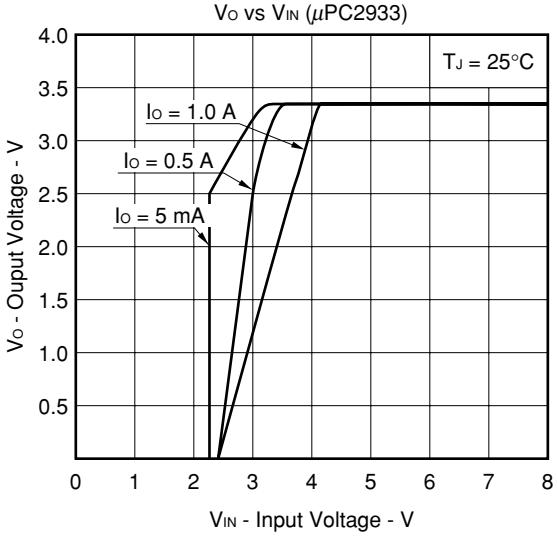
P_d vs T_A



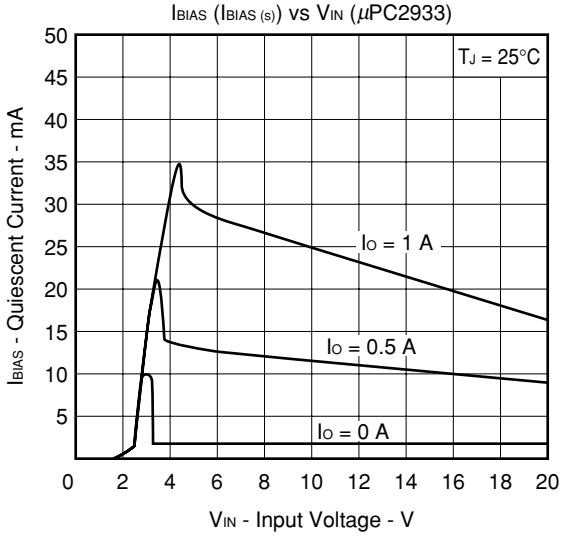
ΔV_O vs T_J



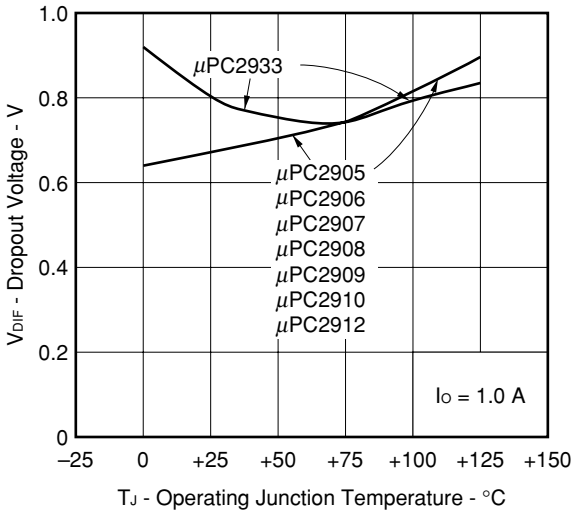
V_O vs V_{IN} (μPC2933)



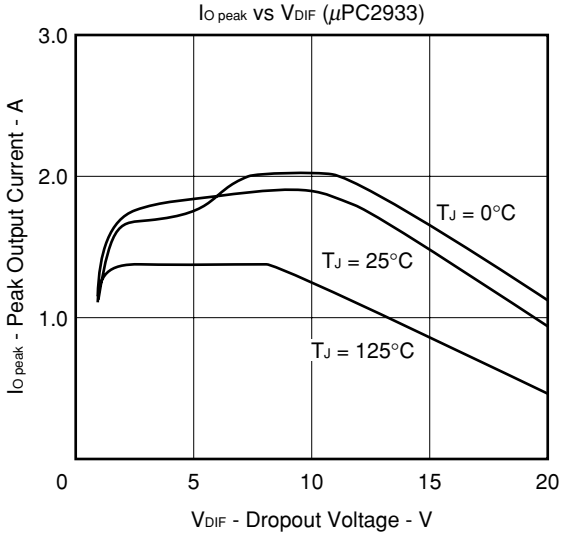
I_{BIAS} ($I_{BIAS\ (S)}$) vs V_{IN} (μPC2933)

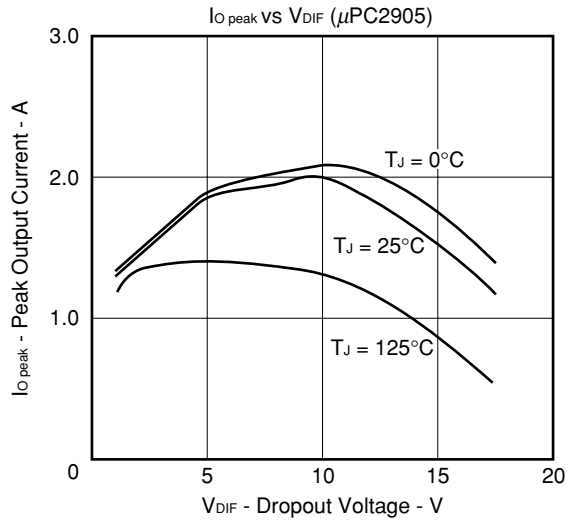


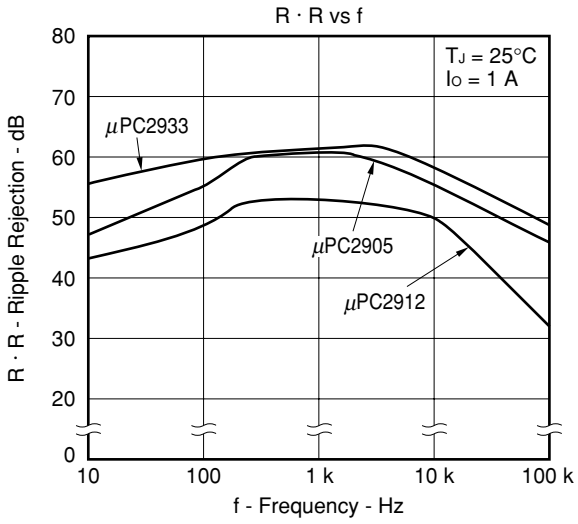
V_{DIF} vs T_J

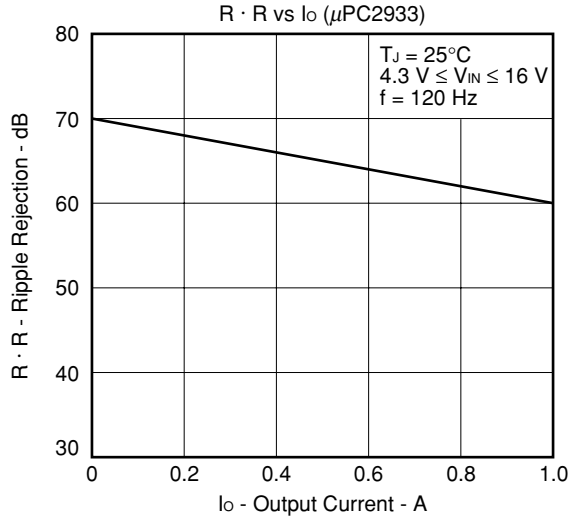


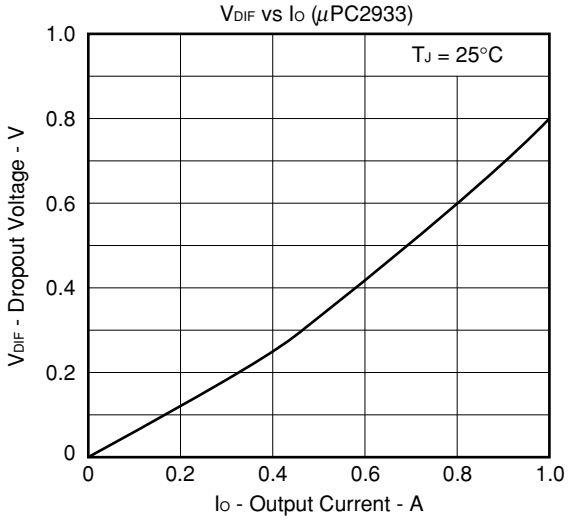
$I_{O\ peak}$ vs V_{DIF} (μPC2933)

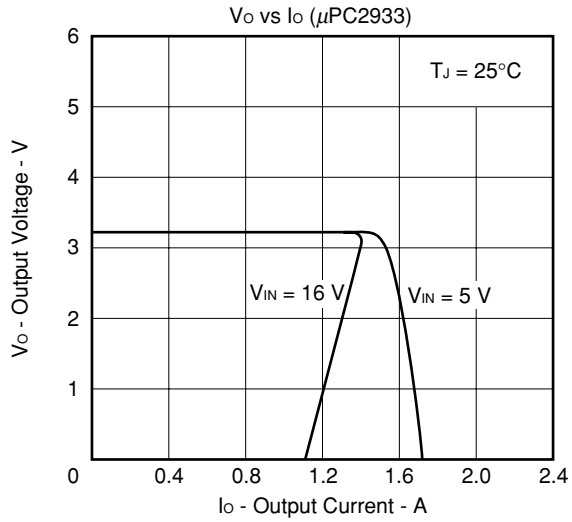



$I_{O\ peak}$ vs V_{DIF} (μPC2905)
$I_{O\ peak}$ - Peak Output Current - A
V_{DIF} - Dropout Voltage - V
T_J = 0°C
T_J = 25°C
T_J = 125°C
3.0
2.0
1.0
0
5
10
15
20


R · R vs f
R · R - Ripple Rejection - dB
f - Frequency - Hz
T_J = 25°C
I_O = 1 A
μPC2933
μPC2905
μPC2912
80
70
60
50
40
30
20
0
10
100
1 k
10 k
100 k


R · R vs I_O (μPC2933)
R · R - Ripple Rejection - dB
I_O - Output Current - A
T_J = 25°C
4.3 V ≤ V_{IN} ≤ 16 V
f = 120 Hz
80
70
60
50
40
30
0
0.2
0.4
0.6
0.8
1.0

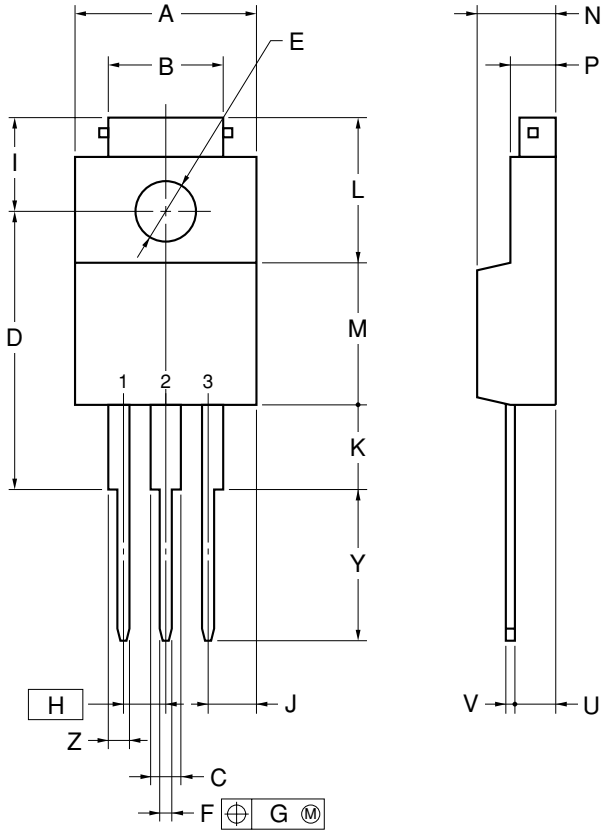

V_{DIF} vs I_O (μPC2933)
V_{DIF} - Dropout Voltage - V
I_O - Output Current - A
T_J = 25°C
1.0
0.8
0.6
0.4
0.2
0
0.2
0.4
0.6
0.8
1.0


V_O vs I_O (μPC2933)
V_O - Output Voltage - V
I_O - Output Current - A
T_J = 25°C
V_{IN} = 16 V
V_{IN} = 5 V
6
5
4
3
2
1
0
0.4
0.8
1.2
1.6
2.0
2.4

PACKAGE DRAWINGS

μPC29xxHF Series

3PIN PLASTIC SIP (MP-45G)



NOTE

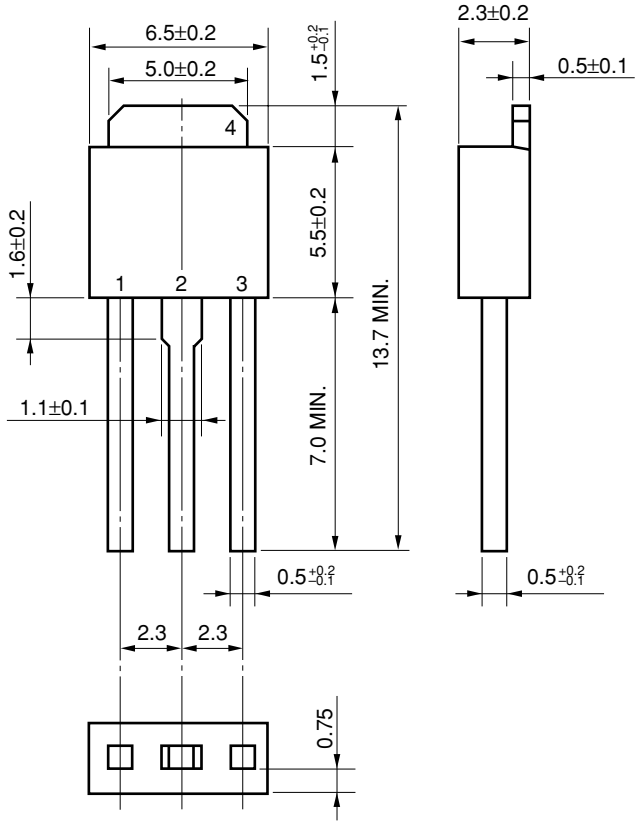
Each lead centerline is located within 0.25 mm of its true position (T.P.) at maximum material condition.

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

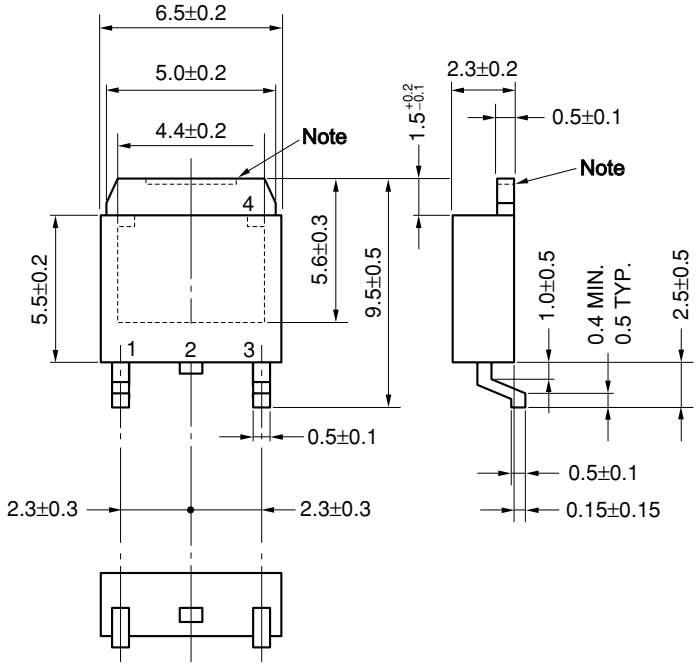
μPC29xxHB Series

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



μPC29xxT Series

<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**

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

For more details, refer to the **Semiconductor Device Mount Manual (http://www.necel.com/pkg/en/mount/index.html)**

Surface mount devices

PC29xxT 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
VPS	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

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 sith low chlorine content (chlorine 0.2 Wt% or below) is recommended.

PC29xxT-AZ Series [Note1], PC29xxT-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 sith low chlorine content (chlorine 0.2 Wt% or below) is recommended.

Through-hole devices

μPC29xxHF Series, μPC29xxHF-AZ Series Note1: Isolated TO-220 (MP-45G)
μPC29xxHB Series, μPC29xxHB-AZ Series Note1, μPC29xxHB-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.

CAUTION ON USE

When using the μPC29xx series at the input voltage which is lower than in the recommended operating condition, the high quiescent current flows through devices because the transistor of the output paragraph is saturated (Refer to "**I_{BIAS} ($I_{BIAS(S)}$) vs V_{IN} curves in TYPICAL CHARACTERISTICS**"). The μPC29xx series have saturation protection circuits, but they sometimes need about 80 mA current. Therefore the power supply on the input needs the enough current capacity to pass this quiescent current when the devices startup.

<R> 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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