NEC

BIPOLAR ANALOG INTEGRATED CIRCUIT

μPC29Mxx Series

THREE TERMINAL LOW DROPOUT VOLTAGE REGULATOR

The μPC29Mxx series of low dropout voltage three terminal positive regulators is constructed with PNP output transistor. The μPC29Mxx series feature the ability to source 0.5 A of output current with a low dropout voltage of typically 0.5 V.

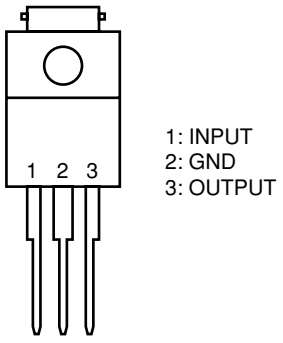
The power dissipation of the μPC29Mxx series can be drastically reduced compared with the conventional three terminal positive voltage regulators that is constructed with NPN output transistor. Also, this series corresponds to the low voltage output (3.0 V, 3.3 V) which is not in the conventional low dropout regulators (μPC24MxxA series).

FEATURES

- Output current in excess of 0.5 A
- Low dropout voltage
  V_{DIF} = 0.5 V TYP. (I_O = 0.5 A)
- On-chip over-current and thermal protection circuit
- On-chip output transistor safe operating area protection circuit

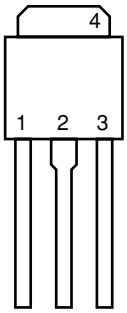
<R> **PIN CONFIGURATIONS (Marking Side)**

μPC29MxxHF Series: Isolated TO-220 (MP-45G)



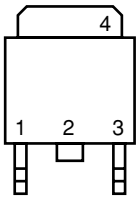
1: INPUT
2: GND
3: OUTPUT

μPC29MxxHB Series: SC-64 (MP-3)



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

μPC29MxxT Series: SC-63 (MP-3Z)



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

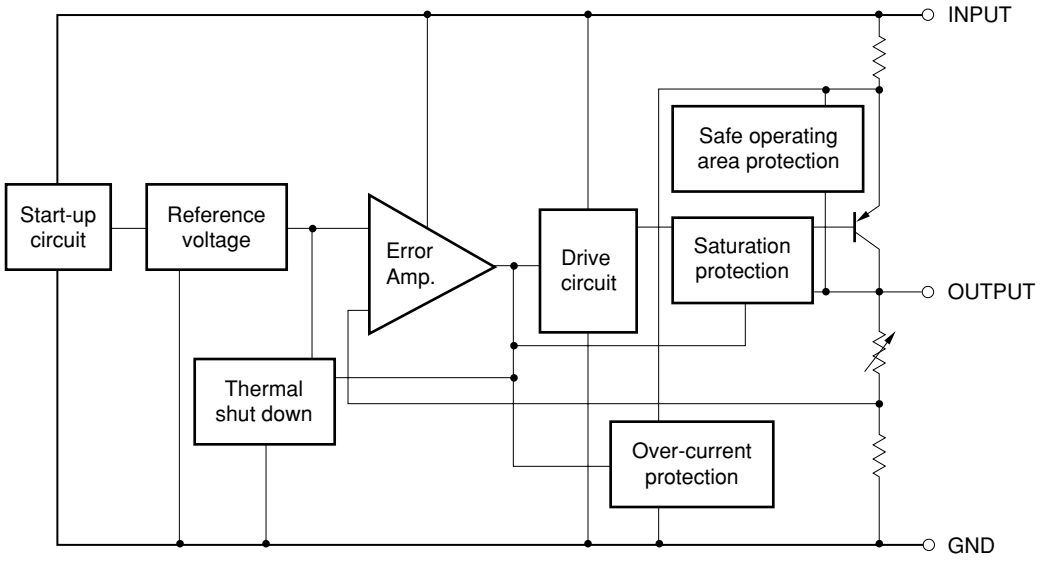
Notes 1. No.2 pin and No.4 fin are common GND.

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

Document No. G10027EJ4V0DS00 (4th edition)
Date Published September 2007 N
Printed in Japan

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
μPC29M03HF	Isolated TO-220 (MP-45G)	3.0 V	29M03
μPC29M03HB	SC-64 (MP-3)	3.0 V	29M03
μPC29M03T	SC-63 (MP-3Z)	3.0 V	29M03
μPC29M33HF	Isolated TO-220 (MP-45G)	3.3 V	29M33
μPC29M33HB	SC-64 (MP-3)	3.3 V	29M33
μPC29M33T	SC-63 (MP-3Z)	3.3 V	29M33
μPC29M05HF	Isolated TO-220 (MP-45G)	5.0 V	29M05
μPC29M05HB	SC-64 (MP-3)	5.0 V	29M05
μPC29M05T	SC-63 (MP-3Z)	5.0 V	29M05
μPC29M06HF	Isolated TO-220 (MP-45G)	6.0 V	29M06
μPC29M06HB	SC-64 (MP-3)	6.0 V	29M06
μPC29M06T	SC-63 (MP-3Z)	6.0 V	29M06
μPC29M07HF	Isolated TO-220 (MP-45G)	7.0 V	29M07
μPC29M07HB	SC-64 (MP-3)	7.0 V	29M07
μPC29M07T	SC-63 (MP-3Z)	7.0 V	29M07
μPC29M08HF	Isolated TO-220 (MP-45G)	8.0 V	29M08
μPC29M08HB	SC-64 (MP-3)	8.0 V	29M08
μPC29M08T	SC-63 (MP-3Z)	8.0 V	29M08
μPC29M09HF	Isolated TO-220 (MP-45G)	9.0 V	29M09
μPC29M09HB	SC-64 (MP-3)	9.0 V	29M09
μPC29M09T	SC-63 (MP-3Z)	9.0 V	29M09
μPC29M10HF	Isolated TO-220 (MP-45G)	10.0 V	29M10
μPC29M10HB	SC-64 (MP-3)	10.0 V	29M10
μPC29M10T	SC-63 (MP-3Z)	10.0 V	29M10
μPC29M12HF	Isolated TO-220 (MP-45G)	12.0 V	29M12
μPC29M12HB	SC-64 (MP-3)	12.0 V	29M12
μPC29M12T	SC-63 (MP-3Z)	12.0 V	29M12

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
μPC29MxxHF	Isolated TO-220 (MP-45G)	• Packed in envelop
μPC29MxxHF-AZ Note2	Isolated TO-220 (MP-45G)	• Packed in envelop
μPC29MxxHB	SC-64 (MP-3)	• Packed in envelop
μPC29MxxHB-AZ Note2	SC-64 (MP-3)	• Packed in envelop
μPC29MxxHB-AY Note3	SC-64 (MP-3)	• Packed in envelop
μPC29MxxT-E1	SC-63 (MP-3Z)	• 16 mm wide embossed taping • Pin 1 on draw-out side • 2000 pcs/reel
μPC29MxxT-E1-AZ Note2	SC-63 (MP-3Z)	• 16 mm wide embossed taping • Pin 1 on draw-out side • 2000 pcs/reel
μPC29MxxT-E1-AY Note3	SC-63 (MP-3Z)	• 16 mm wide embossed taping • Pin 1 on draw-out side • 2000 pcs/reel
μPC29MxxT-E2	SC-63 (MP-3Z)	• 16 mm wide embossed taping • Pin 1 at take-up side • 2000 pcs/reel
μPC29MxxT-E2-AZ Note2	SC-63 (MP-3Z)	• 16 mm wide embossed taping • Pin 1 at take-up side • 2000 pcs/reel
μPC29MxxT-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.)

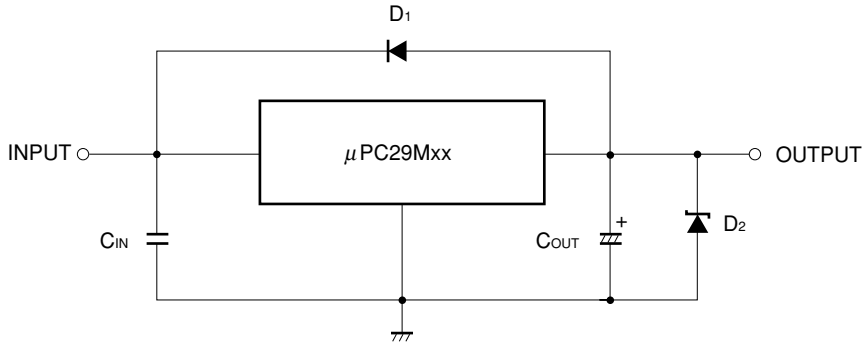
ABSOLUTE MAXIMUM RATINGS (T_A = 25°C, Unless otherwise specified.)

Parameter	Symbol	Rating		Unit
		μPC29MxxHF	μPC29MxxHB, μPC29MxxT	
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}	μPC29M03	4		16	V
		μPC29M33	4.3		16	
		μPC29M05	6		16	
		μPC29M06	7		16	
		μPC29M07	8		16	
		μPC29M08	9		18	
		μPC29M09	10		18	
		μPC29M10	11		18	
		μPC29M12	13		18	
Output Current	I_O	all	0		0.5	A
Operating Ambient Temperature	T_A	all	–30		+85	°C
Operating Junction Temperature	T_J	all	–30		+125	°C

ELECTRICAL CHARACTERISTICS

μPC29M03 (T_J = 25°C, V_{IN} = 5 V, I_O = 350 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 ≤ 350 mA	2.85		3.15	
		0°C ≤ T_J ≤ 125°C, 0 A ≤ I_O ≤ 0.5 A				
Line Regulation	REG_{IN}	4.0 V ≤ V_{IN} ≤ 16 V		7	30	mV
Load Regulation	REG_L	0 A ≤ I_O ≤ 0.5 A		8	30	mV
Quiescent Current	I_{BIAS}	I_O = 0 A		1.8	4.0	mA
		I_O = 0.5 A		17	30	
Startup Quiescent Current	$I_{BIAS\ (s)}$	V_{IN} = 2.95 V, I_O = 0 A		7	30	mA
		V_{IN} = 2.95 V, I_O = 0.5 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		51		$\mu V_{r.m.s.}$
Ripple Rejection	R·R	f = 120 Hz, 4.0 V ≤ V_{IN} ≤ 16 V	48	64		dB
Dropout Voltage	V_{DIF}	0°C ≤ T_J ≤ 125°C, I_O = 0.5 A		0.5	1.0	V
Short Circuit Current	$I_{O\ short}$	V_{IN} = 4.5 V	0.65	1.0	1.5	A
		V_{IN} = 16 V		0.6		
Peak Output Current	$I_{O\ peak}$	V_{IN} = 4.5 V	0.7	1.0	1.5	A
		V_{IN} = 16 V	0.6	0.9	1.5	
Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	0°C ≤ T_J ≤ 125°C, I_O = 5 mA		–0.3		mV/°C

μPC29M33 (T_J = 25°C, V_{IN} = 5 V, I_O = 350 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 ≤ 350 mA	3.14		3.46	
		0°C ≤ T_J ≤ 125°C, 0 A ≤ I_O ≤ 0.5 A				
Line Regulation	REG_{IN}	4.3 V ≤ V_{IN} ≤ 16 V		8	33	mV
Load Regulation	REG_L	0 A ≤ I_O ≤ 0.5 A		10	33	mV
Quiescent Current	I_{BIAS}	I_O = 0 A		1.8	4.0	mA
		I_O = 0.5 A		15	30	
Startup Quiescent Current	$I_{BIAS\ (s)}$	V_{IN} = 3.1 V, I_O = 0 A		9	30	mA
		V_{IN} = 3.1 V, I_O = 0.5 A			80	
Quiescent Current Change	ΔI_{BIAS}	0°C ≤ T_J ≤ 125°C, 4.3 V ≤ V_{IN} ≤ 16 V		2.9	20	mA
Output Noise Voltage	V_n	10 Hz ≤ f ≤ 100 kHz		56		$\mu V_{r.m.s.}$
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 = 0.5 A		0.5	1.0	V
Short Circuit Current	$I_{O\ short}$	V_{IN} = 4.5 V	0.7	1.1	1.5	A
		V_{IN} = 16 V		0.6		
Peak Output Current	$I_{O\ peak}$	V_{IN} = 4.5 V	0.7	1.2	1.5	A
		V_{IN} = 16 V	0.6	1.0	1.5	
Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	0°C ≤ T_J ≤ 125°C, I_O = 5 mA		–0.4		mV/°C

μPC29M05 (T_J = 25°C, V_{IN} = 8 V, I_O = 350 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 ≤ 350 mA	4.75		5.25	
		0°C ≤ T_J ≤ 125°C, 0 A ≤ I_O ≤ 0.5 A				
Line Regulation	REG_{IN}	6 V ≤ V_{IN} ≤ 16 V		26	50	mV
Load Regulation	REG_L	0 A ≤ I_O ≤ 0.5 A		17	50	mV
Quiescent Current	I_{BIAS}	I_O = 0 A		1.9	4.0	mA
		I_O = 0.5 A		16	30	
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 = 0.5 A			80	
Quiescent Current Change	ΔI_{BIAS}	0°C ≤ T_J ≤ 125°C, 6 V ≤ V_{IN} ≤ 16 V		2.4	20	mA
Output Noise Voltage	V_n	10 Hz ≤ f ≤ 100 kHz		87		$\mu V_{r.m.s.}$
Ripple Rejection	R·R	f = 120 Hz, 6 V ≤ V_{IN} ≤ 16 V	46	60		dB
Dropout Voltage	V_{DIF}	0°C ≤ T_J ≤ 125°C, I_O = 0.5 A		0.5	1.0	V
Short Circuit Current	$I_{O\ short}$	V_{IN} = 6.5 V	0.65	1.1	1.5	A
		V_{IN} = 16 V		0.6		
Peak Output Current	$I_{O\ peak}$	V_{IN} = 6.5 V	0.7	1.2	1.5	A
		V_{IN} = 16 V	0.6	1.1	1.5	
Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	0°C ≤ T_J ≤ 125°C, I_O = 5 mA		0.7		mV/°C

μPC29M06 (T_J = 25°C, V_{IN} = 9 V, I_O = 350 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 ≤ 350 mA	5.70		6.30	
		0°C ≤ T_J ≤ 125°C, 0 A ≤ I_O ≤ 0.5 A				
Line Regulation	REG_{IN}	7 V ≤ V_{IN} ≤ 16 V		30	60	mV
Load Regulation	REG_L	0 A ≤ I_O ≤ 0.5 A		30	60	mV
Quiescent Current	I_{BIAS}	I_O = 0 A		2.0	4.0	mA
		I_O = 0.5 A		16	30	
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 = 0.5 A			80	
Quiescent Current Change	ΔI_{BIAS}	0°C ≤ T_J ≤ 125°C, 7 V ≤ V_{IN} ≤ 16 V		2.5	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, 7 V ≤ V_{IN} ≤ 16 V	42	58		dB
Dropout Voltage	V_{DIF}	0°C ≤ T_J ≤ 125°C, I_O = 0.5 A		0.5	1.0	V
Short Circuit Current	$I_{O\ short}$	V_{IN} = 7.5 V	0.7	1.1	1.5	A
		V_{IN} = 16 V		0.6		
Peak Output Current	$I_{O\ peak}$	V_{IN} = 7.5 V	0.7	1.1	1.5	A
		V_{IN} = 16 V	0.6	1.1	1.5	
Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	0°C ≤ T_J ≤ 125°C, I_O = 5 mA		0.44		mV/°C

μPC29M07 (T_J = 25°C, V_{IN} = 10 V, I_O = 350 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 ≤ 350 mA	6.65		7.35	
		0°C ≤ T_J ≤ 125°C, 0 A ≤ I_O ≤ 0.5 A				
Line Regulation	REG_{IN}	8 V ≤ V_{IN} ≤ 16 V		35	70	mV
Load Regulation	REG_L	0 A ≤ I_O ≤ 0.5 A		35	70	mV
Quiescent Current	I_{BIAS}	I_O = 0 A		2.0	4.0	mA
		I_O = 0.5 A		16	30	
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 = 0.5 A			80	
Quiescent Current Change	ΔI_{BIAS}	0°C ≤ T_J ≤ 125°C, 8 V ≤ V_{IN} ≤ 16 V		2.6	20	mA
Output Noise Voltage	V_n	10 Hz ≤ f ≤ 100 kHz		147		$\mu V_{r.m.s.}$
Ripple Rejection	R·R	f = 120 Hz, 8 V ≤ V_{IN} ≤ 16 V	40	56		dB
Dropout Voltage	V_{DIF}	0°C ≤ T_J ≤ 125°C, I_O = 0.5 A		0.5	1.0	V
Short Circuit Current	$I_{O\ short}$	V_{IN} = 8.5 V	0.7	1.1	1.5	A
		V_{IN} = 16 V		0.6		
Peak Output Current	$I_{O\ peak}$	V_{IN} = 8.5 V	0.7	1.2	1.5	A
		V_{IN} = 16 V	0.6	1.1	1.5	
Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	0°C ≤ T_J ≤ 125°C, I_O = 5 mA		0.7		mV/°C

μPC29M08 (T_J = 25°C, V_{IN} = 11 V, I_O = 350 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 ≤ 350 mA	7.6		8.4	
		0°C ≤ T_J ≤ 125°C, 0 A ≤ I_O ≤ 0.5 A				
Line Regulation	REG_{IN}	9 V ≤ V_{IN} ≤ 18 V		40	80	mV
Load Regulation	REG_L	0 A ≤ I_O ≤ 0.5 A		40	80	mV
Quiescent Current	I_{BIAS}	I_O = 0 A		2.0	4.0	mA
		I_O = 0.5 A		15	30	
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 = 0.5 A			80	
Quiescent Current Change	ΔI_{BIAS}	0°C ≤ T_J ≤ 125°C, 9 V ≤ V_{IN} ≤ 18 V		3.0	20	mA
Output Noise Voltage	V_n	10 Hz ≤ f ≤ 100 kHz		150		$\mu V_{r.m.s.}$
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 = 0.5 A		0.5	1.0	V
Short Circuit Current	$I_{O\ short}$	V_{IN} = 9.5 V		1.0		A
		V_{IN} = 18 V		0.55		
Peak Output Current	$I_{O\ peak}$	V_{IN} = 9.5 V	0.7	1.2	1.5	A
		V_{IN} = 18 V	0.6	1.1	1.5	
Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	0°C ≤ T_J ≤ 125°C, I_O = 5 mA		0.7		mV/°C

μPC29M09 (T_J = 25°C, V_{IN} = 12 V, I_O = 350 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 ≤ 350 mA	8.55		9.45	
		0°C ≤ T_J ≤ 125°C, 0 A ≤ I_O ≤ 0.5 A				
Line Regulation	REG_{IN}	10 V ≤ V_{IN} ≤ 18 V		45	90	mV
Load Regulation	REG_L	0 A ≤ I_O ≤ 0.5 A		45	90	mV
Quiescent Current	I_{BIAS}	I_O = 0 A		2.0	4.0	mA
		I_O = 0.5 A		15	30	
Startup Quiescent Current	$I_{BIAS\ (s)}$	V_{IN} = 8.5 V, I_O = 0 A		10	30	mA
		V_{IN} = 8.5 V, I_O = 0.5 A			80	
Quiescent Current Change	ΔI_{BIAS}	0°C ≤ T_J ≤ 125°C, 10 V ≤ V_{IN} ≤ 18 V			20	mA
Output Noise Voltage	V_n	10 Hz ≤ f ≤ 100 kHz		170		$\mu V_{r.m.s.}$
Ripple Rejection	R·R	f = 120 Hz, 10 V ≤ V_{IN} ≤ 18 V	41	57		dB
Dropout Voltage	V_{DIF}	0°C ≤ T_J ≤ 125°C, I_O = 0.5 A		0.5	1.0	V
Short Circuit Current	$I_{O\ short}$	V_{IN} = 10.5 V		1.0		A
		V_{IN} = 18 V		0.55		
Peak Output Current	$I_{O\ peak}$	V_{IN} = 10.5 V	0.7	1.2	1.5	A
		V_{IN} = 18 V	0.6	1.1	1.5	
Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	0°C ≤ T_J ≤ 125°C, I_O = 5 mA		0.8		mV/°C

μPC29M10 (T_J = 25°C, V_{IN} = 13 V, I_O = 350 mA, C_{IN} = 0.22 μF, C_{OUT} = 47 μF, unless otherwise specified.)

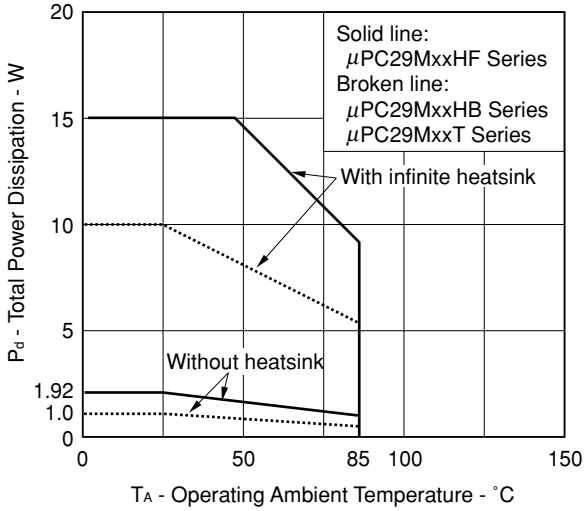
Parameters	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Output Voltage	V_O		9.6	10.0	10.4	V
		0°C ≤ T_J ≤ 125°C, 11 V ≤ V_{IN} ≤ 18 V, 0 A ≤ I_O ≤ 350 mA	9.5		10.5	
		0°C ≤ T_J ≤ 125°C, 0 A ≤ I_O ≤ 0.5 A				
Line Regulation	REG_{IN}	11 V ≤ V_{IN} ≤ 18 V		34	100	mV
Load Regulation	REG_L	0 A ≤ I_O ≤ 0.5 A		10	100	mV
Quiescent Current	I_{BIAS}	I_O = 0 A		2.1	4.0	mA
		I_O = 0.5 A		16	30	
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 = 0.5 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	53		dB
Dropout Voltage	V_{DIF}	0°C ≤ T_J ≤ 125°C, I_O = 0.5 A		0.5	1.0	V
Short Circuit Current	$I_{O\ short}$	V_{IN} = 11.5 V		0.9		A
		V_{IN} = 18 V		0.5		
Peak Output Current	$I_{O\ peak}$	V_{IN} = 11.5 V	0.7	1.2	1.5	A
		V_{IN} = 18 V	0.6	1.2	1.5	
Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	0°C ≤ T_J ≤ 125°C, I_O = 5 mA		0.9		mV/°C

μPC29M12 (T_J = 25°C, V_{IN} = 15 V, I_O = 350 mA, C_{IN} = 0.22 μF, C_{OUT} = 47 μF, unless otherwise specified.)

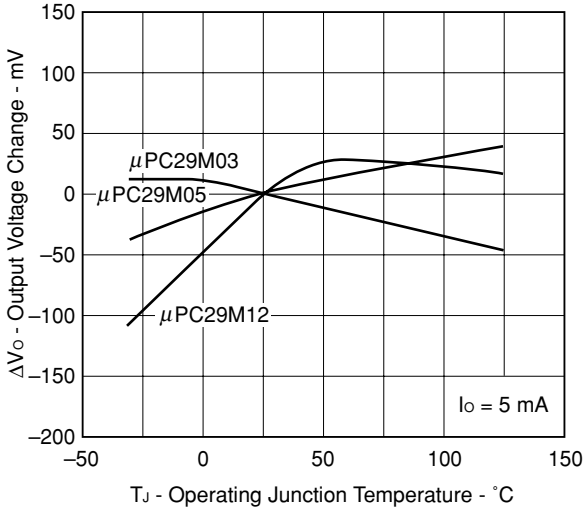
Parameters	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Output Voltage	V_O		11.52	12	12.48	V
		0°C ≤ T_J ≤ 125°C, 13 V ≤ V_{IN} ≤ 18 V, 0 A ≤ I_O ≤ 350 mA	11.4		12.6	
		0°C ≤ T_J ≤ 125°C, 0 A ≤ I_O ≤ 0.5 A				
Line Regulation	REG_{IN}	13 V ≤ V_{IN} ≤ 18 V		25	120	mV
Load Regulation	REG_L	0 A ≤ I_O ≤ 0.5 A		13	120	mV
Quiescent Current	I_{BIAS}	I_O = 0 A		2.1	4.0	mA
		I_O = 0.5 A		14	30	
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 = 0.5 A			80	
Quiescent Current Change	ΔI_{BIAS}	0°C ≤ T_J ≤ 125°C, 13 V ≤ V_{IN} ≤ 18 V		1.7	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	53		dB
Dropout Voltage	V_{DIF}	0°C ≤ T_J ≤ 125°C, I_O = 0.5 A		0.5	1.0	V
Short Circuit Current	$I_{O\ short}$	V_{IN} = 14 V		0.7		A
		V_{IN} = 18 V		0.5		
Peak Output Current	$I_{O\ peak}$	V_{IN} = 14 V	0.7	1.2	1.5	A
		V_{IN} = 18 V	0.6	1.1	1.5	
Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	0°C ≤ T_J ≤ 125°C, I_O = 5 mA		1.2		mV/°C

TYPICAL CHARACTERISTICS

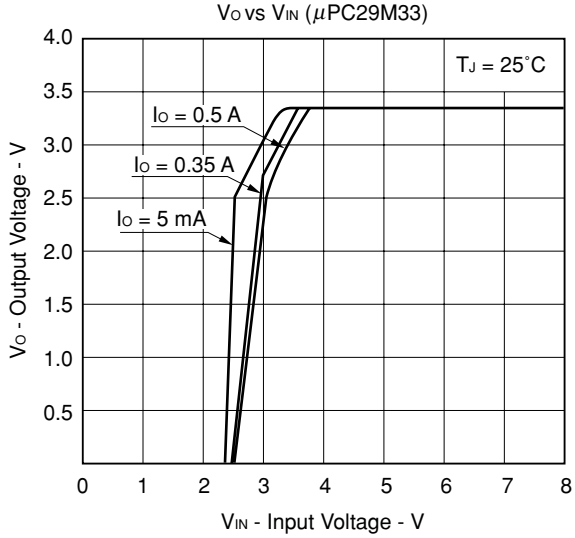
P_d vs T_A



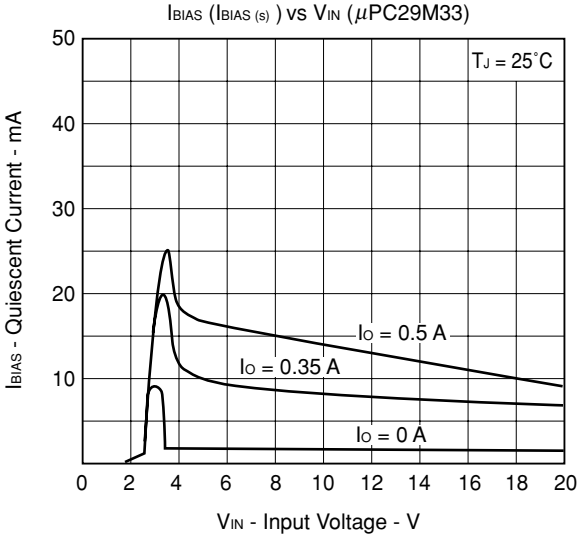
ΔV_O vs T_J



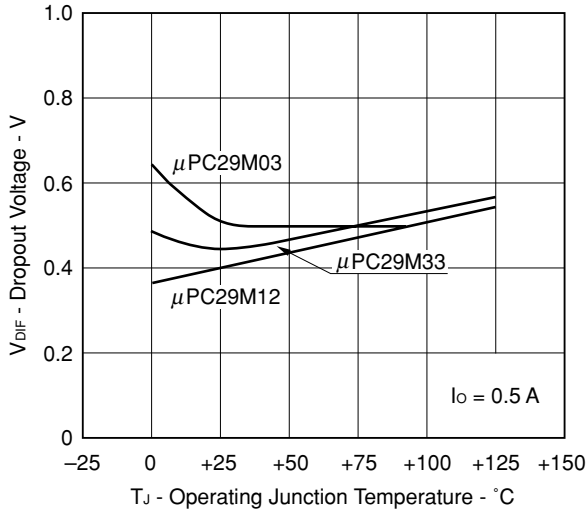
V_O vs V_{IN} (μPC29M33)



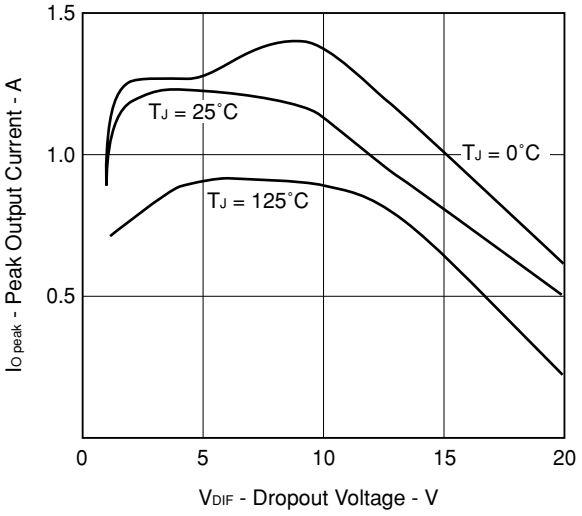
I_{BIAS} ($I_{BIAS\ (S)}$) vs V_{IN} (μPC29M33)



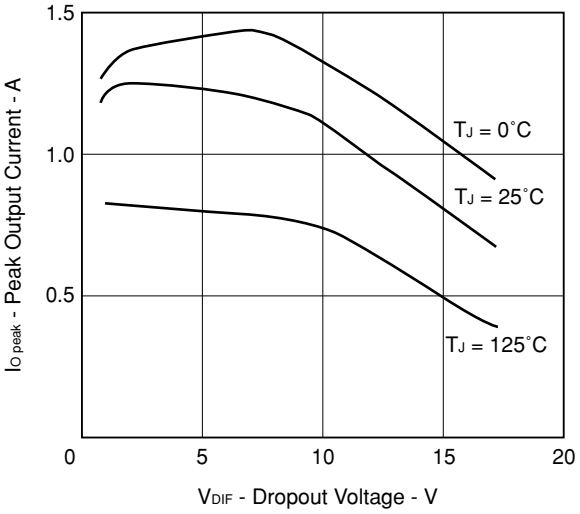
V_{DIF} vs T_J



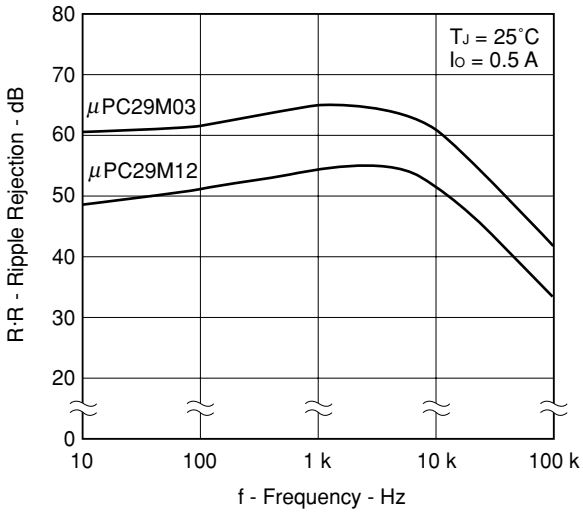
$I_{O\ peak}$ vs V_{DIF} (μPC29M03)



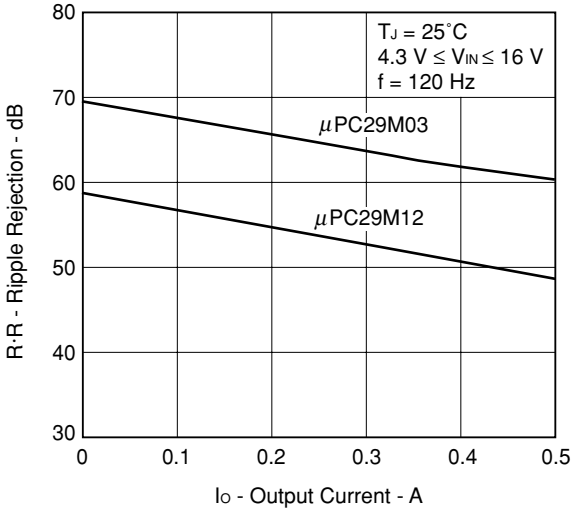
$I_{O\ peak}$ vs V_{DIF} (μPC29M05)



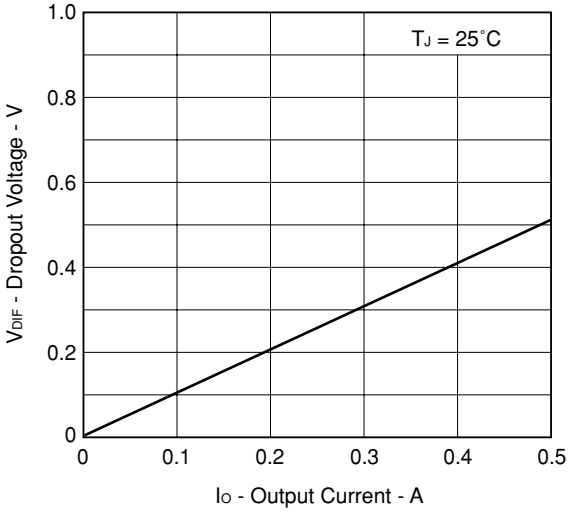
R·R vs f



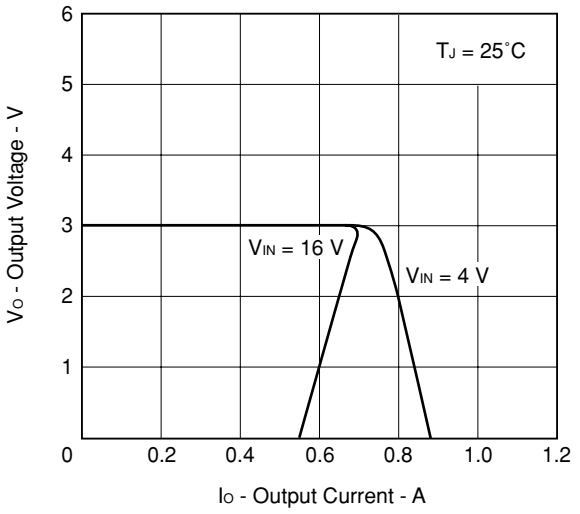
R·R vs I_O



V_{DIF} vs I_O (μPC29M03)



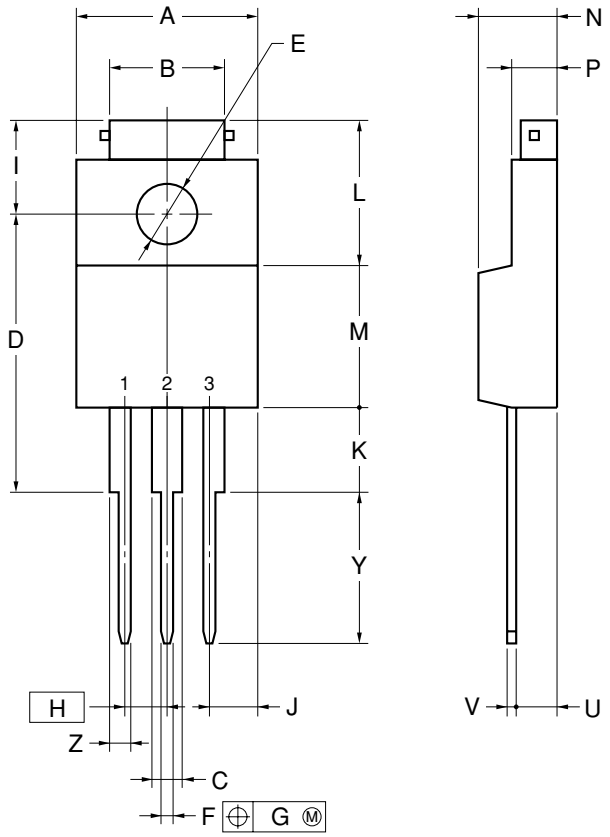
V_O vs I_O (μPC29M03)



PACKAGE DRAWINGS

μPC29MxxHF Series

3PIN PLASTIC SIP (MP-45G)



NOTE

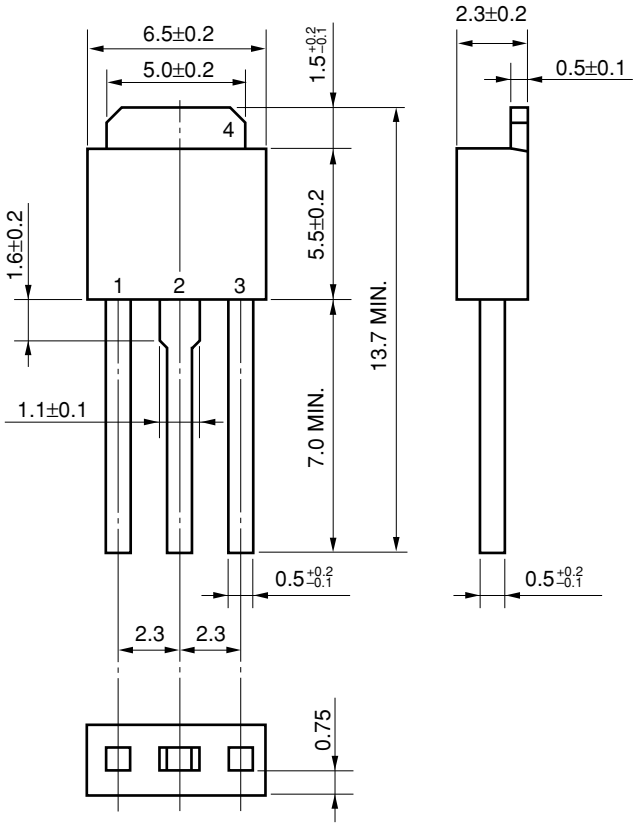
Each lead centerline is located within 0.25 mm of its true position (T.P.) at maximum material condition.

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

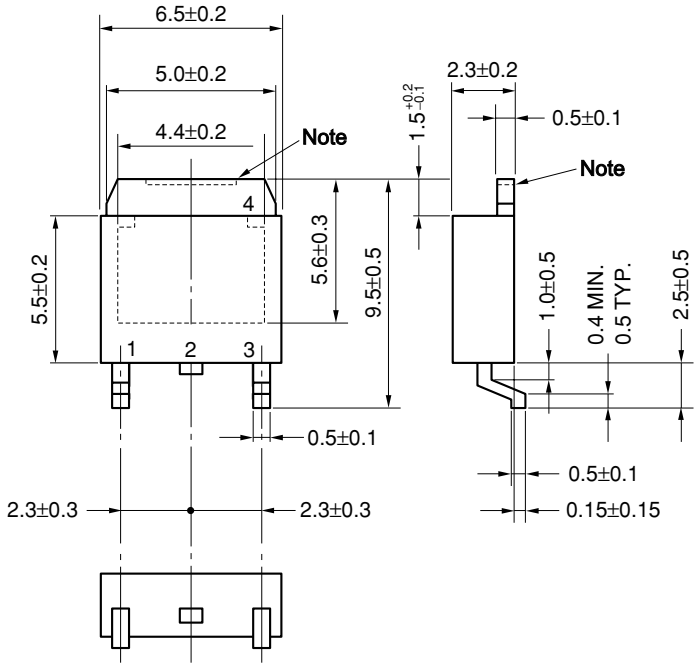
μPC29MxxHB Series

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



μPC29MxxT 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

μPC29MxxT 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.

μPC29MxxT-AZ Series [Note1], μPC29MxxT-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

μPC29MxxHF Series, μPC29MxxHF-AZ Series Note1: Isolated TO-220 (MP-45G)
μPC29MxxHB Series, μPC29MxxHB-AZ Series Note1, μPC29MxxHB-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 μPC29Mxx 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 μPC29Mxx 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

- **The information in this document is current as of September, 2007. The information is subject to change without notice. For actual design-in, refer to the latest publications of NEC Electronics data sheets or data books, etc., for the most up-to-date specifications of NEC Electronics products. Not all products and/or types are available in every country. Please check with an NEC Electronics sales representative for availability and additional information.**
- No part of this document may be copied or reproduced in any form or by any means without the prior written consent of NEC Electronics. NEC Electronics assumes no responsibility for any errors that may appear in this document.
- NEC Electronics does not assume any liability for infringement of patents, copyrights or other intellectual property rights of third parties by or arising from the use of NEC Electronics products listed in this document or any other liability arising from the use of such products. No license, express, implied or otherwise, is granted under any patents, copyrights or other intellectual property rights of NEC Electronics or others.
- Descriptions of circuits, software and other related information in this document are provided for illustrative purposes in semiconductor product operation and application examples. The incorporation of these circuits, software and information in the design of a customer's equipment shall be done under the full responsibility of the customer. NEC Electronics assumes no responsibility for any losses incurred by customers or third parties arising from the use of these circuits, software and information.
- While NEC Electronics endeavors to enhance the quality, reliability and safety of NEC Electronics products, customers agree and acknowledge that the possibility of defects thereof cannot be eliminated entirely. To minimize risks of damage to property or injury (including death) to persons arising from defects in NEC Electronics products, customers must incorporate sufficient safety measures in their design, such as redundancy, fire-containment and anti-failure features.
- NEC Electronics products are classified into the following three quality grades: "Standard", "Special" and "Specific".
  The "Specific" quality grade applies only to NEC Electronics products developed based on a customer-designated "quality assurance program" for a specific application. The recommended applications of an NEC Electronics product depend on its quality grade, as indicated below. Customers must check the quality grade of each NEC Electronics product before using it in a particular application.
  "Standard": Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots.
  "Special": Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support).
  "Specific": Aircraft, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems and medical equipment for life support, etc.

The quality grade of NEC Electronics products is "Standard" unless otherwise expressly specified in NEC Electronics data sheets or data books, etc. If customers wish to use NEC Electronics products in applications not intended by NEC Electronics, they must contact an NEC Electronics sales representative in advance to determine NEC Electronics' willingness to support a given application.

(Note)
(1) "NEC Electronics" as used in this statement means NEC Electronics Corporation and also includes its majority-owned subsidiaries.
(2) "NEC Electronics products" means any product developed or manufactured by or for NEC Electronics (as defined above).