

# BIPOLAR ANALOG INTEGRATED CIRCUIT

# $\mu$ PC37Mxx Series

## TWO-OUTPUT POSITIVE VOLTAGE REGULATORS

### ★ DESCRIPTION

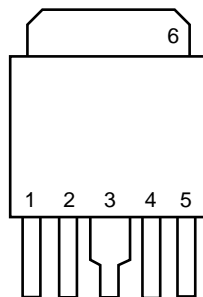
The  $\mu$  PC37Mxx series is a series regulator with two outputs, OUTPUT<sub>1</sub>: 1 A and OUTPUT<sub>2</sub>: 0.5 A, built in a single package. OUTPUT<sub>1</sub> outputs 3.3 V or 2.5 V, and OUTPUT<sub>2</sub> outputs 1.8 V or 2.5 V. This series can be used to realize set miniaturization and component reduction due to the use of on MP-3 or MP-3Z package.

### FEATURES

- ★ • Two-output series regulator built in a single package
- Output voltage accuracy:  $\pm 2\%$
- Peak output current: OUTPUT<sub>1</sub>: 1 A, OUTPUT<sub>2</sub>: 0.5 A
- On-chip saturation protector at low input voltage
- On-chip overcurrent limiter
- On-chip thermal protection

### PIN CONFIGURATION (Marking Side)

MP-3Z (5-pin), MP-3 (5-pin)



- 1: INPUT
- 2: NC
- 3: GND
- 4: OUTPUT<sub>1</sub>
- 5: OUTPUT<sub>2</sub>
- 6: GND (Fin)

### ★ ORDERING INFORMATION

Part Number	Package	Marking	Packing Type
$\mu$ PC37MxxTJ	SC-98 (5-pin MP-3Z)	37Mxx	• Bag stuffing
$\mu$ PC37MxxTJ-E1	SC-98 (5-pin MP-3Z)	37Mxx	• Embossed-type taping (16 mm tape) • Pin 1 on drawout side • 2000 pcs/reel
$\mu$ PC37MxxTJ-E2	SC-98 (5-pin MP-3Z)	37Mxx	• Embossed-type taping (16 mm tape) • Pin 1 on takeup side • 2000 pcs/reel
$\mu$ PC37MxxHB	SC-99 (5-pin MP-3)	37Mxx	• Bag stuffing

"xx" in the part number and marking columns indicates the following.

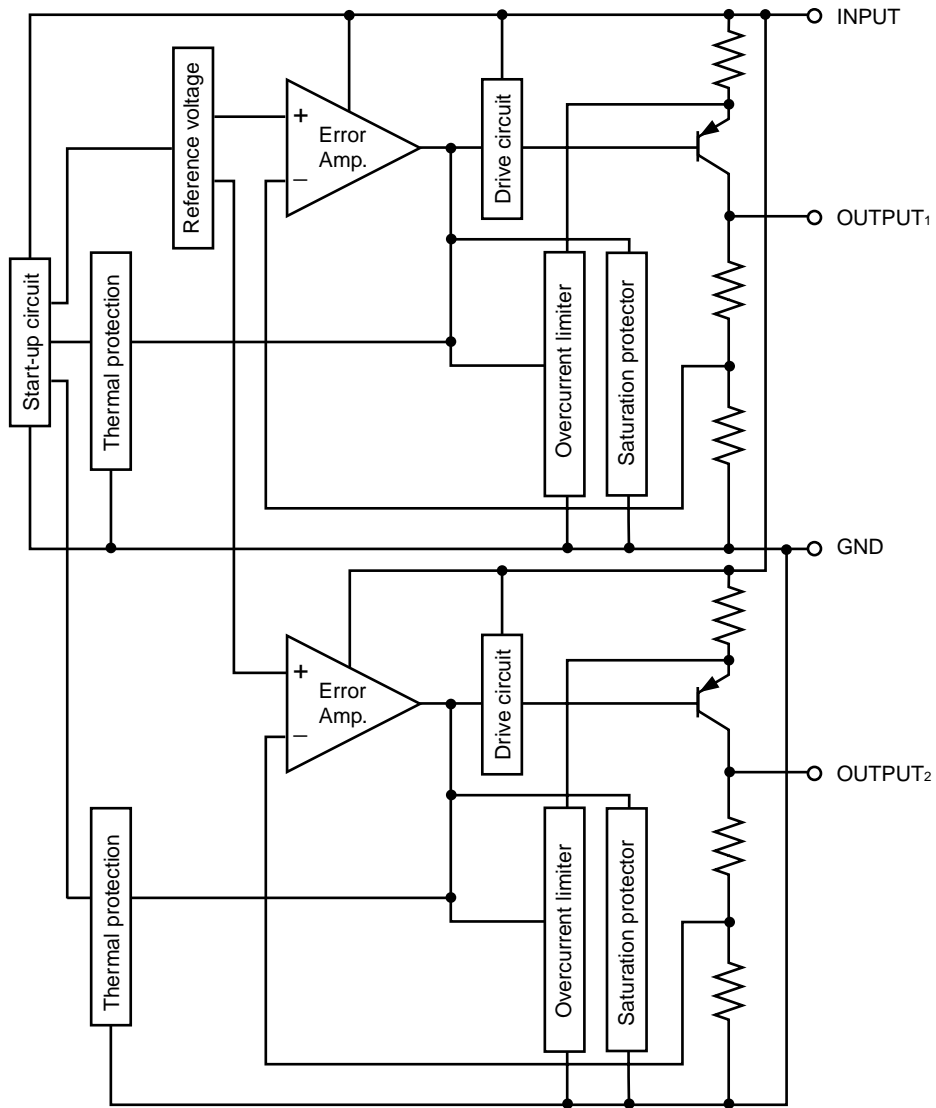
Example

Output Voltage		Part Number	Marking
OUTPUT <sub>1</sub>	OUTPUT <sub>2</sub>		
2.5 V	1.8 V	$\mu$ PC37M21TJ	37M21
3.3 V	1.8 V	$\mu$ PC37M31TJ	37M31
3.3 V	2.5 V	$\mu$ PC37M32TJ	37M32

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★ BLOCK DIAGRAM



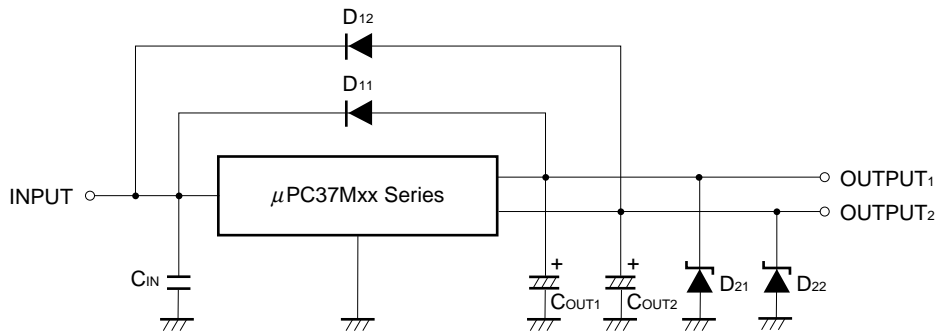
**ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub> = 25°C, unless otherwise specified.)**

Parameter	Symbol	Rating	Unit
Input Voltage	V <sub>IN</sub>	-0.3 to +8	V
Internal Power Dissipation (T <sub>c</sub> = 25°C)	P <sub>T</sub>	10 <sup>Note</sup>	W
Operating Ambient Temperature	T <sub>A</sub>	-40 to +85	°C
Operating Junction Temperature	T <sub>J</sub>	-40 to +150	°C
Storage Temperature	T <sub>stg</sub>	-55 to +150	°C
Thermal Resistance (junction to case)	R <sub>th(J-C)</sub>	12.5	°C/W
Thermal Resistance (junction to ambient)	R <sub>th(J-A)</sub>	125	°C/W

**Note** Internally limited. When the operating junction temperature rises over 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<sub>IN</sub>: 0.1 μF or higher. Set this value according to the length of the line between the regulator and INPUT pin. Be sure to connect C<sub>IN</sub> to prevent parasitic oscillation. Use of a film capacitor or other capacitor with excellent voltage and temperature characteristics is recommended. If using a laminated ceramic capacitor, it is necessary to ensure that C<sub>IN</sub> is 0.1 μF or higher for the voltage and temperature range to be used.

C<sub>OUT1</sub>, C<sub>OUT2</sub>: 10 μF or higher. Be sure to connect C<sub>OUT1</sub> and C<sub>OUT2</sub> to prevent oscillation and improve excessive load regulation. Place C<sub>IN</sub>, C<sub>OUT1</sub> and C<sub>OUT2</sub> as close as possible to the IC pins (within 2 cm). Also, use an electrolytic capacitor with low impedance characteristics if considering use at sub-zero temperatures.

D<sub>11</sub>, D<sub>12</sub>: If the OUTPUT<sub>1</sub> pin or OUTPUT<sub>2</sub> pin has a higher voltage than the INPUT pin, connect a diode.

D<sub>21</sub>, D<sub>22</sub>: If the OUTPUT<sub>1</sub> pin or OUTPUT<sub>2</sub> 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<sub>1</sub> pin or OUTPUT<sub>2</sub> pin from external.

★ RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Type Number	MIN.	TYP.	MAX.	Unit
Input Voltage	V <sub>IN</sub>	μPC37M21	3.2		5.0	V
		μPC37M31	4.5		6.0	
		μPC37M32	4.5		6.0	
Output Current 1	I <sub>O1</sub>	μPC37M21	0		0.3	A
		μPC37M31	0		0.5	
		μPC37M32	0		0.5	
Output Current 2	I <sub>O2</sub>	All	0		0.3	A
Operating Ambient Temperature	T <sub>A</sub>	All	-40		+85	°C
Operating Junction Temperature	T <sub>J</sub>	All	-40		+125	°C

**Caution** Use of conditions other than the above-listed recommended operating conditions is not a problem as long as the absolute maximum ratings are not exceeded. However, since the use of such conditions diminishes the margin of safety, careful evaluation is required before such conditions are used. Moreover, using the MAX. value for all the recommended operating conditions is not guaranteed to be safe.

★ ELECTRICAL CHARACTERISTICS

μPC37M21 (T<sub>J</sub> = 25°C, V<sub>IN</sub> = 3.3 V, I<sub>O1</sub> = 0.3 A, I<sub>O2</sub> = 0.3 A, unless otherwise specified.)

	Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
OUTPUT <sub>1</sub> (2.5 V)	Output Voltage 1	V <sub>O1</sub>		2.45	2.5	2.55	V
	Line Regulation 1	REG <sub>IN1</sub>	3.2 V ≤ V <sub>IN</sub> ≤ 5.0 V	-	2	9	mV
	Load Regulation 11	REG <sub>L11</sub>	5 mA ≤ I <sub>O1</sub> ≤ 0.5 A	-	17	50	mV
	Load Regulation 12	REG <sub>L12</sub>	V <sub>IN</sub> = 5.0 V, 5 mA ≤ I <sub>O1</sub> ≤ 1 A	-	20	66	mV
	Output Noise Voltage 1	V <sub>n1</sub>	10 Hz ≤ f ≤ 100 kHz	-	60	-	μVr.m.s.
	Ripple Rejection 1	R•R <sub>1</sub>	f = 120 Hz, 3.2 V ≤ V <sub>IN</sub> ≤ 5.0 V	-	60	-	dB
	Short Circuit Current 1	I <sub>Oshort1</sub>	V <sub>IN</sub> = 5.0 V	-	0.5	-	A
	Peak Output Current 11	I <sub>Opeak11</sub>	V <sub>IN</sub> = 3.3 V	0.5	0.8	-	A
	Peak Output Current 12	I <sub>Opeak12</sub>	V <sub>IN</sub> = 5.0 V	1.0	1.4	-	A
	Temperature Coefficient of Output Voltage 1	ΔV <sub>O1</sub> /ΔT	I <sub>O1</sub> = 5 mA, 0°C ≤ T <sub>J</sub> ≤ 125°C	-	-0.4	-	mV/°C
OUTPUT <sub>2</sub> (1.8 V)	Output Voltage 2	V <sub>O2</sub>		1.764	1.8	1.836	V
	Line Regulation 2	REG <sub>IN2</sub>	3.2 V ≤ V <sub>IN</sub> ≤ 5.0 V	-	2	9	mV
	Load Regulation 2	REG <sub>L2</sub>	5 mA ≤ I <sub>O2</sub> ≤ 0.5 A	-	17	50	mV
	Output Noise Voltage 2	V <sub>n2</sub>	10 Hz ≤ f ≤ 100 kHz	-	60	-	μVr.m.s.
	Ripple Rejection 2	R•R <sub>2</sub>	f = 120 Hz, 3.2 V ≤ V <sub>IN</sub> ≤ 5.0 V	-	60	-	dB
	Short Circuit Current 2	I <sub>Oshort2</sub>	V <sub>IN</sub> = 5.0 V	-	0.3	-	A
	Peak Output Current 21	I <sub>Opeak21</sub>	V <sub>IN</sub> = 3.3 V	0.5	0.6	-	A
	Peak Output Current 22	I <sub>Opeak22</sub>	V <sub>IN</sub> = 5.0 V	0.5	0.8	-	A
	Temperature Coefficient of Output Voltage 2	ΔV <sub>O2</sub> /ΔT	I <sub>O2</sub> = 5 mA, 0°C ≤ T <sub>J</sub> ≤ 125°C	-	-0.4	-	mV/°C
Total	Quiescent Current	I <sub>BIAS</sub>	I <sub>O1</sub> = 0 A, I <sub>O2</sub> = 0 A	-	4	8	mA
	Startup Quiescent Current	I <sub>BIAS(S)</sub>	V <sub>IN</sub> = 1.7 V, I <sub>O1</sub> = 0 A, I <sub>O2</sub> = 0 A	-	7	40	mA
	Dropout Voltage (INPUT to OUTPUT <sub>1</sub> )	V <sub>DIF1</sub>	I <sub>O1</sub> = 0.5 A	-	-	0.6	V

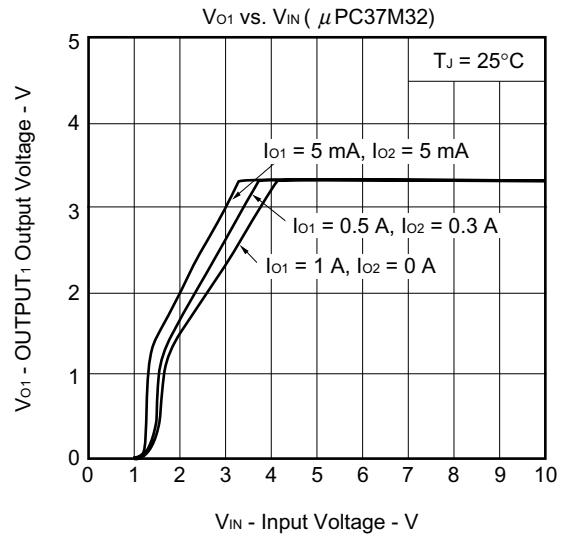
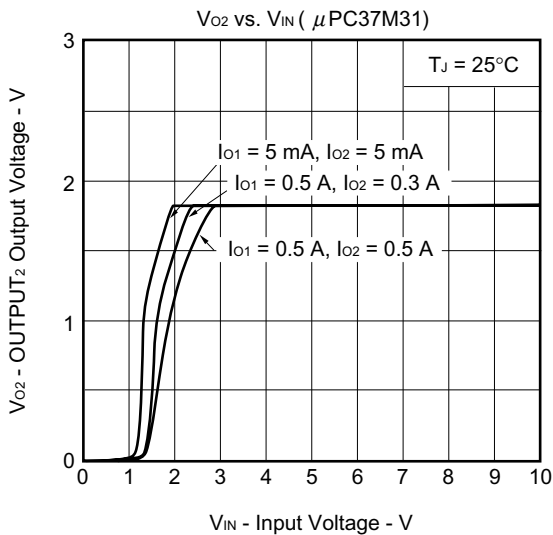
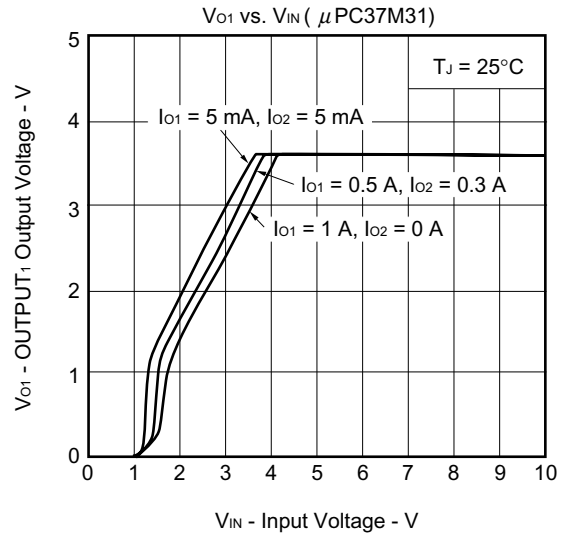
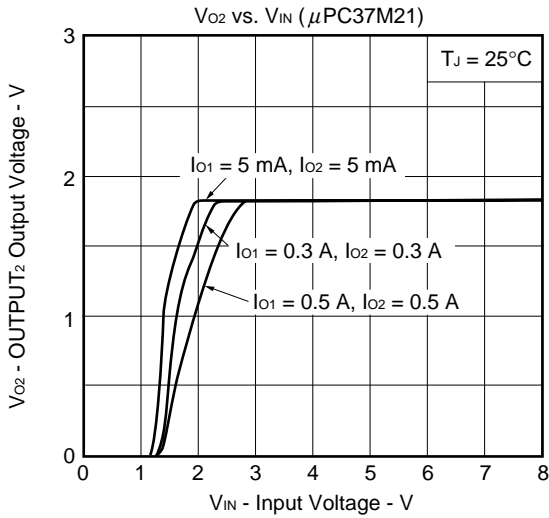
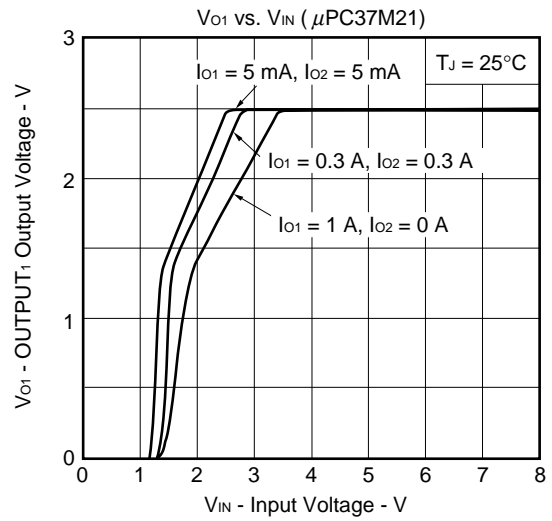
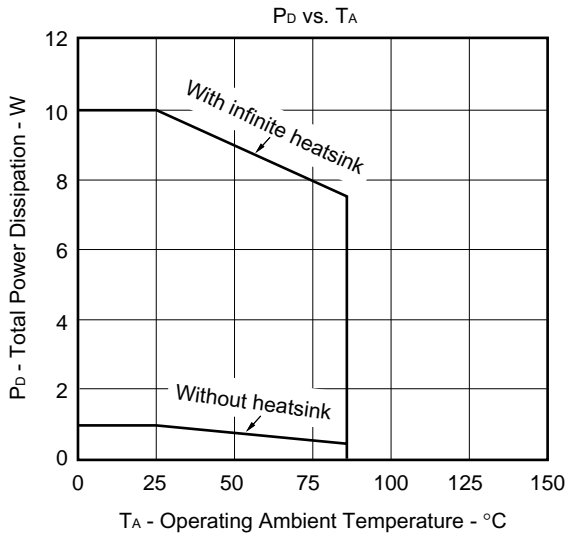
μPC37M31 (T<sub>J</sub> = 25°C, V<sub>IN</sub> = 5 V, I<sub>O1</sub> = 0.5 A, I<sub>O2</sub> = 0.3 A, unless otherwise specified.)

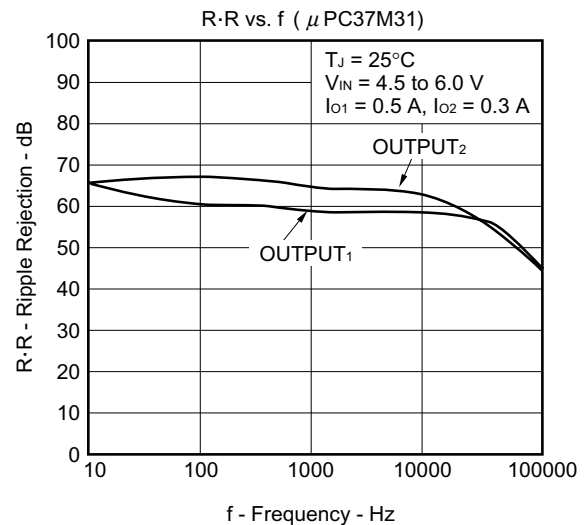
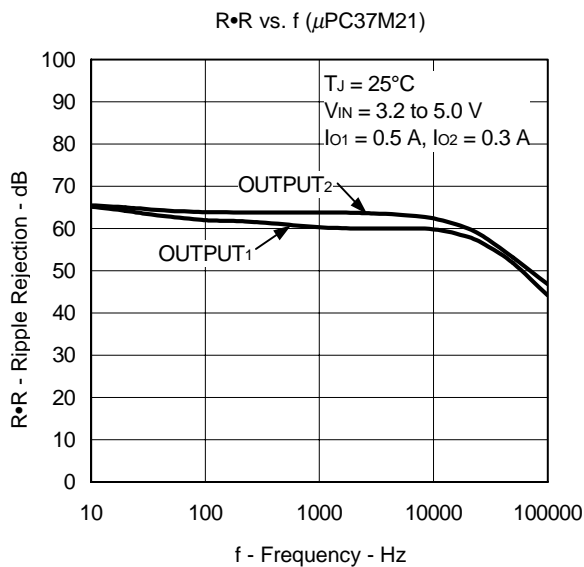
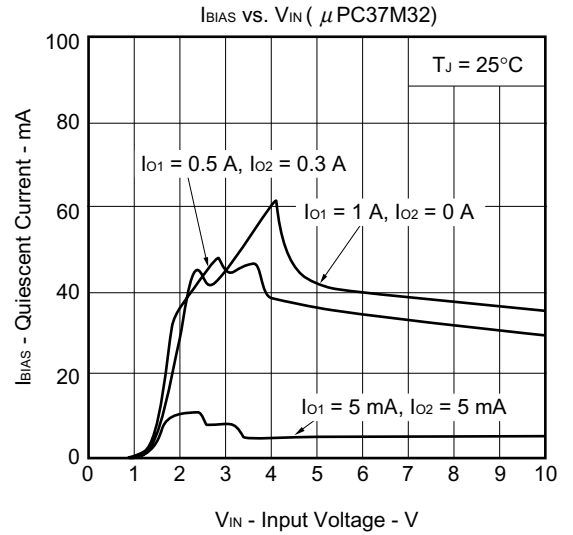
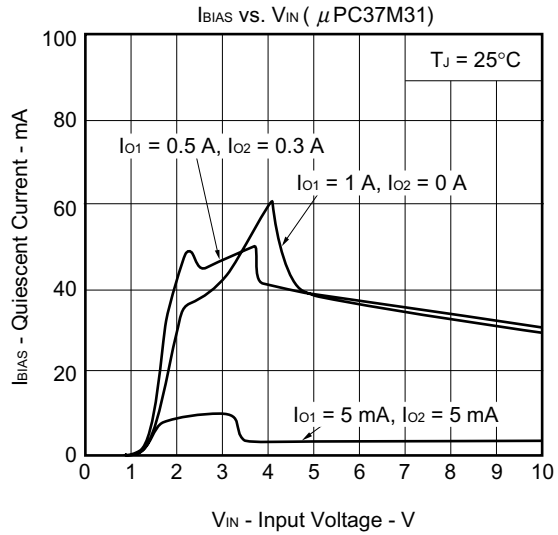
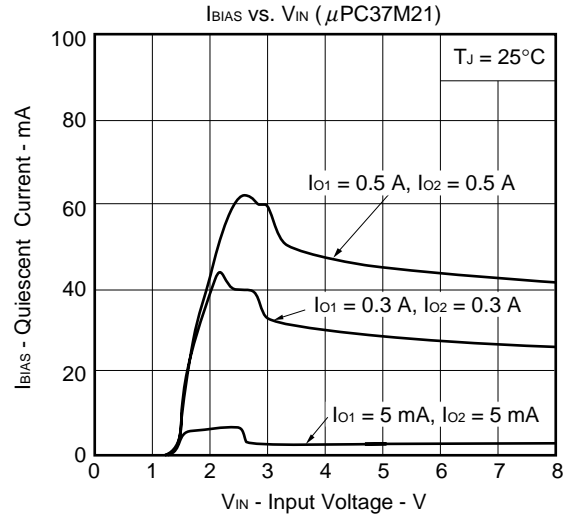
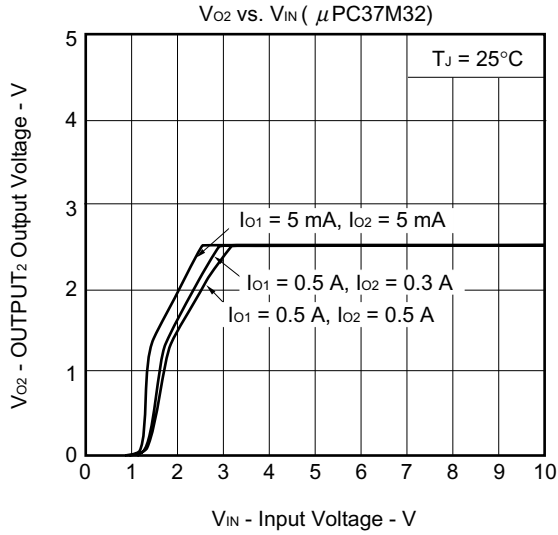
	Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
OUTPUT <sub>1</sub> (3.3 V)	Output Voltage 1	V <sub>O1</sub>		3.234	3.3	3.366	V
	Line Regulation 1	REG <sub>IN1</sub>	4.5 V ≤ V <sub>IN</sub> ≤ 6.0 V	–	2	9	mV
	Load Regulation 1	REG <sub>L1</sub>	5 mA ≤ I <sub>O1</sub> ≤ 1 A	–	20	66	mV
	Output Noise Voltage 1	V <sub>n1</sub>	10 Hz ≤ f ≤ 100 kHz	–	76	–	μVr.m.s.
	Ripple Rejection 1	R•R <sub>1</sub>	f = 120 Hz, 4.5 V ≤ V <sub>IN</sub> ≤ 6.0 V	–	57	–	dB
	Short Circuit Current 1	I <sub>Oshort1</sub>	V <sub>IN</sub> = 6.0 V	–	0.5	–	A
	Peak Output Current 1	I <sub>Opeak1</sub>	V <sub>IN</sub> = 5.0 V	1.0	1.4	–	A
	Temperature Coefficient of Output Voltage 1	ΔV <sub>O1</sub> /ΔT	I <sub>O1</sub> = 5 mA, 0°C ≤ T <sub>J</sub> ≤ 125°C	–	–0.4	–	mV/°C
OUTPUT <sub>2</sub> (1.8 V)	Output Voltage 2	V <sub>O2</sub>		1.764	1.8	1.836	V
	Line Regulation 2	REG <sub>IN2</sub>	4.5 V ≤ V <sub>IN</sub> ≤ 6.0 V	–	2	9	mV
	Load Regulation 2	REG <sub>L2</sub>	5 mA ≤ I <sub>O2</sub> ≤ 0.5 A	–	17	50	mV
	Output Noise Voltage 2	V <sub>n2</sub>	10 Hz ≤ f ≤ 100 kHz	–	60	–	μVr.m.s.
	Ripple Rejection 2	R•R <sub>2</sub>	f = 120 Hz, 4.5 V ≤ V <sub>IN</sub> ≤ 6.0 V	–	60	–	dB
	Short Circuit Current 2	I <sub>Oshort2</sub>	V <sub>IN</sub> = 6.0 V	–	0.3	–	A
	Peak Output Current 2	I <sub>Opeak2</sub>	V <sub>IN</sub> = 5.0 V	0.5	0.8	–	A
	Temperature Coefficient of Output Voltage 2	ΔV <sub>O2</sub> /ΔT	I <sub>O2</sub> = 5 mA, 0°C ≤ T <sub>J</sub> ≤ 125°C	–	–0.4	–	mV/°C
Total	Quiescent Current	I <sub>BIAS</sub>	I <sub>O1</sub> = 0 A, I <sub>O2</sub> = 0 A	–	4	8	mA
	Startup Quiescent Current	I <sub>BIAS(S)</sub>	V <sub>IN</sub> = 1.7 V, I <sub>O1</sub> = 0 A, I <sub>O2</sub> = 0 A	–	7	40	mA
	Dropout Voltage (INPUT to OUTPUT <sub>1</sub> )	V <sub>DIF1</sub>	I <sub>O1</sub> = 0.5 A	–	0.6	1.0	V

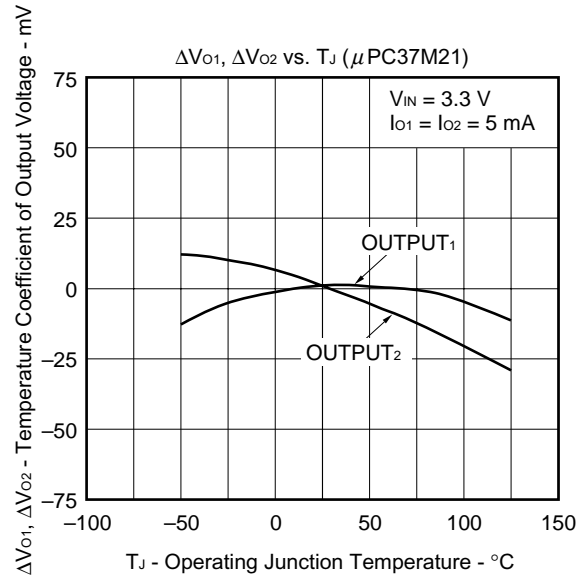
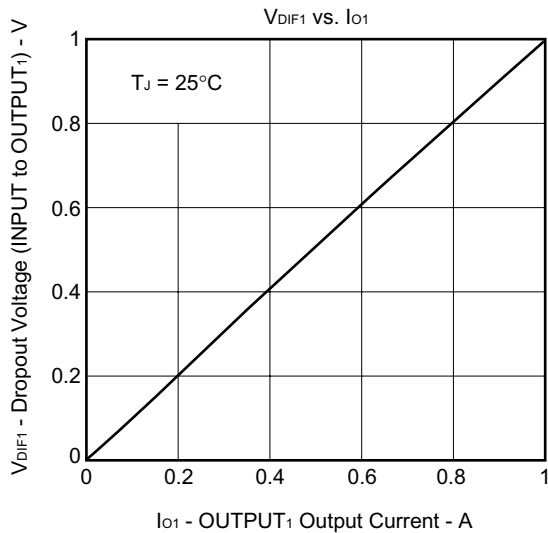
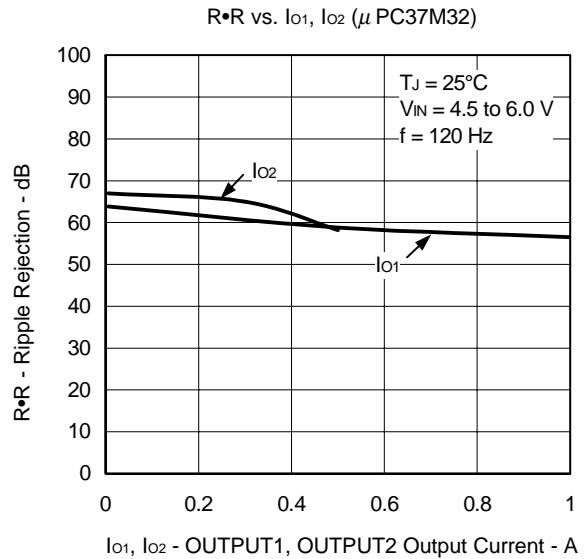
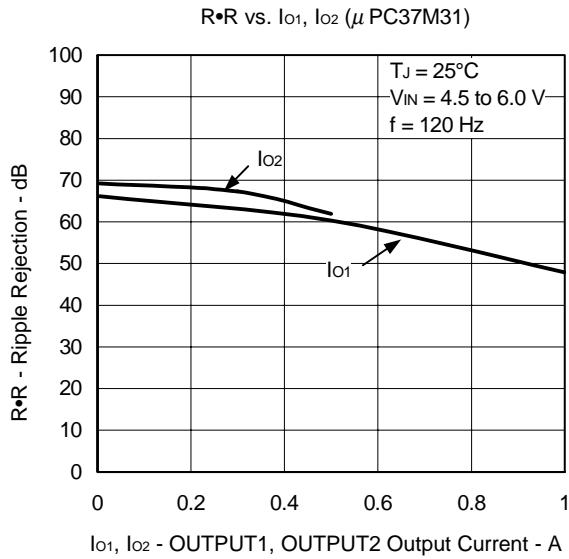
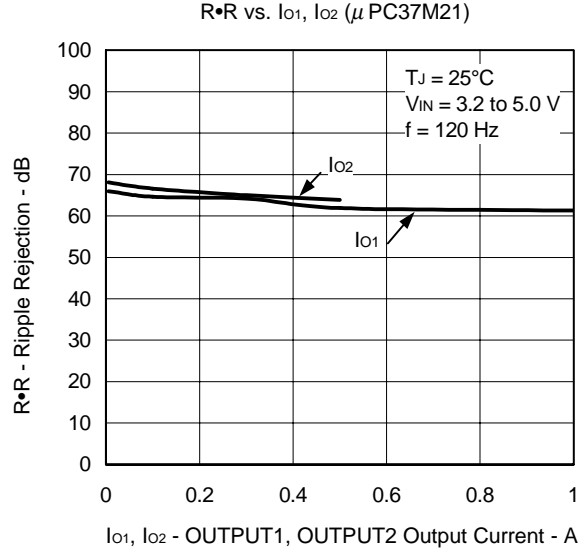
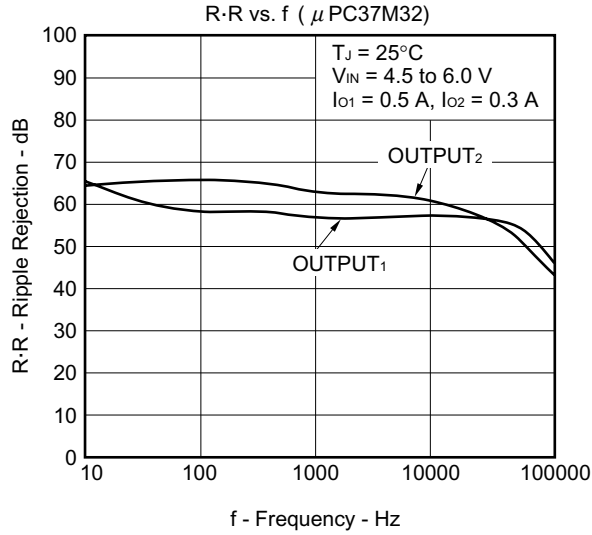
μPC37M32 (T<sub>J</sub> = 25°C, V<sub>IN</sub> = 5 V, I<sub>O1</sub> = 0.5 A, I<sub>O2</sub> = 0.3 A, unless otherwise specified.)

	Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
OUTPUT <sub>1</sub> (3.3 V)	Output Voltage 1	V <sub>O1</sub>		3.234	3.3	3.366	V
	Line Regulation 1	REG <sub>IN1</sub>	4.5 V ≤ V <sub>IN</sub> ≤ 6.0 V	–	2	9	mV
	Load Regulation 1	REG <sub>L1</sub>	5 mA ≤ I <sub>O1</sub> ≤ 1 A	–	20	66	mV
	Output Noise Voltage 1	V <sub>n1</sub>	10 Hz ≤ f ≤ 100 kHz	–	76	–	μVr.m.s.
	Ripple Rejection 1	R•R <sub>1</sub>	f = 120 Hz, 4.5 V ≤ V <sub>IN</sub> ≤ 6.0 V	–	57	–	dB
	Short Circuit Current 1	I <sub>Oshort1</sub>	V <sub>IN</sub> = 6.0 V	–	0.5	–	A
	Peak Output Current 1	I <sub>Opeak1</sub>	V <sub>IN</sub> = 5.0 V	1.0	1.4	–	A
	Temperature Coefficient of Output Voltage 1	ΔV <sub>O1</sub> /ΔT	I <sub>O1</sub> = 5 mA, 0°C ≤ T <sub>J</sub> ≤ 125°C	–	–0.4	–	mV/°C
OUTPUT <sub>2</sub> (2.5 V)	Output Voltage 2	V <sub>O2</sub>		2.45	2.5	2.55	V
	Line Regulation 2	REG <sub>IN2</sub>	4.5 V ≤ V <sub>IN</sub> ≤ 6.0 V	–	2	9	mV
	Load Regulation 2	REG <sub>L2</sub>	5 mA ≤ I <sub>O2</sub> ≤ 0.5 A	–	17	50	mV
	Output Noise Voltage 2	V <sub>n2</sub>	10 Hz ≤ f ≤ 100 kHz	–	60	–	μVr.m.s.
	Ripple Rejection 2	R•R <sub>2</sub>	f = 120 Hz, 4.5 V ≤ V <sub>IN</sub> ≤ 6.0 V	–	60	–	dB
	Short Circuit Current 2	I <sub>Oshort2</sub>	V <sub>IN</sub> = 6.0 V	–	0.3	–	A
	Peak Output Current 2	I <sub>Opeak2</sub>	V <sub>IN</sub> = 5.0 V	0.5	0.8	–	A
	Temperature Coefficient of Output Voltage 2	ΔV <sub>O2</sub> /ΔT	I <sub>O2</sub> = 5 mA, 0°C ≤ T <sub>J</sub> ≤ 125°C	–	–0.4	–	mV/°C
Total	Quiescent Current	I <sub>BIAS</sub>	I <sub>O1</sub> = 0 A, I <sub>O2</sub> = 0 A	–	4	8	mA
	Startup Quiescent Current	I <sub>BIAS(S)</sub>	V <sub>IN</sub> = 2.4 V, I <sub>O1</sub> = 0 A, I <sub>O2</sub> = 0 A	–	7	40	mA
	Dropout Voltage (INPUT to OUTPUT <sub>1</sub> )	V <sub>DIF1</sub>	I <sub>O1</sub> = 0.5 A	–	0.6	1.0	V

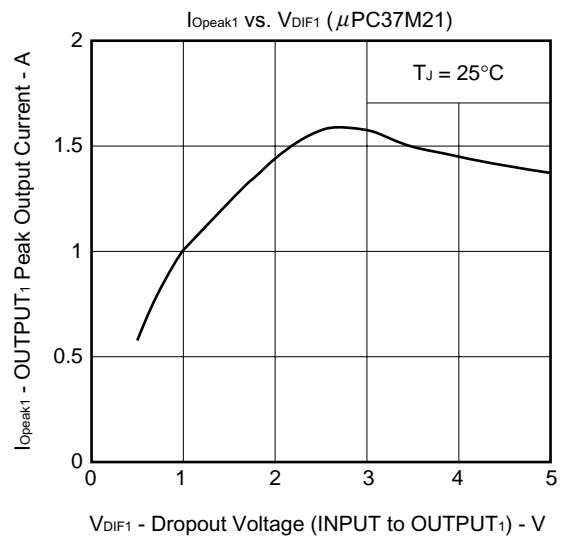
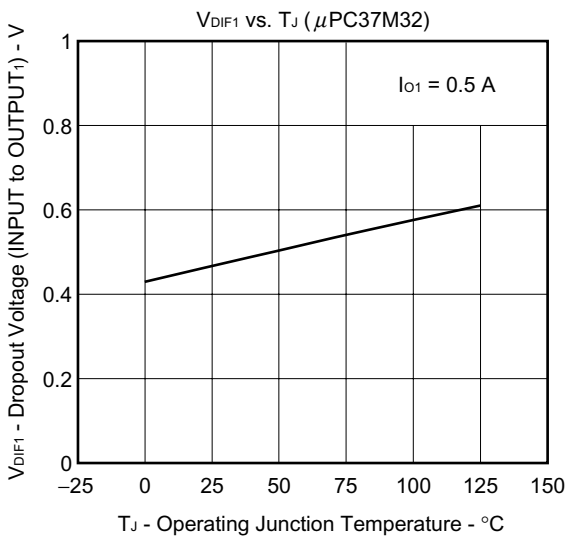
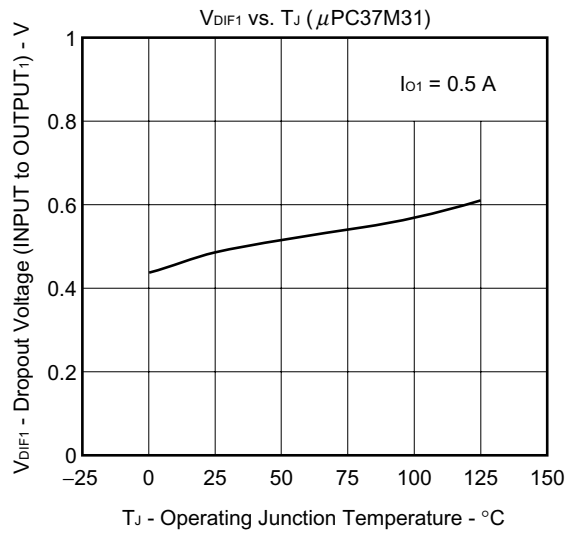
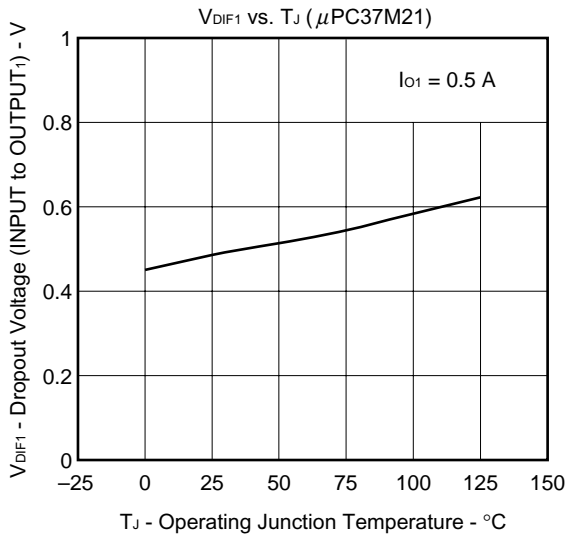
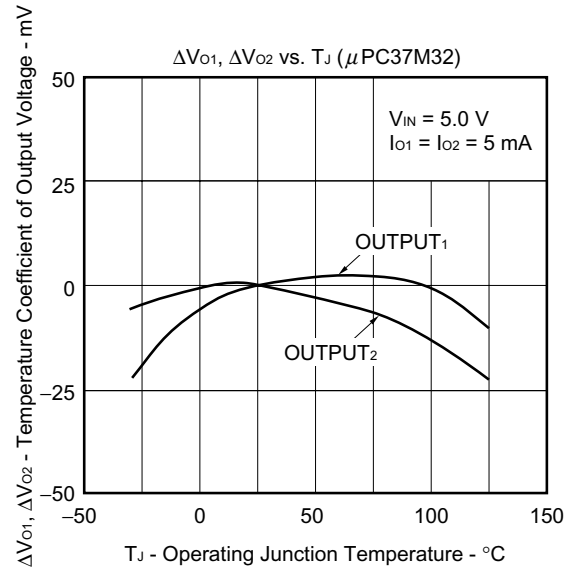
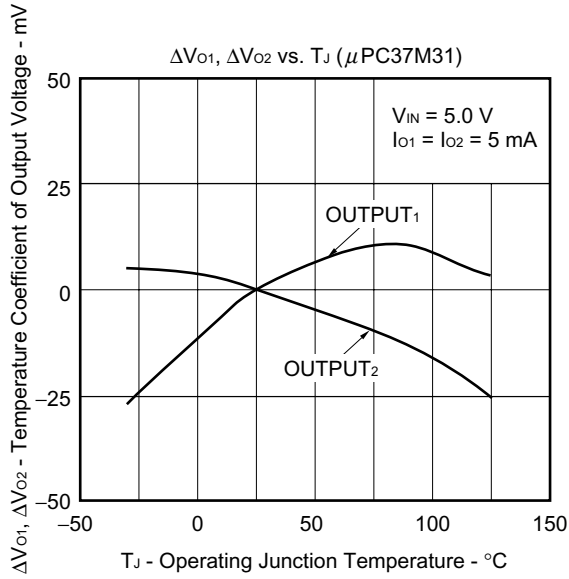
★ TYPICAL CHARACTERISTICS (Reference Values)

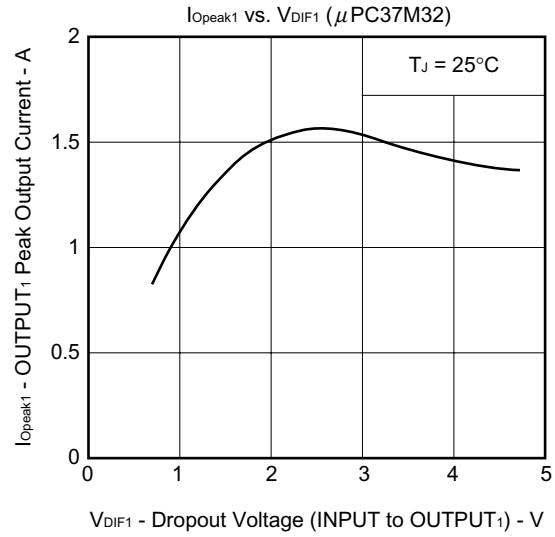
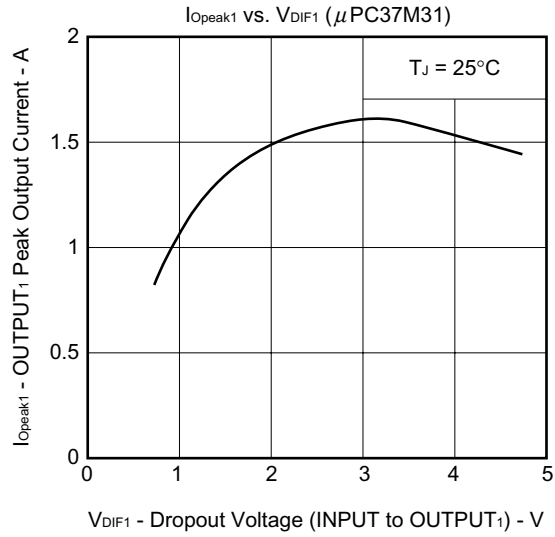






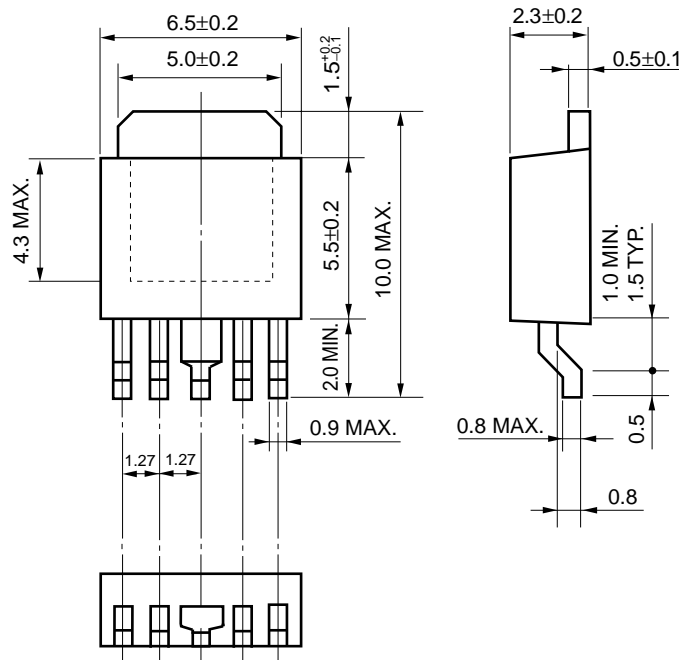




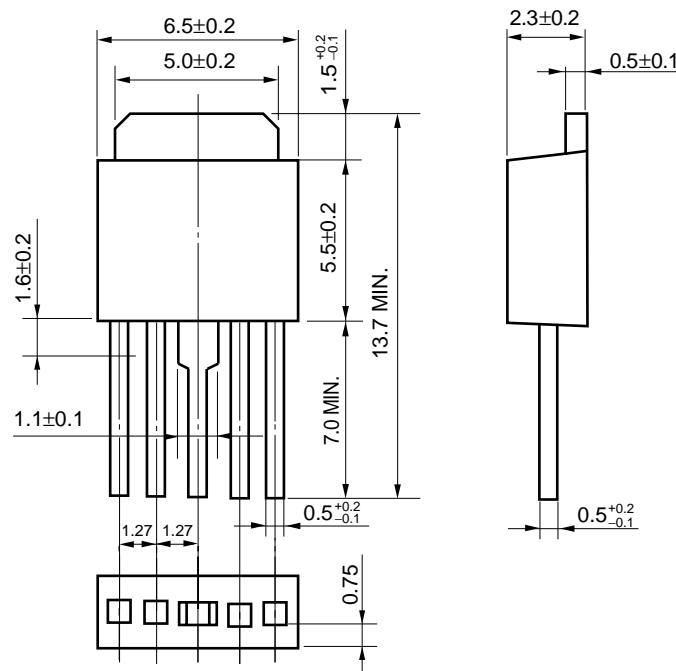


★ PACKAGE DRAWINGS (Unit: mm)

SC-98 (5-pin MP-3Z)



SC-99 (5-pin MP-3)



★ RECOMMENDED MOUNTING CONDITIONS

The following conditions must be met for mounting conditions of the μPC37Mxx series.

For more details, refer to the **Semiconductor Device Mount Manual**

(<http://www.necel.com/pkg/en/mount/index.html>).

Please consult with our sales offices in case other mounting process is used, or in case the mounting is done under different conditions.

**Type of Surface Mount Device**

**μPC37MxxTJ: SC-98 (5-pin 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 reflows 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 reflows processes: 3 times or less.	VP15-00-3
Wave Soldering	Solder temperature: 260°C or below, Flow time: 10 seconds or less, Maximum number of flow processes: 1 time, Pre-heating temperature: 120°C or below (Package surface temperature).	WS60-00-1
Partial Heating Method	Pin temperature: 300°C or below, Heat time: 3 seconds or less (Per each side of the device).	—

**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.

**Type of Through-hole Device**

**μPC37MxxHB: SC-99 (5-pin MP-3)**

Process	Conditions
Wave Soldering (only to leads)	Solder temperature: 260°C or below, Flow time: 10 seconds or less
Partial Heating Method	Pin temperature: 300°C or below, Heat time: 3 seconds or less (Per each pin).

**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 the μPC37Mxx series is used with an input voltage that is lower than the value indicated in the recommended operating conditions, a large quiescent current flows through the device due to saturation of the transistor of the output stage. (Refer to the I<sub>BIAS</sub> (I<sub>BIAS(S)</sub>) vs. V<sub>IN</sub> curves in TYPICAL CHARACTERISTICS).

These products have saturation protector, but a current of up to 40 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**

Document Name		Document No.
Usage of Three-Terminal Regulators	User's Manual	G12702E
Voltage Regulator of SMD	Information	G11872E
★ Semiconductor Device Mount Manual	Information	<a href="http://www.necel.com/pkg/en/mount/index.html">http://www.necel.com/pkg/en/mount/index.html</a>
SEMICONDUCTOR SELECTION GUIDE - Products and Packages-		X13769X

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