

# BIPOLAR ANALOG INTEGRATED CIRCUIT

# $\mu$ PC37M31, 37M32

## TWO-OUTPUT POSITIVE VOLTAGE REGULATORS

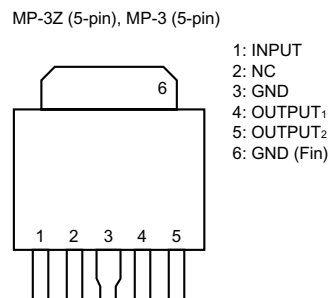
### DESCRIPTION

The  $\mu$  PC37M31 and 37M32 are series regulators 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 and OUTPUT<sub>2</sub> outputs 1.8 V and 2.5 V. These regulators can be used to realize set miniaturization and component reduction due to the use of on MP-3 or MP-3Z package.

### FEATURES

- Two outputs, 3.3 V and 1.8 V or 2.5 V, 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)



### ORDERING INFORMATION

Part Number	Package	Marking	Packing Type
$\mu$ PC37MxxTJ	5-pin MP-3Z (SC-98)	37Mxx	• Bag stuffing
$\mu$ PC37MxxTJ-E1	5-pin MP-3Z (SC-98)	37Mxx	• Embossed-type taping (16 mm tape) • Pin 1 on drawout side • 2000 pcs/reel
$\mu$ PC37MxxTJ-E2	5-pin MP-3Z (SC-98)	37Mxx	• Embossed-type taping (16 mm tape) • Pin 1 on takeup side • 2000 pcs/reel
$\mu$ PC37MxxHB	5-pin MP-3 (SC-99)	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>		
3.3 V	1.8 V	$\mu$ PC37M31TJ	37M31
3.3 V	2.5 V	$\mu$ PC37M32TJ	37M32

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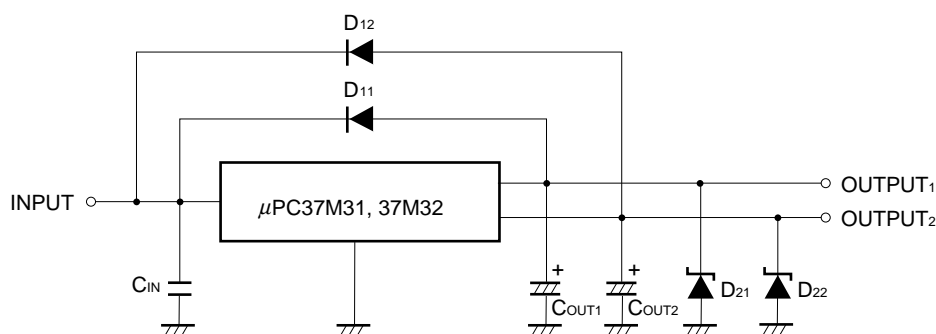
**ABSOLUTE MAXIMUM RATINGS ( $T_A = 25^\circ\text{C}$ , unless otherwise specified)**

Parameter	Symbol	Rating	Unit
Input Voltage	$V_{IN}$	-0.3 to +8	V
Internal Power Dissipation ( $T_c = 25^\circ\text{C}$ )	$P_T$	10 <sup>Note</sup>	W
Operating Ambient Temperature	$T_A$	-40 to +85	$^\circ\text{C}$
Operating Junction Temperature	$T_J$	-40 to +150	$^\circ\text{C}$
Storage Temperature	$T_{stg}$	-55 to +150	$^\circ\text{C}$
Thermal Resistance (junction to case)	$R_{th(J-C)}$	12.5	$^\circ\text{C/W}$
Thermal Resistance (junction to ambient)	$R_{th(J-A)}$	125	$^\circ\text{C/W}$

**Note** Internally limited. When the operating junction temperature rises over  $150^\circ\text{C}$ , 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**



$C_{IN}$ :  $0.1\ \mu\text{F}$  or higher. Set this value according to the length of the line between the regulator and INPUT pin. Be sure to connect  $C_{IN}$  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  $C_{IN}$  is  $0.1\ \mu\text{F}$  or higher for the voltage and temperature range to be used.

$C_{OUT1}$ ,  $C_{OUT2}$ :  $10\ \mu\text{F}$  or higher. Be sure to connect  $C_{OUT1}$  and  $C_{OUT2}$  to prevent oscillation and improve excessive load regulation. Place  $C_{IN}$ ,  $C_{OUT1}$  and  $C_{OUT2}$  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.

$D_{11}$ ,  $D_{12}$ : If the OUTPUT1 pin or OUTPUT2 pin has a higher voltage than the INPUT pin, connect a diode.

$D_{21}$ ,  $D_{22}$ : If the OUTPUT1 pin or OUTPUT2 pin has a lower voltage than the GND pin, connect a Schottky barrier diode.

**Caution** Make sure that no voltage is applied to the OUTPUT1 pin or OUTPUT2 pin from external.

# RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Input Voltage	$V_{IN}$	4.5		6.0	V
Output Current 1	$I_{O1}$	0		0.5	A
Output Current 2	$I_{O2}$	0		0.3	A
Operating Ambient Temperature	$T_A$	-40		+85	°C
Operating Junction Temperature	$T_J$	-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

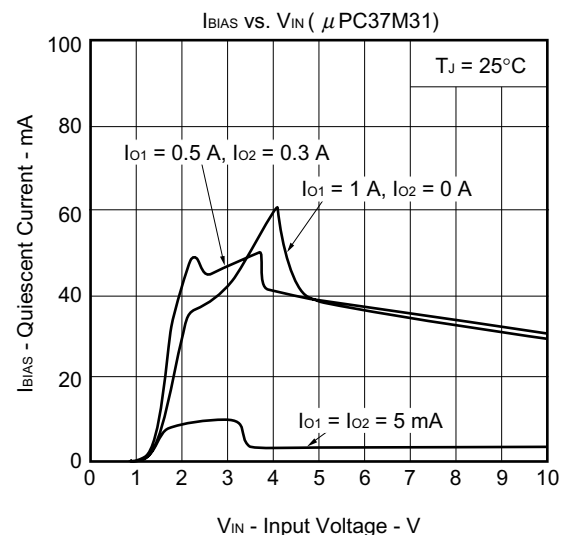
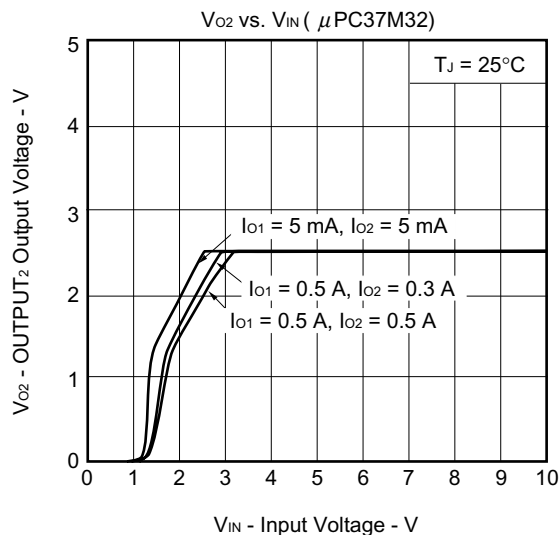
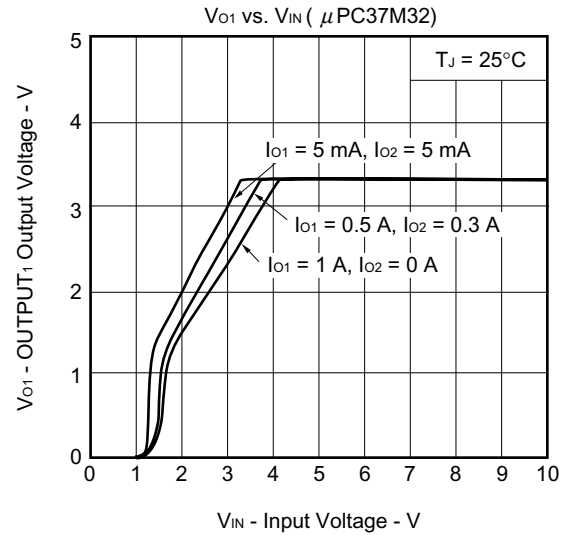
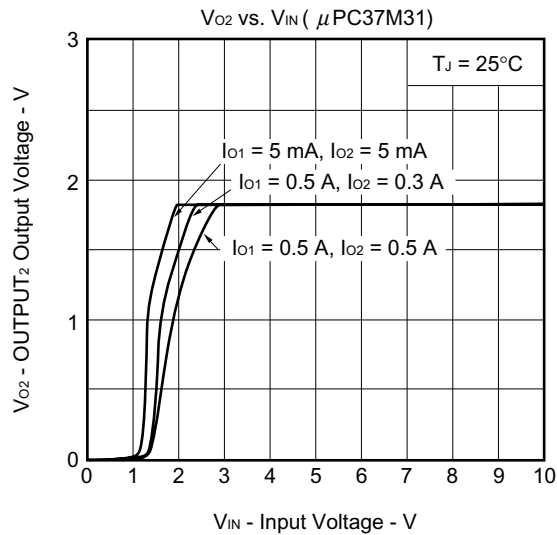
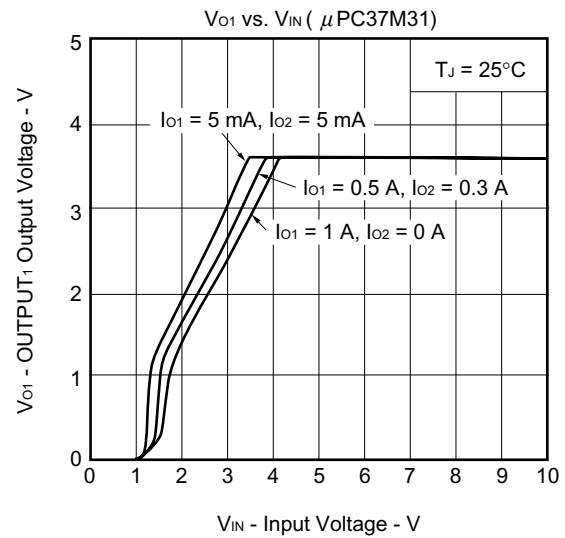
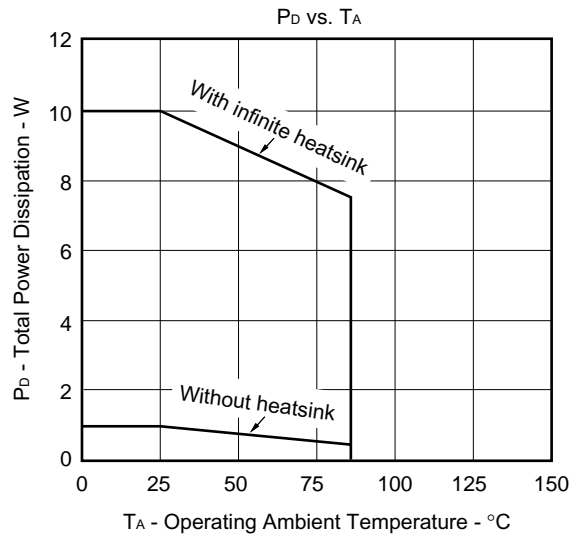
μPC37M31 ( $T_J = 25^\circ\text{C}$ ,  $V_{IN} = 5\text{ V}$ ,  $I_{O1} = 0.5\text{ A}$ ,  $I_{O2} = 0.3\text{ A}$ , unless otherwise specified)

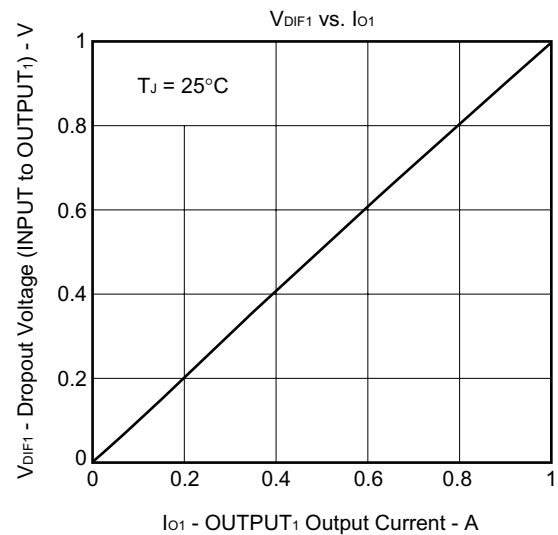
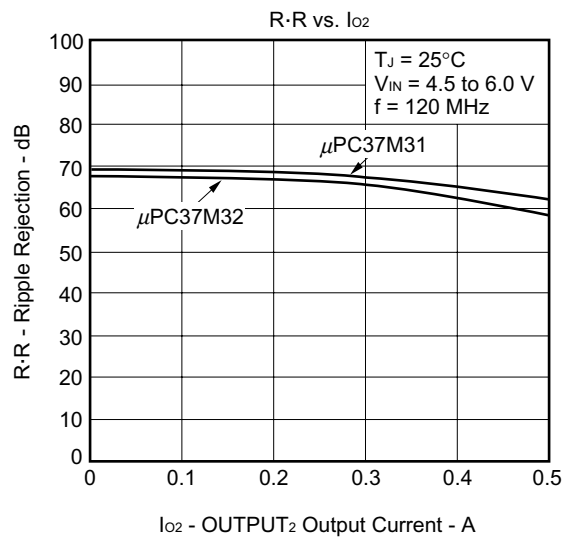
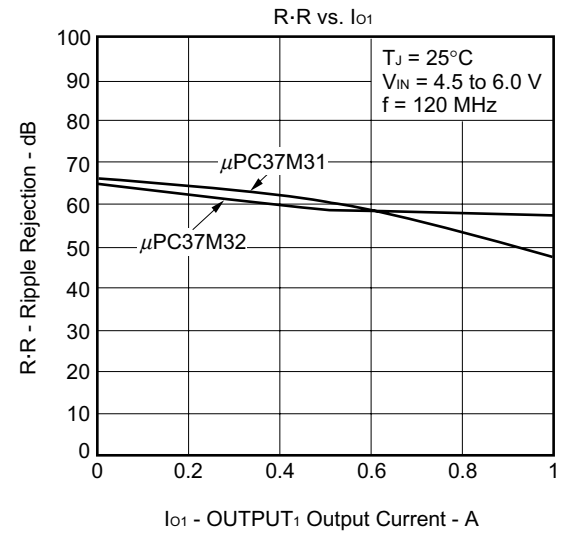
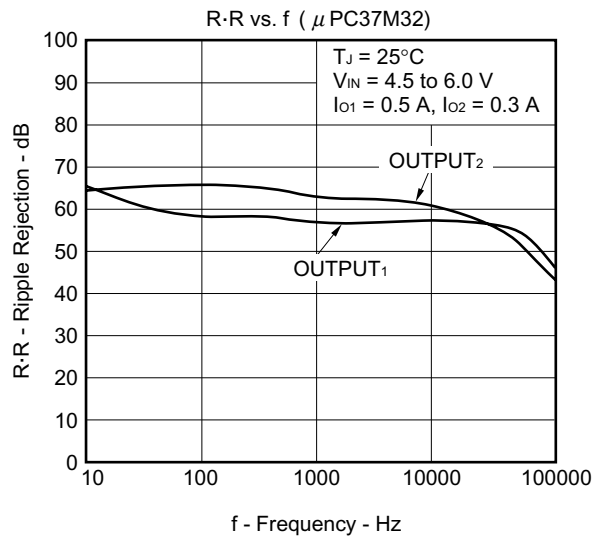
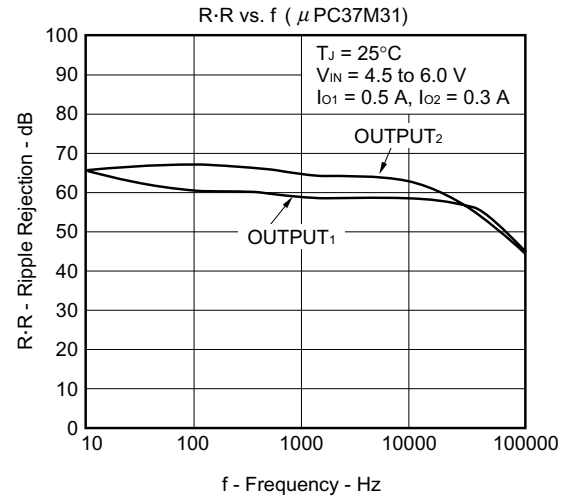
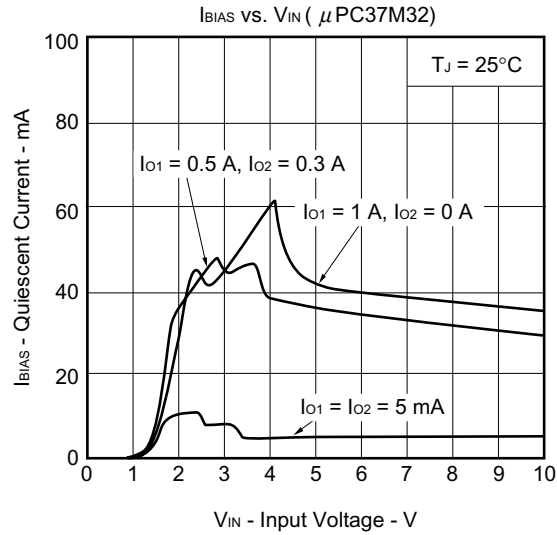
	Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
OUTPUT <sub>1</sub> (3.3 V)	Output Voltage 1	$V_{O1}$		3.234	3.3	3.366	V
	Line Regulation 1	$REG_{IN1}$	$4.5\text{ V} \leq V_{IN} \leq 6.0\text{ V}$	–	2	9	mV
	Load Regulation 1	$REG_{L1}$	$5\text{ mA} \leq I_O \leq 1\text{ A}$	–	20	66	mV
	Output Noise Voltage 1	$V_{n1}$	$10\text{ Hz} \leq I_O \leq 100\text{ kHz}$	–	76	–	μVr.m.s.
	Ripple Rejection 1	$R \cdot R_1$	$f = 120\text{ Hz}$ , $4.5\text{ V} \leq V_{IN} \leq 6.0\text{ V}$	–	57	–	dB
	Short Circuit Current 1	$I_{Oshort1}$	$V_{IN} = 6.0\text{ V}$	–	0.5	–	A
	Peak Output Current 1	$I_{Opeak1}$	$V_{IN} = 5.0\text{ V}$	1.0	1.4	–	A
	Temperature Coefficient of Output Voltage 1	$\Delta V_{O1}/\Delta T$	$I_O = 5\text{ mA}$ , $0^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$	–	-0.4	–	mV/°C
OUTPUT <sub>2</sub> (1.8 V)	Output Voltage 2	$V_{O2}$		1.764	1.8	1.836	V
	Line Regulation 2	$REG_{IN2}$	$4.5\text{ V} \leq V_{IN} \leq 6.0\text{ V}$	–	2	9	mV
	Load Regulation 2	$REG_{L2}$	$5\text{ mA} \leq I_O \leq 0.5\text{ A}$	–	17	50	mV
	Output Noise Voltage 2	$V_{n2}$	$10\text{ Hz} \leq I_O \leq 100\text{ kHz}$	–	60	–	μVr.m.s.
	Ripple Rejection 2	$R \cdot R_2$	$f = 120\text{ Hz}$ , $4.5\text{ V} \leq V_{IN} \leq 6.0\text{ V}$	–	60	–	dB
	Short Circuit Current 2	$I_{Oshort2}$	$V_{IN} = 6.0\text{ V}$	–	0.3	–	A
	Peak Output Current 2	$I_{Opeak2}$	$V_{IN} = 5.0\text{ V}$	0.5	0.8	–	A
	Temperature Coefficient of Output Voltage 2	$\Delta V_{O2}/\Delta T$	$I_O = 5\text{ mA}$ , $0^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$	–	-0.4	–	mV/°C
Total	Quiescent Current	$I_{BIAS}$	$I_{O1} = 0\text{ A}$ , $I_{O2} = 0\text{ A}$	–	4	8	mA
	Startup Quiescent Current	$I_{BIAS(S)}$	$V_{IN} = 1.7\text{ V}$ , $I_{O1} = 0\text{ A}$ , $I_{O2} = 0\text{ A}$	–	7	40	mA
	Dropout Voltage (INPUT to OUTPUT <sub>1</sub> )	$V_{DIF1}$	$I_{O1} = 0.5\text{ A}$	–	0.6	1.0	V

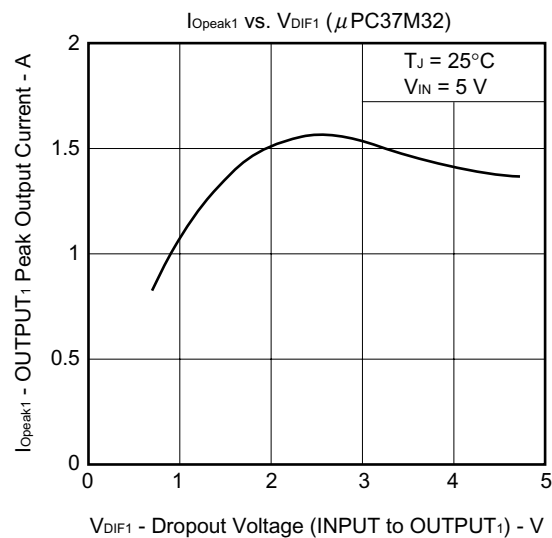
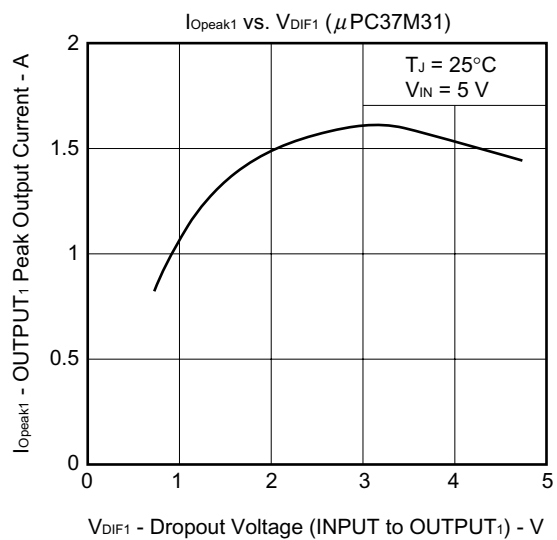
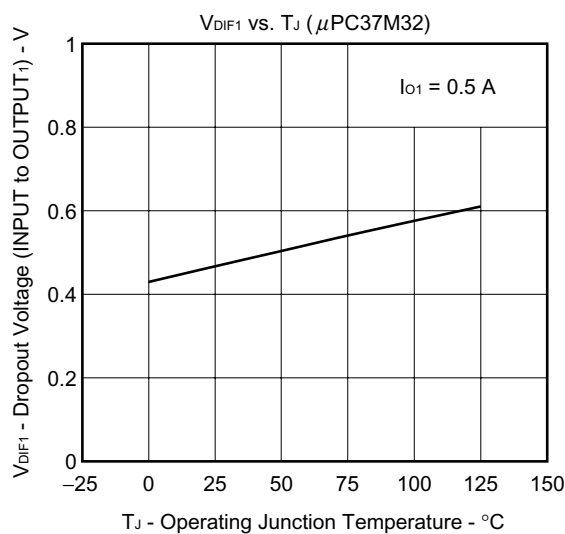
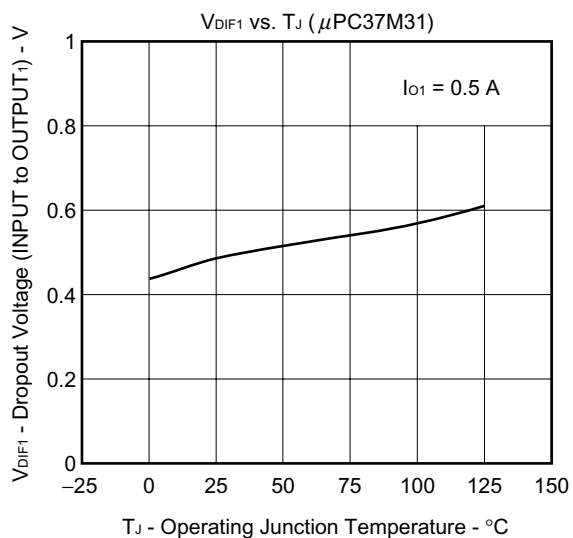
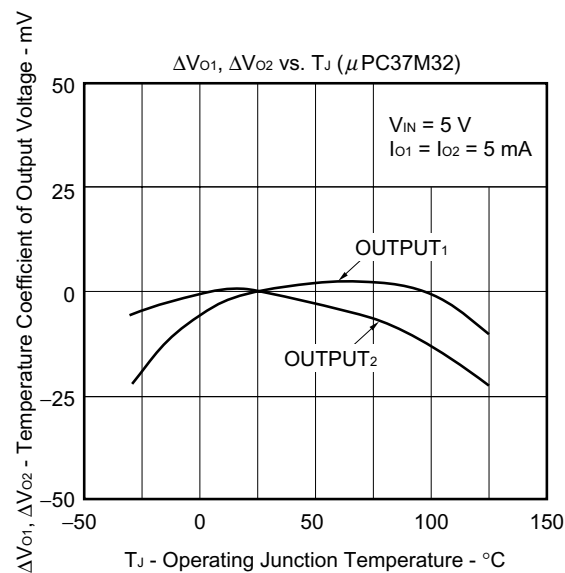
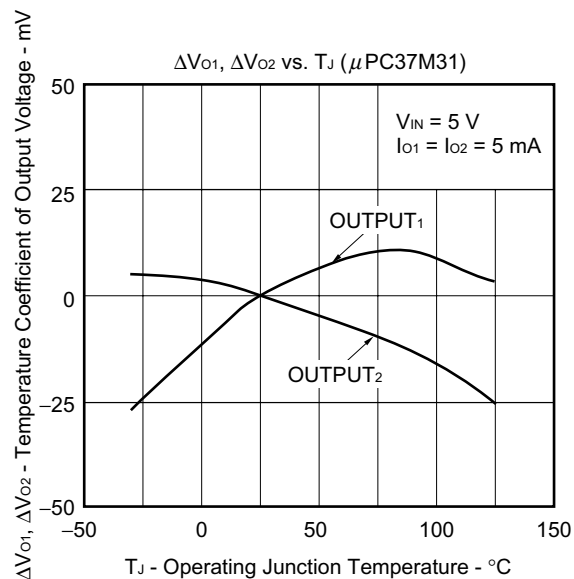
μPC37M32 (T<sub>J</sub> = 25°C, V<sub>IN</sub> = 5 V, I<sub>O1</sub> = 0.5 A, I<sub>O2</sub> = 0.3 A, unless otherwise specified)

	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>O</sub> ≤ 1 A	–	20	66	mV
	Output Noise Voltage 1	V <sub>n1</sub>	10 Hz ≤ I <sub>O</sub> ≤ 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>O</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>O</sub> ≤ 0.5 A	–	17	50	mV
	Output Noise Voltage 2	V <sub>n2</sub>	10 Hz ≤ I <sub>O</sub> ≤ 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>O</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

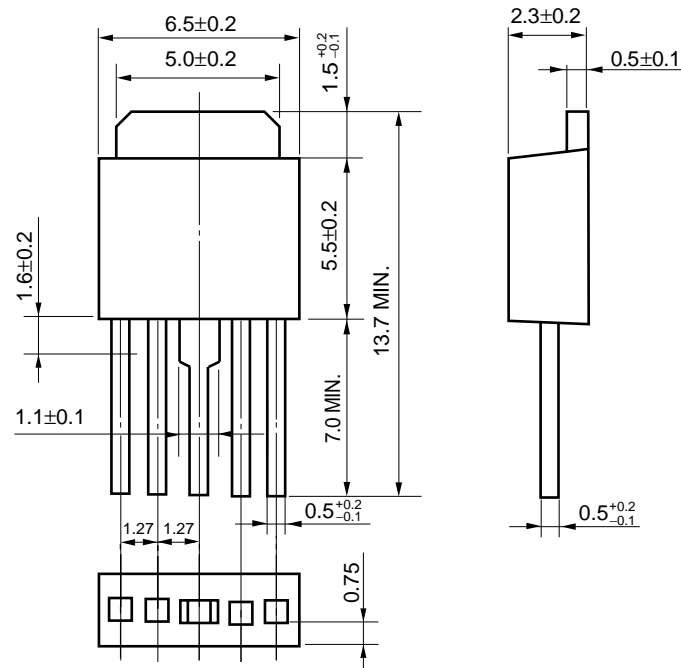
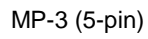
TYPICAL CHARACTERISTICS (Reference Values)







## MP-3Z (5-pin)





## RECOMMENDED MOUNTING CONDITIONS

The following conditions must be met for mounting conditions of the μPC37M31 and 37M32.

For more details, refer to the **Semiconductor Device Mounting Technology Manual (C10535E)**.

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

#### μ PC37M31TJ, μ PC37M32TJ: MP-3Z (5-pin)

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

#### μ PC37M31HB, μ PC37M32HB: MP-3 (5-pin)

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 μ PC37M31 and 37M32 are 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  $I_{BIAS}$  ( $I_{BIAS(S)}$ ) vs.  $V_{IN}$  curves in TYPICAL CHARACTERISTICS).

These products have saturation protector, but a current of up to 70 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 Mounting Technology Manual	Information	C10535E
SEMICONDUCTOR SELECTION GUIDE - Products and Packages-		X13769X

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