µPC824, 4074

Low Noise J-FET Input Quad Operational Amplifier

R03DS0152EJ0100
Rev.1.00
2019.11.12

DESCRIPTION

The µPC824 and 4074 are low noise versions operational amplifier of µPC804 and 4084 series with the general-purpose J-FET input. Compared with the µPC804 and 4084 series, various characteristics such as input referred noise, input offset voltage and input bias current have been improved. It is therefore ideal for application circuits such as preamplifiers and active filters for measurement, audio and measurement where low noise, high input impedance and high-speed characteristics are important.

Depending on the operating ambient temperature, µPC824 is suitable for communication application while µPC4074 is suitable for general-purpose usage.

Along with this series of lineup, the dual type op-amp µPC822 and 4072 with same circuit configuration are also available.

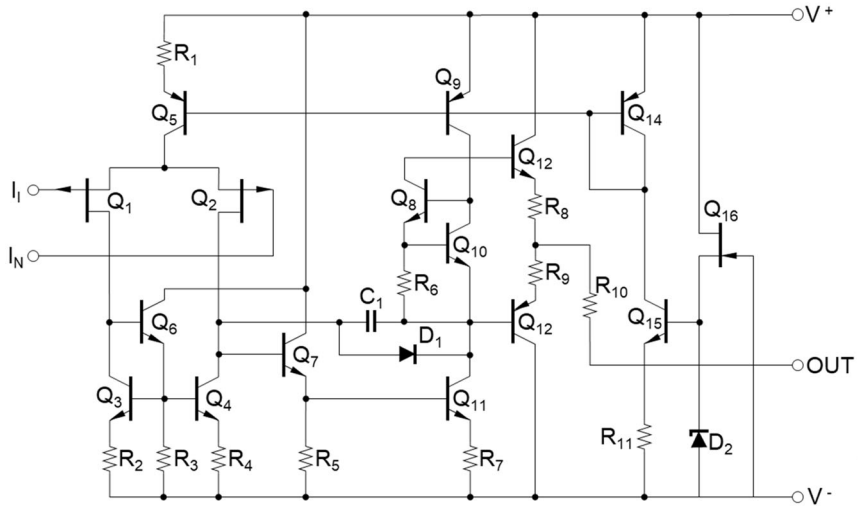
FEATURES

- Input Offset Voltage ±2 mV (TYP.)
- Input Bias Current 30 pA (TYP.)
- Slew Rate 13 V/µs (TYP.)
- Unity Gain Frequency 3 MHz (TYP.)
- Input Referred Noise Voltage Density 17 nV/$\sqrt{\text{Hz}}$ (TYP.) (f = 1 kHz)
- Built-In Phase Compensation Circuit
- Built-In Output Short Circuit Protection
- Standard Quad Op-Amp terminal connection (pin compatible)

ORDERING INFORMATION

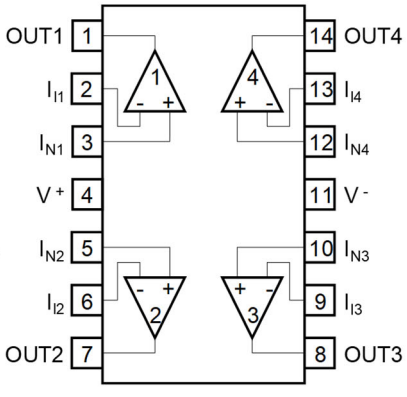
Ordering Name	Package
µPC824G2-A	14-pin plastic SOP (5.72 mm (225 mil))
µPC4074G2-A	14-pin plastic SOP (5.72 mm (225 mil))

EQUIVALENT CIRCUIT (1/4 Circuit)



PIN CONFIGURATION (Top View)

µPC824G2, µPC4074G2



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ABSOLUTE MAXIMUM RATINGS (T_A = 25 °C)

PARAMETER	SYMBOL	µPC824G2	µPC4074G2	UNIT
Supply Voltage Note1	V^+ to V^-	-0.3 to +36		V
Differential Input Voltage	V_{ID}	±30		V
Input Voltage Note2	V_I	V^- -0.3 to V^+ +0.3		V
Output Applied Voltage Note3	V_O	V^- -0.3 to V^+ +0.3		V
Total Power Dissipation Note4	P_T	550		mW
Output Short Circuit Duration Note5		indefinite		s
Operating Ambient Temperature	T_A	-40 to +85	-20 to +80	°C
Storage Temperature	T_{stg}	-55 to +125		°C

[Note] 1. Note that reverse connections of the power supply may damage the ICs.

2. The input terminal must be applied within the input voltage range to avoid deteriorating or damaging the device characteristic. Do not exceed the ratings including during transition state such as ON/OFF, etc. The Op-Amp input voltage must operate within the electrical characteristics range of input common-mode voltage.

3. The output terminal must be applied within the output voltage range to avoid deteriorating or damaging the device characteristic. Do not exceed the ratings including during transition state such as ON/OFF, etc. The Op-Amp output voltage must operate within the electrical characteristics range of maximum output voltage.

4. This is the value at $T_A \leq +25$ °C. De-rate value at -5.5 mW/°C when $T_A > 25$ °C.

5. Please use below the total power dissipation and the de-rating value from Note 4.

RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
Power Supply Voltage	$V^\pm$	±5		±16	V
Load Current	I_O			±10	mA
Load Capacitance (When A_V = +1)	C_L			100	pF

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ELECTRICAL CHARACTERISTICS (T_A = 25 °C, $V^{\pm}$ = ±15 V)

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITION
Input Offset Voltage	V_{IO}		±2	±10	mV	R_S ≤ 50 Ω
Input Offset Current Note6	I_{IO}		±5	±50	pA	
Input Bias Current Note6	I_B		30	200	pA	
Large Signal Voltage Gain	A_V	25000	200000			R_L ≥ 2 kΩ, V_O = ±10 V
Circuit Current Note7	I_{CC}		8	10	mA	I_O = 0 A
Common Mode Rejection Ratio	CMR	70	90		dB	
Supply Voltage Rejection Ratio	SVR	70	90		dB	
Voltage Output Swing	V_{om}	±12	±13.5		V	R_L ≥ 10 kΩ
Voltage Output Swing	V_{om}	±10	±12		V	R_L ≥ 2 kΩ
Input Common-Mode Voltage Range	V_{ICM}	±10	+15 -13		V	
Slew Rate	SR		13		V/μs	A_V = 1
Unity Gain Frequency	f_{unity}		3		MHz	
Input Referred Noise Voltage	V_n		4		$\mu V_{r.m.s}$	R_S = 100 Ω, f = 10 Hz to 10 kHz
Input Referred Noise Voltage Density	e_n		17		$nV/\sqrt{Hz}$	R_S = 100 Ω, f = 1 kHz
Channel Separation			120		dB	
Input Offset Voltage	V_{IO}			±13	mV	R_S ≤ 50 Ω, T_A = -20 to +70 °C
Average V_{IO} Temperature Drift	$\Delta V_{IO}/\Delta T$		±10		μV/°C	T_A = -20 to +70 °C
Input Offset Current Note6	I_{IO}			±2	nA	T_A = -20 to +70 °C
Input Bias Current Note6	I_B			7	nA	T_A = -20 to +70 °C

[Note] 6. The direction of the input bias current is the same direction that flows into the IC because the first stage is comprised of Pch J-FET. When T_J = 25 °C or higher, it increases exponentially with increase in temperature (please see I_B vs. T_A characteristics). During measurement, please kindly take care of $T_J \fallingdotseq T_A$

7. It is the current that flows into the internal circuit. This current flow is irrespective of the channel usage.

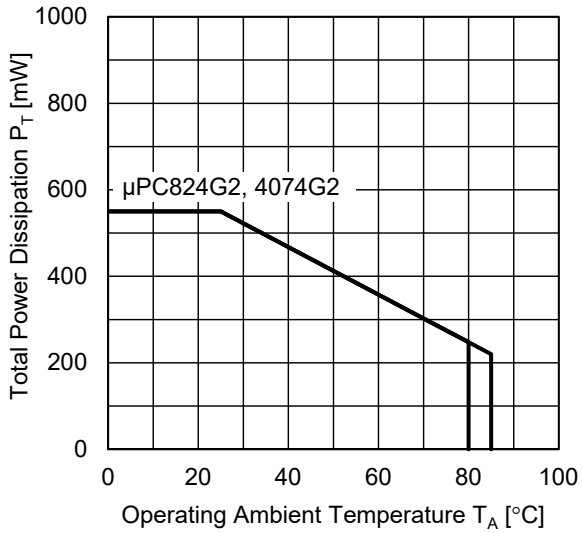
Caution

Since μPC824, 4074 have high input impedance characteristics, please be careful of insulation between the terminals on the board.

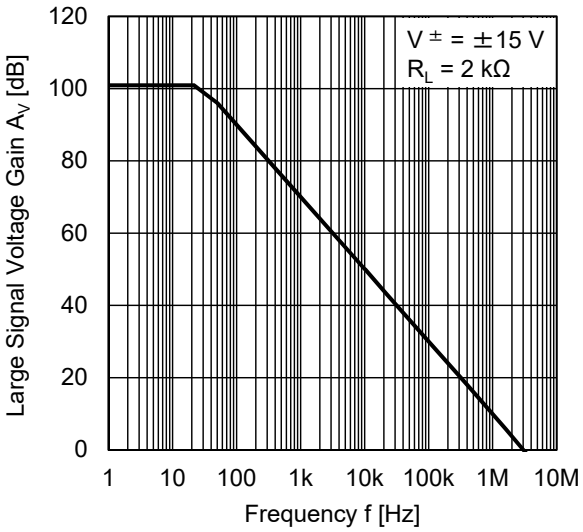
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ELECTRICAL CHARACTERISTICS CURVE (T_A = 25 °C, TYP.)

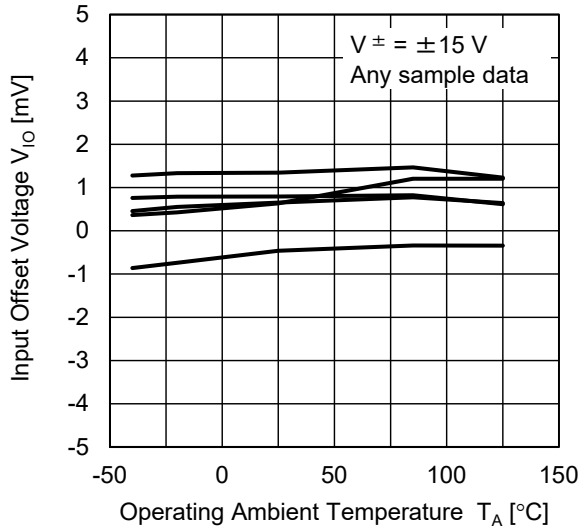
P_T vs. T_A (Absolute maximum rating)



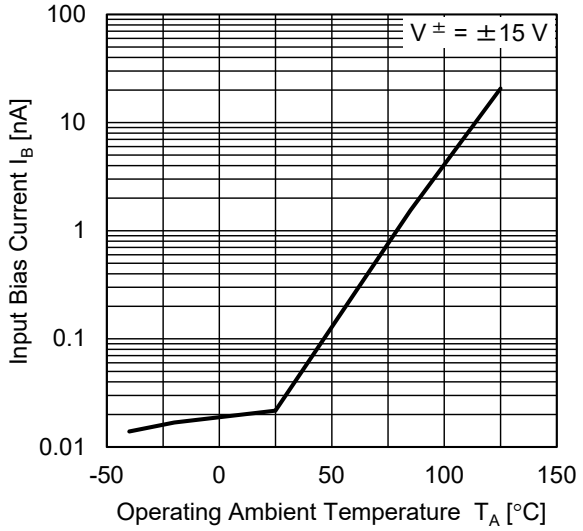
A_V vs. f



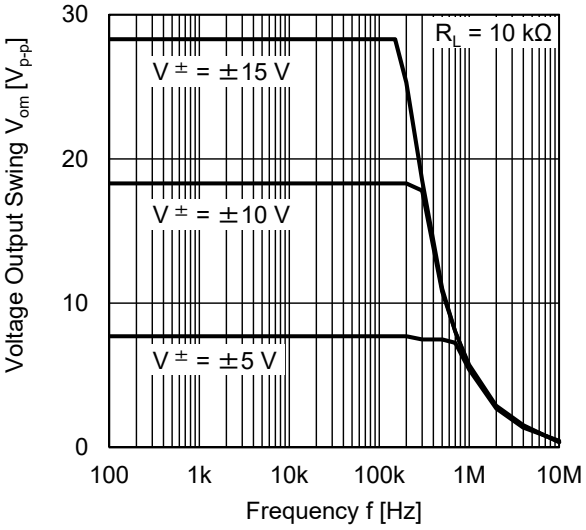
V_{IO} vs. T_A



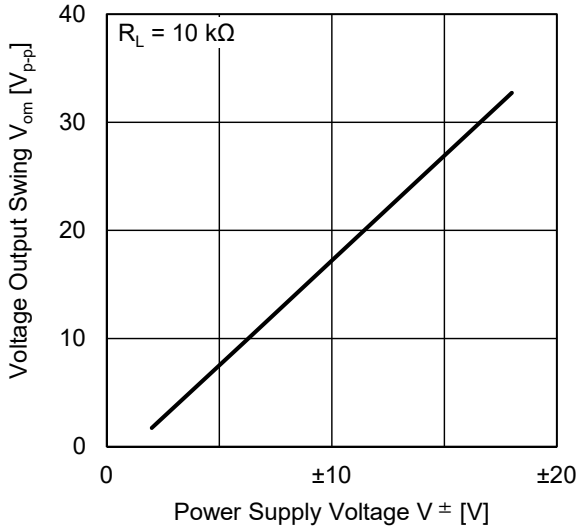
I_B vs. T_A



V_{om} vs. f

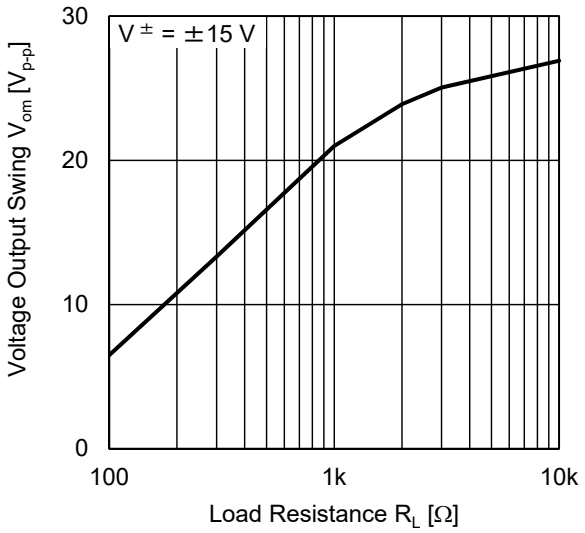


V_{om} vs. $V^{\pm}$

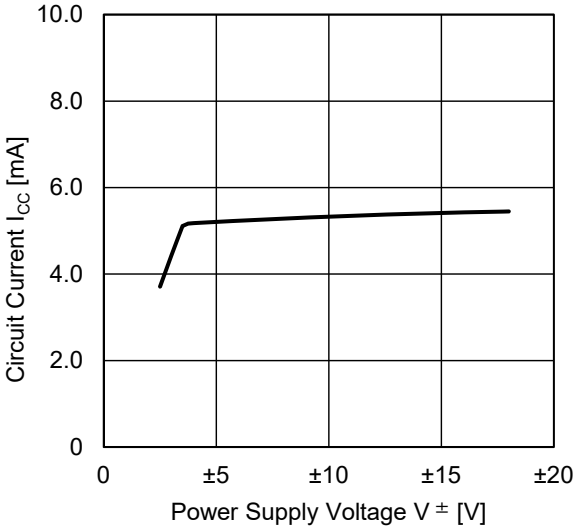


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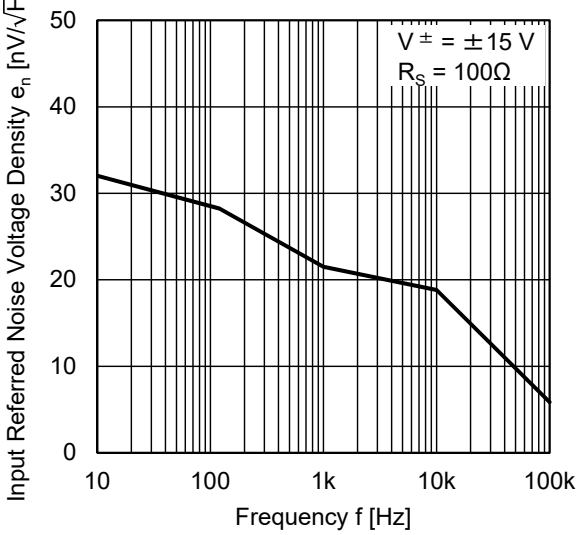
V_{om} vs. R_L



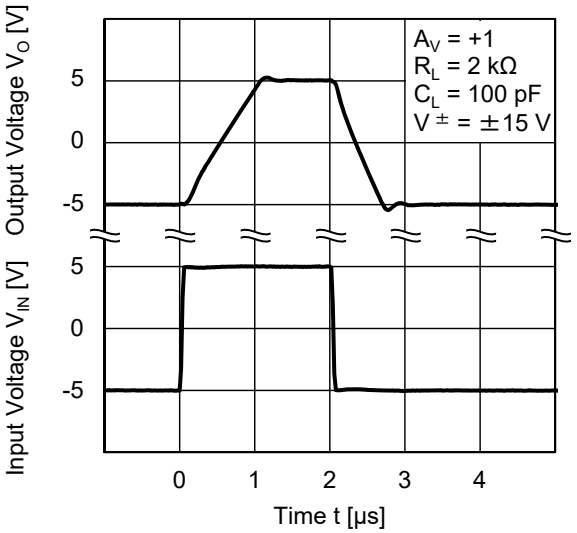
I_{CC} vs. $V^{\pm}$



e_n vs. f



Pulse Response Characteristics

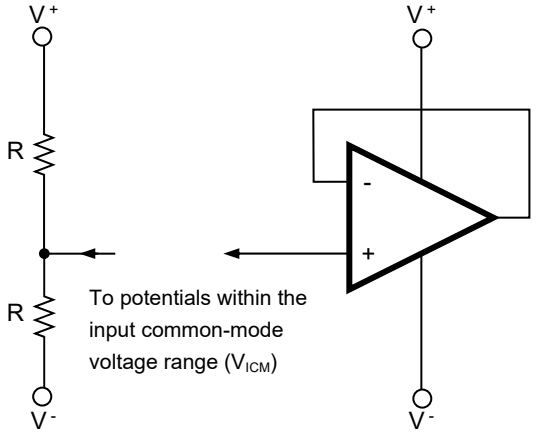


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USE WITH PRECAUTIONS

- Managing unused circuits
  If there is an unused circuit, the following connection is recommended.

Example of handling unused circuit



Note in this example, an intermediate voltage of V^+ and V^- is applied.

- **Power Supply (Dual Power Supply / Single Power Supply)**
  The op-amp operates when a predetermine voltage is applied between V^+ to V^-. Therefore, while it operates from a single power supply (V^- = GND), it is not possible to operate the input and output near GND. So please be careful of the input common-mode voltage range and maximum output voltage.

- **Ratings of input/output pin voltage**
  When the voltage of input/output pin exceeds the absolute maximum rating, the parasitic diode within the IC may conduct, causing characteristics degradation or damage. In addition, if the voltage of input pin is lower than V^-, or the voltage of output pin exceeds the power supply voltage, it is recommended to make a clamping circuit using a diode with low forward voltage (e.g.: Schottky diode) as protection.

- **Input common-mode voltage range**
  When the supply voltage does not meet the condition of electrical characteristics, the input common-mode voltage range is as follows.
  V_{ICM} (TYP.): V^- +2 to V^+ [V] (T_A = 25 °C)
  During designing, do include some margin by considering characteristic variations, temperature characteristics etc.

- **Maximum Output Voltage**
  When the supply voltage does not meet the condition of electrical characteristics, the TYP. value range of the maximum output voltage is as follows:
  $V_{om}{}^+$ (TYP.): V^+ -1.5 [V] (T_A = 25 °C), $V_{om}{}^-$ (TYP.): V^- +1.5 [V] (T_A = 25 °C)
  During designing, do include some margin by considering characteristic variations, temperature characteristics and so on. In addition, also note that the output voltage range ($V_{om}{}^+$ to $V_{om}{}^-$) will become narrow when the output current increases.

- **Handling of ICs**
  When stress is added to the ICs due to warpage or bending of a board, the characteristic may fluctuate due to piezoelectric (piezo) effect. Therefore, pay attention to warpage or bending of a board.

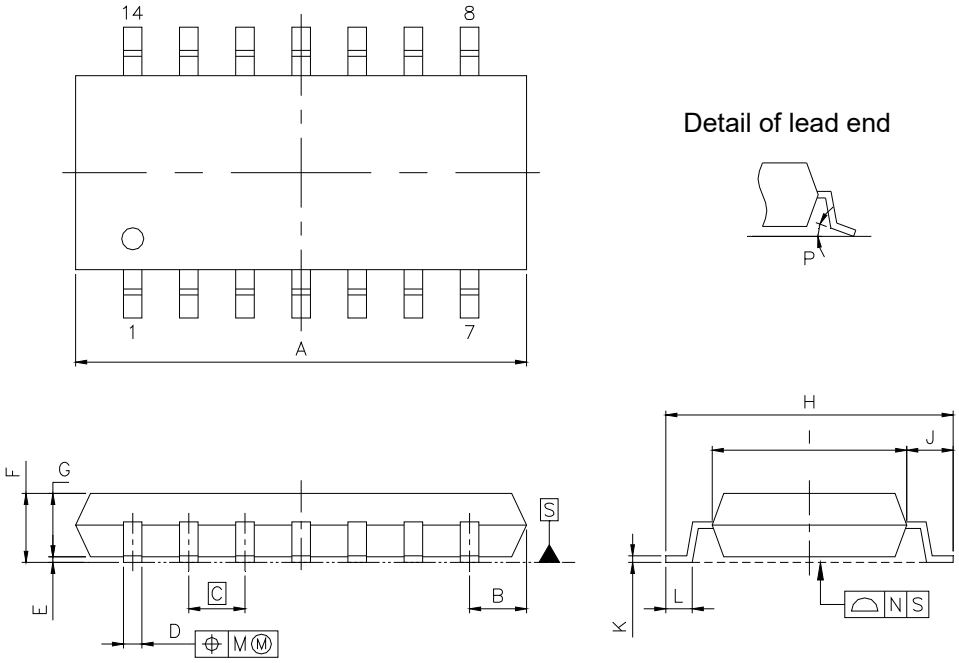
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PACKAGE DRAWINGS

14-PIN PLASTIC SOP

JEITA Package code	RENESAS code	Previous code	MASS (TYP.) [g]
P-SOP14-0225-1.27	PRSP0014DI-A	P14GR-50-225B	0.14

Unit: mm



NOTE

Each lead centerline is located within 0.12 mm of its true position (T.P.) at maximum material condition.

ITEM	MILLIMETERS
A	10.2 ±0.26
B	1.42 MAX
C	1.27 (T.P)
D	0.42 +0.08 -0.07
E	0.1 ±0.1
F	1.59 +0.21 -0.2
G	1.49
H	6.5 ±0.2
I	4.4 ±0.1
J	1.1 ±0.16
K	0.17 +0.08 -0.07
L	0.6 ±0.2
M	0.1
N	0.10
P	3° +7° -3°

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(Rev.4.0-1 November 2017)

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