ICL8021/ICL8022/ICL8023

Low Power Bipolar Operational Amplifier

INTERSIL

GENERAL DESCRIPTION

The Intersil ICL8021 series are low power operational amplifiers specifically designed for applications requiring very low standby power consumption over a wide range of supply voltages. The electrical characteristics of the 8021 series can be tailored to a particular application by adjusting an external resistor, R_{SET}, which controls the quiescent current. This is advantageous because I_Q can be made independent of the supply voltages: it can be set to an extremely low value where power is critical, or to a larger value for high slew rate or wideband applications.

Other features of the 8021 series include low input current that remains constant with temperature, low noise, high input impedance, internal compensation and pin-for-pin compatibility with the 741.

The Intersil 8022 (8023) consists of two (three) low power operational amplifiers in a single 14(16)-pin DIP. Each amplifier is identical to an 8021 low power op amp, and has separate connections for adjusting its electrical characteristics by means of an external resistor, R_{SET}, which controls the quiescent current of that amplifier.

FEATURES

- **V_{OS} = 3mV Max (Adjustable to Zero)**
- **±1.5V to ±18V Power Supply Operation**
- **Power Consumption — 20μW @ ±1V**
- **Input Bias Current — 30nA Max**
- **Internal Compensation**
- **Pin-For-Pin Compatible With 741**
- **Short Circuit Protected**

ORDERING INFORMATION

ICL8021 C TY

Package
- TY — TO-99 Metal Can; PA — 8 pin Minidip — 8021 only
- JD — 14 pin CERDIP; PD — 14 pin Plastic DIP — 8022 only
- JE — 16 pin CERDIP; PE — 16 pin Plastic DIP — 8023 only

Temperature
- C — Commercial — 0°C to +70°C
- M — Military — -55°C to +125°C

Basic Part Number
- 8021 — Single
- 8022 — Dual
- 8023 — Triple

PART NUMBER	TEMPERATURE RANGE	PACKAGE
ICL8021/D	—	DICE**
ICL8021CJA	0°C to 70°C	8 Lead CERDIP
ICL8021CBA	0°C to 70°C	8 Lead S.O.I.C
ICL8021CPA	0°C to 70°C	8 Lead MINIDIP
ICL8021CTY	0°C to 70°C	8 Lead Metal Can
ICL8021MJA	-55°C to +125°C	8 Lead CERDIP
ICL8021MJD	-55°C to +125°C	14 Lead CERDIP
ICL8021MTY	-55°C to +125°C	8 Lead Metal Can
ICL8022/D	—	DICE
ICL8022CJD	0°C to 70°C	14 Lead CERDIP
ICL8022CPD	0°C to 70°C	14 Lead MINIDIP
ICL8022MJD	-55°C to +125°C	14 Lead CERDIP
ICL8023/D	—	DICE
ICL8023CJE	0°C to 70°C	16 Lead CERDIP
ICL8023CPE	0°C to 70°C	16 Lead MINIDIP
ICL8023MJE	-55°C to +125°C	16 Lead CERDIP

**Parameter Min/Max Limits guaranteed at 25°C only for DICE orders.

Note: All typical values have been guaranteed by characterization and are not tested.

ICL8021/ICL8022/ICL8023

ABSOLUTE MAXIMUM RATINGS

Supply Voltage .... ±18V
Differential Input Voltage (Note 1) .... ±15V
Common Mode Input Voltage (Note 1) .... ±15V
Output Short Circuit Duration .... Indefinite
Power Dissipation (Note 2) 300mW

Operating Temperature Range
8021M .... −55°C to +125°C
8021C .... 0°C to +70°C
Storage Temperature Range .... −65°C to +150°C
Lead Temperature (Soldering, 10sec) .... +300°C

NOTE 1: For supply voltages less than ±15V, the absolute maximum input voltage is equal to the supply voltage.

NOTE 2: Rating applies for case temperatures to +125°C; derate linearly at 5.6 mW/°C for ambient temperatures above +95°C.

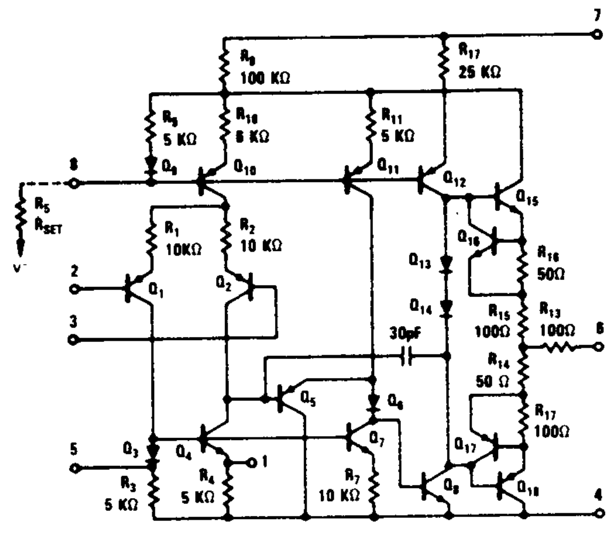

Figure 1: Functional Diagram

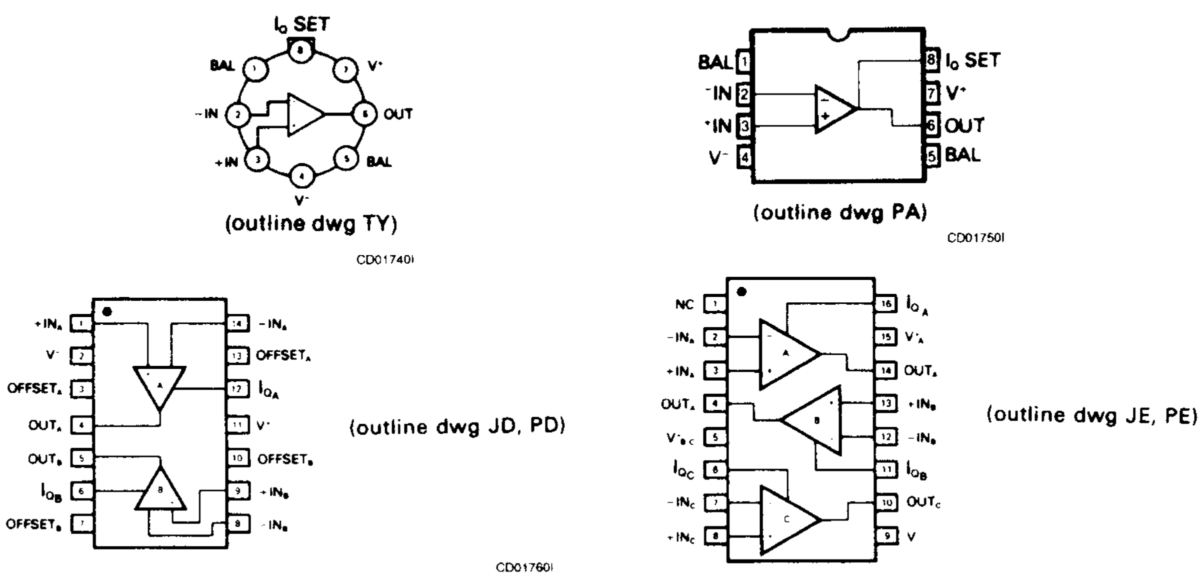

Figure 2: Pin Configurations

Note: All typical values have been guaranteed by characterization and are not tested.

INTERSIL

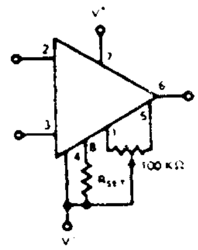

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Figure 3: Voltage Offset Null Circuit

ELECTRICAL CHARACTERISTICS (V_{SUPPLY} = ±6V, I_Q = 30μA, unless otherwise specified.)

CHARACTERISTICS	TEST CONDITIONS	8021M			8021C			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	
The following specifications apply for T_A = 25°C:								
Input Offset Voltage	R_S ≤ 100kΩ		2	3		2	6	mV
Input Offset Current			.5	7.5		.7	10	nA
Input Bias Current			5	20		7	30	nA
Input Resistance		3	10		3	10		MΩ
Input Voltage Range	V_{SUPPLY} = ±15V	±12	±13		±12	±13		V
Common Mode Rejection Ratio	R_S ≤ 10kΩ	70	80		70	80		dB
Supply Voltage Rejection Ratio	R_S ≤ 10kΩ		30	150		30	150	μV/V
Output Resistance	Open Loop		2			2		kΩ
Output Voltage Swing	R_L ≥ 20kΩ, V_{SUPPLY} = ±15V	±12	±14		±12	±14		V
	R_L ≥ 10kΩ, V_{SUPPLY} = ±15V	±11	±13		±11	±13		V
Output Short-Circuit Current			±13			±13		mA
Power Consumption	V_{OUT} = 0		360	480		360	600	μW
Slew Rate (Unity Gain)			0.16			0.16		V/μs
Unity Gain Bandwidth	R_L = 20kΩ, V_{IN} = 20mV		270			270		kHz
Transient Response (Unity Gain)	R_L = 20kΩ, V_{IN} = 20mV							
Risetime			1.3			1.3		μs
Overshoot			10			10		%
The following specifications apply for 0°C ≤ T_A ≤ +70°C (8021C) and −55°C ≤ T_A ≤ +125°C (8021M)								
Input Offset Voltage	R_S ≤ 10kΩ		2.0	4.0		2.0	7.5	mV
Input Offset Current			1.0	11		1.5	15	nA
Input Bias Current			10	32		15	50	nA
Average Temperature Coefficient of Input Offset Voltage	R_S ≤ 10kΩ		5			5		μV/°C
Average Temperature Coefficient of Input Offset Current			1.7			0.8		pA/°C
Large Signal Voltage Gain	R_L = 10kΩ	50	200		50	200		V/mV
Output Voltage Swing	R_L ≥ 10kΩ	±10	±13		±10	±13		V

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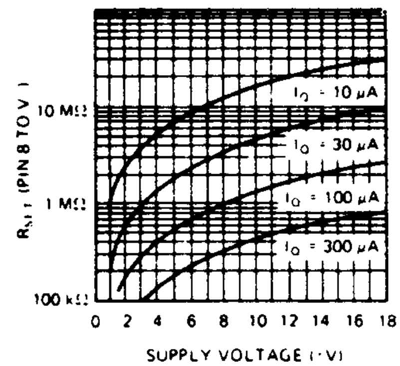
Note: All typical values have been guaranteed by characterization and are not tested.

QUIESCENT CURRENT ADJUSTMENT

QUIESCENT CURRENT SETTING RESISTOR (PIN 8 to V⁻)

V_S	I_Q 10μA	30μA	100μA	300μA
±1.5	1.5MΩ	470kΩ	150kΩ	–
±3	3.3MΩ	1.1MΩ	330kΩ	100kΩ
±6	7.5MΩ	2.7MΩ	750kΩ	220kΩ
±9	13MΩ	4MΩ	1.3MΩ	350kΩ
±12	18MΩ	5.6MΩ	1.5MΩ	510kΩ
±15	22MΩ	7.5MΩ	2.2MΩ	620kΩ

QUIESCENT CURRENT SETTING RESISTOR (PIN 8 to V⁻)



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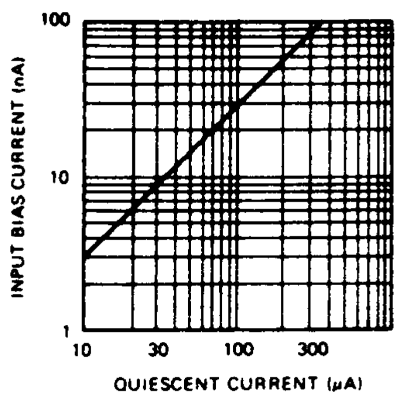
TYPICAL PERFORMANCE CHARACTERISTICS*

(T_A = +25°C, V_S = ±6V, I_Q = 30μA unless otherwise specified.)

INPUT BIAS CURRENT VS QUIESCENT CURRENT



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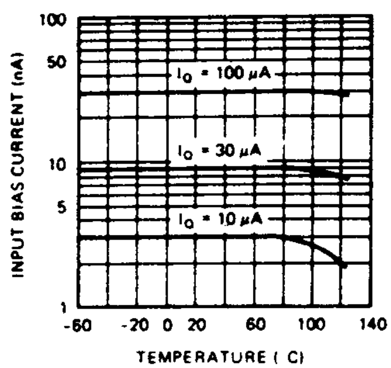
INPUT BIAS CURRENT VS AMBIENT TEMPERATURE



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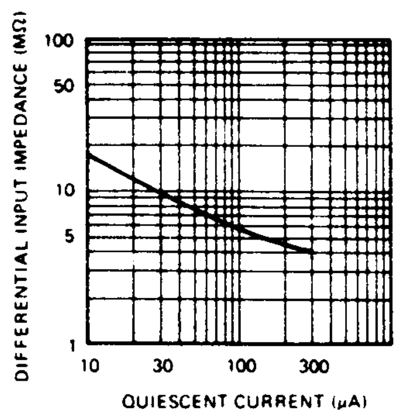
DIFFERENTIAL INPUT IMPEDANCE VS QUIESCENT CURRENT



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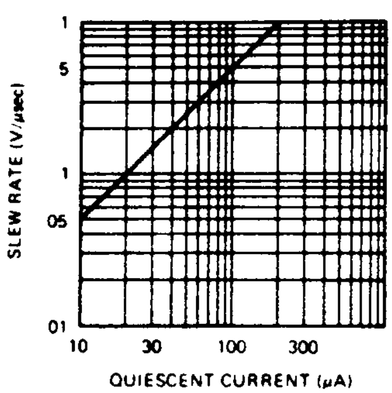
SLEW RATE VS QUIESCENT CURRENT



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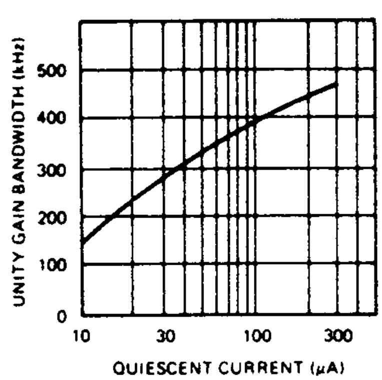
FREQUENCY RESPONSE VS QUIESCENT CURRENT



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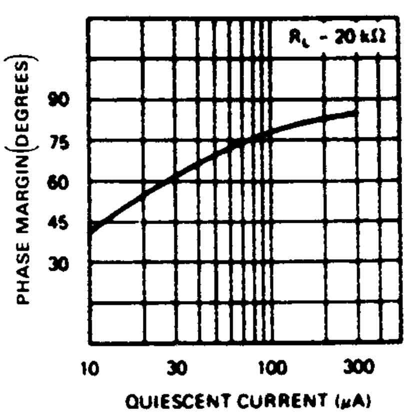
PHASE MARGIN VS QUIESCENT CURRENT



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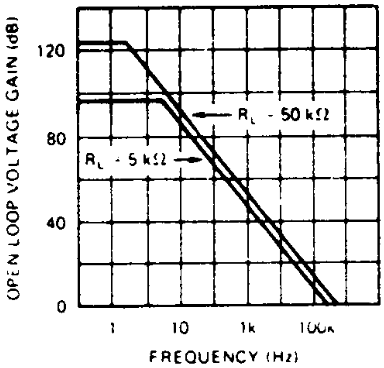
Note: All typical values have been guaranteed by characterization and are not tested.

TYPICAL PERFORMANCE CHARACTERISTICS* (CONT.)

OPEN-LOOP FREQUENCY RESPONSE



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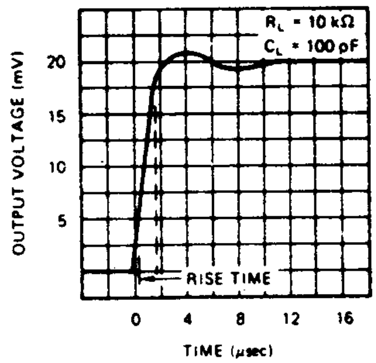
TRANSIENT RESPONSE



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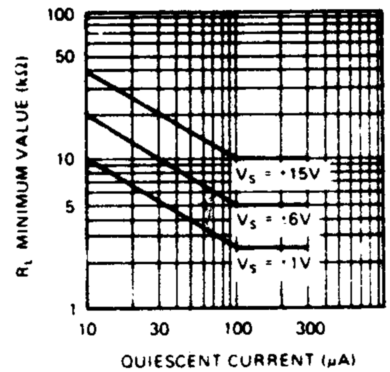
MAXIMUM LOAD VS QUIESCENT CURRENT



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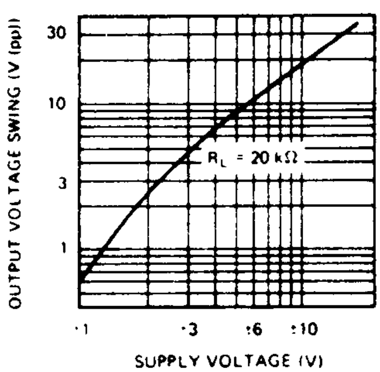
OUTPUT VOLTAGE SWING VS SUPPLY VOLTAGE



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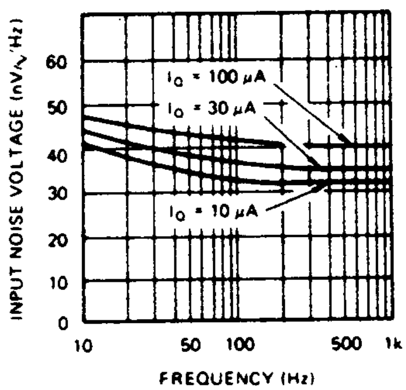
EQUIVALENT INPUT NOISE VOLTAGE VS FREQUENCY



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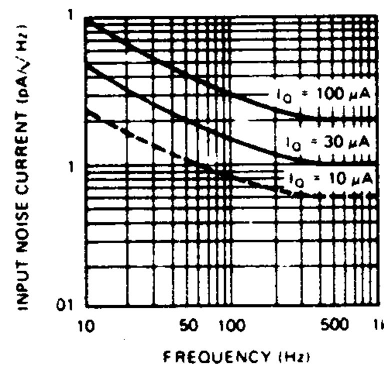
EQUIVALENT INPUT NOISE CURRENT VS FREQUENCY



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*ICL8021C guaranteed only for 0°C ≤ T_A ≤ +70°C

Note: All typical values have been guaranteed by characterization and are not tested.