

Single and Dual Single Supply Ultra-Low Noise, Low Distortion Rail-to-Rail Output, Op Amp

The ISL28191 and ISL28291 are tiny single and dual ultra-low noise, ultra-low distortion operational amplifiers. They are fully specified to operate down to +3V single supply. These amplifiers have outputs that swing rail-to-rail and an input common mode voltage that extends to ground (ground sensing).

The ISL28191 and ISL28291 are unity gain stable with an input referred voltage noise of 1.7nV/√Hz. Both parts feature 0.00018% THD+N at 1kHz.

The ISL28191 is available in the space-saving 6 Ld μ TDFN (1.6mmx1.6mm) and 6 Ld SOT-23 packages. The ISL28291 is available in the 8 Ld SOIC, 10 Ld 1.8mmx1.4mm μ TQFN and 10 Ld MSOP packages. All devices are guaranteed over -40°C to +125°C.

Ordering Information

PART NUMBER	PART MARKING	PACKAGE (Pb-free)	PKG. DWG. #
ISL28191FHZ-T7* (Note 1)	GABJ	6 Ld SOT-23	MDP0038
ISL28191FRUZ-T7* (Note 2)	M8	6 Ld μ TDFN	L6.1.6x1.6A
ISL28291FUZ (Note 1)	8291Z	10 Ld MSOP	MDP0043
ISL28291FUZ-T7* (Note 1)	8291Z	10 Ld MSOP	MDP0043
ISL28291FBZ (Note 1)	28291 FBZ	8 Ld SOIC	MDP0027
ISL28291FBZ-T7 (Note 1)	28291 FBZ	8 Ld SOIC	MDP0027
ISL28291FRUZ-T7* (Note 2)	F	10 Ld μ TQFN	L10.1.8x1.4A
ISL28291EVAL1Z	Evaluation Board		

*Please refer to TB347 for details on reel specifications.

NOTES:

- These Intersil Pb-free plastic packaged products employ special Pb-free material sets, molding compounds/die attach materials, and 100% matte tin plate plus anneal (e3 termination finish, which is RoHS compliant and compatible with both SnPb and Pb-free soldering operations). Intersil Pb-free products are MSL classified at Pb-free peak reflow temperatures that meet or exceed the Pb-free requirements of IPC/JEDEC J STD-020.
- These Intersil Pb-free plastic packaged products employ special Pb-free material sets; molding compounds/die attach materials and NiPdAu plate - e4 termination finish, which is RoHS compliant and compatible with both SnPb and Pb-free soldering operations. Intersil Pb-free products are MSL classified at Pb-free peak reflow temperatures that meet or exceed the Pb-free requirements of IPC/JEDEC J STD-020.

Features

- 1.7nV/√Hz input voltage noise at 1kHz
- 1kHz THD+N typical 0.00018% at 2V_{P-P} V_{OUT}
- Harmonic Distortion -76dBc, -70dBc, f_o = 1MHz
- 61MHz -3dB bandwidth
- 630 μ V maximum offset voltage
- 3 μ A input bias current
- 100dB typical CMRR
- 3V to 5.5V single supply voltage range
- Rail-to-rail output
- Ground Sensing
- Enable pin (not available in the 8 Ld SOIC package option)
- Pb-free (RoHS compliant)

Applications

- Low noise signal processing
- Low noise microphones/preamplifiers
- ADC buffers
- DAC output amplifiers
- Digital scales
- Strain gauges/sensor amplifiers
- Radio systems
- Portable equipment
- Infrared detectors

Absolute Maximum Ratings ($T_A = +25^\circ\text{C}$)

Supply Voltage	5.5V
Supply Turn On Voltage Slew Rate	1V/ μs
Differential Input Current	5mA
Differential Input Voltage	0.5V
Input Voltage	V- - 0.5V to V+ + 0.5V
ESD Tolerance	
Human Body Model	.3kV
Machine Model	.300V
Charged Device Model (CDM)	1200V

Thermal Information

Thermal Resistance (Typical, Note)	θ_{JA} ($^\circ\text{C/W}$)
6 Ld SOT-23 Package	230
6 Ld μTDFN Package	125
8 Ld SO Package	125
10 Ld MSOP Package	150
10 Ld μTQFN Package	180
Ambient Operating Temperature Range	-40 $^\circ\text{C}$ to +125 $^\circ\text{C}$
Storage Temperature Range	-65 $^\circ\text{C}$ to +150 $^\circ\text{C}$
Operating Junction Temperature	+125 $^\circ\text{C}$
Pb-free reflow profile	see link below
	http://www.intersil.com/pbfree/Pb-FreeReflow.asp

CAUTION: Do not operate at or near the maximum ratings listed for extended periods of time. Exposure to such conditions may adversely impact product reliability and result in failures not covered by warranty.

NOTE:

- θ_{JA} is measured with the component mounted on a high effective thermal conductivity test board in free air. See Tech Brief TB379 for details.

IMPORTANT NOTE: All parameters having Min/Max specifications are guaranteed. Typical values are for information purposes only. Unless otherwise noted, all tests are at the specified temperature and are pulsed tests, therefore: $T_J = T_C = T_A$

Electrical Specifications $V_+ = 5.0\text{V}$, $V_- = \text{GND}$, $R_L = \text{Open}$, $R_F = 1\text{k}\Omega$, $A_V = -1$ unless otherwise specified. Parameters are per amplifier. Typical values are at $V_+ = 5\text{V}$, $T_A = +25^\circ\text{C}$. **Boldface limits apply over the operating temperature range, -40 $^\circ\text{C}$ to +125 $^\circ\text{C}$, temperature data guaranteed by characterization.**

PARAMETER	DESCRIPTION	CONDITIONS	MIN (Note 4)	TYP	MAX (Note 4)	UNIT
DC SPECIFICATIONS						
V_{OS}	Input Offset Voltage			270	630 840	μV
$\frac{\Delta V_{OS}}{\Delta T}$	Input Offset Drift vs Temperature	Figure 21		3.1		$\mu\text{V}/^\circ\text{C}$
I_{IO}	Input Offset Current			35	500 900	nA
I_B	Input Bias Current			3	6 7	μA
CMIR	Common-Mode Input Range		0		3.8	V
CMRR	Common-Mode Rejection Ratio	$V_{CM} = 0\text{V}$ to 3.8V	78	100		dB
PSRR	Power Supply Rejection Ratio	$V_S = 3\text{V}$ to 5V	74	80		dB
A_{VOL}	Large Signal Voltage Gain	$V_O = 0.5\text{V}$ to 4V, $R_L = 1\text{k}\Omega$	90 86	98		dB
V_{OUT}	Maximum Output Voltage Swing	Output low, $R_L = 1\text{k}\Omega$		20	50 80	mV
		Output high, $R_L = 1\text{k}\Omega$, $V_+ = 5\text{V}$	4.95 4.92	4.97		V
$I_{S,ON}$	Supply Current per Amplifier, Enabled			2.6	3.5 3.9	mA
$I_{S,OFF}$	Supply Current per Amplifier, Disabled			26	35 48	μA
I_{O+}	Short-Circuit Output Current	$R_L = 10\Omega$	95 90	130		mA
I_{O-}	Short-Circuit Output Current	$R_L = 10\Omega$	95 90	130		mA
V_{SUPPLY}	Supply Operating Range	V_+ to V_-	3		5.5	V
\overline{V}_{ENH}	$\overline{\text{EN}}$ High Level	Referred to V_-	2			V

ISL28191, ISL28291

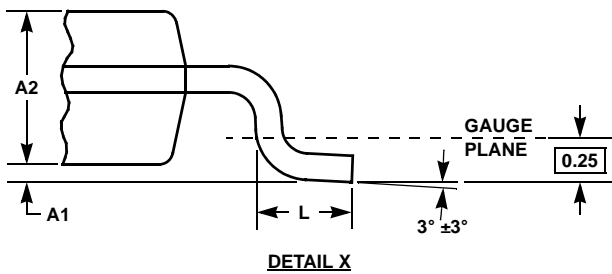
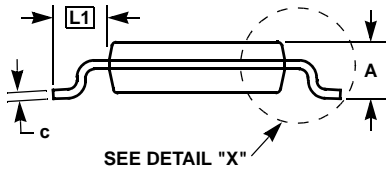
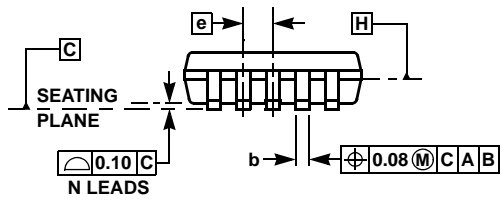
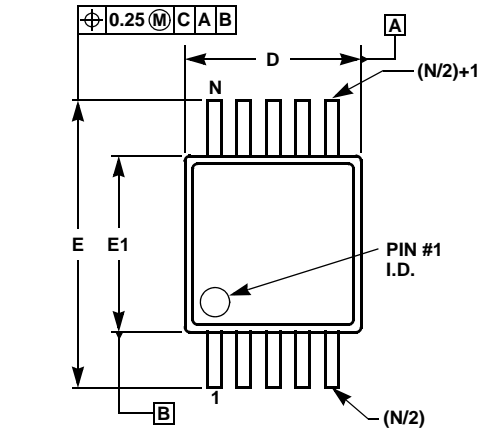
Electrical Specifications $V_+ = 5.0V$, $V_- = GND$, $R_L = \text{Open}$, $R_F = 1k\Omega$, $A_V = -1$ unless otherwise specified. Parameters are per amplifier. Typical values are at $V_+ = 5V$, $T_A = +25^\circ C$. **Boldface limits apply over the operating temperature range, $-40^\circ C$ to $+125^\circ C$, temperature data guaranteed by characterization. (Continued)**

PARAMETER	DESCRIPTION	CONDITIONS	MIN (Note 4)	TYP	MAX (Note 4)	UNIT
$V_{\overline{EN}L}$	\overline{EN} Low Level	Referred to V_-			0.8	V
$I_{\overline{EN}H}$	\overline{EN} Pin Input High Current	$V_{\overline{EN}} = V_+$		0.8	1.1 1.3	μA
$I_{\overline{EN}L}$	\overline{EN} Pin Input Low Current	$V_{\overline{EN}} = V_-$		20	80 100	nA
AC SPECIFICATIONS						
GBW	-3dB Unity Gain Bandwidth	$R_F = 0\Omega$, $C_L = 20pF$, $A_V = 1$, $R_L = 10k\Omega$		61		MHz
THD+N	Total Harmonic Distortion + Noise	$f = 1kHz$, $V_{OUT} + 2V_{P-P}$, $A_V = +1$, $R_L = 10k\Omega$		0.00018		%
HD (1MHz)	2nd Harmonic Distortion	$2V_{P-P}$ output voltage, $A_V = 1$		-76		dBc
	3rd Harmonic Distortion			-70		dBc
ISO	Off-state Isolation $f_O = 100kHz$	$A_V = +1$, $V_{IN} = 100mV_{P-P}$, $R_F = 0\Omega$ $C_L = 20pF$, $A_V = 1$, $R_L = 10k\Omega$		-38		dB
X-TALK ISL28291	Channel-to-Channel Crosstalk $f_O = 100kHz$	$V_S = \pm 2.5V$, $A_V = +1$, $V_{IN} = 1V_{P-P}$, $R_F = 0\Omega$, $C_L = 20pF$, $A_V = 1$, $R_L = 10k\Omega$		-105		dB
PSRR	Power Supply Rejection Ratio $f_O = 100kHz$	$V_S = \pm 2.5V$, $A_V = +1$, $V_{SOURCE} = 1V_{P-P}$, $R_F = 0\Omega$, $C_L = 20pF$, $A_V = 1$, $R_L = 10k\Omega$		-70		dB
CMRR	Common Mode Rejection Ratio $f_O = 100kHz$	$V_S = \pm 2.5V$, $A_V = +1$, $V_{CM} = 1V_{P-P}$, $R_F = 0\Omega$, $C_L = 20pF$, $A_V = 1$, $R_L = 10k\Omega$		-65		dB
e_n	Input Referred Voltage Noise	$f_O = 1kHz$		1.7		nV/\sqrt{Hz}
i_n	Input Referred Current Noise	$f_O = 1kHz$		1.8		pA/\sqrt{Hz}
TRANSIENT RESPONSE						
SR	Slew Rate		12 12	17		$V/\mu s$
t_r , t_f , Small Signal	Rise Time, t_r 10% to 90%	$A_V = 1$, $V_{OUT} = 0.1V_{P-P}$, $R_L = 10k\Omega$, $C_L = 1.2pF$		7		ns
	Fall Time, t_f 90% to 10%			12		ns
t_r , t_f Large Signal	Rise Time, t_r 10% to 90%	$A_V = 2$, $V_{OUT} = 1V_{P-P}$; $R_L = 10k\Omega$, $R_F/R_G = 499\Omega/499\Omega$, $C_L = 1.2pF$		44		ns
	Fall Time, t_f 90% to 10%			50		ns
	Rise Time, t_r 10% to 90%	$A_V = 2$, $V_{OUT} = 4.7V_{P-P}$; $R_L = 10k\Omega$, $R_F/R_G = 499\Omega/499\Omega$, $C_L = 1.2pF$		190		ns
	Fall Time, t_f 90% to 10%			190		ns
$t_{\overline{EN}}$	ENABLE to Output Turn-on Delay Time; 10% \overline{EN} - 10% V_{OUT}	$A_V = 1$, $V_{OUT} = 1V_{DC}$, $R_L = 10k\Omega$, $C_L = 1.2pF$		330		ns
	ENABLE to Output Turn-off Delay Time; 10% \overline{EN} - 10% V_{OUT}	$A_V = 1$, $V_{OUT} = 0V_{DC}$, $R_L = 10k\Omega$, $C_L = 1.2pF$		50		ns

NOTE:

- Parameters with MIN and/or MAX limits are 100% tested at $+25^\circ C$, unless otherwise specified. Temperature limits established by characterization and are not production tested.

Mini SO Package Family (MSOP)



MDP0043

MINI SO PACKAGE FAMILY

SYMBOL	MILLIMETERS		TOLERANCE	NOTES
	MSOP8	MSOP10		
A	1.10	1.10	Max.	-
A1	0.10	0.10	±0.05	-
A2	0.86	0.86	±0.09	-
b	0.33	0.23	+0.07/-0.08	-
c	0.18	0.18	±0.05	-
D	3.00	3.00	±0.10	1, 3
E	4.90	4.90	±0.15	-
E1	3.00	3.00	±0.10	2, 3
e	0.65	0.50	Basic	-
L	0.55	0.55	±0.15	-
L1	0.95	0.95	Basic	-
N	8	10	Reference	-

Rev. D 2/07

NOTES:

1. Plastic or metal protrusions of 0.15mm maximum per side are not included.
2. Plastic interlead protrusions of 0.25mm maximum per side are not included.
3. Dimensions "D" and "E1" are measured at Datum Plane "H".
4. Dimensioning and tolerancing per ASME Y14.5M-1994.