

élantec
 HIGH PERFORMANCE ANALOG INTEGRATED CIRCUITS

EL2038/EL2038C

1 GHz Operational Amplifier

ELANTEC INC

T-79-07-10

EL2038/EL2038C

Features

- Wide gain-bandwidth—1 GHz
- High slew rate—1000 V/ μ s
- High power bandwidth—16 MHz
- Low offset voltage—0.5 mV
- Low supply current—13 mA
- Standard ± 15 V op amp supplies
- Large Open Loop Gain—15 kV/V (83 dB)
- MIL-STD-883 Rev. C Compliant
- Output voltage swing ± 11 V

Applications

- Pulse and Video amplifiers
- Wideband amplifiers
- High speed sample-and-hold circuits
- Local area Networks

Ordering Information

Part No.	Temp. Range	Pkg. Outline #
EL2038CJ	0°C to +75°C	CerDIP MDP0014
EL2038CN	0°C to +75°C	P-DIP MDP0031
EL2038J	-55°C to +125°C	CerDIP MDP0014
EL2038J/883B	-55°C to +125°C	CerDIP MDP0014
EL2038L/883B	-55°C to +125°C	20-Pad MDP0007 LCC

5962-9153501 is the SMD version of this device.

General Description

The EL2038 monolithic operational amplifier offers a 1 GHz gain-bandwidth and 1000 V/ μ s slew rate with excellent DC accuracy. The EL2038 is 67% faster than the HA2539 but with a typical power reduction of 35%. This patented amplifier is stable when driving capacitive loads and is well behaved when the output is overdriven. The EL2038 is compensated for closed loop gains ≥ 20 . The EL2038 is fabricated with Elantec's Complementary Bipolar process, and is zener zap trimmed for low offset voltage.

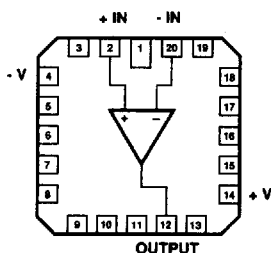
Elantec's high speed amplifiers are widely used in military, video and medical applications. The EL2038 is especially well-suited for high speed video amplifiers, pulse detectors and wide bandwidth filters.

Elantec's EL2038/883B complies with MIL-STD-883 Revision C in all aspects, including burn-in at 125°C. Elantec's facilities comply with MIL-I-45208A, and other applicable quality specifications. For information on Elantec's military processing, see the Elantec document, QRA-2: *Elantec's Military Processing—Monolithic Products.*

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Connection Diagrams

EL2038L



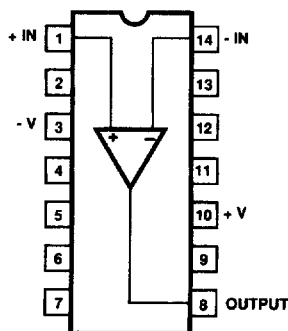
Top View

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Note: Non-designated pins are no connects and are not electrically connected internally.

Manufactured under U.S. Patent No. 4,837,523

EL2038J EL2038CN



Top View

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July 1992 Rev C

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

Voltage between V^+ and V^-	35V	Operating Temperature Range	
Differential Input Voltage	6V	EL2038	-55°C to $+125^\circ\text{C}$
Output Current	50 mA (Peak)	EL2038C	0°C to $+75^\circ\text{C}$
	30 mA (Continuous)	Operating Junction Temperature	
Internal Power Dissipation	See Curves	CerDIP, Ceramic LCC	175°C
		Plastic DIP	150°C
		Lead Temperature (Soldering, 5 seconds)	300°C
		Storage Temperature Range	-65°C to $+150^\circ\text{C}$

Important Note:

All parameters having Min/Max specifications are guaranteed. The Test Level column indicates the specific device testing actually performed during production and Quality inspection. Elantec performs most electrical tests using modern high-speed automatic test equipment, specifically the LTX77 Series system. Unless otherwise noted, all tests are pulsed tests, therefore $T_J = T_C = T_A$.

Test Level	Test Procedure
I	100% production tested and QA sample tested per QA test plan QCX0002.
II	100% production tested at $T_A = 25^\circ\text{C}$ and QA sample tested at $T_A = 25^\circ\text{C}$, T_{MAX} and T_{MIN} per QA test plan QCX0002.
III	QA sample tested per QA test plan QCX0002.
IV	Parameter is guaranteed (but not tested) by Design and Characterization Data.
V	Parameter is typical value at $T_A = 25^\circ\text{C}$ for information purposes only.

DC Electrical Characteristics $V_S = \pm 15\text{V}$, $R_L = 1\text{ k}\Omega$; unless otherwise specified

Parameter	Description	Temp	Min	Typ	Max	EL2038	EL2038C	Units
						Test Level	Test Level	
V_{OS}	Offset Voltage	$+25^\circ\text{C}$		0.5	2	I	I	mV
		Full			6	I	III	mV
TCV_{OS}	Average Offset Voltage Drift	Full		20		V	V	$\mu\text{V}/^\circ\text{C}$
I_B	Bias Current	$+25^\circ\text{C}$		5	15	I	I	μA
		Full			20	I	III	μA
I_{OS}	Offset Current	$+25^\circ\text{C}$		1	4	I	I	μA
		Full			6	I	III	μA
R_{IN}	Input Resistance	$+25^\circ\text{C}$		10		V	V	$\text{k}\Omega$
C_{IN}	Input Capacitance	$+25^\circ\text{C}$		1		V	V	pF
V_{CM}	Common Mode Input Range	Full	± 11	± 12		I	II	V
e_{IN}	Input Noise Voltage ($f = 1\text{ kHz}$, $R_G = 0\Omega$)	$+25^\circ\text{C}$		6		V	V	$\text{nV}/\sqrt{\text{Hz}}$
A_{VOL}	Large Signal Voltage Gain (Notes 1, 2)	$+25^\circ\text{C}$	10k	15k		I	I	V/V
		Full	5k			I	III	V/V
$CMRR$	Common-Mode Rejection Ratio (Note 3)	Full	60	90		I	II	dB
V_O	Output Voltage Swing (Note 1)	Full	± 11	± 12		I	II	V

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DC Electrical Characteristics $V_S = \pm 15V$, $R_L = 1\text{ k}\Omega$; unless otherwise specified — Contd.

Parameter	Description	Temp	Min	Typ	Max	EL2038	EL2038C	Units
						Test Level	Test Level	
I_O	Output Current (Note 13)	Full	± 25	± 50		I	II	mA
R_O	Output Resistance	$+25^\circ\text{C}$		30		V	V	Ω
I_S	Supply Current	Full		13	17	I	II	mA
PSRR	Power Supply Rejection Ratio (Note 8)	Full	60	85		I	II	dB

AC Electrical Characteristics $V_S = \pm 15V$, $R_L = 1\text{ k}\Omega$, unless otherwise specified (Note 14)

Parameter	Description	Temp	Min	Typ	Max	EL2038	EL2038C	Units
						Test Level	Test Level	
GBW	Gain-Bandwidth Product (Notes 4, 5)	$+25^\circ\text{C}$	0.875	1.1		I	III	GHz
FPBW	Full Power Bandwidth (Notes 1, 2, 6)	$+25^\circ\text{C}$	13.5	16		I	III	MHz
t_r	Rise Time (Notes 7, 9)	$+25^\circ\text{C}$		4	5	I	III	ns
OS	Overshoot (Notes 7, 10)	$+25^\circ\text{C}$		30	40	I	III	%
SR	Slew Rate (Note 7)	$+25^\circ\text{C}$	750	1000		I	III	V/ μs
t_s	Settling Time (Notes 11, 12) 10V Step to 0.1%	$+25^\circ\text{C}$		100		V	V	ns

Note 1: $R_L = 1\text{ k}\Omega$, $C_L < 10\text{ pF}$.Note 2: $V_O = \pm 10V$.Note 3: Two tests are performed, $V_{CM} = 0V$ to $+10V$ and $V_{CM} = 0V$ to $-10V$.Note 4: $V_O = 90\text{ mV}$.Note 5: $A_V = 20$.Note 6: Full Power Bandwidth guaranteed based on slew rate measurement using: $\text{FPBW} = \frac{\text{Slew rate}}{2\pi V_{\text{peak}}}$.

Note 7: Refer to Test Circuits section of data sheet.

Note 8: Two tests are performed, $V+ = +15V$, and $V-$ is changed from $-5V$ to $-15V$. $V- = -15V$, and $V+$ is changed from $+5V$ to $+15V$.Note 9: Risettime measurement of 25% to 75% with $V_{OUT} = 200\text{ mV}$.Note 10: $\Delta V_O = 200\text{ mV}$.

Note 11: Settling time measurements are made with techniques in the following reference: "Take The Guesswork Out of Settling-Time Measurements," EDN, September 19, 1985.

Note 12: $A_V = -20$, $R_L = 1\text{ k}\Omega$.Note 13: $R_L = 200\Omega$.

Note 14: 100% AC tested commercial parts available. Consult factory.

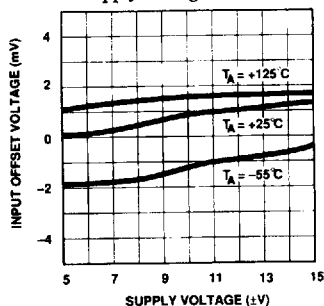
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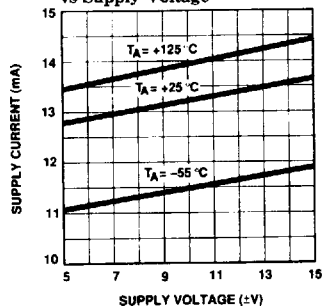
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Typical Performance Curves

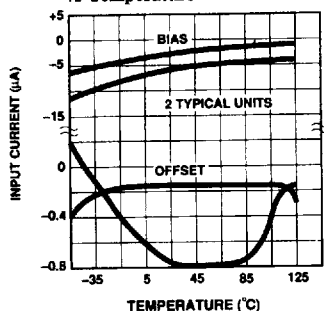
Input Offset Voltage
vs Supply Voltage



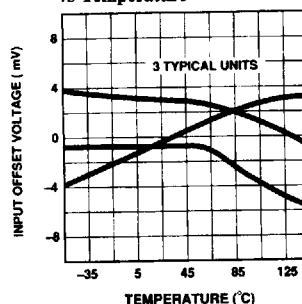
Supply Current
vs Supply Voltage



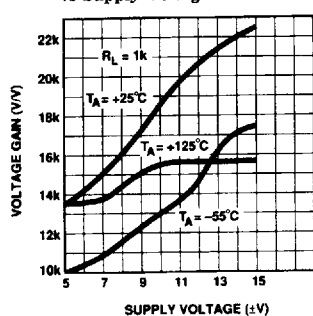
Input Currents
vs Temperature



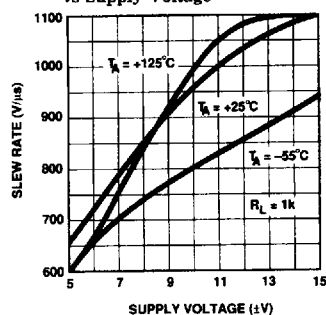
Input Offset Voltage
vs Temperature



Voltage Gain
vs Supply Voltage



Slew Rate
vs Supply Voltage

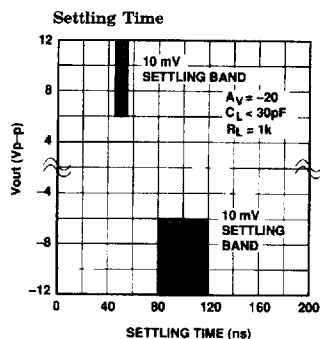
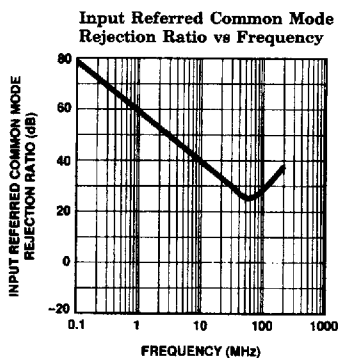
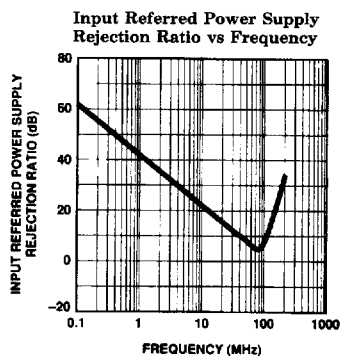
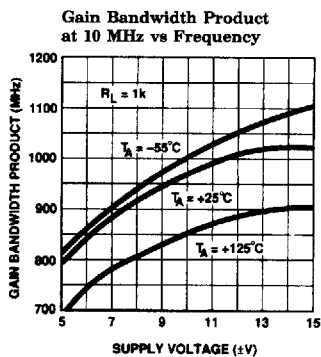
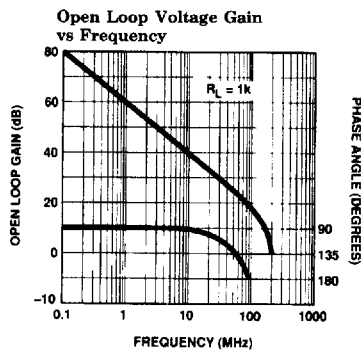
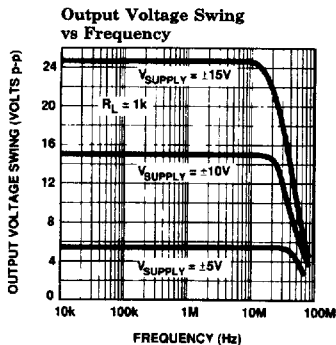


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Typical Performance Curves — Contd.

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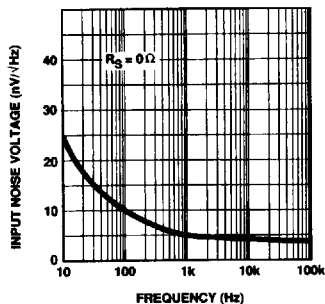
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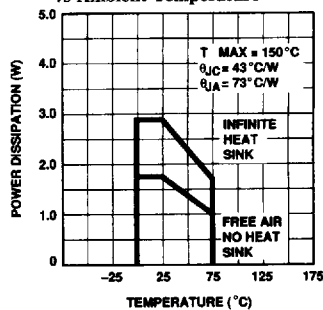
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Typical Performance Curves — Contd.

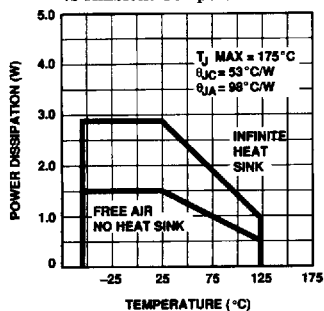
Input Noise Voltage
vs Frequency



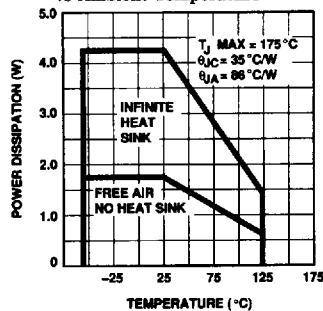
14-Lead Plastic DIP
Maximum Power Dissipation
vs Ambient Temperature



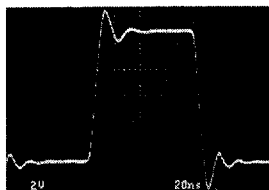
20-Lead LCC
Maximum Power Dissipation
vs Ambient Temperature



14-Lead CerDIP
Maximum Power Dissipation
vs Ambient Temperature



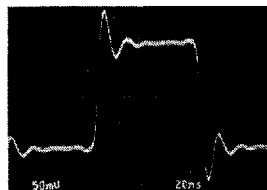
Large Signal Response



$V_{IN} = \pm 0.25V$
 $V_O = \pm 5V$

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Small Signal Response



$V_{IN} = \pm 5mV$
 $V_O = \pm 100mV$

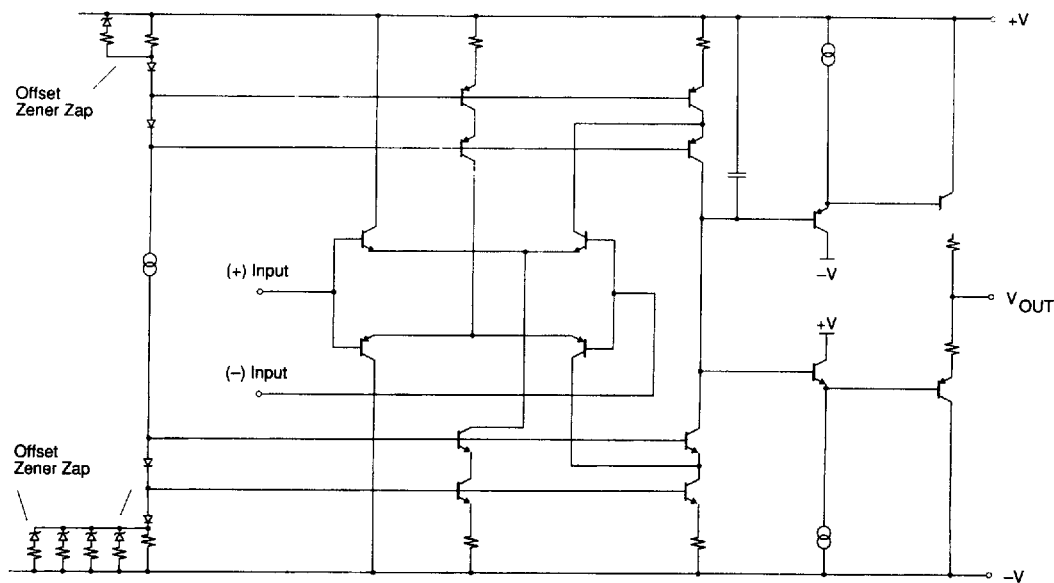
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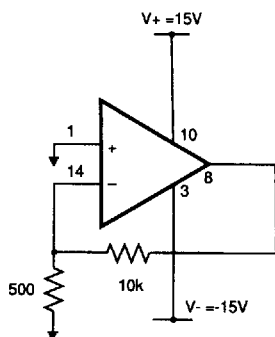
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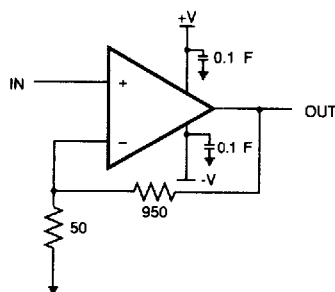
Simplified Schematic

2038-8

Burn-In Circuit

2038-9

Pin numbers are for 14-Lead CerDIP. All packages use the same schematic.

Test Circuit $A_V = 20$ $C_L = 10\text{pF}$ Scope Probe

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EL2038 Macromodel

* Connections:

	+ input	- input	+ Vsupply	- Vsupply	output
.					
.					
.					
.					
.					

.subckt M2038 1 14 10 3 8

* Input Stage

ie 37 8 2mA
 r6 36 37 65
 r7 38 37 65
 rc1 10 30 75
 rc2 10 39 75
 q1 30 1 36 qn
 q2 39 14 38 qna
 ediff 33 0 39 30 7.25
 rdiff 33 0 1Meg

* Compensation Section

ga 0 34 33 0 5.2m
 rh 34 0 .525Meg
 ch 34 0 0.5pF
 rc 34 40 600
 cc 40 0 4pF

* Poles

ep 41 0 40 0 1
 rpa 41 42 75
 cpa 42 0 17pF
 rpb 42 43 50
 cpb 43 0 10pF

* Output Stage

ios1 10 50 1.25mA
 ios2 51 3 1.25mA
 q3 3 43 50 qp
 q4 10 43 51 qn
 q5 10 50 52 qn
 q6 3 51 53 qp
 ros1 52 8 25
 ros2 8 53 25

* Power Supply Current

ips 10 3 9.2mA

* Models

.model qn npn(is=800.0E-18 bf=200 tf=0.2nS)
 .model qna npn(is=864E-18 bf=250 tf=0.2nS)
 .model qp pnp(is=800E-18 bf=60 tf=0.2nS)
 .ends

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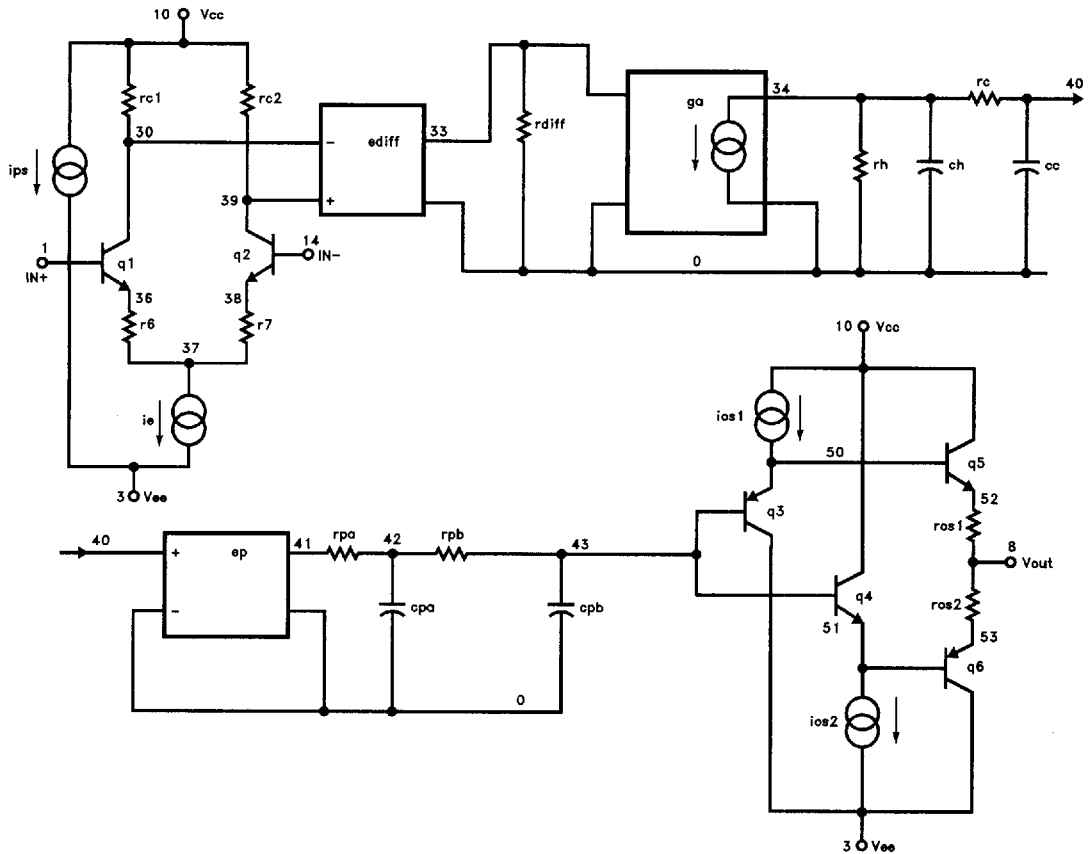
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EL2038 Macromodel — Contd.



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