élantec
HIGH PERFORMANCE ANALOG INTEGRATED CIRCUITS

EL2424/EL2424C

Quad 60 MHz High Speed Operational Amplifier

ELANTEC INC T-79.07-20

Features

- Unity-gain stable
- Wide bandwidth—60 MHz
- High slew rate—200 V/μs
- Wide supply range—
  ±5V to ±15V
- Output short circuit protected
- Low supply current—4 mA per amplifier

Applications

- High frequency active filters
- Video amplifiers
- Pulse amplifiers

Ordering Information

Part No.	Temp. Range	Package	Outline #
EL2424CJ	0°C to +75°C	CerDIP	MDP0010
EL2424CN	0°C to +75°C	P-DIP	MDP0031
EL2424J	−55°C to +125°C	CerDIP	MDP0010
EL2424J/883B	−55°C to +125°C	CerDIP	MDP0010
EL2424L/883B	−55°C to +125°C	LCC	MDP0007
EL2424CM	0°C to +75°C	SOL	MDP0027

General Description

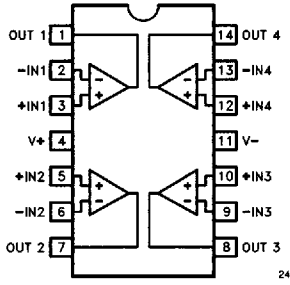
The EL2424 monolithic quad operational amplifier is an example of Elantec's commitment to high speed low power consumption products. This amplifier is unity-gain stable, exhibits Slew Rates of 200V per microsecond, and a Gain Bandwidth of 60 MHz while drawing supply currents of 4 mA per amplifier. The output provides short circuit protection but is capable of delivering currents in excess of 50 mA. The device is manufactured using Elantec's advanced Complementary Bipolar process.

The EL2424 is available in 14-lead Plastic DIP, 14-lead CerDIP, 20-pad LCC, and 20-pad SOL.

Elantec's products and facilities comply with MIL-STD-883, Revision C, MIL-I-45082A, and other applicable quality assurance specifications. For information on Elantec's Military processing, see QRA-2, "*Elantec's Military Processing, Monolithic Integrated Circuits*". For information on Elantec's Commercial processing, see QRA-1, "*Summary of Elantec's Reliability and Quality Assurance Policy*".

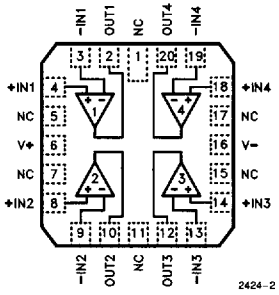
Connection Diagrams

EL2424J/CN



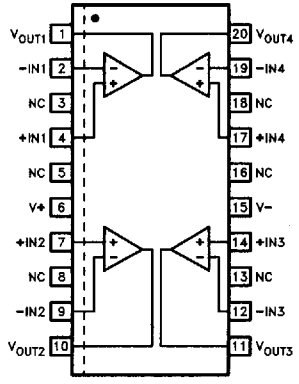
2424-1

EL2424L



2424-2

EL2424CM



2424-3

EL2424/EL2424C

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Quad 60 MHz High Speed Operational Amplifier

Absolute Maximum Ratings (T_A = 25°C)

Voltage between V+ and V−	35V	Storage Temperature Range	−65°C to 150°C
Differential Input Voltage	6V	Maximum Junction Temperature	
Peak Output Current	Short Circuit Protected	CerDIP, LCC	175°C
Output Short Circuit Duration (Note 1)	Continuous	Plastic DIP, SOL	150°C
Internal Power Dissipation	See Curves	Lead Temperature	
Operating Temperature Range		DIP Package	300°C
EL2424	−55°C to +125°C	SOL Package	
EL2424C	0°C to +75°C	Vapor Phase (60 seconds)	215°C
		Infrared (15 seconds)	220°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°C and QA sample tested at T_A = 25°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°C for information purposes only.

DC Electrical Characteristics V_S = ±15V; R_L = 2 kΩ, unless otherwise specified

Parameter	Description	Temp	EL2424				EL2424C				Units
			Min	Typ	Max	Test Level	Min	Typ	Max	Test Level	
V_{OS}	Offset Voltage	25°C		6	15	I		6	15	I	mV
		Full			20	I			20	III	mV
TCV_{OS}	Average Offset Voltage Drift	Full		50		V		50		V	µV/°C
I_B	Bias Current	25°C		1.0	4	I		1.0	4	I	µA
		Full			6	I			6	III	µA
I_{OS}	Offset Current	25°C		0.5	2	I		0.5	2	I	µA
		Full			3	I			3	III	µA
R_{IN}	Input Resistance	25°C		20		V		20		V	kΩ
C_{IN}	Input Capacitance	25°C		1		V		1		V	pF
V_{CM}	Common Mode Input Range	Full	±10	±11		I	±10	±11		II	V
e_{IN}	Input Noise Voltage (f = 1 kHz, R_G = 0Ω)	25°C		7		V		7		V	nV/√Hz
A_{VOL}	Large Signal Voltage Gain (Notes 2, 3)	25°C	5k	13k		I	5k	13k		I	V/V
		Full	4k			I	4k			III	V/V
CMRR	Common-Mode Rejection Ratio (Note 4)	Full	70	87		I	70	87		II	dB

DC Electrical Characteristics $V_S = \pm 15V$; $R_L = 2\ k\Omega$, unless otherwise specified — Contd.

Parameter	Description	Temp	EL2424				EL2424C				Units
			Min	Typ	Max	Test Level	Min	Typ	Max	Test Level	
V_O	Output Voltage Swing	Full	±11	±13		I	±11	±13		II	V
I_{SC}	Short Circuit Current	25°C	±10	+50	±85	I	±10	±50	±85	I	mA
R_O	Output Resistance	25°C		40		V		40		V	Ω
I_S	Supply Current	Full		14	18	I		14	18	II	mA
PSRR	Power Supply Rejection Ratio (Note 5)	Full	60	80		I	60	80		II	dB

AC Electrical Characteristics $V_S = \pm 15V$; $R_L = 2\ k\Omega$, unless otherwise specified

Parameter	Description	Temp	EL2424				EL2424C				Units
			Min	Typ	Max	Test Level	Min	Typ	Max	Test Level	
f_u	Open Loop Unity Bandwidth (Note 6)	25°C		60		V		60		V	MHz
FPBW	Full Power Bandwidth (Note 7)	25°C	2.4	3.2		I	2.4	3.2		I	MHz
t_r	Rise Time (Note 6)	25°C		7		V		7		V	ns
OS	Overshoot (Note 6)	25°C		20		V		20		V	%
SR	Slew Rate (Note 10)	25°C	150	200		I	150	200		I	V/μs
t_s	Settling Time (Note 9) 10V Step to 0.05%	25°C		330		V		330		V	ns
CHSp	Channel Separation f = 1 MHz	25°C		65		V		65		V	dB

Note 1: A heat sink is required to keep the junction temperature below absolute maximum when the output is shorted.

Note 2: $V_O = \pm 10V$.

Note 3: $R_L = 2k\Omega$.

Note 4: Two tests are performed. $V_{CM} = 0V$ to $+10V$ and $V_{CM} = 0V$ to $-10V$.

Note 5: 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 6: $V_O = 100$ mV.

Note 7: Full Power Bandwidth guaranteed based on slew rate measurement using: FPBW = Slew Rate/2π V_{peak}.

Note 8: Refer to Test Circuit section of data sheet.

Note 9: Settling time measurements are made with techniques in the following reference: "*Take The Guesswork Out of Settling-Time Measurements*," EDN September 19, 1985.

Note 10: $V_O = \pm 10V$.

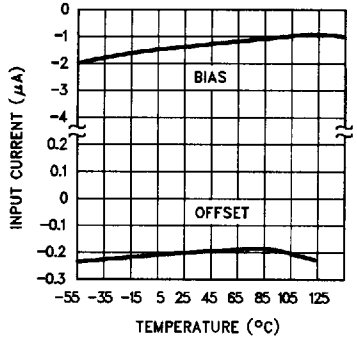
EL2424/EL2424C

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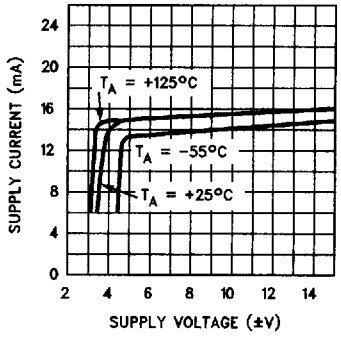
Quad 60 MHz High Speed Operational Amplifier

Typical Performance Curves

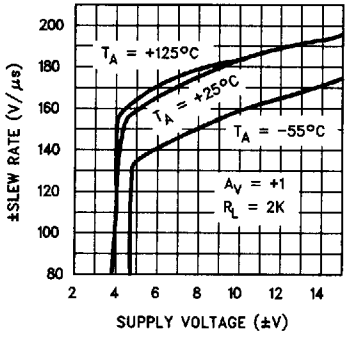
Input Current vs Temperature



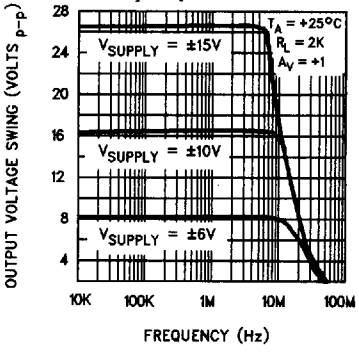
Supply Current vs Supply Voltage



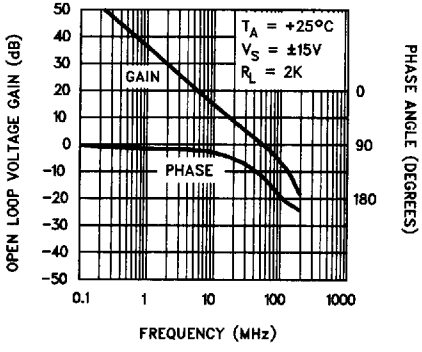
Slew Rate vs Supply Voltage



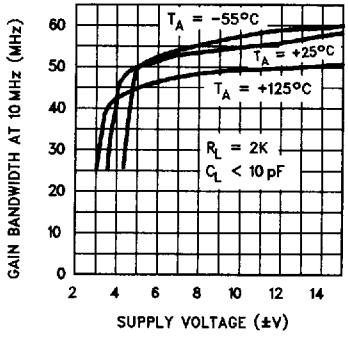
Output Voltage Swing vs Frequency



Open Loop Voltage Gain vs Frequency



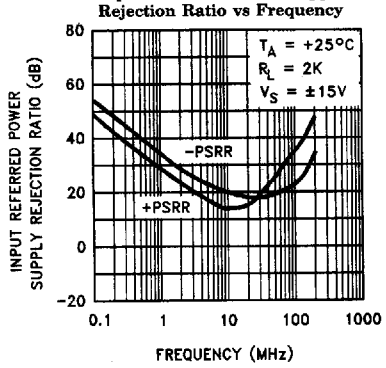
Gain Bandwidth at 10 MHz vs Supply Voltage



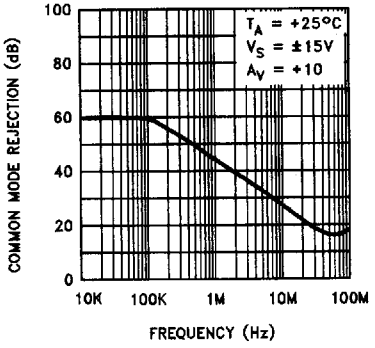
2424-4

Typical Performance Curves — Contd.

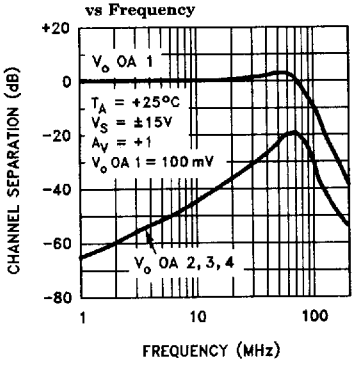
Input Referred Power Supply Rejection Ratio vs Frequency



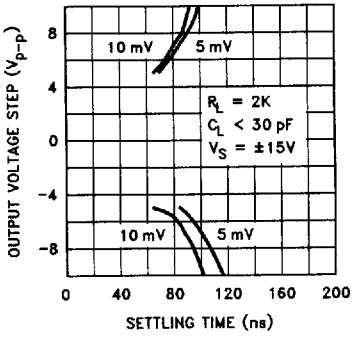
Common Mode Rejection vs Frequency A_V = +10



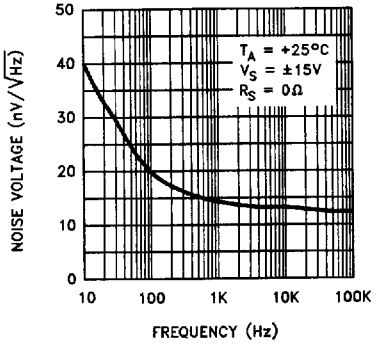
Channel Separation vs Frequency



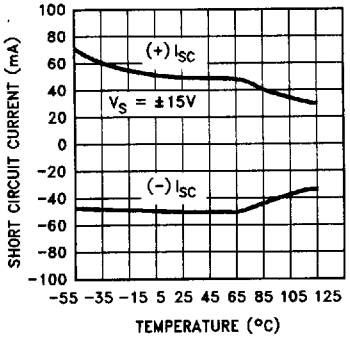
Settling Time A_V = +1



Noise Voltage vs Frequency



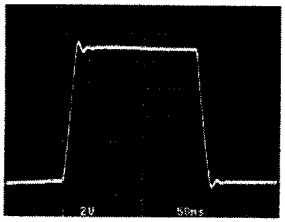
Short Circuit Current vs Temperature



2424-5

Typical Performance Curves — Contd.

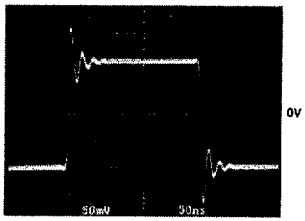
Large Signal Response



$A_V = +1$
$V_{IN} = \pm 5V$
$V_O = \pm 5V$
$R_L = 2k$

2424-6

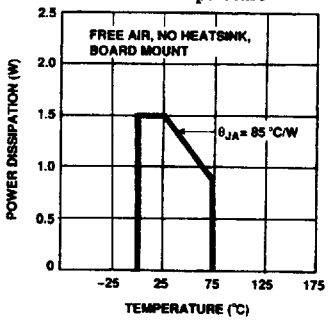
Small Signal Response



$A_V = +1$
$V_{IN} = \pm 100$ mV
$V_O = \pm 100$ mV
$R_L = 2k$

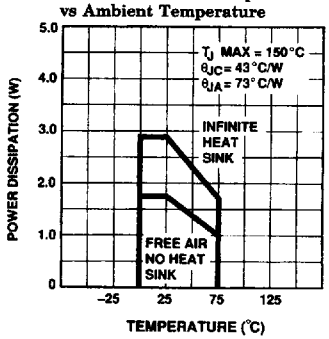
2424-7

20-Lead SOL
Maximum Power Dissipation
vs Ambient Temperature



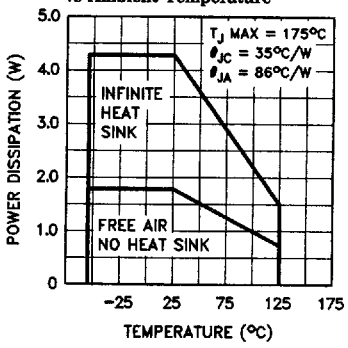
2424-8

14-Lead Plastic DIP
Maximum Power Dissipation
vs Ambient Temperature



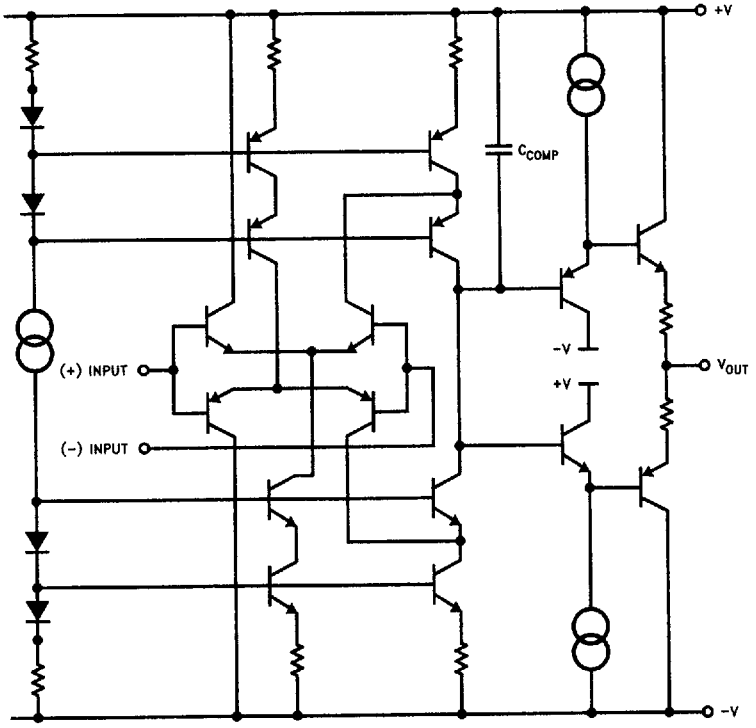
2424-9

14-Lead CerDIP
Maximum Power Dissipation
vs Ambient Temperature



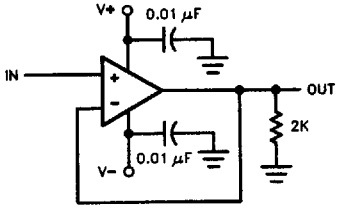
2424-10

Simplified Schematic (One Amplifier)



2424-11

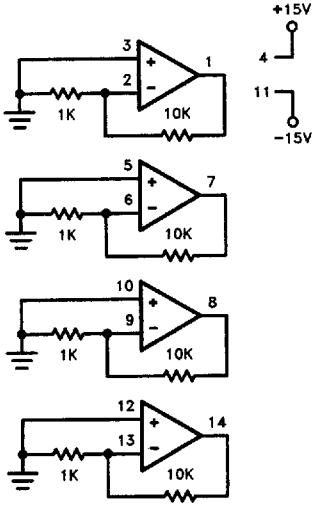
Test Circuit



2424-12

Pin numbers indicated are for the 14-lead DIP. Circuit is identical for all package types.

Burn In Circuit



2424-13

EL2424 Macromodel

```
* Connections:      +input
*                   |     -input
*                   |     |     +Vsupply
*                   |     |     |     -Vsupply
*                   |     |     |     |     output
*                   |     |     |     |     |
.subckt M2424       3     2     7     4     6
* Input stage
ie 37 4 4.5mA
r6 36 37 75
r7 38 37 75
rc1 7 30 75
rc2 7 39 75
q1 30 3 36 qn
q2 39 2 38 qna
ediff 33 0 39 30 2.6
rdiff 33 0 1Meg
* Compensation Section
ga 0 34 33 0 3m
rh 34 0 1Meg
ch 34 0 15pF
rc 34 40 300
cc 40 0 1pF
* Poles
ep 41 0 40 0 1
rpa 41 42 75
cpa 42 0 3pF
rpb 42 43 50
cpb 43 0 3pF
* Output Stage
ios1 7 50 0.5mA
ios2 51 4 0.5mA
q3 4 43 50 qp
q4 7 43 51 qn
q5 7 50 52 qn
q6 4 51 53 qp
ros1 52 6 25
ros2 6 53 25
* models
.model qn npn(is=800.0E-18 bf=350 tf=0.2nS)
.model qna npn(is=864E-18 bf=400 tf=0.2nS)
.model qp pnp(is=800E-18 bf=60 tf=0.2nS)
.ends
```

EL2424 Macromodel — Contd.

