

Features

- Wide gain bandwidth—500 MHz
- High slew rate—350 V/ μ s
- High power bandwidth ($\pm 10 V_{out}$) 5.5 MHz
- Large open loop gain 83 dB
- Low power—5 mA/amplifier
- Low input offset—0.5 mV typ.
- Wide supply voltage range $V_s = \pm 5V$ to $\pm 15V$
- Output short circuit protected

Applications

- High performance active filters
- Video and pulse amplifiers
- Local area networks
- Wideband amplifiers
- Replace two HA2540s

Ordering Information

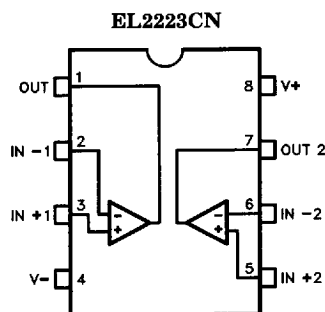
Part No.	Temp. Range	Package	Outline #
EL2223CN	0°C to +75°C	P-DIP	MDP0031
EL2223CM	0°C to +75°C	SOL	MDP0027

General Description

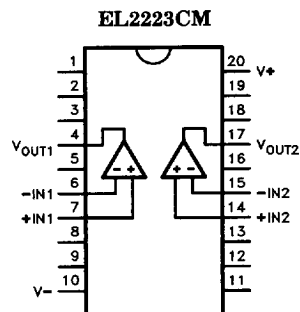
The EL2223 monolithic dual operational amplifier is an extension of Elantec's position in high speed analog products. This patented amplifier features 350 V/ μ s slew rate, a 500 MHz gain bandwidth gain-of-10 stable, along with an excellent speed power relationship. The dual 500 MHz EL2223 consumes only 10 mA, making it ideal for HA2540 type applications. The EL2223 has short-circuit-protected outputs and will operate from $\pm 5V$ to $\pm 15V$. It is fabricated using Elantec's complementary bipolar process which allows both fast PNP and NPN transistors to be manufactured on a single chip.

Elantec's products and facilities comply with MIL-I-45208A, and other applicable quality specifications. For information on Elantec's processing, see Elantec document, QRA-1: "Elantec's Processing, Monolithic Integrated Circuits".

Connection Diagrams



2223-1



2223-3

This product covered under U.S. Patent No. 4,837,523

EL2223C

Dual, 500 MHz High Speed, Operational Amplifier

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

Voltage between V+ and V-	35V	Storage Temperature Range	-65°C to +150°C
Differential Input Voltage	±6V	Maximum Junction Temperature	150°C
Internal Power Dissipation	See Curves	Lead Temperature	
Peak Output Current	Short Circuit Protected	DIP Package	300°C
Output Short Circuit Duration (Note 1)	Continuous	SOL Package	
Operational Temperature Range	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 $T_A = 25^\circ\text{C}$ 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 $V_S = \pm 15\text{V}$; $R_L = 2\text{ k}\Omega$, unless otherwise specified

Parameter	Description	Temp	EL2223C				Units
			Min	Typ	Max	Test Level	
V_{OS}	Offset Voltage	+25°C		0.5	5	I	mV
		Full			8	III	mV
TCV_{OS}	Average Offset Voltage Drift	Full		3		V	$\mu\text{V}/^\circ\text{C}$
I_B	Bias Current	+25°C		1.5	4	I	μA
		Full			6	III	μA
I_{OS}	Offset Current	+25°C		0.2	2	I	μA
		Full			3	III	μA
R_{IN}	Input Resistance	+25°C		6		V	k Ω
C_{IN}	Input Capacitance	+25°C		1		V	pF
V_{CM}	Common Mode Input Range	Full	±10	±12		II	V
e_{IN}	Input Noise Voltage ($f = 1\text{ kHz}$, $R_G = 0\Omega$)	+25°C		7		?	$\text{nV}/\sqrt{\text{Hz}}$
A_{VOL}	Large Signal Voltage Gain (Notes 2, 3)	+25°C	20k	40k		I	V/V
		Full	10k			III	V/V

EL2223C**Dual, 500 MHz High Speed, Operational Amplifier****DC Electrical Characteristics** $V_S = \pm 15V$; $R_L = 2\text{ k}\Omega$, unless otherwise specified — Contd.

Parameter	Description	Temp	EL2223C				Units
			Min	Typ	Max	Test Level	
CMRR	Common-Mode Rejection Ratio (Note 4)	Full	70	90		II	dB
V_O	Output Voltage Swing	Full	± 11	± 12.5		II	V
I_{SC}	Short Circuit Current	$+25^\circ\text{C}$		± 50	± 70	I	mA
R_O	Output Resistance	$+25^\circ\text{C}$		40		V	Ω
I_s	Supply Current	Full		9.5	13	II	mA
PSRR	Power Supply Rejection Ratio (Note 5)	Full	70	90		II	dB

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

Parameter	Description	Temp	EL2223C				Units
			Min	Typ	Max	Test Level	
f_u	Open Loop Unity Bandwidth (Note 6)	$+25^\circ\text{C}$		500		V	MHz
FPBW	Full Power Bandwidth (Notes 2, 7)	$+25^\circ\text{C}$	3.98	5.5		I	MHz
t_r	Rise Time (Note 8)	$+25^\circ\text{C}$		7		V	ns
OS	Overshoot (Note 8)	$+25^\circ\text{C}$		30		V	%
SR	Slew Rate (Note 8)	$+25^\circ\text{C}$	250	350		I	V/ μs
t_s	Settling Time (Notes 9, 10) 10V Step to 0.05%	$+25^\circ\text{C}$		330		V	ns
Ch S_p	Channel Separation ($f = 10\text{ MHz}$)			70		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: $R_L = 2\text{ k}\Omega$.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: $V_O = 100\text{ mV}$.Note 7: Full Power Bandwidth guaranteed based on slew rate measurement using: $FPBW = \text{Slew Rate} / 2\pi V_{peak}$.

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

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

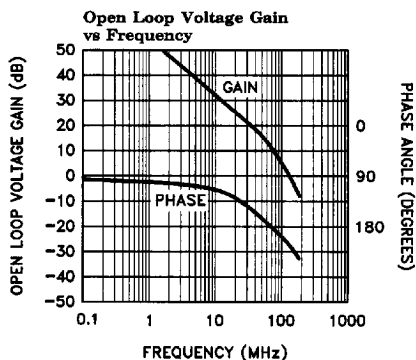
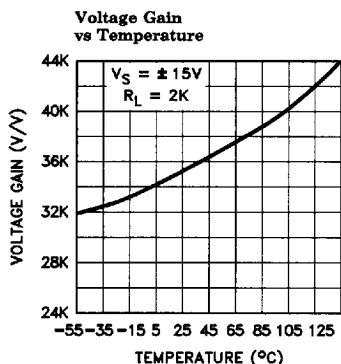
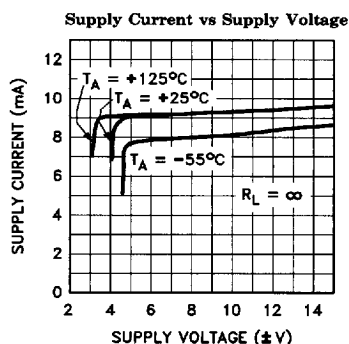
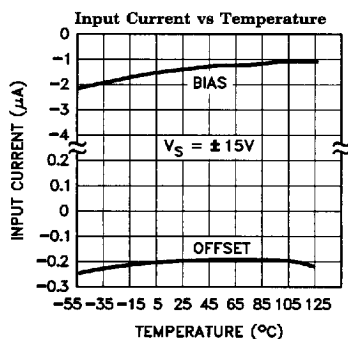
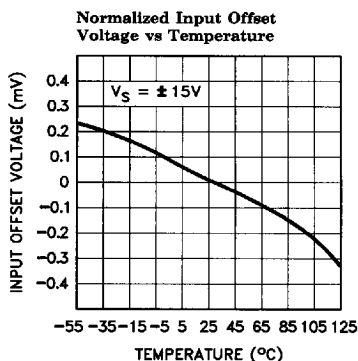
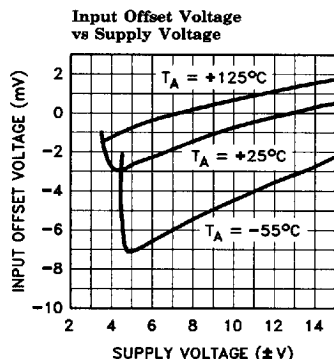
Note 10: $A_V = +10$, $R_L = 2\text{ k}\Omega$.

EL2223C

Dual, 500 MHz High Speed, Operational Amplifier

EL2223C

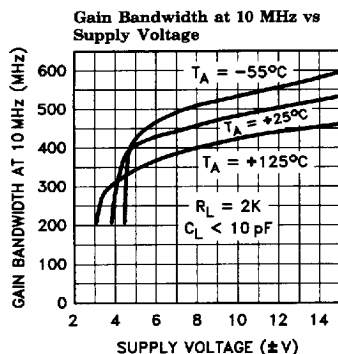
Typical Performance Curves



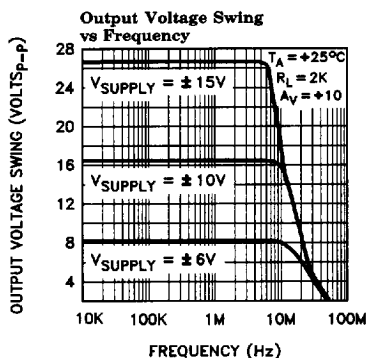
EL2223C

Dual, 500 MHz High Speed, Operational Amplifier

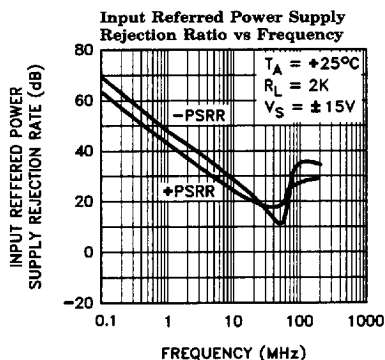
Typical Performance Curves — Contd.



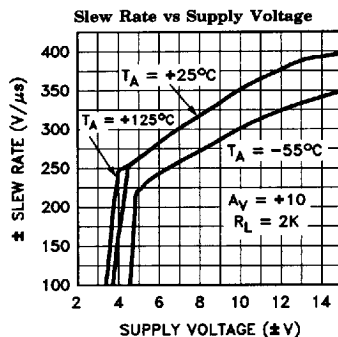
2223-10



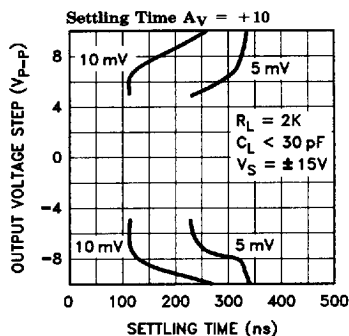
2223-12



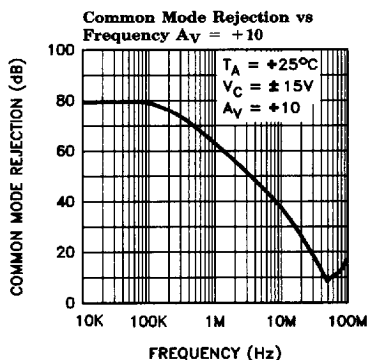
2223-14



2223-11



2223-13

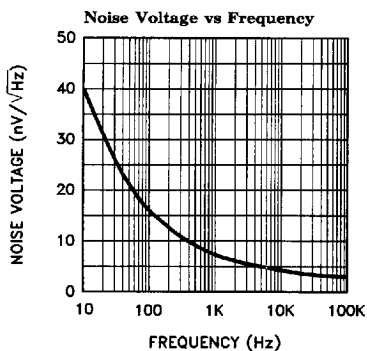


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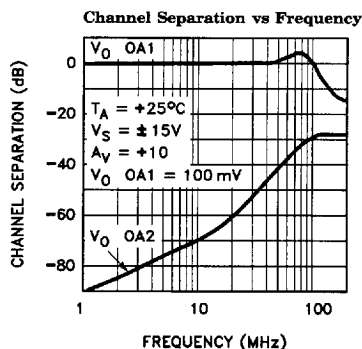
EL2223C

Dual, 500 MHz High Speed, Operational Amplifier

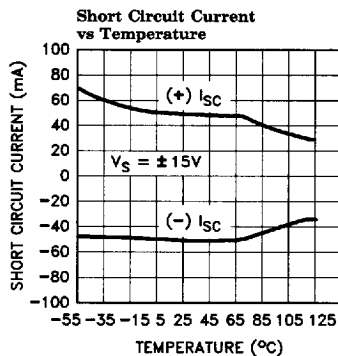
Typical Performance Curves — Contd.



2223-16

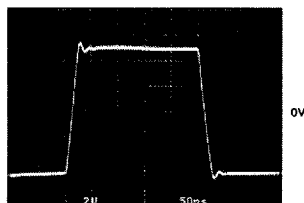


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2223-18

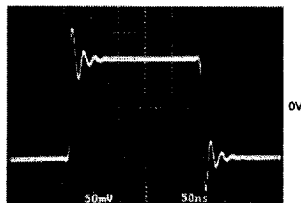
Large Signal Response



$A_V = +10$
 $V_{IN} = \pm 0.5\text{V}$
 $V_O = \pm 5\text{V}$
 $R_L = 2\text{k}$

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Small Signal Response



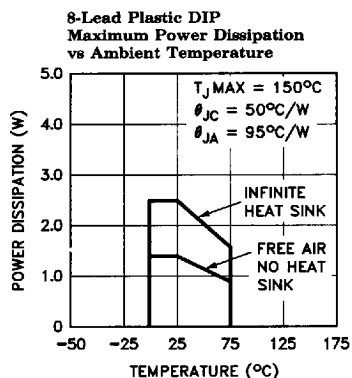
$A_V = +10$
 $V_{IN} = \pm 10\text{ mV}$
 $V_O = \pm 100\text{ mV}$
 $R_L = 2\text{k}$

2223-20

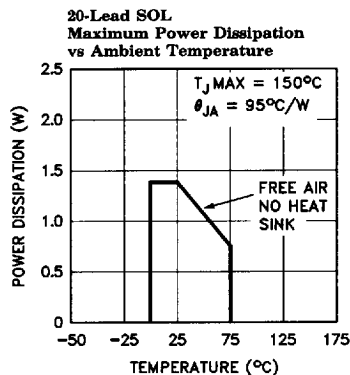
EL2223C

Dual, 500 MHz High Speed, Operational Amplifier

Typical Performance Curves — Contd.

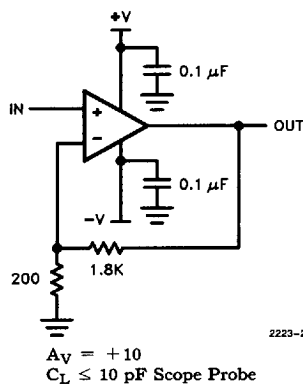


2223-22



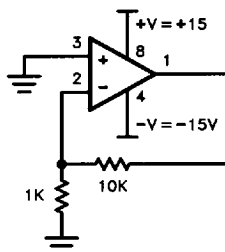
2223-24

Test Circuit



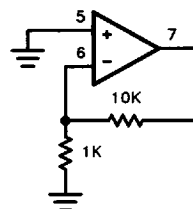
2223-27

Burn-In Circuit



2223-28

Pin numbers are for the 8-Lead CerDIP.
Burn-in circuit is identical for all package types.

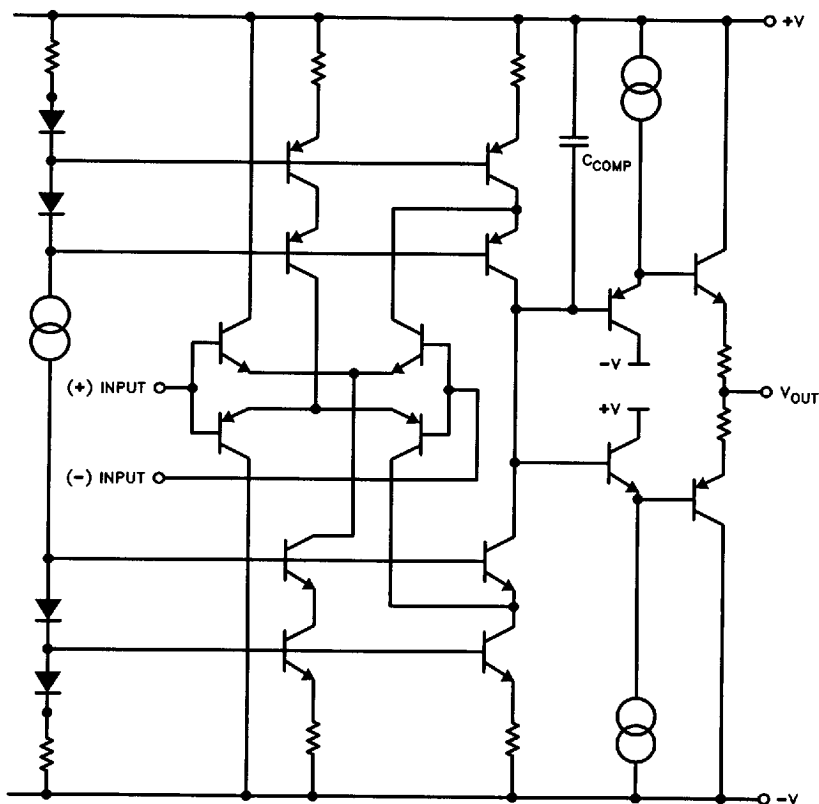


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EL2223C

Dual, 500 MHz High Speed, Operational Amplifier

Simplified Schematic (one amplifier)



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EL2223C

Dual, 500 MHz High Speed, Operational Amplifier

EL2223 Macromodel

* Connections:

	+ input				
*		- input		+ Vsupply	
*				- Vsupply	
*					output
*					

```
.subckt M2233 3 2 7 4 6
```

* Input stage

```
ie 37 4 2mA
```

```
r6 36 37 60
```

```
r7 38 37 60
```

```
rc1 7 30 75
```

```
rc2 7 39 75
```

```
q1 30 3 36 qn
```

```
q2 39 2 38 qna
```

```
ediff 33 0 39 30 7.25
```

```
rdiff 33 0 1Meg
```

* Compensation Section

```
ga 0 34 33 0 2.6m
```

```
rh 34 0 3Meg
```

```
ch 34 0 1.5pF
```

```
rc 34 40 600
```

```
cc 40 0 7pF
```

* Poles

```
ep 41 0 40 0 1
```

```
rpa 41 42 75
```

```
cpa 42 0 25pF
```

```
rpb 42 43 50
```

```
cpb 43 0 15pF
```

* Output Stage

```
ios1 7 50 1.25mA
```

```
ios2 51 4 1.25mA
```

```
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=250 tf=0.2nS)
```

```
.model qna npn (is=864E-18 bf=300 tf=0.2nS)
```

```
.model qp pnp (is=800E-18 bf=60 tf=0.2nS)
```

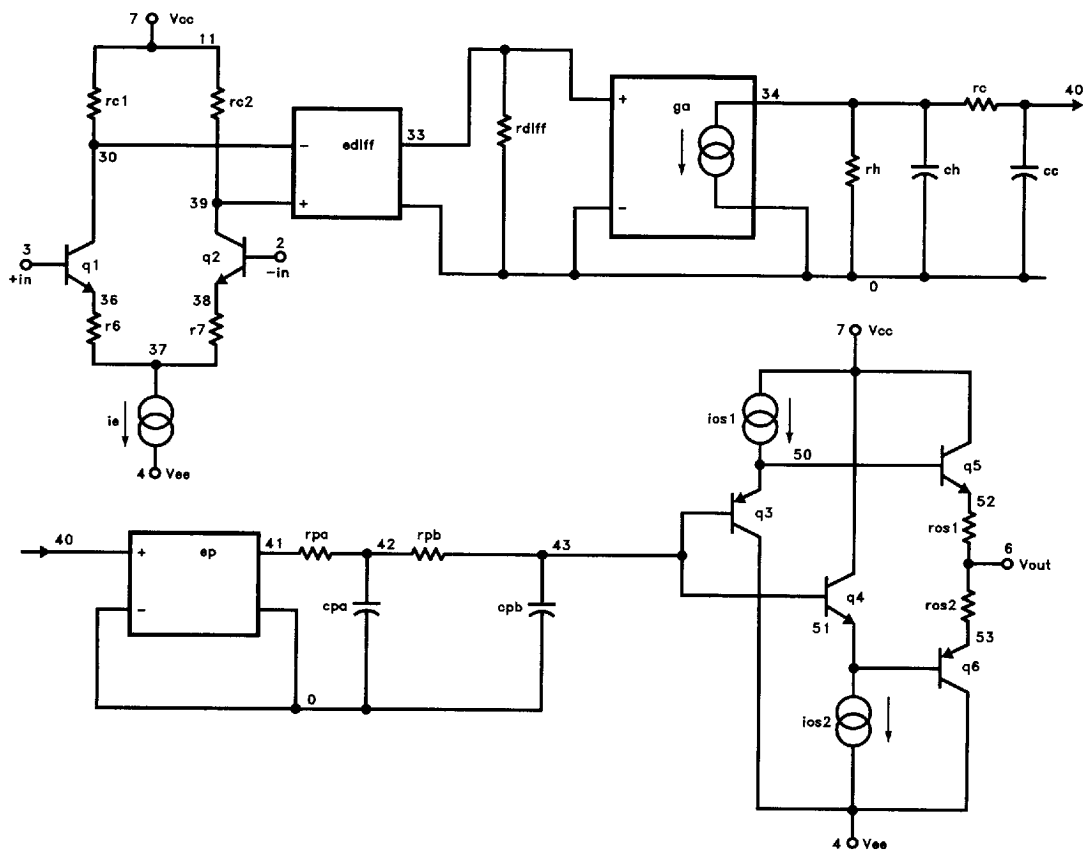
```
.ends
```

EL2223C

Dual, 500 MHz High Speed, Operational Amplifier

EL2223C

EL2223 Macromodel — Contd.



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