



>> DATA SHEET

(DOC No. HX8902B/HX8904B-DS)

>> HX8902B/HX8904B

Rail-to-Rail Operational
Amplifier for TFT LCD

Version 01 August, 2006

>> **HX8902B/HX8904B**

Rail-to-Rail Operational Amplifier
for TFT LCD



Himax Technologies, Inc.
<http://www.himax.com.tw>

Version 01

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1. General Description

The HX8902B and HX8904B are dual and quad operational amplifiers. The amplifier provides rail-to-rail input-output ability with the benefits of precision and low power operation. It can be used to buffer reference voltages for gamma correction in a TFT-LCD.

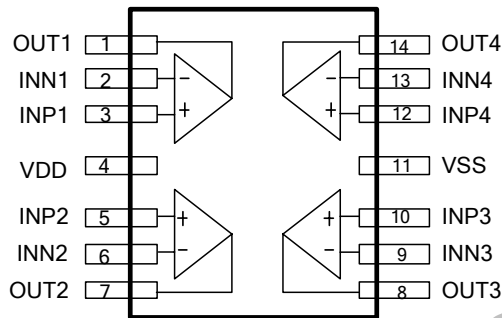
The HX8904B is available in a space-saving 14-pin TSSOP package, 14-pin SOIC and 10-pin MSOP packages. The HX8902B is available in the 8-pin MSOP package. These devices operate over a temperature range from -20°C to $+85^{\circ}\text{C}$.

2. Features

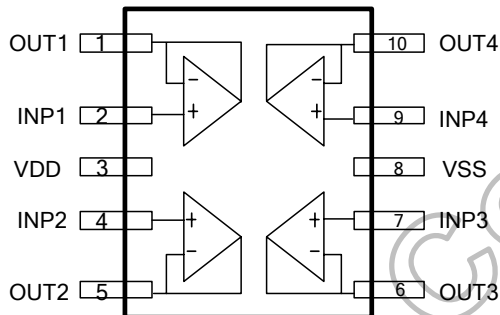
- Power supply 4.5V to 13.5V
- Rail to rail operation
- Low power consumption
- High slew rate
- CMOS process technology
- Available in ultra-small package

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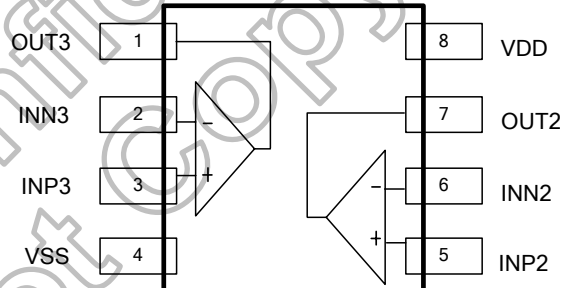
3. Pin Assignment



HX8904B TSSOP-14 / SOIC-14 (Top view)



HX8904B MSOP-10 (Top view)



HX8902B MSOP-8 (Top view)

4. DC Characteristics

4.1 Absolute Maximum Rating (VSS=0V)

Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
Power supply voltage	VDD-VSS	-0.3	-	+14.0	V
Input voltage	V _{in}	-0.3	-	VDD+0.3	V
Operation temperature	T _{OPR}	-20	-	+85	°C
Storage temperature	T _{STG}	-55	-	+125	
Lead temperature	T _{LT}	-	260	-	
ESD HBM	V _{HBM}	-	±2000	-	V

Note: (1) Human body model ESD is tested in MIL-STD-883D Method 3015.7

(2) Device is subject to be damaged permanently if stresses beyond those absolute maximum ratings listed above.

4.2 Recommended Operating Conditions

Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
Power supply voltage	VDD-VSS	4.5	10	13.5	V
Input voltage	V _{in}	VSS	-	VDD	V
Operation temperature	T _a	-10	-	+85	°C

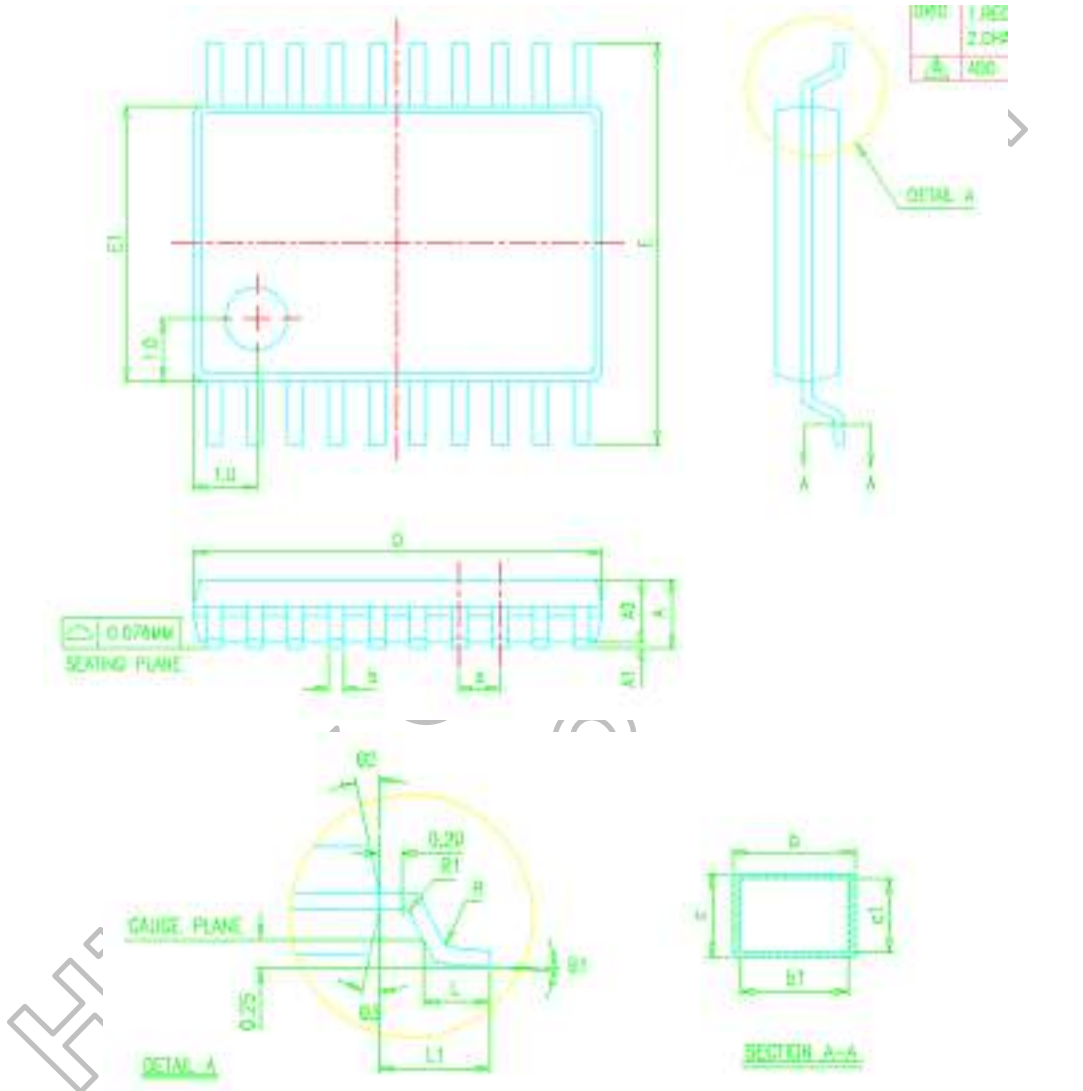
4.3 Electrical Characteristics

(VDD=10V, VSS=0V, TA=25°C unless otherwise specified)

Parameter	Description	Condition	Spec.			Unit
			Min.	Typ.	Max.	
Input Characteristics						
V _{OS}	Input Offset Voltage	V _{DD} =5V, V _{CM} =(V _{DD} -V _{SS})/2 V _{DD} =10V, V _{CM} =(V _{DD} -V _{SS})/2 V _{DD} =12V, V _{CM} =(V _{DD} -V _{SS})/2	-	3	15	mV
I _B	Input Bias Current	V _{CM} =5V	-	2	-	nA
CMRR	Common-Mode Rejection Ratio	For V _{IN} from -0.5V to 10.5V	50	70	-	dB
A _{VOL}	Open-Loop Gain	0.5V ≤ V _{OUT} ≤ 9.5V	-	70	-	dB
Output Characteristics						
V _{OL}	Output Swing Low	I _L =-5mA	-	80	150	mV
V _{OH}	Output Swing High	I _L =5mA	9.85	9.92	-	V
I _{SC}	Short Circuit Current	-	-	±400	-	mA
I _{OUT}	Output Current	-	-	±300	-	mA
Power Supply Performance						
PSRR	Power Supply Rejection Ratio	V _{DD} is moved from 8V to 10V	50	60	-	dB
I _S	Supply Current	No Load	-	0.6	1.0	mA
Dynamic Performance						
SR	Slew Rate	1V ≤ V _{OUT} ≤ 9V, 20% to 80%, R _L =10KΩ, C _L =10pF	-	15	-	V/us
T _S	Settling to 0.1% (A _v =+1)	A _v =+1, V _O =2V step	-	500	-	ns
BW	-3dB Bandwidth	R _L =10KΩ, C _L =10pF	-	8	-	MHz
GBWP	Gain-Bandwidth Product	R _L =10KΩ, C _L =10pF	-	10	-	MHz
PM	Phase Margin	R _L =10KΩ, C _L =10pF	-	50	-	°

5. Package Outline Dimension

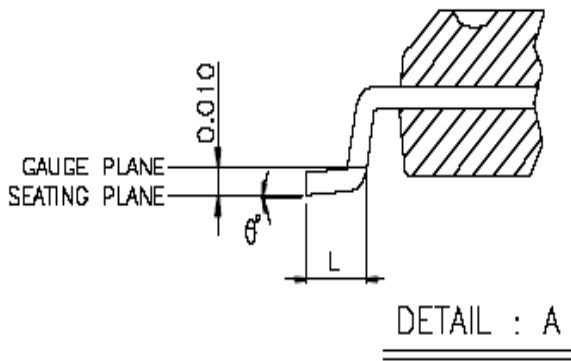
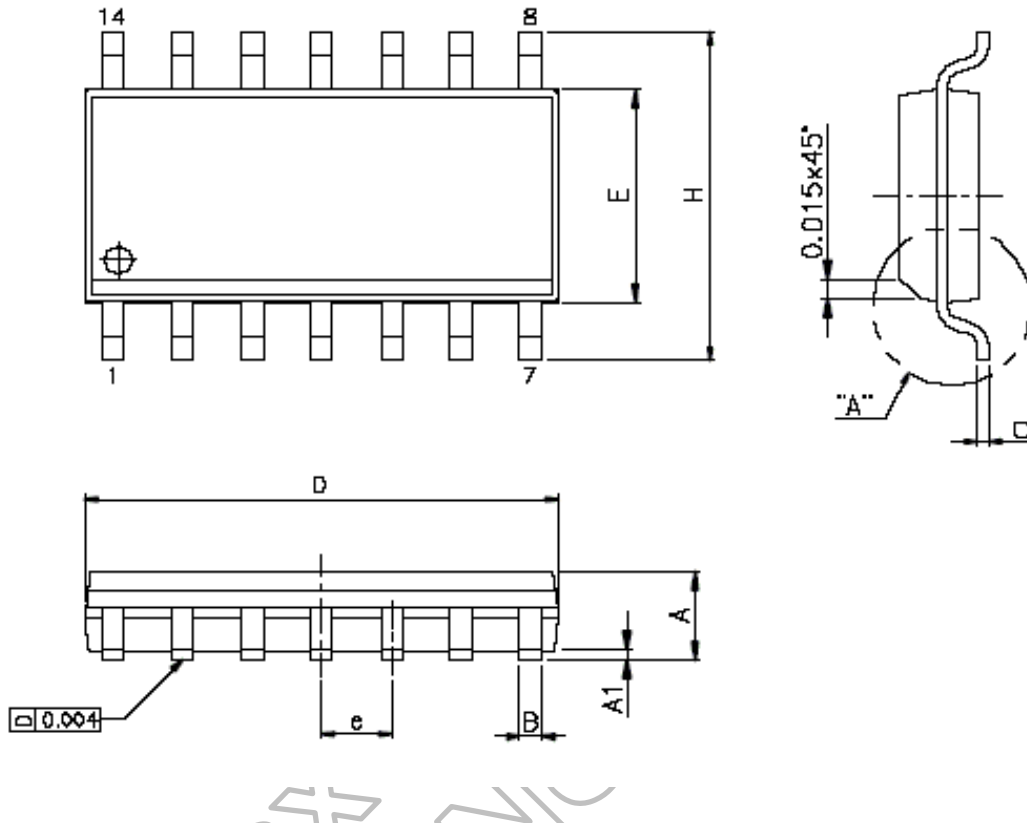
5.1 HX8904B TSSOP-14 package



N	D (MM)			JEDEC
	MIN.	NOM.	MAX.	
14	4.90	5.00	5.10	WD-153 (AB-1)
16	4.90	5.00	5.10	WD-153 (AB)
20	6.40	6.50	6.60	WD-153 (AC)
24	7.70	7.80	7.90	WD-153 (AD)
28	9.60	9.70	9.80	WD-153 (AE)

SYMBOL	DIMENSION IN MM			DIMENSION IN INCH		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A			1.20			0.043
A1	0.05		0.15	0.002		0.006
A2	0.80	0.90	1.05	0.031	0.035	0.041
L	0.50	0.60	0.75	0.020	0.024	0.030
E	6.40 BSC.			0.252 BSC.		
E1	4.30	4.40	4.50	0.169	0.173	0.177
#	0.09			0.004		
R1	0.08			0.004		
b	0.19		0.30	0.007		0.012
b1	0.19	0.22	0.25	0.007	0.009	0.010
e	0.09			0.004		
e1	0.09			0.004		
L1	1.0 REF.			0.039 REF.		
#	0.65 BSC.			0.026 BSC.		
#1	D		B	U		B
#2	12 REF.			12 REF.		
#3	12 REF.			12 REF.		

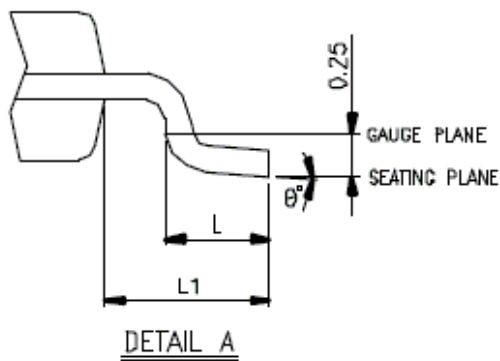
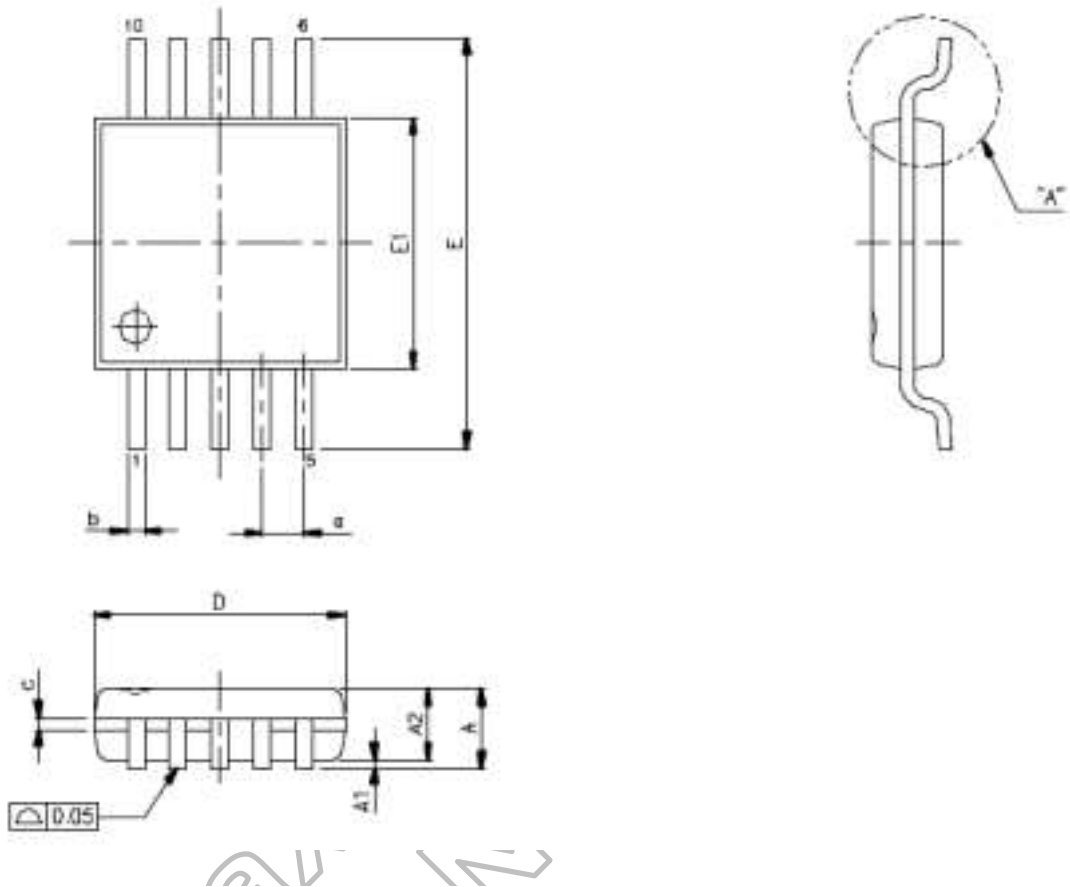
5.2 HX8904B SOIC-14 package



SYMBOLS	MIN.	NOM.	MAX.
A	0.058	0.064	0.068
A1	0.004	-	0.010
B	0.013	0.016	0.020
C	0.0075	0.008	0.0098
D	0.336	0.341	0.344
E	0.150	0.154	0.157
e	-	0.050	-
H	0.228	0.236	0.244
L	0.015	0.025	0.050
θ°	D°	-	B°

UNIT : INCH

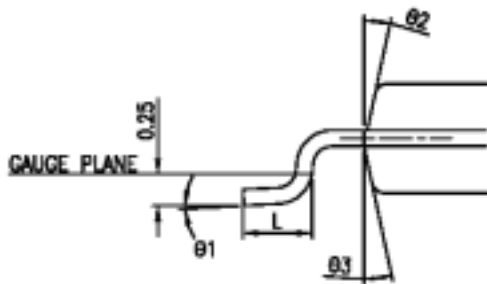
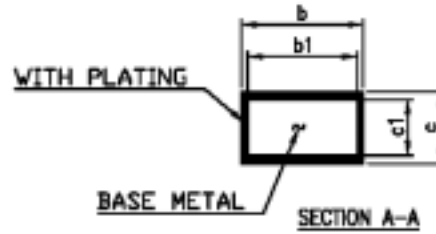
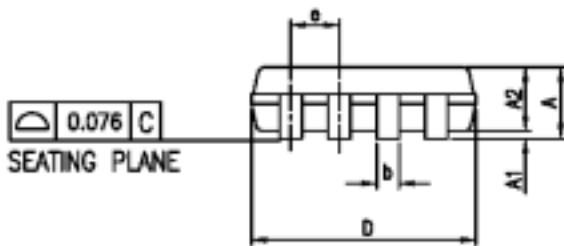
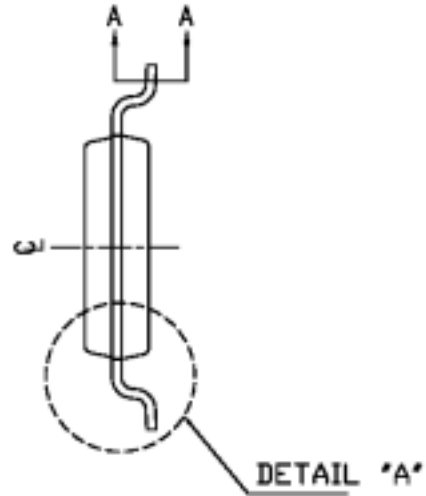
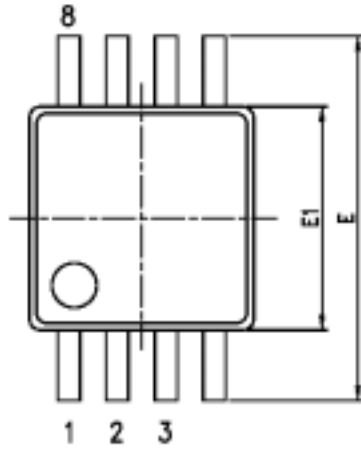
5.3 HX8904B MSOP-10 package



SYMBOLS	MIN.	NOM.	MAX.
A	—	—	1.10
A1	0.00	—	0.15
A2	0.75	0.85	0.95
b	0.17	—	0.27
c	0.08	—	0.23
D	3.00 BSC		
E	4.90 BSC		
E1	3.00 BSC		
e	0.50 BSC		
L	0.40	0.60	0.80
L1	0.95 REF		
θ°	0	—	8

UNIT : MM

5.4 HX8902B MSOP-8 package

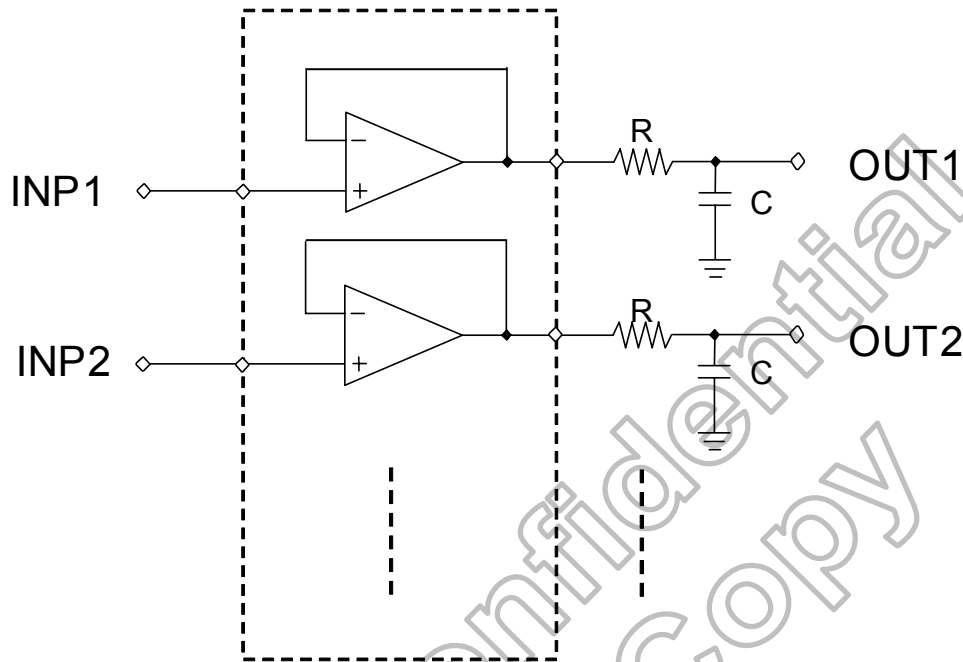


DETAIL "A"
SCALE 25:1

SYMBOL	DIMENSION IN MM			DIMENSION IN INCH		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	----	----	1.10	----	----	0.043
A1	0.05	----	0.15	0.002	----	0.006
A2	0.81	0.86	0.91	0.032	0.034	0.036
c	0.13	----	0.23	0.005	----	0.009
e1	0.13	0.15	0.18	0.005	0.006	0.007
D	2.90	3.00	3.10	0.114	0.118	0.122
E1	2.90	3.00	3.10	0.114	0.118	0.122
E	4.90 BSC			0.193 BSC		
L	0.445	0.55	0.648	0.0175	0.0217	0.0255
theta1	0°		6°	0°		6°

SYMBOL	8L			10L		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
b	0.22	----	0.38	0.17	----	0.27
b1	0.22	0.30	0.33	0.17	0.20	0.23
e	0.65 BSC			0.50 BSC		
JEDEC	MO-187AA			MO-187		

6. Application circuit



Connecting a small R before large loading C is suggested.

7. Ordering Information

Part NO.	Package
HX8904BTAG	14-pin TSSOP(Green process)
HX8904BPAG	14-pin SOP(Green process)
	14-pin SOIC(Green process)
HX8904BMAG	10-pin MSOP(Green process)
HX8902BMAG	8-pin MSOP(Green process)

8. Revision History

Version	EFF.DATE	DESCRIPTION OF CHANGES
01	2006/08/03	New setup

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