QX2011
QXpander Processor

QSOUND

MITSUMI

Device Specifications - Preliminary Information

General Description

The QXpander™ QX2011 is a bipolar analog stereo enhancement processor. This device is part of the QX chip family offered by QSound Labs, and uses the patented QXpander™ technology to produce a spatially widened stereo image from ordinary left and right channel inputs.

This audio enhancement is achieved while using normal stereo signals and standard stereo audio equipment. No special initial encoding of the input signals is required, no additional speakers are required, and no special hardware is needed to produce QXpanded audio.

The 2011 has a TTL-compatible bypass control to select between QXpander enhancement and normal stereo audio. An analog "spread" control is provided to vary the amount of QXpander enhancement. The QX2011 is fabricated in bipolar technology, and is offered in plastic 22 pin SDIP and 24 pin SSOP packages.

Features

- Produce a wide sound image from normal stereo input.
- No encoding of input signals, no special equipment required to QXpand audio.
- TTL-compatible enhancement/bypass control.
- user adjustable enhancement level.
- Low noise: 60 uV_{RMS}.
- single supply voltage, internal reference.
- Few external components, low cost.

Applications

- Television sound systems (Stereo).
- Semi-professional audio equipment.
- Personal/portable audio.
- Multimedia applications for PCs and laptops.
- Multimedia speaker systems.
- Video Games.

Pin Assignment

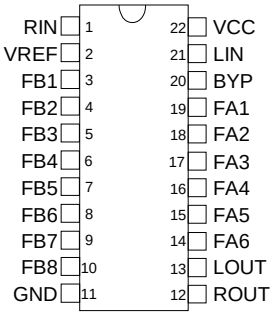


Figure 1: SDIP-22 Pin Assignment

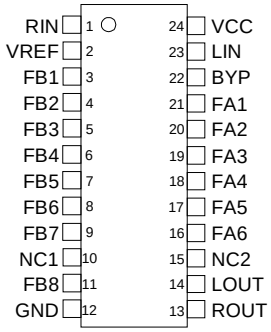


Figure 2: SSOP-24 Pin Assignment

Note: The device data in these specifications are based on engineering samples, and are preliminary. QX2011 specifications are subject to change without notice.

Principles of Operation.

In ordinary stereo systems, the stereo image is formed between the left and right speakers, and is confined by the speaker positions (i.e., the "sound stage" is located between the two speakers). The QXpander™ is designed to form the stereo image beyond the speakers, thus enlarging the "sound stage".

If the center channel is defined as the monaural or common component of the left and right channels, then Figure 3 shows the spatial response of the QXpander™ when operating, and for normal stereo bypass.

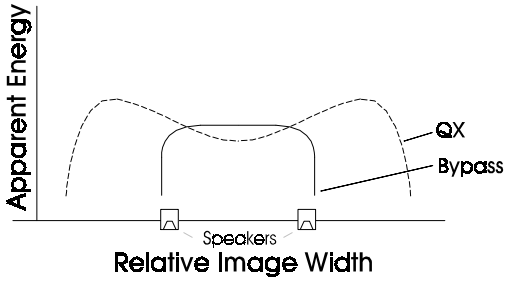


Figure 3: QXpander™ Spatial Response

The amount of QXpander™ enhancement can be controlled with the FB7 and FB8 control pins. The “spread” control allows continuous variable adjustment from maximum QXpander enhancement down to normal stereo signal (bypass). A potentiometer or a voltage divider/decoder pair (for digital systems) is used to set the enhancement (see *Figure 5*).

$R_{VREF,FB8}$	$R_{FB7,FB8}$	QXpander
0Ω	-	Minimum - Bypass
-	0Ω	Maximum

Table 1: Mode Selection

For simple QX/bypass selection, the BYP control input is TTL-compatible and can be directly driven by logic.

V_{BYP}	MODE
0 V	Bypass - Normal Stereo
≥2.1	QXpander enhanced

Table 2: Mode Selection

Normally, the QXpander™ is used in the preamplifier stage between the stereo source and the amplifier stages used to drive the speakers. Figure 4 shows the functional elements of the QX2011.

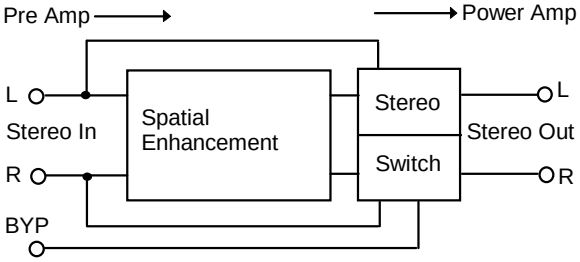


Figure 4: QXpander™ Simplified Block Diagram

QSound applications engineers can assist customers in integrating the QX2011 into their application designs.

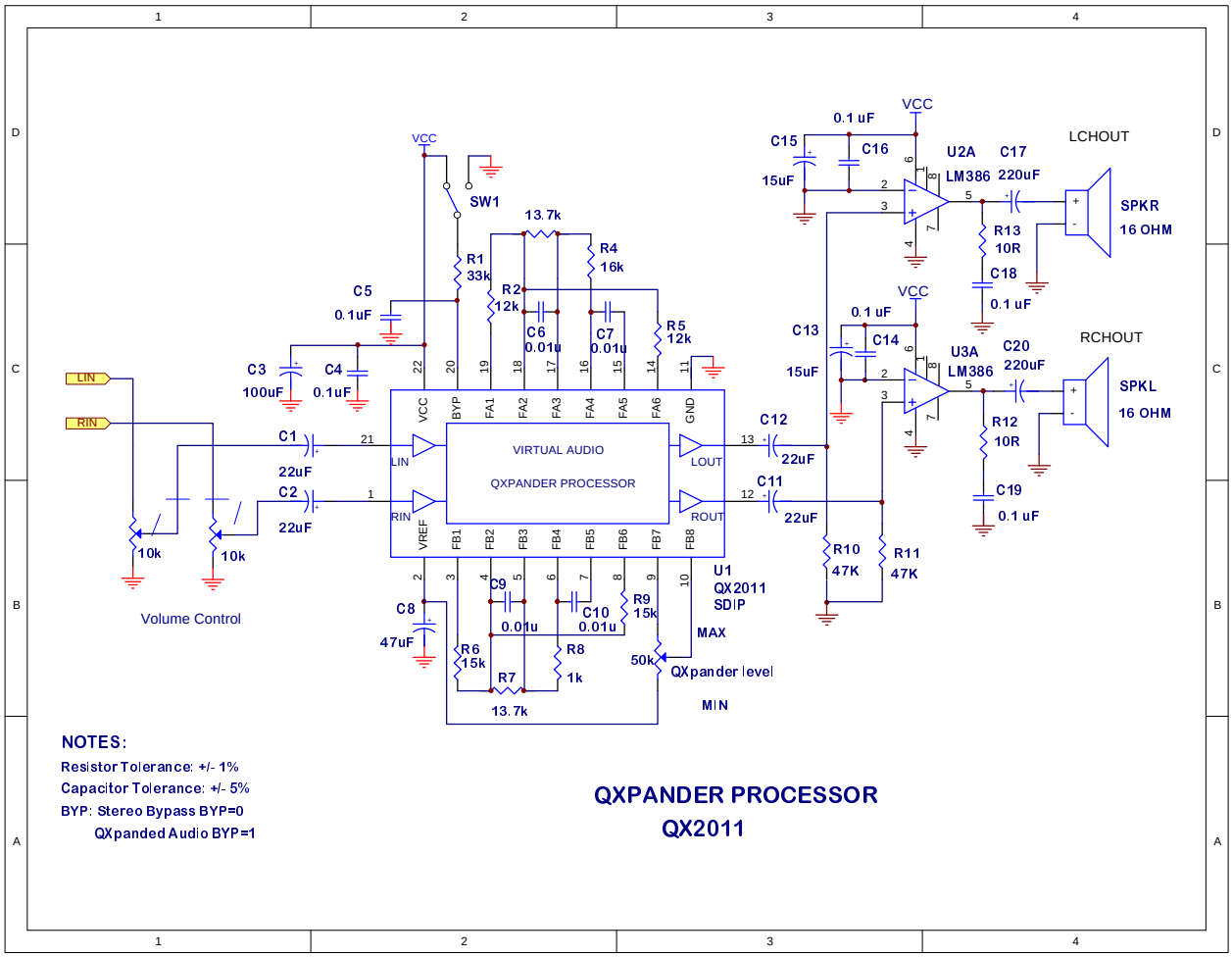


Figure 5: QX2011 QXpander™ Typical Application

Absolute Maximum Ratings*

T_A = +25 °C

Parameter	Symbol	Rating	Unit
Supply Voltage	$V_{CC,max}$	15	V
Input Voltage	$V_{IN,max}$	$GND \le V_{IN} \le V_{CC}$	V
Output Current	$I_{O,max}$	10	mA
Power dissipation, P22	P_d	800	mW
Power dissipation, S24	P_d	650	mW
Operating Temperature	T_{opr}	-20 ~ +75	°C
Storage Temperature	T_{stg}	-40 ~ +125	°C

Warning: Operation of the device at or beyond these limits may result in permanent damage to the device. Normal operation is not guaranteed at these extremes.

Recommended Operating Conditions

Parameter	Symbol	Rating	Unit
Supply Voltage	$V_{CC,op}$	4.5 ~ 12.0	V
Operating Temperature	T_{opr}	-20 ~ +75	°C

Analog Characteristics:

(V_{CC} = 9V, T_A = +25 °C, V_{byp} = 5V, LIN=RIN=0V_{RMS}, unless otherwise specified.)

Parameter	TC	Sym	Min	Typ	Max	Unit
Supply Current		I_{CC}		16	21	mA
Input Impedance		R_I	21	30	39	kΩ
Input Voltage, Analog,1	1	$V_{in,1}$	1.0	1.4		V_{RMS}
Input Voltage, Analog,2	2	$V_{in,2}$	0.5	0.7		V_{RMS}
Voltage Gain, QXpander,1	3	$G_{qx,1}$	3	4	5	dB
Voltage Gain, QXpander,2	4	$G_{qx,2}$	-1	0.5	2	dB
Voltage Gain, QXpander,3	5	$G_{qx,3}$	3	4	5	dB
Voltage Gain, QXpander,4	6	$G_{qx,4}$	-1	0.5	2	dB
Voltage Gain, Bypass,1	7	$G_{by,1}$	-5.6	-5.1	-4.6	dB
Voltage Gain, Bypass,2	8	$G_{by,2}$	-5.6	-5.1	-4.6	dB
Total Harmonic Distortion, QXpander	9	THD_{qx}		0.4	1.0	%
Total Harmonic Distortion, Bypass	10	THD_{by}		0.03	0.3	%
Output Noise Voltage, QXpander	11	$V_{no,qx}$		60	100	μV_{RMS}

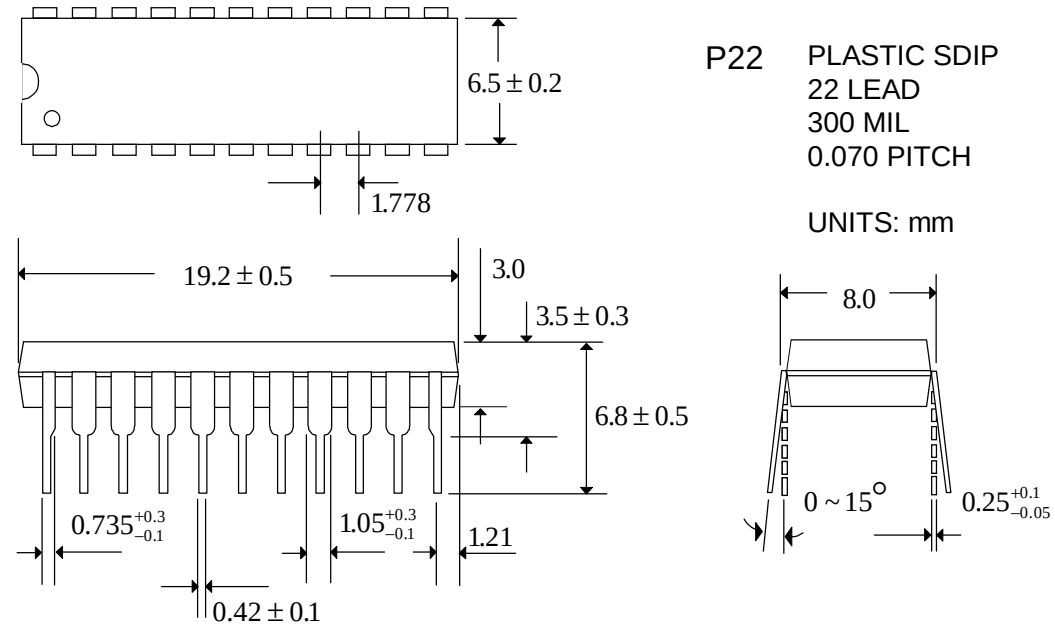
Output Noise Voltage, Bypass	12	$V_{no,by}$		15	32	μV_{RMS}
Signal-Noise Ratio, QXpander		SNR	TBD	TBD		dB
Signal-Noise Ratio, Bypass		SNR	TBD	TBD		dB
Channel Balance	13	CB	-1.0	0	+1.0	dB
BYP Terminal Voltage, H	14	$V_{by,h}$	2.1			V
BYP Terminal Voltage, L	15	$V_{by,l}$			0.7	V
BYP Terminal Current, H	16	$I_{by,h}$			350	µA
BYP Terminal Current, L	17	$I_{by,l}$	-10			µA
Insertion Loss					TBD	dB
Power Supply Rejection Ratio		PSRR	TBD	TBD		dB
Output Voltage, Analog		V_{OUT}	TBD	TBD		V_{RMS}
Output Current, Analog		I_{OUT}			TBD	mA
Load Resistance		R_L	TBD			kΩ
Load Capacitance		C_L			TBD	pF
Usable Bandwidth		BW	20		20000	Hz

Test Conditions:

1. f=1kHz, LIN and RIN 0° phase difference, and output voltage T.H.D. no greater than 1%.
2. f=1kHz, LIN and RIN 180° phase difference, and output voltage T.H.D. no greater than 1%.
3. LIN=1 V_{RMS}, 1 kHz, RIN=0 V, at LOUT.
4. LIN=1 V_{RMS}, 1 kHz, RIN=0 V, at ROUT.
5. LIN=0 V, RIN=1 V_{RMS}, 1 kHz, at ROUT.
6. LIN=0 V, RIN=1 V_{RMS}, 1 kHz, at LOUT.
7. LIN=1 V_{RMS}, 1 kHz, RIN=0 V, V_{BYP}=0V, at LOUT.
8. LIN=0 V, RIN=1 V_{RMS}, 1 kHz, V_{BYP}=0V, at ROUT.
9. Total Harmonic Distortion (THD) at LOUT and ROUT (QXpander active):
   a) LIN = 1 V_{RMS} , RIN = 0 V.
   b) LIN = 0 V, RIN = 1 V_{RMS}.
10. Test Condition 8, V_{BYP} = 0V (Bypass)
11. BW = 20 ~ 20000 Hz, LIN = RIN = 0 V, A curve, QXpander active: at LOUT and ROUT.
12. BW = 20 ~ 20000 Hz, LIN = RIN = 0 V, A curve, V_{BYP} = 0 V (Bypass): at LOUT and ROUT.
13. LIN = RIN = 1 V_{RMS} , 1 kHz, V_{BYP} = 0 V (Bypass), ROUT - LOUT (R - L).
14. High-level input voltage of BYP terminal, QXpander mode, maximum spread
15. Low-level input voltage of BYP terminal, Bypass mode, no spread (normal stereo).
16. Input current of BYP terminal, V_{BYP}=5V
17. Input current of BYP terminal, V_{BYP}=0V

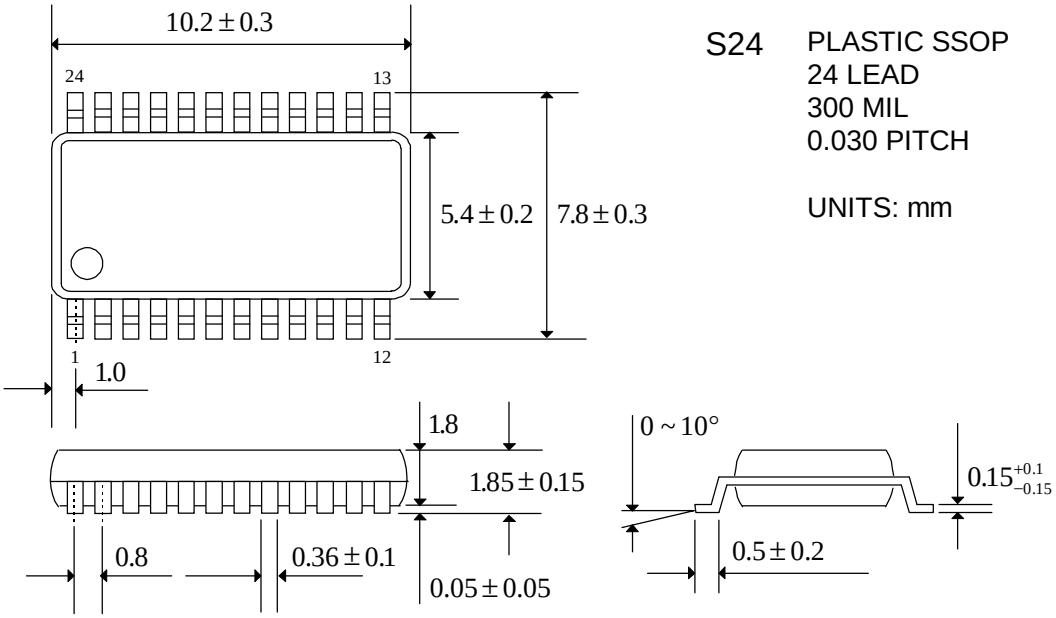
Package Data

Ordering Code	Package Code	Package Type
QX2011-P22C	P22	PLASTIC SDIP
QX2011-S24C	S24	PLASTIC SSOP



P22 PLASTIC SDIP
22 LEAD
300 MIL
0.070 PITCH

UNITS: mm



S24 PLASTIC SSOP
24 LEAD
300 MIL
0.030 PITCH

UNITS: mm