

QXpander™ processor

QX2130FS / QX2130S

The QX pander chip (QX-2000 Series) is a sound enhancement sound processor based on QSOUND's QX pander™ technology, and produces virtual 3D sound from ordinary audio signals. This IC requires no special encoding of input signals or additional speakers, and so simplifies the development of high-value-added personal computers, televisions and audio products.

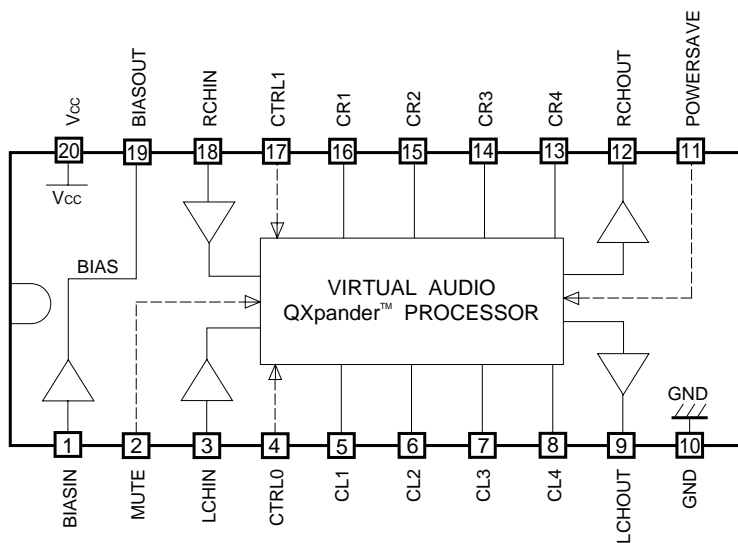
●Applications

Speaker systems for desktop and notebook multimedia personal computers, televisions, audio equipment, video games and other devices

●Features

- 1) Virtual 3D sound from ordinary audio signals.
- 2) No special encoding signals are necessary.
- 3) Three enhanced modes:
 QX1: Pro Listening
 QX2: Wide Listening
 QX3: Wow for Games
- 4) Internal functions for personal computers: power saver function, output muting function and stereo bypass function.
- 5) TTL-compatible control pins (at 5V).
- 6) Low noise ($45\mu V_{rms}$)
- 7) Low power consumption
- 8) Available in SSOP-A20 pin package or SDIP22 pin package.

●Block diagram



Note: The above diagram is for the QX2130FS (SSOP - A20 package)

●Absolute maximum ratings (Ta = 25°C)

| Parameter | Symbol | Limits | | Unit |
|-----------------------|------------------|--------------|--------|------|
| Power supply voltage | V _{cc} | 13 | | V |
| Power dissipation | P _d | QX2130FS | 1000*1 | mW |
| | | QX2130S | 750*2 | |
| Operating temperature | T _{opr} | 0 ~ + 70 | | °C |
| Storage temperature | T _{stg} | − 55 ~ + 125 | | °C |

*1 When mounted on a 90 × 50 × 1.6mm glass epoxy board

Reduced by 10.0mW for each increase in Ta of 1°C over 25°C.

*2 When mounted on a 90 × 50 × 1.6mm glass epoxy board

Reduced by 7.5mW for each increase in Ta of 1°C over 25°C.

●Recommended operating conditions (Ta = 25°C)

| Parameter | Symbol | Min. | Typ. | Max. | Unit |
|--------------------------------|-----------------|------|------|------|------|
| Operating power supply voltage | V _{cc} | 4.5 | — | 12.5 | V |

●Input / output circuits (with QX2130FS)

| | | | | | | | | | |
|-------|---------|-------|--------|-------|----------|-------|---------|-------|------------|
| 1pin | BIAS IN | 2pin | MUTE | 3pin | LCH IN | 4pin | CTRL0 | 5pin | CL1 |
| | | | | | | | | | |
| 6pin | CL2 | 7pin | CL3 | 8pin | CL4 | 9pin | LCH OUT | 11pin | POWER SAVE |
| | | | | | | | | | |
| 12pin | RCH OUT | 13pin | CR4 | 14pin | CR3 | 15pin | CR2 | 16pin | CR1 |
| | | | | | | | | | |
| pin17 | CTRL1 | 18pin | RCH IN | 19pin | BIAS OUT | | | | |
| | | | | | | | | | |

● Analog characteristics ($V_{CC} = +5V$ DC, $GND = 0V$ DC, $T_a = 25^\circ C$)

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Conditions |
|------------------------------------|----------------------|-------|-------|--------|------|---|
| (Supply current) | | | | | | |
| Supply current (QX mode) | I _{CC1} | 1.3 | 3.0 | 5.2 | mA | No signal Input |
| Supply current (stereo mode) | I _{CC2} | 1.3 | 3.0 | 5.2 | mA | No signal Input |
| Supply current (power saving mode) | I _{CC3} | — | 230 | 500 | μA | No signal Input |
| (Maximum input level) | | | | | | |
| Maximum input level (QX3 mode) | V _{INMax.1} | − 8.3 | − 5.3 | — | dBV | V _{IN} = 100Hz V _{OUT} 1% SINGLE channel INPUT |
| Maximum input level (QX2 mode) | V _{INMax.2} | − 7.6 | − 4.6 | — | dBV | V _{IN} = 100Hz V _{OUT} 1% SINGLE channel INPUT |
| Maximum input level (QX1 mode) | V _{INMax.3} | − 7.4 | − 4.4 | — | dBV | V _{IN} = 1kHz V _{OUT} 1% SINGLE channel INPUT |
| Maximum input level (stereo mode) | V _{INMax.4} | − 2.4 | + 0.6 | — | dBV | V _{IN} = 1kHz V _{OUT} 1% SINGLE channel INPUT |
| Maximum output level | V _{OUTMax.} | − 3.0 | + 0.5 | — | dBV | V _{IN} = 1kHz V _{OUT} 1% SINGLE channel INPUT |
| (Maximum mute level) | | | | | | |
| Maximum mute level (QX mode) | VMUTE1 | — | − 86 | − 76 | dBV | BW: DIN AUDIO V _{IN} = 1kHz, − 20dBV |
| Maximum mute level (stereo mode) | VMUTE2 | — | − 97 | − 87 | dBV | BW: DIN AUDIO V _{IN} = 1kHz, − 20dBV |
| Channel balance | CB | − 1.5 | 0 | + 1.5 | dB | V _{IN} = 600Hz, L + RIN |
| Output current | I _{OUT} | — | — | + / −1 | mA | — |
| Load resistance | R _L | 10 | — | — | kΩ | — |
| Load capacitance | C _L | — | — | 1000 | pF | — |
| Input impedance | R _{IN} | 50 | 75 | 100 | kΩ | — |
| Output impedance | R _{OUT} | — | — | 200 | Ω | — |
| (Distortion) | | | | | | |
| Distortion (QX3 mode) | DSTN1 | — | 0.15 | 0.5 | % | THD + NOISE V _{IN} = 1kHz, − 20dBV |
| Distortion (QX2 mode) | DSTN2 | — | 0.07 | 0.3 | % | THD + NOISE V _{IN} = 1kHz, − 20dBV |
| Distortion (QX1 mode) | DSTN3 | — | 0.04 | 0.2 | % | THD + NOISE V _{IN} = 1kHz, − 20dBV |
| Distortion (stereo mode) | DSTN4 | — | 0.02 | 0.2 | % | THD + NOISE V _{IN} = 1kHz, − 20dBV |
| (Output noise voltage) | | | | | | |
| Output noise voltage (QX mode) | VNOISE1 | — | − 87 | − 77 | dBV | BW: DIN AUDIO R _g = 600Ω |
| Output noise voltage (stereo mode) | VNOISE2 | — | − 98 | − 88 | dBV | BW: DIN AUDIO R _g = 600Ω |
| (Crosstalk) | | | | | | |
| Crosstalk (stereo mode) | C _T | — | − 98 | − 88 | dBV | BW: DIN AUDIO V _{IN} = 1kHz, − 20dBV |

* BW1: 400Hz − 30kHz (V_{IN} = 1kHz) , BW2: − 30kHz (V_{IN} = 100Hz)

(V_{CC} = + 12V DC, GND = 0V DC, T_a = 25°C)

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Conditions |
|------------------------------------|----------------------|-------|--------|------|------|--|
| (Supply current) | | | | | | |
| Supply current (QX mode) | I _{CC1} | 2.0 | 4.9 | 12.0 | mA | Quiescent |
| Supply current (stereo mode) | I _{CC2} | 2.0 | 4.9 | 12.0 | mA | Quiescent |
| Supply current (power saving mode) | I _{CC3} | — | 560 | 1200 | μA | Quiescent |
| (Maximum input level) | | | | | | |
| Maximum input level (QX3 mode) | V _{INMAX.1} | + 1.6 | + 4.6 | — | dBV | V _{IN} = 100Hz V _{OUT} 1% SINGLE channel. INPUT |
| Maximum input level (QX2 mode) | V _{INMAX.2} | + 2.3 | + 5.3 | — | dBV | V _{IN} = 100Hz V _{OUT} 1% SINGLE channel INPUT |
| Maximum input level (QX1 mode) | V _{INMAX.3} | + 2.5 | + 5.5 | — | dBV | V _{IN} = 1kHz V _{OUT} 1% SINGLE channel INPUT |
| Maximum input level (stereo mode) | V _{INMAX.4} | + 8.0 | + 11.0 | — | dBV | V _{IN} = 1kHz V _{OUT} 1% SINGLE channel INPUT |
| Maximum output level | V _{OUTMax.} | + 7.8 | + 10.8 | — | dBV | V _{IN} = 1kHz V _{OUT} 1% SINGLE channel INPUT |
| (Maximum mute level) | | | | | | |
| Maximum mute level (QX mode) | VMUTE1 | — | − 85 | − 75 | dBV | BW: DIN AUDIO V _{IN} = 1kHz, − 20dBV |
| Maximum mute level (stereo mode) | VMUTE2 | — | − 97 | − 87 | dBV | BW: DIN AUDIO V _{IN} = 1kHz, − 20dBV |
| Channel balance | CB | — | 0 | — | dB | V _{IN} = 600kHz, L + R _{IN} |
| Output current | I _{OUT} | — | — | ± 1 | mA | |
| Load resistance | R _L | 10 | — | — | kΩ | |
| Load capacitance | C _L | — | — | 1000 | pF | |
| Input impedance | R _{IN} | 50 | 75 | 100 | kΩ | |
| Output impedance | R _{OUT} | — | — | 200 | Ω | |
| (Distortion) | | | | | | |
| Distortion (QX3 mode) | DSTN1 | — | 0.16 | 0.5 | % | THD + NOISE V _{IN} = 1kHz, − 20dBV |
| Distortion (QX2 mode) | DSTN2 | — | 0.07 | 0.3 | % | THD + NOISE V _{IN} = 1kHz, − 20dBV |
| Distortion (QX1 mode) | DSTN3 | — | 0.05 | 0.2 | % | THD + NOISE V _{IN} = 1kHz, − 20dBV |
| Distortion (stereo mode) | DSTN4 | — | 0.02 | 0.2 | % | THD + NOISE V _{IN} = 1kHz, − 20dBV |
| (Output noise voltage) | | | | | | |
| Output noise voltage (QX mode) | VNOISE1 | — | − 85 | − 75 | dBV | BW: DIN AUDIO R _g = 600Ω |
| Output noise voltage (stereo mode) | VNOISE2 | — | − 99 | − 89 | dBV | BW: DIN AUDIO R _g = 600Ω |
| (Crosstalk) | | | | | | |
| Crosstalk (stereo mode) | C _T | — | − 98 | − 88 | dBV | BW: DIN AUDIO V _{IN} = 1kHz, − 20dBV |

* BW1: 400Hz – 30kHz (V_{IN} = 1kHz) , BW2: – 30kHz (V_{IN} = 100Hz)

●Digital characteristics ($V_{CC} = 4.5 - 5.5V$ DC, $GND = 0V$ DC, $T_a = 25^\circ C$)

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Conditions |
|---------------------------|----------|------|------|------|------|-------------------|
| High level Input voltage | V_{IH} | 2.0 | — | 5.0 | V | |
| Low level Input voltage | V_{IL} | 0.0 | — | 0.8 | V | |
| I / O current, high level | I_{IH} | 0.0 | — | 0.3 | mA | $V_{IH} = V_{CC}$ |
| I / O current, low level | I_{IL} | 0.0 | — | 0.1 | mA | $V_{IL} = 0V$ |

($V_{CC} = 5.6 - 12.5V$ DC, $GND = 0V$ DC, $T_a = 25^\circ C$)

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Conditions |
|---------------------------|----------|------|------|------|------|---------------|
| High level Input voltage | V_{IH} | 2.5 | — | 5.0 | V | |
| Low level Input voltage | V_{IL} | 0.0 | — | 0.8 | V | |
| I / O current, high level | I_{IH} | 0.0 | — | 0.4 | mA | $V_{IH} = 5V$ |
| I / O current, low level | I_{IL} | 0.0 | — | 0.1 | mA | $V_{IL} = 0V$ |

●Measurement circuit

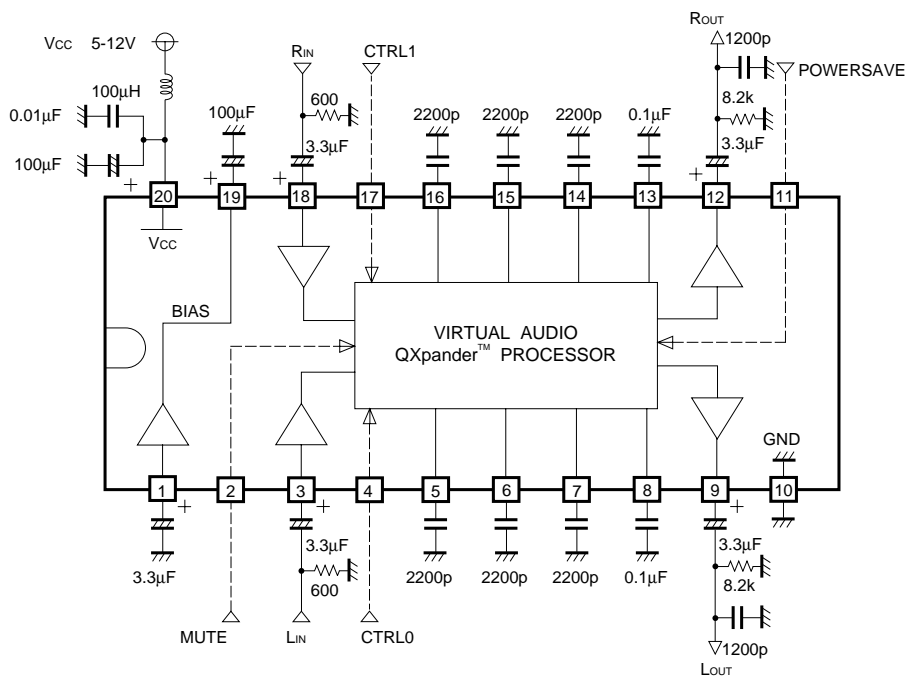


Fig.1

Unit: R (Ω)
C (F)
L (H)

Note: This diagram is for the QX2130FS (SSOP - A20 package) .

●Control mode

(1) CTRL0 & CTRL1 (pins 4 and 17)

| CTRL0 | CTRL1 | MODE | FUNCTIONS | ENHANCEMENT |
|-------|-------|--------|----------------|-------------|
| L | H | STEREO | Stereo Bypass | — |
| L | H | QX1 | Pro Listening | Minimum |
| H | L | QX2 | Wide Listening | Middle |
| H | H | QX3 | Wow for Games | Maximum |

(2) Mute (pin 2)

| CTRL | MODE | FUNCTIONS |
|------|----------|----------------------------|
| L | NOT Mute | Enabled Output (Lch / Rch) |
| H | Mute | Muted Output (Lch / Rch) |

(3) Power saving mode (pin 11)

| CTRL | MODE | FUNCTIONS |
|------|-----------|-----------|
| L | Active | Normal |
| H | Powersave | Shut Down |

●Application example

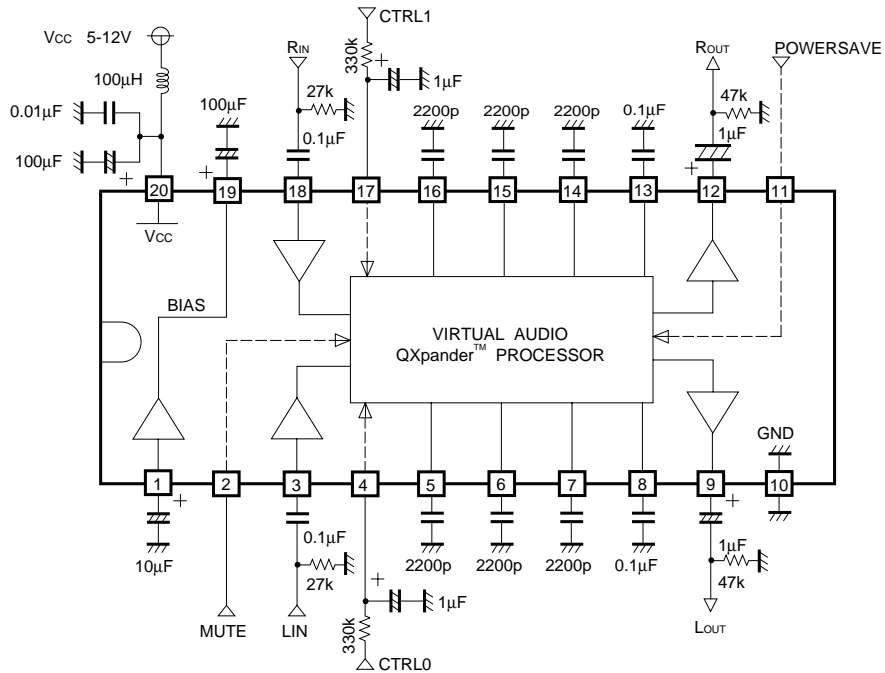


Fig.2

Unit: R (Ω)
C (F)
L (H)

Note: The above diagram is for the QX2130FS (SSOP-A20 package).

●Operation notes

The QX2130FS and QX2130S were developed using technologies patented by QSOUND (U.S.A.) (patents 5,105,462 and 5,208,860), as well as other patented technologies (including related patents pending both inside and outside Japan). To use this IC, this technology must be licensed from QSOUND.

For inquiries concerning QSOUND™ licensing and technologies, contact:

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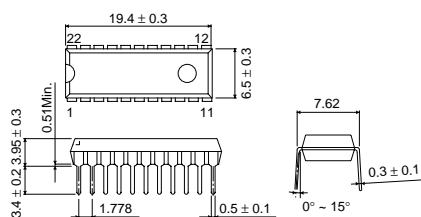
T1Y 5L3

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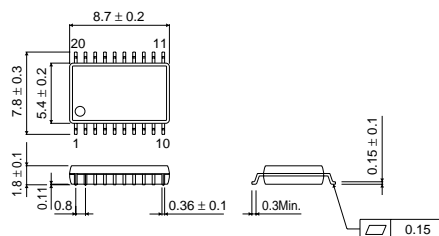
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●External dimensions (Units: mm)



SDIP22



SSOP-A20