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Upgrading from the MMA7330L to the FXLN83xxQ

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1 Introduction

The FXLN83xxQ accelerometers expand Freescale's portfolio, adding best-in-class analog performance. These accelerometers are designed to support analog capability for industrial, medical, and tamper-detection applications. Additionally, these accelerometers provide interface compatibility and simplicity for low-voltage microcontrollers (MCUs). The FXLN83xxQ accelerometers are designed specifically for the Industrial market and are, therefore, part of Freescale's Longevity Program.

The FXLN83xL analog accelerometer replaces the previous generation MMA73xxL Analog 3-axis accelerometer.

This document describes the necessary steps to transition from the MMA73xxL 3-axis Analog Accelerometer family to the new FXLN83xxQ 3-Axis Analog Industrial Accelerometer to bring best-in-class power consumption and bandwidth to your analog applications.

2 Key Benefits of using FXLN83xxQ

Improved battery life in portable applications by reducing overall power consumption:

Specification	MMA7330L	FXNL83xxQ	Units
Current consumption	400	180	μA
Supply voltage range	2.2 – 3.6	1.71 – 3.6	V

Enhanced user experience through performance improvements:

Specification	MMA7330L	FXNL83xxQ	Units
Max Bandwidth	400 XY 300 Z	2700 XY 600 Z	Hz
Max *g*-Range	±12	±16	*g*
Sensitivity @ ±4 *g*	308	114.5[1]	mV/*g*
Noise Density	350	200 XY, 280 Z (130 XY, 200 Z)	μ*g*/√Hz

1. Can be improved by connecting V_{BYP} to the $V_{RefHigh}$ input of your ADC

Enhanced analog output performance:

Specification	MMA7330L	FXNL83xxQ	Units
Output Impedance	32	10	kΩ
Nonratiometric output	No	Yes	
V_{BYP}	No	Yes	

Additional features and performance improvements:

Specification	MMA7330L	FXNL83xxQ	Units
Package	3 x 5 x 1, 14-Pin LGA	3 x 3 x 1, 12-pin QFN	mm
Output at 0 *g*	1.4	0.75	V
Cross-Axis Sensitivity	±5	±4.2	%
Operating Temperature	–40 to 85	–40 to 105	°C

A major feature of the FXLN83xxQ is its nonratiometric output. This means that V_{DD} fluctuations, within the V_{DD} specification for the part, will not change the output offset voltage or sensitivity. Therefore, a noisy power supply will not cause noisy output, thus resulting in a cleaner system. An additional benefit of nonratiometric output is that, when powered by a battery, the device will not suffer from signal drop off when the battery voltage drops as the stored energy is consumed.

Previously with the MMA7330L, and with many other analog accelerometers currently on the market, the sensor's output was ratiometric to V_{DD}. This meant that the output of the sensor was proportional to V_{DD} and as the supply voltage fluctuated so did the output of the sensor. Using a ratiometric part required the user to monitor V_{DD} and perform additional calculations to compensate for fluctuations or changes, such as the previously mentioned battery drop off. With the FXLN83xxQ, such extra effort is a thing of the past as the V_{BYP} output on the FXLN83xxQ can be used as the full scale range input to the system ADC to improve performance. In general, the 0 *g* output from any of the XYZ axes will be equal to 1/2 of the V_{BYP} output.

3 Upgrade Guide

Upgrading to the FXLN83xxQ requires changes to the PCB, including adapting the layout to accept a 3x3x1 12-pin QFN package, rerouting the existing traces, and adding a trace for the V_{BYP} pin.

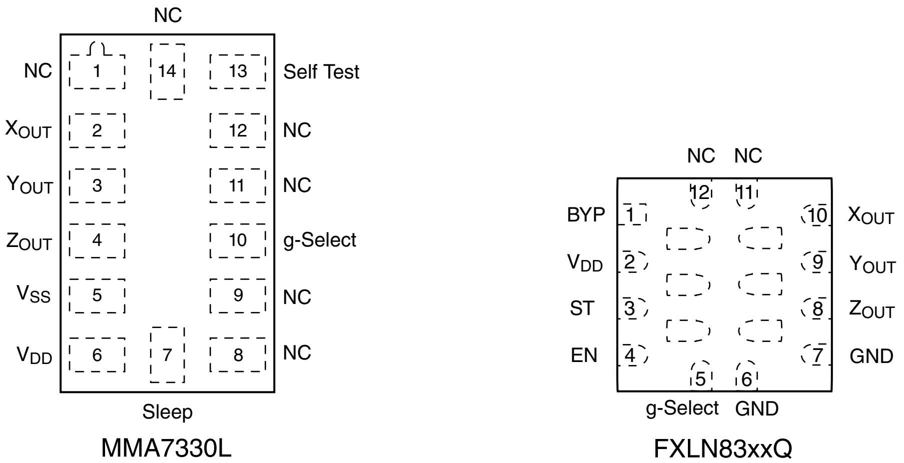


Table 1. Pinout Comparison

MMA7330L			FXLN83xxQ		
Pin	**Name**	**Function**	**Pin**	**Name**	**Function**
2	X_{OUT}	X axis output voltage	10	X_{OUT}	X axis output voltage
3	Y_{OUT}	Y axis output voltage	9	Y_{OUT}	Y axis output voltage
4	Z_{OUT}	Z axis output voltage	8	Z_{OUT}	Z axis output voltage
6	V_{DD}	Power Supply Voltage	2	V_{DD}	Supply voltage
1,8,9,11, 12,14	NC	No internal connection, leave floating	11-12	NC	No internal connection
10	g-Select	Logic input pin to select g level	5	g-Select	g-Range selection pin. Logic low: High-g mode, Logic High: Low-g mode
13	Self-test	Input pin to initiate Self Test	3	ST	Self-test enable pin, enabled when logic high
5	V_{SS}	Connect to Ground	6-7	GND	Connect to Ground
7	Sleep	Sleep mode pin, enabled when logic low	4	EN	Power enable pin, enabled when logic high
			1	V_{BYP}[1]	Internal voltage regulator output capacitor connection

1. The V_{BYP} output on the FXLN83xxQ can be used as the full scale range input to an ADC to improve performance. The benefits of using this output are described in the section, Key Benefits of using FXLN83xxQ.

3.1 Hardware Setup

Based on Table 1, most of the traces will have to be rerouted to replace the MMA7330L with the FXLN83xxQ. The following should be considered when redesigning a PCB originally built for the MMA7330L:

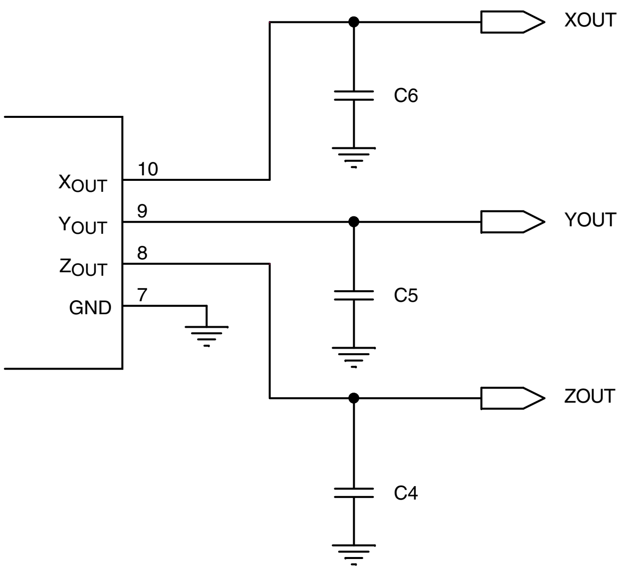
- The pin used for Sleep in the MMA7330L will be named EN and is enabled when logic high (connected to V_{DD}).
- The pin named V_{SS} will be named GND and will continue to be connected to ground.
- The addition of the V_{BYP} pin will require a new trace. The single 0.1 µF capacitor between V_{DD} and V_{SS}/GND should be replaced with a 1.0 µF and a 0.1 µF (each with their own trace from Vdd to GND).

3.2 Capacitor Changes

The capacitors on the X_{OUT}, Y_{OUT}, and Z_{OUT} branches are different on the FXLN83xxQ than on the MMA7330L. Use capacitors as recommended in Table 2.

Table 2. Recommended Minimum Capacitance Specifications

Part Number	Bandwidth	C4 (pF)	C5 (pF)	C6 (pF)
FXLN8361Q	Low	9100	9100	9100
FXLN8362Q	Low	9100	9100	9100
FXLN8371Q	High	8200	3300	3300
FXLN8372Q	High	8200	3300	3300



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