RoHS

High Accuracy Low g Inertial Sensor

MEMS Sensing, State Machine ASIC

MMA6700EG
MMA6701EG

DUAL AXIS
LOW g INERTIAL SENSOR

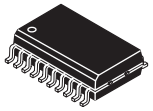
The MMA6700EG series is a dual axis, Low g, XY-axis sensor based on Freescale's HARMEMS technology with an embedded DSP ASIC allowing for additional processing of the digital or analog signals.

Features

- XY-axis of sensitivity in one device
- 10- or 11-bit digital data output
- ±3.5 g or ±5 g full-scale range per axis
  - MMA6700EG: ±3.5 g (11-bit data sensitivity = 3.43 mg/digit typical at 25º C)
  - MMA6701EG: ±5 g (11-bit data sensitivity = 4.91 mg/digit typical at 25ºC)
- SPI-compatible serial interface
- Bidirectional internal self-test
- On-chip temperature sensor and voltage regulator
- Support for signed or unsigned output data
- Selection of integrated signal conditioning low-pass filters
- Capture/hold input for system-wide synchronization support
- 3.3 V or 5 V single supply operation
- Ratiometric analog voltage output
- Traceability through programmable registers, 3 8-bit.
- Customer-assigned one-time-programmable Registers (2 8-bit Registration)
- Minimal external component requirements
- Wide operating temperature range from -40ºC to +125ºC
- 20-pin SOIC wide-body RoHS-compliant package
- Minimum external components, 4 capacitors

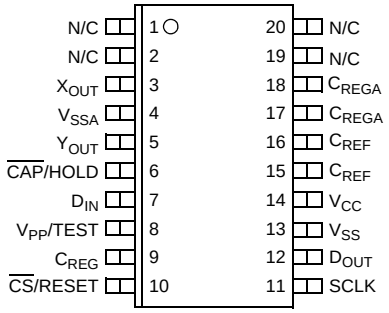
Typical Applications

- With a +3.5 g or +5 g full scale range, the newly designed, high accuracy sensor enables electronic stability control (ESC) designers to accommodate higher original signal noise level without sacrificing resolution.
- Tilt Measurement



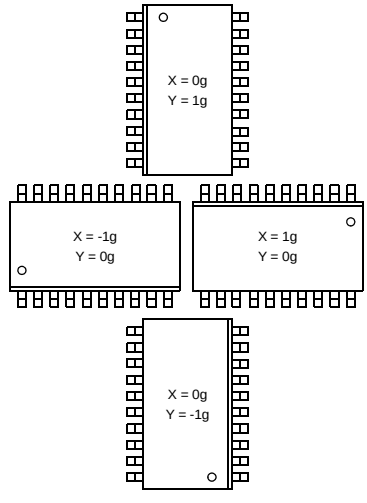
EG SUFFIX (Pb-free)
20-LEAD SOIC
CASE 475A-02

PIN CONNECTIONS



20-PIN SOIC PACKAGE

N/C: NO INTERNAL CONNECTION



ORDERING INFORMATION			
Device	**Temp. Range**	**Case No.**	**Package**
MMA6700EGR2	– 40 to +125°C	475A-02	SOIC-20, Tape and Reel
MMA6700AEGR2	– 40 to +125°C	475A-02	SOIC-20, Tape and Reel
MMA6701EGR2	– 40 to +125°C	475A-02	SOIC-20, Tape and Reel
MMA6701AEGR2	– 40 to +125°C	475A-02	SOIC-20, Tape and Reel

freescale semiconductor

BLOCK DIAGRAM

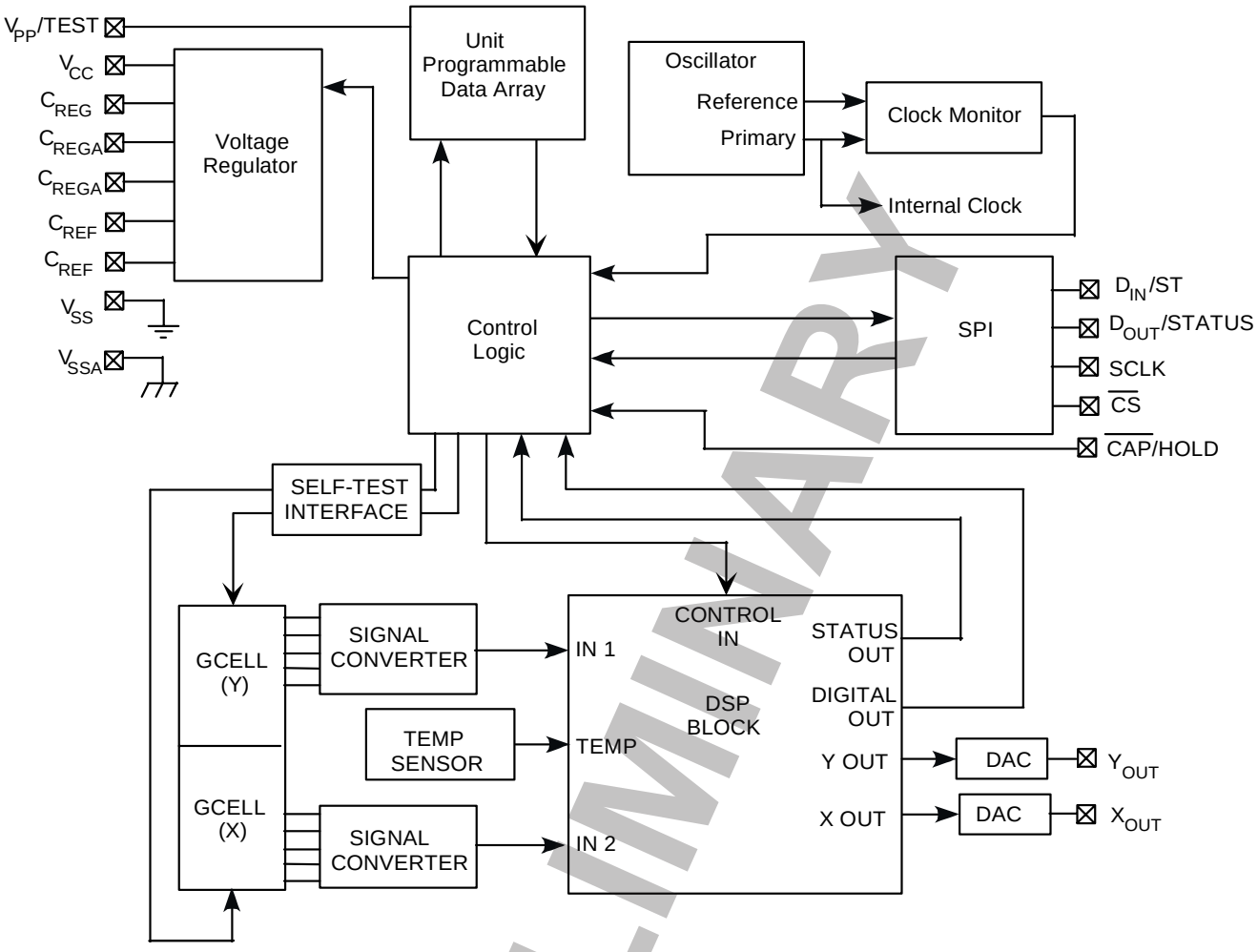


Figure 1. Block Diagram

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Supply Voltage	V_{CC}	-0.3 to 7.0	Vdc
C_{REG}, C_{REGA} , V_{REF}	V_{REG}	-0.3 to 3.0	Vdc
V_{PP}/TEST	V_{PP}	-0.3 to 11.0	Vdc
SCLK, CS, D_{IN}/ST,CAP/HOLD	V_{IN}	-0.3 to V_{CC} + 0.3	Vdc
D_{OUT}/STATUS (high impedance state)	V_{OUT}	-0.3 to V_{CC} + 0.3	Vdc
X_{OUT},Y_{OUT} (DACEN=0)	V_{DAC}	-0.3 to V_{CC} + 0.3	Vdc
Current Drain Per Pin Excluding V_{CC} and V_{SS}	I	10	mAmps
Powered Shock (six sides, 0.5 ms duration)	g_{pms}	$\pm$1500	g
Unpowered Shock (six sides, 0.5 ms duration)	g_{shock}	$\pm$2000	g
Drop Shock (to concrete surface	h_{drop}	1.2	m
Electrostatic Discharge Human Body Model (HBM) Charge Device Model (CDM) Machine Model (MM	 V_{ESD} V_{ESD} V_{ESD}	 $\pm$2000 $\pm$500 $\pm$200	 V V V
Storage Temperature Range	T_{stg}	-40°C to +125°C	°C

PERFORMANCE CHARACTERISTICS

Parameter	Symbol	Min	Typ	MAX	UNITS
Supply Voltage		V_L		V_H	
Standard Operating Voltage, 3.3 V	V_{CC}	+3.15	+3.3	+3.45	V
Standard Operating Voltage, 5V	V_{CC}	+4.75	+5.0	+5.25	V
Operating Temperature Range		T_L		T_H	
	T_A	-40	-	+125	°C
Supply Current					
Standard Operating Voltage, 5.0 V (Digital with Analog Enabled)	I_{dd}	-	-	+9.5	mAmp
Programming Voltage Applied to V_{PP}/TEST	V_{PP}	+7.5	+8.0	+8.5	V
Programming Current Applied to V_{PP}/TEST	I_{PP}	-	-	160	mAmp
Test Mode Activation Voltage Applied to V_{PP}/TEST	V_{TEST}	+6.5	+7.2	+7.5	V
Measurement Range, XY axis	g	-3.5	-	+3.5	g
Digital Sensitivity (D_{OUT})	SENS		3.43		mg/digit
Analog Sensitivity (X_{OUT}, Y_{OUT}) Ratiometric to V_{CC}	SENS		115		mV/V/g
Sensitivity Error (D_{OUT})					
T_A = +25°C	SENS	-3.0	-	+3.0	%
-40°C ≤ T_A ≤ +105°C	SENS	-4.0	-	+4.0	%
+105°C ≤ T_A ≤ +125°C	SENS	-6.0	-	+6.0	%
Offset at 0g,					
SPI. 11-Bit unsigned data	D_{OUT}	-	1024	-	Digit
Analog Output	A_{OUT}	-	$0.5V_{CC}$		V
Offset Error at 0g, SPI, 11-Bit Unsigned Data					
T_A = +25°C	D_{OUT}	-15	-	+15	Digit
-40°C ≤ T_A ≤ +125°C	D_{OUT}	-22	-	+22	Digit
Offset Error at 0g, analog output					
T_A = +25°C	A_{OUT}	-3	-	+3	Digit
-40°C ≤ T_A ≤ +125°C	A_{OUT}	-5	-	+5	Digit
DSP Low-Pass Filter (2^{nd} or 4^{th} Order Selectable)					
Filter Option $00, $13	$f_{C(LPF)}$	8.4	8.8	9.2	Hz
Filter Option $01, $14	$f_{C(LPF)}$	12.4	13.1	13.8	Hz
Filter Option $03, $16	$f_{C(LPF)}$	41.9	44.1	46.3	Hz
Filter Option $02, $15	$f_{C(LPF)}$	47.5	50.0	52.5	Hz
Filter Option $04, $17	$f_{C(LPF)}$	62.8	66.1	69.4	Hz
Filter Option $06, $19	$f_{C(LPF)}$	66.5	70.0	73.5	Hz
Filter Option $05, $18	$f_{C(LPF)}$	83.9	88.3	92.7	Hz
Filter Option $07	$f_{C(LPF)}$	95	100	105	Hz
Filter Option $1A	$f_{C(LPF)}$	134	141	148	Hz
Cross- Axis Sensitivity		-4.0	-	+4.0	%
SPI Clock Rate	t_{SCLK}	8.33	-	-	MHz
Noise (1Hz – 1kHz)	n_{SD}	-	-	140	µg/Hz
Output Loading (D_{OUT}/STATUS)					
Load Resistance	Z_{OUT}	47	-	-	k
Load Capacitance	C_{OUT}	-	-	35	pF

EXTERNAL COMPONENTS

The MMA6700EG requires minimum external components. Aside from a supply bypass capacitor, two 1 μF capacitors provide filtering for the internal analog and digital power supply rails, while a third, 100 nF filter capacitor is required for the internal voltage reference. This circuit configuration is illustrated in Figure 2. Redundant pins are provided for the internal voltage reference and analog supply rails. In safety critical applications, these pins may be connected to separate external capacitors to guard against circuit malfunction in the event of a fault such as an open filter capacitor connection. An internal monitor detects an open digital supply rail filter capacitor condition, which puts the device into reset should this fault occur.

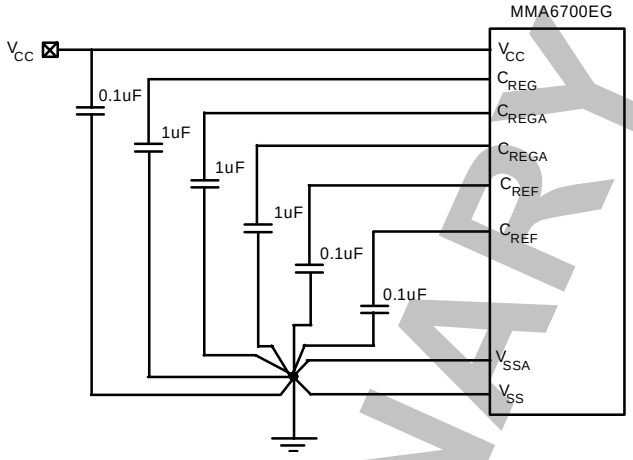
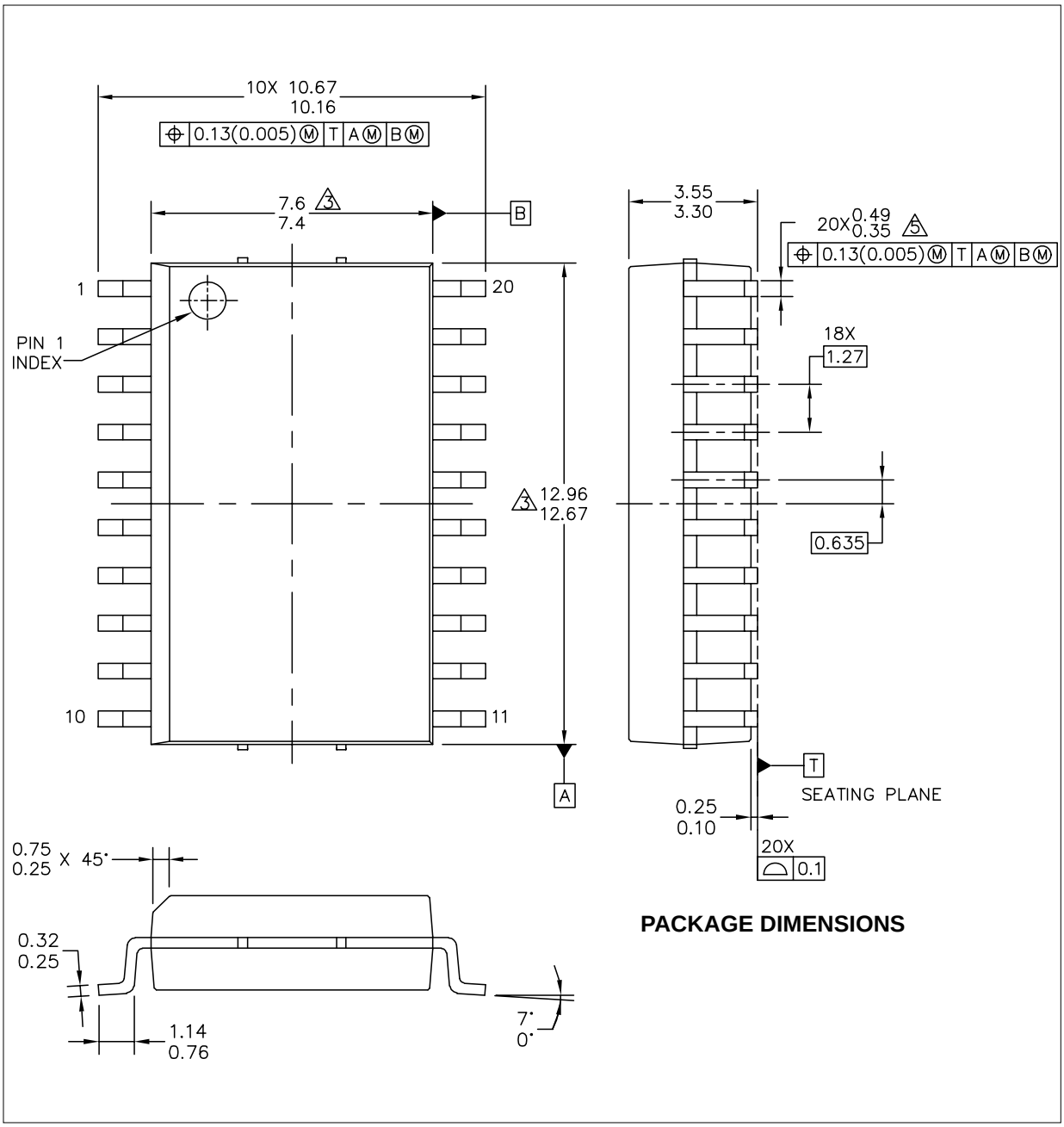


Figure 2. Recommended External Component Configuration



PACKAGE DIMENSIONS

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TITLE: 20LD SOIC W/B, 1.27 PITCH 7.5 X 12.8, ACCLEROMETER CASE–OUTLINE	DOCUMENT NO: 98ASB17933C	REV: C
	CASE NUMBER: 475A–02	06 JUL 2006
	STANDARD: NON–JEDEC	

PACKAGE DIMENSIONS

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M–1994.
2. DIMENSIONS ARE IN MILLIMETERS.
3. THIS DIMENSION DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15(0.006) PER SIDE.
5. THIS DIMENSION DOES NOT INCLUDE DAM BAR PROTRUSION ALLOWABLE DAM BAR PROTRUSION SHALL BE 0.13(0.005) TOTAL IN EXCESS OF THIS DIMENSION AT MAXIMUM MATERIAL CONDITION.

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MMA6700EG
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