IQS7222C OVERVIEW

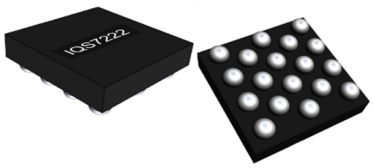
10 Channel Mutual / 8 Channel Self- Capacitive Touch and Proximity Controller with I²C communications interface, configurable GPIOs and low power options

1 Device Overview

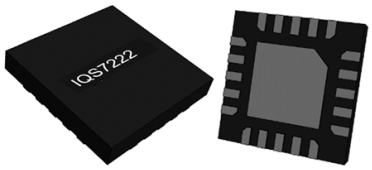
The IQS7222C ProxFusion® IC is a sensor fusion device for various multi-button applications. The sensor is fully I²C compatible and on-chip calculations enable the IC to respond effectively even in lowest power modes.

1.1 Main Features

- Highly flexible ProxFusion® device
- 9 (QFN) / 8 (WLCSP)external sensor pad connections
- Configure up to 10 Channels using the external connections or internal sensor[i]
- External sensor options:
  - Up to 8 self capacitive buttons
  - Up to 4 self capacitive wear detection pairs (with physical reference)
  - Up to 10 projected capacitive touch/proximity sensors
  - Up to 4 inductive sensor elements
- Built-in basic functions:
  - Automatic tuning
  - Noise filtering
  - Differential measurements (reference channels)
  - Debounce & Hysteresis
  - Dual direction trigger indication
- Built-in Signal processing options:
  - Slider output
  - Wheel output
- Design simplicity
  - PC Software for debugging and obtaining optimal settings and performance
  - One-time programmable settings for custom power-on IC configuration
  - Auto-run from programmed settings for simplified integration
- Automated system power modes for optimal response vs consumption
- I2C communication interface with IRQ/RDY(up to fast plus -1MHz)
- Event and streaming modes
- Customizable user interface due to programmable memory
- Supply Voltage 1.8V(-5%)to 3.5V
- Small packages
  - WLCSP18 (1.62 x 1.62 x 0.5 mm) - interleaved 0.4mm x 0.6mm ball pitch
  - QFN20 (3 x 3 x 0.5 mm) - 0.4mm pitch



WLCSP18 & QFN20 package
Representation only



1.2 Applications

- SAR Compliance in Mobile devices
- Wear Detection
- Appliance user interface (Sliders, Wheels & Buttons)
- Waterproof Buttons (Inductive)
- Low power Wake-up Buttons / Proximity

[i] WLCSP18 package has 1 less external pad connection and the maximum amount of buttons that can be configured are less than QFN20 packgae

1.3 Block Diagram

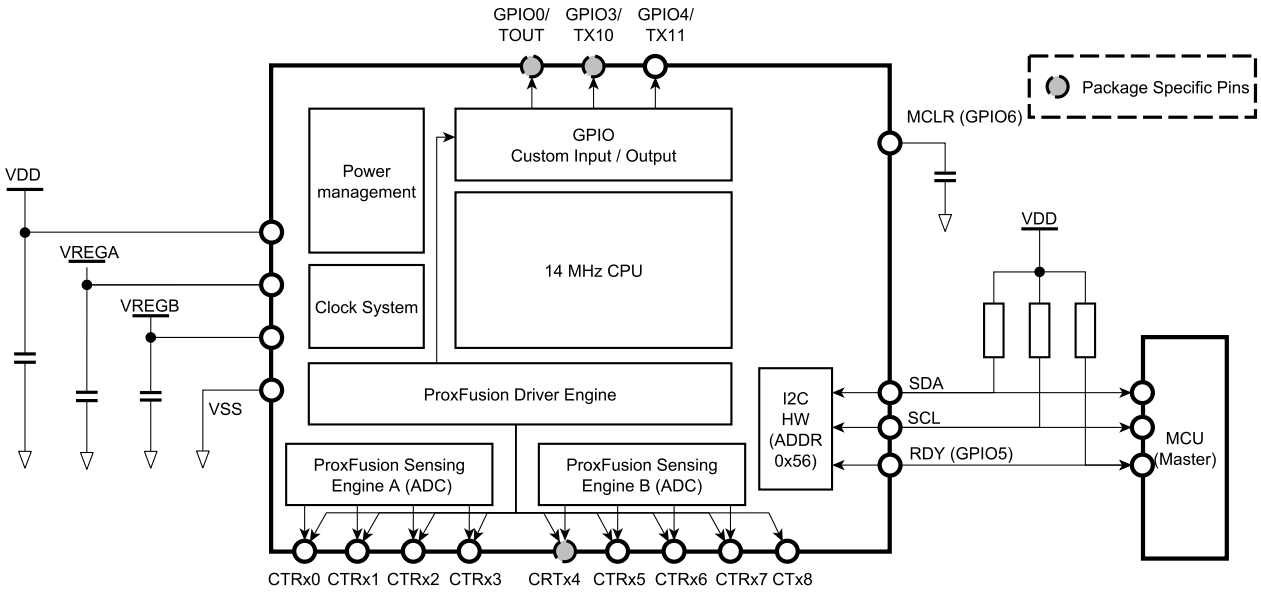


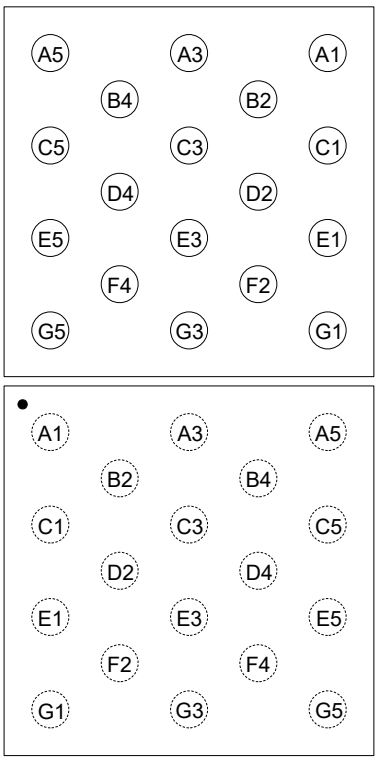
Figure 1.1: Functional Block Diagram[i]

[i] WLCSP18 packages do not have a CRx4 and combines GPIO0 and GPIO3

2 Hardware Connection

2.1 WLCSP18 Pin Diagrams

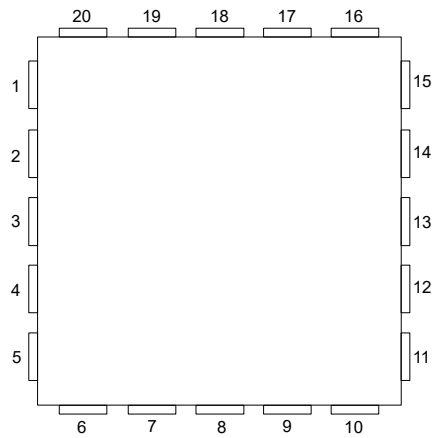
Table 2.1: 18-pin WLCSP18 Package (Bottom/Ball-side View)



Pin no.	Signal
A5	GPIO6 / MCLR
A3	SCL/ GPIO2
A1	Tx9/Tx10/GPIO0/GPIO3[i]
B4	SDA/GPIO1
B2	Tx11/GPIO4
C5	Vdd
C3	RDY/ GPIO5
C1	Tx8
D4	Vss
D2	CRx2/Tx2
E5	VregD
E3	CRx1/Tx1
E1	CRx6/Tx6
F4	CRx0/Tx0
F2	CRx5/Tx5
G5	VregA
G3	CRx3/Tx3
G1	CRx7/Tx7

2.2 QFN20 Pin Diagram

Table 2.2: 20-pin QFN Package (Top View)



Pin no.	Signal name	Pin no.	Signal name
1	VDD	11	CRx6
2	VREGD	12	CRx7
3	VSSD & VSSA	13	CTx8
4	VREGA	14	GPIO0
5	CRx0	15	GPIO3
6	CRx1	16	GPIO4
7	CRx2	17	GPIO5
8	CRx3	18	GPIO2
9	CRx4	19	GPIO1
10	CRx5	20	GPIO6

Area name	Signal name
Tab	Ground

[i] Please note that Tx9 and Tx10 are shorted in the WLCSP18 package

2.3 Reference Schematic

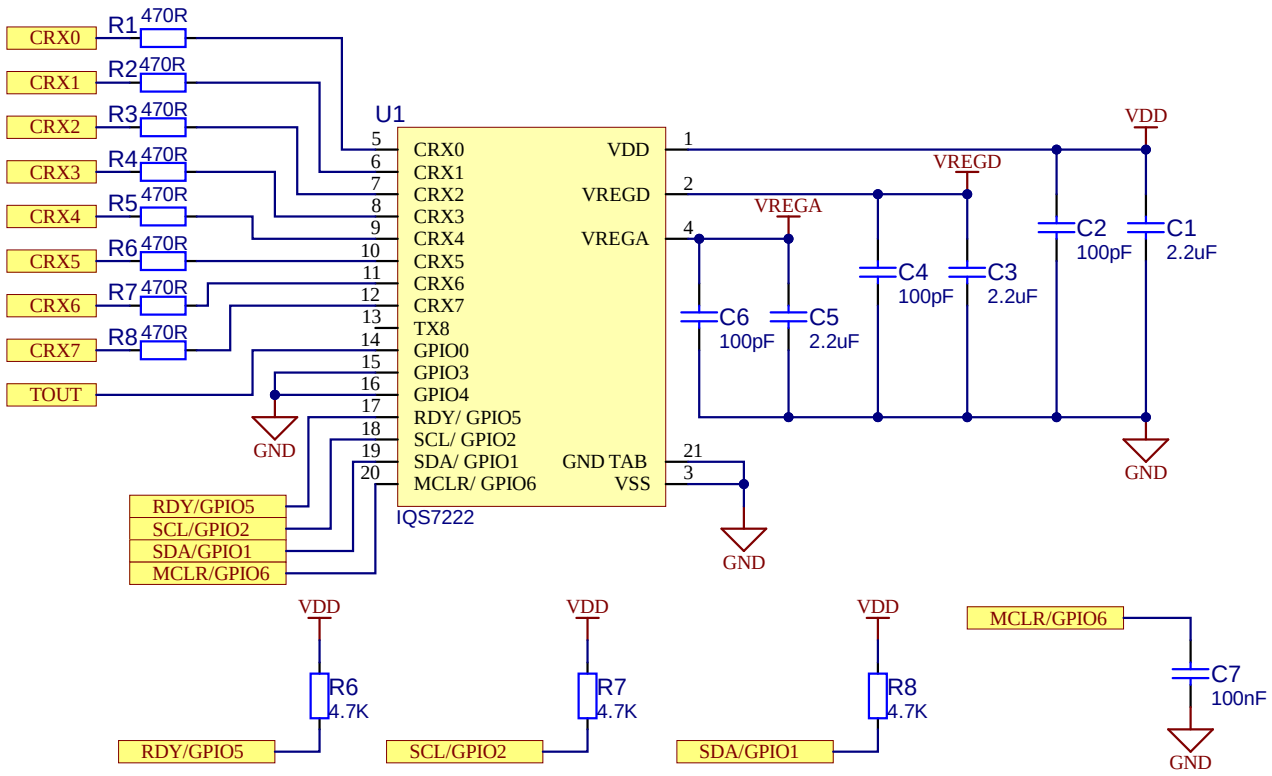


Figure 2.1: 8 Button Self Capacitance Reference Schematic

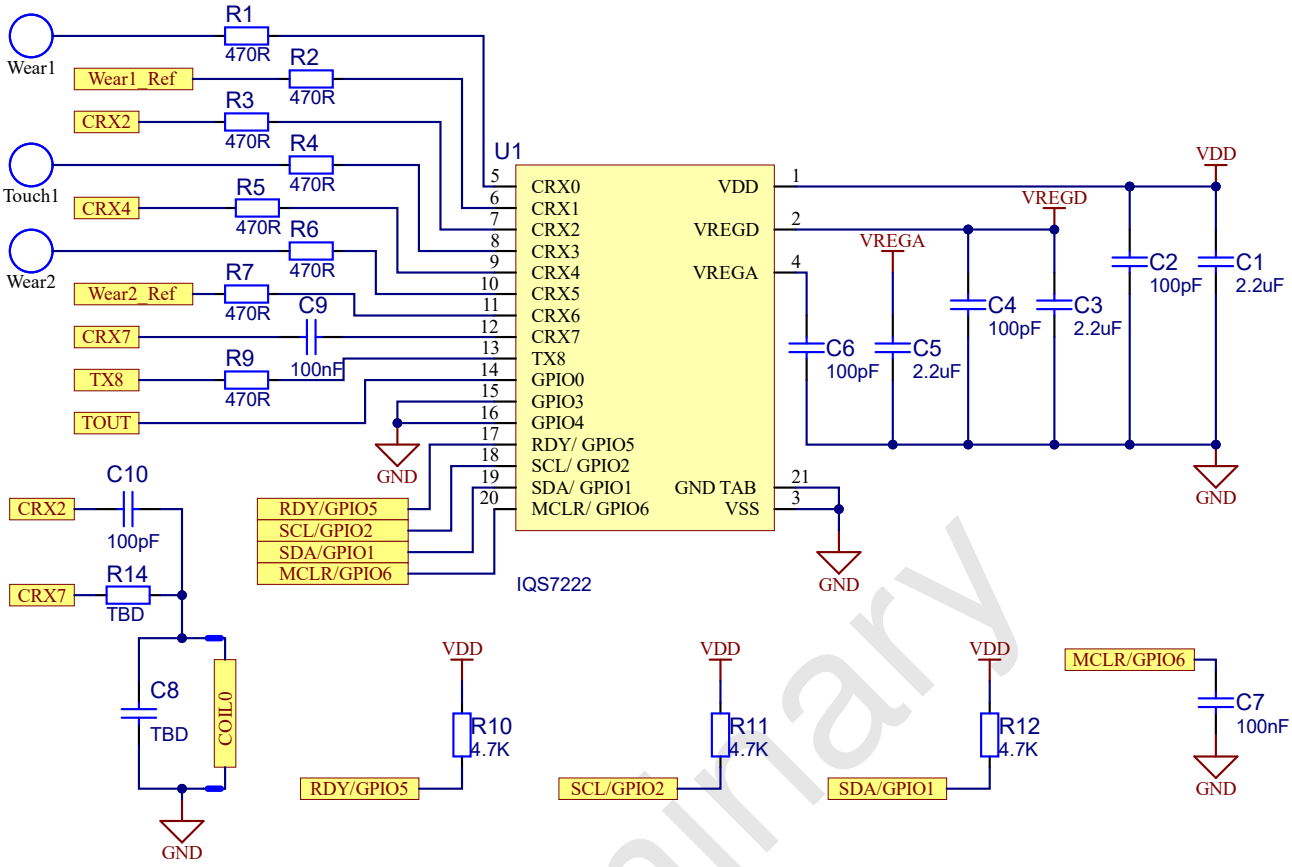


Figure 2.2: Wear, Reference and Inductive Sensing Reference Schematic

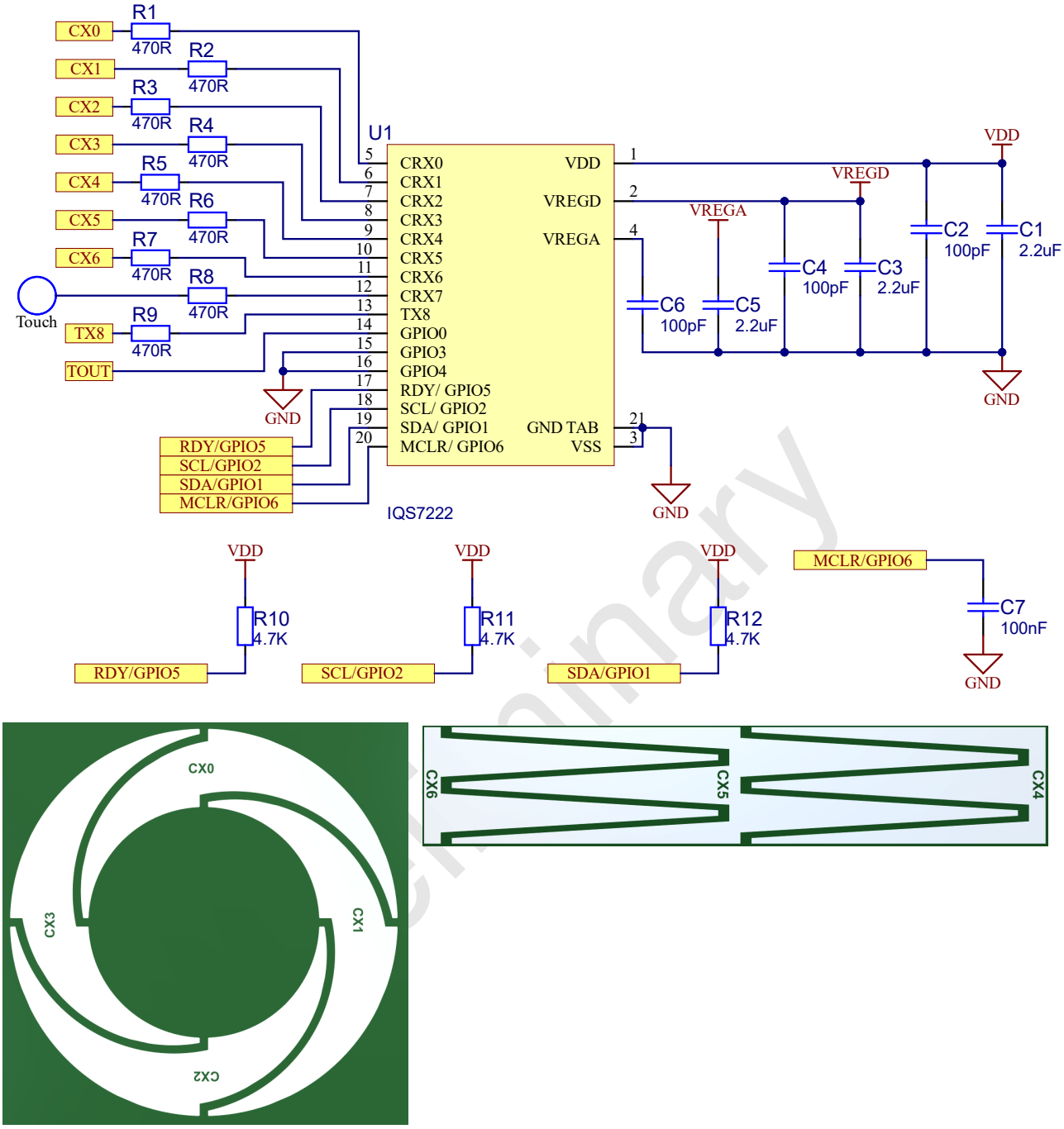


Figure 2.3: 3 Channel Slider, 4 Channel Wheel with Touch Sensor Reference Schematic

3 Electrical Characteristics

3.1 Absolute Maximum Ratings

Table 3.1: Absolute Maximum Ratings

	Min	Max	Unit
Voltage applied at VDD pin to VSS	1.71	3.5	V
Voltage applied to any ProxFusion® pin	-0.3	VREG	V
Voltage applied to any other pin (referenced to VSS)	-0.3	VDD + 0.3 (3.5V max)	V
Storage temperature, T_{stg}	-40	85	℃

3.2 ESD Rating

Table 3.2: ESD Rating

		Value	Unit
$V_{(ESD)}$ Electrostatic discharge	Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001[i]	± 4000	V

3.3 Recommended Operating Conditions

Table 3.3: Recommended Operating Conditions

Recommended operating conditions		Min	Nom	Max	Unit
VDD	Supply voltage applied at VDD pin	1.71		3.5	V
VregA	Internal regulated supply output for analog domain	1.5	1.53	1.75	V
VregD	Internal regulated supply output for digital domain	1.57	1.59	1.8[ii]	V
VSS	Supply voltage applied at VSS pin	0	0	0	V
T_A	Operating free-air temperature	-40	25	85	℃
C_{VDD}	Recommended capacitor at VDD	1	2	10	µF
C_{VREGA}	Recommended external buffer capacitor at VREG, ESR≤ 200mΩ	1	2	10	µF
C_{VREGD}	Recommended external buffer capacitor at VREG, ESR≤ 200mΩ	1	2	10	µF
$Cx_{\_SELF-VSS}$	Maximum capacitance of all external electrodes on all ProxFusion® blocks (self-capacitance mode)	-	-	400	pF
$Cm_{\_CTX-CRX}$	Capacitance of all external electrodes on all ProxFusion® blocks (mutual-cap mode)	0.1	-	90	pF
$Cx_{\_CRX-VSS-1M}$	Maximum capacitance of all external electrodes on all ProxFusion® blocks (mutual-capacitance mode @f_{xfer}=1MHz)			100	pF
$Cx_{\_CRX-VSS-4M}$	Maximum capacitance of all external electrodes on all ProxFusion® blocks (mutual-capacitance mode @ f_{xfer}=4MHz sensing))			25	pF
$\frac{Cx_{CRX-VSS}}{Cm_{CTX-CRX}}$	Capacitance ratio for optimal SNR in mutual capacitance mode	10		20	n/a
$RCx_{\_CRX/CTX}$	Series (in-line) resistance of all mutual capacitance pins (Tx & Rx pins) in mutual capacitance mode	0[iii]	0.47	10[iv]	kΩ
$RCx_{\_SELF}$	Series (in-line) resistance of all self capacitance pins in self capacitance mode	0[ii]	0.47	10[iv]	kΩ

[i] JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process. Pins listed as ±4000 V may actually have higher performance.

[ii] Vdd≥2V

[iii] Nominal series resistance of 470Ω is recommended to prevent received and emitted EMI effects. Typical resistance also adds additional ESD protection

[iv] Series resistance limit is a function of f_{xfer} and the circuit time constant, RC. R_{max} x C_{max} = $\frac{1}{(6x f_{xfer})}$ where "C" is the pin capacitance to Vss.

3.4 Current Consumption

Mutual Inductive Mode Setup: Target: 50, FOSC = 18MHZ, Clock Divider = 0
Self-capacitive Mode Setup: Target = 512, Fxfer = 500kHz
Interface Selection: Event mode

Power mode	Active channels	Report rate (Sampling rate) [ms]	Typical Current [µA]
Active Mode	Mutual Inductive (2 coils)	10	156
	Self-capacitive (8 channels)	10	610
Idle	Self-capacitive (8 channels)	50	120
	Mutual Inductive (2 coils)	80	20
ULP	Wake-up proximity - Distributed self channel	160	9
	Mutual Inductive (2 coils)	200	10

4 Ordering Information

IQS7222C zzz ppb

IC NAME	IQS7222C	=	IQS7222C	
POWER-ON CONFIGURATION	zzz	=	001	8 button self capacitance startup, configurable via I^2C
PACKAGE TYPE	pp	=	CS	WLCSP-18 package
		=	QN	QFN-20 package
BULK PACKAGING	b	=	R	WLCSP-18 Reel (3000pcs/reel) QFN-20 Reel (2000pcs/reel)

Figure 4.1: Order Code Description

5 Package Specification

5.1 Package Outline Description - WLCSP18

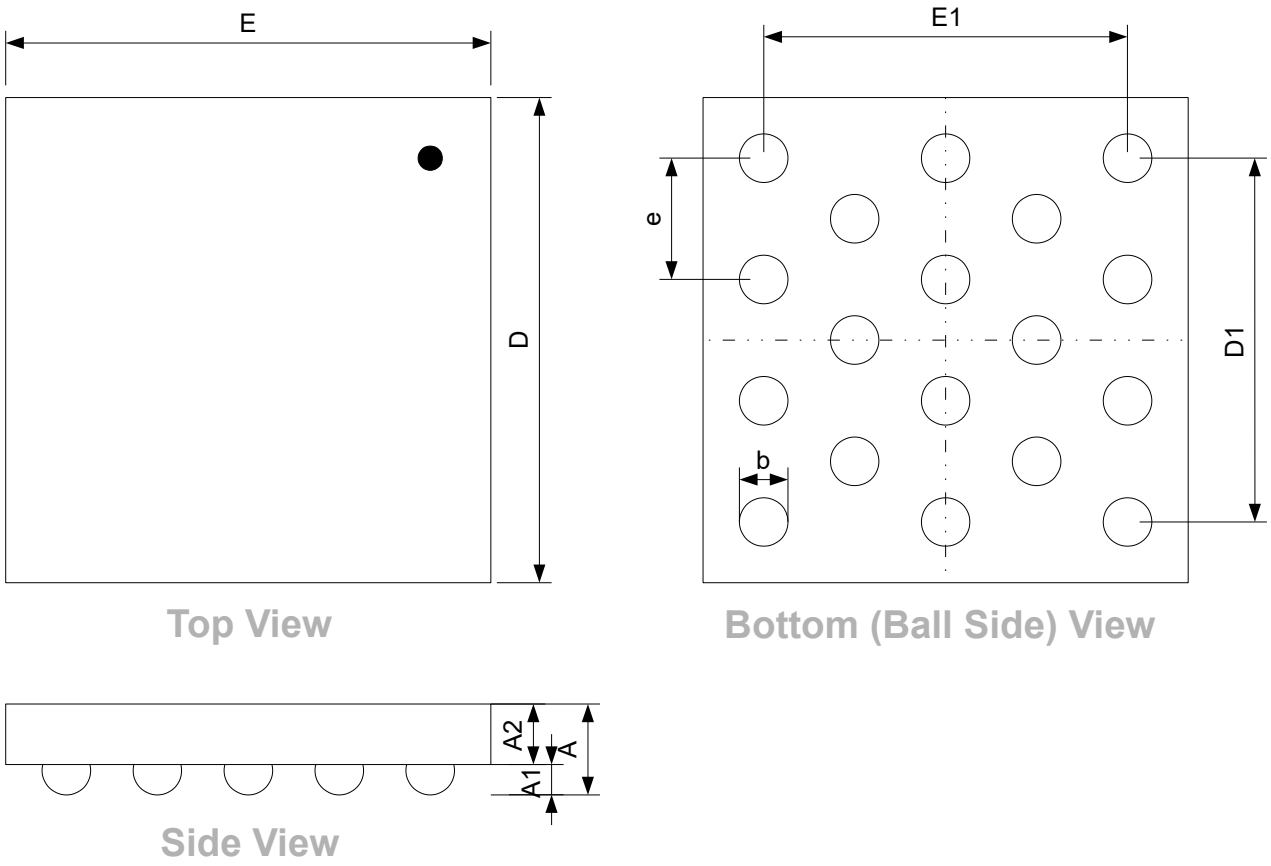


Figure 5.1: WLCSP (1.62x1.62) - 18 Package Outline Visual Description

Table 5.1: WLCSP (1.62x1.62) - 18 Package Outline Visual Description

Dimension	[mm]	Dimension	[mm]
A	0.525±0.05	D1	1.2
A1	0.2±0.02	E	1.620±0.015
A2	0.3±0.025	E1	1.2
b	0.260±0.39	e	0.4
D	1.620±0.015		

5.2 Package Outline Description - QFN20

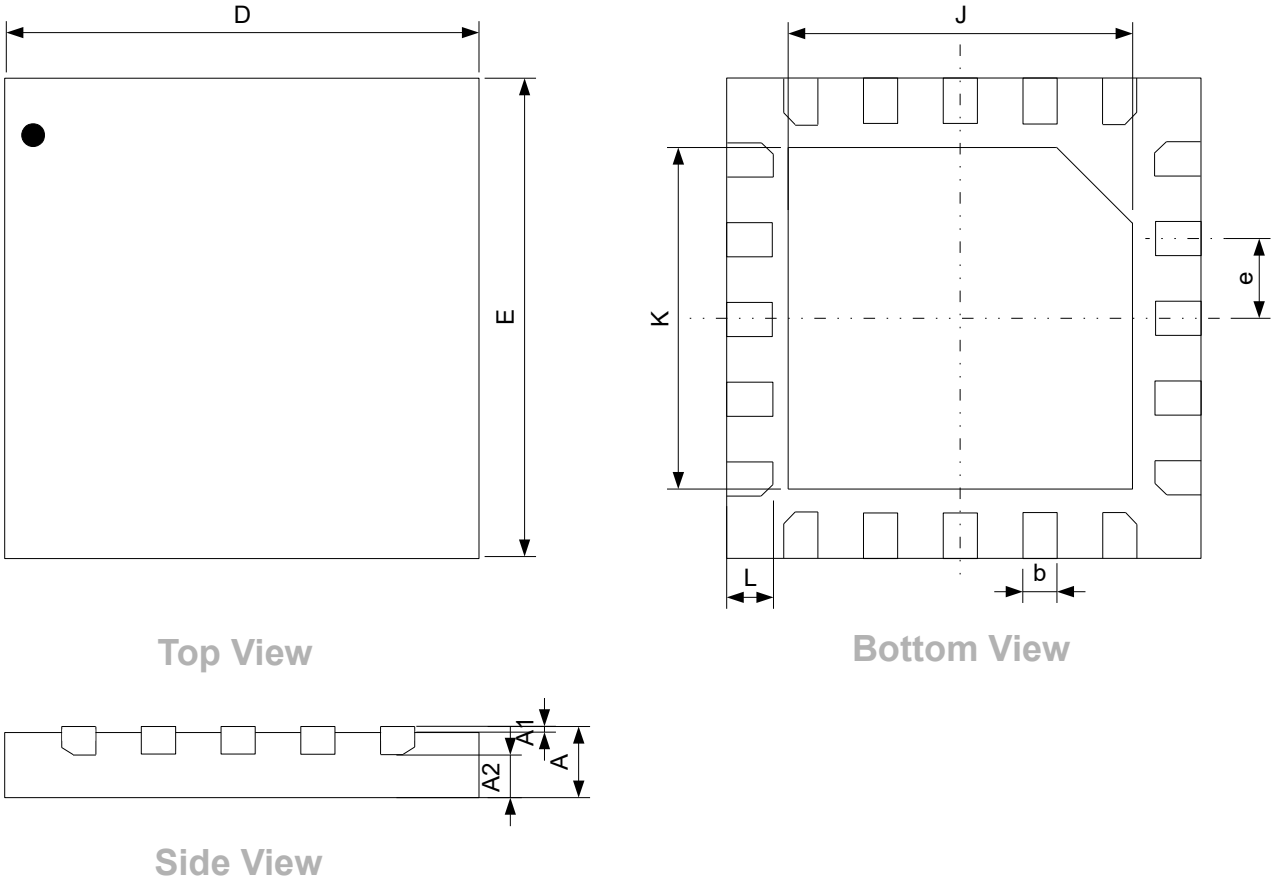


Figure 5.2: QFN (3x3)-20 Package Outline Visual Description

Table 5.2: QFN (3x3)-20 Package Outline Visual Description

Dimension	[mm]	Dimension	[mm]
A	0.5±0.1	E	3
A1	0.035±0.05	e	0.4
A2	0.3	J	1.7±0.1
A3	0.203	K	1.7±0.1
b	0.2±0.05	L	0.4±0.05
D	3		

Contact Information

	USA	Asia	South Africa
Physical Address	11940 Jollyville Rd Suite 120-S Austin TX–78759 USA	Room501A, Block A T-Share International Centre Taoyuan Road Nanshan District Shenzhen Guangdong Province PRC	1 Bergsig Avenue Paarl 7646 South Africa South Africa
Postal Address	11940 Jollyville Rd Suite 120-S Austin TX–78759 USA	Room501A, Block A T-Share International Centre Taoyuan Road Nanshan District Shenzhen Guangdong Province PRC	PO Box 3534 Paarl 7620 South Africa South Africa
Tel	+1 512 538 1995	+86 755 8303 5294 ext 808	+27 21 863 0033
Email	info@azoteq.com	info@azoteq.com	info@azoteq.com

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