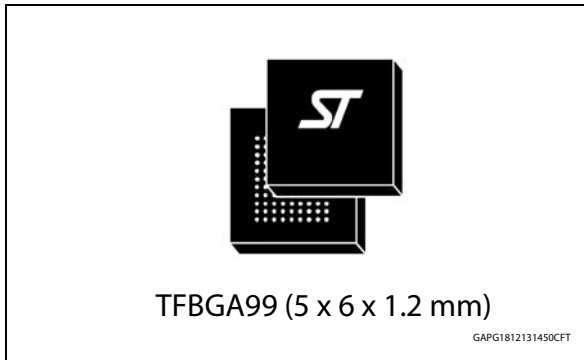

**Fully Integrated GPS/Galileo/Glonass/BeiDou/QZSS Receiver
with embedded RF and in-package Flash**

Data brief

**Features**

- STMicroelectronics® positioning receiver with 48 tracking channels and 2 fast acquisition channels supporting GPS, Galileo, Glonass, BeiDou and QZSS systems
- Single die standalone receiver embedding RF Front-End and low noise amplifier
- -162 dBm indoor sensitivity (tracking mode)
- Fast TTFF < 1 s in Hot start and 30 s in Cold Start
- High performance ARM946 MCU (up to 196 MHz)
- 256 Kbyte embedded SRAM
- In-Package SQI Flash Memory (16 Mbits)
- Real Time Clock (RTC) circuit
- 32-bit Watch-dog timer
- 3 UARTs
- 1 I²C master/slave interface
- 1 Synchronous Serial Port (SSP, Motorola-SPI supported)
- USB2.0 full speed (12 MHz) with integrated physical layer transceiver
- 2 Controller Area Network (CAN)
- 2 channels ADC (10 bits)

- Power Management Unit (PMU) embedding switching regulator
- Operating condition:
 - Main voltage regulator (V_{INL}): 1.6V to 4.3V
 - Backup voltage (V_{INB}): 1.6V to 4.3V
 - Digital voltage (V_{DD}): 1.2 V \pm 10%
 - RF core voltage (V_{CC}): 1.2 V \pm 10%
 - IO Ring Voltage (V_{ddIO}): 1.8 V \pm 5% or 3.3 V \pm 10%
- Package:
 - TFBGA99 (5 x 6 x 1.2 mm) 0.5 mm pitch
- Ambient temperature range: -40/+85°C

Description

STA8090FG is a single die standalone positioning receiver IC working on multiple constellations (GPS/Galileo/Glonass/BeiDou/QZSS).

The minimal BOM makes STA8090FG the ideal solution for cost competitive and small footprint products such as trackers, telematics, portable, tablets, marine and sports accessories.

The device is offered with a complete GNSS firmware which performs all GNSS operations including tracking, acquisition, navigation and data output with no need of external memories.

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1 Overview

STA8090FG is a highly integrated single-chip standalone GNSS receiver designed for positioning system applications.

STA8090FG embeds the new ST GNSS positioning engine capable of receiving signals from multiple satellite navigation systems, including the US GPS, European Galileo, Russia's GLONASS, Chinese BeiDou and Japan's QZSS.

The STA8090FG ability of tracking simultaneously the signals from multiple satellites regardless of their constellation, make this chip capable of delivering exceptional accuracy in urban canyons and in the environments where buildings and other obstructions make satellite visibility challenging.

STA8090FG embeds innovative power management with switching regulator for power consumption optimization.

The extended voltage supply range from 1.6 V to 4.3 V, the 1.8 V and 3.3 V I/O compliance support make the STA8090FG the suitable solution for different user applications.

The STA8090FG combines a high performance ARM946 microprocessor with I/O capabilities and enhanced peripherals. It supports USB2.0 standard at full speed (12 Mbps) with on-chip PHY.

The chip embeds backup logic with real time clock.

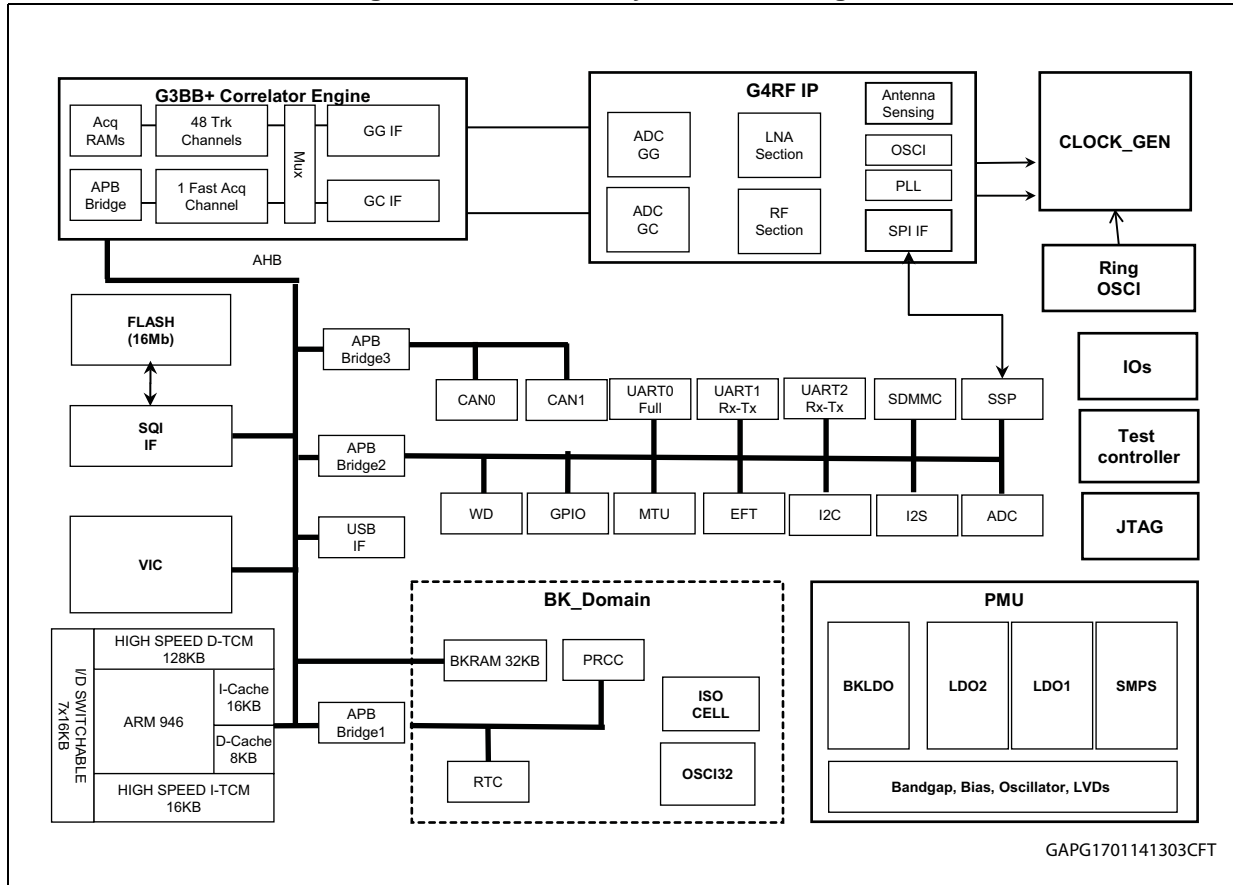
The device is offered with a complete firmware performing all positioning operations including acquisition, tracking, navigation and data output with no need of external memories.

The STA8090FG, using STMicroelectronics CMOSRF Technology, is housed in a TFBGA99 (5 x 6 x 1.2 mm) package with stacked 16 Mbit Flash memory.

2 Pin description

2.1 Block diagram

Figure 1. STA8090FG system block diagram



2.2 TFBGA99 pin configuration

Table 1. TFBGA99 connection diagram (with CAN)

	1	2	3	4	5	6	7	8	9
A	VINM	VINM	SPI_CLK	SPI_CSN	VINL1	VOL1	GND	VINB	VOB
B	VLX	VLX	SPI_DI	UART0_TX	UART0_CTS	UART2_RX	GPIO1	GPIO0	GND
C	GND	GND	SPI_DO	VDDIO_R1	UART2_TX	UART0_RTS	VDD_SQI	VDD_ADC	Reserved
D	VOM	GND	TMS	UART0_DSR	UART0_DTR	GND	ADC_IN2	GND	RTC_XTO
E	VDD_ANA	TDO	TRSTn	UART0_DCD	VDDD	UART0_RX	ADC_IN1	WAKEUP0	RTC_XTI
F	GND	TDI	VDDD	VDDD	GND	GND	WAKEUP1	STDBYn	RSTn
G	USB_DP	TCK	VDDD	GND	GND	GND	STDBY_OUT	PMU_CFG	XTAL_OUT
H	USB_DM	GPIO10	MMC_D3	MMC_CLK	TP_IF_N	GND	GND	VCC_PLL	XTAL_IN
J	CAN0_TX	GPIO11	MMC_D2	MMC_CMD	TP_IF_P	GND	GND	ANT_SENSE2	VCC_CHAIN
K	CAN0_RX	VDDIO_R2	GPIO2	MMC_D1	GND	GND	GND	GND_LNA	ANT_SENSE1
L	GND	I2C_SD	I2C_CLK	MMC_D0	VCC_RF	LNA_IN	VOL2	VINL2	GND

Table 2. TFBGA99 connection diagram (no CAN)

	1	2	3	4	5	6	7	8	9
A	VINM	VINM	SPI_CLK	SPI_CSN	VINL1	VOL1	GND	VINB	VOB
B	VLX	VLX	SPI_DI	UART0_TX	UART0_CTS	UART2_RX	GPIO1	GPIO0	GND
C	GND	GND	SPI_DO	VDDIO_R1	UART2_TX	UART0_RTS	VDD_SQI	VDD_ADC	Reserved
D	VOM	GND	TMS	UART0_DSR	UART0_DTR	GND	ADC_IN2	GND	RTC_XTO
E	VDD_ANA	TDO	TRSTn	UART0_DCD	VDDD	UART0_RX	ADC_IN1	WAKEUP0	RTC_XTI
F	GND	TDI	VDDD	VDDD	GND	GND	WAKEUP1	STDBYn	RSTn
G	USB_DP	TCK	VDDD	GND	GND	GND	STDBY_OUT	PMU_CFG	XTAL_OUT
H	USB_DM	GPIO10	MMC_D3	MMC_CLK	TP_IF_N	GND	GND	VCC_PLL	XTAL_IN
J	UART0_TX	GPIO11	MMC_D2	MMC_CMD	TP_IF_P	GND	GND	ANT_SENSE2	VCC_CHAIN
K	UART0_RX	VDDIO_R2	GPIO2	MMC_D1	GND	GND	GND	GND_LNA	ANT_SENSE1
L	GND	I2C_SD	I2C_CLK	MMC_D0	VCC_RF	LNA_IN	VOL2	VINL2	GND

2.3 Power supply pins

Table 3. Power supply pins

Symbol	I/O voltage	I/O	Description	STA8090FG
VCC_PLL	1.2 V	PWR	Analog supply voltage for PLL RF (1.2V)	H8
VCC_CHAIN	1.2 V	PWR	Analog supply voltage for RF chain (1.2V)	J9
VCC_RF	1.2 V	PWR	Analog supply voltage for RF (1.2V)	L5
VDD_ADC	1.8 V	PWR	Digital supply voltage for ADC (1.8V)	C8
VDD_SQI	1.8 V	PWR	Digital supply voltage for SQI	C7
VDDD	1.1 V	PWR	Digital supply voltage. This value can be configured to 1.0 V, 1.1 V (default) or 1.2 V	E5, F3, F4, G3
VDDIO_R1	1.8 V or 3.3 V	PWR	Digital supply voltage for I/O ring 1 (1.8 V or 3.3 V)	C4
VDDIO_R2	3.3V	PWR	Digital supply voltage for I/O ring 2 (3.3 V)	K2
VINB	1.6 V - 4.3 V	PWR	Backup LDO input supply voltage (1.6 V to 4.3 V)	A8
VINL1	1.6 V - 4.3 V	PWR	LDO1 input supply voltage (1.6 V to 4.3 V)	A5

Table 3. Power supply pins (continued)

Symbol	I/O voltage	I/O	Description	STA8090FG
VINL2	1.6 V - 4.3 V	PWR	LDO2 input supply voltage (1.6 V to 4.3 V)	L8
VINM	1.6 V - 4.3 V	PWR	SMPS coil input supply (1.6 V to 4.3 V)	A1, A2
VDD_ANA	1.6 V - 4.3 V	PWR	SMPS input supply (1.6 V to 4.3 V)	E1
VLX	0 V - 4.3 V	PWR	SMPS coil output	B1, B2
VOB	1.0V	PWR	LDO backup output voltage (1.0 V)	A9
VOL1	1.1 V or 1.8 V	PWR	LDO1 output voltage: PMU_CFG = high -> 1.1 V (it can be also configured to 1.0 V or 1.2 V) PMU_CFG = low -> 1.8 V	A6
VOL2	1.2 V	PWR	LDO2 output voltage (1.2 V)	L7
VOM	1.1 V or 1.8 V	PWR	SMPS output voltage PMU_CFG = high -> 1.8 V PMU_CFG = low -> 1.1 V (it can be also configured to 1.0 V or 1.2 V)	D1
GND	GND	GND	Ground	A7, B9, C1, C2, D2, D6, D8, F1, F5, F6, G4, G5, G6, H6, H7, J6, J7, K5, K6, K8, L1, L9
GND_LNA	GND	GND	Ground	K7

2.4 Main function pins

Table 4. Main function pins

Symbol	I/O voltage	I/O	Description	STA8090FG
ADC_IN1	1.4 V – 0 V typ range	I	ADC Analog input [1]	E7
ADC_IN2	1.4 V – 0 V typ range	I	ADC Analog input [1]	D7
PMU_CFG	1.0 V	I	Power management unit config pin High -> VOL1 = 1.1 V, VOM = 1.8 V Low -> VOL1 = 1.8 V, VOM = 1.1 V	G8
RSTn	1.0 V	I	Reset Input with Schmitt-Trigger characteristics and noise filter.	F9
RTC_XTI	1.4 V (max)	I	Input of the 32 KHz oscillator amplifier circuit and input of the internal real time clock circuit.	E9
RTC_XTO	1.4 V (max)	O	Output of the oscillator amplifier circuit.	D9
STDB_OUT	1.0 V	O	When low, indicates the chip is in Standby mode	G7

Table 4. Main function pins (continued)

Symbol	I/O voltage	I/O	Description	STA8090FG
STDBYn	1.0 V	I	When low, the chip is forced in Standby Mode - All pins in high impedance except the ones powered by Backup supply	F8
WAKEUP0	1.0 V	I	WAKEUP from STANDBY mode	E8
WAKEUP1	1.0 V	I	WAKEUP from STANDBY mode	F7

2.5 Test/emulated dedicated pins

Table 5. Test/emulated dedicated pins

Symbol	I/O voltage	I/O	Description	STA8090FG
TCK	VDDIO_R2	I	JTAG Test Clock	G2
TDI	VDDIO_R2	I	JTAG Test Data In / BOOT3	F2
TDO	VDDIO_R2	O	JTAG Test Data Out	E2
TMS	VDDIO_R2	I	JTAG Test Mode Select / BOOT2	D3
TP_IF_N	1.2 V	O	Diff. Test Point for IF – Neg.	H5
TP_IF_P	1.2 V	O	Diff. Test Point for IF . Pos.	J5
TRSTn ⁽¹⁾	VDDIO_R2	I	JTAG Test Circuit Reset	E3

1. If JTAG interface is not used, pin TRSTn must be asserted low.

2.6 Communication interface pins

Table 6. Communication interface pins

Symbol	I/O voltage	I/O	Alternative function	Function	Description	STA8090FG
CAN0_RX ⁽¹⁾	VDDIO_R2	I	AF0 (default)	CAN0_RX	CAN0 receive data input	K1
		I	AF1	UART0_RX	UART0 Rx data	
		I	AF2	Tsense	External temperature capture port	
		I/O	AF3	I2C_SD	I2C serial data	
CAN0_TX ⁽¹⁾	VDDIO_R2	O	AF0 (default)	CAN0_TX	CAN0 transmit data output	J1
		O	AF1	UART0_TX	UART0 Tx data	
		I/O	AF2	GPIO7	General purpose I/O #7	
		O	AF3	I2C_CLK	I2C clock	

Table 6. Communication interface pins (continued)

Symbol	I/O voltage	I/O	Alternative function	Function	Description	STA8090FG
I2C_CLK	VDDIO_R2	O	AF0 (default)	I2C_CLK	I2C clock	L3
		I/O	AF1	GPIO8	General purpose I/O #8	
		O	AF2	CAN1_TX ⁽¹⁾	CAN1 transmit data output	
		O	AF3	SPI_CSN	SPI chip select active low	
I2C_SD	VDDIO_R2	I/O	AF0 (default)	I2C_SD	I2C serial data	L2
		I/O	AF1	GPIO9	General purpose I/O #9	
		I	AF2	CAN1_RX ⁽¹⁾	CAN1 receive data input	
		I	AF3	SQI_CEN	SQI Flash chip enable	
SPI_DO	VDDIO_R1	O	AF0 (default)	SPI_DO	SPI serial data output	C3
		I/O	AF1	GPIO27	General purpose I/O #27	
		I/O	AF2	SQI_SIO0/SI	SQI Flash data IO 1 / ser. O	
		I/O	AF3	MMC_D1	Multimedia card data 1	
SPI_CLK	VDDIO_R1	O	AF0 (default)	SPI_CLK	SPI clock	A3
		I/O	AF1	GPIO25	General purpose I/O #25	
		O	AF2	SQI_CLK	SQI Flash clock	
		O	AF3	MMC_CLK	Multimedia Clock line	
SPI_CSN	VDDIO_R1	O	AF0 (default)	SPI_CSN	SPI chip select active low / IO_Power Sel Ring 1	A4
		I/O	AF1	GPIO24	General purpose I/O #24	
		I	AF2	SQI_CEN	SQI Flash chip enable	
		I/O	AF3	MMC_CMD	Multimedia card command line	
SPI_DI	VDDIO_R1	I	AF0 (default)	SPI_DI	SPI serial data input	B3
		I/O	AF1	GPIO26	General purpose I/O #26	
		I/O	AF2	SQI_SIO1/SO	SQI Flash data IO 0 / ser. I	
		I/O	AF3	MMC_D0	Multimedia card data 0	
UART0_CTS	VDDIO_R1	I	AF0 (default)	UART0_CTS	UART0 clear to send	B5
		I/O	AF1	GPIO15	General purpose I/O #15	
		O	AF2	MSPout_s_clock	MSP serial clock output	
		O	AF3	Clock GNSS	GNSS clock out	

Table 6. Communication interface pins (continued)

Symbol	I/O voltage	I/O	Alternative function	Function	Description	STA8090FG
UART0_DCD	VDDIO_R1	I	AF0 (default)	UART0_DCD	UART0 data carrier detect	E4
		I/O	AF1	GPIO17	General purpose I/O #17	
		O	AF2	MSPout sdata	MSP serial data output	
		O	AF3	Clock GNSS	GNSS clock out	
UART0_DSR	VDDIO_R1	I	AF0 (default)	UART0_DSR	UART0 data set ready	D4
		I/O	AF1	GPIO16	General purpose I/O #16	
		O	AF2	MSPout lrclk	MSP left/right clock output	
		O	AF3	Sign GC	GLONASS and BeiDou 3-bit coding output (Sign)	
UART0_RTS	VDDIO_R1	O	AF0 (default)	UART0_RTS	UART0 request to send	C6
		I/O	AF1	GPIO14	General purpose I/O #14	
		O	AF2	TCXO_OUT	TCXO out clock	
		O	AF3	Sign GG	GPS and Galileo 3-bit coding output (Sign)	
UART0_DTR	VDDIO_R1	O	AF0 (default)	UART0_DTR	UART0 data terminal read	D5
		I/O	AF1	GPIO18	General purpose I/O #18	
		I	AF2	Timer_ICAPA	Extended function timer - input capture A	
		O	AF3	Mag_1 GG	GPS and Galileo 3-bit coding Output (MAG1)	
UART0_RX	VDDIO_R1	I	AF0 (default)	UART0_RX	UART0 Rx data	E6
		I/O	AF1	GPIO30	General purpose I/O #30	
		I/O	AF2	SQI_SIO2	SQI Flash data IO 2	
		I	AF3	Timer_ICAPA	Extended function timer - input capture A	
UART0_TX	VDDIO_R1	O	AF0 (default)	UART0_TX	UART0 Tx data / BOOT1	B4
		I/O	AF1	GPIO31	General purpose I/O #31	
		I/O	AF2	SQI_SIO3	SQI Flash data IO 3	
		O	AF3	Timer_OCMPA	Extended Function Timer – Output Compare A	

Table 6. Communication interface pins (continued)

Symbol	I/O voltage	I/O	Alternative function	Function	Description	STA8090FG
UART2_RX	VDDIO_R1	I	AF0 (default)	UART2_RX	UART 2 Rx data	B6
		I/O	AF1	GPIO28	General purpose I/O #28	
		I/O	AF2	I2C_SD	I2C serial data	
		I/O	AF3	MMC_D2	Multimedia card data 2	
UART2_TX	VDDIO_R1	O	AF0 (default)	UART2_TX	UART 2 Tx data / BOOT0	C5
		I/O	AF1	GPIO29	General purpose I/O #29	
		O	AF2	I2C_CLK	I2C clock	
		I/O	AF3	MMC_D3	Multimedia card data 2	
USB_DM	VDDIO_R2	USB	AF0 (default)	USB_DM	USB D- signal	H1
		I	AF1	UART1_RX	UART 1 Rx data	
		I	AF2	CAN1_RX ⁽¹⁾	CAN1 receive data input	
		I/O	AF3	I2C_SD	I2C serial data	
USB_DP	VDDIO_R2	USB	AF0 (default)	USB_DP	USB D+ signal	G1
		O	AF1	UART1_TX	UART 1 Tx data	
		O	AF2	CAN1_TX ⁽¹⁾	CAN1 transmit data output	
		O	AF3	I2C_CLK	I2C clock	

1. Only for STA8090FGB.

2.7 Multimedia card pins

Table 7. Multimedia card pins

Symbol	I/O voltage	I/O	Alternative function	Function	Description	STA8090FG
MMC_CLK	VDDIO_R2	O	AF0 (default)	MMC_CLK	Multimedia Clock line	H4
		O	AF1	MSPout Irclk	MSP left/right clock output	
		I	AF2	Timer_ICAPA	Extended function timer - input capture A	
		I/O	AF3	GPIO4	General purpose I/O #4	

Table 7. Multimedia card pins (continued)

Symbol	I/O voltage	I/O	Alternative function	Function	Description	STA8090FG
MMC_CMD ⁽¹⁾	VDDIO_R2	I/O	AF0 (default)	MMC_CMD	Multimedia card command line	J4
		O	AF1	MSPout sdata	MSP serial data output	
		O	AF2	CAN0_TX ⁽²⁾	CAN0 transmit data output	
		I/O	AF3	GPIO5	General purpose I/O #5	
MMC_D0	VDDIO_R2	I/O	AF0 (default)	MMC_D0	Multimedia card data 0	L4
		O	AF1	MSPouts_clock	MSP serial clock output	
		I/O	AF2	I2C_SD	I2C serial data	
		I/O	AF3	GPIO20	General purpose I/O #20	
MMC_D1	VDDIO_R2	I/O	AF0 (default)	MMC_D1	Multimedia card data 1	K4
		I	AF1	MSPin_sdata	MSP serial data input	
		O	AF2	Sign GC	GLONASS and BeiDou 3-bit coding output (Sign)	
		I/O	AF3	GPIO21	General purpose I/O #21	
MMC_D2	VDDIO_R2	I/O	AF0 (default)	MMC_D2	Multimedia card data 2	J3
		I	AF1	MSPin_lrcclk	MSP left/right clock input	
		I	AF2	CAN0_RX ⁽²⁾	CAN0 receive data input	
		I	AF3	Tsense	External temperature capture port	
MMC_D3	VDDIO_R2	I/O	AF0 (default)	MMC_D3	Multimedia card data 2	H3
		I	AF1	MSPin_sclk	MSP serial clock input	
		O	AF2	Sign GG	GPS 3-bit coding output (Sign)	
		I/O	AF3	GPIO23	General purpose I/O #23	

1. A pull down must be present to enable ARM Real Time Debugging via JTAG.

2. Only for STA8090FGB.

2.8 General purpose pins

Table 8. General purpose pins

Symbol	I/O voltage	I/O	Alternative function	Function	Description	STA8090FG
GPIO0	VDDIO_R1	I/O	AF0 (default)	GPIO0	General purpose I/O #0	B8
		I	AF1	PPS_IN	pulse per second input	
		O	AF2	Timer_OCMPB	Extended Function Timer – Output Compare B	
		O	AF3	Mag_0 GC	GLONASS and BeiDou 3-bit coding Output (MAG0)	
GPIO1	VDDIO_R1	I/O	AF0 (default)	GPIO1	General purpose I/O #1	B7
		I	AF1	MSPin_sdata	MSP serial data input	
		O	AF2	PPS_OUT	pulse per second output	
		I	AF3	Tsense	External temperature capture port	
GPIO2	VDDIO_R2	I/O	AF0 (default)	GPIO2	General purpose I/O #2	K3
		I	AF1	MSPin_lrcclk	MSP left/right clock input	
		I	AF2	Timer_ICAPB	Extended function timer - input capture B	
		O	AF3	Mag_1 GC	GLONASS and Beidou 3bit coding Output (MAG1)	
GPIO10	VDDIO_R2	I/O	AF0 (default)	GPIO10	General purpose I/O #10	H2
		I	AF2	Timer_ICAPA	Extended function timer - input capture A	
		O	AF3	Timer_OCMPB	Extended Function Timer – Output Compare B	
GPIO11	VDDIO_R2	I/O	AF0 (default)	GPIO11	General purpose I/O #11	J2
		O	AF2	Timer_OCMPA	Extended Function Timer – Output Compare A	
		I	AF3	Timer_ICAPB	Extended function timer - input capture B	

2.9 RF Front-end pins

Table 9. RF Front-end pins

Symbol	I/O voltage	I/O	Description	STA8090FG
ANT_SENSE1	3.3 V	I	Antenna sensing input 1	K9
ANT_SENSE2	3.3 V	I	Antenna sensing Input 2	J8
LNA_IN	1.2 V	I	Low Noise Amplifier Input	L6
XTAL_IN	1.2 V	I	Input Side of Crystal Oscillator or TCXO Input	H9
XTAL_OUT	1.2 V	O	Output Side of Crystal Oscillator	G9

3 Package and packing information

3.1 ECOPACK[®] packages

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK[®] packages, depending on their level of environmental compliance. ECOPACK[®] specifications, grade definitions and product status are available at: www.st.com.

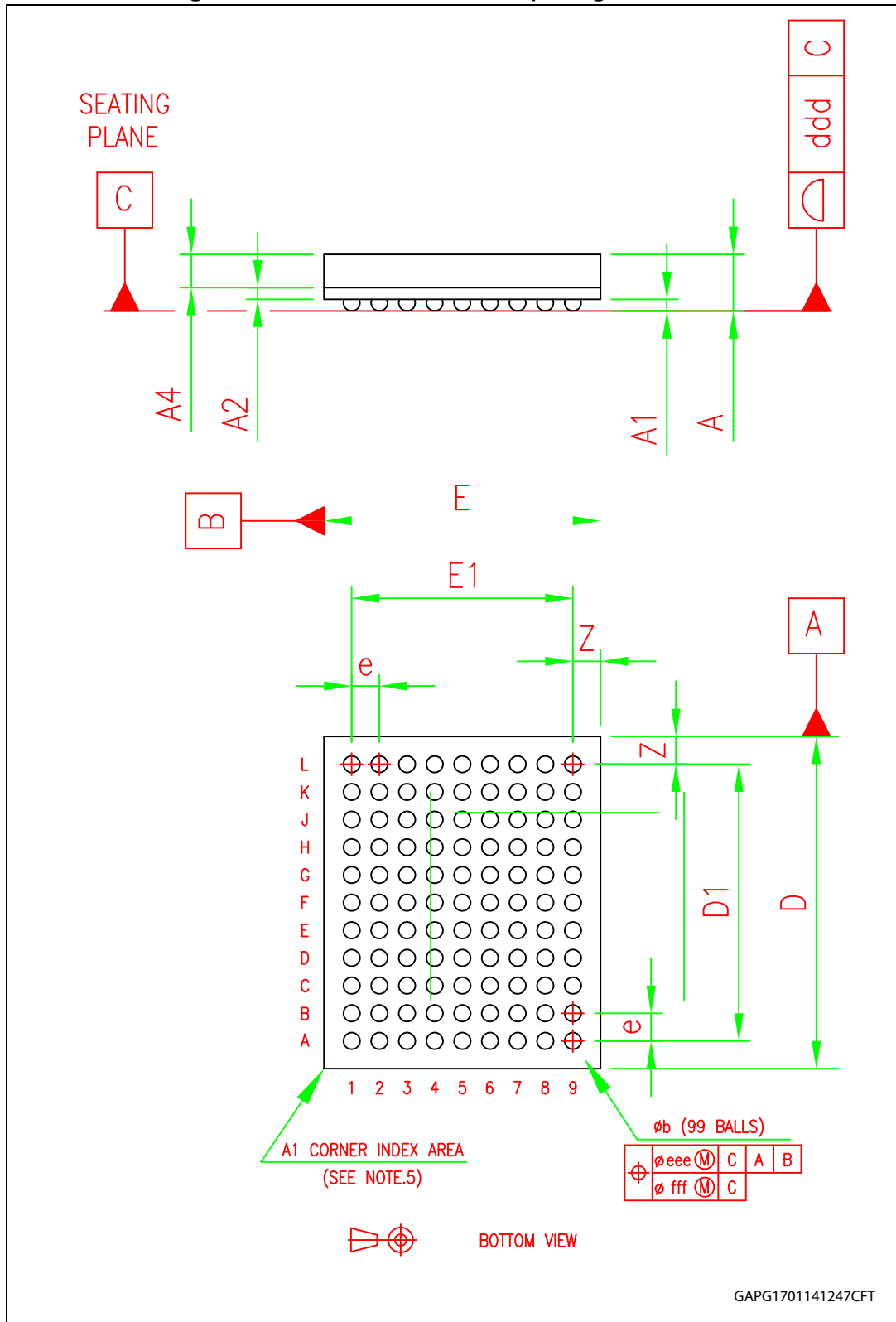
ECOPACK[®] is an ST trademark.

3.2 TFBGA99 5 x 6 x 1.2 mm package information

Table 10. TFBGA99 package dimensions

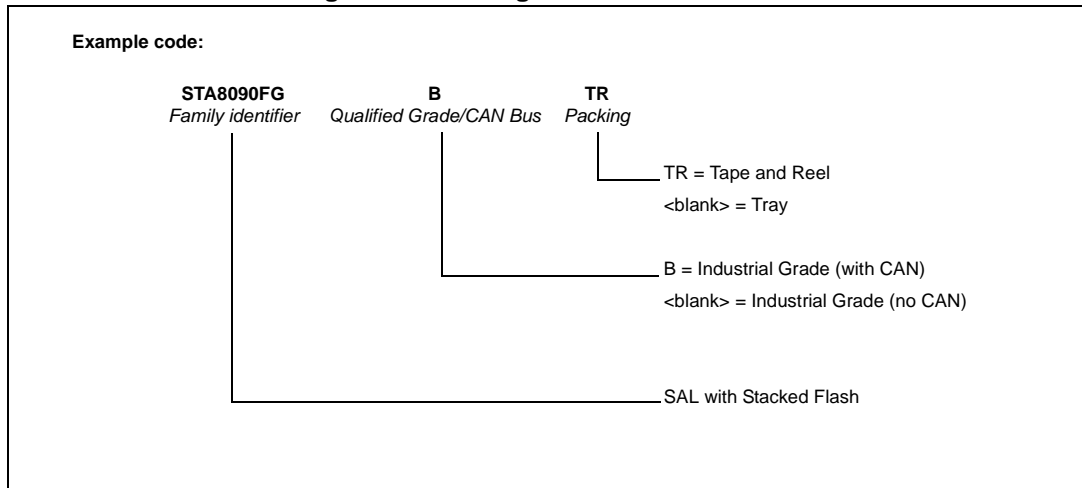
Symbol	Min.	Typ.	Max
A			1.20
A1	0.15		
A2		0.28	
A4			0.60
b	0.25	0.30	0.35
D	5.85	6.00	6.15
D1		5.00	
E	4.85	5.00	5.15
E1		4.00	
e		0.50	
F		0.50	
ddd			0.08
eee			0.15
fff			0.05

Figure 2. TFBGA99 5 x 6 x 1.2 mm package dimension



4 Ordering information

Figure 3. Ordering information scheme



5 Revision history

Table 11. Document revision history

Date	Revision	Changes
18-Dec-2013	1	Initial release.
09-Apr-2014	2	Updated <i>Features</i> list Added following chapters: <ul style="list-style-type: none">– <i>Chapter 1: Overview</i>– <i>Chapter 2: Pin description</i>– <i>Chapter 3: Package and packing information</i>– <i>Chapter 4: Ordering information</i>
10-Apr-2014	3	<i>Table 5: Test/emulated dedicated pins:</i> <ul style="list-style-type: none">– TRSTn: added note <i>Table 7: Multimedia card pins:</i> <ul style="list-style-type: none">– MMC_CMD: added note

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