

# BGS16GA14

SP6T Diversity Antenna Switch with GPIO Interface

## Data Sheet

Revision 3.0 - 2016-02-29

**Edition 2016-02-29**

**Published by Infineon Technologies AG  
81726 Munich, Germany**

**©2016 Infineon Technologies AG  
All Rights Reserved.**

## **LEGAL DISCLAIMER**

The information given in this document shall in no event be regarded as a guarantee of conditions or characteristics. With respect to any examples or hints given herein, any typical values stated herein and/or any information regarding the application of the device, Infineon Technologies hereby disclaims any and all warranties and liabilities of any kind, including without limitation, warranties of non-infringement of intellectual property rights of any third party.

## **Information**

For further information on technology, delivery terms and conditions and prices, please contact the nearest Infineon Technologies Office ([www.infineon.com](http://www.infineon.com)).

## **Warnings**

Due to technical requirements, components may contain dangerous substances. For information on the types in question, please contact the nearest Infineon Technologies Office. Infineon Technologies components may be used in life-support devices or systems only with the express written approval of Infineon Technologies, if a failure of such components can reasonably be expected to cause the failure of that life-support device or system or to affect the safety or effectiveness of that device or system. Life support devices or systems are intended to be implanted in the human body or to support and/or maintain and sustain and/or protect human life. If they fail, it is reasonable to assume that the health of the user or other persons may be endangered.

## Revision History

**Document No.:** BGS16GA14\_\_v3.0.pdf

**Revision History:** Rev. v3.0

**Previous Version:** 2.0

Page	Subjects (major changes since last revision)
12	Carrier tape drawing updated

### Trademarks of Infineon Technologies AG

$\mu$ HVIC<sup>TM</sup>,  $\mu$ IPM<sup>TM</sup>,  $\mu$ PFC<sup>TM</sup>, AU-ConvertIR<sup>TM</sup>, AURIX<sup>TM</sup>, C166<sup>TM</sup>, CanPAK<sup>TM</sup>, CIPOS<sup>TM</sup>, CIPURSE<sup>TM</sup>, CoolDP<sup>TM</sup>, CoolGaN<sup>TM</sup>, COOLiR<sup>TM</sup>, CoolMOS<sup>TM</sup>, CoolSET<sup>TM</sup>, CoolSiC<sup>TM</sup>, DAVE<sup>TM</sup>, DI-POL<sup>TM</sup>, DirectFET<sup>TM</sup>, DrBlade<sup>TM</sup>, EasyPIM<sup>TM</sup>, EconoBRIDGE<sup>TM</sup>, EconoDUAL<sup>TM</sup>, EconoPACK<sup>TM</sup>, EconoPIM<sup>TM</sup>, EiceDRIVER<sup>TM</sup>, eupec<sup>TM</sup>, FCOS<sup>TM</sup>, GaNpowIR<sup>TM</sup>, HEXFET<sup>TM</sup>, HITFET<sup>TM</sup>, HybridPACK<sup>TM</sup>, iMOTION<sup>TM</sup>, IRAM<sup>TM</sup>, ISOFACE<sup>TM</sup>, IsoPACK<sup>TM</sup>, LEDrivIR<sup>TM</sup>, LITIX<sup>TM</sup>, MIPAQ<sup>TM</sup>, ModSTACK<sup>TM</sup>, my-d<sup>TM</sup>, NovalithIC<sup>TM</sup>, OPTIGA<sup>TM</sup>, OptiMOS<sup>TM</sup>, ORIGA<sup>TM</sup>, PowIRaudio<sup>TM</sup>, PowIRStage<sup>TM</sup>, PrimePACK<sup>TM</sup>, PrimeSTACK<sup>TM</sup>, PROFET<sup>TM</sup>, PRO-SIL<sup>TM</sup>, RASIC<sup>TM</sup>, REAL3<sup>TM</sup>, SmartLEWIS<sup>TM</sup>, SOLID FLASH<sup>TM</sup>, SPOC<sup>TM</sup>, StrongIRFET<sup>TM</sup>, SupIRBuck<sup>TM</sup>, TEMPFET<sup>TM</sup>, TRENCHSTOP<sup>TM</sup>, TriCore<sup>TM</sup>, UHVIC<sup>TM</sup>, XHP<sup>TM</sup>, XMC<sup>TM</sup>.

### Other Trademarks

All referenced product or service names and trademarks are the property of their respective owners.

Trademarks updated November 2015

## Contents

<b>1</b>	<b>Features</b>	<b>5</b>
<b>2</b>	<b>Product Description</b>	<b>5</b>
<b>3</b>	<b>Maximum Ratings</b>	<b>6</b>
<b>4</b>	<b>Operation Ranges</b>	<b>7</b>
<b>5</b>	<b>RF Characteristics</b>	<b>8</b>
<b>6</b>	<b>GPIO Specification</b>	<b>9</b>
<b>7</b>	<b>Package related information</b>	<b>9</b>

## List of Figures

1	BGS16GA14 block diagram . . . . .	6
2	Footprint, top view . . . . .	10
3	Package Outline Drawing . . . . .	11
4	Land Pattern Drawing . . . . .	11
5	Laser marking . . . . .	12
6	Carrier Tape . . . . .	12

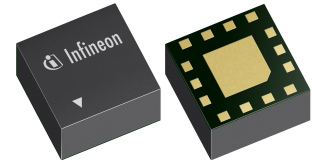
## List of Tables

1	Ordering Information . . . . .	5
2	Maximum Ratings, Table I . . . . .	6
3	Maximum Ratings, Table II . . . . .	7
4	Operation Ranges . . . . .	7
5	RF Input Power . . . . .	7
6	RF Characteristics . . . . .	8
7	IMD2 Testcases . . . . .	9
8	IMD3 Testcases . . . . .	9
9	GPIO Truth Table . . . . .	9
10	Mechanical Data . . . . .	9
11	Pin definition . . . . .	10

## BGS16GA14

### 1 Features

- 6 high-linearity, interchangeable RX ports
- Low insertion loss
- Low harmonic generation
- High port-to-port-isolation
- Suitable for Edge / C2K / LTE / WCDMA Applications
- 0.1 to 3.8 GHz coverage
- No decoupling capacitors required if no DC applied on RF lines
- On chip control logic including ESD protection
- General Purpose Input-Output (GPIO) Interface
- Small form factor 2.0 mm x 2.0 mm
- No power supply blocking required
- High EMI robustness
- RoHS and WEEE compliant package



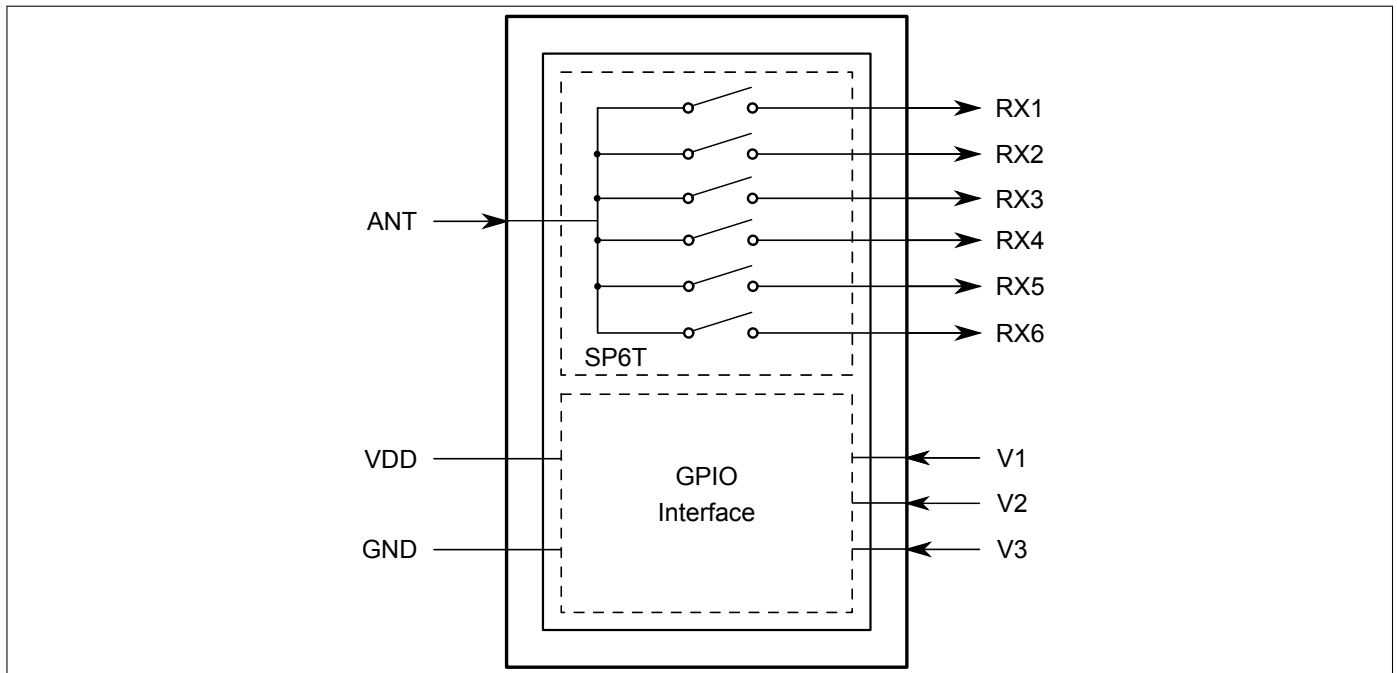
### 2 Product Description

The BGS16GA14 is a Single Pole Eight Throw (SP8T) Diversity Switch Module optimized for wireless applications up to 3.8 GHz. As part of a pin- and functional-compatible SP3T-SP8T product family it has been designed to meet the requirements of chipset reference designs. The module comes in a miniature ATSLP package and comprises of a high power CMOS SP8T switch with integrated GPIO interface. This RF switch is a perfect solution for multimode handsets based on LTE and WCDMA. The switch device configuration is shown in Fig. 1.

The switch is controlled via a GPIO interface. It features DC-free RF ports and unlike GaAs technology, external DC blocking capacitors at the RF ports are only required if DC voltage is applied externally.

**Table 1: Ordering Information**

Type	Package	Marking
BGS16GA14	ATSLP-14	G6


**Figure 1:** BGS16GA14 block diagram

### 3 Maximum Ratings

**Table 2: Maximum Ratings, Table I** at  $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise specified

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Frequency Range	$f$	0.1	–	–	GHz	<sup>1)</sup>
Supply voltage	$V_{dd}$	-0.5	–	3.6	V	–
Storage temperature range	$T_{STG}$	-55	–	150	$^\circ\text{C}$	–
Junction temperature	$T_j$	–	–	125	$^\circ\text{C}$	–
RF input power at all Rx ports	$P_{RF\_Rx}$	–	–	32	dBm	CW
ESD capability, CDM <sup>2)</sup>	$V_{ESDCDM}$	-500	–	+500	V	All pins
ESD capability, HBM <sup>3)</sup>	$V_{ESDHBM}$	-1	–	+1	kV	Digital, digital versus RF
		-1	–	+1	V	RF
ESD capability, system level <sup>4)</sup>	$V_{ESDANT}$	-8	–	+8	kV	ANT versus system GND, with 27 nH shunt inductor

<sup>1)</sup> There is also a DC connection between switched paths. The DC voltage at RF ports  $V_{RFDC}$  has to be 0V.

<sup>2)</sup> Field-Induced Charged-Device Model JESD22-C101. Simulates charging/discharging events that occur in production equipment and processes. Potential for CDM ESD events occurs whenever there is metal-to-metal contact in manufacturing.

<sup>3)</sup> Human Body Model ANSI/ESDA/JEDEC JS-001-2012 ( $R = 1.5\text{ k}\Omega$ ,  $C = 100\text{ pF}$ ).

<sup>4)</sup> IEC 61000-4-2 ( $R = 330\text{ }\Omega$ ,  $C = 150\text{ pF}$ ), contact discharge.

**Table 3: Maximum Ratings, Table II** at  $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise specified

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Thermal resistance junction - soldering point	$R_{thJS}$	–	60	–	K/W	–
Maximum DC-voltage on RF-Ports and RF-Ground	$V_{RFDC}$	0	–	0	V	No DC voltages allowed on RF-Ports
GPIO control voltage levels	$V_{Ctrlx}$	-0.7	–	$V_{dd}+0.7$	V	–

## 4 Operation Ranges

**Table 4: Operation Ranges**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Supply voltage	$V_{dd}$	2.4	3.0	3.4	V	–
Supply current	$I_{dd}$	–	75	175	$\mu\text{A}$	–
GPIO control voltage high	$V_{Ctrl\_H}$	1.35	–	$V_{dd}$	V	–
GPIO control voltage low	$V_{Ctrl\_L}$	0	–	0.45	V	–
GPIO control input capacitance	$C_{Ctrl}$	–	–	2	pF	–
Ambient temperature	$T_A$	-30	25	85	$^\circ\text{C}$	–

**Table 5: RF Input Power**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Rx ports (50 $\Omega$ )	$P_{RF\_Rx}$	–	–	28	dBm	–

## 5 RF Characteristics

**Table 6: RF Characteristics** at  $T_A = -30\text{ }^{\circ}\text{C} \dots 85\text{ }^{\circ}\text{C}$ ,  $P_{IN} = 0\text{ dBm}$ , Supply Voltage  $V_{dd} = 2.4\text{ V} \dots 3.4\text{ V}$ , unless otherwise specified

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
<b>Insertion Loss<sup>1)</sup></b>						
All Rx Ports	IL	–	0.23	0.36	dB	698–960 MHz
		–	0.36	0.56	dB	1428–1990 MHz
		–	0.43	0.58	dB	1920–2170 MHz
		–	0.47	0.62	dB	2170–2690 MHz
		–	0.50	0.71	dB	3400–3600 MHz
		–	0.50	0.74	dB	3600–3800 MHz
<b>Return Loss<sup>1)</sup></b>						
All Rx Ports	RL	20	26	–	dB	698–960 MHz
		14	19	–	dB	1428–1990 MHz
		13	17	–	dB	1920–2170 MHz
		12	15	–	dB	2170–2690 MHz
		11	14	–	dB	3400–3600 MHz
		11	14	–	dB	3600–3800 MHz
<b>Isolation<sup>1)</sup></b>						
All Rx Ports	ISO	32	50	–	dB	698–960 MHz
		26	41	–	dB	1428–1990 MHz
		24	39	–	dB	1920–2170 MHz
		22	37	–	dB	2170–2690 MHz
		19	33	–	dB	3400–3600 MHz
		19	32	–	dB	3600–3800 MHz
<b>Harmonic Generation (UMTS Band 1, Band 5)<sup>1)</sup></b>						
2 <sup>nd</sup> harmonic generation	$P_{H2}$	92	105	–	dBc	25 dBm, 50 $\Omega$ , CW mode
3 <sup>rd</sup> harmonic generation	$P_{H3}$	88	96	–	dBc	25 dBm, 50 $\Omega$ , CW mode
<b>Intermodulation Distortion (UMTS Band 1, Band 5)<sup>1)</sup></b>						
2 <sup>nd</sup> order intermodulation	IMD2 low	–	-105	-100	dBm	IMT, US Cell (see Tab. 7)
3 <sup>rd</sup> order intermodulation	IMD3	–	-110	-105	dBm	IMT, US Cell (see Tab. 8)
2 <sup>nd</sup> order intermodulation	IMD2 high	–	-115	-110	dBm	IMT, US Cell (see Tab. 7)
<b>Switching Time</b>						
RF Rise Time	$t_{RT}$	–	–	2	$\mu\text{s}$	10 % to 90 % RF signal
Switching Time	$t_{ST}$	–	2	4	$\mu\text{s}$	50 % Ctrl signal to 90 % RF signal
Power Up Settling Time	$t_{PUp}$	–	10	25	$\mu\text{s}$	After power down mode

<sup>1)</sup>On application board without any matching components.



**Table 7: IMD2 Testcases**

Band	CW tone 1 (MHz)	CW tone 1 (dBm)	CW tone 2 (MHz)	CW tone 2 (dBm)
IMT	1950	20	190 (IMD2 low)	-15
			4090 (IMD2 high)	
US Cell	835	20	45 (IMD2 low)	-15
			1715 (IMD2 high)	

**Table 8: IMD3 Testcases**

Band	CW tone 1 (MHz)	CW tone 1 (dBm)	CW tone 2 (MHz)	CW tone 2 (dBm)
IMT	1950	20	1760	-15
US Cell	835	20	790	-15

## 6 GPIO Specification

**Table 9: Modes of Operation (Truth Table)**

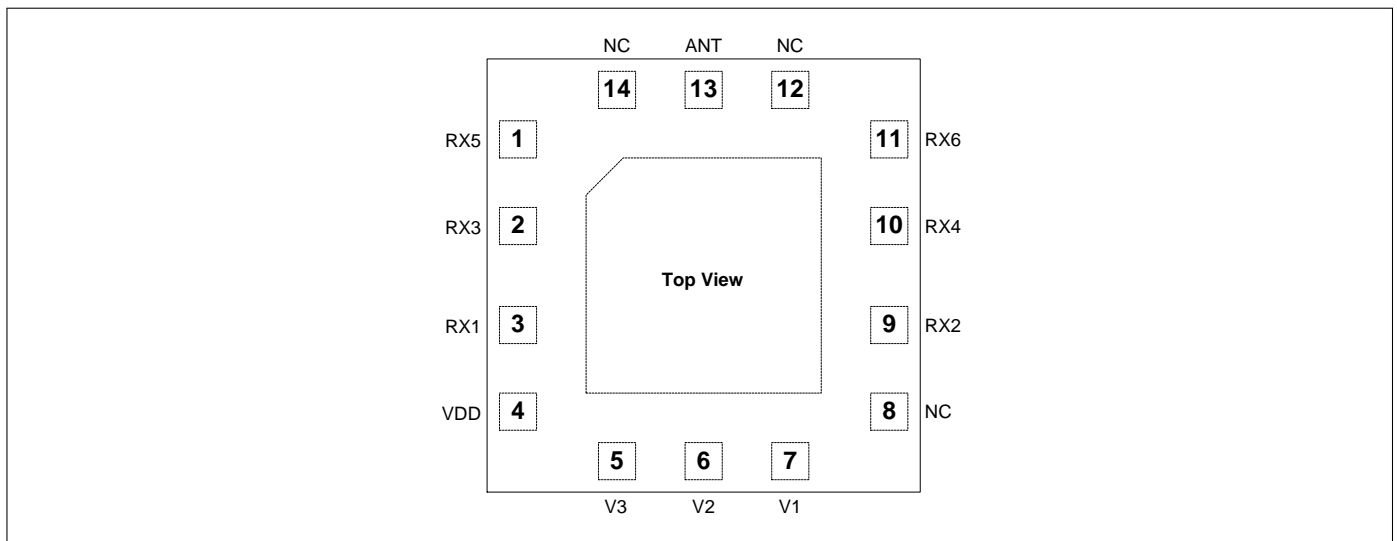
State	Mode	Control Inputs		
		V1	V2	V3
1	RX1-ANT	0	0	0
2	RX2-ANT	0	0	1
3	RX3-ANT	0	1	0
4	RX4-ANT	0	1	1
5	RX5-ANT	1	0	0
6	RX6-ANT	1	0	1
7	RX3/RX5-ANT	1	1	0
8	Shutdown	1	1	1

## 7 Package related information

The switch has a package size of 2000 µm in x-dimension and 2000 µm in y-dimension with a maximum deviation of ±50 µm in each dimension. Fig. 2 shows the footprint from top view. The definition of each pin can be found in Tab. 11. In addition a recommendation for the land pattern is displayed in Fig. 4 followed by information regarding laser marking (see Fig. 5).

**Table 10: Mechanical Data**

Parameter	Symbol	Value	Unit
Package X-Dimension	X	2000 ± 50	µm
Package Y-Dimension	Y	2000 ± 50	µm
Package Height	H	0.65 max	µm


**Figure 2:** Footprint, top view

**Table 11: Pin Definition**

No.	Name	Pin Type	Function
0	GND	GND	RF ground; die pad
1	RX5	I/O	RX port 5
2	RX3	I/O	RX port 3
3	RX1	I/O	RX port 1
4	VDD	PWR	$V_{DD}$ supply
5	V3	I	GPIO control pin
6	V2	I	GPIO control pin
7	V1	I	GPIO control pin
8	NC		Not connected
9	RX2	I/O	RX port 2
10	RX4	I/O	RX port 4
11	RX6	I/O	RX port 6
12	NC		Not connected
13	ANT	I/O	Antenna port
14	NC		Not connected

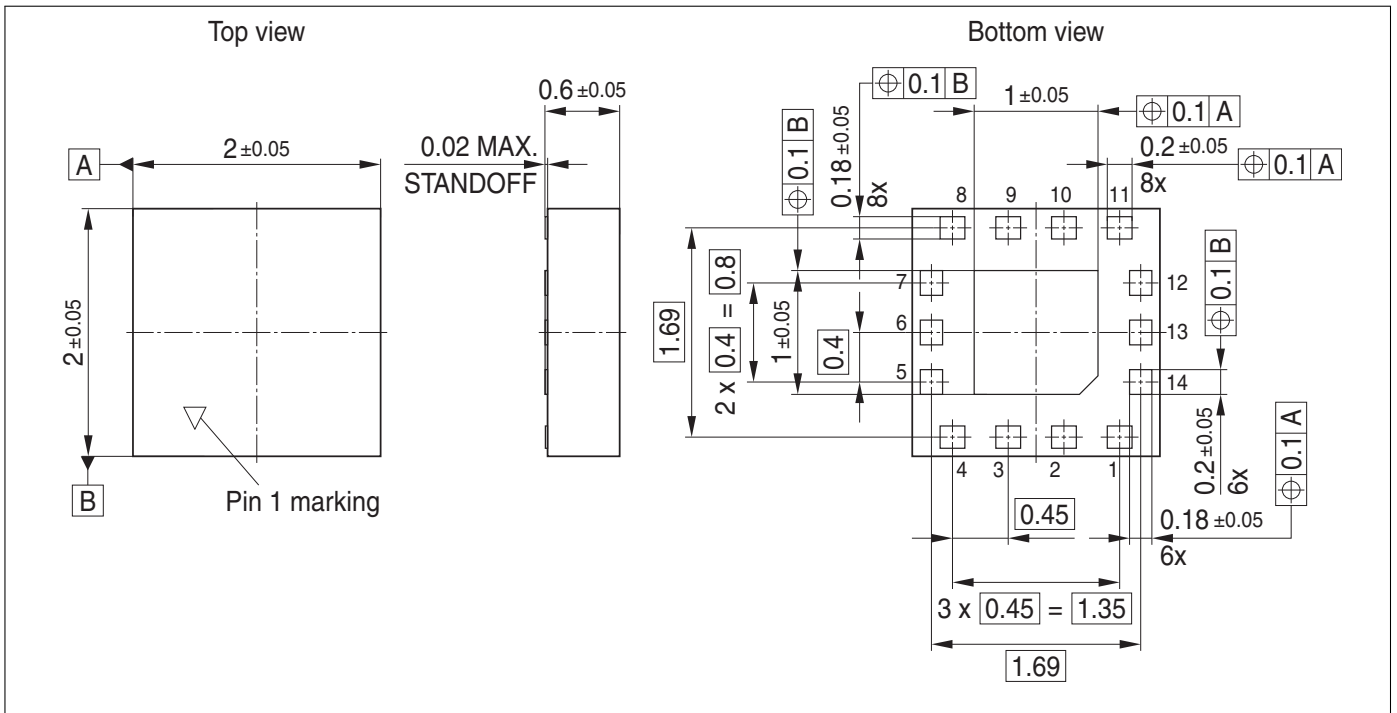


Figure 3: Package Outline Drawing

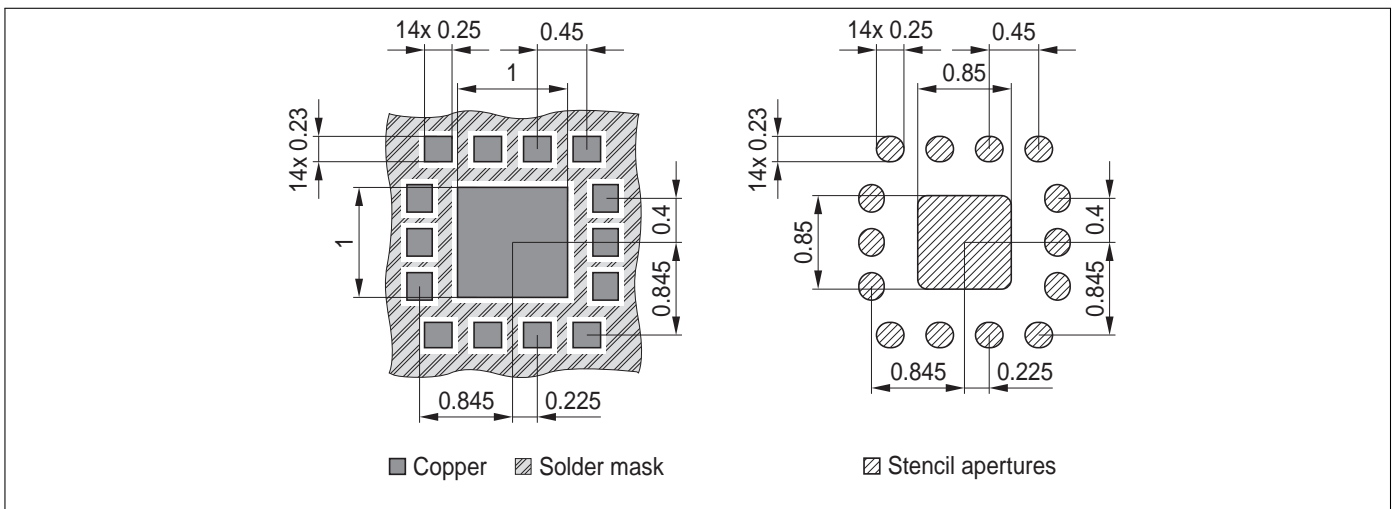
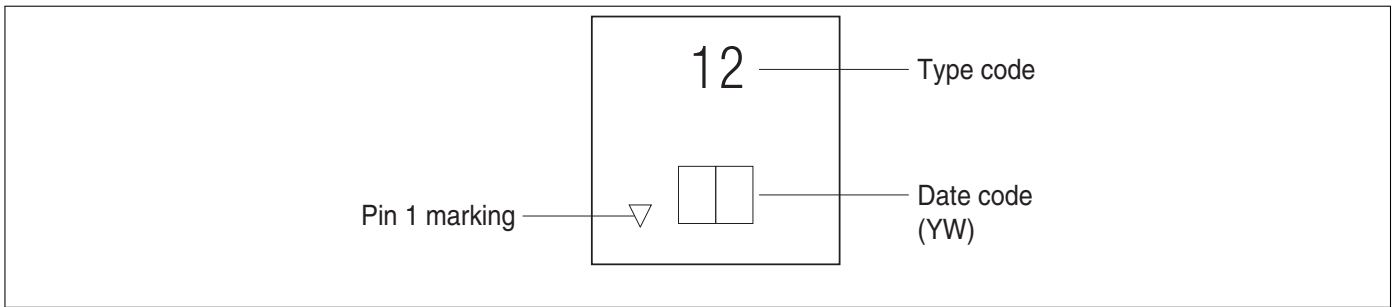
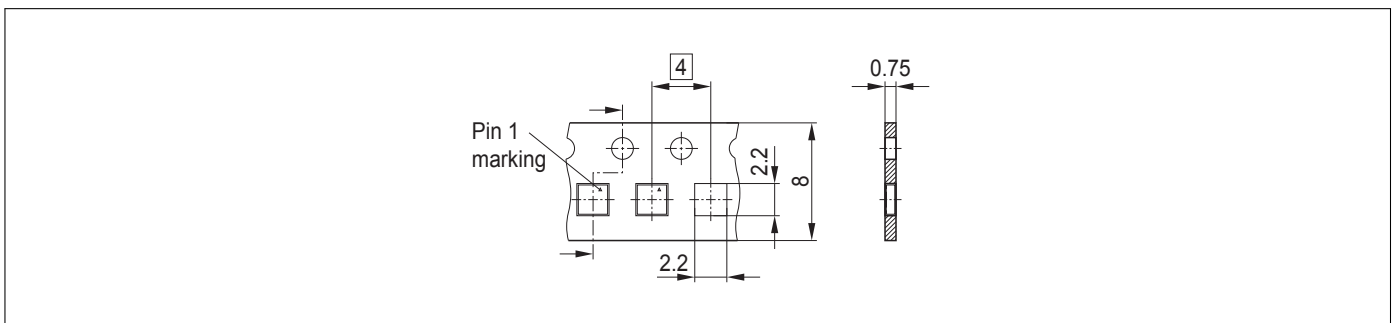


Figure 4: Land Pattern Drawing



**Figure 5:** Laser marking



**Figure 6:** Carrier Tape

[www.infineon.com](http://www.infineon.com)

Published by Infineon Technologies AG

Компания «Океан Электроники» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Поставка оригинальных импортных электронных компонентов напрямую с производств Америки, Европы и Азии, а так же с крупнейших складов мира;
- Широкая линейка поставок активных и пассивных импортных электронных компонентов (более 30 млн. наименований);
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Помощь Конструкторского Отдела и консультации квалифицированных инженеров;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Поставка электронных компонентов под контролем ВП;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Компания «Океан Электроники» является официальным дистрибьютором и эксклюзивным представителем в России одного из крупнейших производителей разъемов военного и аэрокосмического назначения «**JONHON**», а так же официальным дистрибьютором и эксклюзивным представителем в России производителя высокотехнологичных и надежных решений для передачи СВЧ сигналов «**FORSTAR**».



## JONHON

«**JONHON**» (основан в 1970 г.)

Разъемы специального, военного и аэрокосмического назначения:

(Применяются в военной, авиационной, аэрокосмической, морской, железнодорожной, горно- и нефтедобывающей отраслях промышленности)

«**FORSTAR**» (основан в 1998 г.)

ВЧ соединители, коаксиальные кабели, кабельные сборки и микроволновые компоненты:

(Применяются в телекоммуникациях гражданского и специального назначения, в средствах связи, РЛС, а так же военной, авиационной и аэрокосмической отраслях промышленности).



Телефон: 8 (812) 309-75-97 (многоканальный)

Факс: 8 (812) 320-03-32

Электронная почта: [ocean@oceanchips.ru](mailto:ocean@oceanchips.ru)

Web: <http://oceanchips.ru/>

Адрес: 198099, г. Санкт-Петербург, ул. Калинина, д. 2, корп. 4, лит. А