# 23-26GHz Reflective SP4T Switch

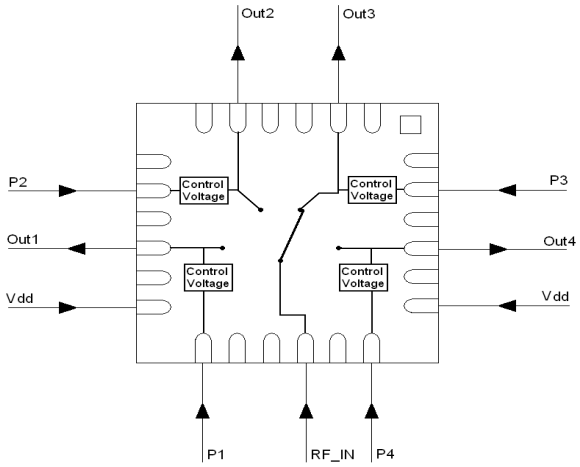
## GaAs Monolithic Microwave IC in QFN package

## Description

The CHS2411-QDG is a monolithic reflective SP4T switch in K-Band. Positive supply voltage only is required.

The circuit is manufactured with a standard PHEMT process: 0.25µm gate length, via holes through the substrate, air bridges and electron beam gate lithography.

The chip is delivered in a 24 Leads RoHS compliant QFN4x4 package.




*Functional Block Diagram*


*Plastic Package*

## Main Features

- Low insertion loss : 4 dB max
- High isolation : 32 dB min
- Fast switching time
- Low consumption
- High temperature range
- Positive supply voltage
- 24L-QFN 4x4 SMD Leadless package

## Main Characteristics

| Parameters | Min | Typ | Max | Unit |
|---|---|---|---|---|
| Frequency range | 23 | | 26 | GHz |
| Insertion loss | | 2.9 | 4 | dB |
| Isolation | 32 | 35 | | dB |
| Return Loss | | -15 | | dB |

**ESD Protection: Electrostatic discharge sensitive device. Observe handling precautions !**



**United Monolithic Semiconductors S.A.S.**
**Route Départementale 128 - B.P.46 - 91401 Orsay Cedex France**
**Tel. : +33 (0)1 69 33 03 08 - Fax : +33 (0)1 69 33 03 09**

## Electrical Characteristics

### Full Temperature Range and nominal state control voltages

| Symbol/Pins | Parameters | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Freq | Frequency range | 23 | | 26 | GHz |
| Iso | Isolation | 32 | 35 | | dB |
| Il | Insertion loss | | 2.9 | 4 | dB |
| Rl | Return loss | | -15 | | dB |
| P1dB | Input power at 1 dBc@24GHz | 18 | 23.5 | | dBm |
| Ssp | Switching speed | | 30 | | ns |
| Top | Operating temperature range | -40 | | 105 | ℃ |

| | | | | | |
|---|---|---|---|---|---|
| Vdd/5V | Positive Supply Voltage | | 5 | | V |
| Idd/5V | Σ of the current on the supply ports (pin6 and 13: see QFN Pin-out description) | | 3.3 | 4.3 | mA |
| ΣPi (i=1,2,3,4) | Σ of the current on the control ports | | 3 | 3.7 | mA |
| Pi (i =1,2,3,4) | OFF state Control Voltage (High state) | | 5 | | V |
| Pi (i =1,2,3,4) | ON state Control Voltage (Low State) | | 0 | | V |

**Remarks:**
- By design the ports OUT1 and OUT2 are respectively symmetrical to ports OUT4 and OUT3.

These performances has been obtained with the chip in QFN package mounted on the recommended boards (ref. 97009 & 97298) described in the document. The performances are highly dependent on this environment.

**For information only:**

The main parameters below are obtained from 3 samples mounted on the board ref. 97298 (room temperature).

| ON/OFF state Control Voltage | typical | | | |
|---|---|---|---|---|
| | Typical insertion loss (dB) | Typical isolation (dB) | Typical return loss (dB) | Typical input power at 1dBc (dBm) |
| **0V/5V** | 2,9 | -35 | -15 | >22 |
| **1V/5V** | 3.1 | -35 | -15 | 16,4 |
| **2V/5V** | 3,7 | -35 | -15,5 | <9 |
| **0V/4,5V** | 3.1 | -35.1 | -15,4 | 19,8 |
| **0V/4V** | 3 | -35.1 | -15,6 | 22 |
| **0,5V/4V** | 3.1 | -35.1 | -15,4 | 17,4 |
| **1V/4V** | 3.1 | -35.1 | -15 | 14 |
| **2V/4V** | no functionnal | no funct. | no funct. | no funct. |



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## Truth Table

| Control Pin | | | | Signal Path State | | | |
|---|---|---|---|---|---|---|---|
| **P1** | **P2** | **P3** | **P4** | **IN to Out1** | **IN to Out2** | **IN to Out3** | **IN to Out4** |
| **Low** | High | High | High | **ON** | OFF | OFF | OFF |
| High | **Low** | High | High | OFF | **ON** | OFF | OFF |
| High | High | **Low** | High | OFF | OFF | **ON** | OFF |
| High | High | High | **Low** | OFF | OFF | OFF | **ON** |

## Absolute Maximum Ratings (1)

| Symbol | Parameters | Values | Unit |
|---|---|---|---|
| Vdd | Positive supply voltage | 6 | V |
| Pin | Maximum peak input power overdrive | 26 | dBm |
| Top | Operating temperature range | -40 to +105 | ℃ |
| Tstg | Storage temperature range | -55 to +125 | ℃ |

(1) Operation of this device above anyone of these parameters may cause permanent damage. Duration < 1s



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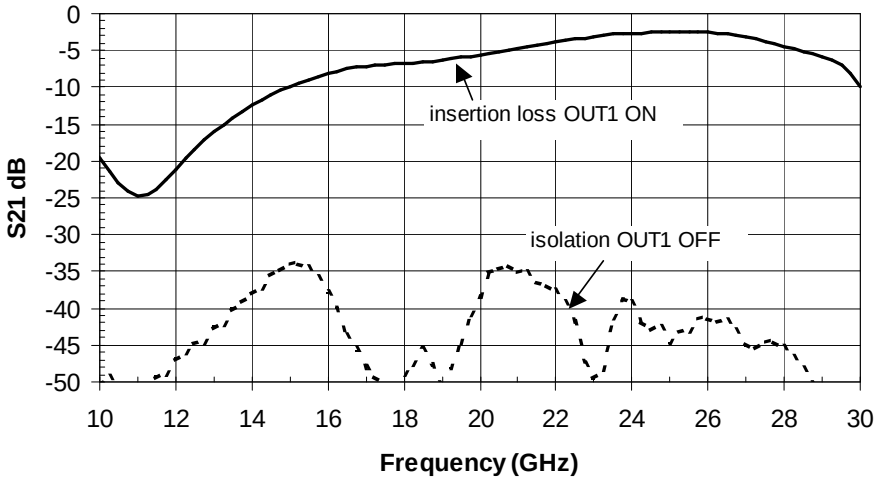
## Typical QFN measurements on board with probes (QFN plan)

**Typical Sij Parameters vs Frequency in QFN package plans**
**(RF - OUT1 path)**

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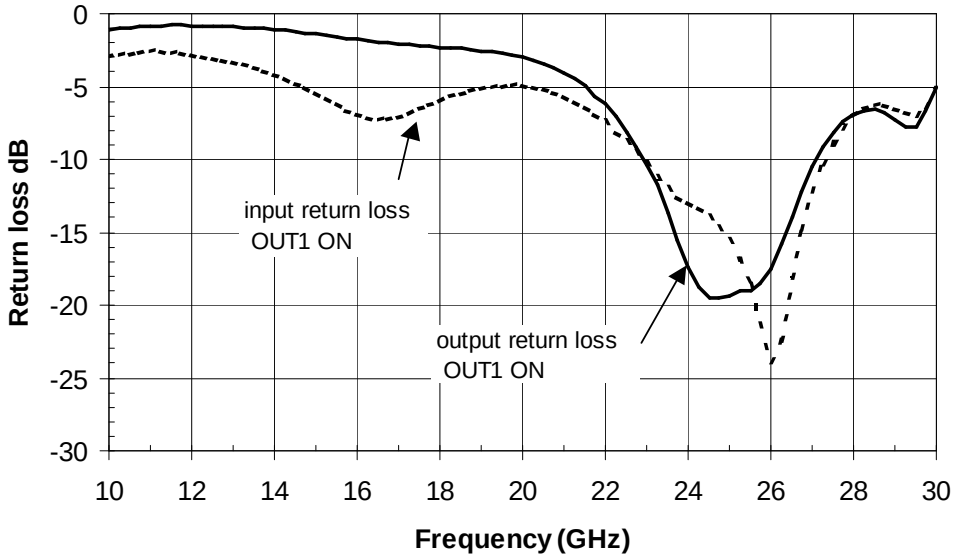




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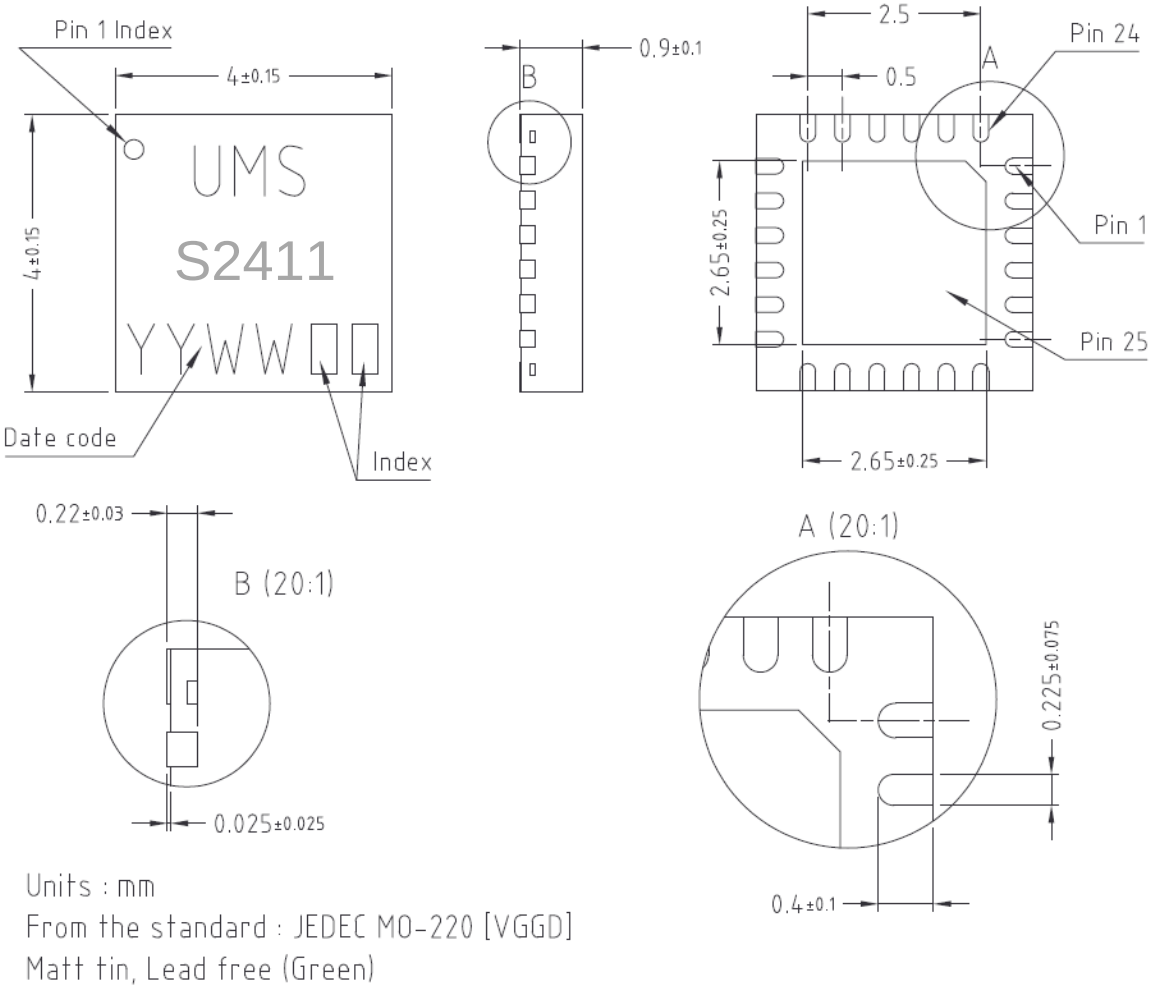
## QFN Outlines and Pin-out [(1)]:




[(1)]The package outline drawing included to this data-sheet is given for indication. Refer to the application note AN0017 available at http://www.ums-gaas.com for exact package dimensions.



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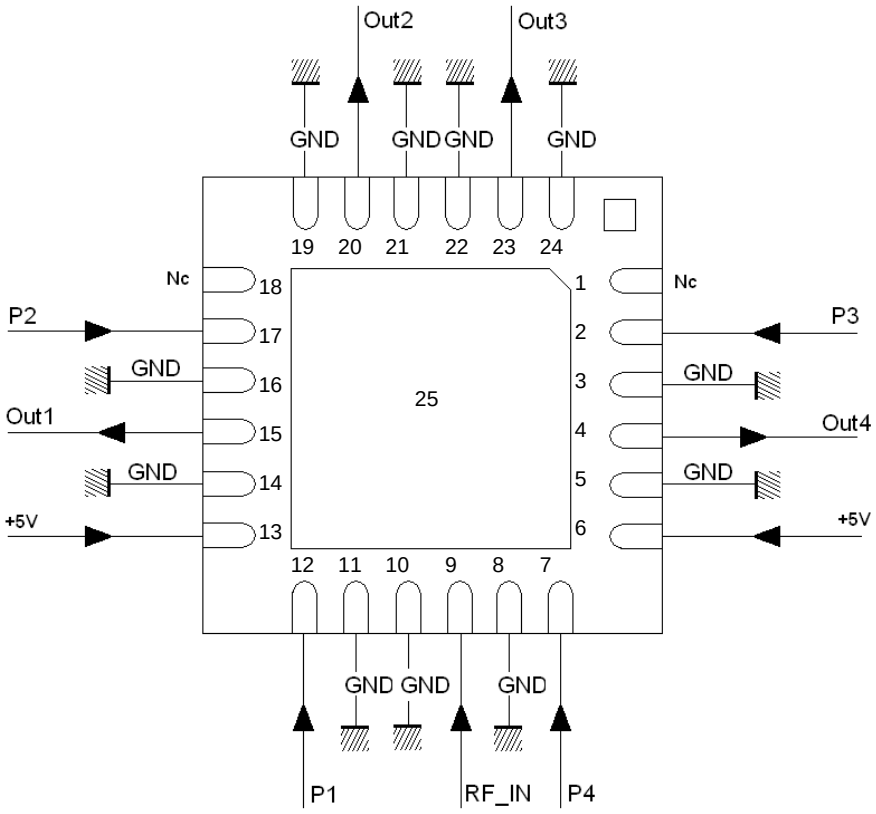
## QFN Pin-out description

| Pin number | Pin name | Description |
|---|---|---|
| 12, 17, 2, 7 | P1, P2, P3, P4 | Control Voltage port |
| 9, 15, 20, 23, 4 | RF IN, Out1, Out2, Out3, Out4 | RF1 Input/Output ports |
| 6, 13 | 5V | Positive supply voltage |
| 3, 5, 8, 10, 11, 14, 16, 19, 21, 22, 24, 25 | GND | Ground |
| 1, 18 | Nc | Not connected |

## Bias configuration



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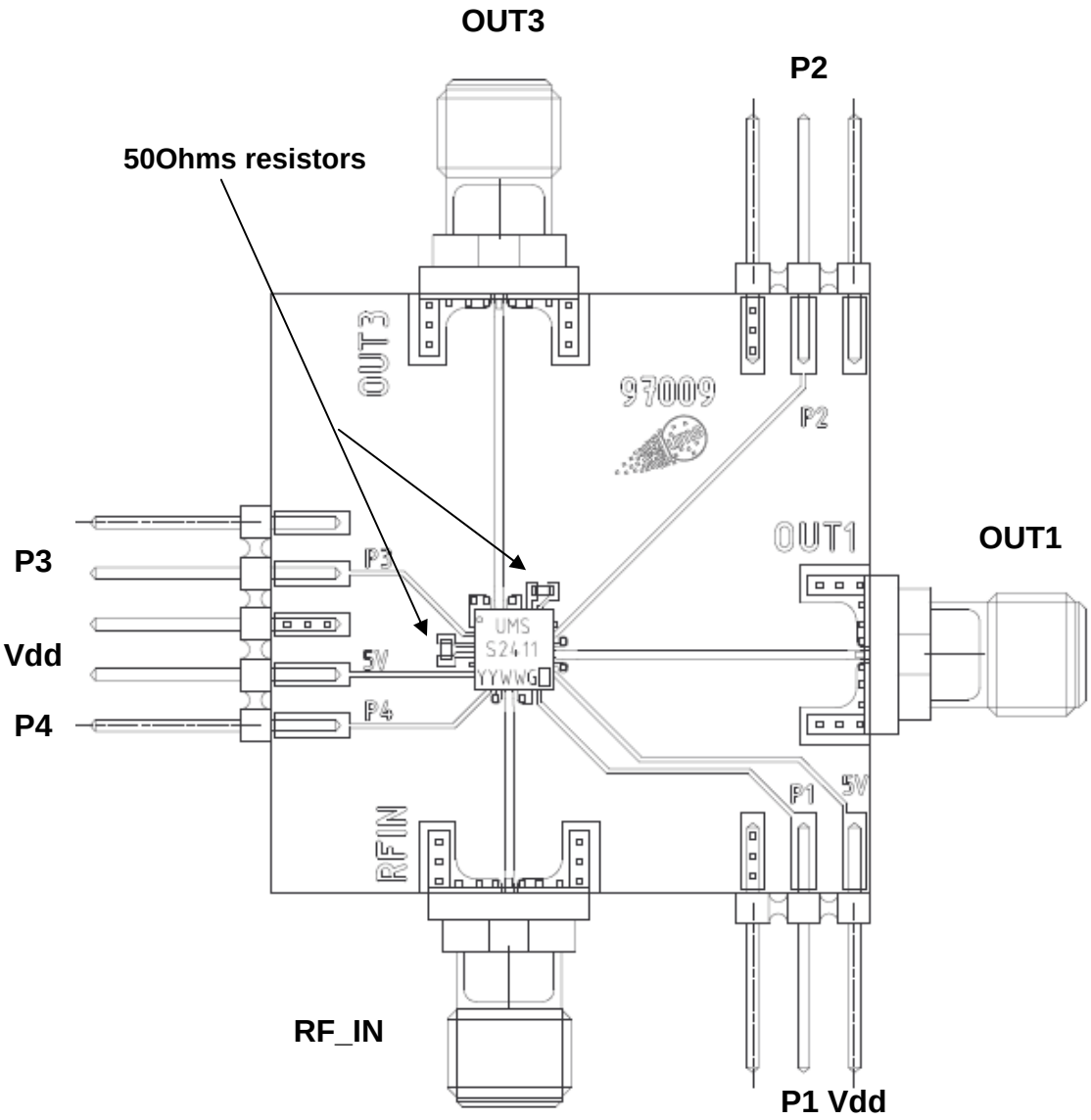
## Evaluation Test Fixture (Ref. 97009)



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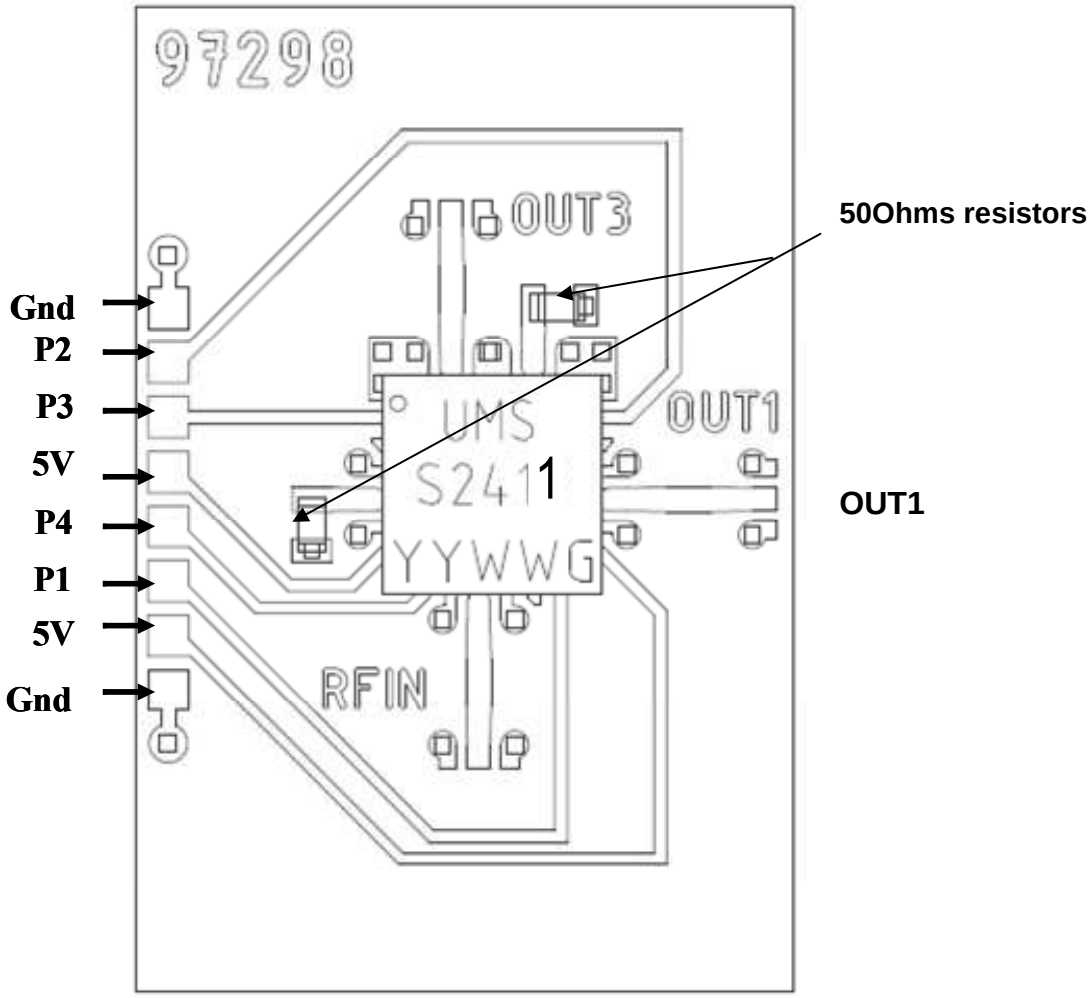
## Recommended Test Fixture (Ref. 97298) for measurements in the package's plans with probes



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## ESD sensitivity

| Standard | Value |
|---|---|
| MIL-STD-1686C | HBM Class 1 (<2000V) |
| ESD STM5.1-1998 | HBM Class 0 (<250V) |

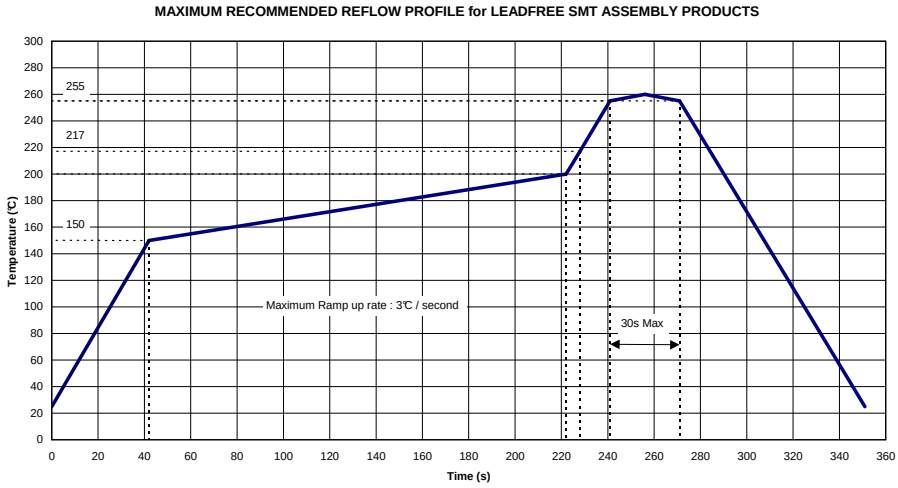
## Package Information

| Parameter | Value |
|---|---|
| Package body material | RoHS-compliant Low stress Injection Molded Plastic |
| Lead finish | 100% matte Sn |
| MSL Rating | MSL1 |

## Recommended surface mount package assembly

(See UMS Application note ref. AN0017)

For volume production the SMD type package can be treated as a standard surface mount component (please refer to the IPC/JEDEC J-STD-020C standard or equivalent). The assembly on the motherboard can be performed using a standard assembly process (e.g. stencil solder printing, standard pick-and-place machinery, and solder reflow oven). However, caution should be taken to perform a good and reliable contact over the whole pad area.




The solder thickness after reflow should be typical 50µm [2 mils] and the lateral alignment between the package and the motherboard should be within 50µm [2 mils].

It is important for the performance of the product that the whole overlapping area between the motherboard and package pads is connected. Voids or other improper connections, in particular, between the ground pads on motherboard and package will lead to a deterioration of the RF performance and the heat dissipation. The latter effect can reduce drastically reliability and lifetime of the product.



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## Ordering Information

QFN 4x4 RoHS compliant package: CHS2411-QDG/XY

Stick: XY=20 Tape and reel: XY=21





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