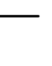
DALLAS SEMICONDUCTOR
CHIP SCALE PACKAGING DESIGN GUIDE



INTRODUCTION

The DS2401X, DS2502X, and DS2430X are custom packages. The packaging method used is known as Chip Scale Packaging or more specifically Coarse Pitch Flip Chip Packaging. This increasingly popular technique yields the **smallest part outline and lowest weight available.** This package addresses the needs of customers facing increasing density challenges.

The part is designed to be assembled with typical SMT processes. Due to the package construction, special consideration should be applied to the SMT assembly process for reliable assembly. This document details process guidelines for those not familiar with this type of package.

PHYSICAL DESCRIPTION

The package consists of a Silicon IC with a proprietary passivation and solderable metallization on the active side (bottom) of the component. The top side of the component is bare silicon with a laser–marked part number and Pin 1 designator. See Figure 1 and Table 1.

PACKAGE OUTLINE Figure 1

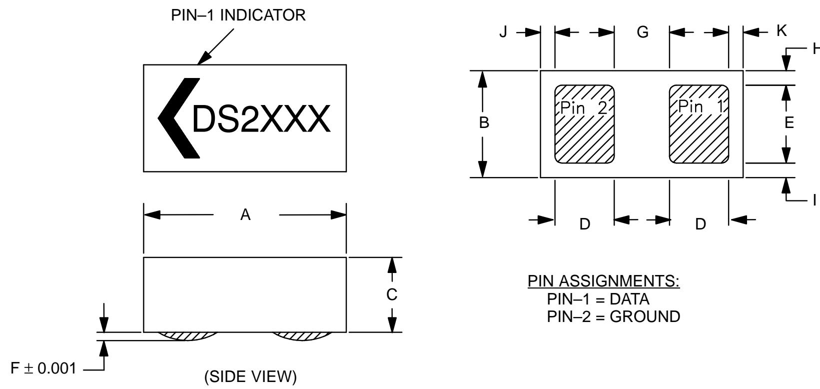
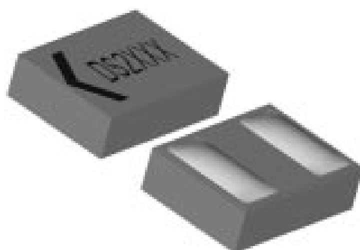


Table 1

	DS2401	DS2502	DS2430
A	0.073	0.076	0.095
B	0.038	0.050	0.069
C	0.027	0.027	0.027
D	0.022	0.024	0.027
E	0.028	0.040	0.059
F	0.004	0.004	0.004
G	0.020	0.020	0.031
H	0.005	0.005	0.005
I	0.005	0.005	0.005
J	0.005	0.004	0.005
K	0.005	0.004	0.005

All Dimensions in Inches Tolerance: ±.001

DS2401X TOP SIDE/BOTTOM SIDE Figure 2



SOLDER PADS/STENCIL DESIGN FOR SMT ASSEMBLY

The PCB land pattern, solder stencil opening and solder volume has been optimized by Dallas Semiconductor. These recommended details are summarized in Table 2 and 3.

Table 2

	DS2401	**DS2502**	**DS2430**
SOLDER PASTE SCREENING			
STENCIL THICKNESS	0.005” (0.127 mm)	0.005” (0.127 mm)	0.005” (0.127 mm)
APERTURE OPENING	0.022” X 0.028” (0.56 mm x 0.71 mm)	0.014” X 0.034” (0.36 mm x 0.86 mm)	0.027” X 0.060” (0.69 mm x 1.52 mm)
PASTE VOLUME	3E–06 IN^3 ± 25% (0.049 mm^3)	2.4E–06 IN^3 ± 25% (0.039 mm^3)	8.1E–06 IN^3 ± 25% (0.133 mm^3)
PASTE TYPE	Senju	Senju	Senju
Senju 63–201 50–9 or similar	TYPE 3, RMA 63/37	TYPE 3, RMA 63/37	TYPE 3, RMA 63/37
SUBSTRATE			
TYPE	FR4	FR4	FR4
LAND SIZE	0.026” X 0.032” (0.66 mm x 0.81 mm)	0.020” X 0.040” (0.51 mm x 1.02 mm)	0.031” X 0.069” (0.79 mm x 1.75 mm)
PITCH	0.046” (1.17 mm)	0.044” (1.12 mm)	0.058” (1.47 mm)
REFLOW PROFILE			
PEAK TEMPERATURE	220 ± 10°C	220 ± 10°C	220 ± 10°C
TIME ABOVE 183	45 ± 15 Seconds	45 ± 15 Seconds	45 ± 15 seconds

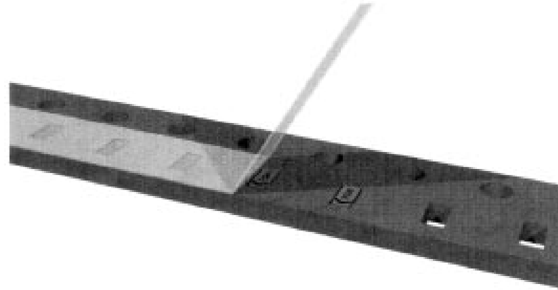
Table 3

	NON–ENCAPSULATED	**UNDERFILLED**	**GLOBTOPPED**
CLEANING PROCESS	Axarel	Axarel	Axarel
BAKE OUT	Not Done	30 min @ 130°C	Not Done
ENCAPSULATION			
MATERIAL	No Encapsulation	Hysol Underfill FP 4520	Hysol Glob Top FP 4323
CURE	N/A	2 hr@ 130°C 15 min@ 145°C	6 hr@ 130°C 30 min@ 145°C
Typical Temp Cycle Performance	–40 ± 85°C, 1000 cyc	–55 ± 125°C, 1500 cyc	–55 ± 125°C, 1500 cyc

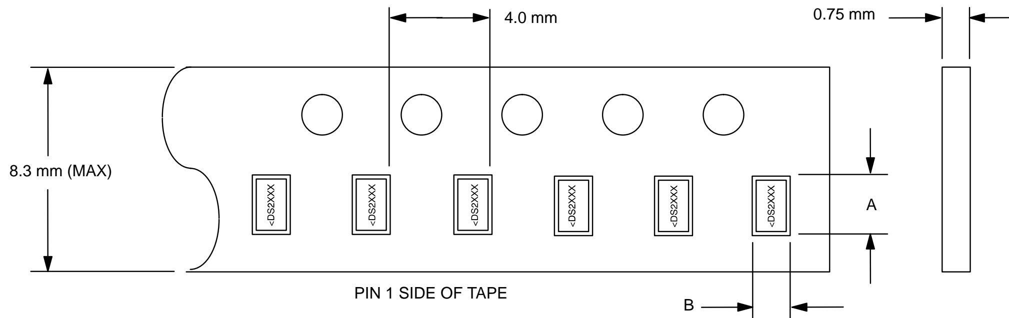
TAPE AND REEL PACKAGING

The part is supplied in a 8 mm punched tape and reel format per EIA 481 (see Figure 3). Dimensions are shown in Figure 4.

8 MM PUNCHED TAPE AND REEL FORMAT Figure 3



TAPE AND REEL FORMAT DIMENSIONS Figure 4



NOTE: THE TAPE DIMENSIONS CONFORM TO THE STANDARD EIA–481–1

Table 4

	DS2401 (mm)	DS2502 (mm)	DS2430 (mm)
A	2.21	2.29	2.74
B	1.32	1.63	2.08

PICK AND PLACE

Optical alignment P&P method should be used. Centering jaws typical of antiquated equipment may crack the silicon package. Complaint tip, minimum pick and placement force, and minimal over–travel are also recommended.

REFLOW

The part can be reflowed by a variety of methods and common profiles. No special requirements or reflow considerations need to be applied to the packages as typical SMT reflow profiles are adequate.

CLEANING AND ASSEMBLY HANDLING

During all subsequent steps handling must be designed to eliminate the striking of the part. During cleaning, the substrate should be secured in a manner to preclude cleaning jets from throwing the PCB against another PCB or striking the delicate component on the interior of a cleaning basket or other surfaces.

REWORK

Hot Gas Rework methods can be used to remove and replace the component.

ENCAPSULATION VS NON–ENCAPSULATION

Encapsulation of the package by a secondary process is NOT required for many applications. Each application and design should be reviewed by the user and a determination made on the benefit of secondary encapsulation. Some applications require a secondary encapsulation to improve thermal cycle performance or to protect the part from mechanical damage in applications where the device might be exposed.

ENCAPSULATION VS NON–ENCAPSULATION Figure 4

1. Non–Encapsulation standard SMT Flow:
   The part has been thoroughly evaluated while SMT assembled on FR4 with no additional added encapsulation. The part assembled in this manner is the most cost effective, adding no additional processing. The part assembled in this manner will withstand –40°C to +85°C temperature cycling on FR4, this is adequate for most of the device's intended markets.

2. Under Filled:
   For the **most robust temperature cycle performance** the addition of a commercially available underfill epoxy will easily enhance thermal cycle performance of the part to –55°C to +125°C on FR4. the process dispenses underfill epoxy alongside the part where it is drawn under the package by surface tension. A subsequent cure completes the process.

   The backside of the component is still exposed in this scenario and while mechanical protection is largely improved, a solid strike by a hard object will still result in a cracked package.

3. Glob Topped:
   Mechanical performance to withstand repeated direct strikes to the package by hard objects can be accomplished by adding a complete dome of epoxy over the entire part. Glob top processing also improves the thermal cycle performance to the –55°C to +125°C level mounted on FR4.