

NOTE

All numerical values are in metric units [with U.S. customary units in brackets]. Dimensions are in millimeters [and inches]. Unless otherwise specified, dimensions have a tolerance of ± 0.13 [$\pm .005$] and angles have a tolerance of $\pm 2^\circ$. Figures and illustrations are for identification only and are not drawn to scale.

1. INTRODUCTION

This specification covers the requirements for application of AMP* 7500 Series SMT DIP switches for soldering directly onto pc (printed circuit) boards. The switches are used to manually program electronic equipment. The switch consists of a housing preloaded with gull-wing contacts in a DIP configuration with low-profile rockers. The rocker connects individual circuits on the pc board. These switches are available in 2, 4, 6, 8, and 10 positions, unsealed with half pitch and contact spacing on 1.27 [.050] centerlines. Each contact position is marked on the housing. Contact position 1 can be used as a make-first, break-last ground. The housing features a standoff to allow easy pc board cleaning after soldering.

The 7500 Series switches have individual SPST (single-pole, single-throw) switching and strippable seal to prevent contaminants from entering the switch. The seal will also withstand temperatures of the soldering process. The switches are supplied in a tube for manual placement and tape-and-reel form for high-speed automatic machine placement.

When corresponding with AMP personnel, use the terminology provided in this specification to facilitate your inquiries for information. Basic terms and features of this product are provided in Figure 1.

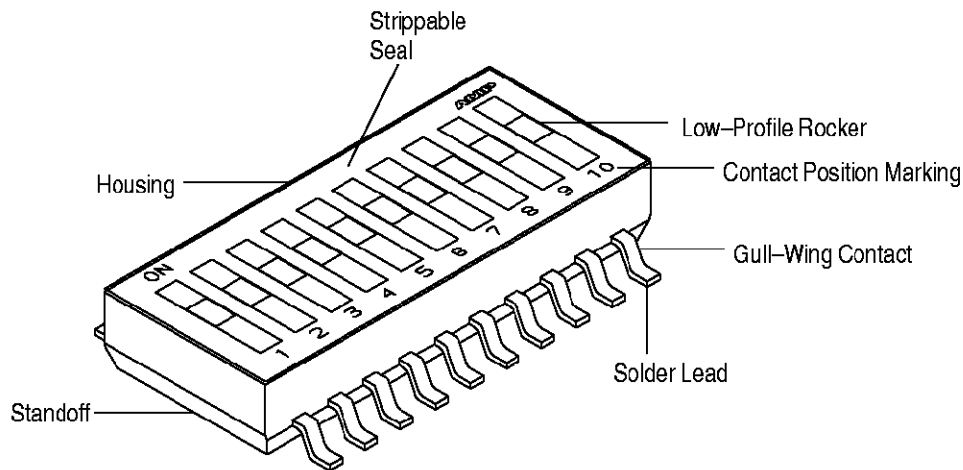


Figure 1

2. REFERENCE MATERIAL**2.1. Revision Summary**

Revisions to this application specification per EC 0990-1081-99 include:

- Added wave soldering to Paragraph 3.11 A

2.2. Customer Assistance

Product Part Number 390233 and Product Code A336 are representative of AMP 7500 Series SMT DIP switch. Use of these numbers will identify the product line and expedite your inquiries through an AMP service network established to help you obtain product and tooling information. Such information can be obtained through a local AMP Representative (Field Service Engineer, Field Applications Engineer, etc.) or, after purchase, by calling the Product Information Center at the number at the bottom of this page.

2.3. Drawings

AMP Customer Drawings for product part numbers are available from the service network. If there is a conflict between the information contained in the Customer Drawings and this specification or with any other technical documentation supplied by AMP, call product information at the number at the bottom of page 1.

2.4. Manuals

AMP Manual 402-40 is available upon request and can be used as a guide to soldering. This manual provides information on various flux types and characteristics with the commercial designation and flux removal procedures. A checklist is included in the manual as a guide for information on soldering problems.

2.5. Specifications

AMP Product Specification 108-1924 provides product performance and test information.

2.6. Instructional Material

AMP Application Specifications (114-series) provide product description and application requirements, Instruction Sheets (408-series) provide assembly instructions, and Customer Manuals (409-series) provide machine setup and operation procedures. Documents available which pertain to this product are:

- 408-6927 Design Recommendations for PC Board Support Fixture
- 408-9816 Handling of Reeled Products

3. REQUIREMENTS**3.1. Safety**

Do not stack switch packages so high that the shipping containers buckle or deform.

3.2. Material

The switch housing and rockers are made of thermoplastic. The contacts are made of copper alloy plated with gold over nickel; contact area (solder lead) is plated with tin-lead.

3.3. Storage**A. Ultraviolet Light**

Prolonged exposure to ultraviolet light may deteriorate the chemical composition used in the switch material.

B. Shelf Life

The switches should remain in the shipping containers until ready for use to prevent deformation to the contacts. The switches should be used on a first in, first out basis to avoid storage contamination that could adversely affect performance.

C. Reeled Contacts

When using reeled switches, store coil wound reels horizontally and traverse wound reels vertically.

3.4. Chemical Exposure

Do not store switches near any chemical listed below as they may cause stress corrosion cracking in the contacts.

Alkalies	Ammonia	Citrates	Phosphates	Citrates	Sulfur Compounds
Amines	Carbonates	Nitrites	Sulfur	Nitrites	Tartrates

3.5. PC Board**A. Material and Thickness**

The pc board material must be glass epoxy (FR-4 or G-10). The minimum pc board thickness must be 0.81 [.032] nominal.

NOTE

Contact the Product Information Center at the number listed at the bottom of page 1 for suitability of other board materials and thicknesses.

B. Tolerance

Maximum allowable bow of the pc board must be 0.13 [.005] over the length of the switch.

C. Pads

The pc board pads must be plated and solderable in accordance with AMP Test Specification 109-11-2. Coplanarity of the pads on the pc board shall be 0.03 [.001].

D. Layout

Recommended pattern and dimensions, as well as tolerance, are provided in Figure 2.

Recommended PC Board Layout

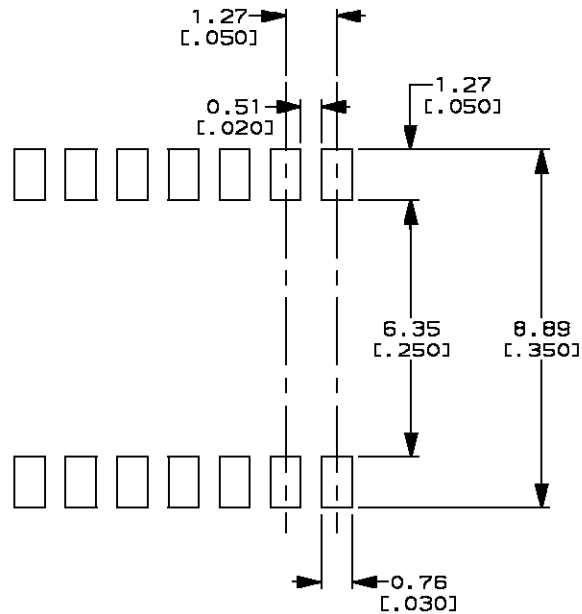


Figure 2

3.6. Solder Paste Characteristics

1. Alloy type shall be 63 Sn/37 Pb, 60 Sn/40 Pb, or 62 Sn/36 Pb/2 Ag
2. Flux incorporated in the paste shall be rosin, mildly active (RMA) type.
3. Paste shall be at least 80% solids by volume.

3.7. Solder Volume

Recommended solder volume before curing for each circuit pad is $(2.89 \times 10^{-2})^3$ [4.48×10^{-5}]³. An outgassing factor, usually approximately 50%, will reduce the volume after curing.

NOTE

Solder volume may vary depending on solder paste composition.

CAUTION

Using paste volume in excess of those recommended could cause excessive wicking of reflowed solder onto the contact solder lead resulting in a weak solder joint.

3.8. Stencil

The stencil aperture is determined by the circuit pad size and stencil thickness. It may be any shape as long as it prevents solder bridging from one pad to another. Generally, the thinner stencil will need a larger aperture to maintain the given volume of solder paste. The following calculations should serve as a guideline in varying deposition parameter.

Let: V_i = solder paste volume before curing
 a = aperture dimension corresponding to pad width
 b = aperture dimension corresponding to pad length
 T_p = thickness of stencil (or deposited solder paste)

Varying apertures will change the required stencil thickness needed to deposit recommended solder paste volume. If the aperture on the stencil is the same as the nominal pad dimension, stencil thickness can be calculated with the following relation:

$$T_p = V_i / (a \times b)$$

$$(2.89 \times 10^{-5})^3 / (1.42 \times 0.57) [(4.48 \times 10^{-5})^3 / (.56 \times 101)]$$

$$0.20 \text{ [.008]}$$

3.9. Screen

The following calculations should serve as a guideline in varying deposition parameter.

Let: T_e = screen emulsion thickness
 T_w = screen weave thickness
 A_o = decimal equivalent of percent of open area
 T_p = thickness of deposited solder paste

Varying apertures will change the required stencil thickness needed to deposit the recommended solder paste volume. Weave thickness and percent of open area are dependent on the mesh count of the screen. For example, an 80-mesh screen has a 49.5% open area and nominal weave thickness of 0.20 [.008]. The amount of paste deposited through a screen is dependent on the aperture, the mesh, and applied emulsion. For an 80-mesh screen with the same aperture as used in this example, the emulsion can be calculated by:

$$T_e = T_p - (T_w \times A_o) = 0.20 - (0.20 \times 12.57) = 0.10 \text{ [.008 - (.008 \times .495) = .004]}$$

3.10. Mask

If a mask is used, it must allow full clearance around the pads as defined in the pc board layout. Exposed traces could cause bridging and create a short, or wick solder away from the contact solder leads, producing a weak solder joint.

CAUTION *Since the switch housing may rest on top of the solder mask, an excessively high mask will allow too much space between the lead and pad for a good solder joint. A solder joint under these conditions would be weak, and would not provide long term performance for the switch.*

3.11. Soldering

NOTE *Hold-downs may be used to ensure stability during the soldering process. If a hold-down aperture is used, the design must ensure that the switch housing will not sit on the solder deposit.*

A. Process

The switches should be soldered using vapor phase, non-focused infrared (IR) reflow, wave, or equivalent soldering technique. For suitability of other techniques, contact Product Information Center at the number at the bottom of page 1. The temperature and time to which the switch can be subjected is specified in Figure 3.

SOLDERING PROCESS	TEMPERATURE (Max)	TIME (Max)
Vapor Phase	260°C [500°F]	30 Seconds
Infrared Reflow (IR)		
Wave	260°C [500°F]	6 Seconds

Figure 3

B. Cleaning

After soldering, removal of fluxes, residues, and activators is necessary. Consult with the supplier of the solder and flux for recommended cleaning solvents. Cleaners must be free of dissolved flux and other contaminants. AMP recommends cleaning with the pc board on its edge. The following is a list of common cleaning solvents that will not the affect connectors for the time and temperature specified. See Figure 4.

CLEANER		TIME (Minutes)	TEMPERATURES (Maximum)	
NAME	TYPE		CELSIUS	FAHRENHEIT
Alpha 2110■	Aqueous	1	132	270
Bioact EC-7◆	Solvent	5	100	212
Butyl Carbitol●	Solvent	1	Room Ambient	
Isopropyl Alcohol	Solvent	5	100	212
Kester 5778⚡	Aqueous	5	100	212
Kester 5779⚡	Aqueous	5	100	212
Loncolerge 520●	Aqueous	5	100	212
Loncolerge 530●	Aqueous	5	100	212
Terpene Solvent	Solvent	5	100	212

■ Product of Fry's Metals, Inc. ◆ Product of Petroferm, Inc. ● Product of Union Carbide Corp. ⚡ Product of Litton Systems, Inc.

Figure 4

DANGER Consideration must be given to toxicity and other safety requirements recommended by the solvent manufacturer. Refer to the manufacturer's Material Safety Data Sheet (MSDS) for characteristics and handling of cleaners. AMP does not recommend using Trichloroethylene and Methylene Chloride because of harmful occupational and environmental effects. Both are carcinogenic (cancer-causing).

NOTE If you have a particular solvent that is not listed, contact Product Information at the number at the bottom of page 1.

C. Drying

When drying cleaned assemblies and pc boards, make certain that temperature limitations are not exceeded: -55° to 105° C [-68° to 221° F]. Excessive temperatures may cause housing degradation.

3.12. Switch Placement

CAUTION Switches should be handled only by the housing to avoid deformation, contamination, or damage to the contact solder leads.

A. Seating

The force required to seat the switch is minimal. Apply only that force necessary to seat the contact solder leads into the top surface of the solder paste. The switch housing standoffs must be seated on the pc board not exceeding the dimension shown in Figure 5.

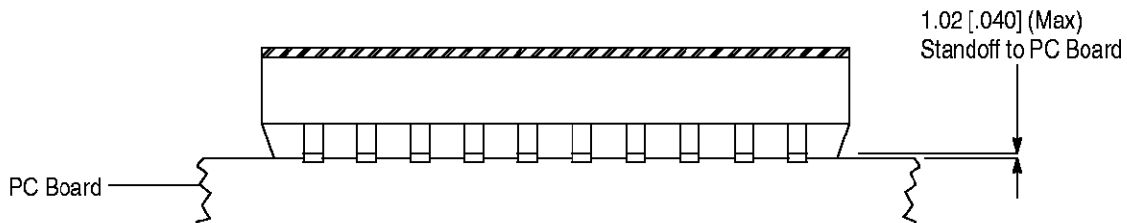


Figure 5

B. Coplanarity

Optimally, the contact solder leads should be centered on the pc board circuit pads. However, slight misalignment is permissible as shown in Figure 6.

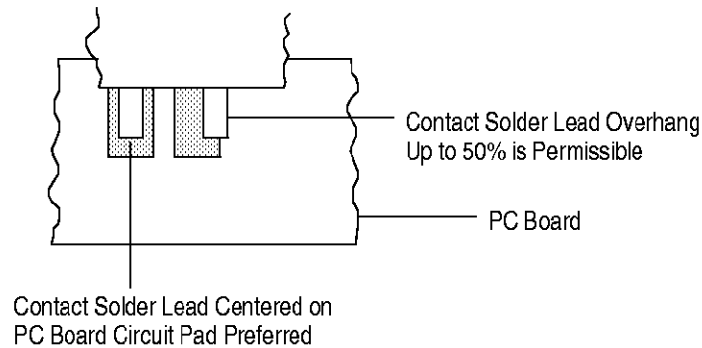


Figure 6

3.13. Checking Installed Switch

All solder joints should conform to those specified in AMP Workmanship Specification 101-21 and all other requirements specified in this document.

1. Solder must have 95% minimum solder coverage over the pc board pad. See Figure 7.
2. The switch must be firmly attached to the pc board; there shall be no evidence of switch movement.
3. The switch housing must not be damaged as a result of application tooling.

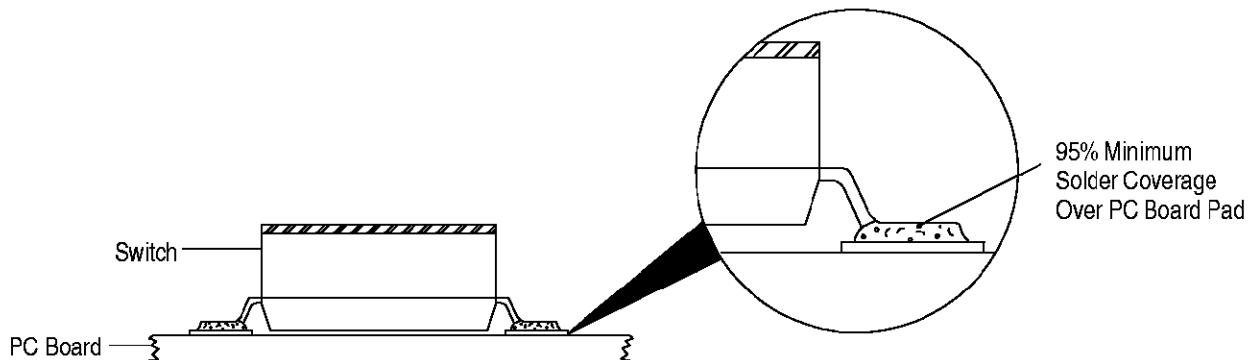


Figure 7

3.14. Switch Spacing

Care must be used to avoid interference between adjacent switches and other components. There is no required spacing between switches, however spacing may be dependent on other components used.

NOTE

The information provided is for manual placement of switches. If robotic equipment is used, other space allowances will be required for the grippers.

3.15. Repair

The switch may be removed from the pc board by standard de-soldering methods and replaced with a new switch.

4. QUALIFICATION

AMP 7300 Series right-angle gull-wing SMT DIP switches are not required to be recognized by Underwriters Laboratories Inc. (UL) or certified by Canadian Standards Association (CSA) at the time of publication.

5. TOOLING

No tooling is required for manual placement of the switches. For machine placement, a pc board support must be used to prevent bowing of the pc board during placement of the switches. The robotic equipment must have a true position accuracy tolerance to properly locate the switch. This includes gripper and fixture tolerances as well as equipment repeatability. It must use the switch datum surfaces detailed on the customer drawing to ensure reliable placement. See Figure 8.

NOTE

Modified designs and additional tooling concepts may be available to meet other application requirements. For additional information, contact one of the service groups at the bottom of page 1.

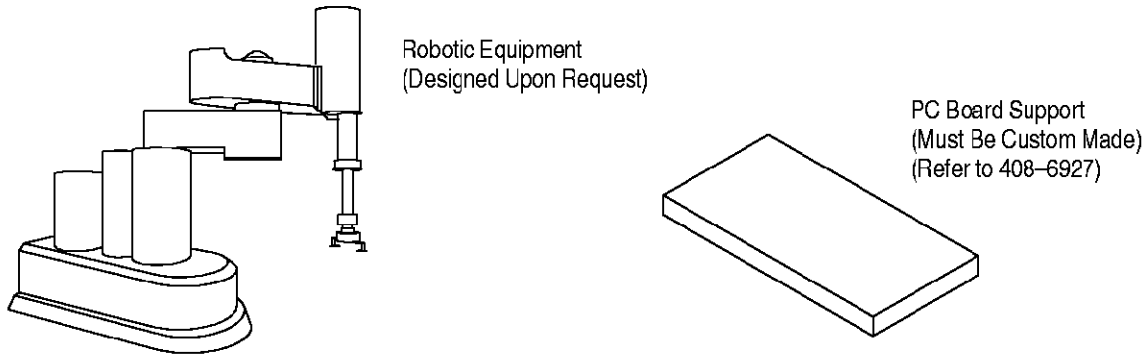
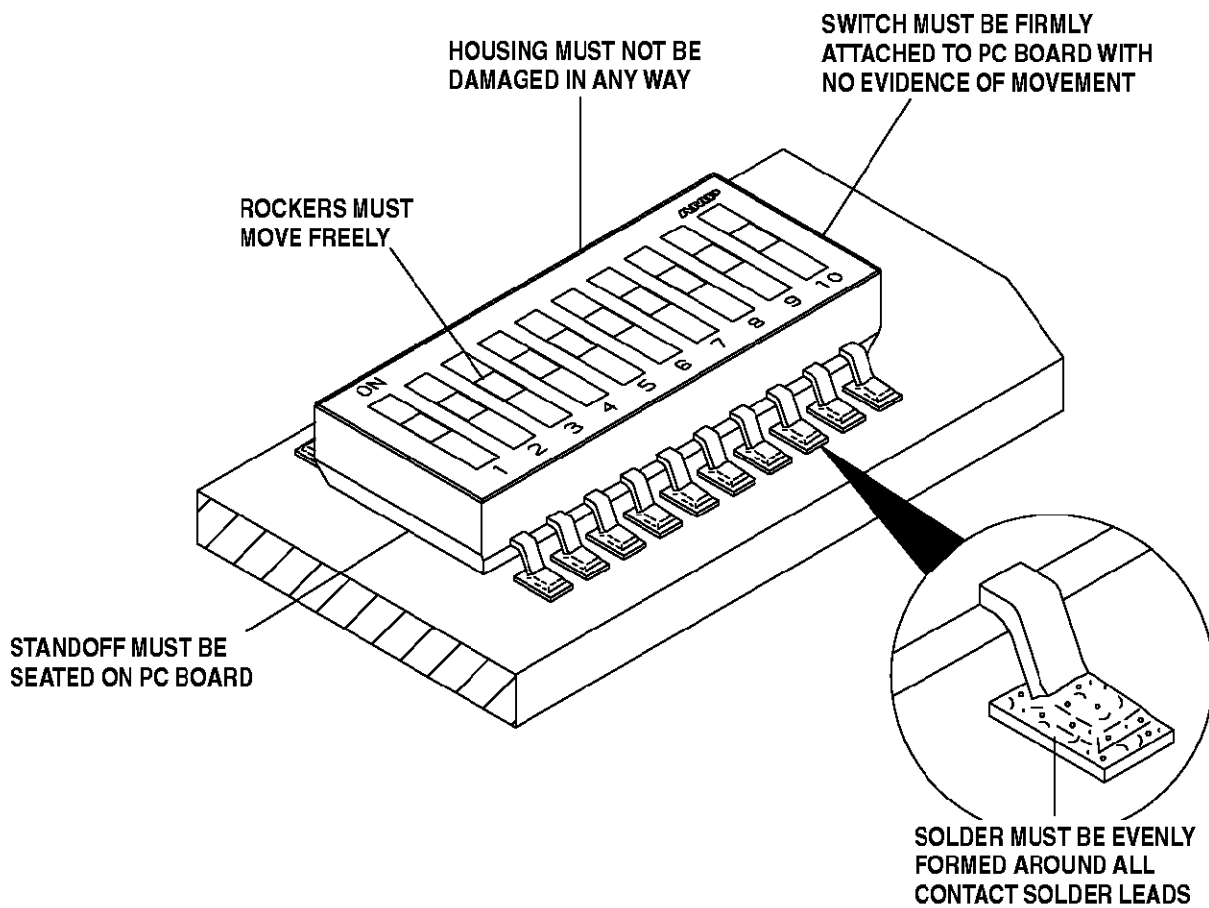


Figure 8

6. VISUAL AID

The illustration below shows a typical application of AMP 7300 Series SMT DIP switches. This illustration should be used by production personnel to ensure a correctly applied product. Applications which DO NOT appear correct should be inspected using the information in the preceding pages of this specification and in the instructional material shipped with the product or tooling.

**FIGURE 9. VISUAL AID**