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SMD BATTERY HOLDER DESIGN GUIDE

V1

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1.1 - PURPOSE

This document describes the engineering design guidelines for surface mount device (SMD) battery holders. Principles included in this document are intended to impart features, techniques, and processes to fabricate consistent and durable holders that optimize leverage industry standards and best practices while reducing manufacturing risk. Due to the many variations of SMD battery holder applications, this guide is not to be assumed comprehensive but rather is meant to cover a wide range of topics frequently encountered by design engineers. Reference specific industry standards and personnel for help with unique applications, product requirements, or process constraints.

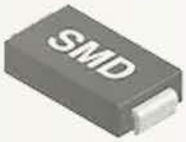
1.2 - INTENDED USER AND MAINTENANCE RESPONSIBILITY

This guide is intended to be used by engineers and manufacturing personnel responsible for product design, development, and fabrication battery holders for surface mount applications. The document should be maintained by engineering management or a design engineering technical lead. This discipline ensures that the user is privy to and can readily add updates to manufacturing techniques, design principles, or standards.

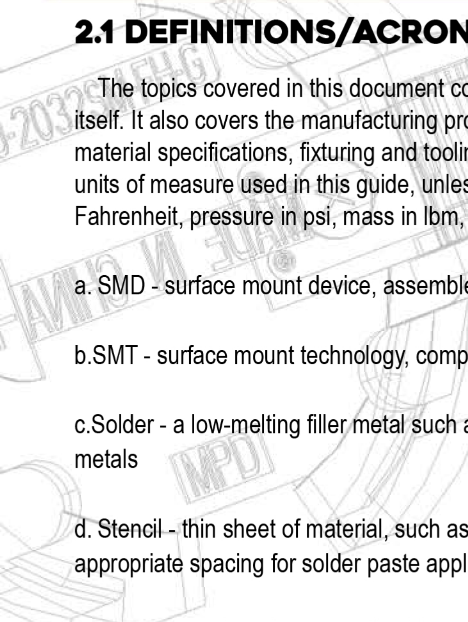
1.3 - SCOPE

The topics covered in this document cover the component specifications and assembly of the holder itself. It also covers the manufacturing process and steps required to fabricate the SMD battery holder. Raw material specifications, fixturing and tooling requirements, or battery features are not in the scope of this document. The units of measure used in this guide, unless explicitly stated otherwise, are Imperial: distance in inches, temperature in degrees Fahrenheit, pressure in psi, mass in lbm, and time in seconds, and force in lbf.

SECTION 2:
KEY DEFINITION, STANDARD, AND PROCESS OVERVIEWS



2.1 DEFINITIONS/ACRONYMS



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a. SMD - surface mount device, assembled using proven surface mount technology

b.SMT - surface mount technology, comprises the suite of soldering and mounting components onto the printed circuit board (PCB)

c.Solder - a low-melting filler metal such as silver, lead, or tin, used to join dissimilar metals; can also refer to the act of applying solder to join metals

d. Stencil - thin sheet of material, such as stainless steel, used to apply solder paste to the PCB. The stencil contains a hole pattern that defines appropriate spacing for solder paste application

e. Surface tension - force on a liquid's surface that reduces the surface area by the bulk fluid pulling the surface molecules toward it; it inhibits the solder paste from flowing into the aperture of an excessively thick stencil

f. Inspection/solder joint integrity techniques - solder joints are inspected visually; characteristics of a good solder joint are bright, shiny metal, clean and smooth, with apparent solder wetting that covers the wire

g. Battery cavity - where the battery sits in the holder

2.2 IPC-7351 SURFACE MOUNT DESIGN REQUIREMENTS AND LAND PATTERN STANDARD

IPC drafted standards for surface mount design in 1995. The standards relate Design for Manufacturability to Design for Environment and focus on the performance of the final product with minimal time to market. The contents of the full standard, which contains mainly quantitative specifications, can be applied with the qualitative guidance in this document to scope SMD Design.

Highlights from IPC-7351 include:

a. Dimensioning

    i. All dimensions are basic (no tolerance included) - tolerance is defined by specific manufacturer and application
    ii. At its maximum dimensions, the component form must be maintained
    iii. Maximum part dimensions dictate the position dimensions

b. Land Pattern Naming Convention

    i. Land pattern name consists of a prefix for the type of device, a pin pitch, provision for one or two nominal lead spans, and several pins

c. Grid-based Component Positioning

    i. To enable uniform test-node accessibility and to maintain predictable routing channels, grid spacing should be at least 0.5mm between centers

2.3 SOLDER JOINT STRENGTH TEST FOR 260C REFLOW

For 260c flow, three solder pastes can be used: SAC-305, REL61, and REL22. The acceptable pastes were subjected to increasing loads until the failure point. The solder blends withstood loads between 10 and 25 kg during a five-sample per part number test, with two-part numbers tested for each solder paste type.

The SAC-305 paste averaged 17.8 and 11.6kg for each part number before failing, while REL61 withstood 12.4 and 14.2kg. Rel22 failed at 18 and 10.8 kg. Rel22 had the highest magnitude but most comprehensive range of strength test average performance.

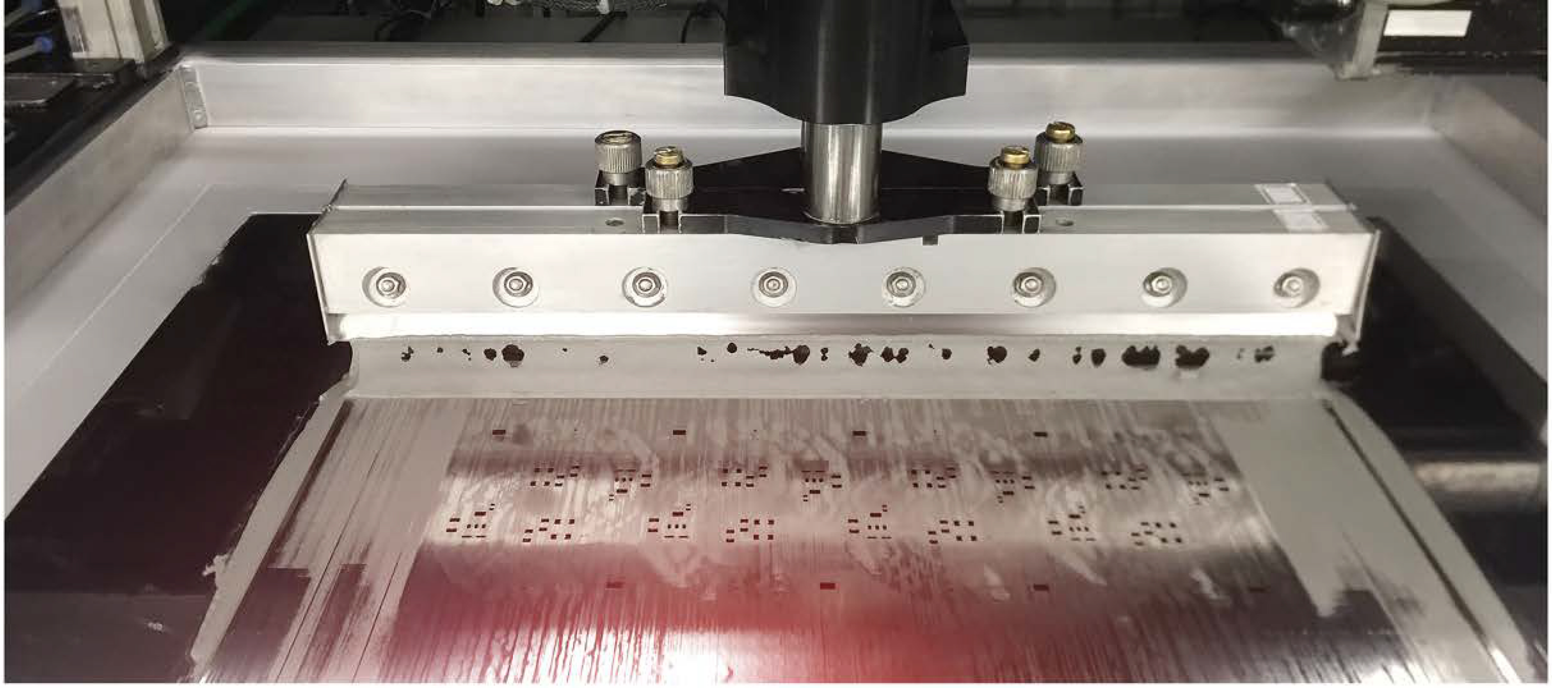
SECTION 3:
GENERAL DESIGN STANDARDS

3.1 STENCIL THICKNESS

The topics covered in this document cover the component specifications and assembly of the holder itself. It also covers the manufacturing process and steps required to fabricate the SMD battery holder. Raw material specifications, fixturing and tooling requirements, or battery features are not in the scope of this document. The units of measure used in this guide, unless explicitly stated otherwise, are Imperial: distance in inches, temperature in degrees Fahrenheit, pressure in psi, mass in lbm, and time in seconds, and force in lbf.

Guidelines for stencil design are as follows:

- Aspect ratio (W/T): for an aperture of length L, width W, and thickness T, the aspect ratio should be more than 1.5
- Area ratio (Area of aperture, L x W, divided by area of stencil walls bordering aperture, 2T[L+W]) should be more than 0.66
- For solder composition, a minimum of five (5) solder particles should fit into the smallest aperture width to ensure sufficient alloy flow



3.2 APERTURE DESIGN

The design of the aperture can minimize undesired solder bond characteristics like bridging and beading fo the paste. Designing the aperture to be generally 0.002” smaller than the pad provides a suitable gasket seal between the PCB and stencil. The IPC-7351 standard mentioned in section 2.2 provides additional guidelines for dimensioning surface mount pads.

3.3 STENCIL MATERIAL AND MOUNTING

While the aperture design has a strong influence on the dispersion of solder paste into the joint, the construction material and mounting strategy of the stencil also affect the solder release and subsequent integrity of the joint. While stainless steel is commonly used as a stencil material, nickel-based alloys benefit small-aperture designs, albeit at a cost premium up to 50% of the stainless value. For non-uniform solder applications, stencil designs can employ multiple thicknesses within a single piece to regulate the amount and location of solder flow.

Tailoring the shape and geometry of variable-thickness stencils provides greater control over the placement of the solder to make the joint. As long as the guidelines in section 3.1 are maintained, the shape of the aperture can be fit to the specific application.

The stencil mounting strategy depends on the scale of the end-use. For high-volume situations, permanently mounting the stencils provides a high level of precision. In applications requiring more flexibility, frame-less stencils use tension to offer a temporary, low-tooling strategy. It is essential to define the manufacturing process before selecting the mounting approach

3.4 STENCIL ALIGNMENT

Typical stencil thicknesses are on the order of thousands of an inch, alignment and placement of the stencils on the PCB are imperative. Accurately aligning the stencils ensures the solder flows where it is intended. The best design practice to ensure proper stencil alignment is to score or mark placement lines on both the stencil and the PCB. These marks are lined up on both components to ensure accurate alignment.

3.5 PCB DESIGN SPECIFICS

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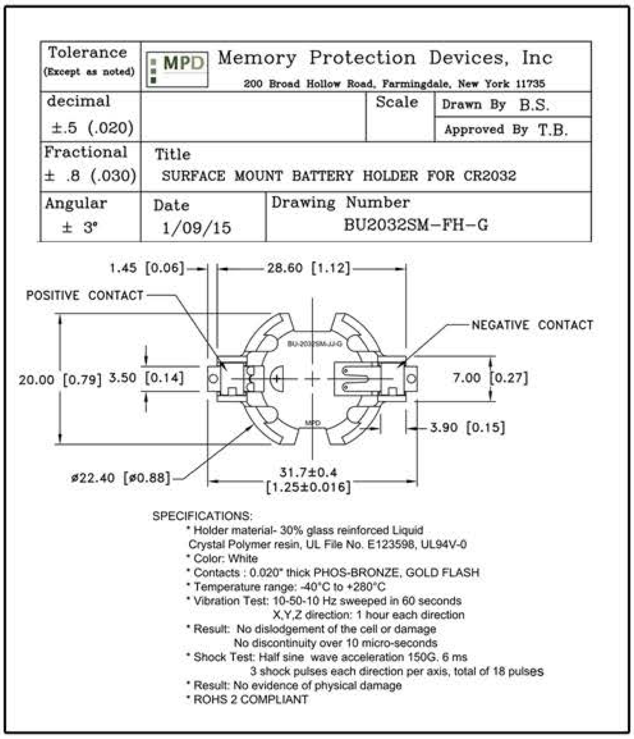
3.6 BATTERY TO CAVITY CONTACT

Nickel-plated stainless steel provides the best solution to avoid galvanic corrosion while maintaining cost efficiency.

3.7 BATTERY CAVITY



Tolerance (Except as noted)	MPD Memory Protection Devices, Inc 200 Broad Hollow Road, Farmingdale, New York 11735		
decimal ±.5 (.020)		Scale	Drawn By B.S. Approved By T.B.
Fractional ± .8 (.030)	Title SURFACE MOUNT BATTERY HOLDER FOR CR2032		
Angular ± 3°	Date 1/09/15	Drawing Number BU2032SM-FH-G	

SPECIFICATIONS:
* Holder material- 30% glass reinforced Liquid Crystal Polymer resin, UL File No. E123598, UL94V-0
* Color: White
* Contacts : 0.020" thick PHOS-BRONZE, GOLD FLASH
* Temperature range: -40°C to +280°C
* Vibration Test: 10-50-10 Hz sweeped in 60 seconds
X,Y,Z direction: 1 hour each direction
* Result: No dislodgement of the cell or damage
No discontinuity over 10 micro-seconds
* Shock Test: Half sine wave acceleration 150G, 6 ms
3 shock pulses each direction per axis, total of 18 pulses
* Result: No evidence of physical damage
* ROHS 2 COMPLIANT

3.7.1 Sizing Guidelines - holder cavity sizes should consider standard battery sizes to enable a brand-agnostic design. This approach designs against disengagement due to vibration failure, poor terminal contact, and failures due to human misuse

3.7.2 Ventilation and Position - due to the potential of gas release from zinc oxidation (electrolytic hydrogen release), low-level discharge, or faulty charging, the battery holder design should consider ventilation. The easiest venting method is to drill outgassing holes in the holder, though its proximity to other system components and enclosures may still allow the local gas concentration to reach its lower explosion limit (LEL, 4 vol% for hydrogen). The battery manufacturer may provide a specification, which is the best source of ventilation guidance. Catalyst pellets are another option to consume undesirable gas. These pellets consume the gas and react to form a non-harmful product.

3.7.3 Vibration Failure Mitigation - pressure contacts could be incorporated to reduce the impact of vibration. Common examples of common contact types are mini snap terminals, printed circuit board pins, thin-gauge flat nickel tab stock, spring clips, multiple point contacts, and standard electrical connectors. The vibration path could also incorporate bends in the vibration path, absorbing some of the resonant vibrations

3.8 MISCELLANEOUS BEST PRACTICES

The thermal management of processor heat has a direct correlation on component performance. Because each application is very different, the design engineers should consider thermal management and heat dissipation paths when designing the PCB board. Passive and active cooling media may be applied to the board assembly, such as forced air or dielectric liquid.

The grade, thickness, and design of SMD holder material can also influence the assembly strategy. Conductive epoxies can mitigate excessive heat generation by accepting some of the process heat, though care should be taken to ensure the solder joint is not overheated.

SECTION 4:
CONCLUSION AND ASSEMBLY CONSIDERATION

This document provides guidelines and best practices for the design of SMD components, along with quantitative specification values for key design features. Individually, stencil geometry, thickness, aperture, ratios within the stencil, PCB board, and system characteristics influence the solder joint and general part design and manufacture. It is just as important, though, to consider what the impact of a change to one of the features above has on the other system parameters. An in-depth risk assessment helps guide the system-level impact of a change to one of the design features.

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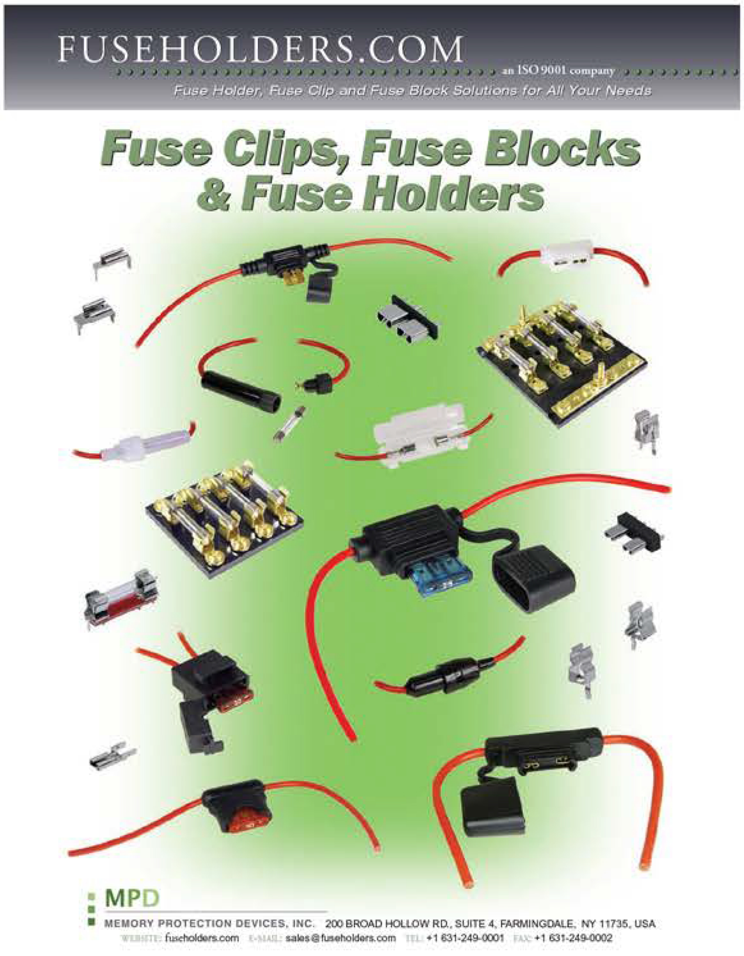

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