

## Product Tape and Reel, Solderability & Package Outline Specification

### Contents

1. General Information
2. Tape and Reel / T&R
3. Package Outline Drawing / POD
4. Electro Static Discharge / ESD
5. Moisture Sensitivity / MSL
6. PCB Design – Land Pattern and Stencil Design
7. Solder Paste
8. Reflow Profile
9. Product Shelf Life

### 1. General Information

This specification covers MicroLeadFrame (MLF | Quad flatpack no leads (QFN's) and DFN (Dual Flat No-Lead) SMT IC packages with soldered electrical connections made to the surface of the connecting PCB, shipped in Tape and Reel.

The QFN has leads on all four sides with the DFN having leads on two sides of the package. QFN and DFN packages have full leads exposed to the edge of the package. The exposed edge of the lead is not plated and a solder fillet is not necessary for proper mounting.

Lead finish for the QFN package is Matte Sn. Lead finish for the DFN packages is NiPdAu.

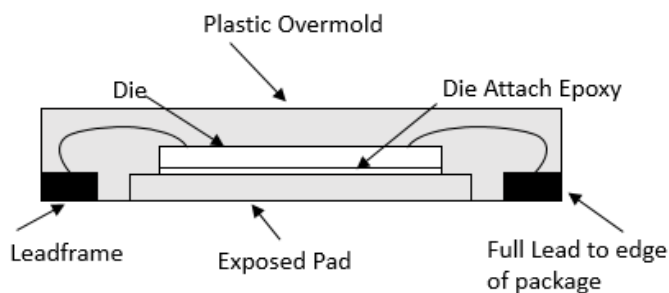


Figure 1  
Cross Section View of a QFN/DFN Package

Cross Section View of a QFN/DFN Package with Full Leads

## Manufacturing Note MN-001 – Product Tape and Reel and Solder Reflow Specification

The packages noted are easily mounted using standard PCB SMT reflow assembly techniques and can be removed and replaced using standard removal techniques. This manufacturing note presents users with general information on how the devices are packaged on tape and reels and how to solder the component to PCB's.

All packages listed in this specification are RoHS compliant lead-free packages. Please see [www.guerrilla-rf.com/environmental](http://www.guerrilla-rf.com/environmental) for additional information.

## 2. Tape and Reel

Guerrilla RF's Tape and Reel specification is in compliance with Electronics Industries Association (EIA) standards for "Embossed Carrier Tape of Surface Mount Components for Automatic Handling". Reference EIA-481. See Table 1 for Tape and Reel specifications along with units per reel.

Devices are loaded with pins down into the carrier pocket with protective cover tape, wound onto a plastic reel. Each reel will be packaged in a cardboard box. There will be product labels on the reel, the protective ESD bag and the outside of the box.

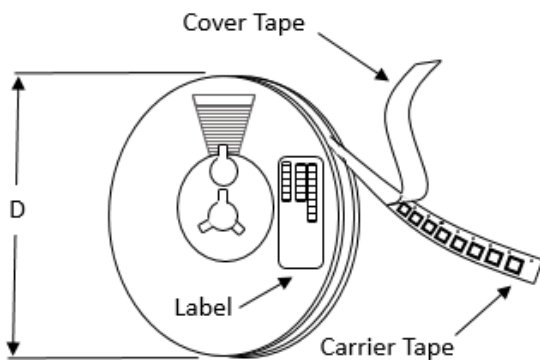


Figure 2  
Tape and Reel Packaging with Reel Diameter Noted (D).

Tape and Reel Packaging

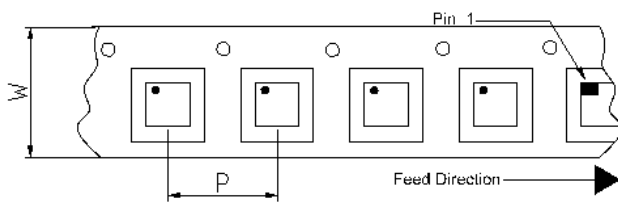


Figure 3  
Carrier Tape, Pitch (P), and Feed Direction Noted for QFN/DFN

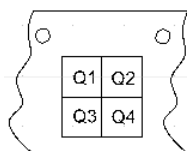


Figure 4  
Pin 1 Quadrant Information

**Table 1 Tape and Reel Specification and Units per Reel**

Package Style Code	Nominal Package Size			Carrier Tape Dimensions			Reel Diameter	Units Per Reel
	Type	Width/Size mm	Leads	Width W mm	Pocket Pitch P mm	Pin 1 Quadrant	D Inches	Qty
A	QFN	2x2x.5	12	8	4	Q1	7"	2500
B	QFN	3x3x.85	16	12	8	Q1	7"	1500
C	DFN	1.5x1.5x.45	6	8	4	Q1	7"	2500
D	DFN	2x2x.75	8	8	4	Q1	7"	2500

### 3. Package Outline Drawing

Package Outline Drawings are provided as a general reference only. Please reference product Gerber files to assist in PCB layout. Files are available at [www.guerrilla-rf.com/products](http://www.guerrilla-rf.com/products) for each part number.

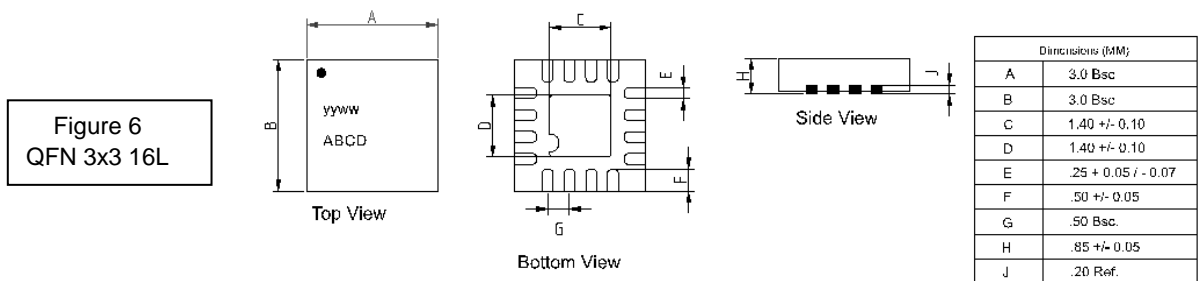
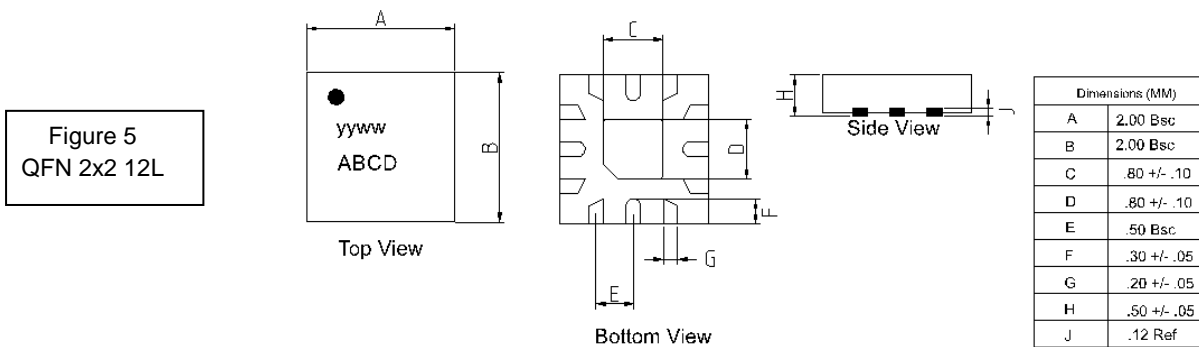


Figure 7  
DFN 1.5x1.5 6L

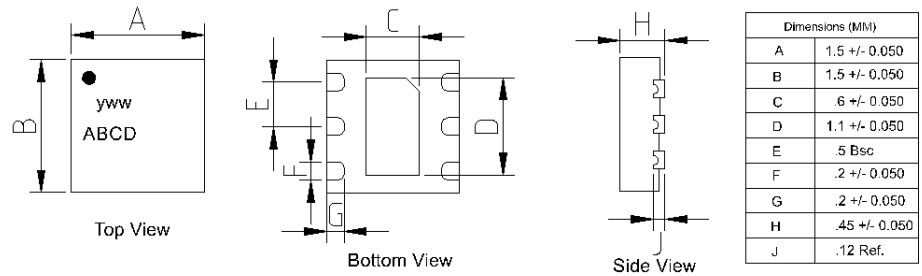
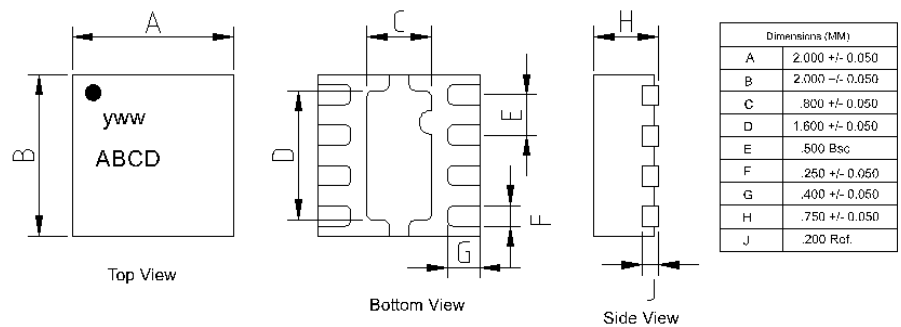


Figure 8  
DFN 2x2 8L



## 4. ESD

Guerrilla RF qualifies devices to **ANSI/ESDA/JEDEC JS-001-2014 and ANSI/ESDA/JEDEC JS-002-2014**. Devices are ESD sensitive and should be handled accordingly. Individual device ratings can be found on Product Data Sheets. JEDEC JESD625B is a common reference for review.

## 5. Moisture Sensitivity Level

Guerrilla RF qualifies devices to JEDEC J-STD-020. Please reference shipping bag and reel label for device MSL and Peak Reflow Ratings. Please reference JEDEC J-STD-033 for Handling of moisture sensitive devices.

## 6. PCB Design Guidelines - Land Pattern and Stencil Design

For Volume Production, devices can be treated as a standard surface mount component (ref IPC/JEDEC J-STD-020) with a standard assembly process. (Stencil solder printing, standard pick & place & solder reflow oven).

PCB design considerations are needed to properly design the PCB and solder stencil to mount the package. Recommended land pattern/gerber files are available to assist in PCB design. Guerrilla RF gerber files can be downloaded at [www.guerrilla-rf.com](http://www.guerrilla-rf.com) at the bottom of each product landing page.

## 7. Solder Paste

There are no special requirements necessary when reflowing components. A low residue, no-clean solder (SN63/Pb37 or SAC alloy) paste is commonly used. The solder-paste manufacturer's printing and temperature profile should be used to optimize the assembly process.

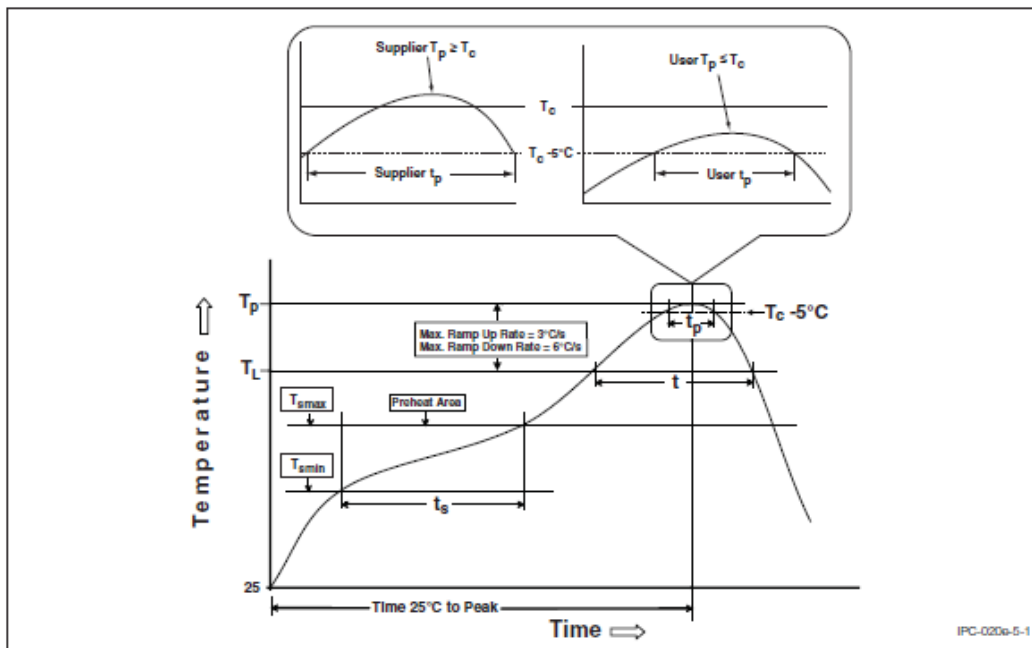
To verify any open or short circuits (bridging) after reflow, optical inspection and x-ray inspection are typical techniques that may be used.

## 8. Reflow Profile

A typical reflow profile is shown in Figure 10 as a reference only. The actual profile parameters depend upon the solder paste used, therefore, recommendations from paste manufacturers should be followed for reflow profile and any post solder cleaning.

Guerrilla RF has tested and qualified the packages listed in Table 1 for three (3x) reflow operations per JEDEC J-STD-020 at a classification temperature of 260C. Note the MSL value is noted on the packaging label of each reel.

Manual or hand soldering is not recommended but if necessary the same temperature profile as the normal reflow soldering should be used. The peak temperature must not exceed the standard assembly reflow process.



## Manufacturing Note MN-001 – Product Tape and Reel and Solder Reflow Specification

Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
<b>Preheat/Soak</b>		
Temperature Min ( $T_{min}$ )	100 °C	150 °C
Temperature Max ( $T_{max}$ )	150 °C	200 °C
Time ( $t_p$ ) from ( $T_{min}$ to $T_{max}$ )	60-120 seconds	60-120 seconds
Ramp-up rate ( $T_L$ to $T_p$ )	3 °C/second max.	3 °C/second max.
Liquidous temperature ( $T_L$ )	183 °C	217 °C
Time ( $t_L$ ) maintained above $T_L$	60-150 seconds	60-150 seconds
Peak package body temperature ( $T_p$ )	For users $T_p$ must not exceed the Classification temp in Table 4-1. For suppliers $T_p$ must equal or exceed the Classification temp in Table 4-1.	For users $T_p$ must not exceed the Classification temp in Table 4-2. For suppliers $T_p$ must equal or exceed the Classification temp in Table 4-2.
Time ( $t_p$ )* within 5 °C of the specified classification temperature ( $T_c$ ), see Figure 5-1.	20* seconds	30* seconds
Ramp-down rate ( $T_p$ to $T_L$ )	6 °C/second max.	6 °C/second max.
Time 25 °C to peak temperature	6 minutes max.	8 minutes max.

**Table 4-2 Pb-Free Process – Classification Temperatures ( $T_c$ )**

Package Thickness	Volume mm <sup>3</sup> <350	Volume mm <sup>3</sup> 350 - 2000	Volume mm <sup>3</sup> >2000
<1.6 mm	260 °C	260 °C	260 °C
1.6 mm - 2.5 mm	260 °C	250 °C	245 °C
>2.5 mm	250 °C	245 °C	245 °C

Figure 9 Typical Reflow Profile & Table 4-2 provided as reference only. Table 4-1 not included. Please reference J-STD-020 for full details.

## 9.0 Product Shelf Life / Floor Life

Shelf life for semiconductor products is based on a number of factors, including moisture sensitivity level (MSL), use of moisture barrier bags (MBBs) and desiccant in product packaging. Under normal use and assuming reasonable turn of inventory there should be no shelf life concerns.

Guerrilla RF's semiconductor's parts are typically shipped in moisture-barrier bags (MBB) with desiccant, humidity indicator card and labeled with the MSL rating. Unless otherwise expressly noted, shelf life expectancy is unlimited from bag seal date, provided storage conditions adhere to IPC/JEDEC J-STD-033C. Within this period, and as long as the Humidity Indicator Card (HIC) does not indicate a need for re-baking, it is safe to reflow components per original MSL rating.

If the humidity indicator card (HIC) indicates that baking is not required, then it is safe to reflow the components per the original MSL rating. In all instances, Guerrilla RF recommends maintaining best known practices and to always properly reheat-seal the moisture barrier bag after opening.

Please note that although unanticipated, factors other than moisture sensitivity could affect the total shelf life of components. Guerrilla RF assumes no responsibility for mishandled or improperly stored products.

Guidelines established by IPC/JEDEC J-STD-033C should be followed when handling and storing semiconductor products.

## Manufacturing Note MN-001 – Product Tape and Reel and Solder Reflow Specification

Table 5-1 Moisture Classification Level and Floor Life

Moisture Sensitivity Level	Floor Life (out of bag) at factory ambient $\leq 30$ °C/60% RH or as stated
1	Unlimited at $\leq 30$ °C/85% RH
2	1 year
2a	4 weeks
3	168 hours
4	72 hours
5	48 hours
5a	24 hours
6	Mandatory bake before use. After bake, must be reflowed within the time limit specified on the label.

**Important Disclaimer.** Information in this report is specific to the Guerrilla RF, Inc (“Guerrilla RF”) products identified. This manufacturing note, including the information contained in it, is provided by Guerrilla RF as a service to its customers and may be used for informational purposes only by the customer. Guerrilla RF assumes no responsibility for errors or omissions on this report or the information contained herein. Information provided is believed to be accurate and reliable, however, no responsibility is assumed by Guerrilla RF for its use, nor for any infringement of patents, or other rights of third parties, resulting from its use. Guerrilla RF assumes no liability for any MTTF/FIT report, manufacturing note, datasheet, datasheet information, materials, products, product information, or other information provided hereunder, including the sale, distribution, reproduction or use of Guerrilla RF products, information or materials. No license, whether express, implied, by estoppel, by implication or otherwise is granted by this report for any intellectual property of Guerrilla RF, or any third party, including without limitation, patents, patent rights, copyrights, trademarks and trade secrets. All rights are reserved by Guerrilla RF. All information herein, products, product information, datasheets, and datasheet information are subject to change and availability without notice. Guerrilla RF reserves the right to change component circuitry, recommended application circuitry and specifications at any time without prior notice. Guerrilla RF may further change its datasheet, product information, documentation, products, services, specifications or product descriptions at any time, without notice. Guerrilla RF makes no commitment to update any materials or information and shall have no responsibility whatsoever for conflicts, incompatibilities, or other difficulties arising from any future changes. GUERRILLA RF INFORMATION, PRODUCTS, PRODUCT INFORMATION, DATASHEETS AND DATASHEET INFORMATION ARE PROVIDED “AS IS” AND WITHOUT WARRANTY OF ANY KIND, WHETHER EXPRESS, IMPLIED, STATUTORY, OR OTHERWISE, INCLUDING FITNESS FOR A PARTICULAR PURPOSE OR USE, MERCHANTABILITY, PERFORMANCE, QUALITY OR NON-INFRINGEMENT OF ANY INTELLECTUAL PROPERTY RIGHT; ALL SUCH WARRANTIES ARE HEREBY EXPRESSLY DISCLAIMED. GUERRILLA RF DOES NOT WARRANT THE ACCURACY OR COMPLETENESS OF THE INFORMATION, TEXT, GRAPHICS OR OTHER ITEMS CONTAINED WITHIN THESE MATERIALS. GUERRILLA RF SHALL NOT BE LIABLE FOR ANY DAMAGES, INCLUDING BUT NOT LIMITED TO ANY SPECIAL, INDIRECT, INCIDENTAL, STATUTORY, OR CONSEQUENTIAL DAMAGES, INCLUDING WITHOUT LIMITATION, LOST REVENUES OR LOST PROFITS THAT MAY RESULT FROM THE USE OF THE MATERIALS OR INFORMATION, WHETHER OR NOT THE RECIPIENT OF MATERIALS HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGE. Customers are solely responsible for their use of Guerrilla RF products in the Customer’s products and applications or in ways which deviate from Guerrilla RF’s published specifications, either intentionally or as a result of design defects, errors, or operation of products outside of published parameters or design specifications. Customers should include design and operating safeguards to minimize these and other risks. Guerrilla RF assumes no liability or responsibility for applications assistance, customer product design, or damage to any equipment resulting from the use of Guerrilla RF products outside of stated published specifications or parameters.

### Appendix A: Revision History

Revision	Date   Reason for Revision
Revision A	4-25-2016 Initial Release
Revision B	10-13-2016 Added package tolerances, corrected typos.
Revision C	11-21-2016 Removed SOT89 reference, updated 3x3 QFN reel size from 1000 to 1500 and added QFN and DFN Lead Finish note.
Revision D	11/28/2017 Added Product Shelf Life/Floor Life Information
Revision E	2/20/2018 Added Reflow Classification Temperature to Section 9. Clarified DFN lead finish. Updated Figure #'s.