

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

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### 1. General Information

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

The QFN and LFM have 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 and LFM package is Matte Sn. Lead finish for the DFN packages is NiPdAu.

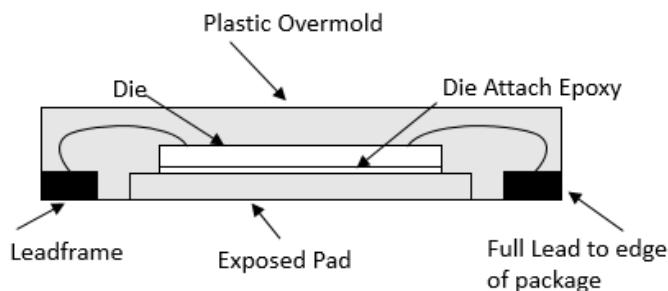


Figure 1  
Cross Section View of a QFN/DFN Package

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

The packages noted are easily mounted using standard PCB SMT reflow assembly techniques and can be removed and replaced using standard removal techniques - see Section 8. 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.

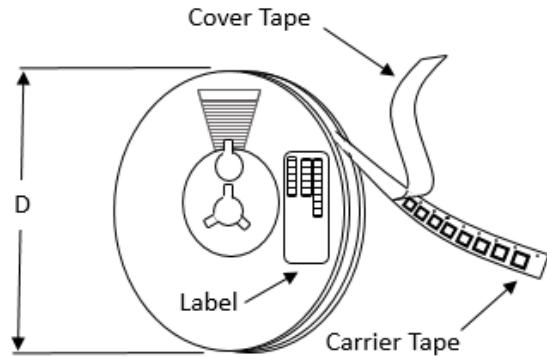
All packages listed in this specification are RoHS compliant lead-free packages. Please see [www.guerrilla-rf.com/environmental](http://www.guerrilla-rf.com/environmental) for additional information.

## 2. Tape and Reel

Guerrilla RF's Tape and Reel specification complies 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 surface of the box.

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



Tape and Reel Packaging

Figure 3  
Carrier Tape, Pitch  
(P), Feed Direction  
and Pin 1 Quadrant

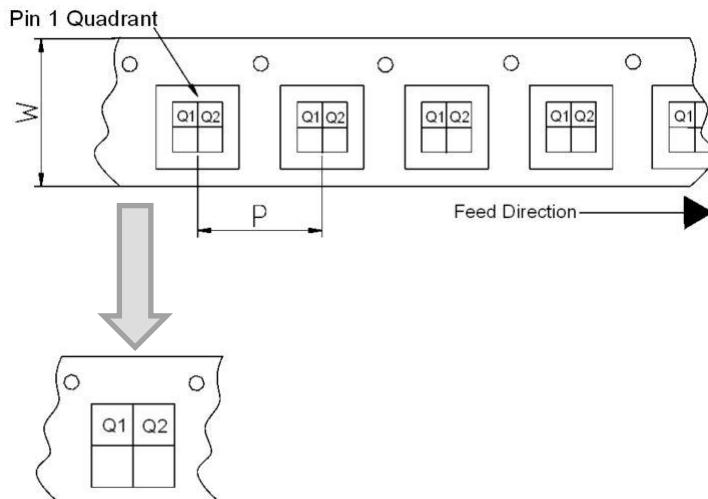


Figure 4  
Pin 1 Quadrant Information

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

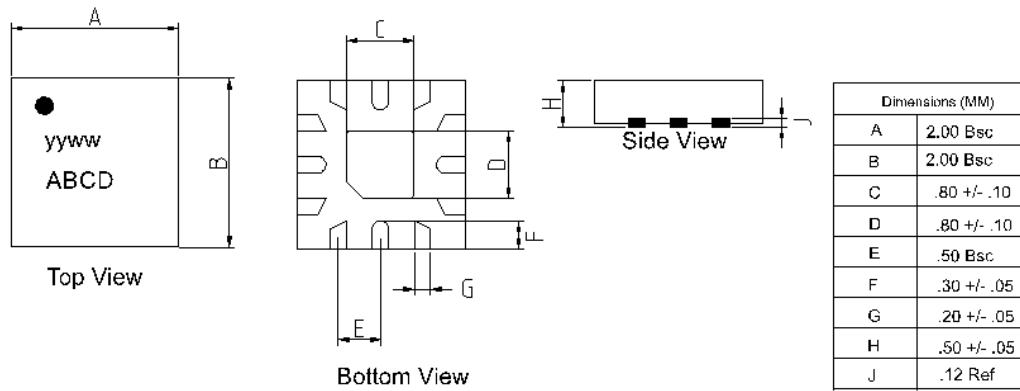
Package Style Code	Nominal Package Size			Carrier Tape Dimensions			Reel Diameter	Units Per Reel
	Type	Width/Size mm	Leads	Width W mm	Pocket Pitch P mm	Pin 1 Quadrant	D Inches	Qty
A	QFN	2x2x.5	12	8	4	Q1	7"	2500
B	QFN	3x3x.85	16	12	8	Q1	7"	1500
C	DFN	1.5x1.5x.45	6	8	4	Q1	7"	2500
D	DFN	2x2x.75	8	8	4	Q1	7"	2500
E	LFM	4x4x.75	Note1	12	8	Q2	7"	1500

Note 1 - Lead count may vary. Reference applicable Product Data Sheet.

### 3. Package Outline Drawings

Package Outline Drawings are provided as a simplified outline and for 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 5  
QFN 2x2 12L



### 3. Package Outline Drawings - Continued

Figure 6  
QFN 3x3 16L

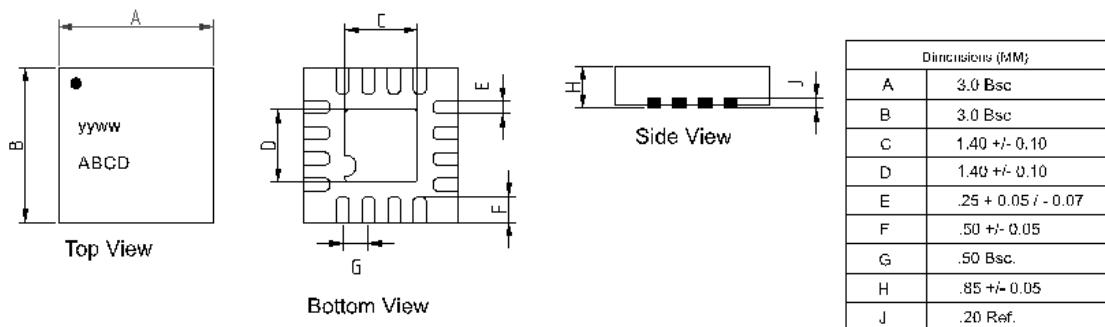


Figure 7  
DFN 1.5x1.5 6L

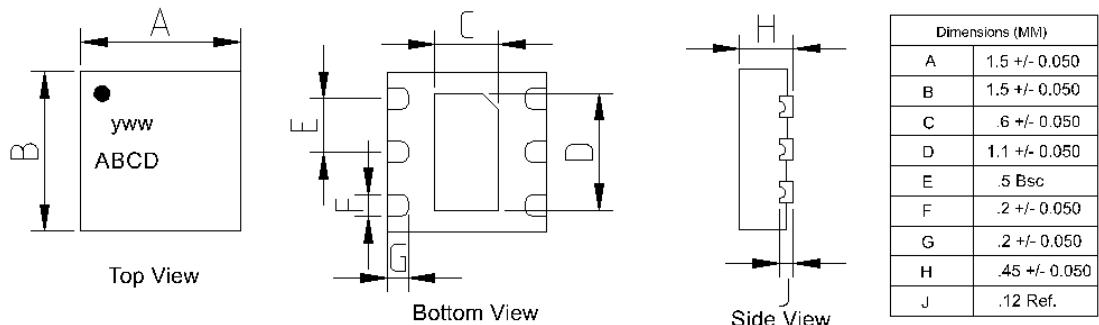
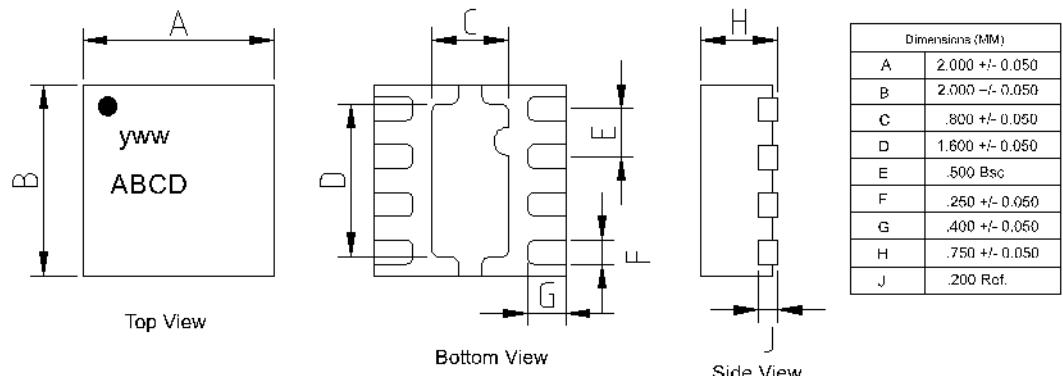
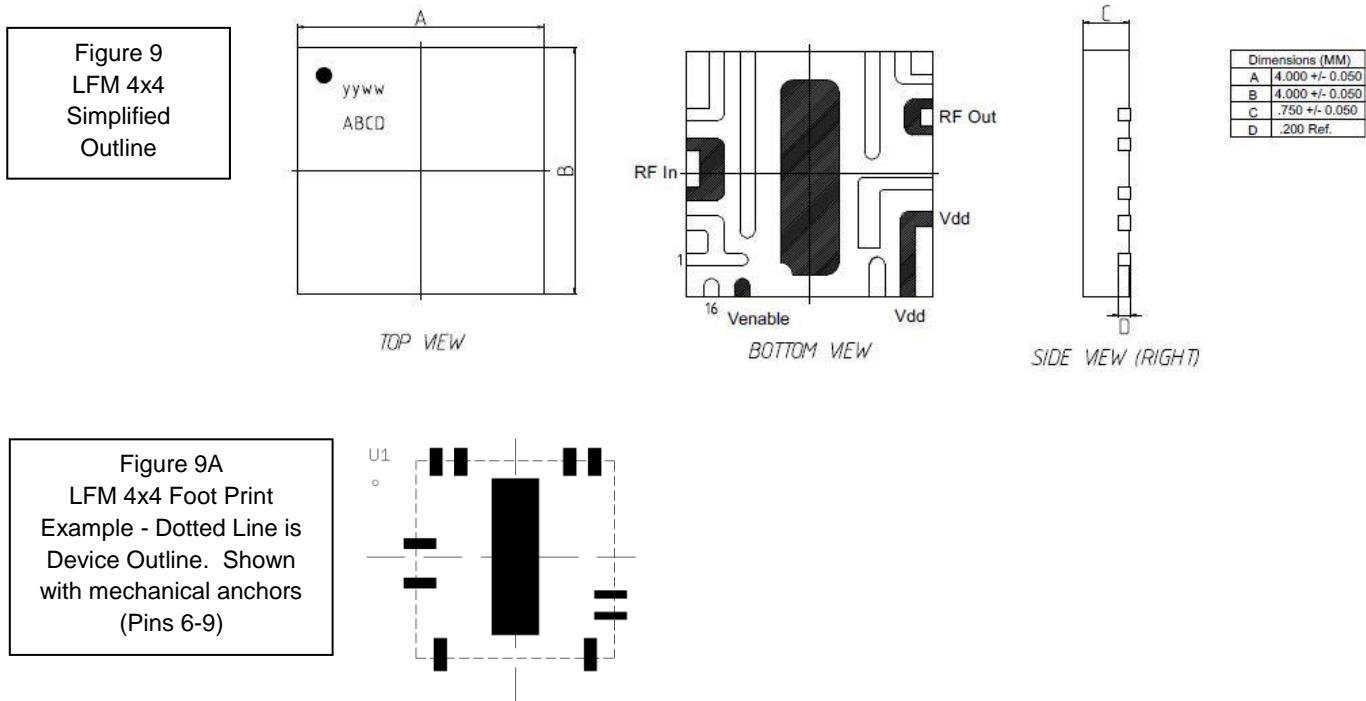


Figure 8  
DFN 2x2 8L



### 3. Package Outline Drawings - Continued



Note: The LFM package bottom metallization is complex. Shaded metallization required for device functionality. Non-shaded area should be covered with solder mask as a keep out area. 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.

### 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.

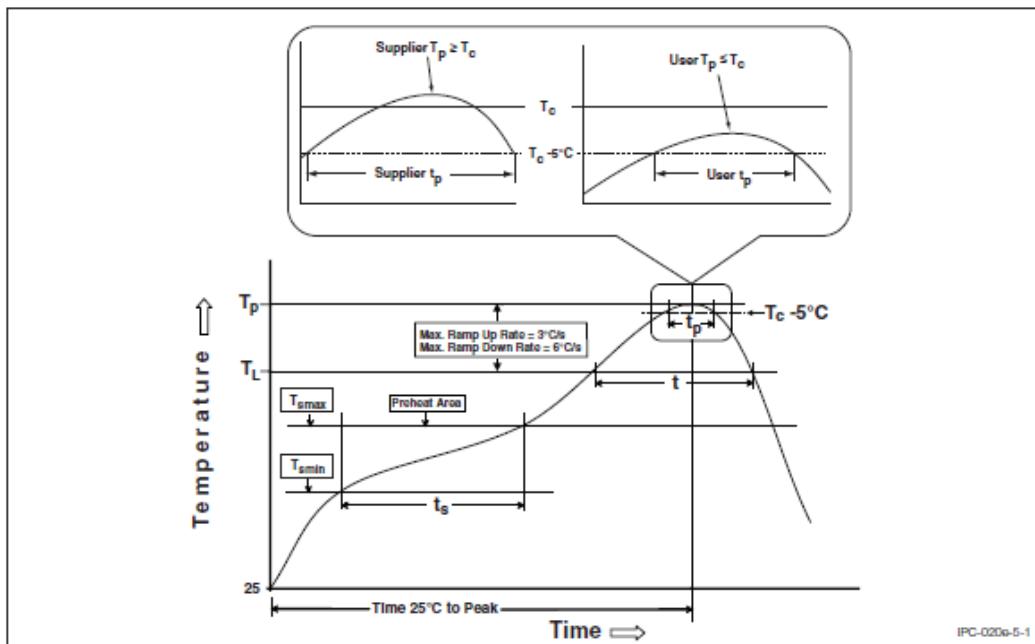
To verify any open or short circuits (bridging) after reflow, optical inspection and x-ray inspection are typical techniques that may be used.

## 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.



Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Preheat/Soak		
Temperature Min ( $T_{smin}$ )	100 °C	150 °C
Temperature Max ( $T_{smax}$ )	150 °C	200 °C
Time ( $t_s$ ) from ( $T_{smin}$ to $T_{smax}$ )	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.

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.

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

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### 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.
Revision F	10/16/2018 Added LFM Package E Updates