

# Surface Mount - Tape & Reel

## User's Guide



Literature Number: SNOA403I  
May 2004–Revised June 2011

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## ***Surface Mount - Tape & Reel***

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Tape-and-Reel is one of the primary methods for shipping surface mount devices. This system simplifies the handling of semiconductors for automated circuit board assembly systems. Tape-and-Reel holds hundreds-to-thousands of surface mount devices so that pick-and-place machines have to be reloaded less frequently.

## 1 General Description

Tape-and-Reel is one of the primary methods for shipping surface mount devices. This system simplifies the handling of semiconductors for automated circuit board assembly systems. Tape-and-Reel holds hundreds-to-thousands of surface mount devices so that pick-and-place machines have to be reloaded less frequently.

## 2 Features

- The reel is made of polystyrene (PS) plastic material and typically coated with antistatic solution.
- The carrier tape is made of standard polycarbonate or polystyrene materials.
- The cover tape is made of polyester material.
- The cover tape uses pressure sensitive or heat activated adhesive.
- Fully compliant to EIA-481 electronics industry standard except for 128Ld and 144Ld QFP package types.
- Meets European standard IEC 60286-3 PACKAGING OF COMPONENTS FOR AUTOMATIC HANDLING PART 3: PACKAGING OF SURFACE MOUNT COMPONENTS ON CONTINUOUS TAPES.
- Product is shipped in either 7-inch or 13-inch reels, depending on package/product types.

NOTE: Please check with your National local representative for details specific to your product needs.

## 3 Cover Tape Peel Strength

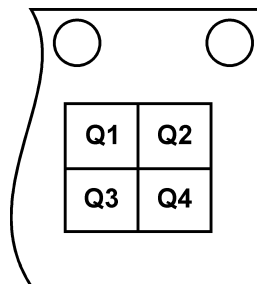
The force required to peel off the cover tape from the carrier tape will fall within the range of 0.1 Newton to 1.3 Newton (10 grams to 130 grams) at a peeling speed to 300 mm per minute. This complies with the EIA standard.

## 4 Electrostatic Charges

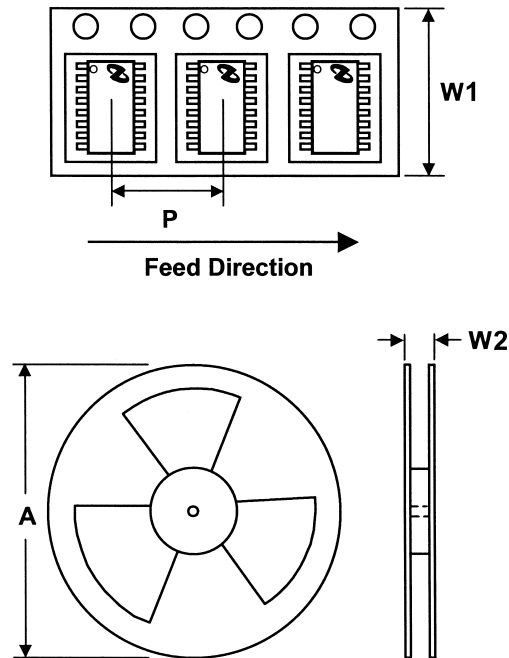
National Semiconductor uses only static dissipative tape-and-reel materials (surface resistivity of  $10^5$  to  $10^{12}$   $\Omega$ ) to avoid damaging static charges building up during the peeling off of the cover tape prior to pick and place. National Semiconductor ran extensive evaluations on cover tape materials and found that static charge build up was very low (less than 200 volts) on static dissipative cover tapes. In comparison, commonly used insulative cover tapes had readings consistently in excess of 3000 volts.

## 5 For All Package Types

For all Package Types			
Overall Hub Length (mm)		Overall Leader Length (mm)	
300 minimum	740 maximum	500 minimum	1200 maximum



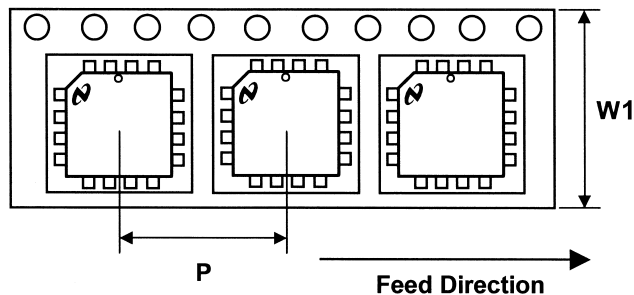
**Figure 1. Pin 1 Orientation**

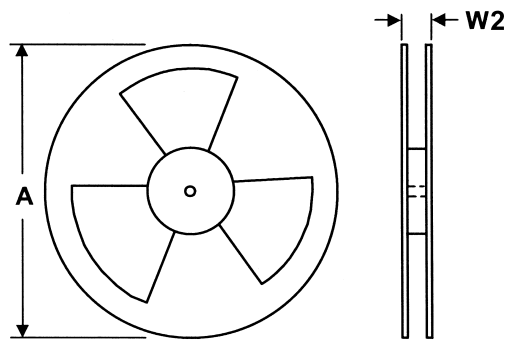
**6 MINI SOIC, SOIC, SSOP, TSSOP and PSOP**


Package Type Lead Count	MKT- Outline Drawing	Tape Size W1 (mm)	Pocket Pitch P(mm)	Pin 1 Quadrant <a href="#">Figure 1</a>	Units per Reel	Reel Size A (inches)	Reel Width W2 (mm)
<b>MINI SOIC</b>							
8 Ld	MUA08A	12	8	Q1	VP/1000/3500	7/13	18/18.4
	MUY08A						
10 Ld	MUB10A	12	8	Q1	VP/1000/3500	7/13	18/18.4
	MUC10A						
Ordering Instruction for 1000 units/reel: no Suffix, Example: LMH6612MM Ordering Instruction for 3500 units/reel: use Suffix 'X'. Example: LMH6612MMX For smaller Value Pack (VP) please contact your local NSC representative							
<b>SOIC</b>							
8 Ld (Narrow)	M08A	12	8	Q1	VP/2500	7/13	18/18.4
14 Ld (Narrow)	M14A	16	8	Q1	VP/2500	7/13	22.4
16 Ld (Narrow)	M16A	16	8	Q1	VP/2500	7/13	22.4
14 Ld (Wide)	M14B	16	12	Q1	1000	13	22.4
16 Ld (Wide)	M16B	16	12	Q1	1000	13	22.4
20 Ld (Wide)	M20B	24	12	Q1	1000	13	30.4
24 Ld (Wide)	M24B	24	12	Q1	1000	13	30.4
28 Ld (Wide)	M28B	24	12	Q1	1000	13	30.4
Note: Standard Packing Option is Rail. Wide Ordering Instruction for 1000 units/reel: use Suffix "X". Example: ADC0831CCWMX Narrow Ordering Instruction for 2500 units/reel: use Suffix 'X'. Example: LMP2231BMAX For smaller Value Pack (VP) please contact your local NSC representative							
<b>TSSOP</b>							
14 Ld	MTC14	12	8	Q1	VP/2500	7/13	18/18.4
	MXA14A						
16 Ld	MTC16	12	8	Q1	VP/2500	7/13	18/18.4
	MXA16A						

Package Type Lead Count	MKT- Outline Drawing	Tape Size W1 (mm)	Pocket Pitch P(mm)	Pin 1 Quadrant <a href="#">Figure 1</a>	Units per Reel	Reel Size A (inches)	Reel Width W2 (mm)
20 Ld	MTC20	16	8	Q1	VP/2500	7/13	22.4
	MXA20A						
24 Ld	MTC24	16	8	Q1	VP/2500	7/13	22.4
28 Ld	MTC28	16	8	Q1	VP/2500	7/13	22.4
	MXA28A						
48 Ld	MTD48	24	12	Q1	1000	13	30.4
56 Ld	MTD56	24	12	Q1	1000	13	30.4
64 Ld	MXD64A	24	12	Q1	1000	13	30.4
Note: Standard Packing Option is Rail. Ordering Instruction for 1000 units/reel: use Suffix "X". Example: LM8207MTX Ordering Instruction for 2500 units/reel: use Suffix 'X'. Example: LMP2234BMTX For smaller Value Pack (VP) please contact your local NSC representative							
10 Ld	MXF10A	12	8	Q1	VP/1000/3500 0	7/13	18/18.4
Ordering Instruction for 1000 units/reel: no Suffix, Example: LM4990MH Ordering Instruction for 3500 units/reel: use Suffix "X". Example: LM4990MHX For smaller Value Pack (VP) please contact your local NSC representative							
<b>SSOP-JEDEC</b>							
16 Ld	MQA16	16	8	Q1	2500	13	22.4
24 Ld	MQA24	16	8	Q1	2500	13	22.4
48 Ld	MS48A	32	16	Q1	1000	13	38.4
Note: Standard Packing Option is Rail. For Tape & Reel Packing use Suffix 'X'. Example: LM82CIMQAX							
<b>SSOP-EIAJ</b>							
20 Ld	MSA20	16	12	Q1	2000	13	22.4
24 Ld	MSA24	16	12	Q1	2000	13	22.4
28 Ld	MSA28	16	12	Q1	2000	13	22.4
Note: Standard Packing Option is Rail. For Tape & Reel Packing use Suffix 'X'. Example: DSP92LV1212AMSAX							
<b>PSOP</b>							
8 Ld	MRA08A	12	8	Q1	VP/2500	7/13	18/18.4
	MRA08B						
Note: Standard Packing Option is Rail. Ordering Instruction for 2500 units/reel: use Suffix 'X'. Example: LP2998MRX Ordering Instruction for 250 units/reel: use Suffix 'E'. Example: LP2998MRE For smaller Value Pack (VP) please contact your local NSC representative							

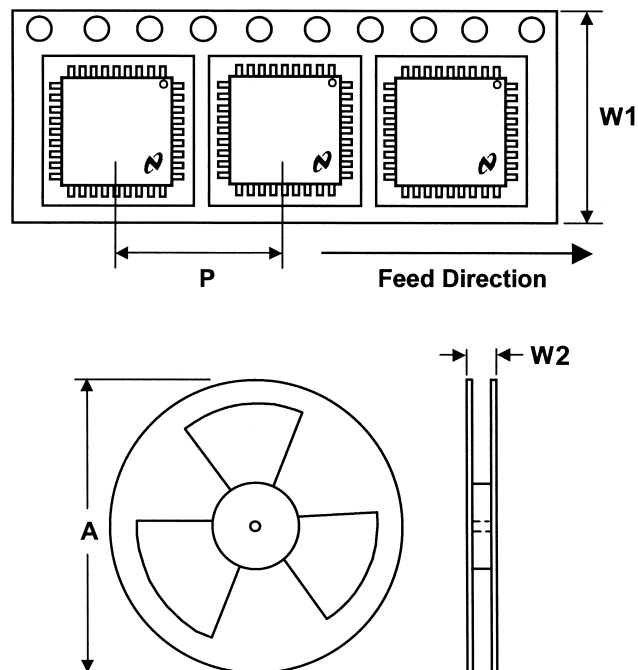
## 7 PLCC





Package Type Lead Count	MKT- Outline Drawing	Tape Size W1 (mm)	Pocket Pitch P(mm)	Pin 1 Quadrant <a href="#">Figure 1</a>	Units per Reel	Reel Size A (inches)	Reel Width W2 (mm)
<b>PLCC</b>							
20 Ld	V20A	16	12	Q1/Q2	1000	13	22.4
28 Ld	V28A	24	16	Q1/Q2	750	13	30.4
44 Ld	V44A	32	24	Q1/Q2	500	13	38.4
68 Ld	V68A	44	32	Q1/Q2	250	13	50.4
84 Ld	V84A	44	36	Q1/Q2	250	13	50.4
Standard Packing Option is Rail. For Tape & Reel Packing please contact your local NSC representative.							

## 8 PQFP, LQFP and TQFP





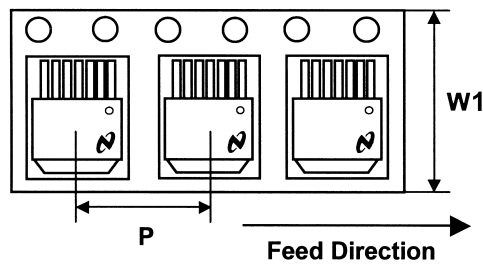
**Table 1.** <sup>(1)</sup>

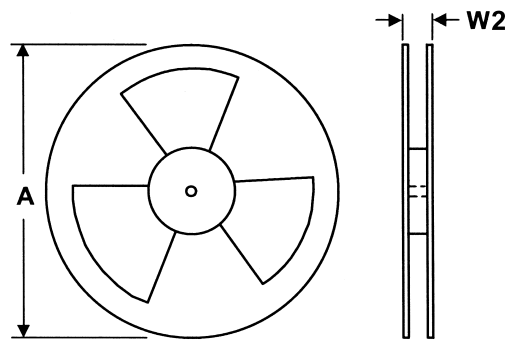
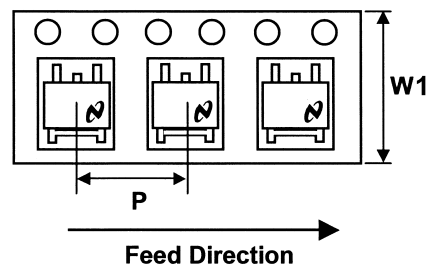
Package Type Lead Count	MKT- Outline Drawing	Tape Size W1 (mm)	Pocket Pitch P(mm)	Pin 1 Quadrant Figure 1	Units per Reel	Reel Size A (inches)	Reel Width W2 (mm)
<b>PQFP</b>							
80 Ld	VJE80A	32	24	Q2	500	13	38.4
Standard Packing Option is Tray. For Tape & Reel Packing please contact your local NSC representative.							
<b>LQFP</b>							
32 Ld	VBE32A	16	12	Q2	1000	13	22.4
44 Ld	VEJ44A	24	16	Q2	1000	13	30.4
48 Ld	VBH48A	16	12	Q2	1000	13	22.4
	VXH48A						
64 Ld	VEH64A	24	16	Q2	1000	13	30.4
80 Ld	VHG80A	24	16	Q2	1000	13	30.4
100 Ld	VJG100A	32	24	Q2	1000	13	38.4
128 Ld	VLB128A	44	24	Q1	500	13	50.4
144 Ld	VNG144A	44	32	Q1	500	13	50.4
144 Ld	VNG144C	44	32	Q2	500	13	50.4
Note: Standard Packing Option is Tray. For Tape & Reel Packing use Suffix 'X'. Example: ADC12040CIVYX							
<b>TQFP</b>							
48 Ld	VBC48A	16	12	Q2	1000	13	22.4
64 Ld	VEC64A	24	16	Q2	1000	13	30.4
80 Ld	VHB80A	24	20	Q2	1000	13	30.4
100 Ld	VJD100A	32	24	Q2	1000	13	38.4
Note: Standard Packing Option is Tray. For Tape & Reel Packing use Suffix 'X'. Example: DS90CF388VJDX							

<sup>(1)</sup> Exposed Heatsink

**9 TO-263, TO-263 THIN, TO-PMOD and TO-252**

**Figure 2. TO-263, TO-263 THIN, TO-PMOD**




**Figure 3. TO-252**


Package Type Lead Count	MKT- Outline Drawing	Tape Size W1 (mm)	Pocket Pitch P(mm)	Pin 1 Quadrant <a href="#">Figure 1</a>	Units per Reel	Reel Size A (inches)	Reel Width W2 (mm)
<b>TO-263</b>							
3 Ld	TS3B	24	16	Q2	500	13	30.4
5 Ld	TS5B	24	16	Q2	500	13	30.4
7 Ld	TS7B	24	16	Q2	500	13	30.4
9 Ld	TS9A	24	16	Q2	500	13	30.4
Note: Standard Packing Option is Rail. For Tape & Reel Packing use Suffix 'X'. Example: LP2954AISX							
<b>TO-263 THIN</b>							
3 Ld	TJ3A	24	12	Q2	1000	13	30.4
5 Ld	TJ5A	24	12	Q2	1000	13	30.4
7 Ld	TJ7A	24	12	Q2	VP/1000	7/13	30.4
9 Ld	TJ9A	24	12	Q2	1000	13	30.4
Ordering Instruction for 1000 units/reel: no Suffix, Example: LM22670TJ-5.0 For smaller Value Pack (VP) please contact your local NSC representative							
<b>TO-252</b>							
3 Ld	TD03B	16	8	Q2	2500	13	22.4
Note: Standard Packing Option is Rail. For Tape & Reel Packing use Suffix 'X'. Example: LM1117DTX-ADJ							
<b>TO-PMOD</b>							
7 Ld	TZA07A	24	16	Q2	250/500	13	30.4
Ordering Instruction for 250 units/reel: no Suffix, Example: LMZ10504TZ-ADJ Ordering Instruction for 500 units/reel: use Suffix "X". Example: LMZ10504TZX-ADJ							
11 Ld	TZA11A	32	20	Q2	250	13	39.2
Ordering Instruction for 250 units/reel: use Suffix "E", Example: LMZ12008TZE							

10 SOT-23, SOT-223, SC-70 and TSOT

Figure 4. SOT-23, SC-70 and TSOT

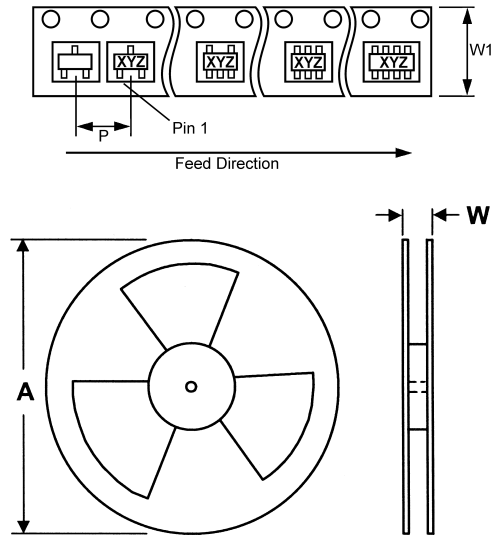
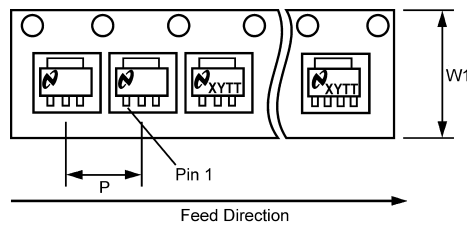


Figure 5. SOT-223



Package Type Lead Count	MKT- Outline Drawing	Tape Size W1 (mm)	Pocket Pitch P(mm)	Pin 1 Quadrant Figure 1	Units per Reel	Reel Size A (inches)	Reel Width W2 (mm)
<b>SOT-23</b>							
3 Ld	MF03A	8	4	Q3	1000/3000	7	14.4
5 Ld	MF05A	8	4	Q3	VP/1000/3000	7	14.4
6 Ld	MF06A	8	4	Q3	VP/1000/3000	7	14.4
8 Ld	MF08A	8	4	Q3	1000/3500	7/13	18/18.4
Ordering Instruction for 1000 units/reel: no Suffix "X". Example: DS90LV011AQMFX Ordering Instruction for 3000 units/reel: use Suffix "X". Example: DS90LV011AQMFX For smaller Value Pack (VP) please contact your local NSC representative							
<b>SC-70</b>							
5 Ld	MAA05A	8	4	Q3	VP/1000/3000	7	14.4
6 Ld	MAA06A	8	4	Q3	1000/3000	7	14.4
Ordering Instruction for 1000 units/reel: no Suffix "X". Example: LMV851MG Ordering Instruction for 3000 units/reel: use Suffix "X". Example: LMV851MGX For smaller Value Pack (VP) please contact your local NSC representative							
<b>SOT-223</b>							
4 Ld	MP04A	16	12	Q3	1000/2000	13	22.4
5 Ld	MP05A	16	12	Q3	1000/2000	13	22.4
Ordering Instruction for 1000 units/reel: no Suffix 'X'. Example: LM317AEMP For 2000 units/reel use Suffix 'X'. Example: LM317AEMPX							
<b>TSOT</b>							
6 Ld	MK06A	8	4	Q3	VP/1000/3000	7	14.4

Package Type Lead Count	MKT- Outline Drawing	Tape Size W1 (mm)	Pocket Pitch P(mm)	Pin 1 Quadrant <a href="#">Figure 1</a>	Units per Reel	Reel Size A (inches)	Reel Width W2 (mm)
Ordering Instruction for 1000 units/reel: no Suffix "X". Example: LM2734XQMK Ordering Instruction for 3000 units/reel: use Suffix "X". Example: LM2734XQMKE For smaller Value Pack (VP) please contact your local NSC representative							

### 11 Micro SMD, Micro SMDxt, Micro Array and POS

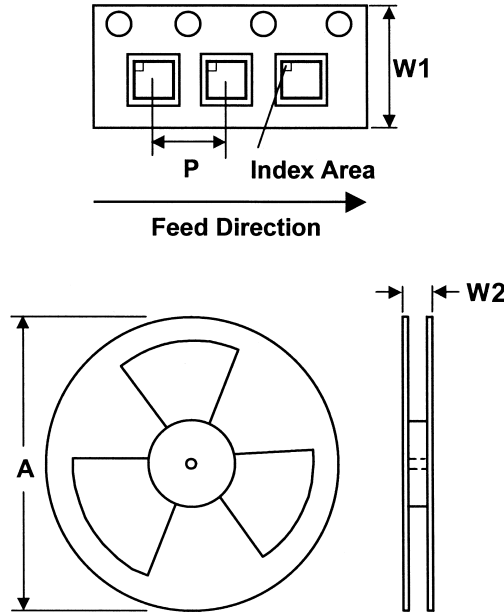
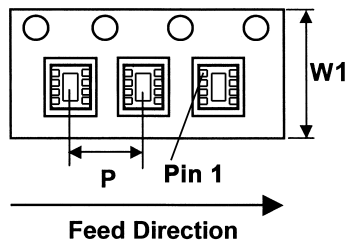


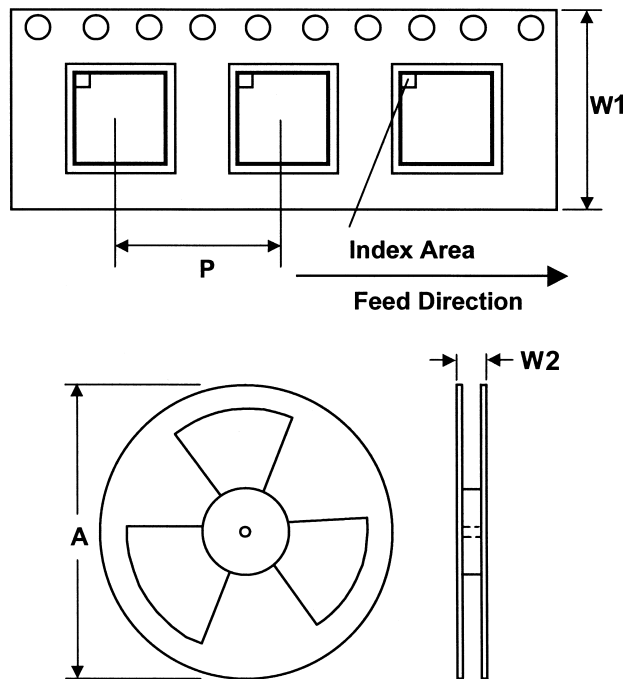
Figure 6. Package on Substrate (POS)



Package Type Lead Count	MKT- Outline Drawing	Tape Size W1 (mm)	Pocket Pitch P(mm)	Pin 1 Quadrant <a href="#">Figure 1</a>	Units per Reel	Reel Size A (inches)	Reel Width W2 (mm)
<b>Micro SMD</b>							
All Micro SMD ≤36 bumps		8	4	Q1	250/3000	7	14.4
Ordering Instruction for 250 units/reel: No Suffix 'X'. Example: LM3206TL For 3000 units/reel use Suffix 'X'. Example: LM3206TLX							
<b>Micro SMDxt</b>							
All Micro SMDxt		12	8	Q1	250/1000	7	18
Ordering Instruction for 250 units/reel: No Suffix 'X'. Example: LM4934RL For 1000 units/reel use Suffix 'X'. Example: LM4934RLX							
<b>Micro Array</b>							
25 bumps	GRA25A	12	8	Q1	VP/1000/350 00	7/13	18/18.4
36 bumps	GRA36A	12	8	Q1	1000/3500	7/13	18/18.4

Package Type Lead Count	MKT- Outline Drawing	Tape Size W1 (mm)	Pocket Pitch P(mm)	Pin 1 Quadrant Figure 1	Units per Reel	Reel Size A (inches)	Reel Width W2 (mm)
49 bumps	GRA49A	12	8	Q1	1000/3500	7/13	18/18.4
Ordering Instruction for 1000 units/reel: no Suffix "X". Example: LMH0307GR Ordering Instruction for 3000 units/reel: use Suffix "X". Example: LMH0307GRX For smaller Value Pack (VP) please contact your local NSC representative							
<b>Package on Substrate (POS)</b>							
8 Ld	SE08A	12	8	Q1	250/3000	7/13	18/18.4
Ordering Instruction for 250 units/reel: use Suffix "E". Example: LM3218SEE Ordering Instruction for 3000 units/reel: use Suffix "X". Example: LM3218SEX							

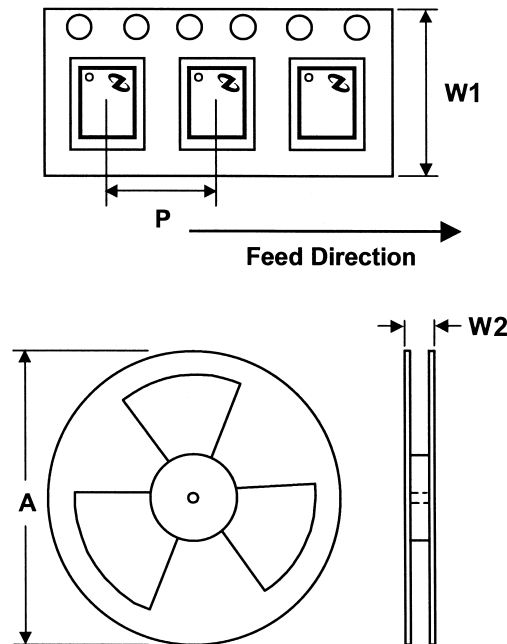
## 12 FBGA, TFBGA, UFBGA, LPGA and LTCC



Package Type Lead Count	MKT- Outline Drawing	Tape Size W1 (mm)	Pocket Pitch P(mm)	Pin 1 Quadrant Figure 1	Units per Reel	Reel Size A (inches)	Reel Width W2 (mm)
<b>FBGA</b>							
49 Bumps	SLC49A	16	12	Q1	2000	13	22.4
64 Bumps	SLC64A	16	12	Q1	2000	13	22.4
81 Bumps	SLC81A	16	12	Q1	2000	13	22.4
100 Bumps	SLC100A	24	16	Q1	1000	13	30.4
Standard Packing Option is Tray. For Tape & Reel Packing use Suffix 'X'. Example: SCANSTA111SMX							
<b>TFBGA</b>							
60 Bumps	SLF60A	16	8	Q2	2500	13	22.4
Standard Packing Option is Tray. For Tape & Reel Packing use Suffix 'X'. Example: LMX9830SMX							
<b>UFBGA</b>							
49 Bumps	SLH49A	12	8	Q1	1000/4500	7/13	18/18.4
Ordering Instruction for 1000 units/reel: No Suffix 'X'. Example: LM2502SM For 4500 units/reel use Suffix 'X'. Example: LM2502SMX							

Package Type Lead Count	MKT- Outline Drawing	Tape Size W1 (mm)	Pocket Pitch P(mm)	Pin 1 Quadrant <a href="#">Figure 1</a>	Units per Reel	Reel Size A (inches)	Reel Width W2 (mm)
<b>LBGA</b>							
196 Bumps	UJB196A	24	20	Q1	1000	13	30.4
Standard Packing Option is Tray. For Tape & Reel Packing use Suffix 'X'. Example: SCAN926260TUFX							
<b>LTCC</b>							
70 Bumps	SB70A	32	16	Q1	1000	13	38.4
Standard Packing Option is Tray. For Tape & Reel Packing use Suffix 'X'. Example: LMX9838SBX							

### 13 Laminated CSP, Laminate TCSP and LLP



Package Type Lead Count (Lead Pitch)	MKT- Outline Drawing	Tape Size W1 (mm)	Pocket Pitch P(mm)	Pin 1 Quadrant <a href="#">Figure 1</a>	Units per Reel	Reel Size A (inches)	Reel Width W2 (mm)
<b>Laminate CSP</b>							
16 Ld	SLB16A	12	8	Q1	2500	13	18.4
24 Ld	SLB24A	12	8	Q1	2500	13	18.4
28 Ld	SLB28A	12	8	Q1	250/2500	7/13	18/18.4
48 Ld	SLB48A	16	12	Q1	250/2500	7/13	22.4
Standard Packing Option is Tape & Reel with Suffix 'X'. Example: LMV2401SLBX							
<b>Laminate TCSP</b>							
20 Ld	SLE20A	12	8	Q1	2500	13	18.4
24 Ld	SLD24A	12	8	Q1	2500	13	18.4
	SLE24A						
32 Ld	SLD32A	12	8	Q1	1000/2500	7/13	18/18.4
Ordering Instruction for smaller quantities: no Suffix 'X'. Example: LP3936SL For larger quantities use Suffix 'X'. Example: LP3936SLX							
<b>Pullback LLP-Dual</b>							

Package Type Lead Count (Lead Pitch)	MKT- Outline Drawing	Tape Size W1 (mm)	Pocket Pitch P(mm)	Pin 1 Quadrant <a href="#">Figure 1</a>	Units per Reel	Reel Size A (inches)	Reel Width W2 (mm)
6 Ld	LDB06A	12	8	Q1	VP/1000/4500	7/13	18/18.4
	LDE06A						
	LDC06D						
	LEB06A						
8 Ld	LDA08A	12	8	Q1	VP/1000/4500	7/13	18/18.4
	LDC08A						
	LDA08B						
	LDA08C						
	YDA08A						
10 Ld	LDA10A	12	8	Q1	VP/1000/4500	7/13	18/18.4
	LDA10B						
14 Ld	LDA14A	12	8	Q1	VP/1000/4500	7/13	18/18.4
	LEE14A						
16 Ld	LDA16A	12	8	Q1	VP/1000/4500	7/13	18/18.4
Ordering Instruction for 1000 units/reel: no Suffix "X". Example: LMH6554LE Ordering Instruction for 4500 units/reel: use Suffix "X". Example: LMH6554LEX For smaller Value Pack (VP) please contact your local NSC representative							
<b>Pullback LLP-Quad</b>							
8 Ld	LQB08A	12	8	Q1	VP/1000/4500	7/13	18/18.4
16 Ld	LQA16A	12	8	Q1	VP/1000/4500	7/13	18/18.4
20 Ld	LQA20A	12	8	Q1	VP/1000/4500	7/13	18/18.4
24 Ld	LQA24A	12	8	Q1	VP/1000/4500	7/13	18/18.4
	YQA24A						
28 Ld	LQA28A	12	8	Q1	VP/1000/4500	7/13	18/18.4
32 Ld	LQA32A	16	12	Q1	250/2500	7/13	22.4
36 Ld	LQA36A	16	12	Q1	250/2500	7/13	22.4
44 Ld	LQA44A	16	12	Q1	250/2500	7/13	22.4
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56 Ld	LQA56A	16	12	Q1	2000	13	22.4
Standard Packing Option is Tray. For Tape & Reel Packing please contact your local NSC representative.							
<b>No Pullback LLP</b>							
6 Ld	LCA06B	12	8	Q1	VP/1000/4500	7/13	18/18.4
	SDB06A						
	SDE06A						
8 Ld	SDA08A	12	8	Q1	VP/1000/4500	7/13	18/18.4
	SDA08B						
	SDA08C						
	SDC08A						
	SDC08B						
10 Ld	SDA10A	12	8	Q1	VP/1000/4500	7/13	18/18.4
	SDC10A						
12 Ld	SDF12A	12	8	Q1	VP/1000/4500	7/13	18/18.4
14 Ld	SDA14A	12	8	Q1	VP/1000/4500	7/13	18/18.4
	SDA14B						
14 Ld	SRC14A	16	12	Q1	250/2500	7/13	22.4

Package Type Lead Count (Lead Pitch)	MKT- Outline Drawing	Tape Size W1 (mm)	Pocket Pitch P(mm)	Pin 1 Quadrant Figure 1	Units per Reel	Reel Size A (inches)	Reel Width W2 (mm)
16 Ld	SDA16A	12	8	Q1	VP/1000/4500	7/13	18/18.4
	SDA16B						
	SQA16A						
	SQB16A						
20 Ld	SPF20A	12	8	Q1	VP/1000/4500	7/13	18/18.4
24 Ld	SQA24A	12	8	Q1	VP/1000/4500	7/13	18/18.4
	SQA24B						
	SQA24C						
28 Ld	SPA28A	12	8	Q1	VP/1000/4500	7/13	18/18.4
	SQA28A						
32 Ld	SQA32A	12	8	Q1	VP/1000/4500	7/13	18/18.4
36 Ld	SQA36A	16	12	Q1	250/2500	7/13	22.4
40 Ld	SQF40A	12	8	Q1	1000/4500	7/13	18/18.4
	SNA40A	16	12	Q1	250/2500	7/13	22.4
	SQA40A	16	12	Q1	250/2500	7/13	22.4
	SQA40B	16	12	Q1	250/2500	7/13	22.4
48 Ld	SPA48A	16	12	Q1	250/2500	7/13	22.4
	SQA48A						
	SQA48D						
	SQF48A						
60 Ld	SQA60A	16	12	Q1	VP/1000/2500	7/13	14.4/22.4
64 Ld	SQA64A	16	12	Q1	250/2500	7/13	22.4
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