Note: The Land Pattern images are shown in the Nominal Density Level

Non-polarized Rectangular Chip Components

Chip Capacitor	Chip Resistor	Chip Inductor
Chip Varistor	Chip Thermistor	Chip Fuse
Chip Non-polarized Diode	Chip Filter	Chip Ferrite Bead

Chip Land Pattern Zero Rotation

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Polarized Rectangle Chip Components

Polarized Chip Capacitor	Chip Diode
Chip Antenna	Chip LED
Polarized Chip Capacitor and Antenna Land Pattern Zero Rotation	Chip Diode and LED Land Pattern Zero Rotation
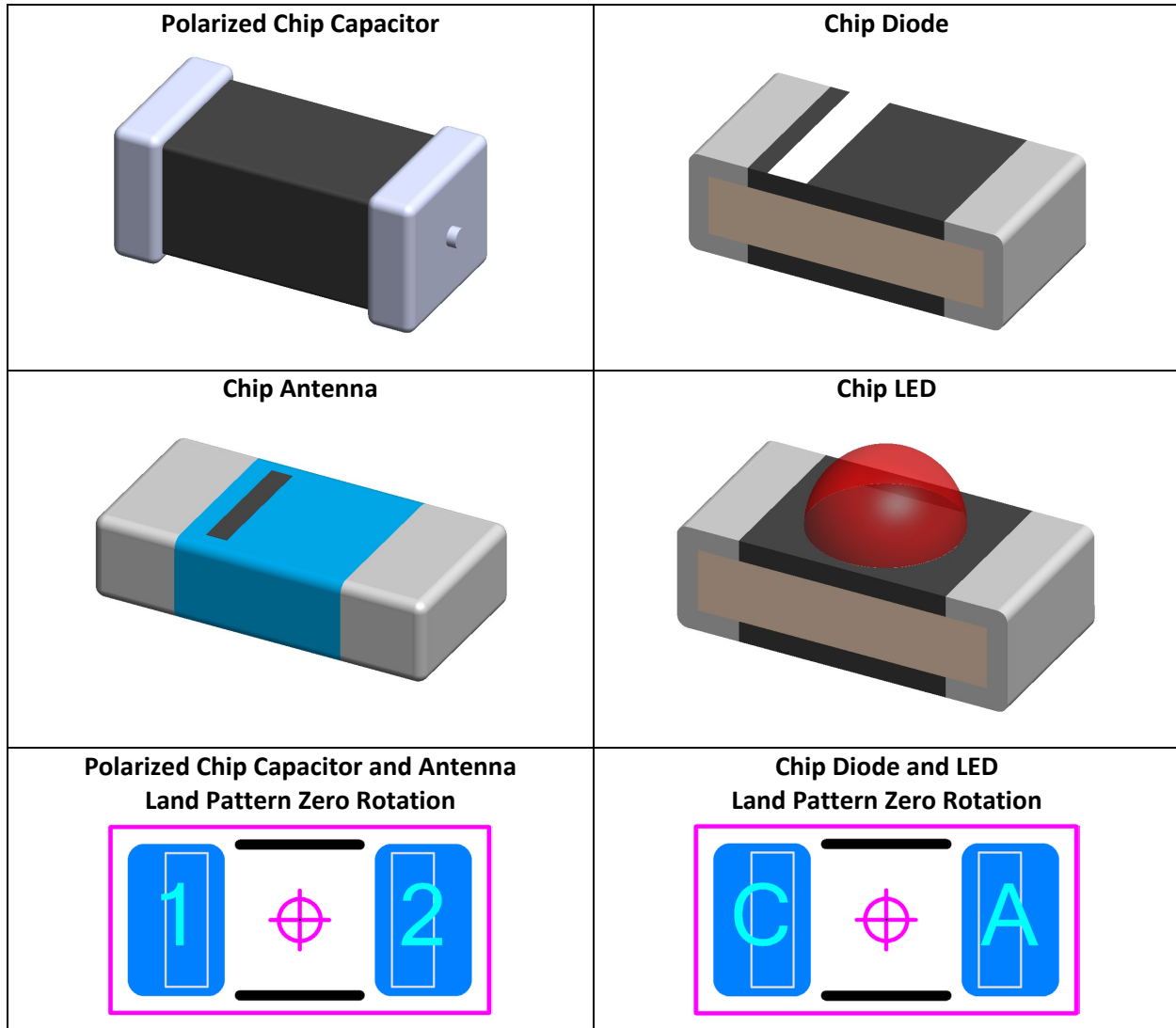
Rectangular Chip Components (unit: mm)

Chip Package Sizes	Rectangular End Cap	Least Density Level			
	Nominal Package Length	Toe	Heel	Side	Courtyard
2010 & Greater	Length > 4.75 mm	0.40	0.00	0.00	0.10
1812 & 1825	Length > 3.85 and <= 4.75 mm	0.30	0.00	0.00	0.10
1206, 1210 & 0612	Length > 2.85 and <= 3.85 mm	0.25	0.00	0.00	0.10
0603, 0705 & 0805	Length > 1.30 and <= 2.85 mm	0.20	0.00	0.00	0.10
0402, 0306 & 0502	Length > 0.75 and <= 1.30 mm	0.15	0.00	0.00	0.10
0201	Length > 0.50 and <= 0.75 mm	0.08	0.00	0.00	0.10
01005 & Less	Length <= 0.50 mm	0.04	0.00	0.00	0.10

Footprint Expert Surface Mount Families

Chip Package Sizes
2010 & Greater
1812 & 1825
1206, 1210 & 0612
0603, 0705 & 0805
0402, 0306 & 0502
0201
01005 & Less

Rectangular End Cap
Nominal Package Length
Length > 4.75 mm
Length > 3.85 and <= 4.75 mm
Length > 2.85 and <= 3.85 mm
Length > 1.30 and <= 2.85 mm
Length > 0.75 and <= 1.30 mm
Length > 0.50 and <= 0.75 mm
Length <= 0.50 mm

Nominal Density Level			
Toe	Heel	Side	Courtyard
0.50	0.00	0.00	0.20
0.40	0.00	0.00	0.20
0.35	0.00	0.00	0.20
0.30	0.00	0.00	0.20
0.20	0.00	0.00	0.15
0.10	0.00	0.00	0.15
0.05	0.00	0.00	0.15

Chip Package Sizes
2010 & Greater
1812 & 1825
1206, 1210 & 0612
0603, 0705 & 0805
0402, 0306 & 0502
0201
01005 & Less

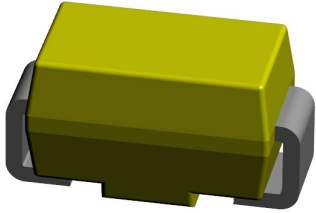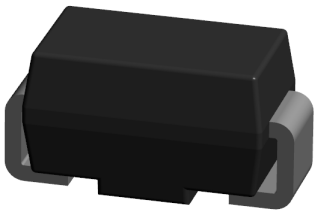| Rectangular End Cap |
|---|
| Nominal Package Length |
| Length > 4.75 mm |
| Length > 3.85 and <= 4.75 mm |
| Length > 2.85 and <= 3.85 mm |
| Length > 1.30 and <= 2.85 mm |
| Length > 0.75 and <= 1.30 mm |
| Length > 0.50 and <= 0.75 mm |
| Length <= 0.50 mm |
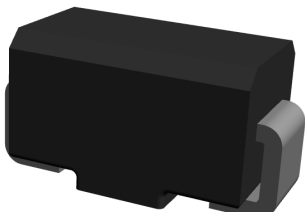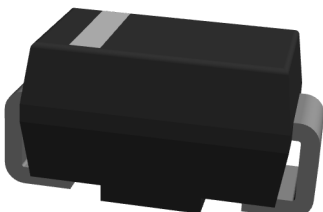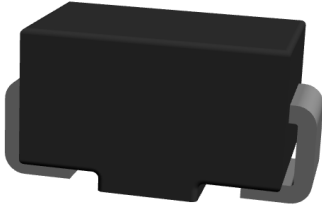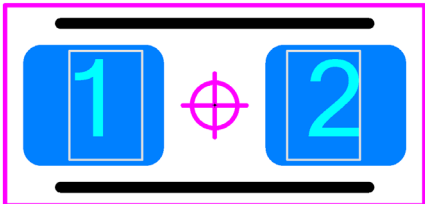
Most Density Level			
Toe	Heel	Side	Courtyard
0.60	0.00	0.05	0.40
0.50	0.00	0.05	0.40
0.45	0.00	0.05	0.40
0.40	0.00	0.05	0.40
0.25	0.00	0.00	0.20
0.12	0.00	0.00	0.20
0.06	0.00	0.00	0.20

Rectangular Chip Component Package Sizes
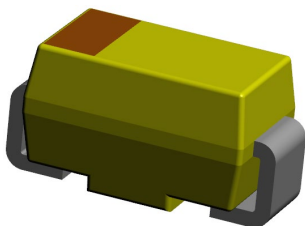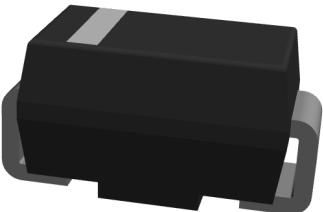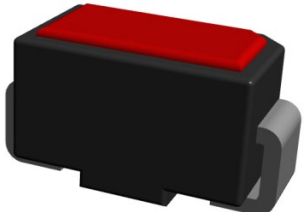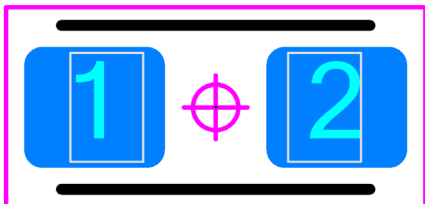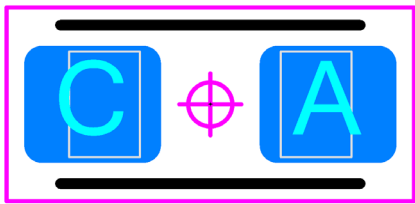
Table of Chip Package Size Codes and Dimensions			
EIA (inch) Name	Inch Dimensions	IEC (metric) Name	Metric Dimensions
01005	0.0157 in × 0.0079 in	0402	0.4 mm × 0.2 mm
0201	0.024 in × 0.012 in	0603	0.6 mm × 0.3 mm
0402	0.039 in × 0.020 in	1005	1.0 mm × 0.5 mm
0603	0.063 in × 0.031 in	1608	1.6 mm × 0.8 mm
0805	0.079 in × 0.049 in	2012	2.0 mm × 1.25 mm
1008	0.098 in × 0.079 in	2520	2.5 mm × 2.0 mm
1206	0.126 in × 0.063 in	3216	3.2 mm × 1.6 mm
1210	0.126 in × 0.098 in	3225	3.2 mm × 2.5 mm
1806	0.177 in × 0.063 in	4516	4.5 mm × 1.6 mm
1812	0.18 in × 0.13 in	4532	4.5 mm × 3.2 mm
2010	0.197 in × 0.098 in	5025	5.0 mm × 2.5 mm
2512	0.25 in × 0.13 in	6332	6.4 mm × 3.2 mm
2920	0.29 in × 0.20 in	7451	7.4 mm × 5.1 mm

Footprint Expert Surface Mount Families

Non-polarized Molded Body Inward Flat Ribbon Components

Molded Capacitors (CAPM)	Molded Non-polarized Diode (DIOMN)	Molded Fuses (FUSM)
Molded Body Inductor (INDM)	Molded Polarized Inductor (INDPM)	Molded Resistors (RESM)

Molded Body Land Pattern Zero Rotation

Polarized Molded Body Inward Flat Ribbon Components

Polarized Capacitor (CAPPM)	Molded Body Diode (DIOM)	Molded Body LED (LEDM)

Polarized Capacitor Land Pattern Zero Rotation

Diode and LED Land Pattern Zero Rotation

Footprint Expert Surface Mount Families

Inward Flat Ribbon L-Leads (unit: mm)

Inward Flat Ribbon L	Least Density Level			
Maximum Package Height	Toe	Heel	Side	Courtyard
Height > 4.20 mm	0.15	0.50	0.00	0.10
Height > 3.20 and <= 4.20 mm	0.10	0.45	0.00	0.10
Height > 2.20 and <= 3.20 mm	0.05	0.40	0.00	0.10
Height > 1.20 and <= 2.20 mm	0.00	0.35	0.00	0.10
Height <= 1.20 mm	0.00	0.30	0.00	0.10

Inward Flat Ribbon L	Nominal Density Level			
Maximum Package Height	Toe	Heel	Side	Courtyard
Height > 4.20 mm	0.20	0.60	0.00	0.20
Height > 3.20 and <= 4.20 mm	0.15	0.55	0.00	0.20
Height > 2.20 and <= 3.20 mm	0.10	0.50	0.00	0.20
Height > 1.20 and <= 2.20 mm	0.05	0.45	0.00	0.20
Height <= 1.20 mm	0.00	0.40	0.00	0.20

Inward Flat Ribbon L	Most Density Level			
Maximum Package Height	Toe	Heel	Side	Courtyard
Height > 4.20 mm	0.25	0.70	0.05	0.40
Height > 3.20 and <= 4.20 mm	0.20	0.65	0.05	0.40
Height > 2.20 and <= 3.20 mm	0.15	0.60	0.05	0.40
Height > 1.20 and <= 2.20 mm	0.10	0.55	0.05	0.40
Height <= 1.20 mm	0.05	0.50	0.05	0.40
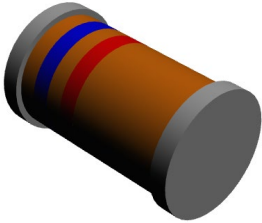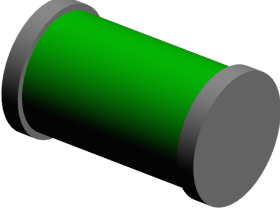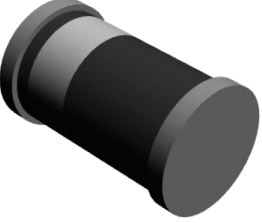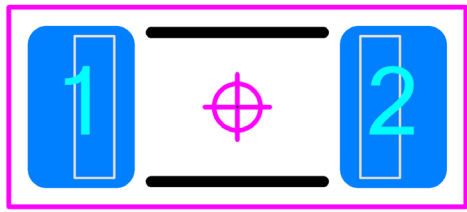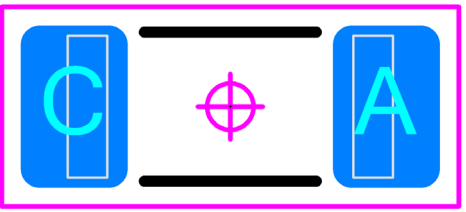
Common Molded Body Tantalum Capacitors			
EIA Size Code	Package Dimensions	KEMET Case Code	AVX Case Code
2012-12	2.0 mm × 1.3 mm × 1.2 mm	R	R
3216-10	3.2 mm × 1.6 mm × 1.0 mm	I	K
3216-12	3.2 mm × 1.6 mm × 1.2 mm	S	S
3216-18	3.2 mm × 1.6 mm × 1.8 mm	A	A
3528-12	3.5 mm × 2.8 mm × 1.2 mm	T	T
3528-21	3.5 mm × 2.8 mm × 2.1 mm	B	B
6032-15	6.0 mm × 3.2 mm × 1.5 mm	U	W
6032-28	6.0 mm × 3.2 mm × 2.8 mm	C	C
7260-38	7.3 mm × 6.0 mm × 3.8 mm	E	V
7343-20	7.3 mm × 4.3 mm × 2.0 mm	V	Y
7343-31	7.3 mm × 4.3 mm × 3.1 mm	D	D
7343-43	7.3 mm × 4.3 mm × 4.3 mm	X	E

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Common Molded Body Diodes		
JEDEC Standard	**Case Code**	**Package Dimensions**
DO-214AA	SMB	5.30 mm × 3.60 mm × 2.25 mm
DO-214AB	SMC	7.95 mm × 5.90 mm × 2.25 mm
DO-214AC	SMA	5.20 mm × 2.60 mm × 2.15 mm

Metal Electrode Leadless Face (MELF)

MELF Resistor (RESMELF)	MELF Fuse (FUSEMELF)	MELF Diode (DIOMELF)

Resistor and Fuse Land Pattern Zero Rotation	MELF Diode Land Pattern Zero Rotation

Metal Electrode Leadless Face (MELF) (unit: mm)

Lead Part	Most Density Level A	Nominal Density Level B	Least Density Level C
Toe (J_T)	0.60	0.40	0.20
Heel (J_H)	0.20	0.10	0.02
Side (J_S)	0.10	0.05	0.01
Round-off factor	Round off to the nearest two place decimal, i.e., 1.00, 1.01, 1.02, 1.03		
Courtyard excess	0.40	0.20	0.10

Common MELF Package Sizes		
Common Case Names	**Size Code**	**Package Dimensions**
MicroMelf (MMU)	0102	2.20 mm L X 1.10 mm Dia.
MiniMelf (MMA)	0204	3.60 mm L X 1.40 mm Dia.
Melf (MMB)	0207	5.80 mm L X 2.20 mm Dia.

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Small Outline Diode (SOD) with Gull-Wing Leads

Small Outline Diode (SOD)	SOD Land Pattern Zero Rotation
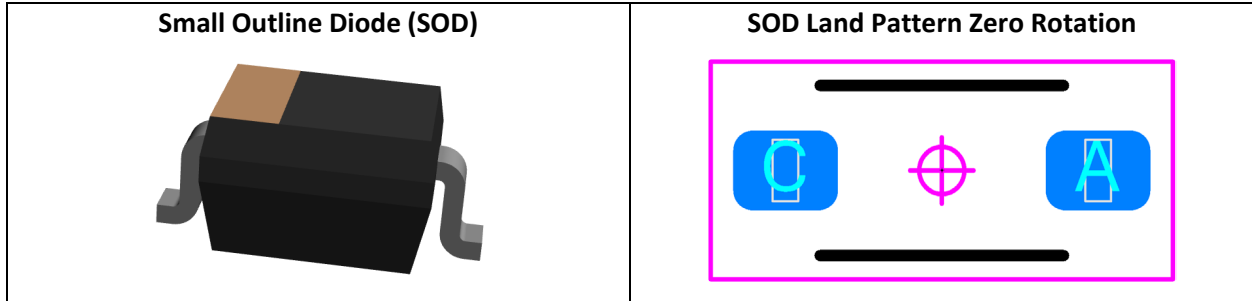
Flat Ribbon L and Gull-Wing Leads (unit: mm)

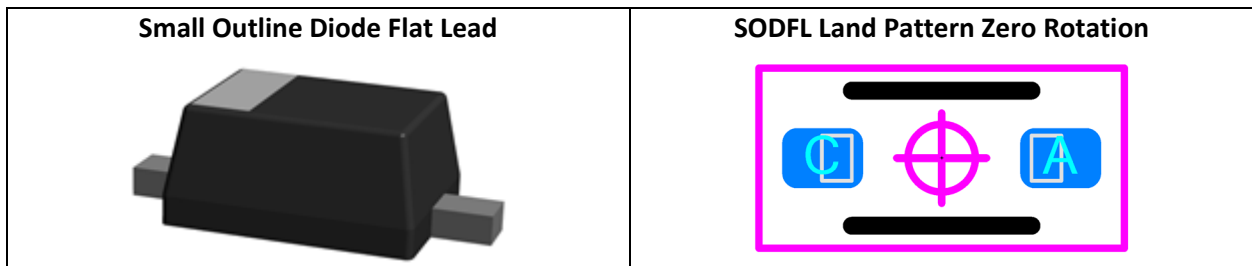| Lead Part	Most Density Level A	Nominal Density Level B	Least Density Level C
Toe (J_T)	0.30	0.25	0.20
Heel (J_H)[1]	0.40	0.35	0.30
Side (J_S)	0.07	0.06	0.05
Round-off factor	Round off to the nearest two place decimal, i.e., 1.00, 1.01, 1.02, 1.03		
Courtyard excess	0.40	0.20	0.10

Common Small Outline Diode (SOD) Sizes	
Case Code	Package Dimensions
SOD-123	3.68 mm × 1.17 mm × 1.60 mm
SOD-128	5.00 mm × 2.70 mm × 1.10 mm
SOD-323	1.70 mm × 1.25 mm × 0.95 mm
SOD-523	1.25 mm × 0.85 mm × 0.65 mm
SOD-723	1.40 mm × 0.60 mm × 0.59 mm

Small Outline Diode Flat Lead (SODFL)

Small Outline Diode Flat Lead	SODFL Land Pattern Zero Rotation

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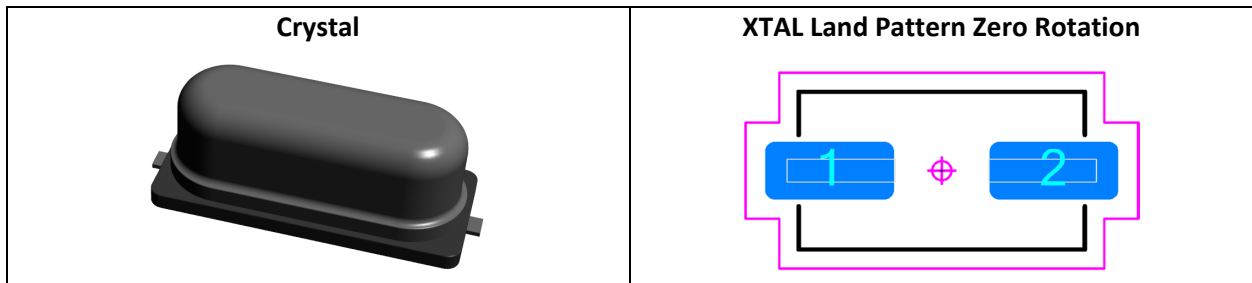Get updates at www.PCBLibraries.com/downloads
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Small Outline Diodes, Flat Lead (unit: mm)

Lead Part	Most Density Level A	Nominal Density Level B	Least Density Level C
Toe (J_T)	0.30	0.20	0.10
Heel (J_H)	0.00	0.00	0.00
Side (J_S)	0.05	0.00	0.00
Round-off factor	Round off to the nearest two place decimal, i.e., 1.00, 1.01, 1.02, 1.03		
Courtyard excess	0.40	0.20	0.10

Capacitor, Aluminum Electrolytic (CAPAE)

Aluminum Electrolytic Capacitor	CAPAE Land Pattern Zero Rotation

Crystals (XTAL)

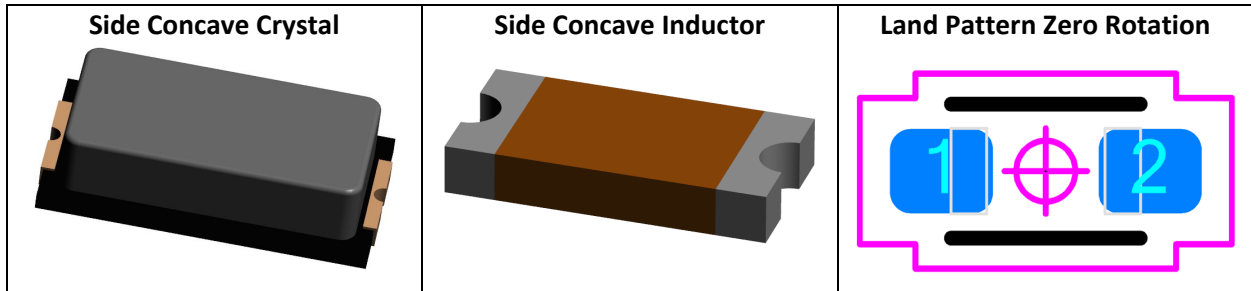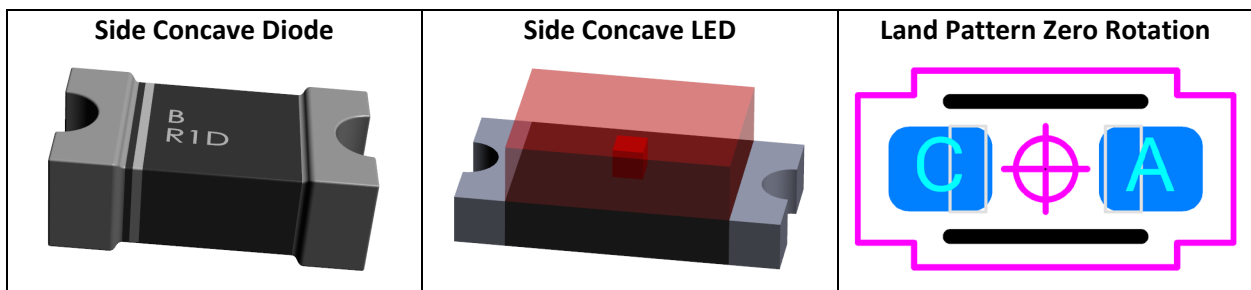| Crystal	XTAL Land Pattern Zero Rotation
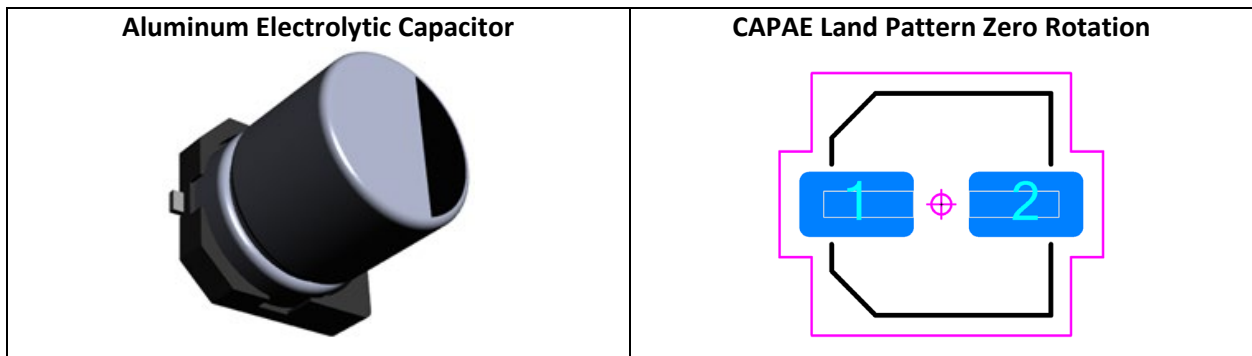
Electrolytic Aluminum Capacitor and Crystal (unit: mm)

Lead Part	Most Density Level A	Nominal Density Level B	Least Density Level C
Toe (J_T)	0.70	0.50	0.30
10.00 mm or higher	1.00	0.70	0.40
Heel (J_H)	0.05	0.00	0.00
10.00 mm or higher	0.10	0.00	0.00
Side (J_S)	0.50	0.40	0.30
10.00 mm or higher	0.60	0.50	0.40
Round-off factor	Round off to the nearest two place decimal, i.e., 1.00, 1.01, 1.02, 1.03		
Courtyard < 10.00 mm	0.40	0.20	0.10
Courtyard > 10.00 mm	0.80	0.40	0.20

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Non-polarized Side Concave Packages 2-pin

Side Concave Crystal	Side Concave Inductor	Land Pattern Zero Rotation

Polarized Side Concave Packages 2-pin

Side Concave Diode	Side Concave LED	Land Pattern Zero Rotation

Side Concave Terminal (unit: mm)

Lead Part	Most Density Level A	Nominal Density Level B	Least Density Level C
Toe (J_T)	0.45	0.35	0.25
Heel (J_H)	0.00	0.00	0.00
Side (J_S)	0.00	0.00	0.00
Round-off factor	Round off to the nearest two place decimal, i.e., 1.00, 1.01, 1.02, 1.03		
Courtyard excess	0.40	0.20	0.10

Non-polarized Dual Flat No-Lead (DFN) 2-pin

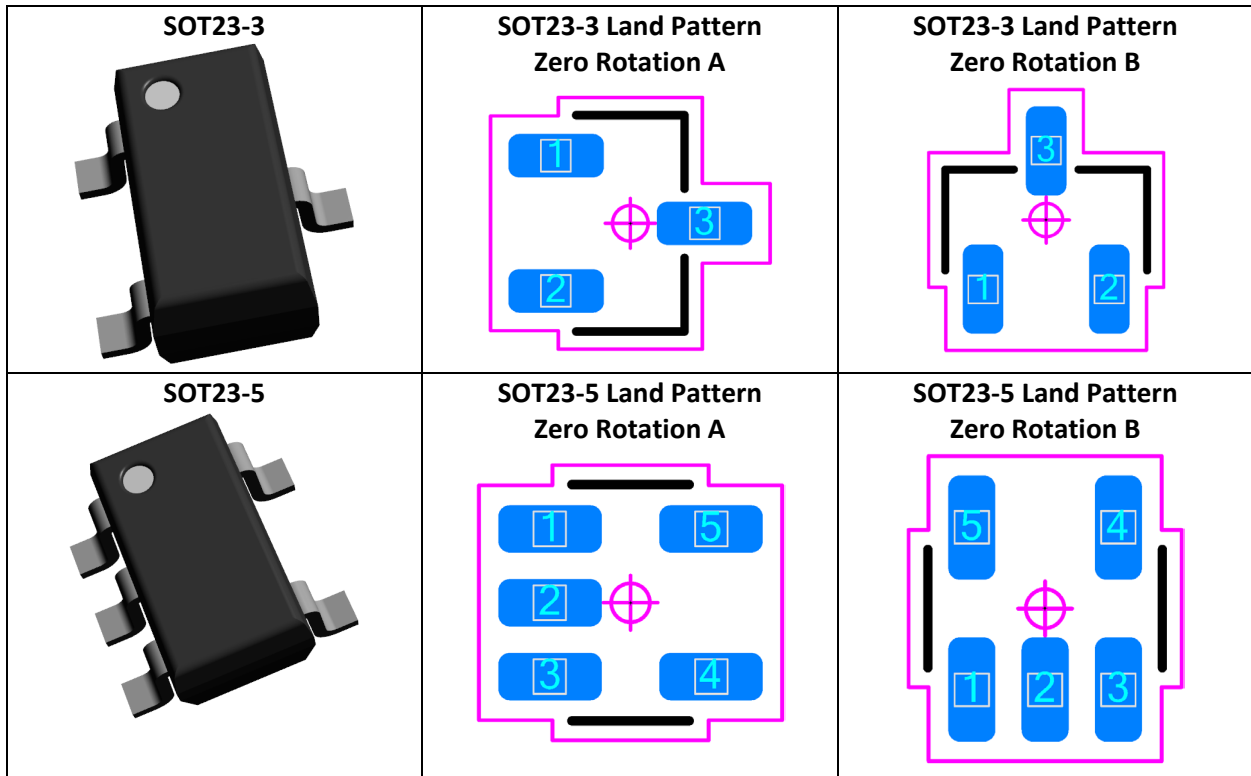| DFN Resistor, Inductor, Capacitor, Crystal, Fuse	Non-polarized DFN Land Pattern Zero Rotation

Polarized Dual Flat No-Lead (DFN) 2-pin

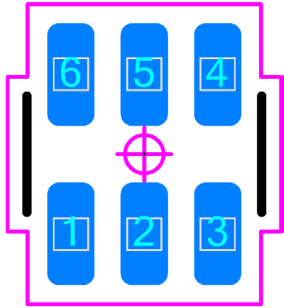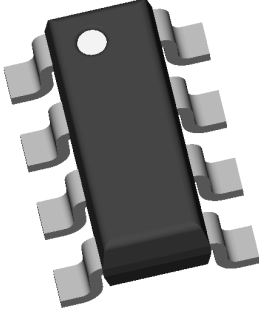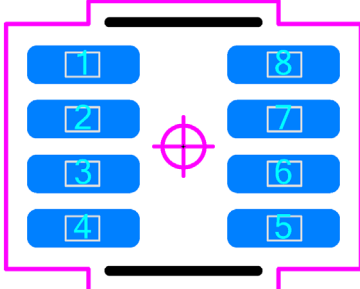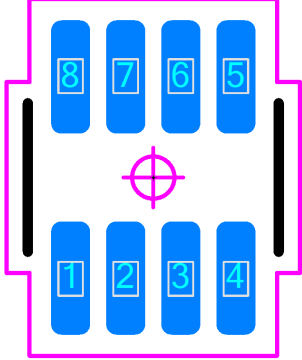| DFN Diode and LED	DFN Diode and LED Land Pattern Zero Rotation
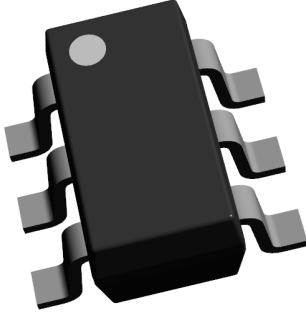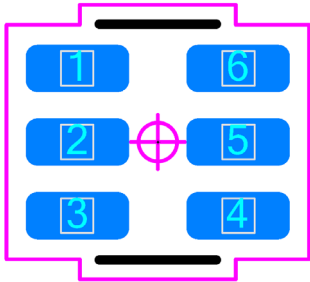
2-Pin Dual Flat No-Lead (DFN) (unit: mm)
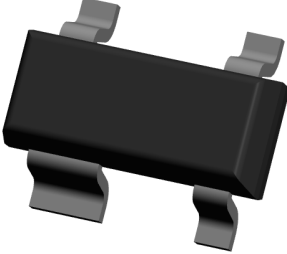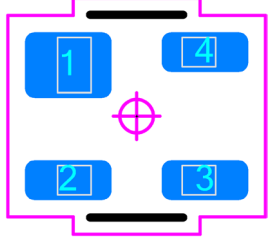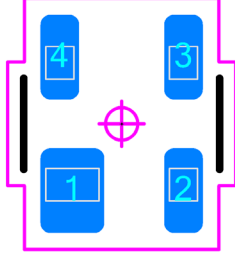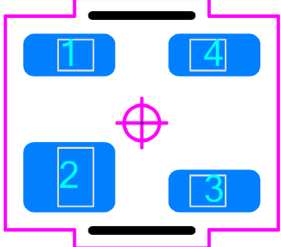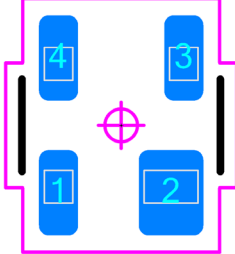
Lead Part	Most Density Level A	Nominal Density Level B	Least Density Level C
Periphery	0.05	0.00	0.00
Round-off factor	Round off to the nearest two place decimal, i.e., 1.00, 1.01, 1.02, 1.03		
Courtyard excess	0.40	0.20	0.10
Dual Flat No-Lead (DFN) Less than 1608 (0603)			
Periphery	0.00	0.00	0.00
Round-off factor	Round off to the nearest two place decimal, i.e., 1.00, 1.01, 1.02, 1.03		
Courtyard excess	0.20	0.15	0.10

Small Outline Transistor SOT23 (SOT)

SOT23-3	SOT23-3 Land Pattern Zero Rotation A	SOT23-3 Land Pattern Zero Rotation B
SOT23-5	SOT23-5 Land Pattern Zero Rotation A	SOT23-5 Land Pattern Zero Rotation B

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![PCB Libraries logo] **Footprint Expert Surface Mount Families**

SOT23-6	SOT23-6 Land Pattern Zero Rotation A	SOT23-6 Land Pattern Zero Rotation B
SOT23-8	SOT23-8 Land Pattern Zero Rotation A	SOT23-8 Land Pattern Zero Rotation B

Small Outline Transistor SOT143 (SOT)

SOT143	SOT143 Land Pattern Zero Rotation A	SOT143 Land Pattern Zero Rotation B
SOT143 Reverse	SOT143R Land Pattern Zero Rotation A	SOT143R Land Pattern Zero Rotation B

Footprint Expert Surface Mount Families

Small Outline Transistor SOT223-4 (SOT)

SOT223-4	SOT223-4 Land Pattern Zero Rotation A	SOT223-4 Land Pattern Zero Rotation B

Small Outline Transistor SOT223-5 (SOT)

SOT223-5	SOT223-5 Land Pattern Zero Rotation A	SOT223-5 Land Pattern Zero Rotation B

Small Outline Transistor SOT223-6 (SOT)

SOT223-6	SOT223-6 Land Pattern Zero Rotation A	SOT223-6 Land Pattern Zero Rotation B

Footprint Expert Surface Mount Families

SOT Flat Ribbon and Gull-Wing Leads (unit: mm)

SOT's	Least Density Level			
Terminal Lead Spacing	**Toe**	**Heel**	**Side**	**Courtyard**
Pitch > 1.92 mm	0.20	0.30	0.05	0.10
Pitch > 0.95 and <= 1.92 mm	0.15	0.20	0.04	0.10
Pitch > 0.65 and <= 0.95 mm	0.15	0.20	0.03	0.10
Pitch > 0.50 and <= 0.65 mm	0.10	0.15	0.01	0.10
Pitch > 0.40 and <= 0.50 mm	0.10	0.15	0.00	0.10
Pitch <= 0.40 mm	0.10	0.15	0.00	0.10

SOT's	Nominal Density Level			
Terminal Lead Spacing	**Toe**	**Heel**	**Side**	**Courtyard**
Pitch > 1.92 mm	0.25	0.35	0.06	0.20
Pitch > 0.95 and <= 1.92 mm	0.20	0.25	0.05	0.20
Pitch > 0.65 and <= 0.95 mm	0.20	0.25	0.04	0.20
Pitch > 0.50 and <= 0.65 mm	0.15	0.20	0.02	0.20
Pitch > 0.40 and <= 0.50 mm	0.15	0.20	0.00	0.20
Pitch <= 0.40 mm	0.15	0.20	0.00	0.20

SOT's	Most Density Level			
Terminal Lead Spacing	**Toe**	**Heel**	**Side**	**Courtyard**
Pitch > 1.92 mm	0.30	0.40	0.07	0.40
Pitch > 0.95 and <= 1.92 mm	0.25	0.30	0.06	0.40
Pitch > 0.65 and <= 0.95 mm	0.25	0.30	0.05	0.40
Pitch > 0.50 and <= 0.65 mm	0.20	0.25	0.03	0.40
Pitch > 0.40 and <= 0.50 mm	0.20	0.25	0.00	0.40
Pitch <= 0.40 mm	0.20	0.25	0.00	0.40

Small Outline Transistor SOT89 (SOT)

SOT89	SOT89 Land Pattern Zero Rotation A	SOT89 Land Pattern Zero Rotation B

Small Outline Flat Lead (SOFL)

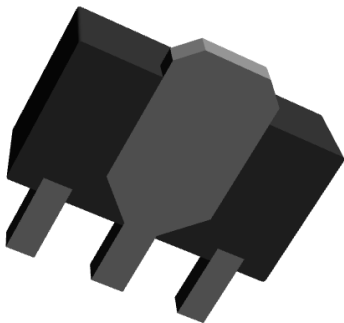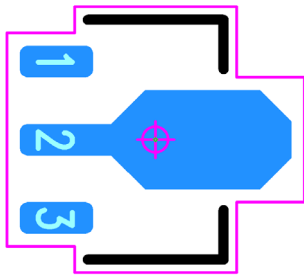| SOTFL 3-Pin	SOTFL 3-Pin Land Pattern Zero Rotation A	SOTFL 3-Pin Land Pattern Zero Rotation B
SOTFL 5-Pin	SOTFL 5-Pin Land Pattern Zero Rotation A	SOTFL 5-Pin Land Pattern Zero Rotation B
SOTFL 6-Pin	SOTFL 6-Pin Land Pattern Zero Rotation A	SOTFL 6-Pin Land Pattern Zero Rotation B
SOTFL 8-Pin	SOTFL 8-Pin Land Pattern Zero Rotation A	SOTFL 8-Pin Land Pattern Zero Rotation B

Small Outline Components, Flat Lead (unit: mm)

Lead Part	Most Density Level A	Nominal Density Level B	Least Density Level C
Toe (J_T)	0.30	0.20	0.10
Heel (J_H)	0.00	0.00	0.00
Side (J_S)	0.05	0.00	0.00
Round-off factor	Round off to the nearest two place decimal, i.e., 1.00, 1.01, 1.02, 1.03		
Courtyard excess	0.40	0.20	0.10

DPAK

DPAK Extended Thermal Tab	DPAK 3-Pin Land Pattern Zero Rotation A	DPAK 3-Pin Land Pattern Zero Rotation B
DPAK Under Body Thermal Tab	**DPAK Land Pattern Zero Rotation A**	**DPAK Land Pattern Zero Rotation B**

DPAK Flat Ribbon and Gull-Wing Leads (unit: mm)

DPAK's	Least Density Level			
Terminal Lead Spacing	Toe	Heel	Side	Courtyard
Pitch > 2.54 mm	0.35	0.40	0.15	0.10
Pitch > 2.29 and <= 2.54 mm	0.35	0.40	0.10	0.10
Pitch > 1.70 and <= 2.29 mm	0.25	0.40	0.05	0.10
Pitch > 1.27 and <= 1.70 mm	0.20	0.35	0.00	0.10
Pitch <= 1.27 mm	0.15	0.30	0.00	0.10

DPAK's	Nominal Density Level			
Terminal Lead Spacing	Toe	Heel	Side	Courtyard
Pitch > 2.54 mm	0.45	0.50	0.20	0.20
Pitch > 2.29 and <= 2.54 mm	0.45	0.50	0.15	0.20
Pitch > 1.70 and <= 2.29 mm	0.35	0.50	0.10	0.20
Pitch > 1.27 and <= 1.70 mm	0.30	0.45	0.05	0.20
Pitch <= 1.27 mm	0.25	0.40	0.05	0.20

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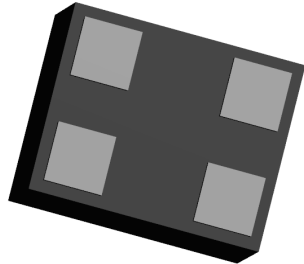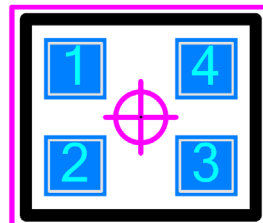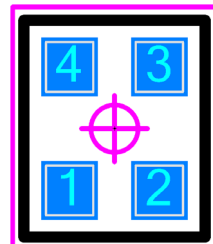
DPAK's	Most Density Level			
Terminal Lead Spacing	Toe	Heel	Side	Courtyard
Pitch > 2.54 mm	0.55	0.60	0.30	0.40
Pitch > 2.29 and <= 2.54 mm	0.55	0.60	0.25	0.40
Pitch > 1.70 and <= 2.29 mm	0.45	0.60	0.20	0.40
Pitch > 1.27 and <= 1.70 mm	0.40	0.55	0.10	0.40
Pitch <= 1.27 mm	0.35	0.50	0.10	0.40

Transistor, Dual Flat No-lead (TRXDFN)

Transistor DFN 3-Pin	DFN 3-Pin Land Pattern Zero Rotation A	DFN 3-Pin Land Pattern Zero Rotation B

Oscillator, Dual Flat No-lead (OSCDFN)

Oscillator DFN 4-Pin	DFN 4-Pin Land Pattern Zero Rotation A	DFN 4-Pin Land Pattern Zero Rotation B

Dual Flat No-lead (DFN) (unit: mm)

Lead Part	Most Density Level A	Nominal Density Level B	Least Density Level C
Periphery	0.05	0.00	0.00
Round-off factor	Round off to the nearest two place decimal, i.e., 1.00, 1.01, 1.02, 1.03		
Courtyard excess	0.40	0.20	0.10
Dual Flat No-Lead (DFN) Less than 1608 (0603)			
Periphery	0.00	0.00	0.00
Round-off factor	Round off to the nearest two place decimal, i.e., 1.00, 1.01, 1.02, 1.03		
Courtyard excess	0.20	0.15	0.10

Oscillator, J-Lead (OSCJ)

Oscillator J-Lead	Oscillator J-Lead Land Pattern Zero Rotation A	Oscillator J-Lead Land Pattern Zero Rotation B

J-Leads (unit: mm)

Lead Part	Most Density Level A	Nominal Density Level B	Least Density Level C
Heel (J_H) (to find Z dim)	0.55	0.35	0.15
Toe (J_T) (to find G dim)	0.10	0.00	0.00
Side (J_S)	0.05	0.03	0.01
Round-off factor	Round off to the nearest two place decimal, i.e., 1.00, 1.01, 1.02, 1.03		
Courtyard excess	0.40	0.20	0.10

Oscillator, L-Lead (OSCL)

Oscillator L-Lead	Oscillator L-Lead Land Pattern Zero Rotation A	Oscillator L-Lead Land Pattern Zero Rotation B

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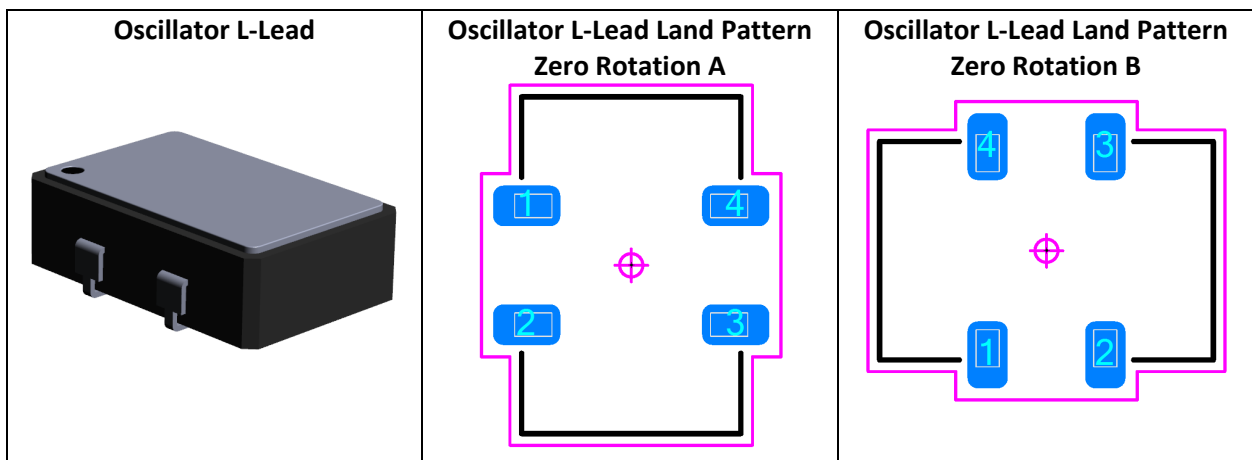
Oscillator Inward Flat Ribbon L Lead (unit: mm)

Lead Part	Most Density Level A	Nominal Density Level B	Least Density Level C
Toe (J_T) (to find G dim)	0.10	0.00	0.00
Heel (J_H) (to find Z dim)	0.60	0.50	0.40
Side (J_S)	0.07	0.06	0.05
Round-off factor	Round off to the nearest two place decimal, i.e., 1.00, 1.01, 1.02, 1.03		
Courtyard excess	0.40	0.20	0.10

Oscillator, Corner Concave (OSCCC)

Oscillator Corner Concave	Oscillator Corner Concave Land Pattern Zero Rotation A	Oscillator Corner Concave Land Pattern Zero Rotation B
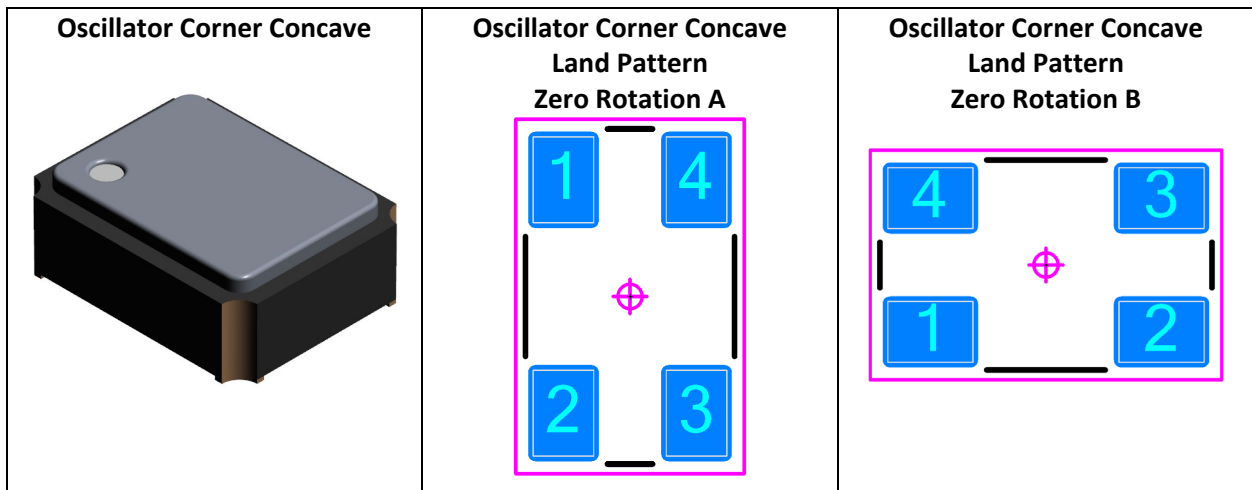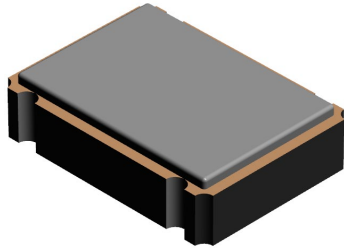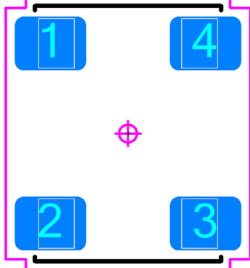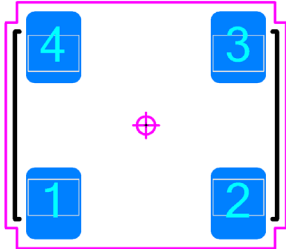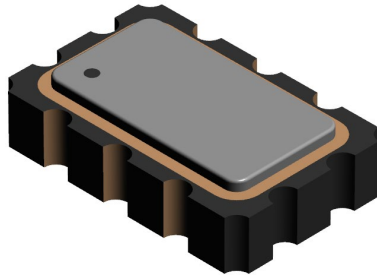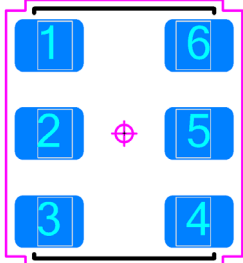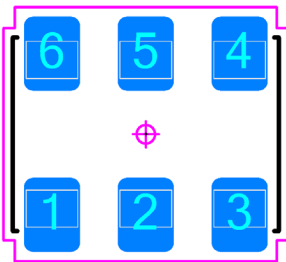
Corner Concave Component Oscillator Lead Package (unit: mm)

Lead Part	Most Density Level A	Nominal Density Level B	Least Density Level C
Outer Periphery[1]	0.20	0.15	0.10
Inner Periphery[2]	0.00	0.00	0.00
Round-off factor	Round off to the nearest two place decimal, i.e., 1.00, 1.01, 1.02, 1.03		
Courtyard excess	0.40	0.20	0.10
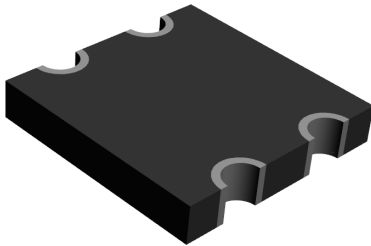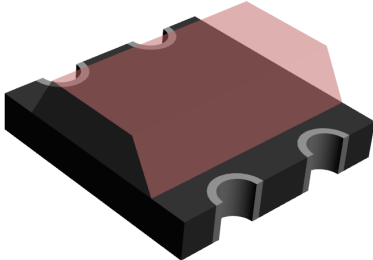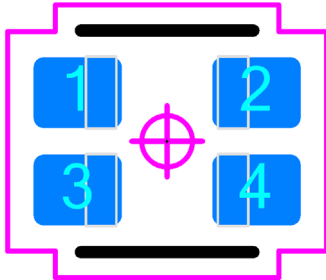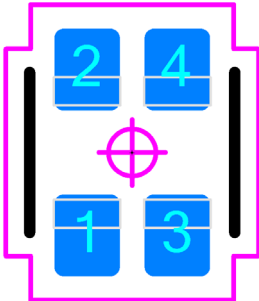
Note 1. The edge of the land associated with the outside of the component body.
Note 2. The edge of the land under the component body.

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Footprint Expert Surface Mount Families

Oscillator, Side Concave (OSCSC)

Oscillator Side Concave 4-Pin	Oscillator Side Concave 4-Pin Land Pattern Zero Rotation A	Oscillator Side Concave 4-Pin Land Pattern Zero Rotation B
Oscillator Side Concave 6-Pin	Oscillator Side Concave 6-Pin Land Pattern Zero Rotation A	Oscillator Side Concave 6-Pin Land Pattern Zero Rotation B

Side Concave (4-Pin) Diode and LED

Diode Side Concave 4-Pin	LED Side Concave 4-Pin
Diode Side Concave 4-Pin Land Pattern Zero Rotation A	LED Side Concave 4-Pin Land Pattern Zero Rotation B

Footprint Expert Surface Mount Families

Side Lead Flat, Concave and Convex Terminal (unit: mm)

Side Lead Terminal Lead Spacing	Least Density Level			
	Toe	Heel	Side	Courtyard
Pitch > 2.54 mm	0.45	0.02	0.00	0.10
Pitch > 1.27 and <= 2.54 mm	0.40	0.00	0.00	0.10
Pitch > 0.80 and <= 1.27 mm	0.35	0.00	0.00	0.10
Pitch > 0.65 and <= 0.80 mm	0.25	0.00	0.00	0.10
Pitch > 0.50 and <= 0.65 mm	0.20	0.00	0.00	0.10
Pitch > 0.40 and <= 0.50 mm	0.15	0.00	0.00	0.10
Pitch <= 0.40 mm	0.10	0.00	0.00	0.10

Side Lead Terminal Lead Spacing	Nominal Density Level			
	Toe	Heel	Side	Courtyard
Pitch > 2.54 mm	0.55	0.04	0.00	0.20
Pitch > 1.27 and <= 2.54 mm	0.50	0.02	0.00	0.20
Pitch > 0.80 and <= 1.27 mm	0.45	0.00	0.00	0.20
Pitch > 0.65 and <= 0.80 mm	0.35	0.00	0.00	0.20
Pitch > 0.50 and <= 0.65 mm	0.30	0.00	0.00	0.20
Pitch > 0.40 and <= 0.50 mm	0.25	0.00	0.00	0.20
Pitch <= 0.40 mm	0.20	0.00	0.00	0.20

Side Lead Terminal Lead Spacing	Most Density Level			
	Toe	Heel	Side	Courtyard
Pitch > 2.54 mm	0.65	0.06	0.01	0.40
Pitch > 1.27 and <= 2.54 mm	0.60	0.04	0.00	0.40
Pitch > 0.80 and <= 1.27 mm	0.55	0.02	0.00	0.40
Pitch > 0.65 and <= 0.80 mm	0.45	0.00	0.00	0.40
Pitch > 0.50 and <= 0.65 mm	0.40	0.00	0.00	0.40
Pitch > 0.40 and <= 0.50 mm	0.35	0.00	0.00	0.40
Pitch <= 0.40 mm	0.30	0.00	0.00	0.40

Small Outline IC (SOIC)

Small Outline IC	SOIC Land Pattern Zero Rotation A	SOIC Land Pattern Zero Rotation B

Small Outline IC (SOIC) with Thermal Tab

SOIC with Thermal Tab	SOIC with Tab Land Pattern Zero Rotation A	SOIC with Tab Land Pattern Zero Rotation B

Small Outline Package (SOP)

Small Outline Package	SOP Land Pattern Zero Rotation A	SOP Land Pattern Zero Rotation B

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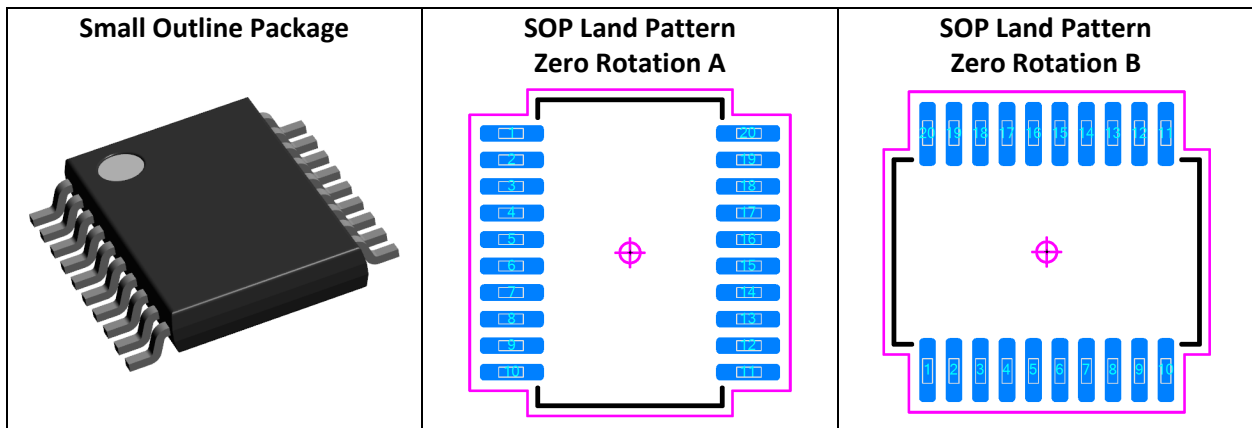
Small Outline Package (SOP) with Thermal Tab

SOP with Thermal Tab	SOP with Tab Land Pattern Zero Rotation A	SOP with Tab Land Pattern Zero Rotation B
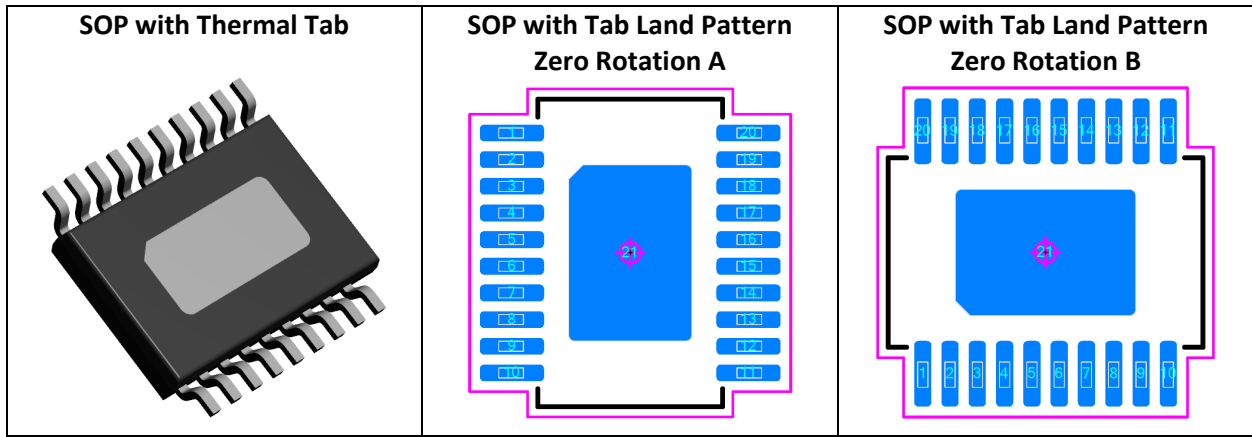
Ceramic Flat Package (CFP)

Ceramic Flat Pack	CFP Land Pattern Zero Rotation A	CFP Land Pattern Zero Rotation B
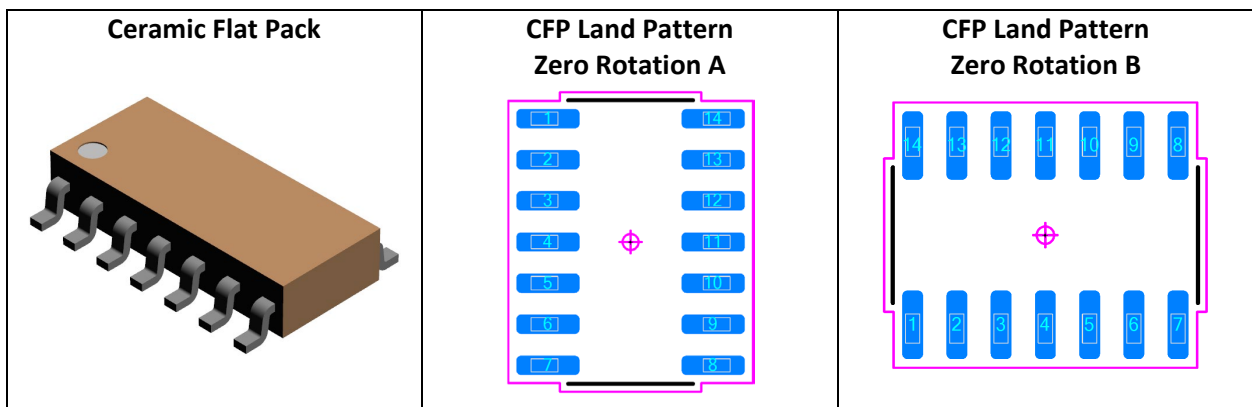
Quad Flat Package (QFP)

Quad Flat Package	QFP Land Pattern Zero Rotation A	QFP Land Pattern Zero Rotation B

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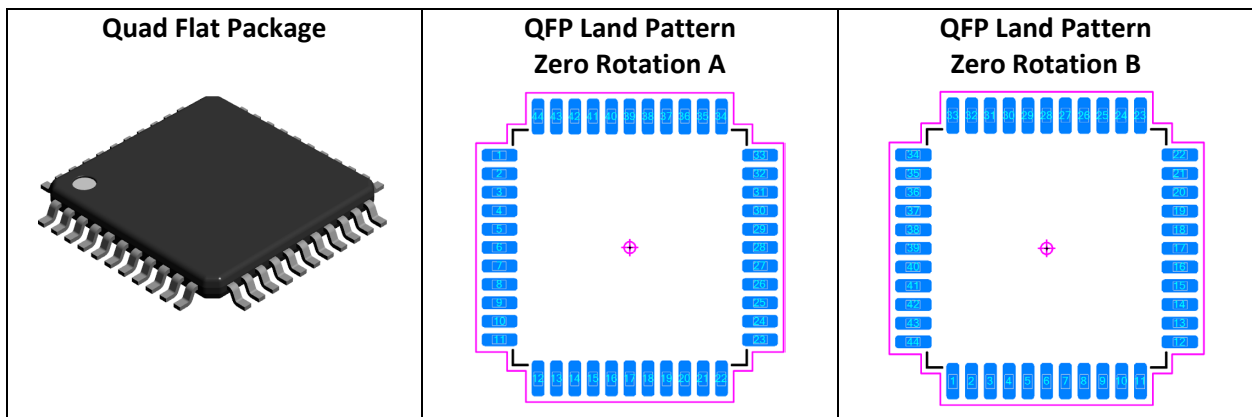
Quad Flat Package (QFP) with Thermal Tab

Quad Flat Package with Thermal Tab	QFP with Tab Land Pattern Zero Rotation A	QFP with Tab Land Pattern Zero Rotation B

Ceramic Quad Flat Package (CQFP)

Ceramic Quad Flat Pack	CQFP Land Pattern Zero Rotation A	CQFP Land Pattern Zero Rotation B

SOP / QFP Flat Ribbon L and Gull-Wing Leads (unit: mm)

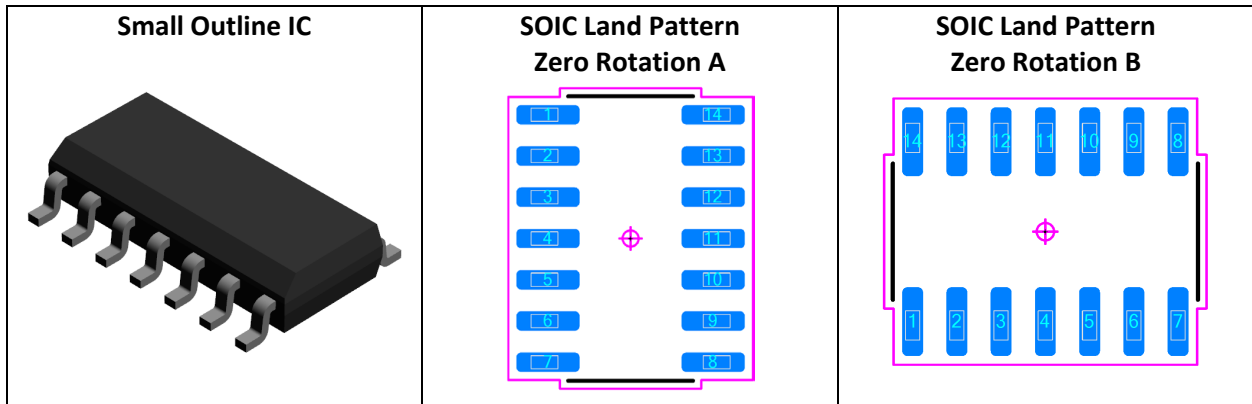| SOP / QFP	Least Density Level			
Terminal Lead Spacing	Toe	Heel	Side	Courtyard
Pitch > 1.00 mm	0.30	0.40	0.05	0.10
Pitch > 0.80 and <= 1.00 mm	0.25	0.35	0.04	0.10
Pitch > 0.65 and <= 0.80 mm	0.20	0.30	0.03	0.10
Pitch > 0.50 and <= 0.65 mm	0.15	0.25	0.01	0.10
Pitch > 0.40 and <= 0.50 mm	0.10	0.20	0.00	0.10
Pitch <= 0.40 mm	0.10	0.20	0.00	0.10

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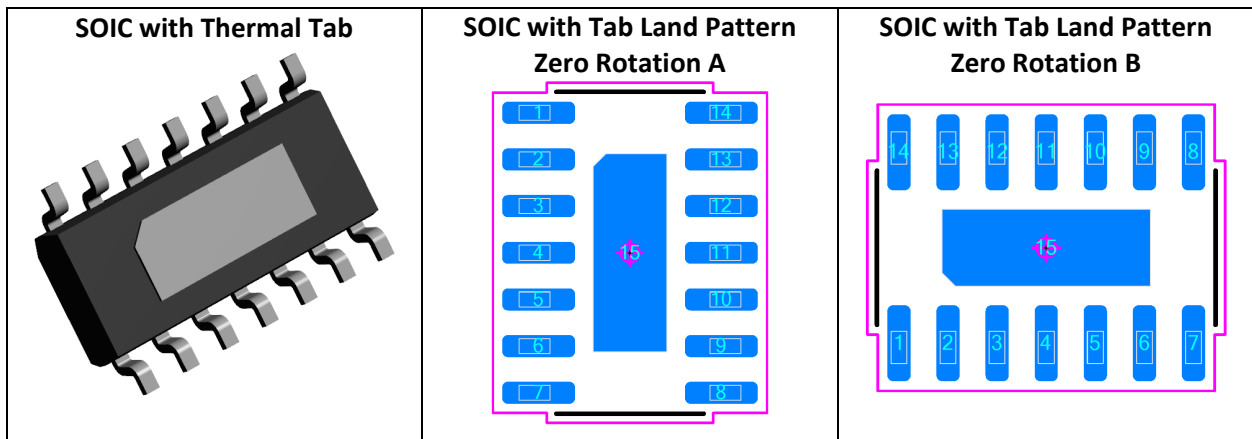| SOP / QFP	Nominal Density Level			
Terminal Lead Spacing	Toe	Heel	Side	Courtyard
Pitch > 1.00 mm	0.35	0.45	0.06	0.20
Pitch > 0.80 and <= 1.00 mm	0.30	0.40	0.05	0.20
Pitch > 0.65 and <= 0.80 mm	0.25	0.35	0.04	0.20
Pitch > 0.50 and <= 0.65 mm	0.20	0.30	0.02	0.20
Pitch > 0.40 and <= 0.50 mm	0.15	0.25	0.00	0.20
Pitch <= 0.40 mm	0.15	0.25	0.00	0.20

SOP / QFP	Most Density Level			
Terminal Lead Spacing	Toe	Heel	Side	Courtyard
Pitch > 1.00 mm	0.40	0.50	0.07	0.40
Pitch > 0.80 and <= 1.00 mm	0.35	0.45	0.06	0.40
Pitch > 0.65 and <= 0.80 mm	0.30	0.40	0.05	0.40
Pitch > 0.50 and <= 0.65 mm	0.25	0.35	0.03	0.40
Pitch > 0.40 and <= 0.50 mm	0.20	0.30	0.00	0.40
Pitch <= 0.40 mm	0.20	0.30	0.00	0.40

Small Outline J-Lead (SOJ)

Small Outline J-Lead	SOJ Land Pattern Zero Rotation A	SOJ Land Pattern Zero Rotation B

Plastic Leaded Chip Carrier (PLCC)

Plastic Leaded Chip Carrier	PLCC Land Pattern Zero Rotation A	PLCC Land Pattern Zero Rotation B

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Footprint Expert Surface Mount Families

Small Outline J-Lead (unit: mm)

Lead Part	Most Density Level A	Nominal Density Level B	Least Density Level C
Heel (J_H) (to find Z dim)	0.55	0.35	0.15
Toe (J_T) (to find G dim)	0.10	0.00	0.00
Side (J_S)	0.05	0.03	0.01
Round-off factor	Round off to the nearest two place decimal, i.e., 1.00, 1.01, 1.02, 1.03		
Courtyard excess	0.40	0.20	0.10

Small Outline L-Lead (SOL)

Small Outline L-Lead

SOL Land Pattern Zero Rotation A

SOL Land Pattern Zero Rotation B
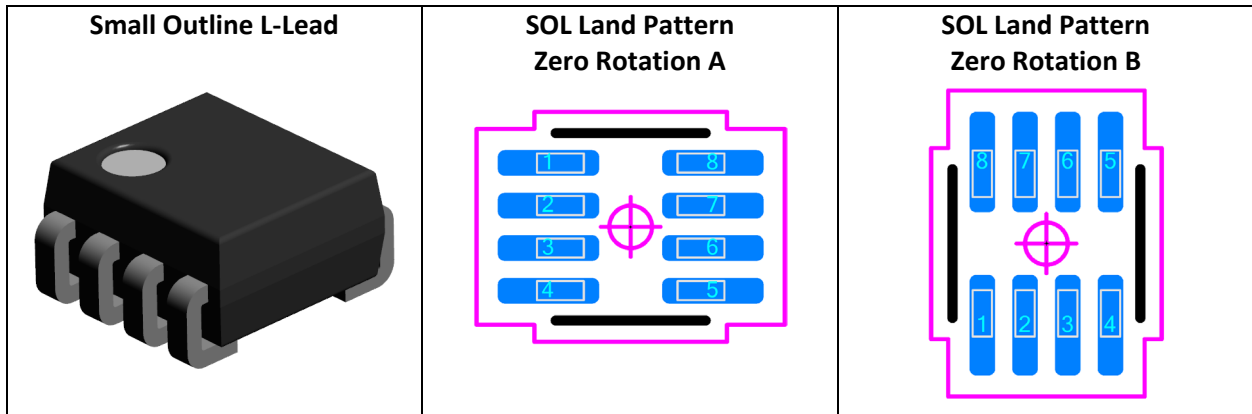
Small Outline Inward L-Lead (SOL) (unit: mm)

Inward L				
Terminal Lead Spacing				
Pitch > 1.00 mm				
Pitch > 0.80 and <= 1.00 mm				
Pitch > 0.65 and <= 0.80 mm				
Pitch > 0.50 and <= 0.65 mm				
Pitch > 0.40 and <= 0.50 mm				
Pitch <= 0.40 mm				

Least Density Level			
Toe	Heel	Side	Courtyard
0.00	0.40	0.05	0.10
0.00	0.35	0.04	0.10
0.00	0.30	0.03	0.10
0.00	0.25	0.01	0.10
0.00	0.20	0.00	0.10
0.00	0.15	0.00	0.10

Inward L				
Terminal Lead Spacing				
Pitch > 1.00 mm				
Pitch > 0.80 and <= 1.00 mm				
Pitch > 0.65 and <= 0.80 mm				
Pitch > 0.50 and <= 0.65 mm				
Pitch > 0.40 and <= 0.50 mm				
Pitch <= 0.40 mm				

Nominal Density Level			
Toe	Heel	Side	Courtyard
0.00	0.50	0.06	0.20
0.00	0.45	0.05	0.20
0.00	0.40	0.04	0.20
0.00	0.35	0.02	0.20
0.00	0.30	0.00	0.20
0.00	0.25	0.00	0.20

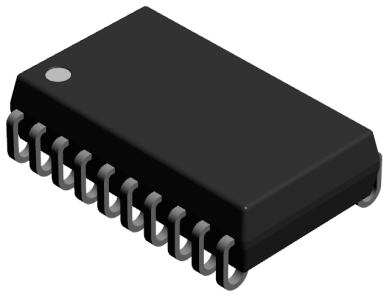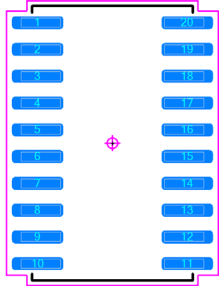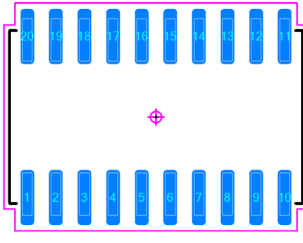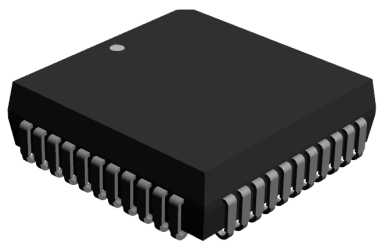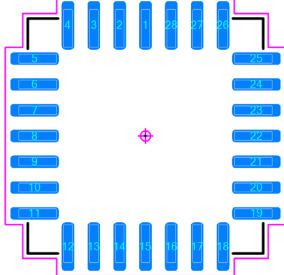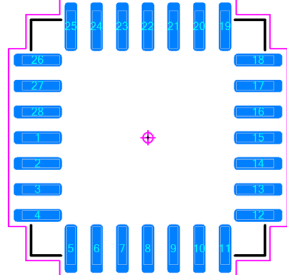| Inward L	Most Density Level			
Terminal Lead Spacing	Toe	Heel	Side	Courtyard
Pitch > 1.00 mm	0.10	0.60	0.07	0.40
Pitch > 0.80 and <= 1.00 mm	0.10	0.55	0.06	0.40
Pitch > 0.65 and <= 0.80 mm	0.10	0.50	0.05	0.40
Pitch > 0.50 and <= 0.65 mm	0.10	0.45	0.03	0.40
Pitch > 0.40 and <= 0.50 mm	0.10	0.40	0.00	0.40
Pitch <= 0.40 mm	0.10	0.35	0.00	0.40

Ball Grid Array, Collapsing Ball (BGA)

Collapsing Ball Grid Array — BGA Land Pattern Zero Rotation A — BGA Land Pattern Zero Rotation B
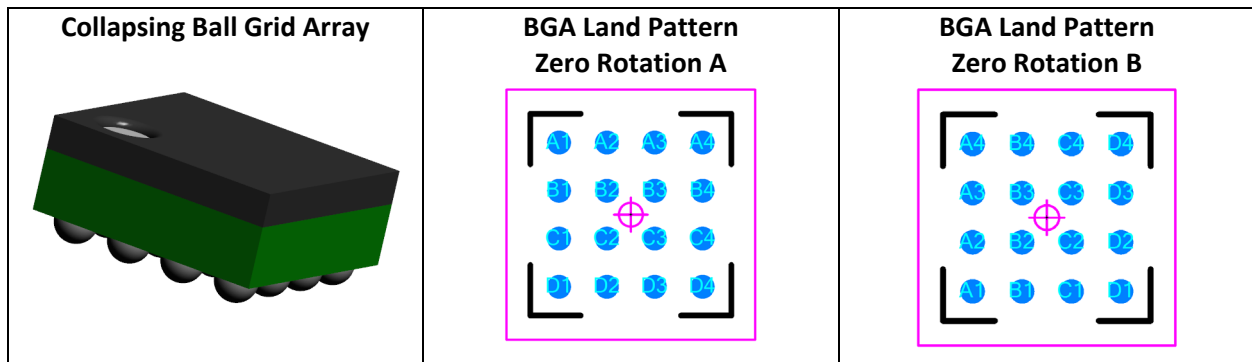
Collapsing Ball Grid Array (BGA) (unit: mm)

Collapsing Ball Grid Array (BGA)				
Nominal Ball Diameter	Ball Size Reduction	Finished Land Diameter	Density Level	Courtyard
0.75	15%	0.65	A	1.00
0.65	15%	0.55	A	1.00
0.60	15%	0.50	A	1.00
0.55	15%	0.47	A	1.00
0.50	10%	0.45	B	0.50
0.45	10%	0.40	B	0.50
0.40	10%	0.36	B	0.50
0.35	10%	0.32	B	0.50
0.30	10%	0.27	B	0.50
0.25	10%	0.23	B	0.50
0.20	0%	0.20	C	0.25
0.17	0%	0.17	C	0.25
0.15	0%	0.15	C	0.25

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Ball Grid Array, Non-collapsing Ball (BGAN)

Non-collapsing Ball Grid Array	BGAN Land Pattern Zero Rotation A	BGAN Land Pattern Zero Rotation B
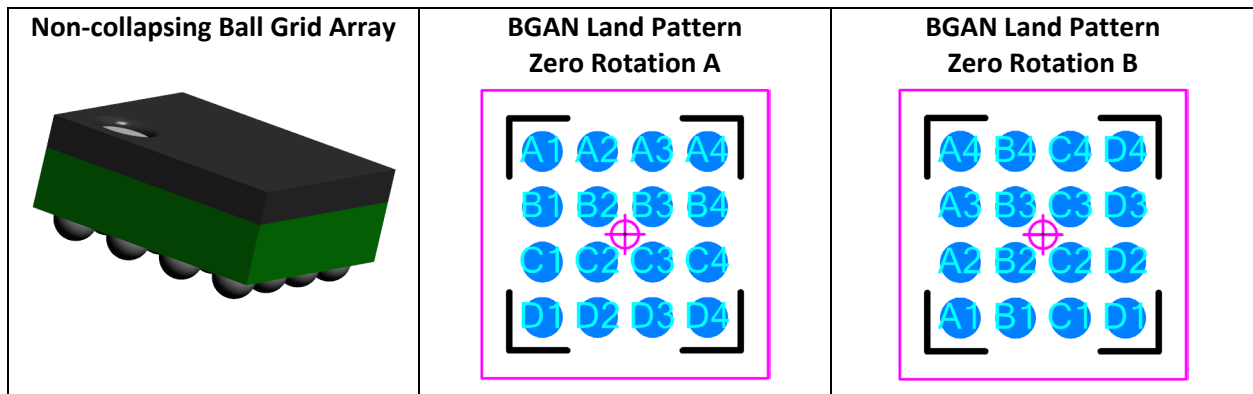
Non-collapsing Ball Grid Array (BGAN) (unit: mm)

Non-collapsing Ball Grid Array (BGAN)				
Nominal Ball Diameter	Ball Size Increase	Finished Land Diameter	Density Level	Courtyard
0.75	20%	0.90	A	1.00
0.65	20%	0.78	A	1.00
0.60	20%	0.72	A	1.00
0.55	20%	0.66	A	1.00
0.50	15%	0.58	B	0.50
0.45	15%	0.52	B	0.50
0.40	15%	0.46	B	0.50
0.35	15%	0.40	B	0.50
0.30	15%	0.35	B	0.50
0.25	15%	0.29	B	0.50
0.20	10%	0.22	C	0.25
0.17	10%	0.19	C	0.25
0.15	10%	0.17	C	0.25

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Column Grid Array (CGA)

Column Grid Array	CGA Land Pattern Zero Rotation A	CGA Land Pattern Zero Rotation B
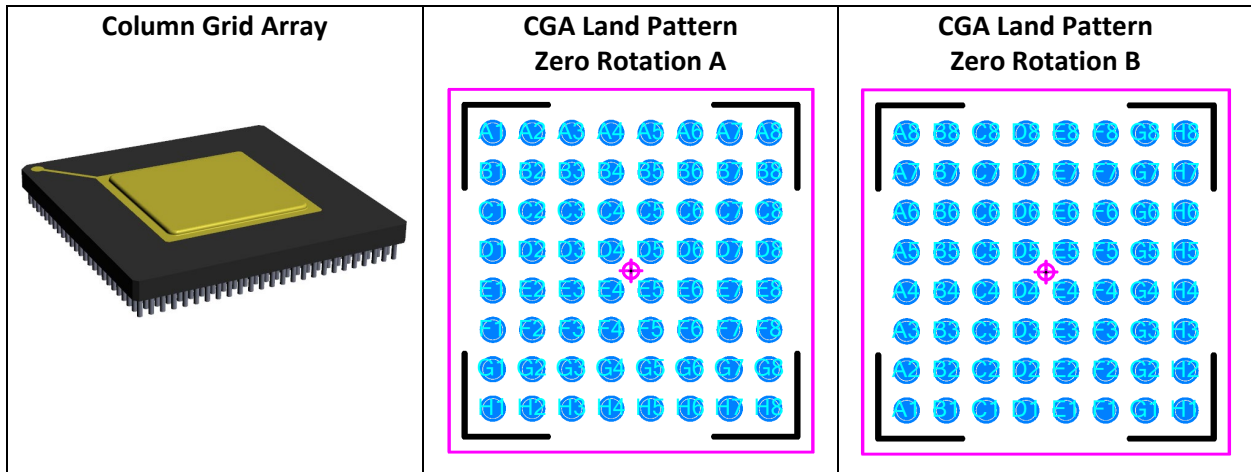
Column Grid Array (CGA)

Lead Part	Most Density Level A	Nominal Density Level B	Least Density Level C
Periphery	0.15	0.10	0.05
Round-off factor	Round off to the nearest two place decimal, i.e., 1.00, 1.01, 1.02, 1.03		
Courtyard excess	1.50	1.00	0.50

Small Outline No-lead (SON)

Small Outline No-lead	SON Land Pattern Zero Rotation A	SON Land Pattern Zero Rotation B

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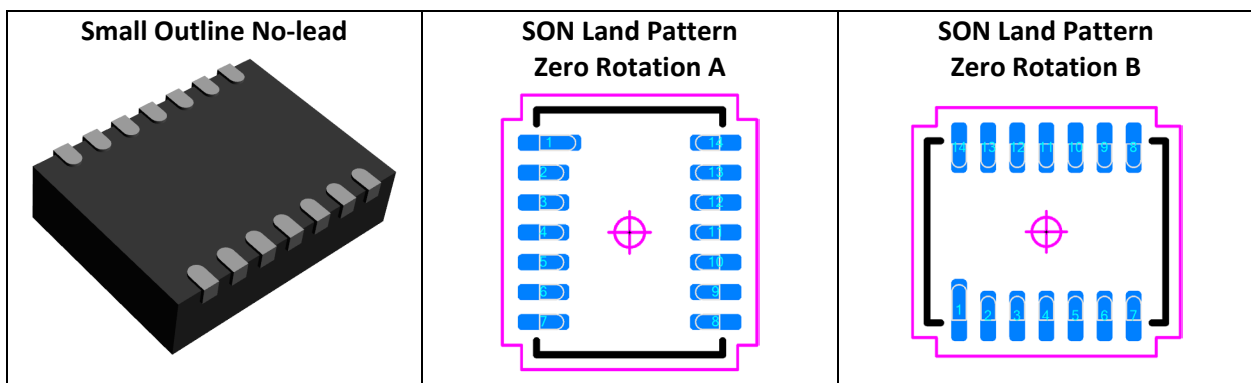
Small Outline No-lead (SON) with Thermal Tab

SON with Thermal Tab	SON with Tab Land Pattern Zero Rotation A	SON with Tab Land Pattern Zero Rotation B
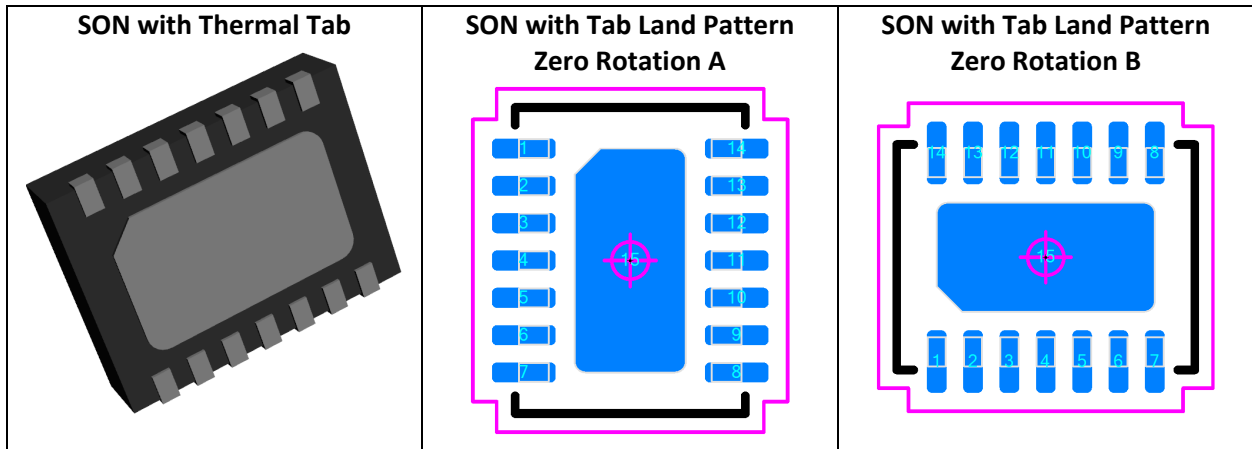
Quad Flat No-lead (QFN)

Quad Flat No-lead	QFN Land Pattern Zero Rotation A	QFN Land Pattern Zero Rotation B
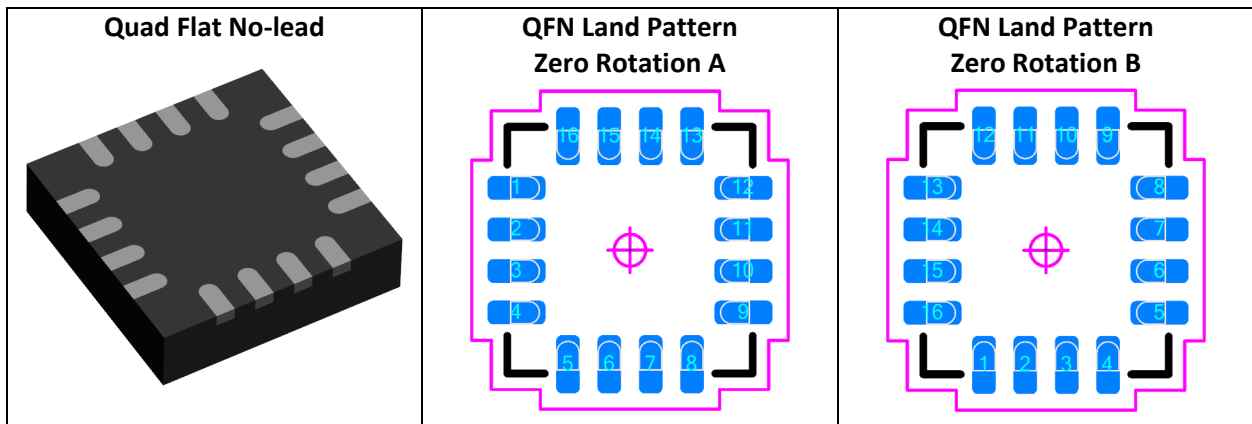
Quad Flat No-lead (QFN) with Thermal Tab

QFN with Thermal Tab	QFN with Tab Land Pattern Zero Rotation A	QFN with Tab Land Pattern Zero Rotation B

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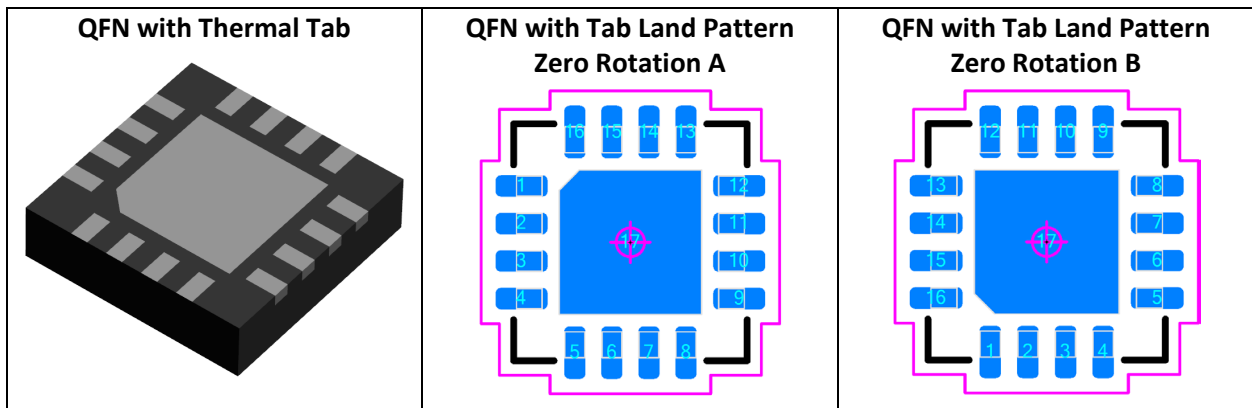
Small Outline No-Lead and Quad Flat No-Lead (unit: mm)

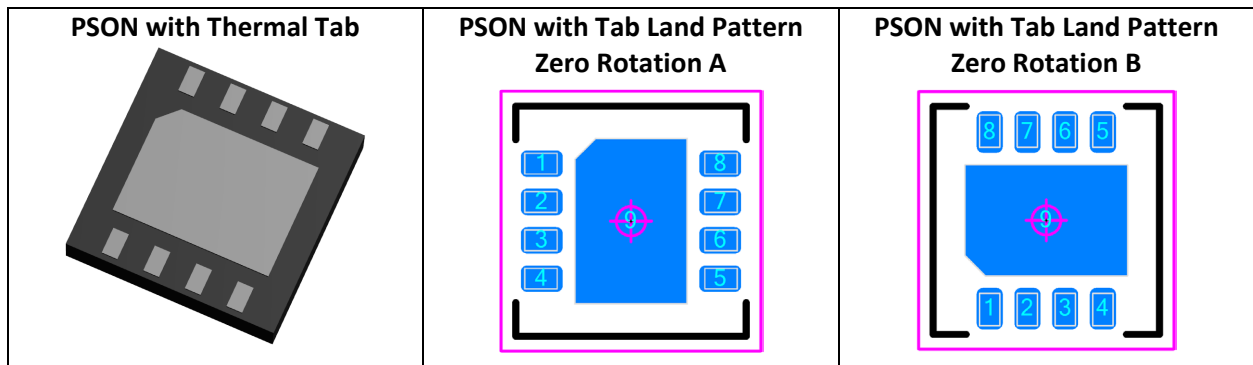| Lead Part	Most Density Level A	Nominal Density Level B	Least Density Level C
Toe (J_T)	0.30	0.20	0.10
Heel (J_H)	0.00	0.00	0.00
Side (J_S)	0.00	0.00	0.00
Round-off factor	Round off to the nearest two place decimal, i.e., 1.00, 1.01, 1.02, 1.03		
Courtyard excess	0.40	0.20	0.10

Pull-back Small Outline No-lead (PSON)

Pull-back Small Outline No-lead	PSON Land Pattern Zero Rotation A	PSON Land Pattern Zero Rotation B
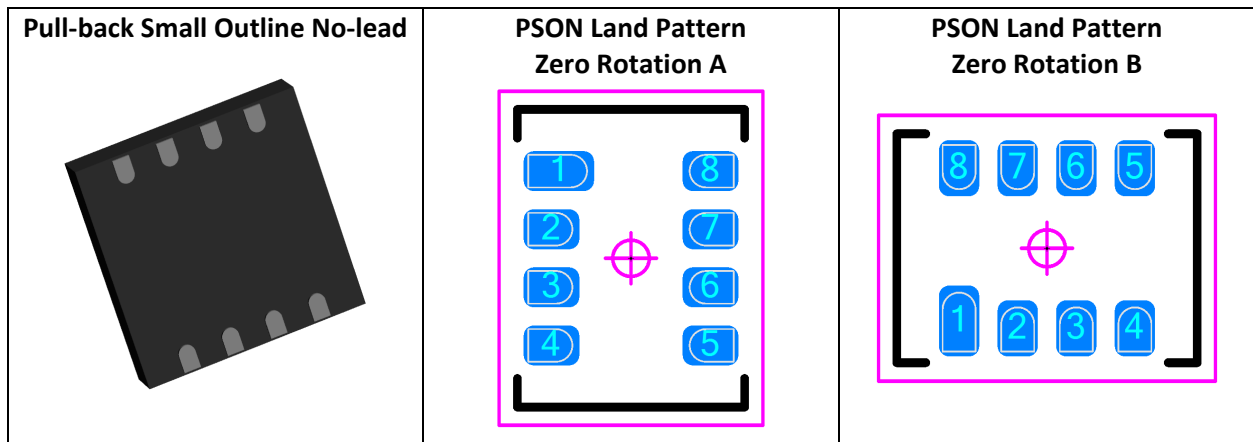
Pull-back Small Outline No-lead (PSON) with Thermal Tab

PSON with Thermal Tab	PSON with Tab Land Pattern Zero Rotation A	PSON with Tab Land Pattern Zero Rotation B

Pull-back Quad Flat No-lead (PQFN)

Pull-back Quad Flat No-Lead	PQFN Land Pattern Zero Rotation A	PQFN Land Pattern Zero Rotation B

Pull-back Quad Flat No-lead (PQFN) with Thermal Tab

PQFN with Thermal Tab	PQFN with Tab Land Pattern Zero Rotation A	PQFN with Tab Land Pattern Zero Rotation B
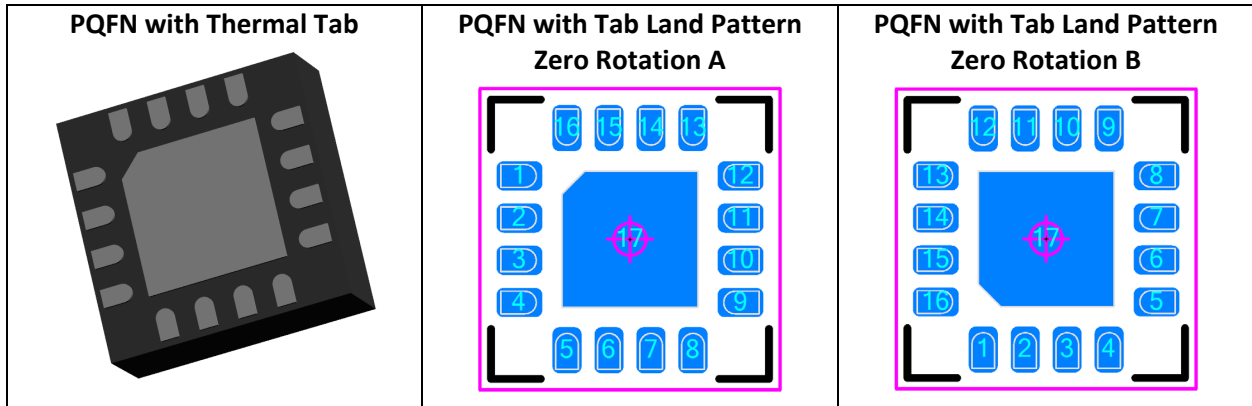
Small Outline No-Lead and Quad Flat No-Lead with Pullback (unit: mm)

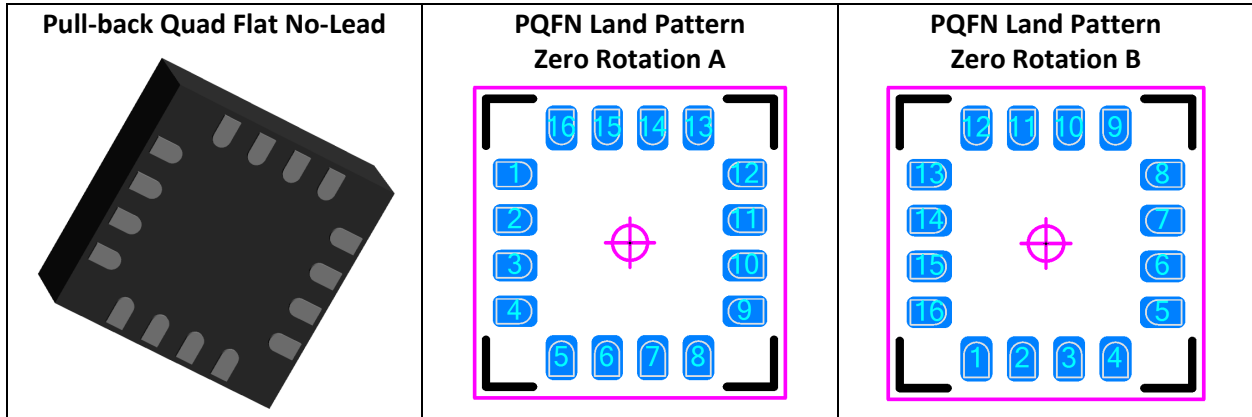| Lead Part	Most Density Level A	Nominal Density Level B	Least Density Level C
Periphery	0.05	0.00	0.00
Round-off factor	Round off to the nearest two place decimal, i.e., 1.00, 1.01, 1.02, 1.03		
Courtyard excess	0.40	0.20	0.10
Dual Flat No-Lead (DFN) Less than 1608 (0603)			
Periphery	0.00	0.00	0.00
Round-off factor	Round off to the nearest two place decimal, i.e., 1.00, 1.01, 1.02, 1.03		
Courtyard excess	0.20	0.15	0.10

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Land Grid Array (LGA)

Land Grid Array	LGA Land Pattern Zero Rotation A	LGA Land Pattern Zero Rotation B

### Land Grid Array (LGA) (unit: mm)

Lead Part	Maximum (Most) Density Level A	Median (Nominal) Density Level B	Minimum (Least) Density Level C
Periphery	0.05	0.00	0.00
Round-off factor	Round off to the nearest two place decimal, i.e., 1.00, 1.01, 1.02, 1.03		
Courtyard excess	0.40	0.20	0.10

Leadless Chip Carrier (LCC)

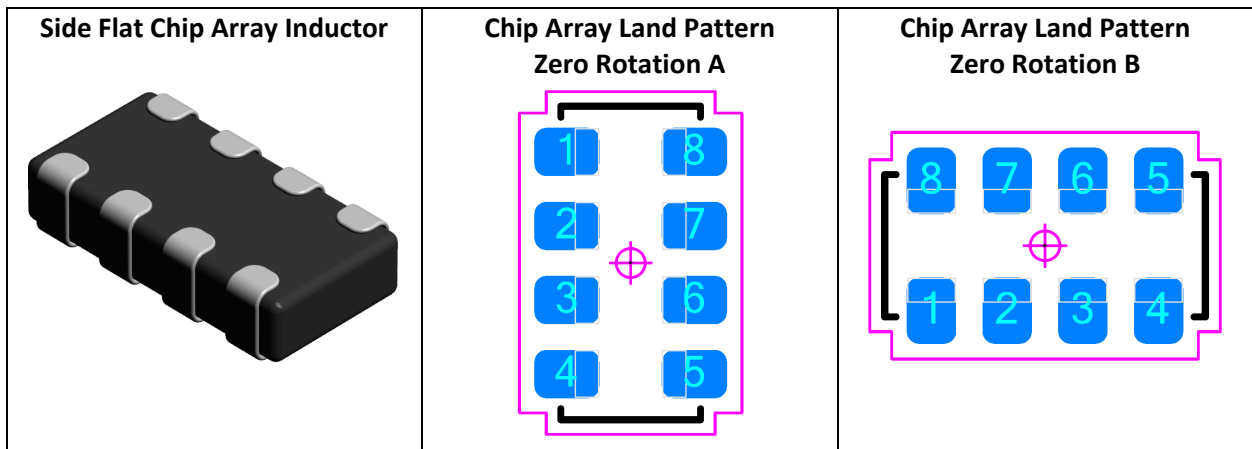| Leadless Chip Carrier	LCC Land Pattern Zero Rotation A	LCC Land Pattern Zero Rotation B
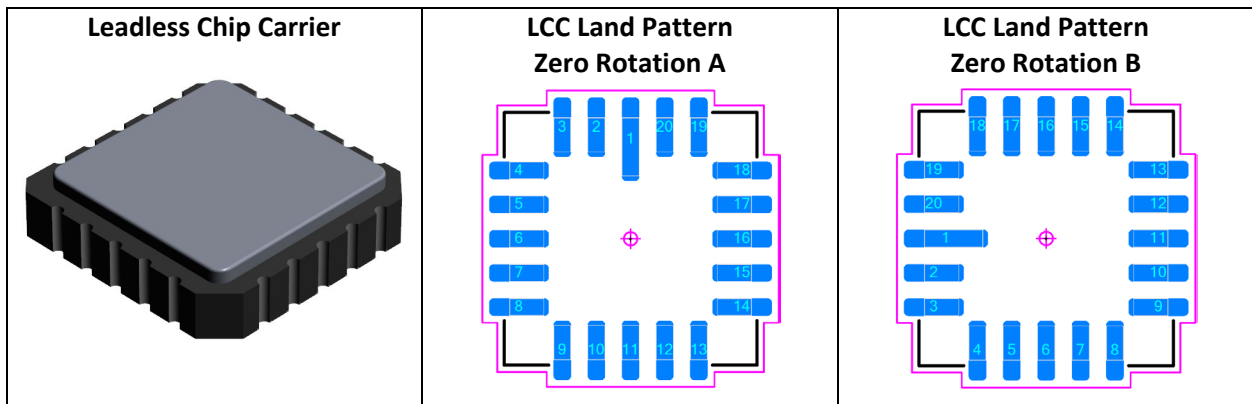
Leadless Chip Carrier (LCC) (unit: mm)

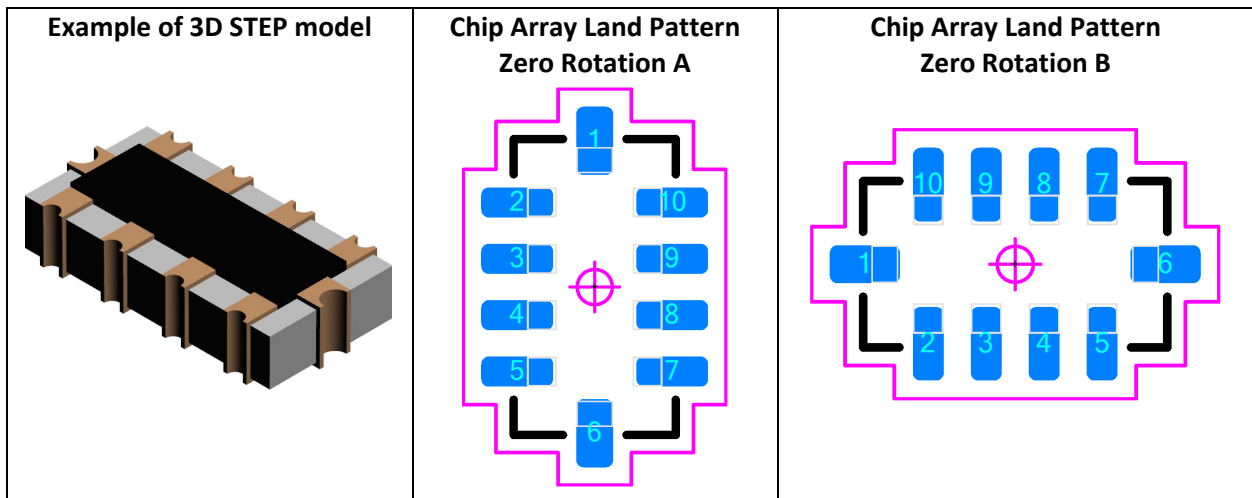| Lead Part	Most Density Level A	Nominal Density Level B	Least Density Level C
Heel (J_H) (to find Z dim)	0.06	0.04	0.02
Toe (J_T) (to find G dim)	0.60	0.50	0.40
Side (J_S)	0.00	0.00	0.00
Round-off factor	Round off to the nearest two place decimal, i.e., 1.00, 1.05, 1.10, 1.15		
Courtyard excess	0.40	0.20	0.10

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Resistor, Side Concave Chip Array (RESCAV)

Concave Chip Array Resistor	Chip Array Land Pattern Zero Rotation A	Chip Array Land Pattern Zero Rotation B
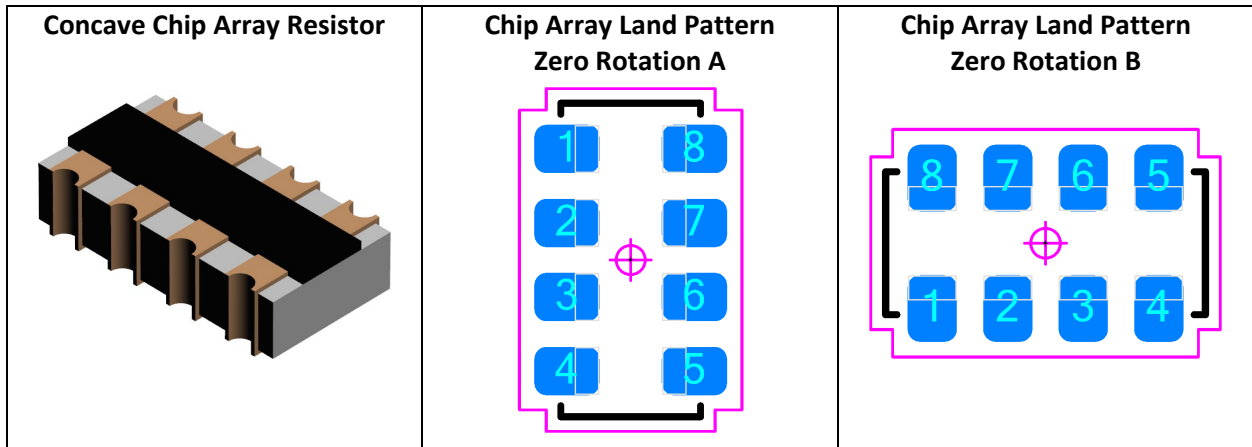
Inductor, Side Flat Chip Array (INDCAV)

Side Flat Chip Array Inductor	Chip Array Land Pattern Zero Rotation A	Chip Array Land Pattern Zero Rotation B

Resistor, Side Concave Chip Array 4-Sided (RESCAV)

Example of 3D STEP model	Chip Array Land Pattern Zero Rotation A	Chip Array Land Pattern Zero Rotation B

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Resistor, Convex Chip Array Type E (RESCAXE)

Convex Chip Array Type E	Chip Array Land Pattern Zero Rotation A	Chip Array Land Pattern Zero Rotation B
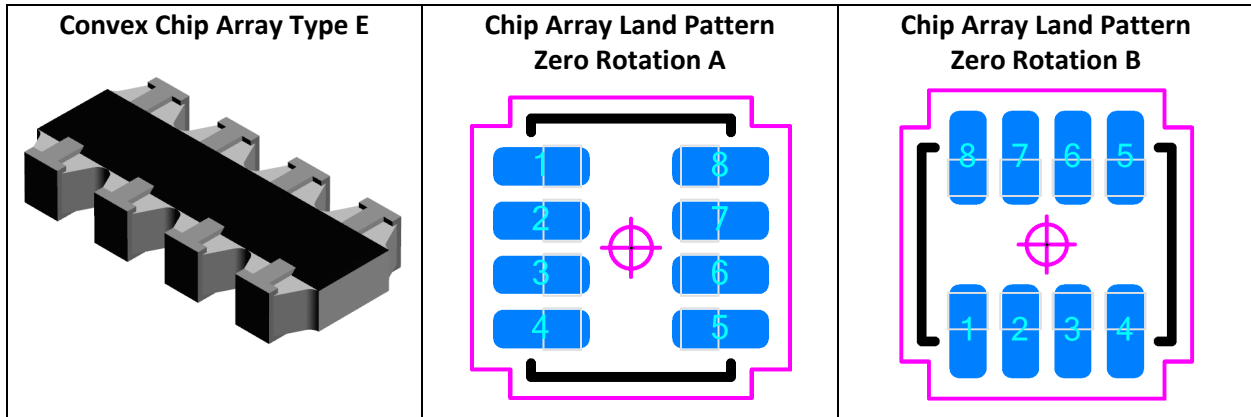
Resistor, Convex Chip Array Type S (RESCAXS)

Convex Chip Array Type S	Chip Array Land Pattern Zero Rotation A	Chip Array Land Pattern Zero Rotation B
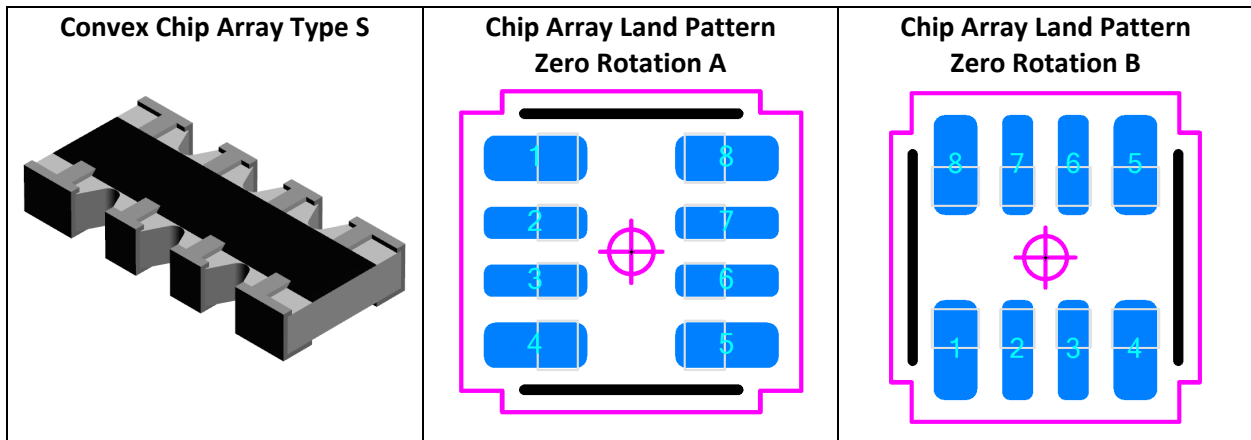
Side Flat/Concave/Convex Terminals (unit: mm)

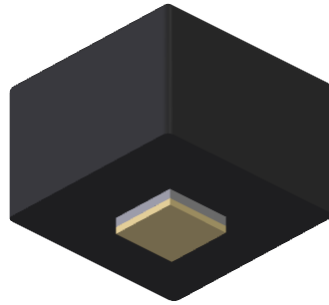| Side Lead	Least Density Level			
Terminal Lead Spacing	Toe	Heel	Side	Courtyard
Pitch > 2.54 mm	0.45	0.02	0.00	0.10
Pitch > 1.27 and <= 2.54 mm	0.40	0.00	0.00	0.10
Pitch > 0.80 and <= 1.27 mm	0.35	0.00	0.00	0.10
Pitch > 0.65 and <= 0.80 mm	0.25	0.00	0.00	0.10
Pitch > 0.50 and <= 0.65 mm	0.20	0.00	0.00	0.10
Pitch > 0.40 and <= 0.50 mm	0.15	0.00	0.00	0.10
Pitch <= 0.40 mm	0.10	0.00	0.00	0.10

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Side Lead	Nominal Density Level			
Terminal Lead Spacing	Toe	Heel	Side	Courtyard
Pitch > 2.54 mm	0.55	0.04	0.00	0.20
Pitch > 1.27 and <= 2.54 mm	0.50	0.02	0.00	0.20
Pitch > 0.80 and <= 1.27 mm	0.45	0.00	0.00	0.20
Pitch > 0.65 and <= 0.80 mm	0.35	0.00	0.00	0.20
Pitch > 0.50 and <= 0.65 mm	0.30	0.00	0.00	0.20
Pitch > 0.40 and <= 0.50 mm	0.25	0.00	0.00	0.20
Pitch <= 0.40 mm	0.20	0.00	0.00	0.20

Side Lead	Most Density Level			
Terminal Lead Spacing	Toe	Heel	Side	Courtyard
Pitch > 2.54 mm	0.65	0.06	0.01	0.40
Pitch > 1.27 and <= 2.54 mm	0.60	0.04	0.00	0.40
Pitch > 0.80 and <= 1.27 mm	0.55	0.02	0.00	0.40
Pitch > 0.65 and <= 0.80 mm	0.45	0.00	0.00	0.40
Pitch > 0.50 and <= 0.65 mm	0.40	0.00	0.00	0.40
Pitch > 0.40 and <= 0.50 mm	0.35	0.00	0.00	0.40
Pitch <= 0.40 mm	0.30	0.00	0.00	0.40

Component Terminal Lead-Forms
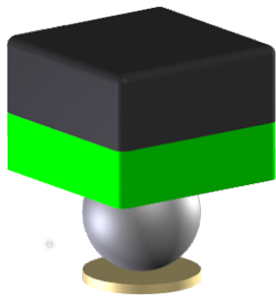
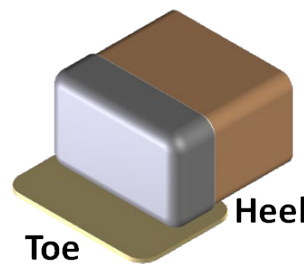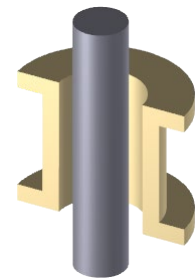|			
Ball Grid Array	**Land Grid Array/Bottom Only**	**Column Grid Array**	**Cylindrical End Cap**
Inward L Lead	**Outward L Lead**	**J-Lead**	**Gull Wing**
Side Concave	**Corner Concave**	**Flat No-Lead Side**	**Flat Lead**
Under Body Outward L	**Inward Flat Ribbon L**	**Rectangular End Cap**	**Through-Hole**
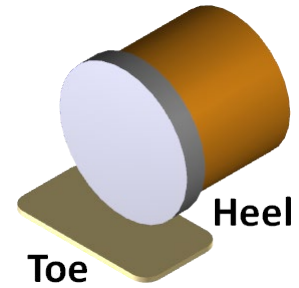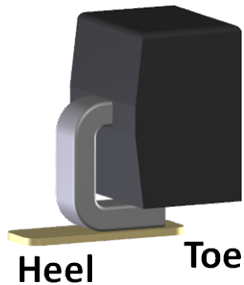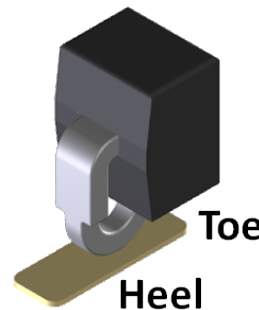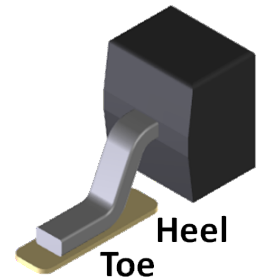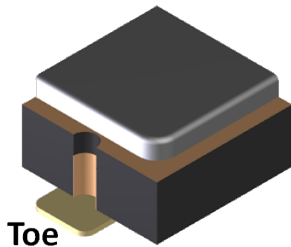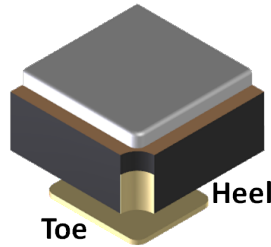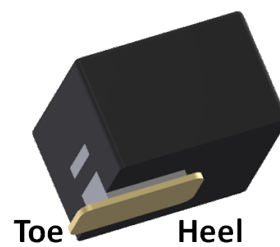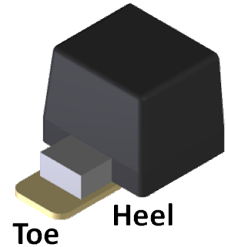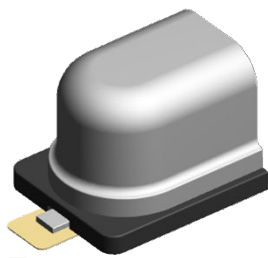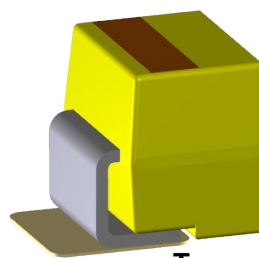
Polarity Marking Legend

The goal of the Polarity Marking Legend is to aid assembly to avoid polarized component packages from being inverted during the assembly machine setup or manual solder process. Therefore, Polarity Marking is only necessary on land patterns that require a specific rotation during the assembly process. For very dense part placements, the polarity marker can be placed under the package and covered up during the assembly process. However, the best practice is to locate the polarity indicator outside the package so that it is visible after the assembly process to allow the end user to visually validate that the assembly insertion process is correct. This is typically known as "Post Assembly Inspection Process".

Polarity Markings are unique from company to company. Here are samples of the most popular shapes.
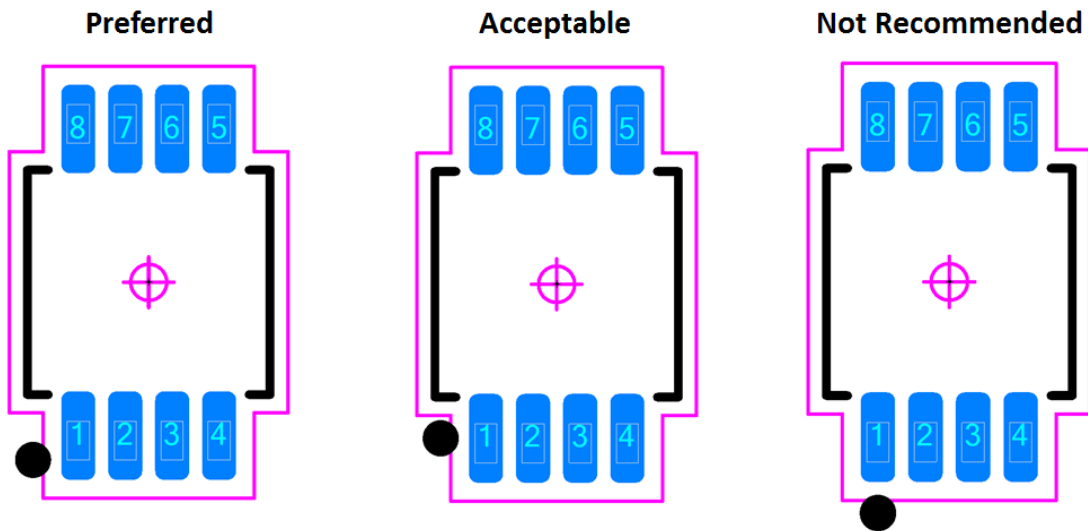
The size, rotation and location of the Polarity Markings are user definable. Here are some recommendations.

The most popular polarity marking is a filled Dot. The size of the Polarity Marking is relevant to the size of the component package and pad width. However, the polarity dot size is also dependent on the part placement density and the assembly shops ability to easily locate the dot to avoid component rotation insertion errors. The smallest visible markings range from 0.25 mm – 0.40 mm and are typically used for micro-miniature packages or very dense part placement PCB layouts. The average size ranges are 0.50 mm – 0.80 mm. The largest recommended polarity dot is 1.00 mm.
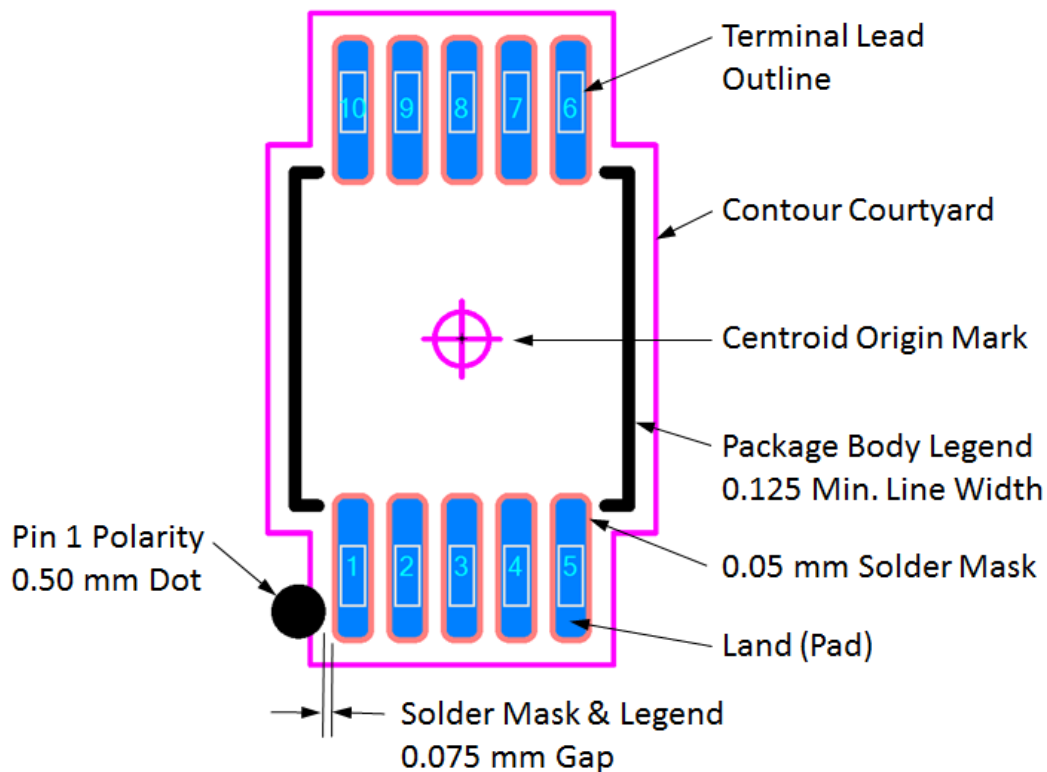
This illustration indicates 3 popular locations for a 0.50 mm dot on an SOP package. The preferred polarity dot placement is at the end of the pad which is the furthest distance from the component package body. This makes the post assembly inspection process easy as the component package may move up or down during assembly reflow, but the dot will always be visible. The acceptable location is the pad center, but this location is also a potential via site. It is advisable to keep legend ink off non-tented vias or tented via holes. The not recommended location has a higher potential of a via site and the marking could collide with other parts during the part placement process.

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Gull Wing Terminal Lead Legend Polarity Marking Location

Preferred   **Acceptable**   **Not Recommended**

The component body outline legend line width should be a minimum of 0.125 mm. The Polarity Marking Symbol and component body legend should have a minimum 0.075 mm gap from the solder mask. The figure below illustrates the anatomy of a land pattern and feature sizes and spaces.

Sample 0.50 mm Pitch SOP Legend and Polarity Marking Rules

Terminal Lead Outline

Contour Courtyard

Centroid Origin Mark

Package Body Legend
0.125 Min. Line Width

0.05 mm Solder Mask

Land (Pad)

Pin 1 Polarity
0.50 mm Dot

Solder Mask & Legend
0.075 mm Gap

Warning, check with your PCB manufacturer to verify if they can meet the dimensional requirements.

Bottom only termination packages – BGA, LGA, CGA, QFN, PQFN, SON, PSON and DFN
The polarity marking size should match the Terminal Width. The gap between the body legend and the polarity marker should range from 0.15 mm – 0.25 mm
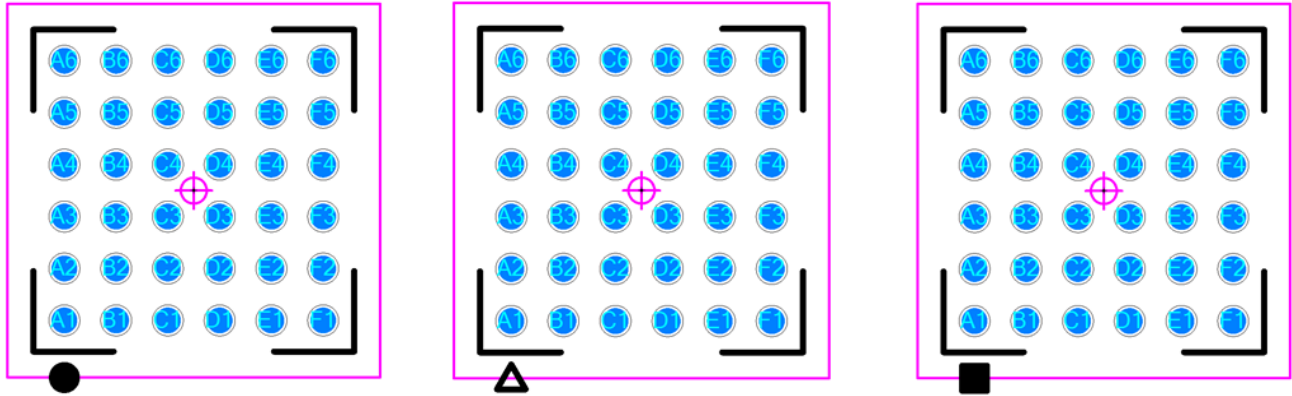
Polarized chip capacitors packages.