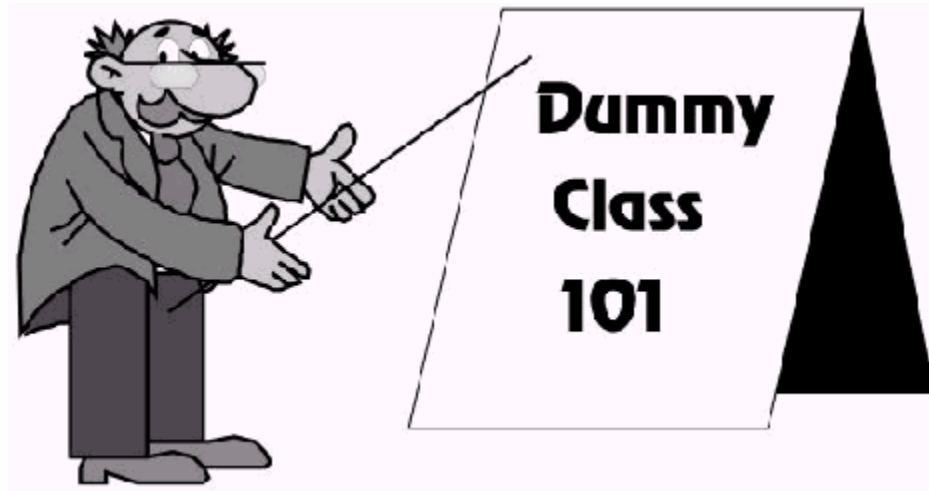


# Quick Study Guide Dummy Components



For more details refer to complete Dummy Class 101 available on [www.topline.tv](http://www.topline.tv)

## Table of contents

	Page
Why Dummy Components? .....	2
Where is TopLine Located? .....	3
Services provided by TopLine .....	3
SMD Component Lead Styles .....	4
Lead Pitch .....	5
Packaging .....	6
Chip Size Codes (0805, 1206, etc) .....	7
Select the Correct Dummy for the Application.....	8
Ball Grid Arrays .....	9
QFP - Quad Flat Pack .....	10
PC Boards, Fiducial Marks, Gerber Files, Parts Placement Data....	11
Practice Kits.....	12
Part Numbering System .....	13-16



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## Why Dummy Components?

Save money by using TopLine Dummy Components for machine evaluation, rework practice, training, acceptance testing, demonstrations and improving SMD assembly processes.

## Where are Dummies used?

- 1) Pick and Place Machines
- 2) Rework Practice
- 3) Training Schools
- 4) Research Laboratories
- 5) Vision Equipment
- 6) SMD Assembly Lines

## Who needs Dummies?

- 1) Everyone whose work involves defining or refining SMD and fine-pitch assembly processes.
- 2) Everyone who demonstrates or evaluates pick and place equipment, rework or soldering machines.

## How much money is saved?

Customers often save up to 80% by using dummy components instead of "live" components.



## Where is TopLine Located?

Near by Los Angeles, California (Just 30 minutes from LAX and 10 minutes from Disneyland). Come visit us soon!

## Stocks - Stores - Deliveries

TopLine has the world's largest inventory of Dummy Components. We ship ex-stock products the same day.

## 7/24 Service

TopLine offers confidential access to price lists, inventory checks and logistics information 24 hours a day on our web site [www.topline.tv](http://www.topline.tv).

## Component Outline Drawings

TopLine's Document Centre provides free instant access to 1000 different component outline drawings and PC board footprints on our web site 24 hours per day.

## SMD Lead Styles

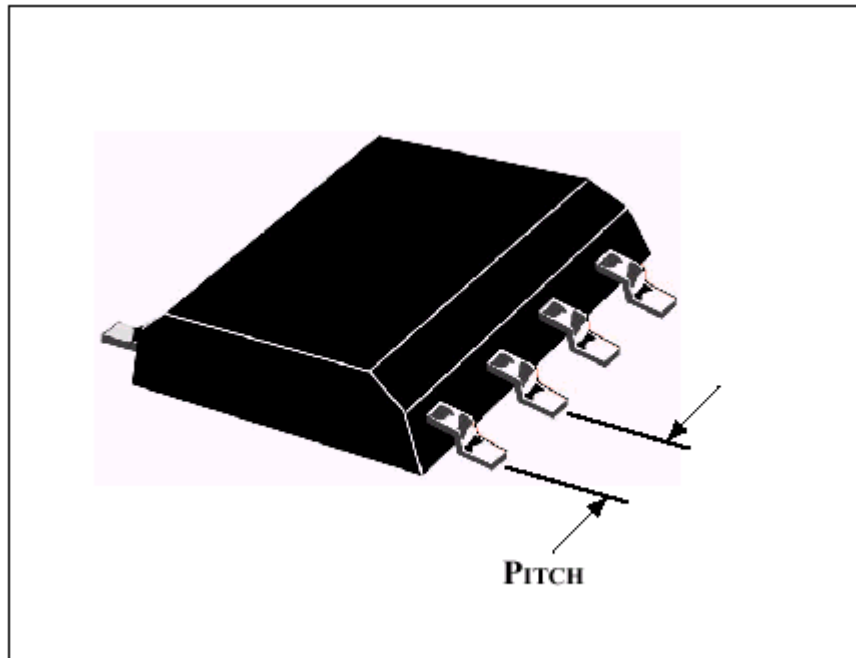
TYPE	DRAWING	COMPONENTS
<b>Gull-wing</b>		SOIC QFP TSOP
<b>J-lead</b>		PLCC SOJ
<b>Ball</b>		BGA Chip Scale Flip Chip (Bump)
<b>Metalized Terminations</b>		Capacitors Resistors Ferrites



## Lead Pitch

**Pitch** is measured from the **centre-to-centre** of the leads.

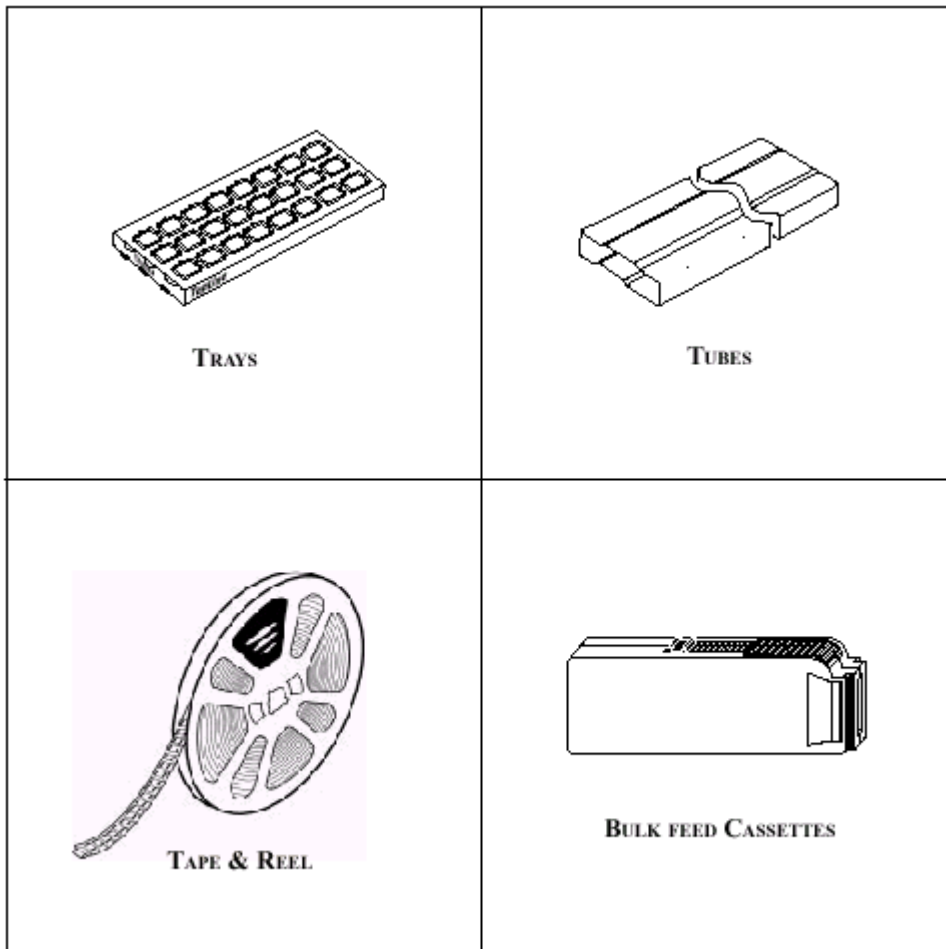
Pitch is **not** the air **gap** between the leads.





## Component Packaging

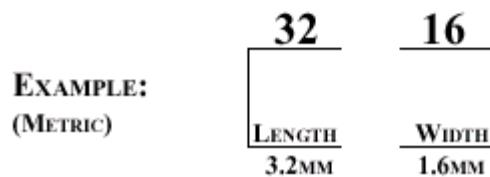
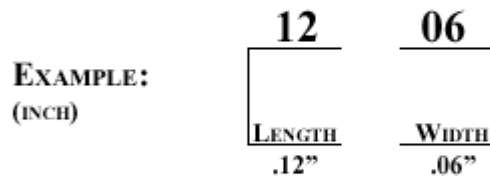
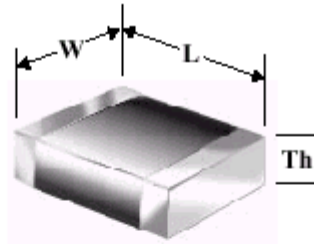
Proper **packaging** is required to **protect** the components from damage during transport. Pick and place machines require the proper feeder to "receive" the component.





## Chip Size Codes

The **foot-print** size of chip components are defined by a 4-digit size code. The Thickness of the component is not defined in the size code.



## Inch versus Metric Codes

**Size code** of ceramic capacitors and resistors are usually stated in Inches. Tantalum capacitors are stated in metric.

SIZE CODE		APPROXIMATE SIZE	
INCH	METRIC	INCH	METRIC
0402	1005	.04" x .02"	1.0 x 0.5mm
0603	1608	.06" x .03"	1.6 x 0.8mm
0805	2012	.08" x .05"	2.0 x 1.2mm
1206	3216	.12" x .06"	3.2 x 1.6mm
1210	3225	.12" x .10"	3.2 x 2.5mm
1812	4532	.18" x .12"	4.5 x 3.2mm

## All Dummies are not Created Equal

Select the correct Dummy to match the application.

**Daisy Chains** are internal **connections** between the leads. Daisy Chains are required to perform "**Continuity**" tests after the component is mounted to the PC Board. Daisy Chain "even" means that leads 1-2, 3-4, 5-6, 7-8, etc. are connected. Refer to the specific drawing for BGAs with Daisy Chains. **Daisy Chain** is **not** required for standard assembly and rework practice.



**DAISY CHAIN**

**ISOLATED** (-ISO) has **NO internal connections** between the leads. Isolated components are required for S.I.R.- Surface Insulation Resistance Testing to measure the amount of chemical residues remaining on the board after cleaning.

**-ISO** is **not** required for standard assembly and rework practice.

Dummy silicon **DIE** is attached inside dummy components when **temperature profiling** is to be performed. Die is **not** required for standard assembly and rework practice.

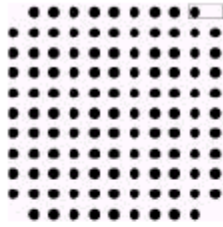
**Markings** (Laser or ink) may be required for specific vision equipment testing. Markings are **not** generally required for standard assembly and rework practice.

**Note:** If the customer does not specify a particular application, TopLine will supply a general-purpose dummy. Be safe - Always **ask** what the application is.



## BGA - Ball Grid Array

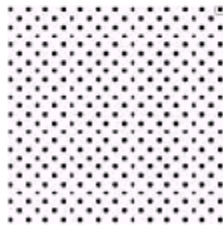
Different ball patterns available on BGA.



**FULL GRID**



**PERIPHERAL**



**STAGGER**



**THERMAL VIA**

### Acronyms for other "Grid Array" components:

**CBGA** - Ceramic Ball Grid Arrays.... For high temperature requirements

**fBGA** - Flex BGA ... uses a flex polyimide substrate

**SBGA** - Super BGA ... has metal heat spreader on top

**PBGA** - Plastic BGA ... Industry standard BGA

**LGA** - Land Grid Array ... pads without the balls

**CGA** - Column Grid Array ... solder columns instead of balls

**CSP** - Chip Scale Package ... Fine-Pitch BGA. Package is max 120% > chip size.

**uBGA** - Chip Scale Package ... trademark of Tessera

**Flip Chip** - Die with solder bumps ... very small.



## QFP - Quad Flat Pack

**QFP** - standard Quad Flat Pack 2.0mm to 3.7mm thick

**TQFP** - Thin Quad Flat Pack 1.0mm thick

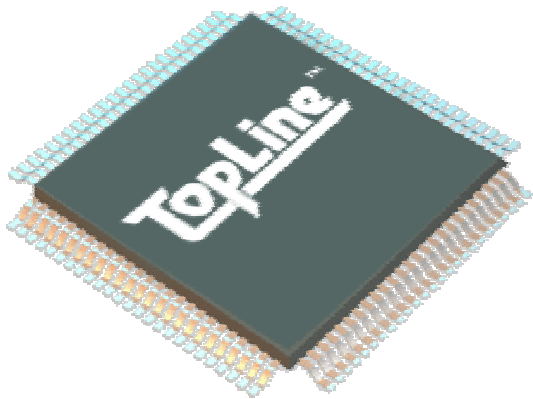
**LQFP** - Low Quad Flat Pack 1.4mm thick

**MQFP** - Metric Quad Flat Pack ...same as a standard QFP

**PQFP** - Plastic Quad Flat Pack ... same as a standard QFP

**BQFP** - Bumper Quad Flat Pack ... Has bumper corners

**SQFP** - Shrink Quad Flat Pack ... similar to QFP, but thinner



**Foot Print adder** to body determines tip-to-tip measurement of the leads.

**TQFP** = 2.0mm standard lead adder

**LQFP** = 2.0mm standard lead adder

**QFP** = 2.6mm, 3.2mm or 3.9mm standard adder

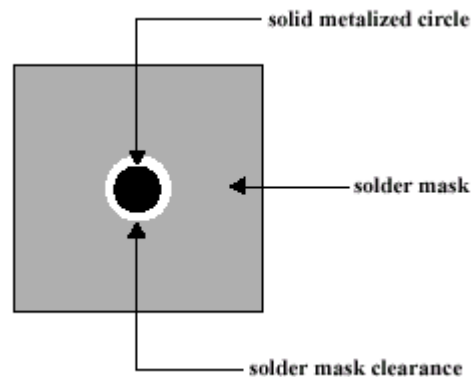
### QFP Lead Count versus Body Size

POPULAR BODY SIZE	LEAD PITCH AVAILABLE					LEAD COUNT RANGE
	0.8MM	0.65MM	0.5MM	0.4MM	0.3MM	
7MM SQUARE	X	X	X	X		32 - 64
10MM SQUARE	X	X	X	X		44 - 80
12MM SQUARE			X			80
14MM SQUARE	X	X	X	X	X	64 - 168
14 x 20MM		X	X			100 - 128
20MM SQUARE			X			144 - 176
24MM SQUARE			X			160 - 216
28MM SQUARE			X	X		208 - 256

a) **Fiducial Marks** assist machine vision equipment to navigate precise locations on PC Boards.

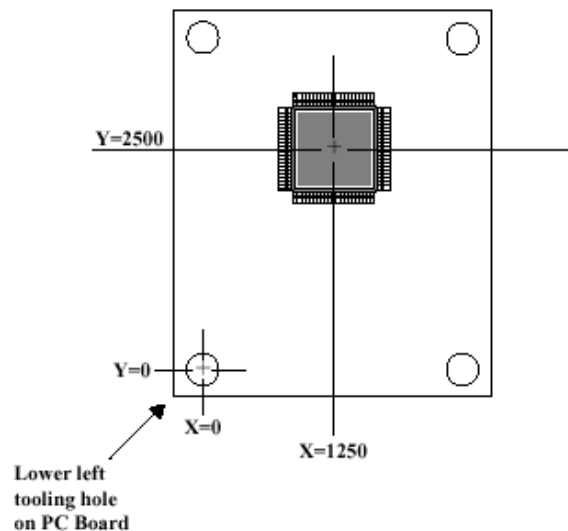
There are two types of Fiducial Marks on PC Boards:

- 1) **Global Fiducials** are located in the far corners of the board.
- 2) **Local Fiducials** located at the centroid of fine-pitch components



b) **Gerber Data** is a machine language for fabricating PC boards and making Solder Paste Stencils.

c) **Parts Placement Data** tell the pick and place machine the X, Y and theta (rotation) location of the components on the PC Board.





## Kits for Machine and Rework

TopLine have 100 different types of kits for all skill levels from beginners to the most advanced. All kits include the PC board and enough components to assemble one side of the board.

### Types of Kits:

- a) SMD
- b) Mixed Technology
- c) BGA
- d) Through hole
- e) Visual inspection boards

### Machine Run Kits:

Packaging: Tape & Reel, tubes and trays. (Please specify special requirements.)

Gerber File: For making the Stencil (optional accessory)

Parts Placement: ASCII File X, Y, theta co-ordinates (optional accessory)

Fiducial marks: Included on the PC board.

Tooling Holes: Included on the PC board.

### Hand Assembled Kits:

Packaging: Individually packaged or multi-pack for manual assembly.

Note: Gerber File and Parts Placement Data is usually not required.

### Other Features:

Solder mask: Green **LPI** is Standard.

Plating / Finish: **HASL (standard)** or Entek on bare copper (special order)

Custom boards available (requires 150 pcs minimum order)



Example of mixed technology board:



# Part Numbering System

## Chip Components

<u>SC</u>	<u>0805</u>	<u>P</u>	<u>7</u>	<u>A</u>
<u>PASSIVES</u>	<u>SIZE CODE</u>		<u>REEL SIZE</u>	
SB = Ferrite Bead	<u>INCH DIMENSIONS</u>		4 = 4" (100mm)	
SC = Ceramic Capacitor	Example: 0805 = .08" x .05"		7 = 7" (180mm)	
SD = Tantalum	(Tantalum SD Code is metric)		11 = 11" (300mm)	
SE = Aluminum Cap	Example: 3216 = 3.2mm x 1.6mm		13 = 13" (330mm)	
SI = Inductor				
SP = Potentiometer				
SR = Resistor				
SRM = Melf Resistor				
SV = Trimmer Cap				
SX = Crystal/Oscillator				
	<u>PACKAGING</u>		<u>REEL MATERIAL</u>	
	P = Paper Tape		A = Plastic	
	E = Plastic Tape		P = Paper	
	F = Bulk Cassette			
	B = Bulk			
	X = Small Qty. Bag			
<u>DISCRETE DEVICE</u>				
SOD = Diode				
SOT = Transistor				
DPAK = Power Device				

## BGA- Ball Grid Array

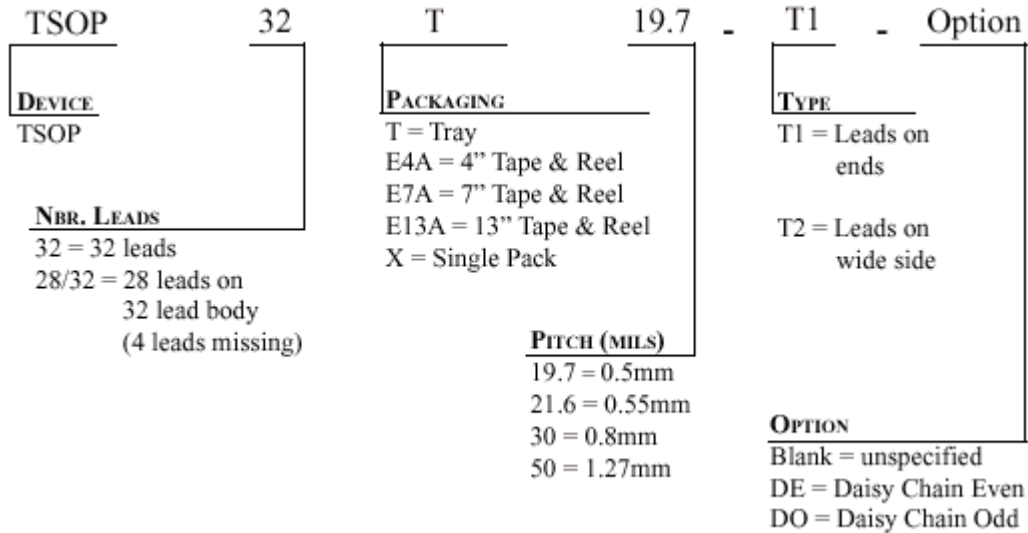
<u>BGA</u>	<u>225</u>	<u>T</u>	<u>1.5</u>	<u>-</u>	<u>DC15</u>
<u>DEVICE</u>	<u>NBR. BALLS</u>		<u>PITCH (MM)</u>		<u>DAISY CHAIN</u>
BGA = Plastic			1.5		Refers to a
CBGA = Ceramic			1.27		drawing number
TBGA = Tape			1.00		
CSP = Chip Scale			.8		
			.75		
			.5		
	<u>PACKAGING</u>				
	T = Trays				
	E7A = 7" Tape & Reel				
	E13A = 13" Tape & Reel				
	X = Single Pack				



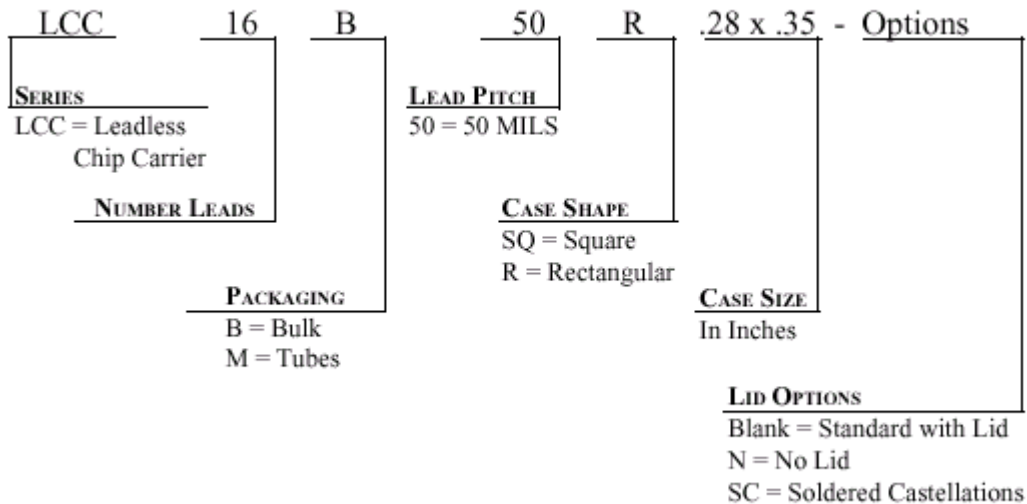


## Part Numbering System

### TSOP



### LCC - Ceramic Leadless Chip Carrier





## Part Numbering System

### SOIC and PLCC

<u>SOL</u>			<u>16</u>	<u>M</u>	<u>Pitch - Option</u>			
<u>DEVICE</u>			<u>NUMBER LEADS</u>					
<u>SERIES</u>	<u>BODY WIDTH</u>		<u>PACKAGING</u>					
	<u>MILS</u>	<u>MM</u>						
SO	150	4.0mm	M = Tubes E4A = 4" Tape & Reel E7A = 7" Tape & Reel E13A = 13" Tape & Reel X = Single Pack					
SOL	300	7.6mm						
SOM	220	5.6mm						
SOP	208	5.3mm						
SOW	330	8.4mm						
SOX	400	10.0mm						
SOY	450	11.1mm						
						<u>PITCH (MILS)</u> Blank = 50mil 25 = 0.65mm 30 = 0.8mm		
<u>J-LEAD 50MIL PITCH</u>			<u>OPTION</u>					
SOLJ	300	7.6mm				Blank = unspecified DE = Daisy Chain Even DO = Daisy Chain Odd BUS = All leads shorted ISO = isolated		
SOXJ	400	10mm						
PLCC	all	all						
<u>FINE PITCH</u>								
QSOP	150	4.0mm						
SSOP	208	5.3mm						
SSOP	300	7.6mm						
TSSOP	173	4.4mm						



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