

# **NORMAL PCB FOOTPRINT CONVENTIONS**

## 1. Padstack conventions

- Unit used for creating padstack is in mil (mili-inch) with 3 "Decimal places".
- Rounding all values of padstack sizes.

### 1.1 SMD padstacks    linh kien dan

#### 1.1.1 GENERIC CONVENTIONS

- Pad dimensions are based on the component pitch
- Pastemask is 1:1 to pad size
- Soldermask = pad size + 6 mils
- Antipad size = thermal relief size = pad size + 15 mils
- All dimensions are in mil
- Use the nominal component pin size to calculate padstack.
  - The length of the padstack is equal to the nominal pin length +5 mils for heel; + 25 mils for toe.
  - The width of the padstack is equal to the nominal pin width +10 mils (i.e. 5 mils on each side). This value can be smaller based on pin pitch to void solder bridge.

#### 1.1.2 PADSTACK NAMING CONVENTIONS

**Table 1 : SMD padstack naming conventions**

Type	Padstack Name	Example
Rectangle	wwwxhhsm	023x040sm
Circle	cxsm	C020sm
Square	sxxsm	S025sm
Oblong	obwwwxhhsm	Ob025x050sm

**\*\*\* Note:**

- www :width ; hhh : height
- We do not use slashes for SMD padstacks.
- For symbols having lead pitch pins such as: QFP, PLCC, ... we can reduce solder mask sizes if the space is very close.

#### 1.1.2.1 GENERIC SURFACE MOUNT COMPONENT PADSTACKS

**Table 2 : SMD padstacks for standard ICs**

Area Array Component Type	SMT Pitch	Pad Dimensions	Padstack Name
BGA	50.000 (1.27 mm)	22 diameter	C022sm
BGA	39.370 (1.00 mm)	22 diameter	C022sm
BGA	31.496 (0.80 mm)	16 diameter	C016sm
BGA	25.591 (0.65 mm)	12 diameter	C012sm
BGA	19.685 (0.5 mm)	10 diameter	C010sm
BGA	15.748 (0.4 mm)	10 diameter	C010sm
CBGA/CCGA	50.000 (1.27 mm)	28 diameter	C028sm
CBGA/CCGA	39.370 (1.00 mm)	27 diameter	C027sm
QFP, SOIC, SOP, TSOP, SSOP, TSSOP, QSOP, QVSOP, SOJ, PLCC etc.	50.0 (1.27 mm)	25 x 80	025x080sm
	39.4 (1.00 mm)	22 x 75	022x075sm
	31.5 (0.80 mm)	22 x 70	022x070sm
	25.6 (0.65 mm)	16 x 70	016x070sm
	25.0 (0.635mm)	16 x 70	016x070sm
	19.7 (0.50 mm)	12 x 70	012x070sm
	15.7 (0.40 mm)	10 x 70	010x070sm

\*\*\* **Note:** Using vias via\_d008c019\_a29ch or via\_d010c019\_a29ch to fan out for 1.00 mm & 0.8 mm BGAs

#### 1.1.2.2 SPECIAL PADSTACKS

Padstack name = Standard name\_(Option1)(Size1)(Option2)(Size2)...(OptionN)(SizeN)

Where:

+ Option1, Option2, ... OptionN: we use these abbreviations for special cases below:

- Regular pad size : r
- Thermal relief : t
- Antipad : a
- Soldermask : m
- Pastemask : p ; use **np** for padstacks with no pastemask
- Padstack with shape : s

+ Size1, Size2, ...SizeN: values added into the padsize corresponding to each Options above.

Example:

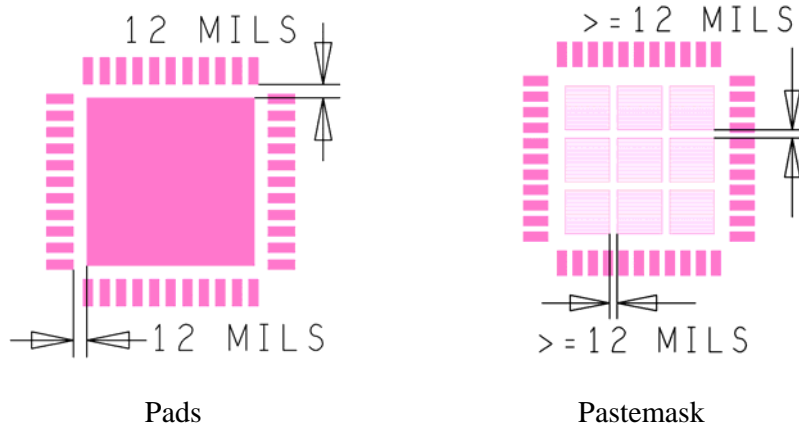
030x040sm\_m032x042: means the soldermask will be 2 mils larger than the pad.

#### **Pastemask for thermal pins :**

- Pastemask should be NULL ( no pastemask )
- Adding small shapes for pastemask . Air gaps between 2 shapes should be at least 12 mils.
- We offer a 12-mil air gap between pins and thermal pin . We can choose a less value in some specific cases.

Please look at pictures below for example :

**Figure 1 : Pastemask for thermal pins**



#### \*\*\* **Note:**

Because the name of padstacks in the package symbol design allows only a maximum of 18 letters, "(Option)(Size)" for padstacks cannot follow the above conventions if the name of a padstack has more than 18 letters.

\*\*\*\*\* **Warning:** Please check all special padstacks and correlative symbols before adding them into the library to avoid coincident errors.

## 2.1 Through Hole Padstacks

All dimensions are in mils. Use the nominal component pin size to calculate padstacks.

### 2.2.1 PLATED THROUGH HOLE PADSTACKS

Feature	Guideline
Padstack name	<p>- <b>Normal Padstack with circular hole</b>            dyyyazzz.pad            Where a = Pad shape (Typically c = Circle, s = Square)            d = Drill            yyy = Finished hole size            zzz = Pad size            Examples:            D042C062            D042S062</p> <p>- <b>Oblong padstack:</b>            DrrrxtttOBwwwxhhh oblong padstack with oblong hole            DyyyOBwwwxhhh oblong padstack with circular hole</p> <p>- <b>Rectangular padstack:</b>            DrrrxtttREwwwxhhh rectangular padstack with rectangular hole            DyyyREwwwxhhh rectangular padstack with circular hole            Where d = Drill            rrr = width of finished hole size ; ttt = height of finished hole size            yyy = finished hole size (circle)            www = pad width ; hhh = pad height            ob = oblong ;            re = rectangle</p> <p><i>Note: *Regular pad sizes for default inner layers should be circular.            *For padstacks having special drills which do not support from Pad Designer of Cadence, we should declare for drill is 1 mil.</i></p>
Nominal Hole Size	<p>- <b>Circular Pins:</b>            X = Nominal lead diameter + 15 mils</p> <p>- <b>Rectangular/Square Pins:</b>            X = [Sqrt (L<sup>2</sup> + W<sup>2</sup>)] + 15 mils            (L= Length, W= Width of lead cross section)</p> <p>- <b>Press:</b>            Per manufacturer specification</p>
Drill Symbol	<p>Per <b>Drill Table</b>  <i>* Note: - With drill size smaller than 50mils make the drill symbol with Width - 50; Height - 50</i>  <i>- For oblong or retanglar drills : we should use two characters according to width and height of drill (perDrill Table) . Ex : character of padstack d100x065ob130x095 should be vM.</i></p>
Pad Size	<p>X + 20 mils for Nominal Holes ≤ (60 mils)            X + 30 mils for Nominal Holes &gt; (60 mils)  <i>Note: Pad sizes may be larger for specific applications like mounting holes.</i></p>
Soldermask	Pad size + 6 mils
Pastemask	Pastemask should be NULL
Antipad	<p>+ Pad size from 40 down : antipad = pad size + 15 mils.            + Pad size from 41 to 80 : antipad = pad size + 20 mils.            + Pad size from 81 to 150 : antipad = pad size + 30 mils.            + Pad size from 150 up : antipad = pad size + 40 mils.</p>
Thermal Relief	<p>- <b>Circular flash for Thermal Relief:</b>            Naming convention: TR_RRR_TTT_WW_N_AA</p>

Where:

TR : Thermal Relief = Antipad

RRR : Regular pad size

TTT : thermal relief diameter size

WW : spoke width.

N : number of the spokes.

AA : angle of the spoke.

Example: TR\_080\_100\_10\_4\_45

pad size = 80 mils; thermal relief = 100 mils; spoke width = 10 mils;  
number of the spokes = 4; angle of the spoke = 45 degrees.

**- Naming conventions for the special flashes:**

+ Oblong : TRXXXYYYBZZ\_WW\_N\_AA (see figure 2 for details)

+ Rectangle : TRXXXYYRZZ\_WW\_N\_AA (see figure 3 for details)

where B : Oblong

R : Rectangle or Square

TR : Thermal Relief

WW : spoke width.

N : number of the spokes.

AA : angle of the spoke.

\* The size of the spokes should be set as the standard unless otherwise specified:

PAD size From 25 to 99 = 10

From 100 to 199 = 15

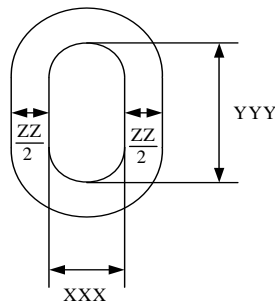
From 200 up = 20

Note: \* For "\_press" padstacks, Thermal Relief\_Geometry = NULL

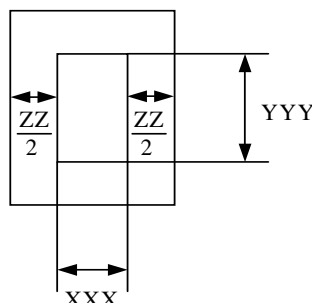
\* In padstack designer program, we should choose "null" for press fit padstacks; choose "flash" for padstacks with flash except TOP and BOTTOM layers, then Thermal Relief for the TOP and BOTTOM are declared the same as the antipad.

\* The flashes for Thermal Relief of the square holes is declared the same as the rectangle holes, and then XXX = YYY

**Figure 2 : Thermal flash for Oblong**



**Figure 3 : Thermal flash for Rectangle**



### 2.2.2 NON-PLATED THROUGH HOLE PADSTACKS

- Non-plated through hole padstacks without annular: Pad size = Drill size, select “Non-Plated” in plating field of Pad\_Designer.
- Non-plated through hole padstacks with annular ring should be created the same as plated through hole padstacks, select “Non-Plated” in plating field of Pad\_Designer.
- All dimensions are in mils. Use the nominal component pin size to calculate padstacks.

Feature	Guideline
Padstack name	<p><b>- Normal Padstack with circular hole</b>  dyyyazzzn.pad  Where a = Pad shape (Typically c = Circle, s = Square)  zzz = Pad size  + zzz = yyy for padstacks without annular ring  + zzz = yyy + 20 mils (for Nominal Holes ≤ 60mils)  or zzz = yyy + 30 mils (for Nominal Holes &gt; 60mils) for padstacks with annular ring  yyy = Finished hole size  d = Drill ; n = non-plated</p> <p>Examples:  D042C042n Non-plated through hole padstack without annular ring  D042C062n Non-plated through hole padstack with annular ring</p> <p><b>- Oblong padstack:</b>  DyyyOBwwwxhhhN oblong padstack with circular non-plated hole  DrrrxtttOBwwwxhhhN oblong padstack with oblong non-plated hole</p> <p><b>- Rectangular padstack:</b>  DyyyREwwwxhhhN rectangular padstack with circular non-plated hole  DrrrxtttREwwwxhhhN rectangular padstack with rectangular non-plated hole  Where ob = oblong; re = rectangle  www = pad width ; hhh = pad height  rrr = width of finished hole size ; ttt = height of finished hole size  d = Drill ; n = non-plated</p> <p><i>Note:</i>  <i>*For padstacks having special drills which do not support from Pad Designer of Cadence, we should declare for drill is 1 mil.</i></p>
Nominal Hole Size	<p>Per manufacturer specification</p> <p><b>- Circular Pins:</b>  X = Nominal lead diameter + 15 mils</p> <p><b>- Rectangular/Square Pins:</b>  <math>X = [\text{Sqrt}(L^2 + W^2)] + 15 \text{ mils}</math>  (L= Length, W= Width of lead cross section)</p>
Drill Symbol	<p>Per <b>Drill Table</b>  <i>* Note: - With drill size smaller than 50mils make the drill symbol with Width - 50; Height - 50</i>  <i>- Also we want to use only CROSS figure for the drill symbol for NON_PLATED PADSTACK.</i>  <i>- For oblong or rectangular drills : we should use two characters according to width and height of drill (per Drill Table) . Ex : character of padstack d100x065ob130x095 should be vM.</i></p>
Pad Size	<p>+ For padstacks without annular ring: Pad size = Drill size, add ROUTE KEEPOUT/ALL the same size of Antipad in the package symbol.  + For padstacks with annular ring:  Pad size = Nominal Hole Size + 20 mils (for Nominal Holes ≤ 60mils) or  Pad size = Nominal Hole Size + 30 mils (for Nominal Holes &gt; 60mils).</p>
Soldermask	<p>+ For padstacks without annular ring: Drill Size + 10 mils</p>

	+ For padstacks with annular ring: Pad Size + 6 mils
Pastemask	Pastemask should be NULL
Antipad	- For padstacks without annular ring: + Drill size from 40 down : antipad = drill size + 20 mils. + Drill size from 41 to 80 : antipad = drill size + 25 mils. + Drill size from 81 to 150 : antipad = drill size + 40 mils. + Drill size from 150 up : antipad = drill size + 50 mils. - For padstacks with annular ring: + Pad size from 40 down : antipad = pad size + 15 mils. + Pad size from 41 to 80 : antipad = pad size + 20 mils. + Pad size from 81 to 150 : antipad = pad size + 30 mils. + Pad size from 150 up : antipad = pad size + 40 mils.
Thermal Relief	NULL for all layers

### 2.2.3 SPECIAL PADSTACKS

Padstack name = Standard name\_(Option1)(Size1)(Option2)(Size2)...(OptionN)(SizeN)

Where:

+ Option1, Option2, ... OptionN: we use these abbreviations for special cases below:

- Regular pad size : r
- Thermal relief : t
- Antipad : a
- Soldermask : m
- Pastemask : p p ; use **np** for padstacks with no pastemask
- Padstack with shape : s
- Press fit padstack : press

+ Size1, Size2, ...SizeN: values added into the padsizes corresponding to each Option above.

Example:

\* d043c063\_m69ap93 : means the soldermask will be 6 mils larger than the pad d043c063 and antipad will be 30 mils larger than the pad d043c063.

**\*\*\* Note:**

*Because the name of padstacks in the package symbol design allows only a maximum of 18 letters, "(Option)(Size)" for padstacks cannot follow the above conventions if the name of a padstack has more than 18 letters.*

**\*\*\*\*\* Warning:** Please check all special padstacks and correlative symbols before adding them into the library to avoid coincident errors.

## 2.2 Color

- Temporary and Permanent Highlight: Red
  - Select: Red
  - DRC: Red
  - Silkscreen top: green
  - Silkscreen bottom: yellow
  - Other colors: please view sample symbol.
- (we shall use a general script for colors)**

## 2.3 Text conventions

- Use script for these conventions.
- Text width: 0 mil
- Need to add the Company property as follows:  
Create a sub-class called: PROP under PACKAGE GEOMETRY class
- Dimension text block = 3

- Add the text "COMPANY NAME"
- Need to add dimensions as follows:  
Create a sub-class called: COMP\_DIM under PACKAGE GEOMETRY class
- Dimension text block = 3
- Dimension Line -> Head Length = 0.08"
- Dimension Line -> Head Width = 0.03"
- Extension Line -> Offset Distance from Element = 0.02"
- Extension Line -> Distance Beyond Dimension Line = 0.02"
- Need to add the Symbol properties as follows:  
Create a sub-class called: COMP\_DIM under PACKAGE GEOMETRY class
  - "SYMBOL: SYMBOL\_NAME" with text block = 5
  - "PADSTACK(S): PADSTACK\_NAME1,PADSTACK\_NAME2,..." with text block = 3
  - "COMP HEIGHT: COMP\_HEIGHT\_MAX MIL [COMP\_HEIGHT\_MAX MM]" with text block = 3
- Need to add the Symbol Revision as follows:  
Create a sub-class called: REV under PACKAGE GEOMETRY class
  - "CREATED BY \_\_\_\_ - DDMMYY " with text block = 3
  - "MODIFIED BY \_\_\_\_ - DDMMYY" with text block = 3 (if Applicable)
  - "CHECKED BY \_\_\_\_ - DDMMYY" with text block = 3 (if Applicable)
  - "MANUFACTURE: COMPANY\_NAME" with text block = 3
  - "P/N: PART\_NUMBER" with text block = 3
  - "SPEC: SPEC\_file\_name" with text block = 3

If we need to add text (Viettel standard) to customer parts just  
ADDED TEXT BY \_\_\_\_ DDMMYY

So that we know the original part came from the customer.

**\*\*\* Note:**

- + If we don't know component height, please add "COMP HEIGHT: N/A".
- + If we don't know company name and part number, please add texts as follows:  
"MANUFACTURE:"  
"P/N:"

## **2.4 Origin (0, 0) of the symbols**

- SMD symbol : Center of the component
- Through hole symbol : Pin 1
- Add text "center" on layer "Package geometry/ BODY\_CENTER" on origin (0 , 0)  
**\*\*\* Note:** Pin 1 of a through hole part must be a SQUARE (not circle) unless otherwise specified.

## **2.5 Fiducials**

- The size of fiducial is 40 inner and 120 outer diameters (I040O120) : regular pad size 40 mils, soldermask 120 mils , no pastemask.
- Two fiducials are required for BGAs. These fiducials shall be placed on diagonally opposite corners.
- One fiducial, preferably in the center, is required for fine pitch packages (such as QFP, SOP, SOIC, SOJ, PLCC etc) with a pin count of 50-100.
- Two fiducials, shall be placed on diagonally opposite corners, is required for fine pitch packages (such as QFP, SOP, SOIC, SOJ, PLCC etc) with a pin count over 100.

## **2.6 Package geometry Assembly Top**

- Line width of Package geometry Assembly Top = 0 mil .

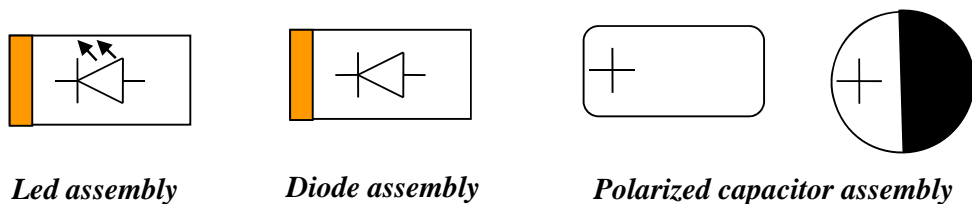


- Assembly must be equal to the body of the part. Use nominal dimension on the data sheet to draw the outline.
  - Do not use “rectangular shape” to draw the outline.
  - Add circle line for indicating pin 1 (inside of the body part).
  - For **polarized CAPACITORS**, **draw line “+”** for positive pin.
  - For DIODE, LEDS: see picture below to draw cathode mark.
- CAPACITORS: using ARC for both end of the PADs  
RESISTORS, INDUCTORS: using SQUARE for both the end of the PADs.

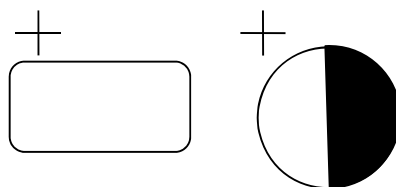
## 2.7 Package geometry Silkscreen

- **Line width of Package geometry Silkscreen Top = 0 mils .**
  - Silkscreen top must be equal to the body of the part. Use nominal dimension on the data sheet to draw the outline.
  - Do not use “rectangular shape” to draw the outline.
  - Silkscreen must never be on any pads of any components.
  - Add triangular shape for indicating pin 1 (outside of the body part).
  - Add texts indicating pin numbers for BGAs and CONNECTORS (both PACKAGE GEOMETRY/SILKSCREEN\_TOP and PACKAGE GEOMETRY/SILKSCREEN\_BOTTOM). Use TEXT\_BLOCK #1.
  - For the connector, will place by the edge of the board:
- The silkscreen should equal to the body of the part.  
Make two triangular shapes to indicate the front of the part (at front corners).
- For **polarized CAPACITORS**, **draw line “+”** for positive pin., draw shape like for diode.
  - For DIODE, LEDS: see picture below to draw cathode mark.
  - For the discrete symbols (applied only for two pins) having real body of part less than 10 mils apart from the pad edge, such as CAPACITORS, INDUCTORS, RESISTORS: Silkscreen are apart from the pad edge 10 mils.
- CAPACITORS: using ARC for both end of the PADs  
RESISTORS, INDUCTORS: using SQUARE for both the end of the PADs.
- Mark pin 5, 10, 15, 20,..., 5n for SOIC, TSOP, QFPs... which have more than 15 pins in a pin array.

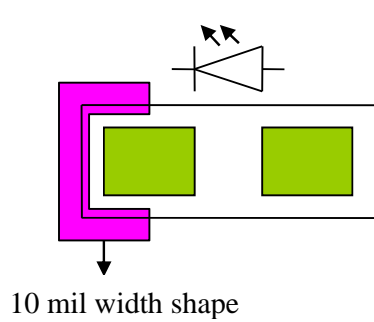
**Figure: LED, Diode, Polarized Capacitor assembly marking**



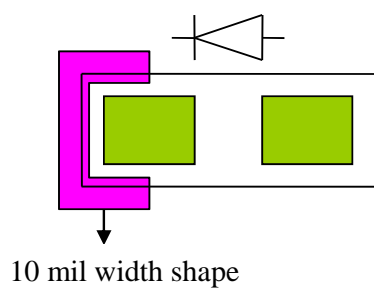
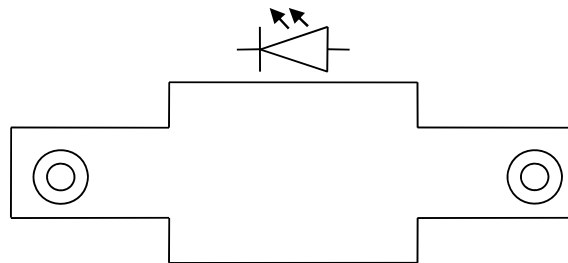
**Figure: LED, Diode, Polarized Capacitor silkscreen marking**



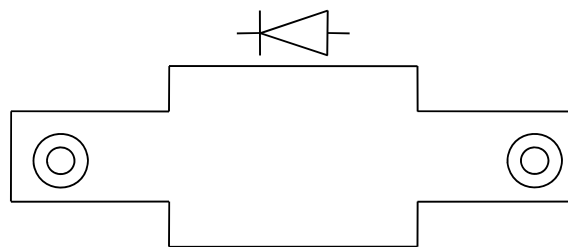
**Silkscreen for Polarized capacitor**



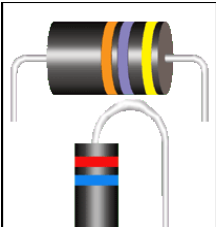
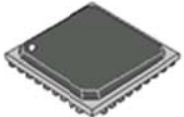
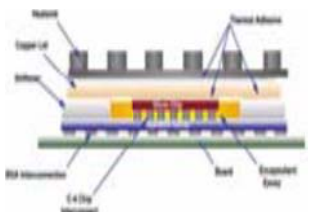
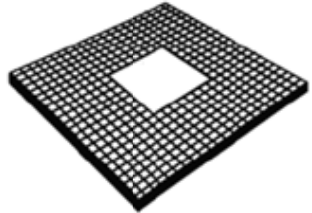

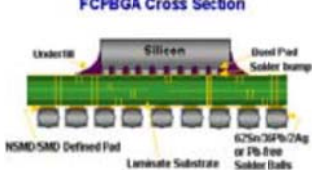

**Silkscreen for LED**











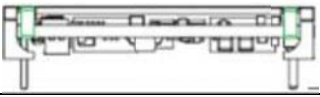
**Silkscreen for Diode**


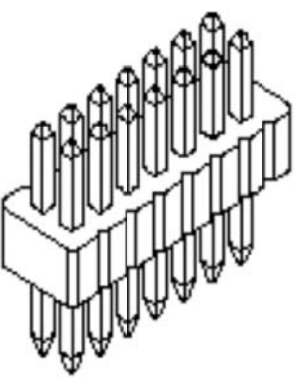







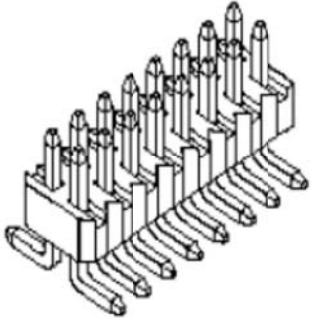



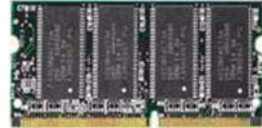

**Table 5 : Types of DFA classes**

DFA Device Class	Acronym	Name	Description	Image
axial	AXIAL	Axial Components	Axial-leaded components are often considered the most common type of discrete component used in through-hole printed wiring assembly. Leads exit from opposite ends or sides.	
bga	BGA	Ball Grid Array	Surface mounting type. External terminals (soldered balls) are laid out in a grid format on the back of the package. The BGA package can be made with a large number of high-density pins. Compared to packages such as the QFP, the BGA is unlikely to have defective mounting on printed circuit boards. The BGA also has structural characteristics that enable efficient mounting.	
bga	HBGA	Hyper Ball Grid Array (Hyper-BGA)	HyperBGA is a registered trademark of Endicott Interconnect Technologies, Inc. A fluoropolymer based chip package that combines low loss, low dielectric constant material and stripline cross section signal speeds beyond 12Gb/s. Body size JEDEC, 33mm to 52.5mm with up to 2577 I/Os, and a bga pitch of 1.00mm and 1.27mm.	
bga	CBGA	Ceramic Ball Grid Array	Ceramic ball grid array, with a square or rectangular array of solder balls on one surface, ball spacing typically 1 mm. The body of the component is ceramic.	
bga	FBGA / FPBGA	Fine-Pitch Ball Grid Array	Pitch of the BGA is typically 1mm or less.	
bga	FCBGA	Flip Chip Ball Grid Array	Flip Chip Ball Grid Array is a laminate-based BGA packaging solution. The FCBGA provides competitive solutions for higher performance applications.	
bga	SIP MODULE	System In Package Module	A fully functional system or subsystem in an IC package format. A SiP may contain one or more IC chips, plus other components traditionally found on the system board. These components may include passive components, RF shields, SAW/BAW filters, pre-packaged ICs, connectors, antennas, camera lenses or other mechanical parts required to achieve full system functionality.	


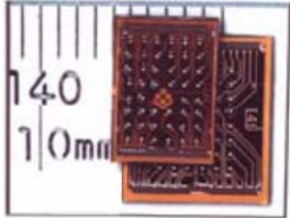

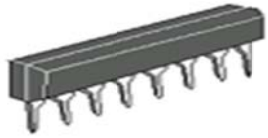


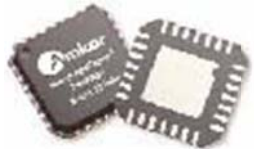
ccga	CCGA	Ceramic Column Grid Array	Ceramic Column Grid Array, surface mount circuit package in which the input and output points are high temperature solder cylinders or columns arranged in a grid pattern. The body of the component is ceramic.	
chip-0201	CHIP-0201	SMT Discrete 0201 size	0201 - 0.02" × 0.01" (0.6 mm × 0.3 mm), two terminals	
chip-0306	CHIP-0306	SMT Discrete 0306 size	0306 - 0.03" × 0.06" (0.8mm x 4.5mm), two terminals on long edge.	
chip-0402	CHIP-0402	SMT Discrete 0402 size	0402 - 0.04" × 0.02" (1.0 mm × 0.5 mm), two terminals	
chip-0508	CHIP-0508	SMT Discrete 0508 size	0508 - 0.05" × 0.08" (1.3 mm × 2.0 mm), two terminals on long edge.	
chip-0603	CHIP-0603	SMT Discrete 0603 size	0603 - 0.06" × 0.03" (1.5 mm × 0.8 mm), two terminals	
chip-0612	CHIP-0612	SMT Discrete 0612 size	0612 - 0.06" × 0.12" (1.5 mm × 3.0 mm), two terminals two terminals on long edge.	
chip-0805	CHIP-0805	SMT Discrete 0805 size	0805 - 0.08" × 0.05" (2.0 mm × 1.3 mm), two terminals	
chip-1206	CHIP-1206	SMT Discrete 1206 size	1206 - 0.12" × 0.06" (3.0 mm × 1.5 mm), two terminals	

				
chip-ge-1210	CHIP-GE-1210	SMT Discrete Greater or Equal to 1210 size	Large chips utilize this classification for simplification of spacing rules.	
chip-ge-1812	CHIP-1812	SMT Discrete 1812 size	1812 - 0.18" × 0.12" (4.6 mm × 3.0 mm), two terminals	
chip-ge-1210	MELF	Metal Electrode Face package	Metal Electrode Leadless Face (MELF) Component Diodes have metallized terminals at each end of a cylindrical body. MELF components are designed to fit the same footprints as flat components,	 Glass  Plastic
equal to chip of same overall body size	RN / CN	Resistor Network / Capacitor Network	These are networks or multiple SM chips linked together at the body. The terminals are paired in symmetry where one discrete terminal is opposite the other.	
conn-bga	CONN-BGA	Connector Ball Grid Array	BGA connectors are high density surface mount connectors utilizing Solder Balls for 2nd level attachment to PCB. Vendors in this category are NexLev and GigArray.	
conn-bga	SM-BRICK	Surface Mount Brick	Surface mount versions of devices used for power conversion, typically from one DC voltage to another DC voltage or from AC to DC. Pins are typically under the part body and require a hot air nozzle to remove, similar connectors with ball grid arrays.	 SMT - Termination  TH - Termination

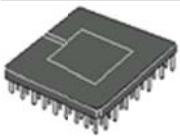
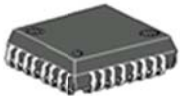




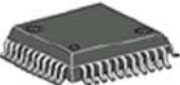
conn-pf	CONN-PF	Connector Press Fit	Press Fit Connectors are connectors that do not require solder to attach them to the PCBA. The most common type is a VHDM or Very High Density	
conn-th	CONN-TH	Connector Through Hole	Through hole connector type. These connectors are typically wave soldered and used as test headers and jumpers.	
conn-th	1/16 BRICK	Sixteenth Brick	Sixteenth-brick 0.9" x 1.3" (22.9 mm x 33 mm). Devices used for power conversion, typically from one DC voltage to another DC voltage or from AC to DC.	
conn-th	1/8 BRICK	Eighth Brick	Eighth-brick 0.9" x 2.3" (22.9 mm x 58.4 mm). Devices used for power conversion, typically from one DC voltage to another DC voltage or from AC to DC.	
conn-th	1/4 BRICK	Quarter Brick	Quarter-brick 1.45" x 2.3" (36.8 mm x 58.4 mm). Devices used for power conversion, typically from one DC voltage to another DC voltage or from AC to DC.	
conn-th	1/2 BRICK	Half Brick	Half-brick 2.3" x 2.4" (58.4 mm x 61.0 mm). Devices used for power conversion, typically from one DC	



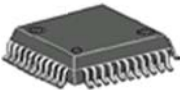



			voltage to another DC voltage or from AC to DC.	
conn-th	FULL BRICK	Full Brick	Full-brick 4.6"x2.4" (116.8 mm x 61.0mm). Devices used for power conversion, typically from one DC voltage to another DC voltage or from AC to DC.	
conn-sm	CONN-SM	Connector Surface Mount	Surface mounting type connector. This can take the form of gull wing, bga, J lead or a combination surface and through hole technologies.	
conn-sm	SIMM	Single in-line memory modules	RAM memory module, 72pin, 4.25-inch, 1.27mm pitch, MO - 116	
conn-sm	DIMM	Dual in-line memory module	RAM memory module, come in 168pin, SDRAM, MO-161; 184 pin, 1.27mm pitch, DDR1, MO-206; 240 pin, 1.00mm pitch, DDR2, MO-237. All modules are 5.250-inch. Has no logic and is the highest mainstream solution among all the DIMMs.	
conn-sm	FB-DIMM	Fully Buffered Dual Inline Memory Module	DDR2, A high performance DIMM which maintains the same form factor as Registered DIMM. 240pin, 5.250-inch, 1.00mm pitch, MO-256.	
conn-sm	SO-DIMM	Small outline dual in-line memory module	SO-DIMM chips are smaller than standard DIMMs, 144pin, 2.661-inch, 0.8mm pitch, MO-190 or 200pin DDR1, 2.661-inch, 0.6mm pitch, MO-224.	
conn-sm	MINI R-DIMM	Mini Registered Dual In line memory module	A small form factor 244pin DIMM, L=3.228/H=1.180inch (Std. height), 0.60mm pitch, 3/5 length of the unbuff/reg DIMM, MO-244. Available in very low profile (VLP), H=.720-inch.	
conn-sm	SOCK	Socket	Used with PGA or PLCC to install a device without solder. The socket is used for frequently removed or replaced	





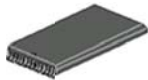



			devices. Often during prototype stages. The connector type applied will typically match the device inserted. LCC: conn-sm, PGA: conn-th, etc.	
csp	CSP	Chip Scale Package	An array package with ball pitch < 1.0 mm. Chip sized package = package ~1.2 x die size.	
dip	DIP	Dual Inline Package	The most basic through hole IC package type, DIPs were used for many years. Leads extend directly down from the longer edges of the package. Currently, use of this type of package is very limited.	
dip	SIP	Single Inline Package	Leads extending directly from one longer edge of the package are vertically mounted on the printed circuit board. The consequent reduction in mounting area allows many devices to be packed into a small area (high-density mounting).	
mlf	DFN	Dual Flat Non-Leaded Packages	A QFN package with signal pins on only 2 sides instead of all 4.	
mlf	QFN	Quad Flat Non-Leaded Package	This is similar to the QFP package, however without the leads. Terminations are located at four edges of the bottom of the package. The QFN package can be made in thinner and high-density models. Also know as a Micro Lead Frame (MLF) package.	
mlf	MLF	Micro Lead Frame Package	A leadframe-based, near-chip scale package with solderable lands instead of leads or balls. Short lead length and exposed die paddle offer improved thermal and electrical performance. Also known as Quad Flat No-lead (QFN) package.	
pga	PGA	Pin Grid Array	Multiple leads extend from the back of the package, This type of package is used for PC CPUs, and was the main choice of high-efficiency pin package before the introduction of BGA. Both	

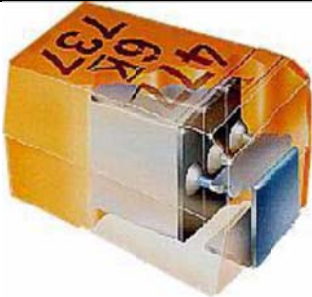

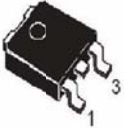


			plastic and ceramic PGAs are available. Normally used with sockets.	
plcc	QFJ	Quad Flat J-Leaded Package	Just like the QFP package, the leads of the QFJ package extend from the four edges of the package. The tips of the leads are wound in the same manner as for the SOJ package.	
plcc	T4, T6	Oscillator	LCC packages for Oscillators and Crystals. These components typically come in 4 terminal (T4) and 6 terminal (T6) leadless packages with castellated terminations.	
plcc	PLCC	Plastic Leaded Chip Carrier	The PLCC is a four-sided plastic package that has "J" leads. Lead count ranges from 18 to 84. PLCC packages can either be square or rectangle. PLCC body widths range from .35" to 1.15". PLCCs have JEDEC-standard package outlines. The standard lead pitch of the PLCC is 1.27 mm. The PLCC "J" Lead configuration requires less board space than equivalent gull wing-leaded components.	
plcc	LCCC	Leadless Ceramic Chip Carrier	Leadless Ceramic Chip Carrier (or CLCC for Ceramic Leadless Chip Carrier). A hermetically sealed ceramic package that has castellations and/or pads around its sides for solder connection in a surface mounting application.	
plcc	LLCC	Leadless Chip Carrier	Leadless Chip Carriers (LLCC) packages are characterized by external connections consisting of metallized inset terminations (a castellation), making the package resemble a miniature castle.	
qfp	QFP	Quad Flat Package	This is the evolved version of the SOP package, with leads extending from four edges of the package. The tips of the leads stretch outward as in the SOP package. This is a popular surface mount type package because the QFP package allows the number of pins to be increased at low cost,	
qfp	TQFP	Thin Quad Flat Package	A thinner version of the QFP package.	

				
qfp	LQFP	Low Profile Quad Flat Package	Lower profile version of the QFP package	
qfp	PQFP	Plastic Quad Flat Package	Four-sided plastic package of the QFP type.	
qfp	VQFP	Very Thin Quad Flat Package	Very Small or Very Thin quad flat package. These QFP packages have low profiles and typically have fine pitch with a high number of I/O's.	
qsop	QSOP	quarter-size small-outline package	quarter-size small-outline package, with pin spacing of 0.635 mm	
radial	RADIAL	RADIAL COMPONENTS	Radial-leaded components are often used in the packaging of capacitors and transistor TO cans. Radials differ from axials in that the leads exit from a common side of the component, rather from opposite ends or sides. This gives the radial a vertical profile and a smaller printed wiring footprint.	
radial	TO	TRANSISTOR OUTLINE PACKAGE	TO package is through-hole mount transistor outline package that is suitable for high power, medium current, and	

			fast-switching power devices. There are many additional types of TO packages. The TO-220 Full Pack package variant, includes a fully encapsulated heat sink that does not require extra hardware for electrical isolation. Often used in motor drive applications and power supplies. TO components come packaged in tubes, bulk, and tape and reel. Popular sizes are TO92, TO5, TO39, TO220.	 <p>TO-220</p>
radial	TOROID	Toroid Inductor	A toroid is a coil of insulated or enameled wire wound on a donut-shaped form made of powdered iron. A toroid is used as an inductor in electronic circuits, especially at low frequencies where comparatively large inductances are necessary such as power applications.	
sc	SC70	Shrink SOT Package	A shrunken version of the small outline transistor package.	
sc	SC	Shrink SOT Package	SC is a plastic, surface mounted package with three leads	
sm-can	SM-CAN	Surface Mount Can	Vertical cylindrical cases which are similar in size and shape to electrolytic radial capacitors. However, with surface mount terminals that facilitate automatic mounting and reflow soldering	
sod	SOD	Small Outline Diode	SOD is a plastic, surface mounted, small outline diode (SOD) package with two leads	
soic	SOIC	Small Outline Integrated Circuit	The SOIC is a rectangular surface-mount integrated circuit package with eight or more gull wing leads. The leads protrude from the longer edge of the package. SOIC packages are JEDEC compliant, and come in a variety of body widths. The SOIC may be shipped in tubes or tape and reel.	
soj	SOJ	Small Outline J-	The tips of the leads extending from the	

		Leaded Package	two longer edges of the package are wound inward as if cradling the package itself. The SOJ package is so named because the leads look like the letter "J" when viewed from the side. They are surface mounted after soldering the wound portions. SOJ packages were formerly used for SIMM (memory modules).	
sop	SOP	Small Outline Package	Leads stretch from the two longer edges of the package, then the lead tips extended outward in a gull wing formation. This is the main type surface mounting and is very widely used, particularly in the areas of microcomputers, memory and analog IC, which use a relatively small number of pins.	
sop	TSOP	Thin Small Outline Package	A thinner version of the SOP package.	
sop	SSOP	Shrink Small Outline Package	The SSOP package is a smaller or 'shrunk' version of the SOIC package, having a compressed body and a tightened lead pitch. Lead count ranges from 8 to 64. SSOP body sizes come in 150, 209 and 300 mils. The SSOP package is JEDEC- and EIAJ-compliant. The package leads are solder plated.	
sop	TSSOP	Thin Shrink Small Outline Package	The TSSOP package has a smaller body and smaller lead pitch than the standard SOIC package. The TSSOP come in body sizes of 3.0mm, 4.4mm and 6.1mm with a thickness of 0.85 mm for the 3.0-mm body and a thickness of 9mm for the 4.4 mm- and 6.1-mm bodies. Lead count ranges from 8 to 56. Its standard lead pitch is 0.65mm. This package type is JEDEC-compliant.	
sot	SOT-23 / SC70	SMALL OUTLINE TRANSISTOR	SMALL OUTLINE TRANSISTOR SOT package is a rectangular surface mount transistor or diode with three or more gull wings leads. The leads are on two length sides of the package. SOT package are JEDEC compliant. Popular sizes are the SOT23, SOT143, SOT223 and SOT89. SOT components are available on plastic tape and reel.	
tant	TANT	Tantalum Capacitor	Capacitors with a tantalum oxide film dielectric are known as tantalum capacitors. The cathode material in standard tantalum capacitors is manganese dioxide. They are known for small size and capacitance extension (Less than 1/4 the size of equivalent aluminum electrolytic capacitors), good frequency characteristics, and long life.	
tant	A-CAP	Tantalum Capacitor	Size A (EIA 3216-18) 3.2 mm × 1.6 mm × 1.6 mm	
tant	B-CAP	Tantalum Capacitor	Size B (EIA 3528-21) 3.5 mm × 2.8 mm × 1.9 mm	
tant	C-CAP	Tantalum Capacitor	Size C (EIA 6032-28) 6.0 mm × 3.2 mm × 2.2 mm	

tant	D-CAP	Tantalum Capacitor	Size D (EIA 7343-31) 7.3 mm × 4.3 mm × 2.4 mm	
tant	E-CAP	Tantalum Capacitor	Size E (EIA 7343-43) 7.3 mm × 4.3 mm × 4.1 mm	
tant	F-CAP	Tantalum Capacitor	Size F (EIA 6032-20) 6.0 mm x 3.2 mm x 2 mm	
tant	K-CAP	Tantalum Capacitor	Size K (EIA 3216-10) 3.2 mm x 1.6 mm x 1 mm	
tant	P-CAP	Tantalum Capacitor	Size P (EIA 2012-15) 2.05 mm x 1.35 mm x 1.5 mm	
tant	R-CAP	Tantalum Capacitor	Size R (EIA 2012-12) 2.05 mm x 1.3 mm x 1.2 mm	
tant	S-CAP	Tantalum Capacitor	Size S (EIA 3216-12) 3.2 mm x 1.6 mm x 1.2 mm	
tant	T-CAP	Tantalum Capacitor	Size T (EIA 3528-12) 3.5 mm x 2.8 mm x 1.2 mm	
tant	V-CAP	Tantalum Capacitor	Size V (EIA 7361-38) 7.3 mm x 6.1mm x 3.45 mm	
tant	W-CAP	Tantalum Capacitor	Size W (EIA 6032-15) 6.0 mm x 3.2 mm x 1.5 mm	
tant	X-CAP	Tantalum Capacitor	Size X (EIA 7343-15) 7.3 mm x 4.3 mm x 1.5 mm	
tant	Y-CAP	Tantalum Capacitor	Size Y (EIA 7343-20) 7.3 mm x 4.3 mm x 2 mm	
to	DPAK	Discrete package or deca-watt (DPAK).	The D2PAK and DPAK are direct surface mount derivatives of the TO-220 power package	
to	D2PAK	Discrete package or deca-watt (DPAK)	Specific type of Footprint Family usually for pwr Transistors / Diodes. D2PAK is large surface mounted package that include a heat sink	

**Table 6 : DFA Minimum Spacing Guidelines**

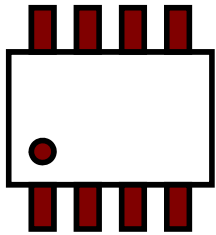
	axial	bga	ccga	chip-0201	chip-0306	chip-0402	chip-0508	chip-0603	chip-0805	chip-1206	chip-ge-1210	conn-bga	conn-pf	conn-sm	conn-th	csp	dip	mlf	pga	plcc	qfp	qsop	radial	sc	sm-can	sod	soic	soj	sop	sot	tant	to
axial	50																															
bga	125	125																														
ccga	125	125	200																													
chip-0201	50	100	100	12																												
chip-0306	50	100	100	15	20																											
chip-0402	50	100	100	15	20	15																										
chip-0508	50	100	100	15	20	20	20																									
chip-0603	50	100	100	18	18	18	20	18																								
chip-0805	50	100	100	20	20	20	20	18	20																							
chip-1206	50	100	100	25	25	25	25	25	25	35																						
chip-ge-1210	50	100	100	40	40	40	40	40	40	40	40																					
conn-bga	50	110	110	110	110	110	110	110	110	110	110	110																				
conn-pf	200	200	200	200	200	200	200	200	200	200	200	200	200																			
conn-sm	125	125	200	75	110	75	110	75	75	75	75	110	200	125																		
conn-th	100	125	200	100	100	100	100	100	100	100	100	110	200	200	100																	
csp	125	125	125	100	100	100	100	100	100	100	100	110	200	125	125	125																
dip	50	125	125	50	50	50	50	50	50	50	50	110	200	125	100	125	50															
mlf	125	125	125	100	110	100	110	100	100	100	100	110	200	125	125	125	125	125														
pga	50	125	125	50	50	50	50	50	50	50	50	110	200	125	100	125	50	125	50													
plcc	100	125	125	40	50	40	50	40	40	40	40	125	200	125	100	125	100	125	100	50												
qfp	125	125	125	50	50	50	50	50	50	50	50	110	200	125	100	125	125	125	125	125	125											
qsop	100	125	125	40	50	40	50	40	40	40	40	110	200	125	100	125	100	125	100	50	125	50										
radial	50	125	125	50	50	50	50	50	50	50	50	110	200	125	100	125	50	125	50	100	125	100	50									
sc	50	100	100	20	50	20	50	20	20	20	20	110	200	75	100	100	50	100	50	40	50	40	50	20								
sm-can	50	200	110	50	50	50	50	50	50	50	50	110	100	110	50	200	50	110	50	100	50	50	50	50	75							
sod	50	100	100	20	50	20	50	20	20	20	20	110	200	75	100	100	50	100	50	40	50	40	50	20	50	20						
soic	75	125	125	25	50	25	50	25	25	25	25	110	200	125	100	125	75	125	75	50	75	50	75	25	50	25	25					
soj	100	125	125	40	50	40	50	40	40	40	40	125	200	125	100	125	100	125	100	50	125	50	100	40	100	40	50	50				
sop	100	125	125	40	50	40	50	40	40	40	40	110	200	125	100	125	100	125	100	50	125	50	100	40	50	40	50	50	50			
sot	50	100	100	20	50	20	50	20	20	20	20	110	200	75	100	100	50	100	50	40	50	40	50	20	50	20	25	40	40	20		
tant	50	100	100	40	50	40	50	40	40	40	40	110	200	75	100	100	50	100	50	40	50	40	50	20	50	20	25	40	40	20	40	
to	100	125	125	40	50	40	50	40	40	40	40	110	200	125	100	125	100	125	100	50	125	50	100	40	50	40	50	50	50	40	40	50

**Table 7 : Manufacturing Ultimate Physical Spacing Limits**

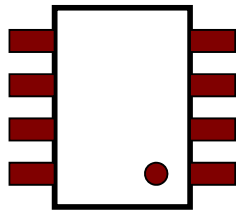
	axial	bga	ccga	chip-0201	chip-0306	chip-0402	chip-0508	chip-0603	chip-0805	chip-1206	chip-ge-1210	conn-bga	conn-pf	conn-sm	conn-th	csp	dip	mlf	pga	plcc	qfp	qsop	radial	sc	sm-can	sod	soic	soj	sop	sot	tant	to
axial	50																															
bga	30	30																														
ccga	30	30	30																													
chip-0201	50	10	10	10																												
chip-0306	30	20	20	10	10																											
chip-0402	50	10	10	10	10	10																										
chip-0508	30	20	20	10	10	10	10																									
chip-0603	50	10	10	10	10	10	10	10																								
chip-0805	50	10	10	10	10	10	10	10	10																							
chip-1206	50	10	10	10	10	10	10	10	10	10																						
chip-ge-1210	50	10	10	25	25	25	25	25	25	25	25																					
conn-bga	30	20	20	10	20	20	20	20	20	20	20	50																				
conn-pf	100	200	200	100	100	100	100	100	100	100	100	75	50																			
conn-sm	100	100	100	20	20	20	20	20	20	25	25	50	100	100																		
conn-th	50	30	30	50	50	50	50	50	50	50	50	50	50	50	50																	
csp	30	30	30	10	20	10	20	10	10	10	10	110	200	100	30	30																
dip	30	30	30	30	30	30	30	30	30	30	30	50	100	100	50	30	30															
mlf	30	30	30	10	20	10	20	10	10	10	10	50	200	100	30	30	30	30														
pga	30	30	30	30	30	30	30	30	30	30	30	50	100	100	50	30	30	30	30													
plcc	100	30	30	25	25	25	25	25	25	25	25	100	100	100	50	30	50	30	50	30												
qfp	30	30	30	10	20	10	20	10	10	20	20	20	100	100	50	30	30	30	30	20	30											
qsop	100	30	30	25	25	25	25	25	25	25	25	20	100	100	50	30	50	30	50	30	20	30										
radial	50	30	30	50	50	50	50	50	50	50	50	50	100	100	50	30	30	30	30	100	30	100	50									
sc	50	10	10	10	20	10	20	10	10	10	10	20	100	25	50	10	30	10	30	25	20	25	50	10								
sm-can	30	150	30	20	20	20	20	20	20	20	20	20	75	30	30	150	30	50	30	75	30	30	30	30	50							
sod	50	10	10	10	20	10	20	10	10	10	10	20	100	25	50	10	30	10	30	25	20	25	50	10	30	10						
soic	75	30	30	10	20	10	20	10	10	10	10	20	100	100	50	30	30	30	30	30	20	30	75	10	30	10	10					
soj	100	30	30	25	25	25	25	25	25	25	25	100	100	100	50	30	50	30	50	30	20	30	100	25	75	25	30	30				
sop	100	30	30	25	25	25	25	25	25	25	25	20	100	100	50	30	50	30	50	30	20	30	100	25	30	25	30	30	30			
sot	50	10	10	10	20	10	20	10	10	10	10	20	100	25	50	10	30	10	30	25	20	25	50	10	30	10	10	25	25	10		
tant	50	10	10	10	25	25	25	25	25	25	25	20	100	25	50	10	30	10	30	25	20	25	50	10	30	10	10	25	25	10	25	
to	100	30	30	25	25	25	25	25	25	25	25	50	100	100	50	30	50	30	50	30	20	30	100	25	30	25	30	30	30	25	25	30

## Package Orientation

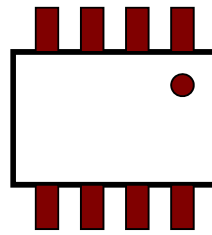
### SOIC



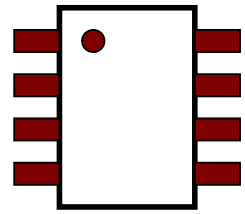
0



90

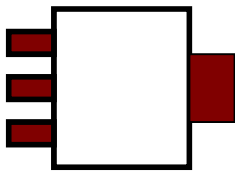


180

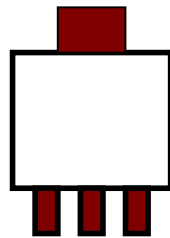


270

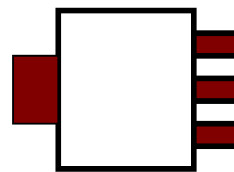
### SOT-REGULATOR



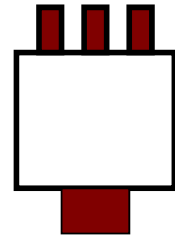
0



90

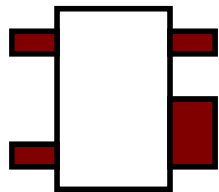


180

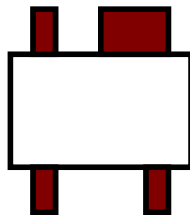


270

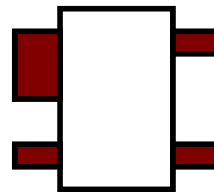
### SOT143



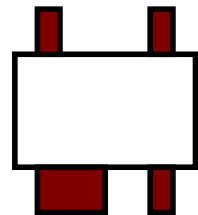
0



90

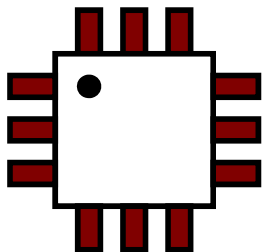


180

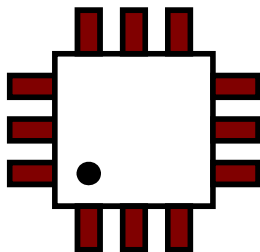


270

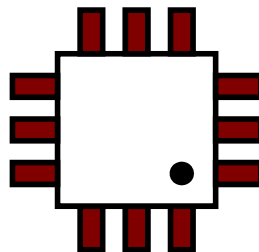
### QFP



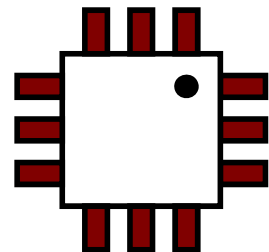
0



90

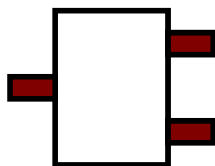


180

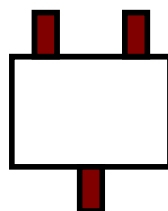


270

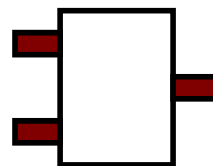
### SOT23 (MINL\_\_C)



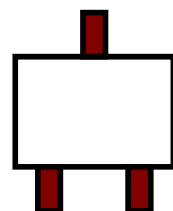
0



90



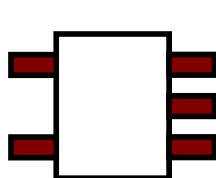
180



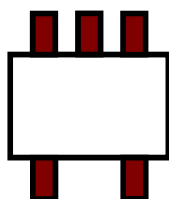
270



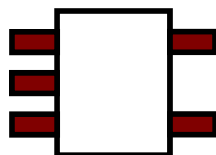
### SOT5



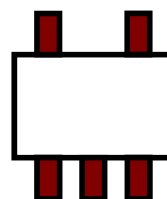
0



90

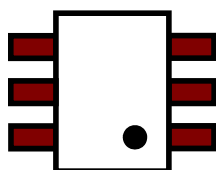


180

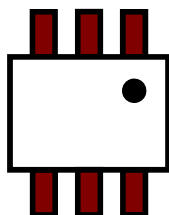


270

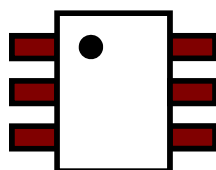
### SOT6



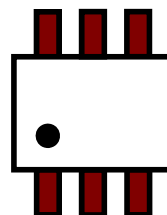
0



90

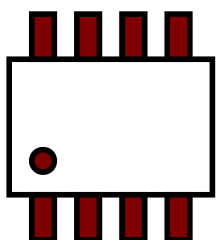


180

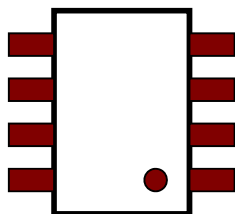


270

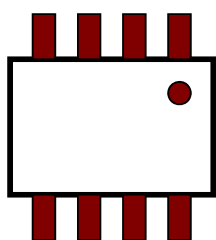
### SOP



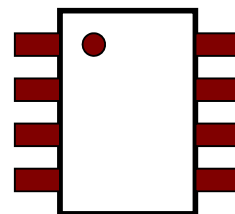
0



90

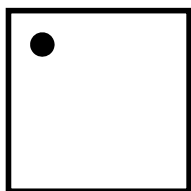


180

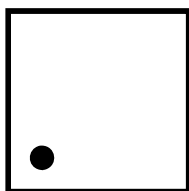


270

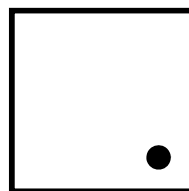
### BGA



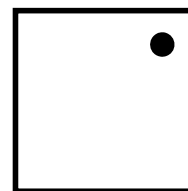
0



90

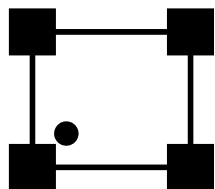


180

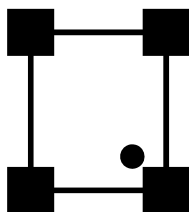


270

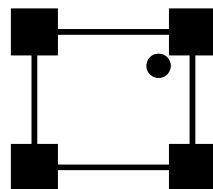
### OSCILLATOR\_XTAL



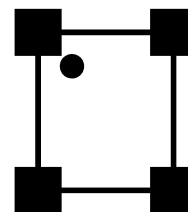
0



90

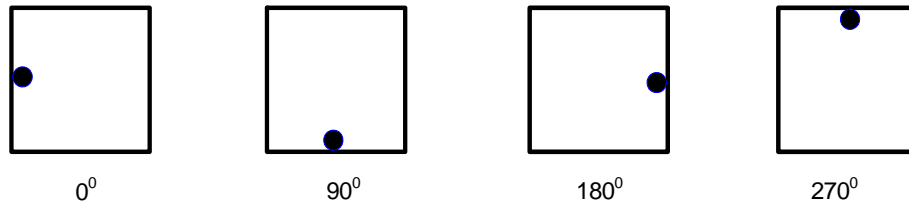


180

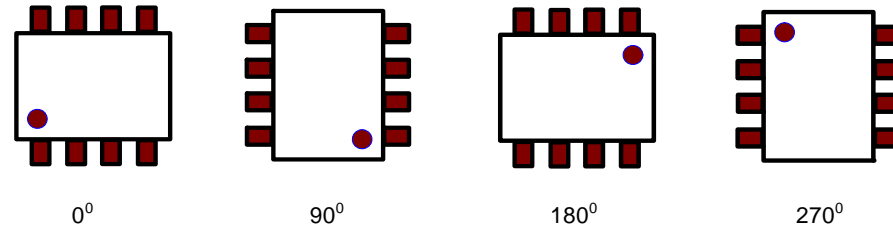


270

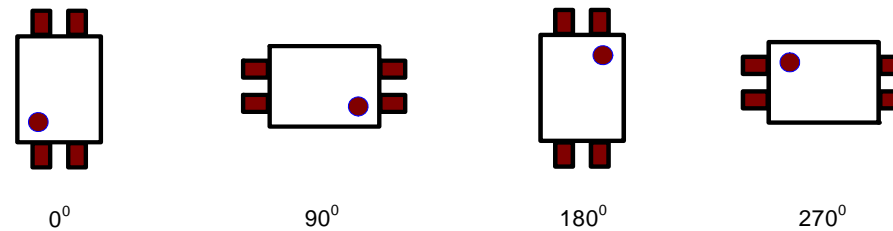
## PLCC



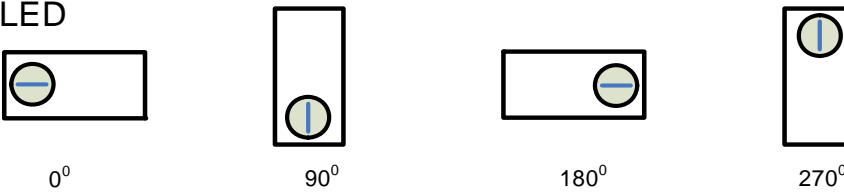
## RN8



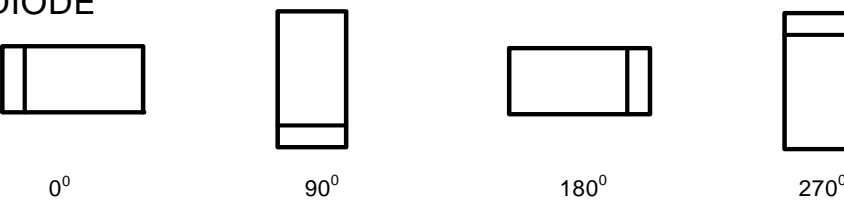
## RN4



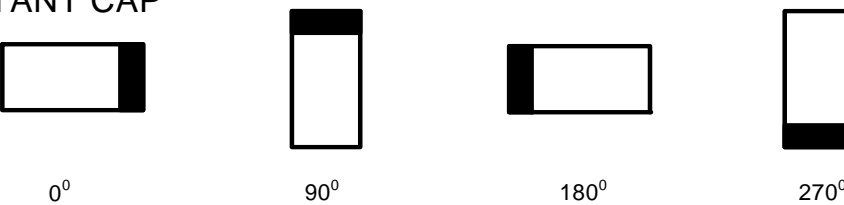
## LED



## DIODE



## TANT CAP



# Drill table

Example: d060c080.pad: Drill size 60, the drill symbol: Figure : Square; Character : H; Width : 60; Height : 60

\* For drill size smaller than 50mils, make the drill symbol with Width : 50; Height : 50

\* Also we want to use only CROSS figure for the drill symbol for all NON\_PLATED PADSTACKS.

\* For rectangular and oblong drill holes, we use 2 characters for Drill/Slot symbol. Example : Characters in Drill/Slot symbol of padstack D059X024REC079X044 should be “GX” .

**Table 8 : Drill table**

Circle					Square					Hexagon					Octagon				
Cir	1*	A	a	27	Sqr	53	A	a	79	Hex	105	A	a	131	Octa	157	A	a	183
Cir	2*	B	b	28	Sqr	54	B	b	80	Hex	106	B	b	132	Octa	158	B	b	184
Cir	3*	C	c	29	Sqr	55	C	c	81	Hex	107	C	c	133	Octa	159	C	c	185
Cir	4*	D	d	30	Sqr	56	D	d	82	Hex	108	D	d	134	Octa	160	D	d	186
Cir	5*	E	e	31	Sqr	57	E	e	83	Hex	109	E	e	135	Octa	161	E	e	187
Cir	6*	F	f	32	Sqr	58	F	f	84	Hex	110	F	f	136	Octa	162	F	f	188
Cir	7*	G	g	33	Sqr	59	G	g	85	Hex	111	G	g	137	Octa	163	G	g	189
Cir	8*	H	h	34	Sqr	60	H	h	86	Hex	112	H	h	138	Octa	164	H	h	190
Cir	9*	I	i	35	Sqr	61	I	i	87	Hex	113	I	i	139	Octa	165	I	i	191
Cir	10*	J	j	36	Sqr	62	J	j	88	Hex	114	J	j	140	Octa	166	J	j	192
Cir	11*	K	k	37	Sqr	63	K	k	89	Hex	115	K	k	141	Octa	167	K	k	193
Cir	12*	L	l	38	Sqr	64	L	l	90	Hex	116	L	l	142	Octa	168	L	l	194
Cir	13*	M	m	39	Sqr	65	M	m	91	Hex	117	M	m	143	Octa	169	M	m	195
Cir	14*	N	n	40	Sqr	66	N	n	92	Hex	118	N	n	144	Octa	170	N	n	196
Cir	15*	O	o	41	Sqr	67	O	o	93	Hex	119	O	o	145	Octa	171	O	o	197
Cir	16*	P	p	42	Sqr	68	P	p	94	Hex	120	P	p	146	Octa	172	P	p	198
Cir	17*	Q	q	43	Sqr	69	Q	q	95	Hex	121	Q	q	147	Octa	173	Q	q	199
Cir	18*	R	r	44	Sqr	70	R	r	96	Hex	122	R	r	148	Octa	174	R	r	200
Cir	19*	S	s	45	Sqr	71	S	s	97	Hex	123	S	s	149	Octa	175	S	s	201
Cir	20*	T	t	46	Sqr	72	T	t	98	Hex	124	T	t	150	Octa	176	T	t	202
Cir	21*	U	u	47	Sqr	73	U	u	99	Hex	125	U	u	151	Octa	177	U	u	203
Cir	22*	V	v	48	Sqr	74	V	v	100	Hex	126	V	v	152	Octa	178	V	v	204
Cir	23*	W	w	49	Sqr	75	W	w	101	Hex	127	W	w	153	Octa	179	W	w	205
Cir	24*	X	x	50	Sqr	76	X	x	102	Hex	128	X	x	154	Octa	180	X	x	206
Cir	25	Y	y	51	Sqr	77	Y	y	103	Hex	129	Y	y	155	Octa	181	Y	y	207
Cir	26	Z	z	52	Sqr	78	Z	z	104	Hex	130	Z	z	156	Octa	182	Z	z	208
Diamond					Triangle					Oblong					Cross				
Dia	209	A	a	235	Tri	261	A	a	287	Obl	313	A	a	339	Cro	365	A	a	391
Dia	210	B	b	236	Tri	262	B	b	288	Obl	314	B	b	340	Cro	366	B	b	392
Dia	211	C	c	237	Tri	263	C	c	289	Obl	315	C	c	341	Cro	367	C	c	393
Dia	212	D	d	238	Tri	264	D	d	290	Obl	316	D	d	342	Cro	368	D	d	394
Dia	213	E	e	239	Tri	265	E	e	291	Obl	317	E	e	343	Cro	369	E	e	395
Dia	214	F	f	240	Tri	266	F	f	292	Obl	318	F	f	344	Cro	370	F	f	396
Dia	215	G	g	241	Tri	267	G	g	293	Obl	319	G	g	345	Cro	371	G	g	397
Dia	216	H	h	242	Tri	268	H	h	294	Obl	320	H	h	346	Cro	372	H	h	398
Dia	217	I	i	243	Tri	269	I	i	295	Obl	321	I	i	347	Cro	373	I	i	399
Dia	218	J	j	244	Tri	270	J	j	296	Obl	322	J	j	348	Cro	374	J	j	400

Dia 219 K k 245	Tri 271 K k 297	Obl 323 K k 349	Cro 375 K k 401
Dia 220 L l 246	Tri 272 L l 298	Obl 324 L l 350	Cro 376 L l 402
Dia 221 M m 247	Tri 273 M m 299	Obl 325 M m 351	Cro 377 M m 403
Dia 222 N n 248	Tri 274 N n 300	Obl 326 N n 352	Cro 378 N n 404
Dia 223 O o 249	Tri 275 O o 301	Obl 327 O o 353	Cro 379 O o 405
Dia 224 P p 250	Tri 276 P p 302	Obl 328 P p 354	Cro 380 P p 406
Dia 225 Q q 251	Tri 277 Q q 303	Obl 329 Q q 355	Cro 381 Q q 407
Dia 226 R r 252	Tri 278 R r 304	Obl 330 R r 356	Cro 382 R r 408
Dia 227 S s 253	Tri 279 S s 305	Obl 331 S s 357	Cro 383 S s 409
Dia 228 T t 254	Tri 280 T t 306	Obl 332 T t 358	Cro 384 T t 410
Dia 229 U u 255	Tri 281 U u 307	Obl 333 U u 359	Cro 385 U u 411
Dia 230 V v 256	Tri 282 V v 308	Obl 334 V v 360	Cro 386 V v 412
Dia 231 W w 257	Tri 283 W w 309	Obl 335 W w 361	Cro 387 W w 413
Dia 232 X x 258	Tri 284 X x 310	Obl 336 X x 362	Cro 388 X x 414
Dia 233 Y y 259	Tri 285 Y y 311	Obl 337 Y y 363	Cro 389 Y y 415
Dia 234 Z z 260	Tri 286 Z z 312	Obl 338 Z z 364	Cro 390 Z z 416