The Design Process, Part 2
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Understanding what to do with the Bill of Materials

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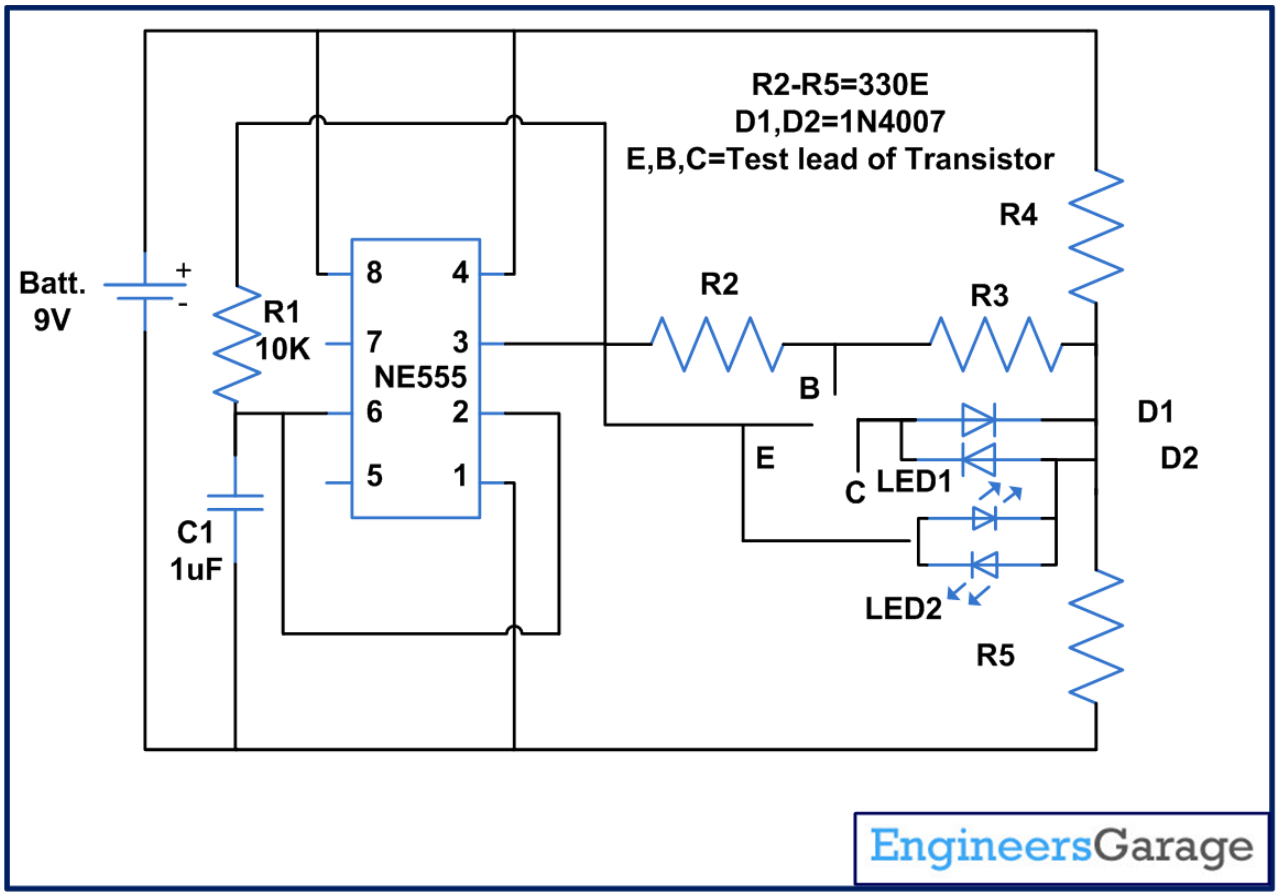
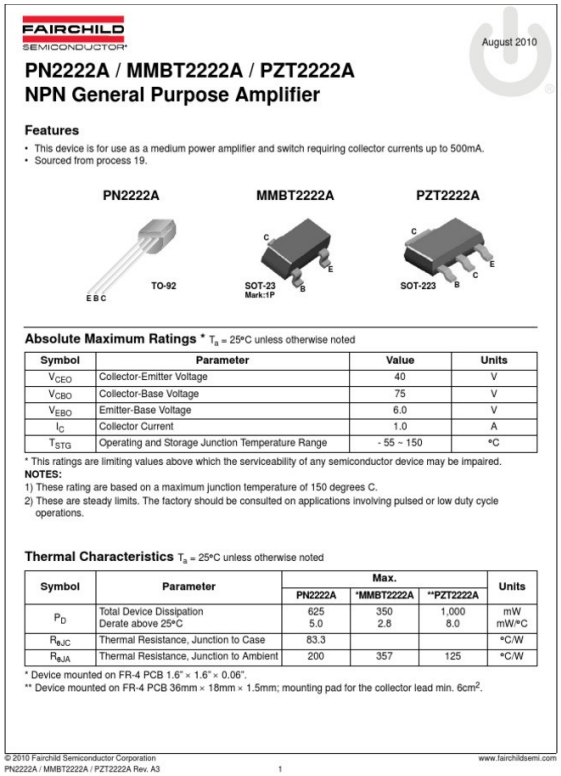
Starting the library of parts is the next step. Each part on the Bill of Materials must be built and entered into the design. There are several pre-existing libraries that you can draw from as you wish, but I find it much easier to work with parts that I have built. Also, depending on the assembly process, parts may have to be built differently.

So, you've been handed a drawing that is covered with various symbols connected with lines. A part number and value may be drawn next to the symbols or maybe just a number corresponding to the same number on the parts list. Here is a sample.



Sometimes the engineer may also supply you with Data Sheets that tell you information about the part including what the PCB Footprint (the array of metal pads that the part will be soldered to) should look like. If you have to find your own data sheets, the easiest way is to do a web search for the part number. You may have to ask the engineer for clarification on several parts and on his connections...mistakes happen, don't be afraid to ask. Data Sheets may be just one page or multiple. In the case of complex integrated circuits, there may be



FAIRCHILD SEMICONDUCTOR

August 2010

PN2222A / MMBT2222A / PZT2222A
NPN General Purpose Amplifier

Features

- This device is for use as a medium power amplifier and switch requiring collector currents up to 500mA.
- Sourced from process 19.

PN2222A — TO-92 (E B C)
MMBT2222A — SOT-23 Mark:1P
PZT2222A — SOT-223

Absolute Maximum Ratings * T_a = 25°C unless otherwise noted

Symbol	Parameter	Value	Units
V_{CEO}	Collector-Emitter Voltage	40	V
V_{CBO}	Collector-Base Voltage	75	V
V_{EBO}	Emitter-Base Voltage	6.0	V
I_C	Collector Current	1.0	A
T_{STG}	Operating and Storage Junction Temperature Range	- 55 ~ 150	°C

* This ratings are limiting values above which the serviceability of any semiconductor device may be impaired.

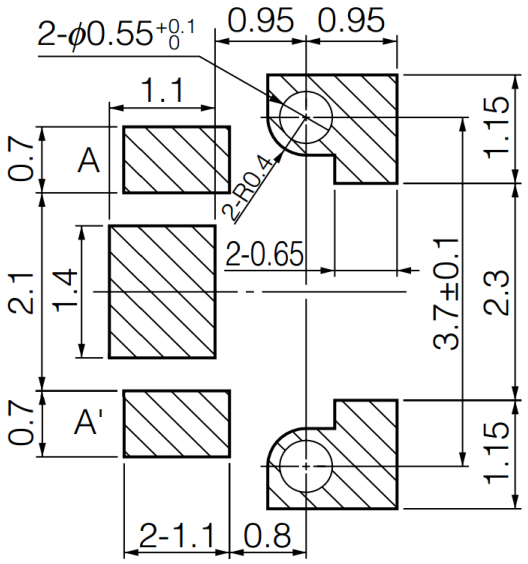
NOTES:
1) These rating are based on a maximum junction temperature of 150 degrees C.
2) These are steady limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.

Thermal Characteristics T_a = 25°C unless otherwise noted

Symbol	Parameter	Max. PN2222A	Max. *MMBT2222A	Max. **PZT2222A	Units
P_D	Total Device Dissipation Derate above 25°C	625 5.0	350 2.8	1,000 8.0	mW mW/°C
$R_{\theta JC}$	Thermal Resistance, Junction to Case	83.3			°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	200	357	125	°C/W

* Device mounted on FR-4 PCB 1.6" × 1.6" × 0.06".
** Device mounted on FR-4 PCB 36mm × 18mm × 1.5mm; mounting pad for the collector lead min. 6cm².

hundreds of pages. Here are some examples of the information contained within data sheets (Note: in the example, PWB means Printed Wire Board, an older name for PCB).

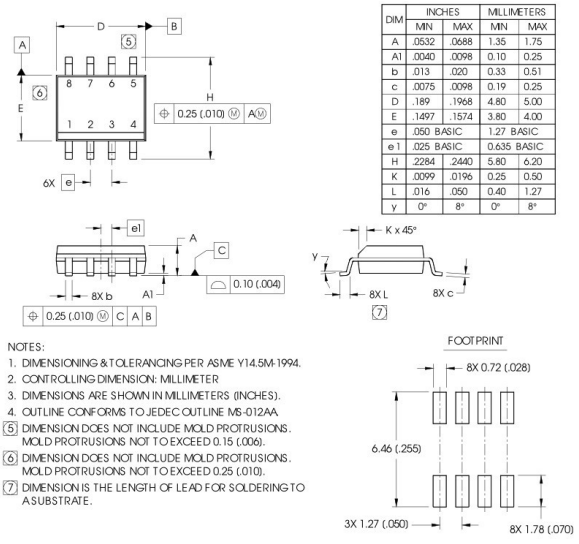


PWB land pattern for reference

When using the dimensions on data sheets, always check the numbers. Some are in metric (millimeters) and some are in English (inches), and occasionally in both, though I have found that they are not always converted correctly. If one dimension is given in parenthesis, that is not the controlling dimension.

Refer to The ANSI (American National Standards Institute) standard, ANSI E32.2-1975, on this web page for explanations of the schematic symbols and their reference designators.

Of course, we will go into all of this in greater detail later.



DIM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS MAX
A	.0532	.0688	1.35	1.75
A1	.0040	.0098	0.10	0.25
b	.013	.020	0.33	0.51
c	.0075	.0098	0.19	0.25
D	.189	.1968	4.80	5.00
E	.1497	.1574	3.80	4.00
e	.050 BASIC		1.27 BASIC	
e1	.025 BASIC		0.635 BASIC	
H	.2284	.2440	5.80	6.20
K	.0099	.0196	0.25	0.50
L	.016	.050	0.40	1.27
y	0°	8°	0°	8°

NOTES:
1. DIMENSIONING & TOLERANCING PER ASME Y14.5M-1994.
2. CONTROLLING DIMENSION: MILLIMETER
3. DIMENSIONS ARE SHOWN IN MILLIMETERS (INCHES).
4. OUTLINE CONFORMS TO JEDEC OUTLINE MS-012AA.
5. DIMENSION DOES NOT INCLUDE MOLD PROTRUSIONS. MOLD PROTRUSIONS NOT TO EXCEED 0.15 (.006).
6. DIMENSION DOES NOT INCLUDE MOLD PROTRUSIONS. MOLD PROTRUSIONS NOT TO EXCEED 0.25 (.010).
7. DIMENSION IS THE LENGTH OF LEAD FOR SOLDERING TO A SUBSTRATE.