

# Driving SMT Assembly

PowerPCB

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Index Designs



USER **2** USER

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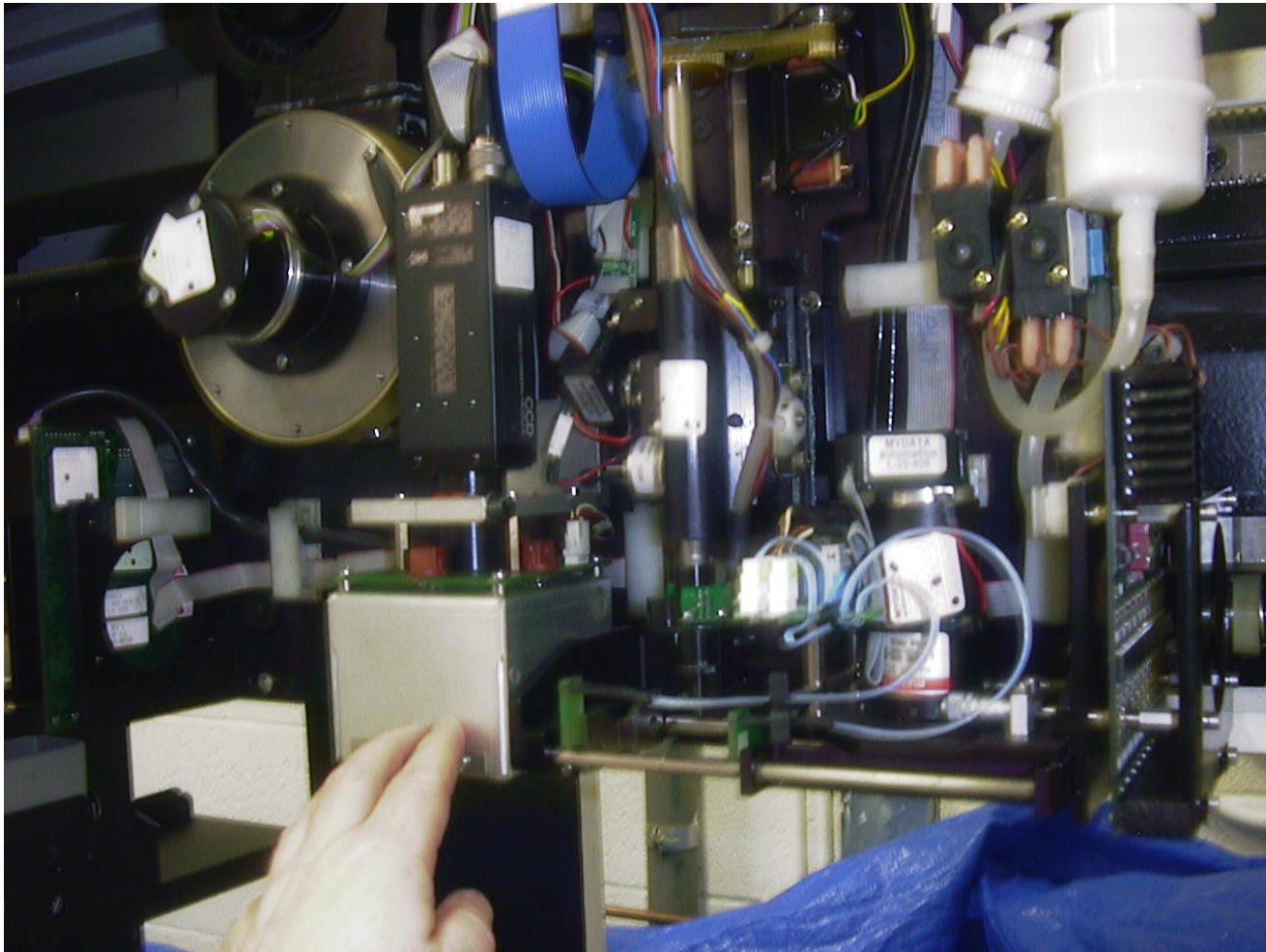
# Goal of “1-Up Assembly” Plan

- v **Simplify SMT Assembly to an Easily Purchased Service**
  - **Assembly Purchase as Easy as Bare Board Purchase**
  - **Tool to Proof Placement and Allow Corrections**
  - **Increase Quality to Far Above Hand Assembly**
  - **Reduce Costs**
  - **Provide Extensive “Digikey Like” Supply of Parts**
  - **Reduce Time Spend Handling \$0.01 Parts**

# Data Required to Drive SMT Assembly

- ✓ **Pick, Transport, Align and Placement of Parts**
  - **Very Complex Robotics**
  - **Different Vendors have Different Techniques**
  - **Files and Software are Machine Dependent**
- ✓ **Corrections Required for Origin and Rotation**
- ✓ **Part Location, Setup and Programming**
  - **Just Locating the Parts takes Time**
  - **Loading a Reel takes 4 Minutes on some Machines**
  - **Coordination of Feeders and Setup takes Hours**

# MyData Alignment and Placement Head



# Pickup, Transport, Align and Placement

- √ **Use Target Machine ID for Placement Reference**
  - **MyData uses PACKAGE**
  - **PACKAGE is very similar to DECAL**
  - **Use PACKAGE as index for Placement Database**
  - **Use PACKAGE as index for Feeder Database/Logic**
- √ **Create PACKAGE to Machine ID Database**
  - **Lookup of Origin and Rotation Correction for PCB**
  - **Lookup of Part Feed Requirements**

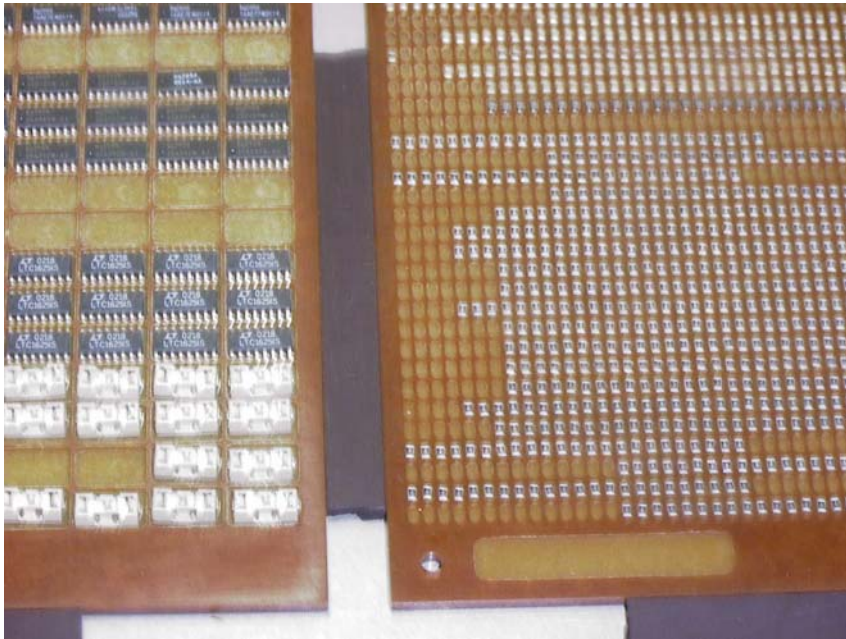
# Rotation Corrections and Feeding Parts

- ✓ **Two Stages of Rotation Correction Required**
  - **PowerPCB Data to Package Library**
  - **Package Library to Assembly Machine**
  - **Adjust for Start, Rotation and CW/CCW**
- ✓ **Part Feeding Data**
  - **Adjust Feeding Scheme to Minimize Setup Time**
  - **Merge Jobs with Common Components**
  - **Download Feeding Setup to Assembly Machine**

# Using Trays to Feed Parts

- ▼ **Pros and Cons of Component Trays**
  - + **Nothing Faster for Loading < 10 Components**
  - + **Very Dense – Single Trays for 100s of Line Items**
  - + **“Instant Insert” onto MyData Tray Wagon**
  - + **Visual Indication of Missing Line Items**
  - **Still a Tedious Task. 400 Parts / Hour = \$0.08/Part**
- **Rapid Part Access**
  - **Most BOM Line Items < 10 Parts (Proto Runs)**
  - **Pill Box with Barcode**
  - **Reel Locating System with LEDs will be next.**

# Component Tray and Pill Box



# Complete Job Setup on Tray Wagon



# Tray Database and Tray Manager

- ✓ **Definition of Holes for each Package**
  - Holes have Name, Size and Pick Position
  - Holes might be used for Several Packages
- ✓ **Generation of Cut Tray Database**
  - Generate CNC Files for Milling Center
  - Drive Laser Cutter for Cardboard Trays
- ✓ **Generation of Component Arrays within Trays**
  - Software to Map BOM Items into Tray Arrays

# Bringing it all Together

- √ **Define PACKAGE Database**
  - Use PowerPCB Attributes or Parallel Database
  - Push Machine ID into Attributes for in house jobs
  - Requires Software to Extract and Process Attributes
- √ **Part Feeding Software**
  - Can be Simple or Very Complex
  - Depends on Nature of Assembly Machine
  - Store Parts for Rapid Access
  - Generate Trays Stuffing Lists

# Tool to Manage BOMs

- v **BOM Builder and Indexer Engine**
  - **Remove All Attributes from Schematic Library**
  - **Annotate BOM Line Items using Search Engine**
  - **Annotate PowerPCB Decals and Packages**
  - **Use PowerPCB to Build PACKAGE Graphics**
  - **Place PACKAGE Graphics onto Customer Gerbers**
  - **Use X,Y Rot. from PowerPCB to Drive Assembly**
  - **Extensive Use of Dynamic Load .DLL**

# Read BOM From Schematic Tools

**BOM Builder - Main Screen**

File Edit Board Report Pick-n-Place

- Cap (C)
- Connector (J)
- Diode (D)
  - (2) 1N5242 SMD-1N5242 Diode, Zener, 1N5242, 12V, 500mw, DL-35, SMT
  - D2 MURD620 SMD-MURD620 Diode, MURD620, Fast, Dual, 6Amp, 200V, D-PAK
  - D3 1N5256 UNASSIGNED Diode, Zener, 30V
- Res (R)
- Transistor (Q)
  - Q4 2N3904 SMQ-2N3904 Transistor, NPN, 2N3904, SOT-23**
  - Q2 2N3906 SMQ-2N3906 Transistor, PNP, 2N3906, SOT-23
  - Q1 IRFR5410 SMQ-IRFR5410 MOSFET, IRFR5410, P Chan, .20 Ohm, 100V, DPAK
  - Q3 IRLR024 SMQ-IRLR024N MOSFET, IRLR024N, N Chan, .065 Ohm, 55V, DPAK Logi

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Ref. Designator: Q4    Part Number: SMQ-2N3904    Value: 2N3904

Description: Transistor, NPN, 2N3904, SOT-23    Package: SOT-23

PCB Decal: SOT-23-213

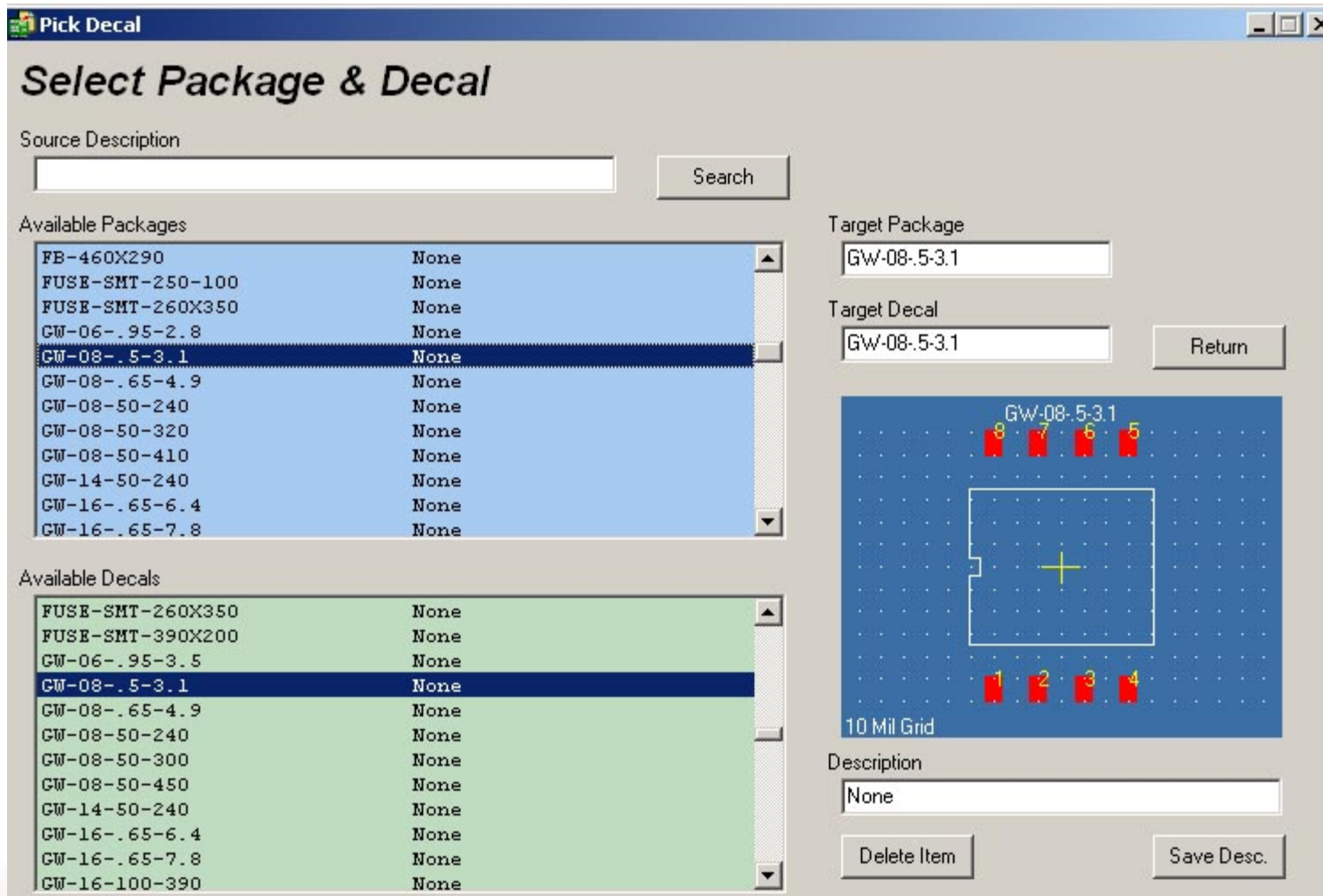
Build K1 Indexer    Test    Color Mode Select:  PCB     PnP    UpDate BOM

Build P1 Indexer

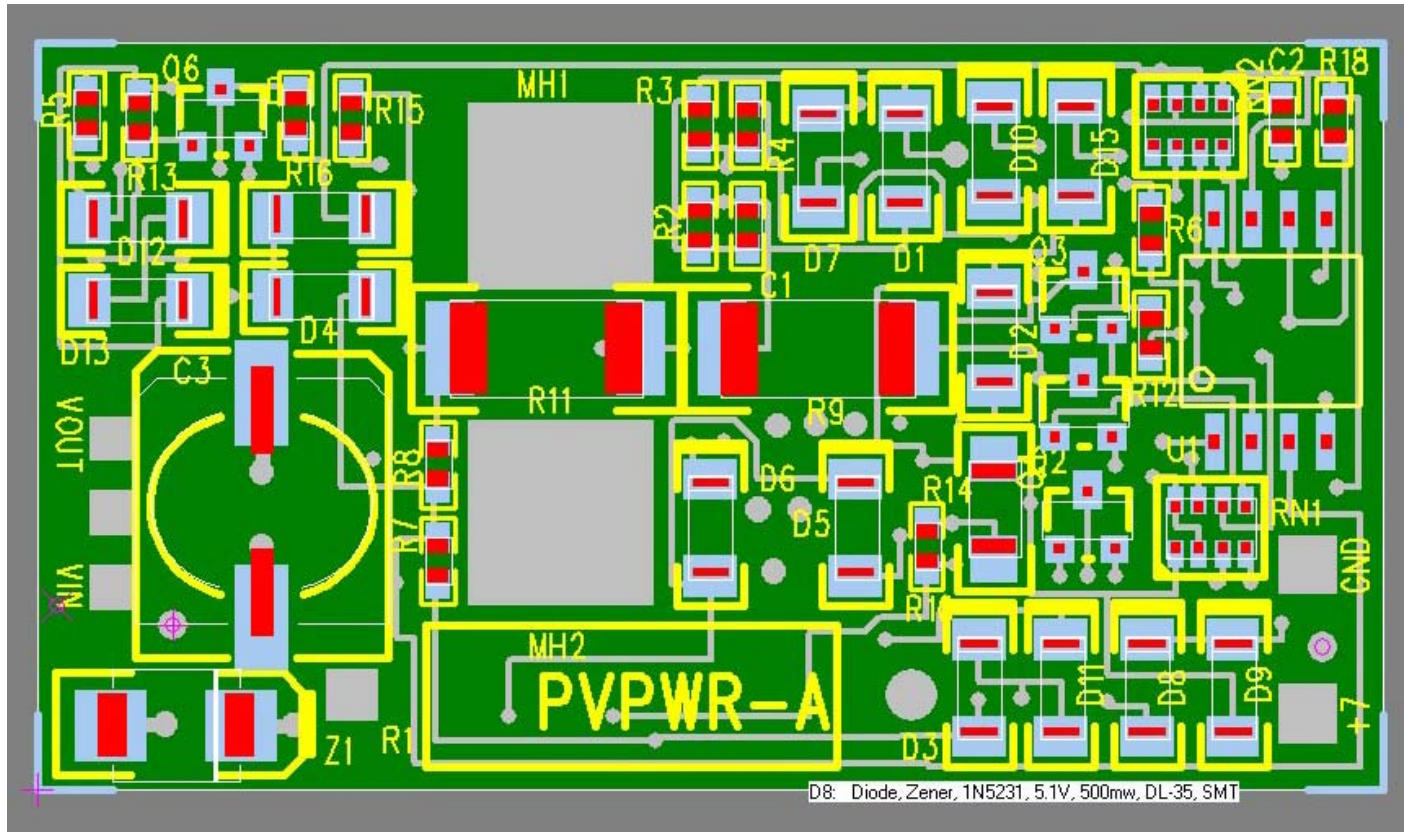
13 Part OK    New Part Decal OK    Bad/Missing/Changed Decal    New Part Unassigned    0 Not Stuffed or Hand Stuffed

C:\sch\Index\RC\_PROTECT\_TEST.bmb    (c) Copyright 2004 by Robert Kondner www.indexdesigns.com

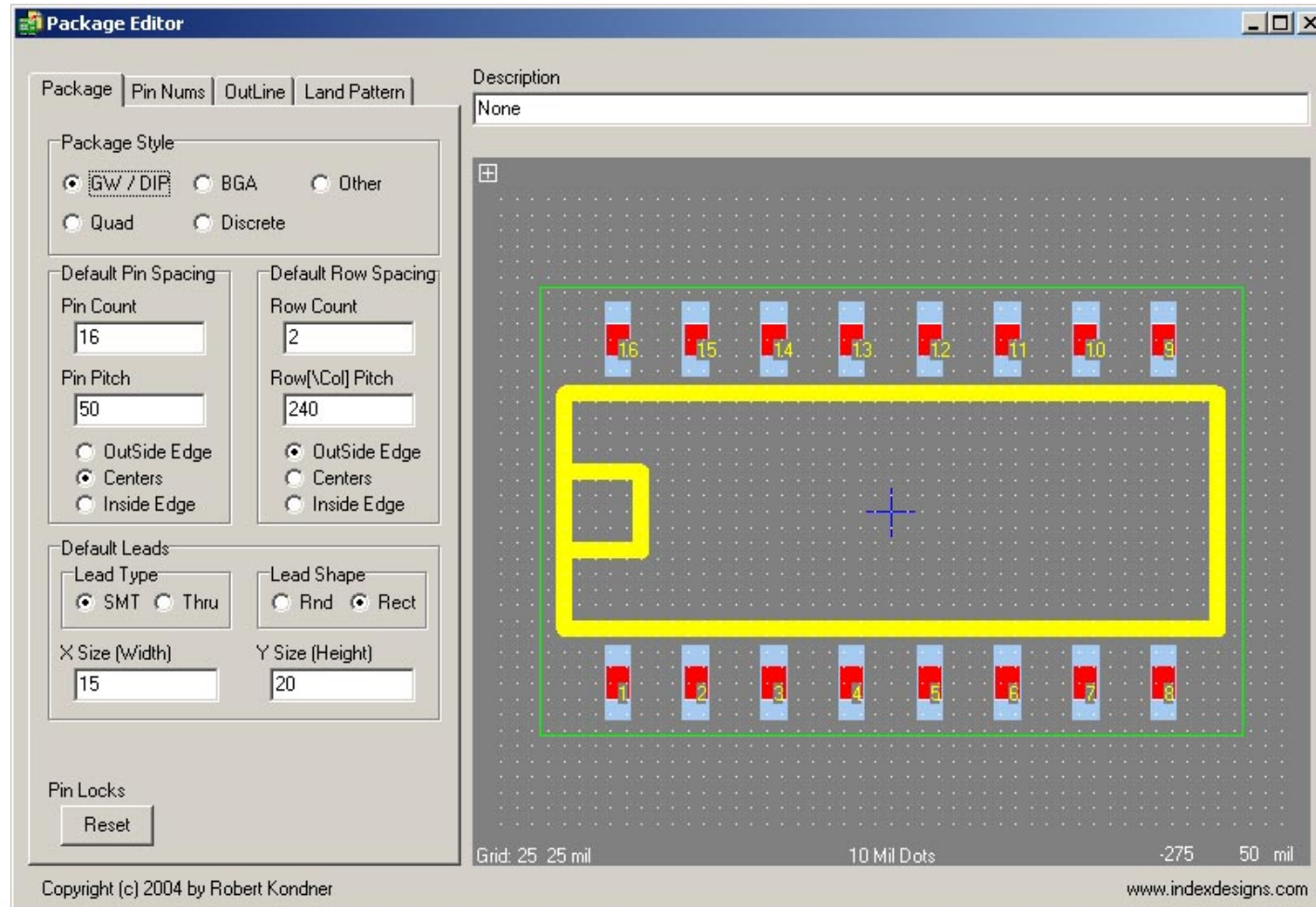
# Map BOM Items to PowerPCB Libraries



# PowerPCB Libraries Driving Assembly



# Package to PowerPCB Decal Wizard



# Interface to Purchasing Database

- ✓ **Parts and Vendors is used to Maintain Data**
  - Excellent low cost tool uses Access database
  - Simple ODBC connection with Delphi Software
  - User Fields hold Attribute Data
- ✓ **Bi-Direction Transfers to Parts and Vendors**
  - Search Engine feeds from P&V Descriptions
  - Data Sync from Schematic/PowerPCB/Assembly
  - Feeds BOM up into P&V for Purchasing

# Parts & Vendors Purchase List Tool

Parts&Vendors ECO 4.0 - C:\Program Files\PV4\indexd.mdb

File Edit Page List View Help

Saved View Current Filter None

Buy RFQ PO Build  
Item Master Vendor Manufacturer

SMRN-ISO-4-2.2K

Title Resistor Network, Isolated, 4 Resistors, 2.2K Ohm.  
Detail 8 Pin, 742 Package

Type PS Status U Revision 0 Date 12/10/2002

Parent P/N  
 Made From  
 Controlled Units each

Notes More Kitting Stock N/A

Decal / Pack	RN-742
Asm_ID RXY	SMRN-ISO-4-222 -90
Part Feed	Tray R150X100 035 -90
Stock Bin	

Stock 0 Cur.Cost \$0.000

History New P/N Chg P/N  
<< >> Copy Delete

All Items in database  
674 items

P/N	Asm_ID RXY	Part Feed
SMR-5%-2512-.05	SMR-5P-2512-R05 -90	Tray R30
SMR-5%-2512-.10	SMR-5P-2512-R10 -90	Tray R30
SMR-5%-2512-.18	SMR-5P-2512-R18 -90	Tray R30
SMR-5%-2512-10	SMR-5P-2512-100 -90	Tray R30
SMR-5%-2512-100	SMR-5P-2512-101 -90	Tray R30
SMR-5%-2512-100K	SMR-5P-2512-104 -90	Tray R30
SMR-5%-2512-10K	SMR-5P-2512-103 -90	Tray R30
SMR-5%-2512-20K	SMR-5P-2512-203 -90	Tray R30
SMR-5%-2512-27	SMR-5P-2512-270 -90	Tray R30
SMR-5%-2512-51K	SMR-5P-2512-513 -90	Tray R30
SMRN-10-25-126X63-2.2K	SMRN-10-25-126X63-222 -90	Tray R15
SMRN-BUS-15-SO16L-4.7K	SMRN-BUS-15-SO16L-472 -90	Tray R45
SMRN-ISO-4-1.0K	SMRN-ISO-4-102 -90	Tray R15
SMRN-ISO-4-10K	SMRN-ISO-4-103 -90	Tray R15
SMRN-ISO-4-150	SMRN-ISO-4-151 -90	Tray R15
SMRN-ISO-4-2.2K	SMRN-ISO-4-222 -90	Tray R15
SMRN-ISO-4-3.0K	SMRN-ISO-4-302 -90	Tray R15
SMRN-ISO-4-33	SMRN-ISO-4-330 -90	Tray R15
SMRN-ISO-8-SO16L-27	SMRN-ISO-8-SO16L-270 -90	Tray R45
SMRN-ISO-8-SO16L-5.1K	SMRN-ISO-8-SO16L-512 -90	Tray R45
SMU-14C88	SMU-14C88 -90	Tray R42
SMU-14C89	SMU-14C89 -90	Tray R42
SMU-29C040-120		
SMU-4N35	SMU-4N35 -90	

Show All Sources Parts List Assy Tree Made From Makes Detail

# Board Level Documentation

- ✓ **Create PDF of PACKAGE Graphics on Gerbers**
  - **Verify Fit BEFORE Bare Board is Fabricated**
  - **Color Printed Image is Easier to View than PCB**
- ✓ **Compare to BOM or Net List – BOM Tools**
  - **Check for Missing, Deleted or Changed Parts**
  - **Check for Changes in Side or Position**
  - **Identify Parts as No-Stuff or Hand-Stuff**

# New Items in Near Future

- ✓ **Wizard to Simplify PACKAGE Generation**
  - Include IPC-7351 Rules
  - Add Solder Paste Data
- ✓ **Generate Low Cost Stencils on CO2 Laser**
  - Use PACKAGE Data to Cut Apertures
- ✓ **Tape Trays to Simplify Setup of Short Runs**
  - Loose Parts is Expensive on Runs or 25 to 100
- ✓ **Component Locating Hardware and Software**
  - Reduce Costs

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USER 2 USER