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Power Conversion Products

By John Shoberg & Ahne Oosterhof

The power conversion commodity family is made up of the following sub–commodities:

- Power Supplies AC/DC
- Power Supplies DC/DC
- Power Supplies DC/AC
- Power Supplies External (Wall Mount & Table Top)
- Transformers (laminated & ferrite)
- EMI Noise Suppression Devices
- Circuit Magnetics
- CRT Magnetics

The main focus of this article will be on power supplies. Although the magnetics portion of the commodity is a significant part of the annual expenditure, it is a declining business. As Tektronix continues to move from internal design and manufacturing of power supplies to external design and manufacturing, and as we move from analog to digital products, this decline will continue until magnetics becomes an insignificant part of the commodity.

The power supply industry is a highly fragmented, very competitive industry with no standards, no direction, no leaders, no followers, and has been labeled as a band of liars and thieves.

❑ Power Supply Industry In Review:

In the past, there were no technology barriers, almost no patent protection, and very few product standards. With the growth of the computer industry came tremendous opportunity and anyone with a soldering iron could enter the race. There was little or no product identity, therefore it was impossible to distinguish one manufacturers product from another.

This trend is now changing as the design and manufacturing technology moves from bulky, inefficient, unreliable, labor intensive products, to compact, very efficient, highly automated designs with multi–year warranties.

❑ Trends:

The manufacturing base has gone from 1400 suppliers in 1987 to about 400 in 1993, with a projection of about 100 in the year 2000. This decline is a combination of industry consolidation, weak suppliers going out of business, and the increased cost of capital equipment, (i.e. surface mount equipment, sophisticated CAD systems, environmental labs etc.) forcing even more suppliers out of business. Even though there has been a considerable shake out, the largest manufacturer still only has a six percent market share. This is another indicator of an industry with no dominant players. Even industry giants such as TRW, Zenith and NCR have withdrawn from this rough and tumble environment.

The U.S. domestic consumption of Switch Mode Power Supplies in 1993 was approximately five billion dollars with roughly half being merchant market and half being captive. The computer industry dominated the market with fifty one percent of the consumption in 1993. The other end of the spectrum is the instrumentation/office automation business which only consumed six percent.

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Power Conversion Products (cont.)

The industry is growing at the rate of about ten percent per year with a shift towards the merchant market as more companies realize that their core competency is not in the design and manufacture of power supplies. Tektronix is an example of this strategic direction.

As Tektronix generates new product designs, and a major function of these new designs is performance and aesthetics, the power supply will be the last part of the design consideration. It is because of this design practice that most power supply requirements cannot be met by off the shelf designs. If would be impossible for a power supply manufacturer to have an infinite combination of footprints and outputs available as standard off-the-shelf solutions.

For many power supply companies, this lack of early supplier involvement has created confusion and the inability to provide timely, cost effective solutions for their customers.

Design solutions are usually met with a combination of one or more of the following:

- Full custom design (black box)
- Modified Standard (gray box)
- Standard (White box)

Using a standard white box gives the shortest time to market with little or no NRE. It generally has all the regulatory requirements completed and has field reliability data to support the "Mean Time Between Failures" (MTBF) requirements. In high volume applications this is usually not cost effective because of paying for features that are not needed.

Using a gray box gives some flexibility, but usually requires some NRE and a longer time to market. Depending on the modifications, it may not be a cost effective solution, and may not have any meaningful field reliability data.

Using full black box gives the greatest flexibility but requires large NRE charges and long development times. This approach is usually a cost effective solution provided there are reasonable volumes. It also offers the greatest risk to reliability since no field data exists.

Since none of these solutions offer the lowest total cost with the highest reliability, several power supply manufacturers have developed distributed power and modular power schemes. These are the fastest growing segments of the power supply industry and promise to be the wave of the future. They theoretically offer infinite flexibility with off-the-shelf components.

Of the solutions that are available in the market today, one of the important factors is product cost. The trend for the last ten years has been a continuous decline in the cost per watt and will continue into the foreseeable future. A typical cost for a high quality, lots-of-features design has gone from about two dollars per watt ten years ago, to one dollar today, and will be about fifty cents in the next five years. A good quality minimum feature design has gone from about fifty cents a watt ten years ago to twenty five cents a watt today, and will be about ten cents a watt in five years.

A major factor for using in–house designs was performance and reliability. Many customers were seriously hurt with power supplies that either didn't perform to the specification or had a high numbers of field failures. This was due to the inability to accurately define a specification or the inability of the power supply manufacturer to understand the specification or both. Today, writing a specification has become an art. Even the smallest detail must be articulated clearly. As a result, power supply manufacturers have become accustomed to interpreting specifications down to the smallest detail.

Most power supply manufacturers ten years ago were offering MTBF's of twenty five thousand hours. Today many manufacturers are offering two hundred and fifty thousand hours and a few are offering over one million hours. In the next five years that will go as high as thirty million hours.

Much of the progress in reliability is due to higher efficiency designs that run cooler, surface mount, and automation. Ten years ago power supplies were sixty five percent efficient, today they are eighty percent efficient, in five years they will be ninety five percent efficient. Today's power supply design technology has caught up with current manufacturing technology. Some power supplies are totally automated with no hand add operations. Even the magnetics and transformers have been designed for automatic pick and place assembly.

As the power supply industry starts to mature so will the manufacturing process. Along with this will come higher quality products. Ten years ago quality was measured in percentage of defects. Today it is measured in several thousand Parts Per Million (PPM). Over the next five years it will be measured in terms of six sigma.

The trend in power supplies will be its evolution as a power component. The nature of the power supply industry will change as it moves from the concept of a sub–assembly to a component. In that sense, growth of DC/DC converters will supersede AC/DC switching power supplies as the industry makes a paradigm shift to distributed and modular power schemes.

For Tektronix, the trend has been to understand the complex nature of power supplies and to build the next generation of products around platform designs. This will allow many new products to use the same power schemes without sacrificing performance, time to market or cost.

❑ Strategies:

The power conversion commodity is a fourteen million dollar business made up of over seventy suppliers ranging from three million dollars to less than one thousand dollars in annual purchases. It is impossible to manage that number of suppliers effectively and it is clearly not utilizing any economies of scale.

As part of the team strategy to reduce cost and to consolidate the supplier base into a core group of around a dozen suppliers, it was determined that the team did not possess enough information to determine who was best in class or best in breed. A series of seminars, from consultants and industry experts, was conducted to educate the team members as to who the world class suppliers were, in both design and manufacturing technologies.

Using the data gathered from the seminars coupled with on–site supplier evaluations, the team developed a supplier migration road map which organized the current supply base into the three following categories:

(continued on page 3)

Power Conversion Products (cont.)

- Preferred Supplier Candidates
- Maintain Supplier Relationship But...Place No New Business
- Move Business And Delete Supplier

The road map produced a few new suppliers who were determined to be strategic to the future success of the commodity and Tektronix. It also shows how to reduce the number of suppliers from more than seventy, to about a dozen. The bulk of the business will be focused on the preferred supplier candidates and at the same time suppliers will be deleted in a controlled environment.

As the commodity strategy moves forward, it will reduce product cost through the utilization of the proper design and manufacturing technologies as well as lowering the cost of doing business through better management practices of a smaller more effective supply base. Emphasis will be placed at each IBD level to design around platform strategies to keep development time and cost to a minimum while maintaining a reasonable product life.

❑ Conclusions:

While the supply base is shrinking from 1400 suppliers to about 100 suppliers, it is incumbent upon the commodity team to make sound and well thought out recommendations on supplier relationships. The supplier road map has addressed the financial strengths, direction of design and manufacturing technologies, geographical opportunities, relative size in relationship to Tektronix business and long term fit. The road map clearly indicates those suppliers that are preferred suppliers or preferred supplier candidates. It is the intent of the commodity team to place the bulk of the power conversion business with preferred suppliers.

The team recommendations to the design community are:

- To seriously consider distributed and modular power schemes as flexible, low cost alternatives to expensive, custom, long time-to-market, no field data, designs.

With many of the larger manufacturers supporting the concept of distributed and modular power, the per watt costs will be coming down significantly.

This concept blends well with platform strategies as it offers flexibility in changes to output loads as well as adding additional outputs without major changes to the original architecture.

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"Loose Lips Sink Ships"

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"Loose Lips Sink Ships" is what they say in wartime, referring to the fact that unauthorized disclosure of secrets could result in harm to your shipmates. In the business world we are at war with our competitors, so that "Loose Lips Sink JOBS". In other words, unauthorized disclosure of company secrets could cost us business, which translates into jobs. These company secrets are commonly called "proprietary information" or "company confidential" information. When you signed your employment agreement with Tektronix, you agreed to preserve company confidences. Such confidences include not only the technology of the company, but also such things as product planning, customer lists, suppliers, etc., ..anything that gives us an advantage over our competitors which is not publicly available.

It is our duty to protect this information, both while employees of Tektronix and after we leave the company. Therefore, don't disclose Tektronix confidential information to people outside of the company without authorization. This applies also to the confidential information of others that has been entrusted to Tektronix under an appropriate Confidential Disclosure Agreement. Additionally, limit those within Tektronix who have access to the information to a "need to know" basis ... the fewer who know, the less likelihood of an inadvertent disclosure.

If you need to share information with outside people, do so only to the extent necessary and under the umbrella of a Confidential Disclosure Agreement. Your Legal Department is here to assist you, so please take advantage of our services.

Do Your Bit To Ensure Our Competitive Edge...Keep Company Secrets "SECRET"!

Update On Quality's Quickswitch Devices

By Norm Adre

The popularity of Quality Semiconductor's Quickswitch devices have grown with multiple sources now available. The Quickswitch is an N–channel switch with a CMOS driver. It has low on–resistance (typ. 5 Ohm) and low capacitance (2 pf + pin capacitance). The Quickswitch acts as 5 Ohm wire when switched on, and an open circuit when switched off. It doesn't provide output drive; instead it relies on the device that is driving data onto the bus. For more information on the Quickswitch technology see Quality Semiconductor's databook. Also, the Quickswitch technology was described in the December issue of Component News (Issue #361, pages 6 – 8).

Table 1. Quickswitch Products Available

Device Types	Description	Pins
74QST3383 (156-6758-00)	Bus exchange switch (five 2 to 2 switch)	24
74QST3384 (156-6515-01)	10-bit Bus Switch	24
74QST3386	Bus exchange switch with extended voltage range (similar to 3383, but has a voltage range of: V_{cc} = 5v and V_{ee} = -2v to allow routing of ECL signals)	24
74QST3388	Bus exchange switch with active termination (similar to 3383 but with a low drive active terminator - see above for more info)	24
74QST3244	8-bit QuickSwitch with 2 enables	20
74QST3245	8-bit QuickSwitch with 1 enable	20
74QST3251	8 to 1 mux/demux	16
74QST3253	Dual 4 to 1 mux/demux	16
74QST3257	Quad 2 to 1 mux/demux	16
74QST3390	16 to 8 mux/demux	28

❑ New Products Available and Planned

Quality's initial QuickSwitch product offerings were the 74QST3383 and 74QST3384. Since then, they have introduced various options and functions (see Table 1). Some of the options include low voltage, resistor terminated parts or devices with a low drive active terminator. The 74QST3388 is the only device with an active low drive terminator. The active low drive terminator forces tri–stated buses to either a TTL high or low to reduce system noise and power dissipation. This is very similar to the bus hold circuit in some selected Texas Instruments ABT devices. Some Quickswitch products are pin for pin compatible with certain 7400 series logic functions. For example, the 74QST3251 is pin for pin compatible with a 74'251.

Another Quickswitch product, the 74QST3386, offers an extended voltage range. The 74QST3386 is similar to 74QST3383 except it has a signal range of +5 to –2 volts. The extended signal range allows routing of high speed ECL signals. Also, this device can be used to route video and RF signals within the specified signal range.

❑ Application Examples

The Quickswitch's near zero propagation delay, no added ground bounce, no added power dissipation and isolation offer numerous applications. Here are a few examples:

❑ Bus Exchange

The variety of MUX/DEMUX functions available in the Quickswitch family target many high speed bus exchange type applications such as memory interleaving, crossbar switching, byte swapping, etc. Also, the 74QST3386, with its extended signal range, can be a cost effective solution for switching ECL signals; or even video and audio signals.

❑ Translation – 5V to 3.3V

A 5V to 3.3V converter can be implemented with the Quickswitch device by adding a diode in series with V_{CC} to reduce the supply voltage to 4.3 volts. Since the output voltage of a Quickswitch device is approximately 1 volt below V_{CC}, the maximum output voltage in this set–up is limited to 3.3 volts max. This translation solution is more efficient than using specific 5V to 3.3V translation devices as it doesn't add propagation delay or additional noise.

❑ Capacitance Isolation

The Quickswitch devices can be used to reduce bus capacitance. Since the off–state of the Quickswitch provides isolation from the input to the output of the Quickswitch, it can be used to disconnect devices from the bus when they are not used. By disconnecting unused devices from the bus, it will isolate their capacitance from the bus which should decrease noise and increase speed through the bus. For additional application ideas for the Quickswitch see Quality's Databook.

❑ Alternate Sources

The popularity of Quality's Quickswitch devices have generated an abundance of alternate sources. Among them are: IDT, Texas Instruments, National Semiconductor, Cypress, and Pericom. Each of these manufacturers will initially source Quality's 74QST3383 and 74QST3384 devices. The alternate sources will be fully compatible, pin for pin and functionally, with Quality's Quickswitch devices.

❑ Package Recommendations

The Quickswitch family is offered in a variety of package styles. To minimize inventory, to simplify manufacturing, and to provide for alternate sourcing, the following package styles are recommended for the Quickswitch family.

DIP packages are recommended over ZIP because Quality is the only manufacturer that offers this family in the ZIP package, and sole sourcing is not recommended. If board space is a concern switch to surface mount.

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Update On Quality's Quickswitch Devices...

Quickswitch's surface mount package offerings include: for 16, 20, 24 and 28 pin, the SOIC, QSOP, and TSSOP are available; for wider width functions, 48 and 56 pins, the SSOP, TSSOP and QVSOP are available. The following surface mount packages are recommended:

- QSOP

Although the SOIC is a standard package that all manufacturers currently offer, the QSOP is a better package because it is smaller and takes up less space. Only the FCT manufacturers (IDT, Cypress and Pericom) and National will offer their Quickswitch products in QSOP, leaving out TI, whose smaller package offering is in the TSSOP package (National may offer their bus switch device in this package too). The QSOP package has a body width and height similar to the standard SO14.150 package which we commonly use and have the manufacturing capability to place. On the other hand, the TSSOP may require additional manufacturing resources to place because the package width and height is not standard with any SOIC package we currently manufacture with. Currently both the 74QST3383 (156–6758–00) and the 74QST3384 (156–6515–01) are Tek part numbered, and are in a 24–pin QSOP package.

- SSOP

For wider width Quickswitch functions in a 48 or 56 pin package, SSOP is recommended because of the manufacturing experience we currently have with this package. Although the TSSOP and QVSOP are much smaller packages, manufacturing will need to evaluate the manufacturability of these package styles to determine any issues which may affect the placement of these parts since the lead spacing is very small – TSSOP's lead spacing is 20 mils, and QVSOP's lead spacing is 15 mils.

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Logic Devices Targeted For Bus Exchange Applications

By Norm Adre

Bus exchange applications such as memory interleaving, byte data swapping, etc., are commonly found in many Tektronix applications. To minimize component parts needed to implement these applications, several logic manufacturers offer a variety of devices targeting these applications. Typically, these devices incorporate a high speed MUX/DEMUX, a latch or register, and line drivers all in one package. The following is a brief overview of the bus exchange devices available today.

❑ TI's Bus Exchange Devices

Texas Instruments (TI) offers several bus exchange type devices. These devices target applications where separate data paths must be multiplexed onto, or demultiplexed from, a single data path. Currently, TI offers two functions; a 12–bit to 24–bit MUX/DEMUX; and a quad 4–to–1 MUX/DEMUX.

❑ 12–bit to 24–bit MUX/DEMUX

TI has several 12–bit to 24–bit MUX/DEMUX parts available with different options available – i.e. low voltage, latched, registered, resistor terminated, etc. TI initially came out with the 74ABT16260 which has a D–type latch at both ends, and has a tri–stateable high output drive buffer (I_{OL}/I_{OH} of 64mA/–15mA). The '16260 function is available in TI's low voltage (3.3V) and their resistor terminated family. Soon, TI will come out with a registered instead of latched version of this device. These parts are currently available in a 56–pin SSOP package and will be available in the smaller TSSOP package. For more details see TI's ABT databook 1993.

❑ Alternate Source – IDT

IDT plans to alternate source TI's 12–bit to 24–bit MUX/DEMUX devices in their FCTCMOS process. IDT's devices will be pin for pin, and functionally compatible with TI's. Also, IDT's devices will be available in 56–pin SSOP package (and TSSOP in the future). Like TI, IDT's bus exchange devices will be available with resistor terminated outputs and in a low voltage option.

❑ Quad 4–to–1 MUX/DEMUX

TI has several Quad 4–to–1 MUX/DEMUX parts available with different options – i.e. low voltage, resistor terminated, etc. TI's initial device is the 74ABT16460 which is Quad 4–to–1 mux with a D–type register and latch at both ends.

❑ Philips MUX Devices

Philips (formerly Signetics) has two devices which target bus exchange applications – the 74F711 and 74F712. The 74F711 is currently Tek part numbered at 156–6486–00 and has been around for a while. The 74F711 is a Quint 2–to–1 MUX which has an invert function and a tri–stateable output. The 74F712 is a Quint 3–to–1 MUX with no tri–stateable output. Both parts are available with 30 Ohm terminated outputs or without. Also, both devices non–terminated parts have high output drive (I_{OL}/I_{OH} of 64mA/–15mA).

Philips is the only source of these devices. Before considering Philip's devices, new designs should consider TI's devices first because their devices have higher functionality, and an alternate source is available.

❑ AMD's Multiple Bus Exchange

About three years ago, AMD introduced their Multiple Bus Exchange (MBE) devices which provide multi–directional communication between 4 ports. AMD had 3 MBE devices available. The 29C982 is a 4–bit by 4–port device with no internal storage (PLCC28). The 29C983(A) is a 9–bit version with an input and output latch available in each port (PLCC68). The 29C985 is a 9–bit version also, but with parity check/generate at all ports (PLCC68). Currently, only the 29C983 is Tek part numbered at 156–3895–00 (PLCC68). AMD is the only source of these devices, and they have no plans to expand the product line in the future. Before considering AMD's devices, new designs should consider TI's devices first because their devices have an alternate source available, they are faster, and are packaged in the 56–pin SSOP which is much smaller than AMD's PLCC packages.

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PCMCIA Standards Update

By John Young

The PCMCIA (Personal Computer Memory Card International Association) started as a trade association founded in 1989. Initially the association was not able to interest anyone in developing a standard which would govern memory cards and their application standards. Therefore, the PCMCIA group decided to develop it's own standard committee. The latest version of the standard was published in July of 1993, "P.C. Card Standard", Release 2.01. The latest JEIDA (Japan Electronics Industry Development Association Release 4.1) standard is now I.C. Memory Card Version 4. The original standards committee consisted of 30 companies. The current membership is more than 400 companies.

The membership of PCMCIA represents a wide range of segments including hardware, software, semiconductor components, connectors, computer peripherals and related industries. As a result of the sudden growth and interest in memory card technology PCMCIA has become the defacto standard for memory cards. Despite the fact that it is not an accredited standards making body, the "P.C. Card Standard" is recognized in the United States, Asia and Europe as the memory card standard. A PC Card is a small form factor adapter for your personal computer, communicator or other electronic device (see Figure 1). PC Cards are about the size of a credit card (see Figure 2, page 7). PC Cards are a key technology for adding memory, storage, and I/O capabilities for portable systems.

PCMCIA has defined mechanical, electrical and functional specifications for providing memory and I/O expansion capabilities in a credit card form factor. It started specifically for memory cards such as FLASH and ROM cards. In Rev 2.0, the standard began to support I/O cards and expansion capabilities.

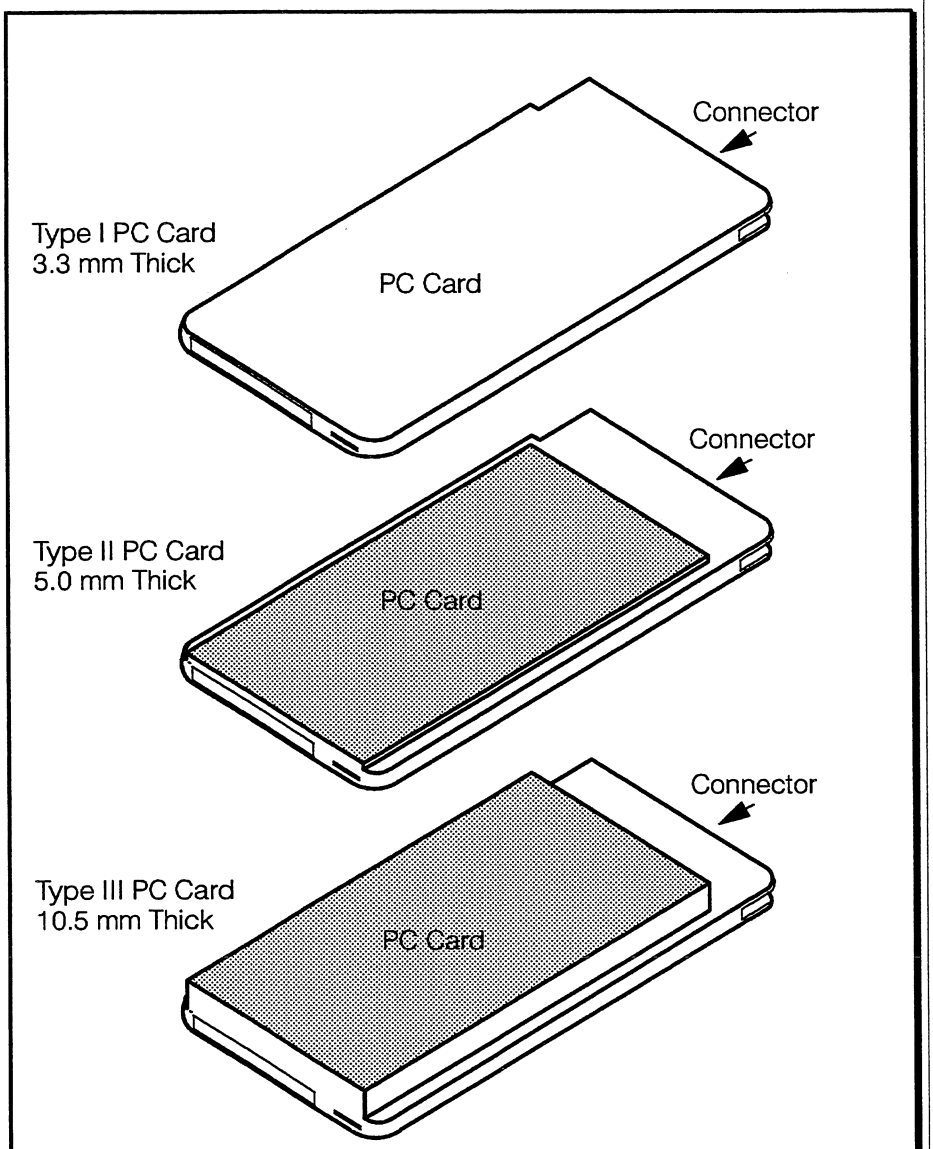

Figure 1. Types of PC Cards

Types of Memory Cards

PCMCIA has defined three different cards Type I, Type II and Type III. Each type shares the same basic length and width form factor, but varies in height.

Type II and III are expected to be the most popular. The following is a list of P.C. cards reflecting sizes and variety:

- Type I Memory Card, Standard memory cards 3.3 mm thick
- Type II Memory cards, standard memory cards, 5.0 mm thick
- Type II Extended Memory cards, type II card with an extension added
- Type III Memory cards, standard memory cards, 10.5 mm thick, small form factor disk drives
- AIMS (Auto Indexing Mass Storage) Memory Cards (formerly known as image cards
- TYPE IV (proposed) 16 mm thick
- FAX/Modem cards
- Lan Cards
- 32-bit Busmaster (high speed) Memory Cards
- Wireless LANs Memory Cards
- 8-bit only low cost memory cards (proposed)

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PCMCIA Standards Update (cont.)

Active Technical Committees

Active Technical Committees and working groups include:

- Card Bus Committee ..... 32 bit busmaster memory card
- Card Physical Committee ..... deals with connectors & physical requirements of the card types
- Modem Committee ..... FAX/Modem memory cards
- 3 Volt/5Volt Working group .... keying of cards
- Power management working group .. defining power levels of memory cards
- Strategic Planning Committee .... Looking at future directions for PCMCIA
- Applications Working group ..... applications for memory cards
- Electrical Committee ..... electrical issues
- XIP Working Group ..... Execute-in-place, use of code in P.C. Cards
- Tuples Working Group .....Tuples codes in software development
- Card Services Committee ..... software development
- Compatibility Committee ... Compliance with P.C. Card Standards.

Additional Marketing Committees

In addition, the following marketing committees are active within PCMCIA:

- Market Pull Committee ..... marketing steering committee
- Collateral Material Committee .. Develops literature
- European Marketing Committee .. coordinates activities in Europe
- Trade Show Committee ..... establishes participation in trade shows
- Market Statistics Committee .... Will develop statistics (business analysis)
- Public Relations Committee ..... Generates Press releases
- Revenue Generation ..... Sales of standards, publications, etc.

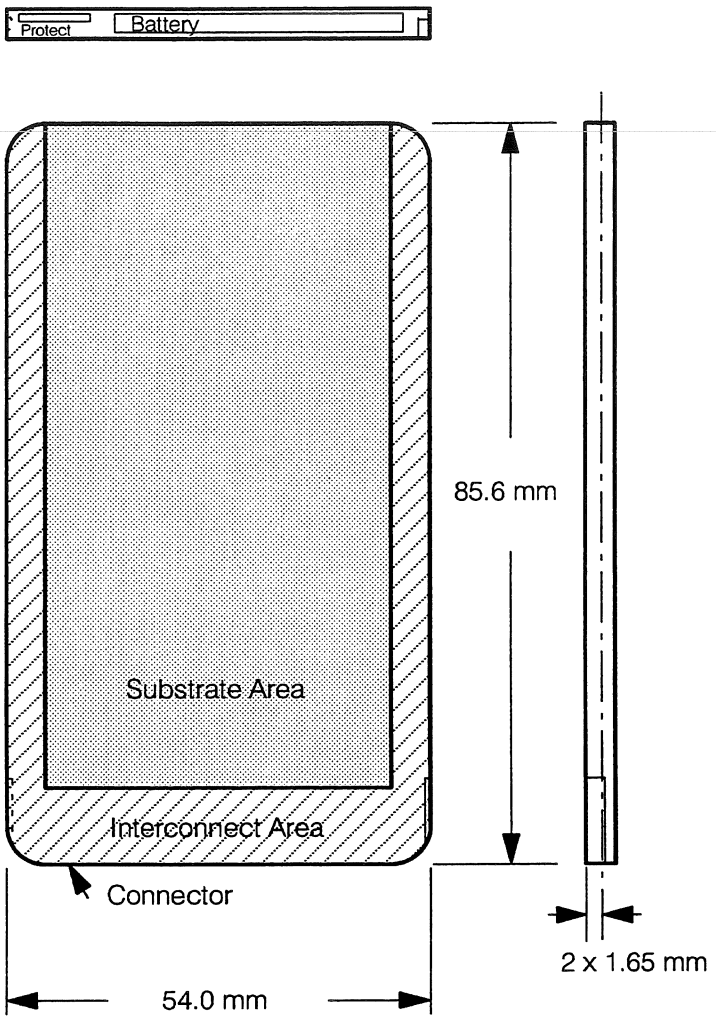

Figure 2. Outline Drawing of the PC Card

New Issue Discussions

Major new issues being discussed within the various PCMCIA committees at this time include the following

Card Physical Committee – EIA (Electronic Industries Association) CE 3.0 Committee activity to develop a memory card connector standard. At this point, it is not clear if EIA 3.0 will adopt the well established PCMCIA standards or attempt to develop a new connector standard.

FAX/Modem Committee – Continuing its efforts to establish a Honda 15 position I/O connector as the standard connector for FAX/Modem cards, and a JAE 7 position I/O connector for a fax/modem D.A.A module (Data Access Arrangement)

LANs Committee – Combined its connector activity with the fax/modem Committee activity, and is looking at microminiature twin coax connector requirements for wireless LANs antenna connectors.

3 Volt vs. 5 Volt Committee – Power requirements for memory cards and keying requirements for connectors and cards of various voltages are the major work items of this committee.

Card Bus Committee – the new 32-bit Busmaster Memory Card activity may include the possible need for a new high speed version of the 68 pin memory card connectors.

(continued on page 8)

PCMCIA Standards Update (cont.)

Compatibility Committee – This committee is just now being formed to determine if companies using PCMCIA "P.C. Cards" logo are in compliance with standards.

In an effort to make "mobile computing" more convenient, mobile data communication companies are looking into wireless communication mediums similar to cellular phone technology. At this time there are three major classes of wireless networks:

1. Wireless Wide Area Networks (WANs) – connectivity within the United States.

2. Wireless Metropolitan Area Networks (MANs) – connectivity in metropolitan areas.

3. Wireless Local Area Networks (LANs) – connectivity within specific areas or a facility.

The most recent activity with PCMCIA involving wireless LANs has created a need for a new connector system. In this case it will be a dual miniature coax connector. This connector is just in concept stage at this time. It may be used in the space between two stacked memory card slots in the host equipment.

Connector requirements continue to grow as this standard evolves. The following connectors are being used as a part of the memory card system:

- 68 position memory card receptacle (surface mounted to the card)
- 68 position memory card header (through-hole and surface mount) Be aware that the mounting configurations for the ejector latches vary between manufacturers.
- 15 position shielded I/O connector for LANs memory card
- 15 position connector for fax/modem memory cards
- 7 position I/O connector for fax/modem memory cards
- 68 position high-speed connectors for 32-bit busmaster cards (concept stage) 2 position dual miniature coax connectors for wireless LANs cards (concept stage)

To date only the 68 position receptacles and headers are written into the standard. The 60 and 88 position headers used in the industry are not covered by PCMCIA standards. Memory cards having 88 positions are DRAM cards, which are covered by JEIDA standards and JEDEC (Joint Electronic Device Engineering Council) E.I.A Standards. The PCMCIA cards use only 68 pin connectors as the primary card–to–host unit connectors.

A good source for information or articles regarding memory cards and PCMCIA is "I.C. Card Systems and Design Magazine" P.O. Box 16775, Memphis, TN 38186–0775

Although the internal PCMCIA socket connector has been standardized for inter-compatibility of PC Card, the external I/O connector appears to be in a state of flux. Recently the PCMCIA cabling subcommittee has selected and advanced the Honda 15 position cable connector as a solution for the LAN (Local Area Network) application. This should aide in the development of alternative sourcing and availability of these connectors. Today due primarily to time–to–market constraints the industry is dominated by non–compatible brands. As of this time, a connector has not been adopted by the PCMCIA committee to fill the need of the 9, 6, 4 or 2 position proposed for the Modem committee.

PCMCIA to AT–attached (ATA) or SCSI (Small Computer System Interface) cable adapters are starting to be developed. However, there has not been a standard approach defined for these applications. Some of the external cables utilize either a 45, 50, 68 or 88 position PCMCIA device. The I/O side will typically implement a 40 position AMP Modu type connector or a *Micro d* type connector in either 50 or 68 positions. The *Micro d* ribbon style connectors are also being used in either 68 or 100 position types. I would expect to see the committee standardize on the *Micro d* type.

We will probably see a continued increase in use of this type of interconnect solution as the volumes increase in the notebook product area, and wearable computing devices gain the bulk of the market.

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Procedure To Setup New Vendors Available From CSI

There is a written procedure now available for Design Engineers who want to work with new vendors. This procedure entitled "Supplier Add/Delete Procedure" is written by the Supply Base Management team and "contains the requirements for changing the status of a supplier on the Active List for the corporation. It covers all inventory and non–inventory materials and services. It applies to all suppliers.". The procedure is intended to apply to all Procurement Agents, Procurement Managers and Commodity Managers.

Other procedures written by Supply Base Management and available in CSI include;

- Preferred Supplier Selection Process
- Supplier Performance Review Guidelines

If you would like controlled or uncontrolled copies of any of the listed procedures please contact Julie Vincent at 627–4887 or Dave Bartles at 627–2542, MS 47–030, daveb@tekig5.pen.tek.com.

How Much Could It Cost...It's Just One P/N??

By Al Lavalle

It is like the litterbug who sees only one bottle, but the roadside cleanup crews manage to collect tons and tons! An unfair analogy maybe, because not all part numbers (P/Ns) are litter. Certainly the most profitable products in the world are somewhere, somehow, connected to a list of P/Ns. So P/Ns are not inherently bad, it's just that too many of them will impede the profitability of any fine company. A 45+ year accumulation of P/Ns has left this company with well over half of a million P/Ns, approximately 1/3 of which are active today.

We've all read the success stories of how the "Widgit" company introduced another high profit margin product of moderate complexity with only four moving parts, one type of screw and an assembly time of 31.7 seconds. The conception and design phase of such products often *insist* upon the usage of a minimum set of "preferred" parts. Indeed, many of ***our*** recent designs are making good use of preferred parts lists as well as "Bill of Material reviews", and common platforms.

While this may be promising for our future, it has little impact on the cost of managing the ocean of P/Ns we currently support. As our P/N base grows, it will drive up the activity and cost in such areas as our MOD system, the number of work–orders to process, customer service, purchasing, etc. Manufacturing costs go up as well due to inventory, set–up times, handling, etc. Some of the unique or older technology P/Ns get **real** expensive if they enter that "Last Time Buy" category.

For these reasons a serious attempt at reducing our P/N base has been launched. A P/N reduction team has been formed consisting of representatives from all the IBDs. Eliminating a P/N can get very messy especially if it has several different applications or is used in a variety of IBDs. Its important to remember that if a P/N is deleted from fifteen products but ***one*** continues to use it, it has not been eliminated and the big savings may not be there. The definition of a "dead" P/N is one that has a status of OB (obsolete), DL (delete), or NP (non–prod) *and* there is no stock on hand. The part reduction team convenes about twice a month to discuss such issues as:

- Multi-divisional usage and the effects of eliminating certain P/Ns
- Accuracy (and availability) of "where used" information
- Customer Service requirements
- Effects on manufacturing, purchasing, and scheduling
- The MOD process

One of the biggest issues is (and always has been) the required resources to get the job done; thus the formation of the "Tiger Team". This is a small group operating within the P/N reduction team. Today there are three in this group:

- Annie Cambron
- Sherry Johnson
- Al LaValle

We have been temporarily reassigned from our regular duties to work full time on identifying and assisting in the elimination of P/Ns. A separate work area was established in Bldg. 47 on Feb. 3 1994 and the following outlines the current state of the project.

Identification of *possible* P/Ns to remove was broken into two general categories:

1) P/Ns that appear to be unnecessary because there has been no usage for more than seven years but have never been removed from active status.

2) P/Ns which we know have current usage and requirements but have exact duplicates in the system or, there are other P/Ns so similar that they should be consolidated into one.

Although the cost of supporting a P/N with **no** usage is less than one with high usage, there are still $$$ associated with it such as inventory space and "part count" every six months. We are currently investigating a block of over 12,000 P/Ns in this category (there are nine other smaller blocks to look at later). Each P/N is being examined for such things as which ones must be kept for Customer Service requirements. We are also finding those which are linked to "common parts" but not to any particular instrument (which makes them look like they are not used, but they really are). Research on this block will be finished in a week or so and it looks like about 3,000 will be moved to a DL status and stock on hand discarded.

Now the second category, those with known current usage that have duplicates – there have been 1,072 identified so far. We believe **all** of these should be removed but it won't be until the MOD process is complete that we will know that for sure. The areas that make up this group are:

- Exact duplicates with prefix 151- and 156-
- Resistors with tight tolerance and tight TC's that will satisfy Form/Fit/Function of loose tolerance and wide TC parts
- Some T&R versions of bulk packaged parts

Many other areas may be examined if time permits.

As mentioned above the MOD process will be employed to document and coordinate all the activities that must occur in order to remove these P/Ns. This is a big job that will require understanding, patience, and effort from folks in machine insertion, MOD processing, purchasing, engineering, our vendors, product safety, data management, customer service, and I'm sure there's probably a lot more. This is something many of us have talked about for years, I feel confident that if we streamline the process as much as possible, roll up our sleeves and work together we can clean up many of the non–essential P/Ns.

Additionally, we will be losing thousands of P/Ns due to some IBD's that were recently sold off, and thousands more associated with a product phase–out project. Altogether this represents over 22% of our active P/N base. This will substantially improve our P/N base management and associated costs and complement our efforts towards the usage of common and preferred parts.

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Connector Technology Update

By John Young

This article will discuss the application strategy as well as general information for the interconnect commodity. Specifically, I will address the following commodity types, which were formulated based on our suppliers product offerings:

- Chip to Board (Sockets)
- Wire to Board
- Board to Board
- I/O
- RF
- Power
- High Voltage

This discussion will be limited in scope to the Chip to Board commodity type.

❑ Chip to Board

This family includes the following areas:

- Sockets: Production and Test

❑ Guideline

Sockets are typically used to interconnect an IC package or module to a PCB. They may be used for production or test purposes.

As a general rule, any time you socket a device you decrease reliability. Use sockets sparingly. Typical reasons for socketing a device would be upgrades or option cards.

❑ General Developments

IC packaging has forced both the move towards decreased centerline spacing and an increase in pin count per device. This is especially true in the area of PGA sockets. Not only have we seen an increase in pin count, but with the introduction of the Interstitial PGA sockets the center line has also decreased from 0.1 to 0.05 centers. We are using Interstitial sockets up to 449 positions on a 39 x 39 matrix. They are offered up to a 41 x 41 fully populated matrix (841 contacts). The primary problems with this type of socketing are the insertion and extraction forces.

McKenzie Engineering, who is our primary supplier for this type of product has developed new low insertion force PGA sockets. This has been accomplished by decreasing normal force, as well as controlling the true position of the contacts. The insertion force has been decreased to 35 grams with a published withdrawal force of 20 grams. This is a decrease from the standard contacts which had 175 grams of insertion force with a withdrawal force of 90 grams.

One thing to be aware of, is the insertion/withdrawal forces are typically measured using a polished steel, bullet nose test pin. In reality you may see a 40 to 50% increase in insertion force based on the geometry of the PGA pin. This increase may be attributed to plating, base material and end preparation of the mating pin.

New contact proposals for PGA sockets have a published rating of 8 to 10 grams of normal force. The new design is untested. There are concerns with respect to inadequate normal forces to remove the contamination caused by processing.

There has been an increase in the use of surface mount PLCC sockets. As usual in the interconnect world manufacturer's have developed sockets which are not footprint compatible. When using PLCC sockets be aware of the differences in the polarization mechanisms. It would be preferable to look at systems which do not use a polarization feature.

SIMM sockets are becoming more popular. Over the past 5 years we waited for sockets to be introduced with wider board thickness tolerances. Initially sockets were developed for 2 layer boards. As the industry continued to expand in this, our SIMM connectors went from 0.1 centerlines to 0.05 centers. Our layer count also increased from 2 layers to 8. Yet the SIMM connector designs stayed with board thickness tolerances of +0.004 –0.003. With the DRAM shortages, the market began to see modules beyond the +004 –0.003 limits. This action helped us to see companies develop extended tolerance SIMM connectors. As an example, within the last 2 years companies such as AMP have listened and increased the board thickness range from +0.004 –0.003 to +/–0.008.

This has helped tremendously in increasing our yield when higher layer counts are required. Ironically, we are seeing a shift back to the tighter tolerance connectors. This is primarily due to:

- Increased cost of the AMP SIMM 2 (Extended tolerances)
- Increased use of off the shelf SIMM modules
- Forest Grove has been able to increase control of PCB thickness ranges

Dual read out SIMM's have also become available recently and they are available up to 160 positions. These have the advantage of using half the current space used by our current SIMM connectors. A new product from AMP called the M3 SIMM, implements a surface mount design, and stands only 5.5 mm off the board, which may take advantage of the TSOP (Thin Small Outline Package). This spaces allows for a layer of TSOPs to be mounted on the motherboard and a double sided module (3.54 mm nominal) over the motherboard.

❑ Memory Cards

As the price of memory cards decreases there is an increased interest in the memory card connectors. The primary issues around these types of devices is the non-standard interfaces for I/O Options.

The combination of PC Card hardware, Card Services software and Socket services software provides the benefit of a "plug and play" portable environment. It is possible to add and remove cards without powering down the system or opening covers to the unit.

The PC Cards provide flexibility to add necessary features after the base system has been purchased.

Most of the newer product manufacturers have looked at implementing a PC Card into their design. The current manufacturers we are looking at would be AMP, and Honda. For our new product lines which are based on a hand held format Honda has a Push–Push design which eliminates the need for ejector buttons, thereby freeing up space on the already filled circuit boards.

For other applications we are looking at dual height sockets which would accommodate Type2 and Type3 cards.

(continued on page 11)

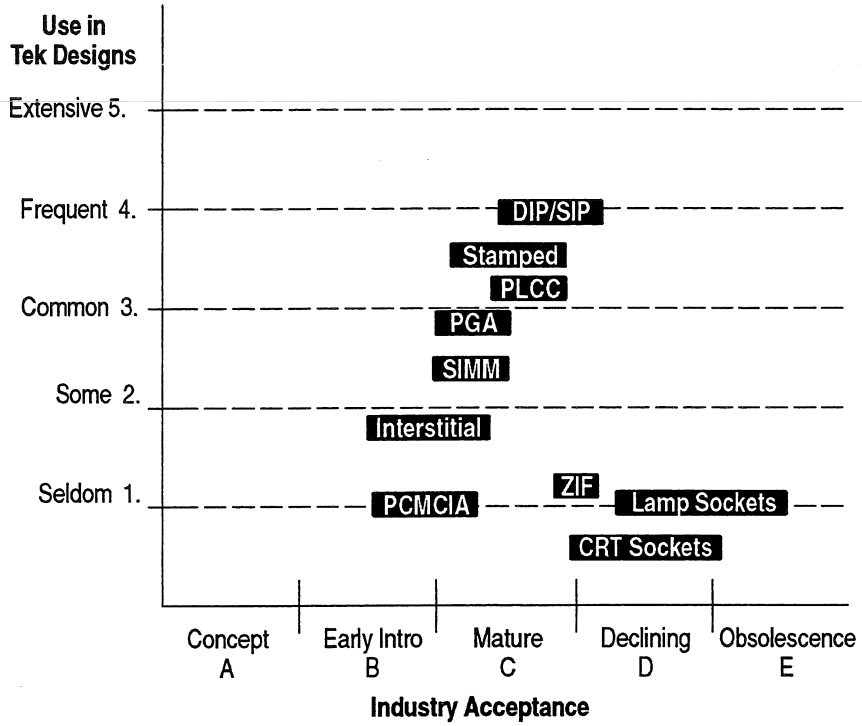
Connector Technology Update (cont.)

DIP Socket

We are beginning to transition from our current supplier of DIP sockets to AMP. This has been done for two reasons. First, Grass Valley group has been using the AMP socket in volume for years. The other reason is based on processing changes in our manufacturing areas. TV products has recently changed to a no wash or "no-clean" flux process at flow solder, which uses a Kester 950E flux. The existing sockets have a open bottom design which has worked well over the years in that this construction allowed the flux to be washed out during the cleaning cycle. When these sockets were used in a "no-clean" process, the flux which would wick up into the mating area would form a thin film causing intermittents in the field. To remedy this we have been updating to a closed bottom design which inhibits the flux contamination. This process has been used by NWD and TV divisions. There still may be some concern with flux entrapment due to the wash process being used by BBO. We are currently running testing to verify the use of the closed bottom design in BBO.

With the use of DIP sockets in memory upgrades we have also changed many of the current single leaf DIP sockets to a dual leaf design. This prevents plastic from contaminating the contact area during insertion.

Figure 1. Trends in Socket Usage – Industry vs. Tek.



Test Sockets

We have not seen an increase in the use of test and burn-in sockets. The primary use of these sockets has been in the NPI stages of a product. Yamaichi Electronics has been the primary supplier of this type of socketing. This is a change from 3M who use to supply most of these devices. 3M has not kept up with the deluge of new package types coming out of Japan. Yamaichi probably has the widest selection of these devices.

Industry Trends in Socketing

Figure 1 above shows the current industry trends versus our use at Tektronix for the Chip-to-Board area within the interconnect commodity.

For questions, comments or further discussion on this article please contact:

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CSI Welcomes Brian Diehm!

The Component and Supplier Information group would like to extend a hearty welcome to Brian Diehm, the new Manager of the Component and Supplier Documentation and Data Administration portion of our group. Brian joined CSI in January and assumed his responsibilities from Julie Vincent who had been acting manager. Please join us in welcoming Brian!

The Component & Supplier Documentation and Data Administration Group:

Brian Diehm – Manager, 627-3437, MS 47-030, briand@tekig5.pen.tek.com.
Joan Bellinger – Reprographics
Ken Buehner – Specifications
Peggy Butler – Specifications
John Haynes – Reprographics
Jim Hookie – Specifications
Gabe Kubichek – Reprographics
Lawrence Lowe – Reprographics
Jose Montoya – Specifications
Diane Argyle – Spec System
Mary Blanchard – NPR System
Eleanor Davis – Item Master
Soboth Saing – CQ System
Merle Vanderzanden – VMR System/CMS System

Switch Terminology And Characteristics

By Curt Bernal

In the process of selecting a switch for a given application, it will become necessary to properly describe the intended function. Although a switch is one of the most basic forms of controlling electrical current, understanding switch terminology may not be so simple.

This is intended to be the first of a series of articles dealing with switching functions, terminology, materials, and characteristics needed to properly apply a switch. There are the obvious terms such as toggle, lever, rocker, push, and rotary, which are self explanatory. The trouble usually begins when describing the switching function. For example, a functional description could be: Double Pole, Single Throw' (DPST), Push–Push Alternate Action.

Let's take one term at a time and expand on it's definition. DPST: Double denotes two, and Pole denotes the number of completely separate (physically and electrically isolated) switching elements (circuits) in this switch. Therefore, Double Pole simply means two isolated sets of contacts. A Throw is the number of switch element positions within the individual Pole.

A Single Throw is the simplest of the switch movements (see Figure 1). Hence, a DPST, would have two completely isolated switch elements that are controlled by a single actuator, and are opened or closed by a single movement of that actuator. If this switch is in the closed position, the two separate contacts (Double Pole, see Figure 2) would be moved to their open position with a single movement of the Push actuator.

Push–Push is straight forward enough, but what about Alternate Action? There are several ways to describe this switching action. In addition to the above, the industry uses: Push–Push Maintained, or just Maintained, and Push–Lock/Push–Release. The clearest of all of the descriptions is the Push–Lock/Push–Release. This describes the actuator latching action, and thereby the contact position. We now know that the above described switch has two separate switching elements which are opened or closed in a single actuator movement, in this case by a push of a button, and that movement will be Locked (Maintained) or Released depending on the previous position.

(continued on page 13)

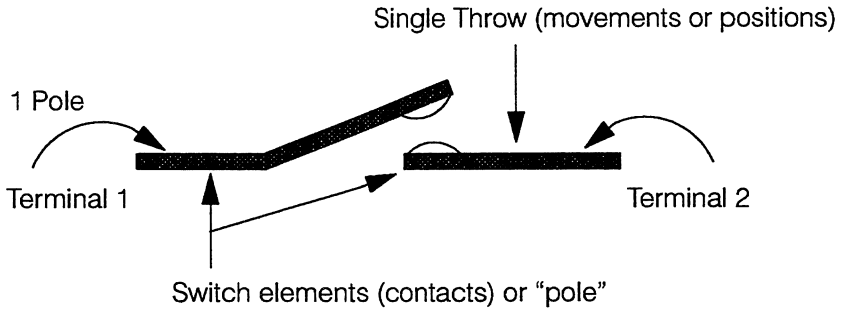


Figure 1. SPST (Single Pole, Single Throw)

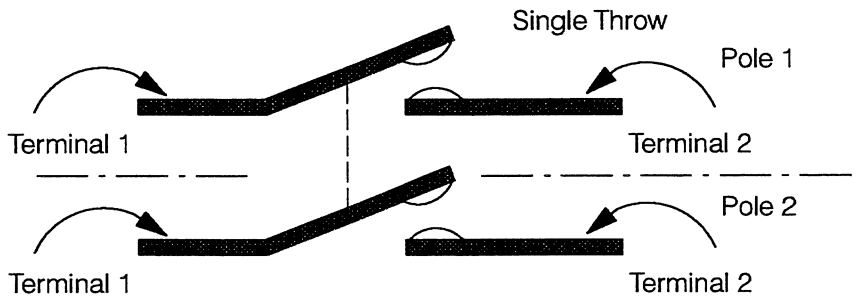


Figure 2. DPST (Double Pole, Single Throw)

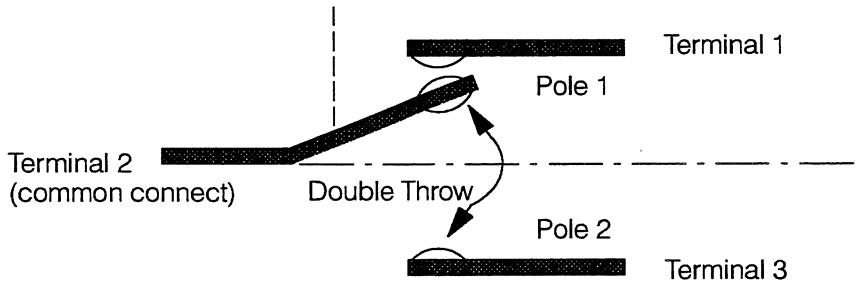


Figure 3. SPDT (Single Pole, Double Throw)

Switch Terminology And Characteristics (cont.)

For Momentary push functions, it becomes necessary to state whether or not the switching elements are Normally Open, or Normally Closed. This means that when the actuator is in it's relaxed state, the switch contacts are closed (Normally Closed, i.e., connected) or open (Normally Open, i.e., disconnected).

In some applications, there is a need to switch the current path between a given set of switching elements within a Pole without opening or breaking the path. This is commonly referred to as Make–Before–Break, or Shorting Contacts. The implication here is a common terminal that can be connected from one switching element to another (3 terminals), therefore a Double Throw (DT) configuration is required. In a Single Throw (ST) configuration, there is only an open, and a closed position (2 terminals). A Make–Before–Break uses a shorting bar to first make connection with terminal 1, before disconnecting from terminal 3 (see Figure 3, page 12).

❑ Switch Characteristics

The ideal switch would have a resistance change from zero ohms when closed, to infinity when open. Since there are no perfect conductors, or insulators, this is not likely to happen. When a voltage is applied to an open switch, a very small "leakage" current will flow due to non–perfect insulating materials. If the voltage is divided by the current, this will then be the resistance of the insulation, hence; Insulation Resistance. In low voltage circuits, the insulation resistance is rarely an issue. This is not the case in high voltage switch applications, where the insulation resistance is an important parameter.

Insulation Resistance is not to be confused with the Dielectric Strength properties of the insulating materials used in a switch. The dielectric strength of an insulating material is the highest potential gradient the material can withstand without breaking down. The dielectric strength of a material is determined by dividing the breakdown voltage by a given thickness of material placed between a pair of test electrodes.

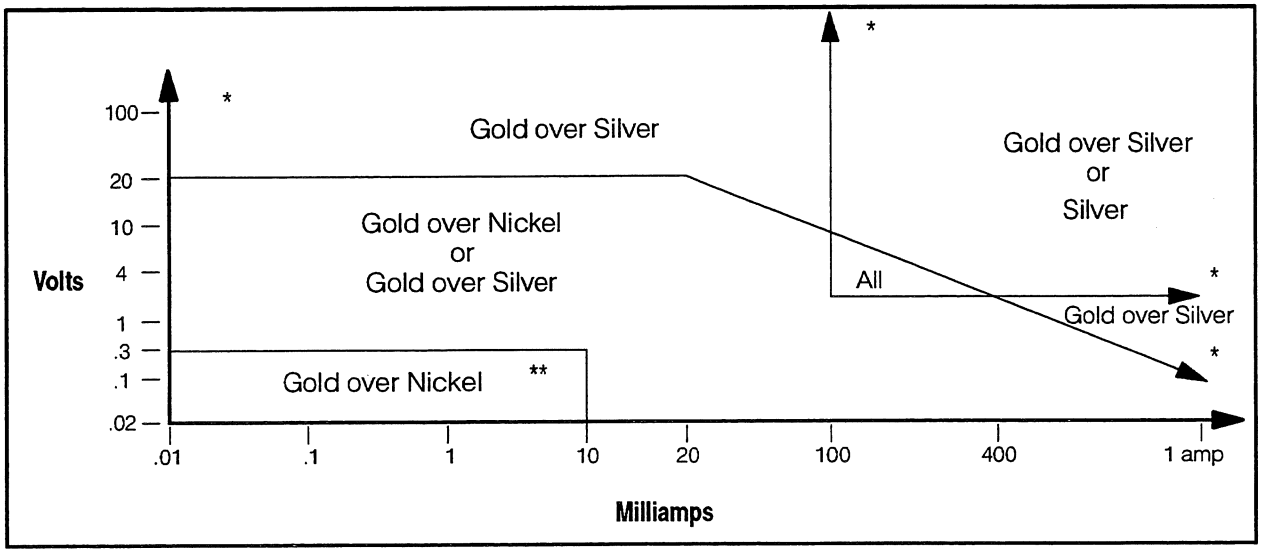
Switch Resistance is the total resistance of the conducting path between the terminals of one connected Pole within a switch. This is dependent on the switch design, and may include the conducting path between joints, staked bolted or welded, or interfaces such as bearings or pivot points, and it will always include the Contact Resistance. *Contact Resistance* is dependent on the contact material, the applied force, the contact area, and the heat generated as a result of the current.

The voltage across a pair of current carrying contacts is an indicator of the temperature of the material at the interface. This is sometimes referred to as the softening voltages of contact material (see Table 1). If the softening voltage is exceeded, the interface of the

(continued on page 14)

Table 1. The Softening Voltages of Contact Materials.

Material	Approximate Softening Voltage	Approximate Melting Voltage
Silver	90 mV	370 mV
Gold	80 mV	430 mV



* Increases to maximum switch rating.
** For high reliability at these low levels, high quality gold plating is recommended.

Figure 4. Recommended Contact Materials (vs. Voltage and Current).

Switch Terminology And Characteristics (cont.)

contact will soften. On the microscopic scale, the cross–sectional area of the conducting surface will control contact resistance. At this point, contact resistance is a function of current due to I^2R heating. If the current is increased, the interface will change from the softening state, to the melting state. When this occurs, there will be a metallic bridge established at the interface, and the cross–sectional area will increase until the current is adequately carried. If the softening level is not reached, then the interface of the conducting area will not be affected. Therefore the cross–sectional area of the contact interface will not change, and the contact resistance will be independent of current. Figure 4 (page 13) shows what contact materials/plating to use for various switching levels. In general, these are good guidelines to use when choosing the proper switch for an application.

However, there are other variables that may affect the low level application. The graph indicates Gold over Nickel as the best choice for the lowest of levels, but this is dependent on the quality of the plating itself. Porosity in the gold plating can expose the base metal. Under certain conditions, corrosion can then occur at the base metal and eventually migrate over the surface of the gold plating. This is sometimes referred to as creeping corrosion. One way to minimize this is to plate the gold much heavier, thereby reducing the number of pores exposing the base metal. The drawback, of course, is this increases the cost of the device. Another method used to try to prevent this problem from occurring is to use a sealed switch.

The gold over silver is a good all around choice for most applications. The gold will be acceptable in most low level applications. If the voltage is increased to the point where arcing occurs, then the gold is burned off and the silver will be acceptable as long as that voltage level is maintained. If this voltage level reverts back to the low level switching, the contact resistance may become a problem.

There are many factors that affect switch performance. In upcoming articles, other forms of contamination effecting contact resistance will be discussed, as will contact design, and life issues.

Reference Materials:
Appling Precision Switches by J.P. Lockwood of Microswitch.
C&K Components, Newton, Mass.

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Instrument Reliability, MTBF 90% LCL And Other Mysteries

By Mark Balcom

We have a facility in building 50 for gathering component and instrument life test information. Usually we use the component information to make "A–B" comparisons. Part of each engineering development cycle is gathering failure information on the new product with our modified "AGREE" testing, where a number of instruments are operated in a hot humid room for at least a year and a record of failures is kept. OK, now that I have operated 10 instruments in a 50 °C room for 18 months and recorded 14 failures, what can I say about that instrument's reliability? Read on.

Demonstrated Mean Time Between Failures (MTBF) is usually stated at the "90% lower confidence level" (90% LCL). What does that mean? any statistic based on a small sample has limited accuracy, so rather than stating an average based on the raw data, a number is calculated that gives a 90% certainty that a true average of the entire population would be greater than: "I have a 90% degree of confidence that the MTBF of product X is XYZ hours or greater.". So, where do I get that number? First, let's look at another complication.

We use an "accelerated" test to gather failure data. Nobody wants to wait till the end of a product's life to be able to predict that life. In other words, we gather data at a faster rate than real life. Then we can use that data to make predictions. In order to make our calculations we must know how much faster the failures are occurring than they would during normal usage. We are ready to start putting the data together.

The mechanisms that lead to failures in electronic components are accelerated to the rate of doubling with each 10°C increase in temperature. Therefore, we can calculate the "acceleration factor" due to temperature: 2 raised to the (25 degree rise/10 degrees) = 5.6. So only considering the temperature of the "AGREE" room, each hour is worth 5.6. The next numbers are subject to argument, but the most commonly accepted are offered here. Ninety percent of component aging occurs during "warm up", the period of time that a circuit is coming up to operating temperature. The stresses incurred during the temperature cycling due to internal heating are responsible. Power cycling at a rate that allows the instrument to reach full operating temperature and cool to ambient will more than double the failure rate. Considering the power on duty cycle and the effects of high humidity, an additional factor of 1.5 is usually assumed. Multiplying these two factors (5.6 & 1.5), results in a multiplication factor of 8.48. Using a factor of 8 would not be unreasonable. Now we can say that each hour in the "AGREE" room is worth 8 hours in our calculations.

We can calculate a "demonstrated MTBF" with the raw numbers: 10 instruments x 18 months x 30 days x 24 hours x 8 = 1,036,800 divided by 14 failures = 74,057 hours. Keep in mind that this number is based on a small sample. What is the number that I can state that I am 90% certain of, the 90% LCL MTBF? The calculation that comes from the statistics books is as follows: 2 times the number of instrument hours (2 x 1,036.800) divided by chi squared at .9 with 2 x the number of failures for degrees of freedom (chi sq. @ .9 for 28 degrees of freedom = 40). MTBF at 90% LCL = 25,920 hours. This is not a bad number. Most of us would like to quote 20,000 hours in our EIS. Discussion on this subject can be found in the "Quality Control Handbook", Third edition by Veran, Grynn and Bingham.

(continued on page 15)

Instrument Reliability, MTBF 90% LCL And Other Mysteries (cont.)

So if we keep a log of failures from the "AGREE" room and have a chi squared table available, we can calculate the elusive MTBF at 90% LCL. Years ago this was something someone else did for us. We have only lost that capability if we are not willing to do it ourselves. Some people will argue the "acceleration" factors that I have used in this discussion, but they were developed using standard engineering practice and I think I remember Jack Stohl using a similar number way back when he was doing the reliability calculations.

Another tool that is quite useful is the Predicted MTBF Based on Parts Count. In the past we sent a schematic diagram set and parts list to the reliability lab and they returned an MTBF prediction. It was very cumbersome work wading through the charts and tables in MIL Spec. 217 to derive the appropriate failure rate numbers, so a number of attempts have been made to build a concise table for general use in the company. I have a copy of one of those lists, but it has an error in it that must be corrected before use.

Basically, you add up all of the components of each class, multiply by class failure rate, add up all of the resulting numbers to calculate the number of anticipated failures per thousand hours. By inverting this number you have your predicted MTBF.

The predicted MTBF can be used in a number of ways. The more complex the system, the higher the failure rate. At what point does a design become complicated enough that you must either start using Mil Spec. parts or use some increased derating in parts application to get the reliability that can feel comfortable with? Only by calculating an MTBF prediction early in the process do we know. If the calculation results in an acceptable number using generic failure rate numbers we don't need to take any special steps in selecting parts. If the number comes out low then we must look at either using special high reliability parts or consider simplifying the design. Finding this early in the design cycle rather than after shipping products can save a lot of embarrassment and the cost of rework. It can also save money to find that our design is not complex enough to waste money using hi-rel parts where they might not be needed.

Finally, by comparing the Predicted MTBF to the 90% LCL demonstrated MTBF, we have an indicator of how well we selected and derated parts in this application.

For questions, comments or further discussion on this article please contact:

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National Will Support The 74C923 Long Term

By Norm Adre

National will continue to support their 20-key encoder, 74C923, for at least 5-7 more years. Initially, I had not recommended this device because it is manufactured on an old Metal Gate CMOS process which, on the life cycle curve, is a declining technology. Also, no other sources for this part are available. However, this particular part is very popular and National intends to keep it around for a long time. Hence, the part is now recommended as it is a cost effective solution for implementing it's targeted application.

National is thinking about building a next generation key encoder and would like to get some ideas on how designers currently use their product and what they want to see in their next generation product. Let me know if you're interested in a next generation line of key encoders, and I'll set up a meeting with National's product engineering to express your ideas.

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Fan Standardization

By Curt Bernal

As part of the part number/supplier reduction effort, CSI has been looking at ways to minimize redundant part numbers. When part numbers are consolidated, the opportunity for better leveraging presents itself. Because of this, CSI has been looking at ways to better manage all commodities and suppliers. The Preferred Parts List (PPL) is part of this goal. One commodity that has yet to be added to the PPL is fans.

Currently, there are several fan part numbers based on the same model fan with the same supplier. Due to unique value added requirements to the fan, these part numbers are technically not duplicates. The value added requirements are typically non–standard lead lengths and connector styles. Recently, there has been efforts to standardize on one connector style, and one lead length such that a single part numbered fan can be used in various products.

The industry standard lead length for fans is right at 12 inches plus or minus a few fractions of an inch. If designs can accommodate this length, one of the variables that cause extra part numbers would be eliminated. A recent project in T&M needed a fan with a 5 inch lead length. CSI and Procurement asked the team to try to use a 12 inch lead length with a latching connector style that could be standardized. The designer was able to use the "standard" connector and full lead length. Having a lead length 7 inches longer than necessary was accommodated with proper lead–dress.

Had this part been set up with a five inch lead length, the chances of having the part propagate into more than one design would be low. The connector that CSI is recommending as the standard is the AMP latching housing connector system. Please contact me if you would like more information on the AMP connector.

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Motorola Exits Standard Linear IC Business

By Jim Williamson

As mentioned in the previous issue of Component News (Issue 372, January 1994, page 11), Motorola Semiconductor has dedicated its internal fabrication facilities to production of custom linear functions for the automotive and telecommunications industries. Virtually all of the standard linear ICs that they had produced for many years have been discontinued.

Motorola has classified their linear products as follows:

- "Category 1" products are Motorola proprietary items that will continue to be manufactured, although with strict allocations.
- "Category 2" products are devices that may be alternate sourced, but in Motorola's opinion they do offer enough added value (i.e. profit) to justify continued manufacture, again with strict allocations.

The delivery performance of these two classes have been poor in recent times. After all of the dislocations caused by the shift in priority have subsided, this should improve.

The implications for these Category 1 and 2 parts that are on the Preferred Parts

(continued on page 17)

Table 1. Linear IC Conversions

Tek P/N	Motorola P/N	New Supplier & P/N
156-1173-00	MC1403N	Analog Devices AD1403N
156-0048-00	MC3346P	Harris CA3046
156-0277-00	MC7805CT	TI UA7805CKC
156-0277-01	MC7805CT	TI UA7805CKC
156-0285-00	MC7812CT	TI UA7812CKC
156-0312-00	MC7815CT	TI UA7815CKC
156-0509-00	MC1408P8	Philips MC1408-8N
156-0527-00	MC7915CT	National LM320T-15
156-0846-00	MC7905CT	National LM7905CT
156-0872-00	MC7912CT	National LM7912CT
156-0872-01	MC7912CT	National LM7912CT
156-0930-00	MC7915ACT	Unitrode UC7915ACT
156-0991-00	MC78L05ACP	National LM78L05ACZ
156-0991-02	MC78L05ACPRP	National LM78L05ACZT3
156-1150-00	MC79L05ACP	National LM79L05ACZ
156-1150-01	MC79L05ACPRE	National LM79L05ACZT4
156-1161-00	LM317T	National LM317T
156-1260-00	MC79L15ACP	National LM79L15ACZ

(Linear IC Conversion Table continued on next page)

Motorola Exits Standard Linear IC Business (cont.)

List is that if the delivery performance has not improved markedly by the end of June 1994, they will be removed from the listand given a "New Design Recommendation" of N, not to be used for new designs.

The remaining classification is "Category 3". These devices are the multi-sourced industry standard products, i.e. "LM3xx" op-amps, three-terminal regulators, etc. This is the group that has been affected the most. This is also the group of parts that we purchased primarily from Motorola.

A few of the Category 3 products are being transferred to outside foundries. The Motorola mask sets are not being used in the manufacture of these devices; rather, the foundries' designs are utilized. In some cases this has been acceptable, in others the foundry material is substandard and cannot be used at Tektronix.

A major project is under way to move this Category 3 business to other suppliers. The two main suppliers to be moved to are National Semiconductor and Texas Instruments. National was the originator of virtually all of the industry-standard products anyway, and was the major supplier of these to Tektronix until a few years ago where for business reasons the sourcing was changed to Motorola. TI's offerings are almost exact equivalents of the same parts. Because of the near exactness between Motorola, National and TI devices, there will be no line trials of the new suppliers. The risk level is very small, and the number of part numbers is very large. Also, Motorola essentially gave no warning as to the discontinuance of the parts, so there wasn't any time anyway to do extensive trials without line downs.

Table 1 on page 16 and continued here, is the first wave of this conversion. What is shown is the Tektronix part number, the old Motorola type number, and the new supplier and its type number.

For questions, comments or more information, please contact:

Jim Williamson
627-2552, MS 47-030
jimwi@tekig5.pen.tek.com

Table 1. Linear IC Conversions (cont.)

Tek P/N	Motorola P/N	New Supplier & P/N
156-1261-00	MC78L15ACP	TI UA78L15ACLP
156-1451-00	LM337T	National LM337T
156-1529-00	LM317LZ	National LM317LZ
156-2263-00	MC79L12ACP	National LM79L12ACZ
156-2298-00	LM358D	National LM358M
156-2416-00	TL780-05CKC	TI TL780-05CKC
156-2558-00	MC7812ACT	TI TL780-12CKC
156-2559-00	MC7912ACT	Unitrode UC7912ACT
156-2667-00	MC3403P	TI MC3403N
156-2698-00	MC7805ACT	TI TL780-05CKC
156-2735-00	MC78L12ACP	National LM78L12ACZ
156-3328-00	ULN2803A	Allegro ULN2803A
156-4386-00	UC3845BN	Unitrode UC3845AN
156-5000-00	LM311D	National LM311M
156-5000-01	LM311DR2	National LM311MX
156-5017-01	MC1458DR2	TI MC1458DR
156-5018-00	LM358D	National LM358M
156-5018-01	LM358DR2	National LM358MX
156-5019-00	LM393D	National LM393M
156-5019-01	LM393DR2	National LM393MX
156-5023-00	MC34001D	TI TL071CD
156-5023-01	MC34001DR2	TI TL071CDR
156-5096-00	LM324D	National LM324M
156-5138-00	MC34002D	TI TL072CD
156-5138-01	MC34002DR2	TI TL072CDR
156-5262-00	LM339D	National LM339D
156-5262-01	LM339DR2	National LM339DR
156-5291-00	MC1413D	TI ULN2003AD
156-5297-00	TL431CD	National LM431ACM
156-5297-01	TL431CDR2	National LM431ACMX
156-5298-00	MC78L05ACD	National LM78L05ACM
156-5298-01	MC78L05ACDR2	National LM78L05ACMX
156-5299-00	MC79L05ACD	National LM79L05ACM
156-5299-01	MC79L05ACDR2	National LM79L05ACMX
156-5522-00	MC1488D	National DS1488M
156-5714-01	LM317LDR2	National LM317LMX
156-5875-00	MC79L12ACD	National LM79L12ACM
156-5882-01	MC26LS32DR2	National DS26LS32ACMX
156-6035-00	MC78L12ACD	National LM78L12ACM
156-6281-00	MC1723CD	TI UA723CD

Component Engineering Announces "CEInfo"

By Abe Ghahyasi

Help on Technology Roadmaps, Bill of Material reviews, Preferred Parts list and any other items dealing with components is now available through an innovation that uses both e–mail and information retrieval technology. You have access to this new services via:

```
ceinfo@tekig5.pen.tek.com
```

ceinfo@tekig5.pen.tek.com is an online gate to Component Engineering which allows users to have access to some of our services via the Email system at any time of the day or night. It is designed to capture and track the user's request and take actions based on the request. There is no human interface or delay, and response time averages between two to five minutes.

Available Services Are:

❑ Bill of Material Reviews

The purpose for Bill of Material reviews is to identify any critical components which may affect the design applications down the line, and to recommend preferrable alternatives. This includes identifying parts which have long term availability problems, cost effective alternatives, long term reliability problems, etc.

It is recommended that Bill of Material (BOM) reviews be done before the first ECB, before each New Board Turn, and Engineering Release.

You can now have a preliminary BOM review of your design, board, etc. by sending a copy of your BOM to:

```
To:ceinfo@tekig5.pen.tek.com
```

With a subject line:
`Subject:CHECK BOM`

It will automatically send you a report taken from the database with parts that either have a New Design recommendation of "DO NOT USE" or "NOT RECOMMENDED", with a note from the database stating the reason for the rating.

You should get the report the same day that you email the BOM to ceinfo. There probably will be some cases where there is no NOTE or rating in the database, and you want the Component Engineers (CEs) to do an actual BOM review, in this case you will send the BOM with the subject line as BOM REVIEW. Once you do this not only do you get the first draft report the same day but also, the supporting CE will be automatically notified to respond to the New Design recommendation. A more thorough review of the BOM from us will be sent to you within two weeks.

You can provide/send more information or notes to CEs in regard to your BOM by including it between a .BEGIN line and a .END line. It is recommended that you provide the following information to CEs if you are doing a BOM review:

```
.BEGIN
Division:
Instrument:
PSR Date:
Design Manager/Contact:
Due Date:
comments.....
.END
```

And then attach the BOM list here.

❑ CE list

To get a current copy of the Component Engineering roster send a message with subject line as CE list.

❑ Comments and Suggestions

We need to hear from you on how we are doing. We do welcome your input/suggestions. Your comments will be well received and will help us to do our jobs better. Please forward your input to:

```
To:ceinfo@tekig5.pen.tek.com
Subject:COMMENTS
```

If you need immediate help with Part Selection or just need a recommendation for a component and don't know who to contact. Send your request with subject line as `URGENT`.

And finally, online help is available at any time by simply sending an email with the subject line as `HELP`.

For help or questions, please do not hesitate to contact us

Abe Ghahyasi
627–2567, MS 47–030
abeg@tekig5.pen.tek.com

Mysterious Unfilled White Space

Online Viewing Of Parts Specifications

By Brian Diehm
Component and Supplier Documentation Manager
627-3437, MS 47-030
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A new utility that allows online viewing of part specifications is scheduled to be implemented on Monday, February 28. Users of the system, named "**Specview**", can type a one–line command on their Sun 4 workstation or X–terminal and immediately see a specification document. Once open, pages (or the entire document) can be printed to a local printer. The viewing tool allows users to magnify or shrink the viewed specification to better fit their screens. Note that locally printed copies of a specification are "uncontrolled copies" for ISO 9000 purposes.

Initially, about 6500 specifications will be available online. These are the part specifications collected since the introduction of Interleaf to the specification process. This collection represents the bulk of preferred parts, but it covers only a small part of the 175,000 part numbers that Tektronix has on file. All new part specifications henceforth will be viewable using Specview.

At first, only Sun 4 and X–terminals will be supported. Support for networked Macintoshes and PCs is being worked on as part of a long–term corporate strategy. Interleaf's WorldView viewing tool is the engine that drives Specview.

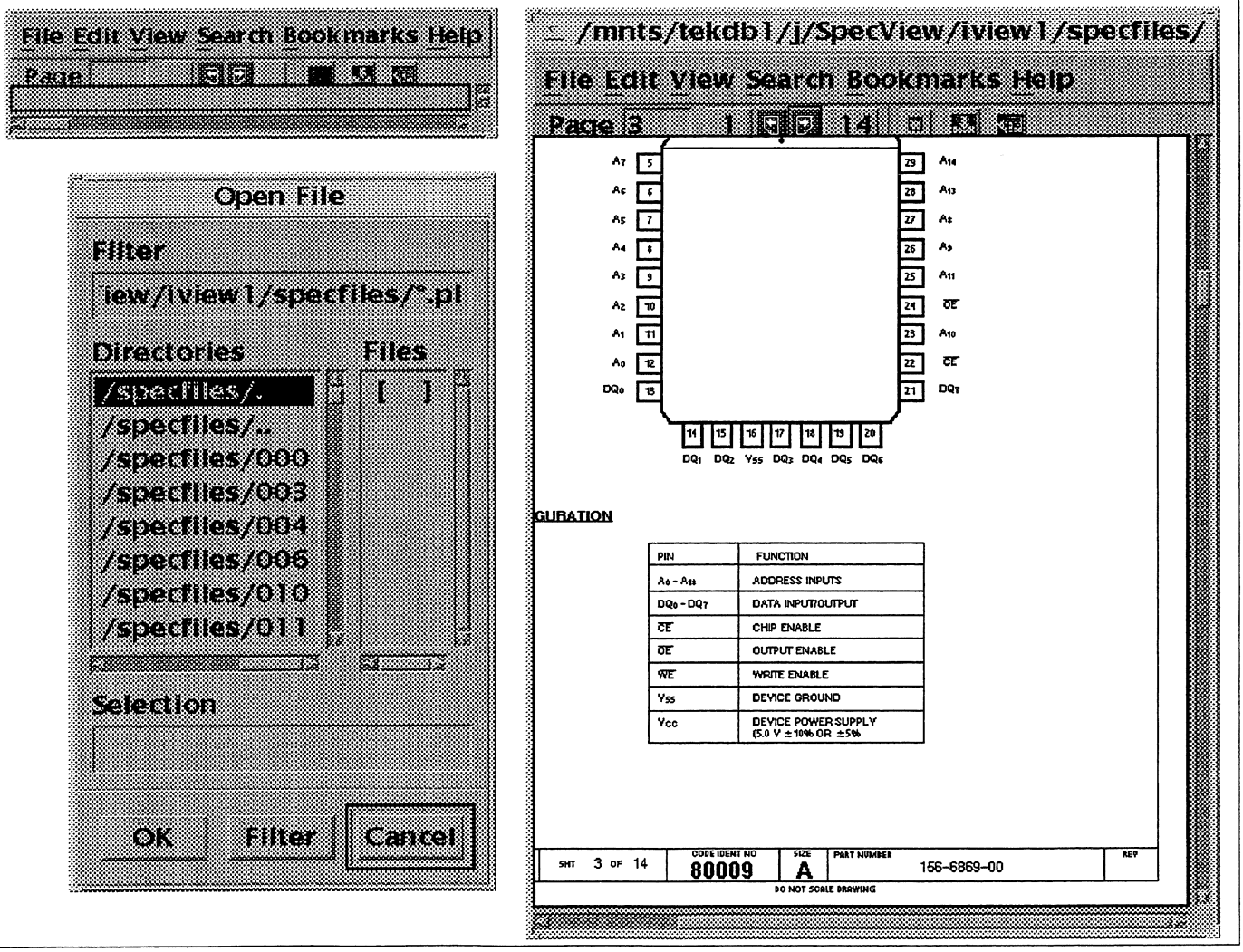
Users wanting to use Specview will need to contact their system administrator to set up the remote mount access to the specification files. Once set up, users simply type at the Unix prompt:

```
Specview xxx-xxxx-xx
```

Where the x sequence is a Tektronix part number. Omitting the part number will open Specview and allow users to direct the program to display one or more specifications.

Specview does not require extensive training to be usable. A Unix man page is being developed, and a quick reference card will be available from David Bartles, Component News editor in CSI on March 4th. David's delivery station is 47–030, or call 627–2542.

Please contact me for questions, comments or more information.



CSI Perspective

by Guest Columnist
Brian Diehm

Requesting New Parts: The NPR System

By now you've probably heard about the recently–introduced New Parts Request (NPR) system. This system replaces all previous part initiation systems (PPIF, NPIF, etc.) and is the only way to create a new Tektronix part number.

Changes are a way of life these days at Tek, and sometimes it helps to step back and evaluate changes in terms of corporate objectives. The corporate objectives behind NPR are to make sure that we evaluate new part numbers before we create them. We need to be certain that:

- The new part represents a wise business decision,
- An equivalent or better part doesn't already exist,
- The part isn't scheduled to soon go out of production,
- It will come from a vendor we have qualified as a quality supplier,
- It has been evaluated for safety, and that...
- It can be used by the manufacturing processes and is "buildable."

The NPR process is the beginning of a system to make sure that checking is done up front, before we become committed to a potential mistake. NPR is a part of an overall structuring of corporate part databases called Pangaea. Many parts of NPR are designed to fit into the larger Pangaea structure that will be in place later, which will include a Parts Data Warehouse (PDW), a Supplier Data Warehouse (SDW), and supplier quality data. Online viewing of parts specifications (see Specview article on page 19) will be integrated seamlessly with the PDW.

❑ Changes of this order, and objectives this sweeping, mean that all functions in the company will need to see the new parts process differently. New parts management must become part of our arsenal of management techniques to reduce our overhead, increase our flexibility, and simply "work smarter."

In the past it has been quick and easy to 'reserve" a part number for immediate use. This made it simple to accomplish some time sensitive milestone tasks, but it masked the costs associated with doing the real work. New products have very recently been designed with parts that were on last–time buy status, or with parts that are known to fail in the field, or where cheaper equivalents have already been on the preferred parts list. The NPR system, by being a "request," gives the other functions of the company time to do the necessary checking up front.

Component Engineers can suggest alternatives and prevent problems that can shut down lines months or years later. Purchasers have a chance to verify that the supplier is one we want to enter into a business partnership with. Safety and board build operations can verify the usability of the part. Once these hurdles are cleared, the NPR system assigns a part number and enters the part into the various Tek systems. However, this all does require some time, time that until now has been deferred until "later." You will need to plan for the fact that the up–front work is now being done up front.

For manufactured parts, NPR turnaround should be quick, usually two days or less. For purchased parts, where more rigorous checking is required, the time can be a few days longer.

NPR allows entry of part requests in two ways: on paper and by email. Use only the method appropriate to the classification of the part:

- Manufactured Parts (all those that will be assigned 650- part numbers and above, including 670, 710, etc.) should be *sent via email.*
- Purchased Parts (all those that do not fit into the category above) should be *sent on paper only,* with all associated documentation attached. Associated documentation can be drawings, manufacturer's specifications, manufacturer's data sheets, and any other data required to complete the online specifications or drawings for the requested part.

If you need to know more about the NPR system, whether in terms of corporate objectives, process and data flow, or the details of using the system, training is available. Contact Mary Blanchard at 627–5824.

For questions, comments or more information, please contact:

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briand@tekig5.pen.tek.com

Component Engineering Commodity Support List

Some examples of the specific type of activities for which the Component Engineer offers assistance are:

IBD Liaison Activities:

- Participation with Engineering Project Teams
- Bill of Material Reviews
- Other issues that cross commodity lines
- Part and vendor reduction projects

Commodity Coverage Activities:

- Generation and maintenance of Preferred Part Lists
- Coordination of component strategies
- Review of new technologies
- Coordination of part evaluations
- Assistance with part selection

Each of the component engineers are prepared to coordinate the appropriate resources to answer your questions.

IBD	Component Engineer			Commodity Technical Strategy
	Name	Phone	E-Mail	
GPID	Abe Ghahyasi	627–2567	Abe.Ghahyasi@TEK.COM	Memory
NWD, T.V. Waveform	Jim Williamson	627–2552	Jim.Williamson@TEK.COM	Linear/Discrete
Telecommunications	John Young	627–2165	John.Young@TEK.COM	Interconnect
T&M Logic Analyzers CDS/Federal Systems	Wilton Hart	627–3035	Wilton.Hart@TEK.COM	Peripherals
T&M DPL/VPL	Curt Bernal	627–6103	curtb@tekig5.PEN.TEK.COM	Electromechanical
T&M MSPL	Gary Johnson	627–1985	Gary.M.Johnson@TEK.COM	Opto–Electronics/ ASICS
	Jeff Riggs	627–6366	jeffr@tekig5.PEN.TEK.COM	Mechanical
T.V.	Norm Adre	627–2524	Norman.Adre@TEK.COM	Digital
FDI	Al Lavalle*	627–6893	allavlle@tekig5.PEN.TEK.COM	Passive
MAP	Ahne Oosterhof	627–1038	ahne@tekig5.PEN.TEK.COM	Power Supplies
	Martin Baggs	627–2534	martinb@banyan.bv.tek.com	Circuit Boards/ Optics Documentation & Software
Building 59	TBD			Hybrids/Chemicals
GVG	George Eckholt	(916) 478–3268	ECKHOLT@GVG47.GVG.TEK.COM	
Comp. Design Plants	TBD			

* Al Lavalle will be assigned to a special project through March of 1994. Jeff Riggs will cover FDI liaison activities. Gary Johnson will cover resistors and Norm Adre will cover capacitors while Al is on special assignment.

Supplier Quality Engineering Site Support List

Some examples of activities that the SQE (Supplier Quality Engineer) is responsible for are:

- Supplier Quality Project Management
- Supplier Quality Information Collection
- DMR Control
- Supplier Quality Improvement
- First contact for line down incidents that are a result of part problems.

It is our intention that all manufacturing sites will have Supplier Quality Engineering coverage and that some of the resources will be drawn from the local IBD's.

Each of the supplier quality engineers are prepared to coordinate the appropriate resources to answer your questions.

Supplier Quality Engineer			
Name	**Phone**	**E-Mail**	**Location**
Nghi Nguyen	627-5098	nghin@banyan.bv.tek.com	73
Gerald Feickert	627-4653	Gerald.E.Feickert@TEK.COM	19
Bob Beville	627-2986	rbeville@tekig5.pen.tek.com	73
Harry Anderton	627-1913	Harry.Anderton@TEK.COM	58 / 46 / 48
Loren Spohn	627-3964	lorens@banyon.bv.tek.com	13
Jim Whitbeck	627-3716	jameswh@pogo.WV.TEK.COM	63
Bill Zangerle	923-4466	wjzanger@ruby.cna.tek.com	R1
TBD			GVG
Ken Erickson	685-2812	kene@orca.wv.tek.com	60

The Component News & Technology Newsletter

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Please address correspondence to : Component News & Technology, ATTN: Dave Bartles – Editor, MS 47-030 or email to daveb@tekig5.pen.tek.com

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