# INTRODUCTION

## SCOPE AND OBJECTIVES

This handbook is intended to serve as a design guide and engineering reference for users of passive electronic components such as discrete, modular, network, chip, hybrid, and assembly type passive devices. It includes descriptions, performance characteristics, and general application information on all major passive discrete and hybrid type electronic component families presently purchased by Component Procurement. Component families presently in development have not been included in this handbook, but will be added in the future as such products are established as standard released families.

An attempt is made to anticipate questions normally raised by circuit designers by identifying those component families which are presently available and how to apply them. Each component family is discussed with respect to product descriptions, definitions, standard applications, technologies, principal parameters, typical performance characteristics, design criteria and economical implications. The treatment given to the discussion of each component family is not technically rigorous, but rather it is intended to provide sufficient information for the potential user to understand the "trade-offs" available in cost, performance, and size between various component technologies. Emphasis is placed on identifying standard component characteristics and recommended design and application practices.

Additional information about specific, unique applications and component designs may be obtained from the responsible component engineer. A list of component engineers and their commodity assignments is available in the "Component Engineering Newsletter".

This handbook is organized by component family and divided into several major sections: resistors, potentiometers, capacitors, networks, magnetics, relays, and crystals. A part number detail catalog is included at the end of each product section for reference.

More definitive data associated with the principal parameters discussed in this handbook is available through the Component Data Bank, which is an information system that provides application, parametric, and dimensional data on all Procurement controlled components. Entry into the Data Bank is accomplished with the use of a "key" which may be obtained through Department 1E9, Engineering Documents, Building 708, Poughkeepsie.

PCE (Procurement Component Engineering) has responsibility for the technical content and distribution of this handbook.

## COMPONENT REQUEST PROCEDURE

Several sources of information are available to assist the circuit designer in selecting an appropriate purchased passive component for a new application:

1. Passive Component Manual
2. Component Data Bank (CDB)
3. Corporate Central File (CCF)
4. PCE Component Newsletter
5. Telephone discussion with appropriate component engineer.

While 1 through 4 above, are reference guides, actual telephone discussion with the component engineer is probably the most definitive and conclusive method, especially for unique, special application requirements. The designer should be prepared to discuss the specific application requirements; that is, electrical, mechanical, environmental, cost, quality, reliability, volume, and schedule objectives, to permit the component engineer to assess the most appropriate component design for the application.

If an existing released P/N, located by searching the preceding sources, can satisfy all application requirements, usage approval can be quickly obtained. This is done through a Procurement Component Request (PCR) followed by a machine phase review request. PCE must review and approve all requests to pick up usage on TUC restricted usage parts.

If a new component needs to be developed, evaluated, and qualified, the designer is requested to complete a PCR form 923-4334-2A/2B (copy included), or supply the equivalent required information to provide the appropriate data which will permit Procurement Engineering to formally size and schedule the P/N release. One copy of the completed request form or equivalent, should be sent to the component engineer and another to:

CCP New Products Office
Department 1E8
Building 708 Poughkeepsie

The request should include as specific a definition as possible of the applications requirements: electrical, mechanical performance; quality and reliability expectations; package design; cost objectives; quantity required by year; and release schedule. The request will be logged and, if supported by PCE/CCP, entered into the New Components Commitment Reference Report ZZ25-5559 which is revised and published monthly. The CCP New Products Office will respond to requests with formal release schedule and will maintain program status.

## ORGANIZATION

The Passive products are controlled by two component engineering departments as follows:

Resistor/Capacitors (D/1D5)

- Resistor Products
  - Discrete Resistors
  - RPACS
  - R Networks
  - Potentiometers
  - Thermistors
- Capacitor Products
  - Tantalum
  - Ceramic
  - Aluminum
  - AC Paper-Oil
  - Plastic Film
  - Mica

Special Passives (D/1D7)

- Relay Products
  - Reed
  - General Purpose
  - Contactors
  - Mercury wetted
  - Solid State
- Magnetic Products
  - Inductors
  - Delay Lines
  - Pulse Transformers

- Discrete Crystals
- Hybrid Crystal Oscillators

Each engineering department is responsible for providing both Development Engineering (DE) and Product Engineering (PE) support for assigned products:

**DE** - New P/N application, evaluation and release.

**PE** - Post release specification maintenance for life; problem resolution; additional sourcing; design; process; materials change evaluations; and general upgrade projects.

The Component Engineering Newsletter lists the current component engineers name, product responsibility and phone number. The newsletter is updated, printed and distributed quarterly to those names appearing on the newsletter distribution list. To receive the newsletter or change the address on the distribution list contact:

Engineering Documents
Dept. 1E9, Bldg. 708-17A
Poughkeepsie 8-253-9713

(Request must include name, department number, building number, location, serial number and manager's signature).

It is highly recommended that recipients of the Passive Manual also be on distribution for the Component Newsletter to assure awareness of new developments and component engineering assignment changes.

## ENVIRONMENTAL PROGRAM

Since the enactment of the Toxic Substances Control Act (TSCA) and the Resource Conservation and Recovery Act (RCRA), Solid and Hazardous Waste regulations, Corporate Component Procurement (CCP) has been environmentally assessing its purchased components for any potential toxic and/or hazardous materials in "as purchased" product.

These assessments will be documented as product Environmental Descriptions (ED) whose purpose will be to:

- Minimize or eliminate adverse environmental effects of IBM products.
- Ensure early identification of potentially toxic and hazardous materials, facilitate review by a specialist, and provide management and users with the effects and related actions.

The ED's will be written for product families and will be formatted as follows:

- Product Description
- Materials of Construction (weight range basis)
- Identification of any toxic or hazardous materials
- IBM exposures in use
- Handling/storage precautions
- Disposal methods
- IBM Material Safety Data Sheet(s) (MSDS) for materials of concern
- Documentation (where applicable and available) of health, safety, toxicity concerns

A method is being developed to incorporate the product families into the MSDS. This will allow use of the Corporate Chemical Data System (CDS) for reviewing the pertinent data concerning any health, safety, or toxic concerns associated with the product. CDS is an online corporate terminal system that stores and displays the information in MSDS.

The ultimate aim of this environmental program is to prepare, maintain, and update Environmental Descriptions for all CCP purchased Active/Optic/Passive components.

## COMPONENT QUALIFICATION AND RELEASE PROCEDURE

The process of releasing a new purchased component generally involves three phases of engineering activity which vary in scope and duration with the nature of the product technology requested. A component from a family of parts whose technology has been well established (for example, R-Pacs) for example, may not require any formal evaluation and could be released immediately. A new product family or complex component technology, however, would normally require rigorous evaluation testing and could take one to two years to develop and release.

The first phase of engineering activity can be considered DEVELOPMENT, during which component specifications are negotiated with both the user and the supplier(s), and a product feasibility evaluation (that is, T-1) is normally conducted on prototype samples by engineering. During this phase a part number is normally assigned to a development level drawing (that is, alphabetic E.C. level), and a qualification and release schedule is established.

The second phase of activity involves a PERFORMANCE EVALUATION in which a thorough laboratory evaluation (that is, T-2) is conducted on a large quantity of component samples representative of the proposed production design and process to determine their ability to meet the performance and reliability objectives of the application.

After successful completion of T-2, the part is released with active status code A or C and a numerical EC number. A Technical Usage Code (TUC) A or C is also assigned. Parts are customer shippable. In the unique event that release is imperative prior to full completion of the T-2 evaluation, the part can be "controlled released" with TUC B indicating incomplete evaluation. If required, a temporary estimated failure rate can be granted based upon current evaluation results. Controlled released parts will be retroactively upgraded to fully released status and customer shippable after successful completion of the T-2 evaluation.

To verify reproducibility of product produced on a "scaled up" production line, the final phase of engineering activity is the "Production Qualification" wherein quality engineering tests the production lots to all applicable specifications. Acceptable product is released to zone for customer usage.

PCE can release components with differing levels of risk and reliability assurance depending upon the nature of the product technology and application conditions. The level is designated by use of the TUC which basically identifies the level of technical assurance supported by PCE, the degree of restriction imposed upon subsequent users, and the Intrinsic Failure Rate (IFR) supported in F/R specification 866451.

Users should be familiar with those items on each part drawing which identify its level, status, and restriction. Any part with a numeric P/N and numeric E.C. level is released (at either "Controlled" or "Active" status). The technical status of a part, that is, its application limitations, is identified by one of the following TUC's.

**A - Full Usage:** Component may be used without restrictions within the limits of the drawing specification. User not required to seek engineering approval.

**B - Conditional Usage:** Evaluation is not yet complete and usage must be approved by the engineering lab of control. This code is usually applied to parts which are at a Controlled Release status and have not completed laboratory qualification.

**C - Limited Usage:** Component has been released for specification applications and new usage must be approved by the engineering lab of control. This code is usually employed for any product which has a substantial exposure to being misapplied in new applications.

**E - Controlled Usage:** Component is technically acceptable but may not be available in sufficient quantities for new usage and, therefore, all new usage must be approved by the engineering lab of control.

**F - Unapproved Usage:** Component has failed evaluation testing and is not satisfactory for use.

**L - Not Evaluated (User Approved Usage):** Component has been released without a formal performance or reliability evaluation. The user is responsible for use approval.

## SPECIFICATIONS

The specifications for purchased component identify the criteria by which incoming product is accepted and rejected, that is, they represent the terms of the contractual agreements between IBM and the suppliers. They are not design, process control, or reliability documents since they relate only to the testing of finished product against functional criteria. The part drawing normally specifies the basic electrical and mechanical parameters required and their initial tolerances or limits. The drawing also references the applicable engineering and quality specifications which identify standard acceptance tests for that product family (including short and long-term stress tests), and allowable defect levels. In addition, the P/N drawing also references general specifications which are partly or fully applicable to the products. These are listed in Table 1-1. Production testing against these specifications is designed to provide assurance that the product meets its initial value requirements and exhibits performance characteristics representative of the product which was originally qualified by more thorough evaluation testing.

The design and application of a component should consider both its "end-of-life" performance characteristics, and its "initial" parameter values. Short and long-term degradation characteristics and component failure rates obviously cannot be specified as lot-to-lot acceptance criteria. They can only be determined through rigorous laboratory characterization testing such as normally conducted for T-2 qualification. Electrical, mechanical, and environmental tests, which attempt to stress the product under worst-case conditions, are normally incorporated in engineering specifications to provide a measure of product reproducibility and relative "goodness". Typical "end-of-life" performance characteristics and expected maximum failure rates* are presented in this handbook for each product family as a design guide. The design and application of specific part numbers, however, should be discussed in detail with respect to these characteristics, with the responsible component engineer.

*Refer to Engineering Specification 866451 for lists of Failure Rates.

Table 1-1. General Specifications

| | |
|---|---|
| 873589 | Purchased Components General Quality Requirements |
| 890350 | Abridged Mech. Drafting Standards - Part I |
| 234399 | SI Metric - Abridged Engineering Standard |
| 873506 | Electrical Components, General Requirements |
| 871300 | Electronic Components, General Requirements |
| 873444 | Supplier Shipping |
| 860681 | Positional Dimensioning - Interpretation |
| 2412436 | Tape and Reel |
| 2413138 | Flammability - Components |
| 866451 | P/N Detail of Failure Rate, ETN, and Reclaim for Purchased Components |

## ALORS

Library of Reliability Algorithms (ALORS) contains general discrete and several new generic algorithms which cover passive components and which project expected field fallout and failure rates for the specified life of the various component technologies.

To become a user of ALORS, the requestor must contact FDS Dept. 284, Bldg. 928, Poughkeepsie, phone 8-253-0162, and obtain authorization to subscribe to ALORS.

## DCS CODES

The scope of this handbook covers all DCS codes from 23400 through 23789. The first two digits (23) identify a Corporate Procurement Controlled component; 3rd and 4th digits (40 through 78) identify major type component; 5th digit breaks component down to specific types. Refer to Table 1-2 for list of product DCS codes.

Table 1-2. Family Breakdown (X)

| DCS | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 2340(X)* | Contactors | Contactors | | | | | | | | |
| 2341(X) | Relays | G.P. Relays | | | | | | | | |
| 2342(X) | Relay, Reed | 1 Pos. | 2 Pos. | 3 Pos. | 4 Pos. | | 6 Pos. | | | |
| 2343(X) | Relay | Solid State | | | | | | | | |
| 2344(X) | Relay | Reed Switch | | | | | | | | |
| 2345(X) | Relay | Motor Str. | | | | | | | | |
| 2346(X) | Relay | Time Delay | | | | | | | | |
| 2347(X) | Relay | Merc Wet | | | | | | | | |
| 2348(X) | Relay | Permiss. | Wire Contact | Duo | | Latch | | | | Special |
| 2350(X) | Pots | Panel | Rheostats | 1 Turn C. | M Turn C. | 1 Turn W.W. | M Turn W.W | 1 Turn Film | M Turn Film | Special |
| 2351(X) | RPAC | Metric | R.125<200 | R.125>200 | R.100<100 | R.100>100 | R/C.150 | R/C.125 | | |
| 2353(X) | Film Res. | 1/8 W. | 1/4 W. | 1/2 W. | 1/10 W. | | | | | Special |
| 2354(X) | Networks | SRM | PRM | R Mod | RC Mod | Chip Res. | Precision | | | Special |
| 2356(X) | Res. Uniq | Pluggable | Thermistor | Sensitor | Feed Thru | Match Pr. | | | Arc Supp. | Special |
| 2358(X) | Res. W.W. | Type 1 | Type 2 | Type 3 Prec. | Type 1 Axial | Alum. Hse. | Wire Formed | | | Special |
| 2359(X) | Res. G.P. | 1/4 W. | 1/2 W. | 1 W. | 2 W. | 1/8 W. | | | | Special |
| 2360(X) | Cap, Mica | Axial | Radial | | | Variable | | | | Special |
| 2361(X) | Cap, Ceram | Axial | Radial | Modular | Chip | Variable | Disc | | | Special |
| 2362(X) | Cap, Film | Polyester | Polycarb | Parylene | Polystyrene | Polypropln | | | | Special |
| 2364(X) | Cap, Alum | Axial DC | Radial DC | | | Chassis/Can | AC | | | Special |
| 2365(X) | Cap, Paper | Axial Non PCB | Multiple Non PCB | Chassis PCB | Chassis Non PCB | | | | Card Mt. Non PCB | Special |
| 2366(X) | Cap,Tant | Axial | Modular | | | Radial Dip | | | | Special |
| 2368(X) | Cap, Unique | Air, Gap | Glass | Feedthru | | | | | | Special |
| 2372(X) | Inductor | A.F. Fixed | A.F. Var. | R.F. Fixed | R.F. Var. | Radial Dip | | | | Special |
| 2373(X) | Transform. | A.F. Fixed | A.F. Var. | Pulse | Wide Band | Sat'u'ble | Auto | | | Special |
| 2374(X) | XTAL OSC | TTL | ECL | | | | | | | Special |
| 2375(X) | Crystal | Solder S. | Kold W. | | | | | | | Special |
| 2378(X) | Delay Line | Fixed | Progmble | | | | | | | Special |

*23 - identifies COMPONENT Procurement Controlled product
40-78 - identifies different types of purchased products
() - 5th digit breaks a product into several distinct families

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TYPE OR PRINT

# Procurement Component Request
# Machine/System Information

DATE

**PROGRAM**

| MACHINE NAME: | DIVISION: | LOCATION: |
|---|---|---|

DESCRIPTION AND COMMENTS:

| PROGRAM MANAGER | DEPT/BLDG | LOCATION | TIE LINE | EXTENSION |
|---|---|---|---|---|

**CONTACTS**

| DEV ENG MANAGER | DEPT/BLDG | LOCATION | TIE LINE | EXTENSION |
|---|---|---|---|---|
| ENG LIAISON | DEPT/BLDG | LOCATION | TIE LINE | EXTENSION |

**DEVELOPMENT DATES**

| PHASE REVIEWS: | I | II | III | ANN: | FCS: |
|---|---|---|---|---|---|

| ANNOUNCE VERIFICATION TEST (AVT) | START | COMPLETE | SHIP VERIFICATION TEST (SVT) | START | COMPLETE |
|---|---|---|---|---|---|

**OPERATING CONDITIONS**

| CLASS: (A1, A2, B, C, D1, D2, E) | GAS: (1, 2, 3) | PARTICULATE. (1, 2, 3) |
|---|---|---|

| PRODUCT LIFE: (YEARS) AVG & MAX | POWER-ON: (K-HOURS) AVG & MAX |
|---|---|
| ON-OFF: (K-CYCLES) AVG & MAX | |

**SYSTEM VOLUME**

PER PLAN: DATED:

| First Year 1Q | 2Q | 19 ____ 3Q | 4Q | 2nd Year 19 ____ | 3rd Year 19 ____ | 4th Year 19 ____ | 5th Year 19 ____ | 6th Year 19 ____ | 7th Year 19 ____ | Program Total |
|---|---|---|---|---|---|---|---|---|---|---|
| Dom. | | | | | | | | | | |
| WTC | | | | | | | | | | |

923-4334-2A

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TYPE OR PRINT

# Procurement Component Request
# Component Information

| DATE | LOCATION NO. | PCR NO. |
|---|---|---|
| | | |

| REQUESTOR | DEPT/BLDG. | LOCATION/DIV. | PHONE NO. | |
|---|---|---|---|---|
| ENGINEERING MANAGER | ENG MGR SIGNATURE | | PHONE NO. | DATE |
| ENG LIAISON | DEPT/BLDG. | LOCATION/DIV. | PHONE NO. | DATE |
| PROGRAM/MACHINE NAME | | | | |

**TYPE OF REQUEST**

| | | |
|---|---|---|
| ☐ APPLICATION APPROVAL | ☐ CRITICAL COMPONENT | REQUEST TUC – |
| ☐ NEW RELEASE | ☐ ROUTINE REQUEST | RELEASE BY |

DOES THIS REQUEST REPLACE AN EXISTING PART? ☐ YES ☐ NO

IF YES, LIST PART(S)

**COMPONENT DESCRIPTION (ATTACH SUPPLEMENTAL DATA AS REQ'D)**

IBM PART NUMBER VENDOR VENDOR PART NUMBER NAME

CIRCUIT APPLICATION:

ELECTRICAL CHARACTERISTICS:

| PACKAGE TYPE | EDS RULES REQ'D BY |
|---|---|
| FAILURE RATE OBJECTIVE | COST OBJECTIVE |

ENVIRONMENT:

Engineering Parts Required (Qty. & Date) (Asterisk Capitalizable Parts)

Production Requirements

Per Plan: ________________ Dated: ______________

Date and Component Quantity Required for Card Assembly

Average Component Count Per Machine: ______________

| | First Year 1Q | 2Q | 3Q | 19______ 4Q | 2nd Year 19______ | 3rd Year 19______ | 4th Year 19______ | 5th Year 19______ | 6th Year 19______ | 7th Year 19______ | Program Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Dom. | | | | | | | | | | | |
| WTC | | | | | | | | | | | |

923-4334-2B Front

**Definitions:**

| | |
|---|---|
| P/N / Name / Description: | Industry Number, Industry Name, Product Family |
| Application: | Circuit In Which Component Is Used and No. Of Components/Machine |
| Package | Description Such As 8 Pin Dip, to 99, Ceramic, Plastic |
| Electrical Characteristics: | If Different From Catalog, Special Power Supply Voltage, Current, Offset Voltage, Bias, Voltage Swing, Gain, etc. |
| Operating Performance: | Access Time, Power Dissipation, Fan Out, Rise Time, Frequency Response, etc. |
| Environment: | Class, Special Conditions, Tj or Ta % Time At Temperature, Hostile Element, Power On Hours, On/Off Cycles, Shelf Life |
| Engineering Requirements: | Components Purchased By the Lab. Note Capitalized Parts With An Asterisk |

923-4334-2B Back