

PRE-RELEASE

MAGNETIC WAFER CARTRIDGE
SPECIFICATION
Texas Instruments #1053123

Consumer Products Group
COMPACT COMPUTERS

10/28/82

SECTION 1

Scope

This document describes the requirements for a single track, continuous loop tape wafer cartridge used in TEXAS INSTRUMENTS calculator/computer products.

SECTION 2

Objective

The purpose of this document is to establish standardization, to assure interchangeability of various manufacturers cartridges, and to establish an acceptable level of quality.

SECTION 3

Applicable Documents

The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the revision and issue in effect on the date of RFQ shall apply. In the event of any conflict between this document and the referred documents, this document shall govern.

MIL-STD-105D (AQL) Sampling Procedures and Tables
For Inspection By Attributes

MIL-STD-810B

Texas Instruments Drawing

1010765	Packaging Requirements, Vendor
1048969	Case, Wafer Top
1048970	Bottom Case, Wafer
1048971	Flange, Tape Reel
1048972	Hub, Tape Reel
1048973	Hub, Pressure Roller
1048975	Rubber Pinch Wheel Tire
1053101	Splice
1053104	Label, Nameplate
1053105	Label, White Protective
1053108	Spring, Pressure Pad
1053109	Pad, Felt
1053110	Roller, Pinch Assembly
1053111	Cover, Protective
1053114	Assembly, Wafer
1053117	Assembly, Spring and Pad
1053119	Assembly, Flange and Hub

SECTION 4

Requirements

4.1 Cartridge Physical Requirements

4.1.1 Physical Dimensions.

The magnetic wafer cartridge shall meet all of the requirements shown on Texas Instruments Drawing # 1053114, as applicable.

4.1.1.1 Housing.

Materials used in the cartridge housing will be non-magnetic. The cartridge will not require cleaning, lubrication or other maintenance by the user.

4.1.1.2 Tape Width.

The magnetic tape shall have a width of .068 inches ± 0 , $-.002$ inches.

4.1.1.3 Tape Length.

The cartridge shall contain tape equal to length specified $+5\%$, -0% .

4.1.1.4 Packing.

The tape is to be wound on the reel with 8 ounces $\pm .5$ ounces tension.

The tape should exhibit a smooth wind showing no layer offset.

4.1.1.5 Splices.

There will be only one splice within the continuous loop.

The foil width shall not exceed that of the magnetic tape and shall meet the requirements of Texas Instruments Drawing # 1053101.

4.1.1.6 Label.

Labels will adhere to the cartridge housing without curling or turning loose.

Inks and colors on label shall not smear or come off under normal use when subjected to the conditions of paragraphs 4.4.

Labels shall meet requirements specified in Texas Instruments Drawing #1053104.

4.2 Tape Requirements

4.2.1 Tape Substrate.

The substrate shall be composed of polyethelene terephthalate or equivalent material with a thickness of $.00075 \pm .00025$ inches.

4.2.2 Tape Coating.

One side of the tape shall be coated with unoriented gamma - Fe₂O₃ or CrO₂. The coercivity shall be 650 oersteds ± 50 oersteds. The surface resistance shall be less than 1×10^{10} ohms/square meter. The coating thickness shall be less than $.00025 \pm .000025$ inches.

The other side of the tape shall be coated with colloidal graphite or equivalent. Coating thickness shall be $.00004 \pm .00001$ inches.

4.2.3 Toxicity.

No toxic materials are allowed.

4.3 Performance Requirements

4.3.1 Electrical.

4.3.1.1 Permanent Errors.

A permanent error and/or non-transient error is defined as a error that reoccurs on the tape for a minimum of three consecutive passes over the read/write head.

To insure that an acceptable quality level is present in the recording medium, the tape must have no permanent errors at a clipping level of 50 % (50 % drop in signal) at 1600 bpi(3200 fci) when tested.

4.3.1.2 Transient Errors.

A transient error is defined as an error that reoccurs no more than two successive passes over the read/write head.

The number of occurrences will be recorded to determine the cleanliness quality level. This test is to be accomplished at 1600 bpi (3200 fci) 50 % clipping level(50 % drop in signal).

4.3.2 Torque.

4.3.2.1 Starting Torque.

The torque required to start rotation of tape within the wafer shall be less than .5 oz-in when engaged in a test mechanism that has nominal tape head and motor capstan penetration into the wafer cartridge.

4.3.2.2 Dynamic Torque.

The torque required to rotate the tape at a linear speed of 10 inches/second shall be less than .25 oz-in when engaged in the test mechanism as described in Paragraph 4.3.2.1.

4.3.3 Life.

The magnetic wafer cartridges less than 35 feet shall demonstrate a mean time between failures of 60 hours.

The magnetic wafer cartridges more than 35 feet shall demonstrate a mean time between failures of 45 hours.

Failures include tape jams, tape spills, splice failure, breakage and distortion of cartridge plastic parts, increasing torque requirements, signal to noise or output level shifts, or dropouts that directly contribute to read/write errors greater than one error per 10 billion bits.

4.4 Date Code Marking

A date code including the week of the year and the year shall be clearly marked on the back surface of the cartridge.

4.5 Packaging Requirements

Cartridges supplied under this specification will be utilized in various applications which require different packaging. The specific packaging required will be called out in individual purchase orders.

4.5.1 Point of Purchase Pack.

Cartridges procured under this paragraph shall be packed as described herein.

Each cartridge shall be put in a heat sealed plastic bag.

The cartridge and its bag will be packaged in point of purchase (POP) box that will hold six cartridges.

The POP box artwork will be as supplied by Texas Instruments.

The cartridges will not be free to move around within the POP box.

The POP boxes will be packaged in a cardboard overpack that will hold twelve POP boxes.

The POP box shall be capable of being shipped (in the cardboard overpack), handled, and stored without serious deformation to the carton or damage to the cartridges as long as reasonable practices in handling and shipping are followed.

The overpacks will be be packaged in a marked primary (shipping) container that complies with Texas Instruments Drawing # 1010765, Vendor Packing Requirements.

4.5.2 Display Card Pack.

Cartridges procured under this paragraph shall be packed as described herein.

Each cartridge shall be shrink wrapped on a card for POP display.

The POP card artwork will be as supplied by Texas Instruments.

Ten shrink wrapped cards will be packaged in a cardboard overpack.

The cards will not be free to move around within the overpack.

The overpack box with the shrink wrapped cartridges inside shall be capable of being shipped, handled, and stored without serious deformation to the carton or damage to the cartridges as long as reasonable practices in handling and shipping are followed.

The overpack boxes will be be packaged in a marked primary (shipping) container that complies with Texas Instruments Drawing # 1010765, Vendor Packing Requirements.

4.5.3 Bulk Pack.

Cartridges procured under this paragraph shall be packed as described herein.

Each cartridge shall be put in a heat sealed plastic bag.

The bagged cartridges will be be packaged in a marked primary (shipping) container that complies with Texas Instruments Drawing # 1010765, Vendor Packing Requirements.

4.6 Environmental Requirements

As a function of these requirements the shipping and storage carton, the plastic bag, and cartridge shall not be affected to the extent that the quality or reliability of the assembled cartridge is affected or jeopardized.

4.6.1 Temperature Range.

Operating.....0C to 40C

Storage.....-40C to 50C

4.6.2 Humidity.

Operating.....35% to 80%

Storage.....25% to 95%

4.6.3 Vibration.

The cartridge, the Point of Purchase Pack, and Display Card Pack must each withstand the conditions described in MIL-STD-810B, Method 514.1, Procedure X per paragraph 4.5.1.3 cycling test using curve XY of Figure 514.1-VII and time schedule table 5.4.1-VII. Omit resonance search and dwell. Test in 3 perpendicular planes from 5-20-5 Hz for one hour in each plane.

4.6.4 Shock.

The magnetic wafer cartridge must withstand drops from a height of 36 inches onto a standard bench top surface once each time on all four sides, top and bottom for a total of six drops in a random sequence.

4.7 Write Enable

An area on the wafer label is reserved as the write enable area. This area must be non reflective. A reflective white 'dot' may be affixed to this area to enable writing.

SECTION 5

Quality Assurance Provisions

5.1 Responsibility For Inspection

The supplier is responsible for meeting all requirements stated herein and shall inspect the goods to insure conformance with these requirements or any others prescribed by Texas Instruments. The supplier may use his own or any other facilities deemed suitable by Texas Instruments for performing the inspections unless otherwise specified in the contract or Purchase Order. Texas Instruments also reserves the right to perform inspections to insure that parts and services conform to Texas Instruments requirements.

5.2 Vendor Qualification

Initially all suppliers to this specification will supply a quantity of cartridges for qualification testing by Texas Instruments. This testing is described in Section 6.

Once a supplier is approved, he is not to change his tooling design, manufacturing process or materials without notifying Texas Instruments. Change approval may be subject to requalification.

5.3 Certification

Every cartridge will be certified during the manufacturing process according to the requirements in paragraphs 4.3.1.1 and 4.3.1.2.

The yeild at the certification point for each lot will be recorded and supplied upon request to Texas Instruments.

The data recorded in meeting the requirements of paragraph 4.3.1.2 will be recorded and supplied to upon request Texas Instruments.

A test tape with known permanent errors (1 error at a 50 % clipping level, ie. 50 % drop in signal), must be cycled through each certifier every two hours of operation to verify the certification process.

5.4 AQL

On all electrical, mechanical, and packaging requirements not specifically specified in the lot acceptance test procedure, the tests conducted by the supplier during the manufacturing process should assure meeting the intent of the specification and, as a minimum, the parameters not included in the lot acceptance tests when tested on a sample basis should meet an AQL of 1.0 percent normal single sampling general inspection level II per MIL-STD-105D (Sampling Procedures and Tables for Inspection by Attributes).

5.5 Lot Acceptance Tests

Every lot of cartridges manufactured will be sampled and inspected in accordance with paragraph 5.6, Inspection Criteria and AQL Percent. Normal lot sizes are 1200. No one lot is to exceed 5000 cartridges.

The lot number is to be on the side of each carton in the lot. Once the acceptance test sample is selected, there will not be any adding to or deleting from the lot except as specified.

The boxes that the sample is taken from are to be selected at random throughout the lot. Once the sample cartridges are separated from the lot, they should be kept together until the lot has been accepted.

5.6 Inspection Criteria and AQL Percent

5.6.1 Packaging and Identification.

All packaging and identification inspection is to be done to a 1.0 percent AQL. If the sample fails, then the entire lot is to be 100 percent screened. All defects found on the sample inspection or 100 percent screening must be corrected or replaced.

Inspect the box/card the sample cartridges came from for damage and identification as specified.

Inspect cartridges for correct labeling, to include correct location of the write protect label, if required for the product.

Inspect the plastic bag, if applicable, for complete seal.

5.6.2 Physical Inspection.

All physical inspection is to be done to a 1.0 percent AQL. If the sample fails, then the entire lot is to be screened 100 percent. All defective cartridges found are to be replaced.

If the defective cartridge found on sample inspection are because of an uneven or loose wind, tape pack unevenness, or distortion outside of limits, then the whole lot is subject to replacement according to severity of the defect.

Cartridge plastics are to be inspected for imperfections, distortion and damage.

The tape pack is inspected for loose turns and even pack to the extent specified per paragraph 4.1.1.4.

The tape pack is to be observed for cinching indications. None are allowed.

5.6.3 Electrical Inspection.

All electrical inspection is to be done to a 1.0 percent AQL. If the sample fails, then the entire lot is to be screened 100 percent. Any cartridges determined to be defective during

the physical inspection must be replaced by new cartridges from the same lot for electrical testing.

The tape is to be tested for permanent errors defined in paragraph 4.3.1.1. A tape with a permanent error is to be considered a failure.

The tape is to be tested for transient errors defined per paragraph 4.3.1.2. A tape with a transient error at this point is to be considered a failure.

The sample tested is not to have special handling such as brushed, wiped, air blown, or in any way cleaned, prior to being tested for permanent and transient errors.

5.6.4 Replacing Defective Cartridges.

All cartridges found to be defective during acceptance testing will be removed from the lot and replaced by known good cartridges so that the lot size stay the same.

SECTION 6

QUALIFICATION PROCEDURE FOR WAFER CARTRIDGE

6.1 Objective

To establish the quality and reliability of the wafer cartridge as a function of design, tooling, and manufacturing process.

6.2 Definitions

6.2.1 Failure.

A failure is defined as any cartridge that does not meet the physical, mechanical, or electrical specifications detailed in Section 4 of this specification.

6.2.2 Functional Test.

A functional test consist of running the cartridge in an approved tape transport, sensing the EOT/BOT splice, writing to the entire length of tape, then reading from the entire length of tape.

6.2.3 Normal Conditions.

Normal conditions for qualification are a temperature of 25 ± 2 degrees celsius with a relative humidity of 30 to 50 percent.

6.3 Procedure

6.3.1 Sample Size.

1000 wafer cartridges shall be tested to establish a qualification.

6.3.2 Initial Measurements.

All cartridges will be initially checked for compliance to dimensional requirements, and mechanical and electrical specifications.

6.3.3 Groupings.

All cartridges under test will be divided into six groups. Groups A,B,C,D, and E are to contain 100 units and Group F is to contain 500 units.

6.3.4 Physical Testing.

Units in Group A shall be subjected to the tests described in paragraphs 6.4.1.1, 6.4.1.2, and 6.4.2.

Units in Group B shall be subjected to the tests described in paragraphs 6.4.1.3, 6.4.1.4, 6.4.1.5, and 6.4.1.6.

Units in Group C shall be subjected in paragraph 6.4.1.7.

Units in Group D shall be subjected to the tests described in paragraph 6.4.1.8.

Units in Group E shall be subjected to the tests described in paragraph 6.4.1.9.

6.3.5 Life Testing.

Units in Groups A, B, C, D, and E shall, after completing all other testing, be life tested as described in paragraph 6.4.3.

Units in Group F shall be life tested as described in paragraph 6.4.3.

6.4 Tests

6.4.1 Environmental Tests.

6.4.1.1 Vibration.

The cartridges, in cardboard overpack, will be tested as described in MIL-STD-810B, Method 514.1, Procedure X per paragraph 4.5.1.3 cycling test using curve XY of Figure 514.1-VII and time schedule table 5.4.1-VII. Omit resonance search and dwell. Test in 3 perpendicular planes from 5-20-5 Hz for one hour in each plane.

The cartridges, in cardboard overpack will be tested as described in MIL-STD-810B, Method 514.1, Procedure XI per paragraph 4.16.2, 4.16.2.3, and 4.16.2.4 except limit to 0.1 inch double amplitude sinusoidal vibration and 40 Hz. Test in 3 perpendicular planes, 1 hour in each plane. All possible product orientations within the shipping container shall be subjected to loose cargo.

The cartridges, in cardboard overpack shall be dropped in a random sequence from a height of 6 feet onto a concrete floor as follows: one flat drop on an end, a side, and the bottom; one corner drop on the bottom corner common to the end and side used on the flat drop test; one edge drop each on the bottom edges of the same side and end previously used. All possible product orientations within the shipping containers shall be subjected to transit drop.

6.4.1.2 Shock.

The magnetic wafer cartridge selected shall be dropped from a height of 36 inches onto a standard bench top surface once each time on all four sides, top and bottom for a total of six drops in a random sequence.

6.4.1.3 High Temperature Extreme.

The cartridges selected for the test will soak for four hours in a chamber at 45 ± 2 degrees Celsius with a relative humidity of 20%. The units will then be functionally tested within five minutes of removal from the chamber.

6.4.1.4 Low Temperature Exterme.

The cartridges selected for the test will soak for four hours in a chamber at 0 ± 2 degrees Celsius with a relative humidity of 20%. The units will then be functionally tested within five minutes of removal from the chamber.

6.4.1.5 Temperature Cycling.

The cartridges selected for the test will soak for one hour in a chamber at -40 ± 2 degrees Celsius. The units will then be removed from the chamber and immediately placed in a chamber at 70 ± 2 degrees Celsius to soak for one hour. The cartridges will then be allowed to stabilize at normal conditions. The cartridges will be functionally tested.

This cycle will be repeated five times.

6.4.1.6 Humidity.

The cartridges selected for the test will soak for 48 hours in a chamber at 55 ± 2 degrees Celsius with a relative humidity of $95 \pm 2\%$. The cartridge will then be removed from chamber and functionally tested at normal conditions.

6.4.1.7 High Temperature Storage.

The cartridges selected for the test will soak for 1000 hours in a chamber at 50 ± 2 degrees Celsius with a relative humidity of 20%. The cartridges will be removed from the chamber at the 168, 500, and 1000 hour points, allowed to stabilize to normal conditions, then functionally tested.

6.4.1.8 Low Temperature Storage.

The cartridges selected for the test will soak for 1000 hours in a chamber at -40 ± 2 degrees Celsius with a relative humidity of 60%. The cartridges will be removed from the chamber at the 168, 500, and 1000 hour points, allowed to stabilize to normal conditions, then functionally tested.

6.4.1.9 Humidity.

The cartridges selected for the test will soak for 360 hours in a chamber at 50 ± 2 degrees Celsius with a relative humidity of $95\% \pm 2\%$. The cartridges will be removed from the chamber, allowed to stabilize to normal conditions, then functionally tested.

6.4.2 Insertion Test.

The cartridges selected for this test will be subjected to 100 insertions into a test fixture designed to simulate an actual tape transport.

6.4.3 Life Tests.

Each cartridge shall be life tested by continuously running the cartridge in an approved tape transport until it fails.

6.5 Pass/Fail Criteria

6.5.1 Definitions.

6.5.1.1 Critical Failure. A critical failure is a failure that would result in a field return.

6.5.1.2 Major Failure. A major failure is a failure that could occur in the field, and would be distracting to the customer.

6.5.1.3 Minor Failure. A minor failure is a failure that would diminish the quality image of the product if found in quantities.

6.5.2 Allowable Failures.

6.5.2.1 Environmental Tests.

No critical failures are allowed.

Only 4 major failures are allowed in any one test.

Only 12 minor failures are allowed in any one test.

6.5.2.2 Life Tests.

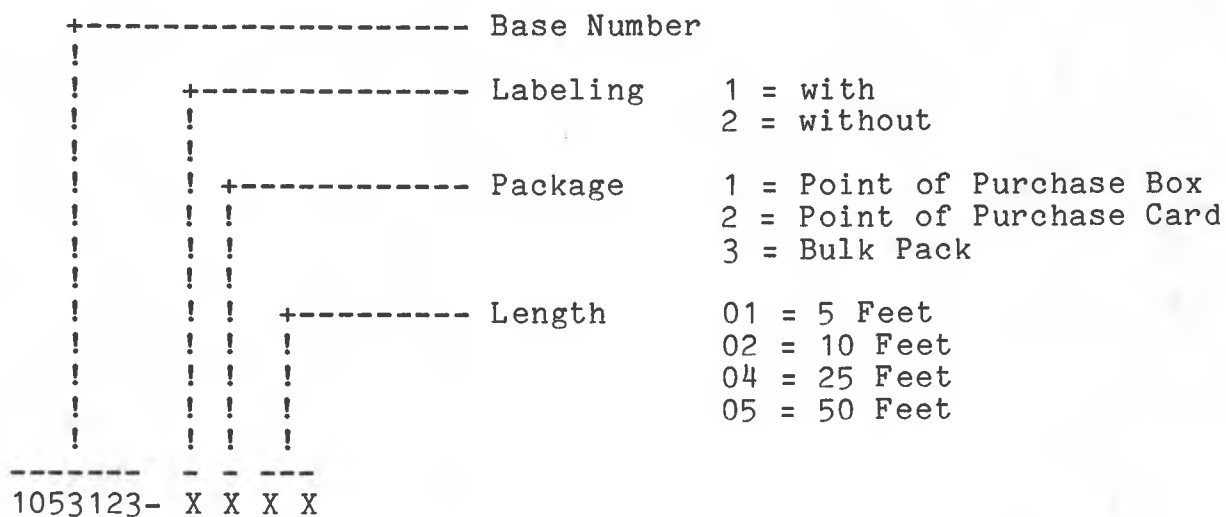
The magnetic wafer cartridges less than 35 feet shall demonstrate a mean time between failures of 60 hours. Additionally, the population shall exhibit less than 1% failures at 3 hours operation, and less than 3% failures at 9 hours operation.

The magnetic wafer cartridges more than 35 feet shall demonstrate a mean time between failures of 45 hours. Additionally, the population shall exhibit less than 1% failures at 3 hours operation, and less than 3% failures at 9 hours operation.

SECTION 7

PARTS DESCRIPTION

The cartridge is described by its complete part number as indicated below.



EXAMPLE: 1053123-1301 specifies 5 feet cartridge with label in bulk packaging.