Issues in Authenticating Military Marked Components

Presented to the 20th Annual

Components for Military & Space Electronics Conference and Exhibition

March 9, 2016
Sheraton Four Points Hotel
Los Angeles, CA

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Authenticating Military Marked Components

- Passing military specification electrical testing does not prove components are authentic
- Military marked components purchased on the open market require traceability to OCM through a (C of C)
- The military marking (JAN, TX, TXV, JAN S, Class B/Q/M, S/V, N, Y) does not prove authenticity as items could be reclaimed or rejects therefore the OCM C of C is required per the specification

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MIL-PRF-19500, para 3.7

3.7 Certification of conformance and acquisition traceability. Manufacturers **and distributors** who offer the products as described in this specification shall provide written certification signed by the company or corporate official who has management responsibility for the production of the products, (1) that the product being supplied has been manufactured and shall be capable of passing the tests in accordance with this specification and conforms to all of the requirements as specified herein, and (2) that all products are as described on the certificate which accompanies the shipment. The responsible official may, by documented authorization, designate other responsible individuals to sign the certificate, but the responsibility for conformance to the facts shall rest with the responsible official. **The certification shall be confirmed by documentation to the Government or to users with Government contracts or subcontracts, regardless of whether the products are acquired directly from the manufacturer or from another source such as a distributor**.* When other sources are involved, their acquisition certification shall be in addition to the certificates of conformance and acquisition traceability provided by the manufacturer and previous distributors. The contract number shall be included on the certificate of the supplier offering the product to the Government. In no case shall the manufacturer's certificate be altered or show signs of alteration.

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Passing Group A Electrical Testing will not verify (Parametric and Functional) :

1) They were produced on the DLA OCM Qualified Line
2) Subjected to the screening tests (mechanical, thermal, burn-in, and electrical tests.
3) Passed the Lot acceptance tests
4) Have not been reclaimed from scrap electronics resulting in damage to the packages, ESD handling damage from the processes.

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- Electrical testing over temperature is the industry standard for testing a component's functional and parametric requirements at the manufacturer's rated conditions.

- Electrical testing should include DC/AC functional and parametric testing over of operating temperatures

- Testing outside OCM ratings do not prove reliability

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The objective of electrical testing is to assure compliance with OCM stated performance.

Types of electrical tests

- Curve trace of input/output leads
- Current drain and leakage
- Logic devices
- Memory devices
- Combinatorial functions
- Speed test over rated temperature
- Software that verifies data sheet performance
- Automated testers with temp capability

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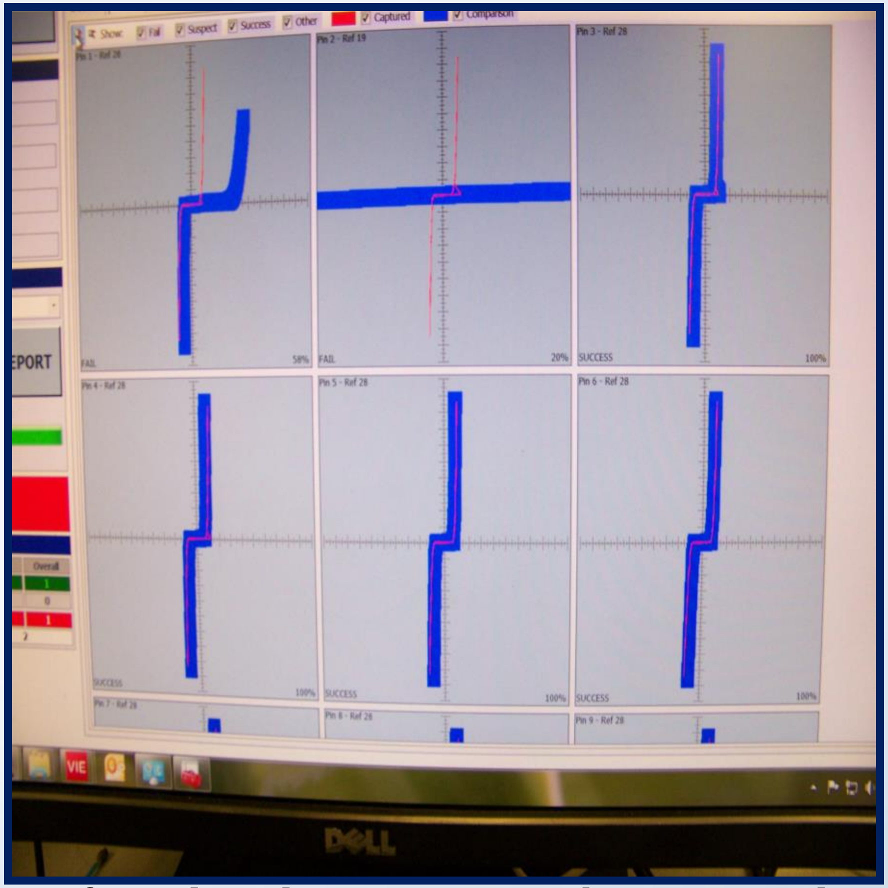
Typical curve trace



- Figure shows a typical curve trace for a digital microcircuit. The curves indicate whether the pins are making contact to the device. The top middle pane shows a pin that is not making contact; the other panes show pins making contact.

- The proper methodology of electrical testing is to use automatic microcircuit testers that can exercise multiple functional and parametric tests at one time to test the device properly in accordance with its port number requirements.

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ATE Capability

Automatic or automated test equipment (ATE) is any apparatus that performs tests on a device under test (DUT), using automation to quickly perform measurements and evaluate the results. An ATE system contains dozens of complex test instruments (real or simulated electronic test equipment) capable of automatically testing and diagnosing faults in sophisticated electronic packaged parts or on wafer testing, including ICs and SoICs. ATE is widely used in the electronic manufacturing industry to test fabricated electronic components and systems.

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ATE Use

- Components and Systems
- ATE’s are also used to test avionics and the electronic modules in automobiles.
- Used for military and electronics, like radar, weapons control, guidance, aircraft systems, wireless communication, etc.
- Also applications in medical and industrial component manufacturing.

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EXAMPLE OF INSTRUMENTATION

- Another form of proper electrical testing is to use an instrumentation board or instrumentation interface between the electronic component, stand-alone test and measurement equipment and PC based test and measurement equipment to provide specific functional and parametric testing.
- These tests are either made available by the component manufacturer or are custom designed by the test lab with the end-customer's review and approval.
- The initial connection is provided by parallel and serial interfaces, including the general purpose interface bus (GPIB).
- Current technological trends require a more powerful interface, such as universal serial bus (USB), PXI, VXI and LXI/Ethernet ports.
- Once a program has been generated and an instrumentation outline has been set up for the test, the device is then ready for electrical testing. All exercises will begin testing at room ambient temperature of approximately 25° C.

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Accurate methodologies of temperature testing:

Electronic components under their extreme operating temperatures are to use a precision temperature forcing system (PTFS)

Liquid nitrogen to accurately condition the component under test.

A PTFS uses compressed forced air with custom-built test fixtures to maintain very cold temperatures as low as -100° C for a DUT as well as to maintain very hot temperatures of up to +300° C.

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Precision Temperature Forcing System to Condition Components For a VLSI Test System

Illustration of VLSI tester record for functional and parametric test data

A test module can be submerged into the proper fluorocarbon medium to accurately heat or freeze the subject devices under test.

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A semiconductor being conditioned at hot temperature utilizing fluorocarbon with recorded parametric data.

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Industry	Temperatures	Test Objectives
Commercial	0° C - 70° C	DC, AC Functional and Parametric Testing
Industrial	-40° C - +85° C	DC, AC Functional and Parametric Testing
Automotive	-45° C - +110° C	DC, AC Functional and Parametric Testing
Military / Aerospace	-55° C - +125° C	Subgroups 1, 2, 3, 4, 5, 6, 7, 8A, 8B. 9, 10, 11
Space	-65° C - +150° C	Subgroups 1, 2, 3, 4, 5, 6, 7, 8A, 8B. 9, 10, 11

Test Objectives and Temperature ranges for electronic component testing. As an example, for military/aerospace applications, the device will be tested first at 25° C. Should the device successfully meet the specification requirements, they are then tested at the extreme hot operating temperature of +125° C. Finally, should the devices successfully meet those requirements, They are ultimately tested at their extreme low temperature of -55° C. Should at any time and at any temperature a device fail a particular functional and/or parametric requirement, the device will be classified as a reject.

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Electronic Test Parameters over Temperature:

Digital Microcircuit

Test Parameters:

Continuity Test
VOH - Output Voltage High
VOL - Output Voltage Low
IIH - Input Current High (Leakage)
IIL - Input Current Low (Leakage)
IOH - Output Current Low (Source)
IOL - Output Current High (Sink)
IOS - Output Short Circuit Test
ICEX - Output High Leakage Test / Collector Cutoff Current
ICCL – Supply Current (Outputs Low)
ICCH – Supply Current (Outputs High)
ICCZ – Supply Current (Outputs 3-State)
ICCQ – Quiescent Supply Current
BV/IBVI – Input Breakdown Voltage/Current
IOZH – 3-State Output Current High
IOZL – 3-State Output Current Low
VIH – Input Voltage High
VIL – Input Voltage Low
VIK/VIC – Input Clamp Diode
IOFF – Off-State Input/Output Current
IOD – Output Drive Current
Functional Test
AC Dynamic (Timing)

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Transistor Testing Over Temperature

Transistors

(Typical Tests as Specified)

ICE(O,S,R,X,V)
O=OPEN S=SHORT
R=RESISTANCE
X=EXTERNAL CONTACTS V=
VOLTS

ICBO
Collector Cutoff Current

IEBO
Emitter Cutoff Current

ICES
Collector Cutoff Current

ICER
Collector Cutoff Current

ICEX
Collector Cutoff Current

VF
Forward Voltage

BVZ
Zener Voltage

BVCBO
Collector Base Breakdown Voltage

BVCEO
Collector Emitter Breakdown Voltage

BVEBO
Emitter Base Breakdown Voltage

BVCES
Collector Emitter Breakdown Voltage

VCE(sat)
Collector Emitter Saturation Voltage

VBE
Base to Emitter Voltage

VBE(sat)
Base Emitter Saturation Voltage

HFE
DC Current Gain

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Diode/Rectifier Testing Over Temperature

Diodes

(Typical Tests as Specified)

VF

Forward Voltage

BVZ

Zener Voltage

BVR

Breakdown Voltage

IR

Reverse Current

ZZ

Zener Impedance

ZZL

Zener Impedance

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SCR Testing Over Temperature

SCR

(Typical Tests as Specified)

IAKR
Reverse off state leakage current

IAKF
Forward off state leakage current

VTM
On state voltage

IL
Latching current

IH
Holding current

VGT
Gate voltage to trigger

IGT
Gate current to trigger

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Typical FET Testing Over Temperature

Field Effect Transistors

(Typical Tests as Specified)

BVGSS
Gate Source Breakdown Voltage

BVDSS
Drain to Source Breakdown Voltage

IGSS
Gate Reverse Current

IDSS
Zero Gate Voltage Drain Current

VGS
Gate Source Voltage

VDS(on)
Drain Source Voltage

RDS(on)
Static Drain Source ON Resistance

GFS
Forward Transconductance

VSD
Diode Forward Voltage

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Typical Data Log

STA# 3	SORT# 2	RTN# 75T	SER# 1		
T1;	IEV=88.80 MA	T2;	IBV=88.00 MA	T3;	ICV=86.80 MA
FT4;	ICBO=O.R.	FT5;	VCE =O.R.	FT6;	HFE =O.R.
T7;	HFE =O.R.				
STA# 3	SORT# 2	RTN# 75T	SER# 2		
T1;	IEV=88.50 MA	T2;	IBV=88.00 MA	T3;	ICV=87.20 MA
FT4;	ICBO=204.8 NA	FT5;	VCE =O.R.	FT6;	HFE =O.R.
T7;	HFE =O.R.				
STA# 3	SORT# 2	RTN# 75T	SER# 3		
T1;	IEV=88.50 MA	T2;	IBV=88.00 MA	T3;	ICV=87.20 MA
FT4;	ICBO=O.R.	FT5;	VCE =O.R.	FT6;	HFE =O.R.
T7;	HFE =O.R.				

Results from electrical test data to demonstrate that the military authenticity cannot be verified.

Conclusion

Military marked components cannot be authenticated to the specification without the required C of C from the OCM /Authorized Distributor or their statement to this effect, as passing counterfeit detection inspections and Electrical Testing does not prove components were manufactured on the OCM qualified line, passed the internal visual inspections, screening and lot testing required.

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