NEOTech
NATEL EPIC OnCore

SN74HC74D

Issue

Analysis of behavior

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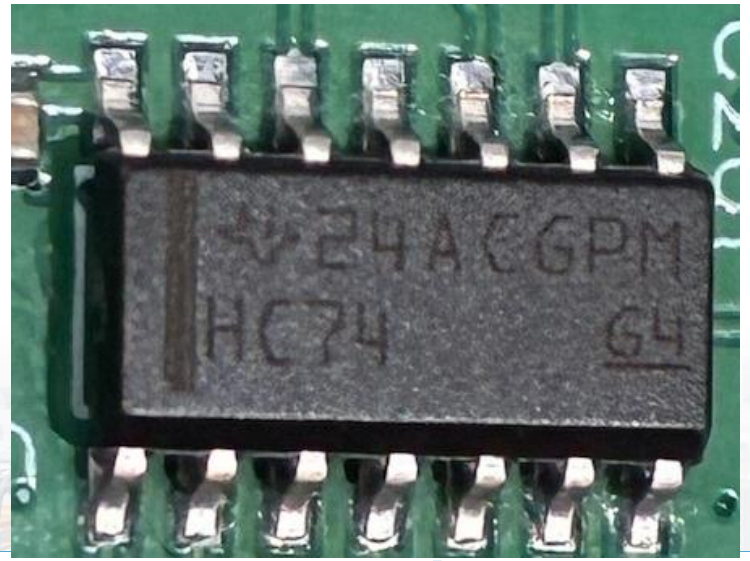
Component Analysis

We notice two main differences on the footprint

Currently on production, the Pcba with this component Fail the FVT.



Units with this component Pass the FVT.

Component Analysis

Orderable part number	Status (1)	Material type (2)	Package | Pins	Package qty | Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
SN74HC74DR	Active	Production	SOIC (D) | 14	2500 | LARGE T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	-40 to 85	HC74
SN74HC74DR.A	Active	Production	SOIC (D) | 14	2500 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	HC74
SN74HC74DRG4	Active	Production	SOIC (D) | 14	2500 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	HC74

Lead Finish / Ball Material	Lead-Free (Pb-Free)?	Description
NiPdAu (Nickel Palladium Gold)	Yes	Electroless Nickel Palladium Gold; commonly used for RoHS-compliant devices. Excellent for solderability and corrosion resistance.
Sn (Tin)	Yes	100% Matte Tin finish; RoHS-compliant, widely used. May be sensitive to tin whiskers in certain conditions.
SnPb (Tin-Lead)	No	Tin-Lead alloy finish, typically 63/37 or 60/40. Not RoHS-compliant. Used only for exempt or legacy applications.
NiAu (Nickel Gold)	Yes	Usually used in BGA or special applications; very stable and corrosion-resistant.

The difference between the part numbers is the component with the G4 is Nikel gold

Failure Mode

We’re using two D-type flip-flops embedded in the same IC (**74HC74**) with the following configuration:
The first flip-flop captures the logic level of a control signal (**US_DUTY_CYCLE**) on the rising edge of a clock. Asynchronous SET and RESET inputs are disabled (tied high). The Q output reflects the sampled value.

The second flip-flop is configured as a frequency divider. Its **/Q** output is fed back into the D input, causing the Q output to toggle on every rising clock edge. This produces a **US_CLKOUT** signal at half the input clock frequency.

The component is assembled in a circuit that generates a 3 MHz signal. In our FVT(Functional Validation Test Machine), we measure the voltage across a 120 Ω, 1%, 10 W resistor. The signal is filtered over a 2-second window, and the acceptable limits are defined as 43.3 V (High) and 39.9 V (Low).In this test, the **SN74HC74D** consistently fails, with measured voltages around 37.25 V, while the **SN74HC74DG4** passes reliably, showing typical measurements of 41.2 V.

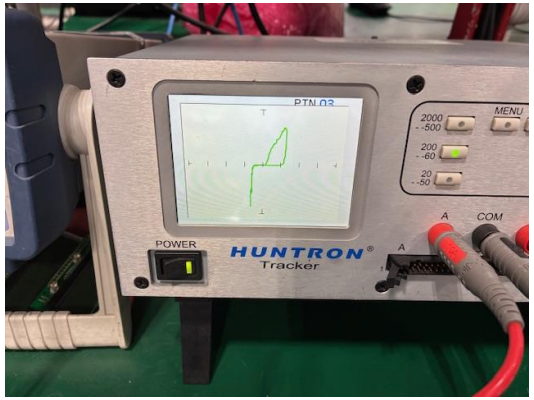
Test

To evaluate the variability caused by differences in termination, we performed a series of tests.

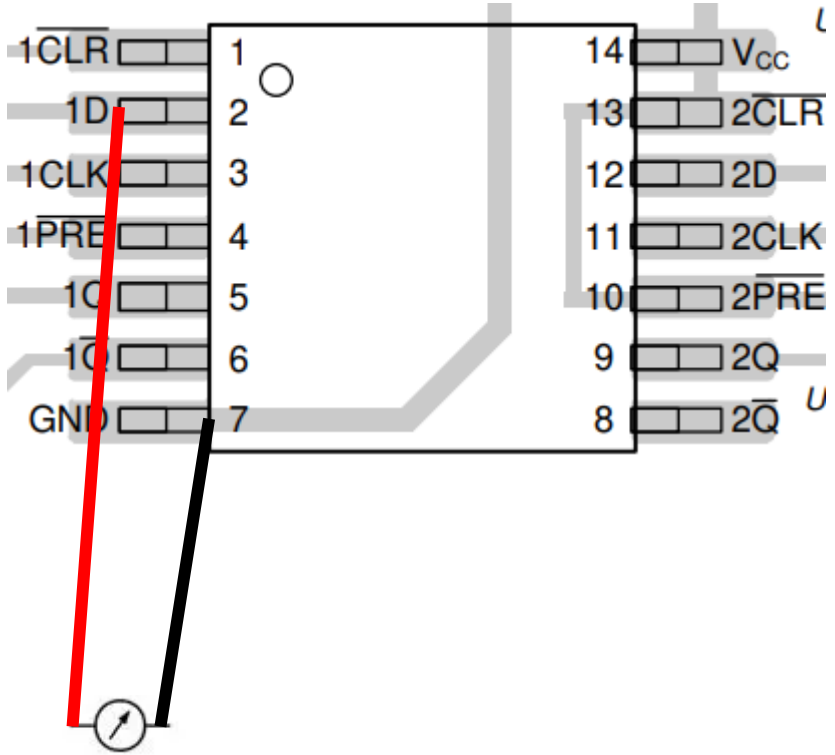
1- Measurement on tracker

SN74HC74D

SN74HC74DG4



2- Voltage Drop test



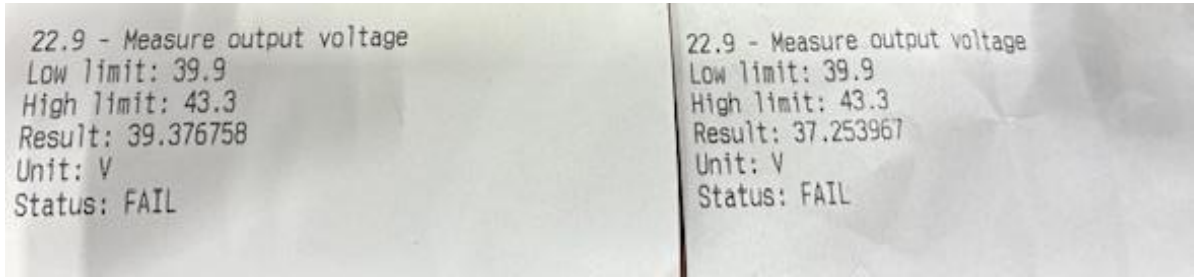
Test

We perform an extra Test, to evaluate whether the termination difference in reaction with the solder type affect the component.

We use lead soldering and assembly the component in a PCB.

Results in SN74HC74D :

Unit with Lead soldering Unit with Lead free soldering



On SN74HC74DG4 no present variation

Conclusion

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- We have approximately **500 PCBAs** assembled with the **SN74HC74D** part number that consistently exhibit the same failure mode, directly associated with this component.
- We request a root cause analysis to identify the reason behind the observed functional difference.
- We kindly ask you to confirm whether there are any functional differences between the **SN74HC74D** and **SN74HC74DG4** part numbers.
- Additionally, we request an investigation across different production lots of the **SN74HC74D** to determine if the issue is lot-specific.