



COPYRIGHT NOTICE

This multimedia file is copyright © 2017 by BiTS Workshop. All rights reserved. It may not be duplicated or distributed in any form without prior written approval.

The content of this presentation is the work and opinion of the author(s) and is reproduced here as presented at the 2017 BiTS China Workshop.

The BiTS logo, BiTS China logo, and 'Burn-in & Test Strategies Workshop' are trademarks of BiTS Workshop.

www.bitsworkshop.org

Deterministic Contact Resistance of BGA Contact Pins

**Praveen kumar Ramamoorthy,
Terry Wang, Yusman Sugianto
Infineon Technologies**



**BiTS China Workshop
Shanghai
September 7, 2017**



BiTS China 2017

Contents

- Introduction
- Force & CRes measurements
- Repeatability Check
- CRes spread at various touchdowns
- Pin force comparison at 0 & 85 K
- Pin tip wear and tear comparison
- Pin height observations
- Pin Stroke Vs CRes for fresh pin
- Conclusion & Next steps

Introduction

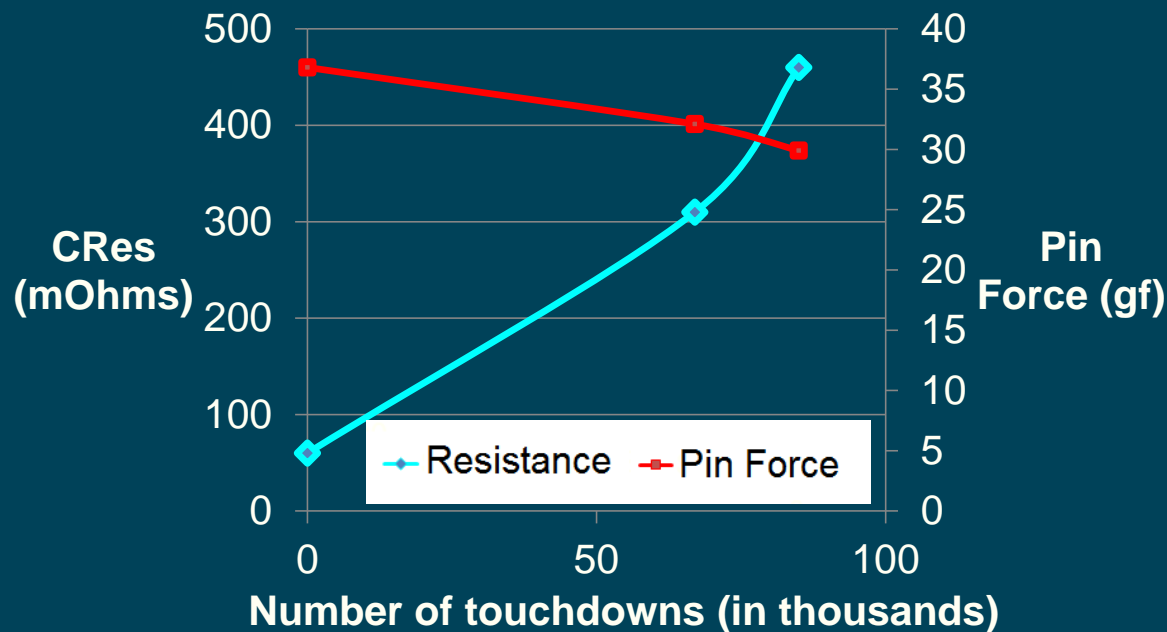
- Force and contact resistance (CRes) of 3 sockets at varying touchdowns from 0 K to 85 K were taken from production and measured through Okins socket analyser
- Data analysis was performed to understand the Force & CRes behaviour of the socket with respect to number of touchdowns
- Note: CRes measurements are through gold plated probe tip and not solder ball



BiTS China 2017

Force & CRes Measurements

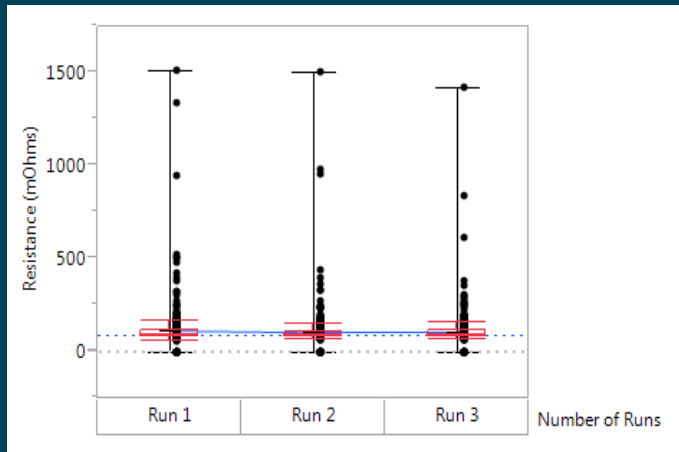
Socket #	No. of Touchdowns	Median Force (gf)	Median Resistance (mOhms)
11	0	36.8	50
32	67109	32.1	310
126	85683	29.9	460



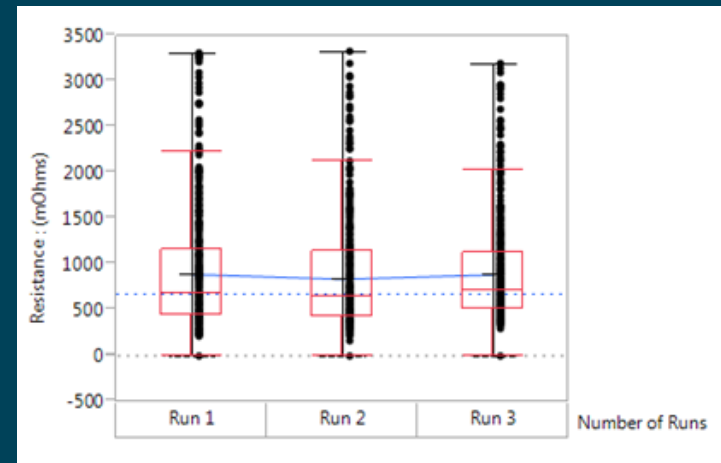
BiTS China 2017

Repeatability Check

- 3 repeated runs were performed on each socket and the data was statistically compared for gauge repeatability & reproducibility (R&R)
- 12 zero resistance measurements were due to hole on the base plate as it was designed to accommodate many sockets



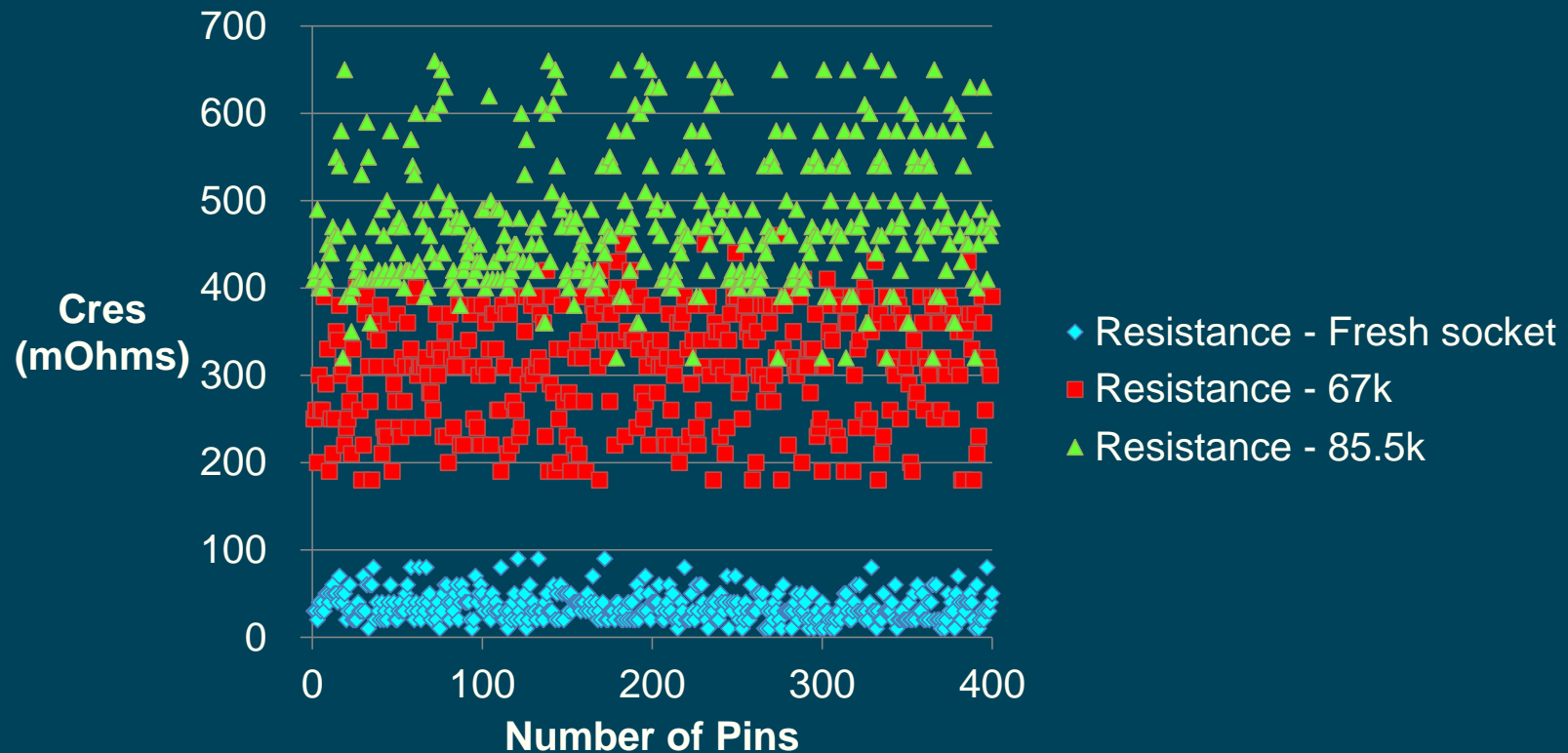
Fresh pins



85k pins

BiTS China 2017

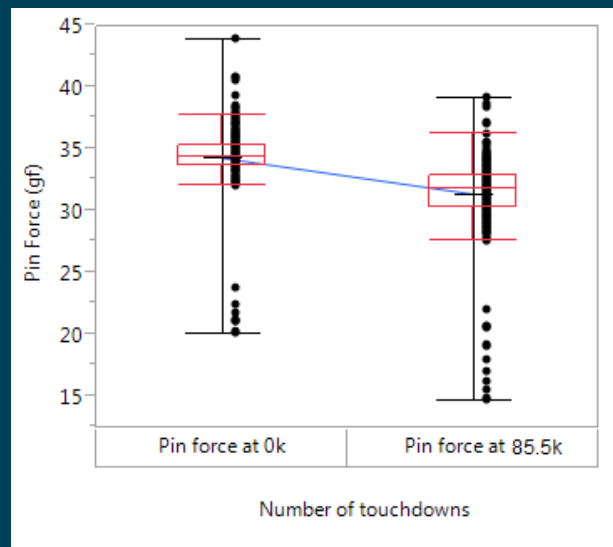
CRes at Various Touchdowns



BiTS China 2017

Pin Force Comparison at 0k & 85k

- Median Pin force of ~ 34.5 gf was observed at 0 K and ~31.5 gf at 85 K
- Spec for fresh pin is 35 ± 1.5 gf
- ~10 – 15% reduction in pin force was observed for End of Life pin

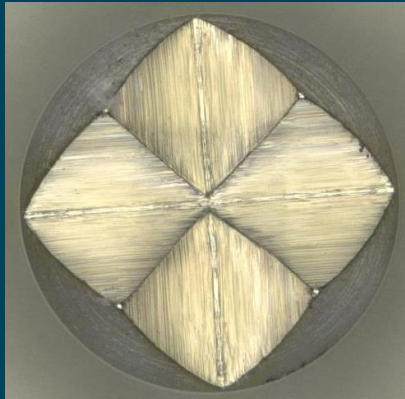


Note: 12 Lesser force measurements were due to hole on the base plate as it was designed to accommodate many sockets

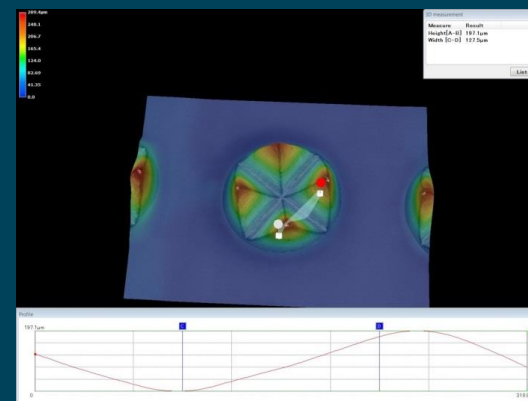
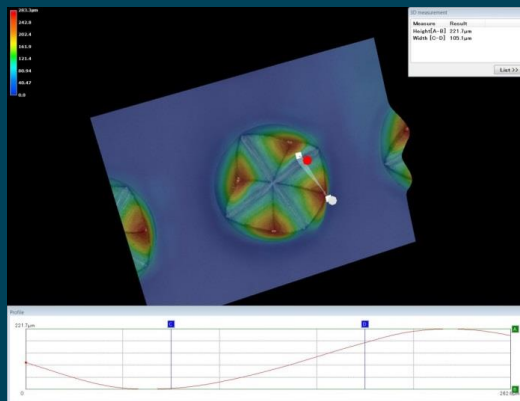
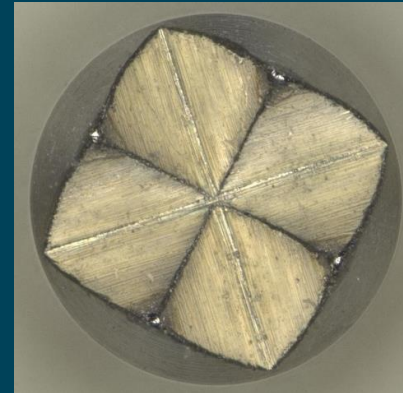
BiTS China 2017

Pin Tip Wear and Tear Comparison

Fresh pin



85 K pin



BiTS China 2017

Pin Height Observations

- 20 – 40 μm reduction in pin height was observed
- With pin stroke until 0.55 mm this reduction in pin height is not significant to increase the CRes or affect the yield

Pin Number	Height Reference @ 0k (um)				
	Tip 1	Tip 2	Tip 3	Tip 4	Average
3	283	283	271	282	279
4	293	291	285	284	288
5	290	298	294	295	294
9	290	284	281	286	285
15	283	283	271	282	279
16	279	262	278	282	275
17	298	294	280	298	292
18	287	284	279	284	283
19	273	265	273	276	271

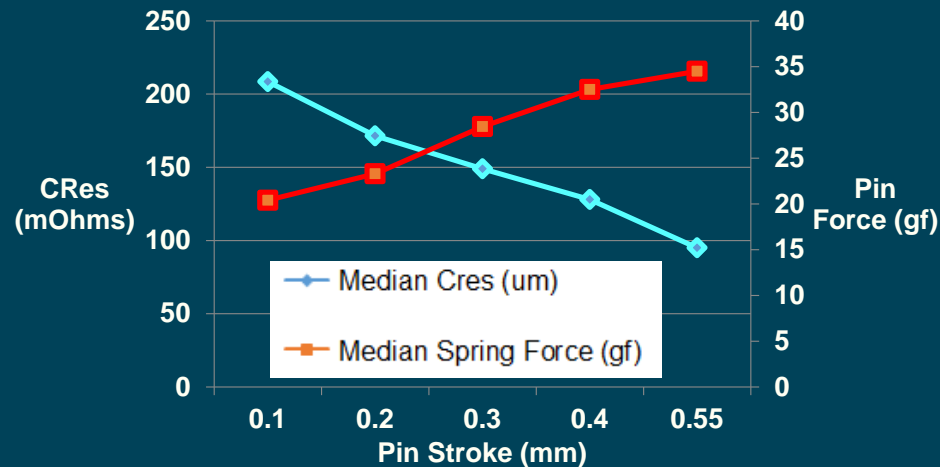
At 0 K touchdowns

Pin Number	Height Reference @ 85k (um)				
	Tip 1	Tip 2	Tip 3	Tip 4	Average
3	264	249	229	253	249
4	221	222	241	237	230
5	243	226	237	258	241
9	246	237	227	244	238
15	241	230	242	254	242
16	244	233	229	243	237
17	252	232	256	264	251
18	255	244	233	258	247
19	238	225	239	253	239

After 85 K touchdowns

BiTS China 2017

Pin Stroke Vs CRes on Fresh Pin



Pin Stroke (mm)	Median Cres (um)	Median Pin Force (gf)
0.1	208.5	20.4
0.2	171.5	23.3
0.3	149	28.45
0.4	128	32.5
0.55	95	34.5

- CRes reduced with increase in Pin stroke
- It was observed to be due to increase in contact area of the pin and probe tip
- Pin force increased with increase in Pin stroke which was due to the compression of the spring

Conclusion & Next Steps

- Data acquired provided insights such as CRes increased with respect to number of touchdowns while Pin force reduced and also that the CRes reduces with increase in deflection for a fresh pin
- The study also pointed out further direction for improvement:
 - Higher force pin for reduced Cres, better yield & prolonged lifespan
 - Improved pin tip design for increased contact between pin and solder ball