SIXTEENTH ANNUAL

BiTS

Burn-in & Test Strategies Workshop™

March 15 - 18, 2015

Hilton Phoenix / Mesa Hotel
Mesa, Arizona

Archive – Session 2

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Session 2

Mike Noel
Session Chair

BiTS Workshop 2015 Schedule

Frontiers Day

Monday March 16 1:30 pm

Spanning the Socket Rainbow

"Contacting Solutions for High Power Bare Die Testing (IGBT MOS-FET and Diodes)"

Markus Wagner - Cohu SEG

"Comparison of Different Methods in Determining Current Carrying Capacity of Semiconductor Test Contacts"

Valts Treibergs - Xcerra Corporation

"Are New Temperature Test Strategies Needed? Meeting Performance and Cost Requirements of Today's Applications"

Andreas Nagy - Xcerra Corporation

"Extreme Temperature and High Current Testing Challenges of Automotive Devices"

Praveen kumar Ramamoorthy & Murad Hudda - Infineon Technologies
Dan Maccoux & Muhamad Izzat bin Roslee - JF Microtechnology

BiTS 2015 Burn-in & Test Strategies Workshop

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BiTS Burn-in & Test Strategies Workshop 2015

Are New Temperature Test Strategies Needed? Meeting Performance and Cost Requirements of Today's Applications

Andy Nagy

Multitest Handler Group & Xcerra Test Cell Innovation

2015 BiTS Workshop
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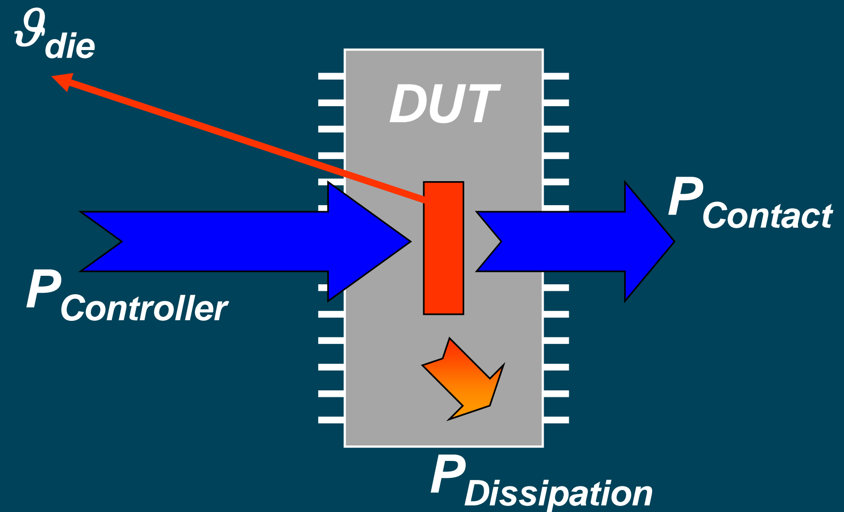
DUT Temperature Physics

Formula to maintain die temperature inside the DUT at set temperature (no drift after contacting):



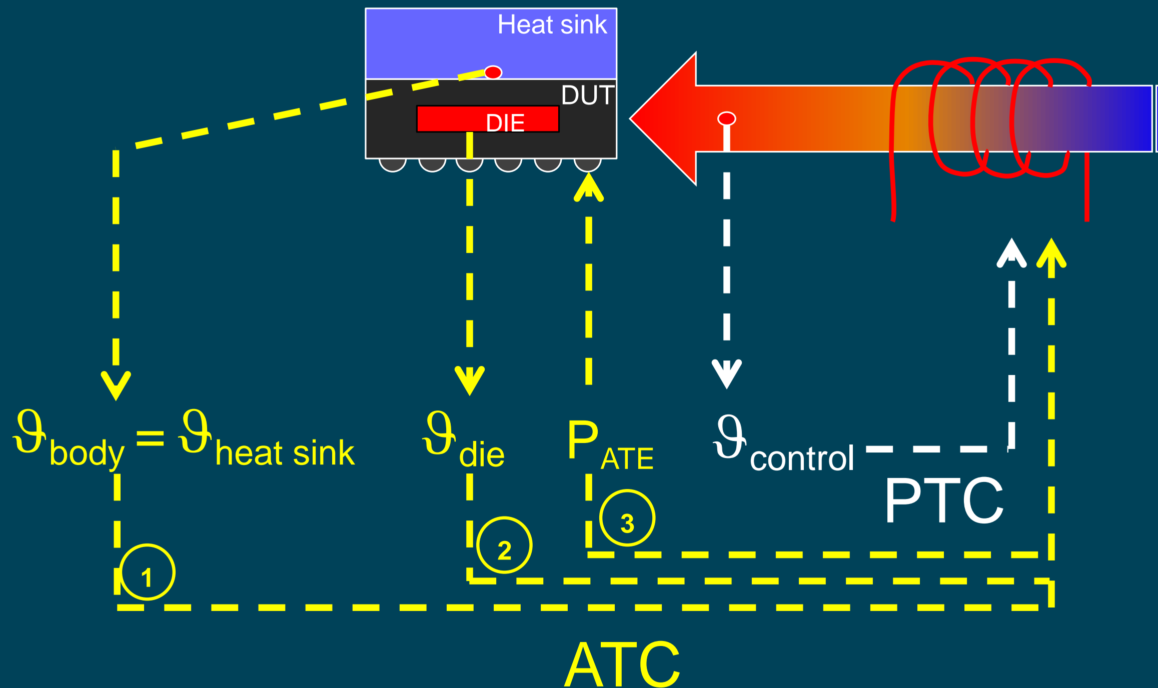
$$P_{controller} = P_{contact} - P_{Dissipation}$$

Energy transferred from handler into DUT

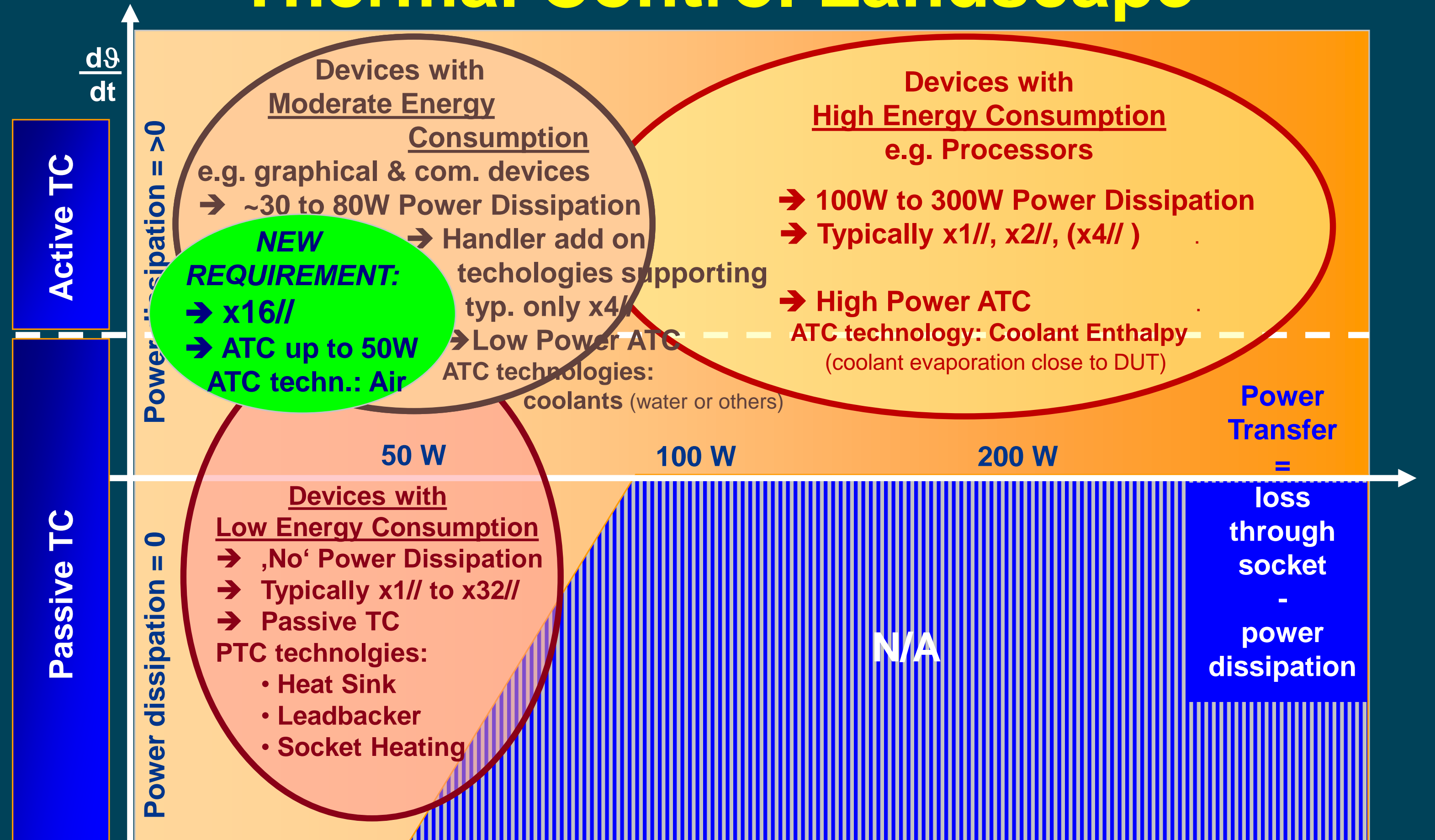
Energy loss through contactor

Energy removed by power dissipation from DUT

Thermal Control Concepts



PTC = Passive Thermal Control
ATC = Active Thermal Control

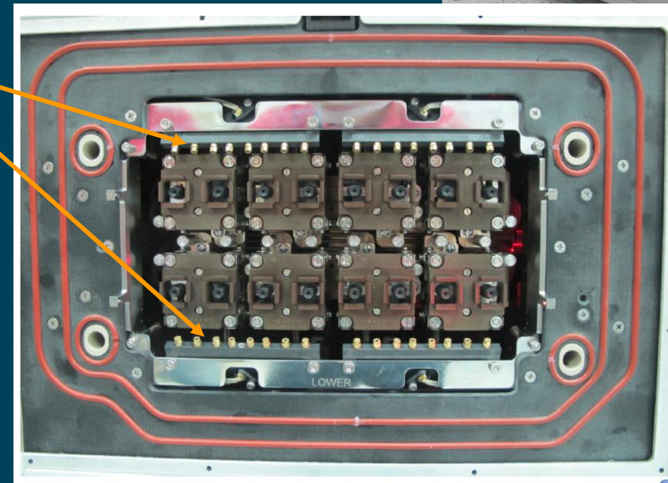

Thermal Control Landscape
dϑ/dt
Active TC
Passive TC
Power dissipation = >0
Power dissipation = 0
Devices with
Moderate Energy Consumption
e.g. graphical & com. devices
~30 to 80W Power Dissipation
Handler add on techologies supporting typ. only x4//
Low Power ATC
ATC technologies: coolants (water or others)
NEW REQUIREMENT:
x16//
ATC up to 50W
ATC techn.: Air
Devices with
High Energy Consumption
e.g. Processors
100W to 300W Power Dissipation
Typically x1//, x2//, (x4//)
High Power ATC
ATC technology: Coolant Enthalpy
(coolant evaporation close to DUT)
50 W
100 W
200 W
Power Transfer = loss through socket - power dissipation
Devices with
Low Energy Consumption
‚No' Power Dissipation
Typically x1// to x32//
Passive TC
PTC technolgies:
Heat Sink
Leadbacker
Socket Heating
N/A

Example for successful PTC

- **Key enabler:**
  - Site specific temperature control architecture
  - Temperature maintained at every state
  - Kit specific setup calibration
  - DUT with little power consumption
- **QFN 7x7 x16// Setup @ MT9510**

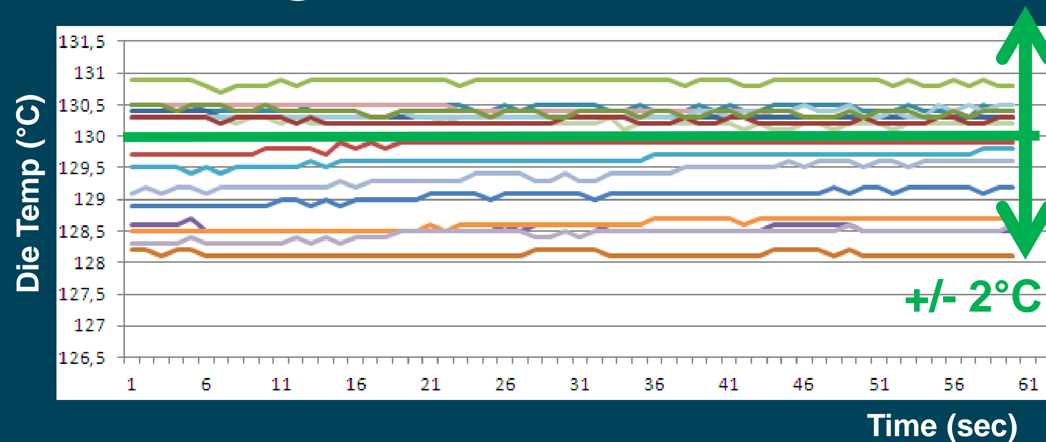
- Min. one air controle nozzle for convective heating / cooling per plunger to maintain temperature of the DUT and the socket

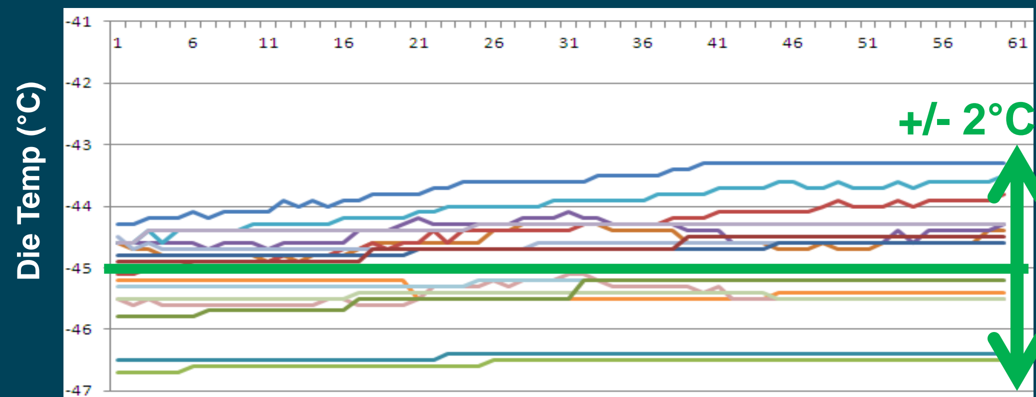
- If no device is under test, controlled air will keep socket and pogo pins on temperature



Example for successful PTC

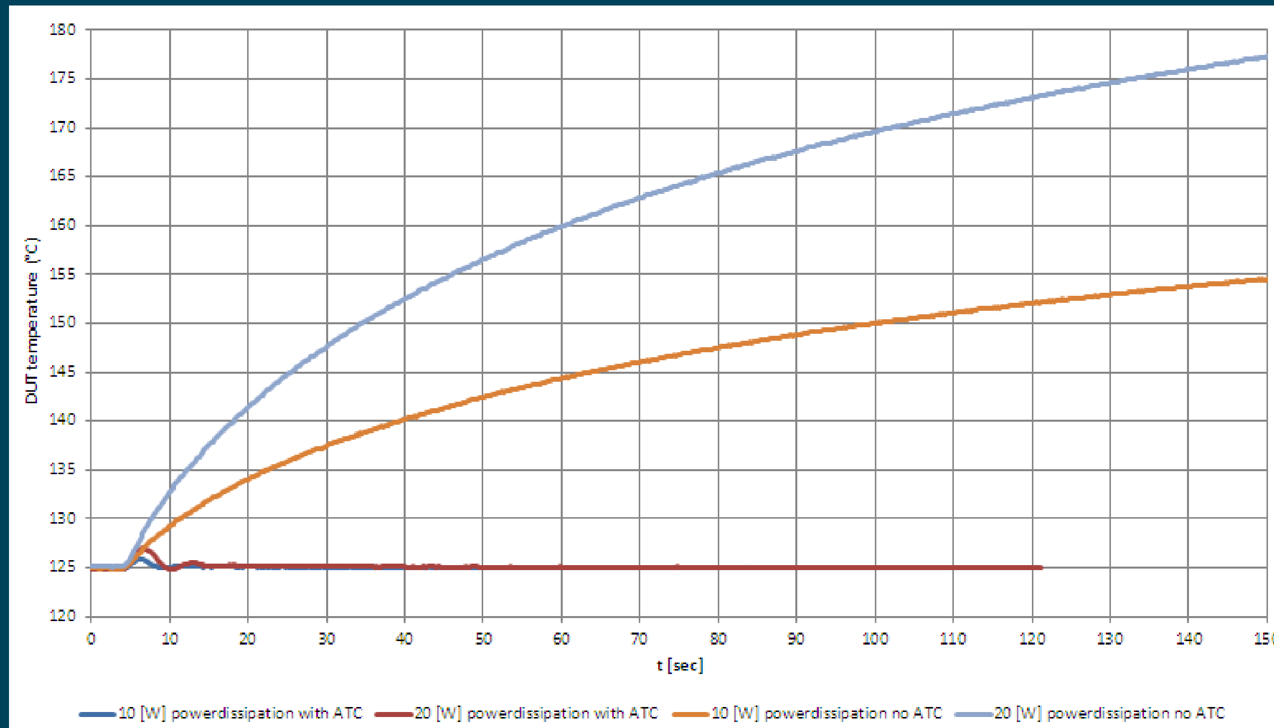
- MT9510 - QFN7x7 x16 sites @ -45°C & 135°C
- Test site stability during long test times within +/- 2°C spec





PTC Limitation vs ATC Capability

Power consumption at electric test will require power dissipation at longer test times to maintain DUT temperature

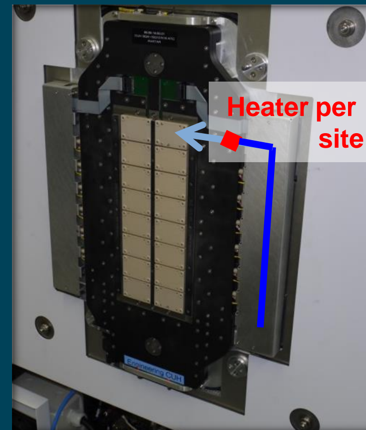


Modular ATC Approach

- MT2168 P&P handler + ATC

MT2168 P&P

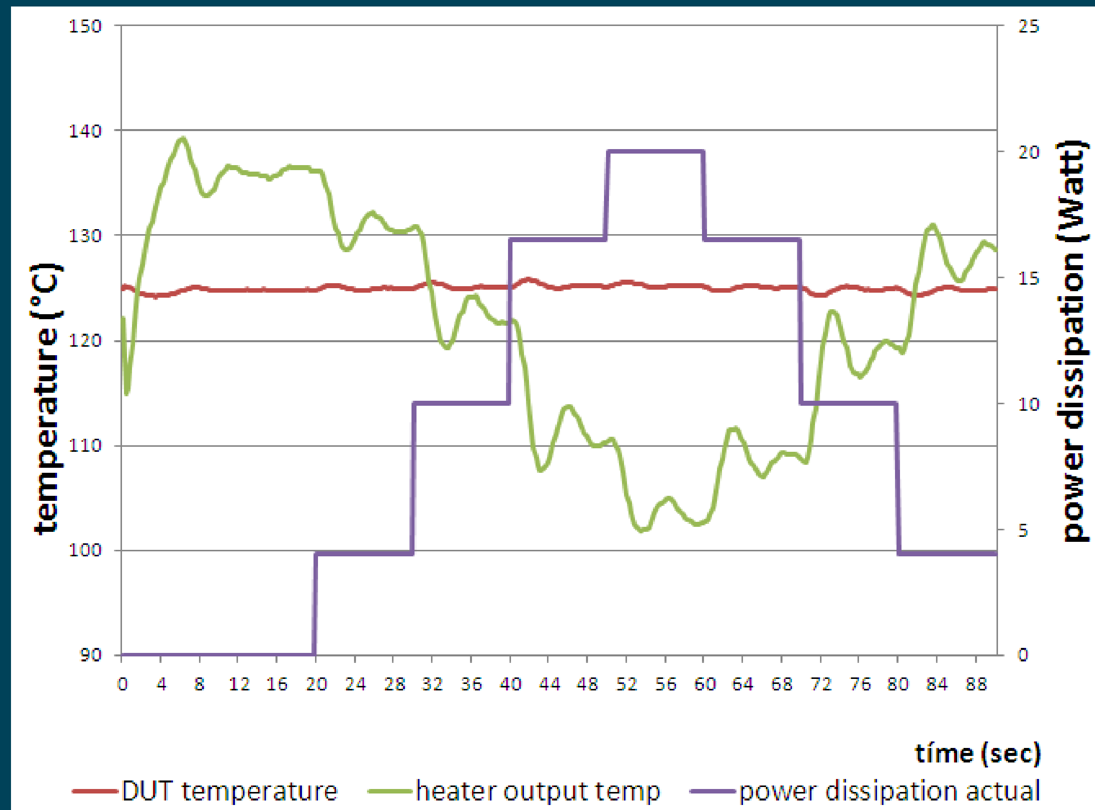
ATC CUH for x16//
(Contact **U**nit **H**older**)**



ATC Sensor routed via leadbacker to the socket

ATC Example @ 125°C (w/o chiller)

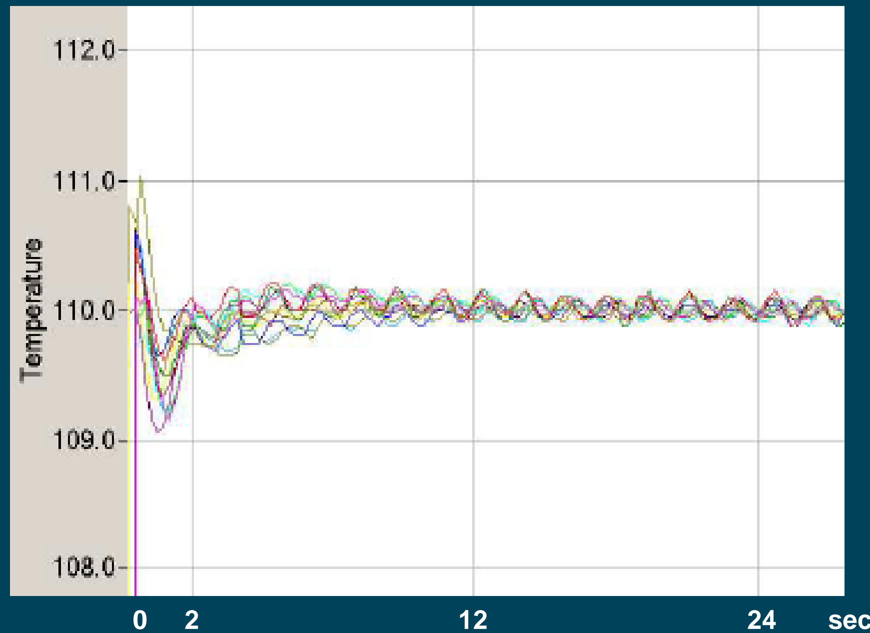
- ATC setup with mock-up device to emulate different power scenario



Temp. Accuracy Example with ATC

Test-Case

MT2168 BGA745/12x12 12 sites



0 2 12 24 sec

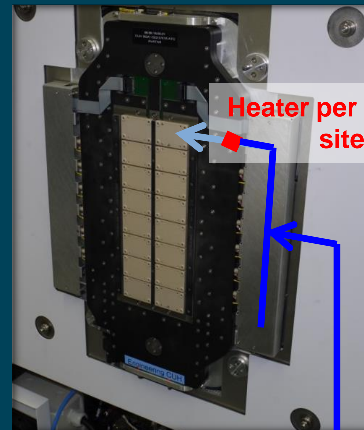
Up to 16-site

Cold for Characterisation via ATC

- MT2168 Amb / AH handler + ATC + Chiller = **Tri-temp P&P handler for device characterisation**

MT2168 Amb / AH

ATC CUH for up to x16//



External cold dry air (e.g. from any 3rd party chiller)

MT2168 Cold for Characterisation

Heat sink temperature [°C]

All 12 sites with device contact to socket

All 12 sites started to cool down to -40deg C

After ReEnter Temperature Window (Stabilization time) 5 [sec]

Set Point = -40 C

10 sec test time

+/- 2 C window

Time / 10sec per devision

- **MT2168 AH + ATC + External Chiller**
- **BGA745/12x12 @ -40 °C**

MT2168 Cold for Characterisation

- MT2168 AH + ATC + External Chiller
- BGA745/12x12 @ -60 °C

Set Point = -60 C

+/- 3 C window

Heat sink temperature [°C]

Temperature

-33.0 -36.0 -39.0 -42.0 -45.0 -48.0 -51.0 -54.0 -57.0 -60.0 -63.0

00:00:00 Time 00:04:10

Time / 10sec per devision

Summary

New Temperature Test Strategy offered via

a) Modular x16// ATC up to 50W

b) Cold for Characterisation

Benefits:

1. **x16// ATC Test → Cost of Test ↓**
2. **Robust design → OEE ↑**
   Air supply versus coolant
   → Lower complexity & easier maintenance
3. **Modular field upgradeable technology → ROI ↑**
4. **Cold for Characterisation → Cost of Test ↓**
   = Tri-temp test at Amb. & AH Handlers
   = supporting cost requirement of AH markets
   that still require cold characterisation