5.2 MICROCIRCUITS (08)

5.2.1 Microchip Technology, France: ATC18RHA

5.2.1.1 Contact Information

Address	ESCC Chief Inspector
Microchip Technology Nantes Route de Gachet 44300 Nantes France	Ms V. Lepaludier Tel. +33 2 40 18 1633 FAX +33 2 40 18 1946 Valerie.Lepaludier@microchip.com

5.2.1.2 Qualification

Current Qualification Certificate No.	In QML since:	Type Designation
357C	May 2019	Integrated Circuits, Silicon, Monolithic, CMOS, Cell-Based Array, based on Type ATC18RHA

Remarks:

Certificate 357 supersedes previous certificate 312B Rev1. New certificate reflects significant changes in the supply chain.

An End-Of-Life of the ATC18RHA ASIC offer for new design has been announced by Microchip in January 2021. Detail is available in Microchip Notification CRS20-0158 (information added in QML issue 22, published in March 2021). ATMX150RHA ASICs is to be used as replacement for any new design. Microchip will stop wafer manufacturing launch by December 2021. Microchip commits to maintain the wafer/die stock, based on customer needs. Microchip will continue Flight Models manufacturing from this wafer/die stock.

Applicable documents:

ESCC Generic Specification No. 9000; ESCC Detail Specification No. 9202/080

ATC18RHA Process Identification Document PID 0032 Rev G, MMT assembly PID 1G-QM-0105 and HCM columns manufacturing and assembly PID 11 issue F.

5.2.1.3 List of Qualified Components

For each ASIC design an ASIC Sheet is produced by Microchip for use in conjunction with the ESCC Detail Specification No. 9202/080. Where the ASIC is not proprietary to the customer the ASIC sheet is published in ESCIES as a supporting document.

ASIC Sheet	Component Type

In the case of ATC18RHA, standard components are also available. These are listed below with their full ESCC Detail Specification:

Detail Specification	Component Type
9512/004	Integrated Circuits, Silicon, 32-bit SPARC Processor, based on Type AT697F
9512/005	Integrated circuits, silicon monolithic, SPARC V8 GNSS controller based on type AT7991

5.2.1.4 Technology Flow Abstract

GENERAL FEATURES

ATC18RHA standard cells family is designed with a 0.18µm radiation hard CMOS technology. This offering is based on 6 metal layers at 1.8V +/-0.15V for the core and 3.3V +/-0.3V for the periphery. This family features arrays with up to 7 Mgates and 544 pads. With its high speed performance, its low supply current and its radiation hard level, the ATC18RHA is suitable for digital applications working in radiation intensive environment.

BASIC INFORMATION

- CMOS technology AT58KRHA
- 40 to 70 kgates per mm²
- Periphery power supply 3.3V and 2.5V
- Core power supply 1.8V
- Low supply current :
  - Operating maximum value: 85nW/gate/MHz with a duty cycle at 20%
- I/O Interfaces:
  - Cold sparing
  - High speed LVDS (655 Mps) and LVPECL
  - PCI
- 544 pads (+ 8 pads power only)
- Embedded memories: Compiled and Synthesized
- EDAC library
- Radiation :
  - No Single Event Latch-Up below a LET Threshold of 80 MeV/mg/cm² at high temperature
  - SEU hardened DFF's to 30 MeV/mg/cm2
  - Tested up to 300 krad (Si), Radiation Level is 100 krads (Si).

COMPONENT TYPES

Device Types as per ESCC Detail Specification 9202/080 and individual custom ESCC ASIC Sheets.

Die	Supply Voltage I/O / core	Max programmable I/O's	Case	Typical Routable gates
ATC18RHA_216	2.5V or 3.3V/1.8V	216	CQFP-F256	1M
ATC18RHA_216	2.5V or 3.3V/1.8V	216	CQFP-F196	1M

Die	Supply Voltage I/O / core	Max programmable I/O's	Case	Typical Routable gates
ATC18RHA_216	2.5V or 3.3V/1.8V	216	CQFP-F160	1M
AT697F	3.3V/1.8V	-	CQFP-F256	0.85M
ATC18RHA_324	2.5V or 3.3V/1.8V	324	CQFP-F352	2.2M
ATC18RHA_324	2.5V or 3.3V/1.8V	324	CQFP-F256	2.2M
ATC18RHA_324	2.5V or 3.3V/1.8V	324	CQFP-F196	2.2M
ATC18RHA_324	2.5V or 3.3V/1.8V	324	CQFP-F160	2.2M
ATC18RHA_324	2.5V or 3.3V/1.8V	324	CLGA-349	2.2M
ATC18RHA_324	2.5V or 3.3V/1.8V	324	CCGA-349	2.2M
ATC18RHA_404	2.5V or 3.3V/1.8V	404	CQFP-T352	3.5M
ATC18RHA_404	2.5V or 3.3V/1.8V	404	CQFP-T256	3.5M
ATC18RHA_404	2.5V or 3.3V/1.8V	404	CLGA-472	3.5M
ATC18RHA_404	2.5V or 3.3V/1.8V	404	CLGA-349	3.5M
ATC18RHA_404	2.5V or 3.3V/1.8V	404	CCGA-472	3.5M
ATC18RHA_404	2.5V or 3.3V/1.8V	404	CCGA-349	3.5M
ATC18RHA_504	2.5V or 3.3V/1.8V	504	CQFP-T352	5.5M
ATC18RHA_504	2.5V or 3.3V/1.8V	504	CQFP-F256	5.5M
ATC18RHA_504	2.5V or 3.3V/1.8V	504	CLGA-625	5.5M
ATC18RHA_504	2.5V or 3.3V/1.8V	504	CLGA-472	5.5M
ATC18RHA_504	2.5V or 3.3V/1.8V	504	CLGA-349	5.5M
ATC18RHA_504	2.5V or 3.3V/1.8V	504	CCGA-625	5.5M
ATC18RHA_504	2.5V or 3.3V/1.8V	504	CCGA-472	5.5M
ATC18RHA_504	2.5V or 3.3V/1.8V	504	CCGA-349	5.5M
AT7991	3.3V/1.8V	-	CQFP-352	7.6M
ATC18RHA_544	2.5V or 3.3V/1.8V	544	CLGA-625	7M
ATC18RHA_544	2.5V or 3.3V/1.8V	544	CCGA-625	7M

5.2.1.5 Technology Flow Definition

The Technology Flow Definition domain covers the design, fabrication, assembly and testing of the ATC18RHA standard cells family.

1. Design

The design manual and the ASIC library data books cover the design in the Microchip Technology Nantes associated Design Centers (Nantes-France, Milan-Italy, Garching-Germany and Winnersh-UK).

- ATC18RHA Design manual ATD-DE-GR-R0212
- ATC18RHA TOS manual ATD-DE-GR-R0324
- ATC18RHA Buffers library databook ATD-TS-LR-R0252

- ATC18RHA Cells library databook ATD-TS-LR-R0251
- ATC18RHA Memory cells library databook ATD-TS-LR-R0254
- ATC18RHA specific library databook ATD-TS-LR-R0253

All ASIC designs will be performed by the customer at the customer site, with Microchip supported tools (front end).
No new design is proposed on this ASIC technology, replaced by the ATMX150RHA.

2. Fabrication

The ATC58KRHA, processed in UMC Taiwan, is a 0.18µm CMOS, 6 metal, Ti, TiN and AlCu process.
From 2021 December, wafer fabrication shall not be maintained. Flight models shall be manufactured from wafer in stock.

3. Assembly

The assembly of ATC18RHA devices is performed in MMT, Thailand, with the following capabilities:

- Die attach Cyanate Ester (JM7000)
- Wire bond Ultrasonic Wedge, 25 and 32 µm Al
- Lid sealing Brazed with Au/Sn alloy or seam welded
- Leads/pads Gold plated (CQFP and CLGA)

The assembly of columns is performed in SERMA HCM, La Rochelle, with the following capabilities:

- Columns 85Pb15Sn with Tinned Copper ribbon, 0.38 mm diameter

4. Control and Test

The control and test of ATC18RHA devices is performed in Microchip technology Nantes. It includes Lot Acceptance, Test Flows and Test Procedures, Qualification Test and Reliability Monitoring, Screening and associated electrical tests and inspections.

5. TCVs and SEC

The die ATC18RHA_324 is used for both test vehicles. All details are described in the ATC18RHA test chip specification, reference ADF-DE-R0561-CUP.

V56 TEST VEHICLE
The V56 is a buffer test vehicle representative of the range of buffers available for performance testing in the CQFP 256 package. It contains standard IO33 buffers, specific IO33 buffers (LVDS, PCI), a PLL, a set of ring oscillators made of different library cells and a set of interconnect lines.

V40 (5 METAL LAYERS) OR V52 (6 METAL LAYERS) TEST VEHICLE – TECHNOLOGY SEC
The V40/V52 SEC is developed for performance and radiation testing in the CQFP 256 package. It contains a set of memory blocks (compiled memories with and without EDACs and synthesized (on gates) memories made with standard and hardened latches), shift registers chains and a PLL.

6. Radiation Characteristics

The AT58KRHA family has been developed to fulfil the following characteristics:

- No Single Event Latch-up below a LET Threshold of 80MeV/mg/cm2 at high temperature
- Availability of SEU hardened cells
- Total dose capability over 100 krads(Si)

5.2.1.6 Manufacturing sites

DESIGN:
Microchip Technology Nantes, BP70602, 44306 Nantes Cedex 3, France

WAFER FABRICATION:
UMC Fab 8S, Hsin-Chu, Taiwan

DIE ASSEMBLY:
MMT, Microchip Technology (Thailand) Co., Ltd. 17/2 Moo 18 Suwintawong Road, Saladang, Bangnumpriew Chachoengsao, Thailand 24000

CCGA COLUMN ASSEMBLY:
HCM SYSTREL, 34 Av. Joliot Curie, ZI Perigny, 17185 Perigny Cedex, France

CONTROL AND TEST:
Microchip Technology Nantes, BP70602, 44306 Nantes Cedex 3, France

5.2.2 Microchip Technology, France: ATMX150RHA

5.2.2.1 Contact Information

Address	ESCC Chief Inspector
Microchip Technology Nantes Route de Gachet 44300 Nantes France	Ms V. Lepaludier Tel. +33 2 40 18 1633 FAX +33 2 40 18 1946 Valerie.Lepaludier@microchip.com

5.2.2.2 Qualification

Current Qualification Certificate No.	In QML since:	Type Designation
359C	May 2019	Integrated Circuits, Silicon, Monolithic, CMOS, Cell-Based Array, based on ATMX150RHA ASIC family.

Remark:

Certificate 359 supersedes previous certificate 342 Rev1. New certificate reflects significant changes in the supply chain.

An End-Of-Life of the ATMX150RHA ASIC offer for new design has been announced by Microchip in April 2025. Information added in QML issue 31. Microchip will stop wafer manufacturing launch by October 2025. Microchip commits to maintain the wafer/die stock, based on customer needs. Microchip will continue Flight Models manufacturing from this wafer/die stock.

APPLICABLE DOCUMENTS:
ESCC Generic Specification No. 9000; ESCC Detail Specification No. 9202/083

Microchip Process Identification Document PID 37 Rev G, MMT PID 1G-QM-0105, HCM columns manufacturing and assembly PID 11 issue F.

5.2.2.3 *List of Qualified Components*
For each ASIC design an ASIC Sheet is produced by Microchip for use in conjunction with the ESCC Detail Specification No. 9202/083. Where the ASIC is not proprietary to the customer the ASIC sheet is published in ESCIES as a supporting document.

ASIC Sheet	Component Type

5.2.2.4 *Technology Flow Abstract*

GENERAL FEATURES
The ATMX150RHA is a mixed-signal ASIC offer providing high-performance and high-density solutions for space applications. The ATMX150RHA standard cells family is designed with a 0.15µm radiation-hardened CMOS technology. This offer is based on a 5 metal layers with an optional 6th thick metal layer technology, dedicated for large ASIC's to avoid voltage drop issues. The core is supplied at 1.8V +/-0.15V and the periphery at 3.3V +/-0.3V or 2.5V +/- 0.2V. This family features arrays with up to 22 Mgates and more than 700 pads. With its high-speed performance, its low supply current and its radiation hardening level, the ATMX150RHA is suitable for digital applications working in radiation intensive environment.

BASIC INFORMATION
- CMOS technology AT77K9RHA
- 40 to 70 kgates per mm²
- Periphery power supply 3.3V and 2.5V
- Core power supply 1.8V
- Low supply current: Operating maximum value: 8.8 nA/gate/MHz with a duty cycle at 20%
- I/O Interfaces:
    - Cold sparing
    - High speed LVDS (655 Mps) and LVPECL
    - PCI
- 704 pads (+ 8 pads power only)
- Compiled memory cells (ROM, SRAM, DPRAM, register files)
- Pre-qualified IP's
    - a regulator 1.8V 200mA Linear Voltage Regulator REG200RHA
    - a 8-channels analog input multiplexer MUX8RHA
    - a PLL 40 to 450 MHz PLL400MRHA
    - a RC Oscillator4/8/10/12 MHz OSCRC10MRHA
    - a bandgap 1.215V reference BG1V2RHA

- Radiation:
    - No Single Event Latchup to a LET threshold of 67.7 MeV.cm²/mg, and up to 78. 2 MeV.cm²/mg, 30°-tilted at high temperature.
    - SEU Hardened DFF's to 30 MeV/mg/ cm2
    - Tested up to 300 kRads(Si).

COMPONENT TYPES

Device Types as per ESCC Detail Specification 9202/083 and individual custom ESCC ASIC Sheets:

Die	Supply Voltage I/O / core	Max programmable I/O's	Case	Typical Routable gates
ATMX150RHA_216	2.5V or 3.3V/1.8V	216	CQFP-256	1M
ATMX150RHA_216	2.5V or 3.3V/1.8V	216	CQFP-132	1M
ATMX150RHA_324	2.5V or 3.3V/1.8V	324	CQFP-352	2.2M
ATMX150RHA_324	2.5V or 3.3V/1.8V	324	CQFP-256	2.2M
ATMX150RHA_324	2.5V or 3.3V/1.8V	324	CQFP-132	2.2M
ATMX150RHA_324	2.5V or 3.3V/1.8V	324	CLGA-472	2.2M
ATMX150RHA_324	2.5V or 3.3V/1.8V	324	CCGA-472	2.2M
ATMX150RHA_404	2.5V or 3.3V/1.8V	404	CQFP-352	3.5M
ATMX150RHA_404	2.5V or 3.3V/1.8V	404	CQFP-256	3.5M
ATMX150RHA_404	2.5V or 3.3V/1.8V	404	CLGA-625	3.5M
ATMX150RHA_404	2.5V or 3.3V/1.8V	404	CLGA-472	3.5M
ATMX150RHA_404	2.5V or 3.3V/1.8V	404	CCGA-625	3.5M
ATMX150RHA_404	2.5V or 3.3V/1.8V	404	CCGA-472	3.5M

Die	Supply Voltage I/O / core	Max programmable I/O's	Case	Typical Routable gates
ATMX150RHA_504	2.5V or 3.3V/1.8V	504	CQFP-352	5.5M
ATMX150RHA_504	2.5V or 3.3V/1.8V	504	CQFP-256	5.5M
ATMX150RHA_504	2.5V or 3.3V/1.8V	504	CLGA-625	5.5M
ATMX150RHA_504	2.5V or 3.3V/1.8V	504	CLGA-472	5.5M
ATMX150RHA_504	2.5V or 3.3V/1.8V	504	CCGA-625	5.5M
ATMX150RHA_504	2.5V or 3.3V/1.8V	504	CCGA-472	5.5M
ATMX150RHA_544	2.5V or 3.3V/1.8V	544	CQFP-352	6.5M
ATMX150RHA_544	2.5V or 3.3V/1.8V	544	CQFP-256	6.5M
ATMX150RHA_544	2.5V or 3.3V/1.8V	544	CLGA-625	6.5M
ATMX150RHA_544	2.5V or 3.3V/1.8V	544	CLGA-472	6.5M
ATMX150RHA_544	2.5V or 3.3V/1.8V	544	CCGA-625	6.5M
ATMX150RHA_544	2.5V or 3.3V/1.8V	544	CCGA-472	6.5M
ATMX150RHA_604	2.5V or 3.3V/1.8V	604	CQFP-352	7.5M
ATMX150RHA_604	2.5V or 3.3V/1.8V	604	CLGA-896	7.5M
ATMX150RHA_604	2.5V or 3.3V/1.8V	604	CLGA-625	7.5M
ATMX150RHA_604	2.5V or 3.3V/1.8V	604	CCGA-896	7.5M
ATMX150RHA_604	2.5V or 3.3V/1.8V	604	CCGA-625	7.5M
ATMX150RHA_644	2.5V or 3.3V/1.8V	644	CQFP-352	8.7M

Die	Supply Voltage I/O / core	Max programmable I/O's	Case	Typical Routable gates
ATMX150RHA_644	2.5V or 3.3V/1.8V	644	CLGA-896	8.7M
ATMX150RHA_644	2.5V or 3.3V/1.8V	644	CLGA-625	8.7M
ATMX150RHA_644	2.5V or 3.3V/1.8V	644	CCGA-896	8.7M
ATMX150RHA_644	2.5V or 3.3V/1.8V	644	CCGA-625	8.7M
ATMX150RHA_704	2.5V or 3.3V/1.8V	704	CQFP-352	10.4M
ATMX150RHA_704	2.5V or 3.3V/1.8V	704	CLGA-896	10.4M
ATMX150RHA_704	2.5V or 3.3V/1.8V	704	CLGA-625	10.4M
ATMX150RHA_704	2.5V or 3.3V/1.8V	704	CCGA-896	10.4M
ATMX150RHA_704	2.5V or 3.3V/1.8V	704	CCGA-625	10.4M

5.2.2.5 Technology Flow Definition

The Technology Flow covers the design, fabrication, assembly and testing of the ATMX150RHA standard cells ASIC family.

1. Design

The design manual and the ASIC library data books cover the design in the Microchip Technology Nantes associated Design Centers (Nantes and Rousset-France, Milan-Italy, Garching-Germany and Winnersh-UK).

ATMX150RHA design manual	2012_EC_054_ELE
ATMX150RHA TOS (Test Oriented Simulation) Manual	ATD-DE-GR-R0324
ATMX150RHA supply & ESD buffer databook	2012_EC_055_ELE
ATMX150RHA buffer 3.3V databook	2012_EC_051_ELE
ATMX150RHA buffer 2.5V databook	2012_EC_052_ELE
ATMX150RHA Cells library databook	2012_EC_050_ELE
ATMX150RHA memory cells library databook	2012_EC_053_ELE
ATMX150RHA power grid verification flow	2014_EC_131-ELE

All ASIC designs will be performed by customer at customer site, with Microchip supported tools (front end).

2. Fabrication

The AT77K9RHA, processed in UMC Taiwan, is a 0.15 µm CMOS, 5-metal with an optional 6th thick metal, Ti, TiN and AlCu process.

3. Assembly

The assembly of ATMX150RHA devices is performed in MMT, Thailand, with the following capabilities:

- Die attach Cyanate Ester (JM7000)
- Wire bond Ultrasonic Wedge, 25 and 32 µm Al
- Lid sealing Brazed with Au/Sn alloy or seam welded
- Leads/pads Gold plated (CQFP and CLGA)

The assembly of columns on CLGA is performed in SERMA HCM, La Rochelle, with the following capabilities:

- Columns 85Pb15Sn with Tinned Copper ribbon, 0.38 mm diameter

4. Control & Test

The control and test of ATMX150RHA devices is performed in Microchip Technology Nantes.

It includes Lot Acceptance, Test Flows and Test Procedures, Qualification Test and Reliability Monitoring, Screening and associated electrical tests and inspections.

5. TCVs and SEC

002NY TEST VEHICLE
The 002NY is a buffer test vehicle representative of the range of buffers available for performance testing in the CQFP-352 package. It contains standard IO33 buffers, specific IO33 buffers (LVDS, PCI), a PLL, a set of ring oscillators made of different library cells and a set of interconnect lines.

002PF TEST VEHICLE
The 002PF is a test vehicle representative of the IP blocks available for performance testing in the CQFP-256 package. It contains the REG200RHA, the OSCR10MRHA, the MUX8RHA, the BG1V2RHA and the PLL400MRHA.

002OP TEST VEHICLE – TECHNOLOGY SEC
The 002OP SEC is developed for radiation testing, process stability, reliability monitoring and performance characterization, it is assembled in the CQFP-352 package. It contains a set of memory blocks (compiled memories with and without EDACs), shift registers chains, high speed LVDS, PCI buffers and a PLL. It uses the thick-metal layer option.

002MS TEST VEHICLE – TECHNOLOGY SEC
The 002MS has the same characteristics than the 002OP, without the thick-metal layer option. 002MS will be embarked on MPW (Multi-Project Wafer) instead of 002OP when MPW ASIC's do not need thick metal layer. When so, 002MS shall be used for reliability quarterly monitoring.

6. Radiation Characteristics

The AT77K9RHA technology has been developed to fulfil the following characteristics:

- Total dose capability over 100 kRads (Si).
- No Single Event Latchup to a LET threshold of 67.7 MeV.cm²/mg, and up to 78.2 MeV.cm²/mg, 30° tilted at high temperature.
- Availability of SEU hardened cells.

5.2.2.6 Manufacturing sites

DESIGN:
Microchip Technology Nantes, BP70602, 44306 Nantes Cedex 3, France

WAFER FABRICATION:
UMC Fab 8C, Hsin-Chu, Taiwan

DIE ASSEMBLY:
MMT, Microchip Technology (Thailand) Co., Ltd. 17/2 Moo 18 Suwintawong Road, Saladang, Bangnumpriew Chachoengsao, Thailand 24000

CCGA COLUMN ASSEMBLY:
SERMA Microelectronics, 34 Av. Joliot Curie, 17185 Perigny Cedex, France

CONTROL AND TEST:

Microchip Technology Nantes, BP70602, 44306 Nantes Cedex 3, France