Product Change Notification

PCN Number: WC154601 **Notification Date: November 17, 2015**

Title: Additional manufacturing location and die revision for selected ATmega48, ATmega88, ATmega168 and ATmega328 microcontrollers

Product Identification:

Part numbers for ATmega48 variants		
ATmega48-20AU	ATmega48P-20MU	ATmega48PA-MN
ATmega48-20AUR	ATmega48P-20MUR	ATmega48PA-MNR
ATmega48-20MU	ATmega48PV-10AU	ATmega48PA-MU
ATmega48-20MUR	ATmega48PV-10AUR	ATmega48PA-MUR
ATmega48V-10AU	ATmega48PV-10MU	ATmega48A-AU
ATmega48V-10AUR	ATmega48PV-10MUR	ATmega48A-AUR
ATmega48V-10MU	ATmega48PA-AN	ATmega48A-MU
ATmega48V-10MUR	ATmega48PA-ANR	ATmega48A-MUR
ATmega48P-20AU	ATmega48PA-AU	
ATmega48P-20AUR	ATmega48PA-AUR	

Part numbers for ATmega88 variants		
ATmega88-20AU	ATmega88P-20MU	ATmega88PA-MN
ATmega88-20AUR	ATmega88P-20MUR	ATmega88PA-MNR
ATmega88-20MU	ATmega88PV-10AU	ATmega88PA-MU
ATmega88-20MUR	ATmega88PV-10AUR	ATmega88PA-MUR
ATmega88V-10AU	ATmega88PV-10MU	ATmega88A-AU
ATmega88V-10AUR	ATmega88PV-10MUR	ATmega88A-AUR
ATmega88V-10MU	ATmega88PA-AN	ATmega88A-MU
ATmega88V-10MUR	ATmega88PA-ANR	ATmega88A-MUR
ATmega88P-20AU	ATmega88PA-AU	
ATmega88P-20AUR	ATmega88PA-AUR	

Part numbers for ATmega168 variants		
ATmega168-20AU	ATmega168P-20ANR	ATmega168A-AU
ATmega168-20AUR	ATmega168P-20AU	ATmega168A-AUR
ATmega168-20MU	ATmega168P-20AUR	ATmega168A-MU
ATmega168-20MUR	ATmega168P-20MQ	ATmega168A-MUR
ATmega168-20MQ	ATmega168P-20MQR	ATmega168PA-AN
ATmega168-20MQR	ATmega168P-20MU	ATmega168PA-ANR
ATmega168V-10AU	ATmega168P-20MUR	ATmega168PA-AU
ATmega168V-10AUR	ATmega168PV-10AN	ATmega168PA-AUR
ATmega168V-10MQ	ATmega168PV-10ANR	ATmega168PA-MN
ATmega168V-10MQR	ATmega168PV-10AU	ATmega168PA-MNR
ATmega168V-10MU	ATmega168PV-10AUR	ATmega168PA-MU
ATmega168V-10MUR	ATmega168PV-10MU	ATmega168PA-MUR
ATmega168P-20AN	ATmega168PV-10MUR	

Part numbers for ATmega328 variants		
ATmega328-AU	ATmega328P-AN	ATmega328P-MN
ATmega328-AUR	ATmega328P-ANR	ATmega328P-MNR
ATmega328-MU	ATmega328P-AU	ATmega328P-MU
ATmega328-MUR	ATmega328P-AUR	ATmega328P-MUR

Reason for Change:

- ☐ Material / Composition
- ☒ Processing / Manufacturing
- ☒ Design / Firmware
- ☐ Datasheet
- ☒ Manufacturing Location
- ☐ Quality / Reliability
- ☐ Logistics
- ☐ Other:

Change Description:

1. *New process variant:* To optimize device manufacturing Atmel has introduced new design revisions of the AVR microcontrollers listed in the table above in a new process variant.

2. *Additional wafer fab:* To ensure an uninterrupted flow of products to meet customer production demands, the new design revision of the products listed will be also manufactured at Tower Panasonic (Japan) wafer fabrication. The facility will manufacture the parts to the same specification as our existing wafer fab sites Atmel's own Colorado Springs (USA) wafer fabrication facility and Semiconductor Manufacturing International Corporation, SMIC (China).

Changes

New die revision changes:

- Full swing crystal oscillator not supported
- Power Save mode current consumption increased (ATmega48P, ATmega88P, ATmega168P)
- Parallel programming timing modified
- Write Wait Delay for NVM is increased
- Device ID

See Appendix 1 for more details on changes.

New die revision samples can be ordered through Atmel Sample Centre by logging on to https://samples.atmel.com/scripts/samplecenter.dll?atmel?cmd=menu, lead time about 2 weeks. Specific ordering codes for new die revision samples only are shown in the table below, and are available for sample orders only until the proposed first shipment date. For all production orders, only standard existing ordering codes will be accepted.

Part number	**New Die Revision Sample Ordering Code**
ATmega48-20AU	ATmega48-20AURS
ATmega48-20AUR	
ATmega48-20MU	ATmega48-20MURS
ATmega48-20MUR	
ATmega48V-10AU	ATmega48V-10AURS
ATmega48V-10AUR	
ATmega48V-10MU	ATmega48V-10MURS
ATmega48V-10MUR	
ATmega48PV-10AU	ATmega48PV-10AURS
ATmega48PV-10AUR	
ATmega48PV-10MU	ATmega48PV-10MURS
ATmega48PV-10MUR	
ATmega48P-20AU	ATmega48P-20AURS
ATmega48P-20AUR	
ATmega48P-20MU	ATmega48P-20MURS
ATmega48P-20MUR	

ATmega48PA-AN	ATmega48PA-AURS
ATmega48PA-ANR	
ATmega48PA-AU	
ATmega48PA-AUR	
ATmega48PA-MN	ATmega48PA-MURS
ATmega48PA-MNR	
ATmega48PA-MU	
ATmega48PA-MUR	
ATmega48A-AU	ATmega48A-AURS
ATmega48A-AUR	
ATmega48A-MU	ATmega48A-MURS
ATmega48A-MUR	

Part number	**New Die Revision Sample Ordering Code**
ATmega88-20AU	ATmega88-20AURS
ATmega88-20AUR	
ATmega88-20MU	ATmega88-20MURS
ATmega88-20MUR	
ATmega88V-10AU	ATmega88V-10AURS
ATmega88V-10AUR	
ATmega88V-10MU	ATmega88V-10MURS
ATmega88V-10MUR	
ATmega88PV-10AU	ATmega88PV-10AURS
ATmega88PV-10AUR	
ATmega88PV-10MU	ATmega88PV-10MURS
ATmega88PV-10MUR	
ATmega88P-20AU	ATmega88P-20AURS
ATmega88P-20AUR	
ATmega88P-20MU	ATmega88P-20MURS
ATmega88P-20MUR	

ATmega88PA-AN	ATmega88PA-AURS
ATmega88PA-ANR	
ATmega88PA-AU	
ATmega88PA-AUR	
ATmega88PA-MN	ATmega88PA-MURS
ATmega88PA-MNR	
ATmega88PA-MU	
ATmega88PA-MUR	
ATmega88A-AU	ATmega88A-AURS
ATmega88A-AUR	
ATmega88A-MU	ATmega88A-MURS
ATmega88A-MUR	

Part number	**New Die Revision Sample Ordering Code**
ATmega168-20AU	ATmega168-20AURS
ATmega168-20AUR	
ATmega168-20MU	ATmega168-20MURS
ATmega168-20MUR	
ATmega168-20MQ	
ATmega168-20MQR	
ATmega168V-10AU	ATmega168V-10AURS
ATmega168V-10AUR	
ATmega168V-10MQ	ATmega168V-10MURS
ATmega168V-10MQR	
ATmega168V-10MU	
ATmega168V-10MUR	
ATmega168P-20AN	ATmega168P-20AURS
ATmega168P-20ANR	
ATmega168P-20AU	ATmega168P-20AURS
ATmega168P-20AUR	

ATmega168P-20MQ	ATmega168P-20MURS
ATmega168P-20MQR	
ATmega168P-20MU	
ATmega168P-20MUR	
ATmega168PV-10AN	ATmega168PV-10AURS
ATmega168PV-10ANR	
ATmega168PV-10AU	
ATmega168PV-10AUR	
ATmega168PV-10MU	ATmega168PV-10MURS
ATmega168PV-10MUR	
ATmega168A-AU	ATmega168A-AURS
ATmega168A-AUR	
ATmega168A-MU	ATmega168A-MURS
ATmega168A-MUR	
ATmega168PA-AN	ATmega168PA-AURS
ATmega168PA-ANR	
ATmega168PA-AU	
ATmega168PA-AUR	
ATmega168PA-MN	ATmega168PA-MURS
ATmega168PA-MNR	
ATmega168PA-MU	
ATmega168PA-MUR	

Part number	**New Die Revision Sample Ordering Code**
ATmega328-AU	ATmega328-AURS
ATmega328-AUR	
ATmega328-MU	ATmega328-MURS
ATmega328-MUR	
ATmega328P-AN	ATmega328P-AURS
ATmega328P-ANR	
ATmega328P-AU	
ATmega328P-AUR	

ATmega328P-MN	ATmega328P-MURS
ATmega328P-MNR	
ATmega328P-MU	
ATmega328P-MUR	

Note 1: The **S** in sample ordering codes will not be marked on the package and is only used for sampling purposes.

Note 2: For special part numbers and parts purchased with SL or QS numbers, please contact your Customer Service Representative.

Identification Method to Distinguish Change:

In those products where the die ID is stated on packages, labels or other material, the previous die revisions have 355xx or 354xx, while the new die revision has 59xxx.

Qualification Data:	☒ Available	☐ Will be available (mm/dd/yr):	☐ Not Applicable
Samples:	☒ Available	☐ Will be available (mm/dd/yr):	☐ Not Applicable

Quantifiable Impact on Quality & Reliability: None

Proposed First Ship Date*: February 17, 2016

**The Proposed First Ship Date is the forecasted date that a customer may expect to receive changed product. This is determined by the estimated date of inventory depletion on the PCN issue date. This may be affected by fluctuations in supply and demand. Consequently, although customers should be prepared to receive changed product on this date, Atmel will continue to ship pre-changed product until a time in which inventory has been depleted. This may result in pre-changed product being shipped to customers after this forecasted date.*

Atmel Contact: Please contact your Atmel Sales Representative or Distributor for additional information (when replying via e-mail please include the PCN number in subject line).

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To be completed by customer: ☐ Approved ☐ Rejected (Please state reason for rejection):

Company: Name: Title: Date: Email Address: Location: Comments:	

Appendix 1: Changes in new die revision

Full swing crystal oscillator not supported (all products)
The full swing crystal oscillator found in previous die revisions is no longer supported. Customers should use other clock sources – refer to the respective datasheet for alternatives.

Power Save mode current consumption – ATmega48P only.

			Previous die revision – ATmega48P only				**New die revision** – ATmega48P only			
Symbol	**Parameter**	**Condition**	**Min**	**Typ.**	**Max**	**Units**	**Min**	**Typ.**	**Max**	**Units**
Icc	Power-save mode(1)(2)	32 kHz TOSC enable, Vcc = 1.8V		0.75	1.6	µA		1.4	1.9	µA

(1) The current consumption values include input leakage current.
(2) Maximum values are characterized values and not test limits in production.

Power Save mode current consumption – ATmega88P only.

			Previous die revision – ATmega88P only				**New die revision** – ATmega88P only			
Symbol	**Parameter**	**Condition**	**Min**	**Typ.**	**Max**	**Units**	**Min**	**Typ.**	**Max**	**Units**
Icc	Power-save mode(1)(2)	32 kHz TOSC enable, Vcc = 1.8V		0.72	1.6	µA		1.4	1.9	µA

(1) The current consumption values include input leakage current.
(2) Maximum values are characterized values and not test limits in production.

Power Save mode current consumption - ATmega168P only.

			Previous die revision – ATmega168P only				**New die revision** – ATmega168P only			
Symbol	**Parameter**	**Condition**	**Min**	**Typ.**	**Max**	**Units**	**Min**	**Typ.**	**Max**	**Units**
Icc	Power-save mode(1)(2)	32 kHz TOSC enable, Vcc = 1.8V		0.8	1.6	µA		1.4	1.9	µA

(1) The current consumption values include input leakage current.
(2) Maximum values are characterized values and not test limits in production

Parallel programming timing modifications (all products)

		Previous die revision				New die revision			
Symbol	**Parameter**	**Min**	**Typ.**	**Max**	**Units**	**Min**	**Typ.**	**Max**	**Units**
t_{WLRH_CE}	/WR Low to RDY/BSY High for Chip Erase	7.5		9	ms	9.8		10.5	ms
t_{BVDV}	/BS1 Valid to DATA valid	0		250	ns	0		335	ns
t_{OLDV}	/OE Low to DATA Valid			250	ns			335	ns

Write Delay for NVM changed (all products)

	Previous die revision	**New die revision**
Symbol	Minimum Wait Delay	Minimum Wait Delay
t_{WD_ERASE}	9ms	10.5ms

Device ID

The device ID has been modified according to the following:

	Any die revision			**Previous die revision**	**New die revision**
	Signature byte address ID (Unchanged)			Device ID read via debugWIRE	Device ID read via debugWIRE
Part	**0x000**	**0x001**	**0x002**		
ATmega48	0x1E	0x92	0x05	0x9205	0x920A
ATmega48V	0x1E	0x92	0x05	0x9205	0x920A
ATmega48A	0x1E	0x92	0x05	0x920A	0x920A
ATmega88	0x1E	0x93	0x0A	0x930A	0x930F
ATmega88V	0x1E	0x93	0x0A	0x930A	0x930F
ATmega88A	0x1E	0x93	0x0A	0x930F	0x930F
ATmega168	0x1E	0x94	0x06	0x9406	0x940B
ATmega168V	0x1E	0x94	0x06	0x9406	0x940B
ATmega168A	0x1E	0x94	0x06	0x940B	0x940B
ATmega328	0x1E	0x95	0x14	0x9514	0x9516
ATmega328P	0x1E	0x95	0x0F	0x950F	0x9516

Note: No change in device ID read from debugWIRE for the "P"/"PA"/"PV" variants of the products.