Introduction

Atmel QTouch Library makes it simple for developers to embed capacitive-touch button, slider, wheel functionality into general-purpose Atmel SMART ARM and AVR® microcontroller applications. QTouch Library for Peripheral Touch Controller can be used for touch sensor pin configuration, acquisition parameter setting as well as periodic sensor data capture and receive touch status updates. This document provides detailed information on QTouch Library release updates.
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Release 5.9 July 2016

Installer builds

GCC

- QTouch Composer Studio extension 5.9.116
- QTouch Library Studio extension 5.9.211
- Dependencies
  - Atmel Studio 7.0.1006 or later versions
  - ASF - 3.30.1 or later versions
  - Atmel Kits – 7.0.70 or later versions
  - EDBG version – 3.19 or later versions

IAR

- QTouch Library IAR Installer build 5.9.211
- Dependencies
  - IAR Embedded Workbench 7.50.1.10273
  - IAR Embedded Workbench for Atmel AVR 6.70.1
  - ASF - 3.29

General Library

Library version 5.0.8

Bug Fixes/Improvements

- The touch acquisition may fail and stop working. This issue has been fixed in the library.
- Possible to miss ADC EOC sampling when waking up from sleep. This issue has been fixed in Atmega324PB library and Atmega328PB library.
- High power consumption issue due to sync_config function has been fixed in the library.
- User board low power project creation for SAM L21 device uses generic low power id instead of Sensor 0.
- User board SAM D10/D11 non-ASF project templates are modified to match with the power numbers of ASF based projects.
- Example projects using RC8MHz as reference clock for DFLL clock source is pre-scaled to 32KHz as recommended.

Safety Library

No Updates in the Safety Library.

Bug Fixes/Improvements
- The touch acquisition may fail and stop working. The work around has been updated in the Safety user guide.
- SAMD20 Safety Example Project Update: All Example projects including GCC/IAR Robustness Projects for SAMD20 using RC8MHz as reference clock for DFLL clock source is pre-scaled to 32KHz as recommended.

**Surface Library**

No Updates in the Surface Library.

**Bug Fixes/Improvements**

- SAMD20 Surface Example Project Update: All Example projects including GCC/IAR QT6/QT2 Projects for SAMD20 using RC8MHz as reference clock for DFLL clock source is pre-scaled to 32KHz as recommended.

**QTouch Composer**

**Feature/Usability Improvements**

- Automatic switching from Embed to DGI mode is supported.
- Fixed error in writing the kit sensor parameters to project.

**Release 5.9 April 2016**

**Installer builds**

**GCC**

- QTouch Composer Studio extension 5.9.108
- QTouch Library Studio extension 5.9.191
- Dependencies
  - Atmel Studio 7.0.634 or later versions
  - ASF - 3.30.1 or later versions
  - Atmel Kits – 7.0.44 or later versions
  - EDBG version – 2.10 or later versions

**IAR**

- QTouch Library IAR Installer build 5.9.191
- Dependencies
  - IAR Embedded Workbench 7.50.1.10273
  - IAR Embedded Workbench for Atmel AVR 6.70.1
  - ASF - 3.29
General Library
Library version 5.0.7

Bug Fixes/Improvements
- Example projects have been updated such that for SAMC20/C21 RevB devices, DPLL is used as main clock and for SAMC20/C21 revC devices, OSC48MHz is used as main clock.
- Non-ASF projects for SAMD10D14AU and SAMD11D14AU devices are supported.
- Qdebug data transmission in mega projects are modified.
- Example projects using DFLL as main clock source have been updated to use scaled RC8MHz clock as reference input clock.
- OSC32K is used as reference clock for DPLL clock source in SAM C20/C21 projects.
- DEF_TOUCH_APP_ERR_HANDLER macro is introduced to enable or disable application error handler function.

Safety Library
Library Version 5.1.14

Bug Fixes/Improvements
- Example projects have been updated such that for SAMC20/C21 RevB devices, DPLL is used as main clock and for SAMC20/C21 revC devices, OSC48MHz is used as main clock.
- Example projects using DFLL as main clock source have been updated to use scaled RC8MHz clock as reference input clock.

Surface Library
Library Version 1.0.3

Feature additions
- There are no updates in the surface library for this release

Release 5.9 February 2016

Installer builds

GCC
- QTTouch Composer Studio extension 5.9.108
- QTTouch Library Studio extension 5.9.178
- Dependencies
  - Atmel Studio 7.0.634
  - ASF - 3.30.1
  - Atmel Kits – 7.0.44
  - EDBG version – 2.10
IAR

- QTouch Library IAR Installer build 5.9.178
- Dependencies
  - IAR Embedded Workbench 7.50.1.10273
  - IAR Embedded Workbench for Atmel AVR 6.70.1
  - ASF - 3.29

General Library

Library version 5.0.7

Feature additions

- Library and device support has been added for ATmega324PB.
- Device support has been extended to SAMD10D14AU, SAMD11D14AU and SAMR21E19A variants.

Bug fixes done

- For SAMC devices, main clock source has been changed from DPLL to OSC48M.
- For SAM L22 projects, the system performance level is changed when MCU frequency is above 8 MHz instead of 12MHz.
- SAM L21/L22 example projects are configured in PL0 with Main Regulator (Buck) configured to run in standby sleep to cater the bug in LP Regulator.

Safety Library

Library version 5.1.14 for SAMC20 device is added for this Release

Feature additions

- Library and device support has been added for SAMC20 device variants.
- Low power Feature has been added for Safety Library version 5.1.14
- Moisture Quick Re-burst Enable/Disable has been added.
- SAMC20 Robustness Example Project added for both IAR and GCC.

Surface Library

Library Version 1.0.3

Feature additions

- There are no updates in the surface library for this release.
Example projects for Atmel Kits

GCC & IAR

- **SAM D20**
  - SAM D20 Xplained Pro and QT1 Xplained Pro Mutual Capacitance example application
  - SAM D20 Xplained Pro and QT1 Xplained Pro Self Capacitance example application
  - SAM D20 Xplained Pro and QT1 Xplained Pro Mutual Capacitance example application with Lump-Low Power configuration
  - SAM D20 Xplained Pro and QT1 Xplained Pro Self Capacitance example application with Lump-Low Power configuration
  - SAM D20 Xplained Pro and QT3 Xplained Pro Mutual Capacitance example application with Lump-Low Power configuration
  - SAM D20 QTouch Robustness Demo Moisture Example Application (self + mutual) example application
  - SAM D20 Xplained Pro and QT2 Xplained Pro Touch Surface example application
  - SAM D20 Xplained Pro and QT6 Xplained Pro Touch Surface example application
  - SAM D20 QTouch Safety Robustness Demo

- **SAM D21**
  - SAM D21 Xplained Pro and QT1 Xplained Pro Mutual Capacitance example application
  - SAM D21 Xplained Pro and QT1 Xplained Pro Self Capacitance example application

- **SAM D11**
  - SAM D11 Xplained Pro Self Capacitance example application

- **SAM D10**
  - SAM D10 Xplained Mini Self Capacitance example application

- **SAM DA1**
  - SAM DA1 Xplained Pro and QT4 Xplained Pro Self Capacitance example application

- **SAM C21**
  - SAM C21 Xplained Pro and QT1 Xplained Pro Mutual Capacitance example application
  - SAM C21 Xplained Pro and QT1 Xplained Pro Self Capacitance example application
  - SAM C21 Xplained Pro Self Capacitance example application(on-board sensor)
  - SAM C21 Xplained Pro and QT5 Xplained Pro Mutual Capacitance example application

- **SAM C20**
  - SAM C20 QTouch Robustness Demo Moisture Example Application
  - SAM C20 QTouch Safety Robustness Demo
- **SAM L21**
  - SAM L21 Xplained Pro and QT3 Xplained Pro Mutual Capacitance example application with Lump-Low Power configuration

- **SAM L22**
  - SAM L22 Xplained Pro and Touch Segment LCD Xplained Pro Mutual Capacitance example application

- **MEGA 328PB**
  - ATmega328PB Xplained Mini Self Capacitance example application

- **MEGA 324PB**
  - ATmega324PB Xplained Pro and QT5 Xplained Pro Mutual Capacitance example application

**Device Support**

QTouch library for PTC supports the following devices.
QTouch Composer

Device Support
- ATmega324PB support has been added for general library in GUI.
- SAM C20 variants have been supported for safety library in GUI.

Feature/Usability Improvements
- In BSW tuning Parameters pane, CSD value limit is modified to 250 instead of 252.
- In Advanced tuning parameters pane, options specific to SAM C20 that are not required were hidden.
- Moisture quick re-burst feature is enabled for safety.
• Fixed code generation logic for low power mega PTC projects.

**Release 5.8 January 2016**

**Installer builds**

**GCC**
- QTouch Composer Studio extension 5.8.94
- QTouch Library Studio extension 5.8.146
- Dependencies
  - Atmel Studio 7.0.634
  - ASF - 3.29.0
  - Atmel Kits – 7.0.44
  - EDBG version – 2.10

**IAR**
- QTouch Library IAR Installer build 5.8.146
- Dependencies
  - IAR Embedded Workbench 7.50.1.10273
  - IAR Embedded Workbench for Atmel AVR 6.70.1

**General Library**
Library version 5.0.7

**Bug fixes done**

- PTC clock is set at 8 MHz for SAML22 example and user board projects.
- Boot time pre-scaler and series resistor setting available in composer during project creation.
- SAML22 Low power user board project is modified to run the CPU in PL0 and Buck regulator is configured to run in standby sleep to facilitate low power.
- ATmega328PB user board project template is modified to support both selfcap and mutualcap configuration.
- System clock pre-scaler is changed to 1 in example project of ATmega328PB Xplained mini to set Device clock to 8MHz.
- Low power user board templates are updated to support low power mode switch to occur correctly independent of number of configured sensors.

**Safety Library**
Library Version 5.1.4
Feature additions
- There are no updates in the safety library for this release.

Surface Library
Library Version 1.0.3

Feature additions
- There are no updates in the surface library for this release.

QTouch Composer

Device Support
- ATmega328PB (AVR device with PTC) support has been added for general library in GUI.
- SAM L22 variants have been supported for general library in GUI.

Feature/Usability Improvements
- Filter level and Auto OS is available on a per channel basis instead of global.
- Low power support for ATmega328PB.
- GND feature is supported in GUI.
- USART support is added in Analyzer for ATmega328PB Xmini Kit.
- Support for new kit (QT5) is added.
- Atmel ICE support is added.

Release 5.8 December 2015

Installer builds

GCC
- QTouch Composer Studio extension 5.8.88
- QTouch Library Studio extension 5.8.142
- Dependencies
  - Atmel Studio 7.0.634
  - ASF - 3.29.0
  - Atmel Kits – 7.0.44
  - EDBG version – 2.10

IAR
- QTouch Library IAR Installer build 5.8.140
- Dependencies
  - IAR Embedded Workbench 7.50.1.10273
General Library
Library version 5.0.7

Feature additions
- Library support for SAM L22 device variants have been added.
- Library support for AVR 8 bit device (ATMEGA328PB) support has been added.
- Filter level and auto-oversample features are available on per channel basis.
- Support for grounding the self/mutual capacitance PTC lines in between measurements has been added.

Bug fixes
- In touch_de-init API, exception caused due to pointer mishandling is fixed.
- In xxxxcap_sensor_disable API, when all the sensors were disabled, PTC was not disabled. This is fixed.

Safety Library
Library Version 5.1.4

Feature additions
- There are no updates in the safety library for this release.
- Safety example Projects have been updated with latest ASF.
- SAMD20 QTtouch Safety Robustness Demo has been updated with latest ASF.

Surface Library
Library Version 1.0.3

Feature additions
- Support for SAMD21 Device Variants have been added.
- Surface Example Projects have been updated with latest ASF.
- Minor Bug fixes are done in the library and application.

Example projects for Atmel Kits

GCC & IAR

- SAM D20
  - SAM D20 Xplained Pro and QT1 Xplained Pro Mutual Capacitance example application
  - SAM D20 Xplained Pro and QT1 Xplained Pro Self Capacitance example application
- SAM D20 Xplained Pro and QT1 Xplained Pro Mutual Capacitance example application with Lump-Low Power configuration
- SAM D20 Xplained Pro and QT1 Xplained Pro Self Capacitance example application with Lump-Low Power configuration
- SAM D20 Xplained Pro and QT3 Xplained Pro Mutual Capacitance example application with Lump-Low Power configuration
- SAM D20 QTouch Robustness Demo Moisture Example Application (self + mutual) example application
- SAM D20 Xplained Pro and QT2 Xplained Pro Touch Surface example application
- SAM D20 Xplained Pro and QT6 Xplained Pro Touch Surface example application
- SAM D20 QTouch Safety Robustness Demo

- **SAM D21**
  - SAM D21 Xplained Pro and QT1 Xplained Pro Mutual Capacitance example application
  - SAM D21 Xplained Pro and QT1 Xplained Pro Self Capacitance example application

- **SAM D11**
  - SAM D11 Xplained Pro Self Capacitance example application

- **SAM D10**
  - SAM D10 Xplained Mini Self Capacitance example application

- **SAM DA1**
  - SAM DA1 Xplained Pro and QT4 Xplained Pro Self Capacitance example application

- **SAM C21**
  - SAM C21 Xplained Pro and QT1 Xplained Pro Mutual Capacitance example application
  - SAM C21 Xplained Pro and QT1 Xplained Pro Self Capacitance example application
  - SAM C21 Xplained Pro Self Capacitance example application (on-board sensor)
  - SAM C21 Xplained Pro and QT5 Xplained Pro Mutual Capacitance example application

- **SAM C20**
  - SAM C20 QTouch Robustness Demo Moisture Example Application

- **SAM L21**
  - SAM L21 Xplained Pro and QT3 Xplained Pro Mutual Capacitance example application with Lump-Low Power configuration

- **SAM L22**
  - SAM L22 Xplained Pro and Touch Segment LCD Xplained Pro Mutual Capacitance example application
MEGA 328PB

- ATMEGA 328PB Xplained Mini Self Capacitance example application

Device Support

The device support has been extended to support these devices.

<table>
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<th>SURFACE LIBRARY</th>
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Atmel PTC QTone Library [RELEASE NOTES]

Atmel-42544-PTC-QTone.Library_ReleaseNotes
Release 5.7 September 2015

Installer builds

GCC
- QTouch Composer Studio extension 5.7.223
- QTouch Library Studio extension 5.7.327
- Dependencies
  - Atmel Studio 6.2.1563
  - ASF - 3.26.0
  - Atmel Kits - 6.2.360
  - Device part packs
    - SAM C21, SAM C20
    - SAM DA1
    - SAM L21 REV B
  - EDBG version – 2.9

IAR
- QTouch Library IAR Installer build 5.7.325
- Dependencies
  - IAR Embedded Workbench 7.40.3.8938

General Library
Library version 5.0.6

Feature additions
- Library support for SAM C20, SAM C21, SAM L21 rev B and SAM D21 B, BU device variants have been added.
- SAM L21 rev A support has been removed.
- Moisture quick re-burst enable/disable parameter has been added.
- Charge Share Delay feature (global parameter) has been added for SAMC2X devices.
- Charge Share Delay auto-tune feature has been added for SAMC2X devices.
- Auto-OS signal stability limit parameter has been added.
- Auto-OS algorithm has been updated.

Safety Library
Library version 5.1.3

Feature additions
- Support for SAMD20 and SAMD21 Device Variants has been added. Please refer QTouch_Library_Selection_guide.xls
• **Auto Over-sample**, **Filter Level**, **PTC Pre-scaler** and **Resistor** selection for individual channel has been added.
• New APIs **touch_mutlicap_sensors_deinit**, **touch_selfcap_sensors_deinit** for Touch De-initialization.
• TOUCH_AUTO_OS_IN_PROGRESS & TOUCH_CC_CALIB_ERROR flags are added as acquisition status flags
• Auto Oversample status per channel has been added in touch_measure_data_t structure
• **touch_mutlicap_sensor_reenable**, **touch_selfcap_sensor_reenable** APIs are modified so that disabled sensors can be re-enabled with or without calibration
• Bug Fix related to Auto Oversample should trigger when sensor is touched is fixed.

**Surface Library**
Library version 1.0.1

**Feature additions**
• No updates are done for this release

**Example projects for Atmel Kits**

**GCC & IAR**

- **SAM D20**
  - SAM D20 Xplained Pro and QT1 Xplained Pro Mutual Capacitance example application
  - SAM D20 Xplained Pro and QT1 Xplained Pro Self Capacitance example application
  - SAM D20 Xplained Pro and QT1 Xplained Pro Mutual Capacitance example application with Lump-Low Power configuration
  - SAM D20 Xplained Pro and QT1 Xplained Pro Self Capacitance example application with Lump-Low Power configuration
  - SAM D20 Xplained Pro and QT3 Xplained Pro Mutual Capacitance example application with Lump-Low Power configuration
  - SAM D20 QTTouch Robustness Demo Moisture Example Application (self + mutual) example application

- **SAM D21**
  - SAM D21 Xplained Pro and QT1 Xplained Pro Mutual Capacitance example application
  - SAM D21 Xplained Pro and QT1 Xplained Pro Self Capacitance example application

- **SAM D11**
  - SAM D11 Xplained Pro Self Capacitance example application
- **SAM D10**
  - SAM D10 Xplained Mini Self Capacitance example application

- **SAM DA1**
  - SAM DA1 Xplained Pro and QT4 Xplained Pro Self Capacitance example application

- **SAM C21**
  - SAM C21 Xplained Pro and QT1 Xplained Pro Mutual Capacitance example application
  - SAM C21 Xplained Pro and QT1 Xplained Pro Self Capacitance example application
  - SAM C21 Xplained Pro Self Capacitance example application (on-board sensor)

- **SAM C20**
  - SAM C20 QTTouch Robustness Demo Moisture Example Application

- **SAM L21**
  - SAM L21 Xplained Pro and QT3 Xplained Pro Mutual Capacitance example application with Lump-Low Power configuration

### Device support

The device variants support for general, safety and surface are given below:

<table>
<thead>
<tr>
<th>GENERAL LIBRARY</th>
<th>SAMD21</th>
<th>SAMD20</th>
<th>SAMC21</th>
<th>SAMC20</th>
<th>SAML21</th>
<th>SAMDA1</th>
<th>SAMR21</th>
<th>SAMD10</th>
<th>SAMD11</th>
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<td>ATSAMC21E15A</td>
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*Atmel PTC QTTouch Library [RELEASE NOTES]*

17
Release 5.6 April 2015

Installer builds

GCC

- Atmel Studio Extension release for GCC Compiler
  - QT Touch Composer Studio extension 5.6.183.0 or later
  - QT Touch Library Studio extension 5.6.233.0 or later

IAR

- Atmel QT Touch Libraries PTC Part pack 5.0.5

General Library

Library version 5.0.5

Feature additions

- Library support for SAMR21 device variants.
- Moisture tolerance feature addition has been done.

Safety Library

Library version 5.0.13
Feature additions
- Suspend and resume API support added.
- SAM D20 Robustness demo additions:
  - GCC Example demo project for robustness demo board updated
  - IAR Example demo project for robustness demo board updated

Surface Library
Library version 1.0.1

Feature additions
- SAMD20J15, SAMD20G15 and SAMD20E15 device support added.
- Linearity Improvement has been done.
- Memory Optimization.
- Separate DPI for both X and Y Axis.

Release 5.5 February 2015

Installer builds

GCC
- Atmel Studio Extension release for GCC Compiler
  - QTouch Composer Studio extension 5.5.159.0 or later
  - QTouch Library Studio extension 5.5.155.0 or later

IAR
- Atmel QTouch Libraries PTC Part pack 5.0.4

General Library
Library version 5.0.4

Feature additions
- Library support for SAML21/SAMD10/SAMD11 variants.
- D11/L21 Xplained Pro example projects added.
- Low power sensor support added along with example project for SAMD20.
- Lumped Sensor configuration support added.
- PTC Suspend/Resume, deinit APIs added, re-enable PTC API modified.

Surface Library
Library version 1.0.0
Feature additions
- Surface library support for SAMD20 variants
- Supports two touches with up to 2mm edge-to-edge touch separation
- Wake-up on surface touch from a standby current down to 4µA
- Supports up to 100 nodes with varying surface size.

Release 5.4 November 2014

Installer builds

GCC
- Atmel Studio Extension release for GCC Compiler
  - QT Touch Composer Studio extension 5.4.78.0 or later
  - QT Touch Library Studio extension 5.4.82.0 or later

IAR
- Atmel QT Touch Libraries PTC Part pack 5.0.3

General Library
Library version 5.0.3
Feature additions
- Formula based Cc calibration feature support.
- Interrupt execution mode feature addition, allows for deterministic interrupt execution time when capacitance measurement is initiated.
- Flag to indicate Auto-Oversamples shift within library.
- Flag to indicate Cc compensation cap calibration error.
- Revision number arrangement includes product classification ID to categorize General library or Safety library.
- New or missed out device variants support added to QT Touch Library extension for General library - ATSAMD21J15A, ATSAMD21G15A, ATSAMD20E18

Safety Library
Library version 5.0.11
Feature additions
- Safety library support for SAMD20 variants
- FMEA Feature Addition.
- Safety Features like CRC, Double Inverse, Run Time Parameter Checks, Static RAM location support for safety library data are part of safety library.
- Quick reburst feature supported.
- Moisture tolerance support for devices by moisture grouping and multi touch grouping.
- Application Burst Again Feature.
- GCC Example demo project for robustness demo board.
- IAR Example demo project for robustness demo board.

Release 5.3 March 2014

Installer builds

GCC
- Atmel Studio Extension release for GCC Compiler
  - QT Touch Composer Studio extension 5.3.37.0 or later
  - QT Touch Library Studio extension 5.3.0.94 or later

IAR
- Atmel QT Touch Libraries PTC Part pack 5.0.2

General Library
Library version 5.0.2

Feature additions
- None

Bug fix done
- Away from touch recalibration threshold parameter cannot be configured using touch.h parameter DEF_MUTLCAP_ATCH_RECAL_DELAY or DEF_SELFCAP_ATCH_RECAL_DELAY for mutual cap/self-cap respectively

Release 5.3 February 2014

Installer builds

GCC
- Atmel Studio Extension release for GCC Compiler
  - QT Touch Composer Studio extension 5.3.29.0 or later
  - QT Touch Library Studio extension 5.3.0.83 or later

IAR
- Atmel QT Touch Libraries PTC Part pack 5.0.1
General Library
Library version 5.0.1

Feature additions
- Runtime sensor disable and re-enable API's added.
- Sensor calibration implemented as a non-blocking feature as compared to blocking API call in the previous version.
- Improvements done for reduced Sensor calibration time.
- Provision to manually set PTC pre-scalar and PTC series resistor.
- Option provided for the user to select Acquisition Frequency mode that allows for more tuning options under conducted or radiated noise environments.
- PTC will be shut down in between successive acquisitions to further lower power consumption.
- New update and get API's added to update and get PTC configuration parameters.
- SAMD21 device family support has been added.
- Improvements done to enable faster touch response time.

Release 5.2 September 2013

Installer builds

GCC
- Atmel Studio Extension release for GCC Compiler
  - QT Touch Composer Studio extension 5.2.0.2027 or later
  - QT Touch Library Studio extension 5.2.0.2077 or later

IAR
- Atmel QT Touch Libraries PTC Part pack 5.0

General Library
Library version 5.0.0

Feature additions
- Self and Mutual capacitance example projects along with libraries have been added to support the ATMEL SAMD20 family of embedded microcontrollers
## Revision History

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<th>Doc Rev.</th>
<th>Date</th>
<th>Comments</th>
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<td>1</td>
<td>18 Sep 2015</td>
<td>Updated with Release 5.7 section.</td>
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<tr>
<td>2</td>
<td>18 Dec 2015</td>
<td>Updated with Release 5.8 section.</td>
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<td>3</td>
<td>13 Jan 2016</td>
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<td>4</td>
<td>17 Feb 2016</td>
<td>Updated with Release 5.9 section. Qtouch Composer section is also added.</td>
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<td>5</td>
<td>1 Apr 2016</td>
<td>Updated with Release 5.9 April release section.</td>
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