Revision	ECO#	Description	Approved	Date
A	N/A	Engineering Release	See ECO	4/26/20

Titus-C Module
Vendor Specific Requirements

Document 099-16692 Titus VSR - LGIT
Version A
April 26, 2020

Authors:

Yazan Alnahhas yalnahhas@apple.com

Michael Miao zhengyu_miao@apple.com

Aaron Cong acong@apple.com

Patrick Lu plu2@apple.com

Table of Contents

About This Document

This document describes the vendor specific requirement used in the Apple Romeo modules.

Audience

This guide assumes you have some familiarity with Apple portable products. This guide is targeted at the module integrator.

Scope

This document describes the integrator specific requirements. These parameters are to be used by whichever product calls this document in its bill of material and is meant to exist in addition to the module ERS; therefore this document cannot be used by itself. This document should be used for Romeo Engineering build.

Auxiliary Documents

Specification	Description
Apple Documents	099-16693 Titus-C Module ERS

Project Specifications

Vendor

LGIT

Part Numbers

Parts revisions

Apple's Agile system and the build matrix should be used to look up component versions and parts numbers.

Project	APN	Plant Code	EEEE	Tick	Benvolio
Titus-C	673-00425	DN8	M9XR	Yes	BNV+

Project	Substrate APN	Config	FOL_ID_R			FOL_ID_EEEE
			Andalusia	Rock	R	
Titus-C	639-08429	03	Lumen-tum+	Kyocera	3	MLFN
		33	Lumen-tum+	Kyocera	3	

Config	Config Byte	R	Andalusia	Rock	Jewel	Beetle	Tick	Benvolio
C**03	0x03	3	Lumentum+	Kyocera	Mektec	HTI	Yes	BNV+
C**33	0x33	Z	Lumentum+	Kyocera	Fujikura	HTI	Yes	BNV+

** For example, for build matrix config C3002, hex value (register 0x11) is 0x02, R code is 2; for C3034, hex value is 0x34, R code is 4, etc.

*** Not all components are defined by “R” code. NVM tracking must be used for all sub-components.

If for any reason, vendor ships parts that come out of a new location, or a configuration different from that listed above, a new Plant Code and EEEER config code will need to be provided by Apple. Changes may not be made without these new codes.

The Plant Code and EEEER code shall be used to determine a unique serial number for each part, which shall be in the form:

PPPYWWDSSSSEEEERV

Where PPP is the plant code, YWWD is the date of manufacture at supplier, SSSS is the sequence number, and EEEER is the config code, and V is the SN checksum. Refer to the ERS for further detail on serial number assignment.

Vendor Specific EEPROM values

OTP Version [7:0]	Value (bin)	Value (hex)
Update AA offset values	0000 0111	0x07

Project [7:4] / Program Variant [3:0]	Value (bin)	Value (hex)
Titus-C	0011 0011	0x33

Integrator [7:3] /Plant [2:0]	Value (bin)	Value (hex)
LGIT Gumi	00001 000	0x08

Andalusia Vendor [7:5] + Version [4:2] + Variant [1:0]					
Vendor	Version	Variant	Apple PN	Value (bin)	Value (hex)
Lumentum	Plus	5,5	056-05281	010 010 00	0x48

Benvolio Vendor [7:5] + Version [4:2] + Variant [1:0]					
Vendor	Version	Variant	Apple PN	Value (bina-ry)	Value (hex)
AMS	Benvolio+ V6	AST2 Bin A	816-02151	001 011 01	0x2D
		AST2 Bin B		001 011 10	0x2E
		AST2 Bin C		001 011 11	0x2F

Midas Vendor [7:5] + Version [4:2] + Variant [1:0]					
Vendor	Version	Variant	Apple PN	Value (bin)	Value (hex)
TSMC	L4.0	Midas A1 v6	816-02390-01 /02	010 010 00	0x48

Substrate Vendor [7:5] + Version [4:2] + Variant [1:0]					
Vendor	Version	Variant	Apple PN	Value (bin)	Value (hex)
Kyocera	POR	-	722-00048	001 001 01	0x25

Rock Vendor [7:5] + Version [4:2] + Variant [1:0]					
Vendor	Version	Variant	Apple PN	Value (bin)	Value (hex)
Kyocera	C4.0	POR	816-01538	001 010 00	0x28

Flex Vendor [7:5] + Version [4:2] + Variant [1:0]					
Vendor	Version	Variant	Apple PN	Value (bin)	Value (hex)
Mektec	revA	POR	632-01931	001 010 00	0x28
Fujikura	revA	POR	632-01931	100 010 00	0x88

Beetle Vendor [7:5] + Version [4:2] + Variant [1:0]					
Vendor	Version	Variant	Apple PN	Value (bin)	Value (hex)
HTI	Beetle+	50um	810-06179-B	010 010 00	0x48

Tick Vendor [7:5] + Version [4:2] + Variant [1:0]					
Vendor	Version	Variant	Apple PN	Value (bin)	Value (hex)
HTI	Tick	V6	810-08189	010 001 01	0x45
HTI	Tick	V7	810-09268	010 010 01	0x49

Tester ID [15:8] + Para/Head ID [7:0]			
Tester	Version	Value (bin)	Value (hex)
FOL	QMC	0000 0001 0000 0001 - 1111 1111 0000 1111	0x01 01-0xFF 0F
1-Step	Direct Imaging	0000 0001 0000 0001 - 1111 1111 0000 0100	0x01 01-0xFF 04
EOL	Direct Imaging	0000 0001 0000 0001 - 1111 1111 0000 0100	0x01 01-0xFF 04
Compliance	HyVision	0000 0001 0000 0001 - 1111 1111 0000 0100	0x01 01-0xFF 04

Midas Attach ID [7:0]			
Tester	Version	Value (bin)	Value (hex)
Midas Passive Attach	Besi	0000 0001 - 1111 1111	0x01-0xFF

AA Offset [7:0]			
Value	Units	Value (Signed binary)	Value (hex)
Z offset as signed integer	Micron	0000 0001 - 1111 1111	0x01-0xFF

Where the first bit in AA Offset sets the sign of the number with “1” indicating negative values. So, [1000 0011 = -3 um] and [0000 0011 = 3um]

Project	Build [7:0]	Value (binary)	Value (hex)
Titus-C	C5.0	0101 0000	0x50
Titus-C	C4.0	0100 0000	0x40
Titus-C	C4.1	0100 0001	0x41
Titus-C	C3.0	0011 0000	0x30
Titus-C	C3.1	0011 0001	0x31
Titus-C	C3.2	0011 0010	0x32
Titus-C	C2.0	0010 0000	0x20
Titus-C	C2.1 (TB & MP)	0010 0001	0x21

Test Software Agorithm Revision [7:0]	Value (binary)	Value (hex)
FOL Test update C3.0	0000 0011	0x03
EOL Test LGIT SW	0000 0100	0x04

Test Software Agorithm Revision [7:0]	Value (binary)	Value (hex)
EOL Test ACE DLL	0000 0100	0x04
Compliance Test update C3.0	0000 0011	0x03

DOE [7:0]	Value (binary)	Value (hex)
No DOE Byte - Cxxxx	0000 0000	0x00
No MiniLizard - CxxxxA	0000 0001	0x01
Burn In - CxxxxB	0000 0010	0x02
CxxxxC	0000 0011	0x03
CxxxxD	0000 0100	0x04
CxxxxE	0000 0101	0x05
CxxxxF	0000 0110	0x06
CxxxxG	0000 0111	0x07
Hot Lot - CxxxxH	0000 1000	0x08
CxxxxJ	0000 1001	0x09
CxxxxK	0000 1010	0x0A
CxxxxL	0000 1011	0x0B
CxxxxM	0000 1100	0x0C
CxxxxN	0000 1101	0x0D
CxxxxP	0000 1110	0x0E
CxxxxQ	0000 1111	0x0F
Rel Config - CxxxxR	0001 0000	0x10
CxxxxS	0001 0001	0x11
CxxxxT	0001 0010	0x12
CxxxxU	0001 0011	0x13
CxxxxV	0001 0100	0x14
Weak Bond - CxxxxW	0001 0101	0x15
CxxxxX	0001 0110	0x16
CxxxxY	0001 0111	0x17
CxxxxZ	0001 1000	0x18

Build Specific Requirements

Specification differences and waivers against the ERS/ECO specification are included in this section.

ERS/MCO Waivers	Build	Configs impacted	Reference Documents	Original Spec/ Description	Waiver/Changes	Future Action
TBD	C5.0	C5000		/	/	/
FAI 7	C4.0	C4033/T	613-11311-02	3.604 ± 0.08	Low Cpk waived	Improved measurement
FAI 22	C4.0	C4033	613-11311-02	0.96 ± 0.087	Low Cpk waived	Improved measurement
FAI 72, 74	C4.0	C4033/T	613-11311-02	0.449 ± 0.12	Low Cpk waived	Align MCO with ERS
FAI 2	C4.0	C4033T	613-11311-02	Max 1.84	Low Cpk waived	Investigate spec relief for standoff overflow
FAI 12	C4.0	C4033T	613-11311-02	1.135 ± 0.100	Low Cpk waived	FA ongoing
FAI 48	C4.0	C4033T	613-11311-02	3.600 ± 0.200	Low Cpk waived	FA ongoing
FAI 65	C4.0	C4033T	613-11311-02	Max 2.740	NG waived	Investigate spec relief (match dimension with D4x)
AST2 bin input	C3.0 onwards	C3.0 onwards	n/a	No bin restrictions specified	Only Bins B and C to be input into main builds. Bin A for focus offset only.	n/a
FAI 22	C3.0 onwards	C3.0 onwards	613-11311-05	0.960 ± 0.087, Cpk > 1.33	0.960 ± 0.087, Cpk > 1.00	Process improvements to increase Cpk
AST2 bin input	5/2020 - 7/2020	5/2020 - 7/2020	n/a	Only Bins B and C to be input into main builds.	Bin A permitted	Reversion to previous rules after this waiver expires

Capacitance Thresholds

Module Configs	Threshold 1	Threshold 2	Threshold 3	Threshold 4	Lock Bit	Arm Status
C5.0	Cap_Mean +800fF	Cap_Mean +131F	Cap_Mean -69fF	Cap_Mean -800fF	4,5,6	Arm_Noread
C4.0	Cap_Mean +800fF	Cap_Mean +131F	Cap_Mean -69fF	Cap_Mean -800fF	4,5,6	Arm_Noread
Test	0xFFFFF	0xFFFFF	0xFFFFF	0xFFFFF	4,5	-

OTP Integrity Check

Parameter	LSL	USL	Notes
OTP Version [7:0]	0x07		
Project [7:4]	0x03		
Program Variant [3:0]	0x03		
Integrator/Plant [7:0]	0x08		
Andalusia Vendor [7:5]	0x02		
Andalusia Version [4:2]	0x02		
Andalusia Variant [1:0]	0x00		
Benvolio Vendor [7:5]	0x01		
Benvolio Version [4:2]	0x03		
Benvolio Variant [1:0]	0x01	0x03	
Midas Vendor [7:5]	0x02		
Midas Version [4:2]	0x02		
Midas Variant [1:0]	0x00		
Substrate Vendor [7:5]	0x01		
Substrate Version [4:2]	0x01		
Substrate Variant [1:0]	0x01		
Rock Vendor [7:5]	0x01		
Rock Version [4:2]	0x02		
Rock Variant [1:0]	0x00		
Flex Vendor [7:5]	0x01	0x04	
Flex Version [4:2]	0x02		
Flex Variant [1:0]	0x00		
Beetle Vendor [7:5]	0x02		
Beetle Version [4:2]	0x02		
Beetle Variant [1:0]	0x00		
Tick Vendor [7:5]	0x02		
Tick Version [4:2]	0x01	0x02	
Tick Variant [1:0]	0x01		
Projector Build [7:0]	0x20	0x50	
General Info Checksum	Must match checksum calculated from respective segment		
NTC/WL Cal Checksum			
Dead Emitter Checksum			
FOL Checksum			
NTC Cal	Must not be zeros		

Change History

Version	Description	Date	By
1	Initial Release	01/29/19	A.Cong
2	• Updated Rock/ Midas+ APN • Corrected R code of 5033 config • Updated nvm map revision description • Include description for AA offset	01/30/19	A.Cong
3	• Correct Midas version name • Correct flex APN	03/07/2019	A.Cong
4	• Update for C4.0 BM • Updated FOL_EEEE_ID	05/07/2019	A.Cong
5	• Waivers for FAI 7, 22, 72, 76	06/07/2019	P. Lu
6	Added new entries to DOE table. OTP Integrity Check table: projector build min/max updated to [0x20 0x50]	06/25/2019	P. Lu
7	Waivers for C4033T	07/03/2019	P. Lu
8	Changed Cpk requirement for FAI22 to 1.00. Added statement restricting usage of Bin A in main builds (only Bins B and C permitted)	8/6/2019	P. Lu
A	Waiver for Bin A input, for the time period ranging from 5/2020 - 7/2020	4/26/2020	P. Lu