

Cypress Semiconductor Automotive Product Qualification Report

QTP# 165103 VERSION *B
May 2019

Automotive PSoC® 4100S Device Family S8PF-10P Technology, Fab25	
CY8C412X CY8C414X	AUTOMOTIVE PROGRAMMABLE SYSTEM-ON-CHIP (PSoC(R))

FOR ANY QUESTIONS ON THIS REPORT, PLEASE CONTACT
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PRODUCT QUALIFICATION HISTORY

Qual Report	Description of Qualification Purpose	Date Comp
165103	Qualification of Automotive PSoC® 4100S Device Family S8PF-10P Technology, Fab25	May 17

PRODUCT DESCRIPTION (for qualification)	
Qualification of Automotive PSoC® 4100S Device Family S8PF-10P Technology, Fab25	
Marketing Part #:	CY8C412X / CY8C414X
Device Description:	Automotive PSOC Programmable System – On – Chip
Cypress Division:	Cypress Semiconductor Corporation – MCU and Connectivity Division(MCD)

TECHNOLOGY/FAB PROCESS DESCRIPTION			
Number of Metal Layers:	Proprietary	Metal Composition:	Proprietary
Passivation Type and Materials:	Proprietary		
Generic Process Technology/Design Rule (□-drawn):	Proprietary		
Gate Oxide Material/Thickness (MOS):	Proprietary		
Name/Location of Die Fab (prime) Facility:	Fab25, Austin Texas		
Die Fab Line ID/Wafer Process ID:	S8PF-10P		

PACKAGE AVAILABILITY

PACKAGE	ASSEMBLY FACILITY SITE	QTP NUMBER
28-Lead SSOP (209mils)	OSE-Taiwan (T)	165105
28-Lead SSOP (209mils)	CML-Philippines (RA)	180909
40-Pin QFN (6x6x0.6mm)	ASEK-Taiwan (G)	171301

MAJOR PACKAGE INFORMATION USED IN THIS QUALIFICATION	
Package Designation:	SP28
Package Outline, Type, or Name:	28-Lead SSOP 209mils
Mold Compound Name/Manufacturer:	G631 / Sumitomo
Mold Compound Flammability Rating:	V-0
Mold Compound Alpha Emission Rate:	N/A (Not low alpha mold compound)
Oxygen Rating Index: >28%	54%
Lead Frame Designation:	Full Metal Pad
Lead Frame Material:	Copper
Substrate Material:	N/A
Lead Finish, Composition / Thickness:	Pure Sn
Die Backside Preparation Method/Metallization:	Backgrind
Die Separation Method:	Wafer Saw
Die Attach Supplier:	Sumitomo
Die Attach Material:	CRM-1076
Bond Diagram Designation	002-16532
Wire Bond Method:	Thermosonic
Wire Material/Size:	Au / 0.8mil
Thermal Resistance Theta JA °C/W:	63
Package Cross Section Yes/No:	Yes
Assembly Process Flow:	49-35999M
Name/Location of Assembly (prime) facility:	OSE-Taiwan (T)
MSL LEVEL	3
REFLOW PROFILE	260C

ELECTRICAL TEST / FINISH DESCRIPTION	
Test Location:	CML-R, ASEK-Taiwan (G)

Note: Please contact a Cypress Representative for other packages availability.

RELIABILITY TESTS PERFORMED PER SPECIFICATION REQUIREMENT

Stress/Test	Test Condition (Temp/Bias)	Result P/F
High Temperature Operating Life Early Failure Rate	AEC-Q100-008 and JESD22-A108, 150°C Dynamic Operating Condition, Vcc Max = 2.07V	P
NVM Endurance /High Temperature Operating Life Latent Failure Rate	AEC-Q100-005 and JESD22-A108, 150°C Dynamic Operating Condition, Vcc Max = 2.07V	P
High Accelerated Saturation Test (HAST)	JESD22-A110, 130C, 5.5V, 85%RH Precondition: JESD22-A113 Moisture Sensitivity MSL 3 192 Hrs, 30C/60%RH+3IR-Reflow, 260°C+0, -5°C	P
Temperature Cycle	JESD22-A104, -65°C to 150°C Precondition: JESD22-A113 Moisture Sensitivity MSL 3 192 Hrs, 30C/60%RH+3IR-Reflow, 260°C+0, -5°C	P
Pressure Cooker	JESD22-A102, 121C, 100%RH, 15 Psig Precondition: JESD22-A113 Moisture Sensitivity MSL 3 192 Hrs, 30C/60%RH+3IR-Reflow, 260°C+0, -5°C	P
Electrostatic Discharge Human Body Model (ESD-HBM)	AEC-Q100-002 500V/1000V/2000V	P
Electrostatic Discharge Charge Device Model (ESD-CDM)	AEC-Q100-011 250V/500V/750V (Corner Pins)	P
Wire Ball Shear	AEC-Q100-001	P
Electrical Distribution	AEC-Q100-009	P
Final Visual	JESD22-B101B	P
Endurance/Data Retention	AEC-Q100-005, 150C, non-biased	P
Constructional Analysis	Criteria: Meet external and internal characteristics of Cypress package	P
Acoustic Microscopy	JEDEC JSTD-020 Precondition: JESD22-A113 Moisture Sensitivity MSL 3 192 Hrs, 30C/60%RH+3IR-Reflow, 260°C+0, -5°C	P
Static Latch-up	AEC-Q100-004, 125C,± 100mA	P
Post Temperature Cycle Wire Bond Pull	Mil-Std 883, Method 2011	P

RELIABILITY FAILURE RATE SUMMARY

Stress/Test	Device Tested/ Device Hours	# Fails	Activation Energy	Thermal AF ³	Failure Rate
High Temperature Operating Life Early Failure Rate	14,362 Devices	0	N/A	N/A	0 PPM
High Temperature Operating Life ^{1,2} Long Term Failure Rate	199,512 Device Hours	0	0.7	170	27 FIT

¹ Assuming an ambient temperature of 55°C and a junction temperature rise of 15°C.

² Chi-squared 60% estimations used to calculate the failure rate..

³ Thermal Acceleration Factor is calculated from the Arrhenius equation

$$AF = \exp \left[\frac{E_A}{k} \left[\frac{1}{T_2} - \frac{1}{T_1} \right] \right]$$

where:

E_A =The Activation Energy of the defect mechanism.

K = Boltzmann's constant = 8.62x10⁻⁵ eV/Kelvin.

T₁ is the junction temperature of the device under stress and T₂ is the junction temperature of the device at use conditions.



Reliability Test Data

QTP #: 165103

<i>Device</i>	<i>Package</i>	<i>Fab Lot #</i>	<i>Assy Lot #</i>	<i>Assy Loc</i>	<i>Duration</i>	<i>Samp</i>	<i>Rej</i>	<i>Failure Mechanism</i>
STRESS: ACOUSTIC, MSL3								
CY8C4146PVE (8A41007AB)	SP28	3643016	611641371	OSE-T	COMP	22	0	
CY8C4146PVE (8A41007AB)	SP28	3637043	611641369	OSE-T	COMP	22	0	
CY8C4146PVE (8A41007AB)	SP28	3646044	611642902	OSE-T	COMP	22	0	
STRESS: BALL SHEAR								
CY8C4146PVE (8A41007AB)	SP28	3643016	611641371	OSE-T	COMP	150	0	
CY8C4146PVE (8A41007AB)	SP28	3639020	611641370	OSE-T	COMP	150	0	
CY8C4146PVE (8A41007AB)	SP28	3637043	611641369	OSE-T	COMP	150	0	
CY8C4146PVE (8A41007AB)	SP28	3646044	611642902	OSE-T	COMP	150	0	
STRESS: BOND PULL								
CY8C4146PVE (8A41007AB)	SP28	3643016	611641371	OSE-T	COMP	150	0	
CY8C4146PVE (8A41007AB)	SP28	3639020	611641370	OSE-T	COMP	150	0	
CY8C4146PVE (8A41007AB)	SP28	3637043	611641369	OSE-T	COMP	150	0	
CY8C4146PVE (8A41007AB)	SP28	3646044	611642902	OSE-T	COMP	150	0	
STRESS: CONSTRUCTIONAL ANALYSIS								
CY8C4146PVE (8A41007AB)	SP28	3643016	611641371	OSE-T	COMP	5	0	
CY8C4146PVE (8A41007AB)	SP28	3639020	611641370	OSE-T	COMP	5	0	
CY8C4146PVE (8A41007AB)	SP28	3637043	611641369	OSE-T	COMP	5	0	
STRESS: DIE SHEAR								
CY8C4146PVE (8A41007AB)	SP28	3643016	611641371	OSE-T	COMP	15	0	
CY8C4146PVE (8A41007AB)	SP28	3639020	611641370	OSE-T	COMP	15	0	
CY8C4146PVE (8A41007AB)	SP28	3637043	611641369	OSE-T	COMP	15	0	
CY8C4146PVE (8A41007AB)	SP28	3646044	611642902	OSE-T	COMP	15	0	
STRESS: DYE PENETRANT								
CY8C4146PVE (8A41007AB)	SP28	3643016	611641371	OSE-T	COMP	15	0	
CY8C4146PVE (8A41007AB)	SP28	3639020	611641370	OSE-T	COMP	15	0	
CY8C4146PVE (8A41007AB)	SP28	3637043	611641369	OSE-T	COMP	15	0	



Reliability Test Data

QTP #: 165103

Device Package Fab Lot # Assy Lot # Assy Loc Duration Samp Rej Failure Mechanism

STRESS: HIGH TEMP DYNAMIC OPERATING LIFE-EARLY FAILURE RATE, 150C, 2.07V, Vcc Max

CY8C4146PVE (8A41007AB)	SP28	3643016	611641371	OSE-T	48	856	0
CYAT81688 (8A206802BB)	AZ0A	3629023	611627389	ASEK-G	48	3333	0
CYAT81688 (8A206802BB)	AZ0A	3632047	611630353	ASEK-G	48	3379	0
CYAT81688 (8A206802BB)	AZ0A	3634008	611631857	ASEK-G	48	3395	0
CYAT81688 (8A206802BB)	AZ0A	3636050	611644750	ASEK-G	48	3399	0

STRESS: ELECTRICAL DISTRIBUTION

CY8C4146PVE (8A41007AB)	SP28	3643016	611641371	OSE-T	COMP	30	0
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STRESS: ENDURANCE / DATA RETENTION

CY8C4146PVE (8A41007AB)	SP28	3643016	611641371	OSE-T	1000	78	0
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STRESS: ENDURANCE / HIGH TEMP DYNAMIC OPERATING LIFE-LATENT FAILURE RATE, 150C, 2.07V, Vcc Max

CY8C4146PVE (8A41007AB)	SP28	3643016	611641371	OSE-T	408	80	0
CY8C4146PVE (8A41007AB)	SP28	3639020	611641370	OSE-T	408	50	0
CY8C4146PVE (8A41007AB)	SP28	3637043	611641369	OSE-T	408	30	0
CY8C4146PVE (8A41007AB)	SP28	3646044	611642902	OSE-T	408	79	0
CYAT81688 (8A206802BB)	AZ0A	3629023	611627389	ASEK-G	408	80	0
CYAT81688 (8A206802BB)	AZ0A	3632047	611630353	ASEK-G	408	90	0
CYAT81688 (8A206802BB)	AZ0A	3634008	611631857	ASEK-G	408	80	0

STRESS: ESD-CHARGE DEVICE MODEL

CY8C4146PVE (8A41007AB)	SP28	3643016	611641371	OSE-T	250	3	0
CY8C4146PVE (8A41007AB)	SP28	3643016	611641371	OSE-T	500	3	0
CY8C4146PVE (8A41007AB)	SP28	3643016	611641371	OSE-T	750	3	0

STRESS: ESD-HUMAN BODY CIRCUIT PER JESD22-A114-B

CY8C4146PVE (8A41007AB)	SP28	3643016	611641371	OSE-T	500	3	0
CY8C4146PVE (8A41007AB)	SP28	3643016	611641371	OSE-T	1000	3	0
CY8C4146PVE (8A41007AB)	SP28	3643016	611641371	OSE-T	2000	3	0



Reliability Test Data

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<i>Device</i>	<i>Package</i>	<i>Fab Lot #</i>	<i>Assy Lot #</i>	<i>Assy Loc</i>	<i>Duration</i>	<i>Samp</i>	<i>Rej</i>	<i>Failure Mechanism</i>
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STRESS: FINAL VISUAL INSPECTION

CY8C4146PVE (8A41007AB)	SP28	3643016	611641371	OSE-T	COMP	3877	0	
CY8C4146PVE (8A41007AB)	SP28	3639020	611641370	OSE-T	COMP	1598	0	
CY8C4146PVE (8A41007AB)	SP28	3637043	611641369	OSE-T	COMP	780	0	
CY8C4146PVE (8A41007AB)	SP28	3646044	611642902	OSE-T	COMP	3855	0	

STRESS: HI-ACCEL SATURATION TEST, 130C, 5.5V, 85%RH, PRE COND 192 HR 30C/60%RH, MSL3

CY8C4146PVE (8A41007AB)	SP28	3643016	611641371	OSE-T	96	80	0	
CY8C4146PVE (8A41007AB)	SP28	3637043	611641369	OSE-T	96	80	0	
CY8C4146PVE (8A41007AB)	SP28	3646044	611642902	OSE-T	96	80	0	

STRESS: LEAD INTEGRITY

CY8C4146PVE (8A41007AB)	SP28	3643016	611641371	OSE-T	COMP	5	0	
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STRESS: PRESSURE COOKER TEST

CY8C4146PVE (8A41007AB)	SP28	3643016	611641371	OSE-T	96	80	0	
CY8C4146PVE (8A41007AB)	SP28	3643016	611641371	OSE-T	168	80	0	
CY8C4146PVE (8A41007AB)	SP28	3637043	611641369	OSE-T	96	80	0	
CY8C4146PVE (8A41007AB)	SP28	3637043	611641369	OSE-T	168	80	0	
CY8C4146PVE (8A41007AB)	SP28	3646044	611642902	OSE-T	96	80	0	
CY8C4146PVE (8A41007AB)	SP28	3646044	611642902	OSE-T	168	80	0	

STRESS: PHYSICAL DIMENSION

CY8C4146PVE (8A41007AB)	SP28	3643016	611641371	OSE-T	COMP	10	0	
CY8C4146PVE (8A41007AB)	SP28	3639020	611641370	OSE-T	COMP	10	0	
CY8C4146PVE (8A41007AB)	SP28	3637043	611641369	OSE-T	COMP	10	0	
CY8C4146PVE (8A41007AB)	SP28	3646044	611642902	OSE-T	COMP	10	0	

STRESS: POST TCT BOND PULL

CY8C4146PVE (8A41007AB)	SP28	3643016	611641371	OSE-T	500	5	0	
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STRESS: PRE/POST LFR CRITICAL PARAMETERS

CY8C4146PVE (8A41007AB)	SP28	3643016	611641371	OSE-T	COMP	30	0	
CY8C4146PVE (8A41007AB)	SP28	3639020	611641370	OSE-T	COMP	30	0	
CY8C4146PVE (8A41007AB)	SP28	3646044	611642902	OSE-T	COMP	30	0	



Reliability Test Data

QTP #: 165103

<i>Device</i>	<i>Package</i>	<i>Fab Lot #</i>	<i>Assy Lot #</i>	<i>Assy Loc</i>	<i>Duration</i>	<i>Samp</i>	<i>Rej</i>	<i>Failure Mechanism</i>
STRESS: STATIC LATCH-UP (+/-100mA 125C)								
CY8C4146PVE (8A41007AB)	SP28	3643016	611641371	OSE-T	COMP	6	0	
STRESS: SOLDERABILITY								
CY8C4146PVE (8A41007AB)	SP28	3643016	611641371	OSE-T	COMP	15	0	
CY8C4146PVE (8A41007AB)	SP28	3639020	611641370	OSE-T	COMP	15	0	
CY8C4146PVE (8A41007AB)	SP28	3637043	611641369	OSE-T	COMP	15	0	
STRESS: TC COND. C -65C TO 150C, PRECONDITION 192 HRS 30C/60%RH								
CY8C4146PVE (8A41007AB)	SP28	3643016	611641371	OSE-T	500	85	0	
CY8C4146PVE (8A41007AB)	SP28	3643016	611641371	OSE-T	1000	80	0	
CY8C4146PVE (8A41007AB)	SP28	3637043	611641369	OSE-T	500	80	0	
CY8C4146PVE (8A41007AB)	SP28	3637043	611641369	OSE-T	1000	80	0	
CY8C4146PVE (8A41007AB)	SP28	3646044	611642902	OSE-T	500	80	0	
CY8C4146PVE (8A41007AB)	SP28	3646044	611642902	OSE-T	1000	80	0	
STRESS: X-RAY								
CY8C4146PVE (8A41007AB)	SP28	3643016	611641371	OSE-T	COMP	15	0	
CY8C4146PVE (8A41007AB)	SP28	3639020	611641370	OSE-T	COMP	15	0	
CY8C4146PVE (8A41007AB)	SP28	3637043	611641369	OSE-T	COMP	15	0	
CY8C4146PVE (8A41007AB)	SP28	3646044	611642902	OSE-T	COMP	15	0	



Document History Page

Document Title: QTP#165103: Automotive PSoC 4100S Device Family S8PF-10P Technology, Fab25
Document Number: 002-19956

Rev.	ECN No.	Orig. of Change	Description of Change
**	5766244	HSTO	Initial spec release
*A	6298813	HSTO	Added "28-lead SSOP and 40-Pin QFN" package option in the package availability table
*B	6564313	HSTO	Added ASEK-Taiwan (G) as Test Site