

PCN Number:	20241119005.2	PCN Date:	November 20, 2024		
Title:	Qualification of RFAB using qualified Process Technology, Die Revision, and additional Assembly/Test Site & BOM options for select devices				
Customer Contact:	Change Management team	Dept:	Quality Services		
Proposed 1st Ship Date:	May 19, 2025	Sample requests accepted until:	December 20, 2024*		
*Sample requests received after December 20, 2024 will not be supported.					
Change Type:					
<input checked="" type="checkbox"/> Assembly Site	<input checked="" type="checkbox"/> Design	<input type="checkbox"/>	Wafer Bump Material		
<input checked="" type="checkbox"/> Assembly Process	<input type="checkbox"/> Data Sheet	<input type="checkbox"/>	Wafer Bump Process		
<input checked="" type="checkbox"/> Assembly Materials	<input type="checkbox"/> Part number change	<input checked="" type="checkbox"/>	Wafer Fab Site		
<input type="checkbox"/> Mechanical Specification	<input checked="" type="checkbox"/> Test Site	<input checked="" type="checkbox"/>	Wafer Fab Materials		
<input checked="" type="checkbox"/> Packing/Shipping/Labeling	<input type="checkbox"/> Test Process	<input checked="" type="checkbox"/>	Wafer Fab Process		
PCN Details					
Description of Change:					
Texas Instruments is pleased to announce the addition of RFAB using the TIB qualified process technology, die change and additional Assembly/Test site (MLA), and BOM options for the devices listed below.					
Current Fab Site			Additional Fab Site		
Current Fab Site	Process	Wafer Diameter	Additional Fab Site	Process	Wafer Diameter
SFAB	J11	150 mm	RFAB	TIB	300 mm
The die was also changed as a result of the process change.					
Construction differences are as follows:					
Current:			New:		
Probe Test	SFAB		None		
Group 1					
	FMX		MLA		
Wire diam/type	1.0mil Cu		0.8mil Cu		
Group 2					
	Current		Proposed		
Wire diam/type	0.96mil Au		0.8mil Cu		
Marking differences	<div style="border: 1px solid black; padding: 5px; display: inline-block;"> O \TI/ YM RC4580Q </div>		<div style="border: 1px solid black; padding: 5px; display: inline-block;"> O YML R4580Q (CAV ID) </div>		
Test coverage, insertions, conditions will remain consistent with current testing.					
Qual details are provided in the Qual Data Section.					
Reason for Change:					
These changes are part of our multiyear plan to transition products from our 150-millimeter and 200-millimeter factories to newer, more efficient manufacturing processes and technologies, underscoring our commitment to product longevity and supply continuity.					
Anticipated impact on Form, Fit, Function, Quality or Reliability (positive / negative):					
None					

Impact on Environmental Ratings:

Checked boxes indicate the status of environmental ratings following implementation of this change. If below boxes are checked, there are no changes to the associated environmental ratings.

RoHS	REACH	Green Status	IEC 62474
<input checked="" type="checkbox"/> No Change			

Changes to product identification resulting from this PCN:**Fab Site Information:**

Chip Site	Chip Site Origin Code (20L)	Chip Site Country Code (21L)	Chip Site City
SH-BIP-1	SHE	USA	Sherman
RFAB	RFB	USA	Richardson

Die Rev:

Current	New
Die Rev [2P] A	Die Rev [2P] A

Assembly/Test Site Information:

Assembly Site	Assembly Site Origin (22L)	Assembly Country Code (23L)	Assembly City
TI Mexico	MEX	MEX	Aguascalientes
MLA	MLA	MYS	Kuala Lumpur

Sample product shipping label (not actual product label)

Group 1 Product Affected:

RC4580QDRQ1

Group 2 Product Affected:

RC4580QPWRQ1

For alternate parts with similar or improved performance, please visit the product page on TI.com

Automotive Qualification Summary
(As per AEC-Q100 Rev. J and JEDEC Guidelines)

RC4580QDRQ1 AEC Q100J Grade-1 Qualification
Approve Date 21-October-2024

Product Attributes

Attributes	Qual Device: <u>RC4580QDRQ1</u>	QBS Process, Product Reference: <u>LM2902BQPWRQ1</u>	QBS Package Reference: <u>LM2903BQDRQ1</u>	QBS Package Reference: <u>OPA2991QDRQ1</u>	QBS Product Reference: <u>RC4580IPWR</u>
Automotive Grade Level	Grade 1	Grade 1	Grade 1	Grade 1	-
Operating Temp Range (C)	-40 to 125	-40 to 125	-40 to 125	-40 to 125	-40 to 125
Product Function	Signal Chain	Signal Chain	Signal Chain	Signal Chain	-
Wafer Fab Supplier	RFAB	RFAB	CFAB	RFAB	RFAB
Assembly Site	MLA	MLA	MLA	MLA	MLA
Package Group	SOIC	TSSOP	SOIC	SOIC	TSSOP
Package Designator	D	PW	D	D	PW
Pin Count	8	14	8	8	8

- QBS: Qual By Similarity, also known as Generic Data
- Qual Device RC4580QDRQ1 is qualified at MSL1 260C

Qualification Results

Data Displayed as: Number of lots / Total sample size / Total failed

Type	#	Test Spec	Min Lot Qty	SS / Lot	Test Name	Condition	Duration	Qual Device: <u>RC4580QDRQ1</u>	QBS Process, Product Reference: <u>LM2902BQPWRQ1</u>	QBS Package Reference: <u>LM2903BQDRQ1</u>	QBS Package Reference: <u>OPA2991QDRQ1</u>
Test Group A - Accelerated Environment Stress Tests											
PC	A1	JEDEC J-STD-020 JESD22-A113	3	77	Preconditioning	MSL1 260C	-	1/Pass	3/Pass	3/924/0	3/924/0
HAST	A2	JEDEC JESD22-A110	3	77	Biased HAST	130C/85%RH	96 Hours	1/77/0	3/231/0	3/231/0	3/231/0
AC/UHAST	A3	JEDEC JESD22-A102/JEDEC JESD22-A118	3	77	Unbiased HAST	110C/85%RH	264 Hours	-	3/231/0	-	-
AC/UHAST	A3	JEDEC JESD22-A102/JEDEC JESD22-A118	3	77	Unbiased HAST	130C/85%RH	96 Hours	1/77/0	-	3/231/0	3/231/0
TC	A4	JEDEC JESD22-A104 and Appendix 3	3	77	Temperature Cycle	-65C/150C	500 Cycles	1/77/0	3/231/0	3/231/0	3/231/0
TC-BP	A4	MIL-STD883 Method 2011	1	5	Post Temp Cycle Bond Pull	-	-	1/5/0	-	-	1/5/0
HTSL	A6	JEDEC JESD22-A103	1	45	High Temperature Storage Life	150C	1000 Hours	-	3/231/0	3/135/0	3/135/0
HTSL	A6	JEDEC JESD22-A103	1	45	High Temperature Storage Life	175C	500 Hours	1/45/0	-	-	-
Test Group B - Accelerated Lifetime Simulation Tests											

Type	#	Test Spec	Min Lot Qty	SS / Lot	Test Name	Condition	Duration	Qual Device: RC4580QDRQ1	QBS Process, Product Reference: LM2902BQPWRQ1	QBS Package Reference: LM2903BODRO1	QBS Package Reference: OPA2991ODRO1
HTOL	B1	JEDEC JESD22-A108	3	77	Life Test	150C	300 Hours	1/77/0	-	1/77/0	-
HTOL	B1	JEDEC JESD22-A108	3	77	Life Test	150C	408 Hours	-	3/231/0	-	1/77/1 ¹
ELFR	B2	AEC Q100-008	3	800	Early Life Failure Rate	125C	48 Hours	-	3/2400/0	1/800/0	-
Test Group C - Package Assembly Integrity Tests											
WBS	C1	AEC Q100-001	1	30	Wire Bond Shear	Minimum of 5 devices, 30 wires Cpk>1.67	Wires	1/30/0	3/90/0	3/90/0	3/90/0
WBP	C2	MIL-STD883 Method 2011	1	30	Wire Bond Pull	Minimum of 5 devices, 30 wires Cpk>1.67	Wires	1/30/0	3/90/0	3/90/0	3/90/0
SD	C3	JEDEC J-STD-002	1	15	PB Solderability	>95% Lead Coverage	-	-	-	1/15/0	-
SD	C3	JEDEC J-STD-002	1	15	PB-Free Solderability	>95% Lead Coverage	-	-	-	1/15/0	-
PD	C4	JEDEC JESD22-B100 and B108	3	10	Physical Dimensions	Cpk>1.67	-	1/10/0	3/30/0	3/30/0	3/30/0
Test Group D - Die Fabrication Reliability Tests											
EM	D1	JESD61	-	-	Electromigration	-	-	Completed Per Process Technology Requirements	Completed Per Process Technology Requirements	Completed Per Process Technology Requirements	Completed Per Process Technology Requirements
TDDB	D2	JESD35	-	-	Time Dependent Dielectric Breakdown	-	-	Completed Per Process Technology Requirements	Completed Per Process Technology Requirements	Completed Per Process Technology Requirements	Completed Per Process Technology Requirements
Type	#	Test Spec	Min Lot Qty	SS / Lot	Test Name	Condition	Duration	Qual Device: RC4580QDRQ1	QBS Process, Product Reference: LM2902BQPWRQ1	QBS Package Reference: LM2903BODRO1	QBS Package Reference: OPA2991ODRO1
HCI	D3	JESD60 & 28	-	-	Hot Carrier Injection	-	-	Completed Per Process Technology Requirements	Completed Per Process Technology Requirements	Completed Per Process Technology Requirements	Completed Per Process Technology Requirements
BTI	D4	-	-	-	Bias Temperature Instability	-	-	Completed Per Process Technology Requirements	Completed Per Process Technology Requirements	Completed Per Process Technology Requirements	Completed Per Process Technology Requirements
SM	D5	-	-	-	Stress Migration	-	-	Completed Per Process Technology Requirements	Completed Per Process Technology Requirements	Completed Per Process Technology Requirements	Completed Per Process Technology Requirements
Test Group E - Electrical Verification Tests											
ESD	E2	AEC Q100-002	1	3	ESD HBM	-	2000 Volts	1/3/0	3/9/0	1/3/0	1/3/0
ESD	E3	AEC Q100-011	1	3	ESD CDM	-	1500 Volts	1/3/0	3/9/0	1/3/0	1/3/0
ESD	E3	AEC Q100-011	1	3	ESD CDM	-	500 Volts	1/3/0	-	1/3/0	1/3/0
LU	E4	AEC Q100-004	1	3	Latch-Up	Per AEC Q100-004	-	1/3/0	3/18/0	1/6/0	1/6/0
ED	E5	AEC Q100-009	3	30	Electrical Distributions	Cpk>1.67 Room, hot, and cold	-	1/30/0	3/90/0	3/90/0	3/90/0
Additional Tests											

- Preconditioning was performed for Autoclave, Unbiased HAST, THB/Biased HAST, Temperature Cycle, Thermal Shock, and HTSL, as applicable
- The following are equivalent HTOL options based on an activation energy of 0.7eV : 125C/1k Hours, 140C/480 Hours, 150C/300 Hours, and 155C/240 Hours
- The following are equivalent HTSL options based on an activation energy of 0.7eV : 150C/1k Hours, and 170C/420 Hours
- The following are equivalent Temp Cycle options per JESD47 : -55C/125C/700 Cycles and -65C/150C/500 Cycles

Ambient Operating Temperature by Automotive Grade Level:

- Grade 0 (or E): -40C to +150C
- Grade 1 (or Q): -40C to +125C
- Grade 2 (or T): -40C to +105C
- Grade 3 (or I) : -40C to +85C

E1 (TEST): Electrical test temperatures of Qual samples (High temperature according to Grade level):

- Room/Hot/Cold : HTOL, ED
- Room/Hot : THB / HAST, TC / PTC, HTSL, ELFR, ESD & LU
- Room : AC/uHAST

Quality and Environmental data is available at TI's external Web site: <http://www.ti.com/>

TI Qualification ID: R-NPD-2309-066

[1]- Rejects mixed back in with tested good units

TI Information
Selective Disclosure

Automotive Qualification Summary (As per AEC and JEDEC Guidelines)

Q006 SOIC at MLA
Approve Date 21-October-2024

Attributes	Qual Device: <u>RC4580QDRQ1</u>	QBS Process, Product Reference: <u>LM2902BQPWRQ1</u>	QBS Package Reference: <u>LM2903BQDRQ1</u>	QBS Package Reference: <u>OPA2991QDRQ1</u>	QBS Product Reference: <u>RC4580IPWR</u>
Automotive Grade Level	Grade 1	Grade 1	Grade 1	Grade 1	-
Operating Temp Range (C)	-40 to 125	-40 to 125	-40 to 125	-40 to 125	-40 to 125
Product Function	Signal Chain	Signal Chain	Signal Chain	Signal Chain	-
Wafer Fab Supplier	RFAB	RFAB	CFAB	RFAB	RFAB
Assembly Site	MLA	MLA	MLA	MLA	MLA
Package Group	SOIC	TSSOP	SOIC	SOIC	TSSOP
Package Designator	D	PW	D	D	PW
Pin Count	8	14	8	8	8

Qualification Results

Data Displayed as: Number of lots / Total sample size / Total failed

Type	#	Test Spec	Min Lot Qty	SS / Lot	Test Name	Condition	Duration	Qual Device: RC4580QDRQ1	QBS Reference: LM2902BQPWRQ1	QBS Reference: LM2903BQDRQ1	QBS Reference: OPA2991QDRQ1
Test Group A - Accelerated Environment Stress Tests											
PC	A1	JEDEC J-STD-020 JESD22-A113	3	77	Preconditioning	MSL1 260C	-	-	3/Pass	3/924/0	3/924/0
PC	A1.1	-	3	22	SAM Precon Pre	Review for delamination	-	-	-	3/66/0	3/66/0
PC	A1.2	-	3	22	SAM Precon Post	Review for delamination	-	-	-	3/66/0	3/66/0
HAST	A2.1	JEDEC JESD22-A110	3	77	Biased HAST	130C/85%RH	96 Hours	-	-	3/231/0	3/231/0
HAST	A2.1.2	-	3	1	Cross Section, post bHAST, 1X	Post stress cross section	Completed	-	-	3/3/0	3/3/0
HAST	A2.1.3	-	3	3	Wire Bond Shear, post bHAST, 1X	Post stress	-	-	-	3/9/0	3/9/0
HAST	A2.1.4	-	3	3	Bond Pull over Stitch, post bHAST, 1X	Post stress	-	-	-	3/9/0	3/9/0
HAST	A2.1.5	-	3	3	Bond Pull over Ball, post bHAST, 1X	Post stress	-	-	-	3/9/0	3/9/0
HAST	A2.2	JEDEC JESD22-A110	3	70	Biased HAST	130C/85%RH	192 Hours	-	-	3/231/0	3/231/0
HAST	A2.2.1	-	3	22	SAM Analysis, post bHAST 2X	Review for delamination	Completed	-	-	3/66/0	3/66/0
HAST	A2.2.2	-	3	1	Cross Section, post bHAST, 2X	Post stress cross section	Completed	-	-	3/3/0	3/3/0
HAST	A2.2.3	-	3	3	Wire Bond Shear, post bHAST, 2X	Post stress	-	-	-	3/9/0	3/9/0
HAST	A2.2.4	-	3	3	Bond Pull over Stitch, post bHAST, 2X	Post stress	-	-	-	3/9/0	3/9/0
HAST	A2.2.5	-	3	3	Bond Pull over Ball, post bHAST, 2X	Post stress	-	-	-	3/9/0	3/9/0
TC	A4.1	JEDEC JESD22-A104 and Appendix 3	3	77	Temperature Cycle	-65C/150C	500 Cycles	-	3/231/0	3/231/0	3/231/0
TC	A4.1.1	-	3	22	SAM Analysis, post TC 1X	Review for delamination	Completed	-	3/66/0	3/66/0	3/66/0
TC	A4.1.2	-	3	1	Cross Section, post TC, 1X	Post stress cross section	Completed	-	3/3/0	3/3/0	3/3/0
TC	A4.1.3	-	3	3	Wire Bond Shear, post TC, 1X	Post stress	-	-	3/9/0	3/9/0	3/9/0
TC	A4.1.4	-	3	3	Bond Pull over Stitch, post TC, 1X	Post stress	-	-	3/9/0	3/9/0	3/9/0
TC	A4.1.5	-	3	3	Bond Pull over Ball, post TC, 1X	Post stress	-	-	3/9/0	3/9/0	3/9/0
TC	A4.2	JEDEC JESD22-A104 and Appendix 3	3	70	Temperature Cycle	-65C/150C	1000 Cycles	-	3/231/0	3/231/0	3/231/0
TC	A4.2.1	-	3	22	SAM Analysis, post TC, 2X	Review for delamination	Completed	-	3/66/0	3/66/0	3/66/0
TC	A4.2.2	-	3	1	Cross Section, post TC, 2X	Post stress cross section	Completed	-	3/3/0	3/3/0	3/3/0

Type	#	Test Spec	Min Lot Qty	SS / Lot	Test Name	Condition	Duration	Qual Device: RC4580QDRQ1	QBS Reference: LM2902BQPWRQ1	QBS Reference: LM2903BQDRQ1	QBS Reference: OPA2991QDRQ1
TC	A4.2.3	-	3	3	Wire Bond Shear, post TC, 2X	Post stress	-	-	3/9/0	3/9/0	3/9/0
TC	A4.2.4	-	3	3	Bond Pull over Stitch, post TC, 2X	Post stress	-	-	3/9/0	3/9/0	3/9/0
TC	A4.2.5	-	3	3	Bond Pull over Ball, post TC, 2X	Post stress	-	-	3/9/0	3/9/0	3/9/0
HTSL	A6.1	JEDEC JESD22-A103	3	45	High Temperature Storage Life	150C	1000 Hours	-	-	3/135/0	3/135/0
HTSL	A6.1.1	-	3	1	Cross Section, post HTSL, 1X	Post stress cross section	Completed	-	-	3/3/0	3/3/0
HTSL	A6.2	JEDEC JESD22-A103	3	44	High Temperature Storage Life	150C	2000 Hours	-	-	3/135/0	3/135/0
HTSL	A6.2.1	-	3	1	Cross Section, post HTSL, 2X	Post stress cross section	Completed	-	-	3/3/0	3/3/0
Test Group C - Package Assembly Integrity Tests											
WBS	C1	AEC Q100-001	1	30	Wire Bond Shear	Minimum of 5 devices, 30 wires Cpk>1.67	Wires	1/30/0	3/90/0	3/90/0	3/90/0
WBP	C2	MIL-STD883 Method 2011	1	30	Wire Bond Pull	Minimum of 5 devices, 30 wires Cpk>1.67	Wires	1/30/0	3/90/0	3/90/0	3/90/0

- QBS: Qual By Similarity, also known as Generic Data
- Qual Device RC4580QDRQ1 is qualified at MSL1 260C

- Preconditioning was performed for Autoclave, Unbiased HAST, THB/Biased HAST, Temperature Cycle, Thermal Shock, and HTSL, as applicable
- The following are equivalent HTOL options based on an activation energy of 0.7eV : 125C/1k Hours, 140C/480 Hours, 150C/300 Hours, and 155C/240 Hours
- The following are equivalent HTSL options based on an activation energy of 0.7eV : 150C/1k Hours, and 170C/420 Hours

- The following are equivalent Temp Cycle options per JESD47 : -55C/125C/700 Cycles and -65C/150C/500 Cycles

Ambient Operating Temperature by Automotive Grade Level:

- Grade 0 (or E): -40C to +150C
- Grade 1 (or Q): -40C to +125C
- Grade 2 (or T): -40C to +105C
- Grade 3 (or I) : -40C to +85C

E1 (TEST): Electrical test temperatures of Qual samples (High temperature according to Grade level):

- Room/Hot/Cold : HTOL, ED
- Room/Hot : THB / HAST, TC / PTC, HTSL, ELFR, ESD & LU
- Room : AC/uHAST

Quality and Environmental data is available at TI's external Web site: <http://www.ti.com/>

TI Qualification ID: R-NPD-2309-066

Automotive Qualification Summary
(As per AEC-Q100 Rev. J and JEDEC Guidelines)

RC4580QPWRQ1 AEC Q100J Grade-1 Qualification
Approve Date 07-October-2024

Product Attributes

Attributes	Qual Device: RC4580QPWRQ1	QBS Package Reference: SN74HCS74QPWRQ1	QBS Package, Process, Product Reference: LM2902BQPWRQ1	QBS Package Reference: OPA4991QPWRQ1
Automotive Grade Level	Grade 1	Grade 1	Grade 1	Grade 1
Operating Temp Range (C)	-40 to 125	-40 to 125	-40 to 125	-40 to 125
Product Function	Signal Chain	Logic	Signal Chain	Signal Chain
Wafer Fab Supplier	RFAB	RFAB	RFAB	RFAB
Assembly Site	MLA	MLA	MLA	MLA
Package Group	TSSOP	TSSOP	TSSOP	TSSOP
Package Designator	PW	PW	PW	PW
Pin Count	8	14	14	14

- QBS: Qual By Similarity, also known as Generic Data
- Qual Device RC4580QPWRQ1 is qualified at MSL1 260C

Qualification Results

Data Displayed as: Number of lots / Total sample size / Total failed

Type	#	Test Spec	Min Lot Qty	SS / Lot	Test Name	Condition	Duration	Qual Device: RC4580QPWRQ1	QBS Package Reference: SN74HCS74QPWRQ1	QBS Package, Process, Product Reference: LM2902BQPWRQ1	QBS Package Reference: OPA4991QPWRQ1
Test Group A - Accelerated Environment Stress Tests											
PC	A1	JEDEC J-STD-020 JESD22-A113	3	77	Preconditioning	MSL1 260C	-	1/Pass	3/Pass	3/Pass	1/Pass
HAST	A2	JEDEC JESD22-A110	3	77	Biased HAST	110C/85%RH	264 Hours	-	-	-	1/77/0
HAST	A2	JEDEC JESD22-A110	3	77	Biased HAST	130C/85%RH	96 Hours	1/77/0	3/231/0	3/231/0	-
AC/UHAST	A3	JEDEC JESD22-A102/JEDEC JESD22-A118	3	77	Autoclave	121C/15psig	96 Hours	-	3/231/0	-	3/231/0
AC/UHAST	A3	JEDEC JESD22-A102/JEDEC JESD22-A118	3	77	Unbiased HAST	110C/85%RH	264 Hours	-	-	3/231/0	-
AC/UHAST	A3	JEDEC JESD22-A102/JEDEC JESD22-A118	3	77	Unbiased HAST	130C/85%RH	96 Hours	1/77/0	-	-	-
TC	A4	JEDEC JESD22-A104 and Appendix 3	3	77	Temperature Cycle	-65C/150C	500 Cycles	1/77/0	3/231/0	3/231/0	1/77/0
TC-BP	A4	MIL-STD883 Method 2011	1	5	Post Temp Cycle Bond Pull	-	-	1/5/0	-	-	1/5/0
HTSL	A6	JEDEC JESD22-A103	1	45	High Temperature Storage Life	150C	1000 Hours	1/45/0	3/135/0	3/231/0	1/45/0
Test Group B - Accelerated Lifetime Simulation Tests											

Type	#	Test Spec	Min Lot Qty	SS / Lot	Test Name	Condition	Duration	Qual Device: RC4580QPWRQ1	QBS Package Reference: SN74HCS74QPWRQ1	QBS Package, Process, Product Reference: LM2902BQPWRQ1	QBS Package Reference: OPA4991QPWRQ1
HTOL	B1	JEDEC JESD22-A108	3	77	Life Test	125C	1000 Hours	1/77/0	3/231/0	-	-
HTOL	B1	JEDEC JESD22-A108	3	77	Life Test	150C	300 Hours	-	-	-	3/231/0
HTOL	B1	JEDEC JESD22-A108	3	77	Life Test	150C	408 Hours	-	-	3/231/0	-
ELFR	B2	AEC Q100-008	3	800	Early Life Failure Rate	125C	48 Hours	-	3/2400/0	3/2400/0	-

Test Group C - Package Assembly Integrity Tests

WBS	C1	AEC Q100-001	1	30	Wire Bond Shear	Minimum of 5 devices, 30 wires Cpk>1.67	Wires	1/30/0	3/90/0	3/90/0	1/30/0
WBP	C2	MIL-STD883 Method 2011	1	30	Wire Bond Pull	Minimum of 5 devices, 30 wires Cpk>1.67	Wires	1/30/0	3/90/0	3/90/0	1/30/0
SD	C3	JEDEC J-STD-002	1	15	PB Solderability	>95% Lead Coverage	-	-	1/15/0	-	-
SD	C3	JEDEC J-STD-002	1	15	PB-Free Solderability	>95% Lead Coverage	-	-	1/15/0	-	-
PD	C4	JEDEC JESD22-B100 and B108	3	10	Physical Dimensions	Cpk>1.67	-	1/10/0	3/30/0	3/30/0	1/10/0

Test Group D - Die Fabrication Reliability Tests

EM	D1	JESD61	-	-	Electromigration	-	-	Completed Per Process Technology Requirements			
TDDB	D2	JESD35	-	-	Time Dependent Dielectric Breakdown	-	-	Completed Per Process Technology Requirements			

Type	#	Test Spec	Min Lot Qty	SS / Lot	Test Name	Condition	Duration	Qual Device: RC4580QPWRQ1	QBS Package Reference: SN74HCS74QPWRQ1	QBS Package, Process, Product Reference: LM2902BQPWRQ1	QBS Package Reference: OPA4991QPWRQ1
HCI	D3	JESD60 & 28	-	-	Hot Carrier Injection	-	-	Completed Per Process Technology Requirements	Completed Per Process Technology Requirements	Completed Per Process Technology Requirements	Completed Per Process Technology Requirements
BTI	D4	-	-	-	Bias Temperature Instability	-	-	Completed Per Process Technology Requirements	Completed Per Process Technology Requirements	Completed Per Process Technology Requirements	Completed Per Process Technology Requirements
SM	D5	-	-	-	Stress Migration	-	-	Completed Per Process Technology Requirements	Completed Per Process Technology Requirements	Completed Per Process Technology Requirements	Completed Per Process Technology Requirements

Test Group E - Electrical Verification Tests

ESD	E2	AEC Q100-002	1	3	ESD HBM	-	2000 Volts	1/3/0	1/3/0	3/9/0	-
ESD	E2	AEC Q100-002	1	3	ESD HBM	-	4000 Volts	-	-	-	1/3/0
ESD	E3	AEC Q100-011	1	3	ESD CDM	-	1500 Volts	-	-	3/9/0	1/3/0
ESD	E3	AEC Q100-011	1	3	ESD CDM	-	500 Volts	1/3/0	1/3/0	-	-
LU	E4	AEC Q100-004	1	3	Latch-Up	Per AEC Q100-004	-	1/3/0	1/6/0	3/18/0	3/18/0
ED	E5	AEC Q100-009	3	30	Electrical Distributions	Cpk>1.67 Room, hot, and cold	-	1/30/0	3/90/0	3/90/0	3/90/0

Additional Tests

- Preconditioning was performed for Autoclave, Unbiased HAST, THB/Biased HAST, Temperature Cycle, Thermal Shock, and HTSL, as applicable
- The following are equivalent HTOL options based on an activation energy of 0.7eV : 125C/1k Hours, 140C/480 Hours, 150C/300 Hours, and 155C/240 Hours
- The following are equivalent HTSL options based on an activation energy of 0.7eV : 150C/1k Hours, and 170C/420 Hours
- The following are equivalent Temp Cycle options per JESD47 : -55C/125C/700 Cycles and -65C/150C/500 Cycles

Ambient Operating Temperature by Automotive Grade Level:

- Grade 0 (or E): -40C to +150C
- Grade 1 (or Q): -40C to +125C
- Grade 2 (or T): -40C to +105C
- Grade 3 (or I) : -40C to +85C

E1 (TEST): Electrical test temperatures of Qual samples (High temperature according to Grade level):

- Room/Hot/Cold : HTOL, ED
- Room/Hot : THB / HAST, TC / PTC, HTSL, ELFR, ESD & LU
- Room : AC/uHAST

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TI Qualification ID: R-NPD-2309-067

TI Information
Selective Disclosure

**Automotive Qualification Summary
(As per AEC and JEDEC Guidelines)**

**Q006 TSSOP at MLA
Approve Date 07-October-2024**

Attributes	Qual Device:	QBS Package Reference:	QBS Package, Process, Product Reference:	QBS Package Reference:
	RC4580QPWRQ1	SN74HCS74QPWRQ1	LM2902BQPWRQ1	OPA4991QPWRQ1
Automotive Grade Level	Grade 1	Grade 1	Grade 1	Grade 1
Operating Temp Range (C)	-40 to 125	-40 to 125	-40 to 125	-40 to 125
Product Function	Signal Chain	Logic	Signal Chain	Signal Chain
Wafer Fab Supplier	RFAB	RFAB	RFAB	RFAB
Assembly Site	MLA	MLA	MLA	MLA
Package Group	TSSOP	TSSOP	TSSOP	TSSOP
Package Designator	PW	PW	PW	PW
Pin Count	8	14	14	14

Qualification Results

Data Displayed as: Number of lots / Total sample size / Total failed

Type	#	Test Spec	Min Lot Qty	SS / Lot	Test Name	Condition	Duration	Qual Device: RC4580QPWRQ1	QBS Reference: SN74HCS74QPWRQ1	QBS Reference: LM2902BQPWRQ1	QBS Reference: OPA4991QPWRQ1
Test Group A - Accelerated Environment Stress Tests											
PC	A1	JEDEC J-STD-020 JESD22-A113	3	77	Preconditioning	MSL1 260C	-	-	3/Pass	3/Pass	1/Pass
PC	A1.1	-	3	22	SAM Precon Pre	Review for delamination	-	-	3/66/0	-	1/22/0
PC	A1.2	-	3	22	SAM Precon Post	Review for delamination	-	-	3/66/0	-	1/22/0
HAST	A2.1	JEDEC JESD22-A110	3	77	Biased HAST	110C/85%RH	264 Hours	-	-	-	1/77/0
HAST	A2.1	JEDEC JESD22-A110	3	77	Biased HAST	130C/85%RH	96 Hours	-	3/231/0	-	-
HAST	A2.1.2	-	3	1	Cross Section, post bHAST, 1X	Post stress cross section	Completed	-	3/3/0	-	1/1/0
HAST	A2.1.3	-	3	3	Wire Bond Shear, post bHAST, 1X	Post stress	-	-	3/9/0	-	1/3/0
HAST	A2.1.4	-	3	3	Bond Pull over Stitch, post bHAST, 1X	Post stress	-	-	3/9/0	-	1/3/0
HAST	A2.1.5	-	3	3	Bond Pull over Ball, post bHAST, 1X	Post stress	-	-	3/9/0	-	1/3/0
HAST	A2.2	JEDEC JESD22-A110	3	70	Biased HAST	110C/85%RH	528 Hours	-	-	-	1/77/0
HAST	A2.2	JEDEC JESD22-A110	3	70	Biased HAST	130C/85%RH	192 Hours	-	3/231/0	-	-
HAST	A2.2.1	-	3	22	SAM Analysis, post bHAST 2X	Review for delamination	Completed	-	3/66/0	-	1/22/0
Type	#	Test Spec	Min Lot Qty	SS / Lot	Test Name	Condition	Duration	Qual Device: RC4580QPWRQ1	QBS Reference: SN74HCS74QPWRQ1	QBS Reference: LM2902BQPWRQ1	QBS Reference: OPA4991QPWRQ1
HAST	A2.2.2	-	3	1	Cross Section, post bHAST, 2X	Post stress cross section	Completed	-	3/3/0	-	1/1/0
HAST	A2.2.3	-	3	3	Wire Bond Shear, post bHAST, 2X	Post stress	-	-	3/9/0	-	1/3/0
HAST	A2.2.4	-	3	3	Bond Pull over Stitch, post bHAST, 2X	Post stress	-	-	3/9/0	-	1/3/0
HAST	A2.2.5	-	3	3	Bond Pull over Ball, post bHAST, 2X	Post stress	-	-	3/9/0	-	1/3/0
TC	A4.1	JEDEC JESD22-A104 and Appendix 3	3	77	Temperature Cycle	-65C/150C	500 Cycles	-	3/231/0	3/231/0	1/77/0
TC	A4.1.1	-	3	22	SAM Analysis, post TC 1X	Review for delamination	Completed	-	3/66/0	3/66/0	1/22/0
TC	A4.1.2	-	3	1	Cross Section, post TC, 1X	Post stress cross section	Completed	-	3/3/0	3/3/0	1/1/0
TC	A4.1.3	-	3	3	Wire Bond Shear, post TC, 1X	Post stress	-	-	3/9/0	3/9/0	1/3/0
TC	A4.1.4	-	3	3	Bond Pull over Stitch, post TC, 1X	Post stress	-	-	3/9/0	3/9/0	1/3/0
TC	A4.1.5	-	3	3	Bond Pull over Ball, post TC, 1X	Post stress	-	-	3/9/0	3/9/0	1/3/0
TC	A4.2	JEDEC JESD22-A104 and Appendix 3	3	70	Temperature Cycle	-65C/150C	1000 Cycles	-	3/231/0	3/231/0	1/77/0
TC	A4.2.1	-	3	22	SAM Analysis, post TC, 2X	Review for delamination	Completed	-	3/66/0	3/66/0	1/22/0

Type	#	Test Spec	Min Lot Qty	SS / Lot	Test Name	Condition	Duration	Qual Device: RC4580QPWRQ1	QBS Reference: SN74HCS74QPWRQ1	QBS Reference: LM2902BQPWRQ1	QBS Reference: OPA4991QPWRQ1
TC	A4.2.2	-	3	1	Cross Section, post TC, 2X	Post stress cross section	Completed	-	3/3/0	3/3/0	1/1/0
TC	A4.2.3	-	3	3	Wire Bond Shear, post TC, 2X	Post stress	-	-	3/9/0	3/9/0	1/3/0
TC	A4.2.4	-	3	3	Bond Pull over Stitch, post TC, 2X	Post stress	-	-	3/9/0	3/9/0	1/3/0
TC	A4.2.5	-	3	3	Bond Pull over Ball, post TC, 2X	Post stress	-	-	3/9/0	3/9/0	1/3/0
HTSL	A6.1	JEDEC JESD22-A103	3	45	High Temperature Storage Life	150C	1000 Hours	-	3/135/0	-	1/45/0
HTSL	A6.1.1	-	3	1	Cross Section, post HTSL, 1X	Post stress cross section	Completed	-	3/3/0	-	1/1/0
HTSL	A6.2	JEDEC JESD22-A103	3	44	High Temperature Storage Life	150C	2000 Hours	-	3/135/0	-	1/45/0
HTSL	A6.2.1	-	3	1	Cross Section, post HTSL, 2X	Post stress cross section	Completed	-	3/3/0	-	1/1/0
Test Group C - Package Assembly Integrity Tests											
WBS	C1	AEC Q100-001	1	30	Wire Bond Shear	Minimum of 5 devices, 30 wires Cpk>1.67	Wires	1/30/0	3/90/0	3/90/0	1/30/0
WBP	C2	MIL-STD883 Method 2011	1	30	Wire Bond Pull	Minimum of 5 devices, 30 wires Cpk>1.67	Wires	1/30/0	3/90/0	3/90/0	1/30/0

- QBS: Qual By Similarity, also known as Generic Data
- Qual Device RC4580QPWRQ1 is qualified at MSL1 260C
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TI Qualification ID: R-NPD-2309-067

ZVEI ID's: SEM-DE-03, SEM-PW-02, SEM-PW-09, SEM-PW-13, SEM-PA-08, SEM-PA-13, SEM-TF-01, SEM-QG-01

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