PCN Number:	20240429000.2	**PCN Date:**	April 30, 2024
Title:	Qualification of RFAB using qualified Process Technology, Die Revision, Datasheet and additional BOM options for select devices		
Customer Contact:	Change Management team	**Dept:**	Quality Services
Proposed 1st Ship Date:	October 27, 2024	**Sample requests accepted until:**	May 30, 2024*

***Sample requests received after May 30, 2024 will not be supported.**

Change Type:

☐	Assembly Site	☒	Design	☐	Wafer Bump Material
☐	Assembly Process	☒	Data Sheet	☐	Wafer Bump Process
☒	Assembly Materials	☐	Part number change	☒	Wafer Fab Site
☐	Mechanical Specification	☐	Test Site	☒	Wafer Fab Materials
☒	Packing/Shipping/Labeling	☐	Test Process	☒	Wafer Fab Process

PCN Details

Description of Change:

Texas Instruments is pleased to announce the addition of RFAB using the HPA9 qualified process technology and additional Assembly 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**
DL-LIN	LINCMOS	150 mm	RFAB	HPA9	300 mm

The die was also changed as a result of the process change.

Construction differences are as follows:

	Current	Proposed
Bond wire diam, material	0.96mil Au	0.80mil Cu

The datasheets will be changing as a result of the above mentioned changes. The datasheet change details can be reviewed in the datasheet revision history. The link to the revised datasheet is available in the table below.

TEXAS INSTRUMENTS

TLC555-Q1

SLFS078C – OCTOBER 2006 – REVISED APRIL 2024

Changes from Revision B (May 2015) to Revision C (April 2024) **Page**

- Added reference to functional safety documentation in *Features* 1
- Deleted *Description (continued)* section..... 1
- Updated *Package Information* table..... 1
- Deleted *Dissipation Ratings* and moved continuous total power dissipation specifications to *Absolute Maximum Ratings* 3
- Changed continuous total power dissipation power rating from 725mW to 900mW at $T_A \leq 25°C$ and from 145mW to 180mW at $T_A = 125°C$, and changed derating factor $T_A = 25°C$ from 5.8mW/°C to 7.2mW/°C, in *Absolute Maximum Ratings* 3
- Updated thermal resistance and characterization parameter values in *Thermal Information* 3
- Changed reset current ($I_{I(RESET)}$) test conditions to $V_{RESET} = V_{DD}$ in both *Electrical Characteristics* tables..... 4
- Added new reset current ($I_{I(RESET)}$) typical values for test condition $V_{RESET} = 0V$ to both *Electrical Characteristics* tables..... 4
- Changed supply current typical value from 170 µA to 180 µA in *Electrical Characteristics: $V_{DD} = 5$ V* 4

- Changed title of *Operating Characteristics* table to *Switching Characteristics* and clarified that values are specified by design or characterization 6
- Deleted initial error of timing interval specification in *Switching Characteristics* 6
- Added text regarding input type to *Overview* 7
- Changed functional block diagram to simplified schematic and moved to *Overview* 7
- Added new *Functional Block Diagram* 7
- Added guidance for RESET pin pullup resistance in *Monostable Operation* 7
- Changed V_{CC} to V_{DD} in *Monostable Operation* 7
- Added clarity regarding nominal operating frequency and parasitic terms in *Astable Operation* 9
- Changed V_{CC} to V_{DD} in *Astable Operation* 9
- Deleted Figure 11, *Equivalent Schematic*, and added guidance concerning the RESET pin in *Device Functional Modes* 12
- Changed V_{CC} to V_{DD} in Table 6-1, *Function Table* 12
- Added references to application note and reference design in *Documentation Support* section 19

Product Folder	Current Datasheet Number	New Datasheet Number	Link to full datasheet
TLC555-Q1	SLFS078B	SLFS078C	http://www.ti.com/product/TLC555-Q1

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
☒ No Change	☒ No Change	☒ No Change	☒ 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
DL-LIN	DLN	USA	Dallas
RFAB	**RFB**	**USA**	**Richardson**

Die Rev:

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

Sample product shipping label (not actual product label)

Product Affected:

TLC555QDRQ1	TLC555ZQDRQ1

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

Automotive New Product Qualification Summary
(As per AEC-Q100 and JEDEC Guidelines)

Redbull TLC555QDRQ1, Grade 1, Q100 Rev H, Q006 - 8D assembled in MLA
Approve Date 06-OCTOBER -2023

Product Attributes

Attributes	Qual Device: TLC555QDRQ1	QBS Process Reference: INA229AQDGSRQ1	QBS Product Reference: TLV9002QDRQ1	QBS Product Reference: TLV9002QDRQ1	QBS Product Reference: TLV9062QDRQ1	QBS Product Reference: TLV9062QDRQ1	QBS Package, Product Reference: OPA2991QDRQ1
Automotive Grade Level	Grade 1	Grade 1	Grade 1	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	-40 to 125	-40 to 125
Product Function	Signal Chain	Signal Chain	Signal Chain	Signal Chain	Signal Chain	Signal Chain	Signal Chain
Wafer Fab Supplier	RFAB	RFAB	RFAB	RFAB	RFAB	RFAB	RFAB
Assembly Site	MLA	ASESHAT	MLA	MLA	MLA	MLA	MLA
Package Group	SOIC	VSSOP	SOIC	SOIC	SOIC	SOIC	SOIC
Package Designator	D	DGS	D	D	D	D	D
Pin Count	8	10	8	8	8	8	8

- QBS: Qual By Similarity
- Qual Device TLC555QDRQ1 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: TLC555QDRQ1	QBS Process Reference: INA229AQDGSRQ1	QBS Product Reference: TLV9002QDRQ1	QBS Product Reference: TLV9002QDRQ1	QBS Product Reference: TLV9062QDRQ1	QBS Product Reference: TLV9062QDRQ1	QBS Package, Product Reference: OPA2991QDRQ1
Test Group A - Accelerated Environment Stress Tests														
PC	A1	JEDEC J-STD-020 JESD22-A113	3	77	Preconditioning	MSL1 260C	-	1/132/0	-	-	-	-	-	3/924/0

Type	#	Test Spec	Min Lot Qty	SS / Lot	Test Name	Condition	Duration	Qual Device: TLC555QDRQ1	QBS Process Reference: INA229AQDGSRQ1	QBS Product Reference: TLV9002QDRQ1	QBS Product Reference: TLV9002QDRQ1	QBS Product Reference: TLV9062QDRQ1	QBS Product Reference: TLV9062QDRQ1	QBS Package, Product Reference: OPA2991QDRQ1
PC	A1	JEDEC J-STD-020 JESD22-A113	3	77	Preconditioning	MSL2 260C	-	-	3/0/0	-	1/0/0	3/0/0	1/0/0	-
HAST	A2	JEDEC JESD22-A110	3	77	Biased HAST	130C/85%RH	96 Hours	1/77/0	3/231/0	-	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	-	-	-	1/77/0	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	1/109/0	3/231/0	-	1/77/0	2/154/0	1/77/0	3/231/0
TC-BP	A4	MIL-STD883 Method 2011	1	5	Post Temp Cycle Bond Pull	-	-	-	1/5/0	-	1/5/0	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
HTSL	A6	JEDEC JESD22-A103	1	45	High Temperature Storage Life	175C	500 Hours	-	3/231/0	-	-	-	-	-
Test Group B - Accelerated Lifetime Simulation Tests														
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	408 Hours	-	-	-	1/77/0	1/77/0	-	1/77/1[1]
ELFR	B2	AEC Q100-008	3	800	Early Life Failure Rate	125C	48 Hours	-	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	-	-	-	1/30/0	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	-	-	-	1/30/0	3/90/0
SD	C3	JEDEC J-STD-002	1	15	PB Solderability	>95% Lead Coverage	-	1/15/0	-	-	-	1/15/0	-	-

Type	#	Test Spec	Min Lot Qty	SS / Lot	Test Name	Condition	Duration	Qual Device: TLC555QDRQ1	QBS Process Reference: INA229AQDGSRQ1	QBS Product Reference: TLV9002QDRQ1	QBS Product Reference: TLV9002QDRQ1	QBS Product Reference: TLV9062QDRQ1	QBS Product Reference: TLV9062QDRQ1	QBS Package, Product Reference: OPA2991QDRQ1
SD	C3	JEDEC J-STD-002	1	15	PB-Free Solderability	>95% Lead Coverage	-	1/15/0	1/15/0	-	-	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	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	Completed Per Process Technology Requirements	Completed Per Process Technology Requirements	Completed Per Process Technology Requirements
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	Completed Per Process Technology Requirements	Completed Per Process Technology Requirements	Completed Per Process Technology Requirements
NBTI	D4	-	-	-	Negative Bias Temperature Instability	-	-	Completed Per Process Technology Requirements	Completed Per Process Technology Requirements	Completed Per Process Technology Requirements	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	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	-	-	-	-	1/3/0
ESD	E2	AEC Q100-002	1	3	ESD HBM	-	4000 Volts	-	-	1/3/0	-	-	1/3/0	-
ESD	E3	AEC Q100-011	1	3	ESD CDM	-	1000 Volts	-	-	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	6	Latch-Up	Per AEC Q100-004	-	1/6/0	1/6/0	1/6/0	-	-	1/6/0	1/6/0
ED	E5	AEC Q100-009	3	30	Electrical Distributions	Cpk>1.67 Room, hot, and cold	-	3/90/0	3/90/0	1/30/0	-	2/60/0	1/30/0	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-2112-081

[1]-HTOL failed due to rejects mixed back in with tested good units. See attached 4C.

Automotive New Product Qualification Summary
(As per AEC-Q100, AEC-Q006, and JEDEC Guidelines)

Redbull TLC555QDRQ1, Grade 1, Q100 Rev H, Q006 - 8D assembled in MLA
Approve Date 06-OCTOBER -2023

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: TLC555QDRQ1	QBS Reference: OPA2991QDRQ1
Test Group A - Accelerated Environment Stress Tests									
PC	A1	JEDEC J-STD-020 JESD22-A113	3	77	Preconditioning	MSL1 260C	-	1/132/0	3/924/0
PC	A1.1	-	3	22	SAM Precon Pre	Review for delamination	-	1/22/0	3/66/0
PC	A1.2	-	3	22	SAM Precon Post	Review for delamination	-	1/22/0	3/66/0
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
HAST	A2.1.3	-	3	30	Wire Bond Shear, post bHAST, 1X	Post stress	Wires	-	3/9/0
HAST	A2.1.4	-	3	30	Bond Pull over Stitch, post bHAST, 1X	Post stress	Wires	-	3/9/0

HAST	A2.1.5	-	3	30	Bond Pull over Ball, post bHAST, 1X	Post stress	Wires	-	3/9/0
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
HAST	A2.2.2	-	3	1	Cross Section, post bHAST, 2X	Post stress cross section	Completed	-	3/3/0
HAST	A2.2.3	-	3	30	Wire Bond Shear, post bHAST, 2X	Post stress	Wires	-	3/9/0
HAST	A2.2.4	-	3	30	Bond Pull over Stitch, post bHAST, 2X	Post stress	Wires	-	3/9/0
HAST	A2.2.5	-	3	30	Bond Pull over Ball, post bHAST, 2X	Post stress	Wires	-	3/9/0
TC	A4.1	JEDEC JESD22-A104 and Appendix 3	3	77	Temperature Cycle	-65C/150C	500 Cycles	1/109/0	3/231/0
TC	A4.1.1	-	3	22	SAM Analysis, post TC 1X	Review for delamination	Completed	1/22/0	3/66/0
TC	A4.1.2	-	3	1	Cross Section, post TC, 1X	Post stress cross section	Completed	-	3/3/0
TC	A4.1.3	-	3	30	Wire Bond Shear, post TC, 1X	Post stress	Wires	-	3/9/0
TC	A4.1.4	-	3	30	Bond Pull over Stitch, post TC, 1X	Post stress	Wires	-	3/9/0
TC	A4.1.5	-	3	30	Bond Pull over Ball, post TC, 1X	Post stress	Wires	-	3/9/0
TC	A4.2	JEDEC JESD22-A104 and Appendix 3	3	70	Temperature Cycle	-65C/150C	1000 Cycles	1/77/0	3/231/0
TC	A4.2.1	-	3	22	SAM Analysis, post TC, 2X	Review for delamination	Completed	1/22/0	3/66/0
TC	A4.2.2	-	3	1	Cross Section, post TC, 2X	Post stress cross section	Completed	1/1/0	3/3/0
TC	A4.2.3	-	3	30	Wire Bond Shear, post TC, 2X	Post stress	Wires	1/3/0	3/9/0
TC	A4.2.4	-	3	30	Bond Pull over Stitch, post TC, 2X	Post stress	Wires	1/3/0	3/9/0
TC	A4.2.5	-	3	30	Bond Pull over Ball, post TC, 2X	Post stress	Wires	1/3/0	3/9/0
HTSL	A6.1	JEDEC JESD22-A103	3	45	High Temperature Storage Life	150C	1000 Hours	1/50/0	3/135/0
HTSL	A6.1.1	-	3	1	Cross Section, post HTSL, 1X	Post stress cross section	Completed	-	3/3/0
HTSL	A6.2	JEDEC JESD22-A103	3	44	High Temperature Storage Life	150C	2000 Hours	1/49/0	3/135/0
HTSL	A6.2	JEDEC JESD22-A103	3	44	High Temperature Storage Life	175C	500 Hours	-	-
HTSL	A6.2.1	-	3	1	Cross Section, post HTSL, 2X	Post stress cross section	Completed	1/1/0	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
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

- QBS: Qual By Similarity
- Qual Device TLC555QDRQ1 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-2112-081

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

Redbull TLC555QDRQ1, Grade 1, Q100 Rev H, Q006 - 8D assembled in FMX
Approve Date 04-MARCH -2024

Product Attributes

Attributes	Qual Device: TLC555QDRQ1	QBS Package Reference: LM2904BQDRQ1	QBS Process Reference: INA229AQDGSRQ1	QBS Package Reference: LM2903BQDRQ1	QBS Product Reference: TLC555QDRQ1	QBS Package Reference: LM2903BQDRQ1
Automotive Grade Level	Grade 1	Grade 1	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	-40 to 125
Product Function	Signal Chain	Signal Chain	Signal Chain	Signal Chain	Signal Chain	Signal Chain
Wafer Fab Supplier	RFAB	CFAB	RFAB	CFAB	RFAB	CFAB
Assembly Site	FMX	FMX	ASESHAT	FMX	MLA	MLA
Package Group	SOIC	SOIC	VSSOP	SOIC	SOIC	SOIC
Package Designator	D	D	DGS	D	D	D
Pin Count	8	8	10	8	8	8

- QBS: Qual By Similarity
- Qual Device TLC555QDRQ1 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: TLC555QDRQ1	QBS Package Reference: LM2904BQDRQ1	QBS Process Reference: INA229AQDGSRQ1	QBS Package Reference: LM2903BQDRQ1	QBS Product Reference: TLC555QDRQ1	QBS Package Reference: LM2903BQDRQ1
Test Group A - Accelerated Environment Stress Tests													

Type	#	Test Spec	Min Lot Qty	SS / Lot	Test Name	Condition	Duration	Qual Device: TLC555QDRQ1	QBS Package Reference: LM2904BQDRQ1	QBS Process Reference: INA229AQDGSRQ1	QBS Package Reference: LM2903BQDRQ1	QBS Product Reference: TLC555QDRQ1	QBS Package Reference: LM2903BQDRQ1
PC	A1	JEDEC J-STD-020 JESD22-A113	3	77	Preconditioning	MSL1 260C	-	1/210/0	-	-	1/0/0	1/132/0	1/77/0
PC	A1	JEDEC J-STD-020 JESD22-A113	3	77	Preconditioning	MSL2 260C	-	-	3/1499/10[1]	3/0/0	-	-	-
HAST	A2	JEDEC JESD22-A110	3	77	Biased HAST	130C/85%RH	96 Hours	1/77/0	3/231/0	3/231/0	1/77/0	1/77/0	-
AC/UHAST	A3	JEDEC JESD22-A102/JEDEC JESD22-A118	3	77	Unbiased HAST	130C/85%RH	96 Hours	1/77/0	-	3/231/0	1/77/0	1/77/0	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	1/109/0	1/77/0
TC-BP	A4	MIL-STD883 Method 2011	1	5	Post Temp Cycle Bond Pull	-	-	-	-	1/5/0	-	-	-
HTSL	A6	JEDEC JESD22-A103	1	45	High Temperature Storage Life	150C	1000 Hours	1/45/0	-	-	-	1/50/0	-
HTSL	A6	JEDEC JESD22-A103	1	45	High Temperature Storage Life	175C	500 Hours	-	3/135/0	3/231/0	-	-	-
Test Group B - Accelerated Lifetime Simulation Tests													
HTOL	B1	JEDEC JESD22-A108	3	77	Life Test	125C	1000 Hours	2/154/0	-	3/231/0	-	1/77/0	-
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	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	3/15/0	3/90/0	1/30/0	1/30/0	3/90/0

Type	#	Test Spec	Min Lot Qty	SS / Lot	Test Name	Condition	Duration	Qual Device: TLC555QDRQ1	QBS Package Reference: LM2904BQDRQ1	QBS Process Reference: INA229AQDGSRQ1	QBS Package Reference: LM2903BQDRQ1	QBS Product Reference: TLC555QDRQ1	QBS Package Reference: LM2903BQDRQ1
WBP	C2	MIL-STD883 Method 2011	1	30	Wire Bond Pull	Minimum of 5 devices, 30 wires Cpk>1.67	Wires	1/30/0	3/15/0	3/90/0	1/30/0	1/30/0	3/90/0
SD	C3	JEDEC J-STD-002	1	15	PB Solderability	>95% Lead Coverage	-	1/15/0	1/15/0	-	1/15/0	1/15/0	-
SD	C3	JEDEC J-STD-002	1	15	PB-Free Solderability	>95% Lead Coverage	-	1/15/0	1/15/0	1/15/0	1/15/0	1/15/0	1/15/0
PD	C4	JEDEC JESD22-B100 and B108	3	10	Physical Dimensions	Cpk>1.67	-	-	3/30/0	3/30/0	1/10/0	1/10/0	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	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	Completed Per Process Technology Requirements	Completed Per Process Technology Requirements
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	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	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	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	1/3/0	-
ESD	E3	AEC Q100-011	1	3	ESD CDM	-	500 Volts	1/3/0	-	1/3/0	1/3/0	1/3/0	-
LU	E4	AEC Q100-004	1	6	Latch-Up	Per AEC Q100-004	-	1/6/0	3/18/0	1/6/0	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	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-2202-165

[1]-Precon fails not package related. Fails due to a crystalline defect in the wafer and can be screened at T0.

Automotive Qualification Summary
(As per AEC and JEDEC Guidelines)

Q006 {SOIC} at {FMX}
Approve Date 04-MARCH -2024

Attributes	Qual Device: TLC555QDRQ1	QBS Package Reference: LM2904BQDRQ1	QBS Process Reference: INA229AQDGSRQ1	QBS Package Reference: LM2903BQDRQ1	QBS Product Reference: TLC555QDRQ1	QBS Package Reference: LM2903BQDRQ1
Automotive Grade Level	Grade 1	Grade 1	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	-40 to 125
Product Function	Signal Chain	Signal Chain	Signal Chain	Signal Chain	Signal Chain	Signal Chain
Wafer Fab Supplier	RFAB	CFAB	RFAB	CFAB	RFAB	CFAB
Assembly Site	FMX	FMX	ASESHAT	FMX	MLA	MLA
Package Group	SOIC	SOIC	VSSOP	SOIC	SOIC	SOIC
Package Designator	D	D	DGS	D	D	D
Pin Count	8	8	10	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: TLC555QDRQ1	QBS Reference: LM2904BQDRQ1	QBS Reference: INA229AQDGSRQ1	QBS Reference: LM2903BQDRQ1	QBS Reference: TLC555QDRQ1	QBS Reference: LM2903BQDRQ1
Test Group A - Accelerated Environment Stress Tests													

Type	#	Test Spec	Min Lot Qty	SS / Lot	Test Name	Condition	Duration	Qual Device: TLC555QDRQ1	QBS Reference: LM2904BQDRQ1	QBS Reference: INA229AQDGSRQ1	QBS Reference: LM2903BQDRQ1	QBS Reference: TLC555QDRQ1	QBS Reference: LM2903BQDRQ1
PC	A1	JEDEC J-STD-020 JESD22-A113	3	77	Preconditioning	MSL1 260C	-	1/210/0	-	-	3/924/0	1/132/0	1/77/0
PC	A1	JEDEC J-STD-020 JESD22-A113	3	77	Preconditioning	MSL2 260C	-	-	3/1499/10[1]	-	-	-	-
PC	A1.1	-	3	22	SAM Precon Pre	Review for delamination	-	1/22/0	-	-	1/22/0	1/22/0	1/22/0
PC	A1.2	-	3	22	SAM Precon Post	Review for delamination	-	1/22/0	-	-	1/22/0	1/22/0	1/22/0
HAST	A2.1	JEDEC JESD22-A110	3	77	Biased HAST	130C	96 Hours	-	3/231/0	-	-	-	-
HAST	A2.1	JEDEC JESD22-A110	3	77	Biased HAST	130C/85%RH	96 Hours	1/77/0	-	-	1/77/0	-	-
HAST	A2.1.2	-	3	1	Cross Section, post bHAST, 1X	Post stress cross section	Completed	1/1/0	3/3/0	-	1/1/0	-	-
HAST	A2.1.3	-	3	3	Wire Bond Shear, post bHAST, 1X	Post stress	-	1/3/0	-	-	1/3/0	-	-
HAST	A2.1.4	-	3	3	Bond Pull over Stitch, post bHAST, 1X	Post stress	-	1/3/0	-	-	1/3/0	-	-
HAST	A2.1.5	-	3	3	Bond Pull over Ball, post bHAST, 1X	Post stress	-	1/3/0	-	-	1/3/0	-	-
HAST	A2.2	JEDEC JESD22-A110	3	70	Biased HAST	130C	192 Hours	-	3/231/0	-	-	-	-
HAST	A2.2	JEDEC JESD22-A110	3	70	Biased HAST	130C/85%RH	192 Hours	1/77/0	-	-	1/77/0	-	-
HAST	A2.2.1	-	3	22	SAM Analysis, post bHAST 2X	Review for delamination	Completed	1/22/0	3/66/0	-	1/22/0	-	-
HAST	A2.2.2	-	3	1	Cross Section, post bHAST, 2X	Post stress cross section	Completed	1/1/0	3/3/0	-	1/1/0	-	-
HAST	A2.2.3	-	3	3	Wire Bond Shear, post bHAST, 2X	Post stress	-	1/3/0	3/9/0	-	1/3/0	-	-

Type	#	Test Spec	Min Lot Qty	SS / Lot	Test Name	Condition	Duration	Qual Device: TLC555QDRQ1	QBS Reference: LM2904BQDRQ1	QBS Reference: INA229AQDGSRQ1	QBS Reference: LM2903BQDRQ1	QBS Reference: TLC555QDRQ1	QBS Reference: LM2903BQDRQ1
HAST	A2.2.4	-	3	3	Bond Pull over Stitch, post bHAST, 2X	Post stress	-	1/3/0	3/9/0	-	1/3/0	-	-
HAST	A2.2.5	-	3	3	Bond Pull over Ball, post bHAST, 2X	Post stress	-	1/3/0	-	-	1/3/0	-	-
TC	A4.1	JEDEC JESD22-A104 and Appendix 3	3	77	Temperature Cycle	-65/150C	500 Cycles	-	3/231/0	-	-	-	-
TC	A4.1	JEDEC JESD22-A104 and Appendix 3	3	77	Temperature Cycle	-65C/150C	500 Cycles	1/77/0	-	-	1/77/0	1/109/0	1/77/0
TC	A4.1.1	-	3	22	SAM Analysis, post TC 1X	Review for delamination	Completed	1/22/0	3/66/0	-	1/22/0	1/22/0	1/22/0
TC	A4.1.2	-	3	1	Cross Section, post TC, 1X	Post stress cross section	Completed	1/1/0	3/3/0	-	1/1/0	1/1/0	1/1/0
TC	A4.1.3	-	3	3	Wire Bond Shear, post TC, 1X	Post stress	-	1/3/0	-	-	1/3/0	1/3/0	1/3/0
TC	A4.1.4	-	3	3	Bond Pull over Stitch, post TC, 1X	Post stress	-	1/3/0	-	-	1/3/0	1/3/0	1/3/0
TC	A4.1.5	-	3	3	Bond Pull over Ball, post TC, 1X	Post stress	-	1/3/0	-	-	1/3/0	1/3/0	1/3/0
TC	A4.2	JEDEC JESD22-A104 and Appendix 3	3	70	Temperature Cycle	-65/150C	1000 Cycles	-	3/231/0	-	-	-	-
TC	A4.2	JEDEC JESD22-A104 and Appendix 3	3	70	Temperature Cycle	-65C/150C	1000 Cycles	1/77/0	-	-	1/77/0	1/77/0	1/77/0
TC	A4.2.1	-	3	22	SAM Analysis, post TC, 2X	Review for delamination	Completed	1/22/0	3/66/0	-	1/22/0	1/22/0	1/22/0

Type	#	Test Spec	Min Lot Qty	SS / Lot	Test Name	Condition	Duration	Qual Device: TLC555QDRQ1	QBS Reference: LM2904BQDRQ1	QBS Reference: INA229AQDGSRQ1	QBS Reference: LM2903BQDRQ1	QBS Reference: TLC555QDRQ1	QBS Reference: LM2903BQDRQ1
TC	A4.2.2	-	3	1	Cross Section, post TC, 2X	Post stress cross section	Completed	1/1/0	3/3/0	-	1/1/0	1/1/0	1/1/0
TC	A4.2.3	-	3	3	Wire Bond Shear, post TC, 2X	Post stress	-	1/3/0	3/9/0	-	1/3/0	1/3/0	1/3/0
TC	A4.2.4	-	3	3	Bond Pull over Stitch, post TC, 2X	Post stress	-	1/3/0	3/9/0	-	1/3/0	1/3/0	1/3/0
TC	A4.2.5	-	3	3	Bond Pull over Ball, post TC, 2X	Post stress	-	1/3/0	3/9/0	-	1/3/0	1/3/0	1/3/0
HTSL	A6.1	JEDEC JESD22-A103	3	45	High Temperature Storage Life	150C	1000 Hours	1/45/0	-	-	-	1/50/0	-
HTSL	A6.1	JEDEC JESD22-A103	3	45	High Temperature Storage Life	175C	500 Hours	-	3/135/0	-	-	-	-
HTSL	A6.1.1	-	3	1	Cross Section, post HTSL, 1X	Post stress cross section	Completed	1/1/0	3/3/0	-	-	1/1/0	-
HTSL	A6.2	JEDEC JESD22-A103	3	44	High Temperature Storage Life	150C	2000 Hours	1/45/0	-	-	-	1/49/0	-
HTSL	A6.2	JEDEC JESD22-A103	3	44	High Temperature Storage Life	175C	1000 Hours	-	3/135/0	-	-	-	-
HTSL	A6.2.1	-	3	1	Cross Section, post HTSL, 2X	Post stress cross section	Completed	1/1/0	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	3/15/0	3/90/0	1/30/0	1/30/0	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	3/15/0	3/90/0	1/30/0	1/30/0	3/90/0

- QBS: Qual By Similarity
- Qual Device TLC555QDRQ1 is qualified at MSL1 260C

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

TI Qualification ID: R-NPD-2202-165

[1]-Precon fails not package related. Fails due to a crystalline defect in the wafer and can be screened at T0.

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

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