


# PRODUCT / PROCESS CHANGE NOTIFICATION

## 1. PCN basic data

1.1 Company		STMicroelectronics International N.V
1.2 PCN No.	AMS/20/12144	
1.3 Title of PCN	New assembly site for General Purpose Analog products in MiniSO8 package	
1.4 Product Category	See product list	
1.5 Issue date	2020-05-14	

## 2. PCN Team

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2.1.3 Quality Manager	Alessandro PLATINI, Jean-Marc BUGNARD

## 3. Change

3.1 Category	3.2 Type of change	3.3 Manufacturing Location
Transfer	Line transfer for a full process or process brick (process step, control plan, recipes) from one site to another site: Assembly site (SOP 2617)	Assembly plant : - TSHT China - Amkor Philippines - Carsem Malaysia

## 4. Description of change

	Old	New
4.1 Description	Assembly plant : - Amkor Philippines - Carsem Malaysia	Assembly plant : - TSHT China - Amkor Philippines - Carsem Malaysia
4.2 Anticipated Impact on form, fit, function, quality, reliability or processability?	No impact	

## 5. Reason / motivation for change

5.1 Motivation	The purpose of the introduction of TSHT for both Assy and Test & Finishing activities is to further improve the rationalization of our manufacturing assets and provide a better support to our customers by enhancing the manufacturing process for higher volume production.
5.2 Customer Benefit	SERVICE IMPROVEMENT

## 6. Marking of parts / traceability of change

6.1 Description	New Finished good codes
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## 7. Timing / schedule

7.1 Date of qualification results	2020-04-30
7.2 Intended start of delivery	2020-08-15
7.3 Qualification sample available?	Upon Request

## 8. Qualification / Validation

8.1 Description	12144 PCN standard-MiniSO TSHT.pdf		
8.2 Qualification report and qualification results	Available (see attachment)	Issue Date	2020-05-14

9. Attachments (additional documentations)
12144 Public product.pdf 12144 PCN standard-MiniSO TSHT.pdf

10. Affected parts		
10. 1 Current		10.2 New (if applicable)
10.1.1 Customer Part No	10.1.2 Supplier Part No	10.1.2 Supplier Part No
LM258AST	LM258AST	
	LM2903ST	
LM2904ST	LM2904ST	
LM293ST	LM293ST	
	LM358AWST	
LM358ST	LM358ST	
	LM358WST	
LM393ST	LM393ST	
	LMV358LIST	
	LMV393IST	
	LMV822AIST	
	LMV822IST	
	LMX358IST	
	PM8834MTR	
TS1852AIST	TS1852AIST	
TS1852IST	TS1852IST	
TS1872AIST	TS1872AIST	
	TS3022IST	
	TS332IST	
TS462CST	TS462CST	
	TS972IST	
TSV358IST	TSV358IST	
	TSV612AIST	
	TSV612IST	
	TSV6192AIST	
	TSV622AIST	
	TSV6292AIST	
	TSV632AIST	
	TSV632IST	
	TSV6392AIST	
	TSV912AIST	
	TSV912IST	
	TSV992AIST	
	TSV992IST	

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**PRODUCT/PROCESS  
CHANGE NOTIFICATION**

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PCN AMS/20/12144

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**Analog, MEMS & Sensors (AMS)**

**New assembly site for General Purpose Analog  
products in MiniSO8 packages**

## WHAT:

Progressing on activities related to process modernization and quality improvement, ST is pleased to announce the introduction of TSHT/China as an added subcontractor for Assy and Test & Finishing activities for some products assembled in our MiniSO8 package.

Please find more information related to material change in the table here below

Material	Current process	Modified process	Comment
Diffusion location	ST Ang Mo Kio (Singapore)/ UMC / ST Agrate	ST Ang Mo Kio (Singapore)/ UMC / ST Agrate	
Assembly location	Amkor Philippines Carsem Malaysia	TSHT China	
Molding compound	Sumitomo G700 Hitachi CEL 8240	Hitachi CEL 9220	
Die attach	Henkel 8290 / QMI519	Henkel 8200T/Henkel8600	
Leadframe	Copper	Copper	
Plating	NiPdAu / Matte Sn	Matte Sn	
Wire	Gold 1.2Mils/1mil / 0.8Mil	Gold 1.3mils / Copper Pd coated 1 mil	

## WHY:

The purpose of the introduction of TSHT for both Assy and Test & Finishing activities for the here above listed commercial products is to further improve the rationalization of our manufacturing assets and provide a better support to our customers by enhancing the manufacturing process for higher volume production.

## HOW:

The qualification program consists mainly of comparative electrical characterization and reliability tests.

You will find here after the qualification test plan which summarizes the various test methods and conditions that ST uses for this qualification program.

## WHEN:

The new material set will be implemented in Q2/2020 in TSHT China.

## Marking and traceability:

Unless otherwise stated by customer's specific requirement, the traceability of the parts assembled with the new material set will be ensured by new internal sales type, date code and lot number.

The changes here reported will not affect the electrical, dimensional and thermal parameters keeping unchanged all the information reported on the relevant datasheets.

There is -as well- no change in the packing process or in the standard delivery quantities. Shipments may start earlier with the customer's written agreement.

# Reliability Qualification plan

*AMS Back-end qualification*

*MSOP 8*

*Production transfer to TSHT*

General Information		Locations	
Product Line	0193, 0358, V992, UY36, UQ18	Wafer fab	ST Singapore UMC, ST Agrate
Product Description	Dual comparator bipolar, Dual op amp bipolar, , Dual op amp, biCMOS, Dual precision op amp, 4 A dual low-side MOSFET driver	Assembly plant	TSHT China
P/N	LM2903WST, LM2904WST, TSV992IST, TSX7192IST, PM8834	Reliability Lab	ST Grenoble, TSHT
Product Group	AMS		
Product division	General Purpose Analog & RF		
Package	MiniSO8, MiniSO8 exposed pad		
Silicon Process technology	Bipolar, HF5CMOS, HVG8A		

Note: This report is a summary of the reliability trials performed in good faith by STMicroelectronics in order to evaluate the potential reliability risks during the product life using a set of defined test methods.

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## **1 APPLICABLE AND REFERENCE DOCUMENTS**

Document reference	Short description
JESD47	Stress-Test-Driven Qualification of Integrated Circuits

## **2 GLOSSARY**

DUT	Device Under Test
PCB	Printed Circuit Board
SS	Sample Size

## **3 RELIABILITY EVALUATION OVERVIEW**

### **3.1 Objectives**

To qualify a new assembly site, TSHT China, for products in MiniSO8 package for Analog products.

### **3.2 Conclusion**

Qualification Plan requirements have to be fulfilled without issue. It is stressed that reliability tests have to show that the devices behave correctly against environmental tests (no failure). Moreover, the stability of electrical parameters during the accelerated tests have to demonstrate the ruggedness of the products and safe operation, which is consequently expected during their lifetime.



## 4 DEVICE CHARACTERISTICS

### 4.1 Device description

LM2903WST



**LM2903W**

Low-power, dual-voltage comparator

Datasheet – production data

#### Features

- Wide, single supply voltage range or dual supplies +2 V to +36 V or  $\pm 1$  V to  $\pm 18$  V
- Very low supply current (0.4 mA) independent of supply voltage (1 mW/comparator at +5 V)
- Low input bias current: 25 nA typ.
- Low input offset current:  $\pm 5$  nA typ.
- Input common-mode voltage range includes negative rail
- Low output saturation voltage: 250 mV typ. ( $I_O = 4$  mA)
- Differential input voltage range equal to the supply voltage
- TTL, DTL, ECL, MOS, CMOS compatible outputs
- ESD internal protection: 2 kV

#### Description

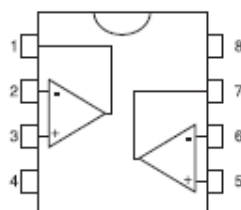
This device consists of two independent low-power voltage comparators designed specifically to operate from a single supply over a wide range of voltages. Operation from split power supplies is also possible.

The input common-mode voltage range includes negative rail even though operated from a single power supply voltage.

All pins are protected against electrostatic discharge up to 2 kV. Consequently, the input voltages must not exceed the  $V_{CC}^+$  or  $V_{CC}^-$  magnitudes.



#### Pin connections (top view)



- 1 - Output 1
- 2 - Inverting input 1
- 3 - Non-inverting input 1
- 4 -  $V_{CC}^-$
- 5 - Non-inverting input 2
- 6 - Inverting input 2
- 7 - Output 2
- 8 -  $V_{CC}^+$

LM2904WST,



## LM2904, LM2904A LM2904W, LM2904AW

Datasheet

### Low-power dual operational amplifier



#### Features

- Frequency compensation implemented internally
- Large DC voltage gain: 100 dB
- Wide bandwidth (unity gain): 1.1 MHz (temperature compensated)
- Very low supply current/amplifier, essentially independent of supply voltage
- Low input bias current: 20 nA (temperature compensated)
- Low input offset current: 2 nA
- Input common-mode voltage range includes negative rail
- Differential input voltage range equal to the power supply voltage
- Large output voltage swing 0 V to  $[V_{CC} - 1.5 \text{ V}]$

#### Description

This circuit consists of two independent, high gain operational amplifiers (op amps) that have frequency compensation implemented internally. They are designed specifically for automotive and industrial control systems. The circuit operates from a single power supply over a wide range of voltages. The low power supply drain is independent of the magnitude of the power supply voltage.

Application areas include transducer amplifiers, DC gain blocks and all the conventional op amp circuits which can now be more easily implemented in single power supply systems. For example, these circuits can be directly supplied from the standard 5 V which is used in logic systems and easily provides the required electronic interfaces without requiring any additional power supply.

In linear mode, the input common-mode voltage range includes ground and the output voltage can also swing to ground, even though operated from a single power supply.

Maturity status link		
	Enhanced V <sub>IO</sub>	Enhanced ESD
LM2904		
LM2904A	✓	
LM2904W		✓
LM2904AW	✓	✓

Related products	
TSB572	Dual op-amps for low-power consumption (380 $\mu$ A with 2.5 MHz GBP)
LM2902 LM2902W	Quad op-amps version
LM2904WH LM2904AH	High temperature version (150 °C)

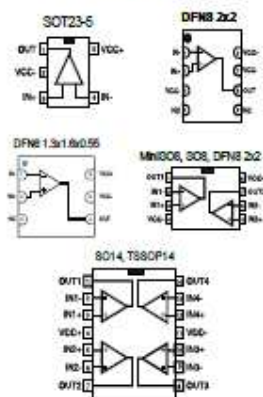
## TSV992ST



# TSV991, TSV992, TSV994 TSV991A TSV992A, TSV994A Datasheet

## Rail-to-rail input/output 20 MHz GBP operational amplifiers

Pin connections  
(top view)



### Features

- Low input offset voltage: 1.5 mV max. (A grade)
- Rail-to-rail input and output
- Wide bandwidth 20 MHz
- Stable for gain  $\geq 4$  or  $\leq -3$
- Low power consumption: 820  $\mu$ A typ.
- High output current: 35 mA
- Operating from 2.5 V to 5.5 V
- Low input bias current, 1 pA typ.
- ESD internal protection  $\geq 5$  kV

### Applications

- Battery-powered applications
- Portable devices
- Signal conditioning and active filtering
- Medical instrumentation
- Automotive applications

### Description

The TSV99x and TSV99xA family of single, dual, and quad operational amplifiers offers low voltage operation and rail-to-rail input and output. These devices feature an excellent speed/power consumption ratio, offering a 20 MHz gain-bandwidth, stable for gains above 4 (100 pF capacitive load), while consuming only 1.1 mA maximum at 5 V. They also feature an ultra-low input bias current. These characteristics make the TSV99x family ideal for sensor interfaces, battery-supplied and portable applications, as well as active filtering. These characteristics make the TSV99x, TSV99xA family ideal for sensor interfaces, battery-supplied and portable applications, as well as active filtering.

Product status link	
TSV991, TSV992, TSV994, TSV991A, TSV992A, TSV994A	
Related products	
See TSV911, TSV912, TSV914, TSV911A, TSV912A, TSV914A	For unity-gain stable amplifiers

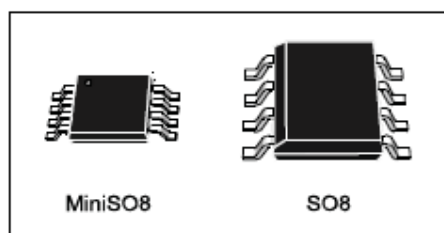
## TSX7192ST



## TSX7192

Low-power, precision, rail-to-rail, 9.0 MHz, 16 V operational amplifiers

Datasheet - production data



### Description

The TSX7192 dual, operational amplifier (op amp) offers high precision functioning with low input offset voltage down to a maximum of 200  $\mu\text{V}$  at 25 °C. In addition, its rail-to-rail input and output functionality allows this product to be used on full range input and output without limitation. This is particularly useful for a low-voltage supply such as 2.7 V that the TSX7192 is able to operate with.

Thus, the TSX7192 has the great advantage of offering a large span of supply voltages, ranging from 2.7 V to 16 V. It can be used in multiple applications with a unique reference.

Low input bias current performance makes the TSX7192 perfect when used for signal conditioning in sensor interface applications. In addition, low-side and high-side current measurements can be easily made thanks to rail-to-rail functionality. The TSX7192 is a decompensated amplifier and must be used with a gain greater than 10 to ensure stability.

High ESD tolerance (4 kV HBM) and a wide temperature range are also good arguments to use the TSX7192 in the automotive market segment.

### Features

- Low input offset voltage: 200  $\mu\text{V}$  max.
- Rail-to-rail input and output
- Low current consumption: 850  $\mu\text{A}$  max.
- Gain bandwidth product: 9 MHz
- Low supply voltage: 2.7 to 16 V
- Stable when used with Gain  $\geq 10$
- Low input bias current: 50 pA max.
- High ESD tolerance: 4 kV HBM
- Extended temp. range: -40 °C to 125 °C
- Automotive qualification

### Related products

- See the TSX7191 for single op amp version
- See the TSX712 for lower speeds with similar precision
- See the TSX562 for low-power features
- See the TSX632 for micro-power features
- See the TSX822 for higher speeds

### Applications

- Battery-powered instrumentation
- Instrumentation amplifier
- Active filtering
- High-impedance sensor interface
- Current sensing (high and low side)

**PM8834**

**PM8834**
**4 A dual low-side MOSFET driver**

Datasheet - production data


**Applications**

- SMPS
- DC-DC converters
- Motor controllers
- Line drivers
- Class-D switching amplifiers

**Description**

The PM8834 is a flexible, high-frequency dual low-side driver specifically designed to work with high capacitive MOSFETs and IGBTs.

Both PM8834 outputs can sink and source 4 A independently. A higher driving current can be obtained by connecting the two PWM outputs in parallel.

The PM8834 provides two enable pins which can be used to enable the operation of one or both of the output lines.

The PM8834 works with a CMOS/TTL-compatible PWM signal.

The device is available in an SO8 or an MSOP8 package with an exposed pad.

**Features**

- Dual independent low-side MOSFET driver with 4 A sink and source capability
- Independent enable for each driver
- Driver output parallelability to support higher driving capability
- Matched propagation delays
- CMOS/TTL-compatible input levels
- Wide input supply voltage range: 5 V to 18 V
- Embedded drivers with anti cross conduction protection
- Low bias switching current
- Short propagation delays
- Rated for a wide operative temperature range: -40 °C to 125 °C
- Industry standard SO8 package and MSOP8 with exposed pad

Table 1. Device summary

Order code	Package	Packing
PM8834	SO8	Tube
PM8834TR		Tape and reel
PM8834M	MSOP 8L-EP	Tube
PM8834MTR		Tape and reel

## 4.2 Construction note

	P/N LM2903WST	P/N LM2904WST	P/N TSV9921ST	P/N TSX71921ST	P/N PM8834
<b>Wafer/Die fab. information</b>					
Wafer fab manufacturing location	ST Singapore	ST Singapore	ST Singapore	UMC Taiwan	Catania
Technology	Bipolar	Bipolar	HF2CMOS	HF5CMOS	BCD6S
Die finishing back side	RAW SILICON	RAW SILICON	RAW SILICON	RAW SILICON	CHROMIUM/NICKEL/GOLD
Die size (microns)					989x1058
Bond pad metallization layers	AlSiCu	AlSiCu	AlSiCu	AlCu	AlCu
Passivation type	Nitride	Nitride	P-VAPOX/NITRIDE	PSG + NITRIDE	TEOS/SiN/Polyimide
<b>Wafer Testing (EWS) information</b>					
Electrical testing manufacturing location	ST Singapore	ST Singapore	ST Singapore	ST Singapore	ST Singapore
<b>Assembly information</b>					
Assembly site	TSHT	TSHT	TSHT	TSHT	TSHT
Package description	MiniSO8	MiniSO8	MiniSO8	MiniSO8	MiniSO8
Molding compound	Hitachi CEL-9220	Hitachi CEL-9220	Hitachi CEL-9220	Hitachi CEL-9220	Hitachi CEL-9220
Frame material	Cu	Cu	Cu	Cu	Cu
Die attach process	Epoxy Glue	Epoxy Glue	Epoxy Glue	Epoxy Glue	Epoxy Glue
Die attach material	Henkel 8200T	Henkel 8200T	Henkel 8200T	Henkel 8200T	Henkel 8600
Wire bonding process	Thermosonic ball bonding	Thermosonic ball bonding	Thermosonic ball bonding	Thermosonic ball bonding	Thermosonic ball bonding
Wires bonding materials/diameters	Cu 1 mil Pd Coated	Cu 1 mil Pd Coated	Cu 1 mil Pd Coated	Cu 1 mil Pd Coated	Gold 1.3Mil
Lead finishing process	electroplating	electroplating	electroplating	electroplating	electroplating
Lead finishing/bump solder material	Matte Sn	Matte Sn	Matte Sn	Matte Sn	Matte Sn
<b>Final testing information</b>					
Testing location	TSHT	TSHT	TSHT	TSHT	TSHT

## 5 TESTS PLAN SUMMARY

### 5.1 Test vehicle

Lot #	Process/ Package	Product Line	Comments
1	Bipolar/MiniSO8	0193	
2	Bipolar/MiniSO8	0358	
3	HF5CMOS/MiniSO8	V992	
4	HVG8A/MiniSO8	UY36	
5	BCD6S/MiniSO8ePad	UQ18	

### 5.2 Test plan summary

Test	PC	Std ref.	Conditions	SS	Steps	Failure/SS					Note
						Lot 1 0193	Lot 2 0358	Lot3 V992	Lot 4 UY36	Lot5 UQ18	
HTB/ HTOL	N	JESD22 A-108	Ta = 125°C or 125°C, BIAS		168 H	77	77	77	77		
					1000H	77	77	77	77		
HTSL	N	JESD22 A-103	Ta = 150°C		168 H	50	50	50	50	3x50	
					500 H	50	50	50	50	3x50	
					1000 H	50	50	50	50	3x50	
PC		JESD22 A-113	Drying 24 H @ 125°C Store 168 H @ Ta=85°C Rh=85% Over Reflow @ Tpeak=260°C 3 times		Final	Below sample + 22units	Below sample + 22units	Below sample + 22units	Below sample + 22units	Below sample + 22units	
UHASt	Y	JESD22 A-102	85%RH / Ta=130°C		96 H	77	77	77	77	3x77	
TC	Y	JESD22 A-104	Ta = -55°C to 150°C		100 cy	77	77	77	77	3x77	
					200 cy	77	77	77	77	3x77	
					500 cy	77	77	77	77	3x77	
					1000cy	77	77	77	77	3x77	
THB	Y	JESD22 A-101	Ta = 85°C, RH = 85%, BIAS		168 H	77	77	77	77		
					500 H	77	77	77	77		
					1000 H	77	77	77	77		



## 6 ANNEXES

### 6.1 Tests Description

Test name	Description	Purpose
<b>Die Oriented</b>		
<b>HTOL</b> High Temperature Operating Life  <b>HTB</b> High Temperature Bias	The device is stressed in static or dynamic configuration, approaching the operative max. absolute ratings in terms of junction temperature and bias condition.	To determine the effects of bias conditions and temperature on solid state devices over time. It simulates the devices' operating condition in an accelerated way.  The typical failure modes are related to, silicon degradation, wire-bonds degradation, oxide faults.
<b>HTRB</b> High Temperature Reverse Bias  <b>HTFB / HTGB</b> High Temperature Forward (Gate) Bias	The device is stressed in static configuration, trying to satisfy as much as possible the following conditions: low power dissipation; max. supply voltage compatible with diffusion process and internal circuitry limitations;	To determine the effects of bias conditions and temperature on solid state devices over time. It simulates the devices' operating condition in an accelerated way.  To maximize the electrical field across either reverse-biased junctions or dielectric layers, in order to investigate the failure modes linked to mobile contamination, oxide ageing, layout sensitivity to surface effects.
<b>HTSL</b> High Temperature Storage Life	The device is stored in unbiased condition at the max. temperature allowed by the package materials, sometimes higher than the max. operative temperature.	To investigate the failure mechanisms activated by high temperature, typically wire-bonds solder joint ageing, data retention faults, metal stress-voiding.
<b>ELFR</b> Early Life Failure Rate	The device is stressed in biased conditions at the max junction temperature.	To evaluate the defects inducing failure in early life.
<b>Package Oriented</b>		
<b>PC</b> Preconditioning	The device is submitted to a typical temperature profile used for surface mounting devices, after a controlled moisture absorption.	As stand-alone test: to investigate the moisture sensitivity level.  As preconditioning before other reliability tests: to verify that the surface mounting stress does not impact on the subsequent reliability performance.  The typical failure modes are "pop corn" effect and delamination.
<b>AC</b> Auto Clave (Pressure Pot)	The device is stored in saturated steam, at fixed and controlled conditions of pressure and temperature.	To investigate corrosion phenomena affecting die or package materials, related to chemical contamination and package hermeticity.
<b>TC</b> Temperature Cycling	The device is submitted to cycled temperature excursions, between a hot and a cold chamber in air atmosphere.	To investigate failure modes related to the thermo-mechanical stress induced by the different thermal expansion of the materials interacting in the die-package system. Typical failure modes are linked to metal displacement, dielectric cracking, molding compound delamination, wire-bonds failure, die-attach layer degradation.



Test name	Description	Purpose
<b>TF / IOL</b> Thermal Fatigue / Intermittent Oper- ating Life	The device is submitted to cycled tem- perature excursions generated by power cycles (ON/OFF) at T ambient.	To investigate failure modes related to the thermo-mechanical stress induced by the different thermal expansion of the materi- als interacting in the die-package system. Typical failure modes are linked to metal displacement, dielectric cracking, molding compound delamination, wire-bonds fail- ure, die-attach layer degradation.
<b>THB</b> Temperature Humi- dity Bias	The device is biased in static configuration minimizing its internal power dissipation, and stored at controlled conditions of ambi- ent temperature and relative humidity.	To evaluate the package moisture resistance with electrical field applied, both electrolytic and galvanic corrosion are put in evidence.
<b>Other</b>		
<b>ESD</b> Electro Static Dis- charge	The device is submitted to a high voltage peak on all his pins simulating ESD stress according to different simulation models. CBM: Charged Device Model HBM: Human Body Model MM: Machine Model	To classify the device according to his suscep- tibility to damage or degradation by exposure to electrostatic discharge.
<b>LU</b> Latch-Up	The device is submitted to a direct current forced/sunk into the input/output pins. Re- moving the direct current no change in the supply current must be observed.	To verify the presence of bulk parasitic effect inducing latch-up.



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**PCN Title** : New assembly site for General Purpose Analog products in MiniSO8 package

**PCN Reference** : AMS/20/12144

**Subject** : Public Products List

Dear Customer,

Please find below the Standard Public Products List impacted by the change.

LMV822IST	TSV992AIST	TSV6192AIST
TSV632AIST	TSV992IST	LMV358LIST
LM358ST	TSV612IST	TSV622AIST
TS462CST	TS332IST	TS1852AIST
LM2904ST	LMV822AIST	TS1872AIST
TSV612AIST	LM293ST	TSV912AIST
TSV912IST	TS3022IST	LMV393IST
LM358AWST	LM393ST	LMX358IST
TS972IST	TS1852IST	TSV6392AIST
PM8834MTR	TSV358IST	LM358WST
LM2903ST	TSV632IST	TSV6292AIST
LM258AST		



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