

# ***Surface-Mount Devices Reliability Report***

*This report presents reliability data for Maxim's surface-mount devices, including the results of extensive reliability stress tests performed solely on epoxy surface-mount packages since 1991.*

*Maxim's surface-mount packages are subjected to reliability standard tests typically applied to epoxy DIP packages, as well as to a series of stringent solder reflow tests that simulate the worst-case PC board assembly. These reliability tests conform to JEDEC Standard No. 22 Test Methods and Procedures for Solid-State Devices.*

*For its surface-mount packages, Maxim uses state-of-the-art packaging materials and processing methods that substantially reduce die surface stress and provide superior moisture resistance. Maxim's surface-mount packages exhibit no degradation after moisture resistance tests, solder reflow simulation, or sequential moisture tests, nor do they show any compromise in other reliability performance.*



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## **Introduction**

Maxim Integrated Products was founded in 1983 with one objective above all others: to build the highest quality, most reliable analog products in the industry. As with all our products, we have stringently applied this philosophy to our surface-mount devices.

With few exceptions, Maxim offers every monolithic product in a high-quality, high-reliability, 3-lead to 44-lead plastic surface-mount package. These products are processed through the same manufacturing flow as are our dual-in-line (DIP) plastic devices, and are tested to the same stringent electrical standard of 100% data sheet parameters and visual AQL levels, with the exception of 100% burn-in. Maxim has taken a leading-edge position by developing a surface-mount packaging system that is unequaled in product performance and reliability, despite the stresses that occur in typical surface-mount assembly operations.

This report summarizes the reliability data used to substantiate assembly quality at Maxim's subcontract assembly facilities in Korea, the Philippines, and Malaysia.

## **Quality Assurance Control Policy**

### **Quality Assurance of Outgoing Product**

Every lot shipped, including commercial product, must conform to exceptionally high standards for outgoing product quality. This is accomplished with inspections, as well as with Quality Assurance electrical and visual lot sampling. Our Quality Assurance testing guarantees an AQL (Acceptable Quality Limit) of:

- 0.1% for electrical conformance to data sheet specifications.
- 0.1% for visually observable packaging defects.

### **Quality Control of Measurement and Test Equipment**

The accuracy and reliability of our production test equipment directly affects product quality. Maxim's standard procedures for ensuring correct operation

and calibration of this equipment include the following:

- 1) Daily computer-controlled calibration of production testers using standards traceable to the National Bureau of Standards (NBS).
- 2) The establishment of KGUs (known good units), and their daily use for verifying correct production setup.

Maxim is compliant to MIL-STD-45662 and all ISO 9000 requirements for calibration control.

## **Surface-Mount Package Reliability**

Surface-mount packages offer significant advantages over the standard epoxy plastic DIPs: namely a smaller footprint and lower profile. However, these physical advantages can cause reliability problems, particularly in high-humidity environments. Achieving surface-mount reliability that rivals that of plastic DIPs (especially in a harsh, humid environments) requires a unique combination of molding compound formulation and cure time, material expansion coefficients, leadframe composition and processing, and lead finish.

### **Effects of Thermal Stress on Surface-Mount Packages**

The surface-mounting of SOIC packages subjects them to more stress than does the soldering of through-hole devices. This exposure to high temperature can degrade the package's moisture resistance, due to microcracks created on the molding compound or leadframe interface. In some cases it can also cause the plastic package to crack (usually at the edge of the die attach pad) from the high-stress-concentration area, and this crack can propagate to the outside of the plastic package. Once a crack is created, corrosive contaminants from flux and solder paste can enter the package.

Subsequent exposure of the device to a humid environment can cause the contaminants to dissolve and flow along the microcracks to the die. The resulting aluminum corrosion can cause premature device failure.

Another reliability concern for surface-mount packages is stress-induced cracking on the die surface

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when the package is subjected to thermal cycling stress. This includes passivation cracking, dielectric cracking or, in the worse case, die cracking. All these defects lead to the malfunction of the integrated circuit inside the surface-mount package.

Using state-of-the-art materials and processing, Maxim has developed a packaging system that reduces stress to the die surface. This system reduces or eliminates the occurrence of micro-cracks, package crack, and stress-induced die cracking, while providing superior moisture resistance. Maxim is constantly looking for improvements in molding compounds, die attach material, and assembly processing, to achieve even better package reliability performance.

## Reliability Methodology

Maxim's surface-mount packages are put through the same stringent reliability qualification requirements as DIP products, plus a sequence of stringent solder reflow tests simulating worst-case surface-mount-package PC board assembly. Therefore, Maxim's surface-mount packages have been tested to the same level of reliability as standard epoxy DIP products in all aspects of package reliability.

Table A lists Maxim's standard reliability tests to qualify epoxy DIP products; these tests apply to epoxy surface-mount packages as well. Table B lists Maxim's reliability tests that simulate PC board assembly and evaluate the moisture resistance of surface-mount packages. These tests take into account the physical advantages of surface-mount packages, which do not apply to epoxy DIP packages.

## Reliability Data

Tables 1–11 list the results of reliability tests Maxim has performed for various surface-mount packages. Table C summarizes the reliability results of the following tests: Life Test, 85/85, Pressure Pot, HAST, Temperature Cycling, and High-Temperature Storage Life Test. It also shows the total number of samples tested, total device hours (or total device cycles), and number of rejects detected during reliability testing.

As the data shows, Maxim's surface-mount packages exhibit no degradation after moisture resistance tests, solder reflow simulation, or sequential moisture tests, nor do they show any compromise in other reliability performance.

**TABLE A: STANDARD RELIABILITY TESTS FOR EPOXY DUAL-IN-LINE & EPOXY SURFACE-MOUNT PACKAGES**

STRESS TEST	TEST CONDITION	DURATION	SAMPLING PLAN (SS/ACC)
Life Test	+135°C, BIAS	1000 Hours	77/1
85/85	+85°C, 85% R.H., BIAS	1000 Hours	77/1
Hast	+120°C, 85% R.H., BIAS	100 Hours	25/1
Pressure Pot	+121°C, 100%, 15 PSIG	168 Hours	77/0
Temperature Cycling	-65°C to +150°C	1000 Cycles	77/1
High-Temperature Storage Life Test	+150°C	1000 Hours	77/1
Solder Shock	+260°C	10 Seconds	15/0
Resistance to Soldering Iron	+300°C	10 Seconds	15/0
Thermal Shock	0°C to +100°C	100 Cycles	77/1

**TABLE B: RELIABILITY TESTS FOR EPOXY SURFACE-MOUNT PACKAGES ONLY**

STRESS TEST	TEST CONDITION	DURATION	SAMPLING PLAN (SS/ACC)
Vapor Phase Reflow with Preconditioning*	1. Preheat (+150°C) 2. +220°C/90 seconds	2 Minutes 3 Cycles	45/0
Sequential Moisture Test with Preconditioning*	1. Solder DIP (+260°C/5 seconds) 2. Pressure Pot	3 Cycles 96 Hours	20/0

\* Preconditioning: +85°C, 85% R.H. Storage for 168 Hours

**TABLE C: RELIABILITY TEST SUMMARY**

STRESS TEST	TOTAL UNITS TESTED	TOTAL DEVICE HOURS (or CYCLES)	No. REJECTED
Life Test	6198	6,198,000 device hours	3
85/85	3169	3,169,000 device hours	1
Hast	448	44,800 device hours	0
Pressure Pot	4623	776,664 device hours	0
Temperature Cycling	5156	5,156,000 device cycles	1
High-Temperature Storage Life Test	3764	3,764,000 device hours	0

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**TABLE 1: LIFE TEST RESULTS**  
(T<sub>A</sub> = +135°C, BIASED)

DEVICE TYPE	DATE CODE	PKG TYPE	SAMPLE SIZE	FAILURES (HRS)			NOTES
				192	500	1000	
MAX241	9211	28 SSOP	65	0	0	0	
MAX232	9215	16 WSO	77	0	0	0	
MAX241	9220	28 SSOP	63	0	0	0	
MAX232	9222	16 WSO	77	0	0	0	
MAX722	9222	16 WSO	80	0	0	0	
MAX244	9233	44 PLCC	80	0	0	0	
MAX232A	9238	16 WSO	77	0	0	0	
MAX663	9238	8 NSO	77	0	0	0	
MAX717	9239	16 WSO	77	0	0	0	
DG211	9243	16 NSO	36	0	0	0	
MAX213	9245	28 WSO	80	0	0	0	
MXL902	9250	18 WSO	50	0	0	0	
MAX213	9251	28 WSO	80	0	0	0	
MAX8212	9301	8 NSO	76	0	0	0	
MAX241	9307	28 WSO	80	0	0	0	
MXL902	9311	18 WSO	52	0	0	0	
MAX8212	9314	8 NSO	77	0	0	0	
MAX232	9314	16 WSO	77	0	0	0	
MAX8212	9315	8 NSO	77	0	0	0	
MAX232	9315	16 WSO	77	1	0	0	FUNCTIONAL
MXL902	9316	18 WSO	66	0	0	0	
DG211	9321	16 NSO	36	0	0	0	
MXL902	9323	18 WSO	45	0	0	0	
MAX8212	9324	8 NSO	77	0	0	0	
MXL902	9325	18 WSO	45	0	0	0	
MAX232	9328	16 WSO	77	0	0	0	
MAX691A	9331	16 WSO	79	0	0	0	
MAX211E	9332	28 SSOP	60	0	0	0	
MAX691A	9333	16 WSO	142	0	0	0	
MAX211E	9333	28 SSOP	74	0	0	0	
MAX722	9334	16 NSO	77	1	0	0	PARAMETRIC
MAX8211	9334	8 NSO	77	0	0	0	
MAX232	9334	16 WSO	72	0	0	0	
MAX8211	9335	8 NSO	77	0	0	0	
MAX8212	9337	8 NSO	77	0	0	0	
MAX722	9341	16 NSO	77	0	0	0	
MAX705	9345	μMAX	77	0	0	0	
MXL902	9348	18 WSO	76	0	0	0	
MAX211E	9350	28 SSOP	80	0	0	0	
MAX832	9351	16 WSO	45	0	0	0	
MAX831	9351	16 WSO	45	0	0	0	
MAX8211	9352	8 NSO	77	0	0	1	PARAMETRIC
MAX211E	9401	28 WSO	80	0	0	0	

DEVICE TYPE	DATE CODE	PKG TYPE	SAMPLE SIZE	FAILURES (HRS)			NOTES
				192	500	1000	
MAX782	9402	36 SSOP	52	0	0	0	
MAX241E	9404	28 SSOP	79	0	0	0	
MAX850	9405	8 NSO	80	0	0	0	
MAX852	9407	8 NSO	78	0	0	0	
MAX853	9407	8 NSO	77	0	0	0	
MAX851	9409	8 NSO	80	0	0	0	
DG211	9409	16 NSO	36	0	0	0	
MAX400	9413	8 NSO	77	0	0	0	
MAX8211	9413	8 NSO	77	0	0	0	
MAX705	9415	μMAX	45	0	0	0	
MAX705	9417	μMAX	45	0	0	0	
MAX8211	9418	8 NSO	76	0	0	0	
MAX240	9420	44 QFP	70	0	0	0	
MAX240	9421	44 QFP	72	0	0	0	
MAX691A	9421	16 NSO	100	0	0	0	
MAX240	9422	44 QFP	76	0	0	0	
MAX240	9423	44 QFP	72	0	0	0	
MAX511	9424	14 NSO	77	0	0	0	
MAX223	9431	28 WSO	77	0	0	0	
MAX213	9434	28 SSOP	70	0	0	0	
MAX241	9436	28 WSO	77	0	0	0	
MAX211	9439	28 SSOP	72	0	0	0	
MAX691	9439	16 WSO	61	0	0	0	
MAX8211	9439	8 NSO	77	0	0	0	
MAX241	9440	28 SSOP	77	0	0	0	
MAX202	9441	16 WSO	76	0	0	0	
MAX232	9441	16 WSO	80	0	0	0	
MAX241	9442	28 SSOP	77	0	0	0	
MAX249	9442	44 PLCC	75	0	0	0	
MAX241	9444	28 WSO	80	0	0	0	
MAX691A	9444	16 WSO	79	0	0	0	
MAX249	9445	44 PLCC	77	0	0	0	
MAX695	9445	16 WSO	77	0	0	0	
MAX693	9446	16 WSO	45	0	0	0	
MAX232	9446	16 WSO	76	0	0	0	
MAX211	9450	28 WSO	71	0	0	0	
MAX211	9451	28 SSOP	74	0	0	0	
MAX232	9451	16 WSO	77	0	0	0	
MAX8212	9508	8 NSO	77	0	0	0	
MAX809	9512	SOT-23	69	0	0	0	
MAX211	9512	28 WSO	80	0	0	0	
MAX809	9514	SOT-23	75	0	0	0	
MAX211	9524	28 SSOP	80	0	0	0	

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**TABLE 2: 85/85 TEST RESULTS**  
(T<sub>A</sub> = +85°C, 85% R.H., BIASED)

DEVICE TYPE	DATE CODE	PKG TYPE	SAMPLE SIZE	FAILURES (HOURS)			NOTES
				168	500	1000	
ICL7106	9125	44 PLCC	30	0	0	0	
MAX232	9140	16 WSO	75	0	0	0	
MAX232	9201	16 WSO	77	0	0	0	
REF01	9204	8 NSO	77	0	0	0	
MAX241	9211	28 SSOP	30	0	0	0	
MAX232	9214	16 WSO	56	0	0	0	
MAX232	9215	16 WSO	45	0	0	0	
MAX241	9220	28 SSOP	30	0	0	0	
MAX232	9222	16 WSO	56	0	0	0	
MAX663	9238	8 NSO	77	0	1	0	FUNCTIONAL
MAX133	9245	44 PLCC	15	0	0	0	
MAX8212	9246	8 NSO	77	0	0	0	
MAX8212	9251	8 NSO	77	0	0	0	
MAX903	9252	8 NSO	77	0	0	0	
MAX8212	9301	8 NSO	77	0	0	0	
MAX232	9314	16 WSO	45	0	0	0	
MAX8212	9314	8 NSO	77	0	0	0	
MAX232	9315	16 WSO	45	0	0	0	
MAX8212	9315	8 NSO	77	0	0	0	
MAX8212	9324	8 NSO	77	0	0	0	
MAX707	9333	8 NSO	80	0	0	0	
MAX232	9334	16 WSO	56	0	0	0	
MAX8211	9334	8 NSO	77	0	0	0	
MAX8211	9335	8 NSO	77	0	0	0	
MAX8212	9337	8 NSO	77	0	0	0	
MAX722	9341	16 NSO	61	0	0	0	
MAX705	9345	µMAX	25	0	0	0	
MAX832	9351	16 WSO	45	0	0	0	
MAX831	9351	16 WSO	45	0	0	0	
MAX8211	9352	8 NSO	77	0	0	0	
MAX853	9407	8 NSO	45	0	0	0	
MAX852	9407	8 NSO	43	0	0	0	
DG412	9409	16 NSO	80	0	0	0	
MAX8211	9413	8 NSO	77	0	0	0	
MAX400	9413	8 NSO	77	0	0	0	
MAX8211	9418	8 NSO	77	0	0	0	
MAX223	9431	28 WSO	45	0	0	0	
MAX213	9434	28 WSO	45	0	0	0	
MAX241	9436	28 WSO	26	0	0	0	
MAX8211	9439	8 NSO	77	0	0	0	
MAX691	9439	16 WSO	45	0	0	0	
MAX211	9439	28 WSO	45	0	0	0	
MAX241	9440	28 SSOP	45	0	0	0	
MAX851	9409	8 NSO	45	0	0	0	
MAX241	9442	28 SSOP	35	0	0	0	
MAX249	9442	44 PLCC	30	0	0	0	
MAX691A	9444	16 WSO	45	0	0	0	
MAX695	9445	16 WSO	45	0	0	0	
MAX693	9446	16 WSO	45	0	0	0	
MAX232	9446	16 WSO	26	0	0	0	
MAX213	9448	28 SSOP	29	0	0	0	
MAX211	9451	28 SSOP	25	0	0	0	
MAX232	9451	16 WSO	26	0	0	0	
MAX8212	9508	8 NSO	77	0	0	0	
REF01	9511	8 NSO	77	0	0	0	
DG303	9513	16 WSO	43	0	0	0	
MAX485	9515	8 NSO	77	0	0	0	

**TABLE 3: PRESSURE POT TEST RESULTS**  
(+121°C, 2 ATM, 100% R.H., UNBIASED)

DEVICE TYPE	DATE CODE	PKG TYPE	SAMPLE SIZE	FAILURES 168 (HOURS)	DEVICE TYPE	DATE CODE	PKG TYPE	SAMPLE SIZE	FAILURES 168 (HOURS)	DEVICE TYPE	DATE CODE	PKG TYPE	SAMPLE SIZE	FAILURES 168 (HOURS)
MAX232	9140	16 WSO	45	0	MAX240	9319	44 QFP	77	0	MAX782	9402	36 SSOP	45	0
MAX232	9201	16 WSO	45	0	MAX8212	9324	8 NSO	45	0	MAX782	9407	36 SSOP	45	0
REF01	9204	8 NSO	77	0	MXL902	9324	18 WSO	45	0	MAX852	9407	8 NSO	45	0
MAX241	9211	28 SSOP	45	0	MXL902	9325	18 WSO	45	0	MAX853	9407	8 NSO	45	0
MAX241	9220	28 SSOP	39	0	MAX232	9328	16 WSO	46	0	MAX782	9409	36 SSOP	45	0
MAX560	9221	28 SSOP	45	0	MAX691A	9331	16 WSO	45	0	DG412	9409	16 NSO	45	0
MAX232	9222	16 WSO	45	0	MAX707	9333	8 NSO	45	0	MAX851	9409	8 NSO	45	0
MAX560	9222	28 SSOP	45	0	MAX232	9334	16 WSO	77	0	MAX400	9413	8 NSO	77	0
MAX241	9225	28 SSOP	45	0	MAX8211	9334	8 NSO	76	0	MAX8211	9413	8 NSO	45	0
MAX663	9238	8 NSO	45	0	MAX8211	9335	8 NSO	77	0	MAX705	9415	µMAX	45	0
MAX8212	9246	8 NSO	77	0	MAX782	9336	36 SSOP	45	0	MAX705	9417	µMAX	45	0
MAX8212	9251	8 NSO	45	0	MAX8212	9337	8 NSO	45	0	MAX8211	9418	8 NSO	45	0
MAX903	9252	8 NSO	77	0	MAX232A	9338	16 WSO	45	0	MAX223	9419	28 SSOP	45	0
MAX8212	9301	8 NSO	45	0	MAX708	9339	8 NSO	20	0	MAX560	9419	28 SSOP	45	0
MAX241	9307	28 SSOP	20	0	MAX706T	9339	8 NSO	20	0	MAX240	9420	44 QFP	45	0
MAX782	9312	36 SSOP	43	0	MAX707	9339	8 NSO	20	0	MAX240	9421	44 QFP	45	0
MAX232	9314	16 WSO	45	0	MAX722	9341	16 NSO	45	0	MAX240	9422	44 QFP	45	0
MAX8212	9314	8 NSO	45	0	MAX705	9345	µMAX	77	0	MAX240	9423	44 QFP	39	0
MAX232	9315	16 WSO	45	0	MAX832	9351	16 WSO	44	0	MAX511	9424	14 NSO	45	0
MAX8212	9315	8 NSO	45	0	MAX8211	9352	8 NSO	45	0	MAX691	9430	16 WSO	77	0

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**TABLE 3: PRESSURE POT TEST RESULTS (continued)**  
(+121°C, 2 ATM, 100% R.H., UNBIASED)

DEVICE TYPE	DATE CODE	PKG TYPE	SAMPLE SIZE	FAILURES 168 (HOURS)	DEVICE TYPE	DATE CODE	PKG TYPE	SAMPLE SIZE	FAILURES 168 (HOURS)	DEVICE TYPE	DATE CODE	PKG TYPE	SAMPLE SIZE	FAILURES 168 (HOURS)
MAX223	9431	28 WSO	77	0	MAX241	9442	28 SSOP	45	0	MAX211	9451	28 SSOP	77	0
MAX213	9434	28 WSO	77	0	MAX782	9442	36 SSOP	45	0	MAX232	9451	16 WSO	77	0
MAX241	9436	28 WSO	77	0	MAX249	9442	44 PLCC	45	0	MX7574	9506	18 WSO	45	0
MAX211	9438	28 WSO	77	0	MAX830	9445	16 WSO	45	0	MAX8212	9508	8 NSO	45	0
MAX782	9438	36 SSOP	45	0	MAX249	9445	44 PLCC	45	0	REF01	9511	8 NSO	45	0
MAX211	9439	28 WSO	77	0	MAX695	9445	16 WSO	45	0	MAX809	9512	SOT-23	45	0
MAX695	9439	16 WSO	77	0	MAX232	9446	16 WSO	77	0	DG302	9513	16 WSO	45	0
MAX241	9440	28 SSOP	45	0	MAX213	9448	28 SSOP	77	0	MAX809	9514	SOT-23	10	0
MAX202	9441	16 WSO	77	0	MAX211	9450	28 WSO	77	0	MAX485	9515	8 NSO	77	0

**TABLE 4: TEMPERATURE CYCLING TEST RESULTS**  
(-65°C TO +150°C, DWELL = 15 MINUTES (AIR TO AIR))

DEVICE TYPE	DATE CODE	PKG TYPE	SAMPLE SIZE	FAILURES (CYCLES)			NOTES	DEVICE TYPE	DATE CODE	PKG TYPE	SAMPLE SIZE	FAILURES (CYCLES)			NOTES
				200	500	1000						200	500	1000	
MAX232	9140	16 WSO	77	0	0	0		MAX851	9409	8 NSO	45	0	0	0	
MAX232	9201	16 WSO	77	0	0	0		DG412	9409	16 NSO	77	0	0	0	
REF01	9204	8 NSO	76	0	0	0		MAX782	9409	36 SSOP	77	0	0	0	
MAX241	9211	28 SSOP	77	0	1	0	PASSIVATION CRACK	MAX8211	9413	8 NSO	77	0	0	0	
MAX232	9214	16 WSO	77	0	0	0		MAX400	9413	8 NSO	77	0	0	0	
MAX232	9215	16 WSO	77	0	0	0		MAX705	9415	μMAX	45	0	0	0	
MAX241	9220	28 SSOP	76	0	0	0		MAX705	9417	μMAX	43	0	0	0	
MAX560	9221	28 SSOP	45	0	0	0		MAX8211	9418	8 NSO	77	0	0	0	
MAX232	9222	16 WSO	77	0	0	0		MAX223	9419	28 SSOP	75	0	0	0	
MAX663	9238	8 NSO	77	0	0	0		MAX560	9419	28 SSOP	77	0	0	0	
MAX133	9245	44 PLCC	77	0	0	0		MAX240	9420	44 QFP	45	0	0	0	
MAX8212	9246	8 NSO	77	0	0	0		MAX240	9421	44 QFP	77	0	0	0	
MAX8212	9251	8 NSO	77	0	0	0		MAX240	9422	44 QFP	45	0	0	0	
MAX903	9252	8 NSO	77	0	0	0		MAX240	9423	44 QFP	77	0	0	0	
MAX8212	9301	8 NSO	77	0	0	0		MAX511	9424	14 NSO	45	0	0	0	
MAX8212	9314	8 NSO	77	0	0	0		MAX223	9431	28 WSO	44	0	0	0	
MAX232	9314	16 WSO	77	0	0	0		MAX213	9434	28 WSO	45	0	0	0	
MAX232	9315	16 WSO	77	0	0	0		MAX241	9436	28 WSO	45	0	0	0	
MAX8212	9315	8 NSO	77	0	0	0		MAX211	9439	28 WSO	45	0	0	0	
MAX782	9312	36 SSOP	45	0	0	0		MAX695	9439	16 WSO	45	0	0	0	
MAX240	9319	44 QFP	77	0	0	0		MAX8211	9439	8 NSO	77	0	0	0	
MAX8212	9324	8 NSO	77	0	0	0		MAX691	9439	16 WSO	44	0	0	0	
MAX232	9328	16 WSO	77	0	0	0		MAX241	9440	28 SSOP	77	0	0	0	
MAX782	9330	36 SSOP	45	0	0	0		MAX202	9441	16 WSO	45	0	0	0	
MAX707	9333	8 NSO	77	0	0	0		MAX241	9442	28 SSOP	77	0	0	0	
MAX232	9334	16 WSO	76	0	0	0		MAX249	9442	44 PLCC	45	0	0	0	
MAX8211	9334	8 NSO	77	0	0	0		MAX782	9442	36 SSOP	77	0	0	0	
MAX8211	9335	8 NSO	77	0	0	0		MAX695	9445	16 WSO	77	0	0	0	
MAX782	9336	36 SSOP	45	0	0	0		MAX249	9445	44 PLCC	45	0	0	0	
MAX8212	9337	8 NSO	77	0	0	0		MAX693	9446	16 WSO	45	0	0	0	
MAX232A	9338	16 WSO	32	0	0	0		MAX232	9446	16 WSO	45	0	0	0	
MAX722	9341	16 NSO	61	0	0	0		MAX213	9448	28 SSOP	44	0	0	0	
MAX705	9345	μMAX	77	0	0	0		MAX211	9450	28 SSOP	45	0	0	0	
MAX832	9351	16 WSO	45	0	0	0		MAX232	9451	16 WSO	45	0	0	0	
MAX831	9351	16 WSO	30	0	0	0		MAX211	9451	28 SSOP	45	0	0	0	
MAX8211	9352	8 NSO	77	0	0	0		MX7574	9506	18 WSO	77	0	0	0	
MAX782	9402	36 SSOP	77	0	0	0		MAX8212	9508	8 NSO	77	0	0	0	
MAX782	9407	36 SSOP	76	0	0	0		REF01	9511	8 NSO	76	0	0	0	
MAX852	9407	8 NSO	45	0	0	0		DG302	9513	16 WSO	76	0	0	0	
MAX853	9407	8 NSO	45	0	0	0		MAX809	9514	SOT-23	13	0	0	0	
								MAX485	9515	8 NSO	77	0	0	0	



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**TABLE 5: HIGH-TEMPERATURE STORAGE LIFE TEST RESULTS**  
(T<sub>A</sub> = +150°C, UNBIASED)

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DEVICE TYPE	DATE CODE	PKG TYPE	SAMPLE SIZE	FAILURES (HOURS)		
				192	500	1000
MAX232	9140	16 WSO	45	0	0	0
MAX232	9201	16 WSO	45	0	0	0
REF01	9204	8 NSO	45	0	0	0
MAX241	9211	28 SSOP	45	0	0	0
MAX232	9214	16 WSO	45	0	0	0
MAX232	9215	16 WSO	45	0	0	0
MAX241	9220	28 SSOP	45	0	0	0
MAX560	9221	28 SSOP	45	0	0	0
MAX232	9222	16 WSO	45	0	0	0
MAX663	9238	8 NSO	45	0	0	0
MAX8212	9246	8 NSO	77	0	0	0
MAX8212	9251	8 NSO	45	0	0	0
MAX8212	9301	8 NSO	45	0	0	0
MAX240	9313	44 QFP	45	0	0	0
MAX8212	9314	8 NSO	45	0	0	0
MAX232	9314	16 WSO	45	0	0	0
MAX8212	9315	8 NSO	45	0	0	0
MAX232	9315	16 WSO	45	0	0	0
MAX240	9319	44 QFP	45	0	0	0
MAX8212	9324	8 NSO	45	0	0	0
MAX707	9333	8 NSO	40	0	0	0
MAX8211	9334	8 NSO	45	0	0	0
MAX232	9334	16 WSO	45	0	0	0
MAX8211	9335	8 NSO	45	0	0	0
MAX782	9336	36 SSOP	45	0	0	0
MAX8212	9337	8 NSO	45	0	0	0
MAX232A	9338	16 WSO	46	0	0	0
MAX722	9341	16 NSO	45	0	0	0
MXL902	9348	18 WSO	77	0	0	0
MAX832	9351	16 WSO	45	0	0	0
MAX831	9351	16 WSO	39	0	0	0
MAX8211	9352	8 NSO	45	0	0	0
MAX782	9402	36 SSOP	45	0	0	0
MAX853	9407	8 NSO	45	0	0	0
MAX852	9407	8 NSO	44	0	0	0
MAX782	9407	36 SSOP	45	0	0	0
MAX782	9408	36 SSOP	45	0	0	0
DG412	9409	16 NSO	45	0	0	0
MAX851	9409	8 NSO	45	0	0	0

DEVICE TYPE	DATE CODE	PKG TYPE	SAMPLE SIZE	FAILURES (HOURS)		
				192	500	1000
MAX782	9409	36 SSOP	45	0	0	0
MAX400	9413	8 NSO	45	0	0	0
MAX8211	9413	8 NSO	45	0	0	0
MAX705	9415	μMAX	25	0	0	0
MAX705	9417	μMAX	25	0	0	0
MAX8212	9418	8 NSO	45	0	0	0
MAX223	9419	28 SSOP	45	0	0	0
MAX560	9419	28 SSOP	45	0	0	0
MAX240	9420	44 QFP	45	0	0	0
MAX240	9421	44 QFP	25	0	0	0
MAX240	9422	44 QFP	23	0	0	0
MAX240	9423	44 QFP	45	0	0	0
MAX511	9424	14 NSO	45	0	0	0
MAX223	9431	28 SSOP	75	0	0	0
MAX213	9434	28 WSO	77	0	0	0
MAX241	9436	28 WSO	77	0	0	0
MAX211	9439	28 WSO	77	0	0	0
MAX695	9439	16 WSO	77	0	0	0
MAX8211	9439	8 NSO	45	0	0	0
MAX691	9439	16 WSO	77	0	0	0
MAX241	9440	28 SSOP	45	0	0	0
MAX202	9441	16 WSO	77	0	0	0
MAX241	9442	28 SSOP	45	0	0	0
MAX249	9442	44 PLCC	25	0	0	0
MAX249	9445	44 PLCC	25	0	0	0
MAX695	9445	16 WSO	45	0	0	0
MAX232	9446	16 WSO	76	0	0	0
MAX693	9446	16 WSO	77	0	0	0
MAX213	9448	28 SSOP	77	0	0	0
MAX211	9450	28 SSOP	77	0	0	0
MAX211	9451	28 SSOP	77	0	0	0
MX7574	9506	18 WSO	45	0	0	0
MAX8212	9508	8 NSO	43	0	0	0
REF01	9511	8 NSO	45	0	0	0
MAX809	9512	SOT-23	32	0	0	0
DG302	9513	16 WSO	45	0	0	0
MAX809	9514	SOT-23	15	0	0	0
MAX485	9515	8 NSO	77	0	0	0

**TABLE 6: THERMAL SHOCK TEST RESULTS**  
(0°C TO +100°C, DWELL = 5 MINUTES (LIQUID TO LIQUID))

DEVICE TYPE	DATE CODE	PACKAGE TYPE	SAMPLE SIZE	FAILURES (CYCLES)
				100
MAX691	9044	16 WSO	46	0
MAX691	9046	16 WSO	46	0
MAX691	9047	16 WSO	46	0
MAX691	9049	16 WSO	46	0
MAX691	9051	16 WSO	46	0
MAX691	9052	16 WSO	46	0
MAX691	9104	16 WSO	46	0
MAX691	9116	16 WSO	46	0
MAX875	9236	8 NSO	45	0
MXL902	9250	16 WSO	45	0

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**TABLE 7: HAST TEST RESULTS**  
 (+85°C, 85% R.H. STORAGE 168 HRS + VAPOR PHASE  
 REFLOW (3 CYCLES) + +120°C, 85% R.H. , BIASED / 100 HRS)

DEVICE TYPE	DATE CODE	PKG TYPE	SAMPLE SIZE	FAILURES (HOURS) 100
MAX782	9319	36 SSOP	24	0
MAX782	9330	36 SSOP	24	0
MAX782	9336	36 SSOP	25	0
MAX705	9345	µMAX	25	0
MAX782	9402	36 SSOP	25	0
MAX782	9407	36 SSOP	25	0
MAX782	9408	36 SSOP	25	0
MAX782	9409	36 SSOP	25	0
MAX705	9415	µMAX	25	0
MAX705	9417	µMAX	25	0
MAX223	9419	28 SSOP	25	0
MAX560	9419	28 SSOP	25	0
MAX240	9422	44 QFP	25	0
MAX240	9423	44 QFP	25	0
MAX249	9442	44 PLCC	25	0
MAX249	9445	44 PLCC	25	0
MAX809	9512	SOT-23	25	0
MAX809	9514	SOT-23	25	0

**TABLE 8: VAPOR PHASE REFLOW TEST RESULTS**  
 (+85°C, 85% R.H. STORAGE 168 HRS + VAPOR PHASE  
 REFLOW (3 CYCLES))

DEVICE TYPE	DATE CODE	PKG TYPE	SAMPLE SIZE	FAILURES (HOURS)
MAX8211	9334	8 NSO	45	0
MAX232	9334	16 WSO	45	0
MAX8211	9335	8 NSO	45	0
MAX240	9342	44 QFP	45	0
MAX705	9345	µMAX	45	0
MAX782	9402	36 SSOP	45	0
MAX782	9407	36 SSOP	45	0
MAX782	9408	36 SSOP	45	0
MAX782	9409	36 SSOP	45	0
MAX400	9413	8 NSO	45	0
MAX705	9415	µMAX	45	0
MAX705	9417	µMAX	45	0
MAX560	9419	28 SSOP	45	0
MAX223	9419	28 SSOP	45	0
MAX240	9420	44 QFP	45	0
MAX240	9421	44 QFP	45	0
MAX240	9422	44 QFP	45	0
MAX240	9423	44 QFP	45	0
MAX782	9438	36 SSOP	45	0
MAX781	9440	36 SSOP	42	0
MAX241	9440	28 SSOP	45	0
MAX249	9442	44 PLCC	45	0
MAX782	9442	36 SSOP	45	0
MAX241	9442	28 SSOP	45	0
MAX249	9445	44 PLCC	45	0
MAX809	9512	SOT-23	45	0
MAX809	9514	SOT-23	45	0

**TABLE 9: RESISTANCE TO SOLDER-IRON HEAT  
 TEST RESULTS**  
 (+300°C, 10 SECONDS CONTACT)

DEVICE TYPE	DATE CODE	PKG TYPE	SAMPLE SIZE	FAILURES (HOURS)
MAX232	9251	16 WSO	15	0
MAX8211	9252	8 NSO	15	0
MAX232	9301	16 WSO	15	0
MAX232	9314	16 WSO	15	0
MAX8212	9314	8 NSO	15	0
MAX232	9315	16 WSO	15	0
MAX8212	9315	8 NSO	15	0
MAX240	9319	44 QFP	15	0
MAX8211	9334	8 NSO	15	0
MAX232	9334	16 WSO	15	0
MAX8211	9335	8 NSO	15	0
MAX782	9336	36 SSOP	15	0
MAX705	9345	µMAX	15	0
MAX782	9402	36 SSOP	15	0
MAX782	9407	36 SSOP	15	0
MAX782	9408	36 SSOP	15	0
MAX782	9409	36 SSOP	15	0
MAX705	9415	µMAX	15	0
MAX705	9416	µMAX	15	0
MAX705	9417	µMAX	15	0
MAX223	9419	28 SSOP	15	0
MAX560	9419	28 SSOP	15	0
MAX240	9420	44 QFP	15	0
MAX240	9421	44 QFP	15	0
MAX240	9422	44 QFP	15	0
MAX241	9440	28 SSOP	15	0
MAX249	9442	44 PLCC	15	0
MAX241	9442	28 SSOP	14	0
MAX249	9445	44 PLCC	15	0
MAX809	9512	SOT-23	15	0
MAX809	9514	SOT-23	15	0

**TABLE 10: SOLDER SHOCK TEST RESULTS**  
 (+260°C, 10 SECONDS IMMERSION)

DEVICE TYPE	DATE CODE	PACKAGE TYPE	SAMPLE SIZE	FAILURES (HOURS)
MAX400	9413	8 NSO	15	0
MAX705	9417	µMAX	15	0
MAX223	9419	28 SSOP	15	0
MAX560	9419	28 SSOP	15	0
MAX240	9420	44 QFP	15	0
MAX240	9421	44 QFP	15	0
MAX240	9422	44 QFP	15	0
MAX240	9423	44 QFP	15	0
MAX782	9438	36 SSOP	15	0
MAX241	9440	28 SSOP	14	0
MAX249	9442	44 PLCC	15	0
MAX782	9442	36 SSOP	15	0
MAX241	9442	28 SSOP	15	0
MAX249	9445	44 PLCC	15	0
MAX809	9512	SOT-23	15	0



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TABLE 11: SEQUENTIAL MOISTURE TEST RESULTS

(+85°C, 85% R.H. STORAGE 168 HRS + 260°C, 5 SECONDS SOLDER DIP IMMERSION THREE TIMES + PRESSURE POT 96 HRS (121°C, 2 ATM, 100% R.H.))

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DEVICE TYPE	DATE CODE	PACKAGE TYPE	SAMPLE SIZE	FAILURES (HOURS)
MAX8211	9022	8 NSO	20	0
DG211	9102	16 WSO	20	0
MAX232	9215	16 WSO	20	0
MAX241	9220	28 SSOP	45	0
MAX741	9221	20 SSOP	45	0
MAX241	9225	28 SSOP	45	0
MAX560	9228	28 SSOP	45	0
MAX232	9229	16 WSO	45	0
MAX741	9235	20 SSOP	45	0
MAX240	9249	44 QFP	20	0
MAX231	9250	16 WSO	45	0
MAX180	9251	44 PLCC	18	0
MAX8211	9301	8 NSO	45	0
MAX8211	9302	8 NSO	45	0
MAX691	9313	16 WSO	20	0
MAX8212	9313	8 NSO	20	0
MAX232	9314	16 WSO	20	0
MAX8212	9314	8 NSO	20	0
MAX232	9315	16 WSO	20	0
MAX8212	9315	8 NSO	20	0
MAX136	9317	44 QFP	20	0
MAX8212	9324	8 NSO	20	0
MAX211	9334	28 SSOP	20	0
MAX8211	9346	8 NSO	20	0
MAX8211	9347	8 NSO	20	0
MAX782	9402	36 SSOP	20	0
ICL7621	9407	8 NSO	20	0
MAX202	9407	16 NSO	20	0
MAX782	9407	36 SSOP	20	0
MAX400	9413	8 NSO	20	0
MAX705	9415	µMAX	20	0
MAX705	9416	µMAX	20	0
MAX705	9417	µMAX	20	0
MAX240	9420	44 QFP	20	0
MAX240	9421	44 QFP	20	0
MAX240	9422	44 QFP	20	0
MAX240	9423	44 QFP	20	0
MAX691A	9424	16 WSO	20	0

DEVICE TYPE	DATE CODE	PACKAGE TYPE	SAMPLE SIZE	FAILURES (HOURS)
MAX511	9424	14 NSO	20	0
MAX674	9437	8 NSO	20	0
MAX435	9441	14 NSO	20	0
MAX249	9442	44 PLCC	20	0
MAX3212	9444	28 WSO	19	0
MAX249	9445	44 PLCC	20	0
MAX736	9448	16 WSO	20	0
MAX664	9449	8 NSO	19	0
MAX543	9450	16 WSO	20	0
MX536	9452	16 WSO	20	0
MX7542	9503	16 WSO	20	0
MAX704	9504	8 NSO	20	0
MAX709	9504	8 NSO	20	0
MAX4426	9504	8 NSO	20	0
ICL7664	9504	8 NSO	20	0
MAX230	9505	20 WSO	20	0
MAX293	9508	16 WSO	20	0
MAX701	9509	8 NSO	19	0
MAX883	9511	8 NSO	20	0
MAX809	9512	SOT-23	20	0
MAX852	9512	8 NSO	20	0
MAX755	9512	8 NSO	20	0
MAX860	9513	8 NSO	19	0
MAX355	9513	16 WSO	20	0
MAX530	9514	24 WSO	20	0
MAX809	9514	SOT-23	20	0
MAX120	9514	24 WSO	20	0
MAX213	9514	28 SSOP	20	0
MAX636	9514	16 WSO	20	0
MAX495	9515	8 NSO	20	0
MAX306	9515	28 WSO	20	0
MAX634	9517	8 NSO	20	0
MAX208	9517	24 WSO	20	0
MAX483	9520	8 NSO	20	0
MAX319	9522	8 NSO	20	0
MAX236	9522	24 WSO	20	0
MAX691	9522	16 WSO	20	0

### Package Description

Table D lists all the package types for surface-mount devices that Maxim currently provides to customers. It also lists four critical dimensions for specific package type, based on lead count.

Maxim's small-outline integrated circuit (SOIC) packages conform to Standard JEDEC outlines, (except the µMAX package).

### Pin Convention

0.150" JEDEC SOIC ("S" package suffix) parts have the same pinout as the 0.300" DIP package equivalent.

0.300" JEDEC SOIC ("W" package suffix) parts also have the same pinout as the 0.300" DIP, except for certain 16-lead products. If a 14-lead product's die is too large to be accommodated in the 0.150", 14-lead (S) package, it is made available in the 0.300", 16-lead (W) package.

### Flatpack Pin Convention

No fixed pin convention exists for 40-lead products assembled in 44-lead flatpacks (PFP). Consult product marketing for specific pinouts.

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### Quad Pack or PLCC Pin Convention

Devices in the 28-lead Quad Pack or Plastic Leaded Chip Carrier (PLCC) are pin-for-pin compatible with the DIP package; i.e., pin 1 on the 28-lead Quad Pack or PLCC will have the same function as pin 1 on the DIP package. All 44-lead devices have the pin convention shown in Table E.

**TABLE D: SURFACE-MOUNT PACKAGE TYPES**

PACKAGE TYPE	LEAD COUNT	PHYSICAL DIMENSIONS			
		MAX WIDTH (mm)	MAX LENGTH (mm)	THICKNESS (mm)	PITCH (mm)
Plastic Narrow Small-Outline Package (NSO)	8	4.000	5.000	1.500	1.270
	14	4.000	8.750	1.500	1.270
	16	4.000	10.000	1.500	1.270
Plastic Wide Small-Outline Package (WSO)	16	7.600	10.500	2.350	1.270
	18	7.600	11.750	2.350	1.270
	20	7.600	13.000	2.350	1.270
	24	7.600	15.600	2.350	1.270
	28	7.600	18.100	2.350	1.270
Plastic Shrink Small-Outline Package (SSOP)	20	5.380	7.330	1.780	0.650
	24	5.380	8.330	1.780	0.650
	28	5.380	10.330	1.780	0.650
	36	7.600	15.600	2.370	0.800
Plastic Leaded Chip Carrier Package (PLCC)	20	9.020	9.020	3.960	1.270
	28	11.560	11.560	3.960	1.270
	44	16.640	16.640	3.960	1.270
Plastic Quad Flatpack (QFP)	44	10.109	10.109	2.388	0.800
μMAX	8	3.050	3.050	0.910	0.650
SOT	3	1.397	3.048	1.067	2.032
	4	1.397	3.048	1.067	2.032

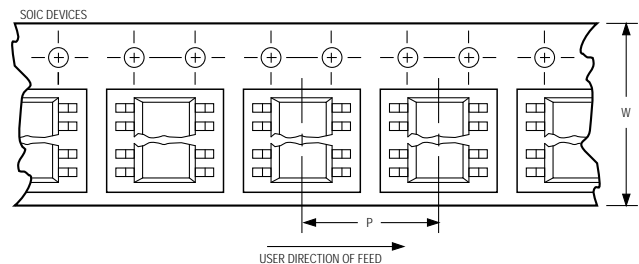
**TABLE E: 44-LEAD QUAD-PACK PIN CONVENTION**

DIP PIN No.	QUAD PIN No.	DIP PIN No.	QUAD PIN No.
	1 N.C.		23 N.C.
1	2	21	24
2	3	22	25
3	4	23	26
4	5	24	27
5	6	25	28
6	7	26	29
7	8	27	30
8	9	28	31
9	10	29	32
10	11	30	33
	12 N.C.		34 N.C.
11	13	31	35
12	14	32	36
13	15	33	37
14	16	34	38
15	17	35	39
16	18	36	40
17	19	37	41
18	20	38	42
19	21	39	43
20	22	40	44

### Surface-Mount Packages in Reeled Tape

Maxim's surface-mount packages are normally shipped in antistatic plastic rails. They are also available mounted in pockets on embossed tape for customers using automatic placement systems. The tape is wound and shipped on reels.

The following diagram and Table F indicate the tape sizes used for the various package types, and the basic orientation convention used. Further tape and reel specifications can be found in the Industrial Association (EIA) specification 481-A.



**TABLE F: SURFACE-MOUNT PACKAGE TAPE SIZES**

PACKAGE TYPE	LEAD COUNT	COMPONENT	TAPE SIZE mm (W)	PART PITCH mm (P)
SOIC (0.150")	8		12	8
	14		16	8
	16		16	8
SOIC (0.300")	16		16	12
	18		24	12
	20		24	12
	24		24	12
PLCC	28		24	12
	44		32	24
QFP	44		24	16
SSOP	20		16	12
	24		16	12
	28		24	12
μMAX	36		24	12
μMAX	8		12	8
SOT	3		8	4
	4		8	4