RELIABILITY REPORT

FOR

MAX5452EUB

PLASTIC ENCAPSULATED DEVICES

April 23, 2003

MAXIM INTEGRATED PRODUCTS

120 SAN GABRIEL DR.

SUNNYVALE, CA 94086

Written by

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Conclusion

The MAX5452 successfully meets the quality and reliability standards required of all Maxim products. In addition, Maxim's continuous reliability monitoring program ensures that all outgoing product will continue to meet Maxim's quality and reliability standards.

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I. Device Description

A. General

The MAX5452 is a dual digital potentiometers that performs the same function as a mechanical potentiometer or variable resistor. The MAX5452 has two 2-terminal variable resistors. The MAX5452 operates from a +2.7V to +5.5V single-supply voltage and use an ultra-low supply current of 0.1µA. This device consists of two fixed resistors each with 256 digitally-controlled wiper contacts. The convenient power-on reset (POR) sets the wiper to midscale position at power-up and the easy-to-use up/down interface allows glitchless switching between resistor taps. Four inputs control the 10-pin MAX5452 variable resistors.

The MAX5452 is ideal for applications requiring digitally-controlled resistors. Three resistance values are available: 10kΩ, 50kΩ, and 100kΩ. An end-to-end resistor temperature coefficient of 35ppm/°C and a ratiometric temperature coefficient of 5ppm/°C make the MAX5452 an excellent choices for adjustable gain circuit requiring low-temperature drift.

The MAX5452 is available in a 10-pin µMAX package. The device is guaranteed over the extended–industrial temperature range (-40°C to +85°C).

B. Absolute Maximum Ratings

Item	Rating
VDD to GND	-0.3V to +6V
CS_, INC_, and U/D_ to GND	-0.3V to +6V
H_, L_, W_ to GND	-0.3V to (VDD +0.3V)
Maximum Continuous Current into H_, L_, and W_	±1mA
Operating Temperature Range	-40°C to +85°C
Junction Temperature	+150°C
Storage Temperature Range	-65°C to +150°C
Lead Temperature (soldering, 10s)	+300°C
Continuous Power Dissipation (TA = +70°C)	
10-Pin uMAX	555mW
Derates above +70°C	
10-Pin uMAX	6.94mW/°C

II. Manufacturing Information

A. Description/Function:	Dual, 256-Tap, Up/Down Interface, Digital Potentiometers
B. Process:	S6 (Standard 0.6 micron silicon gate CMOS)
C. Number of Device Transistors:	9680
D. Fabrication Location:	California, USA
E. Assembly Location:	Malaysia
F. Date of Initial Production:	March, 2001

III. Packaging Information

A. Package Type:	**10-Pin uMAX**
B. Lead Frame:	Copper
C. Lead Finish:	Solder Plate
D. Die Attach:	Non-Conductive Epoxy
E. Bondwire:	Gold (1 mil dia.)
F. Mold Material:	Epoxy with silica filler
G. Assembly Diagram:	#05-3401-0017
H. Flammability Rating:	Class UL94-V0
I. Classification of Moisture Sensitivity per JEDEC standard JESD22-112:	Level 1

IV. Die Information

A. Dimensions:	75 x 88 mils
B. Passivation:	Si_3N_4/SiO_2 (Silicon nitride/ Silicon dioxide)
C. Interconnect:	Aluminum/Si (Si = 1%)
D. Backside Metallization:	None
E. Minimum Metal Width:	0.6 microns (as drawn)
F. Minimum Metal Spacing:	0.6 microns (as drawn)
G. Bondpad Dimensions:	5 mil. Sq.
H. Isolation Dielectric:	SiO_2
I. Die Separation Method:	Wafer Saw

V. Quality Assurance Information

A. Quality Assurance Contacts: Jim Pedicord (Reliability Lab Manager)
Bryan Preeshl (Executive Director**)**
Kenneth Huening (Vice President)

B. Outgoing Inspection Level: 0.1% for all electrical parameters guaranteed by the Datasheet.
0.1% For all Visual Defects.

C. Observed Outgoing Defect Rate: < 50 ppm

D. Sampling Plan: Mil-Std-105D

VI. Reliability Evaluation

A. Accelerated Life Test

The results of the 135°C biased (static) life test are shown in **Table 1**. Using these results, the Failure Rate (λ) is calculated as follows:

$$\lambda = \frac{1}{MTTF} = \frac{1.83}{192 \times 4389 \times 8 \times 2}$$

(Chi square value for MTTF upper limit)

Temperature Acceleration factor assuming an activation energy of 0.8eV

$\lambda = 13.57 \times 10^{-9}$

$\lambda = 13.57$ F.I.T. (60% confidence level @ 25°C)

This low failure rate represents data collected from Maxim's reliability monitor program. In addition to routine production Burn-In, Maxim pulls a sample from every fabrication process three times per week and subjects it to an extended Burn-In prior to shipment to ensure its reliability. The reliability control level for each lot to be shipped as standard product is 59 F.I.T. at a 60% confidence level, which equates to 3 failures in an 80 piece sample. Maxim performs failure analysis on any lot that exceeds this reliability control level. Attached Burn-In Schematic (Spec. # 06-5746) shows the static Burn-In circuit. Maxim also performs quarterly 1000 hour life test monitors. This data is published in the Product Reliability Report (**RR-1M**).

B. Moisture Resistance Tests

Maxim pulls pressure pot samples from every assembly process three times per week. Each lot sample must meet an LTPD = 20 or less before shipment as standard product. Additionally, the industry standard 85°C/85%RH testing is done per generic device/package family once a quarter.

C. E.S.D. and Latch-Up Testing

The DP11-1 die type has been found to have all pins able to withstand a transient pulse of ±1500V per Mil-Std-883 Method 3015 (reference attached ESD Test Circuit). Latch-Up testing has shown that this device withstands a current of ±250mA.

Table 1
Reliability Evaluation Test Results

MAX5452EUB

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	PACKAGE	SAMPLE SIZE	NUMBER OF FAILURES
Static Life Test (Note 1)					
	Ta = 135°C Biased Time = 192 hrs.	DC Parameters & functionality		80	0
Moisture Testing (Note 2)					
Pressure Pot	Ta = 121°C P = 15 psi. RH= 100% Time = 168hrs.	DC Parameters & functionality	uMAX	77	0
85/85	Ta = 85°C RH = 85% Biased Time = 1000hrs.	DC Parameters & functionality		77	0
Mechanical Stress (Note 2)					
Temperature Cycle	-65°C/150°C 1000 Cycles Method 1010	DC Parameters & functionality		77	0

Note 1: Life Test Data may represent plastic DIP qualification lots.
Note 2: Generic Package/Process data

Attachment #1

TABLE II. Pin combination to be tested. 1/ 2/

	Terminal A (Each pin individually connected to terminal A with the other floating)	Terminal B (The common combination of all like-named pins connected to terminal B)
1.	All pins except V_{PS1} 3/	All V_{PS1} pins
2.	All input and output pins	All other input-output pins

1/ Table II is restated in narrative form in 3.4 below.
2/ No connects are not to be tested.
3/ Repeat pin combination I for each named Power supply and for ground

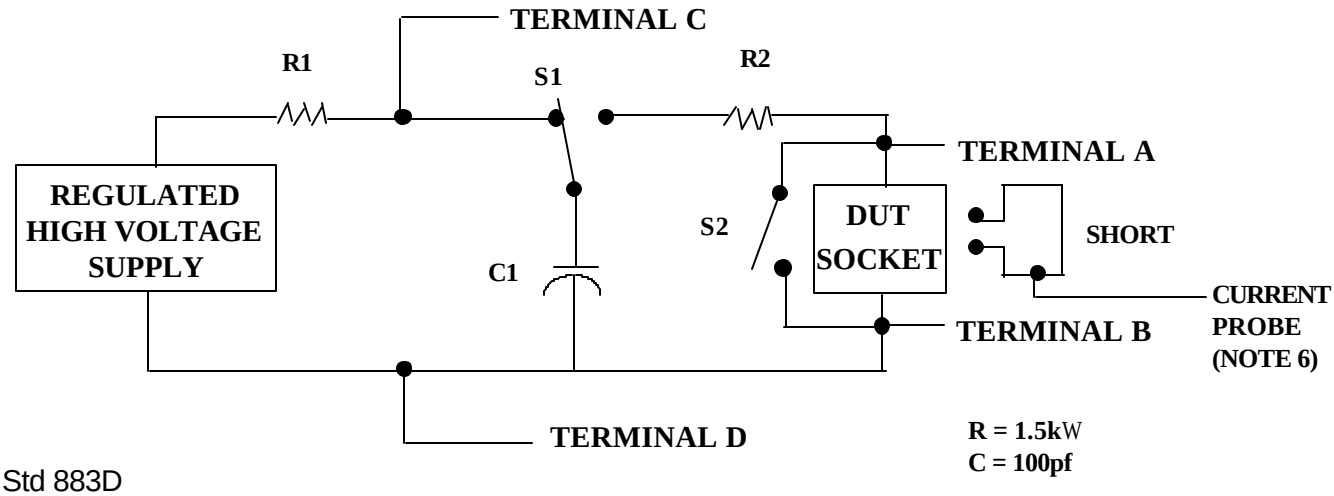
(e.g., where V_{PS1} is V_{DD}, V_{CC}, V_{SS}, V_{BB}, GND, $+V_S$, $-V_S$, V_{REF}, etc).

3.4 Pin combinations to be tested.

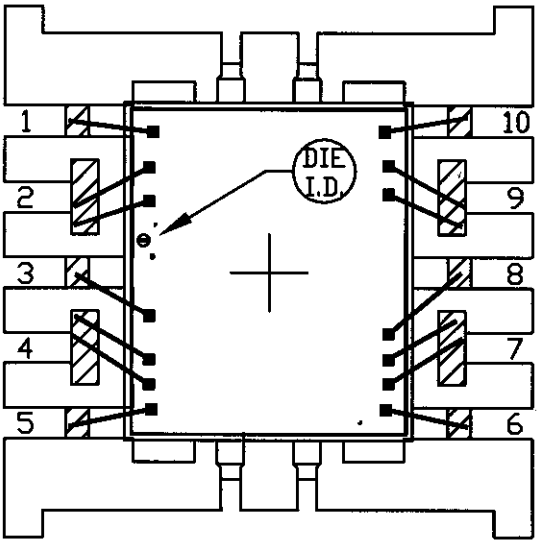
a. Each pin individually connected to terminal A with respect to the device ground pin(s) connected to terminal B. All pins except the one being tested and the ground pin(s) shall be open.

b. Each pin individually connected to terminal A with respect to each different set of a combination of all named power supply pins (e.g., V_{SS1}, or V_{SS2} or V_{SS3} or V_{CC1}, or V_{CC2}) connected to terminal B. All pins except the one being tested and the power supply pin or set of pins shall be open.

c. Each input and each output individually connected to terminal A with respect to a combination of all the other input and output pins connected to terminal B. All pins except the input or output pin being tested and the combination of all the other input and output pins shall be open.



Mil Std 883D
Method 3015.7
Notice 8



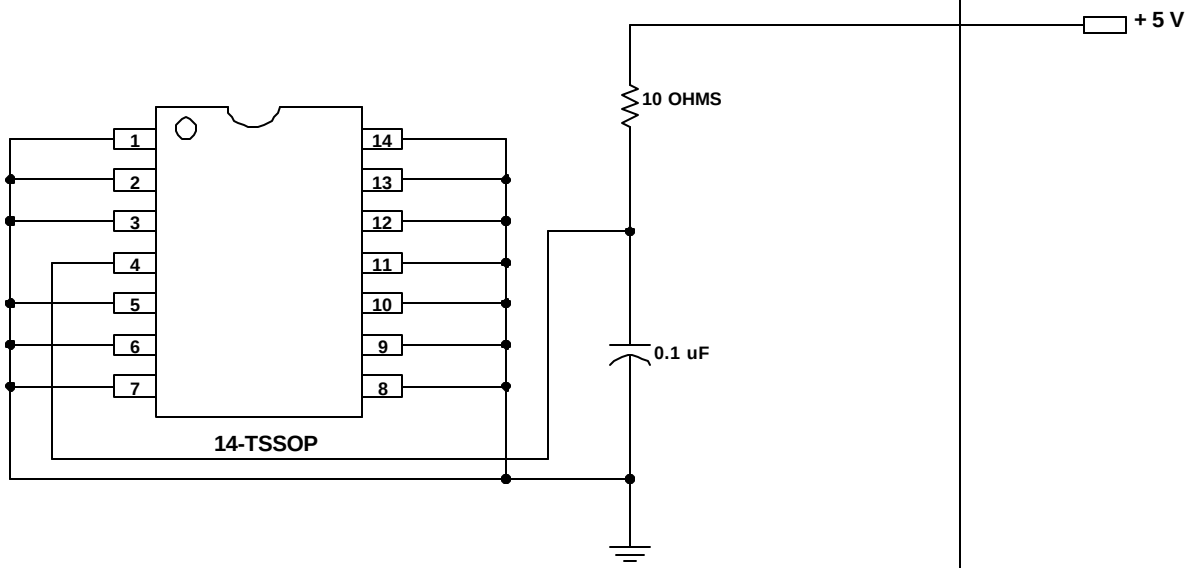
USE NON-CONDUCTIVE EPOXY

BONDING AREA

PKG. CODE: U10C-4		SIGNATURES	DATE	MAXIM CONFIDENTIAL & PROPRIETARY
CAV./PAD SIZE: CHIP ON LEAD	PKG. DESIGN			BOND DIAGRAM #: 05-3401-0017 / REV: A

ONCE PER SOCKET

ONCE PER BOARD



DEVICES: MAX 5451

MAX. EXPECTED CURRENT = 10uA

DRAWN BY: HAK TAN

NOTES: