

16-Output Switch with SPI Control

Thermal Addendum

Introduction

This thermal addendum is provided as a supplement to the MC33996 technical datasheet. The addendum provides thermal performance information that may be critical in the design and development of system applications. All electrical, application, and packaging information is provided in the datasheet.

Packaging and Thermal Considerations

The MC33996 is offered in a 32 pin SOICW exposed pad, single die package. There is a single heat source (P), a single junction temperature (T_J), and thermal resistance (R_{θJA}).

$$\{ T_J \} = [R_{\theta JA}] \cdot \{ P \}$$

The stated values are solely for a thermal performance comparison of one package to another in a standardized environment. This methodology is not meant to and will not predict the performance of a package in an application-specific environment. Stated values were obtained by measurement and simulation according to the standards listed below.

Standards

Table 1. Thermal Performance Comparisons

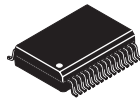
Thermal Resistance	[°C/W]
R _{θJA} (1), (2)	29
R _{θJB} (2), (3)	9.0
R _{θJA} (1), (4)	69
R _{θJC} (5)	2.0

Notes:

1. Per JEDEC JESD51-2 at natural convection, still air condition.
2. 2s2p thermal test board per JEDEC JESD51-5 and JESD51-7.
3. Per JEDEC JESD51-8, with the board temperature on the center trace near the center lead.
4. Single layer thermal test board per JEDEC JESD51-3 and JESD51-5.
5. Thermal resistance between the die junction and the exposed pad surface; cold plate attached to the package bottom side, remaining surfaces insulated.

33996EK

**32-PIN
SOICW-EP**



**EK (PB-FREE) SUFFIX
98ARL10543D
32-PIN SOICW-EP**

Note For package dimensions, refer to the 33996 data sheet.

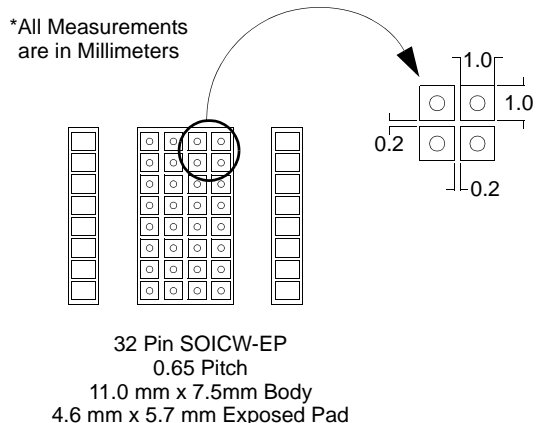


Figure 1. Surface Mount for SOICW Exposed Pad

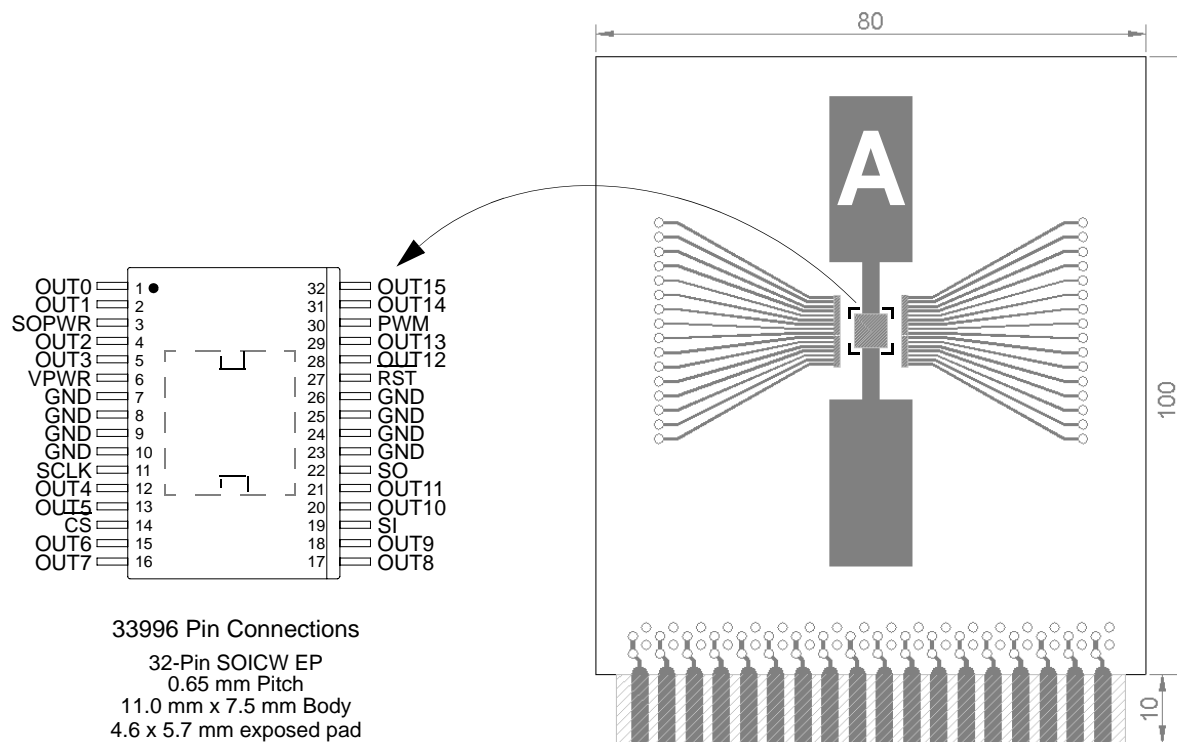


Figure 2. Thermal Test Board

Device on Thermal Test Board

- Material: Single layer printed circuit board
FR4, 1.6 mm thickness
Cu traces, 0.07 mm thickness
- Outline: 80 mm x 100 mm board area,
including edge connector for
thermal testing
- Area A: Cu heat-spreading areas on board
surface
- Ambient Conditions: Natural convection, still air

Table 2. Thermal Resistance Performance

A [mm ²]	R _{θJA} [°C/W]
0	70
300	49
600	47

R_{θJA} is the thermal resistance between die junction and ambient air.

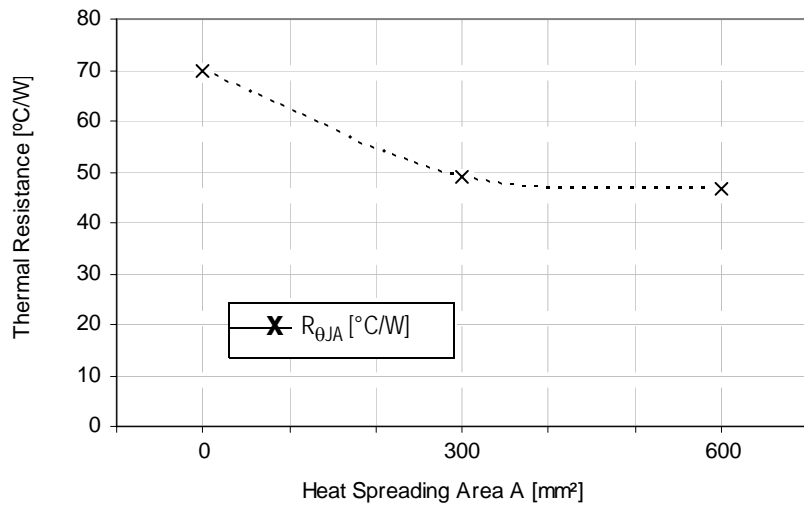


Figure 3. Device on Thermal Test Board $R_{\theta JA}$

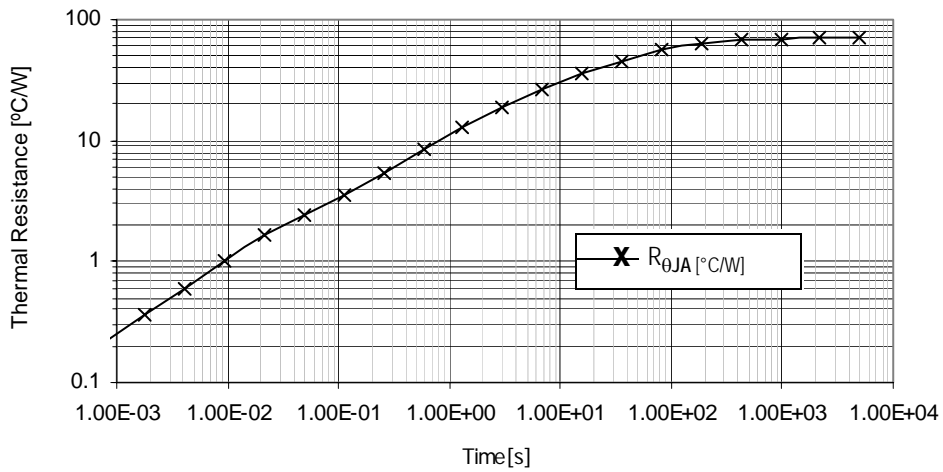


Figure 4. Transient Thermal Resistance $R_{\theta JA}$,
1 W Step response, Device on Thermal Test Board Area A = 600 (mm²)

How to Reach Us:

Home Page:

www.freescale.com

Web Support:

<http://www.freescale.com/support>

USA/Europe or Locations Not Listed:

Freescale Semiconductor, Inc.
 Technical Information Center, EL516
 2100 East Elliot Road
 Tempe, Arizona 85284
 +1-800-521-6274 or +1-480-768-2130
www.freescale.com/support

Europe, Middle East, and Africa:

Freescale Halbleiter Deutschland GmbH
 Technical Information Center
 Schatzbogen 7
 81829 Muenchen, Germany
 +44 1296 380 456 (English)
 +46 8 52200080 (English)
 +49 89 92103 559 (German)
 +33 1 69 35 48 48 (French)
www.freescale.com/support

Japan:

Freescale Semiconductor Japan Ltd.
 Headquarters
 ARCO Tower 15F
 1-8-1, Shimo-Meguro, Meguro-ku,
 Tokyo 153-0064
 Japan
 0120 191014 or +81 3 5437 9125
support.japan@freescale.com

Asia/Pacific:

Freescale Semiconductor Hong Kong Ltd.
 Technical Information Center
 2 Dai King Street
 Tai Po Industrial Estate
 Tai Po, N.T., Hong Kong
 +800 2666 8080
support.asia@freescale.com

For Literature Requests Only:

Freescale Semiconductor Literature Distribution Center
 P.O. Box 5405
 Denver, Colorado 80217
 1-800-441-2447 or 303-675-2140
 Fax: 303-675-2150
LDCForFreescaleSemiconductor@hibbertgroup.com

RoHS-compliant and/or Pb-free versions of Freescale products have the functionality and electrical characteristics of their non-RoHS-compliant and/or non-Pb-free counterparts. For further information, see <http://www.freescale.com> or contact your Freescale sales representative.

For information on Freescale's Environmental Products program, go to <http://www.freescale.com/epp>.

Information in this document is provided solely to enable system and software implementers to use Freescale Semiconductor products. There are no express or implied copyright licenses granted hereunder to design or fabricate any integrated circuits or integrated circuits based on the information in this document.

Freescale Semiconductor reserves the right to make changes without further notice to any products herein. Freescale Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does Freescale Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation consequential or incidental damages. "Typical" parameters that may be provided in Freescale Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals", must be validated for each customer application by customer's technical experts. Freescale Semiconductor does not convey any license under its patent rights nor the rights of others. Freescale Semiconductor products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the Freescale Semiconductor product could create a situation where personal injury or death may occur. Should a Buyer purchase or use Freescale Semiconductor products for any such unintended or unauthorized application, the Buyer shall indemnify and hold Freescale Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that Freescale Semiconductor was negligent regarding the design or manufacture of the part.

Freescale™ and the Freescale logo are trademarks of Freescale Semiconductor, Inc. All other product or service names are the property of their respective owners.

© Freescale Semiconductor, Inc., 2006. All rights reserved.