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MAX9713 Evaluation Kit

Evaluates: MAX9713

General Description

The MAX9713 evaluation kit (EV kit) is a fully assembled and tested printed-circuit board (PCB) that contains the MAX9713 filterless class D amplifier. The EV kit is capable of delivering 6W into an 8Ω load and is designed to operate from a 10V to 25V DC power supply. The MAX9713 EV kit accepts differential or single-ended input signals and provides an option to select between different switching frequencies.

Ordering Information

PART	TYPE
MAX9713EVKIT+	EV Kit

+Denotes lead-free and RoHS-compliant.

Features

♦ **10V to 25V Single-Supply Operation**

♦ **Up to 85% Efficiency**

♦ **Drives 6W into 8Ω or 8W into 16Ω**

♦ **Differential or Single-Ended Input Modes**

♦ **Pin-Selectable Frequency Options**

♦ **Pin-Selectable Gain Options**

♦ **Low 0.1% THD+N**

♦ **Surface-Mount Construction**

♦ **Fully Assembled and Tested**

Component List

DESIGNATION	QTY	DESCRIPTION
C1	1	0.1µF ±10%, 25V X5R ceramic capacitor (0402) TDK C1005X5R1E104K
C2, C3	2	33µF ±10%, 35V tantalum capacitors (D case) AVX TAJD336K035
C4, C5	2	0.1µF ±10%, 25V X7R ceramic capacitors (0603) Murata GRM188R71E104K TDK C1608X7R1E104K or equivalent
C6, C7, C8	3	100pF ±5%, 50V C0G ceramic capacitors (0402) Murata GRP1555C1H101J Taiyo Yuden UMK105CG101JW TDK C1005C0G101J
C9, C10, C12	3	0.47µF ±10%, 6.3V X5R ceramic capacitors (0402) Murata GRM155R60J474K TDK C1005X5R0J474K
C11	1	0.01µF ±10%, 25V X7R ceramic capacitor (0402) Murata GRP155R71E103K TDK C1005X7R1E103M

DESIGNATION	QTY	DESCRIPTION
C13	1	1µF ±10%, 25V X7R ceramic capacitor (0805) TDK C2012X7R1E105K or equivalent
C14	1	1000pF ±10%, 50V X7R ceramic capacitor (0603) Murata GRM188R71H102K TDK C1608X7R1H102KT
C15	0	Not installed, ceramic capacitor (0603)
C16–C22	0	Not installed, ceramic capacitors (0402)
D1	1	5.1V, 20mA zener diode (SOT-23) Central CMPZ5231B LEAD FREE (Top Mark: C8F)
FB1	1	100Ω ±25%, 1.7A ferrite bead (0603) Murata BKP1608HS101-T
FB2, FB3	2	1kΩ ±25%, 150mA ferrite beads (0402) Murata BK1005HM102-T
FOUT1+, FOUT1-, FOUT2+, FOUT2-	0	Not installed, test points
JU1–JU5	5	3-pin headers
JU6, JU7	2	2-pin headers

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For pricing, delivery, and ordering information, please contact Maxim Direct at 1-888-629-4642, or visit Maxim's website at www.maxim-ic.com.

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Component List (continued)

DESIGNATION	QTY	DESCRIPTION
L4, L5	0	Not installed, power inductors
R1	1	10kΩ ±5% resistor (0402)
R2, R3	0	Not installed, resistors (0402)
T1	0	Not installed, common-mode choke
U1	1	32-pin TQFN-EP*, 5mm x 5mm x 0.8mm Maxim MAX9713ETJ+
—	7	Shunts
—	1	PCB: MAX9713 Evalution Kit+

*EP = Exposed paddle.

Component Suppliers

SUPPLIER	PHONE	WEBSITE
AVX Corp.	843-946-0238	www.avxcorp.com
Central Semiconductor Corp.	631-435-1110	www.centralsemi.com
Murata Mfg. Co., Ltd.	770-436-1300	www.murata.com
Taiyo Yuden	800-348-2496	www.t-yuden.com
TDK Corp.	847-803-6100	www.component.tdk.com

Note: Indicate that you are using the MAX9713 when contacting these component suppliers.

Quick Start

Recommended Equipment

Before beginning, the following equipment is needed:

- 15V, 1A power supply
- Audio source (i.e., CD player, cassette player)
- 8Ω/16Ω speaker

Procedure

The MAX9713 EV kit is fully assembled and tested. Follow the steps below to verify board operation. **Caution: Do not turn on the power supply until all connections are completed.**

1) Verify that no shunt is across jumper JU6 (differential input mode).

2) Verify shunt across pins 1-2 of jumper JU1. Install shunt across jumper JU7 (EV kit is enabled).

3) Verify shunts across pins 1-2 of jumpers JU2 and JU3 (Gain = 16dB).

4) Verify shunts across pins 1-2 of jumpers JU4 and JU5 (spread-spectrum mode, frequency centered at 335kHz).

5) Connect the speaker across the OUT+ and OUT- pads.

6) Connect the positive terminal of the 15V power supply to the V+ pad and the ground terminal of the power supply to the GND pad.

7) Connect the audio source across the VIN+ and VIN- pads.

8) Turn on the power supply, and then turn on the audio source.

Detailed Description

The MAX9713 EV kit contains the MAX9713 filterless class D amplifier IC. The EV kit operates from a 10V to 25V DC power supply and accepts a differential or single-ended audio input source. The single-ended input mode accepts up to $2V_{P-P}$ signals, and the differential mode accepts up to $4V_{P-P}$ signals. The audio input source is amplified to drive 6W into an 8Ω speaker.

The MAX9713 EV kit provides three sets of differential outputs. The device outputs (OUT+/-) can be connected directly to a speaker load without any filtering. However, a filter can be added to ease evaluation. The filtered outputs (FOUT1+/-) require installation of filtering components T1, C21, and C22. The LCR filtered outputs (FOUT2+/-) require installation of filtering components L4, L5, C15–C20, R2, and R3.

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Jumper Selection

Shutdown Mode

Jumpers JU1 and JU7 control the shutdown pin ($\overline{\text{SHDN}}$) of the MAX9713. See Table 1 for the JU1 and JU7 functions.

Note: Contact your local Maxim representative for recommended MAX9713 filtering component values.

Gain Selection

Jumpers JU2 and JU3 provide an option to select the output voltage gain. See Table 2 for JU2 and JU3 functions. See Table 5 for power vs. gain and input levels.

Switching Frequency

The MAX9713 has two operating modes, fixed-frequency modulation (FFM) mode and spread-spectrum modulation (SSM) mode. Jumpers JU4 and JU5 control pins FS1 and FS2. See Table 3 for JU4 and JU5 functions.

Table 1. JU1 and JU7 Functions ($\overline{\text{SHDN}}$)

JU1 SHUNT POSITION	JU7 SHUNT POSITION	EV KIT FUNCTION
Pins 1 and 2	Installed ($\overline{\text{SHDN}}$ = high)	EV kit enabled (default)
Pins 2 and 3	Installed, without external signal ($\overline{\text{SHDN}}$ = low)	Shutdown mode
Pins 1 and 2	Not installed, with external signal connected to $\overline{\text{SHDN}}$ pad	$\overline{\text{SHDN}}$ pin driven by external signal. Shutdown is active low.

Table 2. JU2 and JU3 Functions (G1 and G2)

JU2 SHUNT LOCATION	JU3 SHUNT LOCATION	MAX9713 OUTPUT GAIN (dB)
Pins 1 and 2 (G1 = high)	1-2 (G2 = high)	16 (default)
Pins 1 and 2 (G1 = high)	2-3 (G2 = low)	13
Pins 2 and 3 (G1 = low)	1-2 (G2 = high)	19.1
Pins 2 and 3 (G1 = low)	2-3 (G2 = low)	22.1

Note: Make sure a shunt is installed across pins 1-2 of jumper JU1.

Table 3. JU4 and JU5 Functions (FS1 and FS2)

JU4 SHUNT LOCATION	JU5 SHUNT LOCATION	MAX9713 SWITCHING FREQUENCY (kHz)
Pins 1 and 2 (FS1 = high)	1-2 (FS2 = high)	335 ±10%, SSM (default)
Pins 1 and 2 (FS1 = high)	2-3 (FS2 = low)	236, FFM
Pins 2 and 3 (FS1 = low)	1-2 (FS2 = high)	460, FFM
Pins 2 and 3 (FS1 = low)	2-3 (FS2 = low)	335, FFM

Note: Make sure a shunt is installed across pins 1-2 of jumper JU1.

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Jumper JU6 provides an option to select between a differential or single-ended input mode of the EV kit. See Table 4 for JU6 functions.

Table 4. JU6 Functions

SHUNT POSITION	EV KIT INPUT MODE
Not installed	Differential input mode (default)
Installed (VIN- pad AC-coupled to GND)	Single-ended input mode

Table 5. MAX9713 Power vs. Gain and Input Levels at 10% THD+N

GAIN (dB)	V_{IN} DIFF RMS (V)	R_L (Ω)	P_{OUT} AT 10% THD+N (W)
13.0	1.27	16	8
16.1	0.89	16	8
19.1	0.63	16	8
22.1	0.45	16	8
13.0	0.78	8	6
16.1	0.54	8	6
19.1	0.39	8	6
22.1	0.27	8	6

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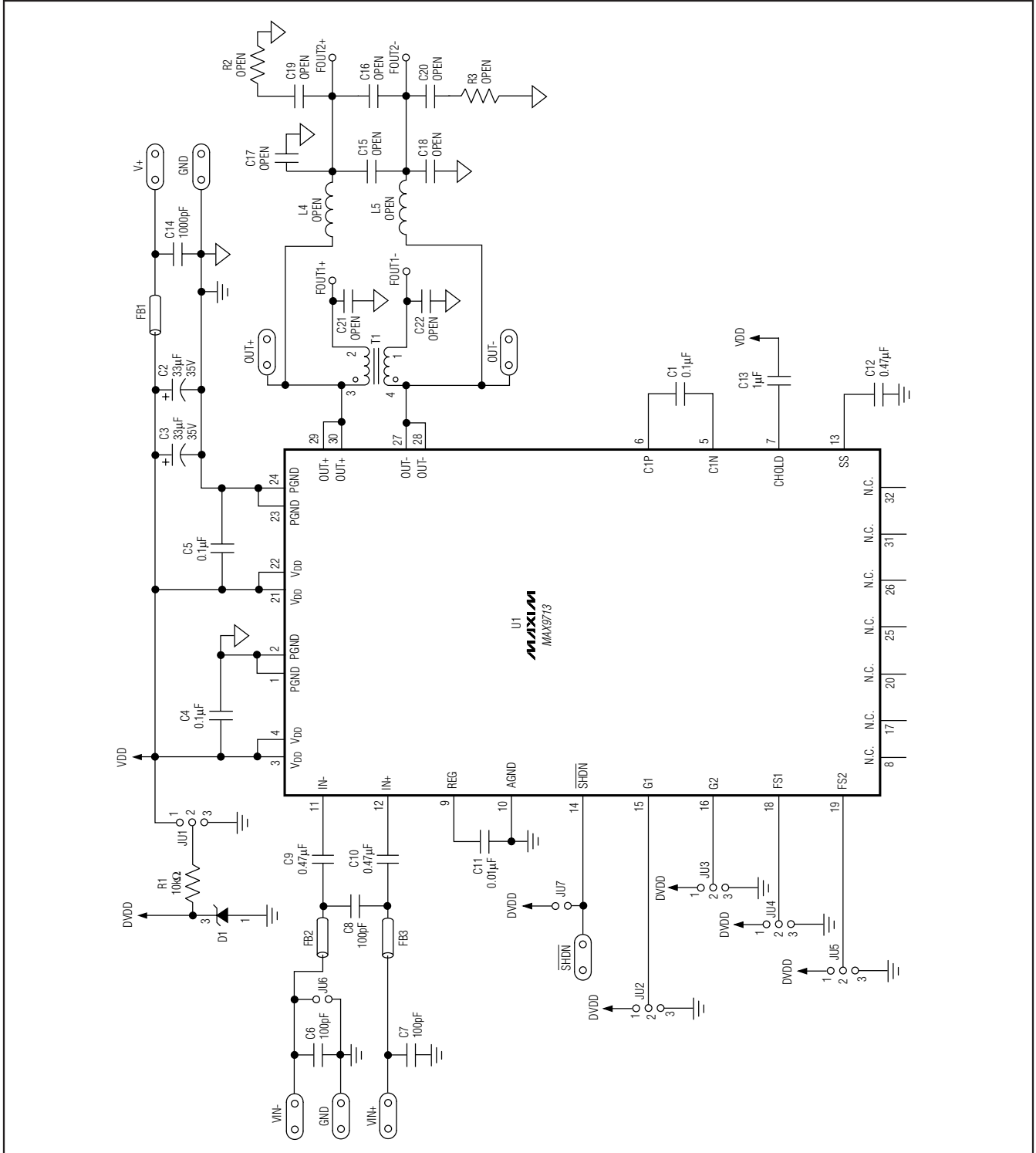
Figure 1. MAX9713 EV Kit Schematic
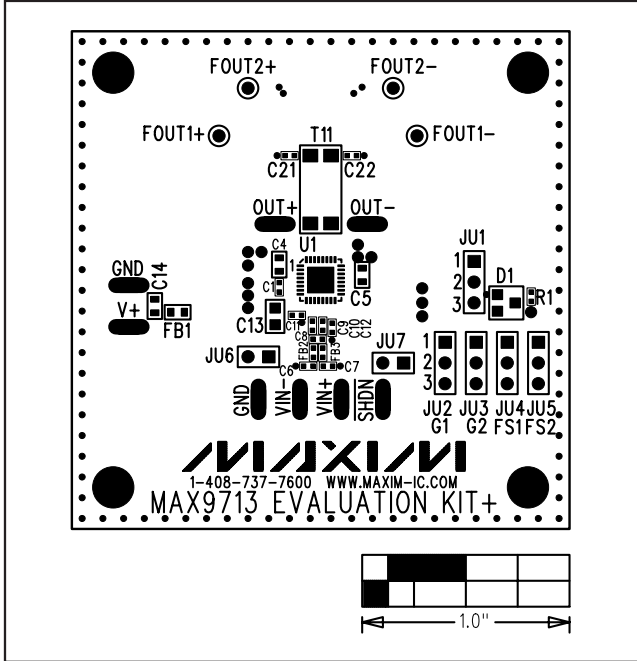
Figure 2. MAX9713 EV Kit Component Placement Guide—Component Side
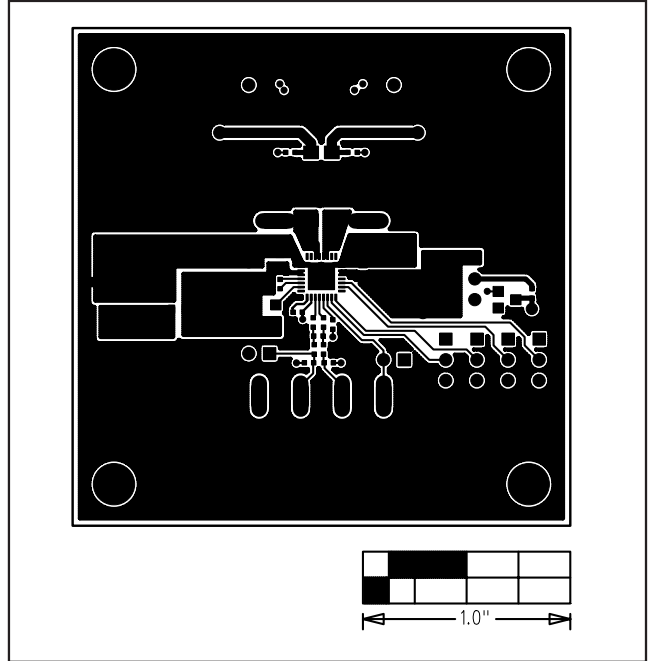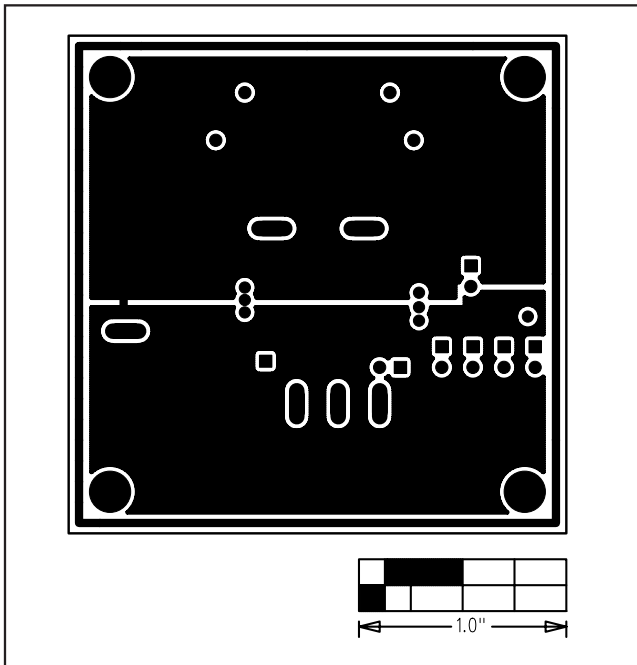

Figure 3. MAX9713 EV Kit PCB—Component Side

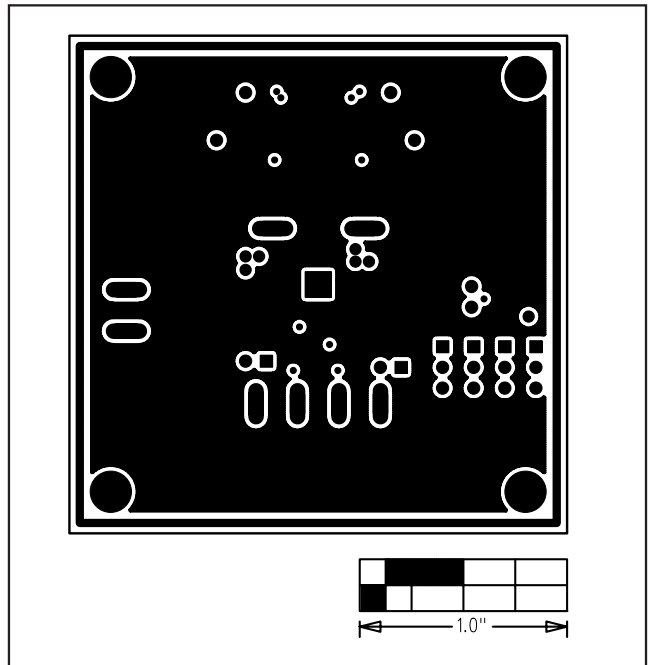Figure 4. MAX9713 EV Kit PCB—Layer 2 (GND)

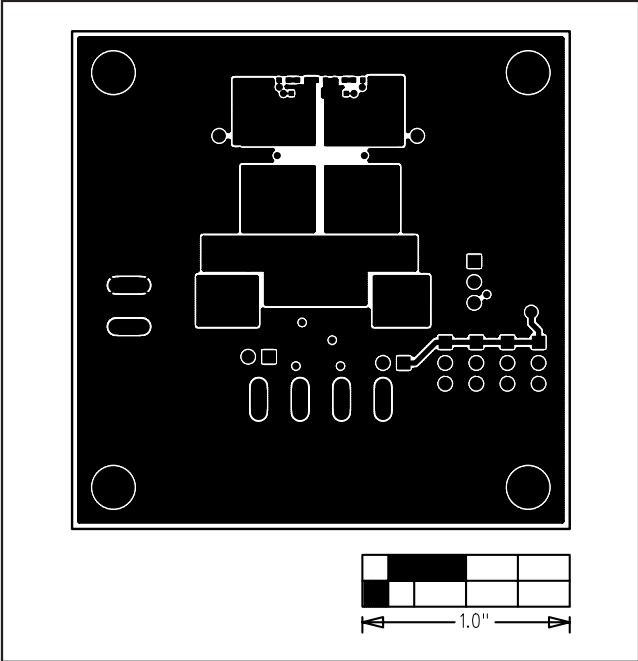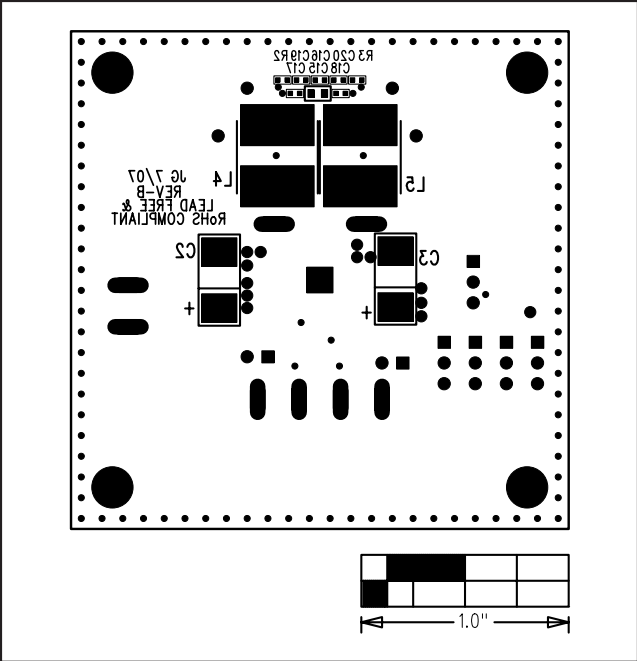Figure 5. MAX9713 EV Kit PCB—Layer 3 (VDD)

Figure 6. MAX9713 EV Kit PCB—Solder Side

Figure 7. MAX9713 EV Kit Component Placement Guide—Solder Side

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REVISION NUMBER	REVISION DATE	REVISION DESCRIPTION	PAGES CHANGED
0	—	Initial release	—
1	4/05	—	—
2	11/07	Update to lead-free and RoHS-compliant; various edits; replaced Figures 1–7.	1–7