

LM4836 Boomer® Audio Power Amplifier Series Stereo 2W Audio Power Amplifiers with DC Volume Control, Bass Boost, and Input Mux

General Description

The LM4836 is a monolithic integrated circuit that provides DC volume control, and stereo bridged audio power amplifiers capable of producing 2W into 4Ω (Note 1) with less than 1.0% THD+N, or 2.2W into 3Ω (Note 2) with less than 1.0% THD+N.

Boomer® audio integrated circuits were designed specifically to provide high quality audio while requiring a minimum amount of external components. The LM4836 incorporates a DC volume control, stereo bridged audio power amplifiers, selectable gain or bass boost, and an input mux making it optimally suited for multimedia monitors, portable radios, desktop, and portable computer applications.

The LM4836 features an externally controlled, low-power consumption shutdown mode, and both a power amplifier and headphone mute for maximum system flexibility and performance.

Note 1: When properly mounted to the circuit board, the LM4836LQ and LM4836MTE will deliver 2W into 4Ω. The LM4836MT will deliver 1.1W into 8Ω. See the Application Information section for LM4836LQ and LM4836MTE usage information.

Note 2: An LM4836LQ and LM4836MTE that have been properly mounted to the circuit board and forced-air cooled will deliver 2.2W into 3Ω.

Key Specifications

■ P _O at 1% THD+N	
■ into 3Ω (LM4836LQ, LM4836MTE)	2.2W(typ)
■ into 4Ω (LM4836LQ, LM4836MTE)	2.0W(typ)
■ into 8Ω (LM4836)	1.1W(typ)
■ Single-ended mode - THD+N at 85mW into 32Ω	1.0%(typ)
■ Shutdown current	0.2μA(typ)

Features

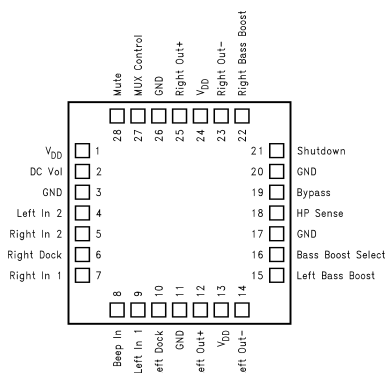
- PC98 and PC99 Compliant
- DC Volume Control Interface
- Input mux
- System Beep Detect
- Stereo switchable bridged/single-ended power amplifiers
- Selectable internal/external gain and bass boost configurable
- "Click and pop" suppression circuitry
- Thermal shutdown protection circuitry

Applications

- Portable and Desktop Computers
- Multimedia Monitors
- Portable Radios, PDAs, and Portable TVs

Connection Diagram

LLP Package



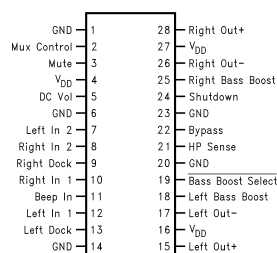
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Top View

Order Number LM4836LQ

See NS Package Number LQA028AA for Exposed-DAP LLP

TSSOP Package



DS101088-2

Top View

Order Number LM4836MT

See NS Package Number MTC28 for TSSOP

Order Number LM4836MTE

See NS Package Number MXA28A for Exposed-DAP TSSOP

Absolute Maximum Ratings (Note 10)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Supply Voltage	6.0V
Storage Temperature	-65°C to +150°C
Input Voltage	-0.3V to $V_{DD} + 0.3V$
Power Dissipation	Internally limited
ESD Susceptibility (Note 12)	2500V
ESD Susceptibility (Note 13)	250V
Junction Temperature	150°C
Soldering Information	
Vapor Phase (60 sec.)	215°C
Infrared (15 sec.)	220°C

See AN-450 "Surface Mounting and their Effects on Product Reliability" for other methods of soldering surface mount devices.

 θ_{JC} (typ) — LQA028AA

θ_{JC} (typ) — MTC28	20°C/W
θ_{JA} (typ) — MTC28	80°C/W
θ_{JC} (typ) — MXA28A	2°C/W
θ_{JA} (typ) — MXA28A (Note 4)	41°C/W
θ_{JA} (typ) — MXA28A (Note 3)	54°C/W
θ_{JA} (typ) — MXA28A (Note 5)	59°C/W
θ_{JA} (typ) — MXA28A (Note 6)	93°C/W

Operating Ratings

Temperature Range	
$T_{MIN} \leq T_A \leq T_{MAX}$	-40°C $\leq T_A \leq$ 85°C
Supply Voltage	2.7V $\leq V_{DD} \leq$ 5.5V

Electrical Characteristics for Entire IC

(Notes 7, 10)

The following specifications apply for $V_{DD} = 5V$ and $T_A = 25^\circ C$ unless otherwise noted.

Symbol	Parameter	Conditions	LM4836		Units (Limits)
			Typical (Note 14)	Limit (Note 15)	
V_{DD}	Supply Voltage			2.7	V (min)
				5.5	V (max)
I_{DD}	Quiescent Power Supply Current	$V_{IN} = 0V, I_O = 0A$	15	30	mA (max)
I_{SD}	Shutdown Current	$V_{pin\ 24} = V_{DD}$	0.2	2.0	μA (max)
V_{IH}	Headphone Sense High Input Voltage			4	V (min)
V_{IL}	Headphone Sense Low Input Voltage			0.8	V (max)

Electrical Characteristics for Volume Attenuators

(Notes 7, 10)

The following specifications apply for $V_{DD} = 5V$ and $T_A = 25^\circ C$ unless otherwise noted.

Symbol	Parameter	Conditions	LM4836		Units (Limits)
			Typical (Note 14)	Limit (Note 15)	
C_{RANGE}	Attenuator Range	Gain with $V_{pin\ 5} \geq 4.5V$	0	± 0.5	dB (max)
			0	-1.0	dB (min)
C_{RANGE}	Attenuator Range	Attenuation with $V_{pin\ 5} = 0V$	-73	-70	dB (min)
A_M	Mute Attenuation	$V_{pin\ 3} = 5V$, Bridged Mode	-88	-80	dB (min)
		$V_{pin\ 3} = 5V$, Single-Ended Mode	-80	-70	dB (min)

Electrical Characteristics for Single-Ended Mode Operation

(Notes 7, 10)

The following specifications apply for $V_{DD} = 5V$ and $T_A = 25^\circ C$ unless otherwise noted.

Symbol	Parameter	Conditions	LM4836		Units (Limits)
			Typical (Note 14)	Limit (Note 15)	
P_O	Output Power	THD+N = 1.0%; $f = 1kHz$; $R_L = 32\Omega$	85		mW
		THD+N = 10%; $f = 1kHz$; $R_L = 32\Omega$	95		mW

Electrical Characteristics for Single-Ended Mode Operation (Continued)

(Notes 7, 10)

The following specifications apply for $V_{DD} = 5V$ and $T_A = 25^\circ C$ unless otherwise noted.

Symbol	Parameter	Conditions	LM4836		Units (Limits)
			Typical (Note 14)	Limit (Note 15)	
THD+N	Total Harmonic Distortion+Noise	$V_{OUT} = 1V_{RMS}$, $f=1kHz$, $R_L = 10k\Omega$, $A_{VD} = 1$	0.065		%
PSRR	Power Supply Rejection Ratio	$C_B = 1.0 \mu F$, $f = 120 Hz$, $V_{RIPPLE} = 200 mV_{rms}$	58		dB
SNR	Signal to Noise Ratio	$P_{OUT} = 75 mW$, $R_L = 32\Omega$, A-Wtd Filter	102		dB
X_{talk}	Channel Separation	$f=1kHz$, $C_B = 1.0 \mu F$	65		dB

Electrical Characteristics for Bridged Mode Operation

(Notes 7, 10)

The following specifications apply for $V_{DD} = 5V$ and $T_A = 25^\circ C$ unless otherwise noted.

Symbol	Parameter	Conditions	LM4836		Units (Limits)
			Typical (Note 14)	Limit (Note 15)	
V_{OS}	Output Offset Voltage	$V_{IN} = 0V$	10	50	mV (max)
P_O	Output Power	THD + N = 1.0%; $f=1kHz$; $R_L = 3\Omega$ (Note 8)	2.2		W
		THD + N = 1.0%; $f=1kHz$; $R_L = 4\Omega$ (Note 9)(Note 15)	2		W
		THD = 1.5% (max); $f = 1 kHz$; $R_L = 8\Omega$	1.1	1.0	W (min)
		THD+N = 10%; $f = 1 kHz$; $R_L = 8\Omega$	1.5		W
THD+N	Total Harmonic Distortion+Noise	$P_O = 1W$, $20 Hz < f < 20 kHz$, $R_L = 8\Omega$, $A_{VD} = 2$	0.3		%
		$P_O = 340 mW$, $R_L = 32\Omega$	1.0		%
PSRR	Power Supply Rejection Ratio	$C_B = 1.0 \mu F$, $f = 120 Hz$, $V_{RIPPLE} = 200 mV_{rms}$; $R_L = 8\Omega$	74		dB
SNR	Signal to Noise Ratio	$V_{DD} = 5V$, $P_{OUT} = 1.1W$, $R_L = 8\Omega$, A-Wtd Filter	93		dB
X_{talk}	Channel Separation	$f=1kHz$, $C_B = 1.0 \mu F$	70		dB

Note 3: The θ_{JA} given is for an MXA28A package whose exposed-DAP is soldered to an exposed 2in² piece of 1 ounce printed circuit board copper.

Note 4: The θ_{JA} given is for an MXA28A package whose exposed-DAP is soldered to a 2in² piece of 1 ounce printed circuit board copper on a bottom side layer through 21 8mil vias.

Note 5: The θ_{JA} given is for an MXA28A package whose exposed-DAP is soldered to an exposed 1in² piece of 1 ounce printed circuit board copper.

Note 6: The θ_{JA} given is for an MXA28A package whose exposed-DAP is not soldered to any copper.

Note 7: All voltages are measured with respect to the ground pins, unless otherwise specified. All specifications are tested using the typical application as shown in Figure 2.

Note 8: When driving 3 Ω loads from a 5V supply the LM4836MTE exposed DAP must be soldered to the circuit board and forced-air cooled.

Note 9: When driving 4 Ω loads from a 5V supply the LM4836MTE exposed DAP must be soldered to the circuit board.

Note 10: *Absolute Maximum Ratings* indicate limits beyond which damage to the device may occur. *Operating Ratings* indicate conditions for which the device is functional, but do not guarantee specific performance limits. *Electrical Characteristics* state DC and AC electrical specifications under particular test conditions which guarantee specific performance limits. This assumes that the device is within the Operating Ratings. Specifications are not guaranteed for parameters where no limit is given, however, the typical value is a good indication of device performance.

Note 11: The maximum power dissipation must be derated at elevated temperatures and is dictated by T_{JMAX} , θ_{JA} , and the ambient temperature T_A . The maximum allowable power dissipation is $P_{DMAX} = (T_{JMAX} - T_A) / \theta_{JA}$. For the LM4836MT, $T_{JMAX} = 150^\circ C$, and the typical junction-to-ambient thermal resistance, when board mounted, is 80 $^\circ C/W$ assuming the MTC28 package.

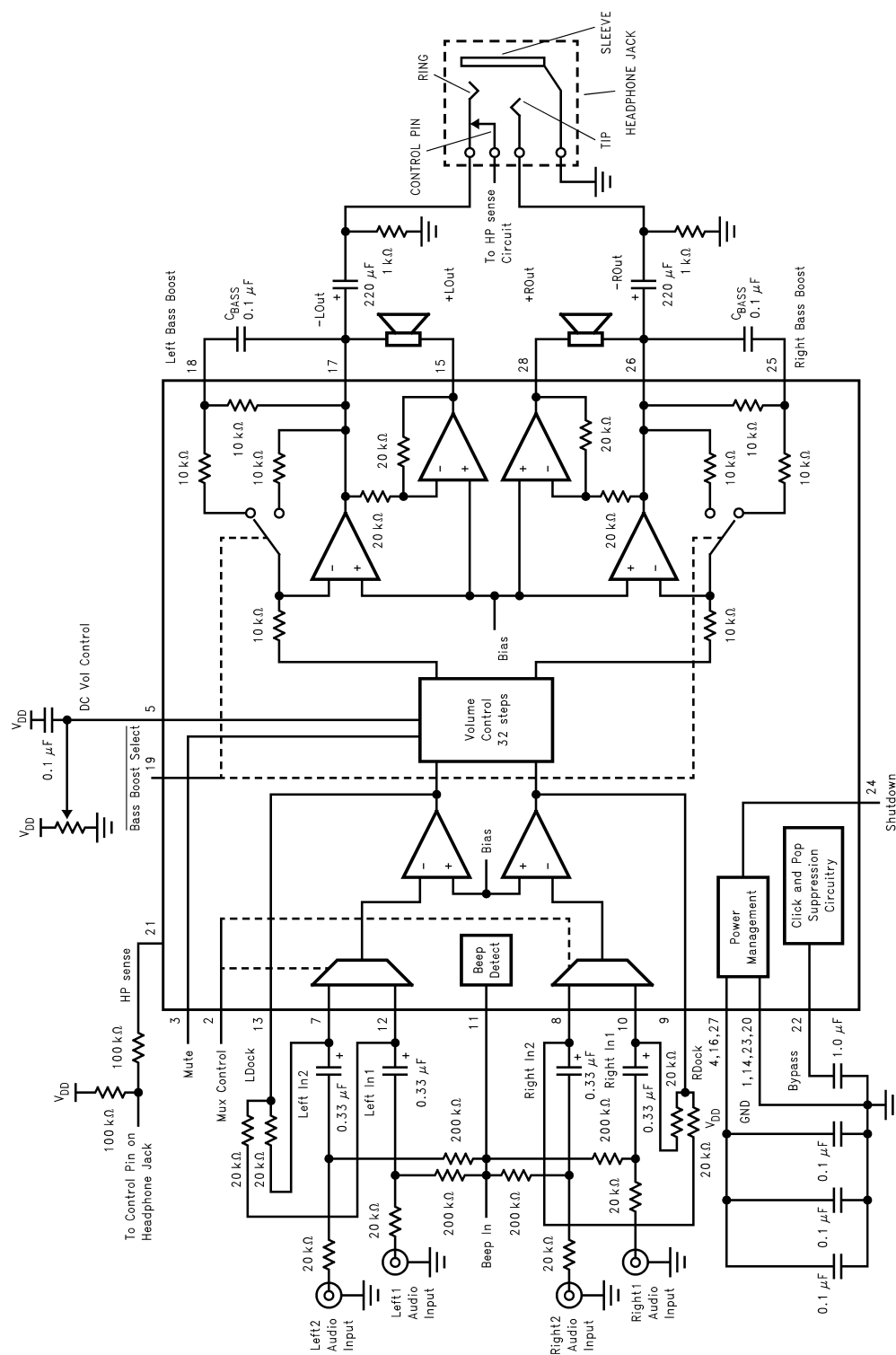
Note 12: Human body model, 100 pF discharged through a 1.5 k Ω resistor.

Note 13: Machine Model, 220 pF–240 pF discharged through all pins.

Note 14: Typicals are measured at 25 $^\circ C$ and represent the parametric norm.

Note 15: Datasheet min/max specification limits are guaranteed by design, test, or statistical analysis.

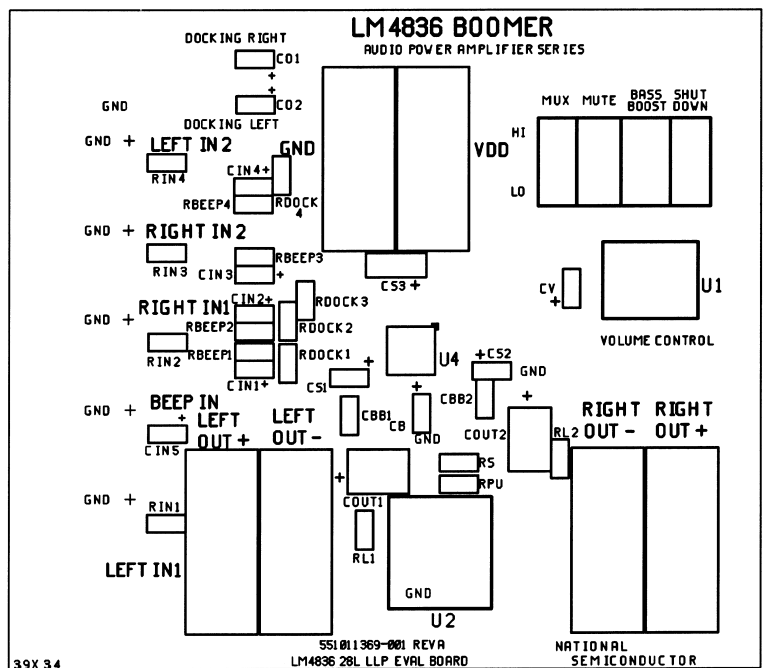
Typical Application



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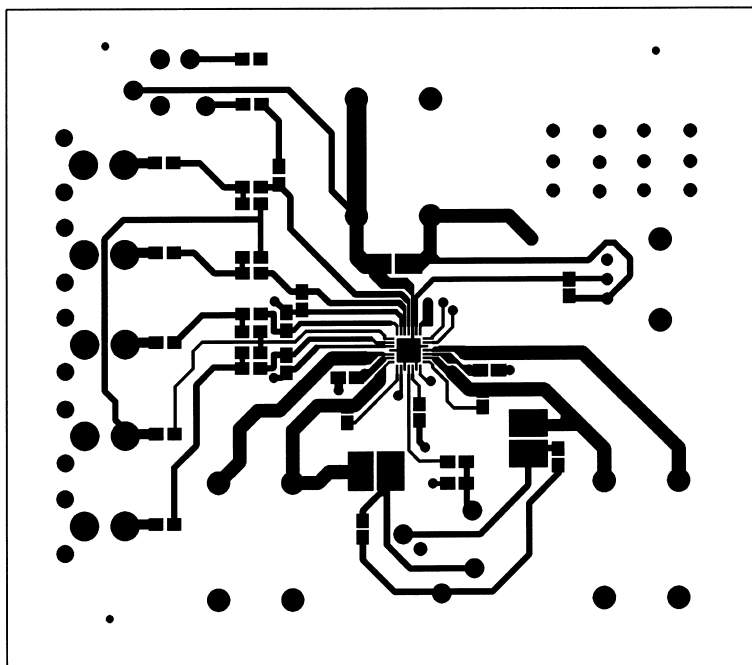
FIGURE 1. Typical Application Circuit

Application Information (Continued)



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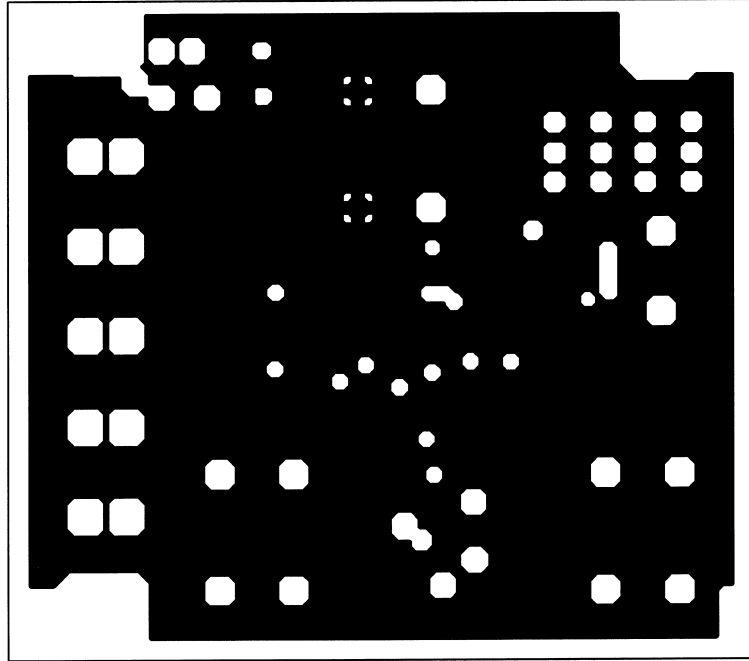
Figure 4. Recommended LQ PC Board Layout:
Component-Side Silkscreen



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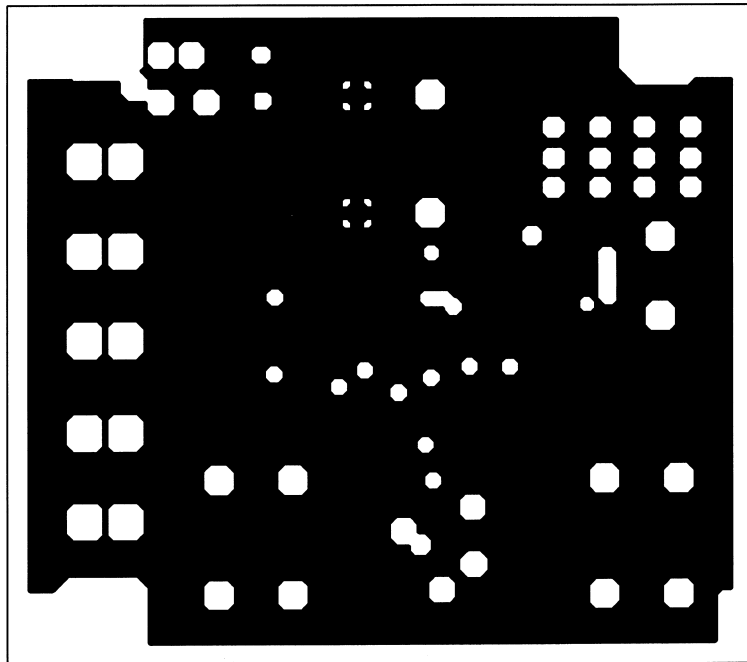
Figure 5. Recommended LQ PC Board Layout:
Component-Side Layout

Application Information (Continued)



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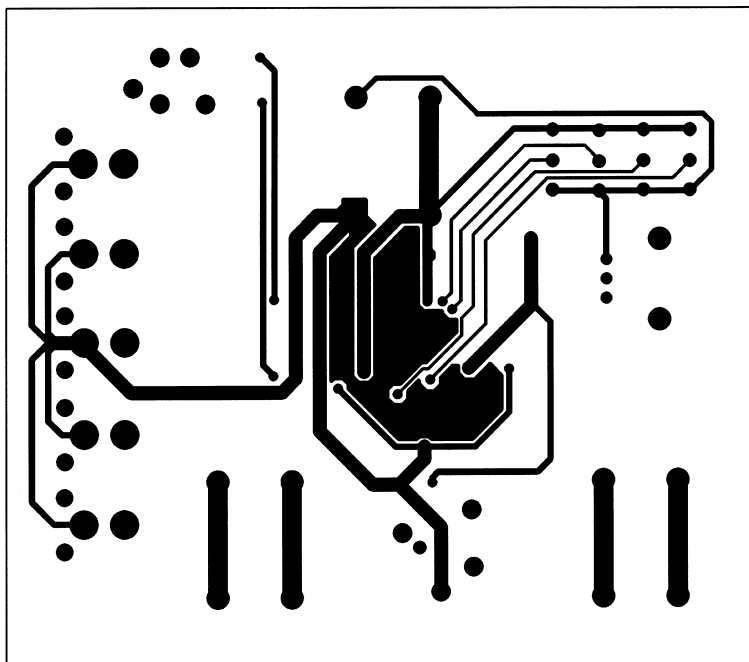
**Figure 6. Recommended LQ PC Board Layout:
Upper Inner-Layer Layout**



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**Figure 7. Recommended LQ PC Board Layout:
Lower Inner-Layer Layout**

Application Information (Continued)



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**Figure 8. Recommended LQ PC Board Layout:
Bottom-Side Layout**