

LMH6703 1.2 GHz, Low Distortion Op Amp with Shutdown

Check for Samples: [LMH6703](#)

FEATURES

- **–3 dB bandwidth** ($V_{OUT} = 0.5 V_{PP}$, $A_V = +2$) **1.2 GHz**
- **2nd/3rd harmonics** (20 MHz, SOT-23) **–69/–90 dBc**
- **Low noise** $2.3nV/\sqrt{Hz}$
- **Fast slew rate** **4500 V/ μ s**
- **Supply current** **11 mA**
- **Output current** **90 mA**
- **Low differential gain and phase** **0.01%/0.02°**

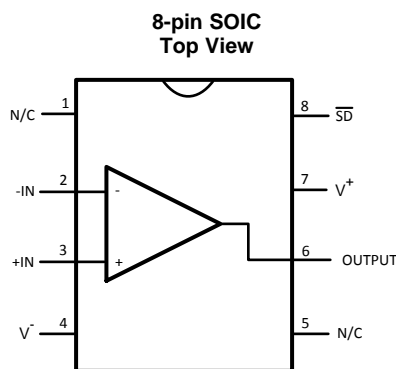
APPLICATIONS

- **RGB video driver**
- **High resolution projectors**
- **Flash A/D driver**
- **D/A transimpedance buffer**
- **Wide dynamic range IF amp**
- **Radar/communication receivers**
- **DDS post-amps**
- **Line driver**

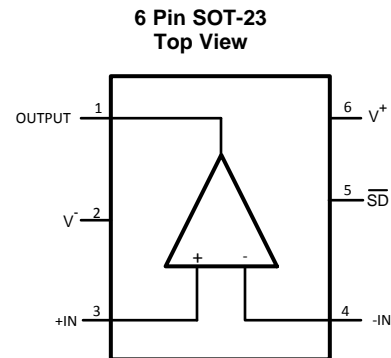
DESCRIPTION

The LMHTM6703 is a very wideband, DC coupled monolithic operational amplifier designed specifically for ultra high resolution video systems as well as wide dynamic range systems requiring exceptional signal fidelity. Benefitting from current feedback architecture, the LMH6703 offers a practical gain range of ± 1 to ± 10 while providing stable operation without external compensation, even at unity gain. At a gain of +2 the LMH6703 supports ultra high resolution video systems with a 750 MHz 2 V_{PP} –3 dB Bandwidth. With 12-bit distortion levels through 10 MHz ($R_L = 100\Omega$), and a $2.3nV/\sqrt{Hz}$ input referred noise, the LMH6703 is the ideal driver or buffer for high speed flash A/D and D/A converters. Wide dynamic range systems such as radar and communication receivers requiring a wideband amplifier offering exceptional signal purity will find the LMH6703 low input referred noise and low harmonic distortion an attractive solution.

CONNECTION DIAGRAMS



See Package Number D0008A



See Package Number D0008A



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

LMH is a trademark of Texas Instruments.

All other trademarks are the property of their respective owners.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of the Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

Copyright © 2005–2013, Texas Instruments Incorporated



These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

Absolute Maximum Ratings ⁽¹⁾

ESD Tolerance ⁽²⁾	Human Body Model	2000V
	Machine Model	200V
V_S		$\pm 6.75V$
I_{OUT}		⁽³⁾
Common Mode Input Voltage		V^- to V^+
Maximum Junction Temperature		+150°C
Storage Temperature Range		-65°C to +150°C
Soldering Information	Infrared or Convection (20 sec.)	235°C
	Wave Soldering (10 sec.)	260°C

- (1) Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is intended to be functional, but specific performance is not ensured. For specifications, see the Electrical Characteristics tables.
- (2) Human body model: 1.5 k Ω in series with 100 pF. Machine model: 0 Ω in series with 200 pF.
- (3) The maximum output current (I_{OUT}) is determined by device power dissipation limitations.

Operating Ratings ⁽¹⁾

Operating Temperature Range		-40°C to +85°C
Supply Voltage Range		$\pm 4V$ to $\pm 6V$
Package Thermal Resistance (θ_{JA}) ⁽²⁾	6 Pin SOT-23	208°C/W
	8 Pin SOIC	160°C/W

- (1) Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is intended to be functional, but specific performance is not ensured. For specifications, see the Electrical Characteristics tables.
- (2) The maximum power dissipation is a function of $T_{J(MAX)}$, θ_{JA} and T_A . The maximum allowable power dissipation at any ambient temperature is $P_D = (T_{J(MAX)} - T_A) / \theta_{JA}$. All numbers apply for package soldered directly into a 2 layer PC board with zero air flow.

Electrical Characteristics ⁽¹⁾

Unless otherwise specified, all limits specified for $T_J = 25^\circ\text{C}$, $A_V = +2$, $V_S = \pm 5\text{V}$, $R_L = 100\Omega$, $R_F = 560\Omega$, $\overline{SD} = \text{Floating}$.

Boldface limits apply at the temperature extremes.

Symbol	Parameter	Conditions	Min ⁽²⁾	Typ ⁽³⁾	Max ⁽²⁾	Units
Frequency Domain Performance						
SSBW	-3 dB Bandwidth	$V_{OUT} = 0.5 V_{PP}$, $A_V = +1$		1800		MHz
		$V_{OUT} = 0.5 V_{PP}$, $A_V = +2$		1200		
LSBW		$V_{OUT} = 2 V_{PP}$		750		
		$V_{OUT} = 4 V_{PP}$		500		
GF	0.1 dB Gain Flatness	$V_{OUT} = 0.5 V_{PP}$		150		MHz
		$V_{OUT} = 2 V_{PP}$		150		
DG	Differential Gain	$R_L = 150\Omega$, 4.43 MHz		0.01		%
DP	Differential Phase	$R_L = 150\Omega$, 4.43 MHz		0.02		deg
Time Domain Response						
t_r	Rise Time	2V Step, 10% to 90%		0.5		ns
		6V Step, 10% to 90%		1.05		ns
t_f	Fall Time	2V Step, 10% to 90%		0.5		ns
		6V Step, 10% to 90%		1.05		ns
SR	Slew Rate	4V Step, 10% to 90% ⁽⁴⁾		4200		V/ μs
		6V Step, 10% to 90% ⁽⁴⁾		4500		V/ μs
t_s	Settling Time	2V Step, V_{OUT} within 0.1%		10		ns
Distortion And Noise Response						
HD2	2 nd Harmonic Distortion	2 V_{PP} , 5 MHz, SOT-23-6		-87		dBc
		2 V_{PP} , 20 MHz, SOT-23-6		-69		
		2 V_{PP} , 50 MHz, SOT-23-6		-60		
HD3	3 rd Harmonic Distortion	2 V_{PP} , 5 MHz, SOT-23-6		-100		dBc
		2 V_{PP} , 20 MHz, SOT-23-6		-90		
		2 V_{PP} , 50 MHz, SOT-23-6		-70		
IMD	3 rd Order Intermodulation Products	50 MHz, $P_O = 5 \text{ dBm/ tone}$		-80		dBc
e_n	Input Referred Voltage Noise	>1 MHz		2.3		nV/ $\sqrt{\text{Hz}}$
i_n	Input Referred Noise Current	Inverting Pin >1 MHz		18.5		pA/ $\sqrt{\text{Hz}}$
	Input Referred Noise Current	Non-Inverting Pin >1 MHz		3		pA/ $\sqrt{\text{Hz}}$
Static, DC Performance						
V_{OS}	Input Offset Voltage			± 1.5	± 7 ± 9	mV
TCV_{OS}	Input Offset Voltage Average Drift	⁽⁵⁾		22		$\mu\text{V}/^\circ\text{C}$
I_B	Input Bias Current	Non-Inverting ⁽⁶⁾		-7	± 20 ± 23	μA
		Inverting ⁽⁶⁾		-2	± 35 ± 44	
TCI_B	Input Bias Current Average Drift	Non-Inverting ⁽⁵⁾		+30		nA/ $^\circ\text{C}$
		Inverting ⁽⁵⁾		-70		

(1) Electrical Table values apply only for factory testing conditions at the temperature indicated. Factory testing conditions result in very limited self-heating of the device such that $T_J = T_A$. Parametric performance is indicated in the electrical tables under conditions of internal self-heating where $T_J > T_A$.

(2) Limits are 100% production tested at 25°C . Limits over the operating temperature range are specified through correlation using Statistical Quality Control (SQC) methods.

(3) Typical numbers are the most likely parametric norm.

(4) Slew Rate is the average of the rising and falling edges.

(5) Drift determined by dividing the change in parameter at temperature extremes by the total temperature change.

(6) Negative input current implies current flowing out of the device.

Electrical Characteristics ⁽¹⁾ (continued)

Unless otherwise specified, all limits specified for $T_J = 25^\circ\text{C}$, $A_V = +2$, $V_S = \pm 5\text{V}$, $R_L = 100\Omega$, $R_F = 560\Omega$, $\overline{\text{SD}} = \text{Floating}$.

Boldface limits apply at the temperature extremes.

Symbol	Parameter	Conditions	Min ⁽²⁾	Typ ⁽³⁾	Max ⁽²⁾	Units
V_O	Output Voltage Range	$R_L = \infty$	± 3.3	± 3.45		V
		$R_L = 100\Omega$	± 3.2 ± 3.14	± 3.4		
PSRR	Power Supply Rejection Ratio	$V_S = \pm 4.0\text{V}$ to $\pm 6.0\text{V}$	48 46	52		dB
CMRR	Common Mode Rejection Ratio	$V_{CM} = -1.0\text{V}$ to $+1.0\text{V}$	45 44	47		dB
I_S	Supply Current (Enabled)	$\overline{\text{SD}} = 2\text{V}$, $R_L = \infty$		11	12.5 15.0	mA
	Supply Current (Disabled)	$\overline{\text{SD}} = 0.8\text{V}$, $R_L = \infty$		0.2	0.900 0.935	mA
Miscellaneous Performance						
R_{IN+}	Non-Inverting Input Resistance			1		M Ω
R_{IN-}	Inverting Input Resistance	Output Impedance of Input Buffer		30		Ω
C_{IN}	Non-Inverting Input Capacitance			0.8		pF
R_O	Output Resistance	Closed Loop		0.05		Ω
CMVR	Input Common Mode Voltage Range	CMRR ≥ 40 dB	± 1.9			V
I_O	Linear Output Current	$V_{IN} = 0\text{V}$, $V_{OUT} \leq \pm 80\text{mV}$	± 55	± 90		mA
Enable/Disable Performance (Disabled Low)						
T_{ON}	Enable Time			10		ns
T_{OFF}	Disable Time			10		ns
	Output Glitch			50		mV _{pp}
V_{IH}	Enable Voltage	$\overline{\text{SD}} \geq V_{IH}$	2.0			V
V_{IL}	Disable Voltage	$\overline{\text{SD}} \leq V_{IL}$			0.8	V
I_{IH}	Disable Pin Bias Current, High	$\overline{\text{SD}} = V^{+ (7)}$		-7	± 70	μA
I_{IL}	Disable Pin Bias Current, Low	$\overline{\text{SD}} = 0\text{V}^{(7)}$	-50	-240	-400	μA
I_{OZ}	Disabled Output Leakage Current	$V_{OUT} = \pm 1.8\text{V}$		0.07	± 25 ± 40	μA

(7) Negative input current implies current flowing out of the device.

Typical Performance Characteristics

($A_V = +2$, $R_L = 100\Omega$, $V_S = \pm 5V$, $R_F = 560\Omega$, $T_A = +25^\circ C$, SOT-23-6; unless otherwise specified).

Small Signal Non-Inverting Frequency Response (SOT-23)

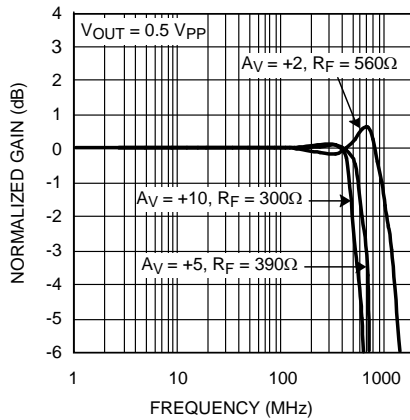


Figure 1.

Large Signal Frequency Response (SOT-23)

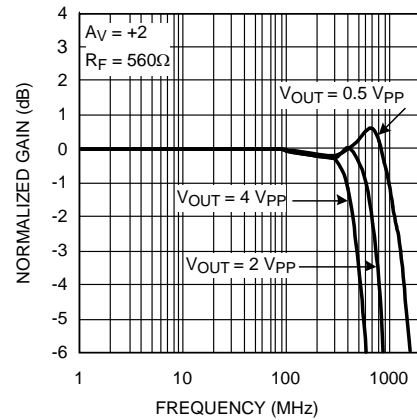


Figure 2.

Large Signal Frequency Response (SOT-23)

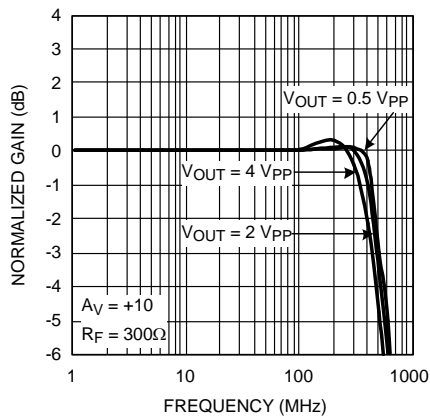


Figure 3.

Small Signal Inverting Frequency Response (SOT-23)

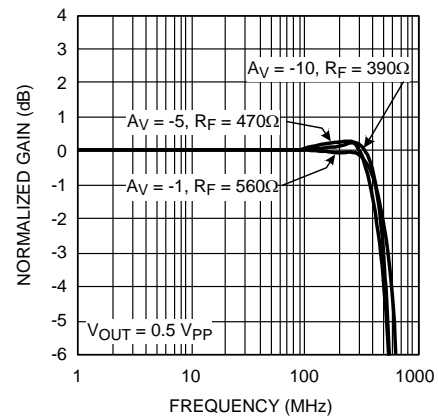


Figure 4.

Small Signal Non-Inverting Frequency Response (SOIC)

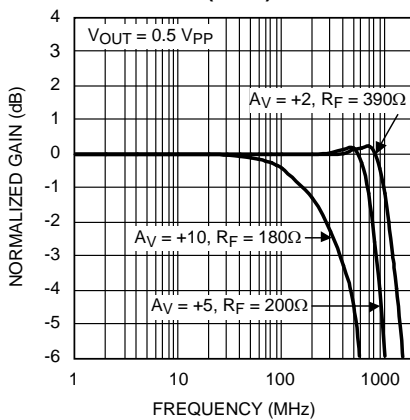


Figure 5.

Large Signal Frequency Response (SOIC)

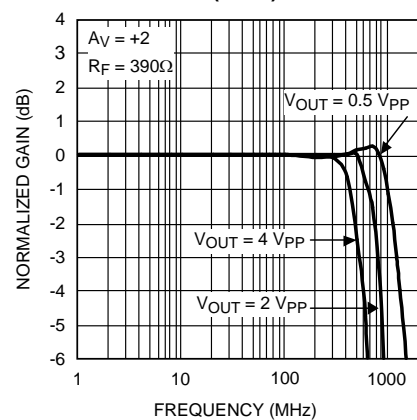


Figure 6.

Typical Performance Characteristics (continued)

($A_V = +2$, $R_L = 100\Omega$, $V_S = \pm 5V$, $R_F = 560\Omega$, $T_A = +25^\circ C$, SOT-23-6; unless otherwise specified).

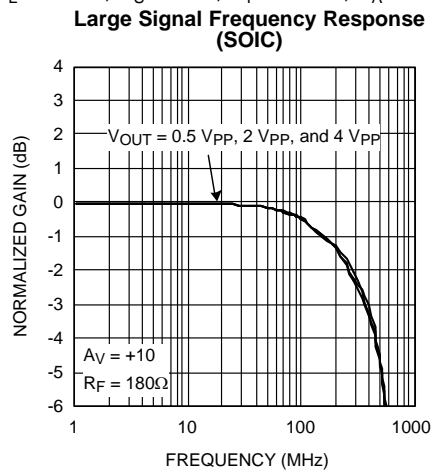


Figure 7.

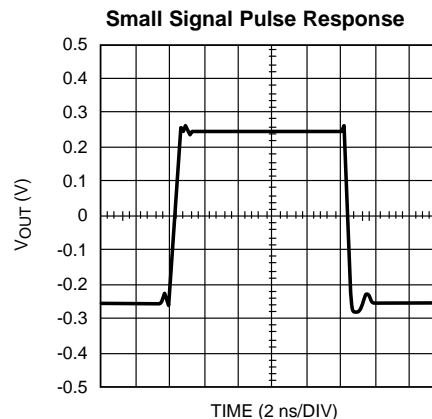


Figure 8.

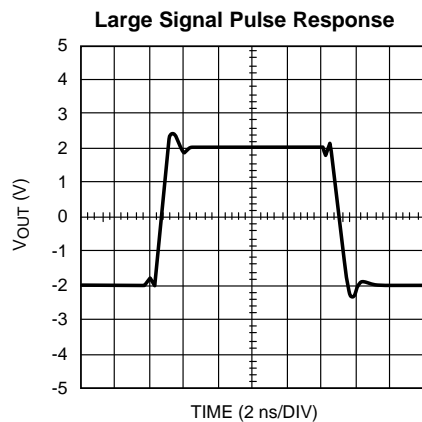


Figure 9.

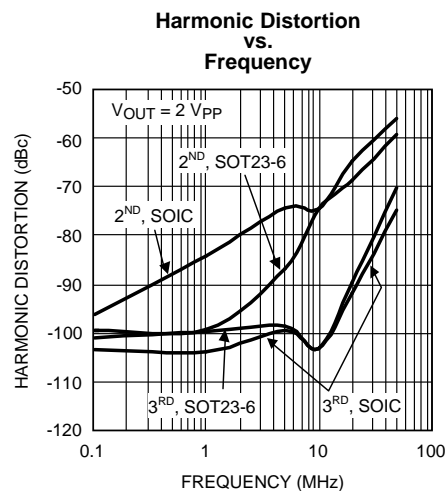


Figure 10.

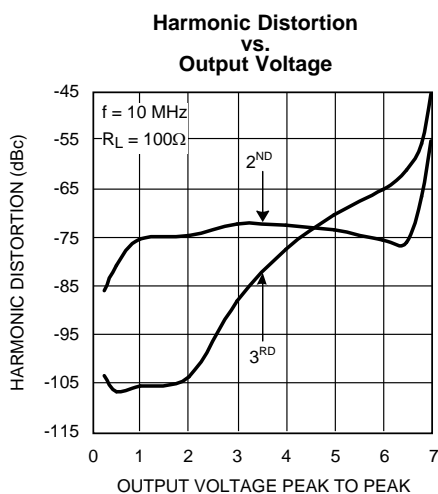


Figure 11.

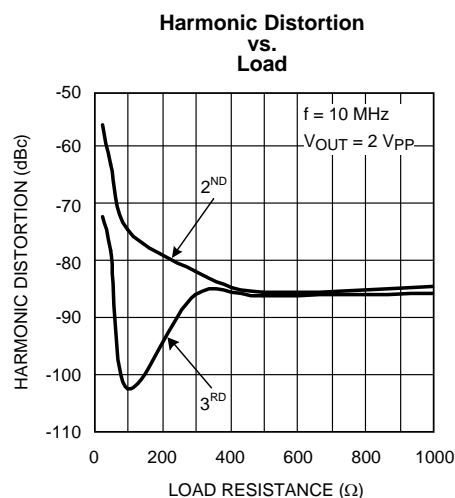


Figure 12.

Typical Performance Characteristics (continued)

($A_V = +2$, $R_L = 100\Omega$, $V_S = \pm 5V$, $R_F = 560\Omega$, $T_A = +25^\circ C$, SOT-23-6; unless otherwise specified).

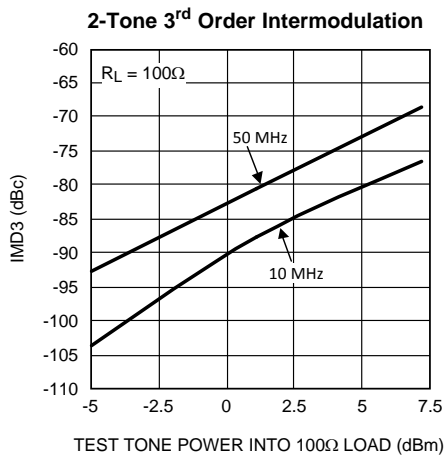


Figure 13.

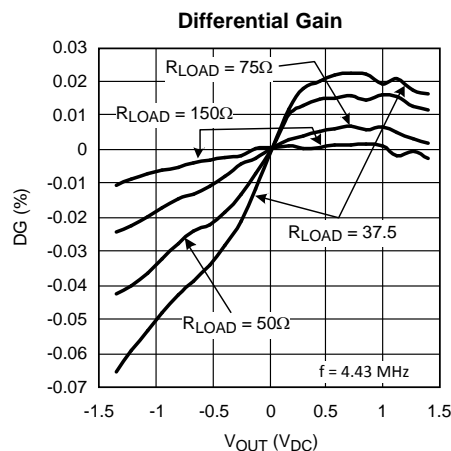


Figure 14.

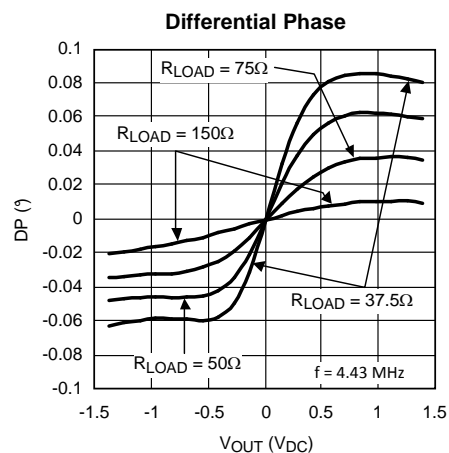


Figure 15.

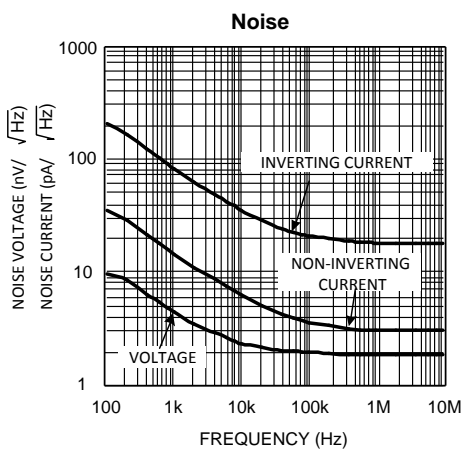


Figure 16.

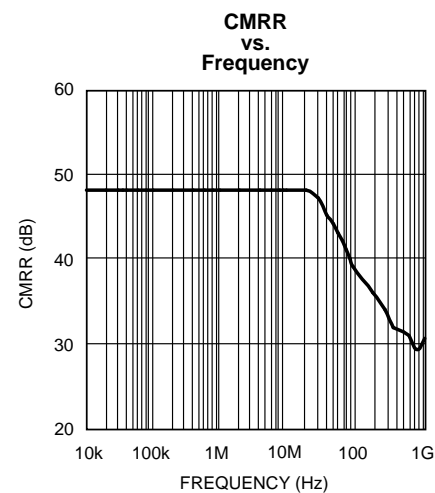


Figure 17.

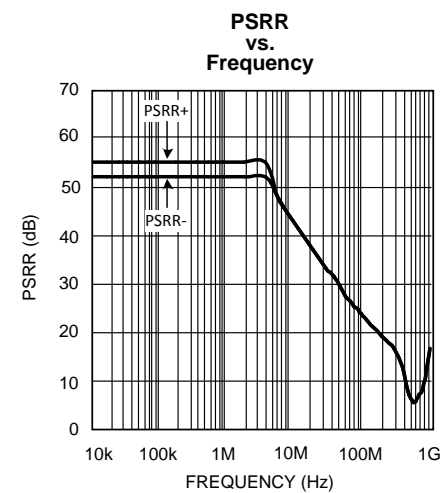


Figure 18.

Typical Performance Characteristics (continued)

($A_V = +2$, $R_L = 100\Omega$, $V_S = \pm 5V$, $R_F = 560\Omega$, $T_A = +25^\circ\text{C}$, SOT-23-6; unless otherwise specified).

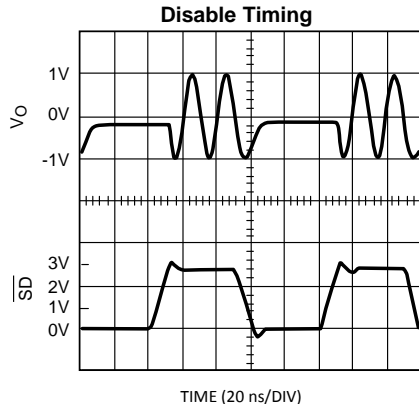


Figure 19.

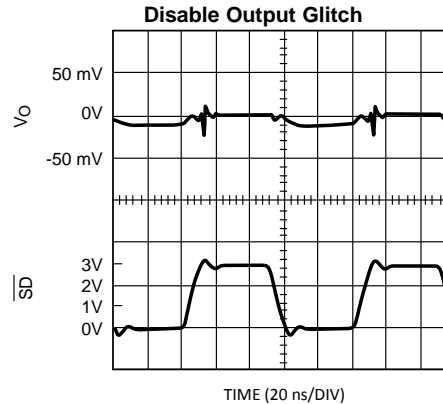


Figure 20.

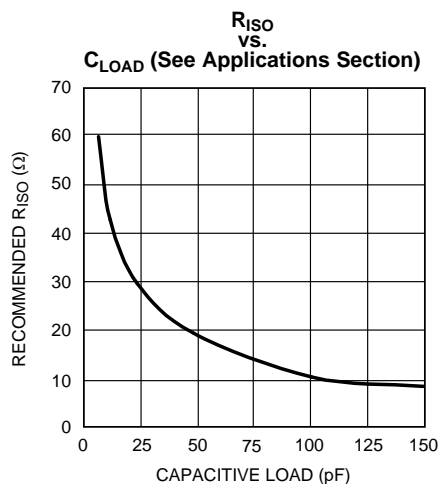


Figure 21.

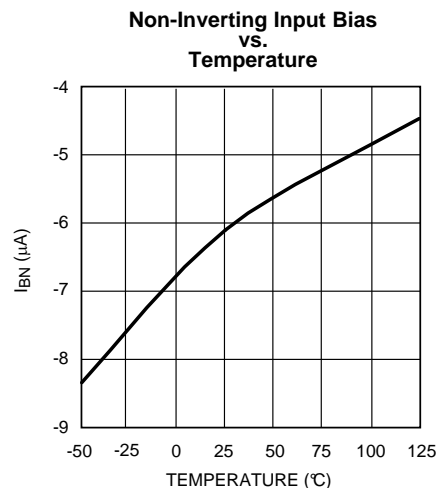


Figure 22.

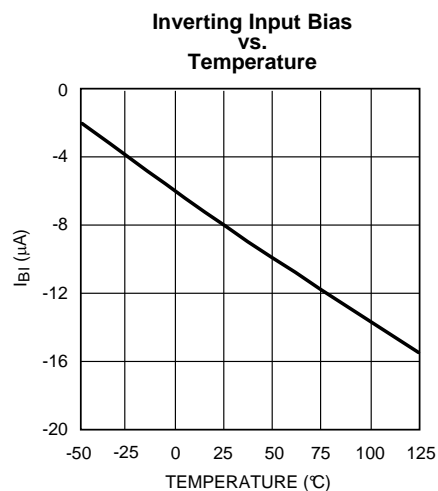


Figure 23.

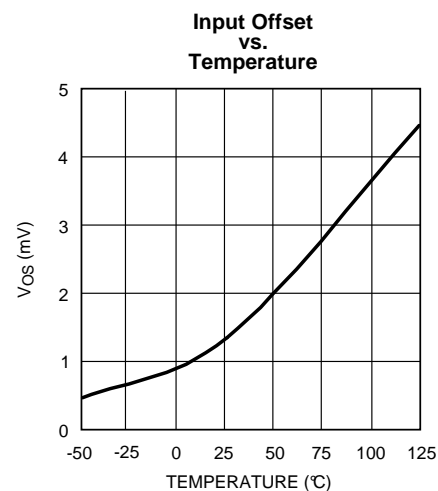


Figure 24.

Typical Performance Characteristics (continued)

($A_V = +2$, $R_L = 100\Omega$, $V_S = \pm 5V$, $R_F = 560\Omega$, $T_A = +25^\circ\text{C}$, SOT-23-6; unless otherwise specified).

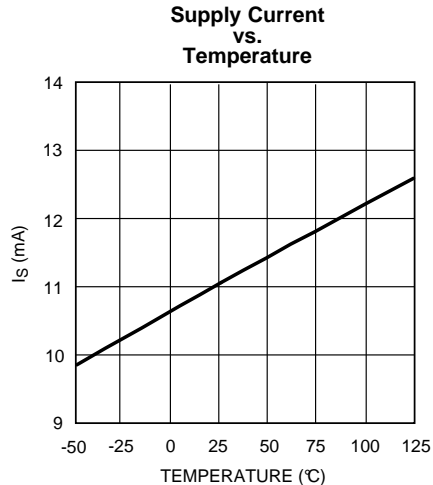


Figure 25.

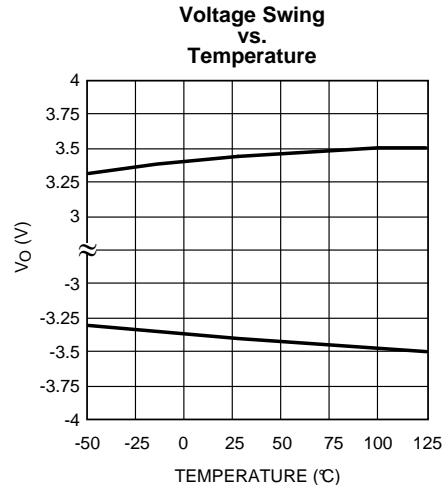


Figure 26.

APPLICATION INFORMATION

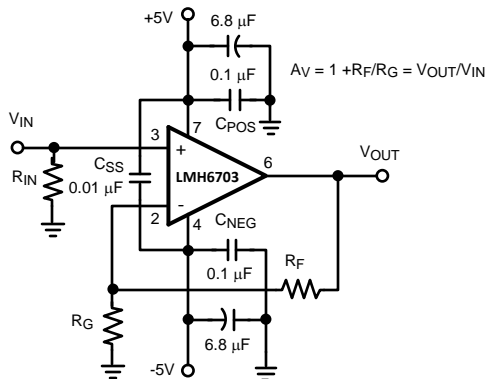


Figure 27. Recommended Non-Inverting Gain Circuit (SOIC Pinout Shown)

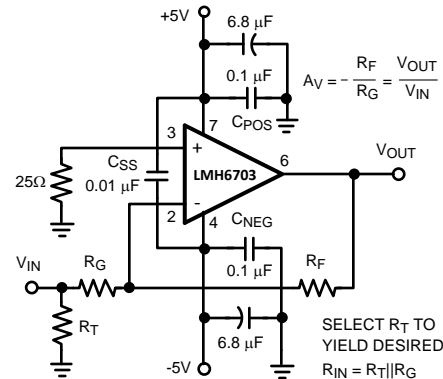


Figure 28. Recommended Inverting Gain Circuit (SOIC Pinout Shown)

GENERAL DESCRIPTION

The LMH6703 is a high speed current feedback amplifier, optimized for excellent bandwidth, gain flatness, and low distortion. The loop gain for a current feedback op amp, and hence the frequency response, is predominantly set by the feedback resistor value. The LMH6703 in the SOT-23-6 package is optimized for use with a 560Ω feedback resistor. The LMH6703 in the SOIC package is optimized for use with a 390Ω feedback resistor. Using lower values can lead to excessive ringing in the pulse response while a higher value will limit the bandwidth. Application Note OA-13 ([SNOA366](#)) discusses this in detail along with the occasions where a different R_F might be advantageous.

EVALUATION BOARDS

Device	Package	Evaluation Board Part Number
LMH6703MF	SOT-23-6	CLC730216
LMH6703MA	SOIC	CLC730227

FEEDBACK RESISTOR SELECTION

One of the key benefits of a current feedback operational amplifier is the ability to maintain optimum frequency response independent of gain by using appropriate values for the feedback resistor (R_F). The Electrical Characteristics and Typical Performance plots specify an R_F of 560Ω (390Ω for the SOIC package), a gain of +2 V/V and ±5V power supplies (unless otherwise specified). Generally, lowering R_F from it's recommended value will peak the frequency response and extend the bandwidth while increasing the value of R_F will cause the frequency response to roll off faster. Reducing the value of R_F too far below it's recommended value will cause overshoot, ringing and, eventually, oscillation.

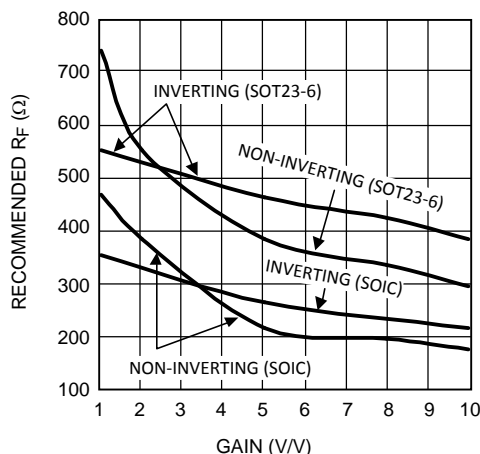


Figure 29. Recommended R_F vs. Gain

Since a current feedback amplifier is dependant on the value of R_F to provide frequency compensation and since the value of R_F can be used to optimize the frequency response, different packages use different R_F values. As shown in Figure 29, Recommended R_F vs. Gain, the SOT-23-6 and the SOIC package use different values for the feedback resistor, R_F . Since each application is slightly different, it is worth some experimentation to find the optimal R_F for a given circuit. In general, a value of R_F that produces ≈ 0.1 dB of peaking is the best compromise between stability and maximum bandwidth. Note that it is not possible to use a current feedback amplifier with the output shorted directly to the inverting input. The buffer configuration of the LMH6703 requires a 560 Ω (390 Ω for SOIC package) feedback resistor for stable operation.

The LMH6703 was optimized for high speed operation. As shown in Figure 29, the suggested value for R_F decreases for higher gains. Due to the output impedance of the input buffer, there is a practical limit for how small R_F can go, based on the lowest practical value of R_G . This limitation applies to both inverting and non inverting configurations. For the LMH6703 the input resistance of the inverting input is approximately 30 Ω and 20 Ω is a practical (but not hard and fast) lower limit for R_G . The LMH6703 begins to operate in a gain bandwidth limited fashion in the region when R_G is nearly equal to the input buffer impedance. Note that the amplifier will operate with R_G values well below 20 Ω , however results may be substantially different than predicted from ideal models. In particular the voltage potential between the Inverting and Non-Inverting inputs cannot be expected to remain small.

Inverting gain applications that require impedance matched inputs may limit gain flexibility somewhat (especially if maximum bandwidth is required). The impedance seen by the source is $R_G \parallel R_T$ (R_T is optional). The value of R_G is R_F / Gain . Thus for a SOT-23 in a gain of -5 V/V, an R_F of 460 Ω is optimum and R_G is 92 Ω . Without a termination resistor, R_T , the input impedance would equal R_G , 92 Ω . Using an R_T of 109 Ω will set the input resistance to match a 50 Ω source. Note that source impedances greater than R_G cannot be matched in the inverting configuration.

For more information see Application Note OA-13 (SNOA366) which describes the relationship between R_F and closed-loop frequency response for current feedback operational amplifiers. The value for the inverting input impedance for the LMH6703 is approximately 30 Ω . The LMH6703 is designed for optimum performance at gains of +1 to +10 V/V and -1 to -9 V/V. Higher gain configurations are still useful, however, the bandwidth will fall as gain is increased, much like a typical voltage feedback amplifier.

The LMH6703 data sheet shows both SOT-23-6 and SOIC data in the Electrical Characteristic section to aid in selecting the right package. The Typical Performance Characteristics section shows SOT-23-6 package plots only.

CAPACITIVE LOAD DRIVE

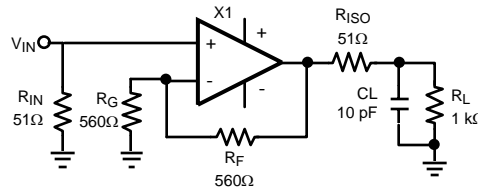


Figure 30. Decoupling Capacitive Loads

Capacitive output loading applications will benefit from the use of a series output resistor R_{ISO} . Figure 30 shows the use of a series output resistor, R_{ISO} , to stabilize the amplifier output under capacitive loading. Capacitive loads from 5 to 120 pF are the most critical, causing ringing, frequency response peaking and possible oscillation. The chart “Suggested R_{ISO} vs. Cap Load” gives a recommended value for selecting a series output resistor for mitigating capacitive loads. The values suggested in the charts are selected for 0.5 dB or less of peaking in the frequency response. This produces a good compromise between settling time and bandwidth. For applications where maximum frequency response is needed and some peaking is tolerable, the value of R_{ISO} can be reduced slightly from the recommended values.

DC ACCURACY AND NOISE

Example below shows the output offset computation equation for the non-inverting configuration (see Figure 27) using the typical bias current and offset specifications for $A_V = +2$:

$$\text{Output Offset : } V_O = (I_{BN} \cdot R_{IN} \pm V_{OS}) (1 + R_F/R_G) \pm I_{BI} \cdot R_F$$

Where R_{IN} is the equivalent input impedance on the non-inverting input.

Example computation for $A_V = +2$, $R_F = 560\Omega$, $R_{IN} = 25\Omega$:

$$V_O = (7 \mu A \cdot 25\Omega \pm 1.5 \text{ mV}) (1 + 560/560) \pm 2 \mu A \cdot 560 \approx -3.7 \text{ mV to } 4.5 \text{ mV}$$

A good design, however, should include a worst case calculation using Min/Max numbers in the data sheet tables, in order to ensure "worst case" operation.

Further improvement in the output offset voltage and drift is possible using the composite amplifiers described in Application Note OA-07 (SNOA365). The two input bias currents are physically unrelated in both magnitude and polarity for the current feedback topology. It is not possible, therefore, to cancel their effects by matching the source impedance for the two inputs (as is commonly done for matched input bias current devices).

The total output noise is computed in a similar fashion to the output offset voltage. Using the input noise voltage and the two input noise currents, the output noise is developed through the same gain equations for each term but combined as the square root of the sum of squared contributing elements. See Application Note OA-12 (SNOA375) for a full discussion of noise calculations for current feedback amplifiers.

PRINTED CIRCUIT LAYOUT

Whenever questions about layout arise, use the evaluation board as a guide. The CLC730216 is the evaluation board for SOT-23-6 samples of the LMH6703 and the CLC730227 is the evaluation board for SOIC samples of the LMH6703.

To reduce parasitic capacitances, ground and power planes should be removed near the input and output pins. Components in the feedback path should be placed as close to the device as possible to minimize parasitic capacitance. For long signal paths controlled impedance lines should be used, along with impedance matching elements at both ends.

Bypass capacitors should be placed as close to the device as possible. Bypass capacitors from each voltage rail to ground are applied in pairs. The larger electrolytic bypass capacitors can be located further from the device, the smaller ceramic bypass capacitors should be placed as close to the device as possible. In Figure 27 and Figure 28 C_{SS} is optional, but is recommended for best second order harmonic distortion.

VIDEO PERFORMANCE

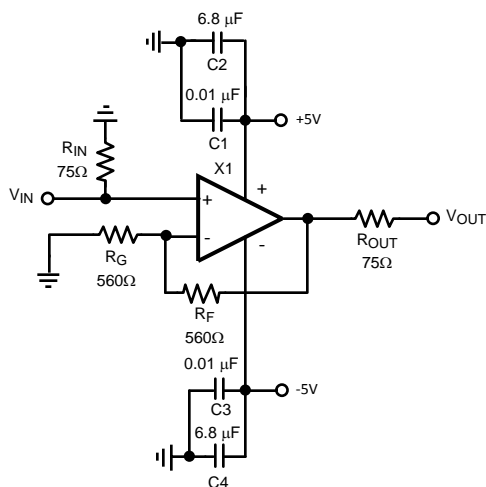


Figure 31. Typical Video Application

The LMH6703 has been designed to provide excellent performance with production quality video signals in a wide variety of formats such as HDTV and High Resolution VGA. NTSC and PAL performance is nearly flawless with DG of 0.01% and DP of 0.02°. Best performance will be obtained with back terminated loads. The back termination reduces reflections from the transmission line and effectively masks transmission line and other parasitic capacitance from the amplifier output stage. Figure 31 shows a typical configuration for driving 75Ω cable. The amplifier is configured for a gain of two compensating for the 6 dB loss due to R_{OUT} .

ENABLE/DISABLE

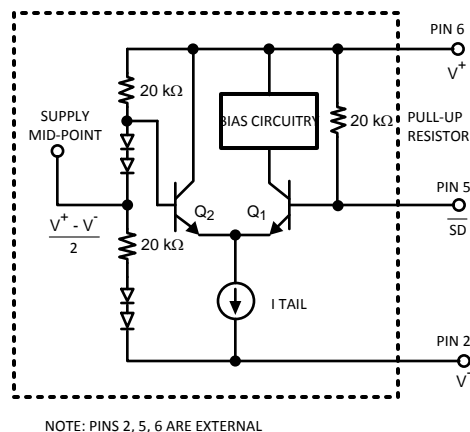


Figure 32. \overline{SD} Pin Simplified Schematic (SOT-23 Pinout Shown)

For $\pm 5V$ supplies only the LMH6703 has a TTL logic compatible disable function. Apply a logic low ($< 0.8V$) to the \overline{SD} pin and the LMH6703 is disabled. Apply a logic high ($> 2.0V$), or let the pin float and the LMH6703 is enabled. Voltage, not current, at the Shutdown pin (\overline{SD}) determines the enable/disable state. Care must be exercised to prevent the shutdown pin voltage from going more than 0.8V below the midpoint of the supply voltages (0V with split supplies, $V^+/2$ with single supply biasing). Doing so could cause transistor Q1 to Zener resulting in damage to the disable circuit (See Figure 32). The core amplifier is unaffected by this, but the shutdown operation could become permanently slower as a result.

Disabled, the LMH6703 inputs and output become high impedances. While disabled the LMH6703 quiescent current is approximately 200 μA . Because of the pull up resistor on the shutdown circuit, the I_{CC} and I_{EE} currents (positive and negative supply currents respectively) are not balanced in the disabled state. The positive supply current (I_{CC}) is approximately 300 μA while the negative supply current (I_{EE}) is only 200 μA . The remaining I_{EE} current of 100 μA flows through the shutdown pin.

The disable function can be used to create analog switches or multiplexers. Implement a single analog switch with one LMH6703 positioned between an input and output. Create an analog multiplexer with several LMH6703's and tie the outputs together.

REVISION HISTORY

Changes from Revision C (March 2013) to Revision D	Page
• Changed layout of National Data Sheet to TI format	14

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Top-Side Markings (4)	Samples
LMH6703MA/NOPB	ACTIVE	SOIC	D	8	95	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 85	LMH67 03MA	Samples
LMH6703MAX/NOPB	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 85	LMH67 03MA	Samples
LMH6703MF/NOPB	ACTIVE	SOT-23	DBV	6	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 85	AR1A	Samples
LMH6703MFX/NOPB	ACTIVE	SOT-23	DBV	6	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 85	AR1A	Samples

(1) The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBSELETE: TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

TBD: The Pb-Free/Green conversion plan has not been defined.

Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) Multiple Top-Side Markings will be inside parentheses. Only one Top-Side Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Top-Side Marking for that device.

Important Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

TAPE AND REEL INFORMATION


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
LMH6703MAX/NOPB	SOIC	D	8	2500	330.0	12.4	6.5	5.4	2.0	8.0	12.0	Q1
LMH6703MF/NOPB	SOT-23	DBV	6	1000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LMH6703MFX/NOPB	SOT-23	DBV	6	3000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3

TAPE AND REEL BOX DIMENSIONS

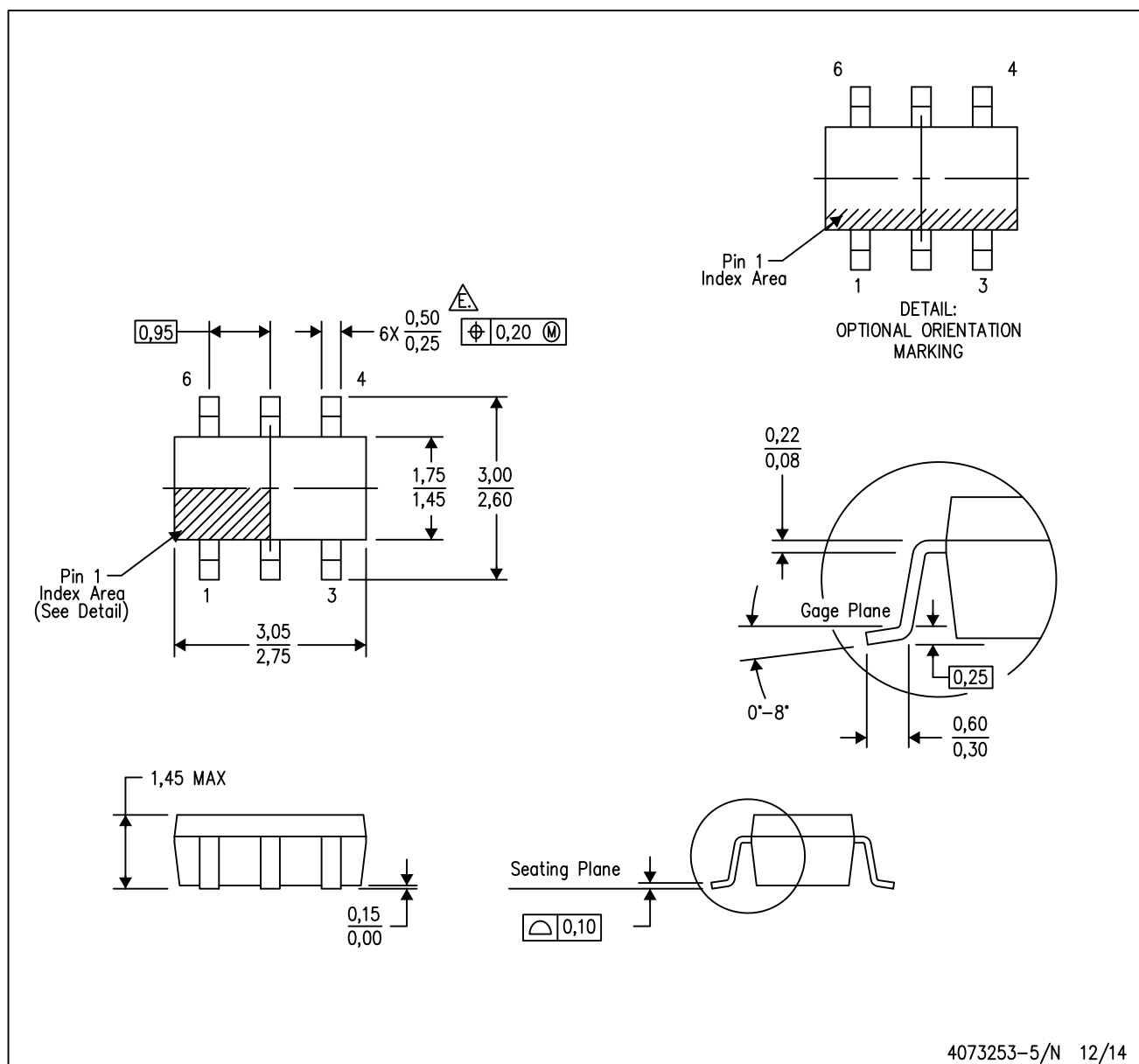


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
LMH6703MAX/NOPB	SOIC	D	8	2500	367.0	367.0	35.0
LMH6703MF/NOPB	SOT-23	DBV	6	1000	210.0	185.0	35.0
LMH6703MFX/NOPB	SOT-23	DBV	6	3000	210.0	185.0	35.0

DBV (R-PDSO-G6)

PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
 - D. Leads 1,2,3 may be wider than leads 4,5,6 for package orientation.
 - E. Falls within JEDEC MO-178 Variation AB, except minimum lead width.

D (R-PDSO-G8)

PLASTIC SMALL OUTLINE



NOTES:

- A. All linear dimensions are in inches (millimeters).
- B. This drawing is subject to change without notice.
- $\triangle C$ Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
- $\triangle D$ Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
- E. Reference JEDEC MS-012 variation AA.

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as "components") are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI's terms and conditions of sale of semiconductor products. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

TI assumes no liability for applications assistance or the design of Buyers' products. Buyers are responsible for their products and applications using TI components. To minimize the risks associated with Buyers' products and applications, Buyers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of significant portions of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI components or services with statements different from or beyond the parameters stated by TI for that component or service voids all express and any implied warranties for the associated TI component or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI's goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have **not** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

Products

Audio	www.ti.com/audio
Amplifiers	amplifier.ti.com
Data Converters	dataconverter.ti.com
DLP® Products	www.dlp.com
DSP	dsp.ti.com
Clocks and Timers	www.ti.com/clocks
Interface	interface.ti.com
Logic	logic.ti.com
Power Mgmt	power.ti.com
Microcontrollers	microcontroller.ti.com
RFID	www.ti-rfid.com
OMAP Applications Processors	www.ti.com/omap
Wireless Connectivity	www.ti.com/wirelessconnectivity

Applications

Automotive and Transportation	www.ti.com/automotive
Communications and Telecom	www.ti.com/communications
Computers and Peripherals	www.ti.com/computers
Consumer Electronics	www.ti.com/consumer-apps
Energy and Lighting	www.ti.com/energy
Industrial	www.ti.com/industrial
Medical	www.ti.com/medical
Security	www.ti.com/security
Space, Avionics and Defense	www.ti.com/space-avionics-defense
Video and Imaging	www.ti.com/video

TI E2E Community

e2e.ti.com