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LMH6640

TFT-LCD Single, 16V Rail-to-Rail High Output Operational Amplifier

General Description

The LMH6640 is a voltage feedback operational amplifier with a rail-to-rail output drive capability of 100 mA. Employing National's patented VIP10 process, the LMH6640 delivers a bandwidth of 190 MHz at a current consumption of only 4mA. An input common mode voltage range extending to 0.3V below the V_- and to within 0.9V of V_+ , makes the LMH6640 a true single supply op-amp. The output voltage range extends to within 100 mV of either supply rail providing the user with a dynamic range that is especially desirable in low voltage applications.

The LMH6640 offers a slew rate of 170 V/ μ s resulting in a full power bandwidth of approximately 28 MHz with 5V single supply ($2 V_{PP}$, -1 dB). Careful attention has been paid to ensure device stability under all operating voltages and modes. The result is a very well behaved frequency response characteristic for any gain setting including +1, and excellent specifications for driving video cables including total harmonic distortion of -64 dBc @ 5 MHz, differential gain of 0.12% and differential phase of 0.12°.

Features

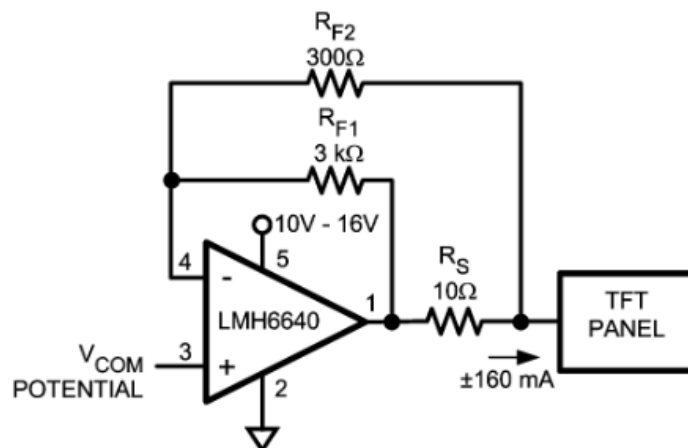
($V_S = 16V$, $R_L = 2 k\Omega$ to $V^+/2$, 25°C, Typical Values Unless Specified)

| | |
|---|-------------------|
| ■ Supply current (no load) | 4 mA |
| ■ Output resistance (closed loop 1 MHz) | 0.35 Ω |
| ■ -3 dB BW ($A_V = 1$) | 190 MHz |
| ■ Settling time ($\pm 0.1\%$, $2 V_{PP}$) | 35 ns |
| ■ Input common mode voltage | -0.3V to 15.1V |
| ■ Output voltage swing | 100 mV from rails |
| ■ Linear output current | ± 100 mA |
| ■ Total harmonic distortion ($2 V_{PP}$, 5 MHz) | -64 dBc |
| ■ Fully characterized for: | 5V & 16V |
| ■ No output phase reversal with CMVR exceeded | |
| ■ Differential gain ($R_L = 150\Omega$) | 0.12% |
| ■ Differential phase ($R_L = 150\Omega$) | 0.12° |

Applications

- TFT panel V_{COM} buffer amplifier
- Active filters
- CD/DVD ROM
- ADC buffer amplifier
- Portable video
- Current sense buffer

Typical Application



Typical Application as a TFT Panel V_{COM} Driver

20086234

Absolute Maximum Ratings (Note 1)

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

ESD Tolerance (Note 2)

| | |
|---------------------------------|---------------------------------|
| Human Body Model | 2 KV |
| Machine Model | 200V |
| V_{IN} Differential | $\pm 2.5V$ |
| Input Current | ± 10 mA |
| Supply Voltages ($V^+ - V^-$) | 18V |
| Voltage at Input/Output Pins | $V^+ + 0.8V, V^- - 0.8V$ |
| Storage Temperature Range | $-65^\circ C$ to $+150^\circ C$ |

| | |
|----------------------------------|----------------|
| Junction Temperature (Note 4) | $+150^\circ C$ |
| Soldering Information | |
| Infrared or Convection (20 sec.) | $235^\circ C$ |
| Wave Soldering (10 sec.) | $260^\circ C$ |

Operating Ratings (Note 3)

| | |
|--------------------------------------|--------------------------------|
| Supply Voltage ($V^+ - V^-$) | 4.5V to 16V |
| Operating Temperature Range (Note 4) | $-40^\circ C$ to $+85^\circ C$ |
| Package Thermal Resistance (Note 4) | |
| 5-Pin SOT23 | $265^\circ C/W$ |

5V Electrical Characteristics

Unless otherwise specified, All limits guaranteed for $T_J = 25^\circ C$, $V^+ = 5V$, $V^- = 0V$, $V_O = V_{CM} = V^+/2$ and $R_L = 2$ k Ω to $V^+/2$. **Boldface** limits apply at temperature extremes. (Note 9)

| Symbol | Parameter | Conditions | Min (Note 6) | Typ (Note 5) | Max (Note 6) | Units |
|----------------------|---------------------------------|--|-----------------|----------------------|-----------------|--------------------|
| BW | -3 dB Bandwidth | $A_V = +1$ ($R_L = 100\Omega$) $A_V = -1$ ($R_L = 100\Omega$) | | 150 58 | | MHz |
| $BW_{0.1\text{ dB}}$ | 0.1 dB Gain Flatness | $A_V = -3$ | | 18 | | MHz |
| FPBW | Full Power Bandwidth | $A_V = +1$, $V_{OUT} = 2 V_{PP}$, -1 dB | | 28 | | MHz |
| LSBW | -3 dB Bandwidth | $A_V = +1$, $V_O = 2 V_{PP}$ ($R_L = 100\Omega$) | | 32 | | MHz |
| GBW | Gain Bandwidth Product | $A_V = +1$, ($R_L = 100\Omega$) | | 59 | | MHz |
| SR | Slew Rate (Note 8) | $A_V = -1$ | | 170 | | V/ μs |
| e_n | Input Referred Voltage Noise | $f = 10$ kHz $f = 1$ MHz | | 23 15 | | nV/ \sqrt{Hz} |
| i_n | Input Referred Current Noise | $f = 10$ kHz $f = 1$ MHz | | 1.1 0.7 | | pA/ \sqrt{Hz} |
| THD | Total Harmonic Distortion | $f = 5$ MHz, $V_O = 2 V_{PP}$, $A_V = +2$ $R_L = 1$ k Ω to $V^+/2$ | | -65 | | dBc |
| t_s | Settling Time | $V_O = 2 V_{PP}$, $\pm 0.1\%$, $A_V = -1$ | | 35 | | ns |
| V_{OS} | Input Offset Voltage | | | 1 | 5 7 | mV |
| I_B | Input Bias Current (Note 7) | | | -1.2 | -2.6 -3.25 | μA |
| I_{OS} | Input Offset Current | | | 34 | 800 1400 | nA |
| CMVR | Common Mode Input Voltage Range | CMRR ≥ 50 dB | | -0.3 | -0.2 -0.1 | V |
| CMRR | Common Mode Rejection Ratio | $V^- \leq V_{CM} \leq V^+ - 1.5V$ | | 72 | 90 | dB |
| A_{VOL} | Large Signal Voltage Gain | $V_O = 4 V_{PP}$, $R_L = 2$ k Ω to $V^+/2$ $V_O = 3.75 V_{PP}$, $R_L = 150\Omega$ to $V^+/2$ | | 86 82 74 70 | 95 78 | dB |
| V_O | Output Swing High | $R_L = 2$ k Ω to $V^+/2$ $R_L = 150\Omega$ to $V^+/2$ | | 4.90 4.75 | 4.94 4.80 | V |
| | Output Swing Low | $R_L = 2$ k Ω to $V^+/2$ $R_L = 150\Omega$ to $V^+/2$ | | | 0.06 0.20 | 0.10 0.25 |