

# LT6550/LT6551

## ABSOLUTE MAXIMUM RATINGS

(Note 1)

Total Supply Voltage

LT6550 ( $V_{CC}$  TO  $V_{EE}$ ) ..... 12.6V

LT6551 ( $V_{CC}$  TO GND) ..... 12.6V

Input Current (Note 9) .....  $\pm 10\text{mA}$

Output Short-Circuit Duration (Note 2) ..... Indefinite

Operating Temperature Range .....  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$

Specified Temperature Range (Note 3)

LT6550C/LT6551C .....  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$

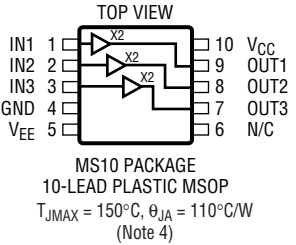
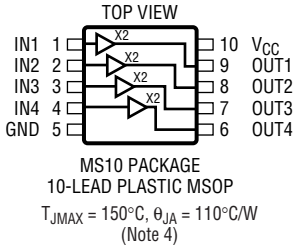
LT6550I/LT6551I .....  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$

Maximum Junction Temperature .....  $150^{\circ}\text{C}$

Storage Temperature Range .....  $-65^{\circ}\text{C}$  to  $150^{\circ}\text{C}$

Lead Temperature (Soldering, 10 sec) .....  $300^{\circ}\text{C}$

## PACKAGE/ORDER INFORMATION

|  <p>MS10 PACKAGE<br/>10-LEAD PLASTIC MSOP<br/><math>T_{JMAX} = 150^{\circ}\text{C}</math>, <math>\theta_{JA} = 110^{\circ}\text{C/W}</math><br/>(Note 4)</p> |                   |  <p>MS10 PACKAGE<br/>10-LEAD PLASTIC MSOP<br/><math>T_{JMAX} = 150^{\circ}\text{C}</math>, <math>\theta_{JA} = 110^{\circ}\text{C/W}</math><br/>(Note 4)</p> |                   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| ORDER PART NUMBER                                                                                                                                                                                                                             | MS10 PART MARKING | ORDER PART NUMBER                                                                                                                                                                                                                               | MS10 PART MARKING |
| LT6550CMS                                                                                                                                                                                                                                     | LTB9              | LT6551CMS                                                                                                                                                                                                                                       | LTC2              |
| LT6550IMS                                                                                                                                                                                                                                     | LTC1              | LT6551IMS                                                                                                                                                                                                                                       | LTC3              |
| <b>Order Options</b> Tape and Reel: Add #TR Lead Free: Add #PBF Lead Free Tape and Reel: Add #TRPBF<br>Lead Free Part Marking: <a href="http://www.linear.com/leadfree/">http://www.linear.com/leadfree/</a>                                  |                   |                                                                                                                                                                                                                                                 |                   |

Consult LTC Marketing for parts specified with wider operating temperature ranges.

## 3.3V ELECTRICAL CHARACTERISTICS

The ● denotes the specifications which apply over the specified temperature range, otherwise specifications are at  $T_A = 25^{\circ}\text{C}$ .  $V_{CC} = 3.3\text{V}$ ,  $V_{GND} = 0\text{V}$ ;  $V_{IN} = 0.75\text{V}$  LT6550 (Pins 1,2,3); LT6551 (Pins 1,2,3,4).  $V_{EE} = 0\text{V}$  LT6550 (Pin 5), unless otherwise noted.

| PARAMETER                                      | CONDITIONS                                                      | MIN | TYP  | MAX  | UNITS                        |
|------------------------------------------------|-----------------------------------------------------------------|-----|------|------|------------------------------|
| DC Output Accuracy                             | No Load, $V_{OUT}$ Ideal = 1.5V                                 | ●   | 30   | 70   | mV                           |
| Output Voltage Matching                        | Between Any Two Outputs                                         | ●   | 25   | 75   | mV                           |
| Input Current                                  | Any Input                                                       | ●   | 15   | 65   | $\mu\text{A}$                |
| Input Impedance, $\Delta V_{IN}/\Delta I_{IN}$ | $V_{IN} = 0\text{V}$ to $1\text{V}$                             | ●   | 100  | 300  | $\text{k}\Omega$             |
| Input Noise Voltage Density                    | $f = 100\text{kHz}$ (Note 10)                                   |     | 12   |      | $\text{nV}/\sqrt{\text{Hz}}$ |
| Input Noise Current Density                    | $f = 100\text{kHz}$ (Note 10)                                   |     | 8    |      | $\text{pA}/\sqrt{\text{Hz}}$ |
| Voltage Gain (Note 5)                          | $0.25\text{V} \leq V_{IN} \leq 1.25\text{V}$                    |     |      |      |                              |
|                                                | No Load                                                         | ●   | 1.9  | 2.1  | V/V                          |
|                                                | $R_L = 150\Omega$                                               | ●   | 1.9  | 2.1  | V/V                          |
|                                                | $R_L = 75\Omega$ , $0.25\text{V} \leq V_{IN} \leq 0.75\text{V}$ |     | 1.85 | 2.15 | V/V                          |
| Output Voltage Swing Low                       | $V_{IN} = -0.1\text{V}$                                         |     |      |      |                              |
|                                                | No Load                                                         | ●   | 10   | 30   | mV                           |
|                                                | $I_{SINK} = 5\text{mA}$                                         | ●   | 60   | 150  | mV                           |
|                                                | $I_{SINK} = 10\text{mA}$                                        | ●   | 90   | 200  | mV                           |

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| PARAMETER                             | CONDITIONS                                                                            |             | MIN               | TYP               | MAX      | UNITS                                |
|---------------------------------------|---------------------------------------------------------------------------------------|-------------|-------------------|-------------------|----------|--------------------------------------|
| Output Voltage Swing High             | $V_{IN} = 1.75\text{V}$<br>No Load<br>$R_L = 150\Omega$<br>$R_L = 75\Omega$           | ●<br>●<br>● | 3.0<br>2.5<br>2.0 | 3.2<br>2.9<br>2.5 |          | V<br>V<br>V                          |
| PSRR                                  | $V_{CC} = 3\text{V to } 10\text{V}$ , $V_{IN} = 0.5\text{V}$                          | ●           | 40                | 48                |          | dB                                   |
| Minimum Supply Voltage (Note 6)       |                                                                                       | ●           | 3                 |                   |          | V                                    |
| Output Short-Circuit Current          | $V_{IN} = 1\text{V}$ , $V_{OUT} = 0\text{V}$                                          | ●           | 35<br>25          | 50                |          | mA<br>mA                             |
| Supply Current per Amplifier (Note 7) |                                                                                       | ●           |                   | 8.5               | 10<br>11 | mA<br>mA                             |
| Slew Rate (Note 8)                    | $R_L = 150\Omega$ , $V_{OUT} = 0.5\text{V to } 2.5\text{V}$<br>Measured from 1V to 2V | ●           | 140<br>115        | 250               |          | V/ $\mu\text{s}$<br>V/ $\mu\text{s}$ |
| Small Signal –3dB Bandwidth           | $R_L = 150\Omega$                                                                     |             |                   | 90                |          | MHz                                  |
| Gain Flatness                         | Less than 0.25dB                                                                      |             |                   | 30                |          | MHz                                  |
| Gain Matching                         | Any One Channel to Any Other Channel                                                  |             |                   | 0.15              |          | dB                                   |
| Settling Time to 3%                   | $R_L = 150\Omega$ , $V_{OUT} = 1\text{V to } 2.5\text{V}$                             |             |                   | 20                |          | ns                                   |
| Settling Time to 1%                   | $R_L = 150\Omega$ , $V_{OUT} = 1\text{V to } 2.5\text{V}$                             |             |                   | 30                |          | ns                                   |
| % Overshoot                           | $V_{OUT} = 1\text{V to } 2.5\text{V}$ , $R_L = 150\Omega$                             |             |                   | 5                 |          | %                                    |
| Differential Gain                     | $R_L = 150\Omega$ , Black Level = 0.6V at Device Output                               |             |                   | 0.09              |          | %                                    |
| Differential Phase                    | $R_L = 150\Omega$ , Black Level = 0.6V at Device Output                               |             |                   | 0.09              |          | Deg                                  |
| Channel Separation                    | Measured at 10MHz                                                                     |             |                   | 60                |          | dB                                   |

### 5V ELECTRICAL CHARACTERISTICS

The ● denotes the specifications which apply over the specified temperature range, otherwise specifications are at  $T_A = 25^\circ\text{C}$ .  $V_{CC} = 5\text{V}$ ,  $V_{GND} = 0\text{V}$ ;  $V_{IN} = 1.25\text{V}$  LT6550 (Pins 1,2,3); LT6551 (Pins 1,2,3,4).  $V_{EE} = 0\text{V}$  LT6550 (Pin 5), unless otherwise noted.

| PARAMETER                                      | CONDITIONS                                                                                                                                                                                                |             | MIN                | TYP               | MAX                | UNITS                  |
|------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|--------------------|-------------------|--------------------|------------------------|
| Output Accuracy                                | No Load, $V_{OUT}$ Ideal = 2.5V                                                                                                                                                                           | ●           |                    | 30                | 70                 | mV                     |
| Output Voltage Matching                        | Between Any Two Outputs                                                                                                                                                                                   | ●           |                    | 40                | 90                 | mV                     |
| Input Current                                  |                                                                                                                                                                                                           | ●           |                    | 15                | 65                 | $\mu\text{A}$          |
| Input Impedance, $\Delta V_{IN}/\Delta I_{IN}$ | $V_{IN} = 0\text{V to } 2\text{V}$                                                                                                                                                                        | ●           | 100                | 300               |                    | k $\Omega$             |
| Input Noise Voltage Density                    | $f = 100\text{kHz}$ (Note 10)                                                                                                                                                                             |             |                    | 12                |                    | nV/ $\sqrt{\text{Hz}}$ |
| Input Noise Current Density                    | $f = 100\text{kHz}$ (Note 10)                                                                                                                                                                             |             |                    | 8                 |                    | pA/ $\sqrt{\text{Hz}}$ |
| Voltage Gain (Note 5)                          | $0.25\text{V} \leq V_{IN} \leq 1.75\text{V}$<br>No Load<br>$R_L = 150\Omega$<br>$R_L = 75\Omega$ , $0.25\text{V} \leq V_{IN} \leq 1.25\text{V}$ , $0^\circ\text{C} \leq T_A \leq 70^\circ\text{C}$ (Only) | ●<br>●<br>● | 1.9<br>1.9<br>1.85 |                   | 2.1<br>2.1<br>2.15 | V/V<br>V/V<br>V/V      |
| Output Voltage Swing Low                       | $V_{IN} = -0.1\text{V}$<br>No Load<br>$I_{SINK} = 5\text{mA}$<br>$I_{SINK} = 10\text{mA}$                                                                                                                 | ●<br>●<br>● |                    | 10<br>60<br>90    | 30<br>150<br>200   | mV<br>mV<br>mV         |
| Output Voltage Swing High                      | $V_{IN} = 2.6\text{V}$<br>No Load<br>$R_L = 150\Omega$<br>$R_L = 75\Omega$ , $0^\circ\text{C} \leq T_A \leq 70^\circ\text{C}$ (Only)                                                                      | ●<br>●<br>● | 4.6<br>3.5<br>2.5  | 4.8<br>4.1<br>3.2 |                    | V<br>V<br>V            |

## 5V ELECTRICAL CHARACTERISTICS

The ● denotes the specifications which apply over the specified temperature range, otherwise specifications are at  $T_A = 25^\circ\text{C}$ .  $V_{CC} = 5\text{V}$ ,  $V_{GND} = 0\text{V}$ ;  $V_{IN} = 1.25\text{V}$  LT6550 (Pins 1,2,3); LT6551 (Pins 1,2,3,4).  $V_{EE} = 0\text{V}$  LT6550 (Pin 5), unless otherwise noted.

| PARAMETER                             | CONDITIONS                                                                                                                                             |             | MIN            | TYP  | MAX          | UNITS                                |
|---------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|----------------|------|--------------|--------------------------------------|
| PSRR                                  | $V_{CC} = 3\text{V to } 10\text{V}$ , $V_{IN} = 0.5\text{V}$                                                                                           | ●           | 40             | 48   |              | dB                                   |
| Minimum Supply Voltage (Note 6)       |                                                                                                                                                        | ●           | 3              |      |              | V                                    |
| Output Short-Circuit Current          | $V_{IN} = 1\text{V}$ , $V_{OUT} = 0\text{V}$<br>$0^\circ\text{C} \leq T_A \leq 70^\circ\text{C}$<br>$-40^\circ\text{C} \leq T_A \leq 85^\circ\text{C}$ | ●<br>●<br>● | 45<br>40<br>30 | 60   |              | mA<br>mA<br>mA                       |
| Supply Current per Amplifier (Note 7) |                                                                                                                                                        | ●           |                | 9.5  | 11.5<br>12.5 | mA<br>mA                             |
| Slew Rate                             | $R_L = 150\Omega$ , $V_{OUT} = 0.5\text{V to } 3.5\text{V}$ ,<br>Measured from 1V to 3V                                                                | ●           | 220<br>180     | 340  |              | V/ $\mu\text{s}$<br>V/ $\mu\text{s}$ |
| Small Signal -3dB Bandwidth           | $R_L = 150\Omega$                                                                                                                                      |             |                | 110  |              | MHz                                  |
| Gain Flatness                         | Less than 0.25dB                                                                                                                                       |             |                | 30   |              | MHz                                  |
| Gain Matching                         | Any One Channel to Any Other Channel                                                                                                                   |             |                | 0.15 |              | dB                                   |
| Settling Time to 3%                   | $R_L = 150\Omega$ , $V_{OUT} = 1\text{V to } 2.5\text{V}$                                                                                              |             |                | 20   |              | ns                                   |
| Settling Time to 1%                   | $R_L = 150\Omega$ , $V_{OUT} = 1\text{V to } 2.5\text{V}$                                                                                              |             |                | 35   |              | ns                                   |
| % Overshoot                           | $V_{OUT} = 1\text{V to } 2.5\text{V}$ , $R_L = 150\Omega$                                                                                              |             |                | 5    |              | %                                    |
| Differential Gain                     | $R_L = 150\Omega$ , Black Level = 1V at Device Output                                                                                                  |             |                | 0.05 |              | %                                    |
| Differential Phase                    | $R_L = 150\Omega$ , Black Level = 1V at Device Output                                                                                                  |             |                | 0.05 |              | Deg                                  |
| Channel Separation                    | Measured at 10MHz                                                                                                                                      |             |                | 60   |              | dB                                   |

## ±5V ELECTRICAL CHARACTERISTICS

(LT6550 Only) The ● denotes the specifications which apply over the specified temperature range, otherwise specifications are at  $T_A = 25^\circ\text{C}$ .  $V_S = \pm 5\text{V}$ ,  $V_{IN} = 0\text{V}$  (Pins 1,2,3)  $V_{GND} = 0\text{V}$  (Pin 4) unless otherwise noted.

| PARAMETER                                      | CONDITIONS                                                                                                                                  |                  | MIN                                 | TYP                                 | MAX               | UNITS                  |
|------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|------------------|-------------------------------------|-------------------------------------|-------------------|------------------------|
| Output Offset                                  |                                                                                                                                             | ●                |                                     | 30                                  | 70                | mV                     |
| Output Voltage Matching                        | Between Any Two Outputs                                                                                                                     | ●                |                                     | 20                                  | 60                | mV                     |
| Input Current                                  |                                                                                                                                             | ●                |                                     | 20                                  | 70                | $\mu\text{A}$          |
| Input Impedance, $\Delta V_{IN}/\Delta I_{IN}$ | $V_{IN} = -1\text{V to } 1\text{V}$                                                                                                         | ●                | 200                                 | 500                                 |                   | k $\Omega$             |
| Input Noise Voltage Density                    | $f = 100\text{kHz}$ (Note 10)                                                                                                               |                  |                                     | 12                                  |                   | nV/ $\sqrt{\text{Hz}}$ |
| Input Noise Current Density                    | $f = 100\text{kHz}$ (Note 10)                                                                                                               |                  |                                     | 8                                   |                   | pA/ $\sqrt{\text{Hz}}$ |
| Voltage Gain                                   | $-1.75\text{V} \leq V_{IN} \leq 1.75\text{V}$<br>No Load<br>$R_L = 150\Omega$<br>$R_L = 75\Omega$ , $-1\text{V} \leq V_{IN} \leq 1\text{V}$ | ●<br>●<br>●<br>● | 1.9<br>1.9<br>1.9                   |                                     | 2.1<br>2.1<br>2.1 | V/V<br>V/V<br>V/V      |
| Output Voltage Swing                           | $V_{IN} = \pm 2.6\text{V}$<br>No Load<br>$R_L = 150\Omega$<br>$R_L = 75\Omega$ , $0^\circ\text{C} \leq T_A \leq 70^\circ\text{C}$ (Only)    | ●<br>●<br>●<br>● | $\pm 4.6$<br>$\pm 3.5$<br>$\pm 2.6$ | $\pm 4.8$<br>$\pm 4.2$<br>$\pm 3.2$ |                   | V<br>V<br>V            |
| PSRR                                           | $V_S = \pm 2.5\text{V to } \pm 5\text{V}$ ,                                                                                                 | ●                | 38                                  | 48                                  |                   | dB                     |
| Output Short-Circuit Current                   | $V_O = 0\text{V}$<br>$0^\circ\text{C} \leq T_A \leq 70^\circ\text{C}$<br>$-40^\circ\text{C} \leq T_A \leq 85^\circ\text{C}$                 | ●<br>●<br>●      | 45<br>40<br>30                      | 60                                  |                   | mA<br>mA<br>mA         |

# **±5V ELECTRICAL CHARACTERISTICS** (LT6550 Only) The ● denotes the specifications which apply over the specified temperature range, otherwise specifications are at $T_A = 25^\circ\text{C}$ . $V_S = \pm 5\text{V}$ , $V_{IN} = 0\text{V}$ (Pins 1,2,3) $V_{GND} = 0\text{V}$ (Pin 4) unless otherwise noted.

| PARAMETER                    | CONDITIONS                                                                                               | MIN | TYP        | MAX        | UNITS                                |
|------------------------------|----------------------------------------------------------------------------------------------------------|-----|------------|------------|--------------------------------------|
| Supply Current per Amplifier |                                                                                                          | ●   | 8.5        | 10.5<br>12 | mA<br>mA                             |
| Slew Rate                    | $R_L = 150\Omega$ , $V_{OUT} = -3\text{V}$ to $3\text{V}$ ,<br>Measured from $-2\text{V}$ to $2\text{V}$ | ●   | 400<br>300 | 600        | V/ $\mu\text{s}$<br>V/ $\mu\text{s}$ |
| Small Signal -3dB Bandwidth  | $R_L = 150\Omega$                                                                                        |     | 90         |            | MHz                                  |
| Gain Flatness                | Less than 0.25dB                                                                                         |     | 30         |            | MHz                                  |
| Gain Matching                | Any One Channel to Any Other Channel                                                                     |     | 0.15       |            | dB                                   |
| Settling Time to 3%          | $R_L = 150\Omega$ , $V_{OUT} = 1\text{V}$ to $2.5\text{V}$                                               |     | 20         |            | ns                                   |
| Settling Time to 1%          | $R_L = 150\Omega$ , $V_{OUT} = 1\text{V}$ to $2.5\text{V}$                                               |     | 30         |            | ns                                   |
| % Overshoot                  | $V_{OUT} = 1\text{V}$ to $2.5\text{V}$ , $R_L = 150\Omega$                                               |     | 5          |            | %                                    |
| Differential Gain            | $R_L = 150\Omega$ , Black Level = 0V at Device Output                                                    |     | 0.15       |            | %                                    |
| Differential Phase           | $R_L = 150\Omega$ , Black Level = 0V at Device Output                                                    |     | 0.09       |            | Deg                                  |
| Channel Separation           | Measured at 10MHz                                                                                        |     | 60         |            | dB                                   |

**Note 1:** Absolute Maximum Ratings are those values beyond which the life of a device may be impaired.

**Note 2:** A heat sink may be required to keep the junction temperature below absolute maximum. This depends on the power supply voltage and how many amplifiers are shorted.

**Note 3:** The LT6550C/LT6551C are guaranteed to meet specified performance from  $0^\circ\text{C}$  to  $70^\circ\text{C}$  and are designed, characterized and expected to meet specified performance from  $-40^\circ\text{C}$  to  $85^\circ\text{C}$  but are not tested or QA sampled at these temperatures. The LT6550I/LT6551I are guaranteed to meet specified performance from  $-40^\circ\text{C}$  to  $85^\circ\text{C}$ .

**Note 4:** Thermal resistance varies depending upon the amount of PC board metal attached to Pin 5 of the device.  $\theta_{JA}$  is specified for a 2500mm<sup>2</sup> test board covered with 2oz copper on both sides.

**Note 5:** Gain is measured by changing the input voltage, and dividing the change in output voltage by the change in input voltage.

**Note 6:** Minimum supply voltage is guaranteed by the PSRR test.

**Note 7:** The supply current specification includes additional output current through the internal feedback and gain resistor.

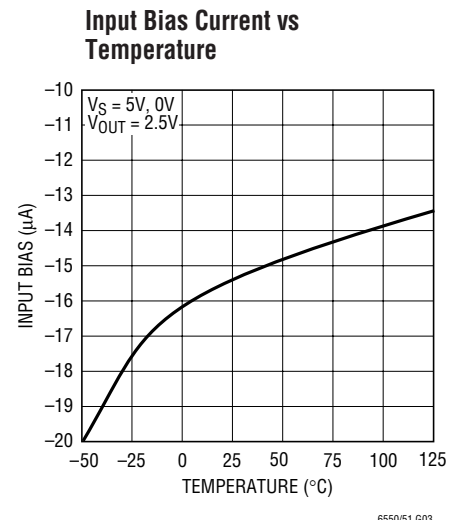
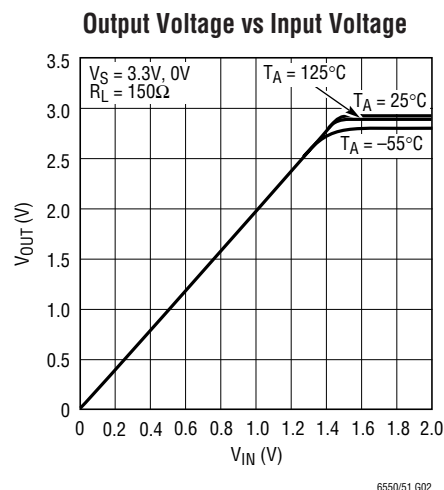
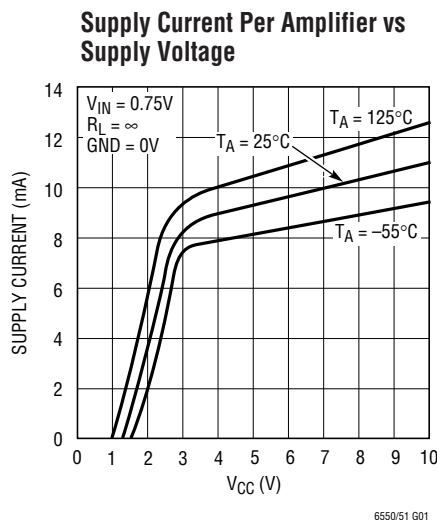
**Note 8:** Guaranteed by correlation to slew rate at 5V and  $\pm 5\text{V}$ .

**Note 9:** The inputs are protected from ESD with diodes to the supplies.

**Note 10:** Noise is input referred, including internal gain resistors.

## **5V/3.3V TYPICAL PERFORMANCE CHARACTERISTICS**

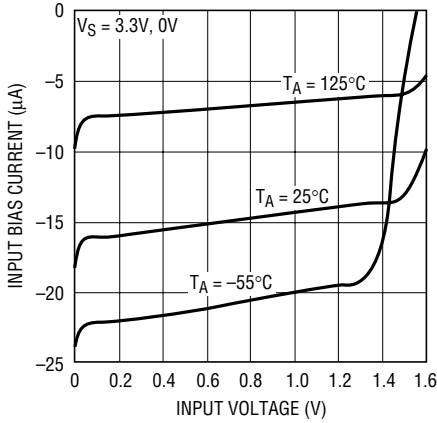
$V_{EE}$  (Pin 5) = 0V (LT6550), GND (Pin 5) = 0V (LT6551)



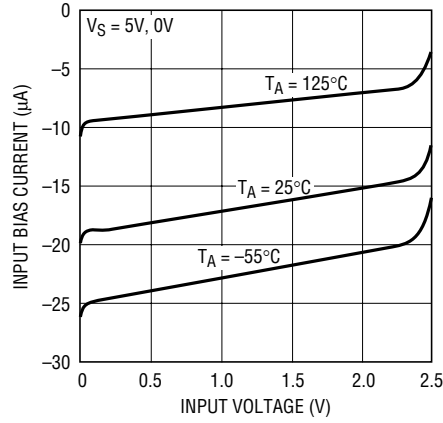
## 5V/3.3V TYPICAL PERFORMANCE CHARACTERISTICS

$V_{EE}$  (Pin 5) = 0V (LT6550), GND (Pin 5) = 0V (LT6551)

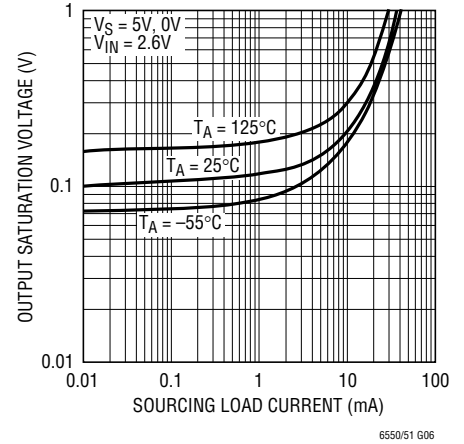
**Input Bias Current vs Input Voltage**



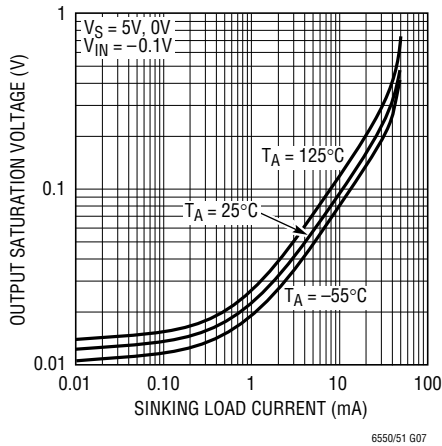
**Input Bias Current vs Input Voltage**



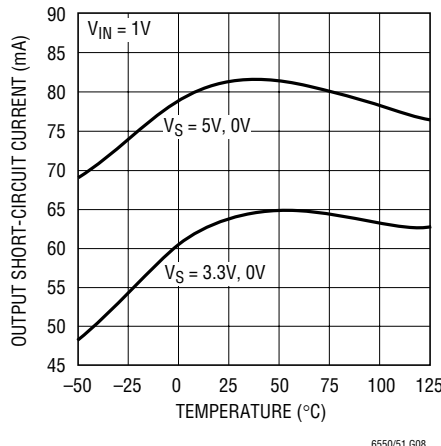
**Output Saturation Voltage vs Load Current (Output High)**



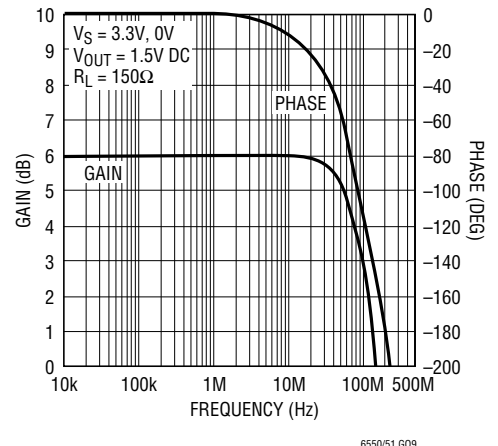
**Output Saturation Voltage vs Load Current (Output Low)**



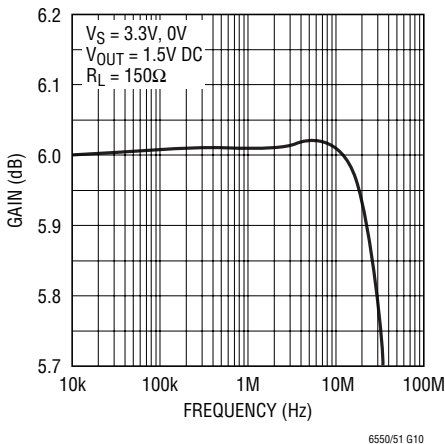
**Output Short-Circuit Current vs Temperature**



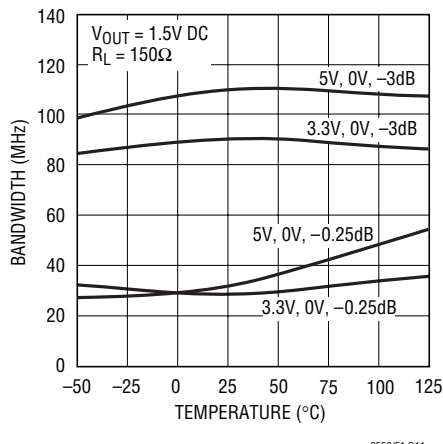
**Gain and Phase vs Frequency**



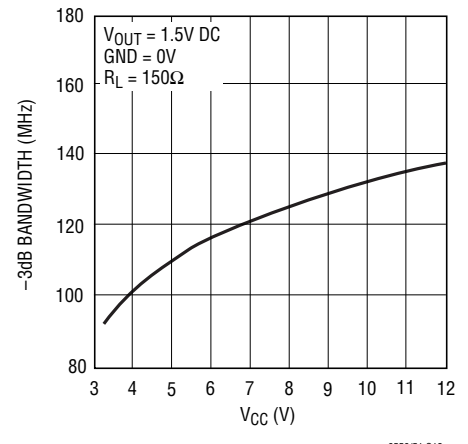
**Gain Flatness vs Frequency**



**-3dB, -0.25dB Bandwidth vs Temperature**



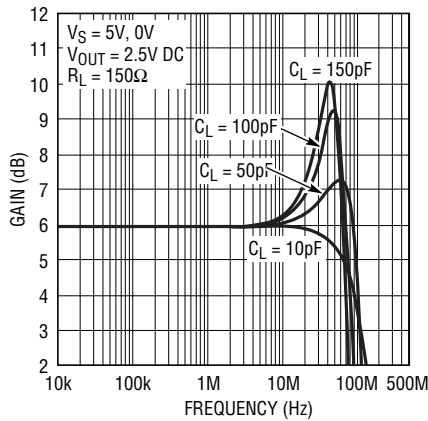
**-3dB Bandwidth vs  $V_{CC}$**



# 5V/3.3V TYPICAL PERFORMANCE CHARACTERISTICS

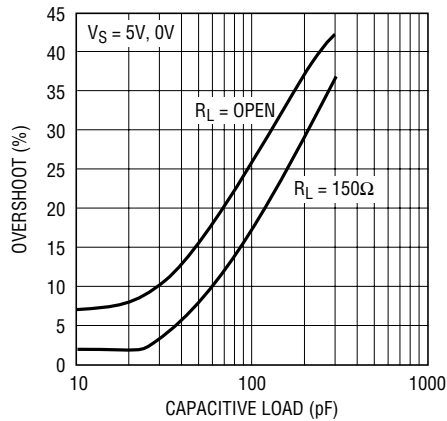
$V_{EE}$  (Pin 5) = 0V (LT6550), GND (Pin 5) = 0V (LT6551)

**Frequency Response with Capacitive Loads**



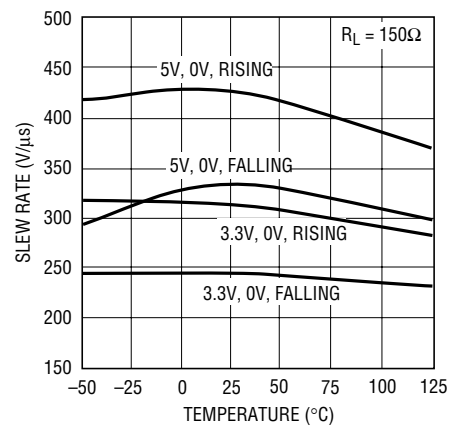
6550/51 G13

**Capacitive Load Handling, Overshoot vs Capacitive Load**



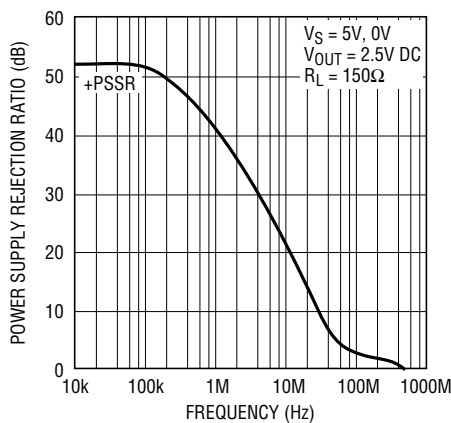
6550/51 G14

**Slew Rate vs Temperature**



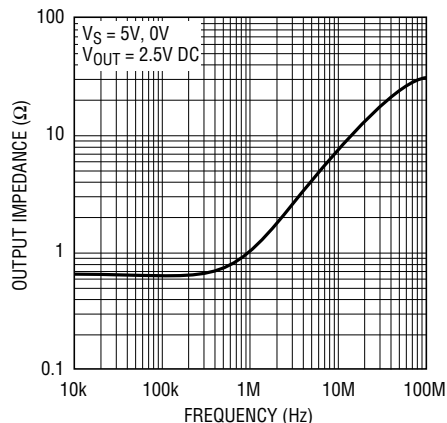
6550/51 G15

**Power Supply Rejection Ratio vs Frequency**



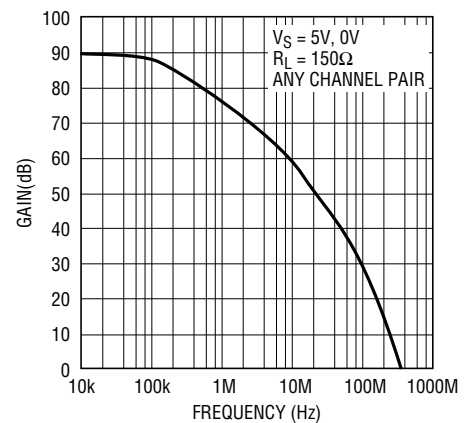
6550/51 G16

**Output Impedance vs Frequency**



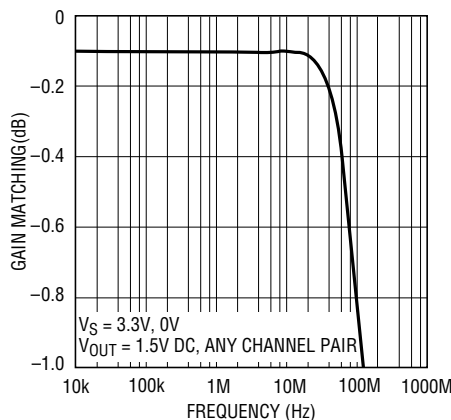
6550/51 G17

**Channel Separation vs Frequency**



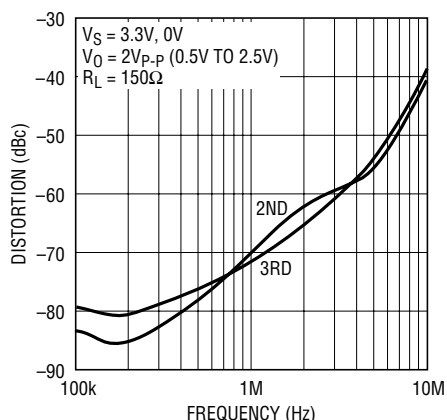
6550/51 G18

**Gain Matching vs Frequency**



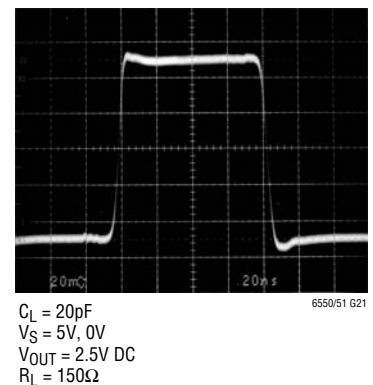
6550/51 G19

**2nd and 3rd Harmonic Distortion vs Frequency**



6550/51 G20

**Small Signal Response**

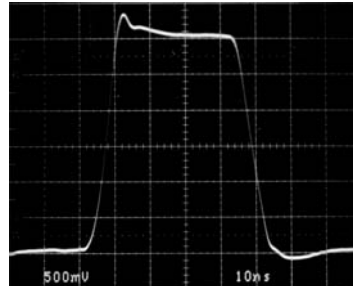


6550/51 G21

## 5V/3.3V TYPICAL PERFORMANCE CHARACTERISTICS

$V_{EE}$  (Pin 5) = 0V (LT6550), GND (Pin 5) = 0V (LT6551)

Large Signal Response



$C_L = 20\text{pF}$   
 $V_S = 5\text{V}, 0\text{V}$   
 $V_{OUT} = 0.5\text{V TO } 3.5\text{V}$   
 $R_L = 150\Omega$

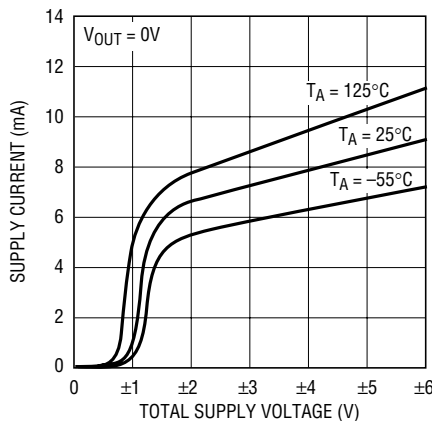
6550/51 G22

## $\pm 5\text{V}$ TYPICAL PERFORMANCE CHARACTERISTICS

(LT6550 Only)

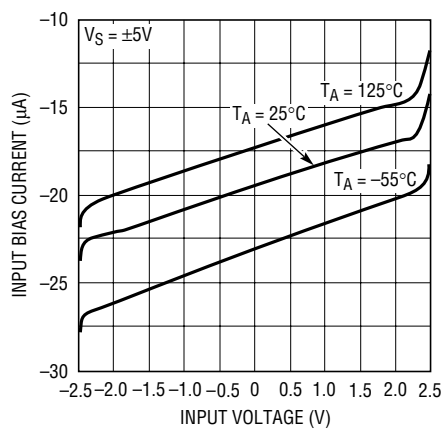
$V_{GND}$  (Pin 4) = 0V

Supply Current vs Total Supply Voltage



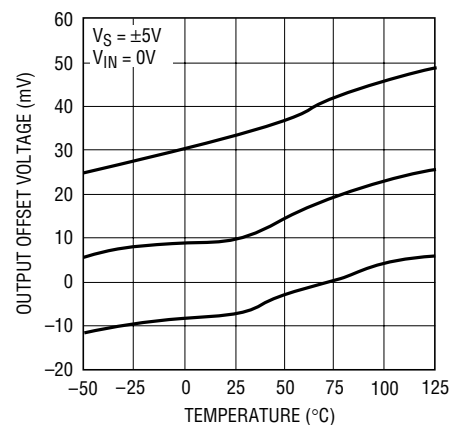
6550/51 G23

Input Bias Current vs Input Voltage



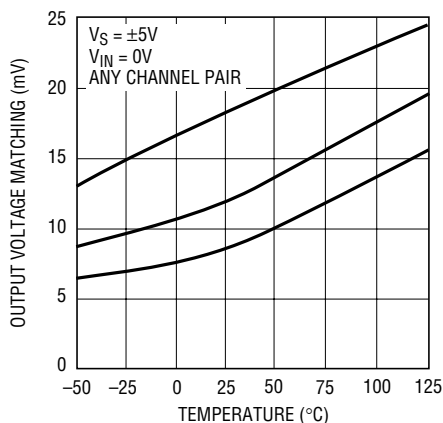
6550/51 G24

Output Offset Voltage vs Temperature of Three Typical Units



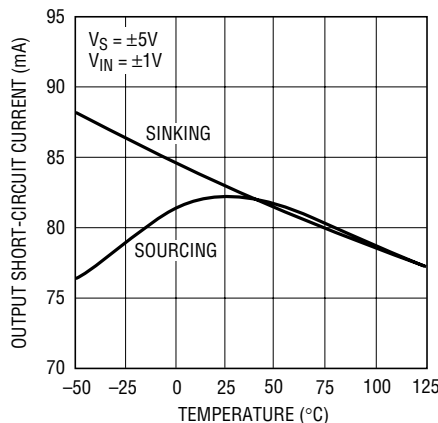
6550/51 G25

Output Voltage Matching vs Temperature of Three Typical Parts



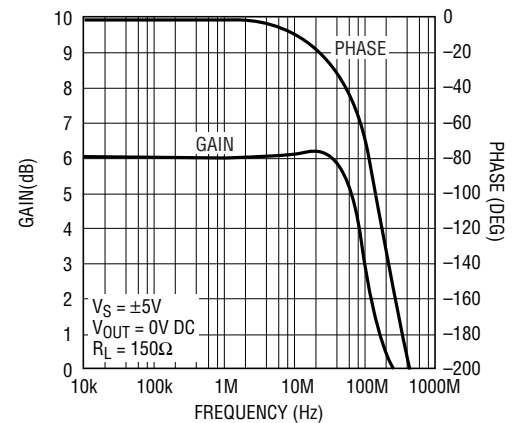
6550/51 G26

Output Short-Circuit Current vs Temperature



6550/51 G27

Gain and Phase vs Frequency



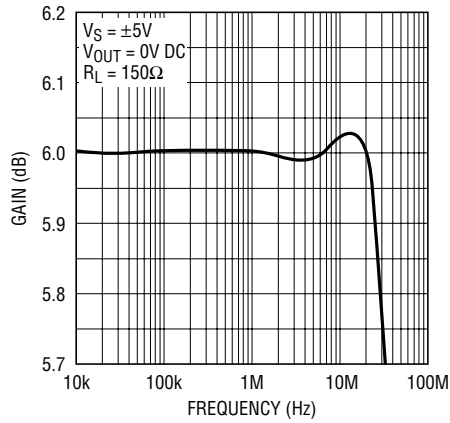
6550/51 G28

65501fa

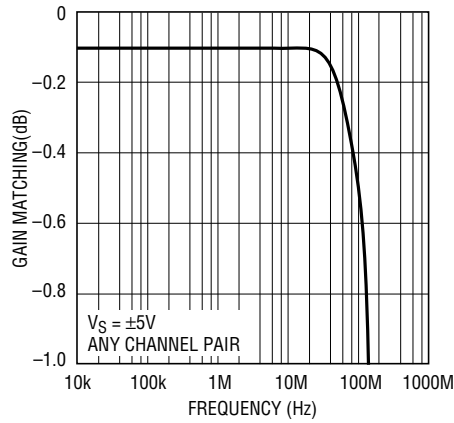
# ±5V TYPICAL PERFORMANCE CHARACTERISTICS (LT6550 Only)

$V_{\text{GND}}$  (Pin 4) = 0V

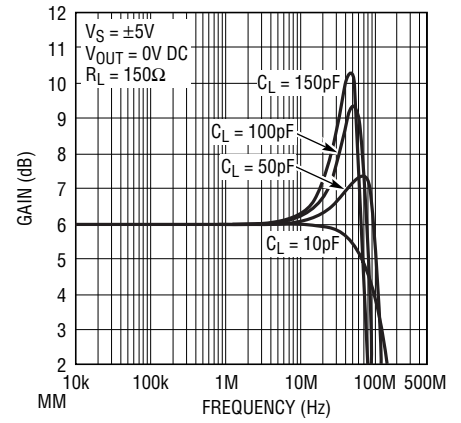
Gain Flatness vs Frequency



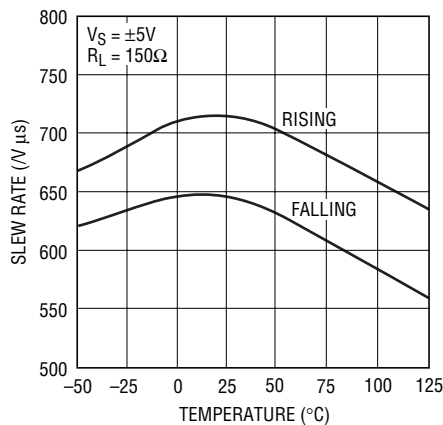
Gain Matching vs Frequency



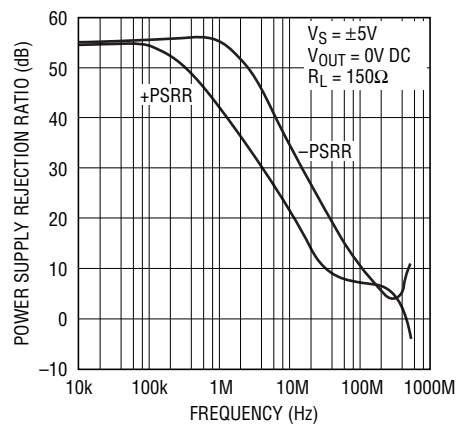
Frequency Response with Capacitive Loads



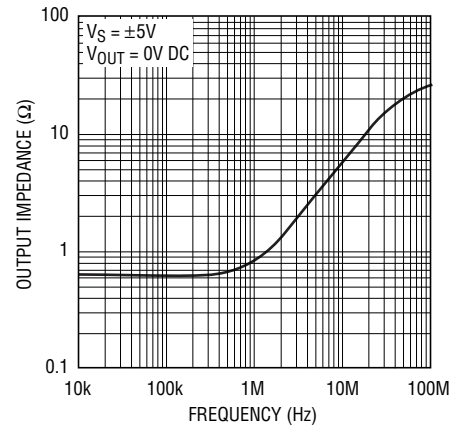
Slew Rate



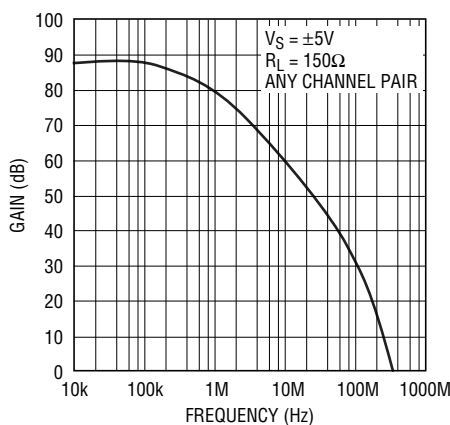
Power Supply Rejection Ratio vs Frequency



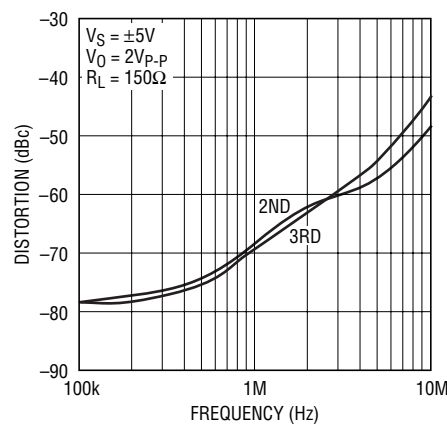
Output Impedance vs Frequency



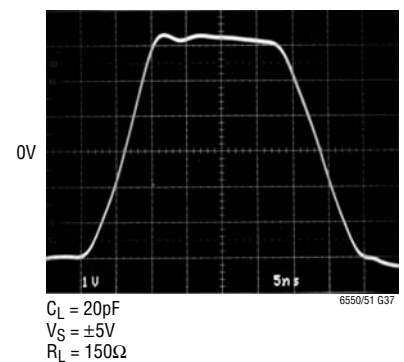
Channel Separation vs Frequency



2nd and 3rd Harmonic Distortion vs Frequency



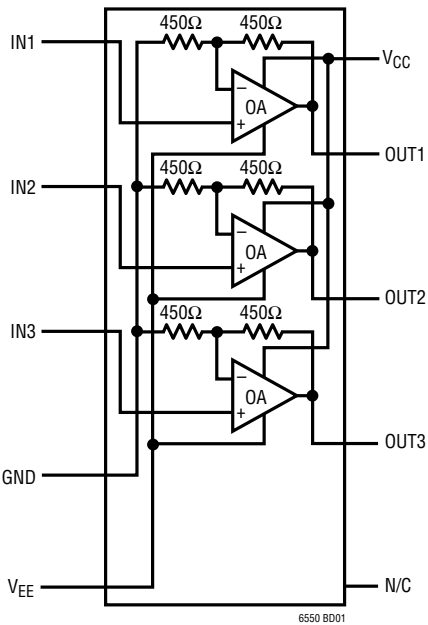
Large Signal Response



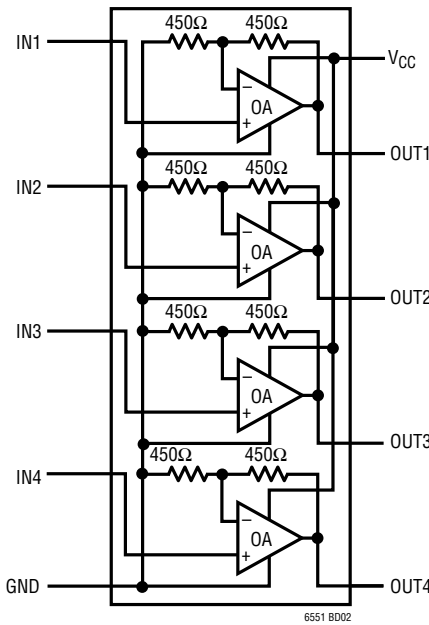


BLOCK DIAGRAMS

LT6550 Block Diagram



LT6551 Block Diagram



## APPLICATIONS INFORMATION

### Amplifier Characteristics

Figure 1 shows a simplified schematic of one channel of the LT6551 quad. Resistors  $R_F$  and  $R_G$  provide an internal gain of 2. (The LT6550 triple is a slight variation with the gain setting resistor,  $R_G$ , connected to a separate ground pin). The input stage consists of transistors Q1 to Q8 and resistor R1. This topology allows for high slew rates at low supply voltages. There are back-to-back series diodes, D1 to D4, across the + and – inputs of each amplifier to limit the differential input voltage to  $\pm 1.4V$ .  $R_{IN}$  limits the current through these diodes if the input differential voltage exceeds  $\pm 1.4V$ . The input stage drives the degeneration resistors of PNP and NPN current mirrors, Q9 to Q12, that convert the differential signals into a single-ended output. The complementary drive generator supplies current to the output transistors that swing from rail-to-rail.

### Input Voltage Range

The input voltage range is  $V_{EE}$  to  $(V_{CC} - 1.75V)$  over temperature. If the device is operated on a single 3V supply

the maximum input is  $(3V - 1.75V)$  or 1.25V, and the internal gain of two will set the output voltage to 2.5V. Increasing the input beyond 1.25V will force the device out of its linear range, no longer a gain of 2, and the output will not increase beyond 2.5V. At a higher supply voltage, i.e. 5V, the maximum input voltage is  $5V - 1.75V$  or 3.25V. However, due to the internal gain of 2, the output will clip with a lower input voltage. For linear unclipped operation the minimum input voltage is  $(V_{OUT\ Min})/2$  and the maximum input voltage is  $(V_{OUT\ Max})/2$  or  $(V_{CC} - 1.75V)$ , whichever is less.

### ESD

The LT6550/LT6551 have reverse-biased ESD protection diodes on all inputs and outputs as shown in Figure 1. If these pins are forced beyond either supply, unlimited current will flow through these diodes. If the current is limited to 10mA or less, no damage to the device will occur.

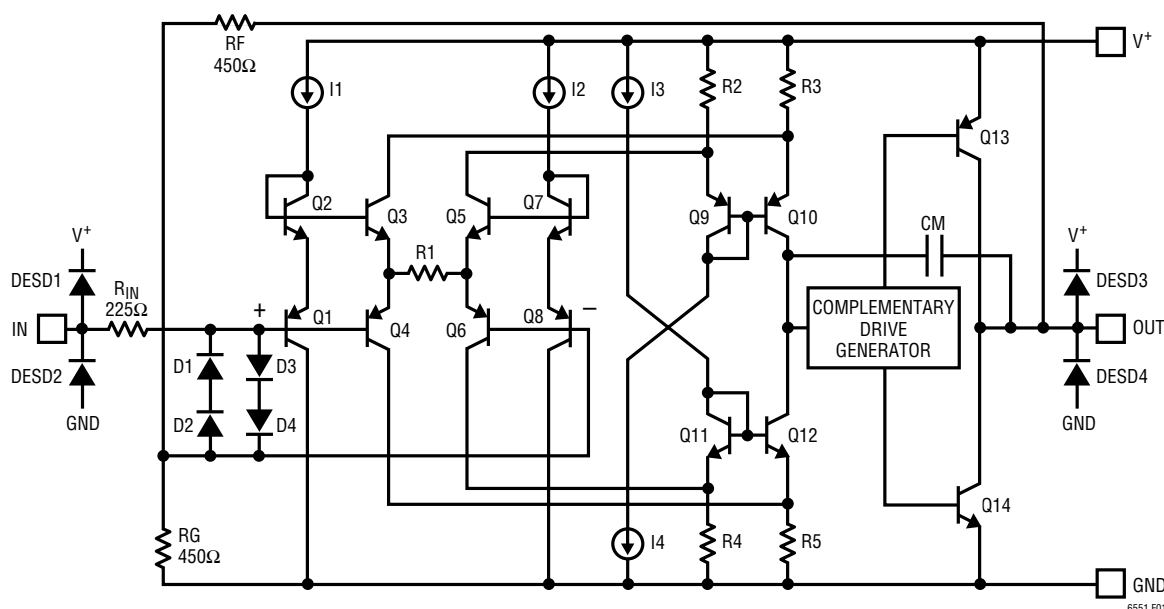


Figure 1. LT6551 Simplified Schematic

APPLICATIONS INFORMATION

Power Dissipation

The LT6550/LT6551, enhanced  $\theta_{JA}$  MS package, has Pin 5 ( $V_{EE}$  for the LT6550 and GND for the LT6551) fused to the lead frame. This thermal connection increases the efficiency of the PC board as a heat sink. The PCB material can be very effective at transmitting heat between the pad area attached to Pin 5 and a ground or power plane layer. Copper board stiffeners and plated through holes can also be used to spread the heat generated by the device. Table 1 lists the thermal resistance for several different board sizes and copper areas. All measurements were taken on 3/32" FR-4 board with 2oz copper. This data can be used as a rough guideline in estimating thermal resistance. The thermal resistance for each application will be affected by thermal interactions with other components as well as board size and shape.

Table 1. Fused 10-Lead MSOP Package

| COPPER AREA                    |                                | BOARD AREA<br>(mm <sup>2</sup> ) | THERMAL RESISTANCE<br>(JUNCTION-TO-AMBIENT) |
|--------------------------------|--------------------------------|----------------------------------|---------------------------------------------|
| TOPSIDE*<br>(mm <sup>2</sup> ) | BACKSIDE<br>(mm <sup>2</sup> ) |                                  |                                             |
| 540                            | 540                            | 2500                             | 110°C/W                                     |
| 100                            | 100                            | 2500                             | 120°C/W                                     |
| 100                            | 0                              | 2500                             | 130°C/W                                     |
| 30                             | 0                              | 2500                             | 135°C/W                                     |
| 0                              | 0                              | 2500                             | 140°C/W                                     |

\*Device is mounted on topside.

As an example, calculate the junction temperature for the circuit in Figure 2 assuming an 85°C ambient temperature.

The device dissipation can be found by measuring the supply current, calculating the total dissipation and then subtracting the dissipation in the load.

The dissipation for the amplifiers is:

$$P_D = (106\text{mA})(5\text{V}) - 4 \cdot (2.5\text{V})^2/150 = 363\text{mW}$$

The total package power dissipation is 363mW. When a 2500 sq mm PC board with 540 sq mm of 2oz copper on top and bottom is used, the thermal resistance is 110°C/W. The junction temperature ( $T_J$ ) is:

$$T_J = (363\text{mW})(110^\circ\text{C/W}) + 85^\circ\text{C} = 125^\circ\text{C}$$

The maximum junction temperature for the LT6551 is 150°C so the heat sinking capability of the board is adequate for the application.

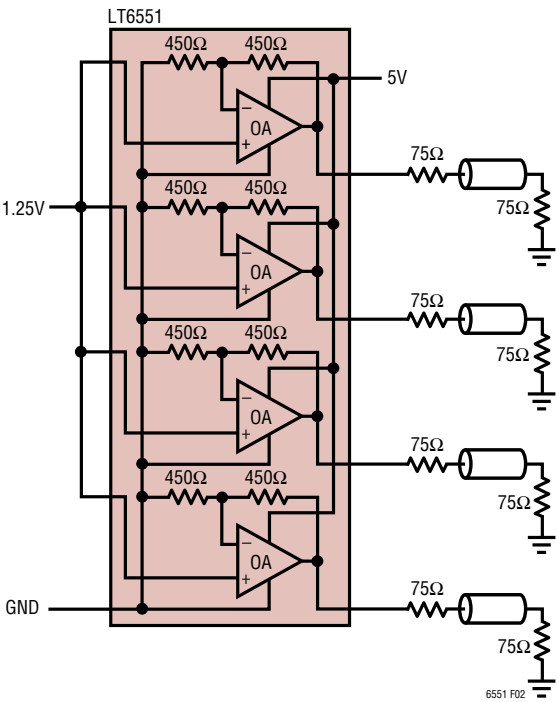
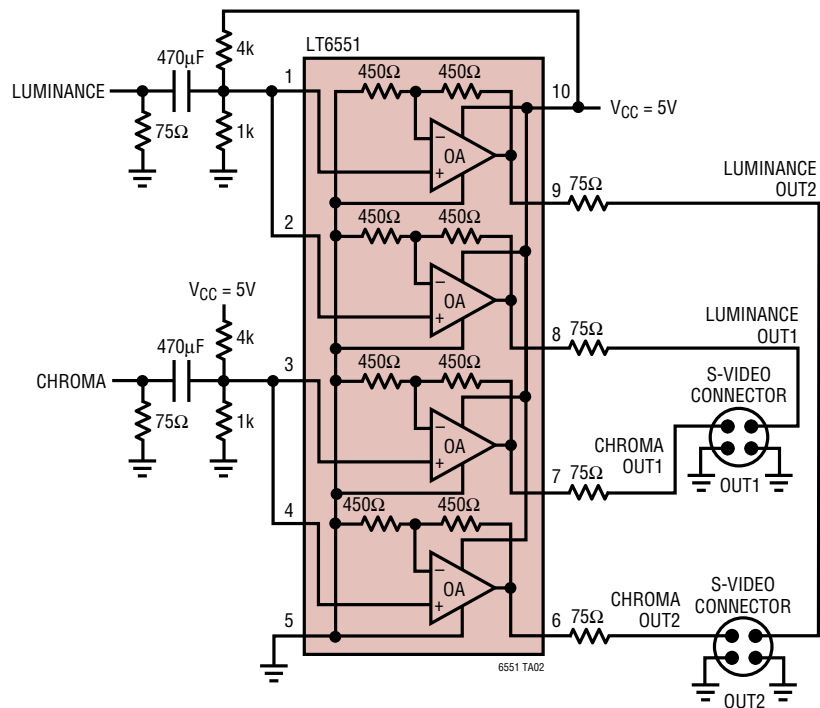


Figure 2. Calculating Junction Temperature

## TYPICAL APPLICATION

S Video Splitter

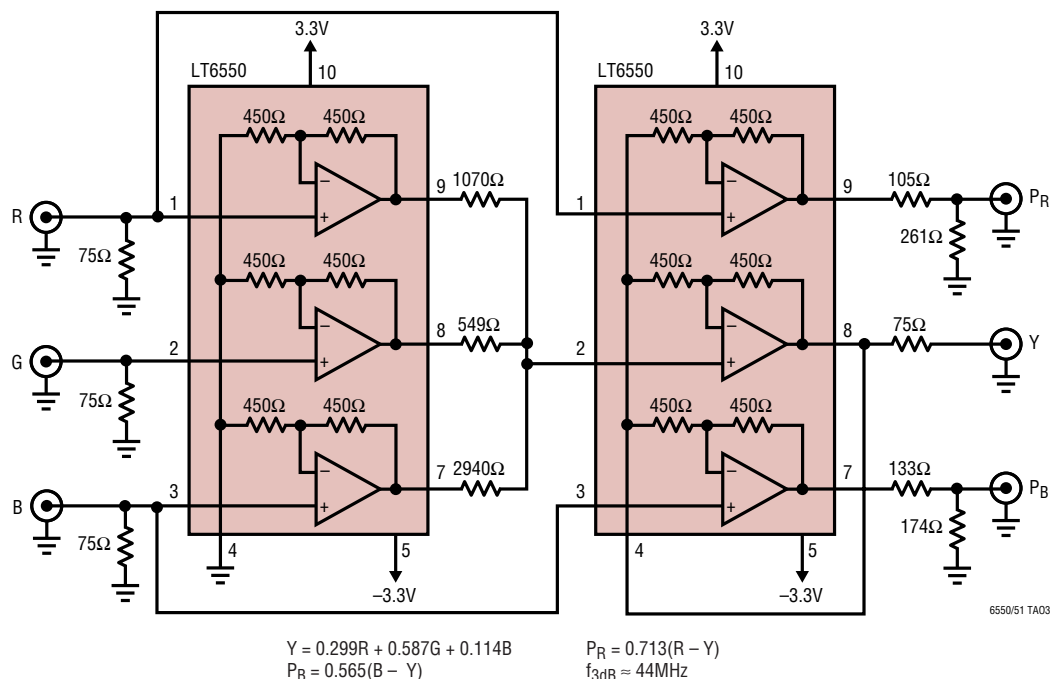


## TYPICAL APPLICATION

Consumer products require generation of  $Y_P B_P R_P$  luminance/chrominance component signals, often from RGB source content. The  $Y_P B_P R_P$  format has a luminance signal and two weighted color difference signals at baseband. Even with their fixed internal gain resistors, two LT6550s connected as shown easily implement the required conversion matrix equations. The Y channel is a weighted average of the 2X amplified RGB signals and with the feedback connection of the Y channel output in the second LT6550 back to the gain-resistor common pin, an implicit Y subtraction is performed for the chroma channels and

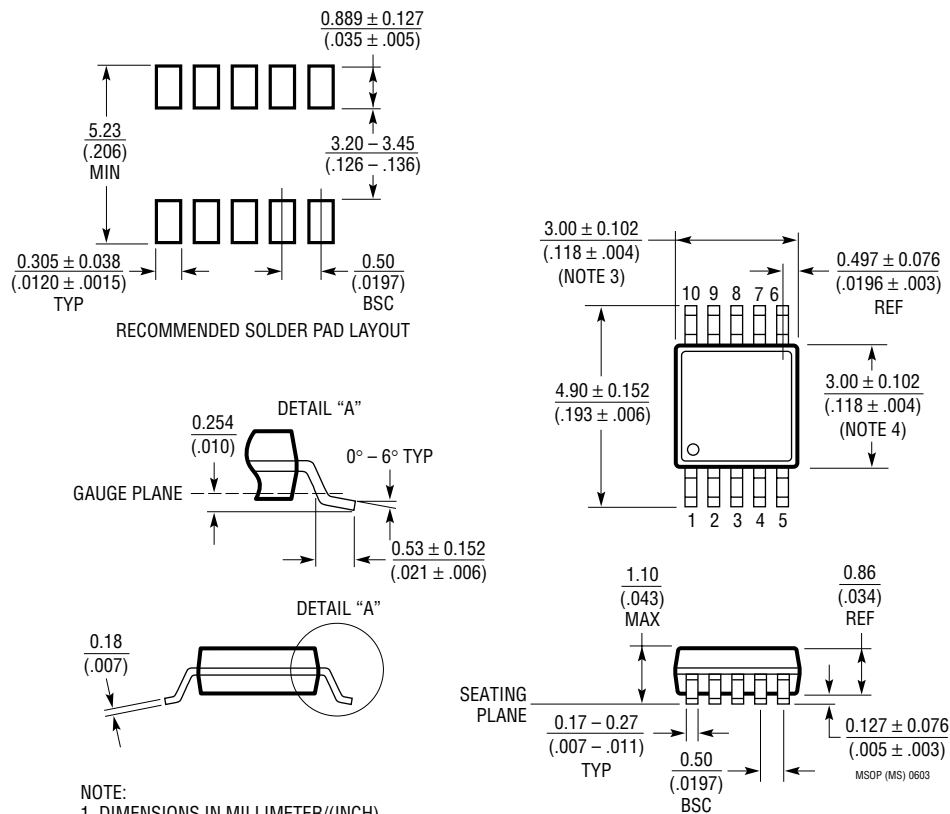
the desired unity gain is produced for the Y-channel. The necessary scaling of the color-difference signals is performed passively by their respective output termination resistor networks. Since this circuit naturally produces bipolar chroma signals ( $\pm 0.35V$  at the cable load) regardless of RGB offset, the simplest implementation is to power the circuit with  $\pm 3.3V$  split supplies. With an available output swing of about  $5.6V$  for this supply configuration, the circuit handles video with composite syncs and/or various offsets without difficulty.

RGB to  $Y_P B_P R_P$  Component-Video Conversion



# PACKAGE DESCRIPTION

**MS Package**  
**10-Lead Plastic MSOP**  
 (Reference LTC DWG # 05-08-1661)

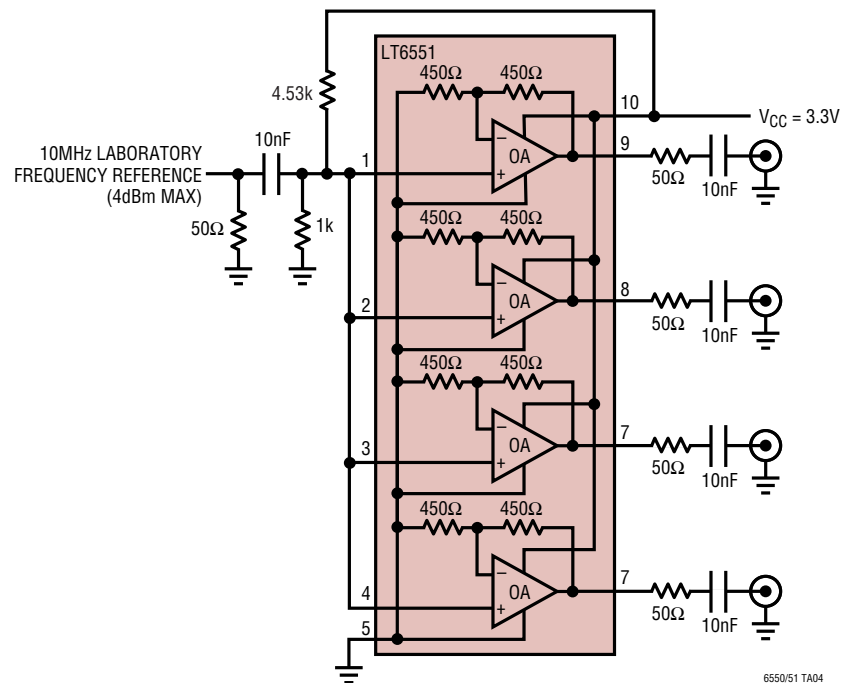


## NOTE:

1. DIMENSIONS IN MILLIMETER/(INCH)
2. DRAWING NOT TO SCALE
3. DIMENSION DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.  
MOLD FLASH, PROTRUSIONS OR GATE BURRS SHALL NOT EXCEED  $0.152\text{mm}$  ( $.006$ ) PER SIDE
4. DIMENSION DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSIONS.  
INTERLEAD FLASH OR PROTRUSIONS SHALL NOT EXCEED  $0.152\text{mm}$  ( $.006$ ) PER SIDE
5. LEAD COPLANARITY (BOTTOM OF LEADS AFTER FORMING) SHALL BE  $0.102\text{mm}$  ( $.004$ ) MAX

TYPICAL APPLICATION

10MHz Reference Distribution Amplifier



RELATED PARTS

| PART NUMBER          | DESCRIPTION                                                                | COMMENTS                                                                 |
|----------------------|----------------------------------------------------------------------------|--------------------------------------------------------------------------|
| LT1259/LT1260        | Dual/Triple 130MHz Current Feedback Amplifiers                             | Shutdown, Operates to $\pm 15V$                                          |
| LT1395/LT1396/LT1397 | Single, Dual, Quad 400MHz Current Feedback Amplifier                       | 800V/ $\mu s$ Slew Rate                                                  |
| LT1398/LT1399        | Dual/Triple 300MHz Current Feedback Amplifier                              | 0.1dB Gain Flatness to 150MHz, Shutdown                                  |
| LT1675/LT1675-1      | 250MHz, Triple and Single RGB Multiplexer with Current Feedback Amplifiers | 100MHz Pixel Switching, -3dB Bandwidth: 250MHz, 1100V/ $\mu s$ Slew Rate |
| LT1809/LT1810        | Single/Dual, 180MHz, Rail-to-Rail Input and Output Amplifiers              | 350V/ $\mu s$ Slew Rate, Shutdown, Low Distortion -90dBc at 5MHz         |