Advance Information

CADEKA
Amplify the Human Experience

# Comlinear™ CLC1602, CLC3602

## Single and Triple 1.8GHz, Low Distortion Amplifiers

### FEATURES

- 0.1dB gain flatness to 115MHz
- 0.01%/0.01° differential gain/ phase error
- 1280MHz -3dB bandwidth at G = 2
- 1.8GHz -3dB bandwidth at G = 1
- 7,400V/µs slew rate
- 200mA output current (easily drives two video loads)
- -76/-90dBc 2nd/3rd harmonics at 20MHz
- -61/-67dBc 2nd/3rd harmonics at 70MHz
- Fully specified at 5V and ±5V supplies
- CLC1602: Lead-free SOT23-6
- Future option CLC3602: Lead-free TSSOP-14

### APPLICATIONS

- Profesional video
- High resolution video graphics
- Video switchers and routers
- Communication receivers
- Active filters
- IF/RF gain stage
- Instrumentation
- CCD imaging

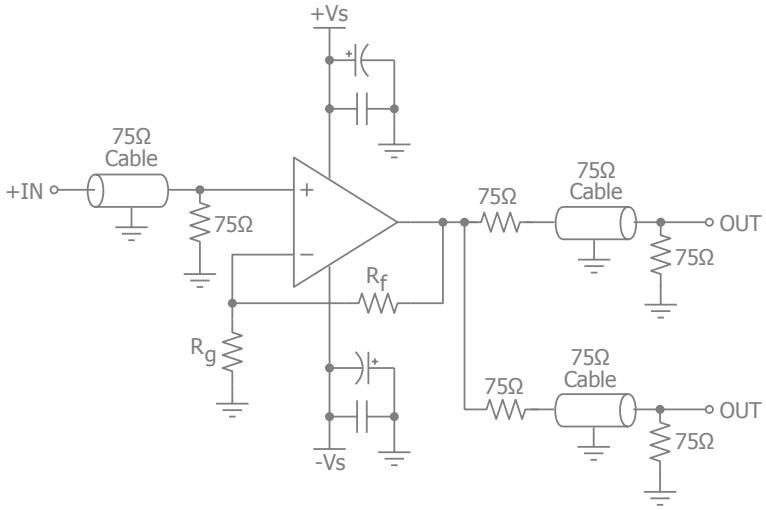
## General Description

The *Comlinear* CLC1602 (single) and CLC3602 (triple) are high-performance, current feedback amplifiers. These amplifiers provide 1.8GHz unity gain bandwidth and provide 7,400V/µs slew rate exceeding the requirements of high-definition television (HDTV) and other multimedia applications.

These *Comlinear* high-performance amplifiers offer excellent video specifications: 0.1dB gain flatness to 115MHz with ample output current to drive multiple video loads. Radar and comunication receivers will benfit from the low harmonic distortion performance (-61/-67dBc HD2/HD3 at 70MHz) of the CLC1602 family of amplifiers.

With 7,400V/µs slew rate, 0.5ns rise/fall times, and 4ns settling time to 0.1% the *Comlinear* CLC1602 and CLC3602 are well suited for pulse amplifying and instrumentation applications.

## Typical Application - Driving Dual Video Loads



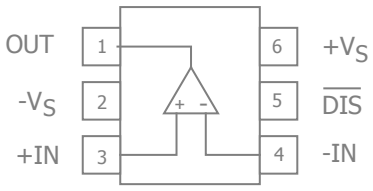

## Ordering Information

| Part Number | Package | Pb-Free | Operating Temperature Range | Packaging Method |
|---|---|---|---|---|
| CLC1602IST6X* | SOT23-6 | Yes | -40°C to +85°C | Reel |
| CLC1602IST6* | SOT23-6 | Yes | -40°C to +85°C | Rail |
| CLC3602ITP14X† | TSSOP-14 | Yes | -40°C to +85°C | Reel |
| CLC3602ITP14† | TSSOP-14 | Yes | -40°C to +85°C | Rail |

*Preliminary Product Information, †Future Product Offering

Moisture sensitivity level for all parts is MSL-1.

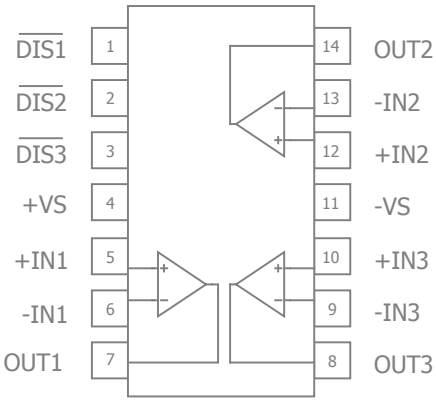
## CLC1602 Pin Configuration




## CLC1602 Pin Assignments

| Pin No. | Pin Name | Description |
|---|---|---|
| 1 | OUT | Output |
| 2 | $-V_S$ | Negative supply |
| 3 | +IN | Positive input |
| 4 | -IN | Negative input |
| 5 | $\overline{DIS}$ | Disable. Enabled if pin is left floating or pulled above $V_{ON}$, disabled if pin is grounded or pulled below $V_{OFF}$. |
| 6 | $+V_S$ | Positive supply |

## CLC3602 Pin Configuration




## CLC3602 Pin Configuration

| Pin No. | Pin Name | Description |
|---|---|---|
| 1 | $\overline{DIS1}$ | Disable pin channel 1. Enabled if pin is left floating or pulled above $V_{ON}$, disabled if pin is grounded or pulled below $V_{OFF}$. |
| 2 | $\overline{DIS2}$ | Disable pin channel 2. Enabled if pin is left floating or pulled above $V_{ON}$, disabled if pin is grounded or pulled below $V_{OFF}$. |
| 3 | $\overline{DIS3}$ | Disable pin channel 3. Enabled if pin is left floating or pulled above $V_{ON}$, disabled if pin is grounded or pulled below $V_{OFF}$. |
| 4 | $+V_S$ | Positive supply |
| 5 | +IN1 | Positive input, channel 1 |
| 6 | -IN1 | Negative input, channel 1 |
| 7 | OUT1 | Output, channel 1 |
| 8 | OUT3 | Output, channel 3 |
| 9 | -IN3 | Negative input, channel 3 |
| 10 | +IN3 | Positive input, channel 3 |
| 11 | $-V_S$ | Negative supply |
| 12 | +IN2 | Positive input, channel 2 |
| 13 | -IN2 | Negative input, channel 2 |
| 14 | OUT2 | Output, channel 2 |

## Absolute Maximum Ratings

The "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the Electrical Characteristics tables are not guaranteed at the absolute maximum ratings. The "Recommended Operating Conditions" table defines the conditions for actual device operation.

| Parameter | Min | Max | Unit |
|---|---|---|---|
| Supply Voltage | 0 | 14 | V |
| Input Voltage Range | $-V_S$ -0.5V | $+V_S$ +0.5V | V |

## Reliability Information

| Parameter | Min | Typ | Max | Unit |
|---|---|---|---|---|
| Junction Temperature | | | 150 | °C |
| Storage Temperature Range | -65 | | 150 | °C |
| Lead Temperature (Soldering, 10s) | | | 300 | °C |
| Package Thermal Resistance | | | | |
| 6-Lead SOT23 | | TBD | | °C/W |
| 14-Lead TSSOP | | TBD | | °C/W |

Notes:
Package thermal resistance ($\theta_{JA}$), JDEC standard, multi-layer test boards, still air.

## ESD Protection

| Product | SOT23-6 | TSSOP-14 |
|---|---|---|
| Human Body Model (HBM) | TBD | TBD |
| Charged Device Model (CDM) | TBD | TBD |

## Recommended Operating Conditions

| Parameter | Min | Typ | Max | Unit |
|---|---|---|---|---|
| Operating Temperature Range | -40 | | +85 | °C |
| Supply Voltage Range | 4 | | 12 | V |

## Electrical Characteristics at +5V

$T_A$ = 25°C, $V_S$ = +5V, $R_f$ = $R_g$ =250Ω, $R_L$ = 150Ω to $V_S$/2, G = 2; unless otherwise noted.

| Symbol | Parameter | Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| Frequency Domain Response | | | | | | |
| UGBW | -3dB Bandwidth | G = +1, $V_{OUT}$ = 0.2$V_{pp}$ | | TBD | | MHz |
| $BW_{SS}$ | -3dB Bandwidth | G = +2, $V_{OUT}$ = 0.2$V_{pp}$ | | 1080 | | MHz |
| $BW_{LS}$ | Large Signal Bandwidth | G = +2, $V_{OUT}$ = 4$V_{pp}$ | | 720 | | MHz |
| $BW_{0.1dBSS}$ | 0.1dB Gain Flatness | G = +2, $V_{OUT}$ = 0.2$V_{pp}$ | | 120 | | MHz |
| $BW_{0.1dBLS}$ | 0.1dB Gain Flatness | G = +2, $V_{OUT}$ = 2$V_{pp}$ | | TBD | | MHz |
| Time Domain Response | | | | | | |
| $t_R$, $t_F$ | Rise and Fall Time | $V_{OUT}$ = 2V step; (10% to 90%) | | 0.6 | | ns |
| $t_S$ | Settling Time to 0.1% | $V_{OUT}$ = 2V step | | TBD | | ns |
| OS | Overshoot | $V_{OUT}$ = 0.2V step | | 8 | | % |
| SR | Slew Rate | 4V step | | 3200 | | V/µs |
| Distortion/Noise Response | | | | | | |
| HD2 | 2nd Harmonic Distortion | 2$V_{pp}$, 5MHz | | -80 | | dBc |
| | | 2$V_{pp}$, 20MHz | | -76 | | dBc |
| | | 2$V_{pp}$, 70MHz | | -58 | | dBc |
| HD3 | 3rd Harmonic Distortion | 2$V_{pp}$, 5MHz | | -80 | | dBc |
| | | 2$V_{pp}$, 20MHz | | -76 | | dBc |
| | | 2$V_{pp}$, 70MHz | | -58 | | dBc |
| $D_G$ | Differential Gain | NTSC (3.58MHz), DC-coupled, $R_L$ = 150Ω | | 0.01 | | % |
| $D_P$ | Differential Phase | NTSC (3.58MHz), DC-coupled, $R_L$ = 150Ω | | 0.01 | | ° |
| IMD | 3rd Order Intermodulation Distortion | $V_{OUT}$ = 2$V_{pp}$, 70MHz, Δf=200kHz | | TBD | | dBc |
| OIP | 3rd Order output Intercept Point | $V_{OUT}$ = 2$V_{pp}$, 70MHz, Δf=200kHz | | TBD | | dBm |
| $e_n$ | Input Voltage Noise | > 1MHz | | 2.3 | | nV/√Hz |
| $i_n$ | Input Current Noise | > 1MHz, Non-inverting | | 46 | | pA/√Hz |
| | | > 1MHz, Inverting | | 35 | | pA/√Hz |
| $X_{TALK}$ | Crosstalk | Channel-to-channel 5MHz | | TBD | | dB |
| DC Performance | | | | | | |
| $V_{IO}$ | Input Offset Voltage | | | 2 | | mV |
| $dV_{IO}$ | Average Drift | | | TBD | | µV/°C |
| $I_{bn}$ | Input Bias Current (Non-inverting) | | | 5 | | µA |
| $dI_{bn}$ | Average Drift | | | TBD | | nA/°C |
| $I_{bi}$ | Input Bias Current (Inverting) | | | 25 | | µA |
| $dI_{bi}$ | Average Drift | | | TBD | | nA/°C |
| PSRR | Power Supply Rejection Ratio | DC | | 87 | | dB |
| $A_{OL}$ | Open-Loop Transimpedance | $V_{OUT}$ = $V_S$ / 2 | | 110 | | kΩ |
| $I_S$ | Supply Current | per channel | | 12 | | mA |
| Disable Characteristics | | | | | | |
| $T_{ON}$ | Turn On Time | | | 0.11 | | us |
| $T_{OFF}$ | Turn Off Time | | | 1.2 | | us |
| $OFF_{IOS}$ | Off Isolation | 5MHz | | TBD | | dB |
| $OFF_{COUT}$ | Off Output Capacitance | | | TBD | | pF |
| $OFF_{ROUT}$ | Off Output Resistance | | | TBD | | kΩ |
| $V_{OFF}$ | Power Down Input Voltage | $\overline{DIS}$ pin, disabled if pin is grounded or pulled below $V_{OFF}$ | | | 1.9 | V |
| $V_{ON}$ | Enable Input Voltage | $\overline{DIS}$ pin, enabled if pin is left open or pulled above $V_{ON}$ | 2.4 | | | V |
| $I_{SD}$ | Disable Supply Current | $\overline{DIS}$ pin is grounded | | 0.12 | | mA |

**Notes:**
1.

## Electrical Characteristics at +5V continued

$T_A$ = 25°C, $V_S$ = +5V, $R_f$ = $R_g$ =250Ω, $R_L$ = 150Ω to $V_S$/2, G = 2; unless otherwise noted.

| Symbol | Parameter | Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| Input Characteristics | | | | | | |
| $R_{IN}$ | Input Resistance | Non-inverting | | TBD | | MΩ |
| $C_{IN}$ | Input Capacitance | | | TBD | | pF |
| CMIR | Common Mode Input Range | | | 1.3 to 3.7 | | V |
| CMRR | Common Mode Rejection Ratio | DC | | 60 | | dB |
| Output Characteristics | | | | | | |
| $R_O$ | Output Resistance | Closed Loop, DC | | TBD | | mΩ |
| $V_{OUT}$ | Output Voltage Swing | $R_L$ = 150Ω | | 1.6 to 3.4 | | V |
| | | $R_L$ = 1kΩ | | TBD | | V |
| $I_{OUT}$ | Output Current | | | ±200 | | mA |
| $I_{SC}$ | Short-Circuit Output Current | $V_{OUT}$ = $V_S$ / 2 | | TBD | | mA |

**Notes:**
1.

## Electrical Characteristics at ±5V

$T_A$ = 25°C, $V_S$ = ±5V, $R_f$ = $R_g$ =250Ω, $R_L$ = 150Ω to $V_S$/2, G = 2; unless otherwise noted.

| Symbol | Parameter | Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| Frequency Domain Response | | | | | | |
| UGBW | -3dB Bandwidth | G = +1, $V_{OUT}$ = 0.2$V_{pp}$ | | 1800 | | MHz |
| $BW_{SS}$ | -3dB Bandwidth | G = +2, $V_{OUT}$ = 0.2$V_{pp}$ | | 1280 | | MHz |
| $BW_{LS}$ | Large Signal Bandwidth | G = +2, $V_{OUT}$ = 4$V_{pp}$ | | 800 | | MHz |
| $BW_{0.1dBSS}$ | 0.1dB Gain Flatness | G = +2, $V_{OUT}$ = 0.2$V_{pp}$ | | 115 | | MHz |
| $BW_{0.1dBLS}$ | 0.1dB Gain Flatness | G = +2, $V_{OUT}$ = 2$V_{pp}$ | | TBD | | MHz |
| Time Domain Response | | | | | | |
| $t_R$, $t_F$ | Rise and Fall Time | $V_{OUT}$ = 2V step; (10% to 90%) | | 0.5 | | ns |
| $t_S$ | Settling Time to 0.1% | $V_{OUT}$ = 2V step | | 4 | | ns |
| OS | Overshoot | $V_{OUT}$ = 0.2V step | | 2 | | % |
| SR | Slew Rate | 4V step | | 7400 | | V/µs |
| Distortion/Noise Response | | | | | | |
| HD2 | 2nd Harmonic Distortion | 2$V_{pp}$, 5MHz | | -81 | | dBc |
| | | 2$V_{pp}$, 20MHz | | -76 | | dBc |
| | | 2$V_{pp}$, 70MHz | | -61 | | dBc |
| HD3 | 3rd Harmonic Distortion | 2$V_{pp}$, 5MHz | | -92 | | dBc |
| | | 2$V_{pp}$, 20MHz | | -90 | | dBc |
| | | 2$V_{pp}$, 70MHz | | -67 | | dBc |
| $D_G$ | Differential Gain | NTSC (3.58MHz), DC-coupled, $R_L$ = 150Ω | | 0.01 | | % |
| $D_P$ | Differential Phase | NTSC (3.58MHz), DC-coupled, $R_L$ = 150Ω | | 0.01 | | ° |
| IMD | 3rd Order Intermodulation Distortion | $V_{OUT}$ = 2$V_{pp}$, 70MHz, Δf=200kHz | | TBD | | dBc |
| OIP | 3rd Order output Intercept Point | $V_{OUT}$ = 2$V_{pp}$, 70MHz, Δf=200kHz | | TBD | | dBm |
| $e_n$ | Input Voltage Noise | > 1MHz | | 2.3 | | nV/√Hz |
| $i_n$ | Input Current Noise | > 1MHz, Non-inverting | | 46 | | pA/√Hz |
| | | > 1MHz, Inverting | | 35 | | pA/√Hz |
| $X_{TALK}$ | Crosstalk | Channel-to-channel 5MHz | | TBD | | dB |
| DC Performance | | | | | | |
| $V_{IO}$ | Input Offset Voltage(1) | | -5 | 2 | +5 | mV |
| $dV_{IO}$ | Average Drift | | | TBD | | µV/°C |
| $I_{bn}$ | Input Bias Current (Non-inverting)(1) | | -30 | 5 | 30 | µA |
| $dI_{bn}$ | Average Drift | | | TBD | | nA/°C |
| $I_{bi}$ | Input Bias Current (Inverting)(1) | | -60 | 25 | 60 | µA |
| $dI_{bi}$ | Average Drift | | | TBD | | nA/°C |
| PSRR | Power Supply Rejection Ratio(1) | DC | 80 | 87 | | dB |
| $A_{OL}$ | Open-Loop Transimpedance | $V_{OUT}$ = $V_S$ / 2 | | 110 | | kΩ |
| $I_S$ | Supply Current(1) | per channel | | 12 | 16 | mA |
| Disable Characteristics | | | | | | |
| $T_{ON}$ | Turn On Time | | | 0.09 | | us |
| $T_{OFF}$ | Turn Off Time | | | 1.2 | | us |
| $OFF_{IOS}$ | Off Isolation | 5MHz | | TBD | | dB |
| $OFF_{COUT}$ | Off Output Capacitance | | | 6.4 | | pF |
| $OFF_{ROUT}$ | Off Output Resistance | | | TBD | | kΩ |
| $V_{OFF}$ | Power Down Input Voltage | $\overline{DIS}$ pin, disabled if pin is grounded or pulled below $V_{OFF}$ | | | 1.4 | V |
| $V_{ON}$ | Enable Input Voltage | $\overline{DIS}$ pin, enabled if pin is left open or pulled above $V_{ON}$ | 2.9 | | | V |
| $I_{SD}$ | Disable Supply Current | $\overline{DIS}$ pin is grounded | | 0.14 | | mA |

**Notes:**
1. 100% tested at 25°C

## Electrical Characteristics at ±5V continued

$T_A$ = 25°C, $V_s$ = ±5V, $R_f$ = $R_g$ =250Ω, $R_L$ = 150Ω to $V_S$/2, G = 2; unless otherwise noted.

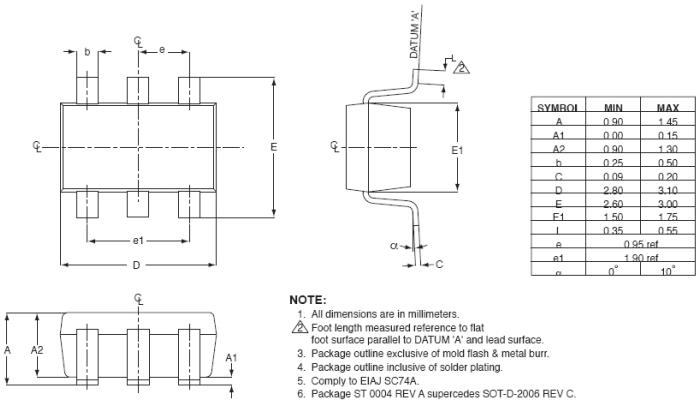
| Symbol | Parameter | Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| Input Characteristics | | | | | | |
| $R_{IN}$ | Input Resistance | Non-inverting | | TBD | | MΩ |
| $C_{IN}$ | Input Capacitance | | | 1.5 | | pF |
| CMIR | Common Mode Input Range | | | ±3.8 | | V |
| CMRR | Common Mode Rejection Ratio(1) | DC | 55 | 60 | | dB |
| Output Characteristics | | | | | | |
| $R_O$ | Output Resistance | Closed Loop, DC | | TBD | | mΩ |
| $V_{OUT}$ | Output Voltage Swing | $R_L$ = 150Ω (1) | -3.5 | ±3.8 | 3.5 | V |
| | | $R_L$ = 1kΩ | | TBD | | V |
| $I_{OUT}$ | Output Current | | | ±200 | | mA |
| $I_{SC}$ | Short-Circuit Output Current | $V_{OUT}$ = $V_S$ / 2 | | TBD | | mA |

**Notes:**
1. 100% tested at 25°C

# Mechanical Dimensions

## SOT23-6 Package

SOT23-6




| SYMBOL | MIN | MAX |
|---|---|---|
| A | 0.90 | 1.45 |
| A1 | 0.00 | 0.15 |
| A2 | 0.90 | 1.30 |
| b | 0.25 | 0.50 |
| C | 0.09 | 0.20 |
| D | 2.80 | 3.10 |
| E | 2.60 | 3.00 |
| E1 | 1.50 | 1.75 |
| L | 0.35 | 0.55 |
| e | 0.95 ref | |
| e1 | 1.90 ref | |
| α | 0° | 10° |

**NOTE:**

1. All dimensions are in millimeters.
2. Foot length measured reference to flat foot surface parallel to DATUM 'A' and lead surface.
3. Package outline exclusive of mold flash & metal burr.
4. Package outline inclusive of solder plating.
5. Comply to EIAJ SC74A.
6. Package ST 0004 REV A supercedes SOT-D-2006 REV C.

## TSSOP-14 Package



For additional information regarding our products, please visit CADEKA at: cadeka.com

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