



# ULTRA-WIDEBAND DIFFERENTIAL VIDEO AMPLIFIER

## UPC1663GV

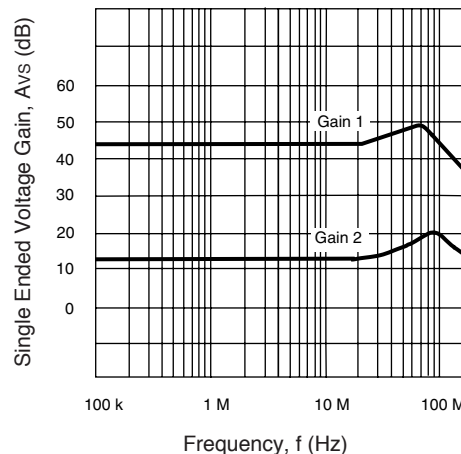
### FEATURES

- **BANDWIDTH AND TYPICAL GAIN:**  
120 MHz at  $A_{VOL} = 300$   
170 MHz at  $A_{VOL} = 100$   
700 MHz at  $A_{VOL} = 10$
- **VERY SMALL PHASE DELAY**
- **GAIN ADJUSTABLE FROM 10 TO 300**
- **NO FREQUENCY COMPENSATION REQUIRED**

### DESCRIPTION

NEC's UPC1663GV is a video amplifier with differential input and output stages. A high frequency process ( $f_T = 6$  GHz) improves AC performance compared with industry-standard video amplifiers. This device is excellent as a sense amplifier for high-density CCDs, as a video or pulse amplifier in high-resolution displays, and in communications equipment.

**SINGLE ENDED VOLTAGE GAIN vs. FREQUENCY**



### ELECTRICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ , $V_{CC} = \pm 6$ V, $R_s = 50 \Omega$ , $f = 10$ MHz)

PART NUMBER PACKAGE OUTLINE			UPC1663GV S08		
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX
$I_{CC}$	Power Supply Current	mA		13	20
$A_{vd}$	Differential Voltage Gain: Gain <sup>1</sup> Gain <sup>2</sup>		200 8	320 10	500 12
BW	Bandwidth (Gain is 3 dB down from the gain at 100 KHz)	Gain <sup>1</sup> Gain <sup>2</sup>		120 700	
$t_R$	Rise Time, $V_{OUT} = 1V_{p-p}$ :	Gain <sup>1</sup> Gain <sup>2</sup>		2.9 2.7	
$t_{pd}$	Propagation Delay, $V_{OUT} = 1V_{p-p}$ :	Gain <sup>1</sup> Gain <sup>2</sup>		2 1.2	
$R_{IN}$	Input Impedance:	Gain <sup>1</sup> Gain <sup>2</sup>		4.0 180	
$C_{IN}$	Input Capacitance			2	
$I_{IO}$	Input Offset Current	$\mu\text{A}$		0.4	5.0
$I_B$	Input Bias Current	$\mu\text{A}$		20	40
$V_N$	Input Noise Voltage, 10 k to 10 MHz	$\mu\text{V}_{r.m.s.}$		3	
$V_I$	Input Voltage Range	V	$\pm 1.0$		
CMRR	Common Mode Rejection Ratio, $V_{cm} = \pm 1$ V, $f \leq 100$ kHz $V_{cm} = \pm 1$ V, $f = 5$ MHz	dB	55 53	94 60	
SVRR	Supply Voltage Rejection Ratio, $\Delta V = \pm 0.5$ V	dB	50	70	
$V_{O(off)}$	Output Offset Voltage, $V_{O(off)} = I_{OUT1} - I_{OUT2}$ Gain <sup>1</sup> Gain <sup>2</sup>	V		0.3 0.1	1.5 1.0
$V_{O(CM)}$	Output Common Mode Voltage	V	2.4	2.9	3.4
$V_{OP-p}$	Max. Output Voltage Swing, Single-ended	Vp-p	3.0	4.0	
$I_{sink}$	Output Sink Current	mA	2.5	3.6	

Notes:

1. Gain select pins GA and GB are connected together.
2. All gain select pins are open.
3. Insert adjustment resistor (0 to 10 k $\Omega$ ) between GA and GB when variable gain is necessary.

**ABSOLUTE MAXIMUM RATINGS<sup>1</sup>** (T<sub>A</sub> = 25°C)

SYMBOLS	PARAMETERS	UNITS	RATINGS
V <sub>C-VE</sub>	Voltage between V <sub>C</sub> and V <sub>E</sub>	V	-0.3 to 14
P <sub>T</sub>	Total Power Dissipation <sup>2</sup>	mW	200
V <sub>ID</sub>	Differential Input Voltage	V	±5
V <sub>IN</sub>	Input Voltage	V	±6
I <sub>O</sub>	Output Current	mA	35
T <sub>OP</sub>	Operating Temperature	°C	-45 to +75
T <sub>STG</sub>	Storage Temperature	°C	-55 to +150

Notes:

1. Operation in excess of any one of these parameters may result in permanent damage.
2. Mounted on 50 cm x 50 cm x 1.6 mm glass epoxy PCB with copper film (T<sub>A</sub> = Max T<sub>OP</sub>).

**RECOMMENDED OPERATING CONDITIONS** (T<sub>A</sub> = 25°C)

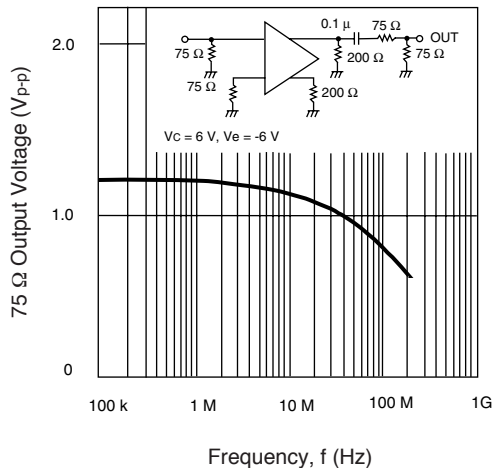
SYMBOLS	CHARACTERISTICS	UNITS	MIN	TYP	MAX
V <sub>C</sub>	Positive Supply Voltage	V	+2	+6	+6.5
V <sub>E</sub>	Negative Supply Voltage	V	-2	-6	-6.5
I <sub>O source</sub>	Source Current	mA			20
I <sub>O sink</sub>	Sink Current	mA			2.5
	Frequency Range	MHz	DC		200

**Attention:**

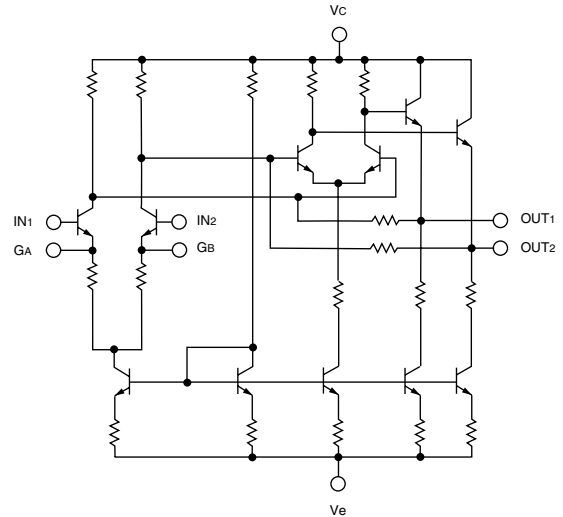
Due to high frequency characteristics, the physical circuit layout is very critical. Supply voltage line bypass, double-sided printed-circuit board, and wide-area ground line layout are necessary for stable operation. Two signal resistors connected to both inputs and two load resistors connected to both outputs should be balanced for stable operation.

**TYPICAL PERFORMANCE CURVES** (T<sub>A</sub> = 25°C)

**VIDEO LINE SINGLE ENDED OUTPUT VOLTAGE SWING vs. FREQUENCY**



**EQUIVALENT CIRCUIT**

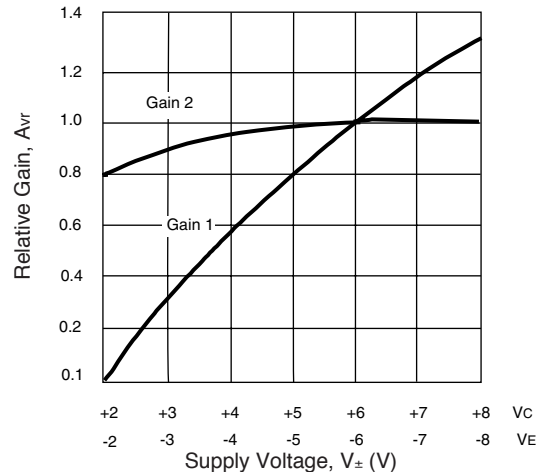


**TYPICAL PERFORMANCE UNDER SINGLE SUPPLY +5 V OPERATION\***

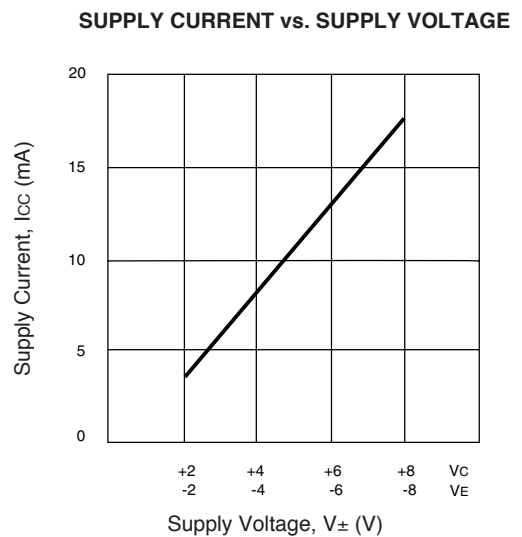
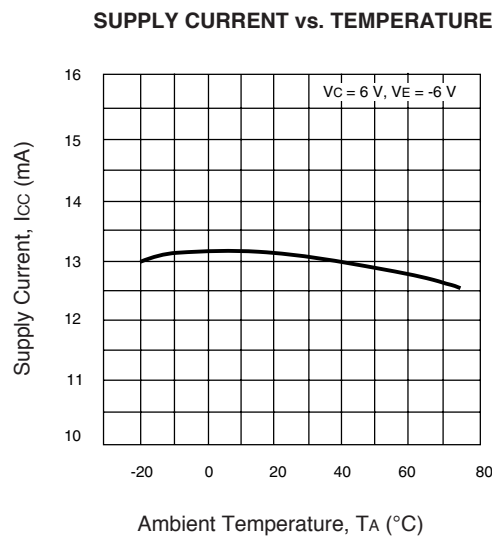
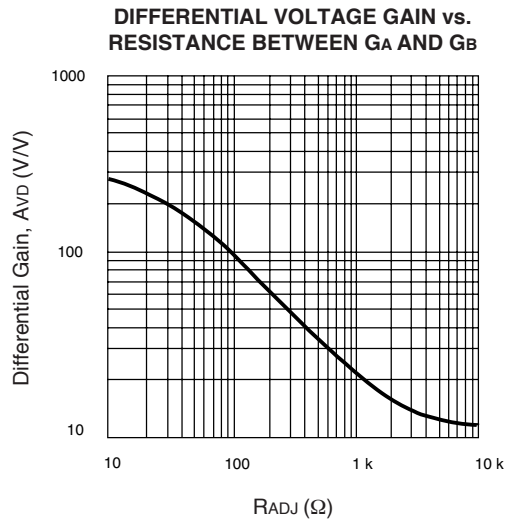
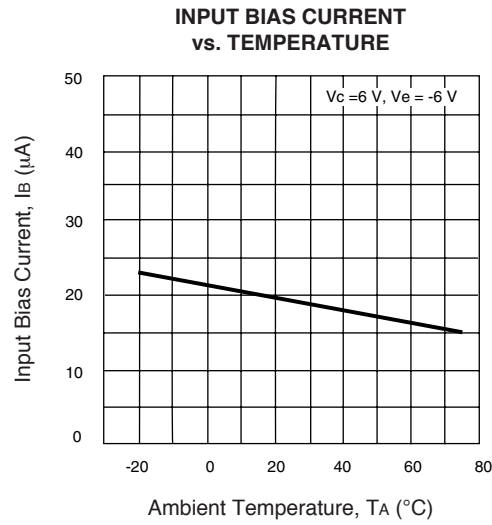
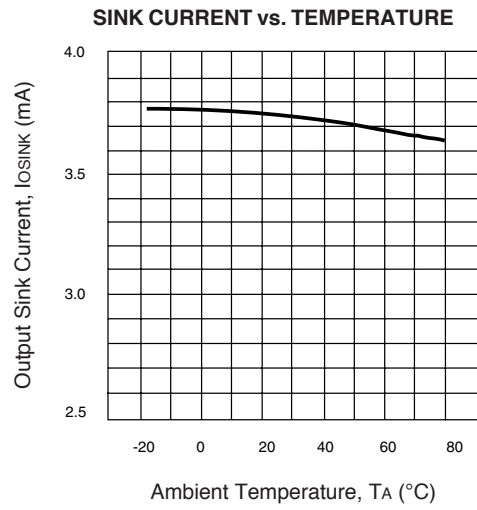
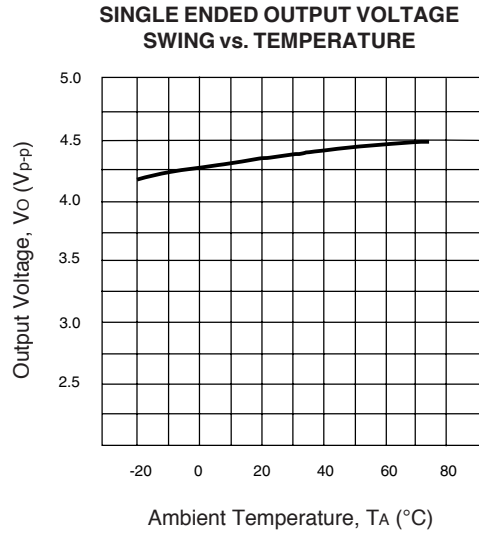
PARAMETER	CONDITIONS	TYPICAL	UNITS
Differential Gain	15 MHz		
Gain 1		35	dB
Gain 2		11	dB
Bandwidth	Gain is 3 dB down from the gain at 100 KHz		
Gain 1		106	MHz
Gain 2		115	MHz
Rise Time	R <sub>S</sub> = 50 Ω, V <sub>OUT</sub> = 80 mVp-p		
Gain 1		2.2	ns
Propagation Delay			
Gain 1	R <sub>S</sub> = 50 Ω, V <sub>OUT</sub> = 80 mVp-p	2.8	ns
Gain 2	R <sub>S</sub> = 50 Ω, V <sub>OUT</sub> = 60 mVp-p	1.8	ns
Phase Shift	100 MHz		
Gain 1		-123	degree
Gain 2		-93	degree
Output Power	Z <sub>L</sub> = 50 Ω, 15 MHz		
R <sub>A</sub> = 240 Ω		5.0	dBm
R <sub>A</sub> = 910 Ω		0	dBm
R <sub>A</sub> = 80 Ω		-11.5	dBm

\* See Application Circuit

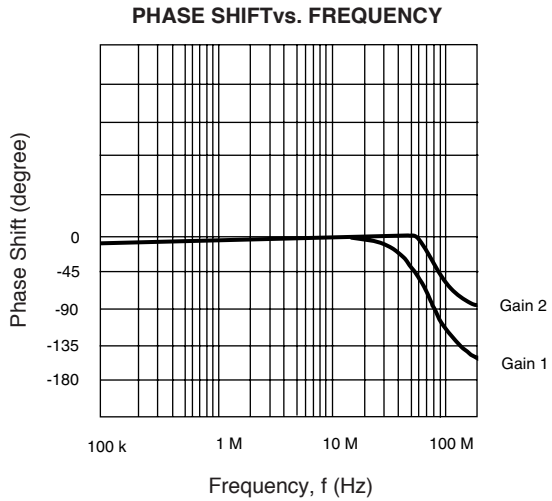
**NORMALIZED VOLTAGE GAIN vs. SUPPLY VOLTAGE**



**TYPICAL PERFORMANCE CURVES** ( $T_A = 25^\circ\text{C}$ )

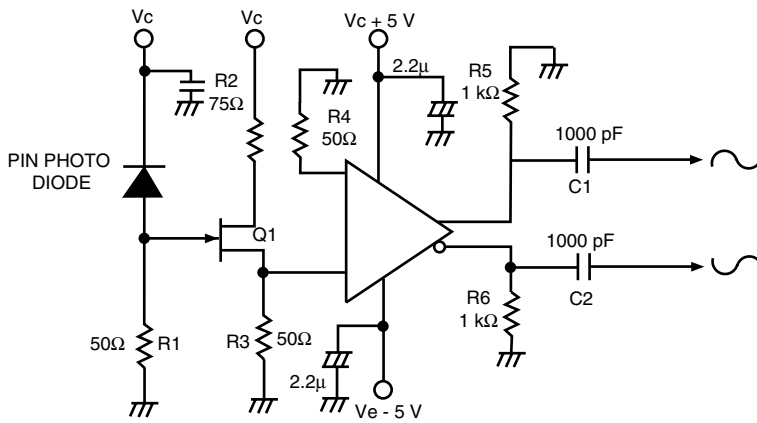


TYPICAL PERFORMANCE CURVES (TA = 25°C)



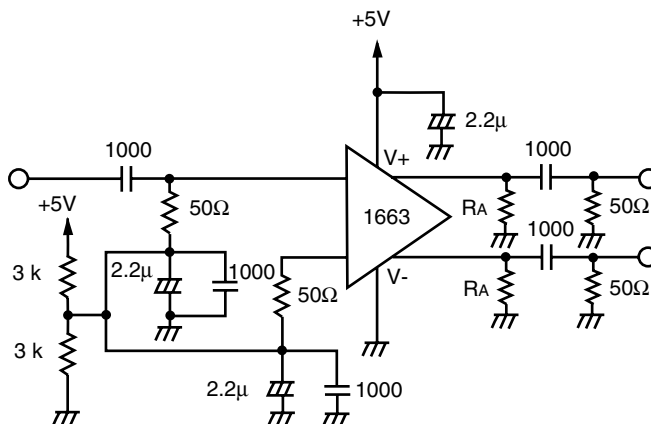
TYPICAL APPLICATIONS

• Photo Signal Detector



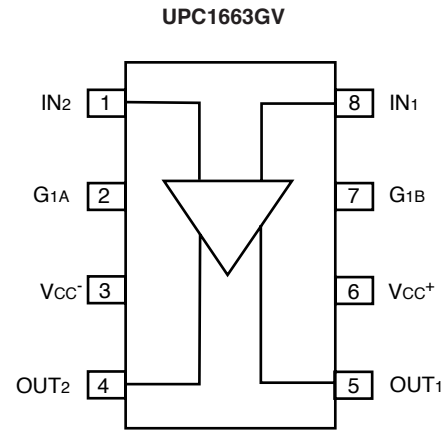
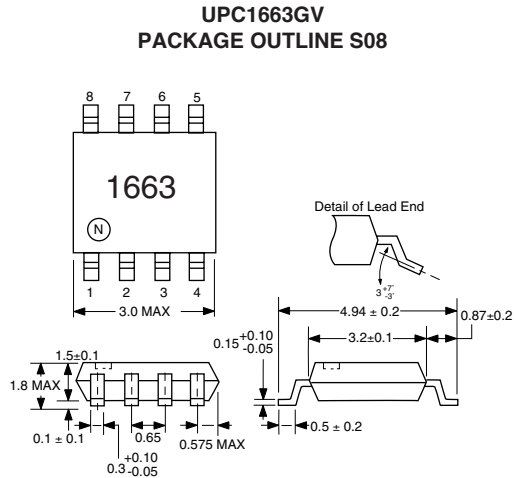
Since the input impedance of the IC falls when the gain rises, stable operation can be achieved by inserting a FET buffer when necessary as illustrated above.

• Application for +5 V Single Supply



**OUTLINE DIMENSIONS** (Units in mm)

**CONNECTION DIAGRAM (TOP VIEW)**



**Notes:**

1. Each lead centerline is located within 0.12 mm (0.005 inch) of its true position at maximum material condition.
2. All dimensions are typical unless otherwise specified.

**ORDERING INFORMATION**

PART NUMBER	QUANTITY
UPC1663GV-E1-A	1000/Reel

**PIN DESCRIPTION**

Pin No.	Pin Name	In single Bias (V)	In single bias (V)	Functions and Applications	Internal Equivalent Circuit
8 1	IN <sub>1</sub> IN <sub>2</sub>	Pin voltage	Apply voltage	Input pin	<p>Internal circuit constants should be referred to application note.</p>
5 4	OUT <sub>1</sub> OUT <sub>2</sub>	0 Pin voltage 0	V <sub>cc</sub> /2 Apply voltage V <sub>cc</sub> /2	Output pin	
6	V <sub>cc</sub> <sup>+</sup>	±2 to ±6.5	-0.3 to +14	Plus voltage supply pin. This pin should be connected with bypass capacitor to minimize AC impedance.	
3	V <sub>cc</sub> <sup>-</sup>		GND	Minus voltage supply pin. This pin should be connected with bypass capacitor to minimize AC impedance.	
7 2	G <sub>1A</sub> G <sub>1B</sub>	—	—	Gain adjustment pin. External resistor from 0 to 10 kW can be inserted between pin 2 and 7 to determine gain value.	

**Life Support Applications**

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CEL Pb-free products have the same base part number with a suffix added. The suffix –A indicates that the device is Pb-free. The –AZ suffix is used to designate devices containing Pb which are exempted from the requirement of RoHS directive (\*). In all cases the devices have Pb-free terminals. All devices with these suffixes meet the requirements of the RoHS directive.

This status is based on CEL’s understanding of the EU Directives and knowledge of the materials that go into its products as of the date of disclosure of this information.

Restricted Substance per RoHS	Concentration Limit per RoHS (values are not yet fixed)	Concentration contained in CEL devices	
		-A	-AZ
Lead (Pb)	< 1000 PPM	Not Detected	(*)
Mercury	< 1000 PPM	Not Detected	
Cadmium	< 100 PPM	Not Detected	
Hexavalent Chromium	< 1000 PPM	Not Detected	
PBB	< 1000 PPM	Not Detected	
PBDE	< 1000 PPM	Not Detected	

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