NEC

ULTRA-WIDEBAND DIFFERENTIAL VIDEO AMPLIFIER

UPC1663G UPC1663GV

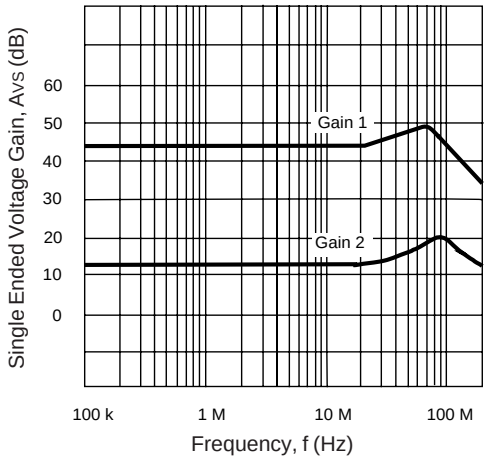
FEATURES

- **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

The UPC1663G and GV are video amplifiers with differential input and output stages. A high frequency process (f_T = 6 GHz) improves AC performance compared with industry-standard video amplifiers. These devices are excellent as sense amplifiers for high-density CCDs, as video or pulse amplifiers in high-resolution displays, and in communications equipment.

SINGLE ENDED VOLTAGE GAIN vs. FREQUENCY



ELECTRICAL CHARACTERISTICS (T_A = 25°C, V_{CC} = ±6 V, R_S = 50 Ω, f = 500 MHz)

PART NUMBER PACKAGE OUTLINE			UPC1663G, GV G08, S08		
SYMBOLS	**PARAMETERS AND CONDITIONS**	**UNITS**	**MIN**	**TYP**	**MAX**
I_{CC}	Power Supply Current	mA		13	20
A_{Vd}	Differential Voltage Gain: Gain[1] Gain[2]		200 8	320 10	500 12
BW	Bandwidth (Gain is 3 dB down from the gain at 100 KHz) Gain[1] Gain[2]	MHz MHz		120 700	
t_R	Rise Time, V_{OUT} = 1V_{p-p}: Gain[1] Gain[2]	ns ns		2.9 2.7	
t_{pd}	Propagation Delay, V_{OUT} = 1 Vp-p: Gain[1] Gain[2]	ns ns		2 1.2	
R_{IN}	Input Impedance: Gain[1] Gain[2]	kΩ kΩ	 50	4.0 180	
C_{IN}	Input Capacitance	pF		2	
I_{IO}	Input Offset Current	µA		0.4	5.0
I_B	Input Bias Current	µA		20	40
V_N	Input Noise Voltage, 10 k to 10 MHz	$\mu V_{r.m.s.}$		3	
V_I	Input Voltage Range	V	±1.0		
CMRR	Common Mode Rejection Ratio, Vcm = ±1 V, f ≤100 kHz Vcm = ±1 V, f = 5 MHz	dB dB	55 53	70 60	
SVRR	Supply Voltage Rejection Ratio, ΔV = ±0.5 V	dB	50	70	
$V_{O(off)}$	Output Offset Voltage, $V_{O(off)}$ = |OUT1 - OUT2| Gain[1] Gain[2]	 V 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	Vp-p	3.0	4.0	
I_{sink}	Output Sink Current	mA	2.5	3.6	

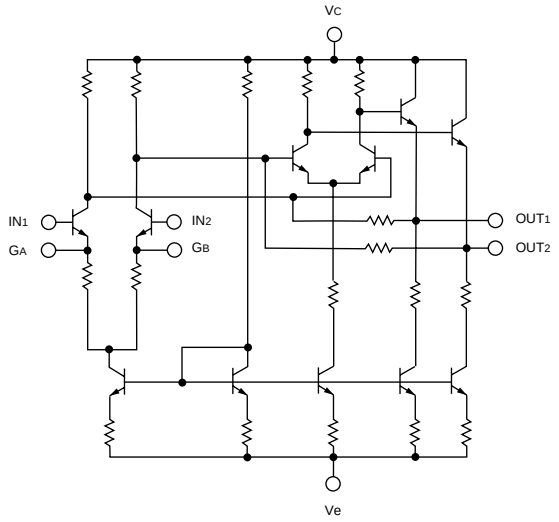
Notes:
1. Gain select pins GA and GB are connected together.
2. All gain select pins are open.
3. Insert adjustment resistor (0 to 10 kΩ) between GA and GB when variable gain is necessary.

ABSOLUTE MAXIMUM RATINGS[1] (T_A = 25°C)

SYMBOLS	PARAMETERS	UNITS	RATINGS
V_C–V_E	Voltage between V_C and V_E UPC1663G, GV	V	-0.3 to 14
P_T	Total Power Dissipation UPC1663G[2] UPC1663GV[3]	 mW mW	 280 200
V_{ID}	Differential Input Voltage	V	±5
V_{IN}	Input Voltage	V	±6
I_O	Output Current	mA	35
T_{OP}	Operating Temperature UPC1663G, UPC1663GV	 °C	 -45 to +75
T_{STG}	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 5 cm x 5 cm x 0.16 mm glass epoxy PCB (T_A = Max T_{OP}).
3. Mounted on 50 cm x 50 cm x 1.6 mm glass epoxy PCB with copper film (T_A = Max T_{OP}).

EQUIVALENT CIRCUIT



RECOMMENDED OPERATING CONDITIONS (T_A = 25°C)

SYMBOLS	CHARACTERISTICS	UNITS	MIN	TYP	MAX
V_C (1663G, GV)	Positive Supply Voltage	V	+2	+6	+6.5
Ve (1663G, GV)	Negative Supply Voltage	V	-2	-6	-6.5
I_O source	Source Current	mA			20
I_O sink	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.

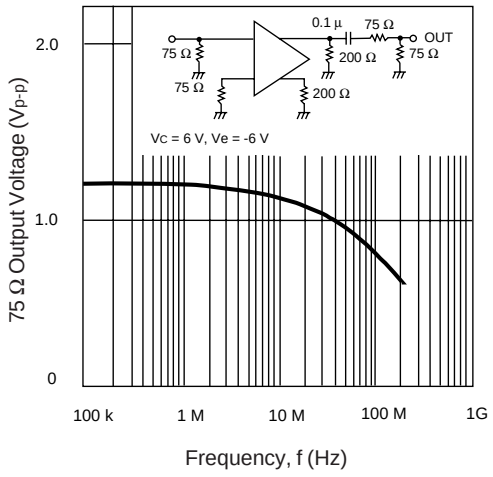
TYPICAL PERFORMANCE UNDER SINGLE SUPPLY +5 V OPERATION*

PARAMETER	CONDITIONS	TYPICAL	UNITS
Differential Gain Gain 1 Gain 2	15 MHz	 35 11	 dB dB
Bandwidth Gain 1 Gain 2	Gain is 3 dB down from the gain at 100 KHz	 106 115	 MHz MHz
Rise Time Gain 1	R_S = 50 Ω, V_{OUT} = 80 mV_{p-p}	 2.2	 ns
Propagation Delay Gain 1 Gain 2	 RS = 50 Ω, V_{OUT} = 80 mVp-p RS = 50 Ω, V_{OUT} = 60 mVp-p	 2.8 1.8	 ns ns
Phase Shift Gain 1 Gain 2	100 MHz	 -123 -93	 degree degree
Output Power R_A = 240 Ω R_A = 910 Ω R_A = 80 Ω	Z_L = 50 Ω, 15 MHz	 5.0 0 -11.5	 dBm dBm dBm

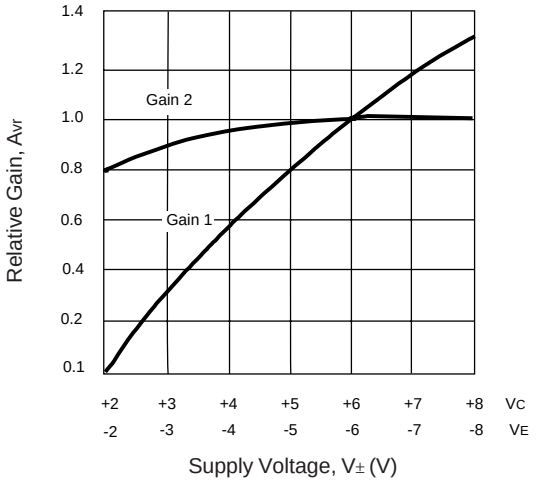
* See Application Circuit

TYPICAL PERFORMANCE CURVES (T_A = 25°C)

VIDEO LINE SINGLE ENDED OUTPUT VOLTAGE SWING vs. FREQUENCY

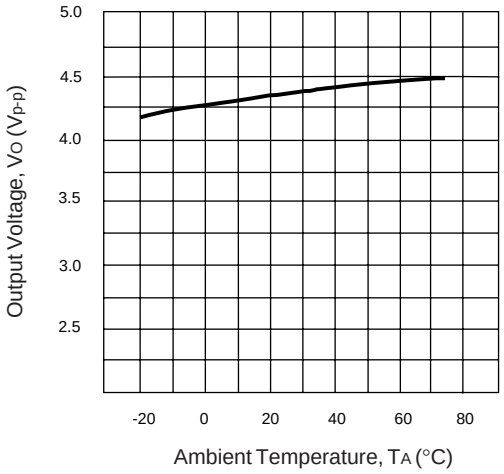


NORMALIZED VOLTAGE GAIN vs. SUPPLY VOLTAGE

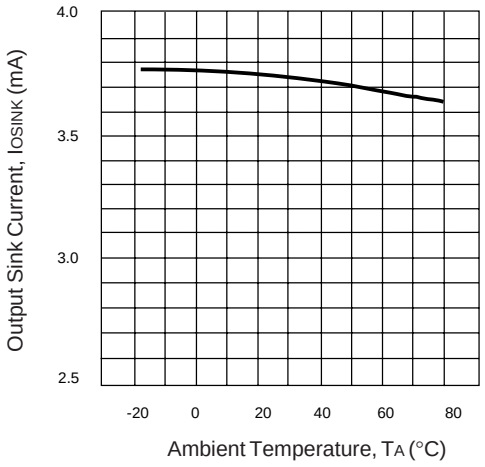


TYPICAL PERFORMANCE CURVES (T_A = 25°C)

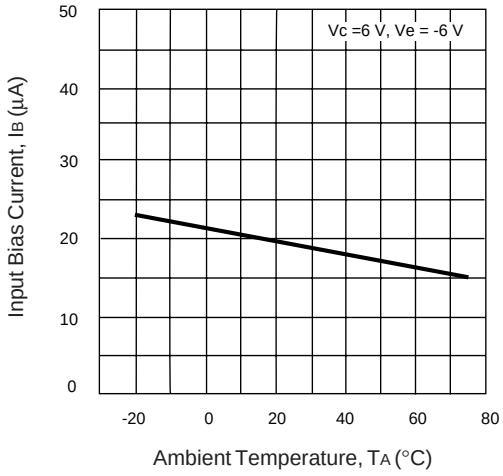
SINGLE ENDED OUTPUT VOLTAGE SWING vs. TEMPERATURE



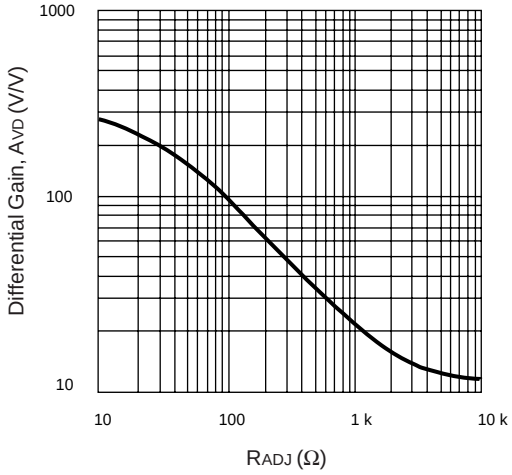
SINK CURRENT vs. TEMPERATURE



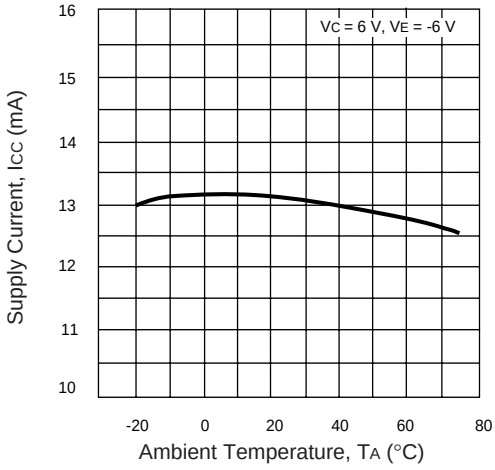
INPUT BIAS CURRENT vs. TEMPERATURE



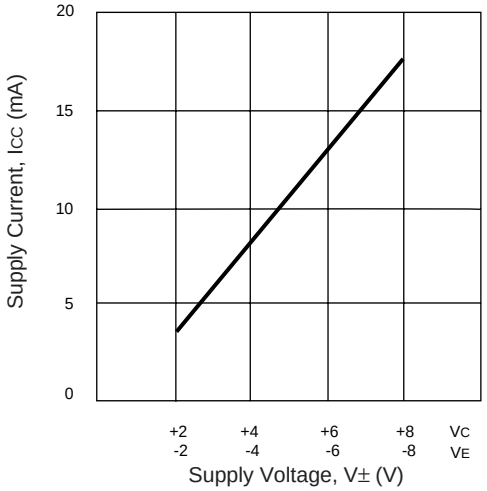
DIFFERENTIAL VOLTAGE GAIN vs. RESISTANCE BETWEEN G_A AND G_B



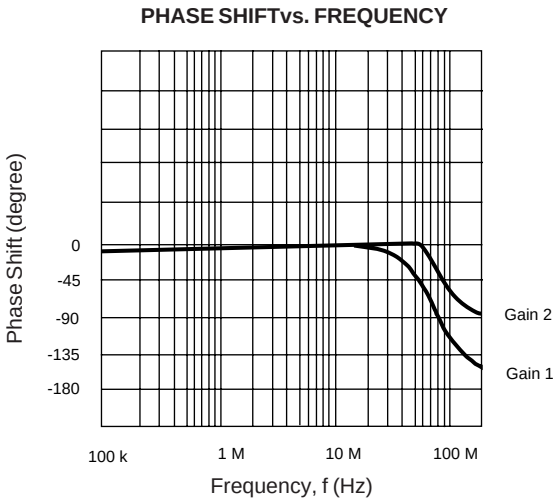
SUPPLY CURRENT vs. TEMPERATURE



SUPPLY CURRENT vs. SUPPLY VOLTAGE

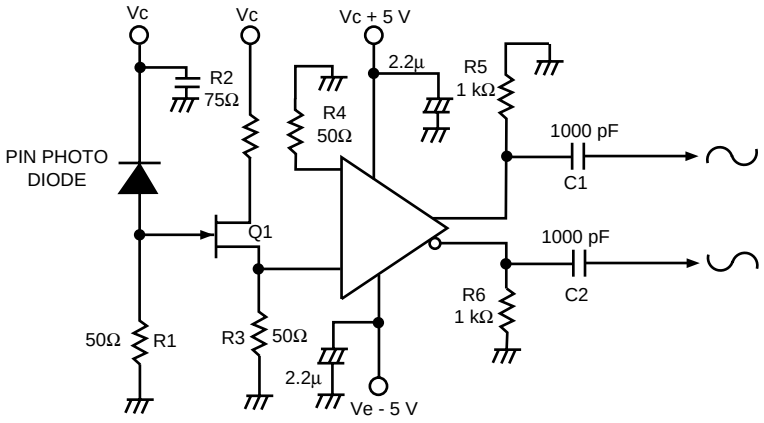


TYPICAL PERFORMANCE CURVES (T_A = 25°C)



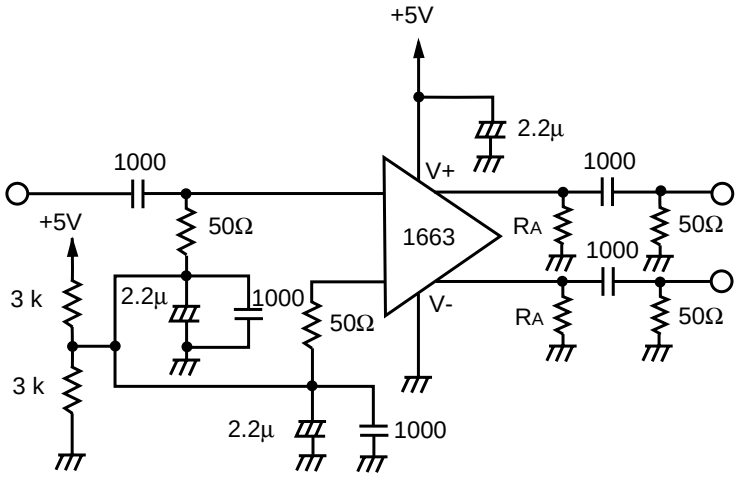
TYPICAL APPLICATIONS

• Photo Signal Detector



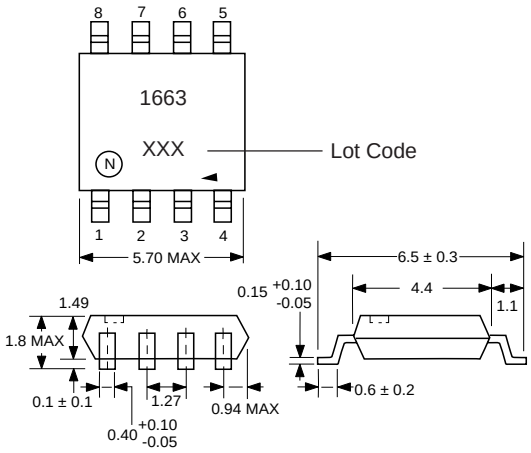
Since the input impedance of the IC falls when the gain rises, stable operation can be achieved by inserting a FET buffer when necessary as illustrated above.

• Application for +5 V Single Supply

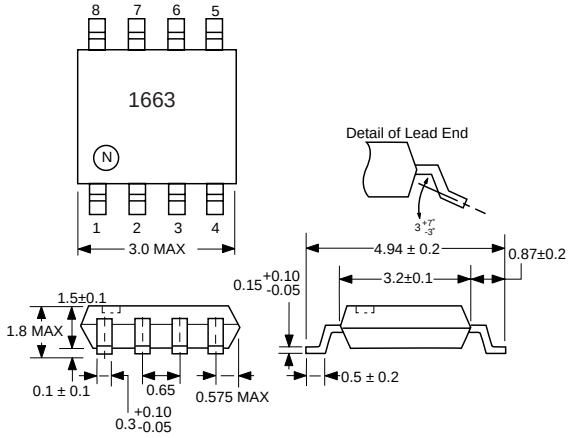


OUTLINE DIMENSIONS (Units in mm)

UPC1663G
PACKAGE OUTLINE G08



UPC1663GV
PACKAGE OUTLINE S08



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
UPC1663G-E1	2500/Reel
UPC1663GV-E1	1000/Reel

CONNECTION DIAGRAM (TOP VIEW)

UPC1663G, GV