DATA SHEET

NEC

BIPOLAR ANALOG INTEGRATED CIRCUIT

μPC1663

DC to VHF WIDEBAND DIFFERENTIAL INPUT AND OUTPUT AMPLIFIER IC

DESCRIPTION

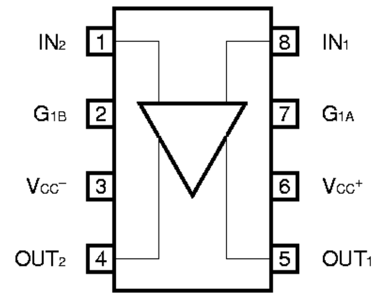
The μPC1663 is a differential input, differential output wideband amplifier IC that uses an high frequency (f_T = 6 GHz) silicon bipolar process (called NESAT™). This process improves bandwidth phase characteristics, input noise voltage characteristics, and low power consumption when compared to conventional HF-band differential amplifier ICs.

These features make this device suitable as a wideband amplifier in high-definition TVs, high-resolution monitors, broadcasting satellite receivers, and video cameras, as a sense amplifier in high-density CCD and optical pick-up products, or as a pulse amplifier for optical data links.

FEATURES

- Bandwidth and typical gain 120 MHz @ A_{VOL} = 300
  170 MHz @ A_{VOL} = 100
  700 MHz @ A_{VOL} = 10
- Phase delay –85 deg. @ A_{VOL} = 100, 100 MHz
- Circuit Current 13mA
- Gain adjustable from 10 to 300 with external resistor
- No frequency compensation required (Small phase delay at 10 MHz or less)

CONNECTION DIAGRAM (Top View)



ORDERING INFORMATION

Part Number	Package	Markings	Supplying Form
μPC1663C	8 pin plastic DIP (300 mil)	C1663C	Magazine case
μPC1663G-E1	8 pin plastic SOP (225 mil)	1663	Embossed tape 12 mm wide. QTY 2500p/reel. Pin 1 is in tape pull-out direction.
μPC1663GV-E1	8 pin plastic SSOP (175 mil)	1663	Embossed tape 8 mm wide. QTY 1000p/reel. Pin 1 is in tape pull-out direction.

Caution: Electro-static sensitive devices

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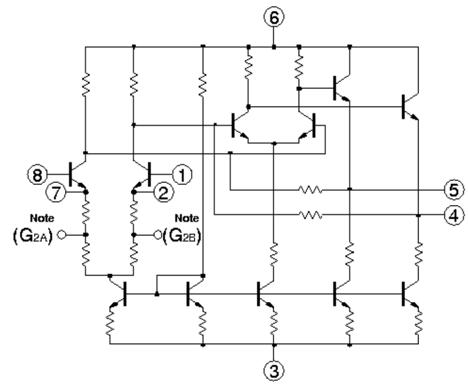
PIN EXPLANATIONS

Pin No.	Pin Name	In dual bias unit: V	In single bias unit: V	Functions and applications	Internal equivalent circuit
8 1	IN1 IN2	Pin voltage 0	Apply voltage $V_{CC}/2$	Input pin	
5 4	OUT1 OUT2	Pin voltage 0	Apply voltage $V_{CC}/2$	Output pin	
6	V_{CC}^+	G, GV ±2 to ±6.5	G, GV –0.3 to 14 C –0.3 to 16	Plus voltage supply pin. This pin should be connected with bypass capacitor to minimize AC impedance.	
2	V_{CC}^-	C ±2 to ±7	GND	Minus voltage supply pin. This pin should be connected with bypass capacitor to minimize AC impedance.	
7 2	G_{1A} G_{1B}	—	—	Gain adjustment pin. External resistor from 0 to 10 kΩ can be inserted between pin 2 and 7 to determine gain value.	Internal circuit constants should be referred to application note.

Note μPC1664 which had G_{2A}, G_{2B} of the other gain adjustment pins is discontinued.

ABSOLUTE MAXIMUM RATINGS (T_A = +25 °C)

PARAMETER	SYMBOL	μPC1663C	μPC1663G	μPC1663GV	UNIT
Supply Voltage	$V_{CC}^{\pm}$	±8	±7	±7	V
Power Dissipation	P_D	500 (T_A = +85 °C)Note	280 (T_A = 75 °C)Note 1	200Note 2	mW
Differential Input Voltage	V_{ID}	±5	±5	±5	V
Input Voltage	V_{ICM}	±6	±6	±6	V
Output Current	I_O	35	35	35	mA
Operating Temperature Range	T_A	–45 to +85	–45 to +75	–45 to +75	°C
Storage Temperature Range	T_{stg}	–55 to +150	–55 to +150	–55 to +150	°C

Note Mounted on double sided copper clad 50 × 50 × 1.6 mm epoxy glass PWB

RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
Supply Voltage	$V_{CC}^{\pm}$ (1663C)	±2	±6	±7	V
Supply Voltage	$V_{CC}^{\pm}$ (1663G, 1663GV)	±2	±6	±6.5	V
Source Current	$I_{O\ source}$			20	mA
Sink Current	$I_{O\ sink}$			2.5	mA
Frequency Range	f_{opt}	DC		200	MHz

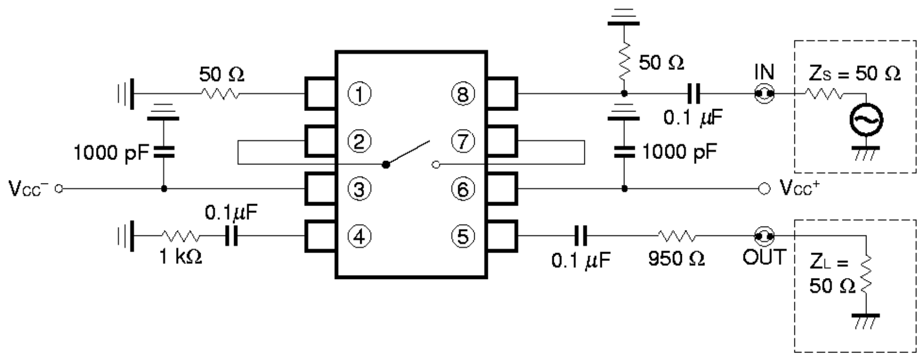
ELECTRICAL CHARACTERISTICS (T_A = +25 °C, $V_{CC}^{\pm}$ = ±6 V)

PARAMETER		SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Differential Voltage Gain	Gain 1	A_{vd}	**Note 1**	200	320	500	
	Gain 2		**Note 2**	8	10	12	
Bandwidth	Gain 1	BW	R_S = 50 Ω (3 dB down point)	—	120	—	MHz
	Gain 2			—	700	—	
Rise Time	Gain 1	t_r	R_S = 50 Ω, V_{out} = 1 V_{P-P}	—	2.9	—	ns
	Gain 2			—	2.7	—	
Propagation Delay	Gain 1	t_{pd}	R_S = 50 Ω, V_{out} 1 V_{P-P}	—	2	—	ns
	Gain 2			—	1.2	—	
Input Impedance	Gain 1	R_{in}		—	4.0	—	kΩ
	Gain 2			50	180	—	
Input Capacitance		C_{in}		—	2	—	pF
Input Offset Current		I_{IO}		—	0.4	5.0	μA
Input Bias Current		I_B		—	20	40	μA
Input Noise Voltage		V_n	R_S = 50 Ω, 10 k to 10 MHz	—	3	—	$\mu V_{r.m.s.}$
Input Voltage Range		V_I		±1.0	—	—	V
Common Mode Rejection Ratio	Gain 2	CMR	V_{cm} = ±1 V, f ≤ 100 kHz	53	94	—	dB
Supply Voltage Rejection Ratio		SVR	ΔV = ±0.5 V	50	70	—	dB
Output Offset Voltage	Gain 1	$V_{O(off)}$	$V_{O(off)}$ = |OUT_1 – OUT_2|	—	0.3	1.5	V
	Gain 2			—	0.1	1.0	
Output Common Mode Voltage		$V_{O(CM)}$		2.4	2.9	3.4	V
Output Voltage Swing		V_{OP-P}	Single-end	3.0	4.0	—	V_{P-P}
Output Sink Current		I_{sink}		2.5	3.6	—	mA
Power Supply Current		I_{CC}		—	13	20	mA

Notes 1. Gain select pins G_{1A} and G_{1B} are connected.

2. All gain select pins are opened.

TEST CIRCUIT

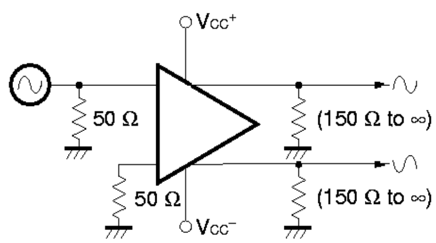


Remarks Measurement value at OUT connector should be converced into DUT's output value at pin 5.

Remarks Definition and test circuit of each characteristic should be referred to application note 'Usage of μPC1663 (Document No. G12290E)'.

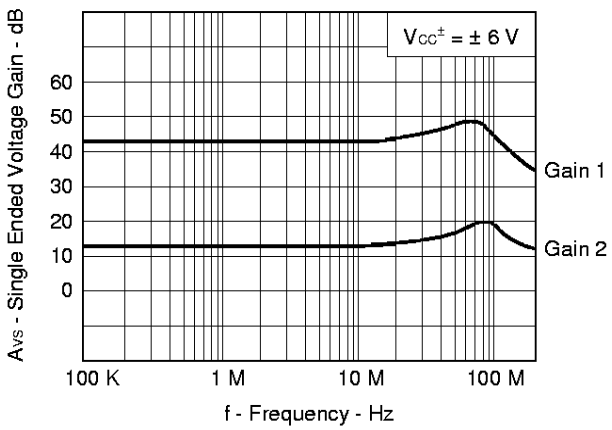
Caution 1. When gain between Gain 1 and Gain 2 is necessary, insert adjustment resistor (0 to 10 kΩ) between G_{1A} and G_{1B} to determine gain value.

2. 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.

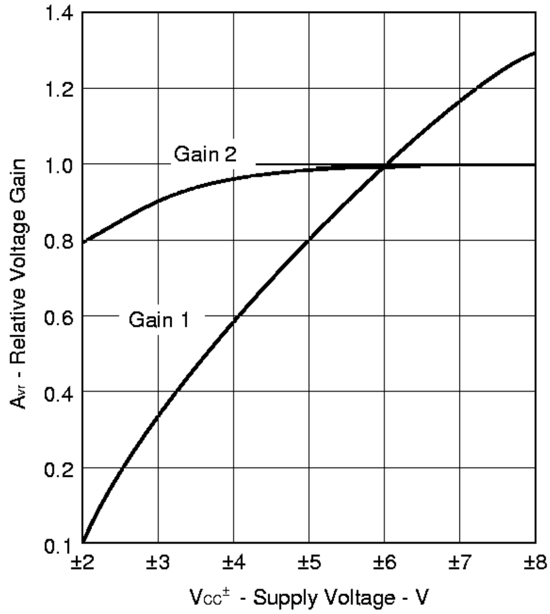


TYPICAL PERFORMANCE CHARACTERISTICS (Unless otherwise specified T_A = 25 °C)

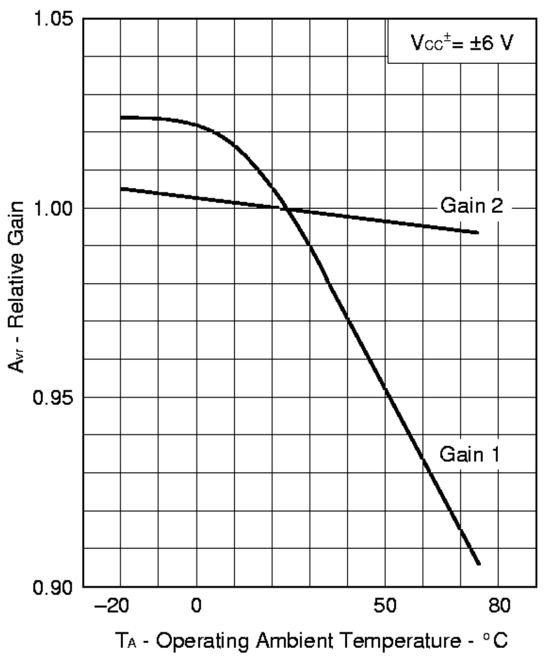
SINGLE ENDED VOLTAGE GAIN vs. FREQUENCY



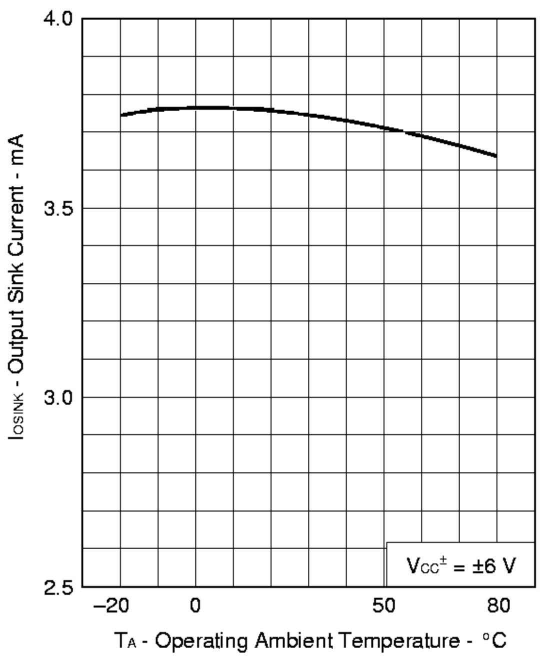
RELATIVE VOLTAGE GAIN vs. OPERATING AMBIENT TEMPERATURE



VOLTAGE GAIN

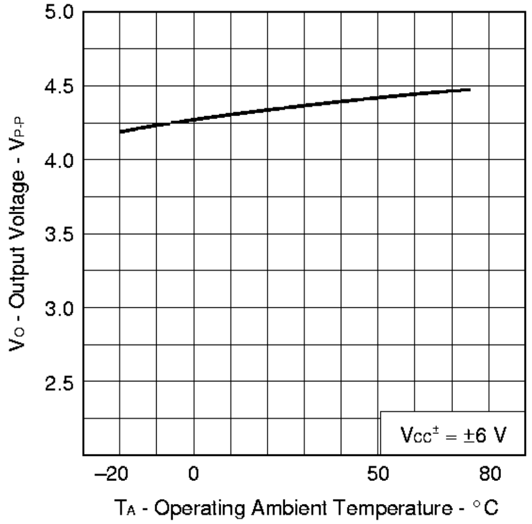


OUTPUT SINK CURRENT vs. OPERATING AMBIENT TEMPERATURE

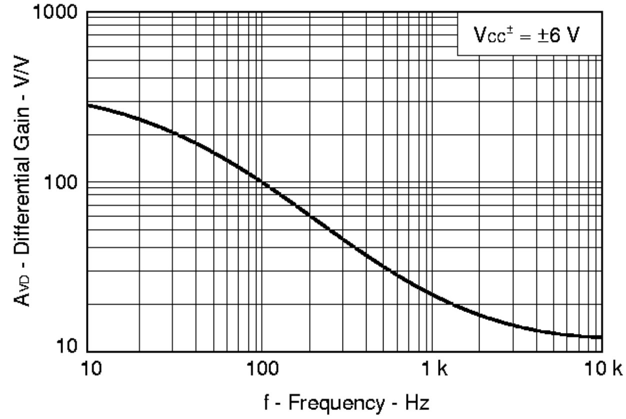


Remarks Relative voltage gains are described based on gains 1.00 at T_A = +25°C, $V_{CC}^{\pm}$ = ±6 V

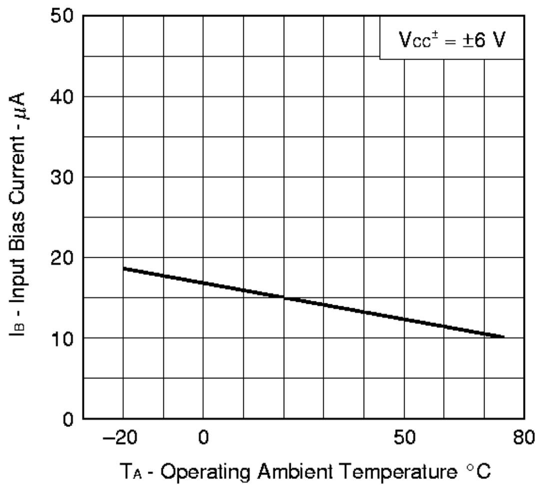
SINGLE ENDED OUTPUT VOLTAGE SWING vs. OPERATING AMBIENT TEMPERATURE



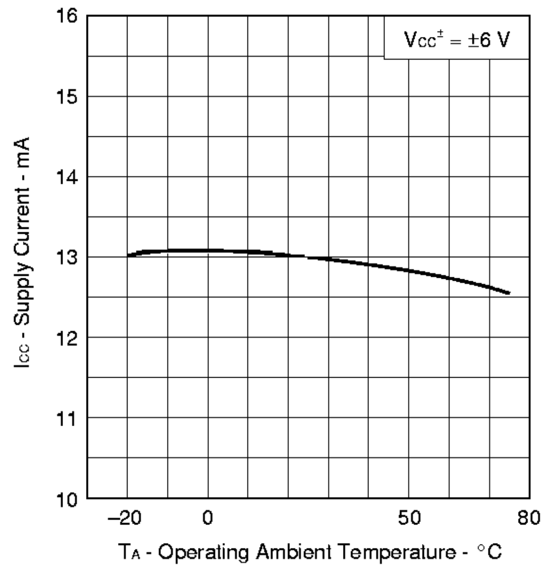
DIFFERENTIAL VOLTAGE GAIN



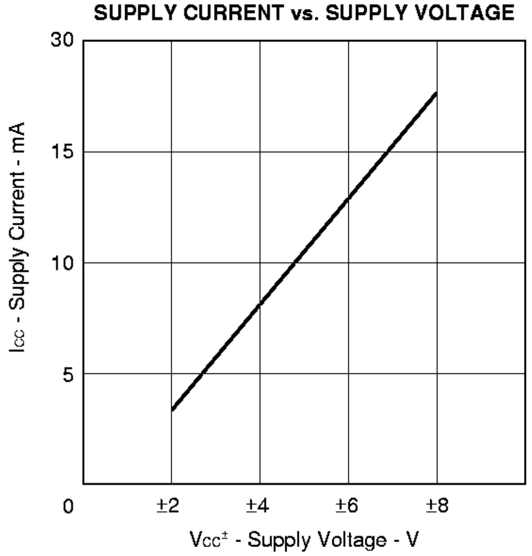
INPUT BIAS CURRENT vs. OPERATING AMBIENT TEMPERATURE



SUPPLY CURRENT vs. OPERATING AMBIENT TEMPERATURE



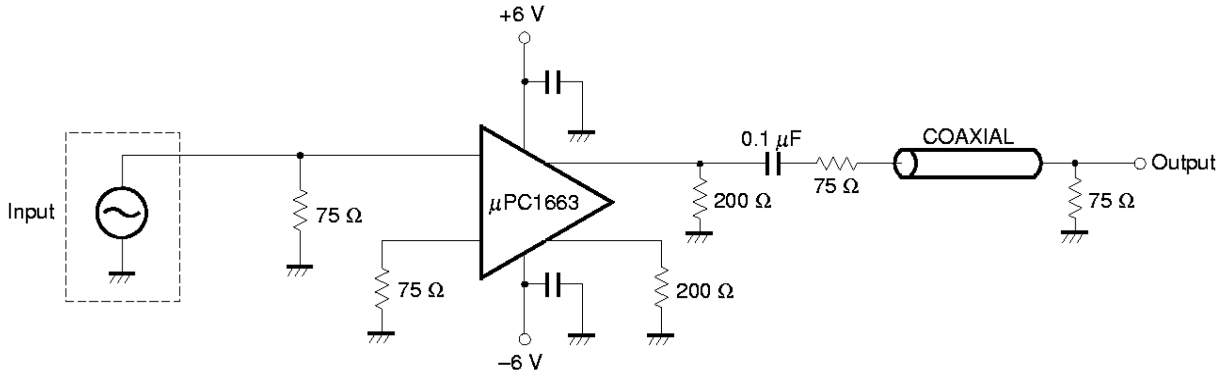
SUPPLY CURRENT vs. SUPPLY VOLTAGE



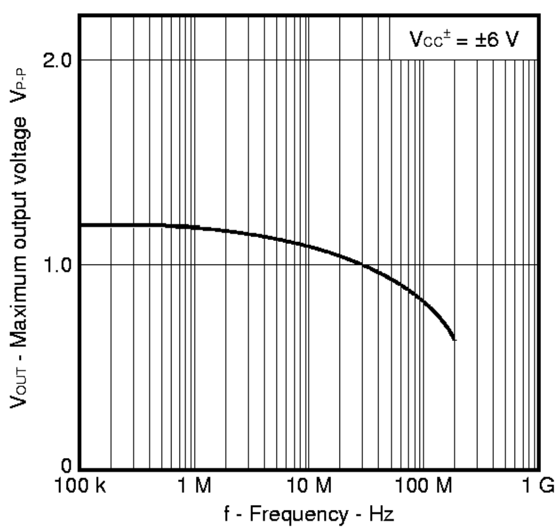
APPLICATION CIRCUIT EXAMPLES

EXAMPLE 1

Video Line Driver Circuit Example

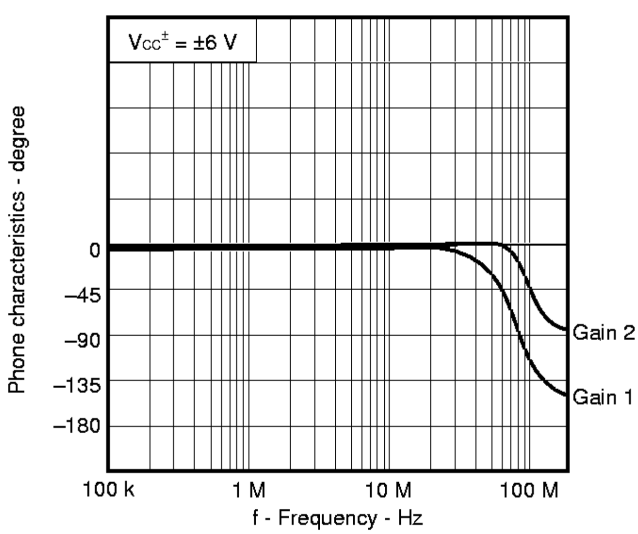


Maximum output voltage vs. Frequency (Video Line, Single Ended)



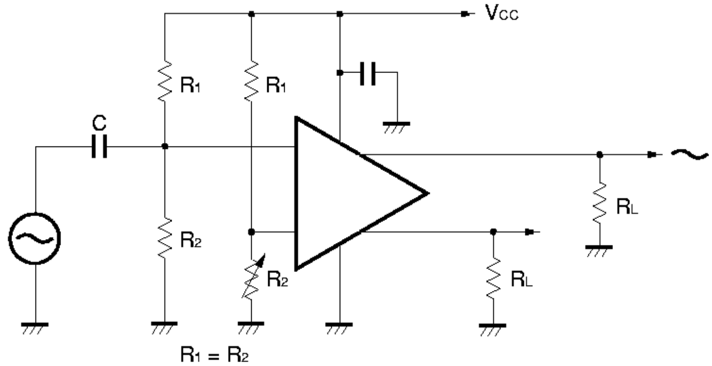
Remark
Differential output voltage is double of single ended output voltage.

Phase Characteristics vs. Frequency



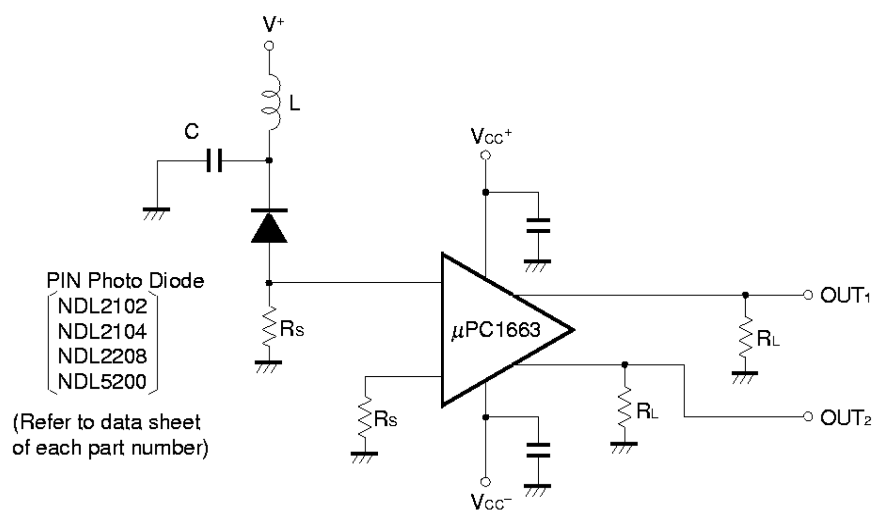
EXAMPLE 2

V_{CC} single supply application example (Outline)



EXAMPLE 3

Photo signal detector circuit example (Outline)



Caution When signal source impedance for μPC1663 is critical, FET source follower buffer should be inserted between PIN Photo diode and μPC1663 input

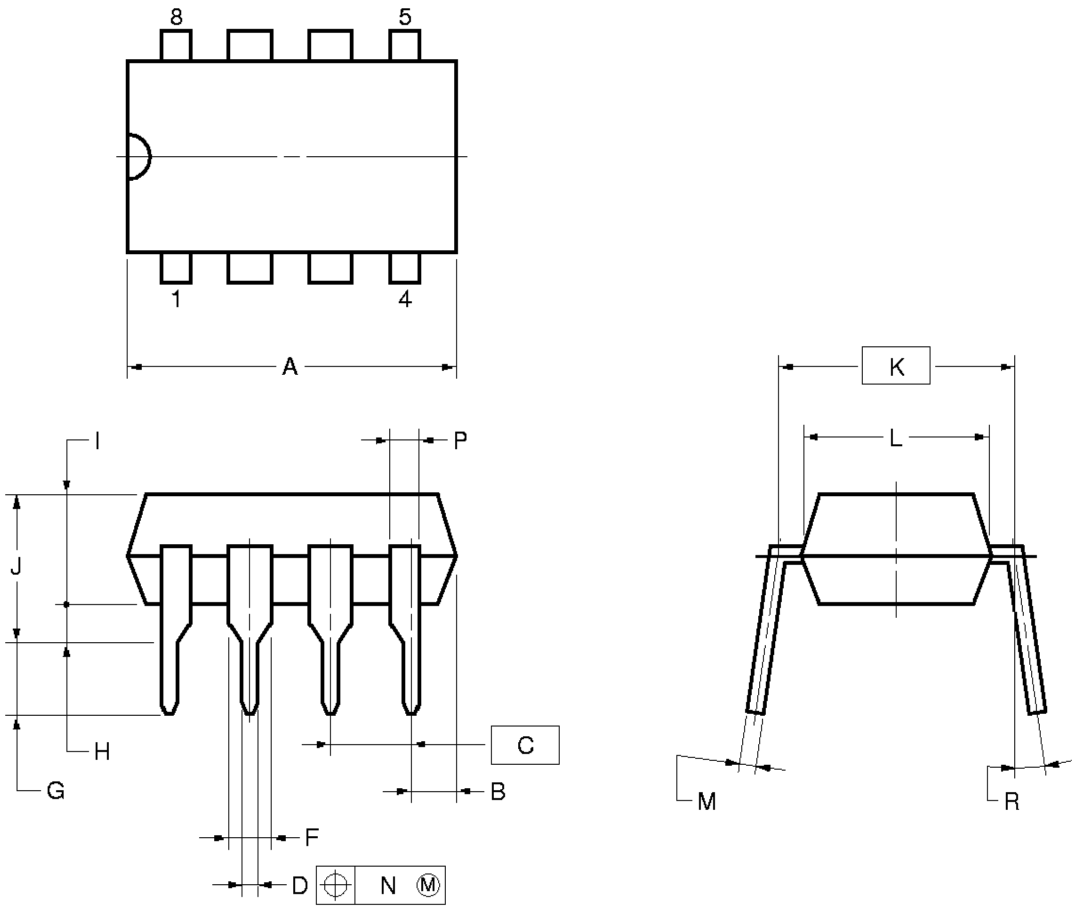
The application circuits and their parameters are for reference only and are not intended for use in actual design-ins.

Precautions for design in and detail application circuit examples should be referred to application note 'Usage to μPC1663 (Document No. G12290E)'.

PACKAGE DIMENSIONS (Unit: mm)

8PIN PLASTIC DIP (300 mil)

– μPC1663C–



NOTES

1) Each lead centerline is located within 0.25 mm (0.01 inch) of its true position (T.P.) at maximum material condition.

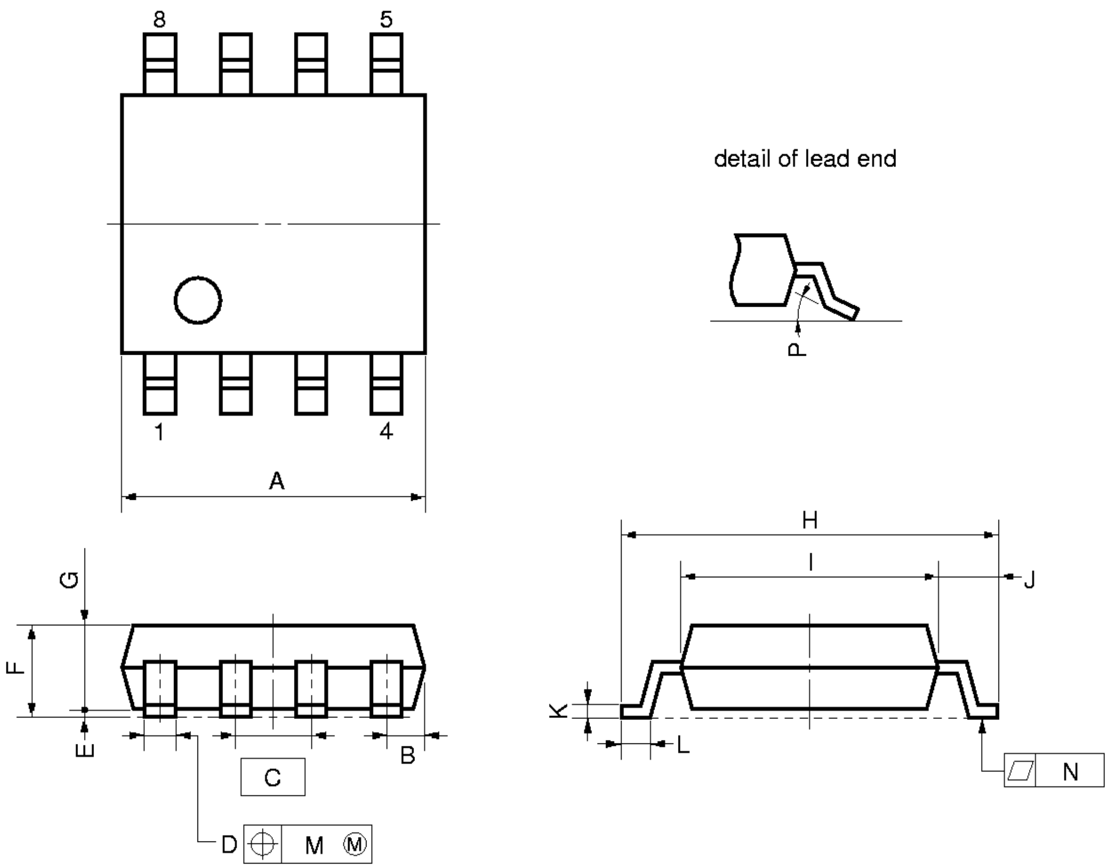
2) Item "K" to center of leads when formed parallel.

ITEM	MILLIMETERS	INCHES
A	10.16 MAX.	0.400 MAX.
B	1.27 MAX.	0.050 MAX.
C	2.54 (T.P.)	0.100 (T.P.)
D	0.50±0.10	$0.020^{+0.004}_{-0.005}$
F	1.4 MIN.	0.055 MIN.
G	3.2±0.3	0.126±0.012
H	0.51 MIN.	0.020 MIN.
I	4.31 MAX.	0.170 MAX.
J	5.08 MAX.	0.200 MAX.
K	7.62 (T.P.)	0.300 (T.P.)
L	6.4	0.252
M	$0.25^{+0.10}_{-0.05}$	$0.010^{+0.004}_{-0.003}$
N	0.25	0.01
P	0.9 MIN.	0.035 MIN.
R	0~15°	0~15°

P8C-100-300B,C-1

8 PIN PLASTIC SOP (225 mil)

– μPC1663C–



NOTE

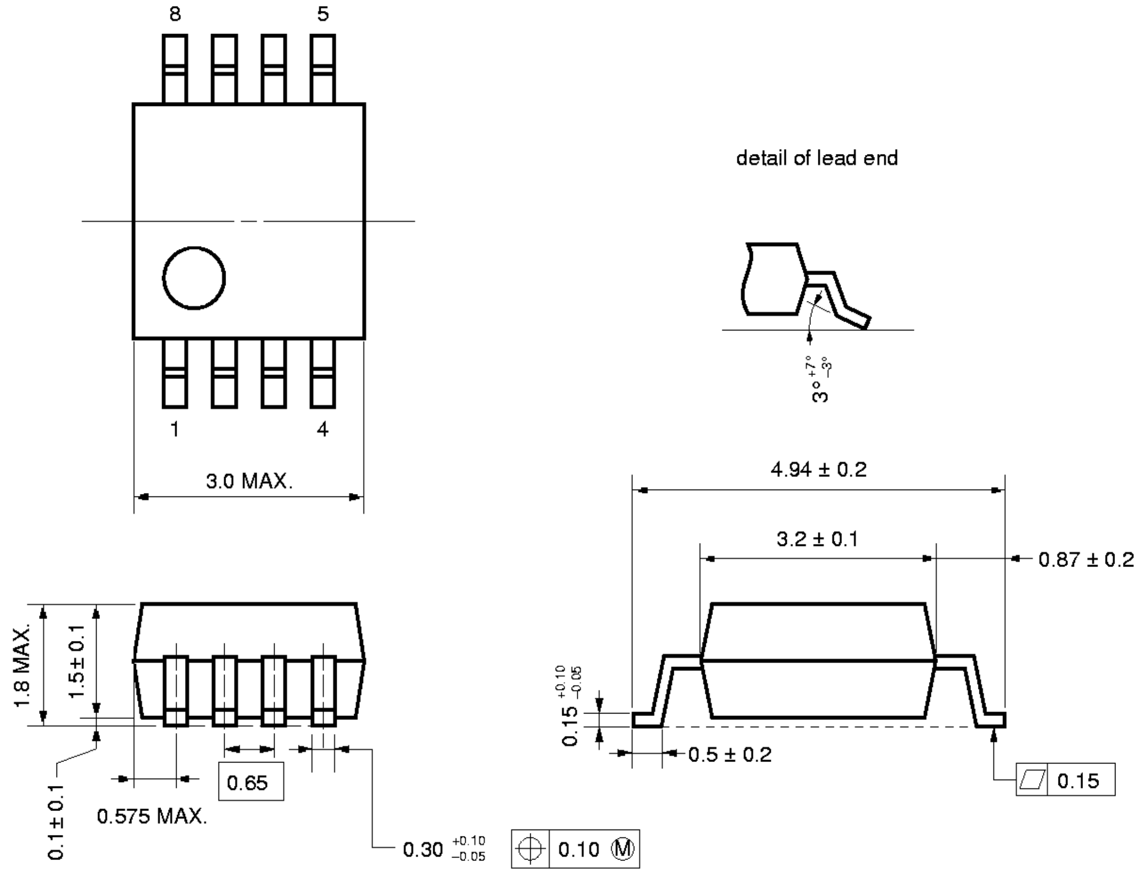
Each lead centerline is located within 0.12 mm (0.005 inch) of its true position (T.P.) at maximum material condition.

ITEM	MILLIMETERS	INCHES
A	5.37 MAX.	0.212 MAX.
B	0.78 MAX.	0.031 MAX.
C	1.27 (T.P.)	0.050 (T.P.)
D	$0.40^{+0.10}_{-0.05}$	$0.016^{+0.004}_{-0.003}$
E	0.1±0.1	0.004±0.004
F	1.8 MAX.	0.071 MAX.
G	1.49	0.059
H	6.5±0.3	0.256±0.012
I	4.4	0.173
J	1.1	0.043
K	$0.15^{+0.10}_{-0.05}$	$0.006^{+0.004}_{-0.002}$
L	0.6±0.2	$0.024^{+0.008}_{-0.009}$
M	0.12	0.005
N	0.10	0.004
P	$3°^{+7°}_{-3°}$	$3°^{+7°}_{-3°}$

S8GM-50-225B-4

8PIN PLASTIC DIP (175 mil)

– μPC1663GV–



RECOMMENDED SOLDERING CONDITIONS

The following conditions (see tables below) must be met when soldering this product.

Please consult with our sales offices in case other soldering process is used, or in case other soldering is done under different conditions.

Surface Mount Types

For more details, refer to our document “SEMICONDUCTOR DEVICE MOUNTING TECHNOLOGY MANUAL” (C10535E).

μPC1663G, μPC1663GV

Soldering method	Soldering conditions	Recommended condition symbol
Infrared ray reflow	Peak package’s surface temperature : 235 °C or below, Reflow time: 30 seconds or below (210 °C or higher), Number of reflow process: 3, Exposure limit[Note]: None	IR35-00-3
VPS	Peak package’s surface temperature : 215 °C or below, Reflow time: 40 seconds or below (200 °C or higher), Number of reflow process: 3, Exposure limit[Note]: None	VP15-00-3
Wave soldering	Solder temperature: 260 °C or below, Flow time: 10 seconds or below, Number of flow process: 1, Exposure limit[Note]: None	WS60-00-1
Partial heating method	Terminal temperature : 300 °C or below, Flow time: 3 seconds or below/pin, Exposure limit[Note]: None	

Note Exposure limit before soldering after dry-pack package is opened.
Storage conditions: 25 °C and relative humidity at 65 % or less.

Caution Do not apply more than a single process at once, except for “Partial heating method”.

Through Hole Mount Type

μPC1663C

Soldering method	Soldering conditions	Recommended condition symbol
Wave soldering	Solder temperature: 260 °C or below, Flow time: 10 seconds or below	
Partial heating method	Pin temperature : 300 °C or below, Flow time: 3 seconds or below/pin, Exposure limit[Note]: None	

[MEMO]

[MEMO]