UPC277G2, UPC393G2

Single Power Supply Dual Comparator

DESCRIPTION

UPC277, UPC393 are dual comparators designed to operate for a single power supply. The features include low-voltage operation, a common-mode input voltage that range from V^- (GND) level, an open collector output, and low current consumption. Furthermore, these products can operate on a split power supply and used widely for various voltage comparison application.

Depending on the usage and operating ambient temperature range, the UPC277 is design for communication industries and UPC393 is design for general purposes.

In addition, compatible DC parameter selection for the comparators also available.

Along with this series of lineup, the quad type comparators, UPC177 and UPC339 with the same circuit configuration are also available.

FEATURES

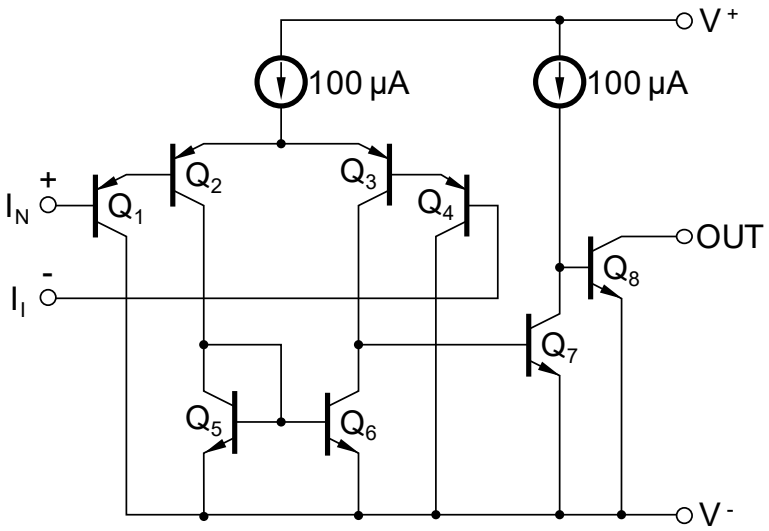
- Input Offset Voltage ±2 mV (TYP.)
- Input Bias Current 25 nA (TYP.)
- Voltage Gain 200000 (TYP.)
- Pulse Response Time 1.3 µs (TYP.)
- Output Sink Current 16 mA (TYP.)
- A wired OR is possible as the output is an open collector.
- Low Voltage Operation $V^+ - V^-$: 2 ~ 32 V

ORDERING INFORMATION

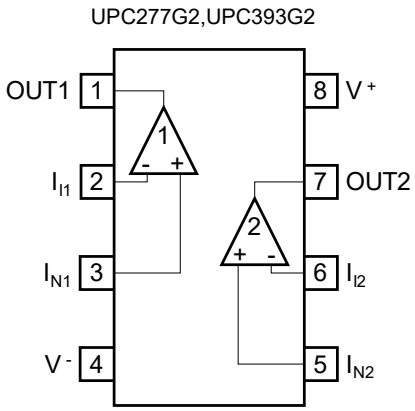
Order Name (1)	Selected Grade	Package
UPC277G2-AP	Standard	8-pin plastic SOP (5.72 mm (225))
UPC277G2(5)-AP	DC parameter selection	8-pin plastic SOP (5.72 mm (225))
UPC393G2-AP	Standard	8-pin plastic SOP (5.72 mm (225))
UPC393G2(5)-AP	DC parameter selection	8-pin plastic SOP (5.72 mm (225))

(1) Order names containing E1 or E2 indicate that the packaging format is embossed taping.
Pin 1 of E1 is on draw-out side, and pin 1 of E2 is at take-up side.

EQUIVALENT CIRCUIT (1/2 CIRCUIT)



PIN CONFIGURATION (Marking side)



ABSOLUTE MAXIMUM RATINGS (T_A = 25 °C)

Parameter	Symbol	UPC277G2, UPC277G2(5)	UPC393G2, UPC393G2(5)	Unit
Power Supply Voltage Note1	$V^+ - V^-$	-0.3 ~ +36		V
Differential Input Voltage	V_{ID}	±36		V
Input Voltage Note 2	V_I	V^- -0.3 ~ V^- +36		V
Output Applied Voltage Note 3	V_O	V^- -0.3 ~ V^- +36		V
Total Power Dissipation Note 4	P_T	440		mW
Output Short Circuit Duration (vs. GND) Note 5	t_S	Indefinite		s
Operating Ambient Temperature	T_A	-40 ~ +85	-20 ~ +80	°C
Storage Temperature	T_{stg}	-55 ~ +125		°C

【Note】 1. Note that reverse connections of the power supply may damage the ICs.

2. The allowable input voltage range without damaging or destructing the device. Independent to power supply voltage range.
   Do not apply voltage of V^- (GND) - 0.3 V or less.
   Note that the comparator will operate normally when the input voltage applied is within the common mode input voltage range.
3. The input voltage range that can be applied to the output pin externally without deteriorating or damaging the device characteristic. The permitted input voltage that can be applied regardless of the power supply voltage. This specification also includes precaution during transition state such as ON/OFF, etc.
4. Power dissipation value when $T_A \leq$ + 25 °C. For T_A > 25 ˚C, de-rate at -4.4 mW/°C
5. Do not exceed the total power dissipation and de-rating rate in note 4.

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Power Supply Voltage (Dual Supply)	$V^{\pm}$	±1		±16	V
Power Supply Voltage (V^- = GND)	V^+	+2		+32	V

ELECTRICAL CHARACTERISTICS

UPC277G2, UPC393G2 (T_A = 25 °C, V^+ = +5 V, V^- = GND)

Parameter	Symbol	MIN.	TYP.	MAX.	Unit	Test Condition
Input Offset Voltage	V_{IO}		±2	±5	mV	V_O = 1.4 V, V_{REF} = 1.4 V, R_S = 0 Ω
Input Offset Current	I_{IO}		±5	±50	nA	V_O ≒ 1.4 V
Input Bias Current Note 6	I_B		25	250	nA	V_O ≒ 1.4 V
Large Signal Voltage Gain	A_V		200000			R_L = 15 kΩ
Circuit Current Note 7	I_{CC}		0.6	1	mA	R_L = ∞, I_O = 0 A
Common Mode Input Voltage Range	V_{ICM}	0		V^+ -1.5	V	
Output Saturation Voltage	V_{OL}		0.2	0.4	V	$V_{I(-)}$ = +1 V, $V_{I(+)}$ = 0 V, $I_{O\ SINK}$ = 4 mA
Output Sink Current	$I_{O\ SINK}$	6	16		mA	$V_{I(-)}$ = +1 V, $V_{I(+)}$ = 0 V, V_O ≤ 1.5 V
Output Leakage Current	$I_{O\ LEAK}$		0.1		nA	$V_{I(+)}$ = +1 V, $V_{I(-)}$ = 0 V, V_O = 5 V
Pulse Response Time Note 8			1.3		μs	R_L = 5.1 kΩ, V_{RL} = 5 V

UPC277G2(5), UPC393G2(5) (T_A = 25 °C, V^+ = +5 V, V^- = GND)

Parameter	Symbol	MIN.	TYP.	MAX.	Unit	Test Condition
Input Offset Voltage	V_{IO}		±2	±2.5	mV	V_O = 1.4 V, V_{REF} = 1.4 V, R_S = 0 Ω
Input Offset Current	I_{IO}		±5	±50	nA	V_O ≒ 1.4 V
Input Bias Current Note 6	I_B		25	60	nA	V_O ≒ 1.4 V
Large Signal Voltage Gain	A_V		200000			R_L = 15 kΩ
Circuit Current Note 7	I_{CC}		0.6	0.8	mA	R_L = ∞, I_O = 0 A
Common Mode Input Voltage Range	V_{ICM}	0		V^+ -1.4	V	
Output Saturation Voltage	V_{OL1}			0.2	V	$V_{I(-)}$ = +1 V, $V_{I(+)}$ = 0 V, $I_{O\ SINK}$ = 4 mA
	V_{OL2}			1.5	V	$V_{I(-)}$ = +1 V, $V_{I(+)}$ = 0 V, $I_{O\ SINK}$ = 10 mA
Output Sink Current	$I_{O\ SINK}$	10	16		mA	$V_{I(-)}$ = +1 V, $V_{I(+)}$ = 0 V, V_O ≤ 1.5 V
Output Leakage Current	$I_{O\ LEAK}$		0.1	100	nA	$V_{I(+)}$ = +1 V, $V_{I(-)}$ = 0 V, V_O = 5 V
Response Time Note 8			1.3		μs	R_L = 5.1 kΩ, V_{RL} = 5 V

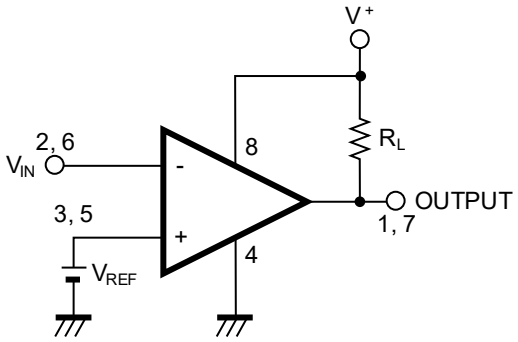
【Note】 6. The current flow direction of the input bias is out from the IC because the first stage of the IC composed of PNP transistor.
The current value is the value when the differential amplified circuit of the input stage is balanced.
When the comparator is active, twice the amount of current will flow to the pin with lower potential.

7. Current flowing through the internal circuit. This current flow regardless of the channel used.

8. Values when the input amplitude is 100 mV and the overdrive is 5 mV.
Increasing the overdrive can shorten the response time.

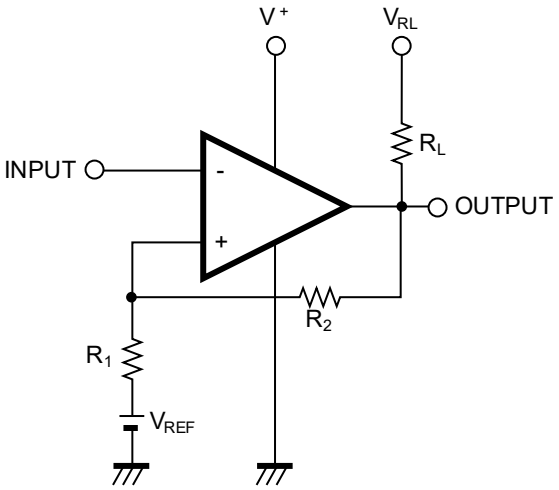
TYPICAL APPLICATION CIRCUIT EXAMPLE

EXAMPLE 1



V_{REF} : V^- ~ V^+ -1.5 [V]

EXAMPLE 2 (With Hysteresis)



- Threshold Voltage

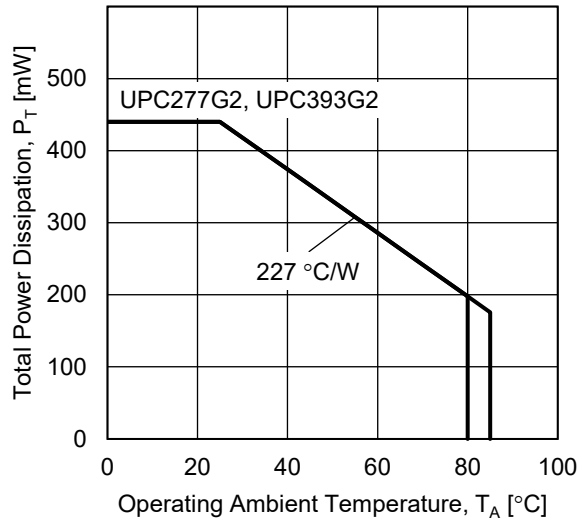
$$V_{TH\ (High)} \fallingdotseq V_{REF} + \frac{R_1}{R_L + R_2 + R_1}(V_{RL} - V_{REF})$$

$$V_{TH\ (Low)} \fallingdotseq V_{REF} - \frac{R_1}{R_1 + R_2}(V_{REF} - V_{OL})$$

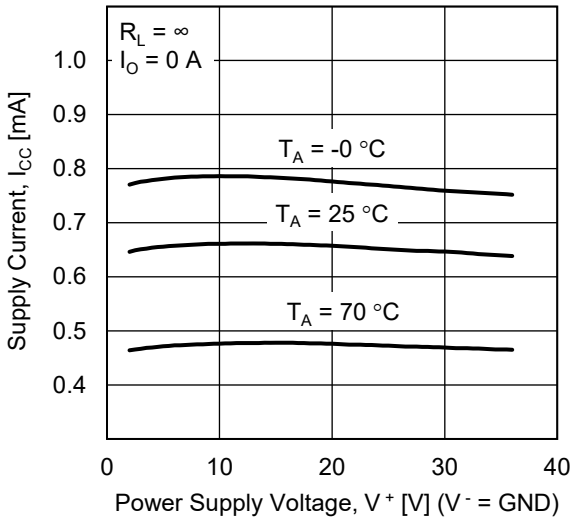
($V_{RL} > V_{REF} > V_{OL}$)

TYPICAL PERFORMANCE CHARACTERISTICS (T_A = 25 °C, TYP.) (Reference value)

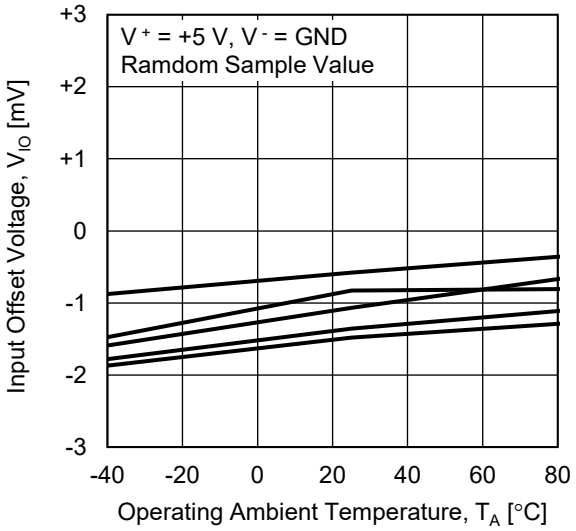
P_T - T_A (Absolute Maximum Ratings)



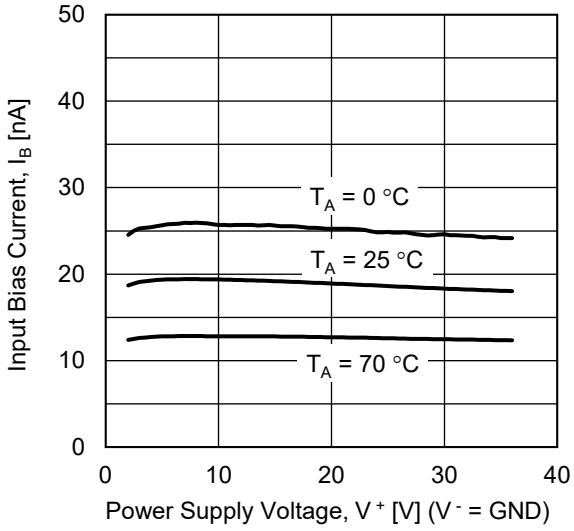
I_{CC} - V^+



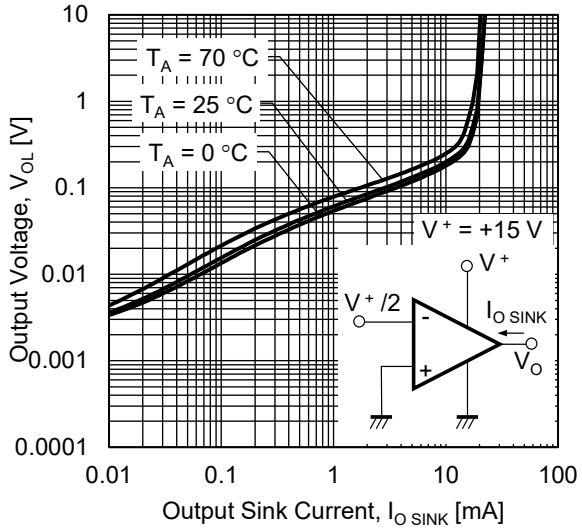
V_{IO} - T_A



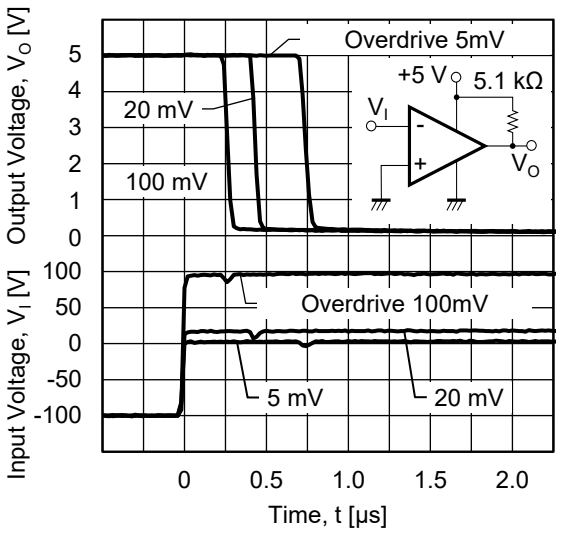
I_B - V^+



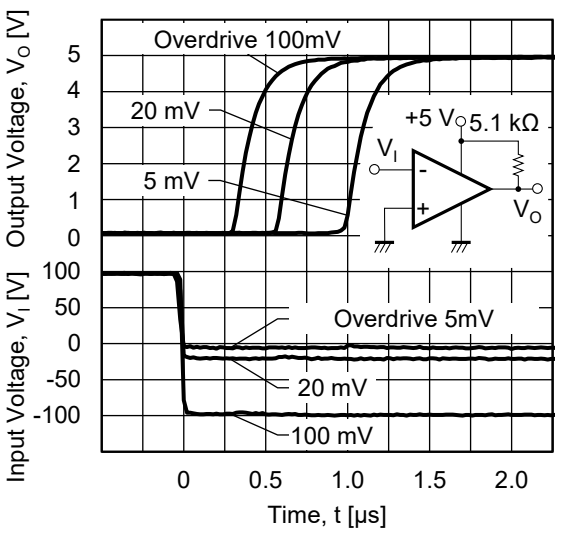
V_{OL} - $I_{O\ SINK}$



Pulse Response Characteristic I



Pulse Response Characteristic II

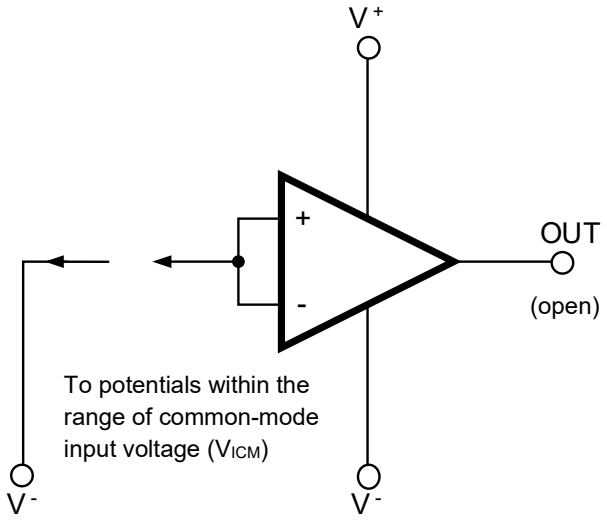


USE WITH PRECAUTIONS

- **Managing unused circuits**

If there is an unused circuit, the following connection is recommended.

Process example of unused circuits



- **Ratings of input/output pin voltage**

When the voltage of input/output pin exceeds the absolute maximum rating, the parasitic diode within the IC may conduct, causing characteristics degradation or damage. In addition, if the input pin is lower than V^-, or the output pin exceeds the power supply voltage, it is recommended to make a clamping circuit using a diode with low forward voltage (e.g.: Schottky diode) as protection.

- **Range of common-mode input voltage**

When the supply voltage does not meet the condition of electrical characteristics, the range of common-mode input voltage is as follows.

V_{ICM} (TYP.): V^- ~ V^+ -1.5 [V] (T_A = 25 °C)

During designing, do include some tolerance by considering temperature characteristics etc.

- **Range of input current**

The “Input Bias Current [I_B]” specified in the electric characteristic table, is the average current value flowing to the +input pin [I_N] and the - input pin [I_I] when the operation amplifier input stage are balanced (in a state where negative feedback is applied).
When the comparator is active, the input stage of the differential amplified circuit will not be balance during comparison, the amount of input current flow is twice the amount to the pin with lower potential.

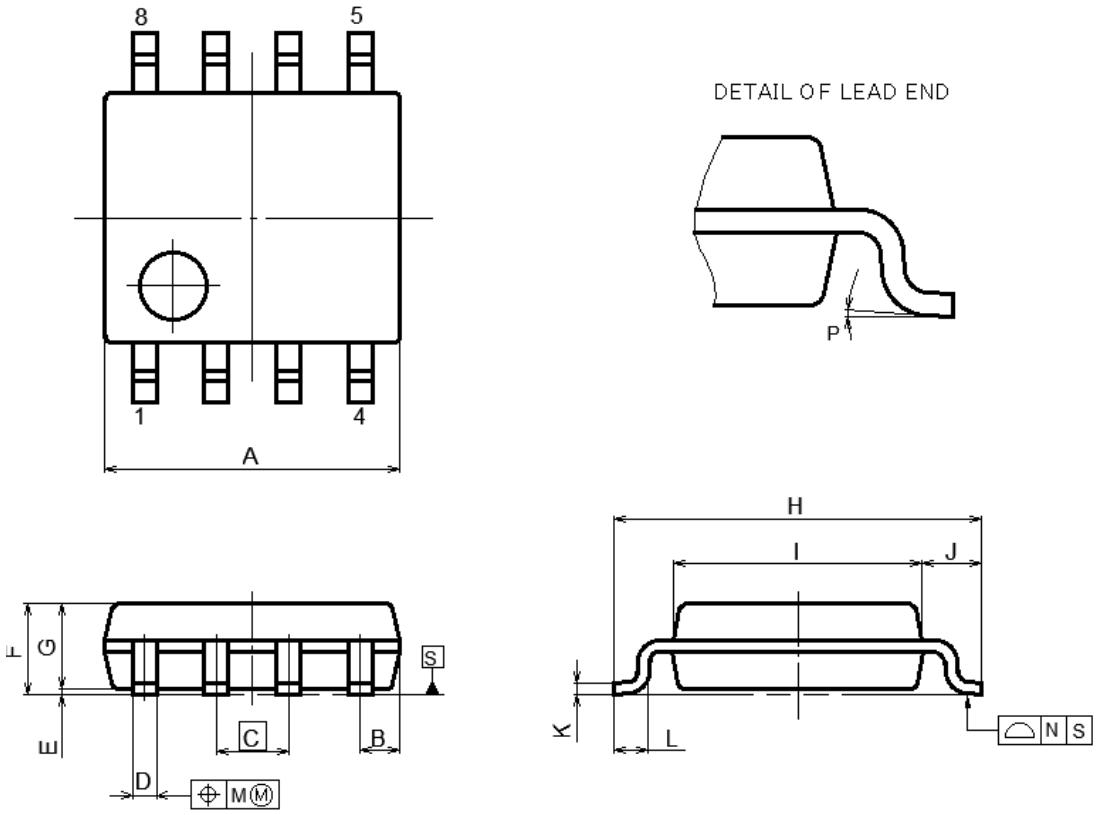
- **Handling of ICs**

When stress is added to the ICs due to warpage or bending of a board, the characteristic may fluctuates due to piezoelectric effect. Therefore, pay attention to warpage or bending of a board.

PACKAGE DRAWINGS

8-PIN PLASTIC SOP

JEITA Package code	RENESAS code	MASS (TYP.) [g]
P-LSOP8-4.4×5.2-1.27	PLSP0008DE-A	0.09[g]



NOTE
EACH LEAD CENTERLINE IS LOCATED WITHIN 0.12 MM OF
ITS TRUE POSITION(T.P.) AT MAXIMUM MATERIAL CONDITION.

(UNIT:mm)

ITEM	DIMENSIONS
A	5.2±0.17
B	0.78MAX
C	1.27(T.P)
D	0.40±0.05
E	0.1±0.1
F	1.59±0.21
G	1.49
H	6.5±0.3
I	4.4±0.1
J	1.05±0.15
K	0.2±0.07
L	0.6±0.20
M	0.1MAX
N	0.1MAX
P	4°±4°

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