

## RS-232 LINE DRIVER/RECEIVER AT 3.3 V/5 V

The  $\mu$ PD4721 is a high-breakdown voltage silicon gate CMOS line driver/receiver based on the EIA/TIA-232-E standard. The internal DC/DC converter can switch between multiple voltages, realizing the allowing it to operate with a single +3.3 V or +5 V power supply. It also provides standby function.

This IC incorporates 2 driver circuits and 2 receiver circuits. An RS-232 interface circuit can be easily configured by connecting 5 capacitors externally.

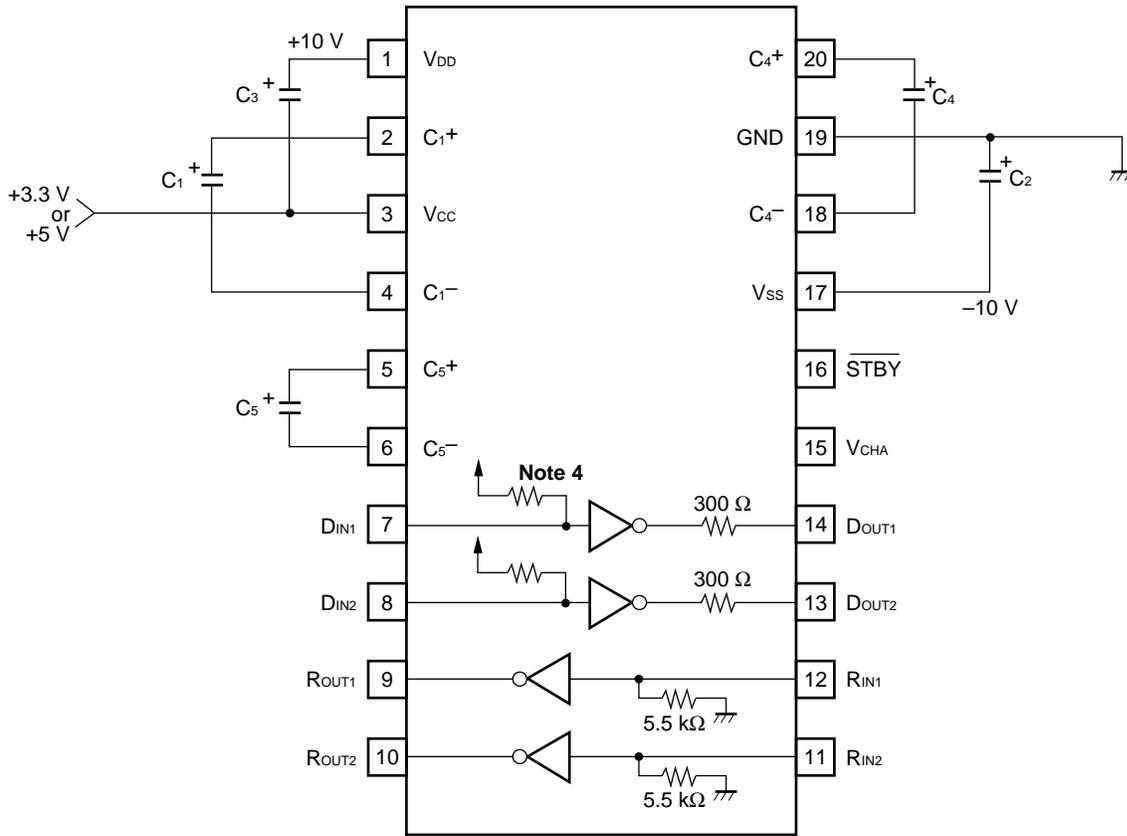
### FEATURES

- Conforms to EIA/TIA-232-E (former name, RS-232C) standards
- Selectable +3.3 V/+5 V single power supply (selected by V<sub>CHA</sub> pin)
- By setting the standby pin to a low level (standby mode), circuit current can be reduced. At such times, the driver output is in a high-impedance state.

### ORDERING INFORMATION

Part number	Package
$\mu$ PD4721GS-GJG	20-pin plastic SSOP (300 mil)

BLOCK DIAGRAM/PIN CONFIGURATION (Top View)



- Note 1.** V<sub>DD</sub> and V<sub>SS</sub> are output pins stepped up internally. These pins should not be loaded directly.
- 2.** Capacitors C<sub>1</sub> to C<sub>5</sub> with a breakdown voltage of 20 V or higher are recommended. And it is recommended to insert the capacitor that is 0.1 μF to 1 μF between V<sub>CC</sub> and GND.
- 3.** If V<sub>CHA</sub> is kept low level (in 5 V mode), capacitor C<sub>5</sub> is not necessary.
- 4.** The pull-up resistors at driver input are active resistors.

**Truth Table**

**Driver**

$\overline{\text{STBY}}$	D <sub>IN</sub>	D <sub>OUT</sub>	Remarks
L	×	Z	Standby mode (DC/DC converter is stopped)
H	L	H	Space level output
H	H	L	Mark level output

**Receiver**

$\overline{\text{STBY}}$	R <sub>IN</sub>	R <sub>OUT</sub>	Remarks
L	×	H	Standby mode (DC/DC converter is stopped)
H	L	H	Mark level input
H	H	L	Space level input

**3 V ↔ 5 V switching** Note 5

V <sub>CHA</sub>	Operating mode
L	5 V mode (double step-up)
H	3 V mode (3 times step-up)

H: high-level, L: low-level, Z: high-impedance, ×: H or L

**Note 5.** When switching V<sub>CHA</sub>, standby mode must be selected ( $\overline{\text{STBY}} = \text{L}$ ).

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

Parameter	Symbol	Ratings	Unit
Supply Voltage (V <sub>CHA</sub> = L)	V <sub>CC</sub>	-0.5 to +7.0	V
Supply Voltage (V <sub>CHA</sub> = H)	V <sub>CC</sub>	-0.5 to +4.5	V
Driver Input Voltage	D <sub>IN</sub>	-0.5 to V <sub>CC</sub> +0.5	V
Receiver Input Voltage	R <sub>IN</sub>	-30.0 to +30.0	V
Control Input Voltage ( $\overline{\text{STBY}}$ , V <sub>CHA</sub> )	V <sub>IN</sub>	-0.5 to V <sub>CC</sub> +0.5	V
Driver Output Voltage	D <sub>OUT</sub>	-25.0 to +25.0 <b>Note 6</b>	V
Receiver Output Voltage	R <sub>OUT</sub>	-0.5 to V <sub>CC</sub> +0.5	V
Input Current (D <sub>IN</sub> , $\overline{\text{STBY}}$ , V <sub>CHA</sub> )	I <sub>IN</sub>	±20.0	mA
Operating Ambient Temperature	T <sub>A</sub>	-40 to +85	°C
Storage Temperature	T <sub>stg</sub>	-55 to +150	°C
Total Power Dissipation	P <sub>T</sub>	0.5	W

**Note 6.** Pulse width = 1 ms, duty = 10 % MAX.

**RECOMMENDED OPERATING CONDITIONS**

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage (V <sub>CHA</sub> = L, 5 V mode)	V <sub>CC</sub>	4.5	5.0	5.5	V
Supply Voltage (V <sub>CHA</sub> = H, 3 V mode)	V <sub>CC</sub>	3.0	3.3	3.6	V
High-Level Input Voltage (D <sub>IN</sub> )	V <sub>IH</sub>	2.0		V <sub>CC</sub>	V
Low-Level Input Voltage (D <sub>IN</sub> )	V <sub>IL</sub>	0		0.8	V
High-Level Input Voltage ( $\overline{\text{STBY}}$ , V <sub>CHA</sub> )	V <sub>IH</sub>	2.4		V <sub>CC</sub>	V
Low-Level Input Voltage ( $\overline{\text{STBY}}$ , V <sub>CHA</sub> )	V <sub>IL</sub>	0		0.6	V
Receiver Input Voltage	R <sub>IN</sub>	-30		+30	V
Operating Ambient Temperature	T <sub>A</sub>	-40		+85	°C
Capacitance of External Capacitor	<b>Note 7</b>	0.33		4.7	μF

**Note 7.** In low temperature (below 0 °C), the capacitance of electrolytic capacitor becomes lower. Therefore, set higher values when using in low temperature.

Concerning the wiring length between the capacitor and the IC, the shorter the better.

Capacitors with good frequency characteristics such as tantalum capacitors, laminated ceramic capacitors, and aluminum electrolytic capacitors for switching power supply are recommended for the external capacitors.

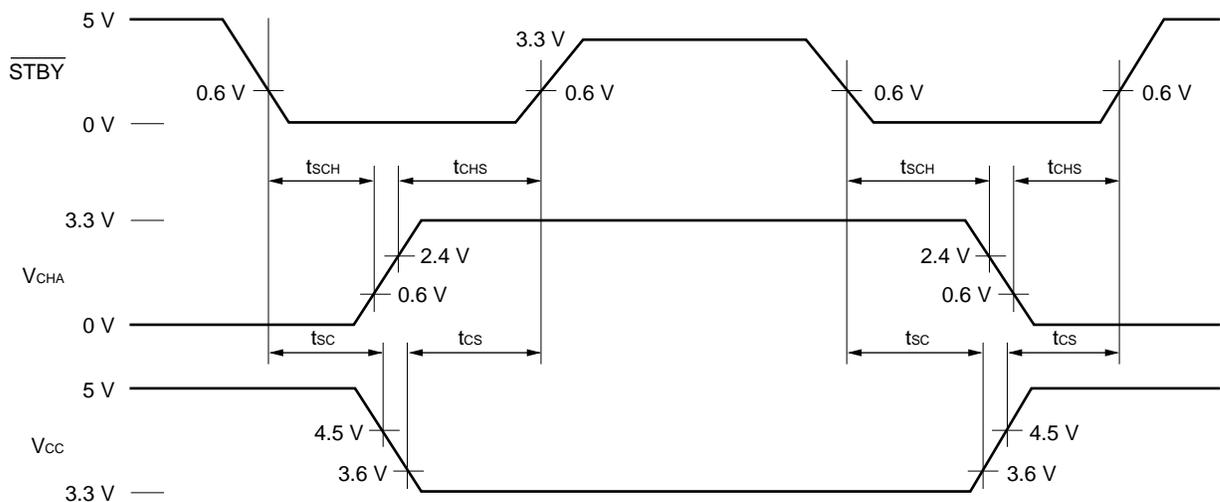
**ELECTRICAL SPECIFICATIONS (TOTAL)**

(Unless otherwise specified,  $T_A = -40$  to  $+85$  °C,  $C_1$  to  $C_5 = 1$  μF)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Circuit Current	I <sub>CC1</sub>	V <sub>CC</sub> = +3.3 V, No load, R <sub>IN</sub> pin OPEN, $\overline{STBY} = H$		6.5	13	mA
		V <sub>CC</sub> = +5.0 V, No load, R <sub>IN</sub> pin OPEN, $\overline{STBY} = H$		4.5	9	mA
Circuit Current	I <sub>CC2</sub>	V <sub>CC</sub> = +3.3 V, R <sub>L</sub> = 3 kΩ (D <sub>OUT</sub> ), D <sub>IN</sub> = GND, R <sub>IN</sub> , R <sub>OUT</sub> pin OPEN, $\overline{STBY} = H$		19	24	mA
		V <sub>CC</sub> = +5.0 V, R <sub>L</sub> = 3 kΩ (D <sub>OUT</sub> ), D <sub>IN</sub> = GND, R <sub>IN</sub> , R <sub>OUT</sub> pin OPEN, $\overline{STBY} = H$		14	18	mA
Circuit Current at Standby	I <sub>CC3</sub>	V <sub>CC</sub> = +3.3 V, No load, D <sub>IN</sub> and R <sub>IN</sub> pins are OPEN, $\overline{STBY} = L$ , T <sub>A</sub> = 25 °C		1	3	μA
		V <sub>CC</sub> = +3.3 V, No load, D <sub>IN</sub> and R <sub>IN</sub> pins are OPEN, $\overline{STBY} = L$		5		μA
		V <sub>CC</sub> = +5.0 V, No load, D <sub>IN</sub> and R <sub>IN</sub> pins are OPEN, $\overline{STBY} = L$ , T <sub>A</sub> = 25 °C		2	5	μA
		V <sub>CC</sub> = +5.0 V, No load, D <sub>IN</sub> and R <sub>IN</sub> pins are OPEN, $\overline{STBY} = L$		10		μA
High-Level Input Voltage	V <sub>IH</sub>	V <sub>CC</sub> = +3.0 to +5.5 V, $\overline{STBY}$ , V <sub>CHA</sub> pin	2.4			V
Low-Level Input Voltage	V <sub>IL</sub>	V <sub>CC</sub> = +3.0 to +5.5 V, $\overline{STBY}$ , V <sub>CHA</sub> pin			0.6	V
High-Level Input Current	I <sub>IH</sub>	V <sub>CC</sub> = +5.5 V, V <sub>I</sub> = +5.5 V, $\overline{STBY}$ , V <sub>CHA</sub> pin			1	μA
Low-Level Input Current	I <sub>IL</sub>	V <sub>CC</sub> = +5.5 V, V <sub>I</sub> = 0 V, $\overline{STBY}$ , V <sub>CHA</sub> pin			-1	μA
Input Capacitance	C <sub>IN</sub>	Driver input and receiver input V <sub>CC</sub> = +3.3 V, for GND, f = 1 MHz			10	pF
		Driver input and receiver input V <sub>CC</sub> = +5.0 V, for GND, f = 1 MHz			10	pF
$\overline{STBY} - V_{CHA}$ Time	t <sub>SCH</sub>	V <sub>CC</sub> = +3.0 to +5.5 V, $\overline{STBY} \downarrow \rightarrow V_{CHA}$ , <b>Note 8</b>	1			μs
V <sub>CHA</sub> - $\overline{STBY}$ Time	t <sub>CHS</sub>	V <sub>CC</sub> = +3.0 to +5.5 V, V <sub>CHA</sub> → $\overline{STBY} \uparrow$ , <b>Note 8</b>	1			μs
$\overline{STBY} - V_{CC}$ Time	t <sub>SC</sub>	V <sub>CC</sub> = +3.0 to +5.5 V, $\overline{STBY} \downarrow \rightarrow V_{CC}$ , <b>Note 8</b>	1			μs
V <sub>CC</sub> - $\overline{STBY}$ Time	t <sub>CS</sub>	V <sub>CC</sub> = +3.0 to +5.5 V, V <sub>CC</sub> → $\overline{STBY} \uparrow$ , <b>Note 8</b>	1			μs

\* The TYP. values are for reference at T<sub>A</sub> = 25 °C.

**Note 8.** Measuring point



**ELECTRICAL SPECIFICATIONS (DRIVER)**(Unless otherwise specified,  $T_A = -40$  to  $+85$  °C,  $C_1$  to  $C_5 = 1$  μF)**3 V mode** (unless otherwise specified,  $V_{CHA} = H$ ,  $V_{CC} = 3.0$  to  $3.6$  V)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Low-Level Input Voltage	$V_{IL}$				0.8	V
High-Level Input Voltage	$V_{IH}$		2.0			V
Low-Level Input Current	$I_{IL}$	$V_{CC} = +3.6$ V, $V_I = 0$ V			-25	μA
High-Level Input Current	$I_{IH}$	$V_{CC} = +3.6$ V, $V_I = 3.6$ V			1.0	μA
Output Voltage	$V_{DO}$	$V_{CC} = +3.3$ V, $R_L = \infty$ , $T_A = 25$ °C		±9.5		V
		$V_{CC} = +3.3$ V, $R_L = 3$ kΩ, $T_A = T_{opt}$	±5.0	±6.0		V
		$V_{CC} = +3.0$ V, $R_L = 3$ kΩ, $T_A = +25$ °C	±5.0			V
Output Short-Circuit Current	$I_{SC}$	$V_{CC} = +3.3$ V, for GND			±40	mA
Slew-Rate <sup>Note 9</sup>	SR	$C_L = 10$ pF, $R_L = 3$ to $7$ kΩ	3.0		30	V/μs
		$C_L = 2\ 500$ pF, $R_L = 3$ to $7$ kΩ	3.0		30	V/μs
Propagation Delay Time <sup>Note 9</sup>	$t_{PHL}$ $t_{PLH}$	$R_L = 3$ kΩ, $C_L = 2\ 500$ pF		2.5		μs
Output Resistor	$R_O$	$V_{CC} = V_{DD} = V_{SS} = 0$ V $V_{OUT} = \pm 2$ V	300			Ω
Standby Output Transfer Time	$t_{DAZ}$	$R_L = 3$ kΩ, $C_L = 2\ 500$ pF, <sup>Note 10</sup>		4	10	μs
Standby Output Transfer Time	$t_{DZA}$	$R_L = 3$ kΩ, $C_L = 2\ 500$ pF, <sup>Note 10</sup>		1	3	ms
Power-On Output Transfer Time	$t_{PRA}$	$R_L = 3$ kΩ, $C_L = 2\ 500$ pF, <sup>Note 11</sup>		1	3	ms

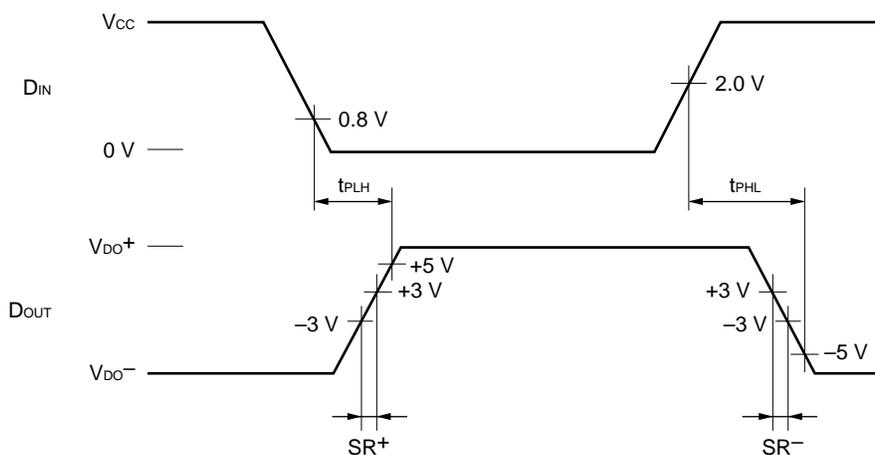
\* The TYP. values are for reference at  $T_A = 25$  °C.

5 V mode (Unless otherwise specified,  $V_{CHA} = L$ ,  $V_{CC} = +5.0 \text{ V} \pm 10 \%$ )

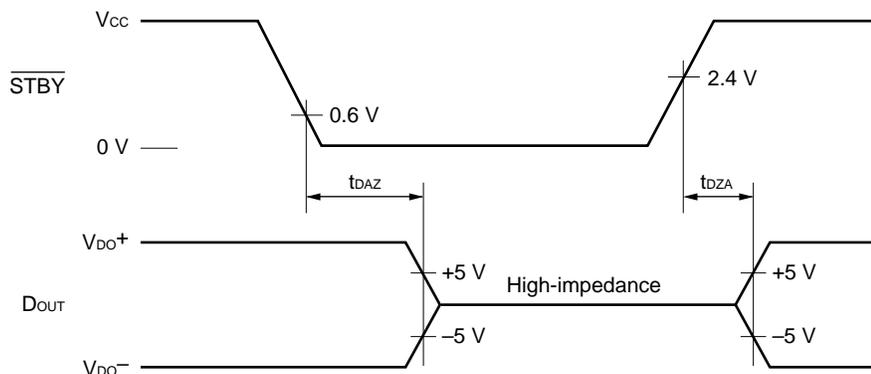
Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Low-Level Input Voltage	$V_{IL}$				0.8	V
High-Level Input Voltage	$V_{IH}$		2.0			V
Low-Level Input Current	$I_{IL}$	$V_{CC} = +5.5 \text{ V}$ , $V_i = 0 \text{ V}$			-40	μA
High-Level Input Current	$I_{IH}$	$V_{CC} = +5.5 \text{ V}$ , $V_i = 5.5 \text{ V}$			1.0	μA
Output Voltage	$V_{DO}$	$V_{CC} = +5.0 \text{ V}$ , $R_L = \infty$ , $T_A = 25 \text{ }^\circ\text{C}$		±9.7		V
		$V_{CC} = +5.0 \text{ V}$ , $R_L = 3 \text{ k}\Omega$ , $T_A = T_{opt}$	±6.0			V
		$V_{CC} = +4.5 \text{ V}$ , $R_L = 3 \text{ k}\Omega$ , $T_A = T_{opt}$	±5.0			V
Output Short-Circuit Current	$I_{sc}$	$V_{CC} = +5.0 \text{ V}$ , for GND			±40	mA
Slew-Rate <sup>Note 9</sup>	SR	$C_L = 10 \text{ pF}$ , $R_L = 3 \text{ to } 7 \text{ k}\Omega$	4.0		30	V/μs
		$C_L = 2 \text{ 500 pF}$ , $R_L = 3 \text{ to } 7 \text{ k}\Omega$	4.0		30	V/μs
Propagation Delay Time <sup>Note 9</sup>	$t_{PHL}$	$R_L = 3 \text{ k}\Omega$ , $C_L = 2 \text{ 500 pF}$		2		μs
	$t_{PLH}$					
Output Resistor	$R_O$	$V_{CC} = V_{DD} = V_{SS} = 0 \text{ V}$ $V_{OUT} = \pm 2 \text{ V}$	300			Ω
Standby Output Transfer Time	$t_{DAZ}$	$R_L = 3 \text{ k}\Omega$ , $C_L = 2 \text{ 500 pF}$ , <sup>Note 10</sup>		4	10	μs
Standby Output Transfer Time	$t_{DZA}$	$R_L = 3 \text{ k}\Omega$ , $C_L = 2 \text{ 500 pF}$ , <sup>Note 10</sup>		0.5	1	ms
Power-On Output Transfer Time	$t_{PRA}$	$R_L = 3 \text{ k}\Omega$ , $C_L = 2 \text{ 500 pF}$ , <sup>Note 12</sup>		0.5	1	ms

\* The TYP. values are for reference at  $T_A = 25 \text{ }^\circ\text{C}$ .

**Note 9.** Measuring point

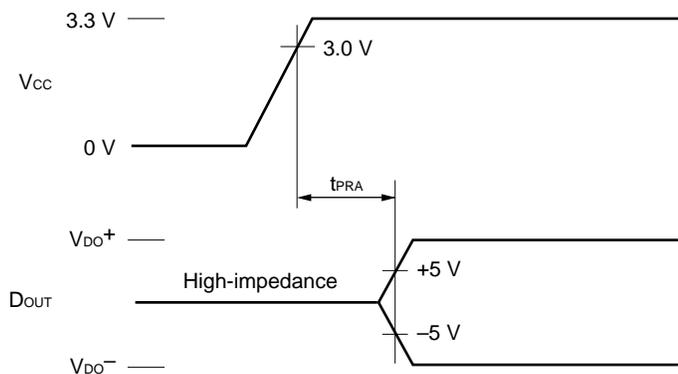


**Note 10.** Measuring point



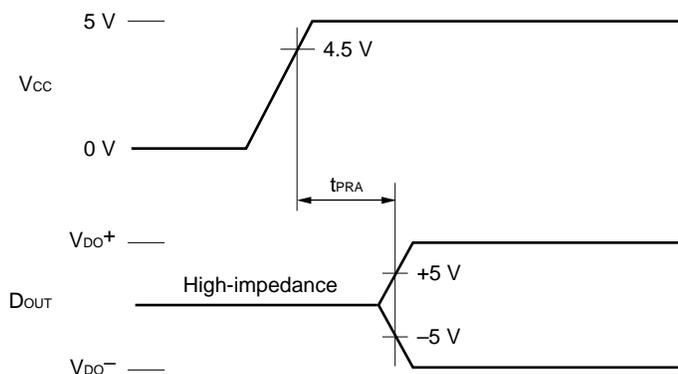
Driver outputs are indefinite during transition time ( $t_{\text{DAZ}}$ ).

**Note 11.** Measuring point



Driver outputs are indefinite during transition time ( $t_{\text{PRA}}$ ).

**Note 12.** Measuring point



Driver outputs are indefinite during transition time ( $t_{\text{PRA}}$ ).

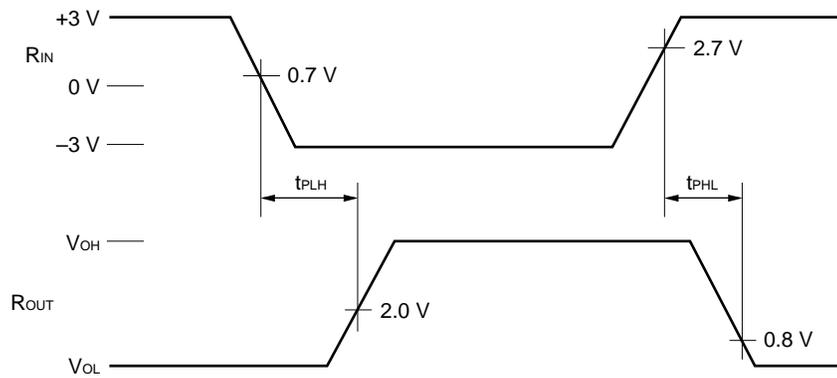
**ELECTRICAL SPECIFICATIONS (RECEIVER)**

(Unless otherwise specified,  $V_{CC} = 3.0$  to  $5.5$  V,  $T_A = -40$  to  $+85$  °C,  $C_1$  to  $C_5 = 1$  μF)

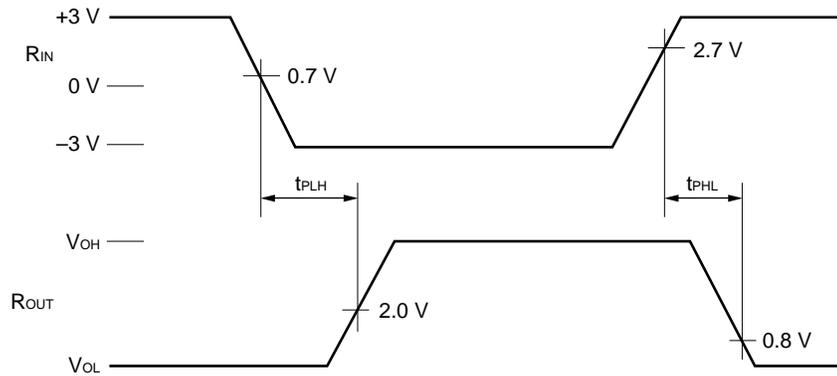
Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Low-Level Output Voltage	$V_{OL1}$	$I_{OUT} = 4$ mA, $\overline{STBY} = H$			0.4	V
High-Level Output Voltage	$V_{OH1}$	$I_{OUT} = -4$ mA, $\overline{STBY} = H$	$V_{CC} - 0.4$			V
Low-Level Output Voltage	$V_{OL2}$	$I_{OUT} = 4$ mA, $\overline{STBY} = L$			0.5	V
High-Level Output Voltage	$V_{OH2}$	$I_{OUT} = -4$ mA, $\overline{STBY} = L$	$V_{CC} - 0.5$			V
Propagation Delay Time ( $\overline{STBY} = H$ )	$t_{PHL}$ $t_{PLH}$	$R_{IN} \rightarrow R_{OUT}$ , $C_L = 150$ pF $V_{CC} = +3.0$ V, <b>Note 13</b>		0.2		μs
Input Resistor	$R_I$		3	5.5	7	kΩ
Input Pin Open Voltage	$V_{IO}$				0.5	V
Input Threshold ( $\overline{STBY} = H$ )	$V_{IH}$	$V_{CC} = +3.0$ to $+5.5$ V	1.7	2.3	2.7	V
	$V_{IL}$	$V_{CC} = +3.0$ to $+5.5$ V	0.7	1.1	1.7	V
	$V_H$	$V_{CC} = +3.0$ to $+5.5$ V (Hysteresis width)	0.5	1.2	1.8	V
Standby Output Transfer Time	$t_{DAH}$	<b>Note 15</b>		0.2	3	μs
Standby Output Transfer Time	$t_{DHA}$	$V_{CHA} = H$ (3 V mode) <b>Note 15</b>		0.6	3	ms
		$V_{CHA} = L$ (5 V mode) <b>Note 15</b>		0.3	1	ms
Power-On Reset Release Time	$t_{PRA}$	$V_{CHA} = H$ (3 V mode) <b>Note 16</b>		1	3	ms
		$V_{CHA} = L$ (5 V mode) <b>Note 17</b>		0.5	1	ms

\* The TYP. values are for reference at  $T_A = 25$  °C.

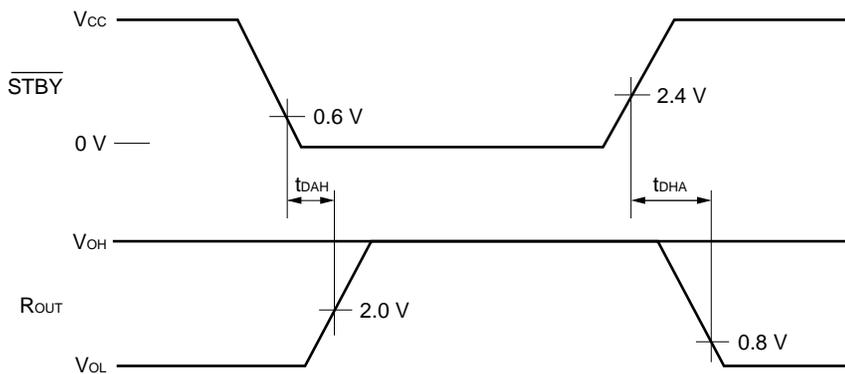
**Note 13.** Measuring point



**Note 14.** Measuring point

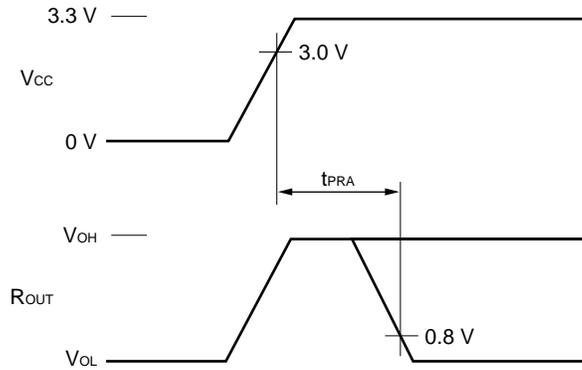


**Note 15.** Measuring point



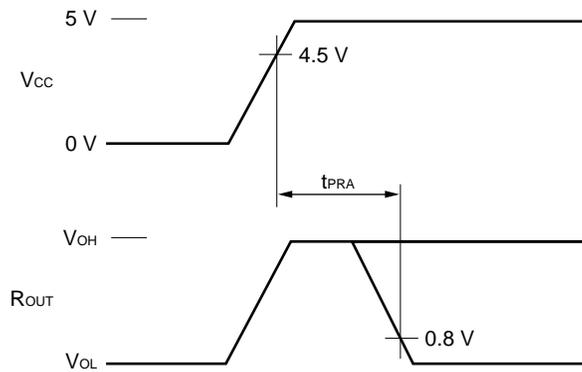
Receiver outputs are indefinite during transition time ( $t_{DHA}$ ).

**Note 16.** Measuring point



Receiver outputs are indefinite during reset release time (t<sub>PRA</sub>).

**Note 17.** Measuring point



Receiver outputs are indefinite during reset release time (t<sub>PRA</sub>).

**REFERENCE MATERIAL**

- IC PACKAGE MANUAL (C10943X)
- NEC SEMICONDUCTOR DEVICE RELIABILITY/QUALITY (IEI-1212)

**RECOMMENDED SOLDERING CONDITIONS**

The following conditions (See table below) must be met when soldering this product.

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

**TYPES OF SURFACE MOUNT DEVICE**

For more details, refer to our document “SMT MANUAL” (C10535E).

**μPD4721 GS-GJG**

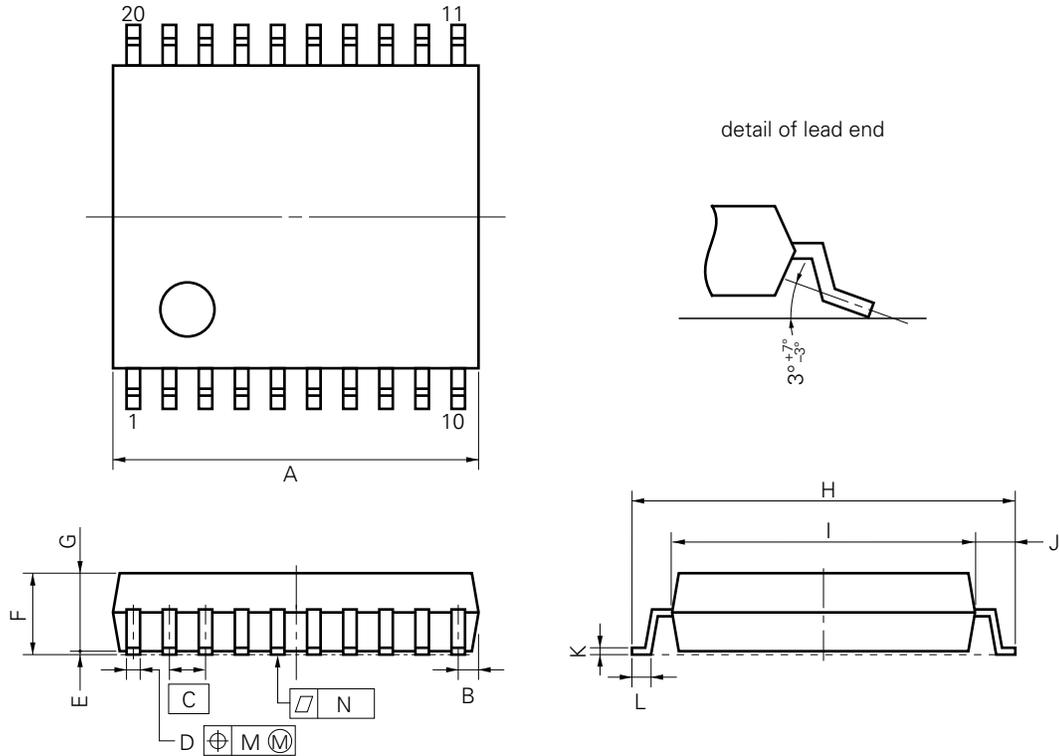
Soldering process	Soldering conditions	Symbol
Infrared ray reflow	Peak package's surface temperature: 230 °C or below, Reflow time: 30 seconds or below (210 °C or higher), Number of reflow process: 2, Exposure limit*: None	IR30-00-2
VPS	Peak package's surface temperature: 215 °C or below, Reflow time: 40 seconds or below (200 °C or higher), Number of reflow process: 2, Exposure limit*: None	VP15-00-2
Wave soldering	Solder Temperature: 260 °C or lower, Reflow time: Within 10 sec, Number of reflowprocess: 1, Exposure limit*: None	WS60-00-1
Partial heating method	Terminal temperature: 300 °C or below, Flow time: 10 seconds or below, Exposure limit*: None	○

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

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

PACKAGE DRAWINGS

20 PIN PLASTIC SHRINK SOP (300 mil)



**NOTE**

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

P20GM-65-300B-2

ITEM	MILLIMETERS	INCHES
A	7.00 MAX.	0.276 MAX.
B	0.575 MAX.	0.023 MAX.
C	0.65 (T.P.)	0.026 (T.P.)
D	0.30±0.10	0.012 <sup>+0.004</sup> <sub>-0.005</sub>
E	0.125±0.075	0.005±0.003
F	2.0 MAX.	0.079 MAX.
G	1.7	0.067
H	8.1±0.3	0.319±0.012
I	6.1±0.2	0.240±0.008
J	1.0±0.2	0.039 <sup>+0.009</sup> <sub>-0.008</sub>
K	0.15 <sup>+0.10</sup> <sub>-0.05</sub>	0.006 <sup>+0.004</sup> <sub>-0.002</sub>
L	0.5±0.2	0.020 <sup>+0.008</sup> <sub>-0.009</sub>
M	0.12	0.005
N	0.10	0.004

[MEMO]

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