NEC

MOS INTEGRATED CIRCUIT

μPD4722

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

The μPD4722 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, allowing it to operate with a single +3.3 V or +5 V power supply. It also provides standby function.

This IC incorporates 4 driver circuits and 4 receiver circuits. An RS-232 interface circuit can be easily configured by connecting 5 capacitors externally.

FEATURES

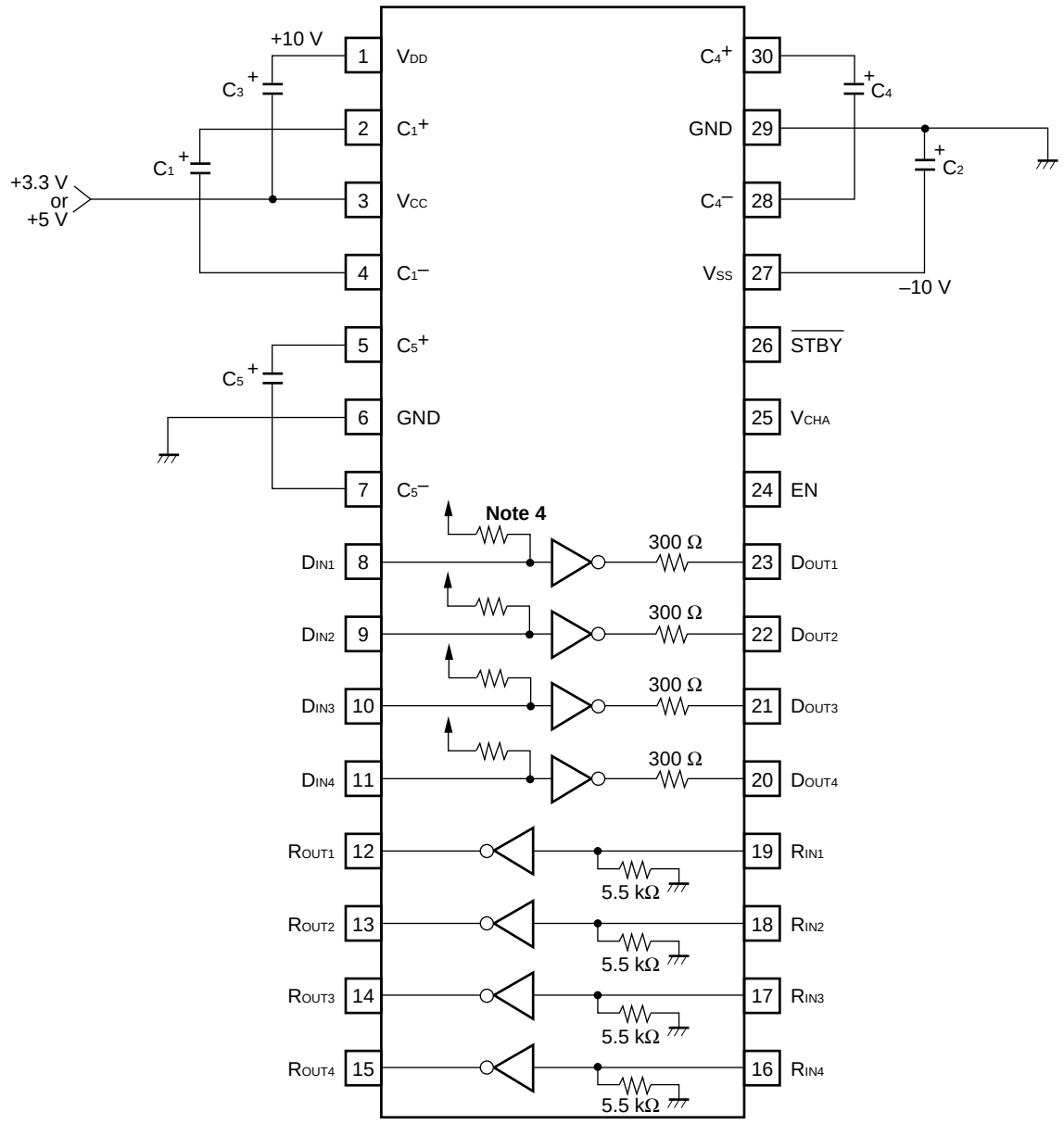
- Conforms to EIA/TIA-232-E (former name, RS-232C) standards
- Selectable +3.3 V/+5 V single power supply (selected by V_{CHA} pin)
- By setting the standby pin to a low level (standby mode), circuit current can be reduced. At such times, the driver output is in a high-impedance state.
- Even in the standby mode, 2 receiver circuits can operate as inverters without hysteresis width. The other 2 circuits are fixed at a high level.

ORDERING INFORMATION

Part number	Package
μPD4722GS-GJG	30-pin plastic SSOP (300 mil)

Document No. S12199EJ3V0DS00 (3rd edition)
(Previous No. IC-3280)
Date Published January 1997 N
Printed in Japan

BLOCK DIAGRAM/PIN CONFIGURATION (TOP VIEW)



Note **1**. V_{DD} and V_{SS} are output pins stepped up internally. These pins should not be loaded directly.

2. Capacitors C_1 to C_5 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_{CC} and GND.

3. If V_{CHA} is kept low level (in 5 V mode), capacitor C_5 is not necessary.

4. The pull-up resistors at driver input are active resistors.

Truth Table

Driver

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

Receiver

$\overline{STBY}$	EN	R_{IN}		R_{OUT}		Remarks
		R_3 to R_4	R_1 to R_2	R_3 to R_4	R_1 to R_2	
L	L	×	×	H	H	Standby mode 1 (DC/DC converter is stopped)
L	H	L	×	H	H	Standby mode 2 (DC/DC converter is stopped, R_3 and R_4 are operated)
L	H	H	×	L	H	Standby mode 2 (DC/DC converter is stopped, R_3 and R_4 are operated)
H	×	L		H		Mark level input
H	×	H		L		Space level input

3 V ↔ 5 V switching[Note 5]

V_{CHA}	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_{CHA}, standby mode must be selected ($\overline{STBY}$ = L).

ABSOLUTE MAXIMUM RATINGS (T_A = 25 °C)

Parameter	Symbol	Ratings	Unit
Supply Voltage (V_{CHA} = L)	V_{CC}	–0.5 to +7.0	V
Supply Voltage (V_{CHA} = H)	V_{CC}	–0.5 to +4.5	V
Driver Input Voltage	D_{IN}	–0.5 to V_{CC} +0.5	V
Receiver Input Voltage	R_{IN}	–30.0 to +30.0	V
Control Input Voltage ($\overline{STBY}$, V_{CHA}, EN)	V_{IN}	–0.5 to V_{CC} +0.5	V
Driver Output Voltage	D_{OUT}	–25.0 to +25.0 **Note 6**	V
Receiver Output Voltage	R_{OUT}	–0.5 to V_{CC} +0.5	V
Input Current (D_{IN}, $\overline{STBY}$, V_{CHA}, EN)	I_{IN}	±20.0	mA
Operating Ambient Temperature	T_A	–40 to +85	°C
Storage Temperature	T_{stg}	–55 to + 150	°C
Total Power Dissipation	P_T	0.5	W

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

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage (V_{CHA} = L, 5 V mode)	V_{CC}	4.5	5.0	5.5	V
Supply Voltage (V_{CHA} = H, 3 V mode)	V_{CC}	3.0	3.3	3.6	V
High-Level Input Voltage (D_{IN})	V_{IH}	2.0		V_{CC}	V
Low-Level Input Voltage (D_{IN})	V_{IL}	0		0.8	V
High-Level Input Voltage ($\overline{STBY}$, V_{CHA}, EN)	V_{IH}	2.4		V_{CC}	V
Low-Level Input Voltage ($\overline{STBY}$, V_{CHA}, EN)	V_{IL}	0		0.6	V
Receiver Input Voltage	R_{IN}	–30		+30	V
Operating Ambient Temperature	T_A	–40		+85	°C
Capacitance of External Capacitor	**Note 7**	0.47		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.

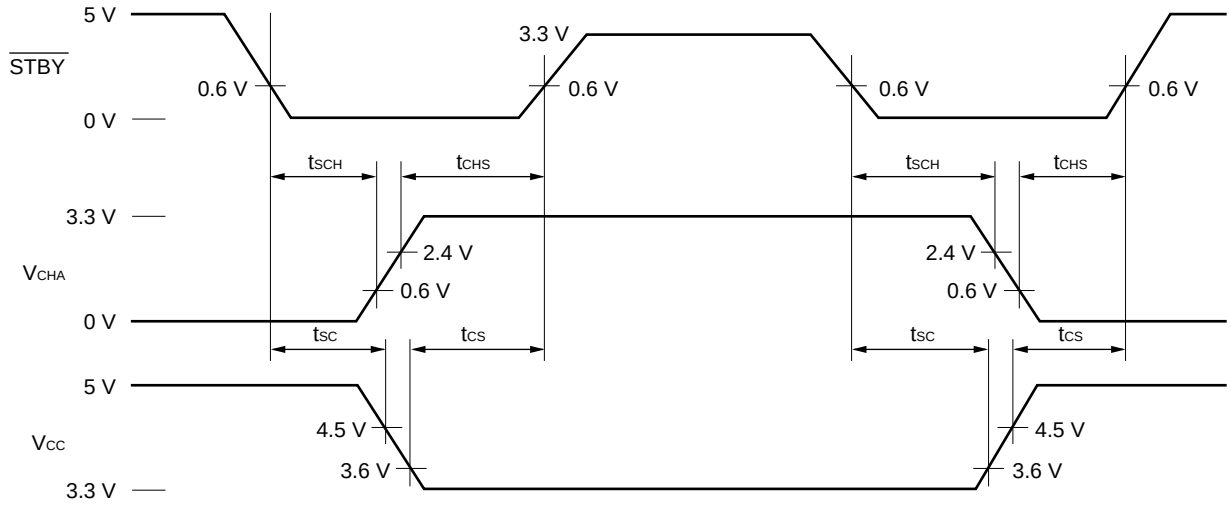
ELECTRICAL SPECIFICATIONS (TOTAL)

(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_{CC1}	V_{CC} = +3.3 V, No load, R_{IN} pin OPEN, $\overline{STBY}$ = H			16	mA
		V_{CC} = +5.0 V, No load, R_{IN} pin OPEN, $\overline{STBY}$ = H			12	mA
Circuit Current	I_{CC2}	V_{CC} = +3.3 V, R_L = 3 kΩ (D_{OUT}), D_{IN} = GND, R_{IN}, R_{OUT} pin OPEN, $\overline{STBY}$ = H			47	mA
		V_{CC} = +5.0 V,R_L = 3 kΩ (D_{OUT}), D_{IN} = GND, R_{IN}, R_{OUT} pin OPEN, $\overline{STBY}$ = H			38	mA
Circuit Current at Standby (Standby Mode 1)	I_{CC3}	V_{CC} = +3.3 V, No load, D_{IN} and R_{IN} pins are OPEN, $\overline{STBY}$ = L, EN = L, T_A = 25 °C		1	3	μA
		V_{CC} = +3.3 V, No load, D_{IN} and R_{IN} pins are OPEN, $\overline{STBY}$ = L, EN = L		5		μA
		V_{CC} = +5.0 V, No load, D_{IN} and R_{IN} pins are OPEN, $\overline{STBY}$ = L, EN = L, T_A = 25 °C		2	5	μA
		V_{CC} = +5.0 V, No load, D_{IN} and R_{IN} pins are OPEN, $\overline{STBY}$ = L, EN = L		10		μA
Circuit Current at Standby (Standby Mode 2)	I_{CC4}	V_{CC} = +3.3 V, No load, D_{IN} and R_{IN} pins are OPEN, $\overline{STBY}$ = L, EN = H, T_A = 25 °C		1	3	μA
		V_{CC} = +3.3 V, No load, D_{IN} and R_{IN} pins are OPEN, $\overline{STBY}$ = L, EN = H		5		μA
		V_{CC} = +5.0 V, No load, D_{IN} and R_{IN} pins are OPEN, $\overline{STBY}$ = L, EN = H, T_A = 25 °C		2	5	μA
		V_{CC} = +5.0 V, No load, D_{IN} and R_{IN} pins are OPEN, $\overline{STBY}$ = L, EN = H		10		μA
High-Level Input Voltage	V_{IH}	V_{CC} = +3.0 to +5.5 V, $\overline{STBY}$, V_{CHA}, EN pin	2.4			V
Low-Level Input Voltage	V_{IL}	V_{CC} = +3.0 to +5.5 V, $\overline{STBY}$, V_{CHA}, EN pin			0.6	V
High-Level Input Current	I_{IH}	V_{CC} = +5.5 V, V_I = 5.5 V, $\overline{STBY}$, V_{CHA}, EN pin			1	μA
Low-Level Input Current	I_{IL}	V_{CC} = +5.5 V, V_I = 0 V, $\overline{STBY}$, V_{CHA}, EN pin			–1	μA
Input Capacitance	C_{IN}	Driver input and receiver input V_{CC} = +3.3 V, for GND, f = 1 MHz			10	pF
		Driver input and receiver input V_{CC} = +5.0 V, for GND, f = 1 MHz			10	pF
$\overline{STBY}$ — V_{CHA} Time	t_{SCH}	V_{CC} = +3.0 to 5.5 V, $\overline{STBY}$ ↓ → V_{CHA}, **Note 8**	1			μs
V_{CHA} — $\overline{STBY}$ Time	t_{CHS}	V_{CC} = +3.0 to 5.5 V, V_{CHA} → $\overline{STBY}$ ↑, **Note 8**	1			μs
$\overline{STBY}$ — V_{CC} Time	t_{SC}	V_{CC} = +3.0 to 5.5 V, $\overline{STBY}$ ↓ → V_{CC}, **Note 8**	1			μs
V_{CC} — $\overline{STBY}$ Time	t_{CS}	V_{CC} = +3.0 to 5.5 V, V_{CC} → $\overline{STBY}$ ↑, **Note 8**	1			μs

***** The TYP. values are for reference at T_A = 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 = ∞, 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[Note 9]	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[Note 9]	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} = ±2 V	300			Ω
Standby Output Transfer Time	t_{DAZ}	R_L = 3 kΩ, C_L = 2 500 pF,[Note 10]		4	10	μs
Standby Output Transfer Time	t_{DZA}	R_L = 3 kΩ, C_L = 2 500 pF,[Note 10]		1	3	ms
Power-On Output Transfer Time	t_{PRA}	R_L = 3 kΩ, C_L = 2 500 pF,[Note 11]		1	3	ms

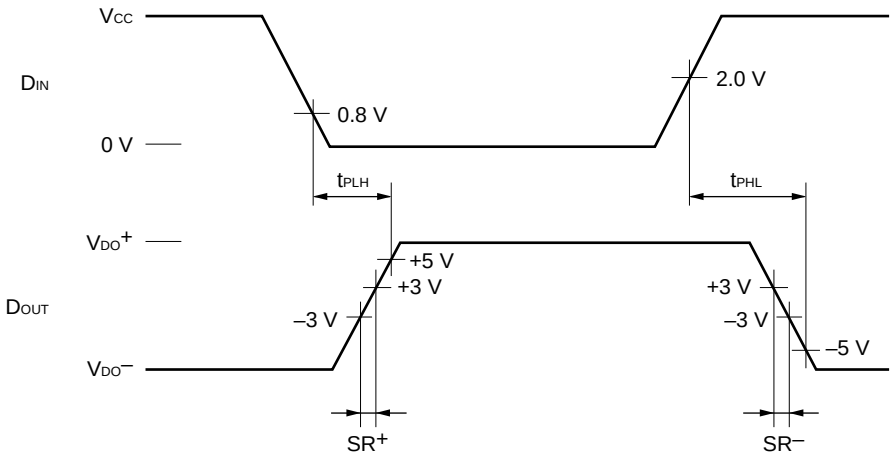
***** The TYP. values are for reference at T_A = 25 °C.

5 V mode (unless otherwise specified, V_{CHA} = L, V_{CC} = +5.0 V ± 10 %)

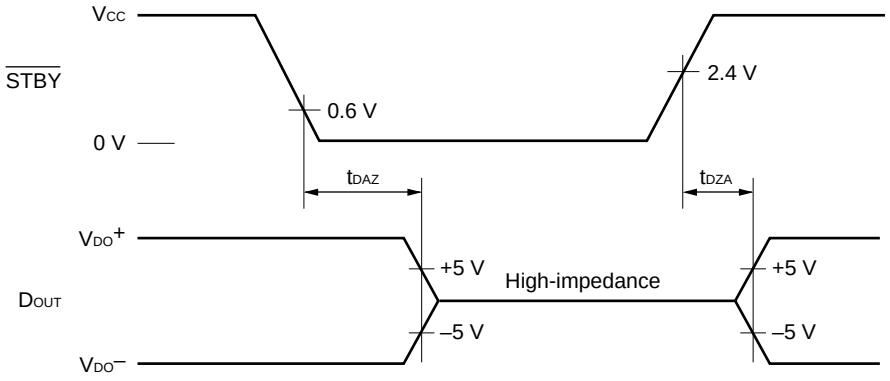
Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Low-Level Input Voltage	V_{IL}				0.8	V
High-Level Input Voltage	V_{IH}		2.0			V
Low-Level Input Current	I_{IL}	V_{CC} = +5.5 V, V_I = 0 V			–40	μA
High-Level Input Current	I_{IH}	V_{CC} = +5.5 V, V_I = 5.5 V			1.0	μA
Output Voltage	V_{DO}	V_{CC} = +5.0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

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

Note 9. Measuring point

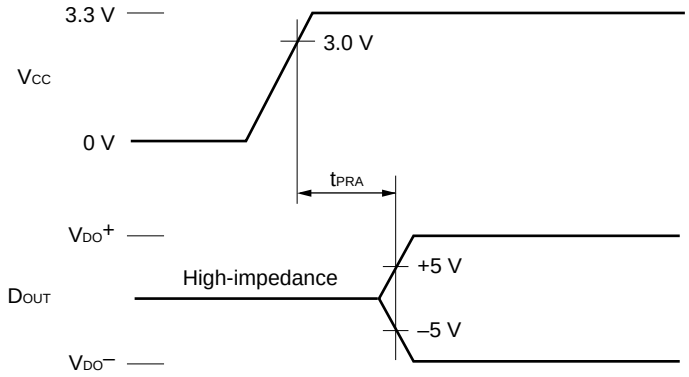


Note 10. Measuring point



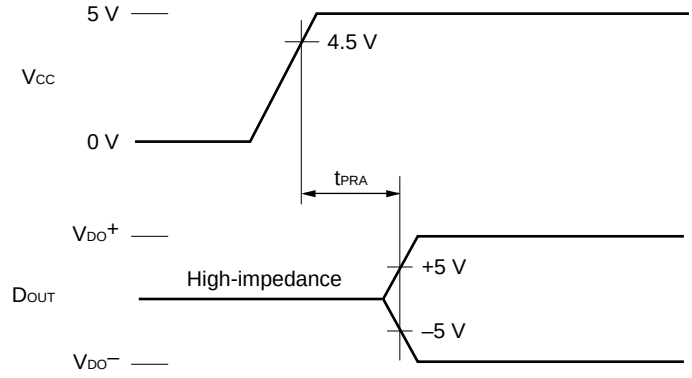
Driver outputs are indefinite during transition time (t_{DZA}).

Note 11. Measuring point



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

Note 12. Measuring point



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

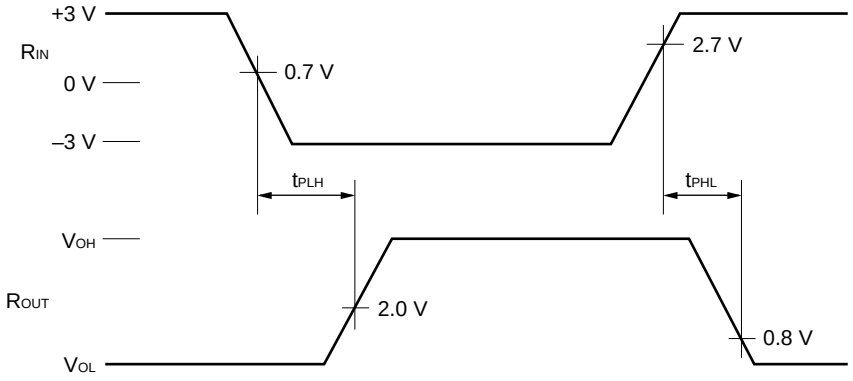
ELECTRICAL SPECIFICATIONS (RECEIVER)

(UNLESS OTHERWISE SPECIFIED, V_{CC} = 3.0 to 5.5 V, T_A = –40 to +85 °C, C_1 to C_5 = 1 μF)

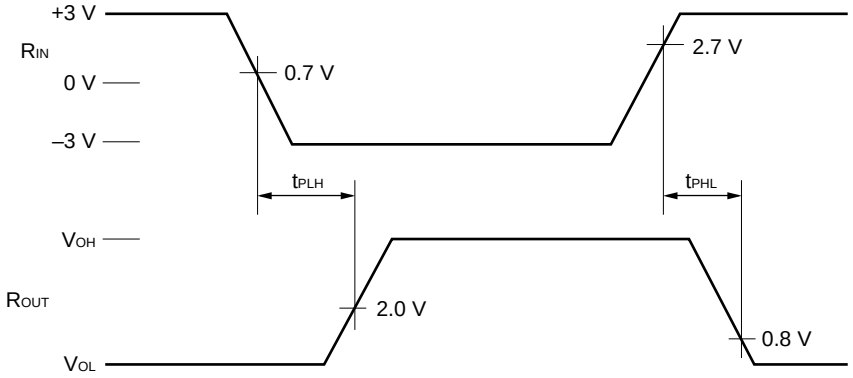
Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Low-Level Output Voltage	V_{OL1}	I_{OUT} = 4 mA, $\overline{STBY}$ = H			0.4	V
High-Level Output Voltage	V_{OH1}	I_{OUT} = –4 mA, $\overline{STBY}$ = H	V_{CC} – 0.4			V
Low-Level Output Voltage	V_{OL2}	I_{OUT} = 4 mA, $\overline{STBY}$ = L			0.5	V
High-Level 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,**Note 13**		0.2		μs
Propagation Delay Time ($\overline{STBY}$ = L)	t_{PHL} t_{PLH}	$R_{IN} \rightarrow R_{OUT}$, C_L = 150 pF V_{CC} = +3.0 V,**Note 14**		0.1		μs
Propagation Delay Time ($\overline{STBY}$ = L)	t_{PHA} t_{PAH}	EN → R_{OUT}, C_L = 150 pF V_{CC} = +3.0 V,**Note 15**		100	300	ns
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
Input Threshold ($\overline{STBY}$ = L, EN = H)	V_{IH}	V_{CC} = +3.0 to +5.5 V, R_{IN3}, R_{IN4}	2.7	1.5		V
	V_{IL}	V_{CC} = +3.0 to +5.5 V, R_{IN3}, R_{IN4}		1.5	0.7	V
Standby Output Transfer Time	t_{DAH}	**Note 16**		0.2	3	μs
Standby Output Transfer Time	t_{DHA}	V_{CHA} = H (3 V mode)**Note 16**		0.6	3	ms
		V_{CHA} = L (5 V mode)**Note 16**		0.3	1	ms
Power-On Reset Release Time	t_{PRA}	V_{CHA} = H (3 V mode)**Note 17**		1	3	ms
		V_{CHA} = L (5 V mode)**Note 18**		0.5	1	ms

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

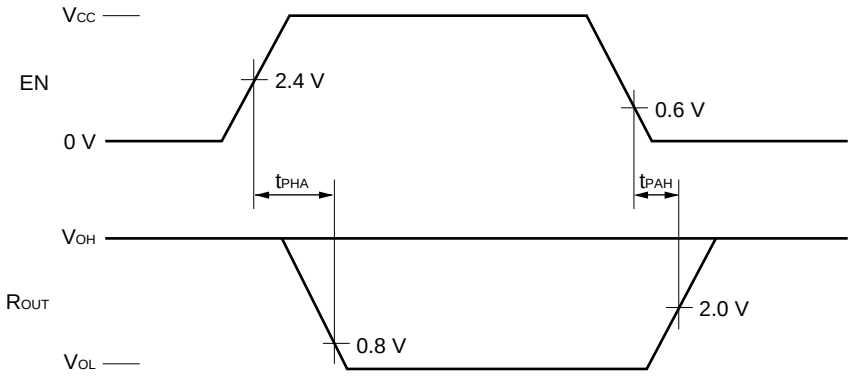
Note 13. Measuring point



Note 14. Measuring point

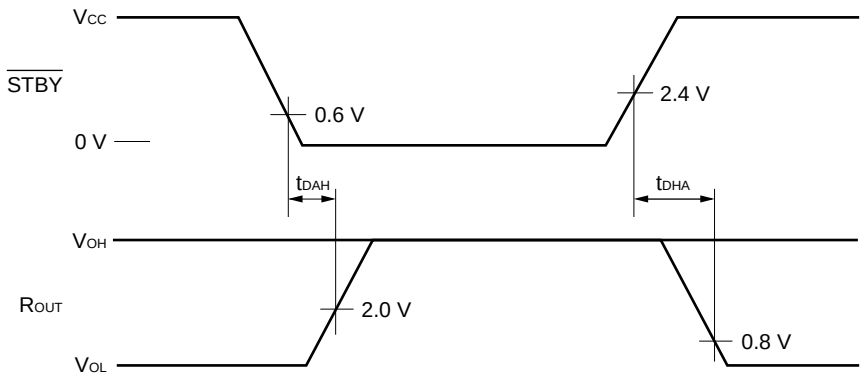


Note 15. Measuring point



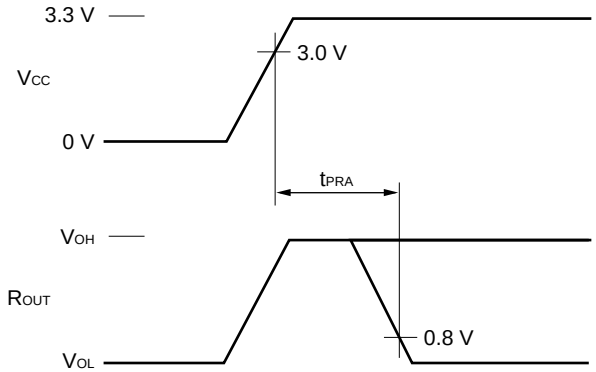
$\overline{\text{STBY}}$ = L

Note 16. Measuring point



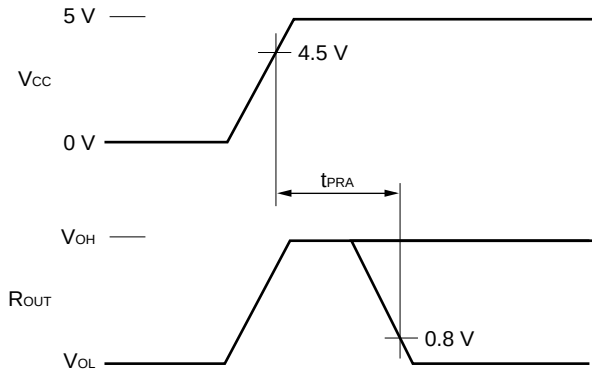
Receiver outputs are indefinite during transition time (t_{DHA}).

Note 17. Measuring point



Receiver outputs are indefinite during reset release time (t_{PRA}).

Note 18. Measuring point



Receiver outputs are indefinite during reset release time (t_{PRA}).

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).

μPD4722 GS-GJG

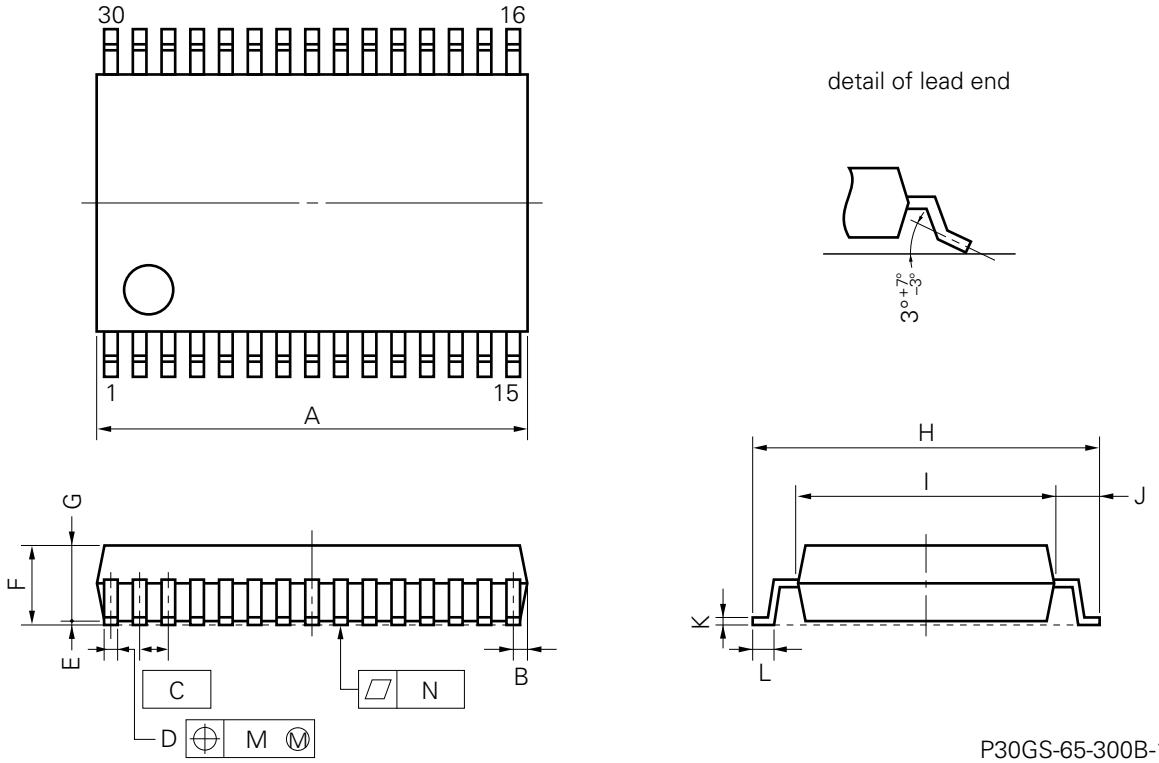
Soldering process	Soldering conditions	Symbol
Infrared ray reflow	Peak package’s surface temperature: 230 °C or below, Reflow time: 30 seconds or below (210 °C or higher), Number of reflow process: 2, Exposure limit*: None	IR30-00-2
VPS	Peak package’s surface temperature: 215 °C or below, Reflow time: 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 below, Flow time: 10 seconds or below, Number of flow process: 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

30 PIN PLASTIC SHRINK SOP (300 mil)



P30GS-65-300B-1

NOTE

Each lead centerline is located within 0.10 mm (0.004 inch) of its true position (T.P.) at maximum material condition.

ITEM	MILLIMETERS	INCHES
A	10.11 MAX.	0.398 MAX.
B	0.51 MAX.	0.020 MAX.
C	0.65 (T.P.)	0.026 (T.P.)
D	$0.30^{+0.10}_{-0.05}$	$0.012^{+0.004}_{-0.003}$
E	0.125±0.075	0.005±0.003
F	2.0 MAX.	0.079 MAX.
G	1.7±0.1	0.067±0.004
H	8.1±0.2	0.319±0.008
I	6.1±0.2	0.240±0.008
J	1.0 ± 0.2	$0.039^{+0.009}_{-0.008}$
K	$0.15^{+0.10}_{-0.05}$	$0.006^{+0.004}_{-0.002}$
L	0.5±0.2	$0.020^{+0.008}_{-0.009}$
M	0.10	0.004
N	0.10	0.004

[MEMO]

[MEMO]

M4 96.5