

## RS-232 LINE DRIVER/RECEIVER

The  $\mu$ PD4713A is a high-voltage silicon gate CMOS line driver/reciever conforming to the EIA/TIA-232-E standard. It can operate with a single +5 V power source because it is provided with a DC-DC converter. In addition, this line driver/receiver has many ancillary functions, including output control, threshold select, and standby functions. Because the  $\mu$ PD4713A is provided with three output driver circuits and three receiver circuits, it can constitute an RS-232 interface circuit with a single chip.

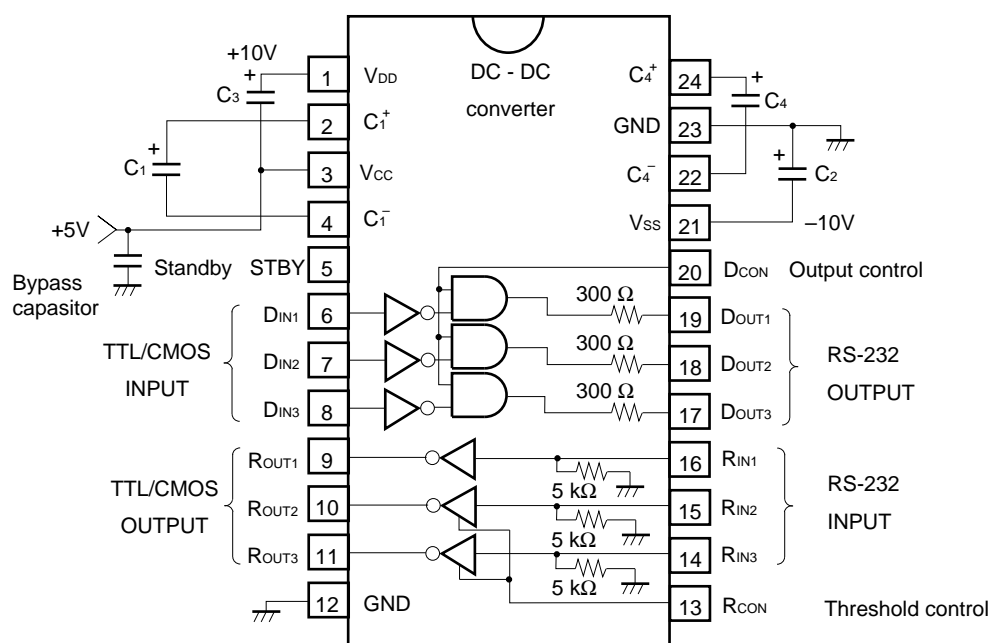
## FEATURES

- Conforms to EIA/TIA-232-E (RS-232C) standard
- +5 V single power source
- Threshold select pin selecting two types of threshold voltages
- Standby mode can be set by making standby pin high to reduce circuit current.
- Three-state output configuration. Both driver and receiver outputs go into high-impedance state in standby mode.

## ORDERING INFORMATION

Part Number	Package
$\mu$ PD4713ACX	24-pin plastic DIP (300 mil)
$\mu$ PD4713AGT	24-pin plastic SOP (375 mil)

## BLOCK DIAGRAM/PIN CONFIGURATION (Top View)



\*  $V_{DD}$  and  $V_{SS}$  are output pins of voltages internally boosted. Connecting a load directly to these pins is not recommended.

\*\* The standby pin is internally pulled down.

\*\*\* Use capacitors with a working voltage of 16 V or higher as  $C_1$  through  $C_4$ . Insert a bypass Capacitor about 0.1 to 1  $\mu$ F between  $V_{CC}$  pin to GND pin.

## TRUTH TABLE

### Drivers

STBY	D <sub>CON</sub>	D <sub>IN</sub>	D <sub>OUT</sub>	Remark
H	X	X	Z	Standby mode (DC-DC converter stops)
L	L	X	L	Mark level output
L	H	L	H	Space level output
L	H	H	L	Mark level output

### Receivers

STBY	R <sub>IN</sub>	R <sub>OUT</sub>	Remark
H	X	Z	Standby mode (DC-DC converter stops)
L	L	H	Mark level input
L	H	L	Space level input

### Receiver input threshold voltage

R <sub>CON</sub>	R <sub>IN1</sub>	R <sub>IN2</sub> to R <sub>IN3</sub>
L	A mode	A mode
H	A mode	B mode

H: high level, L: low level, Z: high impedance, X: H or L

**ABSOLUTE MAXIMUM RATINGS ( $T_A = 25\text{ }^{\circ}\text{C}$ )**

Parameter	Symbol	Ratings	Unit
Supply voltage	$V_{CC}$	-0.5 to +6.0	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
Driver output voltage	$D_{OUT}$	-25.0 to +25.0 <b>Note1</b>	V
Receiver output voltage	$R_{OUT}$	-0.5 to $V_{CC} + 0.5$	V
Receiver input current	$I_{IN}$	$\pm 60.0$	mA
Operating temperature range	$T_A$	-40 to +85	$^{\circ}\text{C}$
Storage temperature range	$T_{stg}$	-55 to +150	$^{\circ}\text{C}$
Power dissipation	$P_T$	0.5	W

**Note 1.** Pulse width: 1 ms, duty factor: 10 % MAX.

**RECOMMENDED OPERATING RANGE**

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Supply voltage	$V_{CC}$	4.5	5.0	5.5	V
Receiver input voltage	$R_{IN}$	-25		+25	V
Operating temperature range	$T_A$	-20		80	$^{\circ}\text{C}$
External capacitance	<b>Note 2</b>	4.7		47	$\mu\text{F}$

**Note 2.** The capacitance of an electrolytic capacitor decreases at a low temperature (0  $^{\circ}\text{C}$  or lower). Determine the capacitance of the capacitor to be used taking this into consideration when the  $\mu$ PD4713A is used at a low temperature. Keep the wiring length between the capacitor and IC as short as possible.

**ELECTRICAL CHARACTERISTICS (OVERALL)**(Unless otherwise specified,  $V_{CC} = +5\text{ V} \pm 10\%$ ,  $T_A = -20\text{ }^{\circ}\text{C}$  to  $+80\text{ }^{\circ}\text{C}$ ,  $C_1$  to  $C_4 = 22\text{ }\mu\text{F}$ )

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Circuit current	$I_{CC1}$	$V_{CC} = +5\text{ V}$ , no load, $R_{IN}$ pin open (Standby pin open)		5.0	18.0	mA
Circuit current	$I_{CC2}$	$V_{CC} = +5\text{ V}$ , $R_L = 3\text{ k}\Omega$ ( $D_{OUT}$ ), $D_{IN} = \text{GND}$ , $R_{IN}$ and $R_{OUT}$ pins open (Standby pin open)		21.0	40.0	mA
Standby circuit current	$I_{CC}$ (Standby)	$V_{CC} = +5\text{ V}$ , no load, $R_{IN}$ pin open (Standby pin high)		50	120	$\mu\text{A}$
Standby low-level input voltage	$V_{IL}$ (Standby)	<b>Note 3</b>			0.8	V
Standby high-level input voltage	$V_{IH}$ (Standby)		2.0			V
Standby high-level input current	$I_{IH}$ (Standby)	$V_{CC} = +5.5\text{ V}$ $V_I = 5.5\text{ V}$			100	$\mu\text{A}$
Standby low-level input current	$I_{IL}$ (Standby)	$V_{CC} = +5.5\text{ V}$ $V_I = 0\text{ V}$			-1	$\mu\text{A}$
Input capacitance	$C_{IN}$	Driver input and receiver input $V_{CC} = +5\text{ V}$ , vs. GND, $f = 1\text{ MHz}$			10	pF

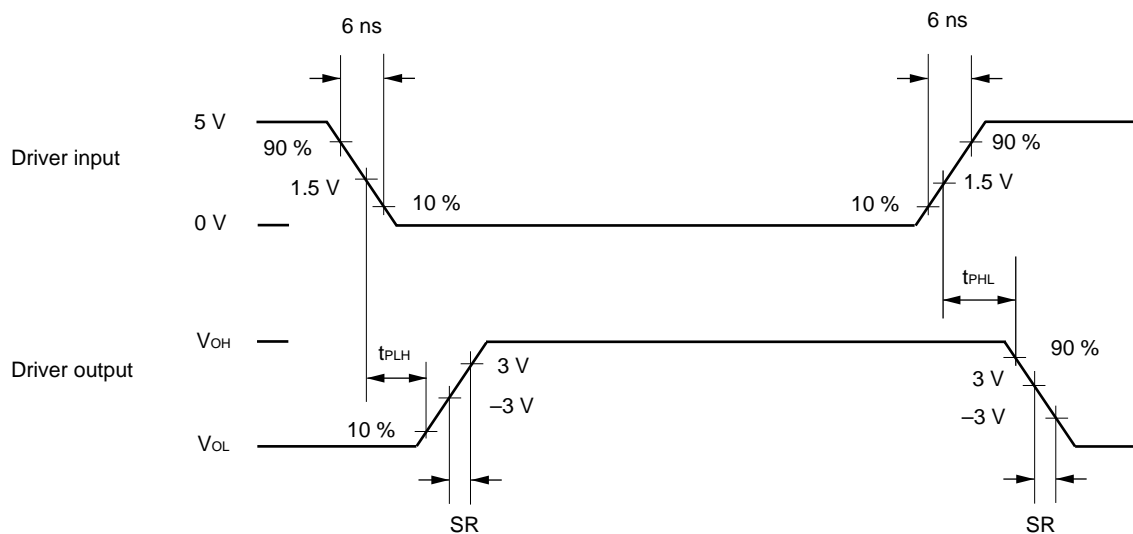
\* TYP.: Typical (reference) value at  $T_A = 25\text{ }^{\circ}\text{C}$ .**Note 3.** Because the standby pin is internally pulled down, if the standby pin is left open, operating mode is in effect.**ELECTRICAL CHARACTERISTICS (DRIVER)**(Unless otherwise specified,  $V_{CC} = +5\text{ V} \pm 10\%$ ,  $T_A = -20\text{ }^{\circ}\text{C}$  to  $+80\text{ }^{\circ}\text{C}$ ,  $C_1$  to  $C_4 = 22\text{ }\mu\text{F}$ )

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	$I_{IL}$		0		-1.0	$\mu\text{A}$
High-level input current	$I_{IH}$		0		1.0	$\mu\text{A}$
Output voltage	$V_{DO}$	$V_{CC} = +5.0\text{ V}$ , $R_L = \infty$ , $T_A = 25\text{ }^{\circ}\text{C}$		$\pm 9.7$		V
		$V_{CC} = +5.0\text{ V}$ , $R_L = 3\text{ k}\Omega$	$\pm 5.5$			V
		$V_{CC} = +4.5\text{ V}$ , $R_L = 3\text{ k}\Omega$	$\pm 5.0$			V
Output short current	$I_{SC}$	$V_{CC} = +5.0\text{ V}$ , vs. GND		$\pm 15$	$\pm 40$	mA
Slew rate	SR	$C_L = 10\text{ pF}$ , $R_L = 3\text{ to }7\text{ k}\Omega$	1.5	9	30	V/ $\mu\text{s}$
		$C_L = 2500\text{ pF}$ , $R_L = 3\text{ to }7\text{ k}\Omega$	1.5	4	30	V/ $\mu\text{s}$
Propagation delay time <b>Note 4</b>	$t_{PHL}$	$R_L = 3.5\text{ k}\Omega$ , $C_L = 2500\text{ pF}$		0.8		$\mu\text{s}$
	$t_{PLH}$					
Output resistance	$R_O$	$V_{CC} = V_{DD} = V_{SS} = 0\text{ V}$ $V_{OUT} = \pm 2\text{ V}$	300	500		$\Omega$
Standby output transition time	$t_{DAZ}$	<b>Note 5</b>		4	10	$\mu\text{s}$
Standby output transition time	$t_{DZA}$	<b>Note 5</b>		25	50	ms

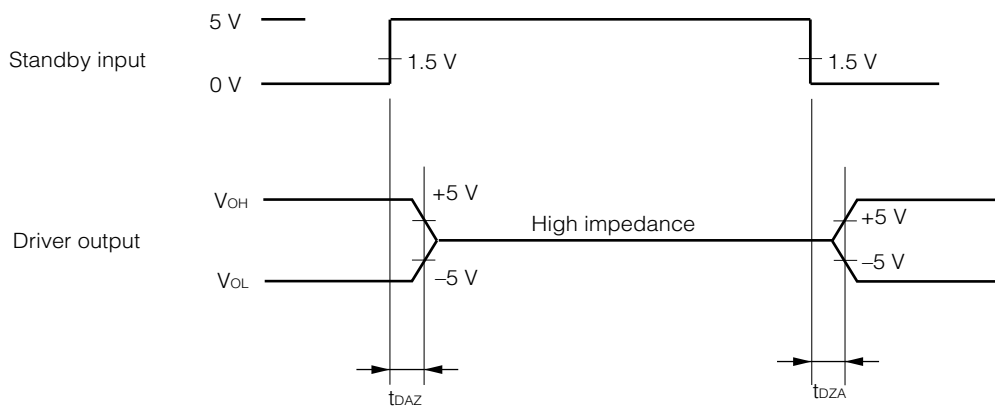
\* TYP.: Typical (reference) value at  $T_A = 25\text{ }^{\circ}\text{C}$ .

#### Note 4. Test point

If the output control pin is made low, the driver output goes low regardless of the driver input state.



#### Note 5. Test Point



Do not perform communication within the standby output transition time  $t_{DZA}$  on power application or on releasing the standby mode.

# ELECTRICAL CHARACTERISTICS (RECEIVER)

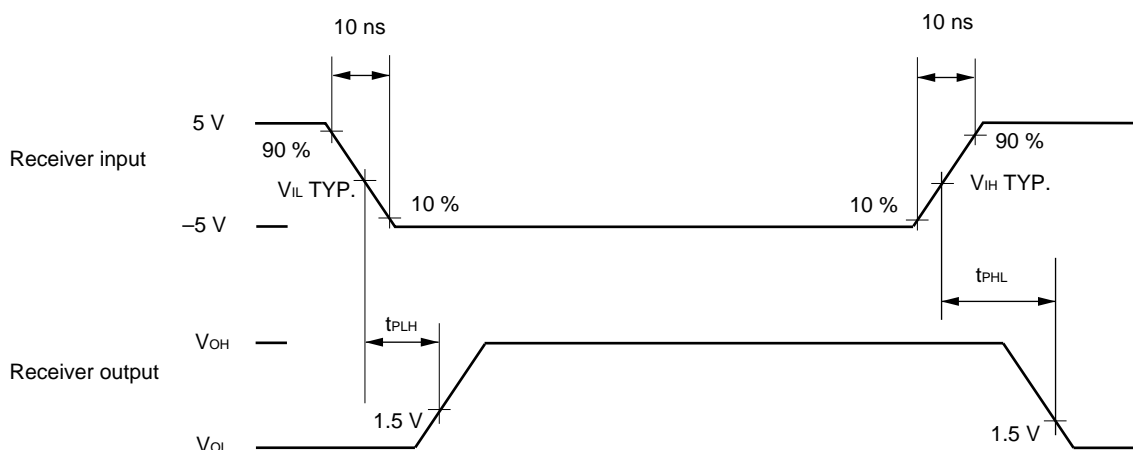
(Unless otherwise specified,  $V_{CC} = +5\text{ V} \pm 10\%$ ,  $T_A = -20\text{ }^{\circ}\text{C}$  to  $+80\text{ }^{\circ}\text{C}$ ,  $C_1$  to  $C_4 = 22\text{ }\mu\text{F}$ )

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Low-level output voltage	$V_{OL}$	$I_{OUT} = 4\text{ mA}$			0.4	V
High-level output voltage	$V_{OH}$	$I_{OUT} = -4\text{ mA}$	$V_{CC}$ -0.8			V
Low-level input voltage	$V_{IL}$	$R_{CON}$ pin			0.8	V
High-level input voltage	$V_{IH}$	$R_{CON}$ pin	2.0			V
Propagation delay time <b>Note 7</b>	$t_{PHL}$ $t_{PLH}$	$R_L = 1\text{ k}\Omega$ , $C_L = 150\text{ pF}$		0.13		$\mu\text{s}$
Input current	$I_{IN}$			1		mA
Input resistance	$R_i$		3	5	7	$\text{k}\Omega$
Input pin release voltage	$V_{IO}$	Input threshold A mode only			0.5	V
Input threshold A mode ( $R_{CON}$ pin low)	$V_{IH}$	$V_{CC} = +5\text{ V}$	1.6	2.2	2.6	V
	$V_{IL}$	$V_{CC} = +5\text{ V}$	0.6	1	1.6	V
	$V_H$	$V_{CC} = +5\text{ V}$ (hysteresis width)	0.5	1.2	1.8	V
Input threshold B mode <b>Note 6</b> ( $R_{CON}$ pin high)	$V_{IH}$	$V_{CC} = +5\text{ V}$	1.6	2.2	2.6	V
	$V_{IL}$	$V_{CC} = +5\text{ V}$	-0.4	-1.8	-3.0	V
	$V_H$	$V_{CC} = +5\text{ V}$ (hysteresis width)	2.6	4.0	5.4	V
Standby output transition time	$t_{DAZ}$	<b>Note 8</b>		0.4	1	$\mu\text{s}$
Standby output transiton time	$t_{DZA}$	<b>Note 8</b>		1	10	ms

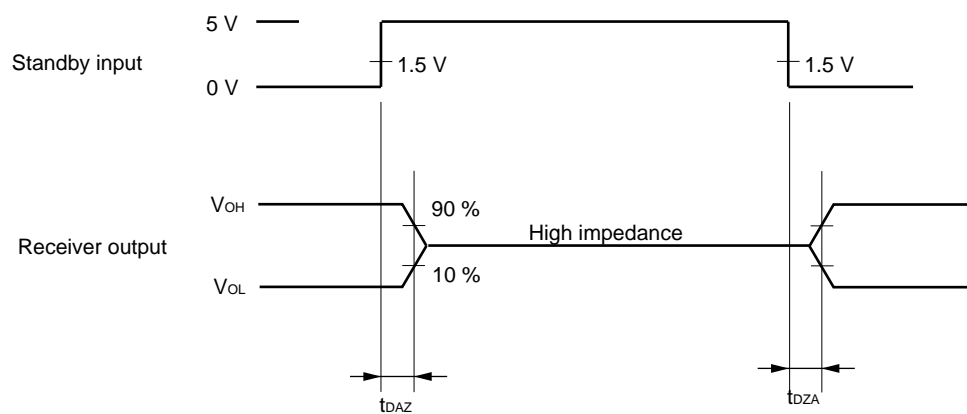
\* TYP.: Typical (reference) value at  $T_A = 25\text{ }^{\circ}\text{C}$ .

**Note 6.** This data is applicable to receivers 2 and 3 only. Receiver 1 is fixed in A mode.

**Note 7.** Test Point



**Note 8. Test Point**

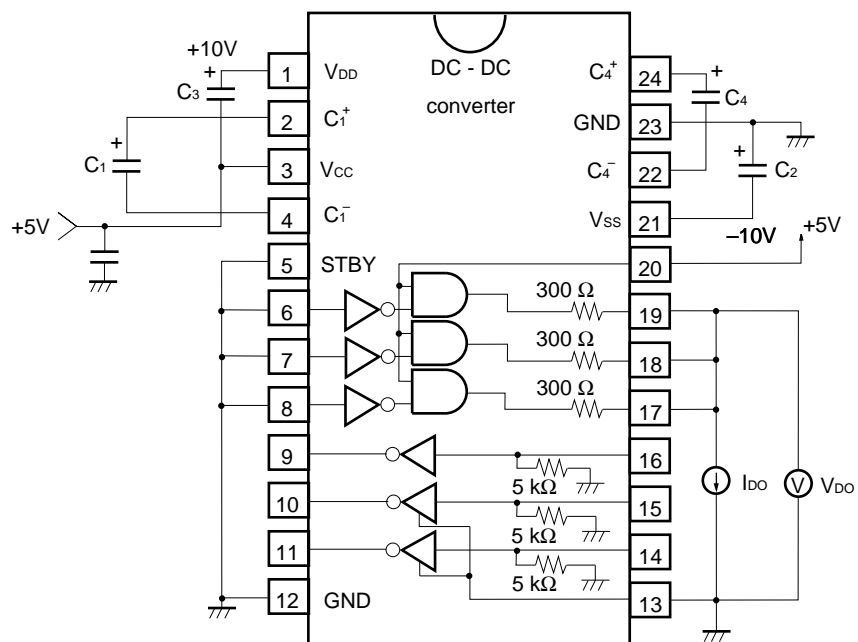


The receiver output is undefined during the standby output transition time  $t_{DZA}$ . Do not perform communication in the standby output transition time  $t_{DZA}$  on power application or on releasing the standby mode.

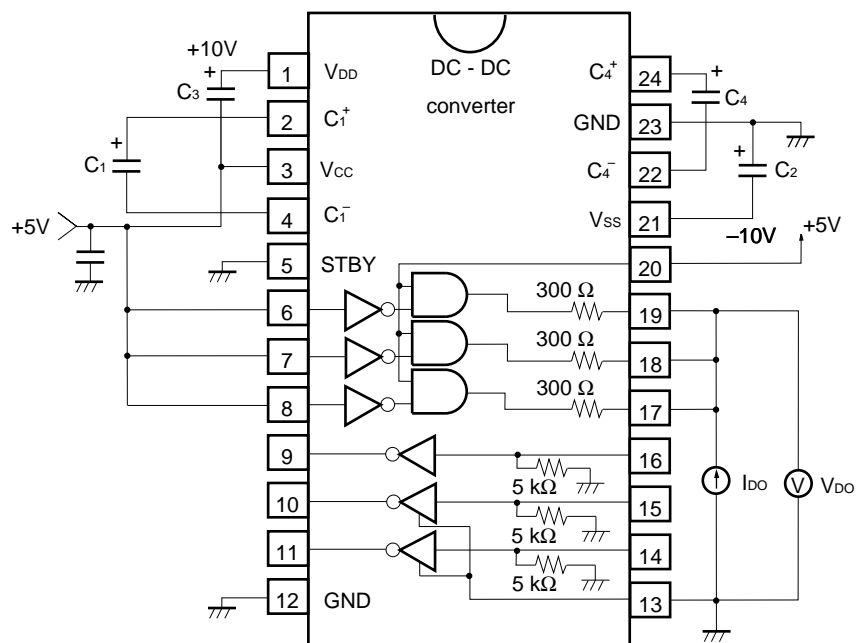


# TEST CIRCUIT

## Driver output voltage/Output current ( + side)

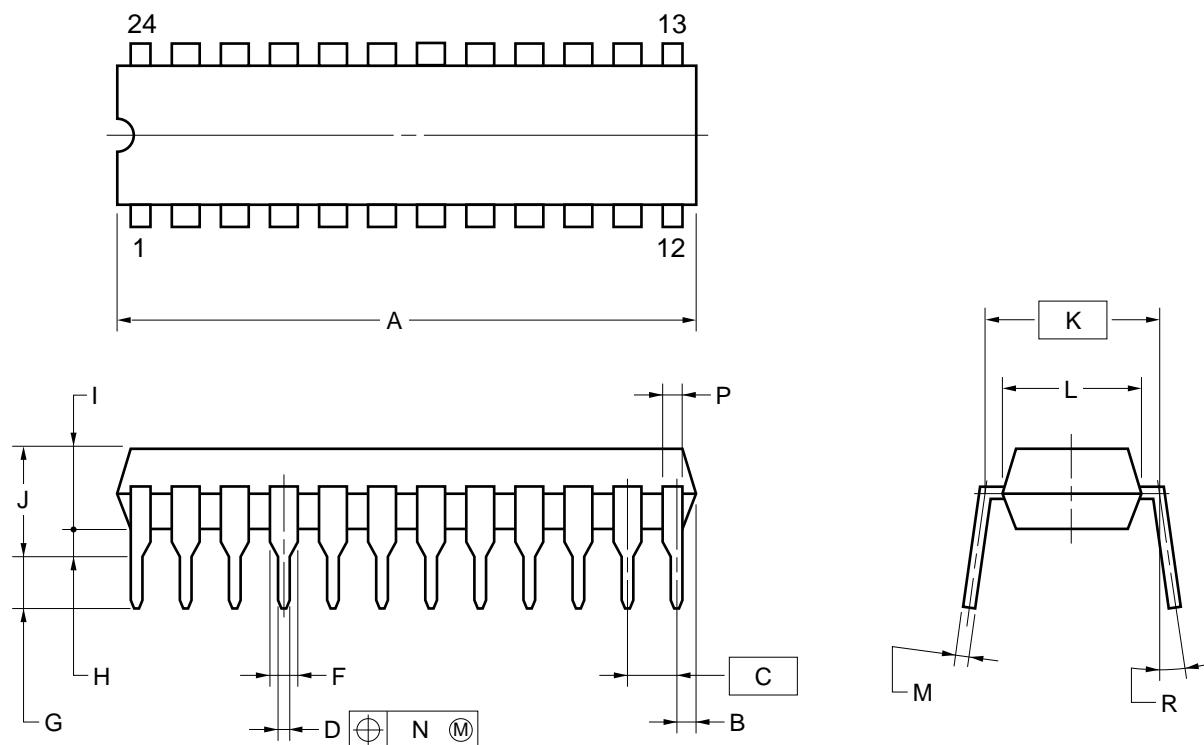


## Driver output voltage/Output current ( - side)



## PACKAGE DRAWINGS

## 24PIN PLASTIC DIP (300 mil)



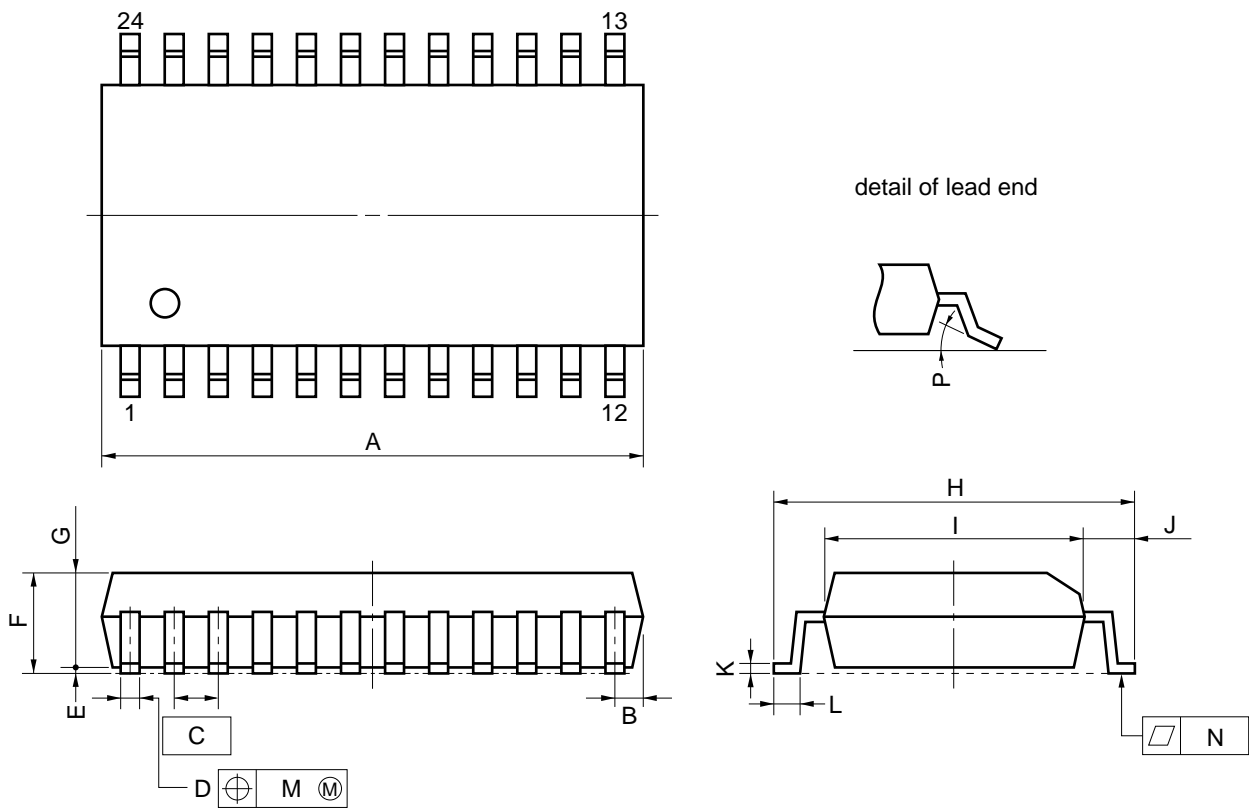
## NOTES

- 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	33.02 MAX.	1.300 MAX.
B	2.54 MAX.	0.100 MAX.
C	2.54 (T.P.)	0.100 (T.P.)
D	0.50±0.10	0.020 <sup>+0.004</sup> <sub>-0.005</sub>
F	1.2 MIN.	0.047 MIN.
G	3.5±0.3	0.138±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 <sup>+0.10</sup> <sub>-0.05</sub>	0.010 <sup>+0.004</sup> <sub>-0.003</sub>
N	0.25	0.01
P	1.0 MIN.	0.039 MIN.
R	0~15°	0~15°

P24C-100-300A-1

24 PIN PLASTIC SOP (375 mil)



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	15.54 MAX.	0.612 MAX.
B	0.78 MAX.	0.031 MAX.
C	1.27 (T.P.)	0.050 (T.P.)
D	0.40 <sup>+0.10</sup> <sub>-0.05</sub>	0.016 <sup>+0.004</sup> <sub>-0.003</sub>
E	0.1±0.1	0.004±0.004
F	2.9 MAX.	0.115 MAX.
G	2.50	0.098
H	10.3±0.3	0.406 <sup>+0.012</sup> <sub>-0.013</sub>
I	7.2	0.283
J	1.6	0.063
K	0.15 <sup>+0.10</sup> <sub>-0.05</sub>	0.006 <sup>+0.004</sup> <sub>-0.002</sub>
L	0.8±0.2	0.031 <sup>+0.009</sup> <sub>-0.008</sub>
M	0.12	0.005
N	0.15	0.006
P	3° <sup>+7°</sup> <sub>-3°</sub>	3° <sup>+7°</sup> <sub>-3°</sub>

P24GM-50-375B-3

## RECOMMENDED SOLDERING CONDITIONS

Soldering the μPD4713A under the conditions listed in the table below is recommended.

For soldering methods and conditions other than those recommended, consult NEC.

### Surface mount type

For the details of the recommended soldering conditions of the surface mount type, refer to Information document “Semiconductor Device Mounting Technology Manual” (C10535EJ7V0IF00)

#### μPD4713AGT

Soldering Method	Soldering Condition	Recommended Condition Symbol
Infrared reflow	Package peak temperature: 235 °C, Time: 30 seconds MAX. (210 °C MIN.), Number of times: 2, Number of days: not limited*	IR35-00-2
VPS	Package peak temperature: 215 °C, Time: 40 seconds MAX. (200 °C MIN.), Number of times: 2, Number of days: not limited*	VP15-00-2
Wave soldering	Soldering bath temperature: 260 °C MAX., Time: 10 seconds MAX., Number of times: 1, Number of days: not limited*	WS60-00-1
Pin partial heating	Pin temperature: 300 °C MAX. (lead temperature), Time: 3 seconds MAX. (per lead pin), Number of days: not limited*	

\* The number of days the device can be stored at 25 °C, 65 % RH MAX. after the dry pack has been opened.

**Caution** Do not use two or more soldering methods in combination (except the pin partial heating method).

### Through-hole type

#### μPD4713ACX

Soldering Method	Soldering Conditions
Wave soldering	Soldering bath temperature: 260 °C MAX., Time: 10 seconds MAX.

## REFERENCE DOCUMENTS

“NEC Semiconductor Device Reliability/Quality Control System” (IEI-1212)

“Quality Grade on NEC Semiconductor Devices” (IEI-1209)

“Semiconductor Device Mounting Technology Manual” (C10535EJ7V0IF00)

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