

## RS-232 LINE DRIVER/RECEIVER

The  $\mu$ PD4711B 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  $\mu$ PD4711B is provided with two output driver circuits and two receiver circuits, it can constitute an RS-232 interface circuit with a single chip.

**FEATURES**

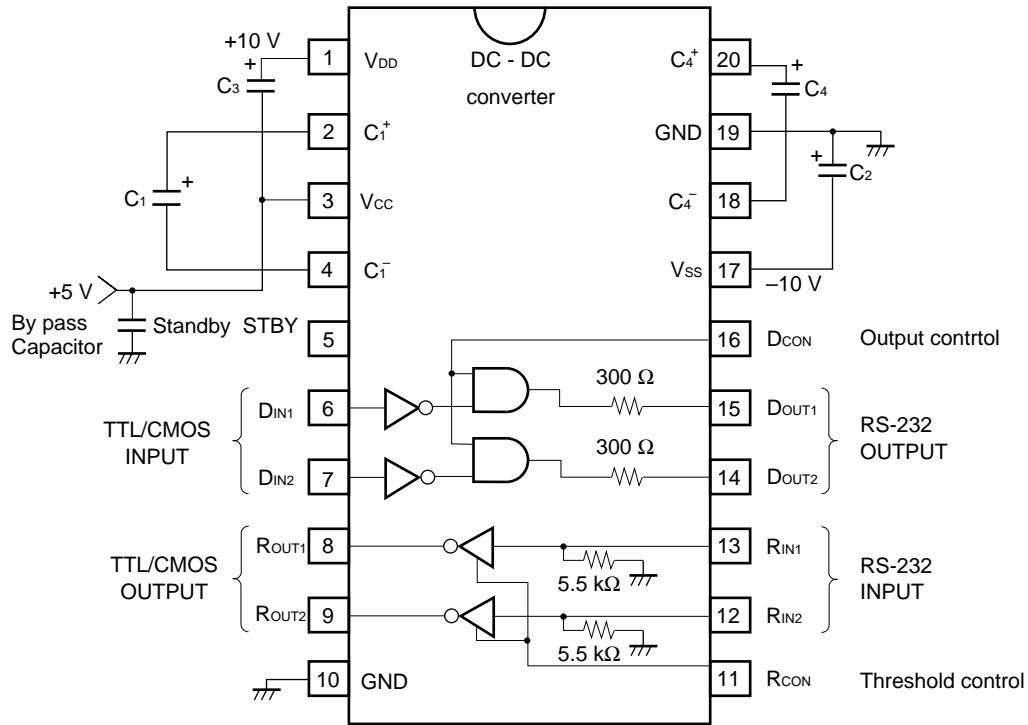
- Conforms to EIA/TIA-232-E (RS-232C) standard
- +5 V single power source
- Threshold select pin selecting two types of threshold voltages
- Standby mode can be set by making standby pin high to reduce circuit current.
- Three-state output configuration. Both driver and receiver outputs go into high-impedance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

**ORDERING INFORMATION**

Part Number	Package
$\mu$ PD4711BCX	20-pin plastic DIP (300 mil)
$\mu$ PD4711BGS	20-pin plastic SOP (300 mil)

The information in this document is subject to change without notice.

BLOCK DIAGRAM/PIN CONFIGURATION (Top View)



- \* V<sub>DD</sub> and V<sub>SS</sub> 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<sub>1</sub> through C<sub>4</sub>. Insert a bypass capacitor about 0.1 to 1 μF between V<sub>CC</sub> 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	Stanby 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> to R <sub>IN2</sub>
L	A mode
H	B mode

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

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

Parameter	Symbol	Ratings	Unit
Supply voltage	V <sub>CC</sub>	-0.5 to +6.0	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
Driver output voltage	D <sub>OUT</sub>	-25.0 to +25.0 <sup>Note 1</sup>	V
Receiver output voltage	R <sub>OUT</sub>	-0.5 to V <sub>CC</sub> + 0.5	V
Receiver input current	I <sub>IN</sub>	±60.0	mA
Operating temperature range	T <sub>A</sub>	-40 to +85	°C
Storage temperature range	T <sub>stg</sub>	-55 to +150	°C
Power dissipation	P <sub>T</sub>	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 <sub>CC</sub>	4.5	5.0	5.5	V
Receiver input voltage	R <sub>IN</sub>	-30		+30	V
Operating temperature range	T <sub>A</sub>	-20		80	°C
External capacitance	<b>Note 2</b>	1.0	22	47	μF

**Note 2.** The capacitance of an electrolytic capacitor decreases at a low temperature (0 °C or lower). Determine the capacitance of the capacitor to be used taking this into consideration when the μPD4711B 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<sub>CC</sub> = +5 V ±10 %, T<sub>A</sub> = -20 °C to +80 °C, C<sub>1</sub> to C<sub>4</sub> = 22 μF)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Circuit current	I <sub>CC1</sub>	V <sub>CC</sub> = +5 V, no load, R <sub>IN</sub> pin open (Standby pin open)		4.5	9.0	mA
Circuit current	I <sub>CC2</sub>	V <sub>CC</sub> = +5 V, R <sub>L</sub> = 3 kΩ (D <sub>OUT</sub> ), D <sub>IN</sub> = GND, R <sub>IN</sub> and R <sub>OUT</sub> pins open (Standby pin open)		15.0	25.0	mA
Standby circuit current	I <sub>CC</sub> (Standby)	V <sub>CC</sub> = +5 V, no load, R <sub>IN</sub> pin open (Standby pin high)		50	120	μA
Standby low-level input voltage	V <sub>IL</sub> (Standby)	<b>Note 3</b>			0.8	V
Standby high-level input voltage	V <sub>IH</sub> (Standby)		2.0			V
Input capacitance	C <sub>IN</sub>	Driver input and receiver input V <sub>CC</sub> = +5 V, vs. GND, f = 1 MHz			10	pF

\* TYP.: Typical (reference) value at T<sub>A</sub> = 25 °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)**

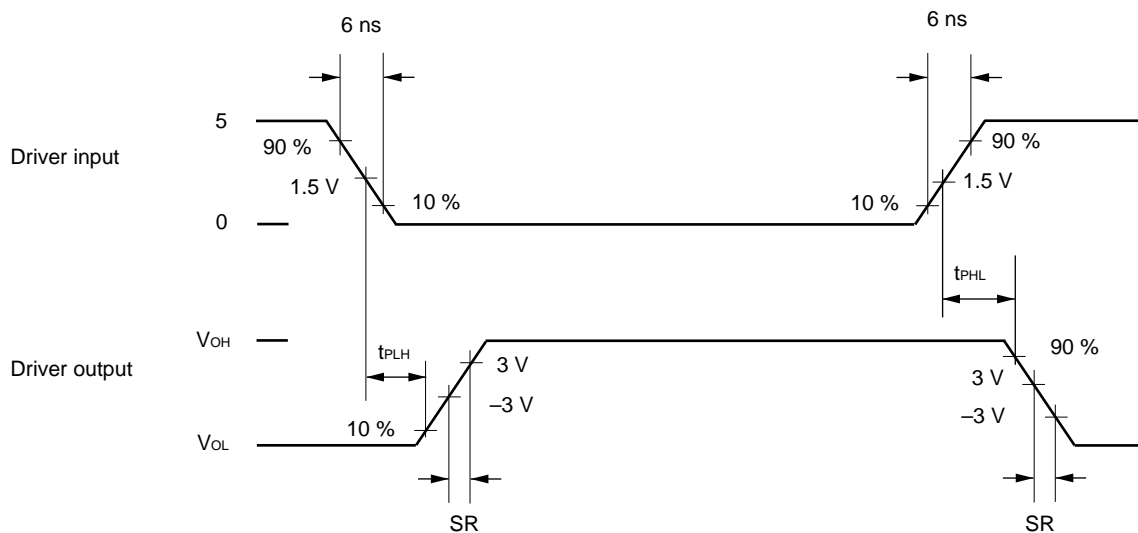
(Unless otherwise specified,  $V_{CC} = +5\text{ V} \pm 10\%$ ,  $T_A = -20\text{ }^\circ\text{C}$  to  $+80\text{ }^\circ\text{C}$ ,  $C_1$  to  $C_4 = 22\text{ }\mu\text{F}$ )

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	11	30	V/ $\mu\text{s}$
		$C_L = 2500\text{ pF}$ , $R_L = 3\text{ to }7\text{ k}\Omega$	1.5	6	30	V/ $\mu\text{s}$
Propagation delay time <sup>Note 4</sup>	$t_{PHL}$	$R_L = 3.5\text{ k}\Omega$ , $C_L = 2500\text{ pF}$				
	$t_{PLH}$			0.8		$\mu\text{s}$
Output resistance	$R_O$	$V_{CC} = V_{DD} = V_{SS} = 0\text{ V}$ $V_{OUT} = \pm 2\text{ V}$	300			$\Omega$
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

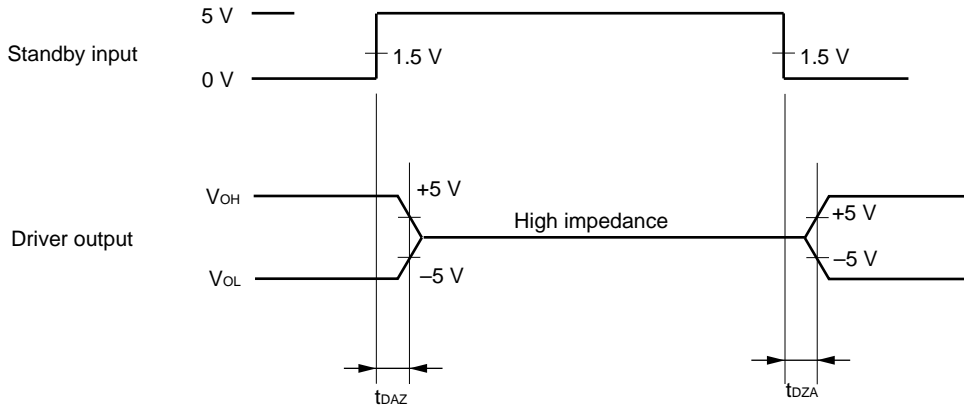
\* TYP.: Typical (reference) value at  $T_A = 25\text{ }^\circ\text{C}$ .

**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<sub>DZA</sub> on power application or on releasing the standby mode.

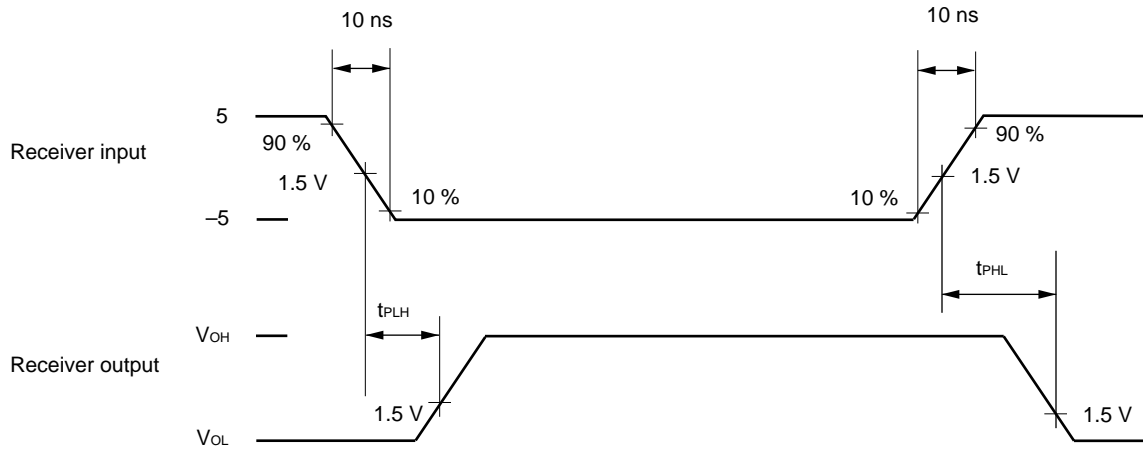
**ELECTRICAL CHARACTERISTICS (RECEIVER)**

(Unless otherwise specified, V<sub>CC</sub> = +5 V ± 10 %, T<sub>A</sub> = -20 °C to +80 °C, C<sub>1</sub> to C<sub>4</sub> = 22 μF)

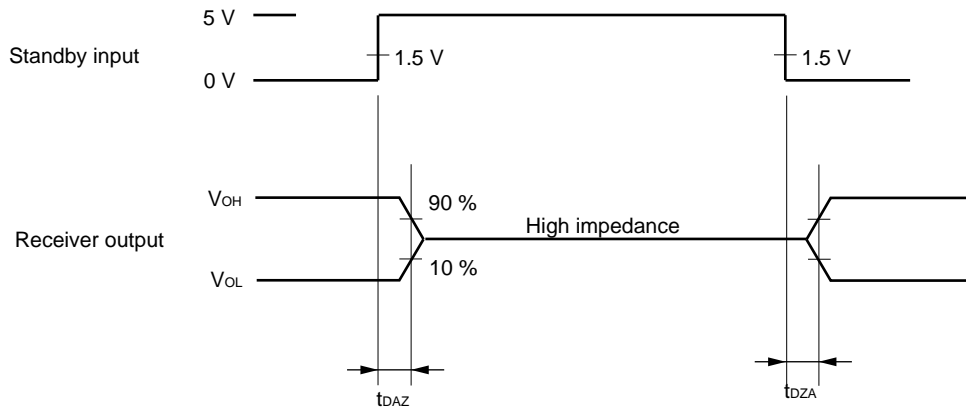
Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Low-level output voltage	V <sub>OL</sub>	I <sub>OUT</sub> = 4 mA			0.4	V
High-level output voltage	V <sub>OH</sub>	I <sub>OUT</sub> = -4 mA	V <sub>CC</sub> -0.8			V
Low-level input voltage	V <sub>IL</sub>	R <sub>CON</sub> pin			0.8	V
High-level input voltage	V <sub>IH</sub>	R <sub>CON</sub> pin	2.0			V
Propagation delay time <sup>Note 6</sup>	t <sub>PHL</sub> t <sub>PLH</sub>	R <sub>L</sub> = 1 kΩ, C <sub>L</sub> = 150 pF		0.13		μs
Input current	I <sub>IN</sub>	V <sub>IN</sub> = ±5 V		1		mA
Input resistance	R <sub>i</sub>	V <sub>IN</sub> = ±3 to ±25	3	5	7	kΩ
Input pin release voltage	V <sub>IO</sub>	Input threshold A mode only			0.5	V
Input threshold A mode (R <sub>CON</sub> pin low)	V <sub>IH</sub>	V <sub>CC</sub> = +5 V	1.6	2.2	2.6	V
	V <sub>IL</sub>	V <sub>CC</sub> = +5 V	0.6	1	1.6	V
	V <sub>H</sub>	V <sub>CC</sub> = +5 V (hysteresis width)	0.5	1.2	1.8	V
Input threshold B mode (R <sub>CON</sub> pin high)	V <sub>IH</sub>	V <sub>CC</sub> = +5 V	1.6	2.2	2.6	V
	V <sub>IL</sub>	V <sub>CC</sub> = +5 V	-0.4	-1.8	-3.0	V
	V <sub>H</sub>	V <sub>CC</sub> = +5 V (hysteresis width)	2.6	4.0	5.4	V
Standby output transition time	t <sub>DAZ</sub>	<b>Note 7</b>		0.4	1	μs
Standby output transition time	t <sub>DZA</sub>	<b>Note 7</b>		0.03	10	ms

\* TYP.: Typical (reference) value at T<sub>A</sub> = 25 °C.

**Note 6.** Test Point



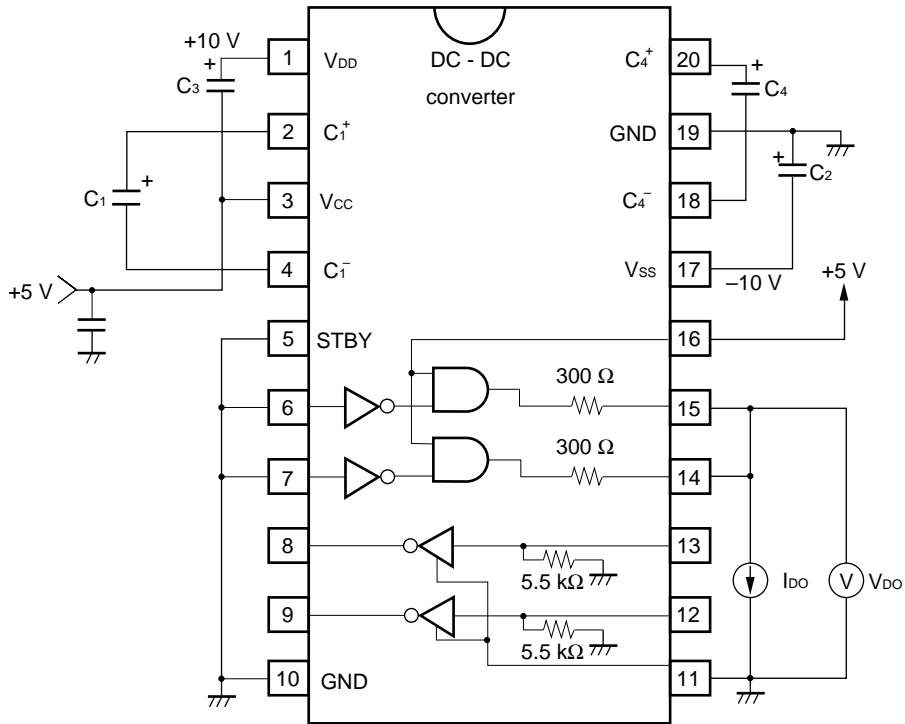
**Note 7.** Test Point



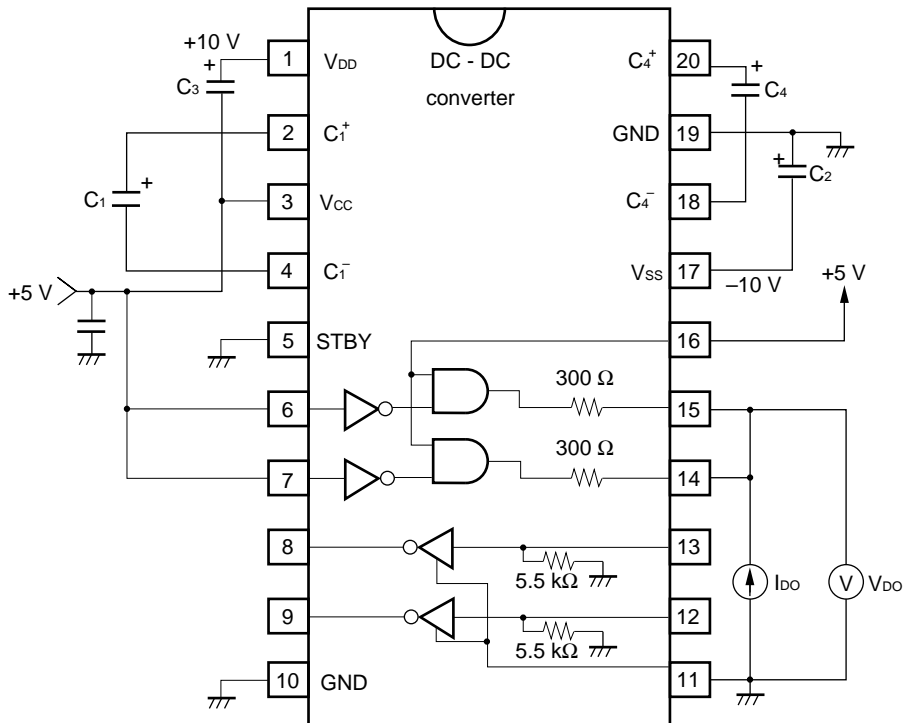
The receiver output is undefined during the standby output transition time t<sub>DZA</sub>. Do not perform communication in the standby output transition time t<sub>DZA</sub> on power application or on releasing the standby mode.

TEST CIRCUIT

Driver output voltage/Output current (+ side)



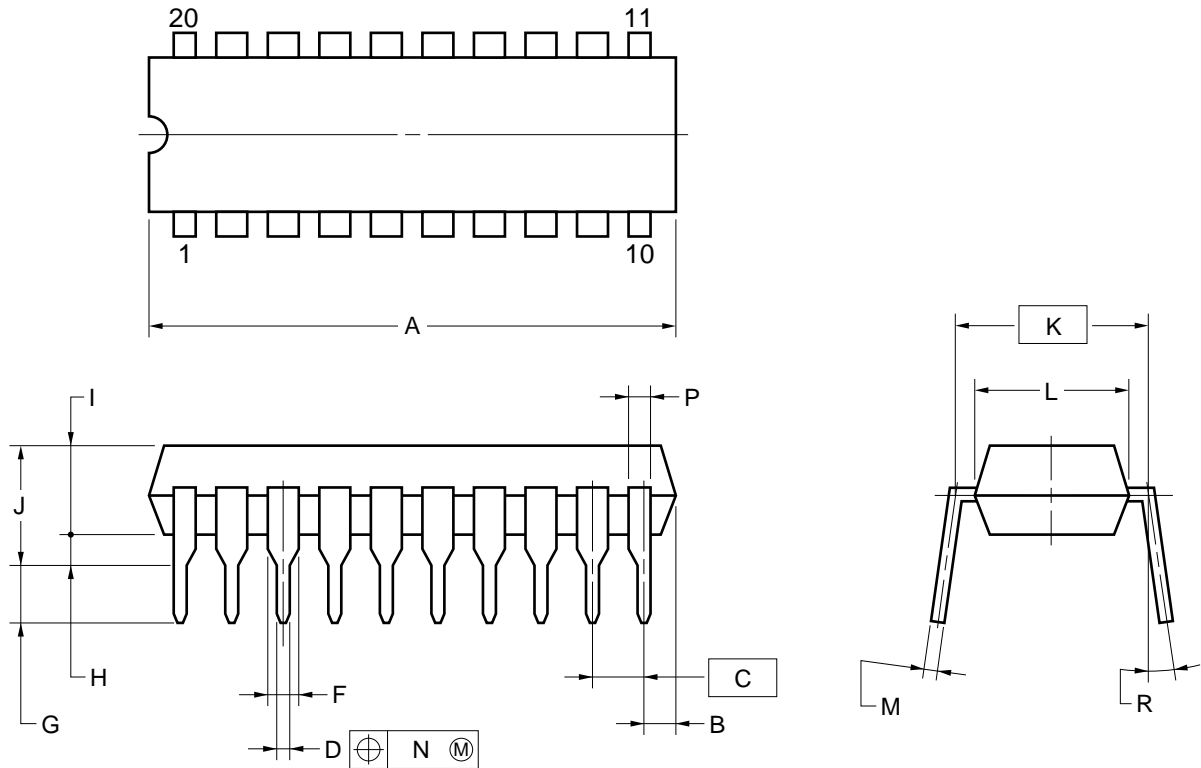
Driver output voltage/Output current (- side)





PACKAGE DRAWINGS

20PIN PLASTIC DIP (300 mil)



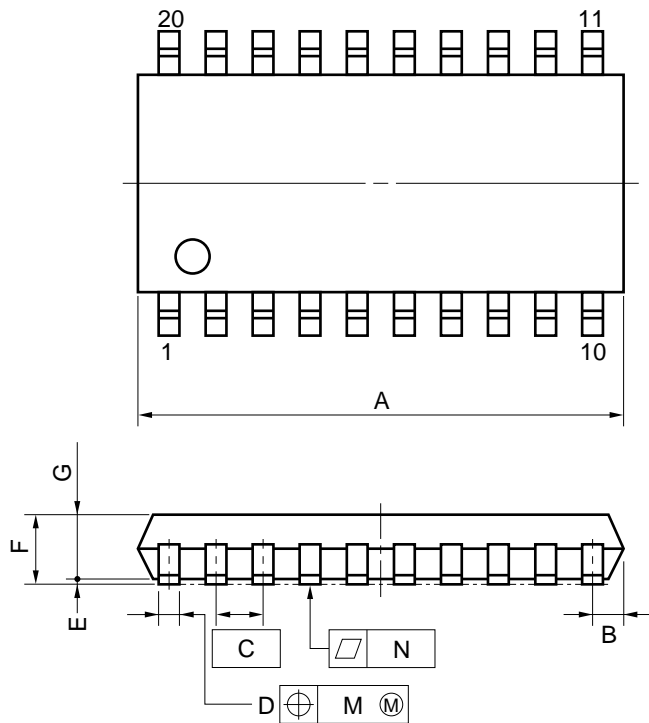
NOTES

- 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.

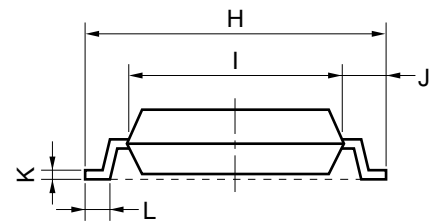
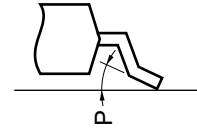
ITEM	MILLIMETERS	INCHES
A	25.40 MAX.	1.000 MAX.
B	1.27 MAX.	0.050 MAX.
C	2.54 (T.P.)	0.100 (T.P.)
D	0.50±0.10	0.020 <sup>+0.004</sup> <sub>-0.005</sub>
F	1.1 MIN.	0.043 MIN.
G	3.5±0.3	0.138±0.012
H	0.51 MIN.	0.020 MIN.
I	4.31 MAX.	0.170 MAX.
J	5.08 MAX.	0.200 MAX.
K	7.62 (T.P.)	0.300 (T.P.)
L	6.4	0.252
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	0.9 MIN.	0.035 MIN.
R	0~15°	0~15°

P20C-100-300A,C-1

20 PIN PLASTIC SOP (300 mil)



detail of lead end



**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	13.00 MAX.	0.512 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	1.8 MAX.	0.071 MAX.
G	1.55	0.061
H	7.7±0.3	0.303±0.012
I	5.6	0.220
J	1.1	0.043
K	0.20 <sup>+0.10</sup> <sub>-0.05</sub>	0.008 <sup>+0.004</sup> <sub>-0.002</sub>
L	0.6±0.2	0.024 <sup>+0.008</sup> <sub>-0.009</sub>
M	0.12	0.005
N	0.10	0.004
P	3° <sup>+7°</sup> <sub>-3°</sub>	3° <sup>+7°</sup> <sub>-3°</sub>

P20GM-50-300B, C-4

**RECOMMENDED SOLDERING CONDITIONS**

Soldering the μPD4711B 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.

**μPD4711BGS**

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**

**μPD4711BCX**

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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