

RS-232 LINE DRIVER/RECEIVER

The μ PD4726 is a high-voltage silicon gate CMOS line driver/receiver conforming to EIA/TIA-232-E Standards. It contains a DC/DC converter and can operate with a +5 V single power supply. In addition, it is also provided with ancillary functions such as a standby function.

This IC is equipped with four driver circuits and seven receiver circuits and can configure a simple RS-232 interface circuit with only four external capacitors.

FEATURES

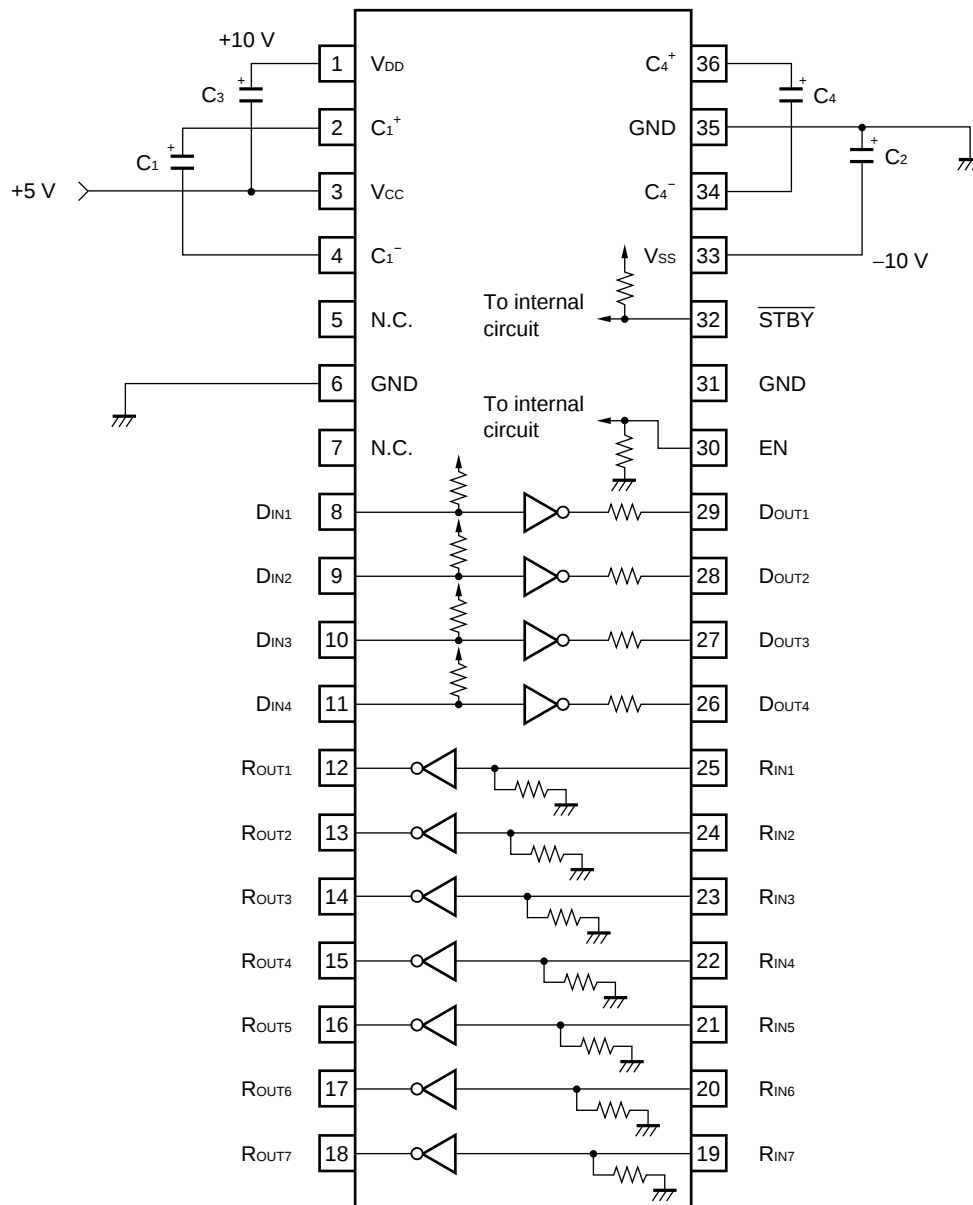
- Conforms to EIA/TIA-32-E (old RS-232C) Standards
- +5 V single power supply
- A standby mode can be set by making the standby pin low to reduce the power dissipation. At this time, the driver outputs go into a high-impedance state.
- Two receiver circuits can operate as inverters without a hysteresis width even in the standby mode. The remaining five receiver circuits are fixed to the high level.

ORDERING INFORMATION

Part Number	Package	Quality Grade
μ PD4726GS-BAF	36-pin plastic SSOP (300 mil)	Standard

Please refer to "Quality grade on NEC Semiconductor Devices" (Document number IEI-1209) published by NEC Corporation to know the specification of quality grade on the devices and its recommended applications.

BLOCK DIAGRAM/PIN CONFIGURATION (Top View)



- Notes**
1. V_{DD} and V_{SS} output internally boosted voltages. Do not connect a load directly to these pins.
 2. It is recommended that capacitors having a breakdown voltage of 20 V or higher be used as C_1 through C_5 . Inserting a bypass capacitor of 0.1 to 1 μ F in between V_{CC} and GND is also recommended.
 3. Be sure to connect all the GND pins. Especially, make sure that pin 31 is connected; otherwise, the μ PD4726 will not operate normally. Be sure to leave the NC pins (pins 5 and 7) open.
 4. The pull-up resistors for D_{IN1} through D_{IN4} and $\overline{STBY}$ and the pull-down resistor for EN are active resistors.

TRUTH TABLE

Drivers

$\overline{\text{STBY}}$	D _{IN}	D _{OUT}	Remarks
L	×	Z	Standby mode (DC/DC converter stops.)
H	L	H	Space level output
H	H	L	Mark level output

Receivers

$\overline{\text{STBY}}$	EN	R _{IN}		R _{OUT}		Remarks
		R ₆ - R ₇	R ₁ - R ₅	R ₆ - R ₇	R ₁ - R ₅	
L	L	×	×	H	H	Standby mode 1 (DC/DC converter stops.)
L	H	L	×	H	H	Standby mode 2 (DC/DC converter stops. R ₆ and R ₇ operate.)
L	H	H	×	L	H	
H	×	L		H		Mark level input
H	×	H		L		Space level input

H: high level

L: low level

Z: high impedance

×: H or L

ABSOLUTE MAXIMUM RATING ($T_a = 25\text{ }^{\circ}\text{C}$)

Parameter	Symbol	Ratings	Unit
Supply voltage	V_{CC}	-0.5 to +7.0	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
Control input voltage ($\overline{STBY}$, EN)	V_{IN}	-0.5 to $V_{CC} + 0.5$	V
Driver output voltage	D_{OUT}	-25.0 to +25.0 ^{Note 5}	V
Receiver output voltage	R_{OUT}	-0.5 to $V_{CC} + 0.5$	V
Input current (D_{IN} , $\overline{STBY}$, EN)	I_{IN}	± 20.0	mA
Operating ambient temperature	$T_{opt.}$	-40 to +85	$^{\circ}\text{C}$
Storage temperature	$T_{stg.}$	-55 to +150	$^{\circ}\text{C}$
Permissible package power dissipation	P_T	0.5	W

Note 5. Pulse width: 1 ms, duty cycle: 10 % MAX.

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Supply voltage ($V_{CHA} = L$)	V_{CC}	4.5	5.0	5.5	V
Input voltage, high (D_{IN})	V_{IH}	2.0		V_{CC}	V
Input voltage, low (D_{IN})	V_{IL}	0		0.8	V
Input voltage, high ($\overline{STBY}$, EN)	V_{IH}	2.4		V_{CC}	V
Input voltage, low ($\overline{STBY}$, EN)	V_{IL}	0		0.8	V
Receiver input voltage	R_{IN}	-30		+30	V
Operating ambient temperature	$T_{opt.}$	-40		+85	$^{\circ}\text{C}$
External capacitance (nominal value)	Note 6	1		4.7	μF

Note 6. Use capacitors whose capacitance fluctuation is within $\pm 50\%$ including fluctuations due to temperature and tolerance (effective value: 0.5 to 7.05 μF).

Use of capacitors with excellent high-frequency characteristics (such as multilayer ceramic capacitors, tantalum capacitors, and aluminum electrolytic capacitors for switching power supply) is recommended. Keep the wiring length between a capacitor and an IC pin as short as possible.

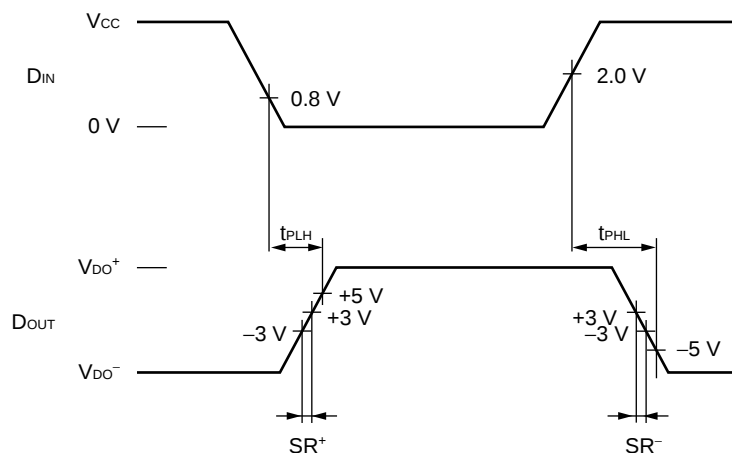
ELECTRICAL SPECIFICATIONS (CHIP)(Unless otherwise specified, $T_a = -40$ to $+85$ °C, C_1 through $C_5 = 1$ μ F)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Circuit current	I_{CC1}	$V_{CC} = +5.0$ V, no load, R_{IN} pin open, $\overline{STBY} = H$			12	mA
Circuit current	I_{CC2}	$V_{CC} = +5.0$ V, $R_L = 3$ k Ω (D_{OUT}), $D_{IN} = GND$, R_{IN} , R_{OUT} pins open, $\overline{STBY} = H$			38	mA
Circuit current in standby mode (standby mode 1)	I_{CC3}	$V_{CC} = +5.0$ V, no load, D_{IN} , R_{IN} pins open, $\overline{STBY} = L$, $EN = L$, $T_a = 25$ °C		9	20	μ A
		$V_{CC} = +5.0$ V, no load, D_{IN} , R_{IN} pins open, $\overline{STBY} = L$, $EN = L$		15		μ A
Circuit current in standby mode (standby mode 2)	I_{CC4}	$V_{CC} = +5.0$ V, no load, D_{IN} , R_{IN} pins open, $\overline{STBY} = L$, $EN = H$, $T_a = 25$ °C		9	20	μ A
		$V_{CC} = +5.0$ V, no load, D_{IN} , R_{IN} pins open, $\overline{STBY} = L$, $EN = H$, $T_a = 25$ °C		15		μ A
Input voltage, high	V_{IH}	$\overline{STBY}$, EN pins, $V_{CC} = +4.5$ to $+5.5$ V	2.4			V
Input voltage, low	V_{IL}	$\overline{STBY}$, EN pins, $V_{CC} = +4.5$ to $+5.5$ V			0.8	V
Input current, high	I_{IH}	$\overline{STBY}$ pin, $V_{CC} = +5.5$ V, $V_I = +5.5$ V			1	μ A
Input current, low	I_{IL}	$\overline{STBY}$ pin, $V_{CC} = +5.5$ V, $V_I = 0$ V			-40	μ A
Input current, high	I_{IH}	EN pin, $V_{CC} = +5.5$ V, $V_I = +5.5$ V			40	μ A
Input current, low	I_{IL}	EN pin, $V_{CC} = +5.5$ V, $V_I = 0$ V			-1	μ A
Input capacitance	C_{IN}	Driver inputs and receiver inputs, $V_{CC} = +5.0$ V, vs. GND, $f = 1$ MHz			10	pF

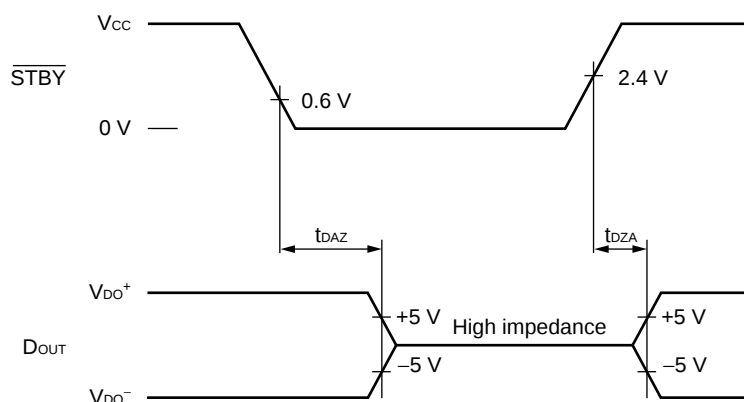
Remark TYP. value is a reference value at $T_a = 25$ °C.

ELECTRICAL SPECIFICATIONS (DRIVERS)(Unless otherwise specified, $T_a = -40$ to $+85$ °C, $V_{CC} = +5.0$ V ± 10 %, C_1 through $C_5 = 1$ μ F)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Input voltage, low	V_{IL}				0.8	V
Input voltage, high	V_{IH}		2.0			V
Input current, low	I_{IL}				-40	μ A
Input current, high	I_{IH}				1.0	μ A
Output voltage	V_{DO}	$V_{CC} = +5.0$ V, $R_L = \infty$, $T_a = 25$ °C		± 9.7		V
		$V_{CC} = +5.0$ V, $R_L = 3$ k Ω , $T_a = T_{opt.}$	± 5.5			V
		$V_{CC} = +4.5$ V, $R_L = 3$ k Ω , $T_a = T_{opt.}$	± 5.0			V
Output short current	I_{SC}	$V_{CC} = +5.0$ V, vs. GND			± 40	mA
Slew rate	SR	$C_L = 10$ pF, $R_L = 3$ to 7 k Ω	4.0		30	V/ μ s
		$C_L = 2\,500$ pF, $R_L = 3$ to 7 k Ω	4.0		30	V/ μ s
Propagation delay time ^{Note 8}	t_{PHL} t_{PLH}	$R_L = 3$ k Ω , $C_L = 2\,500$ pF		2		μ s
Output resistance	R_0	$V_{CC} = V_{DD} = V_{SS} = 0$ V $V_{OUT} = \pm 2$ V	300			Ω
Standby output transition time	t_{DAZ}	$R_L = 3$ k Ω , $C_L = 2500$ pF, ^{Note 9}		4	10	μ s
Standby output transition time	t_{DZA}	$R_L = 3$ k Ω , $C_L = 2500$ pF, ^{Note 9}		0.5	1	ms
Power-ON output transition time	t_{PRA}	$R_L = 3$ k Ω , $C_L = 2500$ pF, ^{Note 10}		0.5	1	ms

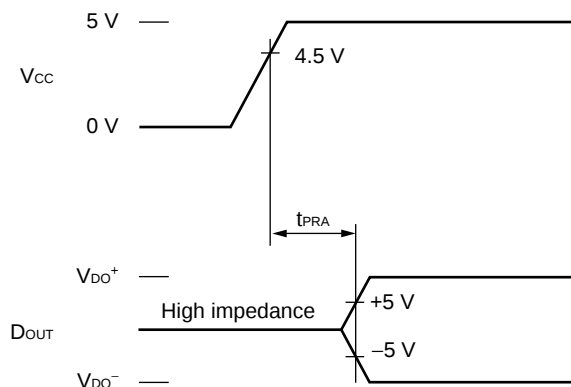
Remark TYP. value is a reference value at $T_a = 25$ °C.**Note 8. Test point**

Note 9. Test point



The driver output is undefined during the standby output transition time t_{DAZ} . Do not perform communication within the standby output transition time t_{DAZ} after the standby mode has been released.

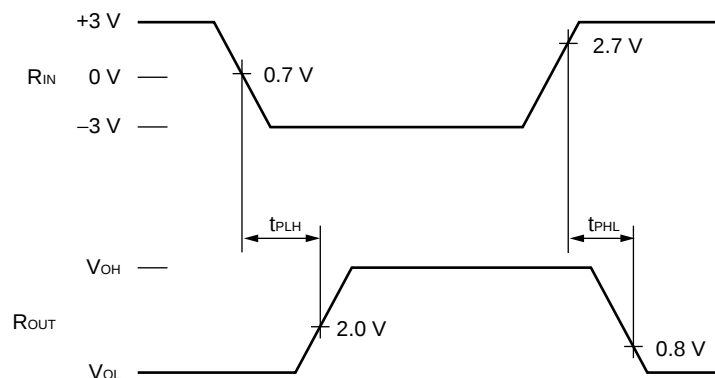
Note 10. Test point



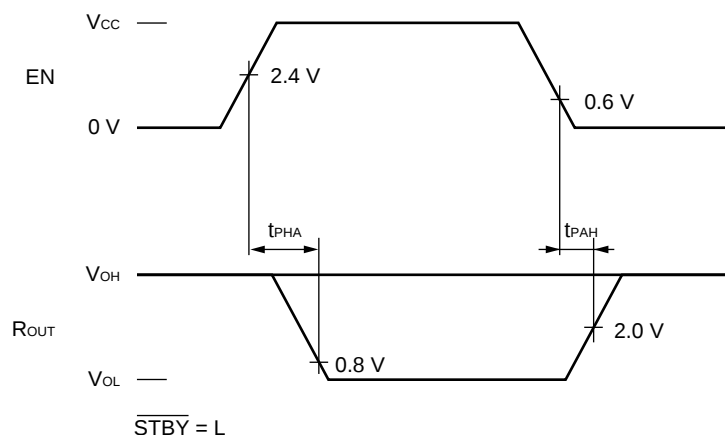
The driver output is undefined during the power-ON output transition time t_{PRA} . Do not perform communication within the power-ON output transition time t_{PRA} on power application.

ELECTRICAL SPECIFICATIONS (RECEIVERS)(Unless otherwise specified, $V_{CC} = 4.5$ to 5.5 V, $T_a = -40$ to $+85$ °C, C_1 through $C_5 = 1$ μF)

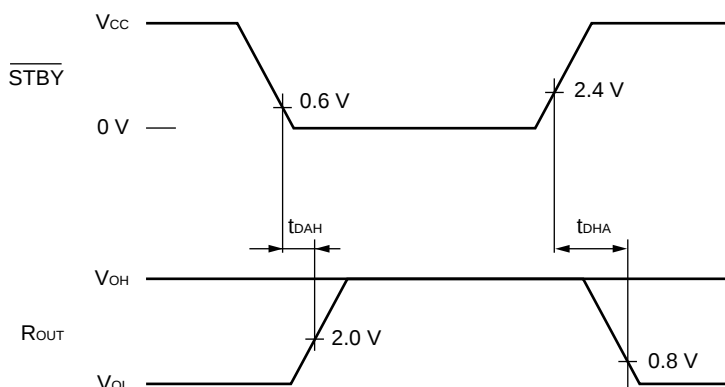
Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Output voltage, low ($\overline{STBY} = H$)	V_{OL1}	$I_{OUT} = 4$ mA			0.4	V
Output voltage, high ($\overline{STBY} = H$)	V_{OH1}	$I_{OUT} = -4$ mA	$V_{CC} - 0.4$			V
Output voltage, low ($\overline{STBY} = L$)	V_{OL2}	$I_{OUT} = 4$ mA			0.5	V
Output voltage, high ($\overline{STBY} = L$)	V_{OH2}	$I_{OUT} = -4$ mA	$V_{CC} - 0.5$			V
Propagation delay time ($\overline{STBY} = H$)	t_{PHL} t_{PLH}	$R_{IN} \rightarrow R_{OUT}$, $C_L = 150$ pF $V_{CC} = +4.5$ V, Note 11		0.2		μs
Propagation delay time ($\overline{STBY} = L$, $EN = H$)	t_{PHL} t_{PLH}	$R_{IN} \rightarrow R_{OUT}$ (R_6 , R_7), $C_L = 150$ pF $V_{CC} = +4.5$ V, Note 11		0.1		μs
Propagation delay time ($\overline{STBY} = L$)	t_{PHA} t_{PAH}	$EN \rightarrow R_{OUT}$ (R_6 , R_7), $C_L = 150$ pF $V_{CC} = +4.5$ V, Note 12		100	300	ns
Input resistance	R_i		3	5.5	7	kΩ
Open voltage across input pins	V_{IO}				0.5	V
Input threshold voltage ($\overline{STBY} = H$)	V_{IH}	$V_{CC} = +4.5$ to $+5.5$ V	1.7	2.3	2.7	V
	V_{IL}	$V_{CC} = +4.5$ to $+5.5$ V	0.7	1.1	1.7	V
	V_H	$V_{CC} = +4.5$ to $+5.5$ V (hysteresis width)	0.5	1.2	1.8	V
Input threshold voltage ($\overline{STBY} = L$, $EN = H$)	V_{IH}	$V_{CC} = +4.5$ to $+5.5$ V, R_{IN6} , R_{IN7}	2.7	1.5		V
	V_{IL}	$V_{CC} = +4.5$ to $+5.5$ V, R_{IN6} , R_{IN7}		1.5	0.7	V
Standby output transition time	t_{DAH}	Note 13		0.2	3	μs
Standby output transition time	t_{DHA}	Note 13		0.3	1	ms
Power-ON output transition time	t_{PRA}	Note 14		0.5	1	ms

Remark TYP. value is a reference value at $T_a = 25$ °C.**Note 11. Test point**

Note 12. Test point

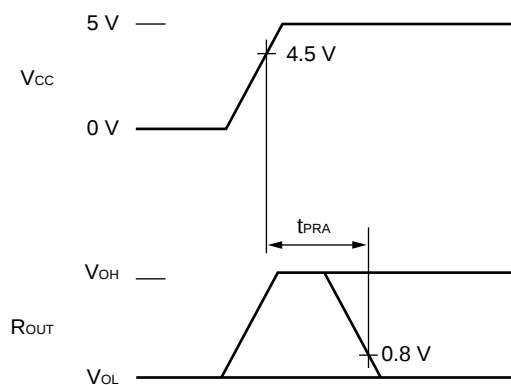


Note 13. Test point



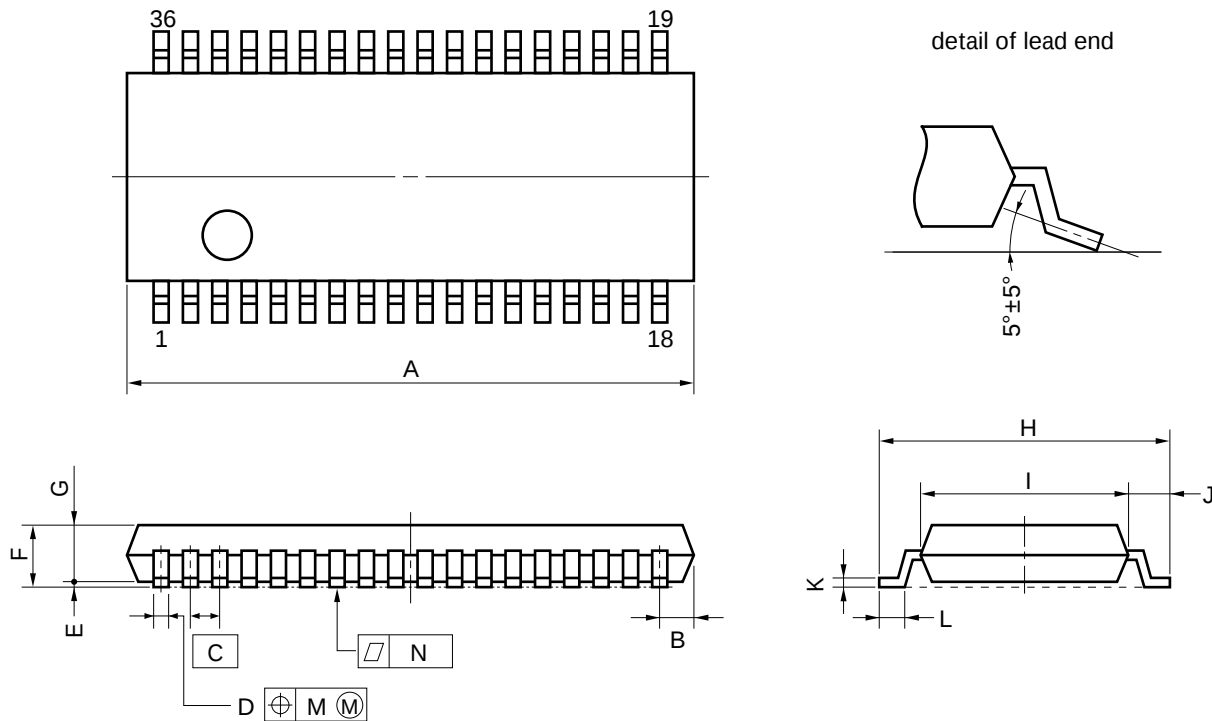
The receiver output is undefined during the standby output transition time t_{DHA} . Do not perform communication within the standby output transition time t_{DHA} after the standby mode has been released.

Note 14. Test point



The receiver output is undefined during the power-ON output transition time t_{PRA} . Do not perform communication within the power-ON output transition time t_{PRA} on power application.

36 PIN PLASTIC SHRINK SOP (300 mil)

**NOTE**

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

P36GM-80-300B-3

ITEM	MILLIMETERS	INCHES
A	15.54 MAX.	0.612 MAX.
B	0.97 MAX.	0.039 MAX.
C	0.8 (T.P.)	0.031 (T.P.)
D	0.35 ^{+0.10} _{-0.05}	0.014 ^{+0.004} _{-0.003}
E	0.125±0.075	0.005±0.003
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 ^{+0.10} _{-0.05}	0.008 ^{+0.004} _{-0.002}
L	0.6±0.2	0.024 ^{+0.008} _{-0.009}
M	0.10	0.004
N	0.10	0.004

RECOMMENDED SOLDERING CONDITIONS

Solder and mount the μPD4726 under the following recommended conditions.
Consult NEC for conditions other than those recommended.

μPD4726GS-BAF

Soldering method	Soldering conditions	Symbol
Infrared ray reflow	Peak temperature of package surface: 235 °C, Reflow time: Within 30 sec (210 °C or higher), Number of reflow process: 2, Exposure limit: None ^{Note}	IR35-00-2
VPS	Peak temperature of package surface: 215 °C, Reflow time: Within 40 sec (200 °C or higher), Number of reflow process: 2, Exposure limit: None ^{Note}	VP15-00-2
Wave soldering	Solder temperature: 260 °C or lower, Reflow time: Within 10 sec, Number of reflow process: 1, Exposure limit: None ^{Note}	WS60-00-1
Partial heating	Pin temperature: 300 °C or lower, Time: Within 10 sec, Exposure limit: None ^{Note}	

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

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

REFERENCE

Document name	Document No.
Semiconductor Device Mounting Technology Manual	IEI-1207
Quality grade on NEC Semiconductor Devices	IEI-1209
NEC Semiconductor Device Reliability/Quality Control system	IEI-1212

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Anti-radioactive design is not implemented in this product.