NEC

MOS INTEGRATED CIRCUIT

μPD4726

RS-232 LINE DRIVER/RECEIVER

The μPD4726 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.

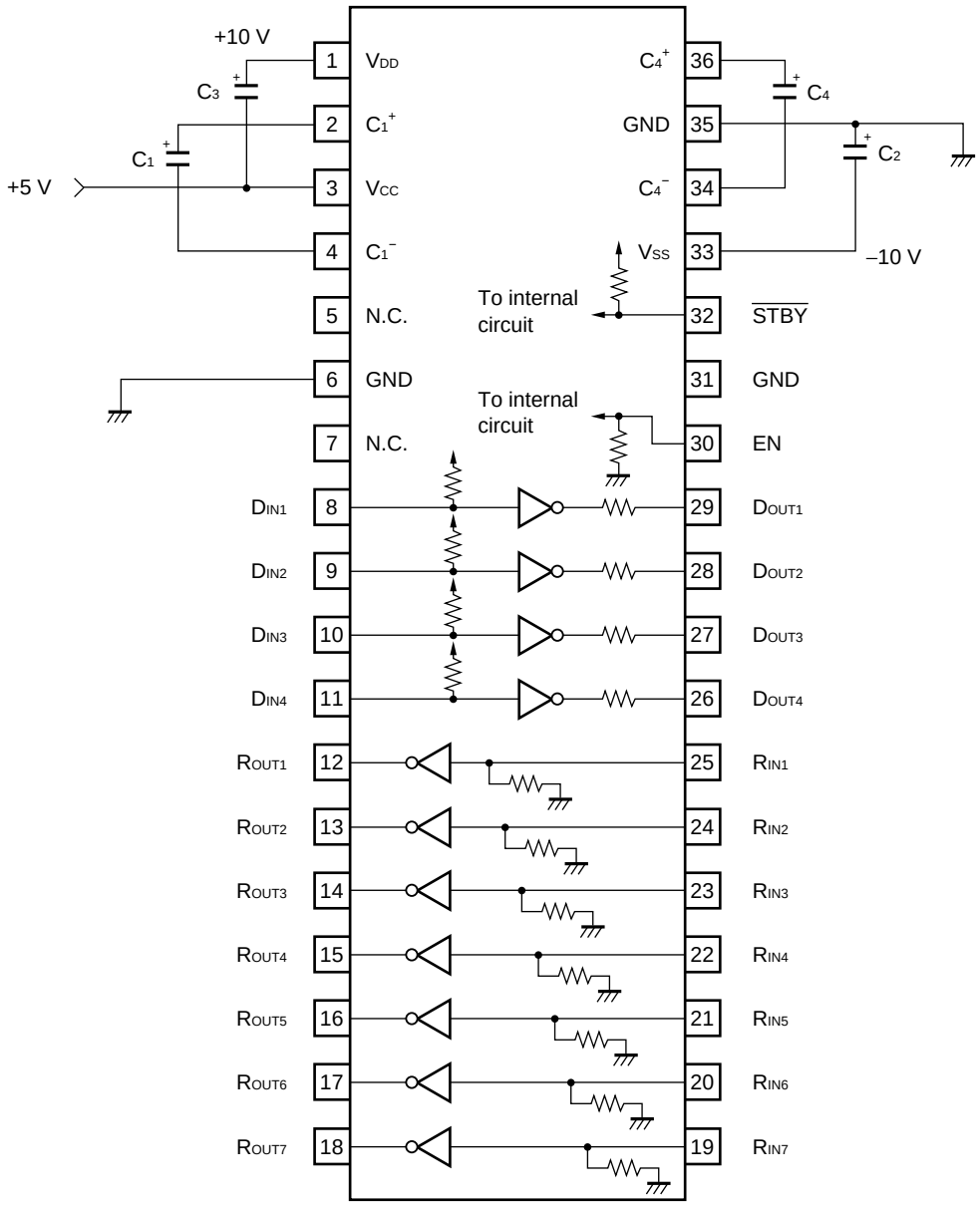
ORDERING INFORMATION

Part Number	Package	Quality Grade
μPD4726GS-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.

Document No. IC-3413 (1st edition)
(O.D.No. IC-8923)
Date Published March 1997 P
Printed in Japan

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 μF 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 μPD4726 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

$\overline{STBY}$	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

$\overline{STBY}$	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 °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_{INI}	±20.0	mA
Operating ambient temperature	$T_{opt.}$	–40 to +85	°C
Storage temperature	$T_{stg.}$	–55 to +150	°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	°C
External capacitance (nominal value)	**Note 6**	1		4.7	μF

Note 6. Use capacitors whose capacitance fluctuation is within ±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 μF)

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 kΩ (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	μA
		V_{CC} = +5.0 V, no load, D_{IN}, R_{IN} pins open, $\overline{STBY}$ = L, EN = L,		15		μA
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	μA
		V_{CC} = +5.0 V, no load, D_{IN}, R_{IN} pins open, $\overline{STBY}$ = L, EN = H, T_a = 25 °C		15		μA
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	μA
Input current, low	I_{IL}	$\overline{STBY}$ pin, V_{CC} = +5.5 V, V_I = 0 V			−40	μA
Input current, high	I_{IH}	EN pin, V_{CC} = +5.5 V, V_I = +5.5 V			40	μA
Input current, low	I_{IL}	EN pin, V_{CC} = +5.5 V, V_I = 0 V			−1	μA
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.

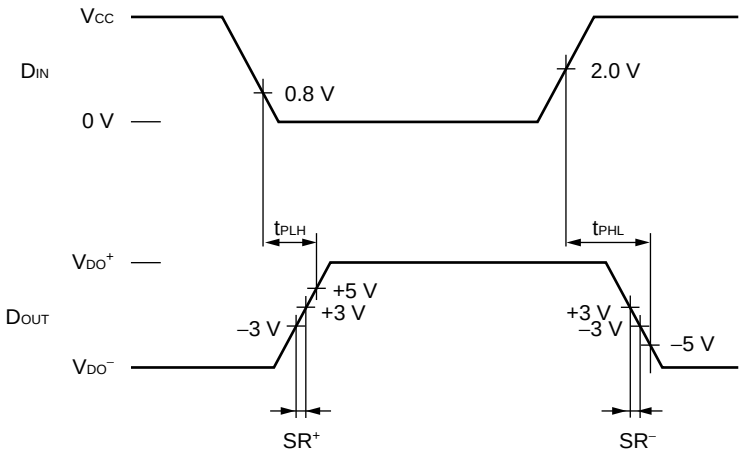
ELECTRICAL SPECIFICATIONS (DRIVERS)

(Unless otherwise specified, T_a = –40 to +85 °C, V_{CC} = +5.0 V ±10 %, C_1 through C_5 = 1 μF)

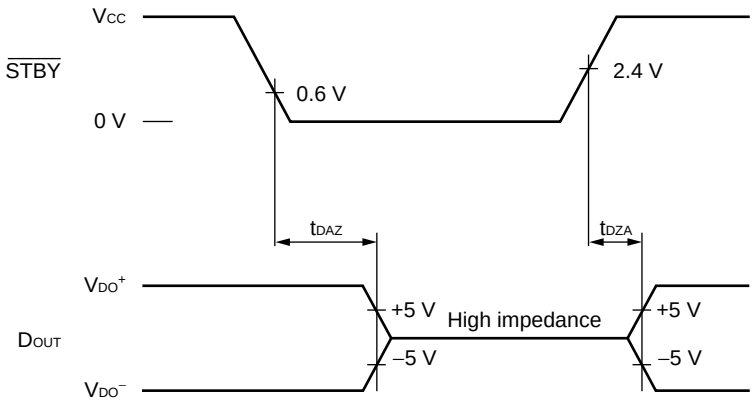
Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Input voltage, low	V_{IL}				0.8	V
Input voltage, high	V_{IH}		2.0			V
Input current, low	I_{IL}				–40	μA
Input current, high	I_{IH}				1.0	μA
Output voltage	V_{DO}	V_{CC} = +5.0 V, R_L = ∞, T_a = 25 °C		±9.7		V
		V_{CC} = +5.0 V, R_L = 3 kΩ, T_a = $T_{opt.}$	±5.5			V
		V_{CC} = +4.5 V, R_L = 3 kΩ, 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 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 8	t_{PHL} t_{PLH}	R_L = 3 kΩ, C_L = 2 500 pF		2		μs
Output resistance	R_0	V_{CC} = V_{DD} = V_{SS} = 0 V V_{OUT} = ±2 V	300			Ω
Standby output transition time	t_{DAZ}	R_L = 3 kΩ, C_L = 2500 pF, Note 9		4	10	μs
Standby output transition time	t_{DZA}	R_L = 3 kΩ, C_L = 2500 pF, Note 9		0.5	1	ms
Power-ON output transition time	t_{PRA}	R_L = 3 kΩ, 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

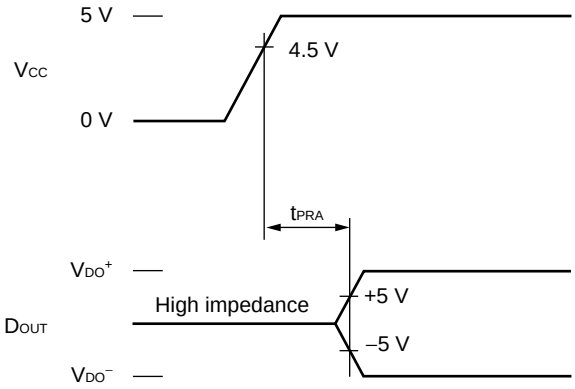


Note 9. Test point



The driver output is undefined during the standby output transition time t_{DZA}. Do not perform communication within the standby output transition time t_{DZA} 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.

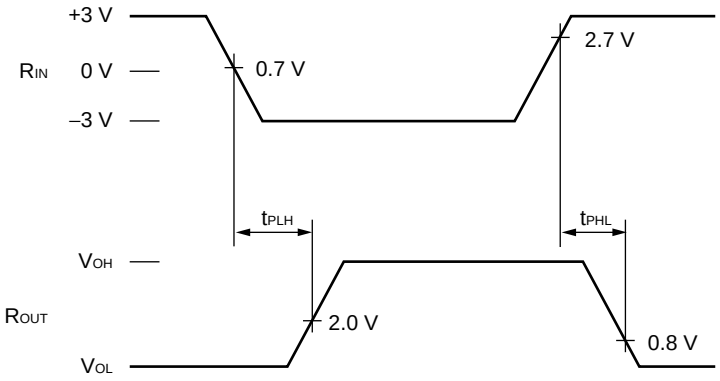
ELECTRICAL SPECIFICATIONS (RECEIVERS)

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

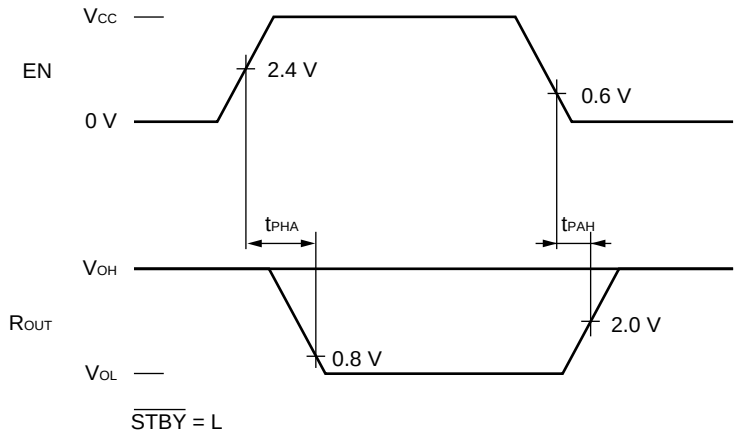
Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Output voltage, low ($\overline{STBY}$ = H)	V_{OL1}	I_{OUT} = 4 mA			0.4	V
Output voltage, high ($\overline{STBY}$ = H)	V_{OH1}	I_{OUT} = –4 mA	V_{CC} – 0.4			V
Output voltage, low ($\overline{STBY}$ = L)	V_{OL2}	I_{OUT} = 4 mA			0.5	V
Output voltage, high ($\overline{STBY}$ = 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.

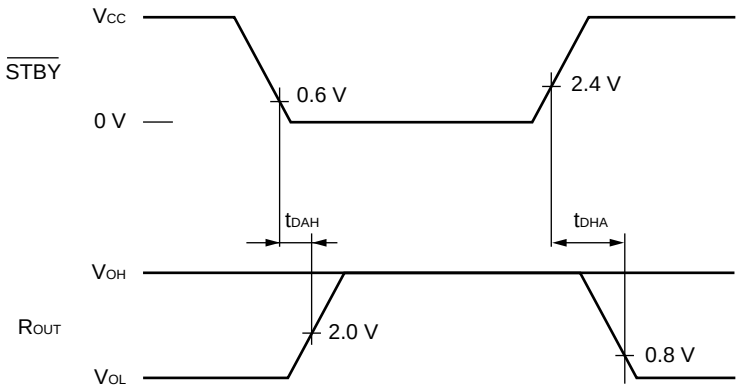
Note 11. Test point



Note 12. Test point

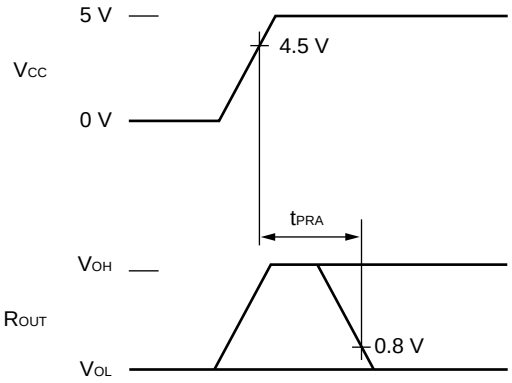


Note 13. Test point



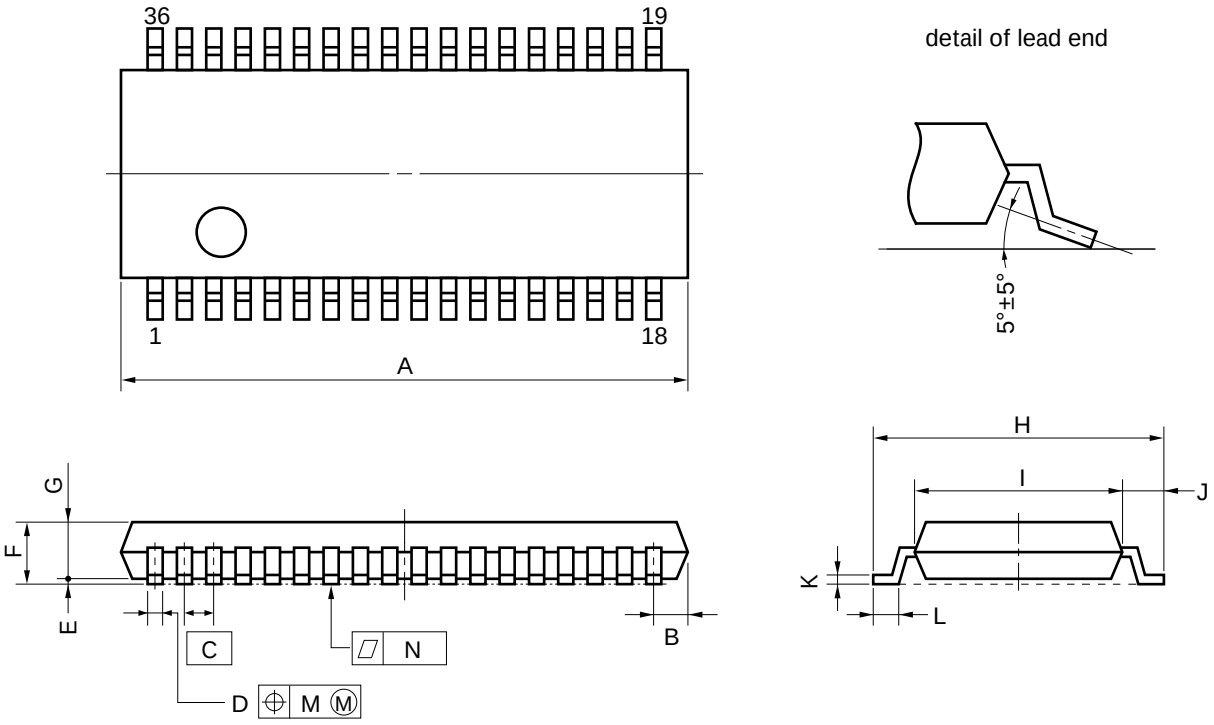
The receiver output is undefined during the standby output transition time t_{DHA}. Do not perform communication within the standby output transition time t_{DHA} after the standby mode has been released.

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)



P36GM-80-300B-3

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	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

M4 96.5