NEC

MOS INTEGRATED CIRCUIT

μPD16813

MONOLITHIC DUAL H BRIDGE DRIVER CIRCUIT

DESCRIPTION

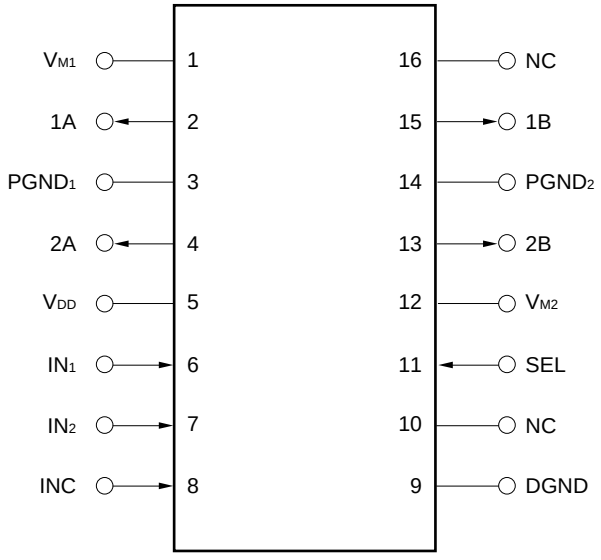
The μPD16813 is a monolithic dual H bridge driver circuit which uses power MOS FETs in its driver stage. By complementing the P channel and N channel of the output stage, the circuit current has been substantially inproved as compared with that of conventional charge pump drivers.

The μPD16813 is therefore ideal as the driver circuit of the 2-phase excitation, bipolar-driven stepping motor for the head actuator of an FDD.

FEATURES

- Low ON resistance (sum of ON resistors of top and bottom transistors)
  R_{ON} = 2.0 Ω TYP.
- Low current consumption: I_{DD} = 100 μA MAX.
- Noise reduction circuit that operates when INC is OFF.
- Compact surface mount package: 16-pin plastic SOP (300 mil)

PIN CONFIGURATION (Top View)



ORDERING INFORMATION

Part Number	Package
μPD16813GS	16-pin plastic SOP (300 mil)

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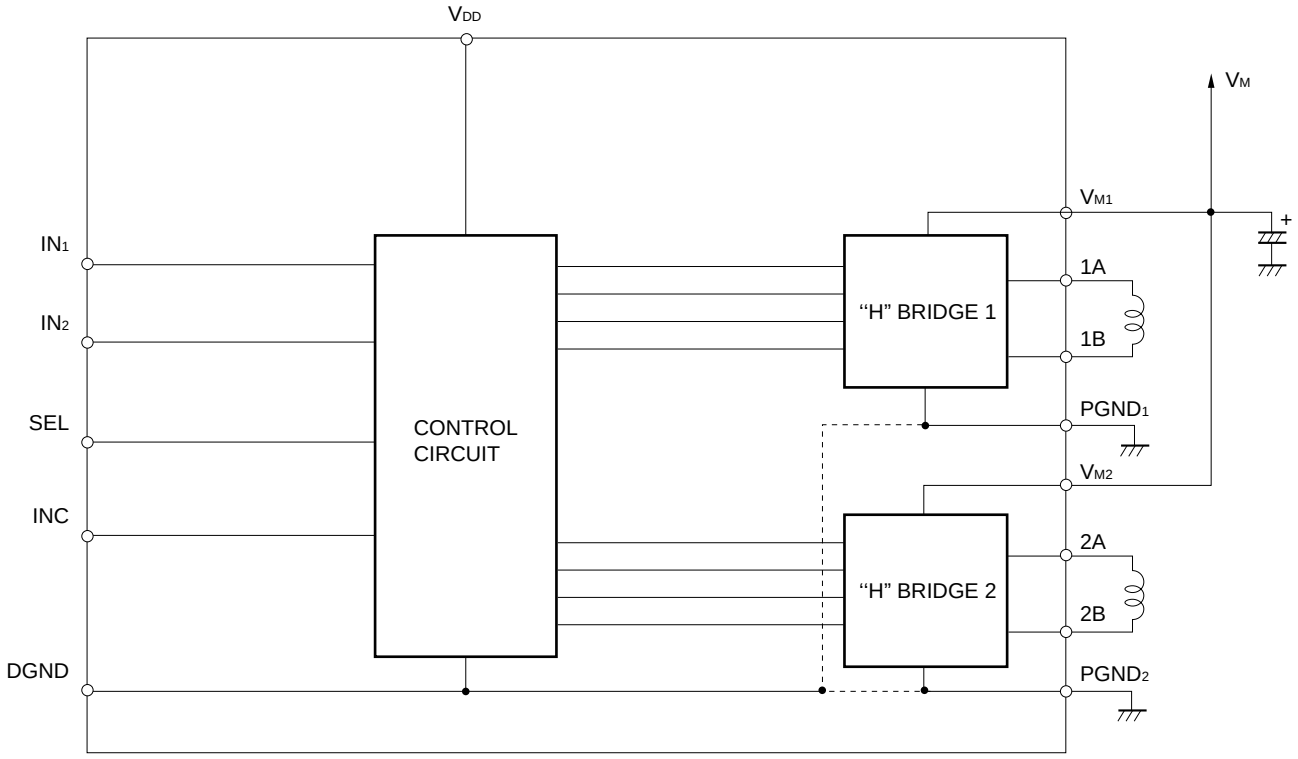
Date Published July 1997 N
Printed in Japan

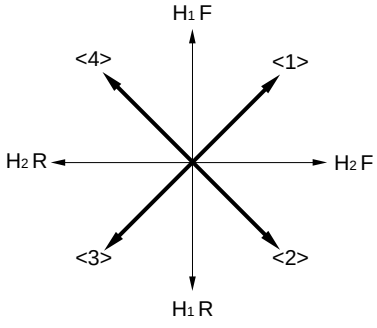
BLOCK DIAGRAM



FUNCTION TABLE

- **In stop mode (SEL = High)**

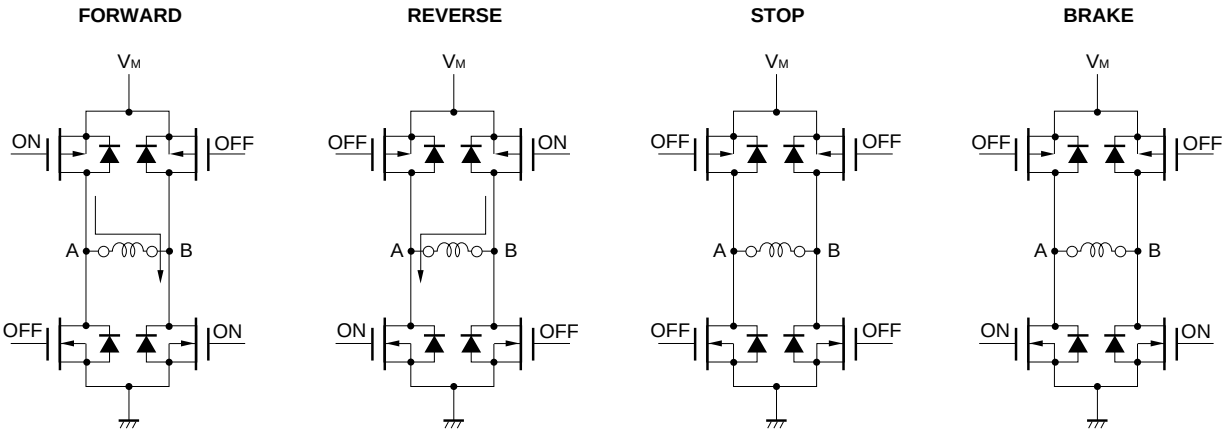
Excitation Direction	INC	IN_1	IN_2	H_1	H_2
<1>	H	H	H	F	F
<2>	H	L	H	R	F
<3>	H	L	L	R	R
<4>	H	H	L	F	R
–	L	×	×	Stop	



- **In brake mode (SEL = Low)**

Excitation Direction	INC	IN_1	IN_2	H_1	H_2
<1>	H	H	H	F	F
<2>	H	L	H	R	F
<3>	H	L	L	R	R
<4>	H	H	L	F	R
–	L	×	×	Brake	

F : Forward
R : Reverse
× : Don't care



ABSOLUTE MAXIMUM RATINGS (T_A = +25 °C)

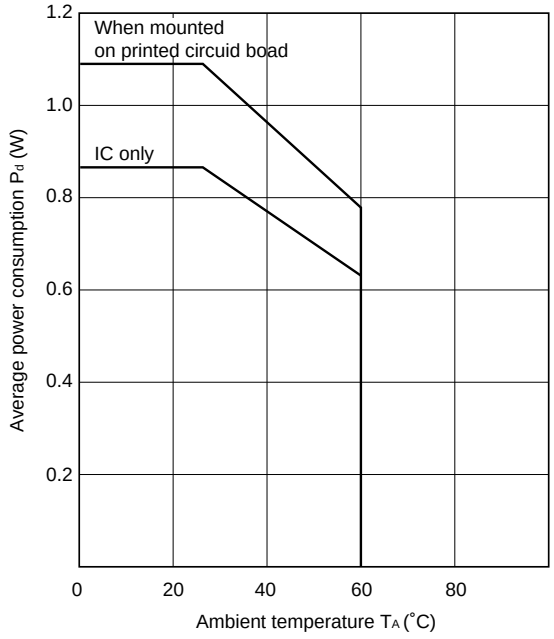
Parameter	Symbol	Rating	Unit
Supply voltage (motor block)	V_M	–0.5 to +7	V
Supply voltage (control block)	V_{DD}	–0.5 to +7	V
Power consumption	P_{d1}	0.862 Note 1	W
	P_{d2}	1.087 Note 2	
Instantaneous H bridge driver current	I_D (pulse)	±1.0 Note 2, 3	A
Input voltage	V_{IN}	–0.5 to V_{DD} + 0.5	V
Operating temperature range	T_A	0 to 60	°C
Operation junction temperature	$T_{j\ MAX.}$	150	°C
Storage temperature range	T_{stg}	–55 to +125	°C

Notes 1. IC only

2. When mounted on a printed circuit board (100 × 100 × 1 mm, glass epoxy)

3. t ≤ 5 ms, Duty ≤ 40 %

P_d – T_A Characteristics



RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Supply voltage (motor block)	V_M	4.0	5.0	6.0	V
Supply voltage (control block)	V_{DD}	4.0	5.0	6.0	V
H bridge driver current[Note]	I_{DR}			±310	mA
Operating temperature	T_A	0		60	°C

Note When mounted on a printed circuit board (100 × 100 × 1 mm, glass epoxy)

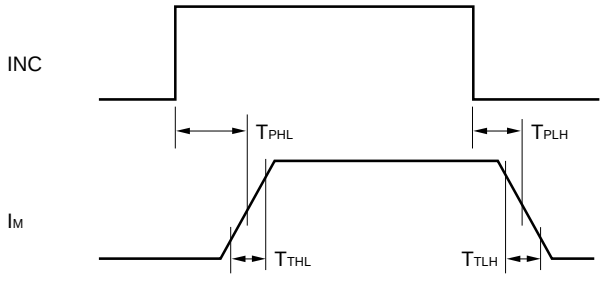
ELECTRICAL SPECIFICATIONS (Within recommended operating conditions unless otherwise specified)

Parameters	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
OFF V_M pin current	I_M	V_M = 6.0 V, V_{DD} = 6.0 V			1.0	μA
V_{DD} pin current	I_{DD}				0.1	mA
Control pin high-level input current	I_{IH}	$V_{IN} = V_{DD}$			1.0	μA
Control pin low-level input current	I_{IL}	V_{IN} = 0 V			–1.0	μA
Control pin high-level input voltage	V_{IH}		3.0		V_{DD} + 0.3	V
Control pin low-level input voltage	V_{IL}		–0.3		0.8	V
H bridge circuit ON resistance[Note 1]	R_{ON1}	V_M = 5 V, V_{DD} = 5 V		2.0	4.0	Ω
R_{ON} relative accuracy	ΔR_{ON}	Excitation direction <2>, <4>[Note 2]			±5	%
	ΔR_{ON}	Excitation direction <1>, <3>			±10	
H bridge circuit propagation delay time	t_{PHL}	V_M = 5 V, V_{DD} = 5 V,[Note 3] T_A = 25 °C, R_M = 20 Ω		2.0	2.5	μs
H bridge circuit propagation delay time	t_{PLH}			0.4	0.65	μs
H bridge circuit rise time	t_{THL}	V_M = 5 V, V_{DD} = 5 V,[Note 3] T_A = 25 °C, R_M = 20 Ω		0.2	0.4	μs
H bridge circuit fall time	t_{TLH}			0.1	0.2	μs

Notes 1. Sum of ON resistances of top and bottom transistors

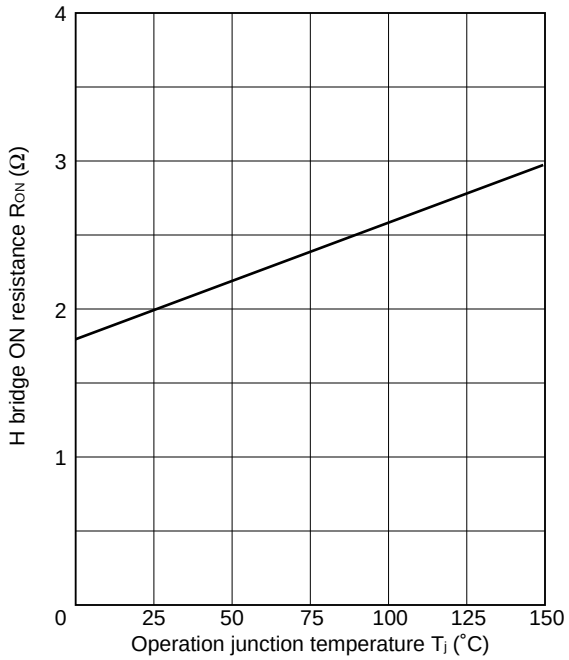
2. For the excitation direction, refer to **FUNCTION TABLE**.

3.

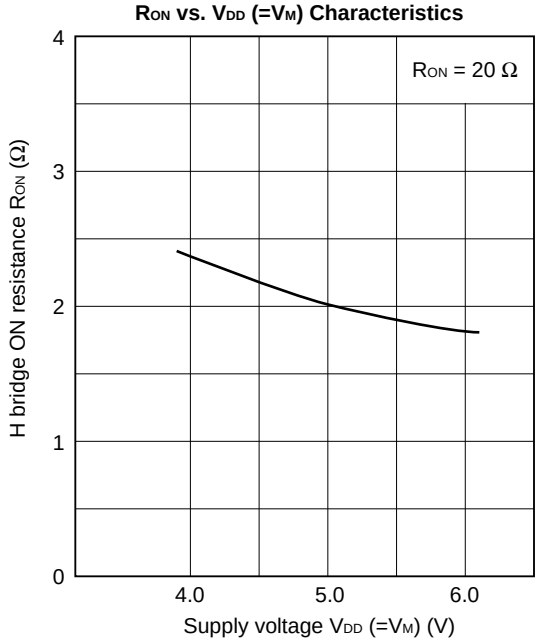


CHARACTERISTIC CURVES

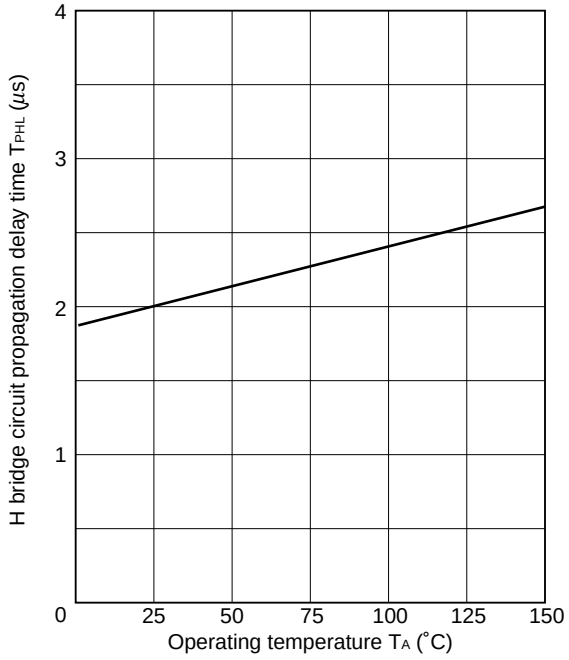
R_{ON} vs. T_j Characteristics



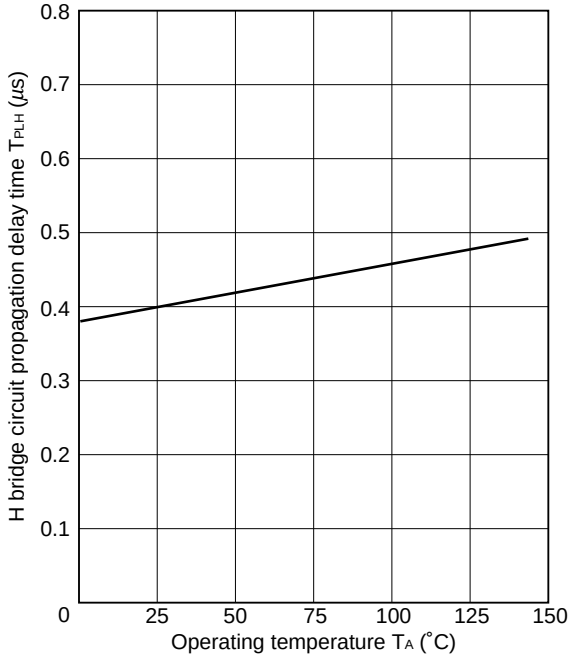
R_{ON} vs. V_{DD} (=V_M) Characteristics



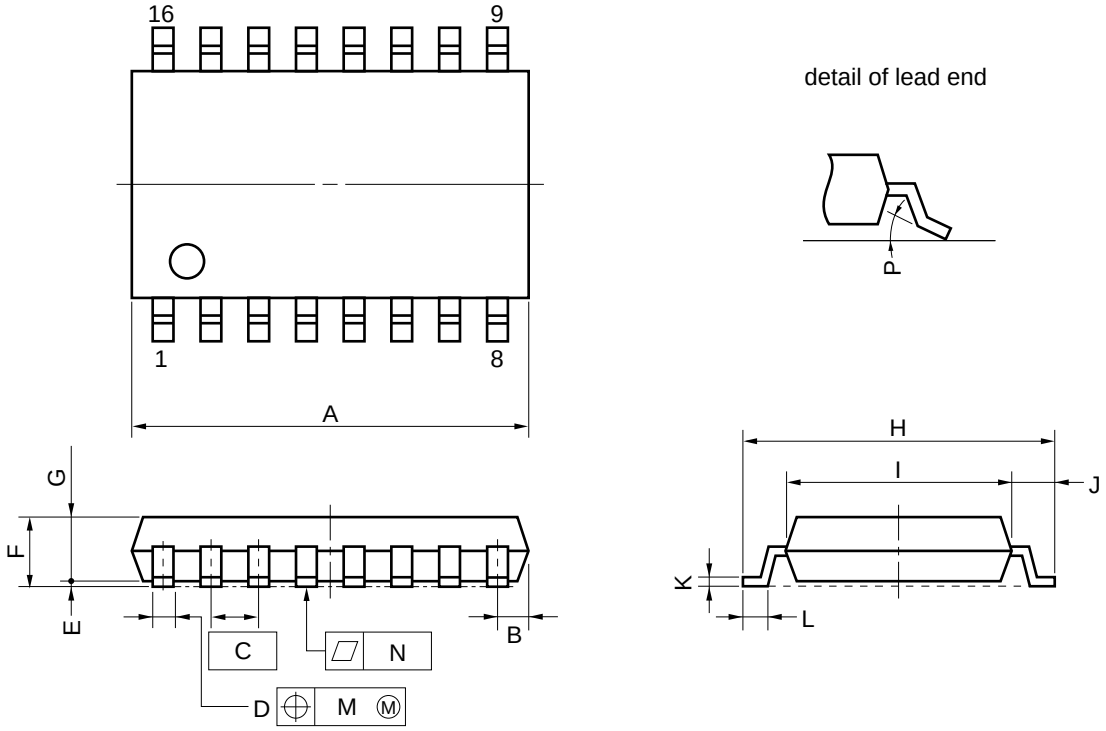
T_{PHL} – T_A Characteristics



T_{PLH} – T_A Characteristics



16 PIN PLASTIC SOP (300 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	10.46 MAX.	0.412 MAX.
B	0.78 MAX.	0.031 MAX.
C	1.27 (T.P.)	0.050 (T.P.)
D	$0.40^{+0.10}_{-0.05}$	$0.016^{+0.004}_{-0.003}$
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	$0.20^{+0.10}_{-0.05}$	$0.008^{+0.004}_{-0.002}$
L	0.6±0.2	$0.024^{+0.008}_{-0.009}$
M	0.12	0.005
N	0.10	0.004
P	$3^{\circ}{}^{+7^{\circ}}_{-3^{\circ}}$	$3^{\circ}{}^{+7^{\circ}}_{-3^{\circ}}$

P16GM-50-300B-4

RECOMMENDED SOLDERING CONDITIONS

It is recommended to solder this product under the conditions described below.
For soldering methods and conditions other than those listed below, consult NEC.

Surface mount type

For the details of the recommended soldering conditions of this type, refer to **Semiconductor Device Mounting Technology Manual (C10535E)**.

Soldering Method	Soldering Conditions	Symbol of Recommended Soldering
Infrared reflow	Peak package temperature: 230 °C, Time: 30 seconds MAX. (210 °C MIN.), Number of times: 1, Number of days: None[Note]	IR30-00
VPS	Peak package temperature: 215 °C, Time: 40 seconds MAX. (200 °C MIN.), Number of times: 1, Number of days: None[Note]	VP15-00
Wave soldering	Solder bath temperature: 260 °C MAX., Time: 10 seconds MAX., Number of times: 1, Number of days: None[Note]	WS60-00
Partial heating	Pin temperature: 300 °C MAX., Time: 10 seconds MAX., Number of days: None[Note]	–

Note The number of storage days at 25 °C, 65 % RH after the dry pack has been opened

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