

## MONOLITHIC DUAL H BRIDGE DRIVER CIRCUIT

### DESCRIPTION

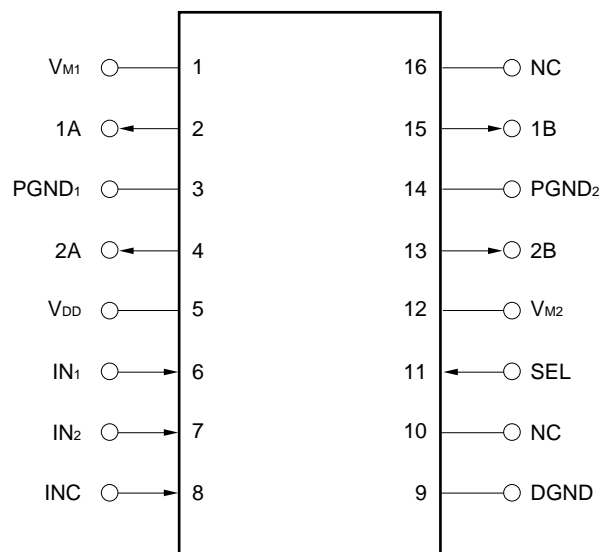
The μPD16813 is a monolithic dual H bridge driver circuit which uses power MOS FETs in its driver stage. By complementing the P channel and N channel of the output stage, the circuit current has been substantially improved as compared with that of conventional charge pump drivers.

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)  
 $R_{ON} = 2.0 \, \Omega$  TYP.
- Low current consumption:  $I_{DD} = 100 \, \mu A$  MAX.
- Noise reduction circuit that operates when INC is OFF.
- Compact surface mount package: 16-pin plastic SOP (300 mil)

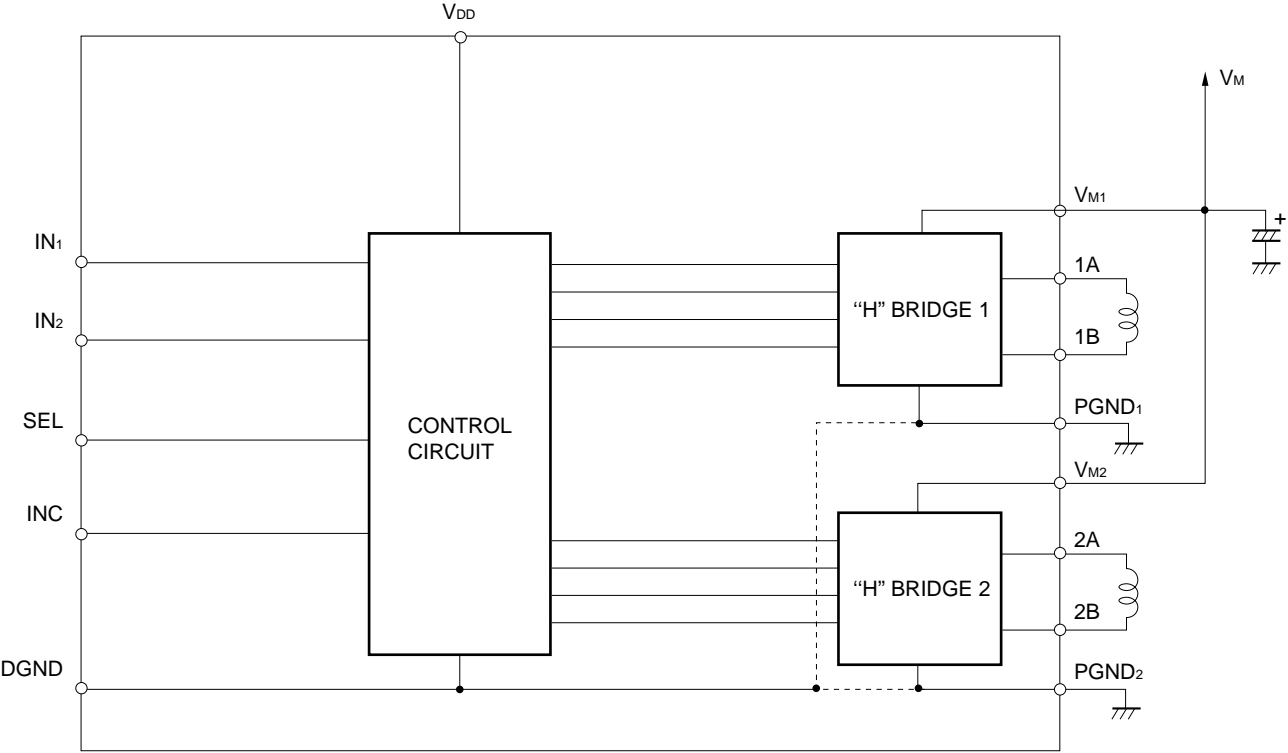
### PIN CONFIGURATION (Top View)



### ORDERING INFORMATION

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

BLOCK DIAGRAM



FUNCTION TABLE

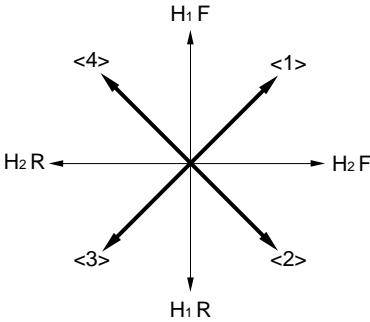
- In stop mode (SEL = High)

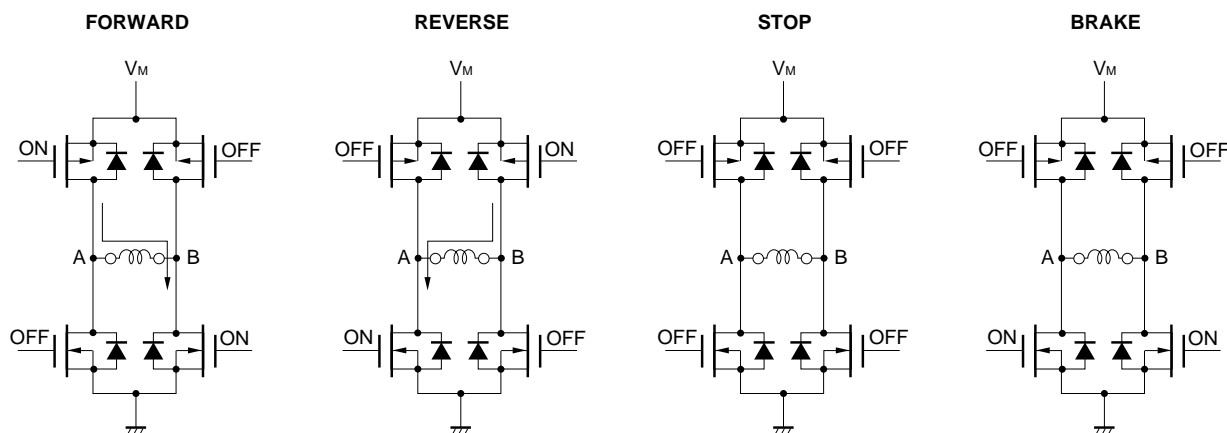
Excitation Direction	INC	IN <sub>1</sub>	IN <sub>2</sub>	H <sub>1</sub>	H <sub>2</sub>
<1>	H	H	H	F	F
<2>	H	L	H	R	F
<3>	H	L	L	R	R
<4>	H	H	L	F	R
–	L	×	×	Stop	

- In brake mode (SEL = Low)

Excitation Direction	INC	IN <sub>1</sub>	IN <sub>2</sub>	H <sub>1</sub>	H <sub>2</sub>
<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





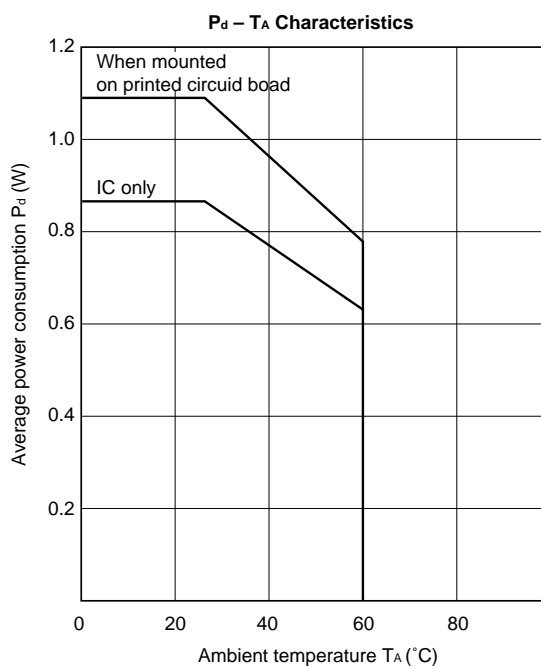
**ABSOLUTE MAXIMUM RATINGS ( $T_A = +25\text{ }^{\circ}\text{C}$ )**

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 <sup>Note 1</sup>	W
	$P_{d2}$	1.087 <sup>Note 2</sup>	
Instantaneous H bridge driver current	$I_D$ (pulse)	$\pm 1.0$ <sup>Note 2, 3</sup>	A
Input voltage	$V_{IN}$	-0.5 to $V_{DD} + 0.5$	V
Operating temperature range	$T_A$	0 to 60	$^{\circ}\text{C}$
Operation junction temperature	$T_{J\text{ MAX.}}$	150	$^{\circ}\text{C}$
Storage temperature range	$T_{\text{stg}}$	-55 to +125	$^{\circ}\text{C}$

**Notes** 1. IC only

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

3.  $t \leq 5\text{ ms}$ , Duty  $\leq 40\%$



## RECOMMENDED OPERATING CONDITIONS

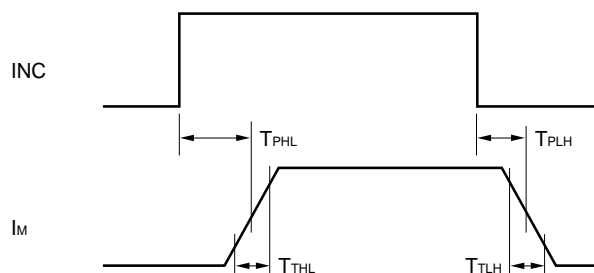
Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Supply voltage (motor block)	$V_M$	4.0	5.0	6.0	V
Supply voltage (control block)	$V_{DD}$	4.0	5.0	6.0	V
H bridge driver current <sup>Note</sup>	$I_{DR}$			±310	mA
Operating temperature	$T_A$	0		60	°C

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

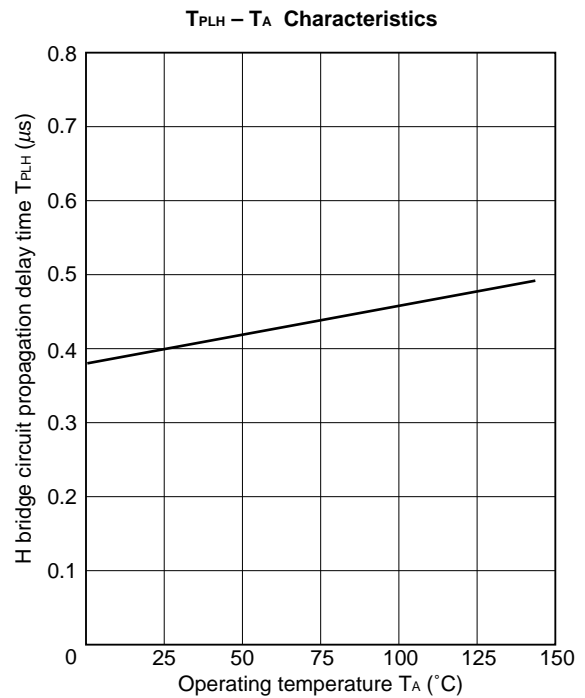
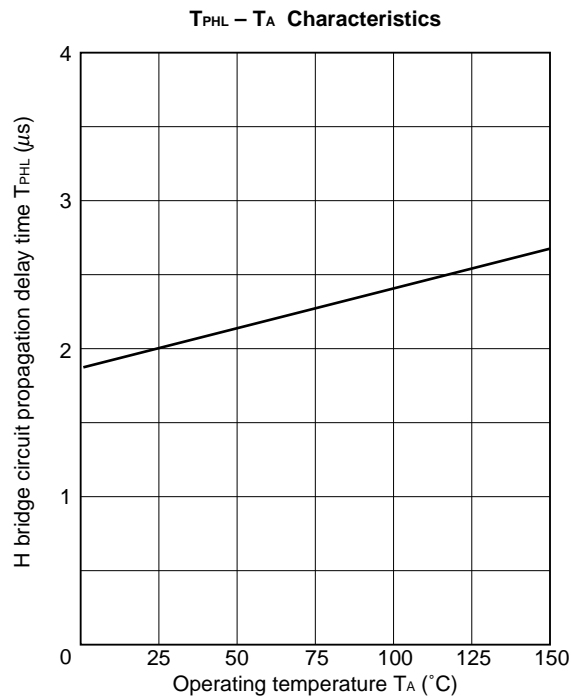
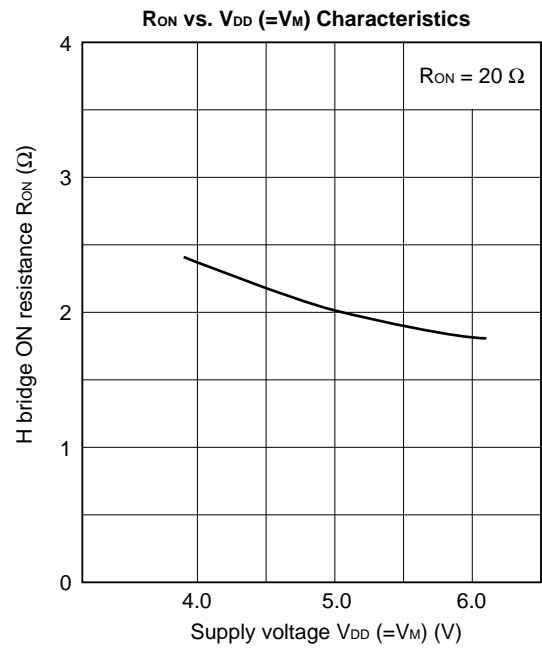
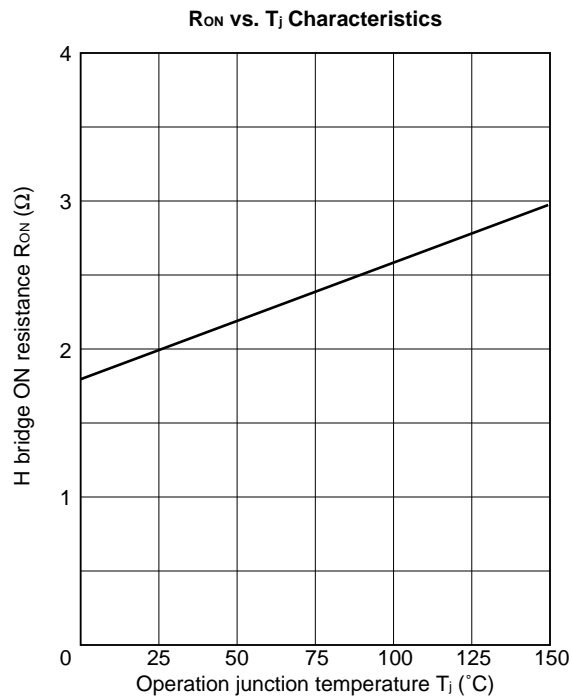
## ELECTRICAL SPECIFICATIONS (Within recommended operating conditions unless otherwise specified)

Parameters	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
OFF $V_M$ pin current	$I_M$	$V_M = 6.0\text{ V}$ , $V_{DD} = 6.0\text{ V}$			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	$I_{IL}$	$V_{IN} = 0\text{ V}$			−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 <sup>Note 1</sup>	$R_{ON1}$	$V_M = 5\text{ V}$ , $V_{DD} = 5\text{ V}$		2.0	4.0	Ω
$R_{ON}$ relative accuracy	$\Delta R_{ON}$	Excitation direction <2>, <4> <sup>Note 2</sup>			±5	%
	$\Delta R_{ON}$	Excitation direction <1>, <3>			±10	
H bridge circuit propagation delay time	$t_{PHL}$	$V_M = 5\text{ V}$ , $V_{DD} = 5\text{ V}$ , <sup>Note 3</sup> $T_A = 25\text{ °C}$ , $R_M = 20\text{ Ω}$		2.0	2.5	μs
H bridge circuit propagation delay time	$t_{PLH}$			0.4	0.65	μs
H bridge circuit rise time	$t_{THL}$	$V_M = 5\text{ V}$ , $V_{DD} = 5\text{ V}$ , <sup>Note 3</sup> $T_A = 25\text{ °C}$ , $R_M = 20\text{ Ω}$		0.2	0.4	μs
H bridge circuit fall time	$t_{TLH}$			0.1	0.2	μs

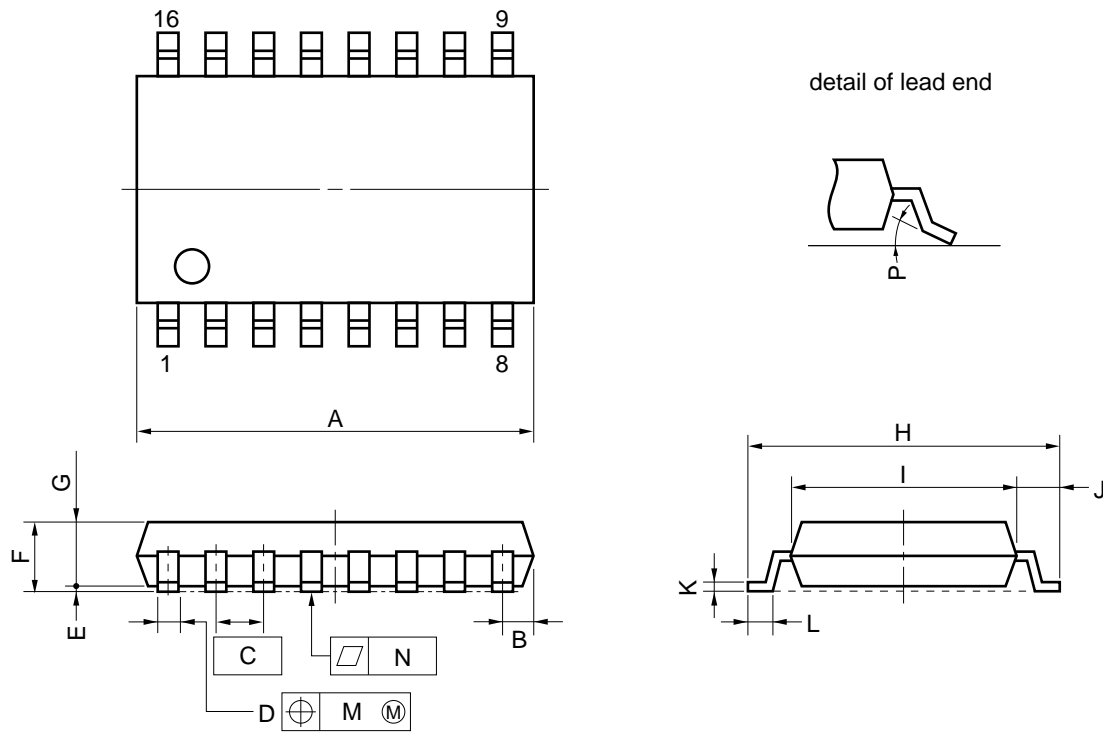
- Notes**
1. Sum of ON resistances of top and bottom transistors
  2. For the excitation direction, refer to **FUNCTION TABLE**.
  - 3.



## CHARACTERISTIC CURVES



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 <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>

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 <sup>Note</sup>	IR30-00
VPS	Peak package temperature: 215 °C, Time: 40 seconds MAX. (200 °C MIN.), Number of times: 1, Number of days: None <sup>Note</sup>	VP15-00
Wave soldering	Solder bath temperature: 260 °C MAX., Time: 10 seconds MAX., Number of times: 1, Number of days: None <sup>Note</sup>	WS60-00
Partial heating	Pin temperature: 300 °C MAX., Time: 10 seconds MAX., Number of days: None <sup>Note</sup>	—

**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).

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Anti-radioactive design is not implemented in this product.