

## MONOLITHIC DUAL H BRIDGE DRIVER CIRCUIT

## DESCRIPTION

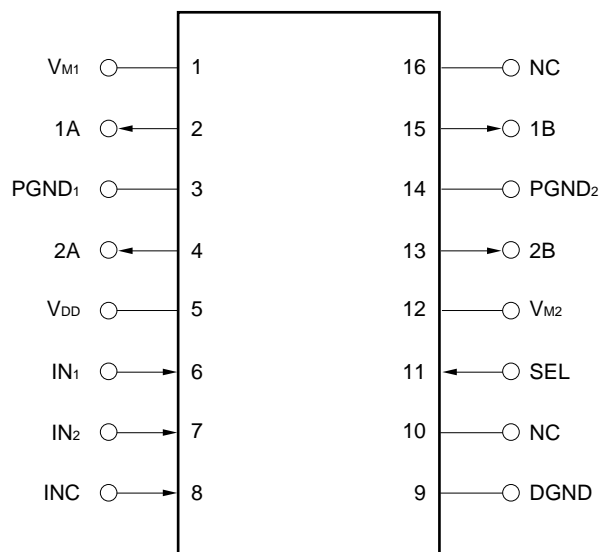
The  $\mu$ PD16813 is a monolithic dual H bridge driver circuit which uses power MOS FETs in its driver stage. By complementing the P channel and N channel of the output stage, the circuit current has been substantially improved as compared with that of conventional charge pump drivers.

The  $\mu$ PD16813 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)

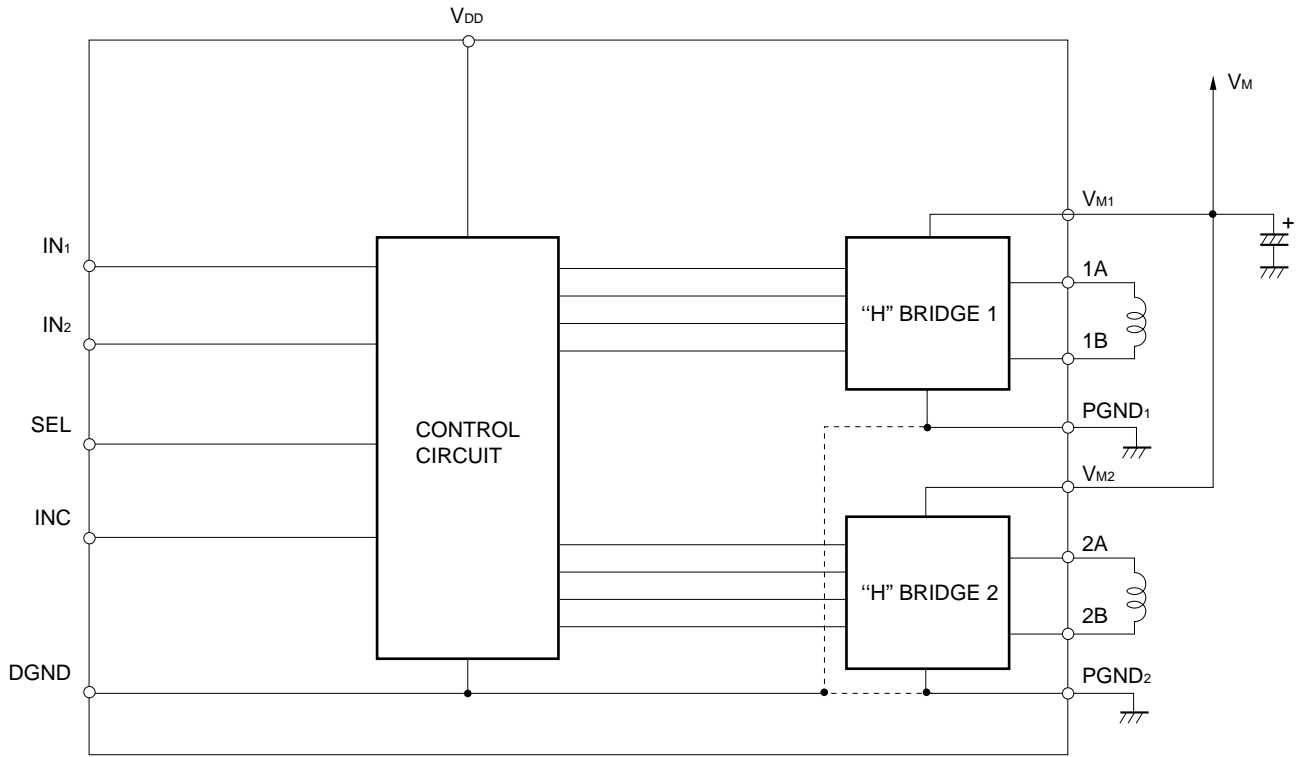
## PIN CONFIGURATION (Top View)



## ORDERING INFORMATION

Part Number	Package
$\mu$ PD16813GS	16-pin plastic SOP (300 mil)

**BLOCK DIAGRAM**



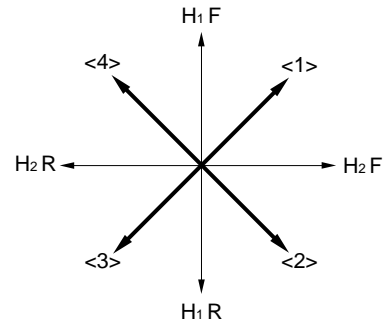
**FUNCTION TABLE**

- In stop mode (SEL = High)

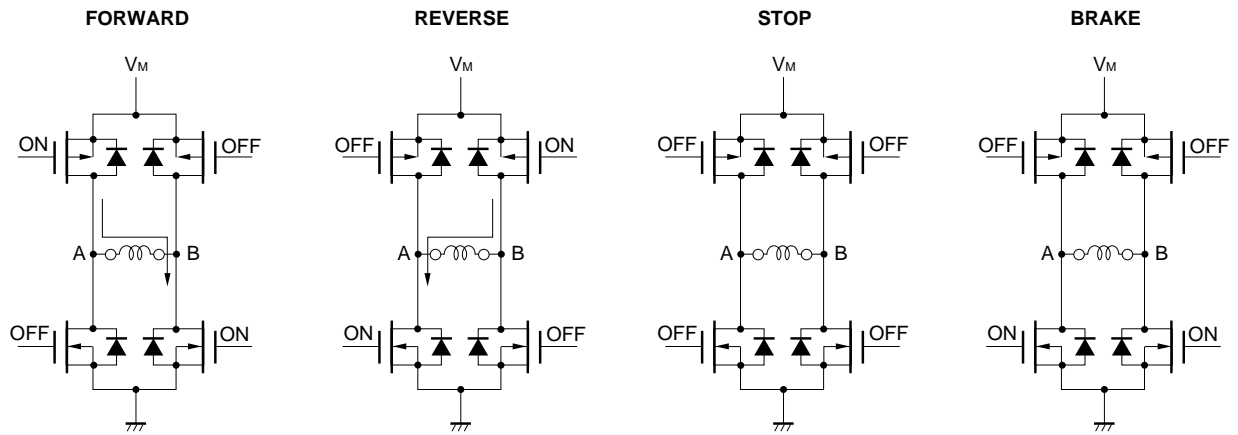
Excitation Direction	INC	IN <sub>1</sub>	IN <sub>2</sub>	H <sub>1</sub>	H <sub>2</sub>
<1>	H	H	H	F	F
<2>	H	L	H	R	F
<3>	H	L	L	R	R
<4>	H	H	L	F	R
-	L	×	×	Stop	

- 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



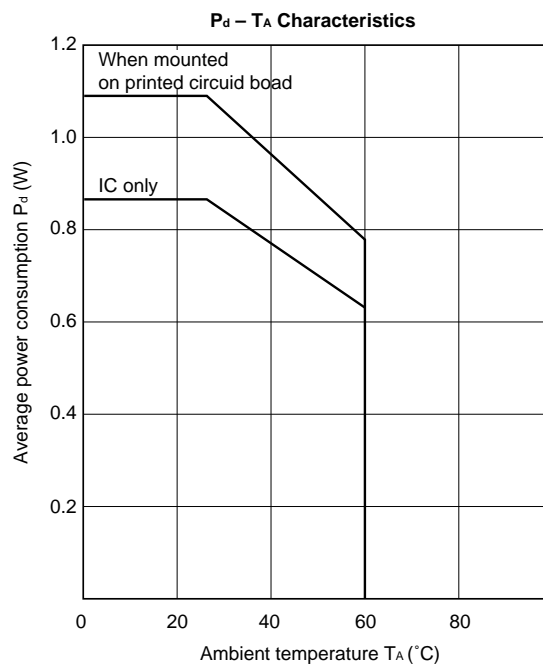
**ABSOLUTE MAXIMUM RATINGS (TA = +25 °C)**

Parameter	Symbol	Rating	Unit
Supply voltage (motor block)	VM	-0.5 to +7	V
Supply voltage (control block)	VDD	-0.5 to +7	V
Power consumption	Pd1	0.862 <sup>Note 1</sup>	W
	Pd2	1.087 <sup>Note 2</sup>	
Instantaneous H bridge driver current	Id (pulse)	±1.0 <sup>Note 2, 3</sup>	A
Input voltage	VIN	-0.5 to VDD + 0.5	V
Operating temperature range	TA	0 to 60	°C
Operation junction temperature	TJMAX.	150	°C
Storage temperature range	Tstg	-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 %



**RECOMMENDED OPERATING CONDITIONS**

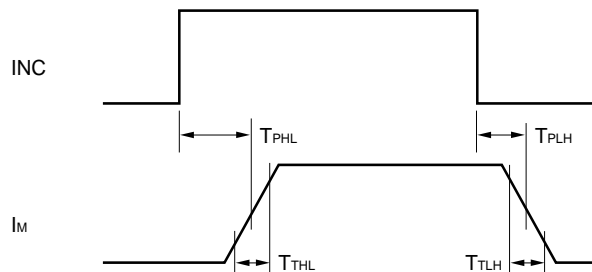
Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Supply voltage (motor block)	$V_M$	4.0	5.0	6.0	V
Supply voltage (control block)	$V_{DD}$	4.0	5.0	6.0	V
H bridge driver current <sup>Note</sup>	$I_{DR}$			±310	mA
Operating temperature	$T_A$	0		60	°C

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

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

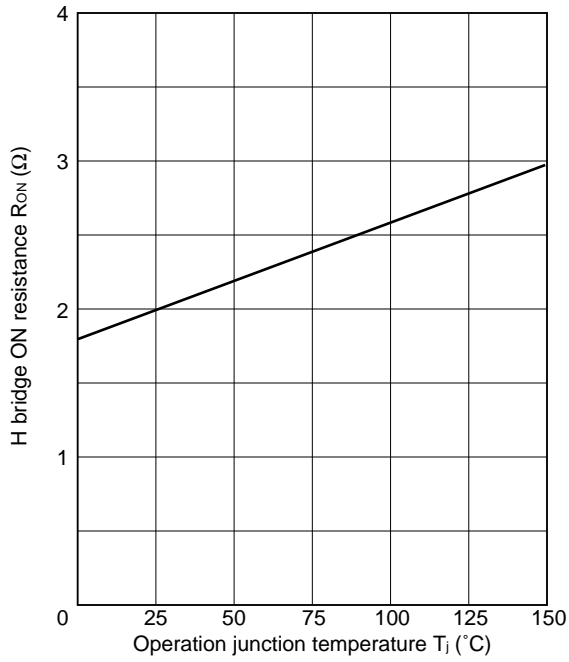
Parameters	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
OFF $V_M$ pin current	$I_M$	$V_M = 6.0\text{ V}, V_{DD} = 6.0\text{ V}$			1.0	μA
$V_{DD}$ pin current	$I_{DD}$				0.1	mA
Control pin high-level input current	$I_{IH}$	$V_{IN} = V_{DD}$			1.0	μA
Control pin low-level input current	$I_{IL}$	$V_{IN} = 0\text{ V}$			-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 <sub>ON</sub> 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	$t_{PHL}$	$V_M = 5\text{ V}, V_{DD} = 5\text{ V}, \text{Note 3}$ $T_A = 25\text{ °C}, R_M = 20\text{ Ω}$		2.0	2.5	μs
H bridge circuit propagation delay time	$t_{PLH}$			0.4	0.65	
H bridge circuit rise time	$t_{THL}$	$V_M = 5\text{ V}, V_{DD} = 5\text{ V}, \text{Note 3}$ $T_A = 25\text{ °C}, R_M = 20\text{ Ω}$		0.2	0.4	μs
H bridge circuit fall time	$t_{TLH}$			0.1	0.2	

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

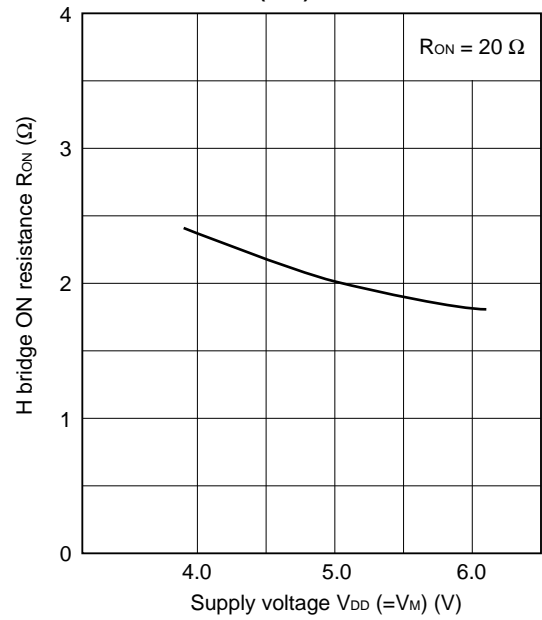


CHARACTERISTIC CURVES

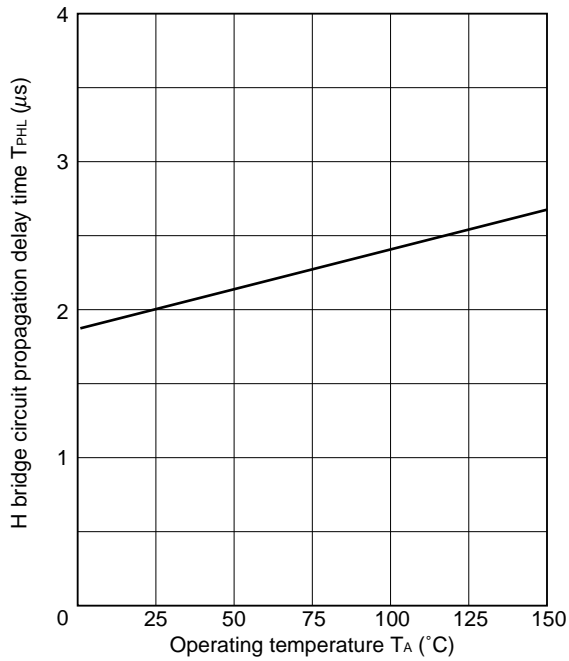
$R_{ON}$  vs.  $T_j$  Characteristics



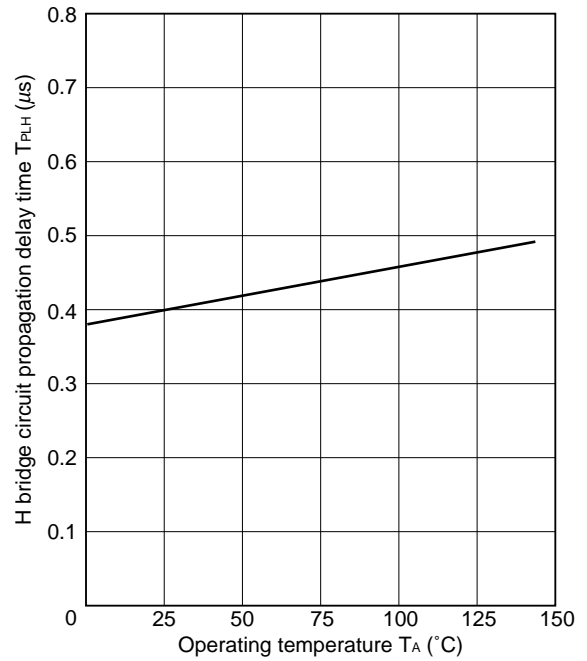
$R_{ON}$  vs.  $V_{DD}$  ( $=V_M$ ) Characteristics



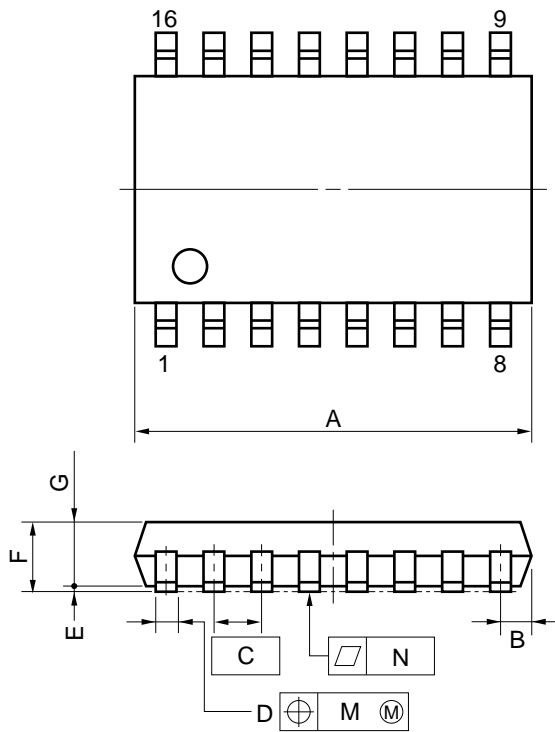
$T_{PHL} - T_A$  Characteristics



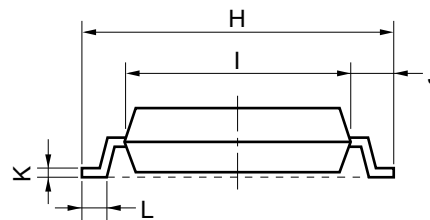
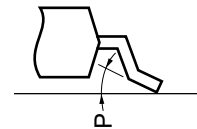
$T_{PLH} - T_A$  Characteristics



16 PIN PLASTIC SOP (300 mil)



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	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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Standard: Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots

Special: Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support)

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Anti-radioactive design is not implemented in this product.



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