

**MONOLITHIC DUAL H BRIDGE DRIVER CIRCUIT****DESCRIPTION**

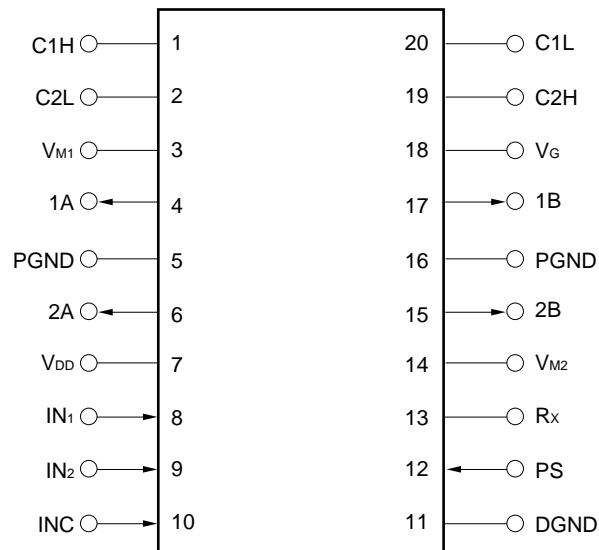
The  $\mu$ PD16803 is a monolithic dual H bridge driver circuit which uses N-channel power MOS FETs in its driver stage. By employing the power MOS FETs for the output stage, this driver circuit has a substantially improved saturation voltage and power consumption as compared with conventional driver circuits that use bipolar transistors.

In addition, the drive current can be adjusted by an external resistor in a power-saving mode.

The  $\mu$ PD16803 is therefore ideal as the driver circuit of the 2-phase excitation, bipolar-driven stepping motor for the head actuator of an FDD.

**FEATURES**

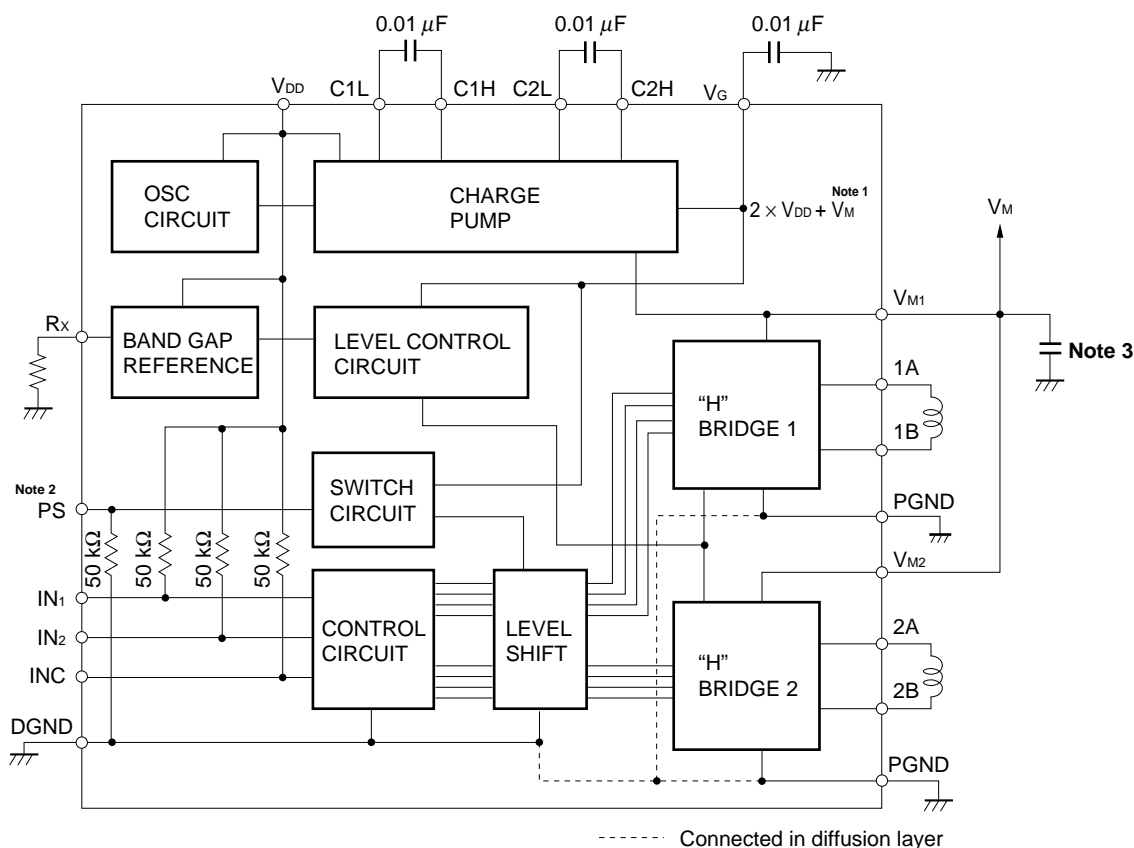
- Low ON resistance (sum of ON resistors of top and bottom transistors)  
 $R_{ON1} = 1.5 \, \Omega$  TYP. ( $V_M = 5.0 \, V$ )  
 $R_{ON2} = 2.0 \, \Omega$  TYP. ( $V_M = 12.0 \, V$ )
- Low current consumption:  $I_{DD} = 0.4 \, mA$  TYP.
- Stop mode function that turns OFF all output transistors
- Compact surface mount package: 20-pin plastic SOP (300 mil)

**PIN CONFIGURATION (Top View)**

## ORDERING INFORMATION

Part Number	Package
μPD16803GS	20-pin plastic SOP (300 mil)

## BLOCK DIAGRAM



**Notes 1.**  $3 \times V_{DD}$  where  $V_M \leq V_{DD}$

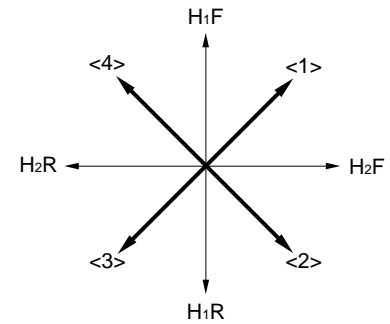
- The power-saving mode is set when the PS pin goes high. In this mode, the voltage of the charge pump circuit is lowered and the ON resistance of the H bridge driver transistor increases, limiting the current. In the power-saving mode, the motor cannot turn.
- It is recommended to connect an external capacitor of  $0.22 \mu F$  or more between  $V_M$  and GND to stabilize the operation.

# FUNCTION TABLE

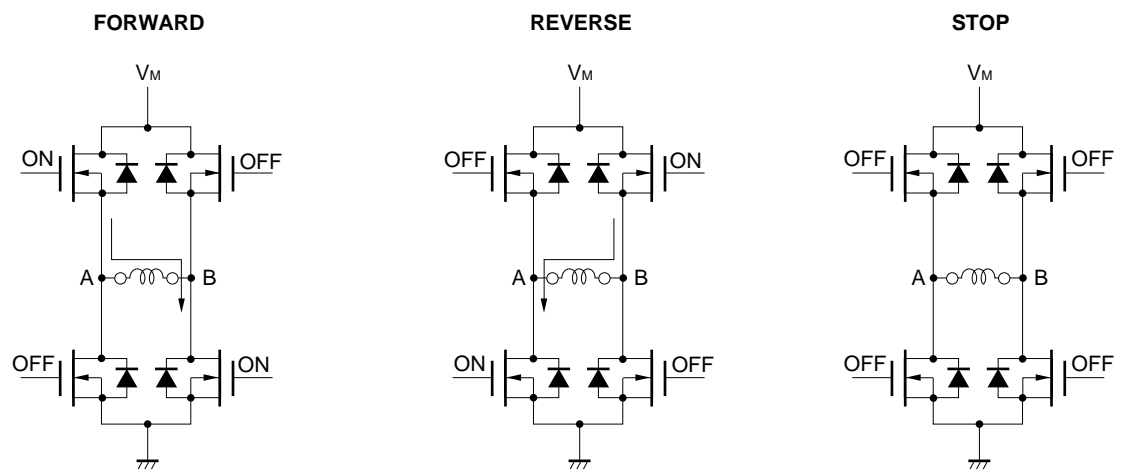
Excitation Direction	INC	IN <sub>1</sub>	IN <sub>2</sub>	H <sub>1</sub>	H <sub>2</sub>
<1>	H	H	H	F	F
<2>	H	L	H	R	F
<3>	H	L	L	R	R
<4>	H	H	L	F	R
—	L	×	×	Stop	

F: Forward

R: Reverse

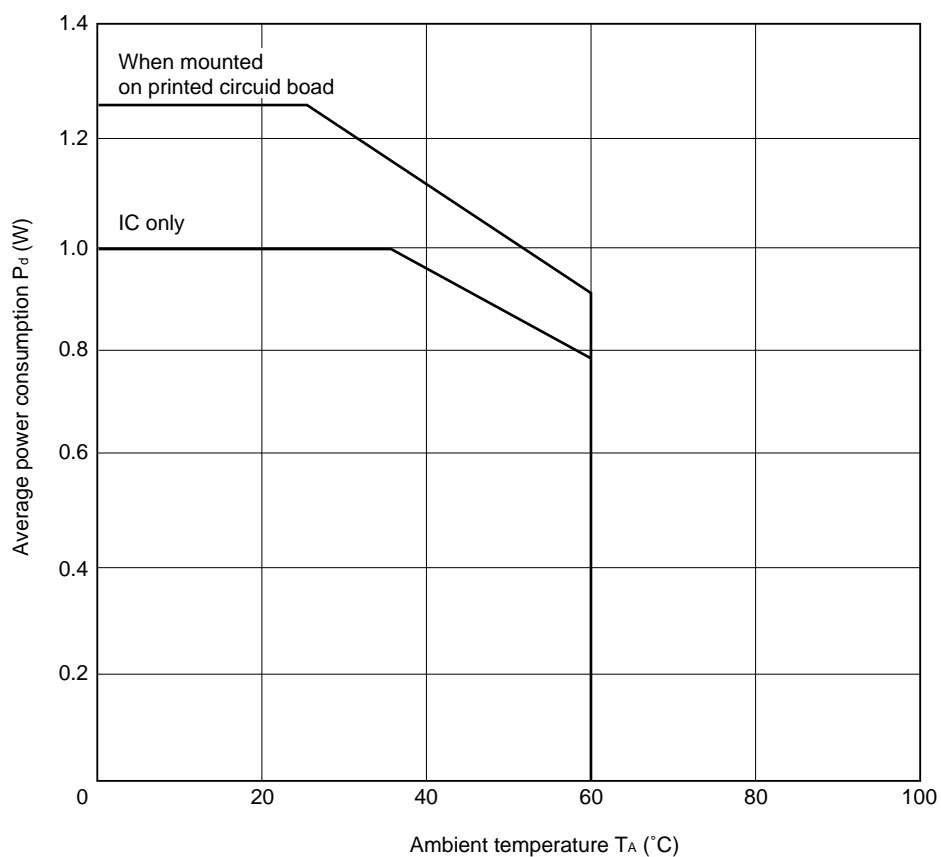


For the excitation waveform timing chart, refer to **APPLICATION EXAMPLE**.



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

Parameter	Symbol	Rating	Unit
Supply voltage (motor block)	$V_M$	-0.5 to +15	V
Supply voltage (control block)	$V_{DD}$	-0.5 to +7	V
Power consumption	$P_{d1}$	1.0 <sup>Note 1</sup>	W
	$P_{d2}$	1.25 <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	$T_{JMAX.}$	150	$^{\circ}\text{C}$
Storage temperature range	$T_{stg}$	-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  $\leq 40\%$  **$P_d - T_A$  Characteristics**

## RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Supply voltage (motor block)	V <sub>M</sub>	4.0	5.0	13.2	V
Supply voltage (control block)	V <sub>DD</sub>	4.0	5.0	6.0	V
R <sub>x</sub> pin connection resistance	R <sub>x</sub>	2			kΩ
H bridge driver current <sup>Note</sup>	I <sub>DR</sub>			±380	mA
Charge pump capacitance	C <sub>1</sub> to C <sub>3</sub>	5		20	nF
Operating temperature	T <sub>A</sub>	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)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
OFF V <sub>M</sub> pin current	I <sub>M</sub>	INC pin low <sup>Note 1</sup> V <sub>M</sub> = 6.0 V V <sub>DD</sub> = 6.0 V			1.0	μA
		V <sub>M</sub> = 13.2 V V <sub>DD</sub> = 6.0 V			1.0	mA
V <sub>DD</sub> pin current	I <sub>DD</sub>	<b>Note 2</b>		0.4	1.0	mA
IN <sub>1</sub> , IN <sub>2</sub> , INC pin high-level input current	I <sub>IH1</sub>	T <sub>A</sub> = 25 °C, V <sub>IN</sub> = V <sub>DD</sub>			1.0	μA
		0 ≤ T <sub>A</sub> ≤ 60 °C, V <sub>IN</sub> = V <sub>DD</sub>			2.0	
IN <sub>1</sub> , IN <sub>2</sub> , INC pin low-level input current	I <sub>IL1</sub>	T <sub>A</sub> = 25 °C, V <sub>IN</sub> = 0 V			−0.15	mA
		0 ≤ T <sub>A</sub> ≤ 60 °C, V <sub>IN</sub> = 0 V			−0.2	
PS pin high-level input current	I <sub>IH2</sub>	T <sub>A</sub> = 25 °C, V <sub>IN</sub> = V <sub>DD</sub>			0.15	mA
		0 ≤ T <sub>A</sub> ≤ 60 °C, V <sub>IN</sub> = V <sub>DD</sub>			0.2	
PS pin low-level input current	I <sub>IL2</sub>	T <sub>A</sub> = 25 °C, V <sub>IN</sub> = 0 V			−1.0	μA
		0 ≤ T <sub>A</sub> ≤ 60 °C, V <sub>IN</sub> = 0 V			−2.0	
IN <sub>1</sub> , IN <sub>2</sub> , INC pin input pull-up resistance	R <sub>INU</sub>	T <sub>A</sub> = 25 °C	35	50	65	kΩ
		0 ≤ T <sub>A</sub> ≤ 60 °C	25		75	
PS pin input pull-down resistance	R <sub>IND</sub>	T <sub>A</sub> = 25 °C	35	50	65	kΩ
		0 ≤ T <sub>A</sub> ≤ 60 °C	25		75	
Control pin high-level input voltage	V <sub>IH</sub>		3.0		V <sub>DD</sub> + 0.3	V
Control pin low-level input voltage	V <sub>IL</sub>		−0.3		0.8	V
H bridge circuit ON resistance <sup>Note 3</sup>	R <sub>ON1</sub>	V <sub>DD</sub> = 5 V, V <sub>M</sub> = 5 V		1.5	3.0	Ω
	R <sub>ON2</sub>	V <sub>DD</sub> = 5 V, V <sub>M</sub> = 12 V		2.0	4.0	
R <sub>ON</sub> relative accuracy	ΔR <sub>ON</sub>	Excitation direction <2>, <4> <sup>Note 4</sup>			±5	%
		Excitation direction <1>, <3>			±10	
V <sub>x</sub> voltage in power-saving mode <sup>Note 5</sup>	V <sub>x</sub>	V <sub>DD</sub> = V <sub>M</sub> = 5 V, R <sub>x</sub> = 50 kΩ		2.5		V
V <sub>x</sub> relative accuracy in power-saving mode	ΔV <sub>x</sub>	Excitation direction <2>, <4> <sup>Note 4</sup>			±5	%
		Excitation direction <1>, <3>			±5	
Charge pump circuit (V <sub>G</sub> ) turn ON time	T <sub>ONG</sub>	V <sub>DD</sub> = 5 V, V <sub>M</sub> = 5 V		0.3	2	ms
H bridge circuit turn ON time	T <sub>ONH</sub>	C <sub>1</sub> = C <sub>2</sub> = C <sub>3</sub> = 10 nF			5	μs
H bridge circuit turn OFF time	T <sub>OFFH</sub>	R <sub>M</sub> = 20 Ω			5	μs

**Notes 1.** When V<sub>DD</sub> < V<sub>M</sub>, a current (I<sub>M1</sub>) always flow from the V<sub>M1</sub> pin to the charge pump circuit because a gate voltage (2 × V<sub>DD</sub> + V<sub>M</sub>) is generated.

**2.** When IN<sub>1</sub> = IN<sub>2</sub> = INC = "H", PS = "L"

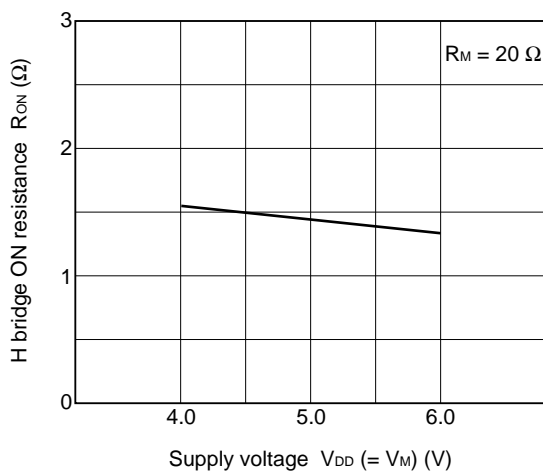
**3.** Sum of ON resistances of top and bottom transistors

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

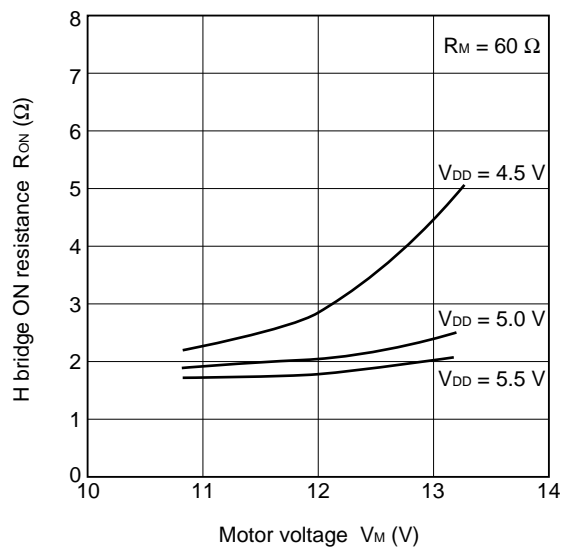
**5.** V<sub>x</sub> is a voltage at point A (FORWARD) or B (REVERSE) of the H bridge in Function Table.

# CHARACTERISTIC CURVES

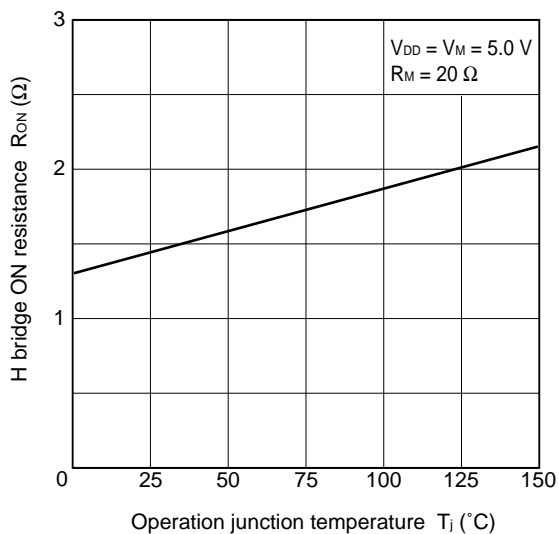
**R<sub>ON</sub> vs. V<sub>DD</sub> (= V<sub>M</sub>) Characteristics**



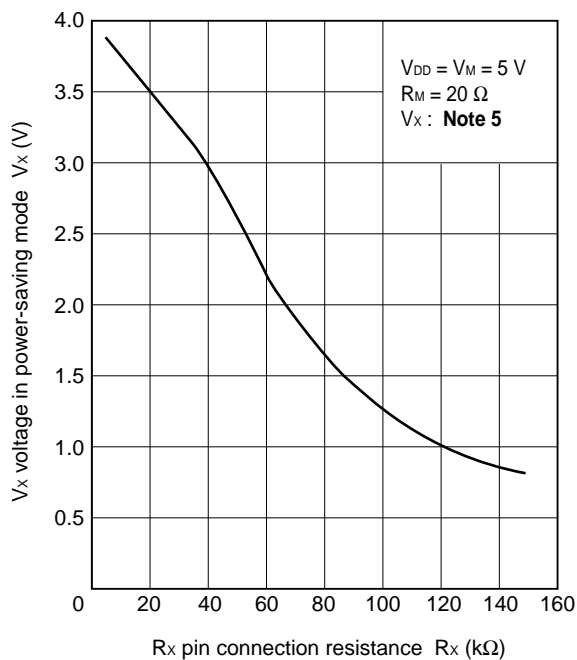
**R<sub>ON</sub> vs. V<sub>M</sub> Characteristics**



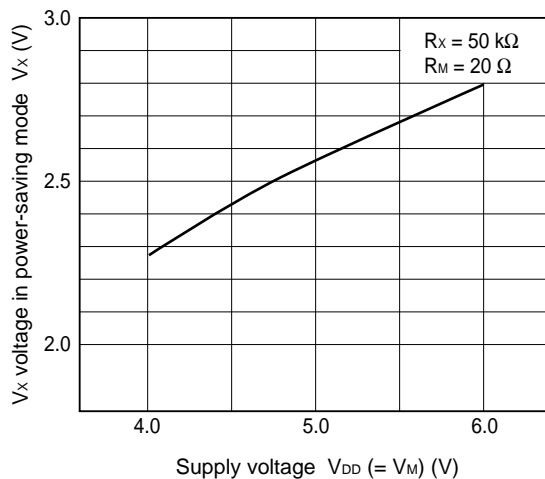
**R<sub>ON</sub> vs. T<sub>j</sub> Characteristics**



**V<sub>x</sub> vs. R<sub>x</sub> Characteristics**



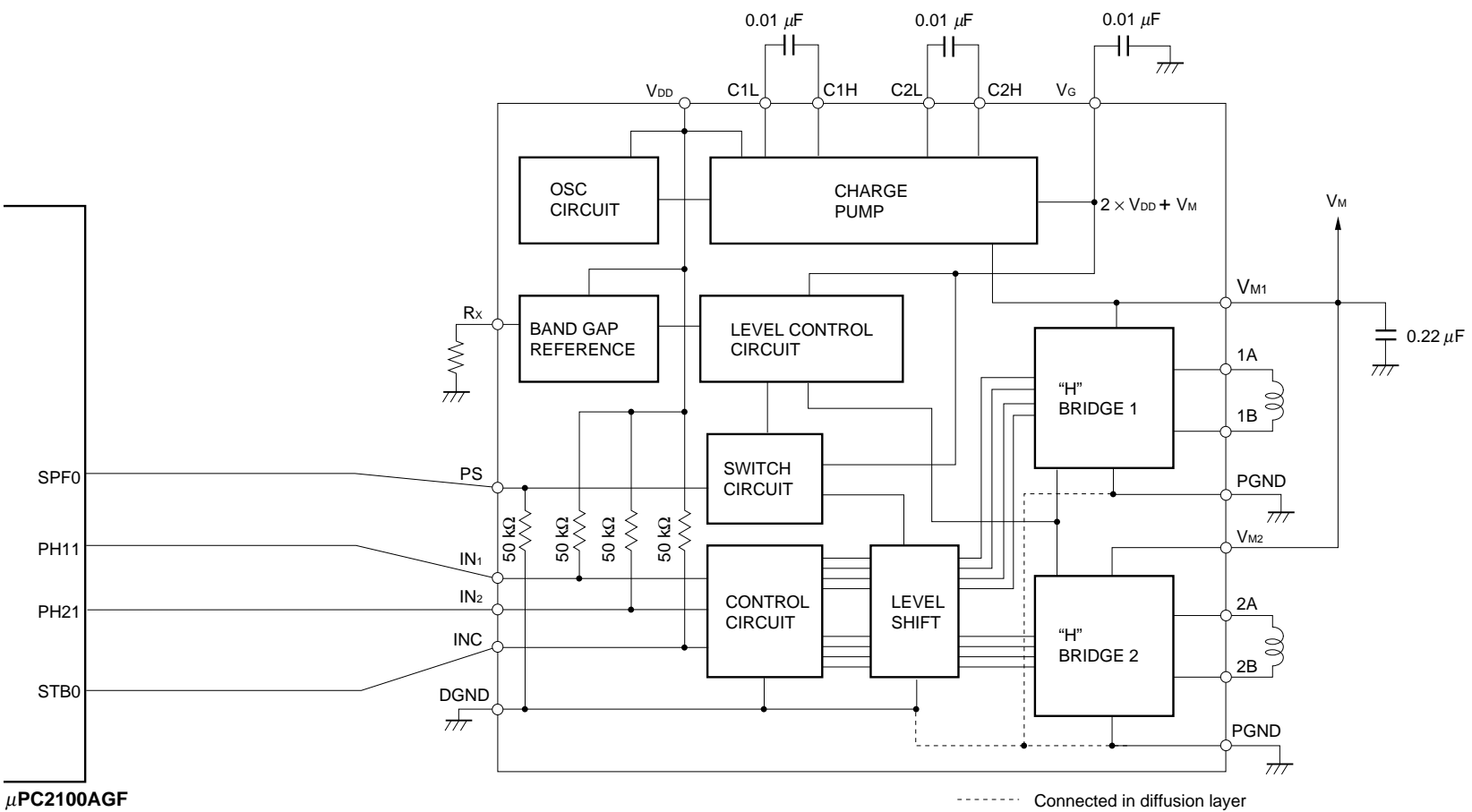
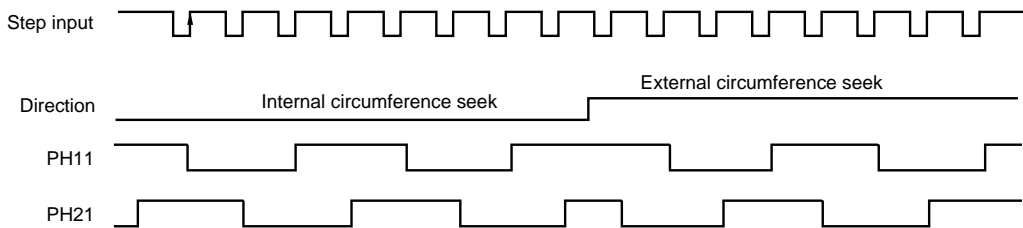
**V<sub>x</sub> vs. V<sub>DD</sub> (= V<sub>M</sub>) Characteristics**



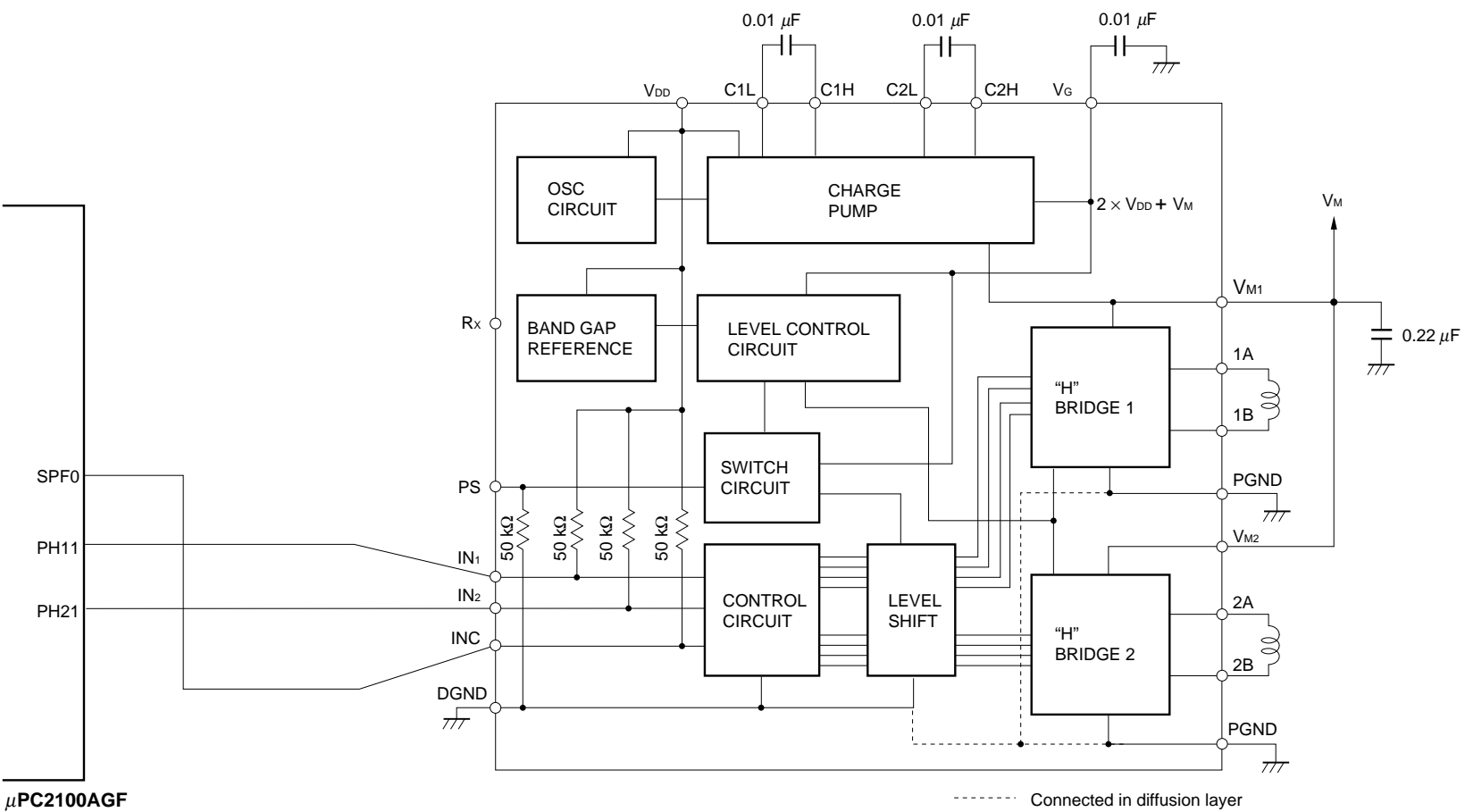
# APPLICATION CIRCUIT EXAMPLE

## 1. Connection with 1-chip FDD LSI μPC2100AGF

μPC2100AGF Stepping Motor Excitation Timing Chart



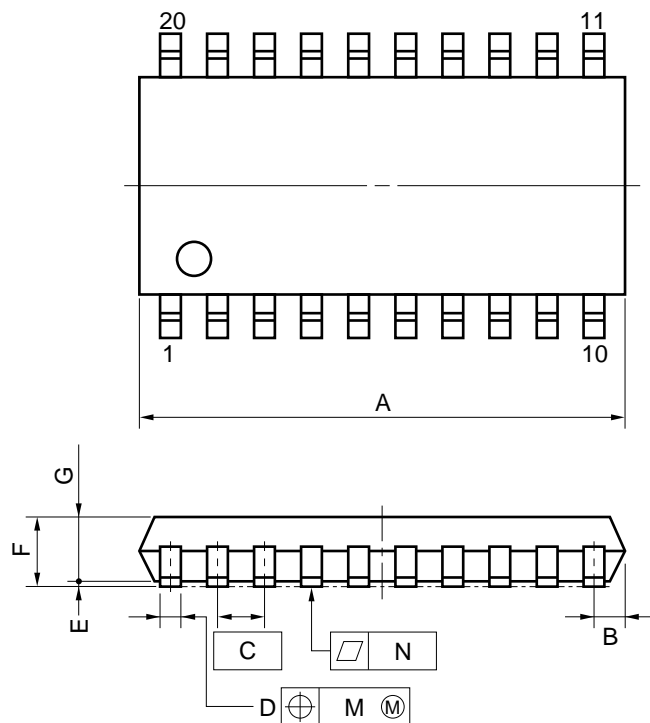
## 2. Connection with 1-chip FDD LSI μPC2100AGF



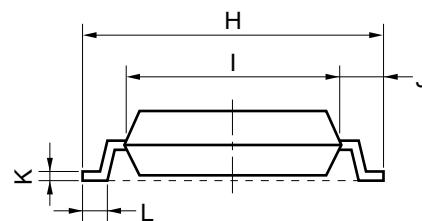
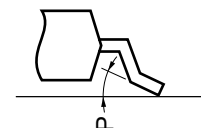
The application circuits and their parameters are for reference only and are not intended for use in actual design-ins.



## 20 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	13.00 MAX.	0.512 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	$0.1 \pm 0.1$	$0.004 \pm 0.004$
F	1.8 MAX.	0.071 MAX.
G	1.55	0.061
H	$7.7 \pm 0.3$	$0.303 \pm 0.012$
I	5.6	0.220
J	1.1	0.043
K	$0.20^{+0.10}_{-0.05}$	$0.008^{+0.004}_{-0.002}$
L	$0.6 \pm 0.2$	$0.024^{+0.008}_{-0.009}$
M	0.12	0.005
N	0.10	0.004
P	$3^{\circ} + 7^{\circ}_{-3^{\circ}}$	$3^{\circ} + 7^{\circ}_{-3^{\circ}}$

P20GM-50-300B, C-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).

[MEMO]

## [MEMO]

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