

MONOLITHIC DUAL H BRIDGE DRIVER CIRCUIT

DESCRIPTION

The μ 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.

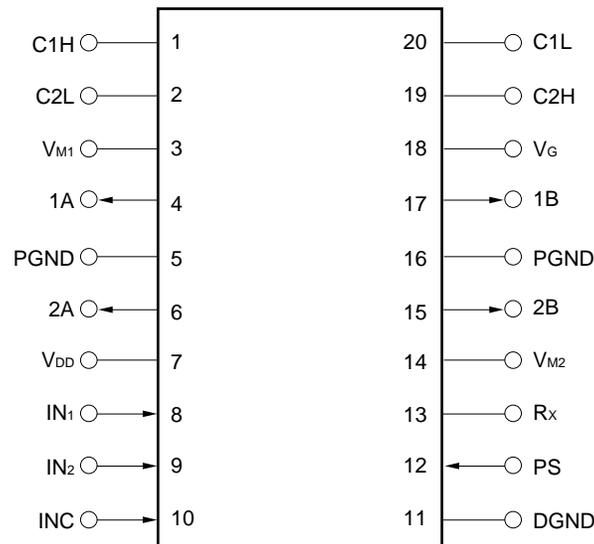
In addition, the drive current can be adjusted by an external resistor in a power-saving mode.

The μ 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)

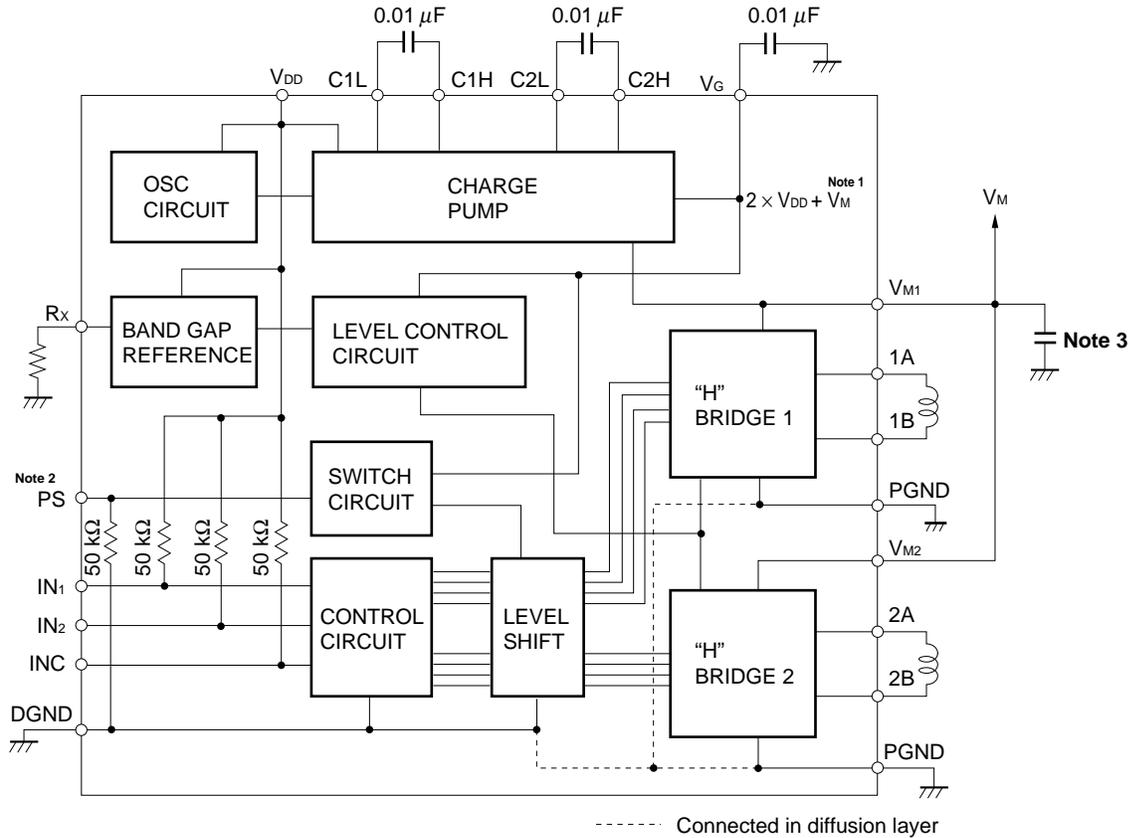
PIN CONFIGURATION (Top View)



ORDERING INFORMATION

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

BLOCK DIAGRAM

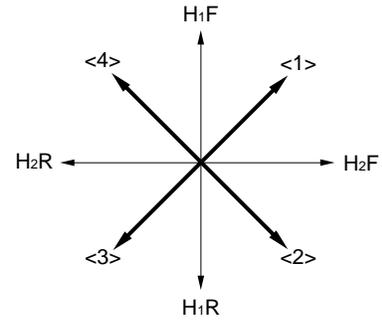


Notes 1. $3 \times V_{DD}$ where $V_M \leq V_{DD}$

2. 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.
3. It is recommended to connect an external capacitor of $0.22 \mu F$ or more between V_M and GND to stabilize the operation.

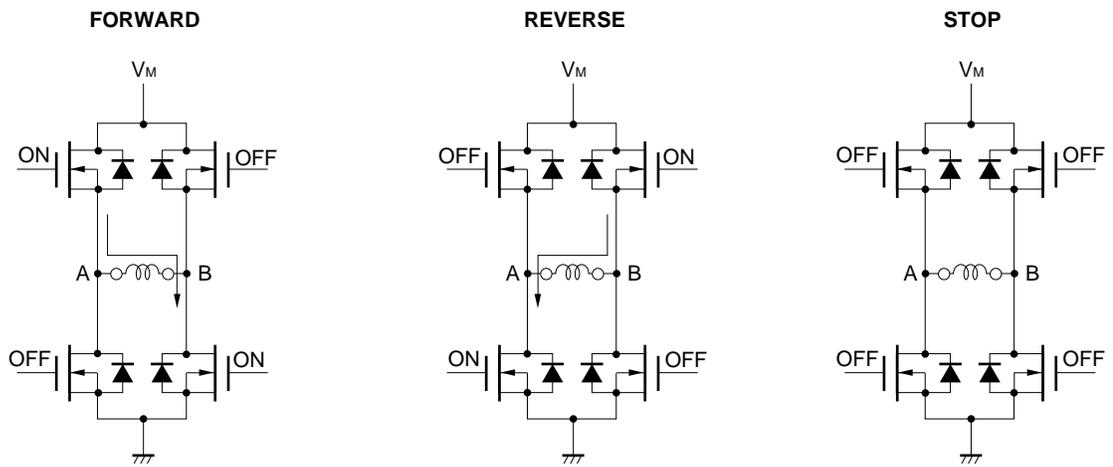
FUNCTION TABLE

Excitation Direction	INC	IN 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	



F: Forward
R: Reverse

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



ABSOLUTE MAXIMUM RATINGS (T_A = 25 °C)

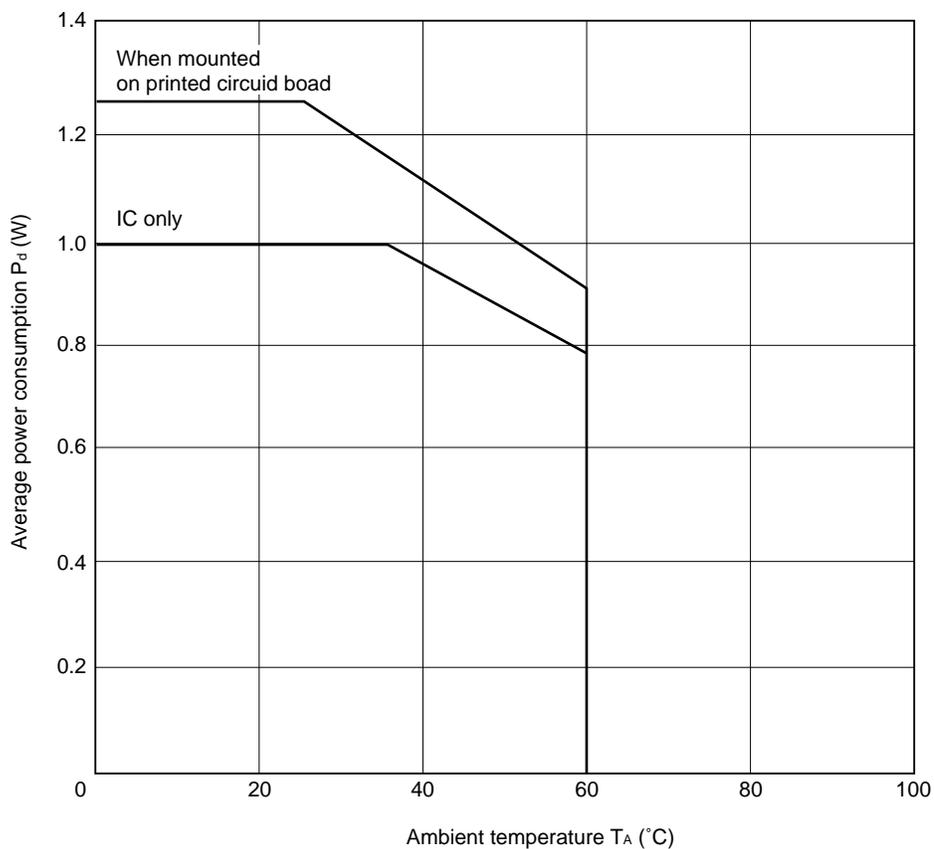
Parameter	Symbol	Rating	Unit
Supply voltage (motor block)	V _M	-0.5 to +15	V
Supply voltage (control block)	V _{DD}	-0.5 to +7	V
Power consumption	P _{d1}	1.0 ^{Note 1}	W
	P _{d2}	1.25 ^{Note 2}	
Instantaneous H bridge driver current	I _b (pulse)	±1.0 ^{Note 2, 3}	A
Input voltage	V _{IN}	-0.5 to V _{DD} + 0.5	V
Operating temperature range	T _A	0 to 60	°C
Operation junction temperature	T _{JMAX.}	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	13.2	V
Supply voltage (control block)	V _{DD}	4.0	5.0	6.0	V
R _x pin connection resistance	R _x	2			kΩ
H bridge driver current ^{Note}	I _{DR}			±380	mA
Charge pump capacitance	C ₁ to C ₃	5		20	nF
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)

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

Notes 1. When V_{DD} < V_M, a current (I_{M1}) always flow from the V_{M1} pin to the charge pump circuit because a gate voltage (2 × V_{DD} + V_M) is generated.

2. When IN₁ = IN₂ = INC = “H”, PS = “L”

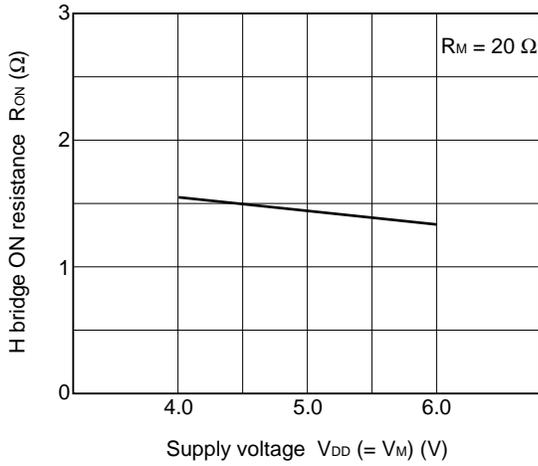
3. Sum of ON resistances of top and bottom transistors

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

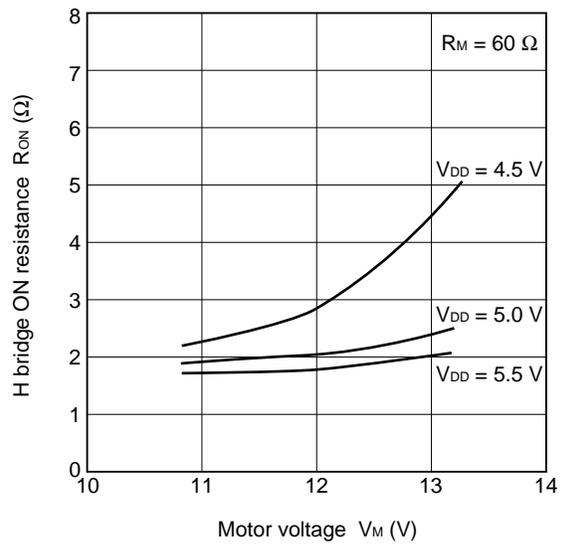
5. V_x is a voltage at point A (FORWARD) or B (REVERSE) of the H bridge in Function Table.

CHARACTERISTIC CURVES

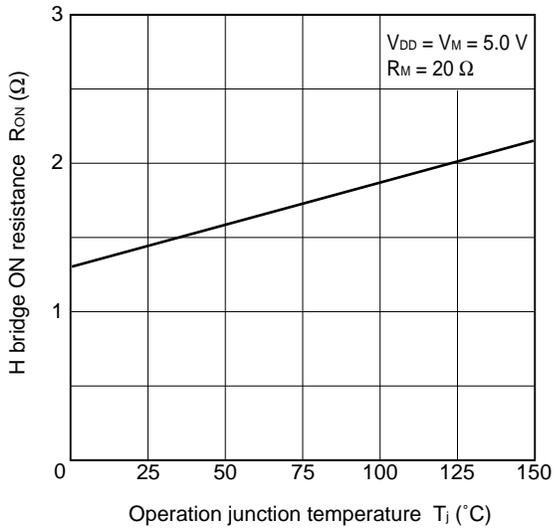
RON vs. VDD (= VM) Characteristics



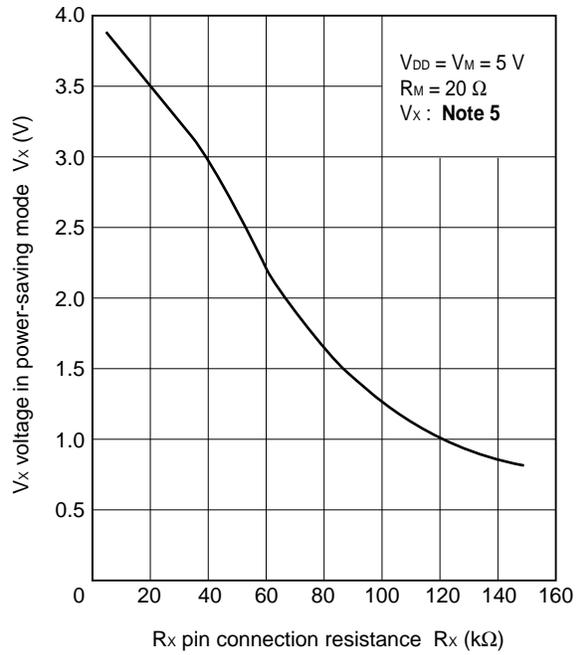
RON vs. VM Characteristics



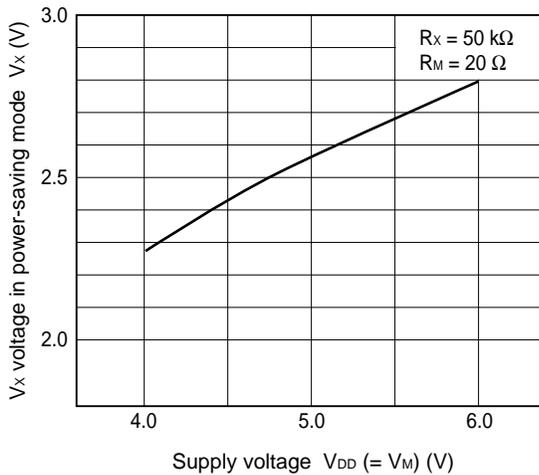
RON vs. Tj Characteristics



Vx vs. Rx Characteristics



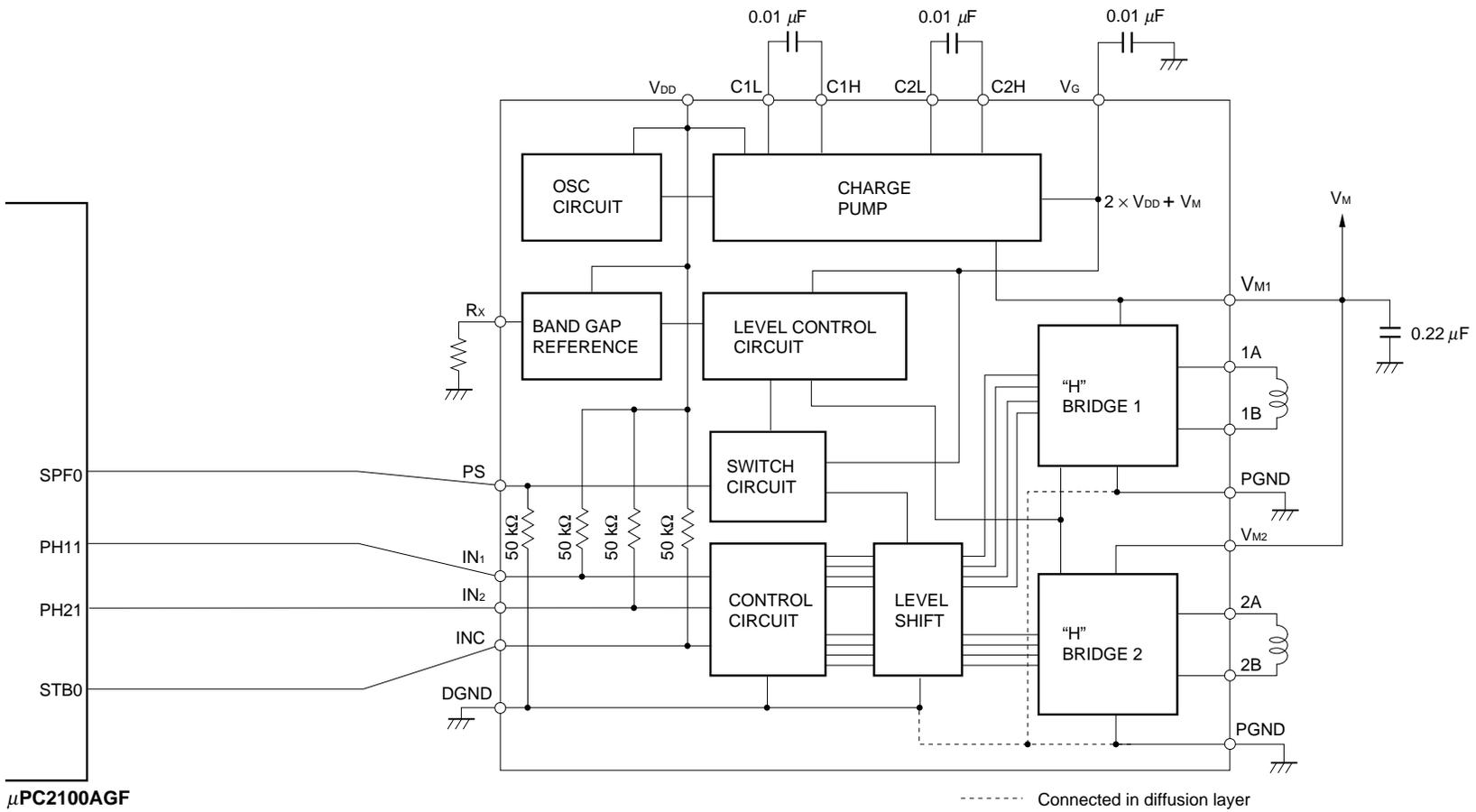
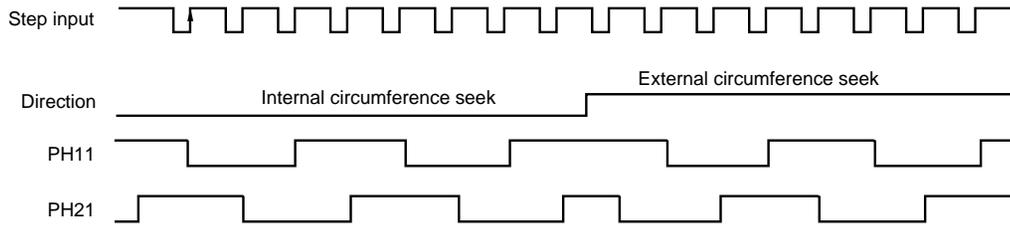
Vx vs. VDD (= VM) Characteristics



APPLICATION CIRCUIT EXAMPLE

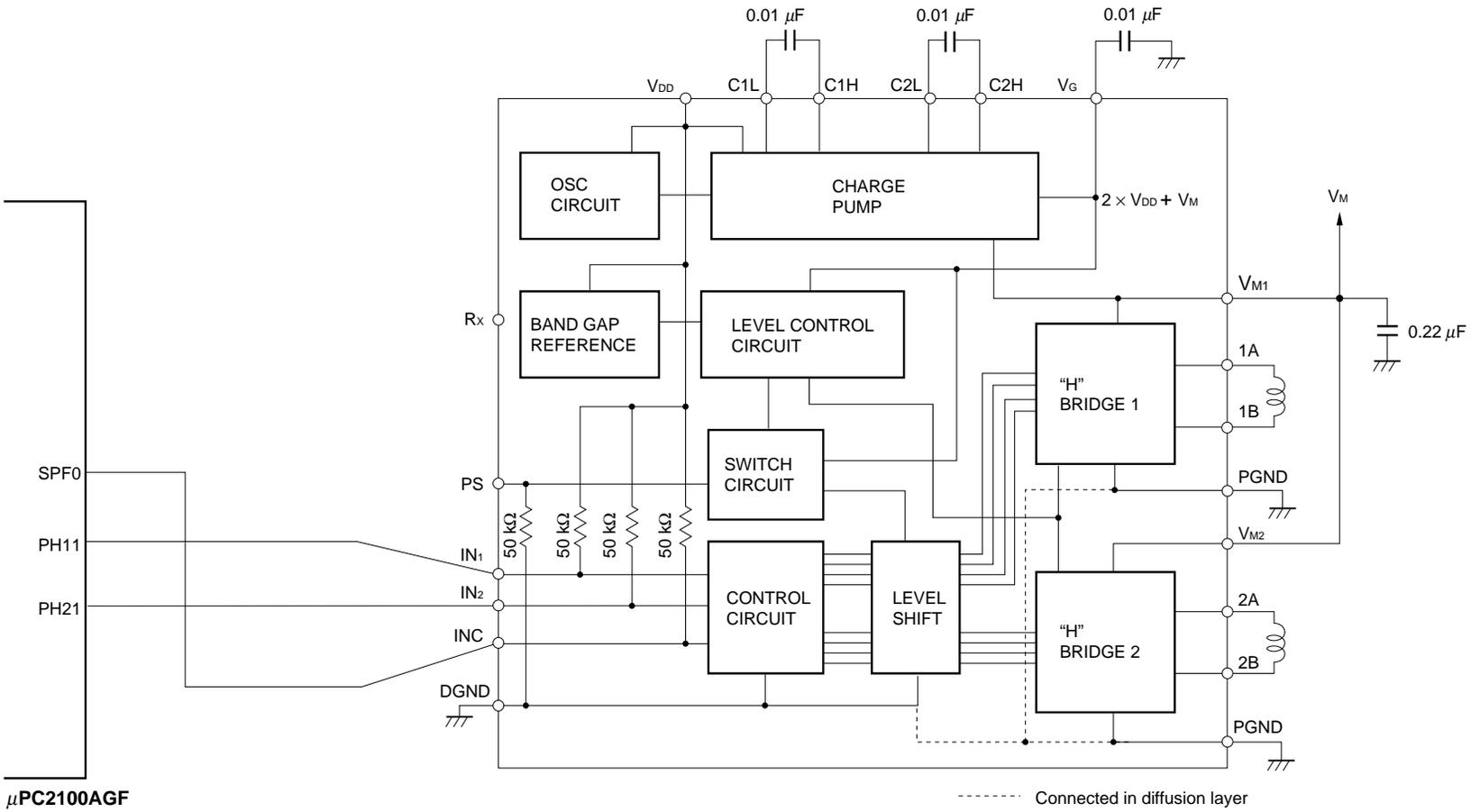
1. Connection with 1-chip FDD LSI μPC2100AGF

μPC2100AGF Stepping Motor Excitation Timing Chart



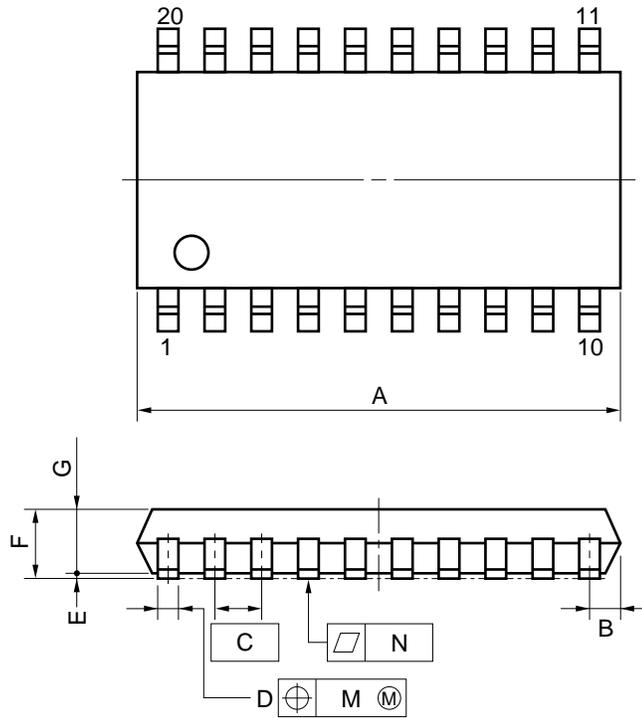
μPC2100AGF

2. Connection with 1-chip FDD LSI μPC2100AGF

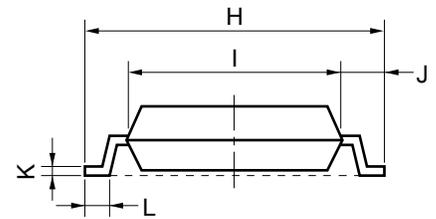
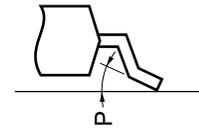


The application circuits and their parameters are for reference only and are not intended for use in actual design-ins.

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±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° ^{+7°} _{-3°}	3° ^{+7°} _{-3°}

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 ^{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).

[MEMO]

[MEMO]

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Anti-radioactive design is not implemented in this product.