DATA SHEET

MOS INTEGRATED CIRCUIT

µPD16803

MONOLITHIC DUAL H BRIDGE DRIVER CIRCUIT

DESCRIPTION

The µPD16803 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.

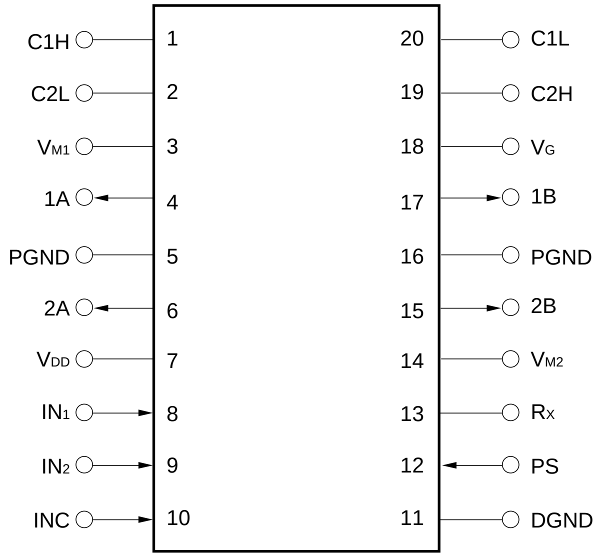
In addition, the drive current can be adjusted by an external resistor in a power-saving mode.

The µPD16803 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 Ω TYP. (V_M = 5.0 V)
  R_{ON2} = 2.0 Ω 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)



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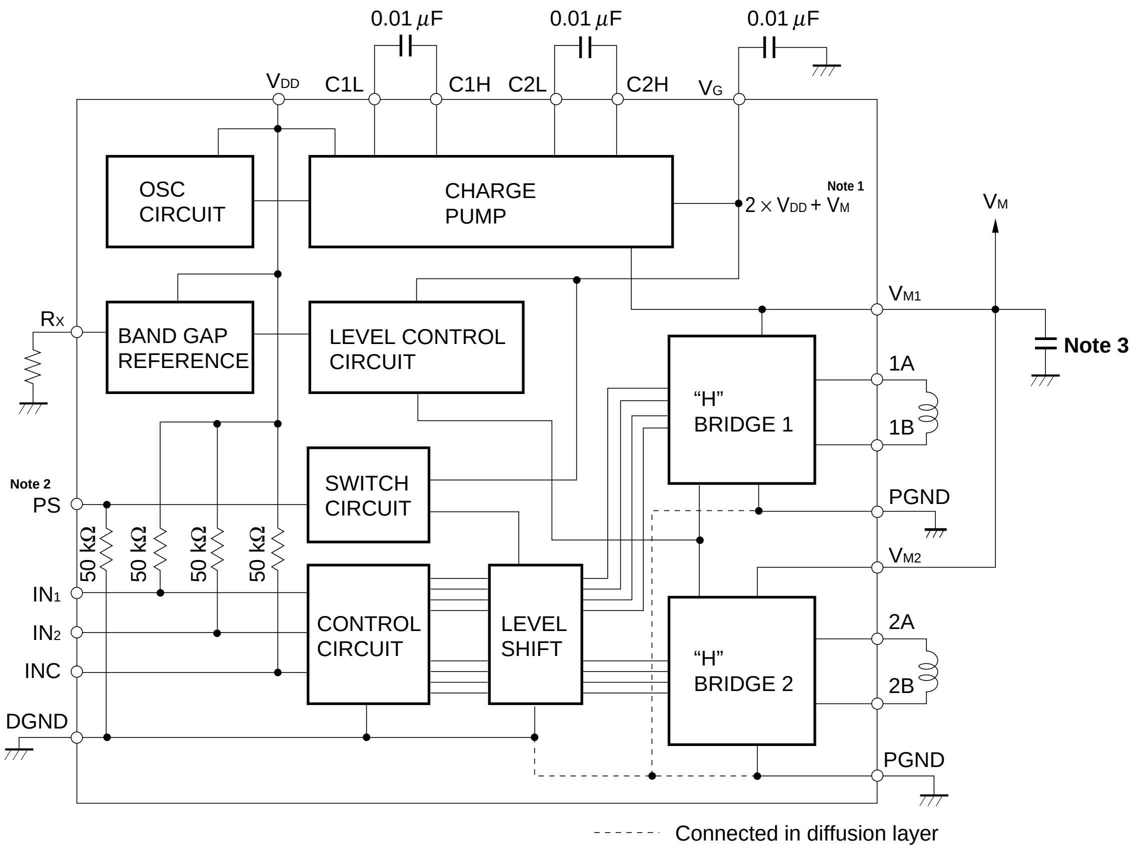
ORDERING INFORMATION

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

BLOCK DIAGRAM



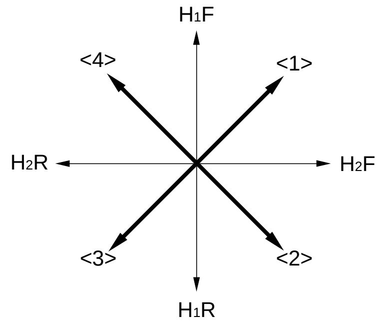
Notes 1. $3 \times V_{DD}$ where $V_M \leq V_{DD}$

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 μF 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	

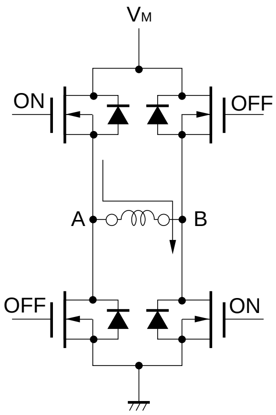


F: Forward

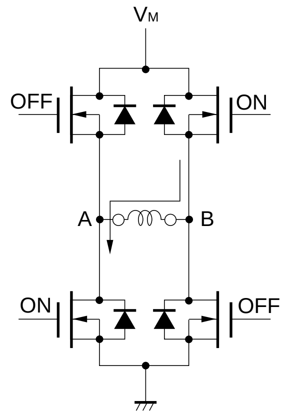
R: Reverse

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

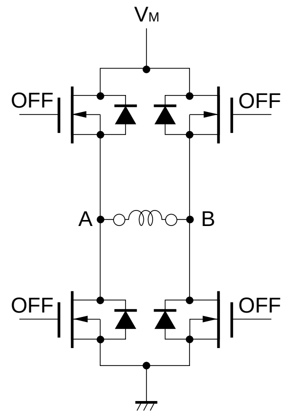
FORWARD



REVERSE



STOP



ABSOLUTE MAXIMUM RATINGS (T_A = 25 °C)

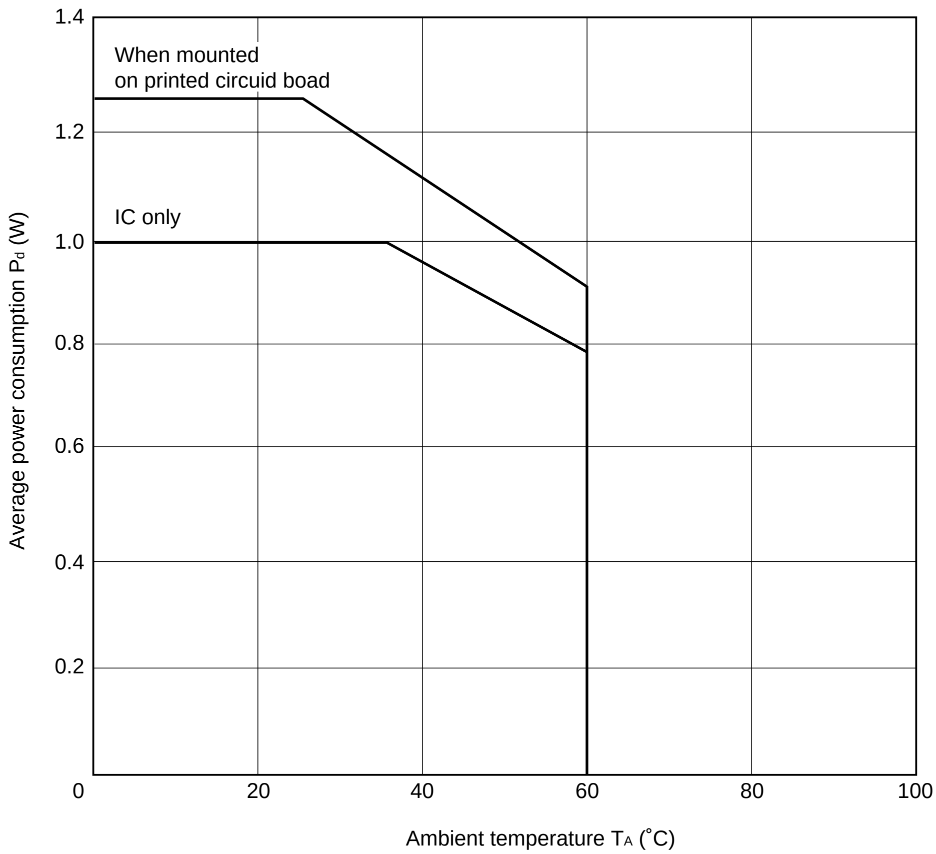
Parameter	Symbol	Rating	Unit
Supply voltage (motor block)	V_M	–0.5 to +15	V
Supply voltage (control block)	V_{DD}	–0.5 to +7	V
Power consumption	P_{d1}	1.0 Note 1	W
	P_{d2}	1.25 Note 2	
Instantaneous H bridge driver current	I_D (pulse)	±1.0 Note 2, 3	A
Input voltage	V_{IN}	–0.5 to V_{DD} + 0.5	V
Operating temperature range	T_A	0 to 60	°C
Operation junction temperature	$T_{jMAX.}$	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
		INC pin low[Note 1], 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, $C_1 = C_2 = C_3$ = 10 nF, R_M = 20 Ω		0.3	2	ms
H bridge circuit turn ON time	T_{ONH}				5	μs
H bridge circuit turn OFF time	T_{OFFH}				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 ($2 \times V_{DD} + V_M$) is generated.

2. When $IN_1 = IN_2$ = INC = "H", PS = "L"

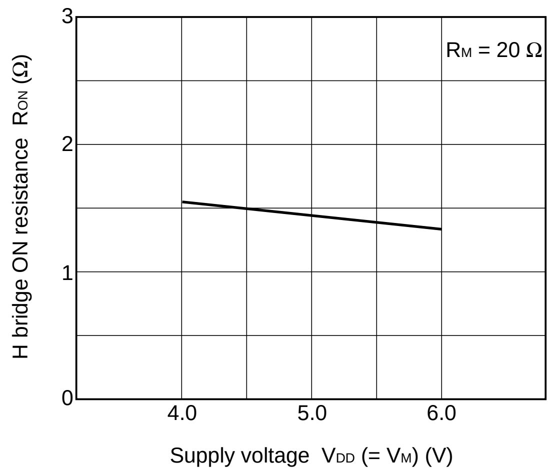
3. Sum of ON resistances of top and bottom transistors

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

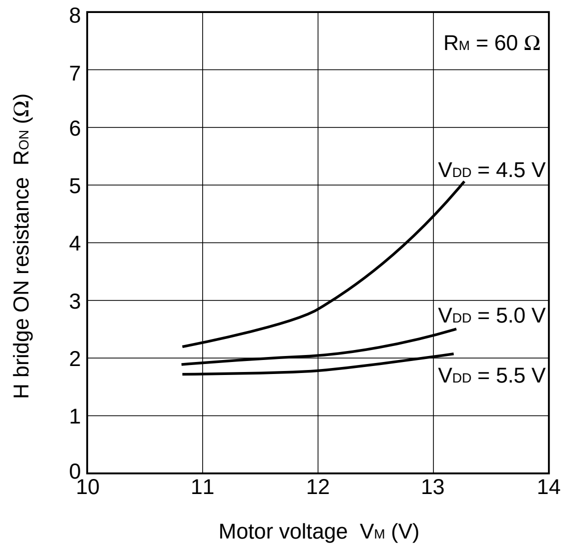
5. V_X is a voltage at point A (FORWARD) or B (REVERSE) of the H bridge in Function Table.

CHARACTERISTIC CURVES

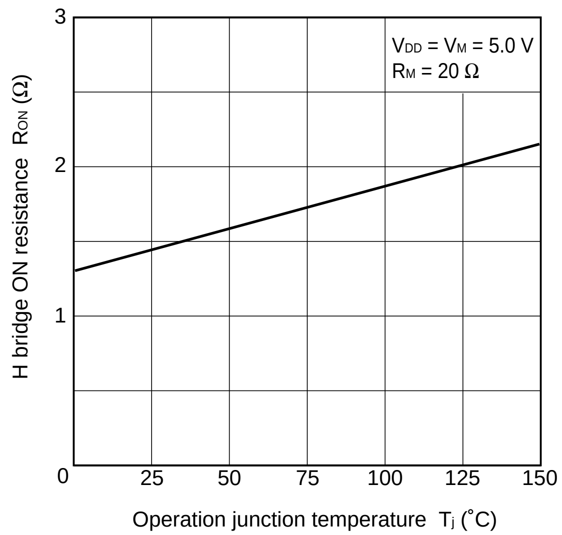
R_{ON} vs. V_{DD} (= V_M) Characteristics



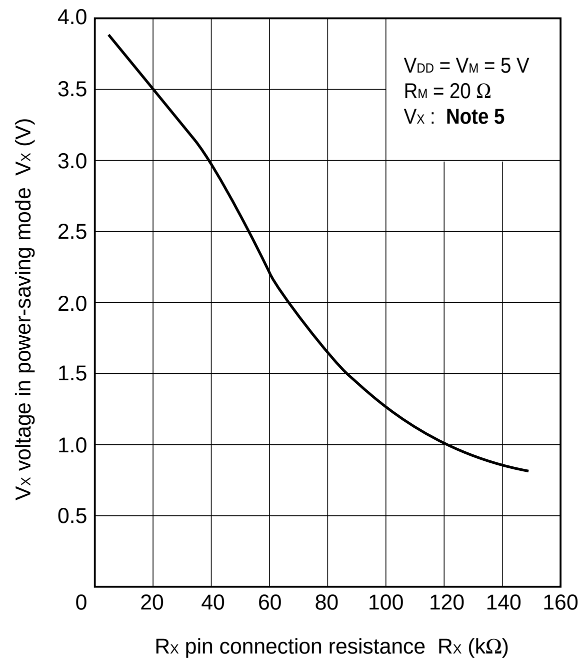
R_{ON} vs. V_M Characteristics



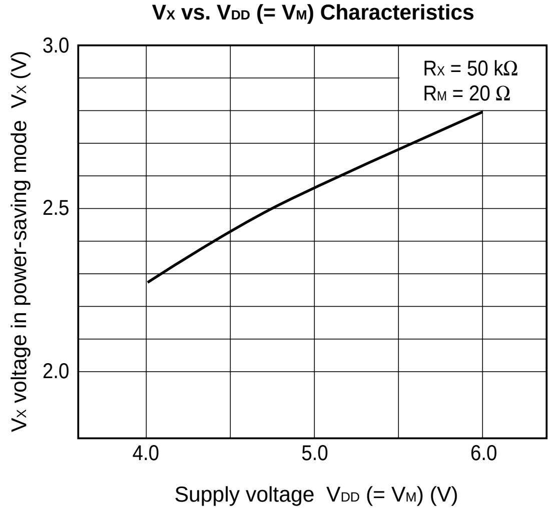
R_{ON} vs. T_j Characteristics



V_X vs. R_X Characteristics



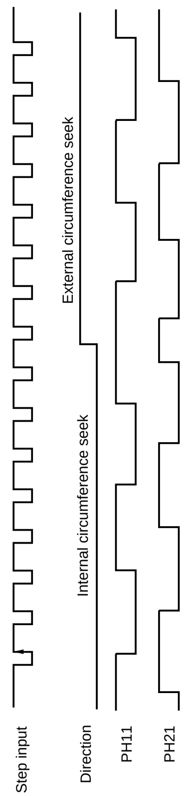
V_X vs. V_{DD} (= V_M) Characteristics

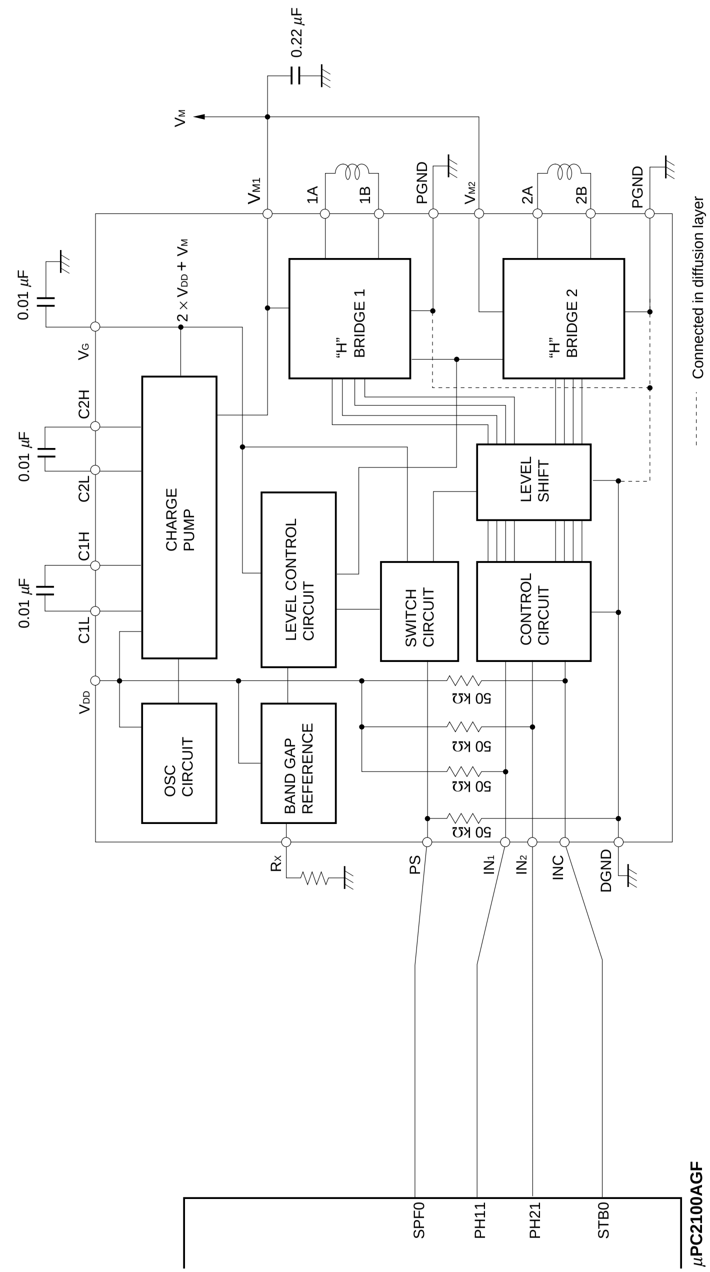


APPLICATION CIRCUIT EXAMPLE

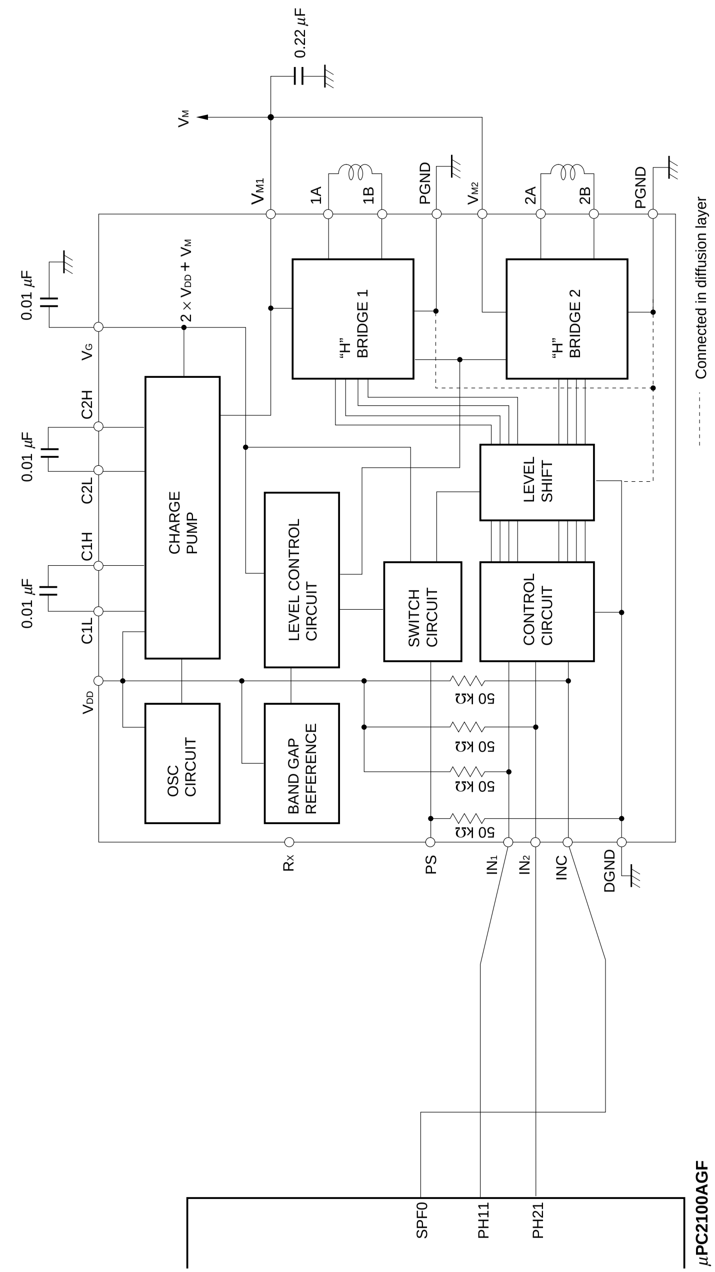
1. Connection with 1-chip FDD LSI μPC2100AGF

μPC2100AGF Stepping Motor Excitation Timing Chart



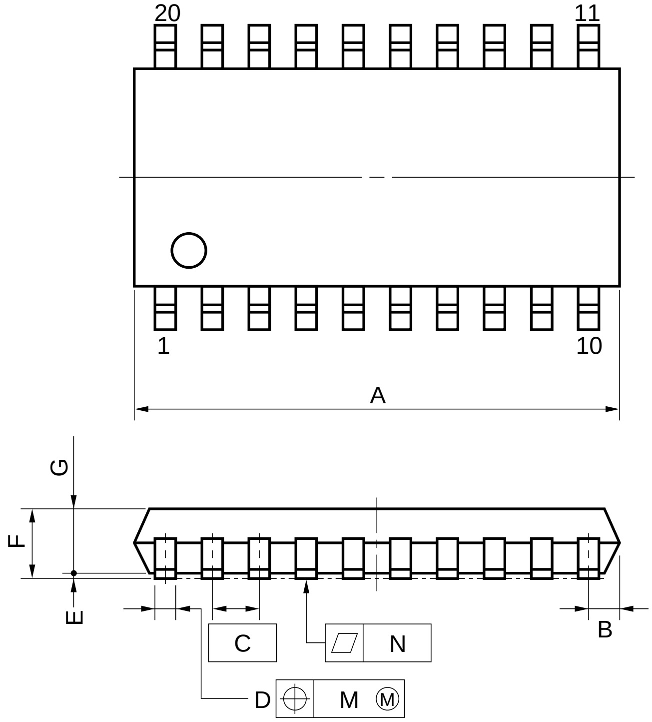


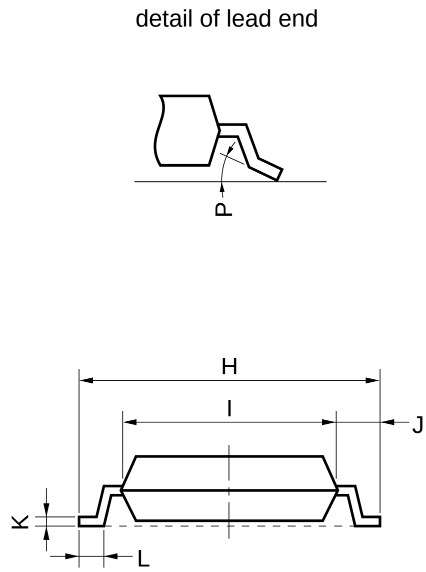
2. Connection with 1-chip FDD LSI μPC2100AGF



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)





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]