NEC

MOS INTEGRATED CIRCUIT

μPD16818

MONOLITHIC DUAL H BRIDGE DRIVER CIRCUIT

DESCRIPTION

The μPD16818 is a monolithic dual H bridge driver IC which uses N-channel power MOS FETs in its output 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 power-saving mode.

The μPD16818 is therefore ideal as the driver circuit of a 2-phase excitation, bipolar-driven stepping motor for the head actuator of an FDD.

FEATURES

- Compatible with 3V-/5V- supply voltage
- Pin compatible with μPD16803
- Low ON resistance (sum of ON resistors of top and bottom MOS FETs)
  R_{ON1}= 1.2 Ω (V_M = 3.0 V)
  R_{ON2} = 1.0 Ω (V_M = 5.0 V)
- Low current consumption: I_{DD} = 0.4 mA TYP. (V_{DD} = 2.7 V to 3.6 V)
- Stop mode function that turns OFF all output MOS FETs
- Drive current can be set in power-saving mode (set by external resistor)
- Compact surface mount package

ORDERING INFORMATION

Part Number	Package
μPD16818GS	20-pin plastic SOP (300 mil)
μPD16818GR-8JG	20-pin plastic SSOP (225 mil)

ABSOLUTE MAXIMUM RATINGS (T_A = 25 °C)

Parameter		Symbol	Condition	Rating	Unit
Supply voltage	Motor block	V_M		–0.5 to +7.0	V
	Control block	V_{DD}		–0.5 to +7.0	
Power consumption	μPD16818GS	P_{D1}		1.0 Note 1	W
		P_{D2}		1.25 Note 2	
	μPD16818GR-8JG	P_{D2S}		0.79 Note 2	
Instantaneous H bridge drive current		$I_{D\ (pulse)}$	PW ≤ 5 ms, Duty ≤ 40 %	±1.0 Note 2	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		$T_{J\ (MAX)}$		150	°C
Storage temperature range		T_{stg}		–55 to +150	°C

Notes 1. IC only

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

The information in this document is subject to change without notice.

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RECOMMENDED OPERAING CONDITIONS

Parameter			Symbol	MIN.	TYP.	MAX.	Unit
Supply voltage	Motor block		V_M	2.7		6.0	V
	Control block		V_{DD}	2.7		6.0	
Rx pin connection resistance			R_X	2			kΩ
H bridge drive current		μPD16818GS	I_{DR}			430	mA
(V_{DD} = V_M = 3 V)**Note**		μPD16818GR-8JG	I_{DRS}			340	
Charge pump capacitor capacitance			C_1-C_3	5		20	nF
Operating temperature			T_A	0		60	°C

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

ELECTRICAL SPECIFICATIONS (Within recommended operating conditions unless otherwise specified)

V_{DD} = V_M = 4.0 V to 6.0 V

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
OFF V_M pin current	I_M	INC pin low V_M = V_{DD} = 6 V			1.0	μA
V_{DD} pin current	I_{DD}	**Note 1**		1.0	2.0	mA
High-level input current	I_{IH1}	T_A = 25 °C, V_{IN} = V_{DD}			1.0	μA
(IN_1, IN_2, INC)		0 ≤ T_A ≤ 60 °C, V_{IN} = V_{DD}			2.0	
Low-level input current	I_{IL1}	T_A = 25 °C, V_{IN} = 0			–0.15	mA
(IN_1, IN_2, INC)		0 ≤ T_A ≤ 60 °C, V_{IN} = 0			–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 voltage	I_{IL2}	T_A = 25 °C, V_{IN} = 0			–1.0	μA
		0 ≤ T_A ≤ 60 °C, V_{IN} = 0			–2.0	
Input pull-up resistance	R_{INU}	T_A = 25 °C	35	50	65	kΩ
(IN_1, IN_2, INC)		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 ON resistance**Note 2**	R_{ON2}	V_{DD} = V_M = 5 V		1.0	2.0	Ω
R_{ON} relative accuracy	ΔR_{ON}	Excitation direction <1>, <3>			±15	%
		Excitation direction <2>, <4>**Note 3**			±5	
Charge pump circuit turn ON time	t_{ONG}	V_{DD} = V_M = 5 V C_1 = C_2 = C_3 = 10nF R_M = 20 Ω		0.3	2.0	ms
H bridge turn ON time	t_{ONH}				2.0	μs
H bridge turn OFF time	t_{OFFH}				5.0	μs

Notes 1. When IN_1 = IN_2 = INC = “H”, PS = “L”

2. Sum of ON resistances of top and bottom MOS FETs

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

ELECTRICAL SPECIFICATIONS (Within recommended operating conditions unless otherwise specified)

$V_{DD} = V_M$ = 2.7 V to 3.6 V

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
OFF V_M pin current	I_M	INC pin low $V_M = V_{DD}$ = 3.6 V			1.0	μA
V_{DD} pin current	I_{DD}	**Note 1**		0.4	1.0	mA
High-level input current	I_{IH1}	T_A = 25 °C, $V_{IN} = V_{DD}$			1.0	μA
(IN_1, IN_2, INC)		0 ≤ T_A ≤ 60 °C, $V_{IN} = V_{DD}$			2.0	
Low-level input current	I_{IL1}	T_A = 25 °C, V_{IN} = 0			–0.09	mA
(IN_1, IN_2, INC)		0 ≤ T_A ≤ 60 °C, V_{IN} = 0			–0.12	
PS pin high-level input current	I_{IH2}	T_A = 25 °C, $V_{IN} = V_{DD}$			0.09	mA
		0 ≤ T_A ≤ 60 °C, $V_{IN} = V_{DD}$			0.12	
PS pin low-level input voltage	I_{IL2}	T_A = 25 °C, V_{IN} = 0			–1.0	μA
		0 ≤ T_A ≤ 60 °C, V_{IN} = 0			–2.0	
Input pull-up resistance	R_{INU}	T_A = 25 °C	35	50	65	kΩ
(IN_1, IN_2, INC)		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}		2.0		V_{DD} + 0.3	V
Control pin low-level input voltage	V_{IL}		–0.3		0.8	V
H bridge ON resistance**Note 2**	R_{ON1}	$V_{DD} = V_M$ = 3 V		1.2	2.4	Ω
R_{ON} relative accuracy	ΔR_{ON}	Excitation direction <1>, <3>			±15	%
		Excitation direction <2>, <4>**Note 3**			±5	
Vx voltage in power-saving mode**Note 4**	V_X	$V_{DD} = V_M$ = 3 V R_X = 270 kΩ	1.0	1.2	1.4	V
Vx relative accuracy in power-saving mode	ΔV_X	Excitation direction <1>, <3>			±5	%
		Excitation direction <2>, <4>			±5	
Charge pump circuit turn ON time	t_{ONG}	$V_{DD} = V_M$ = 3 V		0.3	2.0	ms
H bridge turn ON time	t_{ONH}	$C_1 = C_2 = C_3$ = 10nF			2.0	μs
H bridge turn OFF time	t_{OFFH}	R_M = 20 Ω			5.0	μs

Notes 1. When $IN_1 = IN_2$ = INC = "H", PS = "L"

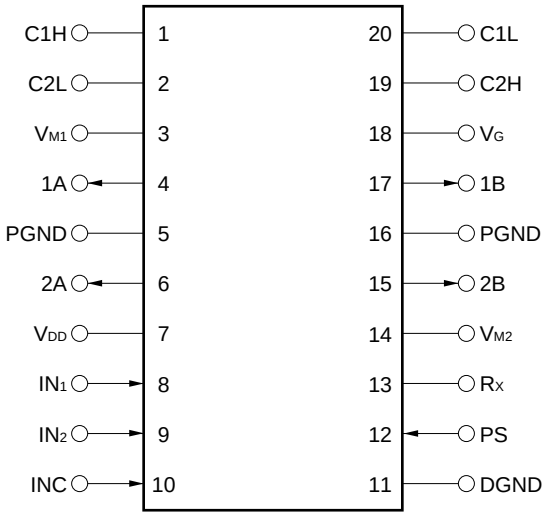
2. Sum of ON resistances of top and bottom MOS FETs

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

4. Vx is a voltage at point A (FORWARD) or B (REVERSE) of the H bridge in FUNCTION TABLE.

PIN CONFIGURATION (Top View)

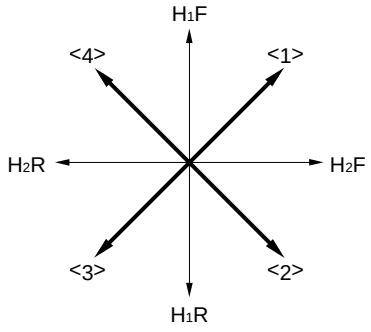
20-pin plastic SOP (300 mil)
20-pin plastic SSOP (225 mil)

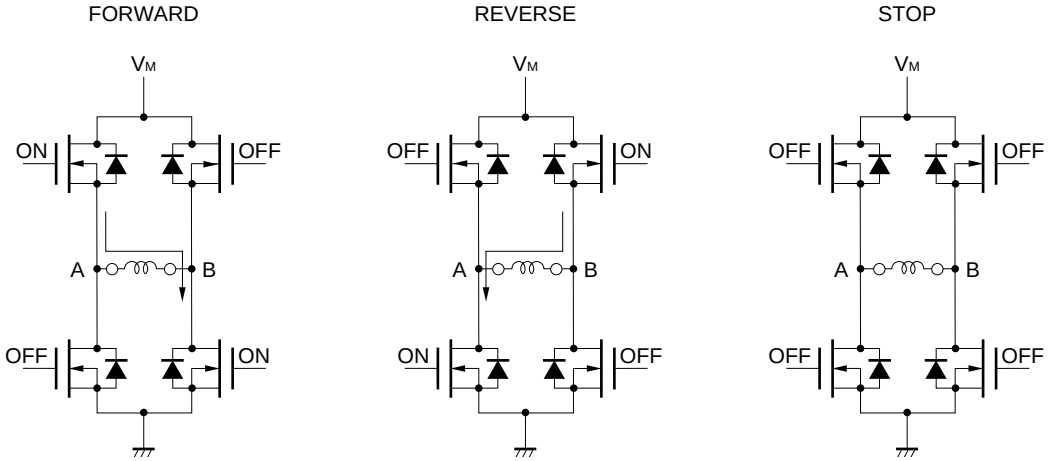


FUNCTION TABLE

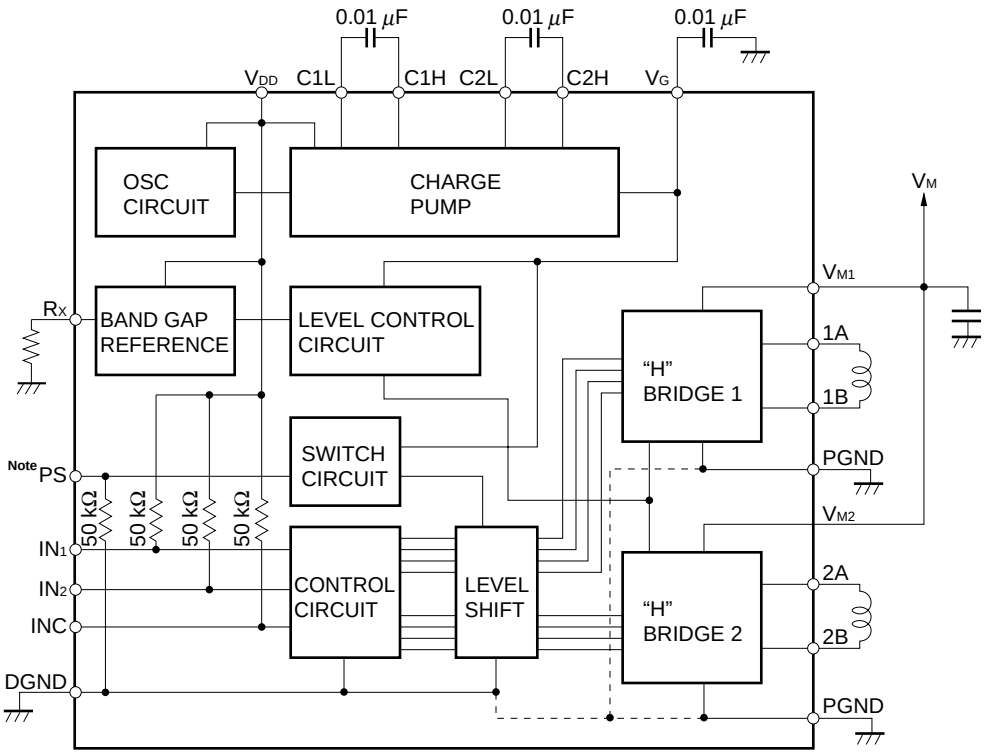
Excitation Direction	INC	IN1	IN2	H1	H2
<1>	H	H	H	F	F
<2>	H	L	H	R	F
<3>	H	L	L	F	R
<4>	H	H	L	R	R
–	L	×	×	Stop	

F: FORWARD
R: REVERSE





BLOCK DIAGRAM

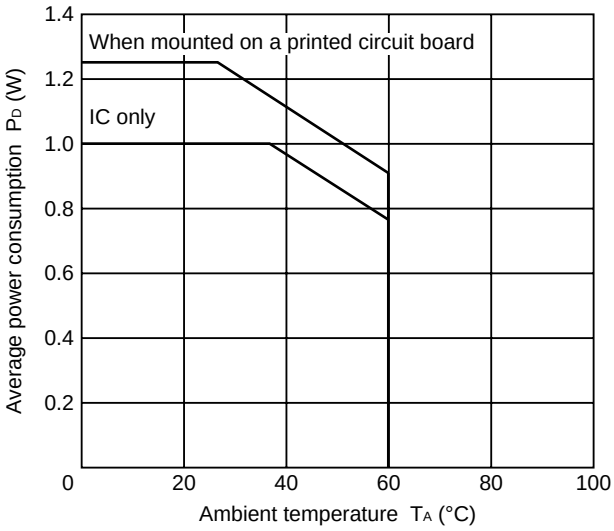


Note The power-saving mode is set when the PS pin goes high. In this mode, the voltage of the charge pump circuit is lowered and the ON resistance of the H bridge driver transistor increases, limiting the current.

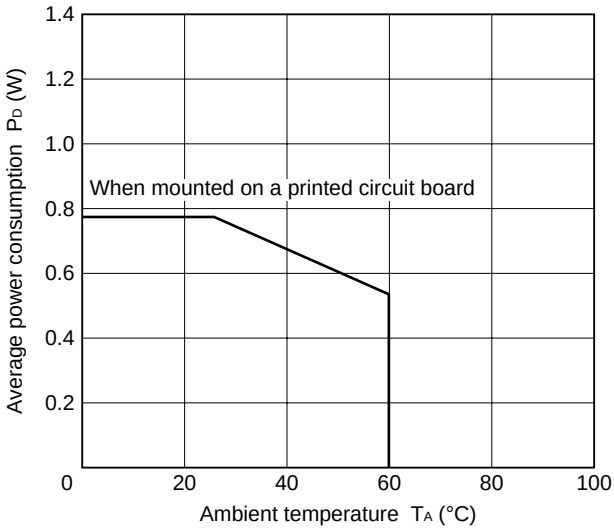
Remark ------ is connected in diffusion layer.

CHARACTERISTIC CURVES

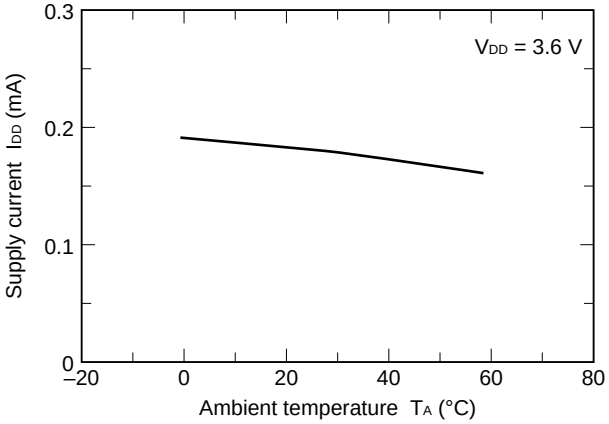
P_D vs. T_A Characteristics (μPD16818GS)



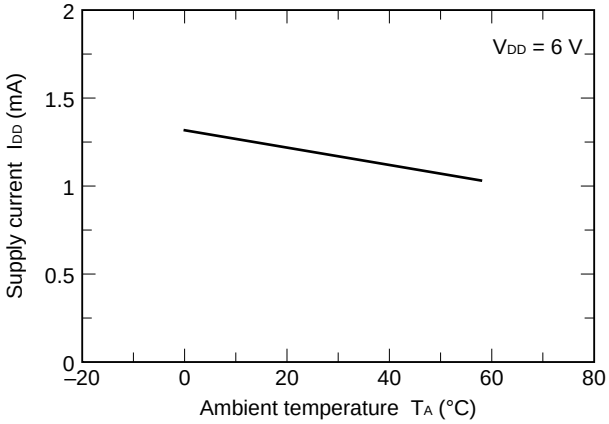
P_D vs. T_A Characteristics (μPD16818GR-8JG)



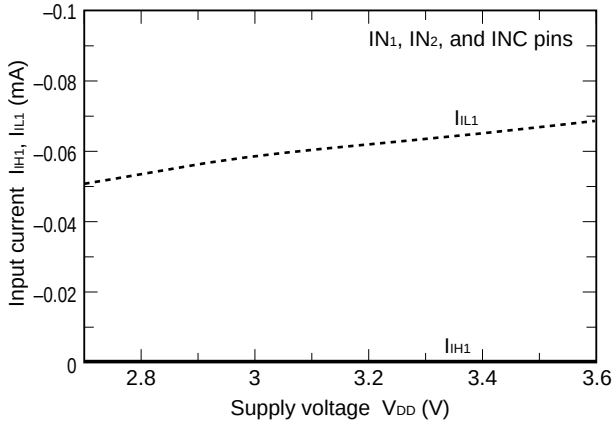
I_{DD} vs. T_A Characteristics



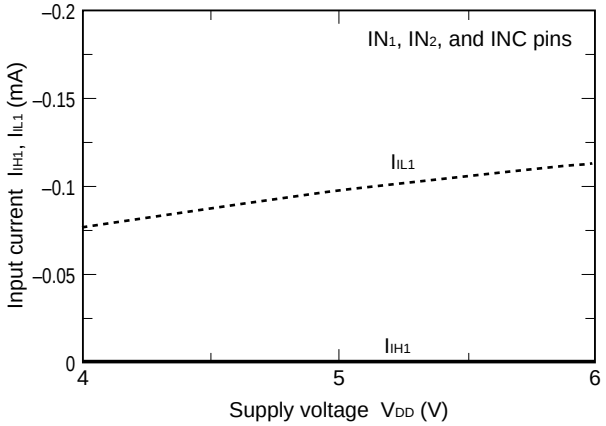
I_{DD} vs. T_A Characteristics



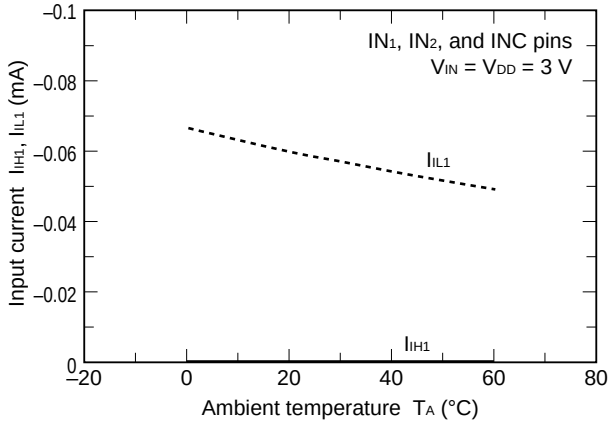
I_{IHL1} vs. V_{DD} Characteristics



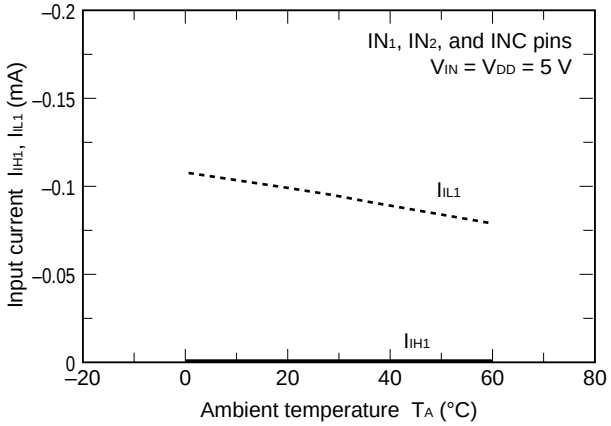
I_{IHL1} vs. V_{DD} Characteristics



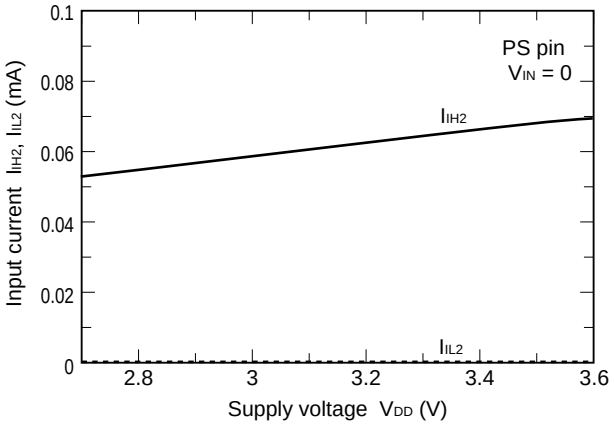
I_{IHL1} vs. T_A Characteristics



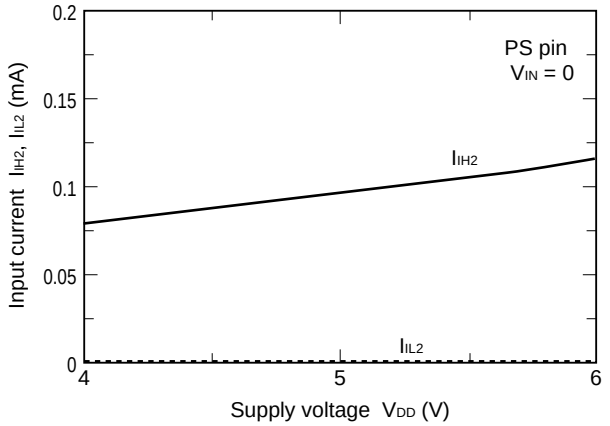
I_{IHL1} vs. T_A Characteristics



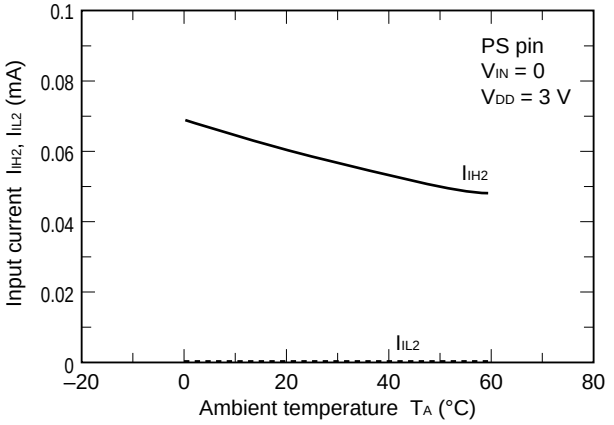
I_{IHL2} vs. V_{DD} Characteristics



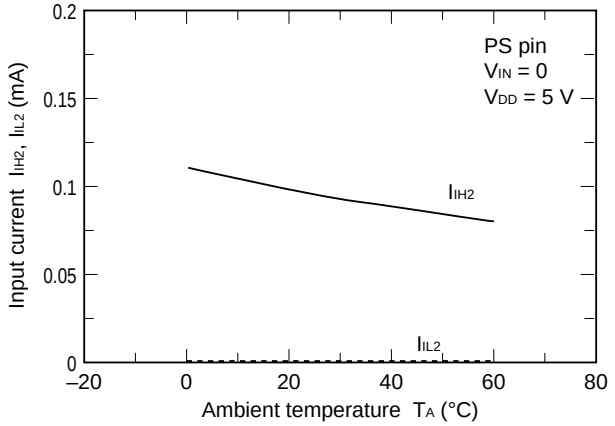
I_{IHL2} vs. V_{DD} Characteristics



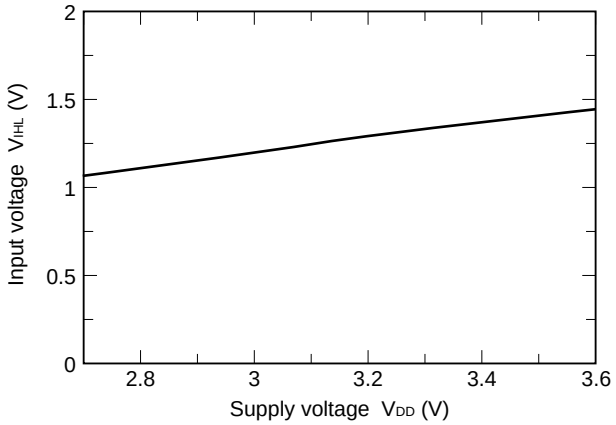
I_{IHL2} vs. T_A Characteristics



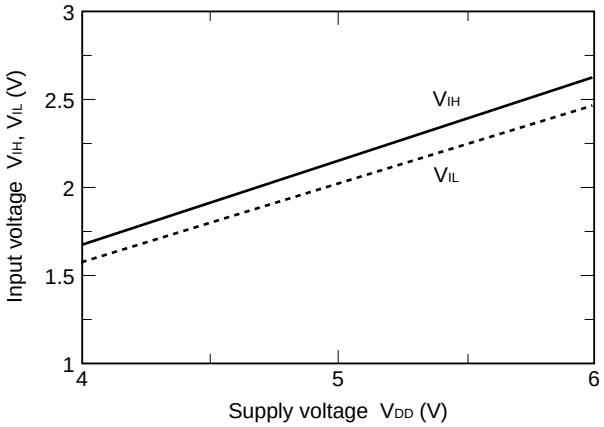
I_{IHL2} vs. T_A Characteristics



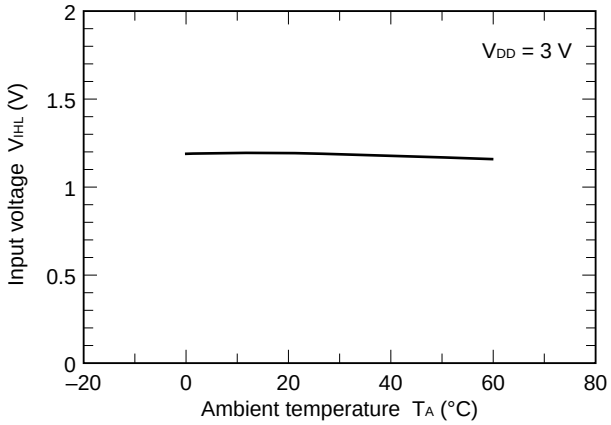
V_{IHL} vs. V_{DD} Characteristics



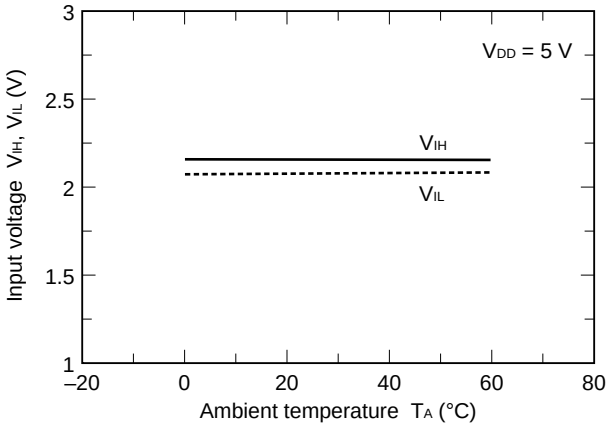
V_{IHL} vs. V_{DD} Characteristics



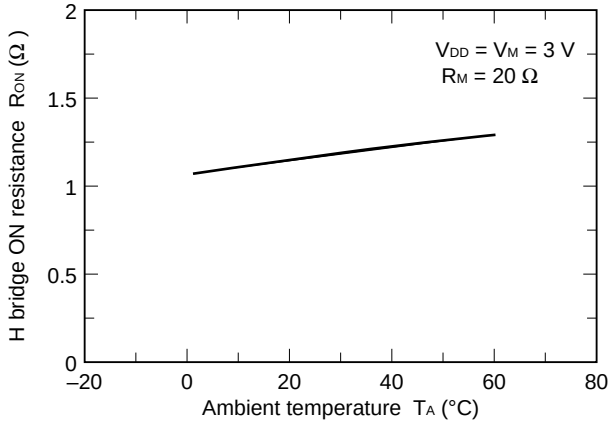
V_{IHL} vs. T_A Characteristics



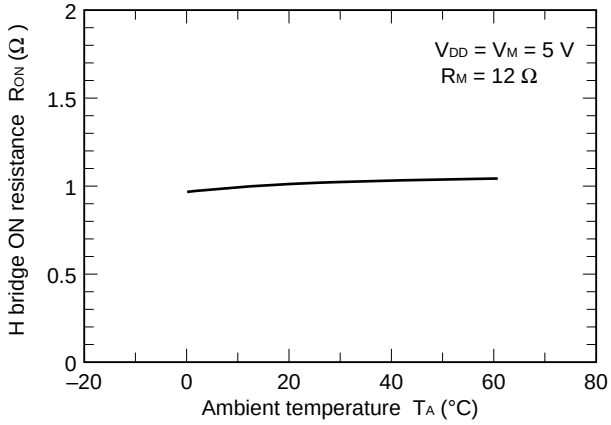
V_{IHL} vs. T_A Characteristics



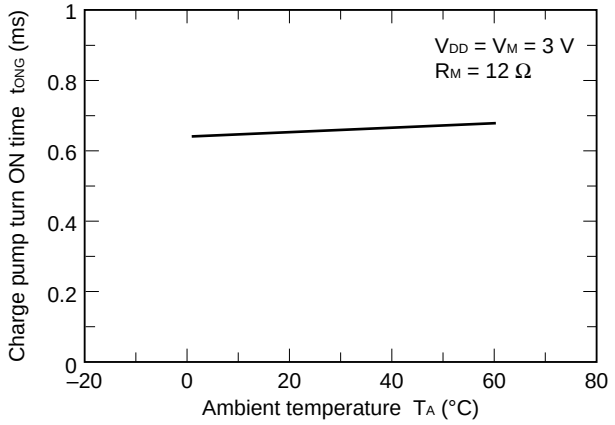
RON vs. TA Characteristics



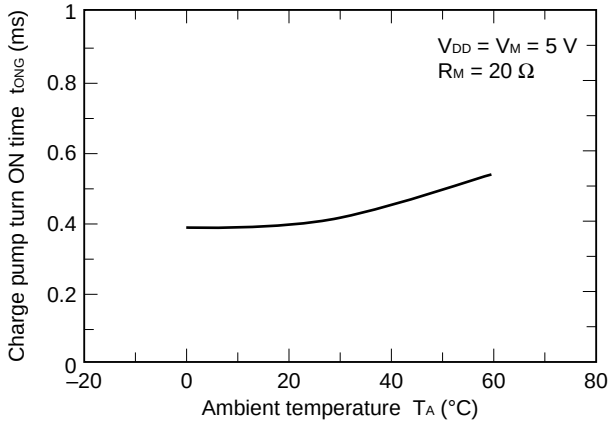
RON vs. TA Characteristics



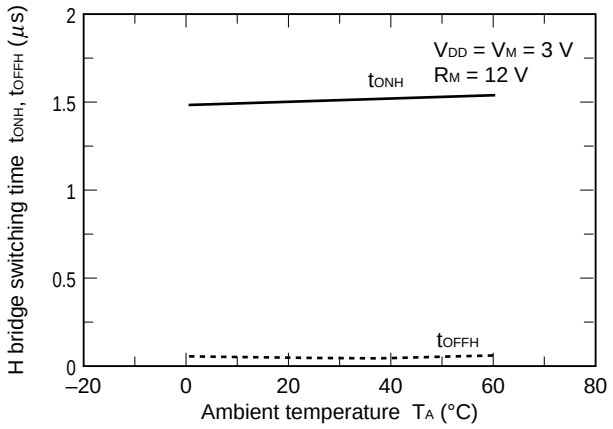
tONG vs. TA Characteristics



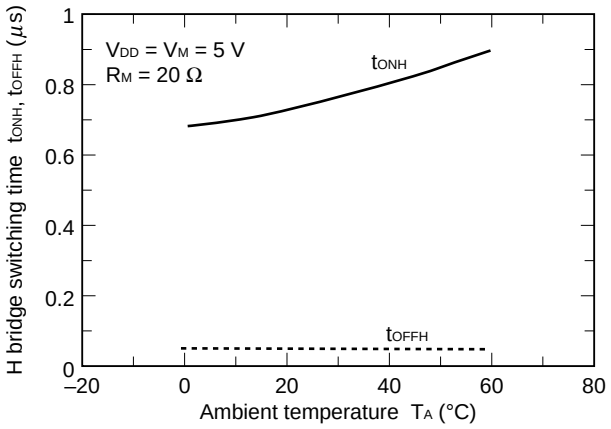
tONG vs. TA Characteristics



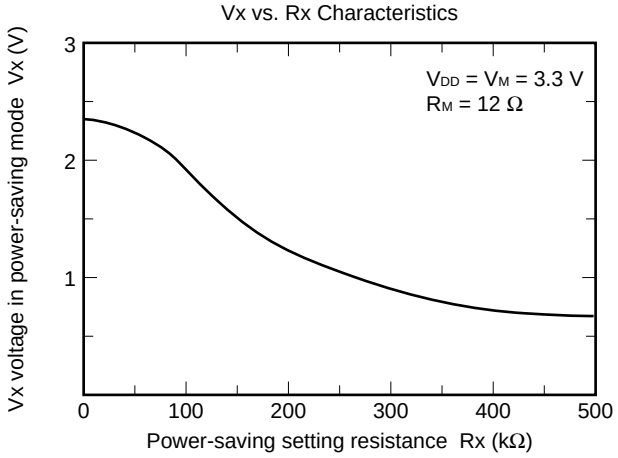
tONH, tOFFH vs. TA Characteristics



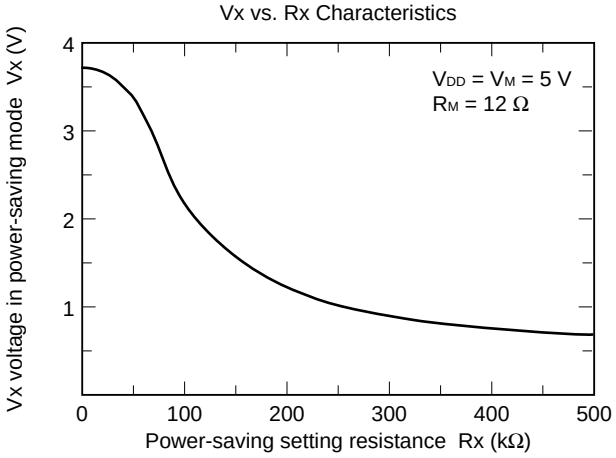
tONH, tOFFH vs. TA Characteristics



Vx vs. Rx Characteristics

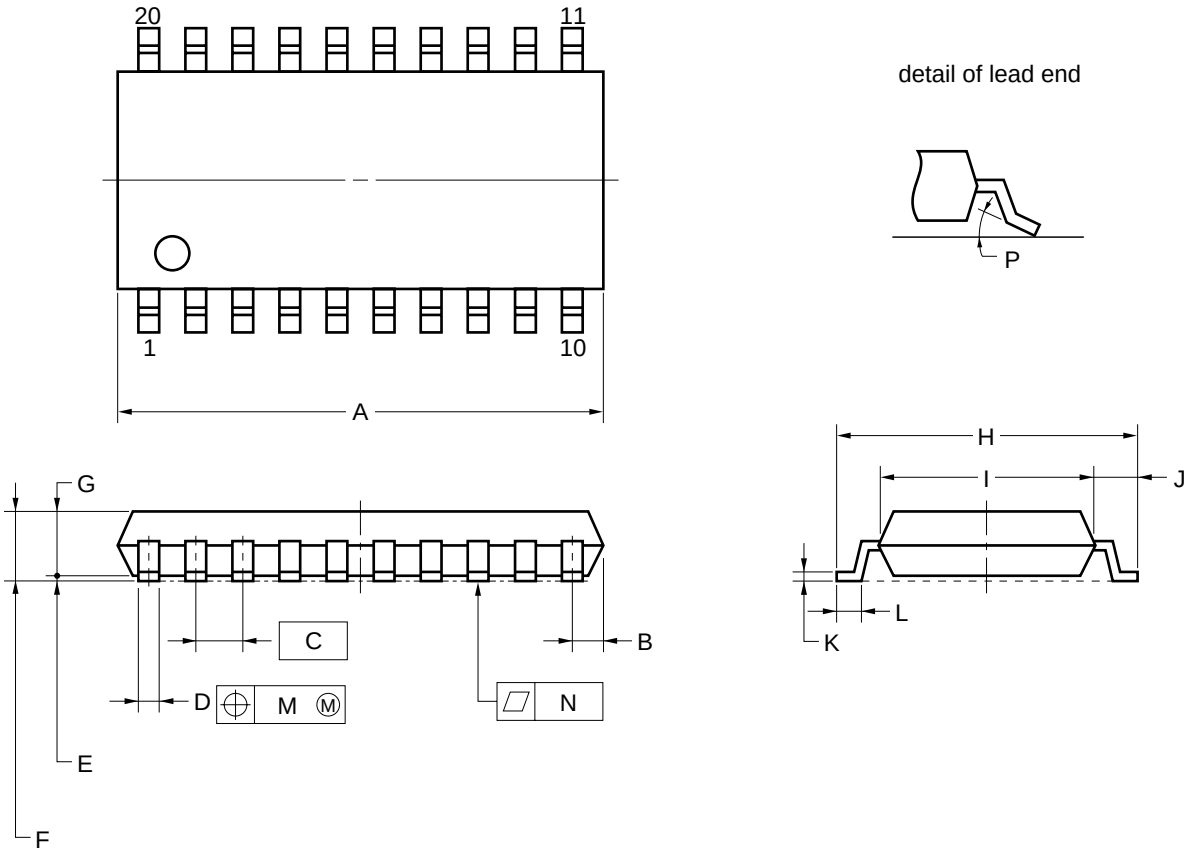


Vx vs. Rx Characteristics



PACKAGE DRAWINGS

20 PIN PLASTIC SOP (300 mil)



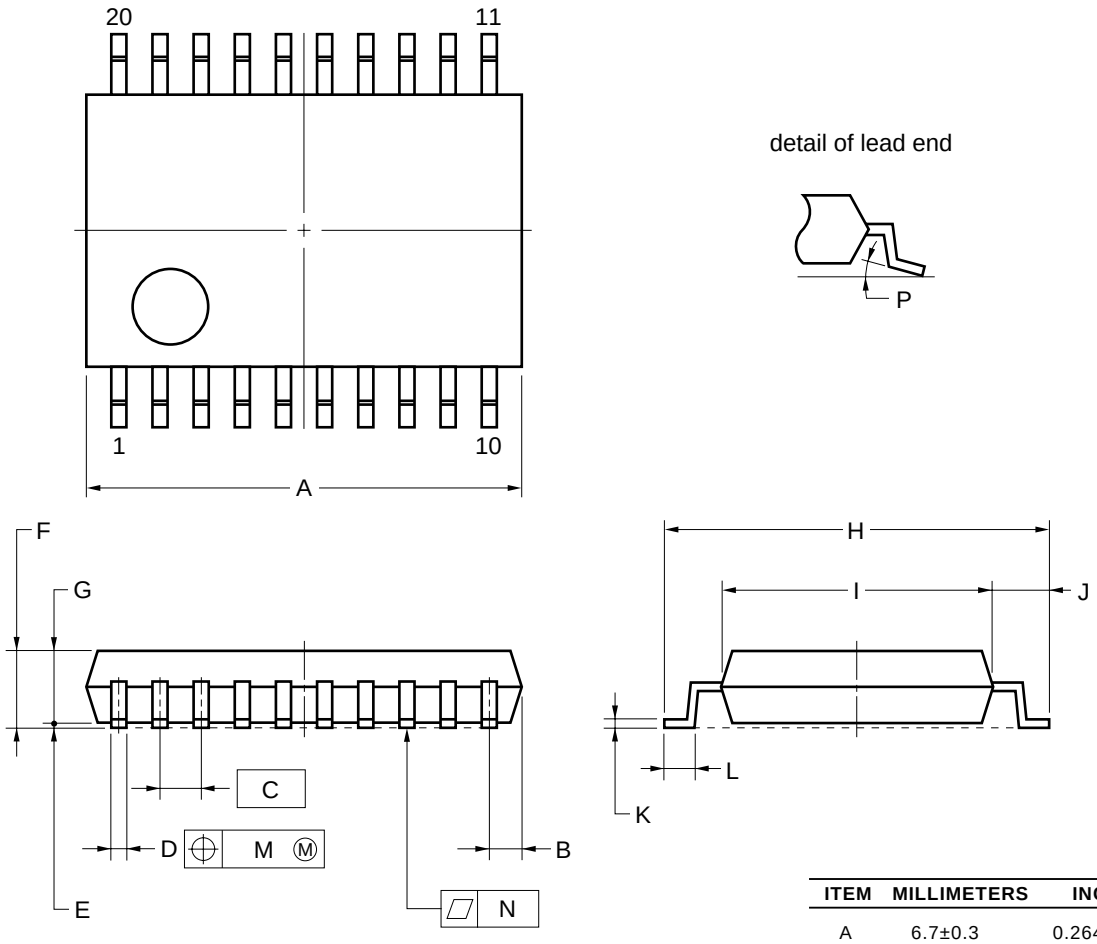
NOTE

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	12.7±0.3	0.500±0.012
B	0.78 MAX.	0.031 MAX.
C	1.27 (T.P.)	0.050 (T.P.)
D	$0.42^{+0.08}_{-0.07}$	$0.017^{+0.003}_{-0.004}$
E	0.1±0.1	0.004±0.004
F	1.8 MAX.	0.071 MAX.
G	1.55±0.05	0.061±0.002
H	7.7±0.3	0.303±0.012
I	5.6±0.2	$0.220^{+0.009}_{-0.008}$
J	1.1	0.043
K	$0.22^{+0.08}_{-0.07}$	$0.009^{+0.003}_{-0.004}$
L	0.6±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-5

20 PIN PLASTIC SHRINK SOP (225mil)



NOTE
Each lead centerline is located within 0.10 mm (0.004 inch) of its true position (T.P.) at maximum material condition.

ITEM	MILLIMETERS	INCHES
A	6.7±0.3	$0.264^{+0.012}_{-0.013}$
B	0.575 MAX.	0.023 MAX.
C	0.65 (T.P.)	0.026 (T.P.)
D	$0.22^{+0.10}_{-0.05}$	$0.009^{+0.004}_{-0.003}$
E	0.1±0.1	0.004±0.004
F	1.45 MAX.	0.057 MAX.
G	1.15±0.1	$0.045^{+0.005}_{-0.004}$
H	6.4±0.2	0.252±0.008
I	4.4±0.1	$0.173^{+0.005}_{-0.004}$
J	1.0±0.2	$0.039^{+0.009}_{-0.008}$
K	$0.15^{+0.10}_{-0.05}$	$0.006^{+0.004}_{-0.002}$
L	0.5±0.2	$0.020^{+0.008}_{-0.009}$
M	0.10	0.004
N	0.10	0.004
P	$3^{\circ}{}^{+7^{\circ}}_{-3^{\circ}}$	$3^{\circ}{}^{+7^{\circ}}_{-3^{\circ}}$

P20GR-65-225C-2

RECOMMENDED SOLDERING CONDITIONS

Solder this product under the following recommended conditions.

For details of the recommended soldering conditions, refer to information document **Semiconductor Device Mounting Technology Manual (C10535E)**.

Surface Mount Type

μPD16818GS 20-pin plastic SOP (300 mil)
μPD16818GR-8JG 20-pin plastic SSOP (225 mil)

Soldering Method	Soldering Conditions	Symbol of Recommended Soldering
Infrared reflow	Package peak temperature: 235°C, Time: 30 seconds MAX.(210°C MIN.), Number of times: 3 MAX., Number of days: None[Note], Flux: Rosin-based flux with little chlorine component (chlorine: 0.2 Wt% MAX.)	IR35-00-3
VPS	Package peak temperature: 215°C, Time: 40 seconds MAX.(200°C MIN.), Number of times: 3 MAX., Number of days: None[Note], Flux: Rosin-based flux with little chlorine component (chlorine: 0.2 Wt% MAX.)	VP15-00-3
Wave soldering	Package peak temperature: 260°C, Time: 10 seconds MAX., Preheating temperature: 120 °C MAX., Number of times: 1, Flux: Rosin-based flux with little chlorine component (chlorine: 0.2 Wt% MAX.)	WS60-00-1

Note Number of days in storage after the dry pack has been opened. The storage conditions are at 25 °C, 65 % RH MAX.

Caution Do not use two or more soldering methods in combination.

[MEMO]

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