NEC

MOS INTEGRATED CIRCUIT

μPD16833A

MONOLITHIC QUAD H BRIDGE DRIVER CIRCUIT

DESCRIPTION

The μPD16833A is a monolithic quad H bridge driver IC which uses power MOS FETs in its driver stage. By using the MOS FETs in the output stage, this driver IC has a substantially improved saturation voltage and power consumption as compared with conventional driver circuits using bipolar transistors.

A low-voltage malfunction prevention function is provided to prevent the IC from malfunctioning when the supply voltage drops. By eliminating the charge pump circuit, the current during power-OFF is drastically decreased.

As the package, a 30-pin plastic shrink SOP is employed to enable the creation of compact, slim application sets.

This driver IC can drive two stepping motors at the same time, and is ideal for driving stepping motors in the lens of a video camera.

FEATURES

- Four H bridge circuits employing power MOS FETs
- Low current consumption by eliminating charge pump
  V_M pin current when power-OFF: 10 μA MAX. V_{DD} pin current: 10 μA MAX.
- Input logic frequency: 100 kHz
- 3-V power supply
  Minimum operating supply voltage: 2.5 V
- Low-voltage malfunctioning prevention circuit
- 30-pin plastic shrink SOP (300 mil) (μPD16833AG3)

ORDERING INFORMATION

Part Number	Package
μPD16833AG3	30-pin plastic shrink SOP (300 mil)

ABSOLUTE MAXIMUM RATINGS (T_A = 25 °C)

Parameter	Symbol	Conditions	Rating	Unit
Supply voltage	V_{DD}		–0.5 to +6.0	V
	V_M		–0.5 to +6.0	V
Input voltage	V_{IN}		–0.5 to V_{DD} + 0.5	V
H bridge drive current[Note 1]	$I_{DR\ (DC)}$	DC	±300	mA
Instantaneous H bridge drive current[Note 1]	$I_{DR\ (pulse)}$	PW ≤ 10 ms, Duty ≤ 5 %	±700	mA
Power dissipation[Note 2]	P_T		1.19	W
Peak junction temperature	$T_{CH\ (MAX)}$		150	°C
Storage temperature range	T_{stg}		–55 to +150	°C

Notes 1. Permissible current per phase, when mounted on a printed circuit board

2. When mounted on a glass epoxy board (10 cm × 10 cm × 1 mm)

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Recommended Operating Conditions

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Supply voltage	V_{DD}	2.5		5.5	V
	V_M	2.7		5.5	V
H bridge drive current	I_{DR}	–200		200	mA
Logic input frequency**Note**	f_{IN}			100	kHz
Operating temperature range	T_A	–10		85	°C
Peak junction temperature	$T_{CH (MAX)}$			125	°C

Note Common to IN and EN pins

DC Characteristics (Unless otherwise specified, $V_{DD} = V_M = 3.0$ V, $T_A = 25$ °C)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
OFF V_M pin current	$I_{M (OFF)}$	with all control pins at low level			10	μA
V_{DD} pin current	I_{DD}	with all control pins at low level			10	μA
High-level input current	I_{IH}	$V_{IN} = V_{DD}$			0.06	mA
Low-level input current	I_{IL}	$V_{IN} = 0$	–1.0			μA
Input pull-down resistor	R_{IND}		50		200	kΩ
High-level input voltage	V_{IH}	V_{DD} = 2.5 V to 5.5 V	$V_{DD} \times 0.7$		$V_{DD} + 0.3$	V
Low-level input voltage	V_{IL}	V_{DD} = 2.5 V to 5.5 V	–0.3		$V_{DD} \times 0.3$	V
H bridge ON resistance**Note**	R_{ON}	$V_{DD} = V_M$ = 2.7 V to 5.5 V			3.0	Ω
Low-voltage malfunction prevention circuit operating voltage	V_{DDS1}	V_M = 5.0 V –10 °C ≤ T_A ≤ +85 °C	0.8		2.5	V
	V_{DDS2}	V_M = 3.0 V –10 °C ≤ T_A ≤+85 °C	0.65		2.5	V

Note Sum of top and bottom ON resistances (@I_{DR} = 100 mA)

AC Characteristics (Unless otherwise specified, $V_{DD} = V_M = 3.0$ V, $T_A = 25$ °C)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
H bridge output circuit turn-ON time	t_{ONH}	R_M = 20 Ω, Figure 1		0.7	20	μs
H bridge output circuit turn-OFF time	t_{OFFH}			0.2	0.5	μs
Rise time	t_r		0.1	0.4	1.0	μs
Fall time	t_f			70	200	ns

FUNCTION TABLE

Channel 1

EN_1	IN_1	OUT1A	OUT1B
H	L	H	L
H	H	L	H
L	L	Z	Z
L	H	Z	Z

Channel 2

EN_2	IN_2	OUT2A	OUT2B
H	L	H	L
H	H	L	H
L	L	Z	Z
L	H	Z	Z

Channel 3

EN_3	IN_3	OUT3A	OUT3B
H	L	H	L
H	H	L	H
L	L	Z	Z
L	H	Z	Z

Channel 4

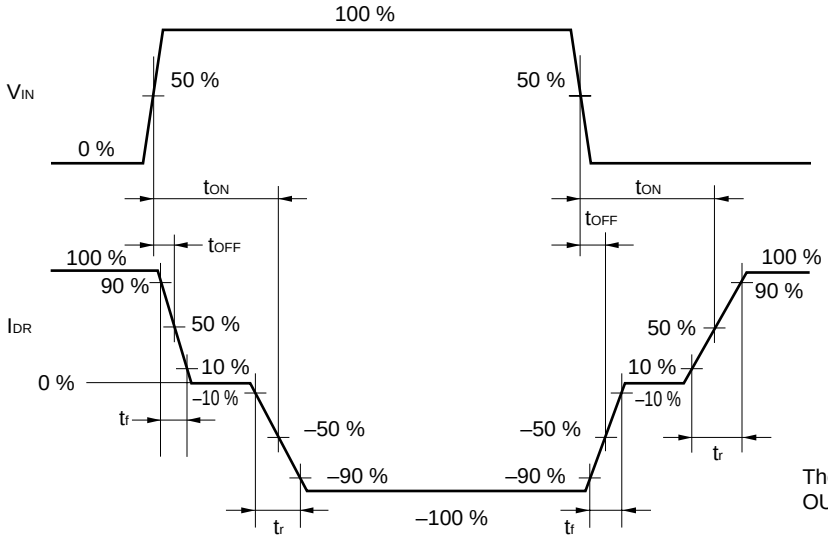
EN_4	IN_4	OUT4A	OUT4B
H	L	H	L
H	H	L	H
L	L	Z	Z
L	H	Z	Z

H: High level, L: Low level, Z: High impedance IN

PIN CONFIGURATION

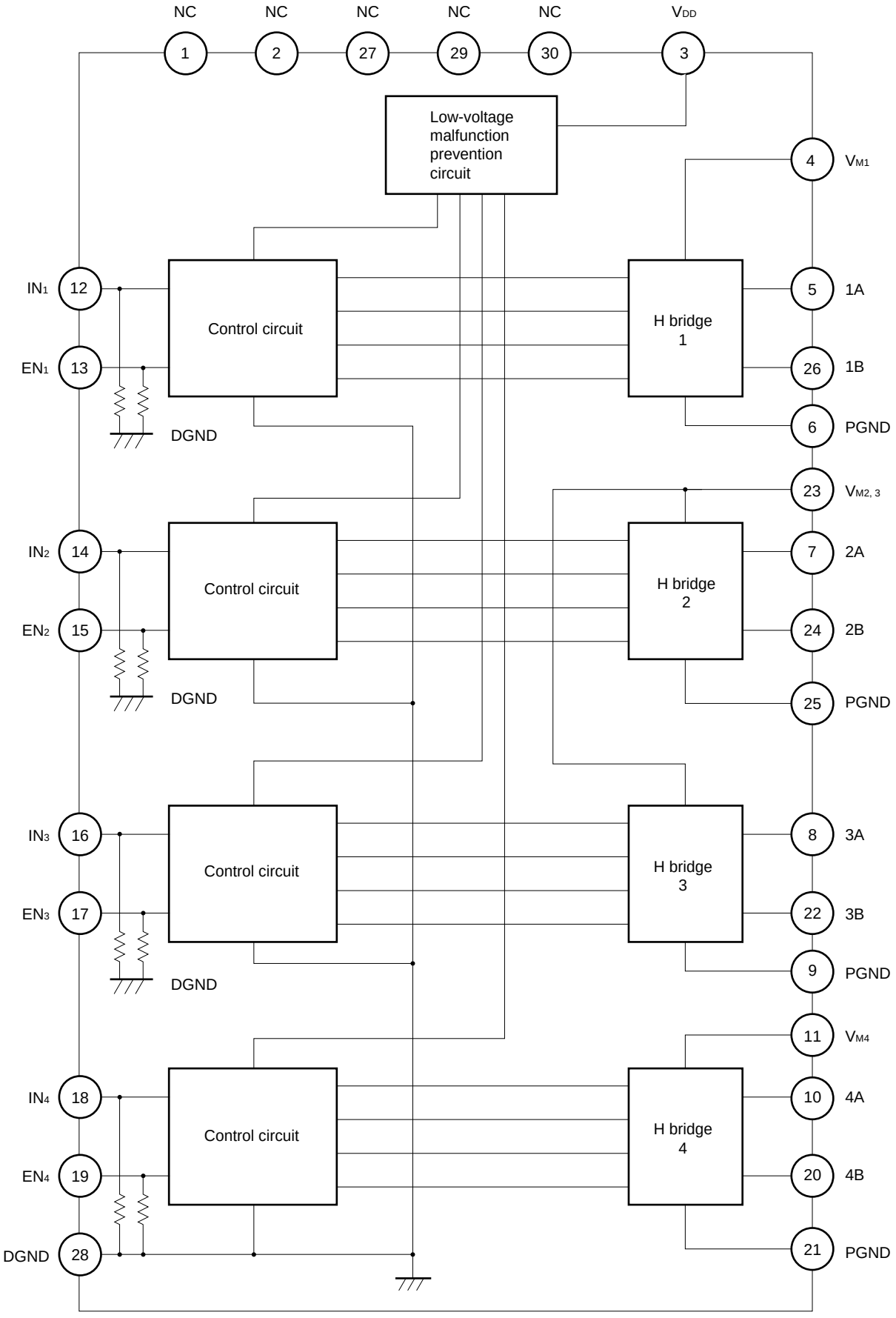
NC	1	30	NC
NC	2	29	NC
V_{DD}	3	28	DGND
V_{M1}	4	27	NC
1A	5	26	1B
PGND	6	25	PGND
2A	7	24	2B
3A	8	23	$V_{M2, 3}$
PGND	9	22	3B
4A	10	21	PGND
V_{M4}	11	20	4B
IN_1	12	19	EN_4
EN_1	13	18	IN_4
IN_2	14	17	EN_3
EN_2	15	16	IN_3

Figure 1. Switching Characteristic Wave

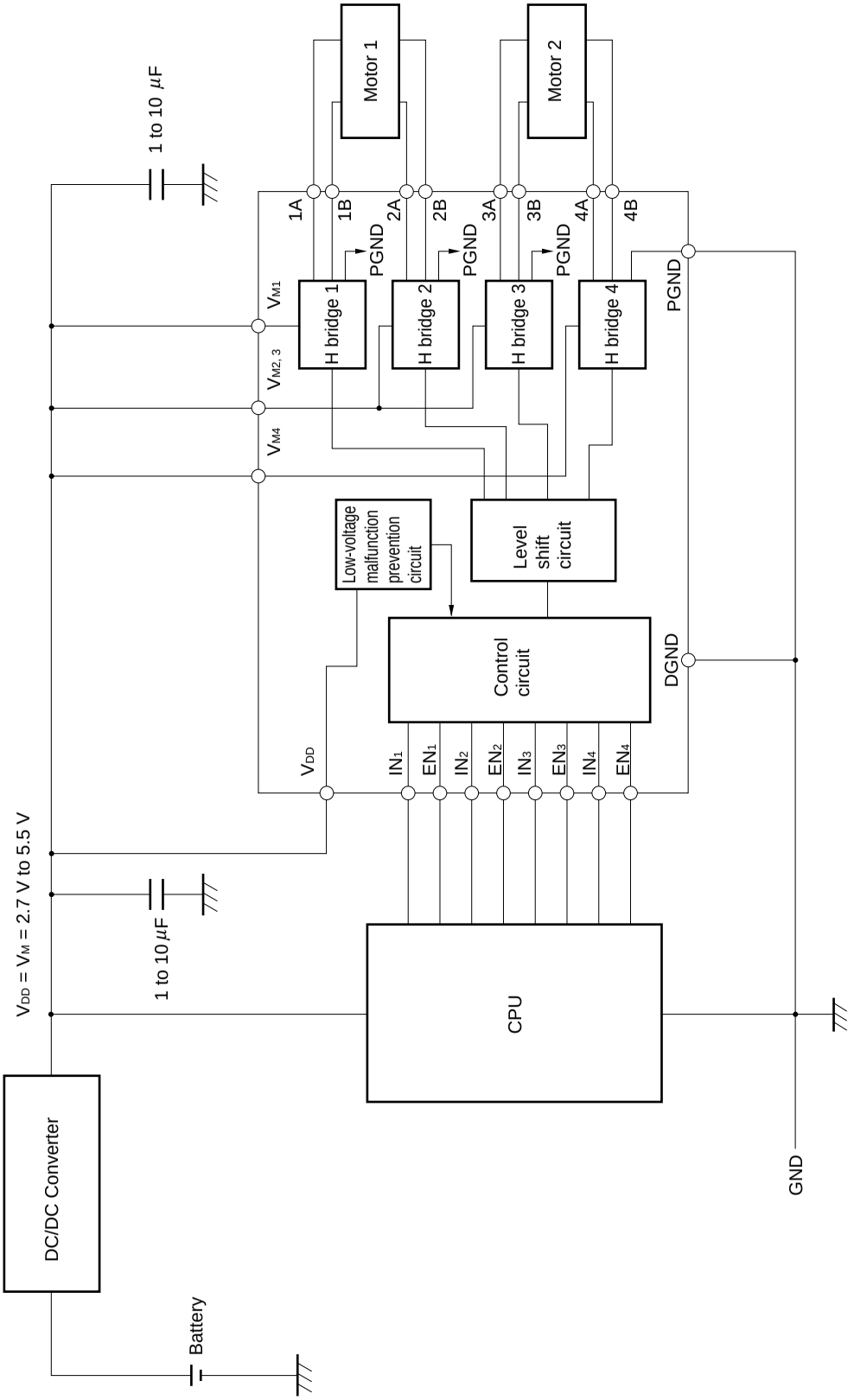


The current flowing in the direction from OUT_A to OUT_B is assumed to be (+).

BLOCK DIAGRAM

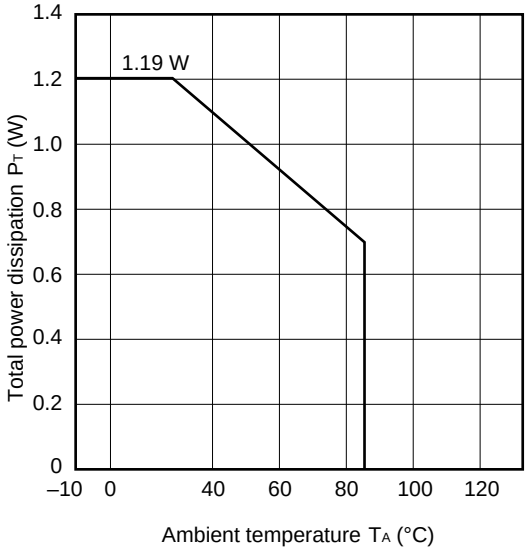


STANDARD CONNECTION EXAMPLE

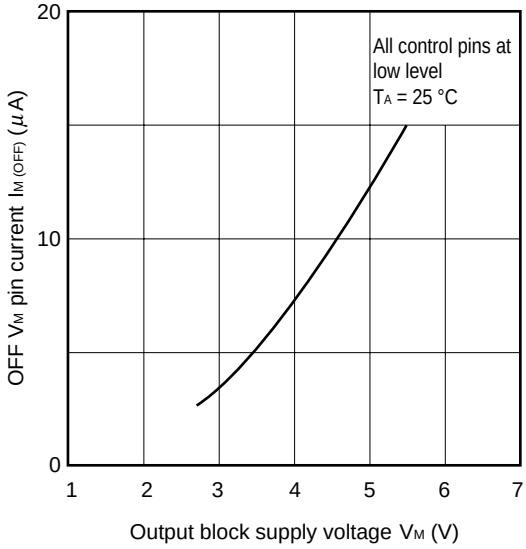


TYPICAL CHARACTERISTICS (T_A = 25 °C)

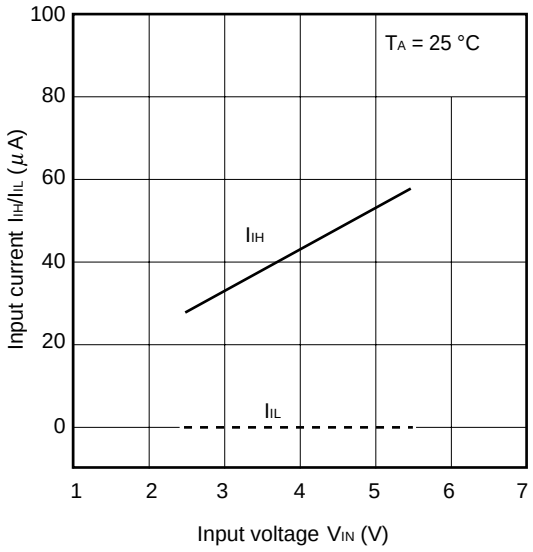
P_T vs. T_A characteristics



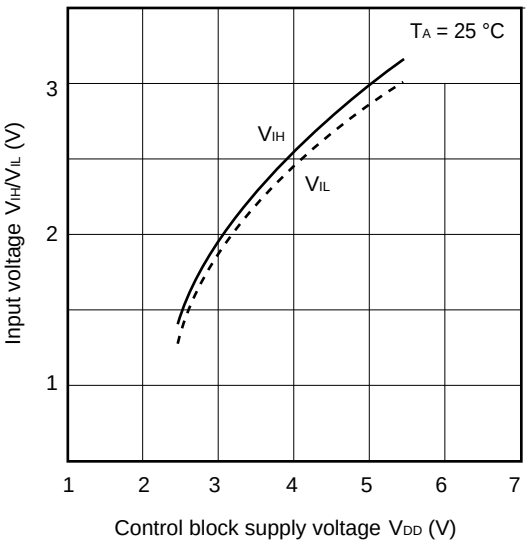
$I_{M(OFF)}$ vs. V_M characteristics



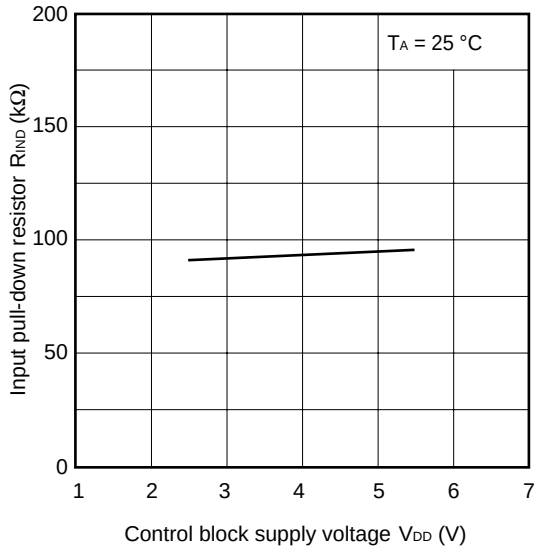
I_{IH}/I_{IL} vs. V_{IN} characteristics



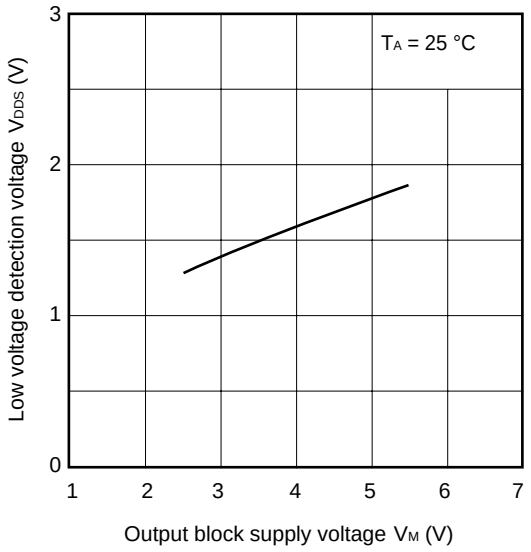
V_{IH}/V_{IL} vs. V_{DD} characteristics



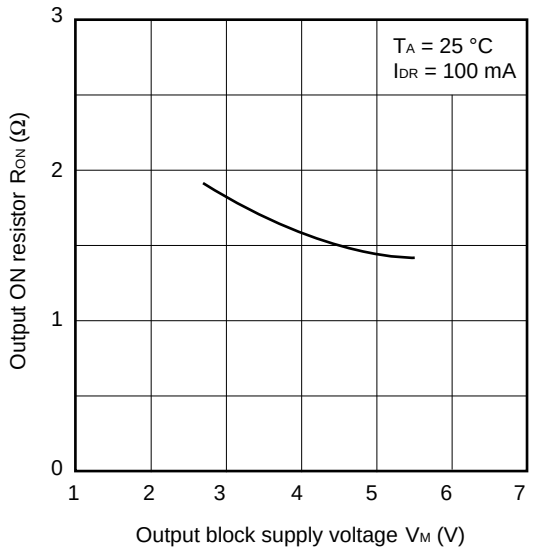
R_{IND} vs. V_{DD} characteristics



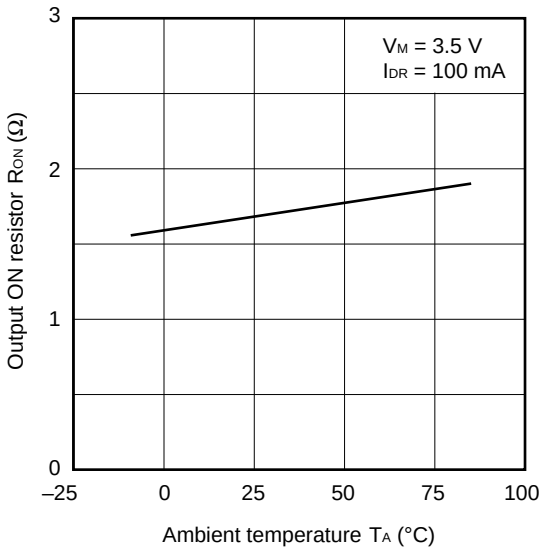
V_{DDS} vs. V_M characteristics



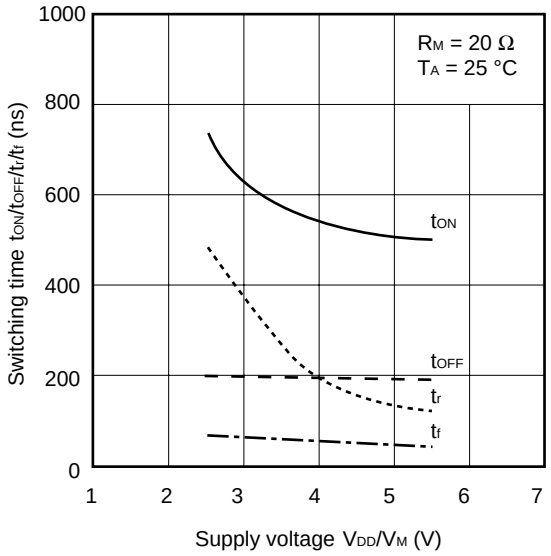
R_{ON} vs. V_M characteristics



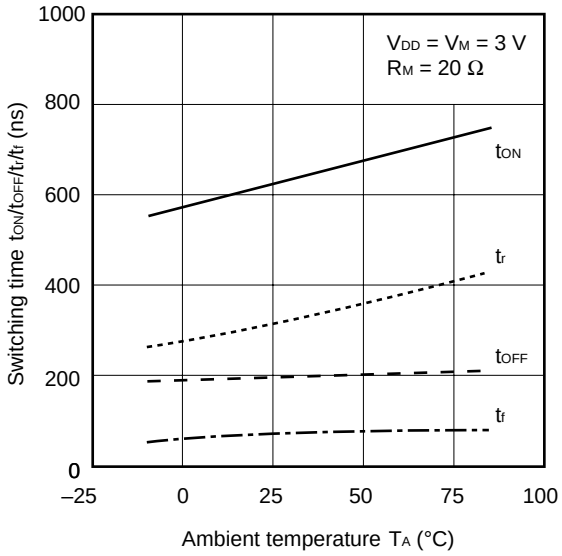
R_{ON} vs. T_A characteristics



Switching time vs. V_{DD}/V_M characteristics

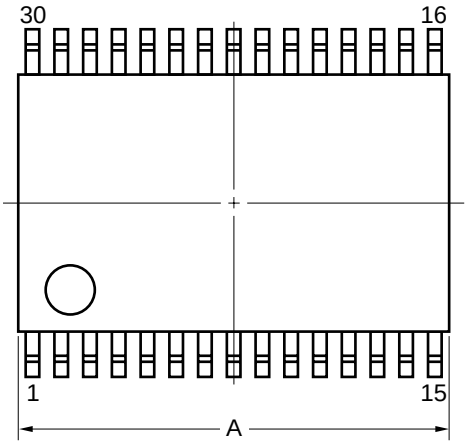


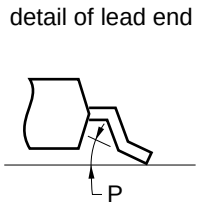
Switching time vs. T_A characteristics

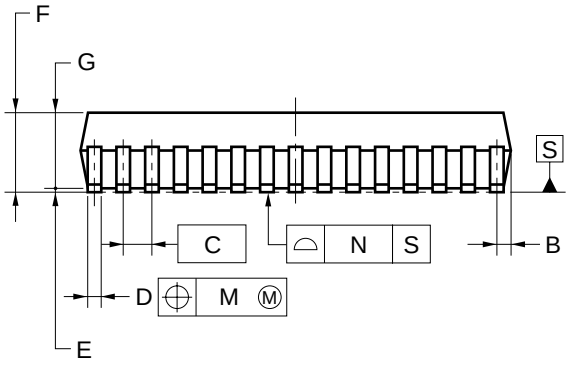


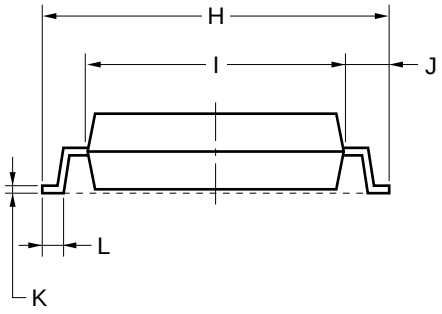
PACKAGE DIMENSION

30-PIN PLASTIC SSOP (7.62 mm (300))









NOTE

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

ITEM	MILLIMETERS
A	9.85±0.26
B	0.51 MAX.
C	0.65 (T.P.)
D	$0.32^{+0.08}_{-0.07}$
E	0.125±0.075
F	2.0 MAX.
G	1.7±0.1
H	8.1±0.2
I	6.1±0.2
J	1.0±0.2
K	$0.17^{+0.08}_{-0.07}$
L	0.5±0.2
M	0.10
N	0.10
P	$3^{\circ}{}^{+7^{\circ}}_{-3^{\circ}}$

P30GS-65-300B-3

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.

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

Soldering Method	Soldering Conditions	Symbol of Recommended Soldering
Infrared reflow	Peak package 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 content (chlorine: 0.2 Wt% MAX.) is recommended.	IR35-00-3
VPS	Peak package temperature: 215 °C, Time: 40 seconds MAX. (200 °C MIN.), (200 °C MIN.), Number of times: 2 MAX., Number of days: None[Note], Flux: Rosin-based flux with little chlorine content (chlorine: 0.2 Wt% MAX.) is recommended.	VP15-00-2
Wave soldering	Soldering bath temperature: 260 °C MAX., Time: 10 seconds MAX., Preheating temperature: 120 °C MAX., Number of times: 1, Flux: Rosin-based flux with little chlorine content (chlorine: 0.2 Wt% MAX.) is recommended.	WS60-00-1

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.

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