

### MONOLITHIC QUAD H BRIDGE DRIVER CIRCUIT

#### DESCRIPTION

The  $\mu$ PD16833A 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  $\mu$ A MAX.  $V_{DD}$  pin current: 10  $\mu$ A 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) ( $\mu$ PD16833AG3)

#### ORDERING INFORMATION

Part Number	Package
$\mu$ PD16833AG3	30-pin plastic shrink SOP (300 mil)

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

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 <sup>Note 1</sup>	$I_{DR}(\text{DC})$	DC	$\pm 300$	mA
Instantaneous H bridge drive current <sup>Note 1</sup>	$I_{DR}(\text{pulse})$	$PW \leq 10 \text{ ms}$ , Duty $\leq 5 \%$	$\pm 700$	mA
Power dissipation <sup>Note 2</sup>	$P_T$		1.19	W
Peak junction temperature	$T_{CH}(\text{MAX})$		150	$^\circ\text{C}$
Storage temperature range	$T_{stg}$		-55 to +150	$^\circ\text{C}$

- Notes**
1. Permissible current per phase, when mounted on a printed circuit board
  2. When mounted on a glass epoxy board (10 cm  $\times$  10 cm  $\times$  1 mm)

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 Not all devices/types available in every country. Please check with local NEC representative for availability and additional information.

## 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 <sup>Note</sup>	$f_{IN}$			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	$\mu$ A
$V_{DD}$ pin current	$I_{DD}$	with all control pins at low level			10	$\mu$ A
High-level input current	$I_{IH}$	$V_{IN} = V_{DD}$			0.06	mA
Low-level input current	$I_{IL}$	$V_{IN} = 0$	-1.0			$\mu$ A
Input pull-down resistor	$R_{IND}$		50		200	k $\Omega$
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 <sup>Note</sup>	$R_{ON}$	$V_{DD} = V_M = 2.7$ V to 5.5 V			3.0	$\Omega$
Low-voltage malfunction prevention circuit operating voltage	$V_{DDS1}$	$V_M = 5.0$ V $-10$ °C $\leq T_A \leq +85$ °C	0.8		2.5	V
	$V_{DDS2}$	$V_M = 3.0$ V $-10$ °C $\leq T_A \leq +85$ °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	$t_{ONH}$	$R_M = 20$ $\Omega$ , Figure 1		0.7	20	$\mu$ s
H bridge output circuit turn-OFF time	$t_{OFFH}$			0.2	0.5	$\mu$ s
Rise time	$t_r$		0.1	0.4	1.0	$\mu$ s
Fall time	$t_f$			70	200	ns

## FUNCTION TABLE

Channel 1

EN <sub>1</sub>	IN <sub>1</sub>	OUT1A	OUT1B
H	L	H	L
H	H	L	H
L	L	Z	Z
L	H	Z	Z

Channel 2

EN <sub>2</sub>	IN <sub>2</sub>	OUT2A	OUT2B
H	L	H	L
H	H	L	H
L	L	Z	Z
L	H	Z	Z

Channel 3

EN <sub>3</sub>	IN <sub>3</sub>	OUT3A	OUT3B
H	L	H	L
H	H	L	H
L	L	Z	Z
L	H	Z	Z

Channel 4

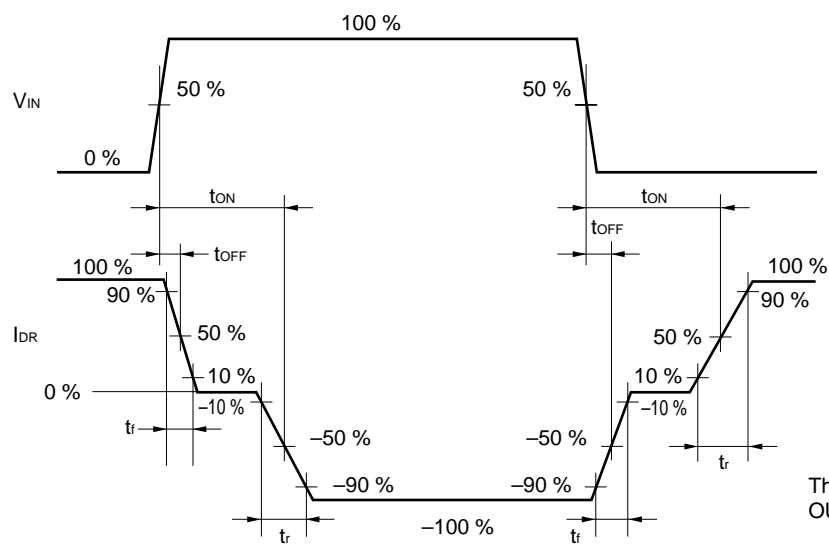
EN <sub>4</sub>	IN <sub>4</sub>	OUT4A	OUT4B
H	L	H	L
H	H	L	H
L	L	Z	Z
L	H	Z	Z

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

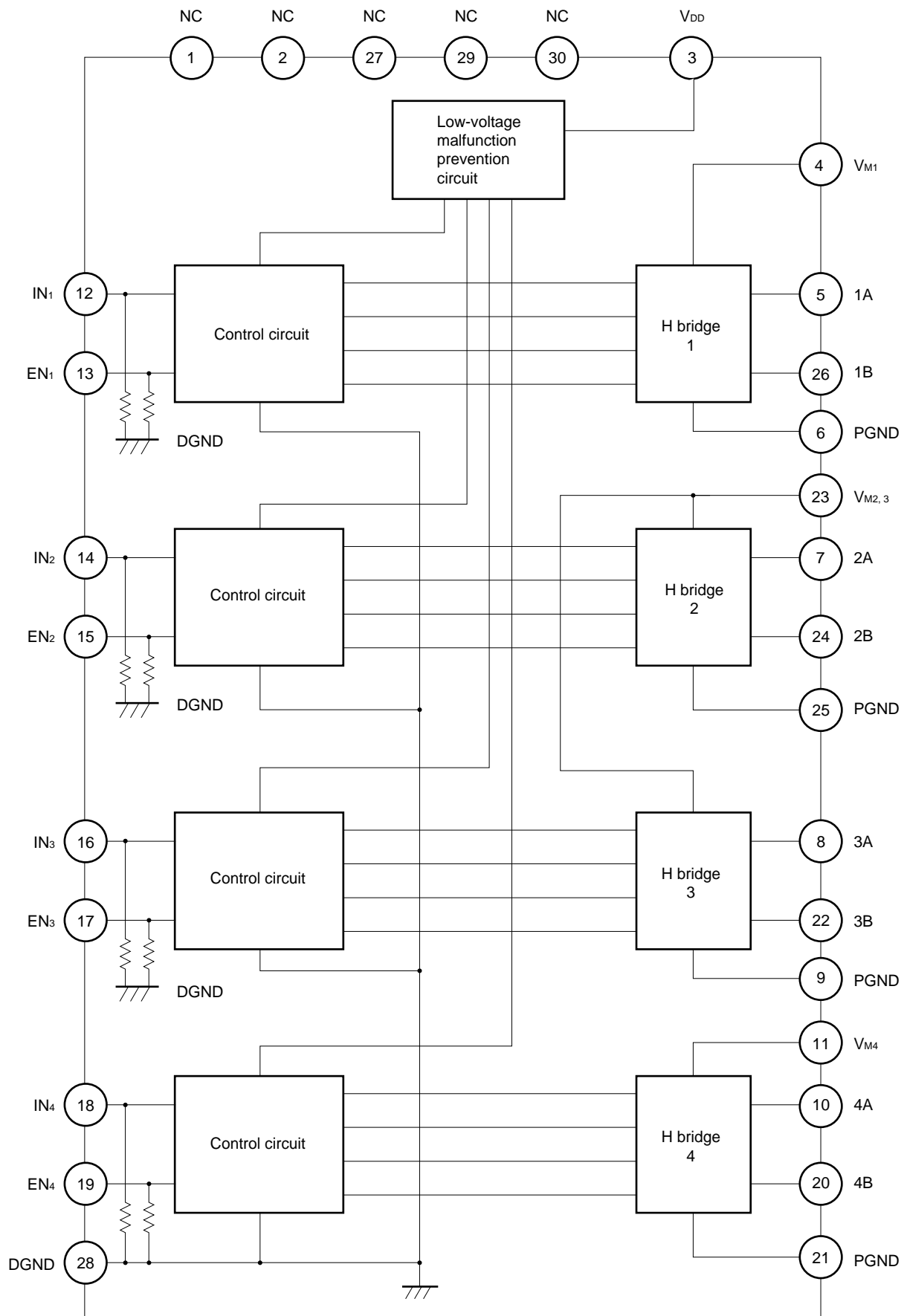
## PIN CONFIGURATION

NC	1	30	NC
NC	2	29	NC
V <sub>DD</sub>	3	28	DGND
V <sub>M1</sub>	4	27	NC
1A	5	26	1B
PGND	6	25	PGND
2A	7	24	2B
3A	8	23	V <sub>M2,3</sub>
PGND	9	22	3B
4A	10	21	PGND
V <sub>M4</sub>	11	20	4B
IN <sub>1</sub>	12	19	EN <sub>4</sub>
EN <sub>1</sub>	13	18	IN <sub>4</sub>
IN <sub>2</sub>	14	17	EN <sub>3</sub>
EN <sub>2</sub>	15	16	IN <sub>3</sub>

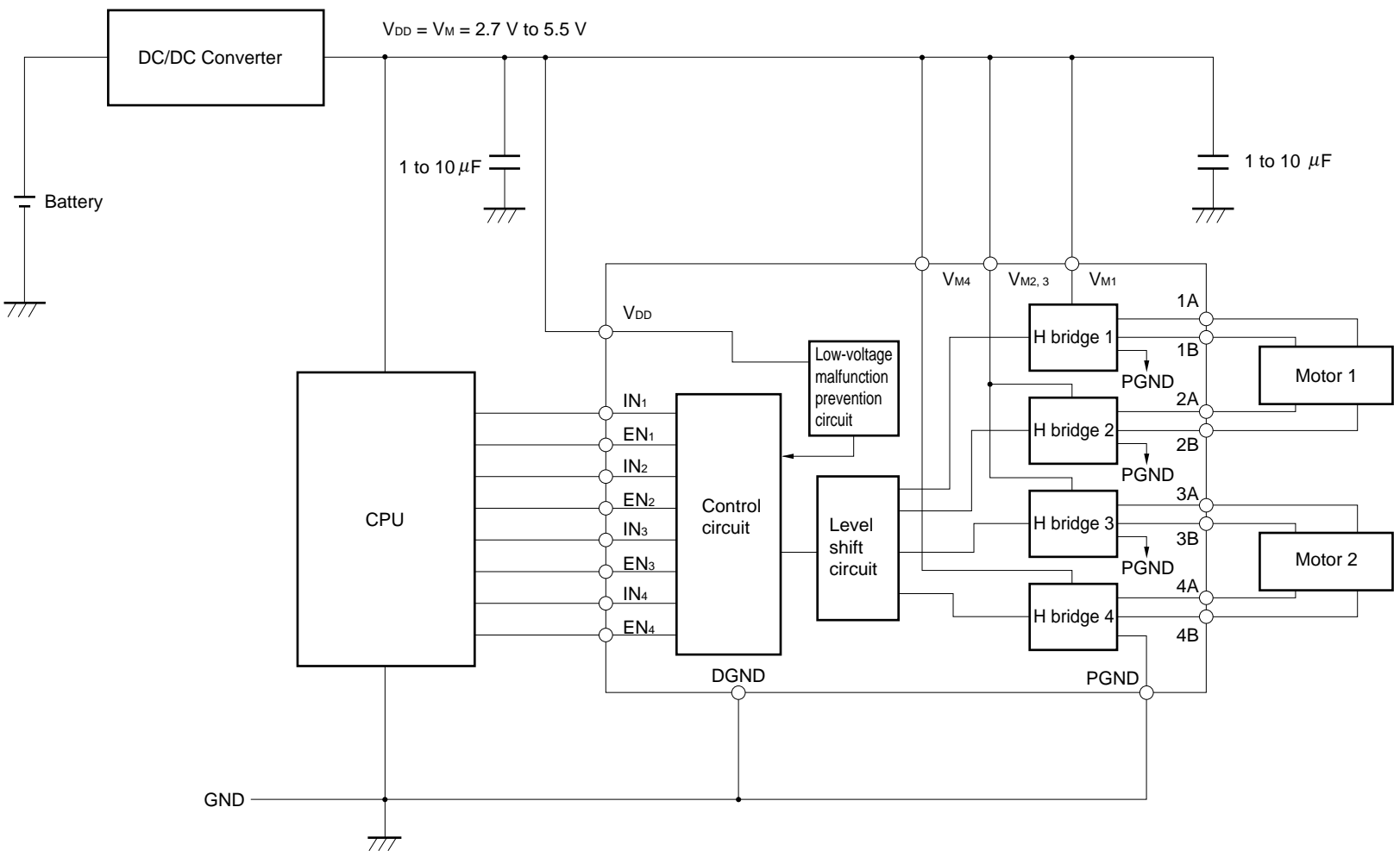
Figure 1. Switching Characteristic Wave



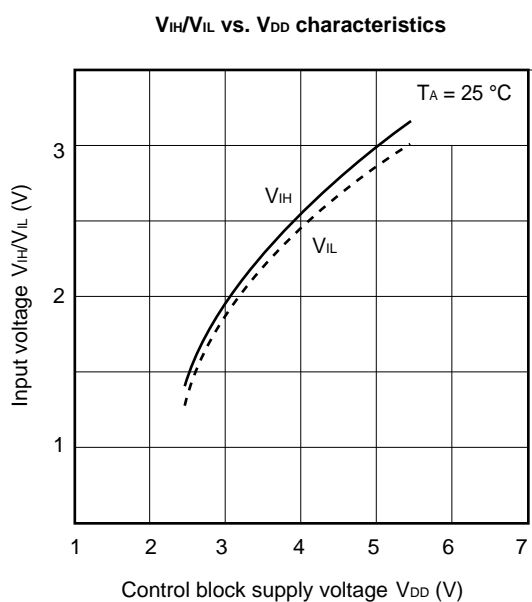
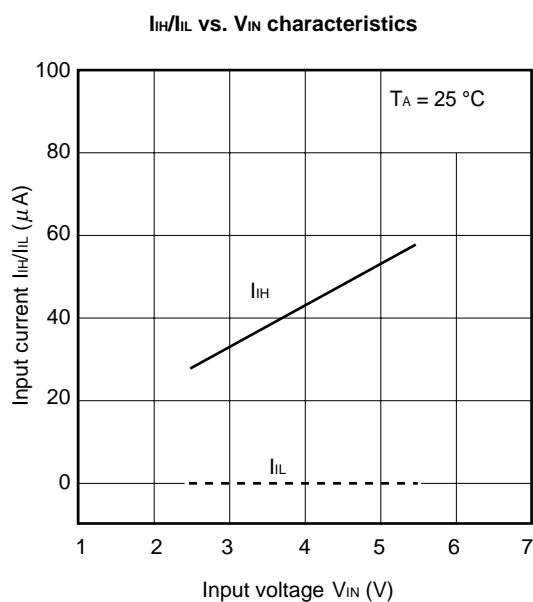
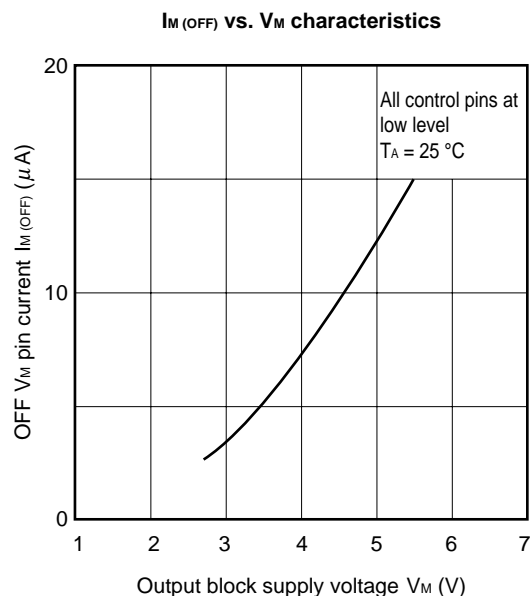
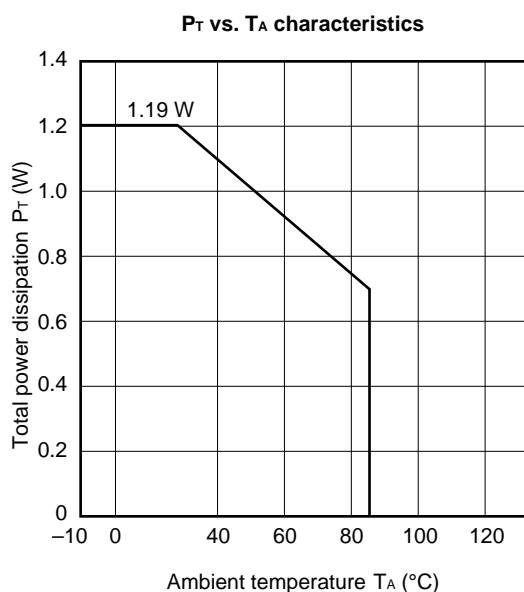
# BLOCK DIAGRAM



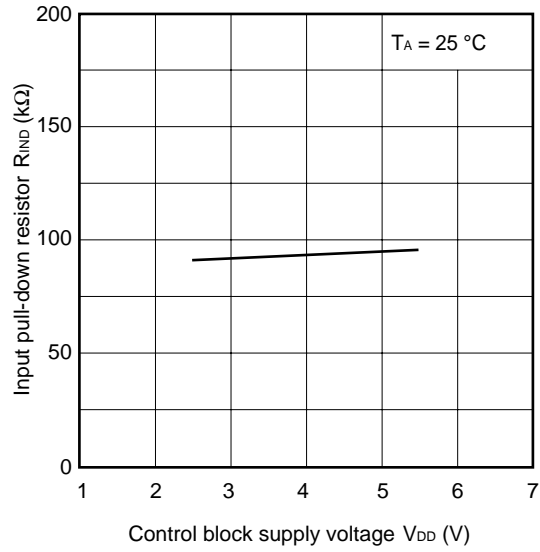
## STANDARD CONNECTION EXAMPLE



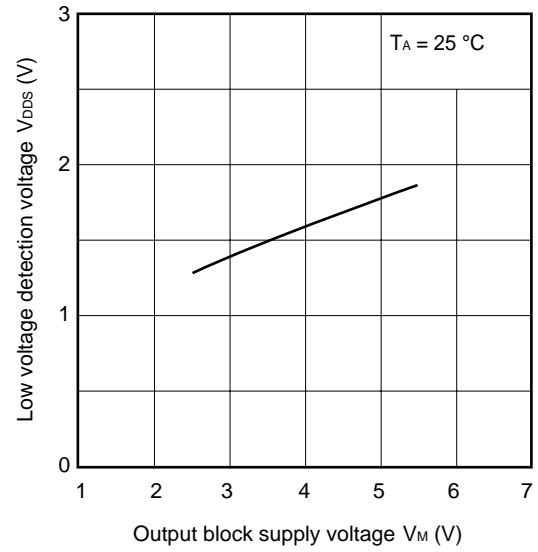
TYPICAL CHARACTERISTICS ( $T_A = 25\text{ }^{\circ}\text{C}$ )



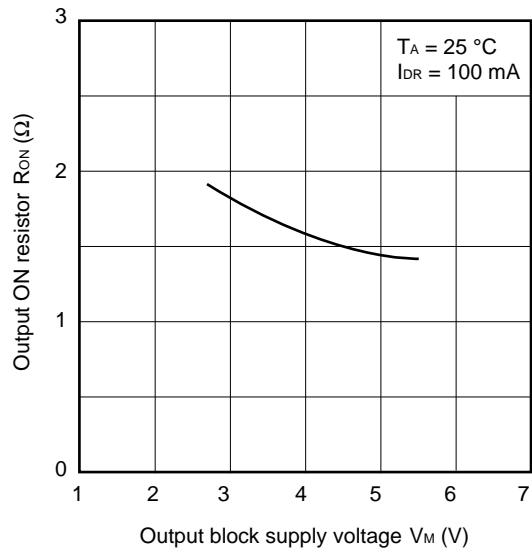
**$R_{IND}$  vs.  $V_{DD}$  characteristics**



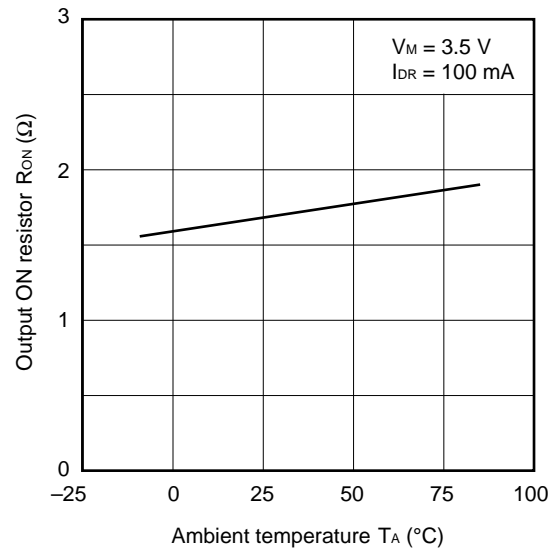
**$V_{DDS}$  vs.  $V_M$  characteristics**



**$R_{ON}$  vs.  $V_M$  characteristics**

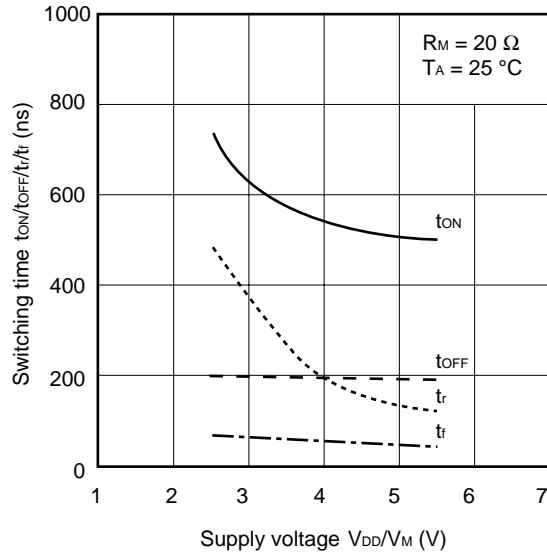


**$R_{ON}$  vs.  $T_A$  characteristics**

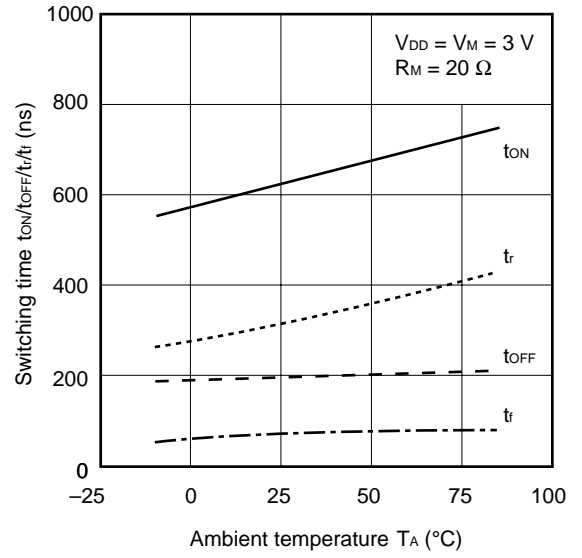




Switching time vs.  $V_{DD}/V_M$  characteristics

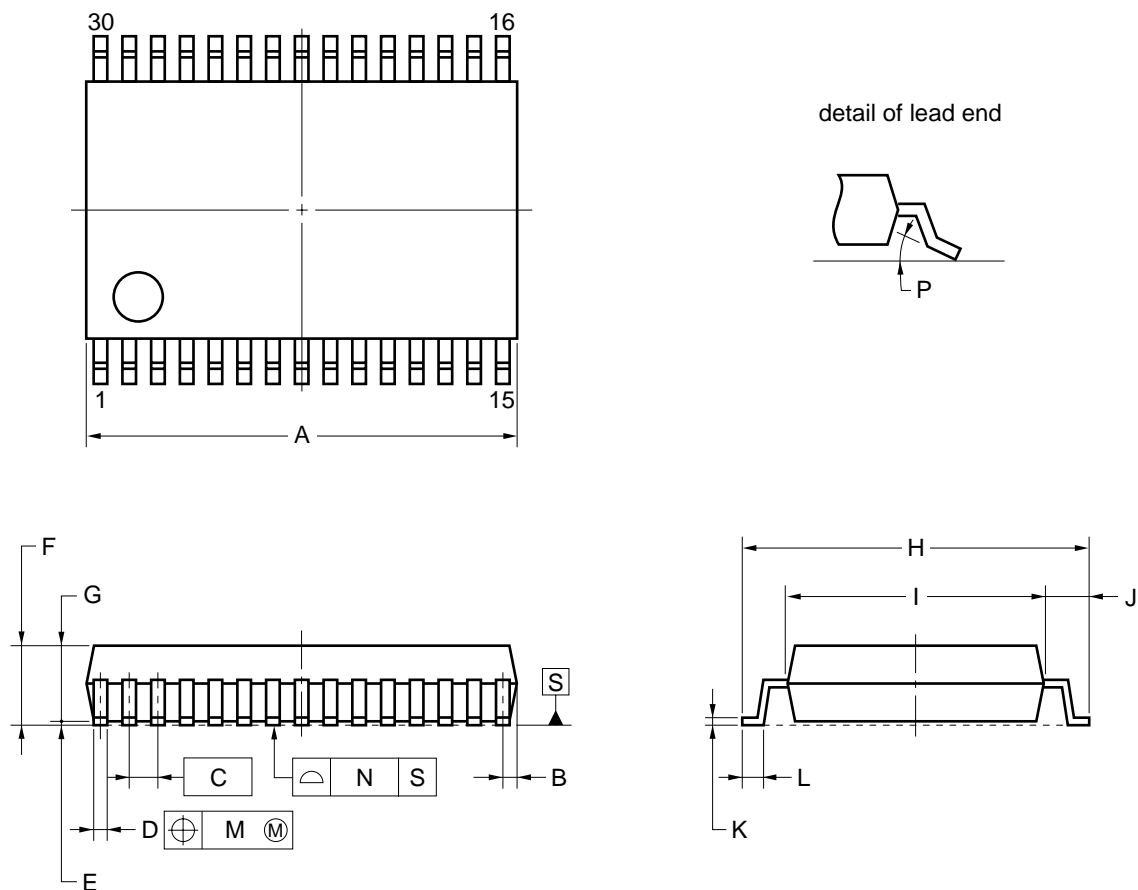


Switching time vs.  $T_A$  characteristics



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 <sup>+0.08</sup> <sub>-0.07</sub>
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 <sup>+0.08</sup> <sub>-0.07</sub>
L	0.5±0.2
M	0.10
N	0.10
P	3° <sup>+7°</sup> <sub>-3°</sub>

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 <sup>Note</sup> , 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 <sup>Note</sup> , 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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