

MONOLITHIC QUAD H BRIDGE DRIVER CIRCUIT

DESCRIPTION

The μ 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 μ A MAX. V_{DD} pin current: 10 μ 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) (μ PD16833AG3)

ORDERING INFORMATION

Part Number	Package
μ 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 ^{Note 1}	$I_{DR} (DC)$	DC	± 300	mA
Instantaneous H bridge drive current ^{Note 1}	$I_{DR} (pulse)$	$PW \leq 10 \text{ ms}, \text{Duty} \leq 5 \%$	± 700	mA
Power dissipation ^{Note 2}	P_T		1.19	W
Peak junction temperature	$T_{CH} (MAX)$		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)

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

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} × 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} × 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	μA
H bridge output circuit turn-OFF time	t _{OFFH}			0.2	0.5	μA
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

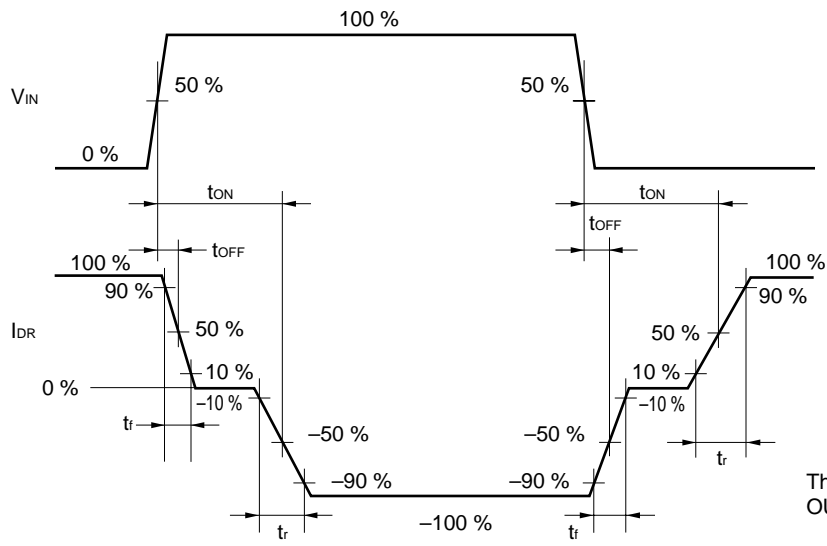
EN ₄	IN ₄	OUT4A	OUT4B
H	L	H	L
H	H	L	H
L	L	Z	Z
L	H	Z	Z

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

PIN CONFIGURATION

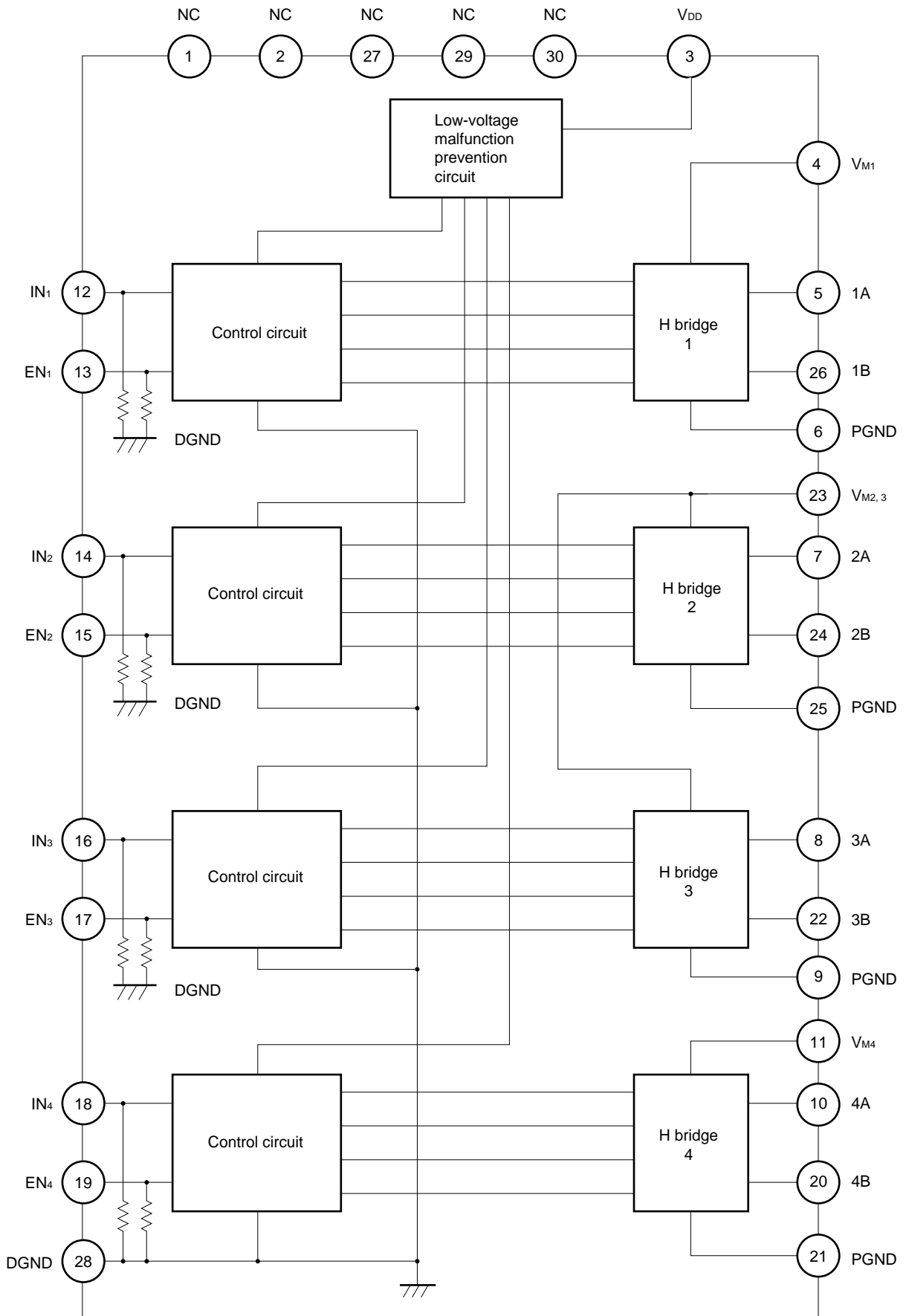
NC	1	30	NC
NC	2	29	NC
V _{DD}	3	28	DGND
V _{M1}	4	27	NC
1A	5	26	1B
PGND	6	25	PGND
2A	7	24	2B
3A	8	23	V _{M2,3}
PGND	9	22	3B
4A	10	21	PGND
V _{M4}	11	20	4B
IN ₁	12	19	EN ₄
EN ₁	13	18	IN ₄
IN ₂	14	17	EN ₃
EN ₂	15	16	IN ₃

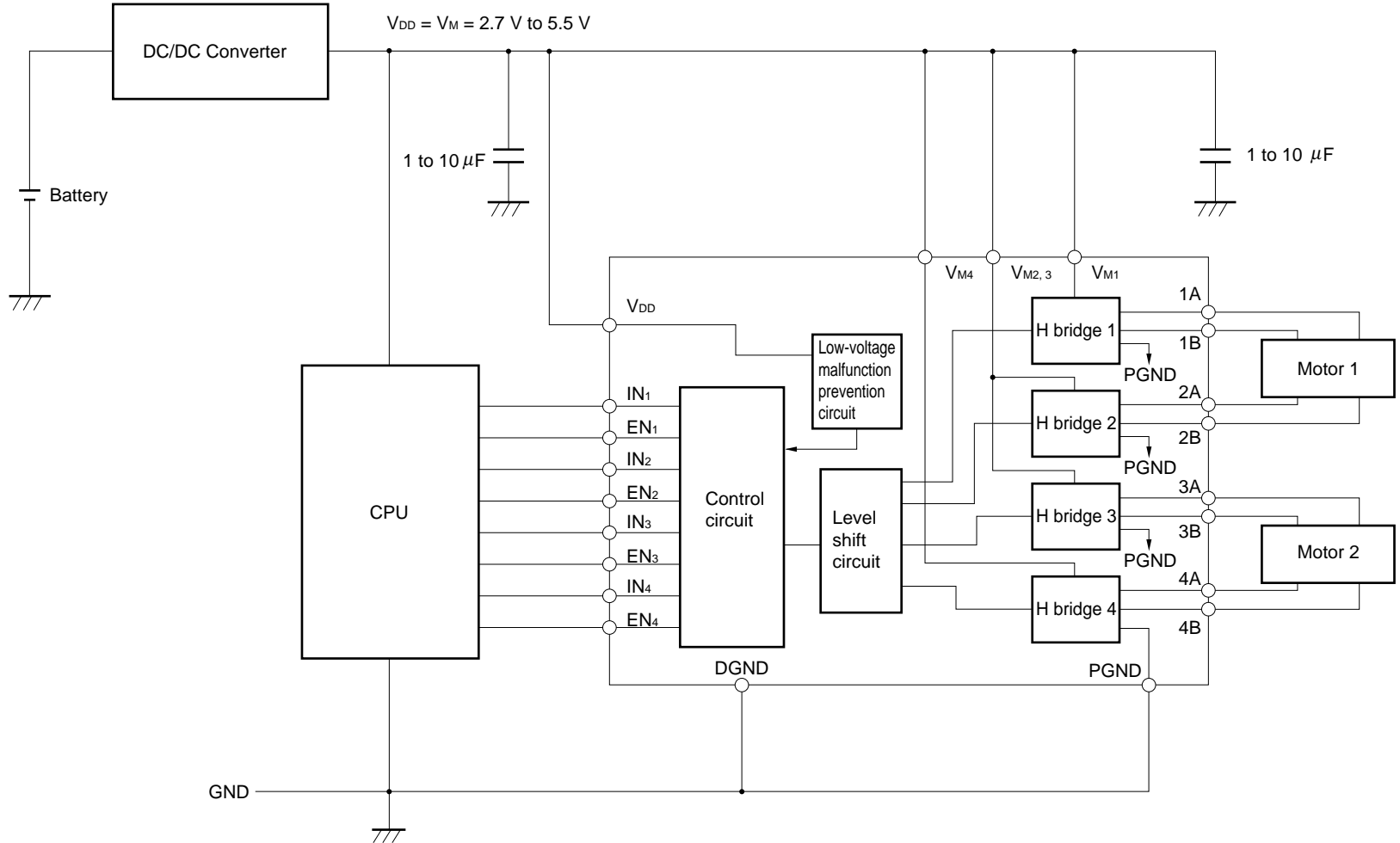
Figure 1. Switching Characteristic Wave



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

BLOCK DIAGRAM

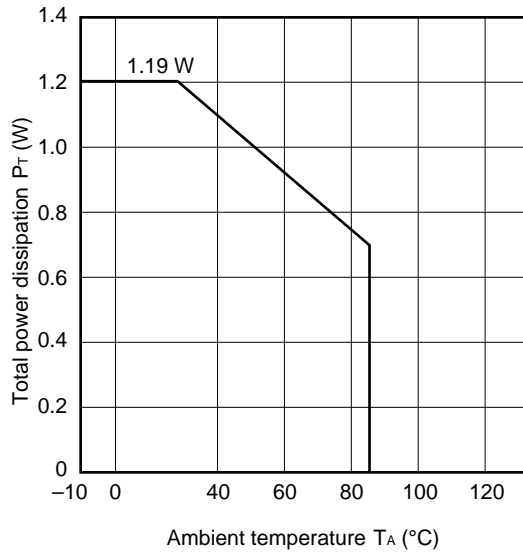




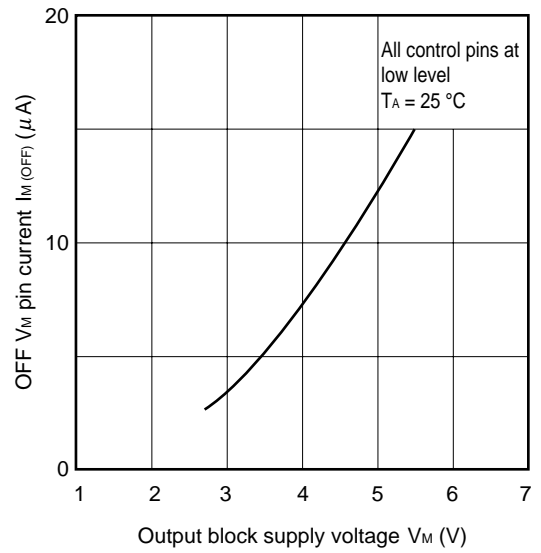
STANDARD CONNECTION EXAMPLE

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

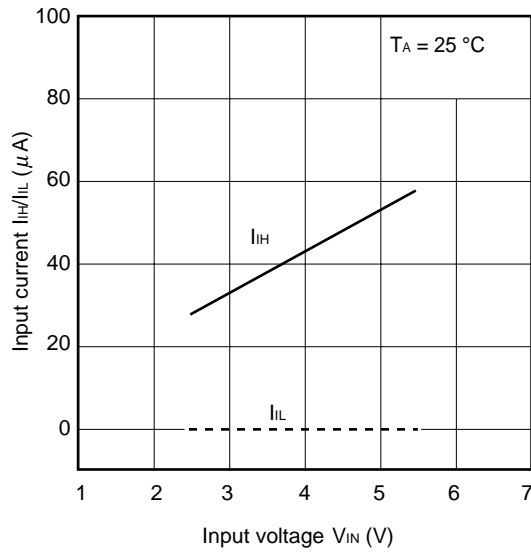
P_T vs. T_A characteristics



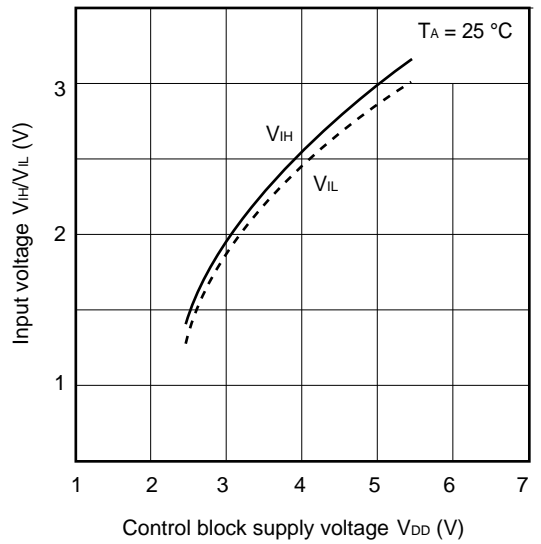
$I_{M(OFF)}$ vs. V_M characteristics



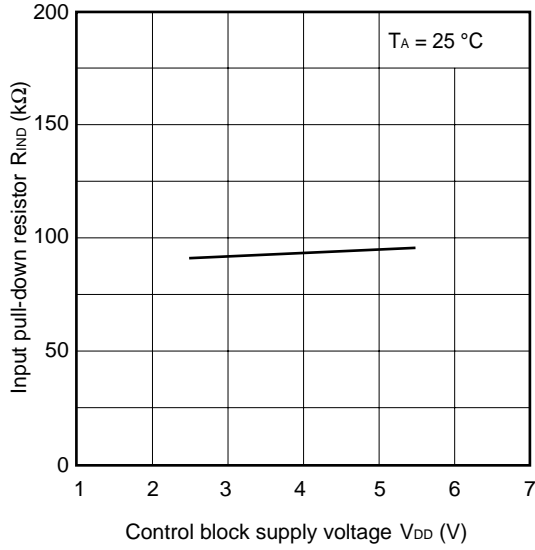
I_{IH}/I_{IL} vs. V_{IN} characteristics



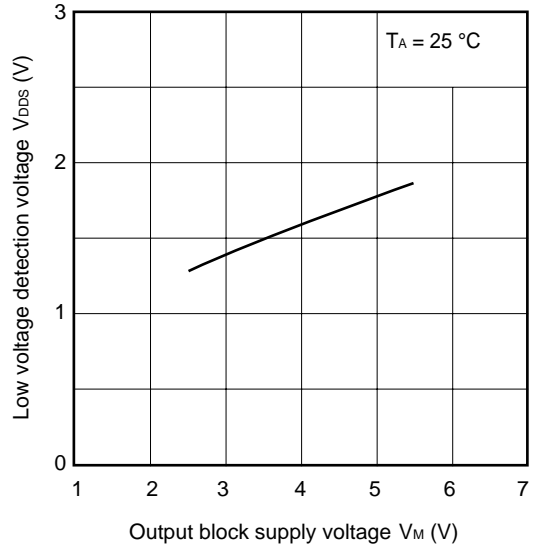
V_{IH}/V_{IL} vs. V_{DD} characteristics



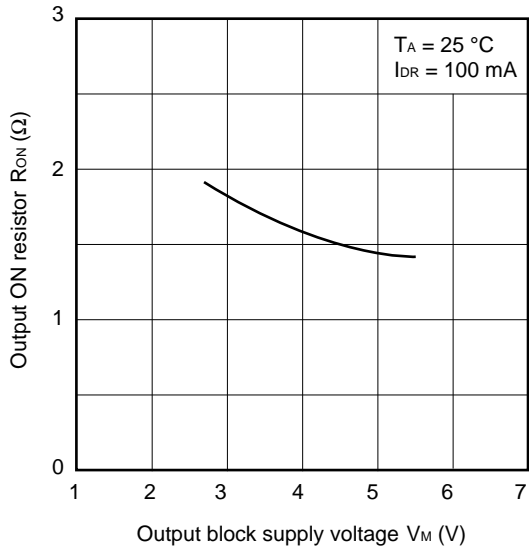
R_{IND} vs. V_{DD} characteristics



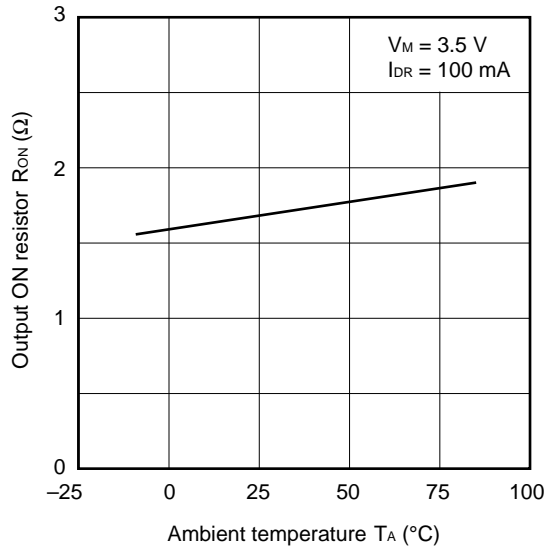
V_{DDs} vs. V_M characteristics



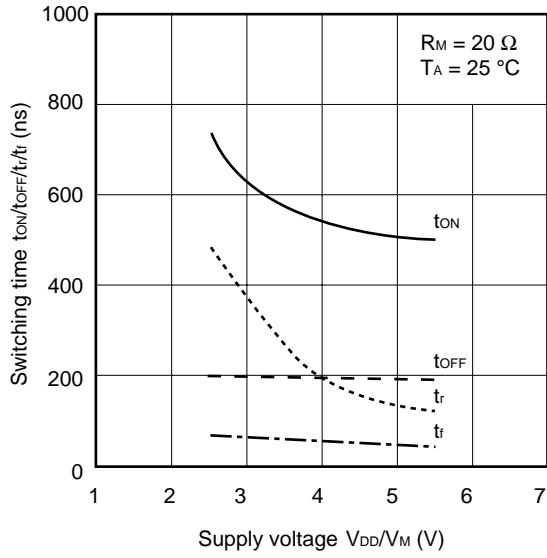
R_{ON} vs. V_M characteristics



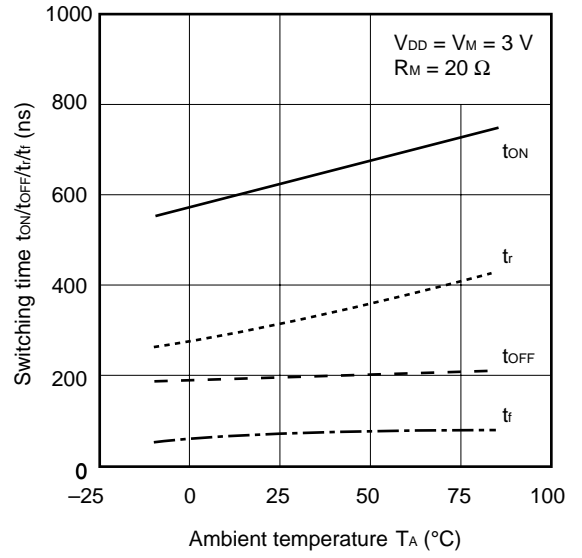
R_{ON} vs. T_A characteristics



Switching time vs. V_{DD}/V_M characteristics

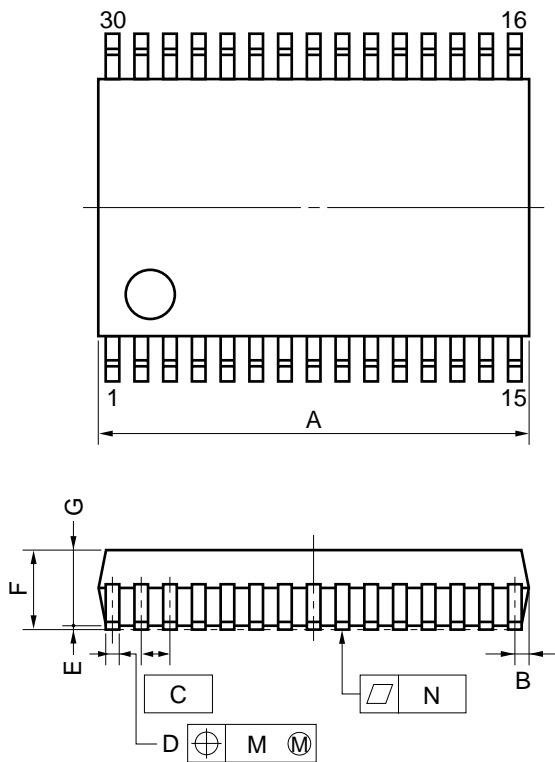


Switching time vs. T_A characteristics

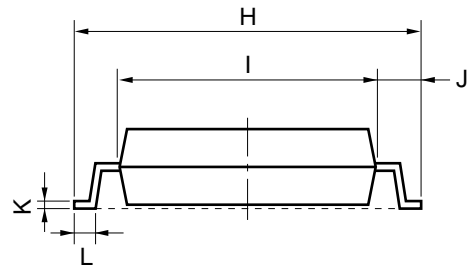
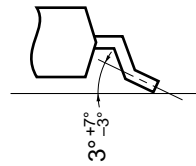


PACKAGE DIMENSION

30 PIN PLASTIC SHRINK SOP (300 mil)



detail of lead end



NOTE

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

P30GS-65-300B-1

ITEM	MILLIMETERS	INCHES
A	10.11 MAX.	0.398 MAX.
B	0.51 MAX.	0.020 MAX.
C	0.65 (T.P.)	0.026 (T.P.)
D	0.30 ^{+0.10} _{-0.05}	0.012 ^{+0.004} _{-0.003}
E	0.125±0.075	0.005±0.003
F	2.0 MAX.	0.079 MAX.
G	1.7±0.1	0.067±0.004
H	8.1±0.2	0.319±0.008
I	6.1±0.2	0.240±0.008
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

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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Standard: Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots

Special: Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support)

Specific: Aircrafts, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems or medical equipment for life support, etc.

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Anti-radioactive design is not implemented in this product.