

MONOLITHIC QUAD H BRIDGE DRIVER CIRCUIT

DESCRIPTION

The μ PD16833 is a monolithic quad H bridge driver IC which uses N-channel 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.

In addition, a low-voltage malfunction prevention function is provided to prevent the IC from malfunctioning when the supply voltage drops.

As the package, a 30-pin 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 video cameras.

FEATURES

- Four H bridge circuits employing power MOS FETs
- 3-V power supply
Minimum operating supply voltage: 2.5 V MIN.
- Low current consumption: 2 mA (MAX.)
- Low-voltage malfunctioning prevention circuit
- 30-pin shrink SOP (300 mil) (μ PD16833G3)

ORDERING INFORMATION

Part Number	Package
μ PD16833G3	30-pin plastic SOP (300 mil)

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

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
Gate drive voltage	V_G		-0.5 to 12	V
H bridge drive current ^{Note 1}	I_D (DC)	DC	± 300	mA/phase
Instantaneous H bridge drive current ^{Note 1}	I_D (pulse)	$PW \leq 10\text{ ms}$, Duty $\leq 5\%$	± 700	mA/phase
Power consumption ^{Note 2}	P_T		1.19	W
Peak junction temperature	T_J (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
Gate drive voltage ^{Note 1}	V _G	V _M + 4.5		11.5	V
Charge pump capacitance	C ₁ , C ₂ , C ₃	5		20	nF
H bridge drive current	I _D	-200		200	mA
Logic input frequency ^{Note 2}	f _{IN}			50	kHz
Operating temperature range	T _A	-10		85	°C
Peak junction temperature	T _{J (MAX)}			125	°C

- Notes**
1. When V_G is applied from an external source
 2. 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	with all control pins at low level			2.0	mA
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 _{BDS1}	V _M = 5.0 V -10 °C ≤ T _A ≤ +85 °C	0.8		2.5	V
	V _{BDS2}	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_D = 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
Charge pump circuit turn ON time	t _{ONG}	C ₁ = C ₂ = C ₃ = 10 nF I _D = 150 mA, Figure 1			3.0	ms
Charge pump circuit oscillation frequency	f _G		100		600	kHz
H bridge output circuit turn ON time	t _{ONH}	C ₁ = C ₂ = C ₃ = 10 nF I _D = 150 mA, Figure 1			5.0	μs
H bridge output circuit turn OFF time	t _{OFFH}	C ₁ = C ₂ = C ₃ = 10 nF I _D = 150 mA, Figure 1			5.0	μs

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

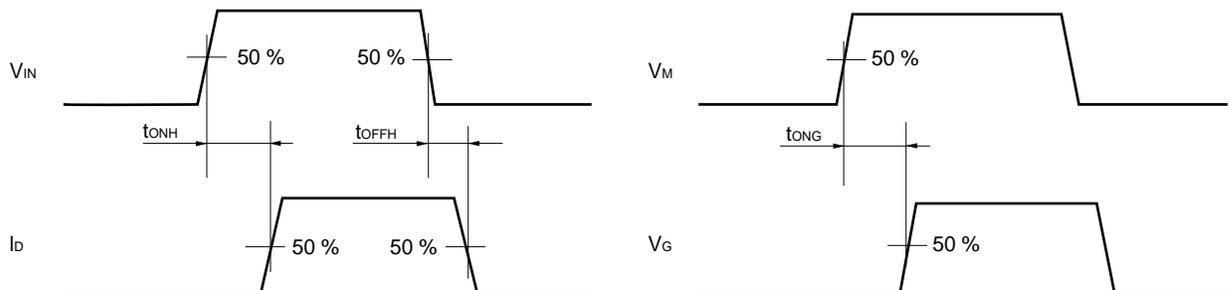
EN ₄	IN ₄	OUT4A	OUT4B
H	L	H	L
H	H	L	H
L	L	Z	Z
L	H	Z	Z

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

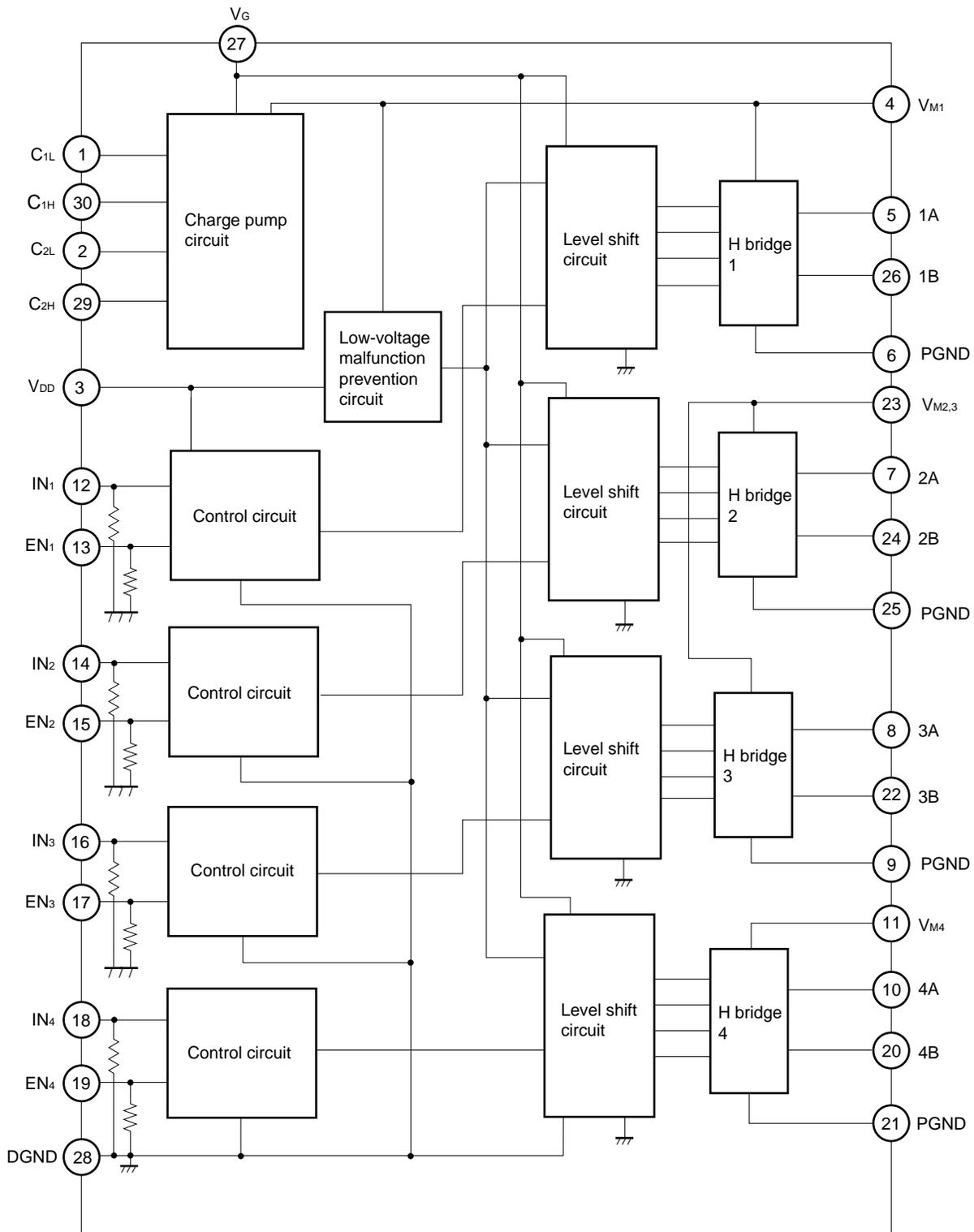
PIN CONFIGURATION

C _{1L}	1	30	C _{1H}
C _{2L}	2	29	C _{2H}
V _{DD}	3	28	DGND
V _{M1}	4	27	V _G
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

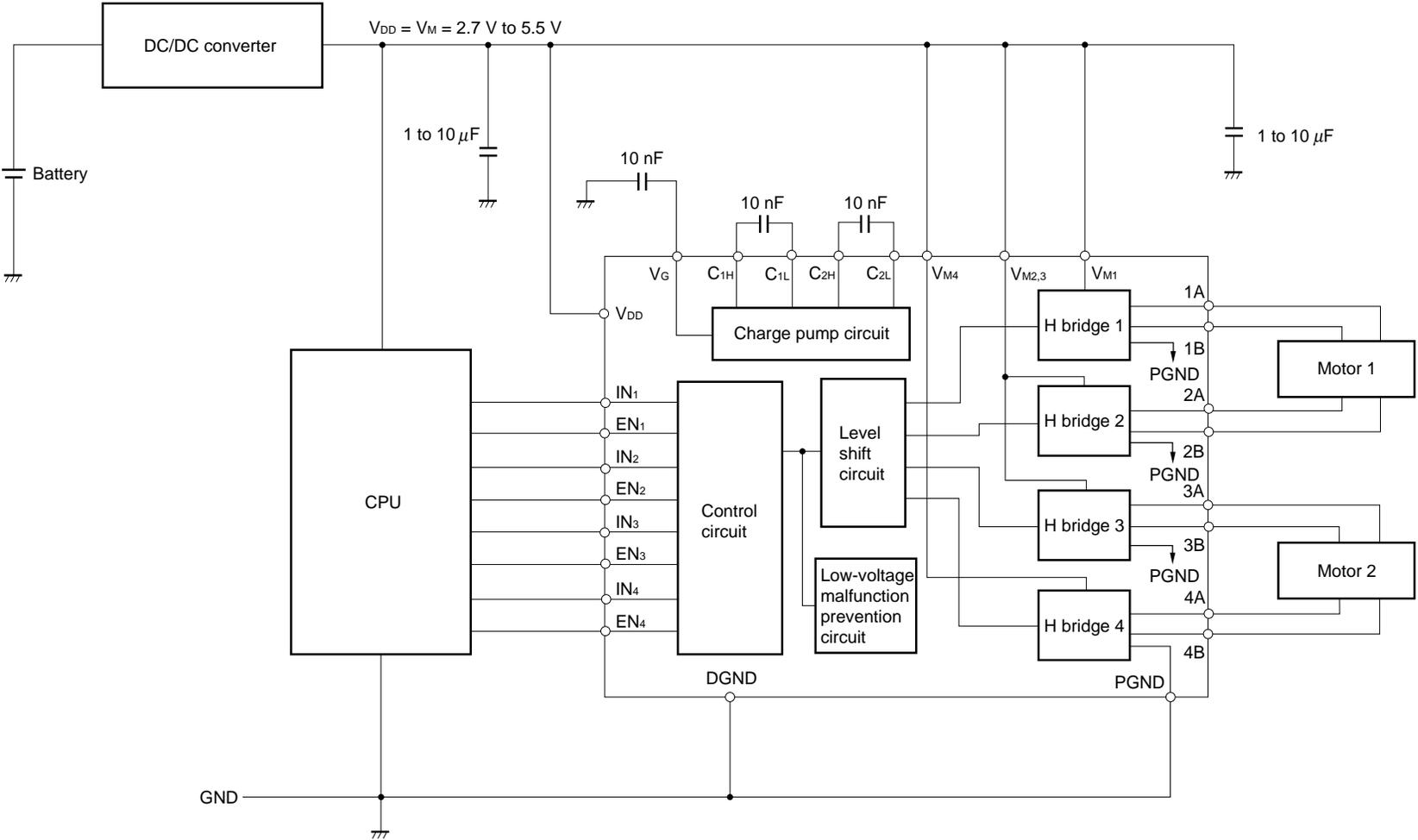


BLOCK DIAGRAM

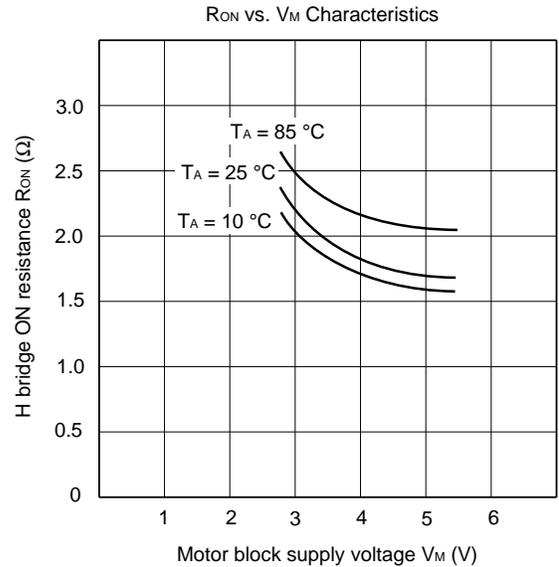
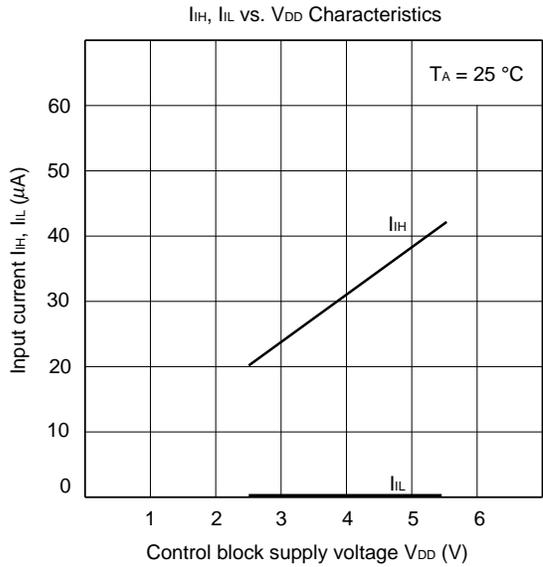
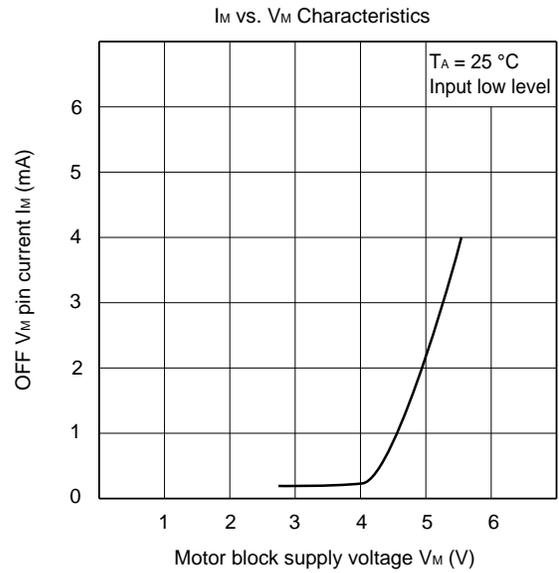
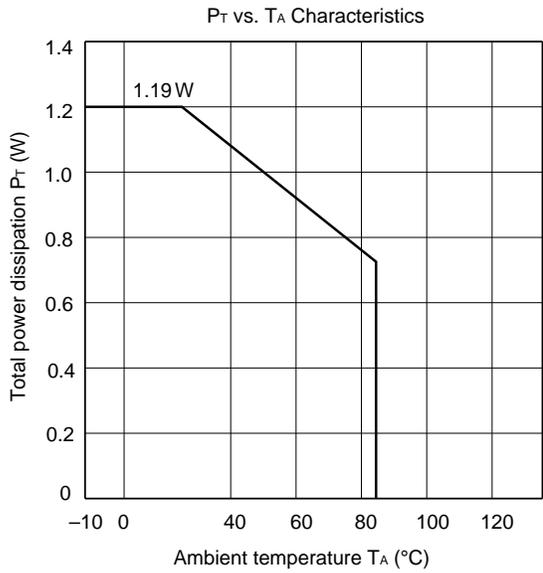


STANDARD CONNECTION EXAMPLE

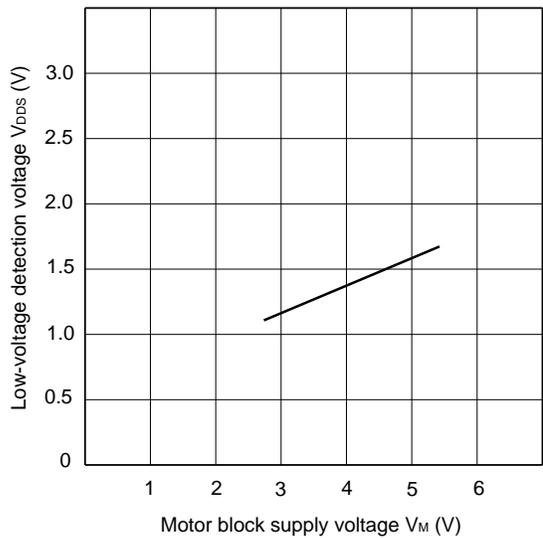
(1) When charge pump is used



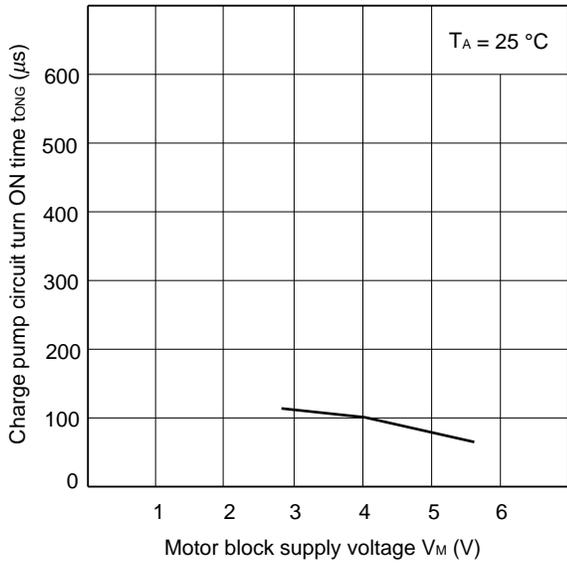
TYPICAL CHARACTERISTICS ($T_A = 25\text{ }^\circ\text{C}$)



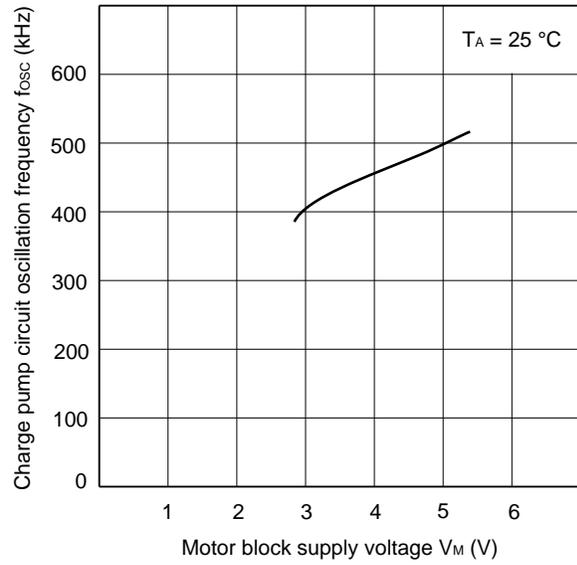
Low-Voltage Malfunction Prevention Circuit Characteristics



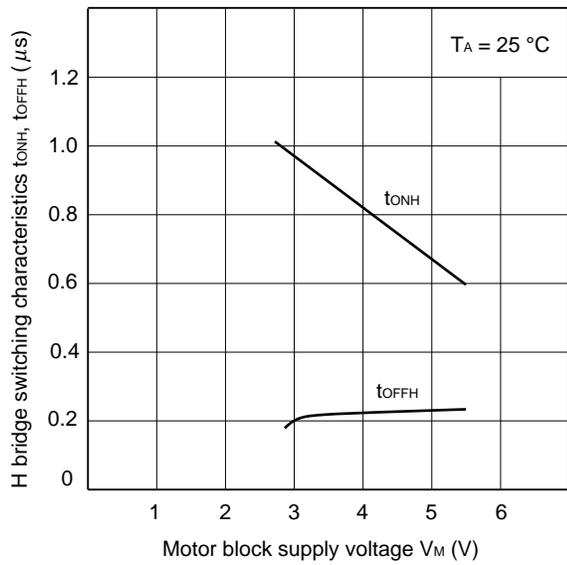
t_{ONG} vs. V_M Characteristics



f_{OSC} vs. V_M Characteristics

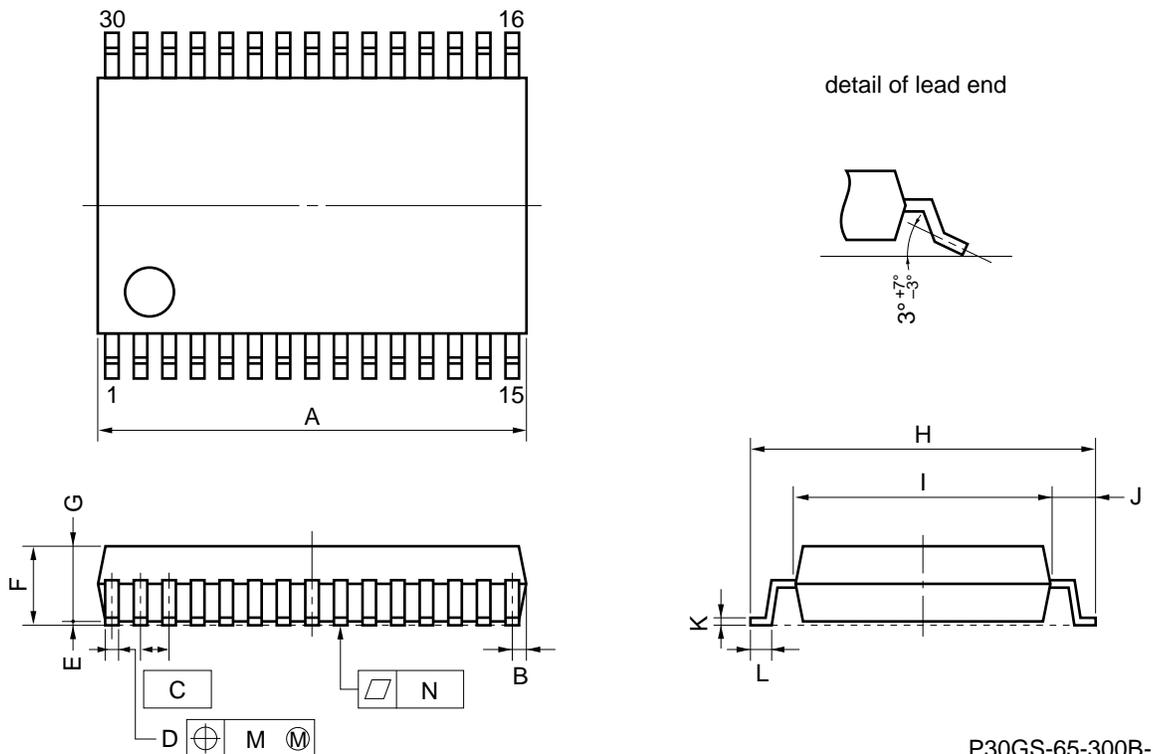


t_{ONH} , t_{OFFH} vs. V_M Characteristics



PACKAGE DIMENSION

30 PIN PLASTIC SHRINK SOP (300 mil)



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 (except pin partial heating).

[MEMO]

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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.