To our customers,

Old Company Name in Catalogs and Other Documents

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Renesas Electronics website: http://www.renesas.com

April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (http://www.renesas.com)

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RENESAS

MOS INTEGRATED CIRCUIT

μPD16877

MONOLITHIC QUAD H-BRIDGE DRIVER CIRCUIT

DESCRIPTION

The μPD16877 is monolithic quad H-bridge driver LSI which uses power MOSFETs in the output stages. By using the MOS process, this driver IC has substantially improved saturation voltage and power consumption as compared with conventional driver circuits using bipolar transistors.

By eliminating the charge pump circuit, the current during power-OFF is drastically decreased.

In addition, a low-voltage malfunction prevention circuit is also provided that prevents the IC from malfunctioning when the supply voltage drops.

As the package, a 24-pin plastic TSSOP is adopted to enable the creation of compact, slim application sets.

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

FEATURES

- Four H bridge circuits employing power MOSFETs
- 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 malfunction prevention circuit
- 24-pin plastic TSSOP (5.72 mm (225))

ORDERING INFORMATION

Part Number	Package
μPD16877MA-6A5	24-pin plastic TSSOP (5.72 mm (225))

Document No. S13964EJ1V0DS00 (1st edition)
Date Published March 2000 N CP(K)
Printed in Japan

ABSOLUTE MAXIMUM RATINGS (T_A = 25°C)

When mounted on a glass epoxy board (10 cm × 10 cm × 1 mm, 15% copper foil)

Parameter	Symbol	Condition	Rating	Unit
Control block supply voltage	V_{DD}		–0.5 to +6.0	V
Output block supply voltage	V_M		–0.5 to +6.0	V
Input voltage	V_{IN}		–0.5 to V_{DD} + 0.5	V
Output terminal voltage	V_{OUT}		6.2	V
Output current	$I_{D(DC)}$	DC	±0.3	A/ch
	$I_{D(pulse)}$	PW ≤ 10 ms, Duty ≤ 5%	±0.7	A/ch
Power consumption	P_T		0.7	W
Peak junction temperature	$T_{CH(MAX)}$		150	°C
Storage temperature range	T_{stg}		–55 to +150	°C

RECOMMENDED OPERATING CONDITIONS

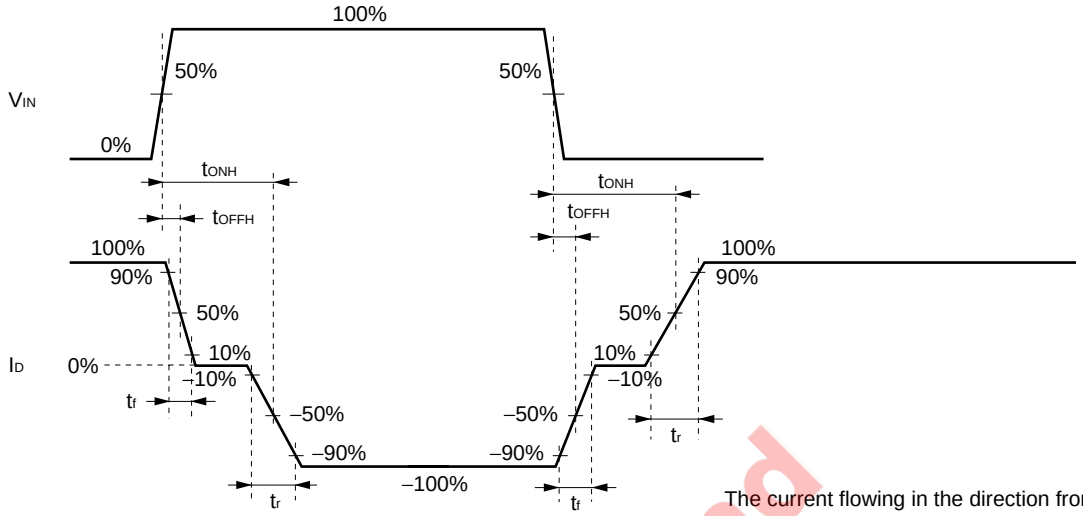
When mounted on a glass epoxy board (10 cm × 10 cm × 1 mm, 15% copper foil)

Parameter	Symbol	Condition	MIN.	TYP.	MAX.	Unit
Control block supply voltage	V_{DD}		2.5		5.5	V
Output block supply voltage	V_M		2.7		5.5	V
Output current	$I_{D(DC)}$	DC	–0.2		+0.2	A
Operating frequency	f_{IN}	IN, EN terminal			100	kHz
Operating temperature range	T_A		–10		85	°C
Peak junction temperature	$T_{CH(MAX)}$				125	°C

CHARACTERISTICS (Unless otherwise specified, V_{DD} = V_M = 3 V, T_A = 25°C)

Parameter	Symbol	Condition	MIN.	TYP.	MAX.	Unit
Off state V_M pin current	$I_{M(OFF)}$	All control terminal: L level			10	μA
V_{DD} pin current	I_{DD}	All control terminal: L 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 V	–1.0			μA
Input pull down resistance	R_{IND}		50		200	kΩ
High level input voltage	V_{IH}	2.5 V ≤ V_{DD} ≤ 5.5 V	0.7 × V_{DD}		V_{DD}+0.3	V
Low level input voltage	V_{IL}		–3.0		0.3 × V_{DD}	V
H-bridge ON resistance	R_{ON}	2.5 V ≤ V_M, V_{DD} ≤ 5.5 V Upper + lower			3.0	Ω
Low voltage malfunction prevention circuit operating voltage	V_{DDS1}	V_M = 5 V –10°C ≤ T_A ≤ +85°C	0.8		2.5	V
	V_{DDS2}	V_M = 3 V –10°C ≤ T_A ≤ +85°C	0.65		2.5	V
H bridge output turn-on time	t_{ONH}	R_M = 20 Ω Figure 1		0.7	20	μs
H bridge output turn-off time	t_{OFFH}			0.2	0.5	μs
H bridge output rise time	t_r		0.1	0.4	1.0	μs
H bridge output fall time	t_f			70	200	ns

Figure 1. Switching time condition



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

FUNCTION TABLE

Channel 1

EN_1	IN_1	OUT_{1A}	OUT_{1B}
H	L	H	L
H	H	L	H
L	L	Z	Z
L	H	Z	Z

Channel 2

EN_2	IN_2	OUT_{2A}	OUT_{2B}
H	L	H	L
H	H	L	H
L	L	Z	Z
L	H	Z	Z

Channel 3

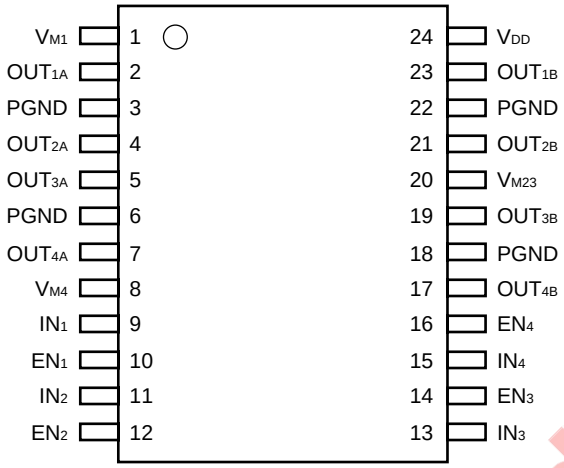
EN_3	IN_3	OUT_{3A}	OUT_{3B}
H	L	H	L
H	H	L	H
L	L	Z	Z
L	H	Z	Z

Channel 4

EN_4	IN_4	OUT_{4A}	OUT_{4B}
H	L	H	L
H	H	L	H
L	L	Z	Z
L	H	Z	Z

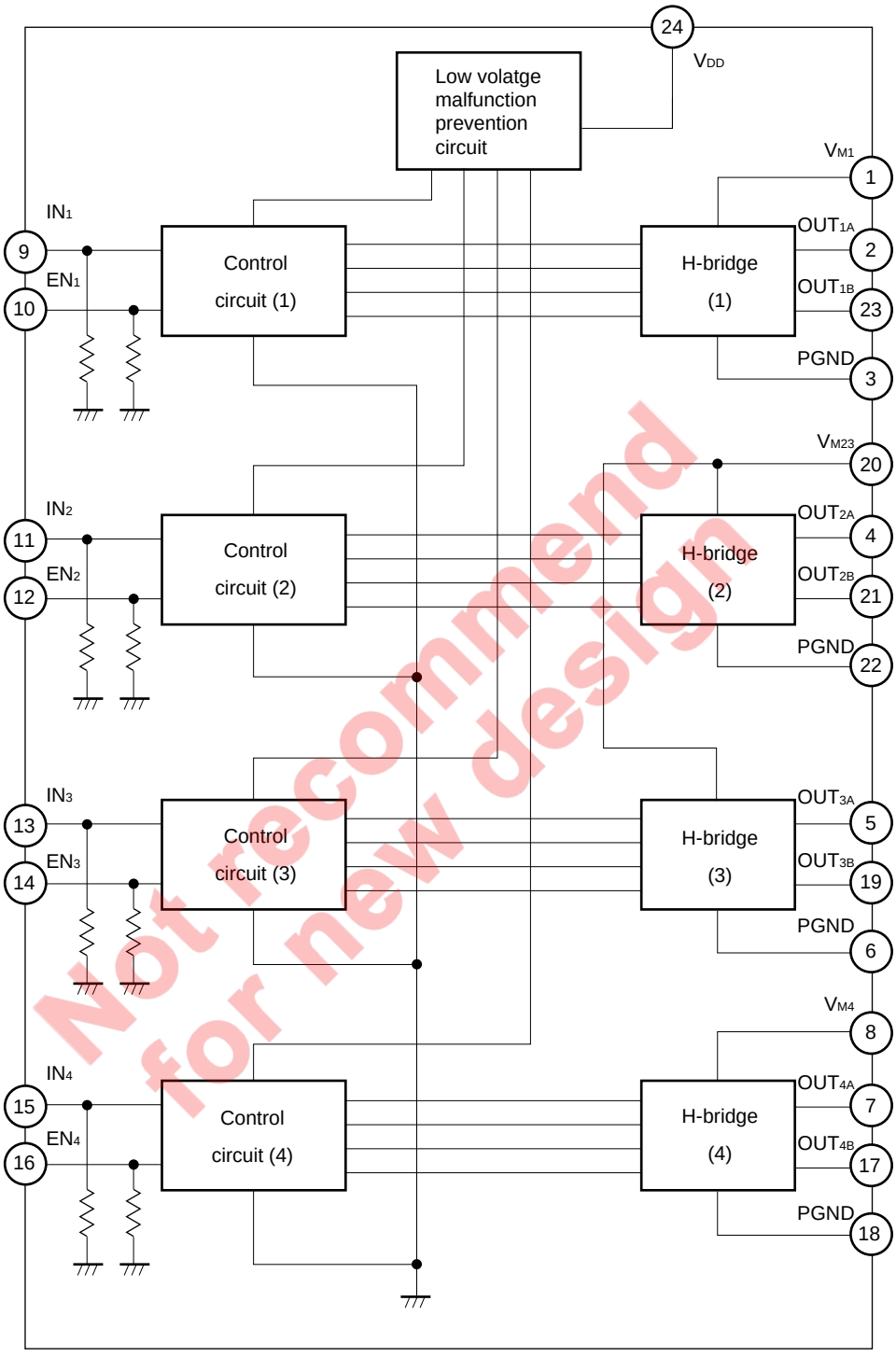
H: High-level, L: Low-level, Z: High impedance

PIN CONNECTION



Pin No.	Pin name	Pin function	Pin No.	Pin name	Pin function
1	V_{M1}	Output block supply voltage input terminal	13	IN_3	Control terminal (channel 3)
2	OUT_{1A}	Output terminal	14	EN_3	Enable terminal (channel 3)
3	PGND	Ground terminal	15	IN_4	Control terminal (channel 4)
4	OUT_{2A}	Output terminal	16	EN_4	Enable terminal (channel 4)
5	OUT_{3A}	Output terminal	17	OUT_{4B}	Output terminal
6	PGND	Ground terminal	18	PGND	Ground terminal
7	OUT_{4A}	Output terminal	19	OUT_{3B}	Output terminal
8	V_{M4}	Output block supply voltage input terminal	20	V_{M23}	Output block supply voltage input terminal
9	IN_1	Control terminal (channel 1)	21	OUT_{2B}	Output terminal
10	EN_1	Enable terminal (channel 1)	22	PGND	Ground terminal
11	IN_2	Control terminal (channel 2)	23	OUT_{1B}	Output terminal
12	EN_2	Enable terminal (channel 2)	24	V_{DD}	Control block supply voltage input terminal

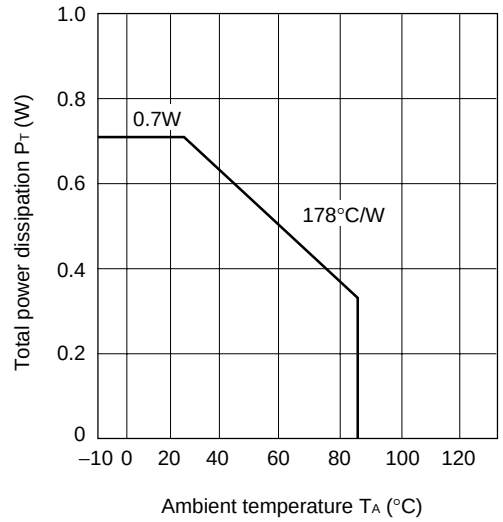
BLOCK DIAGRAM



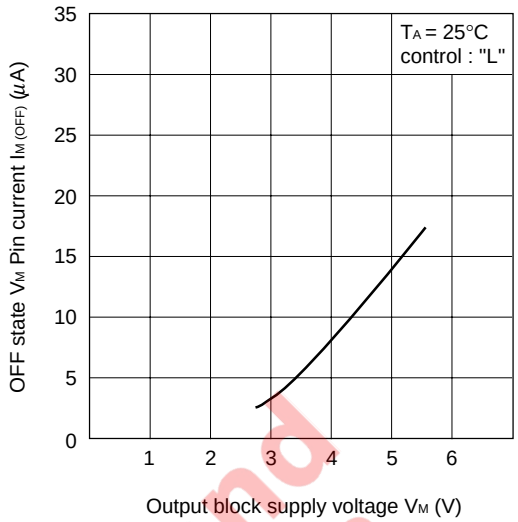
Remark Plural terminal (V_M, PGND) is not only 1 terminal and connect all terminals.

TYPICAL CHARACTERISTICS

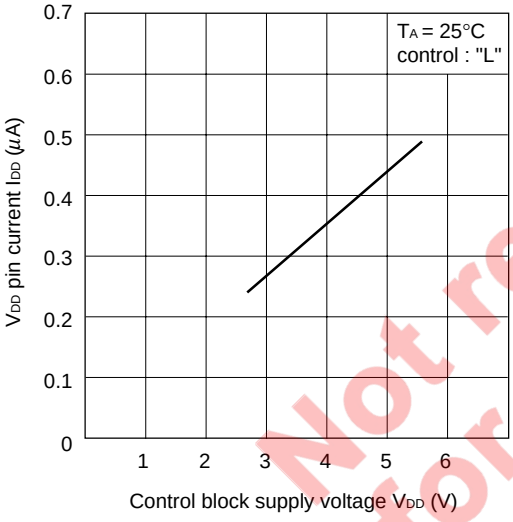
P_T vs. T_A characteristics



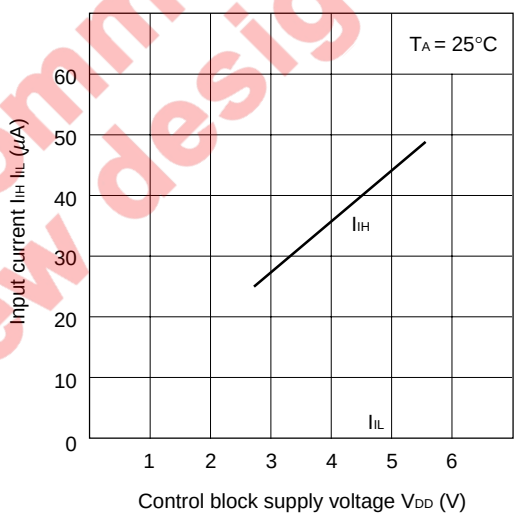
$I_{M\,(OFF)}$ vs. V_M characteristics



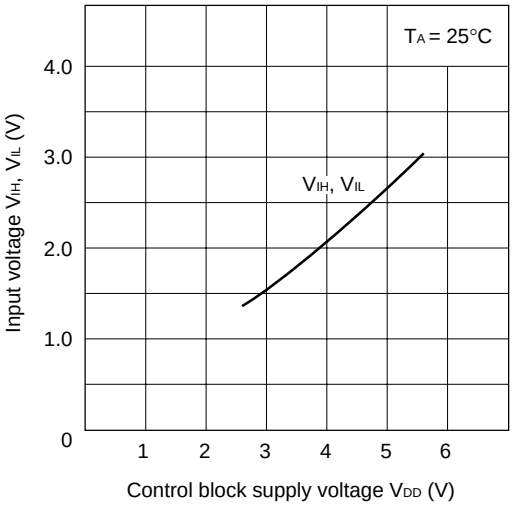
I_{DD} vs. V_{DD} characteristics



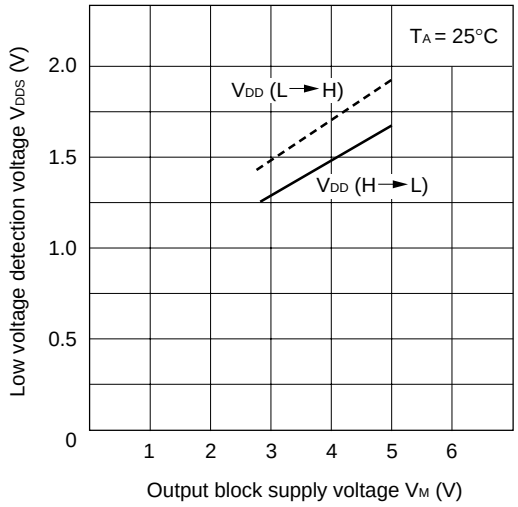
I_{IH}, I_{IL} vs. V_{DD} characteristics



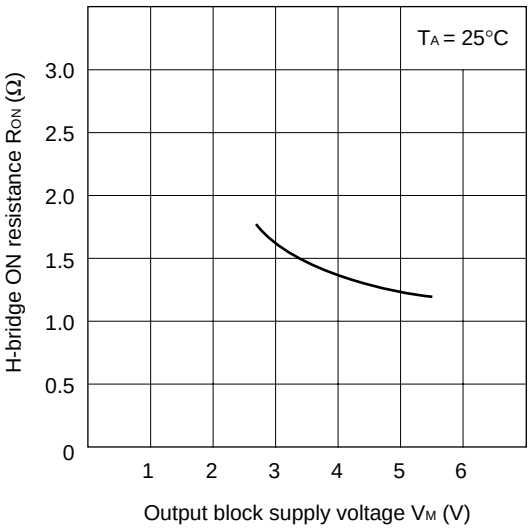
V_{IH}, V_{IL} vs. V_{DD} characteristics



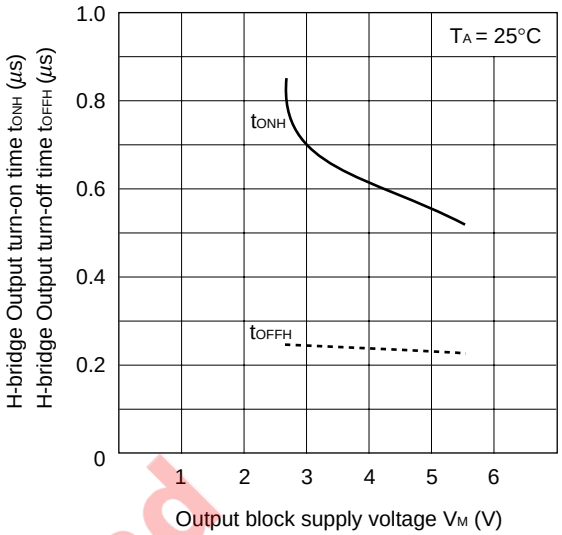
V_{DDS} vs. V_M characteristics



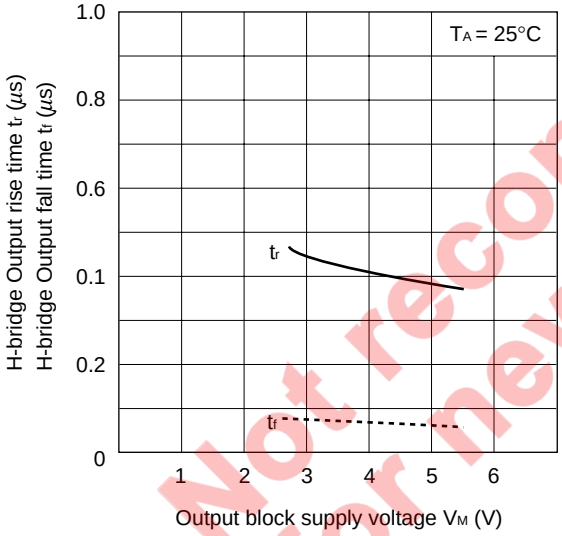
R_{ON} vs. V_M characteristics



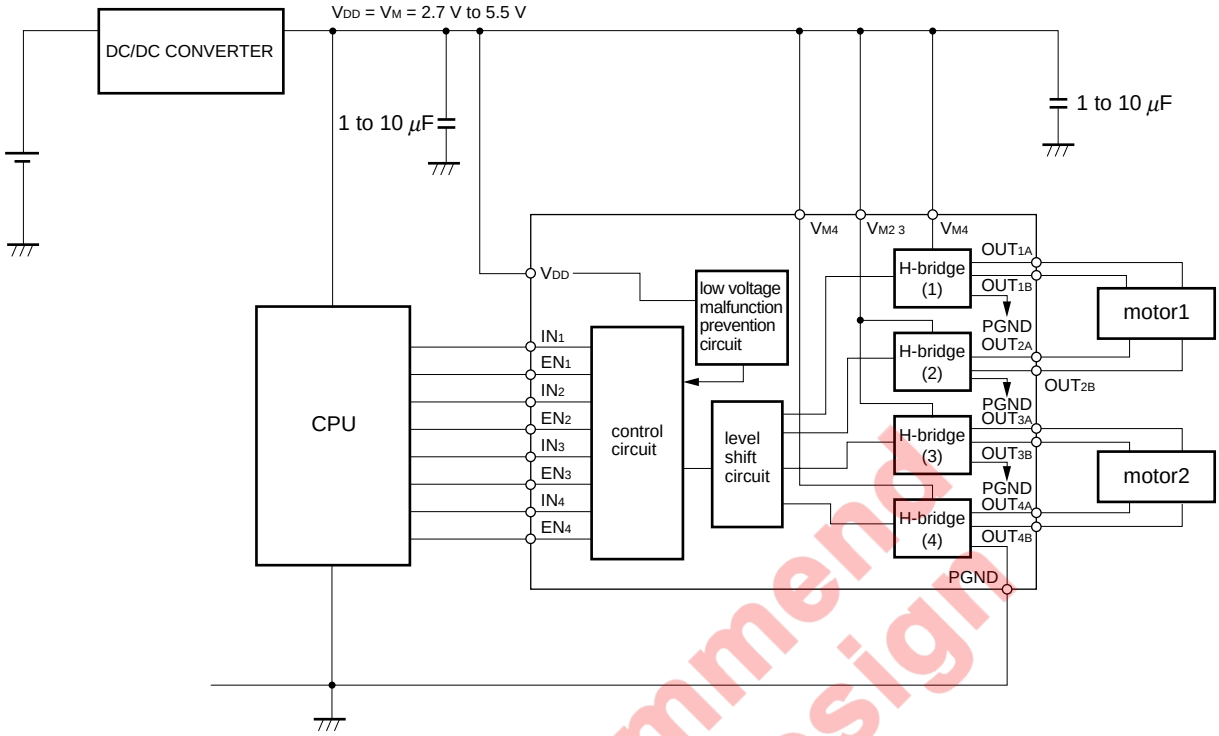
t_{ONH}, t_{OFFH} vs. V_M characteristics



t_r, t_f vs. V_M characteristics

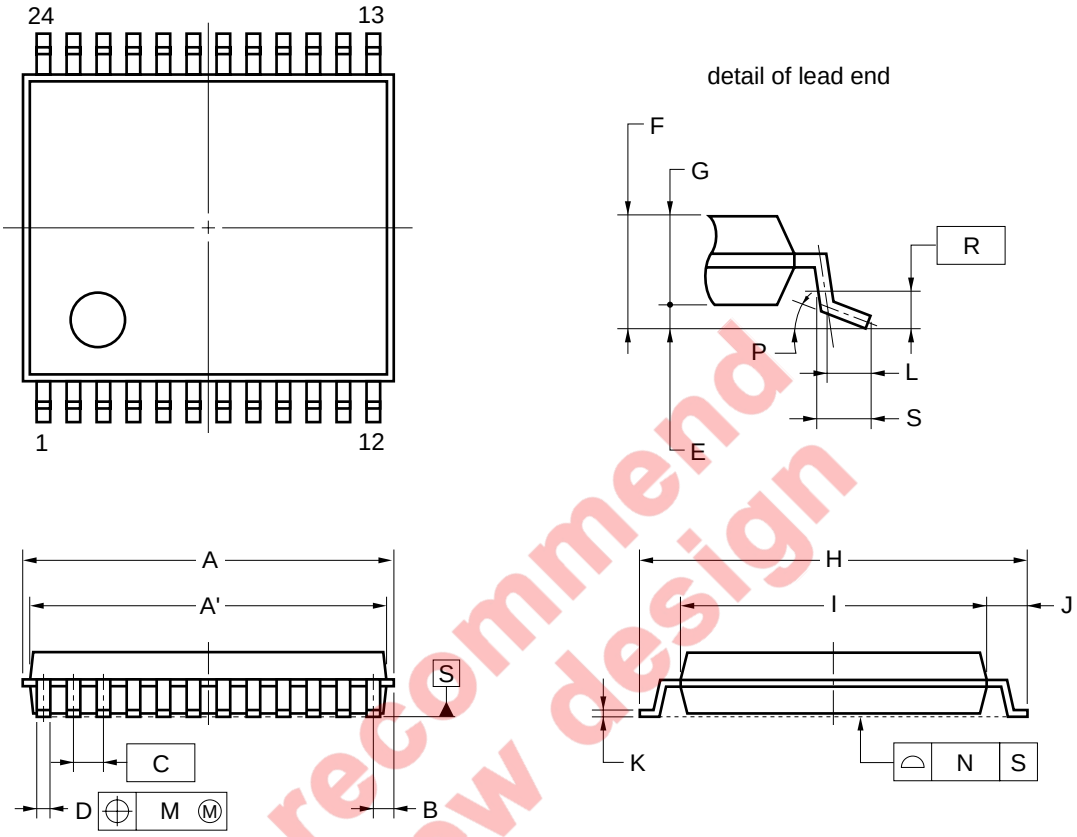


STANDARD CONNECTION EXAMPLE



PACKAGE DIMENSION

24-PIN PLASTIC TSSOP (5.72 mm (225))



NOTE

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

ITEM	MILLIMETERS
A	6.65±0.10
A'	6.5±0.1
B	0.575
C	0.5 (T.P.)
D	0.22±0.05
E	0.1±0.05
F	1.2 MAX.
G	1.0±0.05
H	6.4±0.1
I	4.4±0.1
J	1.0±0.1
K	0.145±0.025
L	0.5
M	0.10
N	0.08
P	$3^{\circ}{}^{+5^{\circ}}_{-3^{\circ}}$
R	0.25
S	0.6±0.15

S24MA-50-6A5

RECOMMENDED SOLDERING CONDITIONS

Solder this product under the following recommended conditions.
For soldering methods and conditions other than those recommended, consult NEC.

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

Soldering Method	Soldering Conditions	Recommended Condition Symbol
Infrared reflow	Package peak temperature: 235°C; Time: 30 secs. max. (210°C min.); Number of times: 3 times max; Number of day: none; Flux: Rosin-based flux with little chlorine content (chlorine: 0.2Wt% max.) is recommended.	IR35-00-3
VPS	Package peak temperature: 215°C; Time: 40 secs. max. (200°C min.); Number of times: 3 times max.; Number of day: none; Flux: Rosin-based flux with little chlorine content (chlorine: 0.2 Wt% max.) is recommended.	VP15-00-3
Wave soldering	Package peak temperature: 260°C; Time: 10 secs. max.; Preheating temperature: 120°C max.; Number of times: once; Flux: Rosin-based flux with little chlorine content (chlorine: 0.2 Wt% max.) is recommended.	WS60-00-1

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

NOTES FOR CMOS DEVICES

① PRECAUTION AGAINST ESD FOR SEMICONDUCTORS

Note:

Strong electric field, when exposed to a MOS device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop generation of static electricity as much as possible, and quickly dissipate it once, when it has occurred. Environmental control must be adequate. When it is dry, humidifier should be used. It is recommended to avoid using insulators that easily build static electricity. Semiconductor devices must be stored and transported in an anti-static container, static shielding bag or conductive material. All test and measurement tools including work bench and floor should be grounded. The operator should be grounded using wrist strap. Semiconductor devices must not be touched with bare hands. Similar precautions need to be taken for PW boards with semiconductor devices on it.

② HANDLING OF UNUSED INPUT PINS FOR CMOS

Note:

No connection for CMOS device inputs can be cause of malfunction. If no connection is provided to the input pins, it is possible that an internal input level may be generated due to noise, etc., hence causing malfunction. CMOS devices behave differently than Bipolar or NMOS devices. Input levels of CMOS devices must be fixed high or low by using a pull-up or pull-down circuitry. Each unused pin should be connected to V_{DD} or GND with a resistor, if it is considered to have a possibility of being an output pin. All handling related to the unused pins must be judged device by device and related specifications governing the devices.

③ STATUS BEFORE INITIALIZATION OF MOS DEVICES

Note:

Power-on does not necessarily define initial status of MOS device. Production process of MOS does not define the initial operation status of the device. Immediately after the power source is turned ON, the devices with reset function have not yet been initialized. Hence, power-on does not guarantee out-pin levels, I/O settings or contents of registers. Device is not initialized until the reset signal is received. Reset operation must be executed immediately after power-on for devices having reset function.

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

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M7 98.8