

M54641L/FP

Bi-Directional Motor Driver with Brake Function

REJ03F0043-0100Z

Rev.1.0

Sep.19.2003

Description

The M54641 is a semiconductor integrated circuit that is capable of directly driving a smallsize bi-directional motor rotating in both forward and reverse directions.

Features

- Wide range of operating voltage ($V_{cc} = 4 - 10V, V_{cc}'(\max) = 20V$)
- Low output saturation voltage in stationary motor circuit (largevoltage across motors)
- Built-in clamp diode
- Provided with output voltage control pin (V_z)
- Built-in thermal shutdown circuit ($T_j(\text{shut}) = 120^\circ\text{C}$ standard)

Application

Sound equipment such as tape deck and radio cassette, and VTR

Function

The M54641 is an IC for driving a smallsize bi-directional motor that rotates in both forward and reverse directions. Giving signal to inputs IN1 and IN2 outputs the signal of the same phase to output pins O1 and O2. That is, giving high-level signal to input IN1 and low-level signal to input IN2 sets output O1 to high-level and output O2 to low-level. Connection of a motor between output pins O1 and O2 uses O1 as an output current source and O2 as an output current sink to rotate the motor. In addition, giving the reverse signal to inputs IN1 and IN2 sets O1 and O2 to low-level and high-level, respectively, resulting in rotating the motor reversely.

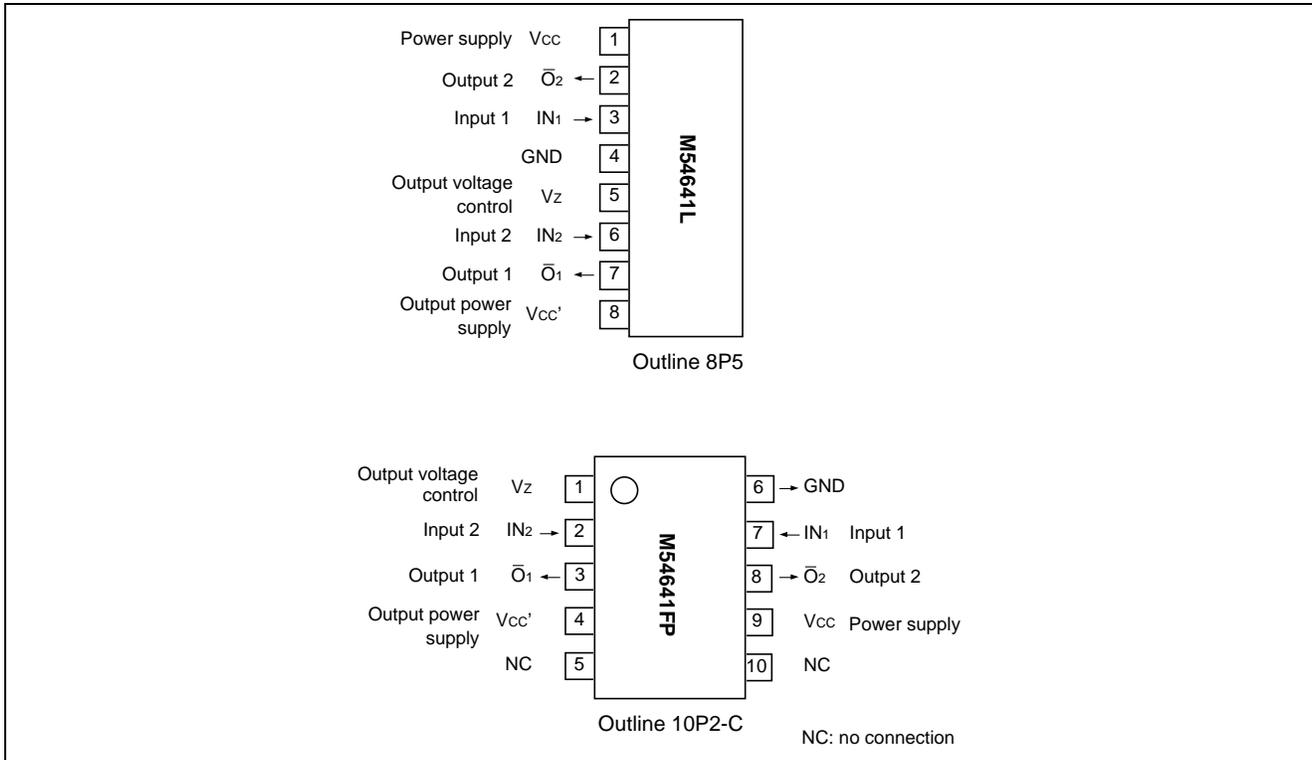
However, when both IN1 and IN2 are set to "H", both O1 and O2 are set to low-level, resulting in sudden stop of motor rotation. (Brake mode)

If the Zener diode of certain voltage, for example, is added to the V_z pin, the output "H" voltage does not rise over the Zener voltage and the motor rotates at constant speed.

If the V_z pin is connected to the output power supply V_{cc}' pin, the rotating speed of the motor can be varied by varying the V_{cc}' voltage.

The motor rush current and the current with the motor put in stationary status are as follows: $I_{op}(\max) = 800\text{mA}$ and $I_o(\max) = 150\text{mA}$.

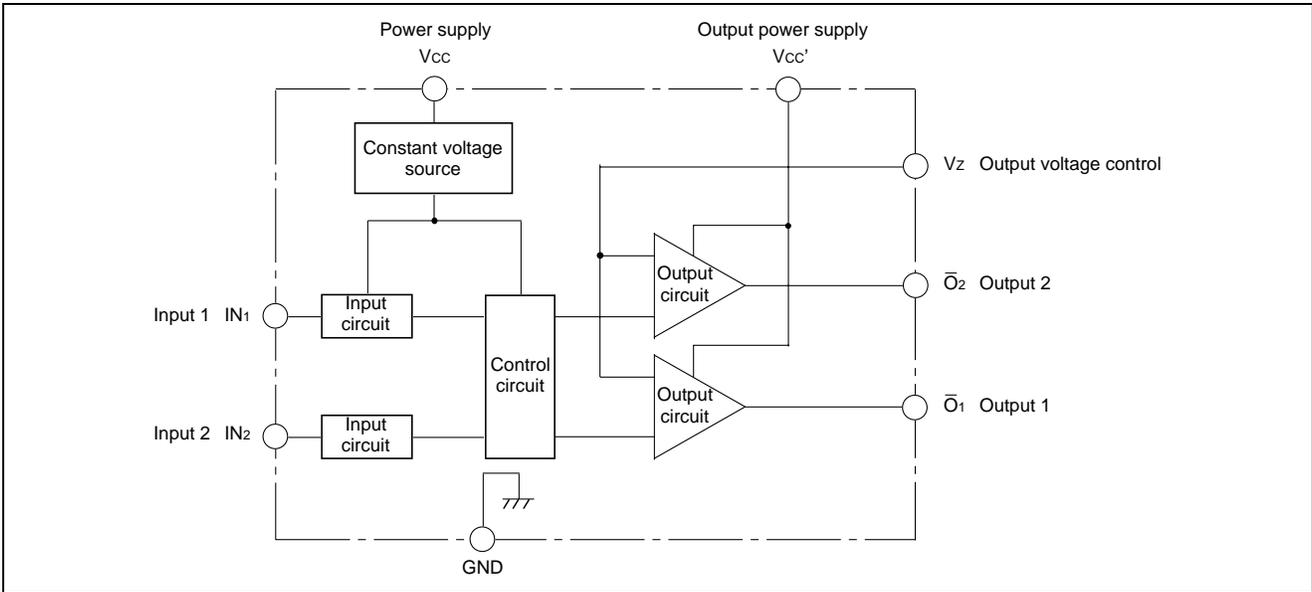
Pin Configuration



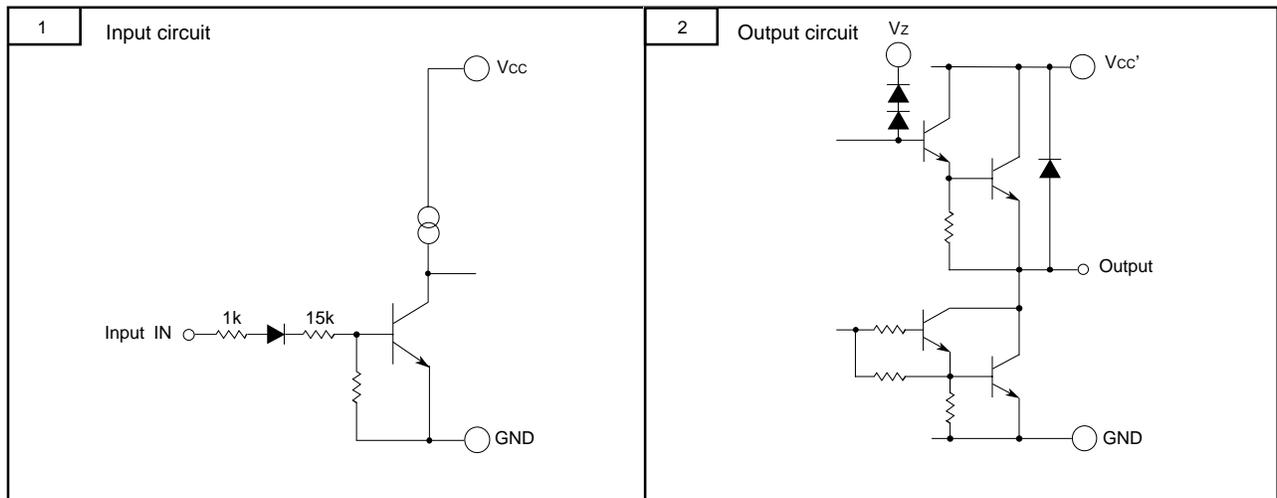
Logic Truth Table

Input		Output		Remarks
IN1	IN2	\bar{O}_1	\bar{O}_2	
	L	"OFF" state	"OFF" state	No operation of IC
H	L	H	L	ex Forward rotation
L	H	L	H	Reverse rotation
H	H	L	L	Brake

Block Diagram



Though the IC is equipped with a thermal shutdown circuit for prevention against thermal breaking, the threshold temperature is set to 100°C min. Set the driving current in such a way that this thermal shutdown circuit cannot operate during normal operation.



Absolute Maximum Ratings

(Ta = 25°C, unless otherwise noted.)

Parameter	Symbol	Ratings	Unit	Conditions
Supply voltage	V _{CC}	-0.5 to +12	V	
Output Supply voltage	V _{CC} '	-0.5 to +20	V	
Input voltage	V _I	0 to V _{CC}	V	V _I < V _{CC}
Output voltage	V _O	-0.5 to V _{CC} ' + 2.5	V	
Allowable motor rush current	I _O (max)	±800	mA	t _{OP} = 10ms: cycle time 0.2Hz or less
Continuous output current	I _O	±150	mA	
Power dissipation	Pd	570	mW	Ta = 60°C(M54641L)
Junction temperature	T _J	100	°C	
Operating temperature	T _{OP}	-10 to 60	°C	
Storage temperature	T _{STG}	-55 to 125	°C	

Recommended Operating Condition

(Ta = 25°C, unless otherwise noted.)

Parameter	Symbol	Limits			Unit
		Min.	Typ.	Max.	
Supply voltage	V _{CC}	4	5	10	V
Output current	I _O			±100	mA
"H" input voltage	V _{IH}	3.0		V _{CC}	V
"L" input voltage	V _{IL}	0		0.6	V
Motor braking interval	t _S	10	100		ms
Operation temperature of thermal protection circuit (junction temperature)	T _S	100	120		°C

Electrical characteristics

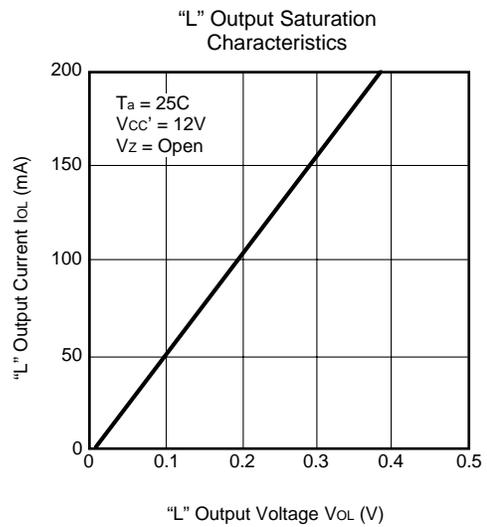
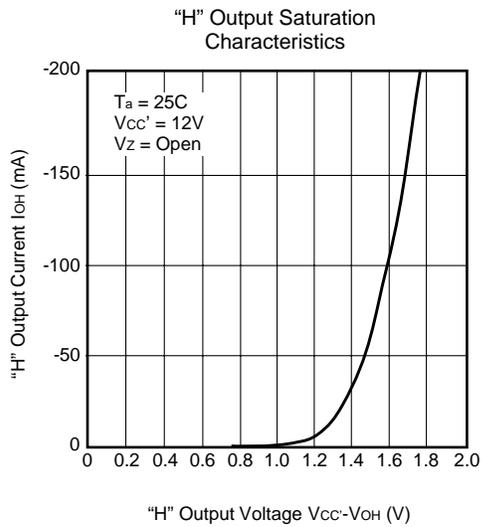
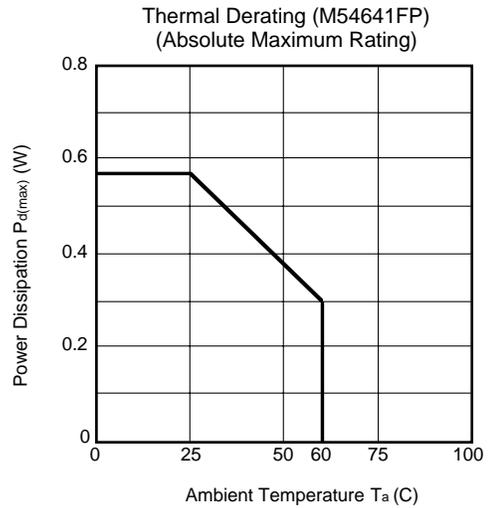
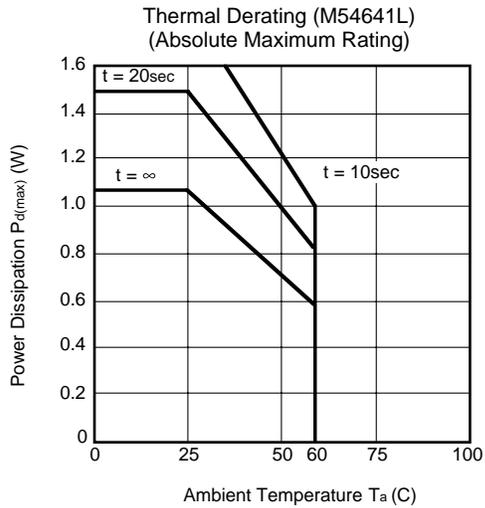
(Ta = 25°C, V_{CC} = 5.0V, unless otherwise noted.)

Parameter	Symbol	Limits			Unit	Test conditions
		Min.	Typ.	Max.		
Output leak current	I _O (leak)			100 -100	μA	V _{CC} ' = 20V V _Z : Open V _O = 20V V _O = 0V
"H" output saturation voltage	V _{OH}	10.2 10.0	10.5 10.4		V	V _{CC} ' = 12V V _Z : Open I _{OH} = -50mA I _{OH} = -100mA
"L" output saturation voltage	V _{OL}		0.1 0.2	0.3 0.4	V	V _{CC} ' = 12V V _Z : Open I _{OH} = 50mA I _{OH} = 100mA
Voltage between outputs (1) and (2) (Voltage across Motor)	V _{O1-O2}	6.3	7.0	7.7	V	V _{CC} ' = 12V V _Z = 7V I _O = ±100mA
Input voltage	I _I		100 240	180 380	μA	V _{CC} ' = 12V V _I = 3V V _I = 5V Output open
Supply current	I _{CC}		1.2 4.5 7.5	3.0 8.0 12.0	mA	V _{CC} = 10V V _{CC} ' = 12V Output OPEN In "OFF" state Forward rotation or reverse rotation Braking

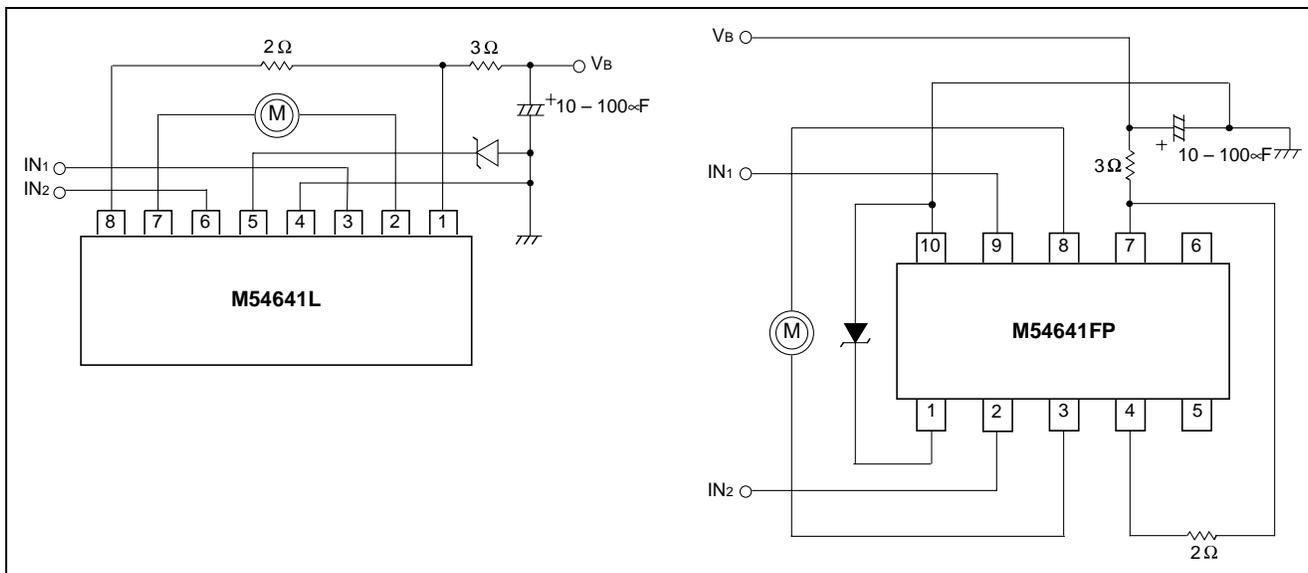
Typical Characteristics

Condition

- With basic installation (epoxy board of 5cm x 5cm x 0.8mm with copper foil on a single side)
- t : Power apply time



Application Example



CAUTIONS

Since the thermal protection function of this IC may not work in abnormal status (oscillation, low supply voltage, output short-circuit, etc.), check the operation in the IC installation status when using this function.

When the motor back electromotive force is large with the brakes applied, for example, malfunction may occur in internal parasitic Di.

If flyback current of 1A or more flows, add Schottky Di to the portion between the output and the GND.

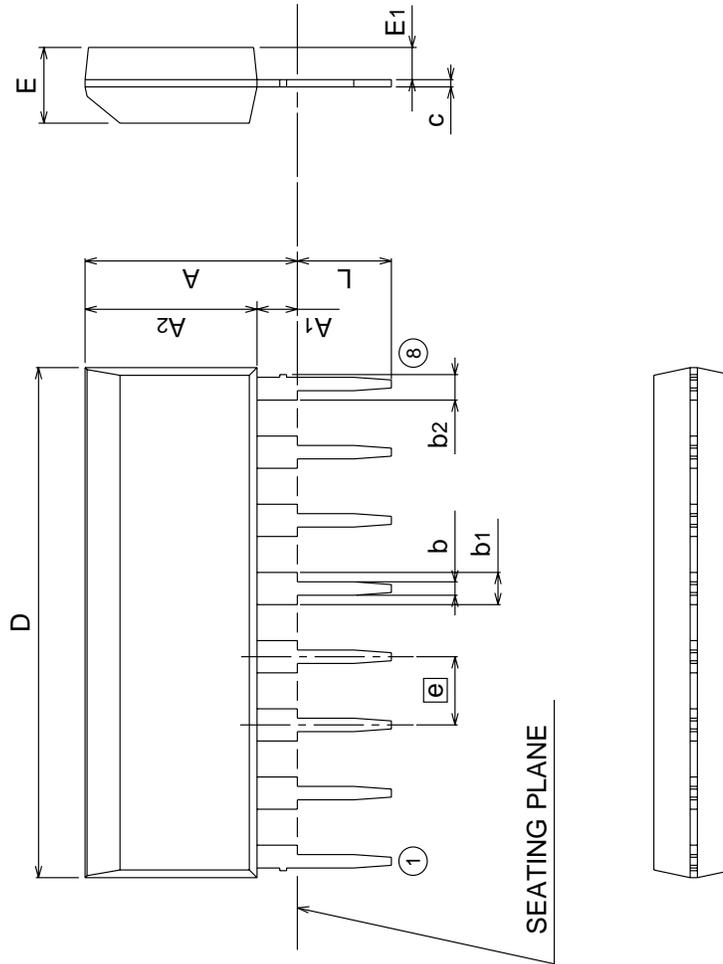
When the IC is used at a high speed for PWM, etc., note that switching of output results in delay of approx. 10μs.

Package Dimensions

8P5

Plastic 8pin 340mil SIP

EIAJ Package Code SIP8-P-340-2.54	JEDEC Code —	Weight(g) 0.73	Lead Material Cu Alloy
--------------------------------------	-----------------	-------------------	---------------------------

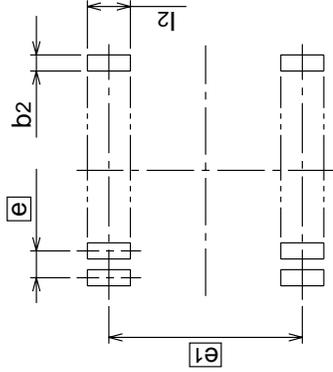
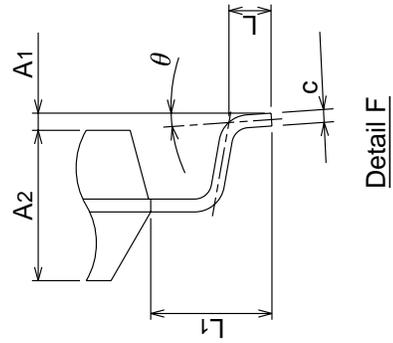
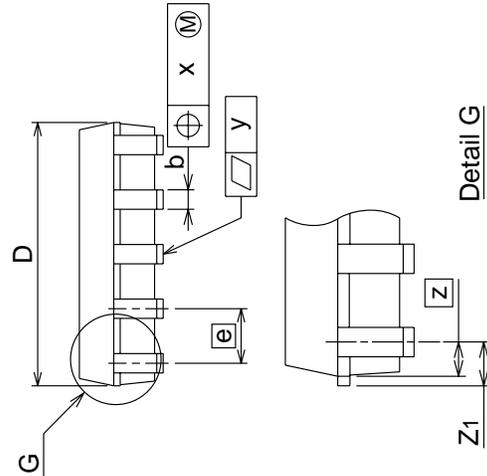
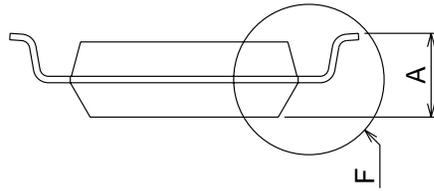
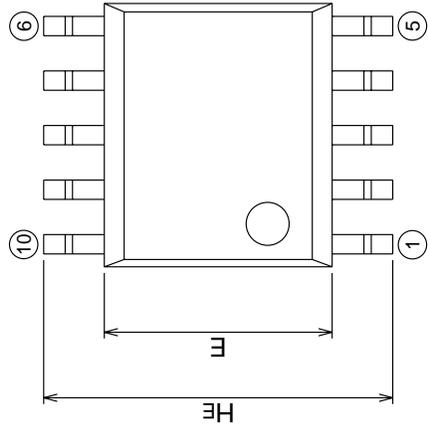


Symbol	Dimension in Millimeters		
	Min	Norm	Max
A	—	—	8.3
A1	1.2	—	—
A2	—	6.4	—
b	0.4	0.5	0.6
b1	1.1	1.2	1.5
b2	0.75	0.85	1.15
c	0.22	0.27	0.34
D	18.8	19.0	19.2
E	2.6	2.8	3.0
E1	1.1	1.2	1.3
e	—	2.54	—
L	3.0	—	—

10P2-C

EIAJ Package Code SOP10-P-300-1.27	JEDEC Code —	Weight(g) 0.12	Lead Material Alloy 42/Cu Alloy
---------------------------------------	-----------------	-------------------	------------------------------------

Plastic 10pin 300mil SOP



Recommended Mount Pad

Symbol	Dimension in Millimeters		
	Min	Nom	Max
A	—	—	2.15
A1	0.05	—	—
A2	—	1.75	—
b	0.4	0.45	0.55
c	0.13	0.15	0.2
D	5.93	6.13	6.33
E	5.1	5.3	5.5
e	—	1.27	—
HE	7.82	8.12	8.42
L	0.3	0.5	0.7
L1	—	1.41	—
Z	—	0.525	—
Z1	—	—	0.675
x	—	—	0.25
y	—	—	0.1
θ	0°	—	10°
b2	—	0.76	—
e1	—	7.62	—
l2	—	1.27	—

RENESAS Technology Corp. Sales Strategic Planning Div. Nippon Bldg., 2-6-2, Ohte-machi, Chiyoda-ku, Tokyo 100-0004, Japan

Keep safety first in your circuit designs!

1. Renesas Technology Corp. puts the maximum effort into making semiconductor products better and more reliable, but there is always the possibility that trouble may occur with them. Trouble with semiconductors may lead to personal injury, fire or property damage.
Remember to give due consideration to safety when making your circuit designs, with appropriate measures such as (i) placement of substitutive, auxiliary circuits, (ii) use of nonflammable material or (iii) prevention against any malfunction or mishap.

Notes regarding these materials

1. These materials are intended as a reference to assist our customers in the selection of the Renesas Technology Corp. product best suited to the customer's application; they do not convey any license under any intellectual property rights, or any other rights, belonging to Renesas Technology Corp. or a third party.
 2. Renesas Technology Corp. assumes no responsibility for any damage, or infringement of any third-party's rights, originating in the use of any product data, diagrams, charts, programs, algorithms, or circuit application examples contained in these materials.
 3. All information contained in these materials, including product data, diagrams, charts, programs and algorithms represents information on products at the time of publication of these materials, and are subject to change by Renesas Technology Corp. without notice due to product improvements or other reasons. It is therefore recommended that customers contact Renesas Technology Corp. or an authorized Renesas Technology Corp. product distributor for the latest product information before purchasing a product listed herein.
The information described here may contain technical inaccuracies or typographical errors.
Renesas Technology Corp. assumes no responsibility for any damage, liability, or other loss rising from these inaccuracies or errors.
Please also pay attention to information published by Renesas Technology Corp. by various means, including the Renesas Technology Corp. Semiconductor home page (<http://www.renesas.com>).
 4. When using any or all of the information contained in these materials, including product data, diagrams, charts, programs, and algorithms, please be sure to evaluate all information as a total system before making a final decision on the applicability of the information and products. Renesas Technology Corp. assumes no responsibility for any damage, liability or other loss resulting from the information contained herein.
 5. Renesas Technology Corp. semiconductors are not designed or manufactured for use in a device or system that is used under circumstances in which human life is potentially at stake. Please contact Renesas Technology Corp. or an authorized Renesas Technology Corp. product distributor when considering the use of a product contained herein for any specific purposes, such as apparatus or systems for transportation, vehicular, medical, aerospace, nuclear, or undersea repeater use.
 6. The prior written approval of Renesas Technology Corp. is necessary to reprint or reproduce in whole or in part these materials.
 7. If these products or technologies are subject to the Japanese export control restrictions, they must be exported under a license from the Japanese government and cannot be imported into a country other than the approved destination.
Any diversion or reexport contrary to the export control laws and regulations of Japan and/or the country of destination is prohibited.
 8. Please contact Renesas Technology Corp. for further details on these materials or the products contained therein.
-



RENESAS SALES OFFICES

<http://www.renesas.com>

Renesas Technology America, Inc.
450 Holger Way, San Jose, CA 95134-1368, U.S.A
Tel: <1> (408) 382-7500 Fax: <1> (408) 382-7501

Renesas Technology Europe Limited.
Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, United Kingdom
Tel: <44> (1628) 585 100, Fax: <44> (1628) 585 900

Renesas Technology Europe GmbH
Dornacher Str. 3, D-85622 Feldkirchen, Germany
Tel: <49> (89) 380 70 0, Fax: <49> (89) 929 30 11

Renesas Technology Hong Kong Ltd.
7/F., North Tower, World Finance Centre, Harbour City, Canton Road, Hong Kong
Tel: <852> 2265-6688, Fax: <852> 2375-6836

Renesas Technology Taiwan Co., Ltd.
FL 10, #99, Fu-Hsing N. Rd., Taipei, Taiwan
Tel: <886> (2) 2715-2888, Fax: <886> (2) 2713-2999

Renesas Technology (Shanghai) Co., Ltd.
26/F., Ruijin Building, No.205 Maoming Road (S), Shanghai 200020, China
Tel: <86> (21) 6472-1001, Fax: <86> (21) 6415-2952

Renesas Technology Singapore Pte. Ltd.
1, Harbour Front Avenue, #06-10, Keppel Bay Tower, Singapore 098632
Tel: <65> 6213-0200, Fax: <65> 6278-8001