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 (Tj(shut) = 120°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.
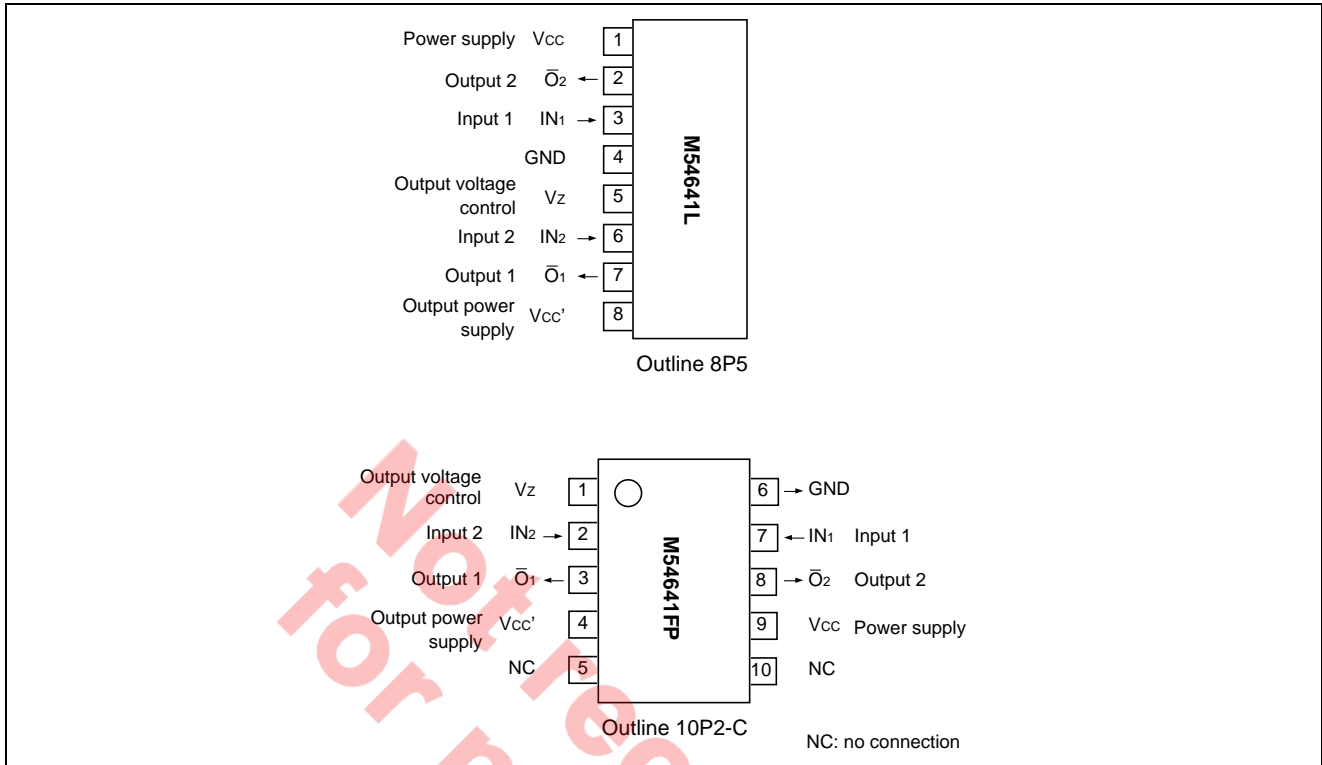
However, when both IN1 and IN2 are set to "H", both O1 and O2 are set to low-level, resulting in sudden stop of motor rotation. (Brake mode)

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: Iop(max) = 800mA and I_o(max) = 150mA.
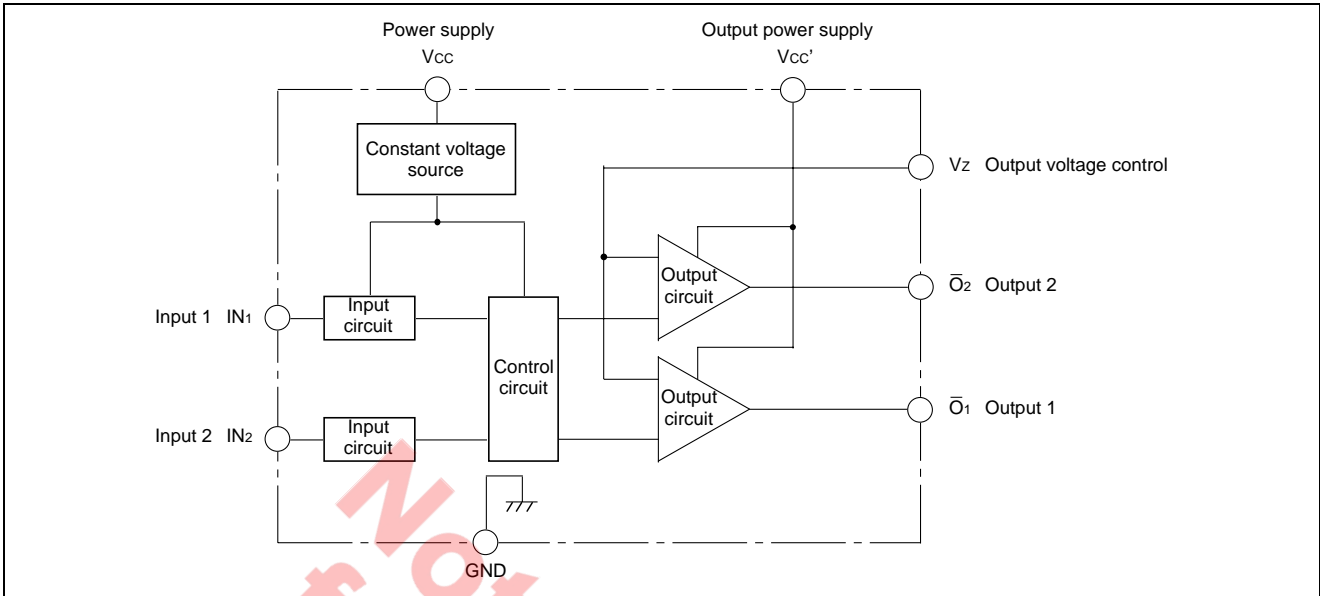
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## Pin Configuration

Outline 8P5

Outline 10P2-C

NC: no connection

Logic Truth Table

Input		Output		
IN1	**IN2**	**$\overline{O}1$**	**$\overline{O}2$**	**Remarks**
	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

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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.
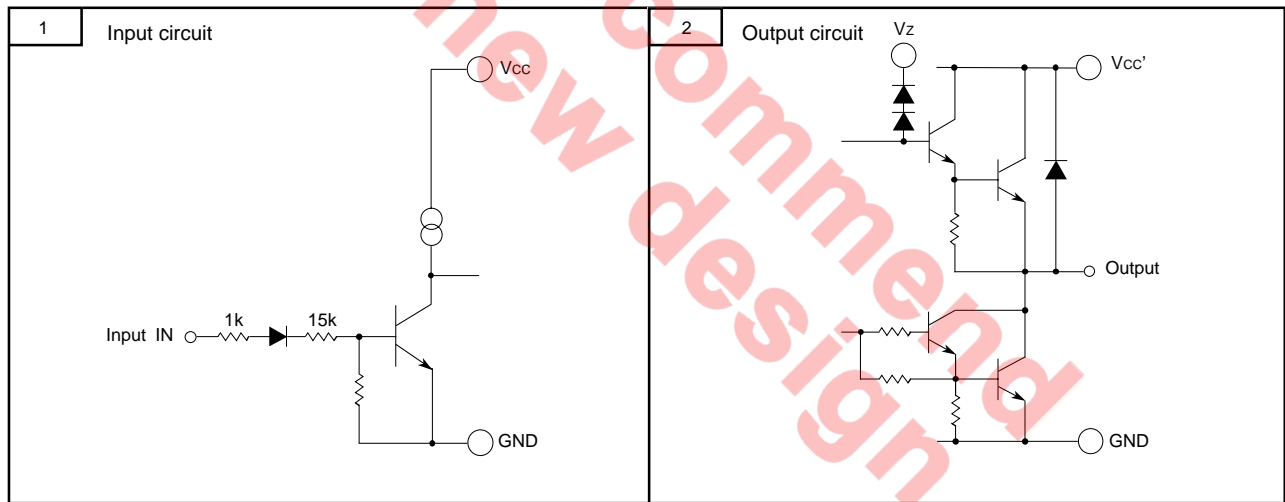
Absolute Maximum Ratings

(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 Vcc	V	VI<VCC
Output voltage	V_O	−0.5 to VCC'+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	Tj	100	°C	
Operating temperature	Topr	−10 to 60	°C	
Storage temperature	Tstg	−55 to 125	°C	

Recommended Operating Condition

(Ta = 25°C, unless otherwise noted.)

Parameter	Symbol	Limits Min.	Typ.	Max.	Unit
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.)

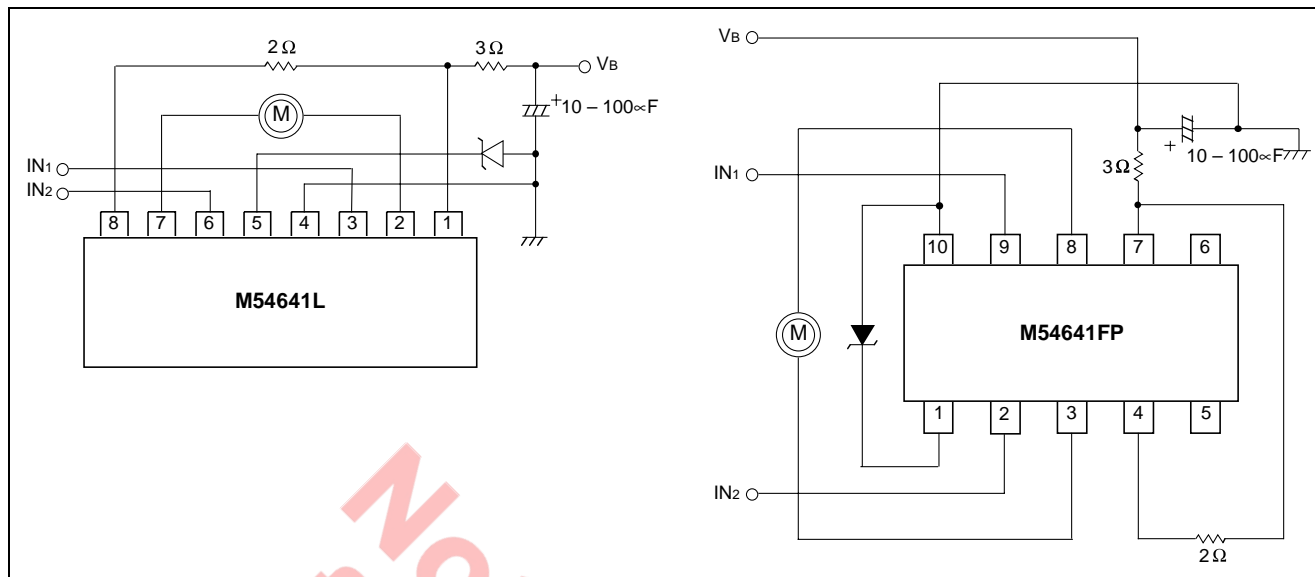| Parameter	Symbol	Limits Min.	Typ.	Max.	Unit	Test conditions	
Output leak current	$I_O(leak)$			100	µA	V_{cc}' = 20V V_z: Open	V_O = 20V
				−100			V_O = 0V
"H" output saturation voltage	V_{OH}	10.2	10.5		V	V_{cc}' = 12V V_z: Open	I_{OH} = −50mA
		10.0	10.4				I_{OH} = −100mA
"L" output saturation voltage	V_{OL}		0.1	0.3	V	V_{cc}' = 12V V_z: Open	I_{OH} = 50mA
			0.2	0.4			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	180	µA	V_{cc}' = 12V V_I = 3V	Output open
			240	380		V_I = 5V	
Supply current	I_{cc}		1.2	3.0	mA	V_{cc} = 10V V_{cc}' = 12V Output OPEN	In "OFF" state
			4.5	8.0			Forward rotation or reverse rotation
			7.5	12.0			Braking

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Typical Characteristics

Condition

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

Thermal Derating (M54641L)
(Absolute Maximum Rating)

Thermal Derating (M54641FP)
(Absolute Maximum Rating)

"H" Output Saturation
Characteristics

"L" Output Saturation
Characteristics
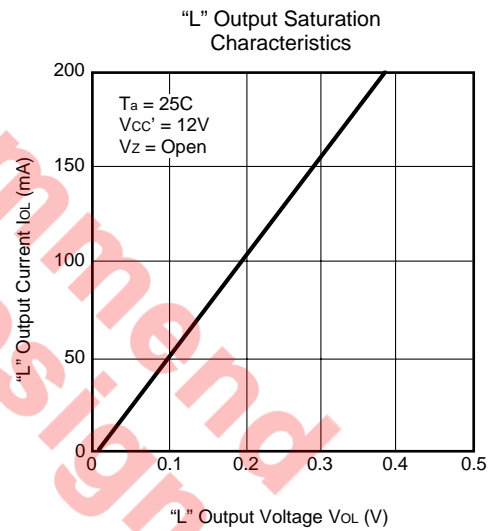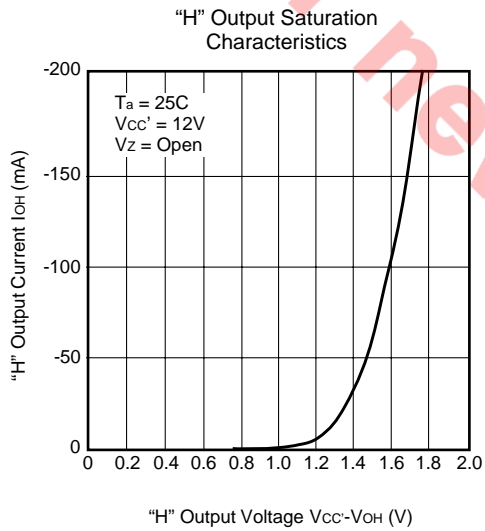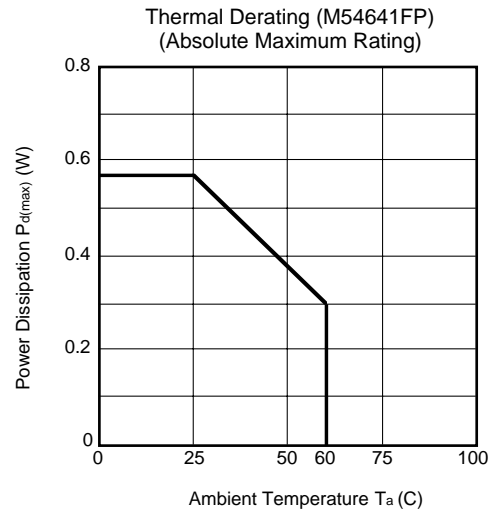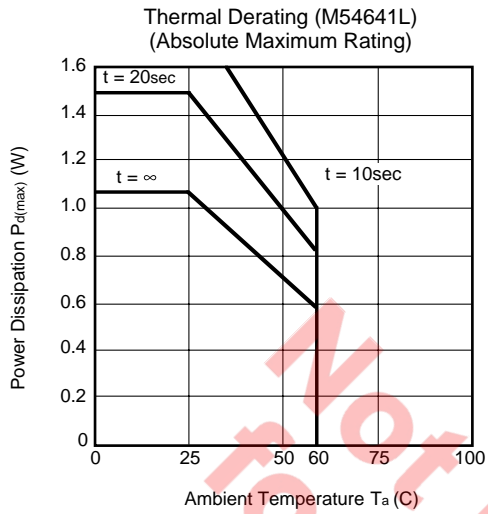
Application Example

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.

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Package Dimensions

Plastic 8pin 340mil SIP

8P5

EIAJ Package Code	JEDEC Code	Weight(g)	Lead Material
SIP8-P-340-2.54	—	0.73	Cu Alloy
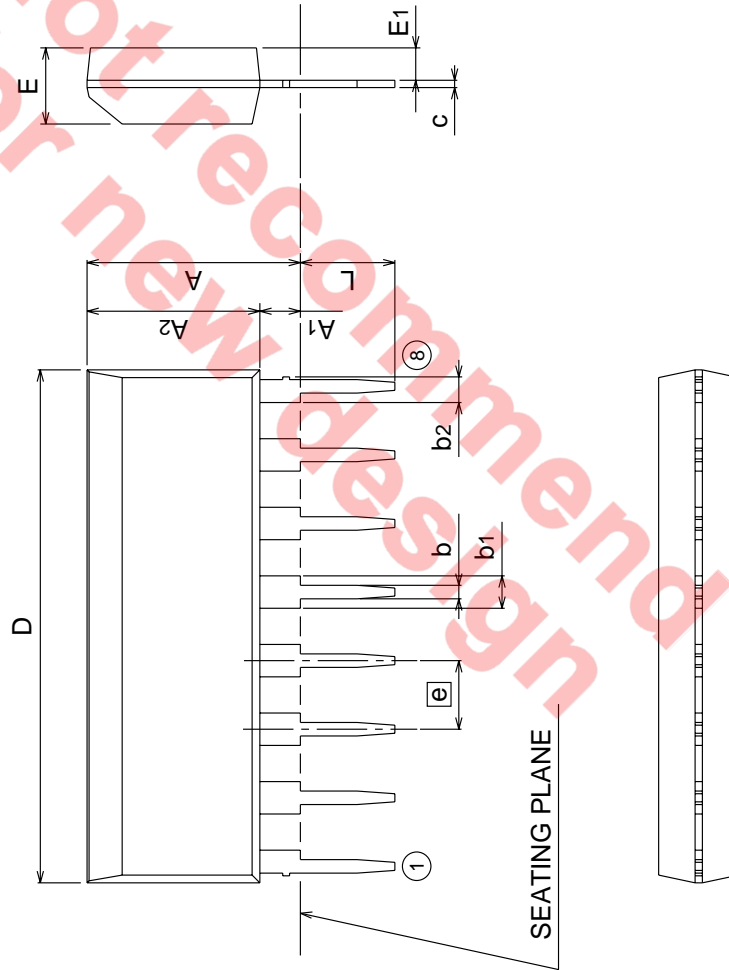
Symbol	Dimension in Millimeters		
	Min	Nom	Max
A	—	—	8.3
A1	1.2	—	—
A2	—	6.4	—
b	0.4	0.5	0.6
b1	1.1	1.2	1.5
b2	0.75	0.85	1.15
c	0.22	0.27	0.34
D	18.8	19.0	19.2
E	2.6	2.8	3.0
E1	1.1	1.2	1.3
e	—	2.54	—
L	3.0	—	—

SEATING PLANE

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10P2-C

Plastic 10pin 300mil SOP

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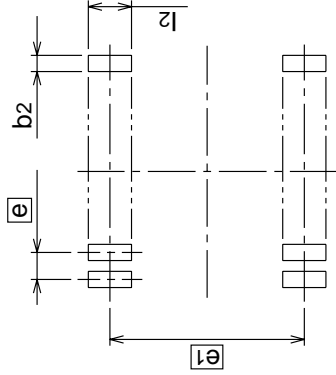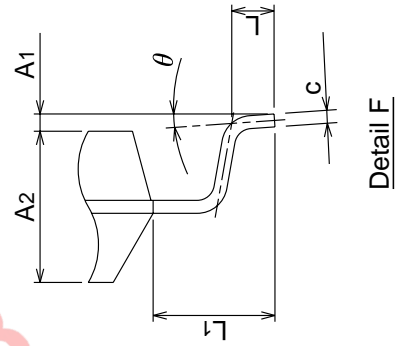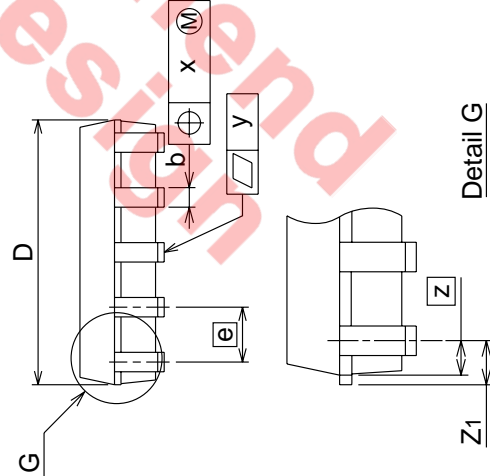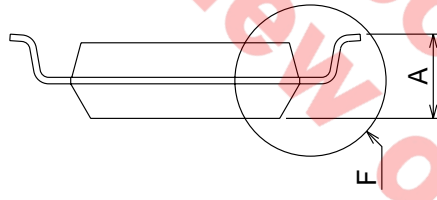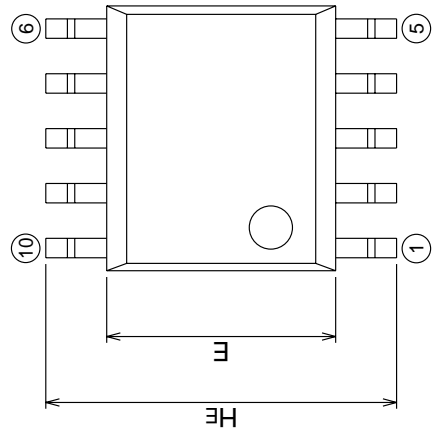
Recommended Mount Pad

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	0.675
Z1	—	—	0.25
x	—	—	0.1
y	—	—	0.1
θ	0°	—	10°
b2	—	0.76	—
e1	—	7.62	—
l2	—	1.27	—

Detail F

Detail G

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