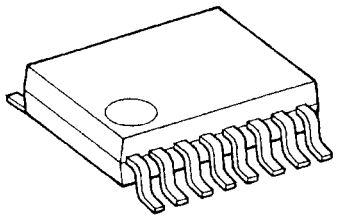
Toshiba Bi-CD Integrated Circuit Silicon Monolithic

TB6552FN,TB6552FL

Dual-Bridge Driver IC for DC motor

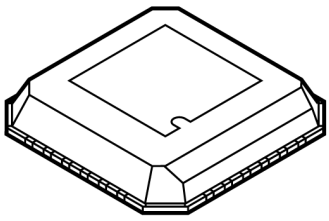
TB6552FN/FL is a dual-bridge driver IC for DC motor with output transistor in LD MOS structure with low ON-resistor. Two input signals, IN1 and IN2, can chose one of four modes such as CW, CCW, short brake, and stop mode. Efficient driven at high temperature is possible by PWM drive system.

TB6552FN



SSOP16-P-225-0.65B

TB6552FL



QON24-P-0505-0.50

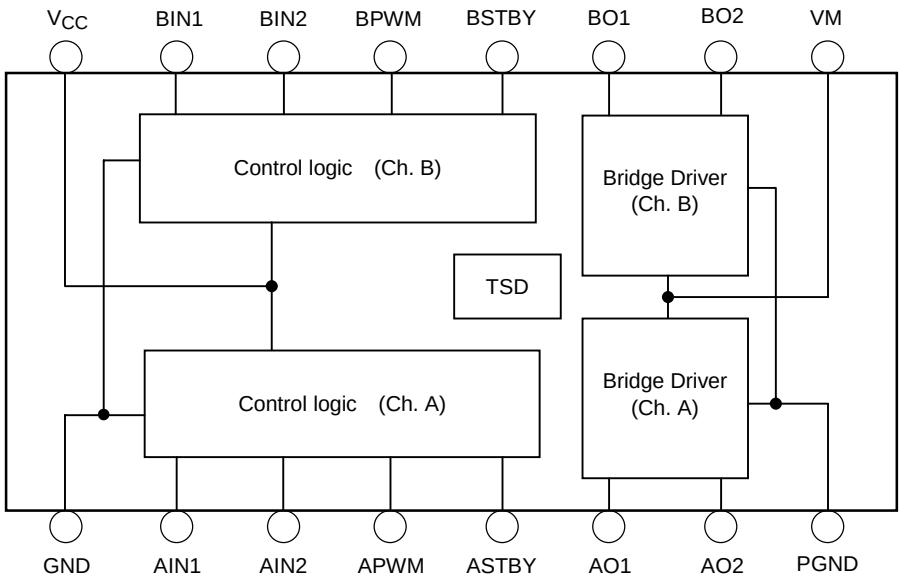
Weight
SSOP16-P-225-0.65B : 0.07 g (typ.)
QON24-P-0505-0.50 : 0.05 g (typ.)

Features

- Power supply voltage for motor: VM ≤ 15 V (max)
- Power supply voltage for control: V_{CC} = 2.7 V to 6.0 V
- Output current: 1 A (max)
- Low ON resistor: 1.5 Ω (typ.)
  (Upper side + Lower side combined @ VM = 5 V)
- Direct PWM control
- Standby system (Power save)
- CW/CCW/short brake/stop function modes.
- Built-in thermal shutdown circuit
- Package: SSOP16 for TB6552FN /QON24 for TB6552FL

* This product has a MOS structure and is sensitive to electrostatic discharge. When handling this product, ensure that the environment is protected against electrostatic discharge by using an earth strap, a conductive mat and an ionizer. Ensure also that the ambient temperature and relative humidity are maintained at reasonable levels.

Block Diagram



Pin Functions

Pin.Name	Pin No		Functional Description	Remarks
	FN	FL		
GND	1	21	Small-signal GND pin	GND for small-signal power supply (V_{CC})
AIN1	2	18	Control signal input 1 (Ch. A)	
AIN2	3	17	Control signal input 2 (Ch. A)	
APWM	4	16	PWM control signal input pin (Ch. A)	Input PWM signal
ASTBY	5	15	Standby control input pin (Ch. A)	Ch. A circuit is in standby (power save) state while this signal is Low.
AO1	7	13	Output pin 1 (Ch. A)	Ch. A connect to motor coil pin
AO2	8	11	Output pin 2 (Ch. A)	Ch. A connect to motor coil pin
PGND	9	10	GND pin for motor	GND for motor power supply (VM)
VM	6	14	Motor power supply pin	VM (ope) = 2.5 V to 13.5 V
BO2	10	8	Output pin 2 (Ch. B)	Ch. B connect to motor coil pin
BO1	11	5	Output pin 1 (Ch. B)	Ch. B connect to motor coil pin
BSTBY	12	4	Standby control input pin (Ch. B)	Ch. B circuit is in standby (power save) state while this signal is Low.
BPWM	13	3	PWM control signal input pin (Ch. B)	Input PWM signal
BIN2	14	2	Control signal input 2 (Ch. B)	
BIN1	15	1	Control signal input 1 (Ch. B)	
V_{CC}	16	22	Small-signal power supply pin	$V_{CC\ (ope)}$ = 2.7 V to 5.5 V

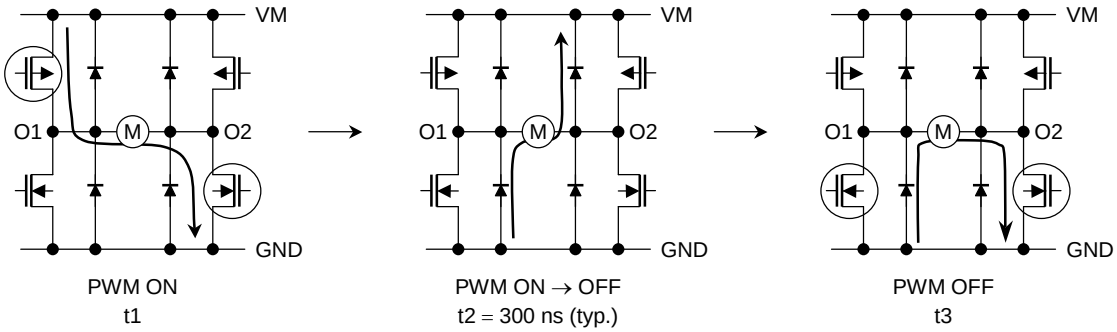
Note: Pins 6, 7, 9, 12, 19, 20, 23 and 24 on the FL are NC (not connected) pins.

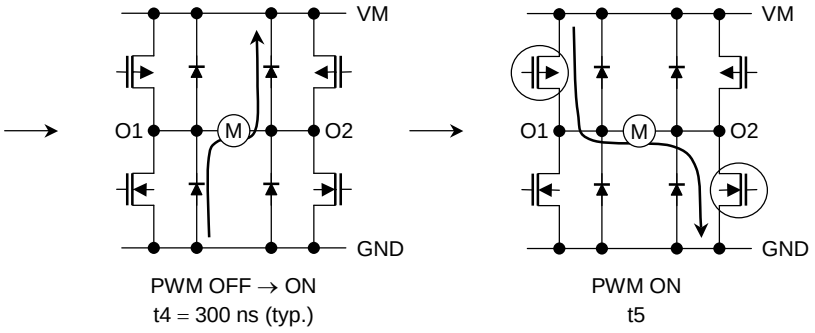
Input/Output Function (common for channel A and B)

Input				Output		
IN1	IN2	STBY	PWM	O1	O2	Mode
H	H	H	H	L	L	Short brake
			L			
L	H	H	H	L	H	CW/CCW
			L	L	L	Short brake
H	L	H	H	H	L	CCW/CW
			L	L	L	Short brake
L	L	H	H	OFF (high impedance)		Stop
			L			
H/L	H/L	L	H	OFF (high impedance)		Standby
			L			

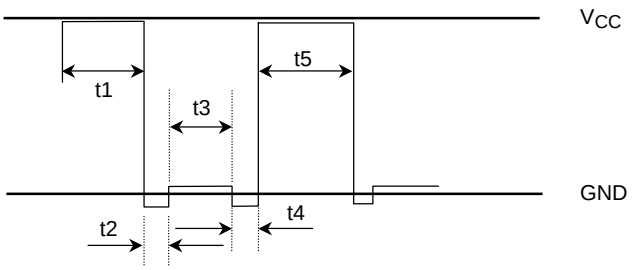
Operating Description

- PWM control function
  Speed can be controlled by inputting the high-level or low-level PWM signal to the pin PWM.
  When PWM control is provided, normal operation and short brake operation are repeated.
  To prevent penetrating current, dead time t2 and t4 is provided in the IC.





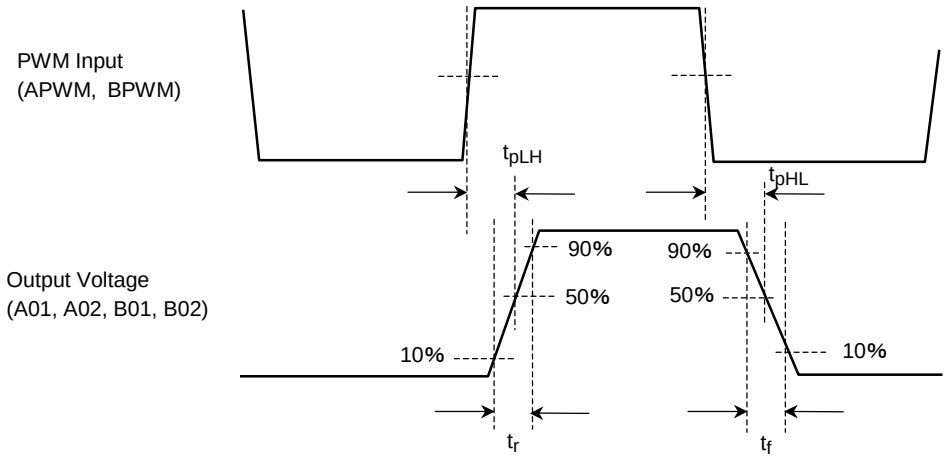
Output Voltage Waveform (O1)



Note: Please set the pin PWM to High when PWM control functionn is not used.

- Switching characteristics of output transistors

  The switching characteristics between PWM input and the output transistors are shown below.



<Typical Value>

Item	Typical Value	Unit
t_{pLH}	1000	ns
t_{pHL}	1000	
t_r	100	
t_f	100	

- Input pin

  Input pins (AIN1, AIN2, APWM, ASTBY, BIN1, BIN2, BPWM and BSTBY) have internal pull-down resistors that are connected to ground.

Maximum Ratings (Ta = 25°C)

Characteristics	Symbol	Rating	Unit	Remarks
Supply voltage	VM	15	V	
	V_{CC}	6		
Input voltage	V_{IN}	−0.2 to 6	V	IN1, 2, STBY and PWM pins
Output current	I_{OUT}	1	A	
Power dissipation	P_D	0.78 (Note 1)	W	
Operating temperature	T_{opr}	−20 to 85	°C	
Storage temperature	T_{stg}	−55 to 150	°C	

Note 1: This value is obtained by 50 × 30 × 1.6 mm glass-epoxy PCB mounting occupied 40% of copper area.

Operating Range (Ta = −20 to 85°C)

Characteristics	Symbol	Min	Typ.	Max	Unit
Supply voltage (V_{CC})	V_{CC}	2.7	3.0	5.5	V
Supply voltage (VM)	VM	2.5	5.0	13.5	V
Output current	Iout	—	—	0.8	A
PWM frequency	fPWM	—	—	100	kHz

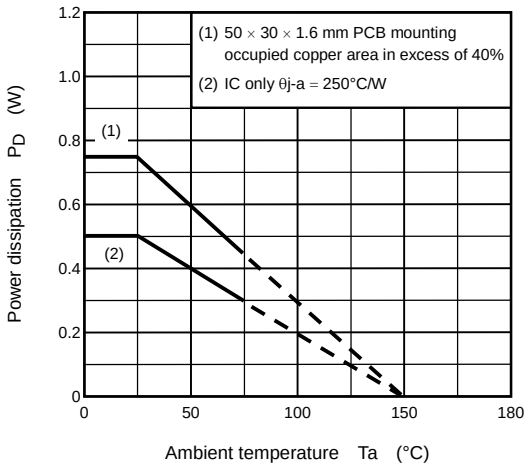
Electrical Characteristics (unless otherwise specified, V_{CC} = 3 V, VM = 12 V, Ta = 25°C)

Characteristics		Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Supply current		$I_{CC\ (STP)}$	—	Stop mode	—	0.9	1.2	mA
		$I_{CC\ (W)}$	—	CW/CCW mode	—	0.9	1.2	
		$I_{CC\ (SB)}$	—	Short break mode	—	0.9	1.2	
		$I_{CC\ (STB)}$	—	(Standby mode)	—	—	10	μA
		$I_{M\ (STB)}$	—		—	—	1	
Control circuit	Input voltage	V_{INH}	—		2	—	V_{CC} + 0.2	V
		V_{INL}	—		−0.2	—	0.8	
	Hysteresis voltage	$V_{IN\ (HIS)}$	—	(Not tested)	—	0.2	—	
	Input current	I_{INH}	—		5	15	25	μA
		I_{INL}	—		—	—	1	
Standby circuit	Input voltage	V_{INSH}	—		2	—	V_{CC} + 0.2	V
		V_{INSL}	—		−0.2	—	0.8	
	Input current	I_{INSH}	—		5	10	20	μA
		I_{INSL}	—		—	—	1	
Output saturating voltage		$V_{sat\ (U+L)}$		I_O = 0.2 A	—	0.3	0.4	V
				I_O = 0.8 A	—	1.2	1.5	
Output leakage current		$I_{L\ (U)}$		VM = 15 V	—	—	1	μA
		$I_{L\ (L)}$			—	—	1	
Diode forward voltage		$V_{F\ (U)}$		I_O = 0.8 A	—	1	1.2	V
		$V_{F\ (L)}$		I_O = 0.8 A	—	1	1.2	
PWM control circuit	PWM frequency	f_{PWM}			—	—	100	kHz
	Minimum clock pulse width	$t_{w\ (PWM)}$			—	—	10	μs
Output transistor switching		Tr		Not tested	—	100	—	ns
		Tf			—	100	—	
		$t_{pLH\ (PWM)}$			—	1000	—	
		$t_{pHL\ (PWM)}$			—	1000	—	
Thermal shutdown circuit operating temperature		T_{SD}		(Not tested)	—	170	—	°C
Thermal shutdown hysteriesis		ΔT_{SD}		(Not tested)	—	20	—	°C

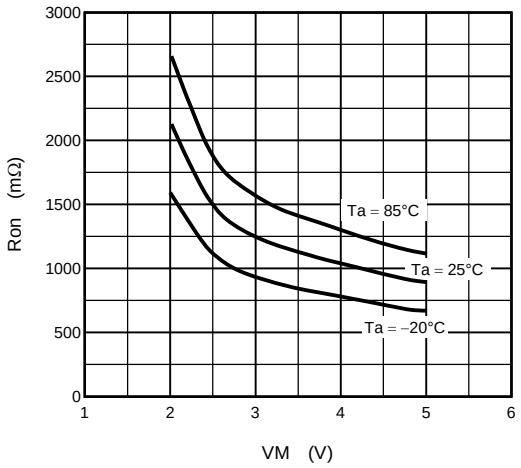
Characteristic Wave Form

TB6552FN

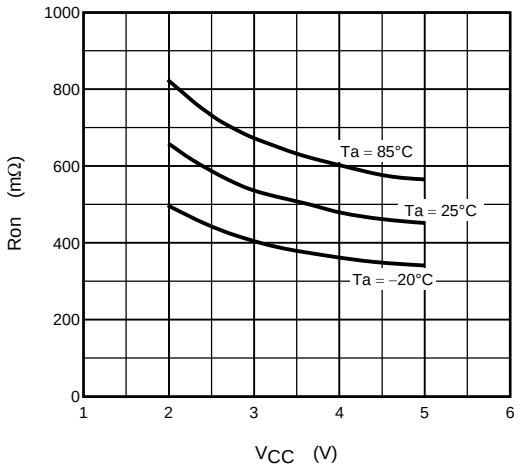
P_D – Ta



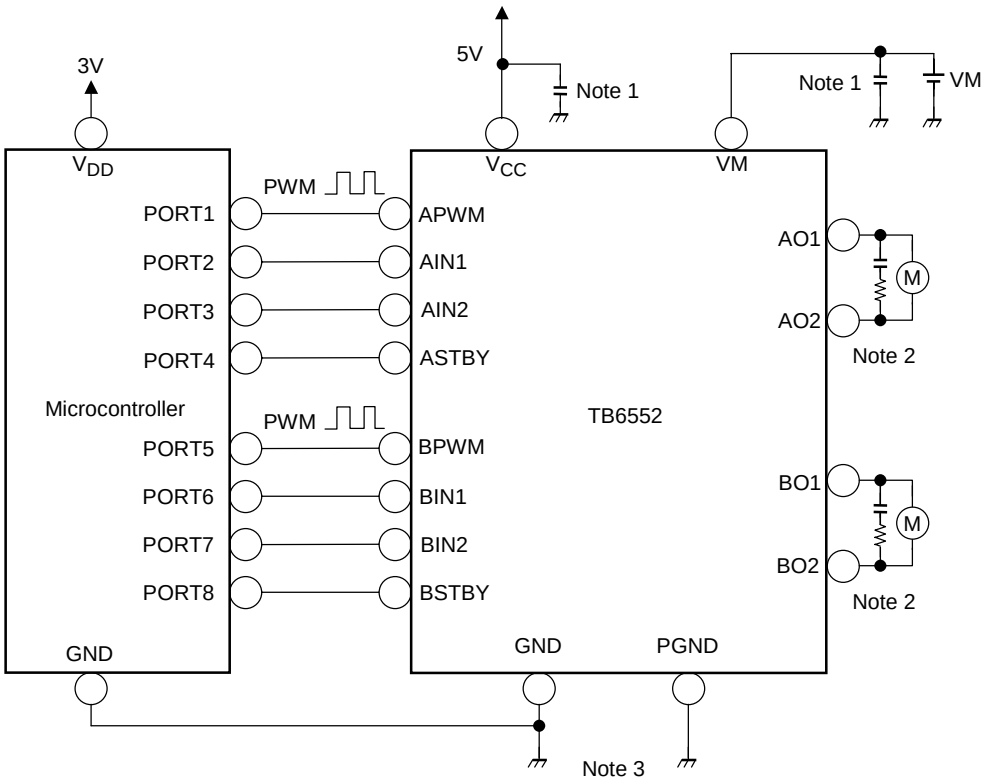
Hi-side VM – Ron



Lo-side V_{CC} – Ron



Typical Application Diagram



Note 1: The power supply capacitor should be connected as close as possible to the IC.

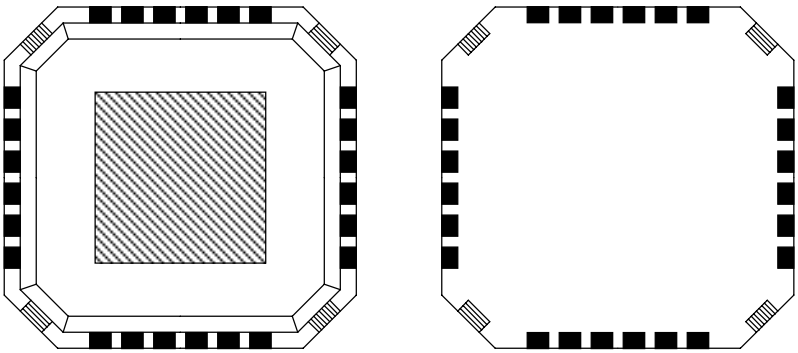
Note 2: When connecting the motor pins through the capacitor for reducing noise, connect a resistor to the capacitor for limiting the charge current.

Note 3: Avoid using common impedance for GND and PGND.

Requests Concerning Use of QON

Outline Drawing of Package

(Upper surface) (Lower surface)



When using QON, please take into account the following items.

Caution

(1) Do not carry out soldering on the island section in the four corners of the package (the section shown on the lower surface drawing with diagonal lines) with the aim of increasing mechanical strength.

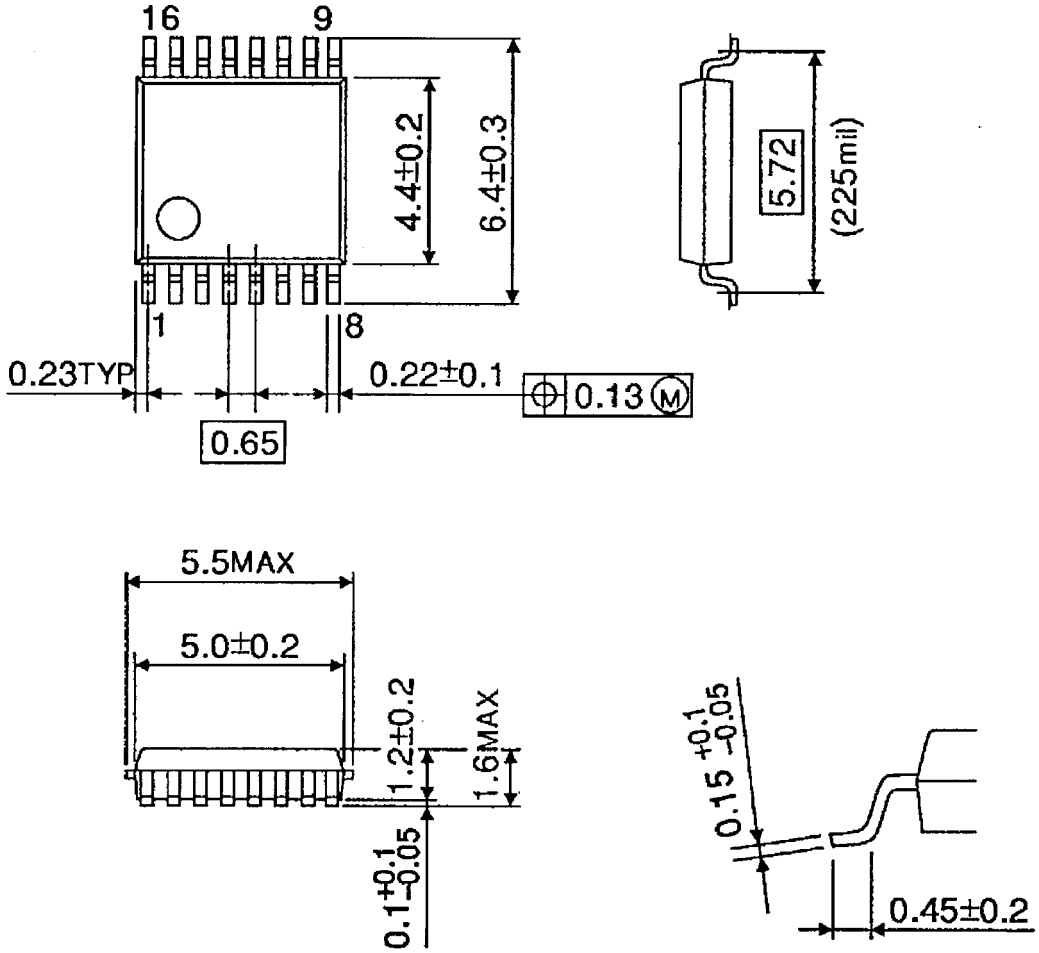
(2) The island section exposed on the package surface (the section shown on the upper surface drawing with diagonal lines) must be used as (Note 6) below while electrically insulated from outside.

Note 6: Ensure that the island section (the section shown on the lower surface drawing with diagonal lines) does not come into contact with solder from through-holes on the board layout.

- When mounting or soldering, take care to ensure that neither static electricity nor electrical overstress is applied to the IC (measures to prevent anti-static, leaks, etc.).
- When incorporating into a set, adopt a set design that does not apply voltage directly to the island section.

Package Dimensions

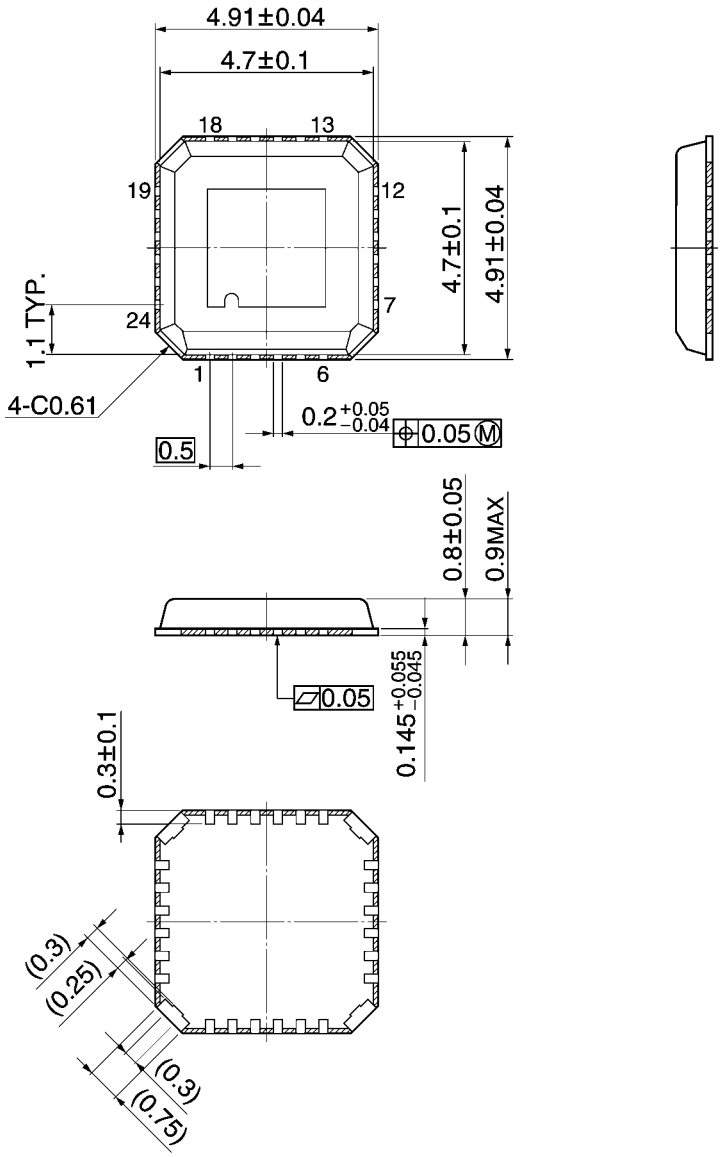
SSOP16-P-225-0.65B Unit : mm



Weight: 0.07 g (typ.)

Package Dimensions

QON24-P-0505-0.50 Unit: mm



Note 1) The solder plating portion in four corners of tne package shall not be treated as an external terminal.

Note 2) Don`t carry out soldering to four corners of the package.

Note 3) area : Resin surface

Weight: 0.05 g (typ.)

RESTRICTIONS ON PRODUCT USE

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