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TOSHIBA CMOS Integrated Circuits Silicon Monolithic

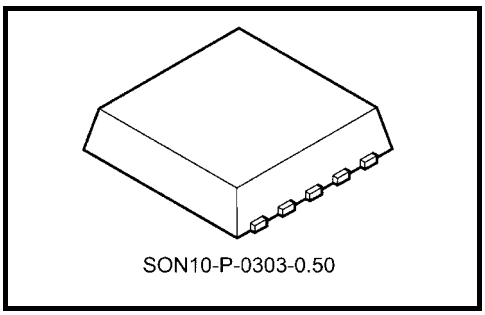
TCA62723FMG

Three-Channel Constant-Current LED Driver

The TCA62723FMG is an optimal constant-current LED driver for RGB pixel LEDs.

Moreover, it is not necessary to connect external resistance to an output in almost all cases.

The forward current of the LED is set up using the external resistor.

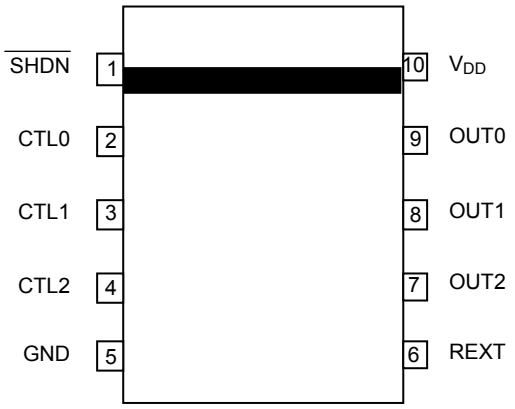


Weight: 0.018 g (typ.)

Features

- Power supply voltage range : V_{IN} = 2.7 to 5.5 V
- Constant current range : 5 to 150 mA
- Low consumption current
  - Supply current at operation (Iout = 20 mA/DC) : 700 μA(MAX)
  - Supply current at standby : 1 μA(MAX)
- For anode common LED
- Package : SON10-P-0303-0.50
  height : 0.8 mm(Typ.)

Pin Layout (Top view)



Terminal Description

Pin No.	Pin Name	Function
1	$\overline{SHDN}$	Input pin for IC ON/OFF control. When the data is “H”, the IC operates; When the data is “L”, power-saving mode applies.
2	CTL0	Input pin for OUT0 ON/OFF control. When the data is “H, OUT0 is turned on; When the data is “L”, OUT0 is turned off.
3	CTL1	Input pin for OUT1 ON/OFF control. When the data is “H, OUT1 is turned on; When the data is “L”, OUT1 is turned off.
4	CTL2	Input pin for OUT3 ON/OFF control. When the data is “H, OUT3 is turned on; When the data is “L”, OUT3 is turned off.
5	GND	GND terminal
6	REXT	This is an output current setting resistor connect terminal. The output current does not flow when this terminal is opened. Excessive output current will destroy the IC if this terminal is connected to GND.
7	OUT2	Output terminal
8	OUT1	
9	OUT0	
10	V_{IN}	2.7 V to 5.5 V supply voltage terminal

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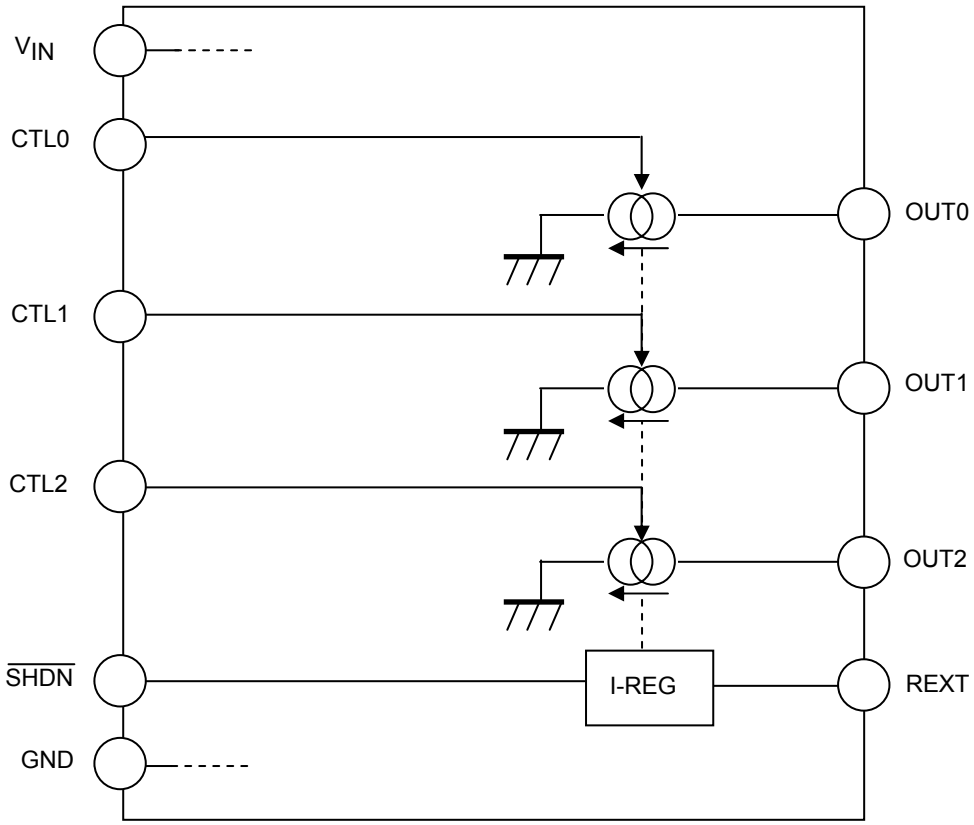
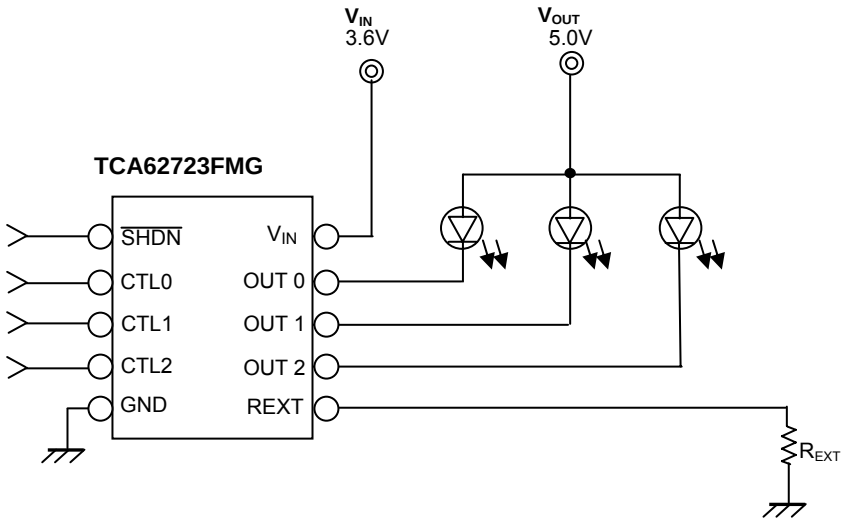
Block Diagram



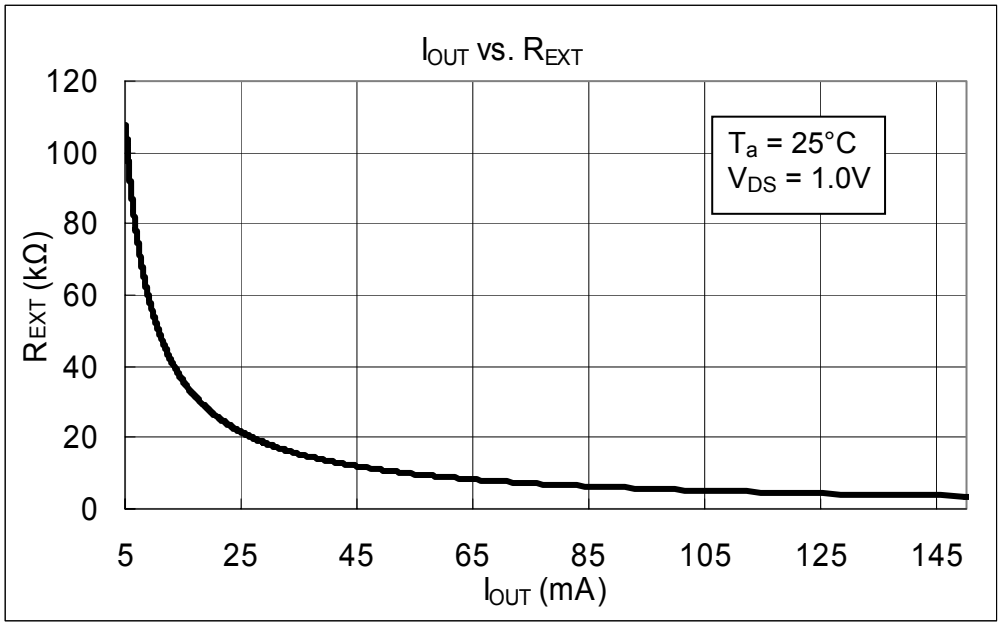
Application Circuit Example



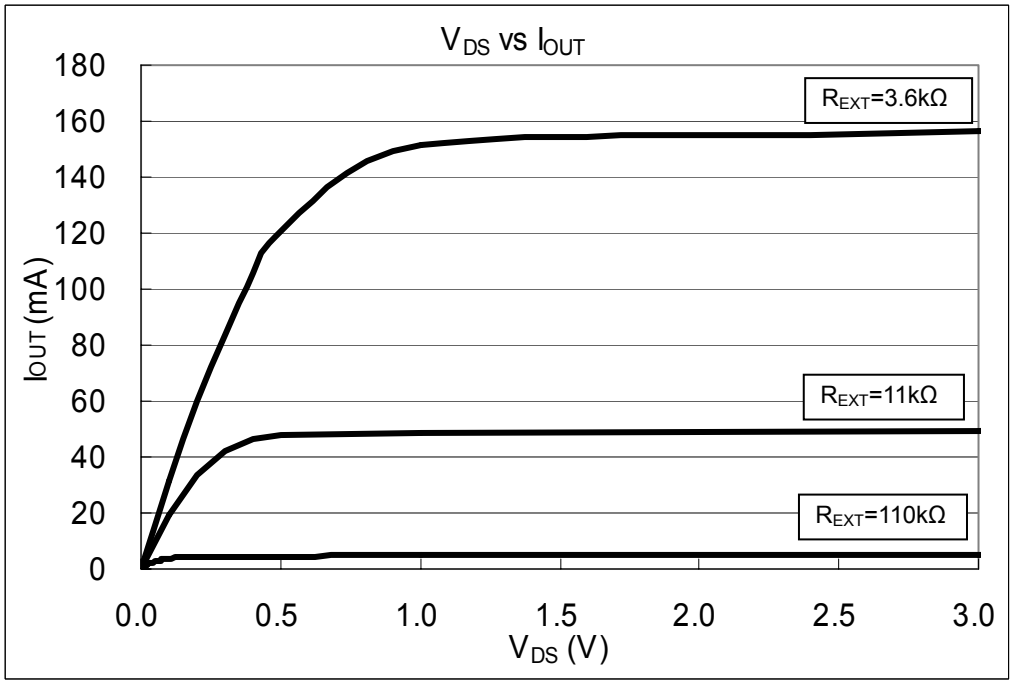
Method of setting I_{OUT}

The current of the terminal OUT0 to 2 is set by resistance connected with the terminal REXT.
I_{OUT} can be set according to the next expression.

$$I_{OUT}\ (mA) = \frac{1.17\ (V)}{R_{EXT}\ (k\Omega)} \times 460$$



Output Voltage – Output Current



Note: These application examples are provided for reference only. Thorough evaluation and testing should be implemented when designing your application's mass production design.

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Current Dimming Control

1) Input analog voltage to REXT terminal

1. Precondition

Please set the range of the analog voltage input by 0 to 1.17V.

2. The maximum current is defined as αmA. (V_{ADJ}=0V)

$$\alpha = 1.17\times \frac{R_1 + R_{EXT}}{R_1 \times R_{EXT}} \times 460$$

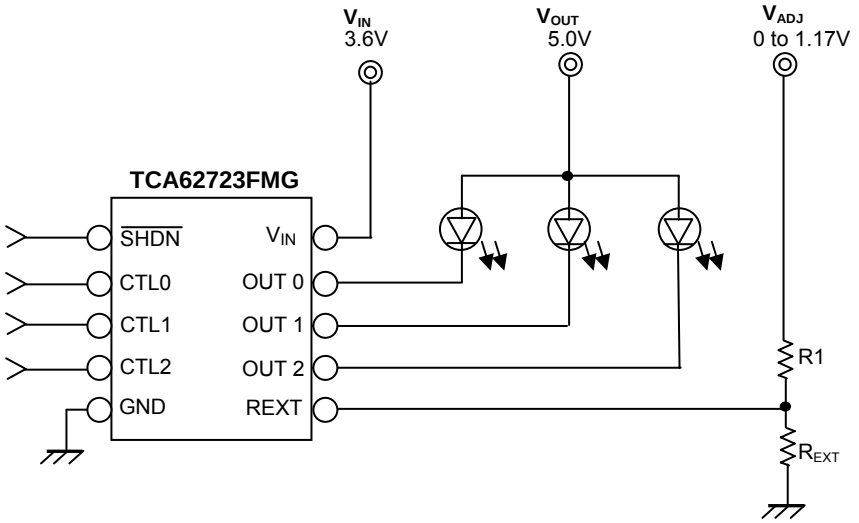
3. A minimum current is defined as βmA. (V_{ADJ}=1.1V)

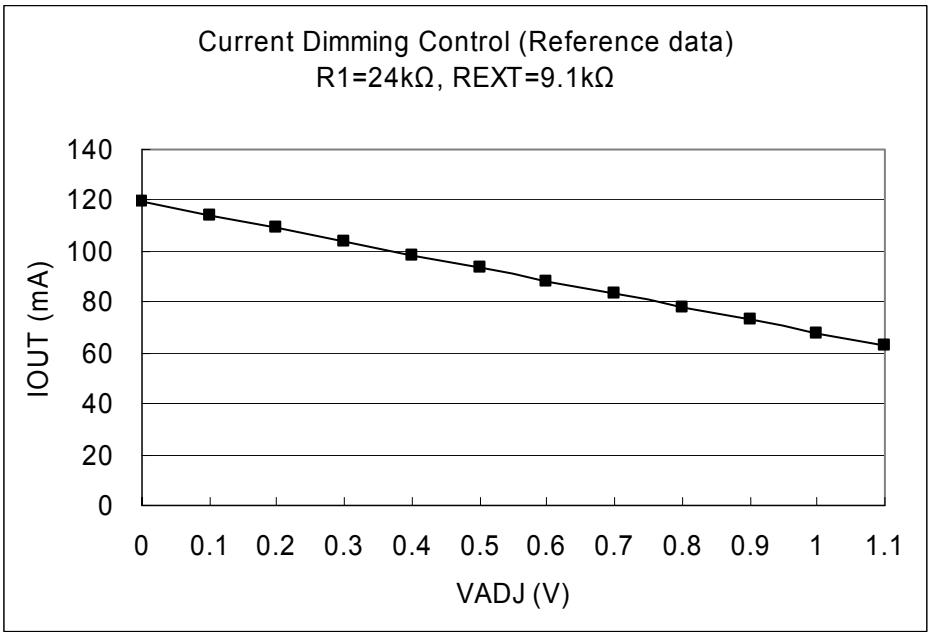
$$\beta = 1.17\times \frac{1}{R_{EXT}} \times 460$$

4. I_{OUT} can be set according to the next expression.

$$I_{OUT} = V_{ADJ}\times \frac{\beta - \alpha}{1.17} + \alpha$$

(Example) Current Dimming from I_{OUT}=120mA to 60mA (Reference data)





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2) Input PWM signal to REXT terminal

I_{OUT} can be set according to the next expression.

$$I_{OUT}= \left[1.17V + \frac{(1.17V - V_{CONT}) \times R_{EXT}}{R_{CONT}} \right] \Big/ R_{CONT}$$

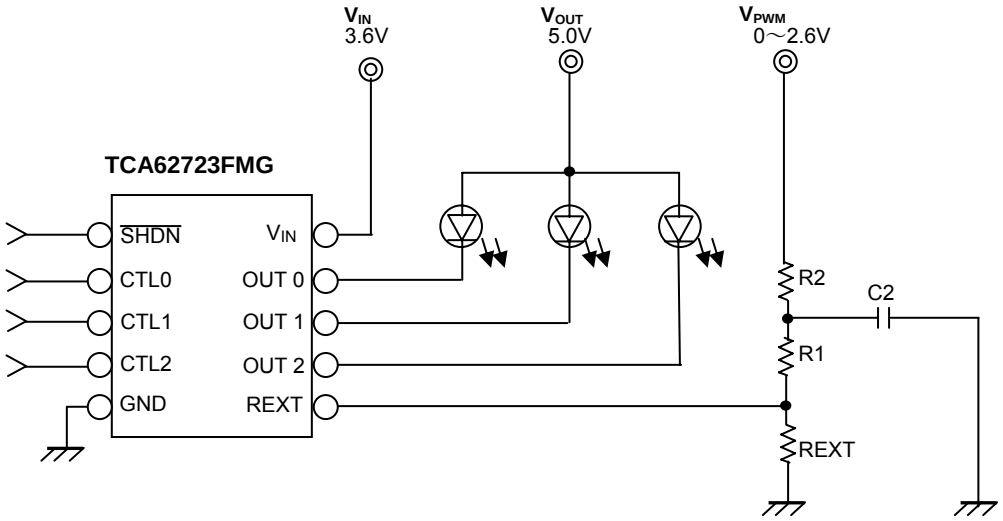
$V_{CONT}=D \times V_{PWM}$ D: PWM Duty (%)

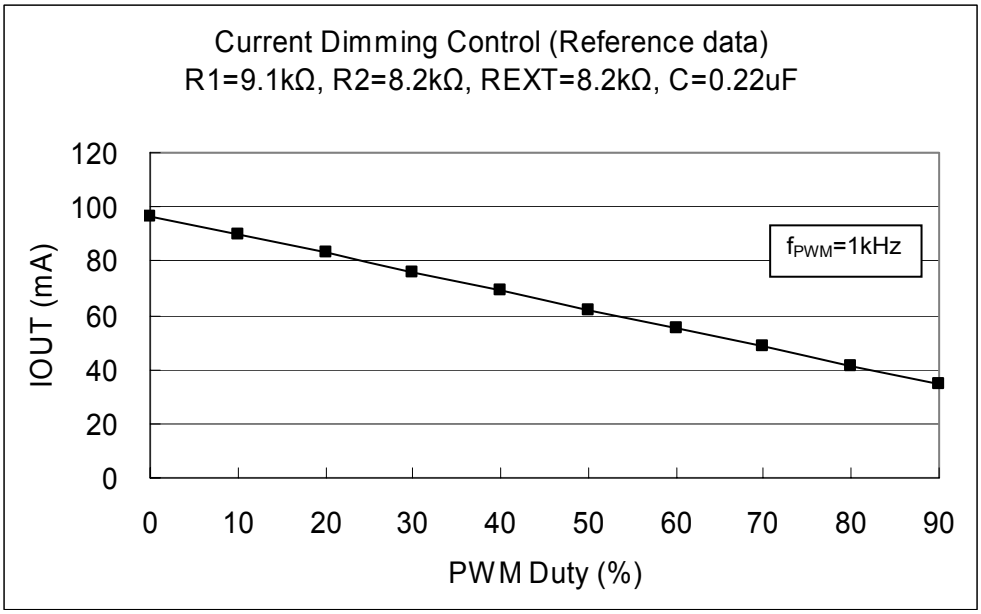
$R_{CONT}=R_1+R_2$

Please define the cutoff frequency to the next expression. ($f_C \leq f_{PWM}$)

$$f_C = \frac{1}{2 \times \pi \times R \times C}$$

$$R = \frac{R_1 \times R_2}{R_1 + R_2}$$





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Maximum Ratings (T_a = 25°C)

Characteristic	Symbol	Ratings	Unit
Supply voltage	V_{IN}	−0.3 ~ +6.0	V
Output voltage	V_{OUT}	−0.3 ~ +6.0	V
Input voltage	V_{IN}	−0.3 ~ V_{IN}+0.3 *Note1	mA
Power dissipation	P_D	0.36 (free air)	W
		0.79 (on PCB) *Note2	
Thermal resistance	$R_{th\ (j-a)}$	340 (free air)	°C/W
		158 (on PCB)	
Operating temperature	T_{opr}	−40 ~ +85	°C
Storage temperature	T_{stg}	−55 ~ +150	°C
Maximum junction temperature	T_j	150	°C

Note1 : However, do not exceed 6V.

Note: Subtract 3.8 mW / degree from the maximum rating value about a degree if the operation temperature exceeds 25°C when the device is mounted on a PCB.

Recommended Operating Condition

Characteristic	Symbol	Condition	Min	Typ.	Max	Unit
Supply voltage	V_{DD}	-	2.7	3.6	5.5	V
Constant current output	I_{OUT}	OUT0 to OUT2	5	-	150	mA/ch
R_{EXT}	R_{EXT}	-	3.6	-	110	kΩ
CTL terminal minimum pulse width	t_{CTL}	R_{EXT}=11kΩ	25	-	-	mA

Electrical Characteristics (unless otherwise specified, V_{IN} = 3.6 V, T_a = 25°C)

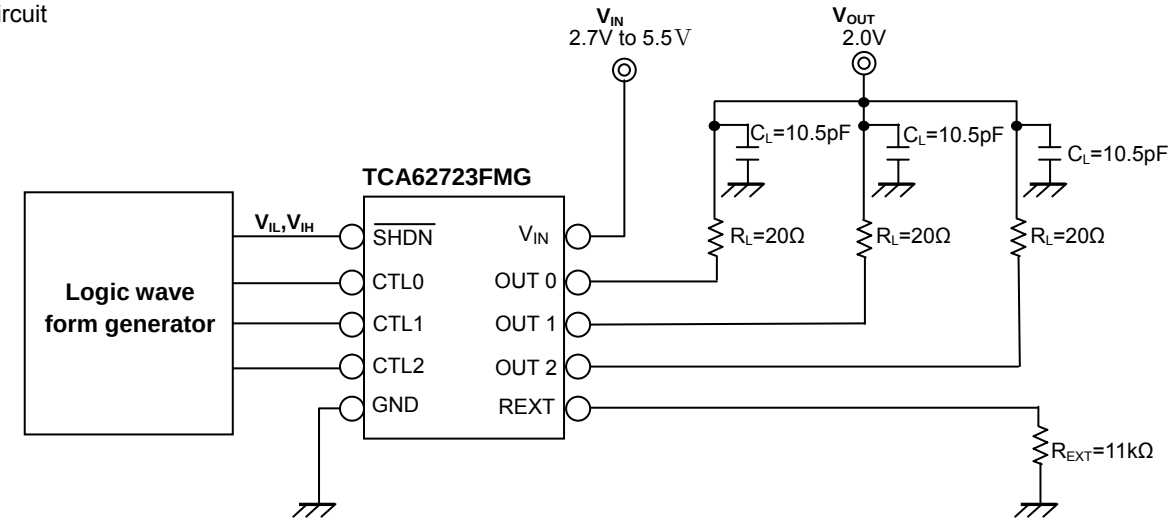
Characteristic		Symbol	Condition	Min	Typ	Max	Unit
Supply voltage		V_{IN}	-	2.7	3.6	5.5	V
Supply current (IC operation)		I_{IN} (On)	R_{EXT} = 27.6kΩ	-	-	700	μA
Supply current (IC standby)		I_{IN} (Off)	$\overline{SHDN}$ = L	-	-	1.0	μA
Input voltage	High level	V_{IH}	CTL0,CTL1,CTL2,$\overline{SHDN}$	0.7V_{IN}	-	V_{IN}+0.15V	V
	Low level	V_{IL}	CTL0,CTL1,CTL2,$\overline{SHDN}$	−0.15	-	0.3V_{IN}	
Input current		I_{IH}	CTL0,CTL1,CTL2,$\overline{SHDN}$	−1.0	-	1.0	μA
		I_{IL}	CTL0,CTL1,CTL2,$\overline{SHDN}$	−1.0	-	1.0	
Gain		GAIN	I_{OUT}/I_{REXT}, R_{EXT} = 11 kΩ	380	460	560	A/A
REXT terminal voltage		V_{REXT}	V_{IN}=3.6 V, R_{EXT} = 11 kΩ	1.1	1.17	1.24	V
Output leakage current		I_{OZ}	$\overline{SHDN}$ = “L”, V_{OUT} = 5.5 V	-	-	0.1	μA
Constant current accuracy between bits		dI_{OUT}	V_{IN} = 3.6 V, R_{EXT} = 11 kΩ	-	±1	±7.5	%
Time from SHDN release to start of operation		t_{RE}	-	-	2	5	ms

Switching characteristic (unless otherwise specified, V_{IN} = 3.6 V, T_a = 25°C)

Characteristic	Symbol	Condition	Min	Typ	MAX	Unit
Propagation delay	tpLH	R_{EXT} = 11kΩ	—	50	—	ns
	tpHL	R_{EXT} = 11kΩ	—	1	—	μs
Rise time	tR	R_{EXT} = 11kΩ	—	50	—	ns
Fall time	tF	R_{EXT} = 11kΩ	—	500	—	ns

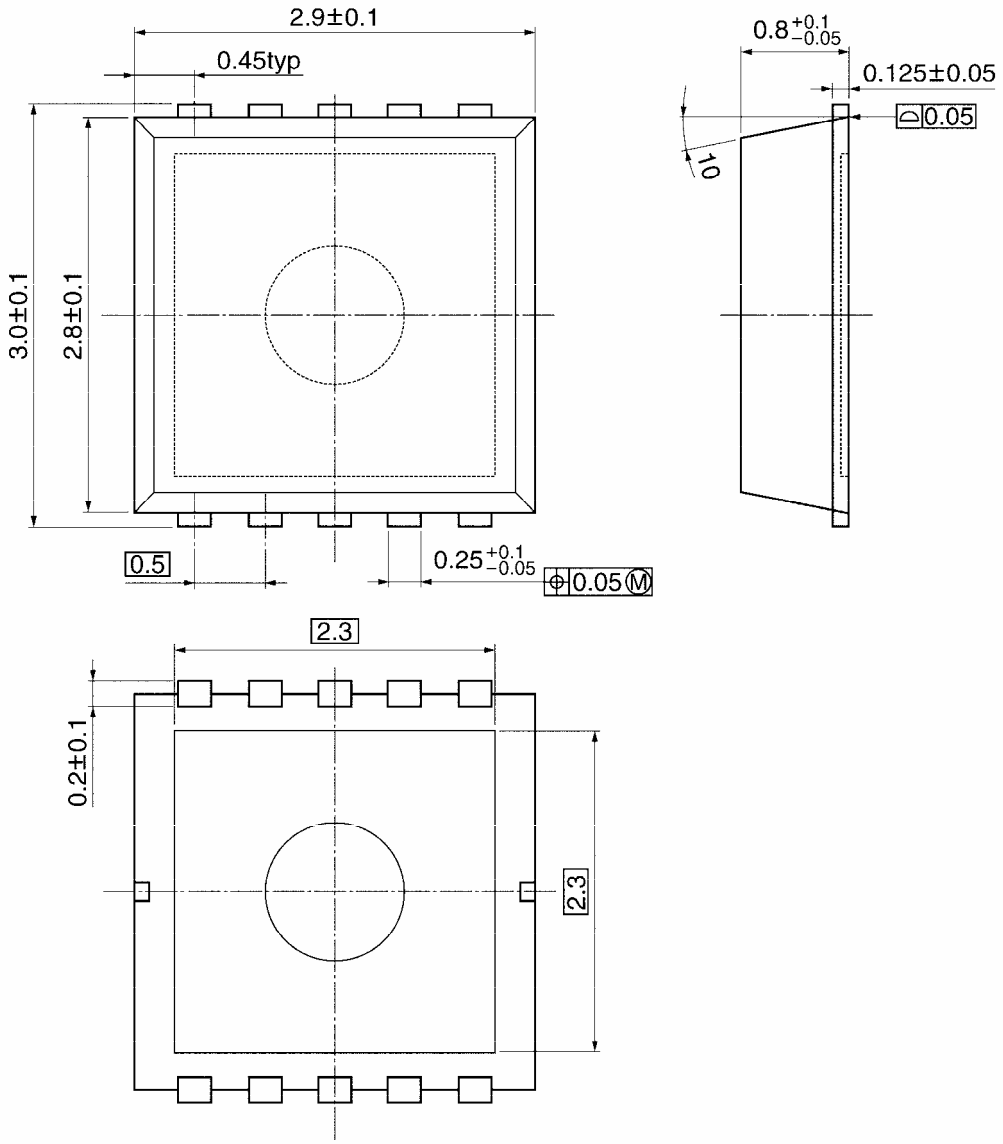
Note: T_a = 25°C, V_{DD} = V_{IH} = 2.7V or 5.5V, V_{OUT}=2.0V, V_{IL} = 0V, R_L = 20Ω, C_L = 10.5pF

Test Circuit



Package Dimensions

SON10-P-0303-0.50 Unit: mm



Weight: 0.016 g (typ.)

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Notes on Contents

Block Diagrams

Some functional blocks, circuits, or constants may be omitted or simplified in the block diagram for explanatory purposes.

Maximum Ratings

The absolute maximum ratings of a semiconductor device are a set of specified parameter values that must not be exceeded during operation, even for an instant.

If any of these ratings are exceeded during operation, the electrical characteristics of the device may be irreparably altered and the reliability and lifetime of the device can no longer be guaranteed.

Moreover, any exceeding of the ratings during operation may cause breakdown, damage and/or degradation in other equipment. Applications using the device should be designed so that no maximum rating will ever be exceeded under any operating conditions.

Before using, creating and/or producing designs, refer to and comply with the precautions and conditions set forth in this document.

Application Examples

The application examples provided in this data sheet are provided for reference only. Thorough evaluation and testing should be implemented when designing your application's mass production design.

In providing these application examples, Toshiba does not grant the use of any industrial property rights.

Handling of the IC

Ensure that the product is installed correctly to prevent breakdown, damage and/or degradation in the product or equipment.

Short circuiting between output and line to ground faults may result in damage to the IC. Please exercise precaution in designing the output line, power line and GND line so as to prevent such damage.

Be careful to insert the IC correctly. Inserting the IC the wrong way (e.g., wrong direction) may result in damage to the IC.

Please exercise precaution in handling external components as shorting and opening such components may cause an overcurrent, which in turn may result in power overcurrent and/or in damage to the IC.

About solderability, following conditions were confirmed

- Solderability

  (1) Use of Sn-63Pb solder Bath
  - solder bath temperature = 230°C
  - dipping time = 5 seconds
  - the number of times = once
  - use of R-type flux

  (2) Use of Sn-3.0Ag-0.5Cu solder Bath
  - solder bath temperature = 245°C
  - dipping time = 5 seconds
  - the number of times = once
  - use of R-type flux

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