GP2TC2

Color Toner Density (Adhesive Volume) Sensor by Diffusive/ Mirror Reflection Method

■ Features

1. Adopted diffusive reflection and mirror reflection method
   Color toner detection : diffusive reflection method
   Black toner detection : mirror reflection method
2. Analog output according to amount of reflective light (adhesive volume of toner)
3. 2 system output : adhesive volume of black toner
   adhesive volume of color toner
4. Detection range of toner density
   (Y, M, C : 0 to 1.0mg/cm^2)
   (K : 0 to 0.6mg/cm^2)
5. High resolution (0.1mg/cm^2)
6. Output can be adjusted by control of LED current

■ Applications

1. Full-color copiers
2. Color LBPs

■ Absolute Maximum Ratings

(Ta=25°C, Vcc=5V)

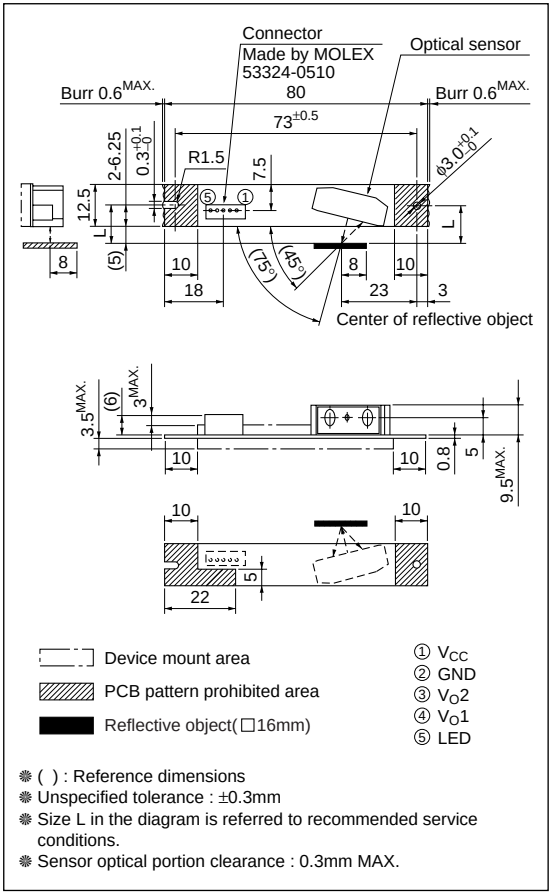
Parameter	Symbol	Rating	Unit
Operating voltage	V_{CC}	−0.3 to 7	V
LED current	I_F	50	mA
Output terminal voltage	V_O	−0.3 to Vcc +0.3	V
Operating termperature	T_{opr}	0 to +60	°C
Storage temperature	T_{stg}	−20 to +70	°C

■ Recommend Operating Conditions

Parameter	Symbol	Rating	Unit
Supply voltage	V_{CC}	4.5 to 5.5	V
Detection distance range	L	11.0 to 11.5	mm

■ Outline Dimensions

(Unit : mm)



- ( ) : Reference dimensions
- Unspecified tolerance : ±0.3mm
- Size L in the diagram is referred to recommended service conditions.
- Sensor optical portion clearance : 0.3mm MAX.

■ Electro-optical Characteristics

(Ta=25°C, V_{CC}=5V)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Output voltage	V_{O1A}	Reflective object A (V_{O1A}:I_{FM}=15mA, V_{O2A}:I_{FM}=20mA)	0.73	1.17	1.61	V
	V_{O2A}		2.12	2.81	3.50	V
	V_{O10}	LED current I_{FM}=0mA	0.2	0.6	1.0	V
	V_{O20}		0.1	0.7	1.3	V
Displacement of output voltage	ΔV_{O1BA}	Displacement of output voltage V_{O1} when reflective object is changed from A to B (I_{FM}=15mA)	1.56	1.74	1.92	V
	ΔV_{O2C0}	$\Delta V_{O2C0}=V_{O2C}-V_{O20}$ (V_{O2C}:Reflective object C, I_{FM}=20mA)	0.39	0.45	0.51	V
	ΔV_{O1A0}	$V_{O1A}-V_{O10}$	0.53	0.57	0.61	V
	ΔV_{O2A0}	$V_{O2A}-V_{O20}$	2.02	2.11	2.20	V
Displacement of output voltage	ΔV_{O12}	$\Delta V_{O12}=(\Delta V_{O1BA}+\Delta V_{O1A0})/\Delta V_{O1A0}$, $\Delta V_{O22}=\Delta V_{O2C0}/\Delta V_{O2A0}$	3.75	4.05	4.35	–
	ΔV_{O22}		0.19	0.21	0.23	–
Rise time	tr	Reflective object C (Munsell N2 no gloss(Reflectivity 3.1%)) (V_{O1A} : I_{FM}=15mA, V_{O2A} : I_{FM}=20mA)	–	70	300	μs
Fall time	tf		–	70	300	μs
Consumption current	I_{CC}	Consumption current at LED current I_{FM}=0mA	–	4	12	mA

Fig.1 Internal Block Diagram

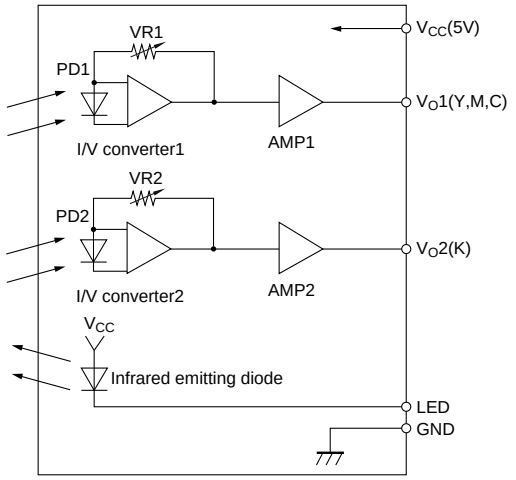


Fig.2 Schematic measurement block diagram

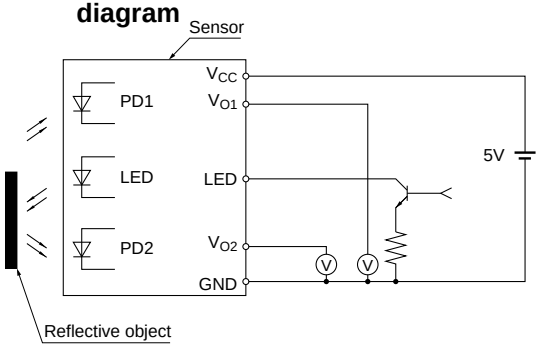


Fig.3 LED lighting condition

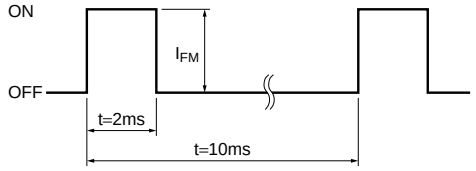


Fig.4 Response Time

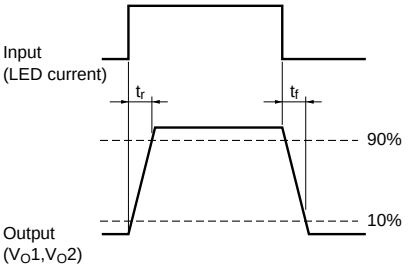
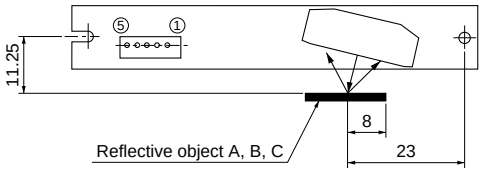


Fig.5 Measurement Condition



Reflective object A : Munsell N4.5 no gloss (reflectivity 15.6%)
Reflective object B : Munsell N7.75 no gloss (reflectivity 54.8%)
Reflective object C : Munsell N2 no gloss (reflectivity 3.1%)

■ Example of application

1. Apply V_{CC}=5V and measure V_{O1_0} at V_O1, V_{O2_0} at V_O2.
2. In order to stabilize output voltage measure 3. to 5. on the LED lighting condition shown in Fig.3 for example.
3. Measure the output voltage V_O1 and V_O2 and adjust I_{FM} in order to fix ΔV_O1 and ΔV_{O2_1} (determine value by your actual application). After the adjustment, memorize the values, V_O1, V_O2 and I_{FM}, (Adjust I_{FM} for V_O1 and V_O2 each, and memorize them.) (If there are the initial memorized values, V_O1, V_O2 and I_{FM}, measure V_O1 and V_O2 at memorized I_{FM}. If there are difference between the measured values and memorized values adjust I_{FM} to let V_O1 and V_O2 be initial values.)
4. Attach the color toner and measure the output voltage at V_O1 (I_{FM} at the value memorized at 3.). Determine the ouput voltage difference ΔV_O1 between the measured value and memorized value V_O1 at 3, and adjust the attached color toner amount.
5. Attach the black toner and measure the output voltage at V_O2 (I_{FM} at the value memorized at 3.). Determine the ouput voltage difference ΔV_O2 between the measured value and memorized value V_O2 at 3, and adjust the attached black toner amount.
6. After the measurement, set I_{FM}=0mA and turn off the LED.
7. To measure them again, start from 1.

Note V_{O1_0} : Output voltage at I_{FM}=0mA
V_{O2_0} : Output voltage at I_{FM}=0mA
V_O1 : V_O1 terminal ouput voltage at no toner
V_O2 : V_O2 terminal ouput voltage at no toner
ΔV_{O1_1} : $V_O1-V_{O1_0}$
ΔV_{O2_1} : $V_O2-V_{O2_0}$
ΔV_O1 : Output voltage when black toner is attached$-V_O1$
ΔV_O2 : Output voltage when black toner is attached$-V_O2$
I_{FM} : LED current

Fig.6 Output Voltage vs. Reflectivity of Reflective Objects

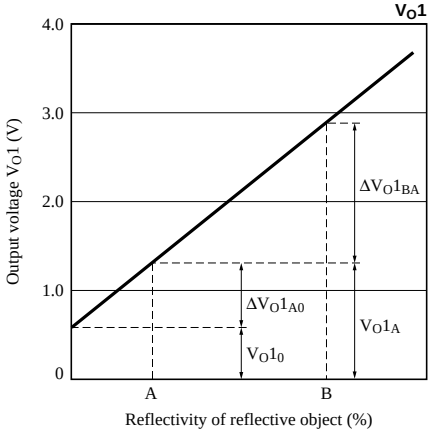
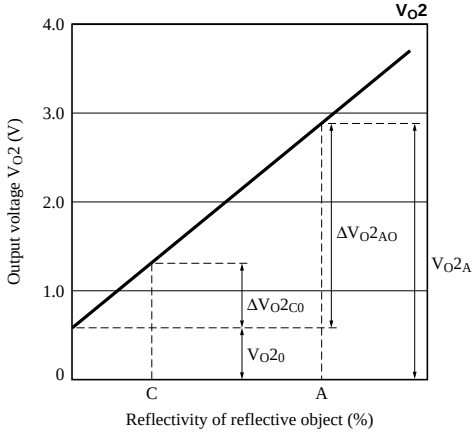


Fig.7 Output Voltage vs. Reflectivity of Reflective Objects



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