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Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832

Email & Skype: info@chipsmall.com Web: www.chipsmall.com

Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China



GM5BW96385A

Light Emitting Diode



■ Features

1. High brightness (2300 mcd @ $I_F = 20$ mA)
2. White Color (achieved via InGaN Blue LED chip in combination with Yellow Phosphor)
3. Similar part to GM5BW96380A, but includes self-protection against static electricity

■ Agency Approvals/Compliance

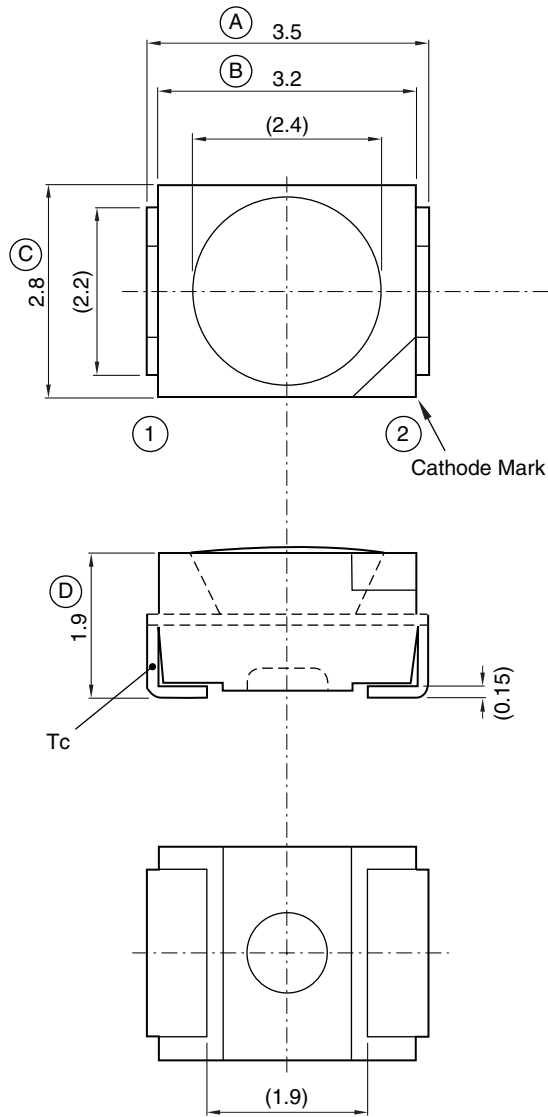
1. RoHS compliant

■ Applications

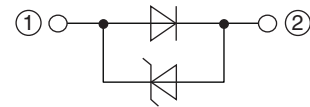
1. General indication (indoor only)
2. Office Automation equipment
3. Audio/visual equipment
4. Home appliances
5. Telecommunications equipment
6. Measuring equipment
7. Machine tools
8. Computers

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External Dimensions



Equivalent Circuit



Pin Arrangement

No.	Name
①	Anode
②	Cathode

NOTES:

1. Units: mm
2. Unspecified tolerance: ± 0.3 mm
3. (): Reference dimensions
4. Case temperature (T_c) measurement point
5. Materials: Leads: Copper alloy, Ag plating
Package: Nylon and silicone resin

GM5BW96385A-1

■ Absolute Maximum Ratings

(Tc = 25°C)

Parameter	Symbol	Rating	Unit
Power dissipation	P	114	mW
Forward current	I _F	30	mA
Peak pulsed forward current *1	I _{FM}	100	mA
Forward current derating factor	DC	0.6	mA/°C
	Pulse	2.0	mA/°C
Reverse current	I _R	70	mA
Operating temperature *2	Tc	-30 to +100	°C
Storage temperature *3	Tstg	-40 to +100	°C
Soldering temperature *4	Tsol	295	°C

- *1 Duty ratio = 1/10, Pulse width = 0.1 ms
- *2 Case temperature (See External Dimensions on page 2)
- *3 Do not exceed these temperatures under any condition while in packing. Refer to *Storage and Handling*.
- *4 Each terminal must be soldered with a 30 W soldering iron within 3 seconds under 295°C. For Reflow Soldering information, see Fig. 15.
- *5 Operating current values here follow the derating curves shown in Fig. 1 through Fig. 3.
- *6 This device uses the leads for heat sinking, therefore the operating temperature range is prescribed by Tc.

■ Electro-optical Characteristics

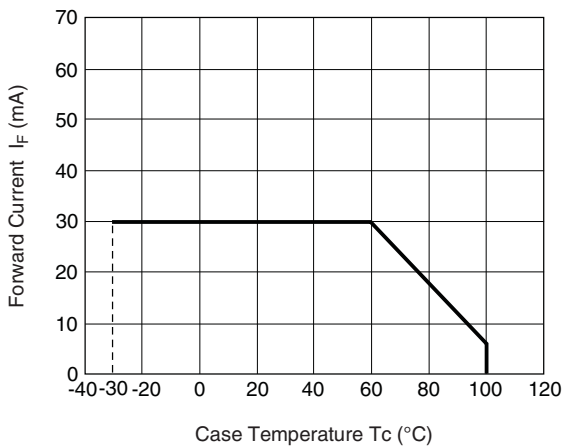
(Tc = 25°C)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Forward voltage 1	V _{F1}	I _F = 10 μA	2.0	—	2.7	V
Forward voltage 2	V _{F2}	I _F = 20 mA	—	(3.2)	3.8	V
Luminous intensity *1	I _V		1800	(2300)	3100	mcd
Chromaticity coordinates *2	x, y			(0.34, 0.36)		*3

- *1 Measured by EG&G Model 550 (Radiometer/Photometer) after 20 ms drive (Tolerance: ±15%)
- *2 Measured by Otsuka Electronics Model MCPD-2000 after 20 ms drive (Tolerance: x, y: ±0.02)
- *3 See Chromaticity Rank table on page 8.
- *4 Parenthesis indicate reference values.

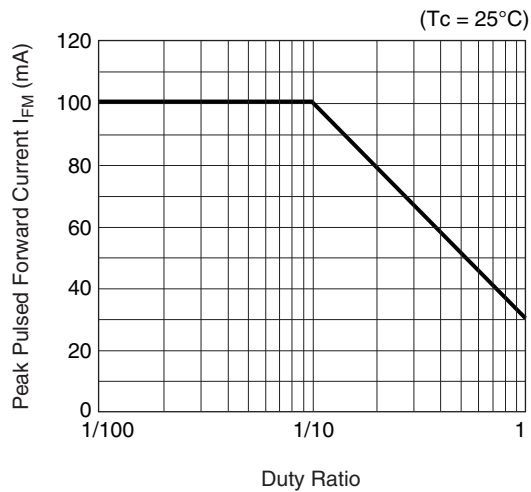
■ Derating Curves

Fig. 1 Forward Current vs. Case Temperature



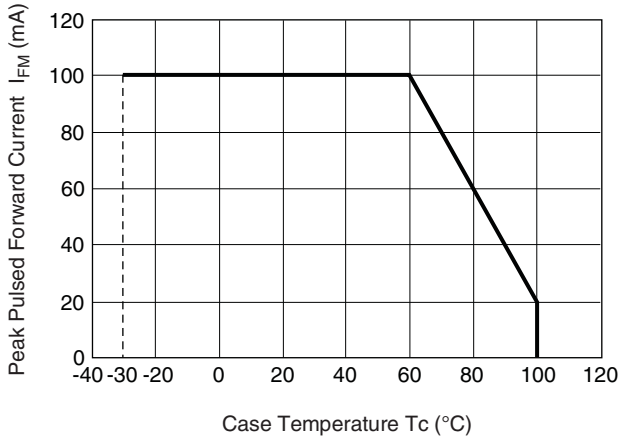
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Fig. 2 Peak Pulsed Forward Current vs. Duty Ratio



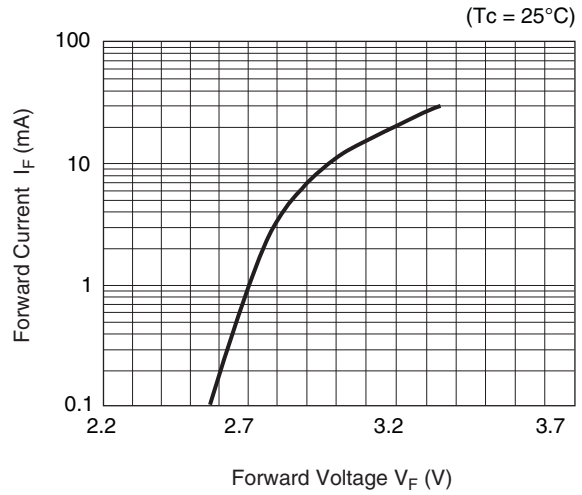
GM5BW96385A-4

Fig. 3 Peak Pulsed Forward Current vs. Case Temperature



GM5BW96385A-3

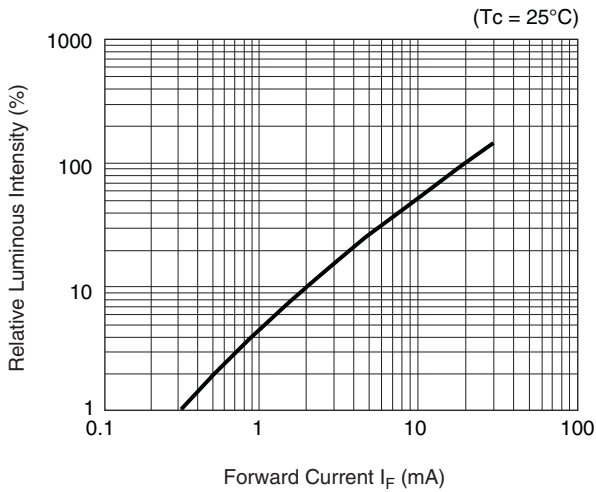
Fig. 5 Forward Current vs. Forward Voltage



GM5BW96385A-6

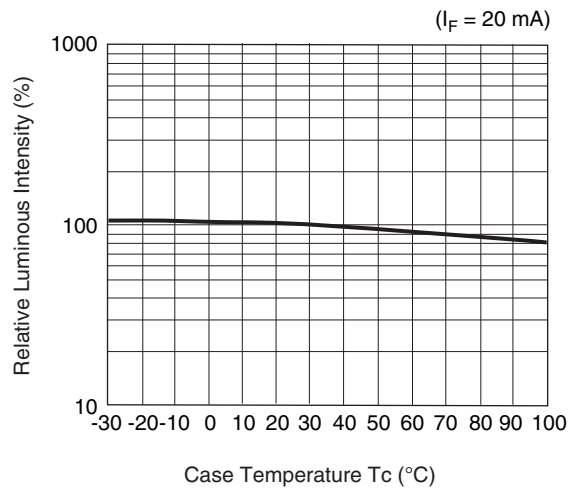
■ Characteristic Diagrams (TYP.)

Fig. 4 Relative Luminous Intensity vs. Forward Current



GM5BW96385A-5

Fig. 6 Relative Luminous Intensity vs. Case Temperature



GM5BW96385A-7

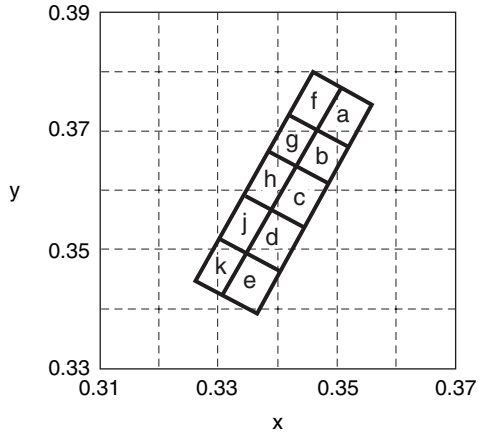
■ Chromaticity Rank Table (Tc = 25°C)

Rank	Chromaticity Coordinates (x, y)								Condition
	Point 1		Point 2		Point 3		Point 4		
	x	y	x	y	x	y	x	y	
a	0.356	0.375	0.351	0.378	0.347	0.370	0.352	0.368	I _F = 20 mA T _C = 25°C
b	0.352	0.368	0.347	0.370	0.343	0.363	0.348	0.361	
c	0.348	0.361	0.343	0.363	0.339	0.356	0.344	0.354	
d	0.344	0.354	0.339	0.356	0.335	0.349	0.340	0.346	
e	0.340	0.346	0.335	0.349	0.331	0.342	0.336	0.339	
f	0.351	0.378	0.347	0.380	0.342	0.373	0.347	0.370	
g	0.347	0.370	0.342	0.373	0.338	0.366	0.343	0.363	
h	0.343	0.363	0.338	0.366	0.334	0.359	0.339	0.356	
j	0.339	0.356	0.334	0.359	0.330	0.352	0.335	0.349	
k	0.335	0.349	0.330	0.352	0.326	0.345	0.331	0.342	

*1 Tolerance: ±0.02.

*2 Delivered quantities of each rank are random and not specifiable.

Fig. 7 Chromaticity Diagram



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■ Reliability and Quality Information

Sharp tests to a Reliability Confidence Level of 90%. These tables illustrate the test criteria and conditions, along with the Number of Samples, the Number of Defectives, and the Lot Tolerance Percent Defective.

No.	Test items	Test Conditions	Samples (n)	Defective (C)	LTPD (%)
1	Temperature cycle	-40°C (30 min) to +100°C (30 min), 100 cycles	22	0	10
2	High temp and high humidity storage	Tstg = +60°C, RH = 90%, t = 1000 hr	22	0	10
3	High temperature storage	Tstg = +100°C, t = 1000 hr	22	0	10
4	Low temperature storage	Tstg = -40°C, t = 1000 hr	22	0	10
5	Operating test	Tc = +25°C, I _F = 30 mA, t = 1000 hr	22	0	10
6	Mechanical shock	15000 m/s ² , 0.5 ms ±X • ±Y • ±Z direction, 3 times (Tc = 25°C)	11	0	20
7	Variable frequency vibration	200 m/s ² , 100 to 2000 to 100 Hz / sweep for 4 min. X • Y • Z direction, 4 times (Tc = 25°C)	11	0	20
8	Resistance to soldering temperatures	Refer to the Soldering Profile; Performed twice	11	0	20
9	Solderability	Solder/flux M705/ESR250 (Senju Metal Industry Co. Ltd.) Soldering temperature 245°C ±5°; dip time 3 sec, 1 hr after Test 2 (above)	11	0	20

● Failure Judgement Criteria

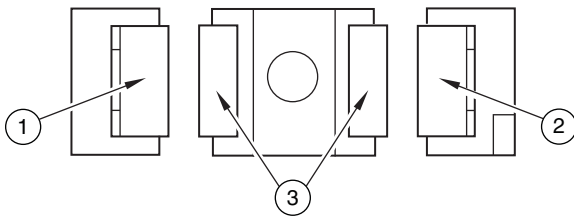
No.	Items	Symbol	Failure judgment criteria (*2)
1	Forward voltage	V _F	V _F > U.S.L × 1.2
2	Luminous intensity (*3)	I _v	I _v < Initial value × 0.5, I _v > Initial value × 2.0

*1 Measuring condition is in accordance with specification.

*2 U.S.L.: Upper Specification Limit.

*3 Solderability failure criterion: Fail if >90% solderability in plated test areas are not soldered. Judgement areas are the bottom and sides as shown in Fig. 8.

Fig. 8 Solderability Judgment Areas



GM5BW96385A-8

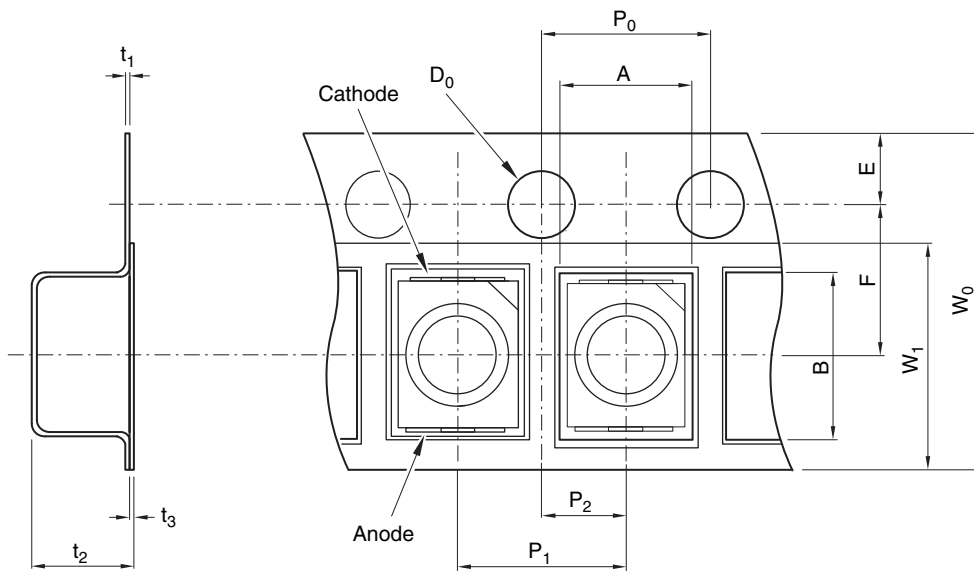
● Quality Level

Sharp utilizes the ISO2859-1 standard when measuring product quality. The method is a single sampling plan, following normal inspection level S-4. This table lists the Defect Judgment Criteria and Defect Classifications.

No.	Test items	Defect Judgment	Defect	AQL
1	Light emission	No light emission	Major defect	.01%
2	Radiation color	Different color vs. that prescribed in the Chromaticity Chart		
3	Taping	Product inserted incorrectly (reversed, upside-down)		
4	Electro-optical characteristics	Does not fully conform to specification values for V_F , I_R , I_V .	Minor defect	0.4%
5	External dimensions	Does not fully conform to specification values for External Dimensions		
6	Appearance	Foreign substances and flaws which affect the appearance: Resin burr which exceeds tolerance, (0.3 mm MAX.) More than 0.4 mm cracks in resin or terminal		

■ Tape Specifications

Fig. 9 Tape Shape and Dimensions



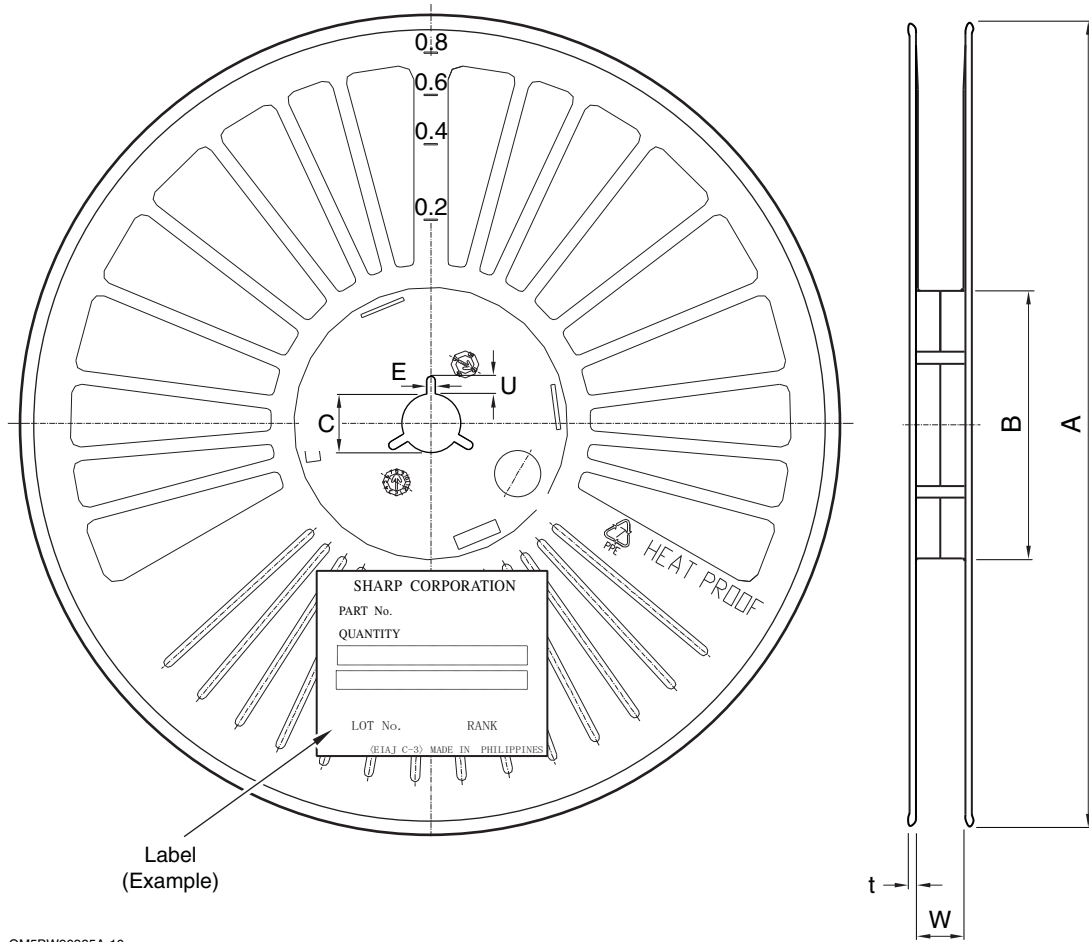
GM5BW96385A-9

■ Tape Dimension Specifications

Parameter		Symbol	Dimension (mm)	Remarks
Embossed pocket	Vertical	A	3.0	Measured at inside bottom square corner
	Horizontal	B	3.7	
	Pitch	P ₁	4.0	
Sprocket hole	Diameter	D ₀	1.5	Accumulated error ±0.5 mm/10 pitch Distance between the edge of the tape and center of the hole
	Pitch	P ₀	4.0	
	Position	E	1.75	
Pocket Position	Vertical	P ₂	2.0	Distance between center lines of the concave square hole and round sprocket hole
	Horizontal	F	3.5	
Cover tape	Width	W ₁	5.4	
	Thickness	t ₃	0.1	
Carrier tape	Width	W ₀	8.0	
	Thickness	t ₁	0.3	
Overall thickness		t ₂	2.6	Includes thicknesses of cover tape and carrier tape

■ Reel Specifications

Fig. 10 Reel Shape and Dimensions



GM5BW96385A-10

■ Reel Dimension Specifications

	Parameter	Symbol	Dimension (mm)	Remarks
Flange	Diameter	A	180	
	Thickness	t	1.3	
	Flange spacing	W	9.5	Shaft core dimension
Hub	External diameter	B	60	
	Spindle hole diameter	C	13	
	Key slit width	E	2.0	
	Key slit depth	U	4	

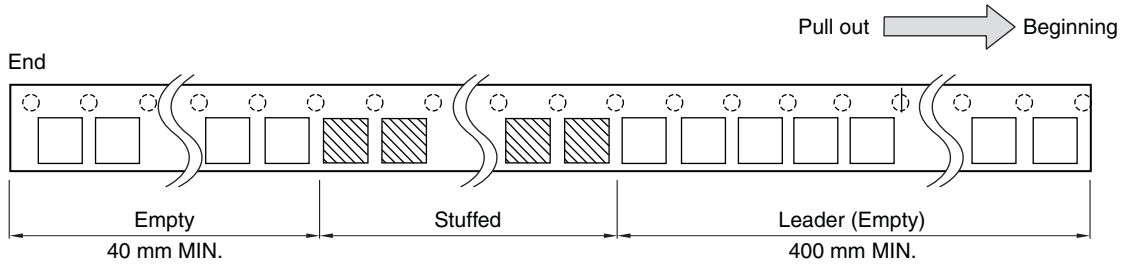
*1 Label on side of flange: part number, quantity, lot number, and rank.

*2 Material: described on flange.

■ Taping Specifications

1. Leader tape standard: JIS C0806

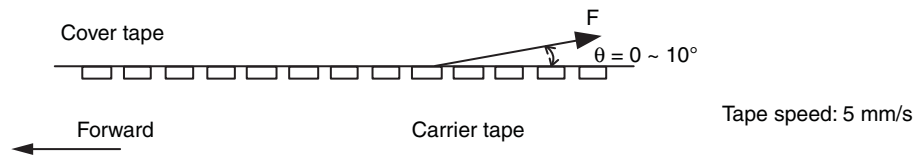
Fig. 11 Leader Tape



GM5BW96385A-11

2. Cover tape peel resistance: $F = 0.1$ to 1.0 N ($\theta = 10^\circ$ or less). See Fig. 10.

Fig. 12 Tape Separation

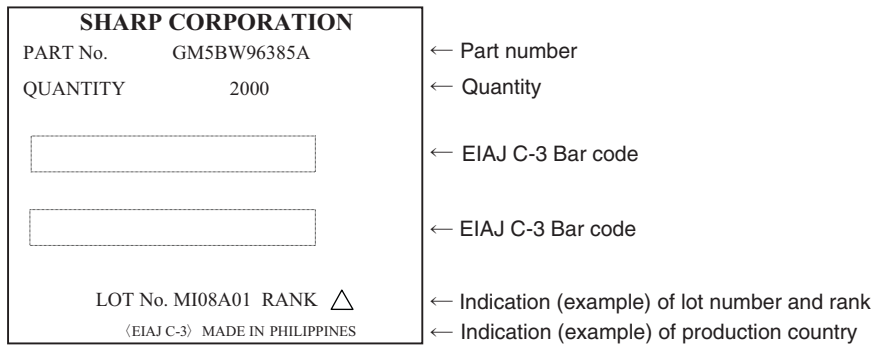


GM5BW96385A-12

3. Tape bending resistance: Cover tape will remain in place on radii of 30 mm or more. Under 30 mm radii, the cover may separate.
4. Joints are not allowed in the cover tape.
5. Parts are packed with an average quantity of 2000 pieces per reel.
6. Product mass: 30 mg (approximately)
7. Sharp guarantees the following:
 - a. No contiguous empty spaces in the tape
 - b. Missing parts will not make up more than 0.1% of the total quantity.
 - c. Parts will be easily removed from the tape.
8. Parts will not stick to the cover tape as it is peeled.

■ **Label and Marking Information**

Fig. 13 Label Contents



LOT Number

MI 08 A 01

① ② ③ ④

- ① Production plant code (alphabetically)
- ② Production year (the last two digits of the year)
- ③ Production month (alphabetically with January corresponding to A)
- ④ Production date (01 ~ 31)

Rank Δ: Chromaticity rank

GM5BW96385A-13

■ **Design Notes**

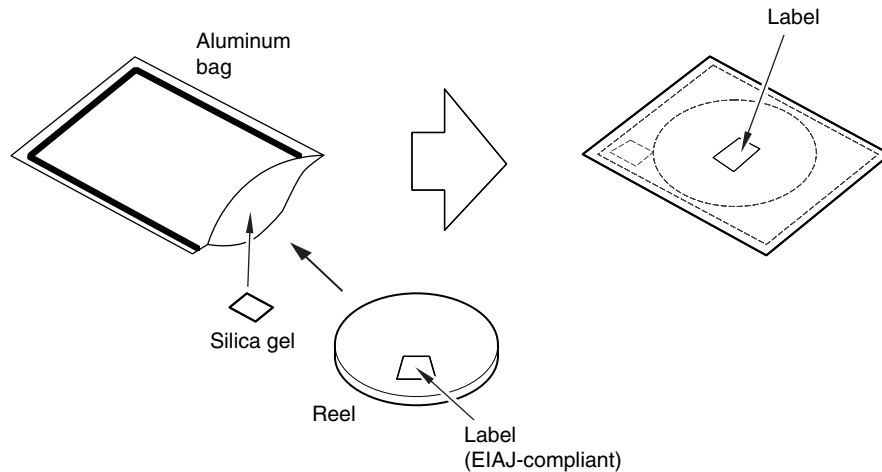
1. Do not allow the circuit design to apply any reverse voltage to the LED at any time, operating or not. Do not bias this part in any manner when it is not operating.
2. This part can be easily damaged by external stress. Make sure they are not mechanically stressed during or after assembly.
3. This product uses a blue LED chip in combination with fluorescent materials to achieve its color. There may be some slight color change due to afterglow of the phosphor when driving this part with pulsed power.
4. This part has a high light output. Looking directly at it during full power output may cause injury.
5. Sharp recommends taking proper personal and environmental static control precautions when handling this part. Static damage may affect this part's reliability.
6. Materials of high thermal conductivity are incorporated in this device to allow generated heat to be effectively transferred from it to the circuit board. For best reliability, Sharp recommends against locating other sources of heat near the LED, and to design the circuit board in such a way that heat can easily escape from the circuit board. Sharp also recommends designing the circuit board so that the part's case temperature is always kept under 100° (when the LED is turned on) including self-heating.
7. Sharp recommends handling these parts in a clean, non-dusty environment since surface dust may be difficult to remove and can affect the optical performance of the part.
8. Sharp recommends confirming the part's performance, reliability, and resistance to any of these conditions, if it is to be used in any of these environments:
 - Direct sunlight, outdoor exposure, dusty conditions
 - In water, oil, medical fluids, and organic solvents
 - Excessive moisture, such as dew or condensation
 - Corrosive (salt) air or corrosive gases, such as Cl, H₂S, NH₃, SO₂, NO_x

■ Manufacturing Guidelines

● Storage and Handling

1. Moisture-proofing: These parts are shipped in vacuum-sealed bags to keep them dry and ready for use. See Fig. 14.

Fig. 14 Factory Moisture-proof Packing



GM5BW96385A-15

2. Store these parts between 5°C and 30°C, at a relative humidity of less than 85%; for no more than one year from the production date.
3. After breaking the package seal, maintain the environment within 5°C to 30°C, at a relative humidity of less than 85%. Solder the parts within 3 days.
4. If the parts will not be used immediately, repack them in a dry box, or re-vacuum-seal them with a desiccant.
5. If the parts are exposed to air for more than 3 days, or if the silica gel telltale indicates moisture contamination, bake the parts:
 - When in the tape carrier, bake them at a temperature of 95°C to 100°C, for 16 to 24 hours.
 - When loose or on a PCB, bake them at a temperature of 110°C to 120°C, for 8 to 12 hours.
 - Note that the reels may become distorted if they are in a stack when baking. Confirm that the parts have cooled to room temperature after baking.

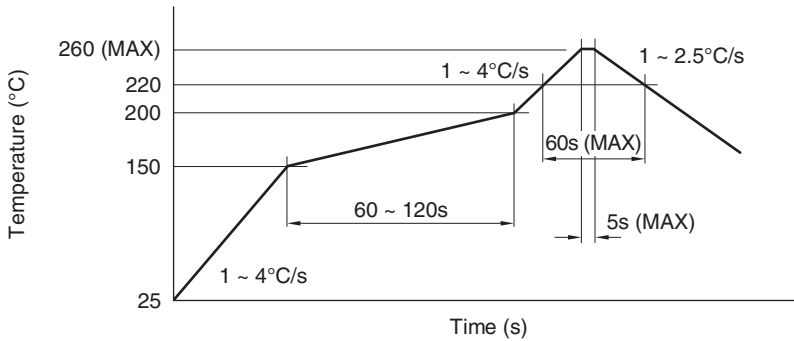
● Cleaning Instructions

1. Sharp does not recommend cleaning printed circuit boards containing this device, or cleaning this device with ultrasonic methods. Process chemicals will affect the structural and optical characteristics of this device.
2. Sharp recommends the use of a solder paste that does not require cleaning.

● Soldering Instructions

1. When soldering with reflow methods, Sharp recommends following the soldering profile in Fig. 15.
2. Do not subject the package to excessive mechanical force during soldering as it may cause deformation or defects in plated connections. Internal connections may be severed due to mechanical force placed on the package due to the PCB flexing during the soldering process.
3. When using a second reflow, the second process should be carried out as soon as possible after the first.
4. Electrodes on this part are silver-plated. If the part is exposed to a corrosive environment, the plating may be damaged, thereby affecting solderability.
5. The Reflow Profile shown in Fig. 15 should be considered as a set of maximum parameters. Since this part uses the leads for heatsinking, the peak temperature should be kept as cool as possible and the cooldown period lengthened as much as possible. Thermal conduction into the LED will be affected by the performance of the reflow process, so verification of the reflow process is recommended. These parts may be used in a nitrogen reflow process.

Fig. 15 Temperature Profile

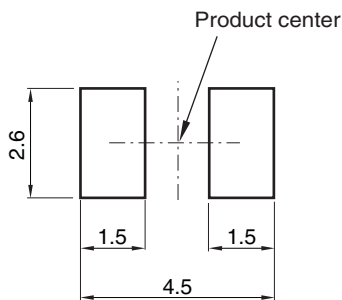


GM5BW96385A-16

● Recommended Solder Pad Design

1. Solderability depends on reflow conditions, solder paste, and circuit board materials. Check the entire process before production commences.
2. Fig. 16 shows the recommended solder pad design for this part.
3. When using backside dip methods, Sharp recommends checking the process carefully: board warping from heat can cause mechanical failure in these parts, in addition to the high heat conducted into the part through the leads. Performing reflow after dip is recommended, with the interval between the two as short as possible.

Fig. 16 Recommended Solder Pad Design



NOTE: Unit: mm

GM5BW96385A-17

● Presence of ODCs

This product shall not contain the following materials, and they are not used in the production process for this product:

- Regulated substances: CFCs, Halon, Carbon tetrachloride, 1.1.1-Trichloroethane (Methylchloroform). Specific brominated flame retardants such as the PBBOs and PBBs are not used in this product at all.

This product shall not contain the following materials banned in the RoHS Directive (2002/95/EC).

- Lead, Mercury, Cadmium, Hexavalent chromium, Polybrominated biphenyls (PBB), Polybrominated diphenyl ethers (PBDE).

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- Personal computers
- Office automation equipment
- Telecommunication equipment (terminal)
- Test and measurement equipment
- Industrial control
- Audio visual equipment
- Consumer electronics

(ii) Measures such as fail-safe function and redundant design should be taken to ensure reliability and safety when SHARP devices are used for or in connection with equipment that requires higher reliability such as:

- Transportation control and safety equipment (i.e., aircraft, trains, automobiles, etc.)
- Traffic signals
- Gas leakage sensor breakers
- Alarm equipment
- Various safety devices, etc.

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- Telecommunication equipment (trunk lines)
- Nuclear power control equipment
- Medical and other life support equipment (e.g. scuba)

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