

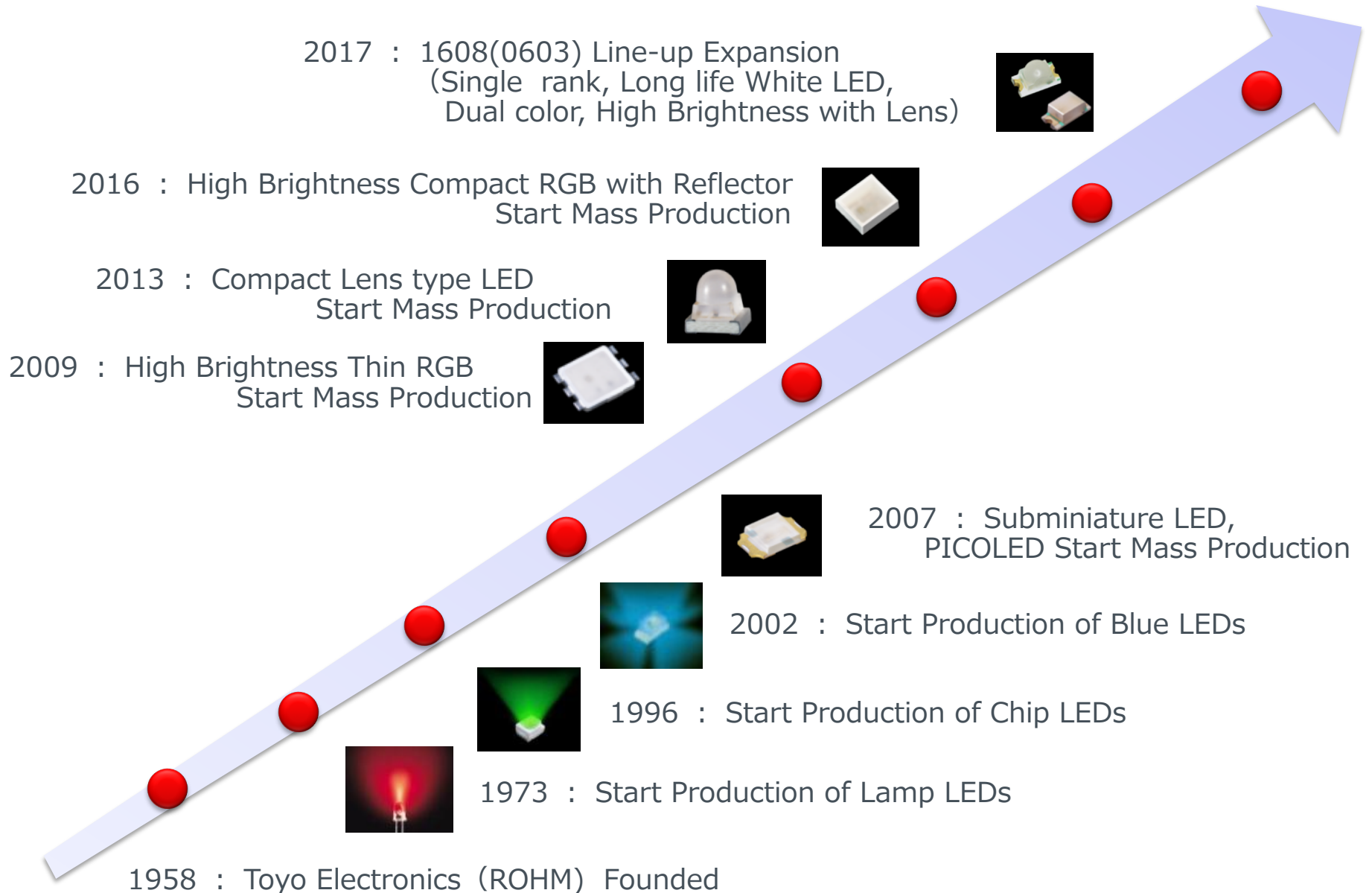


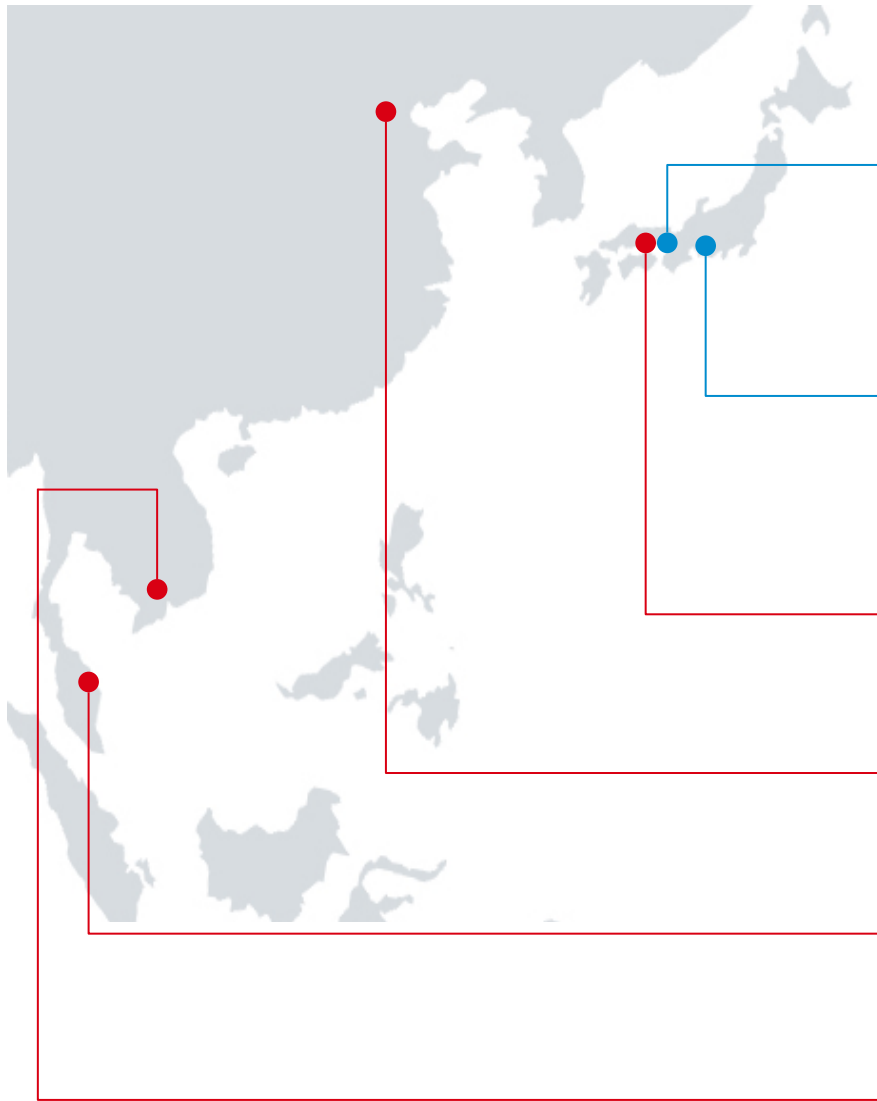
# ROHM LED Introduction for Automotive Application

Feb. 2018  
ROHM LED Division

Rev.006

# Rohm LED History





## Wafer Process

### Headquarters (Kyoto)



- Device factory
- Product development
- QC, PC, Process development
- R&D



ISO14001



### ROHM Hamamatsu Co.,Ltd. (Shizuoka)

- Device factory



ISO14001

## Assembly Process



### ROHM Wako Co.,Ltd. (Okayama)

- Mother factory
- New Product



ISO14001, 9001



### ROHM Semiconductor (China) Co.,Ltd. (Tianjin)

- Production factory



ISO14001, 9001, ISO/TS16949



### ROHM-Wako Electronics (Malaysia) Sdn. Bhd. (Kota Bharu)

- Production factory



ISO14001, 9001, ISO/TS16949



### Magic Micro Co.,Ltd. (Vietnam)

- OEM



ISO14001, 9001, ISO/TS16949

## ■ Integrated manufacture

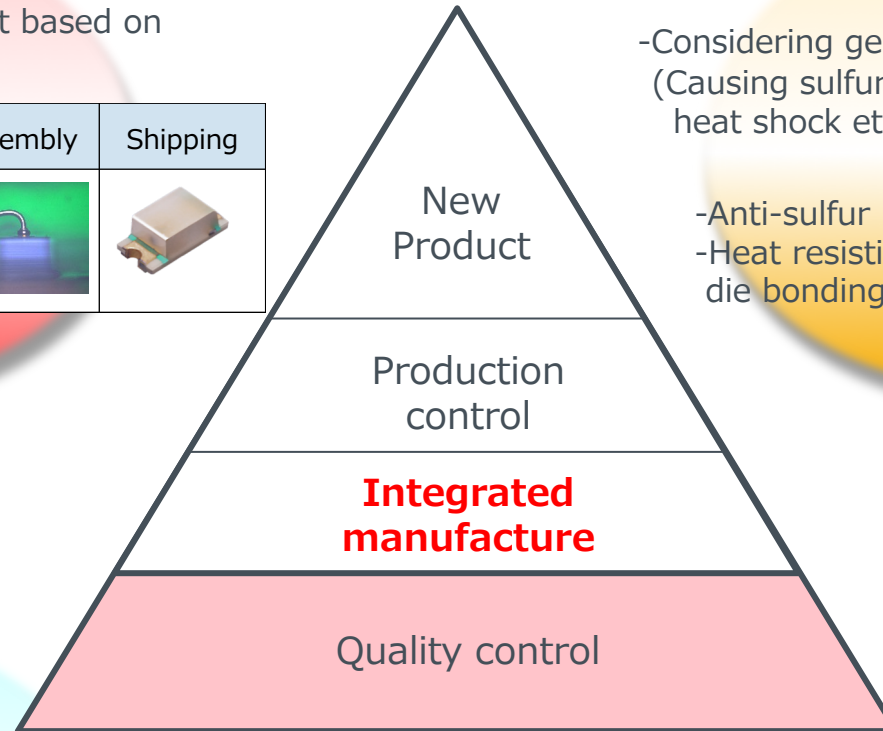
- New product development based on integrated manufacture

	Wafer process	FAB	Assembly	Shipping
Integrated Process				

## ■ Quality Developing

- Considering general problem (Causing sulfurization, flow soldering heat shock etc.)

- Anti-sulfur LED – Without silver LED
- Heat resisting LED – New process die bonding



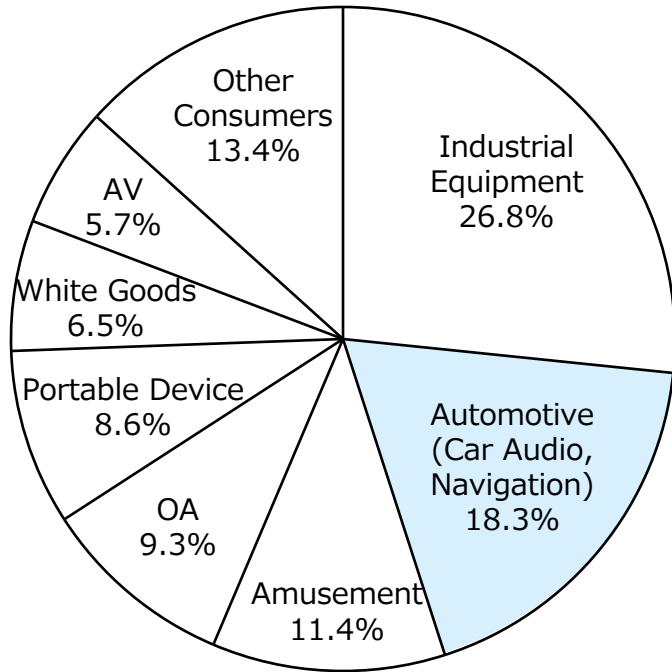
## ■ Quality Control

- Die design is considering assembly process (Height, Pad size and Bottom structure)
- Tractability for all shipping parts. It's covering even super small LED
- Continuous QC activity for Automotive quality (Well-regulated, Fixed 4M, Time control, Automatic)

Product	Marking (bottom view)
SML-P1series 1.0x0.6mm t=0.2mm	

Item		Automotive grade	Consumer grade	
Concept		Produce by Fixed 4M(Man, Machine, Method, Material) with best condition <ul style="list-style-type: none"> <li>•Aim Center level (Trend management)</li> <li>•Process control at processing point (Keep best condition)</li> <li>•Device control (Device check at processing point)</li> </ul>		
Man		•Produced by Operator, Inspector, Maintenance engineer who are authorized by Skill(Knowledge, Technique) and Experience		
Machine		•limited machine which based on Processing accuracy and process capability	•No limitation	
Method	Die bonding, Wire bonding inspection		•Aim Center level (Trend management)	
			•Sampling test (ALL production LOT)	
	Visual inspection(SMD type)		•Guarantee by inspection of all items	
			•Microscope magnification x20	
			•Microscope magnification x10	
	Traceability	Quality record	•Keep for 15yrs	•Keep for 3yrs
		Keep sample	•Keep for 15yrs	•Keep for 3yrs
Quality assurance for shipping parts	Analyze failure item (Dekisokonai kakunin)	•Check nothing of Fatal failure and other abnormality		
		•Analyze all items	•Analyze sampled items	
Material	Incoming inspection Traceability		•Incoming inspection by inspection report from supplier	
			•Keep for 3yrs	
Quality target		•initial failure rate : less than 0.1ppm	•initial failure rate : less than 1ppm	

## Market Segment for Rohm LED



Data source : ROHM  
2017

## Automotive Solution

**Ambient light**  
**Car audio, navigation**  
**Air conditioner panel**

**1608(0603) Series**  
 Long life 1608(0603) SMLD12 series

**RGB Series**  
 MSL0402RGB/SMLVN6RGB  
 MSL0104RGB/MSL0601RGB

**Cluster**

**1608(0603) series**  
 With lens CSL0901 series  
 Tall CSL-10 series  
 Single rank SML-D15 series

**Stop Lamp light source**

**PLCC4**  
 Long life & sulfuration resistance  
 PLCC

■ Our company mission is “Quality is our top priority at all times”. We are focusing to Automotive application with a concept of “Saving energy” and “Miniaturization”

■ To support a wide range of necessities from indicators to function displays, we can provide “Improving life time of small blue and white” and “Small and high brightness RGB”.

# LED Package Lineup

★ AEC-Q101 qualified

Automotive application



Unit (mm)

**Top view**

1608(0603)series(p.7)

Multi color

**SML-P1 series**  
PICOLED  
1.0×0.6×0.2t  
V U D Y M P  
Y2 M2 M F P E B  
WB IR

**SML-E1 series**  
1.6×0.8×0.36t  
V U D Y M P  
E B WB

**SML-D1 series** ★  
1.6×0.8×0.55t  
V U D Y M F P  
E B WB

**CSL09 series** ★  
New  
1.6×0.8×1.24t  
V U D Y W M P  
E B

**SML-H1 series** ★  
2.0×1.25×0.8t  
V U D Y M P  
TB

**SML-M1/MN series** ★  
2.0×1.25×0.8t  
V U D Y M P  
E B WB IR

**SML-Z1/ZN series** ★  
PLCC  
3.5×2.8×1.9t  
V U D Y M F P  
E B WB

**CSL10 series** ★  
Under Development  
1.6×0.8×1.06t  
V Y M E B

**High Power (White)**

**SMLK1 \* series**  
4.5×2.0×0.6t  
WB

**SML-S1 series**  
Reverse Mount available  
3.2×1.6×1.85t  
V U D Y M P  
E B IR

**SML-81 series** ★  
Reverse Mount available  
3.4×1.25×1.1t  
V U D W M  
B WB TB

**CSL07 series**  
2.9×2.4×3.1t  
U D

**SML-D22 series** ★  
New  
1.6×0.8×0.55t  
V U D Y W M P

**SML-52 series**  
1.3×1.5×0.6t  
V U D Y W M P

**SML-82 series** ★  
Reverse Mount available  
3.4×1.25×1.1t  
V U D Y W M P

**SML-P24 series**  
PICOLED-Duo  
1.0×1.0×0.2t  
V U D Y W M P

**SMLP34RGB**  
PICO-RGB  
1.0×1.0×0.2t  
R G B

**SMLP36RGB**  
PICO-RGB  
1.5×1.0×0.2t  
R G B

**MSL0402RGB** ★  
1.8×1.6×0.5t  
R G B

**SMLVN6RGB** ★  
3.5×2.8×0.6t  
R G B

**CSL04 series**  
2.8×1.2×0.8t  
WB

**SML-A1 series**  
1.6×1.15×0.55t  
V U D Y W M P  
E B WB

**MSL0601RGB** ★  
New  
2.9×1.0×1.35t  
R G B

**MSL0104RGB** ★  
6.9×2.2×2.15t  
R G B

RGB series(p.8)

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## Standard, High brightness, Single Rank and Long life

### Optical/Electrical Characteristics(IF=20mA)

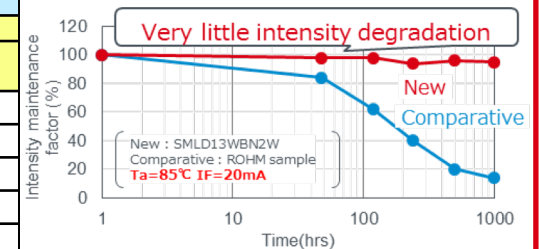
Series	Iv(mcd) [typ.]			
	SML-D12*8W	SML-D13(A)	SML-D14(A)	SML-D15
AEC Q101	YES			
Color	$\lambda$ D (nm)	Standard	High Brightness	High Brightness Single Rank
V	630	40	55	100
U	620	63	85	-
U2	615	-	-	160
D	605	100	120	200
Y	590	63	-	200
W	587	-	110	180
M	572	25	45	60
P	560	6	-	-

(New color < Green, Blue, White > with Long life time)

### Optical/Electrical Characteristics (IF=5mA)

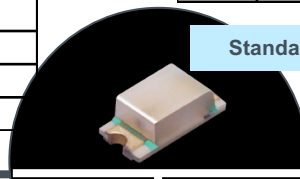
Series	Iv(mcd) [typ.]	
	SMLD12*	Long life
AEC Q101	YES	
Color	$\lambda$ D(nm)/ Chromaticity(x,y)	Long life
E	527	140
E2 ※1	505	120
E3 ※1	496	85
B	470	40
WB	(0.30,0.30)	120

( Load Life test )



Standard

※1) 505nm is suitable for universal design



## Suitable for replacing from PLCC

### Optical/Electrical Characteristics(IF=20mA)

※2 : IF=5mA

Series	Iv(mcd) [typ.]		
	CSL0901*	CSL0902*	
AEC Q101	YES		
Color	$\lambda$ D (nm)	Standard	Ultra High Brightness
V	630	174	250
U	620	300	350
D	605	400	500
Y	590	320	500
W	587	300	400
M	572	100	140
P	560	30	45
E	527	360 ※2	1,100
B	470	56 ※2	360

Under Development  
 [Example] 630nm 20mA

PLCC	CSL0901VT
112mcd	1.6x0.8x1.24t 174mcd

[Schedule]CSL0901(E,B)  
 DS : Available  
 MP : Sep. 2018

[Schedule]CSL0902  
 DS : Available  
 MP : Jul. 2018

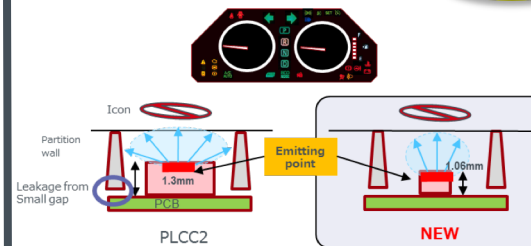
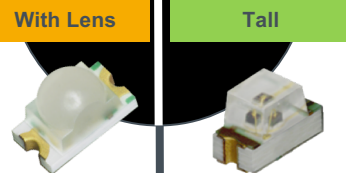
## Designed to prevent Light leakage around icon (Target : replace from PLCC2)

### Optical/Electrical Characteristics(IF=20mA)

※2 : IF=5mA

Series	Iv(mcd) [typ.]	
	CSL1001*	Standard
AEC Q101	YES	
Color	$\lambda$ D (nm)	Standard
V	630	112
Y	590	180
M	571	56
E	527	110 ※2
B	470	18 ※2

Under Development  
 [Schedule]  
 DS : Available  
 MP(E,B) : Aug. 2018  
 MP(V,Y,M) : Mar. 2019



Taller LED reduces light leakage



## Ultra small, High brightness RGB with Reflector

### ■ Optical/Electrical Characteristics(IF=20mA)

Part No.	Resin	Color	Iv(mcd)	$\lambda D$ (nm)	VF(V)
■ ■ ■ MSL0402RGBU	Silicone	Red	400	624	2.1
		Green	550	527	3.5
		Blue	180	470	3.3

When distance is short

When distance is long



Thinner Package



- Unevenly lighted surface
- LED could be seen from outside

- Enables evenly lighted surface
- Prevents the LED from being seen from outside

■ **Evenly lighted surface by taking long distance**

### Top-View

1.8x1.6x0.5t



3.5x2.8x0.6t

Unit.:mm

### Side-View

2.9x1.35x1.0t



6.9x2.15x2.2t

■ **Small foot print and thin Suitable for mobile application**

■ **Make wide area lighting with light guide**

## High brightness RGB with Reflector

### ■ Optical/Electrical Characteristics(IF=20mA)

Part No.	Resin	Color	Iv(mcd)	$\lambda D$ (nm)	VF(V)
■ ■ ■ SMLVN6RGB1U	Silicone	Red	700	624	2.1
		Green	1200	527	3.3
		Blue	400	470	

### ■ Optical/Electrical Characteristics(IF=20mA)

Part No.	Resin	Color	Iv(mcd)	$\lambda D$ (nm)	VF(V)
■ ■ ■ MSL0601RGBU	Silicone	Red	700	624	2.1
		Green	1250	527	3.3
		Blue	360	470	3.2

New

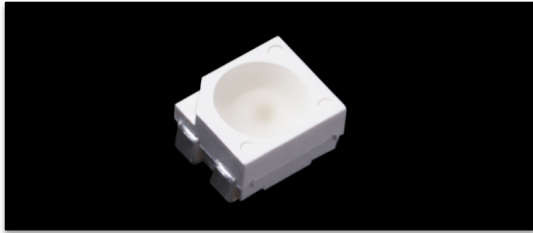
### ■ Optical/Electrical Characteristics(IF=20mA)

Part No.	Resin	Color	Iv(mcd)	$\lambda D$ (nm)	VF(V)
■ ■ ■ MSL0104RGBU	Silicone	Red	700	624	2.1
		Green	1200	527	3.3
		Blue	400	470	3.2

# Silver-Free Ultra High Brightness Red LED(PLCC)



Automotive application



## Silver-Free Design improves Sulfuration Resistance

### SML-Y18 Series

3.5×2.8 t=1.9mm

Color Line-up

**U**

### Applications

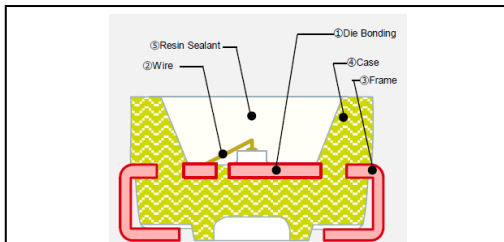
- Outside Indicator
- Automotive
- Industrial Application



### ■ Features

- No silver used for the plating or paste, resulting in greater reliability
- improved sulfuration resistance
- AEC-Q101 qualified

### ■ Silver-Free Construction



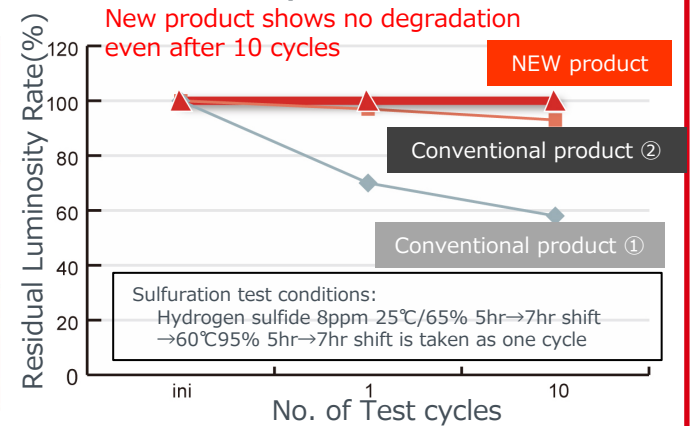
Component	Material	Comments
① DB	Gold Tin	Ag-Free
② Wire	Gold	-
③ Frame	Gold Palladium Plated Copper Frame	Ag-Free
④ Case	-	Heat-/light-resistant material
⑤ Resin Sealant	Silicone Resin	Heat-/light-resistant material

### ■ Improved Sulfuration Resistance

#### LED condition Before/After Sulfuration Test

	Ini.	After 10 cycles
Conventional product ① Silver plating/ Silver paste		Turns black
Conventional product ② Gold palladium plating/ Silver paste		Turns black
<b>NEW product</b> Gold palladium plating/ Gold Tin Die bonding		Does not change

#### Comparison of Residual Luminosity Rate per Sulfuration test cycle



### ■ Optical/Electrical Characteristics(IF=140mA,Ta=25°C)

Part No	Absolute maximum rating		Optical/Electrical characteristics				AEC Q101
	Forward-current IF[mA]	Operating temperature Topr[°C]	Forward-voltage VF[V] Typ.	λD[nm] Typ.	IV[mcd]		
					Min.	Max.	
■ SML-Y18U2T	200	-40~ +100	2.3	618	4,500	9,000	(YES)

Note)The products are under development thus the specification might change without notifications

