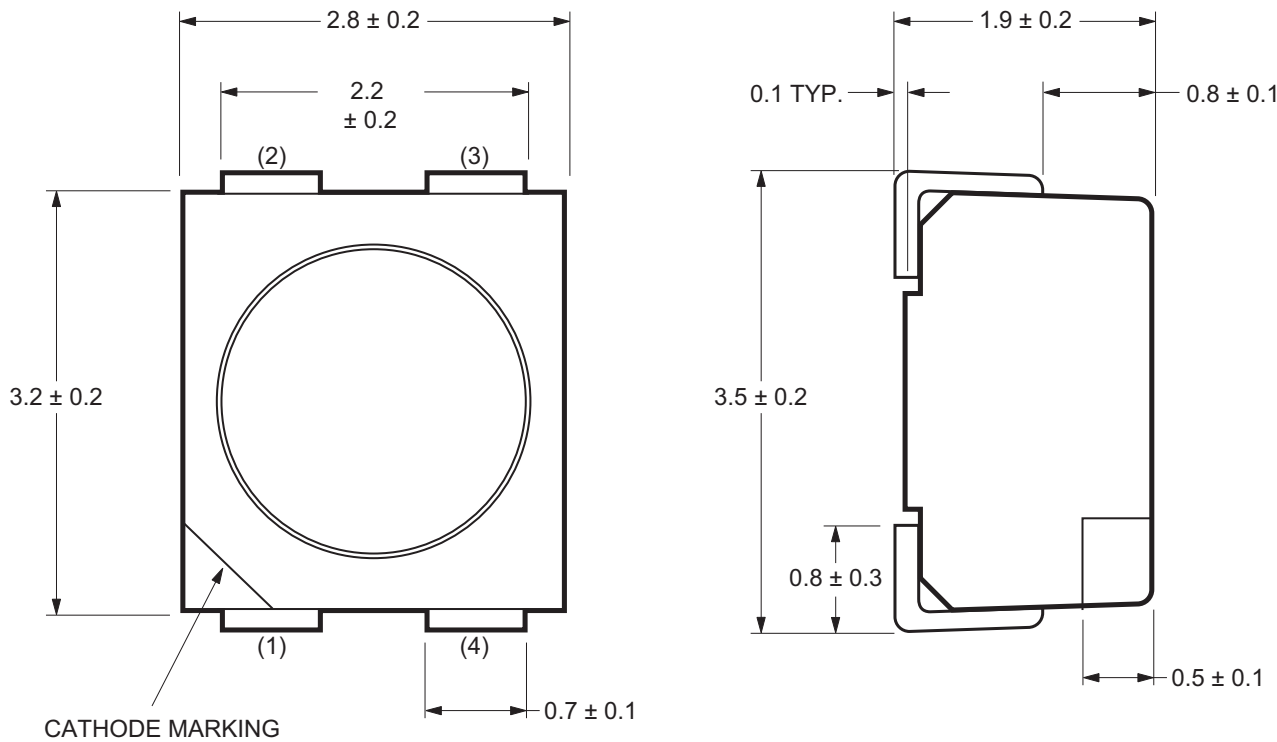


Package Drawing



NOTE: All dimensions in millimeters (mm).

Tri Color	
1	Cathode (Color 1)
2	Common Anode
3	Cathode (Color 3)
4	Cathode (Color 2)
Bi Color	
1	Cathode (Color 1)
2	Anode (Color 1)
3	Cathode (Color 2)
4	Anode (Color 2)

Device Selection Guide

Bi Color

Part Number	Color 1	Color 2
HSMF-A201-xxxxx	GaP Red	GaP Yellow Green
HSMF-A202-xxxxx	GaP Red	GaP Yellow
HSMF-A203-xxxxx	GaP Red	GaP Emerald Green
HSMF-A204-xxxxx	GaP Orange	GaP Yellow Green
HSMF-A205-xxxxx	GaP Orange	GaP Emerald Green
HSMF-A206-xxxxx	GaP Yellow	GaP Yellow Green
HSMF-A211-xxxxx	AlGaAs Red	GaP Yellow Green
HSMF-A212-xxxxx	AlGaAs Red	GaP Yellow
HSMF-A222-xxxxx	AlInGaP Red	AlInGaP Amber
HSMF-A226-xxxxx	AlInGaP Amber	AlInGaP Yellow Green

Part Number	Color 1			Color 2		
	Min. I_V at 20 mA		Typical I_V at 20 mA	Min. I_V at 20 mA		Typical I_V at 20 mA
	Bin ID	(mcd)	(mcd)	Bin ID	(mcd)	(mcd)
HSMF-A201-A00J1	K2	9.0	16.0	L1	11.2	20.0
HSMF-A202-A00J1	K2	9.0	16.0	K1	7.2	12.0
HSMF-A203-A00J1	K2	9.0	16.0	J1	4.5	8.0
HSMF-A204-A00J1	K2	9.0	16.0	L1	11.2	20.0
HSMF-A205-A00J1	K2	9.0	16.0	J1	4.5	8.0
HSMF-A206-A00J1	K2	9.0	16.0	L1	11.2	20.0
HSMF-A211-A00J1	L2	14.0	25.0	L1	11.2	20.0
HSMF-A212-A00J1	L2	14.0	25.0	K1	7.2	12.0
HSMF-A222-A00J1	P1	45.0	80.0	P1	45.0	80.0
HSMF-A226-A00J1	P2	56.0	100.0	M2	22.4	60.0

NOTE: The luminous intensity I_V , is measured at the mechanical axis of the lamp package. The actual peak of the spatial radiation pattern may not be aligned with this axis.

NOTE: I_V tolerance = $\pm 10\%$.

Tri Color

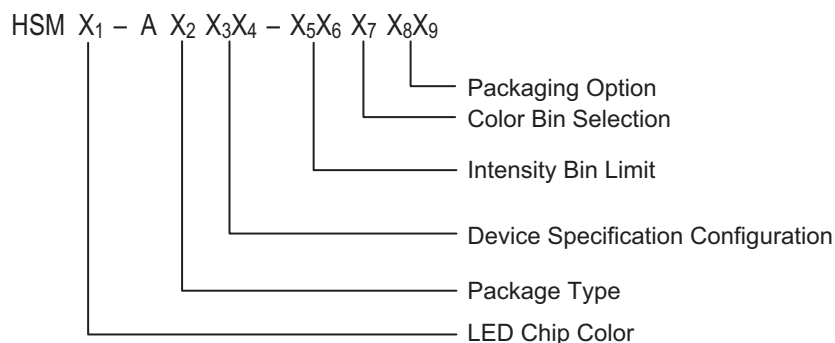
Part Number	Color 1	Color 2	Color 3
HSMF-A341-xxxxx	AlInGaP Red	InGaN Green	InGaN Blue

Part Number	Color 1			Color 2			Color 3		
	Min. I_V @ 20 mA		Typical I_V @ 20 mA	Min. I_V @ 20 mA		Typical I_V @ 20 mA	Min. I_V @ 20 mA		Typical I_V @ 20 mA
	Bin ID	(mcd)	(mcd)	Bin ID	(mcd)	(mcd)	Bin ID	(mcd)	(mcd)
HSMF-A341-A00J1	K2	9.0	13.0	L2	14.0	20.0	K2	9.2	10.0
	P1	45.0	80.0	R1	112.5	160.0	K2	9.2	10.0
	P1	45.0	80.0	R1	112.5	160.0	K2	9.2	10.0
	P1	45.0	80.0	R1	112.5	160.0	N1	28.5	40.0
	P1	45.0	80.0	R1	112.5	160.0	N1	28.5	40.0

NOTE: The luminous intensity I_V , is measured at the mechanical axis of the lamp package. The actual peak of the spatial radiation pattern may not be aligned with this axis.

NOTE: I_V tolerance = $\pm 10\%$.

Part Numbering System



Absolute Maximum Ratings ($T_A = 25^\circ\text{C}$)

Parameters	AlInGaP				
	GaP	AlGaAs	Red, Amber	Yellow Green	GaN/InGaN
DC Forward Current ^a	30 mA	30 mA	30 mA ^{b,c}	20 mA ^c	20 mA
Peak Forward Current ^d	100 mA	100 mA	100 mA	100 mA	100 mA
Power Dissipation	78 mW	78 mW	72 mW	48 mW	120 mW
Reverse Voltage	5V				
Junction Temperature	110°C				
Operating Temperature	-55°C to +100°C				
Storage Temperature	-55°C to +100°C				

- Derate linearly as shown in figure 4.
- Drive Current between 10 mA and 30 mA are recommended for best long-term performance.
- Operation at current below 5 mA is not recommended.
- Duty factor = 10%, Frequency = 1 kHz.

Optical Characteristics ($T_A = 25^\circ\text{C}$)

Color	Peak Wavelength λ_{PEAK} (nm) Typ.	Dominant Wavelength λ_D (nm) ^a Typ.	Viewing Angle $2\theta_{1/2}$ (Degrees) ^b Typ.	Luminous Efficacy η_v (lm/W) ^c Typ.	Luminous Intensity/ Total Flux $I_v(\text{mcd})/\phi_v$ (mIm) Typ.
GaP Red	635	626	120	120	0.45
AlGaAs Red	645	637	120	63	0.45
AlInGaP Red	635	626	120	150	0.45
AlInGaP Red Orange	621	615	120	240	0.45
GaP Orange	600	602	120	380	0.45
AlInGaP Amber	592	590	120	480	0.45
GaP Yellow	583	585	120	580	0.45
AlInGaP Amber	592	590	120	480	0.45
GaP Yellow Green	565	569	120	590	0.45
GaP Emerald Green	558	560	120	650	0.45
InGaN Green	523	525	120	500	0.45
InGaN Blue	468	470	120	75	0.45
GaN Blue	428	462	120	65	0.45
AlInGaP Yellow Green	575	571	120	620	0.45

- The dominant wavelength, λ_D , is derived from the CIE Chromaticity Diagram and represents the color of the device.
- $\theta_{1/2}$ is the off-axis angle where the luminous intensity is 1/2 the peak intensity.
- Radiant intensity, I_e in watts/steradian, may be calculated from the equation $I_e = I_v/\eta_v$, where I_v is the luminous intensity in candelas and η_v is the luminous efficacy in lumens/watt.

Electrical Characteristics ($T_A = 25^\circ\text{C}$)

Dice Technology	Forward Voltage V_F (Volts) @ $I_F = 20\text{ mA}$		Reverse Voltage V_R @ $100\text{ }\mu\text{A}$	Reverse Voltage V_R @ $10\text{ }\mu\text{A}$
	Typ.	Max.	Min.	Min.
GaP	2.2	2.6	5	—
AS AlGaAs	1.9	2.6	5	—
AlInGaP	1.9	2.4	5	—
GaN Blue	3.9	4.3	—	5
InGaN	3.4	4.05	—	5

Figure 1: Relative Intensity vs. Wavelength

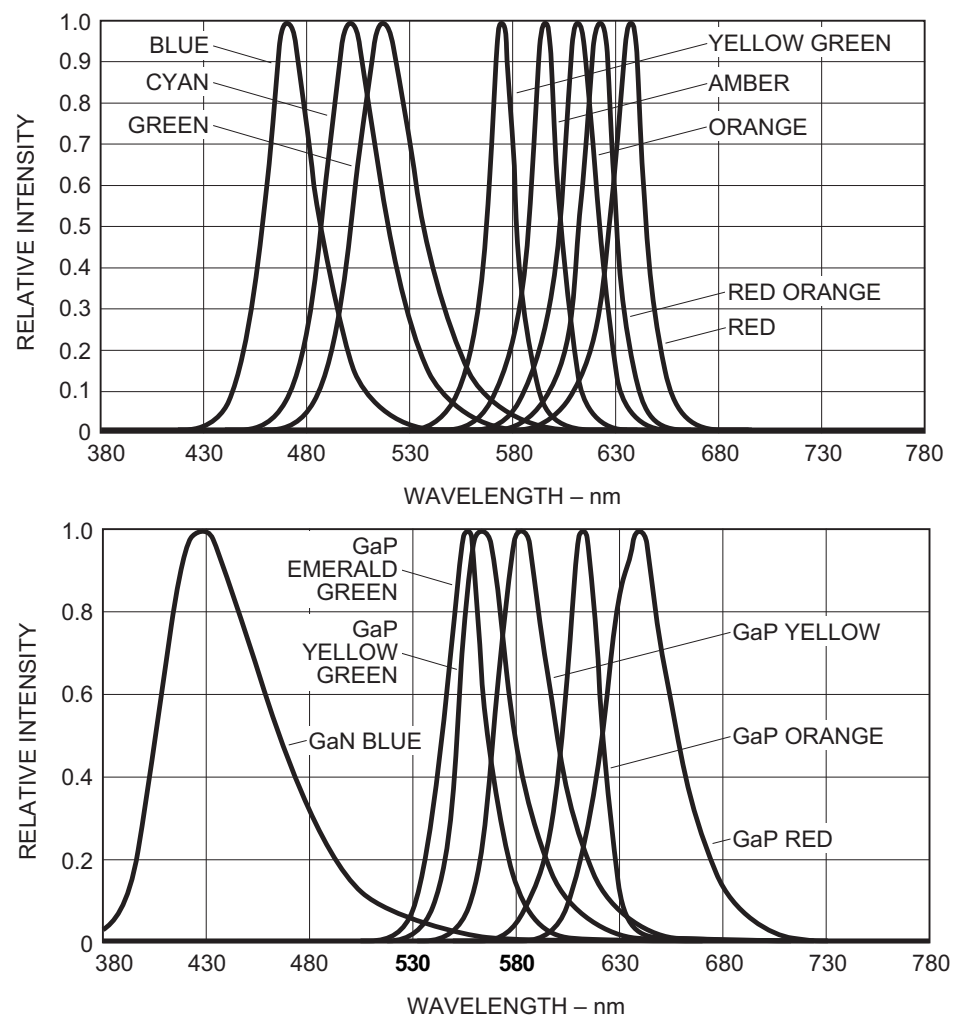


Figure 2: Forward Current vs. Forward Voltage

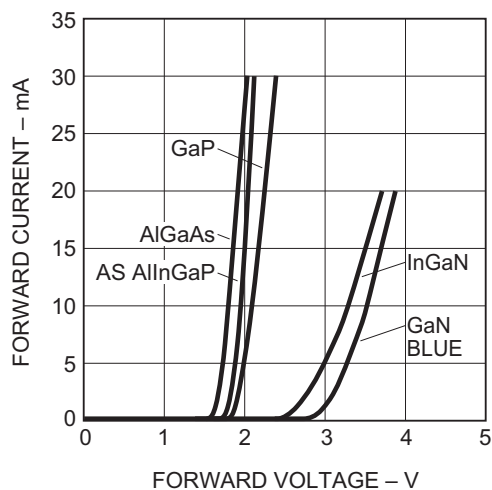


Figure 3: Relative Intensity vs. Forward Voltage

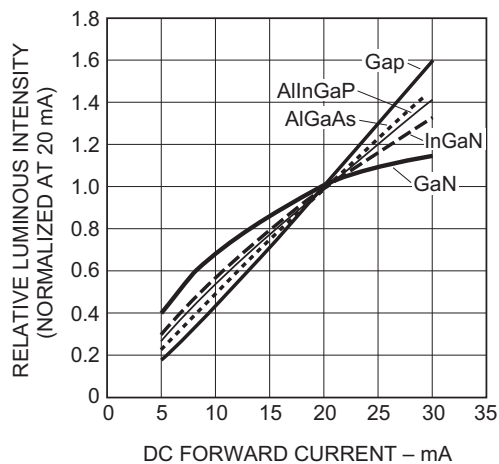


Figure 4: Maximum Forward Current vs. Ambient Temperature. Derated based on $T_{JMAX} = 110^{\circ}\text{C}$, $R\theta_{JA} = 500^{\circ}\text{C/W}$ (1 chip on).

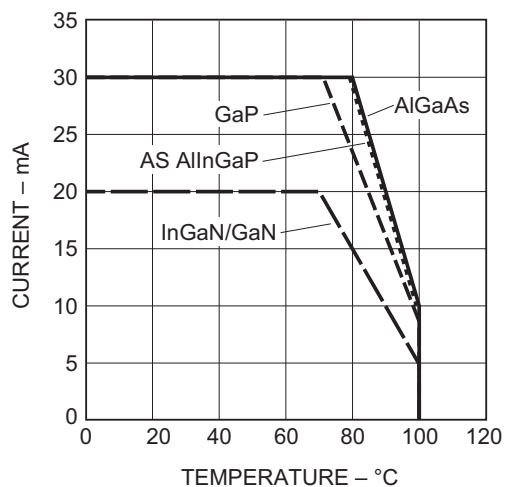


Figure 5: Maximum Forward Current vs. Ambient Temperature. Derated based on $T_{JMAX} = 110^{\circ}C$, $R\theta_{JA} = 700^{\circ}C/W$ (3 chip on).

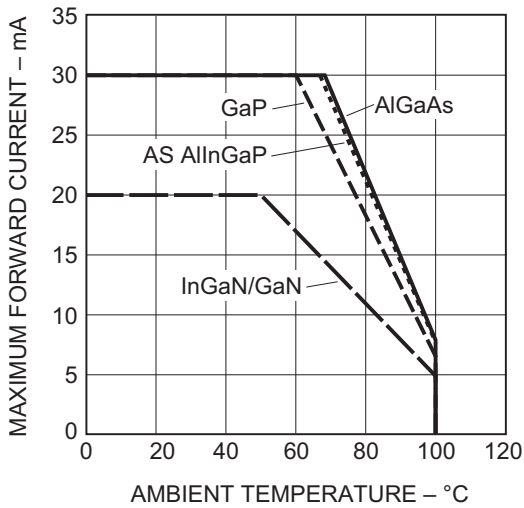


Figure 6: Dominant Wavelength vs. Forward Current – InGaN

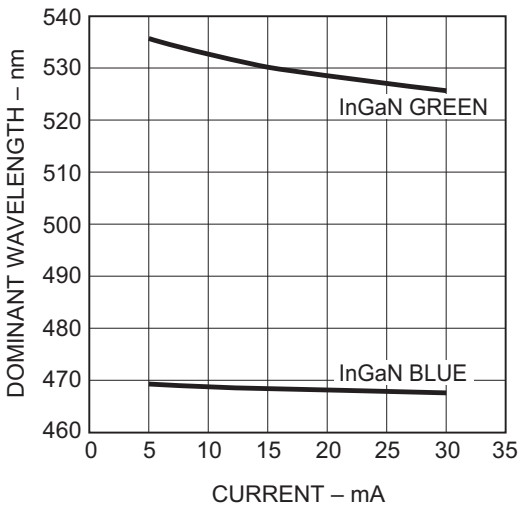


Figure 7: Radiation Pattern

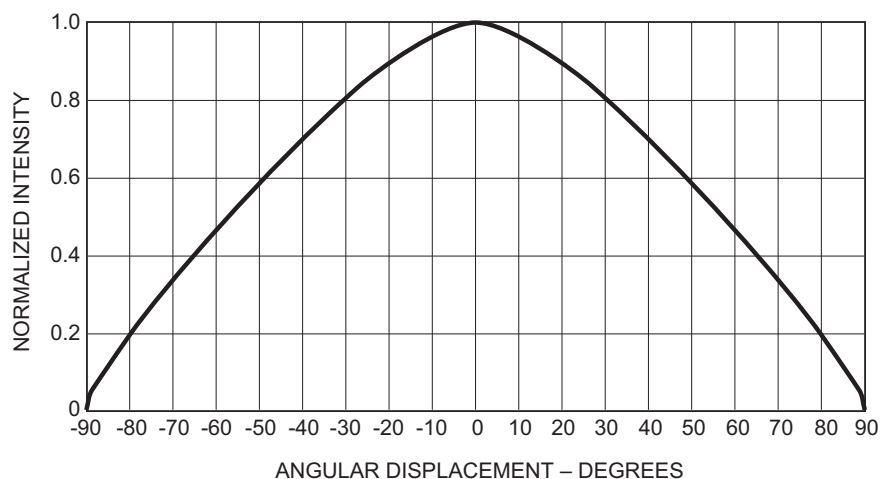
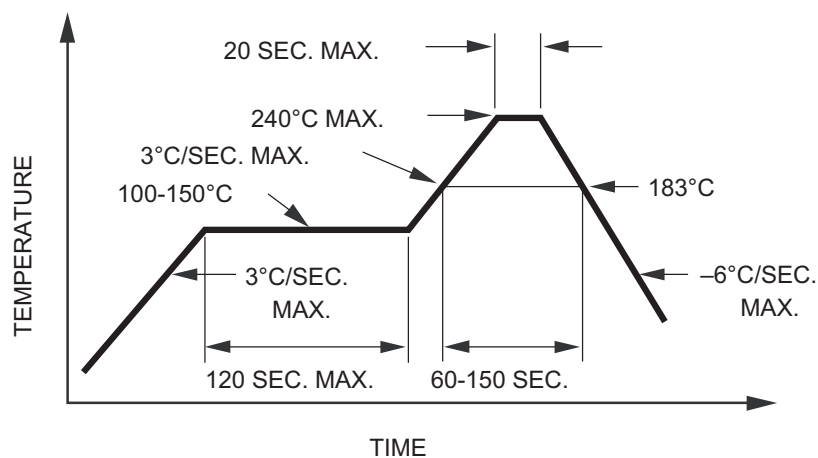


Figure 8: Recommended SnPb Reflow Soldering Profile



NOTE: For detail information on reflow soldering of Avago surface mount LEDs, refer to Avago Application Note AN 1060 Surface Mounting SMT LED Indicator Components.

Figure 9: Recommended Soldering Pad Pattern

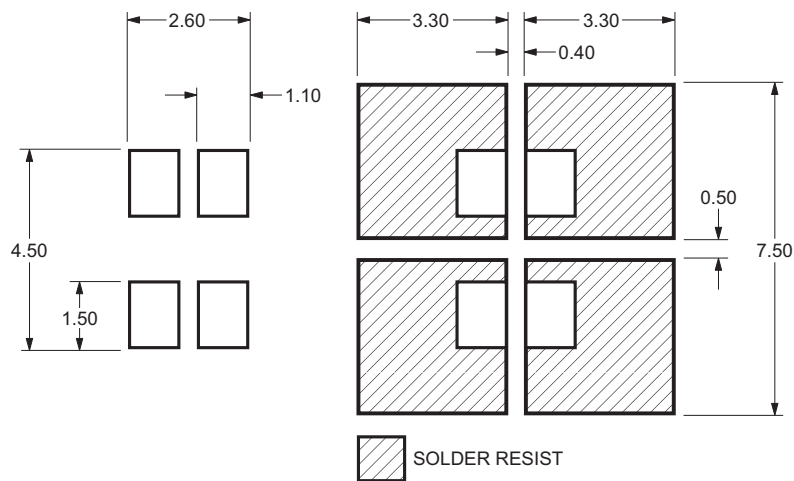


Figure 10: Tape Leader and Trailer Dimension

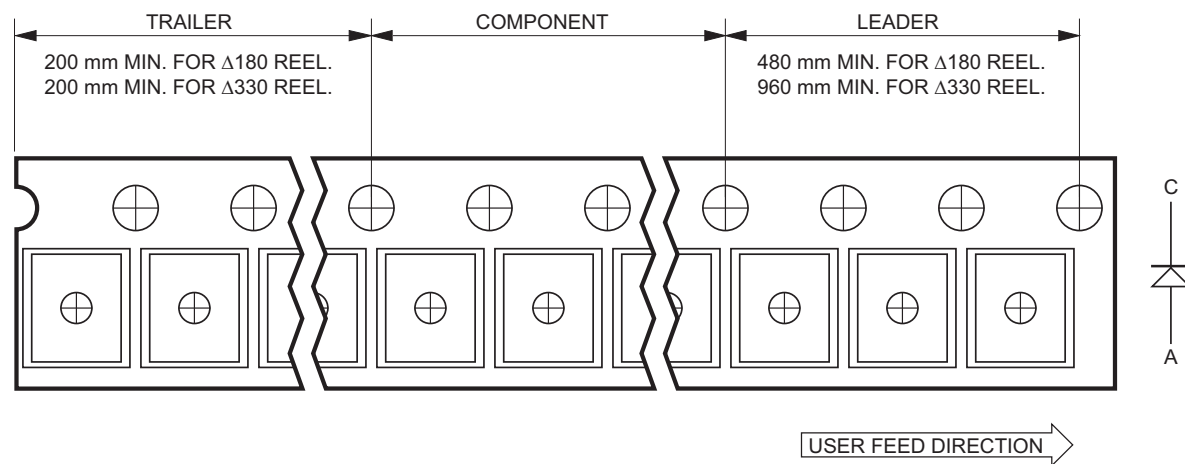


Figure 11: Tape Leader and Trailer Dimension

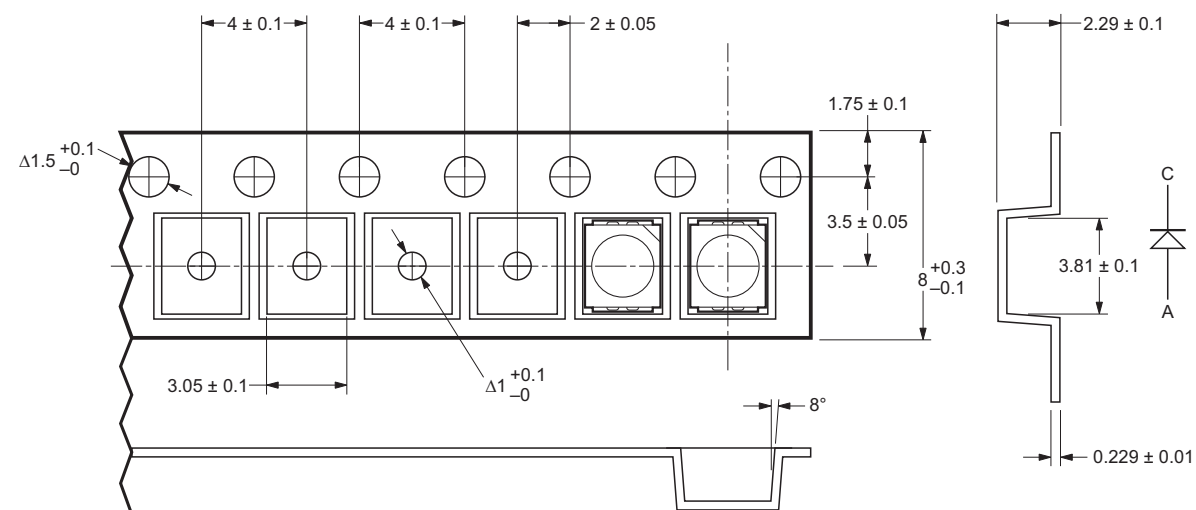


Figure 12: Reel Dimension

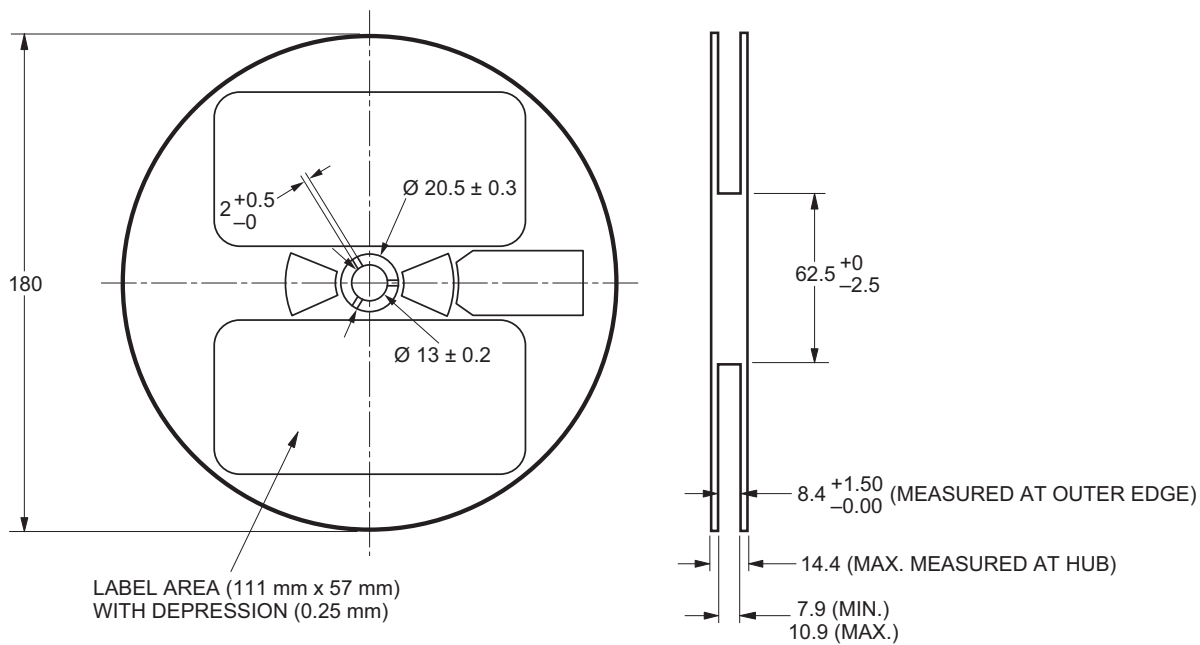


Figure 13: Reeling Orientation

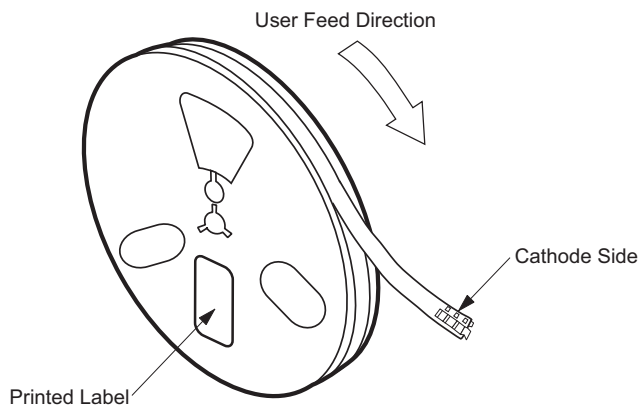
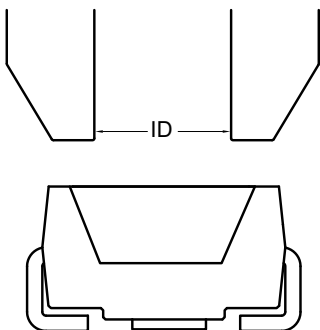


Figure 14: Recommended Pick and Place Nozzle Size



NOTE: Diameter ID should be bigger than 2.3 mm.

Handling Precaution

The encapsulation material of the product is made of silicone for better reliability of the product. As silicone is a soft material, please do not press on the silicone or poke a sharp object onto the silicone. These might damage the product and cause premature failure. During assembly of handling, the unit should be held on the body only. Refer to Avago Application Note AN 5288 for detail information.

Moisture Sensitivity

This product is qualified as Moisture Sensitive Level 2a per Jedec J-STD-020. Precautions when handling this moisture sensitive product is important to ensure the reliability of the product. Do refer to Avago Application Note AN5305 Handling of Moisture Sensitive Surface Mount Devices for details.

1. Storage before use:
 - Unopen moisture barrier bag (MBB) can be stored at <40°C/90%RH for 12 months. If the actual shelf life has exceeded 12 months and the HIC indicates that baking is not required, then it is safe to reflow the LEDs per the original MSL rating.
 - It is not recommended to open the MBB prior to assembly (as an example, for IQC).
2. Control after opening the MBB:
 - The humidity indicator card (HIC) shall be read immediately upon opening of MBB.
 - The LEDs must be kept at <30°C/60%RH at all time and all high temperature related process including soldering, curing or rework need to be completed within 672 hours.
3. Control for unfinished reel:
 - For any unused LEDs, they need to be stored in sealed MBB with desiccant or desiccator at <5%RH.
4. Control of assembled boards:
 - If the PCB soldered with the LEDs is to be subjected to other high temperature processes, the PCB need to be stored in sealed MBB with desiccant or desiccator at <5%RH to ensure no LEDs have exceeded their floor life of 672 hours.
5. Baking is required if:
 - 10% or 15% HIC indicator turns pink.
 - The LEDs are exposed to condition of >30°C/60% RH at any time.

- The LEDs floor life exceeded 672 hours.

Recommended baking condition: 60 ±5°C for 20 hours.

I_V Bin Select (X₅X₆)

Individual reel will contain parts from 1 half bin only.

Table 1: Minimum Intensity Bin Selection for HSMF-A201-xxxxx, HSMF-A204-xxxxx, HSMF-A206-xxxxx

X ₅	Color 1 (Red/ Yellow/Orange)	Color 2 (Green)
A	K2	L1
B	K2	L2
C	K2	M1
D	K2	M2
E	K2	N1
F	L1	L1
G	L1	L2
H	L1	M1
J	L1	M2
K	L1	N1
L	L2	L1
M	L2	L2
N	L2	M1
P	L2	M2
Q	L2	N1
R	M1	L1
S	M1	L2
T	M1	M1
U	M1	M2
V	M1	N1
W	M2	L1
X	M2	L2
Y	M2	M1
Z	M2	M2
1	M2	N1

Table 2: Minimum Intensity Bin Selection for HSMF-A202-xxxxx

X ₅	Color 1 (Red)	Color 2 (Yellow)
A	K2	K1
B	K2	K2
C	K2	L1
D	K2	L2

Table 2: Minimum Intensity Bin Selection for HSMF-A202-xxxxx (Continued)

X ₅	Color 1 (Red)	Color 2 (Yellow)
E	K2	M1
F	L1	K1
G	L1	K2
H	L1	L1
J	L1	L2
K	L1	M1
L	L2	K1
M	L2	K2
N	L2	L1
P	L2	L2
Q	L2	M1
R	M1	K1
S	M1	K2
T	M1	L1
U	M1	L2
V	M1	M1
W	M2	K1
X	M2	K2
Y	M2	L1
Z	M2	L2
1	M2	M1

Table 3: Minimum Intensity Bin Selection for HSMF-A203-xxxxx and HSMF-A205-xxxxx

X ₅	Color 1 (Red/Orange)	Color 2 (Green)
A	K2	J1
B	K2	J2
C	K2	K1
D	K2	K2
E	K2	L1
F	L1	J1
G	L1	J2
H	L1	K1
J	L1	K2
K	L1	L1
L	L2	J1
M	L2	J2
N	L2	K1
P	L2	K2
Q	L2	L1

Table 3: Minimum Intensity Bin Selection for HSMF-A203-xxxxx and HSMF-A205-xxxxx (Continued)

X ₅	Color 1 (Red/Orange)	Color 2 (Green)
R	M1	J1
S	M1	J2
T	M1	K1
U	M1	K2
V	M1	L1
W	M2	J1
X	M2	J2
Y	M2	K1
Z	M2	K2
1	M2	L1

Table 4: Minimum Intensity Bin Selection for HSMF-A211-xxxxx

X ₅	Color 1 (Red)	Color 2 (Green)
A	L2	L1
B	L2	L2
C	L2	M1
D	L2	M2
E	L2	N1
F	M1	L1
G	M1	L2
H	M1	M1
J	M1	M2
K	M1	N1
L	M2	L1
M	M2	L2
N	M2	M1
P	M2	M2
Q	M2	N1
R	N1	L1
S	N1	L2
T	N1	M1
U	N1	M2
V	N1	N1
W	N2	L1
X	N2	L2
Y	N2	M1
Z	N2	M2
1	N2	N1

NOTE: 0 represents full distribution.

Table 5: Minimum Intensity Bin Selection for HSMF-A212-xxxxx

X ₅	Color 1 (Red)	Color 2 (Yellow)
A	L2	K1
B	L2	K2
C	L2	L1
D	L2	L2
E	L2	M1
F	M1	K1
G	M1	K2
H	M1	L1
J	M1	L2
K	M1	M1
L	M2	K1
M	M2	K2
N	M2	L1
P	M2	L2
Q	M2	M1
R	N1	K1
S	N1	K2
T	N1	L1
U	N1	L2
V	N1	M1
W	N2	K1
X	N2	K2
Y	N2	L1
Z	N2	L2
1	N2	M1

Table 6: Minimum Intensity Bin Selection for HSMF-A222-xxxxx

X ₅	Color 1 (Red)	Color 2 (Amber)
A	P1	P1
B	P1	P2
C	P1	Q1
D	P1	Q2
E	P1	R1
F	P2	P1
G	P2	P2
H	P2	Q1
J	P2	Q2
K	P2	R1

Table 6: Minimum Intensity Bin Selection for HSMF-A222-xxxxx (Continued)

X ₅	Color 1 (Red)	Color 2 (Amber)
L	Q1	P1
M	Q1	P2
N	Q1	Q1
P	Q1	Q2
Q	Q1	R1
R	Q2	P1
S	Q2	P2
T	Q2	Q1
U	Q2	Q2
V	Q2	R1
W	R1	P1
X	R1	P2
Y	R1	Q1
Z	R1	Q2
1	R1	R1
2	R2	P1
3	R2	P2
4	R2	Q1
5	R2	Q2
6	R2	R1

Table 7: Minimum Intensity Bin Selection for HSMF-A341-xxxxx

X ₅	Color 1 (Red/ Red Orange)	Color 2 (Green)	Color 3 (Blue)
A	P1	R1	N1
B	P1	R1	N2
C	P1	R1	P1
D	P1	R2	N1
E	P1	R2	N2
F	P1	R2	P1
G	P1	S1	N1
H	P1	S1	N2
J	P1	S1	P1
K	P2	R1	N1
L	P2	R1	N2
M	P2	R1	P1
N	P2	R2	N1
P	P2	R2	N2
Q	P2	R2	P1
R	P2	S1	N1

Table 7: Minimum Intensity Bin Selection for HSMF-A341-xxxxx (Continued)

X ₅	Color 1 (Red/ Red Orange)	Color 2 (Green)	Color 3 (Blue)
S	P2	S1	N2
T	P2	S1	P1
U	Q1	R1	N1
V	Q1	R1	N2
W	Q1	R1	P1
X	Q1	R2	N1
Y	Q1	R2	N2
Z	Q1	R2	P1
1	Q1	S1	N1
2	Q1	S1	N2
3	Q1	S1	P1
4	Q2	R1	N1
5	Q2	R1	N2
6	Q2	R1	P1
7	Q2	R2	N1
8	Q2	R2	N2
9	Q2	R2	P1

Number of Half Bins from X₅

Table 8: Number of Half Bins from X₅ for HSMF-A2xx-xxxxx

X ₆	Color 1	Color 2
0	0	0
A	0	5
B	0	4
C	0	3
D	0	2
E	5	0
F	5	5
G	5	4
H	5	3
J	5	2
K	4	0
L	4	5
M	4	4
N	4	3
P	4	2
Q	3	0
R	3	5
S	3	4

Table 8: Number of Half Bins from X₅ for HSMF-A2xx-xxxxx

X ₆	Color 1	Color 2
T	3	3
U	3	2
V	2	0
W	2	5
X	2	4
Y	2	3
Z	2	2

NOTE: 0 represents full distribution.

Table 9: Number of Half Bins from X₅ for HSMF-A3xx-xxxxx

X ₆	Color 1 (Red/ Red Orange)	Color 2 (Green)	Color 3 (Blue)
0	0	0	0
A	5	5	5
B	5	5	4
C	5	5	3
D	5	4	5
E	5	4	4
F	5	4	3
G	5	3	5
H	5	3	4
J	5	3	3
K	4	5	5
L	4	5	4
M	4	5	3
N	4	4	5
P	4	4	4
Q	4	4	3
R	4	3	5
S	4	3	4
T	4	3	3
U	3	5	5
V	3	5	4
W	3	5	3
X	3	4	5
Y	3	4	4
Z	3	4	3
1	3	3	5
2	3	3	4
3	3	3	3

NOTE: 0 represents full distribution.

Intensity Bin Limits

Bin ID	Min. (mcd)	Max. (mcd)
J1	4.50	5.60
J2	5.60	7.20
K1	7.20	9.00
K2	9.00	11.20
L1	11.20	14.00
L2	14.00	18.00
M1	18.00	22.40
M2	22.40	28.50
N1	28.50	35.50
N2	35.50	45.00
P1	45.00	56.00
P2	56.00	71.50
Q1	71.50	90.00
Q2	90.00	112.50
R1	112.50	140.00
R2	140.00	180.00
S1	180.00	224.00
S2	224.00	285.00
T1	285.00	355.00
T2	355.00	450.00
U1	450.00	560.00
U2	560.00	715.00
V1	715.00	900.00
V2	900.00	1125.00

NOTE: Tolerance of each bin limit = $\pm 10\%$.

Color Bin Select (X_7)

Individual reel will contain parts from 1 full bin only.

Table 10: Color Bin Select for HSMF-A202-xxxxx, HSMF-A203-xxxxx, HSMF-A212-xxxxx, HSMF-A222-xxxxx

X_7	Color 1 (Red)	Color 2 (Emerald Green/ Yellow/Blue)
0	0	0
A	0	ABC
B	0	ABCD
C	0	ABCDE
D	0	BCD
E	0	BCDE
F	0	BCDEF

Table 10: Color Bin Select for HSMF-A202-xxxxx, HSMF-A203-xxxxx, HSMF-A212-xxxxx, HSMF-A222-xxxxx

X_7	Color 1 (Red)	Color 2 (Emerald Green/ Yellow/Blue)
G	0	CDE
H	0	DEF
J	0	CDEF
K	0	AB
L	0	BC
M	0	CD
N	0	DE
P	0	EF

NOTE: 0 represents full distribution.

Table 11: Color Bin Select for HSMF-A201-xxxxx and HSMF-A211-xxxxx

X_7	Color 1 (Red)	Color 2 (Yellow Green)
0	0	0
A	0	EFG
B	0	FGH
C	0	EF
D	0	FG
E	0	GH

NOTE: 0 represents full distribution.

Table 12: Color Bin Select for HSMF-A205-xxxxx

X_7	Color 1 (Yellow/ Amber/Orange)	Color 2 (Emerald Green/Blue)
0	0	0
A	ABC	ABC
B	BCD	ABC
C	CDE	ABC
D	ABC	BCD
E	BCD	BCD
F	CDE	BCD
G	ABC	CDE
H	BCD	CDE
J	CDE	CDE
K	DEF	ABC
L	DEF	BCD
M	DEF	CDE
N	AB	AB

Table 12: Color Bin Select for HSMF-A205-xxxxx

X ₇	Color 1 (Yellow/ Amber/Orange)	Color 2 (Emerald Green/Blue)
P	BC	AB
Q	CD	AB
R	DE	AB
S	AB	BC
T	BC	BC
U	CD	BC
V	DE	BC
W	AB	CD
X	BC	CD
Y	CD	CD
Z	DE	CD
1	AB	DE
2	BC	DE
3	CD	DE
4	DE	DE
5	EF	AB
6	EF	BC
7	EF	CD

NOTE: 0 represents full distribution.

**Table 13: Color Bin Select for HSMF-A204-xxxxx and
HSMF-A206-xxxxx**

X ₇	Color 1 (Yellow/ Amber/Orange)	Color 2 (Yellow Green)
0	0	0
A	ABC	EFG
B	BCD	EFG
C	CDE	EFG
D	DEF	EFG
E	ABC	FGH
F	BCD	FGH
G	CDE	FGH
H	DEF	FGH
J	AB	EF
K	BC	EF
L	CD	EF
M	DE	EF
N	EF	EF
P	AB	FG
Q	BC	FG
R	CD	FG

**Table 13: Color Bin Select for HSMF-A204-xxxxx and
HSMF-A206-xxxxx**

X ₇	Color 1 (Yellow/ Amber/Orange)	Color 2 (Yellow Green)
S	DE	FG
T	EF	FG
U	AB	GH
V	BC	GH
W	CD	GH
X	DE	GH
Y	EF	GH

NOTE: 0 represents full distribution.

Table 14: Color Bin Select for HSMF-A3xx-xxxxx

X ₇	Color 1	Color 2	Color 3
0	0	0	0
A	0	0	ABC
B	0	0	BCD
C	0	0	AB
D	0	0	BC
E	0	0	CD
F	0	ABC	0
G	0	ABC	ABC
H	0	ABC	BCD
J	0	ABC	AB
K	0	ABC	BC
L	0	ABC	CD
M	0	BCD	0
N	0	BCD	ABC
P	0	BCD	BCD
Q	0	BCD	AB
R	0	BCD	BC
S	0	BCD	CD
T	0	AB	ABC
U	0	AB	BCD
V	0	AB	AB
W	0	AB	BC
X	0	AB	CD
Y	0	BC	ABC
Z	0	BC	BCD
1	0	BC	AB
2	0	BC	BC
3	0	BC	CD
4	0	CD	ABC

Table 14: Color Bin Select for HSMF-A3xx-xxxxx

X ₇	Color 1	Color 2	Color 3
5	0	CD	BCD
6	0	CD	AB
7	0	CD	BC
8	0	CD	CD

NOTE: 0 represents full distribution.

Color Bin Limits

Blue	Min. (nm)	Max. (nm)
A	460.0	465.0
B	465.0	470.0
C	470.0	475.0
D	475.0	480.0

Green	Min. (nm)	Max. (nm)
A	515.0	520.0
B	520.0	525.0
C	525.0	530.0
D	530.0	535.0

Emerald Green	Min. (nm)	Max. (nm)
A	552.5	555.5
B	555.5	558.5
C	558.5	561.5
D	561.5	564.5

Yellow Green	Min. (nm)	Max. (nm)
E	564.5	567.5
F	567.5	570.5
G	570.5	573.5
H	573.5	576.5

Amber/Yellow	Min. (nm)	Max. (nm)
A	582.0	584.5
B	584.5	587.0
C	587.0	589.5
D	589.5	592.0

Amber/Yellow	Min. (nm)	Max. (nm)
E	592.0	594.5
F	594.5	597.0

Orange	Min. (nm)	Max. (nm)
A	597.0	600.0
B	600.0	603.0
C	603.0	606.0
D	606.0	609.0
E	609.0	612.0

Red Orange	Min. (nm)	Max. (nm)
A	611.0	616.0
B	616.0	620.0

Red	Min. (nm)	Max. (nm)
Full Distribution		

Packaging Option (X₈X₉)

X ₈ X ₉	
J1	20 mA test current, Top Mount, 7-inch Reel

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