

# Kingbright

Optoelectronic Components



Quality ■  
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**2012-2013**

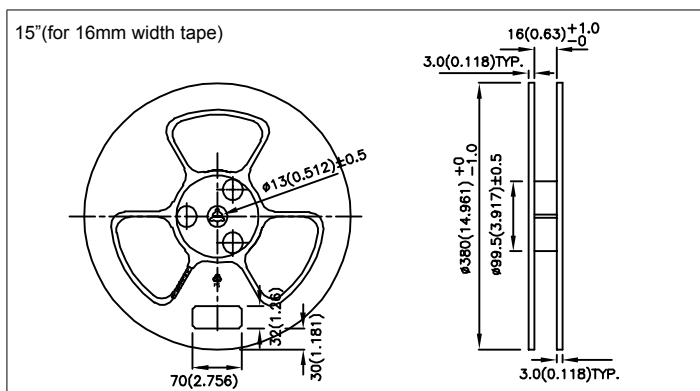
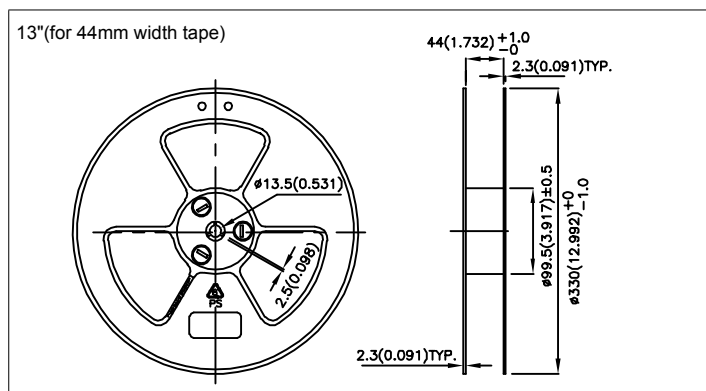
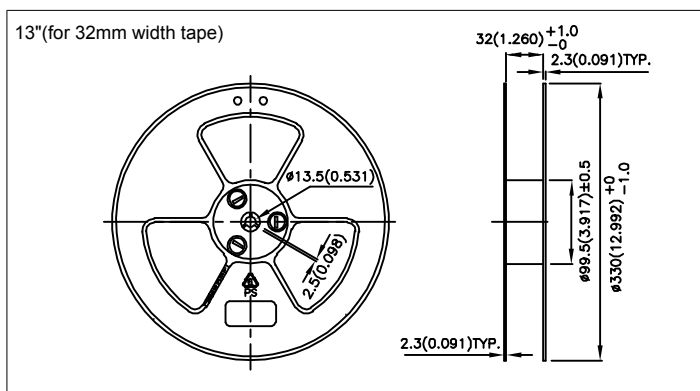
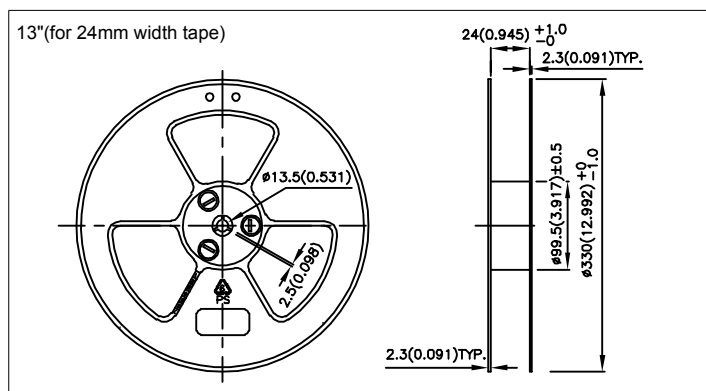
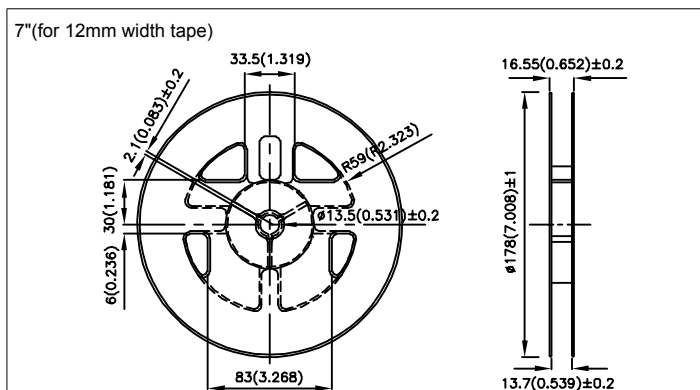
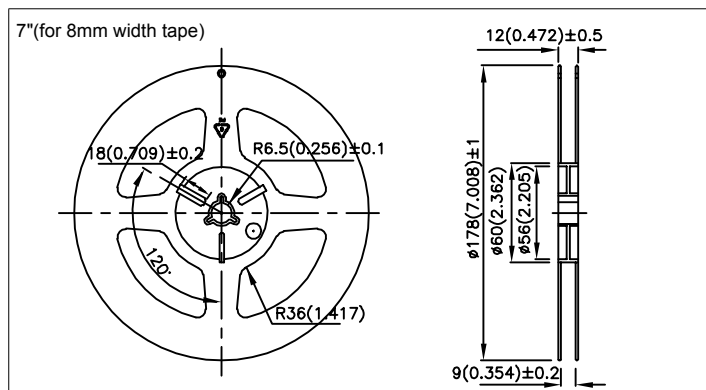
## TECHNICAL NOTES

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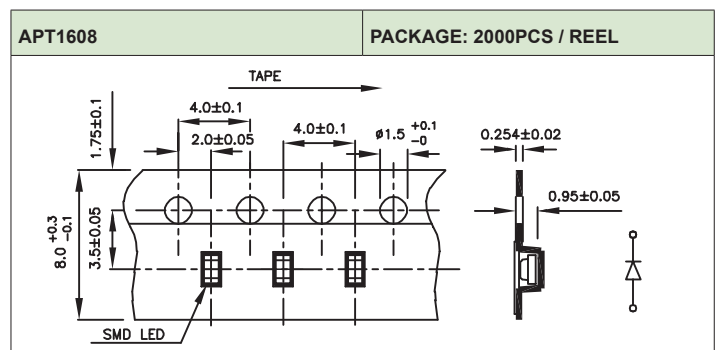
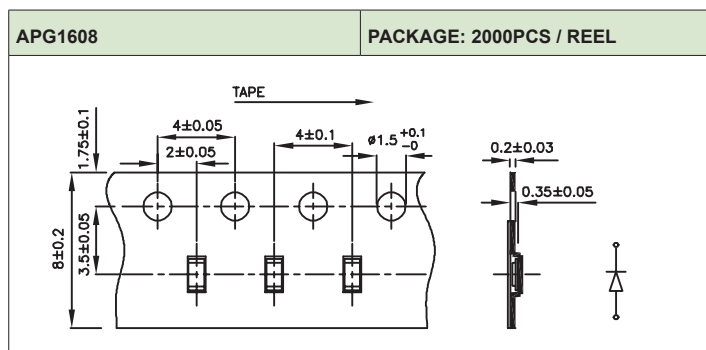
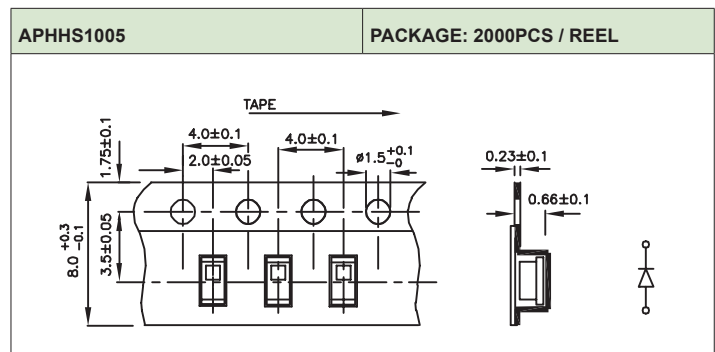
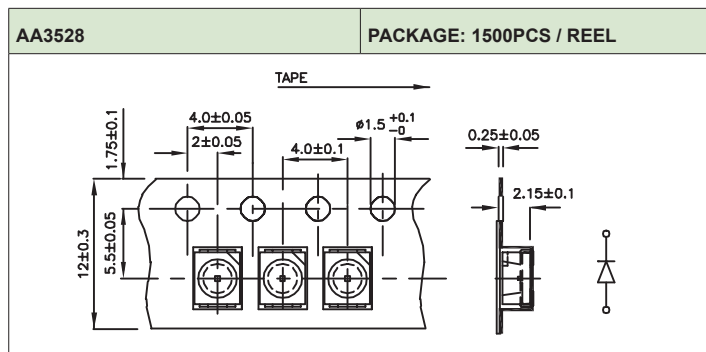
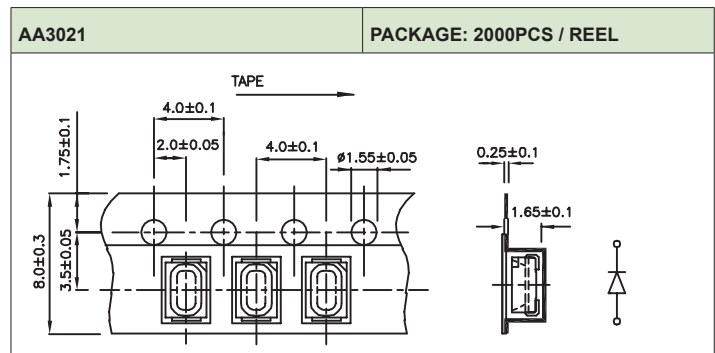
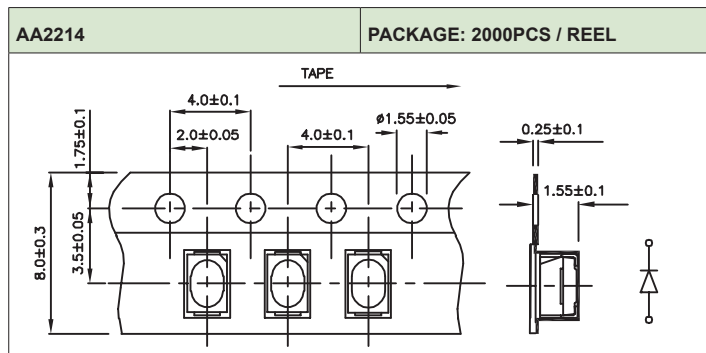
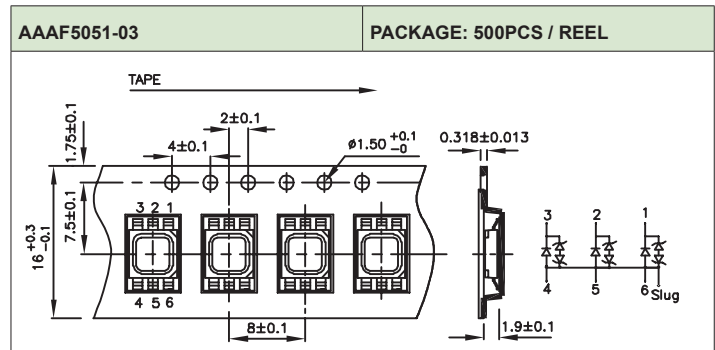
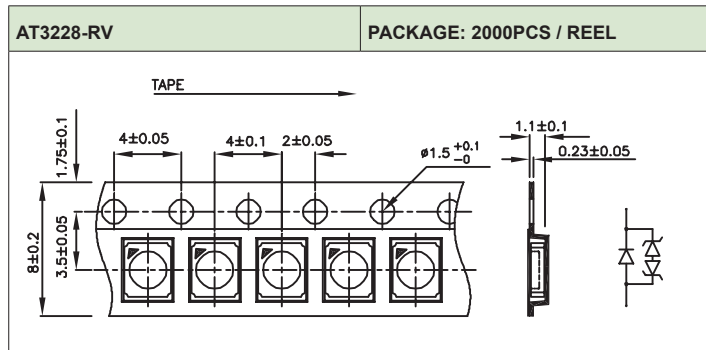
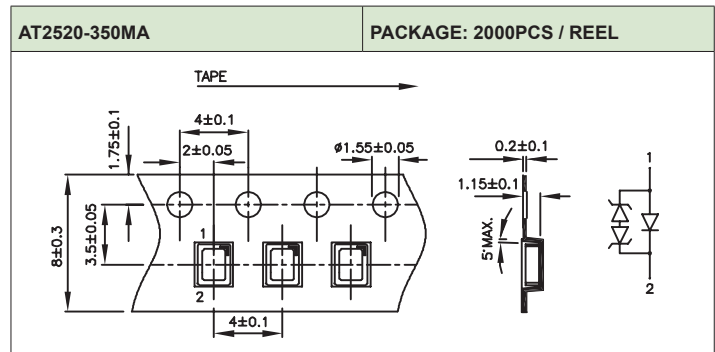
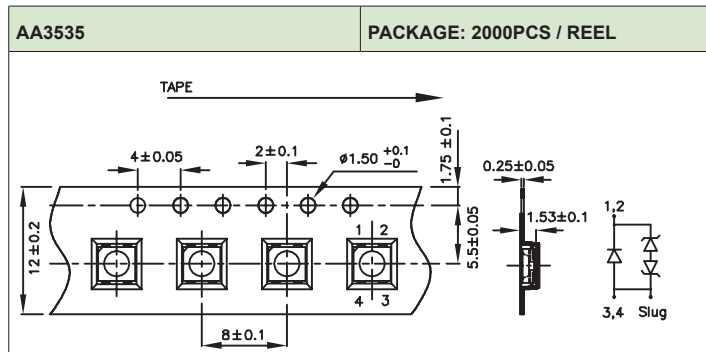
## SMD TAPE SPECIFICATIONS

Reel Dimensions	Part Number		Reel Dimensions	Part Number	Reel Dimensions	Part Number	
7" (for 8mm width tape)	AA2214	APHCM2012-F01	7" (for 12mm width tape)	AA3535	13" (for 24mm width tape)	ACDX02-41xxx-F01	
	AA2810A	APHHS1005		AA3528		ACDX03-41xxx-F01	
	AA3021	APL3015-F01		AA4040		ACSX02-41xxx-F01	
	AM23	APT2012		AAAF3528		ACSX03-41xxx-F01	
	APA1606	APT3216		AM2520xxx03	13" (for 32mm width tape)	ACDX04-41xxx-F01	
	APA2106	APTB1612-F01		AM2520xxx09		ACPSX04-41	
	APA3010	APTB1615-F01		AM27xxx03		ACSX56-41xxx-F01	
	APB3025-F01	APTD1608		AM27xxx09		13" (for 44mm width tape)	ACDX56-41xxx-F01
	APBA3010	APTD3216		APETD3528	ACSX08-51		
	APBD3224-F01	APTF1616		APF3236	15" (for 16mm width tape)		AAAF5051-03
	APBDA3020	APTF3216					
	APBL3025-F01	APTL3216					
	APD3224-F01	APTR3216					
	APFA3010	APT1608					
	APG1608	AT2520-350MA					
	APHB1608	AT3228-RV					
APHBM2012							



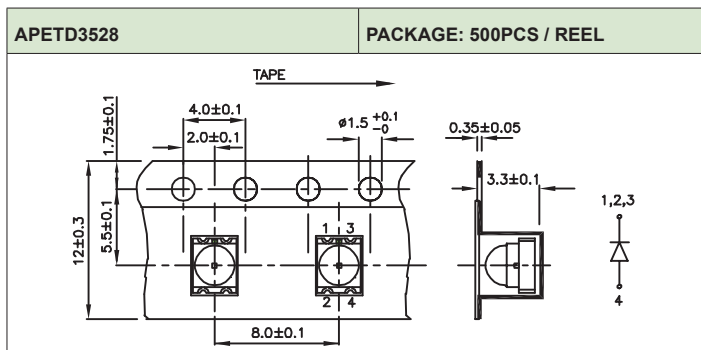
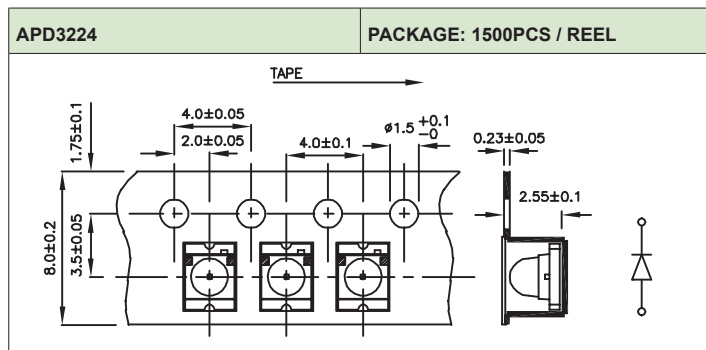
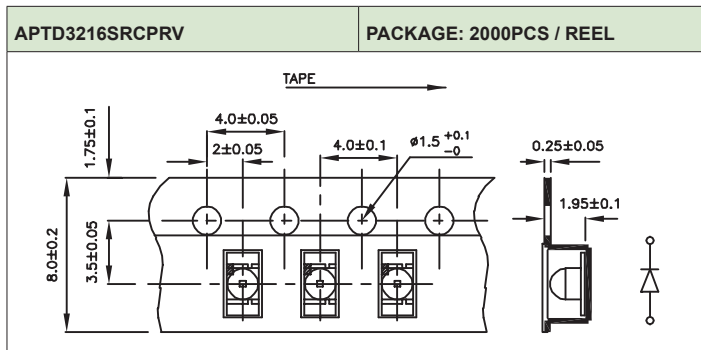
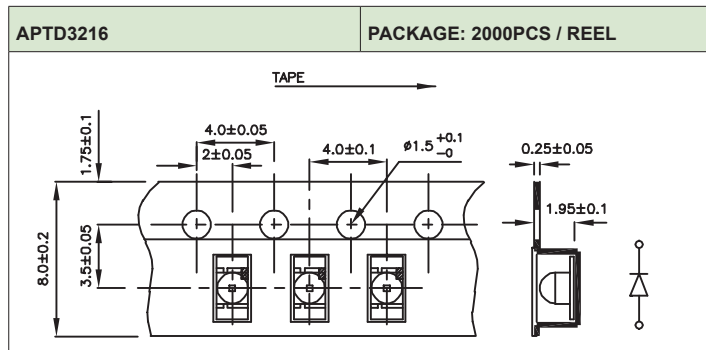
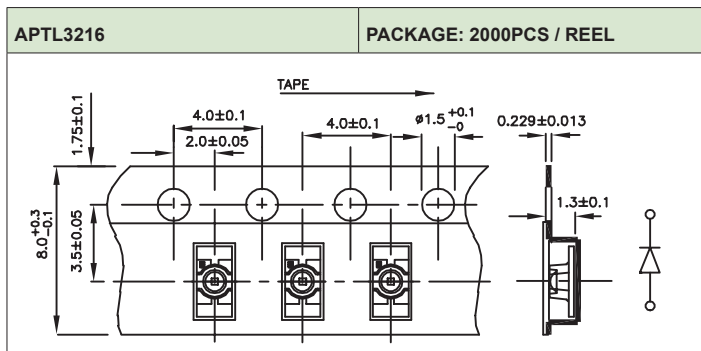
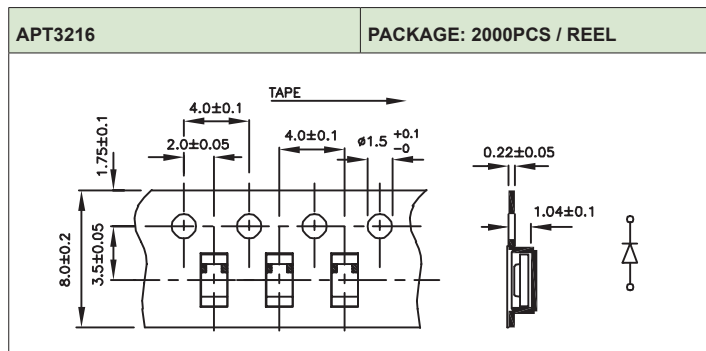
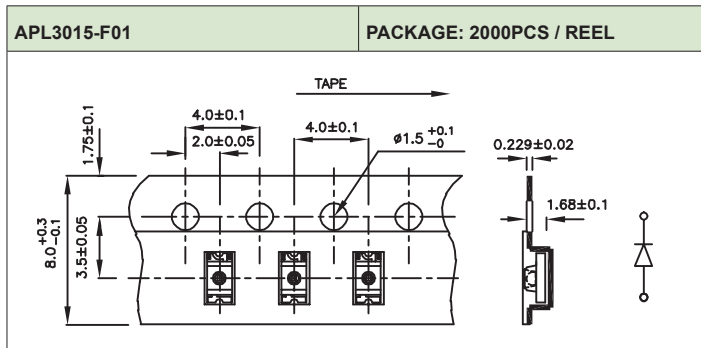
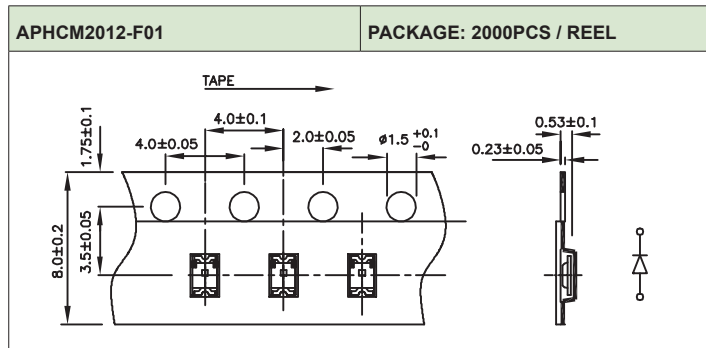
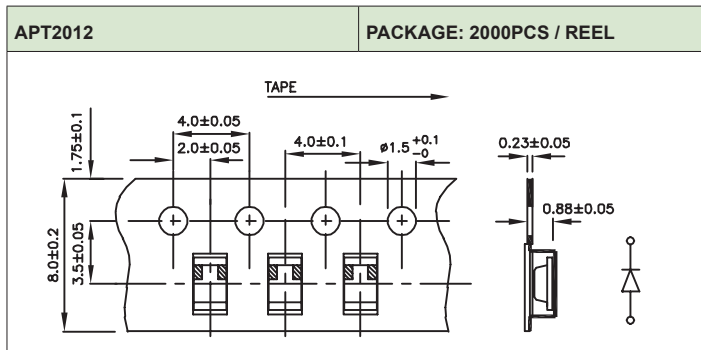
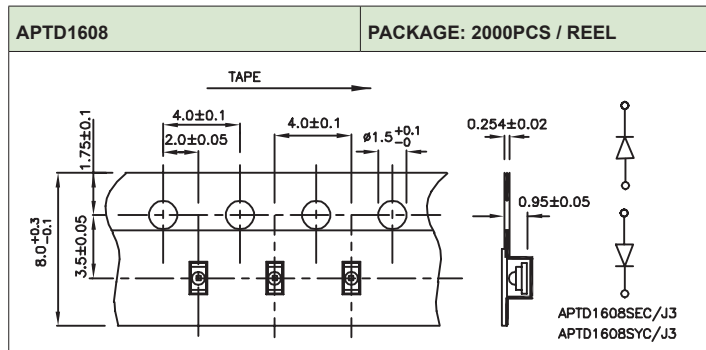
NOTE: 1. All dimensions are in millimeters(inches).

## SMD TAPE SPECIFICATIONS



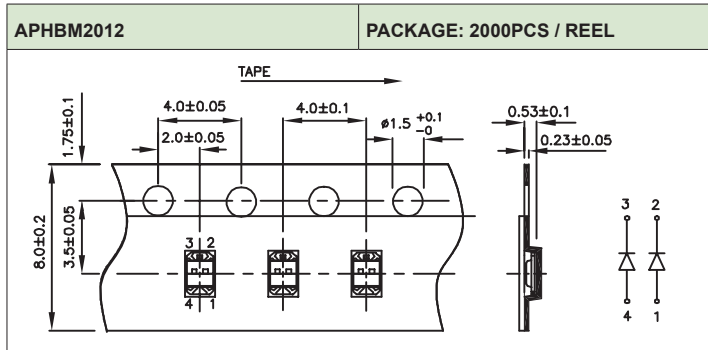
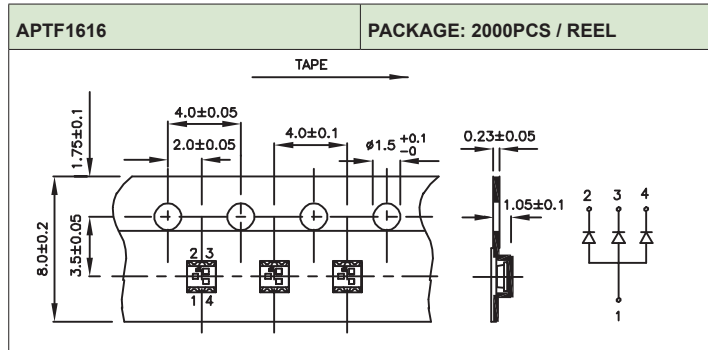
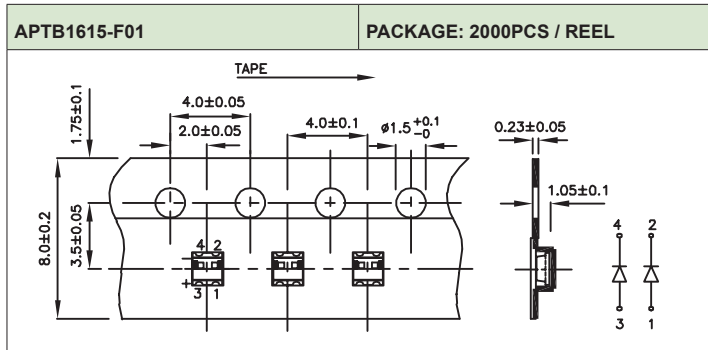
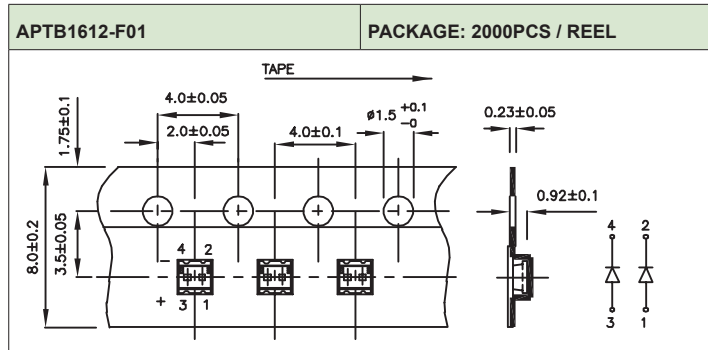
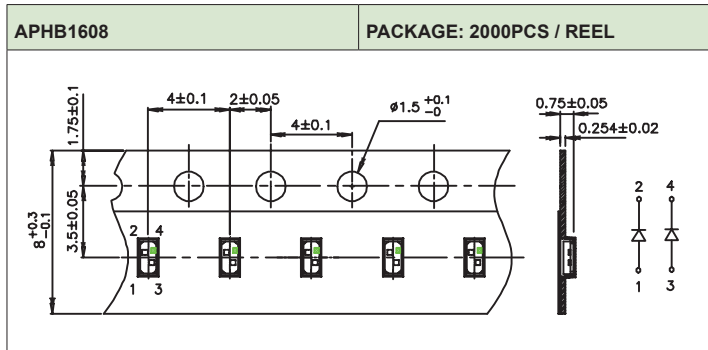
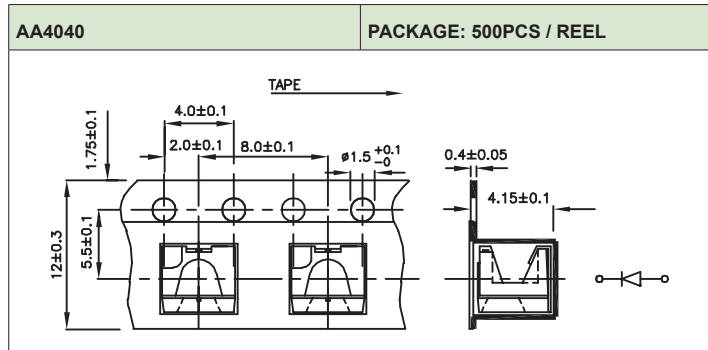
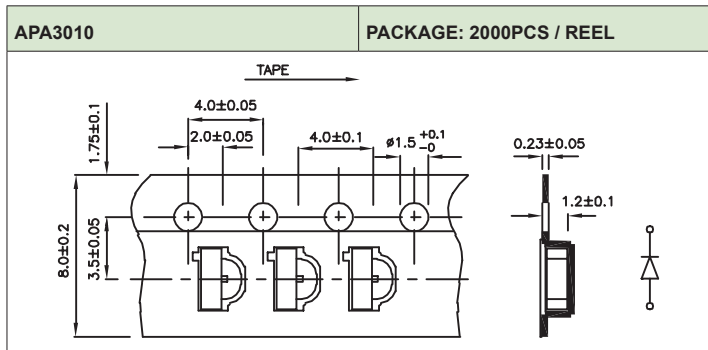
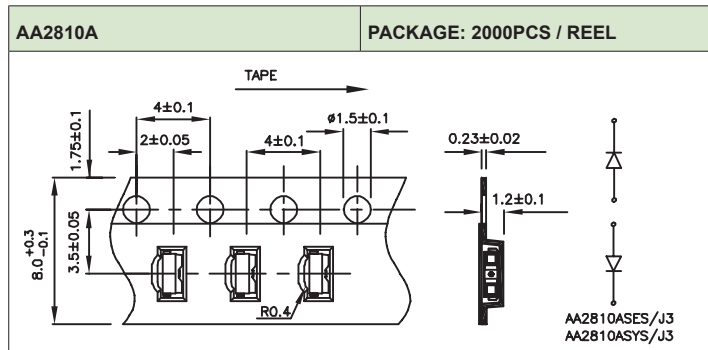
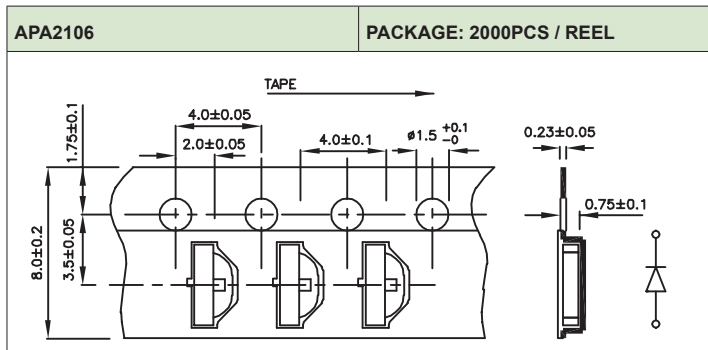
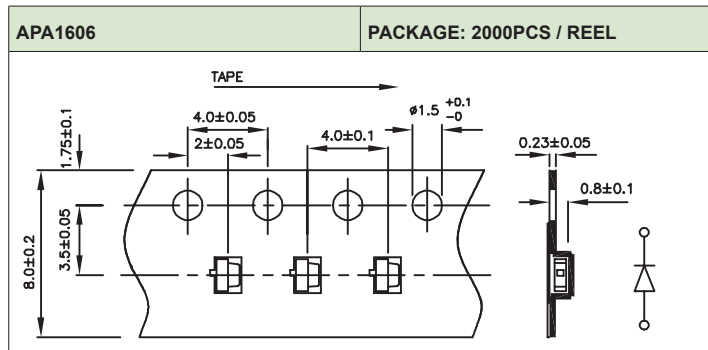
TECHNICAL NOTES ■ SMD TAPE SPECIFICATIONS

## SMD TAPE SPECIFICATIONS



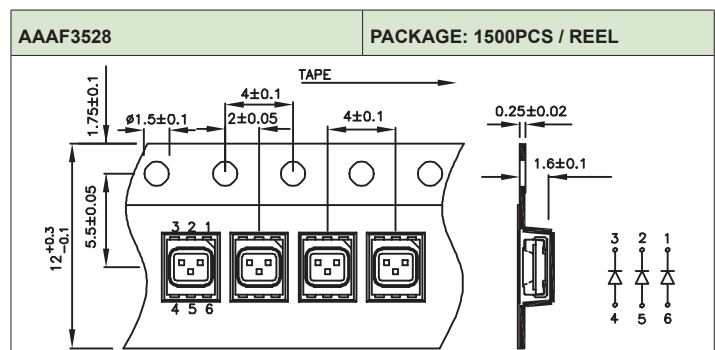
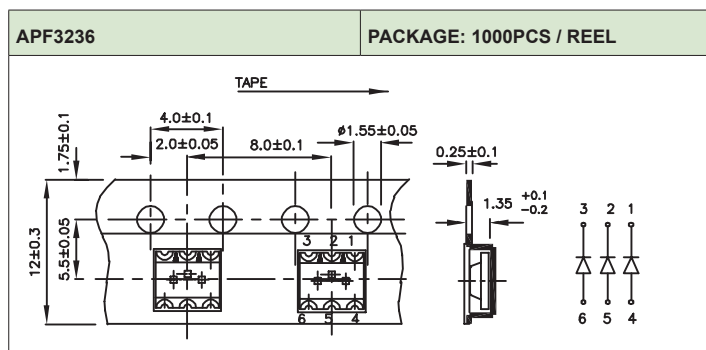
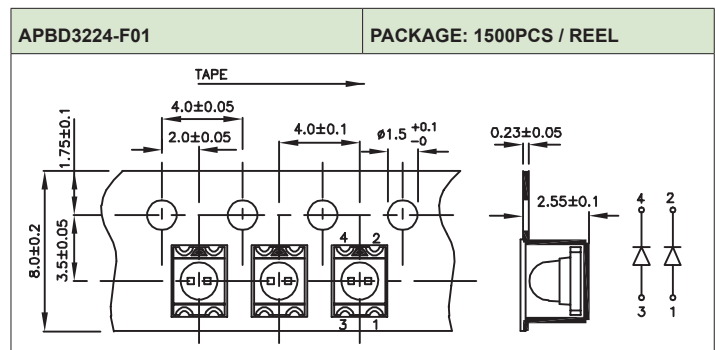
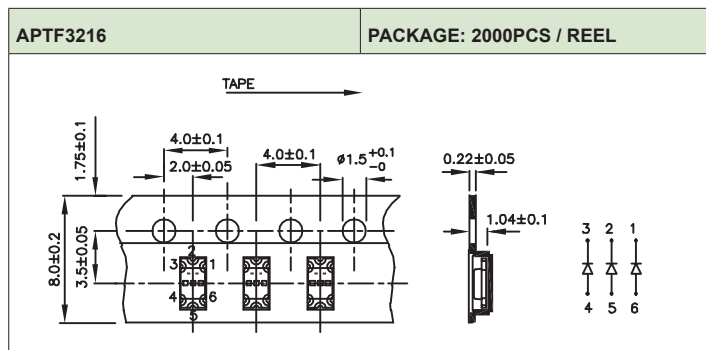
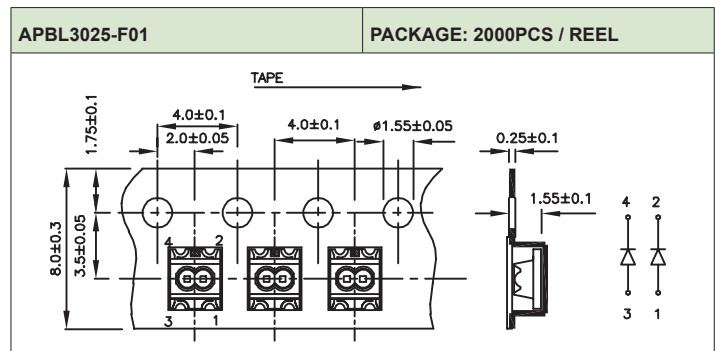
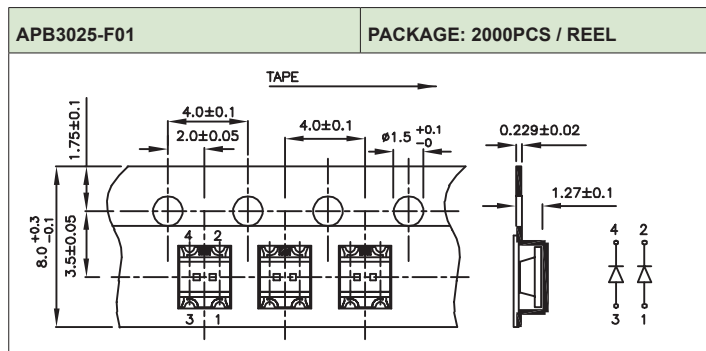
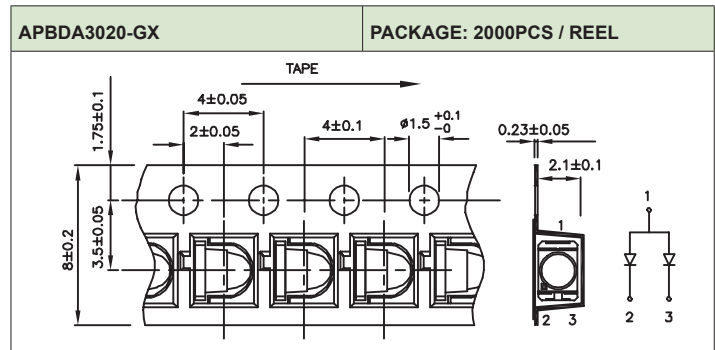
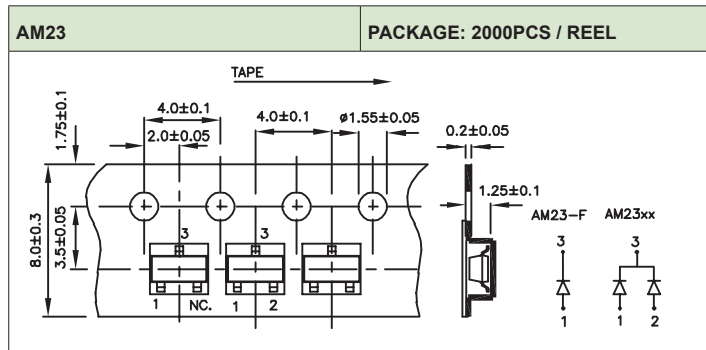
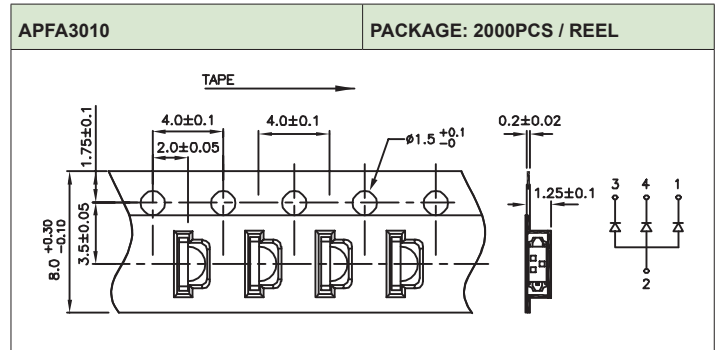
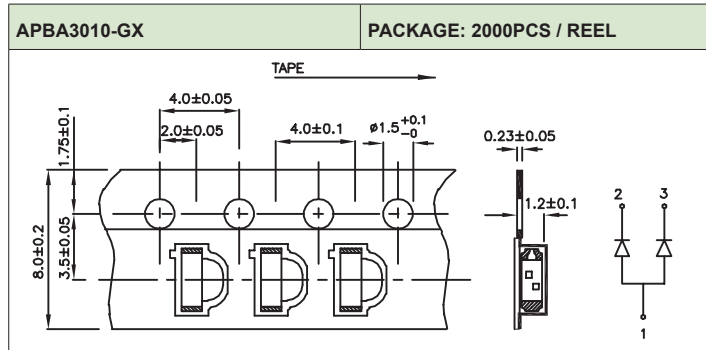
NOTE: 1. All dimensions are in millimeters.

## SMD TAPE SPECIFICATIONS



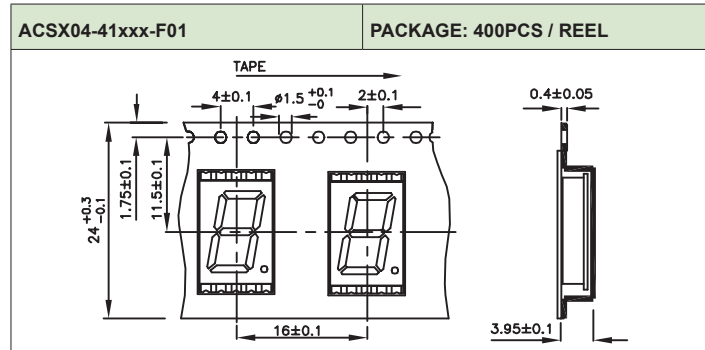
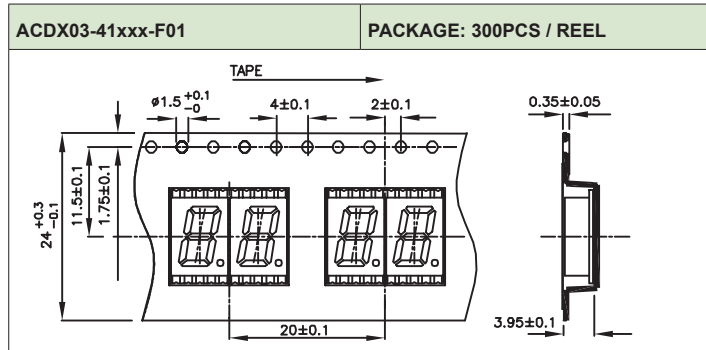
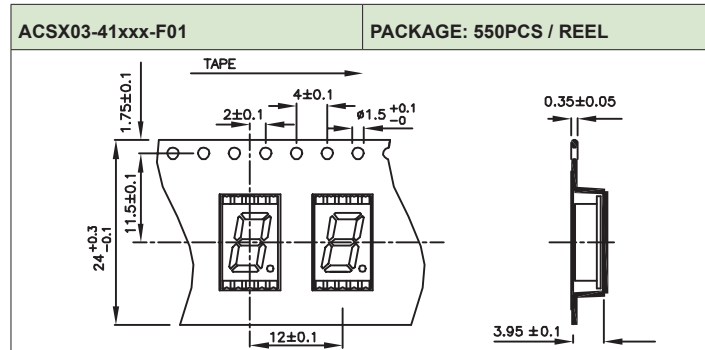
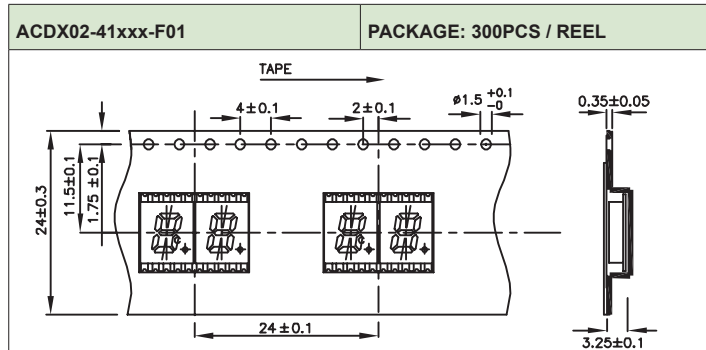
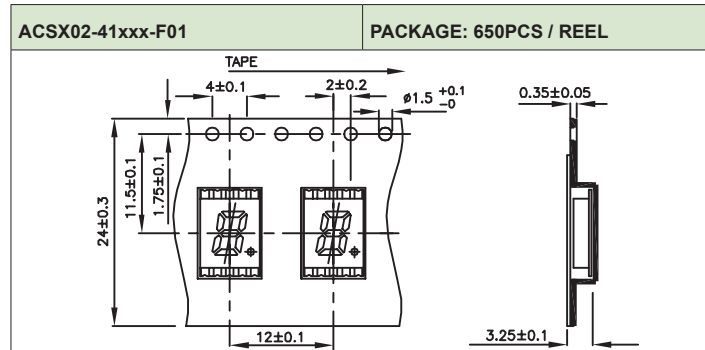
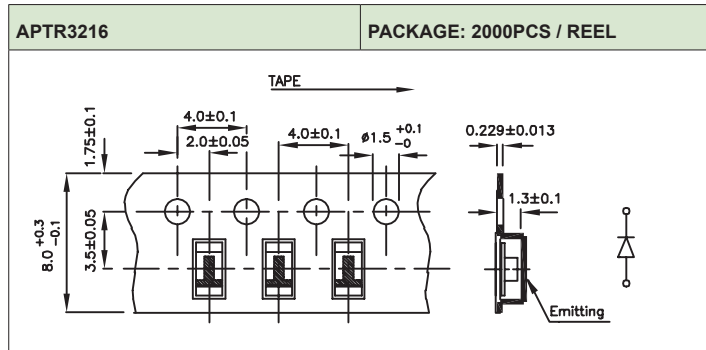
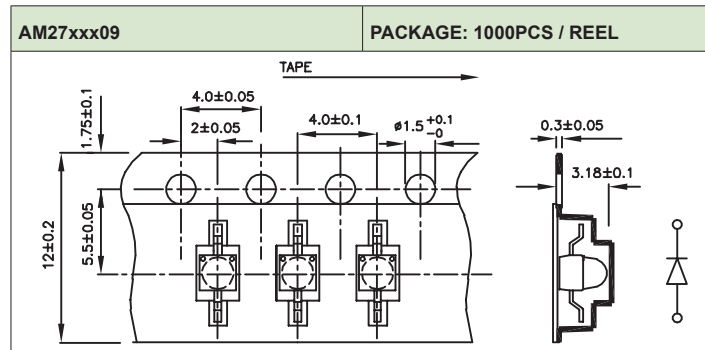
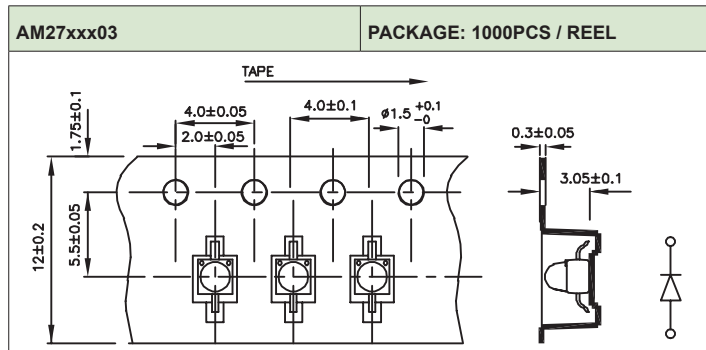
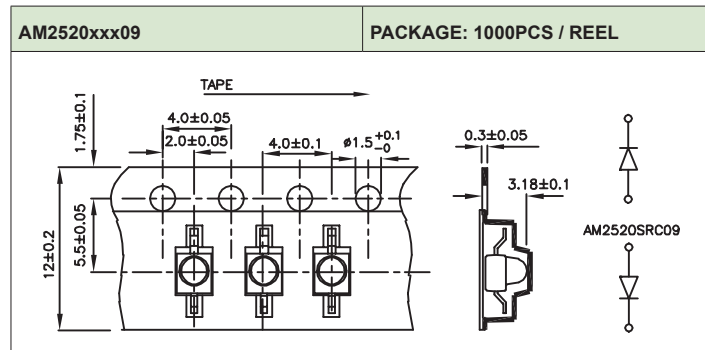
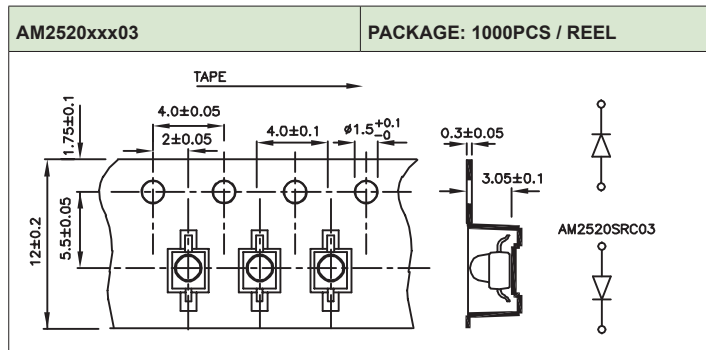
TECHNICAL NOTES ■ SMD TAPE SPECIFICATIONS

## SMD TAPE SPECIFICATIONS



NOTE: 1. All dimensions are in millimeters.

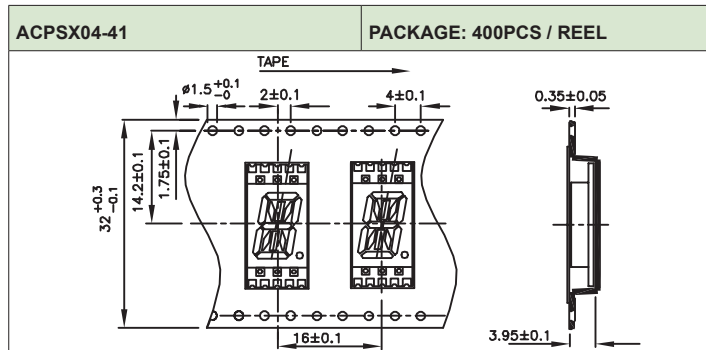
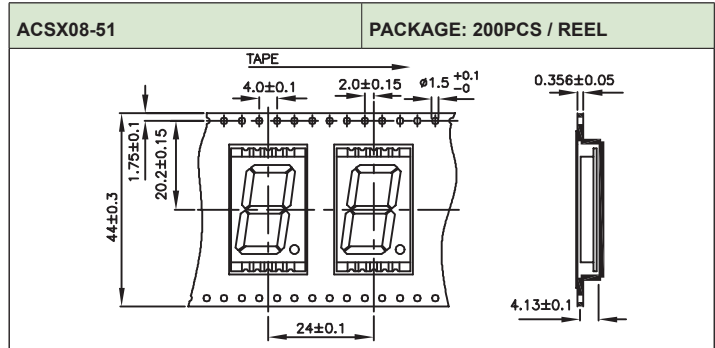
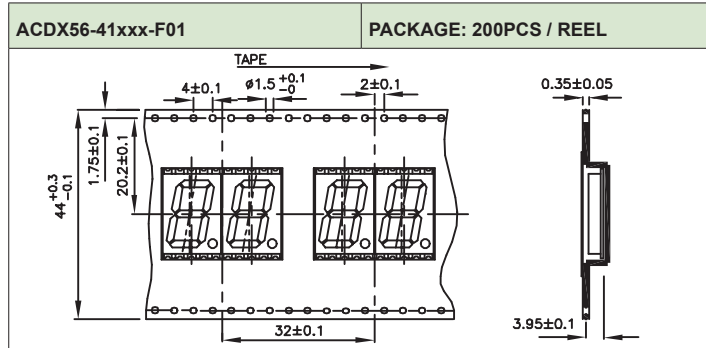
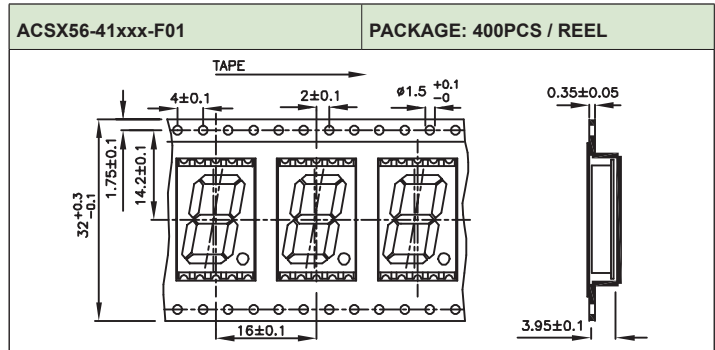
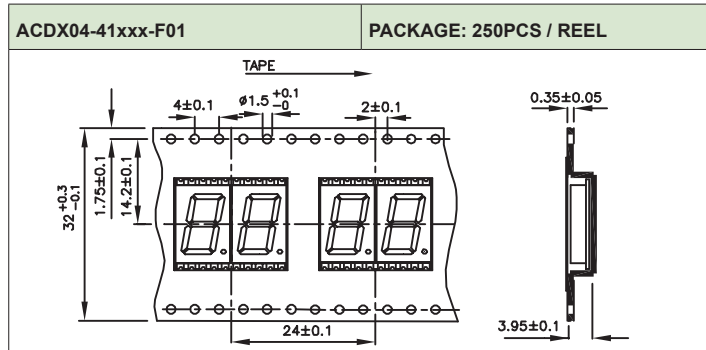
## SMD TAPE SPECIFICATIONS



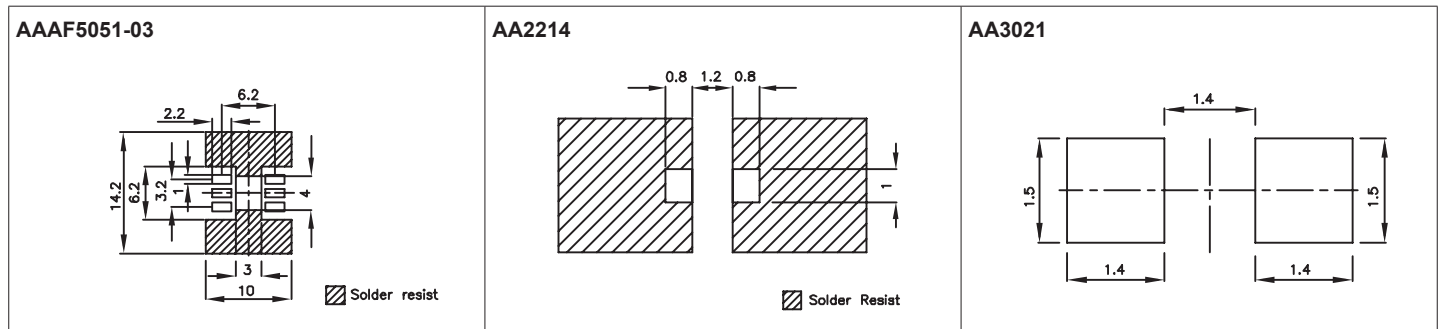
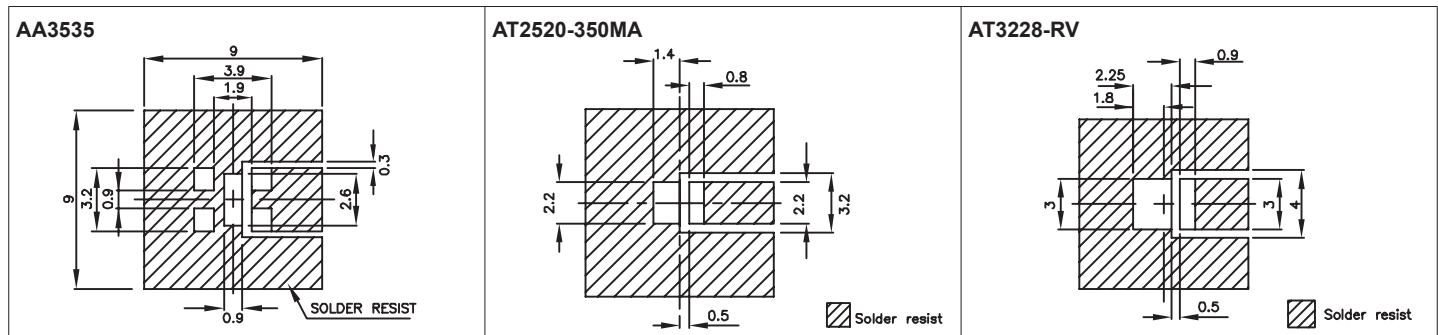
TECHNICAL NOTES ■ SMD TAPE SPECIFICATIONS



## SMD TAPE SPECIFICATIONS



## RECOMMENDED SOLDERING PATTERN



NOTES: 1. All dimensions are in millimeters.  
 2. Tolerance is  $\pm 0.1$ mm unless otherwise noted.

## RECOMMENDED SOLDERING PATTERN

<p><b>AA3528</b></p>	<p><b>APHHS1005</b></p>	<p><b>APG1608, APT1608, APTD1608</b></p>
<p><b>APT2012</b></p>	<p><b>APHCM2012-F01</b></p>	<p><b>APL3015-F01</b></p>
<p><b>APT3216, APTD3216</b></p>	<p><b>APTL3216</b></p>	<p><b>APD3224-F01</b></p>
<p><b>APETD3528</b></p> <p>☒ Solder resist</p>	<p><b>APA1606</b></p>	<p><b>APA2106</b></p>
<p><b>AA2810A</b></p>	<p><b>APA3010-GX, APBA3010-GX</b></p>	<p><b>AA4040</b></p>

TECHNICAL NOTES ■ RECOMMENDED SOLDERING PATTERN

## RECOMMENDED SOLDERING PATTERN

<p><b>APHB1608</b></p>	<p><b>APTB1612-F01</b></p>	<p><b>APTB1615-F01, APTF1616</b></p>
<p><b>APHBM2012</b></p>	<p><b>APFA3010</b></p>	<p><b>AM23-F, AM23xx</b></p>
<p><b>APBDA3020-GX</b></p>	<p><b>APB3025-F01, APBL3025-F01</b></p>	<p><b>APTF3216</b></p>
<p><b>APBD3224-F01</b></p>	<p><b>APF3236</b></p>	<p><b>AAAF3528</b></p> <p>POLARITY MARK</p> <p>SOLDER RESIST</p>
<p><b>AM2520xxx03, AM27xxx03</b></p>	<p><b>AM2520xxx09, AM27xxx09</b></p>	<p><b>APTR3216</b></p> <p>HOLE</p>

NOTES: 1. All dimensions are in millimeters.  
2. Tolerance is  $\pm 0.1$ mm unless otherwise noted.

## RECOMMENDED SOLDERING PATTERN

<p><b>ACSX02-41xxx-F01</b></p>	<p><b>ACDX02-41xxx-F01</b></p>	<p><b>ACSX03-41xxx-F01</b></p>
<p><b>ACDX03-41xxx-F01</b></p>	<p><b>ACSX04-41xxx-F01</b></p>	<p><b>ACDX04-41xxx-F01</b></p>
<p><b>ACSX56-41xxx-F01</b></p>	<p><b>ACDX56-41xxx-F01</b></p>	<p><b>ACSX08-51</b></p>
<p><b>ACPSX04-41</b></p>		

TECHNICAL NOTES ■ RECOMMENDED SOLDERING PATTERN

## TECHNICAL DATA

Absolute maximum ratings (T <sub>A</sub> =25°C)		E,I Hi.Eff.Red Orange	H Bright Red	SR Super Bright Red	SURK Hyper Red	SURK/T Hyper Red	SUR Hyper Red	SUR/E Hyper Red	Unit
		(GaAsP/GaP)	(GaP)	(GaAlAs)	(AlGaInP)	(AlGaInP)	(AlGaInP)	(AlGaInP)	
Reverse voltage	V <sub>R</sub>	● 5	● 5	● 5	● 5	● 5	● 5	● 5	V
Forward current	I <sub>F</sub>	30	25	30	30	30	30	30	mA
Forward current (Peak) 1/10 Duty Cycle, 0.1ms Pulse Width	I <sub>FS</sub>	160	130	155	185	150	185	200	mA
Power dissipation	P <sub>D</sub>	75	62.5	75	75	75	75	75	mW
<b>LED LAMPS:</b>									
Operating temperature	T <sub>A</sub>	-40~+85	-40~+85	-40~+85	-40~+85	-40~+85	-40~+85	-40~+85	°C
Storage temperature	T <sub>STG</sub>	-40~+85	-40~+85	-40~+85	-40~+85	-40~+85	-40~+85	-40~+85	°C
<b>LED DISPLAYS:</b>									
Operating temperature	T <sub>A</sub>	-40~+85	-40~+85	-40~+85	-40~+85	-40~+85	-40~+85	-40~+85	°C
Storage temperature	T <sub>STG</sub>	-40~+85	-40~+85	-40~+85	-40~+85	-40~+85	-40~+85	-40~+85	°C

Operating Characteristics		E,I Hi.Eff.Red Orange	H Bright Red	SR Super Bright Red	SURK Hyper Red	SURK/T Hyper Red	SUR Hyper Red	SUR/E Hyper Red	Unit
		(GaAsP/GaP)	(GaP)	(GaAlAs)	(AlGaInP)	(AlGaInP)	(AlGaInP)	(AlGaInP)	
Forward voltage (typ.) I <sub>F</sub> =20mA	V <sub>F</sub>	● 2.0	● 2.25	● 1.85	● 1.95	● 2.0	● 1.9	● 1.9	V
I <sub>F</sub> =10mA		1.9	2.05	1.8	1.85	1.85	1.85	1.8	
I <sub>F</sub> =2mA		1.7	1.85	1.65	1.75	1.75	1.7	1.7	
Forward voltage (max.) I <sub>F</sub> =20mA, 10mA, 2mA	V <sub>F</sub>	2.5	2.5	2.5	2.5	2.5	2.5	2.5	V
Reverse current V <sub>R</sub> =5V	I <sub>R</sub>	10	10	10	10	10	10	10	µA
Peak Emission Wavelength I <sub>F</sub> =20mA, 10mA, 2mA	λ <sub>p</sub>	627	700	660	650	650	650	640	nm
Dominant Wavelength I <sub>F</sub> =20mA, 10mA, 2mA	λ <sub>D</sub>	625	660	640	630	630	630	630	nm
Spectral line half-width I <sub>F</sub> =20mA, 10mA, 2mA	Δλ <sub>1/2</sub>	45	45	20	28	20	27	25	nm
Capacitance V <sub>F</sub> =0V, f=1MHZ	C	15	40	45	35	35	45	45	pF

## TECHNICAL DATA

Absolute maximum ratings (T <sub>A</sub> =25°C)		N Pure Orange (GaAsP/GaP)	SEK Super Bright Orange (AlGaInP)	SEK/T Super Bright Orange (AlGaInP)	SE Super Bright Orange (AlGaInP)	SE/E Hyper Red (AlGaInP)	SE/J3 Hyper Red (AlGaInP)	G,SG Green, Super Bright Green (GaP)	Unit
Reverse voltage	V <sub>R</sub>	● 5	● 5	● 5	● 5	● 5	● 5	● 5	V
Forward current	I <sub>F</sub>	25	30	30	30	30	30	25	mA
Forward current (Peak) 1/10 Duty Cycle, 0.1ms Pulse Width	i <sub>FS</sub>	145	195	150	195	195	150	140	mA
Power dissipation	P <sub>D</sub>	62.5	75	75	75	75	84	62.5	mW
<b>LED LAMPS:</b>									
Operating temperature	T <sub>A</sub>	-40~+85	-40~+85	-40~+85	-40~+85	-40~+85	-40~+85	-40~+85	°C
Storage temperature	T <sub>STG</sub>	-40~+85	-40~+85	-40~+85	-40~+85	-40~+85	-40~+85	-40~+85	°C
<b>LED DISPLAYS:</b>									
Operating temperature	T <sub>A</sub>	-40~+85	-40~+85	-40~+85	-40~+85	-40~+85	-40~+85	-40~+85	°C
Storage temperature	T <sub>STG</sub>	-40~+85	-40~+85	-40~+85	-40~+85	-40~+85	-40~+85	-40~+85	°C

Operating Characteristics		N Pure Orange (GaAsP/GaP)	SEK Super Bright Orange (AlGaInP)	SEK/T Super Bright Orange (AlGaInP)	SE Super Bright Orange (AlGaInP)	SE/E Hyper Red (AlGaInP)	SE/J3 Hyper Red (AlGaInP)	G,SG Green, Super Bright Green (GaP)	Unit
Forward voltage (typ.) I <sub>F</sub> =20mA	V <sub>F</sub>	● 2.05	● 2.1	● 2.05	● 2.0	● 2.0	● 2.2	● 2.2	V
I <sub>F</sub> =10mA		1.95	2.0	1.95	1.9	1.9	2.0	2.0	
I <sub>F</sub> =2mA		1.85	1.85	1.8	1.8	1.8	1.8	1.9	
Forward voltage (max.) I <sub>F</sub> =20mA, 10mA, 2mA	V <sub>F</sub>	2.5	2.5	2.5	2.5	2.5	2.8	2.5	V
Reverse current V <sub>R</sub> =5V	I <sub>R</sub>	10	10	10	10	10	10	10	μA
Peak Emission Wavelength I <sub>F</sub> =20mA, 10mA, 2mA	λ <sub>p</sub>	607	610	610	610	630	640	565	nm
Dominant Wavelength I <sub>F</sub> =20mA, 10mA, 2mA	λ <sub>D</sub>	610	601	601	601	621	625	568	nm
Spectral line half-width I <sub>F</sub> =20mA, 10mA, 2mA	Δλ <sub>1/2</sub>	35	29	17	29	20	25	30	nm
Capacitance V <sub>F</sub> =0V, f=1MHZ	C	15	15	15	30	25	27	15	pF

## TECHNICAL DATA

Absolute maximum ratings (T <sub>A</sub> =25°C)		PG Pure Green	CGK Green	CGK/T Green	MG Mega Green	ZG Green	ZG/G Green	Y Yellow	Unit
		(GaP)	(AlGaInP)	(AlGaInP)	(AlGaInP)	(InGaN)	(InGaN)	(GaAsP/GaP)	
Reverse voltage	V <sub>R</sub>	● 5	● 5	● 5	● 5	● 5	● 5	● 5	V
Forward current	I <sub>F</sub>	25	30	30	30	25	30	30	mA
Forward current (Peak) 1/10 Duty Cycle, 0.1ms Pulse Width	I <sub>FS</sub>	135	150	150	150	150	100	140	mA
Power dissipation	P <sub>D</sub>	62.5	75	78	75	102.5	120	75	mW
<b>LED LAMPS:</b>									
Operating temperature	T <sub>A</sub>	-40~+85	-40~+85	-40~+85	-40~+85	-40~+85	-40~+85	-40~+85	°C
Storage temperature	T <sub>STG</sub>	-40~+85	-40~+85	-40~+85	-40~+85	-40~+85	-40~+85	-40~+85	°C
<b>LED DISPLAYS:</b>									
Operating temperature	T <sub>A</sub>	-40~+85	-40~+85	-40~+85	-40~+85	-40~+85	-40~+85	-40~+85	°C
Storage temperature	T <sub>STG</sub>	-40~+85	-40~+85	-40~+85	-40~+85	-40~+85	-40~+85	-40~+85	°C

Operating Characteristics		PG Pure Green	CGK Green	CGK/T Green	MG Mega Green	ZG Green	ZG/G Green	Y Yellow	Unit
		(GaP)	(AlGaInP)	(AlGaInP)	(AlGaInP)	(InGaN)	(InGaN)	(GaAsP/GaP)	
Forward voltage (typ.) I <sub>F</sub> =20mA	V <sub>F</sub>	● 2.25	● 2.1	● 2.1	● 2.1	● 3.3	● 3.2	● 2.1	V
I <sub>F</sub> =10mA		2.1	2.0	1.95	2.0	3.0	3.05	1.95	
I <sub>F</sub> =2mA		1.9	1.9	1.8	1.9	2.65	2.8	1.85	
Forward voltage (max.) I <sub>F</sub> =20mA, 10mA, 2mA	V <sub>F</sub>	2.5	2.5	2.6	2.5	4.1	4.0	2.5	V
Reverse current V <sub>R</sub> =5V	I <sub>R</sub>	10	10	10	10	50	50	10	μA
Peak Emission Wavelength I <sub>F</sub> =20mA, 10mA, 2mA	λ <sub>p</sub>	555	574	574	574	515	520	590	nm
Dominant Wavelength I <sub>F</sub> =20mA, 10mA, 2mA	λ <sub>D</sub>	555	570	570	570	525	525	588	nm
Spectral line half-width I <sub>F</sub> =20mA, 10mA, 2mA	Δλ <sub>1/2</sub>	30	20	15	26	30	35	35	nm
Capacitance V <sub>F</sub> =0V, f=1MHZ	C	45	15	15	20	45	100	20	pF

## TECHNICAL DATA

Absolute maximum ratings (T <sub>A</sub> =25°C)		SYK Super Bright Yellow	SYK/T Super Bright Yellow	SY Super Bright Yellow	SY/J3 Super Bright Yellow	QB/D Blue	QB/F Blue	VB/D Blue	Unit
		(AlGaInP)	(AlGaInP)	(AlGaInP)	(AlGaInP)	(InGaN)	(InGaN)	(InGaN)	
Reverse voltage	V <sub>R</sub>	5	5	5	5	5	5	5	V
Forward current	I <sub>F</sub>	30	30	30	30	30	30	30	mA
Forward current (Peak) 1/10 Duty Cycle, 0.1ms Pulse Width	I <sub>FS</sub>	175	150	150	140	150	150	100	mA
Power dissipation	P <sub>D</sub>	75	75	75	75	120	120	120	mW
<b>LED LAMPS:</b>									
Operating temperature	T <sub>A</sub>	-40~+85	-40~+85	-40~+85	-40~+85	-40~+85	-40~+85	-40~+85	°C
Storage temperature	T <sub>STG</sub>	-40~+85	-40~+85	-40~+85	-40~+85	-40~+85	-40~+85	-40~+85	°C
<b>LED DISPLAYS:</b>									
Operating temperature	T <sub>A</sub>	-40~+85	-40~+85	-40~+85	-40~+85	-40~+85	-40~+85	-40~+85	°C
Storage temperature	T <sub>STG</sub>	-40~+85	-40~+85	-40~+85	-40~+85	-40~+85	-40~+85	-40~+85	°C

Operating Characteristics		SYK Super Bright Yellow	SYK/T Super Bright Yellow	SY Super Bright Yellow	SY/J3 Super Bright Yellow	QB/D Blue	QB/F Blue	VB/D Blue	Unit
		(AlGaInP)	(AlGaInP)	(AlGaInP)	(AlGaInP)	(InGaN)	(InGaN)	(InGaN)	
Forward voltage (typ.) I <sub>F</sub> =20mA	V <sub>F</sub>	2.0	2.05	2.0	2.0	3.3	3.3	3.3	V
I <sub>F</sub> =10mA		1.95	1.95	1.95	1.95	3.0	3.0	3.0	
I <sub>F</sub> =2mA		1.85	1.8	1.8	1.85	2.65	2.65	2.65	
Forward voltage (max.) I <sub>F</sub> =20mA, 10mA, 2mA	V <sub>F</sub>	2.5	2.5	2.5	2.5	4.0	4.0	4.0	V
Reverse current V <sub>R</sub> =5V	I <sub>R</sub>	10	10	10	10	50	50	50	μA
Peak Emission Wavelength I <sub>F</sub> =20mA, 10mA, 2mA	λ <sub>P</sub>	590	590	590	590	468	461	445	nm
Dominant Wavelength I <sub>F</sub> =20mA, 10mA, 2mA	λ <sub>D</sub>	590	590	590	589	470	465	450	nm
Spectral line half-width I <sub>F</sub> =20mA, 10mA, 2mA	Δλ <sub>1/2</sub>	20	15	28	20	25	25	22	nm
Capacitance V <sub>F</sub> =0V, f=1MHZ	C	20	25	25	45	100	100	100	pF



## TECHNICAL DATA 5V/14V WITH INTERNAL RESISTANCE

Absolute maximum ratings (T <sub>A</sub> =25°C)		E,I Hi.Eff.Red  (GaAsP/GaP)	SR Super Bright Red  (GaAlAs)	G,SG Green, Super Bright Green  (GaP)	Y Yellow  (GaAsP/GaP)	Unit
Reverse voltage	V <sub>R</sub>	5	5	5	5	V
Forward voltage (Max.) for 5V	V <sub>F</sub>	6	6	6	6	V
Forward voltage (Max.) for 14V	V <sub>F</sub>	16	16	16	16	V
Power dissipation for 5V	P <sub>D</sub>	85	85	85	85	mW
Power dissipation for 14V	P <sub>D</sub>	160	160	160	160	mW
<b>LED LAMPS:</b>						
Operating temperature	T <sub>A</sub>	- 40~+70	- 40~+70	- 40~+70	- 40~+70	°C
Storage temperature	T <sub>STG</sub>	- 40~+85	- 40~+85	- 40~+85	- 40~+85	°C
<b>LED DISPLAYS:</b>						
Operating temperature	T <sub>A</sub>	- 40~+70	- 40~+70	- 40~+70	- 40~+70	°C
Storage temperature	T <sub>STG</sub>	- 40~+85	- 40~+85	- 40~+85	- 40~+85	°C

Operating Characteristics		E,I Hi.Eff.Red  (GaAsP/GaP)	SR Super Bright Red  (GaAlAs)	G,SG Green, Super Bright Green  (GaP)	Y Yellow  (GaAsP/GaP)	Unit
Forward current (typ.) V <sub>F</sub> =5V	I <sub>F</sub>	13	13	11.5	13	mA
Forward current (typ.) V <sub>F</sub> =14V	I <sub>F</sub>	10.5	10.5	10.5	10.5	mA
Forward current (max.) V <sub>F</sub> =5V	I <sub>F</sub>	17.5	17.5	17.5	17.5	mA
Forward current (max.) V <sub>F</sub> =14V	I <sub>F</sub>	13.5	13.5	13.5	13.5	mA
Reverse current V <sub>R</sub> =5V	I <sub>R</sub>	10	10	10	10	uA
Peak Emission Wavelength V <sub>F</sub> =5V,14V	λ <sub>p</sub>	627	660	565	590	nm
Dominant Wavelength V <sub>F</sub> =5V,14V	λ <sub>D</sub>	625	640	568	588	nm
Spectral line half-width V <sub>F</sub> =5V,14V	Δλ <sub>1/2</sub>	45	20	30	35	nm

## TECHNICAL DATA FOR BLINKING LED LAMPS

Absolute maximum ratings (T <sub>A</sub> =25°C)		E,I Hi.Eff.Red  (GaAsP/GaP)	H Bright Red  (GaP)	SR Super Bright Red  (GaAlAs)	G,SG Green, Super Bright Green  (GaP)	Y Yellow  (GaAsP/GaP)	Unit
Reverse voltage	V <sub>R</sub>	0.5	0.5	0.5	0.5	0.5	V
Forward voltage (max.)	V <sub>F</sub>	14	14	14	14	14	V
Total Power dissipation	P <sub>D</sub>	310	310	310	310	310	mW
Operating temperature	T <sub>A</sub>	-40~+70	-40~+70	-40~+70	-40~+70	-40~+70	°C
Storage temperature	T <sub>STG</sub>	-40~+85	-40~+85	-40~+85	-40~+85	-40~+85	°C

Operating Characteristics		E,I Hi.Eff.Red  (GaAsP/GaP)	H Bright Red  (GaP)	SR Super Bright Red  (GaAlAs)	G,SG Green, Super Bright Green  (GaP)	Y Yellow  (GaAsP/GaP)	Unit
Forward current (min.) V <sub>F</sub> =3.5V	I <sub>F</sub>	8	8	8	8	8	mA
Forward current (typ.) V <sub>F</sub> =5V	I <sub>F</sub>	22	22	22	22	22	mA
Supply current V <sub>F</sub> =3.5V ~ 14V	I <sub>SON</sub>	8 ~ 44	8 ~ 44	8 ~ 44	8 ~ 44	8 ~ 44	mA
Blink frequency V <sub>F</sub> =3.5V ~ 14V	f	3 ~ 1.5	3 ~ 1.5	3 ~ 1.5	3 ~ 1.5	3 ~ 1.5	Hz
Peak Emission Wavelength	λ <sub>p</sub>	627	700	660	565	590	nm
Dominant Wavelength	λ <sub>D</sub>	625	660	640	568	588	nm
Spectral line half-width	Δλ <sub>1/2</sub>	45	45	20	30	35	nm

## TECHNICAL DATA FOR INFRARED

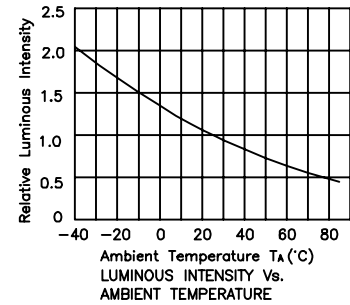
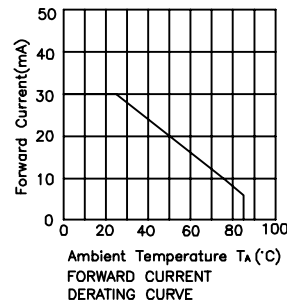
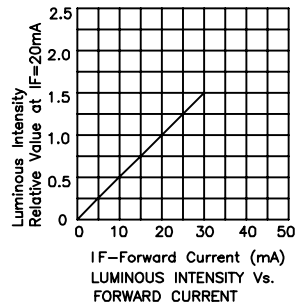
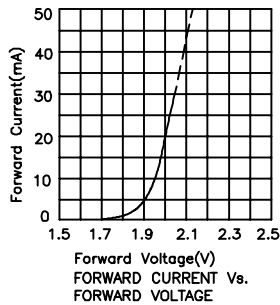
Absolute maximum ratings (T <sub>A</sub> =25°C)		F3	SF4	Unit
		(GaAs)	(GaAlAs)	
Reverse voltage	V <sub>R</sub>	5	5	V
Forward current	I <sub>F</sub>	50	50	mA
Forward current (Peak) 1/100 Duty Cycle, 10μs Pulse Width	i <sub>FS</sub>	1.2	1.2	A
Power dissipation	P <sub>D</sub>	80	80	mW
<b>LED LAMPS:</b>				
Operating temperature	T <sub>A</sub>	-40~+85	-40~+85	°C
Storage temperature	T <sub>STG</sub>	-40~+85	-40~+85	°C
<b>LED DISPLAYS:</b>				
Operating temperature	T <sub>A</sub>	-40~+85	-40~+85	°C
Storage temperature	T <sub>STG</sub>	-40~+85	-40~+85	°C

Operating Characteristics		F3	SF4	Unit
		(GaAs)	(GaAlAs)	
Forward voltage (typ.) I <sub>F</sub> =20mA	V <sub>F</sub>	1.2	1.3	V
Forward voltage (max.) I <sub>F</sub> =20mA	V <sub>F</sub>	1.6	1.6	V
Reverse current V <sub>R</sub> =5V	I <sub>R</sub>	10	10	μA
Peak Emission Wavelength I <sub>F</sub> =20mA	λ <sub>p</sub>	940	880	nm
Spectral line half-width I <sub>F</sub> =20mA	Δλ <sub>1/2</sub>	50	50	nm
Capacitance V <sub>F</sub> =0V, f=1MHZ	C	90	90	pF

## TECHNICAL DATA

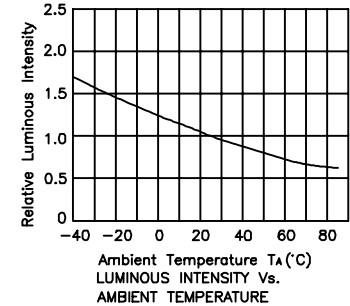
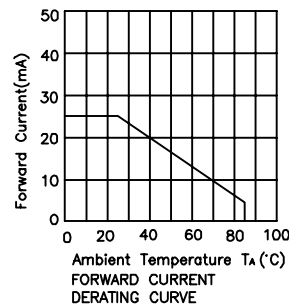
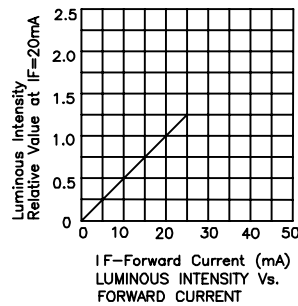
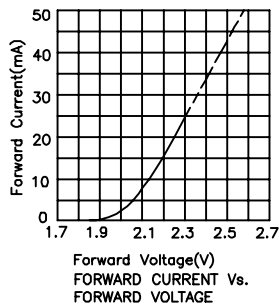
### High Efficiency Red, Orange

### E,I : GaAsP/GaP



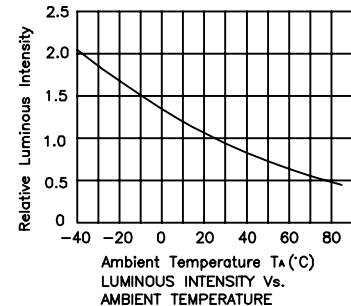
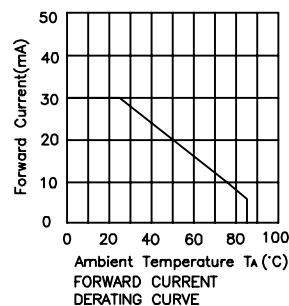
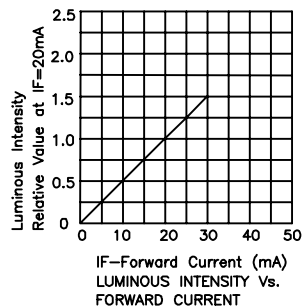
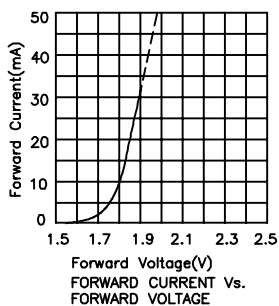
### Bright Red

### H : GaP



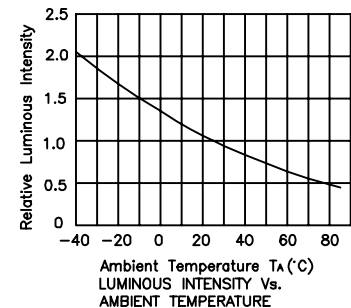
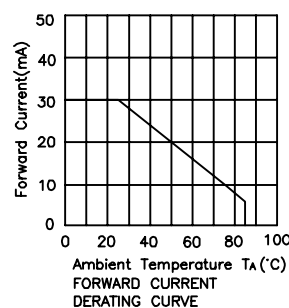
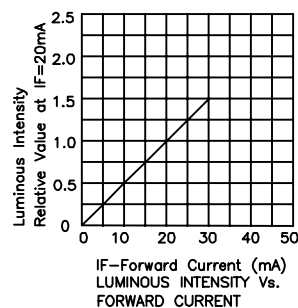
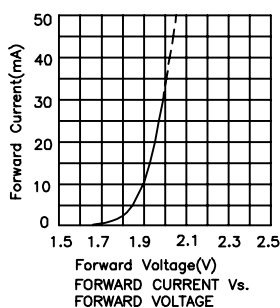
### Super Bright Red

### SR : GaAlAs



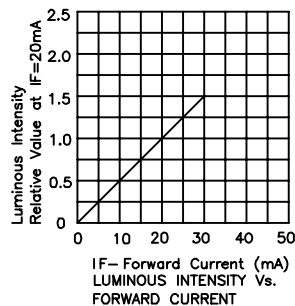
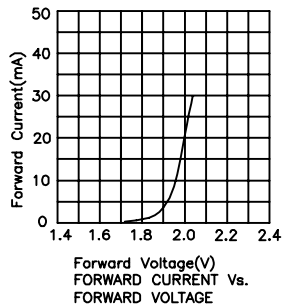
### Hyper Red

### SURK : AlGaInP

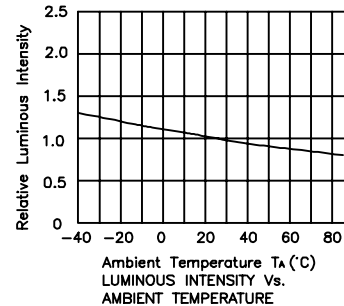
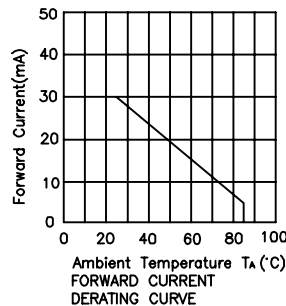


## TECHNICAL DATA

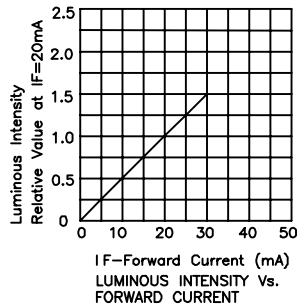
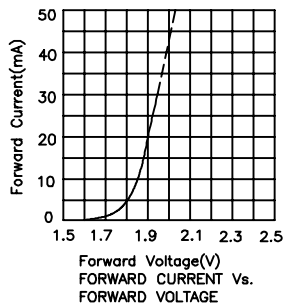
### Hyper Red



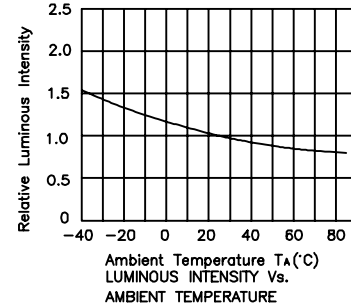
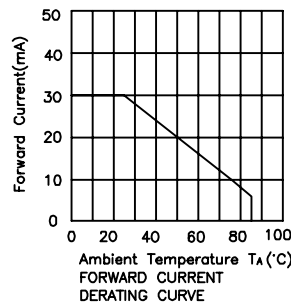
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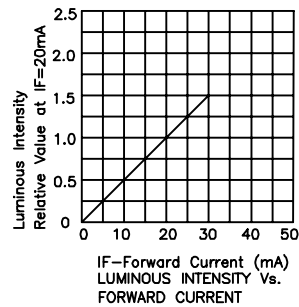
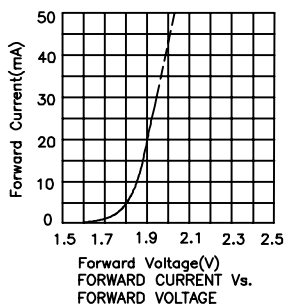
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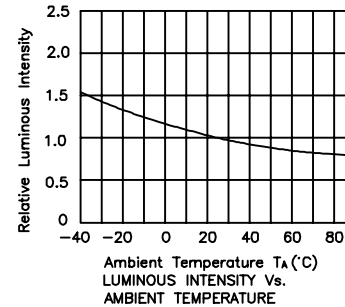
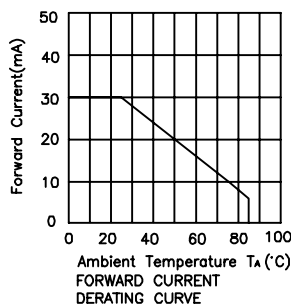
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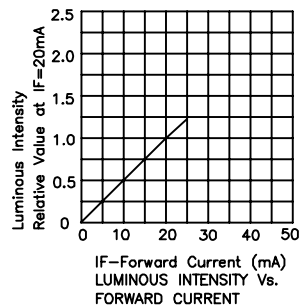
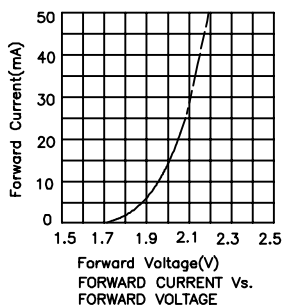
### Hyper Red



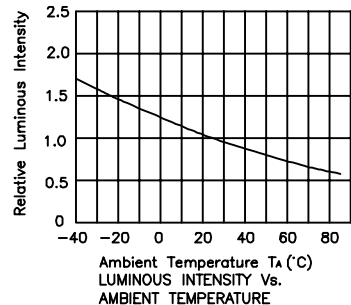
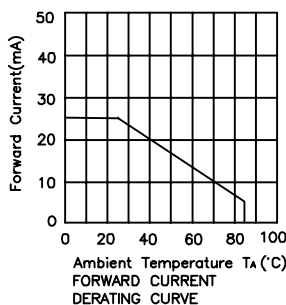
### SUR/E : AlGaInP



### Pure Orange



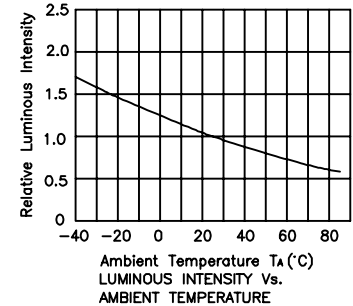
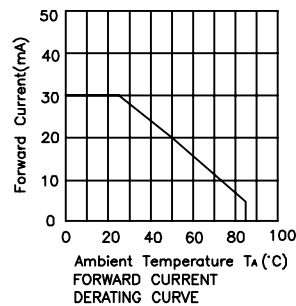
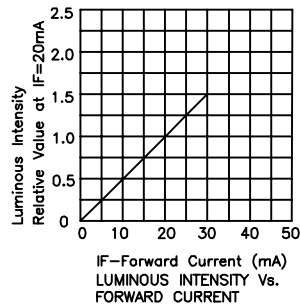
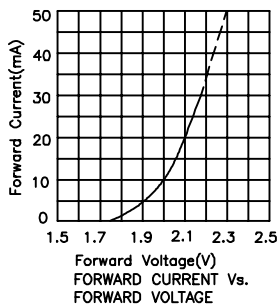
### N : GaAsP/GaP



## TECHNICAL DATA

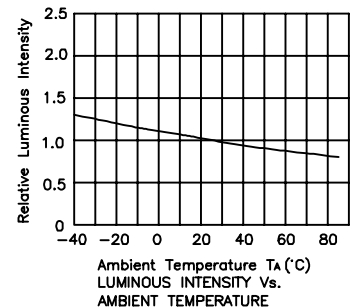
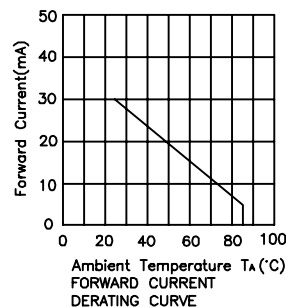
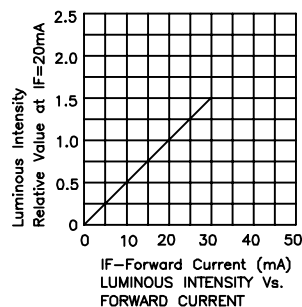
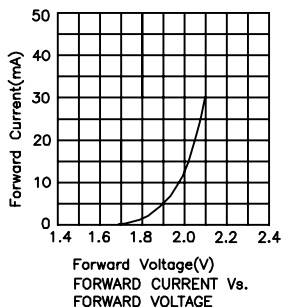
### Super Bright Orange

### SEK : AlGaInP



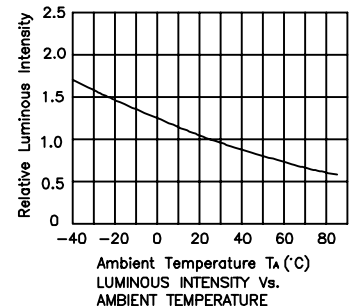
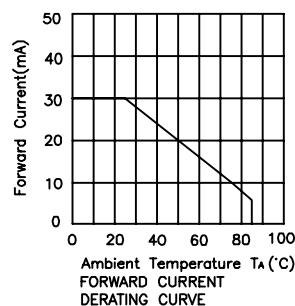
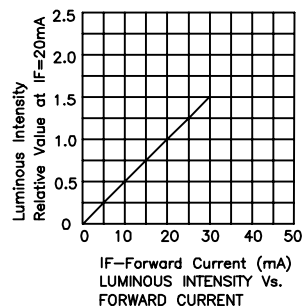
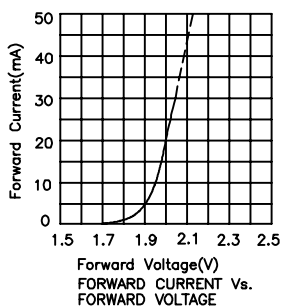
### Super Bright Orange

### SEK/T : AlGaInP



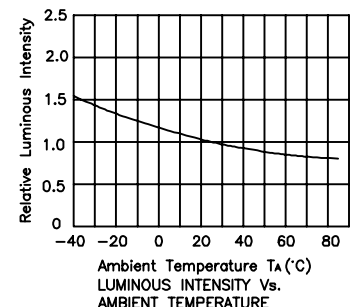
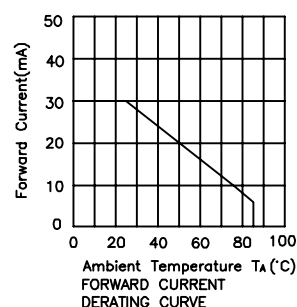
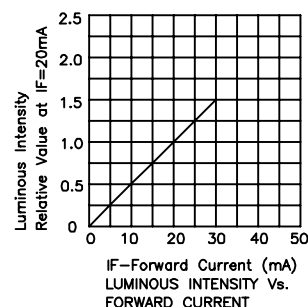
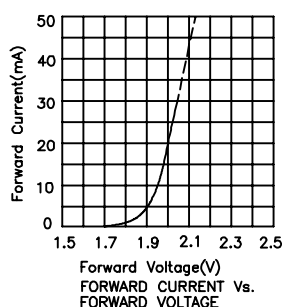
### Super Bright Orange

### SE : AlGaInP



### Hyper Red

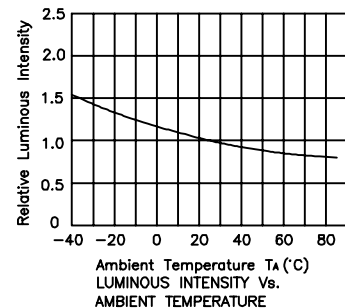
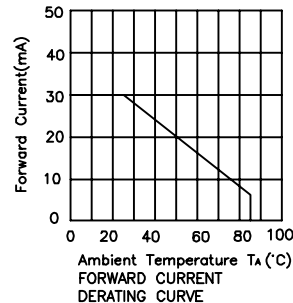
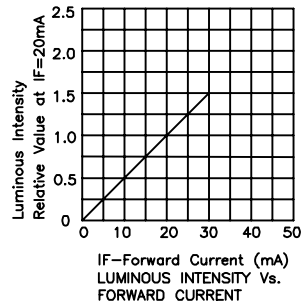
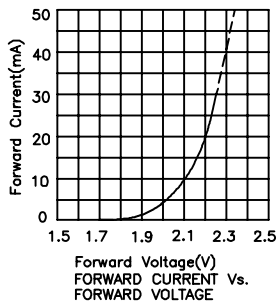
### SE/E : AlGaInP



## TECHNICAL DATA

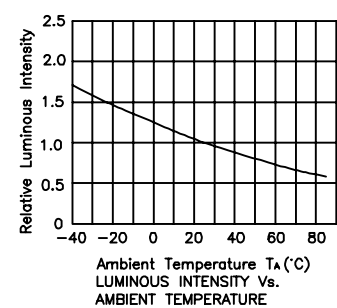
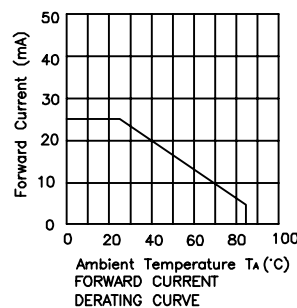
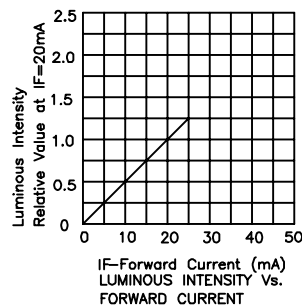
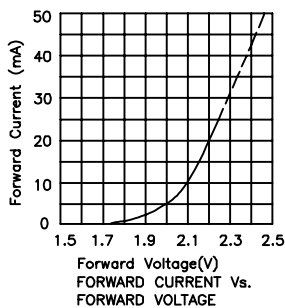
### Hyper Red

### SE/J3 : AlGaInP



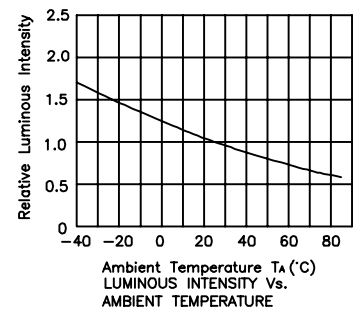
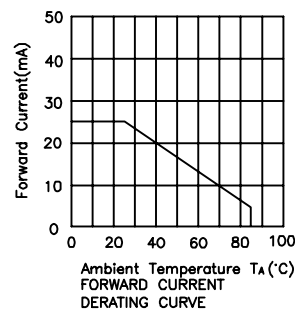
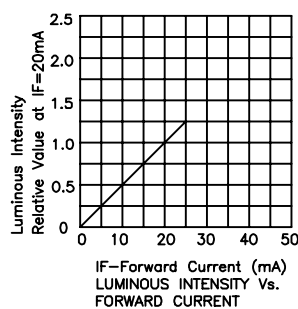
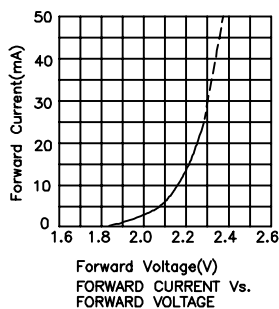
### Green/Super Bright Green

### G,SG : GaP



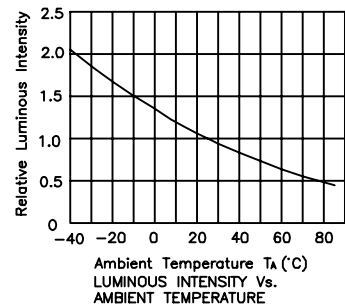
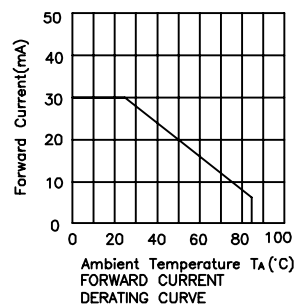
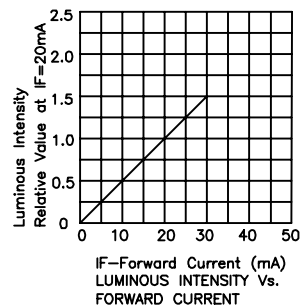
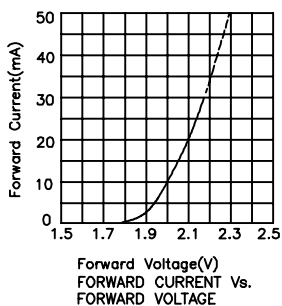
### Pure Green

### PG : GaP



### Green

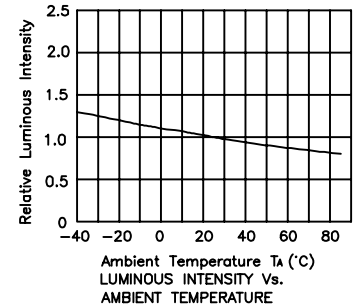
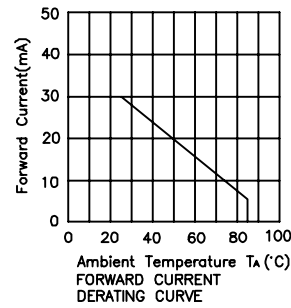
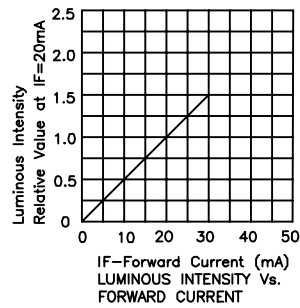
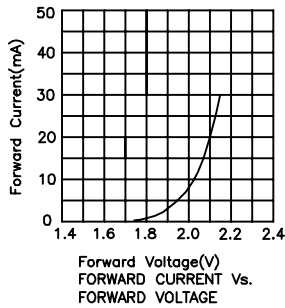
### CGK : AlGaInP



## TECHNICAL DATA

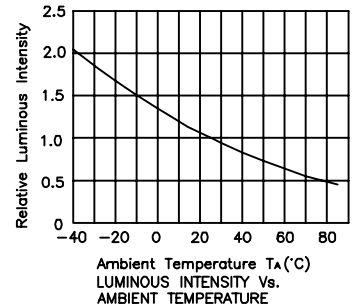
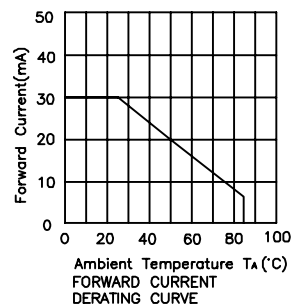
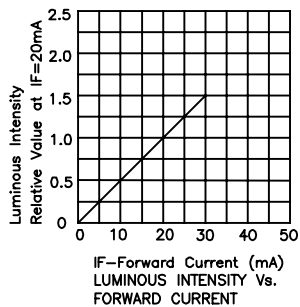
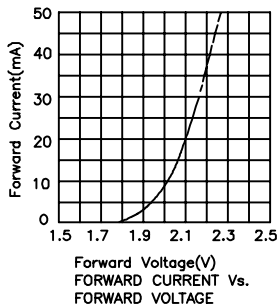
### Green

### CGK/T : AlGaInP



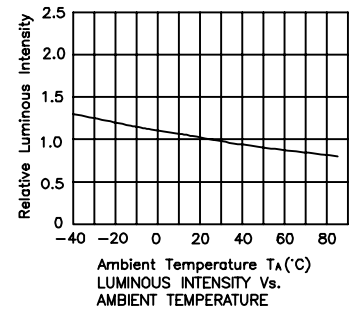
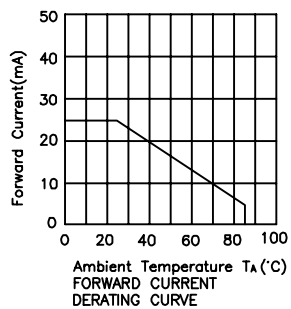
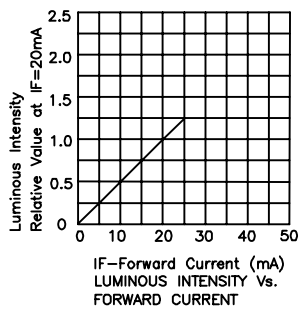
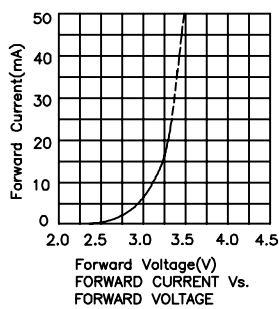
### Mega Green

### MG : AlGaInP



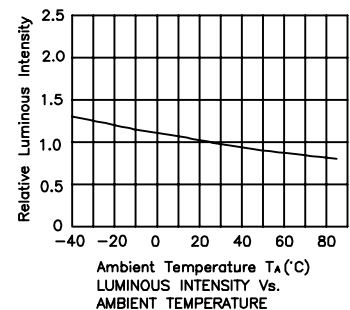
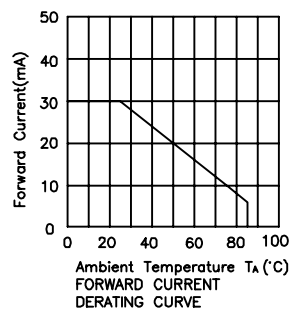
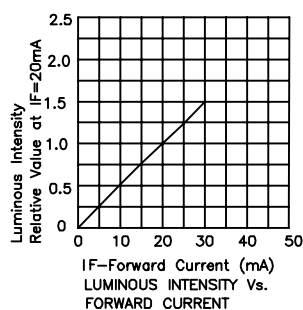
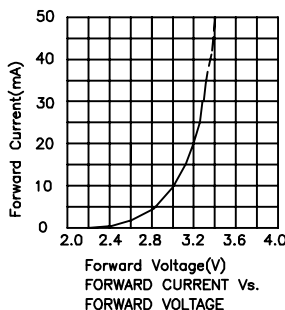
### Green

### ZG : InGaN



### Green

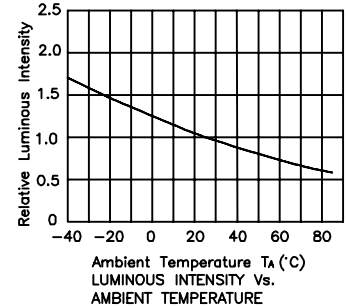
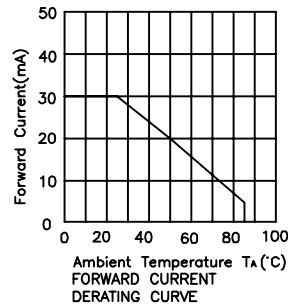
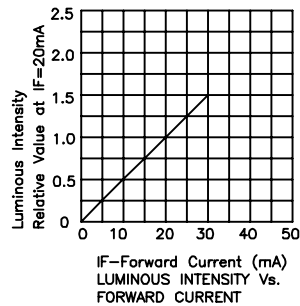
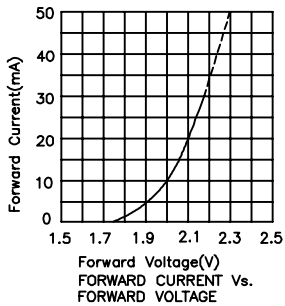
### ZG/G : InGaN



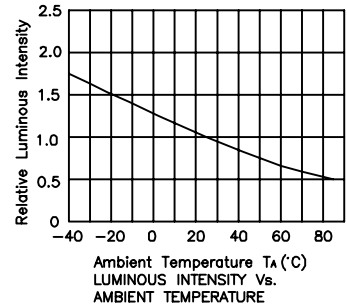
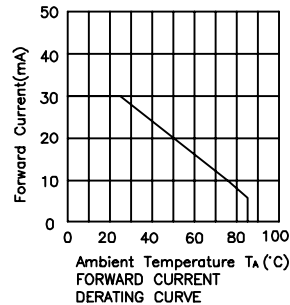
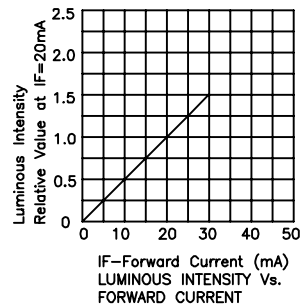
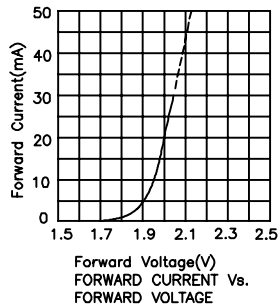


## TECHNICAL DATA

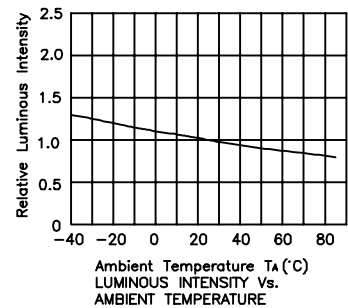
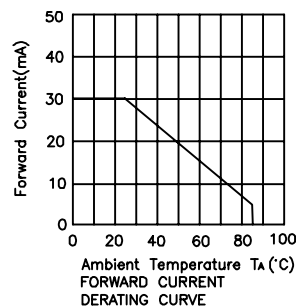
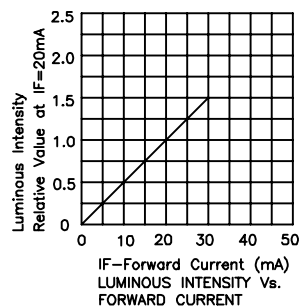
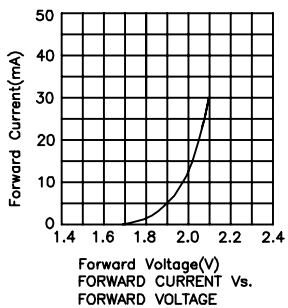
### Yellow Y : GaAsP/GaP



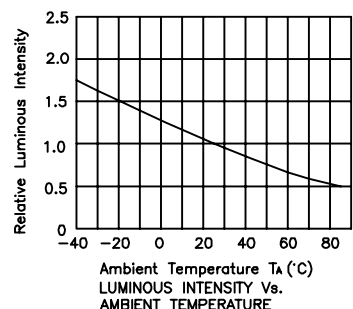
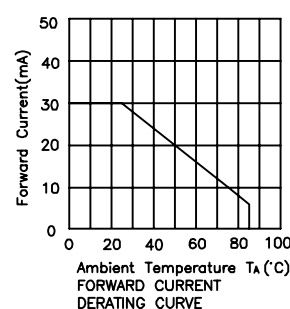
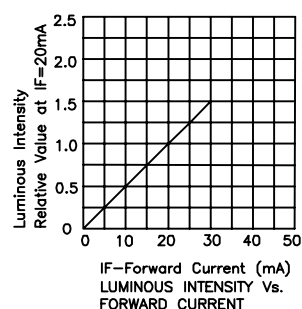
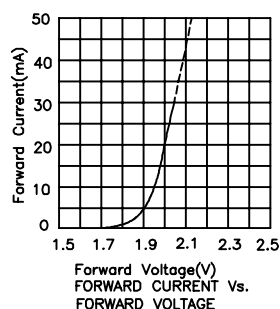
### Super Bright Yellow SYK : AlGaInP



### Super Bright Yellow SYK/T : AlGaInP



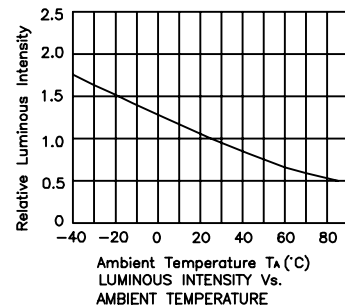
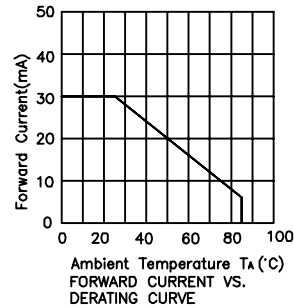
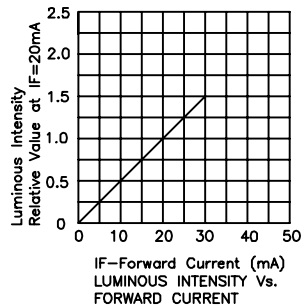
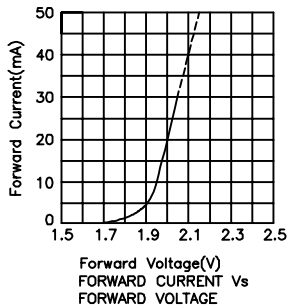
### Super Bright Yellow SY : AlGaInP



## TECHNICAL DATA

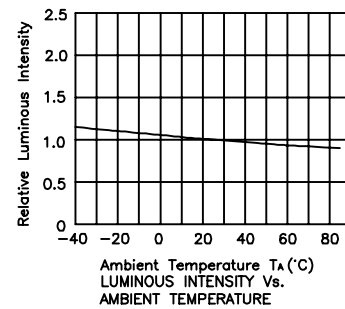
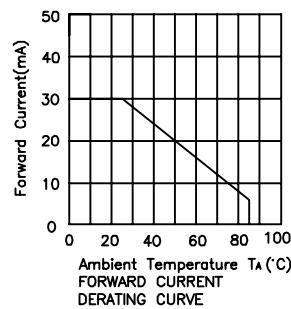
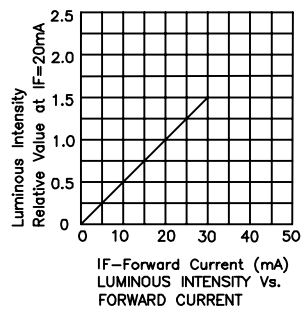
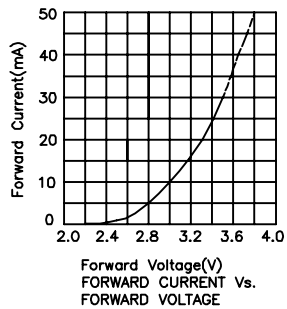
### Super Bright Yellow

### SY/J3 : AlGaInP



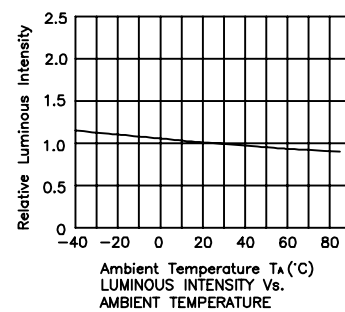
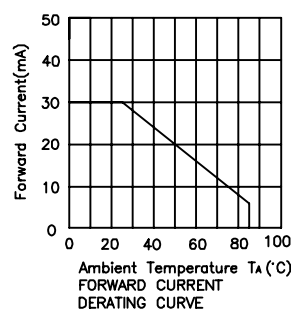
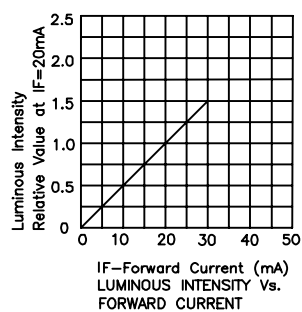
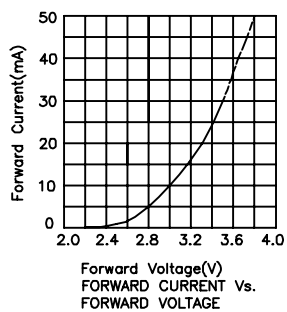
### Blue

### QB/D: InGaN



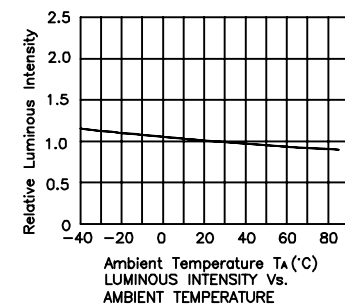
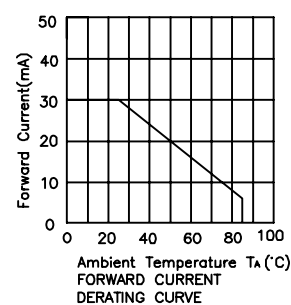
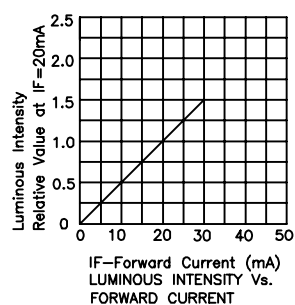
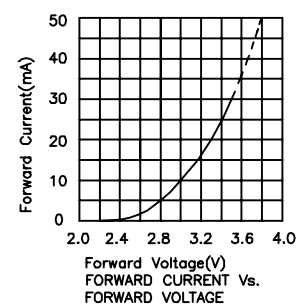
### Blue

### QB/F: InGaN



### Blue

### VB/D : InGaN



## BIN CODE SYSTEMS

SELECTION CODE FOR STANDARD LEDs (T <sub>A</sub> =25°C)					
Group	Light intensity in mcd(10mA)		Group	Light intensity in mcd(10mA)	
	Min.	Max.		Min.	Max.
F	0.1	0.2	W	120	180
G	0.2	0.35	X	180	250
H	0.35	0.5	Y	250	320
I	0.5	0.8	Z	320	450
K	0.8	1.2	ZA	450	550
L	1.2	2	ZB	550	700
M	2	4	ZC	700	1000
N	4	6	ZD	1000	1600
P	6	10	ZE	1600	2200
Q	10	15	ZF	2200	2800
R	15	20	ZG	2800	3400
S	20	30	ZH	3400	4300
T	30	50	ZM	4300	5200
U	50	80	ZN	5200	6300
V	80	120	ZP	6300	7400

SELECTION CODE FOR NPN PHOTOTRANSISTORS (T <sub>A</sub> =25°C)					
Group	Photocurrent(mA)		Group	Photocurrent(mA)	
	Min.	Max.		Min.	Max.
F	0.1	0.2	L	1.2	2
G	0.2	0.35	M	2	4
H	0.35	0.5	N	4	6
I	0.5	0.8	P	6	10
K	0.8	1.2	-	-	-

SELECTION CODE FOR INFRARED EMITTING DIODES (T <sub>A</sub> =25°C)					
Group	Radiant intensity in mW/sr(20mA)		Group	Radiant intensity in mW/sr(20mA)	
	Min.	Max.		Min.	Max.
AK	0.8	1.2	D	8	12
AL	1.2	2	E	12	20
A	2	3	F	20	40
B	3	5	G	40	55
C	5	8	H	55	80

SELECTION CODE FOR SUPER BRIGHT LEDs (T <sub>A</sub> =25°C)					
Group	Light intensity in mcd(20mA)		Group	Light intensity in mcd(20mA)	
	Min.	Max.		Min.	Max.
A	2	3	ZA	3100	3600
B	3	5	ZB	3600	4200
C	5	8	ZC	4200	5000
D	8	12	ZD	5000	6000
E	12	20	ZE	6000	7000
F	20	40	ZF	7000	8000
G	40	55	ZG	8000	9000
H	55	80	ZH	9000	11000
M	80	120	ZM	11000	14000
N	120	200	ZN	14000	18000
P	200	300	ZP	18000	22000
Q	300	400	ZQ	22000	27000
R	400	500	ZR	27000	35000
S	500	700	ZS	35000	43000
T	700	1000	ZT	43000	55000
U	1000	1300	ZU	55000	75000
V	1300	1600	ZV	75000	130000
W	1600	1900	ZW	130000	200000
X	1900	2300	ZX	200000	320000
Y	2300	2700	ZY	320000	490000
Z	2700	3100	ZZ	490000	800000

SELECTION CODE FOR DISPLAYS (T <sub>A</sub> =25°C)					
Group	Light intensity in ucd(10mA)		Group	Light intensity in ucd(10mA)	
	Min.	Max.		Min.	Max.
C	70	140	P	14000	21000
D	140	240	Q	21000	31000
E	240	360	R	31000	52000
F	360	560	S	52000	88000
G	560	900	T	88000	150000
H	900	1400	U	150000	255000
I	1400	2200	V	255000	433000
K	2200	3600	W	433000	736000
L	3600	5600	X	736000	1251000
M	5600	9000	Y	1251000	2126000
N	9000	14000	Z	2126000	3614000

## BIN CODE SYSTEMS

SELECTION CODE FOR LUMINOUS FLUX (T <sub>A</sub> =25°C; Tolerance: +/-15%)					
Group	Luminous Flux in lm		Group	Luminous Flux in lm	
	Min.	Max.		Min.	Max.
A1	0.5	0.6	B10	50	60
A2	0.6	0.7	B11	60	70
A3	0.7	0.8	B12	70	80
A4	0.8	1	B13	80	90
A5	1	1.2	B14	90	100
A6	1.2	1.4	C1	100	120
A7	1.4	1.7	C2	120	140
A8	1.7	2	C3	140	160
A9	2	2.4	C4	160	180
A10	2.4	2.9	C5	180	210
A11	2.9	3.5	C6	210	240
A12	3.5	4.2	C7	240	280
A13	4.2	5	C8	280	320
A14	5	6	C9	320	370
A15	6	7.2	C10	370	430
A16	7.2	8.6	C11	430	490
A17	8.6	10	C12	490	560
B1	10	12	C13	560	640
B2	12	14	C14	640	740
B3	14	17	C15	740	850
B4	17	20	C16	850	1000
B5	20	24	D1	1000	1200
B6	24	29	D2	1200	1400
B7	29	35	D3	1400	1600
B8	35	42	D4	1600	1800
B9	42	50	D5	1800	2100

COLOR CODE FOR GREEN LEDS + DISPLAYS (T <sub>A</sub> =25°C; Tolerance: +/-1nm)				
Group	Dom. Wavelength (nm)			
	Min.	Max.	Min.	Max.
0	556	559	510	515
1	559	561	515	520
2	561	563	520	525
3	563	565	525	530
4	565	567	530	535
5	567	569	535	540
6	569	571	-	-
7	571	573	-	-
8	573	575	-	-

COLOR CODE FOR BLUE LEDS + DISPLAYS (T <sub>A</sub> =25°C; Tolerance: +/-1nm)					
Group	Dom. Wavelength (nm)		Group	Dom. Wavelength (nm)	
	Min.	Max.		Min.	Max.
1	445	450	3A	471	473
2	450	455	3B	473	475
3	455	460	4A	475	477
1A	460	463	4B	477	479
1B	463	466	5A	479	481
2A	466	469	5B	481	483
2B	469	471	5C	483	486

COLOR CODE FOR YELLOW LEDS + DISPLAYS (T <sub>A</sub> =25°C; Tolerance: +/-1nm)					
Group	Dom. Wavelength (nm)		Group	Dom. Wavelength (nm)	
	Min.	Max.		Min.	Max.
1	581	584	5	590	592
2	584	586	6	592	594
3	586	588	7	594	597
4	588	590	8	597	600

SOLDERING INSTRUCTIONS						
Types	Dip soldering / * wave soldering			Iron soldering (with 1.5mm iron tip)		
	Temperature of the soldering bath	Maximum soldering time	Distance from solder joint to package	Temperature of soldering iron	Maximum soldering time	Distance from solder joint to package
LEDS	<=260°C	3s	>=2mm	<=350°C	3s	>2mm
	<=260°C	5s	>=5mm	<=350°C	5s	>5mm
SMDS	-	-	-	<=350°C	3s (one time only)	-
DISPLAYS	*<=260°C	*3s	*>2mm	<=350°C	3s	>2mm
PHOTOCOUPLER	<=260°C	3s	>2mm	<=310°C	3s	-
	-	-	-	<=260°C	10s	-

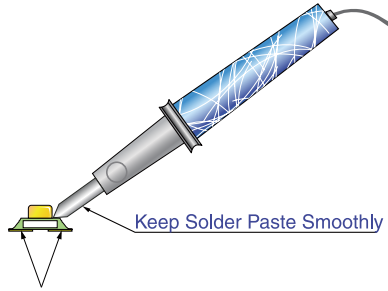
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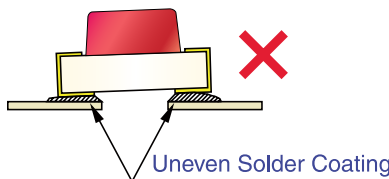
## APPLICATION NOTES

### General Notes

1. We recommend manual soldering operations only for repair and rework purposes. The soldering iron should not exceed 30W in power. The maximum soldering temperature is 300°C for Pb-Sn solder and 350°C for lead-free solder for normal lamps and displays. For blue (425nm), blue-green (525nm), and all white LEDs, the maximum soldering iron temperature is 280°C. Do not place the soldering iron on the component for more than 3 seconds.



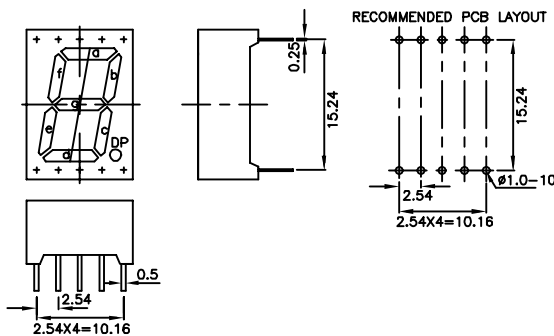
2. The tip of the soldering iron should never touch the lens epoxy.
3. Do not apply stress to the leads when the component is heated above 85°C, otherwise internal wire bonds may be damaged.
4. Through-hole LEDs are incompatible with reflow soldering.
5. If the LED will undergo multiple soldering passes or face other processes where the part may be subjected to intense heat, please check with Kingbright for compatibility.
6. SMD products must be mounted according to specified soldering pad patterns. Refer to the product datasheet for details. Solder paste must be evenly applied to each soldering pad to insure proper bonding and positioning of the component.



7. After soldering, allow at least three minutes for the component to cool down to room temperature before further operations.
8. Recommended PCB pin hole diameters for display products are listed below :

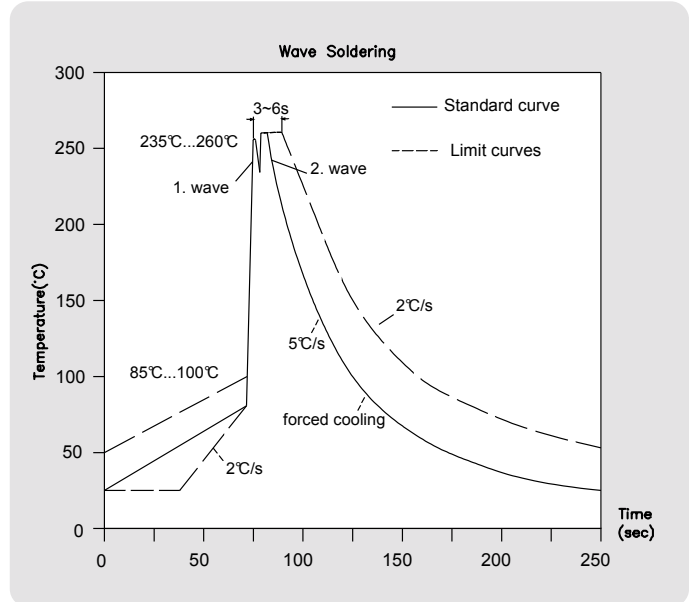
Round pin type : 2 x pin diameters

Square pin type :

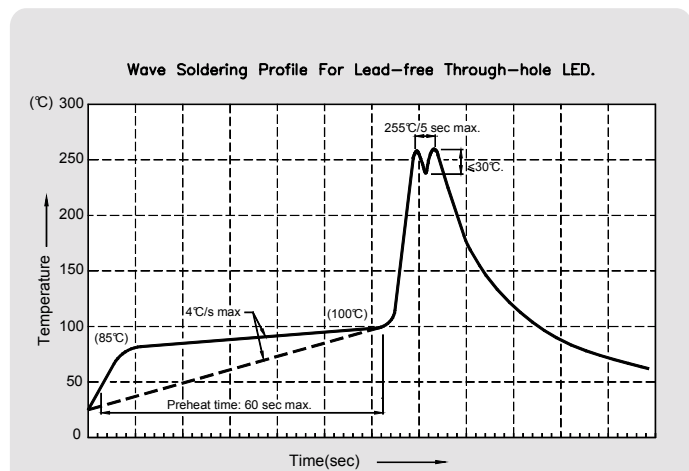


## Recommended Wave Soldering Profiles For Kingbright Through-Hole Products

### 1. Wave Soldering Profile With Pb-Sn Solder



### 2. Lead-Free Wave Soldering Profile



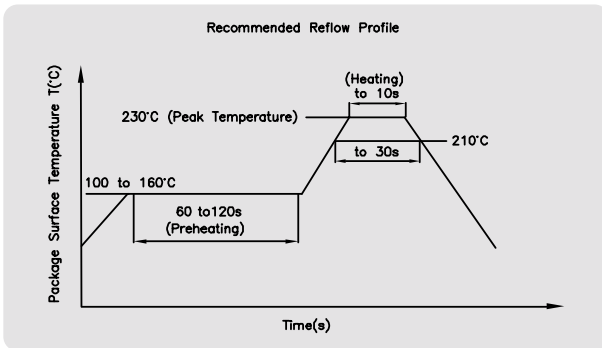
#### Notes:

- Recommend pre-heat temperature of 105°C or less ( as measured with a thermocouple attached to the LED pins) prior to immersion in the solder wave with a maximum solder bath temperature of 260°C.
- Peak wave soldering temperature between 245°C ~ 255°C for 3 sec (5 sec max).
- Do not apply stress to the epoxy resin while the temperature is above 85°C.
- Fixtures should not incur stress on the component when mounting and during soldering process.
- SAC 305 solder alloy is recommended.
- No more than one wave soldering pass.

## Recommended Reflow Soldering Profiles For Kingbright SMD Products

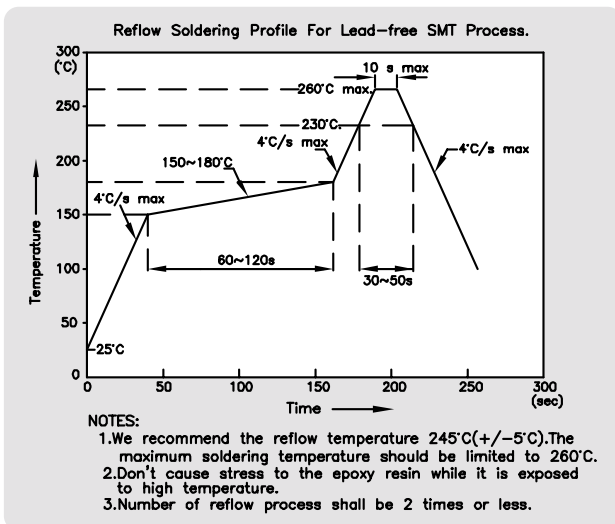
### 1. Reflow Soldering Profiles With Pb-Sn Solder

No more than two soldering passes with the recommended profile.



### 2. Lead-Free Reflow Soldering Profile

No more than two soldering passes with the recommended profile.



## Static Electricity and Voltage Spikes in InGaN/GaN Products

InGaN/GaN products are sensitive to electrostatic discharge (ESD) and other transient voltage spikes. ESD and voltage spikes can affect the component's reliability, increase reverse current, and decrease forward voltage. This may result in reduced light intensity or cause component failure.

Kingbright InGaN/GaN products are stored in anti-static packaging for protection during transport and storage. Please note the anti-static measures below when handling Kingbright InGaN/GaN products.

### Design Precautions

Products using InGaN/GaN components must incorporate protection circuitry to prevent ESD and voltage spikes from reaching the vulnerable component.

## ESD Protection During Production

Static discharge can result when static-sensitive products come in contact with the operator or other conductors. The following procedures may decrease the possibility of ESD damage:

1. Minimize friction between the product and surroundings to avoid static buildup.
2. All production machinery and test instruments must be electrically grounded.
3. Operators must wear anti-static bracelets.
4. Wear anti-static suit when entering work areas with conductive machinery.
5. Set up ESD protection areas using grounded metal plating for component handling.
6. All workstations that handle IC and ESD-sensitive components must maintain an electrostatic potential of 150V or less.
7. Maintain a humidity level of 50% or higher in production areas.
8. Use anti-static packaging for transport and storage.
9. All anti-static equipment and procedures should be periodically inspected and evaluated for proper functionality.

## LED Mounting Method

1. The lead pitch of the LED must match the pitch of the mounting holes on the PCB during component placement. Lead-forming may be required to insure the lead pitch matches the hole pitch. Refer to (Fig.1) for proper lead forming procedures.

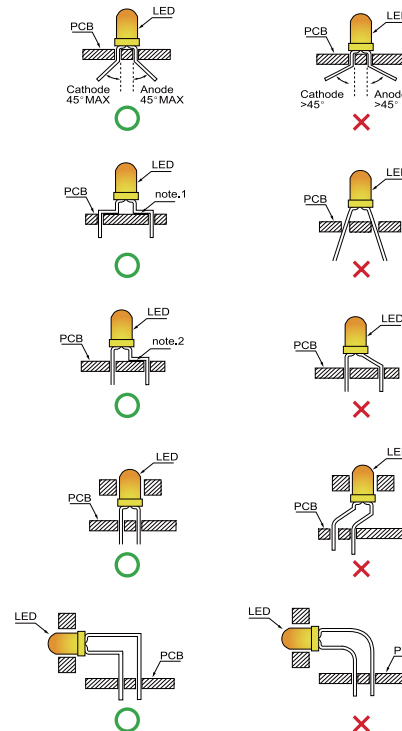


Fig. 1

"○" Correct mounting method  
 "×" Incorrect mounting method  
 Note 1-2 : Do not route PCB trace in the contact area between the leadframe and the PCB to prevent short-circuits.

- When soldering wire to the LED, use individual heat-shrink tubing to insulate the exposed leads to prevent accidental contact short-circuit. (Fig.2)

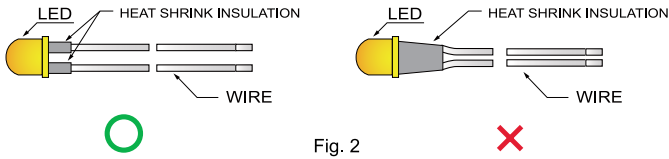


Fig. 2

- Use stand-offs (Fig.3) or spacers (Fig.4) to securely position the LED above the PCB.

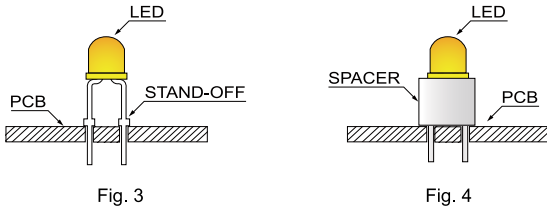


Fig. 3

Fig. 4

## Lead Forming Procedures

- Maintain a minimum of 2mm clearance between the base of the LED lens and the first lead bend. (Fig. 5 and 6)

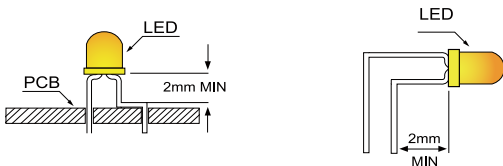


Fig. 5

Fig. 6

- Lead forming or bending must be performed before soldering, never during or after soldering.
- Do not stress the LED lens during lead-forming in order to prevent fractures in the lens epoxy and damage the internal structures.
- During soldering, component covers and holders should leave clearance to avoid placing damaging stress on the LED during soldering. (Fig. 7)

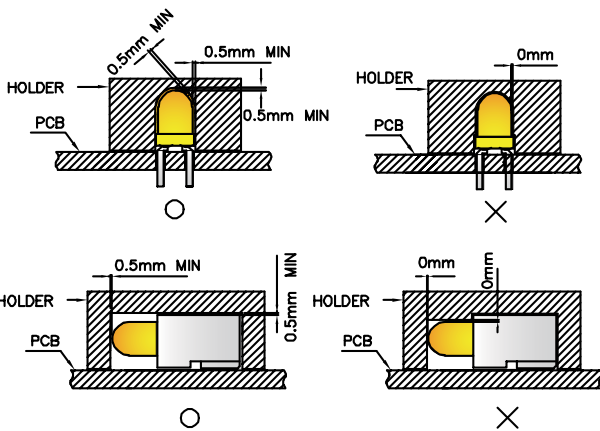


Fig. 7

- During lead forming, use tools or jigs to hold the leads securely so that the bending force will not be transmitted to the LED lens and its internal structures. Do not perform lead forming once the component has been mounted onto the PCB. (Fig. 8)

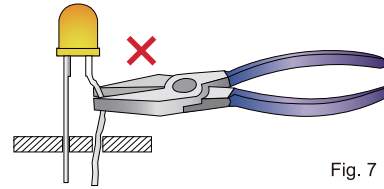


Fig. 8

- Do not bend the leads more than twice. (Fig. 9)

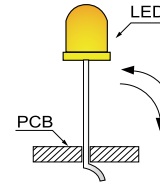


Fig. 9

- After soldering or other high-temperature assembly, allow the LED to cool down to 50°C before applying outside force (Fig. 10). In general, avoid placing excess force on the LED to avoid damage. For any questions please consult with Kingbright representative for proper handling procedures.

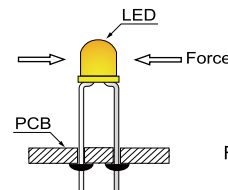


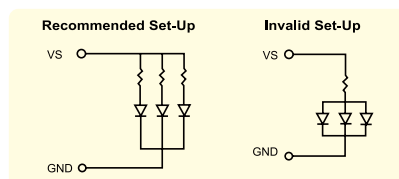
Fig. 10

## Cleaning

- Do not use harsh organic solvents such as trichloroethylene, acetone, Chlorosen, and Diflon S3MC for cleaning because they may cloud or damage the LED lens.
- Isopropyl alcohol or deionized water are recommended solvents for cleaning.
- Special attention should be taken if other chemicals are used for cleaning because other solvents may damage the epoxy in the lens or housing.
- The cleaning process should take place at room temperature and the devices should not be washed for more than one minute.
- When water is used for cleaning, immediately use forced-air drying to remove excess moisture from the LED.

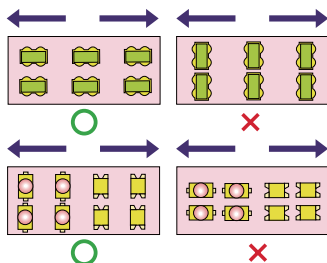
## Miscellaneous Design Notes

- Protective current-limiting resistors may be necessary to operate the LEDs within the specified range.
- LEDs mounted in parallel should each be placed in series with its own current-limiting resistor.

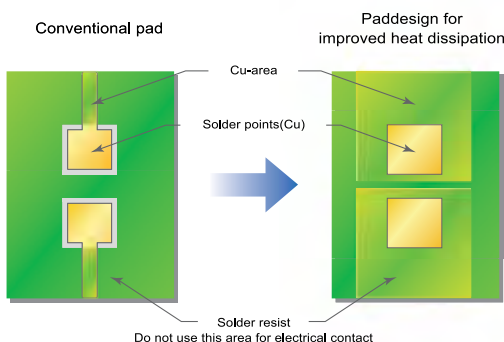




- The driving circuit should be designed to avoid reverse voltages and transient voltage spikes when the circuit is powered up or shut down.
- During soldering, SMD components should be mounted such that the leads are placed perpendicular to the direction of PCB travel to insure the solder on each lead melts simultaneously during reflow.



- Optimal usage of high-power LED devices requires careful design by the end-user to optimize heat dissipation, such as increasing the size of the metal backing around the soldering pad. Refer to the product datasheet for specific design recommendations regarding heat dissipation.

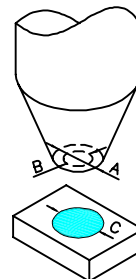


- High temperatures can reduce device performance and reliability. Keep LED devices away from heat source for best performance.

## Restrictions on Product Use

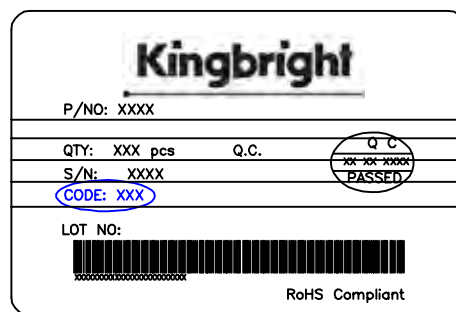
- The information contained within this document is subject to change without notice. Before referencing this document, please confirm it is the most current version available.
- Not all devices and product families are available in every country.
- The light output from UV, blue, white, and other high-power LEDs may cause injury to the human eye when viewed directly.
- LED devices may contain gallium arsenide (GaAs) material. GaAs is harmful if ingested. GaAs dust and fumes are toxic. Do not break, cut, or pulverize LED devices. Do not dissolve LEDs in chemical solvents.
- Semiconductor devices can fail or malfunction due to their sensitivity to electrical fluctuation and physical stress. It is the responsibility of the user to observe all safety standards when using Kingbright products, in order to avoid situations in which the malfunction or failure of a Kingbright product could cause injury, property damage, or the loss of human life. In developing designs, please insure that Kingbright products are used within specified operating conditions as set forth in the most recent product specification datasheet.

- The outer diameter of the SMD pick-up nozzle should not exceed the size of the LED to prevent air leaks. The inner diameter of the nozzle should be as large as possible.



A is the outer diameter of the nozzle  
B is the inner diameter of the nozzle  
C is the window size of the LED

- The size of the nozzle should be as large as possible if the tape is not involved.
- It is not recommended to assemble LEDs with different color bins or intensity bins together as there may be perceivable color or intensity variation. Each bag contains parts from the same bin code. The bin code is printed on the bag's label as shown below.



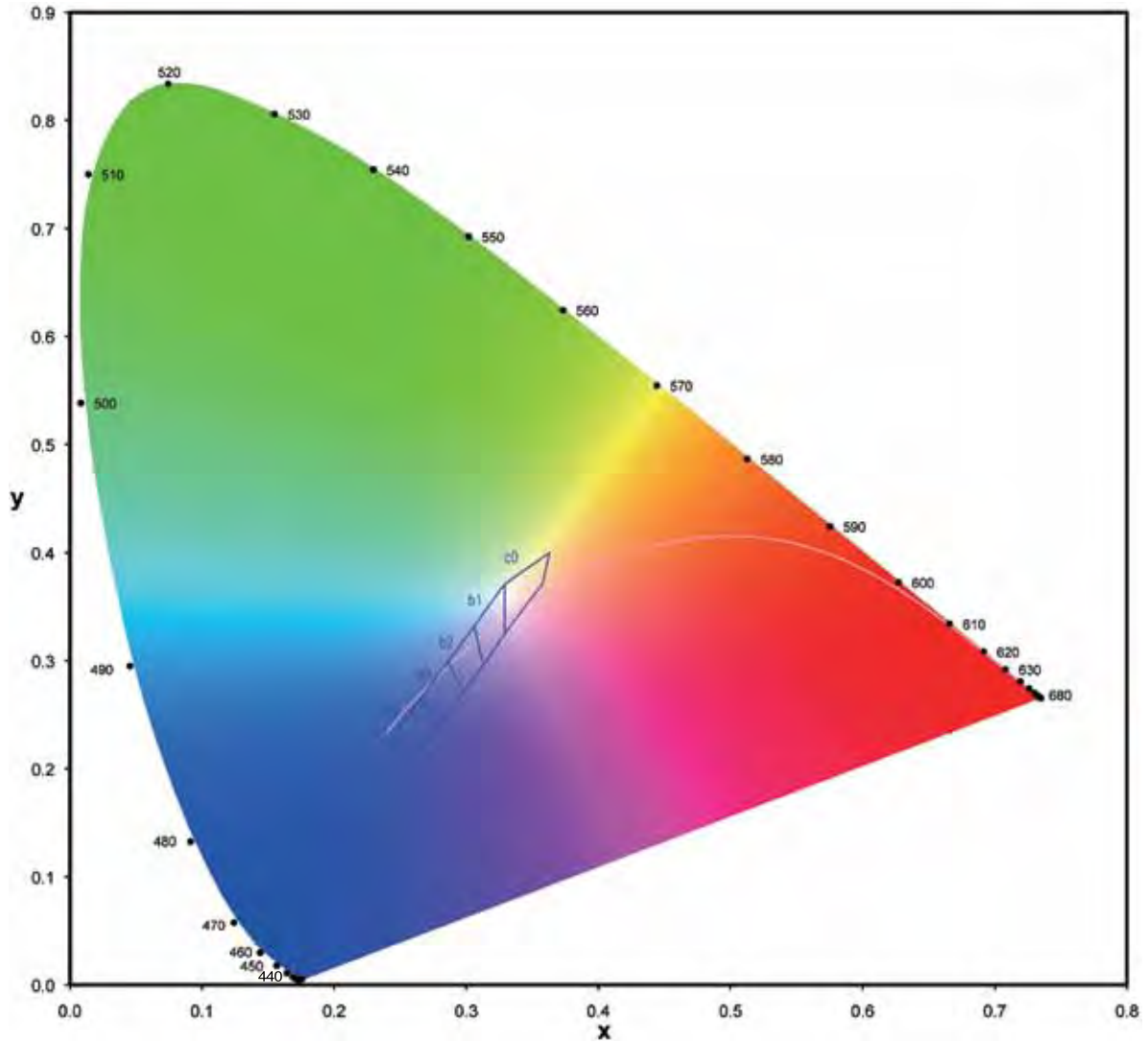
## Storage Control

- Before a sealed moisture barrier bag (MBB) is opened, contained LEDs shall be kept in an environment with temperature below 40°C and humidity below 90% RH. MBB shall be kept sealed until LEDs contained in the bag are ready to be used. Once MBB is opened, it shall be stored in an environment with temperature range of 5°C~30°C and humidity below 60% RH.
- Once MBB is opened, all contained LEDs shall complete soldering process within the specified time frame according to the conditions labeled on Kingbright MBB.
- When the 10% spot of a humidity indicator card (HIC) from MBB indicates wet, the contained LEDs shall be baked according to the baking conditions labeled on Kingbright MBB before mounting.

## Soldering

If LEDs will undergo multiple soldering passes or special processes where LEDs may be subjected to intense heat, please check with Kingbright for compatibility before proceeding.

White Bin Code



Bin	x	y
a2	0.263	0.213
	0.282	0.245
	0.265	0.265
	0.242	0.226
CCT: 15000K~		

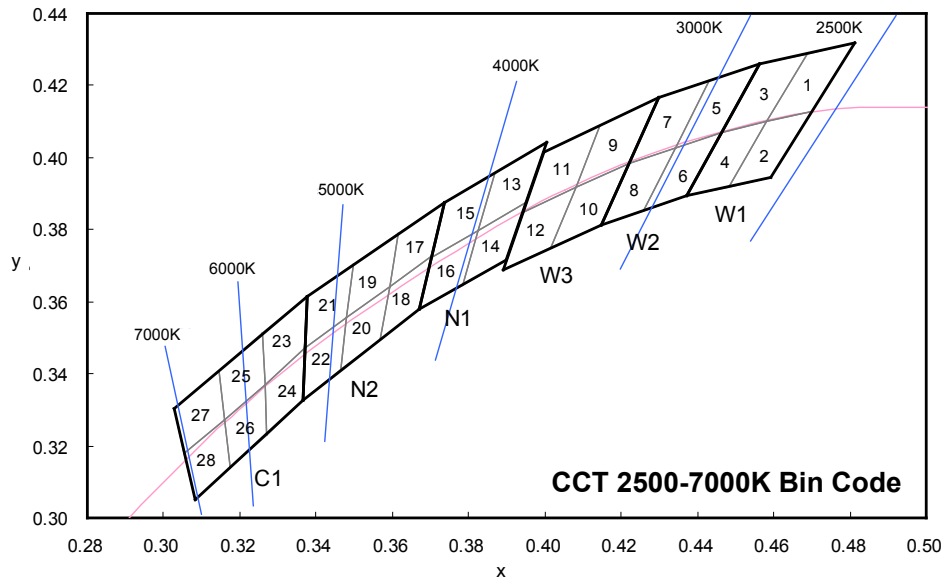
Bin	x	y
b2	0.298	0.271
	0.313	0.296
	0.306	0.332
	0.286	0.299
CCT: 6800~9000K		

Bin	x	y
c0	0.329	0.325
	0.358	0.372
	0.363	0.400
	0.329	0.371
CCT: 4600~5600K		

Bin	x	y
a0	0.282	0.245
	0.298	0.271
	0.286	0.299
	0.265	0.265
CCT: 9000~15000K		

Bin	x	y
b1	0.313	0.296
	0.329	0.325
	0.329	0.371
	0.306	0.332
CCT: 5600~6800K		

## CIE CHROMATICITY DIAGRAM



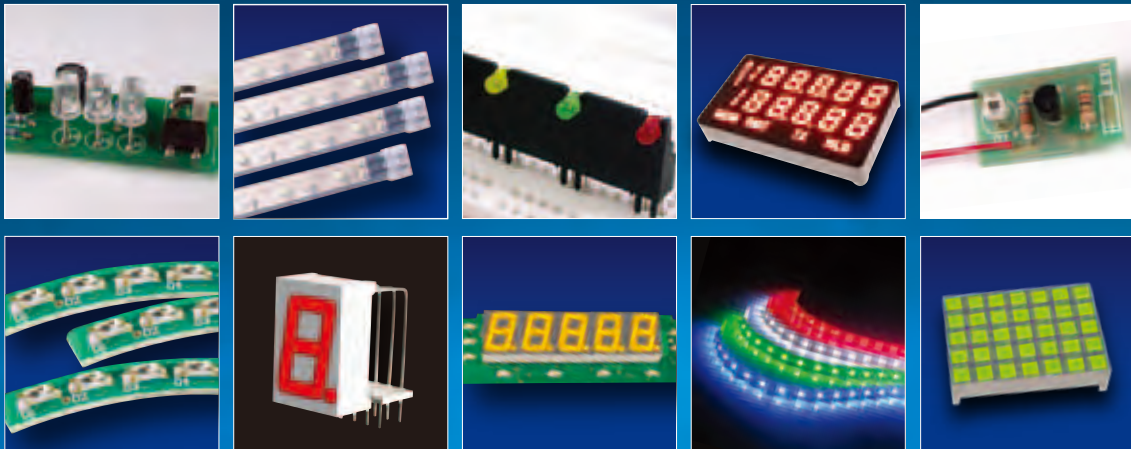
Group	Chromaticity Regions	CCT (K)		
		Min.	Typ.	Max.
W1	1, 2, 3, 4	2580	2700	2870
W2	5, 6, 7, 8	2870	3000	3220
W3	9, 10, 11, 12	3220	3500	3710

Group	Chromaticity Regions	CCT (K)		
		Min.	Typ.	Max.
N1	13, 14, 15, 16	3710	4000	4260
N2	17, 18, 19, 20, 21, 22	4260	4700	5310
C1	23, 24, 25, 26, 27, 28	5310	6000	7040

	x	y		x	y		x	y		x	y
1	0.4582	0.4099	8	0.4147	0.3814	15	0.3702	0.3722	22	0.3481	0.3557
	0.4687	0.4289		0.4221	0.3984		0.3736	0.3874		0.3370	0.3472
	0.4813	0.4319		0.4342	0.4028		0.3869	0.3958		0.3364	0.3328
	0.4700	0.4126		0.4259	0.3853		0.3825	0.3798		0.3466	0.3411
2	0.4483	0.3919	9	0.4080	0.3916	16	0.3670	0.3578	23	0.3376	0.3616
	0.4582	0.4099		0.4146	0.4089		0.3702	0.3722		0.3260	0.3512
	0.4700	0.4126		0.4299	0.4165		0.3825	0.3798		0.3265	0.3371
	0.4593	0.3944		0.4221	0.3984		0.3783	0.3646		0.3370	0.3472
3	0.4465	0.4071	10	0.4017	0.3751	17	0.3736	0.3874	24	0.3370	0.3472
	0.4562	0.4260		0.4080	0.3916		0.3616	0.3788		0.3265	0.3371
	0.4687	0.4289		0.4221	0.3984		0.3592	0.3641		0.3270	0.3230
	0.4582	0.4099		0.4147	0.3814		0.3703	0.3726		0.3364	0.3328
4	0.4373	0.3893	11	0.3941	0.3848	18	0.3703	0.3726	25	0.3260	0.3512
	0.4465	0.4071		0.3996	0.4015		0.3592	0.3641		0.3144	0.3408
	0.4582	0.4099		0.4146	0.4089		0.3568	0.3495		0.3160	0.3274
	0.4483	0.3919		0.4080	0.3916		0.3670	0.3578		0.3265	0.3371
5	0.4342	0.4028	12	0.3889	0.3690	19	0.3616	0.3788	26	0.3265	0.3371
	0.4430	0.4212		0.3941	0.3848		0.3496	0.3702		0.3160	0.3274
	0.4562	0.4260		0.4080	0.3916		0.3481	0.3557		0.3175	0.3139
	0.4465	0.4071		0.4017	0.3751		0.3592	0.3641		0.3270	0.3230
6	0.4259	0.3853	13	0.3825	0.3798	20	0.3592	0.3641	27	0.3144	0.3408
	0.4342	0.4028		0.3869	0.3958		0.3481	0.3557		0.3028	0.3304
	0.4465	0.4071		0.4006	0.4044		0.3466	0.3411		0.3055	0.3177
	0.4373	0.3893		0.3950	0.3875		0.3568	0.3495		0.3160	0.3274
7	0.4221	0.3984	14	0.3783	0.3646	21	0.3496	0.3702	28	0.3160	0.3274
	0.4299	0.4165		0.3825	0.3798		0.3376	0.3616		0.3055	0.3177
	0.4430	0.4212		0.3950	0.3875		0.3370	0.3472		0.3081	0.3049
	0.4342	0.4028		0.3898	0.3716		0.3481	0.3557		0.3175	0.3139

# Kingbright

## Custom Assembly LEDs



Kingbright offers full custom LED options in package with your desired shape, form, color that will further enhance your design solutions. If you have further LED design objectives or specialized requirement to meet, please contact us at 909-468-0500 or email to [sales@KingbrightUSA.com](mailto:sales@KingbrightUSA.com)

For comprehensive product selections, please visit our online store at [www.KingbrightUSA.com](http://www.KingbrightUSA.com) , a streamlined process operating 24/7 online.



# Kingbright Global Presence

Kingbright is committed to serving customers globally with absolute best service possible.



 **QUALITY**  **EFFICIENCY**  **SERVICE**  **INNOVATION**



ISO 9001:2000  
Certificate No. FM 509252

ISO/TS 16949:2002  
Certificate No. TS 505943

ISO 14001:2004  
Certificate No. EMS 505945

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