

# High Brightness LED Lamp Reliability Test Standards

This application note describes the qualification process Cree LED applies to ensure long-term reliability for High Brightness LEDs and details Cree LED’s pre-release qualification testing for High Brightness LEDs.

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## JUDGING CRITERIA

Unless otherwise stated, the judging criteria are shown below.

Item	Symbol	Test Condition	Criteria for Judgment	
			Min.	Max.
Forward Voltage	$V_F$	$I_F = 20 \text{ mA}$	-	Initial Data x 1.1
Reverse Current	$I_R$	$V_R = 5 \text{ V}$	-	P2/P4: 100 $\mu\text{A}$ SMD: 10 $\mu\text{A}$
Luminous Flux/ Intensity	$\Phi_V$	$I_F = 20 \text{ mA}$	Initial Data x 0.7	-

P2: COLOR

Test Items and Results

Type	Test Item	Reference Standard	Test Condition	Note	Number of Failures
Environmental sequence	Temperature Cycle	JEITA ED-4701 100 105	-40°C~25°C~100°C~25°C 30 mins, 5 mins, 30 mins, 5 mins	100 cycles	0/50
	Thermal Shock	MIL-STD-202G	-40°C~100°C 30 mins, 30 mins	100 cycles	0/50
	High Temperature Storage	JEITA ED-4701 200 201	T <sub>A</sub> =100°C	1000 hrs	0/50
	Humidity Heat Storage	JEITA ED-4701 100 103	T <sub>A</sub> =60°C RH=90%	1000 hrs	0/50
	Low Temperature Storage	JEITA ED-4701 200 202	T <sub>A</sub> =-40°C	1000 hrs	0/50
	Solder ability	JEITA ED-4701 300 303	T <sub>sol</sub> =245(±5)°C, 3sec (using flux)	1 time (over95%)	0/50
	Resistance to Soldering Heat	JEITA ED-4701 300 302	T <sub>sol</sub> =260(±5)°C,10sec (3mm from the base of the epoxy bulb)	1time	0/50
Operation sequence	Life Test	-	T <sub>A</sub> =25°C Oval: I <sub>F</sub> =35mA(G/B), I <sub>F</sub> =50mA(R/A) Round: I <sub>F</sub> =30mA(G/B), I <sub>F</sub> =50mA(R/A)	1000 hrs	0/50
	High Humidity Heat Life Test	-	T <sub>A</sub> =60°C RH=90%, I <sub>F</sub> =20mA	500 hrs	0/50
	Low Temperature Life Test	-	T <sub>A</sub> =-40°C I <sub>F</sub> =20mA	1000hrs	0/50

P2: WHITE

Test Items and Results

Type	Test Item	Reference Standard	Test Condition	Note	Number of Failures
Environmental sequence	Temperature Cycle	JEITA ED-4701 100 105	-40°C~25°C~100°C~25°C 30 mins, 5 mins, 30 mins, 5 mins	100 cycles	0/50
	Thermal Shock	MIL-STD-202G	-40°C~100°C 30 mins, 30 mins	100 cycles	0/50
	High Temperature Storage	JEITA ED-4701 200 201	T <sub>A</sub> =100°C	1000 hrs	0/50
	Humidity Heat Storage	JEITA ED-4701 100 103	T <sub>A</sub> =60°C RH=90%	1000 hrs	0/50
	Low Temperature Storage	JEITA ED-4701 200 202	T <sub>A</sub> =-40°C	1000 hrs	0/50
	Solder ability	JEITA ED-4701 300 303	T <sub>sol</sub> =245(±5)°C, 3sec (using flux)	1time (over95%)	0/50
	Resistance to Soldering Heat	JEITA ED-4701 300 302	T <sub>sol</sub> =260(±5)°C,10sec (3mm from the base of the epoxy bulb)	1time	0/50
Operation sequence	Life Test	-	T <sub>A</sub> =25°C, I <sub>F</sub> =30mA	1000 hrs	0/50
	High Humidity Heat Life Test	-	T <sub>A</sub> =60°C RH=90%, I <sub>F</sub> =20mA	500 hrs	0/50
	Low Temperature Life Test	-	T <sub>A</sub> =-40°C, I <sub>F</sub> =20mA	1000hrs	0/50

P4: COLOR

Test Items and Results

Type	Test Item	Reference Standard	Test Condition	Note	Number of Failures
Environmental sequence	Temperature Cycle	JEITA ED-4701 100 105	-40°C~25°C~100°C~25°C 30 mins, 5 mins, 30 mins, 5 mins	100 cycles	0/50
	Thermal Shock	MIL-STD-202G	-40°C~100°C 30 mins, 30 mins	100 cycles	0/50
	High Temperature Storage	JEITA ED-4701 200 201	T <sub>A</sub> =100°C	1000 hrs	0/50
	Humidity Heat Storage	JEITA ED-4701 100 103	T <sub>A</sub> =60°C RH=90%	1000 hrs	0/50
	Low Temperature Storage	JEITA ED-4701 200 202	T <sub>A</sub> =-40°C	1000 hrs	0/50
	Solder ability	JEITA ED-4701 300 303	T <sub>sol</sub> =245(±5)°C, 3sec (using flux)	1time (over95%)	0/50
	Resistance to Soldering Heat	JEITA ED-4701 300 302	T <sub>sol</sub> =260(±5)°C,10sec (3mm from the base of the epoxy bulb)	1time	0/50
Operation sequence	Life Test	-	T <sub>A</sub> =25°C I <sub>F</sub> =30mA(G/B), I <sub>F</sub> =70mA(R/A)	1000 hrs	0/50
	High Humidity Heat Life Test	-	T <sub>A</sub> =60°C RH=90%, I <sub>F</sub> =20mA	500 hrs	0/50
	Low Temperature Life Test	-	T <sub>A</sub> =-40°C, I <sub>F</sub> =30mA	1000hrs	0/50

Judging Criteria

Item	Symbol	Test Condition	Criteria for Judgment	
			Min.	Max.
Forward Voltage	V <sub>F</sub>	I <sub>F</sub> = 30 mA	-	Initial Data x 1.2
Reverse Current	I <sub>R</sub>	V <sub>R</sub> = 5 V	-	100µA
Luminous Flux/Intensity	Φ <sub>V</sub>	I <sub>F</sub> = 20 mA	Initial Data x 0.7	-

P4: WHITE

Test Items and Results

Type	Test Item	Reference Standard	Test Condition	Note	Number of Failures
Environmental sequence	Temperature Cycle	JEITA ED-4701 100 105	-40°C~25°C~100°C~25°C 30 mins, 5 mins, 30 mins, 5 mins	100 cycles	0/50
	Thermal Shock	MIL-STD-202G	-40°C~100°C 30 mins, 30 mins	100 cycles	0/50
	High Temperature Storage	JEITA ED-4701 200 201	T <sub>A</sub> =100°C	1000 hrs	0/50
	Humidity Heat Storage	JEITA ED-4701 100 103	T <sub>A</sub> =60°C RH=90%	1000 hrs	0/50
	Low Temperature Storage	JEITA ED-4701 200 202	T <sub>A</sub> =-40°C	1000 hrs	0/50
	Solder ability	JEITA ED-4701 300 303	T <sub>sol</sub> =245(±5)°C, 3sec (using flux)	1time (over95%)	0/50
	Resistance to Soldering Heat	JEITA ED-4701 300 302	T <sub>sol</sub> =260(±5)°C,10sec (3mm from the base of the epoxy bulb)	1time	0/50
Operation sequence	Life Test	-	T <sub>A</sub> =25°C, I <sub>F</sub> =35mA	1000 hrs	0/50
	High Humidity Heat Life Test	-	T <sub>A</sub> =60°C RH=90%, I <sub>F</sub> =20mA	500 hrs	0/50
	Low Temperature Life Test	-	T <sub>A</sub> =-40°C, I <sub>F</sub> =30mA	1000hrs	0/50

Judging Criteria

Item	Symbol	Test Condition	Criteria for Judgment	
			Min.	Max.
Forward Voltage	V <sub>F</sub>	I <sub>F</sub> = 30 mA	-	Initial Data x 1.2
Reverse Current	I <sub>R</sub>	V <sub>R</sub> = 5 V	-	100µA
Luminous Flux/Intensity	Φ <sub>V</sub>	I <sub>F</sub> = 20 mA	Initial Data x 0.7	-

SMD: CLV1A-FKB & xLM1x

Test Items and Results

Type	Test Item	Reference Standard	Test Condition	Note	Number of Failures
Environmental sequence	Temperature Cycle	JEITA ED-4701 100 105	-40°C~25°C~100°C~25°C 30 mins, 5 mins, 30 mins, 5 mins	100 cycles	0/50
	Thermal Shock	MIL-STD-202G	-40°C~100°C 30 mins, 30 mins	100 cycles	0/50
	High Temperature Storage	JEITA ED-4701 200 201	T <sub>A</sub> =100°C	500 hrs	0/50
	Humidity Heat Storage	JEITA ED-4701 100 103	T <sub>A</sub> =60°C RH=90%	500 hrs	0/50
	Low Temperature Storage	JEITA ED-4701 200 202	T <sub>A</sub> =-40°C	500 hrs	0/50
Operation sequence	Life Test	-	T <sub>A</sub> =25°C I <sub>F</sub> : R=50mA, G=25mA, B=25mA	1000 hrs	0/50
	High Temperature Life Test	-	T <sub>A</sub> =85°C I <sub>F</sub> (single chip):R=30mA,G=15mA, B=15mA I <sub>F</sub> (RGB): R=15mA, G=15mA, B=15mA	1000 hrs	0/50
	High Humidity Heat Life Test	-	T <sub>A</sub> =60°C, RH=90% I <sub>F</sub> (single chip):R=30mA,G=15mA, B=15mA I <sub>F</sub> (RGB): R=15mA, G=15mA, B=15mA	500 hrs	0/50
	Low Temperature Life Test	-	T <sub>A</sub> =-40°C, I <sub>F</sub> : R=50mA, G=25mA . B=25mA	500hrs	0/50

SMD: xLA1A, xLA1B, xLA2A & SP301

Test Items and Results

Type	Test Item	Reference Standard	Test Condition	Note	Number of Failures
Environmental sequence	Temperature Cycle	JEITA ED-4701 100 105	-40°C~25°C~100°C~25°C 30 mins, 5 mins, 30 mins, 5 mins	100 cycles	0/50
	Thermal Shock	MIL-STD-202G	-40°C~100°C 30 mins, 30 mins	100 cycles	0/50
	High Temperature Storage	JEITA ED-4701 200 201	T <sub>A</sub> =100°C	500 hrs	0/50
	Humidity Heat Storage	JEITA ED-4701 100 103	T <sub>A</sub> =60°C RH=90%	500 hrs	0/50
	Low Temperature Storage	JEITA ED-4701 200 202	T <sub>A</sub> =-40°C	500 hrs	0/50
Operation sequence	Life Test	-	T <sub>A</sub> =25°C I <sub>F</sub> =35mA	1000 hrs	0/50
	High Temperature Life Test	-	T <sub>A</sub> =85°C I <sub>F</sub> =15mA	1000 hrs	0/50
	High Humidity Heat Life Test	-	T <sub>A</sub> =60°C, RH=90% I <sub>F</sub> =15mA	500 hrs	0/50
	Low Temperature Life Test	-	T <sub>A</sub> =-40°C, I <sub>F</sub> =35mA	500hrs	0/50

## SMD: xLM2C-ACA/RCA

## Test Items and Results

Type	Test Item	Reference Standard	Test Condition	Note	Number of Failures
Environmental sequence	Temperature Cycle	JEITA ED-4701 100 105	-40°C~25°C~100°C~25°C 30 mins, 5 mins, 30 mins, 5 mins	100 cycles	0/50
	Thermal Shock	MIL-STD-202G	-40°C~100°C 30 mins, 30 mins	100 cycles	0/50
	High Temperature Storage	JEITA ED-4701 200 201	T <sub>A</sub> =100°C	500 hrs	0/50
	Humidity Heat Storage	JEITA ED-4701 100 103	T <sub>A</sub> =60°C RH=90%	500 hrs	0/50
	Low Temperature Storage	JEITA ED-4701 200 202	T <sub>A</sub> =-40°C	500 hrs	0/50
Operation sequence	Life Test	-	T <sub>A</sub> =25°C I <sub>F</sub> =50mA	1000 hrs	0/50
	High Temperature Life Test	-	T <sub>A</sub> =85°C I <sub>F</sub> =15mA	1000 hrs	0/50
	High Humidity Heat Life Test	-	T <sub>A</sub> =60°C, RH=90% I <sub>F</sub> =15mA	500 hrs	0/50
	Low Temperature Life Test	-	T <sub>A</sub> =-40°C, I <sub>F</sub> =50mA	500hrs	0/50



SMD: xLM2C-GCA/BCA

Test Items and Results

Type	Test Item	Reference Standard	Test Condition	Note	Number of Failures
Environmental sequence	Temperature Cycle	JEITA ED-4701 100 105	-40°C~25°C~100°C~25°C 30 mins, 5 mins, 30 mins, 5 mins	100 cycles	0/50
	Thermal Shock	MIL-STD-202G	-40°C~100°C 30 mins, 30 mins	100 cycles	0/50
	High Temperature Storage	JEITA ED-4701 200 201	T <sub>A</sub> =100°C	500 hrs	0/50
	Humidity Heat Storage	JEITA ED-4701 100 103	T <sub>A</sub> =60°C RH=90%	500 hrs	0/50
	Low Temperature Storage	JEITA ED-4701 200 202	T <sub>A</sub> =-40°C	500 hrs	0/50
Operation sequence	Life Test	-	T <sub>A</sub> =25°C I <sub>F</sub> : G=35mA, B=20mA	1000 hrs	0/50
	High Temperature Life Test	-	T <sub>A</sub> =85°C I <sub>F</sub> : G=10mA, B=10mA	1000 hrs	0/50
	High Humidity Heat Life Test	-	T <sub>A</sub> =60°C, RH=90% I <sub>F</sub> : G=15mA, B=15mA	500 hrs	0/50
	Low Temperature Life Test	-	T <sub>A</sub> =-40°C, I <sub>F</sub> : G=35mA, B=20mA	500hrs	0/50

SMD: xLM2D/T-RPC/RCC/APC/ACC

Test Items and Results

Type	Test Item	Reference Standard	Test Condition	Note	Number of Failures
Environmental sequence	Temperature Cycle	JEITA ED-4701 100 105	-40°C~25°C~100°C~25°C 30 mins, 5 mins, 30 mins, 5 mins	100 cycles	0/50
	Thermal Shock	MIL-STD-202G	-40°C~100°C 30 mins, 30 mins	100 cycles	0/50
	High Temperature Storage	JEITA ED-4701 200 201	T <sub>A</sub> =100°C	500 hrs	0/50
	Humidity Heat Storage	JEITA ED-4701 100 103	T <sub>A</sub> =60°C RH=90%	500 hrs	0/50
	Low Temperature Storage	JEITA ED-4701 200 202	T <sub>A</sub> =-40°C	500 hrs	0/50
Operation sequence	Life Test	-	T <sub>A</sub> =25°C I <sub>F</sub> =50mA	1000 hrs	0/50
	High Temperature Life Test	-	T <sub>A</sub> =85°C I <sub>F</sub> =15mA	1000 hrs	0/50
	High Humidity Heat Life Test	-	T <sub>A</sub> =60°C, RH=90% I <sub>F</sub> =15mA	500 hrs	0/50
	Low Temperature Life Test	-	T <sub>A</sub> =-40°C, I <sub>F</sub> =50mA	500hrs	0/50

SMD: xLM2D/T-GPC/GCC/BPC/BCC/CPC/CCC

Test Items and Results

Type	Test Item	Reference Standard	Test Condition	Note	Number of Failures
Environmental sequence	Temperature Cycle	JEITA ED-4701 100 105	-40°C~25°C~100°C~25°C 30 mins, 5 mins, 30 mins, 5 mins	100 cycles	0/50
	Thermal Shock	MIL-STD-202G	-40°C~100°C 30 mins, 30 mins	100 cycles	0/50
	High Temperature Storage	JEITA ED-4701 200 201	T <sub>A</sub> =100°C	500 hrs	0/50
	Humidity Heat Storage	JEITA ED-4701 100 103	T <sub>A</sub> =60°C RH=90%	500 hrs	0/50
	Low Temperature Storage	JEITA ED-4701 200 202	T <sub>A</sub> =-40°C	500 hrs	0/50
Operation sequence	Life Test	-	T <sub>A</sub> =25°C I <sub>F</sub> : G=35mA, B=20mA, C=35mA	1000 hrs	0/50
	High Temperature Life Test	-	T <sub>A</sub> =85°C I <sub>F</sub> : G=10mA, B=10mA, C=10mA	1000 hrs	0/50
	High Humidity Heat Life Test	-	T <sub>A</sub> =60°C, RH=90% I <sub>F</sub> : G=15mA, B=15mA, C=15mA	500 hrs	0/50
	Low Temperature Life Test	-	T <sub>A</sub> =-40°C, I <sub>F</sub> : G=35mA, B=20mA, C=35mA	500hrs	0/50

SMD: ALL OTHER xLM2x & xLM4x

Test Items and Results

Type	Test Item	Reference Standard	Test Condition	Note	Number of Failures
Environmental sequence	Temperature Cycle	JEITA ED-4701 100 105	-40°C~25°C~100°C~25°C 30 mins, 5 mins, 30 mins, 5 mins	100 cycles	0/50
	Thermal Shock	MIL-STD-202G	-40°C~100°C 30 mins, 30 mins	100 cycles	0/50
	High Temperature Storage	JEITA ED-4701 200 201	T <sub>A</sub> =100°C	500 hrs	0/50
	Humidity Heat Storage	JEITA ED-4701 100 103	T <sub>A</sub> =60°C RH=90%	500 hrs	0/50
	Low Temperature Storage	JEITA ED-4701 200 202	T <sub>A</sub> =-40°C	500 hrs	0/50
Operation sequence	Life Test	-	T <sub>A</sub> =25°C I <sub>F</sub> : R=70mA, G=30mA, B=30mA, A=70mA	1000 hrs	0/50
	High Temperature Life Test	-	T <sub>A</sub> =85°C I <sub>F</sub> : R=50mA, G=15mA, B=15mA, A=50mA	1000 hrs	0/50
	High Humidity Heat Life Test	-	T <sub>A</sub> =60°C, RH=90% I <sub>F</sub> : R=50mA, G=15mA, B=15mA, A=50mA	500 hrs	0/50
	Low Temperature Life Test	-	T <sub>A</sub> =-40°C, I <sub>F</sub> : R=70mA, G=30mA, B=30mA, A=70mA	500hrs	0/50

SMD: xLM3x COLOR

Test Items and Results

Type	Test Item	Reference Standard	Test Condition	Note	Number of Failures
Environmental sequence	Temperature Cycle	JEITA ED-4701 100 105	-40°C~25°C~100°C~25°C 30 mins, 5 mins, 30 mins, 5 mins	100 cycles	0/50
	Thermal Shock	MIL-STD-202G	-40°C~100°C 30 mins, 30 mins	100 cycles	0/50
	High Temperature Storage	JEITA ED-4701 200 201	T <sub>A</sub> =100°C	500 hrs	0/50
	Humidity Heat Storage	JEITA ED-4701 100 103	T <sub>A</sub> =60°C RH=90%	500 hrs	0/50
	Low Temperature Storage	JEITA ED-4701 200 202	T <sub>A</sub> =-40°C	500 hrs	0/50
Operation sequence	Life Test	-	T <sub>A</sub> =25°C I <sub>F</sub> : R=50mA, G=25mA, B=25mA	1000 hrs	0/50
	High Temperature Life Test	-	T <sub>A</sub> =85°C I <sub>F</sub> : R=30mA, G=15mA, B=15mA	1000 hrs	0/50
	High Humidity Heat Life Test	-	T <sub>A</sub> =60°C, RH=90% I <sub>F</sub> : R=30mA, G=15mA, B=15mA	500 hrs	0/50
	Low Temperature Life Test	-	T <sub>A</sub> =-40°C, I <sub>F</sub> : R=50mA, G=25mA, B=25mA	500hrs	0/50

SMD: xLM3x WHITE

Test Items and Results

Type	Test Item	Reference Standard	Test Condition	Note	Number of Failures
Environmental sequence	Temperature Cycle	JEITA ED-4701 100 105	-40°C~25°C~100°C~25°C 30 mins, 5 mins, 30 mins, 5 mins	100 cycles	0/50
	Thermal Shock	MIL-STD-202G	-40°C~100°C 30 mins, 30 mins	100 cycles	0/50
	High Temperature Storage	JEITA ED-4701 200 201	T <sub>A</sub> =100°C	500 hrs	0/50
	Humidity Heat Storage	JEITA ED-4701 100 103	T <sub>A</sub> =60°C RH=90%	500 hrs	0/50
	Low Temperature Storage	JEITA ED-4701 200 202	T <sub>A</sub> =-40°C	500 hrs	0/50
Operation sequence	Life Test	-	T <sub>A</sub> =25°C I <sub>F</sub> =25mA	1000 hrs	0/50
	High Temperature Life Test	-	T <sub>A</sub> =85°C I <sub>F</sub> =15mA	1000 hrs	0/50
	High Humidity Heat Life Test	-	T <sub>A</sub> =60°C, RH=90% I <sub>F</sub> =15mA	500 hrs	0/50
	Low Temperature Life Test	-	T <sub>A</sub> =-40°C, I <sub>F</sub> =25mA	500hrs	0/50

SMD: xLMXB

Test Items and Results

Type	Test Item	Reference Standard	Test Condition	Note	Number of Failures
Environmental sequence	Temperature Cycle	JEITA ED-4701 100 105	-40°C~25°C~100°C~25°C 30 mins, 5 mins, 30 mins, 5 mins	100 cycles	0/50
	Thermal Shock	MIL-STD-202G	-40°C~100°C 30 mins, 30 mins	100 cycles	0/50
	High Temperature Storage	JEITA ED-4701 200 201	T <sub>A</sub> =100°C	500 hrs	0/50
	Humidity Heat Storage	JEITA ED-4701 100 103	T <sub>A</sub> =60°C RH=90%	500 hrs	0/50
	Low Temperature Storage	JEITA ED-4701 200 202	T <sub>A</sub> =-40°C	500 hrs	0/50
	Water Proof Test <sup>#</sup>	IEC 60529:2011	IPX8 Immersing in 1m water	24 hrs	0/50
Operation sequence	Life Test	-	T <sub>A</sub> =25°C I <sub>F</sub> : R=20mA, G=25mA, B=15mA	1000 hrs	0/50
	High Temperature Life Test	-	T <sub>A</sub> =85°C I <sub>F</sub> =10mA	1000 hrs	0/50
	High Humidity Heat Life Test	-	T <sub>A</sub> =60°C, RH=90% I <sub>F</sub> = 10mA	500 hrs	0/50
	Low Temperature Life Test	-	T <sub>A</sub> =-40°C, I <sub>F</sub> : R=20mA, G=25mA, B=15mA	500hrs	0/50

\* The test is conducted on component level. It is strongly recommended customer test the product for their application

SMD: xLVBA-FKA

Test Items and Results

Type	Test Item	Reference Standard	Test Condition	Note	Number of Failures
Environmental sequence	Temperature Cycle	JEITA ED-4701 100 105	-40°C~25°C~100°C~25°C 30 mins, 5 mins, 30 mins, 5 mins	100 cycles	0/50
	Thermal Shock	MIL-STD-202G	-40°C~100°C 30 mins, 30 mins	100 cycles	0/50
	High Temperature Storage	JEITA ED-4701 200 201	T <sub>A</sub> =100°C	500 hrs	0/50
	Humidity Heat Storage	JEITA ED-4701 100 103	T <sub>A</sub> =60°C RH=90%	500 hrs	0/50
	Low Temperature Storage	JEITA ED-4701 200 202	T <sub>A</sub> =-40°C	500 hrs	0/50
Operation sequence	Life Test	-	T <sub>A</sub> =25°C I <sub>F</sub> : R=18mA, G=16mA, B=10mA	1000 hrs	0/50
	High Temperature Life Test	-	T <sub>A</sub> =85°C I <sub>F</sub> : R=12mA, G=10mA, B=6mA	1000 hrs	0/50
	High Humidity Heat Life Test	-	T <sub>A</sub> =60°C, RH=90% I <sub>F</sub> : R=12mA, G=10mA, B=6mA	500 hrs	0/50
	Low Temperature Life Test	-	T <sub>A</sub> =-40°C, I <sub>F</sub> : R=18mA, G=16mA, B=10mA	500hrs	0/50



SMD: xLMVx & xLMUx

Test Items and Results

Type	Test Item	Reference Standard	Test Condition	Note	Number of Failures
Environmental sequence	Temperature Cycle	JEITA ED-4701 100 105	-40°C~25°C~100°C~25°C 30 mins, 5 mins, 30 mins, 5 mins	100 cycles	0/50
	Thermal Shock	MIL-STD-202G	-40°C~100°C 30 mins, 30 mins	100 cycles	0/50
	High Temperature Storage	JEITA ED-4701 200 201	T <sub>A</sub> =100°C	500 hrs	0/50
	Humidity Heat Storage	JEITA ED-4701 100 103	T <sub>A</sub> =60°C RH=90%	500 hrs	0/50
	Low Temperature Storage	JEITA ED-4701 200 202	T <sub>A</sub> =-40°C	500 hrs	0/50
Operation sequence	Life Test	-	T <sub>A</sub> =25°C I <sub>F</sub> : R=12mA, G=6mA, B=3mA	1000 hrs	0/50
	High Temperature Life Test	-	T <sub>A</sub> =85°C I <sub>F</sub> : R=5mA, G=3mA, B=3mA	1000 hrs	0/50
	High Humidity Heat Life Test	-	T <sub>A</sub> =60°C, RH=90% I <sub>F</sub> : R=5mA, G=3mA, B=3mA	500 hrs	0/50
	Low Temperature Life Test	-	T <sub>A</sub> =-40°C, I <sub>F</sub> : R=12mA, G=6mA, B=3mA	500hrs	0/50

SMD: xLX6E

Test Items and Results

Type	Test Item	Reference Standard	Test Condition	Note	Number of Failures
Environmental sequence	Temperature Cycle	JEITA ED-4701 100 105	-40°C~25°C~100°C~25°C 30 mins, 5 mins, 30 mins, 5 mins	100 cycles	0/50
	Thermal Shock	MIL-STD-202G	-40°C~100°C 30 mins, 30 mins	100 cycles	0/50
	High Temperature Storage	JEITA ED-4701 200 201	T <sub>A</sub> =100°C	500 hrs	0/50
	Humidity Heat Storage	JEITA ED-4701 100 103	T <sub>A</sub> =60°C RH=90%	500 hrs	0/50
	Low Temperature Storage	JEITA ED-4701 200 202	T <sub>A</sub> =-40°C	500 hrs	0/50
	Water Proof Test <sup>#</sup>	IEC 60529:2011	IPX8 Immersing in 1m water	24 hrs	0/50
Operation sequence	Life Test	-	T <sub>A</sub> =25°C I <sub>F</sub> : R=30mA, G=30mA, B=20mA	1000 hrs	0/50
	High Temperature Life Test	-	T <sub>A</sub> =85°C I <sub>F</sub> =15mA	1000 hrs	0/50
	High Humidity Heat Life Test	-	T <sub>A</sub> =60°C, RH=90% I <sub>F</sub> =15mA	500 hrs	0/50
	Low Temperature Life Test	-	T <sub>A</sub> =-40°C, I <sub>F</sub> : R=30mA, G=30mA, B=20mA	500hrs	0/50

\* The test is conducted on component level. It is strongly recommended customer test the product for their application

SMD: xLX6F-RKB/AKB

Test Items and Results

Type	Test Item	Reference Standard	Test Condition	Note	Number of Failures
Environmental sequence	Temperature Cycle	JEITA ED-4701 100 105	-40°C~25°C~100°C~25°C 30 mins, 5 mins, 30 mins, 5 mins	100 cycles	0/50
	Thermal Shock	MIL-STD-202G	-40°C~100°C 30 mins, 30 mins	100 cycles	0/50
	High Temperature Storage	JEITA ED-4701 200 201	T <sub>A</sub> =100°C	500 hrs	0/50
	Humidity Heat Storage	JEITA ED-4701 100 103	T <sub>A</sub> =60°C RH=90%	500 hrs	0/50
	Low Temperature Storage	JEITA ED-4701 200 202	T <sub>A</sub> =-40°C	500 hrs	0/50
	Water Proof Test#	IEC 60529:2011	IPX8 Immersing in 1m water	24 hrs	0/50
Operation sequence	Life Test	-	T <sub>A</sub> =25°C I <sub>F</sub> : R1=R2=R3=30mA	1000 hrs	0/50
	High Temperature Life Test	-	T <sub>A</sub> =85°C I <sub>F</sub> : R1=R2=R3=15mA	1000 hrs	0/50
	High Humidity Heat Life Test	-	T <sub>A</sub> =60°C, RH=90% I <sub>F</sub> : R1=R2=R3=15mA	500 hrs	0/50
	Low Temperature Life Test	-	T <sub>A</sub> =-40°C, I <sub>F</sub> : R1=R2=R3=30mA	500hrs	0/50

\* The test is conducted on component level. It is strongly recommended customer test the product for their application

SMD: xLX6F-GKB

Test Items and Results

Type	Test Item	Reference Standard	Test Condition	Note	Number of Failures
Environmental sequence	Temperature Cycle	JEITA ED-4701 100 105	-40°C~25°C~100°C~25°C 30 mins, 5 mins, 30 mins, 5 mins	100 cycles	0/50
	Thermal Shock	MIL-STD-202G	-40°C~100°C 30 mins, 30 mins	100 cycles	0/50
	High Temperature Storage	JEITA ED-4701 200 201	T <sub>A</sub> =100°C	500 hrs	0/50
	Humidity Heat Storage	JEITA ED-4701 100 103	T <sub>A</sub> =60°C RH=90%	500 hrs	0/50
	Low Temperature Storage	JEITA ED-4701 200 202	T <sub>A</sub> =-40°C	500 hrs	0/50
	Water Proof Test#	IEC 60529:2011	IPX8 Immersing in 1m water	24 hrs	0/50
Operation sequence	Life Test	-	T <sub>A</sub> =25°C I <sub>F</sub> : G1=G2=G3=35mA	1000 hrs	0/50
	High Temperature Life Test	-	T <sub>A</sub> =85°C I <sub>F</sub> : G1=G2=G3=15mA	1000 hrs	0/50
	High Humidity Heat Life Test	-	T <sub>A</sub> =60°C, RH=90% I <sub>F</sub> : G1=G2=G3=15mA	500 hrs	0/50
	Low Temperature Life Test	-	T <sub>A</sub> =-40°C, I <sub>F</sub> : G1=G2=G3=35mA	500hrs	0/50

\* The test is conducted on component level. It is strongly recommended customer test the product for their application

SMD: xLX6F-BKB

Test Items and Results

Type	Test Item	Reference Standard	Test Condition	Note	Number of Failures
Environmental sequence	Temperature Cycle	JEITA ED-4701 100 105	-40°C~25°C~100°C~25°C 30 mins, 5 mins, 30 mins, 5 mins	100 cycles	0/50
	Thermal Shock	MIL-STD-202G	-40°C~100°C 30 mins, 30 mins	100 cycles	0/50
	High Temperature Storage	JEITA ED-4701 200 201	T <sub>A</sub> =100°C	500 hrs	0/50
	Humidity Heat Storage	JEITA ED-4701 100 103	T <sub>A</sub> =60°C RH=90%	500 hrs	0/50
	Low Temperature Storage	JEITA ED-4701 200 202	T <sub>A</sub> =-40°C	500 hrs	0/50
	Water Proof Test <sup>#</sup>	IEC 60529:2011	IPX8 Immersing in 1m water	24 hrs	0/50
Operation sequence	Life Test	-	T <sub>A</sub> =25°C I <sub>F</sub> : B1=B2=B3=20mA	1000 hrs	0/50
	High Temperature Life Test	-	T <sub>A</sub> =85°C I <sub>F</sub> : B1=B2=B3=15mA	1000 hrs	0/50
	High Humidity Heat Life Test	-	T <sub>A</sub> =60°C, RH=90% I <sub>F</sub> : B1=B2=B3=15mA	500 hrs	0/50
	Low Temperature Life Test	-	T <sub>A</sub> =-40°C, I <sub>F</sub> : B1=B2=B3=20mA	500hrs	0/50

\* The test is conducted on component level. It is strongly recommended customer test the product for their application

SMD: xLX6F-PKW

Test Items and Results

Type	Test Item	Reference Standard	Test Condition	Note	Number of Failures
Environmental sequence	Temperature Cycle	JEITA ED-4701 100 105	-40°C~25°C~100°C~25°C 30 mins, 5 mins, 30 mins, 5 mins	100 cycles	0/50
	Thermal Shock	MIL-STD-202G	-40°C~100°C 30 mins, 30 mins	100 cycles	0/50
	High Temperature Storage	JEITA ED-4701 200 201	T <sub>A</sub> =100°C	500 hrs	0/50
	Humidity Heat Storage	JEITA ED-4701 100 103	T <sub>A</sub> =60°C RH=90%	500 hrs	0/50
	Low Temperature Storage	JEITA ED-4701 200 202	T <sub>A</sub> =-40°C	500 hrs	0/50
Operation sequence	Life Test	-	T <sub>A</sub> =25°C I <sub>F</sub> : B1=B2=B3=30mA	1000 hrs	0/50
	High Temperature Life Test	-	T <sub>A</sub> =85°C I <sub>F</sub> : B1=B2=B3=15mA	1000 hrs	0/50
	High Humidity Heat Life Test	-	T <sub>A</sub> =60°C, RH=90% I <sub>F</sub> : B1=B2=B3=15mA	500 hrs	0/50
	Low Temperature Life Test	-	T <sub>A</sub> =-40°C I <sub>F</sub> : B1=B2=B3=30mA	500hrs	0/50

SMD: ALL OTHER xLX6x

Test Items and Results

Type	Test Item	Reference Standard	Test Condition	Note	Number of Failures
Environmental sequence	Temperature Cycle	JEITA ED-4701 100 105	-40°C~25°C~100°C~25°C 30 mins, 5 mins, 30 mins, 5 mins	100 cycles	0/50
	Thermal Shock	MIL-STD-202G	-40°C~100°C 30 mins, 30 mins	100 cycles	0/50
	High Temperature Storage	JEITA ED-4701 200 201	T <sub>A</sub> =100°C	500 hrs	0/50
	Humidity Heat Storage	JEITA ED-4701 100 103	T <sub>A</sub> =60°C RH=90%	500 hrs	0/50
	Low Temperature Storage	JEITA ED-4701 200 202	T <sub>A</sub> =-40°C	500 hrs	0/50
	Water Proof Test#	IEC 60529:2011	IPX8 Immersing in 1m water	24 hrs	0/50
Operation sequence	Life Test	-	T <sub>A</sub> =25°C I <sub>F</sub> : R=30mA, G=35mA, B=20mA	1000 hrs	0/50
	High Temperature Life Test	-	T <sub>A</sub> =85°C I <sub>F</sub> =15mA	1000 hrs	0/50
	High Humidity Heat Life Test	-	T <sub>A</sub> =60°C, RH=90% I <sub>F</sub> =15mA	500 hrs	0/50
	Low Temperature Life Test	-	T <sub>A</sub> =-40°C, I <sub>F</sub> : R=30mA, G=35mA, B=20mA	500hrs	0/50

\* The test is conducted on component level. It is strongly recommended customer test the product for their application

SMD: xLV1S & xLV1L WHITE

Test Items and Results

Type	Test Item	Reference Standard	Test Condition	Note	Number of Failures
Environmental sequence	Temperature Cycle	JEITA ED-4701 100 105	-40°C~25°C~100°C~25°C 30 mins, 5 mins, 30 mins, 5 mins	100 cycles	0/50
	Thermal Shock	MIL-STD-202G	-40°C~100°C 30 mins, 30 mins	100 cycles	0/50
	High Temperature Storage	JEITA ED-4701 200 201	T <sub>A</sub> =100°C	500 hrs	0/50
	Humidity Heat Storage	JEITA ED-4701 100 103	T <sub>A</sub> =60°C RH=90%	500 hrs	0/50
	Low Temperature Storage	JEITA ED-4701 200 202	T <sub>A</sub> =-40°C	500 hrs	0/50
Operation sequence	Life Test	-	T <sub>A</sub> =25°C I <sub>F</sub> : R=25mA, G=20mA, B=20mA	1000 hrs	0/50
	High Temperature Life Test	-	T <sub>A</sub> =85°C I <sub>F</sub> : R=10mA, G=8mA, B=8mA	1000 hrs	0/50
	High Humidity Heat Life Test	-	T <sub>A</sub> =60°C, RH=90% I <sub>F</sub> : R=10mA, G=8mA, B=8mA	500 hrs	0/50
	Low Temperature Life Test	-	T <sub>A</sub> =-40°C, I <sub>F</sub> : R=25mA, G=20mA, B=20mA	500hrs	0/50



SMD: xLY6x

Test Items and Results

Type	Test Item	Reference Standard	Test Condition	Note	Number of Failures
Environmental sequence	Temperature Cycle	JEITA ED-4701 100 105	-40°C~25°C~100°C~25°C 30 mins, 5 mins, 30 mins, 5 mins	100 cycles	0/50
	Thermal Shock	MIL-STD-202G	-40°C~100°C 30 mins, 30 mins	100 cycles	0/50
	High Temperature Storage	JEITA ED-4701 200 201	T <sub>A</sub> =100°C	500 hrs	0/50
	Humidity Heat Storage	JEITA ED-4701 100 103	T <sub>A</sub> =60°C RH=90%	500 hrs	0/50
	Low Temperature Storage	JEITA ED-4701 200 202	T <sub>A</sub> =-40°C	500 hrs	0/50
	Water Proof Test#	IEC 60529:2011	IPX8 Immersing in 1m water	24 hrs	0/50
Operation sequence	Life Test	-	T <sub>A</sub> =25°C I <sub>F</sub> : R=30mA G=35mA B=20mA	1000 hrs	0/50
	High Temperature Life Test	-	T <sub>A</sub> =85°C I <sub>F</sub> : R=15mA G=15mA B=10mA	1000 hrs	0/50
	High Humidity Heat Life Test	-	T <sub>A</sub> =60°C, RH=90% I <sub>F</sub> =15mA	500 hrs	0/50
	Low Temperature Life Test	-	T <sub>A</sub> =-40°C, I <sub>F</sub> : R=30mA G=35mA B=20mA	500hrs	0/50

\* The test is conducted on component level. It is strongly recommended customer test the product for their application

SMD: xLS6x

Test Items and Results

Type	Test Item	Reference Standard	Test Condition	Note	Number of Failures
Environmental sequence	Temperature Cycle	JEITA ED-4701 100 105	-40°C~25°C~100°C~25°C 30 mins, 5 mins, 30 mins, 5 mins	100 cycles	0/50
	Thermal Shock	MIL-STD-202G	-40°C~100°C 30 mins, 30 mins	100 cycles	0/50
	High Temperature Storage	JEITA ED-4701 200 201	T <sub>A</sub> =100°C	500 hrs	0/50
	Humidity Heat Storage	JEITA ED-4701 100 103	T <sub>A</sub> =60°C RH=90%	500 hrs	0/50
	Low Temperature Storage	JEITA ED-4701 200 202	T <sub>A</sub> =-40°C	500 hrs	0/50
	Water Proof Test#	IEC 60529:2011	IPX8 Immersing in 1m water	24 hrs	0/50
Operation sequence	Life Test	-	T <sub>A</sub> =25°C I <sub>F</sub> : R=14mA G=12mA B=16mA	1000 hrs	0/50
	High Temperature Life Test	-	T <sub>A</sub> =85°C I <sub>F</sub> : R=7mA G=7mA B=5mA	1000 hrs	0/50
	High Humidity Heat Life Test	-	T <sub>A</sub> =60°C, RH=90% I <sub>F</sub> : R=7mA G=7mA B=5mA	500 hrs	0/50
	Low Temperature Life Test	-	T <sub>A</sub> =-40°C, I <sub>F</sub> : R=14mA G=12mA B=16mA	500hrs	0/50

\* The test is conducted on component level. It is strongly recommended customer test the product for their application

SMD: xLQ6x-TKW (RGBW)

Test Items and Results

Type	Test Item	Reference Standard	Test Condition	Note	Number of Failures
Environmental sequence	Temperature Cycle	JEITA ED-4701 100 105	-40°C~25°C~100°C~25°C 30 mins, 5 mins, 30 mins, 5 mins	100 cycles	0/50
	Thermal Shock	MIL-STD-202G	-40°C~100°C 30 mins, 30 mins	100 cycles	0/50
	High Temperature Storage	JEITA ED-4701 200 201	T <sub>A</sub> =100°C	500 hrs	0/50
	Humidity Heat Storage	JEITA ED-4701 100 103	T <sub>A</sub> =60°C RH=90%	500 hrs	0/50
	Low Temperature Storage	JEITA ED-4701 200 202	T <sub>A</sub> =-40°C	500 hrs	0/50
Operation sequence	Life Test	-	T <sub>A</sub> =25°C I <sub>F</sub> : R=G=B=W=150mA	1000 hrs	0/30
	High Temperature Life Test	-	T <sub>A</sub> =85°C I <sub>F</sub> : R=G=B=W=80mA	1000 hrs	0/30
	High Humidity Heat Life Test	-	T <sub>A</sub> =60°C, RH=90% I <sub>F</sub> : R=G=B=W=80mA	500 hrs	0/30
	Low Temperature Life Test	-	T <sub>A</sub> =-40°C I <sub>F</sub> : R=G=B=W=150mA	500hrs	0/30

SMD: xLQ6x-YKW (RGBA)

Test Items and Results

Type	Test Item	Reference Standard	Test Condition	Note	Number of Failures
Environmental sequence	Temperature Cycle	JEITA ED-4701 100 105	-40°C~25°C~100°C~25°C 30 mins, 5 mins, 30 mins, 5 mins	100 cycles	0/50
	Thermal Shock	MIL-STD-202G	-40°C~100°C 30 mins, 30 mins	100 cycles	0/50
	High Temperature Storage	JEITA ED-4701 200 201	T <sub>A</sub> =100°C	500 hrs	0/50
	Humidity Heat Storage	JEITA ED-4701 100 103	T <sub>A</sub> =60°C RH=90%	500 hrs	0/50
	Low Temperature Storage	JEITA ED-4701 200 202	T <sub>A</sub> =-40°C	500 hrs	0/50
Operation sequence	Life Test	-	T <sub>A</sub> =25°C I <sub>F</sub> : R=G=B=A=150mA	1000 hrs	0/30
	High Temperature Life Test	-	T <sub>A</sub> =85°C I <sub>F</sub> : R=G=B=A=80mA	1000 hrs	0/30
	High Humidity Heat Life Test	-	T <sub>A</sub> =60°C, RH=90% I <sub>F</sub> : R=G=B=A=80mA	500 hrs	0/30
	Low Temperature Life Test	-	T <sub>A</sub> =-40°C I <sub>F</sub> : R=G=B=A=150mA	500hrs	0/30

SMD: xLR6x

Test Items and Results

Type	Test Item	Reference Standard	Test Condition	Note	Number of Failures
Environmental sequence	Temperature Cycle	JEITA ED-4701 100 105	-40°C~25°C~100°C~25°C 30 mins, 5 mins, 30 mins, 5 mins	100 cycles	0/50
	Thermal Shock	MIL-STD-202G	-40°C~100°C 30 mins, 30 mins	100 cycles	0/50
	High Temperature Storage	JEITA ED-4701 200 201	T <sub>A</sub> =100°C	500 hrs	0/50
	Humidity Heat Storage	JEITA ED-4701 100 103	T <sub>A</sub> =60°C RH=90%	500 hrs	0/50
	Low Temperature Storage	JEITA ED-4701 200 202	T <sub>A</sub> =-40°C	500 hrs	0/50
Operation sequence	Life Test	-	T <sub>A</sub> =25°C I <sub>F</sub> : R=G=B=W=50mA	1000 hrs	0/30
	High Temperature Life Test	-	T <sub>A</sub> =85°C I <sub>F</sub> : R=G=B=W=50mA	1000 hrs	0/30
	High Humidity Heat Life Test	-	T <sub>A</sub> =60°C, RH=90% I <sub>F</sub> : R=G=B=W=50mA	500 hrs	0/30
	Low Temperature Life Test	-	T <sub>A</sub> =-40°C I <sub>F</sub> : R=G=B=W=50mA	500hrs	0/30

SMD: UHD1110

Test Items and Results

Type	Test Item	Reference Standard	Test Condition	Note	Number of Failures
Environmental sequence	Temperature Cycle	JEITA ED-4701 100 105	-40°C~25°C~100°C~25°C 30 mins, 5 mins, 30 mins, 5 mins	100 cycles	0/50
	Thermal Shock	MIL-STD-202G	-40°C~100°C 30 mins, 30 mins	100 cycles	0/50
	High Temperature Storage	JEITA ED-4701 200 201	T <sub>A</sub> =100°C	500 hrs	0/50
	Humidity Heat Storage	JEITA ED-4701 100 103	T <sub>A</sub> =60°C RH=90%	500 hrs	0/50
	Low Temperature Storage	JEITA ED-4701 200 202	T <sub>A</sub> =-40°C	500 hrs	0/50
Operation sequence	Life Test	-	T <sub>A</sub> =25°C I <sub>F</sub> : R=G=B=10mA	1000 hrs	0/50
	High Temperature Life Test	-	T <sub>A</sub> =85°C I <sub>F</sub> : R=G=B=3mA	1000 hrs	0/50
	High Humidity Heat Life Test	-	T <sub>A</sub> =60°C, RH=90% I <sub>F</sub> : R=G=B=3mA	500 hrs	0/50
	Low Temperature Life Test	-	T <sub>A</sub> =-40°C I <sub>F</sub> : R=G=B=10mA	500hrs	0/50

Judging Criteria

Item	Symbol	Test Condition	Criteria for Judgment	
			Min.	Max.
Forward Voltage	V <sub>F</sub>	I <sub>F</sub> = 5 mA	-	Initial Data x 1.1
Reverse Current	I <sub>R</sub>	V <sub>R</sub> = 5 V	-	10μA
Luminous Flux/Intensity	Φ <sub>V</sub>	I <sub>F</sub> = 5 mA	Initial Data x 0.7	-

SMD: CV94D

Test Items and Results

Type	Test Item	Reference Standard	Test Condition	Note	Number of Failures
Environmental sequence	Temperature Cycle	JEITA ED-4701 100 105	-40°C~25°C~100°C~25°C 30 mins, 5 mins, 30 mins, 5 mins	100 cycles	0/50
	Thermal Shock	MIL-STD-202G	-40°C~100°C 30 mins, 30 mins	100 cycles	0/50
	High Temperature Storage	JEITA ED-4701 200 201	T <sub>A</sub> =100°C	500 hrs	0/50
	Humidity Heat Storage	JEITA ED-4701 100 103	T <sub>A</sub> =60°C RH=90%	500 hrs	0/50
	Low Temperature Storage	JEITA ED-4701 200 202	T <sub>A</sub> =-40°C	500 hrs	0/50
Operation sequence	Life Test	-	T <sub>A</sub> =25°C I <sub>F</sub> : R=50mA,G=35mA,B=20mA	1000 hrs	0/50
	High Temperature Life Test	-	T <sub>A</sub> =85°C I <sub>F</sub> : R=G=B=15mA	1000 hrs	0/50
	High Humidity Heat Life Test	-	T <sub>A</sub> =60°C, RH=90% I <sub>F</sub> : R=G=B=20mA	500 hrs	0/50
	Low Temperature Life Test	-	T <sub>A</sub> =-40°C I <sub>F</sub> : R=G=B=20mA	500hrs	0/50