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 mA	–	Initial Data x 1.1
Reverse Current	I_R	V_R = 5 V	-	P2/P4: 100 µA SMD: 10 µA
Luminous Flux/ Intensity	Φ_V	I_F = 20 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_A=100°C	1000 hrs	0/50
	Humidity Heat Storage	JEITA ED-4701 100 103	T_A=60°C RH=90%	1000 hrs	0/50
	Low Temperature Storage	JEITA ED-4701 200 202	T_A=-40°C	1000 hrs	0/50
	Solder ability	JEITA ED-4701 300 303	Tsol=245(±5)°C, 3sec (using flux)	1 time (over95%)	0/50
	Resistance to Soldering Heat	JEITA ED-4701 300 302	Tsol=260(±5)°C,10sec (3mm from the base of the epoxy bulb)	1time	0/50
Operation sequence	Life Test	-	T_A=25°C Oval: I_F=35mA(G/B), I_F=35mA(A), I_F=50mA(R) Round: I_F=25mA(G/B),I_F=50mA(R/A)	1000 hrs	0/50
	High Humidity Heat Life Test	-	T_A=60°C RH=90%, I_F=20mA	500 hrs	0/50
	Low Temperature Life Test	-	T_A=-40°C Oval: I_F=35mA(G/B), I_F=35mA(A), I_F=50mA(R) Round: I_F=25mA(G/B),I_F=50mA(R/A)	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_A=100°C	1000 hrs	0/50
	Humidity Heat Storage	JEITA ED-4701 100 103	T_A=60°C RH=90%	1000 hrs	0/50
	Low Temperature Storage	JEITA ED-4701 200 202	T_A=-40°C	1000 hrs	0/50
	Solder ability	JEITA ED-4701 300 303	Tsol=245(±5)°C, 3sec (using flux)	1time (over95%)	0/50
	Resistance to Soldering Heat	JEITA ED-4701 300 302	Tsol=260(±5)°C,10sec (3mm from the base of the epoxy bulb)	1time	0/50
Operation sequence	Life Test	-	T_A=25°C, I_F=30mA	1000 hrs	0/50
	High Humidity Heat Life Test	-	T_A=60°C RH=90%, I_F=20mA	500 hrs	0/50
	Low Temperature Life Test	-	T_A=-40°C, I_F=30mA	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_A=100°C	1000 hrs	0/50
	Humidity Heat Storage	JEITA ED-4701 100 103	T_A=60°C RH=90%	1000 hrs	0/50
	Low Temperature Storage	JEITA ED-4701 200 202	T_A=-40°C	1000 hrs	0/50
	Solder ability	JEITA ED-4701 300 303	Tsol=245(±5)°C, 3sec (using flux)	1time (over95%)	0/50
	Resistance to Soldering Heat	JEITA ED-4701 300 302	Tsol=260(±5)°C,10sec (3mm from the base of the epoxy bulb)	1time	0/50
Operation sequence	Life Test	-	T_A=25°C I_F=30mA(G/B), I_F=70mA(R/A)	1000 hrs	0/50
	High Humidity Heat Life Test	-	T_A=60°C RH=90%, I_F=20mA	500 hrs	0/50
	Low Temperature Life Test	-	T_A=-40°C, I_F=30mA	1000hrs	0/50

Judging Criteria

Item	Symbol	Test Condition	Criteria for Judgment	
			Min.	Max.
Forward Voltage	V_F	I_F = 30 mA	–	Initial Data x 1.2
Reverse Current	I_R	V_R = 5 V	-	100μA
Luminous Flux/Intensity	Φ_V	I_F = 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_A=100°C	1000 hrs	0/50
	Humidity Heat Storage	JEITA ED-4701 100 103	T_A=60°C RH=90%	1000 hrs	0/50
	Low Temperature Storage	JEITA ED-4701 200 202	T_A=-40°C	1000 hrs	0/50
	Solder ability	JEITA ED-4701 300 303	Tsol=245(±5)°C, 3sec (using flux)	1time (over95%)	0/50
	Resistance to Soldering Heat	JEITA ED-4701 300 302	Tsol=260(±5)°C,10sec (3mm from the base of the epoxy bulb)	1time	0/50
Operation sequence	Life Test	-	T_A=25°C, I_F=35mA	1000 hrs	0/50
	High Humidity Heat Life Test	-	T_A=60°C RH=90%, I_F=20mA	500 hrs	0/50
	Low Temperature Life Test	-	T_A=-40°C, I_F=35mA	1000hrs	0/50

Judging Criteria

Item	Symbol	Test Condition	Criteria for Judgment	
			Min.	Max.
Forward Voltage	V_F	I_F = 30 mA	–	Initial Data x 1.2
Reverse Current	I_R	V_R = 5 V	-	100μA
Luminous Flux/Intensity	Φ_V	I_F = 20 mA	Initial Data x 0.7	-

SMD: CLV1A-FKB

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_A=100°C	500 hrs	0/50
	Humidity Heat Storage	JEITA ED-4701 100 103	T_A=60°C RH=90%	500 hrs	0/50
	Low Temperature Storage	JEITA ED-4701 200 202	T_A=-40°C	500 hrs	0/50
Operation sequence	Life Test	-	T_A=25°C I_F: R=50mA, G=25mA, B=25mA	1000 hrs	0/50
	High Temperature Life Test	-	T_A=85°C I_F: R=15mA, G=15mA, B=15mA	1000 hrs	0/50
	High Humidity Heat Life Test	-	T_A=60°C, RH=90% I_F: R=15mA, G=15mA, B=15mA	500 hrs	0/50
	Low Temperature Life Test	-	T_A=-40°C, I_F: R=50mA, G=25mA . B=25mA	500hrs	0/50

SMD: CLV1L-FKB

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_A=100°C	500 hrs	0/50
	Humidity Heat Storage	JEITA ED-4701 100 103	T_A=60°C RH=90%	500 hrs	0/50
	Low Temperature Storage	JEITA ED-4701 200 202	T_A=-40°C	500 hrs	0/50
Operation sequence	Life Test	-	T_A=25°C I_F: R=25mA, G=20mA, B=20mA	1000 hrs	0/50
	High Temperature Life Test	-	T_A=85°C I_F: R=10mA, G=8mA, B=8mA	1000 hrs	0/50
	High Humidity Heat Life Test	-	T_A=60°C, RH=90% I_F: R=10mA, G=8mA, B=8mA	500 hrs	0/50
	Low Temperature Life Test	-	T_A=-40°C, I_F: R=25mA, G=20mA . B=20mA	500hrs	0/50

SMD: *LM1*

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_A=100°C	500 hrs	0/50
	Humidity Heat Storage	JEITA ED-4701 100 103	T_A=60°C RH=90%	500 hrs	0/50
	Low Temperature Storage	JEITA ED-4701 200 202	T_A=-40°C	500 hrs	0/50
Operation sequence	Life Test	-	T_A=25°C I_F=25mA	1000 hrs	0/50
	High Temperature Life Test	-	T_A=85°C I_F=15mA	1000 hrs	0/50
	High Humidity Heat Life Test	-	T_A=60°C, RH=90% I_F=15mA	500 hrs	0/50
	Low Temperature Life Test	-	T_A=-40°C, I_F=25mA	500hrs	0/50

SMD: *LA1A, *LA1B, *LA2A & 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_A=100°C	500 hrs	0/50
	Humidity Heat Storage	JEITA ED-4701 100 103	T_A=60°C RH=90%	500 hrs	0/50
	Low Temperature Storage	JEITA ED-4701 200 202	T_A=-40°C	500 hrs	0/50
Operation sequence	Life Test	-	T_A=25°C I_F=35mA	1000 hrs	0/50
	High Temperature Life Test	-	T_A=85°C I_F=15mA	1000 hrs	0/50
	High Humidity Heat Life Test	-	T_A=60°C, RH=90% I_F=15mA	500 hrs	0/50
	Low Temperature Life Test	-	T_A=-40°C, I_F=35mA	500hrs	0/50

SMD: *LM2C

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_A=100°C	500 hrs	0/50
	Humidity Heat Storage	JEITA ED-4701 100 103	T_A=60°C RH=90%	500 hrs	0/50
	Low Temperature Storage	JEITA ED-4701 200 202	T_A=-40°C	500 hrs	0/50
Operation sequence	Life Test	-	T_A=25°C I_F: R=50mA, A=50mA, G=35mA, B=20mA	1000 hrs	0/50
	High Temperature Life Test	-	T_A=85°C I_F: R=15mA, A=15mA, G=15mA, B=10mA	1000 hrs	0/50
	High Humidity Heat Life Test	-	T_A=60°C, RH=90% I_F: R=15mA, A=15mA, G=15mA, B=15mA	500 hrs	0/50
	Low Temperature Life Test	-	T_A=-40°C, I_F: R=50mA, A=50mA, G=35mA, B=20mA	500hrs	0/50

SMD: *LM2D & CLM2B-ATW/CLM2B-RTW

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_A=100°C	500 hrs	0/50
	Humidity Heat Storage	JEITA ED-4701 100 103	T_A=60°C RH=90%	500 hrs	0/50
	Low Temperature Storage	JEITA ED-4701 200 202	T_A=-40°C	500 hrs	0/50
Operation sequence	Life Test	-	T_A=25°C I_F: R=50mA, A=50mA, G=35mA, C=35mA, B=20mA	1000 hrs	0/50
	High Temperature Life Test	-	T_A=85°C I_F: R=15mA, A=15mA, G=15mA, C=15mA, B=10mA	1000 hrs	0/50
	High Humidity Heat Life Test	-	T_A=60°C, RH=90% I_F: R=15mA, A=15mA, G=15mA, C=15mA, B=15mA	500 hrs	0/50
	Low Temperature Life Test	-	T_A=-40°C, I_F: R=50mA, A=50mA, G=35mA, C=35mA, B=20mA	500hrs	0/50

SMD: CLM2B-REW/CLM2B-AEW

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_A=100°C	500 hrs	0/50
	Humidity Heat Storage	JEITA ED-4701 100 103	T_A=60°C RH=90%	500 hrs	0/50
	Low Temperature Storage	JEITA ED-4701 200 202	T_A=-40°C	500 hrs	0/50
Operation sequence	Life Test	-	T_A=25°C I_F: R=20mA, A=20mA	1000 hrs	0/50
	High Temperature Life Test	-	T_A=85°C I_F: R=20mA, A=20mA	1000 hrs	0/50
	High Humidity Heat Life Test	-	T_A=60°C, RH=90% I_F: R=20mA, A=20mA	500 hrs	0/50
	Low Temperature Life Test	-	T_A=-40°C, I_F: R=20mA, A=20mA	500hrs	0/50

SMD: *LM4x

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_A=100°C	500 hrs	0/50
	Humidity Heat Storage	JEITA ED-4701 100 103	T_A=60°C RH=90%	500 hrs	0/50
	Low Temperature Storage	JEITA ED-4701 200 202	T_A=-40°C	500 hrs	0/50
Operation sequence	Life Test	-	T_A=25°C I_F: R=70mA, A=70mA, G=30mA, B=30mA	1000 hrs	0/50
	High Temperature Life Test	-	T_A=85°C I_F: R=50mA, A=50mA, G=15mA, B=15mA	1000 hrs	0/50
	High Humidity Heat Life Test	-	T_A=60°C, RH=90% I_F: R=50mA, A=50mA, G=15mA, B=15mA	500 hrs	0/50
	Low Temperature Life Test	-	T_A=-40°C, I_F: R=70mA, A=70mA, G=30mA, B=30mA	500hrs	0/50

SMD: *LM3x

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_A=100°C	500 hrs	0/50
	Humidity Heat Storage	JEITA ED-4701 100 103	T_A=60°C RH=90%	500 hrs	0/50
	Low Temperature Storage	JEITA ED-4701 200 202	T_A=-40°C	500 hrs	0/50
Operation sequence	Life Test	-	T_A=25°C I_F: R=50mA, A=20mA, G=25mA, B=25mA, W=25mA	1000 hrs	0/50
	High Temperature Life Test	-	T_A=85°C I_F: R=30mA, A=20mA, G=15mA, B=15mA, W=15mA	1000 hrs	0/50
	High Humidity Heat Life Test	-	T_A=60°C, RH=90% I_F: R=30mA, A=20mA, G=15mA, B=15mA, W=15mA	500 hrs	0/50
	Low Temperature Life Test	-	T_A=-40°C, I_F: R=50mA, A=20mA, G=25mA, B=25mA, W=25mA	500hrs	0/50

SMD: *LMX*

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_A=100°C	500 hrs	0/50
	Humidity Heat Storage	JEITA ED-4701 100 103	T_A=60°C RH=90%	500 hrs	0/50
	Low Temperature Storage	JEITA ED-4701 200 202	T_A=-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_A=25°C I_F: R=20mA, G=25mA, B=15mA	1000 hrs	0/50
	High Temperature Life Test	-	T_A=85°C I_F: R=10mA, G=10mA, B=10mA	1000 hrs	0/50
	High Humidity Heat Life Test	-	T_A=60°C, RH=90% I_F: R=10mA, G=10mA, B=10mA	500 hrs	0/50
	Low Temperature Life Test	-	T_A=-40°C, I_F: 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: *LVB*

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_A=100°C	500 hrs	0/50
	Humidity Heat Storage	JEITA ED-4701 100 103	T_A=60°C RH=90%	500 hrs	0/50
	Low Temperature Storage	JEITA ED-4701 200 202	T_A=-40°C	500 hrs	0/50
Operation sequence	Life Test	-	T_A=25°C I_F: R=18mA, G=16mA, B=10mA	1000 hrs	0/50
	High Temperature Life Test	-	T_A=85°C I_F: R=12mA, G=10mA, B=6mA	1000 hrs	0/50
	High Humidity Heat Life Test	-	T_A=60°C, RH=90% I_F: R=12mA, G=10mA, B=6mA	500 hrs	0/50
	Low Temperature Life Test	-	T_A=-40°C, I_F: R=18mA, G=16mA, B=10mA	500hrs	0/50

SMD: *LMV* & *LMU*

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_A=100°C	500 hrs	0/50
	Humidity Heat Storage	JEITA ED-4701 100 103	T_A=60°C RH=90%	500 hrs	0/50
	Low Temperature Storage	JEITA ED-4701 200 202	T_A=-40°C	500 hrs	0/50
Operation sequence	Life Test	-	T_A=25°C I_F: R=12mA, G=6mA, B=3mA	1000 hrs	0/50
	High Temperature Life Test	-	T_A=85°C I_F: R=5mA, G=3mA, B=3mA	1000 hrs	0/50
	High Humidity Heat Life Test	-	T_A=60°C, RH=90% I_F: R=5mA, G=3mA, B=3mA	500 hrs	0/50
	Low Temperature Life Test	-	T_A=-40°C, I_F: R=12mA, G=6mA, B=3mA	500hrs	0/50

Judging Criteria

Item	Symbol	Test Condition	Criteria for Judgment	
			Min.	Max.
Forward Voltage	V_F	I_F = 5 mA	–	Initial Data x 1.1
Reverse Current	I_R	V_R = 5 V	-	10μA
Luminous Flux/Intensity	Φ_V	I_F = 5 mA	Initial Data x 0.7	-

SMD: *LX6E & *LY6C

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_A=100°C	500 hrs	0/50
	Humidity Heat Storage	JEITA ED-4701 100 103	T_A=60°C RH=90%	500 hrs	0/50
	Low Temperature Storage	JEITA ED-4701 200 202	T_A=-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_A=25°C I_F: R=30mA, G=25mA, B=20mA	1000 hrs	0/50
	High Temperature Life Test	-	T_A=85°C I_F: R=15mA, G=15mA, B=10mA	1000 hrs	0/50
	High Humidity Heat Life Test	-	T_A=60°C, RH=90% I_F: R=15mA, G=15mA, B=15mA	500 hrs	0/50
	Low Temperature Life Test	-	T_A=-40°C, I_F: R=30mA, G=25mA, B=20mA	500hrs	0/50

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

SMD: *LX6F single 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_A=100°C	500 hrs	0/50
	Humidity Heat Storage	JEITA ED-4701 100 103	T_A=60°C RH=90%	500 hrs	0/50
	Low Temperature Storage	JEITA ED-4701 200 202	T_A=-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_A=25°C I_F: R1=R2=R3=30mA I_F: A1=A2=A3=30mA I_F: G1=G2=G3=20mA I_F: B1=B2=B3=20mA I_F: P1=P2=P3=30mA I_F: W1=W2=W3=35mA	1000 hrs	0/50
	High Temperature Life Test	-	T_A=85°C I_F: R1=R2=R3=15mA I_F: A1=A2=A3=15mA I_F: G1=G2=G3=15mA I_F: B1=B2=B3=15mA I_F: P1=P2=P3=15mA I_F: W1=W2=W3=15mA	1000 hrs	0/50
	High Humidity Heat Life Test	-	T_A=60°C, RH=90% I_F: R1=R2=R3=15mA I_F: A1=A2=A3=15mA I_F: G1=G2=G3=15mA I_F: B1=B2=B3=15mA I_F: P1=P2=P3=15mA I_F: W1=W2=W3=15mA	500 hrs	0/50
	Low Temperature Life Test	-	T_A=-40°C, I_F: R1=R2=R3=30mA I_F: A1=A2=A3=30mA I_F: G1=G2=G3=20mA I_F: B1=B2=B3=20mA I_F: P1=P2=P3=30mA I_F: W1=W2=W3=35mA	500hrs	0/50

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

SMD: *LY6D & *LY6G & *LX6F

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_A=100°C	500 hrs	0/50
	Humidity Heat Storage	JEITA ED-4701 100 103	T_A=60°C RH=90%	500 hrs	0/50
	Low Temperature Storage	JEITA ED-4701 200 202	T_A=-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_A=25°C I_F: R=30mA G=35mA B=20mA	1000 hrs	0/50
	High Temperature Life Test	-	T_A=85°C I_F: R=15mA G=15mA B=10mA	1000 hrs	0/50
	High Humidity Heat Life Test	-	T_A=60°C, RH=90% I_F: R=15mA G=15mA B=15mA	500 hrs	0/50
	Low Temperature Life Test	-	T_A=-40°C, I_F: 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: *LS6*

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_A=100°C	500 hrs	0/50
	Humidity Heat Storage	JEITA ED-4701 100 103	T_A=60°C RH=90%	500 hrs	0/50
	Low Temperature Storage	JEITA ED-4701 200 202	T_A=-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_A=25°C I_F: R=14mA G=12mA B=16mA	1000 hrs	0/50
	High Temperature Life Test	-	T_A=85°C I_F: R=7mA G=7mA B=5mA	1000 hrs	0/50
	High Humidity Heat Life Test	-	T_A=60°C, RH=90% I_F : R=7mA G=7mA B=5mA	500 hrs	0/50
	Low Temperature Life Test	-	T_A=-40°C, I_F: 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: *LQ6*

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_A=100°C	500 hrs	0/50
	Humidity Heat Storage	JEITA ED-4701 100 103	T_A=60°C RH=90%	500 hrs	0/50
	Low Temperature Storage	JEITA ED-4701 200 202	T_A=-40°C	500 hrs	0/50
Operation sequence	Life Test	-	T_A=25°C I_F: R=G=B=W=150mA I_F: R=G=B=A=150mA	1000 hrs	0/30
	High Temperature Life Test	-	T_A=85°C I_F: R=G=B=W=80mA I_F: R=G=B=A=80mA	1000 hrs	0/30
	High Humidity Heat Life Test	-	T_A=60°C, RH=90% I_F: R=G=B=W=80mA I_F: R=G=B=A=80mA	500 hrs	0/30
	Low Temperature Life Test	-	T_A=-40°C I_F: R=G=B=W=150mA I_F: R=G=B=A=150mA	500hrs	0/30

Judging Criteria

Item	Symbol	Test Condition	Criteria for Judgment	
			Min.	Max.
Forward Voltage	V_F	I_F = 100 mA	–	Initial Data x 1.1
Reverse Current	I_R	V_R = 5 V	-	100μA
Luminous Flux/Intensity	Φ_V	I_F = 100 mA	Initial Data x 0.7	-

SMD: *LR6*

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_A=100°C	500 hrs	0/50
	Humidity Heat Storage	JEITA ED-4701 100 103	T_A=60°C RH=90%	500 hrs	0/50
	Low Temperature Storage	JEITA ED-4701 200 202	T_A=-40°C	500 hrs	0/50
Operation sequence	Life Test	-	T_A=25°C I_F: R=G=B=W=50mA	1000 hrs	0/30
	High Temperature Life Test	-	T_A=85°C I_F: R=G=B=W=30mA	1000 hrs	0/30
	High Humidity Heat Life Test	-	T_A=60°C, RH=90% I_F: R=G=B=W=50mA	500 hrs	0/30
	Low Temperature Life Test	-	T_A=-40°C I_F: R=G=B=W=50mA	500hrs	0/30

Judging Criteria

Item	Symbol	Test Condition	Criteria for Judgment	
			Min.	Max.
Forward Voltage	V_F	I_F = 50 mA	–	Initial Data x 1.1
Reverse Current	I_R	V_R = 5 V	-	100μA
Luminous Flux/Intensity	Φ_V	I_F = 50 mA	Initial Data x 0.7	-

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_A=100°C	500 hrs	0/50
	Humidity Heat Storage	JEITA ED-4701 100 103	T_A=60°C RH=90%	500 hrs	0/50
	Low Temperature Storage	JEITA ED-4701 200 202	T_A=-40°C	500 hrs	0/50
Operation sequence	Life Test	-	T_A=25°C I_F: R=G=B=10mA	1000 hrs	0/50
	High Temperature Life Test	-	T_A=85°C I_F: R=G=B=3mA	1000 hrs	0/50
	High Humidity Heat Life Test	-	T_A=60°C, RH=90% I_F: R=G=B=3mA	500 hrs	0/50
	Low Temperature Life Test	-	T_A=-40°C I_F: R=G=B=10mA	500hrs	0/50

Judging Criteria

Item	Symbol	Test Condition	Criteria for Judgment	
			Min.	Max.
Forward Voltage	V_F	I_F = 5 mA	–	Initial Data x 1.1
Reverse Current	I_R	V_R = 5 V	-	10μA
Luminous Flux/Intensity	Φ_V	I_F = 5 mA	Initial Data x 0.7	-

SMD: UHD111A

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_A=100°C	500 hrs	0/50
	Humidity Heat Storage	JEITA ED-4701 100 103	T_A=60°C RH=90%	500 hrs	0/50
	Low Temperature Storage	JEITA ED-4701 200 202	T_A=-40°C	500 hrs	0/50
Operation sequence	Life Test	-	T_A=25°C I_F: R=5mA, G=3mA, B=3mA	1000 hrs	0/50
	High Temperature Life Test	-	T_A=85°C I_F: R=5mA, G=3mA, B=3mA	1000 hrs	0/50
	High Humidity Heat Life Test	-	T_A=60°C, RH=90% I_F: R=5mA, G=3mA, B=3mA	500 hrs	0/50
	Low Temperature Life Test	-	T_A=-40°C I_F: R=5mA, G=3mA, B=3mA	500hrs	0/50

Judging Criteria

Item	Symbol	Test Condition	Criteria for Judgment	
			Min.	Max.
Forward Voltage	V_F	I_F: R=5mA, G=3mA, B=3mA	–	Initial Data x 1.1
Reverse Current	I_R	V_R = 5 V	-	10μA
Luminous Flux/Intensity	Φ_V	I_F: R=5mA, G=3mA, B=3mA	Initial Data x 0.7	-

SMD: CV94*

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_A=100°C	500 hrs	0/50
	Humidity Heat Storage	JEITA ED-4701 100 103	T_A=60°C RH=90%	500 hrs	0/50
	Low Temperature Storage	JEITA ED-4701 200 202	T_A=-40°C	500 hrs	0/50
Operation sequence	Life Test	-	T_A=25°C I_F: R=50mA,G=35mA,B=20mA	1000 hrs	0/50
	High Temperature Life Test	-	T_A=85°C I_F: R=G=B=15mA	1000 hrs	0/50
	High Humidity Heat Life Test	-	T_A=60°C, RH=90% I_F: R=G=B=20mA	500 hrs	0/50
	Low Temperature Life Test	-	T_A=-40°C I_F: R=G=B=20mA	500hrs	0/50

SMD: *LW6*

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_A=100°C	500 hrs	0/50
	Humidity Heat Storage	JEITA ED-4701 100 103	T_A=60°C RH=90%	500 hrs	0/50
	Low Temperature Storage	JEITA ED-4701 200 202	T_A=-40°C	500 hrs	0/50
Operation sequence	Life Test	-	T_A=25°C I_F: R=G=B=W=30mA	1000 hrs	0/30
	High Temperature Life Test	-	T_A=85°C I_F: R=G=B=W=20mA	1000 hrs	0/30
	High Humidity Heat Life Test	-	T_A=60°C, RH=90% I_F: R=G=B=W=20mA	500 hrs	0/30
	Low Temperature Life Test	-	T_A=-40°C I_F: R=G=B=W=30mA	500hrs	0/30

Judging Criteria

Item	Symbol	Test Condition	Criteria for Judgment	
			Min.	Max.
Forward Voltage	V_F	I_F = 20 mA	–	Initial Data x 1.1
Reverse Current	I_R	V_R = 5 V	-	100μA
Luminous Flux/Intensity	Φ_V	I_F = 20 mA	Initial Data x 0.7	-

SMD: *LMW*

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_A=100°C	500 hrs	0/50
	Humidity Heat Storage	JEITA ED-4701 100 103	T_A=60°C RH=90%	500 hrs	0/50
	Low Temperature Storage	JEITA ED-4701 200 202	T_A=-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_A=25°C I_F: R=20mA G=25mA B=12mA	1000 hrs	0/50
	High Temperature Life Test	-	T_A=85°C I_F: R=10mA G=10mA B=8mA	1000 hrs	0/50
	High Humidity Heat Life Test	-	T_A=60°C, RH=90% I_F: R=10mA G=10mA B=10mA	500 hrs	0/50
	Low Temperature Life Test	-	T_A=-40°C, I_F: R=20mA G=25mA B=12mA	500hrs	0/50

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