The documentation and process conversion measures necessary to comply with this revision shall be completed by 1 Jun 95

INCH-POUND

MIL-S-19500/574A(USAF)
1 December 1994
SUPERSEDING
MIL-S-19500/574(USAF)
1 August 1988

MILITARY SPECIFICATION

SEMICONDUCTOR DEVICE, DIODE, LIGHT EMITTING
TYPES 1N6497, 1N6498, 1N6499, 1N6503, 1N6504, AND 1N6505
JANTX

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1 SCOPE

1.1 Scope This specification covers the detail requirements for red, yellow, and green light-emitting diodes (LED) with internal current regulation requiring no external resistors for operation on any voltage from 3 V dc to 30 V dc. One level of product assurance is provided for each device type as specified in MIL-S-19500

1.2 Physical dimensions See figure 1 for JANTX 1N6497 through 1N6499 and figure 2 for JANTX 1N6503 through 1N6505.

1.3 Maximum ratings.

V_F	$V_{(BR)}$ I_R = 10 µA dc	P_{FM} 1/	T_{op} and T_{stg}
V dc	V dc	mW(pk)	°C
30	5	225	-65 to +100

1/ Derate at 3.0 mW/°C above +25°C.

1.4 Characteristics, radiometric (physical), and photometric (visual)

Type	Color	V_F	I_V θ = 0°	I_F		λV		I_R V_R = 3 V	C V_R = 0 V
		V dc	mcd min	mA dc		nm		µA dc	pF
				Min	Max	Min	Max		
1N6497, 1N6503	Red	20	.5	3.5	7.5	595	695	1	500
1N6498, 1N6504	Yellow	20	.5	3.5	7.5	570	595	1	500
1N6499, 1N6505	Green	25	4	3.5	7.5	525	580	1	500

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to. Defense Electronics Supply Center, ATTN DESC-ELD, 1507 Wilmington Pike, Dayton, OH 45444-5765, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter

AMSC N/A FSC 5980

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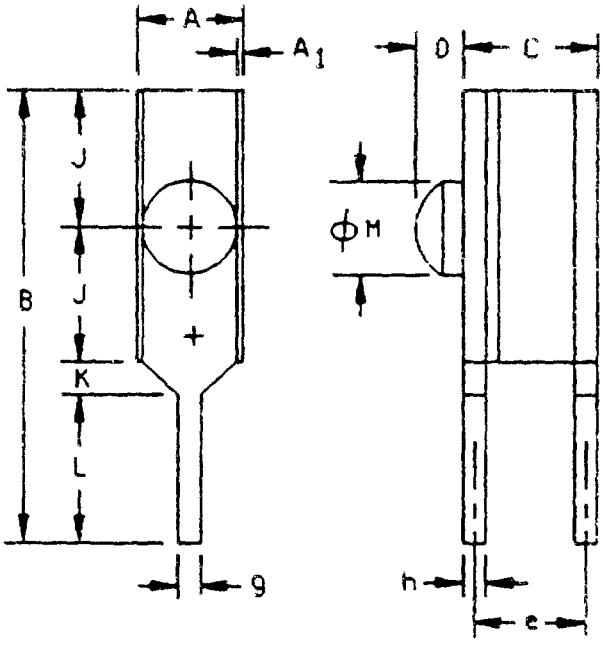
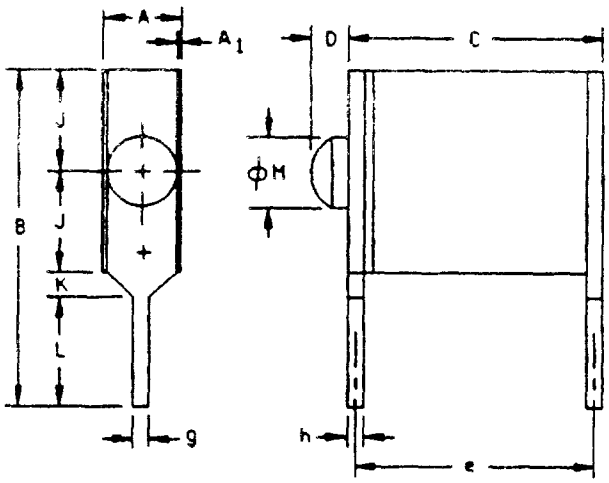


Ltr	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
A	.093	099	2.36	2 51	
A_1	.003	005	0 08	0.13	3
B	.385	445	9.78	11.30	
C	.112	128	2.84	3.25	
D	045 Nominal		1 14 Nominal		
e	.100 BSC		2 54 BSC		4
g	.020	022	0.51	0.56	
h	.018	022	0 46	0 56	
J	123	127	3 12	3.23	
K	.015	045	0.38	1.14	
L	125	145	3 18	3.68	
ϕM	.075	082	1 90	2.08	

NOTES
1. Dimensions are in inches.
2. Metric equivalents are given for general information only
3. The front and back pins are recessed on the two sides to prevent shorting of an adjacent device.
4. The basic pin spacing is between centerlines.

FIGURE 1 Physical dimensions for types 1N6497, 1N6498, and 1N6499



Ltr	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
A	093	099	2.36	2.51	
A_1	.003	.005	0 08	0.13	3
B	385	445	9 78	11.30	
C	.312	.328	7 92	8.33	
D	045 Nominal		1 14 Nominal		
e	300 BSC		7.62 BSC		4
g	.020	022	0 51	0.56	
h	018	022	0 46	0.56	
J	123	.127	3 12	3 23	
K	015	.045	0.38	1.14	
L	.125	145	3 18	3.68	
ϕM	075	.082	1 90	2 08	

NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. The front and back pins are recessed on the two sides to prevent shorting of an adjacent device
4. The basic pin spacing is between centerlines

FIGURE 2 Physical dimensions for types 1N6503, 1N6504, and 1N6505

2 APPLICABLE DOCUMENTS

2 1 Government documents

2 1 1 Specifications, standards, and handbooks The following specifications, standards, and handbooks form a part of this document to the extent specified herein Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6 2)

SPECIFICATION

MILITARY

MIL-S-19500 - Semiconductor Devices General Specification for.

STANDARDS

MILITARY

MIL-STD-750 Test Methods for Semiconductor Devices
MIL-STD 1241 Optical Terms and Definitions

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Defense Printing Service Detachment Office, Building 4D (Customer Service), 700 Robbins Avenue, Philadelphia, PA 19111-5094)

2 2 Non-Government publications The following documents form a part of this document to the extent specified herein Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DODISS cited in the solicitation Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation (see 6.2)

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z7 1-1967 - Nomenclature and Definitions for Illuminating Engineering

(Application for copies should be addressed to American National Standards Institute, 1430 Broadway, New York, NY 10018)

(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents These documents also may be available in or through libraries or other informational services)

2 3 Order of precedence In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained

3 REQUIREMENTS

3 1 Associated detail specification. The individual item requirements shall be in accordance with MIL-S-19500, and as specified herein

3.2 Abbreviations, symbols and definitions. The abbreviations, symbols, and definitions used herein are defined in MIL-S-19500, MIL-STD-1241, and as follows

a I_{FM} - - - - - - - - - Forward current (the subscript M indicates maximum)

b P_{FM} - - - - - - - - Forward power dissipation (the subscript M indicates maximum)

c I_V - - - - - - - - - Luminous intensity (the subscript V is used to designate a photometric or visual quantity to differentiate from I and used herein for current)

d mcd - - - - Milli candela, the candela is a unit of luminous intensity defined such that the luminance of a blackbody radiator at the temperature of solidification of platinum is 60 candelas per square centimeter.

e λ_V - - - - - - Peak radiometric wavelength of diode light emission

f. Θ- - - - - - - - - - The angle at or off the axis of symmetry of a light source at which luminous intensity is measured

g LED- - - - - - - - - Light emitting diode.

3.3 Design, construction, and physical dimensions. The design, construction, and physical dimensions shall be as specified in MIL-S-19500 and on figures 1 and 2 herein

3 3 2 Lead finish Lead finish shall be solderable as defined in MIL-S-19500, MIL-STD-750, and herein Where a choice of lead finish is desired, it shall be specified in the acquisition document (see 6 2)

3 3 3 Terminal lead length Terminal lead lengths other than that specified on figure 1 may be furnished when so stipulated in the acquisition document (see 6 2) where the devices covered herein are required directly for particular equipment-circuit installation or for automatic-assembly-technique programs

3 4 Marking Marking shall be in accordance with MIL-S-19500

4 QUALITY ASSURANCE PROVISIONS

4 1 Sampling and inspection Sampling and inspection shall be in accordance with MIL-S-19500, and as specified herein

4 2 Qualification inspection. Qualification inspection shall be in accordance with MIL-S-19500

4.3 Screening (JANTX only) Screening shall be in accordance with table II of MIL-S-19500, and as specified herein The following measurements shall be made in accordance with table I herein. Devices that exceed the limits of table I herein shall not be acceptable.

4.3.1 Process and power conditioning JANTX diodes shall be subjected to the 100-percent inspection specified in table I, in the order shown.

Screen (see table II of MIL S-19500)	Measurements JANTX level
7	Method 1071, fine leak, test condition H (leak testing 30 minutes after pressurization is acceptable) Method 1071, gross leak, test condition C, except that leak indicator fluid shall be maintained at +100°C ±5°C
9 and 10	Not applicable.
11	Table I, group A, subgroup 2
12	V_F = 30 mA dc; T_A = +25°C, t = 96 hours
13	Subgroup 2 of table I herein, ΔI_{V1} = -20 percent of initial readings ΔI_F = ±1 mA dc

4 4 Quality conformance inspection Quality conformance inspection shall be in accordance with MIL-S-19500

4 4 1 Group A inspection Group A inspection shall be conducted in accordance with MIL-S-19500, and table I herein

4.4 2 Group B inspection Group B inspection shall be conducted in accordance with the conditions specified for subgroup testing in table IVb (JANTX only) of MIL-S-19500 and as specified herein. Electrical measurements (end-points) shall be in accordance with the inspections of table I, group A, subgroup 2 herein

4 4 2 1 Group B inspection, table IVb (JANTX only) of MIL-S-19500.

Subgroup	Method	Condition
2	1051	Test condition A, except T(high) = +100°C (10 cycles); time at temperature extremes 15 minutes minimum
2	1071	Fine leak test condition H (leak testing 30 minutes after pressurization is acceptable). Gross leak test condition C, except that leak indicator fluid shall be maintained at +100°C ±5°C.
3	1027	I_F = 35 mA dc, T_A = +25°C, t = 340 hours

4 4.3 Group C inspection Group C inspection shall be conducted in accordance with the conditions specified for subgroup testing in table V of MIL S-19500 and as follows Electrical measurements (end-points) shall be in accordance with the inspections of table I, group A, subgroup 2 herein.

Subgroup	Method	Condition
2	1056	Test condition A
2	2036	Test condition E.
2	1071	Fine leak: test condition H (leak testing 30 minutes after pressurization is acceptable). Gross leak: test condition C, except that leak indicator fluid shall be maintained at +100°C ±5°C.
3	2016	Nonoperating, 1,500 g's, t = 0 5 ms, 5 blows in each orientation. X1, Y1, and Y2
3	2056	Nonoperating.
3	2006	Nonoperating, 20,000 g's; X1, Y1, and Y2
5	1026	I_F = 35 mA dc, T_A = +25°C

4 5 Methods of inspection Methods of inspection shall be as specified in the appropriate tables and as follows

4 5 1 Luminous intensity This measurement is made with a photometer described, calibrated, and operated as follows

4 5 1 1 Description of photometer

4 5.1 1 1 Type of response The photometer shall be of a type that is designed to respond to illuminance or (luminous incidence), that is, incident luminous flux density or lumens per unit area Units for luminous incidence are lux (lm/m^2). The output of the photometer shall be linearly related to luminous incidence over the range of levels encountered in calibration and measurement The output may be a voltage or a current, or may be rendered directly in the units of luminous incidence

4.5.1 1.2 Spectral response The relative response of the photometer shall be within 6 percent of $v(\lambda)$ at all wavelengths within the effective spectrum of devices to be measured, where $v(\lambda)$ is the photopic spectral luminous efficiency value as given in ANSI Z7.1-1967. The effective spectrum for a given type of device extends from the minimum to the maximum value of λv in 1 4

4.5 1 1.3 Receptance pattern The off-axis receptance of the photometer shall be constant over a large enough angle that it responds equally to light from all parts of the device to be measured. An effective plane of receptance (image of the detecting surface) shall be defined with respect to which the calibration can be performed

4 5 1 2 Calibration of photometer Radiation from a certified (NBS traceable) standard of spectral radiant incidence produces at its specified reference plane a known level of spectral radiant incidence, $E_e(\lambda)$ ($\mu W/cm^2$ per nanometer of wavelength) By passing this radiation through an interference filter of known spectral transmittance, τ_λ in a narrow band (<20 nm) centered at λ_0 (a dimensionless function of wavelength), a narrow band of spectral radiant incidence, $E_e(\lambda)\ \tau_e(\lambda)$ is obtained. This is converted to luminous incidence by integration

$$E_v(\lambda)o = 6.80 \int_0^\infty \left[E_e(\lambda)\ \tau_e(\lambda) \right] v(\lambda)\, d\lambda$$

Where: $E_v(\lambda_o)$ = luminous incidence (lux) at the reference plane of the standard of spectral radiant incidence, for a wavelength,

$$\lambda_o = \lambda_v(avg) = \frac{\lambda_v(min) + \lambda_v(max)}{2}$$

$[\ E_e(\lambda)\ _e(\lambda)\ ]$ = spectral radiant incidence ($\mu W/cm^2/nm$) resulting from passing the flux from the standard of spectral radiant incidence $E_e(\lambda)$ through a filter of spectral transmittance $\tau_e(\lambda)$

$V(\lambda)$ = photopic spectral luminous efficiency value as given in ANSI Z7.1-1967.

6.80 = units conversion constant (lux per $\mu W/cm^2$) obtained from the product of 680 lumens per watt, the peak of the standard observer response, and 10,000 cm^2/m^2

With the photometer receptance plane at the reference plane of the standard of spectral radiant incidence, the luminous incidence thus calculated (in lux) is applied The response of the photometer, to this standard luminous incidence is $P_{std}(\lambda_o)$

4 5 1 3 Operation of photometer The LED to be measured is aligned at the angle specified in 1 4, and at a known distance, d (meters) from the receptance plane of the photometer Specified drive current is applied to the LED and the luminous intensity is computed from the resulting photometer indications, P_{LED}

$$I_{v_{LED}} = \frac{P_{LED}}{P_{std}(\lambda_o)} \cdot E_v(\lambda_o) \cdot d^2$$

where $I_{v_{LED}}$ = luminous intensity of the LED (candelas)

$\frac{P_{LED}}{P_{std}(\lambda_o)}$ = ratio of photometer response from LED to response from standard luminous incidence

$E_v(\lambda_o)$ = standard luminous incidence (lux) calculated as above.

d = distance (meters) from emittance plane of LED to receptance plane of photometer.

NOTE Use of the wavelength designator, λ_o implies only that the photometer response was calibrated at that wavelength The interference filter should not be used with the photometer during measuring, it is used only for calibration

TABLE I Group A inspection

Inspection 1/	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
Subgroup 1						
Visual and mechanical inspection	2071					
Subgroup 2						
Luminous intensity		Θ = 0° (see 3.2f and 4.5.3)	I_V			
1N6497, 1N6498 1N6503 1N6504		V_F = 5 V dc		0.5		mcd
1N6499, 1N6505		V_F = 5 V dc		0.4		mcd
Reverse current	4016	DC method, V_R = 3 V dc	I_R		1.0	µA dc
Forward voltage	4026	DC method	I_F			
1N6497, 1N6498, 1N6499 1N6503, 1N6504, 1N6505		V_F = 30 V dc		3.5	7.5	mA dc
1N6497, 1N6498, 1N6499 1N6503, 1N6504, 1N6505		V_F = 5 V dc		3.5	7.5	mA dc
Subgroup 3						
High temperature		T_A = +100°C				
Luminous intensity		Θ = 15° (see 3.2f and 4.5.1)	I_{V2}			
1N6497, 1N6498 1N6503, 1N6504		V_F = 5 V dc		0.25		mcd
1N6499, 1N6505		V_F = 5 V dc		0.2		mcd
Reverse current	4016	DC method, V_R = 3 V dc	I_R		1.0	µA dc
Forward voltage	4026	DC method	I_F			
1N6497, 1N6498, 1N6499 1N6503, 1N6504, 1N6505		V_F = 30 V dc		3.0		mA dc
1N6497, 1N6498, 1N6499 1N6503, 1N6504, 1N6505		V_F = 5 V dc		3.0		mA dc
Low temperature		T_A = -55°C				
Reverse current	4016	DC method, V_R = 3 V dc	I_R		1.0	µA dc

See footnote at end of table

TABLE I Group A inspection - Continued

Inspection 1/	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
Subgroup 3 Continued						
Forward voltage	4026	DC method	I_F			
1N6497, 1N6498, 1N6499 1N6503, 1N6504, 1N6505		V_F = 30 V dc			15.0	mA dc
1N6497, 1N6498, 1N6499 1N6503, 1N6504, 1N6505		V_F = 5 V dc			15.0	mA dc
Subgroup 4						
Capacitance	4001	V_R = 0 f = 1 MHz	C		500	pf
Subgroups 5, 6, and 7						
Not applicable						

1/ For sampling plans see MIL-S-19500

5 PACKAGING

5 1 Packaging requirements The requirements for packaging shall be in accordance with MIL S-19500

6 NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory)

6 1 Notes The notes specified in MIL-S-19500 are applicable to this specification

6 2 Acquisition requirements

a Title, number, and date of the specification

b Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2 1)

c Lead finish as specified (see 3 3.2).

d Type designation and product assurance level

6 3 Applications These LED's are primarily intended for use as printed circuit board mounted fault indicator lights They also readily lend themselves to other types of applications, such as logic status indicators and power supply on/off indicators

6.4 Changes from previous issue Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes

CONCLUDING MATERIAL

Custodians:
Air Force - 17

Review activities
Air Force 85, 99

Preparing activity.
DLA - ES

(Project 5980-F019)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1 The preparing activity must complete blocks 1, 2, 3, and 8 In block 1, both the document number and revision letter should be given

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I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER MIL-S 19500/574A(USAF)	2. DOCUMENT DATE (YYMMDD) 94-12-01

3 DOCUMENT TITLE
SEMICONDUCTOR DEVICE, DIODE, LIGHT EMITTING, TYPES 1N6497, 1N6498, 1N6499, 1N6503, 1N6504, AND 1N6505

4 NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (Last, First, Middle Initial)	b. ORGANIZATION	
c. ADDRESS (Include Zip Code)	d. TELEPHONE (Include Area Code) (1) Commercial (2) AUTOVON (If applicable)	7. DATE SUBMITTED (YYMMDD)

8. PREPARING ACTIVITY

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c ADDRESS (Include Zip Code) Defense Electronics Supply Center Attn DESC ELDT Dayton, Ohio 45444-5765	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756 2340 AUTOVON 289-2340