The documentation and process conversion measures necessary to comply with this revision shall be completed by 30 January 1999

INCH-POUND

MIL-PRF-19500/574B
30 October 1998
SUPERSEDING
MIL-S-19500/574A(USAF)
1 December 1994

PERFORMANCE SPECIFICATION SHEET

SEMICONDUCTOR DEVICE, DIODE, LIGHT EMITTING
TYPES 1N6497, 1N6498, 1N6499, 1N6503, 1N6504, AND 1N6505
JAN AND 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 performance 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. Two levels of product assurance are provided for each device type as specified in MIL-PRF-19500.

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

1.3 Maximum ratings.

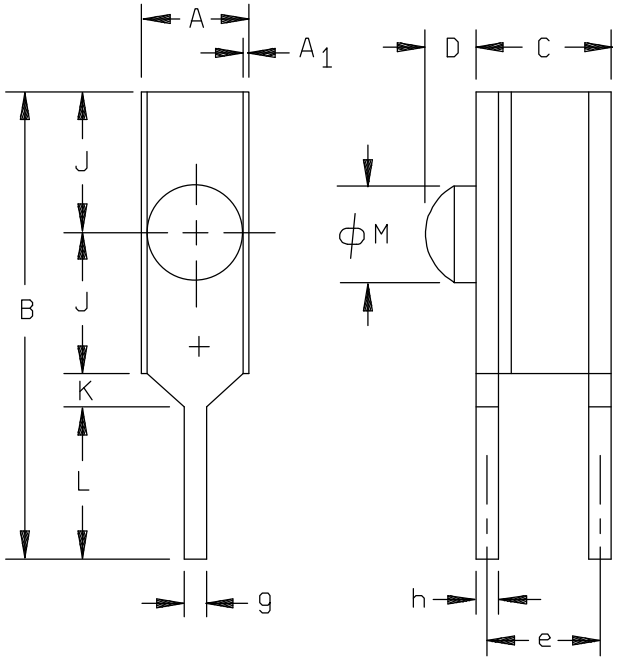
V_F	$V_{(BR)}$ I_R = 10 µA dc	P_{FM} 1/	T_{op} and T_{stg}
V dc	V dc	mW(pk)	°C
30	5	225	-65 to +100

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

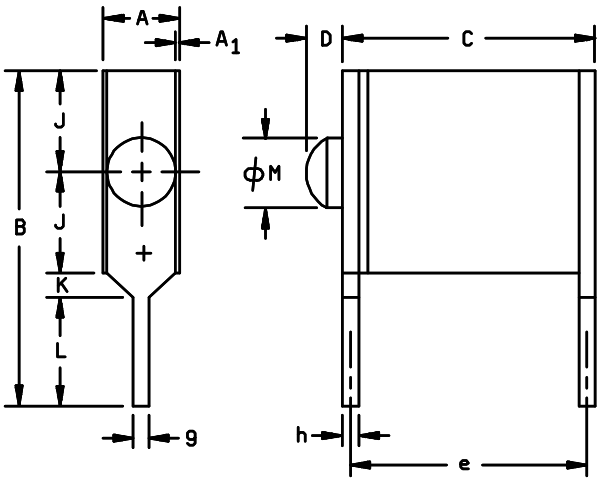
Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Defense Supply Center Columbus, ATTN: DSCC-VAT, 3990 East Broad Street, Columbus, OH 43216-5000, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.



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	
∅M	.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	
∅M	.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 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in sections 3 and 4 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 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

DEPARTMENT OF DEFENSE

MIL-PRF-19500 - Semiconductor Devices, General Specification for.

STANDARD

MILITARY

MIL-STD-750 - Test Methods for Semiconductor Devices.

(Unless otherwise indicated, copies of the above specifications, standards, and handbooks are available from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein (except for related associated specifications or specification sheets), 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 Qualification. Devices furnished under this specification shall be products that are authorized by the qualifying activity for listing on the applicable qualified products list before contract award (see 4.2 and 6.3).

3.2 Associated specification. The individual item requirements shall be in accordance with MIL-PRF-19500 and as specified herein.

3.3 Abbreviations, symbols and definitions. The abbreviations, symbols, and definitions used herein are defined in MIL-PRF-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.

3.4 Interface requirements and physical dimensions. The interface requirements and physical dimensions shall be as specified in MIL-PRF-19500 and on figures 1 and 2 herein.

3.4.1 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.

3.4.2 Lead material and finish. Lead finish shall be solderable as defined in MIL-PRF-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).

3.5 Marking. Marking shall be in accordance with MIL-PRF-19500.

3.6 Electrical performance characteristics. Unless otherwise specified herein, the electrical performance characteristics are as specified in 1.3, 1.4, and table I herein.

3.7 Electrical test requirements. The electrical test requirements shall be the subgroups specified in 4.4.2 and 4.4.3 herein.

4. VERIFICATION

4.1 Classification of inspections. The inspection requirements specified herein are classified as follows:

a. Qualification inspection (see 4.2).

b. Screening (see 4.3)

c. Conformance inspection (see 4.4).

4.2 Qualification inspection. Qualification inspection shall be in accordance with MIL-PRF-19500.

4.3 Screening (JANTX level only). Screening shall be in accordance with MIL-PRF-19500 (Appendix E, table IV), 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.

Screen (see appendix E, table IV, of MIL-PRF-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.

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

4.4 Conformance inspection. Conformance inspection shall be in accordance with MIL-PRF-19500.

4.4.1 Group A inspection. Group A inspection shall be conducted in accordance with appendix E, table V of MIL-PRF-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 appendix E, table VIb (JANTX only) of MIL-PRF-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, appendix E, table VIb (JANTX only) of MIL-PRF-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 appendix E, table VII of MIL-PRF-19500 and as follows. Electrical measurements (end-points) shall be in accordance with the inspections of table I, group A, subgroup 2 herein.

4.4.3.1 Group B inspection, appendix E, table VII of MIL-PRF-19500.

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(8) at all wavelengths within the effective spectrum of devices to be measured, where v(λ) is the photo-optic 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,

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

$[\ E_e(\lambda)\ e(\lambda)\ ]$ = 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 $\tau_e(\lambda)$.

$V(\lambda)$ = photo-optic spectral luminous efficiency value as given in ANSI 27.1-1967.

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}:

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

where I_{VLED} = 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	2071					
Visual and mechanical inspection						
Subgroup 2						
Luminous intensity		$\Theta = 0^\circ$ (see 3.3f and 4.5.3), $V_F = 5$ V dc	I_V			mcd
1N6497, 1N6498				0.5		
1N6503, 1N6504				0.5		
1N6499, 1N6505				0.4		
Reverse current	4016	DC method; $V_R = 3$ V dc	I_R		1.0	µA dc
Forward voltage	4026	DC method	I_F			mA dc
1N6497,1N6498,1N6499 1N6503,1N6504,1N6505		$V_F = 30$ V dc		3.5	7.5	
1N6497,1N6498,1N6499 1N6503,1N6504,1N6505		$V_F = 5$ V dc		3.5	7.5	mA dc
Subgroup 3						
High temperature:		$T_A = +100^\circ$C				
Luminous intensity		$\Theta = 15^\circ$ (see 3.3f and 4.5.1)	I_{V2}			mcd
1N6497, 1N6498		$V_F = 5$ V dc		0.25		
1N6503, 1N6504		$V_F = 5$ V dc		0.2		
1N6499, 1N6505						
Reverse current	4016	DC method; $V_R = 3$ V dc	I_R		1.0	µA dc
Forward voltage	4026	DC method	I_F	3.0		mA dc
1N6497,1N6498,1N6499 1N6503,1N6504,1N6505		$V_F = 30$ V dc				
1N6497,1N6498,1N6499 1N6503,1N6504,1N6505		$V_F = 5$ V 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						
Low temperature:		T_A = -55°C				
Reverse current	4016	DC method; V_R = 3 V dc	I_R		1.0	µA dc
Forward voltage	4026	DC method	I_F		15.0	mA dc
1N6497,1N6498,1N6499 1N6503,1N6504,1N6505		V_F = 30 V dc				
1N6497,1N6498,1N6499 1N6503,1N6504,1N6505		V_F = 5 V 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-PRF-19500.

5. PACKAGING

5.1 Packaging. Packaging shall prevent mechanical damage of the devices during shipping and handling and shall not be detrimental to the device. When actual packaging of material is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Points' packaging activity within the Military Department or Defense Agency, or within the Military Departments' System Command. Packaging data retrieval is available from the managing Military Departments' or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

5.2 Marking. Unless otherwise specified (see 6.2), marking shall be in accordance with MIL-PRF-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-PRF-19500 are applicable to this specification.

6.2 Acquisition requirements. See MIL- PRF-19500.

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Products List QPL No.19500 whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or purchase orders for the products covered by this specification. Information pertaining to qualification of products may be obtained from Defense Supply Center Columbus, ATTN: DSCC-VQE, 3990 East Broad Street, Columbus, OH 43216-5000.

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.

Custodians:
Air Force - 17

Review activities:
Air Force - 85, 99

Preparing activity:
DLA - CC

(Project 5980-0019)