MILITARY SPECIFICATION

SEMICONDUCTOR DEVICE, DIODE, LIGHT EMITTING

TYPES JAN1N5765 AND JANTX1N5765

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

1. SCOPE

1.1 Scope. This specification covers the detail requirements for TX and NON-TX light emitting diodes.

1.2 Physical dimensions. See figure 1.

1.3 Maximum ratings.

BV	I_F 1/	P_T	I_P 2/	T_{op}	T_{stg}
Vdc	mAdc	mW	A(pk)	°C	°C
4	50	150	3.0	-55 to +100	-65 to +100

1/ Derate 0.67 mAdc/°C for T_A above 25°C.

2/ 1 μs pulse width, 300 pps.

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

Limits	I_{v_1} I_F = 20 mAdc @ θ = 0°	I_{v_2} I_F = 20 mAdc @ θ = 30°	λ_v (wavelength)	C V_R = 0 f = 1 MHz	V_F I_F = 20 mAdc	I_R V_R = 3 Vdc
	mcd	mcd	nm	pF	Vdc	μAdc
Min	0.5	0.3	630	---	---	---
Max	3.0	---	700	300	2.0	1

2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein:

SPECIFICATIONS

MILITARY

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

STANDARDS

MILITARY

MIL-STD-202 - Test Methods for Electronic and Electrical Component Parts.
MIL-STD-750 - Test Methods for Semiconductor Devices.
MIL-STD-1241 - Optical Terms and Definitions.

(*Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.*)

2.2 Other publications. The following document forms a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

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

(Application for copies should be addressed to the American National Standards Institute, 1430 Broadway, New York, N.Y. 10018.)

3. REQUIREMENTS

3.1 General. Requirements shall be in accordance with MIL-S-19500, and as specified herein.

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

(a) I_v = Luminous intensity (the subscript "v" is used to designate a photometric or visual quantity to differentiate from "I" as used herein for current).
(b) λ_v = Wavelength of diode light emission. (The subscript "v" is used to designate a photometric or visual quantity to differentiate from λ used in the "LTPD" columns of tables I, II, and III).
(c) Ip = Peak forward pulse 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) θ = The angle at or off the axis of symmetry of a light source at which luminous intensity is measured.
(f) LED = Light emitting diode.

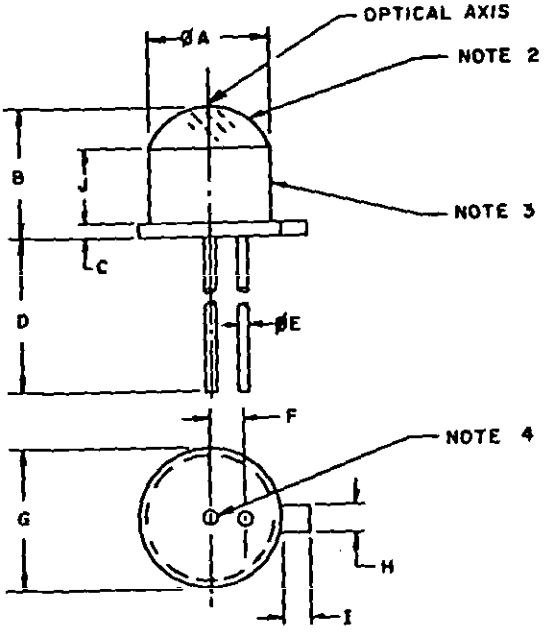
3.3 Design, construction, and physical dimensions. Diodes shall be of the design, construction, and physical dimensions shown on figure 1.

3.3.1 Lead material and finish. Lead material shall be Kovar or Alloy 52. Lead finish shall be gold-plated. (Leads may be tin-plated if specified in the contract or order.

3.3.1.1 Selectivity of lead material. Where choice of lead material (see 3.3.1 above) is desired, it shall be specified in the contract or order (see 6.2).

3.3.2 Terminal-lead length. Terminal-lead length(s) other than that specified in figure 1 may be furnished when so stipulated in the contract or order (see 6.2) where the devices covered herein are required directly for particular equipment-circuit installation or for automatic-assembly-technique programs.

3.4 Performance characteristics. Performance characteristics shall be as specified in tables I, II, III, and IV (table IV is applicable to "TX" types only).



DIMENSIONS				
LTR	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
ØA	.176	.190	4.47	4.83
B	.180	.225	4.57	5.72
C	.016	.024	.41	.61
D	.970	1.030	24.64	26.16
ØE	.016	.019	.41	.48
F	.045	.055	1.14	1.40
G	.200	.220	5.08	5.59
H	.035	.045	.89	1.14
I	.032	.042	.81	1.07
J	.139		3.53	

NOTES:
1. Metric equivalents (to the nearest .01 mm) are given for general information only and are based upon 1 inch = 25.4 mm.
2. Red lens.
3. Glass/metal hermetic can.
4. Cathode lead; both leads isolated from case.

FIGURE 1. Semiconductor device, diode, types JAN1N5765 and JANTX1N5765.

3.5 Marking. The following marking specified in MIL-S-19500 may be omitted from the body of the diode at the option of the manufacturer:

(a) Country of origin.
(b) Manufacturer's identification.

4. QUALITY ASSURANCE PROVISIONS

4.1 General. Quality assurance provisions shall be in accordance with MIL-S-19500, and as specified herein.

4.2 Qualification inspection. Qualification inspection shall consist of the examinations and tests specified in tables I, II, and III.

4.3 Quality conformance inspection. Quality conformance inspection shall consist of the examinations and tests specified for group A inspection (table I), group B inspection (table II), and group C inspection (table III). The following shall apply:

(a) Prior to performing group A inspection, all "TX" types shall be subjected to the tests specified in table IV (see 4.3.1).
(b) If the manufacturer chooses the following option(s) for testing, the sample units that are to be used in group C inspection shall be designated as such prior to conducting the referenced group B tests. Moreover, the number of failed diodes to be counted for lot acceptance or rejection as a result of group C test shall be equal to all failed diodes of the test in group B inspection, which were predesignated for use in group C inspection, plus any additional failures occurring during group C testing.

1. For each life test in group C inspection, the manufacturer has the option of using all or a portion of the sample already subjected to 340 hours of group B life testing for an additional 660 hours of testing to meet the 1,000-hour requirement.
2. For the thermal shock (temperature cycling) test of group C inspection, the manufacturer has the option of using all or a portion of the sample already subjected to 10 cycles of group B thermal shock (temperature cycling) testing for an additional 15 cycles of testing to meet the 25-cycle requirement.

(c) Group C inspection shall be performed when the first lot is produced and thereafter every 6 months during production.

When specified in the contract or purchase order (see 6.2), one copy of the quality conformance inspection data shall be supplied with each shipment by the device manufacturer.

4.3.1 Process- and power-conditioning ("TX" types only). "TX" diodes shall be subjected to the 100-percent inspection specified in table IV, in the order shown.

4.3.1.1 Screening. The parameters I_V, I_R, and V_F of table IV shall be measured and the measurements recorded for all diodes in the lot. All diodes shall be identified such that the delta (Δ) end points can be determined after burn-in. All diodes which fail the seal test or fail to meet the limits of I_V, I_R, and V_F of table IV before burn-in shall be removed from the lot and the quantity removed and type of failure shall be noted on the lot history. All diodes that exceed the delta (Δ) limits of table IV after burn-in shall be removed from the lot and the quantity removed shall be noted on the lot history. If 10 percent or more of the number of diodes subjected to burn-in fail, the entire lot shall be unacceptable as "TX" types.

4.4 Methods of examination and test. Methods of examination and test shall be as specified in tables I, II, III, and IV. Additional details are as specified herein.

4.4.1 Steady-state operation life. The diode shall be forward biased at a maximum continuously applied current of 50 mAdc.

TABLE I. Group A inspection

Examination or test	MIL-STD-750		LTPD		Symbol	Limits		Unit
	Method	Details	Non TX	TX		Min	Max	
Subgroup 1			10	5				
Visual and mechanical examination	2071				---	---	---	---
Subgroup 2			5	3				
Luminous intensity	---	I_F = 20 mAdc; θ = 0° (see 3.2(e) and 4.4.3)			I_{V_1}	0.5	3.0	mcd
Luminous intensity	---	I_F = 20 mAdc; θ = 30°; LED rotated 360° on optical axis (see figure 1, 3.2(e) and 4.4.3)			I_{V_2}	0.3	---	mcd
Reverse current	4016	DC method; V_R = 3 Vdc			I_R	---	1	μAdc
Forward voltage	4011	I_F = 20 mAdc			V_F	---	2.0	Vdc
Subgroup 3			5	3				
Breakdown voltage	4021	I_R = 10 μAdc			BV	4	---	Vdc
Capacitance	4001	V_R = 0; f = 1 MHz			C	---	300	pF

TABLE II. Group B inspection

Examination or test	MIL-STD-750		LTPD		Symbol	Limits		Unit
	Method	Details	Non TX	TX		Min	Max	
Subgroup 1			20	20				
Physical dimensions	2066	See figure 1			---	---	---	---
Subgroup 2			15	15				
Solderability	2026				---	---	---	---
Thermal shock (temperature cycling)	1051	Test condition A, except T(high) = 100°C; 10 cycles; time at temperature extremes = 15 minutes, min (see 4.3(b))			---	---	---	---
Thermal shock (glass strain)	1056	Test condition A			---	---	---	---
Hermetic seal	1071	Test condition H for fine leaks (leak testing 2 hours after pressurization is acceptable); test condition C for gross leaks, except that leak indicator fluid shall be maintained at 100° ±5°C			---	---	---	---
Moisture resistance	1021				---	---	---	---
End points:								
Luminous intensity	---	I_F = 20 mAdc: θ = 0° (see 3.2(e) and 4.4.3)			I_{V_1}	0.5	3.0	mcd

TABLE II. Group B inspection - Continued

Examination or test	MIL-STD-750		LTPD		Symbol	Limits		Unit
	Method	Details	Non TX	TX		Min	Max	
End points: - Continued								
Forward voltage	4011	I_F = 20 mAdc			V_F	---	2.0	Vdc
Reverse current	4016	DC method; V_R = 3 Vdc			I_R	---	1	µAdc
Subgroup 3			10	10				
Shock	2016	Nonoperating; 1,500 G; t = 0.5 ms; 5 blows in each orientation: X_1, Y_1, and Y_2			---	---	---	---
Vibration, variable frequency	2056	Nonoperating			---	---	---	---
Constant acceleration	2006	Nonoperating; 20,000 G; X_1, Y_1, and Y_2 orientations			---	---	---	---
End points: (Same as subgroup 2)								
Subgroup 4			10	10				
Terminal strength	2036	Test condition E			---	---	---	---
End points:								
Hermetic seal	1071	Test condition H for fine leaks (leak testing 2 hours after pressurization is acceptable); test condition C for gross leaks, except that leak indicator fluid shall be maintained at 100° ±5°C			---	---	---	---
Subgroup 5			10	10				
Salt atmosphere (corrosion)	1041				---	---	---	---
Subgroup 6			7	5				
High-temperature life (nonoperating)	1032	T_A = 100°C (see 4.3(b))			---	---	---	---
End points:								
Luminous intensity	---	I_F = 20 mAdc; θ = 0° (see 3.2(e) and 4.4.3)			I_{v1}	0.45	3.0	mcd
Forward voltage	4011	I_F = 20 mAdc			V_F	---	2.0	Vdc
Reverse current	4016	DC method; V_R = 3 Vdc			I_R	---	1.5	µAdc
Subgroup 7			7	5				
Steady-state operation life	1027	I_F = 50 mAdc (see 4.3(b) and 4.4.1)			---	---	---	---
End points: (Same as subgroup 6)								

TABLE III. Group C inspection

Examination or test	MIL-STD-750		LTPD		Symbol	Limits		Unit
	Method	Details	Non TX	TX		Min	Max	
Subgroup 1			7	5				
Low-temperature operation:		T_A = -55°C						
Breakdown voltage	4021	I_R = 10 μAdc			BV	4	---	Vdc
Subgroup 2			10	10				
Thermal shock (temperature cycling)	1051	Test condition A, except T(high) = 100°C; time at *temperature extremes* = 15 minutes, min; total test time = 72 hours, max (see 4.3(b))			---	---	---	---
End points: (Same as subgroup 2 of group B)								
Subgroup 3			10	10				
Resistance to solvents	---	Method 215 of MIL-STD-202 (see 4.4.2)			---	---	---	---
Subgroup 4			λ=7	λ=5				
High-temperature life (nonoperating)	1031	T_A = 100°C (see 4.3(b))			---	---	---	---
End points: (Same as subgroup 6 of group B)								
Subgroup 5			λ=7	λ=5				
Steady-state operation life	1026	I_F = 50 mAdc (see 4.3(b) and 4.4.1)			---	---	---	---
End points: (Same as subgroup 6 of group B)								
Subgroup 6			10	10				
Peak forward pulse current	---	tp = 1 μs; pps = 300			I_P	---	3.0	A(pk)
End points: (Same as subgroup 6 of group B)								

TABLE IV. Process and power conditioning ("TX" types only)

Examination or test	MIL-STD-750		Symbol	Limits		Unit
	Method	Details		Min	Max	
High temperature storage (nonoperating)		T_A = 100°C; time = 72 hours, min	---	---	---	---
Thermal shock (temperature cycling)	1051	Test condition A, except T(high) = 100°C; 10 cycles; time at temperature extremes = 15 minutes, min	---	---	---	---
Constant acceleration	2006	Nonoperating; 20,000 G; Y_1 only	---	---	---	---
Hermetic seal	1071	Test condition H for fine leaks (leak testing 2 hours after pressurization is acceptable); test condition C for gross leaks, except that leak indicator fluid shall be maintained at 100°±5°C	---	---	---	---
Luminous intensity	---	I_F = 20 mAdc; θ = 0° (see 3.2(e) and 4.4.3)	I_{v_1}	0.5	3.0	mcd
Forward voltage	4011	I_F = 20 mAdc	V_F	---	2.0	Vdc
Reverse current	4016	DC method; V_R = 3 Vdc	I_R	---	1	μAdc
Burn-in (Forward bias)	---	I_F = 50 mAdc (constant current shall be maintained); t = 168 hrs, min	---	---	---	---
End points (within 24 hours of burn-in)						
Luminous intensity	---	I_F = 20 mAdc; θ = 0° (see 3.2(e) and 4.4.3)	ΔI_{v_1}	---	-20	%
Forward voltage	4011	I_F = 20 mAdc	ΔV_F	---	±50	mVdc
Reverse current	4016	DC method; V_R = 50 Vdc (The largest limit shall be applicable)	ΔI_R	---	± 100 or ± 25	% nAdc

4.4.2 Resistance to solvents. All areas of the diode body where marking has been applied shall be brushed. After the test, there shall be no evidence of mechanical damage to the device and marking shall remain legible.

4.4.3 Axial luminous intensity. This measurement is made with a photometer described, calibrated, and operated as follows:

4.4.3.1 Description of photometer.

4.4.3.1.1 Spectral response. The photometer's response shall be within 6 percent of V(λ) for all wavelengths between 600 and 700 nm where V(λ) is the Photopic Spectral Luminous Efficiency value as given in American National Standards Institute (ANSI) standard Z7.1-1967.

4.4.3.1.2 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.

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

$$E_v(\lambda_o) = .633 \int_0^\infty E_e(\lambda)\ \tau_e(\lambda)\ V(\lambda)\ d\lambda$$

where: $E_v(\lambda_o)$ = illuminance (footcandles) at the reference plane of the standard of spectral irradiance, for a wavelength, λ_o

$V(\lambda)$ = Photopic Spectral Luminous Efficiency value as given in American National Standards Institute (ANSI) standard Z7.1-1967.

.633 = Units conversion constant (footcandles per $\mu W/cm^2$) obtained from the product of 680 lumens per watt, the peak of the standard observer response and 929 $cm^2/foot^2$.

With the photometer receptance plane at the reference plane of the standard of spectral irradiance, the illuminance thus calculated (in footcandles) is applied. The response of the photometer, to this standard illuminance is $P_{std}(\lambda_o)$.

4.4.3.3 Operation of photometer. The LED to be measured is aligned at the angle specified in the tables with the photometer at a known distance, d(feet) 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 illuminance

$E_v(\lambda_o)$ = standard illuminance (footcandles) calculated as above

d = distance (feet) 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 in measuring - - - it is used only for calibration.

5. PREPARATION FOR DELIVERY

5.1 Preparation for delivery shall be in accordance with MIL-S-19500.

6. NOTES

6.1 Notes. In addition to the notes specified in MIL-S-19500, the following are applicable to this specification.

6.2 Ordering data.

(a) Lead finish if other than gold-plated (see 3.3.1).
(b) Selectivity of lead material (see 3.3.1.1).
(c) Terminal-lead length if other than as specified in figure 1 (see 3.3.2).
(d) Inspection data (see 4.3).

Custodians:
Army - EL
Navy - EC
Air Force - 17

Review activities:
Army - MI, MU
Air Force - 11, 80
DSA - ES

User activities:
Army - SM
Navy - MC, CG, AS, OS, SH
Air Force - 19

Preparing activity:
Air Force - 17

Agent:
DSA - ES

(Project 5961-0317)

SPECIFICATION ANALYSIS SHEET

Form Approved
Budget Bureau No. 22-R255

INSTRUCTIONS: This sheet is to be filled out by personnel either Government or contractor, involved in the use of the specification in procurement of products for ultimate use by the Department of Defense. This sheet is provided for obtaining information on the use of this specification which will insure that suitable products can be procured with a minimum amount of delay and at the least cost. Comments and the return of this form will be appreciated. Fold on lines on reverse side, staple in corner, and send to preparing activity. Comments and suggestions submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or serve to amend contractual requirements.

SPECIFICATION

ORGANIZATION

CITY AND STATE

CONTRACT NUMBER

MATERIAL PROCURED UNDER A

☐ DIRECT GOVERNMENT CONTRACT ☐ SUBCONTRACT

1. HAS ANY PART OF THE SPECIFICATION CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE?

A. GIVE PARAGRAPH NUMBER AND WORDING.

B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES

2. COMMENTS ON ANY SPECIFICATION REQUIREMENT CONSIDERED TOO RIGID

3. IS THE SPECIFICATION RESTRICTIVE?

☐ YES ☐ NO *(If "yes", in what way?)*

4. REMARKS *(Attach any pertinent data which may be of use in improving this specification. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity)*

SUBMITTED BY *(Printed or typed name and activity — Optional)*

DATE

DD FORM 1 JAN 66 1426

REPLACED EDITION OF 1 OCT 54 WHICH MAY BE USED.