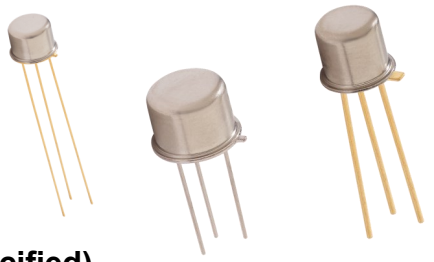
2N718A, 2N1613, 2N1613L

NPN Low Power Silicon Transistor

Rev. V1

Features

- Available in JAN, JANTX and JANTXV per MIL-PRF-19500/181
- Available in TO-18 (2N718A), TO-39 (2N1613) and TO-5 (2N1613L) packages
- Designed for Small Signal General Purpose Switching Applications.



Electrical Characteristics (T_A = +25°C unless otherwise specified)

Parameter	Test Conditions	Symbol	Units	Min.	Max.
Breakdown Voltage, Collector - Emitter	I_C = 100 µA dc	$V_{(BR)CEO}$	V dc	30	—
Collector - Base Cutoff Current	V_{CBO} = 75 V dc	I_{CBO1}	µA dc	—	10
Emitter - Base Cutoff Current	V_{EBO} = 7.0 V dc	I_{EBO1}	µA dc	—	10
Collector-Emitter Breakdown Voltage	I_C= 100 µA dc; R_{BE} = 10 Ω	$V_{(BR)CER}$	V dc	50	—
Emitter - Base Cutoff Current	V_{EB} = 5.0 V dc	I_{EBO2}	nA dc	—	10
Collector - Base Cutoff Current	V_{CB} = 60 V dc	I_{CBO2}	nA dc	—	10
Forward Current Transfer Ratio	V_{CE} = 10 V dc; I_C = 0.1 mA dc V_{CE} = 10 V dc; I_C = 10 mA dc V_{CE} = 10 V dc; I_C = 150 mA dc V_{CE} = 10 V dc; I_C = 500 mA dc	h_{FE1} h_{FE2} h_{FE3} h_{FE3}	-	20 35 40 20	120
Collector-Emitter Saturated Voltage	I_C = 150 mA dc; I_B = 15 mA dc	$V_{CE(SAT)}$	V dc	—	1.5
Base-Emitter Saturated Voltage	I_C = 150 mA dc; I_B = 15 mA dc	$V_{BE(SAT)}$	V dc	—	1.3

Electrical Characteristics (+25°C unless otherwise specified)

Parameter	Test Conditions	Symbol	Units	Min.	Max.
Collector - Base Cutoff Current	T_A = +150°C V_{CB} = 60 V dc	I_{CBO3}	µA dc	—	10
Forward-Current Transfer Ratio	T_A = -55°C V_{CE} = 10 V dc; I_C = 10 mA dc	h_{FE5}		20	
Dynamic Characteristics					
Small-Signal Short-Circuit Forward Current Transfer Ratio	V_{CE} = 5 V dc; I_C = 1 mA dc; f = 1 kHz V_{CE} = 10 V dc; I_C = 5 mA dc; f = 1 kHz	h_{fe}		30 35	100 150
Magnitude of Common Emitter Small-Signal Short-Circuit Forward Current Transfer Ratio	V_{CE} = 10 V dc; I_C = 50 mA dc, f = 20 MHz	$\lvert h_{FE} \rvert$		3	
Open Circuit Output Capacitance	V_{CB} = 10 V dc; I_E = 0; 100 kHz ≤ f ≤ 1 MHz	C_{obo}	pF		25
Small-Signal Short-Circuit Input Impedance	V_{CB} = 10 V dc; I_C = 5 mA dc; f = 1 kHz	h_{ib}	ohms	4	8
Small-Signal Open-Circuit Output Admittance	V_{CB} = 10 V dc; I_C = 5 mA dc; f = 1 kHz	h_{ob}	µohms	0	1.0
Small-Signal Open-Circuit Reverse Voltage Transfer Ratio	V_{CB} = 10 V dc; I_C = 5 mA dc; f = 1 kHz	h_{rb}			3×10^{-4}
Pulse Response	Test Condition A , except test circuit and pulse requirements. See figure 5 of MIL-PRF-19500	$t_{on} + t_{off}$	ns		30

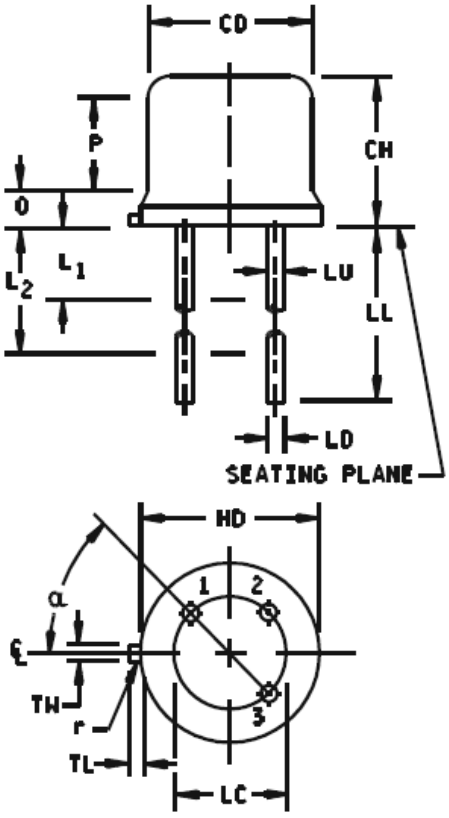
Absolute Maximum Ratings (T_A = +25°C unless otherwise specified)

Ratings	Symbol	Value
Collector - Emitter Voltage	V_{CEO}	30 V dc
Collector - Base Voltage	V_{CBO}	75 V dc
Emitter - Base Voltage	V_{EBO}	7 V dc
Collector Current	I_C	500 mA dc
Collector - Emitter Voltage (R_{BE} = 10Ω)	V_{CER}	50 V dc
Operating & Storage Temperature Range	T_J, T_{STG}	-65°C to +200°C
T_C = +25°C 2N718A 2N1613 2N1613L	P_T (1)	 1.8 W 3.0 W 3.0 W
T_A = +25°C 2N718A 2N1613 2N1613L	$P_{T\,2}$ (2)	 0.5 W 0.8 W 0.8 W
Thermal Resistance, Junction to Case 2N718A 2N1613 2N1613L	$R_{\theta JC}$	 97°C/W 58°C/W 58°C/W
Thermal Resistance, Junction to Ambient 2N718A 2N1613 2N1613L	$R_{\theta JA}$	 325°C/W 175°C/W 175°C/W

(1) Derate linearly at 17.2 mW/°C for type 2N1613 and 2N1613L and at 10.3 mW/°C for type 2N718A for T_C> +25°C.
(2) See figures 3 and 4 of MIL-PRF-19500/181

Outline Drawing (TO-18)

Symbol	Inches		Millimeters		Notes
	Min	Max	Min	Max	
CD	.178	.195	4.52	4.95	
CH	.170	.210	4.32	5.33	
HD	.209	.230	5.31	5.84	
LC	.100 TP		2.54 TP		5
LD	.016	.021	0.41	0.53	8, 9
LL	.500	.750	12.70	19.05	7, 9
LU	.016	.019	0.41	0.48	4, 8, 9
L1		.050		1.27	9
L2	.250		6.35		9
TL	.028	.048	0.71	1.22	5
TW	.036	.046	.91	1.17	
P	.100		2.54		3
Q		.030		0.76	6
r		.010		.025	
α	45° TP		45° TP		



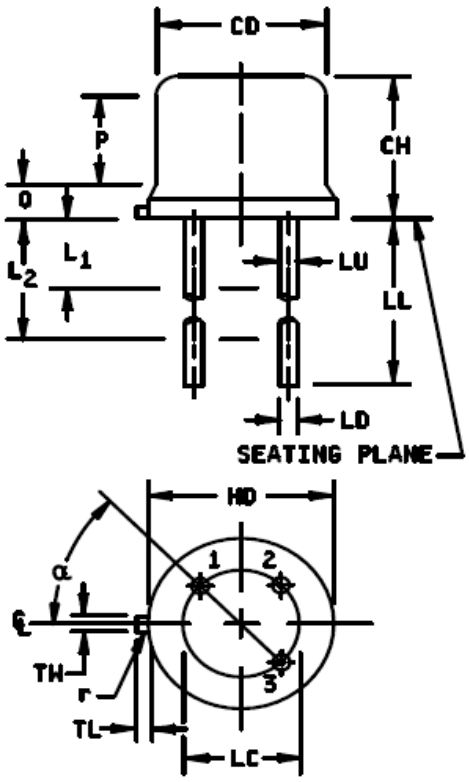
NOTES:

1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. This zone is controlled for automatic handling. The variation in actual diameter within this zone shall not exceed .010 inch (0.254 mm).
4. (Three leads) LU applies between L_1 and L_2. LD applies between L_2 and .5 inch (12.70 mm) from seating plane. Diameter is uncontrolled in L_1 and beyond .5 inch (12.70 mm) from seating plane.
5. Measured from maximum diameter of the actual device.
6. Details of outline in this zone optional.
7. The collector shall be electrically connected to the case.
8. Lead number 1 - emitter; lead number 2 - base; lead number 3 - collector.
9. All three leads.
10. In accordance with ANSI Y14.5M, diameters are equivalent to Φx symbology.

FIGURE 1. Physical dimensions 2N718A (TO-18).

Outline Drawing (TO-39, TO-5 Package)

Symbol	Dimensions				Notes
	Inches		Millimeter		
	Min	Max	Min	Max	
CH	.240	.260	6.10	6.60	
LC	.200 TP		5.08 TP		7
LD	.016	.021	0.41	0.53	8,9
LL	See notes 12, and 13				
LU	.016	.019	0.41	0.48	8,9
L_1		.050		1.27	8, 9
L_2	.250		6.35		8, 9
HD	.335	.370	8.51	9.40	
CD	.305	.335	7.75	8.51	
P	.100		2.54		6
Q		.050		1.27	5
r		.010		0.25	
TL	.029	.045	0.74	1.14	4
TW	.028	.034	0.71	0.86	0.71
α	45° TP		45° TP		7

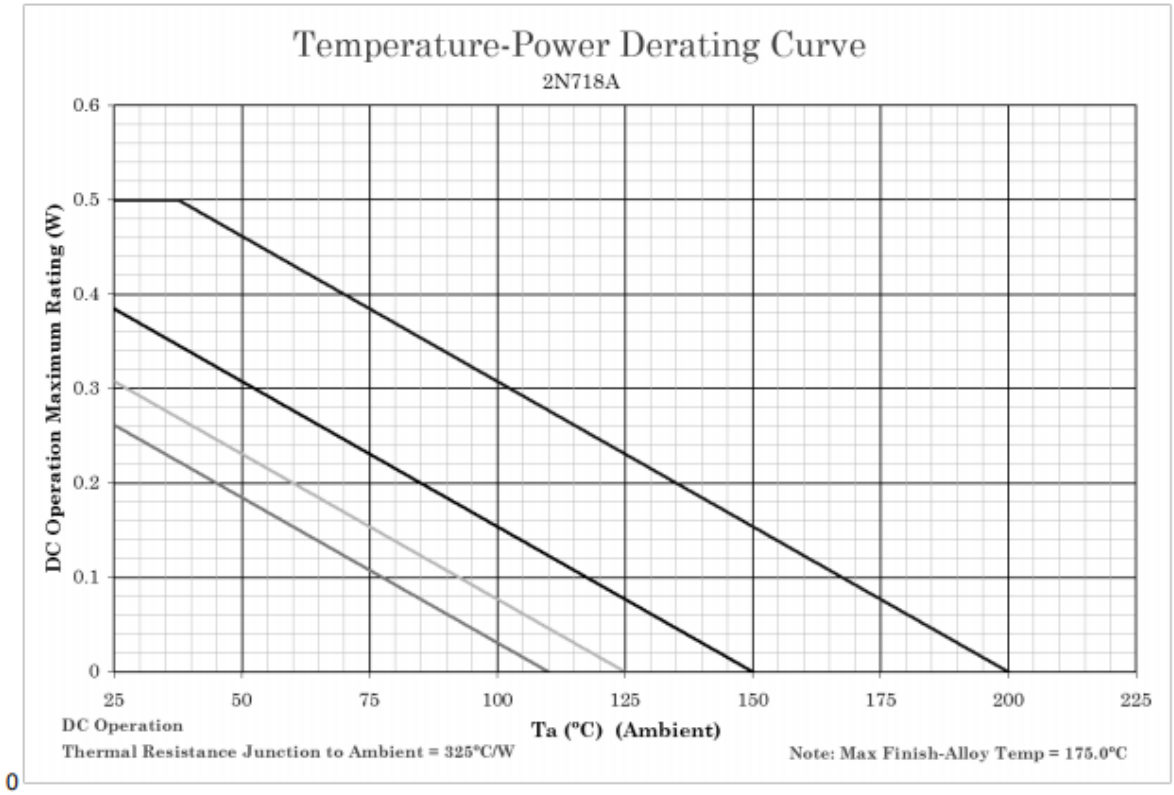


NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Beyond r (radius) maximum, TW shall be held for a minimum length of 0.011 inch (0.28 mm).
4. TL measured from maximum HD.
5. Outline in this zone is not controlled.
6. CD shall not vary more than .010 inch (0.25 mm) in zone P. This zone is controlled for automatic handling.
7. Leads at gauge plane .054 +.001, -.000 inch (1.37 +0.03, -0.000 mm) below seating plane shall be within .007 inch (0.18 mm) radius of true position (TP) at a maximum material condition (MMC) relative to the tab at MMC. The device may be measured by direct methods or by the gauging procedure.
8. LU applies between L_1 and L_2. LU applies between L_2 and LL minimum. Diameter is uncontrolled in L_1 and beyond LL minimum.
9. All three leads.
10. The collector shall be electrically and mechanically connected to the case.
11. r (radius) applies to both inside corners of tab.
12. For transistor types 2N1613, dimension LL is .500 inch (12.70 mm) minimum, and .750 inch (19.05 mm) maximum.
13. For transistor types 2N1613L, dimension LL is 1.500 inches (38.10 mm) minimum, and 1.750 inches (44.45 mm) maximum.
14. Lead number 1 - emitter; lead number 2 - base; lead number 3 - collector.

FIGURE 2. Physical dimensions 2N1613 and 2N1613L (similar to TO-5 and TO-39).

Temperature-Power Derating Curve (2N718A)



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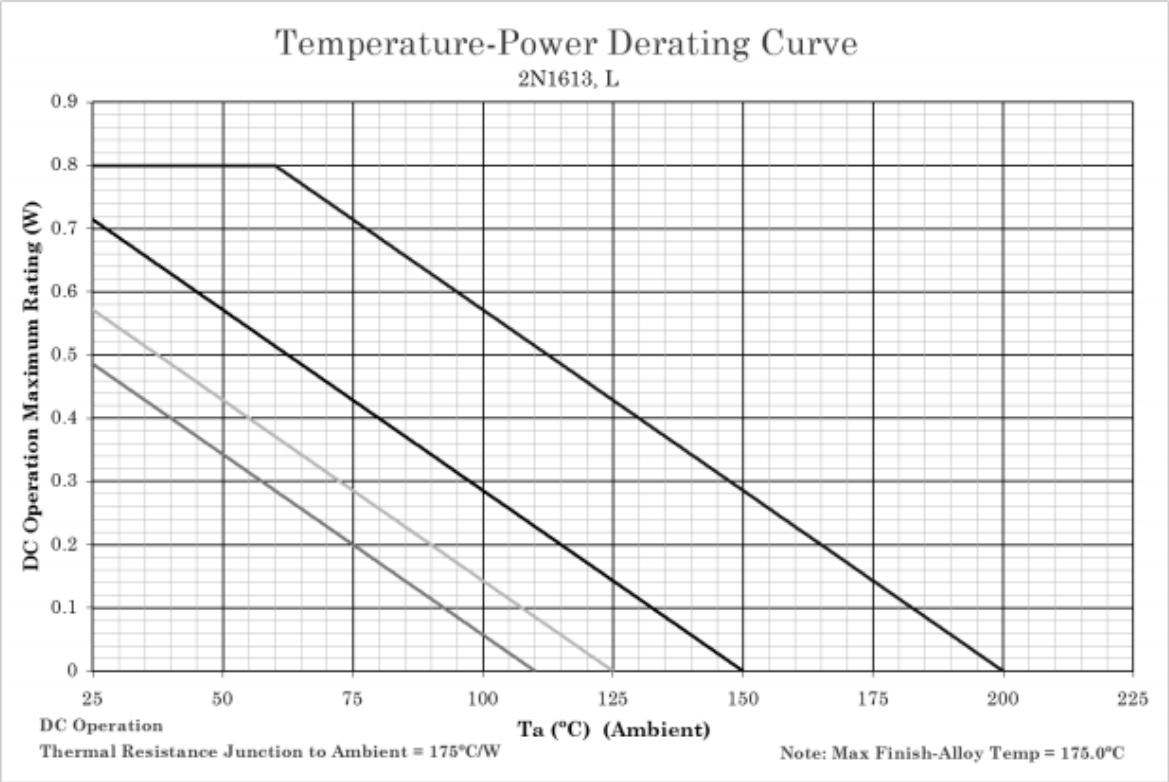
NOTES:

1. This is the true inverse of the worst case thermal resistance value. All devices are capable of operating at ≤ T_J specified on this curve. Any parallel line to this curve will intersect the appropriate power for the desired maximum T_J allowed.
2. Derate design curve constrained by the maximum junction temperature (T_J ≤ 200°C) and power rating specified. (See 1.3 herein.)
3. Derate design curve chosen at T_J ≤ 150°C, where the maximum temperature of electrical test is performed.
4. Derate design curves chosen at T_J ≤, 125°C, and 110°C to show power rating where most users want to limit T_J in their application.

FIGURE 3. Temperature-power derating for 2N718A (TO-18 package).

Temperature-Power Derating Curve (2N1613, 2N1613L)



NOTES:

1. This is the true inverse of the worst case thermal resistance value. All devices are capable of operating at ≤ T_J specified on this curve. Any parallel line to this curve will intersect the appropriate power for the desired maximum T_J allowed.
2. Derate design curve constrained by the maximum junction temperature (T_J ≤ 200°C) and power rating specified. (See 1.3 herein.)
3. Derate design curve chosen at T_J ≤ 150°C, where the maximum temperature of electrical test is performed.
4. Derate design curves chosen at T_J ≤, 125°C, and 110°C to show power rating where most users want to limit T_J in their application.

FIGURE 4. Temperature-power derating for 2N1613 and 2N1613L (TO-5 and TO-39 package).