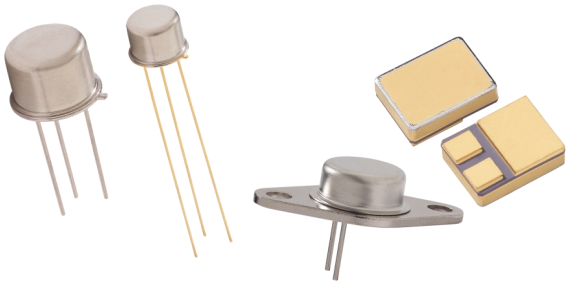
2N5664, 2N5665, 2N5666, 2N5667

NPN High Voltage Power Silicon Transistor

Rev. V1

Features

- Available in JAN, JANTX, JANTXV, JANS and JANSR per MIL-PRF-19500/455
- 2N5664 and 2N5665 available in TO-66 package
- 2N5666 and 2N5667 are available in both TO-5 and TO-39 packages
- 2N5666 is available in the surface mount U3 version



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

Parameter	Test Conditions	Symbol	Units	Min.	Max.
Breakdown Voltage Collector - Emitter	I_C = 10 mA dc, R_1 = 100 Ω 2N5664, 2N5666, 2N5666S 2N5665, 2N5667, 2N5667S	$V_{(BR)CER}$	V dc	250 400	—
Breakdown Voltage Emitter - Base	I_E = 10 mA dc	$V_{(BR)EBO}$	V dc	6	—
Collector - Emitter Cutoff Current	V_{CE} = 200 V dc 2N5664, 2N5666, 2N5666S V_{CE} = 300 V dc 2N5665, 2N5667, 2N5667S	I_{CES1}	µA dc	—	0.2
Collector - Base Cutoff Current	V_{CB} = 200 Vdc 2N5664, 2N5666, 2N5666S V_{CB} = 250 Vdc 2N5664, 2N5666, 2N5666S V_{CB} = 300 V dc 2N5665, 2N5667, 2N5667S V_{CB} = 400 V dc 2N5665, 2N5667, 2N5667S	I_{CBO}	µA dc mA dc µA dc mA dc	— 	0.1 1.0 0.1 1.0
Forward - Current Transfer Ratio	V_{CE} = 2 V dc, I_C = 0.5 A dc 2N5664, 2N5666, 2N5666S 2N5665, 2N5667, 2N5667S	h_{FE1}		40 25	
Forward - Current Transfer Ratio	V_{CE} = 5 V dc, I_C = 1.0 A dc 2N5664, 2N5666, 2N5666S 2N5665, 2N5667, 2N5667S	h_{FE2}		40 25	120 75
Forward - Current Transfer Ratio	V_{CE} = 5 V dc, I_C = 3.0 A dc 2N5664, 2N5666, 2N5666S 2N5665, 2N5667, 2N5667S	h_{FE3}		15 10	
Forward - Current Transfer Ratio	V_{CE} = 5 V dc, I_C = 5.0 A dc	h_{FE4}		5	
Collector - Emitter Saturation Voltage	I_C = 3.0 A dc I_B = 0.3 A dc 2N5664, 2N5666, 2N5666S I_B = 0.6 A dc 2N5665, 2N5667, 2N5667S	$V_{CE(sat)1}$	V dc		0.4
Collector - Emitter Saturation Voltage	I_C = 5.0 A dc, I_B = 1 A dc	$V_{CE(sat)2}$	V dc		1.0

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

Parameter	Test Conditions	Symbol	Units	Min.	Max.
Base - Emitter Saturation Voltage	I_C = 3.0 A dc I_B = 0.3 A dc 2N5664, 2N5666, 2N5666S I_B = 0.6 A dc 2N5665, 21N5667, 2N5667S	$V_{BE(sat)1}$	V dc		1.2
Base - Emitter Saturation Voltage	I_C = 5.0 A dc, I_B = 1 A dc	$V_{BE(sat)2}$	V dc		1.5
Collector - Emitter Cutoff Current	T_A = 150°C V_{CE} = 200 V dc 2N5664, 2N5666, 2N5666S V_{CE} = 300 V dc 2N5665, 2N5667, 2N5667S	I_{CES2}	µA dc	—	100
Forward - Current Transfer Ratio	T_A = -55°C V_{CE} = 5 V dc, I_C = 1.0 A dc 2N5664, 2N5666, 2N5666S 2N5665, 2N5667, 2N5667S	h_{FE5}		15 10	
Dynamic Characteristics					
Magnitude of Common-Emitter Small - Signal Short - Circuit Forward -Current Transfer Ratio	V_{CE} = 5 V dc, I_C = 0.5 A dc, f = 10 MHz	$\lvert h_{FE} \rvert$		2.0	7.0
Open-Circuit Output Capacitance	V_{CB} = 10 V dc, 100 kHz ≤ f ≤ 1 MHz	C_{obo}	pF	—	120
Pulse Response					
Turn-On Time	V_{CC} = 100V dc, I_C = 1.0 A dc, 2N5664, 2N5666, 2N5666S 2N5665, 2N5667, 2N5667S	t_{on}	µs	—	0.25
Turn-Off Time	V_{CC} = 100V dc, I_C = 1.0 A dc, 2N5664, 2N5666, 2N5666S 2N5665, 2N5667, 2N5667S	t_{off}	µs	—	1.5 2.0

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

Ratings	Symbol	Max. Value
Collector-Base Voltage	V_{CBO}	2N5664, 2N5666, S; 2N5666U3 250 V dc 2N5665, 2N5667, S 400 V dc
Collector-Emitter Voltage	V_{CEO}	2N5664, 2N5666, S; 2N5666U3 200 V dc 2N5665, 2N5667, S 300 V dc
Emitter-Base Voltage	V_{EBO}	6 V dc
Collector Current	I_C	5 A dc
Base Current	I_B	1 A dc
Junction and Storage Temperature	T_{stg} + T_J	-65°C to + 200°C

Thermal Characteristics	Symbol	Max. Value
Thermal Resistance, Junction to Ambient 2N5664 2N5665 2N5666, 2N5666S 2N5666U3 2N5667, 2N5667S	$R_{\theta JA}$ (2)	 70°C/W 70°C/W 145°C/W 116°C/W 145°C/W
Thermal Resistance, Junction to Case 2N5664 2N5665 2N5666, 2N5666S 2N5666U3 2N5667, 2N5667S	$R_{\theta JC}$ (2)	 2.6°C/W 2.6°C/W 6.7°C/W 2.3°C/W 6.7°C/W

(2) For thermal impedance see figures 12, 13, 14 and 15 of MIL-PRF-19500/455

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

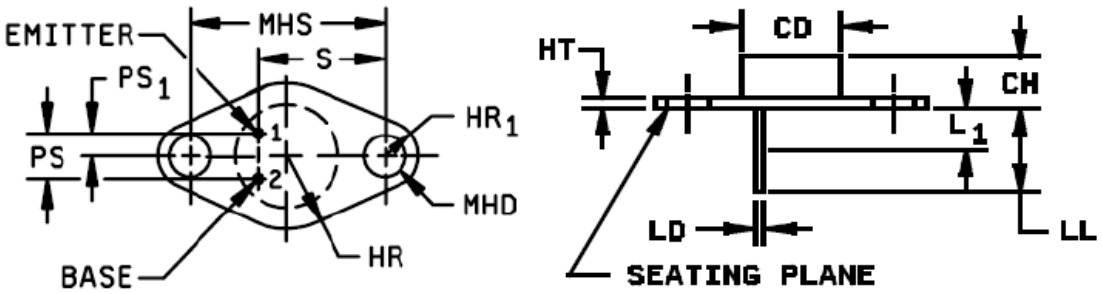
Characteristics	Symbol	Max. Value
T_A = +25°C 2N5664 2N5665 2N5666, 2N5666L 2N5666U3 2N5667, 2N5667S	P_T (1)	 2.5 W 2.5 W 1.2 W 1.5 W 1.2 W
T_C = +100°C 2N5664 2N5665 2N5666, 2N5666L 2N5666U3 2N5667, 2N5667S	P_T (2)	 30 W 30 W 15 W 35 W 15 W

(1) For derating see figures 7, 8, 9, 10 and 11 of MIL-PRF-19500/455

Safe Operating Area		
DC Tests:	T_C = +100°C; I Cycle; t ≥1.0s; $t_r + t_f$ = 10 µs	
Test 1:	V_{CE} = 6 V dc; I_C = 5 A dc	2N5664, 2N5665
Test 2:	V_{CE} = 32 V dc; I_C = 0.75 A dc V_{CE} = 40 V dc; I_C = 0.75 A dc	2N5664 2N5665
Test 3:	V_{CE} = 200 V dc; I_C = 29 mA dc V_{CE} = 300 V dc; I_C = 21 mA dc	2N5664 2N5665
DC Tests:	T_C = +100°C; I Cycle; t ≥1.0s; $t_r + t_f$ = 10 µs	
Test 1:	V_{CE} = 3.0 V dc; I_C = 5 A dc	2N5666, 2N5666S, 2N5667, 2N5667S
Test 2:	V_{CE} = 29 V dc; I_C = 0.4 A dc V_{CE} = 37.5 V dc; I_C = 0.4 A dc	2N5666, 2N5666S 2N5667, 2N5667S
Test 3:	V_{CE} = 200 V dc; I_C = 19 mA dc V_{CE} = 300 V dc; I_C = 14 mA dc	2N5666, 2N5666S 2N5667, 2N5667S

Safe Operating Area (Switching)	
Load condition B (clamped inductive load). T_C= + 100°C, $t_r + t_f$ ≤ 10 µs, duty cycle ≤ 2 percent; t_p = 4 ms; R_S = 0.5Ω, R_{BB1} = 50 Ω, V_{BB1} = 50 V dc, R_{BB2} = 50 Ω, V_{BB2} = -4 V dc, I_C = 5 A dc, V_{CC} = 50 V dc, R_L ≤ 2.5 Ω, L = 40 mH (Triad C-48U or equivalent)	
Clamp voltage = 200 +0, -5 V dc	2N5664, 2N5666, 2N5666S
Clamp voltage = 300 +0, -5 V dc	2N5665, 2N5667, 2N5667S

Outline Drawing (TO-66)

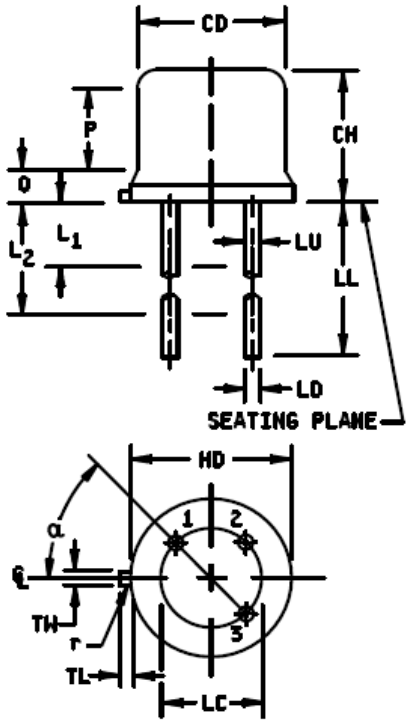


Ltr	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
CH	.250	.340	6.35	8.64	
LD	.028	.034	0.71	0.86	7,9
CD	.470	.500	11.94	12.70	2
PS	.190	.210	4.83	5.33	3
PS_1	.093	.107	2.36	2.72	3
HT	.050	.075	1.27	1.91	2, 5
LL	.360	.500	9.14	12.70	7
L_1		.050		1.27	4
MHD	.142	.152	3.61	3.86	
MHS	.958	.962	24.33	24.43	
HR		.350		8.89	
HR_1	.115	.145	2.92	3.68	
S	.570	.590	14.48	14.99	3

NOTES:
1. Dimensions are in inches. Millimeters are given for general information only.
2. Body contour is optional within zone defined by CD.
3. These dimensions shall be measured at points .050 inch (1.27 mm) to .055 inch (1.40 mm) below seating plane. When gauge is not used, measurement shall be made at seating plane.
4. Within this zone the lead diameter may vary to allow for lead finishes and irregularities.
5. HT dimension does not include sealing flanges.
6. The seating plane of header shall be flat within .001 inch (0.025 mm), concave to .004 inch (0.101 mm), convex inside a .520 inch (13.20 mm) diameter circle on the center of the header, and flat within .001 inch (0.025 mm), concave to .006 inch (0.152 mm), convex overall.
7. Both terminals.
8. The collector shall be electrically connected to the case.
9. LD applies between L_1 and LL. Lead diameter shall not exceed twice LD within L_1.
10. Pin 1 is the emitter, pin 2 is the base.
11. In accordance with ASME Y14.5M, diameters are equivalent to ϕx symbology.

FIGURE 1. Physical dimensions of transistor types 2N5664 and 2N5665 (TO-66).

Outline Drawing (TO-5, TO-39)



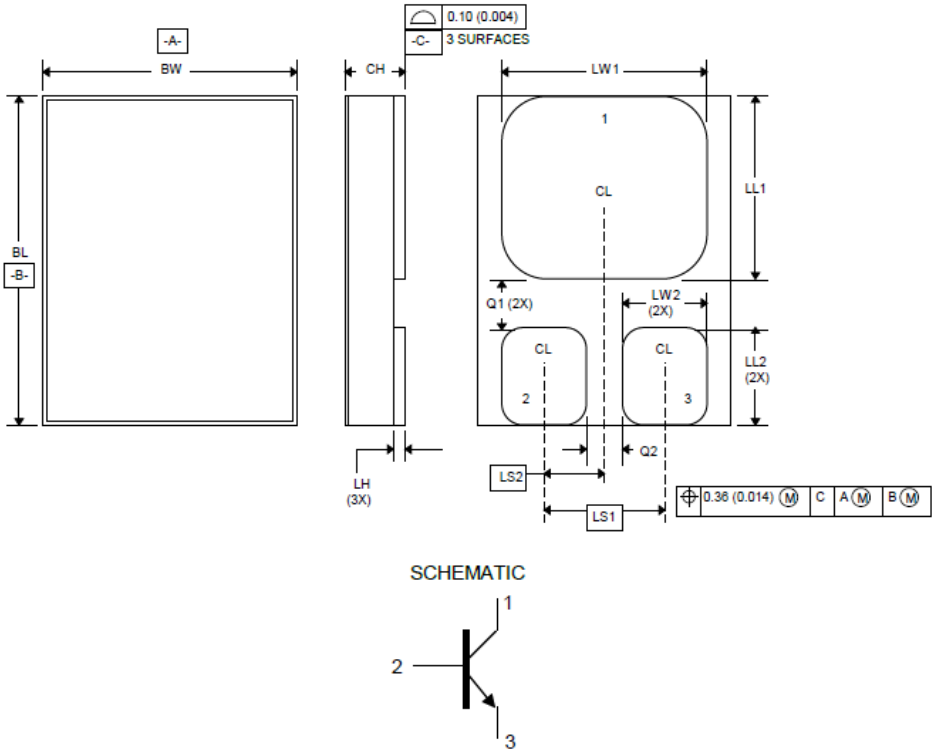
Ltr	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
CD	.305	.335	7.75	8.51	
CH	.240	.260	6.10	6.60	
HD	.335	.370	8.51	9.40	
LC	.200 TP		5.08 TP		6
LD	.016	.021	0.41	0.53	3
LL	See notes 13 and 14				
L_1		.050		1.27	10
L_2	.250		6.35		10
LU	.016	.019	0.41	0.48	4
P	.100		2.54		5
Q					6
r		.007		0.18	
α	45° TP		45° TP		7
TL	.029	.045	0.74	1.14	
TW	.028	.034	0.71	0.86	

NOTES:

1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. Measured in the zone beyond .250 inch (6.35 mm) from the seating plane.
4. Measured in the zone .050 inch (1.27 mm) and .250 inch (6.35 mm) from the seating plane.
5. Variations on dimension CD in this zone shall not exceed .010 inch (0.25 mm).
6. Outline in this zone is not controlled.
7. When measured in a gauging plane .054 inch +.001, -.000 (1.37 mm +.03, -.00) below the seating plane of the transistor, maximum diameter leads shall be within .007 inch (.18 mm) of their true location relative to a maximum width tab. Smaller diameter leads shall fall within the outline of the maximum diameter lead tolerance.
8. The collector shall be electrically connected to the case.
9. Measured from the maximum diameter of the actual device.
10. All three leads
11. Diameter of leads in this zone is not controlled.
12. Lead 1 - emitter; lead 2 - base, lead 3 - collector.
13. For transistor types 2N5666 and 2N5667, LL is 1.500 inch (38.1 mm) minimum and 1.75 inch (44.45 mm) maximum.
14. For transistor types 2N5666S and 2N5667S, LL is .500 inch (12.7 mm) minimum and .75 inch (19.05 mm) maximum.
15. In accordance with ASME Y14.5M, diameters are equivalent to ϕx symbology.

FIGURE 2. Physical dimensions of transistor types 2N5666, 2N5666S, 2N5667 and 2N5667S (TO-5 and TO-39).

Outline Drawing (U3 Package)



Ltr	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
BL	.395	.405	10.04	10.28
BW	.291	.301	7.40	7.64
CH	.1085	.1205	2.76	3.06
LH	.010	.020	0.25	0.51
LW1	.281	.291	7.14	7.39
LW2	.090	.100	2.29	2.54
LL1	.220	.230	5.59	5.84
LL2	.115	.125	2.93	3.17
LS1	.150 BSC		3.81 BSC	
LS2	.075 BSC		1.91 BSC	
Q1	.030		0.762	
Q2	.030		0.762	

NOTES:
1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. In accordance with ASME Y14.5M, diameters are equivalent to ϕx symbology.
4. Terminal 1 - collector, terminal 2 - base, terminal 3 - emitter.

FIGURE 3. Physical dimensions, surface mount (2N5666U3 version).