

2N5664, 2N5665, 2N5666, 2N5667

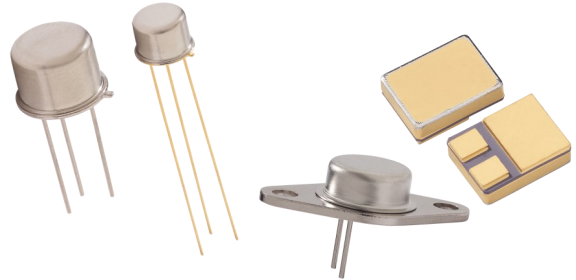


NPN High Voltage Power Silicon Transistor

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 ($T_A = +25^\circ\text{C}$ unless otherwise specified)

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

1

VPT Components and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice.
Visit www.vptcomponents.com for additional data sheets and product information.

For further information and support please visit:
info@vptcomponents.com

Electrical Characteristics ($T_A = +25^\circ\text{C}$ unless otherwise specified)

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

Absolute Maximum Ratings ($T_A = +25^\circ\text{C}$ 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 $+200^\circ\text{C}$

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

2N5664, 2N5665, 2N5666, 2N5667



NPN High Voltage Power Silicon Transistor

Rev. V1

Absolute Maximum Ratings ($T_A = +25^\circ\text{C}$ unless otherwise specified)

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

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

Safe Operating Area

DC Tests: $T_C = +100^\circ\text{C}$; 1 Cycle; $t \geq 1.0\text{s}$; $t_r + t_f = 10 \mu\text{s}$

Test 1: $V_{CE} = 6 \text{ V dc}$; $I_C = 5 \text{ A dc}$ 2N5664, 2N5665

Test 2: $V_{CE} = 32 \text{ V dc}$; $I_C = 0.75 \text{ A dc}$ 2N5664
 $V_{CE} = 40 \text{ V dc}$; $I_C = 0.75 \text{ A dc}$ 2N5665

Test 3: $V_{CE} = 200 \text{ V dc}$; $I_C = 29 \text{ mA dc}$ 2N5664
 $V_{CE} = 300 \text{ V dc}$; $I_C = 21 \text{ mA dc}$ 2N5665

DC Tests: $T_C = +100^\circ\text{C}$; 1 Cycle; $t \geq 1.0\text{s}$; $t_r + t_f = 10 \mu\text{s}$

Test 1: $V_{CE} = 3.0 \text{ V dc}$; $I_C = 5 \text{ A dc}$ 2N5666, 2N5666S, 2N5667, 2N5667S

Test 2: $V_{CE} = 29 \text{ V dc}$; $I_C = 0.4 \text{ A dc}$ 2N5666, 2N5666S
 $V_{CE} = 37.5 \text{ V dc}$; $I_C = 0.4 \text{ A dc}$ 2N5667, 2N5667S

Test 3: $V_{CE} = 200 \text{ V dc}$; $I_C = 19 \text{ mA dc}$ 2N5666, 2N5666S
 $V_{CE} = 300 \text{ V dc}$; $I_C = 14 \text{ mA dc}$ 2N5667, 2N5667S

Safe Operating Area (Switching)

Load condition B (clamped inductive load). $T_C = +100^\circ\text{C}$, $t_r + t_f \leq 10 \mu\text{s}$, duty cycle ≤ 2 percent; $t_p = 4 \text{ ms}$; $R_S = 0.5\Omega$, $R_{BB1} = 50 \Omega$, $V_{BB1} = 50 \text{ V dc}$, $R_{BB2} = 50 \Omega$, $V_{BB2} = -4 \text{ V dc}$, $I_C = 5 \text{ A dc}$, $V_{CC} = 50 \text{ V dc}$, $R_L \leq 2.5 \Omega$, $L = 40 \text{ mH}$ (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

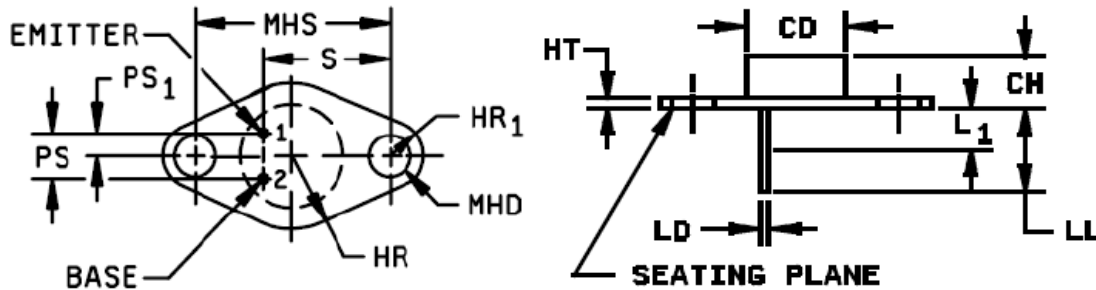
2N5664, 2N5665, 2N5666, 2N5667



NPN High Voltage Power Silicon Transistor

Rev. V1

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 L₁ and LL. Lead diameter shall not exceed twice LD within L₁.
10. Pin 1 is the emitter, pin 2 is the base.
11. In accordance with ASME Y14.5M, diameters are equivalent to ϕ x symbology.

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

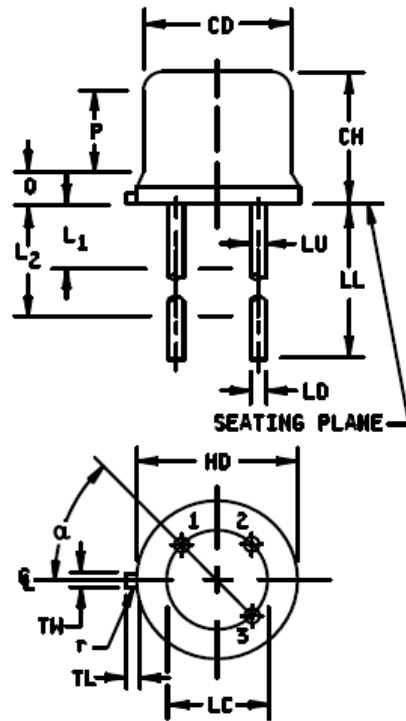
2N5664, 2N5665, 2N5666, 2N5667



NPN High Voltage Power Silicon Transistor

Rev. V1

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 ϕ x symbology.

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

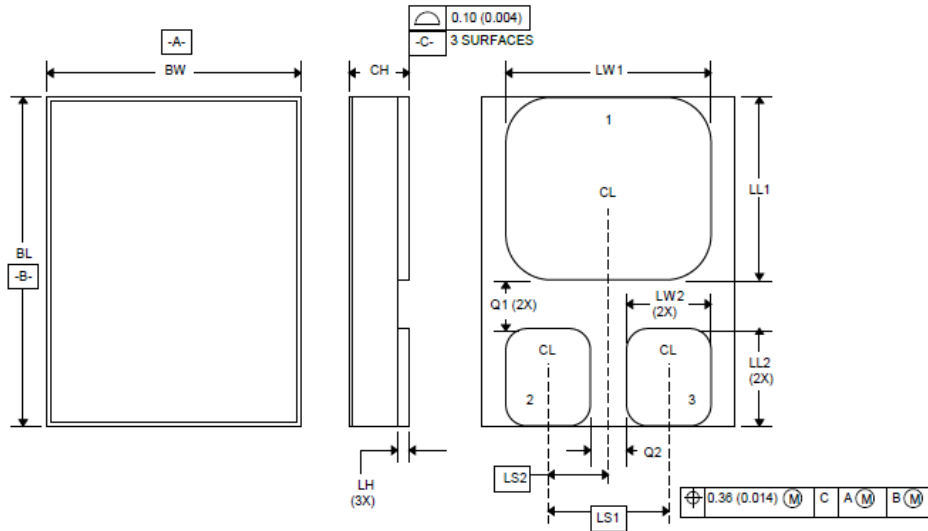
2N5664, 2N5665, 2N5666, 2N5667



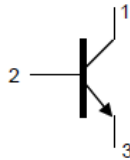
NPN High Voltage Power Silicon Transistor

Rev. V1

Outline Drawing (U3 Package)



SCHEMATIC



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).

VPT COMPONENTS. ALL RIGHTS RESERVED.

Information in this document is provided in connection with VPT Components products. These materials are provided by VPT Components as a service to its customers and may be used for informational purposes only. Except as provided in VPT Components Terms and Conditions of Sale for such products or in any separate agreement related to this document, VPT Components assumes no liability whatsoever. VPT Components assumes no responsibility for errors or omissions in these materials. VPT Components may make changes to specifications and product descriptions at any time, without notice. VPT Components makes no commitment to update the information and shall have no responsibility whatsoever for conflicts or incompatibilities arising from future changes to its specifications and product descriptions. No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document.

THESE MATERIALS ARE PROVIDED "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, RELATING TO SALE AND/OR USE OF VPT COMPONENTS PRODUCTS INCLUDING LIABILITY OR WARRANTIES RELATING TO FITNESS FOR A PARTICULAR PURPOSE, CONSEQUENTIAL OR INCIDENTAL DAMAGES, MERCHANTABILITY, OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT. VPT COMPONENTS FURTHER DOES NOT WARRANT THE ACCURACY OR COMPLETENESS OF THE INFORMATION, TEXT, GRAPHICS OR OTHER ITEMS CONTAINED WITHIN THESE MATERIALS. VPT COMPONENTS SHALL NOT BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, INCLUDING WITHOUT LIMITATION, LOST REVENUES OR LOST PROFITS, WHICH MAY RESULT FROM THE USE OF THESE MATERIALS.

VPT Components products are not intended for use in medical, lifesaving or life sustaining applications. VPT Components customers using or selling VPT Components products for use in such applications do so at their own risk and agree to fully indemnify VPT Components for any damages resulting from such improper use or sale.