

## NPN POWER SILICON TRANSISTOR

Qualified per MIL-PRF-19500/454

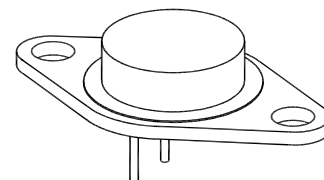
### DEVICES

**2N5660      2N5661      2N5662**  
**2N5660U3    2N5661U3    2N5663**

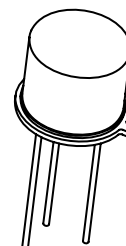
**LEVELS**  
**JAN**  
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### ABSOLUTE MAXIMUM RATINGS ( $T_C = +25^\circ\text{C}$ unless otherwise noted)

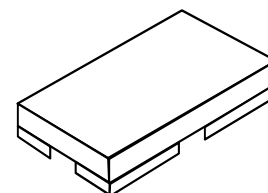
Parameters / Test Conditions	Symbol	2N5660 2N5662	2N5661 2N5663	Unit
Collector-Emitter Voltage	$V_{CEO}$	200	300	Vdc
Collector-Base Voltage	$V_{CBO}$	250	400	Vdc
Collector-Emitter Voltage	$V_{CER}$	250	400	Vdc
Emitter-Base Voltage	$V_{EBO}$	6		Vdc
Base Current	$I_B$	0.5		Adc
Collector Current	$I_C$	2.0		Adc
Operating & Storage Junction Temperature Range	$T_j, T_{stg}$	-65 to +200		$^\circ\text{C}$
		<b>2N5660 2N5661</b>	<b>2N5662 2N5663</b>	
Total Power Dissipation @ $T_A = +25^\circ\text{C}$ <sup>(1)</sup> @ $T_C = +100^\circ\text{C}$	$P_T$	2.0 <sup>(1)</sup> 20 <sup>(3)</sup>	1.0 <sup>(2)</sup> 15 <sup>(4)</sup>	W
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	5.0	6.7	$^\circ\text{C/W}$
Junction-to-Ambient	$R_{\theta JA}$	87.5	175	$^\circ\text{C/W}$
Thermal Resistance, Junction-to-Case <b>2N5660U3</b> <b>2N5661U3</b>	$R_{\theta JC}$	4.5 4.0		$^\circ\text{C/W}$



**TO-66**  
**2N5660, 2N5661**



**TO-5**  
**2N5662, 2N5663**



**U3**  
**2N5660U3, 2N5661U3**

### Note:

- Derate linearly 11.4mW/ $^\circ\text{C}$  for  $T_A > +25^\circ\text{C}$
- Derate linearly 5.7mW/ $^\circ\text{C}$  for  $T_A > +25^\circ\text{C}$
- Derate linearly 200mW/ $^\circ\text{C}$  for  $T_C > +100^\circ\text{C}$
- Derate linearly 150mW/ $^\circ\text{C}$  for  $T_C > +100^\circ\text{C}$

### ELECTRICAL CHARACTERISTICS ( $T_A = +25^\circ\text{C}$ , unless otherwise noted)

Parameters / Test Conditions	Symbol	Min.	Max.	Unit
<b>OFF CHARACTERISTICS</b>				
Collector-Emitter Breakdown Voltage $I_C = 10\text{mAdc}$	$V_{(BR)CEO}$	200		Vdc
2N5660, U3, 2N5662 2N5661, U3, 2N5663		300		
Collector-Base Breakdown Voltage $I_C = 10\text{mAdc}, R_{BE} = 100\Omega$	$V_{(BR)CER}$	250		Vdc
2N5660, U3, 2N5662 2N5661, U3, 2N5663		400		

## ELECTRICAL CHARACTERISTICS ( $T_A = +25^\circ\text{C}$ , unless otherwise noted)

Parameters / Test Conditions	Symbol	Min.	Max.	Unit
<b>OFF CHARACTERISTICS</b>				
Emitter-Base Breakdown Voltage $I_E = 10\mu\text{A}$	$V_{(BR)EBO}$	6.0		Vdc
Collector-Emitter Cutoff Current $V_{CE} = 200\text{Vdc}$ $V_{CE} = 300\text{Vdc}$	$I_{CES}$		0.2 0.2	$\mu\text{A}$
Collector-Base Cutoff Current $V_{CB} = 200\text{Vdc}$ $V_{CB} = 250\text{Vdc}$ $V_{CB} = 300\text{Vdc}$ $V_{CB} = 400\text{Vdc}$	$I_{CBO}$		0.1 1.0 0.1 1.0	$\mu\text{A}$ mA $\mu\text{A}$ mA
<b>ON CHARACTERISTICS <sup>(5)</sup></b>				
Forward-Current Transfer Ratio $I_C = 50\text{mA}$ , $V_{CE} = 2.0\text{Vdc}$ $I_C = 0.5\text{A}$ , $V_{CE} = 5.0\text{Vdc}$ $I_C = 1.0\text{A}$ , $V_{CE} = 5.0\text{Vdc}$ $I_C = 2.0\text{A}$ , $V_{CE} = 5.0\text{Vdc}$	$h_{FE}$		40 25 40 25 15 5.0	120 75
Collector-Emitter Saturation Voltage $I_C = 1.0\text{A}$ , $I_B = 0.1\text{A}$ $I_C = 2.0\text{A}$ , $I_B = 0.4\text{A}$	$V_{CE(sat)}$			0.4 0.8 Vdc
Base-Emitter Saturation Voltage $I_C = 1.0\text{A}$ , $I_B = 0.1\text{A}$ $I_C = 2.0\text{A}$ , $I_B = 0.4\text{A}$	$V_{BE(sat)}$			1.2 1.5 Vdc

## DYNAMIC CHARACTERISTICS

Parameters / Test Conditions	Symbol	Min.	Max.	Unit
Magnitude of Common Emitter Small-Signal Short-Circuit Forward Current Transfer Ratio $I_C = 0.1\text{A}$ , $V_{CE} = 5.0\text{Vdc}$ , $f = 10\text{MHz}$	$ h_{fe} $	2.0	7.0	
Output Capacitance $V_{CB} = 10\text{Vdc}$ , $I_E = 0$ , $100\text{kHz} \leq f \leq 1.0\text{MHz}$	$C_{obo}$		45	pF

## SWITCHING CHARACTERISTICS

Parameters / Test Conditions	Symbol	Min.	Max.	Unit
Turn-On Time $V_{CC} = 100\text{Vdc}$ ; $I_C = 0.5\text{A}$ ; $I_{B1} = 15\text{mA}$ $V_{CC} = 100\text{Vdc}$ ; $I_C = 0.5\text{A}$ ; $I_{B1} = 25\text{mA}$	$t_{on}$		0.25 0.25	$\mu\text{s}$
Turn-Off Time $V_{CC} = 100\text{Vdc}$ ; $I_C = 0.5\text{A}$ ; $I_{B1} = -I_{B2} = 15\text{mA}$ $V_{CC} = 100\text{Vdc}$ ; $I_C = 0.5\text{A}$ ; $I_{B1} = -I_{B2} = 25\text{mA}$	$t_{off}$		0.85 1.2	$\mu\text{s}$

**SAFE OPERATING AREA****DC Test**

$T_C = +100^\circ\text{C}$ , 1 cycle,  $t \geq 1.0\text{s}$

**Test 1**

$V_{CE} = 10\text{Vdc}$ ,  $I_C = 2.0\text{A}$ dc                      2N5660, U3, 2N5661, U3

$V_{CE} = 7.5\text{Vdc}$ ,  $I_C = 2.0\text{A}$ dc                      2N5662, 2N5663

**Test 2**

$V_{CE} = 40\text{Vdc}$ ,  $I_C = 500\text{mA}$ dc                      2N5660, U3, 2N5661, U3

$V_{CE} = 25\text{Vdc}$ ,  $I_C = 600\text{mA}$ dc                      2N5662, 2N5663

**Test 3**

$V_{CE} = 200\text{Vdc}$ ,  $I_C = 36\text{mA}$ dc                      2N5660, U3

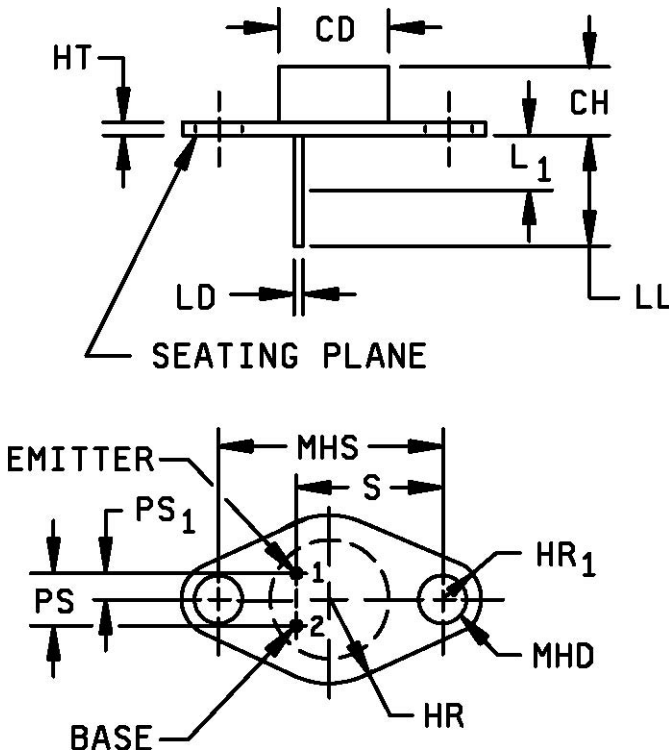
$V_{CE} = 200\text{Vdc}$ ,  $I_C = 27\text{mA}$ dc                      2N5662

**Test 4**

$V_{CE} = 300\text{Vdc}$ ,  $I_C = 19\text{mA}$ dc                      2N5661, U3

$V_{CE} = 300\text{Vdc}$ ,  $I_C = 14\text{mA}$ dc                      2N5663

(5) Pulse Test: Pulse Width =  $300\mu\text{s}$ , Duty Cycle  $\leq 2.0\%$ .

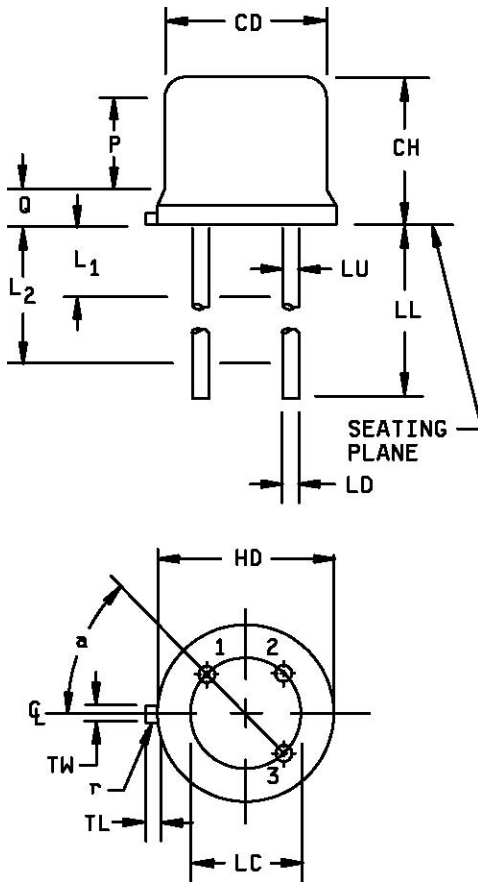
**PACKAGE DIMENSIONS**


Ltr	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
CD	.470	.500	11.94	12.70	7
CH	.250	.340	6.35	8.64	
HR		.350		8.89	
HR <sub>1</sub>	.115	.145	2.92	3.68	4
HT	.050	.075	1.27	1.91	
LD	.028	.034	0.71	0.86	4, 6
LL	.360	.500	9.14	12.70	4
L <sub>1</sub>		.050		1.27	4, 6
MHD	.142	.152	3.61	3.86	4
MHS	.958	.962	24.33	24.43	
PS	.190	.210	4.83	5.33	3
PS <sub>1</sub>	.093	.107	2.36	2.72	3
S	.570	.590	14.48	14.99	3

**NOTES:**

- 1 Dimensions are in inches.
- 2 Millimeters are given for general information only.
- 3 These dimensions should be measured at points .050 inch (1.27 mm) +.005 inch (0.13 mm) -.000 inch (0.00 mm) below seating plane. When gauge is not used, measurement will be made at the seating plane.
- 4 Two places.
- 5 The seating plane of the header shall be flat within .001 inch (0.03 mm) concave to .004 inch (0.10 mm) convex inside a .930 inch (23.62 mm) diameter circle on the center of the header and flat within .001 inch (0.03 mm) concave to .006 inch (0.15 mm) convex overall.
- 6 Lead diameter shall not exceed twice LD within L<sub>1</sub>.
- 7 Body contour is optional within zone defined by CD.
- 8 In accordance with ASME Y14.5M, diameters are equivalent to  $\phi x$  symbology.
- 9 Lead 1 is emitter, lead 2 is base, and case is collector.

**FIGURE 1.** Physical dimensions, 2N5660 and 2N5661, (similar to TO-66).



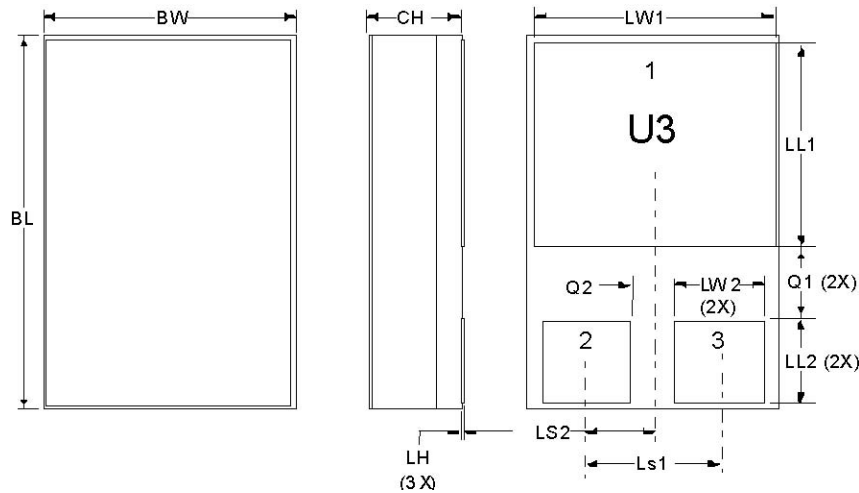
Ltr	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
CD	.305	.355	7.75	9.02	
CH	.240	.260	6.10	6.60	
HD	.335	.370	8.51	9.40	
LC	.200 TP		5.08 TP		6
LD	.016	.021	0.41	0.53	7
LL	1.500	1.750	38.10	44.45	7
LU	.016	.019	0.407	0.482	7
L <sub>1</sub>		.050		1.27	7
L <sub>2</sub>	.250		6.35		7
TL	.029	.045	0.74	1.14	3
TW	.028	.034	0.712	0.863	9
P	.100		2.54		
Q		.050		1.27	4
r		.010		0.25	10
$\alpha$	45° TP		45° TP		6

**NOTES:**

- Dimensions are in inches.
- Millimeters are given for general information only.
- Symbol TL is measured from HD maximum.
- Details of outline in this zone are optional.
- Symbol CD shall not vary more than .010 inch (0.25 mm) in zone P. This zone is controlled for automatic handling.
- Leads at gauge plane .054 inch (1.37 mm) +.001 inch (0.03 mm) - .000 inch (0.00 mm) below seating plane shall be within .007 inch (0.18 mm) radius of TP relative to tab. Device may be measured by direct methods or by gauge.
- Symbol LU applies between L<sub>1</sub> and L<sub>2</sub>. Dimension LD applies between L<sub>2</sub> and LL minimum.
- Lead number three is electrically connected to case.
- Beyond r maximum, TW shall be held for a minimum length of .011 inch (0.28 mm).
- Symbol r applied to both inside corners of tab.
- In accordance with ASME Y14.5M, diameters are equivalent to  $\phi$ x symbology.
- Lead 1 is emitter, lead 2 is base, and lead 3 is collector.

**FIGURE 2.** Physical dimensions, 2N5662 and 2N5663, (similar to TO-5)

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Symbol	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
LW <sub>1</sub>	.281	.291	7.14	7.39
LW <sub>2</sub>	.090	.100	2.29	2.54
LL <sub>1</sub>	.220	.230	5.59	5.84
LL <sub>2</sub>	.115	.125	2.93	3.17
LS <sub>1</sub>	.150 BSC		3.81 BSC	
LS <sub>2</sub>	.075 BSC		1.91 BSC	
Q <sub>1</sub>	.030		0.762	
Q <sub>2</sub>	.030		0.762	
Term 1	Collector			
Term 2	Base			
Term 3	Emitter			

**FIGURE 3.** Physical dimensions, 2N5660U3 and 2N5661U3(U3).

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