



## NPN MEDIUM POWER SILICON TRANSISTOR

**Qualified per MIL-PRF-19500/349**

*Qualified Levels:  
JAN, JANTX and  
JANTXV*

### DESCRIPTION

This family of 2N3506 through 2N3507A high-frequency, epitaxial planar transistors feature low saturation voltage. These devices are also available in TO-5 and low profile U4 packaging. Microsemi also offers numerous other transistor products to meet higher and lower power ratings with various switching speed requirements in both through-hole and surface-mount packages.

**Important:** For the latest information, visit our website <http://www.microsemi.com>.

### FEATURES

- JEDEC registered 2N3506 through 2N3507A series.
- RoHS compliant versions available (commercial grade only).
- $V_{CR(sat)} = 0.5 \text{ V @ } I_C = 500 \text{ mA}$ .
- Rise time  $t_r = 30 \text{ ns max @ } I_C = 1.5 \text{ A, } I_{B1} = 150 \text{ mA}$ .
- Fall time  $t_f = 35 \text{ ns max @ } I_C = 1.5 \text{ A, } I_{B1} = I_{B2} = 150 \text{ mA}$ .

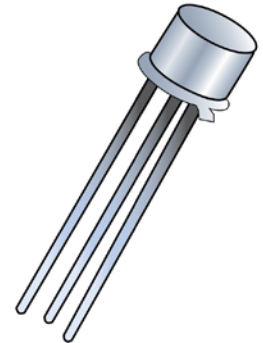
### APPLICATIONS / BENEFITS

- General purpose transistors for medium power applications requiring high frequency switching and low package profile.
- Military and other high-reliability applications.

### MAXIMUM RATINGS


Parameters / Test Conditions	Symbol	2N3506	2N3507	Unit
Collector-Emitter Voltage	$V_{CEO}$	40	50	V
Collector-Base Voltage	$V_{CBO}$	60	80	V
Emitter-Base Voltage	$V_{EBO}$	5.0		V
Thermal Resistance Junction-to-Ambient	$R_{\theta JA}$	175		$^{\circ}\text{C/W}$
Thermal Resistance Junction-to-Case	$R_{\theta JC}$	18		$^{\circ}\text{C/W}$
Collector Current	$I_C$	3.0		A
Total Power Dissipation	$P_D$	@ $T_A = +25 \text{ }^{\circ}\text{C}$ <sup>(1)</sup>		W
		@ $T_C = +110 \text{ }^{\circ}\text{C}$ <sup>(2)</sup>		
Operating & Storage Junction Temperature Range	$T_J, T_{stg}$	-65 to +200		$^{\circ}\text{C}$


- Notes:**
1. Derate linearly 5.71 mW/ $^{\circ}\text{C}$  for  $T_A > +25 \text{ }^{\circ}\text{C}$ .
  2. Derate linearly 55.5 mW/ $^{\circ}\text{C}$  for  $T_C > +110 \text{ }^{\circ}\text{C}$ .



**TO-39 (TO-205AD) Package**

Also available in:

**TO-5 package**  
(long-leaded)  
 [2N3506L – 2N3507AL](#)

**U4 package**  
(surface mount)  
 [2N3506U4 – 2N3507AU4](#)

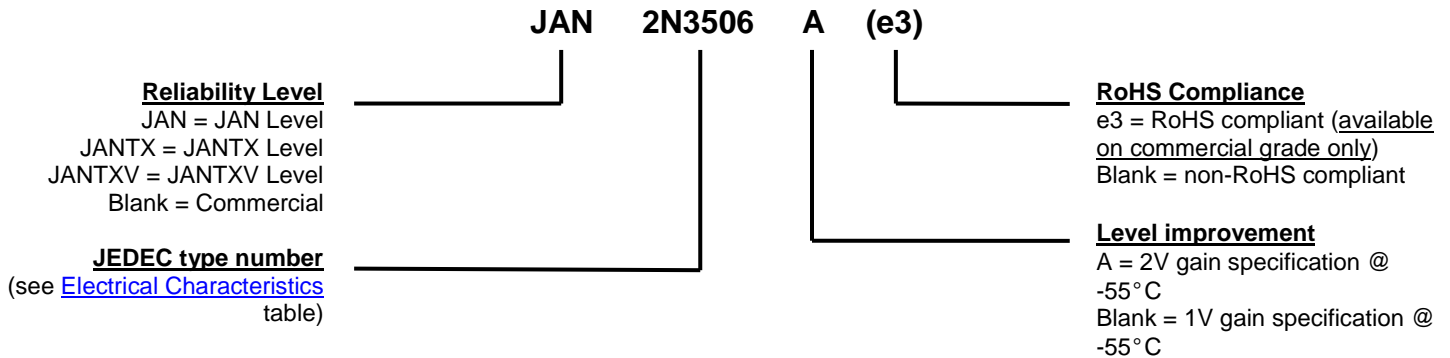
**MSC – Lawrence**  
6 Lake Street,  
Lawrence, MA 01841  
Tel: 1-800-446-1158 or  
(978) 620-2600  
Fax: (978) 689-0803

**MSC – Ireland**  
Gort Road Business Park,  
Ennis, Co. Clare, Ireland  
Tel: +353 (0) 65 6840044  
Fax: +353 (0) 65 6822298

**Website:**  
[www.microsemi.com](http://www.microsemi.com)

**MECHANICAL and PACKAGING**

- CASE: Hermetically sealed, kovar base, nickel cap.
- TERMINALS: Leads are kovar, nickel plated, and finish is solder dip (Sn63/Pb37). Can be RoHS compliant (commercial grade only) with pure matte-tin (commercial grade only).
- MARKING: Part number, date code, manufacturer's ID.
- POLARITY: NPN (see package outline).
- WEIGHT: Approximately 1.064 grams.
- See [Package Dimensions](#) on last page.

**PART NOMENCLATURE**

**SYMBOLS & DEFINITIONS**

Symbol	Definition
$C_{obo}$	Common-base open-circuit output capacitance.
$I_{CEO}$	Collector cutoff current, base open.
$I_{CEX}$	Collector cutoff current, circuit between base and emitter.
$I_{EBO}$	Emitter cutoff current, collector open.
$h_{FE}$	Common-emitter static forward current transfer ratio.
$V_{CEO}$	Collector-emitter voltage, base open.
$V_{CBO}$	Collector-emitter voltage, emitter open.
$V_{EBO}$	Emitter-base voltage, collector open.

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

**OFF CHARACTERISTICS**

Parameters / Test Conditions	Symbol	Min.	Max.	Unit
Collector-Emitter Breakdown Voltage $I_C = 10\text{ mA}$	$V_{(BR)CEO}$	40		V
2N3506		50		
2N3507				
Collector-Emitter Cutoff Current $V_{CE} = 40\text{ V}; V_{EB} = 4\text{ V}$ $V_{CE} = 60\text{ V}; V_{EB} = 4\text{ V}$	$I_{CEX}$		1.0	$\mu\text{A}$
2N3506			1.0	
2N3507				
Collector-Base Breakdown Voltage $I_C = 100\text{ }\mu\text{A}$	$V_{(BR)CBO}$	60		V
2N3506		80		
2N3507				
Emitter-Base Breakdown Voltage $I_E = 10\text{ }\mu\text{A}$	$V_{(BR)EBO}$	5		V

**ON CHARACTERISTICS** <sup>(1)</sup>

Parameters / Test Conditions	Symbol	Min.	Max.	Unit
Forward-Current Transfer Ratio $I_C = 500\text{ mA}, V_{CE} = 1\text{ V}$	$h_{FE}$	50	250	
2N3506		35	175	
2N3507				
Forward-Current Transfer Ratio $I_C = 1.5\text{ A}, V_{CE} = 2\text{ V}$	$h_{FE}$	40	200	
2N3506		30	150	
2N3507				
Forward-Current Transfer Ratio $I_C = 2.5\text{ A}, V_{CE} = 3\text{ V}$	$h_{FE}$	30		
2N3506		25		
2N3507				
Forward-Current Transfer Ratio $I_C = 3.0\text{ A}, V_{CE} = 5\text{ V}$	$h_{FE}$	25		
2N3506		20		
2N3507				
Forward-Current Transfer Ratio $I_C = 500\text{ mA}, V_{CE} = 1.0\text{ V @ } -55^\circ\text{C}$	$h_{FE}$	25		
2N3506		17		
2N3507				
Forward-Current Transfer Ratio $I_C = 500\text{ mA}, V_{CE} = 2.0\text{ V @ } -55^\circ\text{C}$	$h_{FE}$	25		
2N3506A		17		
2N3507A				
Collector-Emitter Saturation Voltage $I_C = 500\text{ mA}, I_B = 50\text{ mA}$	$V_{CE(sat)}$		0.5	V
Collector-Emitter Saturation Voltage $I_C = 1.5\text{ A}, I_B = 150\text{ mA}$	$V_{CE(sat)}$		1.0	V
Collector-Emitter Saturation Voltage $I_C = 2.5\text{ A}, I_B = 250\text{ mA}$	$V_{CE(sat)}$		1.5	V
Base-Emitter Saturation Voltage $I_C = 500\text{ mA}, I_B = 50\text{ mA}$	$V_{BE(sat)}$		1.0	V
Base-Emitter Saturation Voltage $I_C = 1.5\text{ A}, I_B = 150\text{ mA}$	$V_{BE(sat)}$	0.8	1.3	V
Base-Emitter Saturation Voltage $I_C = 2.5\text{ A}, I_B = 250\text{ mA}$	$V_{BE(sat)}$		2.0	V

(1) Pulse Test: Pulse Width = 300  $\mu\text{s}$ , duty cycle  $\leq 2.0\%$ .

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

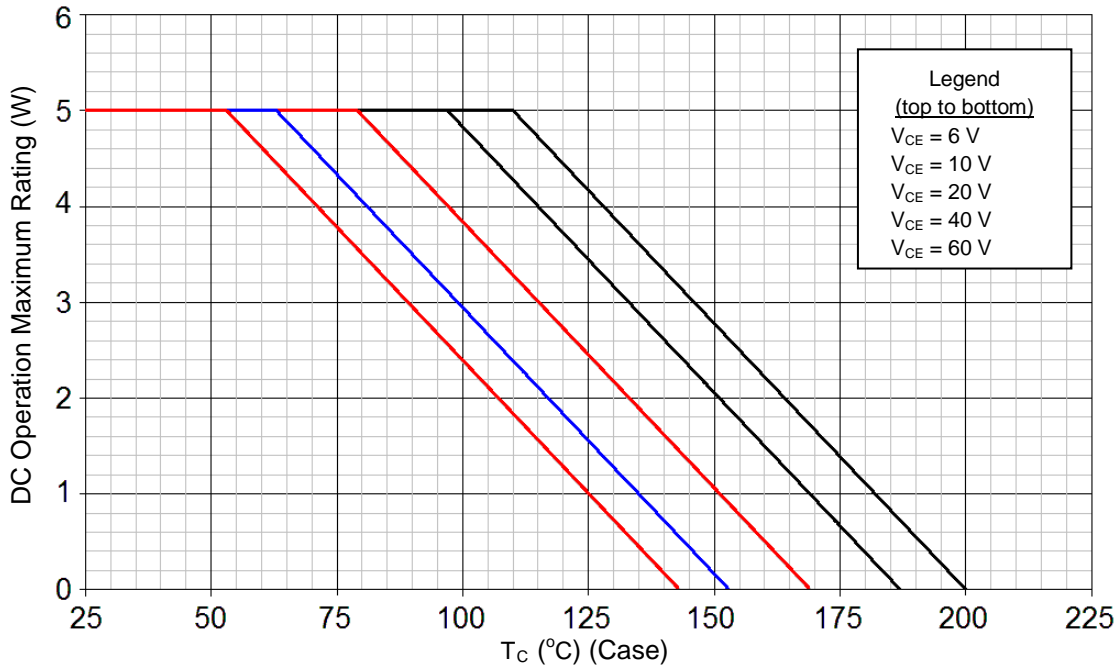
Parameters / Test Conditions	Symbol	Min.	Max.	Unit
Magnitude of Common Emitter Small-Signal Short-Circuit Forward Current Transfer Ratio $I_C = 100\text{ mA}$ , $V_{CE} = 5\text{ V}$ , $f = 20\text{ MHz}$	$ h_{fe} $	3.0	15	
Output Capacitance $V_{CB} = 10\text{ V}$ , $I_E = 0$ , $100\text{ kHz} \leq f \leq 1.0\text{ MHz}$	$C_{obo}$		40	pF
Input Capacitance $V_{EB} = 3.0\text{ V}$ , $I_C = 0$ , $100\text{ kHz} \leq f \leq 1.0\text{ MHz}$	$C_{ibo}$		300	pF

**SWITCHING CHARACTERISTICS <sup>(2)</sup>**

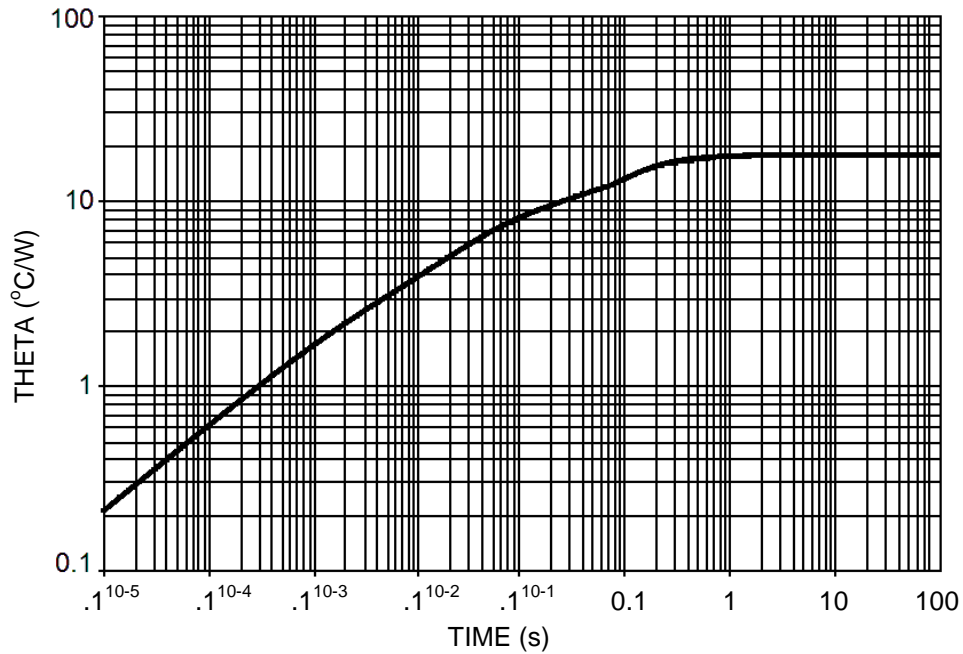
Parameters / Test Conditions	Symbol	Min.	Max.	Unit
Delay Time $I_C = 1.5\text{ A}$ , $I_{B1} = 150\text{ mA}$	$t_d$		15	ns
Rise Time $I_C = 1.5\text{ A}$ , $I_{B1} = 150\text{ mA}$	$t_r$		30	ns
Storage Time $I_C = 1.5\text{ A}$ , $I_{B1} = I_{B2} = 150\text{ mA}$	$t_s$		55	ns
Fall Time $I_C = 1.5\text{ A}$ , $I_{B1} = I_{B2} = 150\text{ mA}$	$t_f$		35	ns

(2) Consult MIL-PRF-19500/349 for additional information.

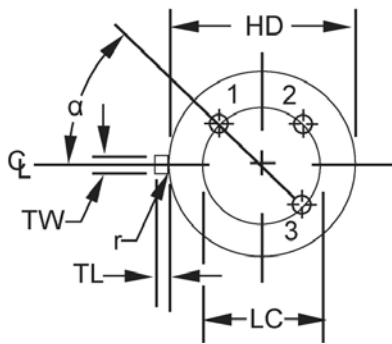
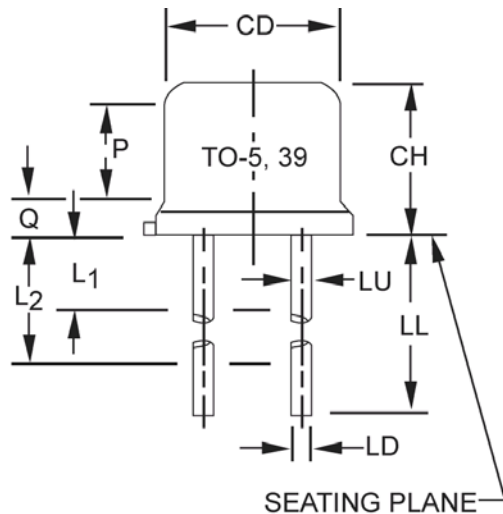
GRAPHS



**FIGURE 1**  
Temperature-Power Derating Curve  
**NOTE:** Thermal Resistance Junction to Case = 18.0 °C/W



**FIGURE 2**  
Maximum Thermal Impedance ( $R_{\theta JC}$ )

**PACKAGE DIMENSIONS**


Symbol	Dimensions				Note
	Inches		Millimeters		
	Min	Max	Min	Max	
<b>CD</b>	0.305	0.335	7.75	8.51	
<b>CH</b>	0.240	0.260	6.10	6.60	
<b>HD</b>	0.335	0.370	8.51	9.40	
<b>LC</b>	0.200 TP		5.08 TP		6
<b>LD</b>	0.016	0.021	0.41	0.53	7, 8
<b>LL</b>	See notes 7, 8, 11				
<b>LU</b>	0.016	0.019	0.41	0.48	7, 8
<b>L1</b>		0.050		1.27	7, 8
<b>L2</b>	0.250		6.35		7, 8
<b>P</b>	0.100		2.54		5
<b>Q</b>		0.050		1.27	4
<b>TL</b>	0.029	0.045	0.74	1.14	3
<b>TW</b>	0.028	0.034	0.71	0.86	2
<b>r</b>		0.010		0.25	10
<b>α</b>	45° TP		45° TP		6

**NOTES:**

1. Dimension are in inches.
2. Millimeters are given for general information only.
3. Beyond r (radius) maximum, TH shall be held for a minimum length of .011 (0.28 mm).
4. Dimension TL measured from maximum HD.
5. Body contour optional within zone defined by HD, CD, and Q.
6. Leads at gauge plane .054 +.001 -.000 inch (1.37 +0.03 -0.00 mm) below seating plane shall be within .007 inch (0.18 mm) radius of true position (TP) at maximum material condition (MMC) relative to tab at MMC.
7. Dimension LU applies between L1 and L2. Dimension LD applies between L2 and LL minimum. Diameter is uncontrolled in L1 and beyond LL minimum.
8. All three leads.
9. The collector shall be internally connected to the case.
10. Dimension r (radius) applies to both inside corners of tab.
11. Dimension LL shall be .5 inches (12.7mm) minimum and .75 inches (19.0 mm) maximum.
12. In accordance with ASME Y14.5M, diameters are equivalent to Φx symbology.
13. Lead 1 = emitter, lead 2 = base, lead 3 = collector.



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**Телефон:** +7 812 627 14 35

**Электронная почта:** [sales@st-electron.ru](mailto:sales@st-electron.ru)

**Адрес:** 198099, Санкт-Петербург,  
Промышленная ул, дом № 19, литера Н,  
помещение 100-Н Офис 331