

# NPN Epitaxial Silicon Transistor

## KSD1616A

### Features

- Audio Frequency Power Amplifier and Medium Speed Switching
- Complement to KSB1116/KSB1116A
- These are Pb-Free Devices

### ABSOLUTE MAXIMUM RATINGS

(Values are at  $T_A = 25^\circ\text{C}$  unless otherwise noted.)

| Symbol    | Parameter                          | Value      | Unit             |
|-----------|------------------------------------|------------|------------------|
| $V_{CBO}$ | Collector-Base Voltage             | 120        | V                |
| $V_{CEO}$ | Collector-Emitter Voltage          | 60         | V                |
| $V_{EBO}$ | Emitter-Base Voltage               | 6          | V                |
| $I_C$     | Collector Current (DC)             | 1          | A                |
| $I_{CP}$  | Collector Current (Pulse) (Note 1) | 2          | A                |
| $T_J$     | Junction Temperature               | 150        | $^\circ\text{C}$ |
| $T_{STG}$ | Storage Temperature                | -55 to 150 | $^\circ\text{C}$ |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Pulse width  $\leq 10$  ms, duty cycle  $< 50\%$ .

### THERMAL CHARACTERISTICS

(Values are at  $T_A = 25^\circ\text{C}$  unless otherwise noted.)

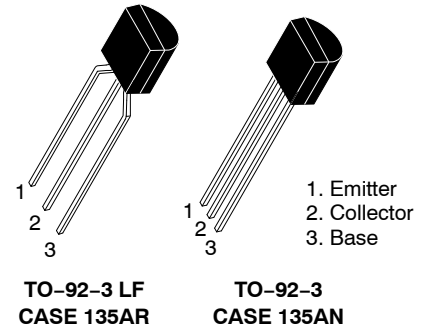
| Symbol          | Parameter                               | Max  | Unit                      |
|-----------------|---|------|---------------------------|
| $P_D$           | Total Device Dissipation                | 0.75 | W                         |
|                 | Derate Above $25^\circ\text{C}$         | 6    | mW/ $^\circ\text{C}$      |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | 160  | $^\circ\text{C}/\text{W}$ |

2. PCB size: FR-4, 76 mm  $\times$  114 mm  $\times$  1.57 mm (3.0 inch  $\times$  4.5 inch  $\times$  0.062 inch) with minimum land pattern size.

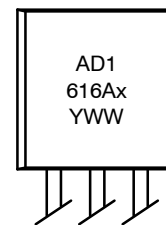


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### MARKING DIAGRAM



A = Assembly Location  
D1616Ax = Specific Device Code  
x = G or Y  
Y = Year of Production  
WW = Work Week Number

### ORDERING INFORMATION

| Device      | Package              | Shipping                |
|-------------|----------------------|-------------------------|
| KSD1616AGBU | TO-92-3 (Pb-Free)    | 10,000 Units / Bulk Bag |
| KSD1616AGTA | TO-92-3 LF (Pb-Free) | 2,000 Units / Fan-Fold  |
| KSD1616AYTA | TO-92-3 LF (Pb-Free) | 2,000 Units / Fan-Fold  |

# KSD1616A

## ELECTRICAL CHARACTERISTICS

(Values are at  $T_A = 25^\circ\text{C}$  unless otherwise noted.)

| Symbol        | Parameter                                     | Conditions  | Min | Typ  | Max  | Unit          |
|---------------|---|---|-----|------|------|---------------|
| $BV_{CBO}$    | Collector-Base Breakdown Voltage              | $I_C = 100 \mu\text{A}, I_E = 0$  | 120 | -    | -    | V             |
| $BV_{CEO}$    | Collector-Emitter Breakdown Voltage           | $I_C = 1 \text{ mA}, I_B = 0$   | 60  | -    | -    | V             |
| $BV_{EBO}$    | Emitter-Base Breakdown Voltage                | $I_E = 100 \mu\text{A}, I_C = 0$  | 6   | -    | -    | V             |
| $I_{CBO}$     | Collector Cut-Off Current                     | $V_{CB} = 60 \text{ V}, I_E = 0$  | -   | -    | 100  | nA            |
| $I_{EBO}$     | Emitter Cut-Off Current                       | $V_{EB} = 6 \text{ V}, I_C = 0$   | -   | -    | 100  | nA            |
| $h_{FE1}$     | DC Current Gain                               | $V_{CE} = 2 \text{ V}, I_C = 100 \text{ mA}$  | 135 | -    | 400  |               |
| $h_{FE2}$     | DC Current Gain                               | $V_{CE} = 2 \text{ V}, I_C = 1 \text{ A}$   | 81  | -    | -    |               |
| $V_{BE(on)}$  | Base-Emitter On Voltage (Note 3)              | $V_{CE} = 2 \text{ V}, I_C = 50 \text{ mA}$   | 600 | 640  | 700  | mV            |
| $V_{CE(sat)}$ | Collector-Emitter Saturation Voltage (Note 3) | $I_C = 1 \text{ A}, I_B = 50 \text{ mA}$  | -   | 0.15 | 0.30 | V             |
| $V_{BE(sat)}$ | Base-Emitter Saturation Voltage (Note 3)      | $I_C = 1 \text{ A}, I_B = 50 \text{ mA}$  | -   | 0.9  | 1.2  | V             |
| $C_{ob}$      | Output Capacitance                            | $V_{CE} = 10 \text{ V}, I_E = 0, f = 1 \text{ MHz}$   | -   | 19   | -    | pF            |
| $f_T$         | Current Gain Bandwidth Product                | $V_{CE} = 2 \text{ V}, I_C = 100 \text{ mA}$  | 100 | 160  | -    | MHz           |
| $t_{ON}$      | Turn-On Time                                  | $V_{CC} = 10 \text{ V}, I_C = 100 \text{ mA},$<br>$I_{B1} = -I_{B2} = 10 \text{ mA},$<br>$V_{BE(off)} = -2 \text{ V} \sim -3 \text{ V}$ | -   | 0.07 | -    | $\mu\text{s}$ |
| $t_{STG}$     | Storage Time                                  |   | -   | 0.95 | -    | $\mu\text{s}$ |
| $t_F$         | Fall Time                                     |   | -   | 0.07 | -    | $\mu\text{s}$ |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

3. Pulse test: pulse width  $< 350 \mu\text{s}$ , duty cycle  $\leq 2\%$  pulsed.

## $h_{FE}$ CLASSIFICATION

| Classification | Y         | G         |
|----------------|-----------|-----------|
| $h_{FE1}$      | 135 ~ 270 | 200 ~ 400 |

TYPICAL PERFORMANCE CHARACTERISTICS

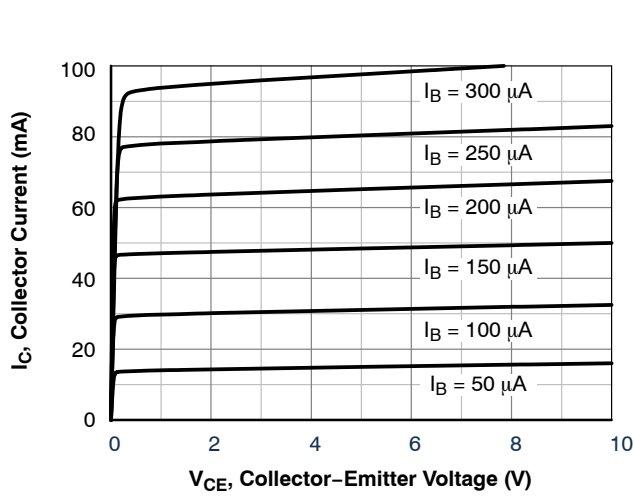


Figure 1. Static Characteristic

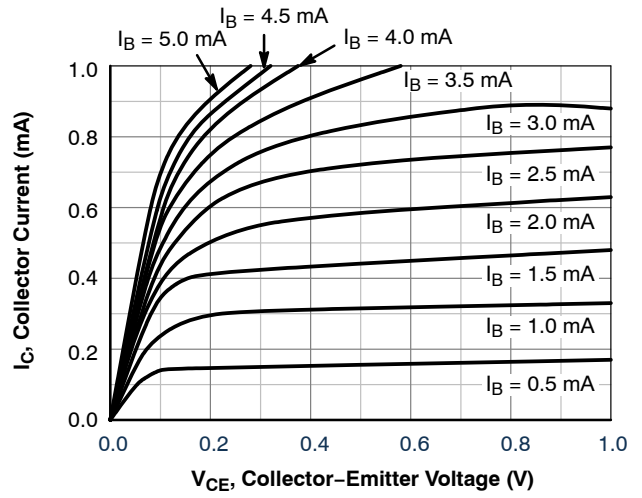


Figure 2. Static Characteristic

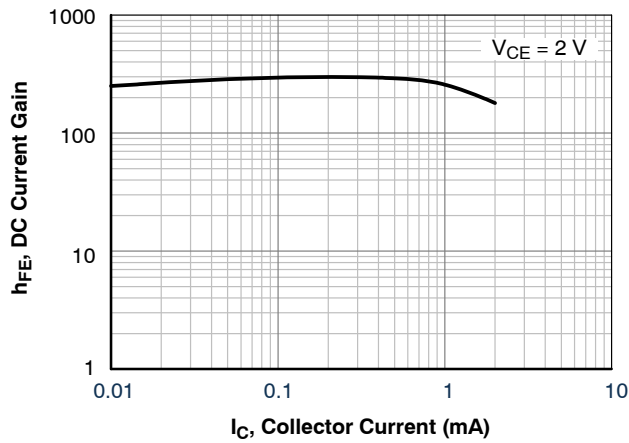


Figure 3. DC Current Gain

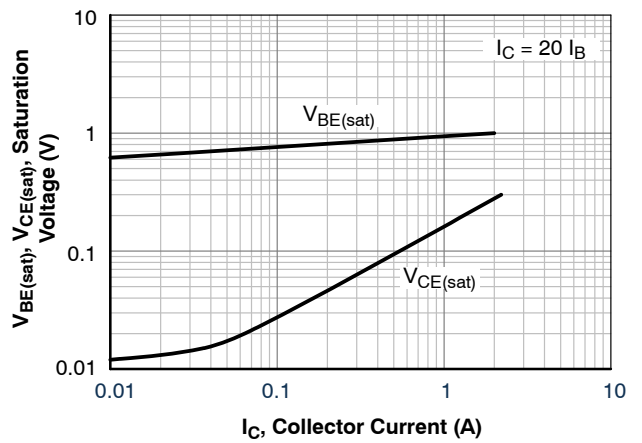


Figure 4. Base-Emitter Saturation Voltage and Collector-Emitter Saturation Voltage

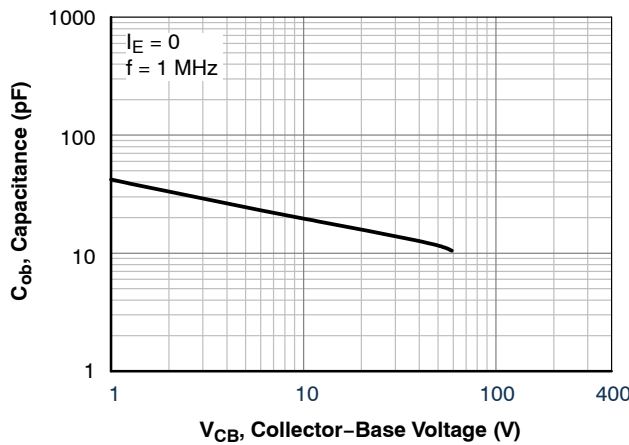


Figure 5. Collector Output Capacitance

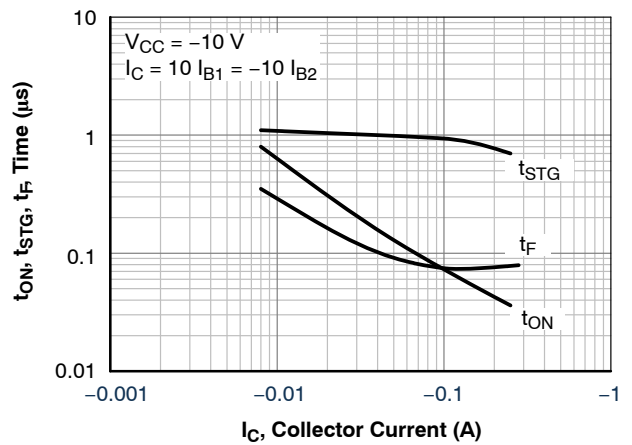


Figure 6. Switching Time

# KSD1616A

## TYPICAL CHARACTERISTICS (continued)

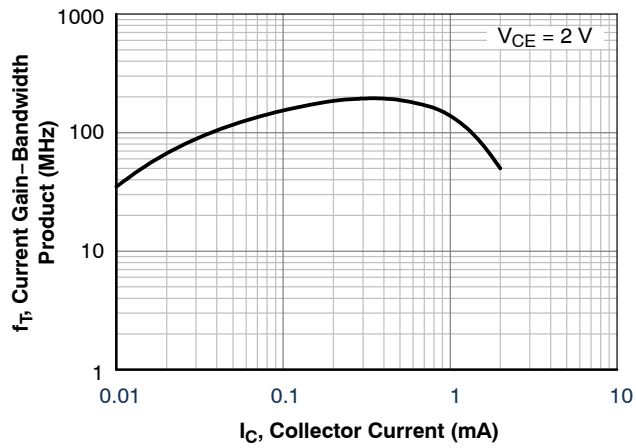


Figure 7. Current Gain Bandwidth Product

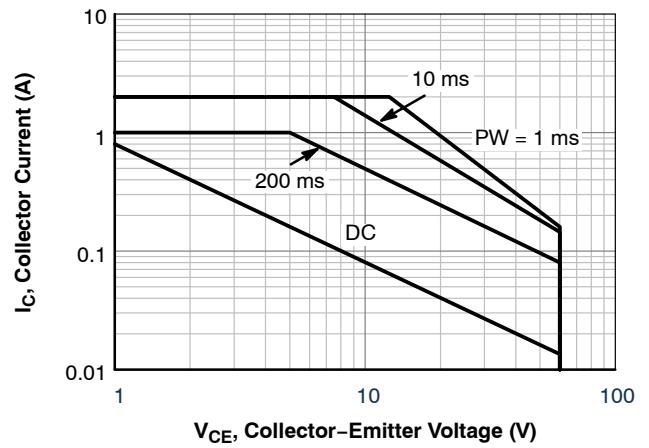


Figure 8. Safe Operating Area

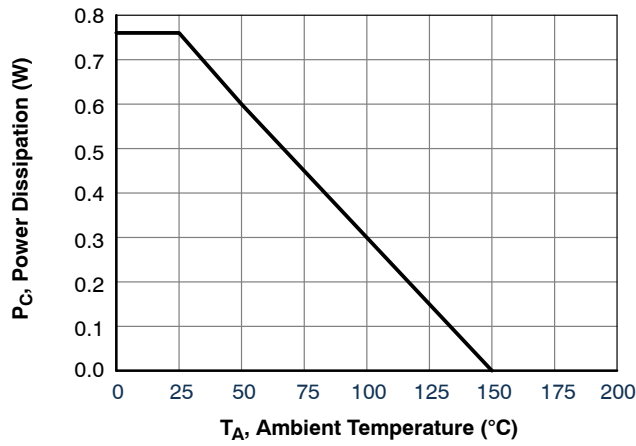
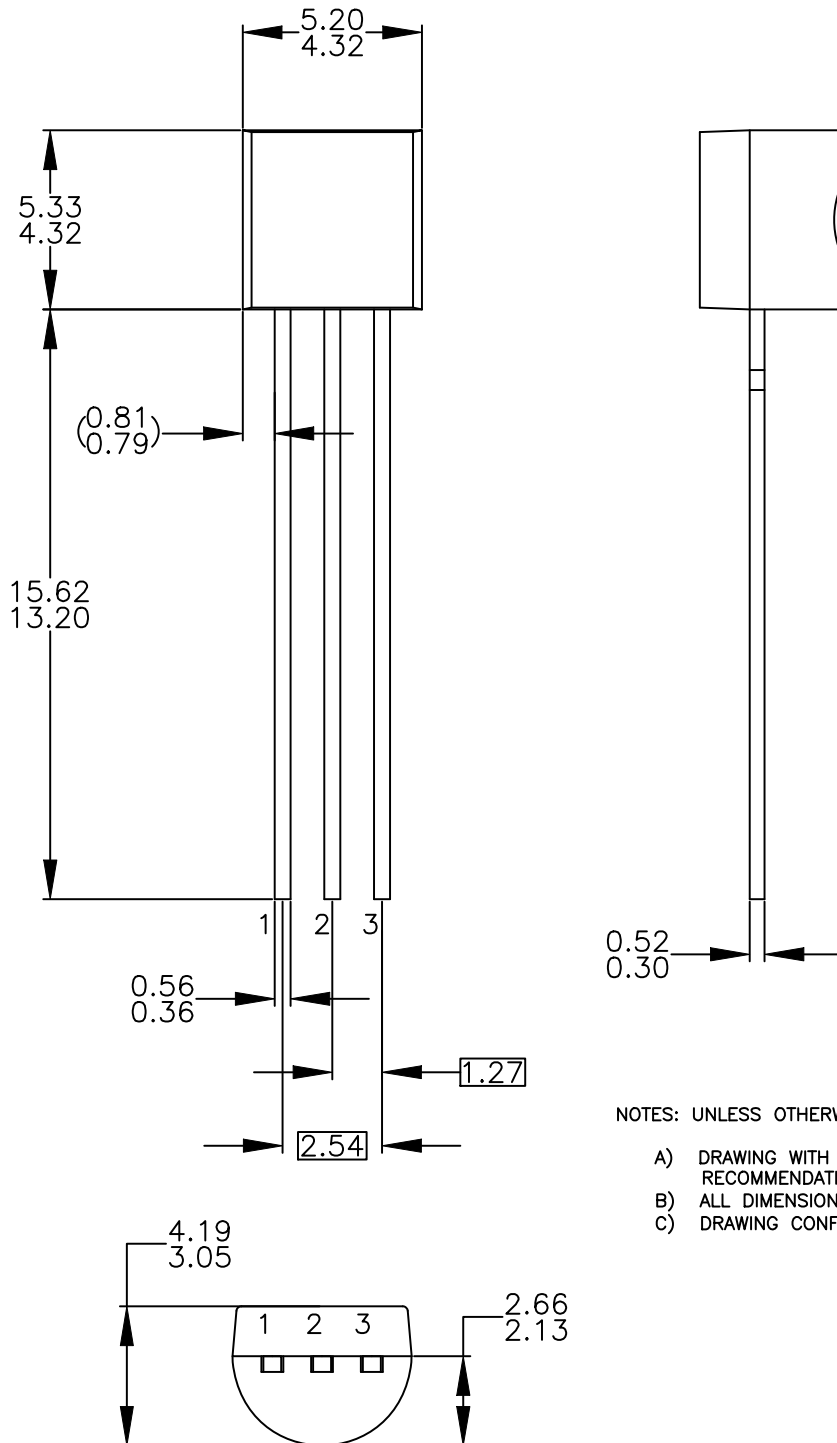


Figure 9. Power Derating

**MECHANICAL CASE OUTLINE**  
**PACKAGE DIMENSIONS**

TO-92 3 4.825x4.76  
CASE 135AN  
ISSUE O

DATE 31 JUL 2016



NOTES: UNLESS OTHERWISE SPECIFIED

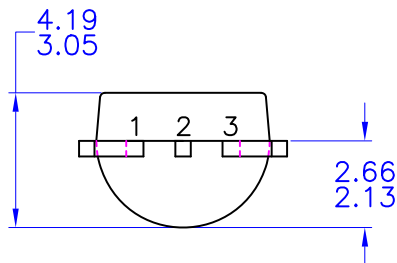
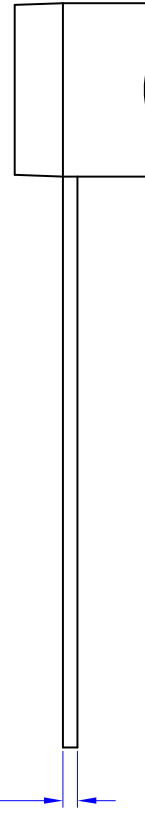
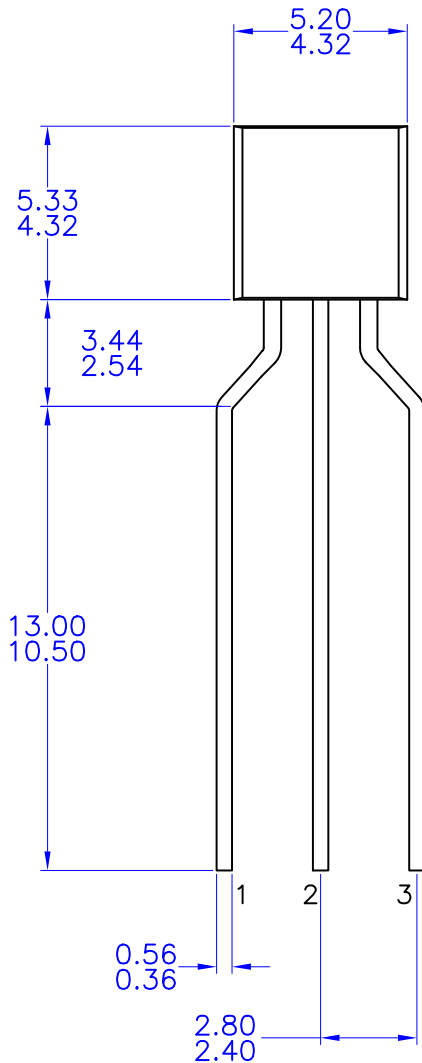
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- B) ALL DIMENSIONS ARE IN MILLIMETERS.
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**TO-92 3 4.83x4.76 LEADFORMED**  
**CASE 135AR**  
**ISSUE O**

DATE 30 SEP 2016



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