

# 2N5883, 2N5884 (PNP) 2N5885, 2N5886 (NPN)

2N5884 and 2N5886 are Preferred Devices

## Complementary Silicon High-Power Transistors

Complementary silicon high-power transistors are designed for general-purpose power amplifier and switching applications.

### Features

- Low Collector-Emitter Saturation Voltage –  
 $V_{CE(sat)} = 1.0 \text{ Vdc}$ , (max) at  $I_C = 15 \text{ Adc}$
- Low Leakage Current  
 $I_{CEX} = 1.0 \text{ mAdc}$  (max) at Rated Voltage
- Excellent DC Current Gain –  
 $h_{FE} = 20$  (min) at  $I_C = 10 \text{ Adc}$
- High Current Gain Bandwidth Product –  
 $f_T = 4.0 \text{ MHz}$  (min) at  $I_C = 1.0 \text{ Adc}$
- Pb-Free Packages are Available\*

### MAXIMUM RATINGS (Note 1)

| Rating                                                                                 | Symbol         | Value       | Unit                     |
|----------------------------------------------------------------------------------------|----------------|-------------|--------------------------|
| Collector-Emitter Voltage<br>2N5883, 2N5885<br>2N5884, 2N5886                          | $V_{CEO}$      | 60<br>80    | Vdc                      |
| Collector-Base Voltage<br>2N5883, 2N5885<br>2N5884, 2N5886                             | $V_{CB}$       | 60<br>80    | Vdc                      |
| Emitter-Base Voltage                                                                   | $V_{EB}$       | 5.0         | Vdc                      |
| Collector Current –<br>Continuous<br>Peak                                              | $I_C$          | 25<br>50    | Adc                      |
| Base Current                                                                           | $I_B$          | 7.5         | Adc                      |
| Total Device Dissipation @ $T_C = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$          | 200<br>1.15 | W<br>W/ $^\circ\text{C}$ |
| Operating and Storage Junction<br>Temperature Range                                    | $T_J, T_{stg}$ | -65 to +200 | $^\circ\text{C}$         |

### THERMAL CHARACTERISTICS

| Characteristic                       | Symbol        | Max   | Unit               |
|--------------------------------------|---------------|-------|--------------------|
| Thermal Resistance, Junction-to-Case | $\theta_{JC}$ | 0.875 | $^\circ\text{C/W}$ |

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

1. Indicates JEDEC registered data. Units and conditions differ on some parameters and re-registration reflecting these changes has been requested. All above values most or exceed present JEDEC registered data.

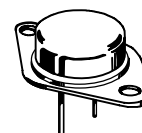
\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.



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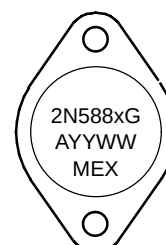
<http://onsemi.com>

## 25 AMPERE COMPLEMENTARY SILICON POWER TRANSISTORS 60 – 80 VOLTS, 200 WATTS



TO-204AA (TO-3)  
CASE 1-07  
STYLE 1

### MARKING DIAGRAM



2N588x = Device Code  
x = 3, 4, 5, or 6  
G = Pb-Free Package  
A = Assembly Location  
YY = Year  
WW = Work Week  
MEX = Country of Origin

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 5 of this data sheet.

Preferred devices are recommended choices for future use and best overall value.

## 2N5883, 2N5884 (PNP) 2N5885, 2N5886 (NPN)

### ELECTRICAL CHARACTERISTICS (Note 2) ( $T_C = 25^\circ\text{C}$ unless otherwise noted)

| Characteristic                                                                                                                                                                                                                                                                                                                                       |                                                                      | Symbol        | Min              | Max                    | Unit |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------|---------------|------------------|------------------------|------|
| Collector-Emitter Sustaining Voltage (Note 3)<br>( $I_C = 200\text{ mA}$ , $I_B = 0$ )                                                                                                                                                                                                                                                               | 2N5883, 2N5885<br>2N5884, 2N5886                                     | $V_{CE(sus)}$ | 60<br>80         | –<br>–                 | Vdc  |
| Collector Cutoff Current<br>( $V_{CE} = 30\text{ Vdc}$ , $I_B = 0$ )<br>( $V_{CE} = 40\text{ Vdc}$ , $I_B = 0$ )                                                                                                                                                                                                                                     | 2N5883, 2N5885<br>2N5884, 2N5886                                     | $I_{CEO}$     | –<br>–           | 2.0<br>2.0             | mA   |
| Collector Cutoff Current<br>( $V_{CE} = 60\text{ Vdc}$ , $V_{BE(off)} = 1.5\text{ Vdc}$ )<br>( $V_{CE} = 80\text{ Vdc}$ , $V_{BE(off)} = 1.5\text{ Vdc}$ )<br>( $V_{CE} = 60\text{ Vdc}$ , $V_{BE(off)} = 1.5\text{ Vdc}$ , $T_C = 150^\circ\text{C}$ )<br>( $V_{CE} = 80\text{ Vdc}$ , $V_{BE(off)} = 1.5\text{ Vdc}$ , $T_C = 150^\circ\text{C}$ ) | 2N5883, 2N5885<br>2N5884, 2N5886<br>2N5883, 2N5885<br>2N5884, 2N5886 | $I_{CEX}$     | –<br>–<br>–<br>– | 1.0<br>1.0<br>10<br>10 | mA   |
| Collector Cutoff Current<br>( $V_{CB} = 60\text{ Vdc}$ , $I_E = 0$ )<br>( $V_{CB} = 80\text{ Vdc}$ , $I_E = 0$ )                                                                                                                                                                                                                                     | 2N5883, 2N5885<br>2N5884, 2N5886                                     | $I_{CBO}$     | –<br>–           | 1.0<br>1.0             | mA   |
| Emitter Cutoff Current ( $V_{EB} = 5.0\text{ Vdc}$ , $I_C = 0$ )                                                                                                                                                                                                                                                                                     |                                                                      | $I_{EBO}$     | –                | 1.0                    | mA   |

### ON CHARACTERISTICS

|                                                                                                                                                                                                |               |                 |            |     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-----------------|------------|-----|
| DC Current Gain (Note 3)<br>( $I_C = 3.0\text{ A}$ , $V_{CE} = 4.0\text{ Vdc}$ )<br>( $I_C = 10\text{ A}$ , $V_{CE} = 4.0\text{ Vdc}$ )<br>( $I_C = 25\text{ A}$ , $V_{CE} = 4.0\text{ Vdc}$ ) | $h_{FE}$      | 35<br>20<br>4.0 | –<br>100   | –   |
| Collector-Emitter Saturation Voltage (Note 3)<br>( $I_C = 15\text{ A}$ , $I_B = 1.5\text{ A}$ )<br>( $I_C = 25\text{ A}$ , $I_B = 6.25\text{ A}$ )                                             | $V_{CE(sat)}$ | –<br>–          | 1.0<br>4.0 | Vdc |
| Base-Emitter Saturation Voltage (Note 3) ( $I_C = 25\text{ A}$ , $I_B = 6.25\text{ A}$ )                                                                                                       | $V_{BE(sat)}$ | –               | 2.5        | Vdc |
| Base-Emitter On Voltage (Note 3) ( $I_C = 10\text{ A}$ , $V_{CE} = 4.0\text{ Vdc}$ )                                                                                                           | $V_{BE(on)}$  | –               | 1.5        | Vdc |

### DYNAMIC CHARACTERISTICS

|                                                                                                                             |          |        |             |     |
|-----------------------------------------------------------------------------------------------------------------------------|----------|--------|-------------|-----|
| Current-Gain – Bandwidth Product (Note 4) ( $I_C = 1.0\text{ A}$ , $V_{CE} = 10\text{ Vdc}$ , $f_{test} = 1.0\text{ MHz}$ ) | $f_T$    | 4.0    | –           | MHz |
| Output Capacitance<br>( $V_{CB} = 10\text{ Vdc}$ , $I_E = 0$ , $f = 1.0\text{ MHz}$ )                                       | $C_{ob}$ | –<br>– | 1000<br>500 | pF  |
| Small-Signal Current Gain ( $I_C = 3.0\text{ A}$ , $V_{CE} = 4.0\text{ Vdc}$ , $f_{test} = 1.0\text{ kHz}$ )                | $h_{fe}$ | 20     | –           | –   |

### SWITCHING CHARACTERISTICS

|              |                                                                                      |       |   |     |               |
|--------------|--------------------------------------------------------------------------------------|-------|---|-----|---------------|
| Rise Time    | $(V_{CC} = 30\text{ Vdc}$ , $I_C = 10\text{ A}$ , $I_{B1} = I_{B2} = 1.0\text{ A}$ ) | $t_r$ | – | 0.7 | $\mu\text{s}$ |
| Storage Time |                                                                                      | $t_s$ | – | 1.0 | $\mu\text{s}$ |
| Fall Time    |                                                                                      | $t_f$ | – | 0.8 | $\mu\text{s}$ |

2. Indicates JEDEC Registered Data.

3. Pulse Test: Pulse Width  $\leq 300\text{ }\mu\text{s}$ , Duty Cycle  $\leq 2.0\%$ .

4.  $f_T = |h_{fe}| \cdot f_{test}$ .

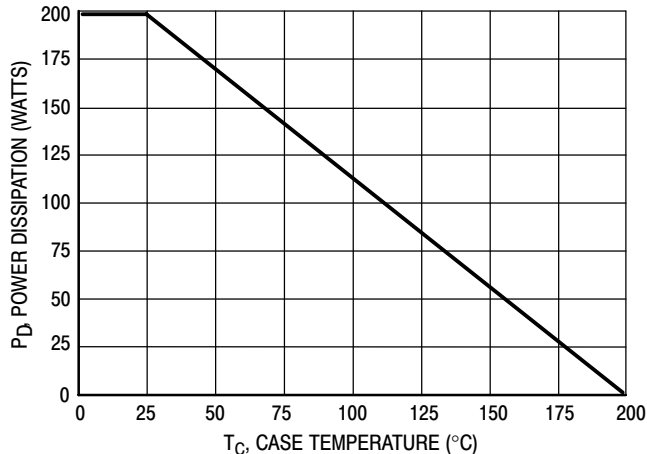


Figure 1. Power Derating

# 2N5883, 2N5884 (PNP) 2N5885, 2N5886 (NPN)

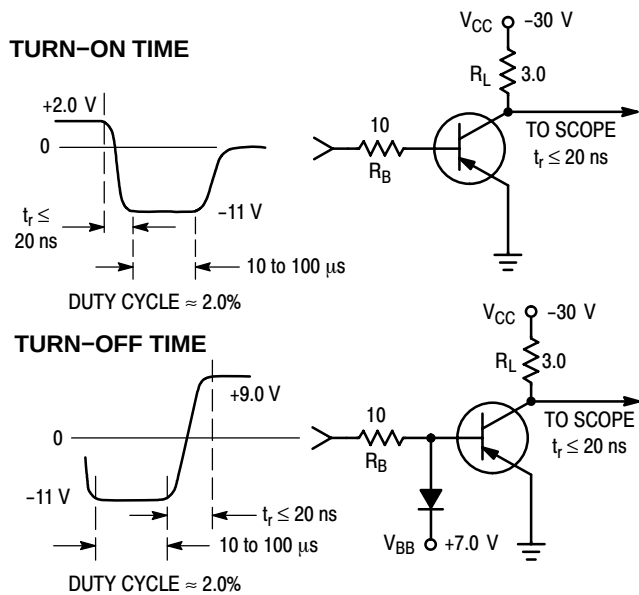


Figure 2. Switching Time Equivalent Test Circuits

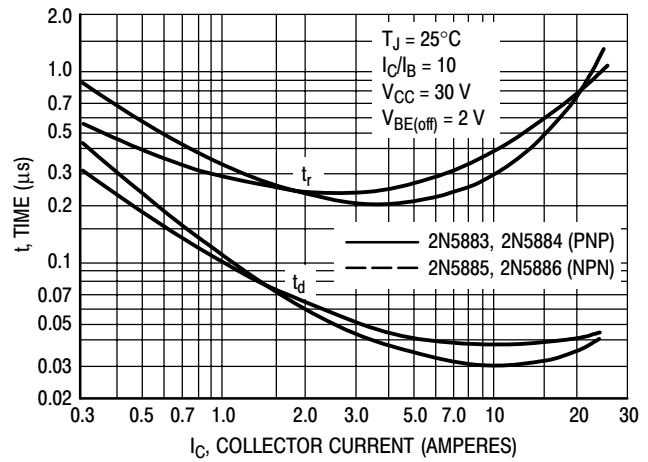


Figure 3. Turn-On Time

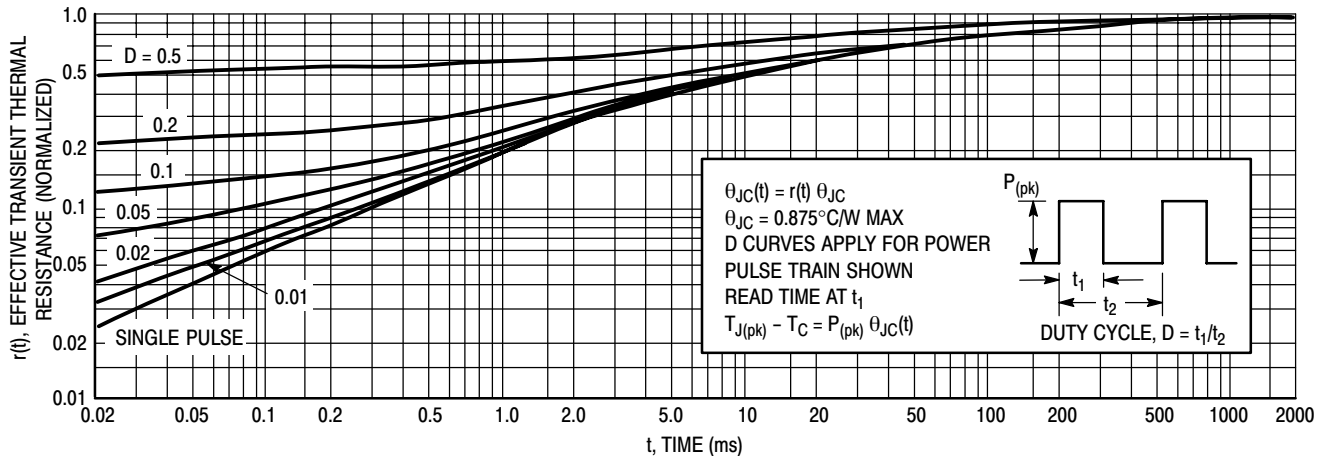


Figure 4. Thermal Response

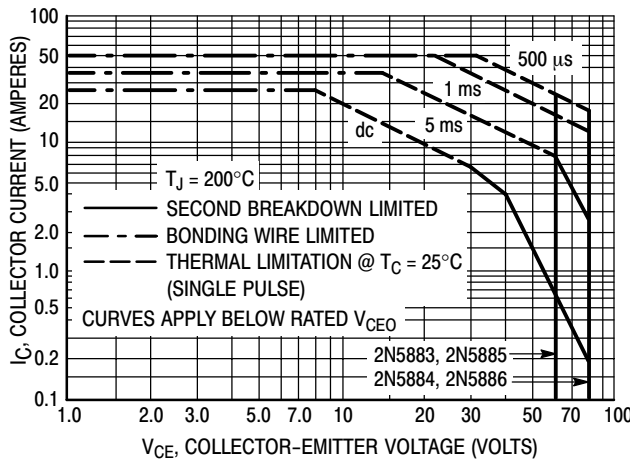


Figure 5. Active-Region Safe Operating Area

There are two limitations on the power handling ability of a transistor: average junction temperature and second breakdown. Safe operating area curves indicate  $I_C - V_{CE}$  limits of the transistor that must be observed for reliable operation; i.e., the transistor must not be subjected to greater dissipation than the curves indicate.

The data of Figure 5 is based on  $T_{J(pk)} = 200^\circ\text{C}$ ;  $T_C$  is variable depending on conditions. Second breakdown pulse limits are valid for duty cycles to 10% provided  $T_{J(pk)} \leq 200^\circ\text{C}$ .  $T_{J(pk)}$  may be calculated from the data in Figure 4. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

## 2N5883, 2N5884 (PNP) 2N5885, 2N5886 (NPN)

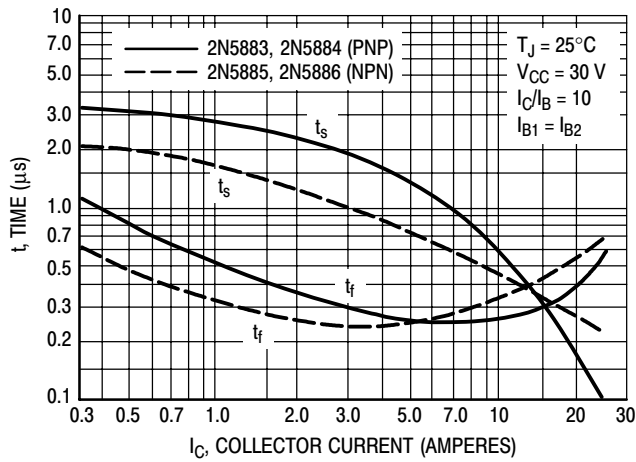


Figure 6. Turn-Off Time

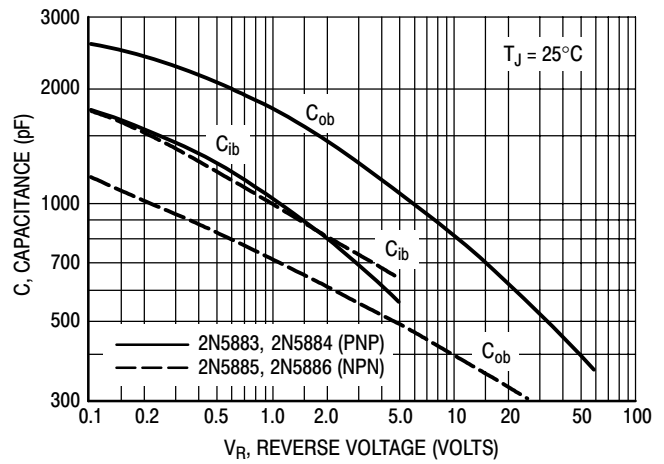


Figure 7. Capacitance

### PNP DEVICES 2N5883 and 2N5884

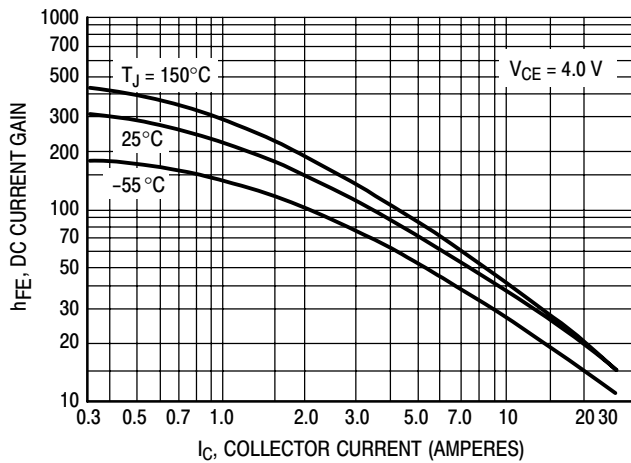


Figure 8. DC Current Gain

### NPN DEVICES 2N5885 and 2N5886

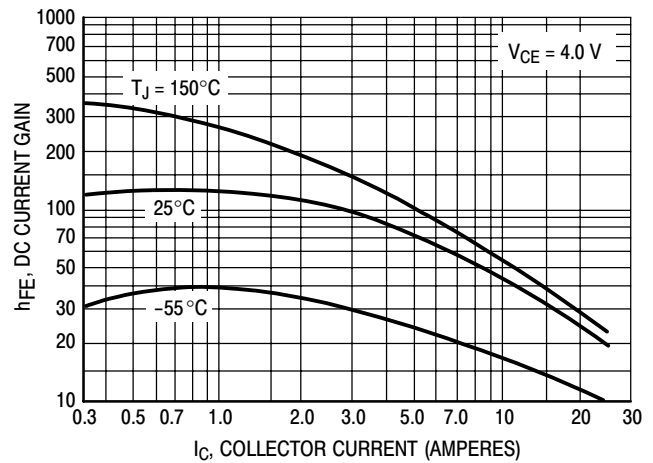


Figure 9. DC Current Gain

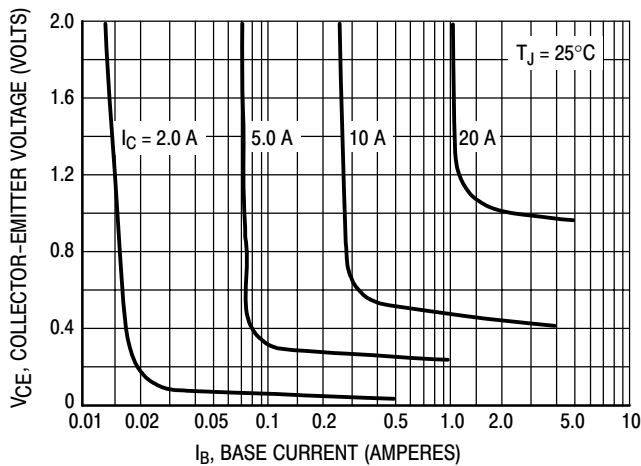


Figure 10. Collector Saturation Region

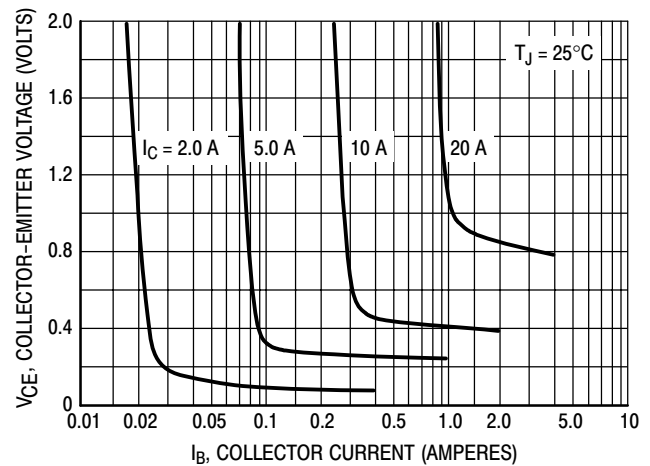


Figure 11. Collector Saturation Region

## 2N5883, 2N5884 (PNP) 2N5885, 2N5886 (NPN)

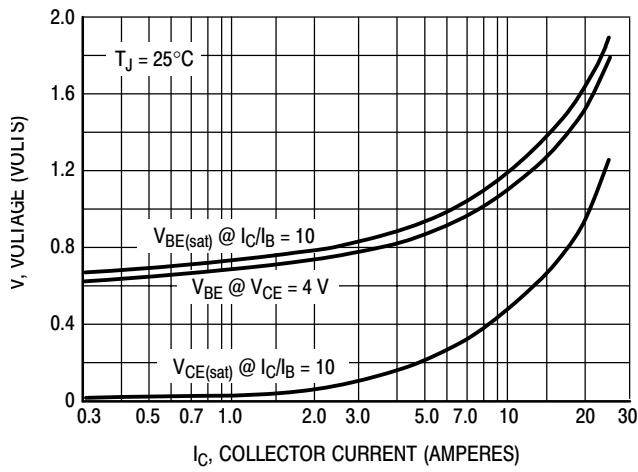


Figure 12. "On" Voltages

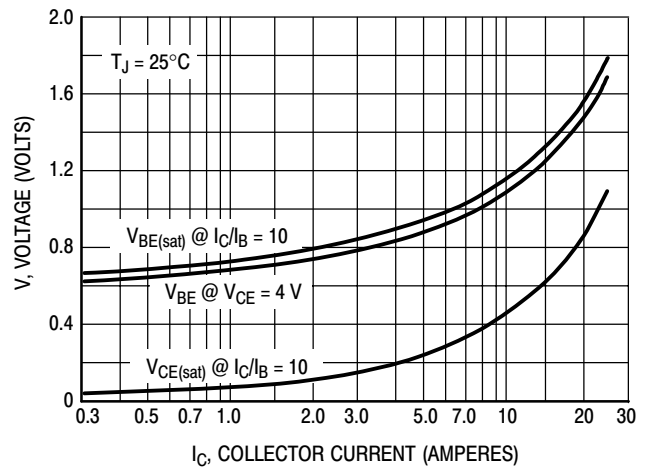


Figure 13. "On" Voltages

### ORDERING INFORMATION

| Device  | Package             | Shipping         |
|---------|---------------------|------------------|
| 2N5883  | TO-204              | 100 Units / Tray |
| 2N5883G | TO-204<br>(Pb-Free) |                  |
| 2N5884  | TO-204              |                  |
| 2N5884G | TO-204<br>(Pb-Free) |                  |
| 2N5885  | TO-204              |                  |
| 2N5885G | TO-204<br>(Pb-Free) |                  |
| 2N5886  | TO-204              |                  |
| 2N5886G | TO-204<br>(Pb-Free) |                  |

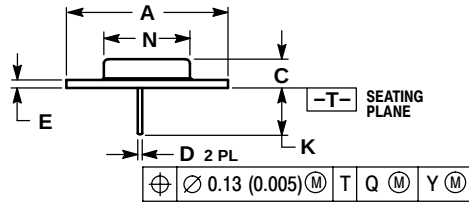
# 2N5883, 2N5884 (PNP) 2N5885, 2N5886 (NPN)

## PACKAGE DIMENSIONS

### TO-204 (TO-3)

CASE 1-07

ISSUE Z



#### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. ALL RULES AND NOTES ASSOCIATED WITH REFERENCED TO-204AA OUTLINE SHALL APPLY.

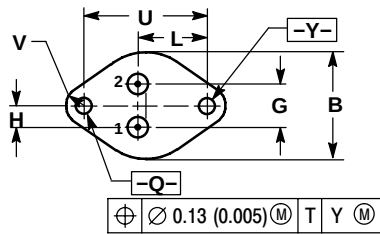
| DIM | INCHES    |           | MILLIMETERS |       |
|-----|-----------|-----------|-------------|-------|
|     | MIN       | MAX       | MIN         | MAX   |
| A   | 1.550 REF | 39.37 REF |             |       |
| B   | ---       | 1.050     | ---         | 26.67 |
| C   | 0.250     | 0.335     | 6.35        | 8.51  |
| D   | 0.038     | 0.043     | 0.97        | 1.09  |
| E   | 0.055     | 0.070     | 1.40        | 1.77  |
| G   | 0.430 BSC | 10.92 BSC |             |       |
| H   | 0.215 BSC | 5.46 BSC  |             |       |
| K   | 0.440     | 0.480     | 11.18       | 12.19 |
| L   | 0.665 BSC | 16.89 BSC |             |       |
| N   | ---       | 0.830     | ---         | 21.08 |
| Q   | 0.151     | 0.165     | 3.84        | 4.19  |
| U   | 1.187 BSC | 30.15 BSC |             |       |
| V   | 0.131     | 0.188     | 3.33        | 4.77  |

#### STYLE 1:

PIN 1. BASE

2. EMITTER

CASE: COLLECTOR



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