

# TIP33A, TIP33C

## NPN High-Power Transistors

Designed for general-purpose power amplifier and switching applications.

### Features

- ESD Ratings: Machine Model, C; > 400 V  
Human Body Model, 3B; > 8000 V
- Epoxy Meets UL 94 V-0 @ 0.125 in
- These are Pb-Free Devices\*

### MAXIMUM RATINGS

| Rating                                                                                 |                                 | Symbol         | Value          | Unit                         |
|----------------------------------------------------------------------------------------|---------------------------------|----------------|----------------|------------------------------|
| Collector – Emitter Voltage                                                            | TIP33A<br>TIP33C                | $V_{CEO}$      | 60<br>100      | Vdc                          |
| Collector – Base Voltage                                                               | TIP33A<br>TIP33C                | $V_{CBO}$      | 60<br>100      | Vdc                          |
| Emitter – Base Voltage                                                                 |                                 | $V_{EBO}$      | 5.0            | Vdc                          |
| Collector Current                                                                      | – Continuous<br>– Peak (Note 1) | $I_C$          | 10<br>15       | Adc<br>Apc                   |
| Base Current – Continuous                                                              |                                 | $I_B$          | 3.0            | Adc                          |
| Total Device Dissipation @ $T_C = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ |                                 | $P_D$          | 80<br>0.64     | Watts<br>W/ $^\circ\text{C}$ |
| Operating and Storage Junction<br>Temperature Range                                    |                                 | $T_J, T_{stg}$ | –65 to<br>+150 | $^\circ\text{C}$             |

### THERMAL CHARACTERISTICS

| Characteristic                          | Symbol          | Max  | Unit               |
|-----------------------------------------|-----------------|------|--------------------|
| Thermal Resistance, Junction-to-Case    | $R_{\theta JC}$ | 1.56 | $^\circ\text{C/W}$ |
| Thermal Resistance, Junction-to-Ambient | $R_{\theta JA}$ | 35.7 | $^\circ\text{C/W}$ |

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.

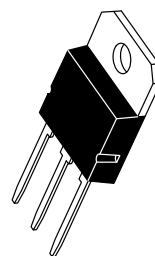
1. Pulse Test: Pulse Width  $\leq 300 \mu\text{s}$ , Duty Cycle  $\leq 2.0\%$ .



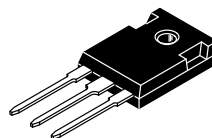
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**10 AMPERE  
NPN SILICON  
POWER TRANSISTORS  
60 & 100 VOLT, 80 WATTS**



**SOT-93 (TO-218)  
CASE 340D  
STYLE 1**



**TO-247  
CASE 340L  
STYLE 3**

**NOTE:** Effective June 2012 this device will be available only in the TO-247 package. Reference FPCN# 16827.

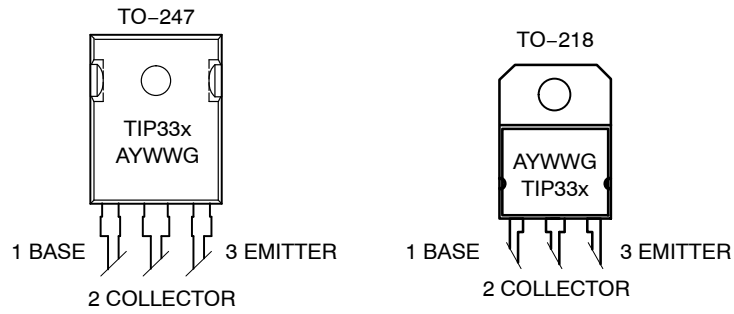
### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 2 of this data sheet.

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

# TIP33A, TIP33C

## MARKING DIAGRAMS



TIP33x = Device Code  
A = Assembly Location  
Y = Year  
WW = Work Week  
G = Pb-Free Package

## ORDERING INFORMATION

| Device Order Number | Package Type        | Shipping        |
|---------------------|---------------------|-----------------|
| TIP33AG             | TO-218<br>(Pb-Free) | 30 Units / Rail |
| TIP33CG             | TO-218<br>(Pb-Free) | 30 Units / Rail |
| TIP33AG             | TO-247<br>(Pb-Free) | 30 Units / Rail |
| TIP33CG             | TO-247<br>(Pb-Free) | 30 Units / Rail |

# TIP33A, TIP33C

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

| Characteristic | Symbol | Min | Max | Unit |
|----------------|--------|-----|-----|------|
|----------------|--------|-----|-----|------|

### OFF CHARACTERISTICS

|                                                                                                                      |                  |                |           |        |     |
|----------------------------------------------------------------------------------------------------------------------|------------------|----------------|-----------|--------|-----|
| Collector–Emitter Sustaining Voltage (Note 2)<br>( $I_C = 30\text{ mA}$ , $I_B = 0$ )                                | TIP33A<br>TIP33C | $V_{CEO(sus)}$ | 60<br>100 | –<br>– | Vdc |
| Collector–Emitter Cutoff Current<br>( $V_{CE} = 30\text{ V}$ , $I_B = 0$ )<br>( $V_{CE} = 60\text{ V}$ , $I_B = 0$ ) | TIP33A<br>TIP33C | $I_{CEO}$      | –         | 0.7    | mA  |
| Collector–Emitter Cutoff Current<br>( $V_{CE} = \text{Rated } V_{CEO}$ , $V_{EB} = 0$ )                              |                  | $I_{CES}$      | –         | 0.4    | mA  |
| Emitter–Base Cutoff Current<br>( $V_{EB} = 5.0\text{ V}$ , $I_C = 0$ )                                               |                  | $I_{EBO}$      | –         | 1.0    | mA  |

### ON CHARACTERISTICS (Note 2)

|                                                                                                                                           |               |          |            |     |
|-------------------------------------------------------------------------------------------------------------------------------------------|---------------|----------|------------|-----|
| DC Current Gain<br>( $I_C = 1.0\text{ A}$ , $V_{CE} = 4.0\text{ V}$ )<br>( $I_C = 3.0\text{ A}$ , $V_{CE} = 4.0\text{ V}$ )               | $h_{FE}$      | 40<br>20 | –<br>100   | –   |
| Collector–Emitter Saturation Voltage<br>( $I_C = 3.0\text{ A}$ , $I_B = 0.3\text{ A}$ )<br>( $I_C = 10\text{ A}$ , $I_B = 2.5\text{ A}$ ) | $V_{CE(sat)}$ | –<br>–   | 1.0<br>4.0 | Vdc |
| Base–Emitter On Voltage<br>( $I_C = 3.0\text{ A}$ , $V_{CE} = 4.0\text{ V}$ )<br>( $I_C = 10\text{ A}$ , $V_{CE} = 4.0\text{ V}$ )        | $V_{BE(on)}$  | –<br>–   | 1.6<br>3.0 | Vdc |

### DYNAMIC CHARACTERISTICS

|                                                                                                              |          |     |   |     |
|--------------------------------------------------------------------------------------------------------------|----------|-----|---|-----|
| Small–Signal Current Gain<br>( $I_C = 0.5\text{ A}$ , $V_{CE} = 10\text{ V}$ , $f = 1.0\text{ kHz}$ )        | $h_{fe}$ | 20  | – | –   |
| Current–Gain — Bandwidth Product<br>( $I_C = 0.5\text{ A}$ , $V_{CE} = 10\text{ V}$ , $f = 1.0\text{ MHz}$ ) | $f_T$    | 3.0 | – | MHz |

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

## TIP33A, TIP33C

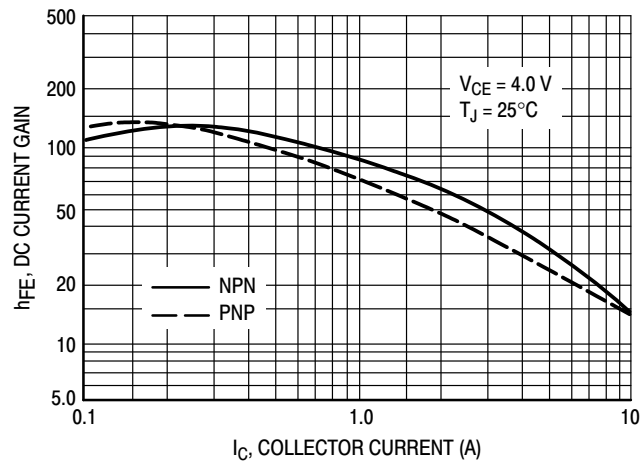


Figure 1. DC Current Gain

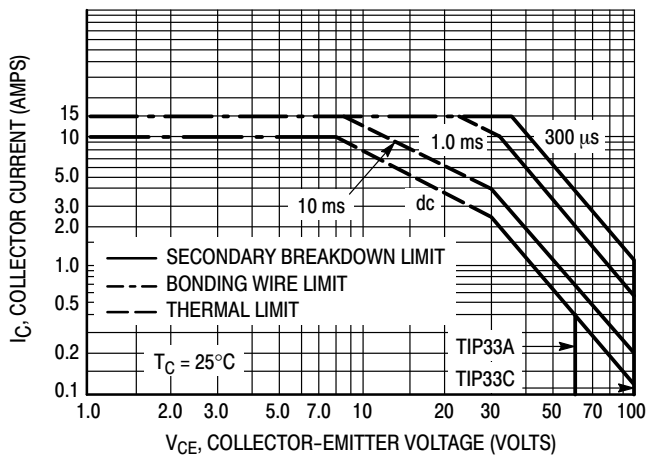


Figure 2. Maximum Rated Forward Bias Safe Operating Area

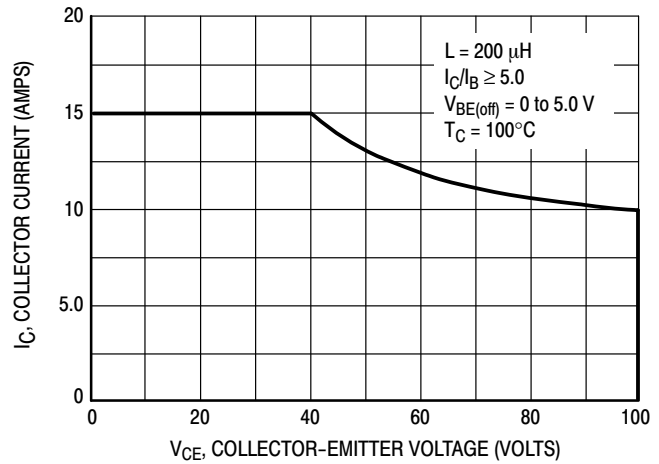


Figure 3. Maximum Rated Forward Bias Safe Operating Area

### FORWARD BIAS

The Forward Bias Safe Operating Area represents the voltage and current conditions these devices can withstand during forward bias. The data is based on  $T_C = 25^\circ\text{C}$ ;  $T_{J(pk)}$  is variable depending on power level. Second breakdown pulse limits are valid for duty cycles to 10%, and must be derated thermally for  $T_C > 25^\circ\text{C}$ .

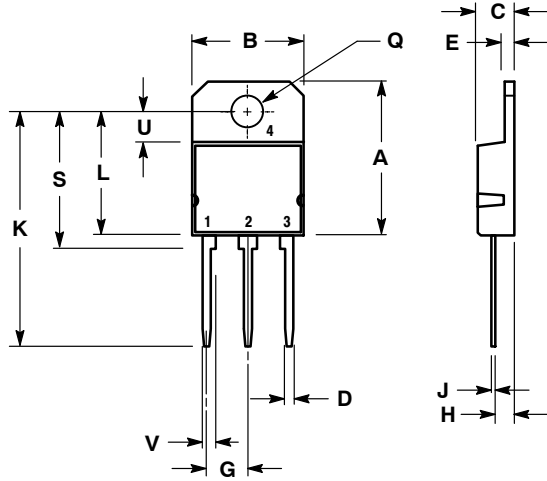
### REVERSE BIAS

The Reverse Bias Safe Operating Area represents the voltage and current conditions these devices can withstand during reverse biased turn-off. This rating is verified under clamped conditions so the device is never subjected to an avalanche mode.

# TIP33A, TIP33C

## PACKAGE DIMENSIONS

### SOT-93 (TO-218) CASE 340D-02 ISSUE E



#### NOTES:

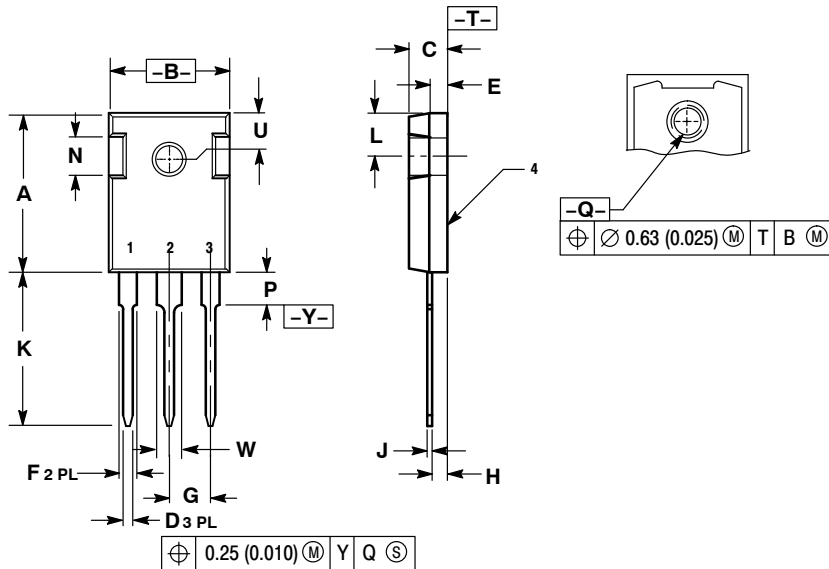
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.

| DIM | MILLIMETERS |       | INCHES    |       |
|-----|-------------|-------|-----------|-------|
|     | MIN         | MAX   | MIN       | MAX   |
| A   | ---         | 20.35 | ---       | 0.801 |
| B   | 14.70       | 15.20 | 0.579     | 0.598 |
| C   | 4.70        | 4.90  | 0.185     | 0.193 |
| D   | 1.10        | 1.30  | 0.043     | 0.051 |
| E   | 1.17        | 1.37  | 0.046     | 0.054 |
| G   | 5.40        | 5.55  | 0.213     | 0.219 |
| H   | 2.00        | 3.00  | 0.079     | 0.118 |
| J   | 0.50        | 0.78  | 0.020     | 0.031 |
| K   | 31.00 REF   |       | 1.220 REF |       |
| L   | ---         | 16.20 | ---       | 0.638 |
| Q   | 4.00        | 4.10  | 0.158     | 0.161 |
| S   | 17.80       | 18.20 | 0.701     | 0.717 |
| U   | 4.00 REF    |       | 0.157 REF |       |
| V   | 1.75 REF    |       | 0.069     |       |

#### STYLE 1:

- PIN 1. BASE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

### TO-247 CASE 340L-02 ISSUE F



#### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.

| DIM | MILLIMETERS |       | INCHES    |       |
|-----|-------------|-------|-----------|-------|
|     | MIN         | MAX   | MIN       | MAX   |
| A   | 20.32       | 21.08 | 0.800     | 0.830 |
| B   | 15.75       | 16.26 | 0.620     | 0.640 |
| C   | 4.70        | 5.30  | 0.185     | 0.209 |
| D   | 1.00        | 1.40  | 0.040     | 0.055 |
| E   | 1.90        | 2.60  | 0.075     | 0.102 |
| F   | 1.65        | 2.13  | 0.065     | 0.084 |
| G   | 5.45 BSC    |       | 0.215 BSC |       |
| H   | 1.50        | 2.49  | 0.059     | 0.098 |
| J   | 0.40        | 0.80  | 0.016     | 0.031 |
| K   | 19.81       | 20.83 | 0.780     | 0.820 |
| L   | 5.40        | 6.20  | 0.212     | 0.244 |
| N   | 4.32        | 5.49  | 0.170     | 0.216 |
| P   | ---         | 4.50  | ---       | 0.177 |
| Q   | 3.55        | 3.65  | 0.140     | 0.144 |
| U   | 6.15 BSC    |       | 0.242 BSC |       |
| W   | 2.87        | 3.12  | 0.113     | 0.123 |

#### STYLE 3:

- PIN 1. BASE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

## TIP33A, TIP33C

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