



**THE DATASHEET OF  
DSS4540X-13**

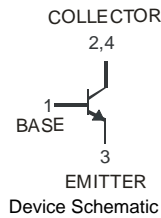


## Features

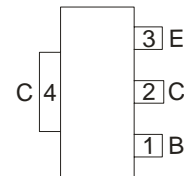
- Complementary PNP Type Available (DSS5540X)
- Ultra Low Collector-Emitter Saturation Voltage
- Ideally Suited for Automated Assembly Processes
- Ideal for Medium Power Switching or Amplification Applications
- **Lead Free By Design/RoHS Compliant (Note 1)**
- **"Green" Device (Note 2)**



Top View



Device Schematic



Pin Out Configuration

## Mechanical Data

- Case: SOT89-3L
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020D
- Terminals: Finish — Matte Tin annealed over Copper leadframe (Lead Free Plating). Solderable per MIL-STD-202, Method 208
- Marking Information: See Page 4
- Ordering Information: See Page 4
- Weight: 0.072 grams (approximate)

## Maximum Ratings @ $T_A = 25^\circ\text{C}$ unless otherwise specified

| Characteristic                        | Symbol    | Value | Unit |
|---------------------------------------|-----------|-------|------|
| Collector-Base Voltage                | $V_{CB0}$ | 40    | V    |
| Collector-Emitter Voltage             | $V_{CE0}$ | 40    | V    |
| Emitter-Base Voltage                  | $V_{EB0}$ | 6     | V    |
| Continuous Collector Current          | $I_C$     | 4     | A    |
| Repetitive Collector Current (Note 3) | $I_{CRM}$ | 5     | A    |
| Peak Pulse Collector Current          | $I_{CM}$  | 10    | A    |
| Continuous Base Current               | $I_B$     | 1     | A    |
| Peak Pulse Base Current               | $I_{BM}$  | 2     | A    |

## Thermal Characteristics

| Characteristic  | Symbol          | Value       | Unit               |
|---|-----------------|-------------|--------------------|
| Power Dissipation (Note 4) @ $T_A = 25^\circ\text{C}$                           | $P_D$           | 0.9         | W                  |
| Thermal Resistance, Junction to Ambient Air (Note 4) @ $T_A = 25^\circ\text{C}$ | $R_{\theta JA}$ | 139         | $^\circ\text{C/W}$ |
| Power Dissipation (Note 5) @ $T_A = 25^\circ\text{C}$                           | $P_D$           | 2           | W                  |
| Thermal Resistance, Junction to Ambient Air (Note 5) @ $T_A = 25^\circ\text{C}$ | $R_{\theta JA}$ | 62.5        | $^\circ\text{C/W}$ |
| Operating and Storage Temperature Range   | $T_J, T_{STG}$  | -55 to +150 | $^\circ\text{C}$   |

- Notes:
1. No purposefully added lead.
  2. Diodes Inc.'s "Green" policy can be found on our website at [http://www.diodes.com/products/lead\\_free/index.php](http://www.diodes.com/products/lead_free/index.php).
  3. Operated under pulsed conditions: pulse width  $\leq 10\text{ms}$ ; duty cycle  $\leq 0.2$ .
  4. Device mounted on FR-4 PCB with minimum recommended pad layout.
  5. Device mounted on FR-4 PCB with 1 inch<sup>2</sup> copper pad layout.

**Electrical Characteristics** @ $T_A = 25^\circ\text{C}$  unless otherwise specified

| Characteristic                               | Symbol        | Min | Typ | Max | Unit          | Test Conditions   |
|--|---------------|-----|-----|-----|---------------|---|
| <b>OFF CHARACTERISTICS</b>                   |               |     |     |     |               |   |
| Collector-Base Breakdown Voltage             | $V_{(BR)CBO}$ | 40  | —   | —   | V             | $I_C = 100\mu\text{A}$  |
| Collector-Emitter Breakdown Voltage (Note 6) | $V_{(BR)CEO}$ | 40  | —   | —   | V             | $I_C = 10\text{mA}$   |
| Emitter-Base Breakdown Voltage               | $V_{(BR)EBO}$ | 6   | —   | —   | V             | $I_E = 100\mu\text{A}$  |
| Collector-Base Cutoff Current                | $I_{CBO}$     | —   | —   | 100 | nA            | $V_{CB} = 30\text{V}, I_E = 0$  |
|  |               | —   | —   | 50  | $\mu\text{A}$ | $V_{CB} = 30\text{V}, I_E = 0, T_A = 150^\circ\text{C}$               |
| Collector-Emitter Cut-Off Current            | $I_{CES}$     | —   | —   | 100 | nA            | $V_{CE} = 30\text{V}, V_{BE} = 0\text{V}$                             |
| Emitter-Base Cutoff Current                  | $I_{EBO}$     | —   | —   | 100 | nA            | $V_{EB} = 5\text{V}, I_C = 0$   |
| <b>ON CHARACTERISTICS (Note 6)</b>           |               |     |     |     |               |   |
| DC Current Gain                              | $h_{FE}$      | 300 | —   | —   | —             | $V_{CE} = 2\text{V}, I_C = 0.5\text{A}$                               |
|  |               | 300 | —   | —   |               | $V_{CE} = 2\text{V}, I_C = 1\text{A}$                                 |
|  |               | 250 | —   | —   |               | $V_{CE} = 2\text{V}, I_C = 2\text{A}$                                 |
|  |               | 100 | —   | —   |               | $V_{CE} = 2\text{V}, I_C = 5\text{A}$                                 |
| Collector-Emitter Saturation Voltage         | $V_{CE(SAT)}$ | —   | —   | 90  | mV            | $I_C = 0.5\text{A}, I_B = 5\text{mA}$                                 |
|  |               | —   | —   | 120 |               | $I_C = 1\text{A}, I_B = 10\text{mA}$                                  |
|  |               | —   | 80  | 150 |               | $I_C = 2\text{A}, I_B = 200\text{mA}$                                 |
|  |               | —   | 160 | 290 |               | $I_C = 4\text{A}, I_B = 200\text{mA}$                                 |
|  |               | —   | 185 | 355 |               | $I_C = 5\text{A}, I_B = 500\text{mA}$                                 |
| Equivalent On-Resistance                     | $R_{CE(SAT)}$ | —   | 37  | 71  | m $\Omega$    | $I_C = 5\text{A}, I_B = 500\text{mA}$                                 |
| Base-Emitter Saturation Voltage              | $V_{BE(SAT)}$ | —   | —   | 1.1 | V             | $I_C = 4\text{A}, I_B = 200\text{mA}$                                 |
|  |               | —   | —   | 1.2 |               | $I_C = 5\text{A}, I_B = 500\text{mA}$                                 |
| Base-Emitter Turn-on Voltage                 | $V_{BE(ON)}$  | —   | —   | 1.1 | V             | $V_{CE} = 2\text{V}, I_C = 2\text{A}$                                 |
| <b>SMALL SIGNAL CHARACTERISTICS</b>          |               |     |     |     |               |   |
| Transition Frequency                         | $f_T$         | 70  | —   | —   | MHZ           | $V_{CE} = 10\text{V}, I_C = 0.1\text{A}, f = 100\text{MHz}$           |
| Collector Capacitance                        | $C_C$         | —   | —   | 75  | pF            | $V_{CB} = 10\text{V}, I_E = 0\text{A}, f = 1\text{MHz}$               |
| <b>SWITCHING CHARACTERISTICS</b>             |               |     |     |     |               |   |
| Turn-On Time                                 | $t_{on}$      | —   | 135 | —   | ns            | $V_{CC} = 10\text{V}, I_C = 2\text{A}, I_{B1} = 40\text{mA}$          |
| Delay Time                                   | $t_d$         | —   | 60  | —   | ns            |   |
| Rise Time                                    | $t_r$         | —   | 75  | —   | ns            |   |
| Turn-Off Time                                | $t_{off}$     | —   | 670 | —   | ns            | $V_{CC} = 10\text{V}, I_C = 2\text{A}, I_{B1} = I_{B2} = 40\text{mA}$ |
| Storage Time                                 | $t_s$         | —   | 570 | —   | ns            |   |
| Fall Time                                    | $t_f$         | —   | 100 | —   | ns            |   |

Notes: 6. Measured under pulsed conditions. Pulse width = 300 $\mu\text{s}$ . Duty cycle  $\leq 2\%$ .

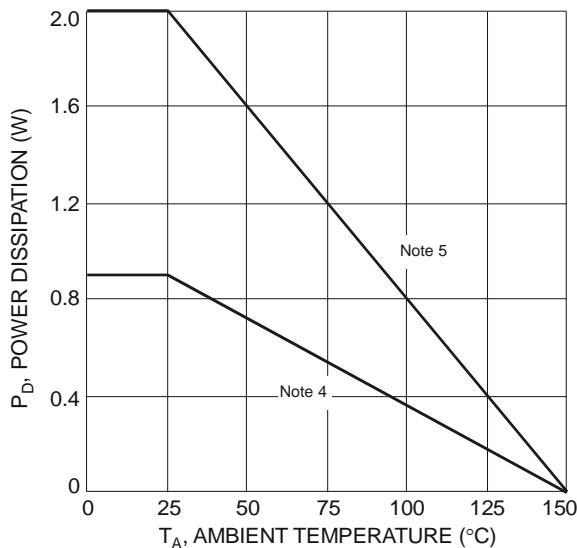


Fig. 1 Power Dissipation vs. Ambient Temperature

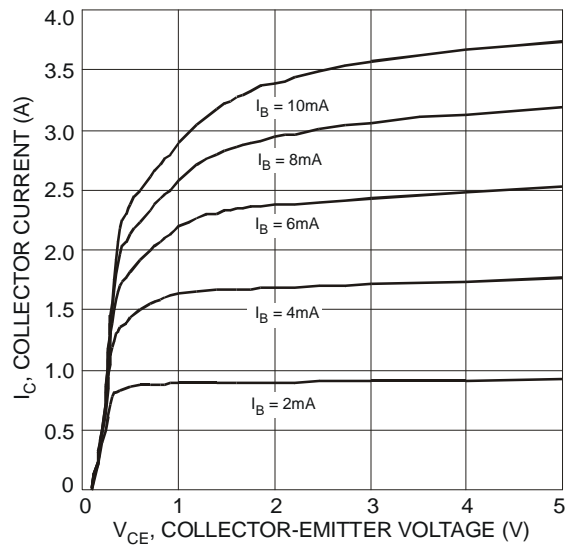


Fig. 2 Typical Collector Current vs. Collector-Emitter Voltage

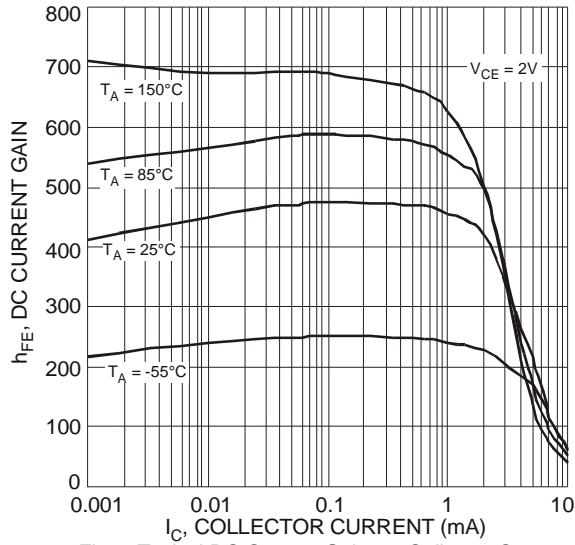


Fig. 3 Typical DC Current Gain vs. Collector Current

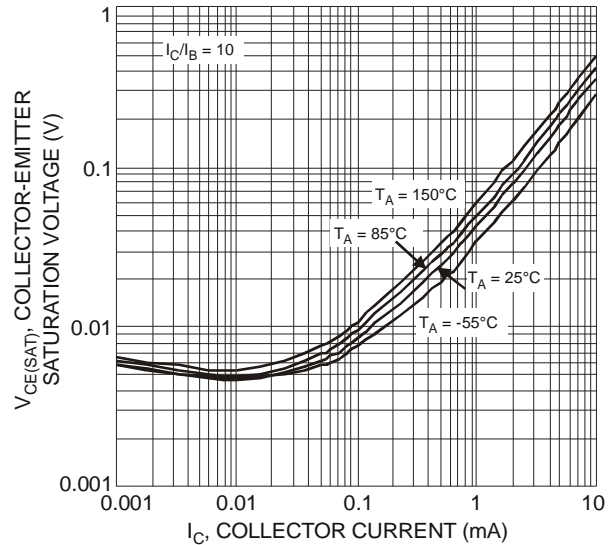


Fig. 4 Typical Collector-Emitter Saturation Voltage vs. Collector Current

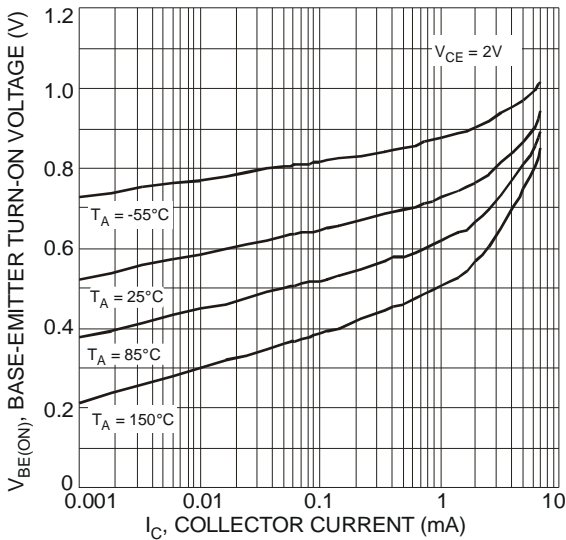


Fig. 5 Typical Base-Emitter Turn-On Voltage vs. Collector Current

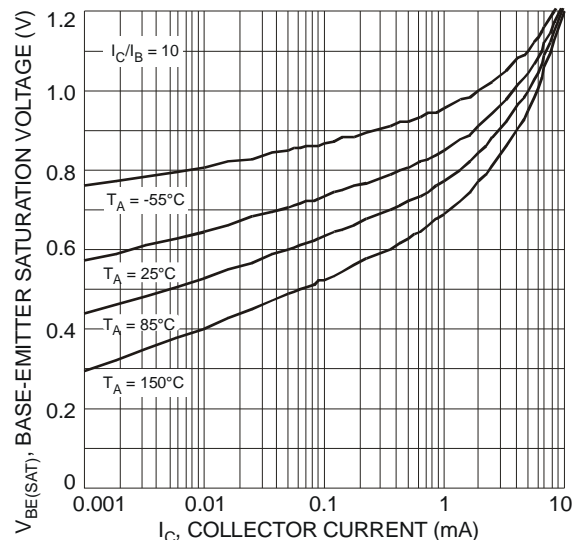


Fig. 6 Typical Base-Emitter Saturation Voltage vs. Collector Current

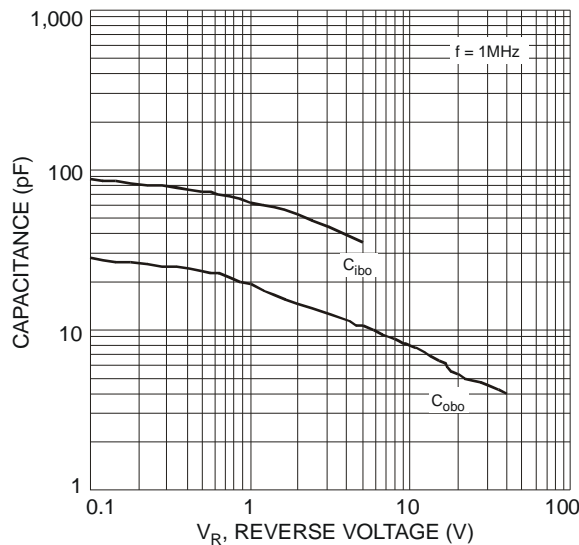


Fig. 7 Typical Capacitance Characteristics

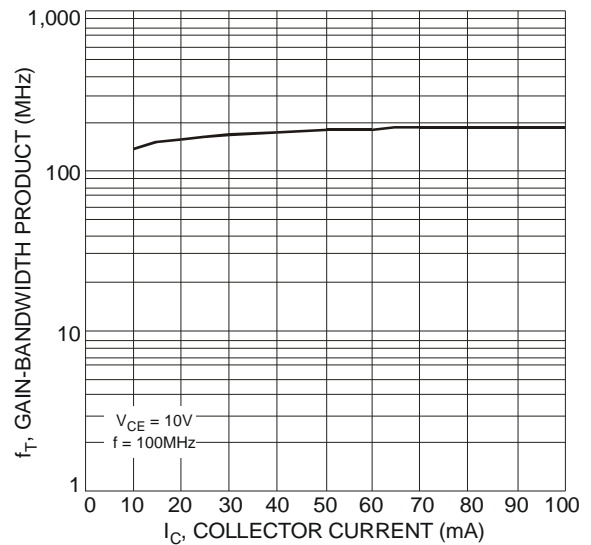
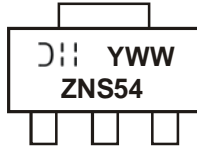


Fig. 8 Typical Gain-Bandwidth Product vs. Collector Current

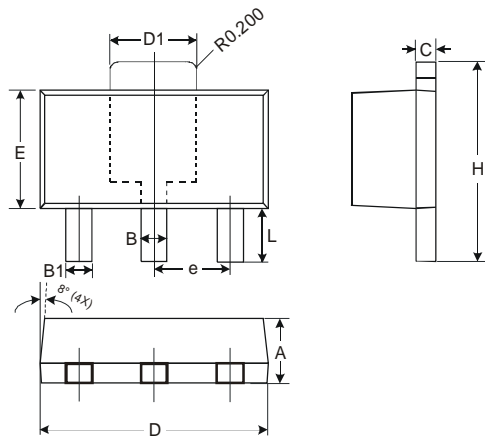
**Ordering Information** (Note 7)

| Part Number | Case     | Packaging        |
|-------------|----------|------------------|
| DSS4540X-13 | SOT89-3L | 2500/Tape & Reel |

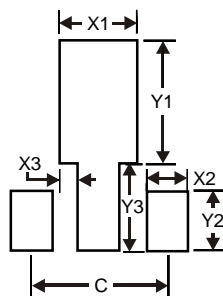
Notes: 7. For packaging details, go to our website at <http://www.diodes.com/datasheets/ap02007.pdf>.

**Marking Information**


ZNS54 = Product Type Marking Code  
 ⌋⌋⌋ = Manufacturer's Code Marking  
 YWW = Date Code Marking  
 Y = Last digit of year (ex: 8 = 2008)  
 WW = Week code 01 - 52

**Package Outline Dimensions**


| SOT89-3L             |      |      |      |
|----------------------|------|------|------|
| Dim                  | Min  | Max  | Typ  |
| A                    | 1.40 | 1.60 | 1.50 |
| B                    | 0.45 | 0.55 | 0.50 |
| B1                   | 0.37 | 0.47 | 0.42 |
| C                    | 0.35 | 0.43 | 0.38 |
| D                    | 4.40 | 4.60 | 4.50 |
| D1                   | 1.50 | 1.70 | 1.60 |
| E                    | 2.40 | 2.60 | 2.50 |
| e                    | —    | —    | 1.50 |
| H                    | 3.95 | 4.25 | 4.10 |
| L                    | 0.90 | 1.20 | 1.05 |
| All Dimensions in mm |      |      |      |

**Suggested Pad Layout**


| Dimensions | Value (in mm) |
|------------|---------------|
| X1         | 1.7           |
| X2         | 0.9           |
| X3         | 0.4           |
| Y1         | 2.7           |
| Y2         | 1.3           |
| Y3         | 1.9           |
| C          | 3.0           |

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