

## DUAL 60V NPN/PNP SILICON MEDIUM POWER TRANSISTORS

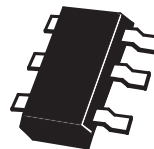
### SUMMARY

**NPN:**  $V_{CE0}=60V$ ;  $I_C=1A$ ;  $h_{FE}=100-300$

**PNP:**  $V_{CE0}=-60V$ ;  $I_C=-1A$ ;  $h_{FE}=100-300$

### DESCRIPTION

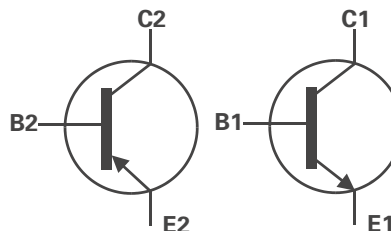
Complementary NPN and PNP medium power transistors packaged in the 6 lead SOT23 package.



**SOT23-6**

### FEATURES

- Low Equivalent On Resistance
  - NPN  $R_{CE(sat)} 210m\Omega$  at 1A
  - PNP  $R_{CE(sat)} 355m\Omega$  at -1A
- Low Saturation Voltage
- $h_{FE}$  characterised up to 2A
- $I_C=1A$  Continuous Collector Current
- SOT23-6 package

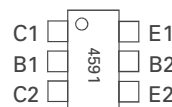


### APPLICATIONS

- MOSFET gate driver
- Low Power Motor Drive
- Low Power DC-DC Converters

### ORDERING INFORMATION

| DEVICE       | REEL SIZE<br>(inches) | TAPE WIDTH<br>(mm) | QUANTITY<br>PER REEL |
|--------------|-----------------------|--------------------|----------------------|
| ZXTD4591E6TA | 7                     | 8mm embossed       | 3000 units           |
| ZXTD4591E6TC | 13                    | 8mm embossed       | 10000 units          |



Top View

### DEVICE MARKING

4591

# ZXTD4591E6

## ABSOLUTE MAXIMUM RATINGS.

| PARAMETER                                                                   | SYMBOL        | LIMIT NPN   | LIMIT PNP   | UNIT                        |
|-----------------------------------------------------------------------------|---------------|-------------|-------------|-----------------------------|
| Collector-Base Voltage                                                      | $V_{CBO}$     | 80          | -80         | V                           |
| Collector-Emitter Voltage                                                   | $V_{CEO}$     | 60          | -60         | V                           |
| Emitter-Base Voltage                                                        | $V_{EBO}$     | 5           | -5          | V                           |
| Peak Pulse Current                                                          | $I_{CM}$      | 2           | -2          | A                           |
| Continuous Collector Current                                                | $I_C$         | 1           | -1          | A                           |
| Base Current                                                                | $I_B$         | 500         | -500        | mA                          |
| Power Dissipation at $T_A=25^{\circ}\text{C}$ (a)<br>Linear Derating Factor | $P_D$         | 1.1<br>8.8  | 1.1<br>8.8  | W<br>mW/ $^{\circ}\text{C}$ |
| Power Dissipation at $T_A=25^{\circ}\text{C}$ (b)<br>Linear Derating Factor | $P_D$         | 1.7<br>13.6 | 1.7<br>13.6 | W<br>mW/ $^{\circ}\text{C}$ |
| Operating and Storage Temperature Range                                     | $T_J:T_{stg}$ | -55 to +150 | -55 to +150 | $^{\circ}\text{C}$          |

## THERMAL RESISTANCE

| PARAMETER               | SYMBOL          | VALUE | UNIT                 |
|-------------------------|-----------------|-------|----------------------|
| Junction to Ambient (a) | $R_{\theta JA}$ | 113   | $^{\circ}\text{C/W}$ |
| Junction to Ambient (b) | $R_{\theta JA}$ | 73    | $^{\circ}\text{C/W}$ |

### NOTES

(a) For a device surface mounted on 25mm x 25mm FR4 PCB with high coverage of single sided 1oz copper, in still air conditions

(b) For a device surface mounted on FR4 PCB measured at  $t \leq 5$  secs.

# ZXTD4591E6

## PNP TRANSISTOR

### ELECTRICAL CHARACTERISTICS (at $T_{amb} = 25^{\circ}\text{C}$ unless otherwise stated).

| PARAMETER                             | SYMBOL        | MIN.                   | TYP. | MAX.         | UNIT   | CONDITIONS.                                                                                                                                                                          |
|---------------------------------------|---------------|------------------------|------|--------------|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Collector-Base Breakdown Voltage      | $V_{(BR)CBO}$ | -80                    |      |              | V      | $I_C = -100\mu\text{A}$                                                                                                                                                              |
| Collector-Emitter Breakdown Voltage   | $V_{(BR)CEO}$ | -60                    |      |              | V      | $I_C = -10\text{mA}^*$                                                                                                                                                               |
| Emitter-Base Breakdown Voltage        | $V_{(BR)EBO}$ | -5                     |      |              | V      | $I_E = -100\mu\text{A}$                                                                                                                                                              |
| Collector Cut-Off Current             | $I_{CBO}$     |                        |      | -100         | nA     | $V_{CB} = -60\text{V}$                                                                                                                                                               |
| Emitter Cut-Off Current               | $I_{EBO}$     |                        |      | -100         | nA     | $V_{EB} = -4\text{V}$                                                                                                                                                                |
| Collector Emitter Cut-Off Current     | $I_{CES}$     |                        |      | -100         | nA     | $V_{CES} = -60\text{V}$                                                                                                                                                              |
| Collector-Emitter Saturation Voltage  | $V_{CE(sat)}$ |                        |      | -0.3<br>-0.6 | V<br>V | $I_C = -500\text{mA}, I_B = -50\text{mA}^*$<br>$I_C = -1\text{A}, I_B = -100\text{mA}^*$                                                                                             |
| Base-Emitter Saturation Voltage       | $V_{BE(sat)}$ |                        |      | -1.2         | V      | $I_C = -1\text{A}, I_B = -100\text{mA}^*$                                                                                                                                            |
| Base-Emitter Turn-On Voltage          | $V_{BE(on)}$  |                        |      | -1.0         | V      | $I_C = -1\text{A}, V_{CE} = -5\text{V}^*$                                                                                                                                            |
| Static Forward Current Transfer Ratio | $h_{FE}$      | 100<br>100<br>80<br>15 |      | 300          |        | $I_C = -1\text{mA}, V_{CE} = -5\text{V}^*$<br>$I_C = -500\text{mA}, V_{CE} = -5\text{V}^*$<br>$I_C = -1\text{A}, V_{CE} = -5\text{V}^*$<br>$I_C = -2\text{A}, V_{CE} = -5\text{V}^*$ |
| Transition Frequency                  | $f_T$         | 150                    |      |              | MHz    | $I_C = -50\text{mA}, V_{CE} = -10\text{V}$<br>$f = 100\text{MHz}$                                                                                                                    |
| Output Capacitance                    | $C_{obo}$     |                        |      | 10           | pF     | $V_{CB} = -10\text{V}, f = 1\text{MHz}$                                                                                                                                              |

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

# ZXTD4591E6

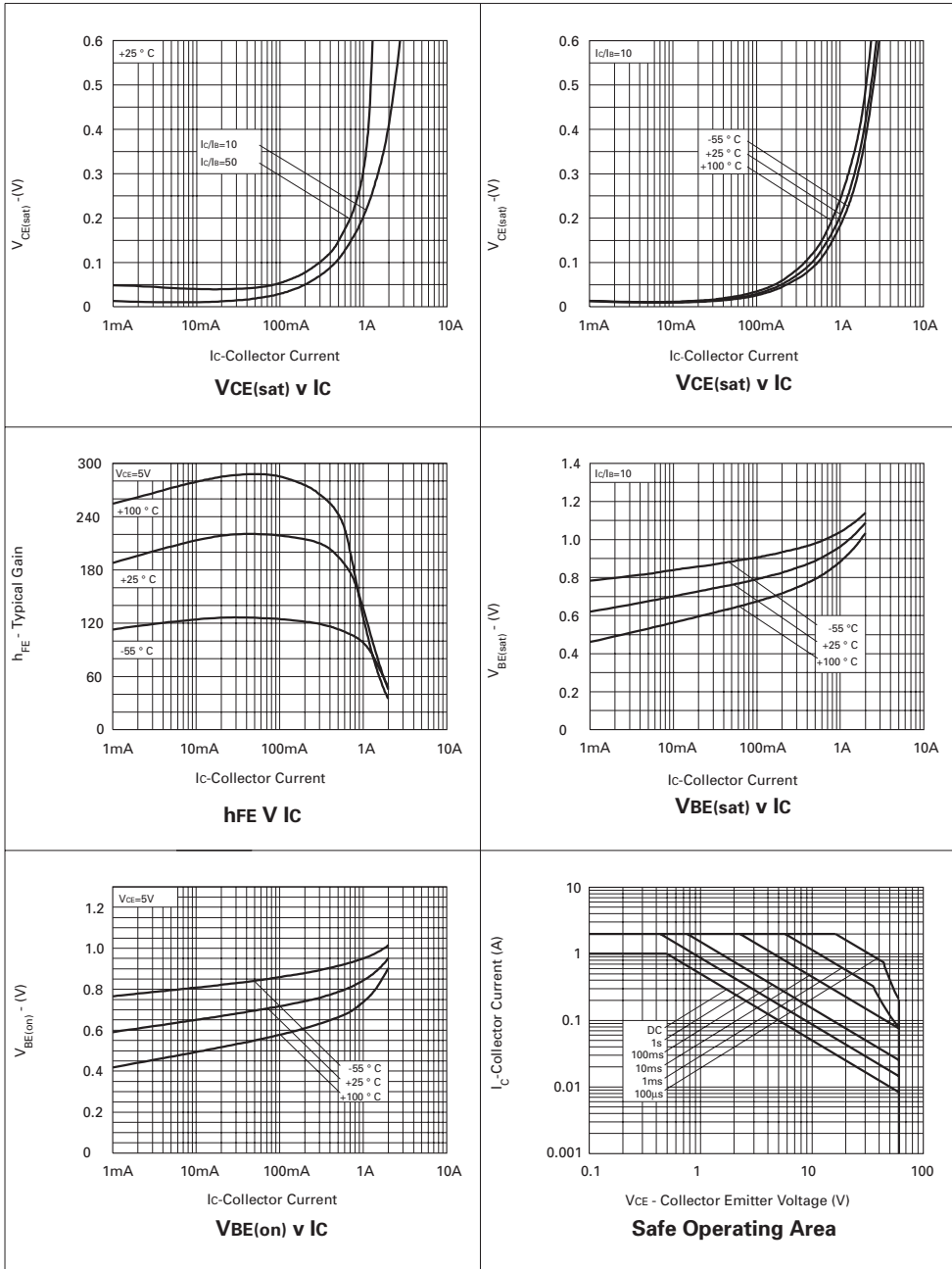
## NPN

### ELECTRICAL CHARACTERISTICS (at $T_{amb} = 25^{\circ}\text{C}$ unless otherwise stated).

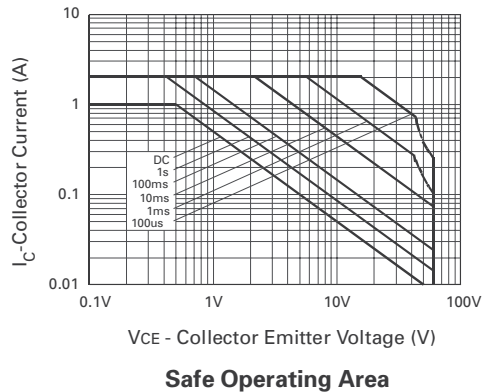
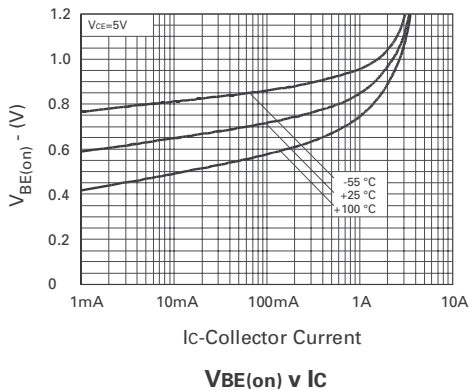
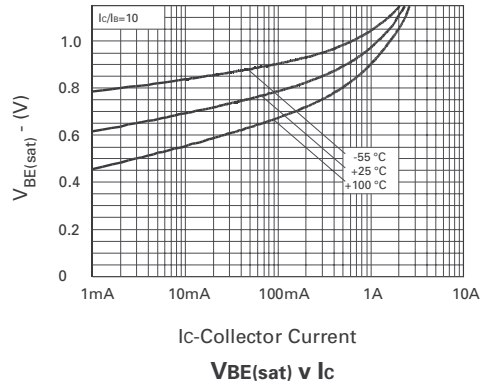
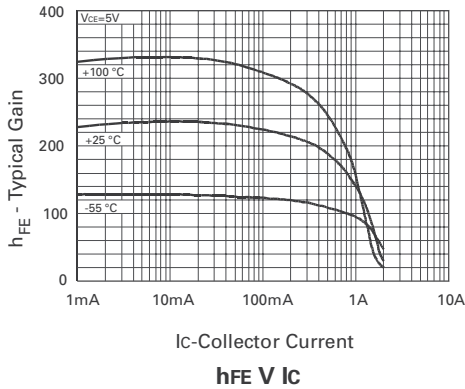
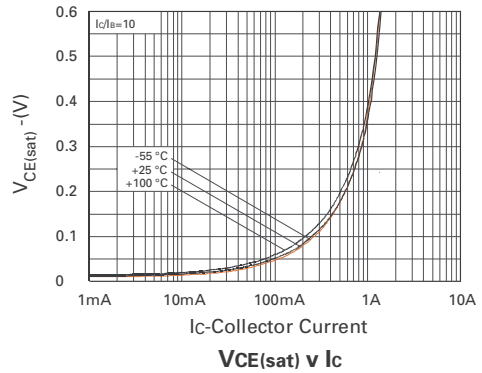
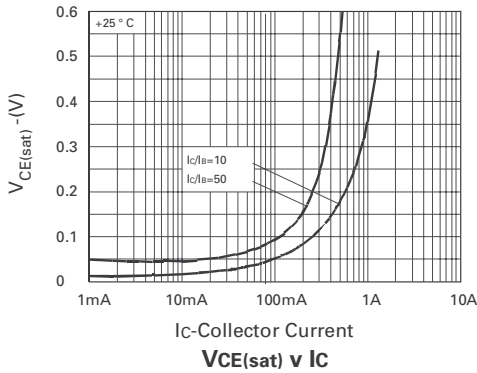
| PARAMETER                             | SYMBOL        | MIN.                   | TYP. | MAX.        | UNIT   | CONDITIONS.                                                                                                                                                                  |
|---------------------------------------|---------------|------------------------|------|-------------|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Collector-Base Breakdown Voltage      | $V_{(BR)CBO}$ | 80                     |      |             | V      | $I_C = 100\mu\text{A}$                                                                                                                                                       |
| Collector-Emitter Breakdown Voltage   | $V_{(BR)CEO}$ | 60                     |      |             | V      | $I_C = 10\text{mA}^*$                                                                                                                                                        |
| Emitter-Base Breakdown Voltage        | $V_{(BR)EBO}$ | 5                      |      |             | V      | $I_E = 100\mu\text{A}$                                                                                                                                                       |
| Collector Cut-Off Current             | $I_{CBO}$     |                        |      | 100         | nA     | $V_{CB} = 60\text{V}$                                                                                                                                                        |
| Emitter Cut-Off Current               | $I_{EBO}$     |                        |      | 100         | nA     | $V_{EB} = 4\text{V}$                                                                                                                                                         |
| Collector Emitter Cut-Off Current     | $I_{CES}$     |                        |      | 100         | nA     | $V_{CES} = 60\text{V}$                                                                                                                                                       |
| Collector-Emitter Saturation Voltage  | $V_{CE(sat)}$ |                        |      | 0.25<br>0.5 | V<br>V | $I_C = 500\text{mA}, I_B = 50\text{mA}^*$<br>$I_C = 1\text{A}, I_B = 100\text{mA}^*$                                                                                         |
| Base-Emitter Saturation Voltage       | $V_{BE(sat)}$ |                        |      | 1.1         | V      | $I_C = 1\text{A}, I_B = 100\text{mA}^*$                                                                                                                                      |
| Base-Emitter Turn-On Voltage          | $V_{BE(on)}$  |                        |      | 1.0         | V      | $I_C = 1\text{A}, V_{CE} = 5\text{V}^*$                                                                                                                                      |
| Static Forward Current Transfer Ratio | $h_{FE}$      | 100<br>100<br>80<br>30 |      | 300         |        | $I_C = 1\text{mA}, V_{CE} = 5\text{V}^*$<br>$I_C = 500\text{mA}, V_{CE} = 5\text{V}^*$<br>$I_C = 1\text{A}, V_{CE} = 5\text{V}^*$<br>$I_C = 2\text{A}, V_{CE} = 5\text{V}^*$ |
| Transition Frequency                  | $f_T$         | 150                    |      |             | MHz    | $I_C = 50\text{mA}, V_{CE} = 10\text{V}$<br>$f = 100\text{MHz}$                                                                                                              |
| Output Capacitance                    | $C_{obo}$     |                        |      | 10          | pF     | $V_{CB} = 10\text{V}, f = 1\text{MHz}$                                                                                                                                       |

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

## NPN TYPICAL CHARACTERISTICS

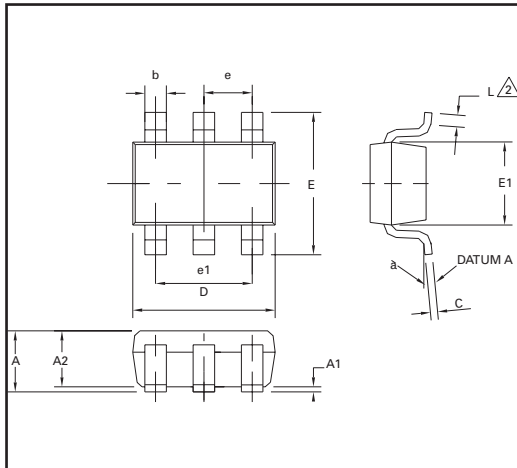


## PNP TYPICAL CHARACTERISTICS

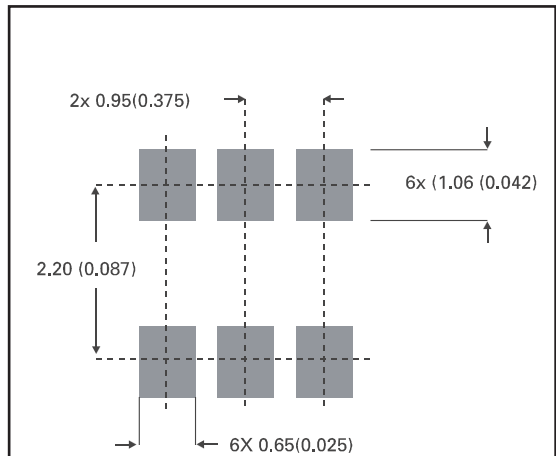


# ZXTD4591E6

## PACKAGE DIMENSIONS



## PAD LAYOUT DETAILS



| DIM | Millimetres |      | Inches    |       |
|-----|-------------|------|-----------|-------|
|     | Min         | Max  | Min       | Max   |
| A   | 0.90        | 1.45 | 0.35      | 0.057 |
| A1  | 0.00        | 0.15 | 0         | 0.006 |
| A2  | 0.90        | 1.30 | 0.035     | 0.051 |
| b   | 0.35        | 0.50 | 0.014     | 0.019 |
| C   | 0.09        | 0.20 | 0.0035    | 0.008 |
| D   | 2.80        | 3.00 | 0.110     | 0.118 |
| E   | 2.60        | 3.00 | 0.102     | 0.118 |
| E1  | 1.50        | 1.75 | 0.059     | 0.069 |
| L   | 0.10        | 0.60 | 0.004     | 0.002 |
| e   | 0.95 REF    |      | 0.037 REF |       |
| e1  | 1.90 REF    |      | 0.074 REF |       |
| L   | 0°          | 10°  | 0°        | 10°   |



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