

# ZXTN07012EFF

## 12V, SOT23F, NPN high gain power transistor

### Summary

$BV_{CEO} > 12V$

$BV_{ECO} > 3V$

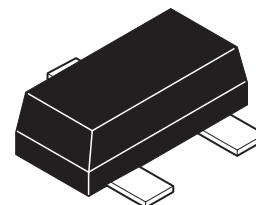
$I_{C(cont)} = 4.5A$

$V_{CE(sat)} < 70mV @ 1A$

$R_{CE(sat)} = 43m\Omega$

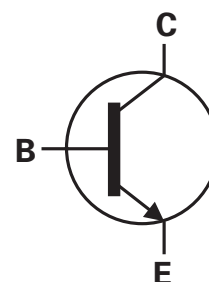
$P_D = 1.5W$

Complementary part number ZXTP07012EFF



### Description

This low voltage NPN transistor has been designed for applications requiring high gain and very low saturation voltage. The SOT23F package is pin compatible with the industry standard SOT23 footprint but offers lower profile and higher dissipation for applications where power density is of utmost importance.

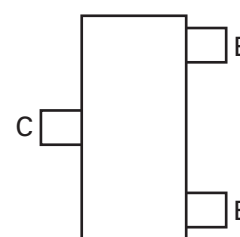


### Features

- Low profile SOT23F package
- Low saturation voltage
- High gain
- High power dissipation

### Applications

- LED driver
- Boost converter
- Logic interface
- Motor drive



Pinout - top view

### Ordering information

| Device         | Reel size (inches) | Tape width (mm) | Quantity per reel |
|----------------|--------------------|-----------------|-------------------|
| ZXTN07012EFFTA | 7                  | 8               | 3000              |

### Device marking

1D3

## Absolute maximum ratings

| Parameter                                          | Symbol         | Limit       | Unit            |
|----------------------------------------------------|----------------|-------------|-----------------|
| Collector-base voltage                             | $V_{CBO}$      | 20          | V               |
| Collector-emitter voltage                          | $V_{CEO}$      | 12          | V               |
| Emitter-collector voltage (reverse blocking)       | $V_{ECO}$      | 3           | V               |
| Emitter-base voltage                               | $V_{EBO}$      | 7           | V               |
| Continuous collector current <sup>(c)</sup>        | $I_C$          | 4.5         | A               |
| Base current                                       | $I_B$          | 1           | A               |
| Peak pulse current                                 | $I_{CM}$       | 10          | A               |
| Power dissipation at $T_{amb} = 25^{\circ}C^{(a)}$ | $P_D$          | 0.84        | W               |
| Linear derating factor                             |                | 6.72        | mW/ $^{\circ}C$ |
| Power dissipation at $T_{amb} = 25^{\circ}C^{(b)}$ | $P_D$          | 1.34        | W               |
| Linear derating factor                             |                | 10.72       | mW/ $^{\circ}C$ |
| Power dissipation at $T_{amb} = 25^{\circ}C^{(c)}$ | $P_D$          | 1.50        | W               |
| Linear derating factor                             |                | 12.0        | mW/ $^{\circ}C$ |
| Power dissipation at $T_{amb} = 25^{\circ}C^{(d)}$ | $P_D$          | 2.0         | W               |
| Linear derating factor                             |                | 16.0        | mW/ $^{\circ}C$ |
| Operating and storage temperature range            | $T_j, T_{stg}$ | - 55 to 150 | $^{\circ}C$     |

## Thermal resistance

| Parameter                          | Symbol          | Limit | Unit          |
|------------------------------------|-----------------|-------|---------------|
| Junction to ambient <sup>(a)</sup> | $R_{\theta JA}$ | 149   | $^{\circ}C/W$ |
| Junction to ambient <sup>(b)</sup> | $R_{\theta JA}$ | 93    | $^{\circ}C/W$ |
| Junction to ambient <sup>(c)</sup> | $R_{\theta JA}$ | 83    | $^{\circ}C/W$ |
| Junction to ambient <sup>(d)</sup> | $R_{\theta JA}$ | 60    | $^{\circ}C/W$ |

### NOTES:

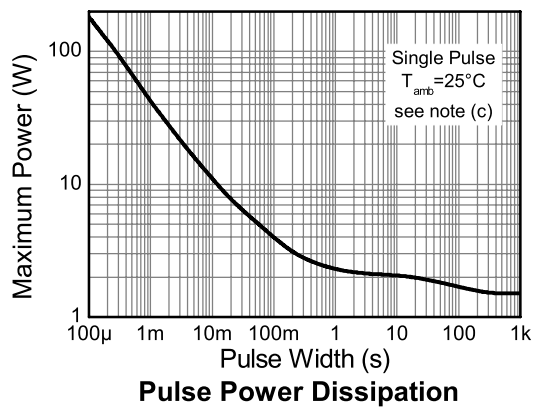
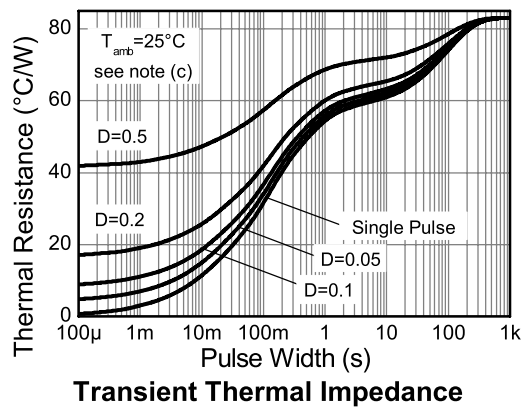
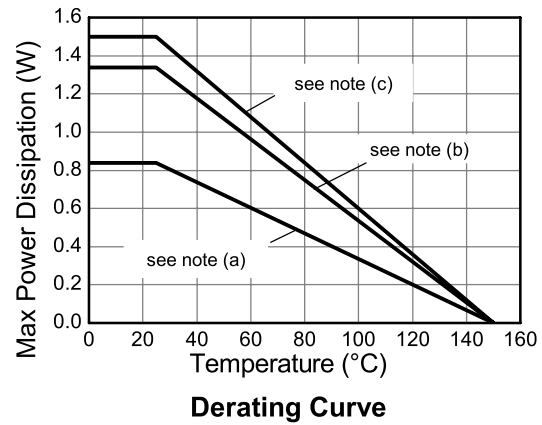
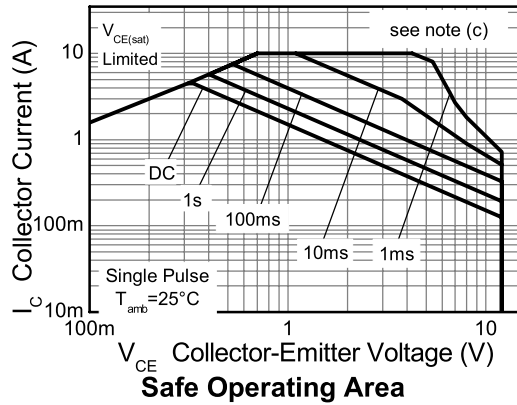
(a) For a device surface mounted on 15mm x 15mm x 1.6mm FR4 PCB with high coverage of single sided 1oz copper, in still air conditions.

(b) Mounted on 25mm x 25mm x 1.6mm FR4 PCB with a high coverage of single sided 2 oz copper in still air conditions.

(c) Mounted on 50mm x 50mm x 1.6mm FR4 PCB with a high coverage of single sided 2 oz copper in still air conditions.

(d) As (c) above measured at  $t < 5$ secs.

## Characteristics



# ZXTN07012EFF

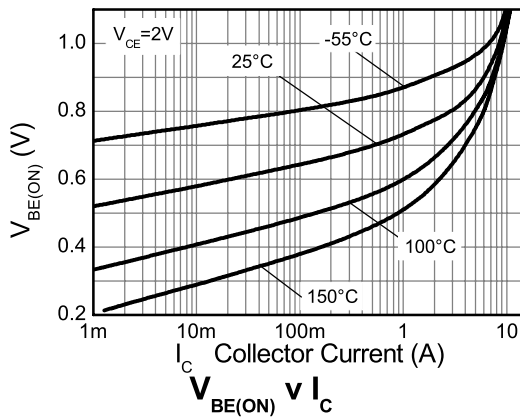
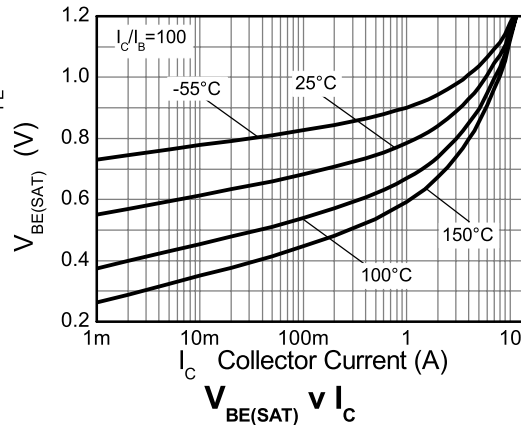
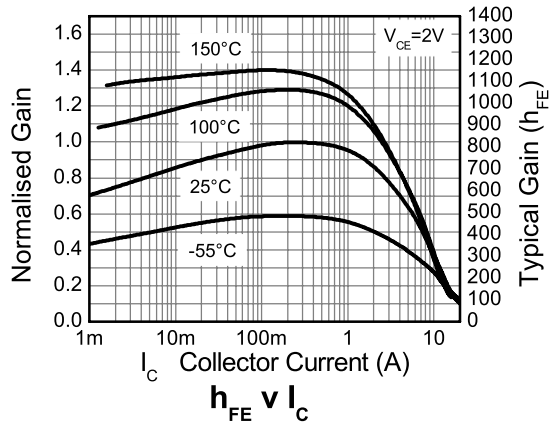
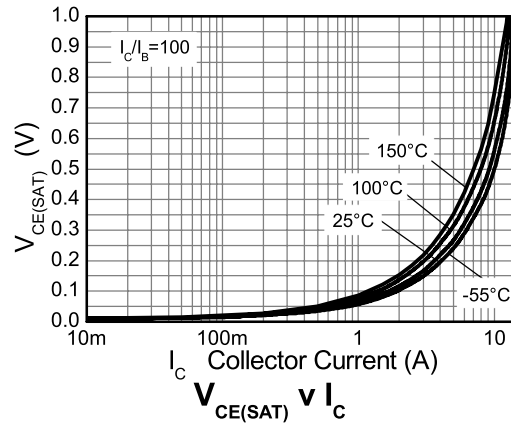
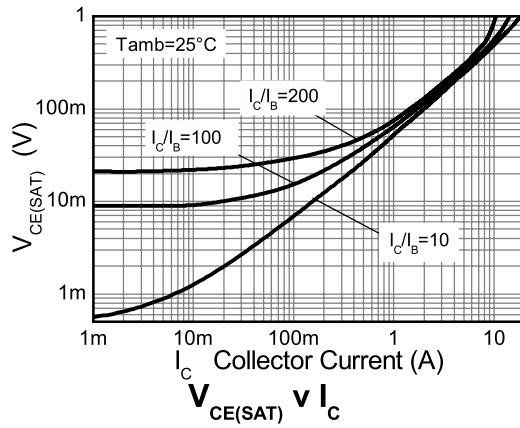
## Electrical characteristics (at $T_{amb} = 25^{\circ}\text{C}$ unless otherwise stated)

| Parameter                                              | Symbol        | Min. | Typ. | Max.     | Unit                | Conditions                                                                                     |
|--------------------------------------------------------|---------------|------|------|----------|---------------------|------------------------------------------------------------------------------------------------|
| Collector-base breakdown voltage                       | $BV_{CBO}$    | 20   | 40   |          | V                   | $I_C = 100\mu\text{A}$                                                                         |
| Collector-emitter breakdown voltage (base open)        | $BV_{CEO}$    | 12   | 17   |          | V                   | $I_C = 10\text{mA}^{(*)}$                                                                      |
| Emitter-base breakdown voltage                         | $BV_{EBO}$    | 7    | 8.3  |          | V                   | $I_E = 100\mu\text{A}$                                                                         |
| Emitter-collector breakdown voltage (reverse blocking) | $BV_{ECX}$    | 6    | 8.2  |          | V                   | $I_E = 100\mu\text{A}$ , $R_{BC} < 1\text{k}\Omega$ or $0.25\text{V} > V_{BC} > -0.25\text{V}$ |
| Emitter-collector breakdown voltage (base open)        | $BV_{ECO}$    | 3.0  | 5.3  |          | V                   | $I_E = 100\mu\text{A}$ ,                                                                       |
| Collector-base cut-off current                         | $I_{CBO}$     |      | <1   | 50<br>20 | nA<br>$\mu\text{A}$ | $V_{CB} = 16\text{V}$<br>$V_{CB} = 16\text{V}$ , $T_{amb} = 100^{\circ}\text{C}$               |
| Emitter-base cut-off current                           | $I_{EBO}$     |      | <1   | 50       | nA                  | $V_{EB} = 5.6\text{V}$                                                                         |
| Collector-emitter saturation voltage                   | $V_{CE(sat)}$ |      | 25   | 40       | mV                  | $I_C = 100\text{mA}$ , $I_B = 0.5\text{mA}^{(*)}$                                              |
|                                                        |               |      | 60   | 85       | mV                  | $I_C = 1\text{A}$ , $I_B = 10\text{mA}^{(*)}$                                                  |
|                                                        |               |      | 50   | 70       | mV                  | $I_C = 1\text{A}$ , $I_B = 100\text{mA}^{(*)}$                                                 |
|                                                        |               |      | 105  | 150      | mV                  | $I_C = 2\text{A}$ , $I_B = 20\text{mA}^{(*)}$                                                  |
|                                                        |               |      | 215  | 320      | mV                  | $I_C = 4.5\text{A}$ , $I_B = 45\text{mA}^{(*)}$                                                |
| Base-emitter saturation voltage                        | $V_{BE(sat)}$ |      | 945  | 1050     | mV                  | $I_C = 4.5\text{A}$ , $I_B = 45\text{mA}^{(*)}$                                                |
| Base-emitter turn-on voltage                           | $V_{BE(on)}$  |      | 850  | 950      | mV                  | $I_C = 4.5\text{A}$ , $V_{CE} = 2\text{V}^{(*)}$                                               |
| Static forward current transfer ratio                  | $h_{FE}$      | 500  | 800  | 1500     |                     | $I_C = 0.1\text{A}$ , $V_{CE} = 2\text{V}^{(*)}$                                               |
|                                                        |               | 400  | 650  |          |                     | $I_C = 2\text{A}$ , $V_{CE} = 2\text{V}^{(*)}$                                                 |
|                                                        |               | 330  | 530  |          |                     | $I_C = 4.5\text{A}$ , $V_{CE} = 2\text{V}^{(*)}$                                               |
|                                                        |               | 140  | 230  |          |                     | $I_C = 10\text{A}$ , $V_{CE} = 2\text{V}^{(*)}$                                                |
| Transition frequency                                   | $f_T$         | 150  | 220  |          | MHz                 | $I_C = 50\text{mA}$ , $V_{CE} = 5\text{V}$<br>$f = 50\text{MHz}$                               |
| Input capacitance                                      | $C_{ibo}$     |      | 229  |          | pF                  | $V_{EB} = 0.5\text{V}$ , $f = 1\text{MHz}^{(*)}$                                               |
| Output capacitance                                     | $C_{Obo}$     |      | 40   | 50       | pF                  | $V_{CB} = 10\text{V}$ , $f = 1\text{MHz}^{(*)}$                                                |
| Delay time                                             | $t_d$         |      | 26.8 |          | ns                  | $V_{CC} = 10\text{V}$ .<br>$I_C = 500\text{mA}$ ,<br>$I_{B1} = I_{B2} = 50\text{mA}$ .         |
| Rise time                                              | $t_r$         |      | 14.2 |          | ns                  |                                                                                                |
| Storage time                                           | $t_s$         |      | 250  |          | ns                  |                                                                                                |
| Fall time                                              | $t_f$         |      | 67.7 |          | ns                  |                                                                                                |

### NOTES:

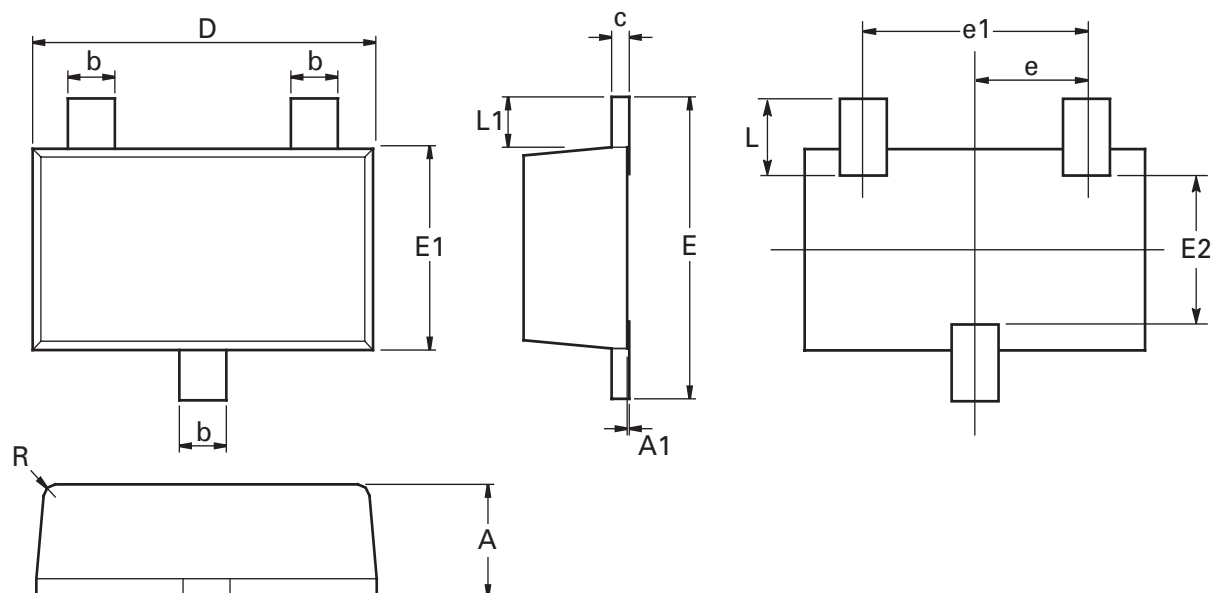
(\*) Measured under pulsed conditions. Pulse width  $\leq 300\mu\text{s}$ ; duty cycle  $\leq 2\%$ .

## Typical characteristics



# ZXTN07012EFF

## Package outline - SOT23F



| Dim. | Millimeters |      | Inches     |        | Dim. | Millimeters |      | Inches |        |
|------|-------------|------|------------|--------|------|-------------|------|--------|--------|
|      | Min.        | Max. | Min.       | Max.   |      | Min.        | Max. | Max.   | Max.   |
| A    | 0.80        | 1.00 | 0.0315     | 0.0394 | E    | 2.30        | 2.50 | 0.0906 | 0.0984 |
| A1   | 0.00        | 0.10 | 0.00       | 0.0043 | E1   | 1.50        | 1.70 | 0.0590 | 0.0669 |
| b    | 0.35        | 0.45 | 0.0153     | 0.0161 | E2   | 1.10        | 1.26 | 0.0433 | 0.0496 |
| c    | 0.10        | 0.20 | 0.0043     | 0.0079 | L    | 0.48        | 0.68 | 0.0189 | 0.0268 |
| D    | 2.80        | 3.00 | 0.1102     | 0.1181 | L1   | 0.30        | 0.50 | 0.0153 | 0.0161 |
| e    | 0.95 ref    |      | 0.0374 ref |        | R    | 0.05        | 0.15 | 0.0019 | 0.0059 |
| e1   | 1.80        | 2.00 | 0.0709     | 0.0787 | O    | 0°          | 12°  | 0°     | 12°    |

**Note:** Controlling dimensions are in millimeters. Approximate dimensions are provided in inches.

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