



# ZXTN25020CFH

## 20V, SOT23, NPN medium power transistor

### Summary

$BV_{CEX} > 70V$

$BV_{CEO} > 20V$

$BV_{ECO} > 5V$

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

$V_{CE(sat)} < 45\text{ mV @ } 1A$

$R_{CE(sat)} = 28\text{ m}\Omega$

$P_D = 1.25W$

Complementary part number ZXTP25020CFH

### Description

Advanced process capability and package design have been used to maximize the power handling and performance of this small outline transistor. The compact size and ratings of this device make it ideally suited to applications where space is at a premium.

### Features

- High power dissipation SOT23 package
- High peak current
- High gain
- Low saturation voltage
- 70V forward blocking voltage
- 5V reverse blocking voltage

### Applications

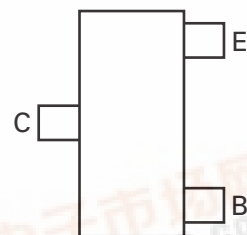
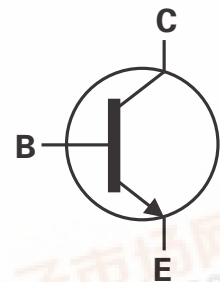
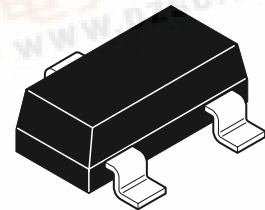
- MOSFET gate drivers
- Power switches
- Motor control
- DC fans
- DC-DC converters

### Ordering information

| Device         | Reel size (inches) | Tape width (mm) | Quantity per reel |
|----------------|--------------------|-----------------|-------------------|
| ZXTN25020CFHTA | 7                  | 8               | 3,000             |

### Device marking

1B3



Pinout - top view

# ZXTN25020CFH

## Absolute maximum ratings

| Parameter                                               | Symbol         | Limit       | Unit  |
|---------------------------------------------------------|----------------|-------------|-------|
| Collector-base voltage                                  | $V_{CBO}$      | 70          | V     |
| Collector-emitter voltage (forward blocking)            | $V_{CEX}$      | 70          | V     |
| Collector-emitter voltage                               | $V_{CEO}$      | 20          | V     |
| Emitter-collector voltage (reverse blocking)            | $V_{ECO}$      | 5           | 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 $T_{amb} = 25^\circ\text{C}^{(a)}$ | $P_D$          | 0.73        | W     |
| Linear derating factor                                  |                | 5.84        | mW/°C |
| Power dissipation at $T_{amb} = 25^\circ\text{C}^{(b)}$ | $P_D$          | 1.05        | W     |
| Linear derating factor                                  |                | 8.4         | mW/°C |
| Power dissipation at $T_{amb} = 25^\circ\text{C}^{(c)}$ | $P_D$          | 1.25        | W     |
| Linear derating factor                                  |                | 9.6         | mW/°C |
| Power dissipation at $T_{amb} = 25^\circ\text{C}^{(d)}$ | $P_D$          | 1.81        | W     |
| Linear derating factor                                  |                | 14.5        | mW/°C |
| Operating and storage temperature range                 | $T_j, T_{stg}$ | - 55 to 150 | °C    |

## Thermal resistance

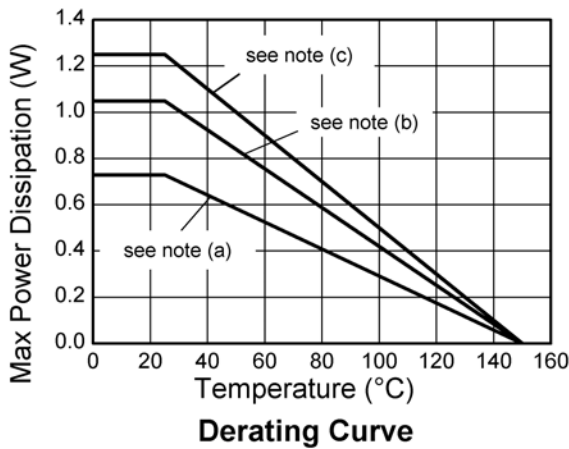
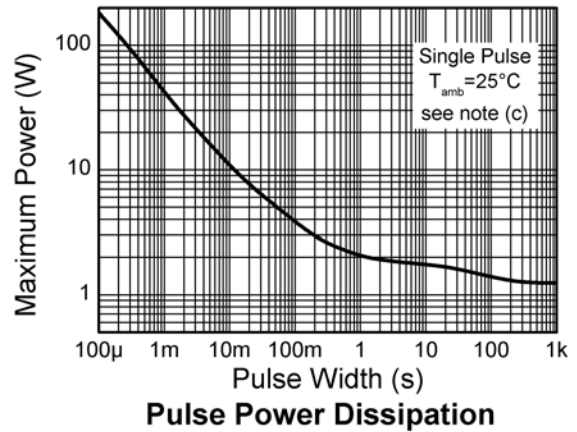
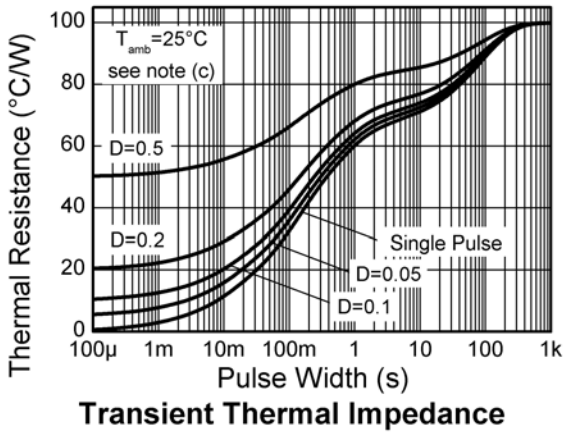
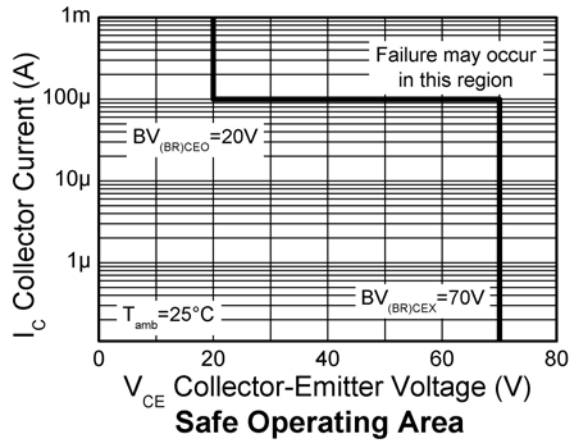
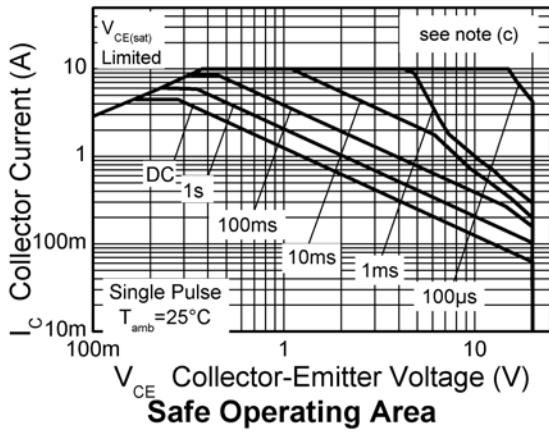
| Parameter                          | Symbol          | Limit | Unit |
|------------------------------------|-----------------|-------|------|
| Junction to ambient <sup>(a)</sup> | $R_{\theta JA}$ | 171   | °C/W |
| Junction to ambient <sup>(b)</sup> | $R_{\theta JA}$ | 119   | °C/W |
| Junction to ambient <sup>(c)</sup> | $R_{\theta JA}$ | 100   | °C/W |
| Junction to ambient <sup>(d)</sup> | $R_{\theta JA}$ | 69    | °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.

# ZXTN25020CFH

## Characteristics



# ZXTN25020CFH

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

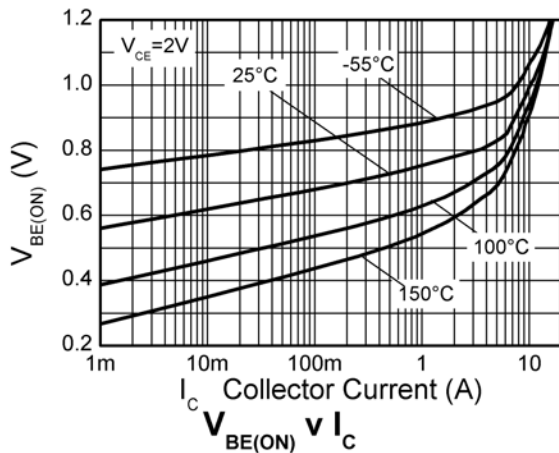
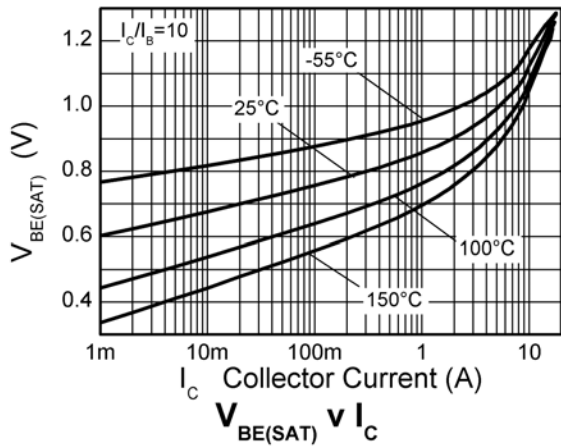
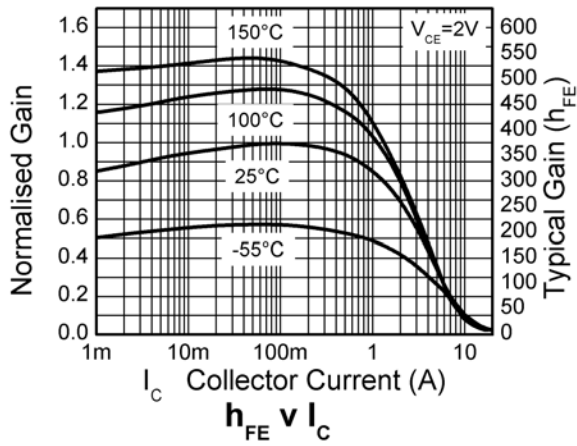
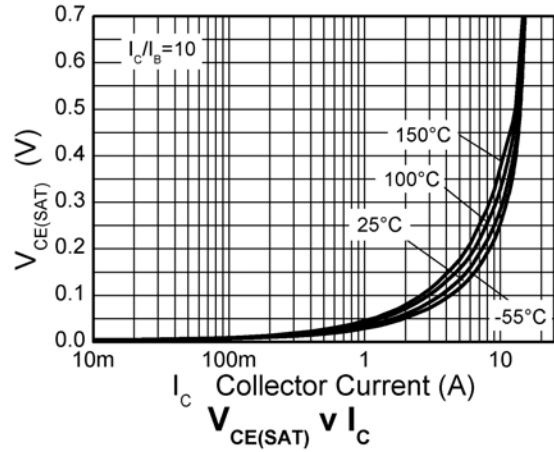
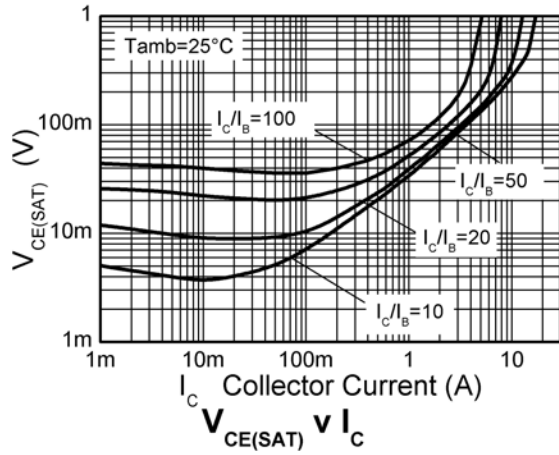
| Parameter                                              | Symbol        | Min.                   | Typ.                         | Max.                          | Unit                       | Conditions                                                                                                                                                                                                                                              |
|--------------------------------------------------------|---------------|------------------------|------------------------------|-------------------------------|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Collector-base breakdown voltage                       | $BV_{CBO}$    | 70                     | 100                          |                               | V                          | $I_C = 100\mu\text{A}$                                                                                                                                                                                                                                  |
| Collector-emitter breakdown voltage (forward blocking) | $BV_{CEX}$    | 70                     | 100                          |                               |                            | $I_C = 100\mu\text{A}$ , $R_{BE} \leq 1\text{k}\Omega$ or $-1\text{V} < V_{BE} < 0.25\text{V}$                                                                                                                                                          |
| Collector-emitter breakdown voltage (base open)        | $BV_{CEO}$    | 20                     | 35                           |                               | 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                      | 8.0                          |                               | V                          | $I_E = 100\mu\text{A}$ , $R_{BC} \leq 1\text{k}\Omega$ or $0.25\text{V} > V_{BC} > -0.25\text{V}$                                                                                                                                                       |
| Emitter-collector breakdown voltage (base open)        | $BV_{ECO}$    | 5                      | 6.6                          |                               | V                          | $I_E = 100\mu\text{A}$ ,                                                                                                                                                                                                                                |
| Collector-base cut-off current                         | $I_{CBO}$     |                        | <1                           | 50<br>20                      | nA<br>$\mu\text{A}$        | $V_{CB} = 56\text{V}$<br>$V_{CB} = 56\text{V}$ , $T_{amb} = 100^{\circ}\text{C}$                                                                                                                                                                        |
| Collector-emitter cut-off current                      | $I_{CEX}$     |                        | -                            | 100                           | nA                         | $V_{CE} = 56\text{V}$ ; $R_{BE} \leq 1\text{k}\Omega$ or $-1\text{V} < V_{BE} < 0.25\text{V}$                                                                                                                                                           |
| Emitter-base cut-off current                           | $I_{EBO}$     |                        | <1                           | 50                            | nA                         | $V_{EB} = 5.6\text{V}$                                                                                                                                                                                                                                  |
| Collector-emitter saturation voltage                   | $V_{CE(sat)}$ |                        | 35<br>53<br>85<br>175<br>125 | 45<br>65<br>100<br>220<br>140 | mV<br>mV<br>mV<br>mV<br>mV | $I_C = 1\text{A}$ , $I_B = 100\text{mA}^{(*)}$<br>$I_C = 1\text{A}$ , $I_B = 20\text{mA}^{(*)}$<br>$I_C = 2\text{A}$ , $I_B = 40\text{mA}^{(*)}$<br>$I_C = 4.5\text{A}$ , $I_B = 90\text{mA}^{(*)}$<br>$I_C = 4.5\text{A}$ , $I_B = 450\text{mA}^{(*)}$ |
| Base-emitter saturation voltage                        | $V_{BE(sat)}$ |                        | 905                          | 1000                          | mV                         | $I_C = 4.5\text{A}$ , $I_B = 90\text{mA}^{(*)}$                                                                                                                                                                                                         |
| Base-emitter turn-on voltage                           | $V_{BE(on)}$  |                        | 815                          | 900                           | mV                         | $I_C = 4.5\text{A}$ , $V_{CE} = 2\text{V}^{(*)}$                                                                                                                                                                                                        |
| Static forward current transfer ratio                  | $h_{FE}$      | 200<br>180<br>90<br>25 | 350<br>320<br>145<br>40      | 500                           |                            | $I_C = 10\text{mA}$ , $V_{CE} = 2\text{V}^{(*)}$<br>$I_C = 1\text{A}$ , $V_{CE} = 2\text{V}^{(*)}$<br>$I_C = 4.5\text{A}$ , $V_{CE} = 2\text{V}^{(*)}$<br>$I_C = 10\text{A}$ , $V_{CE} = 2\text{V}^{(*)}$                                               |
| Transition frequency                                   | $f_T$         |                        | 185                          |                               | MHz                        | $I_C = 50\text{mA}$ , $V_{CE} = 10\text{V}$<br>$f = 100\text{MHz}$                                                                                                                                                                                      |
| Output capacitance                                     | $C_{OBO}$     |                        | 16.8                         | 25                            | pF                         | $V_{CB} = 10\text{V}$ , $f = 1\text{MHz}^{(*)}$                                                                                                                                                                                                         |
| Delay time                                             | $t_d$         |                        | 70.5                         |                               | ns                         | $V_{CC} = 10\text{V}$ .                                                                                                                                                                                                                                 |
| Rise time                                              | $t_r$         |                        | 88                           |                               | ns                         | $I_C = 1\text{A}$ ,                                                                                                                                                                                                                                     |
| Storage time                                           | $t_s$         |                        | 266                          |                               | ns                         | $I_{B1} = I_{B2} = 10\text{mA}$ .                                                                                                                                                                                                                       |
| Fall time                                              | $t_f$         |                        | 65                           |                               | ns                         |                                                                                                                                                                                                                                                         |

### NOTES:

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

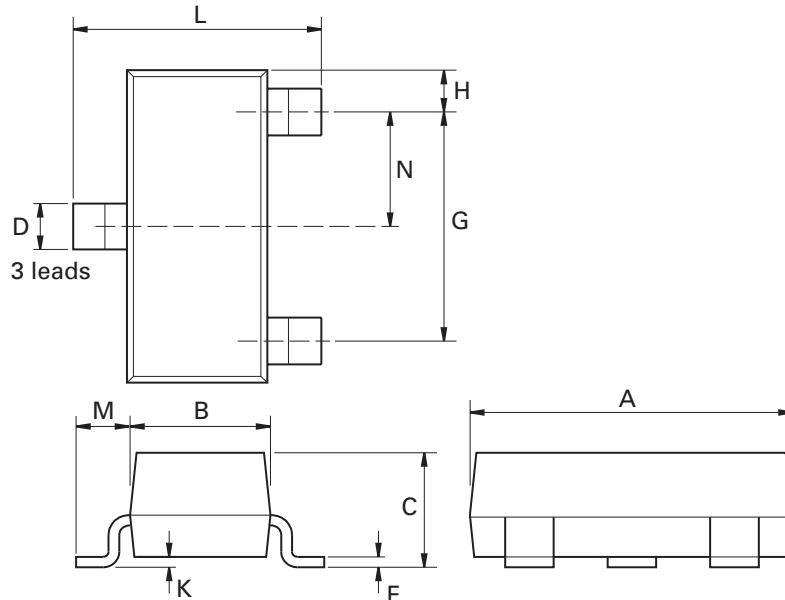
# ZXTN25020CFH

## Typical characteristics



# ZXTN25020CFH

## Package outline - SOT23



| Dim. | Millimeters |      | Inches    |        | Dim. | Millimeters |      | Inches     |        |
|------|-------------|------|-----------|--------|------|-------------|------|------------|--------|
|      | Min.        | Max. | Min.      | Max.   |      | Min.        | Max. | Max.       | Max.   |
| A    | 2.67        | 3.05 | 0.105     | 0.120  | H    | 0.33        | 0.51 | 0.013      | 0.020  |
| B    | 1.20        | 1.40 | 0.047     | 0.055  | K    | 0.01        | 0.10 | 0.0004     | 0.004  |
| C    | -           | 1.10 | -         | 0.043  | L    | 2.10        | 2.50 | 0.083      | 0.0985 |
| D    | 0.37        | 0.53 | 0.015     | 0.021  | M    | 0.45        | 0.64 | 0.018      | 0.025  |
| F    | 0.085       | 0.15 | 0.0034    | 0.0059 | N    | 0.95 NOM    |      | 0.0375 NOM |        |
| G    | 1.90 NOM    |      | 0.075 NOM |        | -    | -           | -    | -          | -      |

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

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