

# ZX3CD2S1M832

## MPPS™ Miniature Package Power Solutions 20V PNP LOW SATURATION TRANSISTOR AND 40V, 1A SCHOTTKY DIODE COMBINATION DUAL

### SUMMARY

PNP Transistor —  $V_{CEO} = -20V$ ;  $R_{SAT} = 64m\Omega$ ;  $I_C = -3.5A$

Schottky Diode —  $V_R = 40V$ ;  $V_F = 500mV$  (@1A);  $I_C = 1A$

### DESCRIPTION

Packaged in the new innovative 3mm x 2mm MLP this combination dual comprises an ultra low saturation PNP transistor and a 1A Schottky barrier diode. This excellent combination provides users with highly efficient performance in applications including DC-DC and charging circuits.

Users will also gain several other **key benefits**:

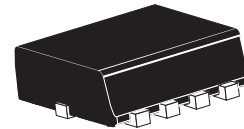
**Performance capability equivalent to much larger packages**

**Improved circuit efficiency & power levels**

**PCB area and device placement savings**

**Lower package height (0.9mm nom)**

**Reduced component count**



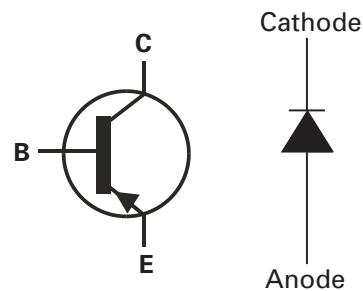
3mm x 2mm Dual Die MLP

### FEATURES

- Extremely Low Saturation Voltage (-220mV @-1A)
- $H_{FE}$  characterised up to -6A
- $I_C = -3.5A$  Continuous Collector Current
- **Extremely Low  $V_F$ , fast switching Schottky**
- 3mm x 2mm MLP

### APPLICATIONS

- DC - DC Converters
- Mobile Phones
- Charging Circuits
- Motor control



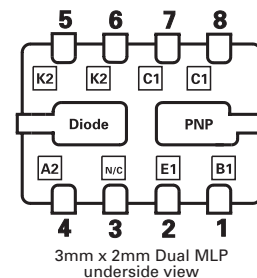
### ORDERING INFORMATION

| DEVICE         | REEL | TAPE WIDTH | QUANTITY PER REEL |
|----------------|------|------------|-------------------|
| ZX3CD2S1M832TA | 7"   | 8mm        | 3000              |
| ZX3CD2S1M832TC | 13"  | 8mm        | 10000             |

### DEVICE MARKING

2S1

### PINOUT



# ZX3CD2S1M832

## ABSOLUTE MAXIMUM RATINGS.

| PARAMETER                                                     | SYMBOL    | VALUE        | UNIT       |
|---------------------------------------------------------------|-----------|--------------|------------|
| <b>Transistor</b>                                             |           |              |            |
| Collector-Base Voltage                                        | $V_{CBO}$ | -25          | V          |
| Collector-Emitter Voltage                                     | $V_{CEO}$ | -20          | V          |
| Emitter-Base Voltage                                          | $V_{EBO}$ | -7.5         | V          |
| Peak Pulse Current                                            | $I_{CM}$  | -6           | A          |
| Continuous Collector Current (a)(f)                           | $I_C$     | -3.5         | A          |
| Base Current                                                  | $I_B$     | 1000         | mA         |
| Power Dissipation at TA=25°C (a)(f)<br>Linear Derating Factor | $P_D$     | 1.5<br>12    | W<br>mW/°C |
| Power Dissipation at TA=25°C (b)(f)<br>Linear Derating Factor | $P_D$     | 2.45<br>19.6 | W<br>mW/°C |
| Power Dissipation at TA=25°C (c)(f)<br>Linear Derating Factor | $P_D$     | 1<br>8       | W<br>mW/°C |
| Power Dissipation at TA=25°C (d)(f)<br>Linear Derating Factor | $P_D$     | 1.13<br>9    | W<br>mW/°C |
| Power Dissipation at TA=25°C (d)(g)<br>Linear Derating Factor | $P_D$     | 1.7<br>13.6  | W<br>mW/°C |
| Power Dissipation at TA=25°C (e)(g)<br>Linear Derating Factor | $P_D$     | 3<br>24      | W<br>mW/°C |
| Storage Temperature Range                                     | $T_{stg}$ | -55 to +150  | °C         |
| Junction Temperature                                          | $T_j$     | 150          | °C         |

## THERMAL RESISTANCE

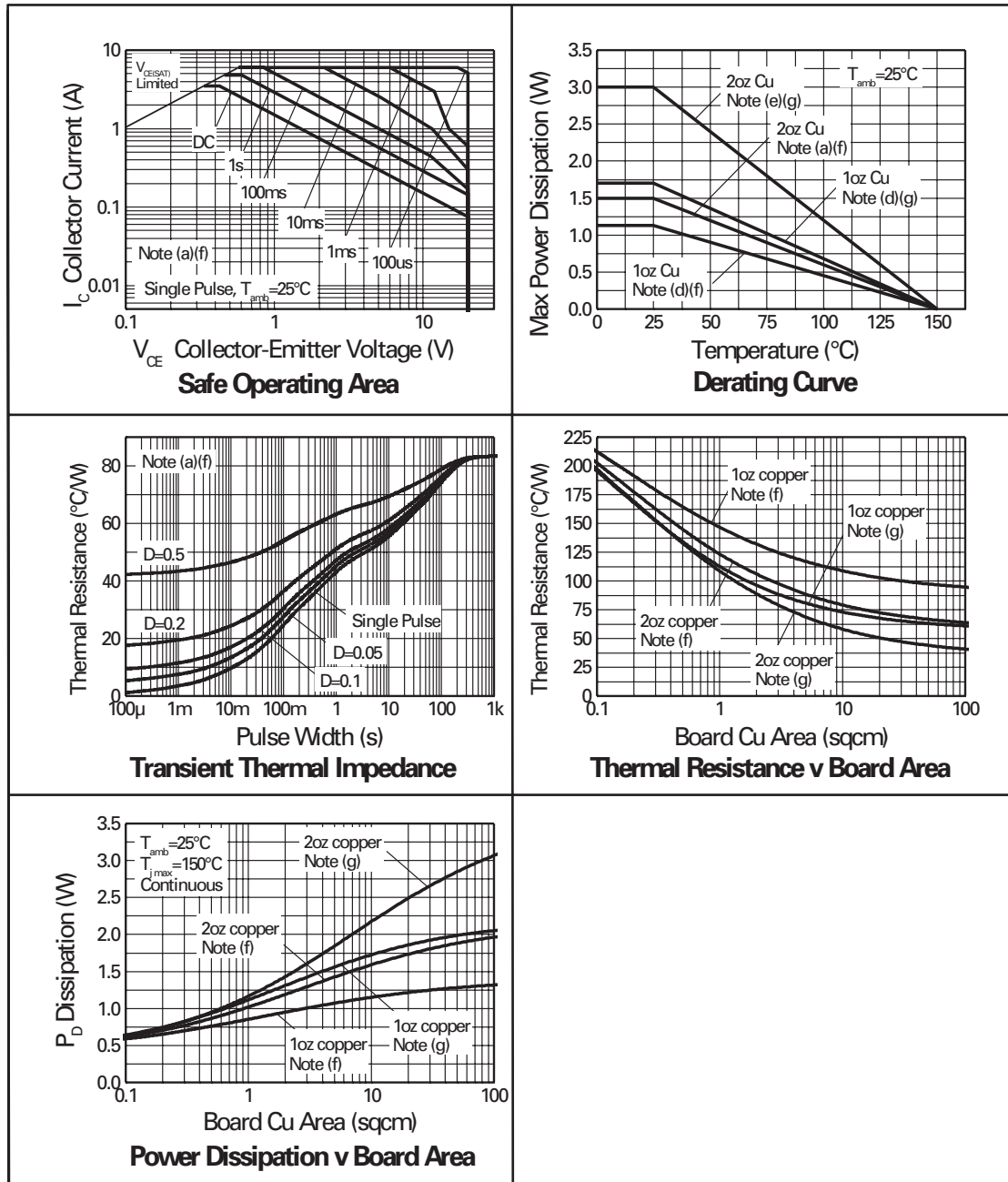
| PARAMETER                  | SYMBOL          | VALUE | UNIT |
|----------------------------|-----------------|-------|------|
| Junction to Ambient (a)(f) | $R_{\theta JA}$ | 83    | °C/W |
| Junction to Ambient (b)(f) | $R_{\theta JA}$ | 51    | °C/W |
| Junction to Ambient (c)(f) | $R_{\theta JA}$ | 125   | °C/W |
| Junction to Ambient (d)(f) | $R_{\theta JA}$ | 111   | °C/W |
| Junction to Ambient (d)(g) | $R_{\theta JA}$ | 73.5  | °C/W |
| Junction to Ambient (e)(g) | $R_{\theta JA}$ | 41.7  | °C/W |

### Notes

- (a) For a dual device surface mounted on 8 sq cm single sided 2oz copper on FR4 PCB, in still air conditions **with all exposed pads attached**. The copper area is split down the centre line into two separate areas with one half connected to each half of the dual device.
- (b) Measured at  $t < 5$  secs for a dual device surface mounted on 8 sq cm single sided 2oz copper on FR4 PCB, in still air conditions **with all exposed pads attached**. The copper area is split down the centre line into two separate areas with one half connected to each half of the dual device.
- (c) For a dual device surface mounted on 8 sq cm single sided 2oz copper on FR4 PCB, in still air conditions **with minimal lead connections only**.
- (d) For a dual device surface mounted on 10 sq cm single sided 1oz copper on FR4 PCB, in still air conditions **with all exposed pads attached**. The copper area is split down the centre line into two separate areas with one half connected to each half of the dual device.
- (e) For a dual device surface mounted on 85 sq cm single sided 2oz copper on FR4 PCB, in still air conditions **with all exposed pads attached**. The copper area is split down the centre line into two separate areas with one half connected to each half of the dual device.
- (f) For a dual device with one active die.
- (g) For dual device with 2 active die running at equal power.
- (h) Repetitive rating - pulse width limited by max junction temperature. Refer to Transient Thermal Impedance graph.
- (i) The minimum copper dimensions required for mounting are no smaller than the exposed metal pads on the base of the device as shown in the package dimensions data. The thermal resistance for a dual device mounted on 1.5mm thick FR4 board using minimum copper 1 oz weight, 1mm wide tracks and one half of the device active is  $R_{th} = 250^{\circ}\text{C/W}$  giving a power rating of  $P_{tot} = 500\text{mW}$ .

# ZX3CD2S1M832

## TRANSISTOR TYPICAL CHARACTERISTICS



# ZX3CD2S1M832

## ABSOLUTE MAXIMUM RATINGS.

| PARAMETER                                                                      | SYMBOL    | VALUE        | UNIT                      |
|--------------------------------------------------------------------------------|-----------|--------------|---------------------------|
| <b>Schottky Diode</b>                                                          |           |              |                           |
| Continuous Reverse Voltage                                                     | $V_R$     | 40           | V                         |
| Forward Voltage @ $I_F=1000\text{mA}(\text{typ})$                              | $V_F$     | 425          | A                         |
| Forward Current                                                                | $I_F$     | 1850         | mA                        |
| Average Peak Forward Current $D=50\%$                                          | $I_{FAV}$ | 3            | A                         |
| Non Repetitive Forward Current $t \leq 100\mu\text{s}$<br>$t \leq 10\text{ms}$ | $I_{FSM}$ | 12<br>7      | A<br>A                    |
| Power Dissipation at $T_A=25^\circ\text{C}$ (a)(f)<br>Linear Derating Factor   | $P_D$     | 1.2<br>12    | W<br>mW/ $^\circ\text{C}$ |
| Power Dissipation at $T_A=25^\circ\text{C}$ (b)(f)<br>Linear Derating Factor   | $P_D$     | 2<br>20      | W<br>mW/ $^\circ\text{C}$ |
| Power Dissipation at $T_A=25^\circ\text{C}$ (c)(f)<br>Linear Derating Factor   | $P_D$     | 0.8<br>8     | W<br>mW/ $^\circ\text{C}$ |
| Power Dissipation at $T_A=25^\circ\text{C}$ (d)(f)<br>Linear Derating Factor   | $P_D$     | 0.9<br>9     | W<br>mW/ $^\circ\text{C}$ |
| Power Dissipation at $T_A=25^\circ\text{C}$ (d)(g)<br>Linear Derating Factor   | $P_D$     | 1.36<br>13.6 | W<br>mW/ $^\circ\text{C}$ |
| Power Dissipation at $T_A=25^\circ\text{C}$ (e)(g)<br>Linear Derating Factor   | $P_D$     | 2.4<br>24    | W<br>mW/ $^\circ\text{C}$ |
| Storage Temperature Range                                                      | $T_{stg}$ | -55 to +150  | $^\circ\text{C}$          |
| Junction Temperature                                                           | $T_j$     | 125          | $^\circ\text{C}$          |

## THERMAL RESISTANCE

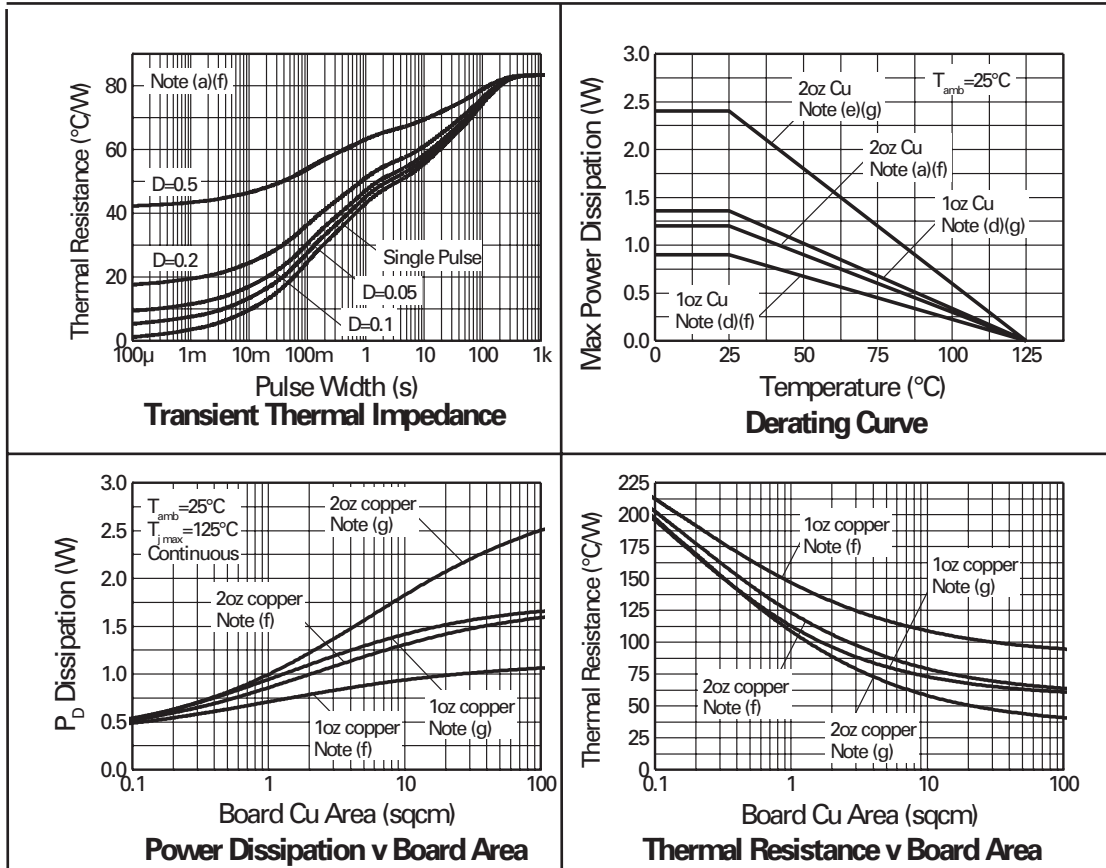
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| Junction to Ambient (d)(f) | $R_{\theta JA}$ | 111   | $^\circ\text{C/W}$ |
| Junction to Ambient (d)(g) | $R_{\theta JA}$ | 73.5  | $^\circ\text{C/W}$ |
| Junction to Ambient (e)(g) | $R_{\theta JA}$ | 41.7  | $^\circ\text{C/W}$ |

### Notes

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- (e) For a dual device surface mounted on 85 sq cm single sided 2oz copper on FR4 PCB, in still air conditions **with all exposed pads attached**. The copper area is split down the centre line into two separate areas with one half connected to each half of the dual device.
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- (h) Repetitive rating - pulse width limited by max junction temperature. Refer to Transient Thermal Impedance graph.
- (i) The minimum copper dimensions required for mounting are no smaller than the exposed metal pads on the base of the device as shown in the package dimensions data. The thermal resistance for a dual device mounted on 1.5mm thick FR4 board using minimum copper 1 oz weight, 1mm wide tracks and one half of the device active is  $R_{\theta h} = 250^\circ\text{C/W}$  giving a power rating of  $P_{tot} = 400\text{mW}$ .

# ZX3CD2S1M832

## SCHOTTKY TYPICAL CHARACTERISTICS



# ZX3CD2S1M832

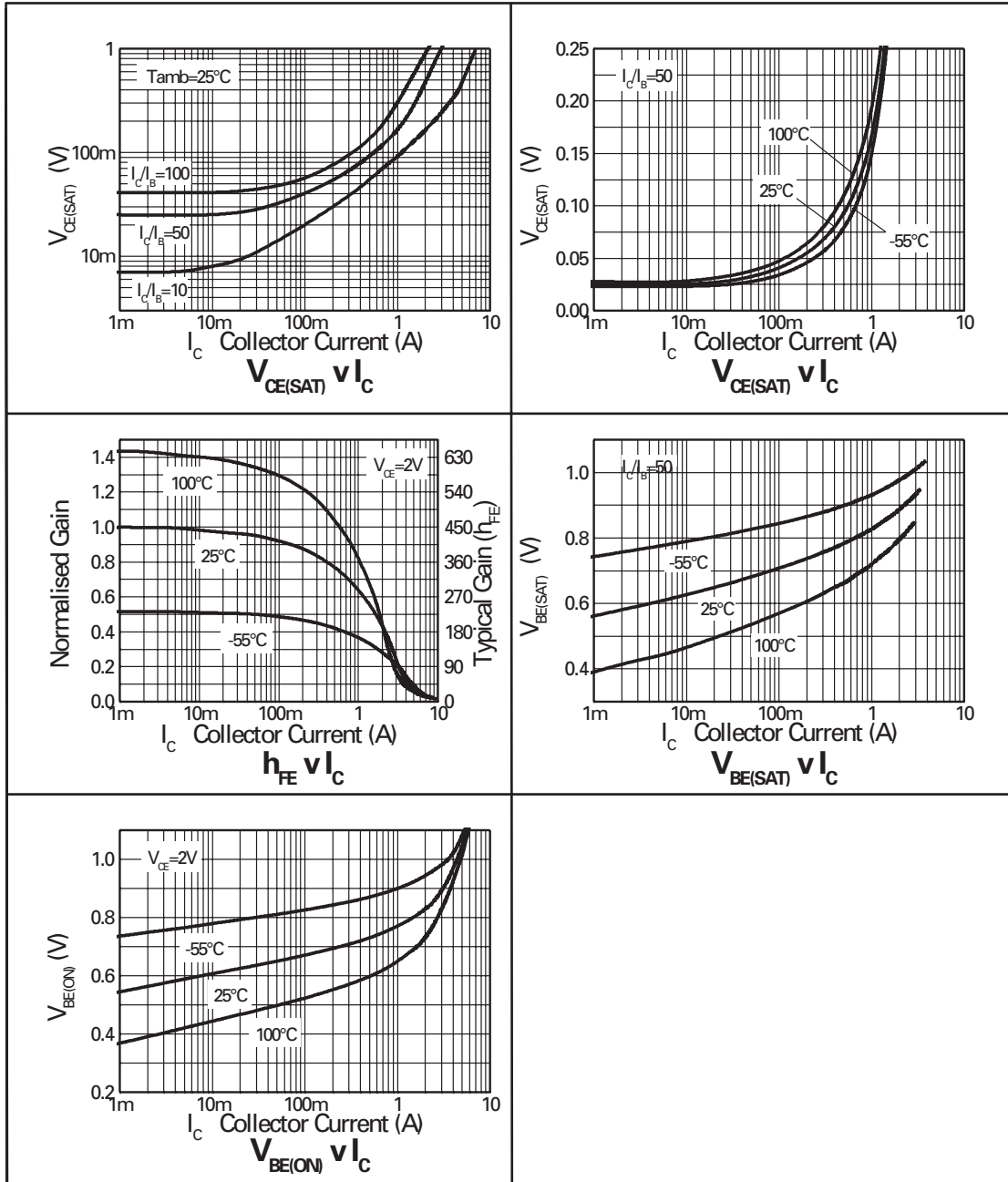
**ELECTRICAL CHARACTERISTICS** (at  $T_{amb} = 25^{\circ}\text{C}$  unless otherwise stated).

| PARAMETER                                        | SYMBOL        | MIN. | TYP.  | MAX.   | UNIT          | CONDITIONS.                                                                                      |
|--------------------------------------------------|---------------|------|-------|--------|---------------|--------------------------------------------------------------------------------------------------|
| <b>TRANSISTOR ELECTRICAL CHARACTERISTICS</b>     |               |      |       |        |               |                                                                                                  |
| Collector-Base Breakdown Voltage                 | $V_{(BR)CBO}$ | -25  | -35   |        | V             | $I_C = -100\mu\text{A}$                                                                          |
| Collector-Emitter Breakdown Voltage              | $V_{(BR)CEO}$ | -20  | -25   |        | V             | $I_C = -10\text{mA}^*$                                                                           |
| Emitter-Base Breakdown Voltage                   | $V_{(BR)EBO}$ | -7.5 | -8.5  |        | V             | $I_E = -100\mu\text{A}$                                                                          |
| Collector Cut-Off Current                        | $I_{CBO}$     |      |       | -25    | nA            | $V_{CB} = -20\text{V}$                                                                           |
| Emitter Cut-Off Current                          | $I_{EBO}$     |      |       | -25    | nA            | $V_{EB} = -6\text{V}$                                                                            |
| Collector Emitter Cut-Off Current                | $I_{CES}$     |      |       | -25    | nA            | $V_{CES} = -16\text{V}$                                                                          |
| Collector-Emitter Saturation Voltage             | $V_{CE(sat)}$ |      | -19   | -30    | mV            | $I_C = -0.1\text{A}, I_B = -10\text{mA}^*$                                                       |
|                                                  |               |      | -170  | -220   | mV            | $I_C = -1\text{A}, I_B = -20\text{mA}^*$                                                         |
|                                                  |               |      | -190  | -250   | mV            | $I_C = -1.5\text{A}, I_B = -50\text{mA}^*$                                                       |
|                                                  |               |      | -240  | -350   | mV            | $I_C = -2.5\text{A}, I_B = -150\text{mA}^*$                                                      |
|                                                  |               |      | -225  | -300   | mV            | $I_C = -3.5\text{A}, I_B = -300\text{mA}^*$                                                      |
| Base-Emitter Saturation Voltage                  | $V_{BE(sat)}$ |      | -1.10 | -1.075 | V             | $I_C = -3.5\text{A}, I_B = -350\text{mA}^*$                                                      |
| Base-Emitter Turn-On Voltage                     | $V_{BE(on)}$  |      | -0.87 | -0.950 | V             | $I_C = -3.5\text{A}, V_{CE} = -2\text{V}^*$                                                      |
| Static Forward Current Transfer Ratio            | $h_{FE}$      | 300  | 475   |        |               | $I_C = -10\text{mA}, V_{CE} = -2\text{V}^*$                                                      |
|                                                  |               | 300  | 450   |        |               | $I_C = -0.1\text{A}, V_{CE} = -2\text{V}^*$                                                      |
|                                                  |               | 150  | 230   |        |               | $I_C = -2\text{A}, V_{CE} = -2\text{V}^*$                                                        |
|                                                  |               | 15   | 30    |        |               | $I_C = -6\text{A}, V_{CE} = -2\text{V}^*$                                                        |
| Transition Frequency                             | $f_T$         | 150  | 180   |        | MHz           | $I_C = -50\text{mA}, V_{CE} = -10\text{V}$<br>$f = 100\text{MHz}$                                |
| Output Capacitance                               | $C_{obo}$     |      | 21    | 30     | pF            | $V_{CB} = -10\text{V}, f = 1\text{MHz}$                                                          |
| Turn-On Time                                     | $t_{(on)}$    |      | 40    |        | ns            | $V_{CC} = -10\text{V}, I_C = -1\text{A}$                                                         |
| Turn-Off Time                                    | $t_{(off)}$   |      | 670   |        | ns            | $I_{B1} = I_{B2} = -50\text{mA}$                                                                 |
| <b>SCHOTTKY DIODE ELECTRICAL CHARACTERISTICS</b> |               |      |       |        |               |                                                                                                  |
| Reverse Breakdown Voltage                        | $V_{(BR)R}$   | 40   | 60    |        | V             | $I_R = 300\mu\text{A}$                                                                           |
| Forward Voltage                                  | $V_F$         |      | 240   | 270    | mV            | $I_F = 50\text{mA}^*$                                                                            |
|                                                  |               |      | 265   | 290    | mV            | $I_F = 100\text{mA}^*$                                                                           |
|                                                  |               |      | 305   | 340    | mV            | $I_F = 250\text{mA}^*$                                                                           |
|                                                  |               |      | 355   | 400    | mV            | $I_F = 500\text{mA}^*$                                                                           |
|                                                  |               |      | 390   | 450    | mV            | $I_F = 750\text{mA}^*$                                                                           |
|                                                  |               |      | 425   | 500    | mV            | $I_F = 1000\text{mA}^*$                                                                          |
|                                                  |               |      | 495   | 600    | mV            | $I_F = 1500\text{mA}^*$                                                                          |
|                                                  |               |      | 420   | —      | mV            | $I_F = 1000\text{mA}, T_a = 100^{\circ}\text{C}^*$                                               |
| Reverse Current                                  | $I_R$         |      | 50    | 100    | $\mu\text{A}$ | $V_R = 30\text{V}$                                                                               |
| Diode Capacitance                                | $C_D$         |      | 25    |        | pF            | $f = 1\text{MHz}, V_R = 25\text{V}$                                                              |
| Reverse Recovery Time                            | $t_{rr}$      |      | 12    |        | ns            | switched from<br>$I_F = 500\text{mA}$ to $I_R = 500\text{mA}$<br>Measured at $I_R = 50\text{mA}$ |

\*Measured under pulsed conditions.

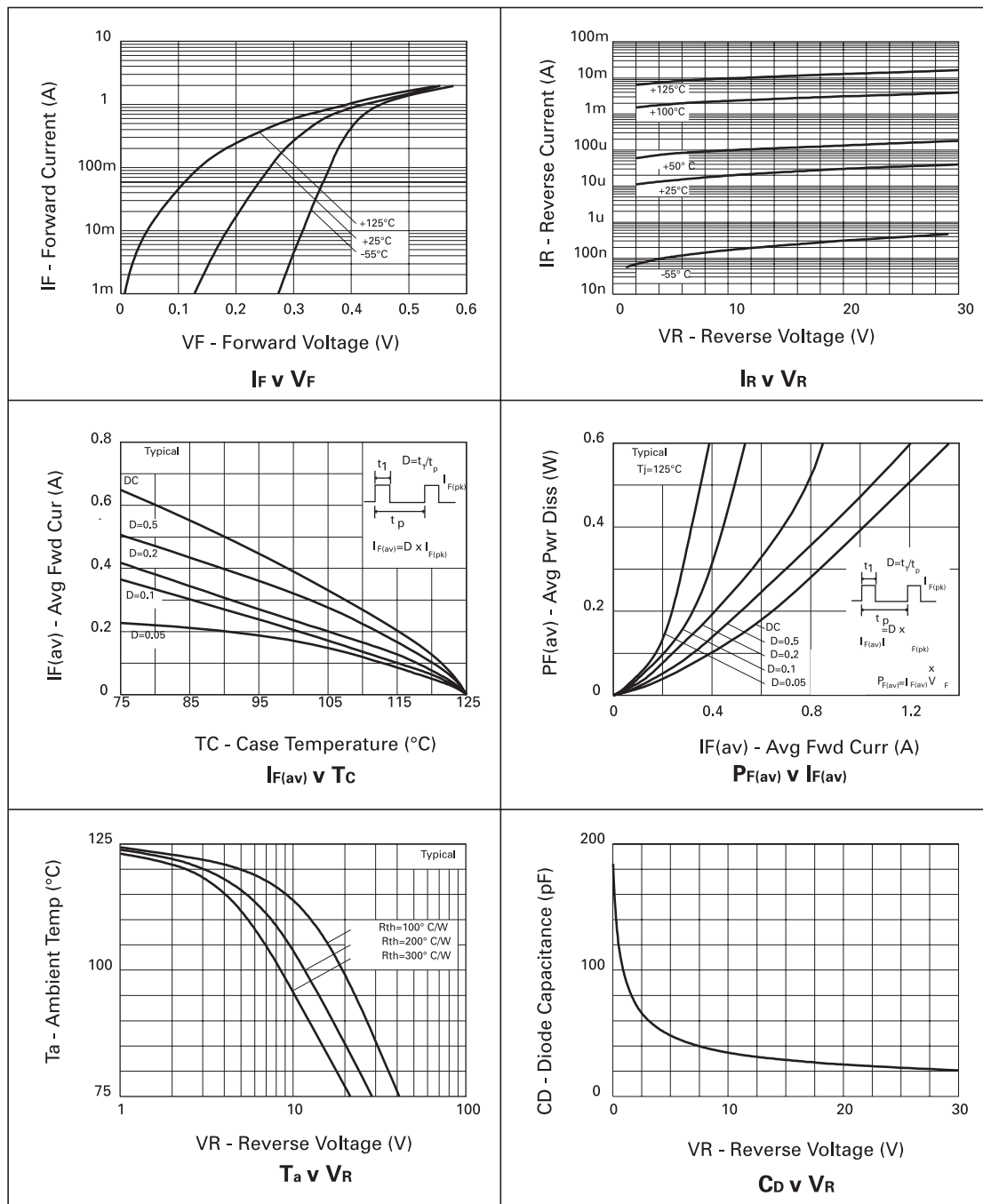
# ZX3CD2S1M832

## TRANSISTOR TYPICAL CHARACTERISTICS



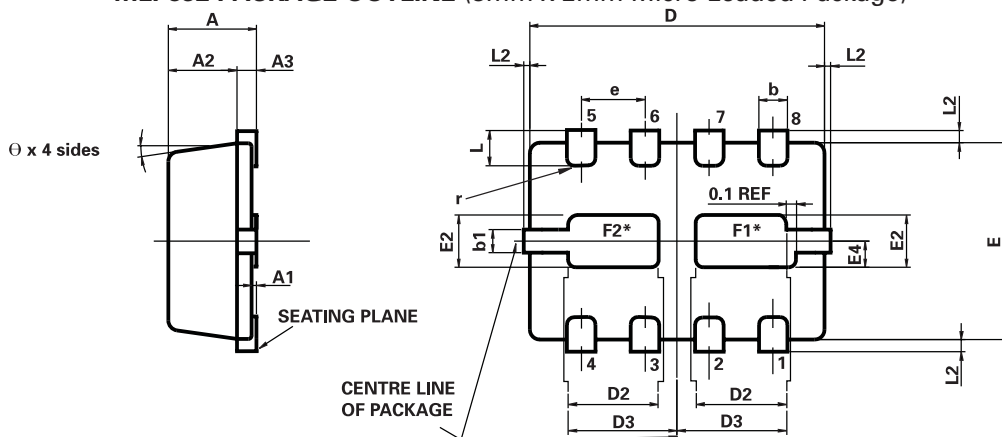
# ZX3CD2S1M832

## SCHOTTKY TYPICAL CHARACTERISTICS



# ZX3CD2S1M832

### MLP832 PACKAGE OUTLINE (3mm x 2mm Micro Leaded Package)



**\*Exposed Flags. Solder connection to improve thermal dissipation is optional.**

### F1 at collector 1 potential

### F2 at collector 2 potential

CONTROLLING DIMENSIONS IN MILLIMETRES  
APPROX. CONVERTED DIMENSIONS IN INCHES

## MLP832 PACKAGE DIMENSIONS

| DIM | MILLIMETRES |      | INCHES    |        | DIM | MILLIMETRES |       | INCHES     |        |
|-----|-------------|------|-----------|--------|-----|-------------|-------|------------|--------|
|     | MIN.        | MAX. | MIN.      | MAX.   |     | MIN.        | MAX.  | MIN.       | MAX.   |
| A   | 0.80        | 1.00 | 0.031     | 0.039  | e   | 0.65 REF    |       | 0.0256 BSC |        |
| A1  | 0.00        | 0.05 | 0.00      | 0.002  | E   | 2.00 BSC    |       | 0.0787 BSC |        |
| A2  | 0.65        | 0.75 | 0.0255    | 0.0295 | E2  | 0.43        | 0.63  | 0.017      | 0.0249 |
| A3  | 0.15        | 0.25 | 0.006     | 0.0098 | E4  | 0.16        | 0.36  | 0.006      | 0.014  |
| b   | 0.24        | 0.34 | 0.009     | 0.013  | L   | 0.20        | 0.45  | 0.0078     | 0.0157 |
| b1  | 0.17        | 0.30 | 0.0066    | 0.0118 | L2  | _____       | 0.125 | 0.00       | 0.005  |
| D   | 3.00 BSC    |      | 0.118 BSC |        | r   | 0.075 BSC   |       | 0.0029 BSC |        |
| D2  | 0.82        | 1.02 | 0.032     | 0.040  | Θ   | 0°          | 12°   | 0°         | 12°    |
| D3  | 1.01        | 1.21 | 0.0397    | 0.0476 |     |             |       |            |        |

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