

# ZX3CD1S1M832

## MPPS™ Miniature Package Power Solutions 12V PNP LOW SATURATION TRANSISTOR AND 40V, 1A SCHOTTKY DIODE COMBINATION DUAL

### SUMMARY

PNP Transistor —  $V_{CE0} = -12V$ ;  $R_{SAT} = 65m\Omega$ ;  $I_C = -4A$

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**

### FEATURES

- Extremely Low Saturation Voltage (-140mV @1A)
- $H_{FE}$  characterised up to -10A
- $I_C = -4A$  Continuous Collector Current
- **Extremely Low  $V_F$ , fast switching Schottky**
- 3mm x 2mm MLP

### APPLICATIONS

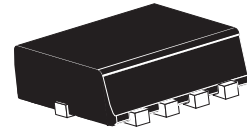
- DC - DC Converters
- Mobile Phones
- Charging Circuits
- Motor control

### ORDERING INFORMATION

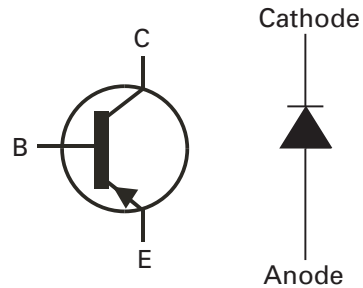
DEVICE	REEL	TAPE WIDTH	QUANTITY PER REEL
ZX3CD1S1M832TA	7''	8mm	3000
ZX3CD1S1M832TC	13''	8mm	10000

### DEVICE MARKING

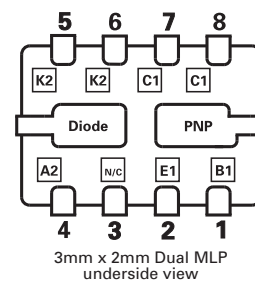
1S1



3mm x 2mm Dual Die MLP



### PINOUT



# ZX3CD1S1M832

## ABSOLUTE MAXIMUM RATINGS.

PARAMETER	SYMBOL	VALUE	UNIT
<b>Transistor</b>			
Collector-Base Voltage	$V_{CBO}$	-20	V
Collector-Emitter Voltage	$V_{CEO}$	-12	V
Emitter-Base Voltage	$V_{EBO}$	-7.5	V
Peak Pulse Current	$I_{CM}$	-12	A
Continuous Collector Current (a)(f)	$I_C$	-4	A
Continuous Collector Current (b)(f)	$I_C$	-4.4	A
Base Current	$I_B$	1000	mA
Power Dissipation at $T_A=25^\circ\text{C}$ (a)(f) Linear Derating Factor	$P_D$	1.5 12	W mW/°C
Power Dissipation at $T_A=25^\circ\text{C}$ (b)(f) Linear Derating Factor	$P_D$	2.45 19.6	W mW/°C
Power Dissipation at $T_A=25^\circ\text{C}$ (c)(f) Linear Derating Factor	$P_D$	1 8	W mW/°C
Power Dissipation at $T_A=25^\circ\text{C}$ (d)(f) Linear Derating Factor	$P_D$	1.13 9	W mW/°C
Power Dissipation at $T_A=25^\circ\text{C}$ (d)(g) Linear Derating Factor	$P_D$	1.7 13.6	W mW/°C
Power Dissipation at $T_A=25^\circ\text{C}$ (e)(g) Linear Derating Factor	$P_D$	3 24	W 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

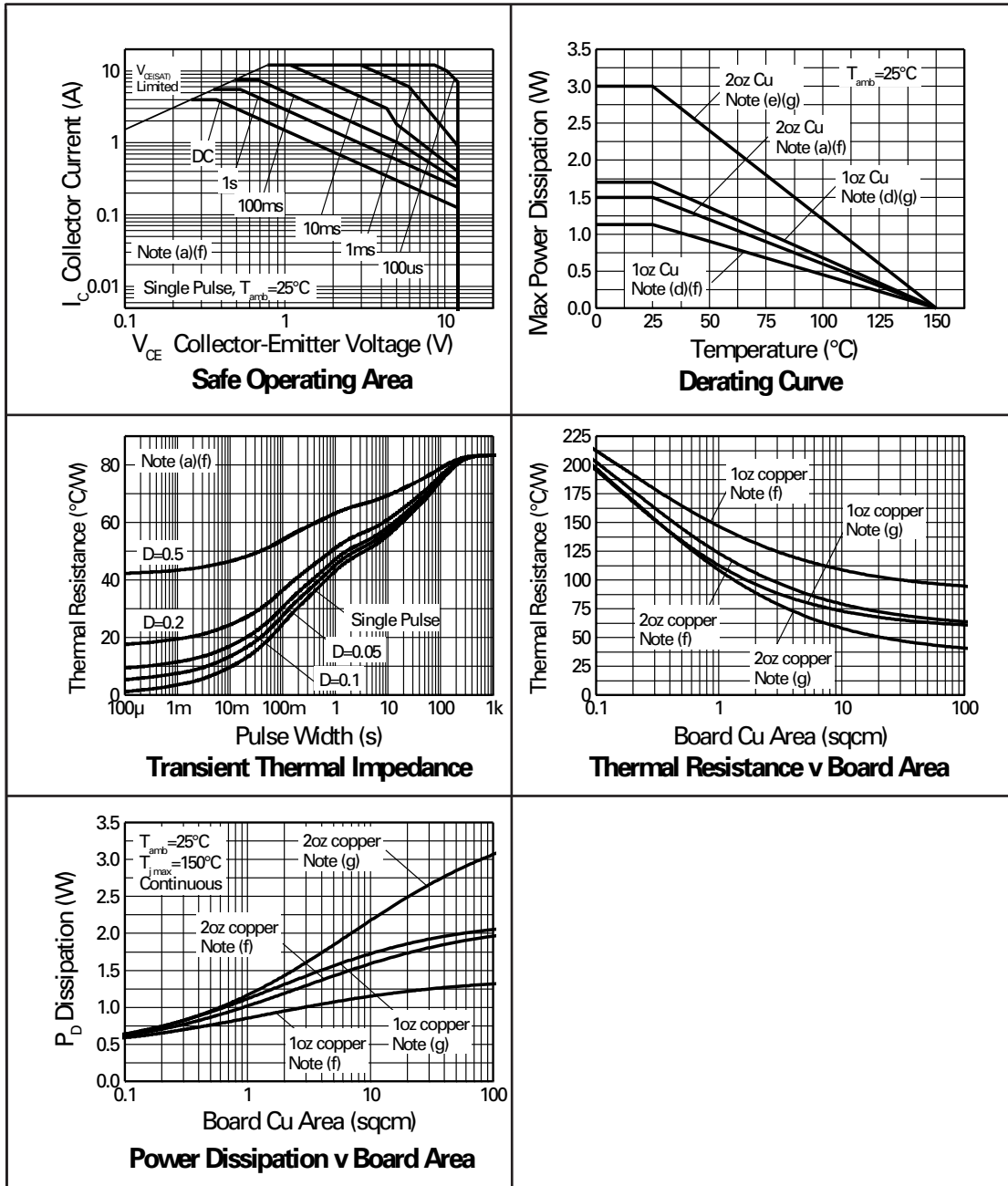
- (a) For a dual device surface mounted on 8 sq cm single sided 2oz copper on FR4 PCB, in still air conditions **with all exposed pads attached**. The copper area is split down the centre line into two separate areas with one half connected to each half of the dual device.
- (b) Measured at  $t < 5$  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 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 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  $P_{tot} = 500\text{mW}$ .



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## TRANSISTOR TYPICAL CHARACTERISTICS



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## 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	mV
Forward Current	$I_F$	1850	mA
Average Peak Forward Current $D=50\%$	$I_{FAV}$	3	A
Non Repetitive Forward Current $t \leq 100\mu\text{s}$ $t \leq 10\text{ms}$	$I_{FSM}$	12 7	A A
Power Dissipation at $T_A=25^\circ\text{C}$ (a)(f) Linear Derating Factor	$P_D$	1.2 12	W mW/ $^\circ\text{C}$
Power Dissipation at $T_A=25^\circ\text{C}$ (b)(f) Linear Derating Factor	$P_D$	2 20	W mW/ $^\circ\text{C}$
Power Dissipation at $T_A=25^\circ\text{C}$ (c)(f) Linear Derating Factor	$P_D$	0.8 8	W mW/ $^\circ\text{C}$
Power Dissipation at $T_A=25^\circ\text{C}$ (d)(f) Linear Derating Factor	$P_D$	0.9 9	W mW/ $^\circ\text{C}$
Power Dissipation at $T_A=25^\circ\text{C}$ (d)(g) Linear Derating Factor	$P_D$	1.36 13.6	W mW/ $^\circ\text{C}$
Power Dissipation at $T_A=25^\circ\text{C}$ (e)(g) Linear Derating Factor	$P_D$	2.4 24	W 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

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

### Notes

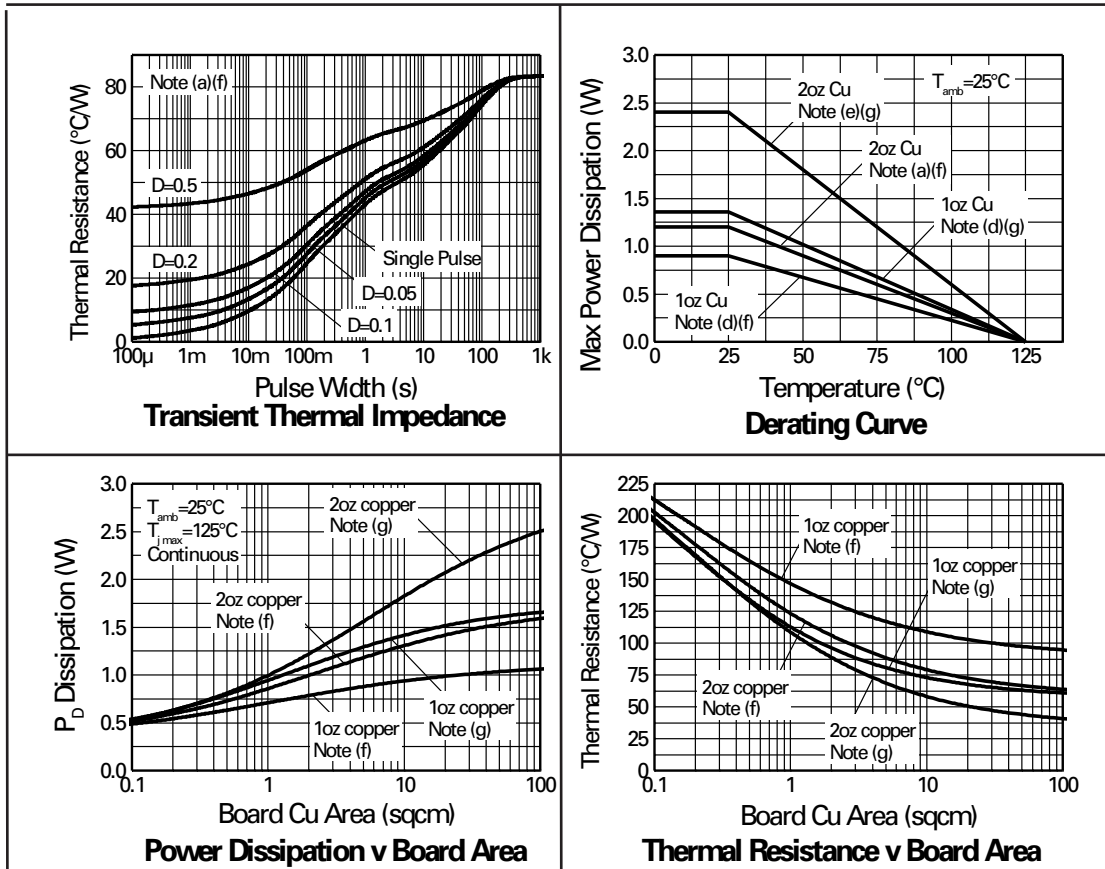
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- (b) Measured at  $t < 5$  secs for a dual device surface mounted on 8 sq cm single sided 2oz copper on FR4 PCB, in still air conditions **with all exposed pads attached**. The copper area is split down the centre line into two separate areas with one half connected to each half of the dual device.
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- (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  $R_{\theta} = 250^\circ\text{C}/\text{W}$  giving a power rating of  $P_{tot} = 400\text{mW}$ .



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## SCHOTTKY TYPICAL CHARACTERISTICS



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## 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	$V_{(BR)CBO}$	-20	-35		V	$I_C = -100\mu\text{A}$
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	-12	-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	$V_{CB} = -16\text{V}$
Emitter Cut-Off Current	$I_{EBO}$			-25	nA	$V_{EB} = -6\text{V}$
Collector Emitter Cut-Off Current	$I_{CES}$			-25	nA	$V_{CES} = -10\text{V}$
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$		-10 -100 -100 -195 -240	-17 -140 -150 -300 -300	mV	$I_C = -0.1\text{A}, I_B = -10\text{mA}^*$ $I_C = -1\text{A}, I_B = -10\text{mA}^*$ $I_C = -1.5\text{A}, I_B = -50\text{mA}^*$ $I_C = -3\text{A}, I_B = -50\text{mA}^*$ $I_C = -4\text{A}, I_B = -150\text{mA}^*$
Base-Emitter Saturation Voltage	$V_{BE(sat)}$		-0.97	-1.05	V	$I_C = -4\text{A}, I_B = -150\text{mA}^*$
Base-Emitter Turn-On Voltage	$V_{BE(on)}$		-0.87	-0.950	V	$I_C = -4\text{A}, V_{CE} = -2\text{V}^*$
Static Forward Current Transfer Ratio	$h_{FE}$	300 300 180 60 45	475 450 275 100 70			$I_C = -10\text{mA}, V_{CE} = -2\text{V}^*$ $I_C = -0.1\text{A}, V_{CE} = -2\text{V}^*$ $I_C = -2.5\text{A}, V_{CE} = -2\text{V}^*$ $I_C = -8\text{A}, V_{CE} = -2\text{V}^*$ $I_C = -10\text{A}, V_{CE} = -2\text{V}^*$
Transition Frequency	$f_T$	100	110		MHz	$I_C = -50\text{mA}, V_{CE} = -10\text{V}$ $f = 100\text{MHz}$
Output Capacitance	$C_{obo}$		21	30	pF	$V_{CB} = -10\text{V}, f = 1\text{MHz}$
Turn-On Time	$t_{(on)}$		70		ns	$V_{CC} = -6\text{V}, I_C = -2\text{A}$
Turn-Off Time	$t_{(off)}$		130		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	$V_F$		240 265 305 355 390 425 495 420	270 290 340 400 450 500 600 —	mV	$I_F = 50\text{mA}^*$ $I_F = 100\text{mA}^*$ $I_F = 250\text{mA}^*$ $I_F = 500\text{mA}^*$ $I_F = 750\text{mA}^*$ $I_F = 1000\text{mA}^*$ $I_F = 1500\text{mA}^*$ $I_F = 1000\text{mA}, T_a = 100^{\circ}\text{C}^*$
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 $I_F = 500\text{mA}$ to $I_R = 500\text{mA}$ Measured at $I_R = 50\text{mA}$

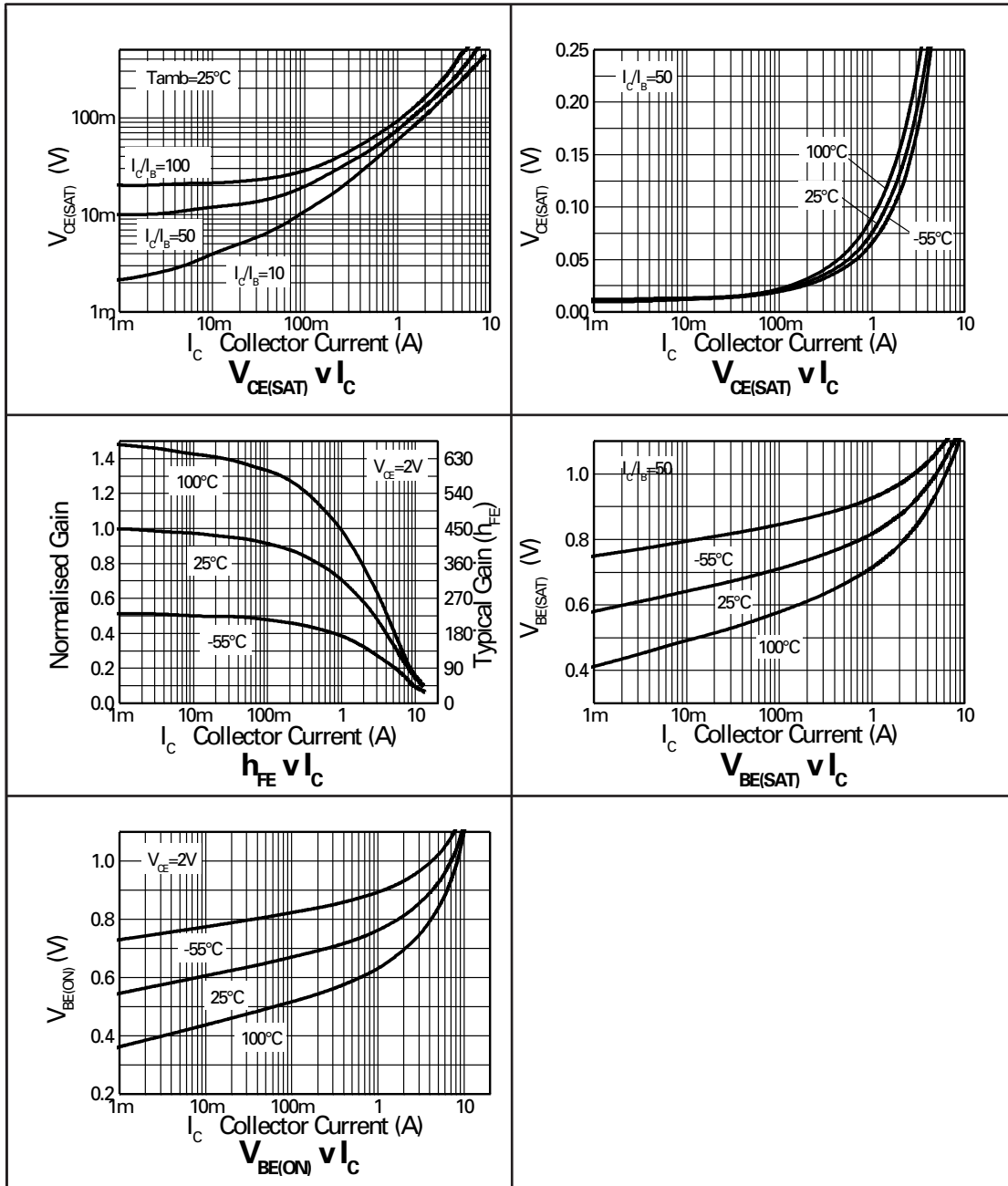
\*Measured under pulsed conditions.



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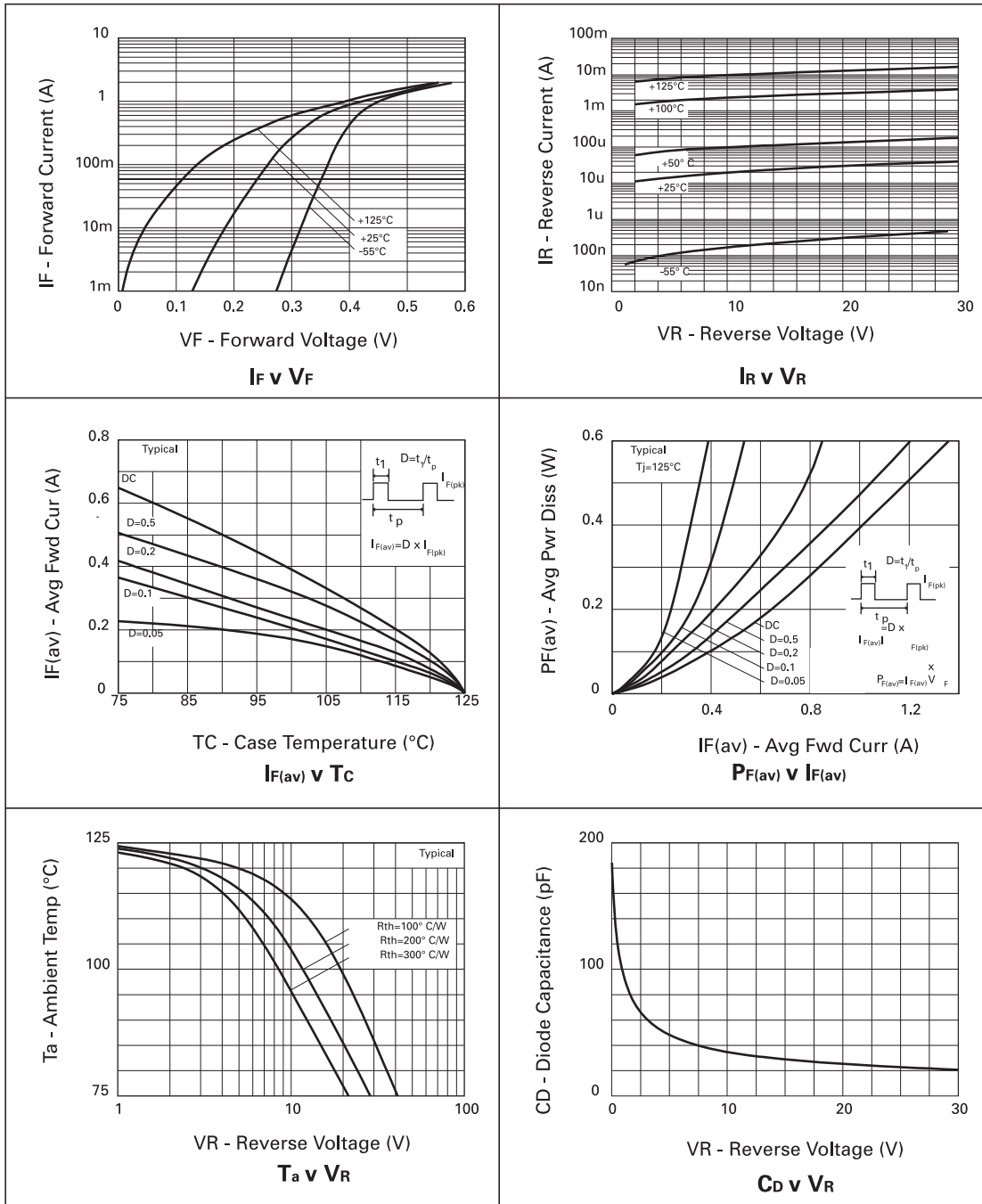
# ZX3CD1S1M832

## TRANSISTOR TYPICAL CHARACTERISTICS



# ZX3CD1S1M832

## SCHOTTKY TYPICAL CHARACTERISTICS

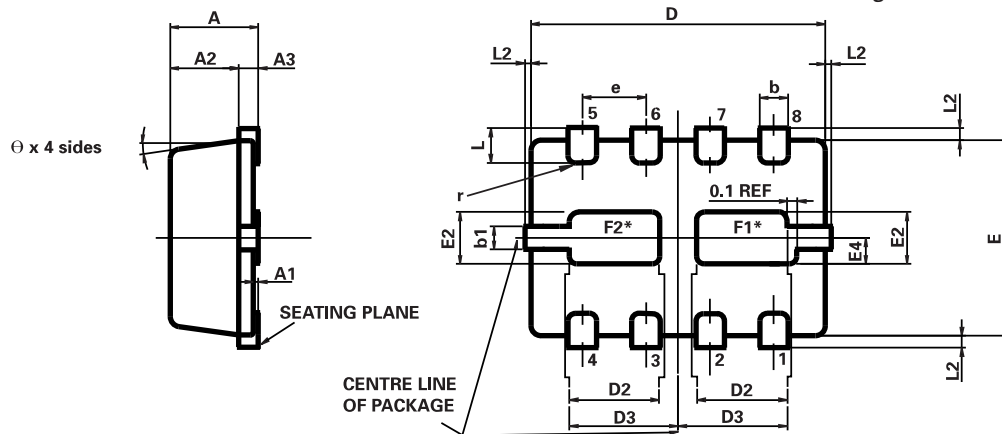


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# ZX3CD1S1M832

## 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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