

NOT RECOMMENDED FOR  
NEW DESIGNS PLEASE USE  
ZXTPS718MC

**ZX3CD2S1M832**

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

**SUMMARY**

**PNP Transistor** —  $V_{CE0} = -20V$ ;  $R_{SAT} = 64m\Omega$ ;  $I_C = -3.5A$

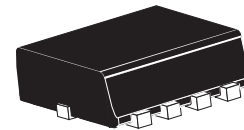
**Schottky Diode** —  $V_R = 40V$ ;  $V_F = 500mV (@1A)$ ;  $I_C=1A$

**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**:

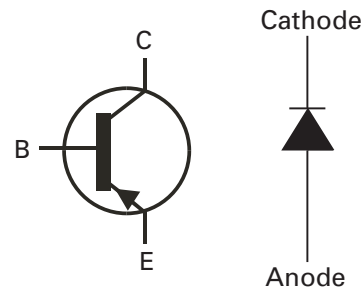
- Performance capability equivalent to much larger packages**
- Improved circuit efficiency & power levels**
- PCB area and device placement savings**
- Lower package height (0.9mm nom)**
- Reduced component count**



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



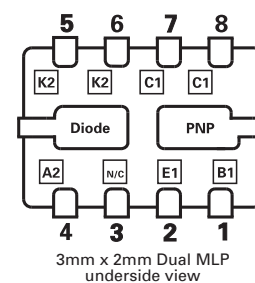
**APPLICATIONS**

- 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

**PINOUT**



**DEVICE MARKING**

2S1

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**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 $T_A=25^\circ\text{C}$ (a)(f) Linear Derating Factor	$P_D$	1.5 12	W mW/ $^\circ\text{C}$
Power Dissipation at $T_A=25^\circ\text{C}$ (b)(f) Linear Derating Factor	$P_D$	2.45 19.6	W mW/ $^\circ\text{C}$
Power Dissipation at $T_A=25^\circ\text{C}$ (c)(f) Linear Derating Factor	$P_D$	1 8	W mW/ $^\circ\text{C}$
Power Dissipation at $T_A=25^\circ\text{C}$ (d)(f) Linear Derating Factor	$P_D$	1.13 9	W mW/ $^\circ\text{C}$
Power Dissipation at $T_A=25^\circ\text{C}$ (d)(g) Linear Derating Factor	$P_D$	1.7 13.6	W mW/ $^\circ\text{C}$
Power Dissipation at $T_A=25^\circ\text{C}$ (e)(g) Linear Derating Factor	$P_D$	3 24	W mW/ $^\circ\text{C}$
Storage Temperature Range	$T_{stg}$	-55 to +150	$^\circ\text{C}$
Junction Temperature	$T_j$	150	$^\circ\text{C}$

**THERMAL RESISTANCE**

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

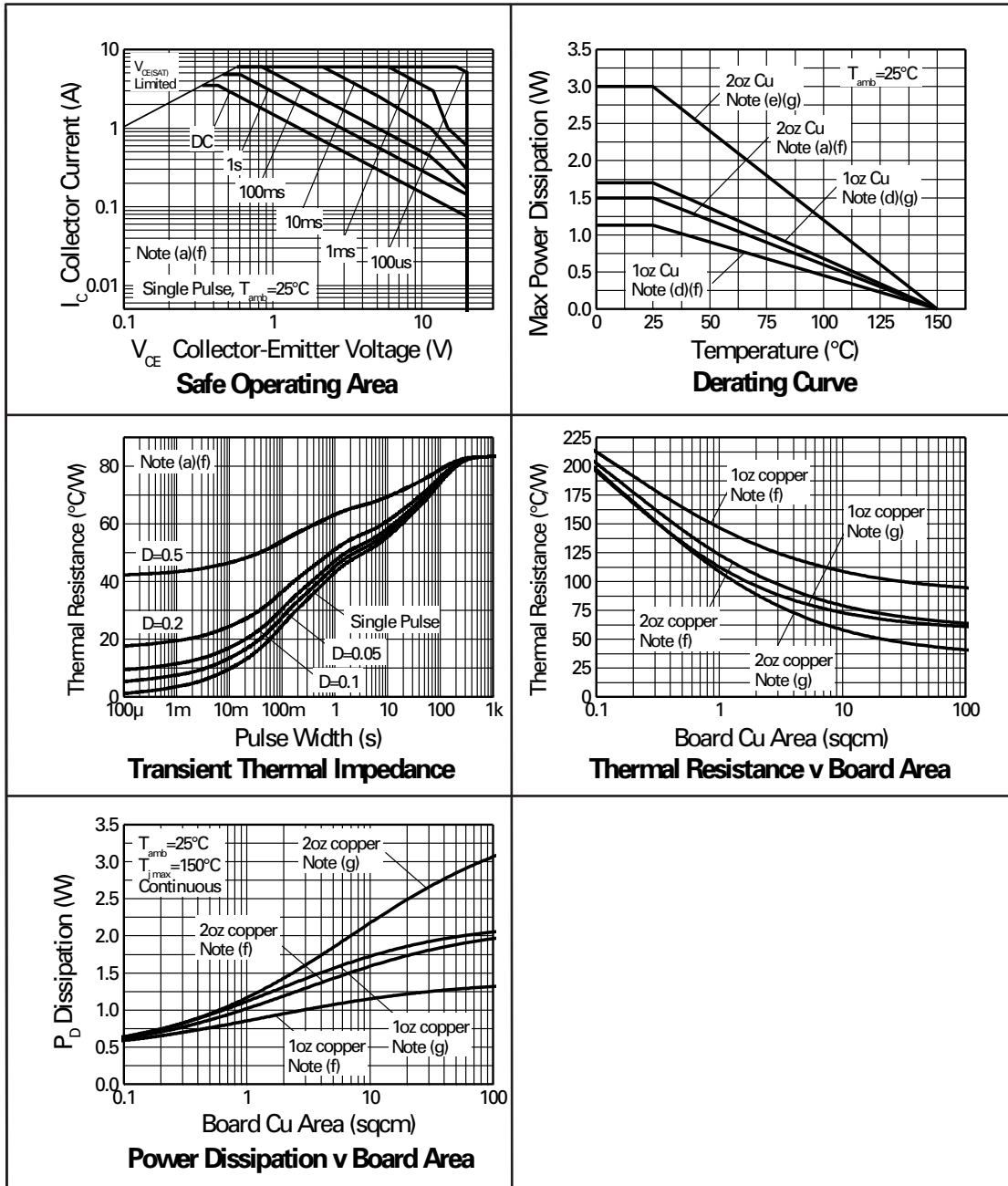
- (a) For a dual device surface mounted on 8 sq cm single sided 2oz copper on FR4 PCB, in still air conditions **with all exposed pads attached**. The copper area is split down the centre line into two separate areas with one half connected to each half of the dual device.
- (b) Measured at  $t < 5$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



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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	$^\circ\text{C}/\text{W}$
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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

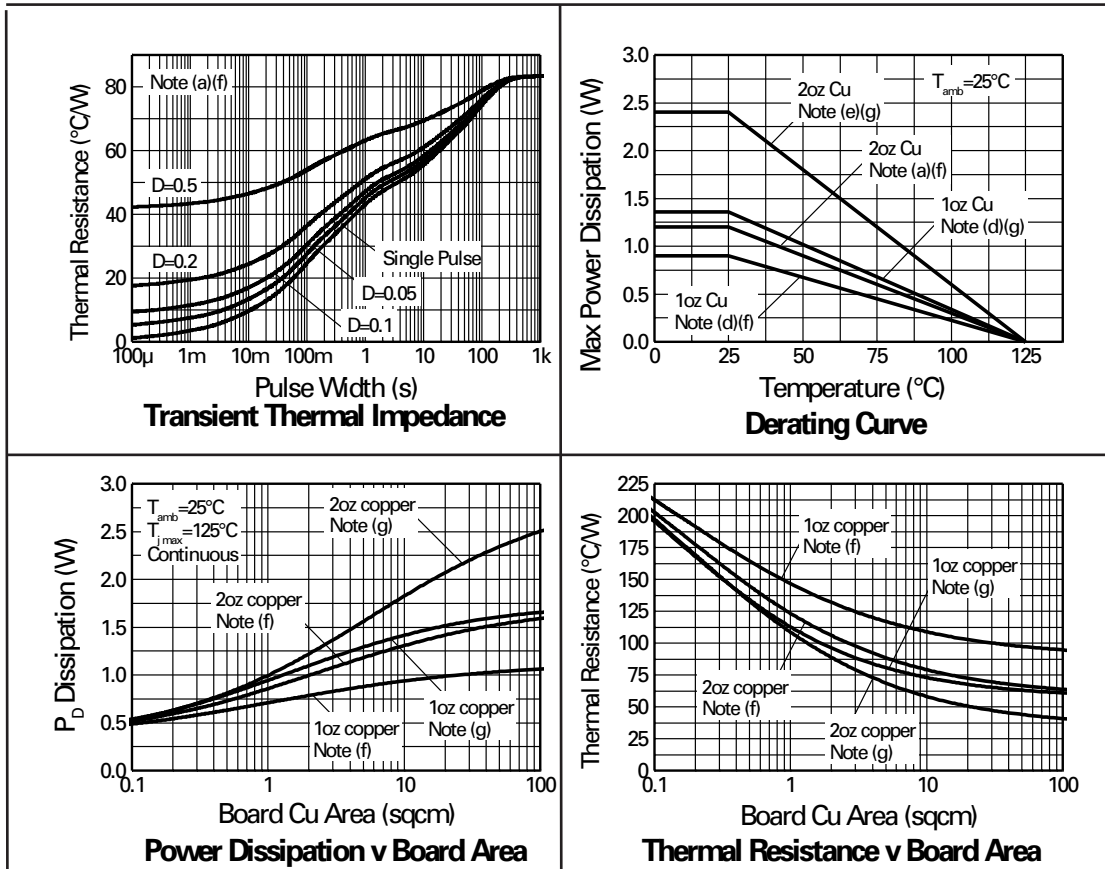
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- (e) For a dual device surface mounted on 85 sq cm single sided 2oz copper on FR4 PCB, in still air conditions **with all exposed pads attached attached**. The copper area is split down the centre line into two separate areas with one half connected 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  $R_{th} = 250^\circ\text{C}/\text{W}$  giving a power rating of  $P_{tot} = 400\text{mW}$ .



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

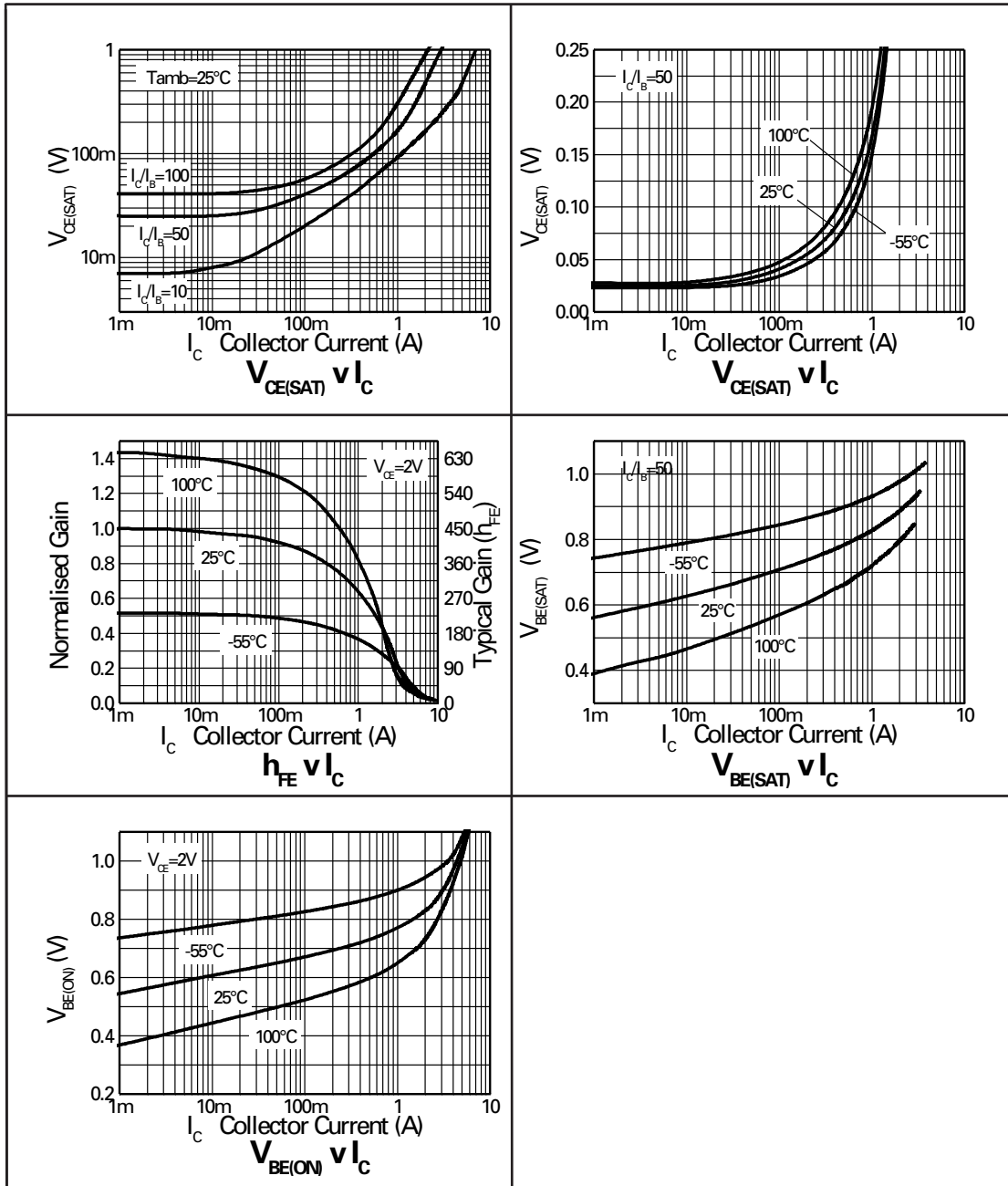
PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	CONDITIONS.
<b>TRANSISTOR ELECTRICAL CHARACTERISTICS</b>						
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	-25	-35		V	$I_C = -100\mu\text{A}$
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	-20	-25		V	$I_C = -10\text{mA}^*$
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	-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	$I_C = -50\text{mA}, V_{CE} = -10\text{V}$ $f = 100\text{MHz}$
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 $I_F = 500\text{mA}$ to $I_R = 500\text{mA}$ Measured at $I_R = 50\text{mA}$

\*Measured under pulsed conditions.

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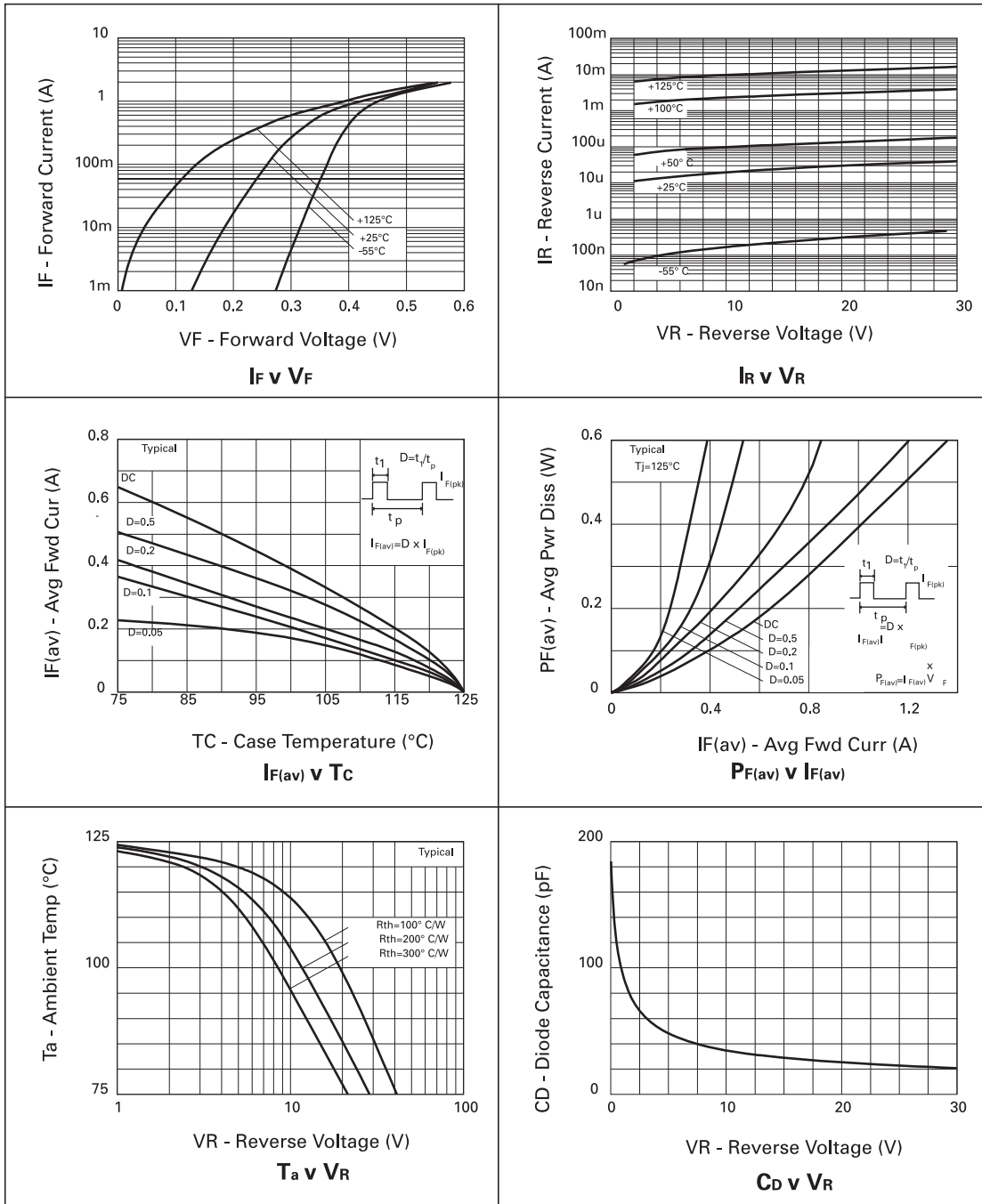
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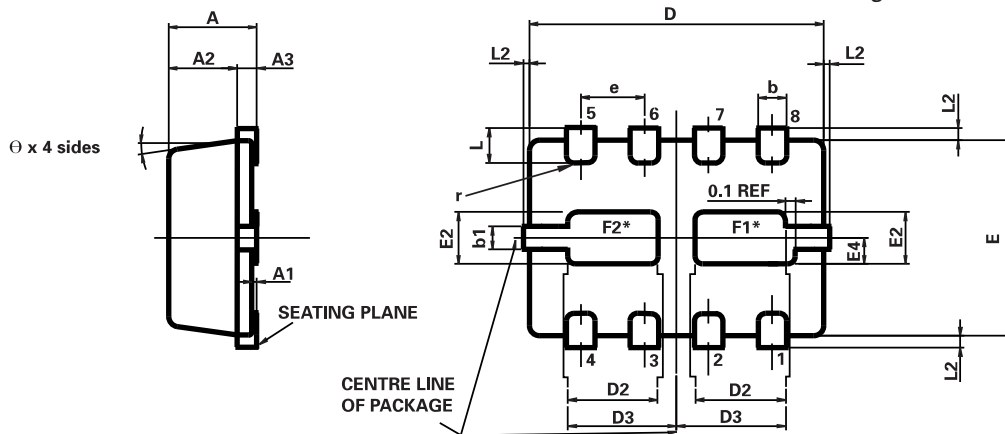




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**MLP832 PACKAGE OUTLINE** (3mm x 2mm Micro Leaded Package)



\*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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