

ZX3CDBS1M832

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

SUMMARY

NPN Transistor — $V_{CEO} = 20V$; $R_{SAT} = 47m\Omega$; $I_C = 4.5A$

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 NPN 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 (**150mV @1A**)
- H_{FE} characterised up to 6A
- $I_C = 4.5A$ Continuous Collector Current
- **Extremely Low V_F , fast switching Schottky**
- 3mm x 2mm MLP

APPLICATIONS

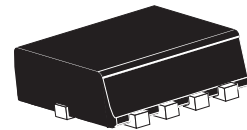
- DC - DC Converters
- Mobile Phones
- Charging Circuits
- Motor control

ORDERING INFORMATION

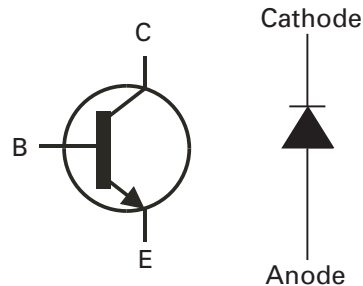
DEVICE	REEL	TAPE WIDTH	QUANTITY PER REEL
ZX3CDBS1M832TA	7"	8mm	3000
ZX3CDBS1M832TC	13"	8mm	10000

DEVICE MARKING

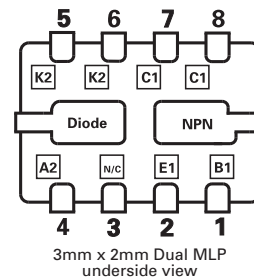
BS1



3mm x 2mm Dual Die MLP



PINOUT



3mm x 2mm Dual MLP underside view

ZX3CDBS1M832

ABSOLUTE MAXIMUM RATINGS.

PARAMETER	SYMBOL	VALUE	UNIT
Transistor			
Collector-Base Voltage	V_{CBO}	40	V
Collector-Emitter Voltage	V_{CEO}	20	V
Emitter-Base Voltage	V_{EBO}	7.5	V
Peak Pulse Current	I_{CM}	12	A
Continuous Collector Current (a)(f)	I_C	4.5	A
Continuous Collector Current (b)(f)	I_C	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

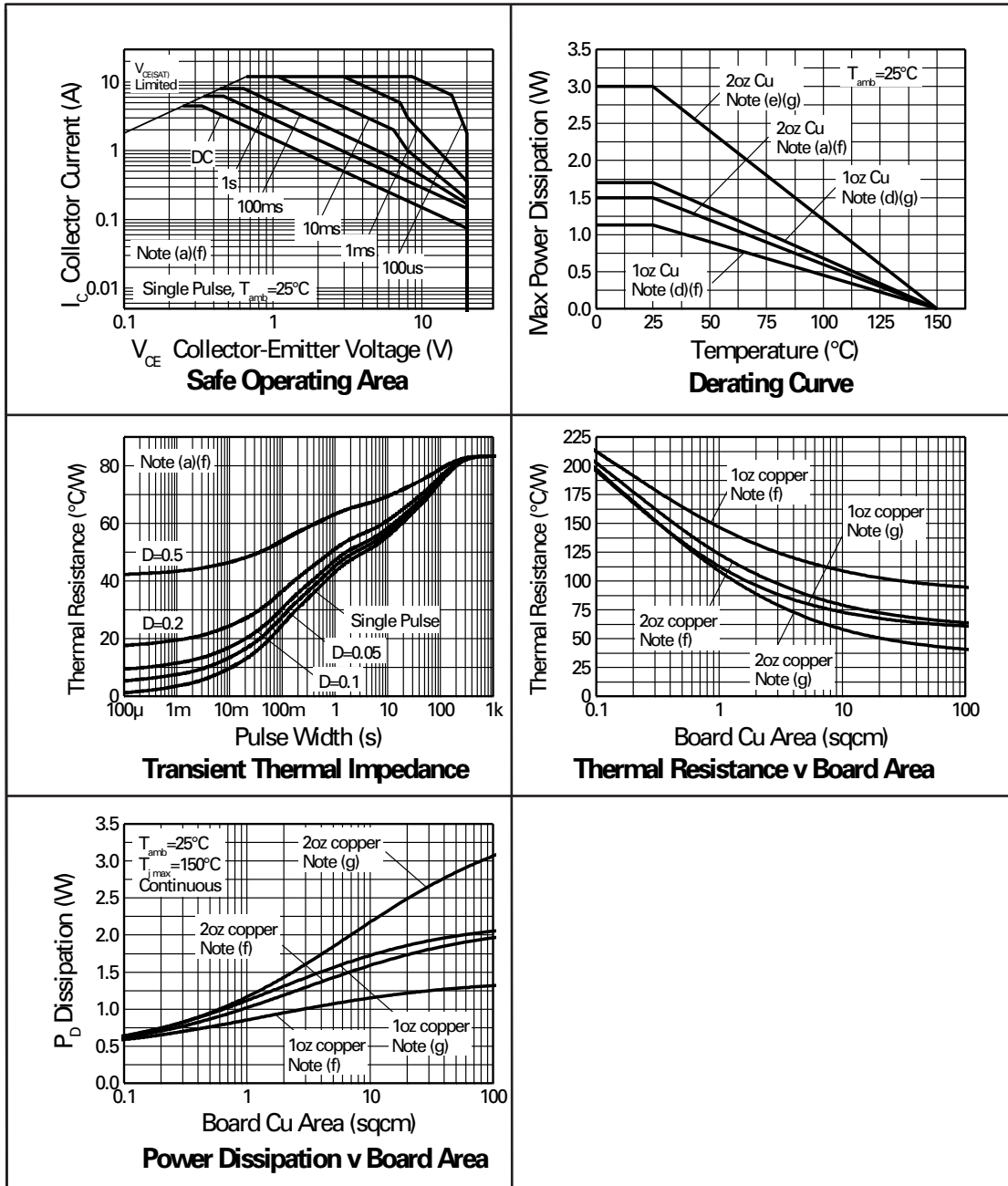
PARAMETER	SYMBOL	VALUE	UNIT
Junction to Ambient (a)(f)	$R_{\theta JA}$	83	$^\circ\text{C/W}$
Junction to Ambient (b)(f)	$R_{\theta JA}$	51	$^\circ\text{C/W}$
Junction to Ambient (c)(f)	$R_{\theta JA}$	125	$^\circ\text{C/W}$
Junction to Ambient (d)(f)	$R_{\theta JA}$	111	$^\circ\text{C/W}$
Junction to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

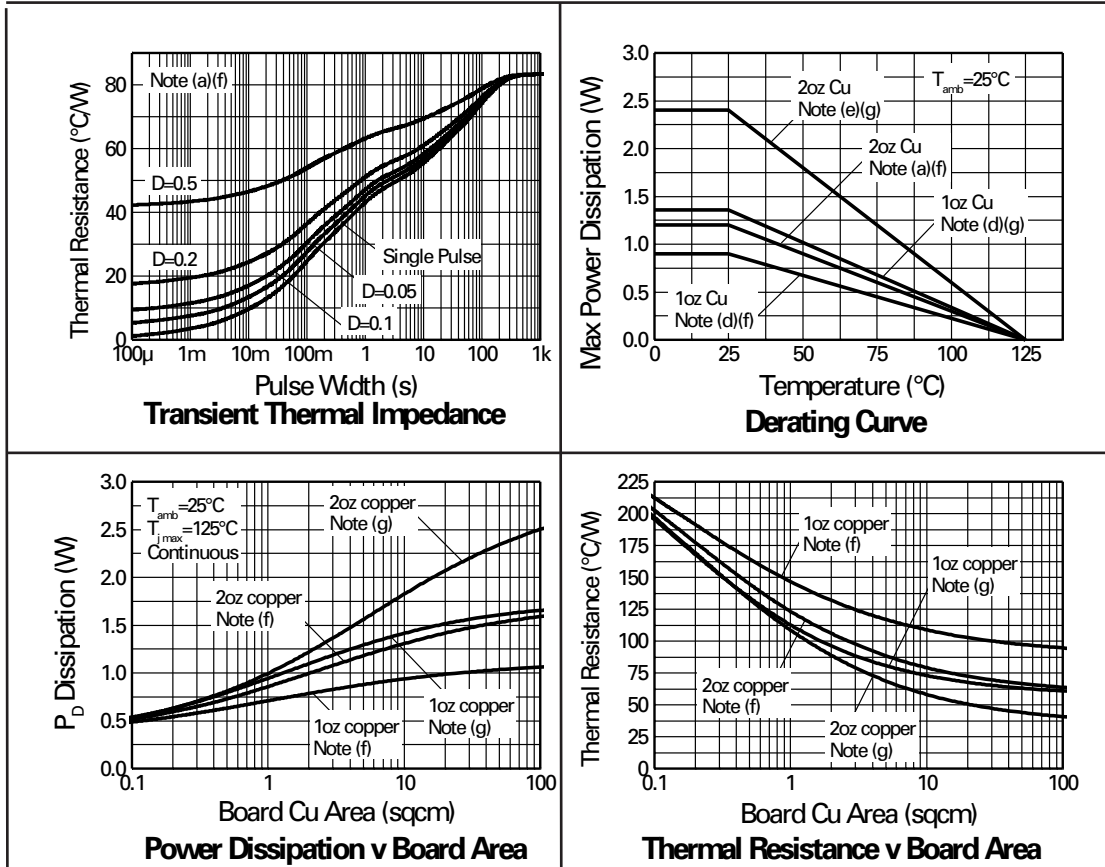
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Junction to Ambient (c)(f)	$R_{\theta JA}$	125	$^\circ\text{C}/\text{W}$
Junction to Ambient (d)(f)	$R_{\theta JA}$	111	$^\circ\text{C}/\text{W}$
Junction to Ambient (d)(g)	$R_{\theta JA}$	73.5	$^\circ\text{C}/\text{W}$
Junction to Ambient (e)(g)	$R_{\theta JA}$	41.7	$^\circ\text{C}/\text{W}$

Notes

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- (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 $R_{th} = 250^\circ\text{C}/\text{W}$ giving a power rating of $P_{tot} = 400\text{mW}$.

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SCHOTTKY TYPICAL CHARACTERISTICS



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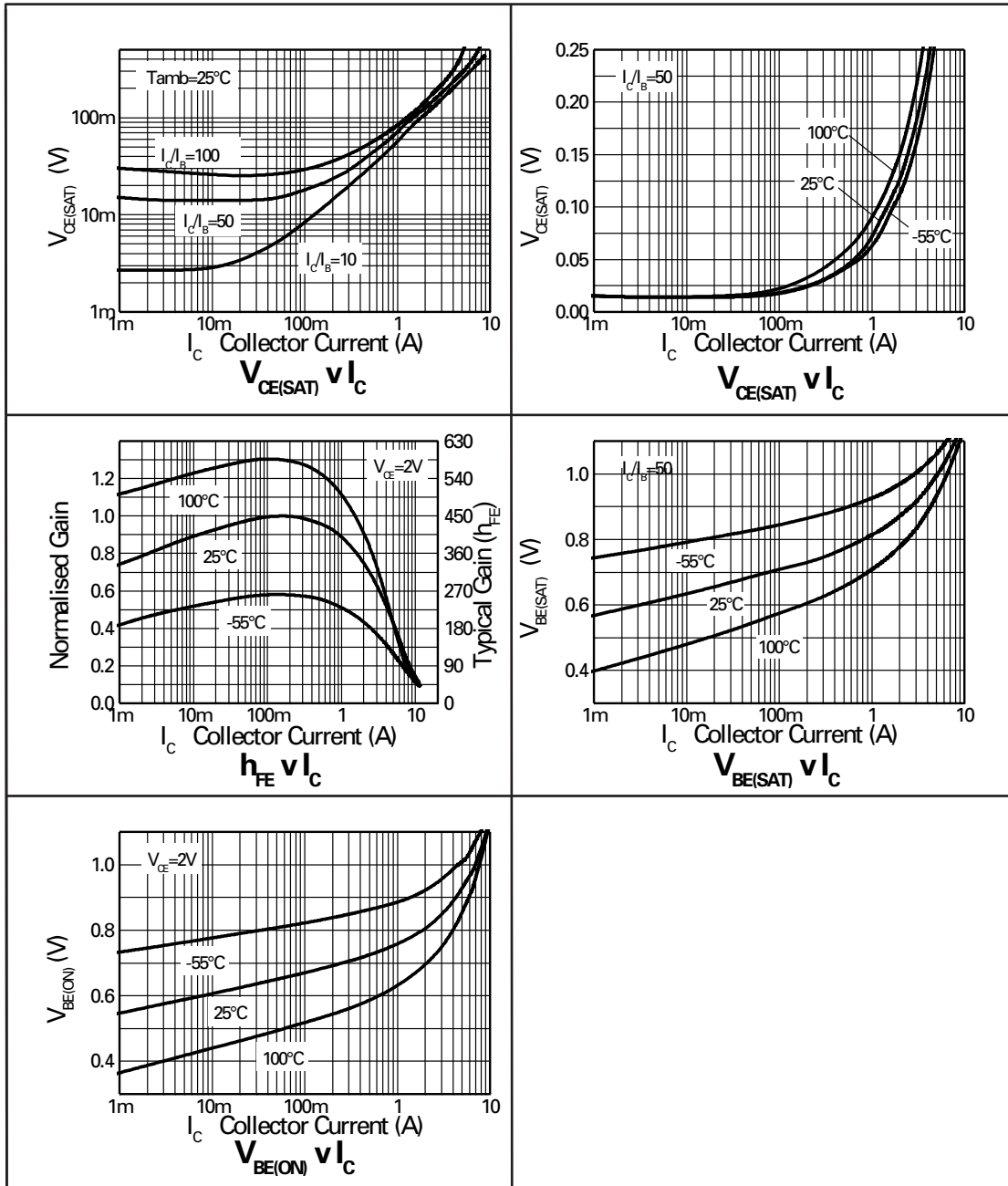
ELECTRICAL CHARACTERISTICS (at $T_{amb} = 25^{\circ}\text{C}$ unless otherwise stated).

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	CONDITIONS.
TRANSISTOR ELECTRICAL CHARACTERISTICS						
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	40	100		V	$I_C = 100\mu\text{A}$
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	20	27		V	$I_C = 10\text{mA}^*$
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	7.5	8.2		V	$I_E = 100\mu\text{A}$
Collector Cut-Off Current	I_{CBO}			25	nA	$V_{CB} = 32\text{V}$
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	$V_{CE(sat)}$		8 90 115 190 210	15 150 135 250 270	mV	$I_C = 0.1\text{A}, I_B = 10\text{mA}^*$ $I_C = 1\text{A}, I_B = 10\text{mA}^*$ $I_C = 2\text{A}, I_B = 50\text{mA}^*$ $I_C = 3\text{A}, I_B = 100\text{mA}^*$ $I_C = 4.5\text{A}, I_B = 125\text{mA}^*$
Base-Emitter Saturation Voltage	$V_{BE(sat)}$		0.98	-1.05	V	$I_C = 4.5\text{A}, I_B = 125\text{mA}^*$
Base-Emitter Turn-On Voltage	$V_{BE(on)}$		0.88	-0.95	V	$I_C = 4.5\text{A}, V_{CE} = 2\text{V}^*$
Static Forward Current Transfer Ratio	h_{FE}	200 300 200 100	400 450 360 180			$I_C = 10\text{mA}, V_{CE} = 2\text{V}^*$ $I_C = 0.2\text{A}, V_{CE} = 2\text{V}^*$ $I_C = 2\text{A}, V_{CE} = 2\text{V}^*$ $I_C = 6\text{A}, V_{CE} = 2\text{V}^*$
Transition Frequency	f_T	100	140		MHz	$I_C = 50\text{mA}, V_{CE} = 10\text{V}$ $f = 100\text{MHz}$
Output Capacitance	C_{obo}		23	30	pF	$V_{CB} = 10\text{V}, f = 1\text{MHz}$
Turn-On Time	$t_{(on)}$		170		ns	$V_{CC} = 10\text{V}, I_C = 3\text{A}$
Turn-Off Time	$t_{(off)}$		400		ns	$I_{B1} = I_{B2} = 10\text{mA}$
SCHOTTKY DIODE ELECTRICAL CHARACTERISTICS						
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	μA	$V_R = 30\text{V}$
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.

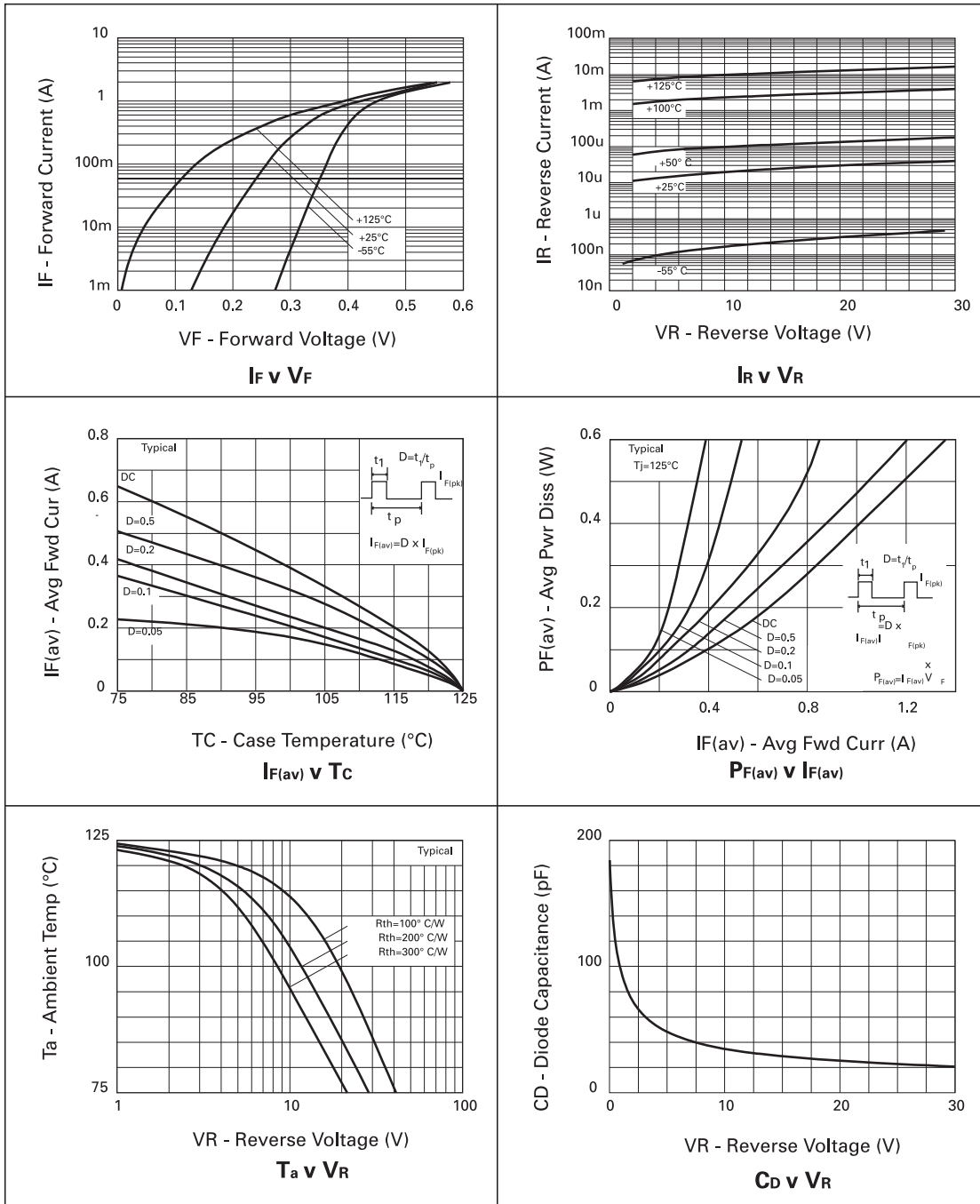
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TRANSISTOR TYPICAL CHARACTERISTICS



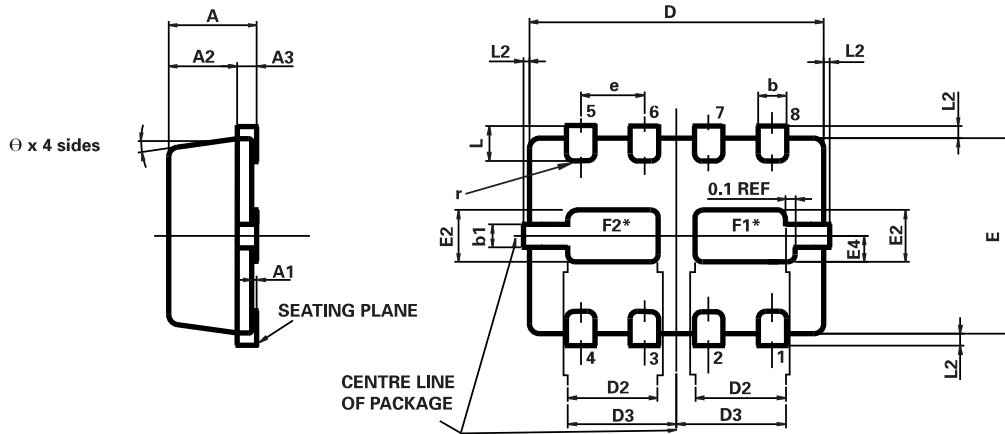
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SCHOTTKY TYPICAL CHARACTERISTICS



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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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