20V NPN LOW SATURATION TRANSISTOR AND 40V, 1A SCHOTTKY DIODE COMBINATION

Features and Benefits

NPN Transistor

- BV_{CEO} > 20V
- I_C = 4.5A Continuous Collector Current
- Low Saturation Voltage (150mV Max @ 1A)
- R_{SAT} = 47mΩ for a Low Equivalent On-Resistance
- h_{FE} Characterized up to 6A for High Current Gain Hold up

Schottky Diode

- BV_R > 40V
- I_{FAV} = 3A Average Peak Forward Current
- Low V_F < 500mV (@ 1A) for Reduced Power Loss
- Fast Switching due to Schottky Barrier
- Low Profile 0.8mm High Package for Thin Applications
- $R_{\theta JA}$ Efficient, 40% Lower than SOT26
- 6mm² Footprint, 50% Smaller than TSOP6 and SOT26
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **For automotive applications requiring specific change control (i.e. parts qualified to AEC-Q100/101/104/200, PPAP capable, and manufactured in IATF 16949 certified facilities), please contact us or your local Diodes representative. https://www.diodes.com/quality/product-definitions/**

Mechanical Data

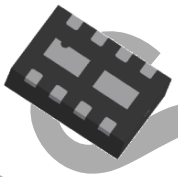
- Package: W-DFN3020-8
- Package Material: Molded Plastic, "Green" Molding Compound UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish – NiPdAu, Solderable per MIL-STD-202, Method 208 e4
- Weight: 0.013 grams (Approximate)

Applications

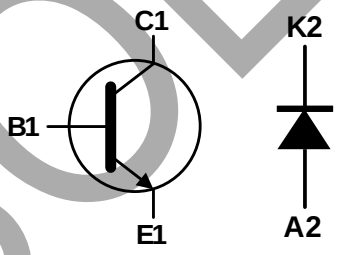
- DC-DC converters
- Charging circuits
- Mobile phones
- Motor controls
- Portable applications

W-DFN3020-8 (Type B)

Top View

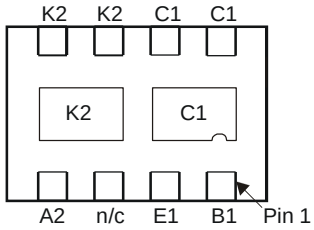


Bottom View



NPN Transistor Schottky Diode

Equivalent Circuit



Bottom View
Pin-Out
n/c = Not Connected Internally

Ordering Information (Note 4)

Part Number	Package	Marking	Reel Size (inches)	Tape Width (mm)	Packing	
					Qty.	Carrier
ZXTNS618MCTA	W-DFN3020-8 (Type B)	BS1	7	8	3000	Reel

Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
2. See https://www.diodes.com/quality/lead-free/ for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
4. For packaging details, go to our website at https://www.diodes.com/design/support/packaging/diodes-packaging/.

Marking Information

BS1 = Product Type Marking Code
Top View, Dot Denotes Pin 1

NPN - Maximum Ratings (@ T_A = +25°C, unless otherwise specified.)

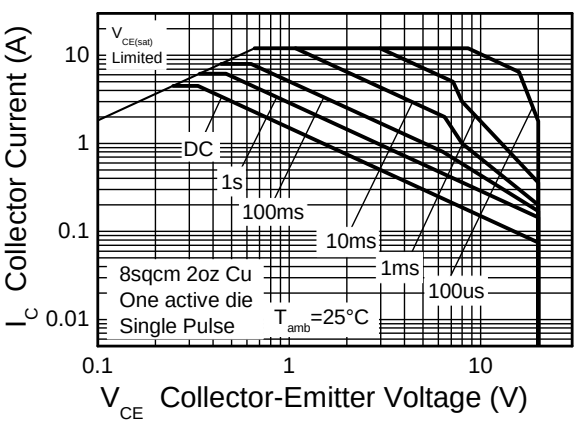
Parameter		Symbol	Limit	Unit
Collector-Base Voltage		V_{CBO}	40	V
Collector-Emitter Voltage		V_{CEO}	20	
Emitter-Base Voltage		V_{EBO}	7	
Peak Pulse Current		I_{CM}	12	A
Continuous Collector Current	(Notes 5 & 8)	I_C	4.5	
	(Notes 6 & 8)		5	
Base Current		I_B	1	

NPN - Thermal Characteristics (@ T_A = +25°C, unless otherwise specified.)

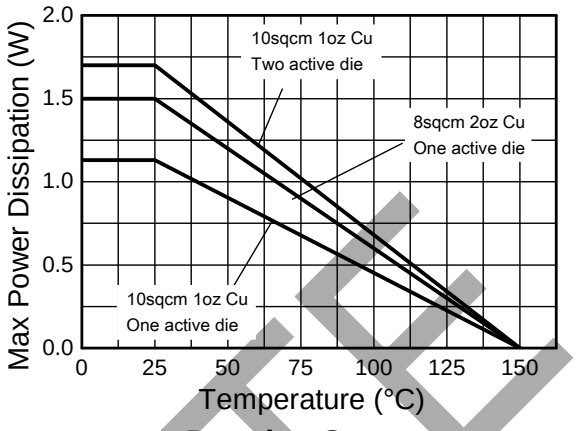
Characteristic		Symbol	Value	Unit
Power Dissipation Linear Derating Factor	(Notes 5 & 8)	P_D	1.5 12	W mW/°C
	(Notes 6 & 8)		2.45 19.6	
	(Notes 7 & 8)		1.13 8	
	(Notes 7 & 9)		1.7 13.6	
Thermal Resistance, Junction to Ambient	(Notes 5 & 8)	$R_{\theta JA}$	83.3	°C/W
	(Notes 6 & 8)		51.0	
	(Notes 7 & 8)		111	
	(Notes 7 & 9)		73.5	
Thermal Resistance, Junction to Lead	(Note 10)	$R_{\theta JL}$	17.1	
Operating and Storage Temperature Range		T_J, T_{STG}	-55 to +150	°C

Notes:
5. For a dual device surface mounted on 28mm x 28mm (8cm^2) FR4 PCB with high coverage of single sided 2 oz copper, in still air conditions; the device is measured when operating in a steady-state condition. The heatsink is split in half with the exposed collector and cathode pads connected to each half.
6. Same as Note 5, except the device is measured at t < 5 sec.
7. Same as Note 5, except the device is surface mounted on 31mm x 31mm (10cm^2) FR4 PCB with high coverage of single sided 1oz copper.
8. For a dual device with one active die.
9. For dual device with two active dies running at equal power.
10. Thermal resistance from junction to solder-point (on the exposed collector pad).

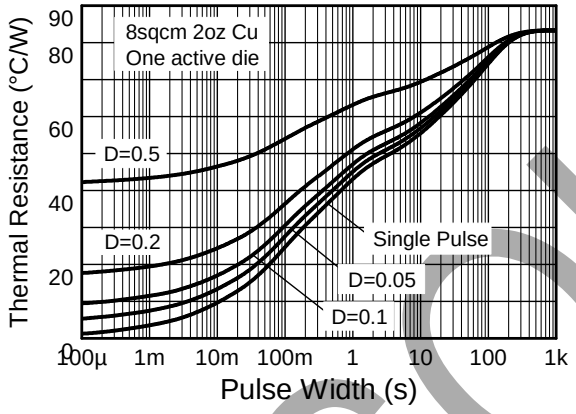
NPN - Thermal Characteristics



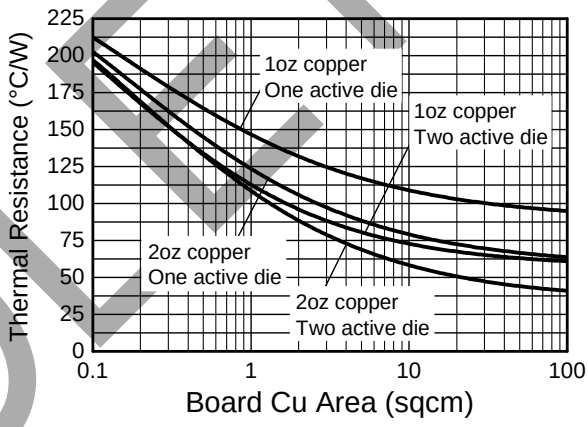
Safe Operating Area



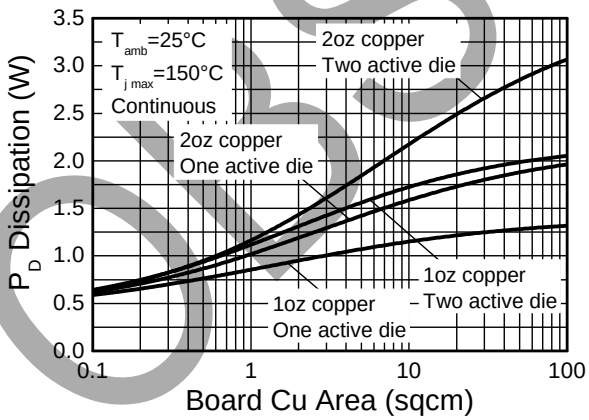
Derating Curve



Transient Thermal Impedance



Thermal Resistance v Board Area



Power Dissipation v Board Area

Schottky - Maximum Ratings (@ T_A = +25°C, unless otherwise specified.)

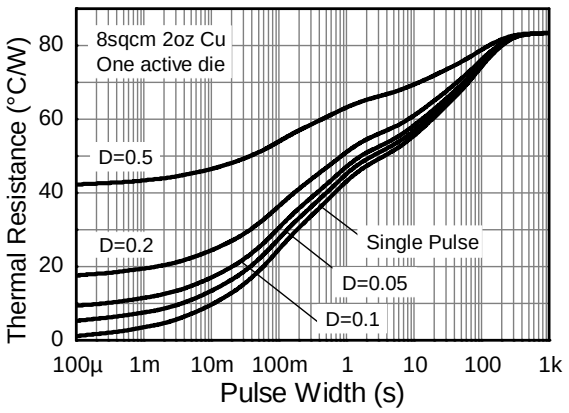
Parameter		Symbol	Limit	Unit
Continuous Reverse Voltage		V_R	40	V
Continuous Forward Current		I_F	1.85	A
Repetitive Peak Forward Current	D = 0.5 Pulse Width ≤ 300µs	I_{FRM}	3	
Non-Repetitive Peak Forward Surge Current	t ≤ 100µs	I_{FSM}	12	
	t ≤ 10ms		7	

Schottky - Thermal Characteristics (@ T_A = +25°C, unless otherwise specified.)

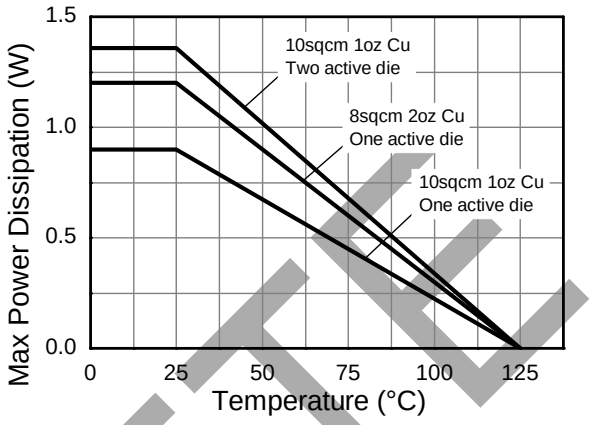
Characteristic		Symbol	Value	Unit
Power Dissipation Linear Derating Factor	(Notes 11 & 14)	P_D	1.2 12	W mW/°C
	(Notes 12 & 14)		2 20	
	(Notes 13 & 14)		0.9 9	
	(Notes 13 & 15)		1.36 13.6	
Thermal Resistance, Junction to Ambient	(Notes 11 & 14)	$R_{\theta JA}$	83.3	°C/W
	(Notes 12 & 14)		51.0	
	(Notes 13 & 14)		111	
	(Notes 13 & 15)		73.5	
Thermal Resistance, Junction to Lead	(Note 16)	$R_{\theta JL}$	20.2	
Storage Temperature Range		T_{STG}	-55 to +150	°C
Maximum Junction Temperature		T_J	+125	

Notes:
11. For a dual device surface mounted on 28mm x 28mm (8cm^2) FR4 PCB with high coverage of single sided 2 oz copper, in still air conditions; the device is measured when operating in a steady-state condition. The heatsink is split in half with the exposed cathode and collector pads connected to each half.
12. Same as Note 11, except the device is measured at t < 5 sec.
13. Same as Note 11, except the device is surface mounted on 31mm x 31mm (10cm^2) FR4 PCB with high coverage of single sided 1oz copper.
14. For a dual device with one active die.
15. For dual device with two active dies running at equal power.
16. Thermal resistance from junction to solder-point (on the exposed cathode pad).

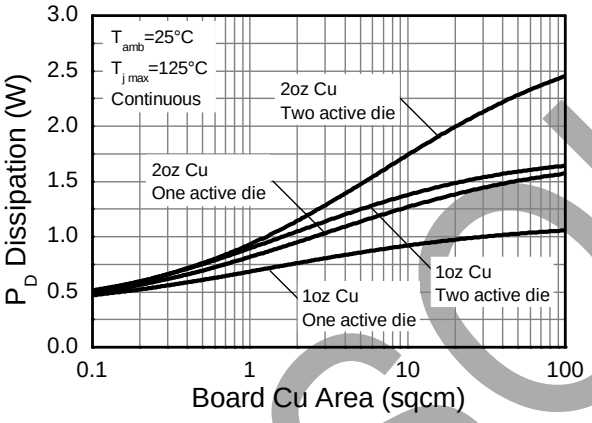
Schottky - Thermal Characteristics



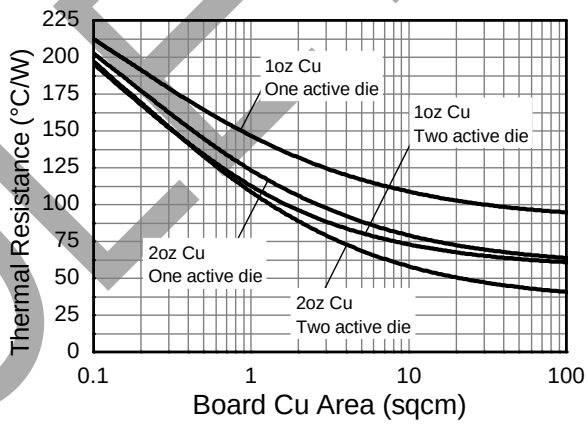
Transient Thermal Impedance



Derating Curve



Power Dissipation v Board Area



Thermal Resistance v Board Area

NPN - Electrical Characteristics (@T_A = +25°C, unless otherwise specified.)

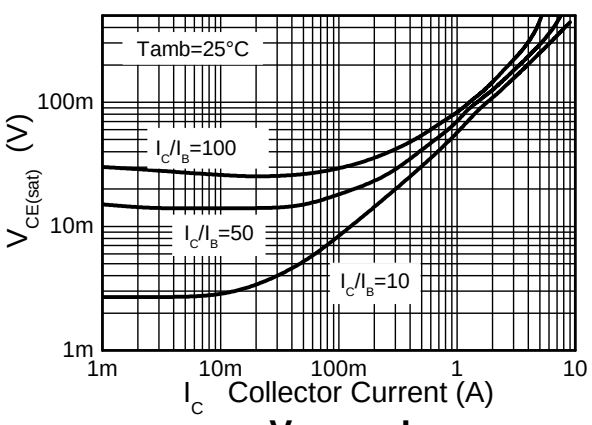
Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
Collector-Base Breakdown Voltage	BV_{CBO}	40	100	—	V	I_C = 100µA
Collector-Emitter Breakdown Voltage (Note 17)	BV_{CEO}	20	27	—	V	I_C = 10mA
Emitter-Base Breakdown Voltage	BV_{EBO}	7	8.2	—	V	I_E = 100µA
Collector Cutoff Current	I_{CBO}	—	—	100	nA	V_{CB} = 32V
Emitter Cutoff Current	I_{EBO}	—	—	100	nA	V_{EB} = 6V
Collector Emitter Cutoff Current	I_{CES}	—	—	100	nA	V_{CES} = 16V
Static Forward Current Transfer Ratio (Note 17)	h_{FE}	200	400	—	—	I_C = 10mA, V_{CE} = 2V
		300	450	—		I_C = 200mA, V_{CE} = 2V
		200	360	—		I_C = 2A, V_{CE} = 2V
		100	180	—		I_C = 6A, V_{CE} = 2V
Collector-Emitter Saturation Voltage (Note 17)	$V_{CE(sat)}$	—	8	15	mV	I_C = 0.1A, I_B = 10mA
		—	90	150		I_C = 1A, I_B = 10mA
		—	115	135		I_C = 2A, I_B = 50mA
		—	190	250		I_C = 3A, I_B = 100mA
		—	210	300		I_C = 4.5A, I_B = 125mA
Base-Emitter Turn-On Voltage (Note 17)	$V_{BE(on)}$	—	0.88	-0.97	V	I_C = 4.5A, V_{CE} = 2V
Base-Emitter Saturation Voltage (Note 17)	$V_{BE(sat)}$	—	0.98	-1.07	V	I_C = 4.5A, I_B = 125mA
Output Capacitance	C_{obo}	—	23	30	pF	V_{CB} = 10V, f = 1MHz
Transition Frequency	f_T	100	140	—	MHz	V_{CE} = 10V, I_C = 50mA f = 100MHz
Turn-on Time	t_{on}	—	170	—	ns	V_{CC} = 10V, I_C = 3A
Turn-off Time	t_{off}	—	400	—	ns	I_{B1} = I_{B2} = 10mA

Schottky - Electrical Characteristics (@T_A = +25°C, unless otherwise specified.)

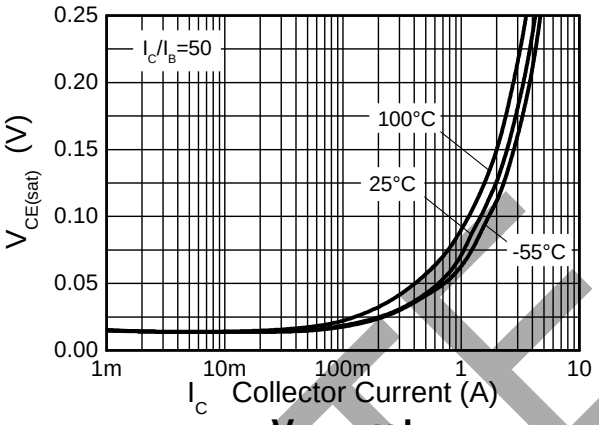
Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
Reverse Breakdown Voltage	BV_R	40	60	—	V	I_R = -300µA
Forward Voltage (Note 17)	V_F	—	240	270	mV	I_F = 50mA
		—	265	290		I_F = 100mA
		—	305	340		I_F = 250mA
		—	355	400		I_F = 500mA
		—	390	450		I_F = 750mA
		—	425	500		I_F = 1000mA
		—	495	600		I_F = 1500mA
		—	420	—		I_F = 1000mA, T_A = +100°C
Reverse Current	I_R	—	50	100	µA	V_R = 30V
Diode Capacitance	C_D	—	25	—	pF	V_R = 25V, f = 1MHz
Reverse Recovery Time	t_{rr}	—	12	—	ns	Switched from I_F = 500mA to I_R = 500mA Measured at I_R = 50mA

Note: 17. Measured under pulsed conditions. Pulse width ≤ 300µs. Duty cycle ≤ 2%.

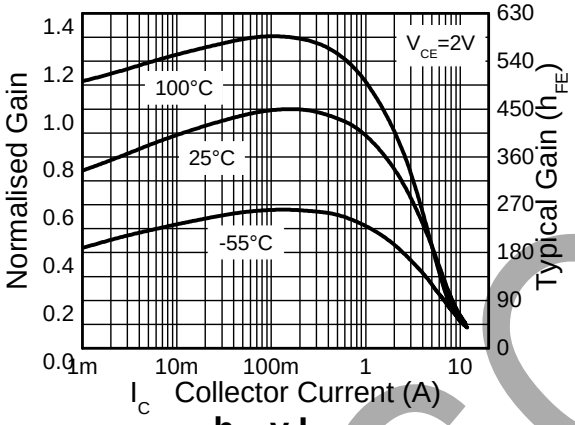
NPN - Typical Electrical Characteristics



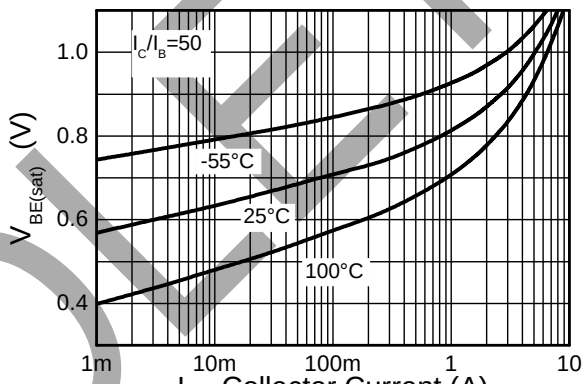
$V_{CE(sat)}$ v I_C



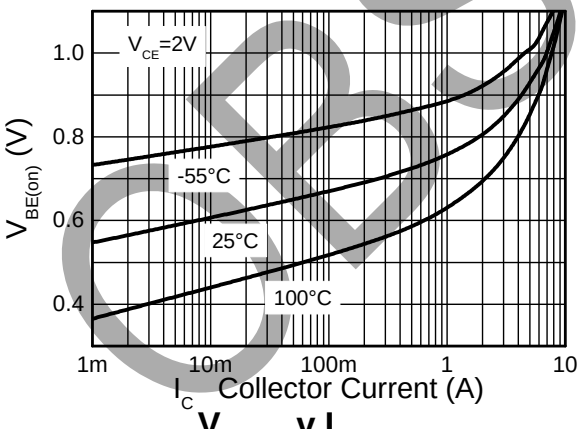
$V_{CE(sat)}$ v I_C



h_{FE} v I_C

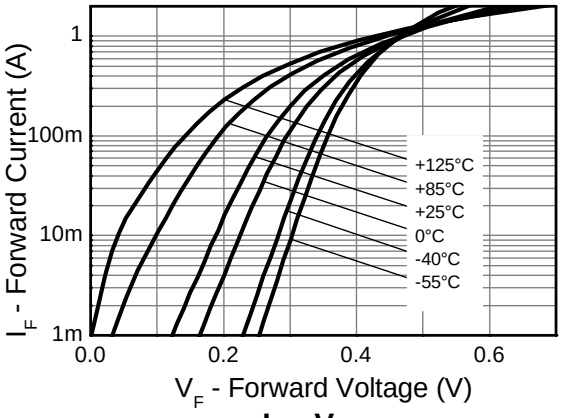


$V_{BE(sat)}$ v I_C

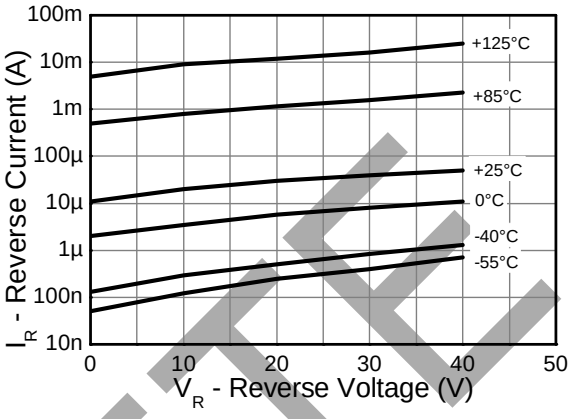


$V_{BE(on)}$ v I_C

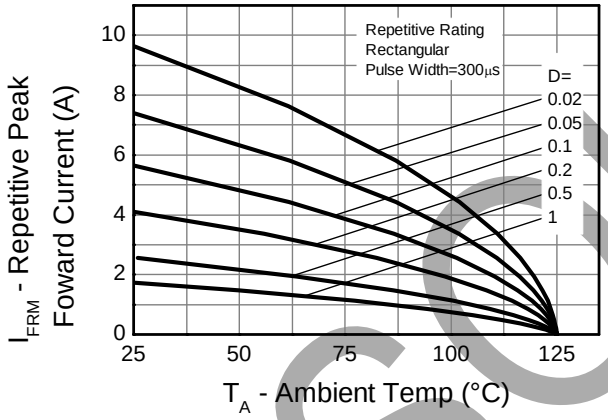
Schottky - Typical Electrical Characteristics



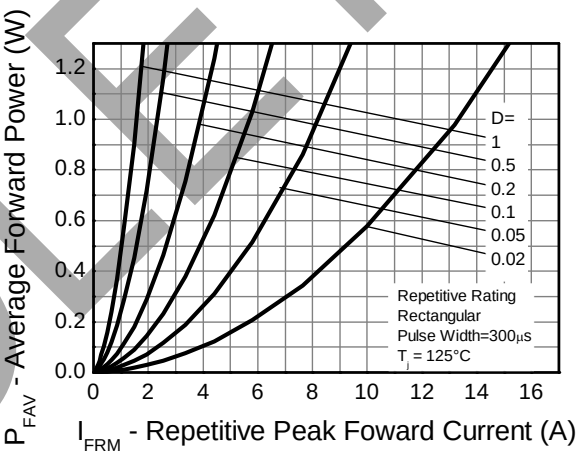
I_F v V_F



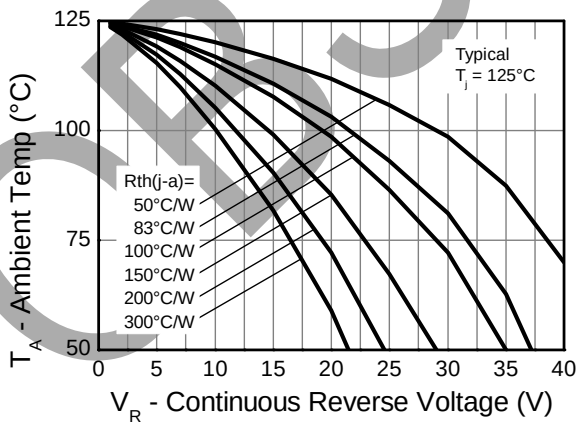
I_R v V_R



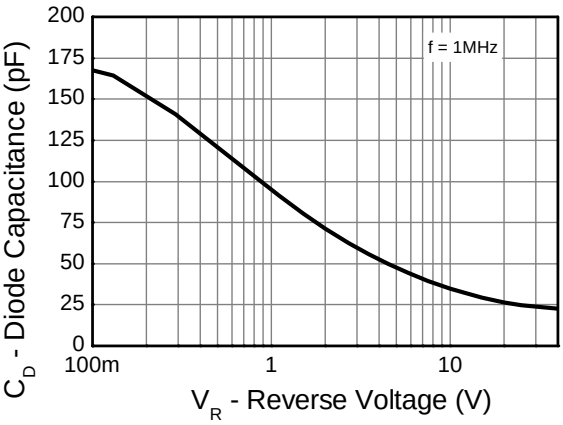
I_{FRM} v T_A



P_{FAV} v I_{FRM}



T_A v V_R

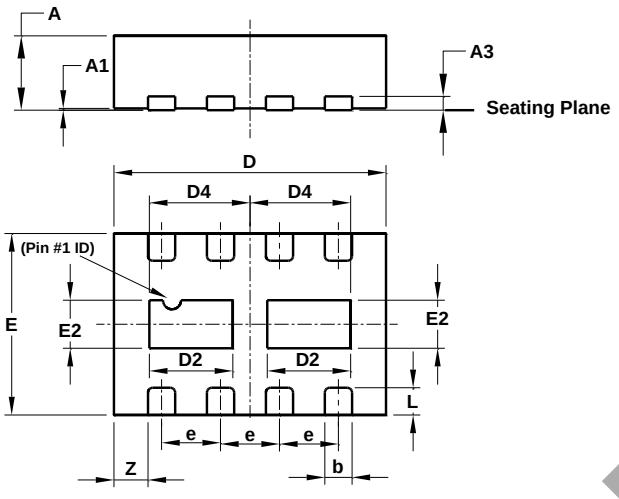


C_D v V_R

Package Outline Dimensions

Please see http://www.diodes.com/package-outlines.html for the latest version.

W-DFN3020-8 (Type B)

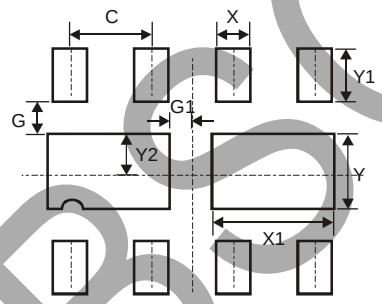


W-DFN3020-8 (Type B)			
Dim	**Min**	**Max**	**Typ**
A	0.77	0.83	0.80
A1	0	0.05	0.02
A3	-	-	0.15
b	0.25	0.35	0.30
D	2.95	3.075	3.00
D2	0.82	1.02	0.92
D4	1.01	1.21	1.11
e	-	-	0.65
E	1.95	2.075	2.00
E2	0.43	0.63	0.53
L	0.25	0.35	0.30
Z	-	-	0.375
All Dimensions in mm			

Suggested Pad Layout

Please see http://www.diodes.com/package-outlines.html for the latest version.

W-DFN3020-8 (Type B)



Dimensions	Value (in mm)
C	0.650
G	0.285
G1	0.090
X	0.400
X1	1.120
Y	0.730
Y1	0.500
Y2	0.365

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