

# TRANSZORB® Transient Voltage Suppressors


**DO-204AL (DO-41)**

PRIMARY CHARACTERISTICS	
$V_{WM}$	5.8 V to 376 V
$V_{BR}$ (uni-directional)	6.45 V to 462 V
$V_{BR}$ (bi-directional)	6.45 V to 462 V
$P_{PPM}$	400 W
$P_D$	1.5 W
$I_{FSM}$ (uni-directional only)	40 A
$T_J$ max.	175 °C
Polarity	Uni-directional, bi-directional
Package	DO-204AL (DO-41)

## DEVICES FOR BI-DIRECTION APPLICATIONS

For bi-directional types, use B suffix (e.g. BZW04P-6V4B).

Electrical characteristics apply in both directions.

## FEATURES

- Glass passivated chip junction
- Available in uni-directional and bi-directional
- 400 W peak pulse power capability with a 10/1000  $\mu$ s waveform, repetitive rate (duty cycle): 0.01 %
- Excellent clamping capability
- Very fast response time
- Low incremental surge resistance
- Solder dip 275 °C max. 10 s, per JESD 22-B106
- AEC-Q101 qualified
- Material categorization: For definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS**  
COMPLIANT

## TYPICAL APPLICATIONS

Use in sensitive electronics protection against voltage transients induced by inductive load switching and lighting on ICs, MOSFET, signal lines of sensor units for consumer, computer, industrial, and telecommunication.

## MECHANICAL DATA

**Case:** DO-204AL, molded epoxy over passivated chip

Molding compound meets UL 94 V-0 flammability rating

Base P/N-E3 - RoHS-compliant, commercial grade

Base P/NHE3 - RoHS-compliant, AEC-Q101 qualified

**Terminals:** Matte tin plated leads, solderable per J-STD-002 and JESD22-B102

E3 suffix meets JESD 201 class 1A whisker test, HE3 suffix meets JESD 201 class 2 whisker test

### Note

- BZW04-213(B) to BZW04-376(B) for commercial grade only

**Polarity:** For uni-directional types the color band denotes cathode end, no marking on bi-directional types

MAXIMUM RATINGS AND THERMAL CHARACTERISTICS ( $T_A = 25\text{ °C}$ unless otherwise noted)			
PARAMETER	SYMBOL	LIMIT	UNIT
Peak pulse power dissipation with a 10/1000 $\mu$ s waveform <sup>(1)</sup> (fig. 1)	$P_{PPM}$	400	W
Peak pulse current with a 10/1000 $\mu$ s waveform <sup>(1)</sup>	$I_{PPM}$	See next table	A
Power dissipation on infinite heatsink at $T_L = 75\text{ °C}$ (fig. 5)	$P_D$	1.5	W
Peak forward surge current, 8.3 ms single half sine-wave uni-directional only <sup>(2)</sup>	$I_{FSM}$	40	A
Maximum instantaneous forward voltage at 25 A for uni-directional only <sup>(3)</sup>	$V_F$	3.5/5.0	V
Operating junction and storage temperature range	$T_J, T_{STG}$	-55 to +175	°C

### Notes

<sup>(1)</sup> Non-repetitive current pulse, per fig. 3 and derated above  $T_A = 25\text{ °C}$  per fig. 2

<sup>(2)</sup> Measured on 8.3 ms single half sine-wave or equivalent square wave, duty cycle = 4 pulses per minute maximum

<sup>(3)</sup>  $V_F = 3.5\text{ V}$  for BZW04P(-)188 and below;  $V_F = 5.0\text{ V}$  for BZW04P(-)213 and above



ELECTRICAL CHARACTERISTICS (T <sub>A</sub> = 25 °C unless otherwise noted)								
PART NUMBER	BREAKDOWN VOLTAGE V <sub>BR</sub> AT I <sub>T</sub> <sup>(1)</sup> (V)		TEST CURRENT I <sub>T</sub> (mA)	STAND-OFF VOLTAGE V <sub>WM</sub> (V)	MAXIMUM REVERSE LEAKAGE AT V <sub>WM</sub> I <sub>D</sub> <sup>(4)</sup> (μA)	MAXIMUM PEAK PULSE CURRENT I <sub>PPM</sub> <sup>(2)</sup> (A)	MAXIMUM CLAMPING VOLTAGE AT I <sub>PPM</sub> V <sub>C</sub> (V)	MAXIMUM TEMPERATURE COEFFICIENT OF V <sub>BR</sub> (%/°C)
	MIN.	MAX.						
<b>UNI-DIRECTIONAL TYPES</b>								
BZW04-5V8	6.45	7.14	10.0	5.80	1000	38.0	10.5	0.057
BZW04-6V4	7.13	7.88	10.0	6.40	500	35.4	11.3	0.061
BZW04-7V0	7.79	8.61	10.0	7.02	200	33.0	12.1	0.065
BZW04-7V8	8.65	9.55	1.0	7.78	50	30.0	13.4	0.073
BZW04-8V5	9.50	10.5	1.0	8.55	10	27.6	14.5	0.075
BZW04-9V4	10.5	11.6	1.0	9.4	5.0	25.7	15.6	0.075
BZW04-10	11.4	12.6	1.0	10.2	1.0	24.0	16.7	0.078
BZW04-11	12.4	13.7	1.0	11.1	1.0	22.0	18.2	0.081
BZW04-13	14.3	15.8	1.0	12.8	1.0	19.0	21.2	0.084
BZW04-14	15.2	16.8	1.0	13.6	1.0	17.8	22.5	0.086
BZW04-15	17.1	18.9	1.0	15.3	1.0	16.0	25.2	0.088
BZW04-17	19.0	21.0	1.0	17.1	1.0	14.5	27.7	0.090
BZW04-19	20.9	23.1	1.0	18.8	1.0	13.0	30.6	0.092
BZW04-20	22.8	25.2	1.0	20.5	1.0	12.0	33.2	0.094
BZW04-23	25.7	28.4	1.0	23.1	1.0	10.7	37.5	0.096
BZW04-26	28.5	31.5	1.0	25.6	1.0	9.6	41.5	0.097
BZW04-28	31.4	34.7	1.0	28.2	1.0	8.8	45.7	0.098
BZW04-31	34.2	37.8	1.0	30.8	1.0	8.0	49.9	0.099
BZW04-33	37.1	41.0	1.0	33.3	1.0	7.4	53.9	0.100
BZW04-37	40.9	45.2	1.0	36.8	1.0	6.7	59.3	0.101
BZW04-40	44.7	49.4	1.0	40.2	1.0	6.2	64.8	0.101
BZW04-44	48.5	53.6	1.0	43.6	1.0	5.7	70.1	0.102
BZW04-48	53.2	58.8	1.0	47.8	1.0	5.2	77.0	0.103
BZW04-53	58.9	65.1	1.0	53.0	1.0	4.7	85.0	0.104
BZW04-58	64.6	71.4	1.0	58.1	1.0	4.3	92.0	0.104
BZW04-64	71.3	78.8	1.0	64.1	1.0	3.9	103	0.105
BZW04-70	77.9	86.1	1.0	70.1	1.0	3.5	113	0.105
BZW04-78	86.5	95.5	1.0	78.0	1.0	3.2	125	0.105
BZW04-85	95.0	105	1.0	85.5	1.0	2.9	137	0.106
BZW04-94	105	116	1.0	94.0	1.0	2.6	152	0.107
BZW04-102	114	126	1.0	102	1.0	2.4	165	0.107
BZW04-110	124	137	1.0	111	1.0	2.2	179	0.107
BZW04-128	143	158	1.0	128	1.0	2.0	207	0.108
BZW04-136	152	168	1.0	136	1.0	1.8	219	0.108
BZW04-145	161	179	1.0	145	1.0	1.7	234	0.108
BZW04-154	171	189	1.0	154	1.0	1.6	246	0.108
BZW04-171	190	210	1.0	171	1.0	1.5	274	0.108
BZW04-188	209	231	1.0	188	1.0	1.4	301	0.108
BZW04-213	237	263	1.0	213	1.0	1.2	344	0.110
BZW04-239	266	294	1.0	239	1.0	1.1	384	0.110
BZW04-256	285	315	1.0	256	1.0	1.0	414	0.110
BZW04-273	304	336	1.0	273	1.0	0.90	438	0.110
BZW04-299	332	368	1.0	299	1.0	0.80	482	0.110
BZW04-342	380	420	1.0	342	1.0	0.75	548	0.110
BZW04-376	418	462	1.0	376	1.0	0.67	603	0.110



ELECTRICAL CHARACTERISTICS (T <sub>A</sub> = 25 °C unless otherwise noted)								
PART NUMBER	BREAKDOWN VOLTAGE V <sub>BR</sub> AT I <sub>T</sub> <sup>(1)</sup> (V)		TEST CURRENT I <sub>T</sub> (mA)	STAND-OFF VOLTAGE V <sub>WM</sub> (V)	MAXIMUM REVERSE LEAKAGE AT V <sub>WM</sub> I <sub>D</sub> <sup>(4)</sup> (µA)	MAXIMUM PEAK PULSE CURRENT I <sub>PPM</sub> <sup>(2)</sup> (A)	MAXIMUM CLAMPING VOLTAGE AT I <sub>PPM</sub> V <sub>C</sub> (V)	MAXIMUM TEMPERATURE COEFFICIENT OF V <sub>BR</sub> (%/°C)
	MIN.	MAX.						
<b>BI-DIRECTIONAL TYPES</b>								
BZW04-5V8B	6.45	7.14	10.0	5.80	1000	38.0	10.5	0.057
BZW04-6V4B	7.13	7.88	10.0	6.40	500	35.4	11.3	0.061
BZW04-7V0B	7.79	8.61	10.0	7.02	200	33.0	12.1	0.065
BZW04-7V8B	8.65	9.55	1.0	7.78	50	30.0	13.4	0.073
BZW04-8V5B	9.50	10.5	1.0	8.55	10	27.6	14.5	0.075
BZW04-9V4B	10.5	11.6	1.0	9.4	5.0	25.7	15.6	0.075
BZW04-10B	11.4	12.6	1.0	10.2	1.0	24.0	16.7	0.078
BZW04-11B	12.4	13.7	1.0	11.1	1.0	22.0	18.2	0.081
BZW04-13B	14.3	15.8	1.0	12.8	1.0	19.0	21.2	0.084
BZW04-14B	15.2	16.8	1.0	13.6	1.0	17.8	22.5	0.086
BZW04-15B	17.1	18.9	1.0	15.3	1.0	16.0	25.2	0.088
BZW04-17B	19.0	21.0	1.0	17.1	1.0	14.5	27.7	0.090
BZW04-19B	20.9	23.1	1.0	18.8	1.0	13.0	30.6	0.092
BZW04-20B	22.8	25.2	1.0	20.5	1.0	12.0	33.2	0.094
BZW04-23B	25.7	28.4	1.0	23.1	1.0	10.7	37.5	0.096
BZW04-26B	28.5	31.5	1.0	25.6	1.0	9.6	41.5	0.097
BZW04-28B	31.4	34.7	1.0	28.2	1.0	8.8	45.7	0.098
BZW04-31B	34.2	37.8	1.0	30.8	1.0	8.0	49.9	0.099
BZW04-33B	37.1	41.0	1.0	33.3	1.0	7.4	53.9	0.100
BZW04-37B	40.9	45.2	1.0	36.8	1.0	6.7	59.3	0.101
BZW04-40B	44.7	49.4	1.0	40.2	1.0	6.2	64.8	0.101
BZW04-44B	48.5	53.6	1.0	43.6	1.0	5.7	70.1	0.102
BZW04-48B	53.2	58.8	1.0	47.8	1.0	5.2	77.0	0.103
BZW04-53B	58.9	65.1	1.0	53.0	1.0	4.7	85.0	0.104
BZW04-58B	64.6	71.4	1.0	58.1	1.0	4.3	92.0	0.104
BZW04-64B	71.3	78.8	1.0	64.1	1.0	3.9	103	0.105
BZW04-70B	77.9	86.1	1.0	70.1	1.0	3.5	113	0.105
BZW04-78B	86.5	95.5	1.0	78.0	1.0	3.2	125	0.105
BZW04-85B	95.0	105	1.0	85.5	1.0	2.9	137	0.106
BZW04-94B	105	116	1.0	94.0	1.0	2.6	152	0.107
BZW04-102B	114	126	1.0	102	1.0	2.4	165	0.107
BZW04-110B	124	137	1.0	111	1.0	2.2	179	0.107
BZW04-128B	143	158	1.0	128	1.0	2.0	207	0.108
BZW04-136B	152	168	1.0	136	1.0	1.8	219	0.108
BZW04-145B	161	179	1.0	145	1.0	1.7	234	0.108
BZW04-154B	171	189	1.0	154	1.0	1.6	246	0.108
BZW04-171B	190	210	1.0	171	1.0	1.5	274	0.108
BZW04-188B	209	231	1.0	188	1.0	1.4	301	0.108
BZW04-213B	237	263	1.0	213	1.0	1.2	344	0.110
BZW04-239B	266	294	1.0	239	1.0	1.1	384	0.110
BZW04-256B	285	315	1.0	256	1.0	1.0	414	0.110
BZW04-273B	304	336	1.0	273	1.0	0.90	438	0.110
BZW04-299B	332	368	1.0	299	1.0	0.80	482	0.110
BZW04-342B	380	420	1.0	342	1.0	0.75	548	0.110
BZW04-376B	418	462	1.0	376	1.0	0.67	603	0.110

Notes

- (1) Pulse test: t<sub>p</sub> ≥ 50 ms
- (2) Surge current waveform per fig. 3 and derated per fig. 2
- (3) All terms and symbols are consistent with ANSI/IEEE C62.35
- (4) For bi-directional types having V<sub>WM</sub> of 10 V and less, the I<sub>D</sub> limit is doubled



ORDERING INFORMATION (Example)				
PREFERRED P/N	UNIT WEIGHT (g)	PREFERRED PACKAGE CODE	BASE QUANTITY	DELIVERY MODE
BZW0410-E3/54	0.350	54	550	13" diameter paper tape and reel
BZW0410HE3/54 <sup>(1)</sup>	0.350	54	550	13" diameter paper tape and reel

Note

<sup>(1)</sup> AEC Q101 qualified

RATINGS AND CHARACTERISTICS CURVES (T<sub>A</sub> = 25 °C unless otherwise noted)

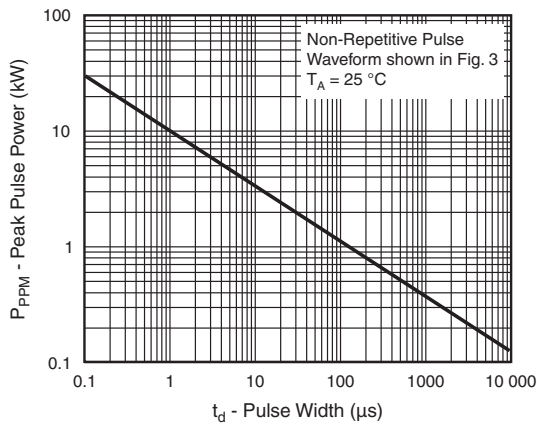


Fig. 1 - Peak Pulse Power Rating Curve

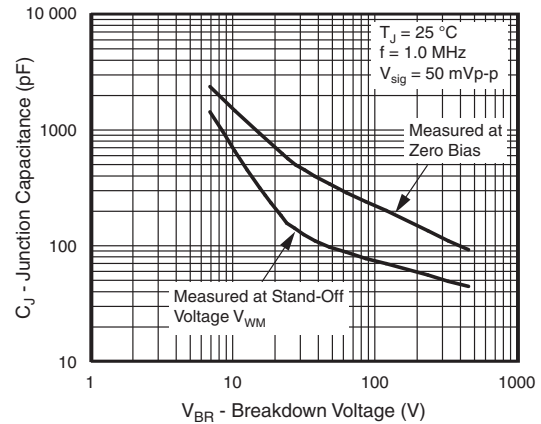


Fig. 4 - Typical Junction Capacitance

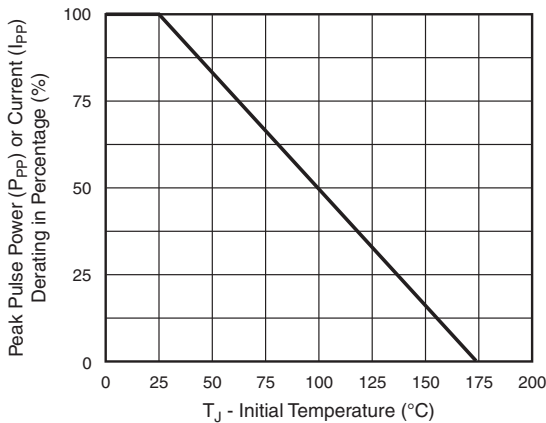


Fig. 2 - Pulse Power or Current vs. Initial Junction Temperature

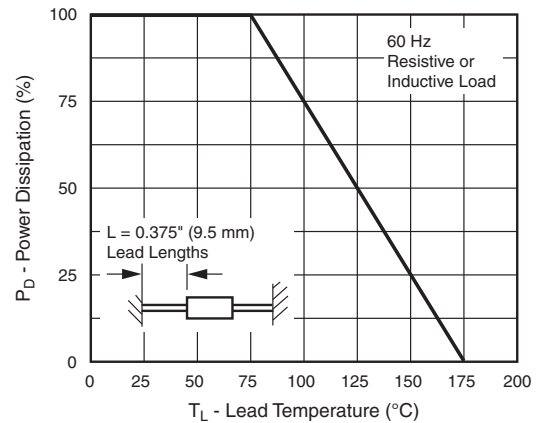


Fig. 5 - Power Derating Curve

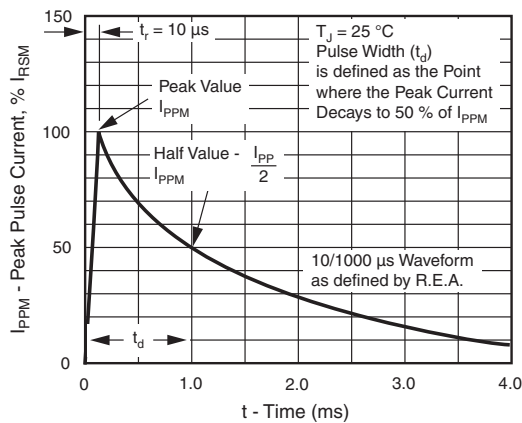


Fig. 3 - Pulse Waveform

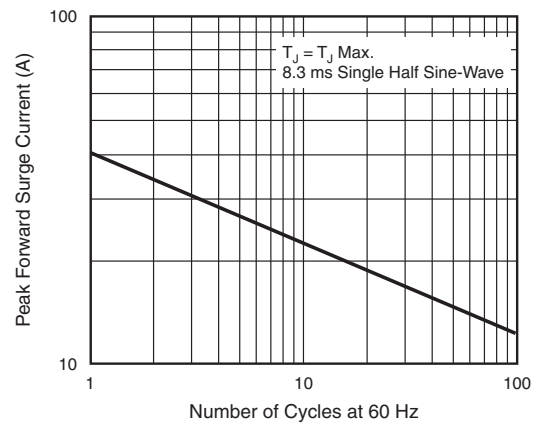
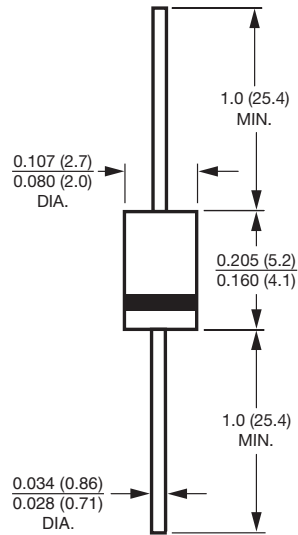


Fig. 6 - Max. Non-Repetitive Forward Surge Current Uni-Directional Only



**PACKAGE OUTLINE DIMENSIONS** in inches (millimeters)

DO-204AL (DO-41)





## Disclaimer

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## Material Category Policy

**Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as RoHS-Compliant fulfill the definitions and restrictions defined under Directive 2011/65/EU of The European Parliament and of the Council of June 8, 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (EEE) - recast, unless otherwise specified as non-compliant.**

**Please note that some Vishay documentation may still make reference to RoHS Directive 2002/95/EC. We confirm that all the products identified as being compliant to Directive 2002/95/EC conform to Directive 2011/65/EU.**

**Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as Halogen-Free follow Halogen-Free requirements as per JEDEC JS709A standards. Please note that some Vishay documentation may still make reference to the IEC 61249-2-21 definition. We confirm that all the products identified as being compliant to IEC 61249-2-21 conform to JEDEC JS709A standards.**