

# MZP4729A Series

## 3 Watt DO-41 Surmetic™ 30 Zener Voltage Regulators

This is a complete series of 3 Watt Zener diodes with limits and excellent operating characteristics that reflect the superior capabilities of silicon-oxide passivated junctions. All this in an axial-lead, transfer-molded plastic package that offers protection in all common environmental conditions.

### Specification Features:

- Zener Voltage Range - 3.6 V to 30 V
- ESD Rating of Class 3 (>16 KV) per Human Body Model
- Surge Rating of 98 Watt @ 1 ms
- Maximum Limits Guaranteed on up to Six Electrical Parameters
- Package No Larger than the Conventional 1 Watt Package
- These are Pb-Free Devices\*

### Mechanical Characteristics:

**CASE:** Void free, transfer-molded, thermosetting plastic

**FINISH:** All external surfaces are corrosion resistant and leads are readily solderable

**MAXIMUM LEAD TEMPERATURE FOR SOLDERING PURPOSES:** 260°C, 1/16" from the case for 10 seconds

**POLARITY:** Cathode indicated by polarity band

**MOUNTING POSITION:** Any

### MAXIMUM RATINGS

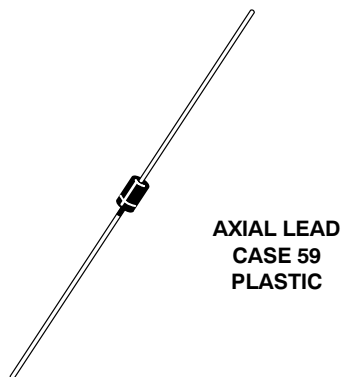
Rating	Symbol	Value	Unit
Max. Steady State Power Dissipation @ $T_L = 75^\circ\text{C}$ , Lead Length = 3/8" Derate above 75°C	$P_D$	3	W
		24	mW/°C
Steady State Power Dissipation @ $T_A = 50^\circ\text{C}$ Derate above 50°C	$P_D$	1	W
		6.67	mW/°C
Operating and Storage Temperature Range	$T_J, T_{stg}$	-65 to +200	°C

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.



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### MARKING DIAGRAM



- A = Assembly Location
- MZP47xxA = Device Number
- YY = Year
- WW = Work Week
- = Pb-Free Package

(Note: Microdot may be in either location)

### ORDERING INFORMATION

Device	Package	Shipping†
MZP47xxARLG	Axial Lead (Pb-Free)	6000/Tape & Reel
MZP47xxATAG	Axial Lead (Pb-Free)	4000/Ammo Pack

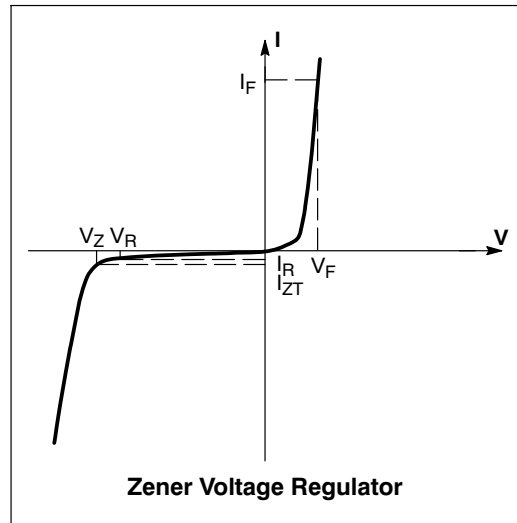
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

## MZP4729A Series

**ELECTRICAL CHARACTERISTICS** ( $T_A = 25^\circ\text{C}$  unless otherwise noted,  $V_F = 1.5\text{ V Max @ } I_F = 200\text{ mA}$  for all types)

Symbol	Parameter
$V_Z$	Reverse Zener Voltage @ $I_{ZT}$
$I_{ZT}$	Reverse Current
$Z_{ZT}$	Maximum Zener Impedance @ $I_{ZT}$
$I_{ZK}$	Reverse Current
$Z_{ZK}$	Maximum Zener Impedance @ $I_{ZK}$
$I_R$	Reverse Leakage Current @ $V_R$
$V_R$	Breakdown Voltage
$I_F$	Forward Current
$V_F$	Forward Voltage @ $I_F$
$I_R$	Surge Current @ $T_A = 25^\circ\text{C}$



**ELECTRICAL CHARACTERISTICS** ( $T_A = 25^\circ\text{C}$  unless otherwise noted,  $V_F = 1.5\text{ V Max @ } I_F = 200\text{ mA}$  for all types)

Device† (Note 1)	Device Marking	Zener Voltage (Note 2)			Zener Impedance (Note 3)			Leakage Current		$I_R$ (Note 4)	
		$V_Z$ (Volts)			@ $I_{ZT}$	$Z_{ZT}$ @ $I_{ZT}$	$Z_{ZK}$ @ $I_{ZK}$	$I_R$ @ $V_R$			
		Min	Nom	Max	mA	$\Omega$	$\Omega$	mA	$\mu\text{A Max}$	Volts	mA
MZP4729A, G	MZP4729A	3.42	3.6	3.78	69	10	400	1	100	1	1260
MZP4735A, G	MZP4735A	5.89	6.2	6.51	41	2	700	1	10	3	730
MZP4746A, G	MZP4746A	17.10	18	18.90	14	20	750	0.25	5	13.7	250
MZP4749A, G	MZP4749A	22.80	24	25.20	10.5	25	750	0.25	5	18.2	190
MZP4750A, G	MZP4750A	25.65	27	28.35	9.5	35	750	0.25	5	20.6	170

**1. TOLERANCE AND TYPE NUMBER DESIGNATION**

The type numbers listed have a standard tolerance on the nominal zener voltage of  $\pm 5\%$ .

**2. ZENER VOLTAGE ( $V_Z$ ) MEASUREMENT**

ON Semiconductor guarantees the zener voltage when measured at 90 seconds while maintaining the lead temperature ( $T_L$ ) at  $30^\circ\text{C} \pm 1^\circ\text{C}$ ,  $3/8''$  from the diode body.

**3. ZENER IMPEDANCE ( $Z_Z$ ) DERIVATION**

The zener impedance is derived from 60 seconds AC voltage, which results when an AC current having an rms value equal to 10% of the DC zener current ( $I_{ZT}$  or  $I_{ZK}$ ) is superimposed on  $I_{ZT}$  or  $I_{ZK}$ .

**4. SURGE CURRENT ( $I_R$ ) NON-REPETITIVE**

The rating listed in the electrical characteristics table is maximum peak, non-repetitive, reverse surge current of 1/2 square wave or equivalent sine wave pulse of 1/120 second duration superimposed on the test current,  $I_{ZT}$ , per JEDEC standards. However, actual device capability is as described in Figure 3 of the General Data sheet for Surmetic 30s.

†The "G" suffix indicates Pb-Free package.

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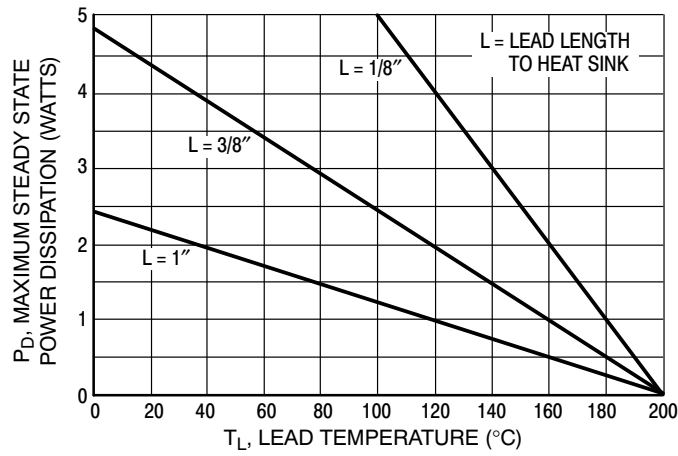


Figure 1. Power Temperature Derating Curve

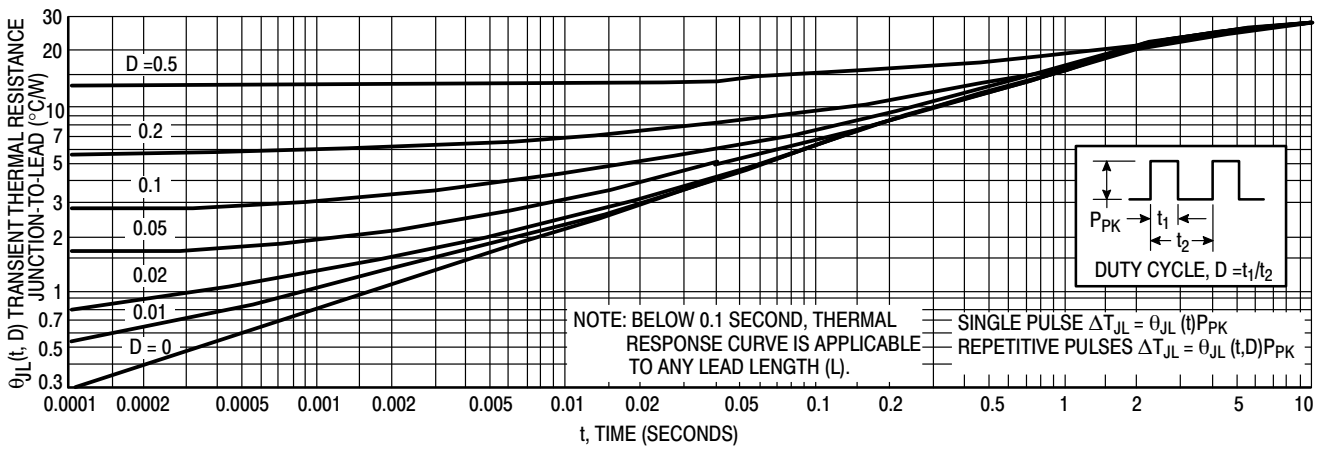


Figure 2. Typical Thermal Response L, Lead Length = 3/8 Inch

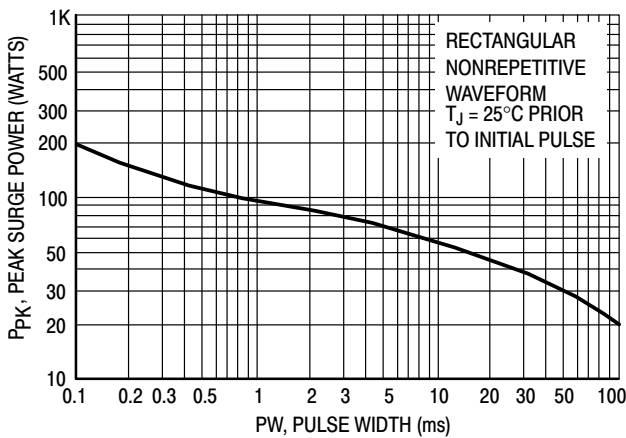


Figure 3. Maximum Surge Power

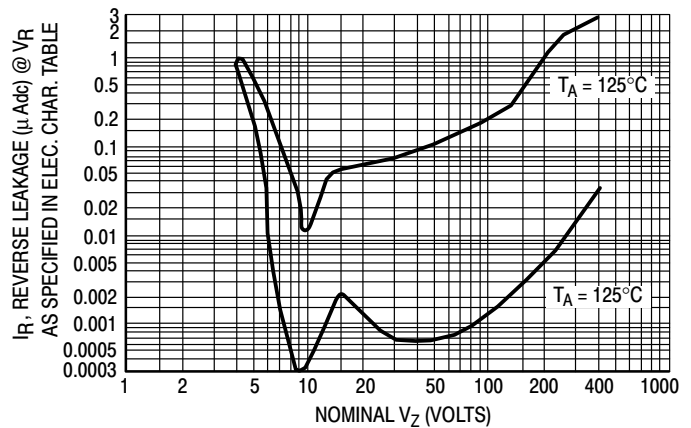


Figure 4. Typical Reverse Leakage

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## APPLICATION NOTE

Since the actual voltage available from a given zener diode is temperature dependent, it is necessary to determine junction temperature under any set of operating conditions in order to calculate its value. The following procedure is recommended:

Lead Temperature,  $T_L$ , should be determined from:

$$T_L = \theta_{LA} P_D + T_A$$

$\theta_{LA}$  is the lead-to-ambient thermal resistance ( $^{\circ}\text{C}/\text{W}$ ) and  $P_D$  is the power dissipation. The value for  $\theta_{LA}$  will vary and depends on the device mounting method.  $\theta_{LA}$  is generally  $30\text{--}40^{\circ}\text{C}/\text{W}$  for the various clips and tie points in common use and for printed circuit board wiring.

The temperature of the lead can also be measured using a thermocouple placed on the lead as close as possible to the tie point. The thermal mass connected to the tie point is normally large enough so that it will not significantly respond to heat surges generated in the diode as a result of pulsed operation once steady-state conditions are achieved. Using the measured value of  $T_L$ , the junction temperature may be determined by:

$$T_J = T_L + \Delta T_{JL}$$

$\Delta T_{JL}$  is the increase in junction temperature above the lead temperature and may be found from Figure 2 for a train of power pulses ( $L = 3/8$  inch) or from Figure 10 for dc power.

$$\Delta T_{JL} = \theta_{JL} P_D$$

For worst-case design, using expected limits of  $I_Z$ , limits of  $P_D$  and the extremes of  $T_J$  ( $\Delta T_J$ ) may be estimated. Changes in voltage,  $V_Z$ , can then be found from:

$$\Delta V = \theta_{VZ} \Delta T_J$$

$\theta_{VZ}$ , the zener voltage temperature coefficient, is found from Figures 5 and 6.

Under high power-pulse operation, the zener voltage will vary with time and may also be affected significantly by the zener resistance. For best regulation, keep current excursions as low as possible.

Data of Figure 2 should not be used to compute surge capability. Surge limitations are given in Figure 3. They are lower than would be expected by considering only junction temperature, as current crowding effects cause temperatures to be extremely high in small spots resulting in device degradation should the limits of Figure 3 be exceeded.

## TEMPERATURE COEFFICIENT RANGES

(90% of the Units are in the Ranges Indicated)

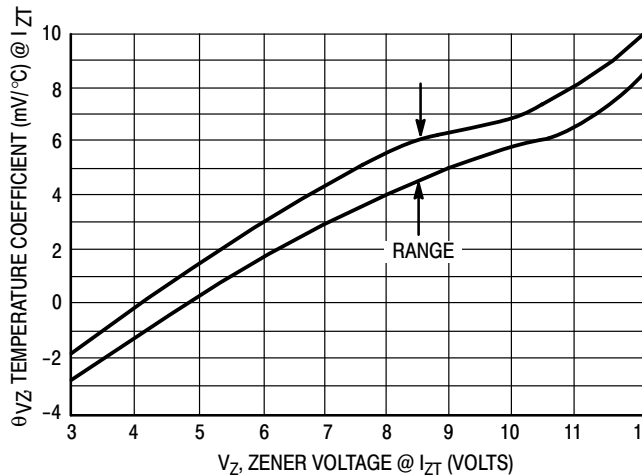


Figure 5. Units to 12 Volts

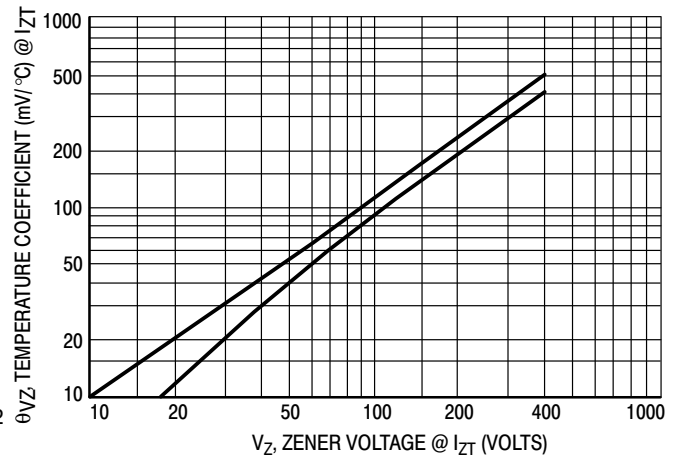


Figure 6. Units 10 to 400 Volts

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## ZENER VOLTAGE versus ZENER CURRENT

(Figures 7, 8 and 9)

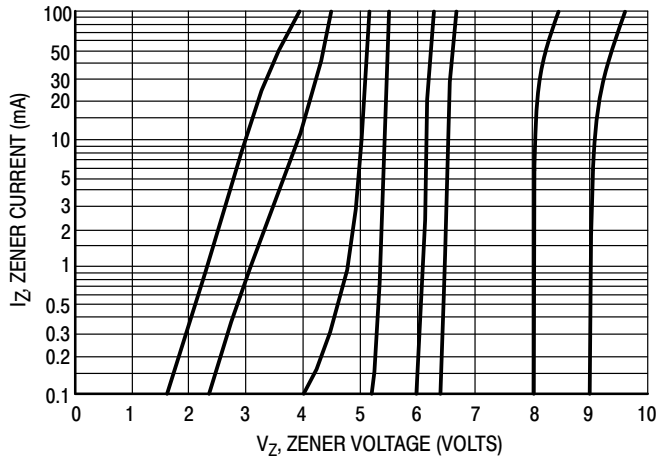


Figure 7.  $V_Z = 3.3$  to 10 Volts

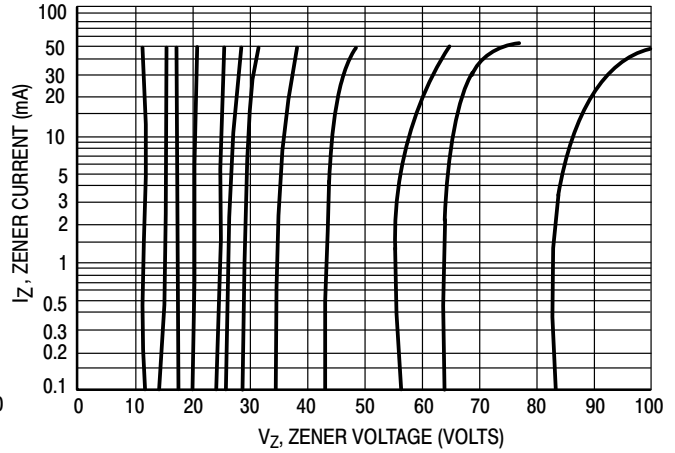


Figure 8.  $V_Z = 12$  to 82 Volts

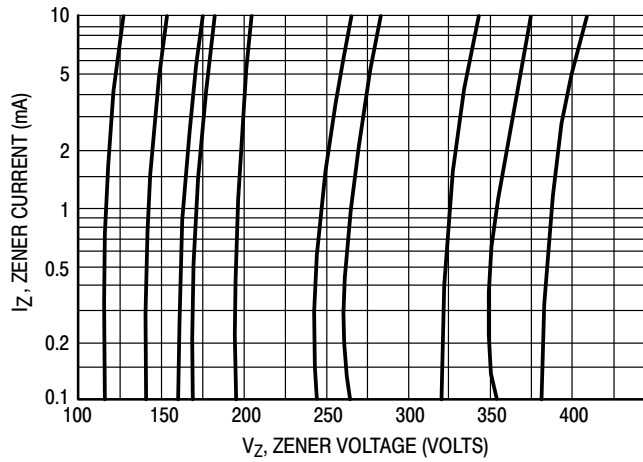


Figure 9.  $V_Z = 100$  to 400 Volts

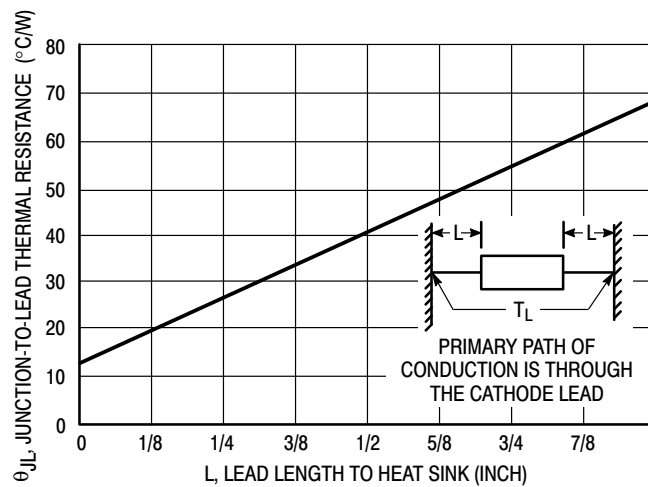
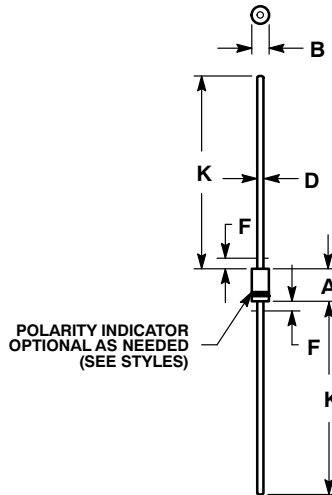


Figure 10. Typical Thermal Resistance

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## PACKAGE DIMENSIONS

AXIAL LEAD  
CASE 59-10  
ISSUE U



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. ALL RULES AND NOTES ASSOCIATED WITH JEDEC DO-41 OUTLINE SHALL APPLY
4. POLARITY DENOTED BY CATHODE BAND.
5. LEAD DIAMETER NOT CONTROLLED WITHIN F DIMENSION.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.161	0.205	4.10	5.20
B	0.079	0.106	2.00	2.70
D	0.028	0.034	0.71	0.86
F	---	0.050	---	1.27
K	1.000	---	25.40	---

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