# 1500 Watt Unidirectional and Bidirectional Transient Voltage Suppressor 

## DESCRIPTION

The popular Transient Voltage Suppressor series of M1.5KE6.8 - M1.5KE400CA with its various upscreening options offer an extended voltage range and provides a wide variety of commercial, high reliability, RoHS and bidirectional options. All have the same high peak pulse power rating of 1500 W and extremely fast response time. They can protect from secondary effects of lightning per IEC61000-4-5 and the class levels as shown below as well as voltage transients from inductive switching and RFI. Since their response time is virtually instantaneous, they also protect from ESD and EFT per IEC61000-4-2 and IEC61000-4-4.

Important: For the latest information, visit our website http://www.microsemi.com.

## FEATURES

- High reliability devices with fabrication and assembly lot traceability

Case 1 Package

- Economical plastic encapsulated TVS series for thru-hole mounting
- $3 \sigma$ lot norm screening performed on standby current ( $\mathrm{I}_{\mathrm{D}}$ )
- $100 \%$ surge tested devices suppress transients up to 1500 watts @ $10 / 1000 \mu$ s (see figure 1)
- Enhanced reliability screening available in reference to MIL-PRF-19500. Refer to Hirel NonHermetic Product Portfolio for more details on the screening options.
(See part nomenclature for all options.)
- Enhanced reliability source controlled devices have wafer fabrication and assembly lot traceability
- Moisture classification is "Level 1" with no dry pack required per IPC/JEDEC J-STD-020B
- RoHS compliant versions available


## APPLICATIONS / BENEFITS

- High-reliability devices
- Protection from switching and RFI induced transients
- Compliant to IEC 61000-4-2 and IEC 61000-4-4 for ESD and EFT protection respectively
- Secondary lightning protection per IEC61000-4-5 with 42 ohms source impedance:

> Class 1: M1.5KE6.8A to M1.5KE200CA
> Class 2: M1.5KE6.8A to M.5KE180CA
> Class 3: M1.5KE6.8A to M1.5KE91CA

Class 4: M1.5KE6.8A to M1.5KE43CA

- Secondary lightning protection per IEC61000-4-5 with 12 ohms source impedance:

Class 1: M1.5KE6.8A to M1.5KE110CA
Class 2: M1.5KE6.8A to M1.5KE56CA
Class 3: M1.5KE6.8A to M1.5KE27CA
Class 4: M1.5KE6.8A to M1.5KE13CA

- Secondary lightning protection per IEC61000-4-5 with 2 ohms source impedance:

Class 2: M1.5KE6.8A to M1.5KE24CA
Class 3: M1.5KE6.8A to M1.5KE12CA

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## MAXIMUM RATINGS

| Parameters/Test Conditions | Symbol | Value | Unit |
| :---: | :---: | :---: | :---: |
| Junction and Storage Temperature | $\mathrm{T}_{\mathrm{J}}$ and $\mathrm{T}_{\text {STG }}$ | -65 to +150 | ${ }^{\circ} \mathrm{C}$ |
| Thermal Resistance, Junction to Lead @ 0.375 inch (10 mm ) from body | $\mathrm{R}_{\text {өJし }}$ | 22 | ${ }^{\circ} \mathrm{C} / \mathrm{W}$ |
| Thermal Resistance, Junction to Ambient ${ }^{(1)}$ | $\mathrm{R}_{\text {өJA }}$ | 82 | ${ }^{\circ} \mathrm{C} / \mathrm{W}$ |
| Peak Pulse Power @ $\mathrm{T}_{\mathrm{L}}=+25^{\circ} \mathrm{C}{ }^{(2)}$ | $\mathrm{P}_{\mathrm{PP}}$ | 1500 | W |
| $\begin{array}{ll}\text { Rated Average Power Dissipation } & @ T_{L}=+40^{\circ} \mathrm{C} \\ & @ T_{A}=+25^{\circ} \mathrm{C}\end{array}$ | $\mathrm{P}_{\text {M(AV) }}$ | $\begin{gathered} 5 \\ 1.52^{(1)} \end{gathered}$ | W |
| $\mathrm{T}_{\text {clamping }}$ (0 volts to $\mathrm{V}_{(\mathrm{BR})} \mathrm{min}$ ) $\quad \begin{array}{r}\text { Unidirectional } \\ \text { Bidirectional }\end{array}$ |  | $\begin{gathered} <100 \\ <5 \end{gathered}$ | $\begin{aligned} & \mathrm{ps} \\ & \mathrm{~ns} \end{aligned}$ |
| Surge Peak Forward Current ${ }^{(3)}$ | $\mathrm{I}_{\text {FSM }}$ | 200 | A |
| Solder Temperature @ 10 s | $\mathrm{T}_{\text {SP }}$ | 260 | ${ }^{\circ} \mathrm{C}$ |

Notes: 1. When mounted on FR4 PC board with $4 \mathrm{~mm}^{2}$ copper pads ( 1 oz ) and track width 1 mm , length 25 mm .
2. At $10 / 1000 \mu \mathrm{~s}$ with repetition rate of $0.01 \%$ or less (see Figure 1).
3. At 8.3 ms half-sine wave for unidirectional devices only.

## MECHANICAL and PACKAGING

- CASE: Void-free transfer molded thermosetting epoxy body meeting UL94V-0
- TERMINALS: Tin-lead or RoHS compliant annealed matte-tin plating readily solderable per MIL-STD-750 method 2026
- MARKING: Part number and polarity band
- POLARITY: Cathode indicated by band. No cathode band on bidirectional devices.
- TAPE \& REEL option: Standard per EIA-296 (add "TR" suffix to part number). Consult factory for quantities.
- WEIGHT: Approximately 1.5 grams
- See Package Dimensions on last page.


## PART NOMENCLATURE



## SYMBOLS \& DEFINITIONS

| SYMBOLS \& DEFINITIONS |  |
| :---: | :---: |
| Symbol | Definition |
| $\alpha_{V(B R)}$ | Temperature Coefficient of Breakdown Voltage: The change in breakdown voltage divided by the change in temperature that caused it expressed in $\% /{ }^{\circ} \mathrm{C}$ or $\mathrm{mV} /{ }^{\circ} \mathrm{C}$. |
| $\mathrm{I}_{\text {(BR) }}$ | Breakdown Current: The current used for measuring breakdown voltage $\mathrm{V}_{(\mathrm{BR})}$. |
| $\mathrm{V}_{\text {(BR) }}$ | Breakdown Voltage: The voltage across the device at a specified current $l_{(B R)}$ in the breakdown region. |
| $\mathrm{V}_{\text {wM }}$ | Working Standoff Voltage: The maximum-rated value of dc or repetitive peak positive cathode-to-anode voltage that may be continuously applied over the standard operating temperature. |
| $\mathrm{V}_{\mathrm{c}}$ | Clamping Voltage: The voltage across the device in a region of low differential resistance during the application of an impulse current (lpp) for a specified waveform. |
| IPP | Peak Impulse Current: The maximum rated random recurring peak impulse current or nonrepetitive peak impulse current that may be applied to a device. A random recurring or nonrepetitive transient current is usually due to an external cause, and it is assumed that its effect will have completely disappeared before the next transient arrives. |
| $\mathrm{P}_{\text {PP }}$ | Peak Pulse Power. The rated random recurring peak impulse power or rated nonrepetitive peak impulse power. The impulse power is the maximum-rated value of the product of $I_{P P}$ and $\mathrm{V}_{\mathrm{c}}$. |
| $\mathrm{I}_{\mathrm{D}}$ | Standby Current: The current through the device at rated stand-off voltage. |

## ELECTRICAL CHARACTERISTICS @ $25^{\circ} \mathrm{C}$

| Industry <br> Type Number | Rated <br> Standoff <br> Voltage <br> $V_{\text {wm }}$ <br> (Note 1) | Breakdown Voltage$\mathbf{V}_{(\mathrm{BR})} \quad @ \quad \mathrm{I}_{(\mathrm{BR})}$ |  | Maximum <br> Clamping <br> Voltage <br> $V_{c}$ @ $I_{\text {pp }}$ | Maximum <br> Standby <br> Current <br> $\mathbf{I}_{\mathrm{D}} @ \mathbf{V}_{\mathrm{wm}}$ | Maximum <br> Peak Pulse <br> Current <br> $I_{\text {PP }}$ <br> (Fig. 2) | Maximum <br> Temperature Coefficient of $\begin{gathered} V_{(B R)} \\ \alpha V_{(B R)} \end{gathered}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Volts | Volts Min. Max. | mA | Volts | $\mu \mathrm{A}$ | A | \% ${ }^{\circ} \mathrm{C}$ |
| M1.5KE6.8A M1.5KE7.5A | $\begin{aligned} & 5.80 \\ & 6.40 \end{aligned}$ | $\begin{aligned} & 6.45-7.14 \\ & 7.13-7.88 \end{aligned}$ | $\begin{aligned} & 10 \\ & 10 \end{aligned}$ | $\begin{aligned} & 10.5 \\ & 11.3 \end{aligned}$ | $\begin{gathered} 1000 \\ 500 \end{gathered}$ | $\begin{aligned} & 143.0 \\ & 132.0 \end{aligned}$ | $\begin{aligned} & 0.057 \\ & 0.061 \end{aligned}$ |
| M1.5KE8.2A <br> M1.5KE9.1A | $\begin{aligned} & 7.02 \\ & 7.78 \end{aligned}$ | $\begin{aligned} & 7.79-8.61 \\ & 8.65-9.55 \end{aligned}$ | $\begin{gathered} 10 \\ 1 \end{gathered}$ | $\begin{aligned} & 12.1 \\ & 13.4 \end{aligned}$ | $\begin{gathered} 200 \\ 50 \end{gathered}$ | $\begin{aligned} & 124.0 \\ & 112.0 \end{aligned}$ | $\begin{aligned} & 0.065 \\ & 0.068 \end{aligned}$ |
| $\begin{aligned} & \text { M1.5KE10A } \\ & \text { M1.5KE11A } \end{aligned}$ | $\begin{aligned} & 8.55 \\ & 9.40 \end{aligned}$ | $\begin{gathered} 9.50-10.50 \\ 10.50-11.60 \end{gathered}$ | $\begin{aligned} & 1 \\ & 1 \end{aligned}$ | $\begin{aligned} & 14.5 \\ & 15.6 \end{aligned}$ | $\begin{gathered} 10 \\ 5 \end{gathered}$ | $\begin{gathered} 103.0 \\ 96.0 \end{gathered}$ | $\begin{aligned} & 0.073 \\ & 0.075 \end{aligned}$ |
| $\begin{aligned} & \text { M1.5KE12A } \\ & \text { M1.5KE13A } \end{aligned}$ | $\begin{aligned} & 10.22 \\ & 11.10 \end{aligned}$ | $\begin{aligned} & 11.40-12.60 \\ & 12.40-13.70 \end{aligned}$ | $\begin{aligned} & 1 \\ & 1 \end{aligned}$ | $\begin{aligned} & 16.7 \\ & 18.2 \end{aligned}$ | $\begin{aligned} & 5 \\ & 5 \end{aligned}$ | $\begin{aligned} & 90.0 \\ & 82.0 \end{aligned}$ | $\begin{aligned} & 0.078 \\ & 0.081 \end{aligned}$ |
| $\begin{aligned} & \text { M1.5KE15A } \\ & \text { M1.5KE16A } \end{aligned}$ | $\begin{aligned} & 12.80 \\ & 13.60 \end{aligned}$ | $\begin{aligned} & 14.30-15.80 \\ & 15.20-16.80 \end{aligned}$ | $\begin{aligned} & 1 \\ & 1 \end{aligned}$ | $\begin{aligned} & 21.2 \\ & 22.5 \end{aligned}$ | $\begin{aligned} & 1 \\ & 1 \end{aligned}$ | $\begin{aligned} & 71.0 \\ & 67.0 \end{aligned}$ | $\begin{aligned} & 0.084 \\ & 0.086 \end{aligned}$ |
| $\begin{aligned} & \text { M1.5KE18A } \\ & \text { M1.5KE20A } \end{aligned}$ | $\begin{aligned} & 15.30 \\ & 17.10 \end{aligned}$ | $\begin{aligned} & 17.10-18.90 \\ & 19.00-21.00 \end{aligned}$ | $\begin{aligned} & 1 \\ & 1 \end{aligned}$ | $\begin{aligned} & 25.2 \\ & 27.7 \end{aligned}$ | $\begin{aligned} & 1 \\ & 1 \end{aligned}$ | $\begin{aligned} & 59.5 \\ & 54.0 \end{aligned}$ | $\begin{aligned} & 0.088 \\ & 0.090 \end{aligned}$ |
| $\begin{aligned} & \text { M1.5KE22A } \\ & \text { M1.5KE24A } \end{aligned}$ | $\begin{aligned} & 18.80 \\ & 20.50 \end{aligned}$ | $\begin{aligned} & 20.90-23.10 \\ & 22.80-25.20 \end{aligned}$ | $\begin{aligned} & 1 \\ & 1 \end{aligned}$ | $\begin{aligned} & 30.6 \\ & 33.2 \end{aligned}$ | $\begin{aligned} & 1 \\ & 1 \end{aligned}$ | $\begin{aligned} & 49.0 \\ & 45.0 \end{aligned}$ | $\begin{aligned} & 0.092 \\ & 0.094 \end{aligned}$ |
| $\begin{aligned} & \text { M1.5KE27A } \\ & \text { M1.5KE30A } \end{aligned}$ | $\begin{aligned} & 23.10 \\ & 25.60 \end{aligned}$ | $\begin{aligned} & 25.70-28.40 \\ & 28.50-31.50 \end{aligned}$ | $\begin{aligned} & 1 \\ & 1 \end{aligned}$ | $\begin{aligned} & 37.5 \\ & 41.4 \end{aligned}$ | $\begin{aligned} & 1 \\ & 1 \end{aligned}$ | $\begin{aligned} & 40.0 \\ & 36.0 \end{aligned}$ | $\begin{aligned} & 0.096 \\ & 0.097 \end{aligned}$ |
| M1.5KE33A <br> M1.5KE36A | $\begin{aligned} & 28.20 \\ & 30.80 \end{aligned}$ | $\begin{aligned} & 31.40-34.70 \\ & 34.20-37.80 \end{aligned}$ | $\begin{aligned} & 1 \\ & 1 \end{aligned}$ | $\begin{aligned} & 45.7 \\ & 49.9 \end{aligned}$ | $\begin{aligned} & 1 \\ & 1 \end{aligned}$ | $\begin{aligned} & 33.0 \\ & 30.0 \end{aligned}$ | $\begin{aligned} & 0.098 \\ & 0.099 \end{aligned}$ |
| $\begin{aligned} & \text { M1.5KE39A } \\ & \text { M1.5KE43A } \end{aligned}$ | $\begin{aligned} & 33.30 \\ & 36.80 \end{aligned}$ | $\begin{aligned} & 37.10-41.00 \\ & 40.90-45.20 \end{aligned}$ | $\begin{aligned} & 1 \\ & 1 \end{aligned}$ | $\begin{aligned} & 53.9 \\ & 59.3 \end{aligned}$ | $\begin{aligned} & 1 \\ & 1 \end{aligned}$ | $\begin{aligned} & 28.0 \\ & 25.3 \end{aligned}$ | $\begin{aligned} & 0.100 \\ & 0.101 \end{aligned}$ |
| M1.5KE47A <br> M1.5KE51A | $\begin{aligned} & 40.20 \\ & 43.60 \end{aligned}$ | $\begin{aligned} & 44.70-49.40 \\ & 48.50-53.60 \end{aligned}$ | $\begin{aligned} & 1 \\ & 1 \end{aligned}$ | $\begin{aligned} & 64.8 \\ & 70.1 \end{aligned}$ | $\begin{aligned} & 1 \\ & 1 \end{aligned}$ | $\begin{aligned} & \hline 23.2 \\ & 21.4 \end{aligned}$ | $\begin{aligned} & 0.101 \\ & 0.102 \end{aligned}$ |
| M1.5KE56A <br> M1.5KE62A | $\begin{aligned} & 47.80 \\ & 53.00 \end{aligned}$ | $\begin{aligned} & 53.20-58.80 \\ & 58.90-65.10 \end{aligned}$ | $\begin{aligned} & 1 \\ & 1 \end{aligned}$ | $\begin{aligned} & 77.0 \\ & 85.0 \end{aligned}$ | $\begin{aligned} & 1 \\ & 1 \end{aligned}$ | $\begin{aligned} & 19.5 \\ & 17.7 \end{aligned}$ | $\begin{aligned} & 0.103 \\ & 0.104 \end{aligned}$ |
| M1.5KE68A M1.5KE75A | $\begin{aligned} & 58.10 \\ & 64.10 \end{aligned}$ | $\begin{aligned} & 64.60-71.40 \\ & 71.30-78.80 \end{aligned}$ | $\begin{aligned} & 1 \\ & 1 \end{aligned}$ | $\begin{gathered} 92.0 \\ 103.0 \end{gathered}$ | $\begin{aligned} & 1 \\ & 1 \end{aligned}$ | $\begin{aligned} & 16.3 \\ & 14.6 \end{aligned}$ | $\begin{aligned} & 0.104 \\ & 0.105 \end{aligned}$ |
| $\begin{aligned} & \text { M1.5KE82A } \\ & \text { M1.5KE91A } \end{aligned}$ | $\begin{aligned} & 70.10 \\ & 77.80 \end{aligned}$ | $\begin{aligned} & 77.90-86.10 \\ & 86.50-95.50 \end{aligned}$ | $\begin{aligned} & 1 \\ & 1 \end{aligned}$ | $\begin{aligned} & 113.0 \\ & 125.0 \end{aligned}$ | $\begin{aligned} & 1 \\ & 1 \end{aligned}$ | $\begin{aligned} & 13.3 \\ & 12.0 \end{aligned}$ | $\begin{aligned} & 0.105 \\ & 0.106 \end{aligned}$ |
| M1.5KE100A <br> M1.5KE110A | $\begin{aligned} & 85.50 \\ & 94.00 \end{aligned}$ | $\begin{gathered} 95.00-105.00 \\ 105.00-116.00 \end{gathered}$ | $\begin{aligned} & 1 \\ & 1 \end{aligned}$ | $\begin{aligned} & 137.0 \\ & 152.0 \end{aligned}$ | $\begin{aligned} & 1 \\ & 1 \end{aligned}$ | $\begin{gathered} 11.0 \\ 9.9 \end{gathered}$ | $\begin{aligned} & 0.106 \\ & 0.107 \end{aligned}$ |
| M1.5KE120A M1.5KE130A | $\begin{aligned} & 102.00 \\ & 111.00 \end{aligned}$ | $\begin{aligned} & 114.00-126.00 \\ & 124.00-137.00 \end{aligned}$ | $\begin{aligned} & 1 \\ & 1 \end{aligned}$ | $\begin{aligned} & \hline 165.0 \\ & 179.0 \end{aligned}$ | $\begin{aligned} & 1 \\ & 1 \end{aligned}$ | $\begin{aligned} & 9.1 \\ & 8.4 \end{aligned}$ | $\begin{aligned} & 0.107 \\ & 0.107 \end{aligned}$ |
| M1.5KE150A M1.5KE160A | $\begin{aligned} & 128.00 \\ & 136.00 \end{aligned}$ | $\begin{aligned} & 143.00-158.00 \\ & 152.00-168.00 \end{aligned}$ | $\begin{aligned} & 1 \\ & 1 \end{aligned}$ | $\begin{aligned} & 207.0 \\ & 219.0 \end{aligned}$ | $\begin{aligned} & 1 \\ & 1 \end{aligned}$ | $\begin{aligned} & 7.2 \\ & 6.8 \end{aligned}$ | $\begin{aligned} & 0.108 \\ & 0.108 \end{aligned}$ |
| M1.5KE170A M1.5KE180A | $\begin{aligned} & 145.00 \\ & 154.00 \end{aligned}$ | $\begin{aligned} & 162.00-179.00 \\ & 171.00-189.00 \end{aligned}$ | $\begin{aligned} & 1 \\ & 1 \end{aligned}$ | $\begin{aligned} & 234.0 \\ & 246.0 \end{aligned}$ | $\begin{aligned} & 1 \\ & 1 \end{aligned}$ | $\begin{aligned} & 6.4 \\ & 6.1 \end{aligned}$ | $\begin{aligned} & 0.108 \\ & 0.108 \end{aligned}$ |
| M1.5KE200A <br> M1.5KE220A | $\begin{aligned} & 171.00 \\ & 185.00 \end{aligned}$ | $\begin{aligned} & 190.00-210.00 \\ & 209.00-231.00 \end{aligned}$ | $\begin{aligned} & 1 \\ & 1 \end{aligned}$ | $\begin{aligned} & 274.0 \\ & 328.0 \end{aligned}$ | $\begin{aligned} & 1 \\ & 1 \end{aligned}$ | $\begin{aligned} & 5.5 \\ & 4.6 \end{aligned}$ | $\begin{aligned} & 0.108 \\ & 0.110 \end{aligned}$ |
| M1.5KE250A M1.5KE300A | $\begin{aligned} & 214.00 \\ & 256.00 \end{aligned}$ | $\begin{aligned} & 237.00-263.00 \\ & 285.00-315.00 \end{aligned}$ | $\begin{aligned} & 1 \\ & 1 \end{aligned}$ | $\begin{aligned} & 344.0 \\ & 414.0 \end{aligned}$ | $\begin{aligned} & 1 \\ & 1 \end{aligned}$ | $\begin{aligned} & 5.0 \\ & 5.0 \end{aligned}$ | $\begin{aligned} & 0.110 \\ & 0.111 \end{aligned}$ |
| M1.5KE350A <br> M1.5KE400A | $\begin{aligned} & 300.00 \\ & 324.00 \end{aligned}$ | $\begin{aligned} & 332.00-368.00 \\ & 380.00-420.00 \end{aligned}$ | $\begin{aligned} & 1 \\ & 1 \end{aligned}$ | $\begin{aligned} & 482.0 \\ & 548.0 \end{aligned}$ | $\begin{aligned} & 1 \\ & 1 \end{aligned}$ | $\begin{aligned} & 4.0 \\ & 4.0 \end{aligned}$ | $\begin{aligned} & 0.111 \\ & 0.111 \end{aligned}$ |

NOTES: 1. Normal selection criteria for TVS devices is by rated stand-off voltage $\left(\mathrm{V}_{\mathrm{wm}}\right)$ and should be equal or greater than dc or continuous peak operating voltage.
2. TVS devices are tested to maximum peak pulse current ( $I_{P P}$ ) with clamping voltage monitored. This surge capability is one of the most significant electrical characteristics of the device and should be considered as part of customer quality inspections.
3. For Bidirectional types having $\mathrm{V}_{\mathrm{w}}$ of 8 volts and under, the $\mathrm{I}_{\mathrm{D}}$ leakage current is doubled. Also for bidirectional parts, the capacitance will be half that shown in Fig. 2 for zero bias.
4. For unidirectional, the forward voltage $\left(V_{F}\right)$ is 3.5 volts maximum at 100 Amps peak for 8.3 ms half-sine wave.

## GRAPHS



FIGURE 1
Peak Pulse Power vs Pulse Time (tw) in $\mu \mathrm{s}$


Test waveform parameters: $\operatorname{tr}=10 \mu \mathrm{~s}, \mathrm{tp}=1000 \mu \mathrm{~s}$
FIGURE 2
Pulse Waveform for 10/1000 Exponential Surge

## GRAPHS (continued)



FIGURE 3
Derating Curve


FIGURE 4
Typical Capacitance vs. Breakdown Voltage

## PACKAGE DIMENSIONS



## NOTES:

1 Dimensions are in inches.
2 Millimeter equivalents are given for information only.
3 The major diameter is essentially constant along its length.
4 In accordance with ASME Y14.5M, diameters are equivalent to $\Phi x$ symbology.

| Symbol | Dimensions |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
|  | Inches |  | Millimeters |  |
|  | Min | Max | Min | Max |
| BD | 0.190 | 0.205 | 4.826 | 5.207 |
| BL | 0.360 | 0.375 | 9.146 | 9.527 |
| LD | 0.038 | 0.042 | 0.958 | 1.074 |
| LL | 1.10 | 1.625 | 27.9 | 41.28 |

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MA1.5KE350CA MXL1.5KE6.8CAe3 MA1.5KE11Ae3 MXL1.5KE120CAe3 MXL1.5KE180A MX1.5KE56Ae3
MX1.5KE120CA MX1.5KE8.2CA MX1.5KE56A MA1.5KE12A MX1.5KE68CA MX1.5KE250A MA1.5KE39CAe3
MXL1.5KE43A MXL1.5KE56CA M1.5KE100Ae3 MA1.5KE27Ae3 MA1.5KE300CA MA1.5KE120CA MXL1.5KE27A
MA1.5KE91A MX1.5KE39Ae3 MXL1.5KE16A MXL1.5KE56Ae3 MX1.5KE82A MXL1.5KE20CAe3 M1.5KE47CA
MXL1.5KE30Ae3 MXL1.5KE18CAe3 MX1.5KE11Ae3 MA1.5KE10CA M1.5KE16Ae3 MXL1.5KE56CAe3
MXL1.5KE11A MA1.5KE16Ae3 M1.5KE39CAe3 M1.5KE6.8CA M1.5KE8.2CA MXL1.5KE47A MA1.5KE47A MA1.5KE43A MA1.5KE11CA MXL1.5KE16CA MA1.5KE130Ae3 MX1.5KE180CAe3 MXL1.5KE100CAe3 MX1.5KE56CAe3 MXL1.5KE15CA MA1.5KE9.1Ae3 MXL1.5KE36A MXL1.5KE30CA MA1.5KE9.1CAe3
MA1.5KE18Ae3 MX1.5KE120Ae3 MA1.5KE51A M1.5KE8.2CAe3 MX1.5KE30CA MXL1.5KE10A MX1.5KE24A
MXL1.5KE8.2CA MXL1.5KE91CAe3 MXL1.5KE120Ae3 MX1.5KE11CA MA1.5KE36CAe3 MX1.5KE36Ae3
MA1.5KE7.5A MXL1.5KE16Ae3 MXL1.5KE170CA MX1.5KE68CAe3 MXL1.5KE10Ae3 MXL1.5KE27CAe3
MX1.5KE82CAe3 MX1.5KE15A MA1.5KE22CAe3 MXL1.5KE43CA MA1.5KE200CAe3 MA1.5KE82CA
MA1.5KE91Ae3 MX1.5KE24CAe3 MA1.5KE200A MX1.5KE100CAe3

