M15KP Plastic Encapsulated TVS Product
Assembly Material Change Technical Note

Reference: **PCN 2011-001**
Subject: **Assembly Material Change to M15KP Product Range**

Introduction
PCN 2011-001 announced the modification of the M15KP product range to enhance the thermal dissipation properties of the device. When TVS devices are subjected to a large current surge, as defined by the I_{PP} rating in the datasheet, a thermal stress is placed on the internal die. Without adequate heat dissipation, this stress can cause damage to the device.
Refer to the M15KP datasheet for further details on the product family. This is located at
http://www.microsemi.com/datasheets/m15KP.pdf

Description of Change
The internal discs in the M15KP product range have been doubled in thickness which results in a decreased junction temperature when the device is subjected to a transient pulse. All Microsemi M15KP devices are surge tested prior to customer delivery and this recent modification assists in increasing yields through the production process. This modification did not require any change to existing production methods; the assembly and test procedures have not been modified. Also, as the die, electrical characteristics and package outline have not been modified, the datasheet does not require modification.

Test Data
The tables below detail the qualification and reliability tests performed on the updated M15KP devices.

Qualification Results	
Test Performed	**Qty/Passed**
Temperature Cycling (-55 °C to + 150 °C – 20 cycles)	1500/1500
Surge (10x)	1400/1400
HTRB (125 °C – 24 hours each direction)	1500/1500
Solder Dip (260°C)	15/15

Surge to Destruction Tests done on 15KP54CA					
Surge @	**% Current**	**Qty/Passed**	**Surge @**	**% Current**	**Qty/Passed**
171	100 % (STD)	20/20	239.4	140 %	17/14
188.1	110 %	20/20	256.5	150 %	14/8
205.2	120 %	20/19	273.6	160 %	8/1
222.3	130 %	19/17	290.7	170 %	1/0

Reliability Data

Term	M Level
Cumulative Hours	> 141,000
Equivalent Device Hours	> 10.98 million
Failure Rate	5×10^{-6}
FIT	>199,000 Hours

Definitions

Cumulative Hours: Number of devices tested * test hours
Equivalent devices hours: Acceleration factor * cumulative hours

where the acceleration factor is the ratio of the Arrhenius model at the test temperature and the use temperature. This is expressed as:

$$A_F = e^{-Ea/k(1/T_{TEST} - 1/T_{USE})}$$ where:

Ea = thermal activation energy (eV) which, for semiconductors is typically 0.7eV
k = Boltzmann's constant = $8.62 \times 10\text{-}5$ eV/°K
T_{TEST} = Test junction temperature of 398 °K
T_{USE} = Typical usage junction temperature of 328 °K

Failure Rate: Number of rejects per sample size * Test hours
FIT: Failure rate $x10^9$