Multilayer ceramic capacitors

Chip, X7R

Series/Type: **Chip**

Date: February 2009

The following products presented in this data sheet are being withdrawn.

Substitute Products: See www.epcos.com/withdrawal_mlcc

Ordering Code	Substitute Product	Date of Withdrawal	Deadline Last Orders	Last Shipments
B37872K5224K072		2009-06-26	2010-06-30	2010-12-31
B37931K5103K001		2009-06-26	2010-06-30	2010-12-31
B37931K5123K060		2009-06-26	2010-06-30	2010-12-31

Ordering Code	Substitute Product	Date of Withdrawal	Deadline Last Orders	Last Shipments
B37931K5123K070		2009-06-26	2010-06-30	2010-12-31
B37931K5123K001		2009-06-26	2010-06-30	2010-12-31
B37931K5153K060		2009-06-26	2010-06-30	2010-12-31
B37872K5334K062		2009-06-26	2010-06-30	2010-12-31
B37872K5334K072		2009-06-26	2010-06-30	2010-12-31
B37872K5474K062		2009-06-26	2010-06-30	2010-12-31
B37872K5474K072		2009-06-26	2010-06-30	2010-12-31
B37872K1102K060		2009-06-26	2010-06-30	2010-12-31
B37931K5153K070		2009-06-26	2010-06-30	2010-12-31
B37931K5153K001		2009-06-26	2010-06-30	2010-12-31
B37931K5183K060		2009-06-26	2010-06-30	2010-12-31
B37931K5183K070		2009-06-26	2010-06-30	2010-12-31
B37931K5183K001		2009-06-26	2010-06-30	2010-12-31
B37931K5223K060		2009-06-26	2010-06-30	2010-12-31
B37931K5223K070		2009-06-26	2010-06-30	2010-12-31
B37931K5223K001		2009-06-26	2010-06-30	2010-12-31
B37931K5273K060		2009-06-26	2010-06-30	2010-12-31
B37931K5273K070		2009-06-26	2010-06-30	2010-12-31
B37931K5273K001		2009-06-26	2010-06-30	2010-12-31
B37931K5333K060		2009-06-26	2010-06-30	2010-12-31
B37931K5333K070		2009-06-26	2010-06-30	2010-12-31
B37931K5333K001		2009-06-26	2010-06-30	2010-12-31
B37931K5393K060		2009-06-26	2010-06-30	2010-12-31
B37931K5393K070		2009-06-26	2010-06-30	2010-12-31
B37931K5393K001		2009-06-26	2010-06-30	2010-12-31
B37931K5473K060		2009-06-26	2010-06-30	2010-12-31
B37931K5473K070		2009-06-26	2010-06-30	2010-12-31
B37931K5473K001		2009-06-26	2010-06-30	2010-12-31
B37931K5563K060		2009-06-26	2010-06-30	2010-12-31
B37931K5563K070		2009-06-26	2010-06-30	2010-12-31
B37931K5563K001		2009-06-26	2010-06-30	2010-12-31
B37941K5223K070		2009-06-26	2010-06-30	2010-12-31
B37941K5223K001		2009-06-26	2010-06-30	2010-12-31
B37941K5273K060		2009-06-26	2010-06-30	2010-12-31
B37941K5273K070		2009-06-26	2010-06-30	2010-12-31
B37941K5273K001		2009-06-26	2010-06-30	2010-12-31
B37941K5333K060		2009-06-26	2010-06-30	2010-12-31
B37941K5333K070		2009-06-26	2010-06-30	2010-12-31

Ordering Code	Substitute Product	Date of Withdrawal	Deadline Last Orders	Last Shipments
B37941K5333K001		2009-06-26	2010-06-30	2010-12-31
B37941K5393K060		2009-06-26	2010-06-30	2010-12-31
B37941K5393K070		2009-06-26	2010-06-30	2010-12-31
B37941K5393K001		2009-06-26	2010-06-30	2010-12-31
B37941K5473K060		2009-06-26	2010-06-30	2010-12-31
B37941K5473K070		2009-06-26	2010-06-30	2010-12-31
B37941K5473K001		2009-06-26	2010-06-30	2010-12-31
B37941K5563K060		2009-06-26	2010-06-30	2010-12-31
B37941K5563K070		2009-06-26	2010-06-30	2010-12-31
B37941K5683K060		2009-06-26	2010-06-30	2010-12-31
B37941K5683K070		2009-06-26	2010-06-30	2010-12-31
B37941K5683K062		2009-06-26	2010-06-30	2010-12-31
B37941K5683K072		2009-06-26	2010-06-30	2010-12-31
B37941K5823K060		2009-06-26	2010-06-30	2010-12-31
B37941K5823K070		2009-06-26	2010-06-30	2010-12-31
B37941K5104K060		2009-06-26	2010-06-30	2010-12-31
B37941K5104K070		2009-06-26	2010-06-30	2010-12-31
B37941K5104K062		2009-06-26	2010-06-30	2010-12-31
B37941K5104K072		2009-06-26	2010-06-30	2010-12-31
B37941K1471K060		2009-06-26	2010-06-30	2010-12-31
B37941K1471K070		2009-06-26	2010-06-30	2010-12-31
B37941K1681K060		2009-06-26	2010-06-30	2010-12-31
B37941K1681K070		2009-06-26	2010-06-30	2010-12-31
B37941K1102K060		2009-06-26	2010-06-30	2010-12-31
B37941K1102K070		2009-06-26	2010-06-30	2010-12-31
B37941K1152K060		2009-06-26	2010-06-30	2010-12-31
B37941K1152K070		2009-06-26	2010-06-30	2010-12-31
B37941K1222K060		2009-06-26	2010-06-30	2010-12-31
B37941K1222K070		2009-06-26	2010-06-30	2010-12-31
B37941K1332K060		2009-06-26	2010-06-30	2010-12-31
B37941K1332K070		2009-06-26	2010-06-30	2010-12-31
B37941K1472K060		2009-06-26	2010-06-30	2010-12-31
B37941K1472K070		2009-06-26	2010-06-30	2010-12-31
B37872K1102K070		2009-06-26	2010-06-30	2010-12-31
B37872K1152K060		2009-06-26	2010-06-30	2010-12-31
B37872K1152K070		2009-06-26	2010-06-30	2010-12-31
B37872K1222K060		2009-06-26	2010-06-30	2010-12-31
B37872K1222K070		2009-06-26	2010-06-30	2010-12-31

Ordering Code	Substitute Product	Date of Withdrawal	Deadline Last Orders	Last Shipments
B37950K5473K062		2009-06-26	2010-06-30	2010-12-31
B37941K1682K060		2009-06-26	2010-06-30	2010-12-31
B37941K1682K070		2009-06-26	2010-06-30	2010-12-31
B37941K1103K060		2009-06-26	2010-06-30	2010-12-31
B37941K1103K070		2009-06-26	2010-06-30	2010-12-31
B37941K1153K060		2009-06-26	2010-06-30	2010-12-31
B37872K1332K060		2009-06-26	2010-06-30	2010-12-31
B37872K1332K070		2009-06-26	2010-06-30	2010-12-31
B37872K1472K060		2009-06-26	2010-06-30	2010-12-31
B37872K1472K070		2009-06-26	2010-06-30	2010-12-31
B37872K1682K060		2009-06-26	2010-06-30	2010-12-31
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B37950K5224K062		2009-06-26	2010-06-30	2010-12-31
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B37941K1223K070		2009-06-26	2010-06-30	2010-12-31
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B37941K2221K070		2009-06-26	2010-06-30	2010-12-31
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B37872K1153K070		2009-06-26	2010-06-30	2010-12-31
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B37950K1104K072		2009-06-26	2010-06-30	2010-12-31
B37950K1154K062		2009-06-26	2010-06-30	2010-12-31
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B37950K2223K062		2009-06-26	2010-06-30	2010-12-31
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B37872K1333K060		2009-06-26	2010-06-30	2010-12-31
B37872K1333K070		2009-06-26	2010-06-30	2010-12-31
B37872K1473K060		2009-06-26	2010-06-30	2010-12-31
B37950K2223K072		2009-06-26	2010-06-30	2010-12-31
B37950K2333K062		2009-06-26	2010-06-30	2010-12-31

Ordering Code	Substitute Product	Date of Withdrawal	Deadline Last Orders	Last Shipments
B37950K2333K072		2009-06-26	2010-06-30	2010-12-31
B37950K2473K062		2009-06-26	2010-06-30	2010-12-31
B37950K2473K072		2009-06-26	2010-06-30	2010-12-31
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B37872K1683K062		2009-06-26	2010-06-30	2010-12-31
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B37872K1104K062		2009-06-26	2010-06-30	2010-12-31
B37872K1104K072		2009-06-26	2010-06-30	2010-12-31
B37950K3103K062		2009-06-26	2010-06-30	2010-12-31
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B37872K2152K060		2009-06-26	2010-06-30	2010-12-31
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B37872K2222K060		2009-06-26	2010-06-30	2010-12-31
B37872K2222K070		2009-06-26	2010-06-30	2010-12-31
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B37872K2472K060		2009-06-26	2010-06-30	2010-12-31
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B37872K2223K062		2009-06-26	2010-06-30	2010-12-31
B37872K2223K072		2009-06-26	2010-06-30	2010-12-31
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B37872K3681K060		2009-06-26	2010-06-30	2010-12-31
B37872K3681K070		2009-06-26	2010-06-30	2010-12-31
B37872K3102K060		2009-06-26	2010-06-30	2010-12-31
B37872K3102K070		2009-06-26	2010-06-30	2010-12-31
B37872K3152K060		2009-06-26	2010-06-30	2010-12-31
B37941K2331K060		2009-06-26	2010-06-30	2010-12-31
B37941K2331K070		2009-06-26	2010-06-30	2010-12-31
B37941K2471K060		2009-06-26	2010-06-30	2010-12-31

Ordering Code	Substitute Product	Date of Withdrawal	Deadline Last Orders	Last Shipments
B37941K2471K070		2009-06-26	2010-06-30	2010-12-31
B37941K2681K060		2009-06-26	2010-06-30	2010-12-31
B37941K2681K070		2009-06-26	2010-06-30	2010-12-31
B37941K2102K060		2009-06-26	2010-06-30	2010-12-31
B37941K2102K070		2009-06-26	2010-06-30	2010-12-31
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B37941K2222K060		2009-06-26	2010-06-30	2010-12-31
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B37941K2332K060		2009-06-26	2010-06-30	2010-12-31
B37941K2332K070		2009-06-26	2010-06-30	2010-12-31
B37941K2472K062		2009-06-26	2010-06-30	2010-12-31
B37941K2472K072		2009-06-26	2010-06-30	2010-12-31
B37941K2682K062		2009-06-26	2010-06-30	2010-12-31
B37941K2682K072		2009-06-26	2010-06-30	2010-12-31
B37872K3152K070		2009-06-26	2010-06-30	2010-12-31
B37872K3222K060		2009-06-26	2010-06-30	2010-12-31
B37872K3222K070		2009-06-26	2010-06-30	2010-12-31
B37872K3332K062		2009-06-26	2010-06-30	2010-12-31
B37872K3332K072		2009-06-26	2010-06-30	2010-12-31
B37872K3472K062		2009-06-26	2010-06-30	2010-12-31
B37872K3472K072		2009-06-26	2010-06-30	2010-12-31
B37872K5102K060		2009-06-26	2010-06-30	2010-12-31
B37872K5102K070		2009-06-26	2010-06-30	2010-12-31
B37872K5122K060		2009-06-26	2010-06-30	2010-12-31
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B37941K0104K070		2009-06-26	2010-06-30	2010-12-31
B37941K0104K062		2009-06-26	2010-06-30	2010-12-31
B37941K0104K072		2009-06-26	2010-06-30	2010-12-31
B37941K5471K060		2009-06-26	2010-06-30	2010-12-31
B37941K5471K070		2009-06-26	2010-06-30	2010-12-31
B37941K5471K001		2009-06-26	2010-06-30	2010-12-31
B37941K5561K060		2009-06-26	2010-06-30	2010-12-31
B37941K5561K070		2009-06-26	2010-06-30	2010-12-31
B37941K5561K001		2009-06-26	2010-06-30	2010-12-31
B37941K5681K060		2009-06-26	2010-06-30	2010-12-31
B37941K5681K070		2009-06-26	2010-06-30	2010-12-31

Ordering Code	Substitute Product	Date of Withdrawal	Deadline Last Orders	Last Shipments
B37941K5681K001		2009-06-26	2010-06-30	2010-12-31
B37941K5821K060		2009-06-26	2010-06-30	2010-12-31
B37941K5821K070		2009-06-26	2010-06-30	2010-12-31
B37931K5471K060		2009-06-26	2010-06-30	2010-12-31
B37931K5471K070		2009-06-26	2010-06-30	2010-12-31
B37931K5471K001		2009-06-26	2010-06-30	2010-12-31
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B37931K5561K070		2009-06-26	2010-06-30	2010-12-31
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B37931K5681K060		2009-06-26	2010-06-30	2010-12-31
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B37931K5102K060		2009-06-26	2010-06-30	2010-12-31
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B37931K5122K060		2009-06-26	2010-06-30	2010-12-31
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B37931K5152K060		2009-06-26	2010-06-30	2010-12-31
B37931K5152K070		2009-06-26	2010-06-30	2010-12-31
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B37931K5182K060		2009-06-26	2010-06-30	2010-12-31
B37931K5182K070		2009-06-26	2010-06-30	2010-12-31
B37931K5182K001		2009-06-26	2010-06-30	2010-12-31
B37931K5222K060		2009-06-26	2010-06-30	2010-12-31
B37872K5152K060		2009-06-26	2010-06-30	2010-12-31
B37872K5152K070		2009-06-26	2010-06-30	2010-12-31
B37872K5182K060		2009-06-26	2010-06-30	2010-12-31
B37931K5222K070		2009-06-26	2010-06-30	2010-12-31
B37931K5222K001		2009-06-26	2010-06-30	2010-12-31
B37931K5272K060		2009-06-26	2010-06-30	2010-12-31
B37931K9223K060		2009-06-26	2010-06-30	2010-12-31
B37931K9223K070		2009-06-26	2010-06-30	2010-12-31
B37931K9223K001		2009-06-26	2010-06-30	2010-12-31
B37931K9333K060		2009-06-26	2010-06-30	2010-12-31

Ordering Code	Substitute Product	Date of Withdrawal	Deadline Last Orders	Last Shipments
B37931K9333K070		2009-06-26	2010-06-30	2010-12-31
B37931K9333K001		2009-06-26	2010-06-30	2010-12-31
B37931K9473K060		2009-06-26	2010-06-30	2010-12-31
B37931K9473K070		2009-06-26	2010-06-30	2010-12-31
B37931K9473K001		2009-06-26	2010-06-30	2010-12-31
B37931K9683K060		2009-06-26	2010-06-30	2010-12-31
B37931K9683K070		2009-06-26	2010-06-30	2010-12-31
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B37931K0103K060		2009-06-26	2010-06-30	2010-12-31
B37931K0103K070		2009-06-26	2010-06-30	2010-12-31
B37931K0103K001		2009-06-26	2010-06-30	2010-12-31
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B37931K5272K070		2009-06-26	2010-06-30	2010-12-31
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B37931K1101K070		2009-06-26	2010-06-30	2010-12-31
B37931K1151K060		2009-06-26	2010-06-30	2010-12-31
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B37931K1681K060		2009-06-26	2010-06-30	2010-12-31
B37931K1681K070		2009-06-26	2010-06-30	2010-12-31
B37931K1102K060		2009-06-26	2010-06-30	2010-12-31
B37931K1102K070		2009-06-26	2010-06-30	2010-12-31
B37931K1152K060		2009-06-26	2010-06-30	2010-12-31
B37931K1152K070		2009-06-26	2010-06-30	2010-12-31
B37931K1222K060		2009-06-26	2010-06-30	2010-12-31

Ordering Code	Substitute Product	Date of Withdrawal	Deadline Last Orders	Last Shipments
B37931K1222K070		2009-06-26	2010-06-30	2010-12-31
B37931K0223K001		2009-06-26	2010-06-30	2010-12-31
B37931K0333K060		2009-06-26	2010-06-30	2010-12-31
B37931K0333K070		2009-06-26	2010-06-30	2010-12-31
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B37931K5391K001		2009-06-26	2010-06-30	2010-12-31
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B37941K5222K060		2009-06-26	2010-06-30	2010-12-31
B37941K5222K070		2009-06-26	2010-06-30	2010-12-31

Ordering Code	Substitute Product	Date of Withdrawal	Deadline Last Orders	Last Shipments
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B37872K5392K060		2009-06-26	2010-06-30	2010-12-31

Ordering Code	Substitute Product	Date of Withdrawal	Deadline Last Orders	Last Shipments
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B37872K5472K060		2009-06-26	2010-06-30	2010-12-31
B37941K5153K001		2009-06-26	2010-06-30	2010-12-31
B37941K5183K060		2009-06-26	2010-06-30	2010-12-31
B37941K5183K070		2009-06-26	2010-06-30	2010-12-31
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B37941K5223K060		2009-06-26	2010-06-30	2010-12-31
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B37872K5562K070		2009-06-26	2010-06-30	2010-12-31
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B37872K5682K070		2009-06-26	2010-06-30	2010-12-31
B37872K5822K060		2009-06-26	2010-06-30	2010-12-31
B37872K5822K070		2009-06-26	2010-06-30	2010-12-31
B37872K5103K060		2009-06-26	2010-06-30	2010-12-31
B37872K5103K070		2009-06-26	2010-06-30	2010-12-31
B37872K5123K060		2009-06-26	2010-06-30	2010-12-31
B37872K5123K070		2009-06-26	2010-06-30	2010-12-31
B37872K5153K060		2009-06-26	2010-06-30	2010-12-31
B37872K5153K070		2009-06-26	2010-06-30	2010-12-31
B37872K5183K060		2009-06-26	2010-06-30	2010-12-31
B37872K5183K070		2009-06-26	2010-06-30	2010-12-31
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B37931K5472K001		2009-06-26	2010-06-30	2010-12-31
B37931K5562K060		2009-06-26	2010-06-30	2010-12-31
B37872K5333K070		2009-06-26	2010-06-30	2010-12-31

Ordering Code	Substitute Product	Date of Withdrawal	Deadline Last Orders	Last Shipments
B37872K5393K060		2009-06-26	2010-06-30	2010-12-31
B37872K5393K070		2009-06-26	2010-06-30	2010-12-31
B37872K5473K060		2009-06-26	2010-06-30	2010-12-31
B37872K5473K070		2009-06-26	2010-06-30	2010-12-31
B37931K5562K070		2009-06-26	2010-06-30	2010-12-31
B37931K5562K001		2009-06-26	2010-06-30	2010-12-31
B37931K5682K060		2009-06-26	2010-06-30	2010-12-31
B37931K5682K070		2009-06-26	2010-06-30	2010-12-31
B37931K5682K001		2009-06-26	2010-06-30	2010-12-31
B37872K5563K060		2009-06-26	2010-06-30	2010-12-31
B37872K5563K070		2009-06-26	2010-06-30	2010-12-31
B37872K5683K060		2009-06-26	2010-06-30	2010-12-31
B37872K5683K070		2009-06-26	2010-06-30	2010-12-31
B37872K5823K060		2009-06-26	2010-06-30	2010-12-31
B37931K5822K060		2009-06-26	2010-06-30	2010-12-31
B37931K5822K070		2009-06-26	2010-06-30	2010-12-31
B37931K5822K001		2009-06-26	2010-06-30	2010-12-31
B37931K5103K060		2009-06-26	2010-06-30	2010-12-31
B37931K5103K070		2009-06-26	2010-06-30	2010-12-31
B37872K5823K070		2009-06-26	2010-06-30	2010-12-31
B37872K5104K060		2009-06-26	2010-06-30	2010-12-31
B37872K5104K070		2009-06-26	2010-06-30	2010-12-31
B37872K5224K062		2009-06-26	2010-06-30	2010-12-31

For further information please contact your nearest EPCOS sales office, which will also support you in selecting a suitable substitute. The addresses of our worldwide sales network are presented at www.epcos.com/sales.

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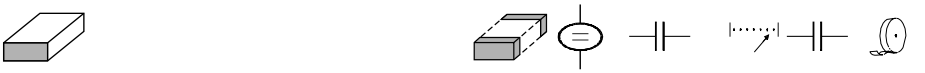
Ordering code system



B37941	K	5	105	K	0	60

Type and size
Chip size (inch/mm) = Temperature characteristic X7R
0603/1608 ≙ B37931
0805/2012 ≙ B37941
1206/3216 ≙ B37872
1210/3225 ≙ B37950

Termination
Standard:
K ≙ nickel barrier for all case sizes
On request:
J ≙ silver-palladium for conductive adhesion: all case sizes

Rated voltage
9 (Code) ≙ 16 VDC
0 (Code) ≙ 25 VDC
5 (Code) ≙ 50 VDC
1 (Code) ≙ 100 VDC
2 (Code) ≙ 200 VDC
3 (Code) ≙ 500 VDC

Capacitance, coded (example)
102 ≙ $10 \cdot 10^2$ pF = 1 nF
104 ≙ $10 \cdot 10^4$ pF = 100 nF
223 ≙ $22 \cdot 10^3$ pF = 22 nF

Capacitance tolerance
J ≙ ±5%
K ≙ ±10% (standard)
M ≙ ±20%

Internal coding

Packaging
60 ≙ cardboard tape, 180-mm reel
62 ≙ blister tape, 180-mm reel
70 ≙ cardboard tape, 330-mm reel
72 ≙ blister tape, 330-mm reel
01 ≙ bulk case

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Features

- High volumetric efficiency
- Non-linear capacitance change
- High insulation resistance
- High pulse strength
- Based on AEC-Q200 Rev-C

Applications

- Blocking and coupling
- Decoupling
- Interference suppression

Termination

- Nickel barrier terminations (Ni) for lead-free soldering
- For conductive adhesion: Silver-palladium terminations (AgPd) on request

Options

- Alternative capacitance values and tolerances available on request

Delivery mode

- Cardboard and blister tape (blister tape for chip thickness ≥1.2 ± 0.1 mm and case sizes ≥1210),180-mm and 330-mm reel available
- Bulk case for case sizes 0603 (16 V, 25 V, 50 V) and 0805 (50 V)

Electrical data

Temperature characteristic			X7R	
Max. relative capacitance change	within −55 ... +125 °C	ΔC/C	±15	%
Climatic category	(IEC 60068-1)		55/125/56	
Standard			EIA	
Dielectric			Class 2	
Rated voltage[1)]		V_R	16, 25, 50, 100, 200, 500	VDC
Test voltage		V_{test}	$2.5 \cdot V_R$/5 s	VDC
Capacitance range		C_R	100 pF ... 1 µF	
Dissipation factor	(limit value)	tan δ	$< 25 \cdot 10^{-3}$	
	(limit value)	tan δ	$< 35 \cdot 10^{-3}$ for 16 V	
Insulation resistance[2)]	(at +25 °C)	R_{ins}	$> 10^5$	MΩ
Insulation resistance[3)]	(at +125 °C)	R_{ins}	$> 10^4$	MΩ
Time constant[3)]	(at +25 °C)	τ	> 1000	s
Time constant[3)]	(at +125 °C)	τ	> 100	s
Operating temperature range		T_{op}	−55 ... +125	°C
Ageing[3)]			yes	

1) Note: No operation on AC line.
2) For C_R >10 nF the time constant $\tau = C \cdot R_{ins}$ is given.
3) Refer to chapter "General technical information", "Ageing".

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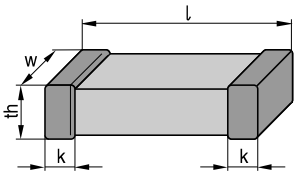
Capacitance tolerances

Code letter	J	K (standard)	M
Tolerance	±5%	±10%	±20%

Dimensional drawing



KKE0329-N

Dimensions (mm)

Case size (inch) / (mm)	0603 / 1608	0805 / 2012	1206 / 3216	1210 / 3225
l	1.60 ±0.15	2.00 ±0.20	3.20 ±0.20	3.20 ±0.30
w	0.80 ±0.10	1.25 ±0.15	1.60 ±0.15	2.50 ±0.30
th	0.80 ±0.10	1.35 max.	1.30 max.	1.70 max.
k	0.10 −0.40	0.13 −0.75	0.25 −0.75	0.25 −0.75

Tolerances to CECC 32101-801

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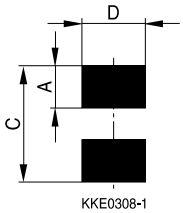
Recommended solder pad



Recommended dimensions (mm) for reflow soldering

Case size	(inch/mm)	Type	A	C	D
	0603/1608	single chip	0.60 ... 0.70	1.80 ... 2.20	0.60 ... 0.80
	0805/2012	single chip	0.60 ... 0.70	2.20 ... 2.60	0.80 ... 1.10
	1206/3216	single chip	0.80 ... 0.90	3.80 ... 4.32	1.00 ... 1.40
	1210/3225	single chip	1.00 ... 1.20	4.00 ... 4.80	1.80 ... 2.30

Recommended dimensions (mm) for wave soldering

Case size	(inch/mm)	Type	A	C	D
	0603/1608	single chip	0.80 ... 0.90	2.20 ... 2.80	0.60 ... 0.80
	0805/2012	single chip	0.90 ... 1.00	2.80 ... 3.20	0.80 ... 1.10
	1206/3216	single chip	1.00 ... 1.10	4.20 ... 4.80	1.00 ... 1.40

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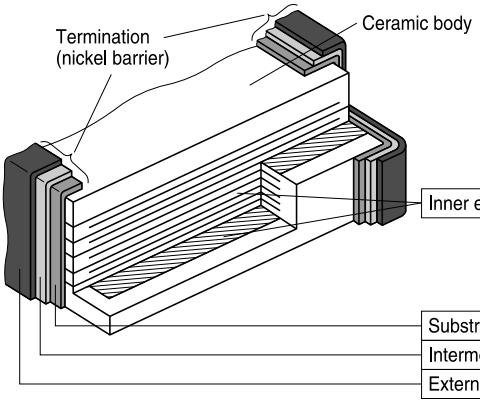
Termination



	NME	BME
Inner electrode	AgPd	Ni

	NME	BME
Substrate electrode	Ag	Cu
Intermediate electrode	Ni	Ni
External electrode	Sn	Sn

NME: Noble Metal Electrode
BME: Base Metal Electrode

KKE0485-5-E

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Product range chip capacitors, X7R

Size **inch (l x w)** mm (l x w)	**0603** 1608				**0805** 2012			
Type	B37931				B37941			
$C_R \setminus V_R$ (VDC)	16	25	50	100	25	50	100	200
100 pF								
150 pF								
220 pF								
270 pF								
330 pF								
390 pF								
470 pF								
560 pF								
680 pF								
820 pF								
1.0 nF								
1.2 nF								
1.5 nF								
1.8 nF								
2.2 nF								
2.7 nF								
3.3 nF								
3.9 nF								
4.7 nF								
5.6 nF								
6.8 nF								
8.2 nF								
10 nF								
12 nF								
15 nF								
18 nF								
22 nF								
27 nF								
33 nF								
39 nF								
47 nF								
56 nF								

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Product range chip capacitors, X7R

Size **inch (l x w)** mm (l x w)	**0603** 1608				**0805** 2012			
Type	B37931				B37941			
$C_R \setminus V_R$ (VDC)	16	25	50	100	25	50	100	200
68 nF								
82 nF								
100 nF								

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Product range chip capacitors, X7R

Size **inch (l x w)** mm (l x w)	**1206** 3216			
Type	B37872			
C_R \ V_R (VDC)	50	100	200	500
470 pF				
680 pF				
1.0 nF				
1.2 nF				
1.5 nF				
1.8 nF				
2.2 nF				
2.7 nF				
3.3 nF				
3.9 nF				
4.7 nF				
5.6 nF				
6.8 nF				
8.2 nF				
10 nF				
12 nF				
15 nF				
18 nF				
22 nF				
27 nF				
33 nF				
39 nF				
47 nF				
56 nF				
68 nF				
82 nF				
100 nF				
220 nF				
330 nF				
470 nF				

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Product range chip capacitors, X7R

Size				
inch (l x w)	**1210**			
mm (l x w)	3225			
Type	B37950			
$C_R \setminus V_R$ (VDC)	50	100	200	500
10 nF				
22 nF				
33 nF				
47 nF				
100 nF				
150 nF				
220 nF				

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Ordering codes and packing for X7R, 16 VDC, nickel barrier terminations

Case size 0603, 16 VDC

C_R	Ordering code	Chip thickness mm	Cardboard tape, ∅180-mm reel ** ≙ 60 pcs./reel	Cardboard tape, ∅330-mm reel ** ≙ 70 pcs./reel	Bulk case ** ≙ 01 pcs.
22 nF	B37931K9223K0**	0.8 ±0.1	4000	16000	15000
33 nF	B37931K9333K0**	0.8 ±0.1	4000	16000	15000
47 nF	B37931K9473K0**	0.8 ±0.1	4000	16000	15000
68 nF	B37931K9683K0**	0.8 ±0.1	4000	16000	15000

Ordering codes and packing for X7R, 25 VDC, nickel barrier terminations

Case size 0603, 25 VDC

C_R	Ordering code	Chip thickness mm	Cardboard tape, ∅180-mm reel ** ≙ 60 pcs./reel	Cardboard tape, ∅330-mm reel ** ≙ 70 pcs./reel	Bulk case ** ≙ 01 pcs.
10 nF	B37931K0103K0**	0.8 ±0.1	4000	16000	15000
15 nF	B37931K0153K0**	0.8 ±0.1	4000	16000	15000
22 nF	B37931K0223K0**	0.8 ±0.1	4000	16000	15000
33 nF	B37931K0333K0**	0.8 ±0.1	4000	16000	15000
47 nF	B37931K0473K0**	0.8 ±0.1	4000	16000	15000
68 nF	B37931K0683K0**	0.8 ±0.1	4000	16000	15000

Ordering codes and packing for X7R, 50 VDC, nickel barrier terminations

Case size 0603, 50 VDC

C_R	Ordering code	Chip thickness mm	Cardboard tape, ∅180-mm reel ** ≙ 60 pcs./reel	Cardboard tape, ∅330-mm reel ** ≙ 70 pcs./reel	Bulk case ** ≙ 01 pcs.
220 pF	B37931K5221K0**	0.8 ±0.1	4000	16000	15000
270 pF	B37931K5271K0**	0.8 ±0.1	4000	16000	15000
330 pF	B37931K5331K0**	0.8 ±0.1	4000	16000	15000
390 pF	B37931K5391K0**	0.8 ±0.1	4000	16000	15000

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Ordering codes and packing for X7R, 50 VDC, nickel barrier terminations

Case size 0603, 50 VDC

C_R	Ordering code	Chip thickness mm	Cardboard tape, ∅180-mm reel ** ≙ 60 pcs./reel	Cardboard tape, ∅330-mm reel ** ≙ 70 pcs./reel	Bulk case ** ≙ 01 pcs.
470 pF	B37931K5471K0**	0.8 ±0.1	4000	16000	15000
560 pF	B37931K5561K0**	0.8 ±0.1	4000	16000	15000
680 pF	B37931K5681K0**	0.8 ±0.1	4000	16000	15000
820 pF	B37931K5821K0**	0.8 ±0.1	4000	16000	15000
1.0 nF	B37931K5102K0**	0.8 ±0.1	4000	16000	15000
1.2 nF	B37931K5122K0**	0.8 ±0.1	4000	16000	15000
1.5 nF	B37931K5152K0**	0.8 ±0.1	4000	16000	15000
1.8 nF	B37931K5182K0**	0.8 ±0.1	4000	16000	15000
2.2 nF	B37931K5222K0**	0.8 ±0.1	4000	16000	15000
2.7 nF	B37931K5272K0**	0.8 ±0.1	4000	16000	15000
3.3 nF	B37931K5332K0**	0.8 ±0.1	4000	16000	15000
3.9 nF	B37931K5392K0**	0.8 ±0.1	4000	16000	15000
4.7 nF	B37931K5472K0**	0.8 ±0.1	4000	16000	15000
5.6 nF	B37931K5562K0**	0.8 ±0.1	4000	16000	15000
6.8 nF	B37931K5682K0**	0.8 ±0.1	4000	16000	15000
8.2 nF	B37931K5822K0**	0.8 ±0.1	4000	16000	15000
10 nF	B37931K5103K0**	0.8 ±0.1	4000	16000	15000
12 nF	B37931K5123K0**	0.8 ±0.1	4000	16000	15000
15 nF	B37931K5153K0**	0.8 ±0.1	4000	16000	15000
18 nF	B37931K5183K0**	0.8 ±0.1	4000	16000	15000
22 nF	B37931K5223K0**	0.8 ±0.1	4000	16000	15000
27 nF	B37931K5273K0**	0.8 ±0.1	4000	16000	15000
33 nF	B37931K5333K0**	0.8 ±0.1	4000	16000	15000
39 nF	B37931K5393K0**	0.8 ±0.1	4000	16000	15000
47 nF	B37931K5473K0**	0.8 ±0.1	4000	16000	15000
56 nF	B37931K5563K0**	0.8 ±0.1	4000	16000	15000
68 nF	B37931K5683K0**	0.8 ±0.1	4000	16000	15000

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Ordering codes and packing for X7R, 100 VDC, nickel barrier terminations

Case size 0603, 100 VDC

		Chip thickness	Cardboard tape, ∅180-mm reel	Cardboard tape, ∅330-mm reel
			** ≙ 60	** ≙ 70
C_R	Ordering code	mm	pcs./reel	pcs./reel
100 pF	B37931K1101K0**	0.8 ±0.1	4000	16000
150 pF	B37931K1151K0**	0.8 ±0.1	4000	16000
220 pF	B37931K1221K0**	0.8 ±0.1	4000	16000
330 pF	B37931K1331K0**	0.8 ±0.1	4000	16000
470 pF	B37931K1471K0**	0.8 ±0.1	4000	16000
680 pF	B37931K1681K0**	0.8 ±0.1	4000	16000
1.0 nF	B37931K1102K0**	0.8 ±0.1	4000	16000
1.5 nF	B37931K1152K0**	0.8 ±0.1	4000	16000
2.2 nF	B37931K1222K0**	0.8 ±0.1	4000	16000

Ordering codes and packing for X7R, 25 VDC, nickel barrier terminations

Case size 0805, 25 VDC

		Chip thickness	Cardboard tape, ∅180-mm reel	Cardboard tape, ∅330-mm reel	Blister tape, ∅180-mm reel	Blister tape, ∅330-mm reel
			** ≙ 60	** ≙ 70	** ≙ 62	** ≙ 72
C_R	Ordering code	mm	pcs./reel	pcs./reel	pcs./reel	pcs./reel
100 nF	B37941K0104K0**	0.8 ±0.1	4000	16000		
100 nF	B37941K0104K0**	1.25 ±0.1			3000	12000

Ordering codes and packing for X7R, 50 VDC, nickel barrier terminations

Case size 0805, 50 VDC

		Chip thickness	Cardboard tape, ∅180-mm reel	Cardboard tape, ∅330-mm reel	Blister tape, ∅180-mm reel	Blister tape, ∅330-mm reel	Bulk case
			** ≙ 60	** ≙ 70	** ≙ 62	** ≙ 72	** ≙ 01
C_R	Ordering code	mm	pcs./reel	pcs./reel	pcs./reel	pcs./reel	pcs.
470 pF	B37941K5471K0**	0.6 ±0.1	5000	20000			10000
560 pF	B37941K5561K0**	0.6 ±0.1	5000	20000			10000
680 pF	B37941K5681K0**	0.6 ±0.1	5000	20000			10000

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Ordering codes and packing for X7R, 50 VDC, nickel barrier terminations

Case size 0805, 50 VDC

C_R	Ordering code	Chip thickness mm	Cardboard tape, ∅180-mm reel ** ≙ 60 pcs./reel	Cardboard tape, ∅330-mm reel ** ≙ 70 pcs./reel	Blister tape, ∅180-mm reel ** ≙ 62 pcs./reel	Blister tape, ∅330-mm reel ** ≙ 72 pcs./reel	Bulk case ** ≙ 01 pcs.
820 pF	B37941K5821K0**	0.6 ±0.1	5000	20000			10000
1.0 nF	B37941K5102K0**	0.6 ±0.1	5000	20000			10000
1.2 nF	B37941K5122K0**	0.6 ±0.1	5000	20000			10000
1.5 nF	B37941K5152K0**	0.6 ±0.1	5000	20000			10000
1.8 nF	B37941K5182K0**	0.6 ±0.1	5000	20000			10000
2.2 nF	B37941K5222K0**	0.6 ±0.1	5000	20000			10000
2.7 nF	B37941K5272K0**	0.6 ±0.1	5000	20000			10000
3.3 nF	B37941K5332K0**	0.6 ±0.1	5000	20000			10000
3.9 nF	B37941K5392K0**	0.6 ±0.1	5000	20000			10000
4.7 nF	B37941K5472K0**	0.6 ±0.1	5000	20000			10000
5.6 nF	B37941K5562K0**	0.6 ±0.1	5000	20000			10000
6.8 nF	B37941K5682K0**	0.6 ±0.1	5000	20000			10000
8.2 nF	B37941K5822K0**	0.6 ±0.1	5000	20000			10000
10 nF	B37941K5103K0**	0.6 ±0.1	5000	20000			10000
12 nF	B37941K5123K0**	0.6 ±0.1	5000	20000			10000
15 nF	B37941K5153K0**	0.6 ±0.1	5000	20000			10000
18 nF	B37941K5183K0**	0.6 ±0.1	5000	20000			10000
22 nF	B37941K5223K0**	0.6 ±0.1	5000	20000			10000
27 nF	B37941K5273K0**	0.6 ±0.1	5000	20000			10000
33 nF	B37941K5333K0**	0.6 ±0.1	5000	20000			10000
39 nF	B37941K5393K0**	0.6 ±0.1	5000	20000			10000
47 nF	B37941K5473K0**	0.6 ±0.1	5000	20000			10000
56 nF	B37941K5563K0**	0.8 ±0.1	4000	16000			
68 nF	B37941K5683K0**	0.8 ±0.1	4000	16000			
68 nF	B37941K5683K0**	1.25 ±0.1			3000	12000	
82 nF	B37941K5823K0**	0.8 ±0.1	4000	16000			
100 nF	B37941K5104K0**	0.8 ±0.1	4000	16000			
100 nF	B37941K5104K0**	1.25 ±0.1			3000	12000	

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Ordering codes and packing for X7R, 100 VDC, nickel barrier terminations

Case size 0805, 100 VDC

		Chip thickness	Cardboard tape, ∅180-mm reel	Cardboard tape, ∅330-mm reel
			** ≙ 60	** ≙ 70
C_R	Ordering code	mm	pcs./reel	pcs./reel
470 pF	B37941K1471K0**	0.6 ±0.1	5000	20000
680 pF	B37941K1681K0**	0.6 ±0.1	5000	20000
1.0 nF	B37941K1102K0**	0.6 ±0.1	5000	20000
1.5 nF	B37941K1152K0**	0.6 ±0.1	5000	20000
2.2 nF	B37941K1222K0**	0.6 ±0.1	5000	20000
3.3 nF	B37941K1332K0**	0.6 ±0.1	5000	20000
4.7 nF	B37941K1472K0**	0.6 ±0.1	5000	20000
6.8 nF	B37941K1682K0**	0.6 ±0.1	5000	20000
10 nF	B37941K1103K0**	0.6 ±0.1	5000	20000
15 nF	B37941K1153K0**	0.6 ±0.1	5000	20000
22 nF	B37941K1223K0**	0.8 ±0.1	4000	16000

Ordering codes and packing for X7R, 200 VDC, nickel barrier terminations

Case size 0805, 200 VDC

		Chip thickness	Cardboard tape, ∅180-mm reel	Cardboard tape, ∅330-mm reel	Blister tape, ∅180-mm reel	Blister tape, ∅330-mm reel
			** ≙ 60	** ≙ 70	** ≙ 62	** ≙ 72
C_R	Ordering code	mm	pcs./reel	pcs./reel	pcs./reel	pcs./reel
220 pF	B37941K2221K0**	0.8 ±0.1	4000	16000		
330 pF	B37941K2331K0**	0.8 ±0.1	4000	16000		
470 pF	B37941K2471K0**	0.8 ±0.1	4000	16000		
680 pF	B37941K2681K0**	0.8 ±0.1	4000	16000		
1.0 nF	B37941K2102K0**	0.8 ±0.1	4000	16000		
1.5 nF	B37941K2152K0**	0.8 ±0.1	4000	16000		
2.2 nF	B37941K2222K0**	0.8 ±0.1	4000	16000		
3.3 nF	B37941K2332K0**	0.8 ±0.1	4000	16000		
4.7 nF	B37941K2472K0**	1.2 ±0.1			3000	12000
6.8 nF	B37941K2682K0**	1.2 ±0.1			3000	12000

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Ordering codes and packing for X7R, 50 VDC, nickel barrier terminations

Case size 1206, 50 VDC

C_R	Ordering code	Chip thickness mm	Cardboard tape, ∅180-mm reel ** ≙ 60 pcs./reel	Cardboard tape, ∅330-mm reel ** ≙ 70 pcs./reel	Blister tape, ∅180-mm reel ** ≙ 62 pcs./reel	Blister tape, ∅330-mm reel ** ≙ 72 pcs./reel
1.0 nF	B37872K5102K0**	0.8 ±0.1	4000	16000		
1.2 nF	B37872K5122K0**	0.8 ±0.1	4000	16000		
1.5 nF	B37872K5152K0**	0.8 ±0.1	4000	16000		
1.8 nF	B37872K5182K0**	0.8 ±0.1	4000	16000		
2.2 nF	B37872K5222K0**	0.8 ±0.1	4000	16000		
2.7 nF	B37872K5272K0**	0.8 ±0.1	4000	16000		
3.3 nF	B37872K5332K0**	0.8 ±0.1	4000	16000		
3.9 nF	B37872K5392K0**	0.8 ±0.1	4000	16000		
4.7 nF	B37872K5472K0**	0.8 ±0.1	4000	16000		
5.6 nF	B37872K5562K0**	0.8 ±0.1	4000	16000		
6.8 nF	B37872K5682K0**	0.8 ±0.1	4000	16000		
8.2 nF	B37872K5822K0**	0.8 ±0.1	4000	16000		
10 nF	B37872K5103K0**	0.8 ±0.1	4000	16000		
12 nF	B37872K5123K0**	0.8 ±0.1	4000	16000		
15 nF	B37872K5153K0**	0.8 ±0.1	4000	16000		
18 nF	B37872K5183K0**	0.8 ±0.1	4000	16000		
22 nF	B37872K5223K0**	0.8 ±0.1	4000	16000		
27 nF	B37872K5273K0**	0.8 ±0.1	4000	16000		
33 nF	B37872K5333K0**	0.8 ±0.1	4000	16000		
39 nF	B37872K5393K0**	0.8 ±0.1	4000	16000		
47 nF	B37872K5473K0**	0.8 ±0.1	4000	16000		
56 nF	B37872K5563K0**	0.8 ±0.1	4000	16000		
68 nF	B37872K5683K0**	0.8 ±0.1	4000	16000		
82 nF	B37872K5823K0**	0.8 ±0.1	4000	16000		
100 nF	B37872K5104K0**	0.8 ±0.1	4000	16000		
220 nF	B37872K5224K0**	1.2 ±0.1			3000	12000
330 nF	B37872K5334K0**	1.2 ±0.1			3000	12000
470 nF	B37872K5474K0**	1.2 ±0.1			3000	12000

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Ordering codes and packing for X7R, 100 VDC, nickel barrier terminations

Case size 1206, 100 VDC

C_R	Ordering code	Chip thickness mm	Cardboard tape, ∅180-mm reel ** ≙ 60 pcs./reel	Cardboard tape, ∅330-mm reel ** ≙ 70 pcs./reel	Blister tape, ∅180-mm reel ** ≙ 62 pcs./reel	Blister tape, ∅330-mm reel ** ≙ 72 pcs./reel
1.0 nF	B37872K1102K0**	0.8 ±0.1	4000	16000		
1.5 nF	B37872K1152K0**	0.8 ±0.1	4000	16000		
2.2 nF	B37872K1222K0**	0.8 ±0.1	4000	16000		
3.3 nF	B37872K1332K0**	0.8 ±0.1	4000	16000		
4.7 nF	B37872K1472K0**	0.8 ±0.1	4000	16000		
6.8 nF	B37872K1682K0**	0.8 ±0.1	4000	16000		
10 nF	B37872K1103K0**	0.8 ±0.1	4000	16000		
15 nF	B37872K1153K0**	0.8 ±0.1	4000	16000		
22 nF	B37872K1223K0**	0.8 ±0.1	4000	16000		
33 nF	B37872K1333K0**	0.8 ±0.1	4000	16000		
47 nF	B37872K1473K0**	0.8 ±0.1	4000	16000		
68 nF	B37872K1683K0**	1.2 ±0.1			3000	12000
100 nF	B37872K1104K0**	1.2 ±0.1			3000	12000

Ordering codes and packing for X7R, 200 VDC, nickel barrier terminations

Case size 1206, 200 VDC

C_R	Ordering code	Chip thickness mm	Cardboard tape, ∅180-mm reel ** ≙ 60 pcs./reel	Cardboard tape, ∅330-mm reel ** ≙ 70 pcs./reel	Blister tape, ∅180-mm reel ** ≙ 62 pcs./reel	Blister tape, ∅330-mm reel ** ≙ 72 pcs./reel
1.0 nF	B37872K2102K0**	0.8 ±0.1	4000	16000		
1.5 nF	B37872K2152K0**	0.8 ±0.1	4000	16000		
2.2 nF	B37872K2222K0**	0.8 ±0.1	4000	16000		
3.3 nF	B37872K2332K0**	0.8 ±0.1	4000	16000		
4.7 nF	B37872K2472K0**	0.8 ±0.1	4000	16000		
6.8 nF	B37872K2682K0**	0.8 ±0.1	4000	16000		
10 nF	B37872K2103K0**	0.8 ±0.1	4000	16000		
15 nF	B37872K2153K0**	1.2 ±0.1			3000	12000

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Ordering codes and packing for X7R, 200 VDC, nickel barrier terminations

Case size 1206, 200 VDC

		Chip thickness	Cardboard tape, ∅180-mm reel	Cardboard tape, ∅330-mm reel	Blister tape, ∅180-mm reel	Blister tape, ∅330-mm reel
			** ≙ 60	** ≙ 70	** ≙ 62	** ≙ 72
C_R	Ordering code	mm	pcs./reel	pcs./reel	pcs./reel	pcs./reel
22 nF	B37872K2223K0**	1.2 ±0.1			3000	12000

Ordering codes and packing for X7R, 500 VDC, nickel barrier terminations

Case size 1206, 500 VDC

		Chip thickness	Cardboard tape, ∅180-mm reel	Cardboard tape, ∅330-mm reel	Blister tape, ∅180-mm reel	Blister tape, ∅330-mm reel
			** ≙ 60	** ≙ 70	** ≙ 62	** ≙ 72
C_R	Ordering code	mm	pcs./reel	pcs./reel	pcs./reel	pcs./reel
470 pF	B37872K3471K0**	0.8 ±0.1	4000	16000		
680 pF	B37872K3681K0**	0.8 ±0.1	4000	16000		
1.0 nF	B37872K3102K0**	0.8 ±0.1	4000	16000		
1.5 nF	B37872K3152K0**	0.8 ±0.1	4000	16000		
2.2 nF	B37872K3222K0**	0.8 ±0.1	4000	16000		
3.3 nF	B37872K3332K0**	1.2 ±0.1			3000	12000
4.7 nF	B37872K3472K0**	1.2 ±0.1			3000	12000

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Ordering codes and packing for X7R, 50 VDC, nickel barrier terminations

Case size 1210, 50 VDC				
		Chip thickness	Blister tape, ∅180-mm reel	Blister tape, ∅330-mm reel
			** ≙ 62	** ≙ 72
C_R	Ordering code	mm	pcs./reel	pcs./reel
47 nF	B37950K5473K0**	0.8 ±0.1	4000	16000
100 nF	B37950K5104K0**	0.8 ±0.1	4000	16000
220 nF	B37950K5224K0**	1.2 ±0.1	3000	12000

Ordering codes and packing for X7R, 100 VDC, nickel barrier terminations

Case size 1210, 100 VDC				
		Chip thickness	Blister tape, ∅180-mm reel	Blister tape, ∅330-mm reel
			** ≙ 62	** ≙ 72
C_R	Ordering code	mm	pcs./reel	pcs./reel
100 nF	B37950K1104K0**	0.8 ±0.1	4000	16000
150 nF	B37950K1154K0**	1.2 ±0.1	3000	12000

Ordering codes and packing for X7R, 200 VDC, nickel barrier terminations

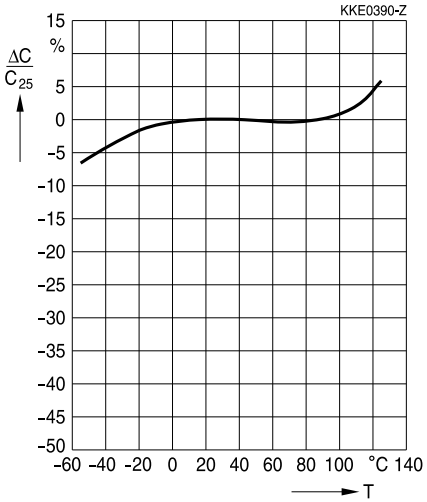
Case size 1210, 200 VDC				
		Chip thickness	Blister tape, ∅180-mm reel	Blister tape, ∅330-mm reel
			** ≙ 62	** ≙ 72
C_R	Ordering code	mm	pcs./reel	pcs./reel
22 nF	B37950K2223K0**	1.2 ±0.1	3000	12000
33 nF	B37950K2333K0**	1.2 ±0.1	3000	12000
47 nF	B37950K2473K0**	1.6 ±0.1	2000	8000

Ordering codes and packing for X7R, 500 VDC, nickel barrier terminations

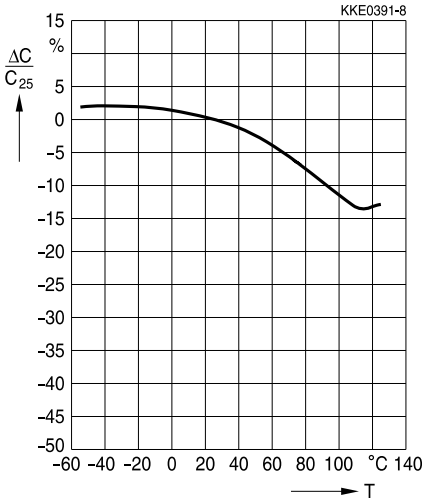
Case size 1210, 500 VDC				
		Chip thickness	Blister tape, ∅180-mm reel	Blister tape, ∅330-mm reel
			** ≙ 62	** ≙ 72
C_R	Ordering code	mm	pcs./reel	pcs./reel
10 nF	B37950K3103K0**	1.6 ±0.1	2000	8000

Typical characteristics[1)]

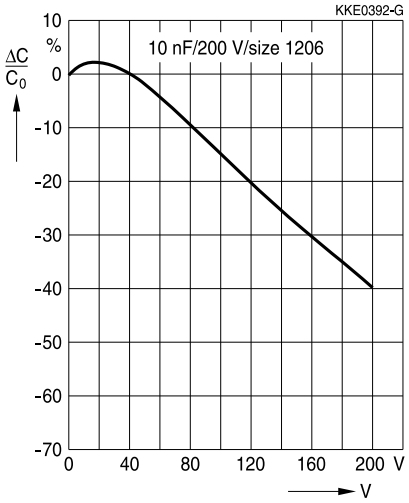
Capacitance change $\Delta C/C_{25}$ versus temperature T for NME



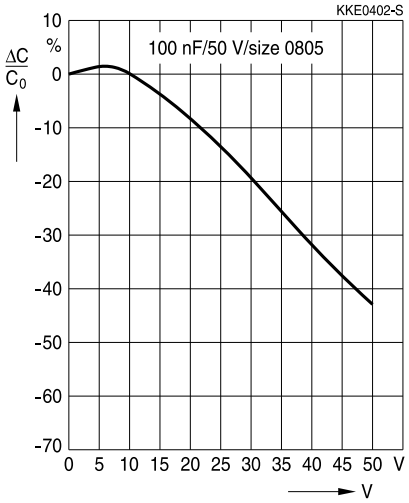
Capacitance change $\Delta C/C_{25}$ versus temperature T for BME



Capacitance change $\Delta C/C_0$ versus superimposed DC voltage V for NME



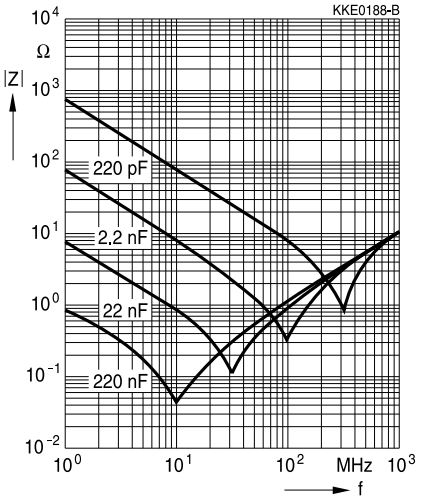
Capacitance change $\Delta C/C_0$ versus superimposed DC voltage V for BME



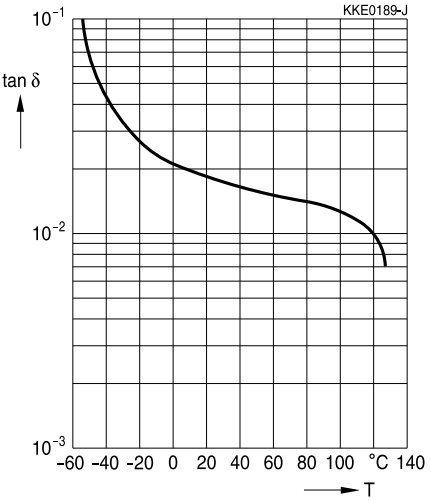
1) For more detailed information on frequency behavior and characteristics see www.epcos.com/mlcc_impedance.

Typical characteristics[1)]

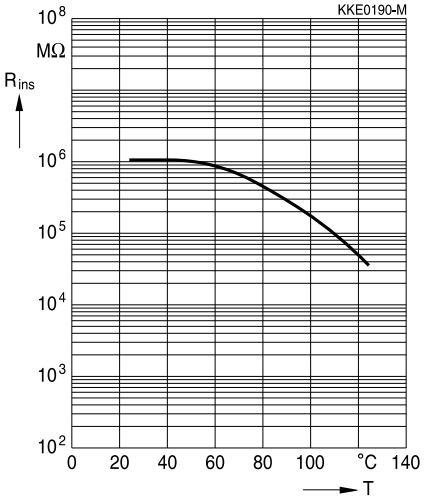
Impedance |Z| versus frequency f



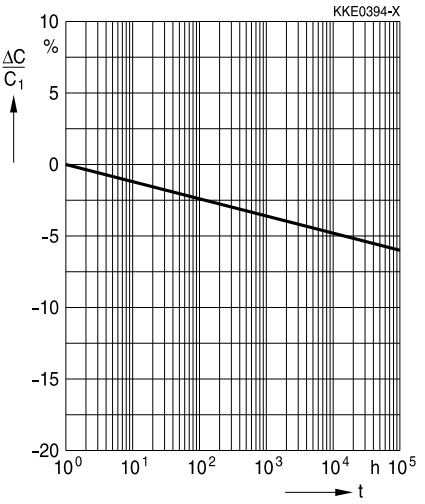
Dissipation factor tan δ versus temperature T



Insulation resistance R_{ins} versus temperature T



Capacitance change $\Delta C/C_1$ versus time t



1) For more detailed information on frequency behavior and characteristics see www.epcos.com/mlcc_impedance.

Cautions and warnings

How to select ceramic capacitors

Remember the following when selecting ceramic capacitors:

1. Ceramic capacitors that must fulfill high quality requirements must be qualified based on AEC-Q200 Rev-C.
2. When ceramic capacitors are used at the connection to a battery or power supply (e.g. clamp 15 or 30 in an automobile) or for safety-relevant applications, two single ceramic capacitors should be connected in series. Alternatively a ceramic capacitor with integrated series circuits should be used in order to reduce the possibility of a short circuit caused by a fracture. The MLSC from EPCOS contains such a series circuit in a single component.
3. The use of multilayer varistors (MLVs) is recommended for ESD protection (see chapter “Effects on mechanical, thermal and electrical stress”, section 1.4).
4. Additional stress factors such as continuous operating voltage or application-specific derating must be taken into account in the selection of components (refer to chapter “Reliability”).

Recommendations for the circuit board design

1. Components with an optimized geometrical design are preferable where permitted by the application.
2. Use at least FR4 circuit board material.
3. Geometrically optimized circuit boards are preferable, especially those that cannot be deformed.
4. Ceramic capacitors should be placed with a sufficient minimum distance from the edge of a circuit board. High bending forces may be exerted there when boards are separated and during further processing of a board (e.g. when incorporating it in a housing).
5. Ceramic capacitors should always be placed parallel to the possible bending axis of a circuit board.
6. Screw connections should not be used to fix a board or connect several boards. Components should not be placed near screw holes. If screw connections are unavoidable, they should be cushioned, for instance using rubber pads.

Recommendations for processing

1. Ensure correct positioning of a ceramic capacitor on the solder pad.
2. Be careful when using casting, injection-molded and molding compounds and cleaning agents. They can damage a capacitor.
3. Support a circuit board and reduce placement forces.
4. Do not straighten a board (manually) if it is distorted by soldering.
5. Separate boards with a peripheral saw, or preferably with a milling head (no dicing or breaking).
6. Be careful when subsequently placing heavy or leaded components (e.g. transformers or snap-in components) because of the danger of bending and fracture.
7. When testing, transporting, packing or inserting a board, avoid any deformation of it so that components are not damaged.
8. Avoid excessive force when plugging a connector into a device soldered onto a board.
9. Only mount ceramic capacitors using the soldering process (reflow or wave) that is permissible for them (see chapter “Soldering directions”).
10. When soldering, select the softest solder profile possible (heating time, peak temperature, cooling time) to avoid thermal stress and damage.
11. Ensure the correct solder meniscus height and solder quantity.
12. Ensure correct dosing of the cement.
13. Ceramic capacitors with external silver-palladium terminations are intended for conductive adhesion - they are not suited for lead-free soldering processes.

This listing does not claim to be complete, but merely reflects the experience of EPCOS AG.

SMD

Symbols and terms

Symbol	English	German
A	Area	Fläche
C	Capacitance	Kapazität
C_0	Initial (original) capacitance	Anfangskapazität
C_1	Capacitance value after one hour's use	Kapazitätswert nach einer Stunde
C_R	Rated capacitance	Nennkapazität
C_{20}	Capacitance at 20 °C	Kapazität bei 20 °C
C_{25}	Capacitance at 25 °C	Kapazität bei 25 °C
ΔC	Capacitance change	Kapazitätsänderung
D	Bending displacement	Durchbiegung
E_a	Activation energy	Aktivierungsenergie
ESR	Equivalent series resistance	Ersatzserienwiderstand
F	Force	Kraft
f	Frequency	Frequenz
f_{meas}	Measuring frequency	Messfrequenz
f_{res}	Self-resonant frequency	Eigenresonanzfrequenz
I_{test}	Test current	Prüfstrom
k	Ageing constant	Alterungskonstante
L	Inductance	Induktivität
N	Quantity (integer values)	Anzahl (ganzzahliger Wert)
P_{loss}	Power dissipation or loss	Verlustleistung
Q_{el}	Electrical charge	Elektrische Ladung
Q	Quality	Güte
R_{ins}	Insulation resistance	Isolationswiderstand
R_P	Parallel resistance	Parallelwiderstand
R_S	Series resistance (circuit resistance)	Serienwiderstand
S_V	Rate of rise of a voltage pulse	Flankensteilheit eines Spannungsimpulses
T	Temperature	Temperatur
T_{meas}	Measuring temperature	Messtemperatur
T_{op}	Operating temperature	Betriebstemperatur
T_{ref}	Reference temperature	Bezugstemperatur
T_{test}	Test temperature	Prüftemperatur
t	Time	Zeit
t_r	Rise time of a voltage pulse	Anstiegszeit eines Spannungsimpulses
t_{test}	Test duration	Prüfdauer
tan δ	Dissipation factor	Verlustfaktor

Symbol	English	German
V	Voltage	Spannung
V_0	Initial (original) voltage (basic voltage level)	Anfangsspannung (Spannungsgrundpegel)
V_{meas}	Measuring voltage	Messspannung
V_R	Rated voltage	Nennspannung
V_S	Amplitude of a voltage pulse	Hub des Spannungsimpulses
V_{RMS}	Measuring (root-mean-square or effective) AC voltage	Effektivspannung
V_{test}	Test voltage	Prüfspannung
|Z|	Magnitude of impedance (AC resistance)	Betrag der Impedanz (Wechselstromwiderstand)
α	Temperature coefficient	Temperaturkoeffizient
ε_0	Absolute dielectric constant	Absolute Dielektrizitätskonstante
ε_r	Relative dielectric constant	Relative Dielektrizitätskonstante
λ	Failure rate	Ausfallrate
τ	Time constant	Zeitkonstante

Abbreviations / Notes

Symbol	English	German
e	Lead spacing (in mm)	Rastermaß (in mm)
SMD	Surface-mounted devices	Oberflächenmontierbares Bauelement
*	To be replaced by a number in ordering codes, type designations etc.	Platzhalter für Zahl im Bestellnummern-code oder für die Typenbezeichnung.
+	To be replaced by a letter.	Platzhalter für einen Buchstaben.
	All dimensions are given in mm.	Alle Maße sind in mm angegeben.
	The commas used in numerical values denote decimal points.	Verwendete Kommas in Zahlenwerten bezeichnen Dezimalpunkte.

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