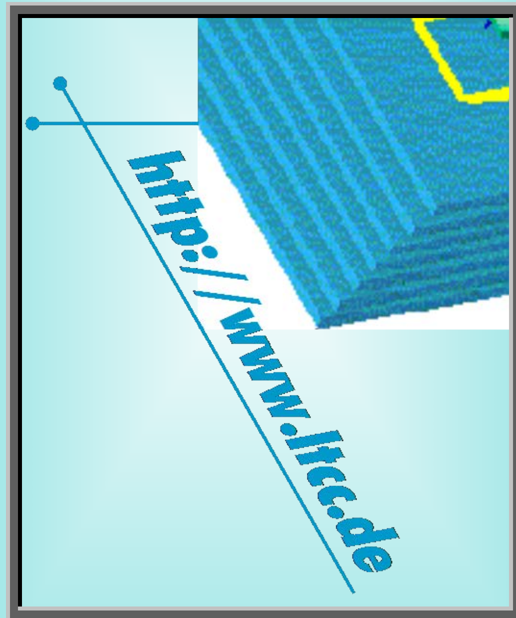
LTCC

—

Low Temperature Cofired Ceramic

—

An Introduction and Overview



Version: 15. February 2006

© IMST GmbH, 2006: Carl-Friedrich-Gauß-Str. 2 D-47475 Kamp-Lintfort, Germany
E-Mail: ltcc@imst.de, Internet: www.ltcc.de or www.imst.de

LTCC – An Introduction and Overview

by Reinhard Kulke and the LTCC team of IMST

This brochure has been prepared by the LTCC staff of the IMST GmbH, Germany. The research has been funded by the European Community in the Brite-Euram III project "RAMP" (Rapid Manufacture of Microwave and Power Modules, BE-97-4883), which runs from October 1998 to September 2001.

The authors do not guarantee, that the collected material is complete or free of errors. All investigations have been made with particularly care. Trade marks and company names have been used for the purpose of information only. The authors explicitly declare not to intend to advertise or to discriminate any company or company's product. Suggestions or corrections are welcome at ltcc@imst.de. The latest information and publications around **LTCC @ IMST** can be found on the internet sites http://www.ltcc.de.

All rights reserved. No parts of this book may be reproduced, stored or transmitted in any manner without the written permission of the publisher. For information, write to IMST GmbH, Carl-Friedrich-Gauss-Str. 2, D-47475 Kamp-Lintfort, Germany. Fax +49-2842-981-199, e-mail info@imst.de.

Release 2006:

Copyright © 2001, 2002 and 2006 by IMST GmbH, Germany

Table of Contents

1. Introduction ... 2
2. Standard-Material Supplier ... 6
 2.1. DuPont ... 6
 2.2. Ferro ... 7
 2.3. Heraeus ... 7
 2.4. Kyocera ... 8
  2.4.1. Kyocera Japan ... 8
  2.4.2. Kyocera America (Vispro Devision) ... 8
 2.5. NIKKO ... 8
 2.6. Nippon Electric Glass ... 8
 2.7. Northrop Grumman ... 8
 2.8. Electro-Science Laboratories ... 8
 2.9. Samsung ... 9
 2.10. Soshin / NGK ... 9
 2.11. CeramTec ... 9
3. LTCC Materials ... 10
 3.1. Ceramic Substrate Materials ... 11
 3.2. LTCC Conductor Pastes and Related Materials ... 15
4. LTCC in Comparison with other RF-Material Systems ... 20
 4.1. Parameter and price comparison between PCB and LTCC ... 21
5. Design Rules ... 24
 5.1. Terminology and typical Design Rules ... 25
 5.2. Vias ... 28
 5.3. Conductors ... 29
 5.4. Inductors ... 30
 5.5. Capacitors ... 30
 5.6. Resistors ... 31
 5.7. I/O Styles ... 32
  5.7.3. Ball Grid Array (BGA) ... 32
  5.7.4. mm-wave Transitions ... 33
 5.8. Wire Bond Pads ... 34
 5.9. Cavities / Windows ... 35
 5.10. Characteristics of Several Processors ... 36
6. LTCC Process ... 37
 6.1. Zero Shrinking Process ... 40
7. Future Technologies on LTCC ... 41
8. LTCC Processors ... 42
9. Abbreviations ... 46
10. Internet Addresses ... 49
11. Patents ... 50
12. References ... 54

© IMST GmbH, 2001, 2002, 2006