



**Richardson  
Electronics**

POWER & MICROWAVE  
TECHNOLOGIES

**AMO**

A M O T E C H

## High Q and Broadband Ceramic Capacitors Overview

# World Best Product

Key Components for IT & Energy Industry Based on  
Advanced Materials



## AMOTECH HIGH Q AND BROADBAND CERAMIC CAPACITORS

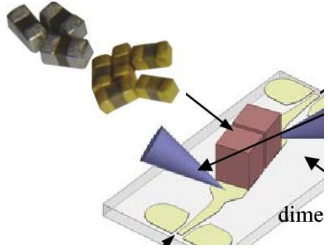


# AMOTECH CERAMIC CAPACITOR

## IC and Systems Package Application

For Flip chip & Wire bonding at mmWave

Broadband capacitor - **ABC series**



IC Developer  
Driven

Device Package

**System in Package**

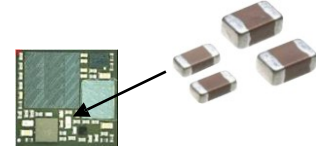
Integration & Miniaturization  
Value Up & Cost Down

System OEM  
Driven

System Module

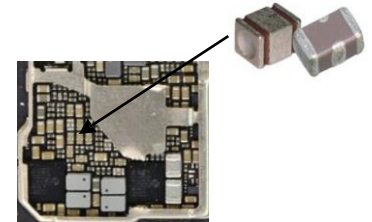
For Space saving

Large capacitance – **ACS, ACX series**



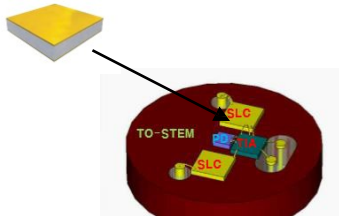
For EMI solution

3 Terminal Capacitor  
- **AFC series**



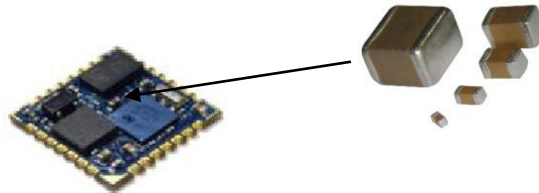
For Wire bonding

Single layer capacitor - **ASC series**



For Wireless application

High Q MLCC - **ACQ series**



# PRODUCT REVIEW

## ◆ High Q MLCC



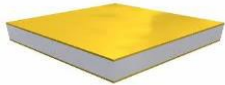
- 1111, 0805, 0603 inch for Macro-cell
- 0402, 0201 inch for Small-cell, CPE
- COG base Low ESR

## ◆ Broadband capacitor



- 0201, 0402 inch plating
- Up to 40GHz solution
- X7R / X5R base

## ◆ Single layer capacitor (under development)



- 10 mil, 15 mil (0.25mm, 0.38mm)
- Gold plating
- High Capacitance with Low loss
- High K material

## ◆ Large Capacitance MLCC

- 0402 – 1210 inch
- High reliability X7R base
- 50, 100V



## - 3 Terminal filter

- 0603 – 1806 inch
- High reliability X7R base
- 50, 100V



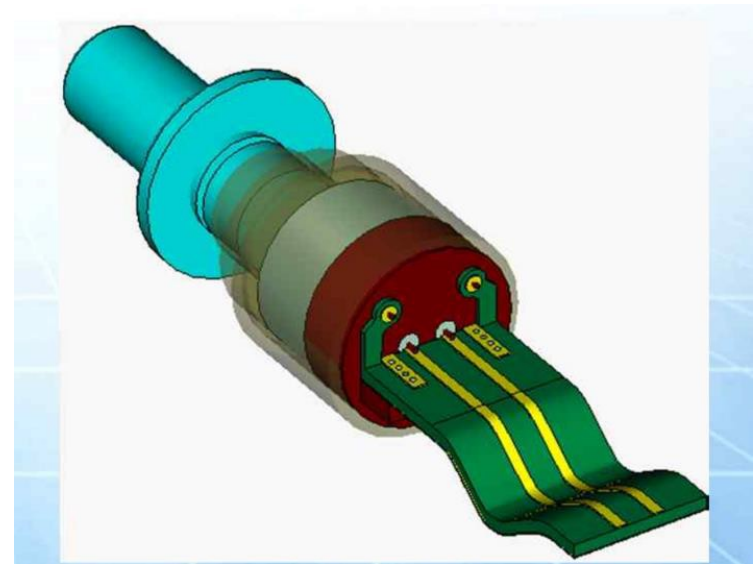
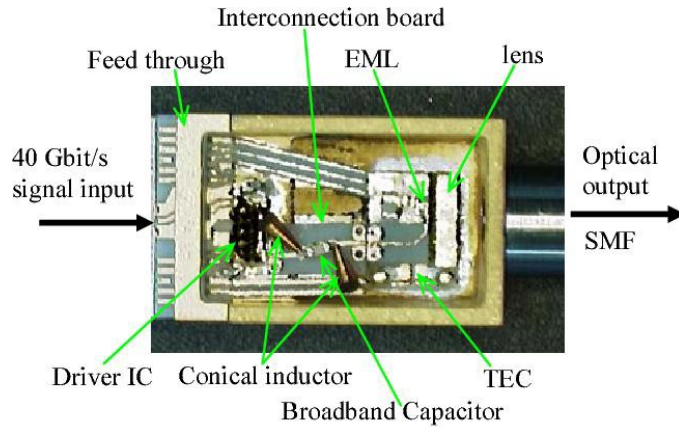
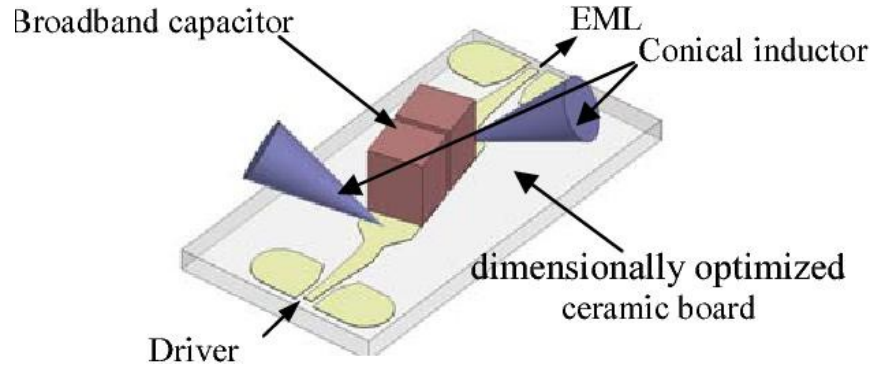
# BROADBAND CAP. FOR mmWAVE & OPTICAL DEVICE

## ➤ ABC series

- Customizable size
- Low insertion loss
- Ultra broadband up to 40Ghz
- Low loss dielectric
- RoHS compliant

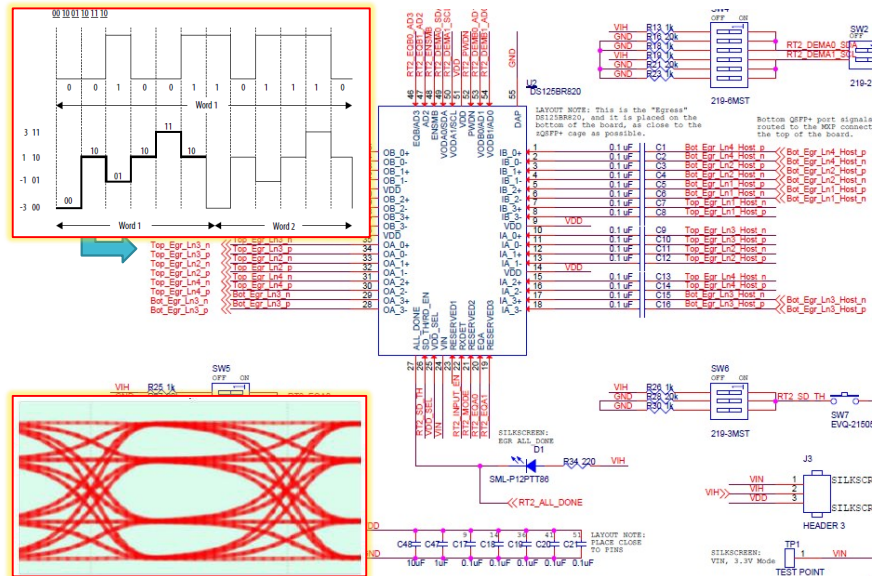
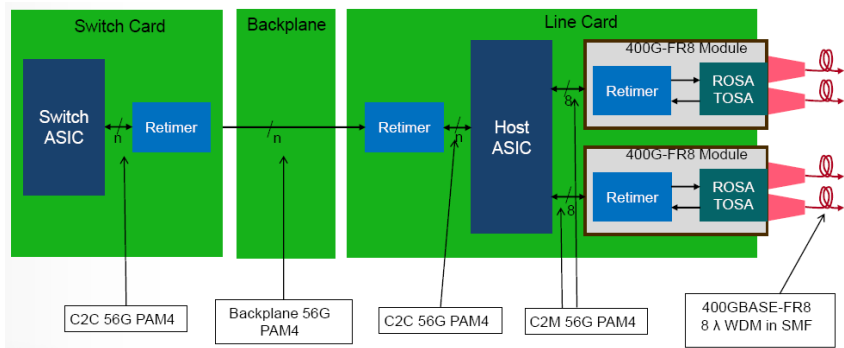
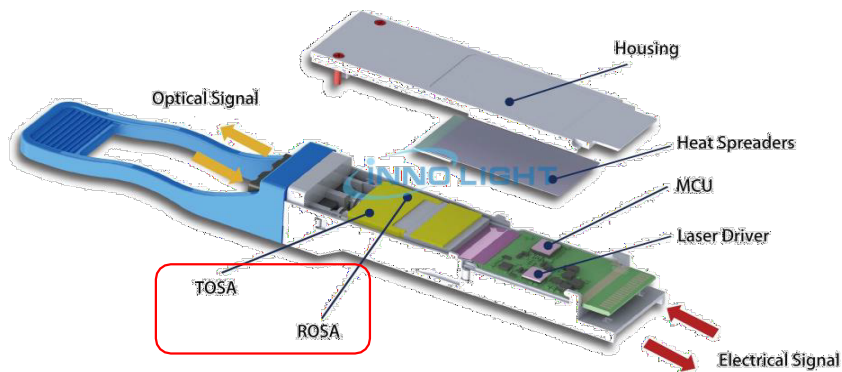


# APPLICATION REVIEW



# Optical Transceiver & Capacitor

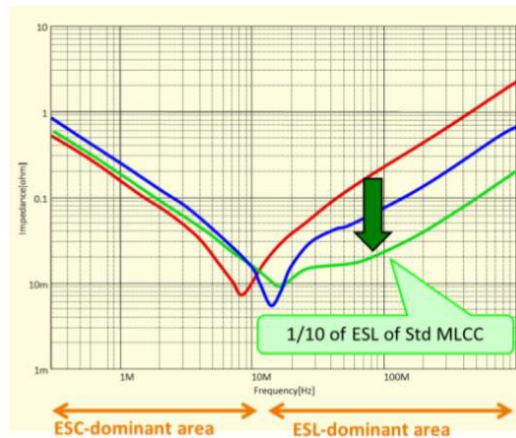
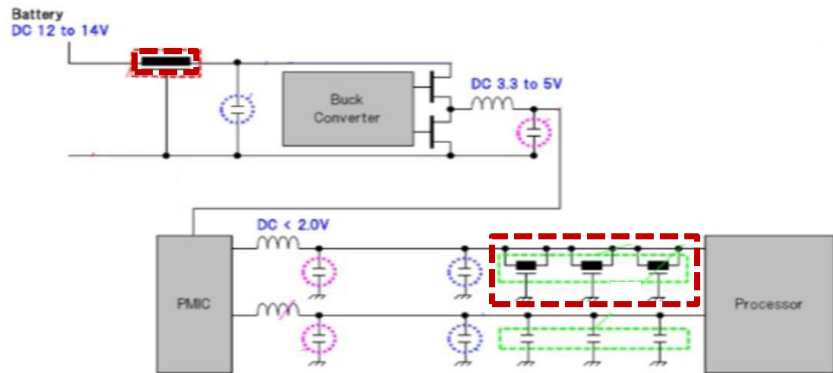
## • Optical Transceiver Block Diagram & Circuit



- DC Blocking Cap → Broadband Cap(BBC) 16 pcs x System
- DC Bias Cap : RF Amp Block → SLC (High Voltage)

# ADVANTAGE OF FEED-THROUGH CAPACITOR

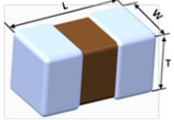
DC power line ripple

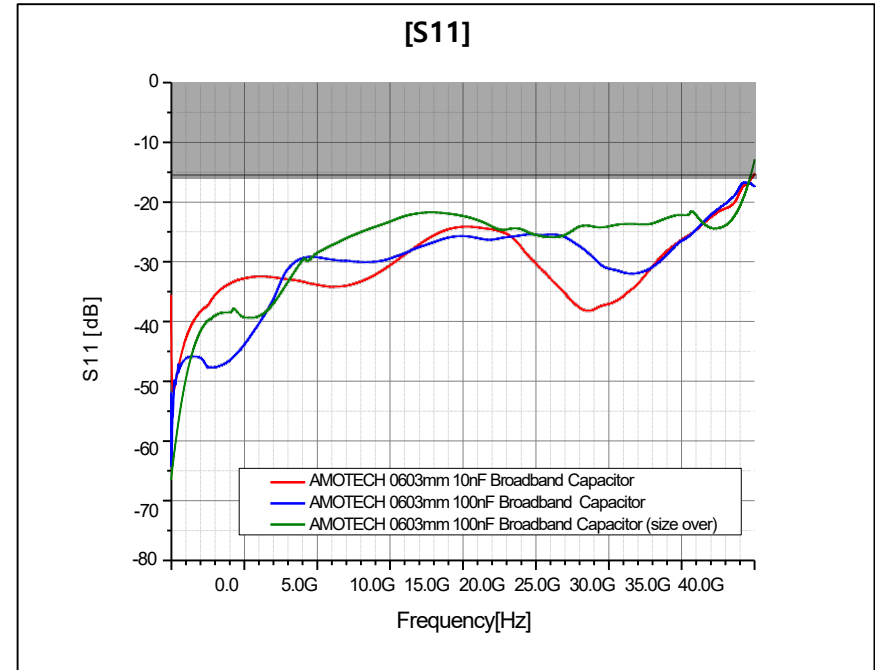
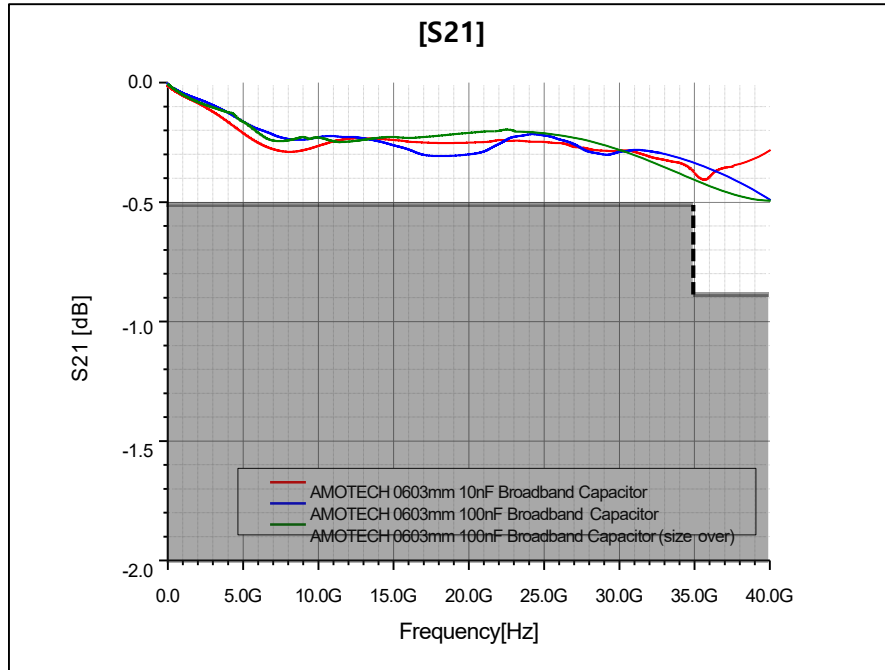


Capacitance	Inductance (Shunt)	Inductance (Series)	Voltage	Current
High Capacitance	Low parasitic inductance	High Series inductance	Low voltage –mobile, Infotainment High Voltage – Industrial,	Depend on internal design



# MAIN CHARACTERISTICS

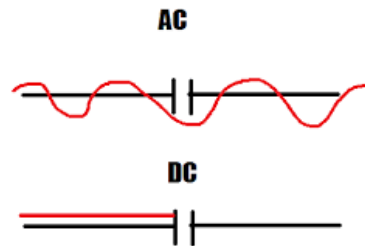
	Lot No.	L (mm)	W (mm)	T (mm)	Capacitance	Layout
AMOTECH #1	S25KBA120002A S20A 11AA	$0.66 \pm 0.03$	$0.35 \pm 0.03$	$0.35 \pm 0.03$	100nF	
AMOTECH #2	S25KBA116003A S20A 21BA	$0.60 \pm 0.03$	$0.30 \pm 0.03$	$0.30 \pm 0.03$	100nF	
AMOTECH #3	S25KBA120005A S20A 10CA	$0.60 \pm 0.03$	$0.30 \pm 0.03$	$0.30 \pm 0.03$	10nF	



# AMOTECH BROADBAND CAPACITOR

## ➤ Applications

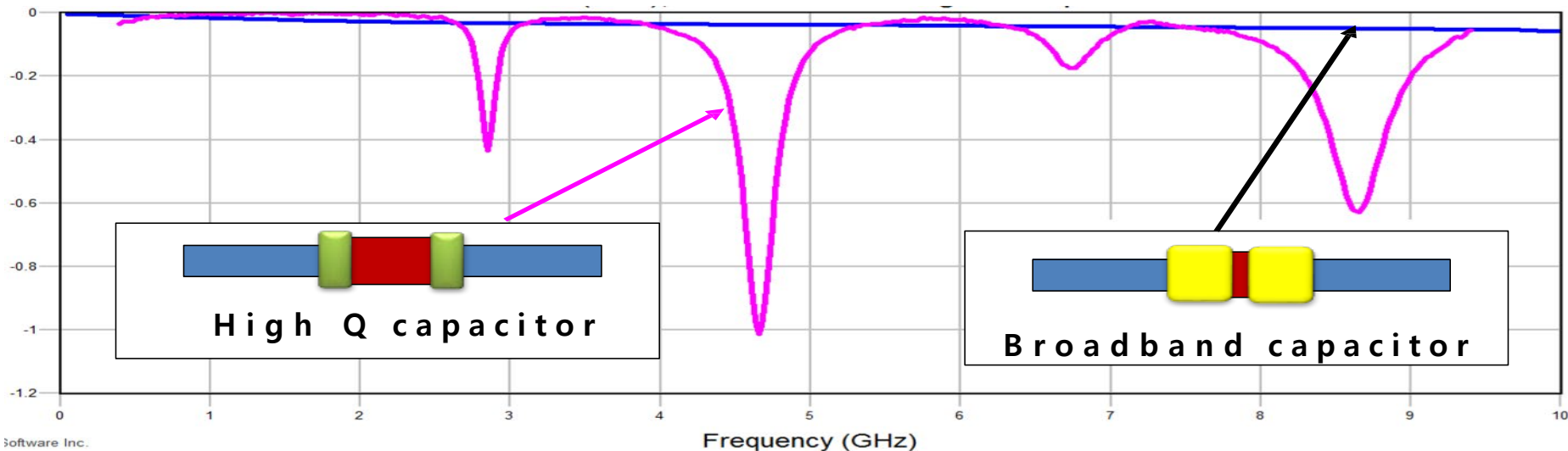
- Wide frequency range **DC blocking**
- Optical devices
- mmWave devices



AC pass band  
( ~ 20GHz, ~40GHz, ~60GHz)

## ※ HIGH Q CAPACITOR VS BROADBAND CAPACITOR

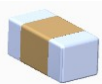
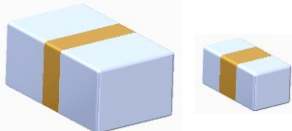
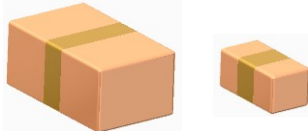
**NOTE : Reducing self resonance of capacitor.**



# PRODUCT LINE UP

## ➤ ABC series (AMOTECH BROADBAND CAPACITOR)

- Wide frequency range DC blocking  
( ABCN series :~ 20GHz, U series ~ 40GHz)
- Low insertion loss
- 0603 ~ 1005 mm / 6.3 ~ 10V

ABCN series	ABCU series	
Tin(Sn) plating	Tin(Sn) plating	Gold(Au) plating
 <p>0201inch/0603mm</p>	 <p>0402inch/1005mm 0201inch/0603mm</p>	 <p>0402inch/1005mm 0201inch/0603mm</p>

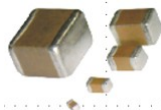
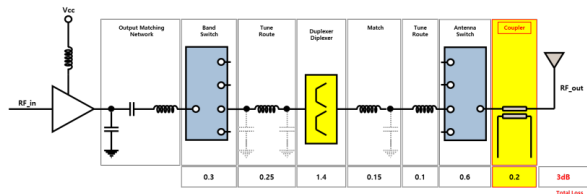
<u>ABCU</u>	<u>10</u>	<u>2</u>	<u>01X</u>	<u>103</u>	<u>P</u>	<u>G</u>	<u>D</u>	<u>G</u>
Series name	Voltage	Material code	Size	Capacitance	Cp. Tolerance	Plating	Taping	Application

### ※ PRODUCT LINE UP

AMOTECH	Part description	Frequency option	Terminal option
<b>ABCU</b> 10201X103P <b>NDG</b> <b>ABCU</b> 10201X103P <b>GDG</b>	0603mm/0201inch, 10V, 10nF, X7S	~ 40 GHz	<b>Ni barrier, Sn plating</b> <b>Ni barrier, Au plating</b>
<b>ABCU</b> 10S02X104P <b>NDG</b> <b>ABCU</b> 10S02X104P <b>GDG</b>	1005mm/0402inch, 10V, 100nF, X7S	~ 40 GHz	<b>Ni barrier, Sn plating</b> <b>Ni barrier, Au plating</b>

# AMOTECH SOLUTION

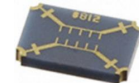
## SMALL/MACRO CELL



• High Q



• Chip Coupler



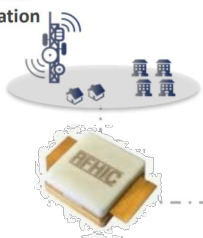
• Substrate Coupler



• 5GANT

### 4G Base Station

Traditional Basestation



Massive MIMO



Small Cells for  
Densification



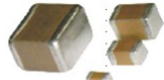
Core Network



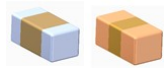
## GaN



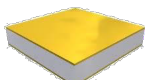
• 3 Term



• High Q

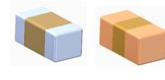


• BBC

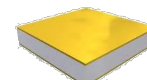


• SLC

## OPTICAL TRANSCIVER



• BBC



• SLC

# AMOTECH TECHNICAL ADVANTAGE

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## ➤ Technical advantage

### Material

**Acquired material technology derived from MLCC investment.**

- In house process of *high K material; X5R, X7R, Y5V*

### Design

**High Frequency Design & Measurement**

- High frequency modeling software (ANSYS-HFSS, ADS)
- *70GHz measurement system* from mmWave technology

### Process

**In-house Plating tech**

- Gold, Nickel, Tin
- *Plasma processing ; surface flatness, migration prevent*

### Production

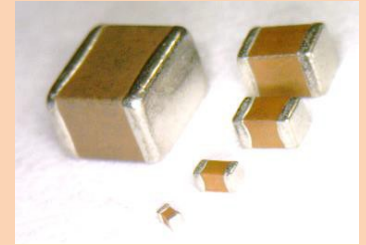
**Small size product mass production experience**

- **Monthly 200Mpcs** production of 0201, 01005

# HIGH Q MULTILAYER CERAMIC CAPACITOR

## ➤ ACQ (High Q) series

- Variable Size
- Low ESR
- High working Voltage
- High self resonance frequencies
- Stable COG dielectric with PME (Precious Metal Electrode)
- RoHS compliant

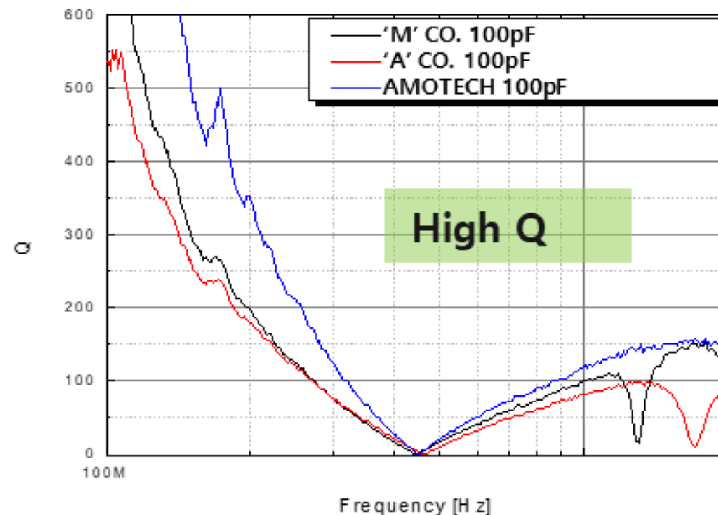
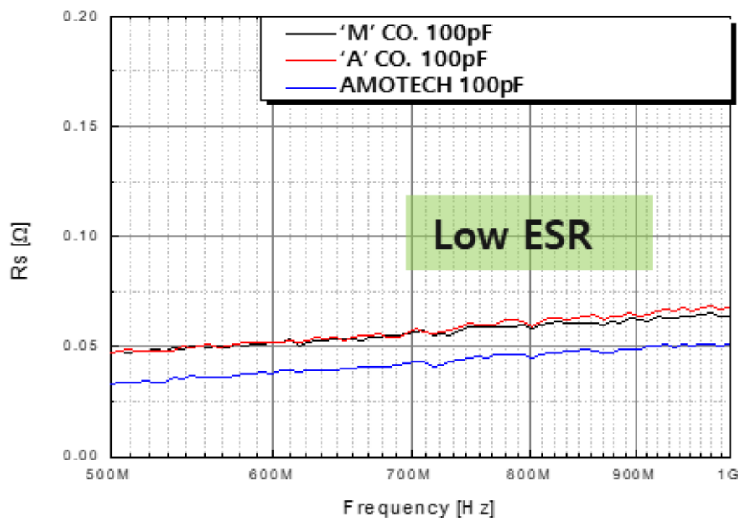


Part No.	Ordering No.	Size		Rated Voltage	Capacitance
		EIA (inch)	JIS (mm)		
ACQ01X2BN□□□JADG	A60Z□□□T200T	0201	0603	200V	Under development
ACQ02X2BN□□□JADG	A60L□□□T250T	0402	1005	250V	0.1~27pF
ACQ03X2BN□□□JADG	A60S□□□T250T	0603	1608	250V	0.1~100pF
ACQ05X2BN□□□JALG	A60F□□□T250T	0805	2012	250V	10~240pF
ACQ11X5BN□□□JALG	A80B□□□T500T	1111	2828	500V	1.2~100pF



# Superior Performance for High Q MLCC

- 25-35% lower ESR against best industry standard, extended HF performance
- lower ESR may allow use of smaller capacitor size, replacing 0603 with 0402 for smaller board size

## ■ Ultra-Low ESR, High Q Performance



# HIGH Q MLCC FOR RF APPLICATION

	AMOTECH	MURATA	ATC	KNOWLES(DLI)	TEMEX
1111inch /2828mm	A80B0R1BT500T	GQM22M5C2HR30B B01D	800B0R1BT500T	1111J500P100BQT	501CHB0R1BSE
0805inch /2012mm	A60F0R1BT250T	GQM2195C2ER10BB 12D	600F0R1BT250T	0805J250P100BQT	251SHF0R1BSE
0603inch /1608mm	A60S0R1BT250T	GQM1875C2ER10BB 12D	600S0R1BT250T	0603J250P100BQT	251SHS0R1BSE
0402inch /1005mm	A60L0R1BT200T	GQM1555C2DR10B B01D	600L0R1BT200T	0402J200P100BQT	201SHL0R1BSE
0402inch /1005mm	A60L0R1BT250T	 <b>To replace 0603inch/1608mm 250V type</b>			
0201inch /0603mm	A60Z0R1BT200T	 <b>To replace 0402inch/1005mm 200V type</b>			

※ BLUE CODE : SIZE CODE

RED CODE : CAPACITANCE & IT'S TOLERANCE

GREEN CODE : VOLTAGE CODE



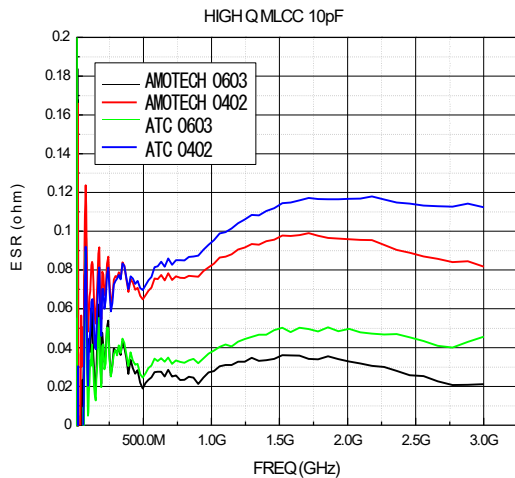
# ADVANTAGE OF AMOTECH HIGH Q MLCC

## ➤ Basis of using AMOTECH high Q MLCC

Higher Q & Higher BDV for PME

\* Lower ESR & High Breakdown voltage

	BDV	ESR 3.5G
M com (BME)	2.0 kV	100mohm
A com (PME)	2.9 kV	110mohm
<b>Amotech (PME)</b>	<b>2.9 kV</b>	<b>80mohm</b>

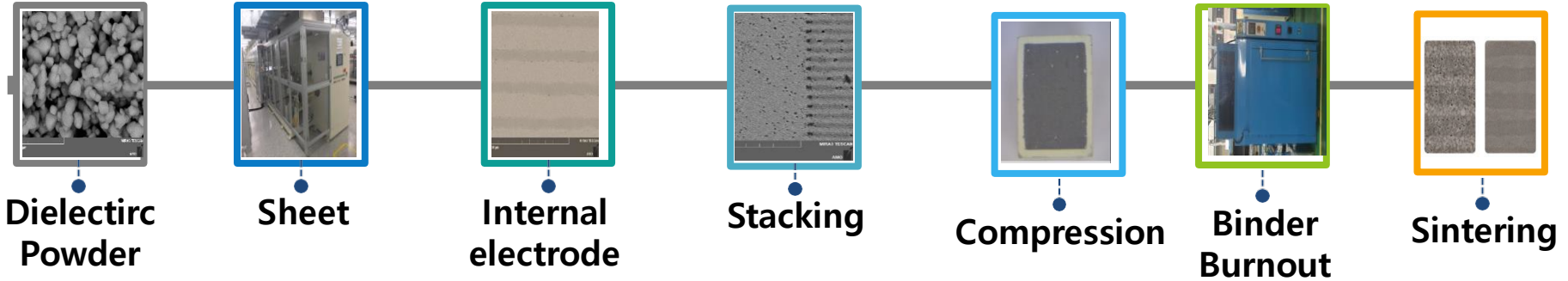


Enough Power Rate

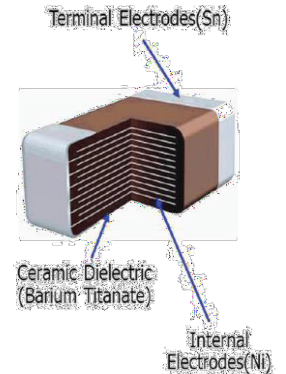
\* 80W test pass @ 3.5GHz, 10pF

	0402	0603
50W	Pass	Pass
60W	Pass	Pass
<b>70W</b>	<b>Pass</b>	<b>Pass</b>
<b>80W</b>	<b>Pass</b>	<b>Pass</b>

# PROCESS TECHNOLOGY



KEY PROCESS	KPI - MLCC
Dielectric Powder	50nm
Dielectric Thickness	1um
Internal electrode	Ni, Cu – 0.5um
Stacking	600 layers
Compression	2000 atm
Binder Burnout	Carbon 1 ppm ↓
Sintering	300°C/min, Precise deoxidation atmosphere



# 품질 인증

## Quality : IATF 16949:2016

Certificate No : RTS0053-1  
IATF Certificate No : 0291282  
Page : 1/2

**km3**

Certificate of Registration  
**QUALITY MANAGEMENT SYSTEM**

This is to certify that  
the quality management system of  
**AMOTECH CO.,LTD.**  
at  
380, Namdongseo-ro, Namdong-gu, Incheon, 21629, Korea

Has been found to conform to the Quality Management System Standards:  
**IATF 16949:2016**

This Certificate is valid for the following product or service ranges:  
**Design and Manufacturing of Multi-layer Ceramic,  
Dielectric Ceramic and Antenna**

Permitted exclusion: NA

Issue Date : Feb. 20. 2018

Certification Date : Feb. 20. 2018      Expiration Date : Feb. 19. 2021

Authorized By *E J Hwang*  
Eun Jo Hwang, President

**km3** **IATF**

Korea Management Register  
1st/F, Aso High Tech City #771, Geomginsil-ro  
Yongpung-gu, Seoul, 07296, Korea  
T: 02-4339-9001 / F: 02-4339-9004

- Mark indicates that km3 is accredited by the IATF for Quality Management System.
- Initial certification date: Mar. 5, 2007 / Latest issue date: Feb. 20, 2018

## Environment : ISO 14001:2015

Certificate No: REM0892

**km3**

Certificate of Registration  
**ENVIRONMENTAL MANAGEMENT SYSTEM**

This is to certify that  
the environmental management system of  
**AMOTECH CO.,LTD.**  
at  
Head Office: (SBL-1)LOT, Namdong Industrial Complex#380, Namdongseo-ro, Namdong-gu, Incheon, Korea  
Poseung Plant: #27, Pyeongtaek-hing-ro 18-beon-gil, Poseung-eup, Pyeongtaek-si, Gyeonggi, Korea

Has been found to confirm to the Environmental Management System Standards:  
**KS I ISO 14001:2015 / ISO 14001:2015**

This Certificate is valid for the following product or service ranges:  
**Design, Development, Manufacture and Service of  
Multi-Layer Ceramic and Dielectric Ceramic for Mobile Phone, Automobile,  
Computer, Network, Home Appliance Industry**

Issue Date: Jan. 22. 2018

Certification Date : Oct. 5. 2017      Valid Date : Oct. 4. 2020

Authorized By *E J Hwang*  
Eun Jo Hwang, President

**km3** **IATF** **KMR**

Korea Management Register  
1st/F, Aso High Tech City, #771, Geomginsil-ro,  
Yongpung-gu, Seoul, 07296, Korea  
T: 02-4339-9001 / F: 02-4339-9004

- km3 is accredited by the KMR (No. KMR-EC-17)
- Mark indicates that km3 is Accredited by the member of the International Accreditation Forum Multilateral Recognition Agreement
- KSC CODE: 151 Initial certification date: Oct. 5, 2005

# Mass production line

Target : Ensure product reliability

Qualified AEC-Q200

IQC

- ▶ Powder Analysis
  - Particle size, Composition, Dielectric constant
- ▶ Paste
  - Solid contents, Viscosity, Thixotropic index

Raw material Analysis

Quality control of Raw material

PQC

- ▶ X's Factor management (measurement)
  - Slurry viscosity, Casting "T", Printing "T", Firing profile, Plating thickness, ...
- ▶ Pre-Inspection(Half-finished good)
  - Cp/Df, IR, Section Analysis, Appearance, Dimension
- ▶ Time · Space deviation Management

Statistical analysis of indicator trends(Data Monitoring)

Preemptive quality accident prevention activities

OQC

- ▶ Final inspection
  - Cp/Df, IR, Solderability, Reliability(High temp. Operation Life test)
- ▶ VOC → VOP is linked to utilize it as an opportunity for improvement
- ▶ Continuous review and operation of measures to identify defects in a short period of time → Zero Defect

Customer-oriented thinking (Prevent defect recurrence)

Feedback continuously occurred Problem and anti-missive activities

# Reliability test equipment



Low/High Temp. Chamber



Temp Cycle Chamber



Temp & Humidity Chamber



\* Ion Migration Evaluation System



ESD Tester



Vibrator



Mechanical Shocker

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