

Strategy for Automotive Market

Seiji Osaka
Senior Vice President

Key Applications - Automotive Market



3 Megatrends: Demand Outlook

Demand for TDK products (exclude batteries)
[TDK estimates]

Applications

Fuel Efficiency

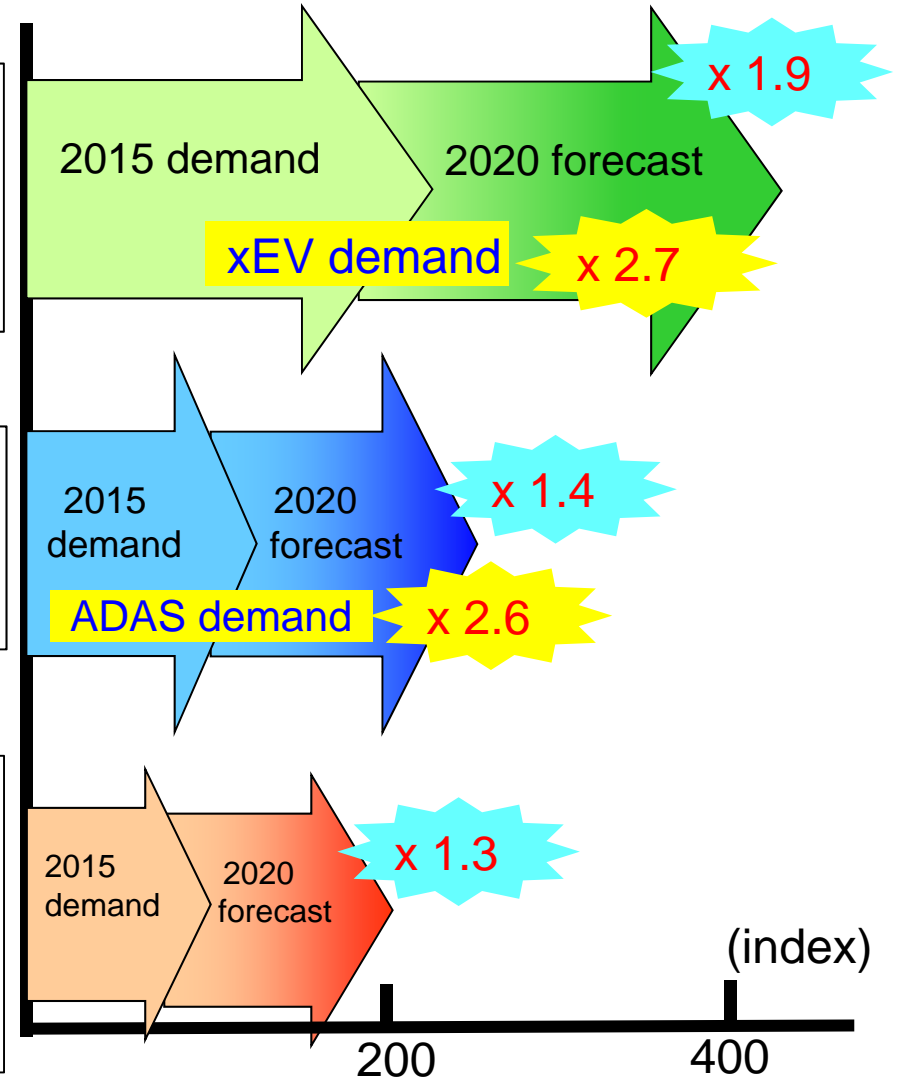
xEV
(electrics, hybrids, fuel cells)
48V System
Engine Control Unit
Idling Stop
Transmission

Safety

ADAS
(Advanced Driver Assistance Systems)
Brake systems (ABS, etc.)
Airbags
TPMS

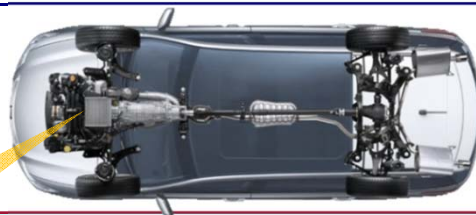
Comfort & Connectivity



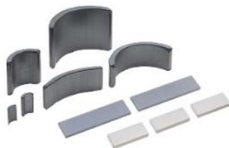
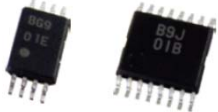


V2X
In-Vehicle Infotainment
Emergency communication (e-Call)
Keyless Entry
LED headlamps
Electric Park Brake (EPB)



Strategic TDK Products for Automotive Applications

Fuel Efficiency

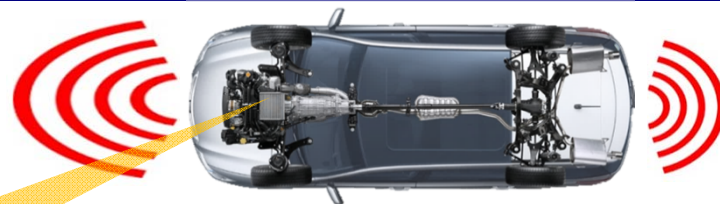


| Strategic Products | Features |
|--|--|
| <p>DC/DC converters & key components</p>  | <ul style="list-style-type: none"> * Miniaturized to provide space-saving advantage to auto makers. * Further reduction in size and higher efficiency achieved through new materials (e.g. GaN, new magnetic materials). |
| <p>On-board chargers</p>  | <ul style="list-style-type: none"> * Demand surging with the increase of EV/PHEV DC/DC converter technologies are utilized to make the chargers smaller, lighter and more efficient. |
| <p>Magnets</p>  | <ul style="list-style-type: none"> * Neodymium magnets: saves energy/electricity when used in EV drive motor. Dy (dysprosium)-free, and rare earth-free magnets are being developed. * Ferrite magnets: Allows DC motors to be highly efficient yet smaller in size. We now have La (lanthanum)-free and Co (cobalt)-free types. |
| <p>TMR sensors</p>  | <ul style="list-style-type: none"> * TMR enhances high-precision control in EPS, thus answering the need for improved fuel efficiency. * TMR allows for higher sensitivity and stable accuracy operation in a wider range of temperature (sensitivity vs. AMR = x30; vs. GMR= x8). |
| <p>Wireless charging system</p>  | <ul style="list-style-type: none"> * By 2022, 10% of EV/PHEV will be equipped with wireless charging system (TDK estimate: 300-500 thousand vehicles). * Magnetic resonance coupling and magnetic technologies will assure highly efficient wireless power transfer.  |

Strategic TDK Products for Automotive Applications

Safety

Comfort & Connectivity



Strategic Products

Features

Common mode filters for CAN-BUS / FlexRay, Ethernet



* High reliability design for automotive use; wide frequency range common mode impedance effective for extended output characteristics that differ with each IC model.

MLCCs



* High-rel. auto grade series, guaranteed for high temp. (150°C): high capacitance, mid-voltage, mega-caps, and soft termination capacitors.

Inductors
High temp. (150°C) power inductors
antenna coils



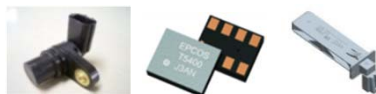
* High-efficiency/high-reliability power inductors designed for performance in the grueling conditions of the engine compartment (-55°C ~ +150°C).
* Antenna coils for use in wireless devices - smart keys, TPMS (tire pressure monitoring system), etc. - are now being mass produced.

SAW devices / thin film high freq. filters
Bluetooth® modules

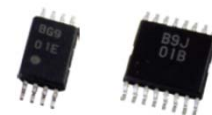


• Communication products have been further developed for automotive applications such as keyless entry and telematics.

Sensors
Magnetic, pressure, current, temperature, light, etc.



Sensors are adapted for automotive use: TMR sensors are used for angle, position, rotation and current sensing applications.



Get products on automotive IC reference designs through close collaboration with IC makers.

TDK Sales Growth in the Automotive Market



Motor magnets (since 1977)

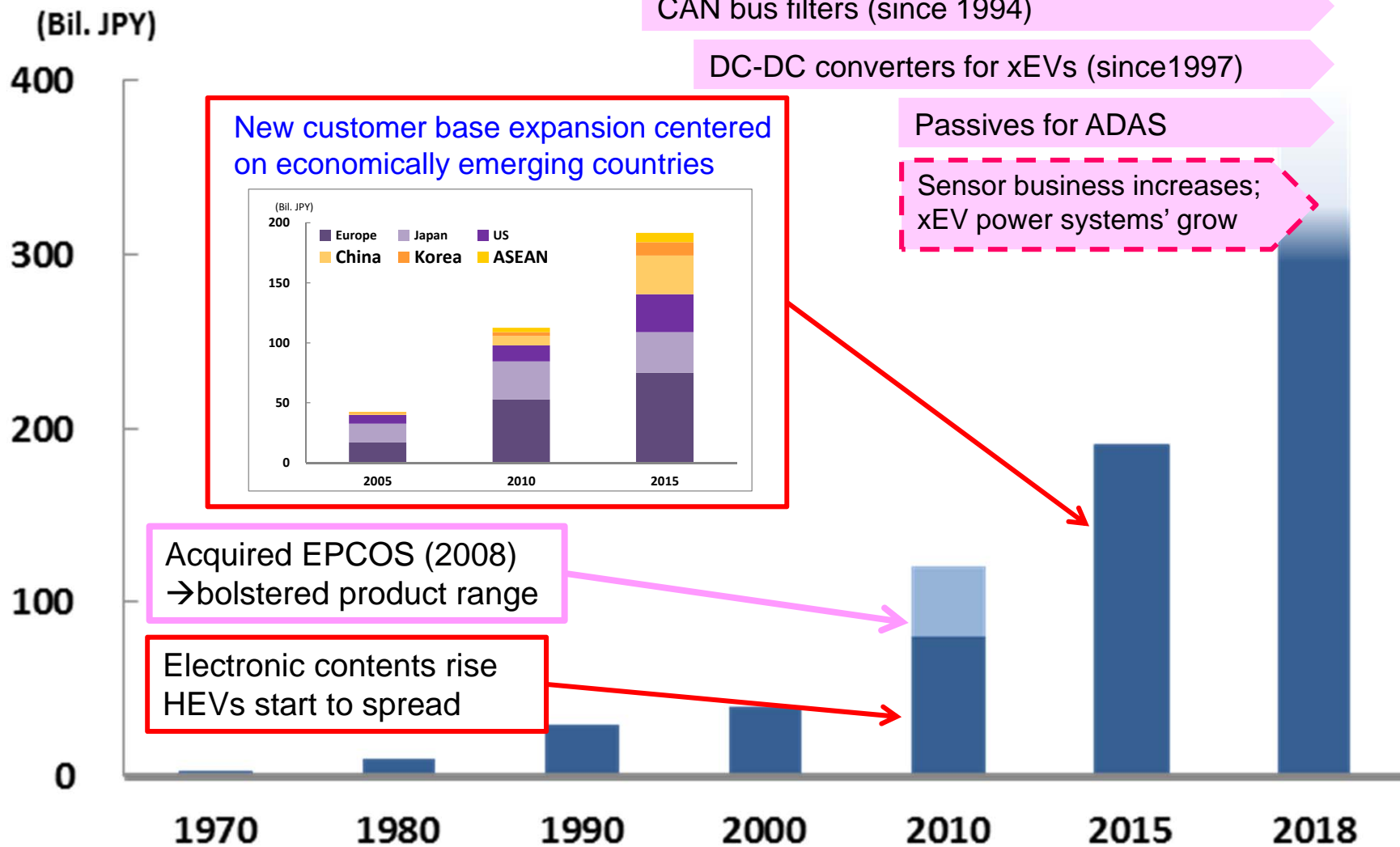
Sales expansion of passive components for ECUs (from 1980s)

CAN bus filters (since 1994)

DC-DC converters for xEVs (since 1997)

Passives for ADAS

Sensor business increases;
xEV power systems' grow



Various Automotive Electronics Solutions



Design and build in automotive
-level quality and reliability

Fuel
Efficiency

Comfort &
Connectivity



Safety



Magnet (Dy-free)



NTC thermistor



On-board chargers

DC-DC Converter



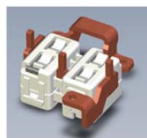
Wireless Charging System



CeraLink



Transformer



Power EMC Filter



PTC element



PZT



TMR angle sensor



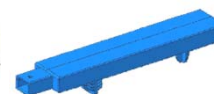
Position sensor
Gear-tooth sensor



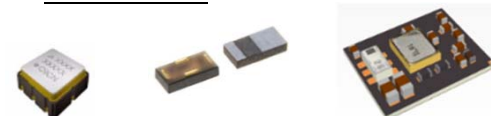
Pressure sensor



Antenna Coil
LF Antenna



3D Antenna Coil



SAW/ thin film devices / modules



Contactless feed



Buzzer



Common mode filter



Inductor



Film Capacitor



ALU Capacitor



MLCC

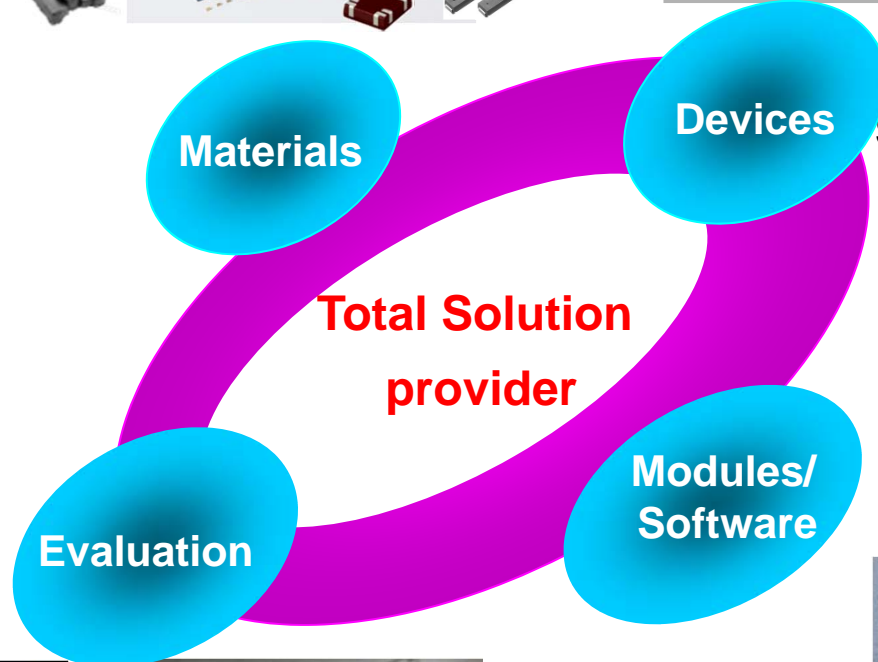
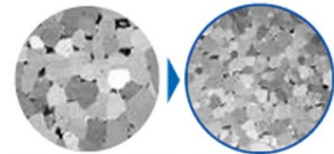
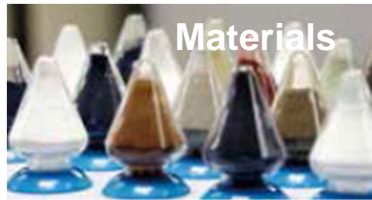


Chip-varistor

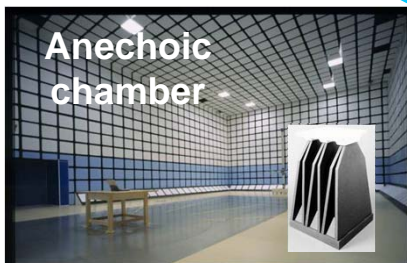
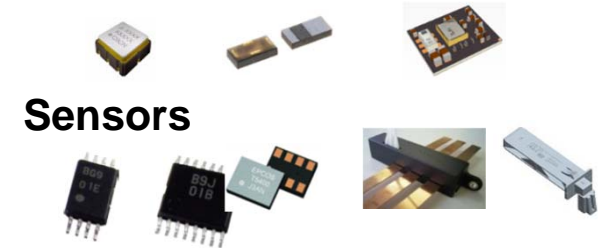
Total Solution Provider to the Automotive Market



As a Total Solution Provider, TDK meets and exceeds customers' needs – from materials technology to electronic components, modules and testing services.



SAW/ thin film devices / modules



➔ Support to meet Automotive EMC Standard "CISPR"

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