ON Semiconductor®

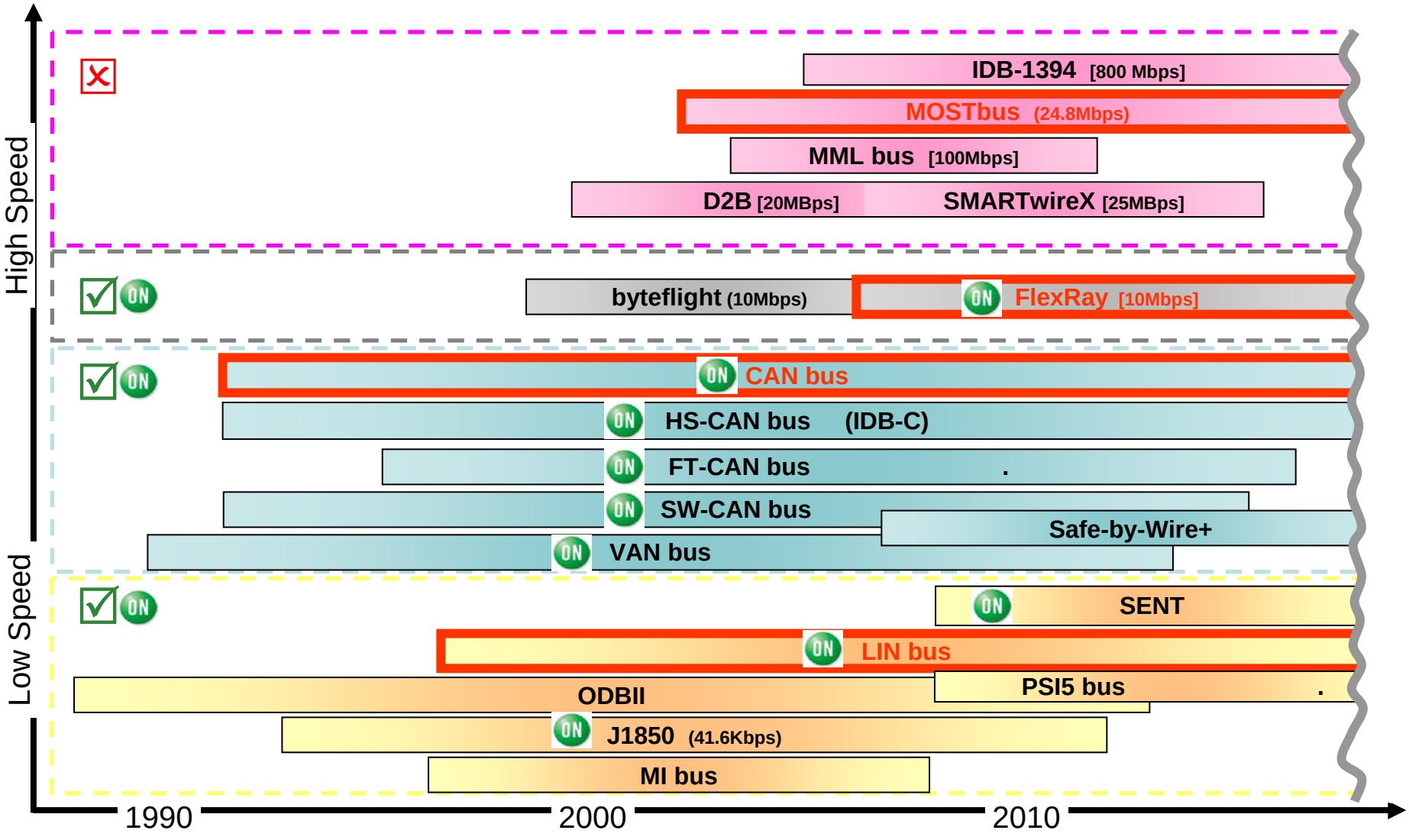
In Vehicle Networking ESD Performance

Agenda

1. Introduction
2. Automotive Requirements
   - Quality, High Temperatures & Robustness
   - EMC/ESD performance
3. Physical layer:
   - ESD Protection
   - Transceivers
4. OEM approvals
5. Take-aways

Introduction

In Vehicle Networking - Standards



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Automotive Requirements

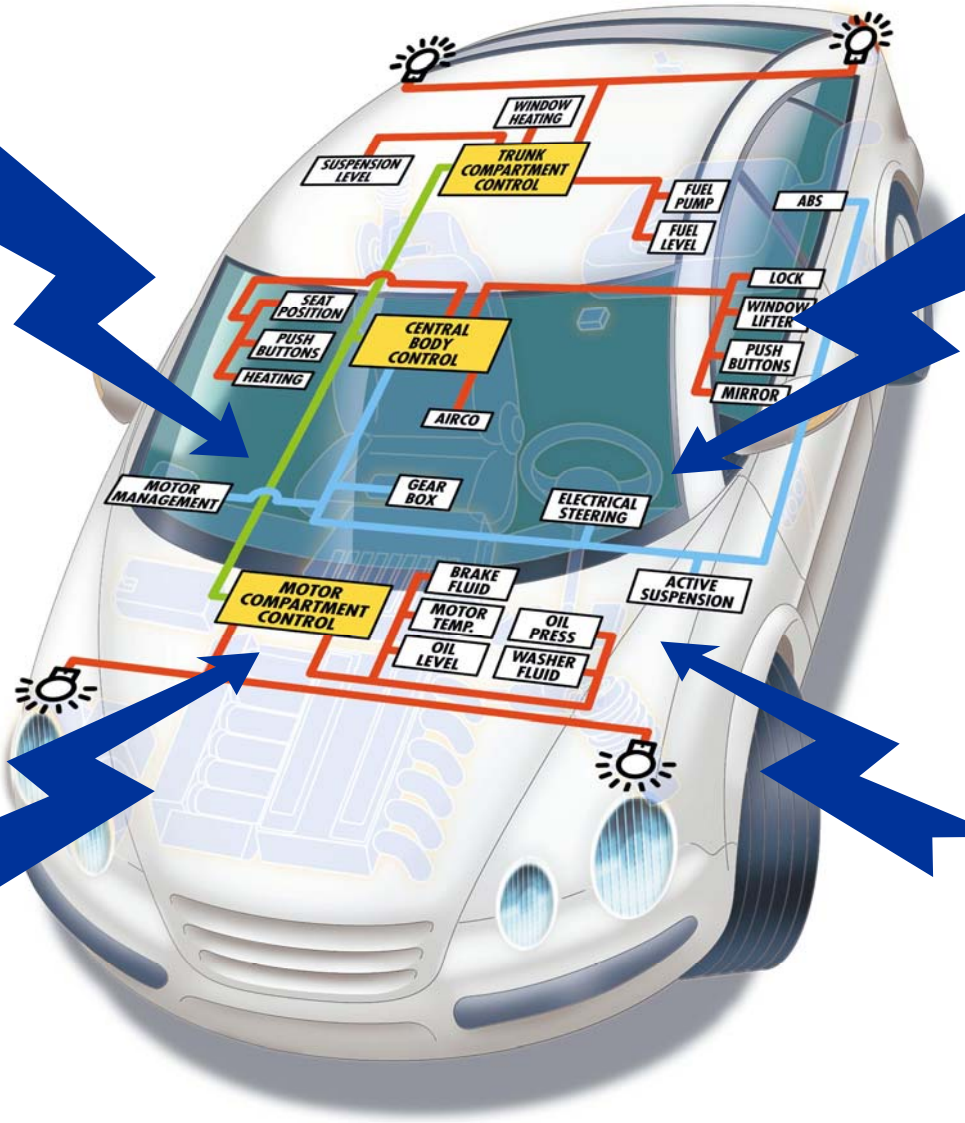
Robustness to error conditions

Quality & safety

EMC:

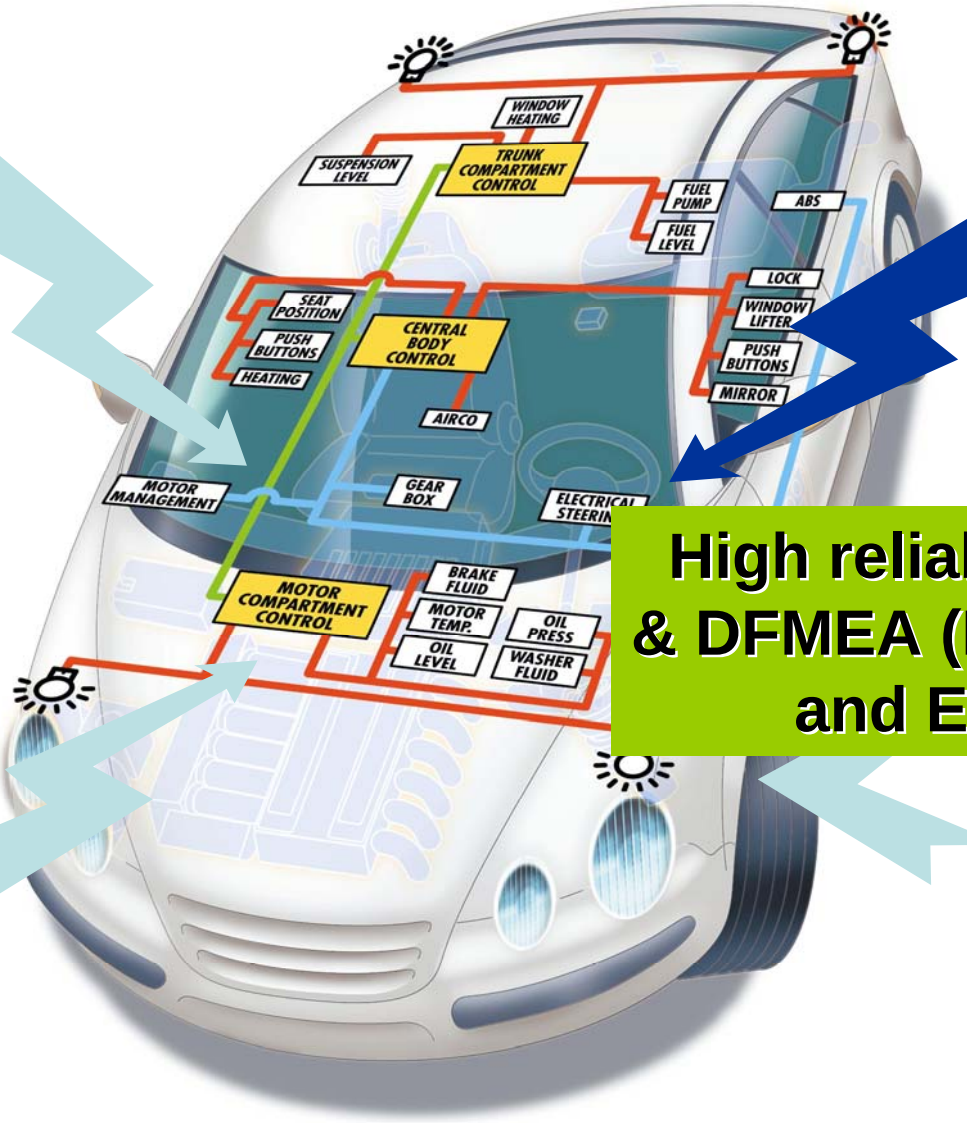
EME, EMS, Schaffner, ESD

High voltage & High temperature



Automotive Requirements

Robustness to error conditions



Quality & safety

High reliability requirements & DFMEA (Design Failure Mode and Effect Analysis)

EMC:

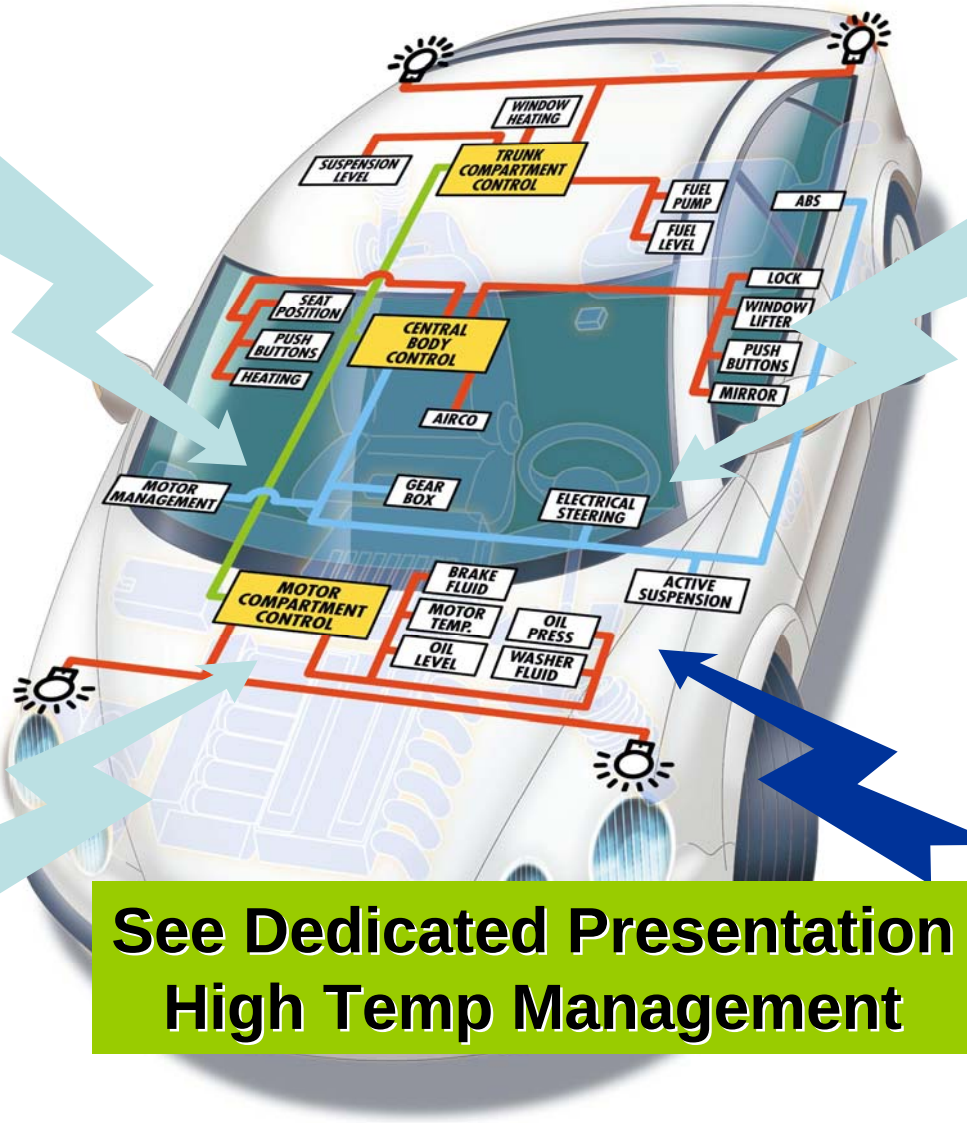
EME, EMS, Schaffner, ESD

High voltage & High temperature

Automotive Requirements

Robustness to error conditions

Quality & safety



EMC:

EME, EMS, Schaffner, ESD

See Dedicated Presentation
High Temp Management

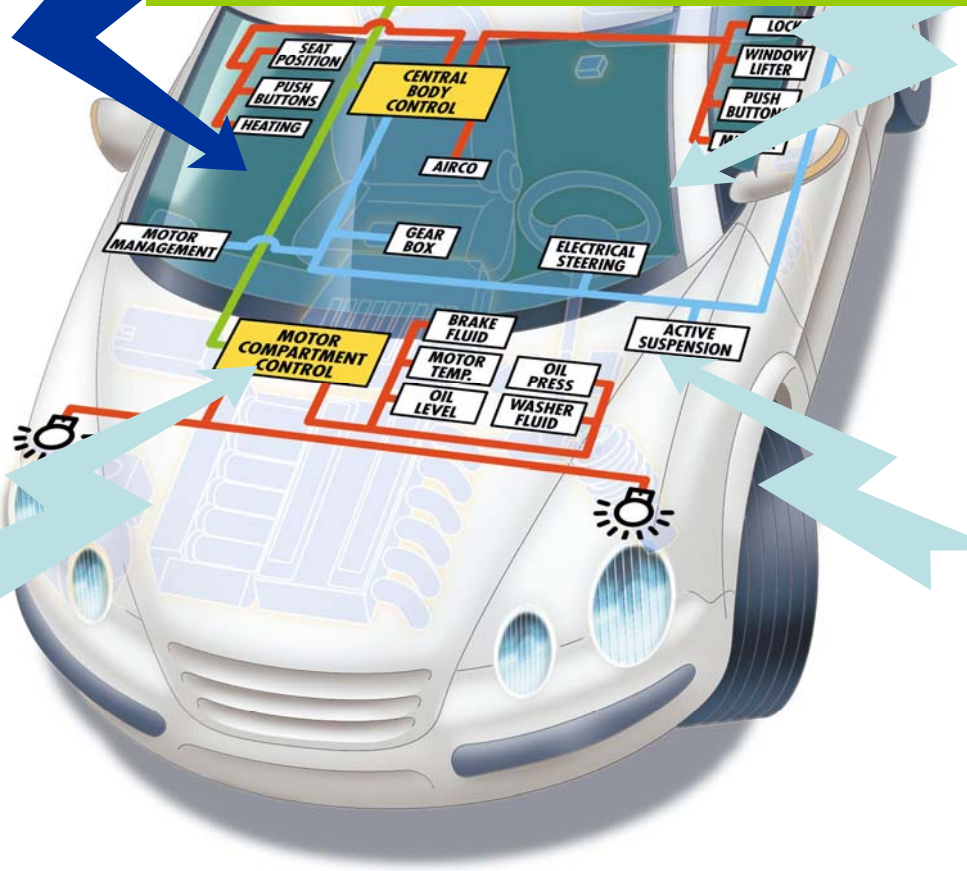
High voltage
&
High temperature

Automotive Requirements

Robustness to error conditions

See: CAN LS Fault Tolerant & Error Detection on HS CAN And System Basis Chips

Quality & safety



EMC:

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Automotive Requirements

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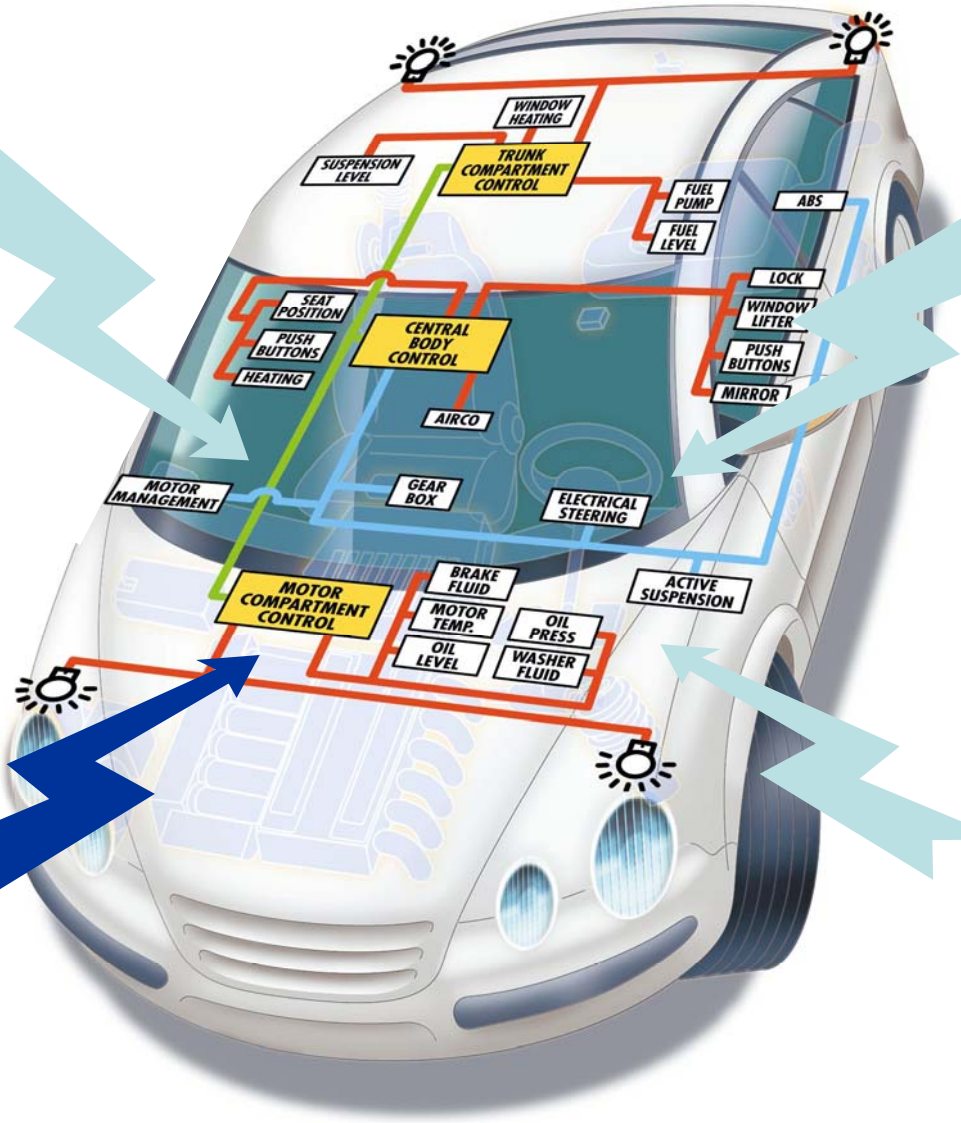


EMC : Definition

Definition (UK Defense Standard 59-41)

"Electro Magnetic Compatibility is the ability of electrical and electronic equipments, subsystems and systems to share the electromagnetic spectrum and perform their desired functions without unacceptable degradation from or to the specified electromagnetic environment."

In other words:

The Electro Magnetic Emission (EME) must be low enough, not to disturb the environment

The Electro Magnetic Susceptibility (EMS) must be low enough, not to be disturbed by the environment

Requirements

Modules, distributed over the car-body have to comply with stringent EMC and ESD

See Dedicated Presentation EMC/EMI

dBm level	Power	Notes
80 dBm	100 kW	Typical transmission power of FM radio station with 50 km range
60 dBm	1 kW = 1000 W	Typical combined radiated RF power of microwave oven elements
50 dBm	100 W	Typical thermal radiation emitted by a human body
40 dBm	10 W	
36 dBm	4 W	Typical maximum output power for a Citizens' band radio station (27 MHz) in many countries
33 dBm	2 W	Maximum output from a UMTS/3G mobile phone (Power class 1 mobiles) Maximum output from a GSM850/900 mobile phone
30 dBm	1 W = 1000 mW	Typical RF leakage from a microwave oven - Maximum output power for DCS 1800 MHz mobile phone Maximum output from a GSM1800/1900 mobile phone
27 dBm	500 mW	Typical cellular phone transmission power Maximum output from a UMTS/3G mobile phone (Power class 2 mobiles)
26 dBm	400 mW	
25 dBm	316 mW	
24 dBm	250 mW	Maximum output from a UMTS/3G mobile phone (Power class 3 mobiles)

ESD Definitions

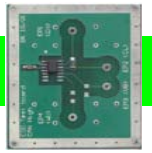
Automotive Electronics Council

Electrostatic Discharge (ESD):

The transfer of electrostatic charge between bodies at different electrostatic potentials.

Component Level

- **Machine Model (MM) ESD:**
  An ESD pulse meeting the waveform criteria specified in this test method, approximating an ESD pulse from a machine or mechanical equipment.
- **Charged Device Model (CDM) ESD:**
  An ESD pulse meeting the waveform criteria specified in this test method, approximating an ESD event that occurs when a component becomes charged (e.g., triboelectric) and discharges to a conductive object or surface.
- **Human Body Model (HBM) ESD:**
  An ESD pulse meeting the waveform criteria specified in this test method.

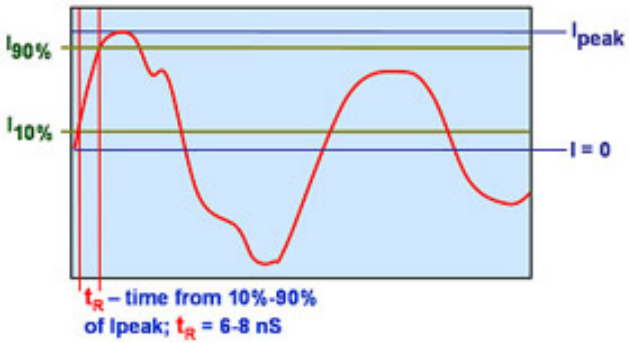


System Level

- **Indirect application**
  Application of the discharge to a coupling plane in the vicinity of the equipment under test (EUT), and simulation of personnel discharge to objects which are adjacent to the EUT.

Component
Machine Model (MM) ESD

- Machine Model simulates a more rapid and severe electrostatic discharge from a charged machine, fixture, or tool.
- Modeled by RC with R=0 Ω, C=200 pF
- Failures are mostly similar to HBM but at much lower voltage levels



Pulse parameters	MM
Reference voltage	200V…400V
Peak current	3.5A…7A
Rise time	10nsec
Pulse duration	150nsec

- Standards:
  - AEC-Q100-003 (200 pF, 0,75 µH, 10 Ω)
  - JESD22-A115-A

"Based on improved static control technology, field failure rate, case study and ESD design data, collected from IC suppliers and contract manufacturers, we propose more realistic and safe MM ESD target levels. .. new levels **30V MM** are easily achievable with static control methods mandated by customers and with today's modern ESD design methods."

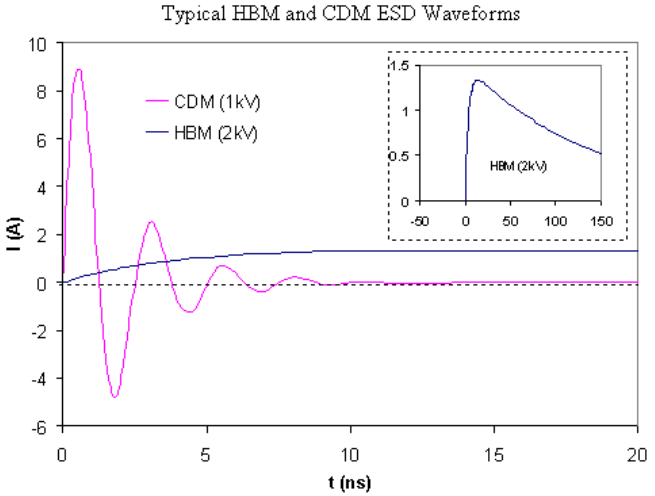
Industry Council: **JEDEC** JEP155, Aug. 2007

Component

Charged Device Model (CDM) ESD

- Represents the discharge of a charged device (and package) to ground through a single device pin.
- Simulates real-world ESD events during automatic handling, marking, picking, placing

- Standards:
  - AEC-Q100-011
  - ESD-DS5.3.1 (➔ ESD-S5.3.1)
  - JESD22-C101 (robotic)



Pulse parameters	CDM
Reference voltage	500V…1KV
Peak current	18A…36A
Rise time	250psec
Pulse duration	750psec

"… improved static control technology specific to CDM, and limited ESD design capability in today's leading technologies, we recommend a **CDM** specification target level of **250V**".

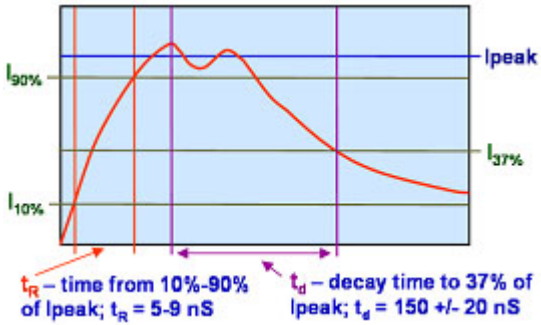
Industry Council: **JEDEC** JEP157, Mar. 2009

Component

Human Body Model (HBM) ESD

- Represents the discharge of a standing individual through a pointing finger
- Modeled by R=1.5 KΩ, C=100 pF

- Standards:
  - AEC-Q100-002
  - ANSI/ESD STM5.1 - 2007
  - JESD22-A114F
  - IEC 61000-4-2 (C= 150pF)
  - MIL883 method 3015

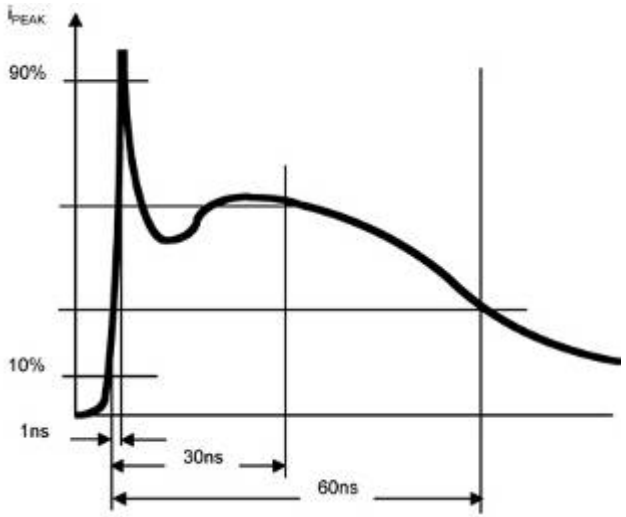


Pulse parameters	**HBM**
Reference voltage	2KV…4KV
Peak current	1.3A…2.6A
Rise time	10nsec
Pulse duration	150nsec

"… new levels **1kV HBM** are easily achievable with static control methods mandated by customers and with today's modern ESD design methods."

Industry Council: **JEDEC** JEP155, Aug. 2007

System
ESD-requirements



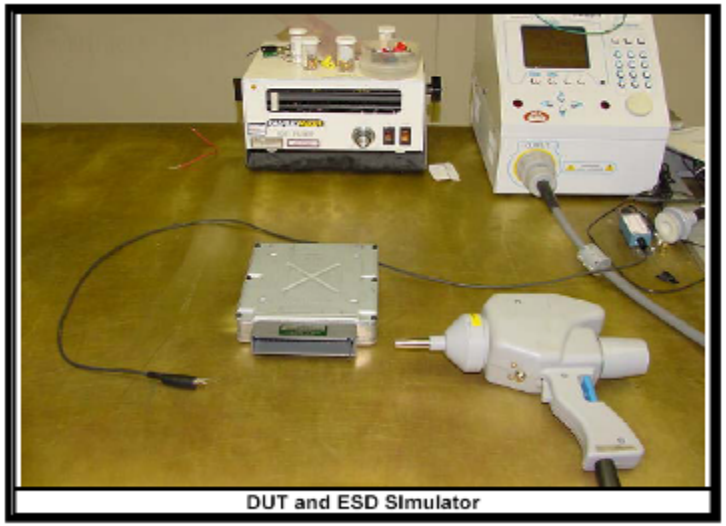
- Model for human ESD events at **application module level** in badly protected environments.
- Only relevant to user accessible application parts :
  - Direct contact discharge (e.g. on connector pins).
  - Air discharge (e.g. on housing, connector, cabling).

Contact Discharge		Air Discharge	
Level	Voltage [kV]	Level	Voltage [kV]
1	2	1	2
2	4	2	4
3	6	3	8
4	8	4	15

- Un-Powered and Powered state.

- Standards :
  - ISO TR 10605 (330 pF / 2000 Ohm)
  - IEC (6)1000-4-2 (150 pF / 330 Ohm)(*)

Voltage [kV]	Peak Current [A] HBM	Peak Current [A] IEC 61000-4-2
2	1.33	7.5
4	2.67	15.0
6	4.00	22.5
8	5.33	30.0
10	6.67	37.5


DUT and ESD SImulator

(*): 3rd Generation [1st Gen. = IEC801-2 (1980); 2nd Gen. = IEC 1000-4-2 (1995)]

System

Transients (not ESD)

- Automotive transients (ISO-7637-1):

  Electrical transient conduction along the supply lines only.

- ISO-7637-1 describes two types of pulses
  - Pulses 1, 2, 3a, 3b, 5, 6 and 7 describe high voltage, high power transient disturbances on the supply line.
  - Pulse 4 defines the minimum battery voltage.

    Note:

    Battery Voltage = module supply voltage.

    Internal IC supply voltage = module supply
    - reverse battery diode
    - module supply regulator
    - internal supply regulator of the chip.

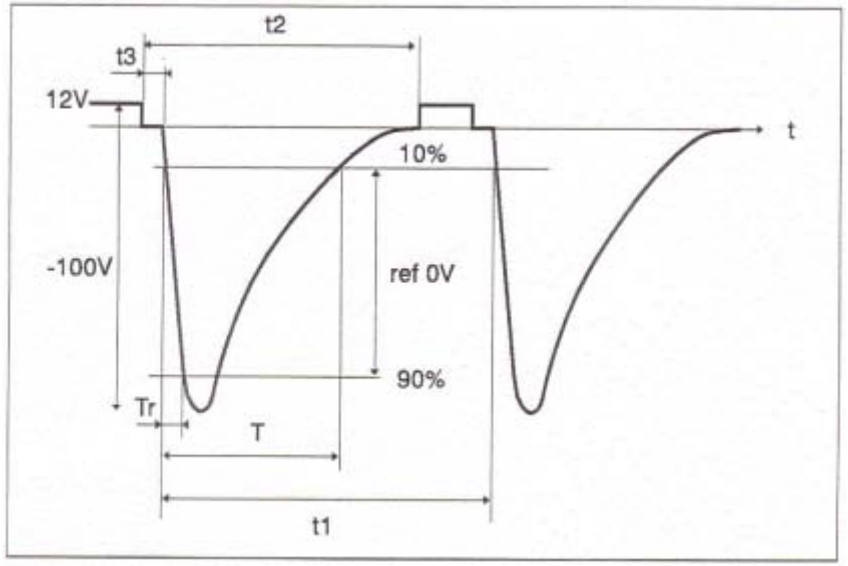
➔ *Schaffner Pulses*

ISO-7637-1 pulses

Standard test pulse 1

Disconnection of a supply from an inductive load, while the device under test remains in parallel with the inductive load

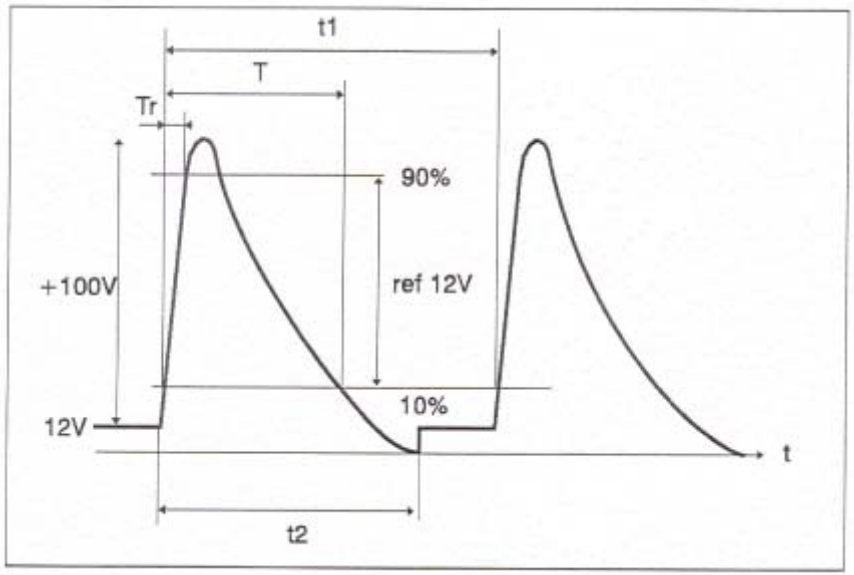
(ISO 7637, part1)



Standard test pulse 2

Interruption of the current in an inductor in series with the device under test

(ISO 7637, part1)

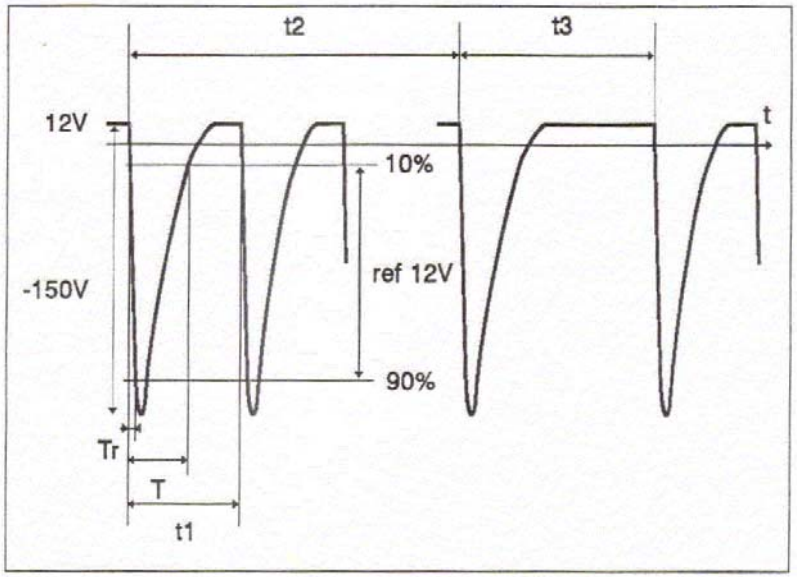


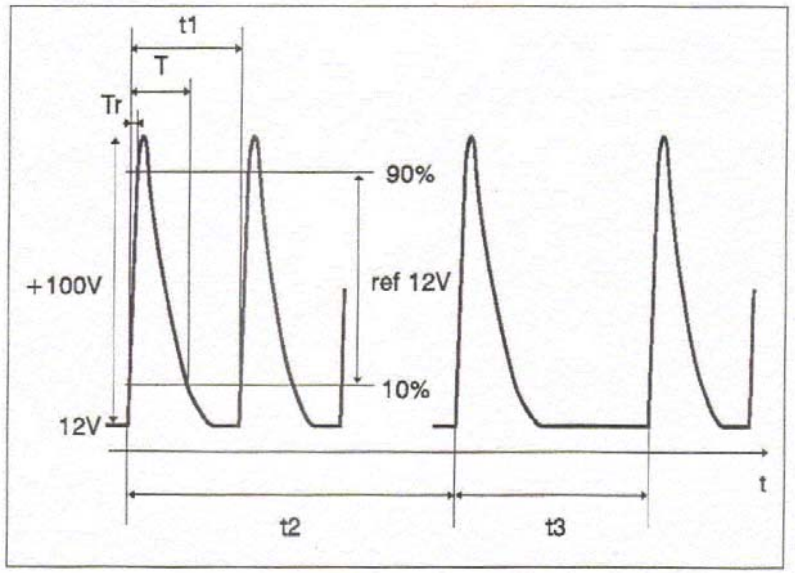
ISO-7637-1 pulses

Standard test pulses 3a and 3b

These pulses simulate transient, occurring as a result of switching processes. They are influenced by distributed capacitances and inductance of the wiring harness.

(ISO 7637, part1)



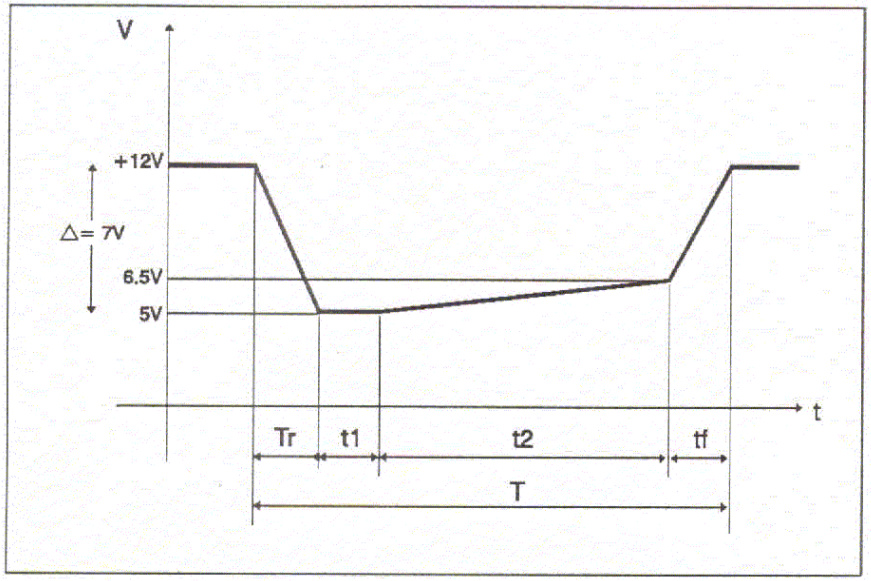


ISO-7637-1 pulses

Standard test pulse 4

BATTERY VOLTAGE DROP:
During motor start, the battery is overloaded and the voltage drops, especially in cold weather.

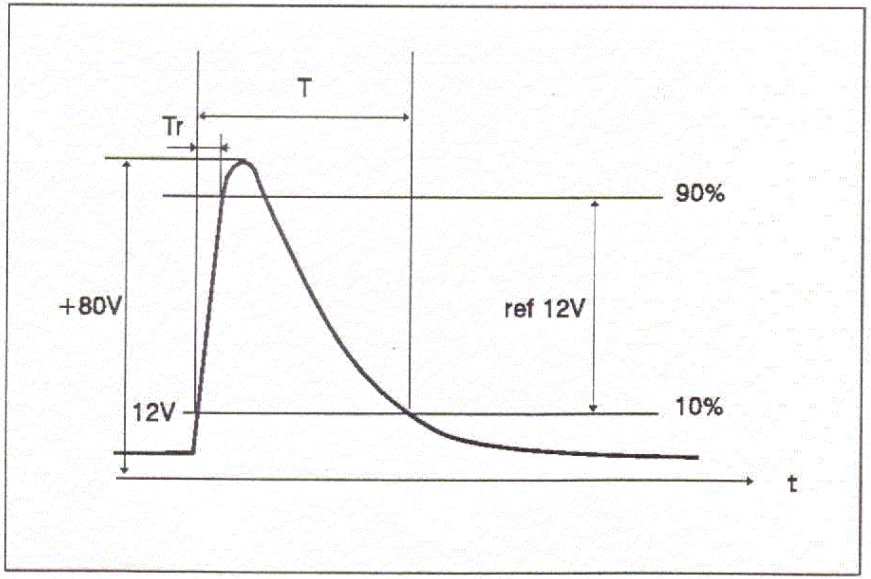
(ISO 7637, part1)



Standard test pulse 5

LOAD DUMP:
This happens when the battery is disconnected while it is being charged by the alternator.

(ISO 7637, part1)

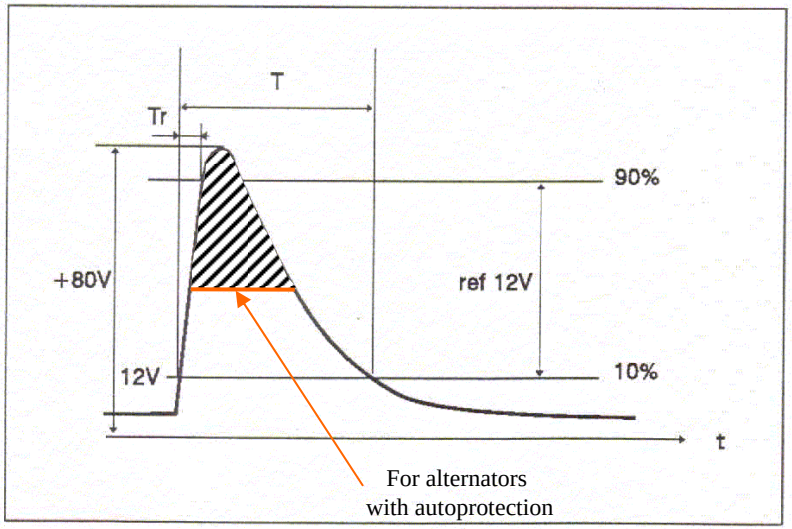


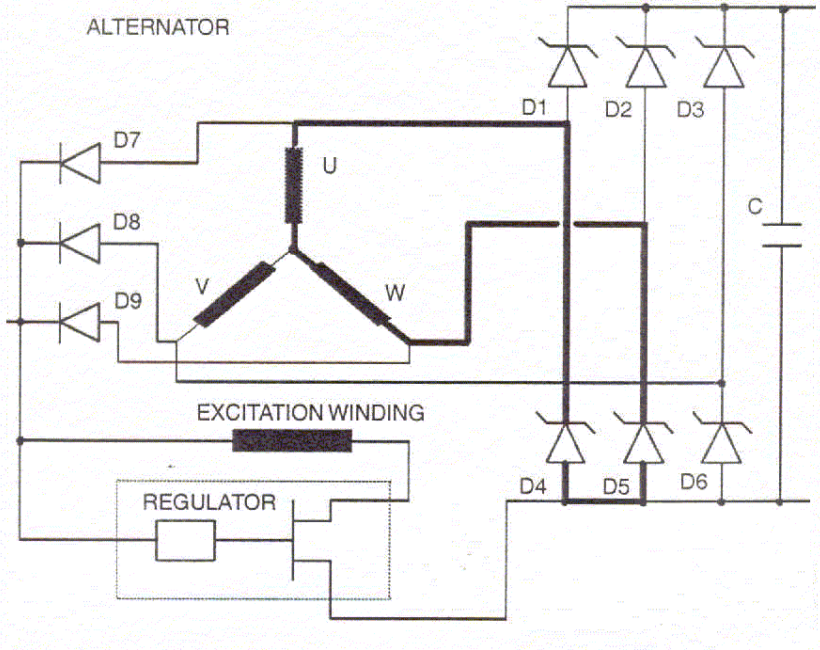
ISO-7637-1 pulses

Standard test pulses 5 : LOAD DUMP clamped

Load dump amplitude depends on alternator speed and field excitation.
Load dump duration depends on the time constant of the field excitation circuit and the amplitude.

Today most alternators have an internal protection against load dump surge. The 6 zener diodes clamp above 24 Volt.





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Component
ESD protection

- ESD Sources and Effects
  - A person can become electrically charged by everyday work activities such as walking across a carpeted floor or standing up from a chair.
  - When a statically-charged person or object touches an ESD sensitive (ESDS) device, there is a possibility that the electrostatic charge could be drained through sensitive circuitry in the device.
  - If the ESD event possesses sufficient energy, damage could occur in the device.
  - The damage may cause the device to be non-functional, or worse, it may be weakened and failed at a later time.

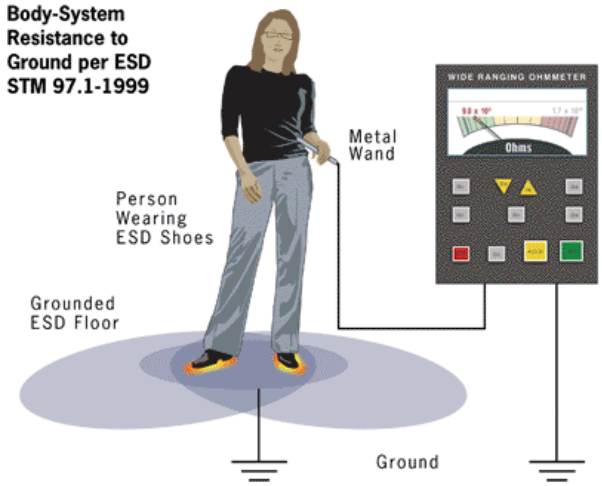
- Sources of Static Electricity

Object or Process	*Material or activity*
Work Surfaces	Waxed, painted, or plastic surfaces
Floors	Waxed, common vinyl tiles, or sealed concrete
Clothes	Common smocks, non-conductive shoes, synthetic materials (e.g. nylon)
Chairs	Fabric, vinyl, fiberglass, finished wood
Packaging	Common plastic bags, foam, trays, tote boxes
Assembly area	Spray cleaners, heat guns, blowers, plastic tools (solder suckers, brushes), cathode ray tubes

Component
ESD protection

- **Avoidance ➔** Keep Component at the same potential as surrounding!

- **ESD Control ➔** Checking of Protection
  - Wrist straps – Check prior to each use to confirm “pass”
  - Heel straps – Check prior to each use to confirm “pass”
  - ESD smocks – Check prior to each use to confirm “pass”
  - Floors – Shall be checked on scheduled audits.
  - Bench mats – Shall be checked on scheduled audits
  - Floor mats – Shall be checked on scheduled audits



<u>Use of ESD protection equipment is pointless without performing proper checking!!</u>

- ESD Procedures and Product Handling in the Development Center

- **Training ➔** all of the above is useless without a properly trained workforce

Why External ESD

- Protection Devices Are Needed
  - Input/output connectors provide a path for ESD to enter the circuit and damage sensitive components.
  - IC's are becoming more vulnerable to ESD as feature size decreases.
  - Protection devices are most effective when placed at the connector or port, suppressing the ESD event before it gets coupled into the board.
  - Mandated standards for ESD immunity (IEC61000-4-2)

- Automotive Bare Die
  - Seremban Die Center of Excellence created to serve growing market for bare die in automotive applications
    - 100% electrical testing per device specification
    - 100% visual inspection
    - TS16949 certified factories
    - Registered to ISO 9001:2000
  - Good growth trend in bare die Zener and TVS diodes for automotive applications

ESD Protection

Zener & TVS Diodes

Zener Voltage Regulators

200 mW	SOD-523	MM5Z (2%, 5%)
200 mW	SOD-323	MM3Z (2%, 5%)
225 mW	SOT-23	BZX84C (5%)
500 mW	SOD-123	MMSZ4 (5%)
1.5 W	SMA	1SMA59 (5%)
3.0 W	SMB	1SMB59 (5%)

Energy Rated Zener Voltage Regulators

MMBZ E, BZX84C E, MMSZ E

(Peak Surge Power of 225 W with 8X20 µsec waveform)

CAN and LIN Dataline ESD Protection

NUP2105LT, NUP1105LT, MMBZ27VCLT, MMBZ27VALT, MMBZ27VCW, MMBZ27VAW

New Products

Transient Voltage Suppressors

200 W*	SOD-123	SMF (Uni)
400 W	SMA	1SMA (Uni, Bi)
600 W	SMB	1SMB5.0, P6SMB (Uni, Bi)
1500 W	SMC	1SMC, 1,5SMC (Uni)

* Peak Surge Power with 10x1000 µsec waveform

Regulating and protecting increasingly complex circuits

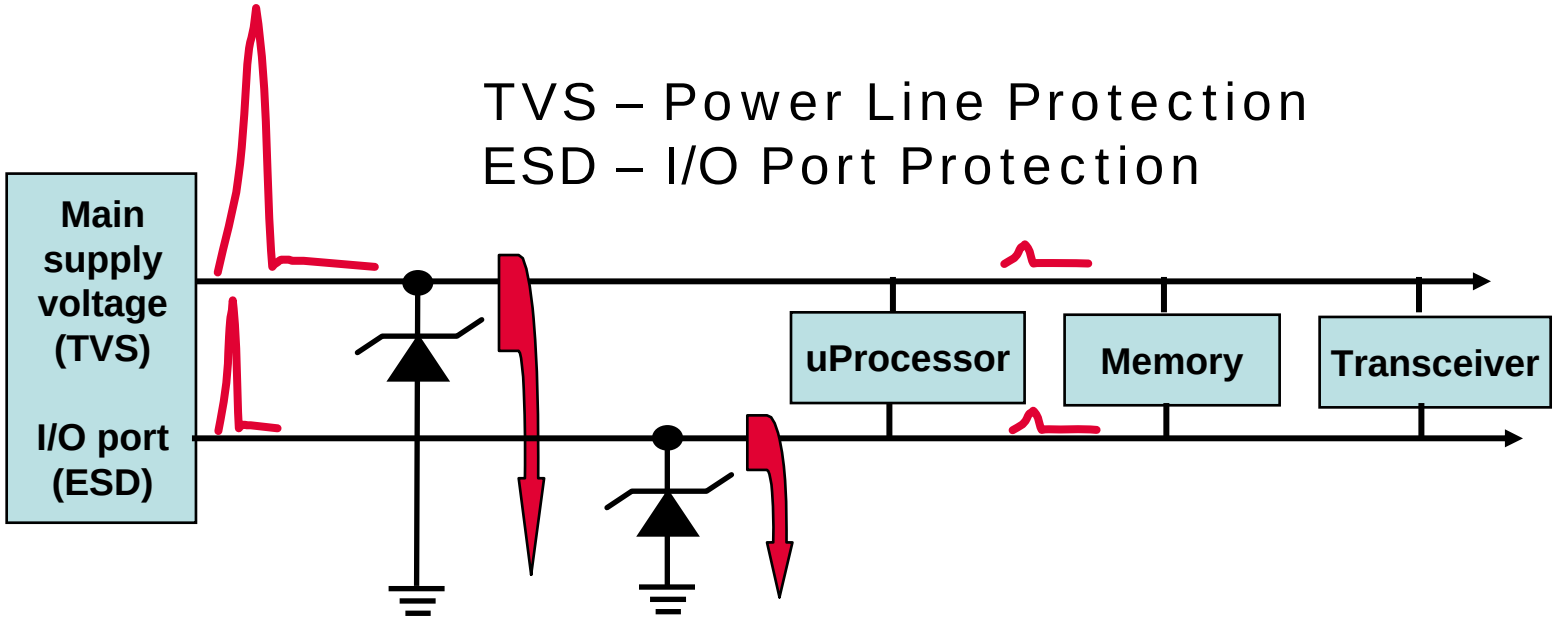
Protection

Transient Voltage Suppression (TVS)

TVS Diodes are used to protect semiconductors in electronic systems from damage or upset due to overvoltage transients on power or signal lines. The major causes of overvoltage transients in electronic systems are:

- Lightning
- Switching of loads in power electronic circuits
- Electrostatic Discharge (ESD)

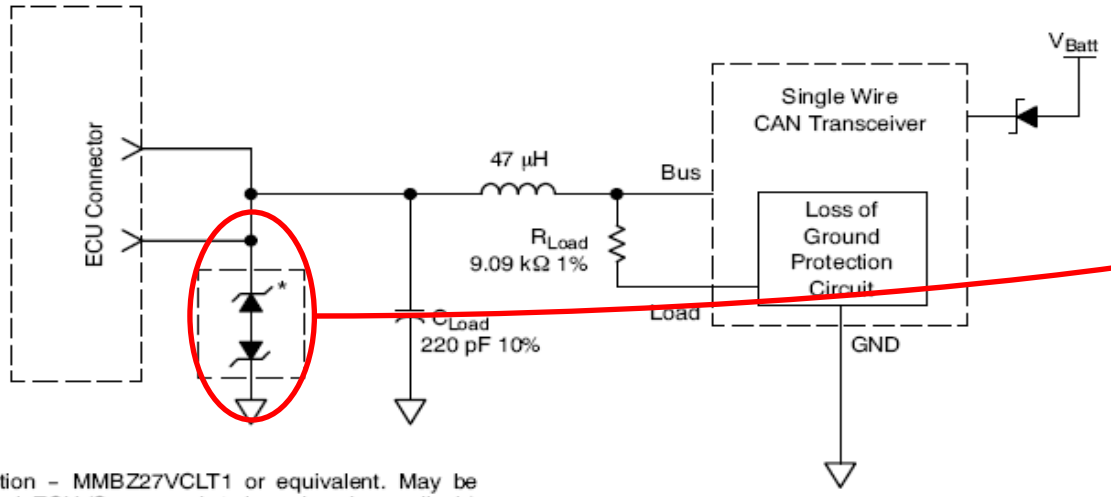
TVS Diodes protect systems by clamping the amplitude of the transient voltage to a safe level and shunting the transient to ground by way of avalanche breakdown



Automotive Network Protection

MMBZ15VDLT1, MMBZ27VCLT1

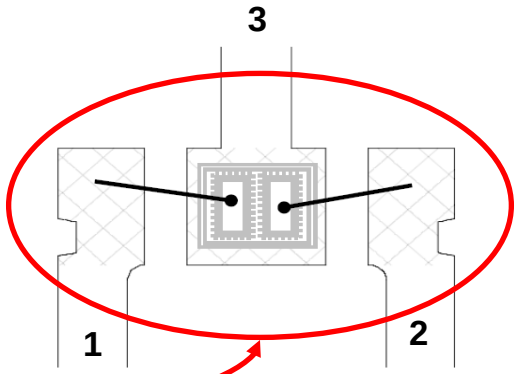
TYPICAL APPLICATIONS



*ESD Protection – MMBZ27VCLT1 or equivalent. May be located in each ECU (C_{Load} needs to be reduced accordingly) or at a central point near the DLC.

Figure 7. Single Wire CAN Network

Figure is the recommended solution for transient EMI/ESD protection. This circuit is shown in the Society of Automotive Engineers February, 2000 J2411 "Single Wire CAN Network for Vehicle Applications" specification (Figure 6, page 11). Note: the dual common anode zener configuration shown above is electrically equivalent to a dual common cathode zener configuration.



MMBZ27VCLT1
RTM: 1994
Package: SOT-23
Pin 3 is Cathode

MMBZ27VALT1
RTM: 2000
Package: SOT-23
Pin 3 is Anode

MMBZ27VCW Dual Zener Diode

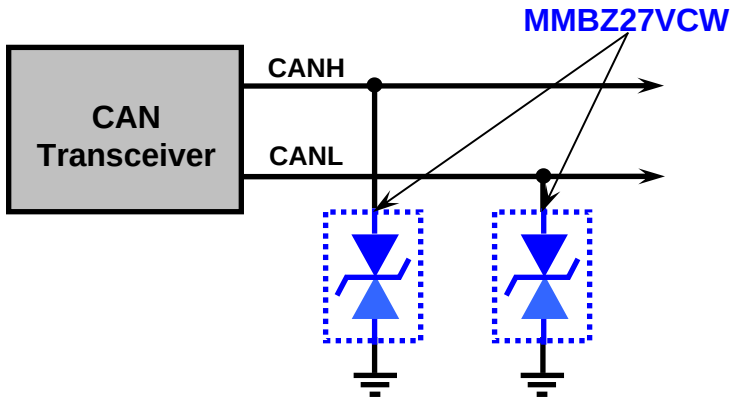
New Product

27 V dual common cathode zeners for ESD protection of CAN and LIN datalines

Product Description

The MMBZ27VCW is designed to provide ESD protection for CAN and LIN transceivers in automotive applications. This new device offers the same electrical performance as the popular and proven MMBZ27VCL, which is the recommended solution for transient EMI/ESD protection by the Society of Automotive Engineers February, 2000 J2411 “Single Wire CAN Network for Vehicle Applications” specification. This device is housed in the SC-70 package, which consumes 40% less board area than the SOT-23. AEC Q101 qualified.

Typical Application Diagram



Key Electrical Specifications

Leakage	< 50 nA at 22 Vrwm
ESD Rating	± 30 kV IEC 61000-4-2
	± 16 kV HBM
Surge Rating	40 W (10x1000 µsec)
Capacitance	30 pF
Breakdown Voltage	27 V

SC-70 Package Specifications

- Length 2.0 mm
- Width 2.2 mm
- Height 1.0 mm
- Pb Free

40% less board area than SOT-23

SC-70

MMBZ27VAW Dual Zener Diode

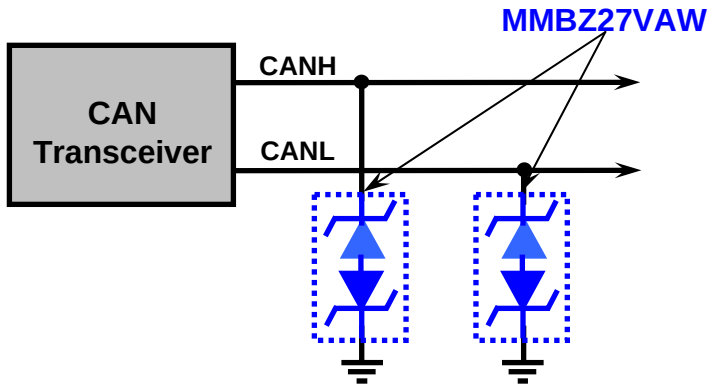
New Product

27 V dual common anode zeners for ESD protection of CAN and LIN datalines

Product Description

The MMBZ27VAW is designed to provide ESD protection for CAN and LIN transceivers in automotive applications. This new device offers the same electrical performance as the popular and proven MMBZ27VAL, which is the recommended solution for transient EMI/ESD protection by the Society of Automotive Engineers February, 2000 J2411 “Single Wire CAN Network for Vehicle Applications” specification. This device is housed in the SC-70 package, which consumes 40% less board area than the SOT-23. AEC Q101 qualified.

Typical Application Diagram



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SC-70 Package Specifications

- Length 2.0 mm
- Width 2.2 mm
- Height 1.0 mm
- Pb Free

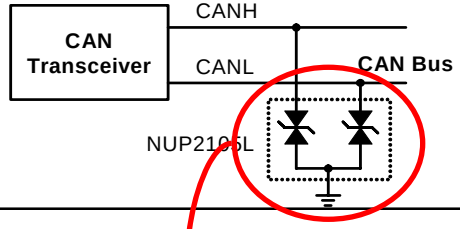
40% less board area than SOT-23

SC-70

NUP2105L – Dual Wire CAN Bus Protector

The NUP2105L has been designed to protect the CAN transceiver in high-speed and fault tolerant networks from ESD and other harmful transient voltage events. The protection circuitry has been integrated into the compact SOT-23 package.

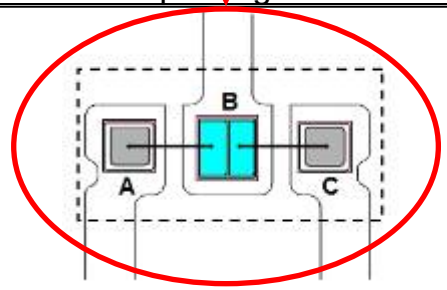
- **Description**
  - Provides bi-directional clamping on the CAN_H and CAN_L signal lines
  - Suitable for 12V systems

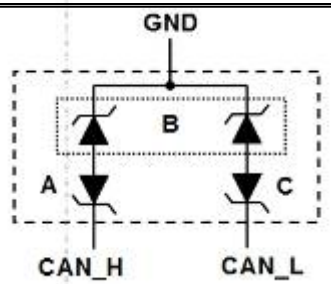


- **Packaging**
  - Industry Standard SOT-23
    - Typical: 2.9mm (L) x 2.4mm (W) x 1.00mm (H)
- **Product Ordering Information**
  - NUP2105LT1
    - 3000/Tape and Reel, Pb-Sn lead finish
  - NUP2105LT1G
    - 3000/Tape and Reel, Tin matte lead finish

- **Features**
  - Compliant to ISO 11898-2 physical layer spec.
  - Bi-directional clamping
  - Capacitance 25pF (typ.)
  - IEC 61000-4-2, Level 4 compliant
  - ISO 7637 compliant
  - Max. clamping voltage of 44V @ 8 A (8x20µs)
  - Integration of 4 diodes into one package
- **Benefits**
  - Increases system reliability and EMI immunity
  - Resolves common mode voltage offset
  - Suitable for 1Mbits/s transmission speed
  - Higher ESD immunity than the CAN transceiver
  - Immunity from repetitive high frequency disturbances
  - Lower clamping voltage than MOV's
  - Reduces component count and saves board space

- **Device architecture**



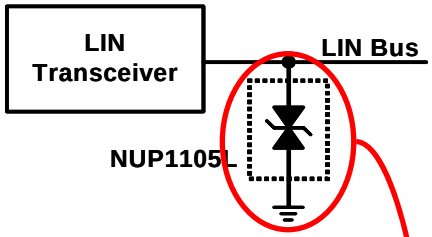


Pin 3 is Cathode

NUP1105L - LIN & Single Wire CAN Protector

The NUP1105L has been designed to protect the LIN transceiver from ESD and other harmful transient voltage events. The protection circuitry has been integrated into the compact SOT-23 package.

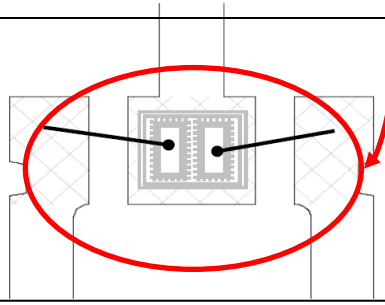
- **Description**
  - Provides bi-directional clamping on the LIN signal line.



- **Packaging**
  - Industry Standard SOT-23
    - Typical: 2.9mm (L) x 2.4mm (W) x 1.00mm (H)
- **Product Ordering Information**
  - NUP1105LT1
    - 3000/Tape and Reel, Pb-Sn lead finish
  - NUP1105LT1G
    - 3000/Tape and Reel, Tin matte lead finish

- **Features**
  - ISO 9141 Compliant
  - Bi-directional clamping
  - IEC61000-4-2, Level 4 compliant
  - ISO 7637 compliant
  - Max. clamping voltage of 40V @ 8 A (8x20µs)
  - Integration of 2 diodes into one package
- **Benefits**
  - Increases system reliability and EMI immunity
  - Resolves common mode voltage offset
  - Higher ESD immunity than the LIN transceiver
  - Immunity from repetitive high frequency disturbances
  - Lower clamping voltage than MOV's
  - Reduces component count and saves board space

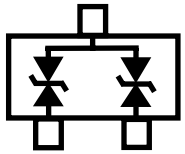
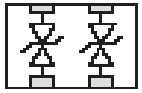
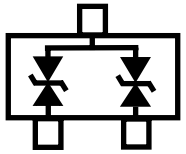
- **Device architecture**



Pin 3 is Cathode

CAN Bus Protectors

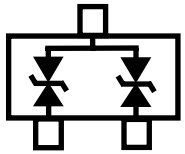
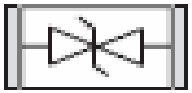
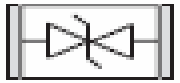
Datasheet Comparison

	ON Semiconductor NUP2105L	Comp 1 xxx	Comp 2 xxx
Package and Pinout	 SOT-23 (2.9 x 2.4 x 1.1 mm)	 0405 (1.4 x 1.0 x 0.7 mm)	 SOT-23 (2.9 x 2.4 x 1.1 mm)
Capacitance @ Vr=0	30 pF max	22 pF max	11 pF typ ✓
ESD Rating max IEC 61000-4-2 Contact	30 kV ✓	25 kV	22 kV
Vc and Ipk max IEC 61000-4-5 8x20 µsec	44 V @ 8.0 A ✓	> 70 V @ 4.0 A	70 V @ 3.0 A
ISO 7637-2 pulse 2a 1x50 µsec	9.5 A ✓	n/a	n/a
ISO 7637-2 pulse 3a 5x50 nsec	50 A ✓	n/a	n/a

Conclusion: ON Semiconductor's NUP2105L has highest ratings on all relevant surge specifications for the CAN Bus Network. ON Semiconductor's capacitance of 30 pF max is low enough to ensure signal integrity for 1 Mbit/sec data transmission rate.

CAN Bus Protectors

Datasheet Comparison

	ON Semiconductor NUP2105L	Comp 1 xxx	Comp 3 xxx
Package and Pinout	 SOT-23 (2.9 x 2.4 x 1.1 mm)	 0805 (2.0 x 1.25 x 1.0 mm)	 0805 (2.0 x 1.25 x 1.0 mm)
Capacitance @ Vr=0	30 pF max ✓	225 pF typ	350 pF typ
ESD Rating max IEC 61000-4-2 Contact	30 kV ✓	n/a	n/a
Vc and Ipk max IEC 61000-4-5 8x20 µsec	44 V @ 8.0 A ✓	42 V @ 1 A	40 V @ 1 A
ISO 7637-2 pulse 2a 1x50 µsec	9.5 A ✓	n/a	n/a
ISO 7637-2 pulse 3 5x50 nsec	50 A ✓	n/a	n/a

Conclusion: ON Semiconductor's NUP2105L capacitance of 30 pF max is low enough to ensure signal integrity for 1 Mbit/sec data transmission rate. The capacitance of the Comp1 and Comp3 parts is too high for high speed CAN networks.

ESD Protection

Conclusions

- ON Semiconductor has a broad range of offerings of standard ESD protection diodes for Power- and Data line protection.

- Competitive Benchmarking
  - The NUP2105L offers the following advantages over competition supplied varistors:
    - Much lower capacitance
    - Lower clamping voltage
    - Fully integrated solution for protecting 2 CAN bus lines.

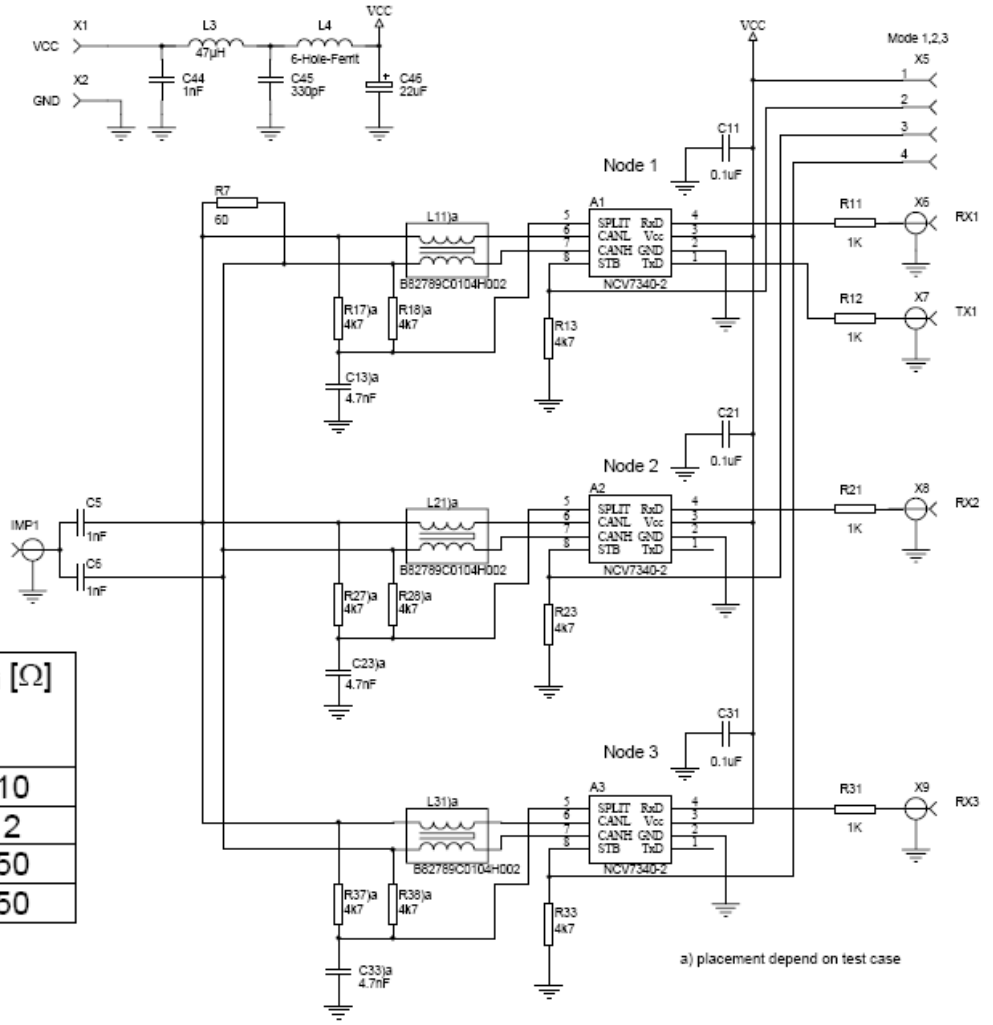
  - The NUP2105L has lower clamping voltage and handles more surge current than the dual line CAN protection parts offered by competitors (based on datasheet comparison).

System
ESD protection

- Transient pulses as tested by independent test house according to ISO 7637 part 2: 2004-06

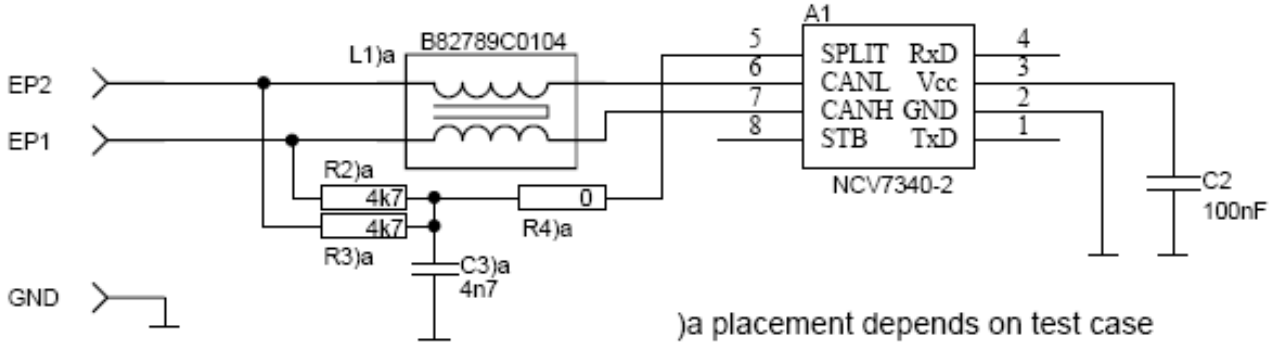
- Tested for following conditions:
  - Without bus filter Network
  - Bus filter network 100 µH CM choke
  - Bus filter network 100 µH CM choke, Split Termination network connected to pin SPLIT.

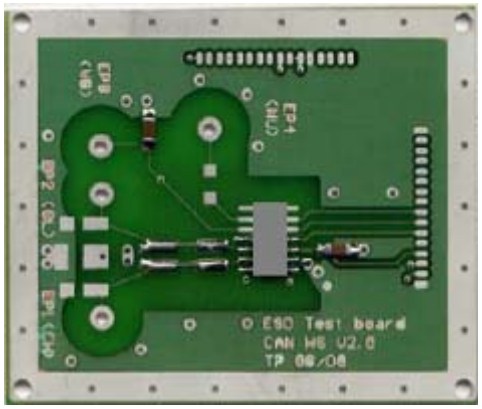
Test pulse	V_s [V]	Pulse repetition frequency [Hz] ($1/T_1$)	Test duration [min]	R_i [Ω]
1	- 100	2	10	10
2a	+ 75	2	10	2
3a	- 150	10	10	50
3b	+ 100	10	10	50



System
ESD protection

- System level ESD according IEC61000-4-2: 2001-12:





– Without bus filter Network *ex. NCV7340:*

IC sample	I/V characteristic # 4	# 5	# 6
Requirement		*6*	
CAN_H	**13**	**14**	**13**
CAN_L	**13**	**15**	**14**

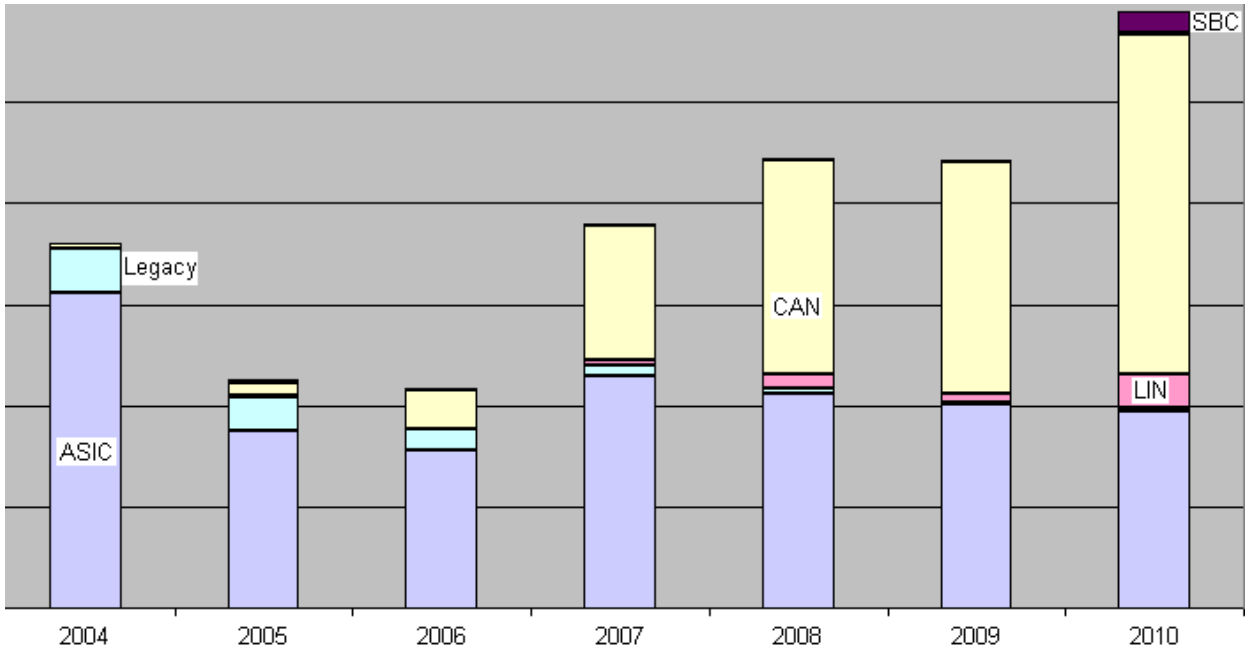
– Bus filter network 100 µH CM choke, Split Termination network connected to pin SPLIT.
ex: NCV7340: >6 KV at the point that test was terminated because of parasitic ESD discharge of layout parts to ground.

ON Semiconductor
Transceivers

WPN	OPN (T&R)	System ESD - IBEE	Standard	Comment
AMIS-30600	AMIS30600LINI1RG	IEC61000-4-2: > 6 kV	LINv1.3/v2.1 J2602	
NCV7321	NCV7321D10R2G	IEC61000-4-2: > 5 kV		
NCV7420	NCV7420D23R2G	IEC61000-4-2: > 8 kV		
	NCV7420D25R2G	IEC61000-4-2: > 8 kV		
AMIS-30660	AMIS30660CANH2RG	IEC61000-4-2: > 4 kV	ISO11898-2	New IP in development
AMIS-30663	AMIS30663CANG2RG	IEC61000-4-2: > 4 kV		
AMIS-42665	AMIS42665TJAA1RG	IEC61000-4-2: > 4 kV	ISO11898-5	
NCV7341	NCV7341D20R2G	IEC61000-4-2 > 6 kV		
NCV7340	NCV7340D10R2G	IEC61000-4-2 > 13 kV		**Soon to be "Release To Market"**
AMIS-41682	AMIS41682CANM1RG	IEC61000-4-2 > 2 kV	ISO11898-3	
AMIS-41683	AMIS41683CANN1RG	IEC61000-4-2 > 2 kV		
NCV7356	See One Pager	SW CAN		

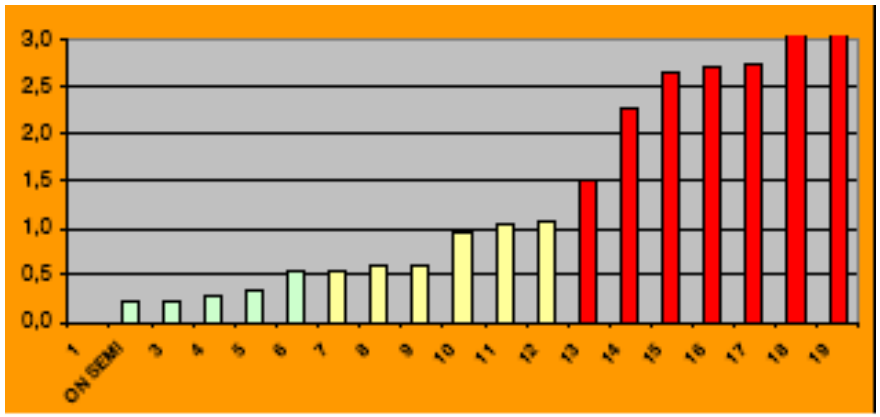
ON Semiconductor

Transceivers



> 250 Munits in the field

<< 1ppm level in Volume Production: Customer data ➔



Agenda

1. Introduction
2. Automotive Requirements
   - Quality, High Temperatures & Robustness
   - EMC/ESD performance
3. Physical layer:
   - ESD Protection
   - Transceivers
4. OEM approvals
5. Take-Aways

OEM approvals:
Versus Standard

- OEM's rely on GIFT:

  http://www2.cs-group.de/MunichGroupServer/

- GIFT / ICT :
  - **G**eneralized **I**nteroperable **F**ault **T**olerant CAN Transceiver
  - **I**nternational Transceiver **C**onformance **T**est
- Automobile Industry: Audi, BMW, Daimler, Ford, PSA and Volkswagen
- CAN - *OSI-1* - Testing and Analysing:
  - Low Speed Fault Tolerant CAN Transceiver
    - **ISO 11898-3**: 2006 ➔ Road vehicles - Controller area network (CAN)
      - Part 3: Low-speed fault tolerant medium dependent interface
  - High Speed CAN Transceiver
    - **ISO 11898-2**: 2003 ➔ Road vehicles - Controller area network (CAN)
      - Part 2: High-speed medium access unit
    - **ISO 11898-5**: 2007 ➔ Road vehicles - Controller area network (CAN)
      - Part 5: High-speed medium access unit with low-power mode

OEM approvals
System ESD

Components tested according to OEM Requirements:

- Standardized Test Methods
- Standardized Test House

FTZ e.V. an der Westsächsischen Hochschule Zwickau (FH)
University of Applied Science
Department of Electrical Engineering
EMC Investigations, Prof. Dr.-Ing. habil. D. Sperling

Dipl.-Ing. B. Körber
bernd.koerber@fh-zwickau.de

- Group of 5 (Audi, BMW, MINI, DAIMLER, PORSCHE, VW)
  - "Hardware Requirements for LIN, CAN and FlexRay Interfaces in Automotive Applications" [Version: 1.0 2008-12-10]
    - Requirements for CAN ECU's
      - CAN Interface Circuit
      - CAN Component Data
      - CAN Layout Hints
    - Requirements for CAN Transceivers
      - CAN Networking Requirements
      - EMC Requirements

Test description	Limit
Transceiver EMC Test specifications ([2] to [4], IEC 61000-4-2: 330 Ohm/ 150pF)	± 6kV
Human Body Model JESD22-A114 / AEC-Q100-002	± 6kV
Charge Device Model JESD22-C101 / AEC-Q100-011	± 500V
Machine Model JESD22-A115 / AEC-Q100-003	± 100V

OEM approvals
System ESD

- Renault / PSA / Fiat
  - "Renault's network transceivers acceptance procedure - Process and acceptance criteria" [**Reference** : 65610/2004/955]
    - [3] *EMC test procedure on multiplexing transceivers*. [NT 64250/2004/1695]
    - [4] *Specific EMC test requirements for CAN High-Speed transceivers.* [NT 65610/2004/505]
  - PSA: "Dossier de Justication de Conformité (DJC) Composants de multiplexage" [Version: 1.0 26-09-2005]
  - Fiat: Testing still performed by Fiat after C&S and IBEE reports are presented.
- USA: Ford / GM
  - Data Link and Physical Layer "Ford Global Implementation Requirements" [31803315]
  - UL-Lab's, Test: 19.2.2 Electro Static Discharge CI280 Powered Tests

Harness Information:	1.7m	Date(s) test performed:	1/18/2008
Grounding Information:	Remote	Temperature (°C):	22
Tested by:	Robert Rising	Humidity (%RH):	27
Sample #	SLC021 (Master)	Discharge Network	330pF, 2kΩ
Mode:	ON	Pretest inspection:	☒ No anomalies ☐ The following anomalies:
		Post test inspection:	☒ No anomalies ☐ The following anomalies:

Discharge Point	± 4kV Air	± 4kV Contact	± 6kV Air	± 6kV Contact	± 8kV Air	± 8kV Contact	± 15kV Air
Can2L	1	1	1	1	1	1	1
CAN2H	1	1	1	1	1	1	1

1 ➔ No anomalies

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In-Vehicle Networking

High

Low

[Complexity]

System Basis Chips
- NCV7420
- NCV7440 "In Development"
- NCV7462 "In Development"

FlexRay™

FlexRay
- NCV7381 "In Development"

GIFT/ICT

CAN LS
- AMIS-41682
- AMIS-41683

CAN HS
- AMIS-30660
- AMIS-30663
- AMIS-42665
- AMIS-42700
- NCV7340
- NCV7341
- NCV7356

lin
LOCAL INTERCONNECT NETWORK

LIN
- AMIS-30600
- NCV7321

Interesting Links

http://www.jedec.org/

http://www.iec.ch/

Automotive Electronics Council
Component Technical Committee

http://www.aecouncil.com/

http://www.esda.org/

SAE International

http://www.sae.org/

ON Semiconductor Links

- IVN In Vehicle Network transceiver products
- BRD8044/D Automotive Solutions Brochure
- TND335/D Transient Over voltage Protection
- AND8253/D System Level Surge Suppression Solutions for the CAN Bus
- AND8181/D TVS Diode Selection Guidelines for the CAN Bus

Result

For More Information

- View the extensive portfolio of power management products from ON Semiconductor at www.onsemi.com
- View reference designs, design notes, and other material supporting automotive applications at www.onsemi.com/automotive