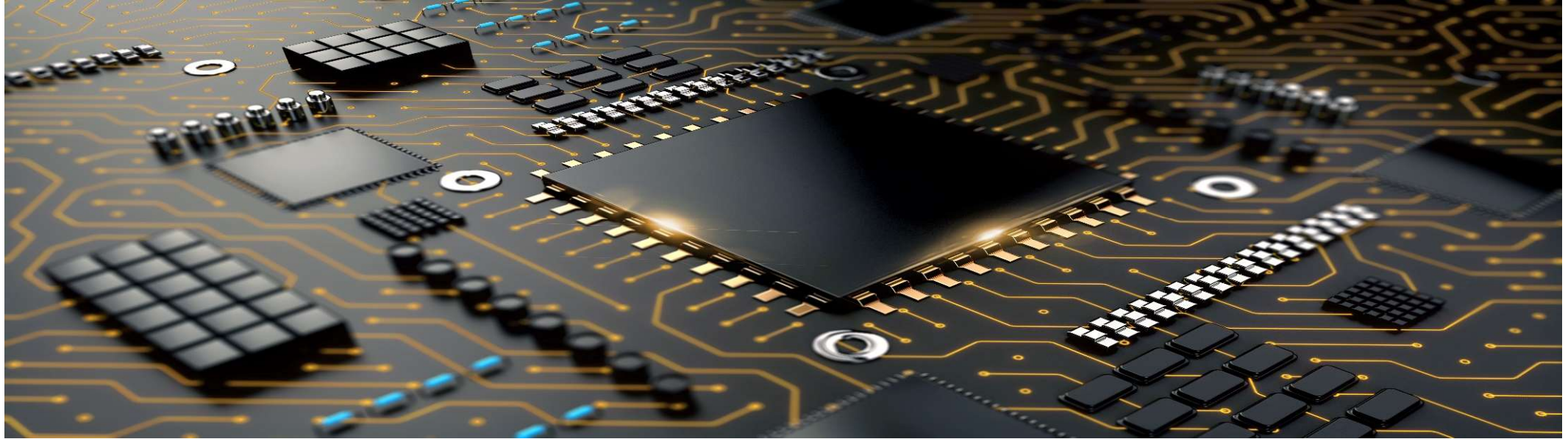




Automotive 2024

Applications & Solutions



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Automotive Compliance Standards

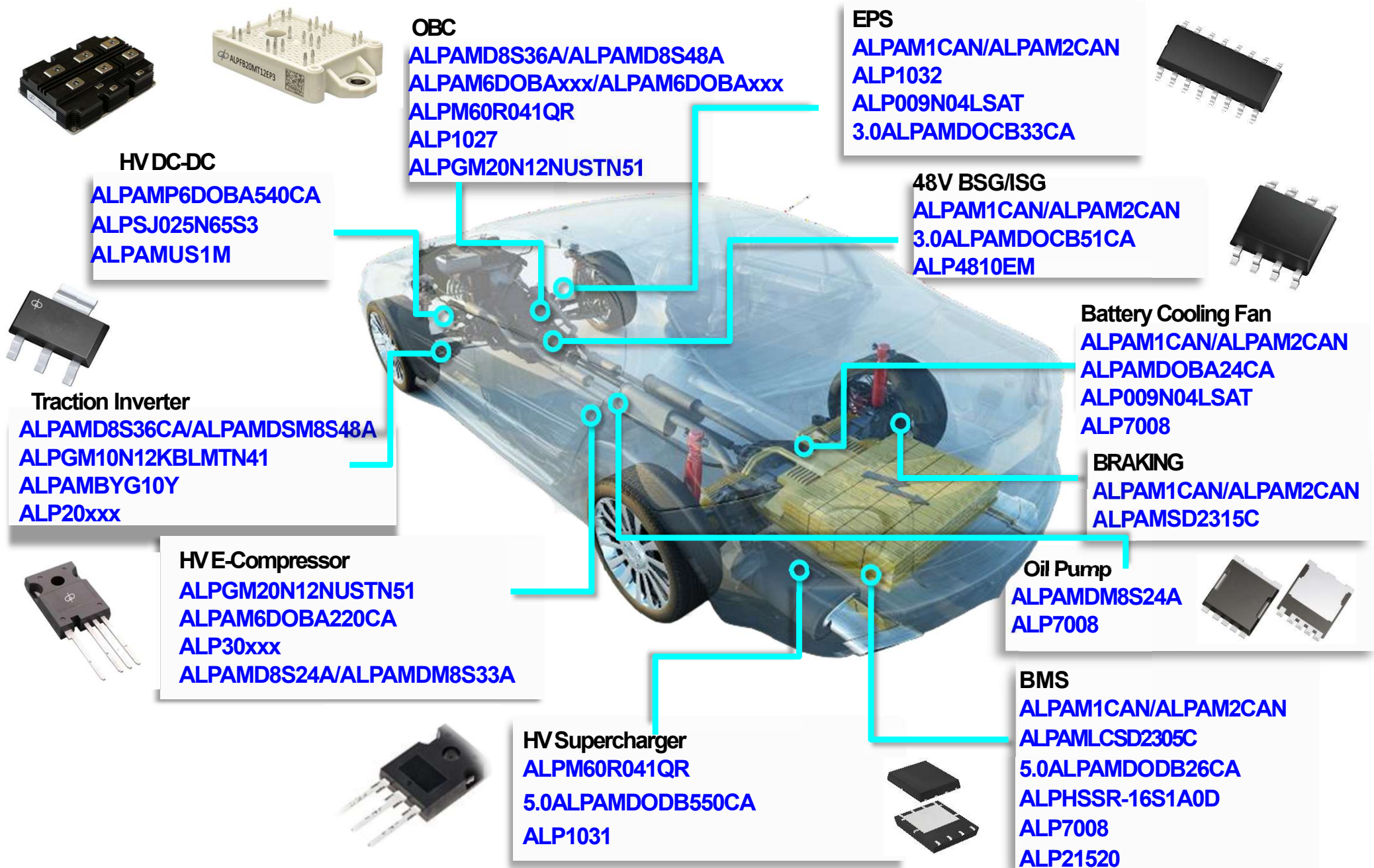


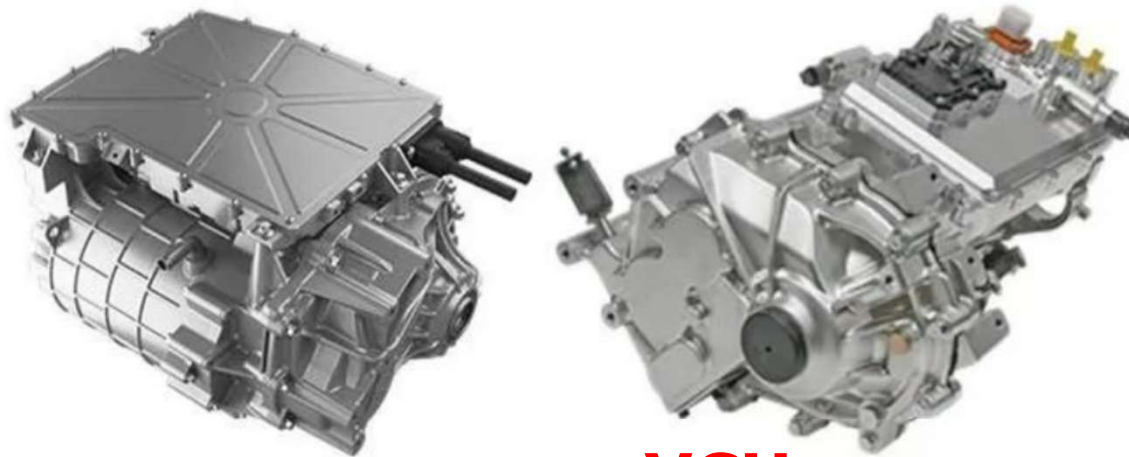
Reference Standards

- ISO 7637-2 & JASO
- ISO 16750-2
- ISO 26262
- AEC-Q101
- AEC-Q100-002
- AEC-Q100-003
- AEC-Q100-011

TRANSIENTS IN AUTOMOTIVE SYSTEMS				
TIME DURATION	CAUSE	VOLTAGE AMPLITUDE	ENERGY LEVEL	FREQUENCY OF OCCURANCE
200ms	Load Dump (Disconnection of battery while at high charging)	< 125V	> 10J	Infrequent
Steady State	Failed Voltage Regulator	18V	-	Infrequent
< 320μs	Inductive Load Switching	80V to 300V	< 1J	Often
200ms	Alternator Field Decay	-100V to -40V	< 1J	Each Turn-Off
90ms	Ignition Pulse, Battery Disconnected	< 75V	< 0.5J	< 500Hz Infrequent
1ms	Harness Coupling	< 200V	< 1J	Often
< 60ns	Electrostatic Discharge	< 15kV	< 10mJ	Infrequent

Power Discrete, Module, High-Side Power Switch and Gate Driver IC Offering In EV/HEV Application





PowerTrain

- Stator
- Rotor

Power Control Unit

- IGBT Discrete/Module

Speed Reducer

- Gear Module
- Semi-Axis

VCU

HV DC-DC

- OBC
- DC-DC Converter
- PDU

Connector

Others

- Charger plug
- Other power connection component

Power Solution in BYD Automotive



Mother line Voltage 330V~850V, Prate=90KW, Ppeak=110KW,
Auxiliary power, TI LM3478, Driver Infineon 1ED020I12,
Semikon/Infineon/Mitsubishi/Fuji IGBT

Application	Description	Production	Alpinesemi	Vishay/Infineon
Auxiliary power	Load dump TVS	6600 TVS series	ALPAMD8S22A	SM8S22A
	Flyback free-wheeling Multi-channel rectifier output	Ultrafast Rectifiers	200V/3A SMA ALPAMHPM320	NRVBAF3200T3G
	Flyback MOS gate I/O protection	600W TVS	ALPAMDOBA18CA	TPSMB18CA/ SMBJ18CA
Driver board	Vce(sat) short protection	Glass Passivated Rectifier	1600V/1.5A ALPAMBYG10Y	BYG10Y
	DC-DC converter	SGT MOSFET 40V~200V	ALP009N04LSAT ALP048N15HSAT ALP016N10HSAT	IAUT300N10S5N014 IAUCN04S7N009 IPT044N15N5
	IGBT gate driver IC	Interlock Bootstrap Diodes Power grid resistance Miller clamp	ALP30xxx	1ED020I12 1ED31xxMU12H TI UCC21520
	SIC MOS module	1200V 40mR EASY 1B	ALPFB20MT12EP3	F4- 23MR12W1M1_B76



Automotive AECQ101 Qualified



ISO26262 is Qualifying



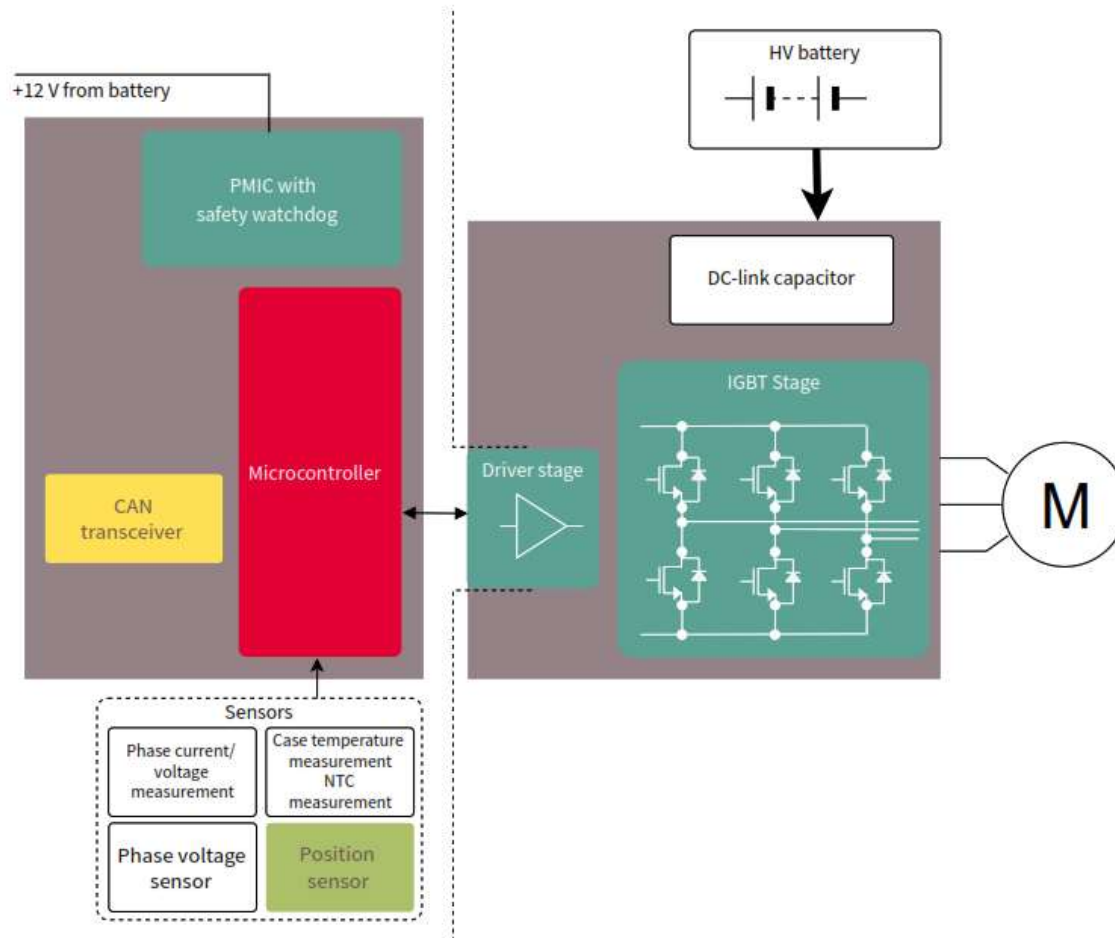
- 3 of SOT-23 Low voltage Schottky
- 2 of 3A 200-400V UF/FRED
- 1-2 of HV SMB or SMC TVS for gate protection
- 2-3 of LV SMB TVS for gate protection



Automotive Main Inverter Solution for Shanghai Auto(High Voltage Gate Driver SiC MOS and IGBT module)



Typical application diagram- main inverter



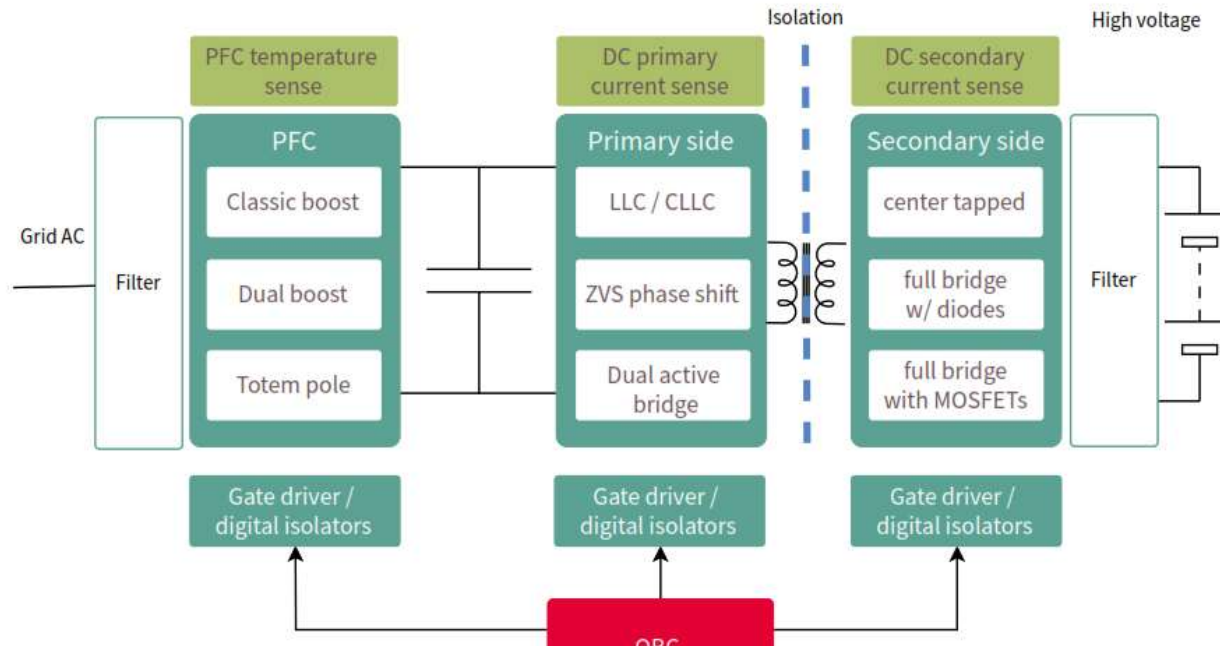
- $V_{DS} = 1200V$, $R_{DS(ON) Typ.} = 18m\Omega$, $I_D = 102A$
- High-speed switching SiC MOSFETs
- Reliable body diode
- All parts tested to above 1350V
- Kelvin reference for stable operation
- Press fit terminal connections
- Low switching losses
- Low junction to case thermal resistance
- Very rugged and easy mounting
- Direct mounting to heatsink (isolated package)

IGBT Module	Voltage	Current	Package	Infineon
ALPGM40N12KBLMHD41	1200V	400A	HPD module	FF380R12A6T4B
ALPGM65N075NUSHD51	750V	650A	HPD module	FS650R08A4P2
SiC MOS Module	Voltage	Current	Package	Infineon
ALPFB20MT12EP3	1200V	102A	Easy Pak 1B	F4-23MR12W1M1_B76

Automotive 7KW-22KW OBC&DC-DC Converter for Shanghai Auto Corp.(Gate Driver IC,IGBTs and SiC MOS)



Typical application diagram- on-board charger



SIC MOSFETs:

- Low on-resistance and low gate charge performance
- Low conduction loss
- Fast Switching speeds
- Withstand extreme dv/dt rate and higher avalanche energy

IGBTs:

- Low saturation voltage
- Fast switching

Gate Drivers:

- Family of rail-to-rail high current drivers for lower system losses
- External (opto/silicon) or built-in galvanic isolation in multiple packages for design flexibility
- Short propagation delays for faster switching
- Suitable for single ended, half bridge, and full bridge topologies

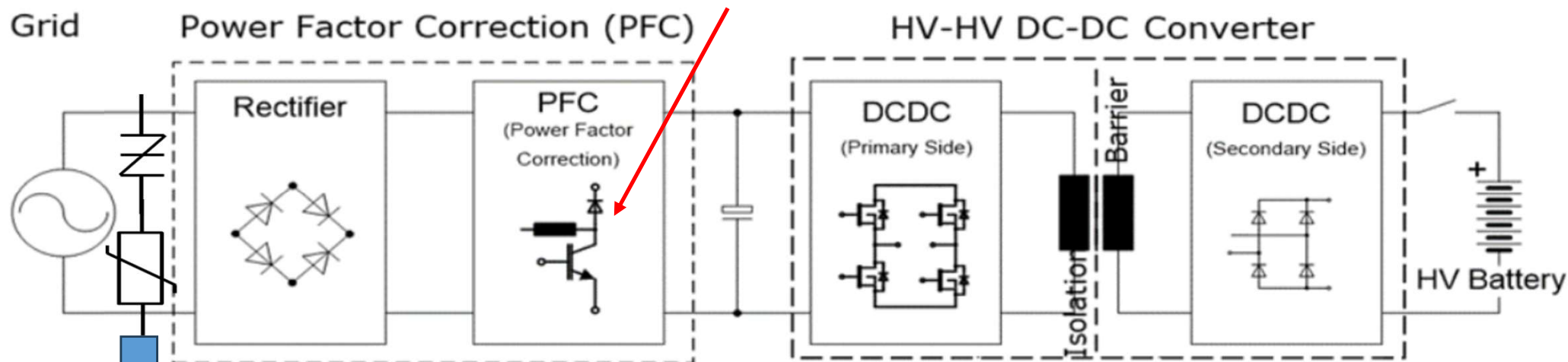
SiC MOSFET	Voltage	(mΩ)	Package	Application
ALPAM020N120S3MQ	1200	20	TO-247-3L	LLC/ZVC PSFB
ALPAM030N120S3MEF	1200	30	TO-263-7L	LLC/ZVC PSFB
ALPAM040N120S2MQ	1200	40	TO-247-3L	LLC/ZVC PSFB

Part Number	Voltage	Package	Key Features +Options	Application
ALP1011	1200V	SOIC-16	Interlock,Bootstrap Diodes,Power grid resistance,Miller clamp	Single phase String Inverter
ALP1001	650V	SOIC-16	Half Bridge,Interlock	
ALP1027	1200V	SOIC-16	Half Bridge,Interlock	
ALP1031	1200V	SOIC-24	Three Phase,Bootstrap Diodes Power grid resistance	Three phase String Inverter

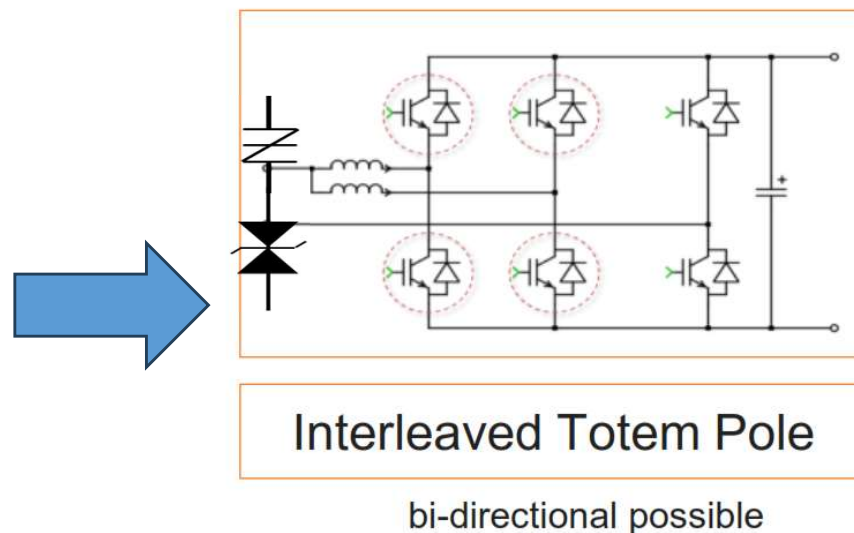
Thyristor and TVS protection for HUAWEI Auto Solution AC input before PFC Rectifier and DC-DC converter



- Non Bridge PFC MOS will be damaged very frequently if no any TVS protection
2KV/4KV/6KV 1.2/50us I/O to I/O surge testing spec



AC power	6KV 1.2/50uS
TSS+MOV (low Cost)	ALP3800S3NLRP+250V/380V MOV
TSS+TVS* (Better Choice)	ALP3800SCLRP+30KPA265CA/ 30KPA345CA TVS



OBC&DC-DC Design Part Number Reference



Application	Diodes	Product family	Alpinesemi	Vishay/Littelfuse
Power input	Load dump TVS	DO-214AB 5000W	5.0ALPAMDODB26CA	5KASMC26CA
	Polarity protection diode	Schottky Rectifiers	60V/3A ALPAMS3P6L	SS3P6L SMA
High voltage side	High Power TVS	DC-DC 30KPAxxx	30KPA265CA/ 30KPA345CA	30KPA265CA/ 30KPA345CA
	Polarity protection diode	Ultrafast Rectifiers	100V/1A DO-219AB (SMF) ALPAMS1FH10	SS1FH10
Auxiliary power	MOS gate protection	TVS	ALPAMDOBA18CA	TPSMB18CA
	Rectifier diode	Ultrafast Rectifiers	200V/1A DO-214AC (SMA) ALPAMUR120	MUR120T3G
Application	MOS/IGBT	Product Family	Alpinesemi	STM/Infineon
OBC Three phase full wave Topology	SJ MOS	ALP60R041QR	600V/41mΩ	IPB65R050CFD7A
	SiC MOS	ALP65R30GIJ21	650V/30mΩ	SCT027W65G3-4AG
DC-DC Converter	IGBT gate driver IC	Interlock Bootstrap Diodes Power grid resistance Miller clamp	ALP1011/ALP1031/1027D	1ED020I12 1ED31xxMU12H TI UCC21520
Single phase full wave rectification		SGT MOSFET	ALP009N04LSAT ALP048N15HSAT ALP016N10HSAT	IAUT300N10S5N014 IAUCN04S7N009 IPT044N15N5



Automotive AECQ101 Qualified



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Battery Raw Material

- Positive Material
- Negative Material
- Diaphragm
- Electrolyte

Battery Management System Other

- Battery Connector
- Protective Shell

ALPINESEMI



BMS Design Part Number Reference



Base on Power IC Solution of MAX17823/LTC6813/LTC6811

Application		Product Family	Alpinesemi	Vishay/Onsemi/ Infineon
Power input	Load dump Protection	6600 TVS series	ALPAMD8S22A	SM8S22A
	Gate Driver IC	Optocoupler MOS driver	ALPHSSR-16S1A0D	QCPLA58JV
	Small signal protection	Signal Diodes	ALPBAT46W	BAT46W-G
	Flyback free-wheeling	Schottky Rectifiers	ALPMBR0520	MBR0520LT1G
Control board	Circuit protection TVS	SMB 600W series	ALPAMDOBA75CA, ALPAMDOCB75CA	SMBJ75CA SMCJ75CA
	Polarity protection, freewheeling	Schottky Rectifiers	40V/1A SMA	SS14
	DC-DC converter	Smart high side power Switch	ALP7008	BTS7008-1EPP
		Isolation Low Side Gate Driver IC	ALP21520	UCC21520
Balance board	CAN,LIN&BUS Protection	LOW IR TVS	ALPAM1CAN/ ALPAM2CAN	VCAN26A2/ PESD2CAN
	Cell protection	ESD/TVS(promote)	ALPAMSD2305C/ ALPAMSD2308C	PLZ6V2C/ PLZ7V5A
	IC Protection	600W TVS	ASMBJ18CA, AP6SMB27CA	SMBJ18CA TPSMB27CA



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Chassis Control

- ESC
- EPB

Body Electronic

- ALS
- BCM

Safe and Comfortable

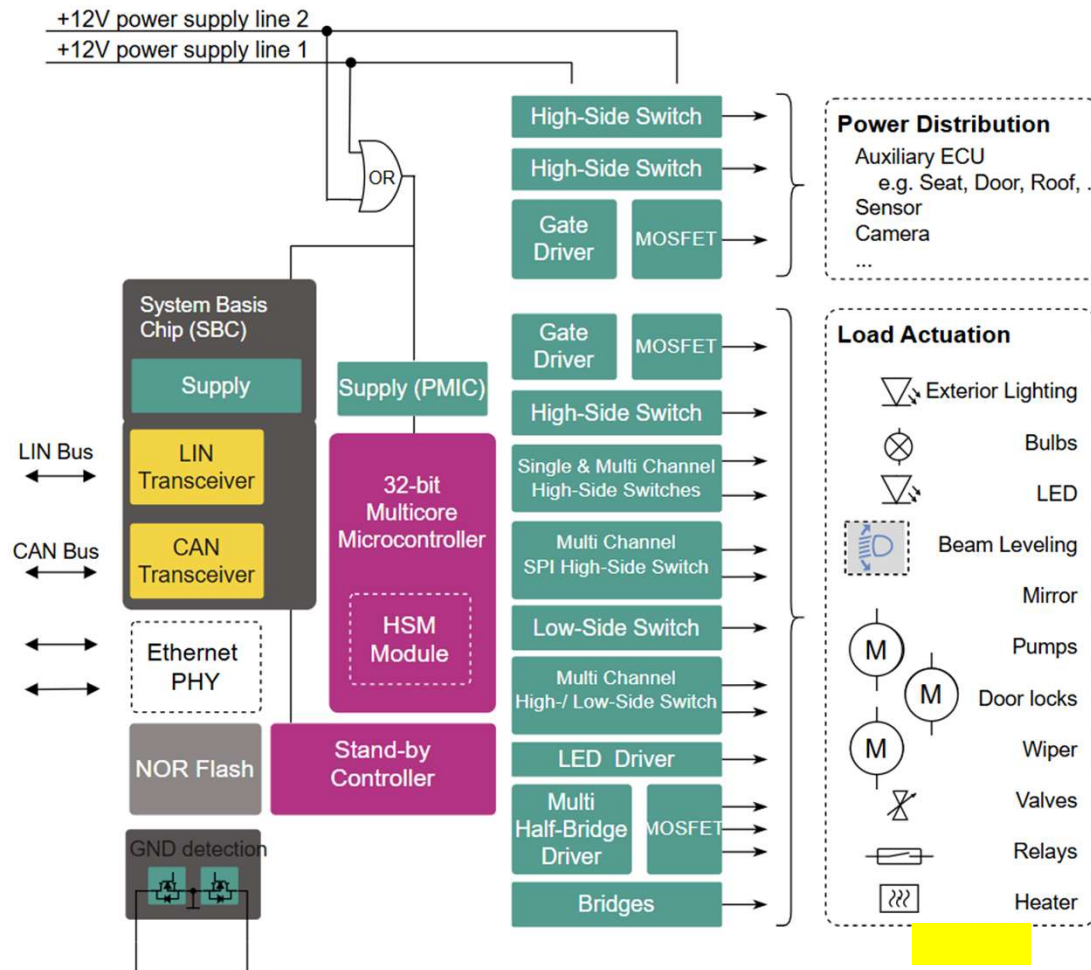
- KEYLESS START
- TPMS



Others

- Vehicle low-voltage wiring harness
- Transmission line

BCM Power IC and Discrete Solution



- Infineon's reference design of Gate driver IC, MOSFET, High-side/low side power switch, Bridge Diodes
 - MCU, ALP9854xxx/Infineon TLE9854QX
 - Multi MOS Gate Driver IC, ALP9189xxx/Infineon TLE9819/ROHM TB9083
 - Half bridge Isolation gate driver IC, ALP1011/Infineon 2ED7259xxx
 - High Side Power Switch, ALP7008xxx/Infineon BTS7008
 - Dual low side gate driver, ALP21520/TI UCC21520
 - SGT MOSFET
 - ALP007N04LSAT Ultra low Rdson TOLL-8L package
 - ALP010N04LSAU PowerDFN56-8L
 - ALP009N04LSAU Double Heat-sink
 - ALP007N04LSAU Double Heat-sink
 - ALP015N04LSAT TOLL-8L package

Automotive Qualified

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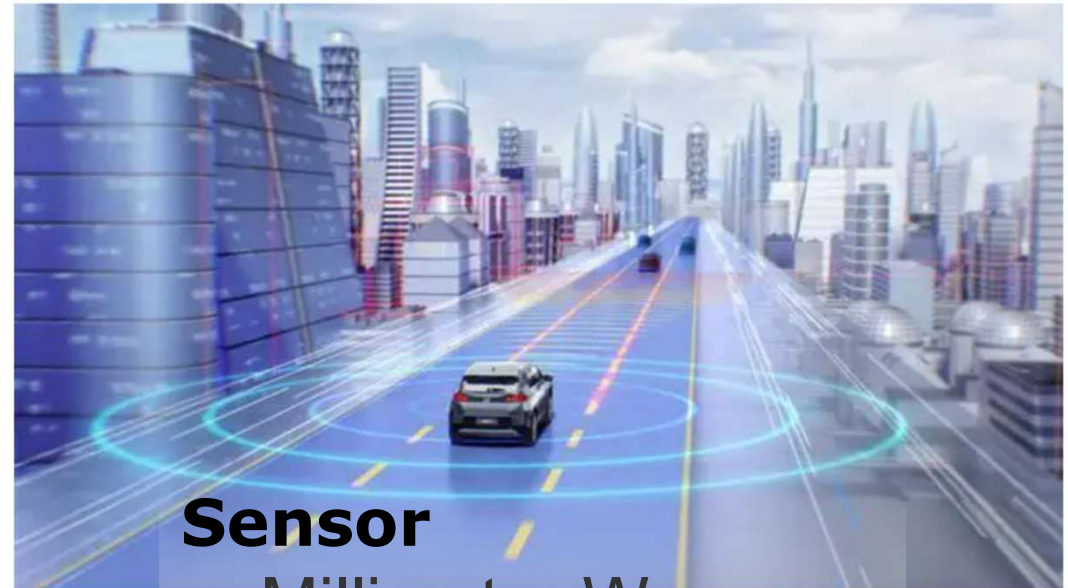
Application		Product family	Infineon
BODY CONTROL SYSTEM	MCU	ALP98xxx	TLE9868QX/TLE9854QX
	Multi MOS gate driver IC	ALP1032	TLE9818/TB9083 Toshiba
	Half bridge Isolation gate driver IC	ALP1011	2EDBX259K
	Smart high side power Switch	ALP7008	BTS7008-1EPP
	Dual low side gate driver IC	ALP21250	UCC21250
	SGT MOSFET	ALP010N04LSAU	IAUCN04S7N009

T-BOX

- WLC
- GPRS
- WIFI

Gateway

- Vehicle Road Cooperative Sensor
- HUB



Sensor

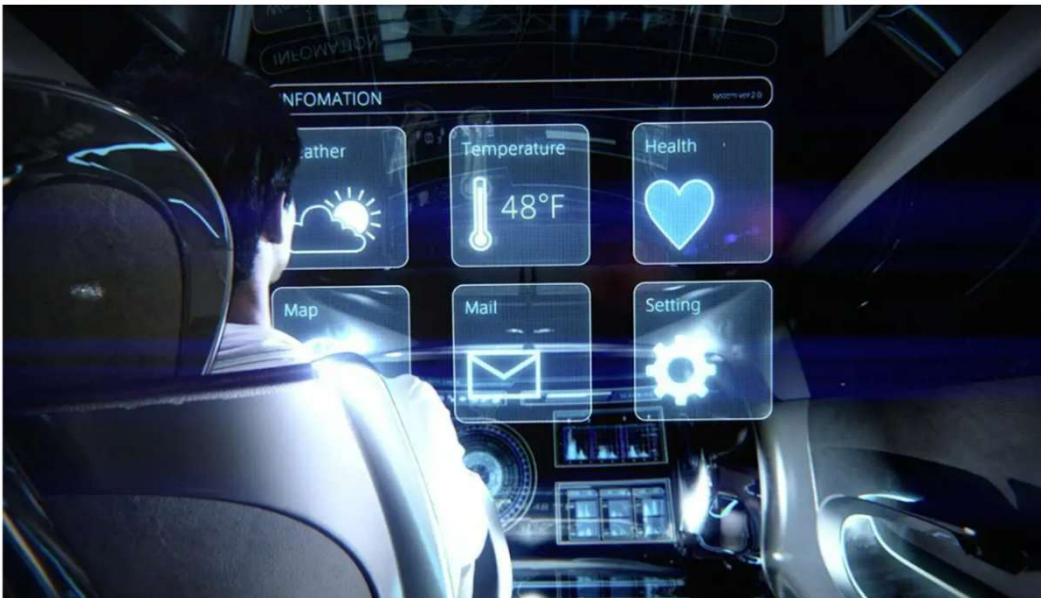
- Millimeter Wave Radar
- Ultrasonic
- Camera
- Radar module
- DCU
- Data Center Capacity/Memory
- PCB Layout



GaN FET
100V

Infotainment

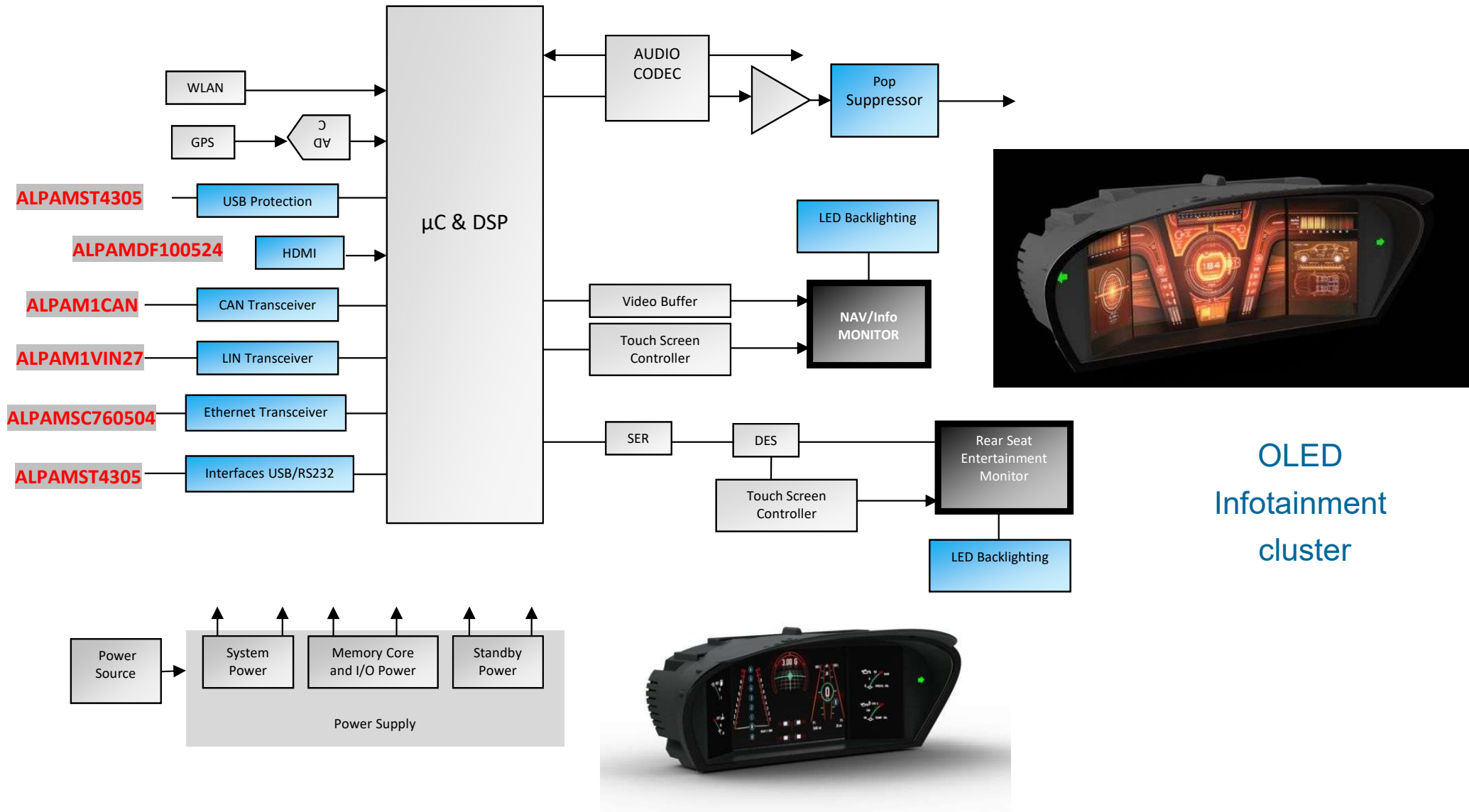
- Smart Bluetooth System
- Voice Interactive System
- 3D Sound System



Driver System

- Central **Display**
- Camera
- HUD
- DMS

T-BOX Infotainment System for BENZ E300 Car Design



OLED
Infotainment
cluster



Brake system

- ABS/EPB/ESC
- iEHB

D-Shaft

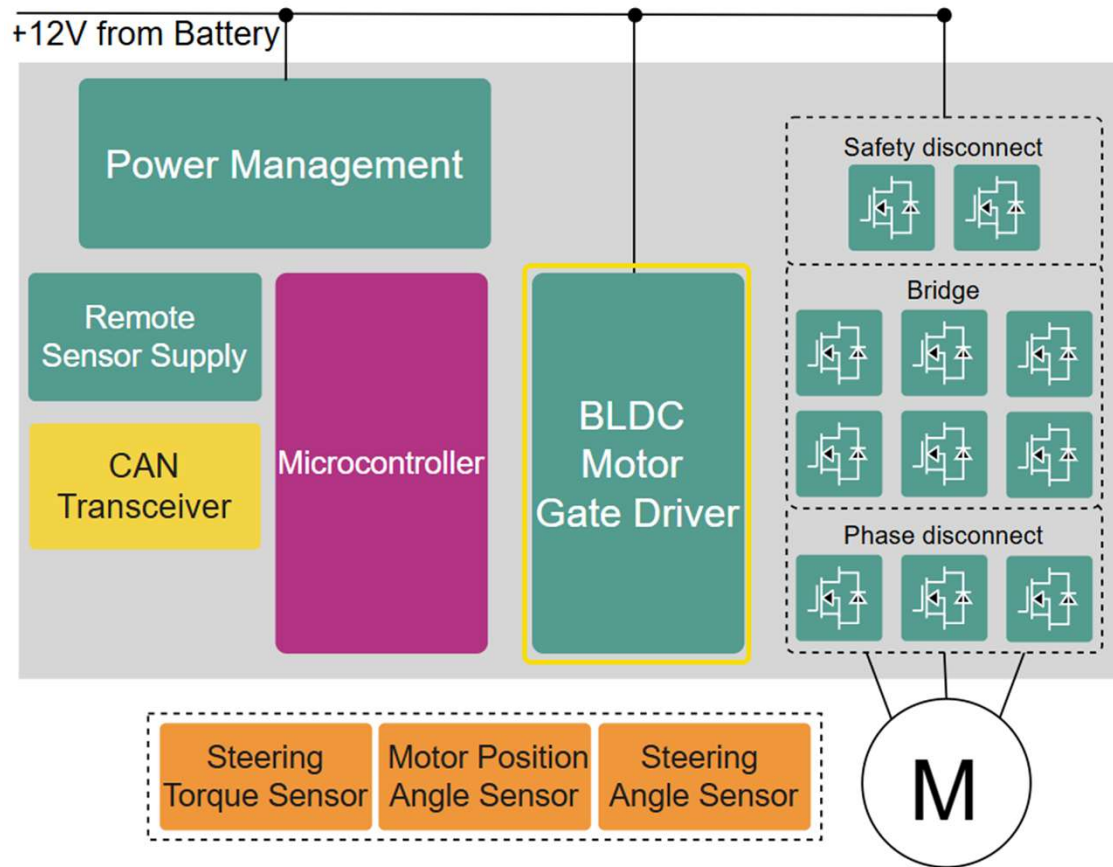
- Driver Shaft
- Suspension
- Wheel
- Subframe

Rotation

- EPS



EPS/EPB TYPICAL APPLICATIONS



■ Infineon's reference design of gate drive and MOS

- Total 6 channels in three phase control

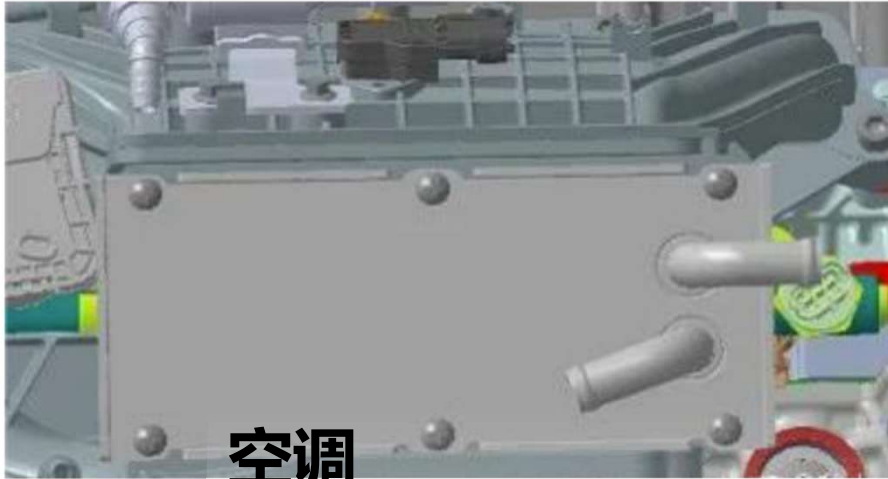
11~22pcs 40V SGT MOSFET, 1pcs 6 channel Gate Driver IC

- ALP007N04LSAT Ultra low Rdson TOLL-8L package
- ALP010N04LSAU PowerDFN56-8L
- ALP009N04LSAU Double Heat-sink
- ALP007N04LSAU Double Heat-sink
- ALP015N04LSAT TOLL-8L package

Application		Product family	Infineon
Power input	Load dump TVS	ALPAMD8S series	DO-218AB, 6600W
	Polarity protection/Fly-wheeling diode	Ultrafast Rectifiers	200V/2A SOD128 Flat STTH2R02AF-Y
DC/DC convertor	Isolation MOS Gate Driver IC	ALP1032	TB9083/TLE9189/A4911
	MOSFET	ALP006N04LSAT	40V/0.75mR TOLL-8L

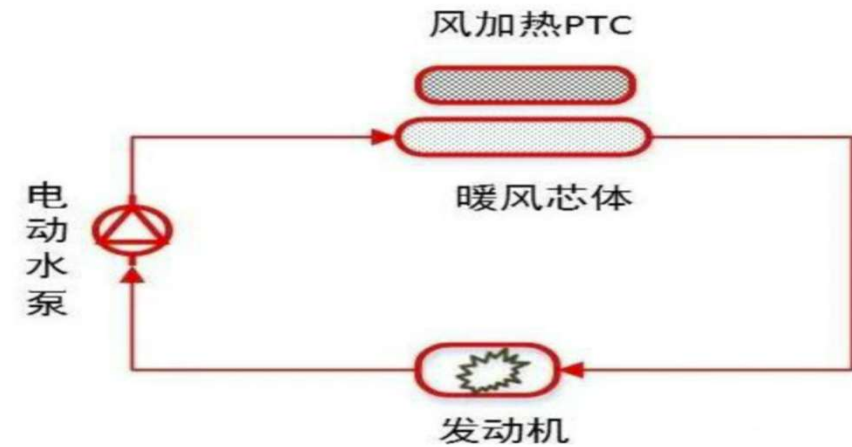
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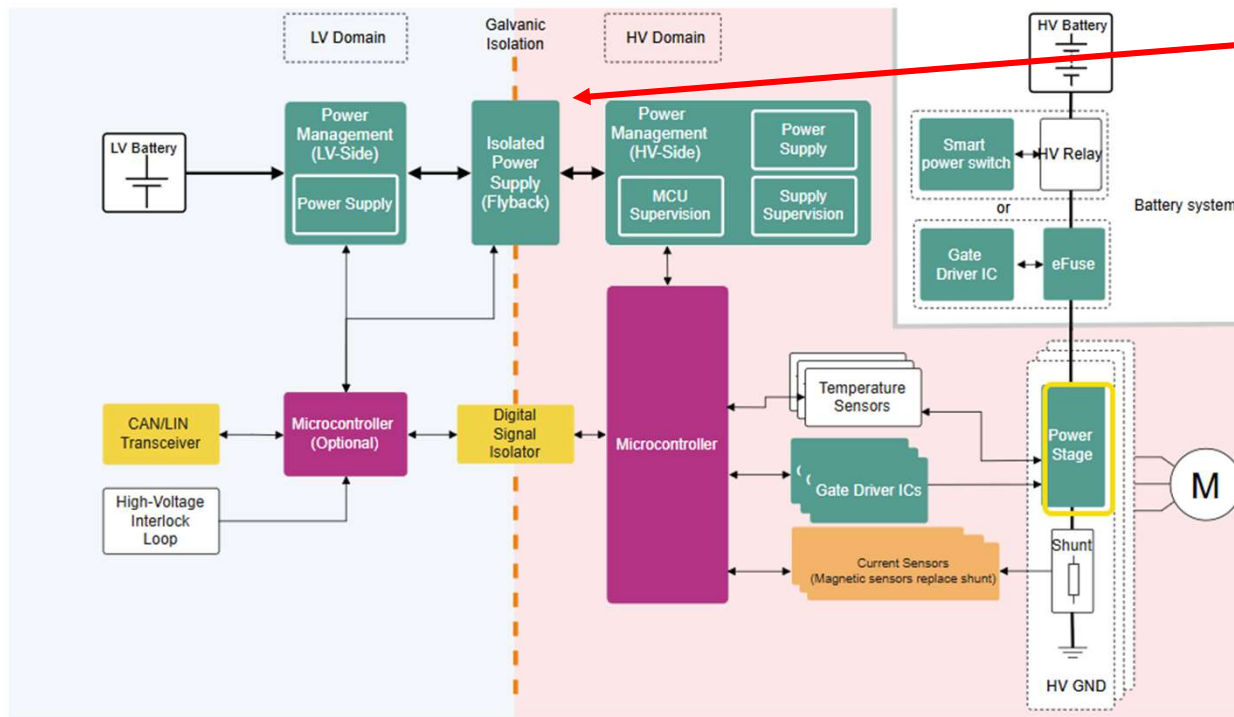
- Compressor
- Solenoid Valve
- Refrigerant pipe
- PTC Thermal
- Condenser
- gas-liquid separator
- P/T sensor
- Refrigerant
- Thermal Change



Thermal management of EV system

- PTC heater
- Cooler
- Water Pump
- Water
- Solenoid Valve
- gas-liquid separator
- P/T sensor
- Refrigerant
- Thermal Change

Power Solution for HVAC Module



ALP1011

Features

- 2-channel isolated gate driver for Si and SiC MOSFETs and GaN HEMTs power switches
- Fast input-to-output propagation (38 ns) with excellent stability (+9/-5 ns)
- Strong output stage: 5 A/9 A source/ sink
- Fast output clamping for $V_{DDA/B} < UVLO$
- Fast UVLO recovery time ($< 2 \mu s$)
- Four VDDA/B UVLO options: 4 V, 8 V, 12 V, 15 V
- CMTI $> 150 V/ns$
- Available in 16/14-pin 300 mil DSO package

Application		Product family	Infineon
HVAC	Half bridge Isolation gate driver IC	ALP1011	1ED 3030AS
	SIC MOS module	ALPFB20MT12EP3	F4-23MR12W1M1_B76
	2 Channel Isolation Gate Driver IC	ALPX259K	2EDBX259K
	Smart high side power Switch	ALP7008	BTS7008-1EPP
	IGBT module	ALPGM20N12NUSTN51	FP200R12N3T7

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IGBT Discrete for PTC Heater and E-compressor

ALP40Q120KAH

100% replace AUIGR4PH50S

3pcs Usage in one PCB

TO-247-3L

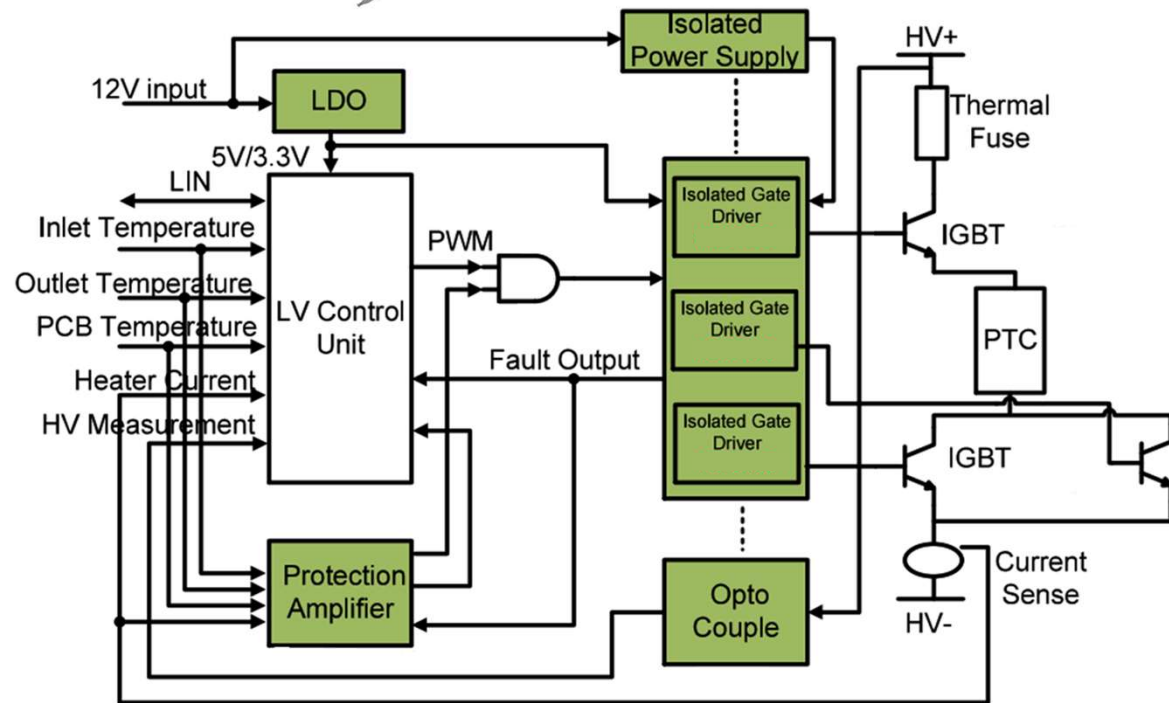
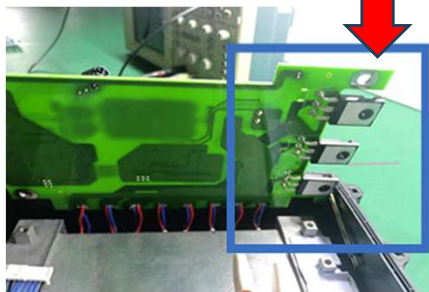


ALP50T65HDT

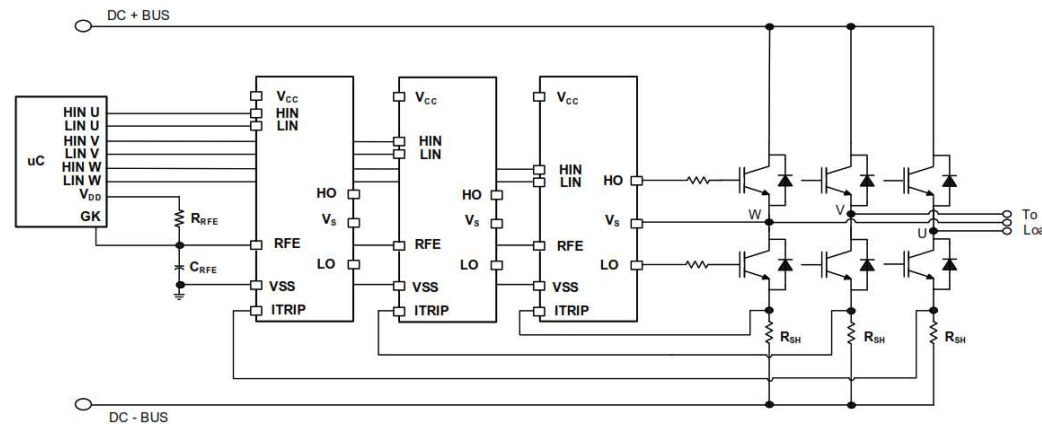
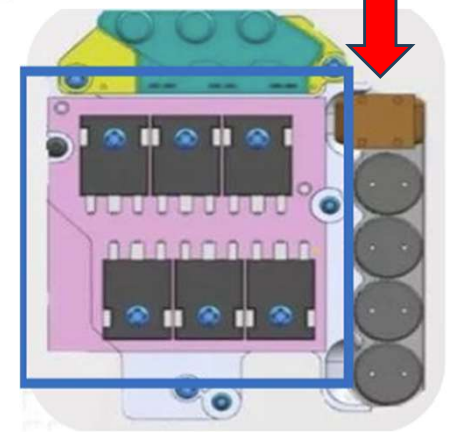
6pcs Usage in one PCB



PTC Heater



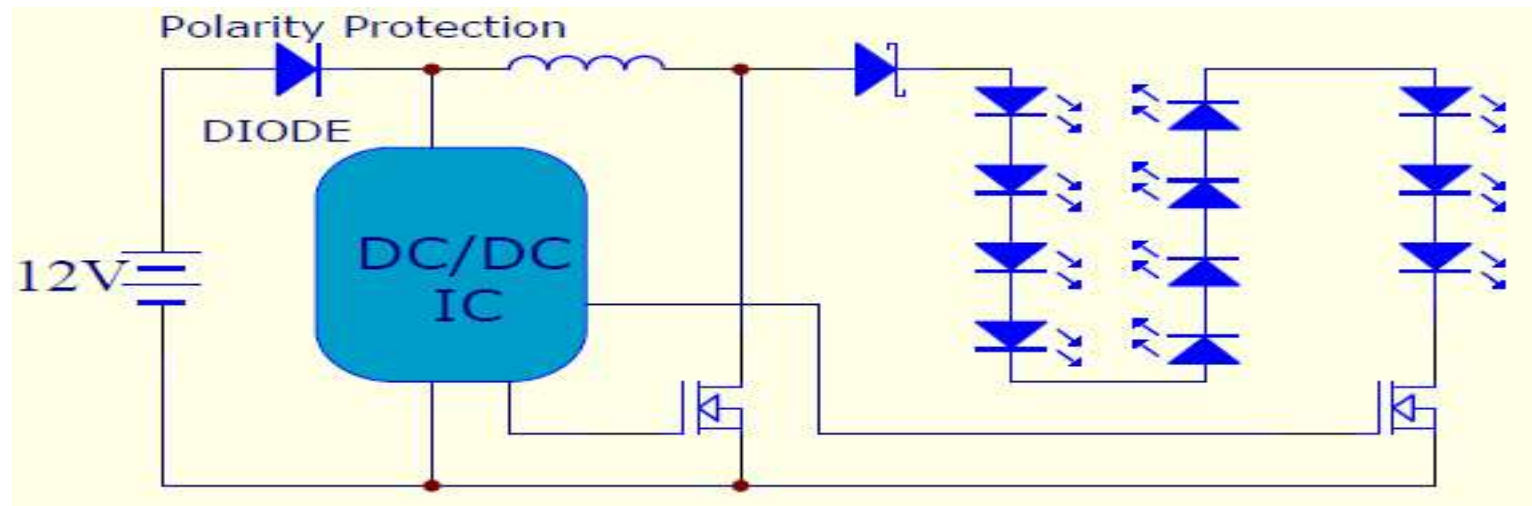
E-Compressor



Smart high Side Power Switch Solution in LED lighting

BCM、Air bag、LED lighting、Entertainment、T-BOX、

Application		Product family	STM
Auxiliary power	Load dump TVS	ALPAMD8S/ALPAMD6S/ALPAMD5S series 5.0ALPAMDOBA24CA/ ALPAMDOBA33CA	DO-218AB 6600W/4600W/3600W SMB 600W
	Polarity protection diode/Fly-wheel diode	Ultrafast Rectifiers	200V/2A SOD128 Flat STTH2R02AF-Y
	Smart high Side Power Switch	ALP7008	BTS7008-1EPP



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