



BMS电池管理系统电路设计方案选型手册

BOURNS[®]

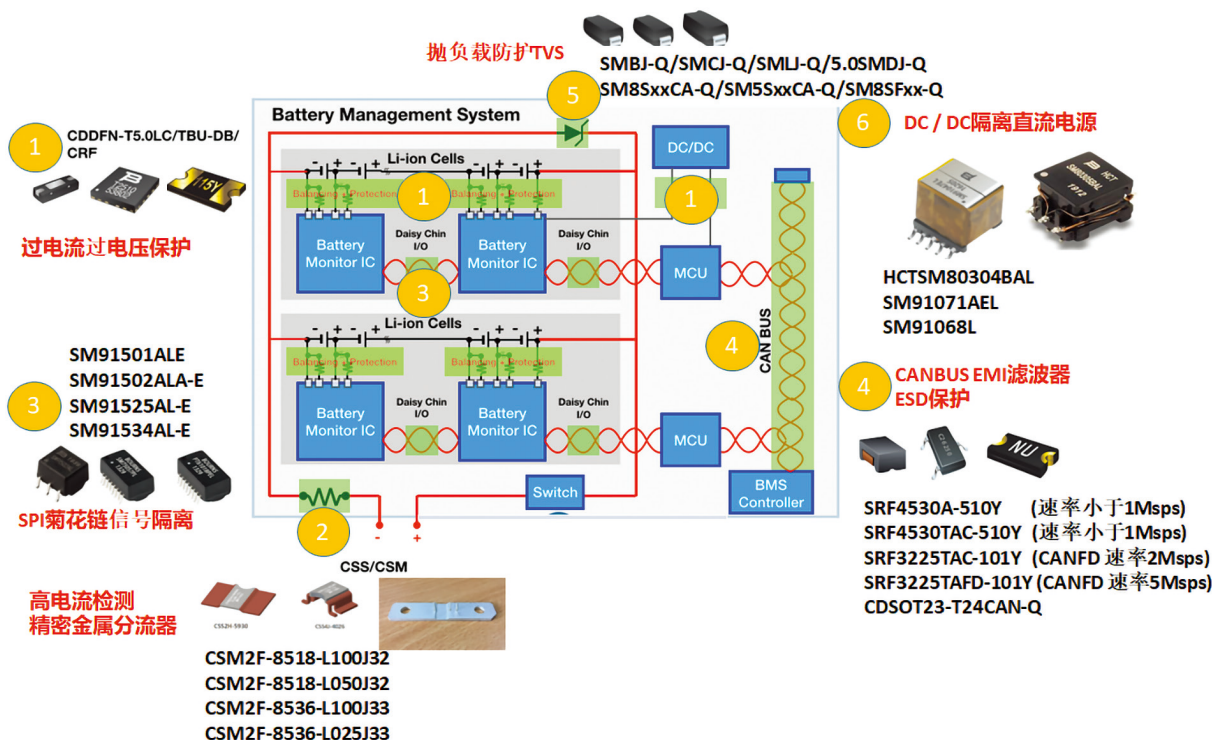
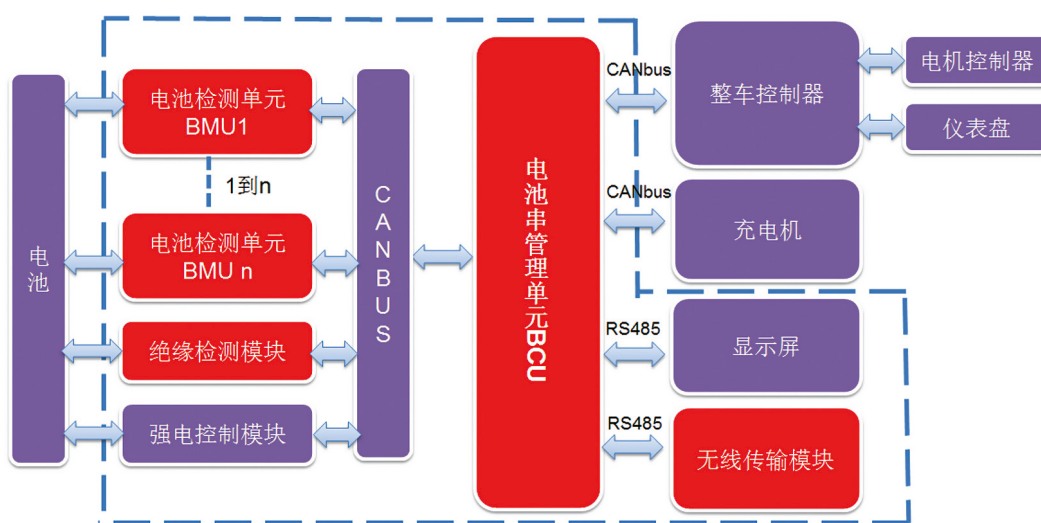
 **MICROCHIP**

 **SIMCom**
a SUNSEA AUT company

什么是BMS

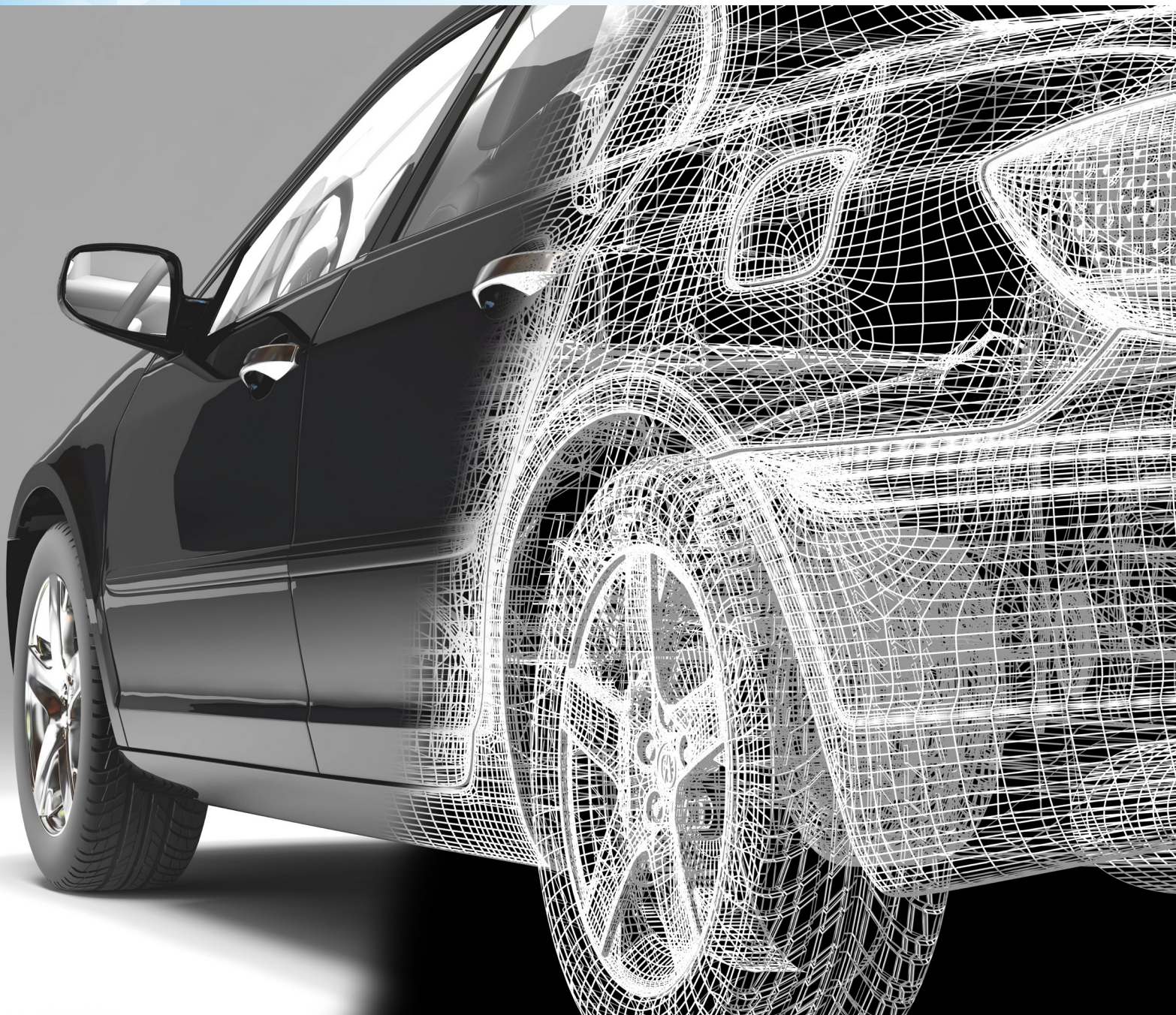
电动汽车的电池管理系统 (BMS) 主要功能就是为了能够提高电池的利用率, 防止电池出现过度充电和过度放电, 延长电池的使用寿命, 针对电动汽车的动力电池参数进行实时监控、故障诊断、SOC估算(电流监视)、行驶里程估算、短路保护、漏电监测、显示报警, 充放电模式选择等, 并通过CAN/Lin总线的方式与车辆集成控制器或充电机进行信息交互, 保障电动汽车高效、可靠、安全运行, 并保证在车辆使用过程中的安全。

BMS的结构功能框图



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Bourns公司的电路保护器件与方案

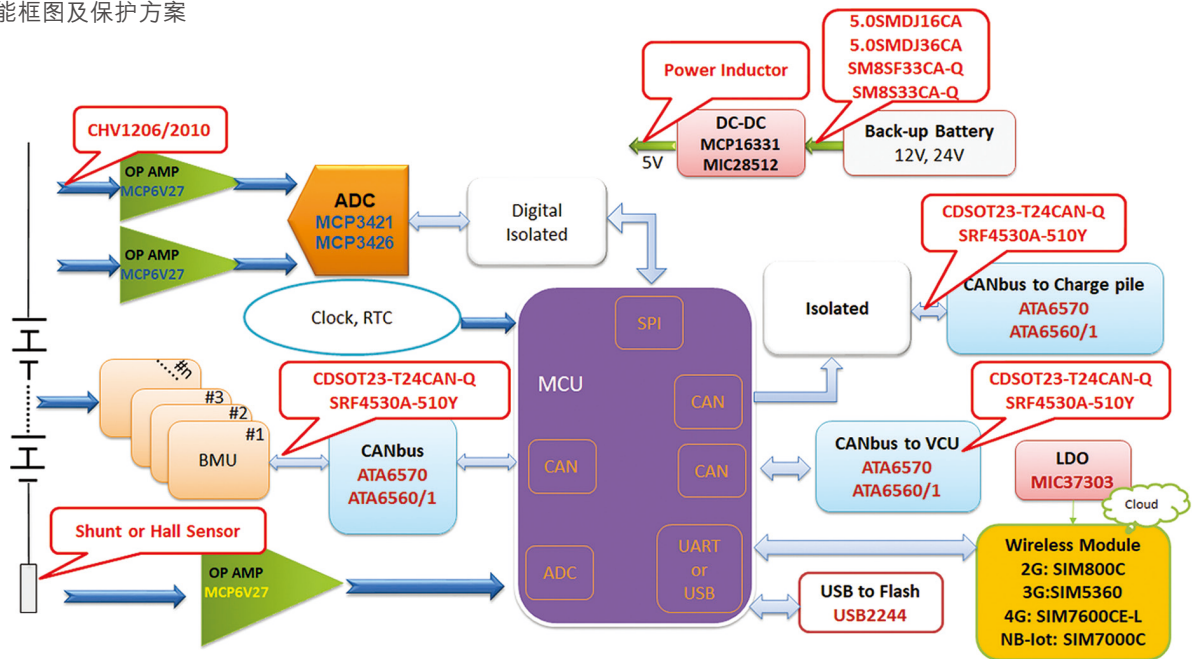
BOURNS®

针对BMS的电路保护系统，世健公司代理的美国Bourns公司为客户提供了一整套的系统级完全满足AEC-Q101/Q200汽车级认证的电子元器件保护解决方案。

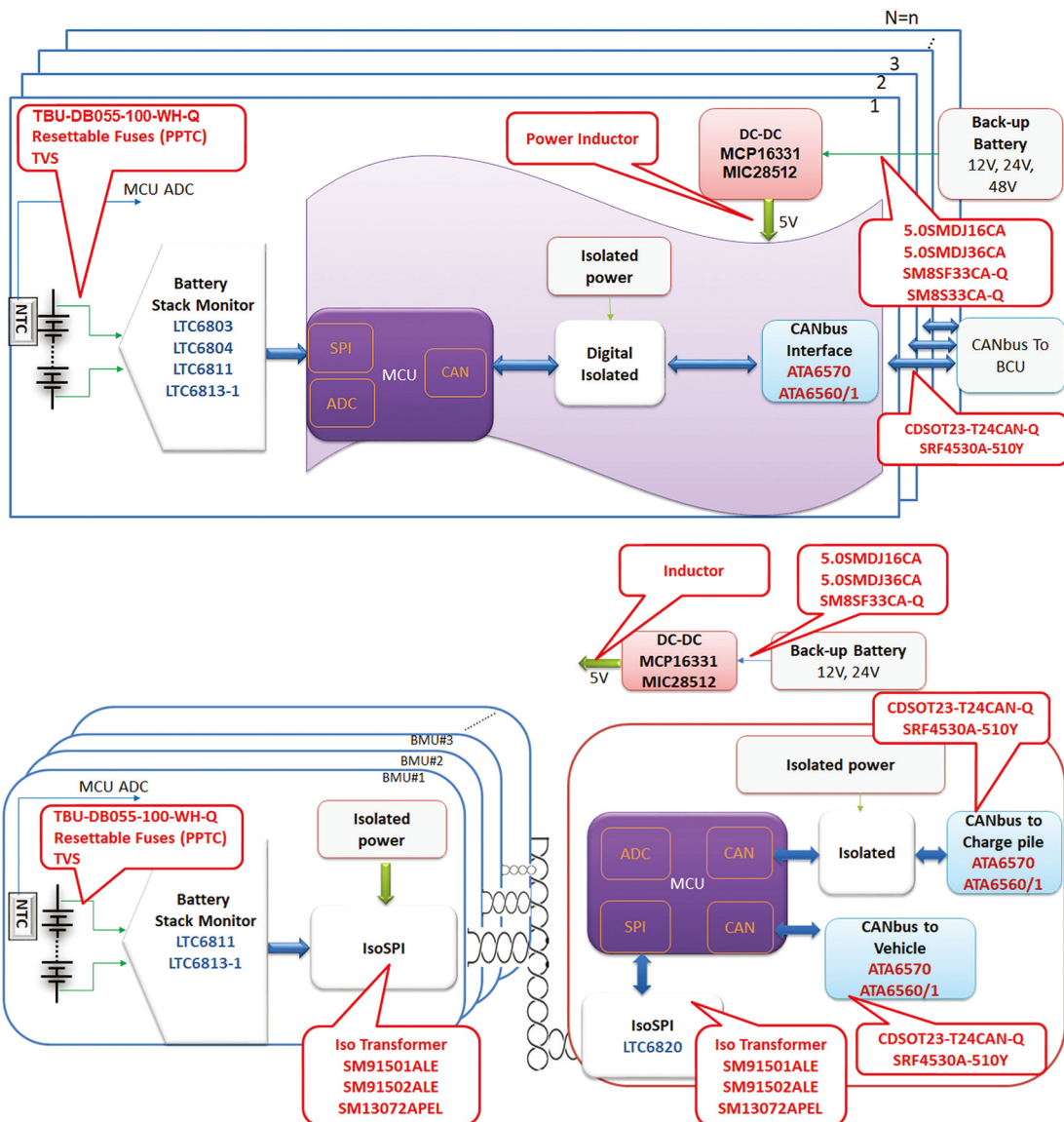
- 功率电感
- PPTC
- TBU
- ESD保护
- CANbus保护 (TVS, CMC)
- 电流检测电阻
- Shunt分流器
- 抛负载保护TVS
- 功率电阻
- 隔离变压器

BMS系统及保护方案功能框图

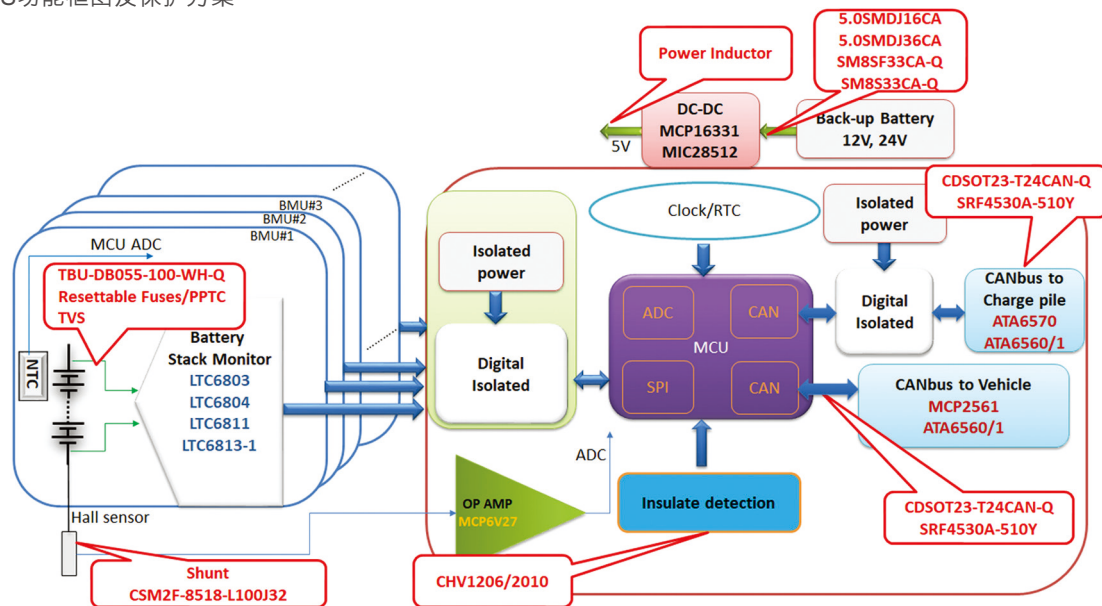
BCU功能框图及保护方案



BMU功能框图及保护方案

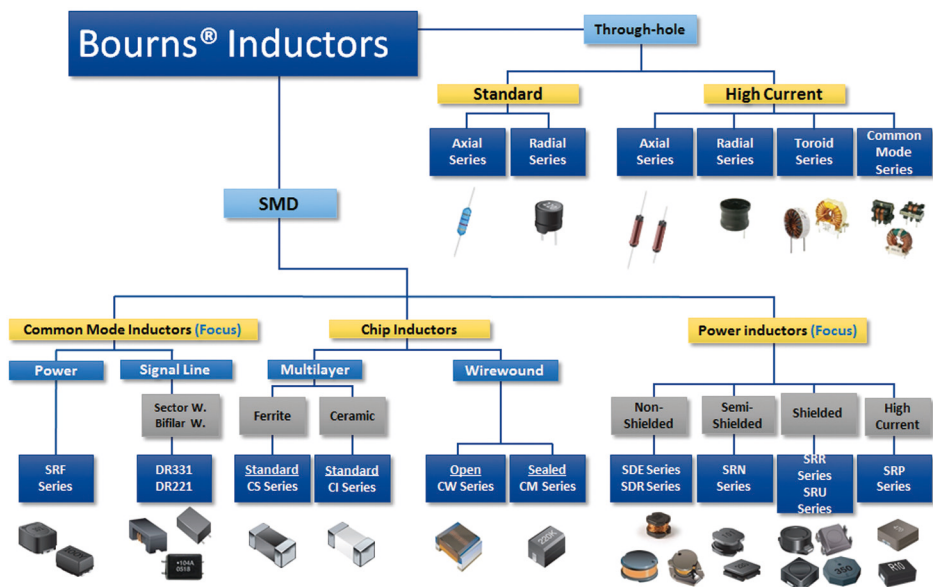


一体式BMS功能框图及保护方案



功率电感选型

Bourns提供的电感器件类型



Bourns提供定制化电感器件服务



Bourns满足AEC-Q认证的车规级电感器件

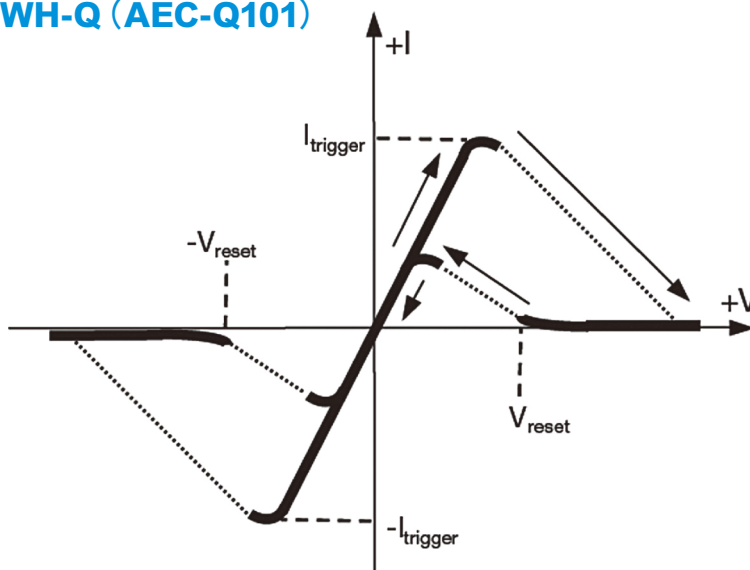
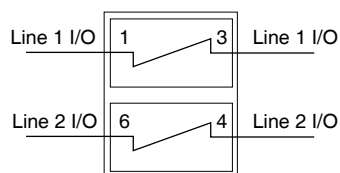
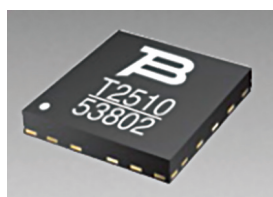
Series	Inductor Value Range(uH)	Max Current Range(A)	Saturation Current Range (A)	Diameter or LxW mm	Core	Shielded	Comment
SRN2010TA	0.47-22	2.35-0.27	2.7-0.38	2x1.6	ferrite (Drum)	Y	Semi Shield
SRN2508A	0.47-10	1.45-0.45	2.5-0.55	2.5x2x0.8	ferrite (Drum)	Y	Semi Shield
SRN3010TA	1-22	2.1-0.6	1.8-0.43	3x3x1	ferrite (Drum)	Y	Semi Shield
SRN3012TA	1-22	2-0.61	2.15-0.49	3x3	ferrite (Drum)	Y	Semi Shield
SRN3015TA	1-47	2.2-0.4	2.2-0.35	3x3	ferrite (Drum)	y	Semi Shield
SRN4012TA	0.47-22	3.2-0.62	4-0.5	4x4	ferrite (Drum)	y	Semi Shield
SRN4026	1-220	3-0.2	3-0.2	4x4	ferrite (Drum)	Y	Semi Shield
SRN5020	1-33	3.6-0.9	4-0.8	5x5	ferrite (Drum)	y	Semi Shield
SRN6028	0.9-100	4.6-0.66	4.6-0.66	6X6	ferrite (Drum)	y	Semi Shield
SRN6045TA	1-220	4.2-0.6	8.5-0.7	6X6	ferrite (Drum)	y	Semi Shield
SRN6045	1-220	8-0.6	13.5-0.88	6x6	ferrite (Drum)	Y	Semi Shield
SRN8040	0.5-100	10-1	12-1	8X8	ferrite (Drum)	y	Semi Shield
SRN8040TA	0.5-330	12-0.7	17-0.75	8x8	ferrite (Drum)	Y	Semi Shield
SDE0403A	1~68	2.7-0.4	4.8-0.55	4x3	Ferrite (Drum)	N	
SDE0604A	1.2-150	5.3-0.52	6-0.52	6x4	Ferrite (Drum)	N	
SDE0805A	1.5-470	5.8-0.55	6.5-0.4	8x5	Ferrite (Drum)	N	
SDE1006A	1.2~820	7.2~0.45	7.2~0.45	9	Ferrite (Drum)	N	
SDR1307A	1.5~1000	9.5~0.65	20~1.0	13	Ferrite (Drum)	N	
SRR0735A	10~680	2.1~0.21	1.85~0.22	7.3x7.3	Ferrite (Drum)	Y	
SRR452A	1.2-390	4.82-0.28	4.82-0.28	5x5x2.8	ferrite (Drum)	Y	
SRR0745A	10~1000	2.1~0.2	2.5~0.24	7.3x7.3	Ferrite (Drum)	Y	
SRR1050A	0.68-330	9.5-0.73	13.5-0.75	10x10.2	ferrite (Drum)	Y	
SRR1210A	1~1000	11~0.75	16.5~0.7	12x10	Ferrite (Drum)	Y	
SRR1260A	1~1000	9.4~0.68	10~0.6	12.5x12.5	Ferrite (Drum)	Y	
SRF1280A	4.7~1000	8.2~0.68	8.8~0.8	12.5x12.5	Ferrite (Drum)	Y	
SRR6040A	1~100	5-0.65	5-0.55	6x4	Ferrite (Drum)	Y	
SRR0745A	10~1000	2.1~0.2	2.5~0.24	7x4.5	Ferrite (Drum)	Y	
SRU1028A	1-150	7~0.7	8.0~0.65	10x10	Ferrite (Drum)	Y	
SRU1038A	1.5~330	7.2~0.55	7.0~0.55	10x10	Ferrite (Drum)	Y	
SRU1048A	1.5~330	7~0.65	7.2~0.52	10x10	Ferrite (Drum)	Y	
SRU1063A	4.7-100	5.5-1.1	5.7-1.2	10x10	ferrite (Drum)	Y	
SRU3028A	10~33	0.72~0.47	0.86~0.48	3.3x3.5	Ferrite (Drum)	Y	
SRU5028A	1.2~100	3.5~0.47	3.4~0.42	5.2x5.2	Ferrite (Drum)	Y	
SRU6025A	1.2~220	4.0~0.42	3.2~0.24	6.2x6.5	Ferrite (Drum)	Y	
SRU8028A	2.5~100	4.5~0.75	4.2~0.7	8x8	Ferrite (Drum)	Y	
SRU8045A	3.5-100	5-1	5-0.92	8x8	ferrite (Drum)	Y	
SRF0703A	8.2~150	2.19~0.58	2.66~0.65	7x3	Ferrite (Drum)	Y	
SRF0905A	10~6500	1.6~0.3		9x5	Ferrite (Drum)	Y	
SRF1260A	0.47~4000	17.6~0.57	33~0.7	12.5x12.5	Ferrite (Drum)	Y	Windings in parallel
SRF1280A	0.47~4000	17.9~0.307	56~0.34	12.5x12.5	Ferrite (Drum)	Y	Windings in parallel
SRP1038A	0.14~47	35~3	60~4.5	10x4	Iron	Y	
SRP1238A	0.1~10	43~7	84~14	13.25x12.5	Iron	Y	
SRP1245A	0.33~18	42~7.5	80~11	12x4	Iron	Y	
SRP1265A	0.15~45	55~6.5	118~9.5	12x6.5	Iron	Y	
SRP1238A	0.1~10	43~7	84~14	12x4	Iron	Y	
SRP23133A	1.5-68	57-12	48-9	23.5x22x12.6	Iron	Y	
SRP7028A	0.22~10	23~3.5	40~6	7.3x6.6	Iron	Y	
SRP4012TA	0.1~10	11.5~1.3	25~1.4	4x1.2	Iron	Y	
SRP4020TA	0.1~15	12~1.5	35~1.9	4.1x4.1x1.9	Iron	Y	
SRP4020FA	0.47-4.7	13.2-5.1	14-4	4.1x4.1x1.9	Iron	Y	
SRP4030FA	0.9-6.8	11.2-4	10-4.6	4.1x4.1x2.8	Iron	Y	
SRP5020TA	0.33-10	12-2.3	21.3-3.4	5.7x5.2x1.8	Iron	Y	
SRP5030CA	0.15-4.7	22.2-5.9	36-8.2	5.5x5.3x2.9	Iron	Y	
SRP6050CA	1-4.7	20-8.5	23-10	6.6x6.4x4.8	Iron	Y	
SRP6050FA	4.7-22	11-5	10.5-5.6	6.6x6.4x5.8	Iron	Y	
SRP1770TA	1 ~ 100	52 ~ 5.3	70~12	17.3 x 16.9 x 6.7	Iron	Y	
SRP5015TA	0.15~22	16~1.2	25~1.7	5.7 x 5.2 x 1.3	Iron	y	
SRP5030TA	0.33~10	14~2.75	25~3.5	5.7 x 5.2 x 2.8	Iron	y	
SRP7050TA	0.1~15	25~1.2	35~1.9	core 7.3 x 6.6 x 4.8	Iron	Y	
PQ2614BHA	2.2-33	30		28X28X16	Ferrite PQ core	Y	
PQ2614BLA	1-33	30		28X28X16	Ferrite PQ core	Y	
PQ2617BHA	3.3-33	28		28x28x19	Ferrite PQ core	Y	

备注：

Max Current = Current with an increase of 40C in Temperature
Saturation Current = Current with a drop of 10% in Inductance

TBU介绍: TBU-DB055-100-WH-Q (AEC-Q101)

TBU的基本工作原理



TBU-DB055-100-WH-Q技术参数

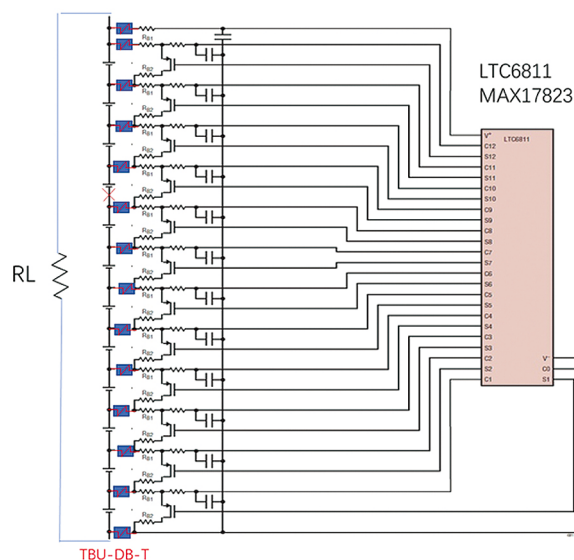
Symbol	Parameter	Min.	Typ.	Max.	Unit
V _{imp}	Peak impulse voltage withstand with duration less than 10ms			550	V
V _{dc}	Peak DC voltage withstand with duration less than 1 hour			450	V
I _{trigger}	Current required for the device to go from operating state to protected state	100	150	200	mA
R _{device}	Series resistance of the TBU device	10.5	13.5	16.5	ohm
T _{block}	Time taken for the device to go into current limiting			1	us
I _q	Current through the triggered TBU device with 50Vdc circuit voltage		0.5		mA
V _{reset}	Voltage below which the triggered TBU device will transition to normal operating state	4.5	7.5	9.5	V

TBU同PTC相比的技术优势

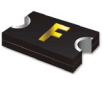
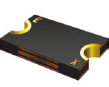
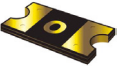
	TBU	PTC
动作响应时间	纳秒级 (小于1us)	毫秒级
动作后内阻变化	自恢复后内阻不变	每次恢复后增大
耐压	车规级 最高550V；工业级最高850V	几十V级别
触发精度	基于Mos工艺，精确触发	随工作环境温度变化而改变

TBU-DB055-100-WH-Q在BMS电路保护上的技术优势

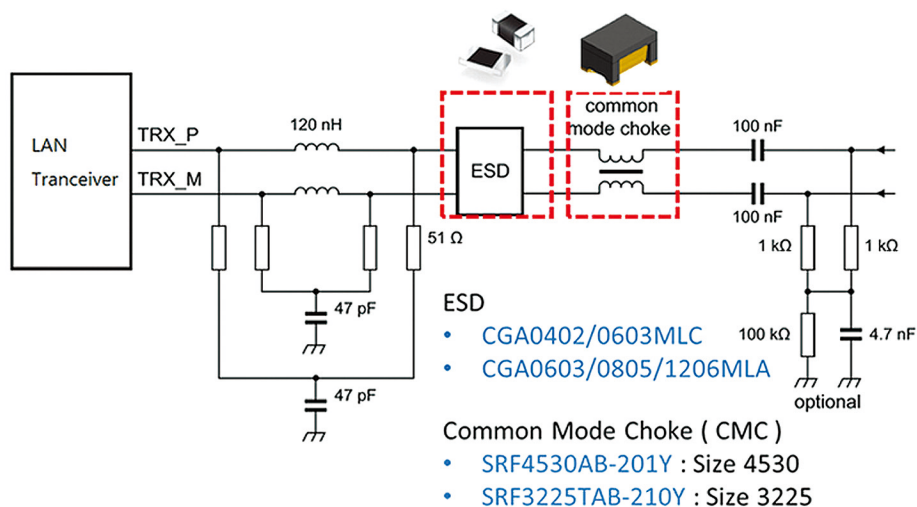
- 快速响应 (<1us)
- 快速恢复
- 高耐压 (550V_{imp}, 450V_{dc})
- 防止交流电搭接损坏
- 动作电流最大 150mA
- 复位电压7.5V (typ.)



PPTC选型

Series	Image	Max Operating Temperature (°C)	Voltage (V)	Current (A)	R1Max (Ω)	Nominal Trip Current (A) at 23C	Time to Trip at 23C (S)	Trip Current at 23C at Time to Trip (A)	Format
MF-RHT		125	16	0.7~13	0.01~0.8	1.4~24	4~13	3.5~60	Radial
MF-SMHT		125	16	1.36~1.6	0.15~0.33	2.72~3.2	10	8	2920 & 3425 package
MF-PSHT		125	16	0.1	7.5	0.6	1.5	2.5	0805 Package
MF-RG		85	16	3~5	0.034~0.0975	5.1~8.5	1-2	15-25	Radial
MF-R		85	60	0.05~11	0.014~22	0.1-22	5-20	0.5-40	Radial
MF-SM		85	6-60	0.3~3	0.048~4.8	0.6-6	3-35	1.5-8	2920 & 3425 package
MF-LSMF		85	6-33	1.85~3.0	0.075~0.15	3.7-5.2	2.5-20	8	2920 package
MF-MSMF		85	6-60	0.1~2.6	0.08~15	0.3-5.2	0.06-5	0.5-8	1812 Package
MF-NSMF		85	6-30	0.12~2	0.085~8.5	0.29-4	0.1-1	1-8	1206 Package

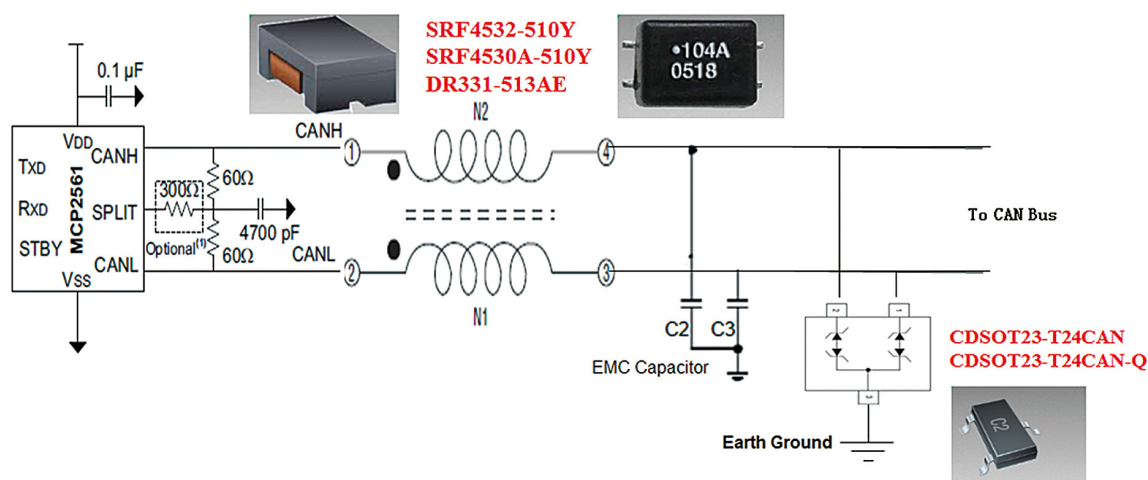
车载以太网保护方案选型



ESD保护选型 (适用于CANbus, 以太网等信号通信传输ESD保护)

Part Number	Working Voltage (V)	ESD Rating	BreakDown Voltage	Capacitance	Clamping Voltage(V)
CGA0402MLC-05E	5	8KV Contact, 15KV Air	300V (1)	0.2pF	30(2)
CGA0402MLC-12E	12	8KV Contact, 15KV Air	300V	0.2pF	30
CGA0402MLC-24E	24	8KV Contact, 15KV Air	300V	0.2pF	30
CGA0603MLC-05E	5	8KV Contact, 15KV Air	300V	0.2pF	30
CGA0603MLC-12E	12	8KV Contact, 15KV Air	300V	0.2pF	30
CGA0603MLC-24E	24	8KV Contact, 15KV Air	300V	0.05pF	30
CGA0603MLA	32V Max	8KV Contact, 15KV Air	71V Max	160pF Max	120V Max
CGA0805MLA	38V Max	8KV Contact, 15KV Air	52V Max	400pF Max	81V Max
CGA1206MLA	56V Max	8KV Contact, 15KV Air	73V Max	840pF Max	110V Max

CANbus保护 (TVS, CMC) 选型



CDSOT23-T24CAN-Q与同类产品对比

		Bourns	Onsemi	Littelfuse
Parameter	Units	CDSOT23-T24CAN-Q	NUP2105L	SM24CANB
V_{DRM}	V	24	24	24
I_{PPSM} (8/20 us current waveform)	A	8	8	10
ESD (Contact)	kV	30	30	30
V_{BR} min. @ $I_{BR} = 1$ mA	V	26.2	26.2	26.7
V_{BR} max. @ $I_{BR} = 1$ mA	V	32	32	N/A
I_R max.	uA	0.1	0.1	0.1
Typical V_C @ I_{PPSM}	V	40	44 max.	50 max.
C (Line to GND), typical	pF	22	30 max.	30
AEC-Q101 Qualified	-	Yes	Yes	Yes

- NOTES
1. CDSOT23-T24CAN-Q比 Littelfuse SM24CANB具有较低的寄生电容 (22pF vs.30pF)
 2. 其他的参数都相似
 3. Onsemi的参数来源于20160127数据手册
 4. Littelfuse的参数来源于20160127数据手册

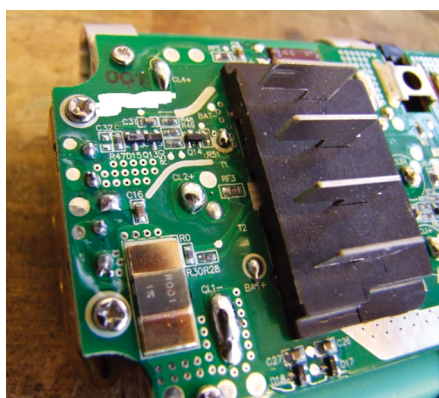
CMC系列产品选型

Series	Size	Inductance(uH)	Current(mA)	DCR (Ω)
SRF4530A-110Y	4.5x3.2x3	11	360	0.5
SRF4530A-220Y	4.5x3.2x3	22	310	0.6
SRF4530A-510Y	4.5x3.2x3	51	230	1
SRF4530A-101Y	4.5x3.2x3	100	200	1.5
SRF3225AB-101Y	3.2x2.5x2.5	100	150	1.5
SRF3225AB-201Y	3.2x2.5x2.5	200	70	5.5

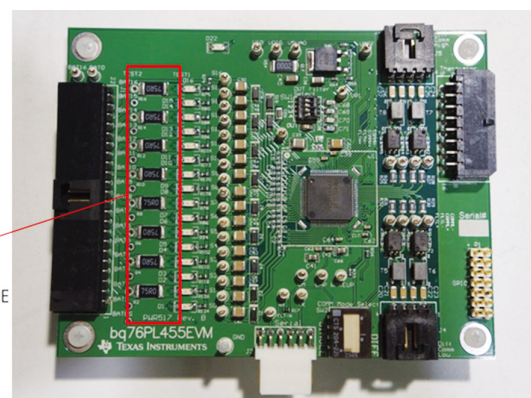
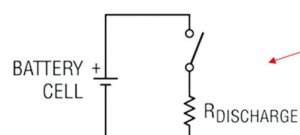
电流检测电阻选型

Model	Image	Size (mm)	Max Current (A)	Voltage Drop @Max Current(mV)	Power(W)	Min Resistance (m Ω)	No of Terminals	Resistive Material
CRF0805		2x1.25	10		0.5	1	2	Metal Alloy
CRF1206		3.2x1.65	32		1	1	2	Metal Alloy
CST0612		1.65x3.05	44.7	22.3	1	0.5	2	Metal Alloy
CRA2512		6.45x3.35	17		3	10	2	Metal Alloy
CRE2512		6.45x3.35	55	50	3	1	2	Metal Alloy
CSS2H-2512		6.35x3.05	140	42.4	6	0.1	2	E Beam Metal Alloy with Copper Terminals
CSS2H-3920		10.04x5.2	245	49	12	0.2	2	E Beam Metal Alloy with Copper Terminals
CSS2H-5930		15x7.75	126.5	63	15	0.2	2	E Beam Metal Alloy with Copper Terminals
CSS4J-4026		10.06x6.6	100	50	5	0.2	4	E Beam Metal Alloy with Copper Terminals

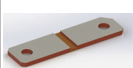
案例照片1：小功率电流采样



案例照片2：被动均衡设计 (Passive Balancing Design)



大电流分流器Shunt选型

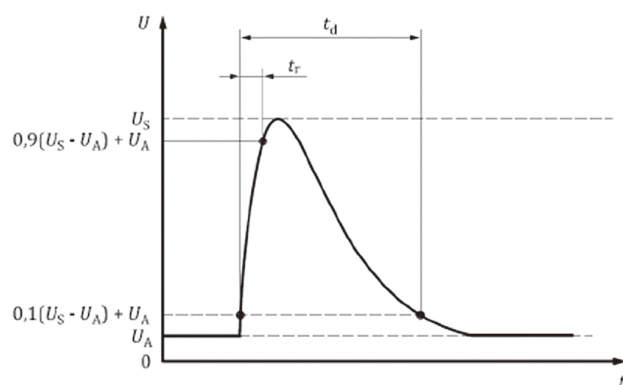
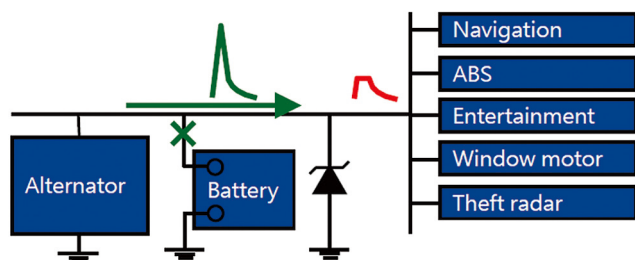
Products	Image	Resistance Range/ Power Rating@70C	Operating Temperature Range	TCR on test points	TCR on Resistive Alloy	Thermal EMF(μV/K)	Resistance Tolerance
CSM2F-6918-STD		50uohm/36W	-40~+170C	+/-200ppm/C for 50uohm	<50ppm/C	<0.25 for 50uohm	+/-5%
CSM2F-7036-STD		50uohm/50W	-40~+170C	+/-200ppm/C for 50uohm	<50ppm/C	<0.25 for 50uohm	+/-5%
CSM2F-8518-STD		50uohm/36W, 100uohm/36W	-40~+170C	+/-200ppm/C for 50uohm; +/-125ppm/C for 100uohm	<50ppm/C	<0.25 for 50uohm; <1.50 for 100uohm	+/-5%
CSM2F-8518- L100J32		50uohm/36W, 100uohm/36W	-40~+170C	+/-150ppm/C for 50uohm; +/-125ppm/C for 100uohm	<50ppm/C	<0.25 for 50uohm; <1.50 for 100uohm	+/-5%
CSM2F-8536-STD		25uohm/50W, 50uohm/50W	-40~+170C	+/-200ppm/C	<50ppm/C		+/-5%

参考设计照片



抛负载保护TVS选型

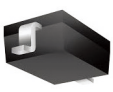
抛负载保护原理



抛负载新旧标准对比

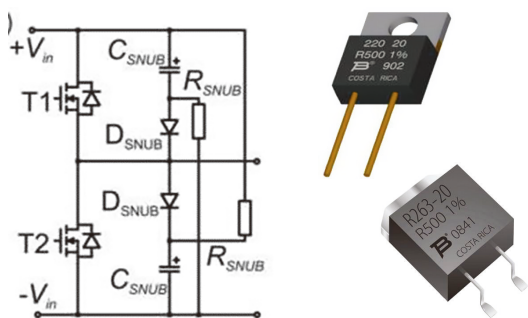
Standard	ISO7637-2 (Old)	ISO16750-2 (New)
Parameter	24V System	24V System
Us	123V to 174V	151V to 202V
Ri	1ohm to 8ohm	1ohm to 8ohm
td	100ms to 350ms	100ms to 350ms
tr	10/+0/-5ms	10/+0/-5ms
Pulse	1 Pulse	10 Pulse(1pulse/min)

AEC-Q 认证的TVS产品列表

	CDSOT23-T24CAN-Q	CDSOD323-TxxC-DSL-Q	SMAJ-Q	SMBJ-Q	SMCJ-Q	SMLJ-Q	5.0SMDJ-Q	SM8S-Q	SM8SF33CA-Q
Package									
Package Type	SOT-23	SOD323	DO-214AC (SMA)	DO-214AA (SMB)	DO-214AB (SMC)	DO-214AB (SMC)	DO-214AB (SMC)	DO-218	0.41" x 0.32"
Peak Pulse Power (Watt) (10/1000 μ s)	-	-	400	600	1500	3000	5000	6600	7000
Peak Pulse Current (A) (10/1000 μ s)	8 (8/20 μ s)	11/6(8/20 μ s)	20.1 ~ 4.3	30.2 ~ 6.5	75.4 ~ 16.1	150.6 ~ 32	252 ~ 72.1	254 ~ 95	132
Stand-Off Voltage (V)	24	12/24	12 ~ 58	12 ~ 58	12 ~ 58	12 ~ 58	12 ~ 43	16 ~ 43	33
Breakdown Voltage (V)	26.2	13.3 / 26.7	13.3 ~ 64.4	13.3 ~ 64.4	13.3 ~ 64.4	13.3 ~ 64.4	13.3 ~ 47.8	17.8 ~ 52.8	36.7

功率电阻选型

RCD电路举例

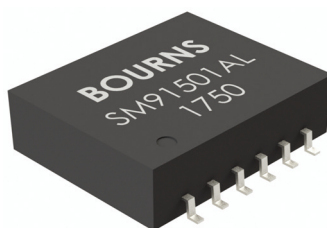
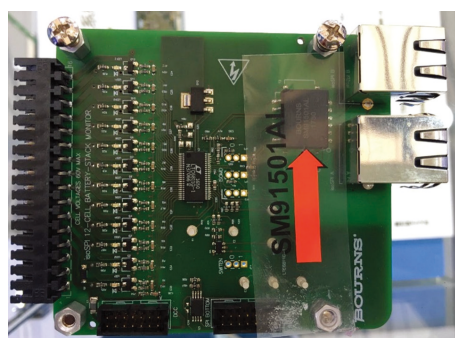


Series	Power (W Heatsink)	Max Operating Voltage	Resistance Range	Operating Temperature
PWR163	25W	250V	0.02-130K	-55~155°C
PWR263	35W	250V	0.02-130K	-55~155°C
PWR220T-20	20W	250V	0.02-130K	-55~155°C
PWR220T-35	35W	250V	0.02-130K	-55~155°C
PWR221T-30	30W	250V	0.02-130K	-55~155°C

信号隔离变压器选型

Bourns #	Chipset	Channel	Voltage/ Isolation	HI-POT Isolation	Center Tap	Choke	AEC-Q200	Operation Temp
SM91073ALE	ADI LTC6811/6804	2	100Vdc/Function	1500Vrms	Yes	Yes	Yes	-40~85°C
SM91074ALE	ADI LTC6811/6804, Maxim MAX17823	2	100Vdc/Function	1500Vrms	Yes	Yes	Yes	-40~125°C
SM91501ALE	ADI LTC6811/6804, NXP MC33771/2	2	1600Vdc/15 years	4300Vdc/3100Vac	Yes	Yes	Yes	-40~125°C
SM91502ALE	ADI LTC6811/6804, NXP MC33771/2	1	1000Vdc/15 years	4300Vdc	Yes	Yes	Yes	-40~125°C
SM13105ALE		2	1600Vdc Max/Reinforced	3100Vrms	Yes	No	WIP	-40~125°C
SM91510ALE	Maxim MAX17823	1	600Vdc/15 years	3200Vdc	Yes	Yes	Yes	-40~125°C
SM13072APEL	Ethernet 802.3	2	N/A	1500Vrms/2250Vdc	Yes	Yes	Yes	-40~125°C
PT61018AAPEL-S	Ethernet 802.3	2	N/A	1500Vrms	Yes	Yes	Yes	-40~85°C

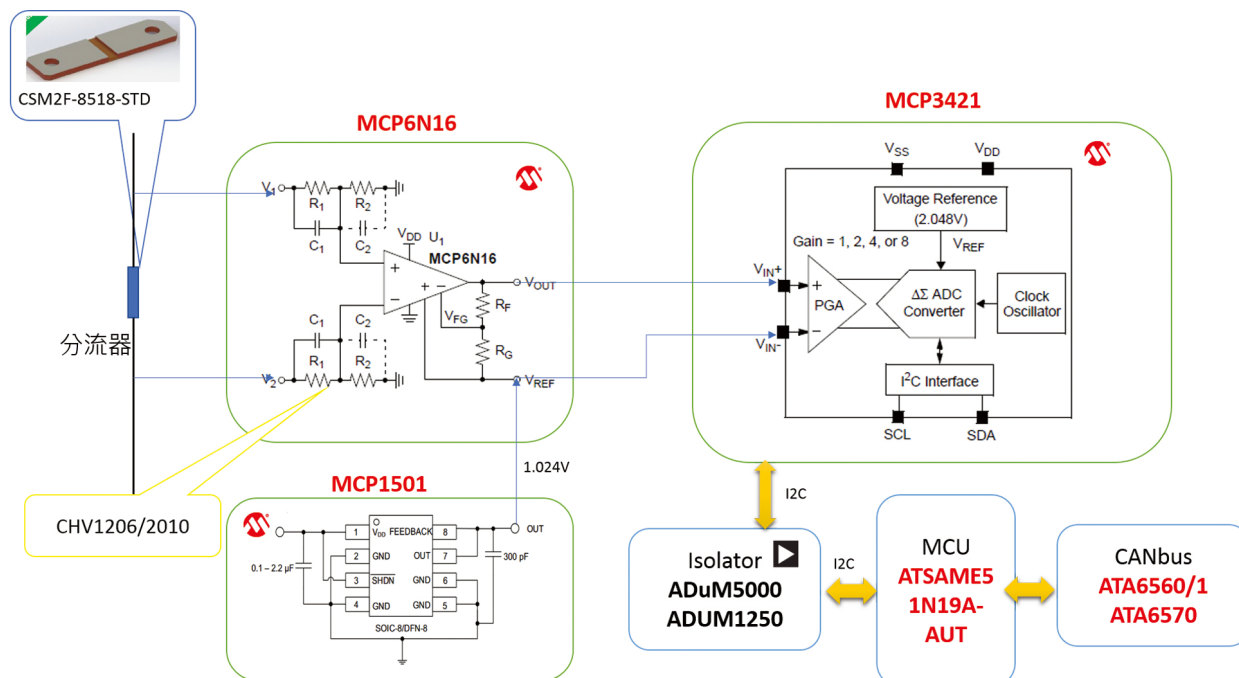
参考设计照片



Microchip公司提供的方案与产品

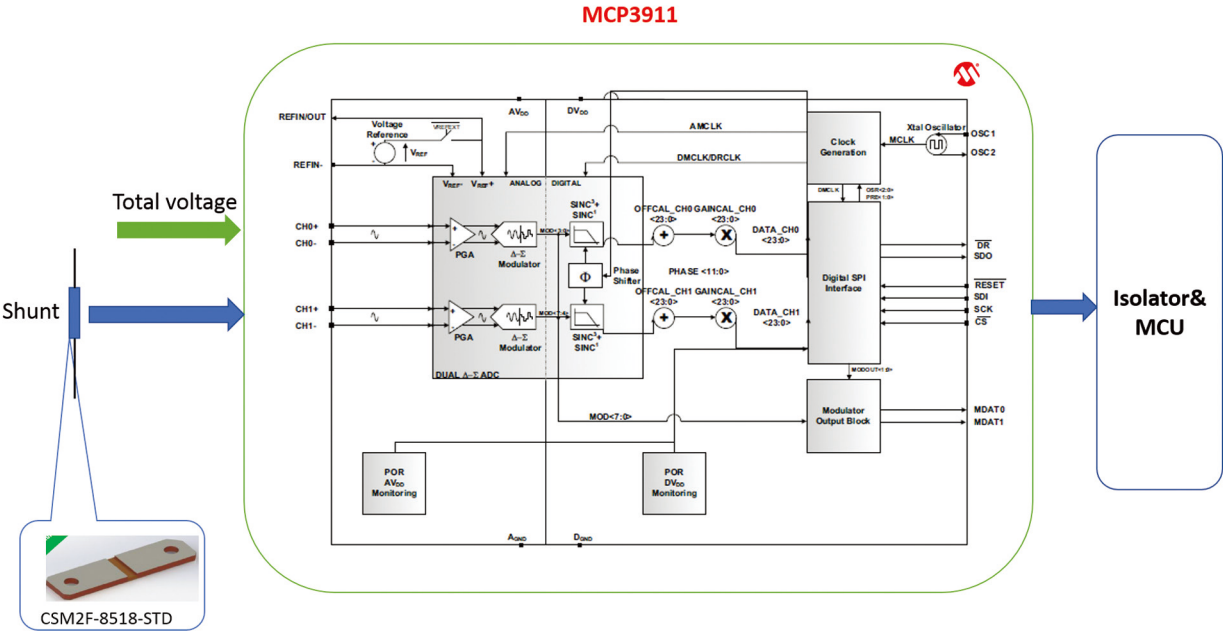


BMS电流测量方案



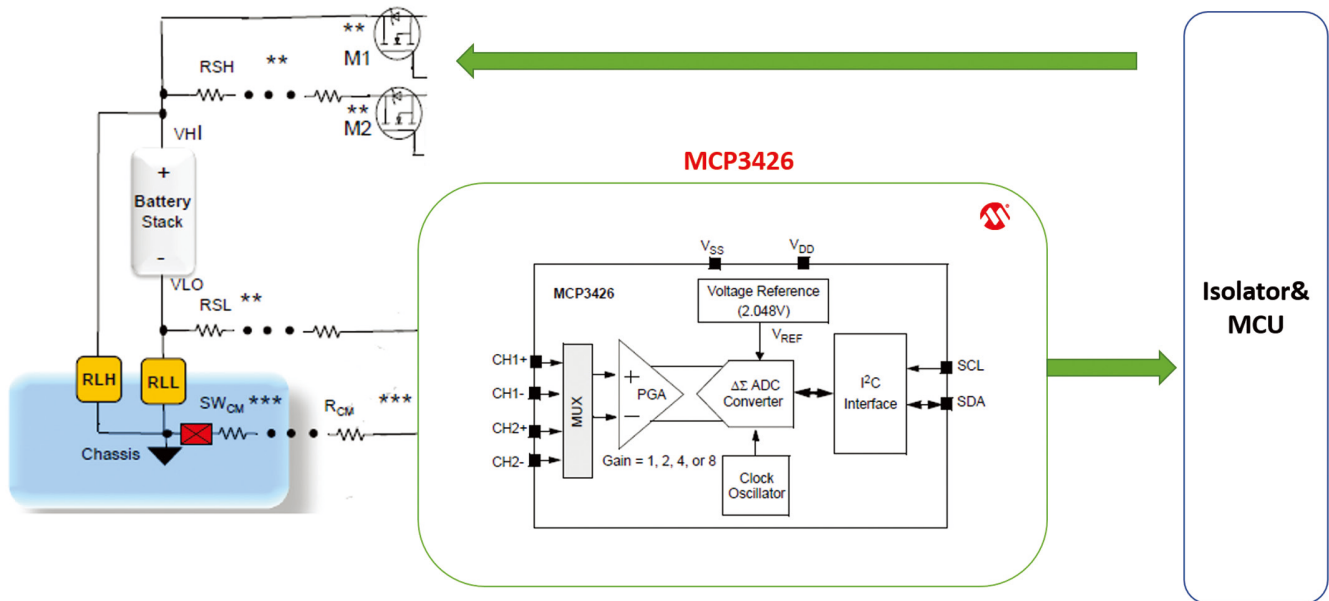
Part	# of Channels	Gain Min (V/V)	Gain Max (V/V)	V _{DD} (V)	I _q Max (μA/amp)	Rail-to-Rail In/Out	GBWP Typ (kHz)	V _{OS} Max (μV)	V _{OS} Drift Max (μV/°C)	Noise Density @ 1kHz (nV/rHz)	Gain Setting Method	Gain Error Max (±%)	Package	Comments
MCP6N16	1	1	10000	1.8-5.5	1600	True	35000	17	0.06	45	2 R	0.15	DFN-8, MSOP-8	Zero-Drift; Select Min. Gain option: 1, 10, 100
Part	Architecture	Input Channels SingleEnded	Input Channels Differential	Total Max Resolution (bits)	Max Sampling Rate (sps)	Lowest Device Output Noise (μVrms)	Integral Non-Linearity Error Typ (± ppm)	Integral Non-Linearity Error Max (± ppm)	Offset Error Typ (μV)	Interface	V _{DD} (V)	I _{DD} Max (μA)	Internal PGA	Package
MCP3421	Delta Sigma	1	1	18	4	1.5	10	35	15	I ² C™	2.7-5.5	190	Y	SOT-23-6
Part	Output Voltage (V)	Initial Accuracy (max%)	V _{CC} Range (V)	Max. Supply Current (μA @ 25°)	Max Load Current (mA)	Temperature Coefficient (ppm/°C)	Max Load Regulation @ 2mA (mV/mA)	Max Line Regulation (μV/V)	V _{IN} Max (V)	Tol Typ (%)	Output Current Min	Noise (μV) rms	Output Current Max	Package
MCP1501	1.024V, 1.250V, 1.800V, 2.048V, 2.500V, 3.000V, 3.300V, 4.096V	0.10	1.65-5.5	350	20	50	0.04	51.2	5.5	0.1	-20mA	7	20mA	SOIC 150mil-8, SOT-23-6, WDFN-8

BMS能量/功率监测方案



Part	Power Type	Device Type	ADC Resolution (bits)	ADC Accuracy (SINAD, Signal to Noise and Distortion) (dB)	Phase Correction	# of PGAs	PGA Range	Active Power Measurement Error	Active Power Measurement Range	Voltage Reference Tolerance (%)	Voltage Reference Drift Typical (ppm/°C)	Interface	Operating Voltage (V)	Package
MCP3911	Single-Phase	Analog-Front-End	24	94.5	Yes	2	1:32	0.1%	10000:1	2	7	SPI	2.7 - 3.6	QFN-20, SSOP 208mil-20

BMS漏电/绝缘监测方案



Part	Architecture	Input Channels Single Ended	Input Channels Differential	Total Max Resolution (bits)	Max Sampling Rate (sps)	Lowest Device Output Noise (μVrms)	Integral Non-Linearity Error Typ (± ppm)	Integral Non-Linearity Error Max (± ppm)	Offset Error Typ (μV)	Interface	Vdd (V)	Idd Max (μA)	Internal PGA	Package
MCP3426	Delta Sigma	2	2	16	15	2.5	10	-	30	I²C™	2.7-5.5	180	Yes	DFN-8, MSOP-8, SOIC-8

CANbus 收发器产品选型

Product	CAN Interface	Version Supported	Wake-up	Interface speed	Operating Voltage (V)	Temp. Range (C)
ATA6565	2	ISO 11898-2, ISO11898-5, ISO/DIS11898-2 (2016) and SAEJ2962-2	Wake-up on Pattern (WUP), as specified in ISO/DIS11898-2(2016), 3.8μs activity filter time	CAN-FD 5Mbit/s	"4.5 - 5.5"	"-40 - +125"
ATA6560	1	Fully ISO 11898-2,-5, SAE J2284 compliant	Silent mode (receive only), Remote wake-up capability via CAN bus	CAN-FD 5Mbit/s	"4.5 - 5.5"	"-40 - +125"
ATA6561	1	Fully ISO 11898-2,-5, SAE J2284 compliant	Remote wake-up capability via CAN bus	CAN-FD 5Mbit/s	"3 - 5.5"	"-40 - +150"
ATA6570	1	ISO 11898-2, ISO11898-5, ISO11898-6, ISO/DIS 11898-2 (2016) and SAEJ2962-2 □ Autonomous bus biasing according to ISO 11898-6	Local wake-up via pin WAKE, Remote wake-up pattern according to ISO 11898-5, Remote wake-up frame according to ISO 11898-6 (selective wake-up), Host wake-up via SPI	5Mbit/s (CAN FD) 4Mbit/s SPI interface	"4.55 - 28"	"-40 - +125"

SIMCOM公司提供的无线模块

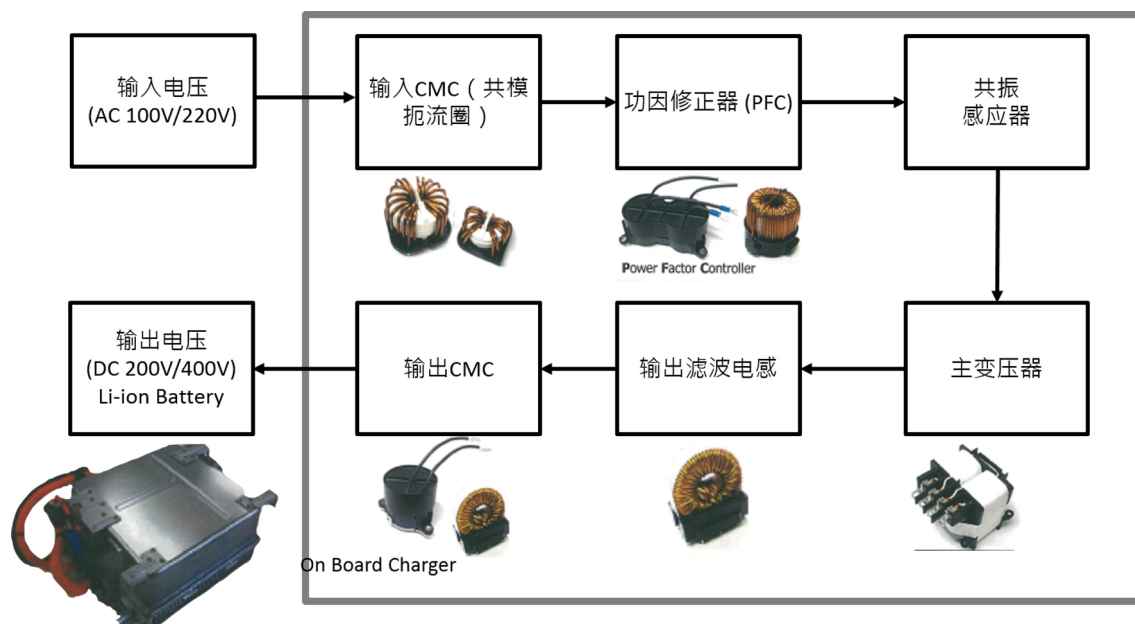


SIMCom Model	Category	Network Protocol	Power supply	BandWidth	Size(mm)	Operation Temp
SIM7600CE-L	4G 7mode	TCP/IP/IPV4/V6 Multi-PDP MT PDP/FTP/FTPS/HTTP HTTPS/DNS	3.4~4.2V	CAT4 150Mbps(DL) 50Mbps(UL)	30*30*2.9	-40 ~ +85°C
SIM5360E	3G W CDM A/ HSPA+	TCP/IP/IPV4/V6 Multi-PDP MT PDP/FTP/FTPS/HTTP HTTPS/SMTP/POP3/DNS	3.4~4.2V	14.4Mbps(DL) 5.76Mbps(UL)	30*30*2.9	-40 ~ +85°C
SIM800C	2G GSM/ GPRS	TCP/UDP/HTTP/FTP/ POPS/SMTP	3.4~4.4V	85.6Kbps(DL) 85.6Kbps(UL)	17.6*15.7*2.3	-40 ~ +85°C
SIM7000C	NB-IoT/eMTC/ GPRS/ GNSS	TCP/IP/IPV4/V6 Multi-PDP MT PDP	3.0~4.3V	300Kbps(DL) 375Kbps(UL)	24*24*2.6	-40 ~ +85°C

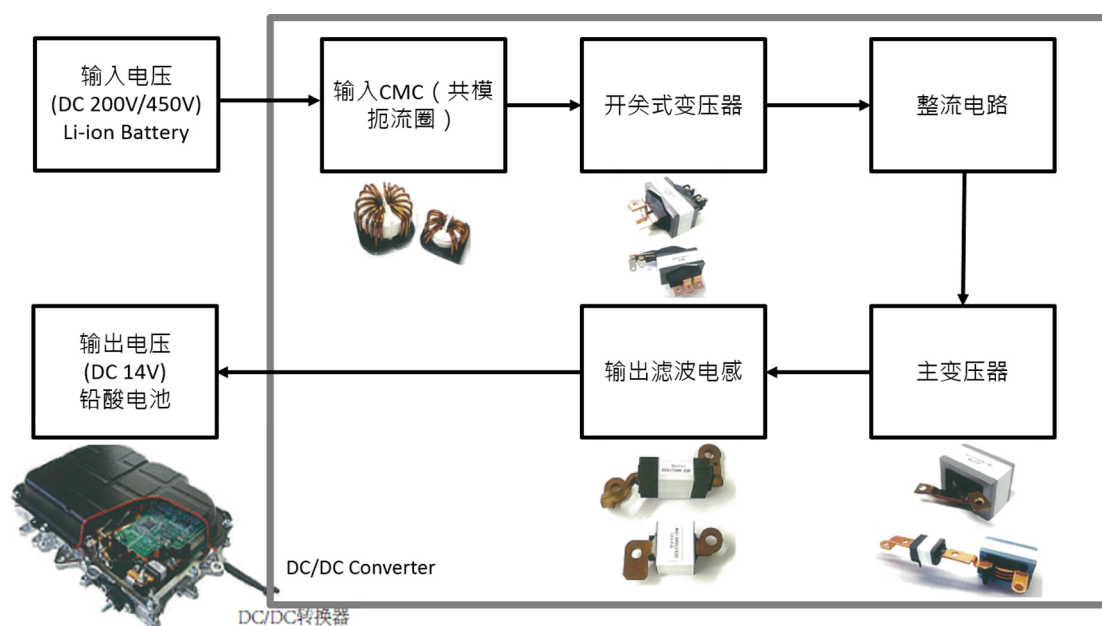
附录

车载充电机OBC与车载DC/DC的磁性器件（定制化设计）

OBC(On Board Charger)应用可以提供的磁性器件：

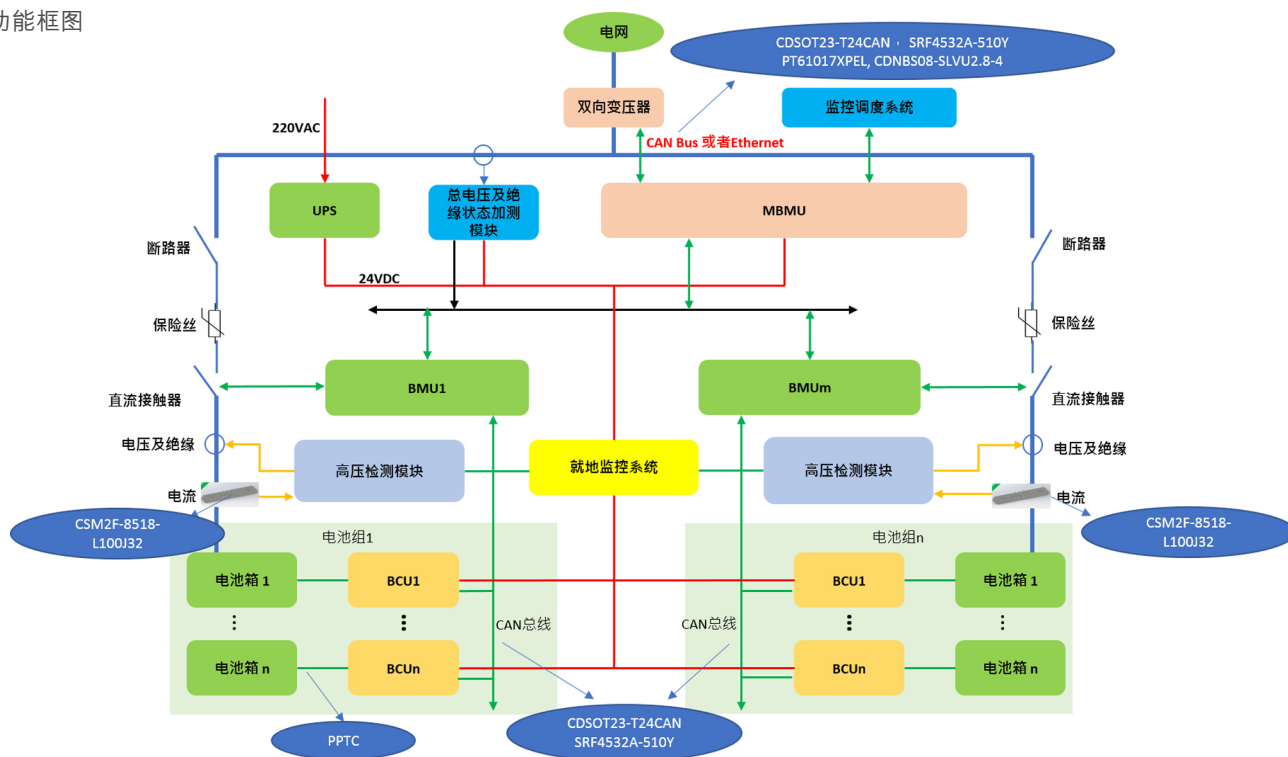


车载DC/DC应用可以提供的磁性器件：



储能BMS系统监控方案设计

功能框图

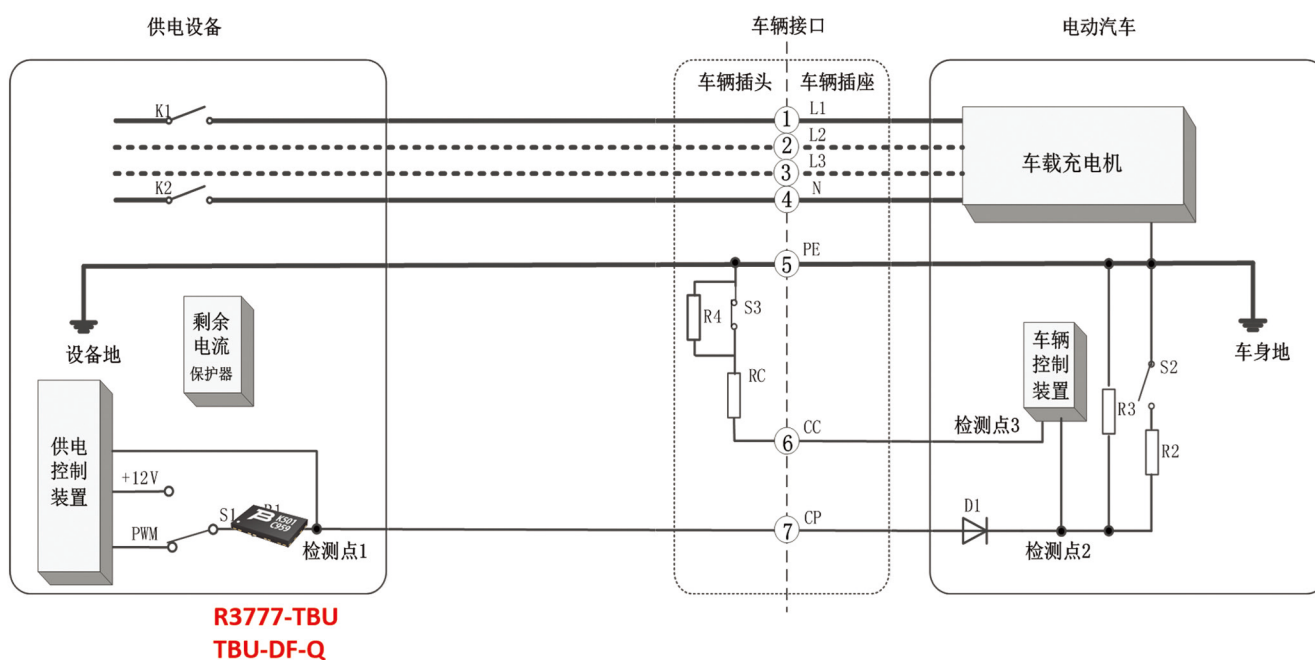


充电桩应用上采用Bourns TBU防交流电搭接的方案设计

TBU产品在该应用中的技术优势：

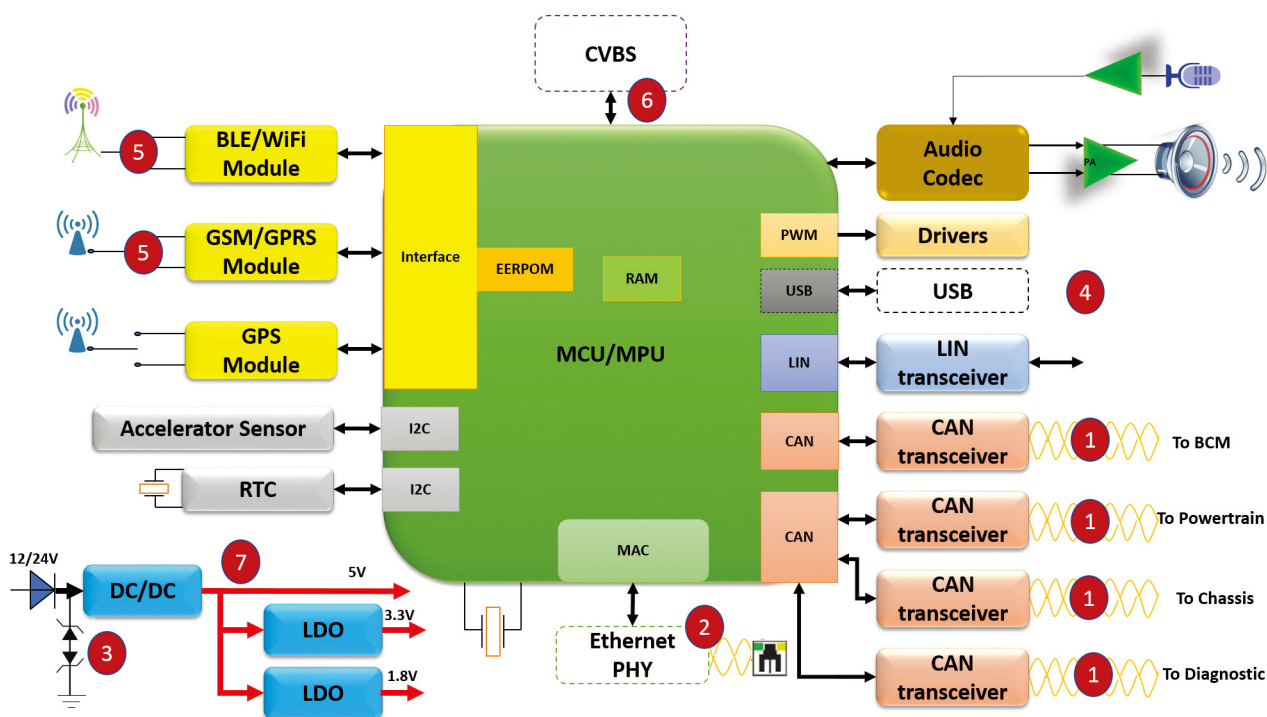
- 快速响应，动作时间小于1us
- 寿命长，无劣化现象
- 耐受380Vac交流电搭接





车载T-box电路系统设计方案设计

Telematics Box,简称车载T-Box或者T-Box车载终端,可以实现对车辆的运行数据、位置数据进行管理,提供包括定位功能、车辆状态、电机数据、BMS工作状态、充电状态、状态报警等功能。



Bourns提供的保护方案

1. CANbus通信保护:

CMC + TVSCMC: SRF4530A-510YTVS: CDSOT23-T24-CAN-Q

2. Ethernet通信保护:

Transformer +TVSTransformer: SM13072APELCMC: SRF3225TAB-201Y, SRF4530A-TVS:CDNBS08-SLVU2.8-4, CDNBS08-SLVU2.8-8, CDSOT23-SRV05-4

3. 抛负载TVS

7kW TVS: SM8SF33CA-Q

TVS: SMAJ-Q, SMBJ-Q, SMCJ-Q

4. USB 保护: PTC+TVS

PTC: MF-NSMF-150-2, MF-NSMF075-2

TVS: CD143A-SR05, CDSOD323-T05C, CG0603MLC-05LE

5. RF天线保护

TVS: CDDFN2-T5.0C

6. CVBS接口保护: GDT + TBU

GDT: 2031-23T-SM

TBU: R3777-TBU, TBU-DB055-100-Q

7. 功率电感

Inductors: Bourns可以提供一系列车规级包含定制化功率电感

其他产品线方案

产品线	功能	产品
IVT/百瑞物联	BLE Module	i412e-e, i410e
	Wifi Module	i2311e, i80
	Wifi+ Bluetooth Combo	i1423-s
SIMCOM	4G Module	SIM7600CE-T, SIM7600CE-L
	Wifi+ Bluetooth Combo	W58
EPSON	Crystal	32.768khz, 16Mhz, 25Mhz...
	RTC	RA8900CE (+/-5ppm, 3225)
Sandisk	EMMC	SDINBDG4-32G-XI1, SDINBDG4-16G-XI1, SDINBDG4-8G-XI1
Microchip	MPU	SAMA5D2
	CAN Transceiver	ATA6560/1, ATA6570

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中国区总部

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