

Battery Management System

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Battery Management System

VISHAY COMPONENTS USED:

- o Power MOSFETS
 - o CAN ESD Protection
 - o Load Dump TVS
 - o TVS Protection
 - o Thermistors NTC
 - o Power Inductors
 - o Shunt Resistors
 - o Thin/Thick Resistors
 - o Schottky Diodes
 - o Zener Diodes
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Application Overview

BMS (Battery Management System) is important electronic control unit for EV/HEV vehicle, which including battery monitor and battery balancing units. In multi-battery packs no two cells are identical, they are varying in cell capacity, self discharge, impedance, temperature characteristics and varying cell aging. These differences in general increase over lifetime and damage batteries. Two types batteries balancing method are used, passive balancing and active balancing. For passive balancing, the discharge current creates power dissipation in the balancing resistor, the dissipated energy is a loss of energy to reducing the capacity of the battery. the generated heat will warm up the battery. For active balancing, the batteries charge is transferred from cells to their neighbor cells, using low ESR MOSFET as power switch to reduce energy loss, the capacity of the battery will be improved. For the application, Vishay offers you a broad portfolio of solutions. With standard devices like MOSFETs, TVS, Schottky Diodes, Zener & CAN ESD Diodes, Shunt Resistors, Power Inductors as well as with temperature sensor NTC components.

Battery Management System : Battery Pack #1, Temperature Sensor

NTC

Product Name	Status	Description	Features	Package	Q-Level
NTCALUG01A		NTC Thermistors, Standard Lug Sensors	Resistance/25c: 4.7K to 100Kohm B25/85: 3535K~4190K	'LUG package	AEC Q200
NTCALUG01T		NTC Thermistors, Standard Lug Sensors, 150 °C	Resistance/25c: 10Kohm; B25/85: 3435K/3984K	'LUG package	AEC Q200
NTCALUG02A		NTC Thermistors, Low Thermal Gradient Lug Sensors	Resistance/25c: 4.7K to 100Kohm; B25/85: 3435K~4190K	'LUG package	AEC Q200
NTCALUG03 Mini Lug		NTC Thermistors, Mini Lug Sensors	Resistance/25c: 10K to 47Kohm B25/85: 3740K~3984K	miniLUG package	AEC Q200

Battery Management System : Battery Pack #2, Temperature Sensor

NTC

Product Name	Status	Description	Features	Package	Q-Level
NTCALUG01A		NTC Thermistors, Standard Lug Sensors	Resistance/25c: 4.7K to 100Kohm B25/85: 3535K~4190K	LUG package	AEC Q200
NTCALUG01T		NTC Thermistors, Standard Lug Sensors, 150 °C	Resistance/25c: 10Kohm; B25/85: 3435K/3984K	LUG package	AEC Q200
NTCALUG02A		NTC Thermistors, Low Thermal Gradient Lug Sensors	Resistance/25c: 4.7K to 100Kohm B25/85: 3435K~4190K	LUG package	AEC Q200
NTCALUG03 Mini Lug		NTC Thermistors, Mini Lug Sensors	Resistance/25c: 10K to 47Kohm B25/85: 3740K~3984K	miniLUG package	AEC Q200

Battery Management System : Current Detection, Shunt Resistor

Power Metal Strip

Product Name	Status	Description	Features	Package	Q-Level
WSBM8518		Power Metal Strip® Battery Shunt Resistor W/Molded Enclosure	Very Low Value (50 $\mu\Omega$, 100 $\mu\Omega$, 125 $\mu\Omega$, and 500 $\mu\Omega$) 25W/36W	8518	
WSBS8518		Power Metal Strip® Battery Shunt Resistor	Very Low Value (50 $\mu\Omega$, 100 $\mu\Omega$, 125 $\mu\Omega$, and 250 $\mu\Omega$) 36W	8518	
WSBS8518...20		Power Metal Strip® Shunt Resistor With Two Sense Pins	Very Low Value (50 $\mu\Omega$, 100 $\mu\Omega$, 125 $\mu\Omega$, and 250 $\mu\Omega$) 36W	8518	
WSBS8518...34		Power Metal Strip® Shunt Resistor	Low TCR (Down to $< \pm 10$ ppm/ $^{\circ}\text{C}$) Very Low Value (100 $\mu\Omega$, 500 $\mu\Omega$, and 1000 $\mu\Omega$) 20W/25W/36W	8518	
WSBS8518...35		Power Metal Strip® Shunt Resistor With Sense Pins	Low TCR (Down to $< \pm 10$ ppm/ $^{\circ}\text{C}$) Very Low Value (100 $\mu\Omega$, 500 $\mu\Omega$, and 1000 $\mu\Omega$) 20W/25W/36W	8518	
WSBS8518...40		Power Metal Strip® Shunt Resistor With Three Sense Pins	Very Low Value (50 $\mu\Omega$, 100 $\mu\Omega$, and 125 $\mu\Omega$) 36W	8518	

Battery Management System : DC/DC Converter, DC/DC Diode

Schottky diodes

Product Name	Status	Description	Features	Package	Q-Level
SS3P4HM3		High Current Density Surface Mount Schottky Rectifiers	Rev. Voltage 40V, IF(AV) 3.0A, VF at IF 0.5	SMP	AEC Q101
V8P10HM3		High Current Density Surface Mount Trench MOS Barrier Schottky Rectifier	Ultra Low VF = 0.466 V at IF = 4A	SMPC	AEC Q101

Battery Management System : DC/DC Converter, MOS switch

MOSFET

Product Name	Status	Description	Features	Package	Q-Level
SQ4080EY		Automotive N-Channel 150 V (D-S) 175 °C MOSFET	VDS=150V; rds(on)/10V=85mohm Id=19A@Tc=25c	SO-8	AEC Q101
SQ4940AEY		Automotive Dual N-Channel 40 V (D-S) 175 °C MOSFET	VDS=40V; rds(on)/4.5V=29mohm Id=8A@Tc=25c	SO-8	AEC-Q101
SQJ402EP		Automotive N-Channel 100 V (D-S) 175 °C MOSFET	VDS=100V; rds(on)/4.5V=14mohm Id=32A@Tc=25c	PowerPAK SO-8L	AEC Q101
SQJ431AEP		Automotive P-Channel 200 V (D-S) 175 °C MOSFET	VDS=200V; rds(on)/-10V=305mohm Id=-9.4A@Tc=25c	PowerPAK SO-8L	AEC Q101
SQJ488EP		Automotive N-Channel 100 V (D-S) 175 °C MOSFET	VDS=100V; rds(on)/4.5V=25.8mohm Id=42A@Tc=25c	PowerPAK SO-8L	AEC Q101
SQJ912AEP		Automotive Dual N-Channel 40 V (D-S) 175 °C MOSFET	VDS=40V; rds(on)/4.5V=11.1mohm Id=30A@Tc=25c	PowerPAK SO-8L	AEC Q101
SQJ952EP		Automotive Dual N-Channel 60 V (D-S) 175 °C MOSFET	VDS=60V; rds(on)/4.5V=24mohm Id=23A@Tc=25c	PowerPAK SO-8L	AEC Q101
SQJ956EP		Automotive Dual N-Channel 60 V (D-S) 175 °C MOSFET	VDS=60V; rds(on)/4.5V=29mohm Id=23A@Tc=25c	PowerPAK SO-8L	AEC Q101
SQM120P10-10m1L		Automotive P-Channel 100 V (D-S) 175 °C MOSFET	VDS=100V; rds(on)/-4.5V=15mohm Id=-120A@Tc=25c	TO-263	AEC Q101
SQS481ENW		Automotive P-Channel 150 V (D-S) 175 °C MOSFET	VDS=150V; rds(on)/-10V=1.095ohm Id=-916A@Tc=25c	PowerPAK 1212-8w	AEC Q101
SQS484EN		Automotive N-Channel 40 V (D-S) 175 °C MOSFET	VDS=40V; rds(on)/4.5V=10mohm Id=16A@Tc=25c	PowerPAK 1212-8	AEC Q101
SQS840EN		Automotive N-Channel 40 V (D-S) 175 °C MOSFET	VDS=40V; rds(on)/4.5V=30mohm; Id=12A@Tc=25c	PowerPAK 1212-8	AEC Q101

Battery Management System : DC/DC Converter, Reverse Polarity Protection

Schottky diodes

Product Name	Status	Description	Features	Package	Q-Level
V8PM10HE3		High Current Density Surface Mount Trench MOS Barrier Schottky	Rectifier Ultra Low VF = 0.50 V at IF = 4 A	TO-277A (SMPC)	AEC-Q101
VSSAF5M12HM3		Surface Mount Trench MOS Barrier Schottky Rectifier	Rev. Voltage 120V, IF(AV) 5.0A VF at IF 0.64, Trench	DO-221AC	AEC-Q101

Battery Management System : DC/DC Converter, Storage Inductor

Power Inductors

Product Name	Status	Description	Features	Package	Q-Level
IHLP-2525CZ-5A		IHLP® Automotive Inductors, High Temperature (155 °C) Series	Inductance 0.47-22uH, Rated current: 2.8-20A	6.47 x 6.47 x 3.0mm	AEC Q200
IHLP-3232DZ-1A		IHLP® Automotive Inductors, Low DCR Series	Inductance 0.22-33uH, Rated current: 3.2-34A	8.18 x 8.18 x 4.0mm	AEC Q200
IHLP-4040DZ-1A		IHLP® Automotive Inductors, Low DCR Series	Inductance 0.19-47uH, Rated current: 8.3-66A	10.16 x 10.16 x 4.0mm	AEC Q200
IHLP-5050FD-5A		IHLP® Automotive Inductors, High Temperature (155 °C) S	Inductance 0.22-22uH, Rated current: 3.2-34A	13.259 x 12.9 x 6.4mm	AEC Q200
IHLP-6767GZ-5A		IHLP® Automotive Inductors, High Temperature (155 °C) Series	Inductance 0.47-47uH, Rated current: 7.25-65A	17.15 x 17.15 x 7.0mm	AEC Q200

Battery Management System : DC/DC Converter, Transient protection

Load dump TVS

Product Name	Status	Description	Features	Package	Q-Level
SM5S..AT		Surface Mount PAR® Transient Voltage Suppressors High Temperature Stability and High Reliability Conditions	Vwm: 10V to 43V; Vbr: 11.1V to 52.8V Pppm(10x1000us): 3600W	DO-218AC	AEC-Q101
SM6A27THE3		Surface Mount PAR® Transient Voltage Suppressors High Temperature Stability and High Reliability Conditions	Vwm: 22V; Vbr: 27V; Pppm(10x1000us): 4600W	DO-218AC	AEC-Q101
SM6S..AT		Surface Mount PAR® Transient Voltage Suppressors High Temperature Stability and High Reliability Conditions	Vwm: 10V to 43V; Vbr: 11.1V to 52.8V Pppm(10x1000us): 4600W	DO-218AC	AEC-Q101
SM8A27THE3		Surface Mount PAR® Transient Voltage Suppressors High Temperature Stability and High Reliability Conditions	Vwm: 22V; Vbr: 27V; Pppm(10x1000us): 6600W	DO-218AC	AEC-Q101
SM8S..AT		Surface Mount PAR® Transient Voltage Suppressors High Temperature Stability and High Reliability Conditions	Vwm: 10V to 43V; Vbr: 11.1V to 52.8V Pppm(10x1000us): 6600W	DO-218AC	AEC Q101

TVS Protection

Product Name	Status	Description	Features	Package	Q-Level
1.5SMC Series		Surface Mount TransZorb® Transient Voltage Suppressor	Vwm: 5.8V to 459V; Vbr: 6.8V to 540V Pppm(10x1000us): 1500W	DO-214AB (SMC)	
SMBJ5.0A thru SMBJ188A		Surface Mount TransZorb® Transient Voltage Suppressor	Vwm: 5.0V to 188V; Vbr: 6.4V to 231V; Pppm(10x1000us): 600W	DO-214AA (SMB)	AEC-Q101
SMC3K24CAHM3		Surface Mount TRANSZORB® Transient Voltage Suppress	Vwm: 22V to 78V; Vbr: 24.4V to 95.8V Pppm(10x1000us): 3000W	DO-214AB (SMC J-Bend)	AEC-Q101

Battery Management System : DC/DC Converter, Voltage Regulator

Optocoupler

Product Name	Status	Description	Features	Package	Q-Level
VOMA617A		Optocoupler Phototransistor Output	High CTR with low forward current High collector emitter voltage	SOP-4 low profile	
VOMA618A		Optocoupler Phototransistor Output	High CTR with low forward current High collector emitter voltage	SOP-4 low profile	

Battery Management System : Main Control Unit, CAN ESD Protection

CAN ESD Protection

Product Name	Status	Description	Features	Package	Q-Level
VCAN26A2-03G		Bidirectional Symmetrical (BiSy) Low Capacitance Dual-Line ESD-Protection Diode in SOT-323	2-line ESD protection, working range +/-26.5V Cd<15pF	SOT-323	
VCAN26A2-03S		Bidirectional Symmetrical (BiSy) Low Capacitance Dual-Line ESD Protection Diode in SOT-23	2-line ESD protection, working range +/-26.5V Cd<13pF	SOT-23	AEC Q101

Battery Management System : Main Control Unit, High Voltage Detection

Resistor

Product Name	Status	Description	Features	Package	Q-Level
MCA 1206 AT		Professional Thin Film Chip Resistors	Resistance 2.43ohm to 1.0Mohm; 0.1W to 0.4W	0402-1206	
MCS 0402 AT MCT 0603 AT MCU 0805 AT		Professional Thin Film Chip Resistors	Resistance 2.43ohm to 1Mohm; 0.1W to 0.4W	0402-1206	
MMA 0204 HV MMB 0207 HV - Prof		Professional High-Voltage Thin Film MELF Resistors	Resistance 340ohm to 10Mohm; 0.4W to 1.0W	0204/0207	
MMU 0102 MMA 0204 MMB 0207 - Prof		Professional Thin Film MELF Resistors	Resistance 0.1ohm to 15Mohm; 0.3W to 1.0W	0102/0204/0207	
RCV e3		High Voltage (up to 0.5 kV) Thick Film Chip Resistors	Resistance 100Kohm to 10Mohm; 0.125W to 0.25W	0805/1206	
TNPW		Lead (Pb)-Bearing High Stability Thin Film Chip Resistors	Resistance 10ohm to 3.01Mohm; 0.063W to 0.33W	0402-1210	

Battery Management System : Main Control Unit, Load Dump TVS

Load Dump TVS

Product Name	Status	Description	Features	Package	Q-Level
SM5S..AT		Surface Mount PAR® Transient Voltage Suppressors High Temperature Stability and High Reliability Conditions	Vwm: 10V to 43V; Vbr: 11.1V to 52.8V Pppm(10x1000us): 3600W	DO-218AC	AEC Q101
SM6A27THE3		Surface Mount PAR® Transient Voltage Suppressors High Temperature Stability and High Reliability Conditions	Vwm: 22V; Vbr: 27V; Pppm(10x1000us): 4600W	DO-218AC	AEC Q101
SM6S..AT		Surface Mount PAR® Transient Voltage Suppressors High Temperature Stability and High Reliability Conditions	Vwm: 10V to 43V; Vbr: 11.1V to 52.8V Pppm(10x1000us): 4600W	DO-218AC	AEC Q101
SM8A27THE3		Surface Mount PAR® Transient Voltage Suppressors High Temperature Stability and High Reliability Conditions	Vwm: 22V; Vbr: 27V Pppm(10x1000us): 6600W	DO-218AC	AEC Q101
SM8S..AT		Surface Mount PAR® Transient Voltage Suppressors High Temperature Stability and High Reliability Conditions	Vwm: 10V to 43V; Vbr: 11.1V to 52.8V; Pppm(10x1000us): 6600W	DO-218AC	AEC Q101

Battery Management System : Main Control Unit, Temperature Sensor

NTC

Product Name	Status	Description	Features	Package	Q-Level
NTCS...E3...SMT		SMD NTC Thermistors with Enhanced Stability	Resistance/25c: 100K to 210Kohm B25/85: 3590K	'0402/0603/0805	
NTCS0603E3.....T		SMD 0603, Glass Protected NTC Thermistors	Resistance/25c: 2.0K to 100Kohm B25/85: 3420-4100	'0402	

Battery Management System : Multicell battery Monitors, Balancing Resistor

Resistor

Product Name	Status	Description	Features	Package	Q-Level
CRCW-HP e3		Pulse Proof, High Power Thick Film Chip Resistors	Resistance 1.0ohm to 1.0Mohm; 0.2W to 1.5W	0402-2512	AEC Q200
MCA 1206 AT		Professional Thin Film Chip Resistors	Resistance 2.43ohm to 1.0Mohm; 0.1W to 0.4W,	0402-1206	AEC Q200
RCL e3		Long Side Termination Thick Film Chip Resistors	Resistance 1.0ohm to 2.2Mohm; 0.25W to 2W,	0406-1225	AEC Q200

Battery Management System : Multicell battery Monitors, Balancing Switch

MOSFET

Product Name	Status	Description	Features	Package	Q-Level
SQ1464EEH		Automotive N-Channel 60 V (D-S) 175 °C MOSFET	VDS=60V; rds(on)/1.5V=1.41ohm Id=0.44A@Tc=25c	SC-70	AEC Q101
SQ2301ES		Automotive P-Channel 20 V (D-S) 175 °C MOSFET	VDS=-20V; rds(on)/-4.5V=120mohm Id=3.9A@Tc=25c	SOT-23	AEC Q101
SQ2303ES		Automotive P-Channel 30 V (D-S) 175 °C MOSFET	VDS=-30V; rds(on)/-4.5V=370mohm Id=2.5A@Tc=25c	SOT-23	AEC Q101
SQ2308CES		Automotive N-Channel 60 V (D-S) 175 °C MOSFET	VDS=60V; rds(on)/4.5V=164mohm Id=2.3A@Tc=25c	SOT-23	AEC Q101
SQ2309ES		Automotive P-Channel 60 V (D-S) 175 °C MOSFET	VDS=-60V; rds(on)/-4.5V=500mohm Id=-1.7A@Tc=25c	SOT-23	AEC Q101
SQ2310ES		Automotive N-Channel 20 V (D-S) 175 °C MOSFET	VDS=20V; rds(on)/4.5V=30mohm Id=6A@Tc=25c	SOT-23	AEC Q101
SQ2351ES		Automotive P-Channel 20 V (D-S) 175 °C MOSFET	VDS=-20V; rds(on)/-4.5V=115mohm Id=-3.2A@Tc=25c	SOT-23	AEC Q101
SQ2361AEES		Automotive P-Channel 60 V (D-S) 175 °C MOSFET	VDS=-60V; rds(on)/-4.5V=230mohm Id=-2.9A@Tc=25c	SOT-23	AEC Q101
SQ2364EES		Automotive N-Channel 60 V (D-S) 175 °C MOSFET	VDS=60V; rds(on)/1.5V=245Mohm Id=4A@Tc=25c	SOT-23	AEC Q101
SQ4940AEY		Automotive Dual N-Channel 40 V (D-S) 175 °C MOSFET	VDS=40V; rds(on)/4.5V=29mohm Id=8A@Tc=25c	SO-8	AEC Q101
SQJ912AEP		Automotive Dual N-Channel 40 V (D-S) 175 °C MOSFET	VDS=40V; rds(on)/4.5V=11.1mohm Id=30A@Tc=25c	PowerPAK SO-8L	AEC Q101

Battery Management System : Multicell battery Monitors, CAN ESD Protection

CAN ESD Protection

Product Name	Status	Description	Features	Package	Q-Level
VCAN26A2-03G		Bidirectional Symmetrical (BiSy) Low Capacitance Dual-Line ESD-Protection Diode in SOT-323	2-line ESD protection, working range +/-26.5V Cd<15pF	SOT-323	AEC Q101
VCAN26A2-03S		Bidirectional Symmetrical (BiSy) Low Capacitance, Dual-Line ESD Protection Diode in SOT-23	2-line ESD protection, working range +/-26.5V; Cd<13pF	SOT-23	

Battery Management System : Multicell battery Monitors, Temperature Sensor

NTC

Product Name	Status	Description	Features	Package	Q-Level
NTCS...E3...SMT		SMD NTC Thermistors with Enhanced Stability	Resistance/25c: 100K to 210Kohm; B25/85: 3590K	'0402/0603/0805	
NTCS0603E3.....T		SMD 0603, Glass Protected NTC Thermistors	Resistance/25c: 2.0K to 100Kohm; B25/85: 3420-410	'0402	

Battery Management System : Multicell battery Monitors, Voltage Detection

Resistor

Product Name	Status	Description	Features	Package	Q-Level
MCA 1206 AT		Professional Thin Film Chip Resistors	Resistance 2.43ohm to 1.0Mohm; 0.1W to 0.4W	0402-1206	AEC Q200
MCS 0402 AT MCT 0603 AT MCU 0805 AT		Professional Thin Film Chip Resistors	Resistance 2.43ohm to 1Mohm; 0.1W to 0.4W	0402-1206	AEC Q200
MMA 0204 HV MMB 0207 HV - Prof		Professional High-Voltage Thin Film MELF Resistors	Resistance 340ohm to 10Mohm; 0.4W to 1.0W	0204/0207	
MMU 0102 MMA 0204 MMB 0207 - Prof		Professional Thin Film MELF Resistors	Resistance 0.1ohm to 15Mohm; 0.3W to 1.0W	0102/0204/0207	
RCV e3		High Voltage (up to 0.5 kV) Thick Film Chip Resistors	Resistance 100Kohm to 10Mohm; 0.125W to 0.25W	0805/1206	
TNPW		Lead (Pb)-Bearing High Stability Thin Film Chip Resistors	Resistance 10ohm to 3.01Mohm; 0.063W to 0.33W	0402-1210	

Battery Management System : Multicell battery Monitors, Zener/TVS Protection

TVS Protection

Product Name	Status	Description	Features	Package	Q-Level
VTVS3V3ASMF to VTVS63GSMF		400 W TransZorb® Transient Voltage Suppressors (TVS)	Vwm: 3.3V to 63V; Vbr: 6.4V to 78.2V Pppm(10x1000us): 400W	DO-219AB (SMF)	AEC Q101

Zener Diode

Product Name	Status	Description	Features	Package	Q-Level
BZT52-Series		Small Signal Zener Diodes	Vz: 2.4V to 75V; Power dissipation 500mW	SOD-123	AEC Q101
BZX384-Series		Small Signal Zener Diodes	Vz: 2.4V to 75V; Power dissipation 200mW	SOD-323	AEC Q101
PLZ Series		Zener Diodes Permitting 500 mW Power Dissipation	Vz: 2.0V to 39V; Power dissipation 500mW	DO-219AC (MicroSMF)	AEC Q101