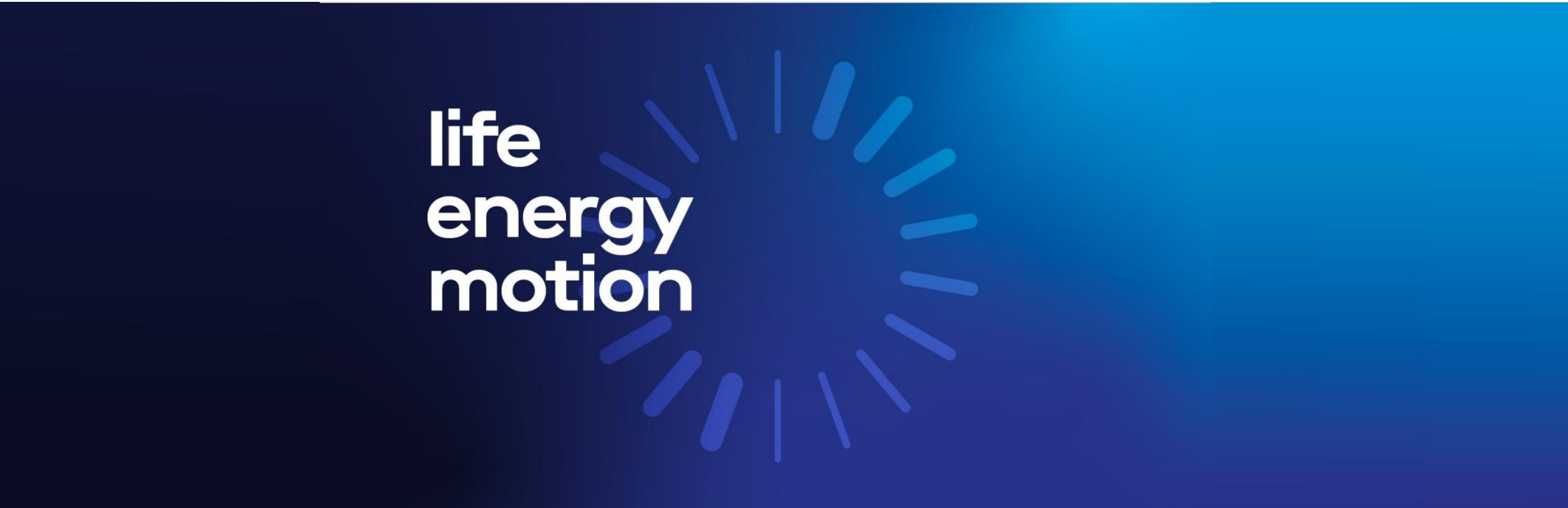
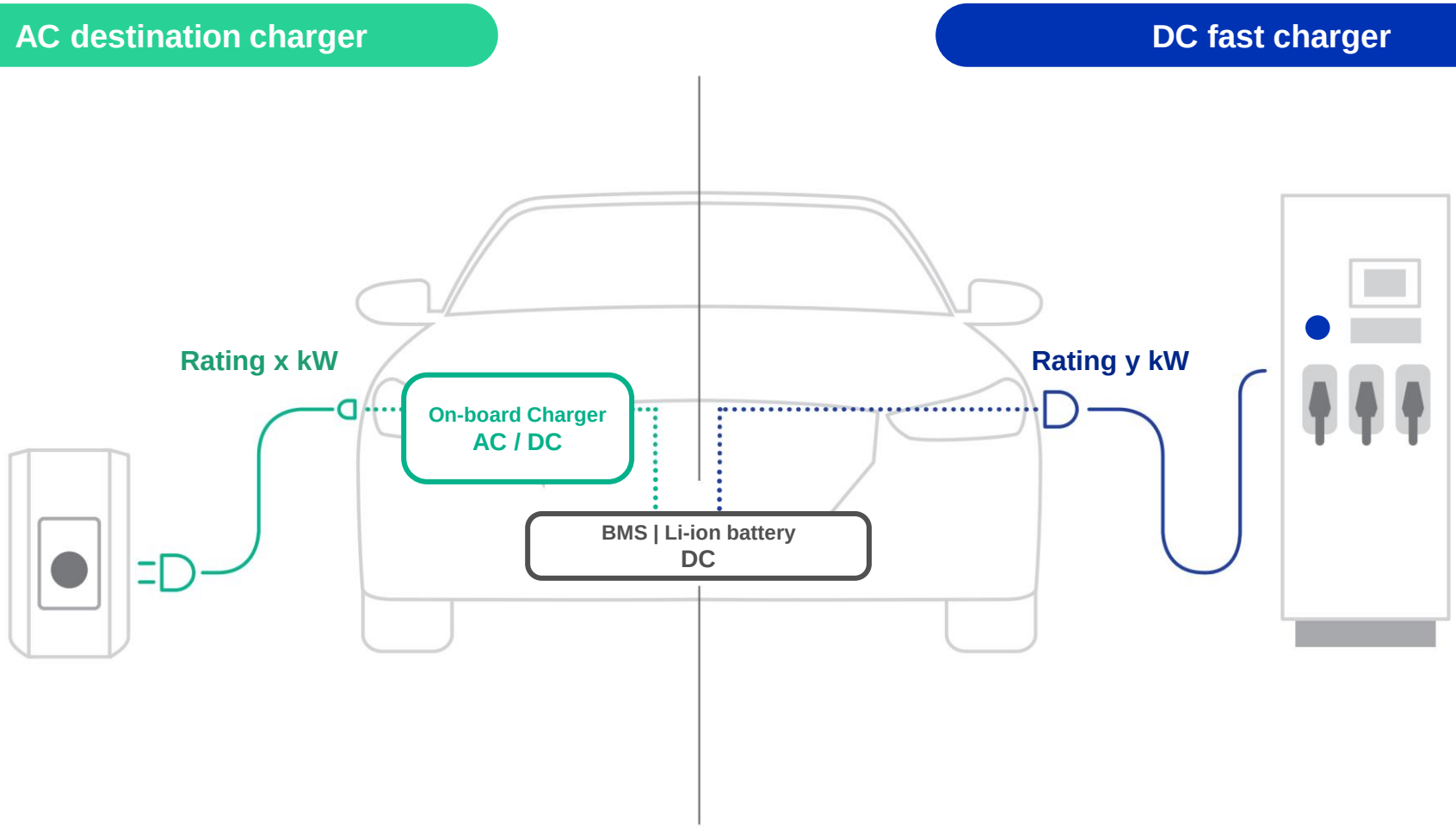
EV Charging Infrastructure applications

LEM International



E-mobility infrastructure

How to charge a BEV | AC and DC chargers



EV charging usage

AC or DC charging ? A question of use case

Home charging
Private

- **Low power**, overnight charging
- **Affordable**
- **Services** (V2Home, load balancing)

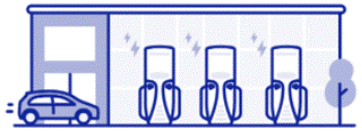
7,4kW – 22kW AC

Workplace charging
Public, Private

- **Charging in 4-6 hours**
- **Transparent** (tariff, payment)
- **Services** (V2G, load balancing)

11 - 22kW AC

1 2 3 4



En-route charging
Public

- **Highest charging speed**
- **Harmonized** and easy to use
- **Convenient** access & billing
- **Simple search and booking**

> 100kW DC

Destination charging
Public

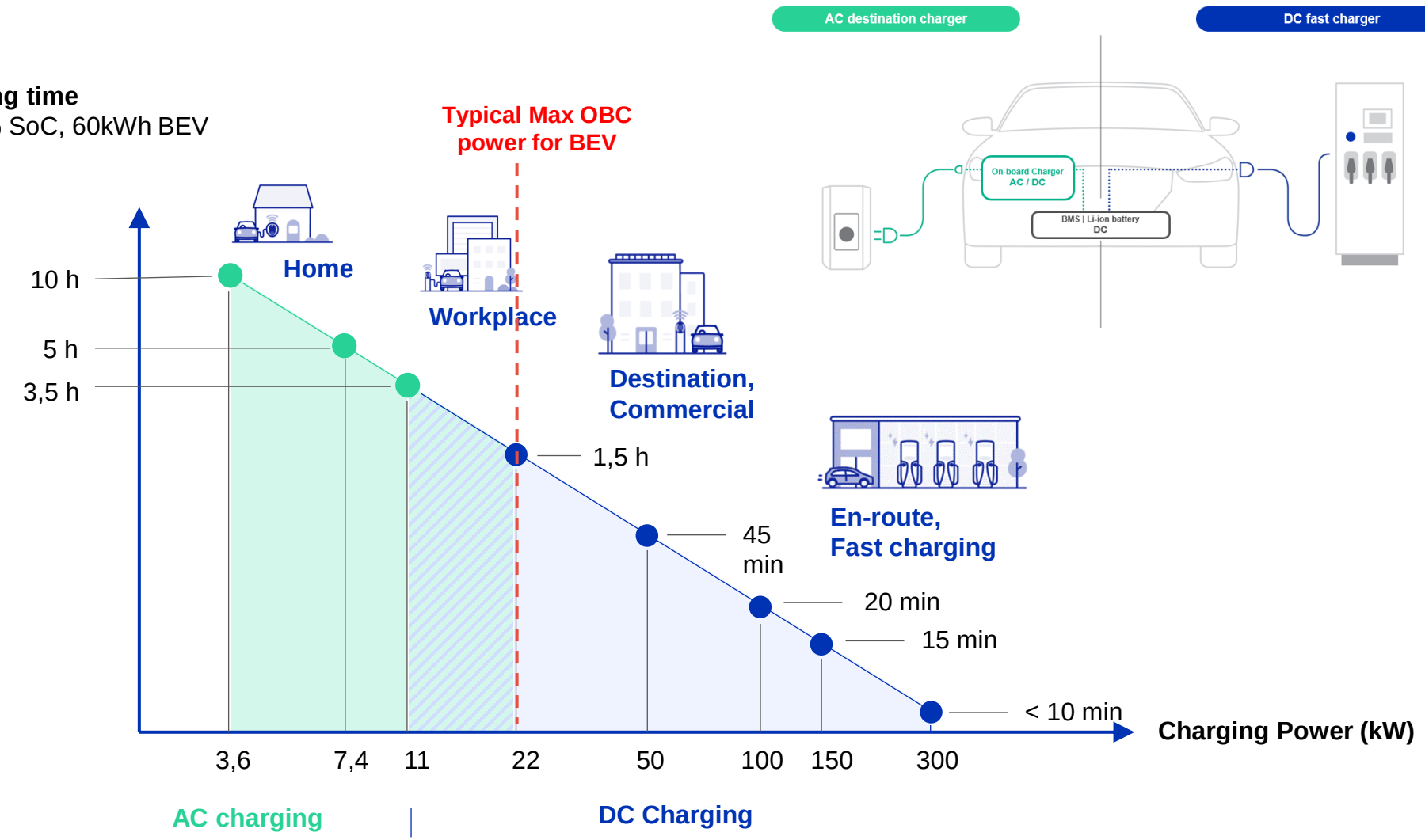
- **Charging in 1-2 hours**
- **Transparent** (tariff, payment)
- **Services** (V2G, load balancing)

11 - 22kW AC

< 50kW DC

> 100kW DC

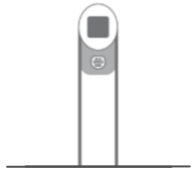
EV charging segmentation



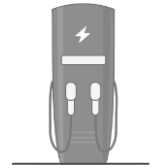
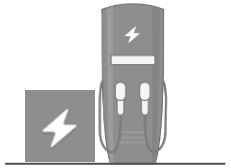
E-mobility infrastructure

AC or DC chargers | Use cases

AC charging

IC-CPD	Wallbox	Pedestal
		
3.6 kW	7.4 – 22kW	
120/240 VAC or 230 VAC [1]		
16 A	30 – 48 A	

DC charging

Wallbox	Fast	Super Fast	Mega
			
11 – 30kW	30 – 250kW	250 – 400kW	>400kW
360 … 1000 V DC			
32 – 80 A	80 – 300 A	300 – 500 A	> 500 A

[1] Supply voltage dependent on region and AC grid voltage

Life Energy Motion

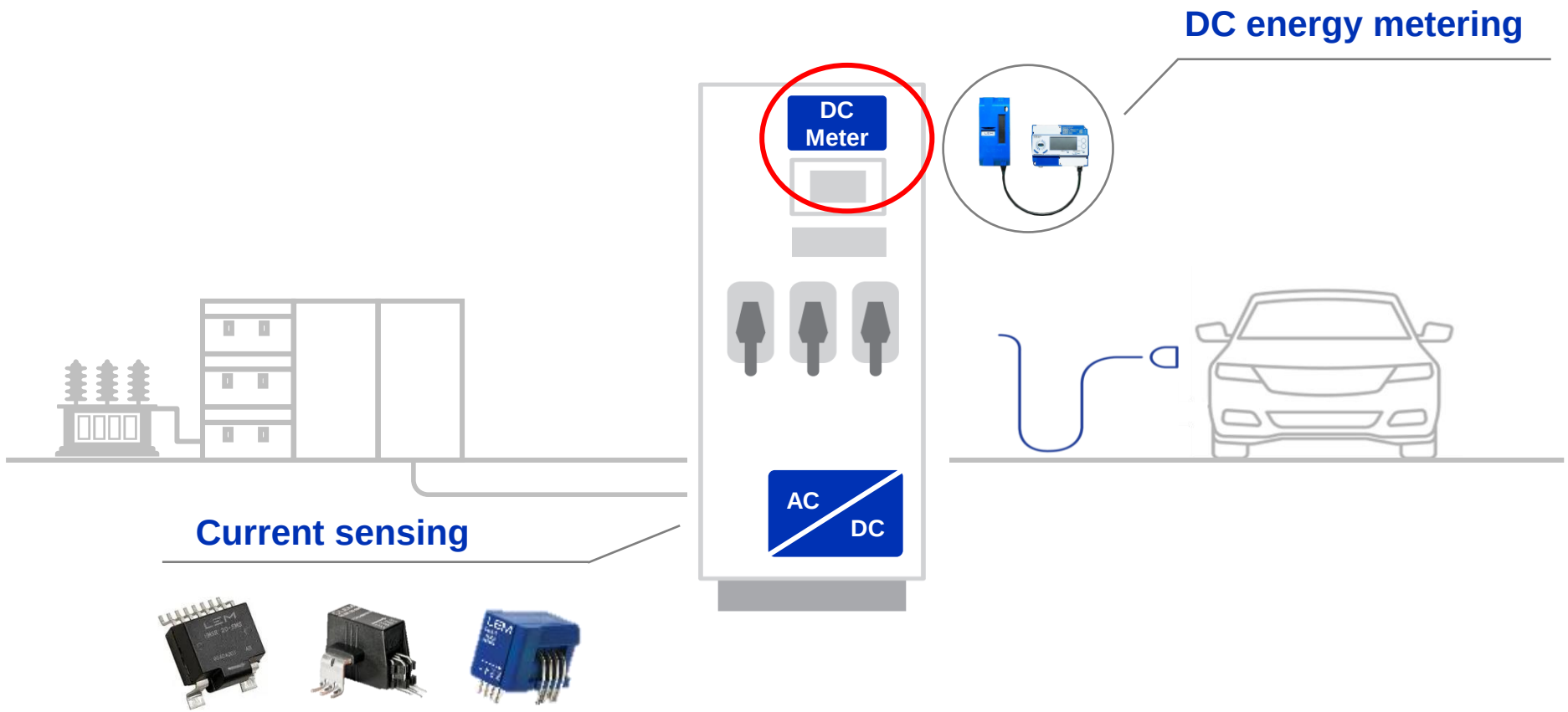
DC charging stations application

LEM’s solutions

LEM provides solutions for power converters and meters

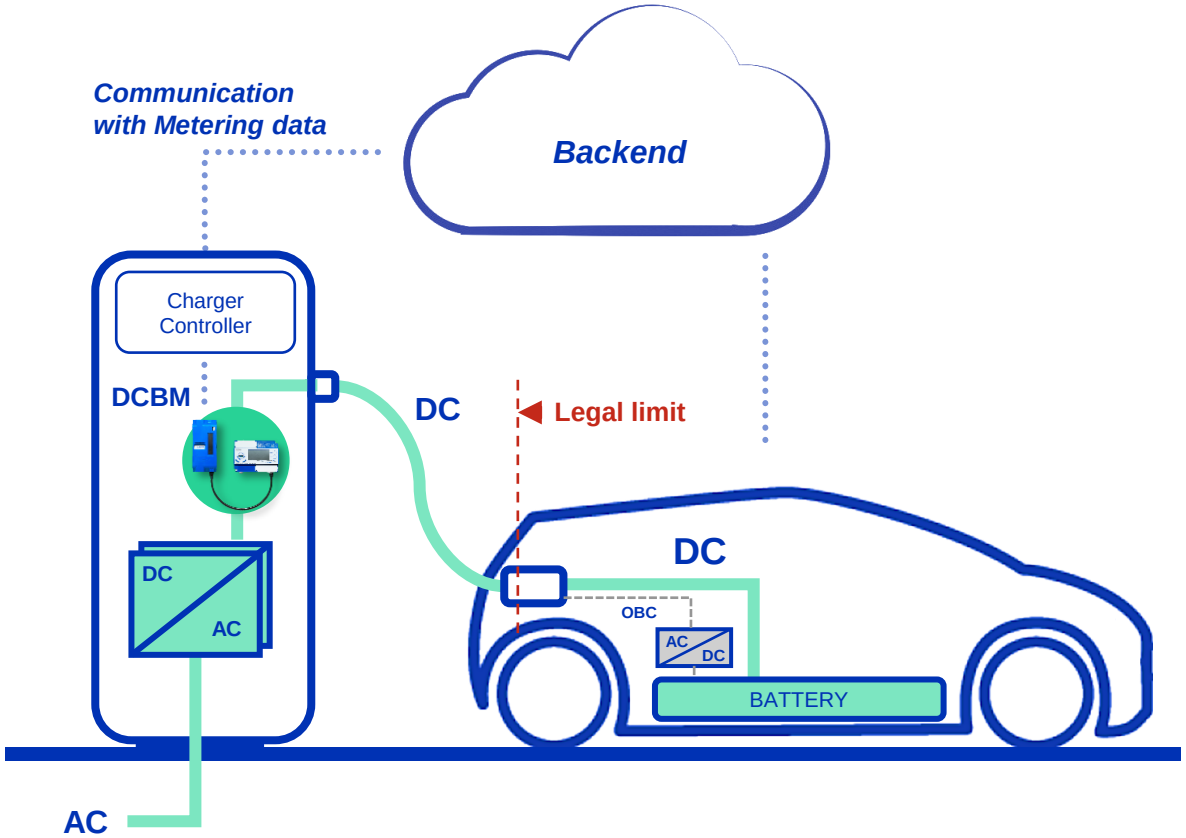
DC chargers

Grid | DC Chargers | Electric Vehicle



DC charging & Energy metering

DCBM Integration into DC charger



- **Energy metering in DC Fast Charging**
  - ENERGY billing of charging sessions (kWh)
  - METROLOGY regulates energy metering
  - TRUST, PERFORMANCE ensure end-user protection

- **DC Meter roles**
  - INTEGRATION of metering within DC charger
  - COMPLIANCE with metrology regulations
  - PROTECTION of user data / charging data
  - Display of charging session information
  - Monitoring of DC Fast Chargers (current, voltage, temperature)

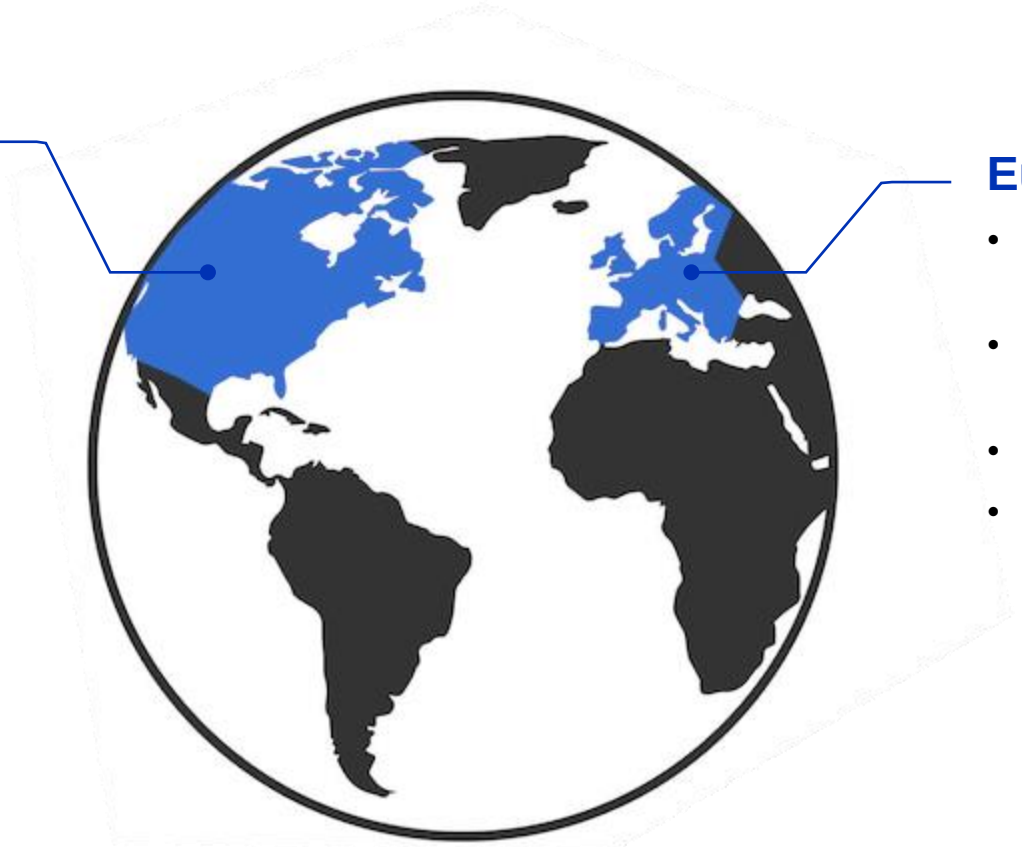
A view on global regulations

Development of Metrology in the global EV charging eco-system

North America

- Regulated at charger level, with **DC energy metering**
- NIST Handbook 44
- **CTEP / NTEP**
- **National Electric Vehicle Infrastructure** (NEVI) Formula Program

cdfa
CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE

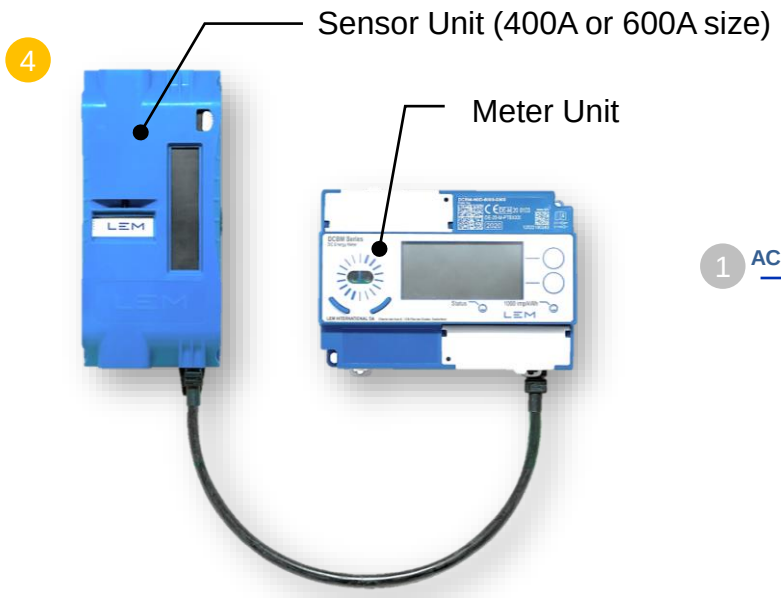


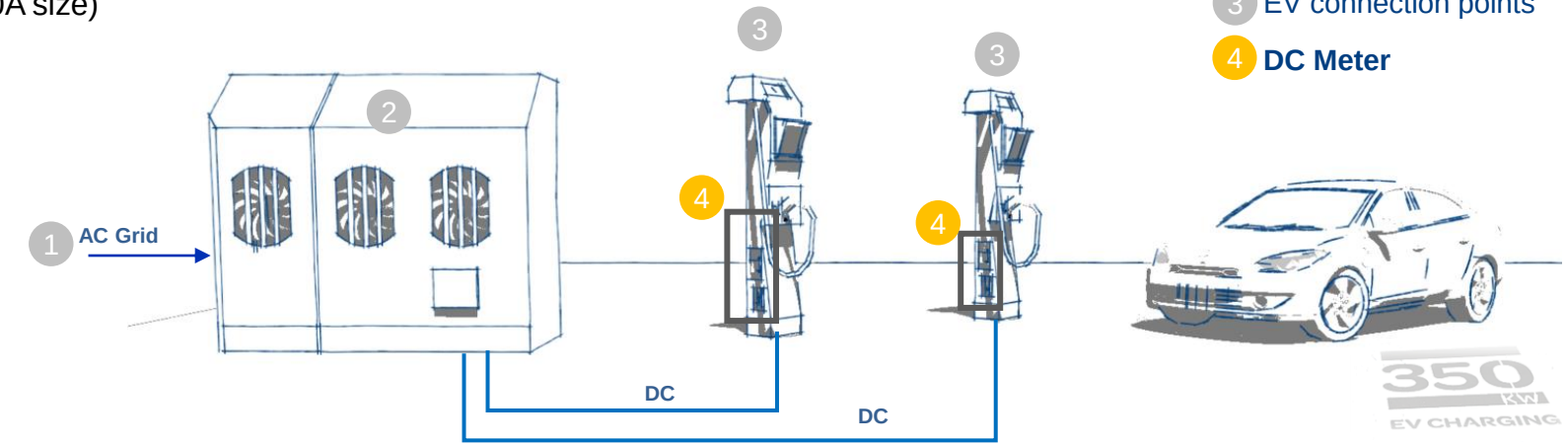
Europe

- Germany initiated the move with **Eichrecht** (Germany, Austria)
- **MID** (2014/32/EU, Annex V), historically made for AC, with trend to integrate DC
- **National regulation** in France
- **Listed in Alternative Fuel Infrastructure Directive (AFIR)** draft

DCBM 400/600 – DC Energy Metering

A complete metering solution for DC Fast Charging





1. AC grid
2. Power converters
3. EV connection points
4. **DC Meter**

A Complete DC Meter Solution

- **kWh-based billing in DC fast charging**
- Certified by **PTB** and **MID** (**2014/32/EU), UL Recognized**
- **400 A or 600 A**, **1000 V DC**
- Operating temperature **-40 °C … +85 °C** (accuracy class B)
- **Ethernet HTTP** interface easy to integrate, with **security**

Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

S.A.F.E. Software Alliance for E-mobility

c UL us

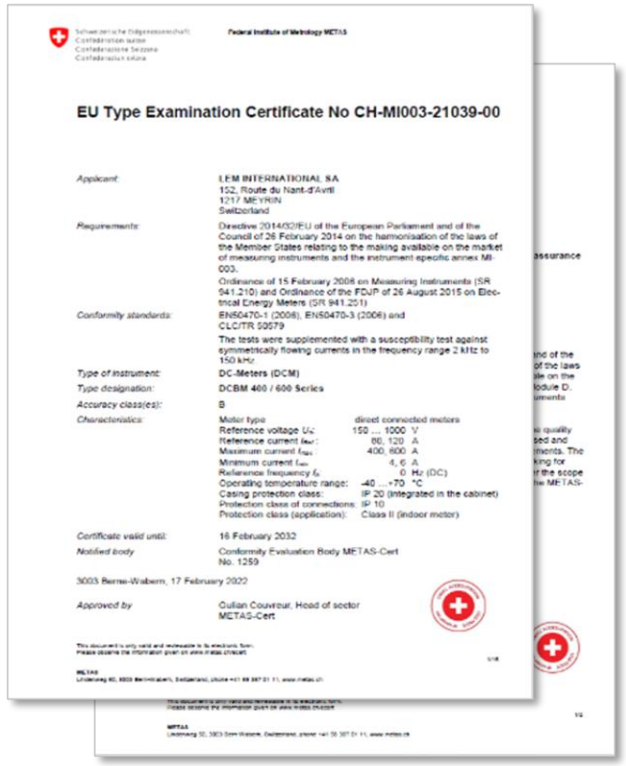
DCBM400/600 certifications and approvals

Germany – MessEV / MessEG

Module B
DE-20-M-PTB-0075, Revision 2

Module D
DE CSA 22 D 002

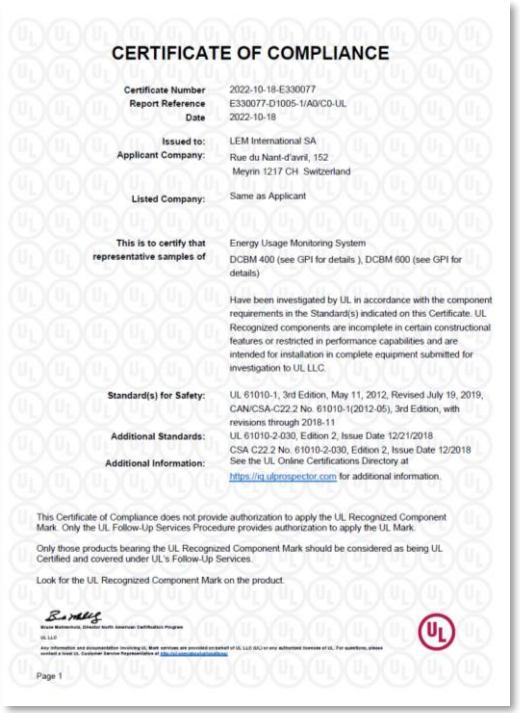
MID – 2014/32/EU



Module B
CH-MI003-21039-00

Module D
6030-01644

UL Recognized



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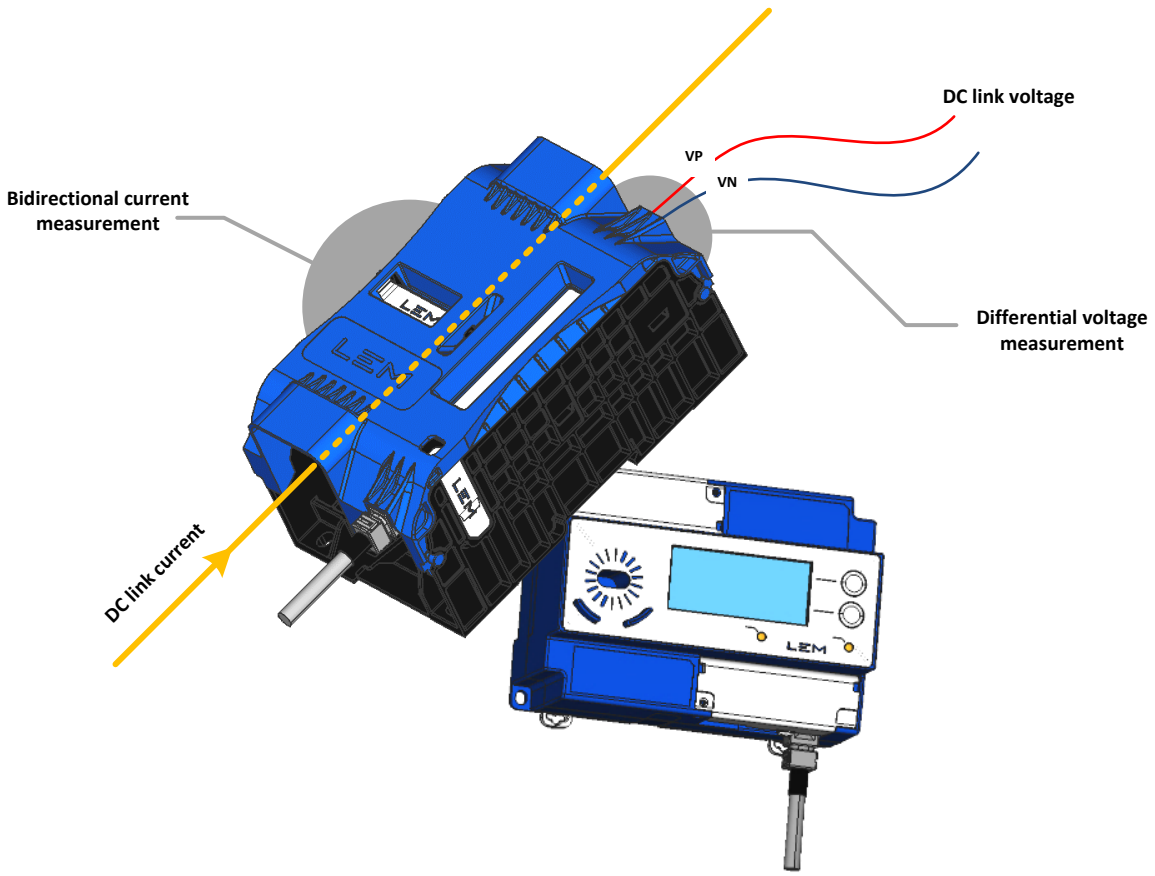
Focus on DCBM400/600 specifications

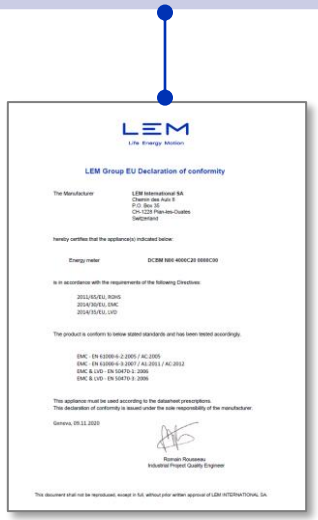
Parameter	DCBM400	DCBM600
Voltage specification	150 … 1000 V DC	
Current specification	Ist : 320 mA Imin : 4 A Itr : 8 A Iref : 80 A Imax : 400 A	Ist : 480 mA Imin : 6 A Itr : 12 A Iref : 120 A Imax : 600 A
Accuracy class	Class B	
Power terminal	Studs, Tin plated	
Operating Temperature Sensor Unit	-40 °C … +85 °C	
Insulation	1000 V DC, Reinforced	
Loss compensation	0 … 14 mΩ (selectable / fixed)	
Voltage measurement	Differential, 4-wire	
Counting direction	Bidirectional	
Communication	Ethernet, HTTP, OCMF	
Data & Security	Transaction & Signature, S.A.F.E.	



Single DC meter family covers multiple certifications

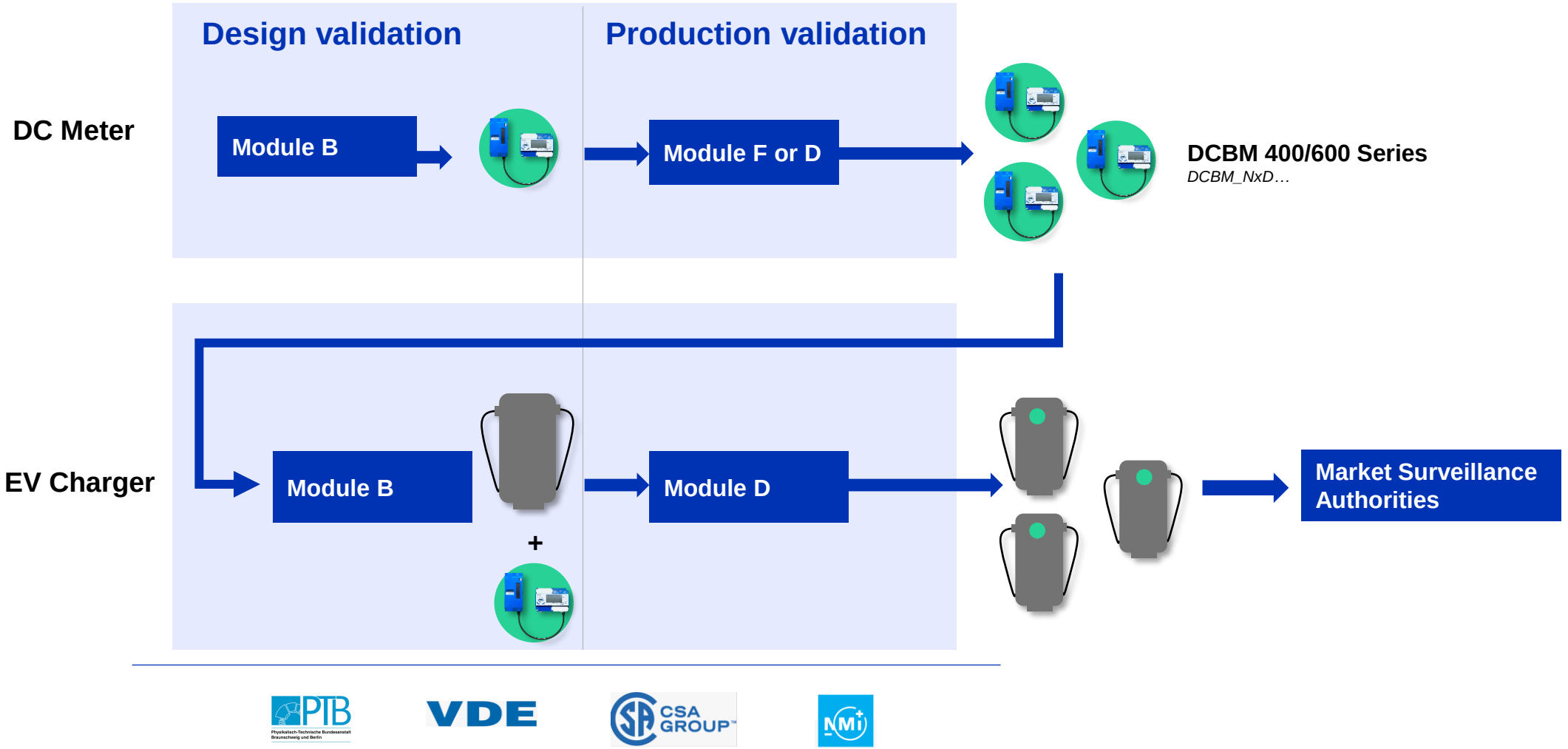
DCBM designations and certifications

	DCBM_N00…	DCBM_NxD…	DCBM_NxM…
Products	DCBM400 and DCBM600		
Certification / Approvals	**CE** marking **UL Recognized**	**Eichrecht** Module B / Module F ➔ D	**MID** Module B / Module D
Coming			**France** (Regulation 22.00.570.001.1)



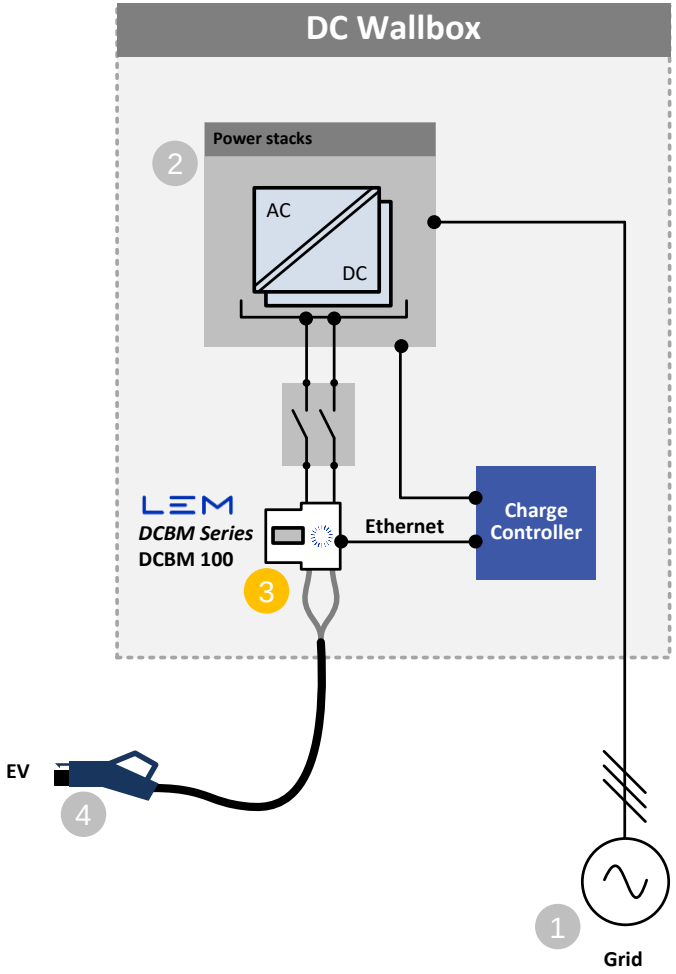
German Eichrect Certification Process

End-to-end certification process



Destination DC charging

DC wallboxes will be an essential brick in the charging landscape: acceptable charging times at affordable costs for the Charging Point Operators (CPOs)



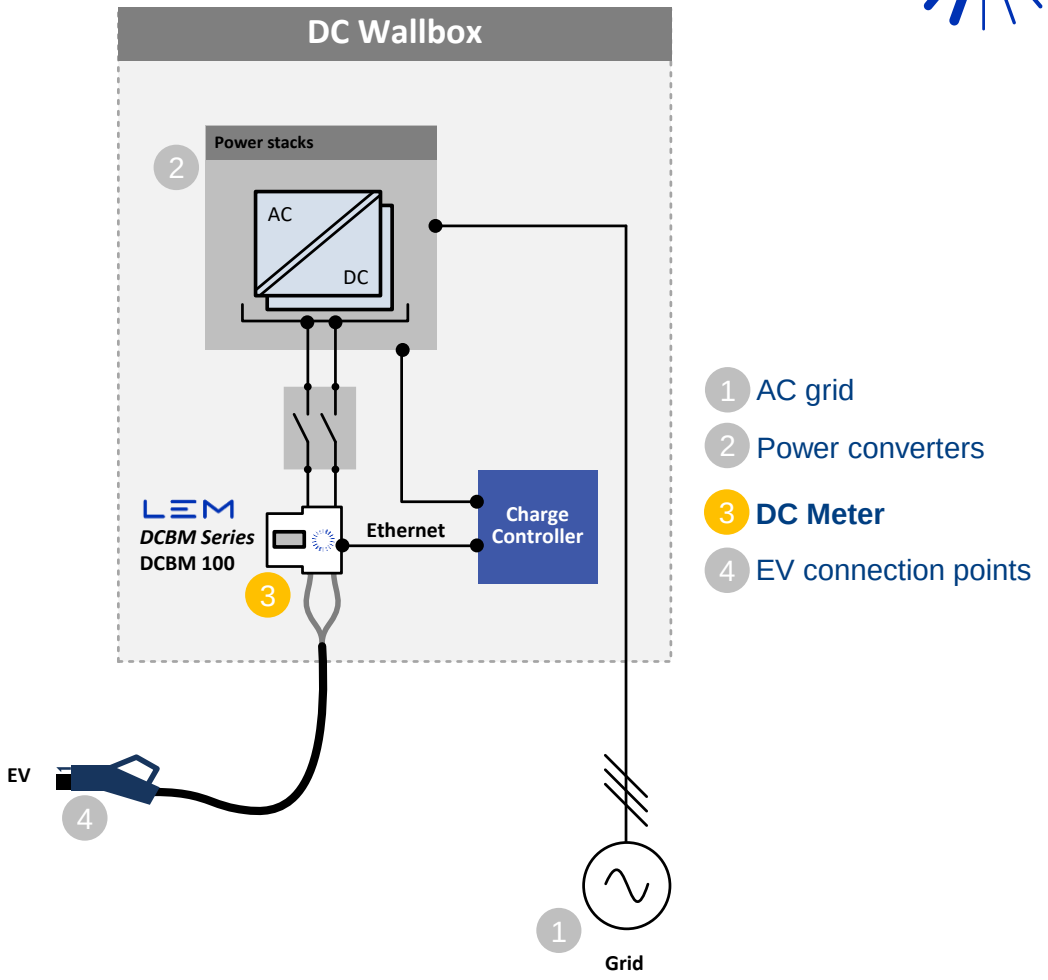
1. AC grid
2. Power converters
3. **DC Meter**
4. EV connection points

LEM DC energy meter for DC wallboxes : DCBM100

- For DC wallboxes, ready for **800V**-platform EVs and **V2G**
- Accuracy class B, **-40°C … +80°C, Imax 80 A, 1000 VDC**
- Ethernet **HTTP,** Plug&Play with **Open API profile**
- **OCMF Readout** data pre-formatted for metrology regulations
- **Monitoring** of the DC link (with current / voltage / temperature)

Focus on DCBM100 specifications

Parameter	DCBM100
Voltage specification	150 … 1000 V DC
Current specification	Ist : 64 mA Imin : 0,8 A Imax : 80 A
Accuracy class	Class B
Power terminal	35 mm²
Operating Temperature Sensor Unit	-40 °C … +80 °C
Insulation	1000 V DC, Reinforced
Loss compensation	Selectable / fixed
Counting direction	Bidirectional
Communication	Ethernet, HTTP, OCMF
Data & Security	Transaction & Signature, S.A.F.E.
Certification	Eichrecht / MID / UL



DCBM Family

DC Charging Infrastructure Integration

- Ethernet communication
- Compliant with latest EVSE protocols (OCMF / SAFE V1.2)
- Charging session handling
- Accuracy Class B
- Current / Voltage / temperature monitoring

DCBM 100

- DC Destination
- < 50 kW
- 1000 VDC / 80A
- Plug and play
- Cable connection 35mm²
- Operating +80°C

*** B samples July 2022 ***
*** C samples Oct 2022 ***
*** SOP Q3 2023***

Available

DCBM 400

- DC Fast Charging
- 50 … 150kW range
- 1000VDC / 400A
- Split design
- Loss compensation
- Cable / busbar
- Operating +85°C
- PTB / MID

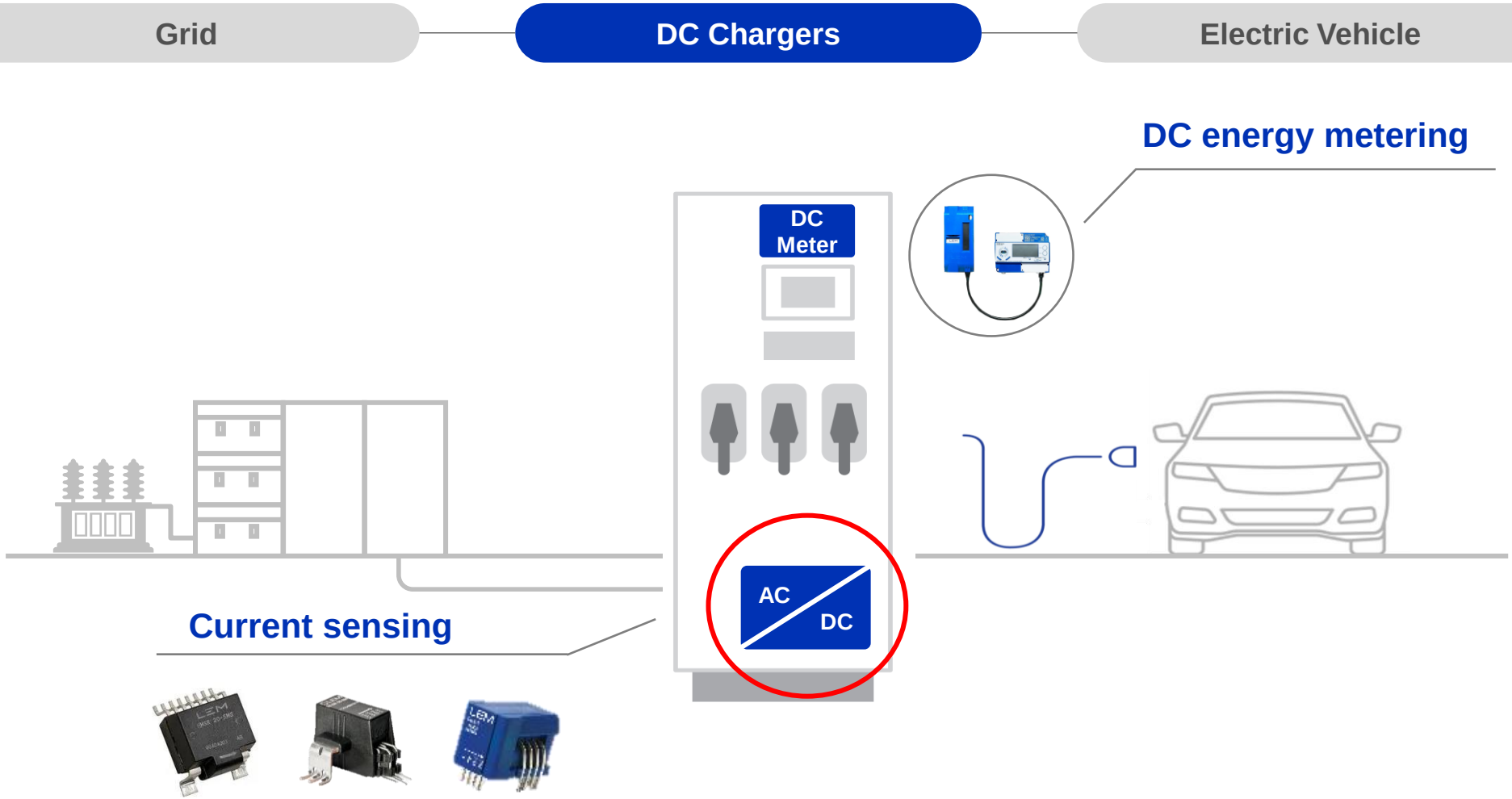
Available

DCBM 600

- DC Fast Charging
- Up to 400kW
- 1000VDC / 600A
- Split design
- Loss compensation
- Cable / busbar
- Operating +85°C
- PTB / MID

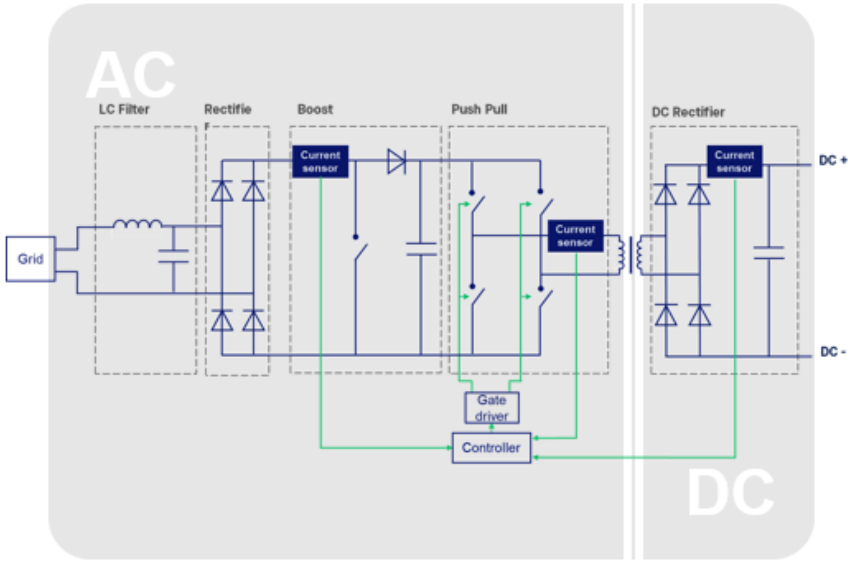
LEM sensors can be used in the AC/DC module

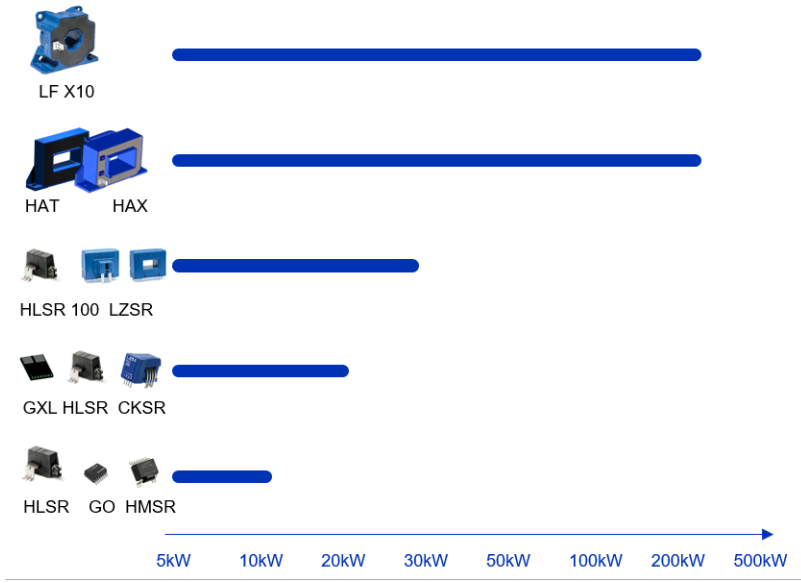
DC chargers



Fast charging stations integrate growing power densities

Power modules AC/DC | Control command function





Multiple stacked power module (AC/DC converters)

Module characteristics:

- 1000V insulation
- 30-50kW
- Up to 150A DC

LEM has a wide range of products to cover all needs

DC chargers | Product portfolio for power module AC/DC

	GO	HMSR	GXM	GXL	HLSR	HLSR 100	CKSR	LZSR
								
Technology	ICS	ICS	ICS	ICS	O/L	O/L	C/L	C/L
Current range max	± 75A	± 75A	± 125	± 200	± 125A	± 200A	± 180A	± 450A
Current RMS max	30A	30A	50A	80A	80A	100A	75A	200A
Output	Voltage	Voltage, ΣΔ*	Voltage	Voltage	Voltage, ΣΔ	Voltage, ΣΔ	Voltage	Voltage
Accuracy at 25°C	<1%	<1%	<1%	<1%	1%	1 %	0.4%	0.4%
Accuracy -40°C .. 85°C	2.7%	2.5%	2.5%	2.5%	3%	3%	1%	1%
Response time	2 µs	2 µs	2 µs	2 µs	2.5 µs	2.5 µs	2.5 µs	3 µs
Bandwidth (-3dB)	300 kHz	300 kHz	300 kHz	300 kHz	400 kHz	90 kHz	300 kHz	200 kHz
Supply voltage	+5V / 3.3V*	+5V / 3.3V*	+5V / 3.3V*	+5V / 3.3V*	+5V	+5V	+5V	+5V
Creepage & Clearance (prim/Sec)	7.5 mm 8.0 mm	8.0 mm 8.0 mm	8.2 mm 8.2 mm	6.0 mm 6.0/ mm	9.42 mm 9.42 mm	9.42 mm 9.42 mm	7.5 mm 7.5 mm	12.9 mm 12.9 mm
Implementation	SOIC 8 or 16	SOIC 16	QFN	QFN	PCBA	PCBA	PCBA	PCBA / Aperture

*ICS SOP timings to be updated by end of January 2023

Thank you