

# Fact Sheet XXL

SCHAEFFLER

FIA Formula E Santiago de Chile

February 3, 2018

Round 4



*#SantiagoEPrix*

Premiere for Team  
Audi Sport ABT Schaeffler  
in Chile's capital



This is Formula E +++ Santiago de Chile +++ All races +++ Team +++ Drivers +++ Car +++ Technology +++ The energy chain +++ Electrified powertrain architectures from Schaeffler +++ History: Formula E and e-vehicles +++ Strategy: mobility for tomorrow +++ Facts and figures +++ Race track +++ Schedule +++ Contacts

# Editorial

With Santiago de Chile now impressively marking the 17th metropolis to host Formula E since its inaugural event, the series once again proves how hot a topic electric mobility has become around the globe. As pioneers in e-mobility we from Schaeffler, together with Team Audi Sport ABT Schaeffler, have been on board of the innovative

electric racing series since day one. In spite of compelling performances in practice, qualifying and the races, we're still lacking a top result this season. That's what we're shooting for this weekend. Please join us for another exciting – and literally electrifying – Formula E event. We've summarized pertinent information, facts and figures for you in this brochure. Enjoy!



Jörg Walz  
Vice President Communications and Marketing  
Schaeffler Automotive

# Contact

Schaeffler Technologies AG & Co. KG  
Communications and Marketing  
Schaeffler Automotive  
Industriestr. 1–3, 91074 Herzogenaurach  
presse@schaeffler.com, www.schaeffler.com

# Motorsport of the future

With a bold concept that is unique in the world, ABB FIA Formula E Championship has been fascinating fans, drivers and manufacturers

A visionary idea has turned into a hot and booming racing series: Welcome to Formula E. Its success formula? Fully electric racing on spectacular city street circuits in the world's largest metropolises, a tight event schedule – and all this with a commitment to environmental compatibility and sustainability. This concept has been well-received, not only by the fans but also by the participating

teams. More and more manufacturers and suppliers regard Formula E as a suitable platform for presenting their brand. Welcome to the future!

## Involved from day one

Schaeffler recognized the potential of Formula E at an early stage and has been partnering with Audi Sport ABT Schaeffler since the inaugural season. In the 2017/2018 season, the team is competing with Champion Lucas di Grassi, Daniel Abt and a new race car. The Audi e-tron FE04 is running with powertrain technology "made by Schaeffler."



# #SantiagoEPrix



Santiago de Chile – Herzogenaurach



12,220 km

In terms of mobility, infrastructure and "green" orientation, **Santiago de Chile** is best-in-class on the continent

## Country and people

At an elevation of 522 meters, Santiago de Chile is located in the Valle de Maipo basin, surrounded by the Coastal Cordillera in the west and the more than 6,000 meter high Andes in the east. Chile's capital is a cultural and political center and home to seven million people, about a third of the country's population.

7,037,000

inhabitants

641 km<sup>2</sup> of area

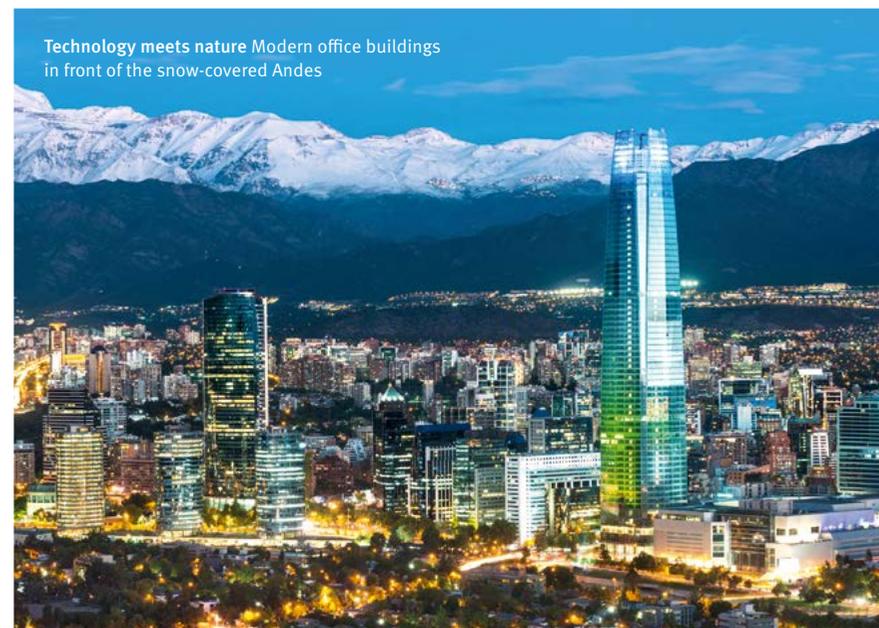
## Mobility role model

Chile is the wealthiest nation in South America and the only one on the continent to belong to the circle of developed industrial countries, OECD. The state of mobility in Santiago is comparably progressive. The subway system was complemented by a new bus network in 2007 and has since formed the integrated Transantiago public transportation system. In 2017, Santiago de Chile was recognized with the prestigious Sustainable Transport Award for sustainable transportation policy. By selecting Santiago, the jury rewarded the city for actions such as pedestrian- and cyclist-friendly street improvements and establishment of new green spaces.

## Going forward

The Nationally Appropriate Mitigation Action (NAMA) is a concept for climate protection activities launched in 2007. Its primary aim is to reduce worldwide emissions. Chile adopted the concept in 2012, which includes the advancement of electric mobility in two different project phases. By 2020, 70,000 electric vehicles are planned to travel on Chile's roads. As a result, emissions are to be reduced by 2.8 million metric tons by 2035.

Technology meets nature Modern office buildings in front of the snow-covered Andes



## Santiago de Chile in February

29 °C  
Daytime temperature

11 °C  
Nighttime temperature

9  
Hours of sunshine/day

0  
Days of rain/month

# Around the *globe*

Africa, Asia, Europe, North and South America – Formula E stops on five continents on its world tour. The calendar has twelve races at ten events in store



4

Santiago Chile

**¡Bienvenidos!**

February 3, 2018

Welcome to Formula E, Chile!  
Spectacular: the race track in the capital city crosses a river.

## Drivers' standings

Pos.	Driver	Team	Points
1	Felix Rosenqvist (S)	Mahindra Racing	54
2	Sam Bird (GB)	DS Virgin Racing	50
3	Jean-Éric Vergne (F)	Techeetah	43
4	Nelson Piquet jr. (BR)	Panasonic Jaguar Racing	25
5	Edoardo Mortara (CH)	Venturi Formula E Team	24
6	Sébastien Buemi (CH)	Renault e.dams	22
7	Nick Heidfeld (D)	Mahindra Racing	21
8	Mitch Evans (NZL)	Panasonic Jaguar Racing	15
9	Daniel Abt (D)	Audi Sport ABT Schaeffler	12
10	António Félix da Costa (P)	Andretti Formula E	8
19	Lucas di Grassi (BR)	Audi Sport ABT Schaeffler	0

## Teams' standings

Pos.	Team	Points
1	Mahindra Racing	75
2	DS Virgin Racing	58
3	Techeetah	43
7	Audi Sport ABT Schaeffler	12



Hong Kong

1 & 2

### Misfortune at season opener

December 2/3, 2017

After coming fifth on Saturday, Daniel Abt as the winner of race two is excluded due to an administrative error. Lucas di Grassi remains without points.

3



Marrakesh Morocco

### Demonstrated potential

January 13, 2018

Following best times in the free practice sessions and a solid qualifying performance, Team Audi Sport ABT Schaeffler has to settle for only one point.



Mexico City Mexico

5

### Goose bump moments

March 3, 2018

Fans experience a unique stadium atmosphere at Autódromo Hermanos Rodríguez.



Punta del Este Uruguay

6

### Welcome back

March 17, 2018

The round at the Uruguayan seaside resort replaces the event in São Paulo. Punta del Este was previously part of the calendar in the first two Formula E seasons.



Rome Italy

7

### Back then ...

April 14, 2018

2,500 years after chariot races à la Ben Hur were held there in antiquity, Formula E makes its debut.



Berlin Germany

9

### Schaeffler's home round

May 19, 2018

The race track, the former Tempelhof airport, is only about ten kilometers away from the government district in Berlin.

### Premiere

June 10, 2018

Circuit races have been prohibited in Switzerland for more than 60 years – as a result of the 1955 tragedy at Le Mans. Formula E is the first series to have received a racing permit again.

Zurich Switzerland



10

### Big Apple

July 14/15, 2018

Formula E was the first ever single-seater series to bring motorsport directly into the heart of New York City. Last season, Lucas di Grassi started his comeback drive toward the title win in the U.S. metropolis.



New York USA

11 & 12



Paris France

8

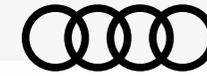
### Mobility in transformation

April 28, 2018

In 2015, the UN countries reached an accord here on improving environmental protection. With a wealth of ideas, Paris attempts to counteract daily gridlock.

# Teamwork

Technology partner Schaeffler, manufacturer and entrant Audi, fielding team ABT, drivers Lucas di Grassi and Daniel Abt and two Audi e-tron FE04 race cars – these are the protagonists making up Team Audi Sport ABT Schaeffler



Active in motorsport with factory-backed commitments since the 1980s +++ Successes in rally, sports car and touring car racing +++ In Formula E, initially gave its name to the team +++ In 2016/2017, partnership with Schaeffler and ABT intensified +++ Manufacturer and entrant from 2017/2018 season on



- Formula E**  
1 x drivers' champion
- WEC**  
2 x drivers' world champion  
2 x manufacturers' world champion  
13 x 24 H Le Mans winner
- DTM/Super Touring Cars**  
10 x drivers' champion (DTM)  
4 x manufacturers' champion (DTM)  
12 x drivers' champion (STW)  
8 x manufacturers' champion (STW)
- Rally**  
2 x drivers' world champion  
2 x manufacturers' world champion

- Titles and victories**  
Schaeffler has celebrated triumphs in series such as:
- Formula E, WEC,
  - 24 H Le Mans, DTM,
  - 24 H Nürburgring,
  - Dakar Rally and endurance rallies

## SCHAEFFLER

Innovative technology group +++ Motorsport as a platform for technology transfer between road and race track +++ Commitments in diverse racing series +++ Contributes know-how as an electric mobility pioneer to Formula E +++ Developed powertrain for Audi e-tron FE04



- Formula E**  
1 x drivers' champion
- DTM**  
5 x drivers' champion  
4 x teams' champion
- ADAC GT Masters**  
1 x drivers' champion  
1 x teams' champion



Founded in 1896 as a smithy +++ Allgäu-based family business +++ Leading tuner for automobiles from the Volkswagen Group +++ Firmly established in motorsport since the 1990s +++ Formula E racing team since season one +++ Daniel Abt is CEO Hans-Jürgen Abt's son

# #66

## Daniel Abt

Date of birth December 3, 1992  
Place of birth Kempton (D)  
Residence Kempton (D)  
Height 1.79 m  
Weight 72 kg

- 2009 1st ADAC Formel Masters
- 2012 2nd GP3 Series
- 2015 1st 24 Hours of Le Mans (in class)
- 2016 7th Formula E
- 2017 8th Formula E



Good luck Daniel Abt (left) and Georg F.W. Schaeffler, Supervisory Board Chairman

The car's transformation into the new Audi e-tron FE04



## Lucas di Grassi

Date of birth August 11, 1984  
Place of birth São Paulo (BR)  
Residence Monaco (MC)  
Height 1.80 m  
Weight 75 kg



- 2007 2nd GP2 Series, Formula 1 test driver
- 2014 2nd 24 Hours of Le Mans, 4th WEC
- 2015 3rd Formula E
- 2016 2nd Formula E
- 2017 1st Formula E



# #1



**Powertrain** NEW  
Motor generator unit (MGU),  
1-speed transmission

**Bodywork**  
Specification spark-carbon body,  
specification front and rear wings

**Battery**  
Available amount of energy: 28 kWh.  
Charging time: approx. 45 min.

**Steering wheel**  
With shifting and recuperation  
paddles

## Audi e-tron FE04

880 kg  
weight including driver

5,000 mm Length

1,790 mm Width

1,070 mm Height

200 kW  
output in qualifying

180 kW NEW  
output in race  
(2016/2017: 170 kW)

# Electrifying

Formula E proves that racing also works without the sound of engines and the smell of gasoline. A technology overview

The sound on the race track is a new one, and it's a sound of silence. Yet anyone who's ever been to a Formula E race knows that the human senses are stimulated – electrified – in every respect nonetheless. The high-tech race cars are on a par with their counterparts powered by IC engines and deliver highly thrilling motorsport where, in addition to pure speed, management of the energy from the battery with maximum efficiency plays a key role.

In terms of technological development, Formula E follows a technical roadmap. It includes specifications for teams and manufacturers designed to prevent a technological arms race. In the 2014/2015 inaugural season, identical electric race cars were used. Since season two, the teams have been able to develop the powertrain themselves. To the ABT Schaeffler FE01 and the FE02 – the race cars fielded in the 2015/2016 and 2016/2017 seasons – Schaeffler contributed

**“Motorsport is emotion – and emotion is what we need in electric mobility as well”**

Prof. Peter Gutzmer,  
Deputy CEO and Chief Technology  
Officer of Schaeffler AG

its know-how as a pioneer in electric mobility and as the team's official technology partner. In the new Audi e-tron FE04, technology “made by Schaeffler” operates as well. Schaeffler engineers together with Audi again developed the combination of the motor and transmission including the control electronics.

## The spectacle intensifies

In the coming years, the technical roadmap provides for adjustments to make Formula E even more attractive. For the 2018/2019 season, for instance, the amount of energy available from the lithium-ion battery will increase from the current 28 to 54 kilowatt hours so that the vehicles will be able to cover a full race distance, eliminating the currently customary car change. The maximum power output will be raised from 200 to 250 kilowatts.

**1** *The new high-efficiency transmission of the Audi e-tron FE04 has one forward speed*

## Interview



On the hunt for hundredths  
Dr. Simon Opel (34) is Director Special  
Projects Motorsports at Schaeffler

## 3 questions for ... ... Dr. Simon Opel

*What thoughts come to your mind when looking back on three seasons that have culminated in the Formula E Champion's crown?*

*That it was a very exciting period, from the very first second when we created the concept for the powertrain together with ABT. It was a continuous learning process of how to find the best compromise between performance and energy efficiency.*

### *What is the technical and emotional motivation for season four?*

*As engineers, we're always striving to come up with the best possible technical solution. However, in terms of time and money, that's not always feasible.*

*However, in collaboration with Audi and their resources, we've significantly enhanced our powertrain yet again. In Formula E, details and hundredths matter with respect to the components and the setup. Plus, our motivation is obviously unbroken, with victories and titles continuing to be the name of the game ...*

### *As a Schaeffler engineer, what is your assessment of the electric mobility megatrend?*

*For me, electric mobility is a technology that has to be communicated to people via emotions. This is the only way to show that electric mobility can be fun as well. Motorsport and Formula E are perfectly suited for this. And as engineers, we learn a lot from developments for Formula E. Still, I don't believe that electric mobility is the cure-all for everyone. The various questions about mobility require answers that best meet the respective need, in other words: what type of powertrain is truly suitable for what purpose?*

# Schaeffler know-how for energy chain and powertrain architectures

Sustainable mobility begins with renewable production of primary energy and includes the entire energy chain, culminating in diverse and smart solutions for locomotion. Schaeffler develops innovative solutions for a wide variety of powertrains



## Energy production

Sustainable mobility can only be successfully achieved if the primary energy for locomotion is produced from renewable sources as well, for instance by wind and hydropower, solar or geothermal energy. Schaeffler develops powerful components for wind farms and hydropower stations and supports their operators with services such as remote diagnosis. Together with its partners, Schaeffler also conducts research into new approaches to developing renewable sources, for instance with wave and tidal power stations for predictable supply of economically produced electricity.



## Energy storage and conversion

Before electrical energy can drive a wheel it has to be placed into intermediate storage. There are various possibilities to do so, starting with the charging current for batteries. In the field of hydrogen/fuel cells, Schaeffler engineers are conducting research into surface coatings for efficiency improvements. In addition, renewable electricity can be used to produce synthetic fuels for internal combustion engines which, under specific circumstances, can be near-CO<sub>2</sub> neutral across the entire energy chain.



## Energy utilization

Also with respect to utilizing energy for the powertrain, there are diverse solutions for which Schaeffler develops a wide range of special technologies. In addition to optimizing the internal combustion engine and mated transmission, Schaeffler engineers are working on solutions for the electrification of the powertrain, optimal interaction of the IC engine and the electric motor for hybrid vehicles and tailor-made electric powertrains (battery-electric and fuel cell systems).



## Electrified powertrain architectures

Fully electric and hybrid electric vehicles will be playing an important part in mobility of the future. From high-voltage hybrid modules to electric axles through to visionary wheel-hub drive systems, Schaeffler offers an extensive and innovative product portfolio. Also in focus of the globally active technology group are solutions for the "last mile." They include the Bio-Hybrid that shows an all-new approach to urban micro-mobility and E-Boards that can be stowed and carried along without requiring a lot of space.

- 1 Hybrid module
- 2 Wheel hub drive in the People Mover
- 3 E-Axle
- 4 Bio-Hybrid
- 5 E-Board



# The **SUCCESS** story

Involved from day one and now the reigning champion – a brief look at Schaeffler's first three seasons in Formula E

## 2014/2015

### Cooperation signed and sealed

At the time of Formula E's debut, Schaeffler and ABT Sportsline with drivers Lucas di Grassi and Daniel Abt are **the only German team**. The season starts sensationally: Di Grassi wins the inaugural race in Beijing. After five additional podiums, the Brazilian finishes third overall, Abt eleventh overall.



## 2015/2016

### Schaeffler inside

Schaeffler contributes the **know-how for the powertrain** of the race car, the ABT Schaeffler FE01. In terms of racing, Team ABT Schaeffler Audi Sport continues to run on the highest level. Following three wins, Lucas di Grassi finishes the season in position two overall with a deficit of only two points. Daniel Abt, on finishing runner-up in front of his home crowd in Berlin, achieves his best result to date and ends the season in seventh place overall.



## More than a century of electric vehicles



1899 La Jamais Contente

### Electric vehicles dominate the early days

There are more e-cars on the road than cars with IC engines and Porsche manufactures e-powertrains for Lohner. First car traveling at more than 100 km/h: "La Jamais Contente".



1972 Mercedes-Benz E-Transporter

### Club of Rome: "The Limits to Growth"

IC engines come under pressure, plus an oil crisis emerges. Industry responds with premature e-powertrains. Batteries are too heavy and deliver insufficient range.



1996 General Motors EV1

### Range: 250 km; 0.19 cd

The EV1 is a purpose-designed electric vehicle. The next quantum leap: Sony invents the lithium-ion battery with which Tesla stirs up the auto industry in 2008.



1997 Toyota Prius

### Hybrid with electric motor and IC engine

Prius becomes a million-seller. E-drive works with hydrogen and oxygen even without a traction battery: Mercedes in 2003 showcases the world's first fuel cell passenger car.



2014 FIA Formula E

### Motorsport with e-drive

July 2009: McLaren-Mercedes wins with hybrid drive for the first time in Formula 1. In September 2014, Formula E debuts – as the first electrically powered racing series.

## 2016/2017

### Champion!

Formula E has long become established as a **staple in motorsport**. At the top of the standings, a well-known duel begins to unfold. Halfway through the season, Sébastien Buemi seems to be the sure champion. Then Lucas di Grassi embarks on a comeback drive which he crowns with the title win at the finale in Montreal.



# Mobility for tomorrow

For Schaeffler, innovation has been part of its corporate DNA ever since the company was founded. Lateral and interdisciplinary thinking is part of the program

Schaeffler is known as an innovation leader delivering a wealth of technologies that make automobiles more fuel-efficient, environmentally friendly and safer. Additionally, the company offers products for trains, aircraft, wind turbines and many other industrial sectors. Schaeffler can be found wherever things are in motion. And motion means mobility as well. The challenges facing mobility of the future are immense. That's why Schaeffler is committed to its holistic "Mobility for tomorrow" strategy concept geared to finding sustainable solutions for the world of tomorrow.

**"Progressive climate change, increasing urbanization and globalization, as well as digitalization will have a substantial impact on our lives and work. This particularly applies to the field of mobility"**

Klaus Rosenfeld,  
Chief Executive Officer Schaeffler



## Compact info



Lucas di Grassi

- lucasdigrassi.com.br
- lucasdigrassiofficial
- @LucasdiGrassi
- lucasdigrassi
- LucasDiGrassi

#1

Daniel Abt

- danielabt.de
- abtdaniel
- @Daniel\_Abt
- daniel\_abt
- AbtDaniel



#66

Audi e-tron FE04

- Aerodynamics**  
Adjustable front and rear wings
- Electric motor**  
Audi Schaeffler MGU02
- Battery**  
Lithium-ion battery from Williams (34 kWh, 28 kWh of which is usable)
- Transmission**  
High-efficiency 1-speed racing transmission
- Brakes**  
Hydraulic dual-circuit braking system, adjustable brake force distribution, plus braking effect due to recuperation via e-drive
- Suspension**  
Independent front and rear
- Weight**  
880 kg minimum (including driver)
- Dimensions**  
Length 5,000 mm, width 1,790 mm, height 1,070 mm

The Audi e-tron FE04 accelerates from 0 to 100 km/h in

**3.5** seconds

**200 kW** output in qualifying

**180 kW** output in race

**3** drivers with the largest number of #FanBoost votes have 100 kJ more energy

**1** #FanBoost in second car

fanboost.fiaformulae.com



### Schaeffler facts

- 89,400 employees worldwide
- 13.3 bn euros of sales in 2016
- > 2,300 patent applications filed in 2016
- 25,000 active patents and patent applications
- 170 locations in 50 countries
- 75 plants worldwide
- 60 Schaeffler components in automobiles worldwide (average)
- 17 research and development centers worldwide

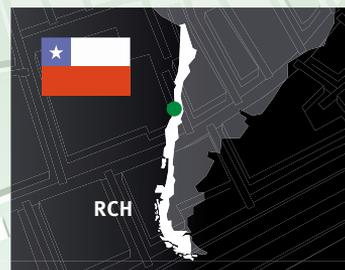
### Schaeffler in Formula E

- 1** drivers' title
- 36** races
- 4** fastest race laps
- 4** #1 pole positions
- 6** victories
- 24** podium positions
- 32** #FanBoost

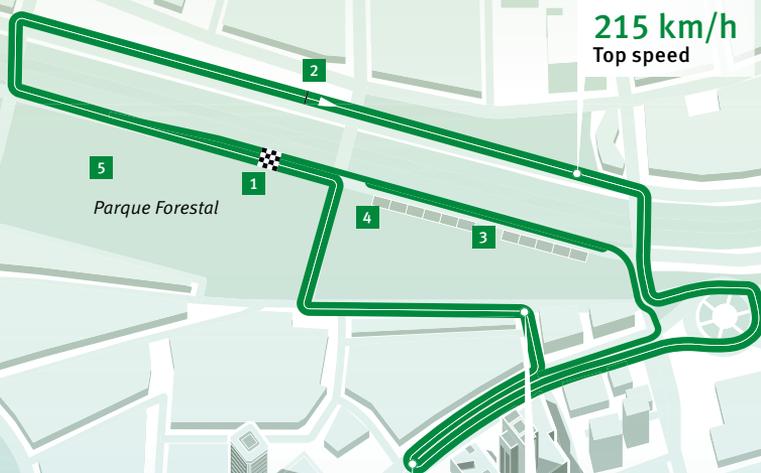
# The *race track*

Parque Forestal Ciudad De Santiago

**SCHAEFFLER**



RCH



**215 km/h**  
Top speed

5

Parque Forestal

1

4

3

**90 km/h**  
Fastest turn

**35 km/h**  
Slowest turn

**2,470 m**

Track length

- 1 Finish
- 2 Start
- 3 Pit lane
- 4 Media Center
- 5 E-Village

## Schaeffler

- [schaefflergroup](#)
- [@schaefflergroup](#)
- [schaeffler.com](#)
- [SchaefflerGlobal](#)

## Audi Sport

- [AudiSport](#)
- [@audiformulae](#)
- [audi.com/audisport](#)
- [audisport](#)
- [audisportsnaps](#)

## Team ABT

- [abtmotorsport](#)
- [@abtmotorsport](#)
- [abt-sportsline.de](#)
- [ABTSportslineTV](#)
- [abtmotorsport](#)

## FIA Formula E

- [fiaformulae](#)
- [@FIAFormulaE](#)
- [fiaformulae.com](#)
- [FIAFormulaE](#)
- [fiaformulae](#)

## February 3, 2018 (local time)

08:00 – 08:45	Free practice 1	15:00	Driver parade
10:30 – 11:00	Free practice 2	15:23	Pit lane open
12:00 – 12:36	Qualifying (4 groups)	16:04	Race (37 laps)
12:45 – 13:00	Super Pole	17:05	Podium
14:00 – 14:30	Autograph session (E-Village)	17:25 – 17:40	Press conference (Media Center)



Learn more about mobility for tomorrow



Video Racing for a reason