

# Fact Sheet XXL

SCHAEFFLER

FIA Formula E Berlin

May 19, 2018

Round 9



*#BerlinEPrix*

German round on home soil for Team Audi Sport ABT Schaeffler and driver Daniel Abt at the former Tempelhof airport



This is Formula E +++ Berlin +++ 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

Brimming with energy after four consecutive podium finishes our team is traveling to the season's big highlight: the E-Prix on home soil in Berlin. The event already has a history of fans in the grandstands – including some hundred Schaeffler employees – cheering our drivers

on to delivering top performances. 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. Enjoy Formula E and a – literally – electrifying experience. We have summarized all pertinent information, facts and figures for you in this brochure.



Jörg Walz  
Vice President Communications & Editor-in-Chief Schaeffler

# Contact

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# 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."



# #BerlinEPrix

Berlin–Herzogenaurach

373 km

The heart of Germany, open-minded people and a clear focus on mobility for tomorrow – that's Berlin

## Country and people

Although Berlin with a population of about 3.6 million ranks outside the top 50 on the list of the world's big cities, it is in the top spot by far in Germany. The metropolis that used to be divided into East and West has been the capital of Germany as a whole since the country's reunification in 1990 and is the seat of the German federal government. Berliners are regarded as bubbly and outgoing.

**3,570,000**  
inhabitants

**891 km<sup>2</sup>** of area



## Typically German

When it comes to local public transportation residents and tourists can rely on a well-organized and reliable network. Verkehrsverbund Berlin-Brandenburg (VBB) with a route network of some 30,000 square meters is one of Europe's largest transportation authorities in terms of area coverage. Regional trains, S-Bahn suburban trains, subway and buses have more than 3,100 stops and a network length of about 1,900 kilometers – roughly corresponding to the distance between Berlin and Moscow.

## Solutions for the future

As in practically any big city motorized personal transportation imposes a major burden on the environment. Actions by the Senate of Berlin to counteract this problem include additional speed limits. A project billed as "New Mobility Berlin" thinks a step further ahead by analyzing and supporting the rollout of electric mobility solutions. Its aim is to substantially upgrade residential and living spaces through innovative concepts. Initial successes include the high popularity enjoyed by eScooter provider COUP and the steadily growing number of bike rentals.



National record The Berlin Television Tower (368 meters) in the background is Germany's tallest building

Berlin in May

20 °C   
Daytime temperature

8 °C   
Nighttime temperature

8   
Hours of sunshine/day

10   
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



Berlin  
Germany

## Right in the middle

May 19, 2018

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

## Drivers' standings

Pos.	Driver	Team	Points
1	Jean-Éric Vergne (F)	Techeetah	147
2	Sam Bird (GB)	DS Virgin Racing	116
3	Felix Rosenqvist (S)	Mahindra Racing	86
4	Sébastien Buemi (CH)	Renault e.dams	70
5	Lucas di Grassi (BR)	Audi Sport ABT Schaeffler	58
6	Daniel Abt (D)	Audi Sport ABT Schaeffler	56
7	Nelson Piquet jr. (BR)	Panasonic Jaguar Racing	45
8	Mitch Evans (NZ)	Panasonic Jaguar Racing	43
9	André Lotterer (D)	Techeetah	41
10	Oliver Turvey (GB)	NIO Formula E Team	34

## Teams' standings

Pos.	Team	Points
1	Techeetah	188
2	DS Virgin Racing	133
3	Audi Sport ABT Schaeffler	114
4	Mahindra Racing	107



Hong Kong

## 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.

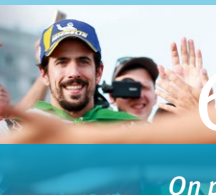


Santiago Chile

## 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.



Punta del Este  
Uruguay

## Double disappointment

February 3, 2018

At Formula E's inaugural event in Chile, both campaigners of Team Audi Sport ABT Schaeffler are forced to retire.

## On podium

March 17, 2018

The second driver of Team Audi Sport ABT Schaeffler, title defender Lucas di Grassi, celebrates his first podium finish this season as well: position two.



Paris France

## Podium hat-trick

April 28, 2018

Lucas di Grassi finishes in second position for the third time in a row, overtaking his teammate, Daniel Abt, in the standings.

## 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



New York USA

## 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.

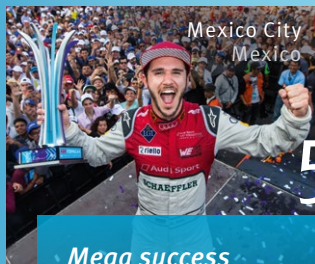


Marrakesh Morocco

## 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

## Mega success

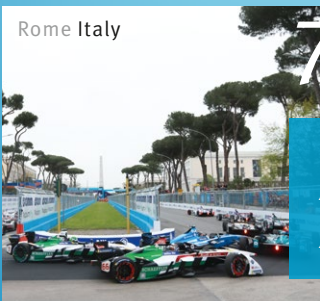
March 3, 2018

From fifth on the grid to first at the finish – Daniel Abt is the first German ever to win a Formula E race.

## Top twice

April 14, 2018

31 points in total – with second place for di Grassi and fourth for Abt Team Audi Sport ABT Schaeffler experiences its most successful event this season.



Rome Italy

# 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 of 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

## Daniel Abt

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

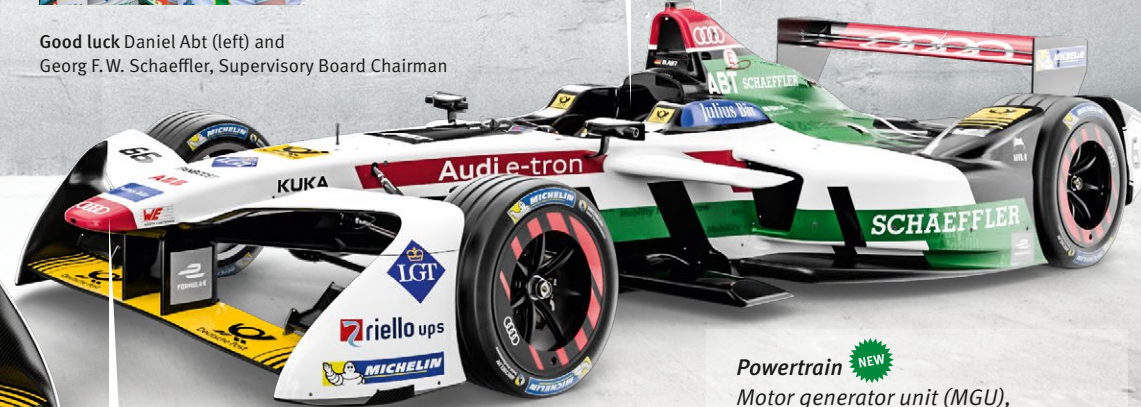


- 2009 1st ADAC Formel Masters
- 2012 2nd GP3 Series
- 2015 1st 24 Hours of Le Mans (in class)
- 2016 7th Formula E
- 2017 8th Formula E



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



## Audi e-tron FE04

5,000 mm Length  
1,790 mm Width  
1,070 mm Height

880 kg weight including driver

200 kW output in qualifying

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

**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

# 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.

# 1

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

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 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.



Result of a joint project The motor-generator unit designed by Schaeffler and Audi

Interview



Prof. Peter Gutzmer (right), Deputy CEO and Chief Technology Officer of Schaeffler AG, and Matthias Zink, CEO Automotive of Schaeffler AG, in an interview

# 3

## questions for ...

... Prof. Peter Gutzmer and Matthias Zink

### Why are you active in Formula E with Schaeffler?

*Peter Gutzmer: "Ever since the beginning of the automobile's history, motorsport has been fascinating the masses. In this context, Formula E is regarded as the key to technology transfer for future production technologies and mobility for tomorrow – that's why, in 2014, we were the first renowned supplier to enter the series together with Team ABT Sportsline. The huge emotionalization of this racing series and the success achieved to date prove the overall concept, and therefore the capabilities of electric mobility and our engineers, right. We're also already thinking about an extension of our successful electric motorsport activities."*

*Matthias Zink: "Motorsport has an additional, very important effect: it requires expertise of taking the technology to the limits – in terms of function, weight and service life."*

### What, exactly, does the technology transfer between motorsport and production look like?

*Peter Gutzmer: "There's a huge amount to be learned in the development of the systems and components for Formula E. It starts with the motor on which we tried out various design principles, continues with the fundamentals of the cooling concepts for electric powertrains and extends all the way to the functionalities in the interaction of the battery, software and control units, as well as starting-from-rest and recuperation performance. All of our three Formula E powertrains have differed from each other. Now we're consistently applying this knowledge to production developments."*

### With Schaeffler you're also present in the DTM as the sponsor of a complete vehicle. This series has always been using conventional internal combustion engines. How does that fit together with your electric philosophy?

*Matthias Zink: "Electric mobility is our future, but electric mobility is also the future of the internal combustion engine. As many studies reveal, we will not be able to achieve the envisioned targets by 2030 strictly with battery-electric mobility. In the total analysis, this will only be possible if we use renewable energies to create CO<sub>2</sub>-neutral energy carriers which, ideally, can be achieved in an ICE system. The future of personal mobility will be shaped by a sound mix of hybrids, efficient IC engines and electric powertrains."*

# 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

- > 90,000 employees worldwide
- 14 bn euros of sales in 2017
- 2,400 patent applications filed in 2017
- 26,000 active patents and patent applications
- 170 locations in 50 countries
- 75 plants worldwide
- 60 Schaeffler components in automobiles worldwide (average)
- 18 research and development centers worldwide

### Schaeffler in Formula E

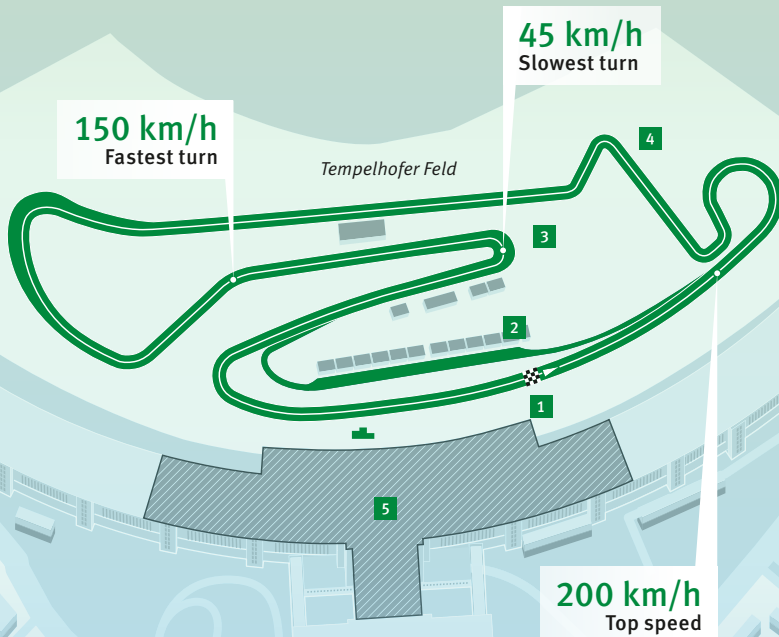
- 1** drivers' title
- 41** races
- 6** fastest race laps
- 4** #1 pole positions
- 7** victories
- 28** podium positions
- 38** #FanBoost



# The *race track*

Tempelhof Circuit

**SCHAEFFLER**



**2,375 m**  
Track length

- 1 Start/Finish
  - 2 Pit lane
  - 3 Media Center
  - 4 eMotion VIP Area
  - 5 E-Village
- Podium

## May 19, 2018 (local time)

09:00 – 09:45	Free practice 1	17:00 – 17:10	Driver parade
11:30 – 12:00	Free practice 2	17:23	Pit lane open
14:00 – 14:36	Qualifying (4 groups)	18:04	Race (45 laps)
14:45 – 15:00	Super Pole	19:05	Podium
16:25 – 16:55	Autograph session (E-Village)	19:25 – 19:40	Press conference (Media Center)



## Schaeffler

- f schaefflergroup
- t @schaefflergroup
- schaeffler.com
- SchaefflerGlobal

## Audi Sport

- f AudiSport
- t @audiformulae
- audi.com/audisport
- audisport

## Team ABT

- f abtmotorsport
- t @abtmotorsport
- abt-sportsline.de
- ABTSportslineTV
- abtmotorsport

## FIA Formula E

- f fiaformulae
- t @FIAformulaE
- fiaformulae.com
- FIAFormulaE
- fiaformulae



Learn more about mobility for tomorrow



Video Racing for a reason