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mDSF: Uncompromised Engine Fuel Efficiency and Performance Via DSF and Miller Cycle Synergies

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Tula Technology's Dynamic Skip Fire (DSF)



Start of Production: All-New 2019 Silverado

At the 2018 NAIAS, GM announced that the 2019MY Silverado will be equipped with "Dynamic Fuel Management"



"It's revolutionary; It's like nothing we've ever seen before"

--Mark Reuss, Executive Vice President, General Motors

Miller engines limited by efficiency-performance tradeoff



2-Step Miller strategy presents opportunity for DSF



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mDSF: Improved efficiency and NVH via Miller cycle



Normal 4-cylinder operation



mDSF can be mechanized cost-effectively



mDSF engine dynamometer testing

Engine	Audi EA888 Gen. 3B
Displacement	1984 cm ³ (2.0L, I4)
Compression Ratio	11.7:1
Intake Camshaft	2-Step Miller (AVS) 140° CA (Lo), 170° CA (Hi)
Test Fuel	Gasoline 93 ON



mDSF cam strategy has minimal impact on I4 fuel consumption



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mDSF asymmetric lifts impact engine performance



mDSF shows significant fuel consumption reduction



mDSF vehicle fuel consumption projections

Calibrated GT-SUITE vehicle model (VW Jetta)

Steady-state engine fuel consumption maps

1588 kg TWC

6-Speed A/T + Torque Converter

Passive NVH mitigation HW

Upsized 2.1L mDSF engine

Standard certification cycles:

- US City / Highway
- WLTC Class 3
- NEDC
- JC08





mDSF engine operates at higher efficiency throughout drive cycle



mDSF improves DSF and 2-Step Miller CO₂ emissions



mDSF technology enhances DSF and Miller value



mDSF development continues at accelerated pace

- Tula-FEV-Delphi mDSF cylinder head
- Ch Engine controls algorithms for dynamic Hi Fire-Lo Fire-Deac
- Combustion system optimization

Demonstration vehicle by Q1 2019



mDSF is the next generation of DSF engine technology

 mDSF integrates DSF and Miller cycle technology with high synergy – projected to reduce CO₂ by 6.6-8.6% from industry benchmark Miller cycle engine

mDSF implemented cost-effectively using existing valvetrain hardware with expected industry-leading value of \$30/%

mDSF development moving forward with fully functional cylinder head, new controls algorithms and demonstration vehicle



Thank You!

Chris Chandler, Casey Horner, Alex Perry (Tula PT Integration/Testing)

Jack Parsels, Jack Lehnert, Steve Niederer (Tula Electronics Lab)

Robert Wang, Ben Wolk, Anastasios Arvantis (Tula Simulation/NVH)

Hermes Fernandez, Keith Confer, Rich Roe (Delphi Engines/Valvetrain)

Mark Duffy, Stephen Bowyer (FEV)





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Thank you!

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