



U.S. Department
of Transportation
**National
Highway
Traffic Safety
Administration**

ODI RESUME

Investigation: EA19001
Prompted By: PE18003
Date Opened: 04/19/2019
Date: 09/19/2024
Closed:
Investigator: Bruce York
Reviewer: Bruce York
Approver: Tanya Topka
Subject: Electrical overstress

MANUFACTURER & PRODUCT INFORMATION

Manufacturer: Chrysler (FCA US, LLC)
Products: ZF AIR BAG CONTROL UNIT, 2011-2013 TOYOTA COROLLA MATRIX, 2013-2014 HONDA FIT EV, 2014 KIA SEDONA, 2011-2012 RAM 4500, 2013-2019 KIA OPTIMA, 2011-2012 RAM 5500, 2013-2019 HYUNDAI SONATA HYBRID, 2012-2015 HONDA CIVIC, 2012-2014 ACURA TSX, 2012-2015 HONDA CIVIC GX, 2015-2017 ACURA TLX, 2013 KIA FORTE KOUP, 2013 MITSUBISHI OUTLANDER, 2012-2019 TOYOTA TACOMA, 2012-2017 HONDA FIT, 2013-2015 HONDA ACCORD, 2015-2017 JEEP COMPASS, 2014-2019 ACURA RLX, 2014-2019 ACURA RLX HYBRID, 2015-2017 JEEP PATRIOT, 2012-2019 FIAT 500, 2013-2015 HONDA CIVIC HYBRID, 2013-2016 MITSUBISHI LANCER SPORTBACK, 2014-2015 MITSUBISHI LANCER RALLIART, 2012-2014 ACURA TL, 2012-2018 TOYOTA AVALON, 2013-2019 HYUNDAI SONATA, 2009-2012 RAM 1500, 2013-2015 MITSUBISHI LANCER EVOLUTION, 2012-2014 ACURA TSX SPORT WAGON, 2010-2011 DODGE NITRO, 2012-2017 TOYOTA TUNDRA, 2010-2018 JEEP WRANGLER, 2010-2012 RAM 3500, 2013-2017 MITSUBISHI LANCER, 2011-2019 TOYOTA COROLLA, 2010-2012 JEEP LIBERTY, 2010-2012 RAM 2500, 2013 KIA FORTE, 2012-2014 HONDA RIDGELINE, 2012-2015 HONDA CIVIC SI, 2012-2017 TOYOTA SEQUOIA, 2012-2016 HONDA CR-V, 2013-2018 TOYOTA AVALON HYBRID, 2012-2016 KIA OPTIMA HYBRID
Population: 12,300,000

Problem Description: Certain FCA, Honda, Hyundai, Kia, Mitsubishi and Toyota vehicles are equipped with an air bag control unit produced by TRW (ZF), which could fail during a crash event resulting in non-deployment of air bags and seat belt pretensioners. These control units may suffer electrical overstress due to harmful signals (electrical transients) produced by the crash event, causing the unit to stop working during the crash.

FAILURE REPORT SUMMARY

	ODI	Manufacturer	EWR D&I	Other	Total	EWR Field Reports
All Incidents:	0	1	0	1	2	0
Crashes/Fires:	2	0	0	0	2	0
Injury Incidents:	1	0	0	0	1	0
Number of Injuries:	2	0	0	0	2	0
Fatality Incidents:	1	0	0	0	1	0
Number of Fatalities:	1	0	0	0	1	0

Description of Other:

The incident listed as "Other" was identified by ODI via monitoring insurance salvage (public) web sites. The incident listed as "Manufacturer" was identified by ZF. Each involved Toyota vehicles, and neither was filed as a Vehicle Owner's Questionnaire.

ACTION/SUMMARY INFORMATION

Action: This (EA) Engineering Analysis is closed with recall actions.

Summary:

The Office of Defects Investigation (ODI) opened this investigation to determine if the failure of airbags to deploy during severe crashes, in certain vehicles, was the result of a safety related defect. During the investigation a complex failure was studied that can result in non-deployment of subject vehicle air bags and other restraint system devices in severe crash events.

The subject vehicles may be equipped with an airbag control unit (ACU) for the supplemental restraint system (SRS) Electronic Control Unit (ECU) manufactured by ZF-TRW. The ECU receives signals from crash sensors mounted in the vehicle and deploys the vehicle air bags and seat belt pretensioners in accordance with manufacturer design specifications. The ECU in the subject vehicles contains a model DS84 application-specific integrated circuit (ASIC) which controls the communication of the crash sensor signal, firing commands (i.e., when to deploy the airbag(s) and/or pretensioners), and fault information (e.g., diagnostic trouble codes).

In September 2016, FCA announced recall 16V-668 for certain model year (MY) 2010 to 2014 Chrysler, Dodge and Jeep products manufactured with the subject ZF-TRW ACU. In this recall, FCA discussed an EOS condition that resulted in a failure of the subject DS84 ASIC, which caused air bag non-deployment. FCA noted that the defect condition had only been observed in vehicles equipped with sensor harnessing routed across the front of the vehicle. Other FCA vehicles that also used the subject ACU, but were not equipped with cross-car harnessing, had not experienced EOS failures, despite similar time in service.

During the course of this investigation, ODI sent two separate Information Request (IR) letters to six vehicle manufacturers (including FCA, Hyundai, Honda, Kia, Mitsubishi, and Toyota) and one IR letter to ZF-TRW. These IR letters resulted in ODI receiving comprehensive data from these manufacturers and suppliers.

Studies of this data found that the DS84 ASIC does not have sufficient protection against negative electrical transients or electrical overstress (“EOS”) that can be generated in certain severe crashes. An electrical transient occurs when the electrical power supplied to a circuit changes momentarily over a short duration of time. In these severe crash cases, the crash sensors and other powered wiring can be damaged and short circuited so as to create a negative electrical transient of sufficient intensity and duration (that are outside the vehicle manufacturer's specification) to damage the ASIC before the restraint device deployment signal is received by the SRS ECU. This damaged signal can lead to incomplete or nondeployment of the air bags and/or pretensioners. Airbag non-deployment and/or lack of pretensioner operation can increase the risk or severity of injury in a crash. A total of 8 fatalities and 14 injuries were associated with known EOS events.

The common element in all investigated manufacturers vehicles is the SRS ECU containing a DS84 ASIC manufactured by ZF-TRW. The risk associated with the ASIC is equally shared among all OEMs involved in the investigation. The actual real-world risk can be mitigated by other factors which were assessed by ODI during this investigation.

The first mitigating factor involves protections built into the ACU design which protect the DS84 ASIC from damage. There are multiple strategies and levels of protection employed by different OEMs that provide effective EOS mitigation. The two most common strategies at the ACU level are circuit protection diodes on the remote sensor signal lines, and current limiting resistors that protect critical components.

The second mitigating factor is found at the vehicle level and involves the location and routing of the wires leading from the crash sensors to the SRS ECU. If the wires are well protected in a crash and are not routed with other power wires carrying large currents, the risk for an EOS event is significantly reduced or eliminated.

These design specific factors combine to produce a spectrum of risk for the vehicles equipped with ACUs using the DS84 ASIC. Given the many of years of field exposure, it is possible to divide the subject population into two groups; vehicles which have experienced EOS events, and vehicles which have not experienced EOS field events.

Four of the six OEMs involved in this investigation have experienced EOS field events on at least one of their models equipped with a DS84 ASIC. All vehicle models (including the Toyota models identified in the Failure Report Summary of the opening resume for this investigation) with field events have been recalled. In an abundance of caution, ODI kept this investigation open five years to monitor field performance and did not identify any field events on vehicles not included in existing safety recalls.

Given the spectrum of risk identified in this investigation and that all vehicles with a demonstrated unreasonable risk have been recalled, ODI is closing this investigation.

ODI is closing this investigation with the following manufacturer safety recalls: 16V-668, 18E-043, 18V-137, 18V-363, and 20V-024. With the recall actions taken by the subject vehicle and equipment manufacturers, this investigation is closed.

The closing of this investigation does not constitute a finding by NHTSA that a safety-related defect does not exist on other model or model year vehicles outside of the recall scopes. The agency reserves the right to take further action if warranted by the circumstances.