ABSTRACT

ASIC-level FTA used in automotive applications in cabin temperature environment. FTA analysis completed from perspective of fault(s) causing hazard regardless of time when fault(s) occur. This could be from time \( t = 0 \), onward.

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1 Introduction

1.1 Abbreviations

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<th>Description</th>
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<tr>
<td>AMP</td>
<td>Amplifier</td>
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<tr>
<td>BG</td>
<td>Bandgap</td>
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<td>BVDSS</td>
<td>Drain Source Breakdown Voltage</td>
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<td>BW</td>
<td>Bond Wire</td>
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<td>COMP</td>
<td>Comparator</td>
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<tr>
<td>EPB</td>
<td>Electronic Park Brake</td>
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<td>IDDQ</td>
<td>Quiescent Supply Current</td>
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<td>OVST</td>
<td>Over Voltage Stress Test</td>
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<td>PT</td>
<td>Production Test</td>
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<td>PTAT</td>
<td>Proportional to Absolute Temperature</td>
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<td>REF</td>
<td>Reference</td>
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<td>REG</td>
<td>Regulator</td>
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<td>S/C</td>
<td>Short Circuit</td>
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<td>SOA</td>
<td>Safe Operating Area</td>
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<td>URA</td>
<td>Unintended Relay Actuation</td>
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<tr>
<td>V5AOV</td>
<td>V5A Regulator Over Voltage</td>
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<tr>
<td>V5OV</td>
<td>V5 Regulator Over Voltage</td>
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1.2 Reference

1. TPS54310-Q1 specification (SGLS280), January 2007, Texas Instruments

1.3 Diagrams

Figure 1. Device Block Diagram
Figure 2. TPS54310-Q1 Undervoltage Fault Tree
Figure 3. Faulty Regulation Fault Tree
Figure 4. Faulty Voltage Monitoring Fault Tree
Figure 5. HS Pre-Driver Failure Fault Tree
Figure 6. Voltage Reference Failure Fault Tree

Voltage reference generation fault

VREF FAULT
Q=1.950e-5

BG reference voltage fault
BG voltage scaling circuit failure
BG trimming circuit failure

BG FAULT
r=0.0065
Q=6.500e-6

SCALING FAULT
r=0.0065
Q=6.500e-6

TRIM FAULT
r=0.0065
Q=6.500e-6
Figure 7. OSC Frequency Setting Failure
Figure 8. LS Pre-Driver Failure Fault Tree
Figure 9. VIN Failure Fault Tree

VIN supply failure

VIN UV
Q=6.760e-10

VIN supply low

VIN LOW
Q=1.300e-5

VIN pin and/or bond wire fault

VIN Pin Fault
r=0.0065
Q=6.500e-6

VIN Supply Voltage Low

VIN LOW
r=0.0065
Q=6.500e-6

VIN UVLO Monitor Failure

VIN UVLO Fault
Q=5.200e-5

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Figure 10. VSENSE Power Good Detection Failure Fault Tree
Figure 11. Set/Reset Circuit Failure Fault Tree
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Figure 21. Internal Regulator Failure Fault Tree

Figure 22. TPS54310 Undervoltage Fault Tree Importance Diagram
Figure 23. Faulty Regulation Fault Tree Importance Diagram

Figure 24. VSENSE Monitoring Fault Tree Importance Diagram
2 **Scope**

ASIC level FTA used in automotive applications in cabin temperature environment. FTA analysis completed from perspective of fault(s) causing hazard regardless of time when fault(s) occur. This could be from time t=0 onward.

3 **Hazards**

Faulty Switch Regulator leading to undervoltage condition

4 **Analysis**

4.1 **Description**

Cut Set: A group of events which will cause system failure when occurring together

1\textsuperscript{st} Order Cut Set: Single event failure causing hazard.

2\textsuperscript{nd} Order Cut Set: Two failing events causing hazard.

3\textsuperscript{rd} Order Cut Set: Three failing events causing hazard.

4\textsuperscript{th} Order Cut Set: Four failing events causing hazard.

Base Event: Description of base events in associated fault tree diagram. Base events and their description referenced to TI's design database.

4.2 **Faulty Switch Regulator Cut Sets**

Hazard: Faulty Switch regulator leading to under voltage condition.

For this hazard a total 36 individual cut sets have been analyzed.

5 **Conclusion**

ASIC level hazard FTA completed. Switch regulator proactive system level monitoring and protection considerations were included.
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