DRV3205-Q1 Applications in 24-V Automotive Systems

ABSTRACT

This application report describes operation of the DRV3205-Q1 device with various high voltage supply profiles expected in an automotive 24-V battery system.

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1 Introduction

The designers of automotive electronics face many technical challenges during the system design process. The challenges include designing protection circuits against a variety of electrical hazards. This application report focuses on protection against transient surges which are one of the sources of electrical hazards in these systems. The DRV3205-Q1 device is designed to withstand a 60-V absolute-maximum battery voltage and 70-V on gate and source motor pins (GHSx,SHSx) which adds a margin of robustness against such hazard.

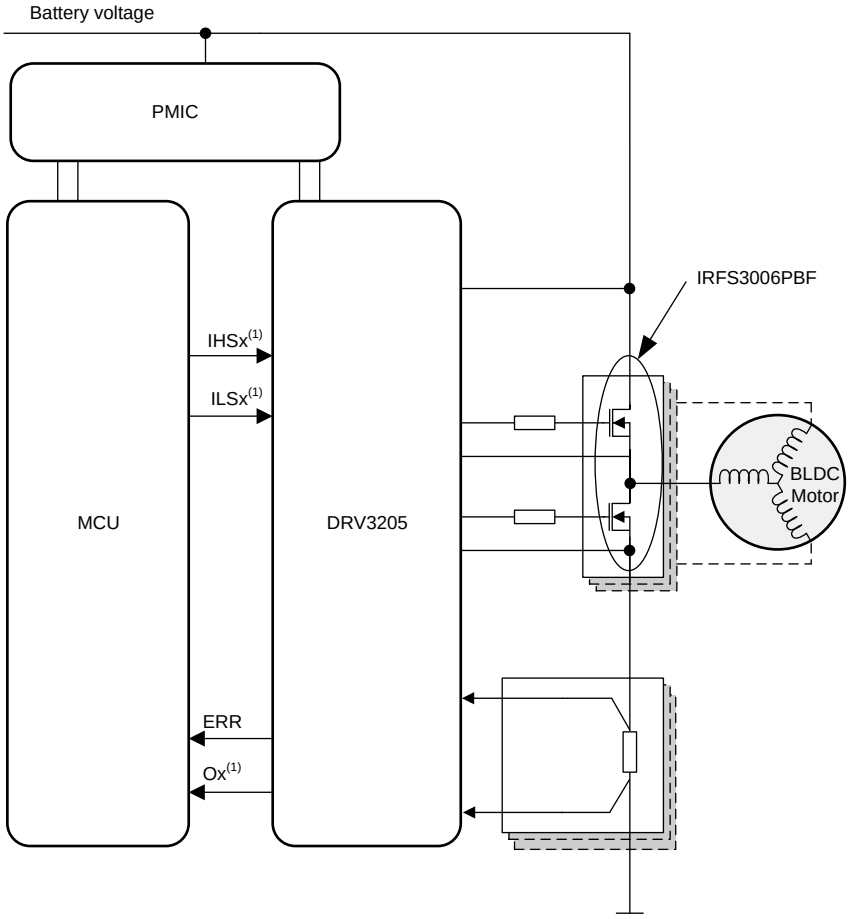
2 Test Procedure

Use the following steps for the test procedure:

Step 1. Run DRV3205-Q1 test sample through automatic test to record test result and data log.

Step 2. Run the supply profile bench test.

Step 3. Repeat step 1 and compare the test results.



(1) X = 1, 2 , or 3

Figure 1. Test Schematic

3 Hardware and Test Conditions

The hardware and test conditions include the following:

- PWM frequency: 16 KHz
- FET part number: IRFS3006PBF
- Switching pattern: All 6 FETs switch per the PWM cycles

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4 PCB Layout Guideline

For additional layout guidelines, refer to *DRV3205-Q1 Three-Phase Automotive Gate Driver With Three Integrated Current Shunt Amplifiers and Enhanced Protection, Diagnostics, and Monitoring* (SLVSDJ4).

5 Test 1 Condition

5.1 Supply Profile 1

Supply provide 1 is a typical automotive 24-V battery surge profile.

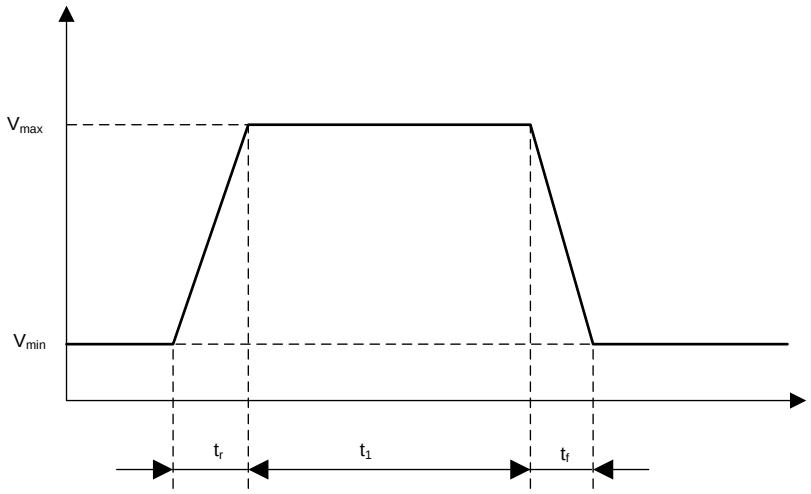

Figure 2. Supply Profile 1 Timing Chart

Table 1. Supply Profile 1 Test Conditions

CONDITIONS	LIMITS
V_{MAX}	33 V
V_{MIN}	28.3 V
t_r	< 10 ms
t_f	< 10 ms
t_1	60 min.
t_{test}	100 C
Number of cycles	1

Table 2. Supply Profile 1 Test Result

CRITERIA	RESULT	COMMENT
DUTs Tested	6 Units	Sample size for this test
ERR pin asserted	No	No fault was detected by DRV3205.
Status flag latched unexpectedly	No	No fault was detected by DRV3205.
Unintentional Gate Driver shutdown	No	No fault was detected by DRV3205.
Current Consumption of Device	Normal	No damaged to DRV3205
Thermal Shut Down Occurred	No	DRV3205 junction temperature remained lower than thermal shutdown threshold
Post ATE test	Pass	No damaged to DRV3205

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5.2 Supply Profile 2

Supply provide 2 is a typical automotive 24-V battery surge profile.

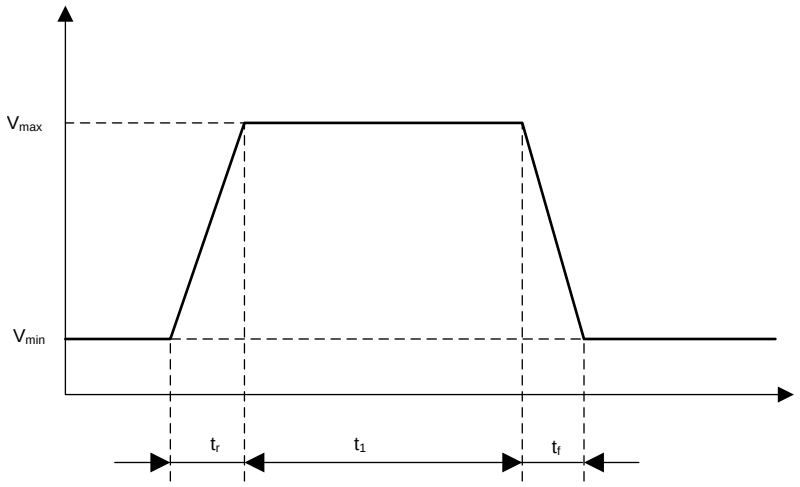

Figure 3. Supply Profile 2 Timing Chart

Table 3. Supply Profile 2 Test Conditions

CONDITIONS	LIMITS
V_{MAX}	42 V
V_{MIN}	25.3 V
t_r	10 ms
t_f	10 ms
t_1	60 s
t_{test}	RT
Number of cycles	1

Table 4. Supply Profile 2 Test Result

CRITERIA	RESULT	COMMENT
DUTs tested	6 Units	Sample size for this test
ERR pin inserted	No	No fault was detected by DRV3205.
Status flag latched unexpectedly	No	No fault was detected by DRV3205.
Unintentional gate-driver shutdown	No	No fault was detected by DRV3205.
Post ATE test	Pass	No damaged to DRV3205
Current consumption of device	Normal	No damaged to DRV3205
Thermal shutdown occurred?	No	DRV3205 junction temperature remained lower than thermal shutdown threshold

6 Summary

The high-voltage operation capability of the DRV3205-Q1 device was demonstrated in this document. The DRV3205-Q1 device can operate without interruption using a typical, automotive 24-V battery under high-voltage profile (profile 1 and 2) test. The support of an extended absolute-maximum voltage on VS, VSH, GHSx, and SHSx pins enables this performance. Notably no damage or parametric degradation was observed.

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