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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **ID** | **Section Name** | **Description** | **Procedure** | **LSL** | **Target** | **USL** | **Interface / Testpoint** | **Unit** |
| **1** | **Firmware programming** | **Programming of Microcontroller with test software** | Program the software in the Microcontroller.  (SW01022012V0-716) | **1** | **1** | **1** |  | **TRUE/FALSE** |
| **2** | **Socket J1** | **Check J1 Socket is present** |  | **1** | **1** | **1** |  | **TRUE/FALSE** |
| **3** | **Socket J2** | **Check J2 Socket is present** |  | **1** | **1** | **1** |  | **TRUE/FALSE** |
| **4** | **Socket J6** | **Check J6 Socket is present** |  | **1** | **1** | **1** |  | **TRUE/FALSE** |
| **6** | **Socket J3 GND** | **Check J3 Sockets are present** |  | **1** | **1** | **1** |  | **TRUE/FALSE** |
| **9** | **C60/C58 Polarity** | **Check C60 and C58 are present, also make sure polarity of electrolyte is correct.** | Check C60/C58 polarity  Negative on C58 should face J2  Negative on C60 should face C58 | **1** | **1** | **1** |  | **TRUE/FALSE** |
| **7a** | **Load dump** | **Test the load dump circuit 24V** | **1. Set the power supply (J1) to 24 V DC. 2. Measure voltage at TP6.** | **12,49** | **12,67** | **12,85** | **TP6** | **Voltage** |
| **7b** | **Load dump** | **Test the load dump circuit 48V** | **1. Change the power supply to 47 V DC. 2. If voltage on TP6 falls, then this means that load dump has shut down. So the load dump is checked and is functioning properly. On the other hand if the voltage on TP6 do not fall, then this means that load dump is not functioning properly.** | **0** | **1,58** | **1,74** | **TP6** | **Voltage** |
| **8** | **Reverse polarity** | **Test of reverse polarity** | Reverse supply the PCB with 24 V with current limitation. Check that the PCB do not consume huge current. | **0** | **5** | **10** |  | **milli Ampere** |
| **10** | **3.3 V supply** | **Test 3.3 V supply** | **Supply 12V onto J1 and measure voltage at TP4 (+3.3V)** | **3,24** | **3,32** | **3,36** | **TP4** | **Voltage** |
| **11** | **12 V supply** | **Test +12 V supply** | **Supply 12V onto J1 and measure voltage at TP6 (+12V)** | **12,44** | **12,63** | **12,82** | **TP6** | **Voltage** |
| **12** | **V\_PUP supply** | **Test V\_PUP supply** | **Supply 12V onto J1 and measure voltage at TP7** | **23,79** | **23,99** | **24,19** | **TP7** | **Voltage** |
| **13** | **"-12 V supply"** | **Test -12 V V supply** | Supply 12V onto J1 and measure voltage at TP54 | **-11,93** | **-11,71** | **-11,49** | **TP54** | **Voltage** |
| 14 | Supply shutdown 12V | Test shutdown of BuckBoost | Via LIN, disable SMPS\_ENA. Measure voltage at TP8 | 5,50 | 5,59 | 6,10 | TP8 | Voltage |
| **15** | **Supply shutdown 3.3V** | **Test shutdown of BuckBoost** | **Via LIN, disable SMPS\_ENA. Measure voltage +3.3V** | **3,24** | **3,32** | **3,36** | **TP4** | **Voltage** |
| **16** | **Supply shutdown 3.3V** | **Test shutdown of BuckBoost** | **Via LIN, disable SMPS\_ENA. Measure voltage +12V** | **0** | **1,13** | **1,25** | **TP6** | **Voltage** |
| **17** | **ADC measurement on VCC** | **Test ADC conversions** | **Via LIN, enable SMPS\_ENA. Read out AD\_VCC in mV** | **11432** | **11624** | **11817** | **LIN** | **ADC value** |
| **18** | **ADC measurement on 12 V** | **Test ADC conversions** | Via LIN, enable SMPS\_ENA. Read out AD\_12V in mV | **12280** | **12550** | **12820** | **LIN** | **ADC value** |
| **19** | **Read Ambient temp** | **Read ambient temperature using external measurement device** | Read ambient temperature in °Celcius. | **20 °C** | **25 °C** | **30 °C** | **External Device** | **°Celcius** |
| **20** | **Read FET\_TEMP** | **Read FET temp in °Celcius.** | Via Lin read out the FET temp and compare it with external sensor (results from ID = 19). | **[External sensor value] - 5 °C** | **[External sensor value] +3 °C** | **[External sensor value] + 9 °C** | **LIN** | **°Celcius** |
| **21** | **Read PCB ambient temp** | **Read ambient temp using on board sensor.** | Via LIN read out ambient temp using sensor on the PCB and compare it with external temp meas (ID= 19). | **[External sensor value] – 5,5 °C** | **[External sensor value] +1,7 °C** | **[External sensor value] + 8,8 °C** | **LIN** | **°Celcius** |
| **22** | **EnableBW** | **Communication interface EnableBW** | Apply 12V to J2-1 or TP52 (EnableBW). Via LIN readout COMMAND\_IN in mV. | **11142** | **11384** | **11586** | **LIN** | **milli Voltage** |
| **23** | **EnableFW** | **Communication interface EnableFW** | Apply 12V to J2-2 or TP52 (EnableFW). Via LIN readout COMMAND\_OUT in mV. | **11142** | **11388** | **11586** | **LIN** | **milli Voltage** |
| **25** | **Heartbeat Turn-on delay** | **Turn-on delay for Heartbeat** | Via LIN, activate heartbeat signal of 50Hz square wave with 50% dutycycle. Measure the time between "activation via LIN" and signal on TP55 rising over 1 V. In other words start the timer after sending the commando from test device in order to activate heartbeat. Then stop the timer when voltage level on TP55 reaches 1 V. | **24** | **30** | **45** | **LIN and TP55** | **milli seconds** |
| **26** | **Heartbeat turn-OFF delay** | **Turn-off delay for Heartbeat** | Via LIN, activate heartbeat signal of 50Hz square wave with 50% duty-cycle. Wait for 1 second. Then do the following: Via LIN deactivate the heartbeat signal. Measure the time between "deactivation via LIN" and signal on TP55 falling below 1.5 V. In other words start the timer after sending the deactivation commando from test device. Then stop the timer when voltage level on TP55 falls down to 1.5 V. | **64,0** | **77,5** | **100,0** | **LIN and TP55** | **milli seconds** |
| **27** | **H-Bridge forward current Meas** | **Test motor current in forward mode by measurement device** | Apply 12 V to the PCB. Apply 1.5R load resistor Between TP27 & TP28. Via LIN, activate H-bridge in forward setting with 40% duty-cycle, **heartbeat disabled**. Measure motor current through 1.5R resistor in mA using external device. | **-0,18** | **0,05** | **0,23** | **TP27 and TP 28** | **milli Ampere** |
| **28** | **H-Bridge forward current** | **Test motor current in forward mode via lin** | Apply 12 V to the PCB. Apply 1.5R load resistor Between TP27 & TP28. Via LIN, activate H-bridge in forward setting with 40% duty-cycle, **heartbeat disabled**. Measure motor current via LIN in mA. Compare results to results from ID = 27. | **660** | **1861** | **3061** | **LIN** | **ADC value** |
| **29** | **H-Bridge backward current Meas** | **Test motor current in backward mode by measurement device** | Apply 12 V to the PCB. Apply 1.5R load resistor Between TP27 & TP28. Via LIN, activate H-bridge in backward setting with 40% duty-cycle, **heartbeat disabled**. Measure motor current through 1.5R resistor in mA using external device. | **-0,22** | **0,05** | **0,27** | **TP27 and TP 28** | **milli Ampere** |
| **30** | **H-Bridge backward current** | **Test motor current in backward mode via lin** | Apply 12 V to the PCB. Apply 1.5R load resistor Between TP27 & TP28. Via LIN, activate H-bridge in backward setting with 40% duty-cycle, **heartbeat disabled**. Measure motor current via LIN in mA. Compare results to results from ID = 27. | **701** | **1863** | **3025** | **LIN** | **milli Ampere** |
| **31a** | **H-Bridge forward PWM OUT with HB** | **Test motor duty in forward mode by measurement device** | Apply 12 V to the PCB. Apply 1.5R load resistor Between TP27 & TP28. Via LIN, activate H-bridge in forward setting with 40% duty-cycle, **heartbeat enabled**. Measure motor duty using external device. | **3,35** | **3,50** | **3,65** | **TP27 and TP 28** | **Voltage** |
| **31b** | **H-Bridge forward current Meas with HB** | **Test motor current in forward mode by measurement device** | Apply 12 V to the PCB. Apply 1.5R load resistor Between TP27 & TP28. Via LIN, activate H-bridge in forward setting with 40% duty-cycle, **heartbeat enabled**. Measure motor current through 1.5R resistor in mA using external device. | **2,2** | **2,4** | **2,6** | **TP27 and TP 28** | **Ampere** |
| **32** | **H-Bridge forward current with HB** | **Test motor current in forward mode via lin** | Apply 12 V to the PCB. Apply 1.5R load resistor Between TP27 & TP28. Via LIN, activate H-bridge in forward setting with 40% duty-cycle, **heartbeat enabled**. Measure motor current via LIN in mA.  Current is measured via LIN, Value measured in step ID 28 is subtracted. Result is compared to ID 31b. | **21000** | **22000** | **23000** | **LIN** | **ADC value** |
| **33a** | **H-Bridge backward PWM OUT with HB** | **Test motor duty in backward mode by measurement device** | Apply 12 V to the PCB. Apply 1.5R load resistor Between TP27 & TP28. Via LIN, activate H-bridge in backward setting with 40% duty-cycle, **heartbeat enabled**. Measure motor duty using external device. | **3,35** | **3,50** | **3,65** | **TP27 and TP 28** | **Voltage** |
| **33b** | **H-Bridge backward PWM OUT with HB** | **Test motor current in backward mode by measurement device** | Apply 12 V to the PCB. Apply 1.5R load resistor Between TP27 & TP28. Via LIN, activate H-bridge in backward setting with 40% dutycycle, **heartbeat enabled**. Measure motor current through 1.5R resistor in mA using external device. | **2,3** | **2,4** | **2,5** | **TP27 and TP 28** | **Ampere** |
| **34a** | **Test H-Bridge timing** | **Current use in standby** | Disconnect 1.5R load resistor  Measure PCBA current usage without H-Bridge enabled(Standby current usage) | **20** | **50** | **80** | **J1** | **Mili Ampere** |
| **34b** | **Test H-Bridge timing** | **Current use with H-Bridge activated** | Via LIN, activate H-bridge in backward setting with 40% dutycycle, **heartbeat enabled**. Measure PCBA current usage and compare to result in 34a. | **[result from 34a] - 40mA** | **[result from 34a]** | **[result from 34a] + 40mA** | **J1** | **Mili Ampere** |
| **35** | **Hall Activated** | **Test hall-sensors going ON** | Activate mechanical movement of magnet assembly nearby hall sensor PCBA Via LIN, verify that both hall signals change as expected | **0** | **1** | **1** | **LIN** | **TRUE/FALSE** |
| **~~36~~** | **~~Hall deactivated~~** | **~~Test hall-sensors going OFF~~** | ~~Via LIN, disable ENA\_HALL Activate mechanical movement of magnet assembly nearby hall sensor PCBA Via LIN, verify that both hall signals are static high~~ | **~~0~~** | **~~1~~** | **~~1~~** | **~~LIN~~** | **~~TRUE/FALSE~~** |
| **37** | **EOS\_IN switch ON LIN** | **Test EOS\_IN switch** | Supply PCB with 12 V Activate SW1 by mechanical movement Via LIN, verify that EOS\_IN goes high | **0** | **1** | **1** | **LIN** | **TRUE/FALSE** |
| **38** | **EOS\_IN switch OFF LIN** | **Test EOS\_IN switch** | Supply PCB with 12 V Deactivate SW1 by mechanical movement Via LIN, verify that EOS\_IN goes low | **0** | **1** | **1** | **LIN** | **TRUE/FALSE** |
| **39** | **EOS\_IN switch ON MEAS** | **Test EOS\_IN switch** | Supply PCB with 12 V  Via LIN, enable RETRACTED outputMeasure voltage at J1-5 (Retracted) | **11,50** | **11,70** | **11,90** | **TP51 or J1-5** | **Voltage** |
| **40** | **EOS\_IN switch OFF MEAS** | **Test EOS\_IN switch** | Supply PCB with 12 V  Via LIN, disable RETRACTED output Measure voltage at J1-5 (Retracted) | **0** | **0,04** | **0,09** | **TP51 or J1-5** | **Voltage** |
| **41** | **EOS\_OUT switch ON LIN** | **Test EOS\_OUT switch** | Supply PCB with 12 V Activate SW2 by mechanical movement Via LIN, verify that EOS\_OUT goes high | **0** | **1** | **1** | **LIN** | **TRUE/FALSE** |
| **42** | **EOS\_OUT switch OFF LIN** | **Test EOS\_OUT switch** | Supply PCB with 12 V Deactivate SW2 by mechanical movement Via LIN, verify that EOS\_OUT goes low | **0** | **1** | **1** | **LIN** | **TRUE/FALSE** |
| **43** | **EOS\_OUT switch ON MEAS** | **Test EOS\_OUT switch** | **Supply PCB with 12 V**  **Via LIN, enable EXTENDED output Measure voltage at J1-1 (Extended)** | **11,50** | **11,70** | **11,90** | **TP50 or J1-1** | **Voltage** |
| **44** | **EOS\_OUT switch OFF MEAS** | **Test EOS\_OUT switch** | Supply PCB with 12 V  Via LIN, disable EXTENDED output Measure voltage at J1-1 (Extended) | **0** | **0,04** | **0,09** | **TP50 or J1-1** | **Voltage** |
| **45** | **Test POT-U Output 0%** | **Test POT-U output** | Supply the PCB with 12 V Via LIN, set position output type to POT-U, and position output duty to 0% in 1 second In test equipment, J1-2 should be disconnected from LIN signal, and connected to voltage probe instead Measure voltage at J1-2 (POS/LIN) | **0,01** | **0,03** | **0,1** | **J1-2** | **Voltage** |
| **46** | **Test POT-U Output 40%** | **Test POT-U output** | Supply the PCB with 12 V Via LIN, set position output type to POT-U, and position output duty to 40% @ 1kHz in 1 second In test equipment, J1-2 should be disconnected from LIN signal, and connected to voltage probe instead  Measure voltage at J1-2 (POS/LIN) | **3,90** | **4,00** | **4,10** | **J1-2** | **Voltage** |
| **47** | **Test POT-U Output 80%** | **Test POT-U output** | Supply the PCB with 12 V Via LIN, set position output type to POT-U, and position output duty to 80% @ 1kHz in 1 second In test equipment, J1-2 should be disconnected from LIN signal, and connected to voltage probe instead Measure voltage at J1-2 (POS/LIN) | **7,90** | **8,00** | **8,10** | **J1-2** | **Voltage** |
| **48** | **Test POT-C Output 0%** | **Test POT-C output** | Supply the PCB with 12 V Via LIN, set position output type to POT-C, and position output duty to 0% in 1 second.  In test equipment, J1-2should be disconnected from LIN signal, and connected to a 100 Ohm resistor. Measure the current sourced at J1-2. | **-0,01** | **0** | **0,10** | **J1-2** | **milli Ampere** |
| **49** | **Test POT-C Output 40%** | **Test POT-C output** | Supply the PCB with 12 V Via LIN, set position output type to POT-C, and position output duty to 40% in 1 second.  In test equipment, J1-2 should be disconnected from LIN signal, and connected to a 100 Ohm resistor. Measure the current sourced at J1-2. | **8,67** | **8,79** | **8,91** | **J1-2** | **milli Ampere** |
| **50** | **Test POT-C Output 80%** | **Test POT-C output** | Supply the PCB with 12 V Via LIN, set position output type to POT-C, and position output duty to 80% in 1 second.  In test equipment, J1-2 should be disconnected from LIN signal, and connected to a 100 Ohm resistor. Measure the current sourced at J1-2. | **17,39** | **17,60** | **17,82** | **J1-2** | **milli Ampere** |
| **51** | **Test Dig Out 10 %** | **Test "Digital out" output** | Supply the PCB with 24 V Via LIN, set position output type to "Digital out", and position output duty to 10% @75 Hz in 1 second In test equipment, J1-2 should be disconnected from LIN signal, and connected to voltage probe instead Measure average voltage at J1-2 | **1,70** | **2,40** | **3.10** | **J1-2** | **Voltage** |
| **52** | **Test Dig Out 50 %** | **Test "Digital out" output** | Supply the PCB with 24 V Via LIN, set position output type to "Digital out", and position output duty to 50% @ 75Hz in 1 second In test equipment, J1-2 should be disconnected from LIN signal, and connected to voltage probe instead Measure average voltage at J1-2 | **11,30** | **12,00** | **12,70** | **J1-2** | **Voltage** |
| **53** | **Test Dig Out 90 %** | **Test "Digital out" output** | Supply the PCB with 24 V Via LIN, set position output type to "Digital out", and position output duty to 90% @ 75Hz in 1 second In test equipment, J1-2 should be disconnected from LIN signal, and connected to voltage probe instead Measure average voltage at J1-2 | **20,90** | **21,60** | **22,30** | **J1-2** | **Voltage** |
| **~~54~~** | **~~LIN Sleep~~** | **~~Test LIN transceiver sleep~~** | ~~Via LIN, activate NSLP (Active low) in order to put LIN transceiver to sleep Measure the voltage at TP56 and verify that INH\_3V3 goes low~~ | **~~0~~** | **~~0,01~~** | **~~0,03~~** | **~~TP56~~** | **~~Voltage~~** |
| **~~55~~** | **~~LIN WAKE~~** | **~~Test LIN transceiver sleep~~** | ~~Via LIN, send WAKE command Measure the voltage at TP56 and verify that INH\_3V3 goes high~~ | **~~2,88~~** | **~~3,23~~** | **~~3,51~~** | **~~TP56~~** | **~~Voltage~~** |
| **56** | **LIN Sleep** | **Test MCU can wak e LIN.** | Via LIN, activate NSLP (Active low) in order to put LIN transceiver to sleep.  At the same time, activate setting that makes MCU activate NWAKE after 1second, to wake up LIN transceiver locally Via MCU, activate NWAKE Measure the voltage at TP56 and verify that INH\_3V3 goes high | **2,88** | **3,23** | **3,51** | **TP56** | **Voltage** |
| **~~57~~** | **~~Lin master~~** | **~~Lin master~~** | ~~ViaLin, activate LIN\_PULLDOWN in 3 sec. And measure voltage at J1-2 goes low.~~ | **~~0,00~~** | **~~0,22~~** | **~~0,44~~** | **~~J1-2~~** | **~~Voltage~~** |