Hotplate and Double Pulse Generator Evaluation Board User's Manual

EVBUM2901G-EVB

Hotplate and Double Pulse Generator Description

A Hotplate and Double pulse generator extension board is designed to provide HOT temperature testing conditions and variable 10pulse PWM generation for a Discrete double pulse tester.

The Extension board together with the Discrete Double pulse tester supports HOT temperature testing of all **onsemi**'s discrete packages (SiC, Si) within 1200 V breakdown voltage using Daughter cards.

The purpose of the Extension board is integrating laboratory PWM generator, heat source and +5 V output into a compact solution powered from a single 12 V adapter (Included).

This document provides a user' manual for using the Extension board together with discrete Double pulse tester. Details of layout, schematics and bill of materials are included in the user's manual.

Evaluation Board Operation

The board is designed as RoHS compliant. Design of the board was not qualified for manufacturing. No tests were made on whole operating temperature range. No lifetime tests were performed. The board must be used in laboratory environment only and must be operated by skilled personal trained on all safety standards. Further details of used components are in their respective datasheets. PWM resolution and value of sensed temperature are indicative.

Features

- Hotplate PCB with Low Thermal Resistance
- Hotplate Temperature Regulation (OFF, 125°C, 150°C, 175°C)
- 10pulse PWM Generator (5 V, Freq. 30 kHz, Pulse Width from 0.2 μs to 10 μs)
- Fully Compatible with Discrete Double Pulse Tester
- Power Adapter Included
- Intuitive Interface Using LED Indicators and Display

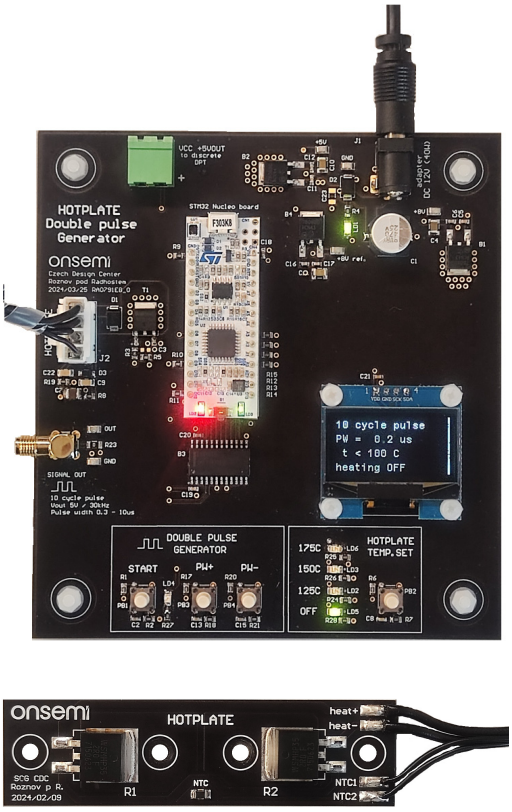


Figure 1. Hotplate and Double Pulse Signal Generator Board

Discrete double pulse tester user's manual: EVBUM2897

APPLICATIONS INFORMATION

Controlling Board

The control board is powered from AC/DC 12 V 40 VA adapter (included). The power supply part contains a linear LDO source +8 V, +8 Vref. for powering the NUCLEO F303K8 control processor. Power Source +5 V 1 A is intended for external discrete DPT power supply (+VCC connector).

The Controlling board can be used simultaneously for generating a PWM signal − SMA connector signal OUT and controlling heat for hotplate module (connector HOTPLATE).

Generator control and hotplate control are separated. The buttons can be used to select functions (START generation, Pulse width length, temperature selection) LEDs indicate the set hotplate temperature.

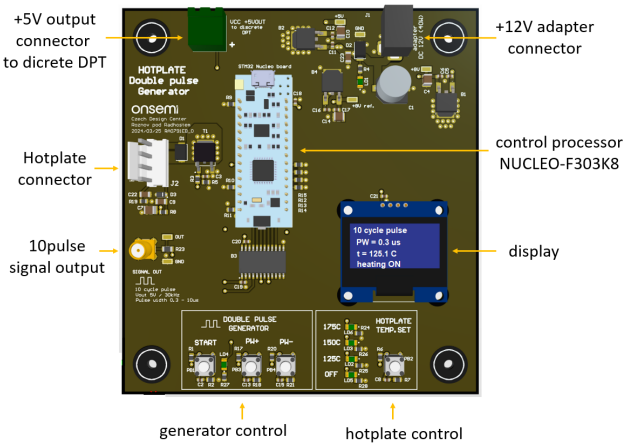


Figure 2. Controlling Board

HOTPLATE Board

Hotplate PCB is a 1−layer IMS PCB adapted for mounting to discrete daughter cards. The PCB is assembled with two heating resistors R1, R2 in series connection. The NTC thermistor senses actual temperature on the hotplate. Thermal conducting pad is included. For better heat distribution on the DUT transistors, it is recommended to stick it on the HOTPLATE module.

Figure 3. Hotplate Board, Thermal Conducting Pad

Temperature Regulation

The temperature is regulated by a regulation loop using Anti−WindUp Proportional−Sumation Controller. The output of this controller is a variable duty cycle (generated using 30 kHz switching frequency), which controls heating resistors on the Hotplate. Power switching of the heating resistors is ensured by **onsemi**'s 47 mΩ N−Channel Logic Level Power MOSFET, controlled directly from +5 V/0 V logic. Temperature sensing is ensured using 4.7 kΩ NTC on a Hotplate. Measured temperature range is limited by 200°C upper limit and 100°C lower limit (non−linear properties of NTC). The regulation loop schematic is shown on Figure 4.

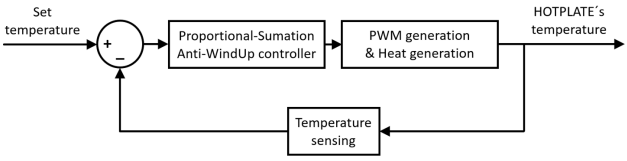


Figure 4. Regulation Loop Block Schematic

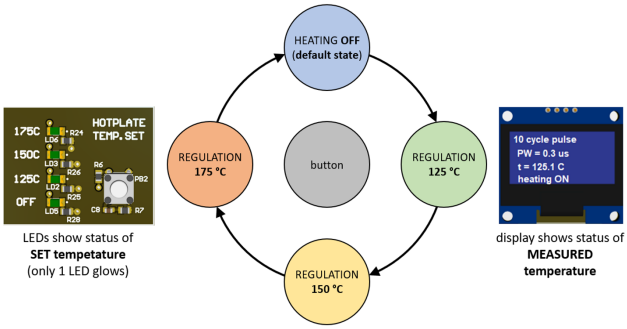


Figure 5. Describes User's Controlling of the Hotplate

There is only single button which switches between 4 states when pressed.

Double Pulse Generating

10pulse generation includes 3 seconds delay before the generation and also 2 seconds delay after the generation. This is implemented because of safety and user's comfort. START button is disabled when 10pulse generation (including delay) is in progress.

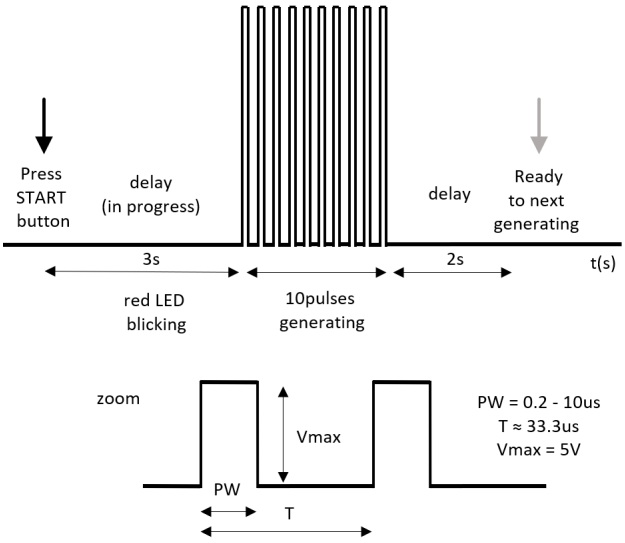
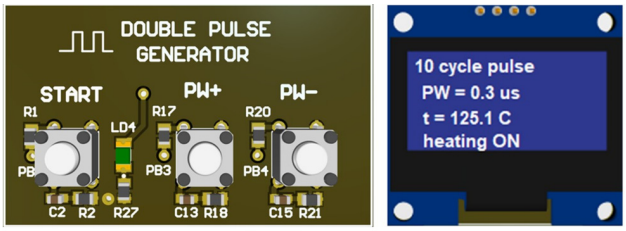


Figure 6. Timing Waveform Double Pulse Generating



button START	starts 10pulse generation (including delay)	
button PW+	increases set value of PW (Pulse Width)	
button PW-	decreases set value of PW (Pulse Width)	
LED LD4	blank	10pulse generation (including delay) **ready**
	blinking	10pulse generation (including delay) **in progress**

Figure 7. Describes User's Controlling of the 10pulse Generator

Protective Functions

10pulse generation feature of the board can be simply excluded by user's controlling or disconnecting signal output. Heat generation feature using Hotplate can be also simply excluded by user's controlling or disconnecting Hotplate from a connector. Software in microcontroller includes feature for detection of Hotplate's disconnection. Figure 8 shows Hotplate's disconnected status shown on a display. Status of set temperature is set to default off state when every disconnection is detected.

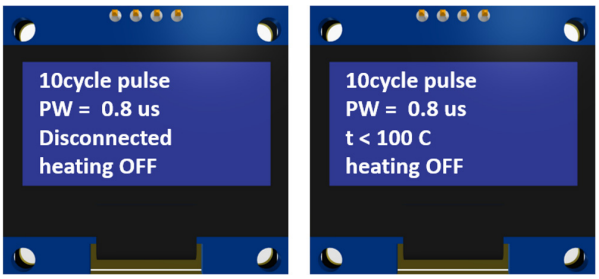


Figure 8. HOTPLATE Connector Disconnected and Connected Display Status

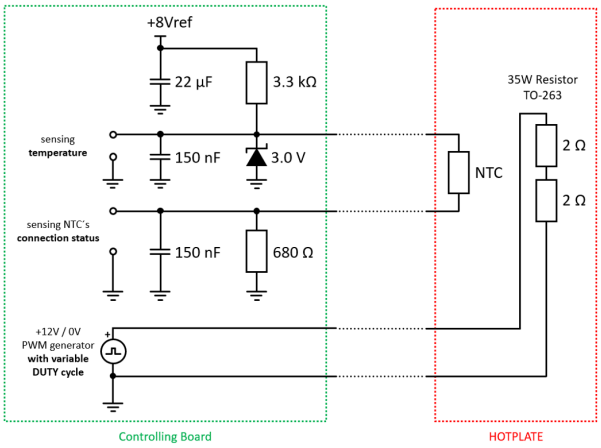


Figure 9. Hotplate Board Connection Schematic

Measurement Process

Turning on procedure Discrete DPT together with Hotplate.

- Ensure that all power sources are turned off
- Ensure that setup is fully prepared (check connection of a High Voltage power source, used gate resistors, used Daughter cards, using thermal conducting pad between Hotplate and tested devices, probes connection according to Figure 12 etc.)
- Plug 230 VAC/12 VDC Adapter into controlling board, then into 230 VAC Grid
- Make sure that all power supply indication LEDs glow
- Verify that high side and low side gate to source voltages are equal to V_{EE} (V_{EE} defined by used insulated DC/DC)
- Do a testing 10pulse generation using START button and check corresponding between measured Gate to Source signal and information showed on a display
- Make sure that Pulse Width is set to 0.2 µs
- Turn on High voltage power supply
- Do a Double Pulse Testing with respect to limits of tested devices

ATTENTION: Touch only user buttons when using with the powered controlling board, connecting or disconnecting hotplate from its connector must be done before powering the controlling board.

CAUTION: Do not touch HOTPLATE board and daughter card during operation. The temperature reaches up to 175°C. Risk of burns! Wait a few minutes after turning off the heating.

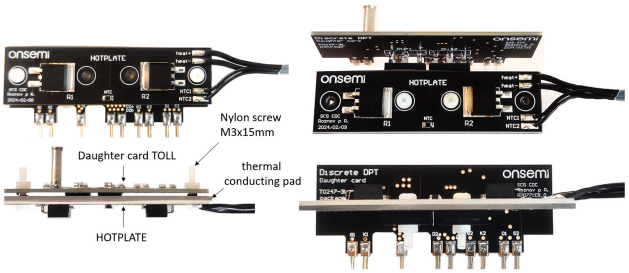


Figure 10. Mounting Hotplate on the Daughter Card TOLL and TO247−4L Package

Recommended mounting to the daughter card is using set high temperature nylon screws M3x15 mm (included)

Recommended mounting torque ≈ 0.05 − 0.2 Nm

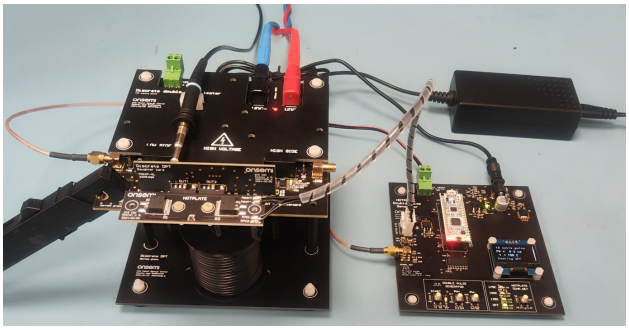


Figure 11. Measurement Setup − Discrete DPT + Extension Board Hotplate and Double Pulse Signal Generator

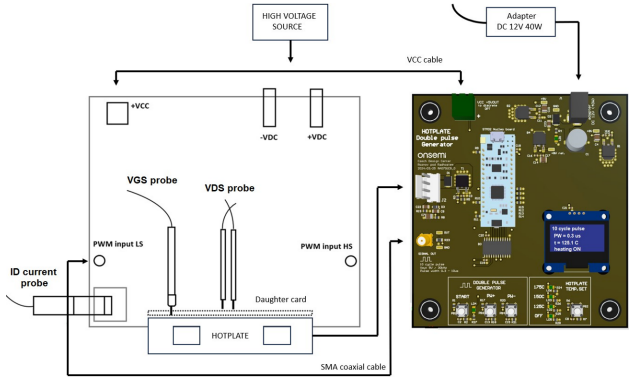


Figure 12. Double Pulse Test Setup for HOT Temperature

Application Test

Figure X shows thermal camera measurements for 150°C set temperatures. The measurements show that NTC's temperature corresponds to a set temperature. Temperature at the tested device's package is very similar to a set temperature, because of a designing NTC into the middle of the hotplate and designing heating resistors as close as possible to the tested device's package. The purpose of the heat generation using the hotplate is providing very similar testing conditions for a testing device with very similar package.

Figure 15 shows Double pulse test waveforms V_{DS}, I_D, V_{GS} in hot temperature 150°C. Measurement setup was used according to Figure 11 and 12. The waveforms do not show any large oscillations during switching.

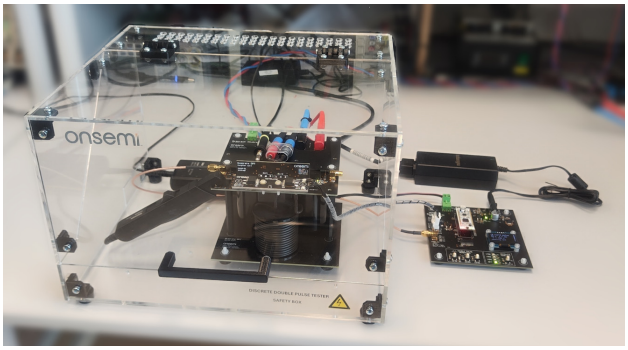


Figure 13. onsemi Safety Box for Double Pulse Testing

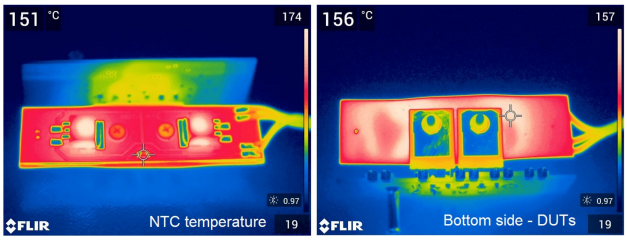


Figure 14. Thermal Camera Measurements

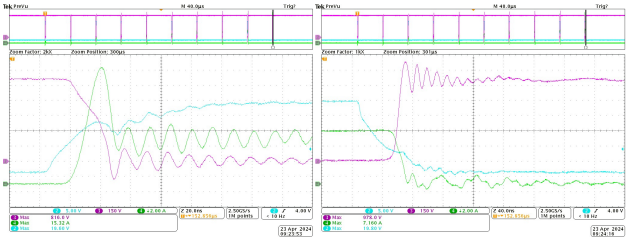


Figure 15. Double Pulse Test Waveforms in Hot Temperature TO247−4L NTH4L022N120M3S

Waveforms: blue − VGS, green − ID, red − VDS

DPT conditions: V_{DC} = 800 V, I_D ≈ 70 A, R_G = 3R9, T_j = 150°C, V_{GS} = 18/−3 V, PW = 1.4 µs

Controlling Board Schematic

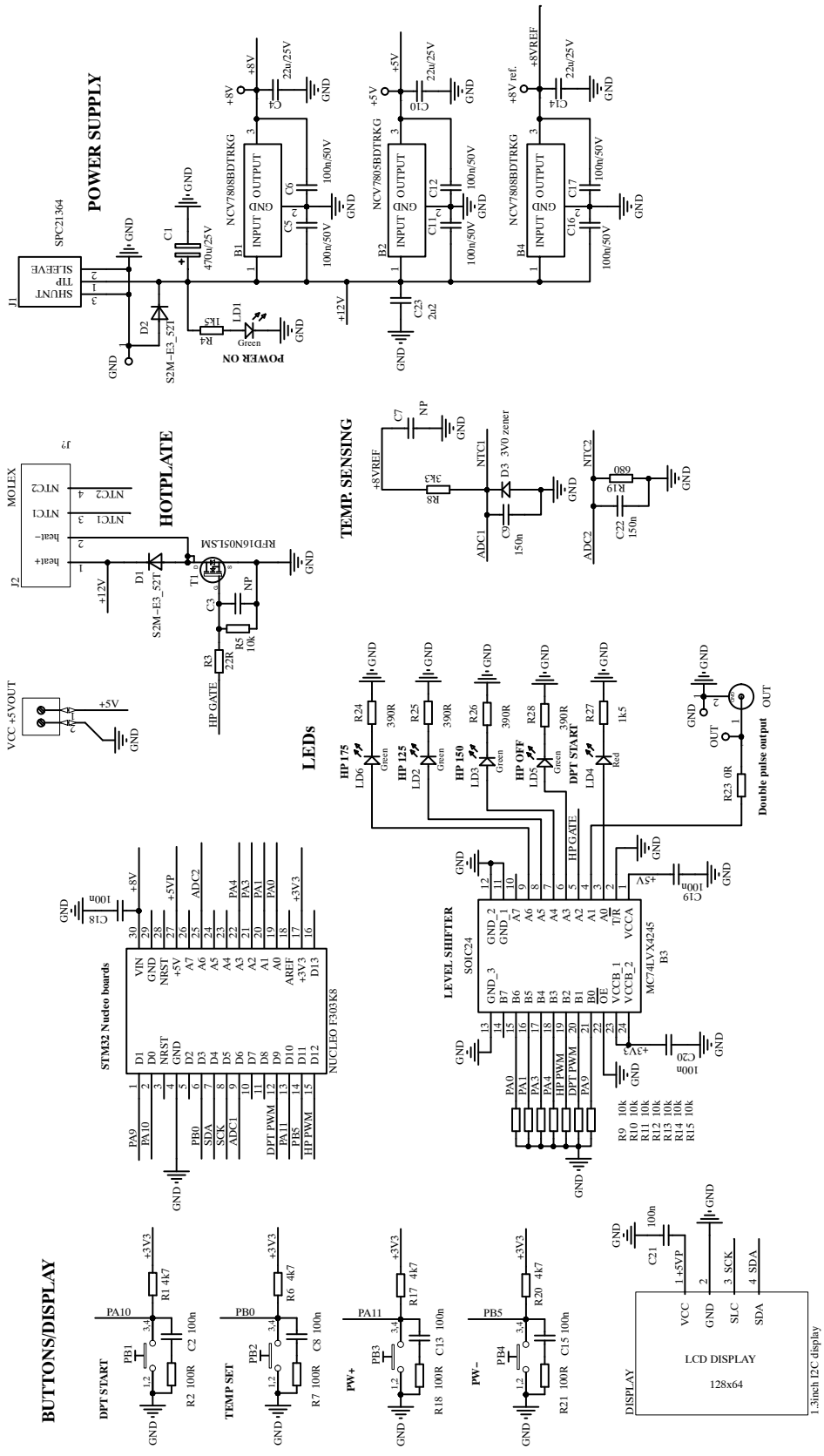


Figure 16. Controlling Board Schematic

ADDITIONAL INFORMATION

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