FEATURES

- 5.5V - 50V Operation
- 15A Maximum Output Current
- Built-In High-side Current Sensing with Tunable Range/Sensitivity

DESCRIPTION

The LoneStar III Five Designs DC Pulse Modulator Board is a high-speed pulse width modulator to measure the peak voltage/current with a tail biter output circuit.

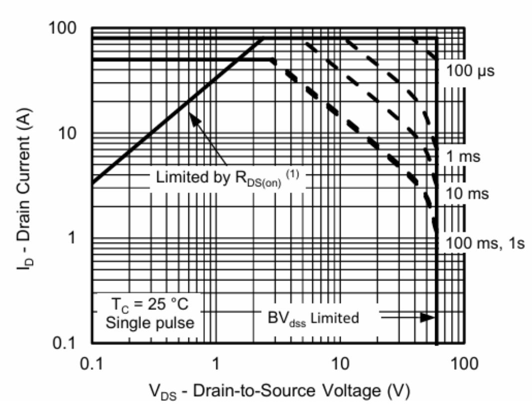
ELECTRICAL CHARACTERISTICS

Table 1: Recommended Operating Conditions (T_A=25°C)
Test Cond: 50V, 8A Period: 1ms, DC: 5%, R15=20mΩ

SYMBOL	PARAMETER	CONDITIONS	MIN	MAX	UNITS
VDD	DC Supply		5.5	50	V
VD	Current Sense Amp DC Supply	See Note 1	12	50	V
IOUT	Switched Current Output	See Note 2	-	15	A
PULSE IN	Input "High" Pulse	50Ω load	9.5	10.5	V
	Input "Low" Pulse		0	1	V
VOUT	Switched Voltage Output	See Note 3	5.5	50	V
PW	Pulse Width	Resistive load	4	FIGURE 1	µsec
t_r	Rise time	Resistive load	-	60	ns
t_f	Fall time	Resistive load	-	80	ns
IDV	DMM Voltage	Max Accuracy	-	10.0	V
		Absolute Max	-	20.0	V
Vsense	VR15	Max Accuracy	-	200	mV
		Absolute Max	-	400	mV

NOTE 1: VD MUST BE ≥ VDD
NOTE 2: R15=20mΩ to 10A max accuracy, recommended R15=10mΩ to 15A
NOTE 3: Capacitive load to 2nF

FIGURE 1: Vishay SUD50P06-15L, Q2, SOA



When operating high voltage and current, use sud50p06-15L Datasheet, SUD50P06-15L_RC: R-C Thermal Model Parameters, & Vishay AN609 to determine pulse width and duty cycle to not exceed Q2 maximum junction temperature. Highly recommend forced air when operating high voltage & current.

SENSE RESISTOR, R15, SELECTION:

Sense resistor, R15, selection value should achieve full-scale resistor voltage range, VR15, between 50mV and 200mV. 200mV is the maximum voltage for accurate measurements. The current sense amplifier, U1, maximum output for accuracy measurements is 10V when VR15 =200mV.

At 25°C, the current sense amplifier gain is: $49.5 \le G_{U1} \le 50.5$. Setting VR15 to midrange, ~ 0.1V, allows current to increase 2*IDS_{PK} when measuring current over frequency to remain in full-scale voltage range for maximum accuracy.

When VDD ≥ 12VDC, install J13 jumper so that VDD = VD. Use Equation 1 to determine R15:

$$R15 \le \frac{(10V - 0.5V)}{(IDS_{PK} * 50.5 * 2)} \quad \textbf{[1]}$$

When VDD is low and the peak current is high, the peak detected current is calculated incorrectly when IDV is GREATER than VDD, VDD=VD. For example, VDD=VD=8VDC, Iout=10A, R15=20mΩ, $G_{U1} = 50$ results in IDV=8V and the calculated current=8A. Three solutions to calculate the proper current.

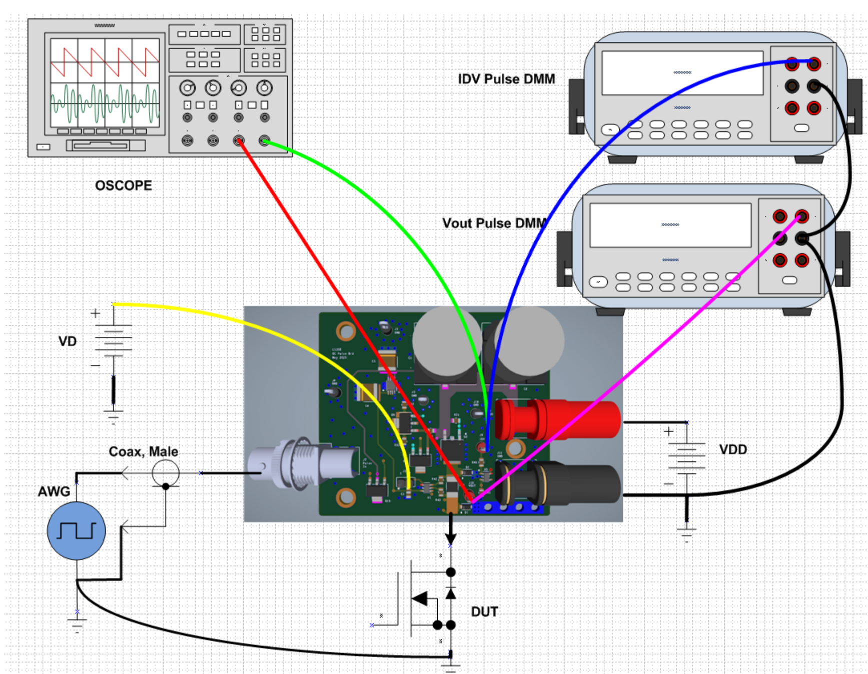
1. Use a smaller sense resistor, R15.
2. Use a smaller load resistor, R41, to reduce G_{U1}: $G_{U1} = \frac{5*R42}{1k}$
3. Use another current sense amplifier supply voltage, VD; **Figure 2**.

When VDD ≤ 10VDC & VD = VDD the following Equation 2 should be used to determine R15:

$$R15 \le \frac{(VDD - 0.5V)}{(IDS_{PK} * 50.5 * 2)} \quad \textbf{[2]}$$

Alternatively, when VDD ≤ 10VDC, connect VD=12VDC by removing J13 jumper and connecting VD (+) to J13-2 and VD (-) to GND. Use Equation 1 to determine R15.

Figure 2: Measurement Set-Up: VDD≤12VDC & VD=12VDC



CALIBRATION:

The Pulse DC Modulator boards should be calibrated to account for R15 resistance & U1 gain tolerances as well as other losses. The current sense amplifier U1 has a 50V/V gain. An equivalent sense resistor, $R15_{eqv}$, value must be calculated to accurately calculate the DUT current. Select VDD ≥ 12VDC and RTEST value so that VR15 ≥ 50mV. RTEST value does not need to be measured because it is not used to determine $R15_{eqv}$.

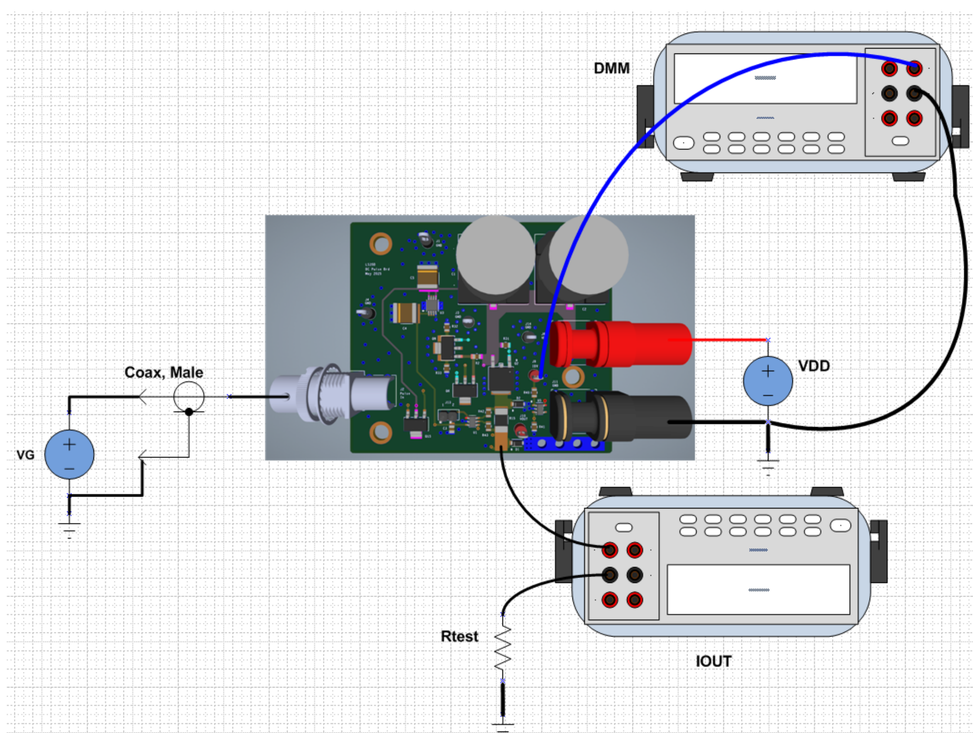
CALIBRATION SET-UP:

Refer to **Figure 3** for calibration setup:

1. With power off, connect VDD (+) to J8 & VDD (-) to J11.
2. With power off, connect VG (+) to J2 Pulse In & VG (-) to J11.
3. Connect J9 IDV (+) to DMM (+) & DMM (-) to J11.
4. Set desired VDD
5. Connect desired RTEST that achieves VR15 ≥ 50mV
    a. Ensure RTEST PDISS is not exceeded
6. Set VG=5VDC
7. Turn-On VG
8. Record VDMM & Iout, then use equation 3 to determine $R15_{eqv}$.

$$R15_{eqv} = \frac{VDMM}{Iout} \quad [3]$$

Figure 3: Calibration Set-Up: VD≥12V

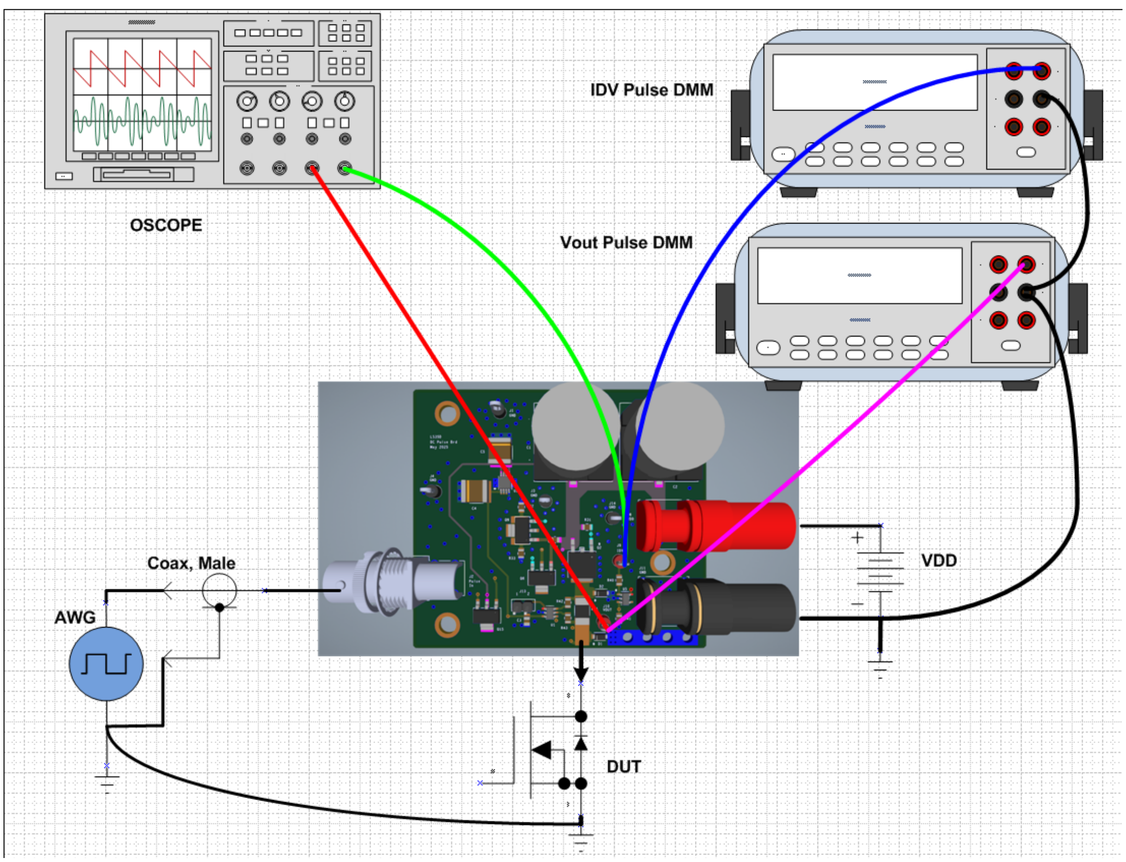


OPERATION PROCEDURES:

Refer to **Figure 4** for setup & follow the procedures below:

1. With power off, connect VDD (+V) input power supply to J8 & VDD (-) ground/return to J11.
2. With pulse generator, **PG**, off, connect **PG** output to J2 Pulse In.
    a. SET PG High=10V
    b. Set PG Low=0V
    c. Set PG to desired period & duty cycle
3. Connect J9 IDV to DMM.
    a. If desired, then connect oscope to J9 to observe current pulse.
4. Connect J10 VOUT to DMM.
    a. If desired, then connect oscope to J10 to observe drain pulse.
5. Connect VOUT to DUT.
    a. Do not use J10 test point to connect to DUT. The trace width to J10 may not have ample current handling capacity.
6. Turn-On **PG** Output.

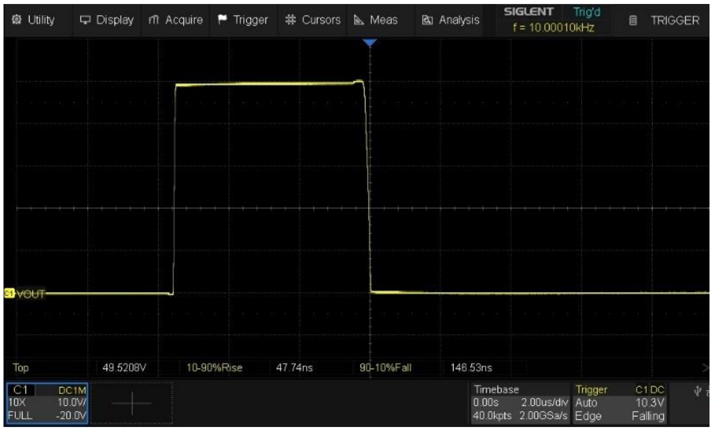
Figure 4: Measurement Set-Up: VD=VDD≥12V

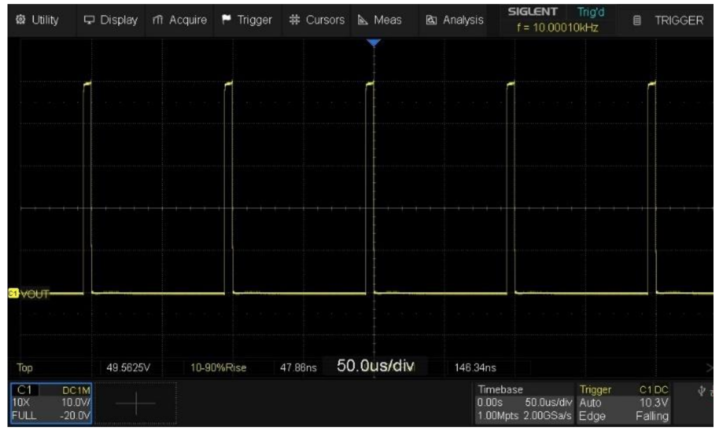


TYPICAL TRANSIENT PERFORMANCE CHARACTERISTICS:

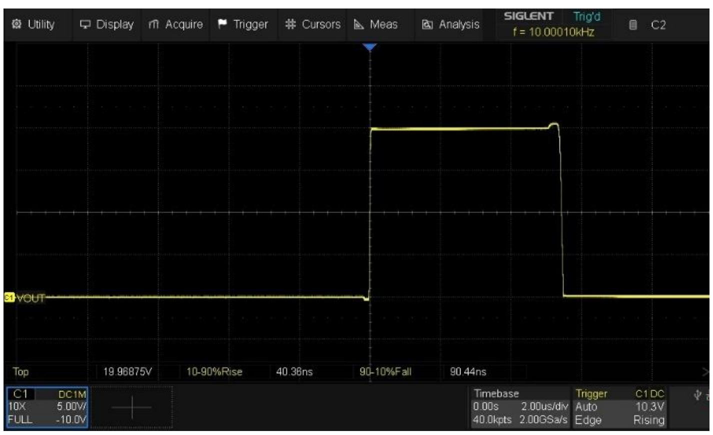
TEST CONDITIONS: 25°C, PERIOD: 100µS, DC=5%, NO LOAD

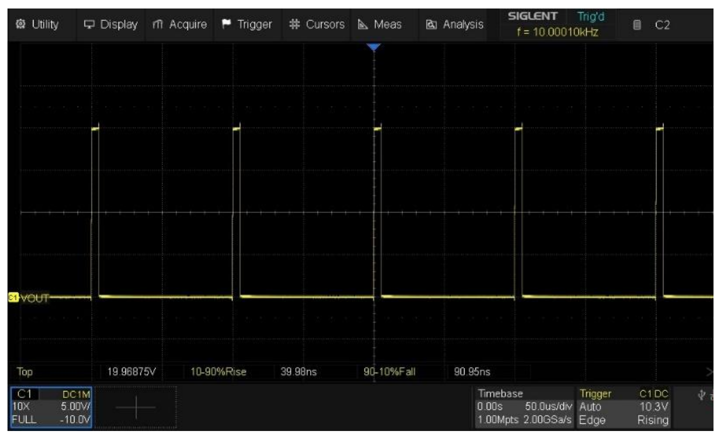
VDD=VD~50V





VDD=VD~20V





TYPICAL PERFORMANCE CHARACTERISTICS:

TEST CONDITIONS: 25°C, PERIOD: 100µS, DC=5%, RSENSE=0.020mΩ, RLOAD=5.9Ω, R15$_{eqv}$=0.99Ω

VDD=VD~50V, IOUT=8.49A

TEST CONDITIONS: 25°C, PERIOD: 100µS, DC=5%, RSENSE=0.020mΩ, RLOAD=31.4Ω, R15$_{eqv}$=0.99Ω

VDD=VD~20V, IOUT=638.27mA

J9 & J10 CABLE RECOMMENDATIONS:

Recommend Pomona 36" Mini-Grabber to BNC cable, Pomona Part #: 5187-C-36, to connect J9 to IDV Pulse DMM & J10 to Vout Pulse DMM to reduce cable inductance, capacitance, & unwanted noise. Using unshielded wires allows unwanted noise to couple onto the unshielded wire and affect the current measurement accuracy & repeatability results.

Important Notice

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