GS61008P Sync Buck demo board

- Universal GaN half bridge with open loop control
- On-board PWM dead time generation
- For 48V-12V Sync Buck DC/DC evaluation
- 100V/90A 7mohm GaN E-HEMT (GS61008P)
**Test procedure for 48-12V open loop sync buck DC/DC**

1. Apply 9VDC to J2
2. Apply PWM signal (0-5V) to J1. If a signal generator is used, set to Hi-Z output mode. Start with 25% duty cycle and frequency 300kHz.
3. Monitor high/low side gate signals and ensure the dead time is around 15-20ns. If needed adjust dead time by tuning TR1/TR2.
4. For efficiency measurement, add current meter and use TP7/TP10 for VIN and TP8/TP9 for VOUT measurement.
5. Connect load to CON3(VOUT+) and CON4(VOUT-) 
6. Apply 48VDC to CON1(VIN+) and CON2 (VIN-) 
7. Adjust duty cycle, frequency and load current, monitor the efficiency and device temperature. 
8. After testing, turn off 48VDC VIN first, then PWM signal and 9VDC last.
Efficiency measurement

- $V_{IN}=48V$, $V_{OUT}=12V$, $F_{SW}=300K$-1MHz
- $L=10\mu H$ (SER2918-103KL)
- $I_{OUT}=0$-12A / 20A (300kHz)
- $T_{AMB}=25^\circ C$, forced air cooling (200 LFM)

$F_{SW}=300kHz$:
- 97.6% Peak efficiency @ $I_{OUT}=8A$
- 96% Full load efficiency @ $I_{OUT}=20A$, $T_{JMAX} = 100^\circ C$

$F_{SW}=500kHz$:
- 96.8% Peak efficiency @ $I_{OUT}=10A$

$F_{SW}=1MHz$:
- 95% peak efficiency @ $I_{OUT}=11A$
- $T_{JMAX} = 100^\circ C$ at 10A
Efficiency measurement

- 100V GS61008P Matches TI 80V GaN half bridge performance at 1MHz (95% peak)
- Significant efficiency improvement over Si MOSFET
Efficiency measurement – Impact of output inductor

48-12V Sync Buck Efficiency (GS61008P)

- L = 10uH
- L = 4uH

Lower eff. due to additional inductor loss ($\Delta I_L$)

Enter DCM

System Efficiency

IOUT (A)
Switching waveforms

$V_{IN}=48\text{V}$, $V_{OUT}=12\text{V}$, $I_{OUT}=10\text{A}$, $F_{SW}=1\text{MHz}$
Switching waveforms

Rising Edge ($I_{\text{OUT}}=10\,\text{A}$, $F_{\text{SW}}=1\,\text{MHz}$)

$V_{\text{ds\_peak}} = 70\,\text{V}$

$T_{\text{rise}} = 2.7\,\text{ns}$
Switching waveforms

Falling Edge ($I_{OUT}=10A$, $F_{SW}=1$MHz)

$T_{fall} = 2.5$ns

$V_{SW}$

$V_{GS}$
Thermal measurement

48-12V Sync Buck Tj measurement (GS61008P)

- Tj - 300kHz
- Tj - 500kHz
- Tj - 1MHz

Maximum Junction Temperature (degC)

IOUT (A)
Thermal measurement

$T_{J\text{MAX}} = 91^\circ C$ ($I_{\text{OUT}}=10A/1\text{MHz}$), $L=$SER2918H-103KL

$T_{J\text{MAX}} = 62^\circ C$ ($I_{\text{OUT}}=10A$, $F_{\text{SW}}=500\text{kHz}$), $L=$SER2918H-103KL
Thermal measurement – SER2014-402L

I_{OUT}=5A  
F_{sw}=300kHz  
SER2014-402L

I_{OUT}=10A  
F_{sw}=300kHz  
SER2014-402L

I_{OUT}=15A  
F_{sw}=300kHz  
SER2014-402L

I_{OUT}=20A  
F_{sw}=300kHz  
SER2014-402L
Thermal measurement

\[ T_{\text{JMAX}} = 91^\circ \text{C} \ (I_{\text{OUT}}=10\text{A/1MHz}) \]

\[ T_{\text{JMAX}} = 62^\circ \text{C} \ (I_{\text{OUT}}=10\text{A, } F_{\text{SW}}=500\text{kHz}) \]