Title	**Preliminary Reference Design Report for a 150 W Three-Phase Inverter Using BridgeSwitch™-2 BRD2463C and LinkSwitch™-TN2 LNK3204D in FOC Operation**
Specification	340 VDC Input, 150 W Continuous Three-Phase Inverter Output Power, 750 mA$_{RMS}$ Continuous Motor Phase Current
Application	High-Voltage Brushless DC (BLDC) Motor Drive
Author	Applications Engineering Department
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Summary and Features

- Integrated 600 V FREDFETs with ultra-soft, fast recovery diodes
- Fully self-biased operation (wired to support external bias supply if required)
  - +5 V auxiliary supply
- 97% full-load efficiency (external supply)
  - PCB-level cooling (no heatsink required)
- < 10 mW (total for inverter) no-load power consumption using sleep-mode
- High-side and low-side cycle-by-cycle current limit
- Optional latching low-side current limit
- Two-level device over-temperature protection (latching or hysteretic)
- System-level temperature monitoring
- High-voltage bus monitor with four undervoltage thresholds and one overvoltage threshold
- Simplified error notification via Error Flag (EF) pin
- Supports any microcontroller suitable for sensorless field-oriented control (FOC)
- Instantaneous phase-current telemetry reporting for each BridgeSwitch-2 IC

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1. Introduction

This document describes a 150 W, high efficiency, three-phase inverter using three BridgeSwitch-2 BRD2463C devices to drive a high-voltage brushless DC (BLDC) motor. The design showcases the BridgeSwitch-2 device performance – high efficiency, phase current reporting, self-supplied operation, extremely low no-load operation, internal and system-level monitoring plus fault protection. A high-voltage, low part-count buck converter utilizing the LinkSwitch-TN2 (LNK3204D) IC provides an optional external supply to increase full-load efficiency. A current sense amplifier is also included for each phase to provide an alternative current reporting mechanism.

This report is a preliminary summary. To receive additional information including bill of materials, printed circuit board (PCB) layout, computer performance data and test setup, contact your local PI representative.

Figure 1 – Populated Circuit Board Top View.

Figure 2 – Populated Circuit Board Bottom View.

2. Inverter Specification

The table below provides the electrical specification of the three-phase inverter design. Operation is based on sensorless field-oriented control (FOC) employing a Space Vector Modulation (SVM) control technique.

Description	Symbol	Min.	Typ.	Max.	Units	Comments
Input						
Voltage	V_{IN}	270	340	365	V	2-wire DC Input.
Current	I_{IN}		0.46		A_{RMS}	RMS Current
Power	P_{IN}		153		W	At Efficiency = 96%.
Output						
Power	P_{OUT}		147		W	Inverter Output Power
Motor Phase Current	$I_{MOT(RMS)}$		0.75		A_{RMS}	Continuous RMS per Phase
Inverter Peak Output Current	$I_{INT(PK)}$		2.50		A	Inverter Peak Current
PWM Carrier Frequency[1]	f_{PWM}		10		kHz	Three-Phase FOC Modulation
Inverter Efficiency	η		96		%	Self-Supplied Operation
Output Speed	ω		3000		RPM	Motor Speed at 150 W Inverter Output
Environmental						
Ambient Temperature	T_{AMB}	-20	29	65	°C	Average Ambient Temperature. Closed case. Free Convection
Device Case Temperature	$T_{PACKAGE}$		75	111	°C	0.75 A_{RMS} Phase Current in Self-Supplied Operation
System Level Monitoring						
DC Bus Sensing						
OV Threshold	V_{OV}		362		V	Reported through Status Communication Bus (FAULT Pin)
1st UV Threshold	V_{UV100}		212		V	
2nd UV Threshold	V_{UV85}		182		V	
3rd UV Threshold	V_{UV60}		152		V	
4th UV Threshold	V_{UV55}		122		V	
Over Current Protection[2]	I_{OCP}		2.50		A_{PK}	At XL/XH = 42.2 kΩ
System Warning Temperature[3]	T_{SYS}		90		°C	

Notes: 1. 20 kHz is the maximum recommended PWM frequency when using self-supply
2. This can be manually configured by adjusting the value of the XL/XH resistors. For BRD2463C, the maximum current protection level is 2.50 A at an XL/XH resistance of 42.2 kΩ.
3. Sensed through an external thermistor, the temperature threshold depends on the chosen NTC thermistor.

Table 1 – Inverter Specification.
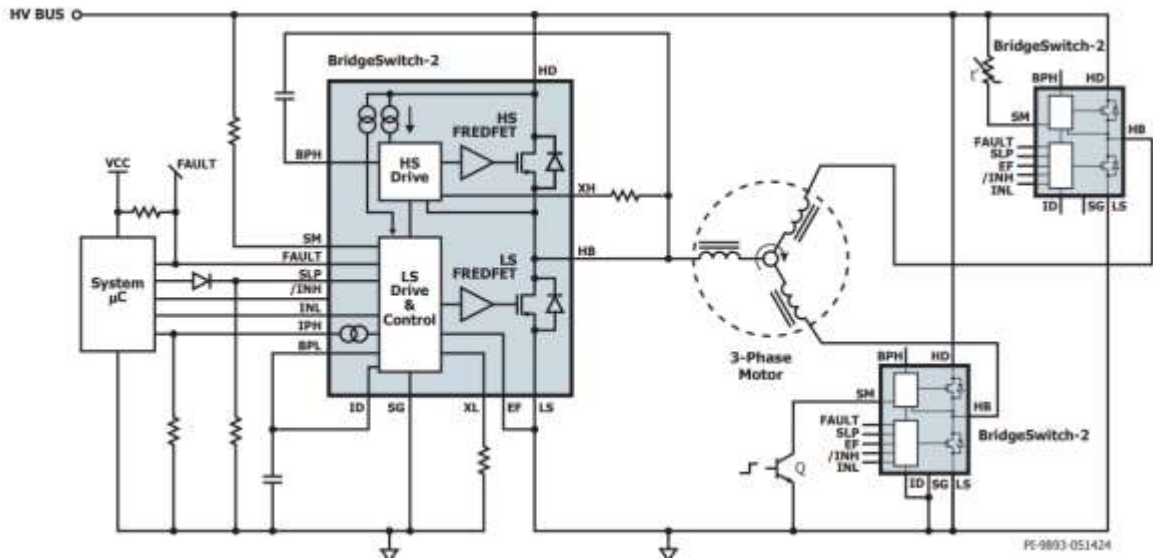
3. Simplified Schematic

Figure 3 – BridgeSwitch Three-Phase Inverter Schematic
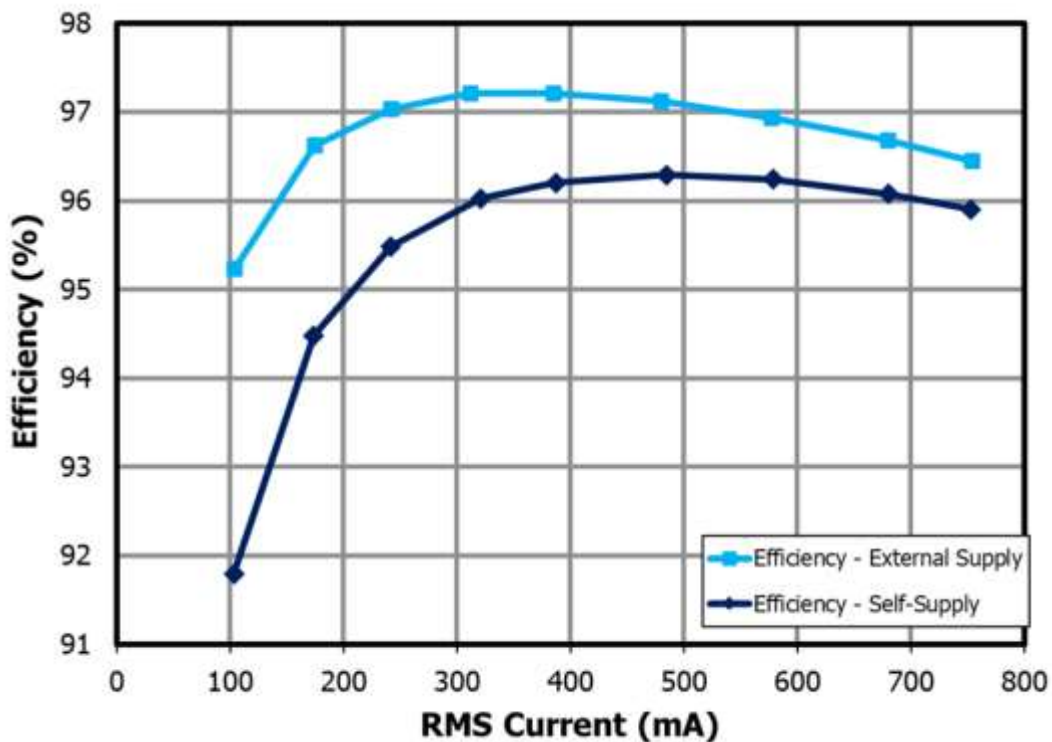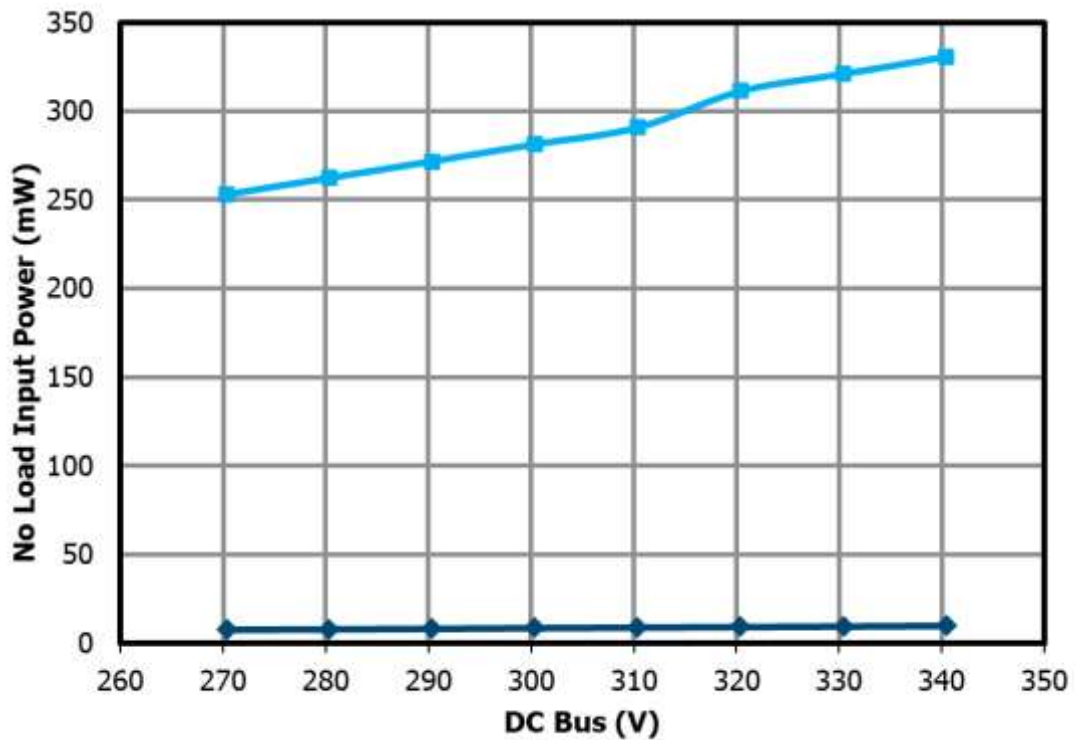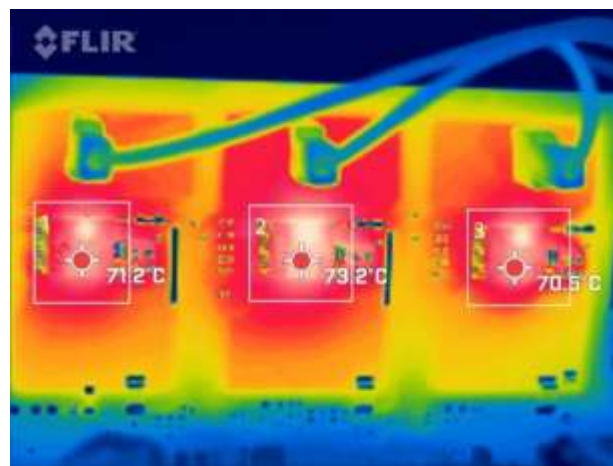
4. Preliminary Performance Information

Figure 4 – 3-Phase Inverter Efficiency Across Load

Figure 5 – No-Load Input Power Comparison (Sleep Mode ON vs. OFF)

Figure 6 – BridgeSwitch-2 Case Temperature at 750 mA Phase Current
(External Supply Mode) 29 °C Ambient

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