

# EV POWER INVERTER CONTROL REFERENCE PLATFORM GEN 1

System control design enablement kit with functional safety support for developing ASIL D high voltage power inverters for electric vehicle traction motors.

#### **OVERVIEW**

The NXP EV power inverter control reference platform provides a hardware reference design, system enablement software, and functional safety enablement to develop a complete ASIL D compliant high voltage, high power traction motor inverter for electric vehicles.

#### **FEATURES AND BENEFITS**

- System control enablement kit for designing 100 kW class power inverters
- Efficient system BOM designed for ASIL D safety requirements
- Basic software enablement with inverter services layer, drivers & SDK
- ±0.1 high accuracy software RDC with advanced motor control software
- Drives up to ±15 A into a broad range of IGBT and SiC power devices
- <2 us iSense compatible 2 level IGBT OC protection with soft shutdown
- ullet 5 kV galvanic signal isolation compatible with IGBTs up to 1700 V
- Standard signal interfaces for motor resolvers and output current sensors
- Support for redundant CAN bus interfaces



#### **APPLICATIONS**

- EV motor power inverters
- High voltage DC to DC boost circuits
- High voltage on-board chargers

#### **FEATURED PRODUCTS**

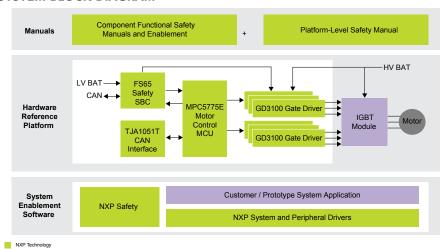
- NXP components featured in the platform include:
- GD3100 isolated IGBT gate driver with <2us short-circuit protection</li>
- MPC5775E high performance ASIL D MCU with advanced motor control libraries and software resolver
- FS65 robust ASIL D SBC with fail-silent and Grade 0 capabilities
- TJA1051T redundant high-speed CAN bus interface

#### KIT INCLUDES

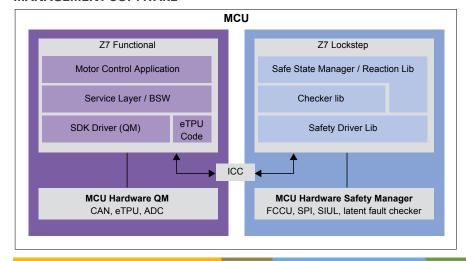
Offerings	Туре	Offering Packages		
		Inverter Platform Enablement Kit	Inverter Platform Safety Kit	
Hardware design package (schematics & layout)	DOC	DL		
NXP device datasheets	DOC	DL		
NXP device functional safety documents	DOC	DL		
NXP device software drivers (GD3100 & FS65)	SW	DL		
Reference design enablement kit including control, driver, RDC interface, & sensor boards	HW	X		
BSW with service level, SDK, driver & GUI software	SW	DL		
Reference design enablement kit user manual	DOC	DL		
Design guide application note	DOC	DL		
BSW user manual	DOC	DL		
System proof-of-concept prototype test results	DOC	DL		
Safety basic software & safe-state library	SW		DL	
Basic safety software user manual	DOC		DL	
Inverter safety concept manual				
Analysis & fault reaction matrix	DOC		DL	

DL = downloadable from NXP

#### **SYSTEM BLOCK DIAGRAM**



### SYSTEM ENABLEMENT AND FUNCTIONAL SAFETY MANAGEMENT SOFTWARE



The reference platform has been designed into an evaluation prototype demonstrating >98 % electrical efficiency operating from 340 V supply voltage. It is designed to interface to a Fuji M653 IGBT module rated for 800 A / 750 V operation (purchased separately from Fuji Electronics).

## EVALUATION PROTOTYPE PERFORMANCE SUMMARY

Parameter       Value       Units         Operating Input Voltage Range       240-420       VDC         Maximum Output¹       150       KVA         Nominal Voltage       340       VDC         Peak Current²       420       A, rms         Control Input Supply Voltage Range³       8.5 - 16       VDC         Motor Operating Speed       0-10,000       RPM         PWM Switching Frequency       3-12       kHz         Control Type       current/ speed/ torque         Maximum Electrical Efficiency       98       %         Communication Interface       CAN         Inverter Mechanical Envelope       28 x 28 x 15.43       cm         Power Devices       IGBT       1 module         Standby Power Consumption       <1       mA	Inverter Performance Summary			
Range Maximum Output¹ 150 KVA  Nominal Voltage 340 VDC  Peak Current² 420 A, rms  Control Input Supply Voltage Range³ 8.5 - 16 VDC  Motor Operating Speed 0-10,000 RPM  PWM Switching 3-12 kHz  Control Type current/ speed/ torque  Maximum Electrical 98 %  Communication Interface CAN  Inverter Mechanical 28 x 28 x Envelope 15.43  Power Devices IGBT 1 module  Standby Power Consumption 340 VDC	Parameter	Value	Units	
Nominal Voltage 340 VDC  Peak Current² 420 A, rms  Control Input Supply Voltage Range³ 8.5 - 16 VDC  Motor Operating Speed 0-10,000 RPM  PWM Switching 3-12 kHz  Control Type current/ speed/ torque  Maximum Electrical 98 %  Efficiency Communication Interface CAN  Inverter Mechanical 28 x 28 x Envelope 15.43  Power Devices IGBT 1 module  Standby Power Consumption 420 A, rms  VDC  WDC  A, rms  VDC  A, rms  VDC  A, rms  A B.5 - 16  VDC  RPM  PMM  SHZ  AHZ  Current/ speed/ torque  A B		240-420	VDC	
Peak Current <sup>2</sup> Peak Current <sup>2</sup> Control Input Supply Voltage Range <sup>3</sup> Motor Operating Speed  PWM Switching Frequency  Control Type  Maximum Electrical Efficiency  Communication Interface  Inverter Mechanical Envelope  Power Devices  Standby Power Consumption  420  A, rms  420  A, rms 420  A, rms  420  A, rms  420  A, rms  420	Maximum Output <sup>1</sup>	150	KVA	
Control Input Supply Voltage Range³ 8.5 - 16 VDC  Motor Operating Speed 0-10,000 RPM  PWM Switching 3-12 kHz  Frequency current/ Speed/torque  Maximum Electrical 98 %  Efficiency Communication Interface CAN  Inverter Mechanical 28 x 28 x Envelope 15.43  Power Devices IGBT 1 module  Standby Power Consumption 4.5 CAN  Inverter Mechanical 28 x 28 x CM  Frequency 15.43  Frequency 1	Nominal Voltage	340	VDC	
Voltage Range <sup>3</sup> Motor Operating Speed 0-10,000 RPM  PWM Switching Frequency 3-12 kHz  Control Type current/ speed/ torque  Maximum Electrical Efficiency P8 %  Communication Interface CAN  Inverter Mechanical 28 x 28 x Envelope 15.43 cm  Power Devices IGBT 1 module  Standby Power Consumption < <1 mA	Peak Current <sup>2</sup>	420	A, rms	
PWM Switching Frequency  Control Type  Maximum Electrical Efficiency  Communication Interface  Inverter Mechanical Power Devices  Standby Power Consumption  3-12  kHz  kHz  kHz  kHz  kHz  kHz  kHz  kH		8.5 - 16	VDC	
Frequency  Control Type  Control Type  Maximum Electrical Efficiency  Communication Interface  Inverter Mechanical Envelope  Power Devices  Standby Power Consumption  Current/ speed/ torque  8  %  CAN  Envelope  15.43  Cm  Inverter Mechanical Envelope  15.43  Cm  And  And  And  And  And  And  And  An	Motor Operating Speed	0-10,000	RPM	
Control Type speed/torque  Maximum Electrical 98 %  Efficiency Communication Interface CAN  Inverter Mechanical 28 x 28 x Envelope 15.43  Power Devices IGBT 1 module  Standby Power Consumption <1 mA		3-12	kHz	
Efficiency 98 %  Communication Interface CAN  Inverter Mechanical 28 x 28 x Envelope 15.43 cm  Power Devices IGBT 1 module  Standby Power Consumption <1 mA	Control Type	speed/		
Inverter Mechanical 28 x 28 x Envelope 15.43 cm  Power Devices IGBT 1 module  Standby Power Consumption <1 mA		98	%	
Envelope 15.43 cm  Power Devices IGBT 1 module  Standby Power Consumption <1 mA	Communication Interface	CAN		
Standby Power Consumption <1 mA			cm	
Consumption <1 mA	Power Devices	IGBT	1 module	
	,	<1	mA	
HV Bus Capacitance 440 uF	HV Bus Capacitance	440	uF	

<sup>&</sup>lt;sup>1</sup> Measurement conditions: HV bus capacitance of 440 uF, Fuji M653 IGBT module

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<sup>&</sup>lt;sup>2</sup> 1K - 3K RPM

<sup>&</sup>lt;sup>3</sup> Range extension to 18 VDC is possible with hardware design update