UCC34141EVM-116 Evaluation Module for Automotive and Industrial Bias Supply Applications

TEXAS INSTRUMENTS

Description

The UCC34141EVM-116 is intended to allow designers to evaluate the performance characteristics and capabilities of the UCC34141-Q1 quickly and easily for use in automotive, isolated, gate driver bias applications, as well as a variety of isolated industrial bias power applications. The EVM allows users to test functions of the UCC34141-Q1 such as: Enable/Disable (EN) of the device, as well as configure the isolated output voltage for 15V<VDD<20V, and -5V<VEE<0V and easily apply variable loads to the outputs. This EVM allows the user to measure efficiency across the input voltage range and varying output loads according to system requirements. Another feature of the EVM is the ease of probing during test. Test points are strategically placed and described according to the Input, Output, Test Points (I/O/TP) Descriptions table found later in this document.

Features

- UCC34141-Q1, 1.5W, DC/DC, 5kV$_{RMS}$, isolated converter module, configurable for single positive, dual positive, or dual positive/negative output voltages

- Transformer, power stage and control, fully integrated into a low-profile, 5.85mm × 7.5mm × 2.6mm wide body, 16-pin SOIC package
- Evaluate UCC34141-Q1 integrated protection features: UVLO, OVLO, short-circuit, OVP, UVP, and thermal shutdown
- AEC-Q100, full rated power up to 105°C, <3pF isolation capacitance, SSM frequency modulation

Applications

- Hybrid, electric and power train system (EV/HEV)
  - Inverter and motor control
  - On-board charger (OBC) and wireless charger
  - DC/DC converter
- Grid infrastructure
  - EV charging station power module
  - DC charging (pile) station
  - String inverter
- Motor drive
  - AC inverter and VF drive, robot servo drive
- Industrial transport
  - Off-highway vehicle electric drive

UCC34141EVM-116 Hardware Board (Top View)

UCC34141EVM-116 Hardware Board (Bottom View)

1 Evaluation Module Overview

1.1 Introduction

This evaluation module user's guide provides a description, as well as directions for use of the UCC34141EVM-116, variant 001, to evaluate the Texas Instruments UCC34141-Q1, high-frequency DC-DC converter module with integrated transformer. This EVM allows designers to quickly and efficiently evaluate the UCC34141-Q1 for use in automotive or industrial applications requiring gate driver IC bias power as high as 1.5W, providing up to 5kV$_{RMS}$ isolation.

1.2 Kit Contents

Table 1-1. UCC34141EVM-116 Kit Contents

Designator	Description	Quantity
PCB1/HVP116E2	UCC34141EVM-116 EVM	1

1.3 Specification

Table 1-2. UCC34141EVM-116 Electrical Characteristics

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
INPUT CHARACTERISTICS						
V$_{IN}$	Input voltage range	P$_{VDD}$=1.5W	8.5	12	20	V
V$_{IN\_ON}$	Input voltage on	P$_{VDD}$=P$_{VEE}$=0W			5.5	V
V$_{IN\_OFF}$	Input voltage off	P$_{VDD}$=P$_{VEE}$=0W		4.65		V
EN to /PG delay		I$_{VDD}$=I$_{VEE}$=0mA		5		ms
OUTPUT CHARACTERISTICS						
VDD	DC full load set-point	8.5V<V$_{IN}$<20V, I$_{VDD}$=83mA	17.6	18.0	18.3	V
I$_{VDD}$	VDD load current range	8.5V<V$_{IN}$<20V	0		83	mA
P$_{MAX}$	Maximum output power	I$_{VDD}$=83mA, I$_{VEE}$=0mA			1.5	W
VEE	DC full load set-point	6V<V$_{IN}$<20V, I$_{VEE}$=65mA	-4.89	-5.00	-5.11	V
I$_{VEE}$	VEE load current	6V<V$_{IN}$<20V, P$_{VDD}$=0W	0		65	mA
SYSTEM CHARACTERISTICS						
F$_{SW}$	Switching frequency	V$_{IN}$=6.5V, no load		27.4		MHz
		V$_{IN}$=9V, no load		22.3		
		V$_{IN}$=17V, no load		16.3		
T$_{MAX}$	Maximum temperature rise above ambient (T$_C$-T$_A$), T$_A$=21°C	V$_{IN}$=10V, I$_{VDD}$=84mA, I$_{VEE}$=0mA		46.5		°C
		V$_{IN}$=12V, I$_{VDD}$=84mA, I$_{VEE}$=0mA		51		
		V$_{IN}$=20V, I$_{VDD}$=84mA, I$_{VEE}$=0mA		73.5		

1.4 Device Information

Table 1-3 lists the UCC34XXX devices compatible with this EVM and the hardware changes needed for device functionality.

Table 1-3. UCC34XXX Devices Compatible with the UCC3414EVM-116 EVM

Part Number	Necessary Changes	Compatibility
UCC34141-Q1	None	Full
UCC34141	None	Full
UCC34141D-Q1	None	Full
UCC34141D	None	Full

1.5 Pin Configuration and Functions
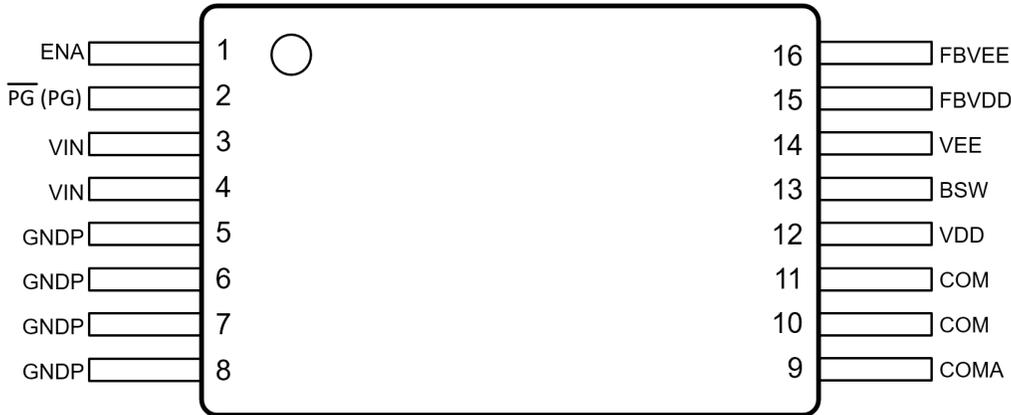
Figure 1-1. DHA Package, 16-Pin SSOP (Top View)

Table 1-4. Pin Functions

PIN NAME	PIN NO.	TYPE [1]	DESCRIPTION
BSW	13	P	Internal buck-boost converter switch pin. Connect an inductor from this pin to COM. Recommend a 3.3µH to 10µH chip inductor. If using the device in single output mode leave this pin floating.
BSW	13	P	Internal buck-boost converter switch pin. Connect an inductor from this pin to COM. Recommend a 3.3µH to 10µH chip inductor. Connect a low parasitic inductance Schottky diode between BSW and VEE pins. If using the device in single output mode leave this pin floating.
COM	10, 11	G	Secondary ground. Connect to Source of power switch.
COMA	9	G	Secondary-side analog sense reference connection for the noise sensitive analog feedback input FBVDD, and FBVEE. Connect the low-side FBVDD feedback resistor and high frequency decoupling filter capacitors close to the COMA pin and respective feedback pin FBVDD. Connect to secondary-side gate drive voltage reference, COM. Use a single point connection and place the high frequency decoupling ceramic capacitor close to the COMA pin.
ENA	1	I	Enable pin. Forcing ENA LOW disables the device. Pull HIGH to enable normal device functionality. Can be used to program input UVLO with a resistor divider from VIN.
FBVDD	15	I	Feedback (VDD – COM) output voltage sense pin and to adjust the output (VDD – COM) voltage. Connect a resistor divider from VDD to COMA so that the midpoint is connected to FBVDD. The equivalent FBVDD voltage is regulated at 2.5V with the internal hysteresis control across isolation. Adding a 470pF ceramic capacitor for high frequency decoupling in parallel with the low-side feedback resistor is needed. The 470pF ceramic capacitor for high frequency bypass must be next to the FBVDD and COMA pins on top layer or back layer connected with vias.
FBVEE	16	I	Feedback (COM – VEE) output voltage sense pin used to adjust the output (COM – VEE) voltage. Connect one feedback resistor to VEE to program the (COM – VEE) voltage from 2V to 8V. Connect a 10pF ceramic capacitor from FBVEE to COMA for bypassing high frequency noise. The 10pF ceramic capacitor must be next to the FBVEE pin on top layer or back layer connected with vias. If using the device in single output mode connect a 180kΩ resistor to VEE.
GNDP	5, 6, 7, 8	G	Primary-side ground connection for VIN. Place several vias to copper pours for thermal relief.
$\overline{PG}$(PG)	2	O	Power-Good open-drain output pin. Remains active when $V_{VIN\_UVLOP} \leq V_{VIN} \leq V_{VIN\_OVLOP}$; $V_{VDD\_UVP} \leq V_{FBVDD} \leq V_{VDD\_OVP}$; $V_{VEE\_UVP} \leq V_{FBVEE} \leq V_{VEE\_OVP}$; $T_{J\_Primary} \leq T_{SHUT\_P\_R}$; and $T_{J\_secondary} \leq T_{SHUT\_S\_R}$. Pull up to a 3.3V or 5V rail through a 4.99kΩ resistor. Connect a 1uF decoupling capacitor in 0402 body size for by-passing the high frequency noise next to the Power-Good pin on the same side of the PCB as the IC. This pin is active low for UCC34141-Q1 but can active high depending on the part number.
VDD	12	P	Secondary-side isolated output voltage from transformer. Connect a 10µF and a parallel 0.1µF ceramic capacitor from VDD to COM. The 0.1µF ceramic capacitor in 0402 body size is for bypassing high frequency noise and must be next to the VDD and COM pins.
VEE	14	P	Secondary-side isolated output voltage for negative rail. Connect a 2.2µF ceramic capacitor from VEE to COM for bypassing high frequency noise. If using the device in single output mode connect VEE directly to COM.

Table 1-4. Pin Functions (continued)

PIN		TYPE [1]	DESCRIPTION
NAME	NO.		
VIN	3, 4	P	Primary input voltage. Connect a 10µF and a parallel 0.1µF ceramic capacitor from VIN to GNDP. The 0.1µF ceramic capacitor in 0402 body size is for by-passing the high frequency noise and must be next to the VIN and GNDP pins on the same side of the PCB as the IC.

(1)   P = power, G = ground, I = input, O = output

2 Hardware

2.1 EVM Setup and Operation

2.1.1 Recommended Test Equipment

1. V_{BIAS}: DC power supply1: 5V, 10mA
2. V_{IN}: DC power supply2: 20V, 500mA
3. I_{VDD}: Electronic load (set to constant resistance) or fixed resistor: 18V, 83mA
4. I_{VEE}: Electronic load (set to constant resistance) or fixed resistor: 5V, 65mA
5. (3) multimeters measuring DC voltage <30V
6. (2) multimeters measuring DC current <200mA on I_{VDD}, I_{VEE}, <500mA on I_{VIN}
7. Oscilloscope: 4-channel, 500MHz or higher, voltage probes, current probes
8. Minimum wire gauge 20 AWG to 22 AWG or better
9. Thermal camera (optional) or thermocouple to measure U1 case temperature

2.1.2 External Connections for Easy Evaluation

The UCC34141EVM-116 EVM utilizes screw terminals for quickly connecting to VIN, VDD and VEE. Connecting the appropriate ammeters and voltmeters, as shown in Figure 2-1, allows measuring for accurate EVM efficiency.

2.1.2.1 Connecting Test Equipment

1. Move shunt jumper, SH-J1 into the J2, 1-2, EN OFF position. This verifies the EVM cannot start while test equipment is being connected.
2. Connect a +5V DC bias power supply J1:1-2 (adjust to +3.3V to +5V). The +5V supply at J1 serves as the pullup bias for /PG and ENA. Turn off/disable the +5V DC Bias power supply.
3. Connect the VIN DC power supply capable of 5V<VIN<20V, 500mA at J3:1-2 (VIN). Adjust the power supply to 12V, and set the current limit to 1A. Turn off/disable the VIN power supply.
4. Connect a variable load between J4:1 (VDD) and J4:2 (COM). If using an electronic load, set to constant resistance (CR), 650Ω (≅500mW). Leave the load disabled until the EVM is powered.
5. Connect a second load between J4:2 (COM) and J4:3 (VEE). If using an electronic load, set to constant resistance (CR), 250Ω (≅10mW). Leave the load disabled until the EVM is powered. Since the required load is small, a through-hole, 500mW, load resistor can be connected between J4:2-3.
6. Some electronic loads are not able to regulate/stabilize CC when setting in the low mA range. Monitor the input current and load currents by inserting ammeters as shown in Figure 4-1. A current probe can be used with the oscilloscope to verify the stability of the DC current being regulated by an electronic load.
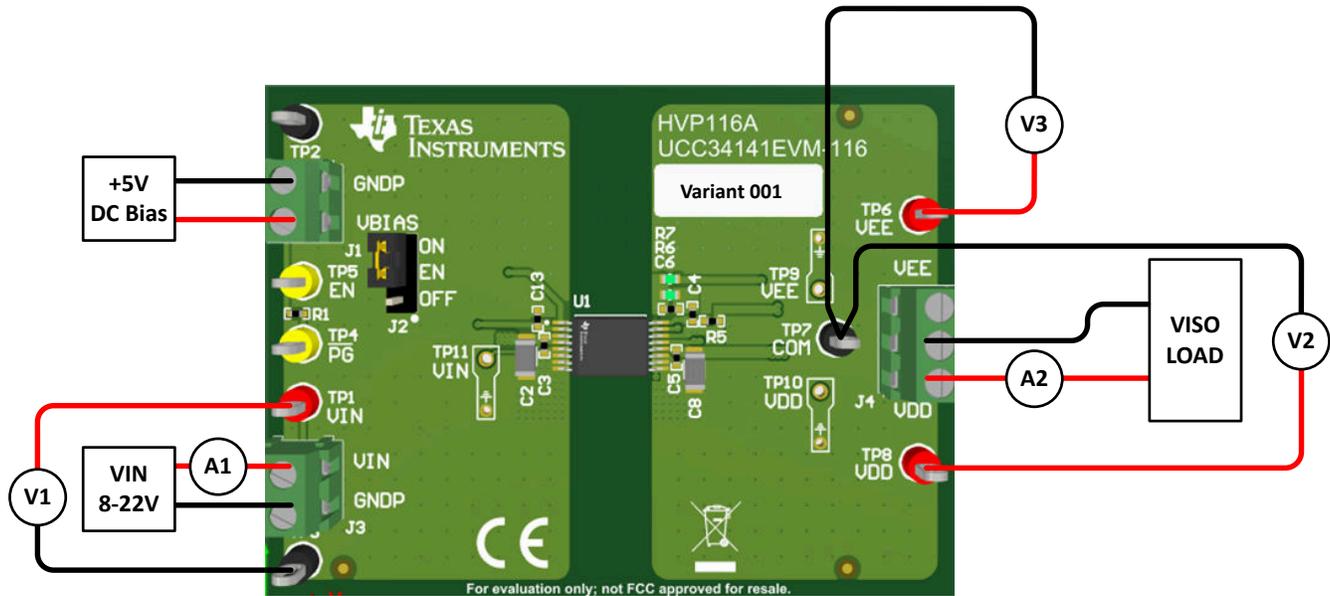
Figure 2-1. Typical Efficiency Measurement Setup

2.1.3 Powering the EVM

WARNING

- Hot Surface. Contact can cause burns. U1 package surface can reach temperatures of 45°C above ambient. Do not touch!
- Do not test this EVM unless you are trained in the proper safety, handling and testing of power electronics.

Power On for Start-Up

1. Verify VIN and +5V DC Bias power supplies are off/disabled and no voltage is applied to the UUT
2. Move shorting jumper, SH-J1, into the J2:2-3, EN ON position. NOTE: removing the shorting jumper, SH-J1 also results in EN ON.
3. Turn on the VIN DC power supply. Verify 12V is present at TP1-to-TP3
4. Verify the loads on VDD and VEE are disabled
5. Turn on the +5V DC bias power supply. EVM is now enabled with VDD and VEE in regulation under no load condition.
6. Verify +18V present on VDD-COM, and -5V present on VEE-COM
7. Enable the load on VDD, enable the load on VEE
8. The UCC34141-Q1 is now regulating VDD and VEE and processing approximately 0.5W of isolated output power
9. Vary VIN between 5V<VIN<20V, vary IVDD between 0mA<IVDD<83mA, Vary IVEE between 0mA<IVEE<6mA
10. Insert oscilloscope probes into TP9, TP10 and TP11 for measuring VEE, VDD and VIN start-up, steady state and AC ripple voltage

Power Off for Shutdown

1. Move shorting jumper SH-J1 into the J2:1-2, EN OFF position
2. Turn off +5V, DC bias power supply
3. Disable IVDD load
4. Disable IVEE load
5. Turn off VIN power supply

2.2 Test Points

Table 2-1 describes the various EVM test points, allowing easy access for connecting oscilloscope probes, DVM test leads and wire connections to lab test equipment as outlined in Recommended Test Equipment. Pay attention to maintain separation between the primary side, GNDP and secondary side, COM. Primary-side test points are not to be referenced to COM through improper test equipment insertion. Likewise, secondary-side test points are not to be referenced to GNDP through improper test equipment insertion.

Table 2-1. Input, Output, Test Point (I/O/TP) Descriptions

Pin	I/O/TP	Color	Description	Min	Typ	Max	Unit
J1	I	Green	V_{BIAS}, EN and /PG bias	3	V_{BIAS}	5	V
SH-J1	I	Black	J2 shorting jumper		0		V
J2:1-2	I	Black	EN, off		0		V
J2:2-3	I	Black	EN, on (SH-J1 removed is EN, on)		V_{BIAS}		V
J3	I	Green	V_{IN}, primary input voltage	5	12	20	V
J4:1-2	O	Green	Secondary VDD-to-COM	0		18	V
J4:2-3	O	Green	Secondary VEE-to-COM	-5		0	V
TP1	TP	Red	V_{IN}, positive probe point	5	12	20	V
TP2	TP	Black	GNDP, shared primary GND test point		0		V
TP3	TP	Black	GNDP, shared primary GND test point		0		V
TP4	TP	Yellow	/PG, power good test point		V_{BIAS}		V
TP5	TP	Yellow	EN, enable test point		V_{BIAS}		V
TP6	TP	Red	VEE, secondary VEE test point	-5		0	V
TP7	TP	Black	COM, secondary side reference		0		V
TP8	TP	Red	VDD, secondary VDD test point	0		18	V
TP9	TP	PCB	VEE-to-COM, secondary VDD scope probe point	-5		0	V
TP10	TP	PCB	VDD-to-COM, secondary VDD scope probe point	0		18	V
TP11	TP	PCB	V_{IN}-to-GNDP scope probe point	5	12	20	V

2.3 Oscilloscope Probe Points

Using TP9-11 oscilloscope probe PCB test points: The UCC34141-Q1 is a high frequency DC-DC module that requires careful measurement for accurately capturing transient events and measuring high frequency, AC ripple voltage. Remove the *witch hat* probe tip cover and ground lead from the scope probe. If scope probe ground springs are not available, wrap a piece of 22 AWG bare wire around the scope probe ground ring or use a fitted ground spring and insert the probe tip and ground into the EVM as shown in Figure 2-2.
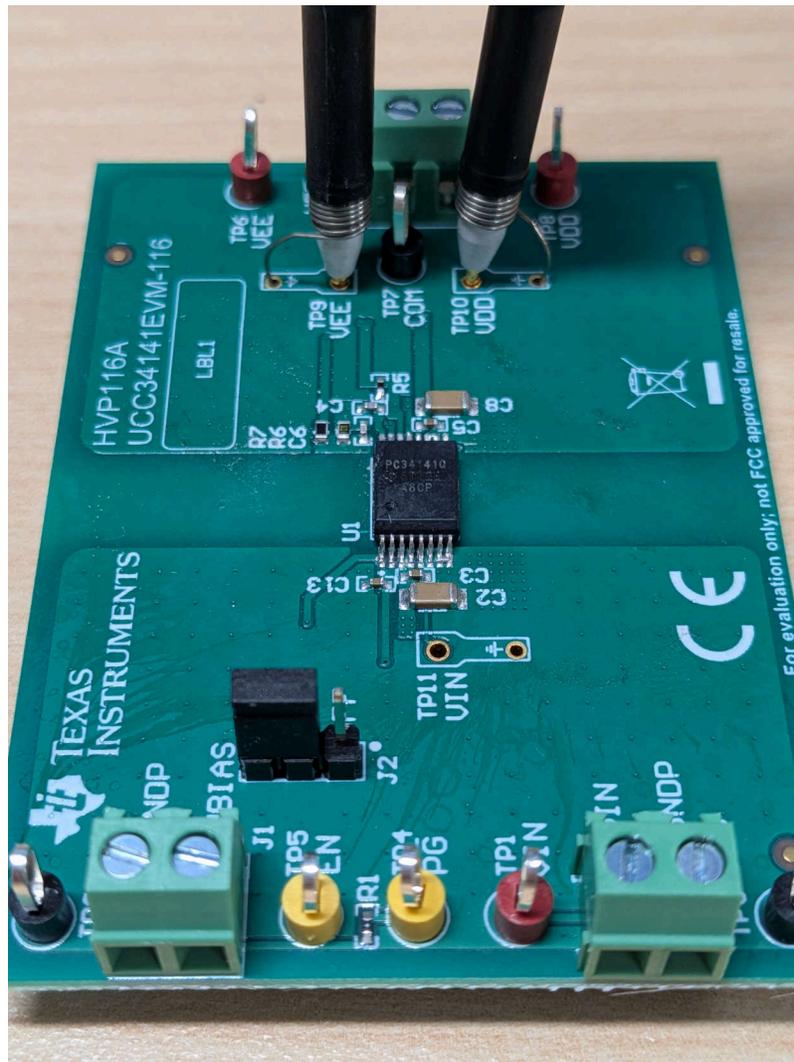
Figure 2-2. PCB Oscilloscope Probe Test Points

The EVM output nomenclature (VDD, VEE, COM) corresponds to what is commonly used when referring to isolated gate driver ICs. As shown in Figure 4-1, TP4 (COM) is the midpoint reference intended to connect to the COM pin of the isolated gate driver IC. When the UCC34141-Q1 is used to bias a gate driver IC, VDD (VDD-COM) and VEE (VEE-COM) are referred to with respect to COM.

3 Implementation Results

3.1 Performance Data

Unless otherwise specified, all performance data and waveforms are collected using a resistive load.

3.1.1 Efficiency Data
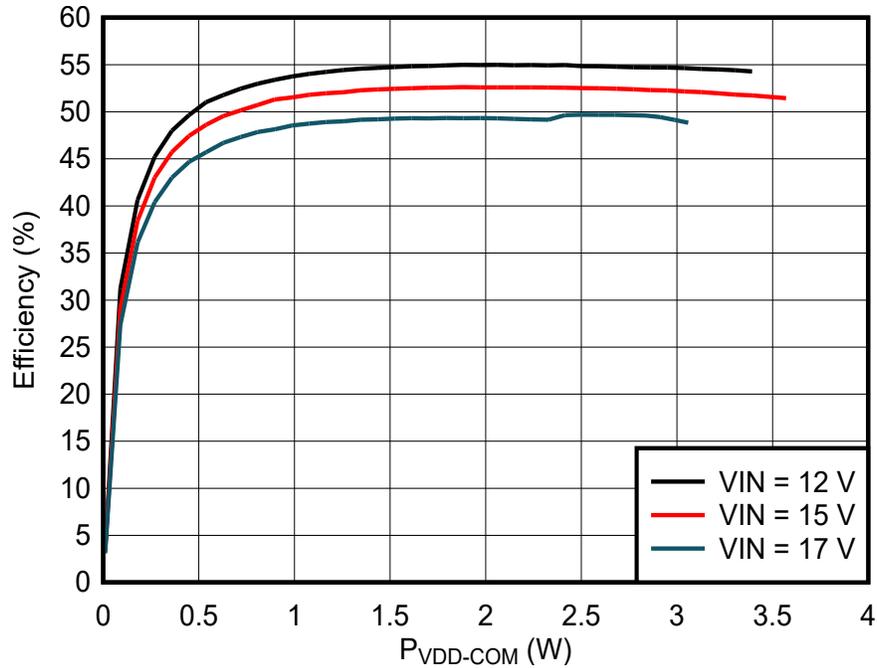
Figure 3-1. Measured Efficiency, VDD-COM Loading Only

Table 3-1. Efficiency Test Data (V_{IN} = 12V)

V_{IN} (V)	I_{IN} (mA)	VDD (V)	I_{VDD} (mA)	VEE (V)	I_{VEE} (mA)	P_{IN} (W)	$P_{VDD-VEE}$ (W)	Eff (%)
12	24.0	17.96	5.0	-5.06	0.0	0.29	0.09	31.2
12	49.6	17.96	15.0	-5.05	0.0	0.60	0.27	45.2
12	75.3	17.95	25.0	-5.05	0.0	0.90	0.45	49.6
12	101.1	17.95	35.0	-5.05	0.0	1.21	0.63	51.8
12	127.0	17.94	45.0	-5.05	0.0	1.52	0.81	53.0
12	153.0	17.94	55.0	-5.05	0.0	1.84	0.99	53.8
12	179.1	17.94	65.0	-5.05	0.0	2.15	1.17	54.2
12	205.3	17.93	75.0	-5.05	0.0	2.46	1.34	54.6
12	232.0	17.93	85.0	-5.04	0.0	2.78	1.52	54.7
12	258.5	17.92	95.0	-5.04	0.0	3.10	1.70	54.9
12	285.0	17.91	105.0	-5.04	0.0	3.42	1.88	55.0
12	312.1	17.91	115.0	-5.04	0.0	3.75	2.06	55.0
12	339.3	17.90	125.0	-5.03	0.0	4.07	2.24	55.0
12	366.3	17.90	135.0	-5.03	0.0	4.40	2.42	55.0
12	394.2	17.89	145.0	-5.02	0.0	4.73	2.59	54.8
12	422.1	17.89	155.0	-5.02	0.0	5.06	2.77	54.7
12	449.5	17.88	165.0	-5.01	0.0	5.39	2.95	54.7
12	477.9	17.88	175.0	-5.00	0.0	5.73	3.13	54.6
12	506.2	17.87	185.0	-5.00	0.0	6.07	3.31	54.4

Table 3-2. Efficiency Test Data (V_{IN} = 15V)

V_{IN} (V)	I_{IN} (mA)	VDD (V)	I_{VDD} (mA)	VEE (V)	I_{VEE} (mA)	P_{IN} (W)	$P_{VDD-VEE}$ (W)	Eff (%)
15	20.6	17.96	5.0	-5.05	0.0	0.31	0.09	29.1
15	41.7	17.96	15.0	-5.05	0.0	0.63	0.27	43.0
15	63.1	17.95	25.0	-5.05	0.0	0.95	0.45	47.4
15	84.5	17.95	35.0	-5.05	0.0	1.27	0.63	49.6
15	106.2	17.95	45.0	-5.05	0.0	1.59	0.81	50.7
15	127.7	17.94	55.0	-5.05	0.0	1.92	0.99	51.5
15	149.6	17.94	65.0	-5.05	0.0	2.24	1.17	52.0
15	171.6	17.93	75.0	-5.04	0.0	2.57	1.35	52.3
15	193.7	17.93	85.0	-5.04	0.0	2.91	1.52	52.4
15	216.0	17.93	95.0	-5.04	0.0	3.24	1.70	52.6
15	238.3	17.92	105.0	-5.03	0.0	3.57	1.88	52.6
15	261.1	17.91	115.0	-5.03	0.0	3.92	2.06	52.6
15	283.7	17.90	125.0	-5.02	0.0	4.26	2.24	52.6
15	306.5	17.90	135.0	-5.02	0.0	4.60	2.42	52.6
15	329.5	17.89	145.0	-5.01	0.0	4.94	2.59	52.5
15	352.8	17.89	155.0	-5.00	0.0	5.29	2.77	52.4
15	376.4	17.88	165.0	-5.00	0.0	5.65	2.95	52.3
15	400.4	17.88	175.0	-5.00	0.0	6.01	3.13	52.1
15	425.2	17.87	185.0	-4.99	0.0	6.38	3.31	51.8
15	450.2	17.86	195.0	-4.99	0.0	6.75	3.48	51.6

Table 3-3. Efficiency Test Data (V_{IN} = 17V)

| V_{IN} (V)	I_{IN} (mA)	VDD (V)	I_{VDD} (mA)	VEE (V)	I_{VEE} (mA)	P_{IN} (W)	$P_{VDD-VEE}$ (W)	Eff (%)
17	19.3	17.97	5.0	-5.06	0.0	0.33	0.09	27.3
17	39.2	17.97	15.0	-5.05	0.0	0.67	0.27	40.4
17	59.1	17.96	25.0	-5.05	0.0	1.00	0.45	44.7
17	79.2	17.96	35.0	-5.05	0.0	1.35	0.63	46.7
17	99.3	17.95	45.0	-5.05	0.0	1.69	0.81	47.8
17	119.6	17.95	55.0	-5.05	0.0	2.03	0.99	48.5
17	140.3	17.95	65.0	-5.05	0.0	2.38	1.17	48.9
17	161.0	17.94	75.0	-5.04	0.0	2.74	1.35	49.2
17	182.0	17.94	85.0	-5.04	0.0	3.09	1.52	49.3
17	203.3	17.93	95.0	-5.03	0.0	3.46	1.70	49.3
17	224.6	17.93	105.0	-5.03	0.0	3.82	1.88	49.3
17	245.8	17.92	115.0	-5.02	0.0	4.18	2.06	49.3
17	267.8	17.92	125.0	-5.02	0.0	4.55	2.24	49.2
17	286.2	17.89	135.0	-5.01	0.0	4.86	2.41	49.6
17	306.6	17.86	145.0	-5.01	0.0	5.21	2.59	49.7
17	327.2	17.81	155.0	-5.00	0.0	5.56	2.76	49.6
17	346.4	17.64	165.0	-5.00	0.0	5.89	2.91	49.4
17	368.4	17.48	175.0	-4.99	0.0	6.26	3.06	48.8

3.1.2 Regulation Data
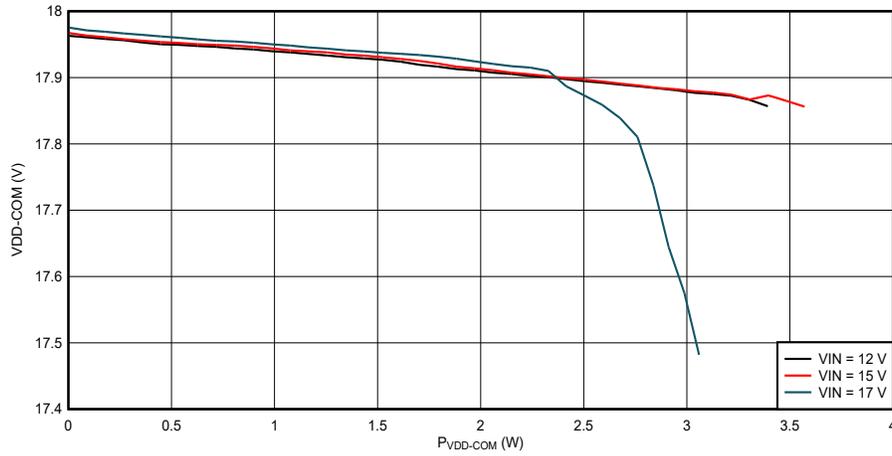
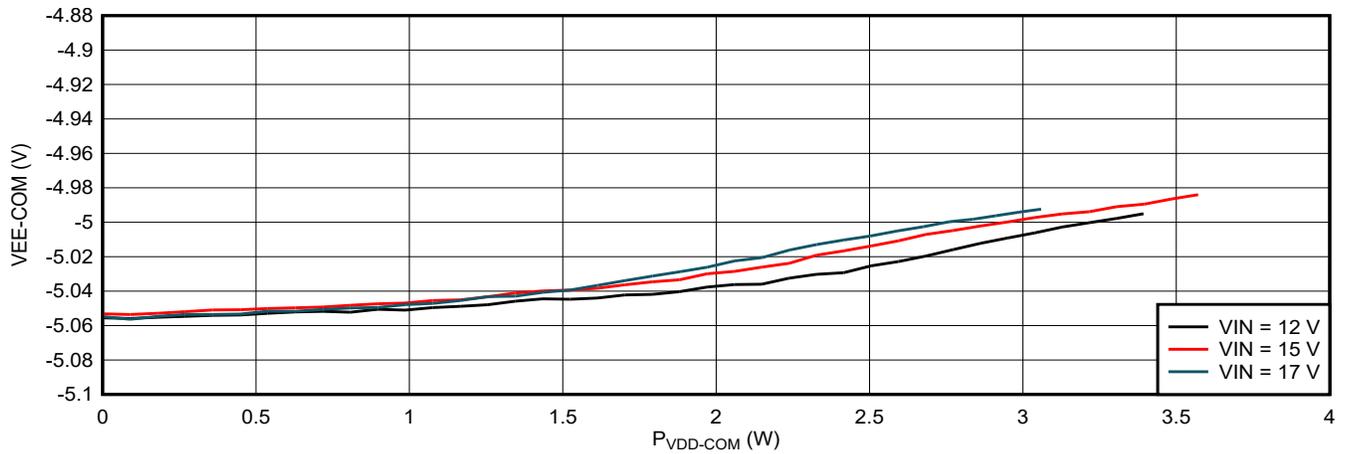**Figure 3-2. Regulation vs Power, VDD-COM Loading Only**

Figure 3-3. Regulation vs Power, VDD-COM Loading Only

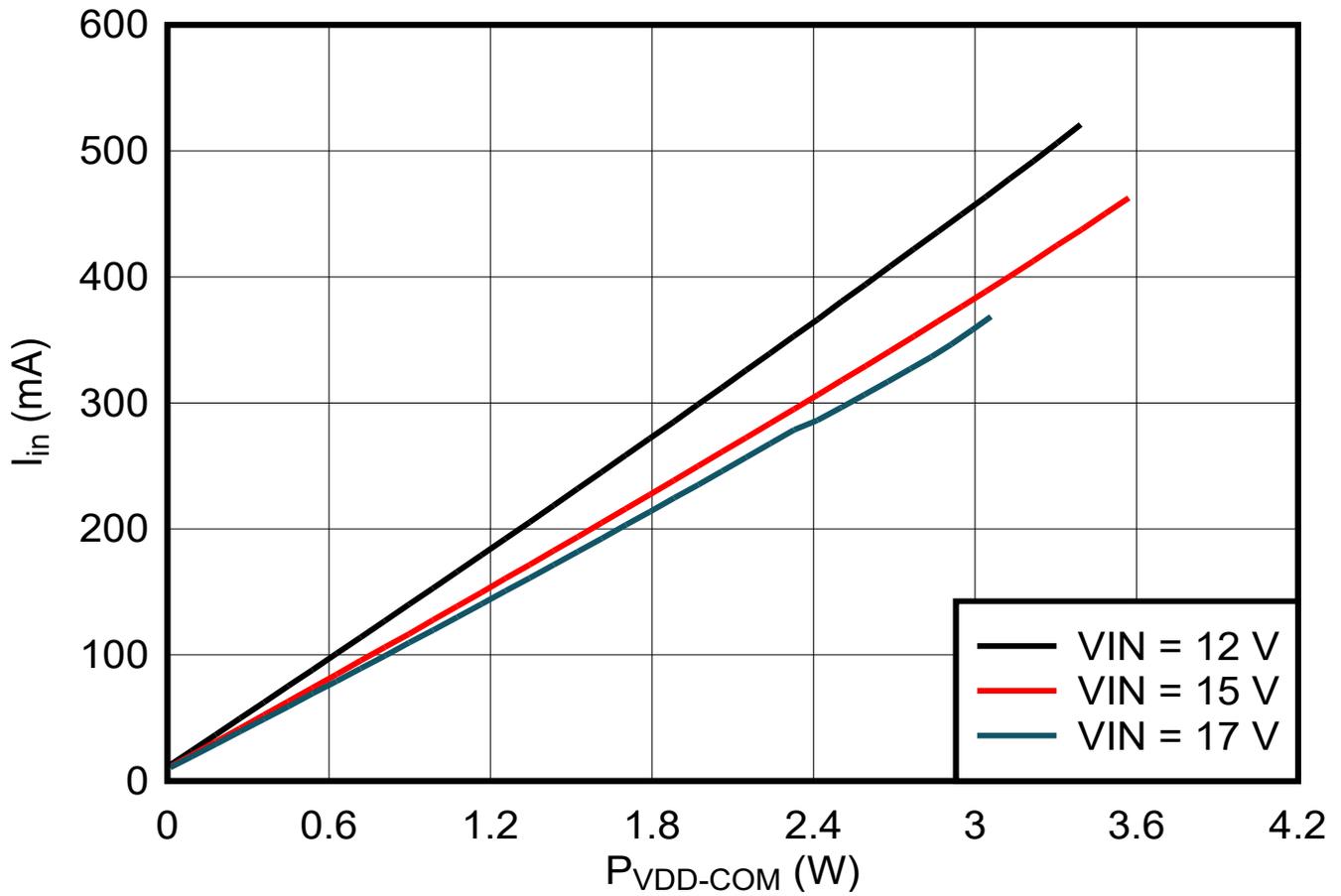### *3.1.3 Steady State Input Current*

Figure 3-4. Input Current vs Power, VDD-COM Loading Only
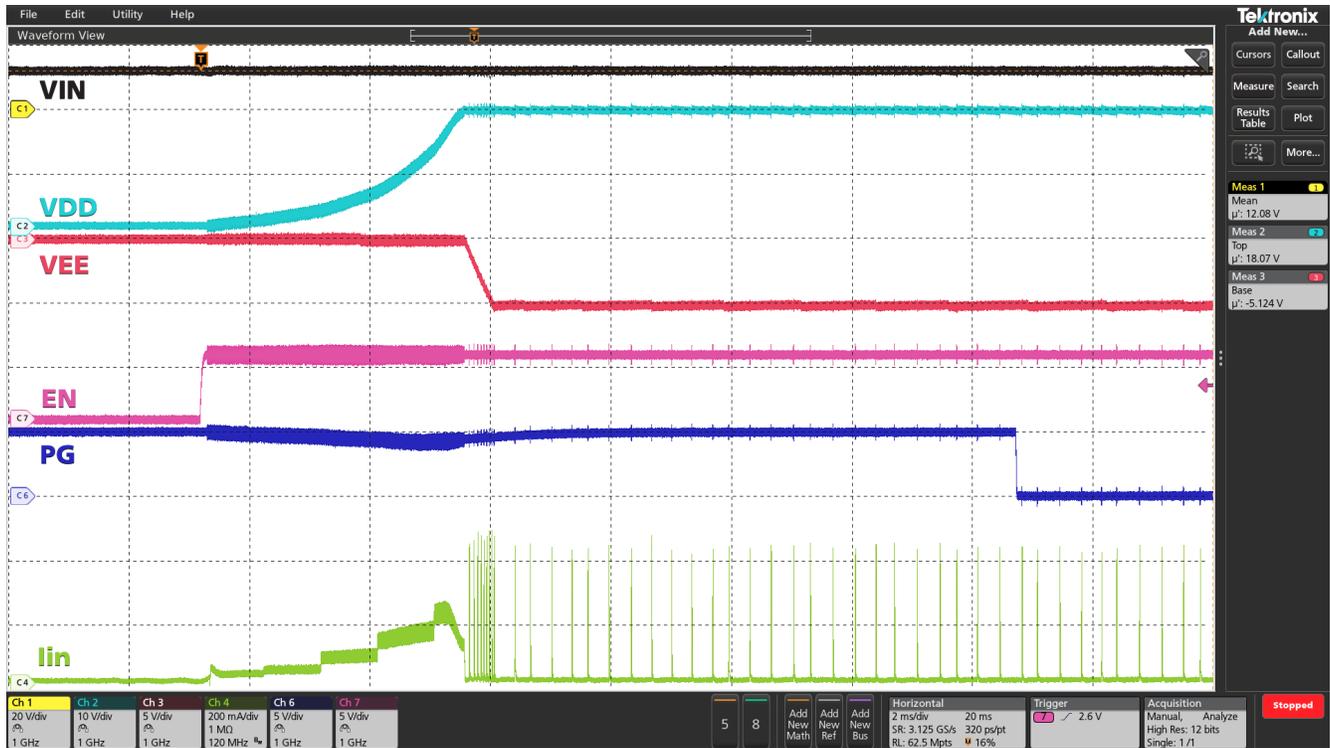
3.1.4 Start-up Waveforms

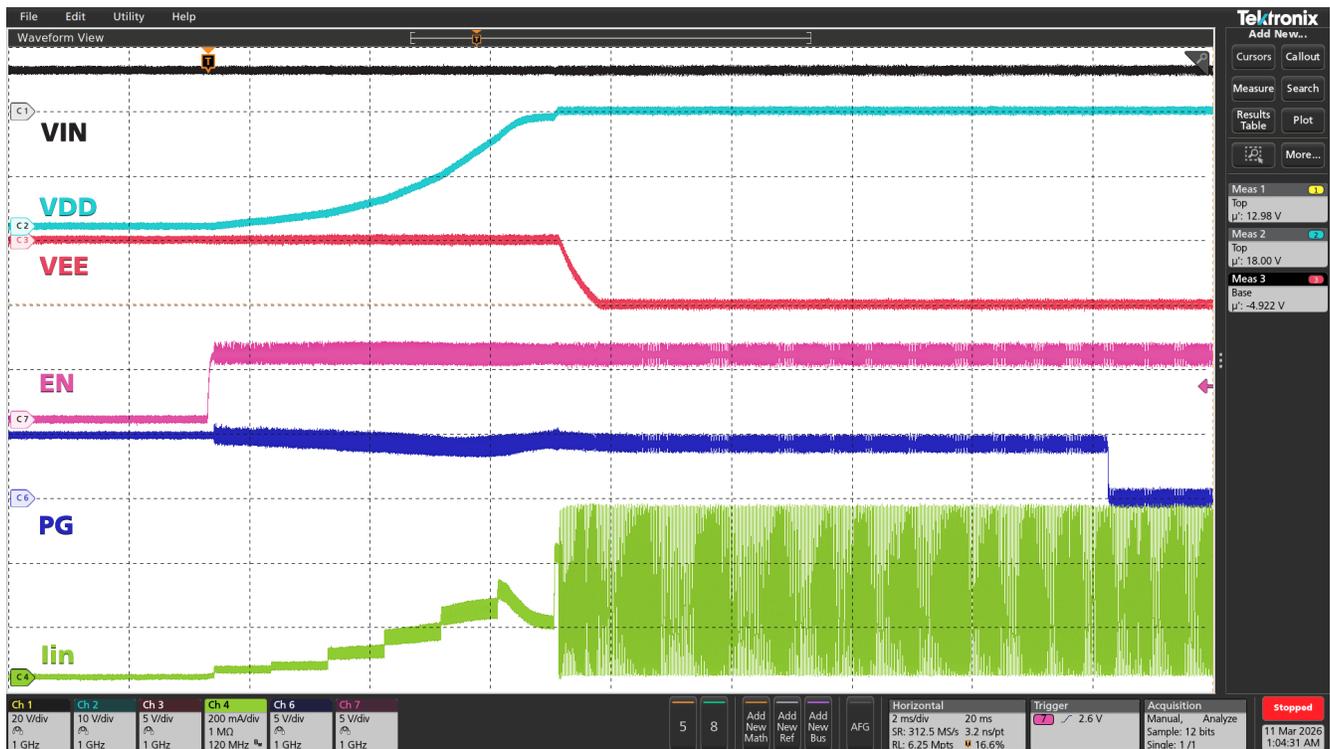**Figure 3-5. ENA Triggered Start-Up: V$_{IN}$=12V; I$_{VDD-COM}$=0mA; I$_{VEE-COM}$=0mA**

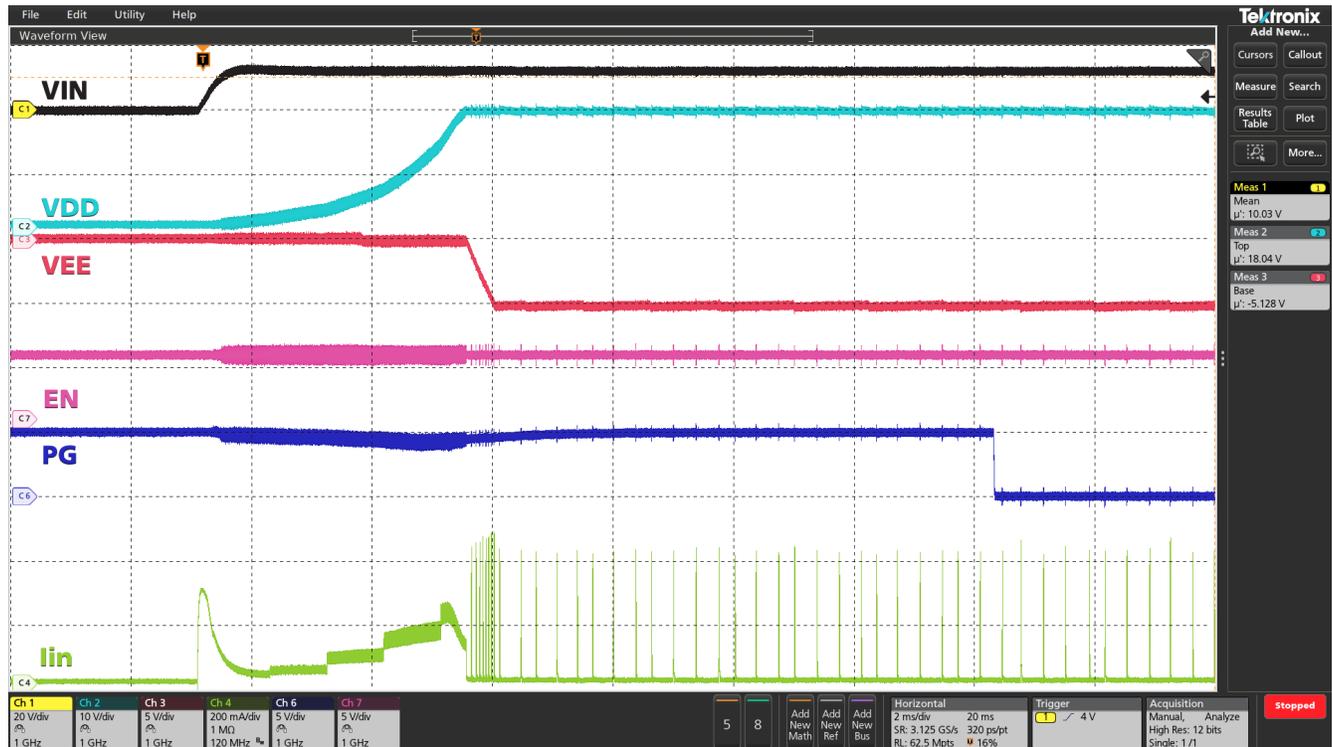**Figure 3-6. ENA Triggered Start-Up: V$_{IN}$=12V; I$_{VDD-COM}$=72mA; I$_{COM-VEE}$=40mA**

Figure 3-7. V$_{IN}$ Triggered Start-Up: V$_{IN}$=12V; I$_{VDD-COM}$=0mA; I$_{VEE-COM}$=0mA
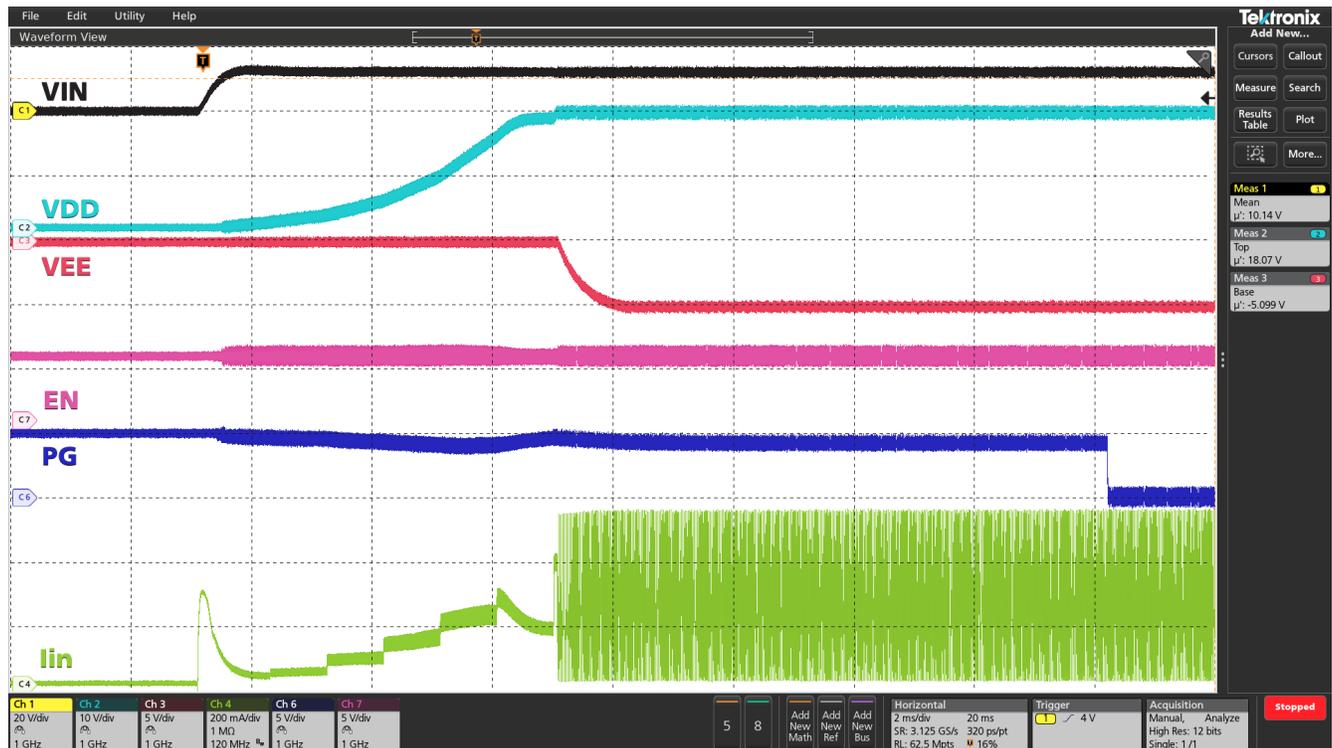
Figure 3-8. V$_{IN}$ Triggered Start-Up: V$_{IN}$=12V; I$_{VDD-COM}$=72mA; I$_{COM-VEE}$=40mA
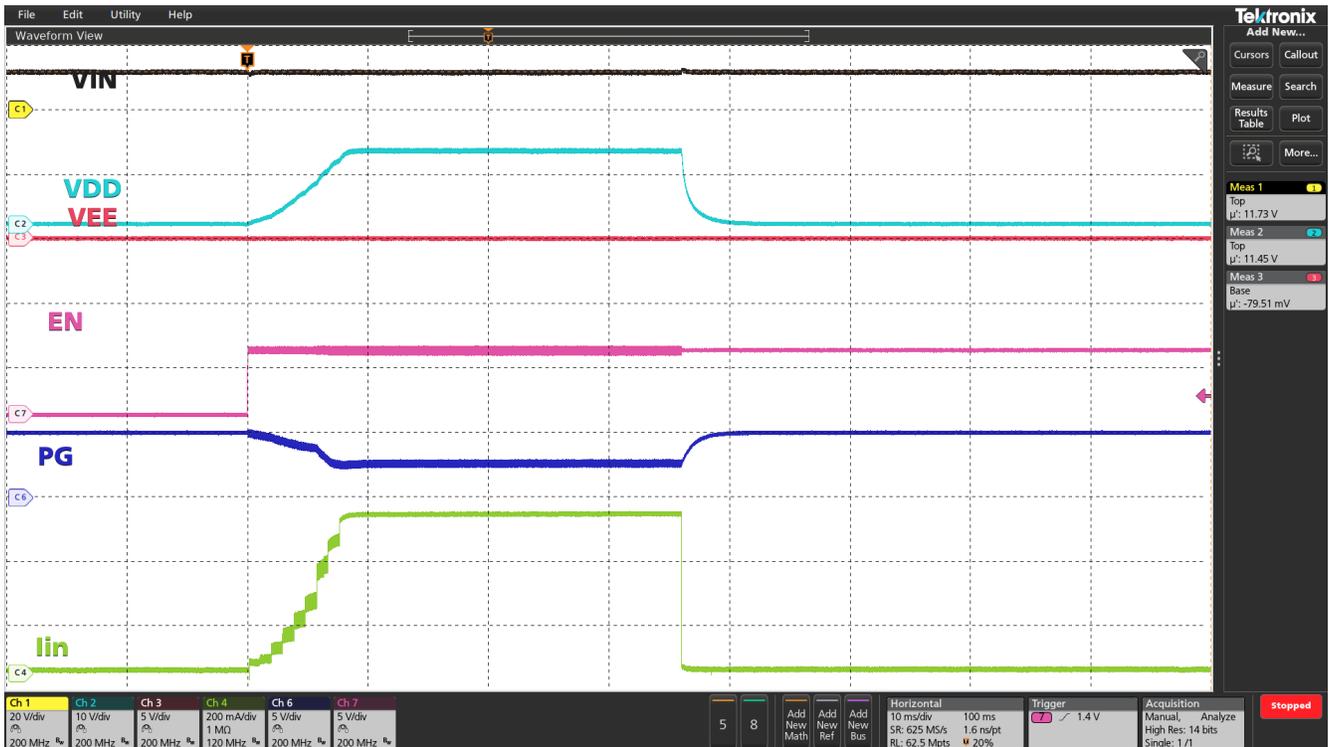
Figure 3-9. ENA Triggered Overloaded Start-Up: V_{IN}=12V; $I_{VDD-COM}$=389mA; $R_{VDD-COM}$=46 ohms; $I_{COM-VEE}$=0mA

3.1.5 Output Ripple
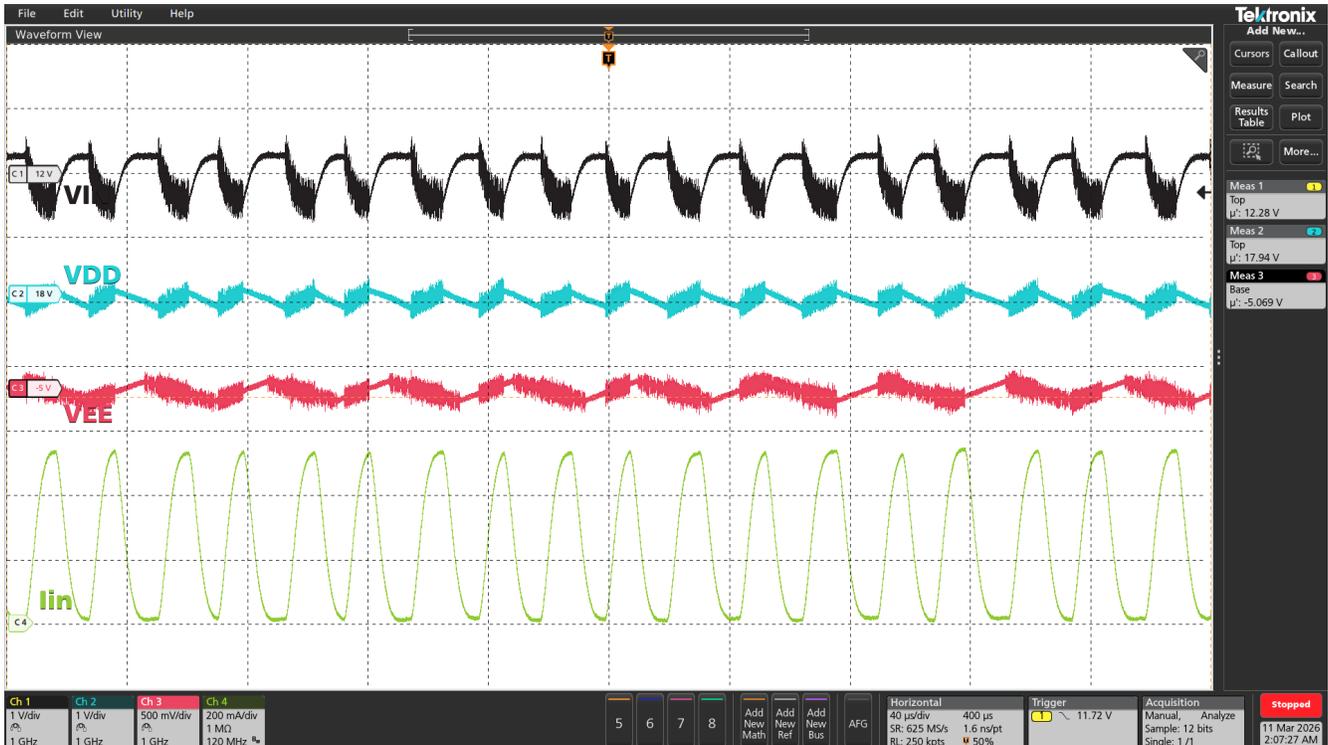
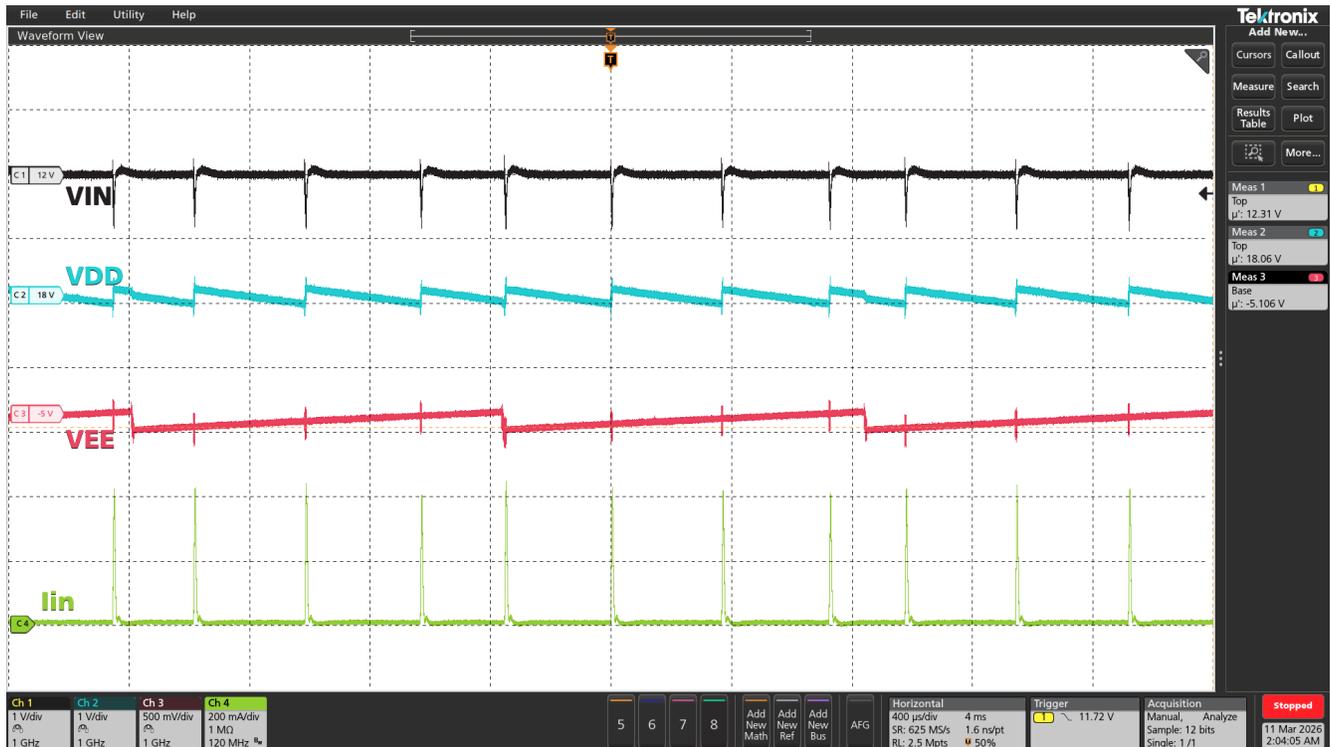**Figure 3-10. Steady State Output Ripple: V_{IN}=12V; $I_{VDD-COM}$=72mA; $I_{COM-VEE}$=40mA**

Figure 3-11. Steady State Output Ripple: V$_{IN}$=12V; I$_{VDD-COM}$=0mA; I$_{COM-VEE}$=0mA
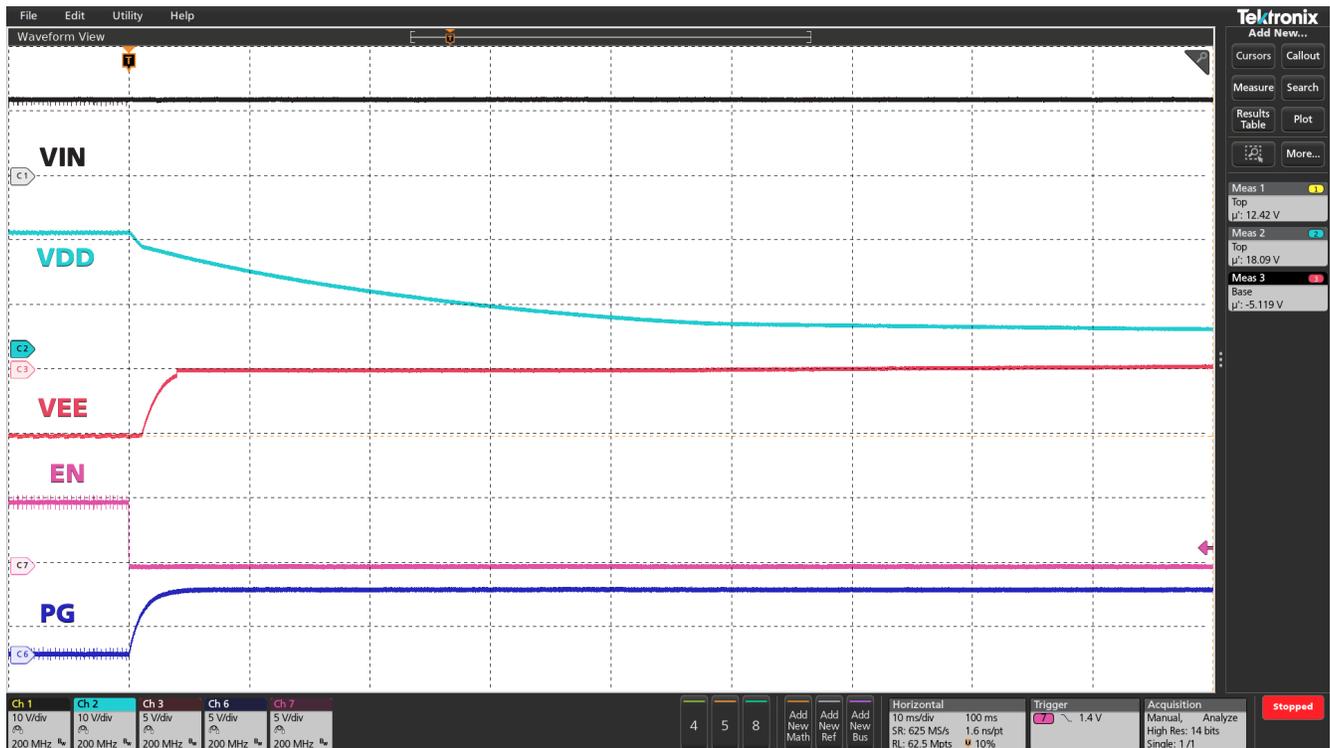
3.1.6 Shutdown

Figure 3-12. ENA Triggered Shut-Down: V$_{IN}$=12V; I$_{VDD-COM}$=0mA; I$_{VEE-COM}$=0mA
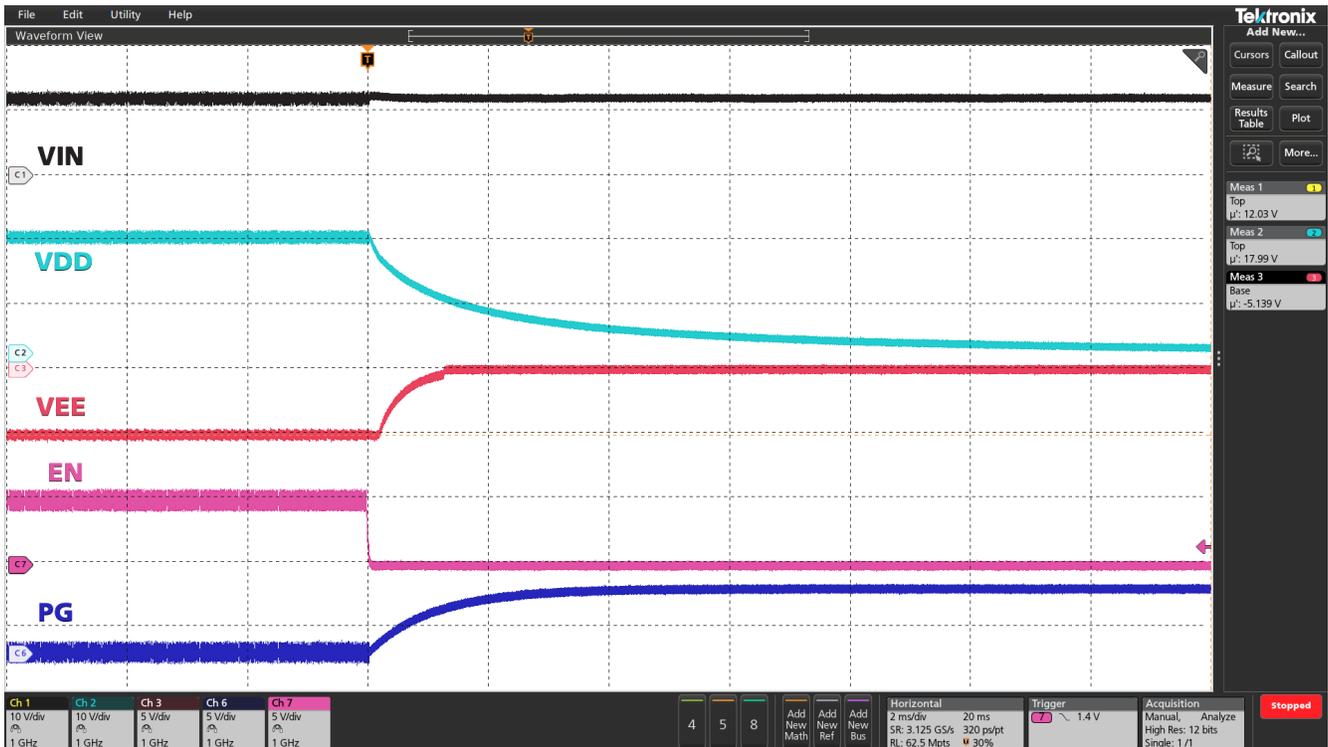
Figure 3-13. ENA Triggered Shut-Down: V$_{IN}$=12V; I$_{VDD-COM}$=72mA; I$_{COM-VEE}$=40mA
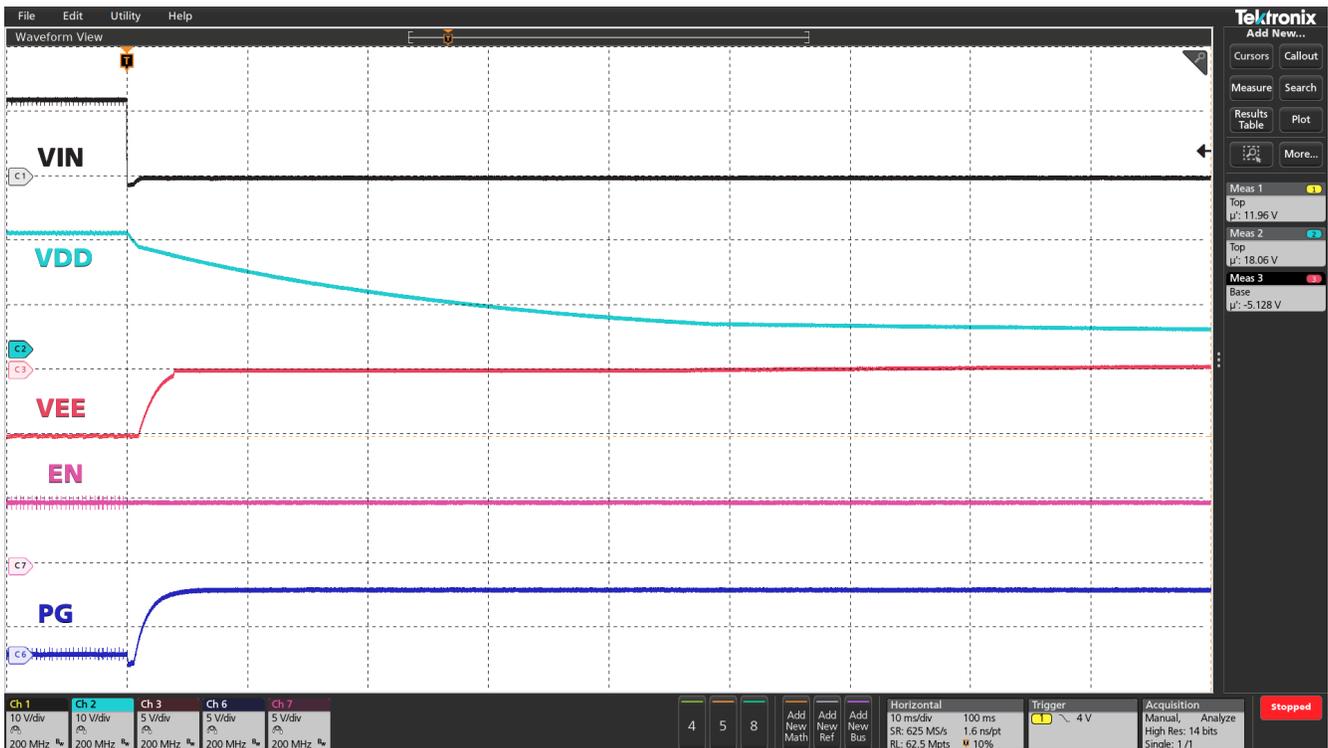

Figure 3-14. V$_{IN}$ Triggered Shut-Down: V$_{IN}$=12V; I$_{VDD-COM}$=0mA; I$_{VEE-COM}$=0mA

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Submit Document Feedback   *Supply Applications*
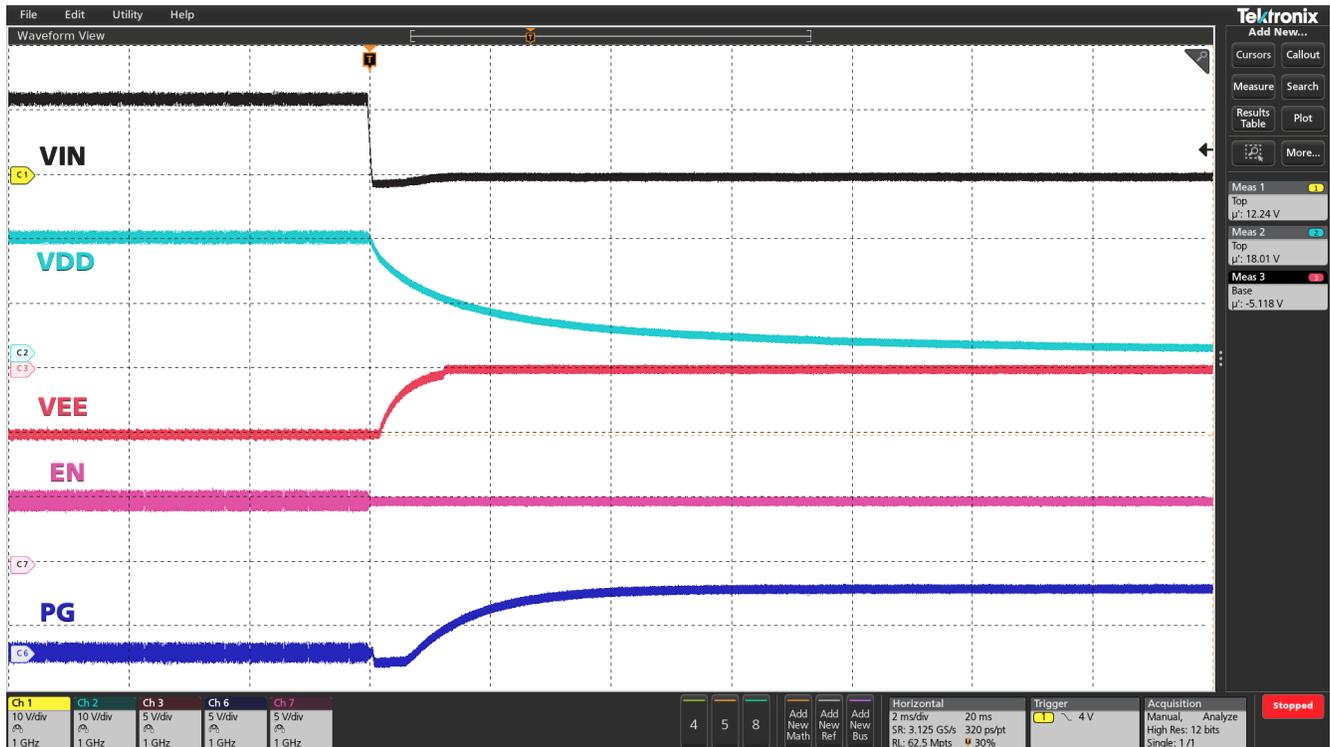
Copyright © 2026 Texas Instruments Incorporated

Figure 3-15. V$_{IN}$ Triggered Shut-Down: V$_{IN}$=12V; I$_{VDD-COM}$=72mA; I$_{COM-VEE}$=40mA

3.1.7 Thermal Performance

Full load EVM operation can result in very hot U1 package temperature. Use caution not to touch the U1 case when probing or handling the EVM during full load operation.
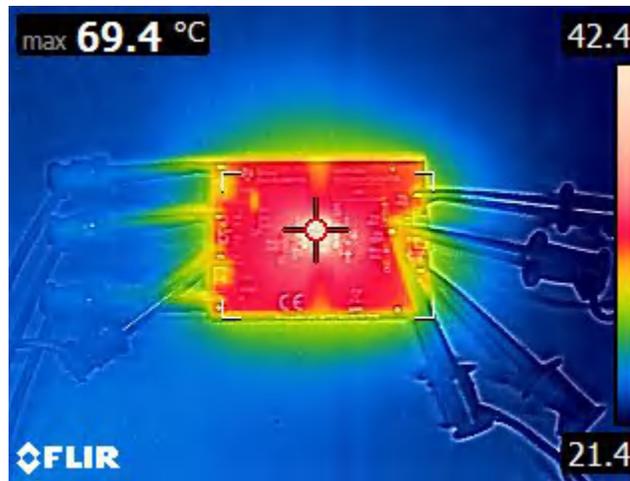

Figure 3-16. Thermal Image: V$_{IN}$=12V; I$_{VDD-COM}$=72mA; I$_{COM-VEE}$=40mA

$$T_{RISE} = 69.4°C - 21.4°C = 48°C \tag{1}$$

4 Hardware Design Files

4.1 Schematic

Figure 4-1 shows the EVM electrical schematic. R3-4 and C10-12 are intentionally unpopulated as indicated by a red X, placed directly over the component.
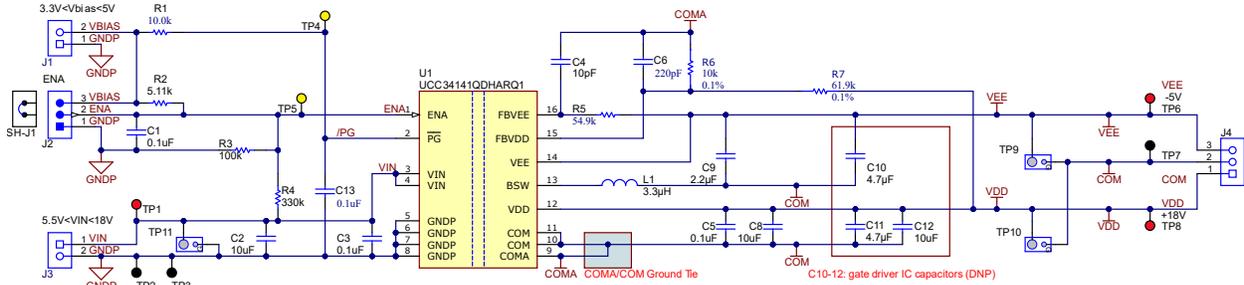

Figure 4-1. UCC34141EVM-116 Schematic, Rev A

4.2 Assembly and Printed Circuit Board (PCB) Layout

The UCC34141EVM-116 is designed using a four-layer, FR4, PCB, fabricated with 2-ounce copper on all four layers. The EVM, PCB demonstrates the important use of ground planes and tented stitching vias for shielding and improving EMI performance. For higher density PCBs such as automotive traction inverters, the PCB can include several additional signal layers but similar design methodology can be applied as best as possible.
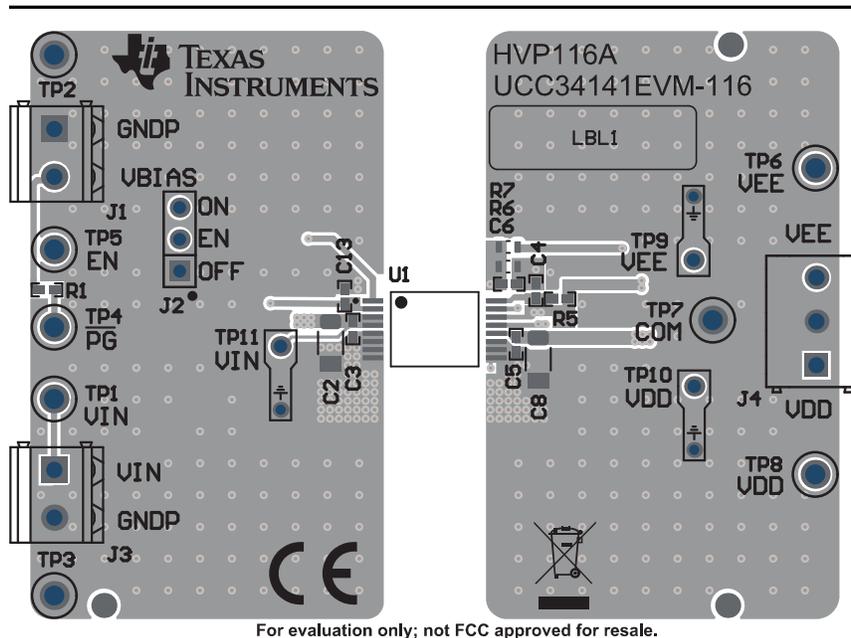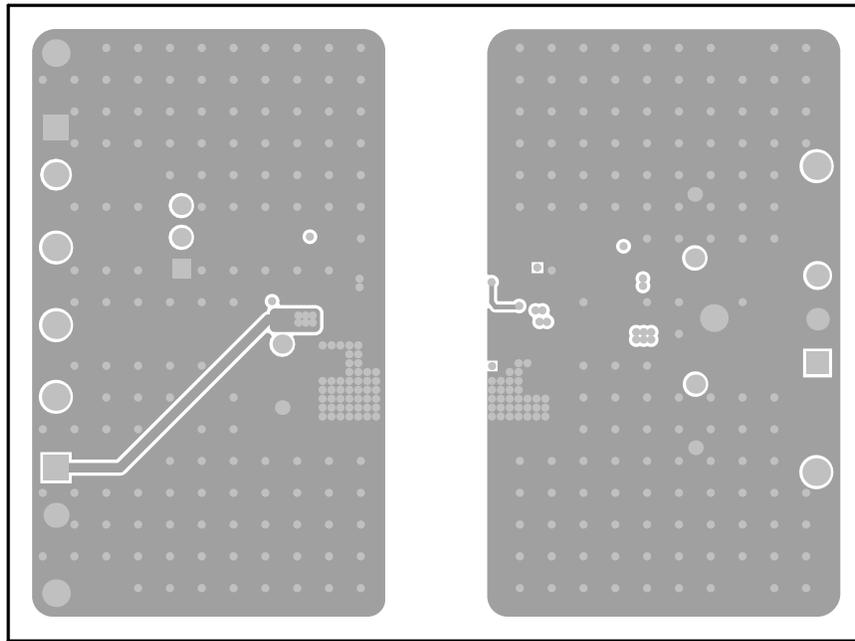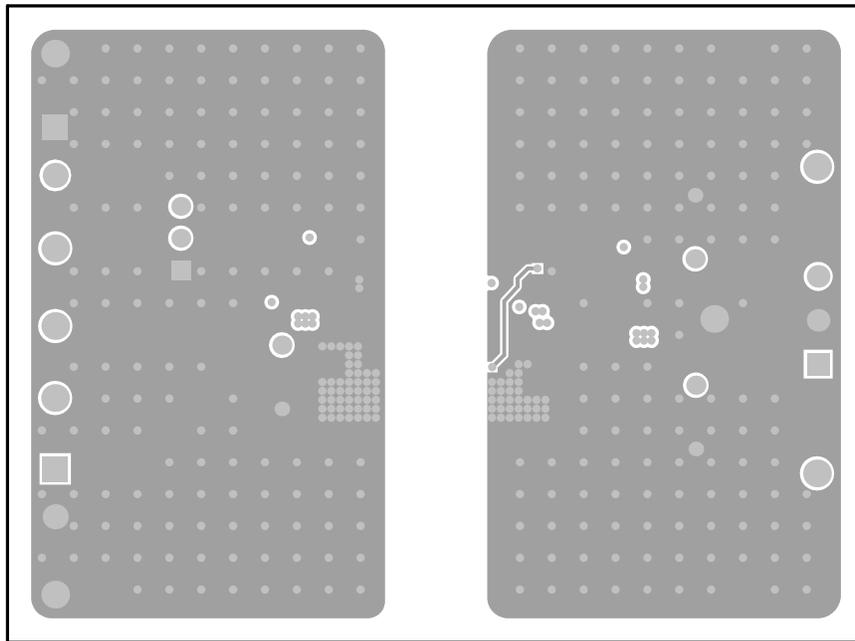

Figure 4-2. PCB Top Layer, Assembly

Figure 4-3. Ground Layer 2
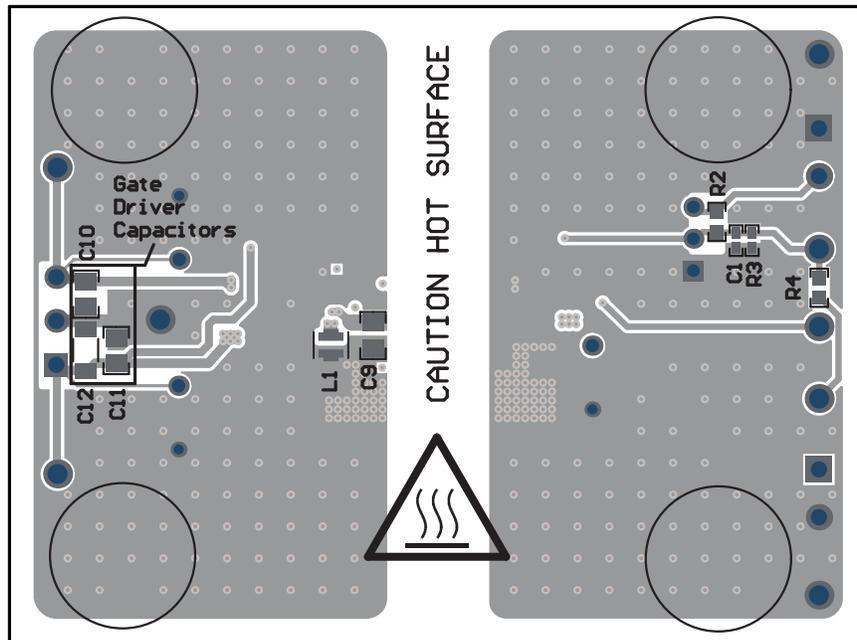

Figure 4-4. Ground Layer 3

Figure 4-5. PCB Bottom Layer, Assembly (mirrored view)

4.3 Bill of Materials (BOM)

Table 4-1. Bill of Materials (BOM)

Designator	Quantity	Value	Description	PartNumber	Manufacturer
PCB1	1	N/A	Printed Circuit Board	HVP116	Any
C1, C3, C5, C13	4	0.1uF	CAP, CERM, 0.1uF, 50V, +/- 10%, X7R, AEC-Q200 Grade 1, 0402	GCM155R71H104KE02D	MuRata
C2, C8	2	10uF	CAP, CERM, 10uF, 35V, +/- 10%, X7R, AEC-Q200 Grade 1, 1206_190	CGA5L1X7R1V106K160AC	TDK
C4	1	10pF	CAP, CERM, 10pF, 50V, +/- 5%, C0G/NP0, AEC-Q200 Grade 1, 0402	CGA2B2C0G1H100D050BA	TDK
C6	1	220pF	CAP, CERM, 220pF, 50V,+/- 5%, C0G/NP0, AEC-Q200 Grade 1, 0402	CGA2B2C0G1H221J050BA	TDK
C9	1	2.2uF	CAP, CERM, 2.2uF, 16V, +/- 10%, X7R, 0805	C2012X7R1C225K125AB	TDK
H1, H2, H3, H4	4	N/A	Bumpon, Hemisphere, 0.44X 0.20, Clear	SJ-5303 (CLEAR)	3M
J1, J3	2	N/A	Terminal Block, 2x1, 3.81mm, 24-16 AWG, 10A, 300VAC, TH	6.91214E+11	Wurth Elektronik
J2	1	N/A	Header, 100mil, 3x1, Tin, TH	PEC03SAAN	Sullins Connector Solutions
J4	1	N/A	Terminal Block, 3.5mm, 3x1, Tin, TH	6.91214E+11	Wurth Elektronik
L1	1	3.3uH	Inductor Power Shielded Wirewound 3.3uH 20% 100KHz Ferrite 0.88A 0.3Ω DCR T/R	NRV2010T3R3MGF	Taiyo Yuden
LBL1	1	N/A	Thermal Transfer Printable Labels, 0.650" W x 0.200" H - 10,000 per roll	THT-14-423-10	Brady

Table 4-1. Bill of Materials (BOM) (continued)

Designator	Quantity	Value	Description	PartNumber	Manufacturer
R1	1	10.0k	RES, 10.0k, 1%, 0.2W, AEC-Q200 Grade 0, 0402	ERJPA2F1002X	Panasonic
R2	1	5.11k	RES, 5.11k, 1%, 0.1W, AEC-Q200 Grade 0, 0603	CRCW06035K11FKEA	Vishay-Dale
R5	1	54.9k	RES, 54.9k, 1%, 0.063W, AEC-Q200 Grade 0, 0402	CRCW040254K9FKED	Vishay-Dale
R6	1	10k	10 kOhms ±0.1% 0.1W, 1/10W Chip Resistor 0603 (1608 Metric) Automotive AEC-Q200 Thin Film	ERA-3AEB103V	Panasonic
R7	1	61.9k	61.9 kOhms ±0.1% 0.1W, 1/10W Chip Resistor 0603 (1608 Metric) Automotive AEC-Q200 Thin Film	ERA-3AEB6192V	Panasonic Electronic Components
SH-J1	1	1x2	Shunt, 100mil, Gold plated, Black	SNT-100-BK-G	Samtec
TP1, TP6, TP8	3	N/A	Test Point, Multipurpose, Red, TH	5010	Keystone Electronics
TP2, TP3, TP7	3	N/A	Test Point, Multipurpose, Black, TH	5011	Keystone Electronics
TP4, TP5	2	N/A	Test Point, Multipurpose, Yellow, TH	5014	Keystone Electronics
U1	1	N/A	Automotive 1.5W, 12V-Vin, 25V-Vout, High Efficiency, High-Density, >5 kVRMS, Isolated DC-DC Module	UCC34141QDHARQ1	Texas Instruments
C10, C11	0	4.7uF	CAP, CERM, 4.7uF, 35V, +/- 10%, X7R, AEC-Q200 Grade 1, 0805	CGA4J1X7R1V475K125AC	TDK
C12	0	10uF	CAP, CERM, 10uF, 35V, +/- 10%, X7R, AEC-Q200 Grade 1, 1206_190	CGA5L1X7R1V106K160AC	TDK
R3	0	100k	RES, 100k, 5%, 0.1W, AEC-Q200 Grade 0, 0402	ERJ-2GEJ104X	Panasonic
R4	0	330k	RES, 330k, 1%, 0.1W, AEC-Q200 Grade 0, 0603	ERJ-3EKF3303V	Panasonic

5 Additional Information

5.1 Trademarks

All trademarks are the property of their respective owners.

6 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

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    2.2 TI warrants that the TI EVM will conform to TI's published specifications for ninety (90) days after the date TI delivers such EVM to User. Notwithstanding the foregoing, TI shall not be liable for a nonconforming EVM if (a) the nonconformity was caused by neglect, misuse or mistreatment by an entity other than TI, including improper installation or testing, or for any EVMs that have been altered or modified in any way by an entity other than TI, (b) the nonconformity resulted from User's design, specifications or instructions for such EVMs or improper system design, or (c) User has not paid on time. Testing and other quality control techniques are used to the extent TI deems necessary. TI does not test all parameters of each EVM. User's claims against TI under this Section 2 are void if User fails to notify TI of any apparent defects in the EVMs within ten (10) business days after delivery, or of any hidden defects with ten (10) business days after the defect has been detected.

    2.3 TI's sole liability shall be at its option to repair or replace EVMs that fail to conform to the warranty set forth above, or credit User's account for such EVM. TI's liability under this warranty shall be limited to EVMs that are returned during the warranty period to the address designated by TI and that are determined by TI not to conform to such warranty. If TI elects to repair or replace such EVM, TI shall have a reasonable time to repair such EVM or provide replacements. Repaired EVMs shall be warranted for the remainder of the original warranty period. Replaced EVMs shall be warranted for a new full ninety (90) day warranty period.

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User shall operate the Evaluation Kit within TI's recommended guidelines and any applicable legal or environmental requirements as well as reasonable and customary safeguards. Failure to set up and/or operate the Evaluation Kit within TI's recommended guidelines may result in personal injury or death or property damage. Proper set up entails following TI's instructions for electrical ratings of interface circuits such as input, output and electrical loads.

NOTE:
EXPOSURE TO ELECTROSTATIC DISCHARGE (ESD) MAY CAUSE DEGREDATION OR FAILURE OF THE EVALUATION KIT; TI RECOMMENDS STORAGE OF THE EVALUATION KIT IN A PROTECTIVE ESD BAG.

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3.1 *United States*

3.1.1 *Notice applicable to EVMs not FCC-Approved:*

FCC NOTICE: This kit is designed to allow product developers to evaluate electronic components, circuitry, or software associated with the kit to determine whether to incorporate such items in a finished product and software developers to write software applications for use with the end product. This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of this chapter, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter.

3.1.2 *For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant:*

CAUTION

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC Interference Statement for Class A EVM devices

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC Interference Statement for Class B EVM devices

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- *Reorient or relocate the receiving antenna.*
- *Increase the separation between the equipment and receiver.*
- *Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.*
- *Consult the dealer or an experienced radio/TV technician for help.*

3.2 *Canada*

3.2.1 *For EVMs issued with an Industry Canada Certificate of Conformance to RSS-210 or RSS-247*

Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-exempt RSSs. Operation is subject to the following two conditions:

(1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Concernant les EVMs avec appareils radio:

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Concerning EVMs Including Detachable Antennas:

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication. This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Concernant les EVMs avec antennes détachables

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante. Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d'usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur

3.3   *Japan*

  3.3.1   *Notice for EVMs delivered in Japan:* Please see http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_01.page 日本国内に輸入される評価用キット、ボードについては、次のところをご覧ください。

    https://www.ti.com/ja-jp/legal/notice-for-evaluation-kits-delivered-in-japan.html

  3.3.2   *Notice for Users of EVMs Considered "Radio Frequency Products" in Japan:* EVMs entering Japan may not be certified by TI as conforming to Technical Regulations of Radio Law of Japan.

If User uses EVMs in Japan, not certified to Technical Regulations of Radio Law of Japan, User is required to follow the instructions set forth by Radio Law of Japan, which includes, but is not limited to, the instructions below with respect to EVMs (which for the avoidance of doubt are stated strictly for convenience and should be verified by User):

1.   Use EVMs in a shielded room or any other test facility as defined in the notification #173 issued by Ministry of Internal Affairs and Communications on March 28, 2006, based on Sub-section 1.1 of Article 6 of the Ministry's Rule for Enforcement of Radio Law of Japan,

2.   Use EVMs only after User obtains the license of Test Radio Station as provided in Radio Law of Japan with respect to EVMs, or

3.   Use of EVMs only after User obtains the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to EVMs. Also, do not transfer EVMs, unless User gives the same notice above to the transferee. Please note that if User does not follow the instructions above, User will be subject to penalties of Radio Law of Japan.

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1.   電波法施行規則第6条第1項第1号に基づく平成18年3月28日総務省告示第173号で定められた電波暗室等の試験設備でご使用いただく。

2.   実験局の免許を取得後ご使用いただく。

3.   技術基準適合証明を取得後ご使用いただく。

なお、本製品は、上記の「ご使用にあたっての注意」を譲渡先、移転先に通知しない限り、譲渡、移転できないものとします。

         上記を遵守頂けない場合は、電波法の罰則が適用される可能性があることをご留意ください。 日本テキサス・イ

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  3.3.3   *Notice for EVMs for Power Line Communication:* Please see http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_02.page

    電力線搬送波通信についての開発キットをお使いになる際の注意事項については、次のところをご覧ください。https://www.ti.com/ja-jp/legal/notice-for-evaluation-kits-for-power-line-communication.html

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  3.4.1   *For EVMs subject to EU Directive 2014/30/EU (Electromagnetic Compatibility Directive)*:

    This is a class A product intended for use in environments other than domestic environments that are connected to a low-voltage power-supply network that supplies buildings used for domestic purposes. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

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    4.2   User must read and apply the user guide and other available documentation provided by TI regarding the EVM prior to handling or using the EVM, including without limitation any warning or restriction notices. The notices contain important safety information related to, for example, temperatures and voltages.

    4.3   *Safety-Related Warnings and Restrictions:*

        4.3.1   User shall operate the EVM within TI's recommended specifications and environmental considerations stated in the user guide, other available documentation provided by TI, and any other applicable requirements and employ reasonable and customary safeguards. Exceeding the specified performance ratings and specifications (including but not limited to input and output voltage, current, power, and environmental ranges) for the EVM may cause personal injury or death, or property damage. If there are questions concerning performance ratings and specifications, User should contact a TI field representative prior to connecting interface electronics including input power and intended loads. Any loads applied outside of the specified output range may also result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM user guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative. During normal operation, even with the inputs and outputs kept within the specified allowable ranges, some circuit components may have elevated case temperatures. These components include but are not limited to linear regulators, switching transistors, pass transistors, current sense resistors, and heat sinks, which can be identified using the information in the associated documentation. When working with the EVM, please be aware that the EVM may become very warm.

        4.3.2   EVMs are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems. User assumes all responsibility and liability for proper and safe handling and use of the EVM by User or its employees, affiliates, contractors or designees. User assumes all responsibility and liability to ensure that any interfaces (electronic and/or mechanical) between the EVM and any human body are designed with suitable isolation and means to safely limit accessible leakage currents to minimize the risk of electrical shock hazard. User assumes all responsibility and liability for any improper or unsafe handling or use of the EVM by User or its employees, affiliates, contractors or designees.

    4.4   User assumes all responsibility and liability to determine whether the EVM is subject to any applicable international, federal, state, or local laws and regulations related to User's handling and use of the EVM and, if applicable, User assumes all responsibility and liability for compliance in all respects with such laws and regulations. User assumes all responsibility and liability for proper disposal and recycling of the EVM consistent with all applicable international, federal, state, and local requirements.

5.   *Accuracy of Information:* To the extent TI provides information on the availability and function of EVMs, TI attempts to be as accurate as possible. However, TI does not warrant the accuracy of EVM descriptions, EVM availability or other information on its websites as accurate, complete, reliable, current, or error-free.

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