TPS2291xxEVM-656

This user's guide describes the characteristics, operation, and use of the TPS2291xxEVM-656 evaluation module (EVM). This EVM demonstrates the Texas Instruments TPS2291xx load switch with controlled turn on. The device contains a P-channel MOSFET that can operate over an input voltage of 1.4V to 5.5V. The switch is controlled by an on/off input (ON), which is capable of interfacing directly with low-voltage control signals. This user's guide includes setup instructions, schematic diagram, bill of materials, and printed-circuit board layout drawings for the EVM.

1 Introduction

The TPS2291xxEVM-656 evaluation module (EVM) helps designers evaluate the operation and performance of the TPS2291xx load switches. The board features the small 4-pin CSP package for a small solution size.

Table 1. TPS22910, TPS22912, TPS22913 Vout Rise Time, Enable, and Discharge Options

EVM	Device	Rise Time (µS) Typ.	VIN(V)	Enable (ON Pin)	Quick Output Discharge
HPA656-001	TPS22910A	0.5	5	Active Low	No
HPA656-0011	TPS22912C	1000	5	Active High	No
HPA656-0014	TPS22913B	100	5	Active High	Yes
HPA656-0015	TPS22913C	1000	5	Active High	Yes

1.1 Related Documentation From Texas Instruments

TPS2291xx, ULTRA-SMALL, LOW r_{ON} LOAD SWITCH data sheet

2 Setup

This section describes the jumpers and connectors on the EVM as well as how to properly connect, set up, and use the TPS2291xxEVM-656.

2.1 J1/J3 – Input Connections

This is the connection for the leads from the input source. Connect the positive connection to the VIN J1 and the negative connection to the GND J3.

2.2 J4/J6 – Output Connections

This is the connection for the output of the TPS2291xxEVM. Connect the positive connection of the load to the VOUT J4 and the negative connection to the GND J6.

2.3 JP3 – ON

This is the enable input for the device. A shorting jumper must be installed on JP3 in either the HI or LO positions. The TPS2291xx family contains products that are active high and active low (refer to Table 1). ON must not be left unconnected. An external enable source can be applied to the EVM by removing the shunt and connecting a signal to the center pin of JP3. Refer to the Datasheet for proper ON and OFF voltage level settings. A switching signal may also be used and connected at this point.

2.4 J2/J5 – V_{IN} Sense and V_{OUT} Sense

These two connectors are used when very accurate measurements of input or output voltage are required. Ron measurements should be made using these sense connections and measuring the voltage drop from VIN to VOUT and then calculating the resistance.

2.5 JP1/JP2 – Input Capacitors

During normal operation a shorting jumper is placed on JP2 and connects C2 capacitor from the input of the device to ground. JP1 and C1 may be used to connect a user selected capacitor value from the input of the device to ground. Refer to the Applications Section of the Datasheet for additional information on selecting the input capacitors.

2.6 JP4/JP5 – Output Capacitors

During normal operation a shorting jumper is placed on JP4 and connects C3 capacitor from the output of the device to ground. JP5 and C4 may be used to connect a user selected capacitor value from the output of the device to ground. Refer to the Applications Section of the Datasheet for additional information on selecting the output capacitors.

2.7 JP6/JP7/JP8 – Output Resistors

During normal operation no shorting jumpers are placed on JP6, JP7, or JP8. A shorting jumper may be used on JP6 to connect R1 load resistor from the output of the device to ground. JP7 and JP8 may be used to connect R2 and R3 user selected load resistors from the output of the device to ground. R1, R2, and R3 are intended for light loads of the output; observe the 1/8W power rating for these parts.

NOTE: R2 is populated on some EVM's with a 14Ω 1/8W resistor, the maximum power rating for this part can be easily exceeded, observe the power rating for R2 if it is populated and used on your EVM.

3 Operation

Connect the positive input of the power supply to the VIN J1 and the negative lead of the power supply to GND J3. The input voltage range of the TPS2291xx is 1.4 V to 5.5 V.

Output load can be applied by connecting between J4 VOUT and J6 GND. The TPS2291xx is rated for a maximum continuous current of 2A. Configure jumper JP3 as required. JP3 must be installed for proper operation. When the ON pin is asserted, the TPS2291xx will control the slew rate of VOUT. The slew rate of the device is internally controlled to avoid inrush current. When ON is deasserted, the TPS2291xx will open the P-Channel MOSFET. Devices equipped with the Quick Output Discharge (QOD) option will connect a 150Ω on-chip load resistor to the output for quick discharge. Devices equipped with the QOD function are noted in Table 1.

4 Test Results

See the *Typical Characteristics* section of the TPS2291xx data sheet.

5 Board Layout, Schematic, and Bill of Materials

This section provides the TPS2291xxEVM-656 board layout, schematic, and bill of materials.

5.1 Board Layout

For best performance, all traces should be as short as possible. To be most effective, the input and output capacitors should be placed close to the device to minimize the effects that parasitic trace inductances may have on normal and short-circuit operation. Using wide traces for V_{IN}, V_{OUT}, and GND helps minimize the parasitic electrical effects along with minimizing the case to ambient thermal impedance Figure 1, Figure 2, and Figure 3 show the board layout for the TPS2291xxEVM-656 PCB.

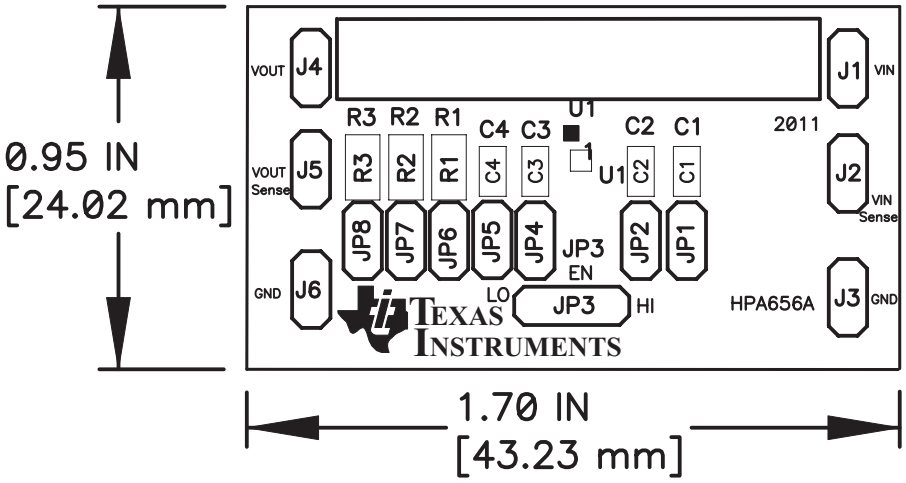

Figure 1. Top Assembly Layer

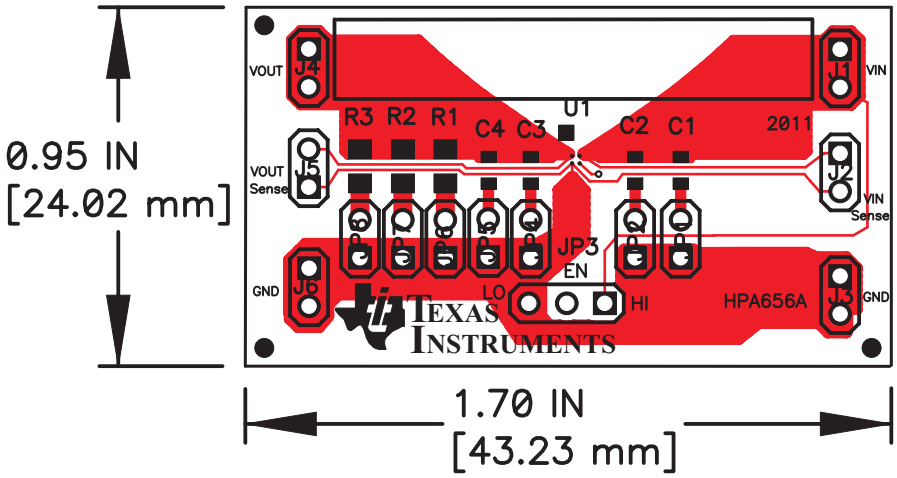

Figure 2. Top Layer

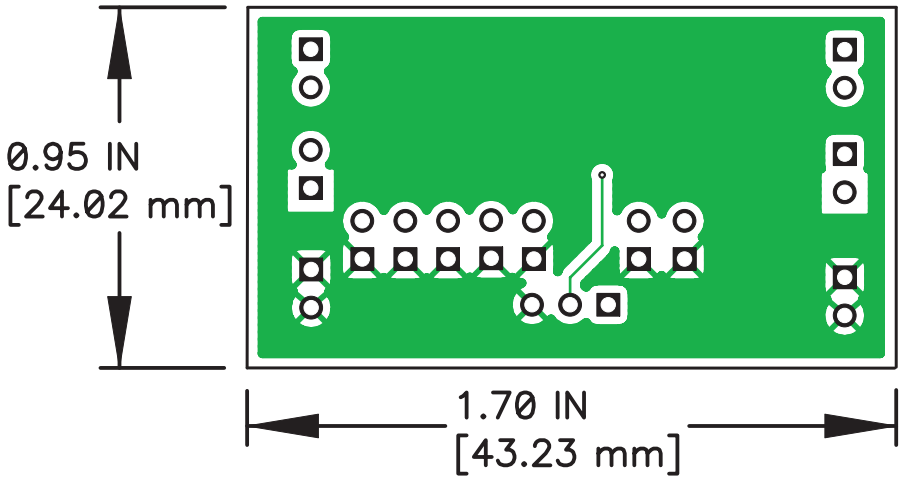

Figure 3. Bottom Layer

5.2 Schematic and Bill of Materials

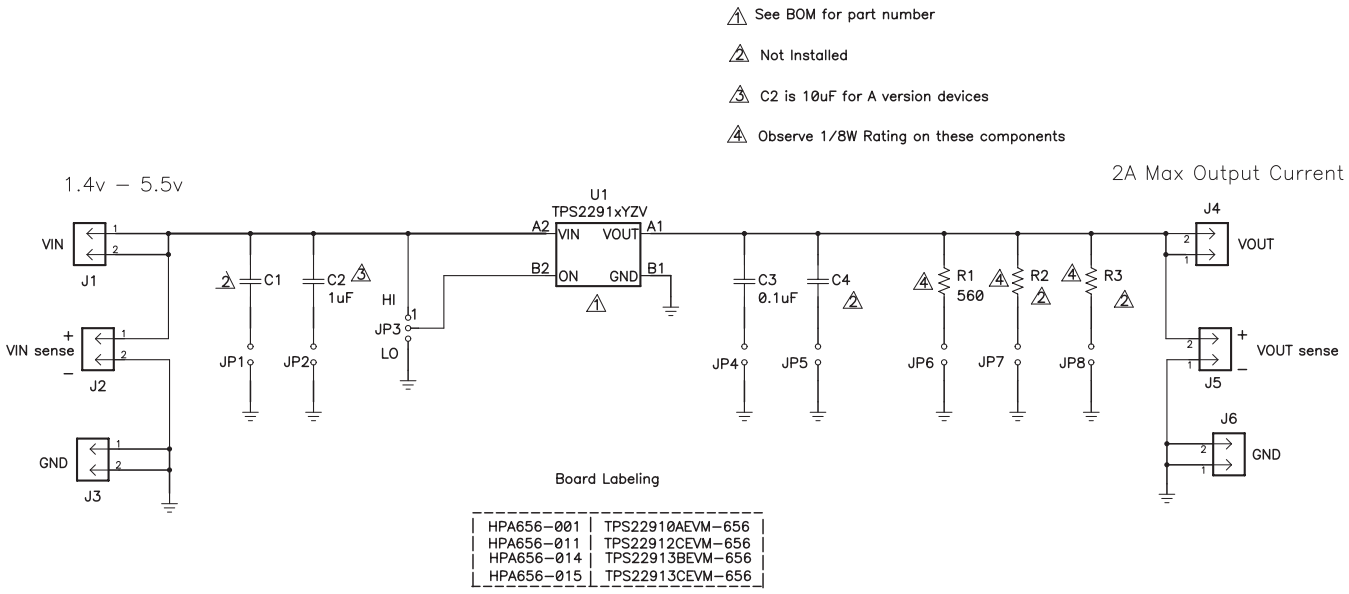

Figure 4. TPS2291xxEVM-656 Schematic

Table 2. Bill of Materials[1] [2] [3] [4]

Count	RefDes	Value	Description	Size	Part Number	MFR
1	–		PCB, 0.9 In x 1.7 In x 0.062 In		HPA656	Any
1	C3	0.1 µF	Capacitor, Ceramic,16-V, X7R, 10%	603	Std	Std
1	C2	1 µF, use 10 µF for A type devices	Capacitor, Ceramic,6.3-V, X5R, 10%	603	Std	Std
0	C1, C4	OPEN	Capacitor, Ceramic	603	Std	Std
1	R1	560 Ω	Resistor, 5% 1/8W	805	Std	Std
1	R2	OPEN	Resistor, 5% 1/8W	805	Std	Std
0	R3	OPEN	Resistor, 5% 1/8W	805	Std	Std
13	J1 – J6, JP1–2, JP4–8	PEC02SAAN	Header,2pin, 100mil spacing	0.100 inch x 2	PEC02SAAN	Sullins
1	JP3	PEC03SAAN	Header,3pin, 100mil spacing IC,	0.100 inch x 3	PEC03SAAN	Sullins
1	U1	TPS2291xxYZPV	Single Chip, Low Input Voltage Current-Limited Load Switch with Shut Off Auto-Restart	YZV	TPS2291xxYZV	TI
3	N/A	N/A	Shunt, 100-mil, Black	0.100	929950-00	3M

(1) These assemblies are ESD sensitive, ESD precautions shall be observed.
(2) These assemblies must be clean and free from flux and all contaminants. Use of no clean flux is not acceptable.
(3) These assemblies must comply with workmanship standards IPC-A-610 Class 2.
(4) Ref designators marked with an asterisk (**) cannot be substituted. All other components can be substituted with equivalent components.

Table 3.

Assembly number	Text
HPA656-001	TPS22910AEVM-656
HPA656-011	TPS22912CEVM-656
HPA656-014	TPS22913BEVM-656
HPA656-015	TPS22913CEVM-656

5.3 VOUT Rise Time Examples

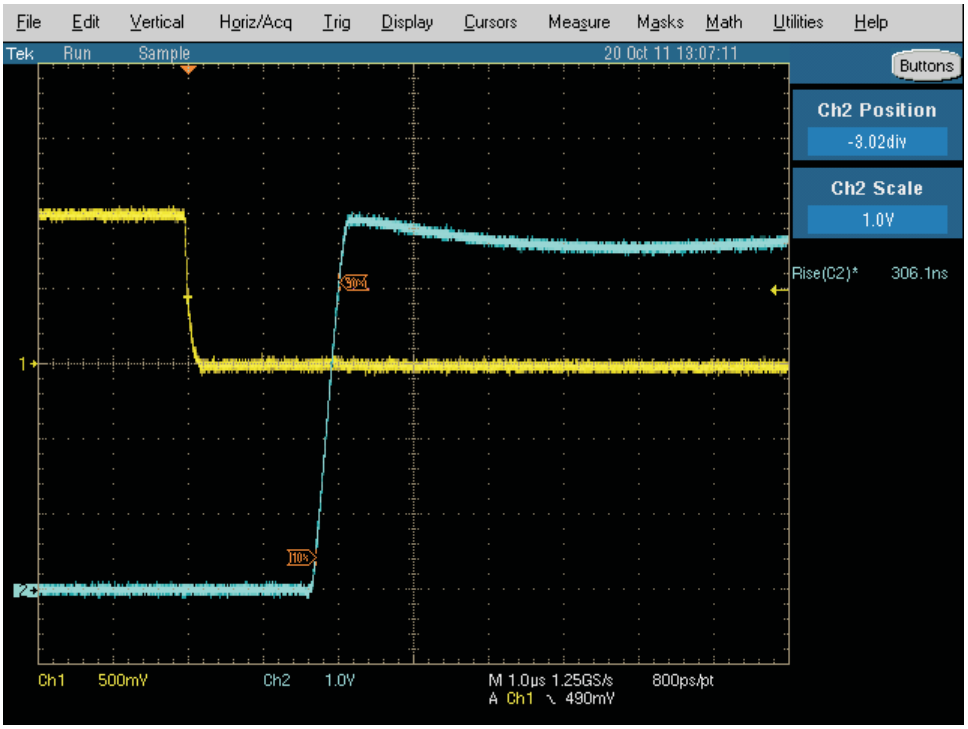

Figure 5. TPS22910A Trise Example

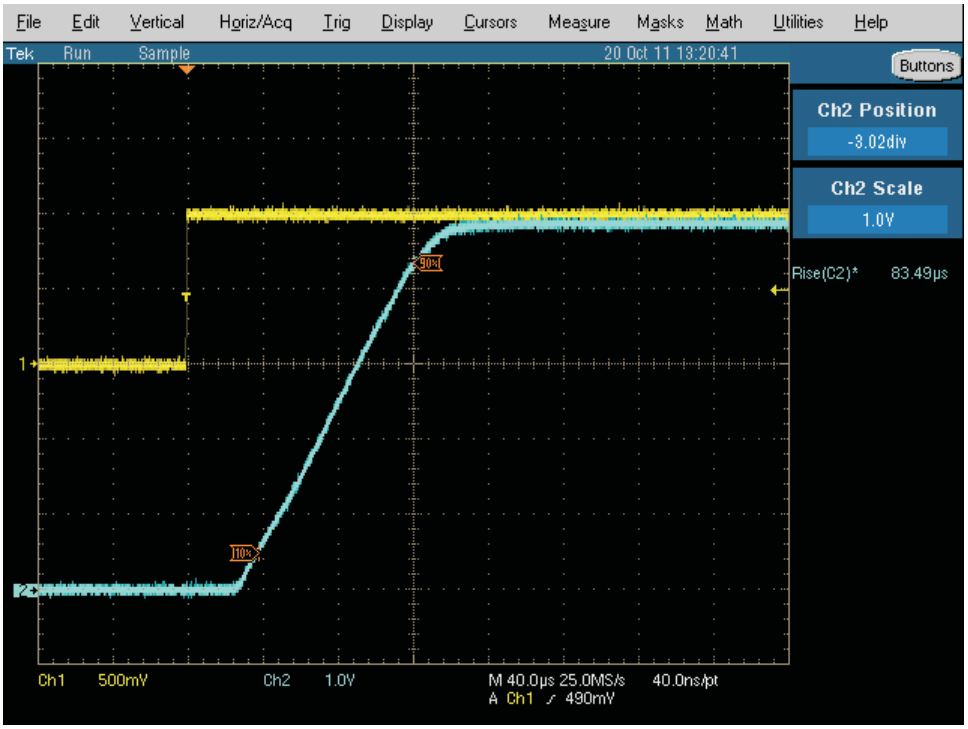

Figure 6. TPS22913B Trise Example

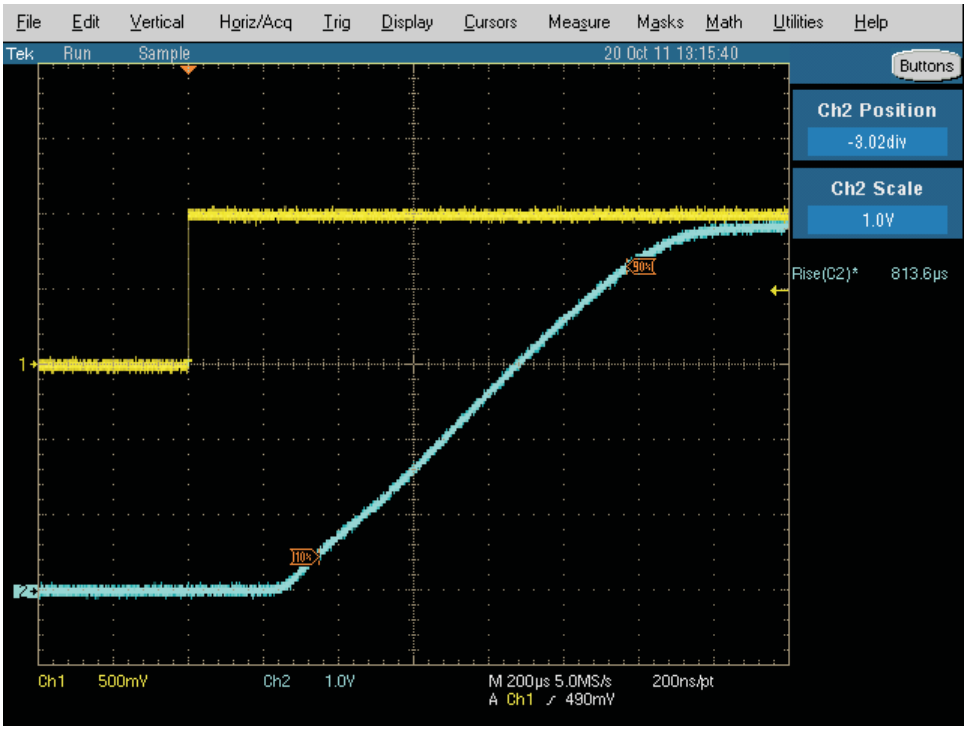

Figure 7. TPS22913C Trise Example

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EVM Warnings and Restrictions

It is important to operate this EVM within the input voltage range of 1.4 V to 5.5 V and the output voltage range of unspecified.

Exceeding the specified input range may cause unexpected operation and/or irreversible damage to the EVM. If there are questions concerning the input range, please contact a TI field representative prior to connecting the input power.

Applying loads outside of the specified output range may result in unintended operation and/or possible permanent damage to the EVM. Please consult the EVM User's 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, some circuit components may have case temperatures greater than 50°C. The EVM is designed to operate properly with certain components above 60°C as long as the input and output ranges are maintained. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors. These types of devices can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during operation, please be aware that these devices may be very warm to the touch.

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