

4.5-V to 18-V Input, 6-A and 3.5-A Dual Synchronous Step-Down Converter Evaluation Module

This document is provided with the TPS65276 PMIC evaluation module (EVM) as a supplement to the TPS65276 data sheet. This user's guide includes the schematic, hardware setup, software installation and bill of materials (BOM).

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1 Introduction

This document presents the information required to operate the TPS65276 PMIC as well as the support documentation including schematic, layout, hardware setup, software installation and bill of materials.

2 Background

The TPS65276 PMIC is designed to provide dual (6 A and 3.5 A) continuous currents with an operational range of 4.5 to 18 V. The TPS65276 features externally programmed switching frequency ranging from 200 kHz to 1.6 MHz, external compensation, soft-start and enable.

As there are many possible options to set the converters, [Table 1](#) presents the performance specification summary for the EVM.

Table 1. Summary of Performance

| Test Conditions | Performance |
|---|----------------------------|
| $V_{IN} = 4.5 \text{ V to } 18 \text{ V}$ | Buck1 : 1.2 V, up to 6 A |
| $f_{sw} = 500 \text{ kHz (25}^\circ\text{C ambient)}$ | Buck2 : 1.8 V, up to 3.5 A |

The EVM is designed to provide access to the features of the TPS65276. Some modifications can be made to this module to test performance at different input and output voltages, current and switching frequency. Contact the TI Field Applications Group for advice on these matters.

3 TPS65276 Schematic

Figure 1 shows the TPS65276 PMIC EVM schematic.

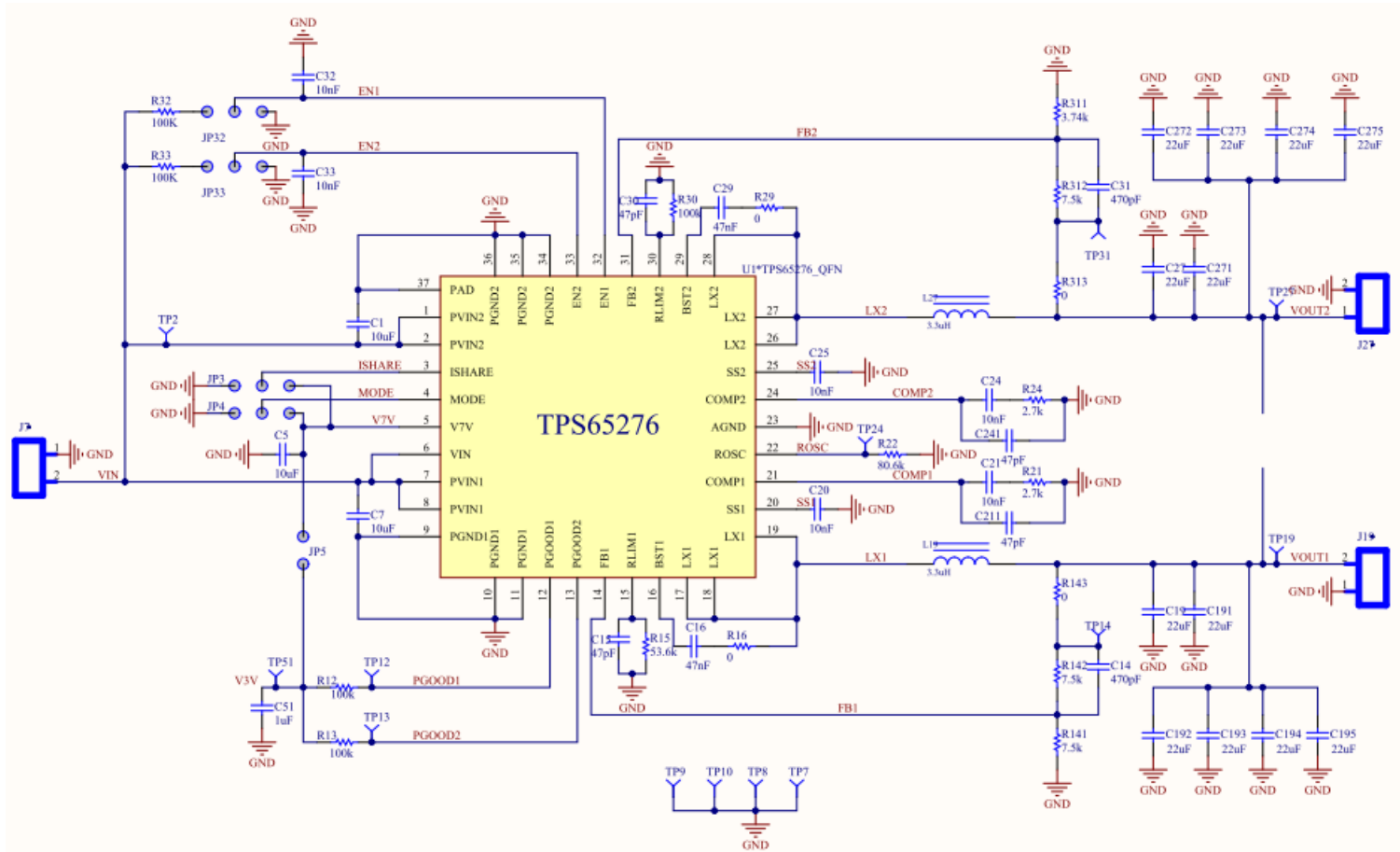


Figure 1. TPS65276 Schematic

4 Board Layout

Figure 2 through Figure 6 illustrate the printed-circuit boards for this EVM.

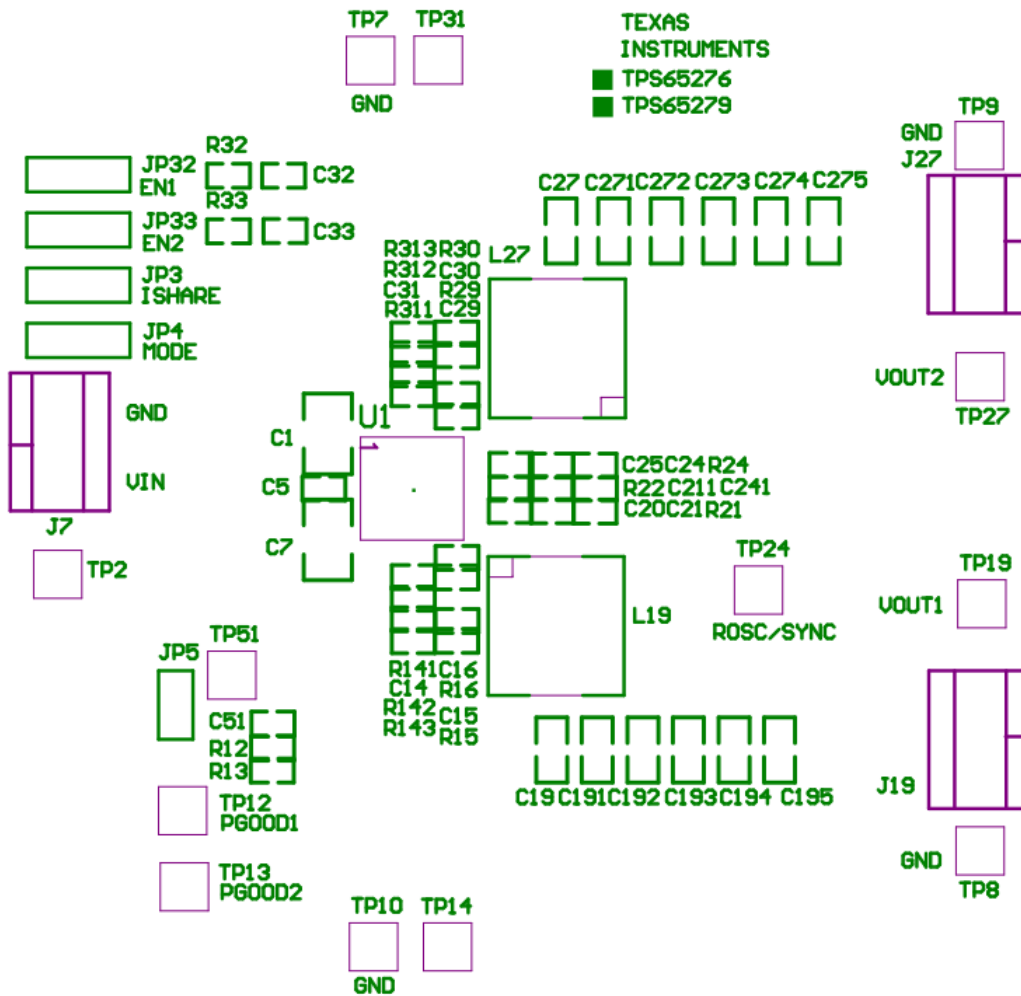


Figure 2. Component Placement (Top Layer)

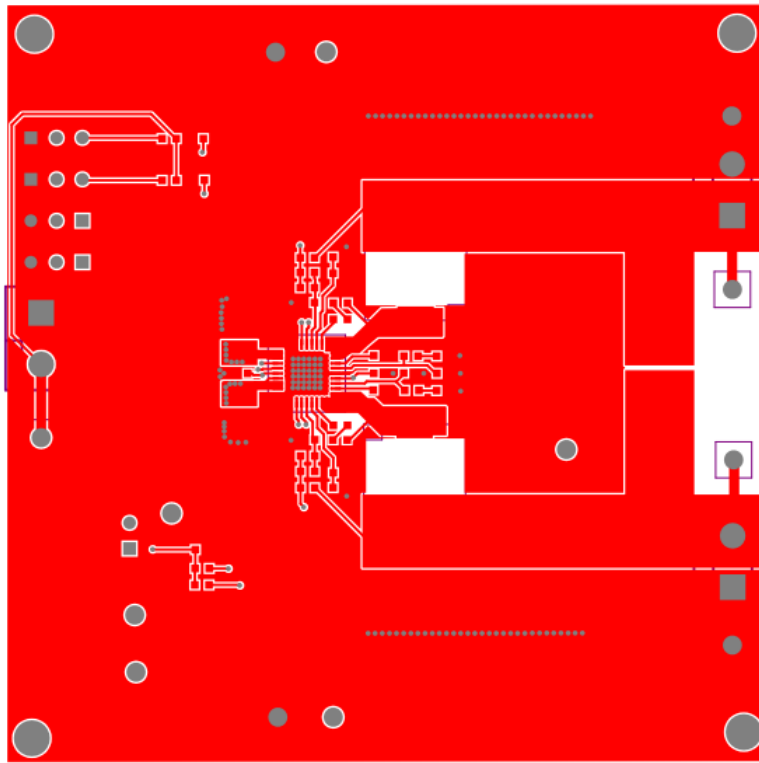


Figure 3. Board Layout (Top Layer)

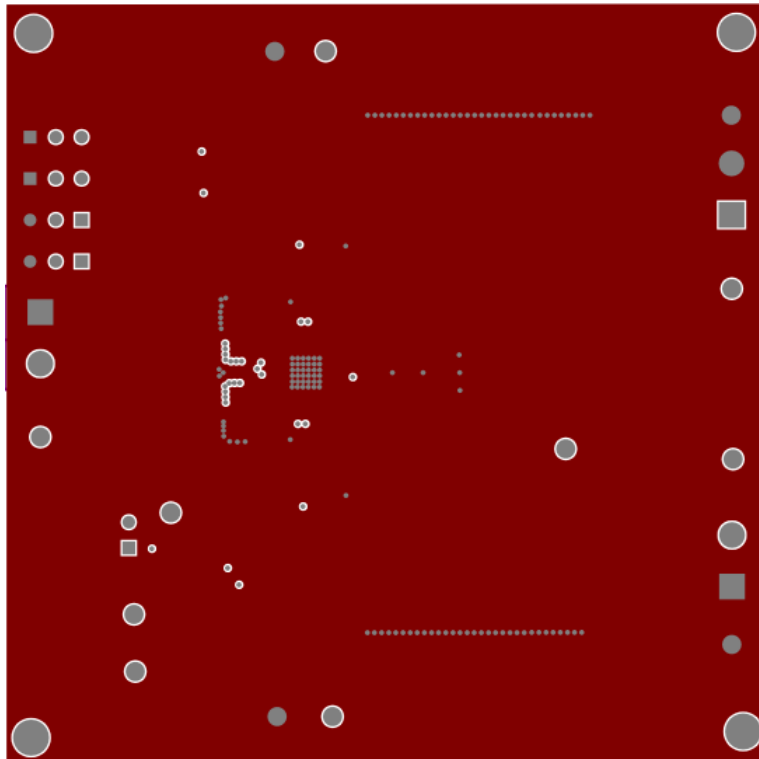


Figure 4. Board Layout (Second Layer)

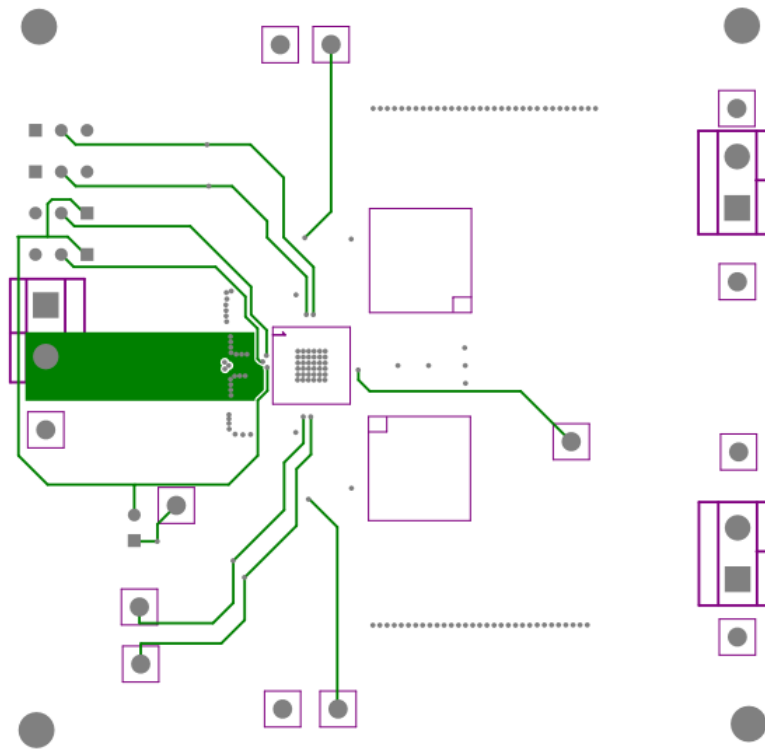


Figure 5. Board Layout (Third Layer)

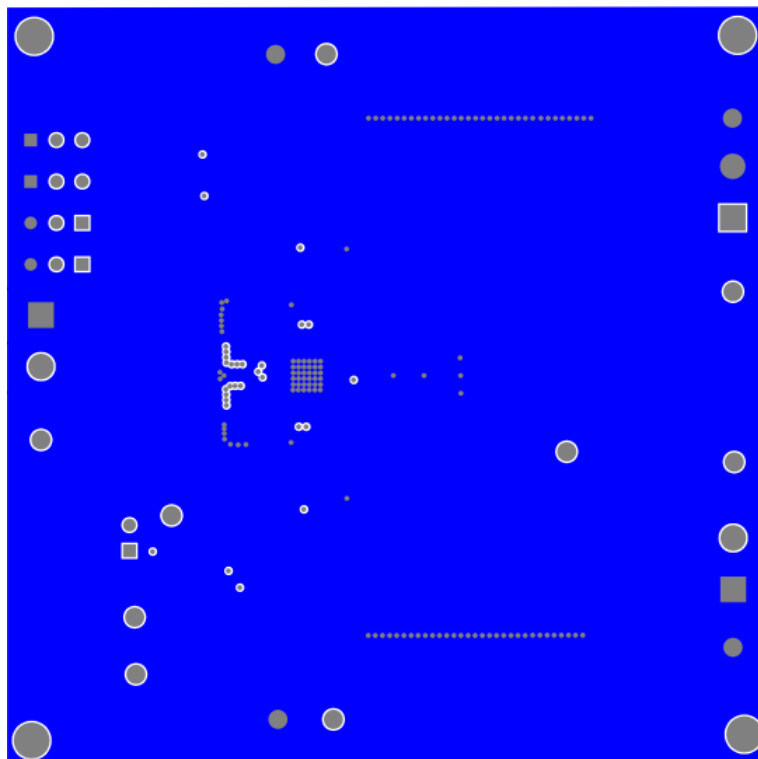
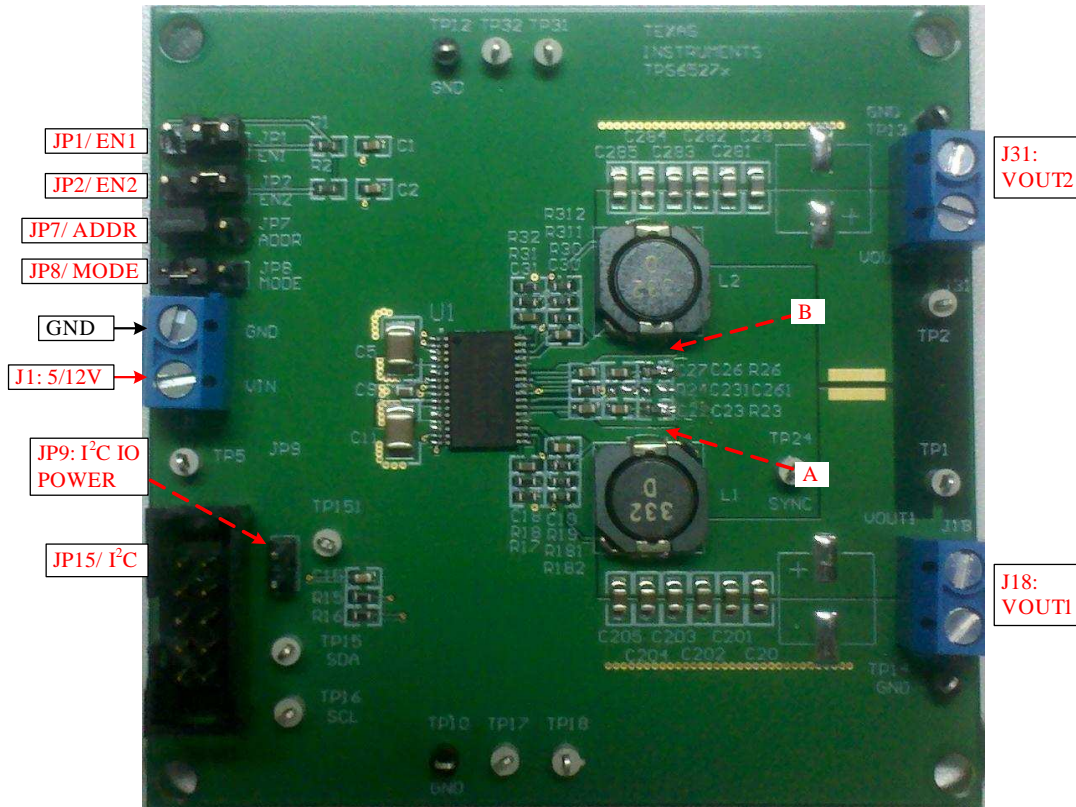


Figure 6. Board Layout (Bottom Layer)

5 Bench Test Setup Conditions

5.1 Header Description and Jumper Placement

Figure 7 illustrates the header description and jumper placement for the EVM.



Test points:
 A: LX of Vout1
 B: LX of Vout2
 Vout1, Vout2

Figure 7. Header Description and Jumper Placement

Table 2 shows the I/O connections for the EVM.

Table 2. Input/Output Connection

| Jumper Number | Function | Description |
|---------------|-----------------|--------------------------------------|
| J1 | Vin Connector | Apply power supply to this connector |
| J18 | Buck1 Connector | Output of Buck1 |
| J31 | Buck2 Connector | Output of Buck2 |

Table 3 shows the jumpers and switches for the EVM.

Table 3. Jumpers and Switches

| Jumper Number | Function | Placement | Comment |
|---------------|--------------------|---|----------------------------|
| JP1 | Buck1 enable (EN1) | Connect EN1 to GND to disable Vout1, connect EN1 to Vin through a 100-kΩ resistor to enable Vout1; Leave open to enable Vout1 | |
| JP2 | Buck2 enable (EN2) | Connect EN2 to GND to disable Vout2, connect EN2 to Vin through a 100-kΩ resistor to enable Vout2; Leave open to enable Vout2 | |
| JP7 | ISHARE | Logic pin to configure current share mode, tie to high to parallel two buck converters, in current share mode, buck 1 will be used; tie to low to run in separate mode. | |
| JP8 | Mode | Operation mode control pin. Connect this pin to GND to set forced PWM mode; leave the pin open to set auto PSM-PWM. | |
| JP15 | PGOOD power | Power connected to the PGOOD pull-up resistor. | On board V_{CC} is 6.25V |

6 Power-Up Procedure

Use the following steps to power-up the EVM:

1. Apply 12 V to J1
2. Toggle JP1 or JP2 to enable Vout1 and Vout2, respectively
3. Apply loads to the output connectors.

7 EVM Bill of Materials

Table 4 is the BOM for the EVM.

Table 4. EVM Bill of Materials

| # | Value | Qty | Designator | Footprint | MFG | MFG Part Number | Description |
|-------------------|-----------------------------|-----|--|---------------|------------------------|----------------------|--|
| 1 | 10nF | 6 | C20, C21, C24, C25, C32, C33 | 0603 | Panasonic -ECG | ECJ-1VB1H103K | CAP 10nF 50V CERAMIC X7R 0603 |
| 2 | 10uF | 2 | C1, C7 | 1210 | Panasonic -ECG | ECJ-4YB1E106M | CAP 10nF 25V CERAMIC X7R 1210 |
| 3 | 10uF | 1 | C5 | 0603 | Panasonic -ECG | ECJ-4YB1E106M | CAP 10UF 10V CERAMIC X5R 0603 |
| 4 | 1uF | 1 | C51 | 0603 | Panasonic -ECG | ECJ-BVB1A105K | CAP 1UF 10V 10% X5R 0603 |
| 5 | 470uF | 2 | C14, C31 | 0603 | Panasonic -ECG | ECJ-1VC1H471J | CAP 470pF 50V CERAMIC X7R 0603 |
| 6 | 47nF | 2 | C16, C29 | 0603 | Panasonic -ECG | ECJ-1VF1H473Z | CAP 47nF 50V CERAMIC X7R 0603 |
| 7 | 22uF | 12 | C19, C27, C191, C192, C193, C194, C195, C271, C272, C273, C274, C275 | 0805 | Panasonic -ECJ | ECJ-2F60J226M | CAP CER 22F 6.3V 20% X6S 0805 |
| 8 | 470uF | | C204, C284 | E_CAP_D8_L6.7 | Nichicon | RHA0J471MCN1GS | CAP ALUM 470UF 6.3V 20% SMD |
| 9 | 47pF | 2 | C15, C30 | 0603 | Panasonic -ECJ | ECJ-0EC1H470 | CAP 47pF 50V CERAMIC X7R 0603 |
| 10 | 47pF | | C211, C241 | 0603 | Panasonic -ECJ | ECJ-0EC1H470 | CAP 47pF 50V CERAMIC X7R 0603 |
| 11 | ED500/2DS | 3 | J1, J19, J27 | TB_2X5.0MM | OnShore Technology Inc | ED500/2DS | Terminal Block, 2-pin, 15-A, 5.0mm |
| 12 | HEADER 3 PIN ⁽¹⁾ | 4 | JP3, JP4, JP32, JP33 | JMP0.3 | Mil-Max | 800-10-064-10-001000 | Three Pin Header, Break SIPs into groups of 3 |
| 13 | HEADER 2 PIN ⁽¹⁾ | 1 | JP5 | JMP0.2 | Mil-Max | 800-10-064-10-001000 | Two Pin Header, Break SIPs into groups of 2 |
| 14 | 3.3uH | 2 | L19, L27 | IND3 | Coilcraft | MSS1048-332NLB | SMT power inductor |
| 15 | 100K | 5 | R12, R13, R30, R32, R33 | 0603 | Panasonic -ECG | ERJ-3EKF1003V | RES 100k OHM 1/10W 1% 0603 SMD |
| 16 | 80.6k | 1 | R22 | 0603 | Panasonic -ECG | ERJ-3EKF8062V | RES 80.6k OHM 1/10W 1% 0603 SMD |
| 17 | 53.6k | 1 | R15 | 0603 | Panasonic -ECG | ERJ-3EKF5362V | RES 53.6k OHM 1/10W 1% 0603 SMD |
| 18 | 7.5k | 3 | R141, R142, R312 | 0603 | Panasonic -ECG | ERJ-3EKF7501V | RES 7.5k OHM 1/10W 1% 0603 SMD |
| 19 | 3.74k | 1 | R311 | 0603 | Panasonic -ECG | ERJ-3EKF3741V | RES 3.74k OHM 1/10W 1% 0603 SMD |
| 20 | 0 | 4 | R16, R29, R143, R313 | 0603 | Panasonic -ECG | ERJ-3GEY0R00V | RES 0 OHM 1/10W 1% 0603 SMD |
| 21 | 2.7k | 2 | R21, R24 | 0603 | Panasonic -ECG | ERJ-3EKF2701V | RES 2.70K OHM 1/10W 1% 0603 SMD |
| 22 | Test Point White | 9 | TP2, TP12, TP13, TP14, TP19, TP24, TP27, TP31, TP51 | TP | Keystone | 5002 | TEST POINT PC MINI .040"D WHITE |
| 23 | Test Point Black | 4 | TP7, TP8, TP9, TP10 | TP | Keystone | 5001 | TEST POINT PC MINI .040"D BLACK |
| 24 | | 5 | | | | | Jumper, 2.54mm, open top, Applied on item 12, 13 |
| 25 ⁽²⁾ | | 4 | | | 3M | SJ-5303 (CLEAR) | BUMPON HEMISPHERE .44X.20 CLEAR |
| 26 | | 1 | U1 | | Texas Instruments | TPS65276RHHR | |

⁽¹⁾ Item 12: split into 3 pins

⁽²⁾ Install item 25 on bottom at corners

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- 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.

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Les changements ou les modifications pas expressément approuvés par la partie responsable de la conformité ont pu vider l'autorité de l'utilisateur pour actionner l'équipement.

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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.

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2. Use this product only after you obtained the license of Test Radio Station as provided in Radio Law of Japan with respect to this product, or
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