# *EV2667-G-00A*
## Evaluation Board of 1A Linear Charger with Power Path Management for Single-Cell Li-Ion Battery in QFN Package

## DESCRIPTION

The EV2667-G-00A is an evaluation board for the MP2667, a highly-integrated single-cell Li-Ion/Li-Polymer battery charger with system power path management, targeted at space limited portable applications. It takes input power from either an AC adapter or a USB port to supply the system load and charge the battery independently. The charger section features constant current pre charge (PRE.C), constant current fast charge (CC), constant voltage (CV) regulation, charge termination, and charge status.

EV2667 ensures the continuous power to the system by automatically selecting the input, the battery or both to power the system.

EV2667 provides system short circuit protection to prevent the Li-Ion battery from being damaged due to excessive high current.

EV2667 cuts off the path between battery and system when battery UVLO to prevent the Li-Ion battery from being overly discharged.

Through the I2C connector on EV2667, the customer can program the charging parameters, such as: input current limit, input minimum voltage regulation, charging current, battery regulation voltage, and battery UVLO.

## FEATURES

- Fully Autonomous Charger for Single-Cell Li-Ion/Polymer Batteries
- Current Limit for USB Port
- Complete Power Path Management for Simultaneously Powering the System and Charging the Battery
- ±0.5% Charging Voltage Accuracy
- 13V Maximum Voltage for the Input Source
- I²C Interface for Setting charging Parameters and Status Reporting
- Robust Charging Protection Including Battery Temperature Monitor and Programmable Timer
- Battery Disconnection Function

## APPLICATIONS

- Wearable devices
- Smart Handheld Devices
- Fitness Accessories
- Smart Watches

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## ELECTRICAL SPECIFICATION

| Parameter | Symbol | Value | Units |
|---|---|---|---|
| Input Voltage | $V_{IN}$ | 4.35 - 5.5 | V |
| Battery Voltage | $V_{BATT}$ | 3.60 - 4.545 | V |
| Input Current Limit | $I_{IN\_LIM}$ | 77- 993 | mA |
| Input Minimum Voltage Regulation | $V_{IN\_MIN}$ | 3.88 -5.08 | V |
| Fast Charge Current | $I_{CC}$ | 26 - 1049 | mA |
| Discharge Current | $I_{DSCHG}$ | 100 - 1600 | mA |

EV2667-G-00A – LINEAR CHARGER WITH POWER PATH MANAGEMENT EV BOARD

# EV2667-G-00A EVALUATION BOARD



**(L x W x H) 2.5" x2.5"x 0.063"**
**(6.35cm x 6.35cm x 0.16cm)**

| Board Number | MPS IC Number |
|---|---|
| EV2667-G-00A | MP2667GG-xxxx* |

*: "xxxx" is the register setting option. The factory default is "0000". This content can be viewed in I²C register map. For customer options, please contact an MPS FAE to obtain an "xxxx" value.
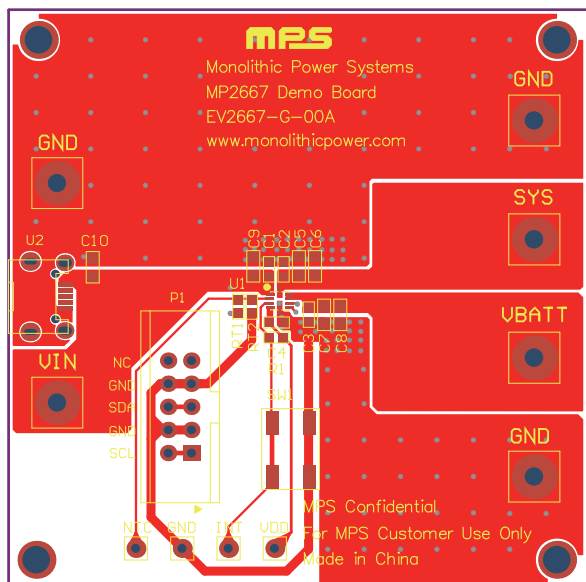
EV2667-G-00A – LINEAR CHARGER WITH POWER PATH MANAGEMENT EV BOARD

# EVALUATION BOARD SCHEMATIC
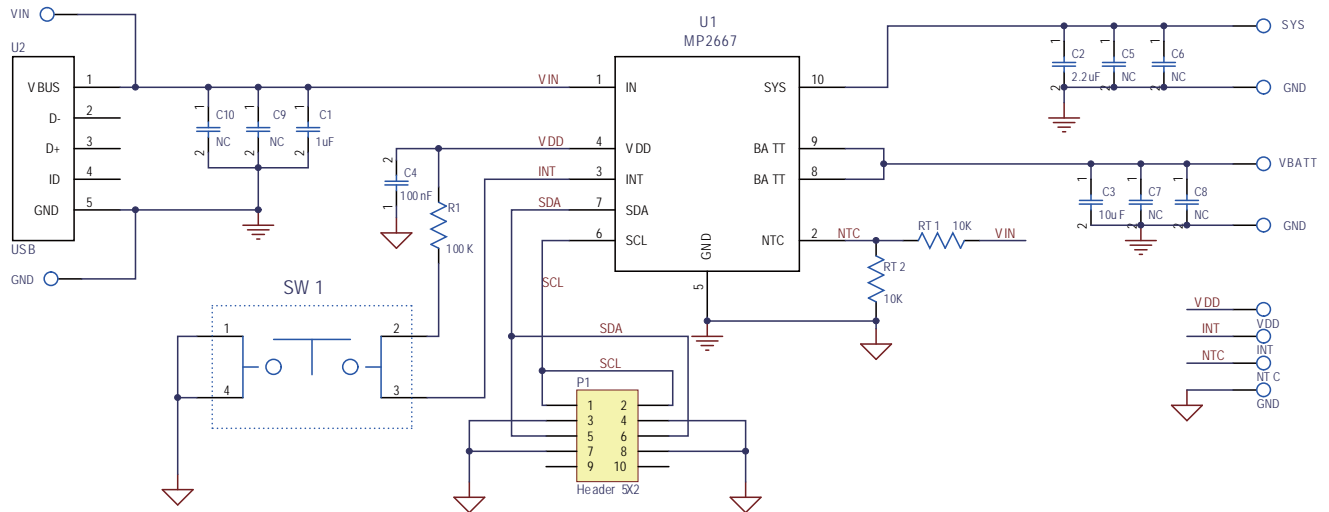


# EV2667-G-00A BILL OF MATERIALS

| Qty | Ref | Value | Description | Package | Manufacture | Manufacture_PN |
|---|---|---|---|---|---|---|
| 1 | C1 | 1µF | Ceramic Capacitor;25V;X7R;0603; | 0603 | muRata | GRM188R71E105KA12D |
| 1 | C2 | 2.2µF | Capacitor;16V;X5R | 0603 | muRata | GRM188R61C225KE15D |
| 1 | C3 | 10µF | Capacitor;16V;X5R | 0603 | muRata | GRM188R61C106KAALD |
| 1 | C4 | 100nF | Ceramic Capacitor;50V;X7R | 0603 | Murata | GCJ188R71H104KA12D |
| 4 | C5, C6, C7, C8 | NC | Ceramic Capacitor;16V;X7R;0805 | 0805 | muRata | GRM21BR71C475KA73L |
| 2 | C9, C10 | NC | Ceramic Capacitor;25V;X7R;0805; | 0805 | muRata | GRM21BR71E225KA73L |
| 1 | P1 | | Header, 5-Pin, Dual row | | | |
| 1 | R1 | 100kΩ | Film Resistor;1%; | 0603 | Yageo | RC0603FR-07100KL |
| 2 | RT1, RT2 | 10kΩ | Film Resistor;1%; | 0603 | Yageo | RC0603FR-0710KL |
| 1 | U2 | | Micro-B USB connector; | | | |
| 1 | U1 | | 2X2mm | QFN-10 | MPS | MP2667GG-xxxx |

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# PRINTED CIRCUIT BOARD LAYOUT



**Figure 1: Top Layer**
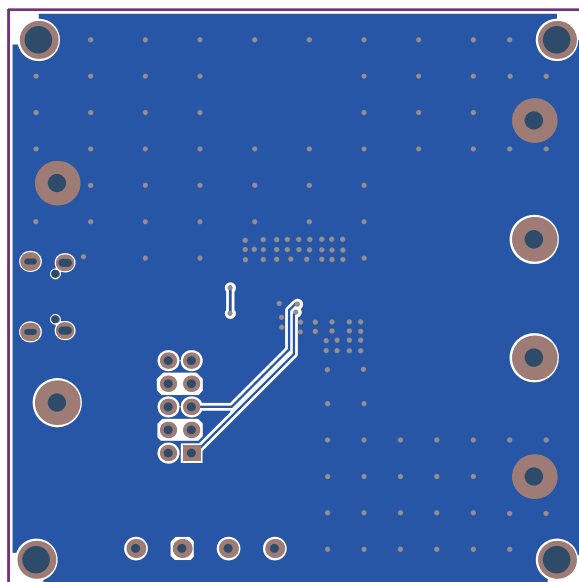


**Figure 2: Bottom Layer**



**Figure 3: Top Silk Layer**

 EV2667-G-00A – LINEAR CHARGER WITH POWER PATH MANAGEMENT EV BOARD
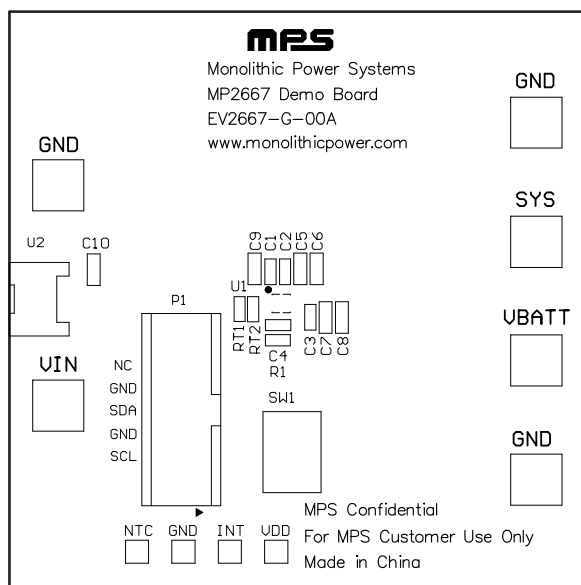
# QUICK START GUIDE

This board is designed for MP2667 which is a highly-integrated single-cell Li-Ion/Li-Polymer battery charger with system power path management function. And layout accommodates most commonly used capacitors. The default function of this board is preset for charger mode and the charge full voltage is preset to 4.200V for 1 cell Li-Ion battery.

Evaluation Platform Preparation:

1) A computer with at least one USB port and a USB cable. The MP2667 evaluation software must be properly installed.

2) USB-to-I²C Communication Kit (EVKT-USBI2C-02)



**Figure 4: USB-to-I²C Communication Kit**

3) Software - Double-click on the "MP2667 Evaluation Kit" EXE file to run the MP2667 evaluation software. The software supports the Windows® XP and Windows 7 operating systems.

The MP2667 Evaluation Kit EXE file is available on MPS website:

http://hz-coc-ebench/InstallationlFile.aspx?categoryID=7



**Figure 5: MP2667 Evaluation Kit EXE file on Ebench**

4) Original Test Setup for MP2667 in Figure6

Attach the input voltage ($V_{IN}$=5V) and the input ground to the VIN and GND pins, respectively.

Attach the positive and negative ends of the load to the SYS and GND pins, respectively.

Attach the positive and negative ends of the battery ($V_{BATT}$=3 - 4.2V) to the BATT and GND pins, respectively.
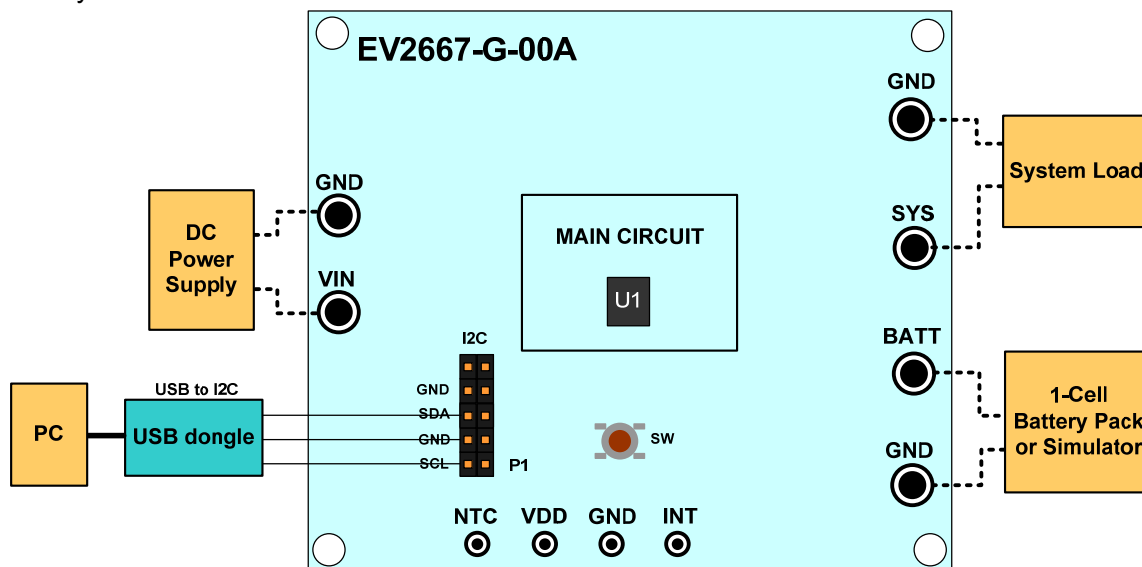


**Figure 6: Test Setup for MP2667**

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5) Turn on the computer. Launch the MP2667 evaluation software. The main window of the software is shown in Figure 7.



**Figure 7: MP2667 evaluation interface**

**Procedure**

**Make sure all the connections are normal – both the USB-to-I2C Communication Kit and the EV2667-G-00A are connected correctly. It is ready to run the program!**

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**Charger Function**

```
┌─────────── Charge Operation Control ───────────┐
│  Input Minimum Voltage(Vin_MIN)   [4.60V      ▼] │
│                                                  │
│  Input Current Limit (Iin_LIM)    [470mA      ▼] │
│                                                  │
│  Fast Charge Current (ICC)        [257mA      ▼] │
│                                                  │
│  Battery UVLO Threshold(Vbatt_UVLO) [2.8V     ▼] │
│                                                  │
│  Terminal Current(ITERM)          [52mA       ▼] │
│                                                  │
│  Battery Regulation Voltage(Vbatt_REG) [4.200V ▼]│
│                                                  │
│  Pre Charge to Fast Charge(Vbatt_PRE) [3.0V   ▼] │
│                                                  │
│  Battery Recharge Threshold(VRECH) [Vbatt_REG-300mV ▼]│
│                                                  │
│  Discharge Current Limit(IDSCHG)  [1000mA     ▼] │
│                                                  │
│        ☑ EN_TERM        ☐ TERM_TMR               │
└──────────────────────────────────────────────────┘
```
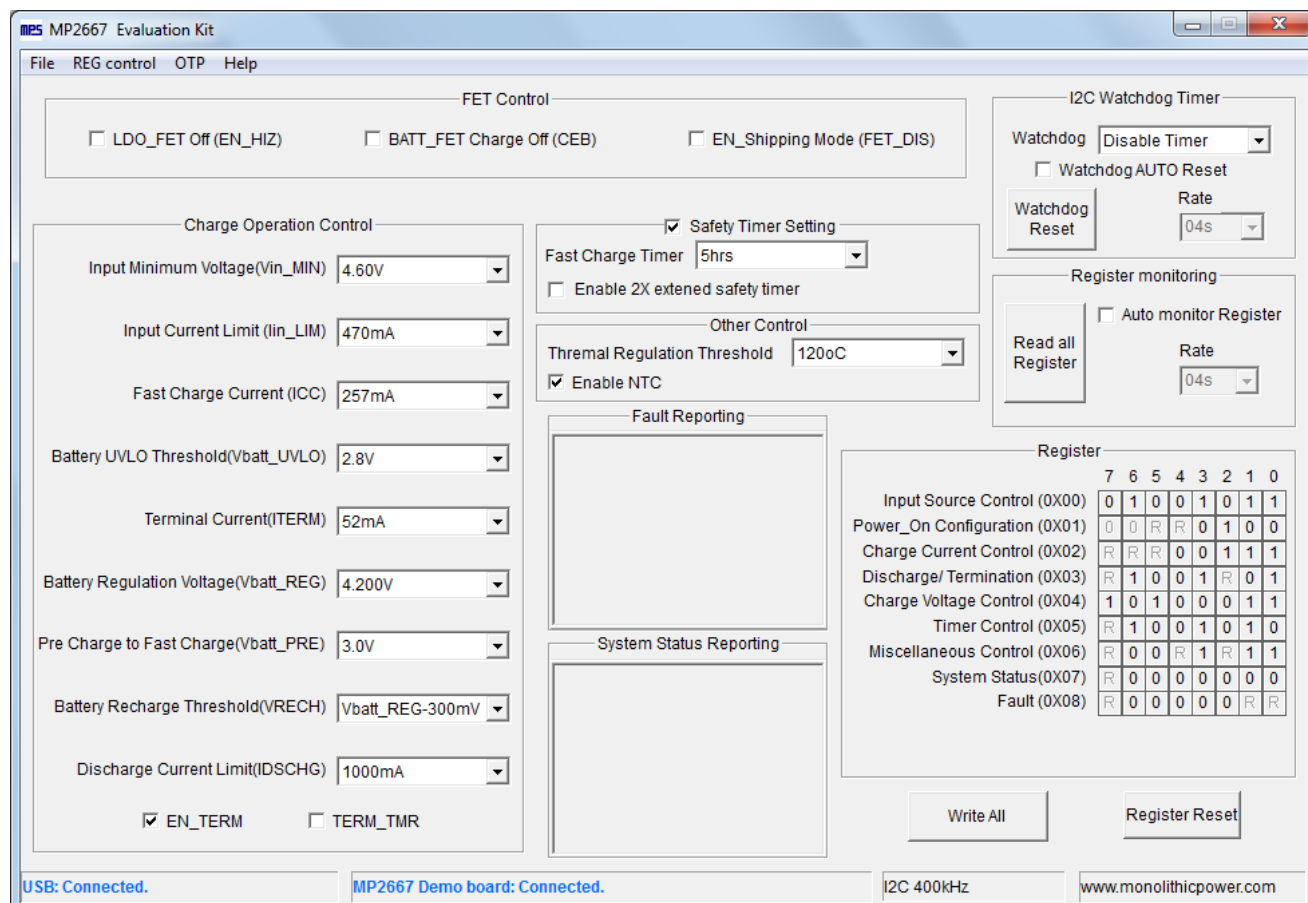
1. Set Input Minimum Voltage at 4.60 V (the range is 3.88 - 5.08V)

```
Input Minimum Voltage(Vin_MIN)  [4.60V        ▼]
                                ┌──────────────┐
                                │ 4.60V        ▲│
                                │ 4.68V        ││
                                │ 4.76V        ││
                                │ 4.84V        ││
                                │ 4.92V        ▓│
                                │ 5.00V        ││
                                │ 5.08V        ▼│
                                └──────────────┘
```

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2. Set Input Current Limit to 470mA (the range is 77 – 993mA)

Input Current Limit (Iin_LIM) | 470mA
- 118mA
- 345mA
- 470mA
- 540mA
- 635mA
- 734mA
- 993mA

3. Set Fast Charge Current to 257mA (the range is 26 – 1049mA)

Fast Charge Current (ICC) | 257mA
- 257mA
- 290mA
- 323mA
- 356mA
- 389mA
- 422mA
- 455mA
- 488mA
- 521mA
- 554mA
- 587mA

4. Set BATT UVLO threshold to 2.8V (the range is 2.4 – 3.1V)

Battery UVLO Threshold(Vbatt_UVLO) | 2.8V
- 2.7V
- 2.8V
- 2.9V
- 3.0V
- 3.1V

5. Set Charge Terminal Current to 52mA (the range is 24 – 108mA)

Terminal Current(ITERM) | 52mA
- 24mA
- 52mA
- 80mA
- 108mA

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6. Set Battery Regulation Voltage to 4.200V (the range is 3.6 - 4.545V)

Battery Regulation Voltage(Vbatt_REG) 4.200V
- 4.200V
- 4.215V
- 4.230V
- 4.245V
- 4.260V
- 4.275V
- 4.290V
- 4.305V
- 4.320V
- 4.335V
- 4.350V

7. Set Pre - Charge to Fast Charge Threshold Voltage to 3.0 V (the range is 2.8 – 3.0V)

Pre Charge to Fast Charge(Vbatt_PRE) 3.0V
- 2.8V
- 3.0V

8. Set Battery Auto-recharge Voltage to $V_{BATT\_REG}$ – 300mV (the range is 150mV or 300mV)

Battery Recharge Threshold(VRECH) Vbatt_REG-300mV
- Vbatt_REG-150mV
- Vbatt_REG-300mV

9. Set Battery Discharge Current Limit to 1000mA (the range is 100mA to 1600mA):

Discharge Current Limit(IDSCHG) 1000mA
- 1000mA
- 1100mA
- 1200mA
- 1300mA
- 1400mA

10. Termination Function Select

☑ EN_TERM    ☐ TERM_TMR

**Table 1 Termination Function Selection Table**

| EN_TERM | TERM_TMR | After $I_{BATT}$ hit $I_{TERM}$ in CV mode | |
|---|---|---|---|
| | | Operation | Charge Status |
| ☐ | x | Keep CV Charge | Charge |
| ☑ | ☐ | Charge Done | Charge Done |
| ☑ | ☑ | Keep CV Charge | Charge Done |

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**Others**

1. FET Control:

FET Control

☐ LDO_FET Off (EN_HIZ)     ☐ BATT_FET Charge Off (CEB)     ☐ EN_Shipping Mode (FET_DIS)

EN_HIZ only controls the on/off of the LDO FET.

CEB only control the on/off of the Battery FET in charge mode.

FET_DIS selected could turn off the Battery FET at both charge and discharge mode.
FET_DIS unselected could not turn on Battery FET; pull INT to low by push button could turn on Battery FET when it's turned off by FET_DIS.

2. Other Control.

Other Control

Thremal Regulation Threshold  120oC

☑ Enable NTC

3. Safety Timer Setting

☑ Safety Timer Setting

Fast Charge Timer  5hrs

☐ Enable 2X extened safety timer

4. I$^2$C Watchdog Timer

I2C Watchdog Timer

Watchdog  Disable Timer

☐ Watchdog AUTO Reset

Watchdog Reset          Rate  04s

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5. Resister Auto Monitor

**Register monitoring**

Read all Register

☐ Auto monitor Register

Rate
04s

6. Content of the Registers:

| Register | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Input Source Control (0X00) | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 |
| Power_On Configuration (0X01) | 0 | 0 | R | R | 0 | 1 | 0 | 0 |
| Charge Current Control (0X02) | R | R | R | 0 | 0 | 1 | 1 | 1 |
| Discharge/ Termination (0X03) | R | 1 | 0 | 0 | 1 | R | 0 | 1 |
| Charge Voltage Control (0X04) | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 1 |
| Timer Control (0X05) | R | 1 | 0 | 0 | 1 | 0 | 1 | 0 |
| Miscellaneous Control (0X06) | R | 0 | 0 | R | 1 | R | 1 | 1 |
| System Status(0X07) | R | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Fault (0X08) | R | 0 | 0 | 0 | 0 | 0 | R | R |

7. Monitor the MP2667 operation status and Fault report

**Fault Reporting**

**System Status Reporting**

❖**Notes**❖

**Please contact local FAE to apply:**

1. **The latest datasheet to get the other detailed description on the operation of this part**

2. **The "MP2667 Evaluation Kit" EXE file**