

## Bill of materials

Table 1. AEK-MOT-TK200G1 bill of materials

| Item | Q.ty | Ref.  | Value                                       | Description                         | Manufacturer     | Part Number          |
|------|------|---|---|-------------------------------------|------------------|----------------------|
| 1    | 1    | C1  | 47uF, WCAP-ASLI_D6.3H7.7, 50 V, $\pm 20$ %  | SMD Electrolytic Capacitor          | Würth Elektronik | 865080645012         |
| 2    | 4    | C2, C9, C51, C52  | 10uF, 0805C, 25 V, $\pm 20$ %               | SMD Ceramic Capacitor               | TAIYO YUDEN      | TMK212BC6106MG-T     |
| 3    | 1    | C3  | 220uF, WCAP-ASLI_10x10.5, 50 V, $\pm 20$ %  | SMD Electrolytic Capacitor          | Würth Elektronik | 865080657018         |
| 4    | 5    | C4, C7, C8, C16, C24  | 100nF, 0805C, 100 V, $\pm 10$ %             | SMD Ceramic Capacitor               | Würth Elektronik | 885012207128         |
| 5    | 7    | C5, C10, C67, C70, C73, C78, C79                                | 10nF, 0603C, 25 V, $\pm 10$ %               | SMD Ceramic Capacitor               | TDK              | CGA3E2X7R2A103K080AA |
| 6    | 2    | C6, C11   | 220nF, 0805C, 50 V, $\pm 10$ %              | SMD Ceramic Capacitor               | Würth Elektronik | 885382207008         |
| 7    | 2    | C12, C13  | 2.2uF, 0805C, 25 V, $\pm 10$ %              | SMD Ceramic Capacitor               | Würth Elektronik | 885012207079         |
| 8    | 2    | C14, C15  | 330uF, WCAP-ASLI_D12.5H14, 50 V, $\pm 20$ % | SMD Electrolytic Capacitor          | Würth Elektronik | 865080662019         |
| 9    | 4    | C17, C22, C23, C29  | 10nF, 0805C, 50 V, $\pm 10$ %               | SMD Ceramic Capacitor               | Würth Elektronik | 885012207092         |
| 10   | 8    | C18, C19, C20, C21, C25, C26, C27, C28                          | NM, 0805C                                   | SMD Ceramic Capacitor (not mounted) | -                | -                    |
| 11   | 13   | C30, C41, C42, C47, C48, C55, C56, C61, C64, C66, C69, C72, C75 | 100nF, 0603C, 50 V, $\pm 10$ %              | SMD Ceramic Capacitor               | Würth Elektronik | 885012206095         |

| Item | Q.ty | Ref.  | Value   | Description   | Manufacturer     | Part Number                 |
|------|------|---|---|---|------------------|-----------------------------|
| 12   | 2    | C31,<br>C32   | 22nF, 0805C, 50 V, ±10 %                          | SMD Ceramic Capacitor   | Würth Elektronik | 885012207094                |
| 13   | 10   | C33,<br>C35,<br>C36,<br>C38,<br>C43,<br>C44,<br>C53,<br>C54,<br>C57,<br>C58 | N.M., 0603C                                       | SMD Ceramic Capacitor (not mounted)   | -                | -                           |
| 14   | 2    | C34,<br>C37   | 2.2uF, 0603C, 25 V, ±10 %                         | SMD Ceramic Capacitor   | MURATA           | GRM188C71E225KE11D          |
| 15   | 4    | C39,<br>C40,<br>C45,<br>C46   | 1uF, 0603C, 25 V, ±10 %                           | SMD Ceramic Capacitor   | Würth Elektronik | 885012206076                |
| 16   | 2    | C49,<br>C50   | 47pF, 0603C, 50 V, ±5 %                           | SMD Ceramic Capacitor   | Würth Elektronik | 885012006055                |
| 17   | 1    | C59   | 1uF, 0805C, 50 V, ±10 %                           | SMD Ceramic Capacitor   | Würth Elektronik | 885012207103                |
| 18   | 1    | C60   | 4.7uF, WCAP-<br>CSGP_1210_H=2.5mm, 50 V,<br>±10 % | SMD Electrolytic Capacitor  | Würth Elektronik | 885012209048                |
| 19   | 1    | C62   | 470nF, 0805C, 50 V, ±10 %                         | SMD Ceramic Capacitor   | Würth Elektronik | 885012207102                |
| 20   | 4    | C63,<br>C65,<br>C68,<br>C71   | 47nF, 0603C, 50 V, ±10 %                          | SMD Ceramic Capacitor   | Würth Elektronik | 885012206093                |
| 21   | 1    | C74   | 33pF, 0603C, 50 V, ±5 %                           | SMD Ceramic Capacitor   | Würth Elektronik | 885012006054                |
| 22   | 2    | C76,<br>C77   | 10pF, 0603C, 50 V, ±5 %                           | SMD Ceramic Capacitor   | Würth Elektronik | 885012006051                |
| 23   | 1    | D1  | SM6T36CAY, SMB C2                                 | Automotive 600 W, 30.8 V TVS in SMB   | ST               | <a href="#">SM6T36CAY</a>   |
| 24   | 1    | D2  | LED Red, 2V, WL-SMCW_0805,                        | WL-SMCW SMT Mono-color<br>Chip LED Waterclear,<br>size 0805, Red, 2V,<br>140deg_150080RS75000     | Würth Elektronik | 150080RS75000               |
| 25   | 7    | D3, D4,<br>D8, D9,<br>D10,<br>D11,<br>D12                                   | STTH3R02AFY, SOD128 Flat                          | Automotive 200 V, 3 A ultrafast diode   | ST               | <a href="#">STTH3R02AFY</a> |
| 26   | 1    | D5  | LED Amber, 2V, WL-SMCW_0805                       | WL-SMCW SMT Mono-color<br>Chip LED Waterclear,<br>size 0805, Amber, 2V,<br>140deg_150080AS75000   | Würth Elektronik | 150080AS75000               |
| 27   | 2    | D6, D7  | LED Green, 3.2V, WL-SMCW_0805                     | WL-SMCW SMT Mono-color<br>Chip LED Waterclear,<br>size 0805, Green, 3.2V,<br>140deg_150080GS75000 | Würth Elektronik | 150080GS75000               |
| 28   | 2    | D13,<br>D14   | LED Blue, 3.2V, WL-SMCW_0805                      | WL-SMCW SMT Mono-color<br>Chip LED Waterclear,  | Würth Elektronik | 150080BS75000               |

| Item | Q.ty | Ref.   | Value   | Description  | Manufacturer     | Part Number                |
|------|------|--|---|--|------------------|----------------------------|
|      |      |  |   | size 0805, Blue, 3.2V, 140deg_150080BS75000  |                  |                            |
| 29   | 1    | D15  | 150080YS75000, WL-SMCW_0805                             | WL-SMCW SMT Mono-color Chip LED Waterclear, size 0805, Yellow, 2V, 140deg  | Würth Elektronik | 150080YS75000              |
| 30   | 1    | J1   | 12V, 691213510002                                       | WR-TBL Serie 2135 Horizontal Entry Modular, Rising Cage Clamp, pitch 5.08mm, 2p  | Würth Elektronik | 691213510002               |
| 31   | 4    | J2, J3, J4, J5                                 | 691102710002, 691102710002                              | WR-TBL Serie 102 Horizontal Entry Modular, Pressure Clamp, pitch 5mm, 2p   | Würth Elektronik | 691102710002               |
| 32   | 1    | J6   | 691135710004, 691135710004                              | WR-TBL Serie 1357 Horizontal Cable Entry, Pressure Clamp, THT, pitch 5mm, 4p   | Würth Elektronik | 691135710004               |
| 33   | 1    | J7   | 61201421621, WR-BHD 2.54 mm Male Box Header             | Male Box Header WR-BHD, THT, Vertical, pitch 2.54 mm, 14 pins  | Würth Elektronik | 61201421621                |
| 34   | 2    | JP1, JP3                                       | Header 3x1, WR-PHD 3pin 2.54 mm THT Pin Header          | Header, 3-Pin, Single row  | Würth Elektronik | 61300311121                |
| 35   | 1    | JP2  | Header 2x1, 61300211121                                 | Header, 2-Pin, Single row  | Würth Elektronik | 61300211121                |
| 36   | 4    | M1, M2, M3, M4                                 | Hole 3mm, M3  | Mountig hole, D=3mm  | Würth Elektronik | 970100365                  |
| 37   | 3    | P1, P2, P3                                     | 61300211121   | WR-PHD Pin Header, THT, pitch 2.54mm, Single Row, Vertical, 2p   | Würth Elektronik | 61300211121                |
| 38   | 1    | P4   | 61900211121   | WR-WTB THT Male Vertical Locking Header, pitch 2.54mm, 2p  | Würth Elektronik | 61900211121                |
| 39   | 2    | P5, P6   | 61900311121   | WR-WTB THT Male Vertical Locking Header, pitch 2.54mm, 3p  | Würth Elektronik | 61900311121                |
| 40   | 1    | Q1   | BC847, SOT23  | NPN Bipolar Transistor   | Nexperia         | BC847                      |
| 41   | 3    | Q2, Q4, Q5                                     | BSS138, SOT23   | N-Channel Enhancement Mode Vertical DMOS FET   | Onsemi           | BSS138                     |
| 42   | 1    | Q3   | STL64N4F7AG, PowerFLAT 5x6 WF/STL260N4F7, PowerFLAT 5x6 | Automotive-grade N-channel 40 V, 7.0 mOhm typ., 64 A STripFET F7 power MOSFET in a PowerFLAT 5x6 package/N-channel 40 V, 1.05 mOhm typ., 120 A STripFET F7 power MOSFET in a PowerFLAT 5x6 package | ST               | STL64N4F7AG, or STL260N4F7 |
| 43   | 4    | Q6, Q7, Q8, Q9                                 | STL76DN4LF7AG, PowerFLAT 5x6 double island WF           | Automotive-grade dual N-channel 40 V, 5 mOhm typ., 40 A STripFET F7 power MOSFET in PowerFLAT 5x6 double island package  | ST               | STL76DN4LF7AG              |
| 44   | 1    | R1   | 2k7, 0603R, 1/8 W, $\pm 1\%$                            | SMD Resistor   | VISHAY           | MCT06030C2701FP500         |
| 45   | 22   | R2, R6, R7, R37, R53, R54, R64, R66, R67, R68, | 1k, 0603R, 1/8 W, $\pm 1\%$                             | SMD Resistor   | PANASONIC        | ERJH3EF1001V               |

| Item | Q.ty | Ref.  | Value                         | Description                | Manufacturer | Part Number     |
|------|------|---|-------------------------------|----------------------------|--------------|-----------------|
|      |      | R69,<br>R70,<br>R71,<br>R72,<br>R73,<br>R74,<br>R75,<br>R78,<br>R79,<br>R80,<br>R81,<br>R82 |                               |                            |              |                 |
| 46   | 9    | R3,<br>R13,<br>R14,<br>R20,<br>R21,<br>R26,<br>R27,<br>R33,<br>R34                          | 100k, 0805R, 1/4 W, $\pm 5\%$ | SMD Resistor               | PANASONIC    | ERJT06J104V     |
| 47   | 2    | R4, R5  | 10k, 0805R, 1/4 W, $\pm 5\%$  | SMD Resistor               | PANASONIC    | ERJT06J103V     |
| 48   | 1    | R8  | NM, 0603R                     | SMD Resistor (not mounted) | -            | -               |
| 49   | 2    | R9, R10   | 6k8, 0603R, 1/8 W, $\pm 1\%$  | SMD Resistor               | PANASONIC    | ERJH3EF6801V    |
| 50   | 8    | R11,<br>R12,<br>R22,<br>R23,<br>R24,<br>R25,<br>R35,<br>R36                                 | 62R, 0805R, 1/4 W, $\pm 5\%$  | SMD Resistor               | PANASONIC    | ERJT06J620V     |
| 51   | 8    | R15,<br>R16,<br>R18,<br>R19,<br>R28,<br>R29,<br>R31,<br>R32                                 | NM, 0805R                     | SMD Resistor               | -            | -               |
| 52   | 2    | R17,<br>R30   | 0.4R, 2512R, 1 W, $\pm 1\%$   | Thick film resistor        | Yageo        | PT2010FK-7W0R4L |
| 53   | 2    | R38,<br>R65   | 4k7, 0603R, 1/8 W, $\pm 1\%$  | SMD Resistor               | PANASONIC    | ERJH3EF4701V    |
| 54   | 2    | R39,<br>R40   | 442R, 0603R, 1/8 W, $\pm 1\%$ | SMD Resistor               | PANASONIC    | ERJH3EF4420V    |
| 55   | 4    | R41,<br>R42,<br>R43,<br>R44   | 10R, 0603R, 1/8 W, $\pm 1\%$  | SMD Resistor               | PANASONIC    | ERJH3EF10R0V    |
| 56   | 8    | R45,<br>R48,<br>R49,<br>R52,<br>R57,<br>R59,<br>R60,<br>R62                                 | 0R, 0603R, 1/8 W, $\pm 1\%$   | SMD Resistor               | PANASONIC    | ERJH3G0R00V     |

| Item | Q.ty | Ref.                                | Value                               | Description   | Manufacturer     | Part Number                      |
|------|------|-------------------------------------|-------------------------------------|---|------------------|----------------------------------|
| 57   | 5    | R46,<br>R47,<br>R50,<br>R51,<br>R61 | N.M., 0603R                         | SMD Resistor  | -                | -                                |
| 58   | 2    | R55,<br>R56                         | 22R, 0603R, 1/8 W, $\pm 1$ %        | SMD Resistor  | PANASONIC        | ERJH3EF22R0V                     |
| 59   | 1    | R58                                 | 120R, 0603R, 1/8 W, $\pm 1$ %       | SMD Resistor  | PANASONIC        | ERJH3EF1200V                     |
| 60   | 3    | R63,<br>R83,<br>R84                 | 10K, 0603R, 1/8 W, $\pm 1$ %        | SMD Resistor  | PANASONIC        | ERJH3EF1002V                     |
| 61   | 2    | R76,<br>R77                         | 100, 0603R, 1/8 W, $\pm 1$ %        | SMD Resistor  | PANASONIC        | ERJH3EF1000V                     |
| 62   | 2    | S1, S2                              | 430152043826                        | Switch  | Würth Elektronik | 430152043826                     |
| 63   | 2    | T1, T2                              | TEST POINT, TEST POINT_1.27MM_SMD   | Simple pin (for 2,54mm pitch array)   | Any              | Any                              |
| 64   | 1    | U1                                  | LD1117S50TR, SOT-223                | Adjustable and fixed low drop positive voltage regulator                                  | ST               | <a href="#">LD1117S50TR</a>      |
| 65   | 1    | U2                                  | L99DZ200GTR, LQFP 64 10x10x1.4      | Automotive front door device with LIN and HS-CAN providing dual H-bridge driving          | ST               | <a href="#">L99DZ200GTR</a>      |
| 66   | 2    | U3, U4                              | TSC103IYPT, TSSOP-8L                | High-voltage, high-side current sense amplifier   | ST               | <a href="#">TSC103IYPT</a>       |
| 67   | 1    | U5                                  | MCP2562FD-E_SN, SO-8,               | CAN BUS TRANSCEIVER   | Microchip        | MCP2562FD-E/SN                   |
| 68   | 1    | U6                                  | SPC582B60E1MH00Y, TQFP 64 10x10x1.0 | 32-bit power architecture MCU for automotive general purpose applications - Chorus family | ST               | <a href="#">SPC582B60E1MH00Y</a> |
| 69   | 1    | X1                                  | 830059537, WE-XTAL_CFPX-104         | WE-XTAL Quartz Crystal, SMT, CFPX-104, 40MHz, +/-20ppm                                    | Würth Elektronik | 830059537                        |
| 70   | 1    | -                                   | 60900213421                         | Jumper 2.54mm   | Würth Elektronik | 60900213421                      |
| 71   | 4    | -                                   | 970100365                           | Nylon spacer M3x10mmF/F   | Würth Elektronik | 970100365                        |
| 72   | 4    | -                                   | 97790603111                         | Nylon screw M3x6mm  | Würth Elektronik | 97790603111                      |
| 73   | 1    | -                                   | 61900211621                         | Receptacle housing  | Würth Elektronik | 61900211621                      |
| 74   | 2    | -                                   | 61900113722DEC                      | WR-WTB 2.54 mm Female Crimp Contact   | Würth Elektronik | 61900113722DEC                   |
| 75   | 1    | -                                   | 60900213421                         | WR-PHD 2.54mm Jumper with Test Point  | Würth Elektronik | 60900213421                      |

## Evaluation board license agreement

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For the European Regulation of the Evaluation Board, the applicable EU directives are considered, with a particular attention to the Low Voltage Directive (LVD) 2014/35/EU, the Electromagnetic Compatibility (EMC) Directive 2014/30/EU, and the Radio Equipment Directive (RED) 2014/53/EU. If the Evaluation Board is outside the scope of the foregoing Directives, then the General Product Safety Directive (GPSD) 2001/95/EC and Council Directive 93/68/EEC, amending Directive 73/23/EEC on electrical equipment designed for use within certain voltage limits, are applicable.

The Evaluation Board meets the requirements of the Restriction of Hazardous Substances (RoHS 2 or RoHS recast) Directive 2011/65/EU, Annex II, as amended by Directive 2015/863/EU.

### Notice applicable to Evaluation Boards not FCC-Approved

This kit is designed to allow:

1. 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
2. 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 47 CFR, Chapter I ("FCC Rules"), 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.

### For Evaluation Boards annotated as FEDERAL COMMUNICATIONS COMMISSION (FCC) Part 15 Compliant

- **FCC Interference Statement for Class A Evaluation Boards:** 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 Evaluation Boards:** 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 to 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.
- 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.

### WARRANTY

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"Affiliates" means any corporation or other entity directly or indirectly controlled by, controlling or under common control with the entity in question, for so long as such ownership exists. "Control" means the direct or indirect beneficial ownership of more than fifty (50%) percent of the stock or other equity interests entitled to vote for the election of directors or an equivalent governing body. Any such corporation or other legal entity shall be deemed to be an Affiliate of such Party only as long as such Control exists.

#### **TERMINATION**

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#### **SEVERABILITY**

If any provision of this agreement is or becomes, at any time or for any reason, unenforceable or invalid, no other provision of this agreement shall be affected thereby, and the remaining provisions of this agreement shall continue with the same force and effect as if such unenforceable or invalid provisions had not been inserted in this Agreement. In addition, any unenforceable or invalid provision shall be deemed replaced by a provision that is valid and enforceable and that comes closest to expressing the intention of the unenforceable or invalid provision.



**WAIVER**

The waiver by either party of any breach of any provision of this Agreement shall not operate or be construed as a waiver of any other or a subsequent breach of the same or a different provision.

**RELATIONSHIP OF THE PARTIES**

Nothing in this Agreement shall create, or be deemed to create, any joint venture, partnership, principal-agent, employer-employee or other relationship between the Parties, except that of independent contractors. Neither Party has the authority or power to bind, to contract in the name of, or to create a liability for the other in any way or for any purpose.

**SURVIVAL**

Any provision of this Agreement which imposes an obligation after termination of this Agreement shall survive the termination of this Agreement.

**SECTION HEADINGS**

Section headings are inserted for convenience only and shall not be used to interpret this Agreement.

**WASTE AND RECYCLING**

**The Evaluation Board is not to be disposed of as urban waste. At the end of its life cycle, differentiated waste collection must be followed.** Consult the local authorities for more information on the proper disposal channels. It is mandatory to separately collect the Evaluation Board and make sure it is delivered it to the appropriate waste management and recycling centers.

As of 15 August 2018, in all the countries belonging to the European Union, the Evaluation Board is subject to the WEEE Directive 2012/19/EU requirement; therefore, it is forbidden to dispose of the Evaluation Board as undifferentiated waste or with other domestic wastes. Consult the local authorities for more information on the proper recycling centers.

Disposing of the Evaluation Board incorrectly may cause damage to the environment and may be subject to fines based on specific countries' rules.

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