

## Bill of materials

Table 1. STDES-7KWBOC bill of materials

Item	Q.ty	Ref.	Part / Value	Description	Manufacturer	Order code
1	1	-	-	Table 2. Mother board	ST	Not available for separate sale
2	1	-	-	Table 3. IMS board	ST	Not available for separate sale
3	1	-	-	Table 4. Control board	ST	Not available for separate sale

Table 2. Mother board bill of materials

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
1	6	C1, C8, C39, C149, C15, C156	470 nF 0603 (1608 Metric) 25V ±10% X7R	Ceramic capacitors	Wurth Electronics Inc.	885012206075
2	2	C2, C153	6.8 µF 1206 (3216 Metric) 16 V ±20% X7R	Ceramic capacitors	TDK Corporation	CGA5L1X7R1C685M160AC
3	2	C3, C154	6.8 µF 1206 (3216 Metric) 16 V ±20% X7R	Ceramic capacitors	TDK Corporation	CGA5L1X7R1C685M160AC
4	3	C4, C7, C151	100 µF Radial, Can - SMD 16 V ±20%	Aluminium capacitors	Panasonic Electronic Components	EEE-FT1C101AR
5	1	C5	0.1 µF 0603 (1608 Metric) 50 V ±10% X7R	Ceramic capacitor	Wurth Electronics Inc.	885012206095
6	29	C6, C11, C12, C82, C83, C85, C98, C100, C102, C103, C122, C195, C202, C211, C213, C215, C216, C218, C220, C221, C223, C225, C226, C228, C230, C347, C348, C349, C350	1 µF 0805 (2012 Metric) 50 V ±10%	Ceramic capacitors	Wurth Elektronik	885012207103
7	1	C9	100 µF 20 V 2917 (7343 Metric) 20 V ±20%	Capacitor	AVX Corporation	TAJE107M020RNJ
8	2	C10, C157	6.8 pF 0603 (1608 Metric) 50 V 0.5 pF C0G/NP0	Capacitors (not mounted)	Wurth Electronics Inc.	885012006050
9	2	C15, C158	8.2 nF 0603 (1608 Metric) 50 V ±10%	Ceramic capacitors	Kemet	C0603C822K5RACTU

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
10	3	C16, C41, C159	68 nF 0603 (1608 Metric) 50 V ±10% X7R	Ceramic capacitors	Würth Electronics Inc.	885012206094
11	1	C17	470pF 0603 (1608 Metric) 50 V ±10% C0G	Ceramic capacitor	Würth Electronics Inc.	885012206081
12	1	C18	27 pF 0603 (1608 Metric) 50 V ±5% C0G/NP0	Ceramic capacitor	Murata Electronics North America	GCM1885C1H270JA16D
13	32	C20, C23, C25, C28, C30, C31, C33, C36, C43, C45, C46, C50, C113, C114, C119, C121, C146, C147, C148, C152, C168, C194, C201, C207, C208, C212, C217, C222, C227, C285, C287, C288	0.1 µF 0603 (1608 Metric) 50 ±10%	Ceramic capacitors	Würth Elektronik	885012206095
14	2	C21, C22	47 µF 2917 (7343 Metric) ±10%	Ceramic capacitors	AVX Corporation	TAJD476K025RNJ
15	1	C27	47 µF 2917 (7343 Metric) ±10%	Ceramic capacitor	AVX Corporation	TAJD476K010RNJ
16	5	C29, C351, C352, C353, C354	10 µF 0805 (2012 Metric) 25 V ±10%	Ceramic capacitors	Samsung Electro-Mechanics America, Inc.	CL21A106KAYNNNG
17	2	C32, C35	100 µF 25 V Radial-SMD, 6.3x5.4 mm	Aluminium capacitors	Würth	865080445010
18	1	C34	1 µF 1206 (3216 Metric) 50 V ±20%	Ceramic capacitor	Kemet	C1206C105M3RACTU
19	11	C37, C47, C79, C99, C162, C163, C165, C166, C199, C206, C289	10 nF 0603 (1608 Metric) 50 ±10%	Ceramic capacitors	Würth Elektronik	885012206089
20	2	C38, C284	47 µF radial-SMD, 5x5.4 mm 10 V ±20%	Aluminium capacitors	Würth	875105242006
21	1	C40	68 nF 0603 (1608 Metric) 50 V ±10%	Ceramic capacitor	Würth	885012206094
22	1	C42	220pF 0603 (1608 Metric) 50 V ±10%	Ceramic capacitor	Würth	885012206079
23	4	C44, C48, C286, C290	150 pF 0603 (1608 Metric) 50 ±10%	Ceramic capacitors	Würth Elektronik	885012206103
24	2	C49, C75	4.7 nF 0805 (2012 Metric) 50 V ±10%	Ceramic capacitors	KEMET	C0805C472K5RACTU

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
25	4	C51, C164, C167, C169	2.2 $\mu$ F 0805 (2012 Metric) 50 V $\pm$ 10% X7R	Ceramic capacitors	TDK Corporation	C2012X7R1H225K125AC
26	2	C52, C170	10 nF 0603 (1608 Metric) 50 $\pm$ 10%	Ceramic capacitors	Wurth Elektronik	885012206089
27	8	C53, C54, C67, C69, C76, C77, C93, C94	2.2 nF 1812 (4532 Metric) 1000 V (1kV) $\pm$ 5% C0G/NP0	Ceramic capacitors	KEMET	C1812C222JDGACTU
28	5	C55, C65, C66, C68, C92	0.1 $\mu$ F 630V 1812 (4532 Metric) 630 V $\pm$ 10%	Ceramic capacitors	WURTH	885342211006
29	2	C56, C72	1 $\mu$ F 630 V radial $\pm$ 20%	Ceramic capacitors	TDK Electronics Inc.	B32923C3105M000
30	4	C57, C58, C86, C87	33 nF 1700 V radial 1700 V $\pm$ 5%	Ceramic capacitors	EPCOS / TDK	B32672L8333J 3
31	6	C59, C60, C64, C88, C89, C91	0.1 $\mu$ F 630 V 1812 (4532 Metric) 630 V $\pm$ 10%	Ceramic capacitors	WURTH	885342211006
32	5	C61, C73, C107, C112, C133	4.7 nF radial, disc 440 V <sub>AC</sub> $\pm$ 20%	Ceramic capacitors	KEMET	ERK610Z472MCRU
33	2	C62, C90	82 $\mu$ F radial, 22x35 mm 500	Ceramic capacitors	TDK	B43268A6826M060
34	1	C63	68 $\mu$ F radial, 22x30 mm 500	Ceramic capacitors	TDK	B43268A6686M060
35	4	C78, C95, C198, C205	0.47 $\mu$ F 0603 (1608 Metric) 25 $\pm$ 10%	Ceramic capacitors	Wurth Elektronik	885012206075
36	5	C80, C96, C124, C197, C204	2.2 $\mu$ F SMD, 3216-18 10 V	Ceramic capacitors	Kemet	T491A225M010ATT
37	2	C81, C97	47 nF 0603 (1608 Metric) 50 $\pm$ 10%	Ceramic capacitors	Murata Electronics North America	GCM188R71H473KA55D
38	2	C84, C101	4.7 nF 0603 (1608 Metric) 50 $\pm$ 10% X7R	Ceramic capacitors	Wurth Elektronik	885012206063
39	1	C104	47 nF 0603 (1608 Metric) 50 V $\pm$ 10% X7R	Ceramic capacitors	Murata Electronics North America	GCM188R71H473KA55D
40	2	C108, C109	1 $\mu$ F radial $\pm$ 20%	Ceramic capacitors	EPCOS (TDK)	B32924C3105M189
41	1	C110	0.47 $\mu$ F 305 V <sub>AC</sub> X2 $\pm$ 20%	Ceramic capacitor	TDK	B32922H3474M
42	1	C111	0.1 $\mu$ F radial 305 V <sub>AC</sub> $\pm$ 20%	Ceramic capacitor	EPCOS (TDK)	B32921C3104M000
43	2	C115, C118	470 pF 0603 (1608 metric) 50 V $\pm$ 5% C0G/NP0	Ceramic capacitors	Wurth Electronics Inc.	885012006061
44	1	C116	1 nF 0805 (2012 metric) 100 V $\pm$ 10%	Ceramic capacitor	Wurth Elektronik	885012207116
45	4	C117, C120, C193, C200	100 pF 0603 (1608 metric) 50 $\pm$ 10%	Ceramic capacitors	Wurth Elektronik	885012206077

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
46	4	C123, C196, C203, C283	4.7 $\mu$ F 0805 (2012 Metric) 25 V $\pm$ 20%	Ceramic capacitors	Würth Elektronik	885012107018
47	3	C125, C127, C128	N.M. 0603 (1608 metric) 50 $\pm$ 10%	Ceramic capacitors		
48	1	C126	10 nF 630 V radial $\pm$ 20%	Ceramic capacitors	EPCOS (TDK)	B32921C3103M289
49	5	C129, C130, C136, C137, C139	0.1 $\mu$ F 0603 (1608 metric) 50 V $\pm$ 10%	Ceramic capacitors	Würth	885012206095
50	2	C131, C134	2.7 nF 0603 (1608 metric) 50 V $\pm$ 10%	Ceramic capacitors	Samsung Electro-Mechanics	CL10B272KB8NNNC
51	2	C132, C135	47 nF 0603 (1608 metric) 50 V $\pm$ 10%	Ceramic capacitors	Murata Electronics North America	GCM188R71H473KA55D
52	2	C138, C141	2.2 $\mu$ F 0805 (2012 metric) 50 V $\pm$ 10%	Ceramic capacitors	TDK Corporation	C2012X7R1H225K125AC
53	1	C140	470 nF 0603 (1608 metric) 25 V $\pm$ 10%	Ceramic capacitor	Würth	885012206075
54	1	C142	22 nF 0603 (1608 metric) 50 V $\pm$ 10% X7R	Ceramic capacitor	Würth Elektronik	885012206091
55	2	C144, C145	47 pF 0603 (1608 metric) 50 V $\pm$ 5% C0G	Ceramic capacitors	TDK Corporation	C1608C0G1H470J080AA
56	1	C155	1 $\mu$ F 0603 (1608 Metric) 50 V $\pm$ 10%	Ceramic capacitor	Samsung Electro-Mechanics America, Inc.	CL10A105KB8NNNC
57	1	C160	470 pF 0603 (1608 metric) 50 V $\pm$ 5% C0G	Ceramic capacitor	TDK Corporation	CGA3E2C0G1H471J080AD
58	1	C161	27 pF 0603 (1608 metric) 50 V $\pm$ 5% C0G/NP0	Ceramic capacitor	Murata Electronics North America	GCM1885C1H270JA16D
59	4	C175, C176, C189, C190	150 pF 0805 (2012 metric) 50 V $\pm$ 5%	Ceramic capacitors	Würth Elektronik	885012007058
60	2	C177, C191	0.1 $\mu$ F 0805 (2012 metric) 50 V $\pm$ 10%	Ceramic capacitors	Würth Elektronik	885012207098
61	5	C178, C179, C185, C186, C187	560 $\mu$ F radial, 35X45 pitch 10 450 $\pm$ 20%	Aluminum electrolytic capacitors	EPCOS (TDK)	B43268A5567M060
62	1	C182	0.1 $\mu$ F 630 V radial $\pm$ 20%	Ceramic capacitor	TDK Electronics Inc.	B32921C3104M000
63	2	C183, C184	47 nF 1210 (3225 metric) 630 V $\pm$ 20% X7R	Ceramic capacitors	TDK	CGA6M4X7R2J473M200AA
64	1	C188	0.047 $\mu$ F 630 V radial $\pm$ 20%	Ceramic capacitor	TDK Electronics Inc.	B32921C3473M189
65	1	C192	100 pF 0603 (1608 metric) 50 $\pm$ 10%	Ceramic capacitor	Würth Elektronik	885012206077
66	2	C209, C210	10 pF 0603 (1608 metric) 25 V $\pm$ 5%	Ceramic capacitors	Würth Elektronik	885012006032

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
67	4	C214, C219, C224, C229	0.22 µF 0805 (2012 metric) 50 V ±10%	Ceramic capacitors	Wurth Elektronik	885012207100
68	24	C231, C233, C235, C237, C239, C242, C244, C246, C248, C250, C252, C255, C257, C259, C261, C263, C265, C268, C270, C272, C274, C276, C278, C281	0.1 µF 0603 (1608 metric) 50 V ±10%	Ceramic capacitors	Wurth Elektronik	885012206095
69	12	C232, C234, C240, C245, C247, C253, C258, C260, C266, C271, C273, C279	4.7 µF 0603 (1608 metric) 10 V ±20%	Ceramic capacitors	Wurth Electronics Inc.	885012106012
70	8	C236, C241, C249, C254, C262, C267, C275, C280	100 pF 0603 (1608 metric) 50 V ±10% C0G/NP0	Ceramic capacitors	Wurth Electronics Inc.	885012206077
71	8	C238, C243, C251, C256, C264, C269, C277, C282	1 µF 0603 (1608 metric) 50 V ±10%	Ceramic capacitors	Samsung Electro-Mechanics America, Inc.	CL10A105KB8NNNC
72	1	C291	470 µF radial-SMD, 10x10 mm 25 V ±20%	Aluminium electrolytic capacitor	Wurth Elektronik	865060457009
73	8	C360, C361, C362, C363, C364, C365, C366, C367	33 pF 0603 (1608 metric) 25 ±5%	Ceramic capacitors	Wurth Elektronik	885012006035
74	11	D1, D3, D83, D84, D85, D86, D87, D88, D89, D90, D91	Green 0603 (1608 metric)	Green LED diode	Wurth Elektronik	150060VS55040
75	1	D2	STPS3150UY DO-214AA, SMB 820 mV 3A	Automotive 150 V, 3 A power Schottky rectifier	ST	<a href="#">STPS3150UY</a>
76	2	D4, D82	BZT52C9V1-7-F SOD-123 9.1 V 500 MW SOD123	Zener diodes	Diodes Incorporated	BZT52C9V1-7-F
77	1	D5	2.7 V 500 mW DO-213AC, MINI-MELF, SOD-80 1.5V @ 200 mA 10 µA @ 1 V 500 mW	Zener diode	Vishay Semiconductor Diodes Division	TZMB2V7-GS08
78	4	D6, D15, D67, D68	LS L296-P2Q2-1-Z 0603 (1608 metric)	Red LED diode	OSRAM Opto Semiconductors Inc.	LS L296-P2Q2-1-Z
79	8	D7, D8, D9, D10, D16, D17, D18, D19	1N4148WS SC-90, SOD-323F 1V @ 10 mA 150 mA 75 V	General purpose diodes	Fairchild/ON Semiconductor	1N4148WS

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
80	8	D11, D12, D13, D14, D20, D21, D22, D23	STPSC20065GY-TR D2PAK, TO-263AB	Automotive 650 V, 20 A SiC power Schottky diode	ST	STPSC20065GY-TR
81	1	D24	P6KE440A DO-204AC, DO-15, Axial 600 W	600 W TVS in DO-15	ST	P6KE440A
82	1	D26	BZV55-B15,115 DO-213AC, MINI-MELF, SOD-80 900 mV @ 10mA 50 nA @ 10.5 V 500 mW	Zener diode	Nexperia USA Inc.	BZV55-B15,115
83	11	D28, D29, D30, D31, D32, D33, D34, D36, D37, D38, D39	BAT754 SOT-23-3 200 mA (DC) 200 MA	Schottky diodes	Nexperia USA Inc.	BAT754,215
84	1	D35	ESDCAN24-2BLY TO-236-3, SC-59, SOT-23-3	Automotive dual-line TVS in SOT23-3L for CAN bus (12 V system)	ST	ESDCAN24-2BLY
85	4	D40, D41, D45, D46	SMAJ18A-TR DO-214AC, SMA 400 W	400 W TVS in SMA	ST	SMAJ18A-TR
86	2	D42, D47	STBR3012G2Y-TR TO-263-3, D <sup>2</sup> Pak (2 Leads + Tab), TO-263AB 1.3 V @ 30 A	Automotive 1200 V, 30 A bridge rectifier diode	ST	STBR3012G2Y-TR
87	4	D43, D44, D48, D49	SMAJ5.0A-TR DO-214AC, SMA 400 W	400 W TVS in SMA	ST	SMAJ5.0A-TR
88	8	D50, D52, D54, D56, D58, D60, D62, D64	STTH1R06A DO-214AC, SMA 1.7 V @ 1 A	600 V, 1 A Turbo 2 ultra-fast diode	ST	STTH1R06A
89	8	D51, D53, D55, D57, D59, D61, D63, D65	STPS1L30A DO-214AC, SMA 1 A	30 V, 1 A low drop power Schottky rectifier	ST	STPS1L30A
90	8	D66, D69, D70, D73, D74, D77, D78, D81	STPS360AFY SOD-128 3 A	Automotive 60 V, 3 A power Schottky rectifier	ST	STPS360AFY
91	4	D92, D93, D94, D95	BZV55-C16,115 DO-213AC, MINI-MELF, SOD-80 900 mV @ 10 mA 50 nA @ 11.2 V 500 mW	Zener diodes	Nexperia USA Inc.	BZV55-C16,115
92	1	F1	Fuse10X38 2XClips	Fuse	Eaton+Mersen	BK/1A3400-09-R+A214107
93	1	HT1	Heatsink1	Heat-sink	AAVID THERMALLOY	
94	1	IC1	A6986F5V 16-TSSOP (0.173", 4.40 mm width) exposed pad	Automotive 38 V, 1.5 A synchronous step-down	ST	A6986F5V

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
				switching regulator with 30 $\mu$ A quiescent current		
95	4	IC2, IC3, IC4, IC5	A6387D	High-voltage high and low side driver for automotive applications	ST	A6387D
96	4	IC6, IC7, IC8, IC9	STGAP1AS SMD SO24	Galvanically isolated single gate driver	ST	STGAP1S
97	2	ICS1, ICS2	ACS724LLCTR-20A U-T 8-SOIC (0.154", 3.90 mm width)	Hall current sensors	Allegro MicroSystems, LLC	ACS724LLCTR-20AU-T
98	2	ICS3, ICS4	ACS724LLCTR-30A B-T 8-SOIC (0.154", 3.90 mm width)	Hall current sensors	Allegro MicroSystems, LLC	ACS724LLCTR-30AB-T
99	16	J1, J3, J5, J7, J9, J11, J13, J15, J24, J39, J40, J43, J45, J47, J49, J52	Con4F	Connector headers	Sullins Connector Solutions	PPTC022LFBN-RC
100	16	J2, J4, J6, J8, J10, J12, J14, J16, J23, J41, J42, J44, J46, J48, J50, J51	CON4	Connector headers	Molex Connector Corporation	0015912040
101	1	J22	CONN, 10-pin	Connector header	Sullins Connector Solutions	SBH11-PBPC-D05-ST-BK
102	2	J27, J32	Jump1	Uninsulated shorting plug	Harwin Inc.	D3080-05
103	1	J28	-200-450 V	Shank, THR	Würth Electronics Inc.	74651195R
104	1	J29	+200-450 V	Shank, THR	Würth Electronics Inc.	74651195R
105	1	J33	P	Shank, THR	Würth Electronics Inc.	74651195R
106	1	J35	N	Shank, THR	Würth Electronics Inc.	74651195R
107	1	J36	Earth	Shank, THR	Würth Electronics Inc.	74651195R
108	1	J38	Con2	Connector header	Amphenol FCI	77311-118-02LF
109	11	J55, J56, J59, J60, J63, J67, J68, J74, J75, J78, J80	con4-2x2-strip-female	Connector headers (not mounted)	Any	Any
110	9	J57, J58, J61, J62, J66, J72, J76, J77, J79	con4-2x2-strip-male_90	Connector headers	Würth Elektronik	61300421021
111	2	J69, J70	con4-2x2-strip-male_90	Connector headers	Würth Elektronik	61300421021
112	10	J81, J82, J83, J84, J85, J86,	SpacrM4X14	Tower	Harwin Inc.	R40-1001402

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
		J87, J88, J89, J90				
113	1	JP1	CON2	Terminal block	Würth Electronics	691253510002
114	2	L1, L29	10 µH 2.5 A non-standard ±20%	Fixed inductors	TDK Corporation	VLS5045EX-100M-CA
115	2	L2, L3	70 Ohm@100 MHz 0603 (1608 metric)	Ferrite beads	Murata Electronics North America	BLM18SG700TN1D
116	1	L4	6.8 µH 1.5 A 100 MOhm 1919 (4848 metric) ±30%	Fixed inductor	Würth Electronics Inc.	744042006
117	2	L5, L36	330 Ohm@100 MHz 0603 (1608 metric)	Ferrite beads	Murata Electronics North America	BLM18SG331TN1D
118	1	L6	120 Ohm@100 MHz 0603 (1608 metric)	Ferrite bead	Murata Electronics North America	BLM18AG121SN1D
119	10	L7, L11, L14, L20, L21, L27, L28, L32, L33, L37	470 Ohm 0603 (1608 metric)	Ferrite beads	Würth Electronics Inc.	742792643
120	2	L9, L13	16.8 µH 30 A	Inductors	Würth	750344211
121	2	L10, L17	900 µH 32 A vertical, 12 PC pin	CMC	Würth Electronics Inc.	7448053201
122	2	L15, L19	10 µH 31.5 A non-standard ±15%	Fixed inductors	WÜRTH ELEKTRONIK	S20100037
123	2	L16, L18	1.5 mH 38 A vertical, 12 PC pin 38 A	CMC	Würth Elektronik	7448063801
124	2	L22, L25	33 µH 1210 (3225 metric) ±10%	Fixed inductors	Würth Elektronik	744764133
125	2	L23, L26	10 µH 600 mA 1008 (2520 metric) ±20%	Fixed inductors	Würth Elektronik	74438323100
126	1	L24	470 µH 1812 (4532 metric) ±10%	Fixed inductors	Würth Elektronik	74476624
127	2	L30, L31	514 µH 26 A radial, D 70 mm x H 56 mm	Inductors	Würth Electronics Inc.	750344522
128	2	L34, L35	10 µH 30 A non-standard ±15%	Fixed inductors	Würth Electronics Inc.	7443641000
129	1	MOV1	250 V disc 20 mm	Varistor	EPCOS (TDK)	B72220S0251K101
130	2	P1, P2	CON64AB	Connector Erni 284166 32X2	ERNI	284166
131	1	P3	CON64AB	Connector Erni 284166 32X2	ERNI	284166
132	1	P4	CON64AB	Connector ERNI 533406 32X2 male 90 grade	ERNI	384241
133	7	PS1, PS2, PS3, PS4, PS5, PS7, PS8	MGJ3T12150505MC -R7 0.91" L x 0.89" W x 0.58" H (23.0mm x 22.6 mm x 14.7 mm)	DC-DC converters	Murata Power Solutions Inc.	MGJ3T12150505MC-R7



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134	1	PS9	PES1-S12-S5-M 8-SMD module, 5 leads 1 W	DC-DC converter	CUI Inc.	PES1-S12-S5-M-TR
135	8	Q1, Q2, Q3, Q4, Q5, Q6, Q7, Q8	STB47N60DM6AG D2PACK	Automotive-grade N-channel 600 V, 70 mOhm typ., 36 A MDmesh DM6 Power MOSFET in a D2PAK package	ST	STB47N60DM6AG
136	1	Q9	STN1NK80Z TO-261-4, TO-261AA 2.5 W (Tc)	N-channel 800 V, 13 Ohm typ., 0.25 A SuperMESH Zener protected Power MOSFET in a SOT-223 package	ST	STN1NK80Z
137	2	Q11, Q13	STN4NF03L TO-261-4, TO-261AA 3.3W (Tc)	N-Channel 30V - 0.039 Ohm - 4A - SOT-223 STripFET power MOSFET	ST	STN4NF03L
138	2	Q15, Q16	MJD32CT4-A TO-252-3, DPak (2 leads + tab), SC-63	Automotive-grade low voltage PNP power transistor	ST	MJD32CT4-A
139	4	Q17, Q18, Q20, Q21	SCTH35N65G2V-7A G H2PAK-7	Automotive-grade silicon carbide power MOSFET 650 V, 45 A, 55 mOhm (typ. T <sub>J</sub> = 25 C) in an H2PAK-7 package	ST	SCTH35N65G2V7AG
140	2	Q19, Q22	TN3050H-12GY-TR TO-263-3, D <sup>2</sup> Pak (2 leads + tab), TO-263AB	1200 V, 30 A automotive-grade AEC-Q101 SCR thyristor	ST	TN3050H-12GY-TR
141	12	R1, R2, R10, R11, R16, R17, R28, R140, R193, R194, R197, R223	0.0 0805 (2012 metric) 0.125 W, 1/8 W jumper	Resistors	Yageo	RC0805JR-070RL
142	2	R3, R32	1 M 0603 (1608 metric) 0.1 W, 1/10 W ±1%	Resistors	TE Connectivity	CRGCQ0603F1M0
143	2	R6, R198	249 k 0603 (1608 metric) 0.1 W, 1/10 W ±1%	Resistors	Vishay	MCT06030C2493FP500
144	2	R7, R199	86.6 k 0603 (1608 metric) 0.1 W, 1/10 W ±1%	Resistors	Stackpole	RMCF0603FT86K6
145	1	R8	43 k 0603 (1608 metric) 0.1 W, 1/10 W ±1%	Resistors	Panasonic	ERJ-3EKF4302V
146	2	R9, R195	NM 0805 (2012 metric) 0.125 W, 1/8 W ±1%	Resistors (not mounted)	Any	Any

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
147	2	R13, R31	3.57 k 0603 (1608 metric) 0.1 W, 1/10 W $\pm 1\%$	Resistors	Yageo	RC0603FR-073K57L
148	62	R14, R15, R20, R23, R26, R29, R34, R49, R50, R70, R71, R117, R118, R119, R120, R128, R129, R130, R131, R132, R133, R135, R137, R139, R141, R142, R143, R145, R148, R153, R154, R155, R156, R158, R159, R160, R161, R162, R163, R164, R165, R166, R167, R168, R169, R170, R171, R172, R173, R174, R175, R177, R179, R182, R183, R184, R185, R186, R189, R190, R191, R192	0.0 0603 (1608 metric) 0.1 W, 1/10 W jumper	Resistors	Yageo	RC0603JR-070RL
149	3	R21, R22, R152	0.0 0603 (1608 metric) 0.1 W, 1/10 W jumper	Resistors	Yageo	RC0603JR-070RL
150	2	R25, R509	N.M 0603 (1608 Metric) 0.1 W, 1/10 W jumper	Resistors	Yageo	RC0603JR-070RL
151	1	R27	0.0 1206 (3216 metric) 0.25 W, 1/4 W jumper	Resistor	Yageo	RC1206JR-070RL
152	1	R30	N.M 0603 (1608 metric) 0.1 W, 1/10 W jumper	Resistor (not mounted)	Yageo	RC0603JR-070RL
153	1	R33	75 K 0603 (1608 metric) 0.1 W, 1/10 W $\pm 1\%$	Resistor	Yageo	RC0603FR-0775KL
154	8	R35, R36, R38, R39, R298, R299, R300, R301	390 K 1206 (3216 metric) 0.25 W, 1/4 W $\pm 1\%$	Resistors	Yageo	RC1206FR-07390KL
155	3	R37, R40, R43	68K 2512 (6432 metric) 2 W $\pm 1\%$	Resistors	TE Connectivity Passive Product	352168KFT
156	2	R41, R302	7.5 k 005 (2012 metric) 0.125 W, 1/8 W $\pm 1\%$	Resistors	Yageo	RC0805FR-077K5L

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
157	4	R42, R48, R303, R308	4.02 K 0603 (1608 Metric) 0.1 W, 1/10 W $\pm 0.1\%$	Resistors	Panasonic Electronic Components	ERA-3AEB4021V
158	4	R44, R46, R304, R306	2.2 K 0603 (1608 metric) 0.1 W, 1/10 W $\pm 1\%$	Resistors	Yageo	RC0603FR-072K2L
159	3	R45, R305, R520	39 0603 (1608 metric) 0.1 W, 1/10 W $\pm 1\%$	Resistors	Panasonic Electronic Components	ERJ-3EKF39R0V
160	2	R47, R307	160 0603 (1608 metric) 0.1 W, 1/10 W $\pm 1\%$	Resistors	Yageo	RC0603FR-07160RL
161	2	R51, R211	4.7 k 0603 (1608 metric) 0.1 W, 1/10 W $\pm 1\%$	Resistors		
162	1	R52	24 1206 (3216 Metric) 0.25 W, 1/4 W $\pm 1\%$	Resistor	Yageo	RC1206FR-0724RL
163	2	R53, R73	NM 1206 (3216 metric) 0.25 W, 1/4 W $\pm 1\%$	Resistors (not mounted)	Any	Any
164	8	R54, R55, R63, R64, R75, R76, R80, R81	1 2512 (6432 metric) 1 W $\pm 1\%$	Resistors (not mounted)	Vishay Dale	CRCW25121R00FKEG
165	8	R56, R57, R66, R67, R77, R78, R79, R82	10 k 0805 (2012 metric) 0.1 W, 1/10 W $\pm 1\%$	Resistors	Yageo	RC0805FR-0710KL
166	2	R58, R61	470 k 2512 (6432 metric) 1 W $\pm 5\%$	Resistors	Vishay Dale	CRCW2512470KJNEG
167	1	R72	24 1206 (3216 Metric) 0.25 W, 1/4 W $\pm 1\%$	Resistor	Yageo	RC1206FR-0724RL
168	6	R74, R221, R268, R277, R286, R295	100 0603 (1608 metric) 0.1 W, 1/10 W $\pm 1\%$	Resistors	Yageo	RC0603FR-07100RP
169	12	R83, R121, R122, R134, R136, R144, R146, R150, R187, R188, R224, R225	100 0603 (1608 metric) 0.1 W, 1/10 W $\pm 1\%$	Resistors	Yageo	RC0603FR-07100RP
170	3	R84, R86, R90	165 k 1206 (3216 metric) 0.25 W, 1/4 W $\pm 1\%$	Resistors	Yageo	RC1206FR-07165KL
171	1	R87	2.7 k 5329 5 W $\pm 5\%$	Power resistor	TE CONNECTIVITY	SMF52K7JT
172	1	R92	499 0805 (2012 metric) 0.125 W, 1/8 W $\pm 1\%$	Resistor	Stackpole	RNCP0805FTD499R
173	2	R94, R107	10 k 0603 (1608 metric) 0.1 W, 1/10 W $\pm 1\%$	Resistors	Yageo	RC0603FR-0710KL

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
174	15	R96, R97, R98, R99, R100, R101, R103, R104, R105, R109, R110, R111, R113, R114, R115	470 k 1206 (3216 metric) 0.25 W, 1/4W ±1%	Resistors	Yageo	RC1206FR-07470KL
175	3	R102, R106, R108	10 k 0805 (2012 metric) 0.1 W, 1/10 W ±1%	Resistors	Yageo	RC0805FR-0710KL
176	1	R112	499 0603 (1608 metric) 0.1 W, 1/10 W ±1%	Resistors	Stackpole	RNCP0805FTD499R
177	1	R116	5 K 0603 (1608 metric) 0.1 W, 1/10 W ±1%	Resistors	Panasonic	ERA-3AEB4991V
178	4	R123, R124, R126, R127	NM 0603 (1608 metric) 0.1W, 1/10W 1%	Chip resistors (not mounted)	Any	Any
179	3	R138, R147, R149	NM 0603 (1608 metric) 0.1 W, 1/10 W ±1%	Chip resistors (not mounted)	Any	Any
180	1	R151	120 0603 (1608 metric) 0.125 W, 1/8 W ±1%	Resistor	Vishay Beyschlag	MCT06030C1200FP500
181	8	R176, R178, R510, R511, R512, R516, R517, R518	1.5 K 0603 (1608 metric) 0.1 W, 1/10 W ±1%	Chip resistors	TE Connectivity	CRGCQ0603F1K5
182	2	R180, R181	3 K 0603 (1608 metric) 0.1 W, 1/10 W ±1%	Chip resistors	Vishay	MCT06030C3001FP500
183	1	R196	1 M 0603 (1608 metric) 0.1 W, 1/10 W ±1%	Resistor	Vishay	CRCW06031M00FKEA
184	1	R200	43 k 0603 (1608 metric) 0.1 W, 1/10 W ±1%	Resistor	Panasonic	ERA-3AEB433V
185	2	R201, R206	270 0603 (1608 metric) 0.1 W, 1/10 W ±1%	Resistors	Vishay	CRCW0603270RFKEA
186	4	R202, R203, R207, R208	390 0603 (1608 metric) 0.1 W, 1/10 W ±1%	Resistors	Yageo	RC0603FR-07390RL
187	2	R204, R209	27 2512 (6432 metric) 1 W ±1%	Resistors	Yageo	AC2512FK-0727RL
188	2	R205, R210	1 k 0603 (1608 metric) 0.1 W, 1/10 W ±1%	Resistors	Yageo	RC0603FR-071KL
189	4	R212, R213, R218, R219	10 k 0805 (2012 metric) 0.1 W, 1/10 W ±1%	Resistors	Vishay Foil Resistors (Division of Vishay Precision Group)	Y162910K0000F9R

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
190	2	R214, R220	100 0805 (2012 metric) 0.125 W, 1/8 W $\pm 1\%$	Resistors		
191	3	R215, R216, R217	180 K 1206 (3216 metric) 0.25 W, 1/4 W $\pm 0.1\%$	Resistors	Panasonic Electronic Components	ERA-8AEB184V
192	1	R222	3.6 k 0805 (2012 metric) 0.125 W, 1/8 W $\pm 1\%$	Resistors	Yageo	RC0805FR-073K6L
193	16	R226, R232, R235, R241, R244, R250, R253, R259, R523, R524, R525, R526, R527, R528, R529, R530	330 0805 (2012 metric) 0.1 W, 1/10 W $\pm 0.01\%$	Resistors	TE Connectivity	CRG0805F330R
194	4	R227, R236, R245, R254	10 1210 (3225 Metric) 0.5 W, 1/2 W $\pm 1\%$	Resistors	Stackpole Electronics Inc.	RMCF1210FT10R0
195	8	R228, R231, R237, R240, R246, R249, R255, R258	1 2010 (5025 metric) 1 W $\pm 1\%$	Resistors	Vishay Dale	CRCW20101R00FKEFHP
196	8	R229, R233, R238, R242, R247, R251, R256, R260	20 2010 (5025 metric) 1 W $\pm 1\%$	Resistors	Stackpole Electronics Inc.	RMCP2010FT20R0
197	8	R230, R234, R239, R243, R248, R252, R257, R261	4.7 2010 (5025 metric) 1 W $\pm 5\%$	Resistors	Bourns Inc.	CRM2010-JW-4R7ELF
198	8	R262, R264, R271, R273, R280, R282, R289, R291	0.0 0603 (1608 metric) 0.1 W, 1/10 W jumper	Resistors	Yageo	RC0603JR-070RL
199	2	R263, R265	750 0603 (1608 metric) 0.1 W, 1/10 W $\pm 1\%$	Resistors	Yageo	RC0603FR-07750RL
200	4	R266, R284, R293, R521	2.7 2010 (5025 metric) 1 W $\pm 1\%$	Resistors	Panasonic	ERJ-12ZYJ2R7U
201	4	R267, R285, R294, R522	10 2010 (5025 metric) 1 W $\pm 1\%$	Resistors	Stackpole Electronics Inc.	RMCP2010FT10R0
202	4	R269, R278, R287, R296	2.2 1206 (3216 metric) 0.25 W, 1/4W $\pm 1\%$	Resistors	Bourns Inc.	CRM1206-JW-2R2ELF
203	4	R270, R279, R288, R297	100 0603 (1608 metric) 0.1 W, 1/10 W $\pm 1\%$	Resistors	Yageo	RC0603FR-07100RP
204	3	R513, R514, R515	8.2 K 0603 (1608 metric) 0.1 W, 1/10 W $\pm 1\%$	Resistors	Panasonic	ERJ-3EKF8201V
205	2	RT1, RT2	10 K 0805 (2012 metric) 210 mW	Thermistor	Vishay BC Components	NTCS0805E3103FLT
206	2	SP1, SP2	SupportM3X40	Support	Essentra	TCBN-T1-M3-8-40
207	1	T1	2000 ohm 4 A 50 V	Filter	Würth	744237151

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
208	2	T2, T4	750316796 0.560" L x 0.530" W (14.22 mm x 13.46 mm)	Current sense filters	Würth Electronics Inc.	750316796
209	2	T3, T5	XFRM_LIN/CT-SEC_0 375-425 V ±10%	Transformer	WURTH	750317867
210	1	T6	7448011305 vertical, 4 PC pin 1.3 A	CMC	Würth Elektronik	7448011305
212	24	TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8, TP9, TP10, TP11, TP12, TP13, TP14, TP15, TP16, TP58, TP59, TP60, TP61, TP62, TP63, TP64, TP65	5001 0.100" Dia x 0.180" L (2.54mm x 4.57mm)	Test points	Keystone Electronics	5001
211	1	T7	100 µH 150 mA horizontal, 4 L-Lead	CMC	EPCOS (TDK)	B82789C0104N002
213	30	TP17, TP25, TP26, TP27, TP28, TP29, TP30, TP31, TP32, TP33, TP34, TP35, TP37, TP38, TP39, TP40, TP41, TP42, TP43, TP44, TP45, TP46, TP47, TP49, TP50, TP52, TP54, TP56, TP57, TP66	ALERT 0.079" L x 0.047" W (2.00 mm x 1.20 mm)	Test points	Harwin Inc.	S2751-46R
214	11	TP18, TP19, TP20, TP21, TP22, TP23, TP24, TP48, TP51, TP53, TP55	5001 0.100" diameter x 0.180" L (2.54 mm x 4.57 mm)	Test points	Keystone Electronics	5001
215	9	TW1, TW38, TW39, TW40, TW41, TW42, TW43, TW44, TW82	SCREW_M4X6	Screws	RS Pro	483-0158
216	16	TW2, TW4, TW5, TW6, TW7, TW8, TW10, TW11, TW12, TW13, TW14, TW49, TW50, TW54, TW56, TW81	Con1	Towers	RS	222-402
217	10	TW3, TW9, TW15, TW17, TW53, TW55,	Con1	Screws	RS	482-8515

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
		TW57, TW70, TW71, TW72				
218	3	TW16, TW48, TW52	SCREW_M4X6	Screws	RS Pro	483-0158
219	20	TW18, TW19, TW20, TW21, TW22, TW23, TW24, TW25, TW26, TW27, TW28, TW29, TW30, TW31, TW32, TW33, TW34, TW35, TW36, TW37	Con1	Screws	RS	482-8515
220	2	TW47, TW51	Spacer M4x12	Spacers	Würth Elektronik	970120474
221	3	TW58, TW61, TW65	Screw_M3X6	Screws	RS	482-8515
222	8	TW59, TW62, TW64, TW68, TW73, TW74, TW75, TW76	SpacerM3X40	Spacers	Würth Elektronik	971400324
223	4	TW60, TW63, TW66, TW69	Screw_M3X6	Screws	RS	482-8515
224	4	TW77, TW78, TW79, TW80	Con1	Screws	RS	482-8515
225	2	U1, U16	A6986F 16-TSSOP (0.173", 4.40 mm width) exposed pad	Automotive 38 V, 1.5 A synchronous step-down switching regulator with 30 $\mu$ A quiescent current	ST	A6986F
226	1	U2	LF50CDT-TRY TO-252-3, DPak (2 leads + tab), SC-63	Very low drop voltage regulator with inhibit	ST	LF50CDT-TRY
227	3	U3, U4, U7	ESDA6V1LY TO-236-3,SC-59,SO T-23-3	Automotive dual Transil array for ESD protection	ST	ESDA6V1LY
228	1	U5	L4931ABD120TR 8- SOIC (0.154", 3.90 mm width)	Very low drop voltage regulators with inhibit	ST	L4931ABD120TR
229	1	U6	ESDA14V2LY TO-236-3,SC-59,SO T-23-3	Automotive dual Transil array for ESD protection	ST	ESDA14V2LY
230	2	U8, U28	TSZ121IYLT SC-74A, SOT-753	Very high accuracy (5 $\mu$ V) zero drift 5 V CMOS Op-Amp, single, GBP = 400 kHz	ST	TSZ121IYLT
231	2	U9, U27	ACPL-782T-500E 8- SMD, Gull Wing	Opamp	Broadcom Limited	ACPL-782T-500E
232	3	U10, U12, U14	BAR43SFILM TO-236-3, SC-59, SOT-23-3 100 mA	30 V, 100 mA Vf 0.33 V @ 2 mA SMD general	ST	BAR43SFILM

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
				purpose signal Schottky diode		
233	1	U11	TS3021HIYLT SC-74A, SOT-753	Rail-to-rail 1.8 V high-speed comparator, 150°C extended temperature range	ST	TS3021HIYLT
234	1	U13	TSV611ILT SC-74A, SOT-753, SOT23-5L	Rail to rail input/output 5 V CMOS Op-Amp, micro-power (10 uA), GBP = 120 kHz	ST	TSV611ILT
235	1	U15	LTC2875HS8#PBF 8-SOIC (0.154", 3.90mm Width)	IC TXRX CAN	Linear Technology	LTC2875HS8#PBF
236	2	U17, U18	ACPL-K49T-000E 8-SOIC (0.268", 6.81mm Width)	Optoisolator transistors	Broadcom Limited	ACPL-K49T-000E
237	8	U19, U20, U21, U22, U23, U24, U25, U26	ACPL-K72T-060E	High speed automotive optocouplers	Broadcom/Avago	ACPL-K72T-060E

**Table 3. IMS board bill of materials**

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
1	8	C53, C54, C67, C69, C76, C77, C93, C94	2.2 nF 1812 (4532 metric) 1000 V (1 kV) ±5%	Capacitors (not mounted)	KEMET	C1812C222JDGACTU
2	6	C59, C60, C64, C88, C89, C91	0.1 µF 630 V 1812 (4532 metric) 630 ±10%	Ceramic capacitors	Wurth Elektronik	885342211006
3	4	C175, C176, C189, C190	150 pF 0805 (2012 metric) 50 V ±5%	Ceramic capacitors	Wurth Elektronik	88501207058
4	2	C177, C191	0.1 µF 0805 (2012 Metric) 50 V ±10%	Ceramic capacitors	Wurth Elektronik	885012207098
5	8	D11, D12, D13, D14, D20, D21, D22, D23	STPSC20065GY-TR D2PAK	Automotive 650 V, 20 A SiC power Schottky diode	ST	STPSC20065GY-TR
6	4	D40, D41, D45, D46	SMAJ18A-TR DO-214AC, SMA 400 W	400 W TVS in SMA	ST	SMAJ18A-TR
7	2	D42, D47	STBR3012G2Y-TR TO-263-3, D <sup>2</sup> Pak (2 leads + tab), TO-263AB 1.3 V @ 30 A	Automotive 1200 V, 30 A bridge rectifier diode	ST	STBR3012G2Y-TR
8	4	D43, D44, D48, D49	SMAJ5.0A-TR DO-214AC, SMA 400W	400 W TVS in SMA	ST	SMAJ5.0A-TR
9	2	BX1, BX2	BOX	Aluminium boxes (not mounted)	HAMMOND	1550P
10	16	J2, J4, J6, J8, J10, J12, J14, J16, J23, J41,	CON4	Connector headers	Molex Connector Corporation	0015912040



Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
		J42, J44, J46, J48, J50, J51				
11	8	Q1, Q2, Q3, Q4, Q5, Q6, Q7, Q8	STB47N60DM6AG D2PAK	Automotive-grade N-channel 600 V, 70 mOhm typ., 36 A MDmesh DM6 Power MOSFET in a D2PAK package	ST	STB47N60DM6AG
12	4	Q17, Q18, Q20, Q21	SCTH35N65G2V-7A G H2PAK-7	Automotive-grade silicon carbide Power MOSFET 650 V, 45 A, 55 mOhm (typ. T <sub>J</sub> = 25 C) in an H2PAK-7 package	ST	SCTH35N65G2V7AG
13	2	Q19, Q22	TN3050H-12GY-TR TO-263-3, D <sup>2</sup> Pak (2 leads + tab), TO-263AB	1200 V, 30 A automotive-grade AEC-Q101 SCR thyristor	ST	TN3050H-12GY-TR
14	8	R54, R55, R63, R64, R75, R76, R80, R81	1 2512 (6432 metric) 1 W ±1%	Resistors	Vishay Dale	CRCW25121R00FKEG
15	12	R56, R57, R66, R67, R77, R78, R79, R82, R212, R213, R218, R219	10k 0805 (2012 metric) 0.1 W, 1/10 W ±1%	Resistors	Yageo	RC0805FR-0710KL
16	2	R204, R209	27 2512 (6432 Metric) 1W 1%	Resistors	Yageo	AC2512FK-0727RL
17	2	R214, R220	100 0805 (2012 Metric) 0.125W, 1/8W 1%	Resistors		
18	2	RT1, RT2	10K 0805 (2012 Metric) 210mW	Thermistors	Vishay BC Components	NTCS0805E3103FLT
19	16	TW2, TW4, TW5, TW6, TW7, TW8, TW10, TW11, TW12, TW13, TW14, TW49, TW50, TW54, TW56, TW81	Con1	Towers	RS	222-402
20	20	TW18, TW19, TW20, TW21, TW22, TW23, TW24, TW25, TW26, TW27, TW28, TW29, TW30, TW31, TW32, TW33, TW34, TW35, TW36, TW37	Con1	Screws	RS	482-8515
21	2	TW47, TW51	Spacer M4x12 M4x12	Spacers	Würth Elektronik	970120474
22	1	IMS PCB	(90.4x63.8mm + 203x138.5 mm) x 1.63mm	IMS PCB	-	-

**Table 4. Control board bill of materials**

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
1	24	C1, C3, C5, C6, C9, C10, C13, C30, C31, C33, C35, C37, C40, C42, C45, C48, C51, C57, C59, C60, C72, C73, C76, C81	0.1 $\mu$ F 0603 (1608 Metric) 50 V $\pm$ 10%	Ceramic capacitors	KEMET	C0603C104K5RACTU
2	2	C2, C4	15 pF 0603 (1608 Metric) 25 V $\pm$ 10%	Ceramic capacitors	Any	Any
3	21	C7, C8, C11, C12, C32, C34, C36, C38, C41, C43, C46, C49, C52, C55, C58, C62, C64, C66, C68, C74, C84	10 nF 0603 (1608 metric) 50 V $\pm$ 5%	Ceramic capacitors	AVX Corporation	06035C103JAT2A
4	2	C14, C15	6 pF 0603 (1608 metric) 50 V $\pm$ 10%	Ceramic capacitors	Any	Any
5	14	C16, C17, C18, C19, C20, C21, C22, C23, C24, C25, C26, C27, C28, C29	100 pF 0603 (1608 metric) 50 V $\pm$ 5%	Ceramic capacitors	Murata Electronics North America	GRM1885C1H101JA01D
6	3	C39, C69, C70	2.2 $\mu$ F 0603 (1608 metric) 16 V $\pm$ 20%	Ceramic capacitors	TDK Corporation	CGA3E1X7S1C225M080A C
7	5	C44, C47, C50, C53, C56	4.7 $\mu$ F 0805 (2012 metric) 10 V $\pm$ 10%	Ceramic capacitors	Murata Electronics North America	GCM21BC71A475KA73L
8	1	C54	0.1 $\mu$ F 0603 (1608 metric) 16 V $\pm$ 10%	Ceramic capacitor	Würth Electronics Inc.	885012206046
9	4	C61, C63, C65, C67	47 nF 0603 (1608 metric) 50 V $\pm$ 10%	Ceramic capacitors	Murata Electronics North America	GCM188R71H473KA55D
10	1	C71	1 $\mu$ F 0603 (1608 metric) 50 V $\pm$ 10%	Ceramic capacitors	Samsung Electro-Mechanics America, Inc.	CL10A105KB8NNNC
11	3	C75, C79, C91	6.8 $\mu$ F 1206 (3216 metric) 16 V $\pm$ 20%	Ceramic capacitors	TDK Corporation	CGA5L1X7R1C685M160A C
12	4	C77, C80, C86, C94	100 $\mu$ F radial, Can - SMD 16 V $\pm$ 20%	Aluminium capacitors	Panasonic Electronic Components	EEE-FT1C101AR
13	4	C78, C82, C92, C96	470 nF 0603 (1608 metric) 25 V $\pm$ 10%	Ceramic capacitors	Würth Electronics Inc.	885012206075
14	1	C83	10 $\mu$ F 1206 (3216 metric) 16 V $\pm$ 10%	Ceramic capacitor	AVX Corporation	TAJA106K016RNJ

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
15	1	C85	0.47 $\mu$ F 1206 (3216 metric) 50 V $\pm$ 10%	Ceramic capacitor	Würth Electronics Inc.	885012208091
16	2	C87, C98	8.2 nF 0603 (1608 metric) 50 V $\pm$ 5%	Ceramic capacitors	TDK Corporation	CGA3E2NP01H822J080AA
17	1	C88	470 pF 0603 (1608 metric) 50 V $\pm$ 5%	Ceramic capacitor	TDK Corporation	CGA3E2C0G1H471J080AD
18	1	C89	27 pF 0603 (1608 metric) 50 V $\pm$ 5%	Ceramic capacitor	Murata Electronics North America	GCM1885C1H270JA16D
19	2	C90, C99	68 nF 0603 (1608 metric) 50 V $\pm$ 10%	Ceramic capacitors	KEMET	C0603C683K5RACTU
20	1	C93	22 $\mu$ F 1206 (3216 metric) 6.3 V $\pm$ 20%	Ceramic capacitor	TDK Corporation	CGA5L1X7R0J226M160AC
21	1	C95	0.1 $\mu$ F 0603 25 V $\pm$ 10%	Ceramic capacitor	Kemet	C0603C104K3RAC
22	1	C97	6.8 pF 0603 (1608 metric) 50 V 0.5 pF	Ceramic capacitor	Würth Electronics Inc.	885012006050
23	1	C100	820 pF 0603 (1608 metric) 50 V $\pm$ 10%	Ceramic capacitor		
24	1	C101	47 pF 0603 (1608 metric) 50 V $\pm$ 5%	Ceramic capacitor	TDK Corporation	C1608C0G1H470J080AA
25	1	C102	6.8 pF 0603 (1608 metric) 50 V 0.5 pF	Ceramic capacitor (not mounted)	Würth Electronics Inc.	885012006050
26	1	D1	LED BLUE 0402 (1005 metric) 5 mA	Blue LED	Vishay Semiconductor Opto Division	VLMB1500-GS08
27	2	D2, D5	LED RED 0402 (1005 metric) 20 mA	Red LED	Vishay Semiconductor Opto Division	VLMS1500-GS08
28	2	D3, D4	LED YELLOW-GREEN 0402 (1005 metric) 20 mA	Yellow-green LED	Vishay Semiconductor Opto Division	VLMG1500-GS08
29	2	J1, J2	USART_CON	Connectors	TE Connectivity AMP Connectors	215079-4
30	3	J3, J4, J5	JUMPER-con2-strip-male	Jumpers	Any	Any
31	1	J6	JTAG	Connector header	Sullins Connector Solutions	SBH11-PBPC-D07-ST-BK
32	2	J7, J9	Con3	Headers	Harwin Inc.	M20-9990345
33	1	J8	SWD/COM	Connector header	Any	Any
34	1	J10	JUMPER	Connector header	Any	Any
35	2	J11, J14	JUMPER	Jumpers	Any	Any
36	1	J12	EXT SUPPLY	Terminal block	Phoenix Contact	1725656
37	1	J13	GND CON	Connector header		
38	7	J15, J16, J17, J18, J19, J20, J21	Jumper_Female	Jumpers	Sullins Connector Solutions	QPC02SXGN-RC

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
39	3	L1, L2, L4	470 OHM 0402 (1005 metric)	Ferrite beads	Würth Electronics Inc.	7427927141
40	1	L3	10 µH 2.5A non-standard ±20%	Fixed inductor	TDK Corporation	VLS5045EX-100M-CA
41	1	L5	8.2 µH-2.8A non-standard ±20%	Fixed inductor	Würth Electronics Inc.	78438357082
42	1	P1	Digital power connector	Connector Erni 90° 384241 32X2 male	ERNI	384241
43	1	Q1	BC847ALT1G TO-236-3, SC-59, SOT-23-3	Transistor	ON Semiconductor	BC847ALT1G
44	2	R1, R6	39 0603 (1608 metric) 0.1 W, 1/10 W ±1%	Resistors	Panasonic Electronic Components	ERJ-3EKF39R0V
45	2	R2, R5	820 0603 (1608 metric) 0.1 W, 1/10 W ±1%	Resistors	Yageo	RC0603FR-07820RL
46	2	R3, R8	47 0603 (1608 metric) 0.1 W, 1/10 W ±1%	Resistors	Yageo	RC0603FR-0747RL
47	8	R4, R7, R9, R12, R30, R59, R62, R63	0 0603 (1608 metric) 0.1 W, 1/10 W jumper	Resistors	Panasonic Electronic Components	ERJ-3GEY0R00V
48	4	R10, R11, R13, R14	0 2512 (6432 metric) 1 W jumper	Resistors (not mounted)	Yageo	RC2512JK-070RL
49	17	R15, R16, R19, R20, R21, R22, R25, R26, R27, R28, R29, R31, R48, R49, R53, R54, R79	10 k 0603 (1608 metric) 0.1 W, 1/10 W ±1%	Resistors	Yageo	RC0603FR-0710KL
50	4	R17, R18, R23, R24	4.99 k 0603 (1608 metric) 0.1 W, 1/10 W ±1%	Resistors	Vishay Dale	CRCW06034K99FKEA
51	1	R32	470 0603 (1608 metric) 0.1 W, 1/10 W ±1%	Resistor		
52	1	R33	390 0603 (1608 metric) 0.1 W, 1/10 W ±1%	Resistor	Yageo	RC0603FR-07390RL
53	14	R34, R35, R36, R37, R38, R39, R40, R41, R42, R43, R44, R45, R46, R47	10 0603 (1608 metric) 0.1 W, 1/10 W ±1%	Resistors		
54	2	R50, R52	0 0603 (1608 metric) 0.1 W, 1/10 W ±1%	Resistors		
55	1	R51	0 0603 (1608 metric) 0.1 W, 1/10 W ±1%	Resistor (not mounted)		

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
56	1	R55	0 0603 (1608 metric) 0.1 W, 1/10 W jumper	Resistor (not mounted)	Panasonic Electronic Components	ERJ-3GEY0R00V
57	4	R56, R57, R58, R60	0 0603 (1608 metric) 0.1 W, 1/10 W ±1%	Resistors		
58	2	R61, R64	0 0603 (1608 metric) 0.1 W, 1/10 W ±1%	Resistor (not mounted)		
59	2	R65, R66	100 0603 (1608 metric) 0.1 W, 1/10 W ±1%	Resistors	Yageo	RC0603FR-07100RP
60	1	R67	470 0603 (1608 metric) 0.1 W, 1/10 W ±1%	Resistor		
61	1	R68	680 0603 (1608 metric) 0.1 W, 1/10 W ±1%	Resistor		
62	2	R69, R74	0 1206 (3216 metric) 0.25 W, 1/4W jumper	Resistors	Yageo	RC1206JR-070RL
63	2	R70, R75	1M 0603 (1608 metric) 0.1 W, 1/10 W ±1%	Resistors	Vishay Dale	CRCW06031M00FKEAC
64	1	R71	249 k 0603 (1608 metric) 0.1 W, 1/10 W ±1%	Resistor		
65	1	R72	86.6 k 0603 (1608 metric) 0.1 W, 1/10 W ±1%	Resistor		
66	1	R73	43 k 0603 (1608 metric) 0.1 W, 1/10 W ±1%	Resistor		
67	1	R76	220 k 0603 (1608 metric) 0.1 W, 1/10 W ±1%	Resistor		
68	1	R77	560 k 0603 (1608 metric) 0.1 W, 1/10 W ±1%	Resistor		
69	1	R78	24 k 0603 (1608 metric) 0.1 W, 1/10 W ±1%	Resistor		
70	1	SW1	Miniswitch-KMR211GLFS 4.60 mm x 2.80 mm	Switch	C&K	KMR211GLFS
71	54	TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8, TP9, TP10, TP11, TP12, TP13, TP14, TP15, TP16, TP17, TP18, TP19, TP20, TP21, TP22, TP23, TP24, TP25, TP26, TP27, TP28, TP29, TP30, TP31, TP32,	5001 0.100" Dia x 0.180" L (2.54 mm x 4.57 mm)	Test points	Keystone Electronics	5001

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
		TP33, TP34, TP35, TP36, TP37, TP38, TP39, TP40, TP41, TP42, TP43, TP44, TP45, TP46, TP47, TP48, TP49, TP50, TP52, TP53, TP54, TP55				
72	1	TP51	VDD_LV 0.100" Dia x 0.180" L (2.54 mm x 4.57 mm)	Test point	Keystone Electronics	5001
73	2	U1, U2	LTV-0601 8-SOIC (0.154", 3.90 mm width)	Optoisolators	Lite-On Inc.	LTV-0601
74	4	U3, U4, U5, U6	TS3011IYLT SC-74A, SOT-753	Rail-to-rail high-speed comparators	ST	TS3011IYLT
75	4	U9, U10, U11, U12	DA108S1RL 8-SOIC (0.154", 3.90 mm width)	Diode arrays	ST	DA108S1RL
76	1	U13	STM6315RDW13F TO-253-4, TO-253AA	Open drain microprocessor reset	ST	STM6315RDW13F
77	2	U14, U15	A6986F 16-TSSOP (0.173", 4.40 mm width) exposed pad	Automotive 38 V, 1.5 A synchronous step-down switching regulator with 30 $\mu$ A quiescent current	ST	A6986F
78	1	U7	SN74AHC32MPWREP 14-TSSOP (0.173", 4.40mm width)	IC gate	Texas Instruments	SN74AHC32MPWREP
79	1	U8	SPC58NN84E7 eLQFP176	32-bit power architecture MCU for high performance applications	ST	SPC58NN84E7
80	1	Y1	40 MHz 0.098" L x 0.079" W (2.50 mm x 2.00 mm)	Crystal	ECS Inc.	ECS-400-8-36CKM

## Evaluation board license agreement

**Important:** All information on this document is subject to this Evaluation Board License Agreement.

By using this evaluation board or kit (together with all related software, firmware, components, and documentation provided by ST, "Evaluation Board"), You ("You") are agreeing to be bound by the terms and conditions of this Evaluation Board License Agreement ("Agreement"). Do not use the Evaluation Board until You have read and agreed to this Agreement. Your use of the Evaluation Board constitutes Your acceptance of this Agreement.

### LICENSE

STMicroelectronics ("ST") grants You the right to use the enclosed Evaluation Board offering limited features only to evaluate and test ST products solely for Your evaluation and testing purposes in a research and development setting. The Evaluation Board shall not be, in any case, directly or indirectly assembled as a part in any production of Yours as it is solely developed to serve evaluation purposes and has no direct function and is not a finished product. If software and/or firmware is accompanied by a separate end user license agreement ("EULA"), then such software and/or firmware shall be governed by such EULA.

### EVALUATION BOARD STATUS

The Evaluation Board offers limited features allowing You only to evaluate and test the ST products. The Evaluation Board is not intended for consumer or household use. You are not authorized to use the Evaluation Board in any production system, and it may not be offered for sale or lease, or sold, leased or otherwise distributed for commercial purposes. If the Evaluation Board is incorporated in an evaluation system, the evaluation system may be used by You solely for Your evaluation and testing purposes. Such evaluation system may not be offered for sale or lease or sold, leased or otherwise distributed for commercial purposes and must be accompanied by a conspicuous notice as follows: "This device is not, and may not be, offered for sale or lease, or sold or leased or otherwise distributed for commercial purposes".

### OWNERSHIP AND COPYRIGHT

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### RESTRICTIONS AND WARNINGS

Before You handle or use the Evaluation Board, You must carefully review any related documentation provided by ST. Such documentation may contain important warnings. You shall comply with all such warnings and other instructions and employ reasonable safety precautions in using the Evaluation Board. Failure to do so may result in death, personal injury, or property damage. If You have any questions regarding the safe usage of the Evaluation Board, You should contact ST for guidance.

You may not sell, assign, sublicense, lease, rent or otherwise distribute the Evaluation Board for commercial purposes, in whole or in part, or use Evaluation Board in a production system, with the exception that if You are an authorized ST distributor, You may resell the Evaluation Board in compliance with the applicable terms and conditions. Except as provided in this Agreement or as explicitly permitted in the documentation of the Evaluation Board, You may not reproduce the Evaluation Board or modify,

reverse engineer, de-compile or disassemble its software and/or firmware, in whole or in part.

You shall not use the Evaluation Board in any safety critical or functional safety testing, including but not limited to testing of life supporting, military or nuclear applications. ST expressly disclaims any responsibility for such usage which shall be made at Your sole risk, even if ST has been informed in writing of such usage. Unless expressly designated in writing by ST as suitable for use in testing automotive or aerospace applications, You shall not use the Evaluation Board in such testing.

### Notice applicable to Evaluation Boards according to European Regulation

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

ST WARRANTS THAT IT HAS THE RIGHT TO PROVIDE THE EVALUATION BOARD TO YOU. THIS WARRANTY IS PROVIDED BY ST IN LIEU OF ALL OTHER WARRANTIES, WRITTEN OR ORAL, STATUTORY, EXPRESS OR IMPLIED, INCLUDING ANY WARRANTY AS TO MERCHANTABILITY, NON-INFRINGEMENT, FITNESS FOR ANY PARTICULAR PURPOSE, OR UNINTERRUPTED OR ERROR-FREE OPERATION, ALL OF WHICH ARE EXPRESSLY DISCLAIMED. THE EVALUATION BOARD IS PROVIDED "AS IS".



YOU WARRANT TO ST THAT YOU WILL ENSURE THE EVALUATION BOARD IS USED ONLY BY ELECTRONICS EXPERTS WHO UNDERSTAND THE DANGERS OF HANDLING AND USING SUCH ITEMS, YOU ASSUME ALL RESPONSIBILITY AND LIABILITY FOR ANY IMPROPER OR UNSAFE HANDLING OR USE OF THE EVALUATION BOARD BY YOU, YOUR EMPLOYEES, AFFILIATES, CONTRACTORS, AND DESIGNEES.

#### **LIMITATION OF LIABILITIES**

IN NO EVENT SHALL ST BE LIABLE TO YOU, WHETHER IN CONTRACT, TORT (INCLUDING NEGLIGENCE), STRICT LIABILITY, OR ANY OTHER LEGAL THEORY, FOR ANY INDIRECT, SPECIAL, CONSEQUENTIAL, INCIDENTAL, PUNITIVE, OR EXEMPLARY DAMAGES WITH RESPECT TO ANY MATTERS RELATING TO THIS AGREEMENT, REGARDLESS OF WHETHER ST HAS BEEN ADVISED OF THE POSSIBILITY OF THE SAME. IN NO EVENT SHALL ST'S LIABILITY ARISING OUT OF THIS AGREEMENT IN THE AGGREGATE EXCEED THE AMOUNT PAID BY YOU UNDER THIS AGREEMENT FOR THE PURCHASE OF THE EVALUATION BOARD, OR TEN UNITED STATES DOLLARS (\$10.00) IF NO PURCHASE PRICE WAS PAID.

#### **INDEMNIFICATION**

You shall, at Your expense, defend ST and its Affiliates against a claim or action brought by a third party for infringement or misappropriation of any patent, copyright, trade secret or other intellectual property right of a third party to the extent resulting from (1) Your combination of the Evaluation Board with any other component, system, software, or firmware, (2) Your modification of the Evaluation Board, or (3) Your use of the Evaluation Board in a manner not permitted under this Agreement.

You shall indemnify ST and its Affiliates against and pay any resulting costs and damages finally awarded against ST or its Affiliates or agreed to in any settlement, provided that You have sole control of the defense and settlement of the claim or action, and ST cooperates in the defense and furnishes all related evidence under its control at Your expense. ST will be entitled to participate in the defense of such claim or action and to employ counsel at its own expense.

"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**

ST may terminate this Agreement without notice if You breach this Agreement. Upon termination, You shall immediately destroy or return all copies of the software, firmware, and documentation of the Evaluation Board to ST and certify in writing to ST that You have done so.

#### **APPLICABLE LAW AND JURISDICTION**

This Agreement shall be governed, construed and enforced in accordance with the laws of Switzerland, without regard to its conflict of laws rules. The UN Convention on Contracts for the International Sale of Goods shall not apply to this Agreement. In case of dispute and in the absence of an amicable settlement, the only competent jurisdiction shall be the Courts of Geneva, Switzerland. Any breach of this Agreement by You may result in irreparable damage to ST for which ST will not have an adequate remedy at law. Accordingly, in addition to any other remedies and damages available, You acknowledge and agree that ST may immediately seek enforcement of this Agreement in any jurisdiction by means of specific performance or injunction, without any requirement to post a bond or other security.

#### **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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