

Item No.	Designator	Quantity	Value	Part Number	Manufacturer	Description	Package name	Standard dimensions mm (inch)	Not Mounted
1	C1	1	0.1 $\mu$ F	ECWF6104JL	Panasonic	Film, 630 V, $\pm 5$ %		Through Hole	
2	C2	1	0.22 $\mu$ F			Ceramic, 50 V, $\pm 10$ %		1.6 x 0.8 (0603)	
3	C3, C18, C43, C49, C50	5	1000 pF			Ceramic, 50 V, $\pm 10$ %		1.6 x 0.8 (0603)	
4	C4	1	10000 pF			Ceramic, 630 V, $\pm 10$ %		3.2 x 1.6 (1206)	
5	C5	1	1 $\mu$ F	LE105-M	OKAYA	Polypropylene Film, 275 VAC, $\pm 10$ %		Through Hole	
6	C6, C7	2	3300 pF			Ceramic, 50 V, $\pm 10$ %		1.6 x 0.8 (0603)	
7	C8, C25	2	2.2 $\mu$ F			Ceramic, 50 V, $\pm 10$ %		1.6 x 0.8 (0603)	
8	C9, C12	2	0.22 $\mu$ F	LE224-MX	OKAYA	Polypropylene Film, 310 VAC, $\pm 10$ %		Through Hole	
9	C10, C17, C20, C33, C40, C64, C65	7	0.1 $\mu$ F			Ceramic, 50 V, $\pm 10$ %		1.6 x 0.8 (0603)	
10	C11	1	22 $\mu$ F			Aluminum Electrolytic, 50 V, $\pm 20$ %		Through Hole	
11	C13, C15, C47	3	2200 pF	DE1E3KX222MN5AA01	MURATA	Disc Ceramic, 250 VAC, $\pm 10$ %		Through Hole	
12	C14	1	4.7 $\mu$ F			Ceramic, 50 V, $\pm 10$ %		3.2 x 1.6 (1206)	
13	C16, C34	2	0.22 $\mu$ F			Ceramic, 50 V, $\pm 10$ %		1.6 x 0.8 (0603)	
14	C19, C38, C54, C58	4	1 $\mu$ F			Ceramic, 50 V, $\pm 10$ %		1.6 x 0.8 (0603)	
15	C21	1	470 pF			Ceramic, 50 V, $\pm 5$ %		1.6 x 0.8 (0603)	
16	C22	1	220 $\mu$ F			Aluminum Electrolytic, 25 V, $\pm 20$ %		Through Hole	
17	C23	1	1.0 $\mu$ F	ECWFD2W105K	Panasonic	Film, 450 V, $\pm 10$ %		Through Hole	
18	C24	1	0.1 $\mu$ F	MMX0450K104	Nissei	Film, 450 V, $\pm 10$ %		Through Hole	
19	C26, C28	2	220 pF			Ceramic, 50 V, $\pm 5$ %		1.6 x 0.8 (0603)	
20	C27	1	10 pF			Ceramic, 50 V, $\pm 5$ %		1.6 x 0.8 (0603)	
21	C29	1	22 $\mu$ F			Ceramic, 25 V, $\pm 20$ %		3.2 x 2.5 (1210)	
22	C30	1						1.6 x 0.8 (0603)	Not Mounted
23	C31, C32	2	330 $\mu$ F			Aluminum Electrolytic, 450 V, $\pm 20$ %		Through Hole	
24	C35	1	470 pF			Ceramic, 50 V, $\pm 10$ %		1.6 x 0.8 (0603)	
25	C36, C37, C39, C53, C55	5	2.2 $\mu$ F			Ceramic, 50 V, $\pm 10$ %		2.0 x 1.2 (0805)	

Item No.	Designator	Quantity	Value	Part Number	Manufacturer	Description	Package name	Standard dimensions mm (inch)	Not Mounted
26	C41, C78	2	56 $\mu$ F			Aluminum Electrolytic, 35 V, $\pm$ 20 %		Through Hole	
27	C42, C45	2	0.047 $\mu$ F	ECWF6473JL	Panasonic	Film, 630 V, $\pm$ 5 %		Through Hole	
28	C44	1	100 pF			Ceramic, 1 kV, $\pm$ 5 %		3.2 x 1.6 (1206)	
29	C46	1	150 pF			Ceramic, 1000 V, $\pm$ 5 %		3.2 x 1.6 (1206)	
30	C51	1	0.01 $\mu$ F			Ceramic, 50 V, $\pm$ 5 %		1.6 x 0.8 (0603)	
31	C52	1	4700 pF			Ceramic, 50 V, $\pm$ 5 %		1.6 x 0.8 (0603)	
32	C56, C57, C59, C60, C61, C62, C63, C66, C67, C69	10	560 $\mu$ F		Panasonic	Aluminum Organic Polymer, 16 V, $\pm$ 20 %		Through Hole	
33	C68	1	0.01 $\mu$ F			Ceramic, 50 V, $\pm$ 10 %		1.6 x 0.8 (0603)	
34	C70	1	10 $\mu$ F			Ceramic, 50 V, $\pm$ 10 %		3.2 x 2.5 (1210)	
35	C71, C72, C74, C75, C76, C77	6	22 $\mu$ F			Ceramic, 25 V, $\pm$ 20 %		2.0 x 1.2 (0805)	
36	C73	1	2200 pF			Ceramic, 50 V, $\pm$ 10 %		1.6 x 0.8 (0603)	
37	C79	1	0.01 $\mu$ F			Film, 630 V, $\pm$ 10 %		Through Hole	
38	C80, C81	2	2.2 $\mu$ F			Ceramic, 25 V, $\pm$ 10 %		1.6 x 0.8 (0603)	
39	D1, D2, D13	3	-	CRG04A	TOSHIBA	General Purpose Diode	S-FLAT	1.6 x 3.5	
40	D3, D4, D5, D7, D11, D12, D17, D19, D24, D25, D26	11	-	1SS187	TOSHIBA	Switching Diode	S-Mini	2.9 x 2.5	
41	D6, D22	2	-	CRF03A	TOSHIBA	Fast Recovery Diode	S-FLAT	1.6 x 3.5	
42	D8, D14	2	-	CRH01	TOSHIBA	High Efficiency Diode	S-FLAT	1.6 x 3.5	
43	D9, D16, D20, D21	4	-	CRS04	TOSHIBA	Schottky Barrier Diode	S-FLAT	1.6 x 3.5	
44	D10	1	-	D25XB60-7000	SHINDENGEN	Diode Bridge		Through Hole	
45	D15	1	-	S3V60	SHINDENGEN	Diode Bridge		Through Hole	
46	D18	1	-	(TRS6V65H) Under development	TOSHIBA	SiC Schottky Barrier Diode	DFN8x8	8 x 8	
47	D23	1	-	CRS13	TOSHIBA	Schottky Barrier Diode	S-FLAT	1.6 x 3.5	
48	F1	1	10A	FSL250V10AEM	Nippon Seisen	250V			
49	HS	1	-	15FP23-L65	LSI	Heat Sink		Through Hole	
50	HS2	1	-	HTE30-20(3)-60	Mizutani Electric	Heat Sink		Through Hole	
51	HS3	1	-	38SQ38H10	LSI	Heat Sink		Through Hole	

Item No.	Designator	Quantity	Value	Part Number	Manufacturer	Description	Package name	Standard dimensions mm (inch)	Not Mounted
52	HS4	1		15FP23-L50	LSI	Heat Sink		Through Hole	
53	L1, L2	2	5 mH	ADR-25-07-050T	UENO	Choke Coil		Through Hole	
54	L3	1	335 $\mu$ H	BCH20W-10335Y	UENO	Inductor		Through Hole	
55	PC1	1	-	TLP385(GR	TOSHIBA	Photocoupler	4pin SO6L	3.8 x 7.5	
56	Q1	1	-	RN2402	TOSHIBA	Transistor	S-Mini	2.9 x 1.5	
57	Q2, Q3, Q4, Q5	4	-	RN1402	TOSHIBA	Transistor	S-Mini	2.9 x 2.5	
58	Q6	1	-	TK090U65Z	TOSHIBA	MOSFET	TOLL	11 x 10	
59	Q7, Q8	2	-	TK20A60W5	TOSHIBA	MOSFET	TO-220SIS	Through Hole	
60	Q10, Q11, Q12, Q13	4	-	TPH1R306P1	TOSHIBA	MOSFET	SOP Advance	5.0 x 6.0	
61	Q14, Q15, Q16	3	-	TPHR9203PL	TOSHIBA	MOSFET	SOP Advance	5.0 x 6.0	
62	R1	1	120 k			1/10 W, $\pm$ 5 %		1.6 x 0.8 (0603)	
63	R2, R3, R4	3	220 k			1/4 W, $\pm$ 5 %		3.2 x 1.6 (1206)	
64	R5	1	39 k			1/10 W, $\pm$ 5 %		1.6 x 0.8 (0603)	
65	R6, R7	2	270 k			1/4 W, $\pm$ 10 %		3.2 x 1.6 (1206)	
66	R8	1	2.7 k			1/10 W, $\pm$ 1 %		1.6 x 0.8 (0603)	
67	R9	1	1 M			1/10 W, $\pm$ 5 %		1.6 x 0.8 (0603)	
68	R10, R11	2	82 k			1/4 W, $\pm$ 5 %		3.2 x 1.6 (1206)	
69	R12, R14, R98, R99, R113, R115, R116	7	10			1/8 W, $\pm$ 5 %		1.6 x 0.8 (0603)	
70	R13, R70, R72, R85	4						1.6 x 0.8 (0603)	Not Mounted
71	R15	1	100			1/8 W, $\pm$ 5 %		1.6 x 0.8 (0603)	
72	R16, R91, R96	3	100 k			1/10 W, $\pm$ 5 %		1.6 x 0.8 (0603)	
73	R17	1	470			1/8 W, $\pm$ 5 %		1.6 x 0.8 (0603)	
74	R18	1	330 k			1/10 W, $\pm$ 5 %		1.6 x 0.8 (0603)	
75	R19, R51, R104	3	220			1/8 W, $\pm$ 5 %		1.6 x 0.8 (0603)	
76	R20	1	27 k			1/10 W, $\pm$ 1 %		1.6 x 0.8 (0603)	
77	R21	1	18 k			1/10 W, $\pm$ 1 %		1.6 x 0.8 (0603)	
78	R22, R102	2	2.2 k			1/10 W, $\pm$ 5 %		1.6 x 0.8 (0603)	

Item No.	Designator	Quantity	Value	Part Number	Manufacturer	Description	Package name	Standard dimensions mm (inch)	Not Mounted
79	R23	1	47 k			1/10 W, $\pm 1\%$		1.6 x 0.8 (0603)	
80	R24, R25, R28, R30, R31, R49, R75, R81, R82, R97	10	10 k			1/10 W, $\pm 5\%$		1.6 x 0.8 (0603)	
81	R26	1	22			1/8 W, $\pm 5\%$		1.6 x 0.8 (0603)	
82	R27	1	22 k			1/10 W, $\pm 5\%$		1.6 x 0.8 (0603)	
83	R29	1	36 k			1/10 W, $\pm 5\%$		1.6 x 0.8 (0603)	
84	R32	1	56			1/8 W, $\pm 1\%$		1.6 x 0.8 (0603)	
85	R33	1	150			1/4 W, $\pm 5\%$		3.2 x 1.6 (1206)	
86	R34, R35	1	5.1	A5MC-5R1JK L3.5	Uchihashi Estec	2.1 W, $\pm 5\%$		Through Hole	
87	R36, R37, R38	3	150 k			1/10 W, $\pm 0.5\%$ , $\pm 25$ ppm		2.0 x 1.2 (0805)	
88	R39	1	130 k			1/10 W, $\pm 0.5\%$ , $\pm 25$ ppm		2.0 x 1.2 (0805)	
89	R40	1	120 k			1/10 W, $\pm 0.5\%$ , $\pm 25$ ppm		2.0 x 1.2 (0805)	
90	R41	1	9.1 k			1/10 W, $\pm 0.5\%$		1.6 x 0.8 (0603)	
91	R42	1	2.2			1/4 W, $\pm 5\%$		3.2 x 1.6 (1206)	
92	R43, R44, R45	3	68 m			1 W, $\pm 1\%$		3.2 x 1.6 (1206)	
93	R46	1	10			1/4 W, $\pm 5\%$		3.2 x 1.6 (1206)	
94	R47, R84, R105	3	4.7 k			1/10 W, $\pm 5\%$		1.6 x 0.8 (0603)	
95	R48, R59, R60	3	10 k			1/10 W, $\pm 1\%$		1.6 x 0.8 (0603)	
96	R50	1	470 k			1/10 W, $\pm 5\%$		1.6 x 0.8 (0603)	
97	R52, R53, R54, R55, R56	5	180 k			1/4 W, $\pm 1\%$		2.0 x 1.2 (0805)	
98	R57	1	9.1 k			1/10 W, $\pm 1\%$		1.6 x 0.8 (0603)	
99	R58	1	22K	RK73G2ATTD2202D	KOA	Resistor, 1/8W, $\pm 0.5\%$		2.0 x 1.25 (805)	
100	R58	1	22 k			1/8 W, $\pm 0.5\%$		2.0 x 1.2 (0805)	
101	R61	1	1 k			1/8 W, $\pm 1\%$		1.6 x 0.8 (0603)	
102	R62	1	3.3 k			1/10 W, $\pm 1\%$		1.6 x 0.8 (0603)	
103	R63, R64, R65, R66, R67	5	470 k			1/8 W, $\pm 0.5\%$		2.0 x 1.2 (0805)	

Item No.	Designator	Quantity	Value	Part Number	Manufacturer	Description	Package name	Standard dimensions mm (inch)	Not Mounted
104	R68	1	27 k			1/8 W, $\pm 0.5\%$		2.0 x 1.2 (0805)	
105	R69	1	68 k			1/10 W, $\pm 1\%$		1.6 x 0.8 (0603)	
106	R71	1	43 k			1/10 W, $\pm 1\%$		1.6 x 0.8 (0603)	
107	R73, R103, R117	3	0			1/10 W		1.6 x 0.8 (0603)	
108	R74, R76	2	0			1/4 W		3.2 x 1.6 (1206)	
109	R77, R78	2	47			1/4 W, $\pm 5\%$		3.2 x 1.6 (1206)	
110	R79	1	750 k			1/10 W, $\pm 1\%$		1.6 x 0.8 (0603)	R79
111	R80	1	360 k			1/10 W, $\pm 1\%$		1.6 x 0.8 (0603)	
112	R83	1	2.2			1/8 W, $\pm 5\%$		1.6 x 0.8 (0603)	
113	R86	1	200			1/8 W, $\pm 5\%$		1.6 x 0.8 (0603)	
114	R88, R89	2	4.7			1/4 W, $\pm 5\%$		3.2 x 1.6 (1206)	
115	R92, R93, R94, R95	4	0			2 A		3.2 x 1.6 (1206)	
116	R100	1	3.3 k			1/10 W, $\pm 5\%$		1.6 x 0.8 (0603)	
117	R101	1	3.9 k			1/10 W, $\pm 5\%$		1.6 x 0.8 (0603)	
118	R106	1	150			1/8 W, $\pm 1\%$		1.6 x 0.8 (0603)	
119	R107	1	8.2 k			1/10 W, $\pm 0.5\%$		1.6 x 0.8 (0603)	
120	R108	1	2.2 k			1/10 W, $\pm 0.5\%$		1.6 x 0.8 (0603)	
121	R109, R110, R111, R112	4	100			1/4 W, $\pm 5\%$		3.2 x 1.6 (1206)	
122	R114	1	1 k			1/8 W, $\pm 5\%$		1.6 x 0.8 (0603)	
123	RL1	1	DC12V	G5CA-1A-DC12V	OMRON	DC12 V, 10 A		Through Hole	
124	T1	1	-	TR072-132-0	PAT			Through Hole	
125	T2	1	-	TR071-132-0	PAT			Through Hole	
126	TB1	1	-	OTB-771N-BL-3P	Osada	300 v, 24 A			
127	TB2	1	-	OTB-781N-B-4P	Osada	250 V, 24A			
128	TH1	1	-	EC2F103A2-40113	SEMITEC	10 k $\Omega$ $\pm 1\%$ , 3435K		Through Hole	
129	U1, U4	2	-	TA75W393FU	TOSHIBA		SM8	2.9 x 4.0	
130	U2, U3	2	-	UCC28910D	Texas Instruments			3.9 x 4.9	
131	U5	1	-	UCC256303-3DDB	Texas Instruments			9.9 x 3.9	
132	U6	1	-	NJM2904M	NJRC			5 x 5	

Item No.	Designator	Quantity	Value	Part Number	Manufacturer	Description	Package name	Standard dimensions mm (inch)	Not Mounted
133	U7, U10	2	-	TL431LIBIDBZR	Texas Instruments			2.9 x 1.3	
134	U8, U9	2	-	UCC24612-2DBV	Texas Instruments			2.9 x 1.55	
135	U11	1	-	TPS2412D	Texas Instruments			3.9 x 4.9	
136	VAR1	1	680 V	ERZV10D681	Panasonic			Through Hole	
137	ZD1	1	6.8 V	CRY68	TOSHIBA		S-FLAT	1.6 x 3.5	
138	ZD2	1	6.2 V	CRY62	TOSHIBA		S-FLAT	1.6 x 3.5	
139	ZD3	1	-				S-FLAT	1.6 x 3.5	Not Mounted

## Terms of Use

This terms of use is made between Toshiba Electronic Devices and Storage Corporation ("We") and customers who use documents and data that are consulted to design electronics applications on which our semiconductor devices are mounted ("this Reference Design"). Customers shall comply with this terms of use. Please note that it is assumed that customers agree to any and all this terms of use if customers download this Reference Design. We may, at its sole and exclusive discretion, change, alter, modify, add, and/or remove any part of this terms of use at any time without any prior notice. We may terminate this terms of use at any time and for any reason. Upon termination of this terms of use, customers shall destroy this Reference Design. In the event of any breach thereof by customers, customers shall destroy this Reference Design, and furnish us a written confirmation to prove such destruction.

### 1. Restrictions on usage

1. This Reference Design is provided solely as reference data for designing electronics applications. Customers shall not use this Reference Design for any other purpose, including without limitation, verification of reliability.
2. This Reference Design is for customer's own use and not for sale, lease or other transfer.
3. Customers shall not use this Reference Design for evaluation in high or low temperature, high humidity, or high electromagnetic environments.
4. This Reference Design shall not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable laws or regulations.

### 2. Limitations

1. We reserve the right to make changes to this Reference Design without notice.
2. This Reference Design should be treated as a reference only. We are not responsible for any incorrect or incomplete data and information.
3. Semiconductor devices can malfunction or fail. When designing electronics applications by referring to this Reference Design, customers are responsible for complying with safety standards and for providing adequate designs and safeguards for their hardware, software and systems which minimize risk and avoid situations in which a malfunction or failure of semiconductor devices could cause loss of human life, bodily injury or damage to property, including data loss or corruption. Customers must also refer to and comply with the latest versions of all relevant our information, including without limitation, specifications, data sheets and application notes for semiconductor devices, as well as the precautions and conditions set forth in the "Semiconductor Reliability Handbook".
4. When designing electronics applications by referring to this Reference Design, customers must evaluate the whole system adequately. Customers are solely responsible for all aspects of their own product design or applications. WE ASSUME NO LIABILITY FOR CUSTOMERS' PRODUCT DESIGN OR APPLICATIONS.
5. No responsibility is assumed by us for any infringement of patents or any other intellectual property rights of third parties that may result from the use of this Reference Design. No license to any intellectual property right is granted by this terms of use, whether express or implied, by estoppel or otherwise.
6. THIS REFERENCE DESIGN IS PROVIDED "AS IS". WE (a) ASSUME NO LIABILITY WHATSOEVER, INCLUDING WITHOUT LIMITATION, INDIRECT, CONSEQUENTIAL, SPECIAL, OR INCIDENTAL DAMAGES OR LOSS, INCLUDING WITHOUT LIMITATION, LOSS OF PROFITS, LOSS OF OPPORTUNITIES, BUSINESS INTERRUPTION AND LOSS OF DATA, AND (b) DISCLAIM ANY AND ALL EXPRESS OR IMPLIED WARRANTIES AND CONDITIONS RELATED TO THIS REFERENCE DESIGN, INCLUDING WARRANTIES OR CONDITIONS OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, ACCURACY OF INFORMATION, OR NONINFRINGEMENT.

### 3. Export Control

Customers shall not use or otherwise make available this Reference Design for any military purposes, including without limitation, for the design, development, use, stockpiling or manufacturing of nuclear, chemical, or biological weapons or missile technology products (mass destruction weapons). This Reference Design may be controlled under the applicable export laws and regulations including, without limitation, the Japanese Foreign Exchange and Foreign Trade Law and the U.S. Export Administration Regulations. Export and re-export of this Reference Design are strictly prohibited except in compliance with all applicable export laws and regulations.

### 4. Governing Laws

This terms of use shall be governed and construed by laws of Japan.

## ご利用規約

本規約は、お客様と東芝デバイス&ストレージ株式会社（以下「当社」といいます）との間で、当社半導体製品を搭載した機器を設計する際に参考となるドキュメント及びデータ（以下「本リファレンスデザイン」といいます）の使用に関する条件を定めるものです。お客様は本規約を遵守しなければなりません。本リファレンスデザインをダウンロードすることをもって、お客様は本規約に同意したものとみなされます。なお、本規約は変更される場合があります。当社は、理由の如何を問わずいつでも本規約を解除することができます。本規約が解除された場合は、お客様は、本リファレンスデザインを破棄しなければなりません。またお客様が本規約に違反した場合は、お客様は、本リファレンスデザインを破棄し、その破棄したことを証する書面を当社に提出しなければなりません。

### 第1条 禁止事項

お客様の禁止事項は、以下の通りです。

1. 本リファレンスデザインは、機器設計の参考データとして使用されることを意図しています。信頼性検証など、それ以外の目的には使用しないでください。
2. 本リファレンスデザインを販売、譲渡、貸与等しないでください。
3. 本リファレンスデザインは、高温・多湿・強電磁界などの対環境評価には使用できません。
4. 本リファレンスデザインを、国内外の法令、規則及び命令により、製造、使用、販売を禁止されている製品に使用しないでください。

### 第2条 保証制限等

1. 本リファレンスデザインは、技術の進歩などにより予告なしに変更されることがあります。
2. 本リファレンスデザインは参考用のデータです。当社は、データおよび情報の正確性、完全性に関して一切の保証をいたしません。
3. 半導体素子は誤作動したり故障したりすることがあります。本リファレンスデザインを参考に機器設計を行う場合は、誤作動や故障により生命・身体・財産が侵害されることのないように、お客様の責任において、お客様のハードウェア・ソフトウェア・システムに必要な安全設計を行うことをお願いします。また、使用されている半導体素子に関する最新の情報（半導体信頼性ハンドブック、仕様書、データシート、アプリケーションノートなど）をご確認の上、これに従ってください。
4. 本リファレンスデザインを参考に機器設計を行う場合は、システム全体で十分に評価し、お客様の責任において適用可否を判断して下さい。当社は、適用可否に対する責任を負いません。
5. 本リファレンスデザインは、その使用に際して当社及び第三者の知的財産権その他の権利に対する保証または実施権の許諾を行うものではありません。
6. 当社は、本リファレンスデザインに関して、明示的にも黙示的にも一切の保証（機能動作の保証、商品性の保証、特定目的への合致の保証、情報の正確性の保証、第三者の権利の非侵害保証を含むがこれに限らない。）をせず、また当社は、本リファレンスデザインに関する一切の損害（間接損害、結果的損害、特別損害、付随的損害、逸失利益、機会損失、休業損、データ喪失等を含むがこれに限らない。）につき一切の責任を負いません。

### 第3条 輸出管理

お客様は本リファレンスデザインを、大量破壊兵器の開発等の目的、軍事利用の目的、あるいはその他軍事用途の目的で使用してはなりません。また、お客様は「外国為替及び外国貿易法」、「米国輸出管理規則」等、適用ある輸出関連法令を遵守しなければなりません。

### 第4条 準拠法

本規約の準拠法は日本法とします。