

## Lead (Pb)-Free Thick Film, Rectangular Chip Resistors



### FEATURES

- Stability  $\Delta R/R = 1\%$  for 1000 h at 70 °C
- Pure tin solder contacts on Ni barrier layer provides compatibility with lead (Pb)-free and lead containing soldering processes
- Metal glaze on high quality ceramic
- Compliant to RoHS Directive 2002/95/EC
- Halogen-free according to IEC 61249-2-21 definition
- AEC-Q200 qualified, rev. C compliant



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**

STANDARD ELECTRICAL SPECIFICATIONS								
MODEL	SIZE		RATED DISIPATION $P_{70^\circ\text{C}}$ W	LIMITING ELEMENT VOLTAGE $U_{\text{max. AC/DC}}$	TEMPERATURE COEFFICIENT ppm/K	TOLERANCE %	RESISTANCE RANGE $\Omega$	SERIES
	INCH	METRIC						
CRCW0201	0201	RR 0603M	0.05	30	$\pm 100$ $\pm 200$	$\pm 1$ $\pm 1$ $\pm 5$	47R to 1M0	E24; E96
							10R to 1M0	E24; E96 E24
Zero-Ohm-Resistor: $R_{\text{max.}} = 50 \text{ m}\Omega$ , $I_{\text{max.}}$ at 70 °C = 1.0 A								
D10/CRCW0402	0402	RR 1005M	0.063	50	$\pm 100$ $\pm 200$	$\pm 1$ $\pm 5$	1R0 to 10M	E24; E96 E24
							Zero-Ohm-Resistor: $R_{\text{max.}} = 20 \text{ m}\Omega$ , $I_{\text{max.}}$ at 70 °C = 1.5 A	
D11/CRCW0603	0603	RR 1608M	0.10	75	$\pm 100$ $\pm 200$	$\pm 1$ $\pm 5$	1R0 to 10M	E24; E96 E24
							Zero-Ohm-Resistor: $R_{\text{max.}} = 20 \text{ m}\Omega$ , $I_{\text{max.}}$ at 70 °C = 2.0 A	
D12/CRCW0805	0805	RR 2012M	0.125	150	$\pm 100$ $\pm 200$	$\pm 1$ $\pm 5$	1R0 to 10M	E24; E96 E24
							Zero-Ohm-Resistor: $R_{\text{max.}} = 20 \text{ m}\Omega$ , $I_{\text{max.}}$ at 70 °C = 2.5 A	
D25/CRCW1206	1206	RR 3216M	0.25	200	$\pm 100$ $\pm 200$	$\pm 1$ $\pm 5$	1R0 to 10M	E24; E96 E24
							Zero-Ohm-Resistor: $R_{\text{max.}} = 20 \text{ m}\Omega$ , $I_{\text{max.}}$ at 70 °C = 3.5 A	
CRCW1210	1210	RR 3225M	0.5	200	$\pm 100$ $\pm 200$	$\pm 1$ $\pm 5$	1R0 to 10M	E24; E96 E24
							Zero-Ohm-Resistor: $R_{\text{max.}} = 20 \text{ m}\Omega$ , $I_{\text{max.}}$ at 70 °C = 5.0 A	
CRCW1218	1218	RR 3246M	1.0	200	$\pm 100$ $\pm 200$	$\pm 1$ $\pm 5$	1R0 to 2M2	E24; E96 E24
							Zero-Ohm-Resistor: $R_{\text{max.}} = 20 \text{ m}\Omega$ , $I_{\text{max.}}$ at 70 °C = 7.0 A	
CRCW2010	2010	RR 5025M	0.75	400	$\pm 100$ $\pm 200$	$\pm 1$ $\pm 5$	1R0 to 10M	E24; E96 E24
							Zero-Ohm-Resistor: $R_{\text{max.}} = 20 \text{ m}\Omega$ , $I_{\text{max.}}$ at 70 °C = 6.0 A	
CRCW2512	2512	RR 6332M	1.0	500	$\pm 100$ $\pm 200$	$\pm 1$ $\pm 5$	1R0 to 10M	E24; E96 E24
							Zero-Ohm-Resistor: $R_{\text{max.}} = 20 \text{ m}\Omega$ , $I_{\text{max.}}$ at 70 °C = 7.0 A	

### Notes

- These resistors do not feature a limited lifetime when operated within the permissible limits. However, resistance value drift increasing over operating time may result in exceeding a limit acceptable to the specific application, thereby establishing a functional lifetime.
- Marking: See data sheet "Surface Mount Resistor Marking" (document number 20020).
- Power rating depends on the max. temperature at the solder point, the component placement density and the substrate material.



TECHNICAL SPECIFICATIONS										
PARAMETER	UNIT	CRCW0201	D10/ CRCW0402	D11/ CRCW0603	D12/ CRCW0805	D25/ CRCW1206	CRCW1210	CRCW1218	CRCW2010	CRCW2512
Rated dissipation $P_{70}$ <sup>(1)</sup>	W	0.05	0.063	0.1	0.125	0.25	0.5	1.0	0.75	1.0
Limiting element voltage $U_{max. AC/DC}$	V	30	50	75	150	200	200	200	400	500
Insulation voltage $U_{ins}$ (1 min)	V	50	> 75	> 100	> 200	> 300	> 300	> 300	> 300	> 300
Insulation resistance	$\Omega$	> $10^9$								
Category temperature range	$^{\circ}\text{C}$	- 55 to + 155								
Failure rate	$\text{h}^{-1}$	$1 \times 10^{-9}$	< $0.1 \times 10^{-9}$							
Weight	mg	0.17	0.65	2	5.5	10	16	29.5	25.5	40.5

**Note**

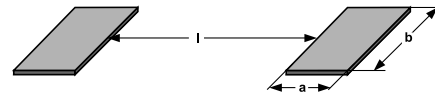
<sup>(1)</sup> The power dissipation on the resistor generates a temperature rise against the local ambient, depending on the heat flow support of the printed-circuit board (thermal resistance). The rated dissipation applies only if the permitted film temperature of 155 °C is not exceeded.

PART NUMBER AND PRODUCT DESCRIPTION																	
Part Number: CRCW0603562RFKEC <sup>(2)</sup>																	
C	R	C	W	0	6	0	3	5	6	2	R	F	K	E	C		
MODEL		VALUE		TOLERANCE		TCR		PACKAGING		SPECIAL							
CRCW0201 CRCW0402 CRCW0603 CRCW0805 CRCW1206 CRCW1210 CRCW1218 CRCW2010 CRCW2512		R = Decimal K = Thousand M = Million 0000 = Jumper		F = $\pm 1.0\%$ J = $\pm 5.0\%$ Z = Jumper		K = $\pm 100$ ppm/K N = $\pm 200$ ppm/K 0 = Jumper S = Special		EA, EB, EC, ED, EE, EF, EG, EH, EK		Up to 2 digits							
Product Description: D11/CRCW0603 100 562R 1 % ET6 e3																	
D11/CRCW0603		100		562R		1 %		ET6		e3							
MODEL		TCR		RESISTANCE VALUE		TOLERANCE		PACKAGING		LEAD (Pb)-FREE							
CRCW0201 D10/CRCW0402 D11/CRCW0603 D12/CRCW0805 D25/CRCW1206 CRCW1210 CRCW1218 CRCW2010 CRCW2512		$\pm 200$ ppm/K $\pm 100$ ppm/K		10R = 10 $\Omega$ 562R = 562 $\Omega$ 10K = 10 k $\Omega$ 1M = 1 M $\Omega$ 0R0 = Jumper		$\pm 5\%$ $\pm 1\%$		ET1, ET5, ET6, ET7, EF4, E02, E67, E82, ET9		e3 = Pure tin termination finish							

**Note**

<sup>(2)</sup> Preferred way for ordering products is by use of the PART NUMBER.

PACKAGING							
MODEL	UNIT	PAPER TAPE ON REEL ACC. TO IEC 60286-3, TYPE I			BLISTER TAPE ON REEL ACC. TO IEC 60286-3, TYPE II		
		QUANTITY	PART NUMBER	PRODUCT DESC.	QUANTITY	PART NUMBER	PRODUCT DESC.
CRCW0201	180 mm/7"	10 000	ED	ET7			
	330 mm/13"	50 000	EE	EF4			
D10/CRCW0402	180 mm/7"	10 000	ED	ET7			
	330 mm/13"	50 000	EE	EF4			
D11/CRCW0603	180 mm/7"	5000	EA	ET1			
	285 mm/11.25"	10 000	EB	ET5			
	330 mm/13"	20 000	EC	ET6			
D12/CRCW0805	180 mm/7"	5000	EA	ET1			
	285 mm/11.25"	10 000	EB	ET5			
	330 mm/13"	20 000	EC	ET6			
D25/CRCW1206	180 mm/7"	5000	EA	ET1			
	285 mm/11.25"	10 000	EB	ET5			
	330 mm/13"	20 000	EC	ET6			
CRCW1210	180 mm/7"	5000	EA	ET1			
	285 mm/11.25"	10 000	EB	ET5			
	330 mm/13"	20 000	EC	ET6			
CRCW1218	180 mm/7"				4000	EK	ET9
CRCW2010	180 mm/7"				4000	EF	E02
CRCW2512	180 mm/7"				2000	EG	E67
					4000	EH	E82

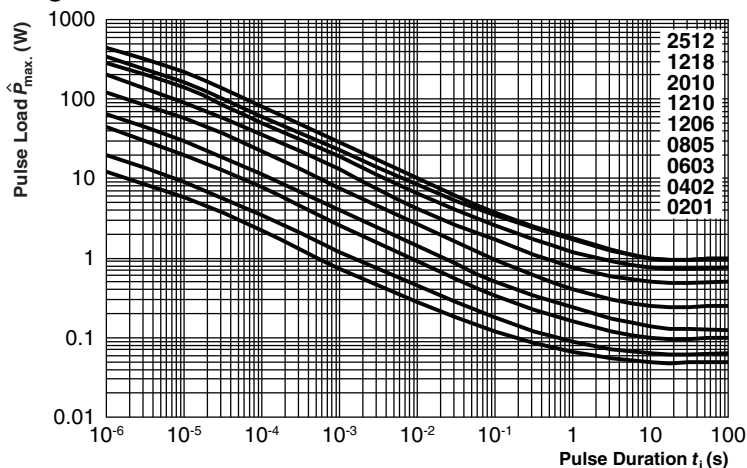
**DIMENSIONS**


SIZE		DIMENSIONS in millimeters					SOLDER PAD DIMENSIONS in millimeters					
							REFLOW SOLDERING			WAVE SOLDERING		
INCH	METRIC	L	W	H	T1	T2	a	b	l	a	b	l
0201	0525	0.6 ± 0.05	0.3 ± 0.05	0.23 ± 0.05	0.15 ± 0.05	0.15 <sup>+0.05</sup> / <sub>-0.10</sub>	0.28	0.43	0.23			
0402	1005	1.0 ± 0.05	0.5 ± 0.05	0.35 ± 0.05	0.25 ± 0.05	0.2 ± 0.1	0.4	0.6	0.5			
0603	1608	1.55 <sup>+0.10</sup> / <sub>-0.05</sub>	0.85 ± 0.1	0.45 ± 0.05	0.3 ± 0.2	0.3 ± 0.2	0.5	0.9	1.0	0.9	0.9	1.0
0805	2012	2.0 <sup>+0.20</sup> / <sub>-0.10</sub>	1.25 ± 0.15	0.45 ± 0.05	0.3 <sup>+0.20</sup> / <sub>-0.10</sub>	0.3 ± 0.2	0.7	1.3	1.2	0.9	1.3	1.3
1206	3216	3.2 <sup>+0.10</sup> / <sub>-0.20</sub>	1.6 ± 0.15	0.55 ± 0.05	0.45 ± 0.2	0.4 ± 0.2	0.9	1.7	2.0	1.1	1.7	2.3
1210	3225	3.2 ± 0.2	2.5 ± 0.2	0.55 ± 0.05	0.45 ± 0.2	0.4 ± 0.2	0.9	2.5	2.0	1.1	2.5	2.2
1218	3246	3.2 <sup>+0.10</sup> / <sub>-0.20</sub>	4.6 ± 0.15	0.55 ± 0.05	0.45 ± 0.2	0.4 ± 0.2	1.05	4.9	1.9	1.25	4.8	1.9
2010	5025	5.0 ± 0.15	2.5 ± 0.15	0.6 ± 0.1	0.6 ± 0.2	0.6 ± 0.2	1.0	2.5	3.9	1.2	2.5	3.9
2512	6332	6.3 ± 0.2	3.15 ± 0.15	0.6 ± 0.1	0.6 ± 0.2	0.6 ± 0.2	1.0	3.2	5.2	1.2	3.2	5.2



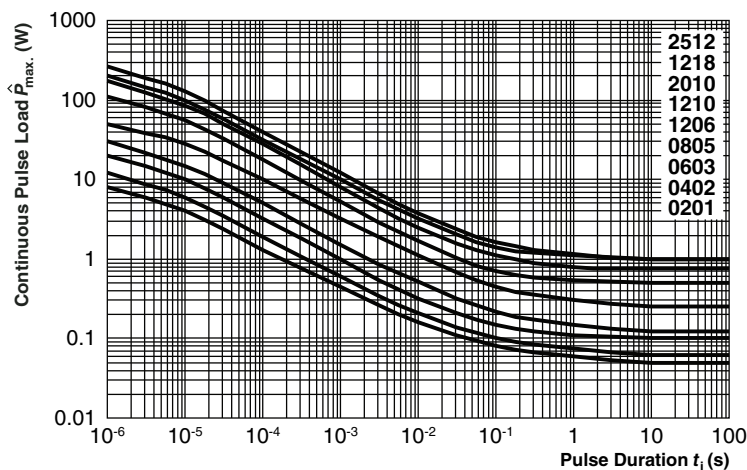
**FUNCTIONAL PERFORMANCE**

**Single Pulse**



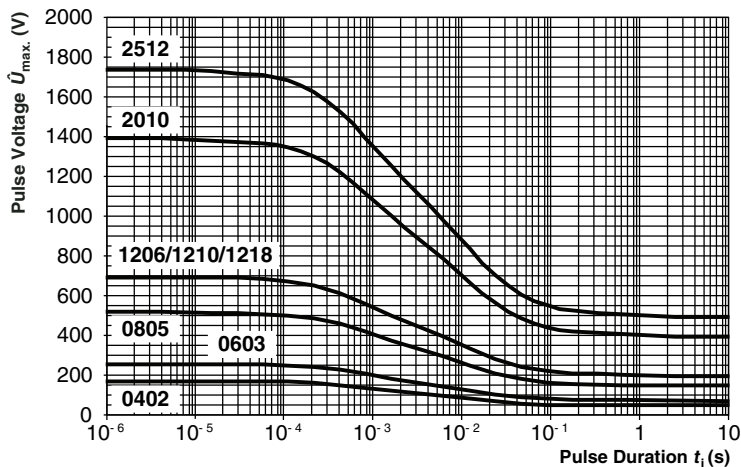
Maximum pulse load, single pulse; applicable if  $\bar{P} \rightarrow 0$  and  $n < 1000$  and  $\bar{U} \leq \bar{U}_{max}$ ; for permissible resistance change equivalent to 8000 h operation

**Continuous Pulse**



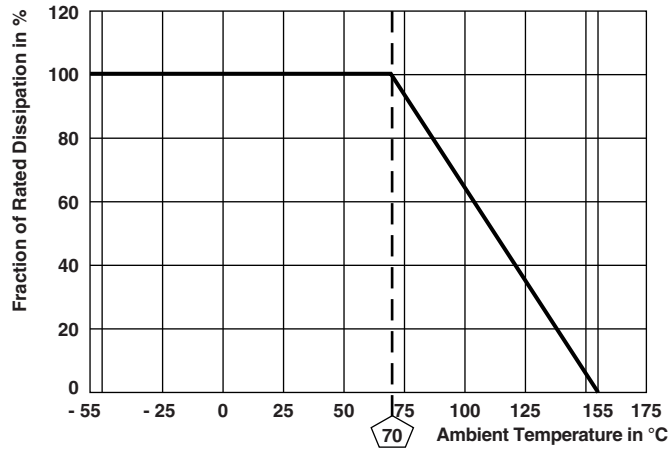
Maximum pulse load, continuous pulses; applicable if  $\bar{P} \leq P(9_{amb})$  and  $\bar{U} \leq \bar{U}_{max}$ ; for permissible resistance change equivalent to 8000 h operation

**Pulse Voltage**



Maximum pulse voltage, single and continuous pulses; applicable if  $\hat{P} \leq \hat{P}_{max}$ ; for permissible resistance change equivalent to 8000 h operation

### Derating



### Non-Linearity



### Current Noise



TEST PROCEDURES AND REQUIREMENTS						
EN 60115-1 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE ( $\Delta R$ )		
				SIZE 0402 to 2512		SIZE 0201
				STABILITY CLASS 1 OR BETTER	STABILITY CLASS 2 OR BETTER	REQUIREMENTS PERMISSIBLE CHANGE ( $\Delta R/R$ )
			Stability for product types:			
			<b>D/CRCW e3</b>	1 $\Omega$ to 10 M $\Omega$	1 $\Omega$ to 10 M $\Omega$	10 $\Omega$ to 1 M $\Omega$
4.5	-	Resistance	-	$\pm 1\%$	$\pm 5\%$	$\pm 1\%$ ; $\pm 5\%$
4.7	-	Voltage proof	$U = 1.4 \times U_{ins}$ ; 60 s	No flashover or breakdown		
4.13	-	Short time overload	$U = 2.5 \times \sqrt{P_{70} \times R} \leq 2 \times U_{max.}$ ; duration: Acc. to style	$\pm (0.25\% R + 0.05 \Omega)$	$\pm (0.5\% R + 0.05 \Omega)$	$\pm (1\% R + 0.05 \Omega)$
4.17.2	58 (Td)	Solderability	Solder bath method; Sn60Pb40 non activated flux; (235 $\pm$ 5) $^{\circ}$ C (2 $\pm$ 0.2) s	Good tinning ( $\geq 95\%$ covered) no visible damage		
			Solder bath method; Sn96.5Ag3Cu0.5 non-activated flux; (245 $\pm$ 5) $^{\circ}$ C (3 $\pm$ 0.3) s	Good tinning ( $\geq 95\%$ covered) no visible damage		
4.8.4.2	-	Temperature coefficient	(20/- 55/20) $^{\circ}$ C and (20/125/20) $^{\circ}$ C	$\pm 100$ ppm/K	$\pm 200$ ppm/K	$\pm 100$ ppm/K, $\pm 200$ ppm/K
4.32	21 (Uu <sub>3</sub> )	Shear (adhesion)	RR 1608 and smaller: 9 N RR 2012 and larger: 45 N	No visible damage		
4.33	21 (Uu <sub>1</sub> )	Substrate bending	Depth 2 mm; 3 times	No visible damage, no open circuit in bent position $\pm (0.25\% R + 0.05 \Omega)$   $\pm (0.5\% R + 0.05 \Omega)$		
4.19	14 (Na)	Rapid change of temperature	30 min. at - 55 $^{\circ}$ C; 30 min. at 125 $^{\circ}$ C			
			5 cycles 1000 cycles	$\pm (0.25\% R + 0.05 \Omega)$ $\pm (1\% R + 0.05 \Omega)$	$\pm (0.5\% R + 0.05 \Omega)$ $\pm (1\% R + 0.05 \Omega)$	$\pm (0.5\% R + 0.05 \Omega)$ $\pm (1\% R + 0.05 \Omega)$
4.23	-	Climatic sequence:	-			
4.23.2	2 (Ba)	Dry heat	125 $^{\circ}$ C; 16 h			
4.23.3	30 (Db)	Damp heat, cyclic	55 $^{\circ}$ C; $\geq 90\%$ RH; 24 h; 1 cycle			
4.23.4	1 (Aa)	Cold	- 55 $^{\circ}$ C; 2 h	$\pm (1\% R + 0.05 \Omega)$	$\pm (2\% R + 0.1 \Omega)$	$\pm (2\% R + 0.1 \Omega)$
4.23.5	13 (M)	Low air pressure	1 kPa; (25 $\pm$ 10) $^{\circ}$ C; 1 h			
4.23.6	30 (Db)	Damp heat, cyclic	55 $^{\circ}$ C; $\geq 90\%$ RH; 24 h; 5 cycles			
4.23.7	-	DC load	$U = \sqrt{P_{70} \times R}$			
4.25.1	-	Endurance at 70 $^{\circ}$ C	$U = \sqrt{P_{70} \times R} \leq U_{max.}$ ; 1.5 h on; 0.5 h off;			
			70 $^{\circ}$ C; 1000 h	$\pm (1\% R + 0.05 \Omega)$	$\pm (2\% R + 0.1 \Omega)$	$\pm (2\% R + 0.1 \Omega)$
			70 $^{\circ}$ C; 8000 h	$\pm (2\% R + 0.1 \Omega)$	$\pm (4\% R + 0.1 \Omega)$	$\pm (4\% R + 0.1 \Omega)$

TEST PROCEDURES AND REQUIREMENTS						
EN 60115-1 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE ( $\Delta R$ )		
				SIZE 0402 to 2512		SIZE 0201
				STABILITY CLASS 1 OR BETTER	STABILITY CLASS 2 OR BETTER	REQUIREMENTS PERMISSIBLE CHANGE ( $\Delta R/R$ )
			Stability for product types:			
			<b>D/CRCW e3</b>	1 $\Omega$ to 10 M $\Omega$	1 $\Omega$ to 10 M $\Omega$	10 $\Omega$ to 1 M $\Omega$
4.18.2	58 (Td)	Resistance to soldering heat	Solder bath method (260 $\pm$ 5) $^{\circ}$ C; (10 $\pm$ 1) s	$\pm$ (0.25 % $R$ + 0.05 $\Omega$ )	$\pm$ (0.5 % $R$ + 0.05 $\Omega$ )	$\pm$ (1 % $R$ + 0.05 $\Omega$ )
4.35	-	Flamability, needle flame test	IEC 60695-11-5; 10 s	No burning after 30 s		
4.24	78 (Cab)	Damp heat, steady state	(40 $\pm$ 2) $^{\circ}$ C; (93 $\pm$ 3) % RH; 56 days	$\pm$ (1 % $R$ + 0.05 $\Omega$ )		$\pm$ (2 % $R$ + 0.1 $\Omega$ )
4.25.3	-	Endurance at upper category temperature	155 $^{\circ}$ C, 1000 h	$\pm$ (1 % $R$ + 0.05 $\Omega$ )	$\pm$ (2 % $R$ + 0.1 $\Omega$ )	$\pm$ (2 % $R$ + 0.1 $\Omega$ )
4.40	-	Electrostatic discharge (human body model)	IEC 61340-3-1; 3 pos. + 3 neg. discharges; ESD voltage acc. to size	$\pm$ (1 % $R$ + 0.05 $\Omega$ )		
4.29	45 (XA)	Component solvent resistance	Isopropyl alcohol; 50 $^{\circ}$ C; method 2	No visible damage		
4.30	45 (XA)	Solvent resistance of marking	Isopropyl alcohol; 50 $^{\circ}$ C; method 1, toothbrush	Marking legible, no visible damage		
4.22	6 (Fc)	Vibration, endurance by sweeping	f = 10 Hz to 2000 Hz; x, y, z $\leq$ 1.5 mm; A $\leq$ 200 m/s <sup>2</sup> ; 10 sweeps per axis	$\pm$ (0.25 % $R$ + 0.05 $\Omega$ )	$\pm$ (0.5 % $R$ + 0.05 $\Omega$ )	$\pm$ (0.5 % $R$ + 0.05 $\Omega$ )
4.37	-	Periodic electric overload	$U = \sqrt{15 \times P_{70} \times R}$ $\leq 2 \times U_{max.}$ ; 0.1 s on; 2.5 s off; 1000 cycles	$\pm$ (1 % $R$ + 0.05 $\Omega$ )		
4.27	-	Single pulse high voltage overload, 10 $\mu$ s/700 $\mu$ s	$\dot{U} = 10 \times \sqrt{P_{70} \times R}$ $\leq 2 \times U_{max.}$ ; 10 pulses	$\pm$ (1 % $R$ + 0.05 $\Omega$ )		

All tests are carried out in accordance with the following specifications:

- EN 60115-1, generic specification
- EN 140400, sectional specification
- EN 140401-802, detail specification
- IEC 60068-2, environmental test procedures

Packaging of components is done in paper or blister tapes according to IEC 60286-3.



## Disclaimer

All product specifications and data are subject to change without notice.

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