

Characteristics Data

TOS9300 Series

May 13, 2025

KIKUSUI ELECTRONICS CORP.

Ver.1.02

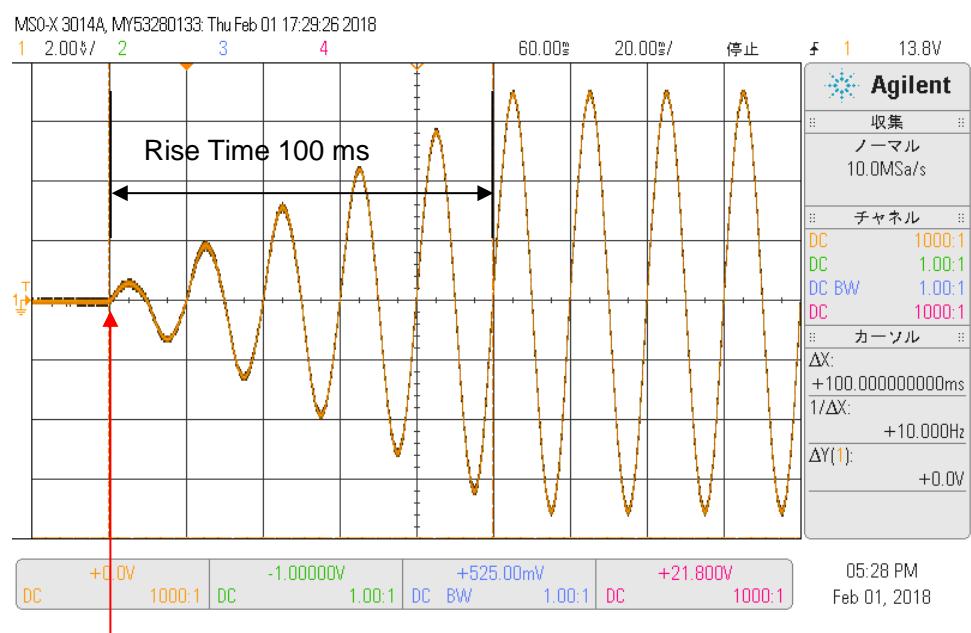
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*All numerical data provided in this document are reference values only and do not constitute a product guarantee across all models.

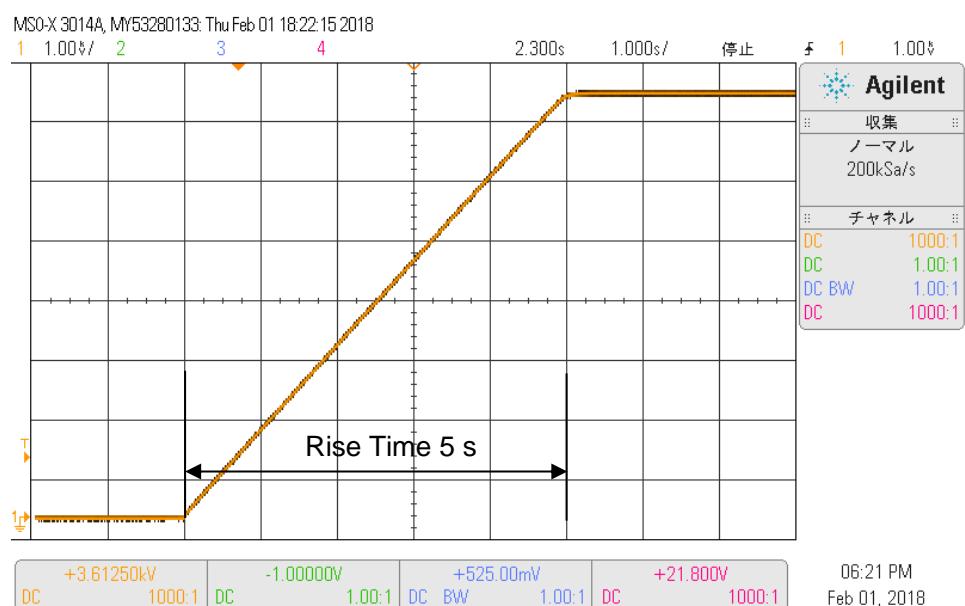
* This data applies to all models of TOS9300 series except TOS9311.

Model	TOS9300 Series	Temperature	
Item	Voltage Rise Waveform (ACW: AC withstand voltage test)	Testing Circuit	
Condition	Test Voltage = 5000 V, Open (No load), Rise Time = 0.1 s		

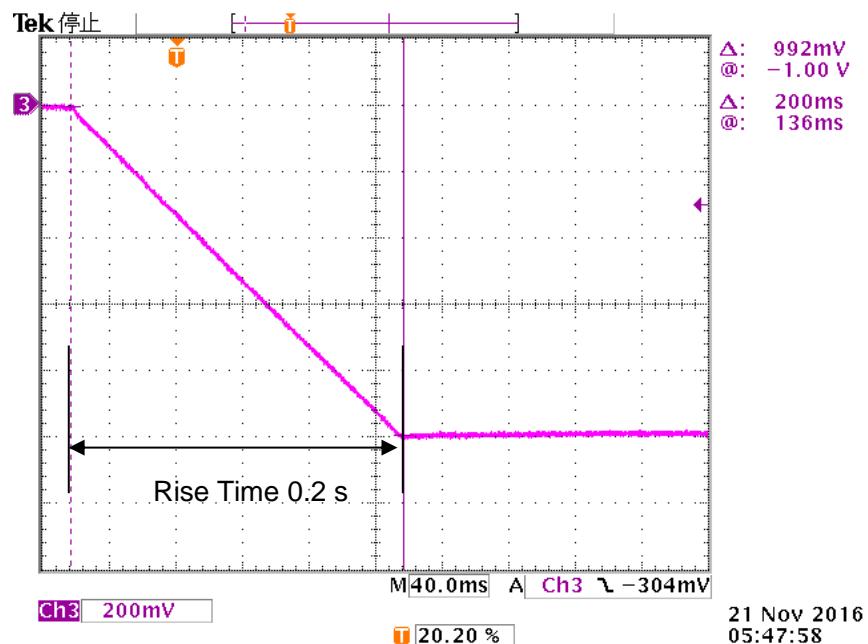


Zero-crossing (zero potential) start

Model	TOS9300 Series	Temperature	
Item	Voltage Rise Waveform (DCW: DC withstand voltage test)	Testing Circuit	
Condition	Test Voltage = 7200 V, Open (No load), Rise Time = 5 s		



Model	TOS9300 Series	Temperature	
Item	Voltage Rise Waveform (IR: insulation resistance test)	Testing Circuit	
Condition	Test Voltage = -1000 V, Open (No load), Rise Time = 0.2 s		



Model	TOS9300 Series	Temperature	
Item	Voltage Fall Waveform (ACW)	Testing Circuit	
Condition	Test Voltage = 5000 V, Open (No load), Fall Time = 0.1 s/5 s		

MSO-X 3014A, MY53280133, Fri Feb 02 18:58:04 2018

1 500V/ 2 3 4 186.6ms 20.00% / 停止 1 394V

Agilent

収集 ノーマル 10.0MSa/s

チャネル

- DC 1000:1
- DC 1.00:1
- DC BW 1.00:1
- DC 1000:1

カーソル

ΔX: +100.000000000ms

1/ΔX: +10.000Hz

ΔY(1): -2.95625kV

06:57 PM Feb 02, 2018

Fall Time = 0.1 s

MSO-X 3014A, MY53280133, Thu Feb 01 18:31:58 2018

1 2.00V/ 2 3 4 3.100s 1.000s / 停止 1 325V

Agilent

収集 ノーマル 200kSa/s

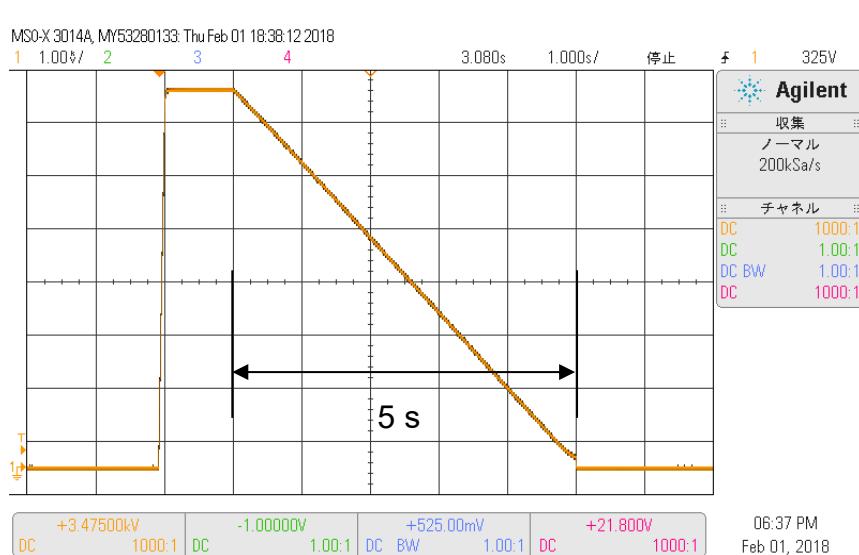
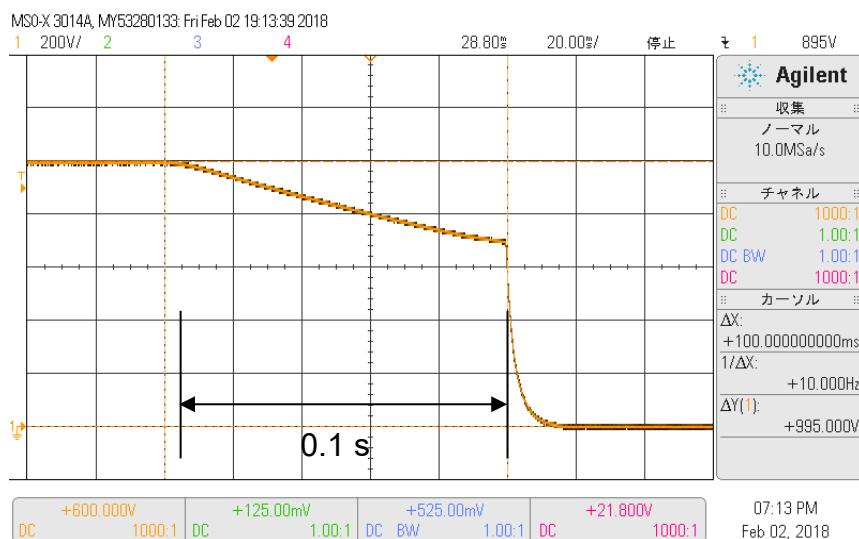
チャネル

- DC 1000:1
- DC 1.00:1
- DC BW 1.00:1
- DC 1000:1

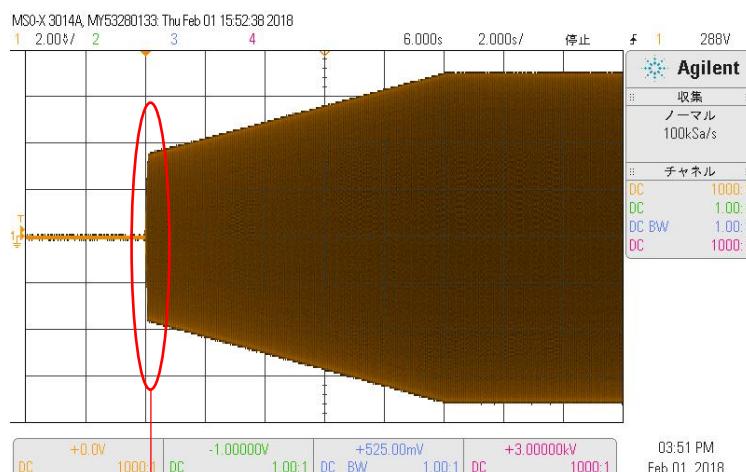
06:31 PM Feb 01, 2018

Fall Time = 5 s

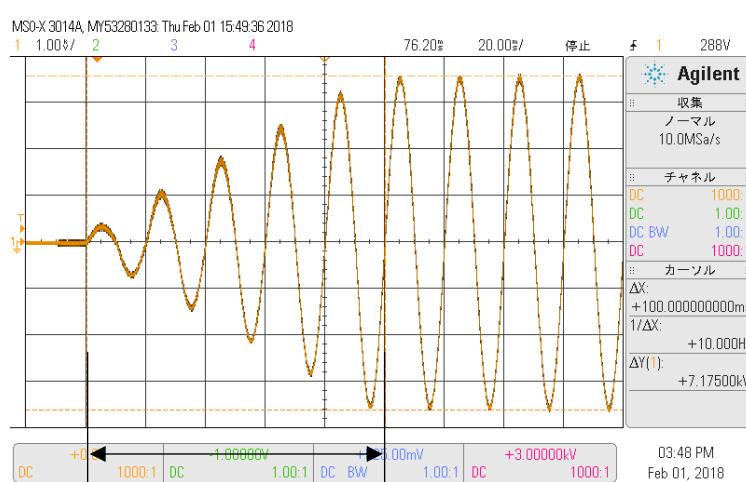
Model	TOS9300 Series	Temperature	
Item	Voltage Fall Waveform (DCW)	Testing Circuit	
Condition	Test Voltage = 7200 V, Open (No load)		



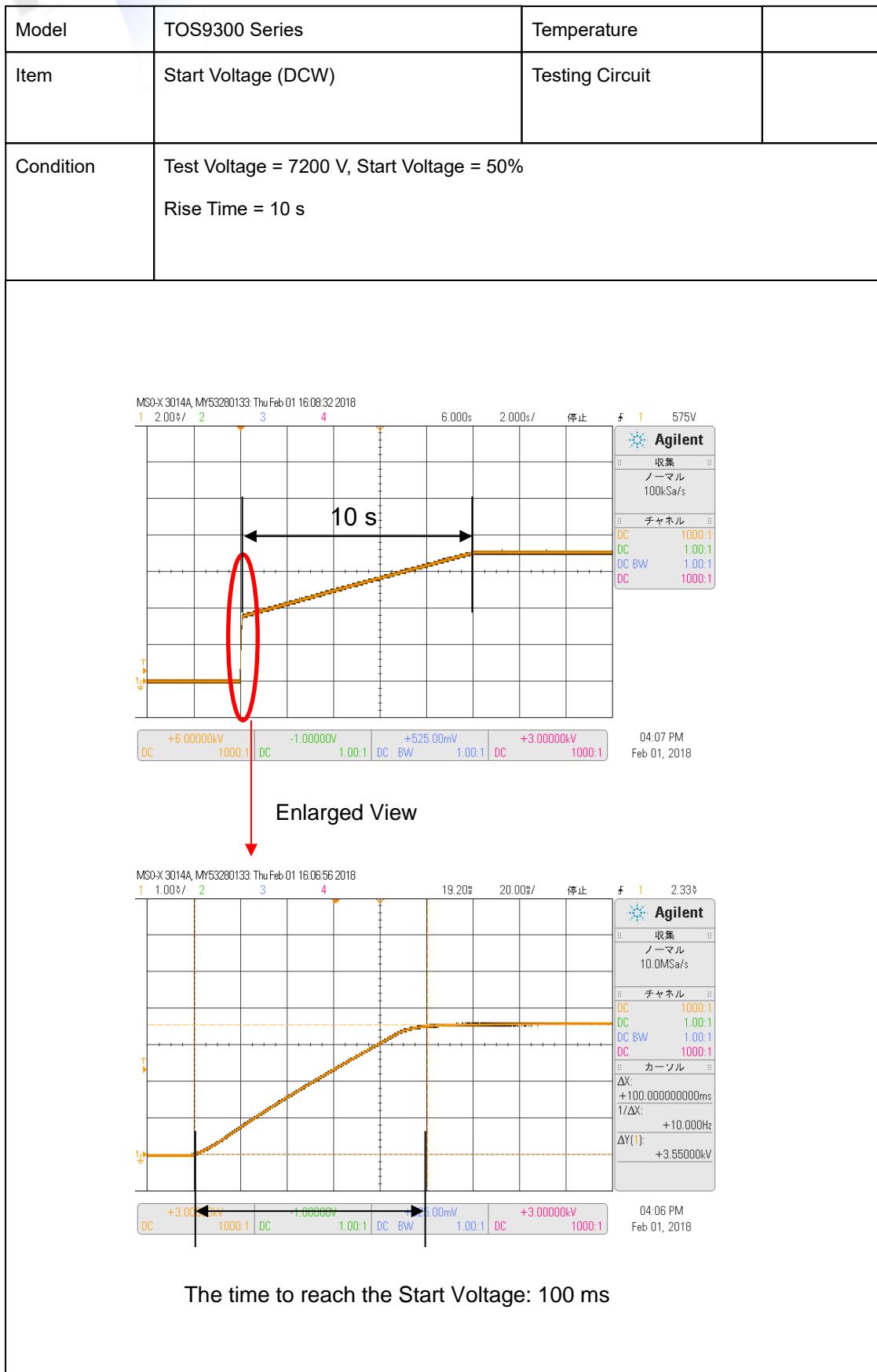
Model	TOS9300 Series	Temperature	
Item	Start Voltage (ACW)	Testing Circuit	
Condition	Test Voltage = 5000 V, 50 Hz Start Voltage = 50%, Rise Time = 10 s		



Enlarged View



The time to reach the Start Voltage: 100 ms



Model	TOS9300 Series	Temperature	
Item	Ripple Voltage (DCW)	Testing Circuit	
Condition	Test Voltage = 5000 V, Measurement Current = 20 mA		

MSO-X 3014A, MY53200133: Mon Feb 05 11:32:10 2018

1 5V/ 2 3 4 0.0s 10.00% 停止

Agilent
収集 ノーマル 10.0MSa/s
チャネル AC 1000:1 DC 1.00:1 DC BW 1.00:1 DC 1000:1
測定値 p-p(1): 33.0V 最大(|): 15.3V 最小(|): -17.7V

AC +0.0V 1000:1 DC +125.00mV 1.00:1 DC +525.00mV 1.00:1 DC +21.800V 1000:1

11:31 AM Feb 05, 2018

V_{p-p} = 33 V

Enlarged View

MSO-X 3014A, MY53200133: Mon Feb 05 11:32:57 2018

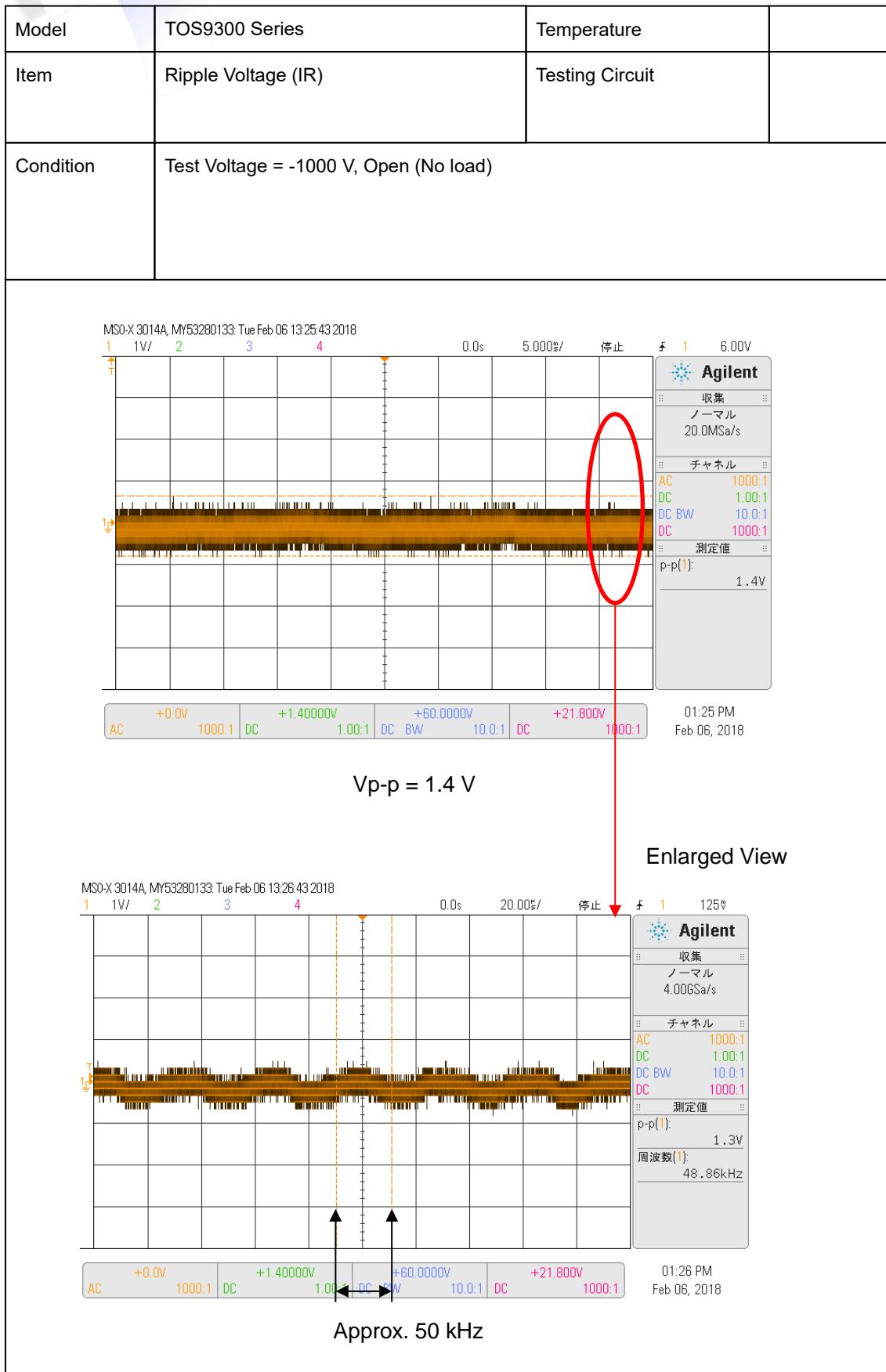
1 5V/ 2 3 4 0.0s 10.00% 停止

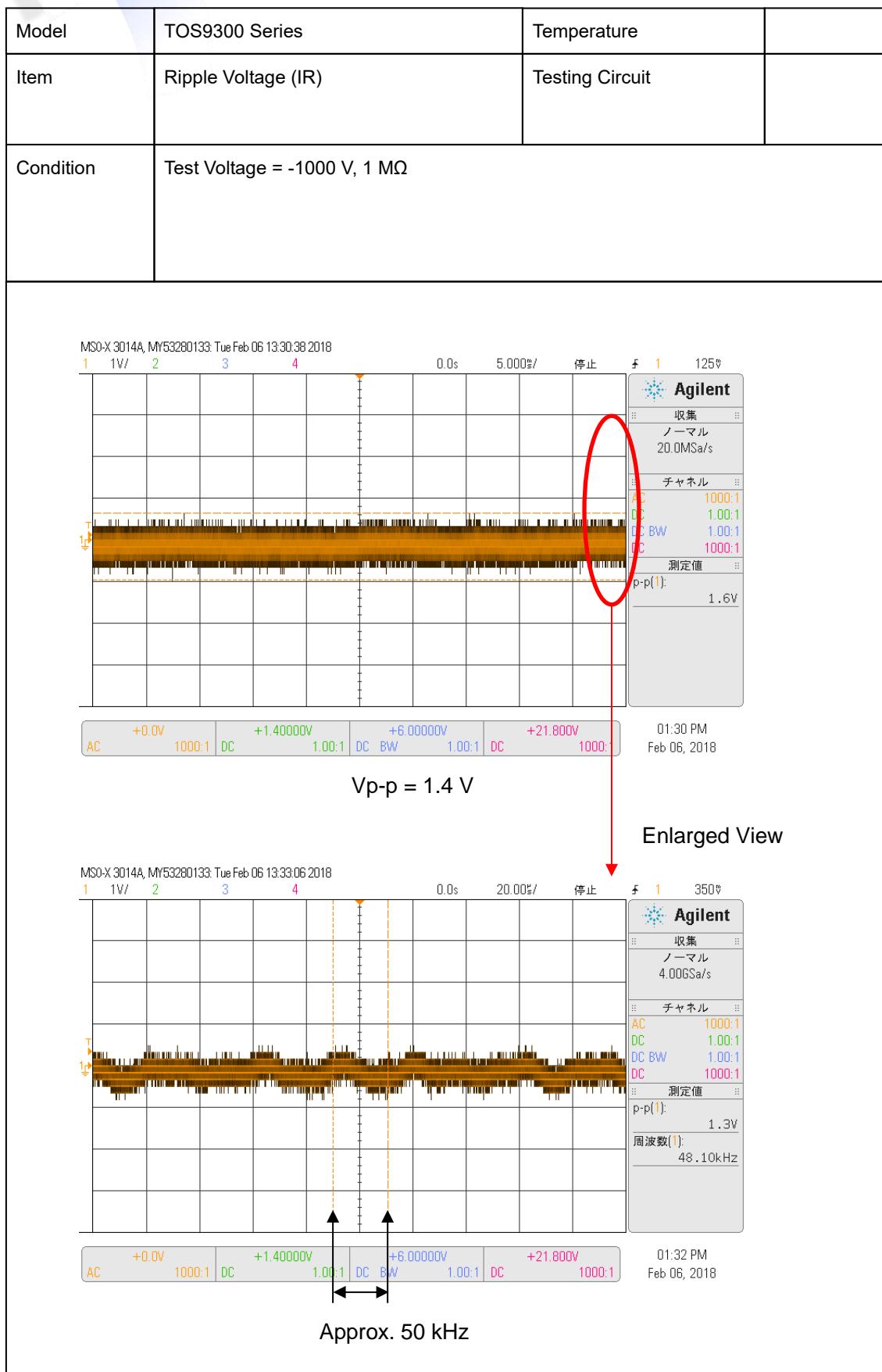
Agilent
収集 ノーマル 4.00GSa/s
チャネル AC 1000:1 DC 1.00:1 DC BW 1.00:1 DC 1000:1
測定値 p-p(1): 26.3V 最大(|): 14.7V 最小(|): -11.7V 周波数(|): 49.346kHz

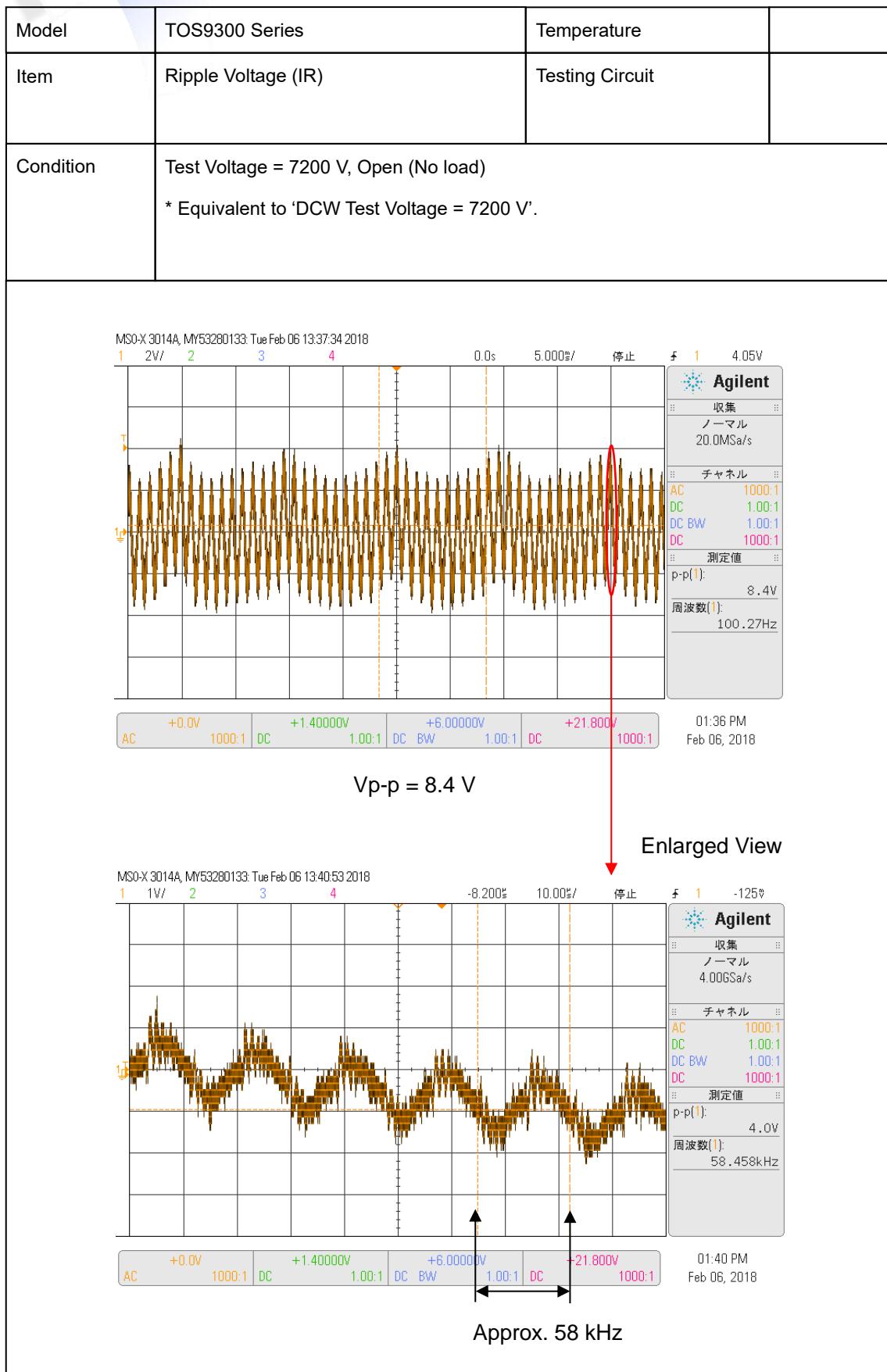
AC +0.0V 1000:1 DC +125.00mV 1.00:1 DC +525.00mV 1.00:1 DC +21.800V 1000:1

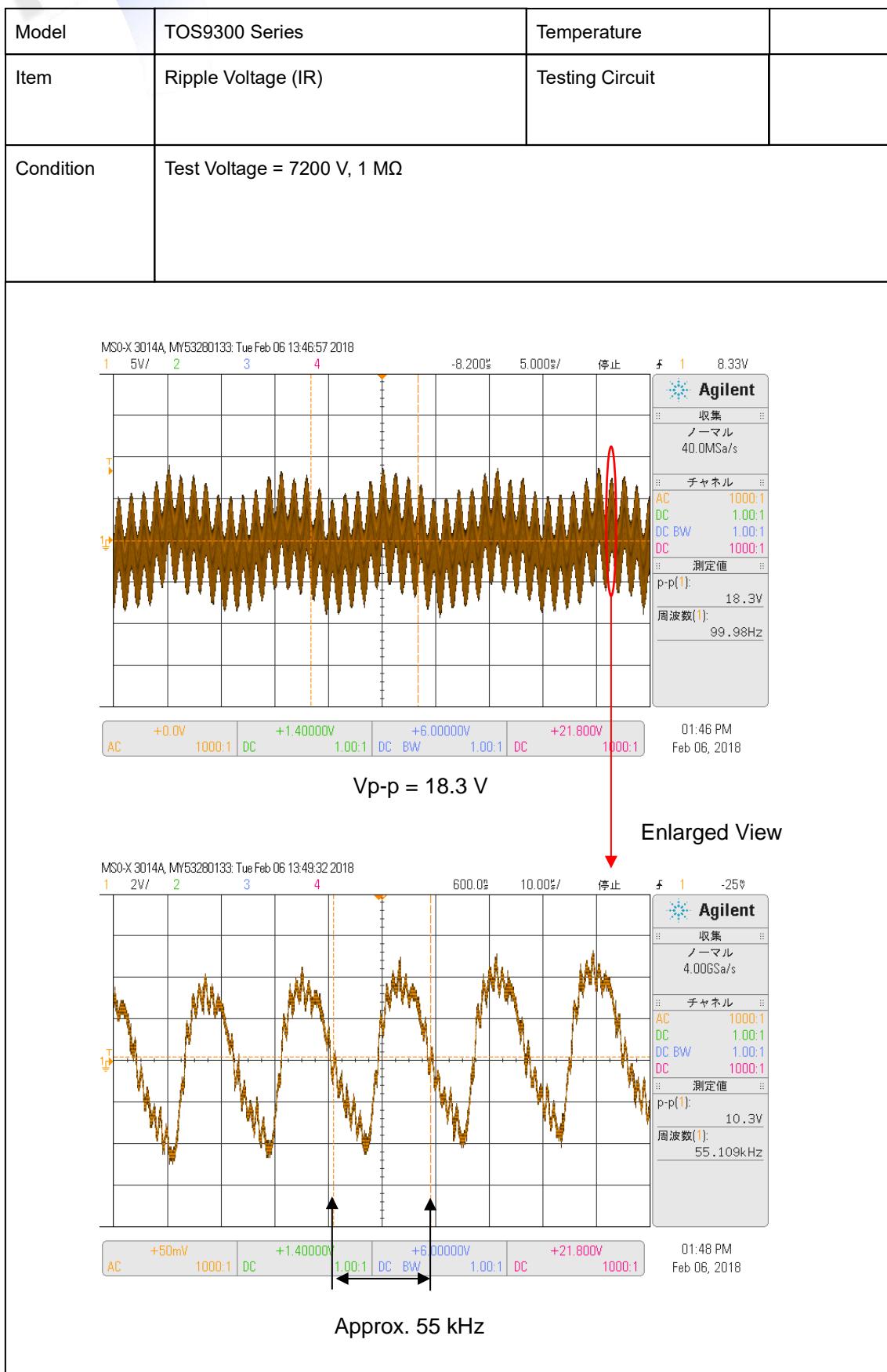
11:31 AM Feb 05, 2018

Approx. 50 kHz

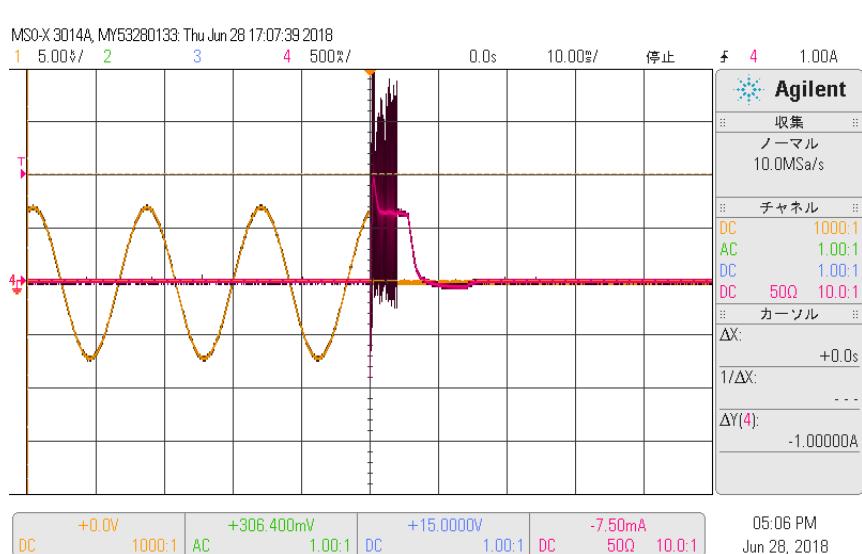
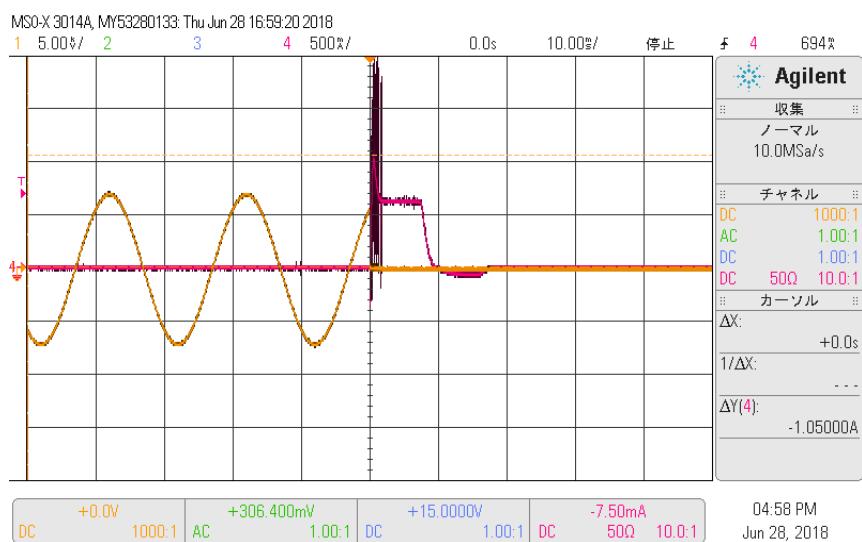


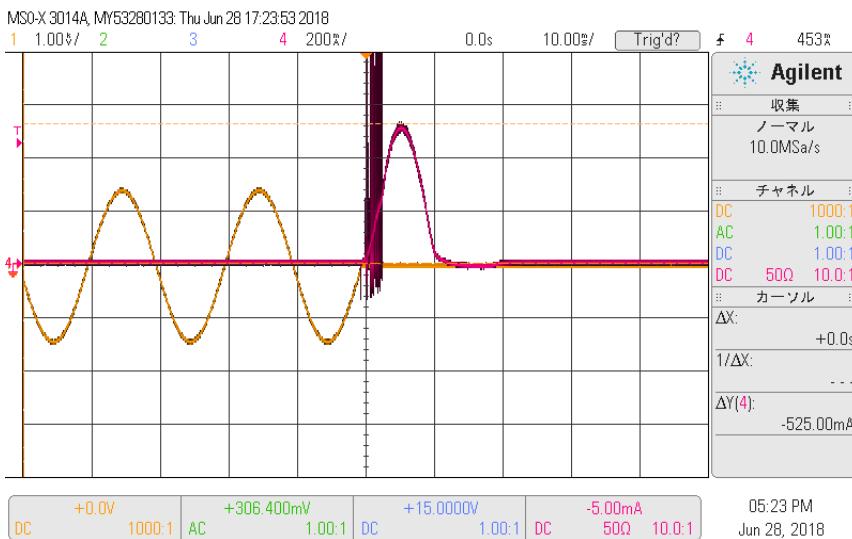
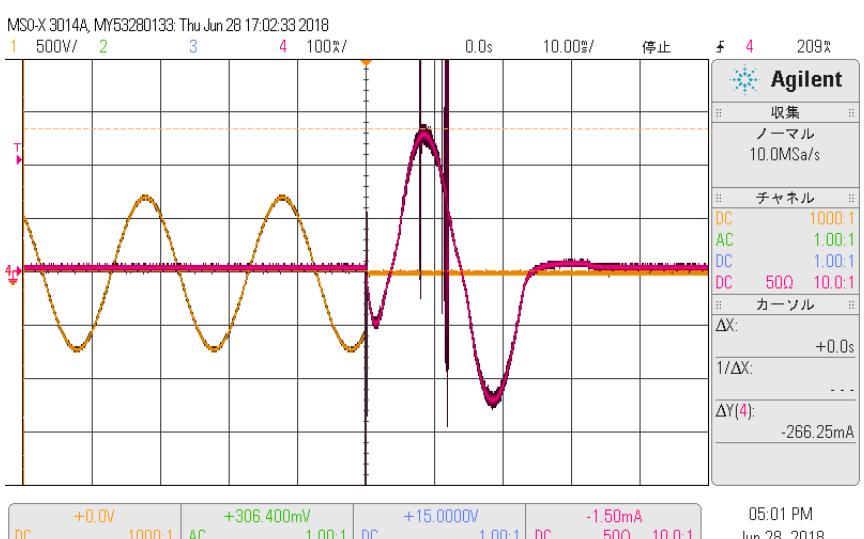




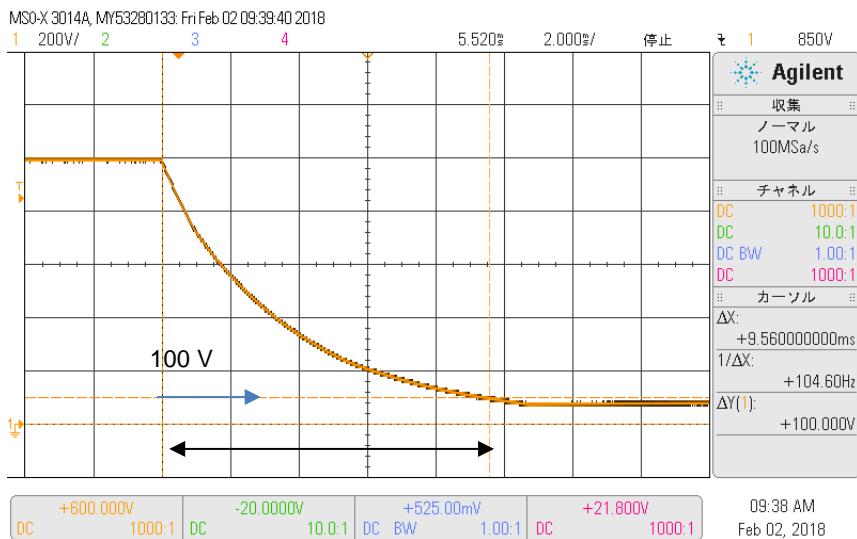


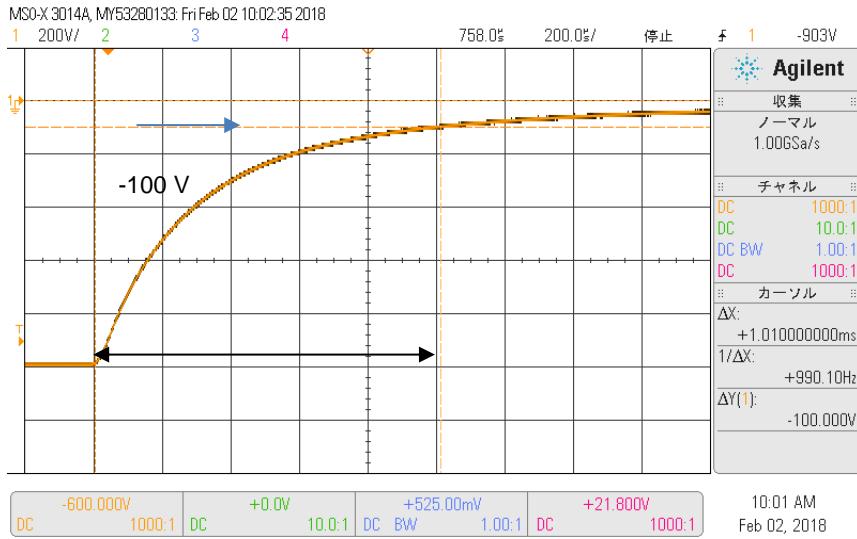
Model	TOS9300 Series	Temperature	
Item	Short-Circuit Current (ACW)	Testing Circuit	
Condition	Test Voltage = 5000 V		



Model	TOS9300 Series	Temperature				
Item	Short-Circuit Current (ACW)	Testing Circuit				
Condition	Test Voltage = 1000 V/500 V					
 <p>MSO-X 3014A, MY53280133: Thu Jun 28 17:23:53 2018 1 500V/ 2 +306.400mV 3 1.00:1 4 100%/ 0.0s 10.00%/ Trig'd? 453ns Agilent 収集 ノーマル 10.0MSa/s チャネル DC 1000:1 AC 1.0:1 DC 1.0:1 DC 50Ω 10.0:1 カーソル ΔX: +0.0s 1/ΔX: --- ΔY(4): -525.00mA 05:23 PM Jun 28, 2018</p>						
1000 V - 50 Hz: Approx. 525 mA						
 <p>MSO-X 3014A, MY53280133: Thu Jun 28 17:02:33 2018 1 500V/ 2 +306.400mV 3 1.00:1 4 100%/ 0.0s 10.00%/ 停止 4 209ns Agilent 収集 ノーマル 10.0MSa/s チャネル DC 1000:1 AC 1.0:1 DC 1.0:1 DC 50Ω 10.0:1 カーソル ΔX: +0.0s 1/ΔX: --- ΔY(4): -266.25mA 05:01 PM Jun 28, 2018</p>						
500 V - 50 Hz/60 Hz: Approx. 262 mA						

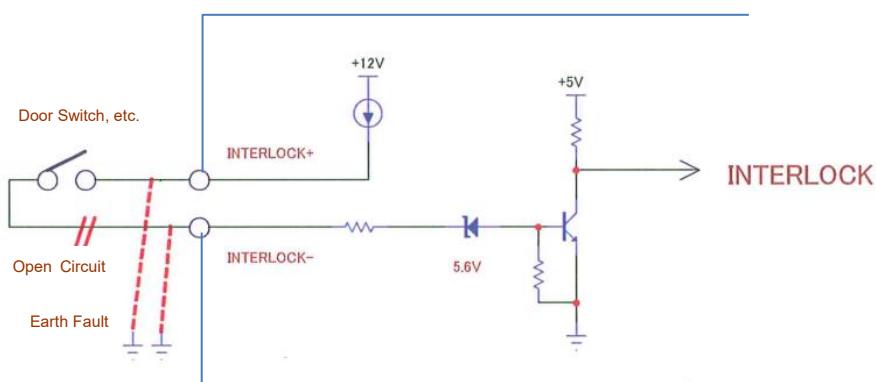
Model	TOS9300 Series	Temperature				
Item	Short-Circuit Current (DCW)	Testing Circuit				
Condition	Test Voltage = 7200 V/1000 V					
<p>MSO-X 3014A, MY53280133: Thu Jun 28 17:11:53 2018</p> <p>1 2.00V/ 2 3 4 100% / 5.000ms 5.000ms/ Trig'd? 66.3%</p> <p>Agilent</p> <p>収集 ノーマル 20.0MSa/s</p> <p>チャネル</p> <ul style="list-style-type: none"> DC 1000:1 AC 1.00:1 DC 1.00:1 DC 50Ω 10.0:1 <p>カーソル</p> <p>ΔX: +0.0s</p> <p>1/ΔX: ---</p> <p>ΔY(4): -282.50mA</p> <p>DC +6.00000V 1000:1 AC +306.400mV 1.00:1 DC +15.000V 1.00:1 DC -1.50mA 50Ω 10.0:1</p> <p>05:11 PM Jun 28, 2018</p>						
7200 V: Approx. 282 mA						
<p>MSO-X 3014A, MY53280133: Thu Jun 28 17:09:50 2018</p> <p>1 500V/ 2 3 4 50% / 5.000ms 5.000ms/ Trig'd? 66.3%</p> <p>Agilent</p> <p>収集 ノーマル 20.0MSa/s</p> <p>チャネル</p> <ul style="list-style-type: none"> DC 1000:1 AC 1.00:1 DC 1.00:1 DC 50Ω 10.0:1 <p>カーソル</p> <p>ΔX: +0.0s</p> <p>1/ΔX: ---</p> <p>ΔY(4): -179.50mA</p> <p>DC +1.50000V 1000:1 AC +306.400mV 1.00:1 DC +15.000V 1.00:1 DC -750uA 50Ω 10.0:1</p> <p>05:08 PM Jun 28, 2018</p>						
1000 V: Approx. 179 mA						

Model	TOS9300 Series	Temperature	
Item	Discharge Function (DCW/IR)	Testing Circuit	
Condition	<p>Test Voltage = DCW: 7200 V, IR: -1000 V</p> <p>The capacitor of 9400 pF was connected.</p>		
	 <p>MSO-X 3014A, MY53200133: Fri Feb 02 09:39:40 2018</p> <p>1 200V/ 2 3 4 5.520ms 2.000% / 停止 1 850V</p> <p>Agilent</p> <ul style="list-style-type: none"> 収集 ノーマル 100MSa/s チャネル <ul style="list-style-type: none"> DC 1000:1 DC 10.0:1 DC BW 1.00:1 DC 1000:1 カーソル <ul style="list-style-type: none"> ΔX: +9.560000000ms 1/ΔX: +104.60Hz ΔY(1): +100.000V <p>09:38 AM Feb 02, 2018</p> <p>Discharge Time: Approx. 10 ms</p>		

Model	TOS9300 Series	Temperature		
Item	Discharge Function (DCW/IR)	Testing Circuit		
Condition	 <p>MSO-X 3014A, MY53200133: Fri Feb 02 10:02:35 2018</p> <p>1 200V/ 2 3 4 758.0% 200.0% / 停止 1 -903V</p> <p>Agilent</p> <ul style="list-style-type: none"> 収集 ノーマル 1.00GSa/s チャネル <ul style="list-style-type: none"> DC 1000:1 DC 10.0:1 DC BW 1.00:1 DC 1000:1 カーソル <ul style="list-style-type: none"> ΔX: +1.010000000ms 1/ΔX: +990.10Hz ΔY(1): -100.000V <p>10:01 AM Feb 02, 2018</p> <p>Discharge Time: Approx. 1 ms</p>			

Model	TOS9300 Series			Temperature																																																																																																																																																																																																																																					
Item	Pin Assignment of SIGNAL I/O Connector			Testing Circuit																																																																																																																																																																																																																																					
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<table border="1"> <thead> <tr> <th>Pin no.</th> <th>IN/OUT</th> <th>Signal name</th> <th colspan="3">Description</th> </tr> </thead> <tbody> <tr><td>1</td><td>IN</td><td>INTERLOCK+</td><td colspan="3">Activate/release interlock.</td></tr> <tr><td>2</td><td>-</td><td>COM</td><td colspan="3">Circuit common (chassis potential) shared by input and output.</td></tr> <tr><td>3</td><td>IN</td><td>PM0</td><td colspan="3">Select setup memories and auto test program memories.</td></tr> <tr><td>4</td><td>IN</td><td>PM1</td><td colspan="3"></td></tr> <tr><td>5</td><td>IN</td><td>PM2</td><td colspan="3"></td></tr> <tr><td>6</td><td>IN</td><td>PM3</td><td colspan="3"></td></tr> <tr><td>7</td><td>IN</td><td>PM4</td><td colspan="3"></td></tr> <tr><td>8</td><td>IN</td><td>PM5</td><td colspan="3"></td></tr> <tr><td>9</td><td>IN</td><td>PM6</td><td colspan="3"></td></tr> <tr><td>10</td><td>IN</td><td>PM7</td><td colspan="3"></td></tr> <tr><td>11</td><td>IN</td><td>STB</td><td colspan="3">Recall setup memories and programs selected with the PM0 to PM7 signals.</td></tr> <tr><td>12</td><td>-</td><td>Reserved</td><td colspan="3">Not used.</td></tr> <tr><td>13</td><td>-</td><td>Reserved</td><td colspan="3"></td></tr> <tr><td>14</td><td>-</td><td>Reserved</td><td colspan="3"></td></tr> <tr><td>15</td><td>IN</td><td>START</td><td colspan="3">Start a test.</td></tr> <tr><td>16</td><td>IN</td><td>STOP</td><td colspan="3">Stop a test.</td></tr> <tr><td>17</td><td>IN</td><td>ENABLE</td><td colspan="3">Enable the START signal.</td></tr> <tr><td>18</td><td>-</td><td>COM</td><td colspan="3">I/O circuit common (chassis potential).</td></tr> <tr><td>19</td><td>IN</td><td>INTERLOCK-</td><td colspan="3">Activate/release interlock.</td></tr> <tr><td>20</td><td>-</td><td>COM</td><td colspan="3">I/O circuit common (chassis potential).</td></tr> <tr><td>21</td><td>-</td><td>+24V</td><td colspan="3">+24 V internal power supply output terminal. Maximum output current 100 mA.</td></tr> <tr><td>22</td><td>OUT</td><td>H.V ON/LINE ON</td><td colspan="3">Set to on in any of the following conditions. Testing, Auto testing. Voltage remaining across the output terminals. Power being supplied to the EUT from the TOS9303LC through AC LINE OUT.</td></tr> <tr><td>23</td><td>OUT</td><td>RISE</td><td colspan="3">Set to on when the voltage is rising</td></tr> <tr><td>24</td><td>OUT</td><td>TEST</td><td colspan="3">Set to on during test time</td></tr> <tr><td>25</td><td>OUT</td><td>PASS</td><td colspan="3">Set to on for the duration of time specified by Pass Hold when a PASS judgment is made.</td></tr> <tr><td>26</td><td>OUT</td><td>U FAIL</td><td colspan="3">Set to on continuously when a Upper-FAIL judgment is made. Or set to on continuously along with the L FAIL signal when Contact-FAIL judgment is made.</td></tr> <tr><td>27</td><td>OUT</td><td>L FAIL</td><td colspan="3">Set to on continuously when an Lower-FAIL judgment is made. Or set to on continuously along with the U FAIL signal when Contact-FAIL judgment is made.</td></tr> <tr><td>28</td><td>OUT</td><td>PD</td><td colspan="3">Set to on when the test mode is set to partial discharge test.</td></tr> <tr><td>29</td><td>OUT</td><td>READY</td><td colspan="3">Set to on when the product is ready to start a test.</td></tr> <tr><td>30</td><td>OUT</td><td>PROTECTION</td><td colspan="3">Set to on when a protection function is activated.</td></tr> <tr><td>31</td><td>OUT</td><td>STEP END</td><td colspan="3">Set to on when each step ends during an auto test.</td></tr> <tr><td>32</td><td>OUT</td><td>CYCLE END</td><td colspan="3">Set to on when the last step ends during an auto test.</td></tr> <tr><td>33</td><td>OUT</td><td>ACW</td><td colspan="3">Set to on when the test mode is set to AC withstand voltage test.</td></tr> <tr><td>34</td><td>OUT</td><td>DCW</td><td colspan="3">Set to on when the test mode is set to DC withstand voltage test.</td></tr> <tr><td>35</td><td>OUT</td><td>IR</td><td colspan="3">Set to on when the test mode is set to insulation resistance test.</td></tr> <tr><td>36</td><td>OUT</td><td>EC</td><td colspan="3">Set to on when the test mode is set to earth continuity test.</td></tr> <tr><td>37</td><td>OUT</td><td>LC</td><td colspan="3">Set to on when the test mode is set to leakage current test.</td></tr> </tbody> </table>						Pin no.	IN/OUT	Signal name	Description			1	IN	INTERLOCK+	Activate/release interlock.			2	-	COM	Circuit common (chassis potential) shared by input and output.			3	IN	PM0	Select setup memories and auto test program memories.			4	IN	PM1				5	IN	PM2				6	IN	PM3				7	IN	PM4				8	IN	PM5				9	IN	PM6				10	IN	PM7				11	IN	STB	Recall setup memories and programs selected with the PM0 to PM7 signals.			12	-	Reserved	Not used.			13	-	Reserved				14	-	Reserved				15	IN	START	Start a test.			16	IN	STOP	Stop a test.			17	IN	ENABLE	Enable the START signal.			18	-	COM	I/O circuit common (chassis potential).			19	IN	INTERLOCK-	Activate/release interlock.			20	-	COM	I/O circuit common (chassis potential).			21	-	+24V	+24 V internal power supply output terminal. Maximum output current 100 mA.			22	OUT	H.V ON/LINE ON	Set to on in any of the following conditions. Testing, Auto testing. Voltage remaining across the output terminals. Power being supplied to the EUT from the TOS9303LC through AC LINE OUT.			23	OUT	RISE	Set to on when the voltage is rising			24	OUT	TEST	Set to on during test time			25	OUT	PASS	Set to on for the duration of time specified by Pass Hold when a PASS judgment is made.			26	OUT	U FAIL	Set to on continuously when a Upper-FAIL judgment is made. Or set to on continuously along with the L FAIL signal when Contact-FAIL judgment is made.			27	OUT	L FAIL	Set to on continuously when an Lower-FAIL judgment is made. Or set to on continuously along with the U FAIL signal when Contact-FAIL judgment is made.			28	OUT	PD	Set to on when the test mode is set to partial discharge test.			29	OUT	READY	Set to on when the product is ready to start a test.			30	OUT	PROTECTION	Set to on when a protection function is activated.			31	OUT	STEP END	Set to on when each step ends during an auto test.			32	OUT	CYCLE END	Set to on when the last step ends during an auto test.			33	OUT	ACW	Set to on when the test mode is set to AC withstand voltage test.			34	OUT	DCW	Set to on when the test mode is set to DC withstand voltage test.			35	OUT	IR	Set to on when the test mode is set to insulation resistance test.			36	OUT	EC	Set to on when the test mode is set to earth continuity test.			37	OUT	LC	Set to on when the test mode is set to leakage current test.		
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22	OUT	H.V ON/LINE ON	Set to on in any of the following conditions. Testing, Auto testing. Voltage remaining across the output terminals. Power being supplied to the EUT from the TOS9303LC through AC LINE OUT.																																																																																																																																																																																																																																						
23	OUT	RISE	Set to on when the voltage is rising																																																																																																																																																																																																																																						
24	OUT	TEST	Set to on during test time																																																																																																																																																																																																																																						
25	OUT	PASS	Set to on for the duration of time specified by Pass Hold when a PASS judgment is made.																																																																																																																																																																																																																																						
26	OUT	U FAIL	Set to on continuously when a Upper-FAIL judgment is made. Or set to on continuously along with the L FAIL signal when Contact-FAIL judgment is made.																																																																																																																																																																																																																																						
27	OUT	L FAIL	Set to on continuously when an Lower-FAIL judgment is made. Or set to on continuously along with the U FAIL signal when Contact-FAIL judgment is made.																																																																																																																																																																																																																																						
28	OUT	PD	Set to on when the test mode is set to partial discharge test.																																																																																																																																																																																																																																						
29	OUT	READY	Set to on when the product is ready to start a test.																																																																																																																																																																																																																																						
30	OUT	PROTECTION	Set to on when a protection function is activated.																																																																																																																																																																																																																																						
31	OUT	STEP END	Set to on when each step ends during an auto test.																																																																																																																																																																																																																																						
32	OUT	CYCLE END	Set to on when the last step ends during an auto test.																																																																																																																																																																																																																																						
33	OUT	ACW	Set to on when the test mode is set to AC withstand voltage test.																																																																																																																																																																																																																																						
34	OUT	DCW	Set to on when the test mode is set to DC withstand voltage test.																																																																																																																																																																																																																																						
35	OUT	IR	Set to on when the test mode is set to insulation resistance test.																																																																																																																																																																																																																																						
36	OUT	EC	Set to on when the test mode is set to earth continuity test.																																																																																																																																																																																																																																						
37	OUT	LC	Set to on when the test mode is set to leakage current test.																																																																																																																																																																																																																																						
<table border="1"> <thead> <tr> <th>Input signal</th> <th>Output signal</th> </tr> </thead> <tbody> <tr> <td>Opening the input terminals is equivalent to high-level input.</td> <td> <ul style="list-style-type: none"> • Open collector output • Output withstand voltage: 30 Vdc • Output saturation voltage: Approx. 1.1 V (25°C) • Maximum output current 400 mA (TOTAL) </td></tr> <tr> <td> <ul style="list-style-type: none"> • Low-active control • High-level input voltage: 11 V to 15 V • Low-level input voltage: 0 V to 4 V • Low-level input current: -5 mA max. • Input time width: 5 ms min. </td> <td></td></tr> </tbody> </table>			Input signal	Output signal	Opening the input terminals is equivalent to high-level input.	<ul style="list-style-type: none"> • Open collector output • Output withstand voltage: 30 Vdc • Output saturation voltage: Approx. 1.1 V (25°C) • Maximum output current 400 mA (TOTAL) 	<ul style="list-style-type: none"> • Low-active control • High-level input voltage: 11 V to 15 V • Low-level input voltage: 0 V to 4 V • Low-level input current: -5 mA max. • Input time width: 5 ms min. 																																																																																																																																																																																																																																		
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Model	TOS9300 Series	Temperature	
Item	INTERLOCK Terminal Operating Condition on SIGNAL I/O	Testing Circuit	
Condition			



TOS9300 Internal Circuit

Interlock Terminal Condition	Interlock Operation
INTERLOCK+ and INTERLOCK- are short-circuited.	Interlock is released.
The circuit is open.	Interlock is activated.
INTERLOCK+ is in contact with the ground (earth).	Interlock is activated.
INTERLOCK- is in contact with the ground (earth).	Interlock is activated.

Model	TOS9300 Series	Temperature	
Item	Timing Setting and Typical Value	Testing Circuit	
Condition			

Timing Item	Setting Value/Setting Range
<COMMON>	
1. START – READY	1 - 5 ms*
2. START – HV_ON	12 - 15 ms*
3. TEST – HV_ON	30 ms*
<STOP>	
4. STOP – TEST	Max 3 ms*
5. STOP – READY	Max 3 ms*
<PASS>	
6. TEST – PASS	Max 3 ms*
7. PASS – READY	Max 3 ms*
<FAIL>	
8. TEST – FAIL	Max 3 ms*
9. FAIL – READY	Max 3 ms*
<PROTECTION>	
10. INTERLOCK – PROTECTION	20 ms or less*
11. STOP – PROTECTION	Max 10 ms*
12. PROTECTION – READY	Max 3 ms*

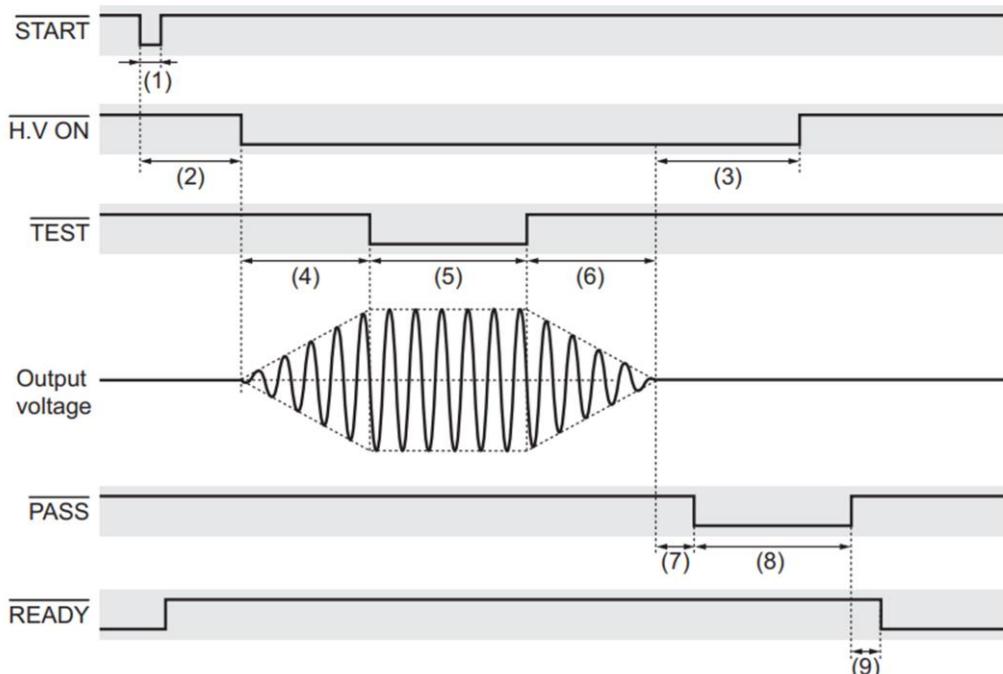
*TYP: It is a typical value at an ambient temperature of 23 °C and does not guarantee the performance of TOS9300 Series.

Model	TOS9300 Series	Temperature	
Item	Timing Chart of SIGNAL I/O Signals STOP Signal of ACW	Testing Circuit	
Condition	Test Voltage = 1.2 kV, Rise Time = 0.1 s, Pass Hold: 50 ms, Frequency: 50 Hz No load (waveform monitoring with a high voltage probe)		

Output Voltage waveform is a high-frequency oscillation starting at the beginning of the TEST phase.

The values shown above are typical values at an ambient temperature of 23 °C and do not guarantee the performance of TOS9300 Series.

Model	TOS9300 Series	Temperature	
Item	Timing Chart of SIGNAL I/O Signals PASS Signal of ACW	Testing Circuit	
Condition	Rise Time: ON, Test Time: ON Fall Time: ON, Pass Hold: 50 ms No load (waveform monitoring with a high voltage probe)		



No.	Description
(1)	5 ms min.
(2)	Approx. 20 ms ¹
(3)	Approx. 30 ms ^{*1}
(4)	Rise Time
(5)	Test Time

1 TYP (typical value)

No.	Description
(6)	Fall Time
(7)	Approx. 5 ms ^{*1}
(8)	Pass Hold
(9)	Approx. 2 ms ^{*1}

TYP is a typical value at an ambient temperature of 23 °C and does not guarantee the performance of TOS9300 Series.

Model	TOS9300 Series	Temperature	
Item	Timing Chart of SIGNAL I/O Signals FAIL Signal of ACW	Testing Circuit	
Condition	Rise Time: ON Test Time: OFF Pass Hold: 50 ms		

The timing chart illustrates the sequence of events and signal waveforms for the TOS9300 Series. The signals shown are:

- START**: A pulse that triggers the sequence.
- H.V ON**: A pulse indicating high voltage application.
- TEST**: A pulse indicating the test phase.
- Output voltage**: A waveform showing oscillations during the test phase.
- STOP**: A pulse indicating the end of the test phase.
- Upper-FAIL or Lower-FAIL**: A pulse indicating a failure condition.
- READY**: A pulse indicating the system is ready for the next cycle.

Timing intervals are labeled as follows:

- (1) Between START and H.V ON
- (2) Between H.V ON and TEST
- (3) Between TEST and the start of the Output voltage waveform
- (4) Between the end of the Output voltage waveform and the start of the STOP pulse
- (5) Between the end of the STOP pulse and the start of the Upper-FAIL or Lower-FAIL pulse
- (6) Between the end of the Upper-FAIL or Lower-FAIL pulse and the start of the READY pulse

No.	Description	No.	Description
(1)	5 ms min.	(4)	Approx. 5 ms ^{*1}
(2)	Approx. 20 ms ¹	(5)	Approx. 5 ms ^{*1}
(3)	Rise Time	(6)	Approx. 6 ms ^{*1}

1 TYP (typical value)

TYP is a typical value at an ambient temperature of 23 °C and does not guarantee the performance of TOS9300 Series.

Model	TOS9300 Series	Temperature	
Item	Timing Chart of SIGNAL I/O Signals PROTECTION Signal of ACW	Testing Circuit	
Condition	<p>Rise Time: ON, Test Time: OFF</p> <p>No load (waveform monitoring with a high voltage probe), Started the test with SIGNAL I/O. Aborted the test with an interlock operation.</p>		
<p>The timing chart illustrates the sequence of events and their timing intervals:</p> <ul style="list-style-type: none"> START: Initial signal, with interval (1) indicated by a vertical dashed line from the start of the pulse to the baseline. H.V ON: Follows START with interval (2) indicated by a vertical dashed line from the start of the pulse to the baseline. TEST: Follows H.V ON with interval (3) indicated by a vertical dashed line from the start of the pulse to the baseline. INTERLOCK: Follows TEST with interval (4) indicated by a vertical dashed line from the start of the pulse to the baseline. PROTECTION: Follows INTERLOCK with interval (5) indicated by a vertical dashed line from the start of the pulse to the baseline. Output voltage: A waveform showing oscillations between two levels, starting at the end of the PROTECTION pulse. STOP: Follows the end of the output voltage with interval (6) indicated by a vertical dashed line from the start of the pulse to the baseline. READY: Final signal, with interval (7) indicated by a vertical dashed line from the start of the pulse to the baseline. STOP: Final signal, with interval (8) indicated by a vertical dashed line from the start of the pulse to the baseline. READY: Final signal, with interval (9) indicated by a vertical dashed line from the start of the pulse to the baseline. STOP: Final signal, with interval (10) indicated by a vertical dashed line from the start of the pulse to the baseline. 			

No.	Description
(1)	5 ms min.
(2)	Approx. 20 ms ¹
(3)	Approx. 20 ms ¹
(4)	Rise Time
(5)	Approx. 10 ms ¹

1 TYP (typical value)

No.	Description
(6)	5 ms min.
(7)	Approx. 0.5 ms ¹
(8)	Approx. 10 ms ¹
(9)	Approx. 90 ms ¹
(10)	Approx. 100 ms ¹

TYP is a typical value at an ambient temperature of 23 °C and does not guarantee the performance of
TOS9300 Series.

Model	TOS9300 Series	Temperature	
Item	Timing Chart of SIGNAL I/O Signals STOP Signal of DCW	Testing Circuit	
Condition	Test Voltage = 1.7 kV, Rise Time = 0.1 s, Test Time: OFF, Frequency: 50 Hz, No load (waveform monitoring with a high voltage probe)		

The timing chart illustrates the sequence of events and signal levels for the TOS9300 Series. The signals are as follows:

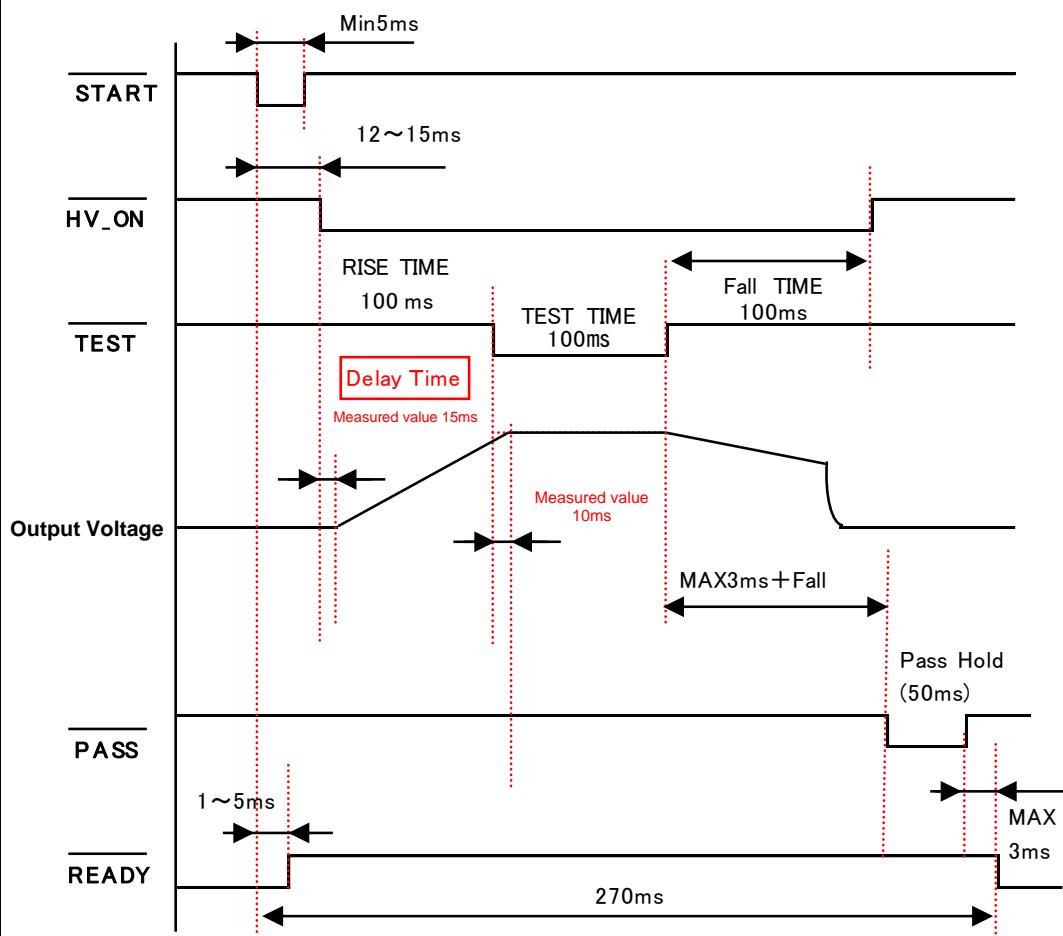
- START:** A pulse with a minimum duration of 5ms.
- HV_ON:** A pulse starting 12-15ms after START, ending 30ms after HV_ON begins, and returning to ground 100ms later.
- TEST:** A pulse starting during the HV_ON period, ending 100ms after HV_ON ends, and returning to ground 3ms later.
- Output Voltage:** A waveform showing a measured rise time of 15ms and a measured delay time of 10ms.
- STOP:** A pulse starting 1-5ms after HV_ON ends, ending 5ms after HV_ON ends, and returning to ground 3ms later.
- READY:** A pulse starting 1-5ms after HV_ON ends, ending 5ms after HV_ON ends, and returning to ground 3ms later.

Key time intervals and measurements shown in the chart include:

- Min 5ms (between START and HV_ON start).
- 12-15ms (between HV_ON start and HV_ON end).
- 30ms (between HV_ON end and HV_ON return).
- 100ms (between HV_ON start and TEST start).
- Max 3ms (between TEST end and HV_ON return).
- Rise Time (between HV_ON start and HV_ON end).
- TEST TIME (duration of the TEST pulse).
- Delay Time (duration of the measured voltage rise).
- Measured value 15ms (rise time of the output voltage).
- Measured value 10ms (delay time of the output voltage).
- 1-5ms (duration of the STOP pulse).
- Min 5ms (duration of the READY pulse).
- Max 3ms (duration of the READY pulse).

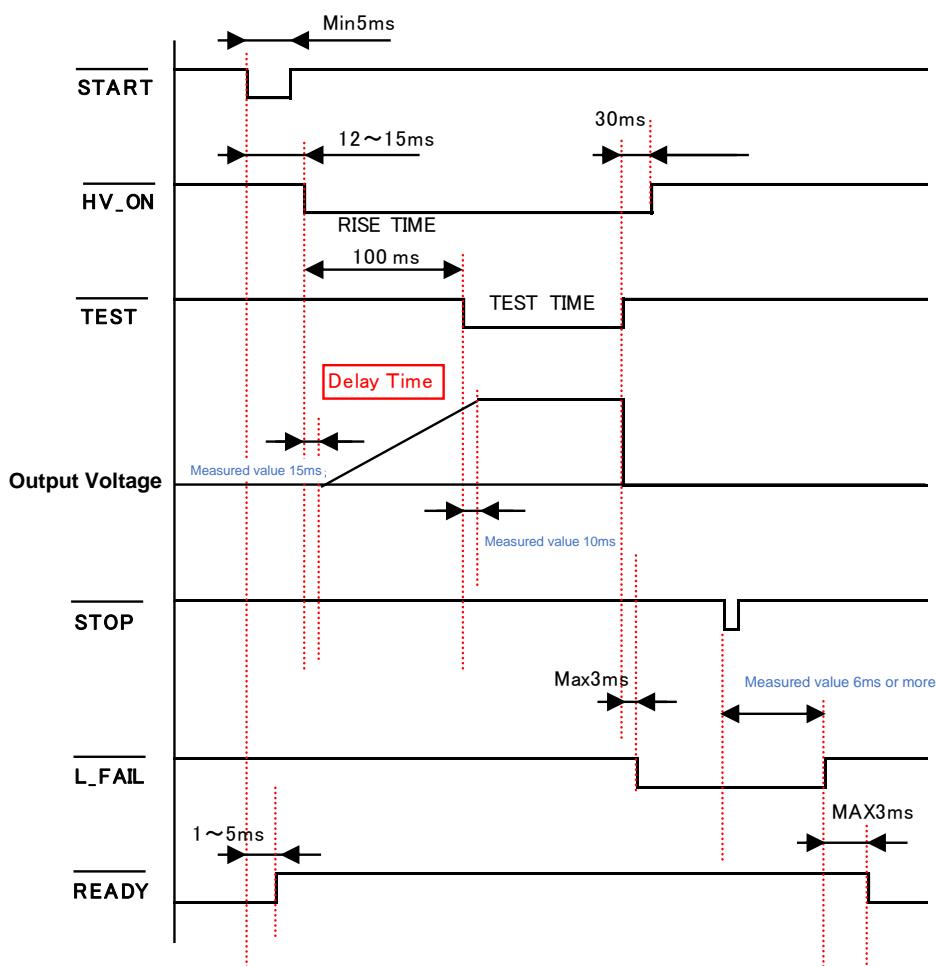
The values shown above are typical values at an ambient temperature of 23 °C and do not guarantee the performance of TOS9300 Series.

Model	TOS9300 Series	Temperature	
Item	Timing Chart of SIGNAL I/O Signals PASS Signal of DCW	Testing Circuit	
Condition	Test Voltage = 1.7 kV, Rise Time = 0.1 s, Test Time = 0.1 s, Fall Time = 0.1 s, Pass Hold: 50 ms, No load (waveform monitoring with a high voltage probe)		



The values shown above are typical values at an ambient temperature of 23 °C and do not guarantee the performance of TOS9300 Series.

Model	TOS9300 Series	Temperature	
Item	Timing Chart of SIGNAL I/O Signals FAIL Signal of DCW	Testing Circuit	
Condition	Test Voltage = 1.7 kV, Rise Time = 0.1 s, Test Time = OFF, Fall Time = OFF, Lower Limit = 0.1 mA, No load (waveform monitoring with a high voltage probe)		



The values shown above are typical values at an ambient temperature of 23 °C and do not guarantee the performance of TOS9300 Series.

Model	TOS9300 Series	Temperature	
Item	Timing Chart of SIGNAL I/O Signals PROTECTION Signal of DCW	Testing Circuit	
Condition	Test Voltage = 1.7 kV, Rise Time = 0.1 s, Test Time = OFF, Judge Delay = 0.1 s, No load (waveform monitoring with a high voltage probe)		

The timing chart illustrates the sequence and timing requirements for various control signals:

- START:** Initial pulse with a minimum duration of Min 5ms.
- HV ON:** Follows START with a pulse width of 12 ~ 15ms. It includes a rise time of 100ms and a maximum duration of MAX 3ms.
- TEST:** Triggered by HV ON with a duration of 30ms.
- Protection:** Triggered by TEST with a duration of 20ms or less. It includes a maximum duration of MAX 10ms.
- INTERLOCK:** Triggered by Protection with a duration of 20ms or less.
- Output Voltage:** Rises during HV ON and remains high until STOP.
- STOP:** Triggered by INTERLOCK with a maximum duration of MAX 3ms.
- READY:** Triggered by STOP with a minimum duration of Min 5ms.

The values shown above are typical values at an ambient temperature of 23 °C and do not guarantee the performance of TOS9300 Series.

Model	TOS9300 Series	Temperature	
Item	Timing Chart of SIGNAL I/O Signals STOP Signal of IR	Testing Circuit	
Condition	Test Voltage = 1.0 kV, Rise Time = 0.1 s, Test Time = OFF, Fall Time = OFF, Pass Hold: 50 ms, No load (waveform monitoring with a high voltage probe)		
	<p>The timing chart illustrates the sequence of events and their timing requirements for the TOS9300 Series. The signals are:</p> <ul style="list-style-type: none"> START: A pulse with a minimum duration of 5ms. HV ON: A pulse starting 12-15ms after START, with a duration of 100ms. It includes a 'Rise Time' measurement between HV ON and TEST. TEST: A pulse starting 30ms after HV ON, with a maximum duration of 3ms. It includes a 'Delay Time' measurement before it starts. Output Voltage: A waveform showing a measured rise time of 3.2ms from the start of HV ON to the start of TEST. STOP: A pulse starting 1-5ms after HV ON, with a minimum duration of 5ms. READY: A pulse starting Max3ms after HV ON, with a maximum duration of 3ms. <p>Measured values shown in blue text:</p> <ul style="list-style-type: none"> Measured value 3.2ms (between HV ON start and TEST start) Measured value 3.2ms (between HV ON end and TEST start) <p>Timing labels in red text:</p> <ul style="list-style-type: none"> Min 5ms (for START pulse) 12-15ms (time from START to HV ON start) 100ms (duration of HV ON pulse) Max3ms (duration of TEST pulse) Min5ms (duration of STOP pulse) Max3ms (duration of READY pulse) 1-5ms (time from HV ON start to STOP start) 		

The values shown above are typical values at an ambient temperature of 23 °C and do not guarantee the performance of TOS9300 Series.

Model	TOS9300 Series	Temperature	
Item	Timing Chart of SIGNAL I/O Signals PASS Signal of IR	Testing Circuit	
Condition	Test Voltage = 1.0 kV, Rise Time = 0.1 s, Test Time = 0.1 s, Pass Hold: 50 ms, No load (waveform monitoring with a high voltage probe)		

Output Voltage

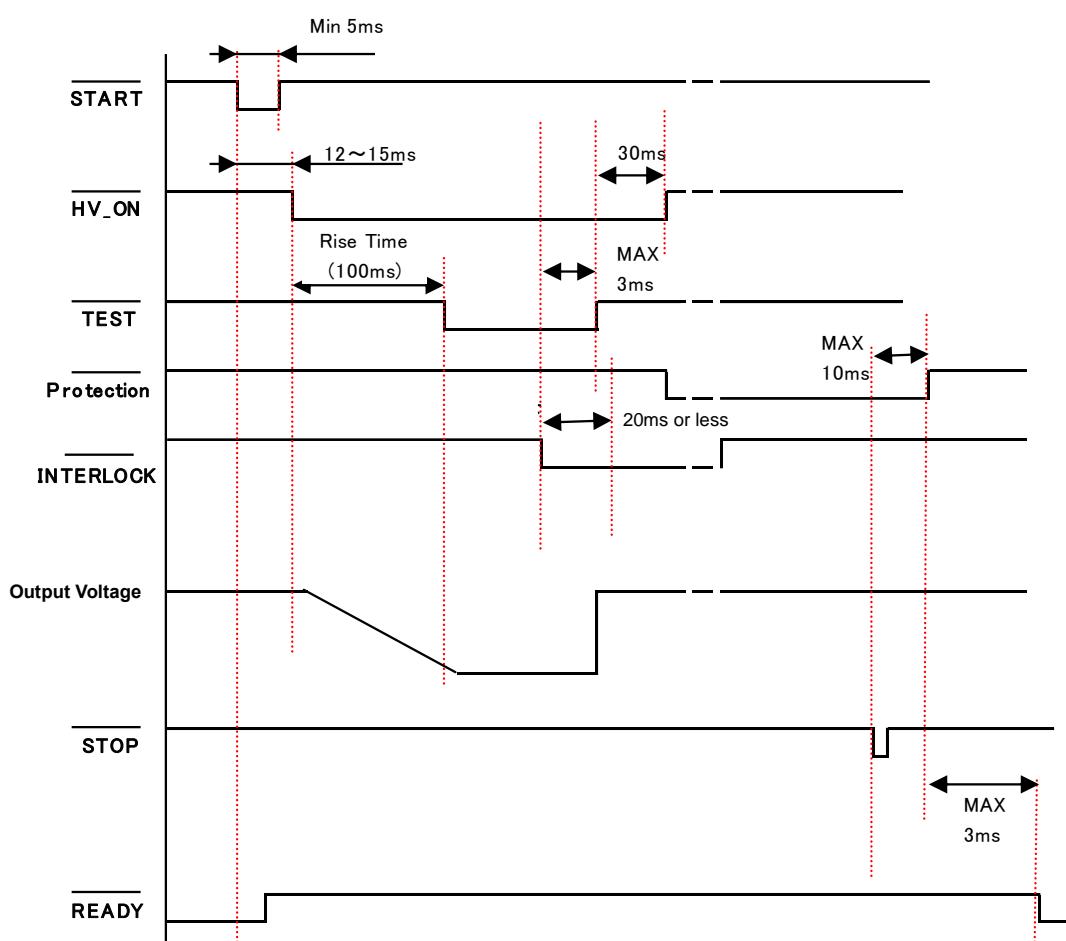
The chart illustrates the timing sequence of various signals:

- START:** Initial signal, with a minimum pulse width of **Min 5ms**.
- HV_ON:** Follows START with a pulse width of **12~15ms**. A note indicates ***When Discharge Time was ON: 30ms**.
- TEST:** Follows HV_ON with a pulse width of **30ms**.
- Output Voltage:** The main output signal, which rises during the **TEST** phase. It has a **RISE TIME** of **100 ms** and a **TEST TIME** of **100ms**.
- PASS:** A signal indicating test results. It has a **Measured value 3.2ms** during the **TEST** phase, followed by a **Delay Time**, another **Measured value 3.2ms**, and a **Pass Hold (50ms)** period.
- READY:** Final signal, with a **1~5ms** pulse width.

The values shown above are typical values at an ambient temperature of 23 °C and do not guarantee the performance of TOS9300 Series.

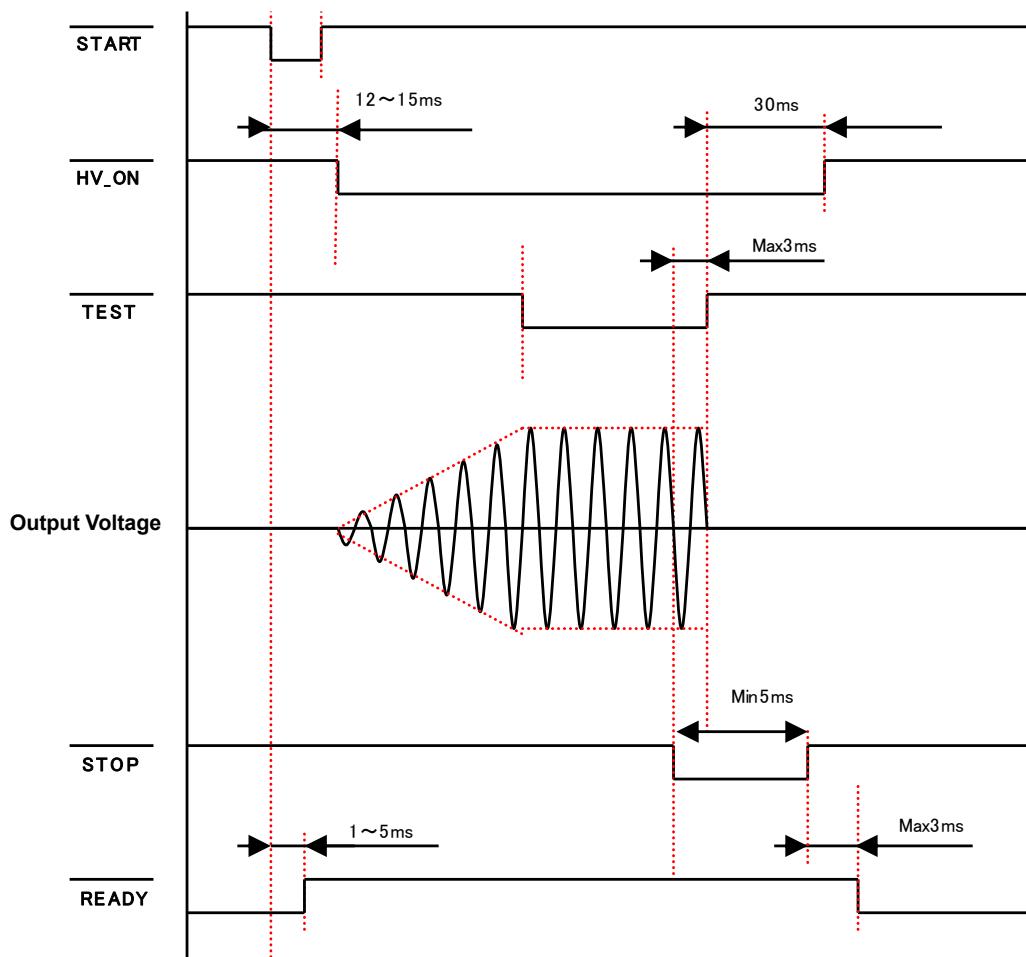
Model	TOS9300 Series	Temperature	
Item	Timing Chart of SIGNAL I/O Signals FAIL Signal of IR	Testing Circuit	
Condition	Test Voltage = 1.0 kV, Rise Time = 0.1 s, Test Time = OFF, Pass Hold = 50 ms, Lower Limit = 0.2 mA, Judge Delay = 0.1 s, No load (waveform monitoring with a high voltage probe)		

Model	TOS9300 Series	Temperature	
Item	Timing Chart of SIGNAL I/O Signals PROTECTION Signal of IR	Testing Circuit	
Condition	Test Voltage = 1.0 kV, Rise Time = 0.1 s, Test Time = OFF, Judge Delay = 0.1 s, No load (waveform monitoring with a high voltage probe)		



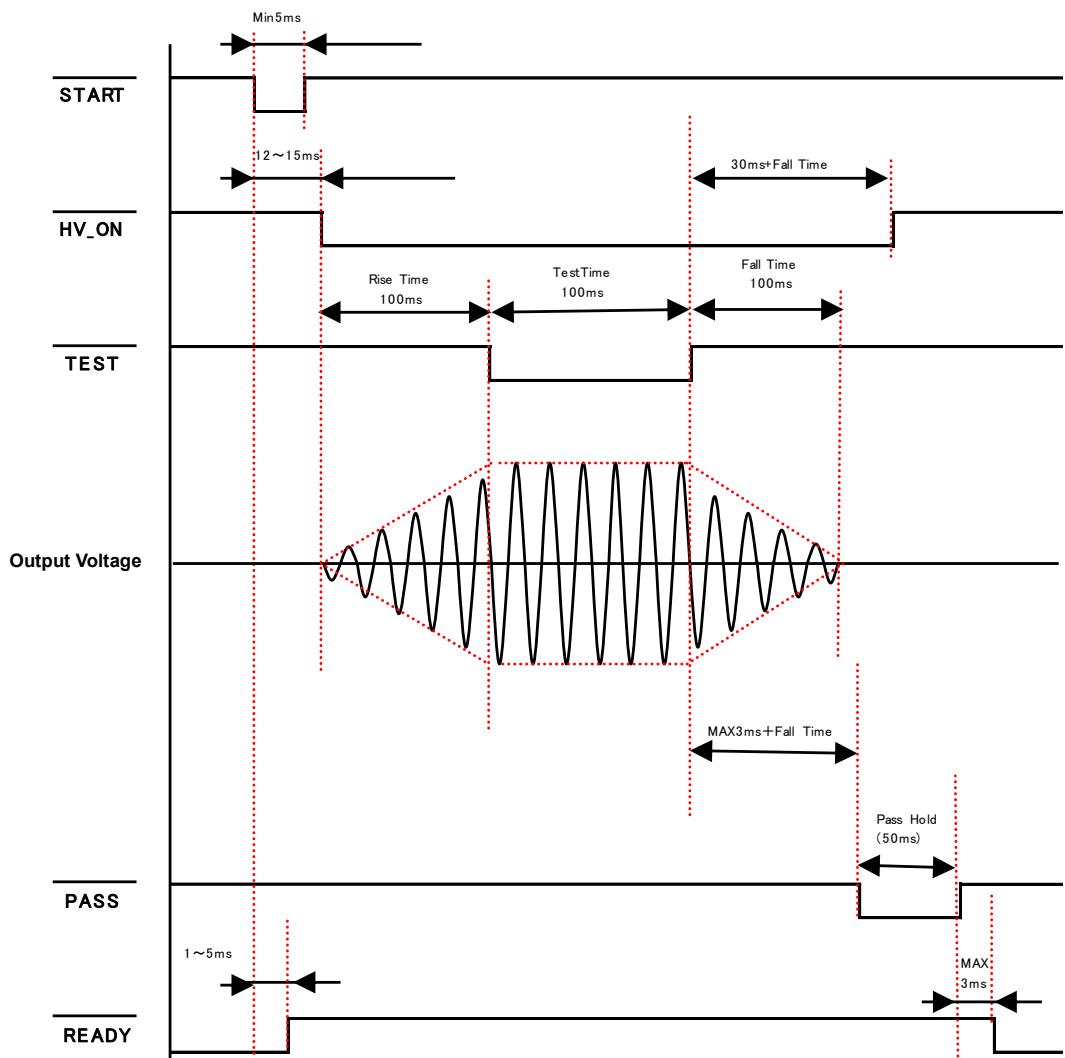
The values shown above are typical values at an ambient temperature of 23 °C and do not guarantee the performance of TOS9300 Series.

Model	TOS9300 Series	Temperature	
Item	Timing Chart of SIGNAL I/O Signals STOP Signal of ECAC (AC earth continuity test)	Testing Circuit	
Condition	Test Current = 5 A, Rise Time = 0.1 s, Test Time = OFF, Fall Time = OFF, Pass Hold = 50 ms, Frequency = 50 Hz, The output was short-circuited.		



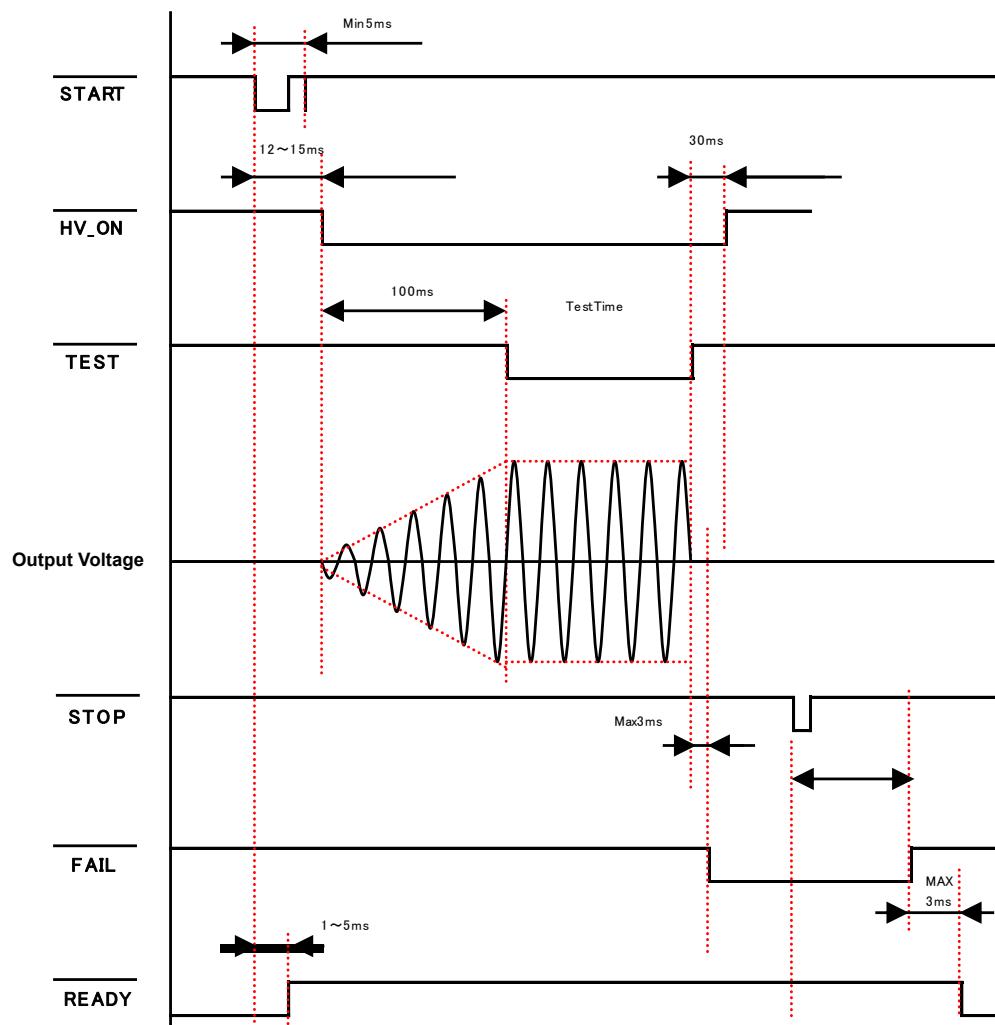
The values shown above are typical values at an ambient temperature of 23 °C and do not guarantee the performance of TOS9300 Series.

Model	TOS9300 Series	Temperature	
Item	Timing Chart of SIGNAL I/O Signals PASS Signal of ECAC	Testing Circuit	
Condition	Test Current = 5 A, Rise Time = 0.1 s, Test Time = 0.1 s, Fall Time = 0.1 s, Pass Hold = 50 ms, Frequency = 50 Hz, The output was short-circuited.		



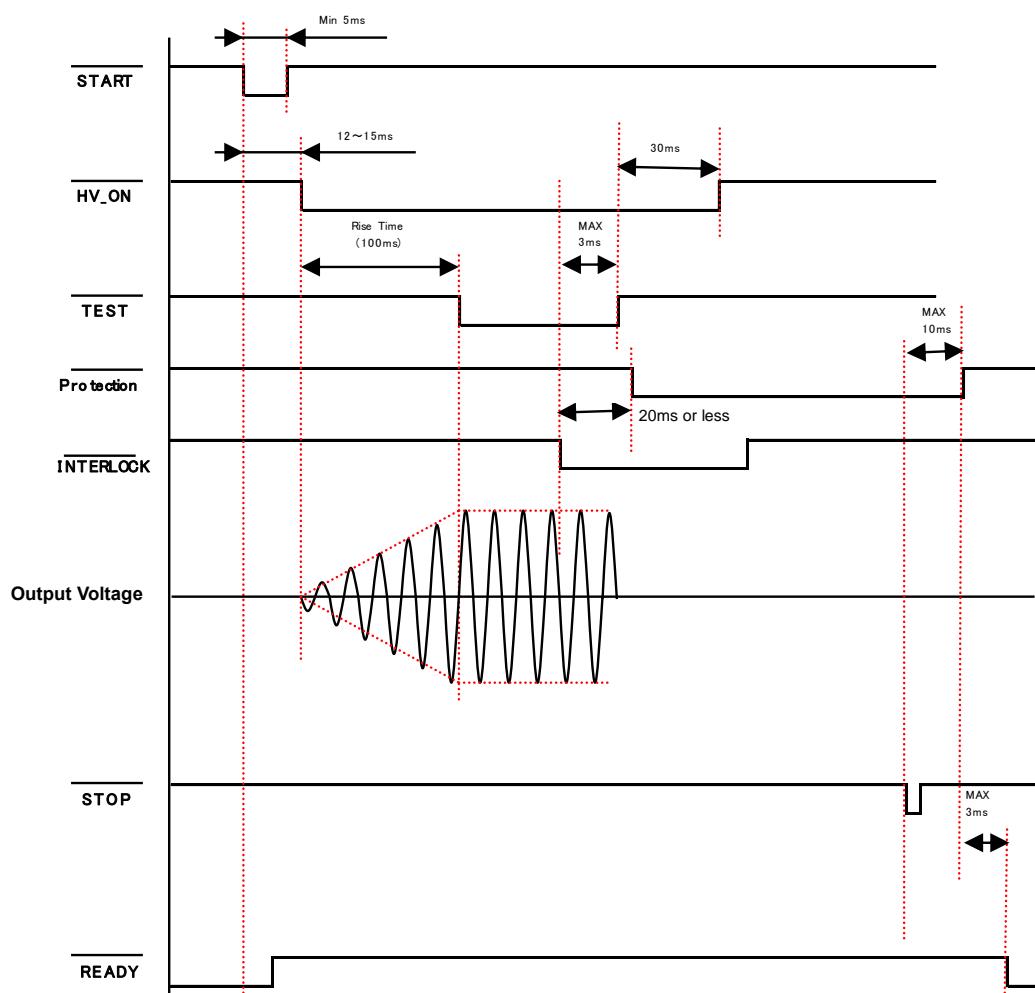
The values shown above are typical values at an ambient temperature of 23 °C and do not guarantee the performance of TOS9300 Series.

Model	TOS9300 Series	Temperature	
Item	Timing Chart of SIGNAL I/O Signals FAIL Signal of ECAC	Testing Circuit	
Condition	Test Current = 5 A, Rise Time = 0.1 s, Test Time = OFF, Fall Time = OFF, Upper Limit: 0.000 1Ω, Pass Hold = 50 ms, Frequency = 50 Hz, No load (waveform monitoring with a high voltage probe)		



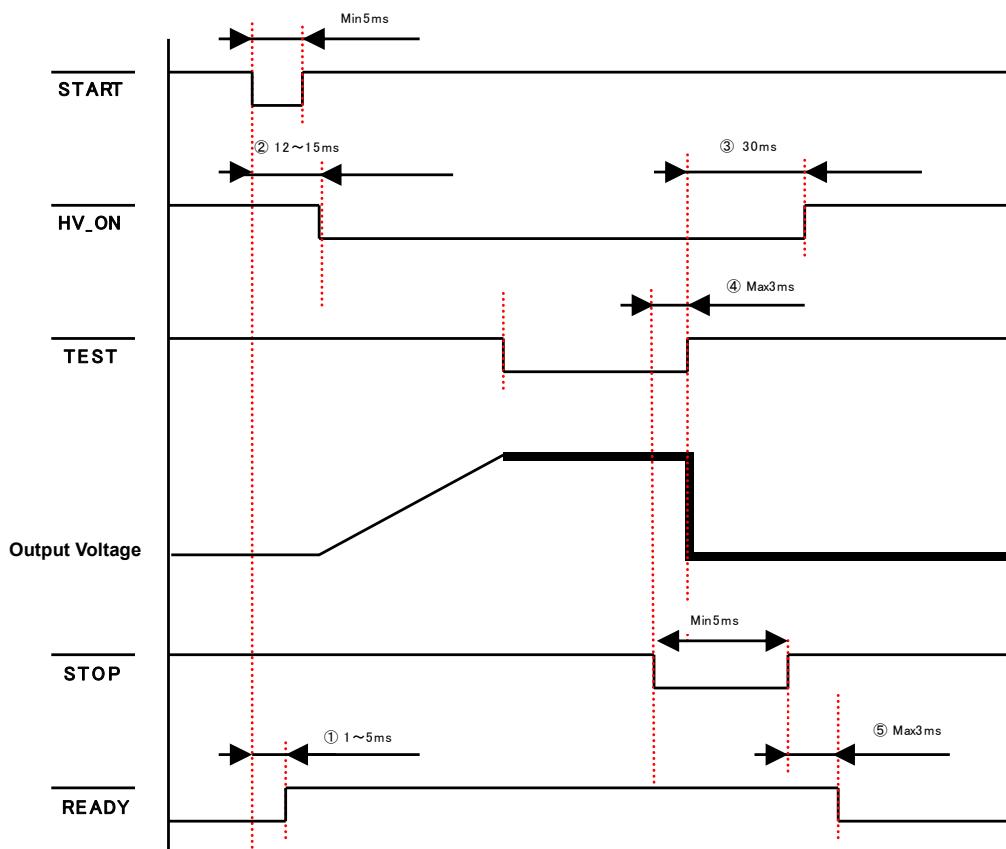
The values shown above are typical values at an ambient temperature of 23 °C and do not guarantee the performance of TOS9300 Series.

Model	TOS9300 Series	Temperature	
Item	Timing Chart of SIGNAL I/O Signals PROTECTION Signal of ECAC	Testing Circuit	
Condition	Test Current = 5 A, Rise Time = 0.1 s, Test Time = OFF, Fall Time = OFF, Frequency = 50 Hz, The output was short-circuited.		



The values shown above are typical values at an ambient temperature of 23 °C and do not guarantee the performance of TOS9300 Series.

Model	TOS9300 Series	Temperature	
Item	Timing Chart of SIGNAL I/O Signals STOP Signal of ECDC (DC earth continuity test)	Testing Circuit	
Condition	Test Current = 5 A, Rise Time = 0.1 s, Test Time = OFF, Fall Time = OFF, Pass Hold = 50 ms, The output was short-circuited.		

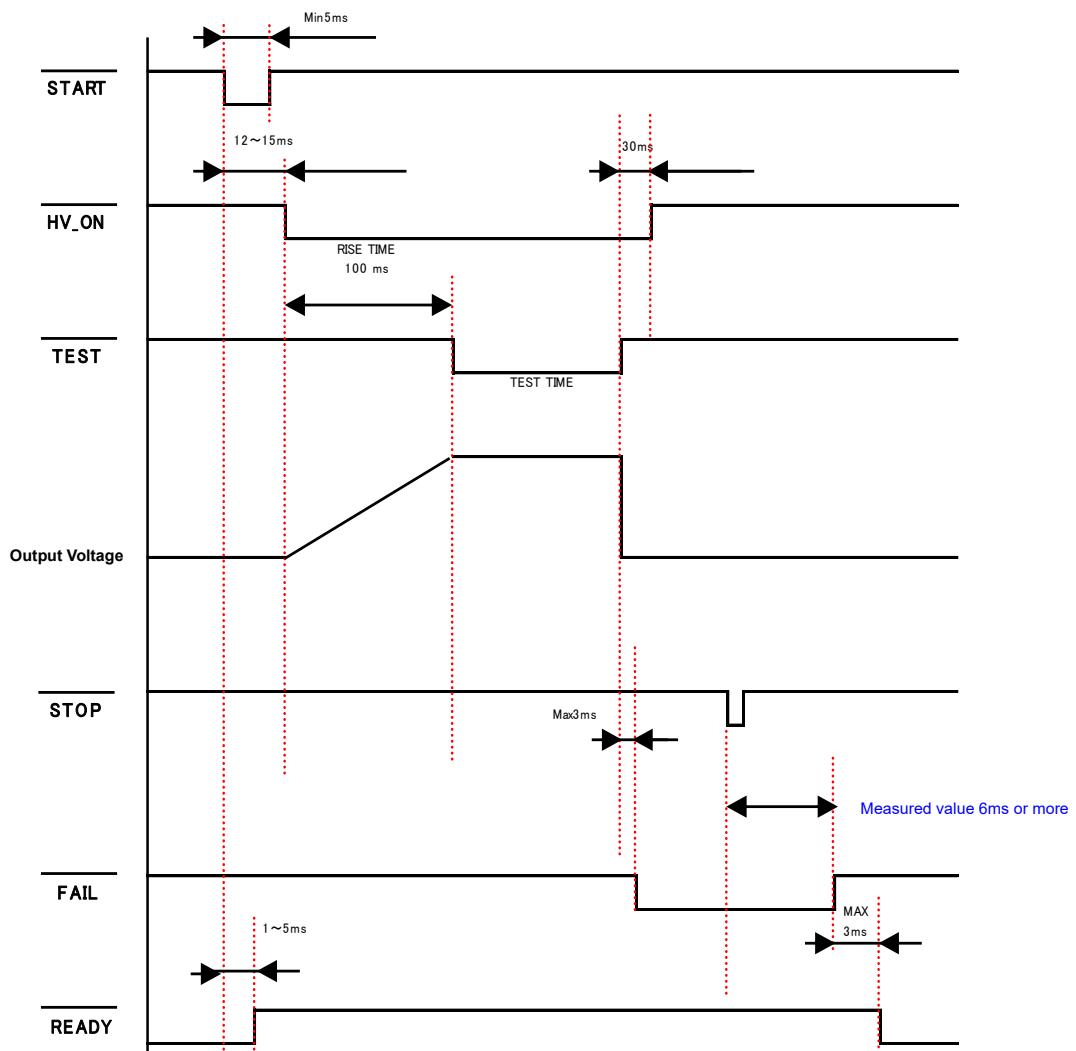


The values shown above are typical values at an ambient temperature of 23 °C and do not guarantee the performance of TOS9300 Series.

Model	TOS9300 Series	Temperature	
Item	Timing Chart of SIGNAL I/O Signals PASS Signal of ECDC	Testing Circuit	
Condition	Test Current = 5 A, Rise Time = 0.1 s, Test Time = 0.1 s, Fall Time = 0.1 s, Pass Hold = 50 ms, The output was short-circuited.		

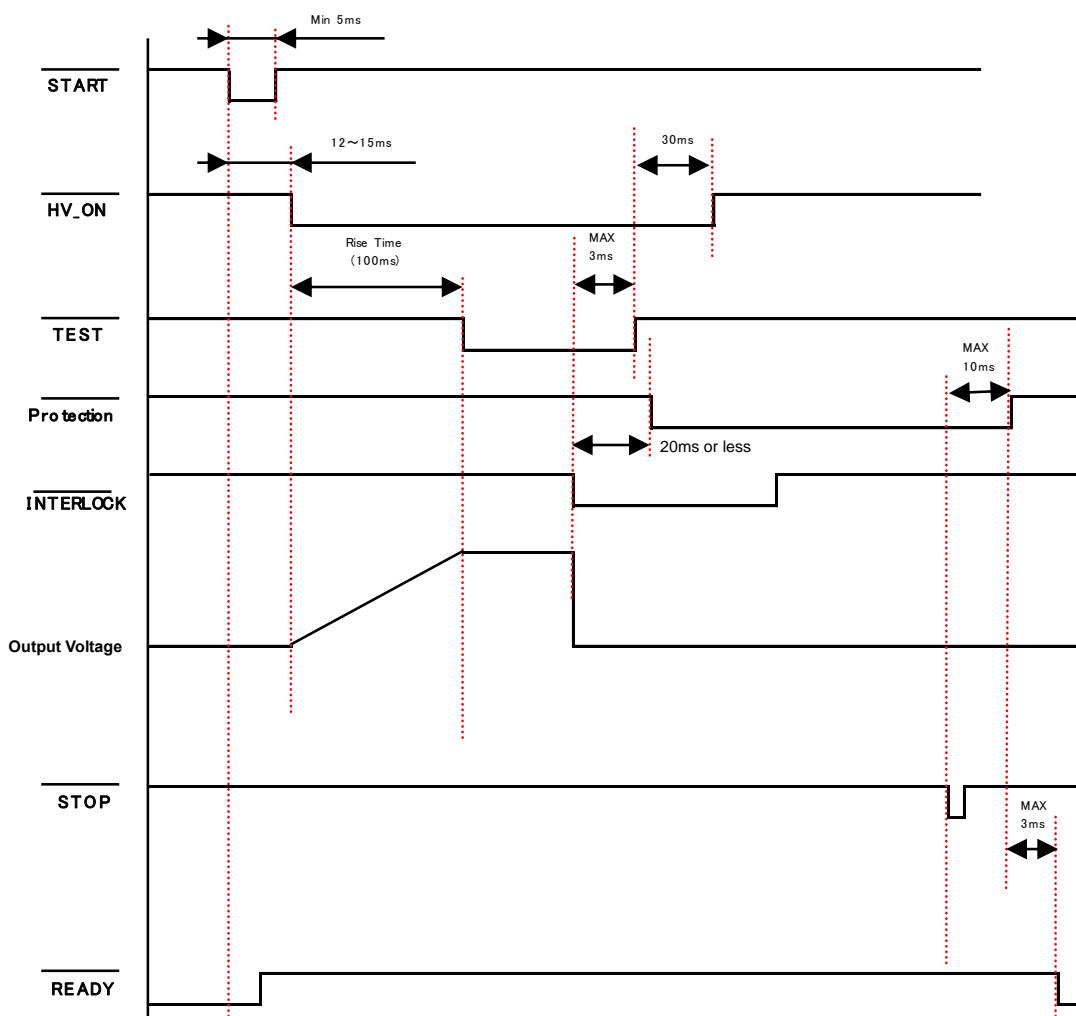
The values shown above are typical values at an ambient temperature of 23 °C and do not guarantee the performance of TOS9300 Series.

Model	TOS9300 Series	Temperature	
Item	Timing Chart of SIGNAL I/O Signals FAIL Signal of ECDC	Testing Circuit	
Condition	Test Current = 5 A, Rise Time = 0.1 s, Test Time = OFF, Fall Time = OFF, Upper Limit = 0.0001 Ω, Pass Hold = 50 ms, No load (waveform monitoring with a high voltage probe)		



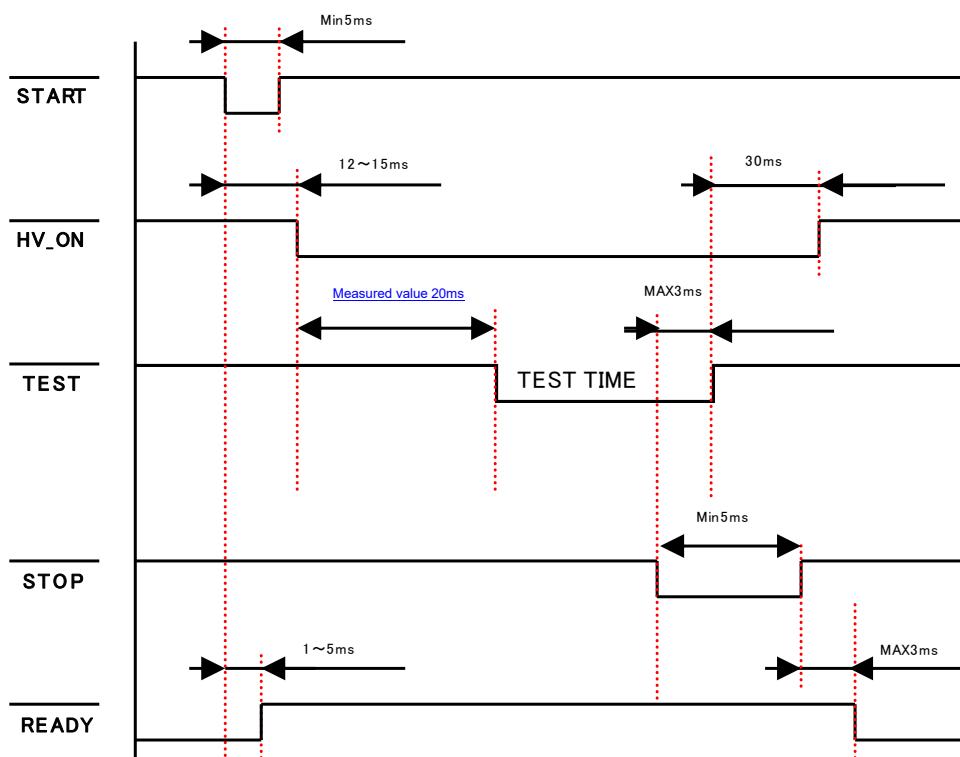
The values shown above are typical values at an ambient temperature of 23 °C and do not guarantee the performance of TOS9300 Series.

Model	TOS9300 Series	Temperature	
Item	Timing Chart of SIGNAL I/O Signals PROTECTION Signal of ECDC	Testing Circuit	
Condition	Test Current = 5 A, Rise Time = 0.1 s, Test Time = OFF, Fall Time = OFF, The output was short-circuited.		



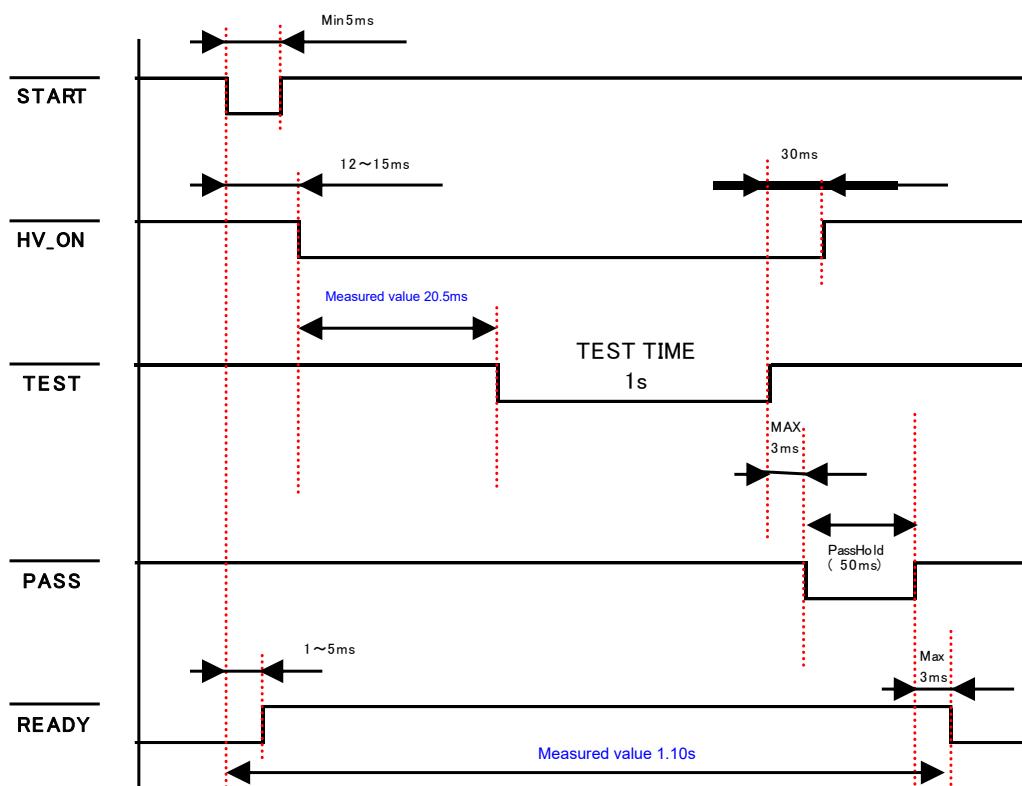
The values shown above are typical values at an ambient temperature of 23 °C and do not guarantee the performance of TOS9300 Series.

Model	TOS9300 Series	Temperature	
Item	Timing Chart of SIGNAL I/O Signals STOP Signal of LC (TC, PCC, Patient test)	Testing Circuit	
Condition	Polarity: Normal, Condition: Normal, Pass Hold: 50 ms, Test Time: 1 s Network: C (TC: touch current), I (patient leakage current), Probe: Enc-Enc (TC), Probe: Patient 110% (Patient), 110% OUT: OFF (TC), ON-Normal (Patient)		



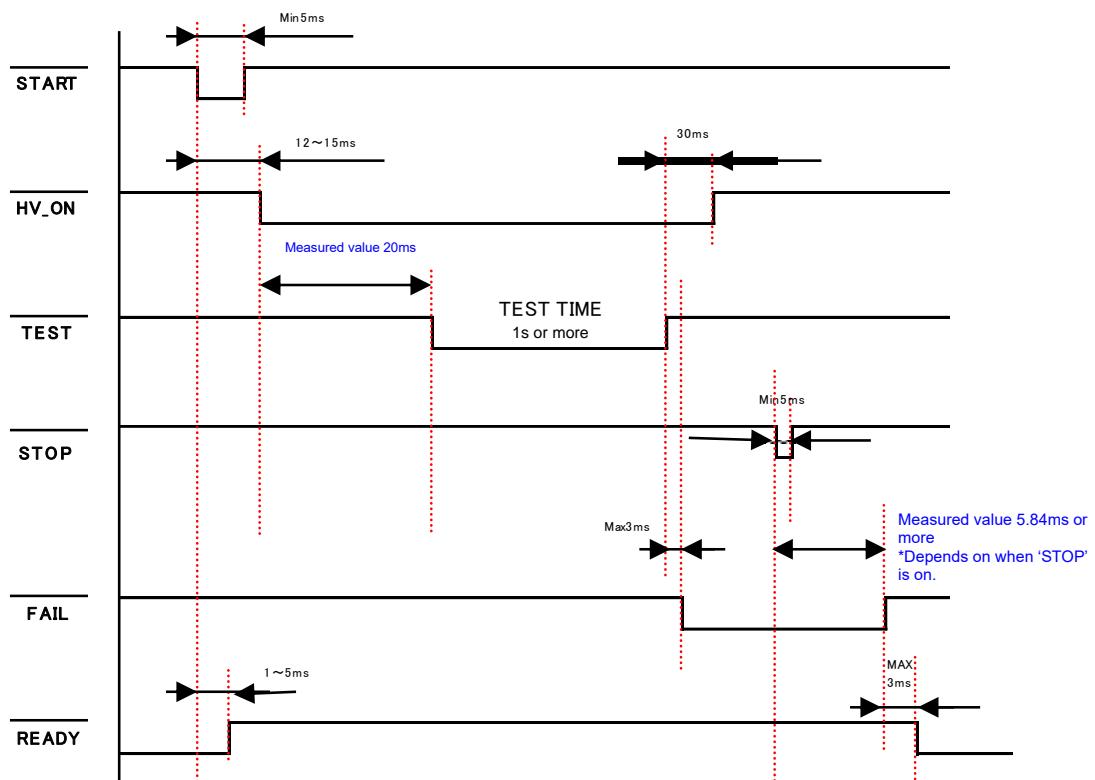
The values shown above are typical values at an ambient temperature of 23 °C and do not guarantee the performance of TOS9300 Series.

Model	TOS9300 Series	Temperature	
Item	Timing Chart of SIGNAL I/O Signals PASS Signal of LC (TC, PCC, Patient test)	Testing Circuit	
Condition	Polarity: Normal, Condition: Normal, Pass Hold: 50 ms, Test Time: OFF Network: C (TC: touch current), I (patient leakage current), Probe: Enc-Enc (TC), Probe: Patient 110% (Patient), 110% OUT: OFF (TC), ON-Normal (Patient)		



The values shown above are typical values at an ambient temperature of 23 °C and do not guarantee the performance of TOS9300 Series.

Model	TOS9300 Series	Temperature	
Item	Timing Chart of SIGNAL I/O Signals FAIL Signal of LC (TC, PCC, Patient test)	Testing Circuit	
Condition	Polarity: Normal, Condition: Normal, Pass Hold: 50 ms, Test Time: OFF, Upper Limit: 1.0001 mA, Lower Limit: 1 mA, Network: C (TC: touch current), I (patient leakage current), Probe: Enc-Enc (TC), Probe: Patient 110% (Patient), 110% OUT: OFF (TC), ON-Normal (Patient)		



The values shown above are typical values at an ambient temperature of 23 °C and do not guarantee the performance of TOS9300 Series.

Model	TOS9300 Series	Temperature	
Item	Timing Chart of SIGNAL I/O Signals PROTECTION Signal of LC (TC, PCC, Patient test)	Testing Circuit	
Condition	Polarity: Normal, Condition: Normal, Pass Hold: 50 ms, Test Time: 1 s Network: C (TC: touch current), I (patient leakage current), Probe: Enc-Enc (TC), Probe: Patient 110% (Patient), 110% OUT: OFF (TC), ON-Normal (Patient)		

The timing chart illustrates the sequence and timing requirements for the following signals:

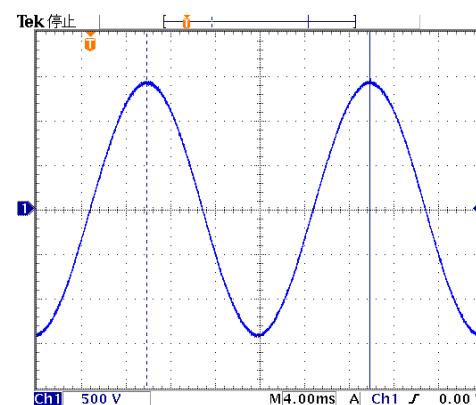
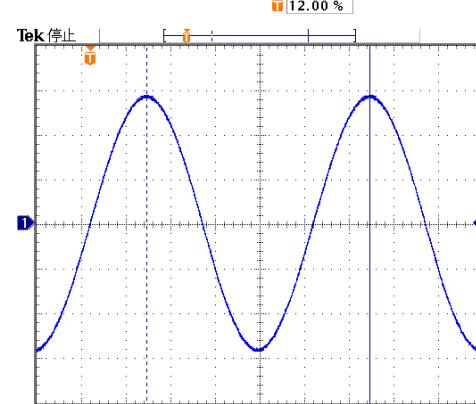
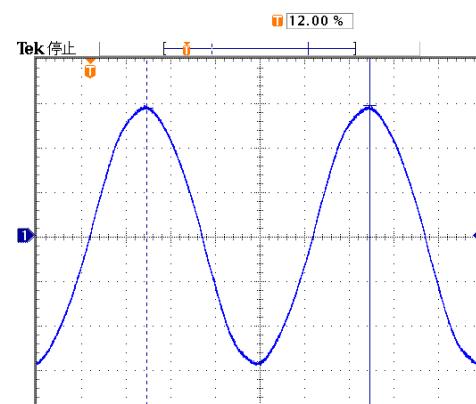
- START:** Minimum duration of 5ms.
- HV_ON:** Duration of 12~15ms.
- TEST:** Maximum duration of 3ms.
- Protection:** Duration of 30ms.
- INTERLOCK:** Maximum duration of 10ms. A note specifies "Measured value 20ms or less".
- STOP:** Maximum duration of 3ms.
- READY:** This signal is shown at the bottom, indicating the start of the sequence.

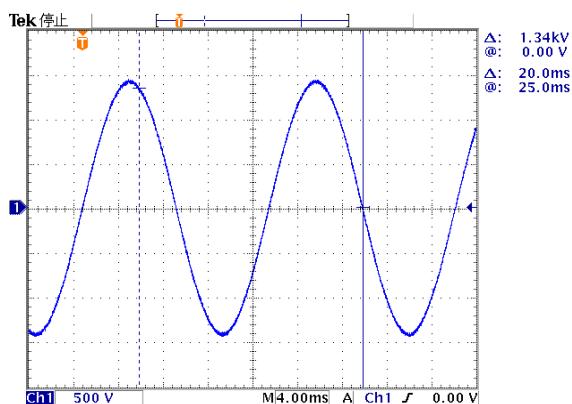
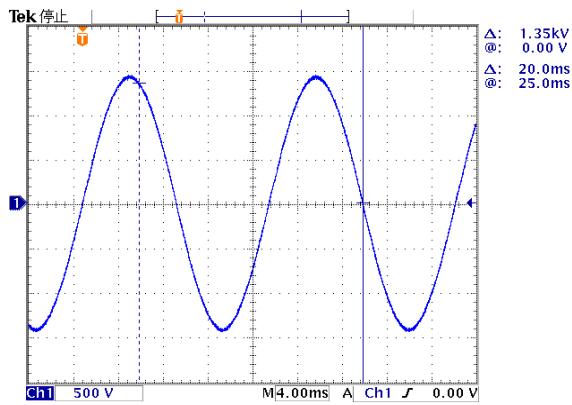
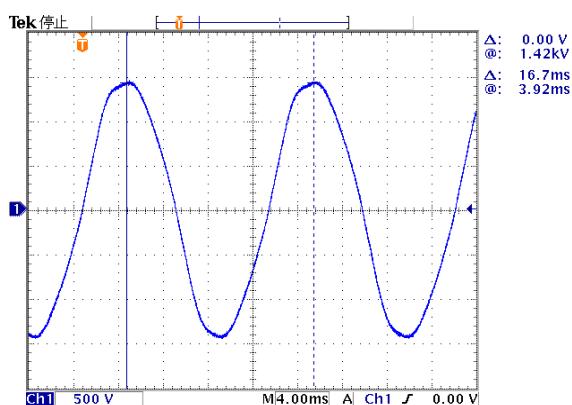
The chart uses red dotted vertical lines to mark specific points in time for each signal transition.

The values shown above are typical values at an ambient temperature of 23 °C and do not guarantee the performance of TOS9300 Series.

Model	TOS9300 Series	Temperature																			
Item	Contact Check Operation with TOS9320	Testing Circuit																			
Condition	Combined with TOS9301 and TOS9320. Contact Check: ON CH1 to CH4 of the scanner: Low Rise Time: ON																				
<p>The timing diagram illustrates the sequence of events and their timing for the contact check operation. The sequence starts with a 'START' pulse, followed by an 'H.V ON' pulse. The 'TEST' pulse is triggered during the 'H.V ON' pulse. Below these, four channels (1CH, 2CH, 3CH, 4CH) are shown transitioning between 'High' and 'Low' states. The timing intervals are labeled as follows:</p> <ul style="list-style-type: none"> (1) Duration from the start of 'H.V ON' to the start of 'TEST'. (2) Duration of the 'H.V ON' pulse. (3) Duration from the end of 'H.V ON' to the start of the first channel transition. (4) Duration of the 'TEST' pulse. (5) Duration from the end of the 'TEST' pulse to the start of the second channel transition. (6) Duration from the start of the first channel transition to the start of the second channel transition. (7) Duration of each individual channel transition (either High-to-Low or Low-to-High). 																					
<table border="1"> <thead> <tr> <th>No.</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>(1)</td> <td>5 ms min.</td> </tr> <tr> <td>(2)</td> <td>Approx. 180 ms¹</td> </tr> <tr> <td>(3)</td> <td>Rise Time</td> </tr> <tr> <td>(4)</td> <td>Test Time</td> </tr> </tbody> </table>		No.	Description	(1)	5 ms min.	(2)	Approx. 180 ms ¹	(3)	Rise Time	(4)	Test Time	<table border="1"> <thead> <tr> <th>No.</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>(5)</td> <td>Varies depending on the EUT</td> </tr> <tr> <td>(6)</td> <td>Approx. 50 ms¹</td> </tr> <tr> <td>(7)</td> <td>Approx. 30 ms¹</td> </tr> </tbody> </table>		No.	Description	(5)	Varies depending on the EUT	(6)	Approx. 50 ms ¹	(7)	Approx. 30 ms ¹
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<p>1 TYP (typical value)</p> <p><u>TYP is a typical value at an ambient temperature of 23 °C and does not guarantee the performance of TOS9300 Series.</u></p>																					

Model	TOS9300 Series	Temperature				
Item	Stray Capacitance on ACW	Testing Circuit				
Condition	Measured by connecting the lead wire, test lead and high voltage scanner (TOS9320) under the open circuit condition.					
Measurement environment		Output voltage				
		1 kV	2 kV	3 kV	4 kV	5 kV
When a lead wire 350 mm long is hung in air (typical value)		2 µA	4 µA	6 µA	8 µA	10 µA
When the supplied lead wire TL31-TOS is used (typical value)		16 µA	32 µA	48 µA	64 µA	80 µA
Per high voltage scanner (typical value, excluding the test lead)		22 µA	44 µA	66 µA	88 µA	110 µA

Model	TOS9300 Series	Temperature			
Item	Output Voltage Waveform of ACW with Capacitor Connected	Testing Circuit			
Condition					
<p>Output Frequency: 50 Hz CF: Crest factor</p> <table border="1"> <tr> <td>1KV No load</td> <td>CF=1.437</td> </tr> </table>			1KV No load	CF=1.437	
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<table border="1"> <tr> <td>1KV 0.01uF × 10</td> <td>CF=1.414</td> </tr> </table>			1KV 0.01uF × 10	CF=1.414	
1KV 0.01uF × 10	CF=1.414				
					

Model	TOS9300 Series	Temperature 41.07	
Item	Output Voltage Waveform of ACW with Capacitor Connected	Testing Circuit	
Condition			
Output Frequency: 60 Hz			
1KV No load CF=1.436		 <p>19 Jun 2018 17:52:03</p>	
1KV 0.01uF CF=1.429		 <p>19 Jun 2018 17:55:50</p>	
1KV 0.01uF × 10 CF=1.392		 <p>19 Jun 2018 17:59:37</p>	

Model	TOS9300 Series			Temperature										
Item	Power Consumption			Testing Circuit										
Condition	WT1802-02-M-HE/EX2: Precision Power Analyzer PCR6000LE: AC Power Supply DR25600: Decade Resistor Box													
AC Input Frequency = 50 Hz														
ACW: 5 kV, No load, Output Frequency: 50 Hz														
AC Voltage (V)	AC Current (A)	Apparent Power (VA)	Power Consumption (W)	Output Power (W)	Power Factor (%)	Efficiency (%)								
90	1.053	94.45	72.97	—	77.3	—								
100	0.985	98.45	73.41	—	74.6	—								
220	0.548	120.85	70.92	—	58.7	—								
240	0.526	126.18	70.95	—	56.2	—								
ACW: 5 kV, No load, Output Frequency: 60 Hz														
90	1.029	92.51	70.65	—	76.4	—								
100	0.967	96.78	71.48	—	73.9	—								
220	0.539	118.67	68.94	—	58.1	—								
240	0.516	123.95	69.01	—	55.7	—								
ACW: 5 kV, 100 mA, Output Frequency: 50 Hz														
90	7.827	690.5	677.2	501.8	98.1	74.1								
100	7.302	717.7	671.1	501.8	93.5	74.8								
220	3.162	695.8	636.7	501.8	91.5	78.8								
240	2.972	711.4	636.0	501.8	89.4	78.9								
ACW: 5 kV, 100 mA, Output Frequency: 60 Hz														
90	7.993	704.2	676.6	500.0	96.1	73.9								
100	7.105	698.6	666.1	500.0	95.3	75.1								
220	3.193	699.8	632.8	500.0	90.4	79.0								
240	2.956	708.1	635.1	500.0	89.7	78.7								
DCW: 7.2 kV, 14.4 mA														
90	2.307	208.2	185.0	103.7	88.9	56.0								
100	2.075	206.6	184.2	103.7	89.2	56.3								
220	1.011	219.9	179.5	103.7	81.6	57.8								
240	0.953	228.1	180.7	103.7	79.2	57.4								
IR: 1 kV, 1 mA														
90	0.634	57.1	33.5	1.0	58.7	3.0								
100	0.592	59.1	33.4	1.0	56.6	3.0								
220	0.375	82.9	33.1	1.0	40.0	3.0								
240	0.365	88.3	33.1	1.0	37.5	3.0								

Model	TOS9300 Series			Temperature										
Item	Power Consumption			Testing Circuit										
Condition	WT1802-02-M-HE/EX2: Precision Power Analyzer PCR6000LE: AC Power Supply DR25600: Decade Resistor Box													
AC Input Frequency = 60 Hz														
ACW: 5 kV, No load, Output Frequency: 50 Hz														
AC Voltage (V)	AC Current (A)	Apparent Power (VA)	Power Consumption (W)	Output Power (W)	Power Factor (%)	Efficiency (%)								
90	0.884	79.31	61.48	-	77.5	-								
100	0.791	78.93	61.06	-	77.4	-								
220	0.473	104.10	60.28	-	57.9	-								
240	0.471	113.27	60.30	-	53.2	-								
ACW: 5 kV, No load, Output Frequency: 60 Hz														
AC Voltage (V)	AC Current (A)	Apparent Power (VA)	Power Consumption (W)	Output Power (W)	Power Factor (%)	Efficiency (%)								
90	0.901	81.00	63.00	-	77.8	-								
100	0.825	82.27	62.98	-	76.6	-								
220	0.490	107.90	61.58	-	57.1	-								
240	0.477	115.24	62.00	-	53.8	-								
ACW: 5 kV, 100 mA, Output Frequency: 50 Hz														
AC Voltage (V)	AC Current (A)	Apparent Power (VA)	Power Consumption (W)	Output Power (W)	Power Factor (%)	Efficiency (%)								
90	8.107	716.8	678.5	498.8	94.7	73.5								
100	7.082	698.6	665.9	498.8	95.3	74.9								
220	3.129	686.4	638.4	498.8	93.0	78.1								
240	2.880	692.0	634.6	498.8	91.7	78.6								
ACW: 5 kV, 100 mA, Output Frequency: 60 Hz														
AC Voltage (V)	AC Current (A)	Apparent Power (VA)	Power Consumption (W)	Output Power (W)	Power Factor (%)	Efficiency (%)								
90	7.907	704.3	677.2	502.0	96.2	74.1								
100	7.100	699.1	668.7	502.0	95.7	75.1								
220	3.192	700.6	637.0	502.0	90.9	78.8								
240	2.954	707.4	637.0	502.0	90.0	78.8								
DCW: 7.2 kV, 14.4 mA														
AC Voltage (V)	AC Current (A)	Apparent Power (VA)	Power Consumption (W)	Output Power (W)	Power Factor (%)	Efficiency (%)								
90	2.290	205.0	184.9	103.7	90.2	56.1								
100	2.058	205.1	184.1	103.7	89.8	56.3								
220	1.004	220.7	179.2	103.7	81.2	57.8								
240	0.953	228.6	178.9	103.7	78.3	58.0								
IR: 1 kV, 1 mA														
AC Voltage (V)	AC Current (A)	Apparent Power (VA)	Power Consumption (W)	Output Power (W)	Power Factor (%)	Efficiency (%)								
90	0.653	59.2	34.0	1.0	57.4	2.9								
100	0.599	60.0	33.3	1.0	55.5	3.0								
220	0.390	86.0	33.2	1.0	38.5	3.0								
240	0.385	93.0	33.5	1.0	36.0	3.0								

Model	TOS9300 Series			Temperature										
Item	Power Consumption			Testing Circuit										
Condition	WT1802-02-M-HE/EX2: Precision Power Analyzer PCR6000LE: AC Power Supply DR25600: Decade Resistor Box													
AC Input Frequency = 50 Hz														
EC AC: 40 A, 100 mA, READY status, Output Frequency: 50 Hz														
AC Voltage (V)	AC Current (A)	Apparent Power (VA)	Power Consumption (W)	Output Power (W)	Power Factor (%)	Efficiency (%)								
90	0.825	74.23	50.00		67.4	–								
100	0.766	76.50	49.70		65.0	–								
220	0.466	102.57	49.08		47.9	–								
240	0.450	108.00	49.04		45.4	–								
EC AC: 40 A, 100 mA, READY status, Output Frequency: 60 Hz														
90	0.826	74.21	50.00	–	67.4	–								
100	0.766	76.51	49.68	–	64.9	–								
220	0.467	102.67	49.08	–	47.8	–								
240	0.449	107.80	49.08	–	45.5	–								
EC AC: 40 A, 0.1 Ω, Output Frequency: 50 Hz														
90	3.654	326.90	295.60	160	90.4	54.1								
100	3.285	326.70	293.70	160	89.9	54.5								
220	1.536	337.56	286.26	160	84.8	55.9								
240	1.401	335.98	285.78	160	85.1	56.0								
EC AC: 40 A, 0.1 Ω, Output Frequency: 60 Hz														
90	3.577	319.10	294.70	160	92.4	54.3								
100	3.207	318.90	291.90	160	91.5	54.8								
220	1.505	331.06	285.03	160	86.1	56.1								
240	1.403	336.44	284.95	160	84.7	56.2								
EC DC: 40 A, 0.1 Ω														
90	3.580	319.9	295.3	160.0	92.3	54.2								
100	3.220	320.0	293.2	160.0	91.6	54.6								
220	1.515	332.6	286.4	160.0	86.1	55.9								
240	1.409	337.6	285.7	160.0	84.6	56.0								

Model	TOS9300 Series	Temperature	
Item	Power Consumption	Testing Circuit	
Condition	WT1802-02-M-HE/EX2: Precision Power Analyzer PCR6000LE: AC Power Supply DR25600: Decade Resistor Box		

AC Input Frequency = 60 Hz

EC AC: 40 A, 100 mA, READY status, Output Frequency: 50 Hz

AC Voltage (V)	AC Current (A)	Apparent Power (VA)	Power Consumption (W)	Output Power (W)	Power Factor (%)	Efficiency (%)
90	0.833	74.93	50.07	—	66.8	—
100	0.769	77.01	49.87	—	64.8	—
220	0.478	105.15	49.14	—	46.7	—
240	0.466	111.85	49.12	—	43.9	—

EC AC: 40 A, 100 mA, READY status, Output Frequency: 60 Hz

90	0.834	74.98	50.04	—	66.7	—
100	0.773	77.26	49.80	—	64.5	—
220	0.478	105.15	49.13	—	46.7	—
240	0.466	111.82	49.12	—	43.9	—

EC AC: 40 A, 0.1 Ω, Output Frequency: 50 Hz

90	3.490	310.00	292.00	160	94.2	54.8
100	3.206	319.20	294.40	160	92.2	54.3
220	1.519	333.51	286.58	160	85.9	55.8
240	1.418	340.00	286.00	160	84.1	55.9

EC AC: 40 A, 0.1 Ω, Output Frequency: 60 Hz

90	3.493	312.40	294.20	160	94.2	54.4
100	3.224	320.60	292.80	160	91.3	54.6
220	1.494	328.46	285.54	160	86.9	56.0
240	1.429	342.50	285.11	160	83.2	56.1

EC DC: 40 A, 0.1 Ω

90	3.555	317.0	295.6	160.0	93.2	54.1
100	3.195	317.8	293.8	160.0	92.4	54.5
220	1.517	333.7	286.6	160.0	85.9	55.8
240	1.418	340.9	286.2	160.0	84.0	55.9

Model	TOS9300 Series	Temperature	
Item	Power Consumption	Testing Circuit	
Condition	WT1802-02-M-HE/EX2: Precision Power Analyzer PCR6000LE: AC Power Supply DR25600: Decade Resistor Box		

AC Input Frequency: 50 Hz, LC: READY status

AC Voltage (V)	AC Current (A)	Apparent Power (VA)	Power Consumption (W)	Output Power (W)	Power Factor (%)	Efficiency (%)
90	0.737	66.26	38.57	—	58.2	—
100	0.681	68.05	38.31	—	56.3	—
220	0.421	92.56	37.92	—	41.0	—
240	0.410	98.22	38.18	—	38.9	—

AC Input Frequency: 50 Hz, LC: TC MODE ON status

90	0.867	78.0	46.3	—	59.3	—
100	0.801	80.1	46.0	—	57.4	—
220	0.478	105.3	45.1	—	42.8	—
240	0.461	110.8	45.2	—	40.7	—

AC Input Frequency: 60 Hz, LC: READY status

90	0.752	67.54	38.59	—	57.1	—
100	0.697	69.64	38.28	—	55.0	—
220	0.447	97.92	37.90	—	38.7	—
240	0.429	102.78	38.13	—	37.1	—

AC Input Frequency: 60 Hz, LC: TC MODE ON status

90	0.883	79.4	46.3	—	58.3	—
100	0.816	81.6	45.8	—	56.1	—
220	0.499	109.8	45.1	—	41.1	—
240	0.480	115.3	45.2	—	39.2	—

Model	TOS9300 Series	Temperature	
Item	Power Consumption	Testing Circuit	
Condition	Combined with TOS9301 and TOS9320. WT1802-02-M-HE/EX2: Precision Power Analyzer PCR6000LE: AC Power Supply		

TOS9301 + TOS9320, AC Input Frequency: 50 Hz

Output Condition	AC Voltage (V)	AC Current (A)	Apparent Power (VA)	Power Consumption (W)	Output Power (W)	Power Factor (%)	Efficiency (%)
EXTERNAL I/O switch is ON. EXTERNAL LED is ON.	90	0.072	6.42	2.79	-	43.5	-
	100	0.069	7.01	2.81	-	40.1	-
	220	0.065	14.22	3.06	-	21.5	-
	240	0.076	16.16	3.13	-	19.4	-
EXTERNAL I/O switch is OFF. EXTERNAL LED is OFF.	90	0.057	5.05	2.04	-	40.4	-
	100	0.055	5.53	2.05	-	37.1	-
	220	0.059	13.01	2.25	-	17.3	-
	240	0.063	14.99	2.27	-	15.1	-
CH1/CH2/CH3/CH4 LEDs are ON. DANGER LED is ON. EXTERNAL LED is OFF.	90	0.360	32.0	17.8	-	55.7	-
	100	0.331	33.8	17.6	-	52.0	-
	220	0.194	42.6	17.8	-	41.7	-
	240	0.185	44.4	17.7	-	39.8	-

TOS9301 + TOS9320, AC Input Frequency: 60 Hz

Output Condition	AC Voltage (V)	AC Current (A)	Apparent Power (VA)	Power Consumption (W)	Output Power (W)	Power Factor (%)	Efficiency (%)
EXTERNAL I/O switch is ON. EXTERNAL LED is ON.	90	0.075	6.80	2.84	-	41.8	-
	100	0.071	7.11	2.83	-	39.8	-
	220	0.073	16.10	3.10	-	19.3	-
	240	0.077	18.40	3.12	-	17.0	-
EXTERNAL I/O switch is OFF. EXTERNAL LED is OFF.	90	0.060	5.40	2.04	-	37.8	-
	100	0.057	5.74	2.08	-	36.2	-
	220	0.068	14.97	2.23	-	14.9	-
	240	0.072	17.39	2.28	-	13.1	-
CH1/CH2/CH3/CH4 LEDs are ON. DANGER LED is ON. EXTERNAL LED is OFF.	90	0.357	32.0	17.6	-	54.9	-
	100	0.325	32.2	17.5	-	54.2	-
	220	0.194	42.8	17.3	-	40.3	-
	240	0.187	45.0	17.5	-	38.8	-

Model	TOS9300 Series	Temperature	26°C
Item	Leakage Current (Protective Conductor Current)	Testing Circuit	
Condition	TOS3200: Leakage Current Tester PCR2000W: AC Power Supply		

TOS9301

AC Input	Condition	Polarity	Measured Value	Converted Value*
100V	Normal condition	Normal	0.61 m A	1.83 m A
		Reverse	0.614 m A	1.842 m A
100V	Single fault mode Disconnected power supply line (neutral) condition	Normal	1.1 m A	3.3 m A
		Reverse	1.14 m A	3.42 m A

TOS9303

AC Input	Condition	Polarity	Measured Value	Converted Value*
100V	Normal condition	Normal	0.62 m A	1.86 m A
		Reverse	0.606 m A	1.818 m A
100V	Single fault mode Disconnected power supply line (neutral) condition	Normal	1.09 m A	3.27 m A
		Reverse	1.14 m A	3.42 m A

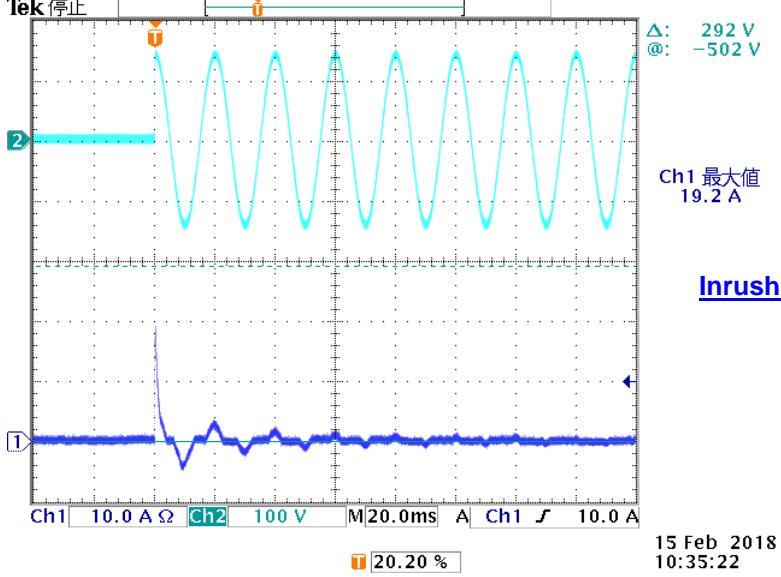
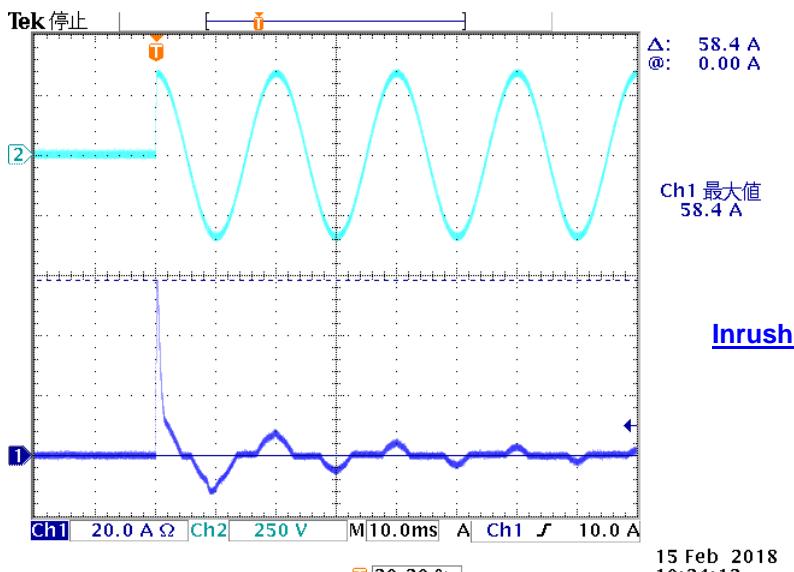
TOS9303LC

AC Input	Condition	Polarity	Measured Value	Converted Value*
100V	Normal condition	Normal	0.607 m A	1.821 m A
		Reverse	0.621 m A	1.863 m A
100V	Single fault mode Disconnected power supply line (neutral) condition	Normal	1.09 m A	3.27 m A
		Reverse	2.25 m A	6.75 m A

Conversion

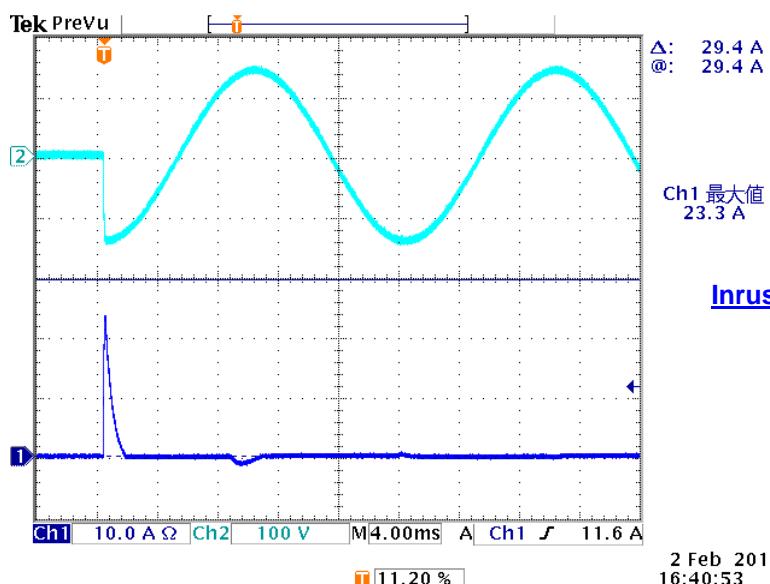
Max. Input Voltage 250 V Max. Input Frequency 60 Hz

*Converted value = Measured value x (Max. Input Voltage/Power Supply Voltage) x (Max. Input Frequency/Power Supply Frequency)

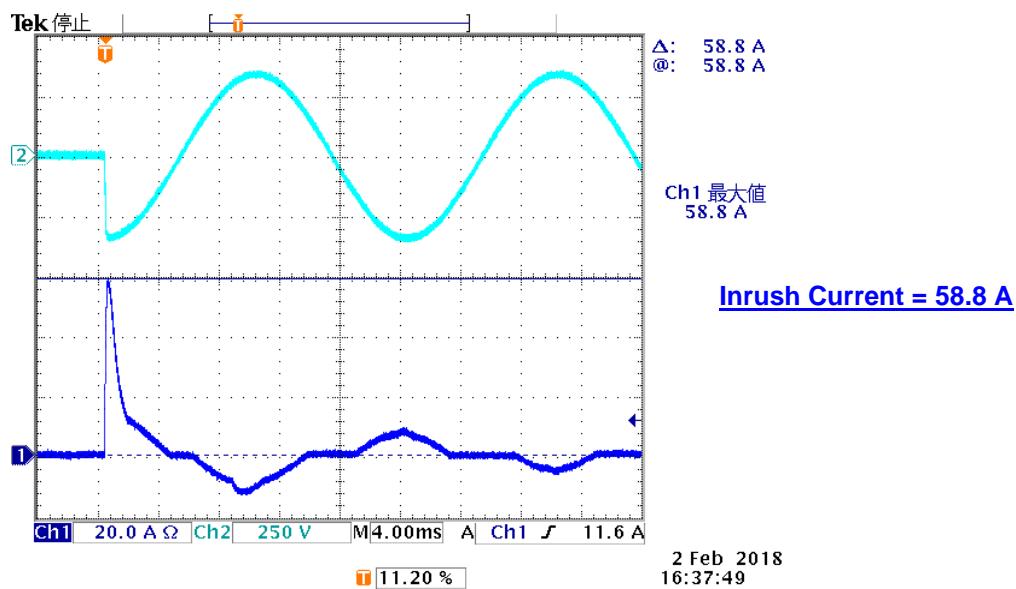
Model	TOS9300 Series	Temperature	25°C			
Item	Inrush Current Waveform of AC Input TOS9301	Testing Circuit				
Condition	TDS3014B: Digital Oscilloscope 100 MHz TCPA400: Current Probe Amplifier TCP404XL: AC/DC Current Probe					
<p><u>Input: 100 Vac Condition: Phase 90° at POWER ON</u></p>  <p>Ch1 10.0 A Ω Ch2 100 V M 20.0ms A Ch1 ∫ 10.0 A</p> <p>15 Feb. 2018 10:35:22</p> <p><u>Inrush Current = 19.2 A</u></p>						
<p><u>Input: 240 Vac Condition: Phase 90° at POWER ON</u></p>  <p>Ch1 20.0 A Ω Ch2 250 V M 10.0ms A Ch1 ∫ 10.0 A</p> <p>15 Feb. 2018 10:34:12</p> <p><u>Inrush Current = 58.4 A</u></p>						

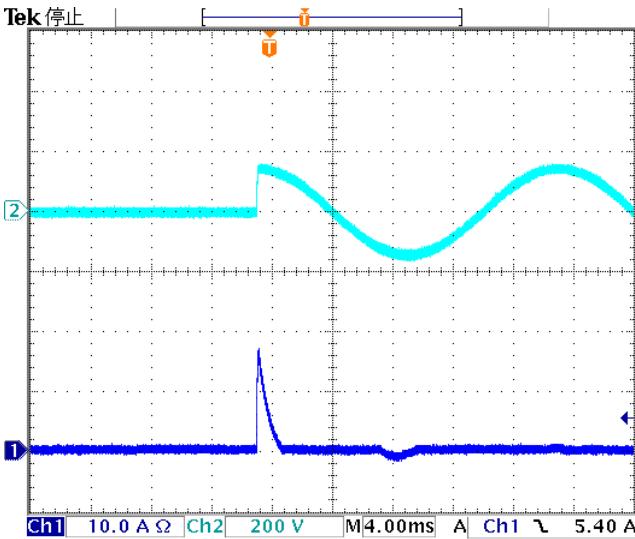
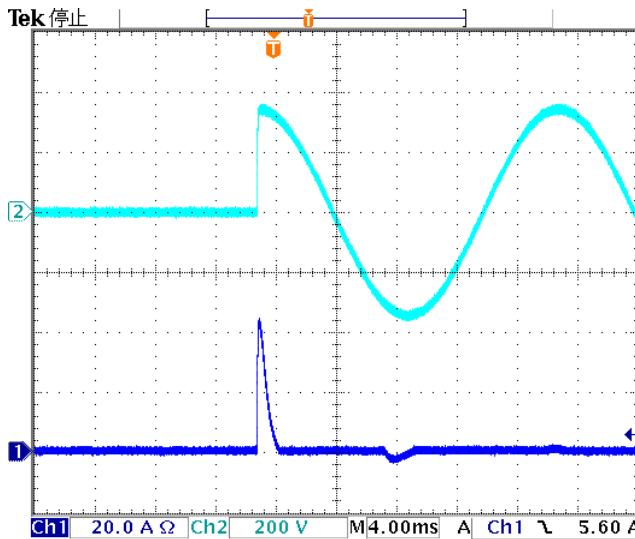
Model	TOS9300 Series	Temperature	25°C
Item	Inrush Current Waveform of AC Input TOS9303LC	Testing Circuit	
Condition	TDS3014B: Digital Oscilloscope 100 MHz TCPA400: Current Probe Amplifier TCP404XL: AC/DC Current Probe		

Input: 100 Vac Condition: Phase 90° at POWER ON



Input: 240 Vac Condition: Phase 90° at POWER ON



Model	TOS9300 Series	Temperature	25°C			
Item	Inrush Current Waveform of AC Input TOS9320	Testing Circuit				
Condition	TDS3014B: Digital Oscilloscope 100 MHz TCPA400: Current Probe Amplifier TCP404XL: AC/DC Current Probe					
<p><u>Input: 100 Vac Condition: Phase 90° at POWER ON</u></p>  <p>Ch1 最大値 17.0 A</p> <p><u>Inrush Current = 17.0 A</u></p> <p>13 Mar 2018 19:04:52</p>						
<p><u>Input: 240 Vac Condition: Phase 90° at POWER ON</u></p>  <p>Ch1 最大値 44.4 A</p> <p><u>Inrush Current = 44.4 A</u></p> <p>13 Mar 2018 19:43:22</p>						

Model	TOS9300 Series	Temperature	25°C
Item	Noise	Testing Circuit	
Condition	Power Supply Voltage: 100 Vac/50 Hz a) READY Status b) ACW 5 kW, No load, The fan controller was working.		

TOS9301

Position	Measured Noise Level	Calculated Noise Level after Background Noise Correction
Front side	a) 42.9 dB(A) b) 43.3 dB(A)	a) 41.9 dB(A) b) 43.3 dB(A)
Left side	a) 43.7 dB(A) b) 44.1 dB(A)	a) 43.7 dB(A) b) 44.1 dB(A)
Rear side	a) 47.2 dB(A) b) 44.5 dB(A)	a) 47.2 dB(A) b) 44.5 dB(A)
Right side	a) 44.8 dB(A) b) 47.0 dB(A)	a) 44.8 dB(A) b) 47.0 dB(A)
Top side	a) 46.7 dB(A) b) 46.9 dB(A)	a) 46.7 dB(A) b) 46.9 dB(A)
Background Noise	35.4 dB(A)	

No. of samples: 2 units, Measurement results (a/b) was obtained by the separate units.

TOS9303LC

Position	Measured Noise Level	Calculated Noise Level after Background Noise Correction
Front side	a) 42.0 dB(A) b) 42.5 dB(A)	a) 41.0 dB(A) b) 41.5 dB(A)
Left side	a) 45.6 dB(A) b) 46.0 dB(A)	a) 45.6 dB(A) b) 46.0 dB(A)
Rear side	a) 47.4 dB(A) b) 45.7 dB(A)	a) 47.4 dB(A) b) 45.7 dB(A)
Right side	a) 44.5 dB(A) b) 45.0 dB(A)	a) 44.5 dB(A) b) 45.0 dB(A)
Top side	a) 47.5 dB(A) b) 47.1 dB(A)	a) 47.5 dB(A) b) 47.1 dB(A)
Background Noise	35.4 dB(A)	

No. of samples: 2 units, Measurement results (a/b) was obtained by the separate units.

Measurement Environment

(If the difference between the measured noise level and background noise is 4 dB or more)

Difference between measured noise level and background noise [dB]	4	5	6	7	8	9	10
Correction value [dB]	-2	-2	-1	-1	-1	-1	0

Model	TOS9300 Series	Temperature	25°C
Item	Command Control Time (via RS232C interface)	Testing Circuit	
Condition	See the command control time below for the typical commands.		
MEAS?			
Response Time:	Approx. 371 ms		
RES?			
Response Time:	Approx. 152 ms		
INIT:TEST			
Output Response Time:	Approx. 7.1 ms		
START			
Output Response Time:	Approx. 6.7 ms		