

TEST DATA OF TUHS3F12

Regulated DC Power Supply
February 28, 2014

Approved by : Nobuyuki Shiraishi
Nobuyuki Shiraishi Design Manager

Prepared by : Takayuki Yamamoto
Takayuki Yamamoto Design Engineer

COSEL CO.,LTD.

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Model	TUHS3F12																																																					
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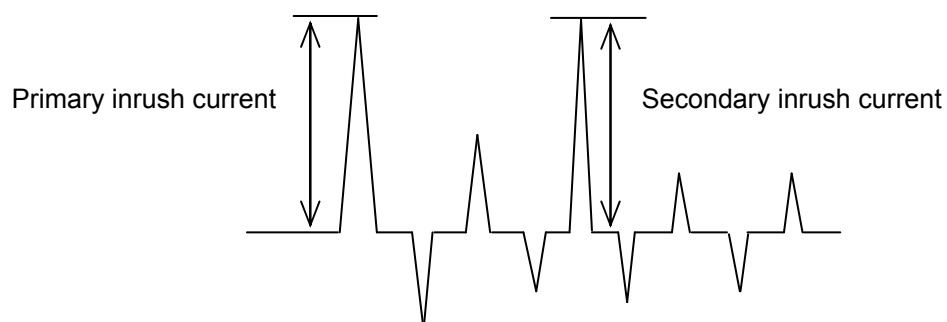
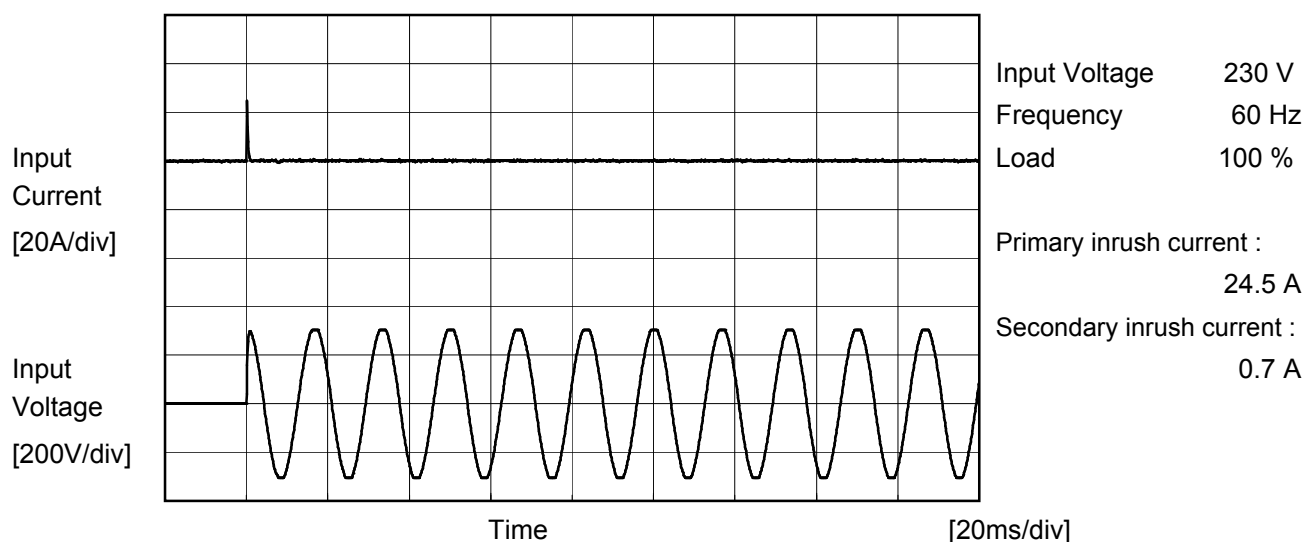
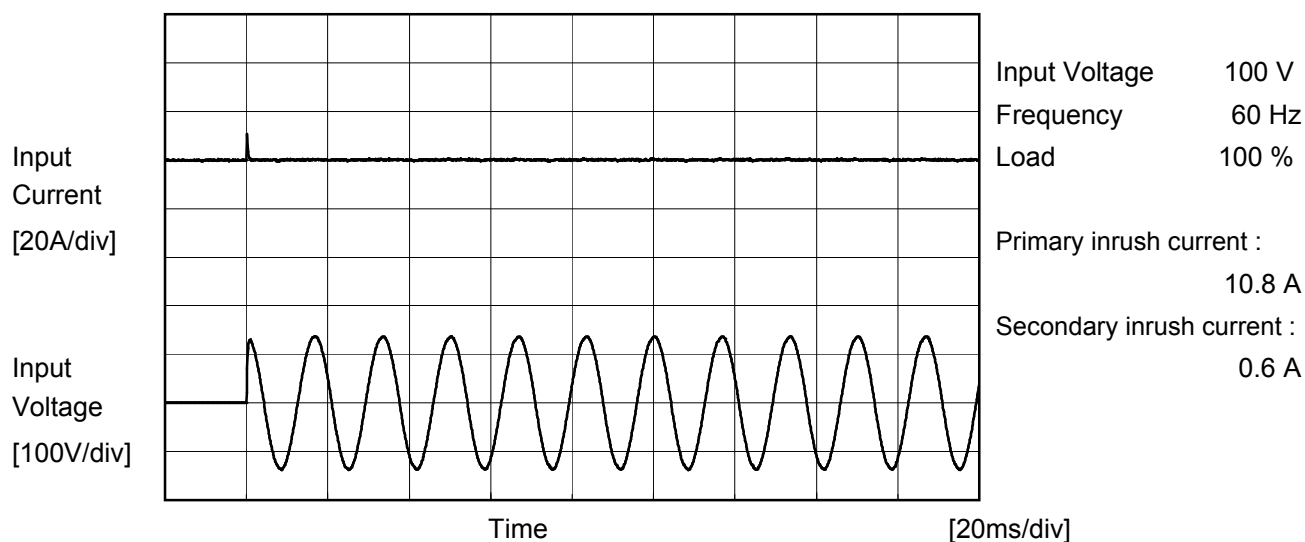
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Item	Inrush Current		
Object	_____		



		Temperature 25°C Testing Circuitry Figure B
Model	TUHS3F12	
Item	Leakage Current	
Object	_____	

1.Results

[mA]

Standards		Input Volt.			Note
		100 [V]	200 [V]	230 [V]	
DEN-AN	Both phases	0.003	0.004	0.004	Operation
	One of phases	0.003	0.005	0.006	Stand by
IEC60950-1	Both phases	0.002	0.005	0.005	Operation
	One of phases	0.003	0.005	0.005	Stand by

The value for "One of phases" is the reference value only.

2.Condition

Leakage current value is concluded after measuring both phases of AC input and by choosing the larger one.

There is no FG in TUHS series and it is a reinforced insulation power supply of the class 2.


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<div><div><div>—△—</div><div>Input Volt.</div><div>100V</div></div><div><div>---□---</div><div>Input Volt.</div><div>200V</div></div><div><div>-·-○-·-</div><div>Input Volt.</div><div>230V</div></div></div> <p>Output Voltage [V]</p> <p>Load Current [A]</p> <p>Note: Slanted line shows the range of the rated load current.</p>		<table><tr><th rowspan="2">Load Current [A]</th><th colspan="3">Output Voltage [V]</th></tr><tr><th>Input Volt. 100[V]</th><th>Input Volt. 200[V]</th><th>Input Volt. 230[V]</th></tr><tr><td>0.00</td><td>12.034</td><td>12.034</td><td>12.034</td></tr><tr><td>0.04</td><td>12.034</td><td>12.034</td><td>12.034</td></tr><tr><td>0.08</td><td>12.033</td><td>12.034</td><td>12.033</td></tr><tr><td>0.12</td><td>12.032</td><td>12.033</td><td>12.033</td></tr><tr><td>0.16</td><td>12.032</td><td>12.032</td><td>12.032</td></tr><tr><td>0.20</td><td>12.031</td><td>12.032</td><td>12.031</td></tr><tr><td>0.24</td><td>12.030</td><td>12.031</td><td>12.031</td></tr><tr><td>0.25</td><td>12.029</td><td>12.030</td><td>12.030</td></tr><tr><td>0.28</td><td>12.029</td><td>12.030</td><td>12.030</td></tr><tr><td>--</td><td>-</td><td>-</td><td>-</td></tr><tr><td>--</td><td>-</td><td>-</td><td>-</td></tr></table>		Load Current [A]	Output Voltage [V]			Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]	0.00	12.034	12.034	12.034	0.04	12.034	12.034	12.034	0.08	12.033	12.034	12.033	0.12	12.032	12.033	12.033	0.16	12.032	12.032	12.032	0.20	12.031	12.032	12.031	0.24	12.030	12.031	12.031	0.25	12.029	12.030	12.030	0.28	12.029	12.030	12.030	--	-	-	-	--	-	-	-
Load Current [A]	Output Voltage [V]																																																					
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0.16	12.032	12.032	12.032																																																			
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0.24	12.030	12.031	12.031																																																			
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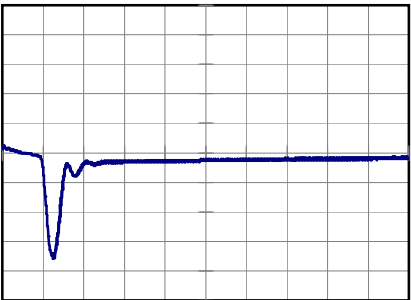
Model		TUHS3F12	
Item		Dynamic Load Response	Temperature 25°C Testing Circuitry Figure A
Object		+12V 0.25A	

Input Volt. 230V
Cycle 500ms

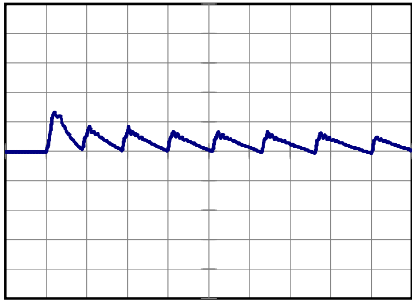
Load Current  0.25A / 100us

Min.Load (0A)←→
Load 100%(0.25A)

200 mV/div



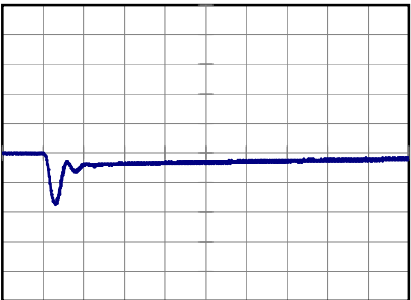
200 us/div



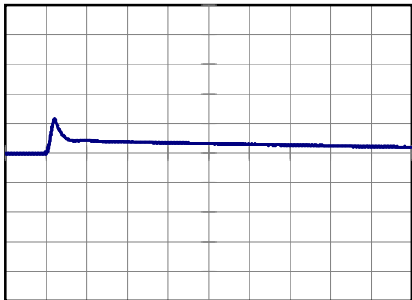
200 us/div

Load 20% (0.05A)←→
Load 100%(0.25A)

200 mV/div



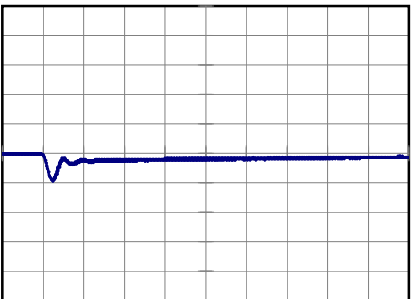
200 us/div



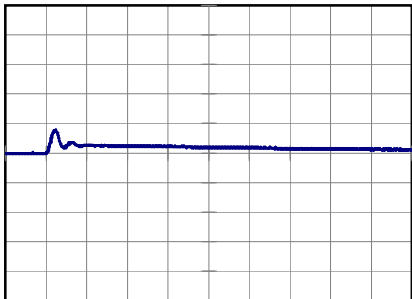
200 us/div

Load 50% (0.125A)←→
Load 100% (0.25A)

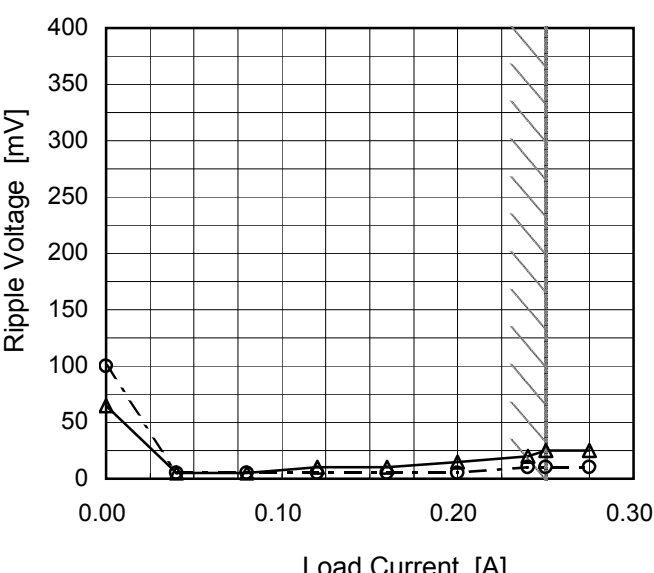
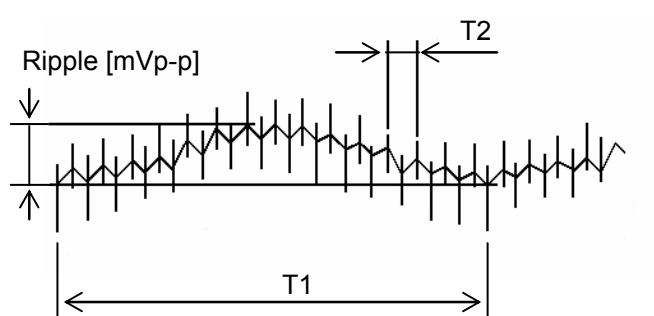
200 mV/div



200 us/div



200 us/div

Model		TUHS3F12		Temperature 25°C																																							
Item		Ripple Voltage (by Load Current)		Testing Circuitry Figure C																																							
Object		+12V0.25A																																									
1.Graph				2.Values																																							
<div><div><div>—△— Input Volt. 100V</div><div>- -○- - Input Volt. 230V</div></div></div>				<table><tr><th rowspan="2">Load Current [A]</th><th colspan="2">Ripple Voltage [mV]</th></tr><tr><th>Input Volt. 100 [V]</th><th>Input Volt. 230 [V]</th></tr><tr><td>0</td><td>65</td><td>100</td></tr><tr><td>0.04</td><td>5</td><td>5</td></tr><tr><td>0.08</td><td>5</td><td>5</td></tr><tr><td>0.12</td><td>10</td><td>5</td></tr><tr><td>0.16</td><td>10</td><td>5</td></tr><tr><td>0.20</td><td>15</td><td>5</td></tr><tr><td>0.24</td><td>20</td><td>10</td></tr><tr><td>0.25</td><td>25</td><td>10</td></tr><tr><td>0.28</td><td>25</td><td>10</td></tr><tr><td>--</td><td>-</td><td>-</td></tr><tr><td>--</td><td>-</td><td>-</td></tr></table>		Load Current [A]	Ripple Voltage [mV]		Input Volt. 100 [V]	Input Volt. 230 [V]	0	65	100	0.04	5	5	0.08	5	5	0.12	10	5	0.16	10	5	0.20	15	5	0.24	20	10	0.25	25	10	0.28	25	10	--	-	-	--	-	-
Load Current [A]	Ripple Voltage [mV]																																										
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0	65	100																																									
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<div>Measured by 100 MHz Oscilloscope.</div> <div>Ripple Voltage is shown as p-p in the figure below.</div> <div>Note: Slanted line shows the range of the rated load current.</div>																																											
<div><div><div>T1: Due to AC Input Line</div><div>T2: Due to Switching</div></div></div>																																											
Fig. Complex Ripple Wave Form																																											

Model	TUHS3F12		
Item	Ripple-Noise	Temperature	25°C
		Testing Circuitry	Figure C
Object	+12V0.25A		
1.Graph		2.Values	
<div><div><div><div></div><div></div></div><div><div></div><div></div></div></div><div><div></div><div></div></div><div><div></div><div></div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> 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Model	TUHS3F12																																						
Item	Ripple Voltage (by Ambient Temp.)	Testing Circuitry Figure C																																					
Object	+12V0.25A																																						
1.Graph		2.Values																																					
<div><div><div>---□---</div><div>Input Volt. 100V</div></div><div><div>—△—</div><div>Input Volt. 200V</div></div></div> <table><thead><tr><th>Ambient Temperature [°C]</th><th>Input Volt. 100V [mV]</th><th>Input Volt. 200V [mV]</th></tr></thead><tbody><tr><td>-45</td><td>25</td><td>10</td></tr><tr><td>-40</td><td>20</td><td>10</td></tr><tr><td>-20</td><td>25</td><td>10</td></tr><tr><td>0</td><td>25</td><td>10</td></tr><tr><td>25</td><td>25</td><td>10</td></tr><tr><td>50</td><td>25</td><td>10</td></tr><tr><td>70</td><td>25</td><td>10</td></tr><tr><td>85</td><td>25</td><td>10</td></tr><tr><td>90</td><td>30</td><td>10</td></tr><tr><td>--</td><td>-</td><td>-</td></tr><tr><td>--</td><td>-</td><td>-</td></tr></tbody></table>		Ambient Temperature [°C]	Input Volt. 100V [mV]	Input Volt. 200V [mV]	-45	25	10	-40	20	10	-20	25	10	0	25	10	25	25	10	50	25	10	70	25	10	85	25	10	90	30	10	--	-	-	--	-	-		
Ambient Temperature [°C]	Input Volt. 100V [mV]	Input Volt. 200V [mV]																																					
-45	25	10																																					
-40	20	10																																					
-20	25	10																																					
0	25	10																																					
25	25	10																																					
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70	25	10																																					
85	25	10																																					
90	30	10																																					
--	-	-																																					
--	-	-																																					
Measured by 100 MHz Oscilloscope. Note: Slanted line shows the range of the rated ambient temperature.																																							

Model	TUHS3F12																																																						
Item	Ambient Temperature Drift	Testing Circuitry Figure A																																																					
Object	+12V0.25A																																																						
1.Graph		2.Values																																																					
<div><div>—△— Input Volt. 100V</div><div>---□--- Input Volt. 200V</div><div>-·-○-·- Input Volt. 230V</div></div> <p>Output Voltage [V]</p> <p>Ambient Temperature [°C]</p> <p>Load 100%</p>		<table><tr><th rowspan="2">Ambient Temperature [°C]</th><th colspan="3">Output Voltage [V]</th></tr><tr><th>Input Volt. 100[V]</th><th>Input Volt. 200[V]</th><th>Input Volt. 230[V]</th></tr><tr><td>-45</td><td>12.057</td><td>12.058</td><td>12.058</td></tr><tr><td>-40</td><td>12.058</td><td>12.059</td><td>12.059</td></tr><tr><td>-20</td><td>12.055</td><td>12.055</td><td>12.055</td></tr><tr><td>0</td><td>12.044</td><td>12.045</td><td>12.045</td></tr><tr><td>25</td><td>12.029</td><td>12.030</td><td>12.030</td></tr><tr><td>50</td><td>11.997</td><td>11.998</td><td>11.998</td></tr><tr><td>70</td><td>11.968</td><td>11.969</td><td>11.969</td></tr><tr><td>85</td><td>11.945</td><td>11.947</td><td>11.947</td></tr><tr><td>90</td><td>11.923</td><td>11.926</td><td>11.925</td></tr><tr><td>--</td><td>-</td><td>-</td><td>-</td></tr><tr><td>--</td><td>-</td><td>-</td><td>-</td></tr></table>			Ambient Temperature [°C]	Output Voltage [V]			Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]	-45	12.057	12.058	12.058	-40	12.058	12.059	12.059	-20	12.055	12.055	12.055	0	12.044	12.045	12.045	25	12.029	12.030	12.030	50	11.997	11.998	11.998	70	11.968	11.969	11.969	85	11.945	11.947	11.947	90	11.923	11.926	11.925	--	-	-	-	--	-	-	-
Ambient Temperature [°C]	Output Voltage [V]																																																						
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--	-	-	-																																																				
Note: Slanted line shows the range of the rated ambient temperature.																																																							



Model		TUHS3F12	Testing Circuitry Figure A
Item		Output Voltage Accuracy	
Object		+12V0.25A	

1. Output Voltage Accuracy

This is defined as the value of the output voltage, regulation load, ambient temperature and input voltage varied at random in the range as specified below.

Temperature : -40 - 85°C

Input Voltage : 85 - 264V

Load Current : 0 - 0.25A

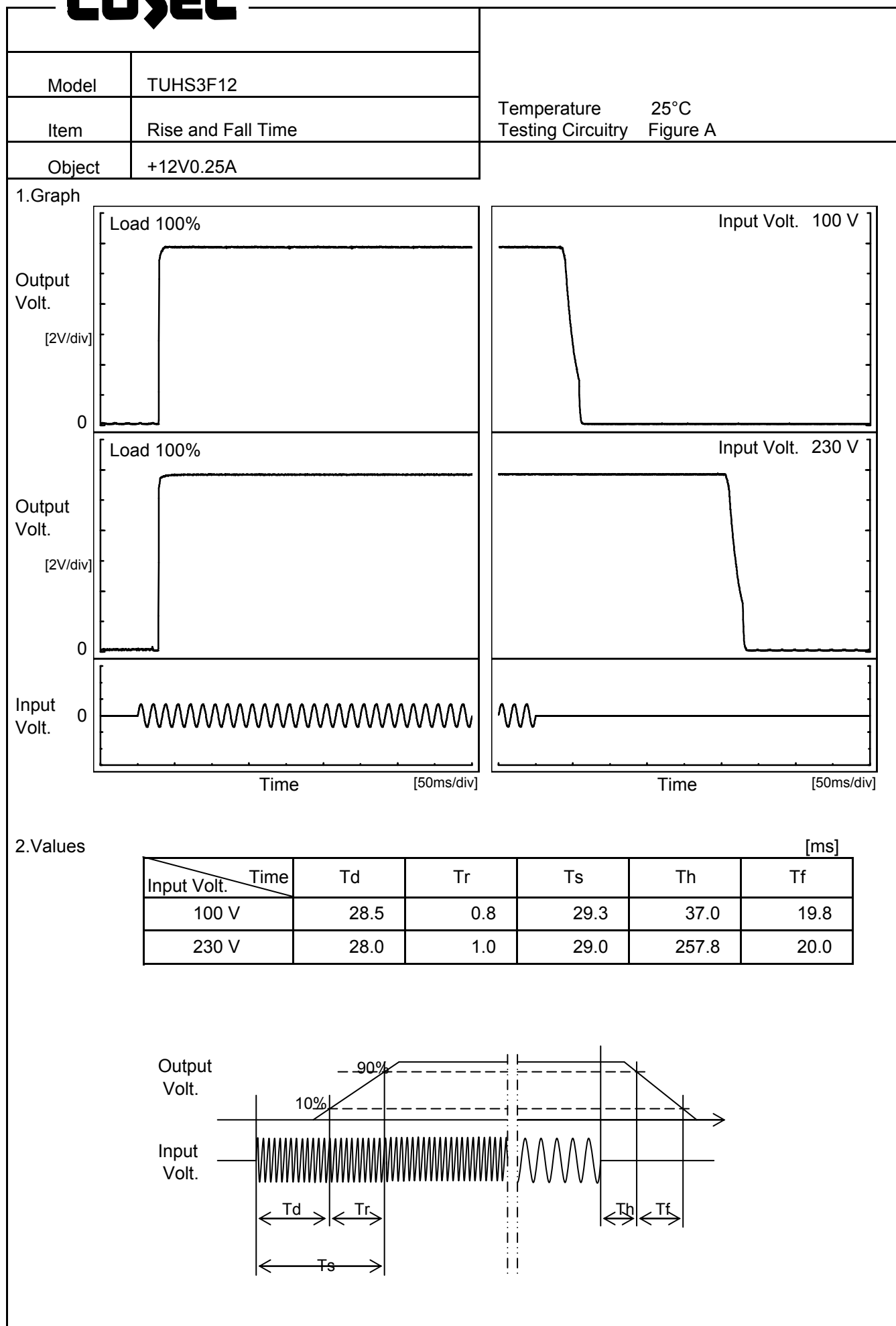
* Output Voltage Accuracy = $\pm(\text{Maximum of Output Voltage} - \text{Minimum of Output Voltage}) / 2$

* Output Voltage Accuracy (Ratio) = $\frac{\text{Output Voltage Accuracy}}{\text{Rated Output Voltage}} \times 100$

2. Values

Item	Temperature [°C]	Input Voltage[V]	Output		Output Voltage Accuracy	
			Current[A]	Voltage[V]	Value [mV]	Ratio [%]
Maximum Voltage	-40	85	0	12.060	±58	±0.5
Minimum Voltage	85	85	0.25	11.945		

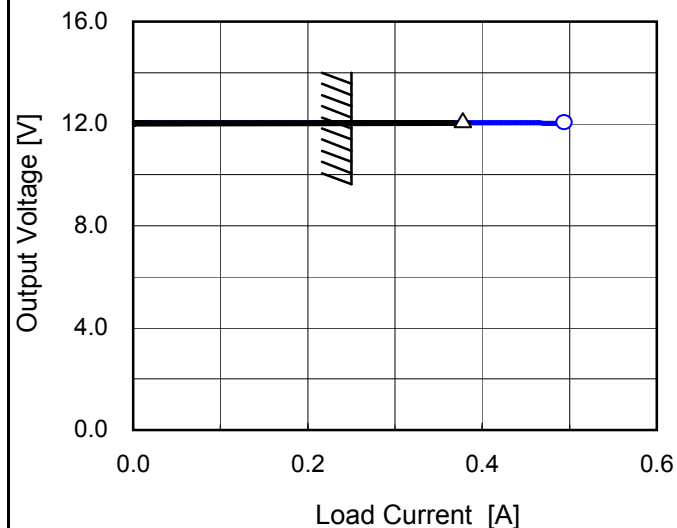
Model	TUHS3F12		
Item	Time Lapse Drift	Temperature	25°C
		Testing Circuitry	Figure A
Object	+12V0.25A		
1.Graph		2.Values	
<div><div><div>Output Voltage [V]</div><div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></di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Model	TUHS3F12																																		
Item	Hold-Up Time	Temperature	25°C																																
		Testing Circuitry	Figure A																																
Object	+12V0.25A																																		
1.Graph		2.Values																																	
<div><div>---□--- Load 50%</div><div>—△— Load 100%</div></div> <div>Hold-Up Time [ms]</div> <div>Input Voltage [V]</div> <p>This duration covers from Shut-off of input voltage to the moment when output voltage descends to the rated range of voltage accuracy. Note: Slanted line shows the range of the rated input voltage.</p>		<table><tr><th rowspan="2">Input Voltage [V]</th><th colspan="2">Hold-Up Time [ms]</th></tr><tr><th>Load 50%</th><th>Load 100%</th></tr><tr><td>75</td><td>41</td><td>15</td></tr><tr><td>85</td><td>57</td><td>23</td></tr><tr><td>100</td><td>83</td><td>37</td></tr><tr><td>120</td><td>125</td><td>59</td></tr><tr><td>200</td><td>373</td><td>180</td></tr><tr><td>230</td><td>499</td><td>258</td></tr><tr><td>264</td><td>664</td><td>348</td></tr><tr><td>280</td><td>750</td><td>395</td></tr><tr><td>--</td><td>-</td><td>-</td></tr></table>		Input Voltage [V]	Hold-Up Time [ms]		Load 50%	Load 100%	75	41	15	85	57	23	100	83	37	120	125	59	200	373	180	230	499	258	264	664	348	280	750	395	--	-	-
Input Voltage [V]	Hold-Up Time [ms]																																		
	Load 50%	Load 100%																																	
75	41	15																																	
85	57	23																																	
100	83	37																																	
120	125	59																																	
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Model	TUHS3F12																																																					
Item	Instantaneous Interruption Compensation	Temperature	25°C																																																			
Object	+12V0.25A	Testing Circuitry	Figure A																																																			
1.Graph		2.Values																																																				
<div><div>—△— Input Volt. 100V ---□--- Input Volt. 200V ---○--- Input Volt. 230V</div><p>Instantaneous Compensation Time [ms]</p><p>Load Current [A]</p><p>Note: Slanted line shows the range of the rated load current.</p></div>		<table><tr><th rowspan="2">Load Current [A]</th><th colspan="3">Time [ms]</th></tr><tr><th>Input Volt. 100[V]</th><th>Input Volt. 200[V]</th><th>Input Volt. 230[V]</th></tr><tr><td>0.00</td><td>-</td><td>-</td><td>-</td></tr><tr><td>0.04</td><td>112</td><td>496</td><td>651</td></tr><tr><td>0.08</td><td>98</td><td>436</td><td>576</td></tr><tr><td>0.12</td><td>83</td><td>376</td><td>501</td></tr><tr><td>0.16</td><td>69</td><td>316</td><td>427</td></tr><tr><td>0.20</td><td>55</td><td>255</td><td>352</td></tr><tr><td>0.24</td><td>41</td><td>195</td><td>277</td></tr><tr><td>0.25</td><td>37</td><td>180</td><td>258</td></tr><tr><td>0.28</td><td>26</td><td>135</td><td>202</td></tr><tr><td>--</td><td>-</td><td>-</td><td>-</td></tr><tr><td>--</td><td>-</td><td>-</td><td>-</td></tr></table>		Load Current [A]	Time [ms]			Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]	0.00	-	-	-	0.04	112	496	651	0.08	98	436	576	0.12	83	376	501	0.16	69	316	427	0.20	55	255	352	0.24	41	195	277	0.25	37	180	258	0.28	26	135	202	--	-	-	-	--	-	-	-
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Model	TUHS3F12	Testing Circuitry Figure A																																							
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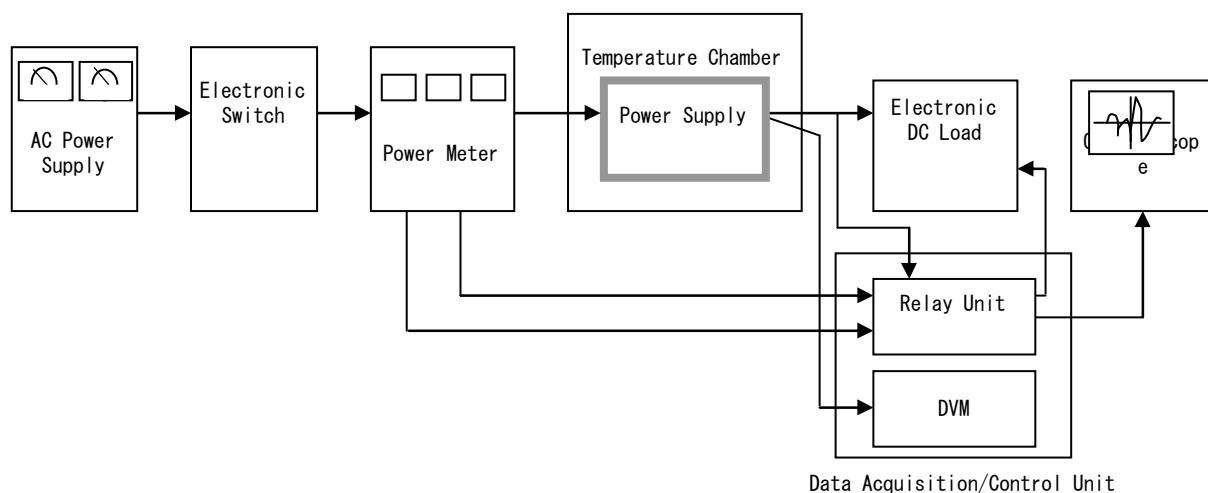


Figure A

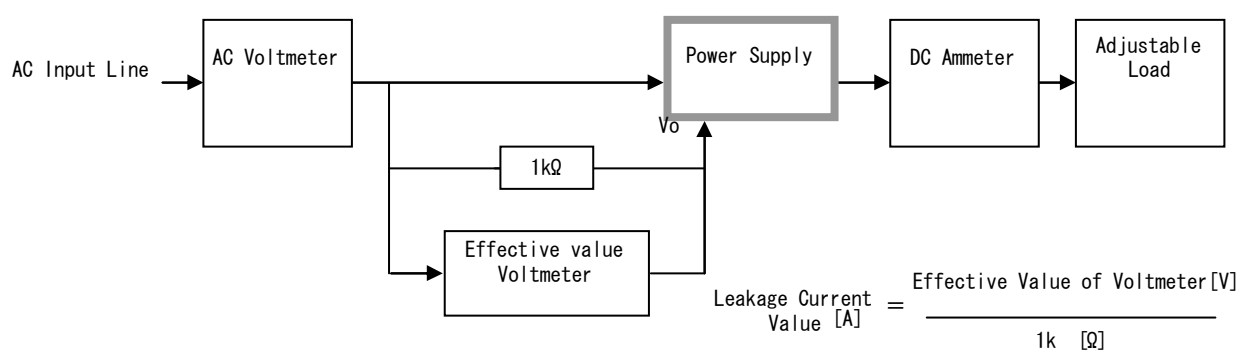


Figure B (DEN-AN)

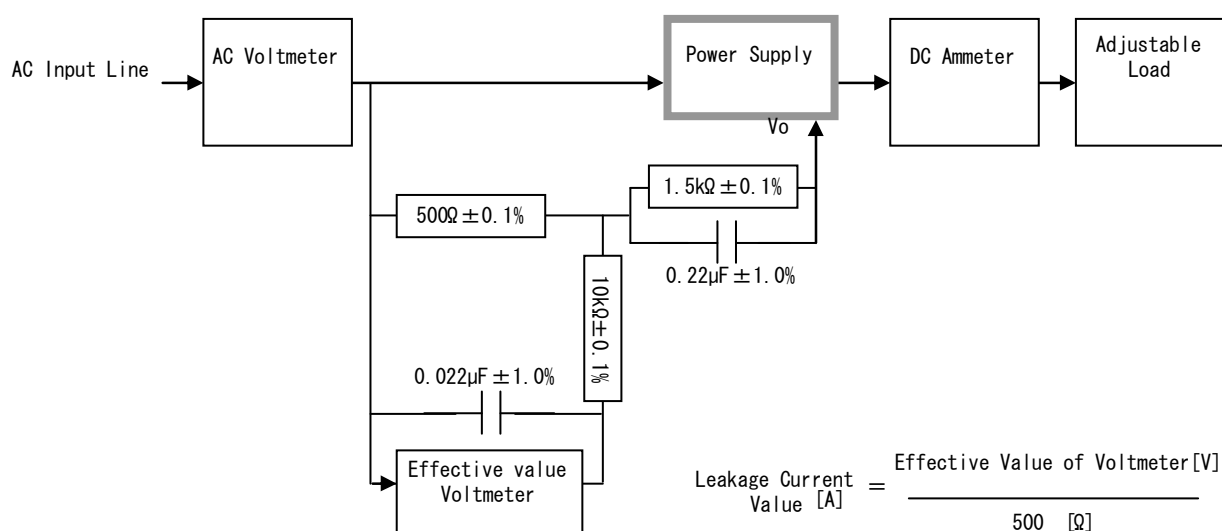


Figure B (IEC60950-1)

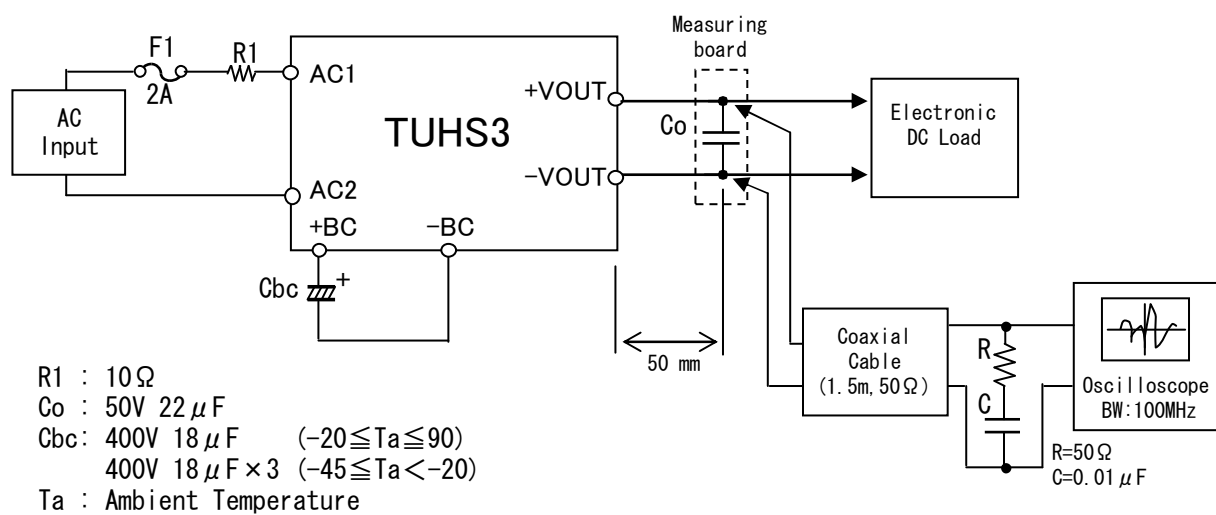


Figure C