



No. CHD40012-011-01

参考資料
Reference data

TECHNICAL DATA

MODEL: SWL240-36

SANKEN ELECTRIC CO.,LTD.

CHD40012-011-01
June 13, 2019

内容 (CONTENTS)

| | |
|---|---------|
| 1.入力特性 (Input Characteristics) |3 |
| 入力電流 (Input Current) |3 |
| 入力電力 (Input Power) |3 |
| 力率 (Power Factor) |3 |
| 効率 (Efficiency) |3 |
| 突入電流 (Inrush Current) |3 |
| 漏洩電流 (Leakage Current) |3 |
| 起動停止電圧 (Start-Up Voltage & Stop Voltage) |3 |
| 入力瞬断時間 (Hold up time) |3 |
| 2.出力特性 (Output Characteristics) |4 |
| 出力偏差 (Output Standard Voltage) |4 |
| 入出力相互変動 (Input/Output Voltage Change Fluctuation) |4 |
| 温度ドリフト (Temperature Drift) |4 |
| 経時ドリフト (Warm-Up Drift) |4 |
| リップル電圧 (Ripple Voltage) |4 |
| リップルノイズ電圧 (Ripple Noise Voltage) |4 |
| 出力電圧可変範囲 (Output Voltage Variable Range) |4 |
| 3.保護特性 (Protection Characteristics) |5 |
| 過電流検出値 (Over Current Protection) |5 |
| 過電圧検出値 (Over Voltage Protection) |5 |
| リセット時間 (Reset Time) |5 |
| 4.環境試験 (Environment Test) |5 |
| 振動試験 (Vibration) |5 |
| 高温スタート (Power on at high temp) |5 |
| 低温スタート (Power on at low temp) |5 |
| 耐衝撃 (Shock) |5 |
| 5.耐ノイズ特性 (Noise Tolerance Characteristics) |5 |
| 注入ノイズ耐量 (AC Line Noise) |5 |
| 雷サージ耐量 (Lightning Surge) |5 |
| 静電気耐量 (ESD) |5 |
| 6.その他の特性 (Other Characteristics) |6 |
| 絶縁耐圧 (Withstand Voltage) |6 |
| 絶縁抵抗 (Insulation Resistance) |6 |
| 7.ダイナミック時の負荷特性 (Dynamic Load) |6 |
| 図1(Fig.1):入力電流特性(負荷電流に対して) Input Current Characteristics (vs. Load Current) |7 |
| 図2(Fig.2):力率特性(負荷電流に対して) Power Factor Characteristics (vs. Load Current) |7 |
| 図3(Fig.3):効率特性(負荷電流に対して) Efficiency Characteristics (vs. Load Current) |7 |
| 図4(Fig.4):突入電流特性(入力電圧に対して) Inrush Current Characteristics (vs. Input Voltage) |8 |
| 図5(Fig.5):漏洩電流(入力電圧に対して) Leakage Current Characteristics (vs. Load Current) |8 |
| 図6(Fig.6):出力電圧精度特性(負荷電流に対して) Output Voltage Accuracy Characteristics (vs. Load Current) |8 |
| 図7(Fig.7):経時ドリフト特性 Warm-Up Drift Characteristics |9 |
| 図8(Fig.8):リップル電圧特性(負荷電流に対して) Ripple Voltage Characteristics (vs. Load Current) |9 |
| 図9(Fig.9):過電流特性(負荷電流に対して) Over Current Protection Characteristics (vs. Load Current) |9 |
| 図10(Fig.10):過電圧特性(温度に対して) Over Voltage Protection Characteristics (vs. Temperature) |10 |
| 図11(Fig.11):起動時間特性(入力電圧に対して) Start-Up Time Characteristics (vs. Input Voltage) |10 |
| 図12(Fig.12):入力瞬断時間(負荷電流に対して) Holduptime Characteristics (vs. Load Current) |10 |
| 図13(Fig.13):ダイナミック時の負荷波形 Dynamic Load Waveform |11 |
| 図14(Fig.14):出力電圧立上り波形 Output Voltage Rising Waveform |11 |
| 図15(Fig.15):出力電圧立下り波形 Output Voltage Falling Waveform |11 |
| 図16(Fig.16):突入電流波形 Inrush Current Waveform |12 |
| 図17(Fig.17):過電圧波形 Over Voltage Waveform |12 |
| 図18(Fig.18):雑音端子電圧波形(Vin=100V) Conduction Noise Waveform(Vin=100V) |13 |
| 図19(Fig.19):雑音端子電圧波形(Vin=230V) Conduction Noise Waveform(Vin=230V) |13 |
| 試験回路図 : Test Circuit |14 |
| |14 |

| | | |
|-----------------------|------|------|
| 入力電圧 Input Voltage | MIN | 85V |
| | NOM | 100V |
| | | 240V |
| MAX | 265V | |

| | | | | | |
|----------------------|------|------|--|--|--|
| 出力 Output Circuit | | 36V | | | |
| 負荷電流 Load Current | MIN | 0A | | | |
| | NOM | 6.7A | | | |
| | MAX | - | | | |
| | PEAK | - | | | |

1.入力特性 Input Characteristics

Ta=25°C

| 試験項目 Test Item | 条件 Condition | | 試験結果 Test Results | | | 仕様 SPEC | 備考 Remarks |
|--|-----------------|------------|----------------------|----------|------------------|--|---------------|
| | 入力 Vin | 負荷 Load | Vin=100V | Vin=240V | | | |
| | | | | | | | |
| 入力電流 Input Current | NOM | NOM | 2.688A | 1.123A | | 2.8A/1.2A _{typ} | 図1 Fig.1 |
| 入力電力 Input Power | NOM | NOM | 266.5W | 256.02W | | --- | |
| 力率 Power Factor | NOM | NOM | 1.00 | 0.95 | | 0.99/0.95 _{typ} | 図2 Fig.2 |
| 効率 Efficiency | NOM | NOM | 90.6% | 94.3% | | 91/94% _{typ} | 図3 Fig.3 |
| 突入電流 Inrush Current | NOM | NOM | 16.0A | - | 33.0A (Vin=200V) | 100V:15A _{typ} 200V:30A _{typ} | 図4 Fig.4 |
| 漏洩電流 Leakage Current | NOM | NOM | 0.077mA | 0.192mA | | 0.150/0.250mA or less 60Hz | 図5 Fig.5 |
| 起動停止電圧 Start-Up Voltage & Stop Voltage | --- | MIN | | | ON35V・OFF10V | --- | --- |
| | --- | NOM | | | ON55V・OFF48V | --- | --- |
| 入力瞬断時間 Hold up time | 100V | NOM | 27ms | | | 20mstyp | 図12 Fig.12 |

2.出力特性 Output Characteristics

*総合安定度:②+③+④ Output Regulation:②+③+④

Ta=25°C

| 試験項目 Test Item | 条件 Condition | | 試験結果 Test Results | | | | 備考 Remarks |
|---|------------------------|------------|-----------------------------------|---|--|--|---------------|
| | 入力 Vin | 負荷 Load | +36V | | | | |
| 1 出力偏差 Output Standard Voltage | NOM | NOM | 35.660V | | | | |
| 2 入出力相互変動 Voltage Change Fluctuation | MIN | MIN | 35.700V | | | | 図6 Fig.6 |
| | MAX | MAX | 36.053V | | | | |
| 3 温度ドリフト Temperature Drift | NOM | NOM | -0.140V 0.130V | | | | 図6 Fig.6 |
| 4 経時ドリフト Warm-Up Drift | NOM | NOM | 0.000V 0.012V | | | | 図7 Fig.7 |
| 総合安定度 Total Regulation | | | 35.560V ~ 36.195V | | | | |
| 仕様 SPEC | | | 34.200V ~ 37.800V | | | | |
| 5 リップル電圧 Ripple Voltage | NOM | NOM | 18.0mV | | | | 図8 Fig.8 |
| | 室温 Room Temperature | | Ta=25°C | | | | |
| 仕様 SPEC | | | 170(Ta=-10~0°C) 140(Ta=0~50°C) | | | | |
| リップルノイズ電圧 Ripple Noise Voltage | NOM | NOM | 54.0mV | | | | |
| | 室温 Room Temperature | | Ta=25°C | | | | |
| 仕様 SPEC | | | 220(Ta=-10~0°C) 170(Ta=0~50°C) | | | | |
| 6 出力電圧可変範囲 Output Voltage Variable Range | MIN | MIN | - | | | | |
| | MAX | MAX | - | | | | |
| 仕様 SPEC | | | - | | | | |
| コメント Comment | | | | | | | |
| 使用プローブ=リップル電圧1:1 リップルノイズ電圧1:1 | | | | Used Probe = Ripple Voltage 1:1 Ripple Noise Voltage 1:1 | | | |

Model: SWL240-36

3.保護特性 Protection Characteristics

| 試験項目 Test Item | 条件 Condition | | 試験結果 Test Results | | | 仕様 SPEC | 備考 Remarks |
|-----------------------------------|-----------------|------------|----------------------|---------|---------|------------------|---------------|
| | 入力 Vin | 負荷 Load | | | | | |
| 過電流検出値 Over Current Protection | | | Ta=-10°C | Ta=25°C | Ta=60°C | | |
| +36V | MIN | MAX | 8.61A | 9.33A | 9.80A | 6.8A以上(or more) | 図9 Fig.9 |
| 過電圧検出値 Over Voltage Protection | | | Ta=-10°C | Ta=25°C | Ta=60°C | | |
| +36V | MAX | MIN | 48.5V | 50.0V | 51.2V | 41.4V以上(or more) | 図10 Fig.10 |
| リセット時間 Reset Time | MAX | MIN | 29.0s (Ta=25°C) | | | --- | --- |

4.環境試験 Environment Test

Ta=25°C

| 試験項目 Test Item | 条件 Condition | | 試験結果 Test Results | | | 仕様 SPEC | 備考 Remarks |
|--|-----------------|------------|---|--|--|--|---------------|
| | 入力 Vin | 負荷 Load | | | | | |
| 振動試験(非動作時) Vibration (Non-Operating) | --- | --- | 周波数10Hz~55Hz,周期3分,加速度2G X・Y・Z方向に各60分,にて試験後外観・特性に問題なし Frequency 10~55Hz, Sweep cycle 3min., Acceleration 19.6m/s ² , Direction X/Y/Z 60 minutes par each axis. There is no problem in appearance and characteristics | | | 正常に起動 Normal Operation | |
| 高温スタート Power on at high temp | NOM | NOM | POWER OFFにて80°Cに1時間放置後POWER ON Left the power supply at 80°C for one hour and turned on. | | | 正常に起動 Normal Operation | |
| 低温スタート Power on at low temp | NOM | NOM | POWER OFFにて-15°Cに1時間放置後POWER ON Left the power supply at -15°C for one hour and turned on. | | | 正常に起動 Normal Operation | |
| 耐衝撃 Shock | --- | --- | 床面から50mmの高さより各辺3回自然落下後 外観・特性に問題なし Lift one side of surface of the unit 50mm and drop it on the board. Drop 3 times for each side. There is no problem in appearance and characteristics | | | 196m/s ² 正常に起動 Normal Operation | --- |

5.耐ノイズ特性 Noise Tolerance Characteristics

Ta=25°C

| 試験項目 Test Item | 条件 Condition | | 試験結果 Test Results | | | 仕様 SPEC | 備考 Remarks |
|--|-----------------|-----------------|----------------------|------|----------------------|------------|---------------|
| | 入力 Vin | 負荷 Load | | | | | |
| 注入ノイズ耐量 ACLInoise (50ns~1000ns) | MIN ~ MAX | MIN ~ MAX | L-L | ±2.0 | kV No Err, No Damage | L-L | ±2.0kV |
| | | | L-FG | ±2.0 | kV No Err, No Damage | L-FG | ±2.0kV |
| | | | N-FG | ±2.0 | kV No Err, No Damage | | |
| 雷サージ耐量 LightningSurge (1.2×50μs) | NOM | NOM | L-L | ±2.0 | kV No Err, No Damage | L-L | ±2.0kV |
| | | | L-FG | ±2.0 | kV No Err, No Damage | L-FG | ±2.0kV |
| | | | N-FG | ±2.0 | kV No Err, No Damage | | (3 times) |
| 静電気耐量ESD | MIN ~ MAX | MIN ~ MAX | Air | ±8.0 | kV No Err, No Damage | Air | ±8.0kV |
| | | | Contact | ±6.0 | kV No Err, No Damage | Contact | ±6.0kV |
| | | | C: 150pF, R: 330Ω | | | | |

6. その他の特性 Other Characteristics

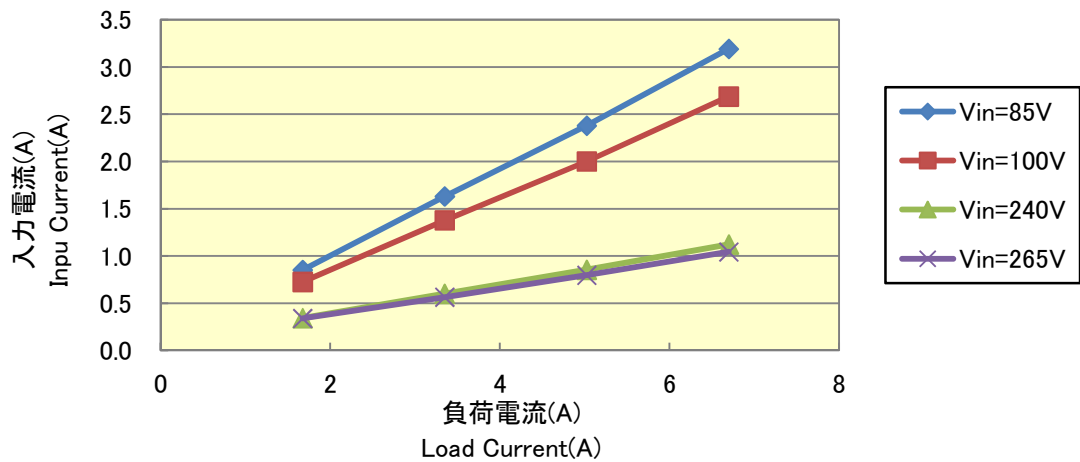
Ta=25°C

| 試験項目 Test Item | 条件 Condition | | 試験結果 Test Results | | | 仕様 SPEC | 備考 Remarks |
|-------------------------------|-----------------|------------|---|---|---|--|---------------|
| | 入力 Vin | 負荷 Load | | | | | |
| 絶縁耐圧 Withstand Voltage | --- | --- | P-S 3.0/3.6kV (漏電流) Leakage Current 1.82/1.93mA | P-E 2.0/2.4kV (漏電流) Leakage Current 1.56/1.67mA | S-E 0.5/0.6kV (漏電流) Leakage Current 1.44/1.59mA | P-S:3.0kV1m,3.6kV 1s P-E:2.0kV1m,2.4kV 1s S-E:0.5kV1m,0.6kV 1s (漏電流10mA以下) Leakage Current 10mA or less | --- |
| 絶縁抵抗 Insulation Resistance | --- | --- | P-S1000MΩ 以上 (or more) | P-E1000MΩ 以上 (or more) | S-E1000MΩ 以上 (or more) | P-S100MΩ以上 (DC500Vカテ-) P-S100MΩ or more (DC500VMegger) | --- |

7. ダイナミック時の負荷特性 Dynamic Load Characteristics 参考データ Reference data

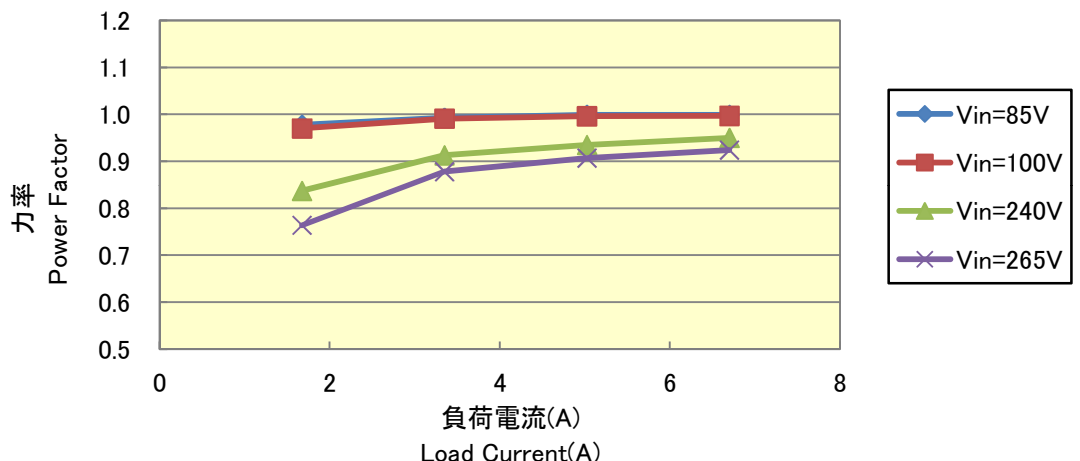
| 試験条件 Test Condition | | 試験結果 Test Results | | | | | 備考 Remarks |
|---------------------------|-----------------|---------------------------|-----------------------------------|-------|--|--|---------------|
| | | +36V | | | | | |
| 出力電圧 Output Voltage | 条件 Condition | Ta=25°C | | 35.0V | | | 図13 |
| | | | | 36.1V | | | |
| | 条件 Condition | 入力電圧 Vin | NOM | | | | Fig.13 |
| | | 出力電流 Output Current | 0A (1ms) ~ 6.7A (1ms) | | | | |

図1 入力電流特性(負荷電流に対して)
Fig.1 Input Current Characteristics (vs Load Current)



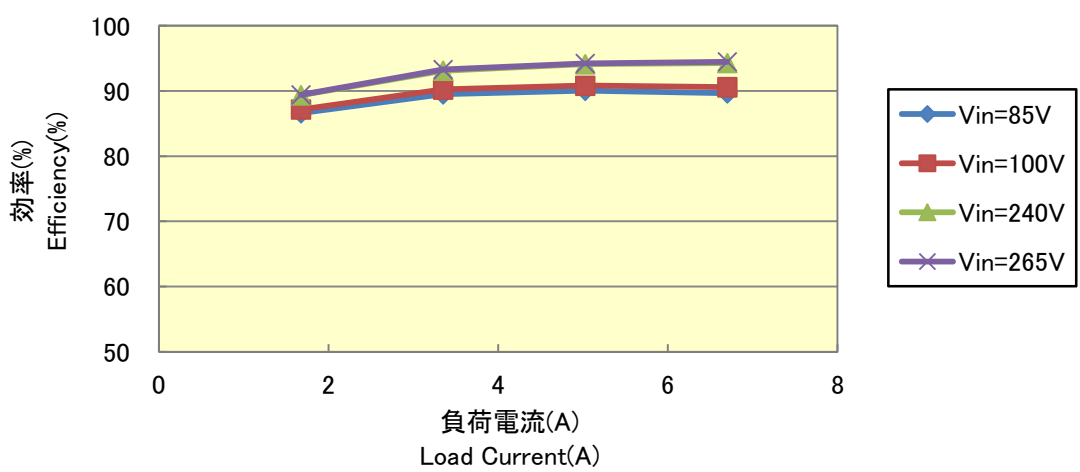
| | |
|----------------|--------------|
| 型名:Model | SWL240-36 |
| 入力:Input | AC85V~265V |
| 出力:Output | 36V 25%~100% |
| 温度:Temperature | Ta=25°C |
| 備考:Remarks | |

図2 力率特性(負荷電流に対して)
Fig.2 Power Factor Characteristics (vs Load Current)



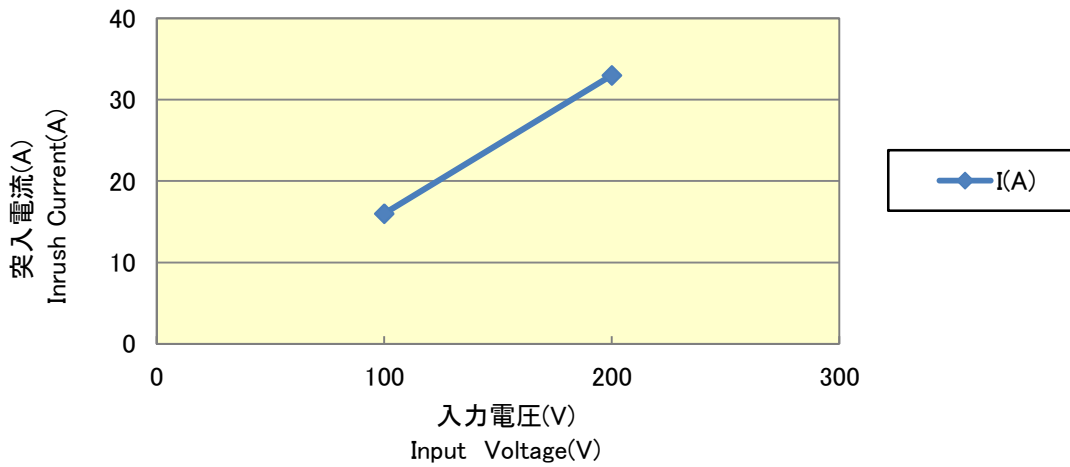
| | |
|----------------|--------------|
| 型名:Model | SWL240-36 |
| 入力:Input | AC85V~265V |
| 出力:Output | 36V 25%~100% |
| 温度:Temperature | Ta=25°C |
| 備考:Remarks | |

図3 効率特性(負荷電流に対して)
Fig.3 Efficiency Characteristics (vs Load Current)



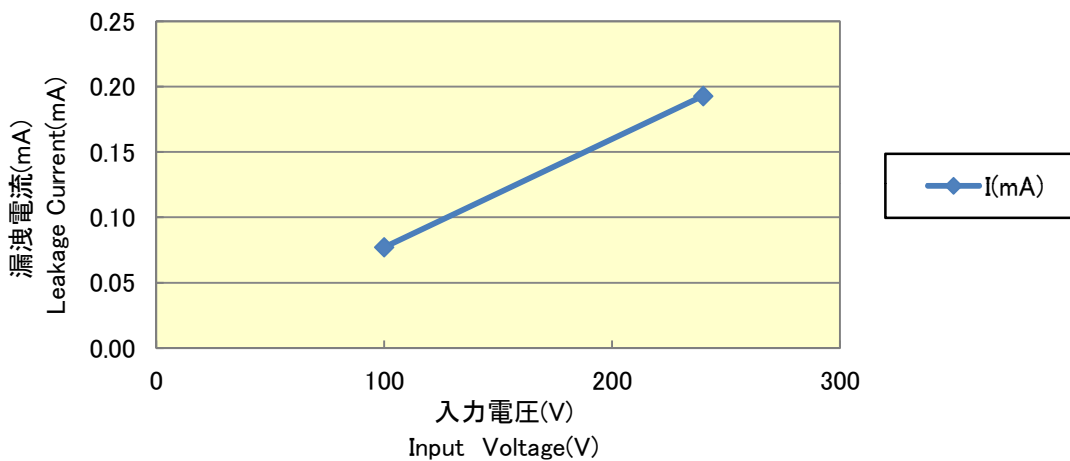
| | |
|----------------|--------------|
| 型名:Model | SWL240-36 |
| 入力:Input | AC85V~265V |
| 出力:Output | 36V 25%~100% |
| 温度:Temperature | Ta=25°C |
| 備考:Remarks | |

図4 突入電流特性(入力電圧に対して)
Fig.4 Inrush Current Characteristics (vs Input Voltage)



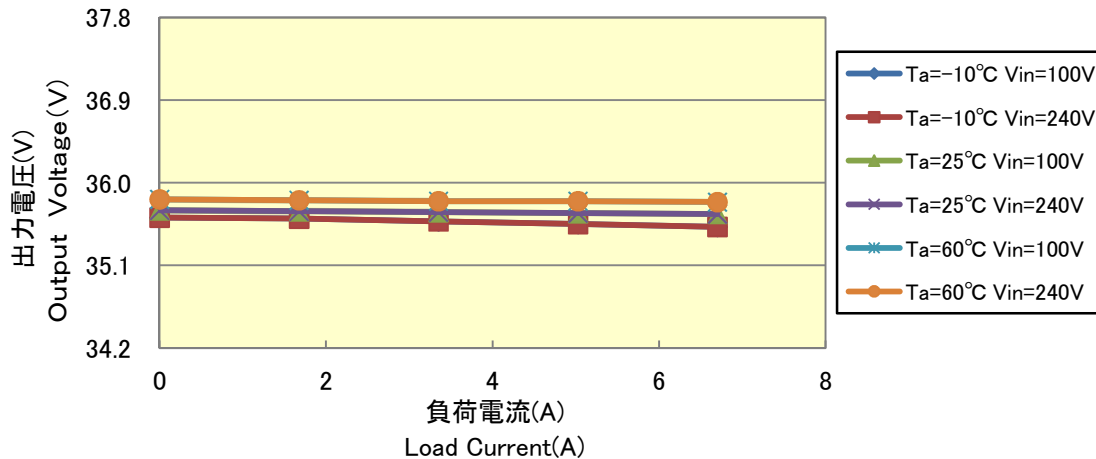
| | |
|----------------|-------------------------|
| 型名:Model | SWL240-36 |
| 入力:Input | AC100~200V |
| 出力:Output | 36V 6.7A |
| 温度:Temperature | Ta=25°C |
| 備考:Remarks | コールドスタート時 Cold Start |

図5 漏洩電流特性(入力電圧に対して)
Fig.5 Leakage Current Characteristics (vs Load Current)



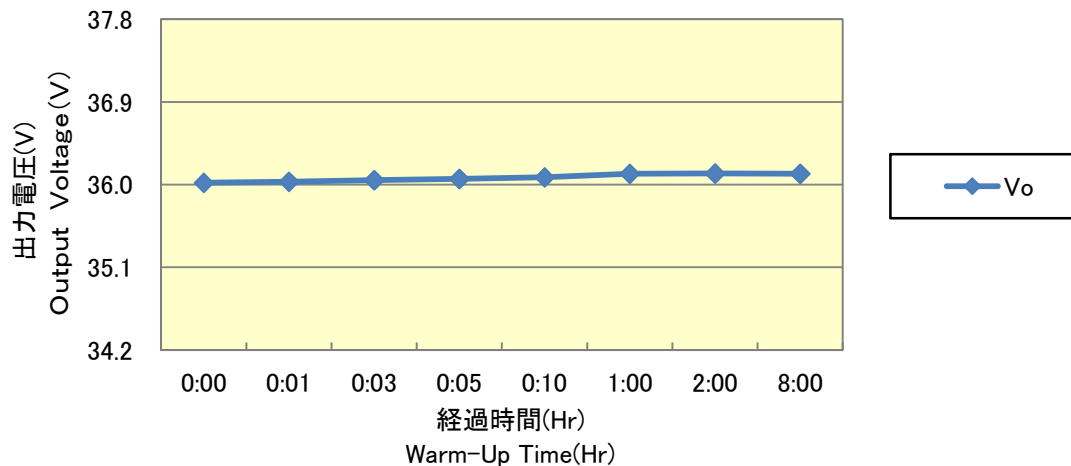
| | |
|----------------|-----------------|
| 型名:Model | SWL240-36 |
| 入力:Input | AC100~240V 60Hz |
| 出力:Output | 36V 6.7A |
| 温度:Temperature | Ta=25°C |
| 備考:Remarks | |

図6 出力電圧精度特性(負荷電流に対して)
Fig.6 Output Voltage Accuracy Characteristics (vs Load Current)



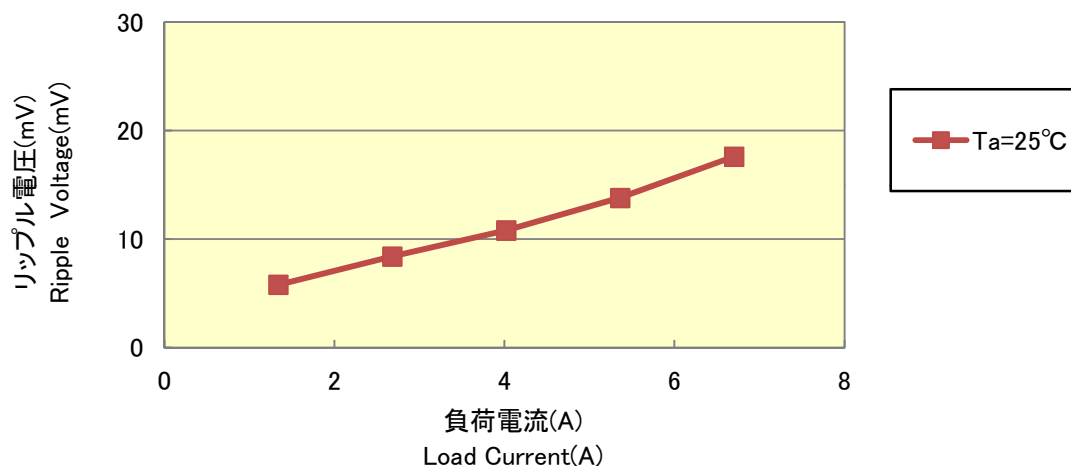
| | |
|----------------|---------------|
| 型名:Model | SWL240-36 |
| 入力:Input | AC100~240V |
| 出力:Output | 36V 0%~100% |
| 温度:Temperature | Ta=-10°C~60°C |
| 備考:Remarks | |

図7 経時ドリフト特性
Fig.7 Warm-Up Drift Characteristics



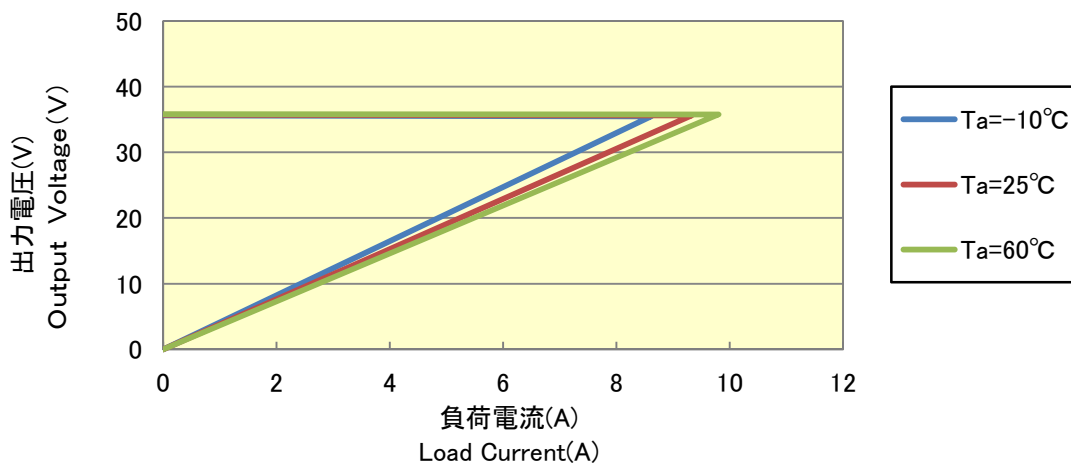
| | |
|----------------|-----------|
| 型名:Model | SWL240-36 |
| 入力:Input | AC100V |
| 出力:Output | 36V 6.7A |
| 温度:Temperature | Ta=25°C |
| 備考:Remarks | |

図8 リプル電圧特性(負荷電流に対して)
Fig.8 Ripple Voltage Characteristics (vs Load Current)



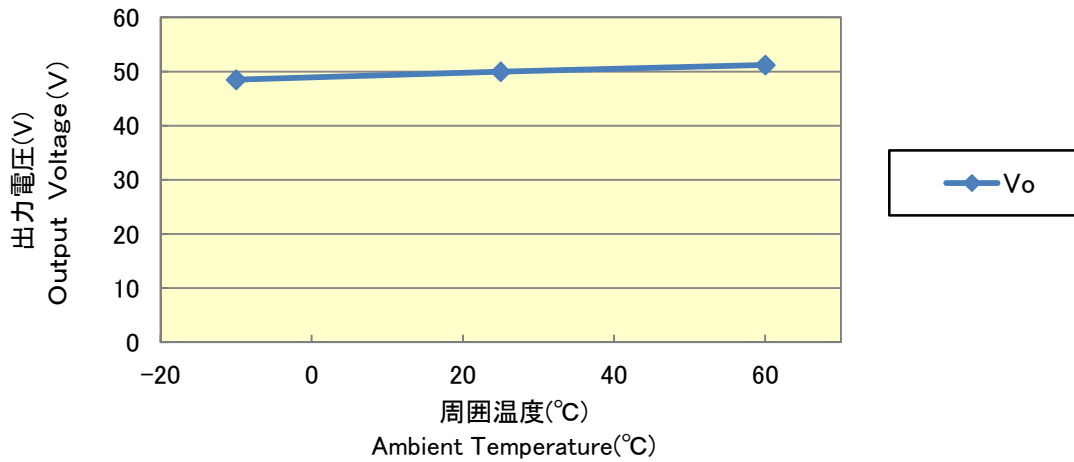
| | |
|----------------|---------------|
| 型名:Model | SWL240-36 |
| 入力:Input | AC100V |
| 出力:Output | 36V 40%~100% |
| 温度:Temperature | Ta=-10°C~60°C |
| 備考:Remarks | |

図9 過電流特性(負荷電流に対して)
Fig.9 Over Current Protection Characteristics (vs Load Current)



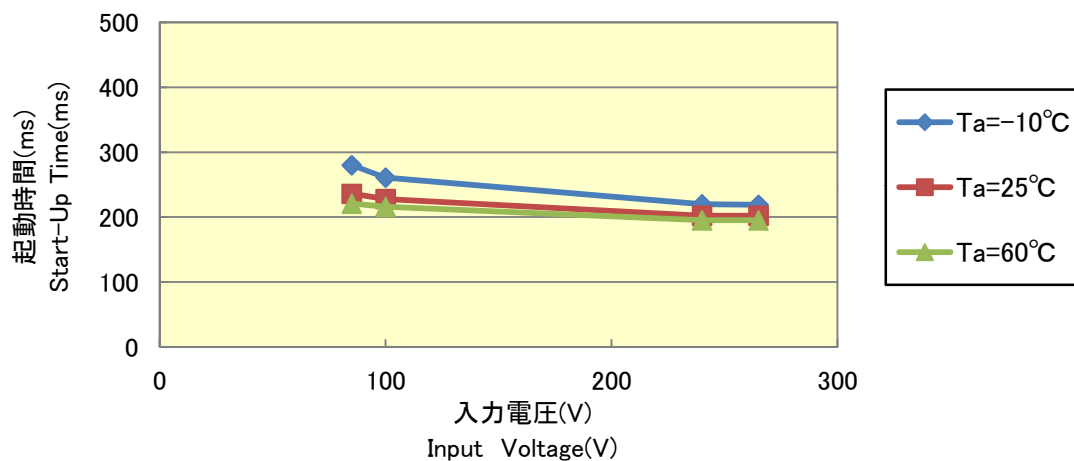
| | |
|----------------|---------------|
| 型名:Model | SWL240-36 |
| 入力:Input | AC85V |
| 出力:Output | 36V |
| 温度:Temperature | Ta=-10°C~60°C |
| 備考:Remarks | |

図10 過電圧特性(温度に対して)
Fig.10 Over Voltage Protection Characteristics (vs Temperature)



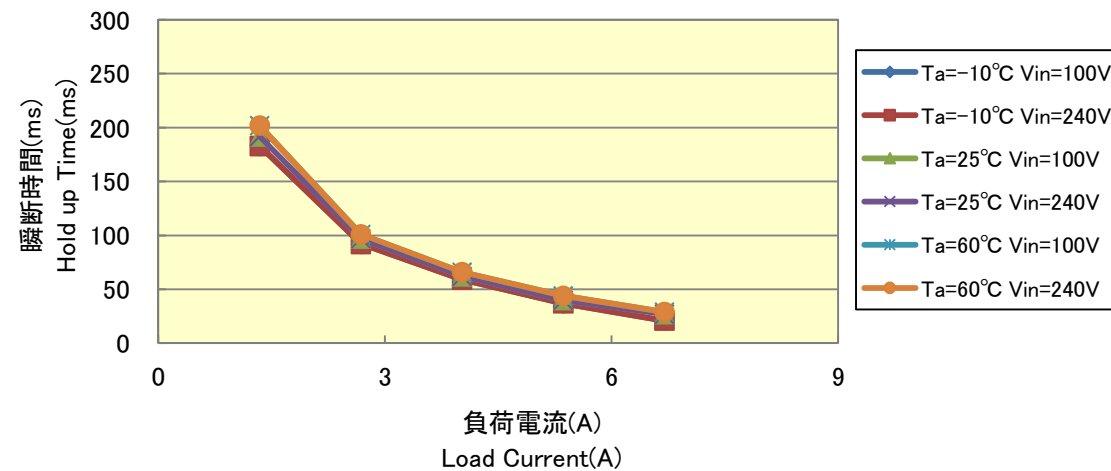
| | |
|----------------|---------------|
| 型名:Model | SWL240-36 |
| 入力:Input | AC265V |
| 出力:Output | Io=0A |
| 温度:Temperature | Ta=-10°C~60°C |
| 備考:Remarks | |

図11 起動時間特性(入力電圧に対して)
Fig.11 Start-Up Time Characteristics (vs Input Voltage)



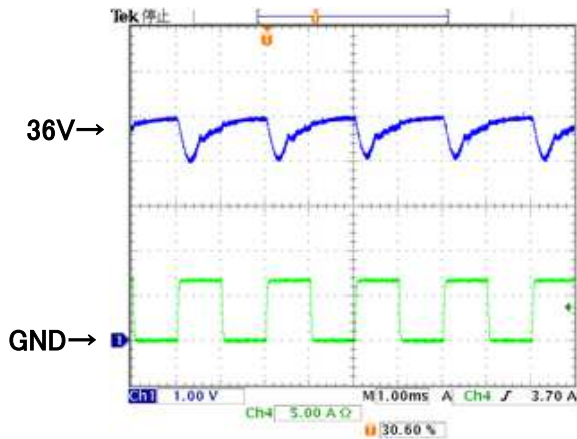
| | |
|----------------|---------------|
| 型名:Model | SWL240-36 |
| 入力:Input | AC85V~265V |
| 出力:Output | Io=6.7A |
| 温度:Temperature | Ta=-10°C~60°C |
| 備考:Remarks | |

図12 入力瞬断時間(負荷電流に対して)
Fig.12 Hold up time Characteristics (vs Load Current)



| | |
|----------------|---------------|
| 型名:Model | SWL240-36 |
| 入力:Input | AC100V~240V |
| 出力:Output | 36V 20%~100% |
| 温度:Temperature | Ta=-10°C~60°C |
| 備考:Remarks | |

図13 タイミング時の負荷波形
Fig.13 Dynamic Load Waveform

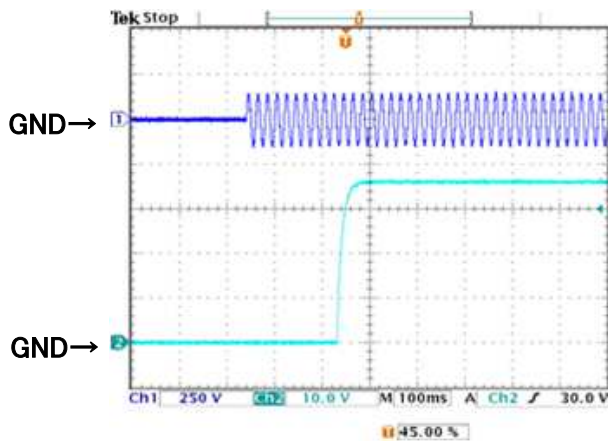


出力電圧
Output Voltage

出力電流
Output Current

| | |
|----------------|--|
| 型名:Model | SWL240-36 |
| 入力:Input | AC100V |
| 出力:Output | $I_o=0A \leftrightarrow 6.7A$ |
| 温度:Temperature | $T_a=25^\circ C$ |
| 備考:Remarks | 出力電圧 OutputVoltage Vertical: 1V/div 出力電流 OutputCurrent Vertical: 5A/div 時間 TimeHorizontal: 1ms/div |

図14 出力電圧立上り波形
Fig.14 Output Voltage Rising Waveform

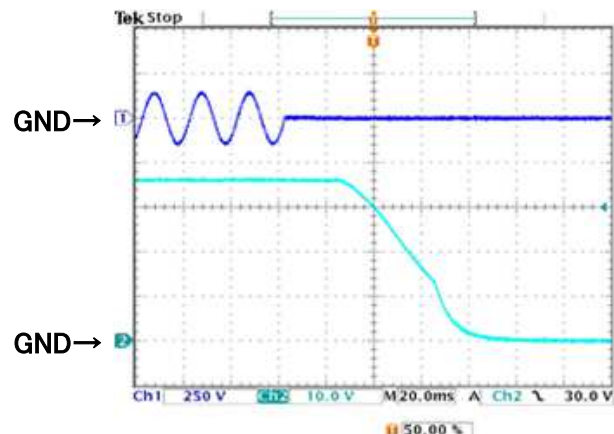


入力電圧
Input Voltage

出力電圧
Output Voltage

| | |
|----------------|--|
| 型名:Model | SWL240-36 |
| 入力:Input | $V_{in}=100V$ |
| 出力:Output | $I_o=6.7A$ |
| 温度:Temperature | $T_a=25^\circ C$ |
| 備考:Remarks | 入力電圧 InputVoltageVertical: 250V/div 出力電圧 OutputVoltageVertical: 10V/div 時間 TimeHorizontal: 100ms/div |

図15 出力電圧立下り波形
Fig.15 Output Voltage Falling Waveform

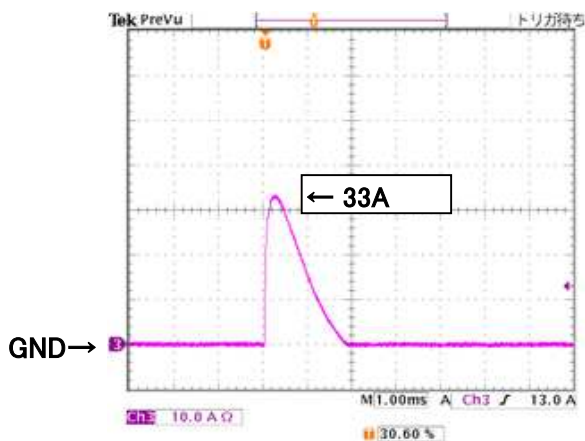


入力電圧
Input Voltage

出力電圧
Output Voltage

| | |
|----------------|---|
| 型名:Model | SWL240-36 |
| 入力:Input | $V_{in}=100V$ |
| 出力:Output | $I_o=6.7A$ |
| 温度:Temperature | $T_a=25^\circ C$ |
| 備考:Remarks | 入力電圧 InputVoltageVertical: 250V/div 出力電圧 OutputVoltageVertical: 10V/div 時間 TimeHorizontal: 20ms/div |

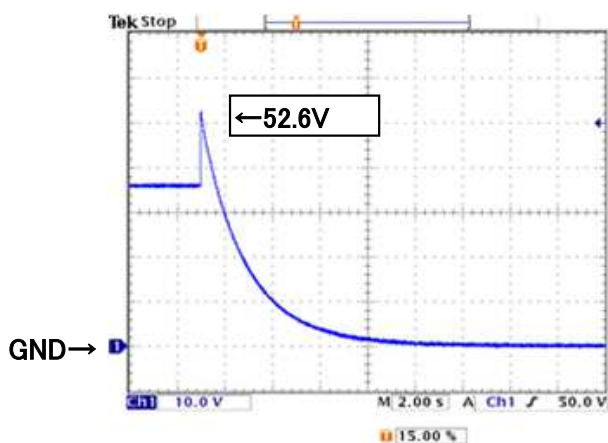
図16 突入電流波形
Fig.16 Inrush Current Waveform



突入電流
Inrush Current

| | |
|----------------|---|
| 型名:Model | SWL240-36 |
| 入力:Input | Vin=200V |
| 出力:Output | Io=6.7A |
| 温度:Temperature | Ta=25°C |
| 備考:Remarks | 入力電流 InrushCurrentVertical: 10A/div 時間 TimeHorizontal: 0.4ms/div ノイズフィルタへの 突入電流は除く Excluding inrush current to noise |

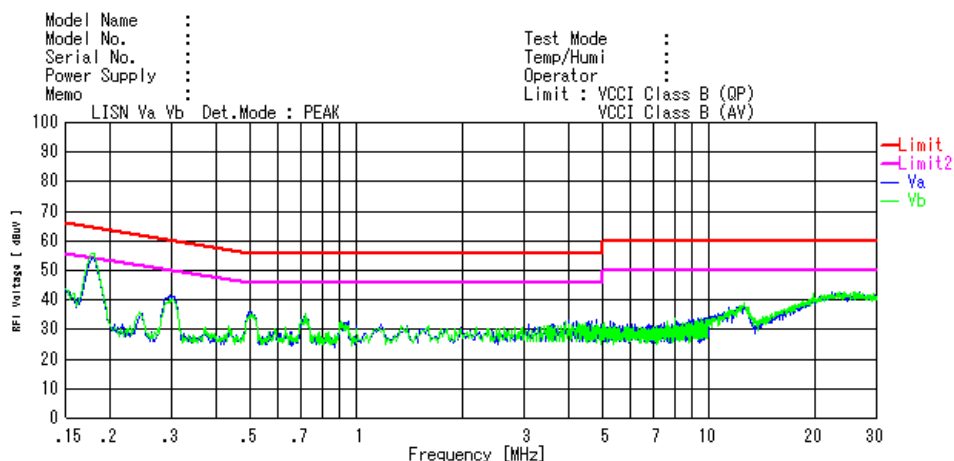
図17 過電圧波形
Fig.17 Over Voltage Waveform



出力電圧
Output Voltage

| | |
|----------------|--|
| 型名:Model | SWL240-36 |
| 入力:Input | Vin=100V |
| 出力:Output | Io=0A |
| 温度:Temperature | Ta=25°C |
| 備考:Remarks | 出力電圧 OutputVoltageVertical: 10V/div 時間 TimeHorizontal: 2s/div |

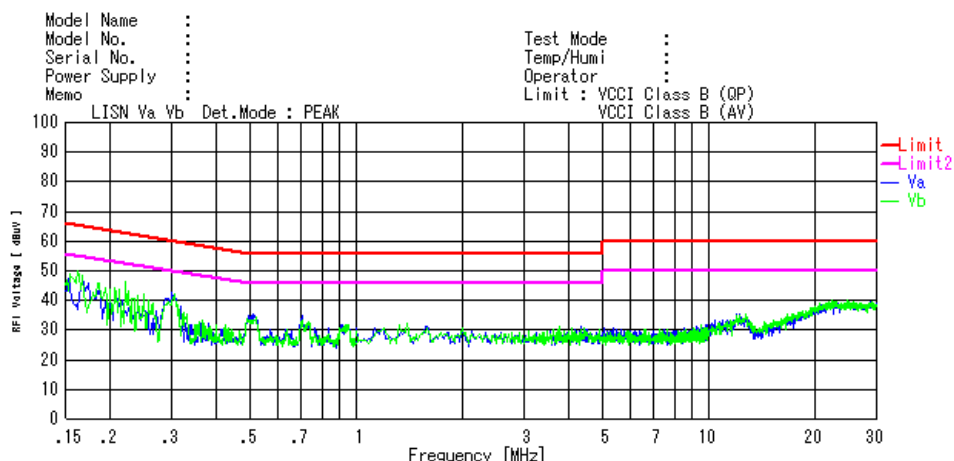
図18 雑音端子電圧波形 参考データ
Fig.18 Conduction Noise Waveform Reference data



| LinePhase | Frequency [MHz] | Results | | Limit | | Margin | |
|-----------|-----------------|----------|-----------|----------|-----------|----------|-----------|
| | | QP[dBuV] | AVE[dBuV] | QP[dBuV] | AVE[dBuV] | QP[dBuV] | AVE[dBuV] |
| A | 0.194 | 48.7 | 45.6 | 63.9 | 53.9 | 15.2 | 8.3 |
| B | 0.194 | 49.1 | 45.4 | 63.9 | 53.9 | 14.8 | 8.5 |

| | |
|----------------|-----------|
| 型名:Model | SWL240-36 |
| 入力:Input | Vin=100V |
| 出力:Output | Io=6.7A |
| 温度:Temperature | Ta=25°C |
| 備考:Remarks | |

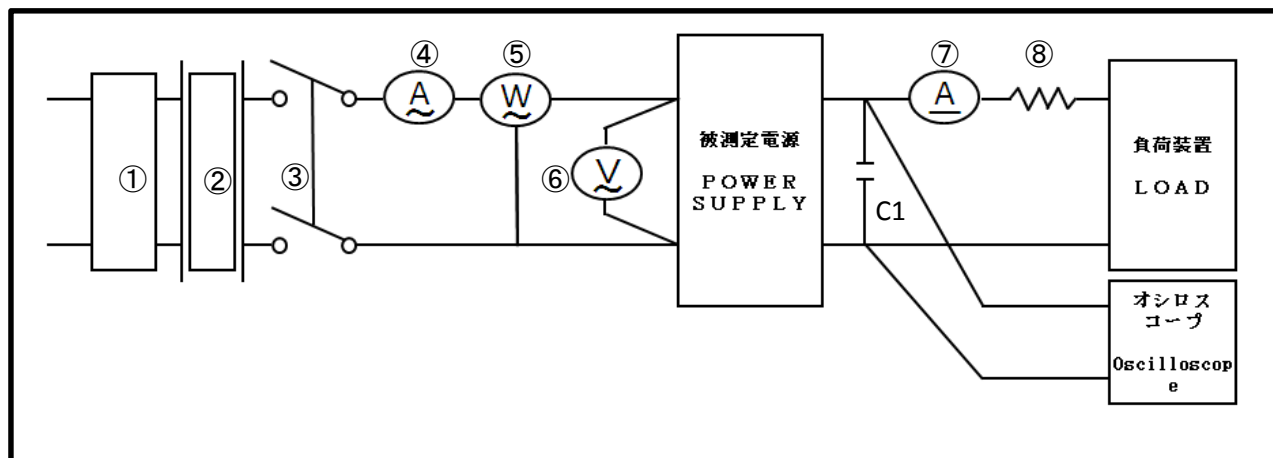
図19 雑音端子電圧波形 参考データ
Fig.19 Conduction Noise Waveform Reference data



| LinePhase | Frequency [MHz] | Results | | Limit | | Margin | |
|-----------|-----------------|----------|-----------|----------|-----------|----------|-----------|
| | | QP[dBuV] | AVE[dBuV] | QP[dBuV] | AVE[dBuV] | QP[dBuV] | AVE[dBuV] |
| A | 0.15 | 50.8 | 24.6 | 66.0 | 56.0 | 15.2 | 31.4 |
| B | 0.15 | 50.6 | 23.5 | 66.0 | 56.0 | 15.4 | 32.5 |

| | |
|----------------|-----------|
| 型名:Model | SWL240-36 |
| 入力:Input | Vin=230V |
| 出力:Output | Io=6.7A |
| 温度:Temperature | Ta=25°C |
| 備考:Remarks | |

試験回路図 Test Circuit



使用計測機器

- ①スライダック
- ②絶縁トランス
- ③ブレーカー
- ④電流計
- ⑤電力計
- ⑥電圧計
- ⑦電流計
- ⑧シャント抵抗

Measuring instruments

- Variable autotransformer
- Isolation transformer
- A circuit breaker
- Ammeter
- Wattmeter
- Voltmeter
- Ammeter
- Shunt resistor

2次側出力電圧はDMMで測定

Output voltage is measured with DMM

負荷コンデンサ Load capacitor

C1: Electrolytic Capacitor 100 μ F
Film Capacitor 0.1 μ F