EZA2500-32048

EVALUATION DATA

型式データ

DWG NO.V008-53-01A

TDK-Lambda

目次 INDEX

使用記号 Terminology used

定義 Definition

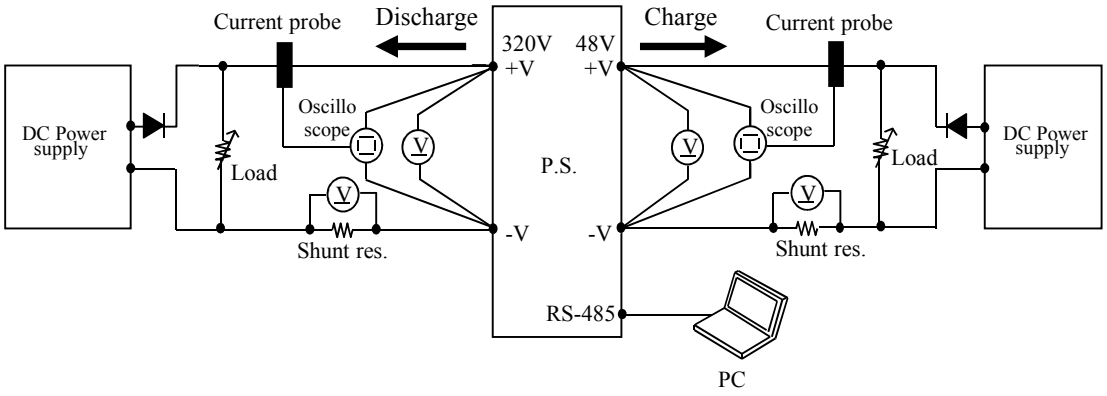
Vin ·····	入力電圧 Input voltage	Io ·····	出力電流 Output current
Vo ·····	出力電圧 Output voltage	Po ·····	出力電力 Output power
Iin ·····	入力電流 Input current	Ta ·····	周囲温度 Ambient temperature

※ 特記無き特性は、他律CV制御のデータです。
試験結果は、代表データでありますが、全ての製品はほぼ同等な特性を示します。
従いまして、以下の結果は参考値とお考え願います。
Otherwise stated characteristics are data of heteronomy charge CV control.
Test results are typical data. Nevertheless the following results are considered to be reference data because all units have nearly the same characteristics.

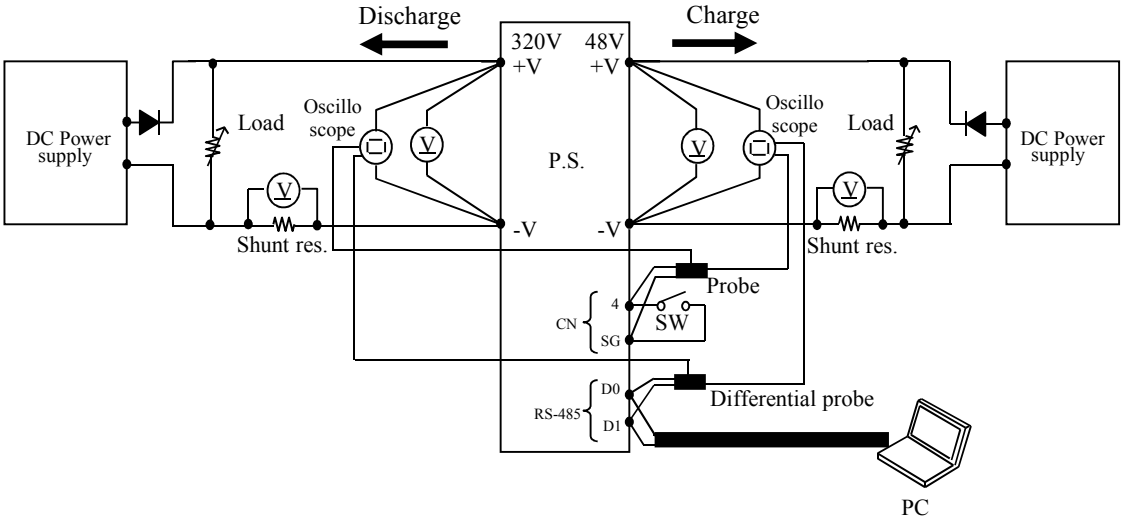
1. 測定方法 Evaluation method

1.1 測定回路 Measurement Circuits

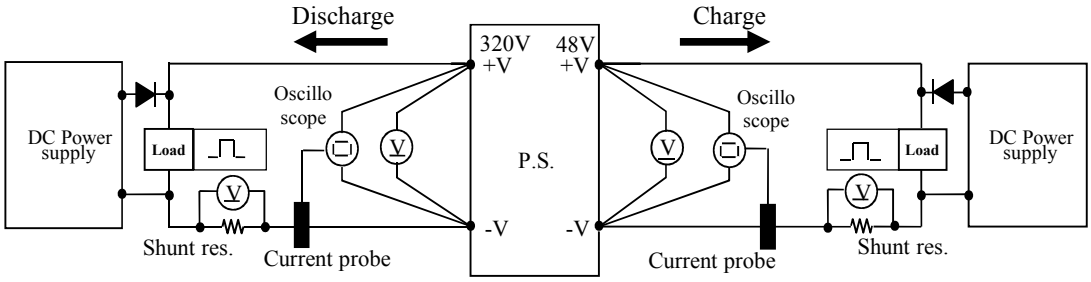
(1) ・静特性・定電流特性
Steady state characteristics and Constant current characteristics
・過電圧保護特性
Over voltage protection (OVP) characteristics
・力行・回生切換え特性
Generation and Regeneration switching characteristics
・定電流指令応答特性
Constant current command responce characteristics
・バッテリ保護特性
Battery protection characteristics



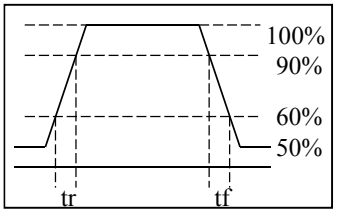
(2) ・出力立ち上がり・立ち下り特性
Output rise & fall characteristics
・出力電圧指令応答特性(外部出力端子 / RS-485)
Output voltage command responce characteristics (External terminal / RS-485)



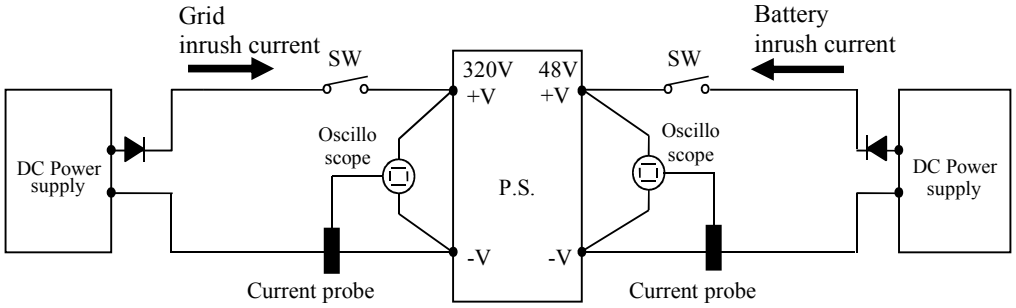
(3) 負荷急変特性
Dynamic load response characteristics



Output current waveform

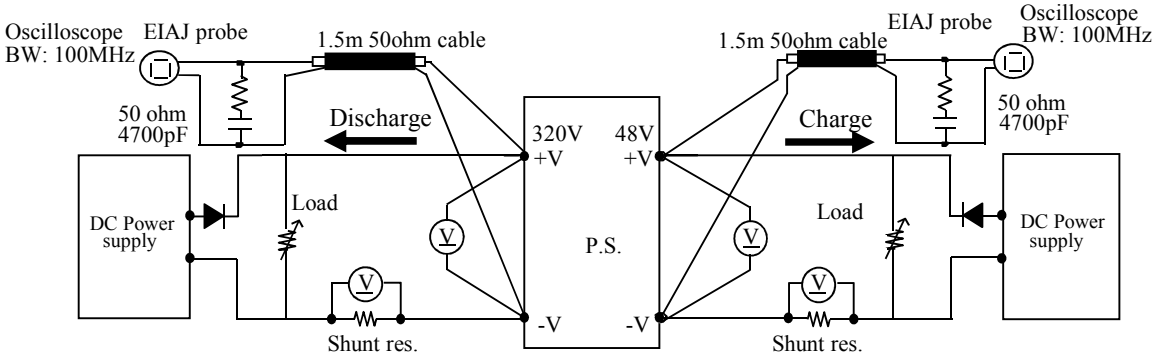


(4) 突入電流特性
Inrush current characteristics



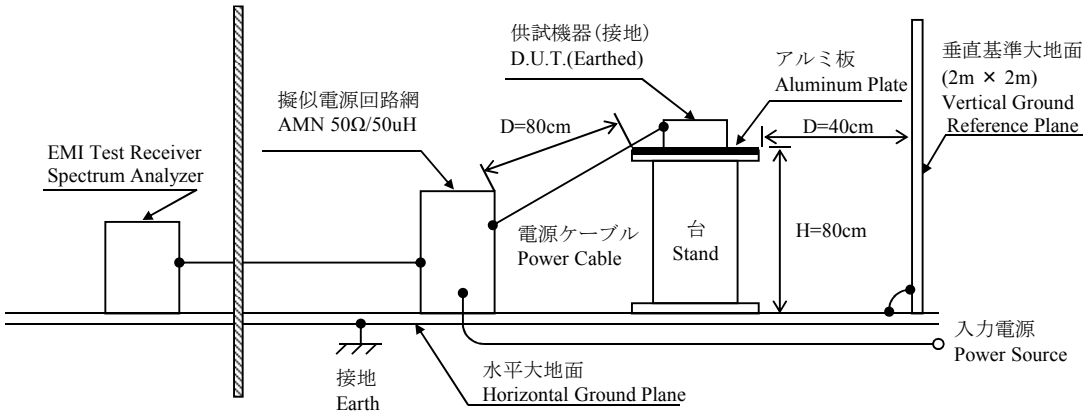
(5) 出力電圧リップル・ノイズ波形
Output voltage ripple and noise waveform

Normal mode (JEITA Standard RC-9131A)

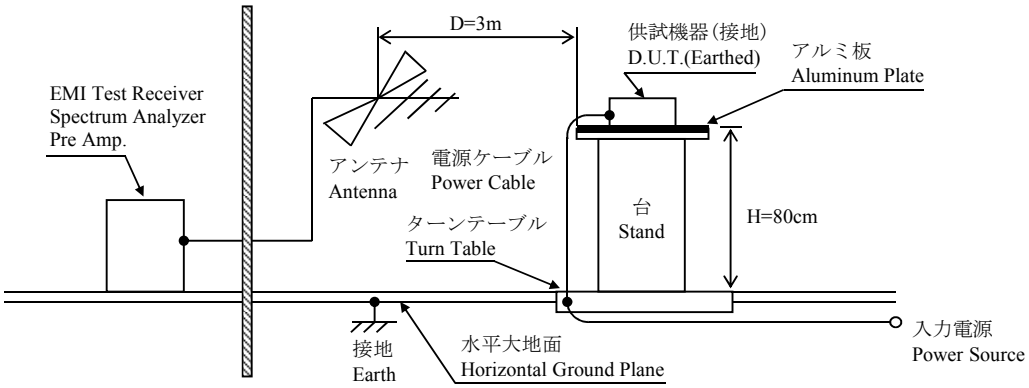


(6) EMI特性 Electro-Magnetic Interference characteristics

(a) 雑音端子電圧 (帰還ノイズ) Conducted Emission Noise



(b) 雑音電界強度(放射ノイズ) Radiated Emission Noise



1.2 使用測定機器　List of equipment used

	EQUIPMENT USED	MANUFACTURER	MODEL NO.
1	DIGITAL PHOSPHOR OSCILLOSCOPE	TEKTRONIX	TDS3012
2	DIGITAL STORAGE OSCILLOSCOPE	YOKOGAWA ELECT.	DL9040L
3	DIGITAL MULTIMETER	AGILENT	34401A
4	DATA ACQUISITION / SWITCH UNIT	AGILENT	34970A
5	CURRENT PROBE	YOKOGAWA ELECT.	701930
6	CURRENT PROBE	YOKOGAWA ELECT.	701928
7	SHUNT RESISTER	YOKOGAWA ELECT.	2215
8	CONTROLLED TEMP. CHAMBER	ESPEC CORP.	PL-4KP
9	SPECTRUM ANALYZER	ROHDE & SCHWARZ	FSA
10	EMI TEST RECEIVER	ROHDE & SCHWARZ	ESHS10
11	EMI TEST RECEIVER	ROHDE & SCHWARZ	ESVS10
12	RF RELAY MATRIX	ROHDE & SCHWARZ	PSU
13	AMN	KYORITU DENSHI	KNW-242
14	ANTENNA(BICONICAL ANTENNA)	SCHWARZBECK	BBA9106
15	DYNAMIC DUMMY LOAD	TAKASAGO	FK-1000H
16	DYNAMIC DUMMY LOAD	KIKUSUI	PLZ1004W
17	DC POWER SUPPLY	TDK-LAMBDA	GEN60-85
18	DC POWER SUPPLY	TDK-LAMBDA	GEN600-8.5

2. 特性データ Characteristics

2.1 静特性 Steady state data

(1) 入力・負荷・温度変動 Regulation - line and load, Temperature drift

(a)力行 Generation mode

Vo=48V

1. Regulation - line and load Condition Ta:25℃

Iout \ Vin	300VDC	320VDC	380VDC	line regulation	
0%	48.004V	48.007V	48.030V	26mV	0.054%
50%	47.886V	47.890V	47.850V	40mV	0.083%
100%	47.787V	47.705V	47.766V	82mV	0.171%
load	217mV	301mV	265mV		
regulation	0.451%	0.627%	0.551%		

2. Temperature drift Conditions Vin=320VDC
Iout=52A

Ta	-10℃	+25℃	+40℃	temperature stability	
Vout	47.689V	47.705V	47.766V	78mV	0.161%

(b)回生 Regeneration mode

Vo=320V ※1

1. Regulation - line and load Condition Ta:25℃

Iout \ Vin	36VDC	48VDC	line regulation	
0%	320.545V	320.570V	25mV	0.053%
50%	320.134V	320.195V	61mV	0.127%
100%	319.936V	319.735V	200mV	0.417%
load	609mV	835mV		
regulation	0.190%	0.261%		

2. Temperature drift Conditions Vin=48VDC
Iout=7.8A

Ta	-10℃	+25℃	+40℃	temperature stability	
Vout	318.291V	319.735V	319.164V	1444mV	0.451%

2.1 静特性 Steady state data

(1) 入力・負荷・温度変動 Regulation - line and load, Temperature drift

(b)回生 Regeneration mode

Vo=380V ※1

1. Regulation - line and load　　Condition Ta:25℃

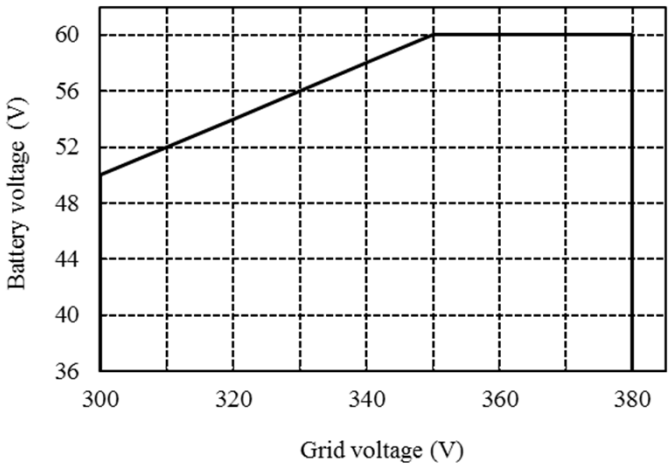
Iout \ Vin	36VDC	48VDC	60VDC	line regulation	
0%	380.682V	380.464V	380.255V	427mV	0.112%
50%	380.372V	380.155V	380.247V	217mV	0.057%
100%	380.182V	379.698V	379.857V	484mV	0.127%
load	501mV	766mV	398mV		
regulation	0.157%	0.239%	0.114%		

2. Temperature drift　　Conditions Vin=48VDC
Iout=6.5A

Ta	-10℃	+25℃	+40℃	temperature stability	
Vout	379.111V	379.698V	379.740V	630mV	0.197%

※1 表1 より、回生動作では入力電圧に応じて最大出力電圧が制限されます。
そのため、Vo=320V,380Vそれぞれの出力において入力・負荷・温度変動を表記しています。
From Table 1, the maximum output voltage changes according to input voltage in regeneration operation.
Therefore, these characteristics shows input/load regulation and temperature drift characteristic
at each of Vo = 320V, 380V.

Table1 Grid voltage To Battery voltage

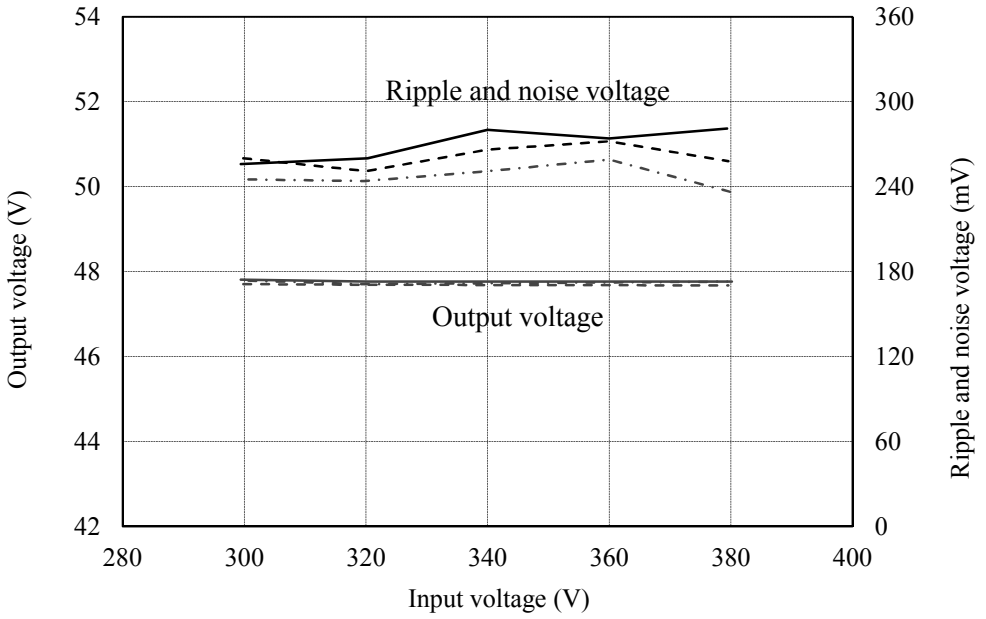


(2) 出力電圧・出力リップル、ノイズ電圧 対 入力電圧
Output voltage and ripple and noise voltage vs. Input voltage

(a)力行 Generation mode

Vo=48V

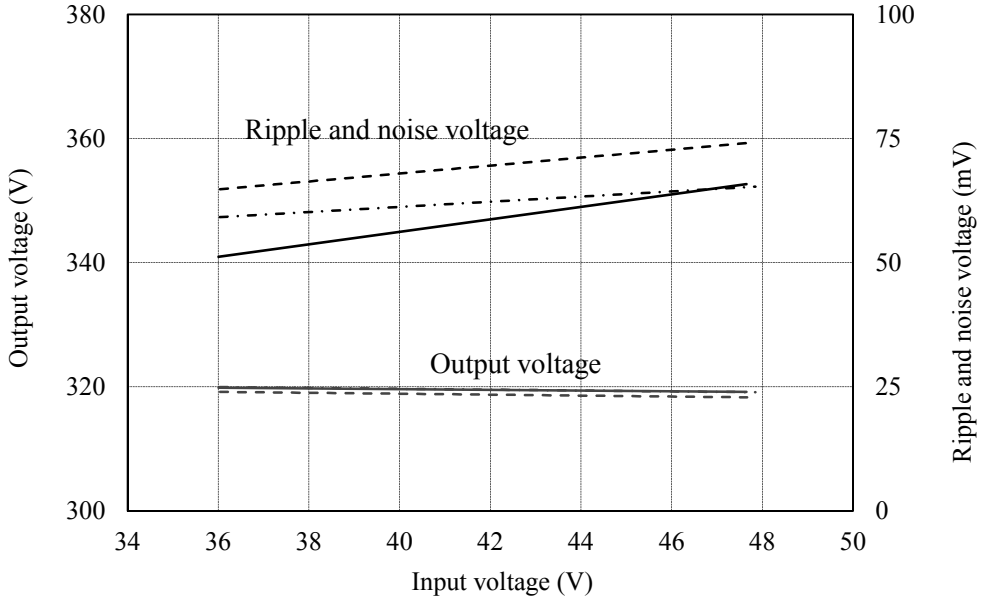
Conditions
Po : 2500 W
Ta : -10 ℃
: 25 ℃
: 40 ℃



(b)回生 Regeneration mode

Vo=320V ※1

Conditions
Po : 2500 W
Ta : -10 ℃
: 25 ℃
: 40 ℃

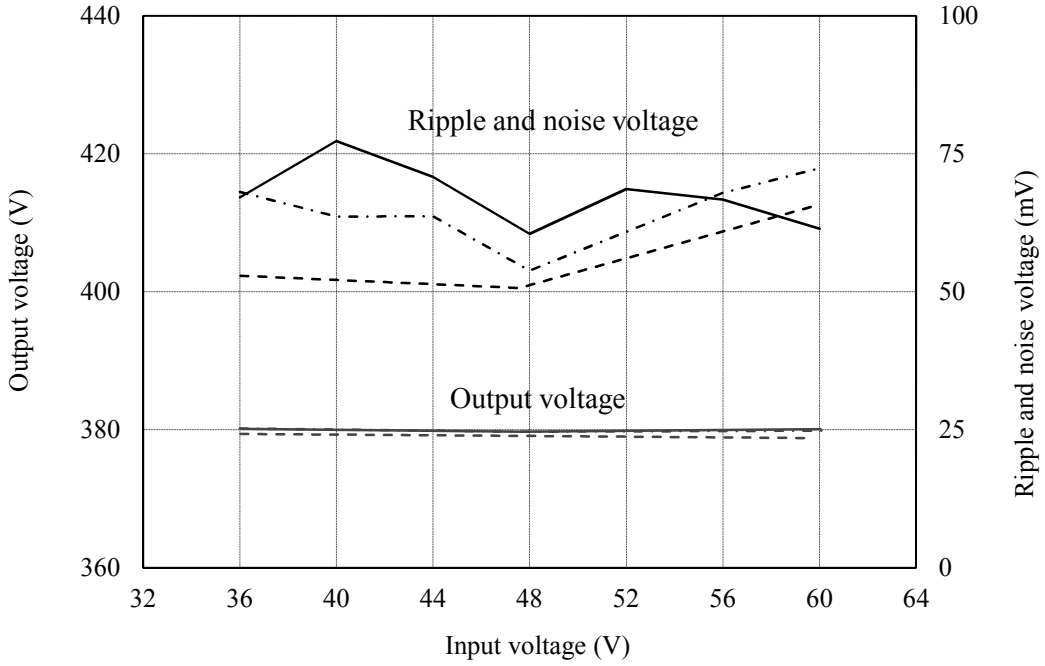


(2) 出力電圧・出力リップル、ノイズ電圧 対 入力電圧
Output voltage and ripple and noise voltage vs. Input voltage

(b)回生 Regeneration mode

Vo=380V ※1

Conditions
Po : 2500 W
Ta : -10 ℃
: 25 ℃
: 40 ℃



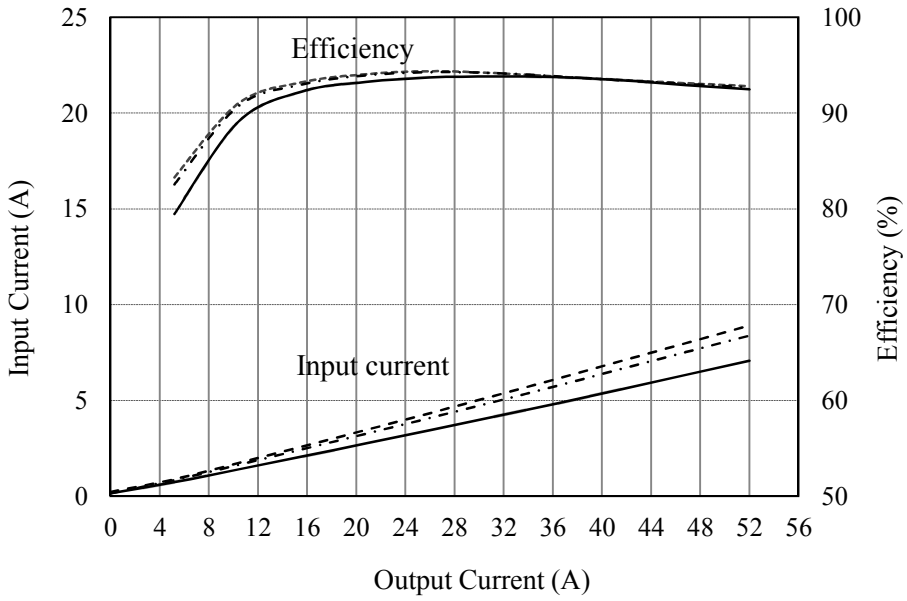
※1 回生動作では入力電圧に応じて最大出力電圧が制限されます。そのため、Vo=320V,380V
それぞれの出力において出力電圧・出力リップル、ノイズ電圧 対 入力電圧を表記しています。
From Table 1, the maximum output voltage changes according to input voltage in regeneration operation. Therefore, these characteristics shows output and ripple and noise voltage to input voltage characteristic at each of Vo = 320V, 380V.

(3) 入力電流 対 出力電流、効率 対 出力電流
Input current vs. Output current
Efficiency vs. Output current

(a)力行 Generation mode

Vo=48V

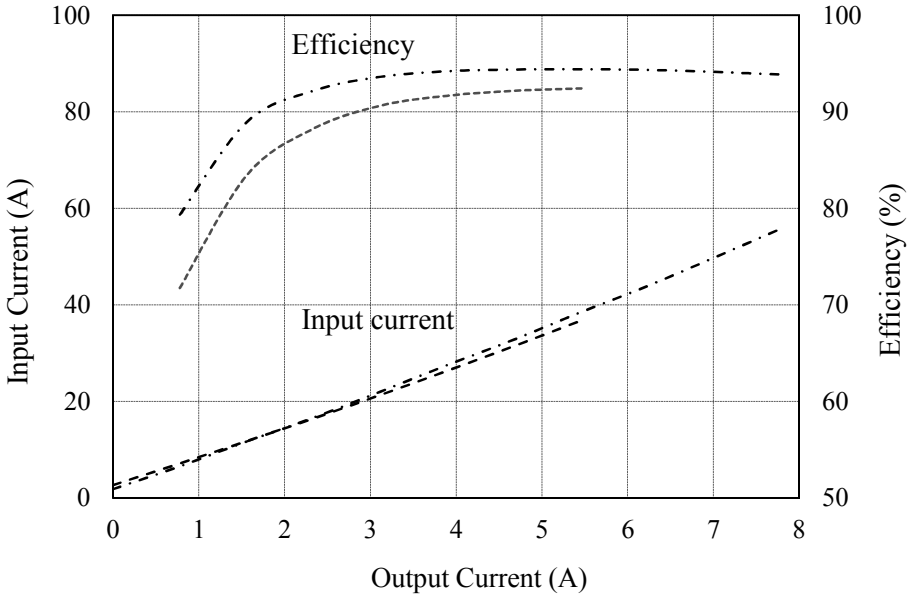
Conditions
Vin : 300 VDC – – – -
: 320 VDC – · – · –
: 380 VDC ——
Ta : 25 ℃



(b)回生 Regeneration mode

Vo=320V ※1

Conditions
Vin : 36 VDC – – – -
: 48 VDC – · – · –
Ta : 25 ℃

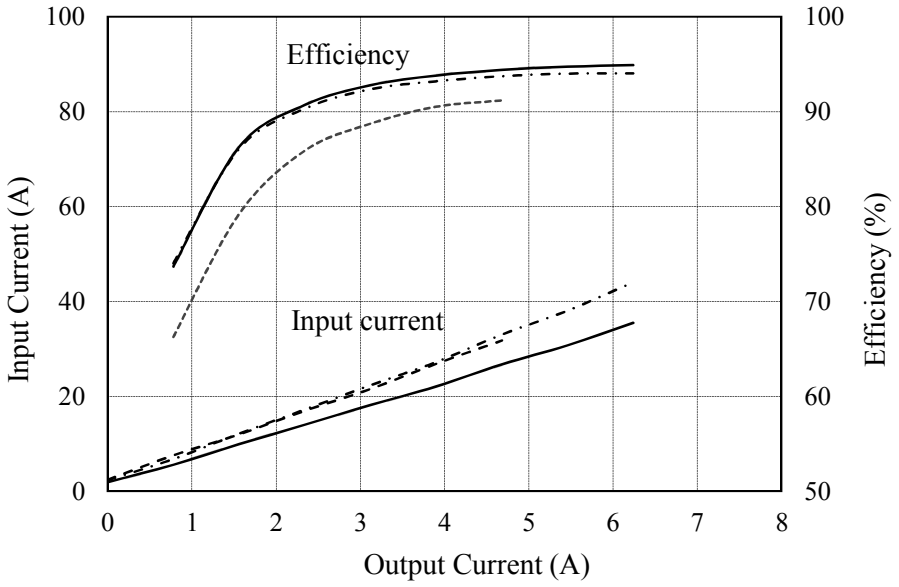


(3) 入力電流 対 出力電流、効率 対 出力電流
Input current vs. Output current
Efficiency vs. Output current

(b)回生 Regeneration mode

Vo=380V ※1

Conditions
Vin : 36 VDC– – –·
: 48 VDC–·–·–
: 60 VDC——
Ta : 25 ℃



※1 回生動作では入力電圧に応じて最大出力電圧が制限されます。
そのため、Vo=320V,380Vそれぞれの出力において入力電流 対 出力電流、効率 対 出力電流を表記しています。
From Table 1, the maximum output voltage changes according to input voltage in regeneration operation.
Therefore, these characteristics shows input current to output current and efficiency to output current characteristic at each of Vo = 320V, 380V.

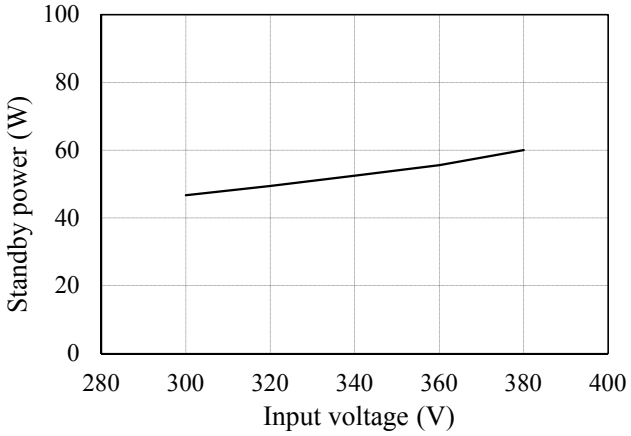
2.2 待機電力特性
Standby power characteristics

(a)力行 Generation mode

Condition Ta : 25 ℃
Vo : 48 V

Vo=48V, Io=0A

Vin [V]	Iin [A]	Pin [W]
300	0.16	46.83
320	0.15	49.47
340	0.15	52.50
360	0.15	55.63
380	0.16	61.10



(b)回生 Regeneration mode

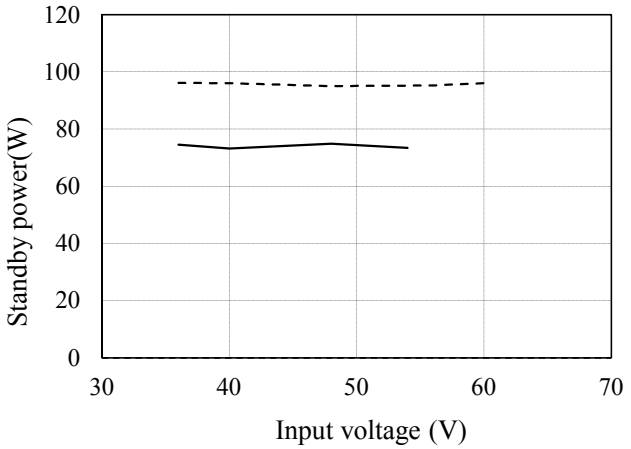
Condition Ta : 25 ℃
Vo : 320 V
: 380 V

Vo=320V, Io=0A

Vin [V]	Iin [A]	Pin [W]
36	2.07	74.56
40	1.83	73.24
48	1.56	74.88
54	1.36	73.39

Vo=380V, Io=0A

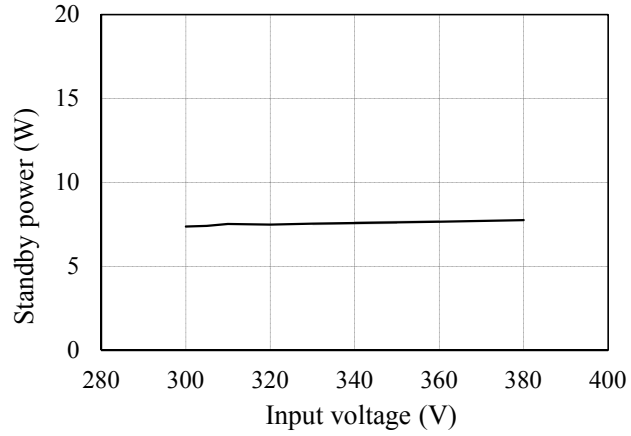
Vin [V]	Iin [A]	Pin [W]
36	2.67	96.17
40	2.40	96.05
48	1.98	95.04
56	1.70	95.22
60	1.60	96.00



(C)待機時 wating

Condition Ta : 25 ℃
Vo : 48 V

Vin [V]	Iin [A]	Pin [W]
300	0.02	7.38
320	0.02	7.49
340	0.02	7.58
360	0.02	7.67
380	0.02	7.75



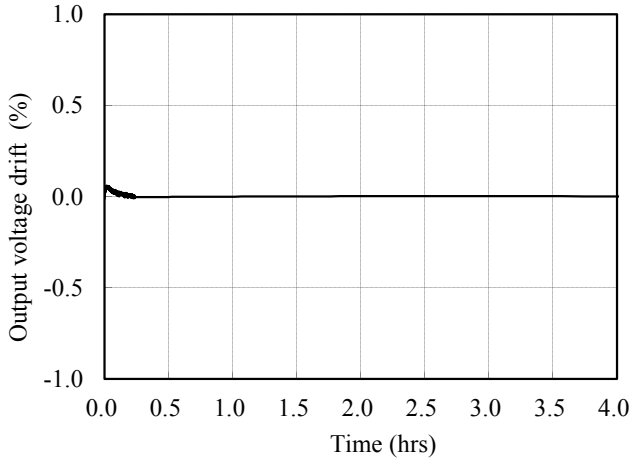
2.3 通電ドリフト特性

Warm up voltage drift characteristics

(a)力行 Generation mode

Conditions Vin : 320VDC
Io : 52A
Ta : 25℃

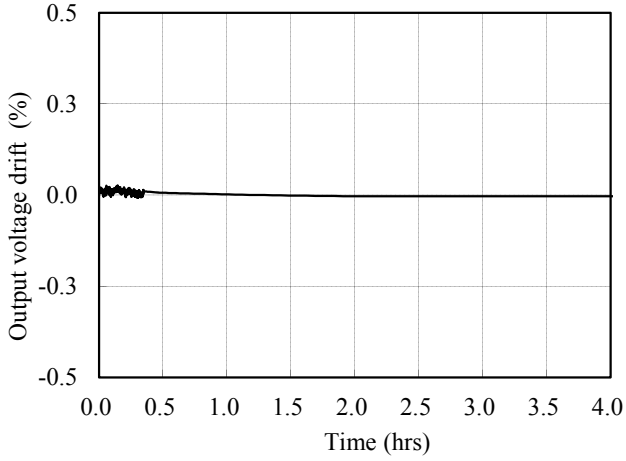
Vo=48V



(b)回生 Regeneration mode

Conditions Vin : 48VDC
Io : 7.8A
Ta : 25℃

Vo=320V

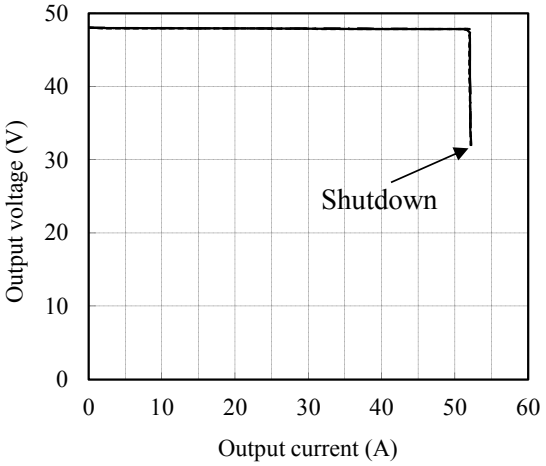


2.4 定電流特性
Constant current characteristics

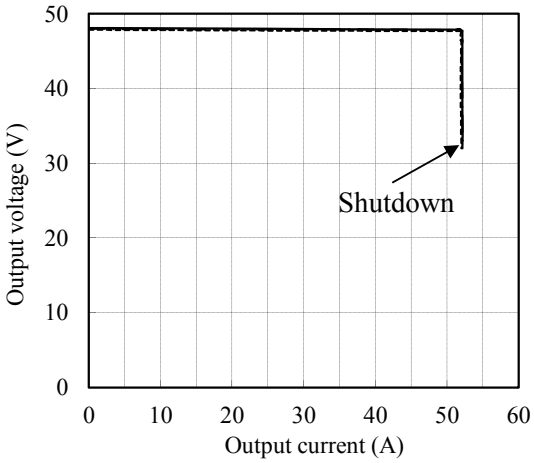
(a)力行 Generation mode

Vo=48V

Conditions Vin : 300 VDC
320 VDC
380 VDC
Ta : 25 ℃
Constant Current Value : 52 A
Low Voltage Protection Value : 32 V



Conditions Vin : 320 VDC
Ta : -10 ℃
25 ℃
40 ℃
Constant Current Value : 52 A
Low Voltage Protection Value : 32 V

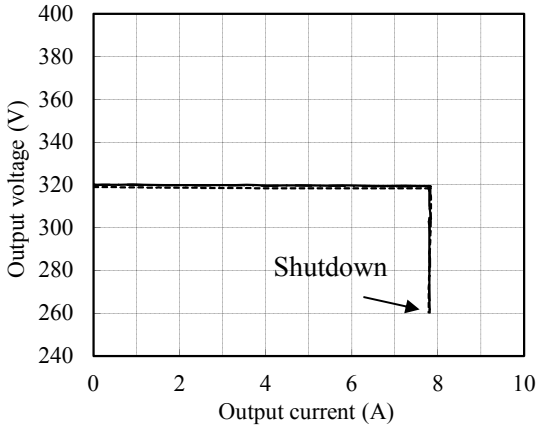


2.4 定電流特性
Constant current characteristics

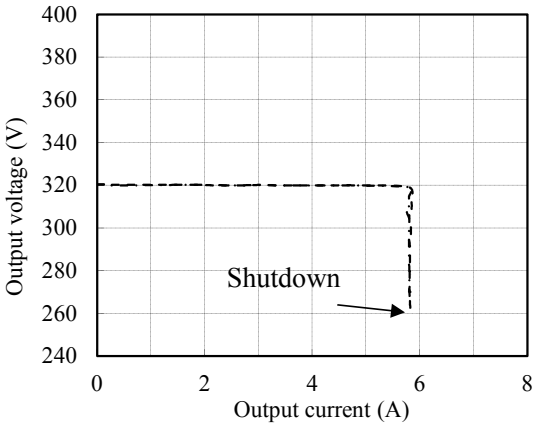
(b)回生 Regeneration mode

Vo=320V

Conditions Vin : 48 VDC
Ta : -10 ℃ -------
25 ℃ –·–·–·–
40 ℃ ———
Constant Current Value : 7.8 A
Low Voltage Protection Value : 260 V



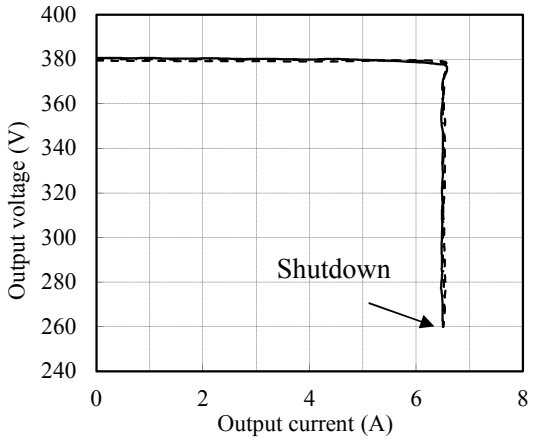
Conditions Vin : 36 VDC --------
48 VDC –·–·–·–
Ta : 25 ℃
Constant Current Value : 5.8 A※1
Low Voltage Protection Value : 260 V



※1 Vin=36V,Vo=320Vの時,最大出力電流はIo=5.8A.
When operating parameters are Vin=V36,Vo=320V,
maximum Io=5.8A.

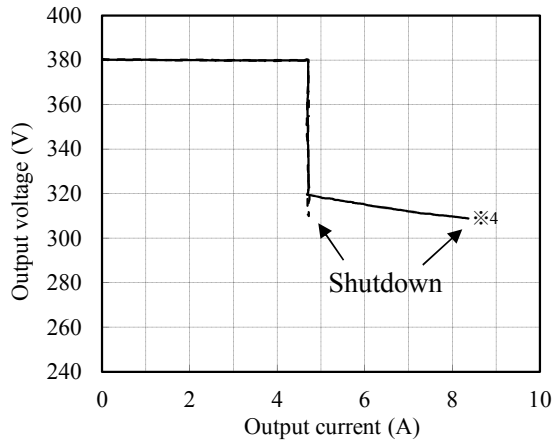
Vo=380V

Conditions Vin : 48 VDC
Ta : -10 ℃ -------
25 ℃ –·–·–·–
40 ℃ ———
Constant Current Value : 6.5 A※2
Low Voltage Protection Value : 260 V



※2 Vin=48V,Vo=380Vの時,最大出力電流はIo=6.5A.
When operating parameters are Vin=48,Vo=380,
maximum Io=6.5A.

Conditions Vin : 36 VDC ---------
48 VDC –·–·–·–
60 VDC ———
Ta : 25 ℃
Constant Current Value : 4.7 A※3
Low Voltage Protection Value : 310 V

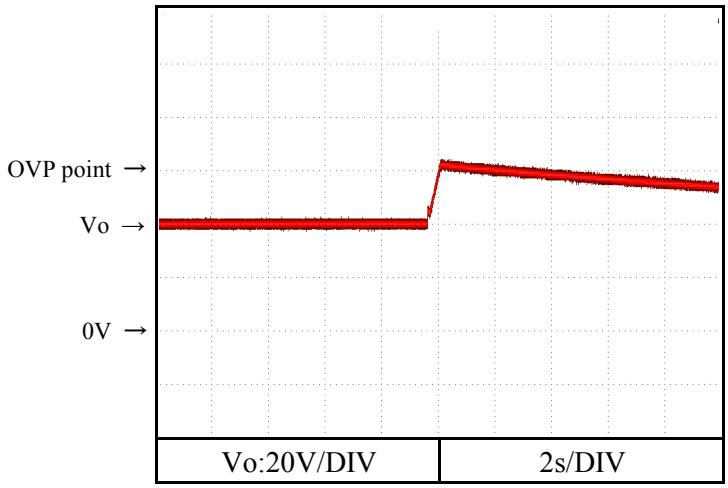


※3 Vin=36V,Vo=380Vの時,最大出力電流はIo=4.7A.
When operating parameters are Vin=36,Vo=380,
maximum Io=4.7A.
※4 Vin=60V,Vo=380Vの時,ディレーティング範囲外
であるため,出力電流が制御不可となる.
When operating parameters are Vin=60V,Vo=380V,
they are nonstandard of derating.
therefore output current is uncontrollable.

2.5 過電圧保護特性
Over voltage protection (OVP) characteristics

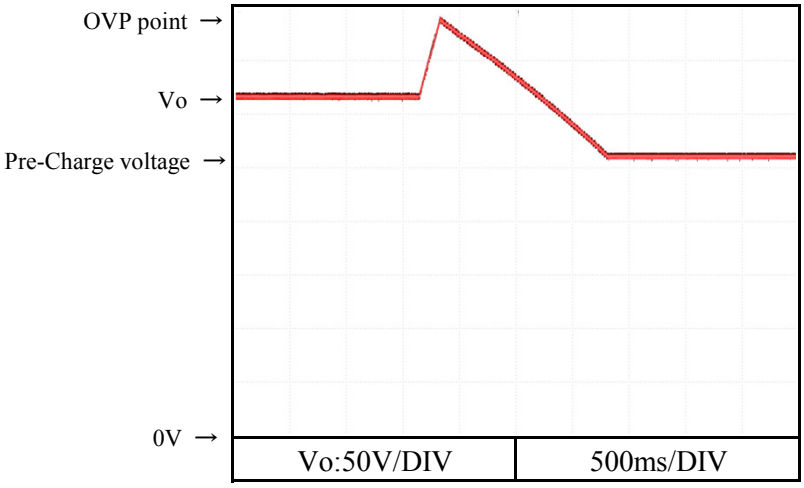
(a)力行 Generation mode

Conditions Ta : 25℃
Vin : 320VDC
Io : 0A
Over Voltage Protection Value : 62V



(b)回生 Regeneration mode (Pre-charge voltage is 260V)

Conditions Ta : 25℃
Vin : 48VDC
Io : 0A
Over Voltage Protection Value : 390V



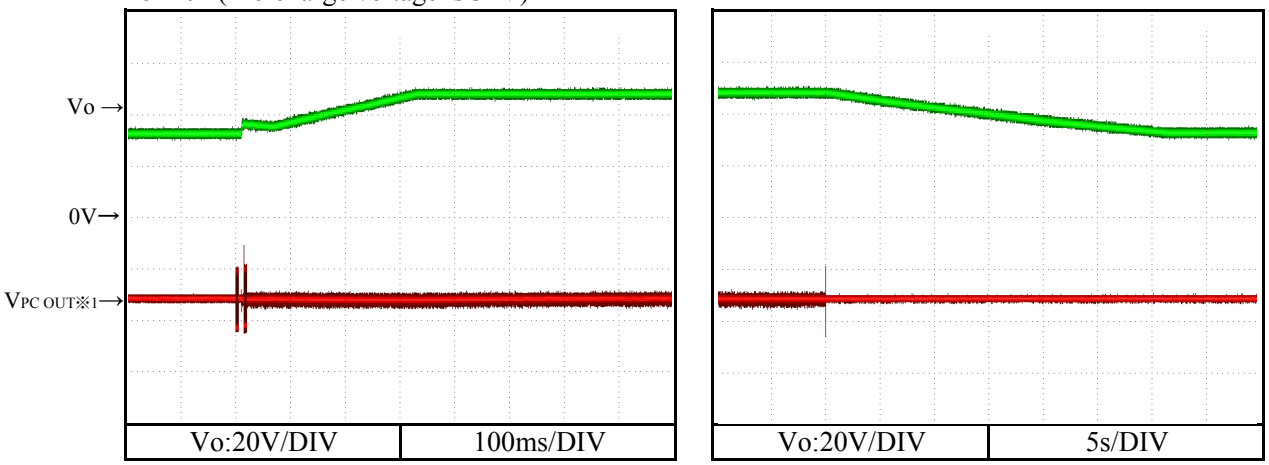
2.6 出力立ち上がり、立ち下り特性（RS-485通信によるON/OFF）
Output rise & fall characteristics (ON/OFF Control by RS-485)

(a) 力行 Generation mode

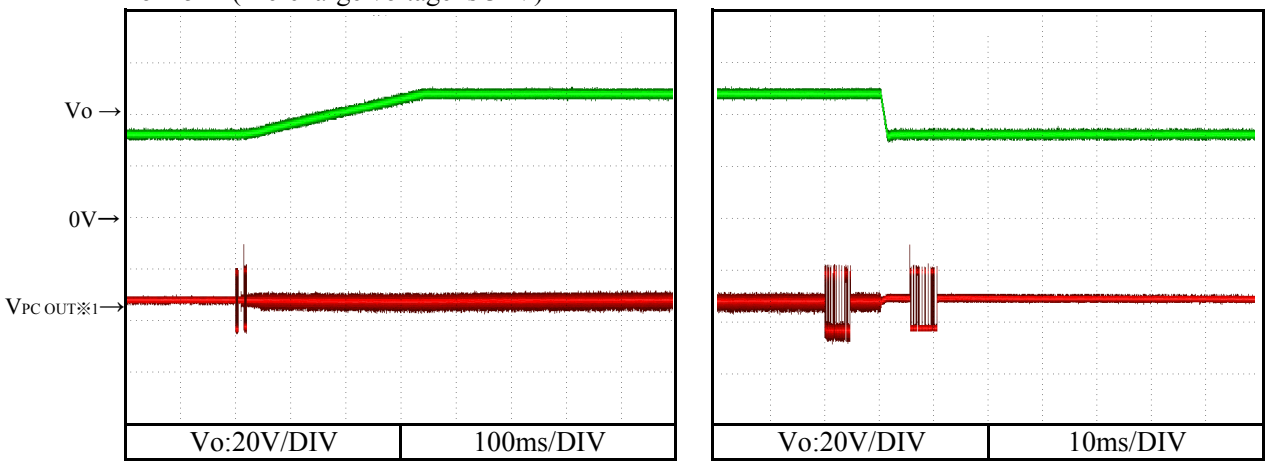
Vo = 48V

Conditions Vin : 320VDC
Ta : 25℃

Io = 0A(Pre-charge voltage is 32V)



Io = 52A(Pre-charge voltage is 32V)



※1 半2重通信方式のため、送信信号に対し応答信号が現れます。
By half-duplex communication system, response signal and transmittes signal are output.

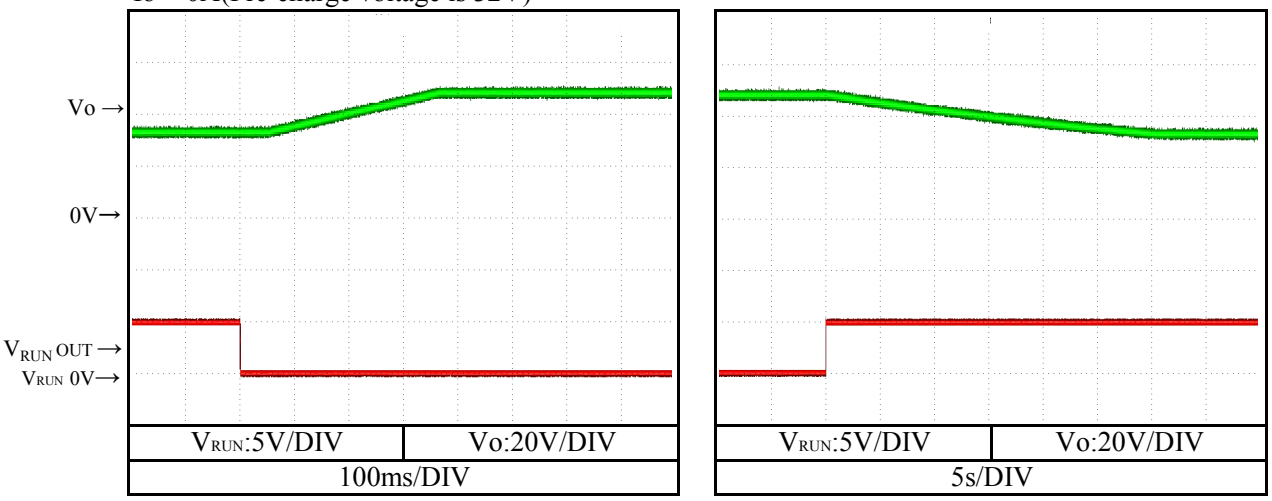
2.6 出力立ち上がり、立ち下り特性 (外部RUN信号によるON/OFF)
Output rise & fall characteristics (ON/OFF Control by External terminal)

(a) 力行 Generation mode

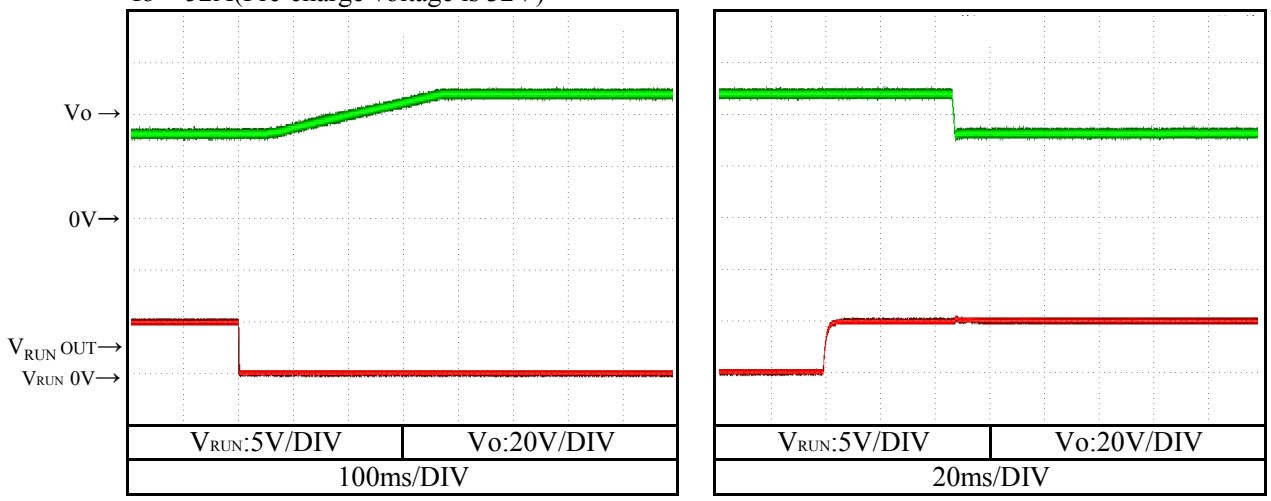
Vo = 48V

Conditions Vin : 320VDC
Ta : 25℃

Io = 0A(Pre-charge voltage is 32V)



Io = 52A(Pre-charge voltage is 32V)



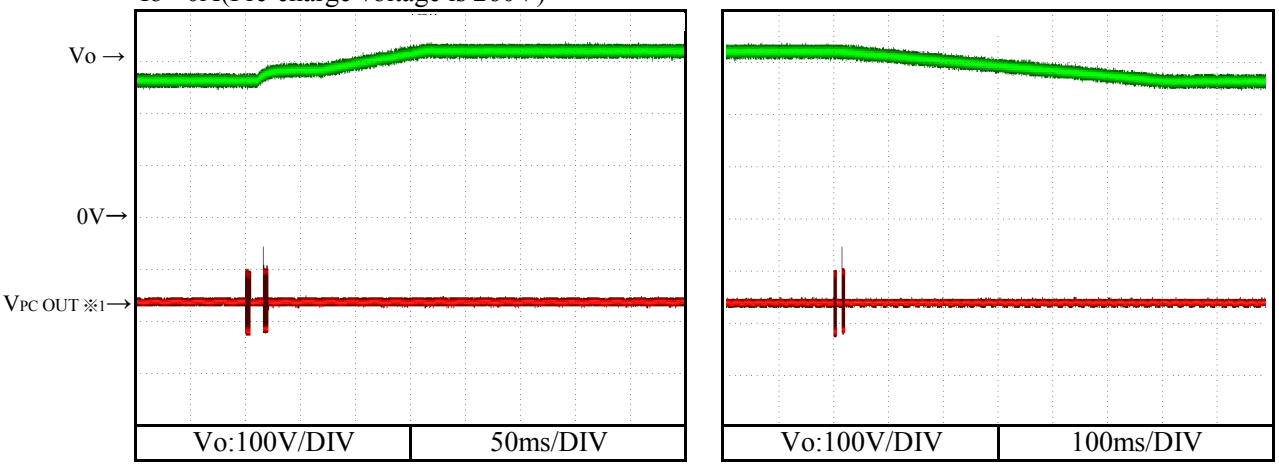
2.6 出力立ち上がり、立ち下り特性（RS-485通信によるON/OFF）
Output rise & fall characteristics (ON/OFF Control by RS-485)

(b) 回生 Regeneration mode

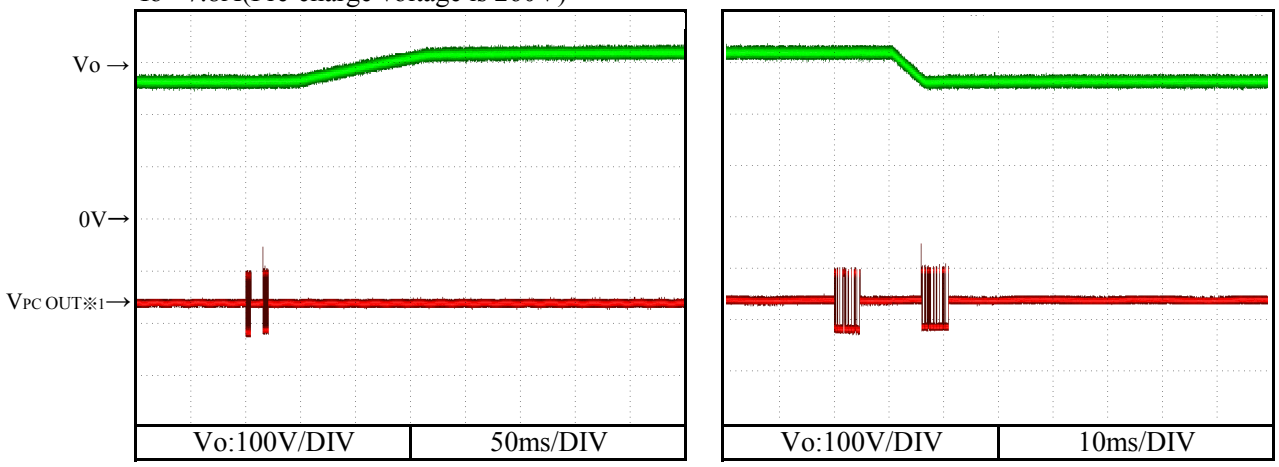
Vo = 320V

Conditions Vin :48VDC
Ta :25℃

Io =0A(Pre-charge voltage is 260V)



Io =7.8A(Pre-charge voltage is 260V)



※1 半2重通信方式のため、送信信号に対し応答信号が現れます。
By half-duplex communication system, response signal and transmittes signal are output.

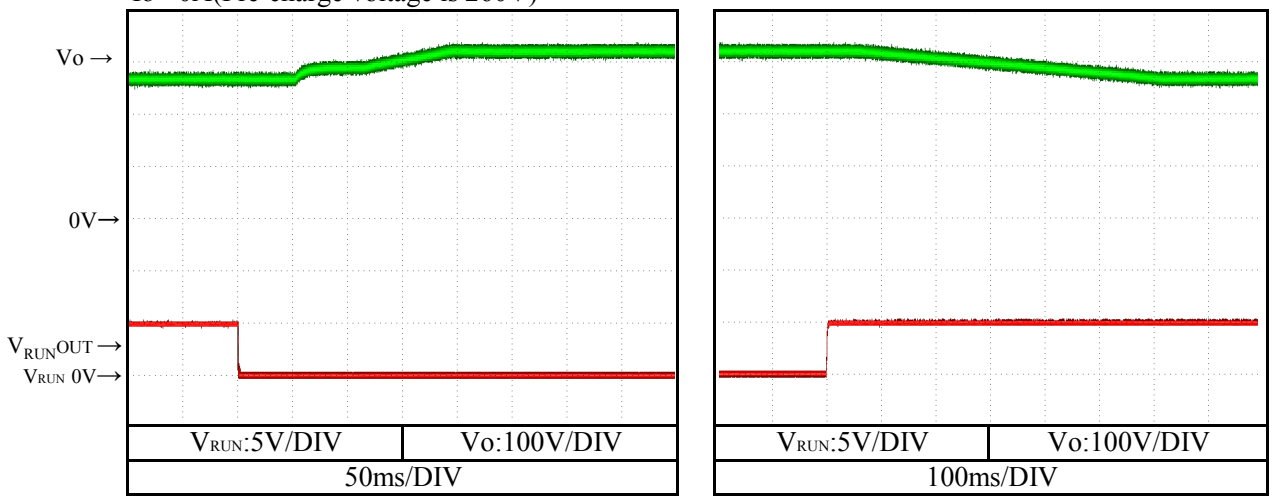
2.6 出力立ち上がり、立ち下り特性 (外部RUN信号によるON/OFF)
Output rise & fall characteristics (ON/OFF Control by External terminal)

(b) 回生 Regeneration mode

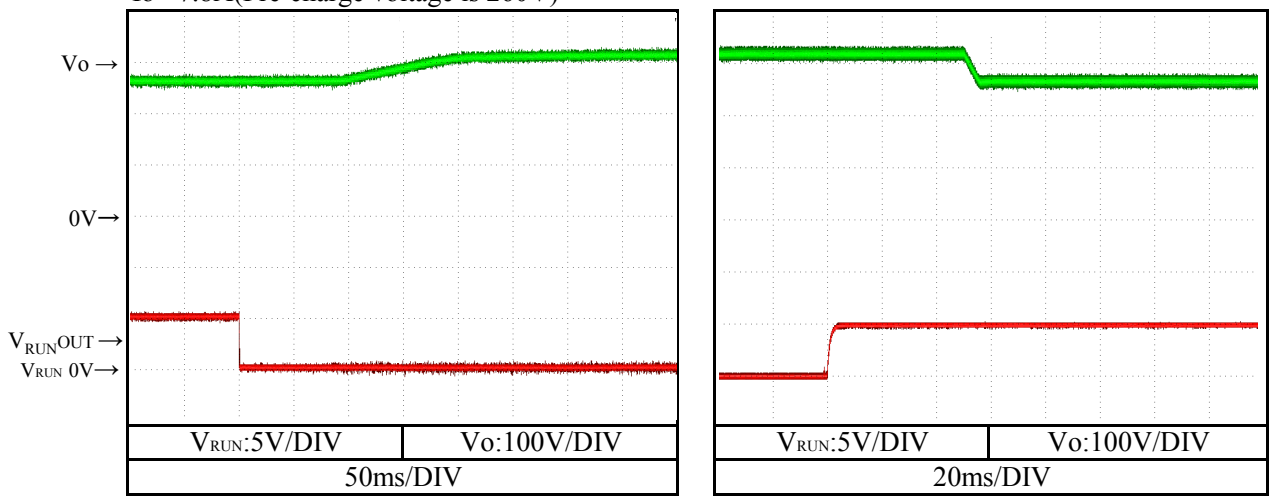
Vo = 320V

Conditions Vin :48VDC
Ta :25℃

Io =0A(Pre-charge voltage is 260V)



Io =7.8A(Pre-charge voltage is 260V)



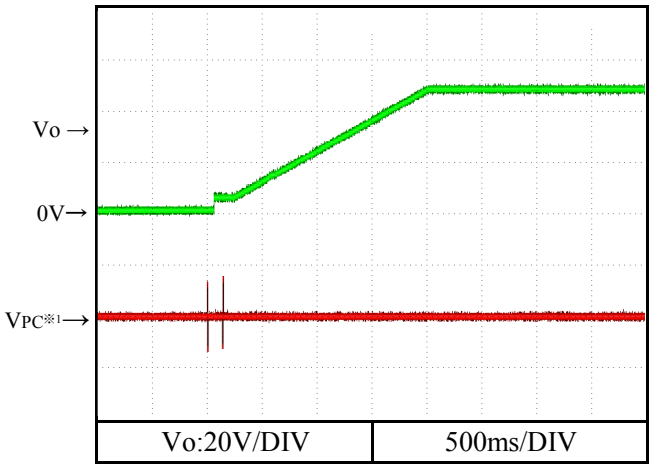
2.7　0Vランプアップ起動特性
0V ramp up characteristics

(a)RS-485通信によるON/OFF
ON/OFF Control by RS-485

力行 Generation mode
Vo = 48V

Conditions　Vin :320VDC
Ta :25℃

Io = 52A



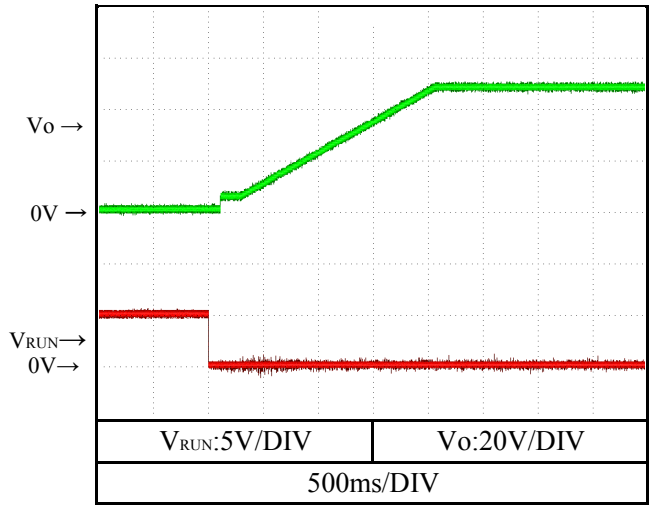
※1　半2重通信方式のため、送信信号に対し応答信号が現れます。
By half-duplex communication system, response signal and transmittes signal are output.

(b)外部RUN信号によるON/OFF
ON/OFF Control by External terminal

力行 Generation mode
Vo = 48V

Conditions　Vin :320VDC
Ta :25℃

Io = 52A

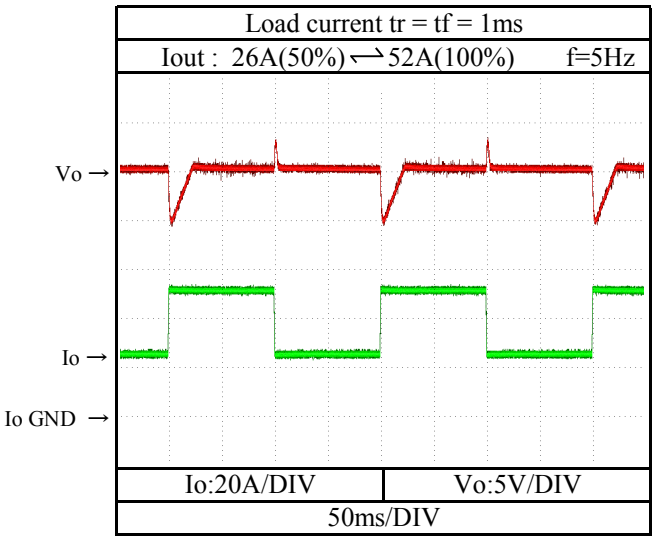


2.8 過渡応答(負荷急変)特性
Dynamic load response characteristics

(a)力行 Generation mode

Conditions Vin : 320VDC
Ta : 25℃

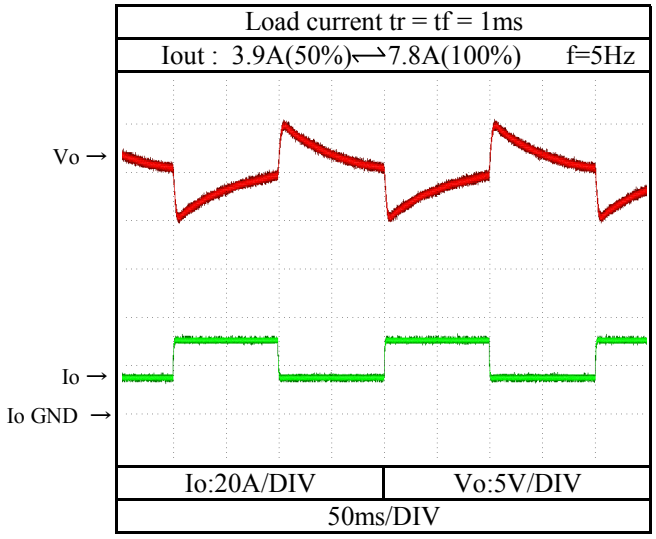
Vo=48V



(b)回生 Regeneration mode

Conditions Vin : 48VDC
Ta : 25℃

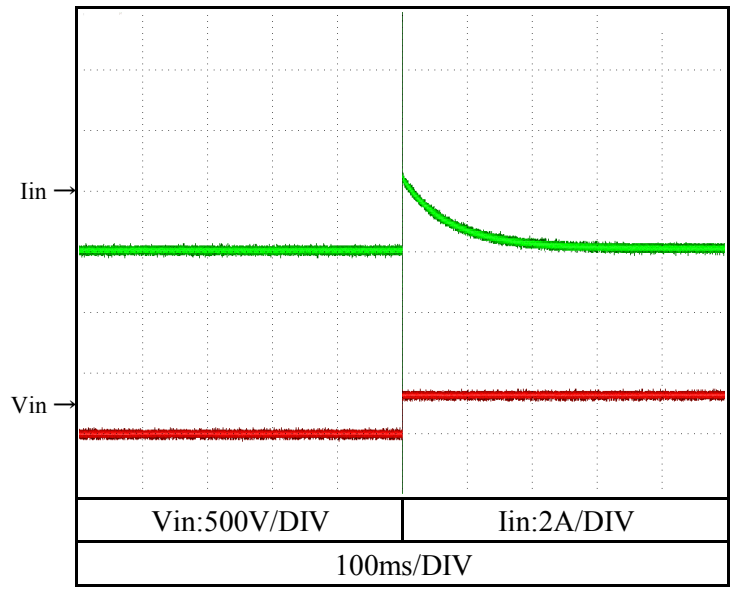
Vo=320V



2.9 入力サージ電流（突入電流）特性
Inrush current characteristics

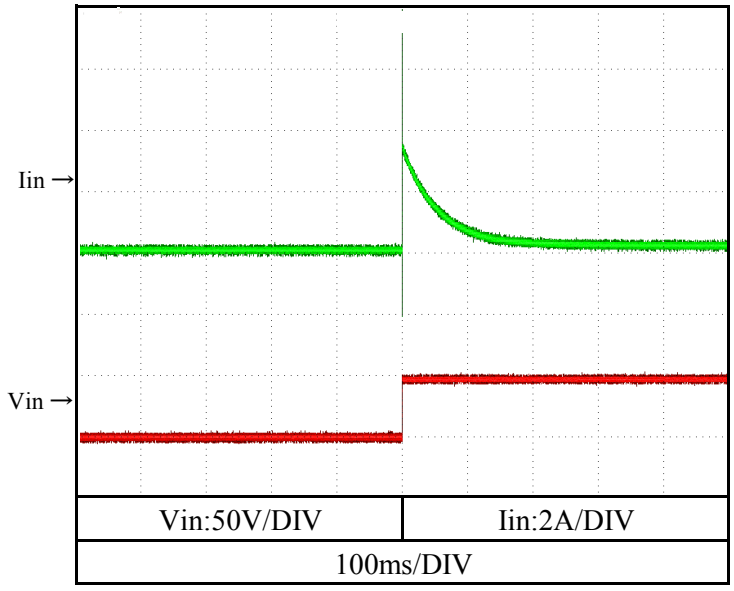
(a)グリッド側
Grid side

Conditions Vin : 320VDC
Ta : 25℃



(b)バッテリ側
Battery side

Conditions Vin : 48VDC
Ta : 25℃

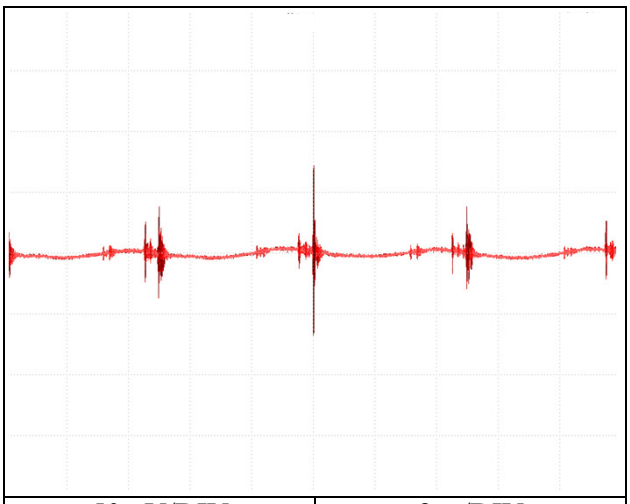


2.10 出力電圧リップル、ノイズ波形
Output voltage ripple and noise waveform

(a)力行 Generation mode

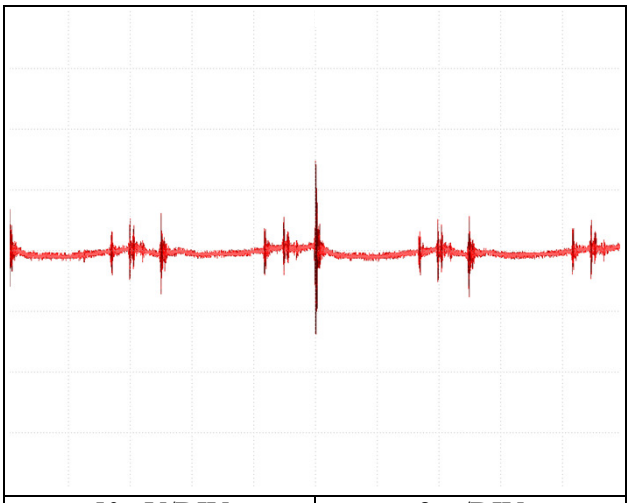
Conditions
Ta: 25℃
Vin: 320VDC
Vo: 48VDC

Io=0A



50mV/DIV	2μs/DIV

Io=52A



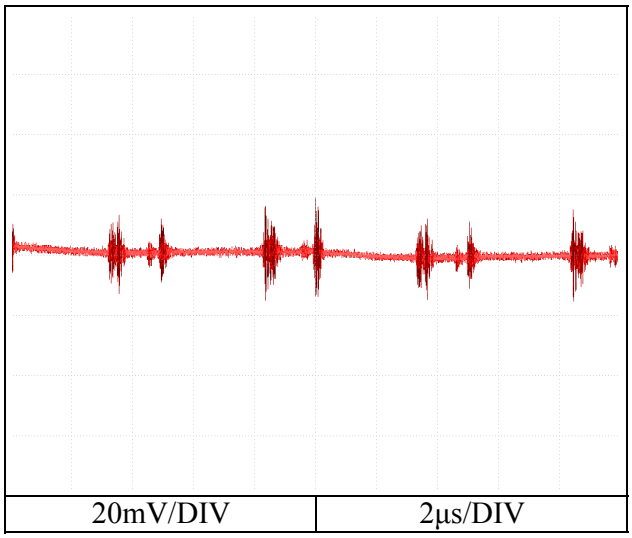
50mV/DIV	2μs/DIV

2.10 出力電圧リップル、ノイズ波形
Output voltage ripple and noise waveform

(b)回生 Regeneration mode

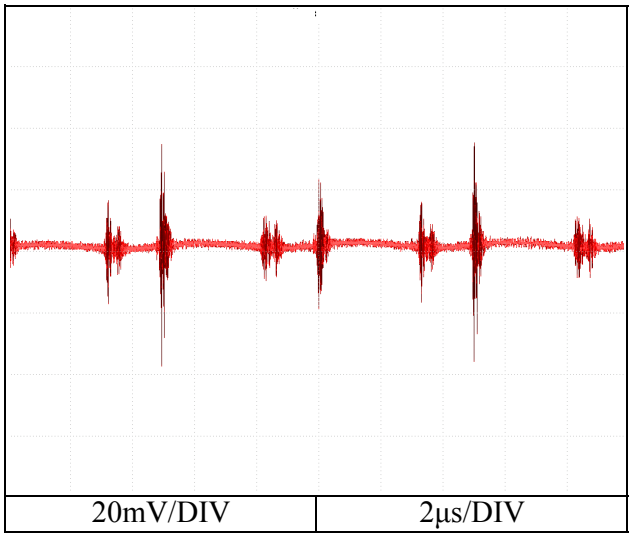
Conditions
Ta: 25℃
Vin: 48VDC
Vo: 320VDC

Io =0A



20mV/DIV	2μs/DIV

Io =7.8A



20mV/DIV	2μs/DIV

2.11 E M I 特性
Electoro-Magnetic Interference characteristics
雑音端子電圧
Conducted Emission

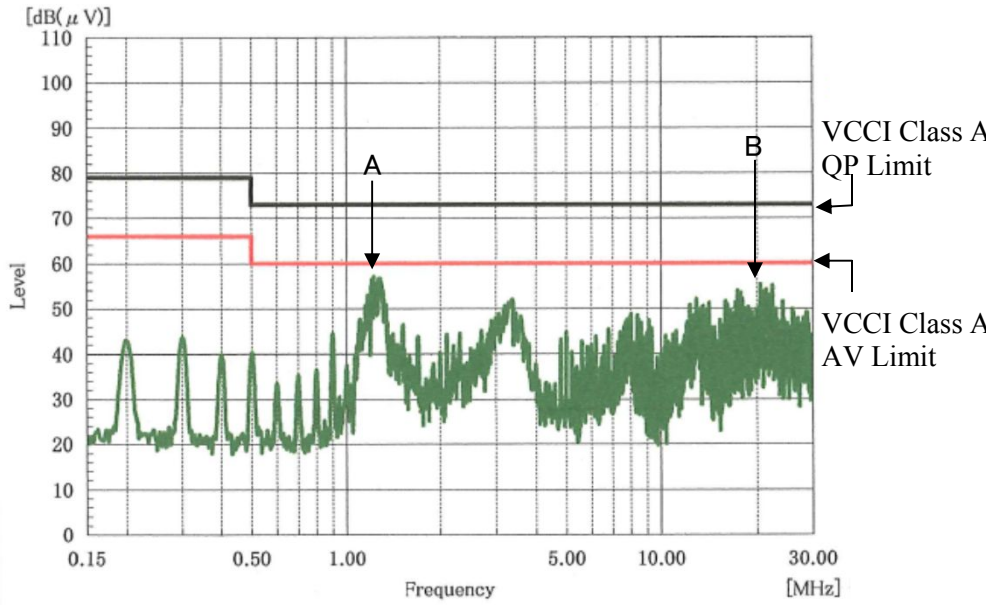
力行 Generation mode

Condition
Vin : 320VDC
Io : 52A

Vo = 48V

Ref. Data	Point A (1.21425MHz) Limit (dBuV)	Measure (dBuV)
QP	73.0	52.7
AV	60.0	33.0

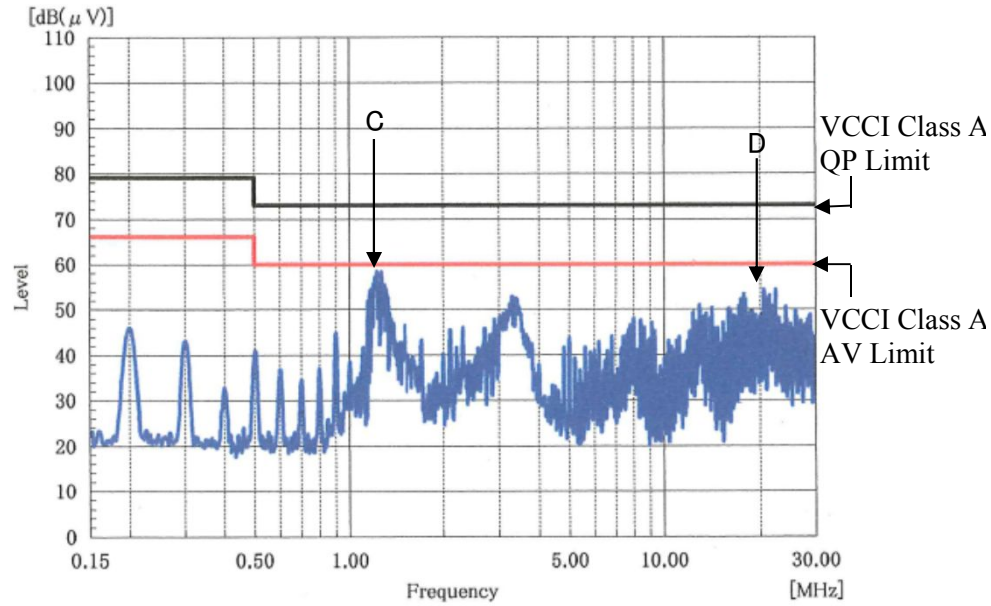
Ref. Data	Point B (20.5496MHz) Limit (dBuV)	Measure (dBuV)
QP	73.0	54.5
AV	60.0	51.7



Phase : -V

Ref. Data	Point C (1.21721MHz) Limit (dBuV)	Measure (dBuV)
QP	73.0	53.0
AV	60.0	33.2

Ref. Data	Point D (20.54636MHz) Limit (dBuV)	Measure (dBuV)
QP	73.0	53.3
AV	60.0	50.6



Phase : +V

EN55011-A,EN55032-Aの限界値はVCCI class Aの限界値と同じ
Limit of EN55011-A,EN55032-A are same as its VCCI class A.
上記は、尖頭値検波(PK)方式にて測定した波形です。
The above is wave measured by the peak detection mode.

2.11 E M I 特性

Electoro-Magnetic Interference characteristics

雑音電界強度

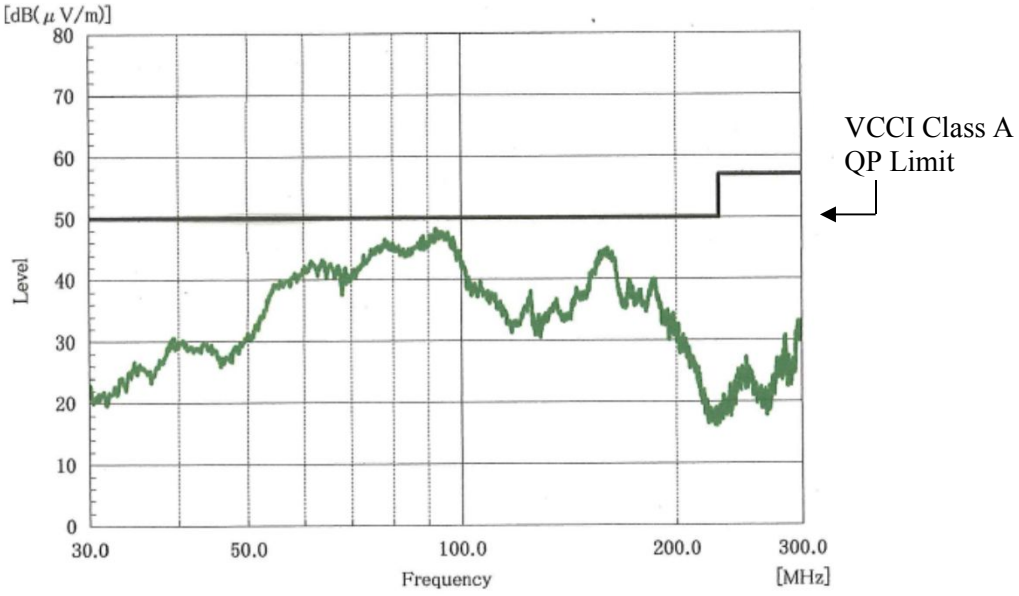
Radiated Emission

力行 Generation mode

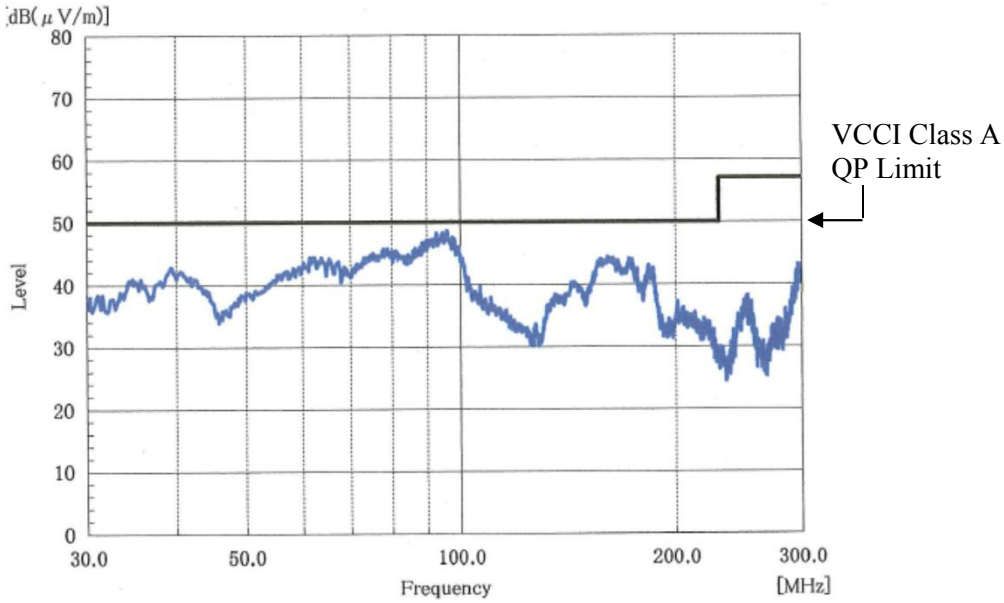
Condition
Vin : 320VDC
Io : 52A

Vo = 48V

HORIZONTAL



VERTICAL

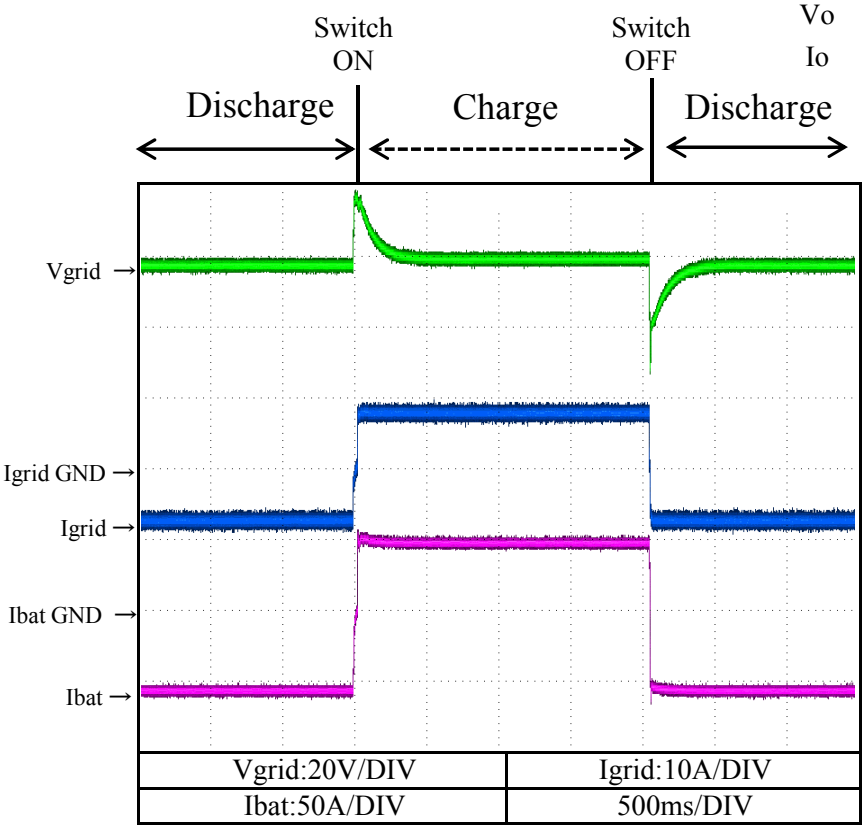


EN55011-A,EN55032-Aの限界値はVCCI class Aの限界値と同じ
Limit of EN55011-A,EN55032-A are same as its VCCI class A.
上記は、尖頭値検波(PK)方式にて測定した波形です。
The above is wave measured by the peak detection mode.

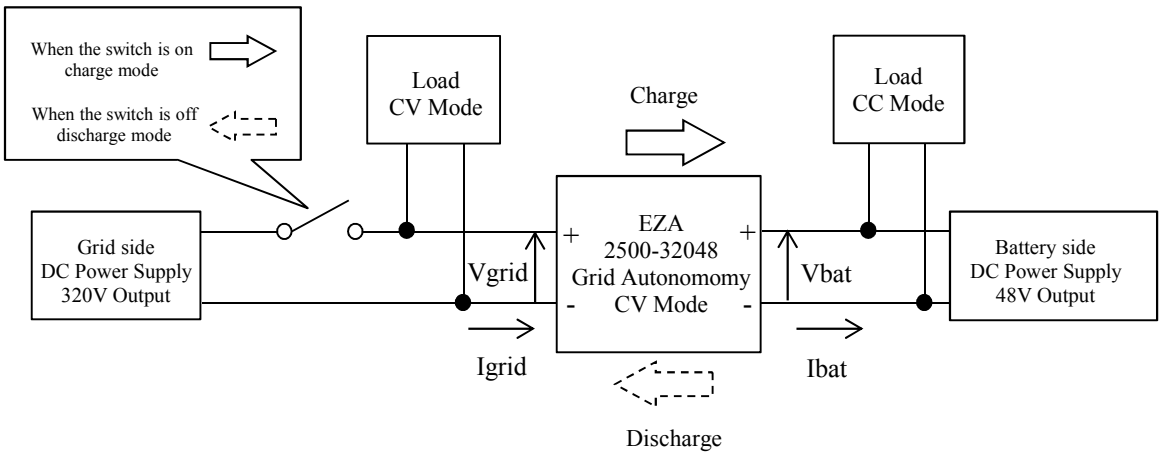
2.12 力行・回生切替特性
Generation and Regenerative switching characteristics

グリッド自律CVモード
Grid Automonomy CV mode

	Charge	Discharge
Vin	: 320 VDC	| 48 VDC
Vo	: 48 V	| 320 V
Io	: 52 A	| 7.8 A



Igrid,Ibatの矢印の向きが電流の正です。
EZA2500-32048をグリッド自律モードで動作させています。
グリッド側に接続されているDC電源の出力をON/OFFすることで
力行・回生の切り替えを行います。
The direction of Igrid and Ibat arrow is positive current.
EZA2500-32048 is operated in autonomomy CV mode.
Performs switching generation mode and regeneration mode
by turning ON / OFF the DC power supply connected to battery side.

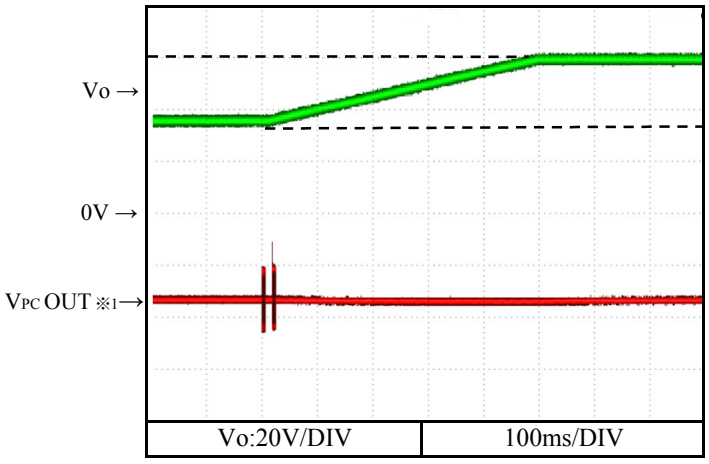


2.13 出力電圧指令応答特性
Output voltage command responce characteristics

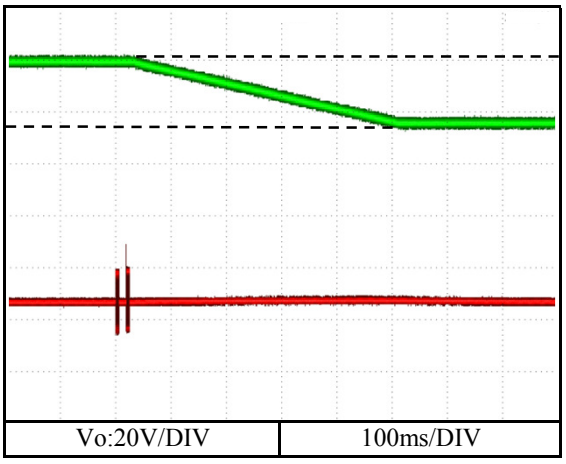
(a)力行　Generation mode

Conditions
Ta ：25℃
Vin ：320VDC
Io ：41A

Vo: 36V⇒60V



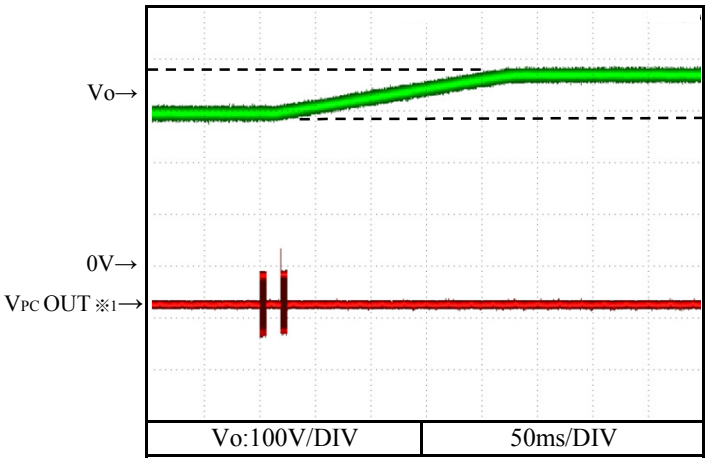
Vo: 60V⇒36V



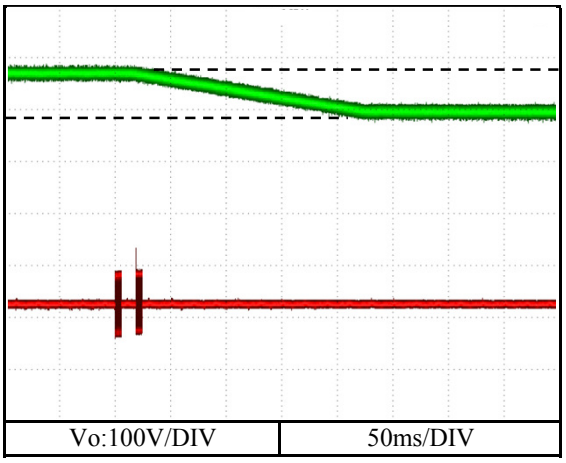
(b)回生　Regeneration mode

Conditions
Ta ：25℃
Vin ：48VDC
Io ：6.5A

Vo: 300V⇒380V



Vo: 380V⇒300V



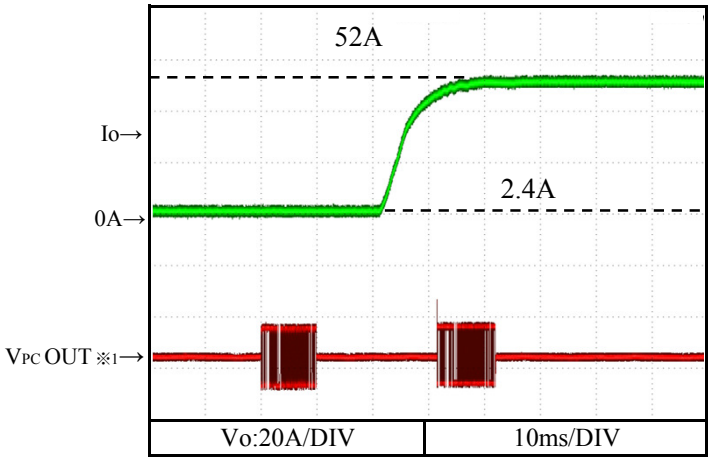
※1 半2重通信方式のため、送信信号に対し応答信号が現れます。
By half-duplex communication system, response signal and transmittes signal are output.

2.14 定電流指令応答特性
Constant current command responce characteristics

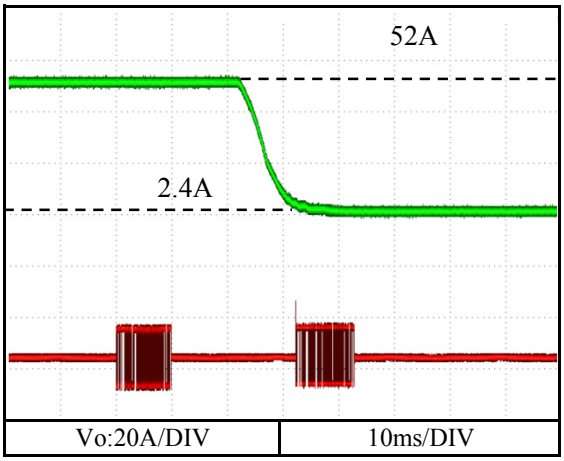
(a)力行　Generation mode

Conditions
Ta :25℃
Vin : 320VDC
Vo : 48VDC

Io: 2.4A⇒52A



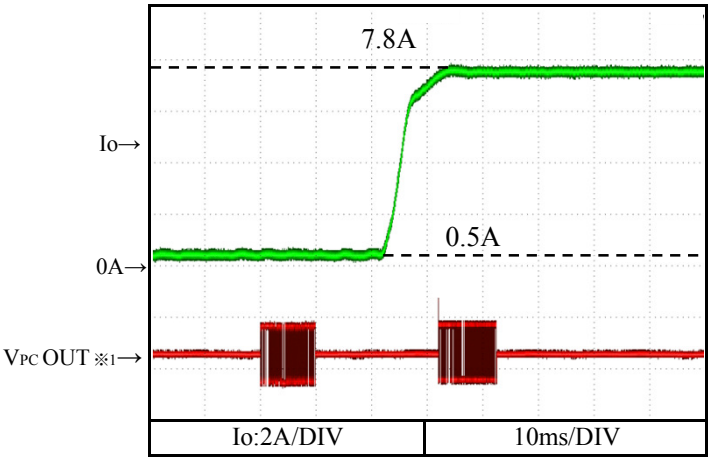
Io: 52A⇒2.4A



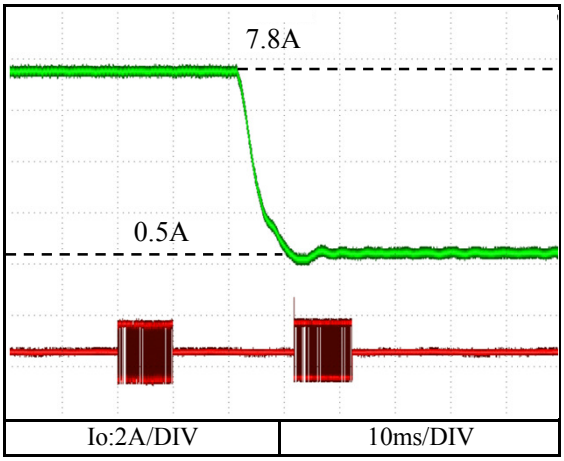
(b)回生　Regeneration mode

Conditions
Ta :25℃
Vin : 48VDC
Vo : 320VDC

Io: 0.5A⇒7.8A



Io: 7.8A⇒0.5A



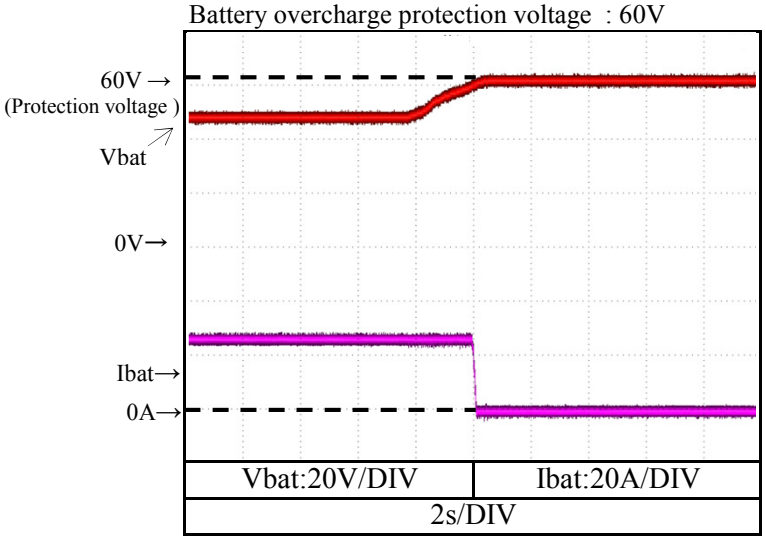
※1 半2重通信方式のため、送信信号に対し応答信号が現れます。
By half-duplex communication system, response signal and transmittes signal are output.

2.15 バッテリ保護特性
Battery protection characteristics

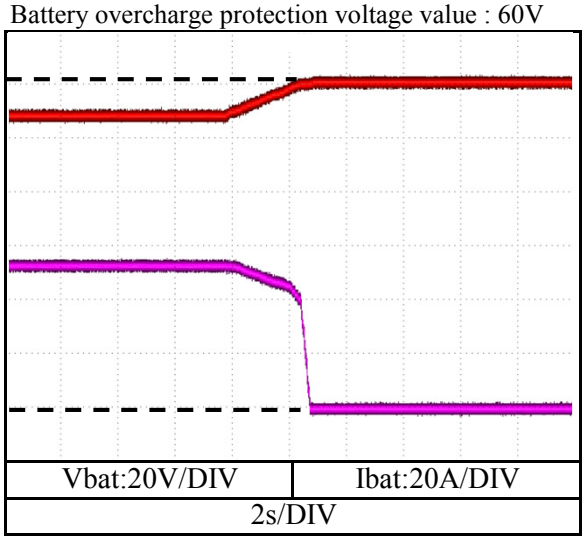
(a)グリッド自律モード【充電】
Grid Autonomy mode [charge]

Conditions
Ta ：25℃
Vin ：320VDC
Vo ：48VDC⇒60VDC

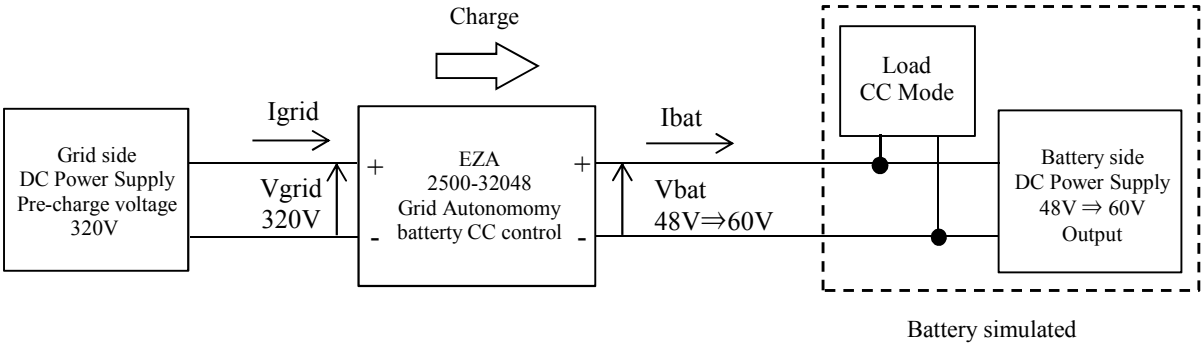
Battery voltage[Vbat] : 48V ⇒ 60V
Charge current[Ibat] : 26A
Battery overcharge protection voltage : 60V



Battery voltage[Vbat] : 48V ⇒ 60V
Charge current[Ibat] : 52A
Battery overcharge protection voltage value : 60V



充電電流は上記波形では正方向になります。
バッテリ電圧Vbatが過充電保護設定電圧まで上昇すると、充電電流Ibatを制限し
バッテリ電圧が設定電圧以上にならないよう動作します。
Charge current is positive current in the above waveform.
When battery voltage reaches to overcharge protection voltage value,
EZA limits charge current and keeps battery voltage under protection voltage.

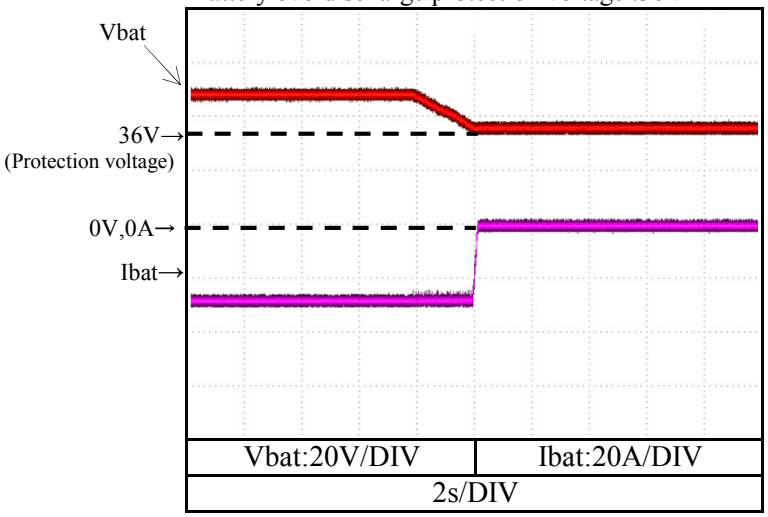


2.15 バッテリ保護特性
Battery protection characteristics

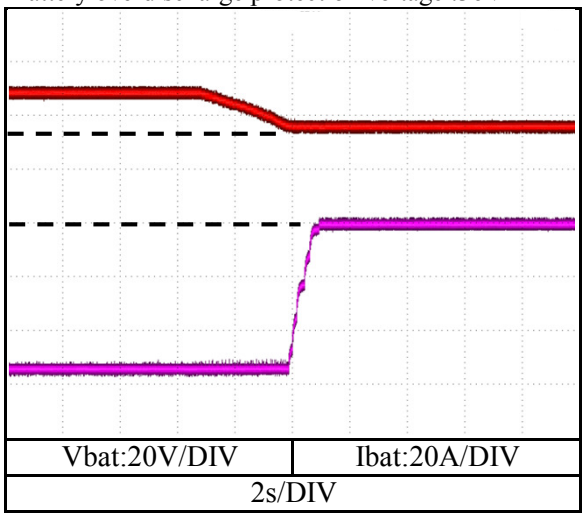
(b)グリッド自律モード【放電】
Grid Autonomy mode [discharge]

Conditions
Ta :25℃
Vin : 48VDC⇒36VDC
Vo : 320VDC

Battery voltage[Vbat] 48V ⇒ 36V
Discharge current[Ibat] :28A
Battery overdischarge protection voltage :36V



Battery voltage[Vbat] 48V ⇒ 36V
Discharge current[Ibat] :54A
Battery overdischarge protection voltage :36V



放電電流は上記波形では負方向になります。
バッテリ電圧Vbatが過放電保護設定電圧まで低下すると、放電電流Ibatを制限し
バッテリ電圧が設定電圧以下にならないよう動作します。
Discharge current is negative current in the above waveform.
When battery voltage reaches to overdischarge protection voltage value,
EZA limits discharge current and keeps battery voltage over protection voltage.