

3.8V-30V Vin, 2A, High Efficiency Synchronous Step-down DCDC Converter

[illegible]

3f ZUZXRfe ReZ_ Raa R_TVd Z_Uf deR A4
f eW_TeZ_acZ_eVd V_e/cacZV ac VTe d
A cRSVVVTeZ_d T__VTaU avcZVVRd
D RcedaVR Vd _Z d
5 ZeZf eUa Vcd deV d ZY&G G *G R_U
%G Zafe

EYWD4E %R 2 d Tyc fd Sf T T Væ/c æ
 ZV Zafe æRXV R XZX W) G e Z G YZY
 ZæXæVd R * d UæZY dZV D76E R UR 7
 dZV D76E EYWD4E %RU æZX eV aVR
 TfæV_e UV T æc df aa æd eV Af dV D ZæZX
 D4Bf ReZ AD YZY RddZæd eV T Væ/c
 RTYZ Z_X YZY WXYZ_T Re ZYe RU c dæR_US
 T UæZ
 EYV d æTYZX WæfV_T TR SV ac XæR VU W
 9 e 9 æYc fXY V æ/c_R dVdZæ æ e
 æZ ZVd VæVc eV a Vc WXYZ_T c eV V æ/c_R
 T a V æd dZVd EYV D4E %R d a Vc
 T VæZ W YZY Zafe æRXV e fæfe
 æRXV æY R ZZ f) d

Vc aVReZ_XWVRZe/ aVRe dV dR XVf Vdd eVc ZV_eU				
G:	:_afe dRXVdR_XV	)		G
G FE	fæfe dRXVdR_XV	)		G
E	aVReZ_X f_TeZ_e/ aVRe dV	%	&	4

G _{6D5}	9f R_3 U UV 93 aVc2 D: 6564 D %daVTZReZ_R aZd	&	&	G
	4 YRcXU5V ZV UV 45 aVc2 D: 6564 D %daVTZReZ_R aZd			G

- (1) 6564 U Tf V_e 6A && dR/d eVRe & G93 R d dRW R_f VTf cZ_X ZYR deR URdU 6D5 T _ec ac TVdd
 (2) 6564 U Tf V_e 6A & dR/d eVRe & G45 R d dRW R_f VTf cZ_X ZYR deR URdU 6D5 T _ec ac TVdd

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C 2

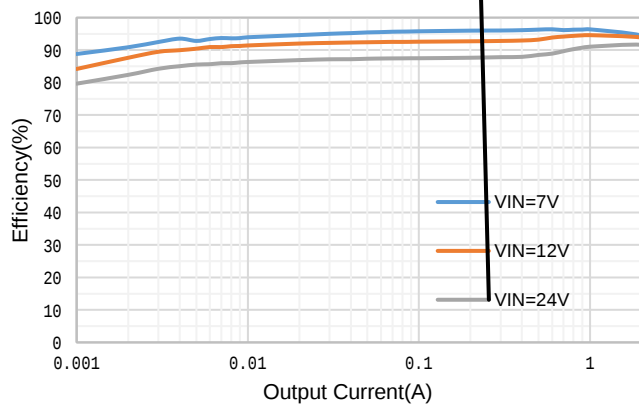
G: . G E . % 4 & 4 e aZ R R f V Z e d e U f _ U v c & 4

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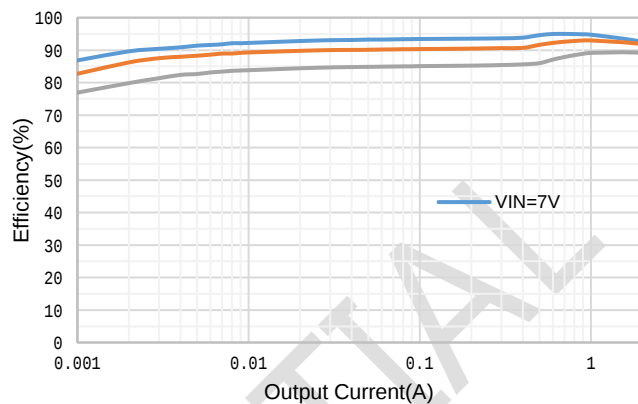
G:	aVRe_XZ_afe eRXV		)	G
G: PFG=	:_afeFG= EYdY U 9 de/d/d	G: cZ_X	()	G G
:D95	DYf eJ _ Tf dV_eW G: aZ_	6 . _ RU		

e P 2l	R _eZ V		*	f d
G GA	7WUSRT Vc eRXV ZY dVdaVTee dWcV TV eRXV	G73 GC67 cZ_X G73 GC67 W Z_X	&	
G3 EFG	3 E DH FG= eYdY U	3 E DH W Z_X	&	G
ED5	EYVc R dYf dJ _eYdY U	E cZ_X 9 dVdZ	&	4 4

5VzVUW SV_TYTYRtRtVcZReZ_ cUVdZ_W_TeZ_.



7Zf dV 6WZ_T 7DH. & 9 G FE. &G



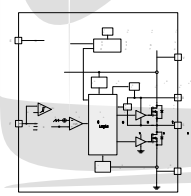
7Zf dV 6WZ_T 7DH. & 9 G FE. G

7Zf dV% = RU CVXf ReZ_ G: . G G FE. &G

7Zf dV & =Z_V CVXf ReZ_ G FE. &G := 25. 2

7Zf dV B f Z dTV_eTf αV_eGDEV aVRef dV

7Zf dV (C5D GD EV aVRef dV



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deRefa ZY feeZXXVc_XYZTfa 9ZTfa Z_V_RS U _TV faefedRTYVd dXf ReZ _ ceZ V V TMUdeD YZTV Vc
YRaaV_dVde

H YV_eV faefe eRXVUc ad SV eYVdVe RfV eVd WdRe eRXV Z eRT eYVUVTdRdVZ faefe eRXV
Z_RTVeRZ_ac a eZ _ EYZ dZ ReZ _ R Tf cf_UVceVW ZXT_UZ_d+

H YV_eVZafe eRXVZe e RZeRZeYVdVe faefe eRXV

H YV_ VcTf cV_e Tf d TRfdZXRUVTdRdVZ faefe eRXV

H YV_eVRS VT_UZ_dRdV VU eV faefe eRXV Z deZ ZTdRdVf_UVcd WdRe 3feZdY f USV_eU
eReZ eV faefe eRXVUc ad SV & UfVe VcTf cV_e YZTfa Z SV eZXXVcU

EYVd ZYZ_XWbfV_T WdVD4E %Z dVeS aRT_ZXR dZ cSve W_CE aZ_R_UeVXc f_U

:_ dVZe cdVe_ZXWbfV_T UV R dVZe f aRTVU SVe W_CE aZ_e eVXc f_U WdReZb ZYZ_XWbfV_T
VcR ZVdR_XVW 9 e 9H MYCEe ZWRZeYVWbfV_T Z& 9 R_U YV_CE ZT_VT eU
e eVXc f_U eVWbfO f eVd P_U %

2eRXZV_T T WbfV_T Ufe TTV Z Z AUS ZZ f WZ V 5fcZXeVT_UZ_ W RXVUWdV_TV
W eVZafee eV fafee RZ_RZ_eV fafee RXVW V_ZX eVD4E %V eV_Ud _eZ VaRdeeV_V_U
W_eVT T TTVf_eZeVdVf_ZUaVR_ZUfTe cTfV_eZRTYZ/ W EYVT T ZR VUe deReR_V TTV_TV
aVR_ZUfTe cTfV_eZRTYZ/ VU c_TVRadUWVc_ZU R Z f _eZ V e P R VRaac Z ReV *fd aRddVd
2dRdVf ee V_dV_eVReeV fafee RXVTR_SV_eVcW eV TYR_XVdZ_Zafe RXV YV_D4E % aVdRdV
Z_5 W_TeZ_eVd ZYXWbfV_T SVXZ_de UVTdRdV ZYR_ZZ f UVTdRdVe) 9 EYV_ZZ f
WbfV_T Z ZR Zda ddSVRfUZ_ZeVdV_TV

5fcZXd a Vc_RUa Vc WPa ZReZ_d UfVe eV=5 W_TeZ_eV fafee RXVTR_T dV eRT eV
d aVTYR_XVd W_eV_Zafe RXV 2deV_Zafe RXV_Z dUfTVUe_VRceV fafee RXV_ZV UfZXd_ZX
a VcfaR_Ua VcU_Raa ZReZ_eV WZ V W_eVYZYdZV D76E deRee Raac RTYeV_ZZ f RfV
H_ZY fe=5 W_TeZ_UV SV_UeYZa ZeeVd_ZYX R SVT VVaReZRU ceV fafee RXV_ZV
fe W_Xf ReZ_E R ZYeZac SV eVD4E %=5 UVRfe ReZR dUfTVdeVd_ZYXWbfV_T e
ZTdRdVeV WTeZVUfe T TVR_U RZ_RZ_dXf ReZ_

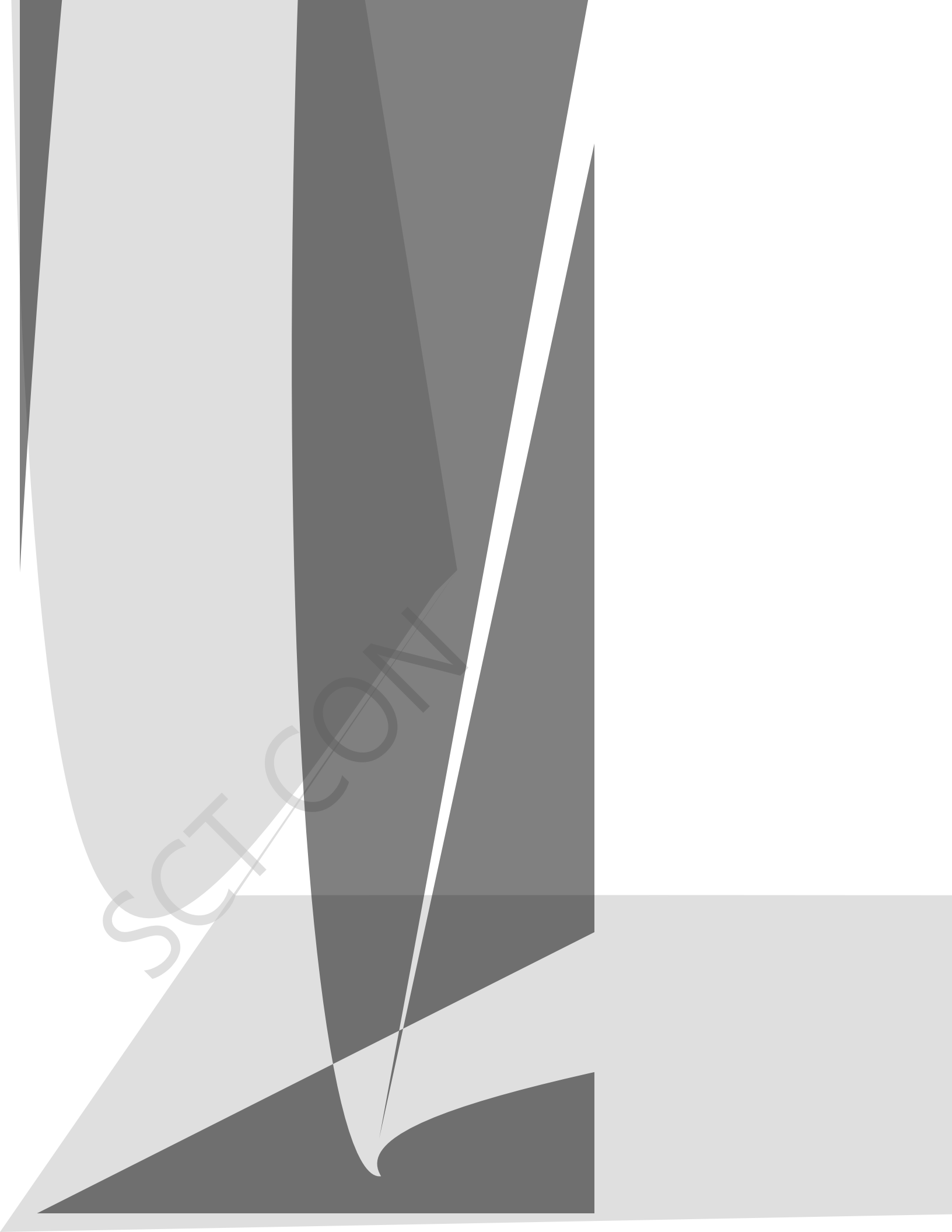
6 V_ZeVUfe TTVReeVdVeWbfV_T Z Z AUS eV ZZ f _eZ V D4E %TR_deZ RZ_RZ deRSV
Rufde V_e W_eV fafee RXVUfZXeV_eR_dZ_W YZY_Zafe RXVe fafee RXV

:W_eV_Zafe fafee RXVReZ_Ze YZY V V_ZeV TfV_eV TVUdeVT aV_dReZ_daVT_ZUaVR eV YZY
dZV D76E TR_edYfeU_bfZ V_fXYe RufdeeV fafee RXV EYZ_Z TRfdVeV fafee RXVe
T_eZ f fd_ZTdRdVf_eZ Vc RXV ac eTeZ_ZeZXVdU E R ZYeZ_dZReZ_YV_eVT_UfTeZ_eZ V W
eV YZYdZV D76E e fTYd eV ZZ f _eZ VUfVe eV_ZTdRdV_Z_ZafeR_U fafee RXVUWdV_TV
D4E % Z d_ZYe R V TfV_eT_e UV 2WceVYZYdZV D76E_ZeVc_W W_eV dZV D76E
Z dV RZ aV_f_eZeV_ZUfTe cTfV_eUc adSV eVdVf_ZU R V TfV_e 5fcZXeYZaVcZU eV_V eT T
TTV ZSVS T W W deReZ_Xd eVd_ZYXWbfV_T Z UVTdRdV

)G dWdV_TV eRXV eVYXYdZV D76E d c_d W R J fæfe eRXVT_e fVe ZTdRdV H YV_eV73
aZ_ eRXV d SV V eV)G dWdV_TV eRXV eVYXYdZV D76E TR_d c_ _RXRZ_

EYVD4E %ac eT eVUV ZVW eVUR RXVUf c_XV TVddZV YReR_U a VcUZdZReZ_T_UZ_d_TV
eV f_TeZ_eV aVRe dV V TWUd & 4 eVZ_e/c_R eVc R dV_d cde ad a Vc D76Ed d ZYX H YV_eV
f_TeZ_eV aVRe dV d SV & 4 eVUV ZV d eR d ZY_e/c_R d W d e a YRdV

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EYV fæfe æRXV dVeS R_V e/c_R d/dZe cUZ JVc
C R_U C _ e aZR Raa dReZ_ dTYV ReZ
CVT _ V_UVC d/dZeR_TV d FdV6bfReZ_
e TRTf ReVC

V a ! V a dg db b d e da V
□ ddb b e gV g

G	<	
&G	& <	
G	% <	

$$_1 = (\text{---} - 1) \quad _2$$

YVd/+

Gc67 d eYV WUSRT dWdV_TV æRXV e aZR
)G

9ZYVcd dTYZXWbfV_T/d dfaa æd R Vcac Wd WfæfeZUfTe dR_U fæfeTRaRTæ d d/df eZX_Z Vc
æRXV R_U TfæV_e cZaVd 9 V Vc eYV YZYVc d dTYZXWbfV_T TRfdVd V æR d dTYZX dd YZY
U_XRUvdT _ Væ/cd VdR a VcWdZ_T R_U eYVc R aVdWc R_TV : eYd UVdZ_R UVReV d dTYZX
WbfV_T W& 9 d dVVTæUe RTYX/ VS eYd R d fæZ_dZVR_UYZYWWdZ_T aVdReZ_

EYVd/RdV dV VdR VTe d dY f U SV T _ dZVdU Z dVVTæX_ZUfTe c df TYRd ZUfTæR_TV dRe dReZ_ TfæV_e eYV
C D TfæV_eR_U54 d/dZeR_TV 54C =RcXVcZUfTæR_TV d/df æ Z Vdd_ZUfTe c TfæV_e cZa VR_U eYVdWdV VRUd
e Vc fæfe æRXV cZaV 9 V Vc eYV RcXVc RfV_ZUfTe cR R d T æVda _Ud e R SZXVc aY dZR dZV
YZYVcdVcZ/d d/dZeR_TV R_U VcdRe dReZ_ TfæV_e 2 X Ud VWcUæ/c_ZZXeYV_ZUfTæR_TV e fdV d e R
eYV_ZUfTe caVR e aVR cZaV TfæV_ee SVRaac Z ReV & WæV R Z f fæfeTfæV_e

EYVaVR e aVR cZaV TfæV_eZ_eYV_ZUfTe c:=AA TR_SV TRTf ReMU Rd _ 6bfReZ_ (

$$= \frac{(\quad - \quad)}{\quad}$$

(

H YVd/+

:=AA d eYV_ZUfTe caVR e aVR TfæV_e
= d eYV_ZUfTæR_TV WZUfTe c
W d eYVd dTYZXWbfV_T
G FE d eYV fæfe æRXV
G: d eYV_Zafe æRXV

DZTV eYV_ZUfTe c TfæV_e cZaV_ZTcVdVd æY eYV_Zafe æRXV d eYV R Z f_Zafe æRXV_Z Raa dReZ_ d
R R d fdVUe TRTf ReV eYV_Z_Z f_ZUfTæR_TV d/bf dU FdV6bfReZ_) e TRTf ReV eYV_ZUfTæR_TV RfV

$$= \frac{\quad}{(\quad)} (1 - \frac{\quad}{(\quad)})$$

)

H YVd/+

= : d eYV_Z_Z f_ZUfTæR_TV d/bf dU
W d eYVd dTYZXWbfV_T
G FE

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7 c eY Z V R a V e 7 I (C T V R Z T R a R T Z c d R e M U W c & G Z a R d R V R d V f d W U 2 _ U R 7 W c Y X Y W b f V _ T W e V c X T R a R T Z c Z a R T V U R d T d V R d a d d S V e e V U V Z V a Z d

2 7 T V R Z T R a R T Z c f d e S V T _ V T e M U S V e W _ 3 E a Z _ R _ U D H a Z _ W c a c a V c a V R e Z _ 2 T V R Z T R a R T Z c Z Y I (C c S V e V c X d R U V U Z V T e Z Z d V T V _ U V U E Y V T R a R T Z c d Y f U Y R V R G c Y X Y V c e R X V R e Z X

E Y V d V V T e Z _ W f e a f e T R a R T Z c Z R W W T e f e a f e e R X V c Z a V Z d e V R U d e R a V R _ U R U e R d Z _ e a V d W c R _ T V

E Y V f e a f e c Z a V Z V d d V e R T a d W U W e a R e d _ V Z T R f d W U S e V Z U f T e c T f a V e c Z a V X Z X e Y c f X Y e V 6 b f Z R V _ e D V c Z d C V d Z e T V 6 D C W e V f e a f e T R a R T Z c d R _ U e V e V c Z T R f d W U S e V Z U f T e c T f a V e c Z a V T Y R c X Z X R _ U U Z T Y R c X Z X e V f e a f e T R a R T Z c d E R T Y Z V d R f e a f e e R X V c Z a V T Y d V R 6 D C f e a f e T R a R T Z c Z V T V R Z T R a R T Z c 7 c T V R Z T R a R T Z c d e V T R a R T Z R _ T V U Z R e d e V f e a f e c Z a V 7 c d Z a Z R e Z _ e V f e a f e e R X V c Z a V T R _ S V d e Z R e M U S 6 b f R e Z _ % U V d Z U

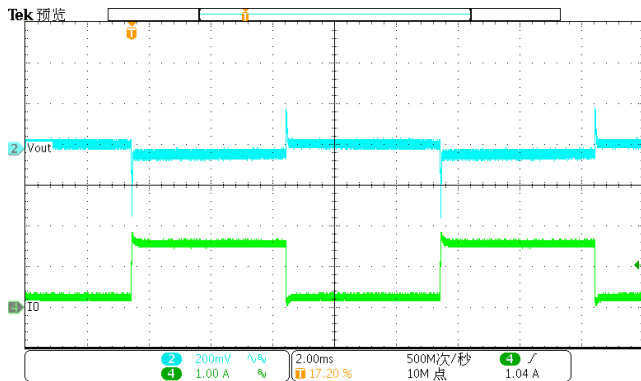
$$\Delta V_{OUT} = \frac{(\quad - \quad)}{8 \quad 2} \quad \%$$

H Y V d V +

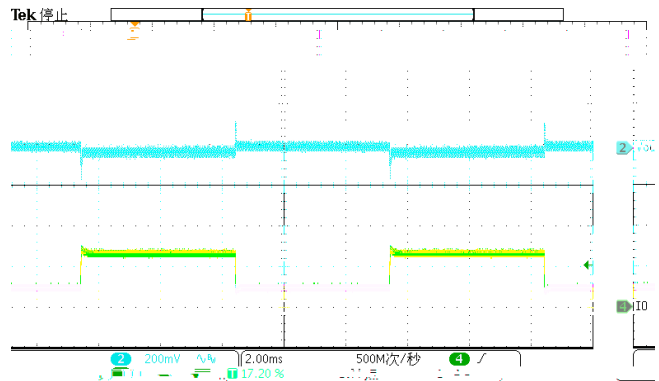
V_{OUT} Z e V f e a f e e R X V c Z a V
W_H Z e V d Z Y Z X W b f V _ T
= Z e V Z U f T e R _ T V W Z U f T e c
4 F E Z e V f e a f e T R a R T Z R _ T V
G F E Z e V f e a f e e R X V
G: Z e V Z a f e e R X V

5 f V e T R a R T Z c d U V X d R U Z X f _ U V c 5 4 S Z d e V S Z d e R X V T R _ d Z Z R e d M U f T V T R a R T Z R _ T V 4 V R Z T R a R T Z c d T R _ d V d e W e V Z T R a R T Z R _ T V R e d e M U e R X V E Y V d W d V V R V R c X Z _ e V e R X V R e Z X e V _ d f d V R U b f R e V W W T e Z V T R a R T Z R _ T V E a Z R e 7 T V R Z T f e a f e T R a R T Z c d c W c d e R a a Z R e Z _ d

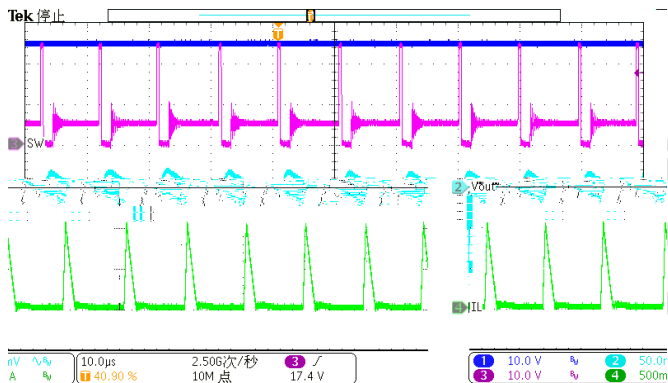
VOUT	FREQUENCY	R1	R2	R _{RT}	L1	C8	COUT
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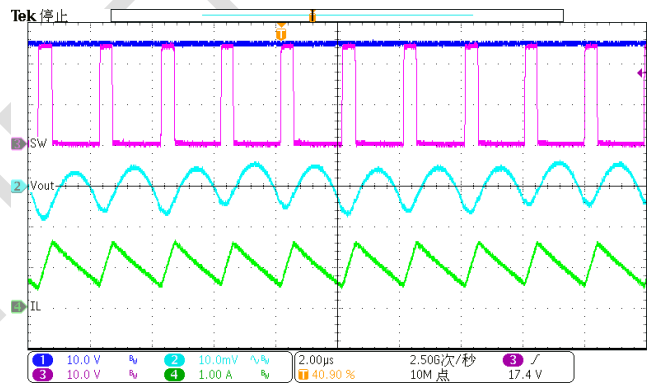
$$7Zf \, dV = RUEdR_{dZ}_e \, 2 \,)2 \, 2 \, fd$$



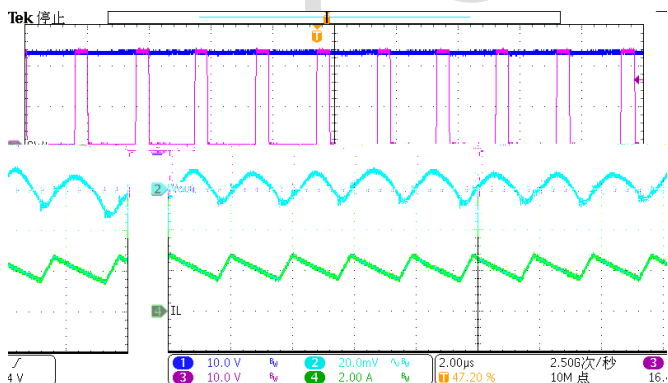
$$7Zf \, dV * = RUEdR_{dZ}_e \, \&2 \, \&2 \, 2 \, fd$$



$$7Zf \, dV \quad f\ae f e C\Za \, V := 25. \, 2$$



$$7Zf \, dV \quad f\ae f e C\Za \, V := 25. \, 2$$



$$7Zf \, dV \quad f\ae f e C\Za \, V := 25. \, 2$$



$$7Zf \, dV \quad EYc \, R \, \%G \, \&G \, FE \, 2$$

SCTCO

SCT Co

