

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

H ZV:_afeCR_XV+)G G
 Fae 24 _e_f fd fæfe4fæV_e
)G 7WUSRT CWWd_TV G æRV
 :_eXReU* 9ZYDZV D76ER_U
 = DZV D76E
 FæR= BfZdTV_e4fæV_e+ f2
 DYfæU _4fæV_e+ f2
 AVR TfæV_e UV T_æ
 Af dVD ZaaZX UV AD Z ZYe RU
) _d ZZ f _æZ V
 Ac XdR RSVD WdReEZ V
 CR_U DacRU DaVæf æZ_ WcdUf TVU 6 :
 2UfdæRSV7æbfV_T+ 9 9
 Dfaa ædææfa æYacV SædVU fæfe
 AcVTæZ_6_RSVEYædY UWcAc XdR RSV
 :_afeG æRVF_UVcG æRV= T feAc æTeZ_
 FG= EYædY UR_U9 dæVædæ
 = 5c a fe UV aVææZ_ R Z f *)
 Ufe T TV
 9ZTfa UVWc VcTfæV_eAc æTeZ_
 Vc æRV R_U VcEV aVææf dV Ac æTeZ_
 2 RæRSV Z_R_74D E&) ART RXV

3f ZJZXRe ReZ_ Raa Z_TVd Z_UfææR A4
 f æV_TæZ_ææZææd V æ/cææV ac VTe æ
 A æRSVVVæææ_Zd T _VTæU aVææYæRd
 D RædaVR Væd _æ æ
 5æææææU a Vcd dæ/ d æY&G G *G R_U
 %G Zæfe

EYVD4E %æR 2d _TYc _fd SfT T _VæVc æY
 ZV Zæfe æRV æR_XZX W)G e Z G YæY
 ZæXæææd R * _d_UææYædæV D76E R_U R 7
 dZV D76E EYVD4E %RU ææZ X æV aVR
 TfæV_e UV T_æ dfaa æd æV Af dV D ZaaZX
 D4æf ReZ_ AD YæY Rddææ æV T _VæVc _
 RTYæZ ZX YæY WææZ/T Re æYe RU c dæR_US
 T _Uææ_
 EYV d æTYZX WæbfV_T TR_ SV ac XdR VU W
 9 e 9 æYc fXY V æVc_R dædææ æ
 ææZ ZVd VæVc æV a Vc WææZ/T c æV V æVc_R
 T a Væd dZVd EYVD4E %R d a Vc
 T _VæZ_ W YæY Zæfe æRV e fæfe
 æRV æY R ææZ 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	aVRe_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

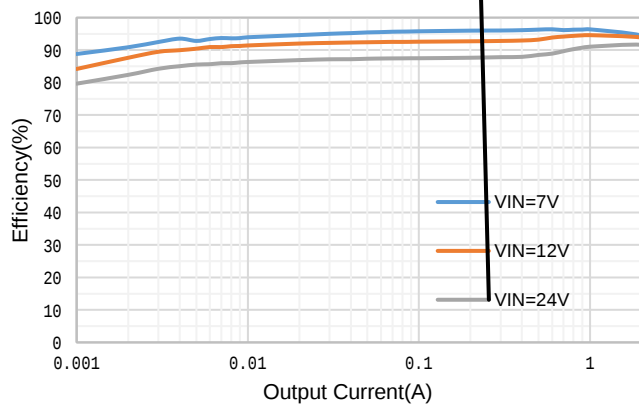
G: . G E . % 4 & 4 e aZ R R f V Z e d e U f _ U v c & 4

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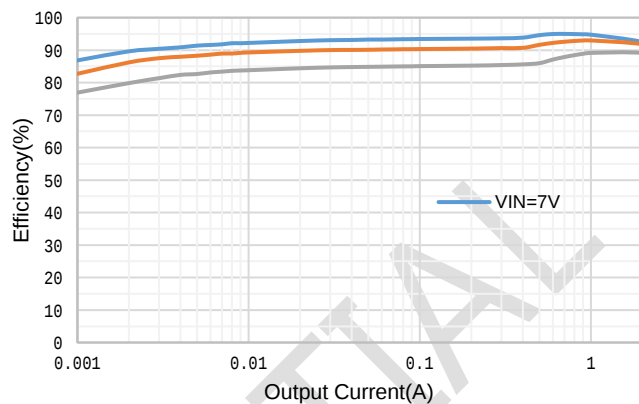
G:	aVRe_XZ_afe eRXV		)	G
G: PFG=	:_afeFG= EYdY U 9 de/d/d	G: cZ_X	()	G G
:D95	DYf eJ _ Tf aV_eW G: aZ_	6 . _ RU		

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

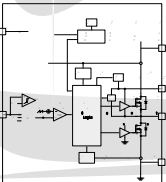
7Zf dV% = RU CVXf ReZ_ G: . G G FE. &G

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_VRSW _TV faefedRTYVd dXf ReZ_ ceZ VV TMUdeD YZYV Vc
YRaaV_dVde

H YV_eV faefe eRXVUc ad SV eYVdVe RfV eYVd 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_dRdVd VU eYV faefe eRXV Z deZ ZTdRdVf_UVcd WdRe 3feZdY f USV_eU
eYV_eV faefe eRXVUc ad SV & UfVe VcTf cV_e YZTfa Z SVeZXXVcU

EYVd ZYZ_XWbfV_T WeYVD4E %Z dVeS aRTZXRdVZe cSve W_CE aZ_R_UeVXc f_U

:_ dVZe cdVeZ_XWbfV_T UV R dVZe f aRTVU SVe W_CE aZ_e eYVXc f_U eYV_eVd ZYZ_XWbfV_T
VcR ZVdR_XVW 9 e 9H MYCEe ZWRZeYVbfV_T Z& 9 R_U YV_CE ZT_VT eU
e eYVXc f_U eYVWbfO f eYVd P_U %

2eRXZV_T T WbfV_T Ufe TTV Z Z AUS ZZ f W V 5fcX eVT UZ W RXVU Wc TV
W eV Zafee eV fafee RZ eV fafee RXV W ZX eVD4E %V eV Ud eZ VaRdeeV V U
W eVT T T TVf eZeV dVf ZU aVR ZUf Te cTf eV eZ RTY Z W EYVT T Z R Ue dR eR V T TV TV
aVR ZUf Te cTf eV eZ RTY Z W U c TVR adU eVc ZU R Z f eZ V e P R V Raac Z ReV *f d aRddVd
2dR dVf e e V df dV eReeV fafee RXVTR SV eVcW eV TYR Xvd Z Zafe RXV YV D4E % aV dR dV
Z =5 W TeZ eV d ZY Z X WbfV_T SVXZ de UVT dR dV ZYR ZZ f UVT dR dV e) 9 EYV ZZ f
WbfV_T Z ZR Z d a ddSV RfUZ ZeV dVc TV

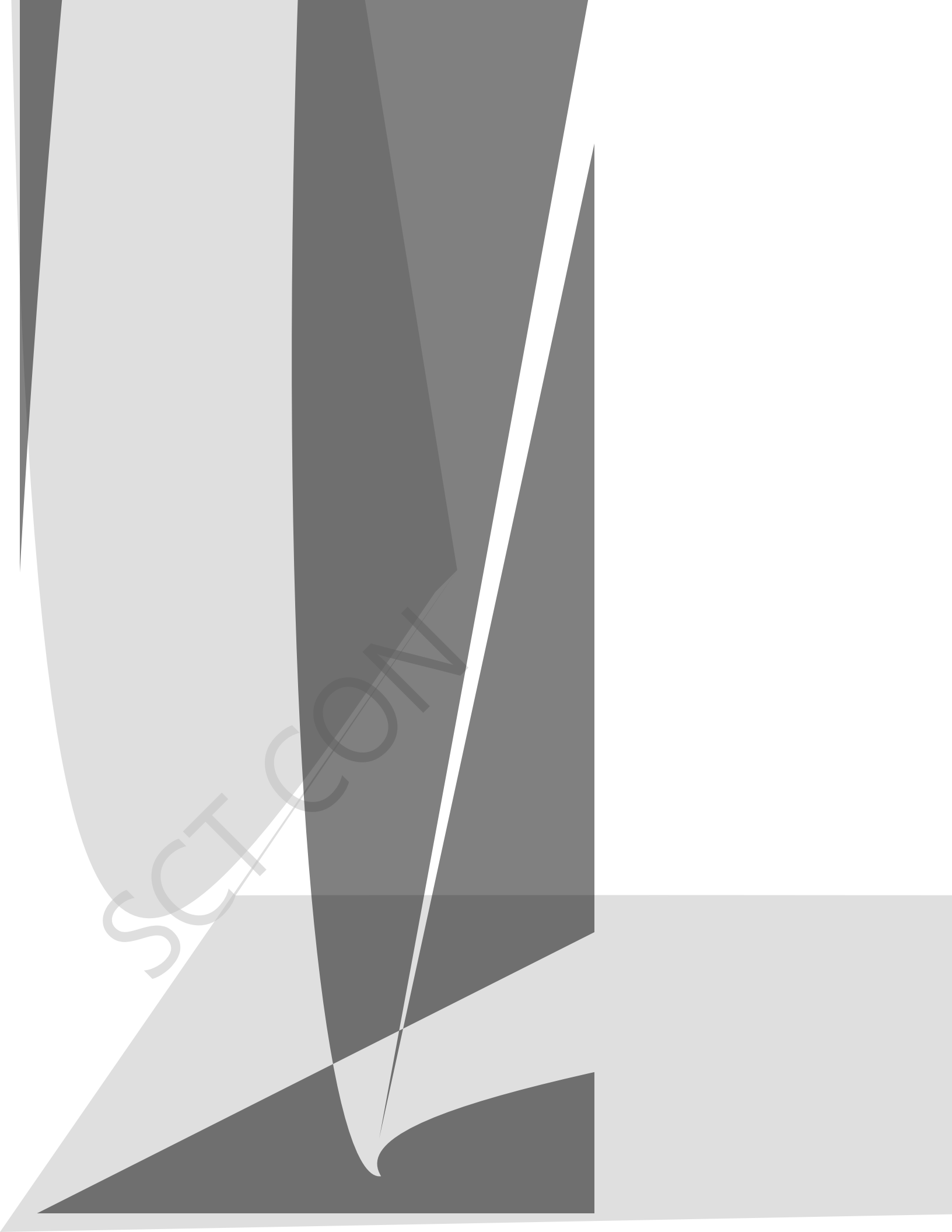
5fcX d a Vc _R Ua Vc W Ra ZReZ d UfVe eV=5 W TeZ eV fafee RXVTR_T dV eRT eV
d aV TYR Xvd W eV Zafe RXV 2d eV Zafe RXV d cUf TVUe VR eV fafee RXV ZV Uf cX d ZX
a VcfaR_Ua VcU _Raa ZReZ eV W V V eV YZY dZV D76E dR e Raac RTYeV ZZ f RfV
H ZY fe=5 W TeZ UV SV UeY a ZeeV d ZY Z X R SVT V V aR eR U ceV fafee RXV Z V
fe W Xf ReZ _E R Z eY d ac SV eVD4E %=5 UVRfe ReZ R cUf TV d eV d ZY Z X WbfV_T e
ZT dR dVeV W TeZ VUfe T TVR_U RZ eZ cXf ReZ _

6 V_ W eV Ufe T TVR eV dV eWbfV_T Z Z AUS eV ZZ f eZ V D4E %TR deZ RZ eZ dR SV
Rufde V_e W eV fafee RXV Uf cX eV eR dZ W YZY Zafe RXVe fafee RXV

:W eV Zafe fafee RXV dR Z e YZY V V W eV Tf eV TVU d eV T aV dR eZ daVT ZU aVR eV YZY
dZV D76E TR edYfeU _bf Z V fXYe RufdeeV fafee RXV EY Z TR f dV eV fafee RXVe
T eZ f fd ZT dR dVf eZ Vc RXV ac eV TeZ d eZ X V dU E R Z eY d Z ReZ _YV eV T Uf TeZ eZ V W
eV YZY dZV D76E e f TY d eV ZZ f eZ V UfVe eV ZT dR dV Z ZafeR_U fafee RXV U Wc TV
D4E % Z d ZY e R V Tf eV eT _e UV 2 W ceV YZY dZV D76E d e c W W eV dZV D76E
Z dV RZ aV_f eZeV ZUf Te cTf eV eUc ad SV eV dVf ZU R V Tf eV e 5fcX eY d aVcZU eV_V eT T
TTV ZSVS T W W dR eZ X d eV d ZY Z X WbfV_T Z UVT dR dV

)G dWdV_TV eRXV eVYXYdZV D76E d c_d W R Z 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_eVc_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 dV dV ZY Z_eVc_R d W dReaYdV



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 eZXZ 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 feZ_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 Z 6bfReZ_ (
= (-) (

H YVd/+

:=AA d eYV ZUfTe caVR e aVR TfæV_e
= d eYV ZUfTæR_TV WZUfTe c
W d eYV d 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 ZZ f ZUfTæR_TV d/bf dU FdV6bfReZ_) e TRTf ReV eYV ZUfTæR_TV RfV

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

H YVd/+

= : d eYV ZZ f ZUfTæR_TV d/bf dU
W d eYV d dTYZXWbfV_T
G FE

SCT CONF

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 d 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 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 d d 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

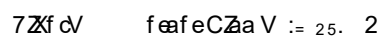
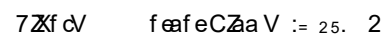
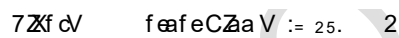
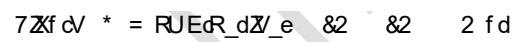
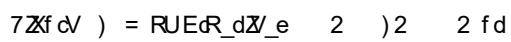
$$\Delta V_{OUT} = \frac{(\quad - \quad)}{8 \quad 2} \quad \%$$

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 R d e V S R 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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