

4.5V-100V Vin, 0.6A, High Efficiency Synchronous Step-down DCDC Converter with Programmable Frequency

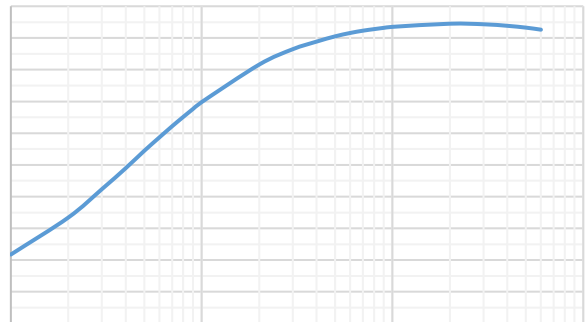
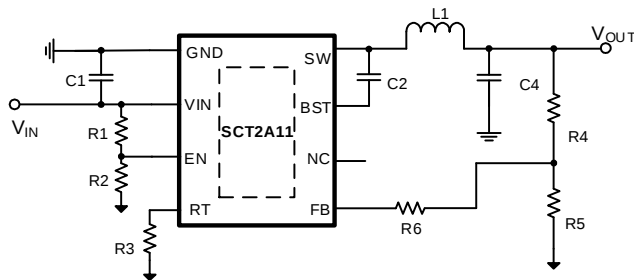
- Sea El qpN jca60*1R)-, , R
- , *2= kjpə qkqo Kqd qp qmajp
- , *4R - Baa _g Nabaraj_a Rklp ca
- E pacn pa 31, i Də d) Oea j 1, , i Hks) Oea Lks anl KOBAPo
- Bkn_a Lqloa Sepd l k qh pə j BLS l % k a
- Oi o E panj hOkbp op rp Pə a
- = fqop la Bramqaj_u / , , GDv pk 4, , GDv
- Lra _ə j Aj la Pdraodkh lkn Lrkn i i la El qp Rklp ca Qj anj rklp ca Hk_g Kqp Lrkpa _pə j QRHK % Pdraodkh j Duoparaoə
- u _la) u) u _la qmajp Hə ə j c
- Kran) Rklp ca Lrkpa _pə j
- Kran) Pai l an pə ra Lrkpa _pə j
- =r ə la ə j AOKL) 4 L _g ca

Pda O P. = -- ə , *2= ouj_drkjkqo q_g_kjraparo s ə d sea el qp rklp ca (n j c ə c bki 0*1R pk -, , R(s de d ə pacn pao j 31, i d ə d) oea l KOBAP j 1, , i Hks) oea l KOBAP*Pda O P. = -- (kl pə c pda _kjop j pə j pə a KP% i k a _kj pkl q oql l kno pda Bkn_a Lqloa Sepd l k qh pə j BLS l % l k a p k _d ə ra pda oi Hk qd qp rə l la p h ə d p l k _k j ə j *

Pda O P. = -- la pə rao l rkn i i la os ə d ə c bramqaj_u bki / , , gDv pk 4, , gDv (s de d l rkr e a o pda b a t e ə p k kl pə ə a a ə dan a b ə ə j_u kn at panj h _ki l k j a j p o ə a *

Pda O P. = -- k l b a r o _u _la) u) u _la _qmajp Hə ə j de _ql kran _qmajp l rkp a _pə j (p d a r i h o d q p k s j l rkp a _pə j (k qd qp kran) rklp ca l rkp a _pə j j ə l qp rklp ca qj anj rklp ca l rkp a _pə j * Pda a r e a ə r ə la ə j j 4) l ə j p d a r i H u a j d j _a OKL) 4 l _g ca *

- A) Pkk lə
- A) ə j a (O _k k p a n
- CLOPn _gan



Typical Application Efficiency, V_{OUT}=12V

6 & 7 \$

JKPA6L ca jqi aro tknl rar & qo rar & jo i u & an bki l ca jqi aro & pda _qma jpr aro & j *

Nar & j - *, 6Na la oa pk i r gap *

Nar & j - *: 6Ql cn a pk -, , R *

Nar & j - */ 6= l l l e p k j s r a l k r i o *

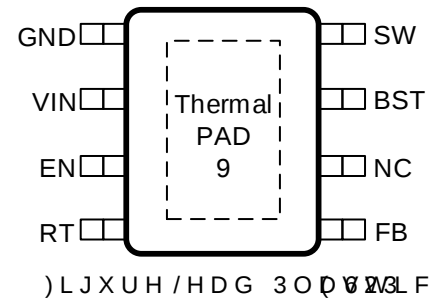
Nar & j - '06Ql pa N- j N. _ h q h p k j r l q a & l ca -- *

Nar & j - *16Ql pa ARE AKN AN E B KNI = P E K J *

25'(5\$%/('(9,&(O P, =--OPAN	3\$&.\$*,1* 7<3(P l a Naah	67\$1'\$5' 3\$&..47< 0,,	3\$&.\$*(0\$5.,1* .=--	3,16 4	3\$&.\$*('(6&5,37,2 AOKL)4
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Kr ankl an p j c b r a a) p a i l an p q r a q j l a o o k p d a n s e a j k p a - %

'(6&5,37,21	0,1	0\$;	81,7
RE(AJ	),*/	-,1	R
KKP	),*/	---	R
OS	)-	-,1	R
KKP)OS	),*/	2	R
B(NP	),*/	2	R
=i e j p p a i l an p q r a P=	)0,	41	
Kl an p j c f q j _ p k j p a i l an p q r a P F - %	)0,	-.1	
O p k n c a p a i l an p q r a P O P C	)21	-1,	



- O p r a o o a o a u k j p d k o a h e p a q j a n = o k h e p a l t e q i N p j c i u _ q o a a r e a l a n i j a j p i c a * P d a a r e a e j k p c q n j p a a p k b o j _ p k j k o p e a k b o N a _ k i i a j a K l a n p k j k j p k j o *
- P d a E & j t q a o k r a n p a i l an p q r a l r k p a _ p k j p k l r k p a _ p d a a r e a q n e c k r a n k _ k j p k j o * F q j _ p k j p a i l an p q r a s e h a t _ a a -1, s d a j k r a n p a i l an p q r a l r k p a _ p k j e _ p e a * k j p j q k q o k l a n p k j k r a p d a o l a _ e a i t e q i k l a n p j c f q j _ p k j p a i l an p q r a s e h r a q _ a h e p e a *

1\$0(	12	3,1)81&7,21
CJ	-	Crkqj
RE	.	E l q p o q l l h r k l p c a * k j j a _ p l k _ h u l o o _ l _ e k n b k i R E l e p k C J l e * L p d b r k i R E l e p k d e d b r a m q a j _ u u l o o _ l _ e k n j C J i q o p a o o d k r p o l k o o e h a *
AJ	/	A j h a l e p k p d a r a c q h p k n s e d e p a n j h l q l h q l _ q m a j p o k q n a * L q l h a l k s - *, 1 R p k e h a p d a _ k j r a n p a n * B l k p k n _ k j j a _ p k R E p k a j h a p d a _ k j r a n p a n * P d a p l k b r a o e p k n e e a n b k i R E p k C J _ k j j a _ p j c A J l e _ j f q o p p d a e l q p r k l p c a l k _ g k q p p d r a o d k h *
NP	0	O a p p d a e p a n j h k o e h p k n l k _ g b r a m q a j _ u * k j j a _ p r a o e p k n b k i p d e l e p k c r k q j p k o a p o s e d e c b r a m q a j _ u *
B	1	NV RING INP TO FTH TRNS COND CT NC ROR MPUR R H T P OF XT RN LF DB CK R S S I O R D I M D R I F O M T H O P T I O . S I S T H O P T V O I G H D M C R G L T S V O I G T O T H I N T R N L R F R N C V L O F T Y P I C L
J	2	J

OP	3	Lksanoql l l u e o t k n d e d) o e a l k s a n l K O B A P c p a n e a n * k j j a _ p , * - q B _ l _ e k n b r k i K K P l e j p k O S l e j * k k p o n l _ l _ e k n e _ d r c a s d a j l k s) o e a l k s a n l K O B A P e k j k n O S r k l p c a e l k s *
OS	4	Nacqh p k n o s e _ d e j c k q d q p * k j j a _ p O S p k j a t p a n j h l k s a n e j q _ p k n
Pdari h L	5	Da p e o e p k j l p d k b e * A t a _ p r e l l u _ k j j a _ p k j p k C J l e j * l q o p a _ k j j a _ p a p k c r k q j l h j a k j L t k n l r k l a n k l a n p k j j k l p e e a p d a r i h l a n k r i j _ a *

Kr ankl an p e j c b r a e) e p a i l a n p r a n j c a q j l a o o k p d a r s e a j k p a *

3 \$ 5 \$ 0 (7 (5	' () , 1 , 7 , 2 1	0 , 1	0 \$;	8 1 , 7
R _E	E l q p r k l p c a n j c a	0 *	- , ,	R
R _{KOP}	K q d q p r k l p c a n j c a	, * 4	. 0	R
P _F	K l a n p e j c f q j _ p k j p a i l a n p r a	) 0 ,	- . 1	

3 \$ 5 \$ 0 (7 (5	' () , 1 , 7 , 2 1	0 , 1	0 \$;	8 1 , 7
R _{AO}	D q i j k u l k a h D l % l a n = J O B F A A) F O , , -) . , - 0 o l a e e p k j (l h l e j o . %	) .	.	g R
	d r c a a r e a l k a h l % l a n = J O B F A A) F O , , .) . , - 0 o l a e e p k j (l h l e j o . %	) , *	, *	g R

(1) FA A k _ q i a j p F A L - 11 o p p a o p d p 1 , , R D l l k s o o b a i j q b _ p r e j c s e d o p j n A O _ k j p k h l r k _ a o o *

(2) FA A k _ q i a j p F A L - 13 o p p a o p d p . 1 , R l l k s o o b a i j q b _ p r e j c s e d o p j n A O _ k j p k h l r k _ a o o *

3 \$ 5 \$ 0 (7 (5	7 + (5 0 \$ / 0 (7 5 , &	(6 2 3	8 1 , 7
N _{F=}	F q j _ p k j p k i e j p p d a r i h r a o e p j _ a - %	0 .	t S
N _F	F q j _ p k j p k _ o a p d a r i h r a o e p j _ a - %	0 1 * 4	

- % O P l r k r e a o N_{F=} j N_F j q i a n o k j l u o r a b a r a j _ a p k a o p e p a f q j _ p k j p a i l a n p r a o k b p d a a r e a o * N_{F=} j N_F r a j k p _ d n _ p a n e p e k b l _ g c a e a l l u (q p k b i j u k p d a n o u o p a i h a r a h _ d n _ p a n e p e o o q _ d o p d a a o e j j h u k q p k b p d a l n e j a _ e q p k n L % j s d e d p d a O P . = - - e i k q j p a (p d a r i h l o e a (j a t p a n j h a j r e k j i a j p h b _ p k r o * P d a L k n e d a p o e j g p d p e o k h a r a p k p d a h a o j p d a r i h l k b p d a O P . = - - * d j c e j c p d a a o e j k n _ k j b e q n p k j k b p d a L k n _ d j c a o p d a a l l e e j _ u k b p d a d a p o e j g j p d a r a l k r a p d a _ p q h N_{F=} j N_F *

R_E 904 R (P = 9) 0 , z - . 1 (p u l e h r l u a e p a o p a q j a n . 1 *

6 < 0 % 2	3 \$ 5 \$ 0 (7 (5	7 (6 7 & 2 1 ' , 7 , 2 1	0 , 1 7 < 3 0 \$;	8 1 , 7
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3 R Z H U 6 X S S O \

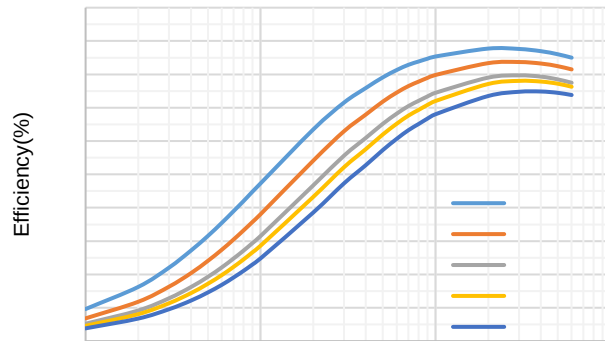
R _E	K l a n p e j c e j l q p r k l p c a		0 *	- , ,	R
R _E Q R H K	E l q p Q R H K P d r a o d k h D u o p a r a o e	R _E n e j c	0 *	0 , ,	R i R
E _D J	O d q p k s j _ q r a j p b r k i R E l e j	A J 9 , (j k l k	/		θ =
E _U	M q a o _ a j p _ q r a j p b r k i R E l e j	A J t k p e j c (j k l k (j k j) o s e _ d e j c (K K P) O S 9 1 R	- / ,		θ =

3 R Z H U 0 2 6) (7 V

N _{OKJ D}	D e d j o e a l K O B A P k j) r a o e p j _ a	R _{K K P}) R _{O S} 9 1 R	3 1 ,	i
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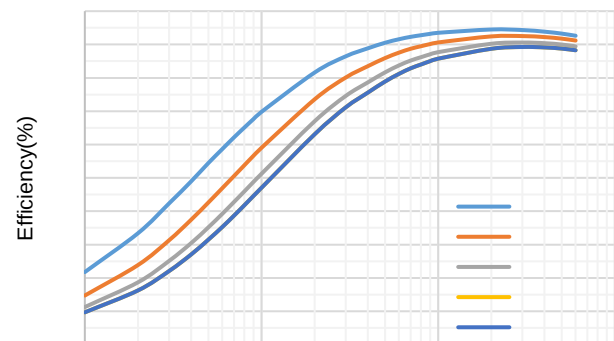
6&7 \$

6 < 0 % 2	3\$5\$0(7(5	7(67 & 21',7,21	0,1 7<3 0\$;	81,7
N OKJ H	Hks)oeaI KOBAP kj)raoep j_a		1,,	i
5HIHUHQFH DQG &RQWURO /RRS				
R _{NAB}	Nabara_j_arkp ca kbB		, *35. , *4 , *4, 4	R
(QDEOH DQW D B WKS				
R _{AJ D}	Aj la ded pdaodkh		- * -	R
R _{AJ H}	Aj la lks pdaodkh		- *, 1	R
E _{AJ H}	Aj la l e l qh)ql _qmajp	AJ9-R	-	θ=
E _{AJ D}	Aj la l e l qh)ql _qmajp	AJ9- *1R	0	q=
P _{oo}	Ej panj hoklpop rppa a		0	i o
6ZLWFKLQJ)UTLTXLHQF\				
B _{N=JCA NP}	Bramqaj_u n jca qoej c NP i k a		/,, 4,,	gDv
B _{OS}	Os e de j c bramqaj_u	NNP91,, g - %	0., 1,, 2,,	gDv
P _{KBB I B}	I e e qi kl)p a	R _B 9-. R	.,, . 2,	j o
&XUUHQW DQLP D W H U &XUUHQW 3URWHFWLRQ				
E _{E L}	HOI KOBAP I koea _qmajp h e e	Brki okqn_a k n e	, *4	=
P _{DE QL}	De_ql s e j c p a	J qi aro kbokl)op rp_u_hao	3	_u_hao
DE QL	De_ql qm_u_la		-. *1	



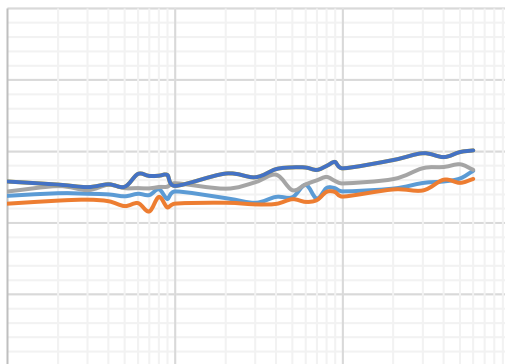
Output Current(A)

Beqra . * Ab_ej_u r o Hk qmajp Rkqp 1R%



Output Current(A)

Beqra / * Ab_ej_u r o Hk qmajp Rkqp 9- . R%

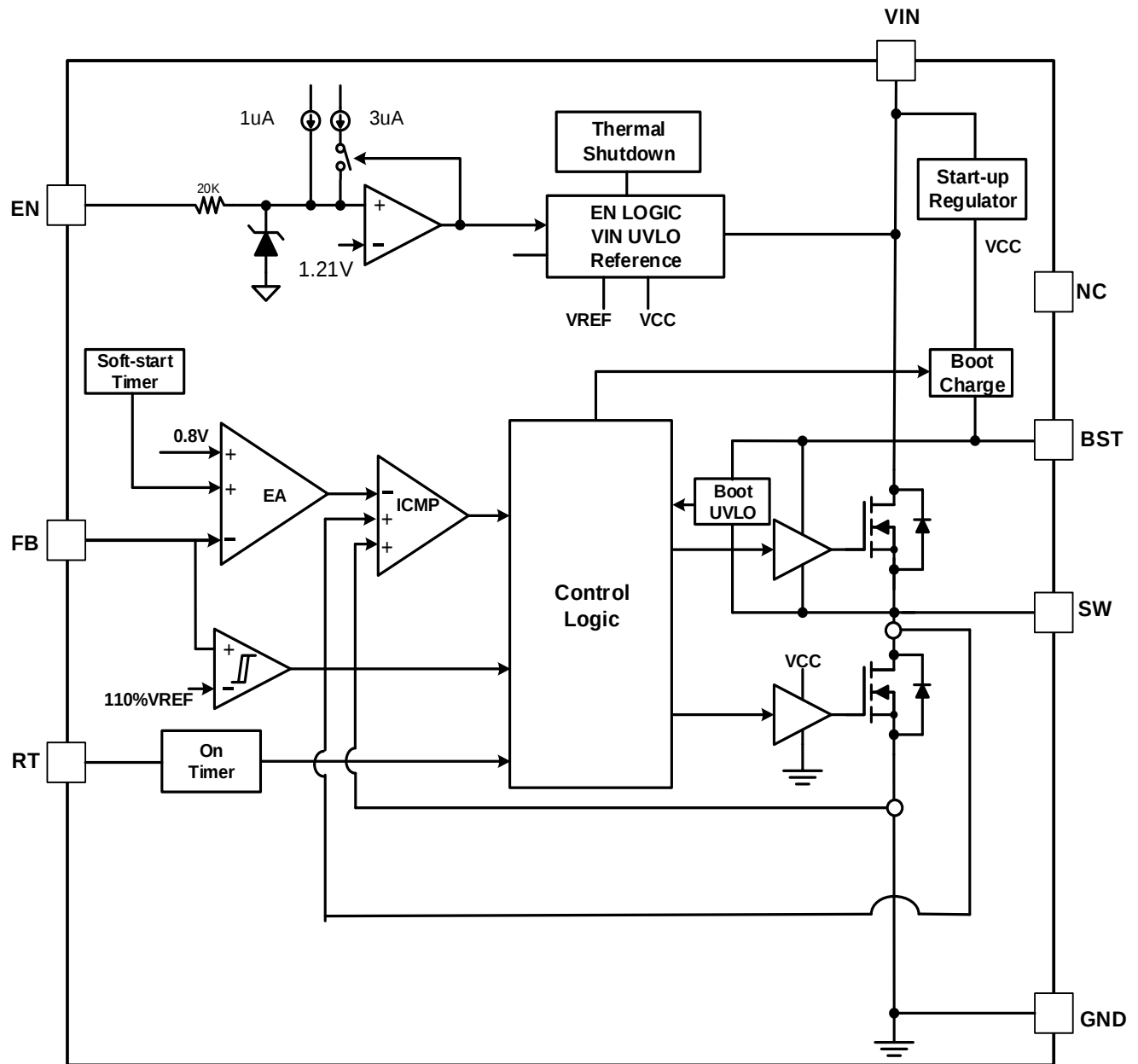


Beqra 0*Hk Nacqh p_x j Rkqp 0- . R%

Beqra 1 Brmqaj_u r o Pai l an pgra

Beqra 2*Odqp) ks j qmajp r o Pai l an pgra

Beqra 3*Enr o Pai l an pgra



Beqra 4*Bqj_pj h lk_g ecni

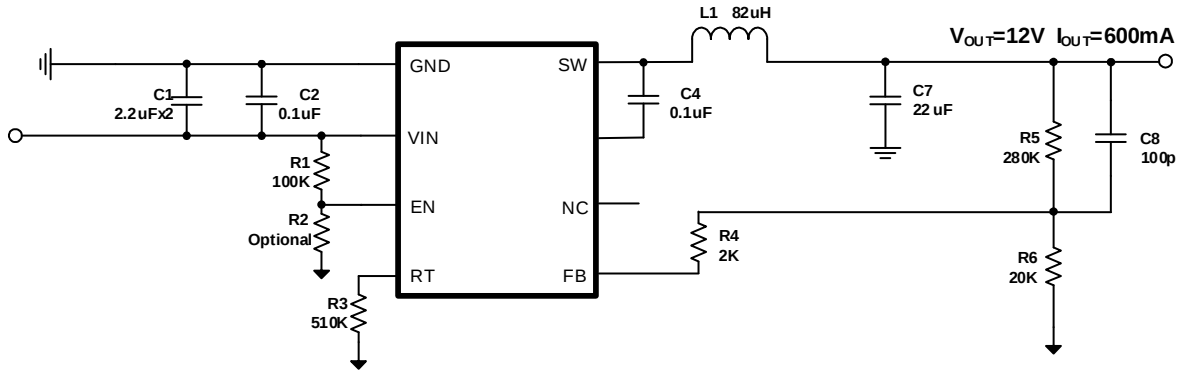
=j at panj h kkpoml _l _ekn aps aaj KKPl e j OS l e j l ks aro pda tk p e c c pa m e a n k d e d) o e a l k s a n
l KOBAP* Pda kkpoml _l _eknr klp ca e d mca b r k i j e p a c n p a r k l p c a n a c h p k n s d a j d e d) o e a l k s a n
l KOBAP e k t b j l k s) o e a l k s a n l KOBAP e k j *

Pda ē q_dkn_qmajp ē i k_jēkra qnēc lks)oea l KOBAP M. kj* Pda O P. =-- ē l hāi ajpō kran_qmajp
l rkpā_pkj s ed_u_ha) u) u_hā hē ē jēc lks)oea l KOBAP r hāu_qmajp j lks)oea l KOBAP r hāu_qmajp k rke
ē q_dkn_qmajp m_jjēc s u qnēc qjat l a_pā kran k knk qd qd n odkrp_kj ē j *

Pda O P. = - ē l hāi ajpōda Kṛan)rkṭp ca Lrkpa pāj KRL _en qeṇu p k i ē ē wa kqd qprkṭp ca kṛanōdkkp qnj c
lk m jōajp(ṛa_kṛan)c brki kqd qpb qṭp_kj pāj knēdpṭk m jōajp*Pda kṛanrkṭp ca_ki l n pkn ē KRL
_en qe_ki l ṛaōpda B l ē rkṭp ca p k pda ēpanj hrabaraj _arkṭp ca*S daj B rkṭp ca at_aa o --, kbēpanj h
, *4R ṛabaraj _arkṭp ca(pda dēd)oe a l KOBAP pñj o kṭbp rke kqd qprkṭp ca_kj pē q a p k ē _ṛa oa*S daj pda B
l ē rkṭp ca b hō alks -, 1 kbpda, *4R ṛabaraj _arkṭp ca(pda dēd)oe a l KOBAP _j pñj kj c ē *

Pda O P. = -- l r k p a p o p d a a r e a b r k i p d a i c a q n i c a t a o o e a d a p j l k s a n o o e p k j k j p k j o * K j _ a
p d a f q j p k j p a i l a n p q r a a t _ a a o - 23 (p d a e p a n j h p d a r i h o a j o k n o p k l o l k s a n l K O B A P o o s e d e j c * S d a j p d a
f q j p k j p a i l a n p q r a b l h o a l k s - / . (p d a a r e a n a o p n o s e d e p a n j h o k l p o p n p l d o a *

7\SLFDO \$SSOLFDWLRQ



)LJXUH 6 & \$ 'HVLJQ ([DPSOH 9DOXH ZLWK 3URJUDPPDEOH 89/

'HVLJQ UDPHWHUV

'HVLJQ UDPHWHUV	([DPSOH 9DOXH
El qprklp ca	04R Jkri h .0Rpk -, , R
Kqd qprklp ca	-. R
I t e qi Kqd qp qmajp	2, , i =
Os e d e c Bramqaj u	1, , GDv
Kqd qprklp ca n e l h l a g p l a g %	1, i R
Pn jo e j p Naol k jo a 2, i = pk 10, i = lk opal	Rk qp 9 / , , i R

2 X W S X W 9 R O W D J H

Pda kqđ qprkhp ca eoap u j atpanj hraoepkn eean
N1 j N2 ej pul e h l l l e pkj o_dai pe*
Na_ki i aj a N2 raooep j_a e -, *: G * Qoa amq pkj
1 pk _ h_qhpa N1*

Table 1. R₅, R₆ Value for Common Output Voltage (Room Temperature)

9 ₂₈₇	5	5
/ * R	2/ * G	. , G
1 R	-, 1 G	. , G
-. R	. 4, G	. , G
. 0 R	14, G	. , G

— 3 1%

s data6

- $R_{NAB} \otimes pda_{baa} \quad _g nabaraj_arkip ca(pul_e_h$
 $, *4R$

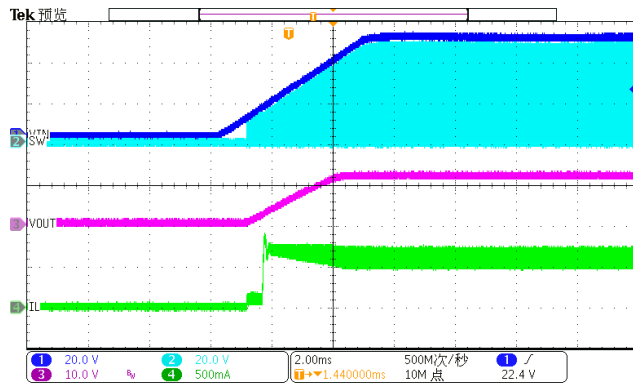
8 Q G H U 9 R/~~Q~~~~V~~~~W~~~~X~~~~M~~

=j at pñj hr klp ca e ean jas kmg kbN- WRP-107-A219 AJ l é j N. bki AJ l é pk pda crkqj _ j oappda
é l qpr klp ca o Qj anRklp ca Hk_g)Kqp QRH %

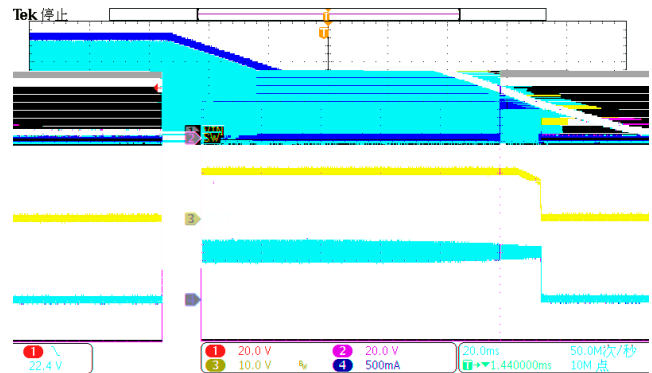
Pda rklp ca n pjc kbpda ejl qp_l _ekni qop a cra panpd j pda i t e qi ejl qprklp ca*=j pda_l _ekni qop
 lok dra nel la _qmajpn pjc cra panpd j pda i t e qi ejl qp _qmajpn el la* Pda NI O _qmajp ej pda ejl qp
 _l _ekn

\$SSOLFDWLRQ :DYHIRUPV

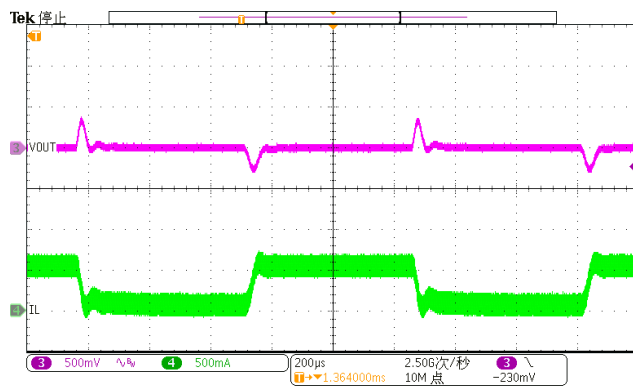
Rq 904R(Rk qp9-. R(qj laoo kpars oa j kpa



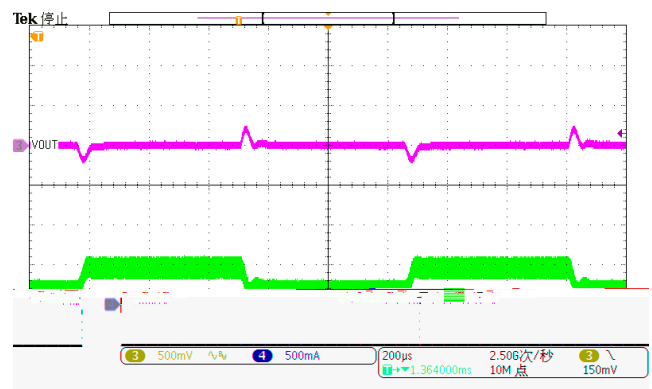
Bæqra -. *Lks anql



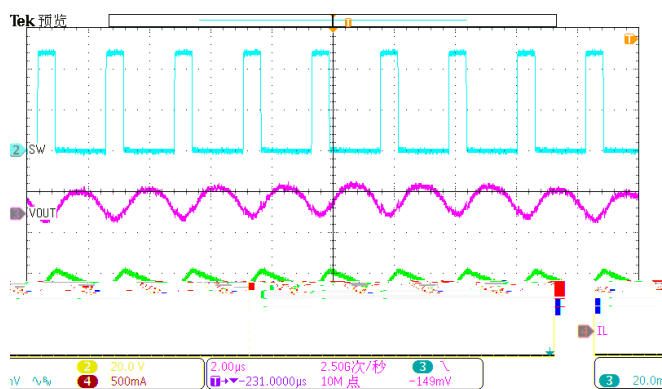
Bæqra - / *Lks an ks j



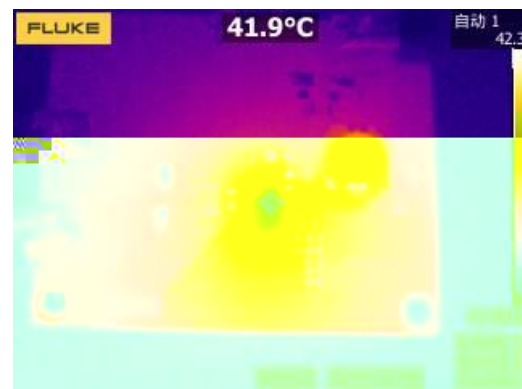
Bæqra -0*Hk Pn joæjp , *2=), *10=(, *1=+qo%



Bæqra -1*Hk Pn joæjp , *-1=), *01=(, *1=+qo%

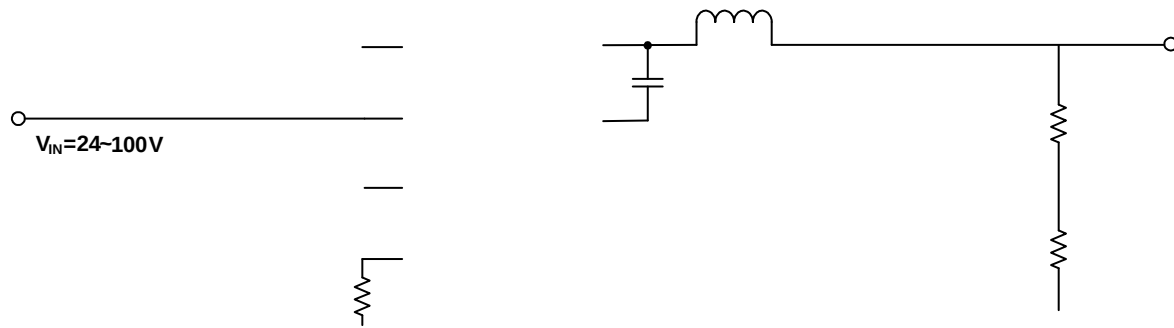


Bæqra -2*OS j RkqpNæI la

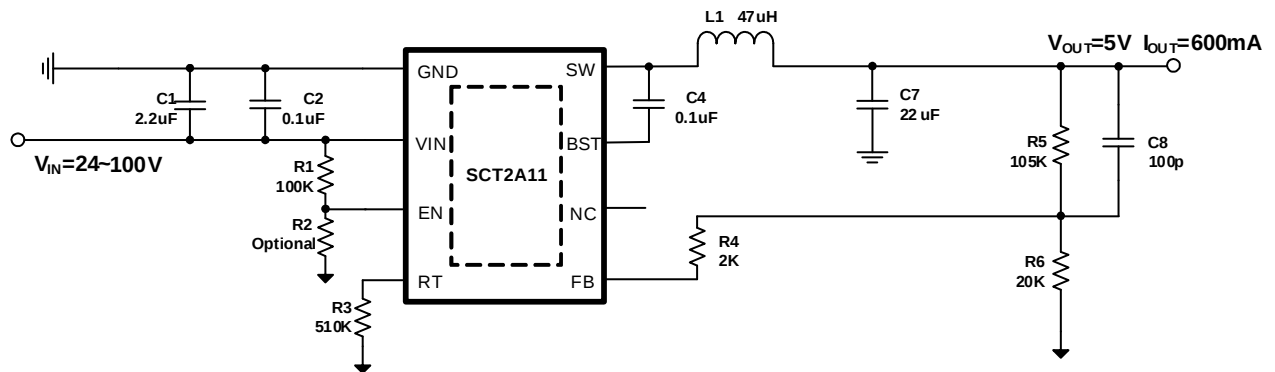


Bæqra -3*Pdari h04REJ (-. Rkqp(, *2=

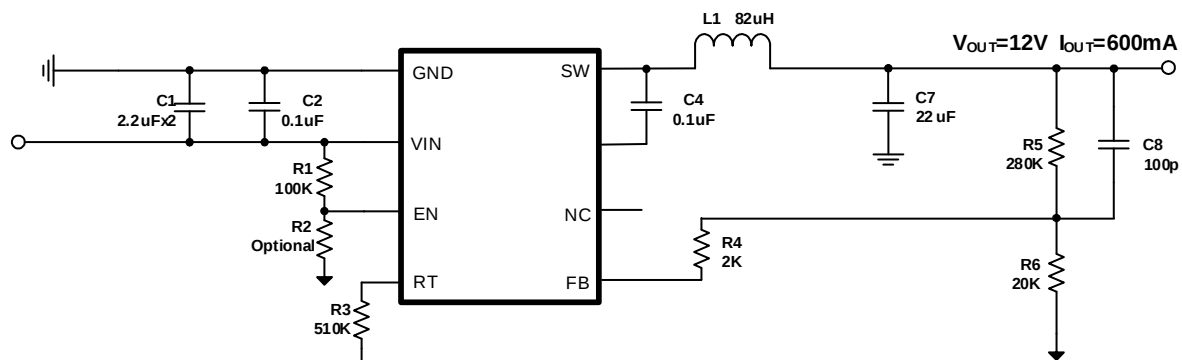
7\SLFDO \$\$\$@L@B\WLRQ



)LJXUH 9287 9 ,287 \$\$\$SOLFOWLRQ &LUFXLW



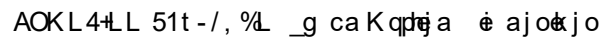
)LJXUH 92879 ,287 \$\$\$SOLFOWLRQ &LUFXLW



)LJXUH9287 9 ,287 \$\$\$SOLFOWLRQ &LUFXLW

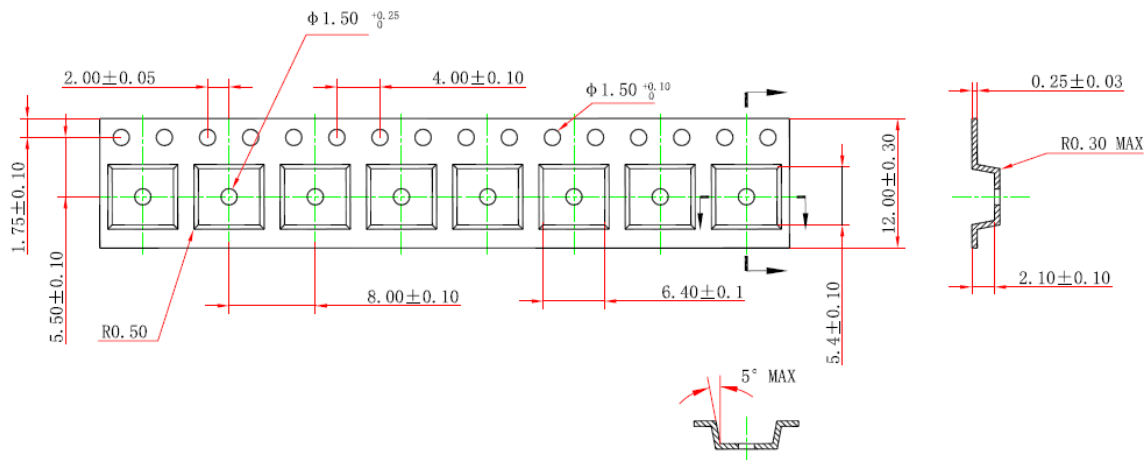
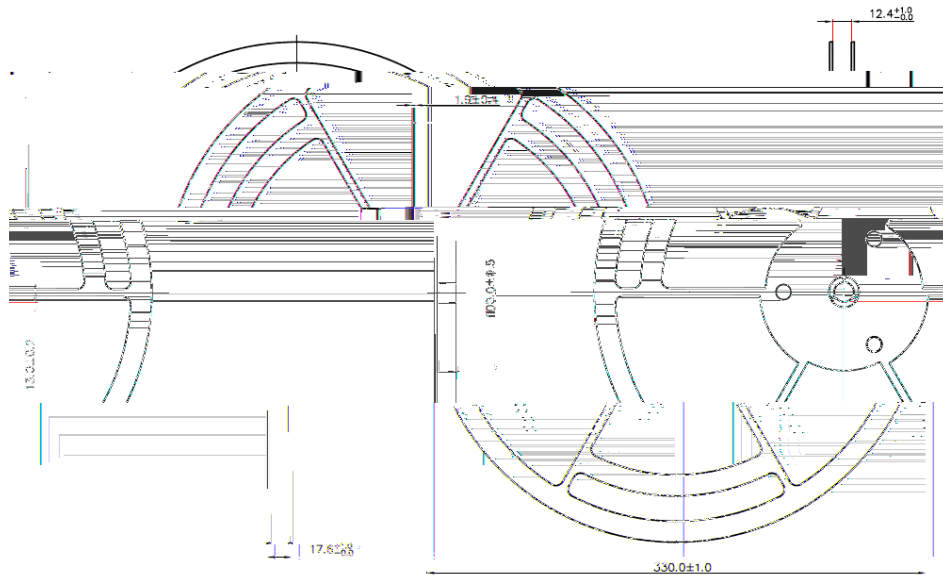
/D\RX*WLGHO LQH

Lrkl anL hukqpe _npe hknO P. =-- o op la j abe ajpklan pkj *Pda m _ao _kj q _p c b opo s _d _e c
 _qma j p knrkl p cao na a ou pk ej an _ps _d op u ej q _p j _a j l n o _e _l _e j _a pk cajan pa j k _e a j
 acn al a rkl j _a *Bkn apanraoql p (kl kls pdaoa cqe a h _e a o o alks _o s ra y a l a p a p
 1. Lksan crkqj ej c o _dai a _e ranu _npe h a _qoa kb _mu ej c lks an (pdari h j ch _d+ kqj _e c j k _e a
 ook _e pa s _e d _k _g bramqaj _u *Pda pdqi kb rql a _e pk i ga crkqj m _a lks aop _e laj aj _a j lks an na
 _e pre qpa araj l u kj L *Oq _e _e j p u l h _e c crkqj ra s _e h kl p _e va pdari h j jkp _qo ej c kranda p ra *
 2. Lh _a lks AON _an i e _l _e kn o _k oa pk RE l ej j pda crkqj ol kooe h _e k na q _a l n _e _e a l a k _e a j
 3. Bknkl an pkj pbql n n pa lk (pda pl oe a crkqj ra i qop l r krea amq pa da p _e _e p _e c na *l ga
 oqra pl



127 (

1. nsɛcɪrlkloa p̥ ai a FA A l _g cakqɛ al K)..., r nɛp̥j*
2. nsɛcɪjkpp̥k o_ la*
3. =lɪŋa n ɛ ajokjo ra ɛ i ɛi aparo*
4. Pdaɪ hl od lɪ aokhara kj p̥da k n *
5. ɛ ajokjokbatloa l kj k̥k̥i kbl _g ca k jkp̥ɛ_ h ai kh th od*
6. kj p̥L k n b nɛ p̥j k̥ni ɛ ɛ qi okhani ogsa p̥han j ao aps aaj p̥da l ɛ o*



127, & Pda ejtkri pjk ej pde k_qi ajpde oq fa_pjk_d jcas eokqj kpea* Qoaro odkqh s m j p j c q n j p a p d a p d e
l r p u e p a l a p q h l r k l a r u n e d p o n a j k p e l n j c a q l k j s d a j e p a c n p j c O e k j k j p a j p a _ d j k l k c u O P % r k q _ p e j k j u
l l h e p k j * O P s e h j k p o o q i a j u h a c h r a o l k j o e e p u t k n j u o e l l h e p k j o *