

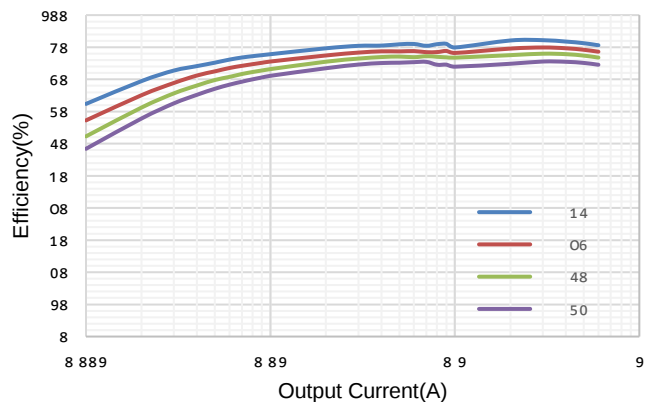
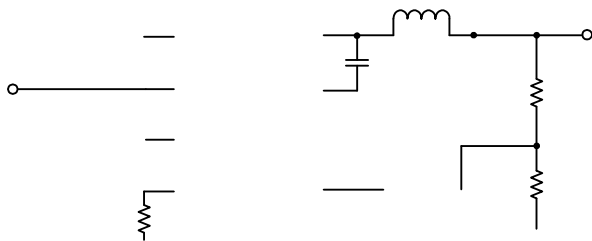
4.5V-100V Vin, 0.6A, High Efficiency Synchronous Step-down DCDC Converter with Programmable Frequency

- R_d DkpoM i b 5/)0Q, ++Q
- +)1 j i d p j p n J p d k p o p m i o
- +)3Q , A _ f M a m i Q j g b
- D o b m o _ 20+h C d c (N d _ i _ 0++h G r (N d _ K j r m H J N A O n
- K p g A m l p i t H j _ p g a j i K A H r d e , ++p L p d n i o p m i o d N g k H j _
- / h n D o m g N j a (n o m O d h
- _ p n o g A m l p i t . ++F C u g 3++F C u
- K m d d i i g O c m n c j g a j m K n j b m h h g D k p o Q j g b P i _ r f Q j g b G j f J p o K n j o a j i P Q G J O c m n c j g _ i _ C t n o m n d h
- t g (t (t g p m i o G h d d b
- J q r f Q j g b K n j o a j i
- J q r f O h k m p m K n j o a j i
- q g g d i N J K (3 K f b
- (Q j g
- (d N j j o m
- B K N O m f m

Oc N O _ , + d h +) 1 n t i c n j i j p n p f j i q m m r d e r d _ d k p o q j g b m i b d b a n j h /) 0 Q d j , ++Q r c d c d o b m o n i 20+h c d c (n d _ H J N A O i _ 0++h g r (n d _ H J N A O) O c N O _ , + _ j k a d b a j i n o i d j i d h J O h j _ j i o n j n p k k j n a K A H r d e d k d g , ++p g r l p d n i o p m i o r c d c n n d h a j i q m m j i c d q d b c d c a d d i t o g u c o g _ j m o i _ t j i _ d j i)

Oc N O _ , + a p m n k n j b m h h g n r d c d b a m l p i t a n j h . ++f C u g 3++f C u r c d c k n j q d _ n a a g s d d h g j k a d h d e m a d d i t j m s o m g j h k j i o n d h)

Oc N O _ , + j a a m t g (t (t g p m i o G h d i _ c d p k j q m p m i o k n j o a j i a r h g n c p o j r i k n j o a j i j p d k p o j q r f q j g b k n j o a j i i _ d k p o q j g b p i _ r f q j g b k n j o a j i) O c _ q d d q g g d i 3 (k d a r h g u i c i _ N J K (3 k f b)



M NJI ZG	G r (nd_ HJNA Oji (mncho i		0++	h
Q _M A	M a mi qjϑ b jaA=		+)24- +)3 +)3+3	Q
Q _I ZC	i g cϑc æmncj g_		, > ,	Q
Q _I ZG	i g g r æmncj g_		,)+0	Q
D _I ZG	i g kð kpϑpk pmi o	I 8, Q	,	
D _I ZC	i g kð kpϑpk pmi o	I 8,)0Q	/	p
Q _h n	Do rh gnj æno roth		/	h n
A _M I B ZMO	Aml p i t mi b pnð b MOh j_		. ++ 3++	f Cu
A _{NR}	Nr ϑ cð b aml p i t	M _{MD} 80++ f ,	/ - + 0++ 1++	f Cu
Q _J AAZHð	Hð ðh ph j æð	Qð 8, - Q	- ++ - 1+	i n
D _h ZK	GNHJNA Okjnðð pmi oðh ð	Anjh njpm g_ mð	+)3	
O _{CD} PK	Cd pk r ðð b ðh	I ph m janjaðno r t gn	2	t gn
CD PK	Cd pk _pð t g		, -)0	
Q _J QK	A _ f j q rjϑ b r ϑc mnk oq ma mi qjϑ b	Q _A =*Q _M A nðð b Q _A =*Q _M A a gð b	, , + , +0	
Q _N	Oc rh gncpo_jr i æmncj g_	Q _E nðð b Ct no mnð	, 12 . 0	

Oc N O-, + a /)0Q, ++Q d kpo +)l j p d k p o d o m g j h k i n o _ n t i c n i j p n p f j i q n o m r d e p d d
20+h M_nji c d c (n d _ i _ 0 ++h M_nji g r (n d _ k j r m H J N A O h) d d k g h i o j i n o i o j i a h j i o g g j
m b p g o j p d k p o q j o b k n i q d d b s o i o g i _ g _ o m i n d i o m n k j i n)

Oc n r d c d b a n l p i t d k r i b m h h g a r h . ++f C u j 3 ++F C u r d e m n d j m a i b g j k o d i n d e n e k j r m
a d d i t j n e s o m g j h k j i o n d i n) O c N O-, + a o m n i d o m g / h n n j a (n o r o a h g j q d g r b
d r p n c p m i o i _ j p d k p o q j o b j q m c j j o _ p n i b n o r p k) O c _ q d o j n p k k j r n h j i j o d n o r p k r d e k m (
d n _ j p d k p o j i _ d j i) O c n h g n n h j _ (o m i n d j i o i K R H h j _ i _ K A H h j _ j k m a j i n i n p m
c d c a d d i t j q n r d _ g _ p m i o m i b) O c l p d n i o p m i o d d k d o , ++p p i _ m j g _ i j i (n r d c d b
j i _ d j i g c d q c d c a d d i t o g o c o g _)

Oc N O-, + c n _ a p d d k p o n o r p k q j o b j a .) 0 Q r d e / ++h Q c t n o m n d) O c l k d d c d c (q j o b
k d r d e k m d j i a m n c j g a o i p n _ g _ o n o a d k p o q j o b g f j p o a m n c j g n r d e o j s o m g
m n d j m g h o p m o c d c n P Q G j n t n o h m l p a n h i o) A g a i b l k d i g n a _ q d r d e a d o m g
k p o p k p m i o g a e k d) j i i a i b l k d g Q D _ a n o j n o r n p k a _ q d p g h a d o)

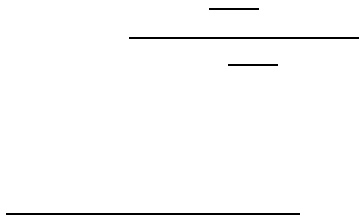
Oc N O-, + a o g r i o a j i a o m n d o _ a d k p o p i _ r a j o b g f j p o a j p d k p o j q r a j o b k r i o a j i
j q m p m i o k r i o a j i r d e t g (t (t g p m i o g a i b i _ c d p k h j _ j p d k p o c m n c j n k r i o a j i i _
a r h g n c p o _ j r i k r i o a j i)

Oc N O-, + h k g t n j i n o i d j i (O d h H j _ j i o g k n i q d d b a n o m i n d i o r d e k n p _ j a s _ n r d c d b
a n l p i t) o a b d i d b j a c n r d c d b t g a c d c (n d _ H J N A O L , d o r n _ j i a m a s _ d o r g
i _ a d _ p g m p m i o n d n g c r b p k a j p d k p o q j o b) R c i a c d c (n d _ H J N A O L , d o r n _ j a i _
a g r (n d _ H J N A O L - d o r n _ j i a m _ _ a h _ p m a j i) R c i n i n _ a q o t p m i o k n n d b j i a
g r n d _ H J N A O g r n e i a J H K p m i o a m n c j g a _ q d o r n j i l , i _ a g r (n d _ H J N A O L -
o r n j a) = n _ j i Q d i _ Q j o q j o b a _ q d k m _ d o m l p a n _ j a (a h i _ o r n j a g r (n d _ H J N A O L -)
O d m k o j i t g (t (t g n _)

Oc N O-, + a i g _ r c i a Q D k d q j o b n n j p o /) Q i _ a l k d q j o b s _ n a i g
a m n c j g j a ,) , Q) O c _ q d a h _ g _ r c i a Q D k d q j o b a o g r .) 3 Q j n r c i a l k d q j o b a
g r ,) + 0 Q) i d o m g , p k p o p k p m i o n j p m g l k d o r n a _ q d i g r c i l k d a j o)

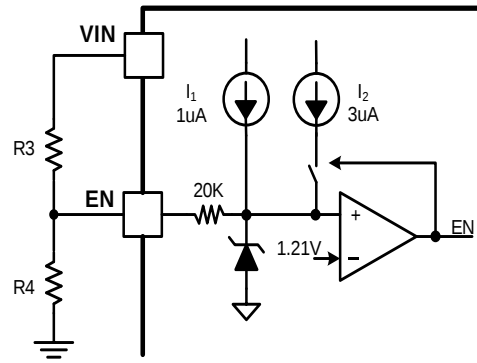
l k d d c d c q j o b k d a o i j i i o _ g Q D _ a n o j n o r n p k a _ q d)

A j m c d c m t n o h P Q G j a m n c j g j i i o i s o m g m n d j m d d m M i _ M n e j r i d A d p m 4 a r h Q D
g l) O c P Q G j n d b i _ a o b a m n c j g i g p g o _ t l p a j i , i _ l p a j i - m n k a d o)



R c m

Qno r05Qd nñ æmncj g_ g_ i g æ _ qd
 Qnq k5Qd a æmncj g_ g_ _ ð g æ _ qd
 D8. p
 D8. p
 Q I M8,)-, Q
 Q H A8,)+0Q



Àðpm 4) Nt no h PQGJ t i g _ ð d

Oc N O- ,+ mbpgonæ ðorñ gmami qjðb o+)3Qr ðæ±, qgmi jq næ jk mailbohk mðpm i_ qjðb mi b) Oc jpkpoqjðb ðn o t mnðqj m_ ð d mañh æ jpkpoi j_ q æ A= kð) ð ð m j h h i _ _ g p n , qgmi j m æ m m n ð q m) P n l p ð j i . q g p g o m n ð o i j a m n ð q j m _ ð d m) Q j ð k n j q æ d i t o ð c o g _ n g r b m q ð m n ð q j m m m j h h i _ _) C j r q m æ æ q ð n m q j c ð c æ m b p g j n r ð h j m n p n k æ g q j i j æ æ æ b j p k p o q j ð b p m t)

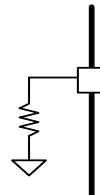
r c m

- $M_A = Z_{OUK}$ ð æ m n ð q j m j i i æ b æ j p k p o q æ A= kð)
- $M_A = Z = J O$ ð æ m n ð q j m j i i æ b æ A= kð q æ b r j p i _)

Oc N O- ,+ ð o b m o n i ð o r ñ g n j æ (n o r o ð n p ð æ o m h k n æ m a m i q j ð b a n j h u n j q j ð q j +) 3 Q m a m i q j ð b ð / h n) ð æ l k ð ð k p g _ g r ,) + 0 Q n r ð c ð b n q k n i _ æ ð o r ñ g n j æ (n o r o m n o) Oc n j æ (n o r o g j m n o n _ p n ð b n c p o j r i _ p q æ r h g j q n g _ ð b)

Oc nr ð c ð b a n l p i t j æ N O- ,+ ð n o t k g ð b m n ð q j m o i M O k ð i _ æ b r j p i _)

Ð m n ð q j m æ b a n l p i t h j _ m n ð q j m k g _ o i M O k ð q æ b r j p i _ n o æ n r ð c ð b a n l p i t j q m r d _ m i b a n j h . + + F C u q 3 + + F C u) M O k ð ð i j o g r _ q g æ æ æ b j m c j r o _ q æ b r j p i _) P n l p ð j i / j m æ k g o ð À ð p m , +) q _ o r h ð æ m n ð o i q j m n r ð c ð b a n l p i t i _ _)



R c m

æ r ð n r ð c ð b g f a n l p i t

Àðpm , +) N æ b A n l p i t

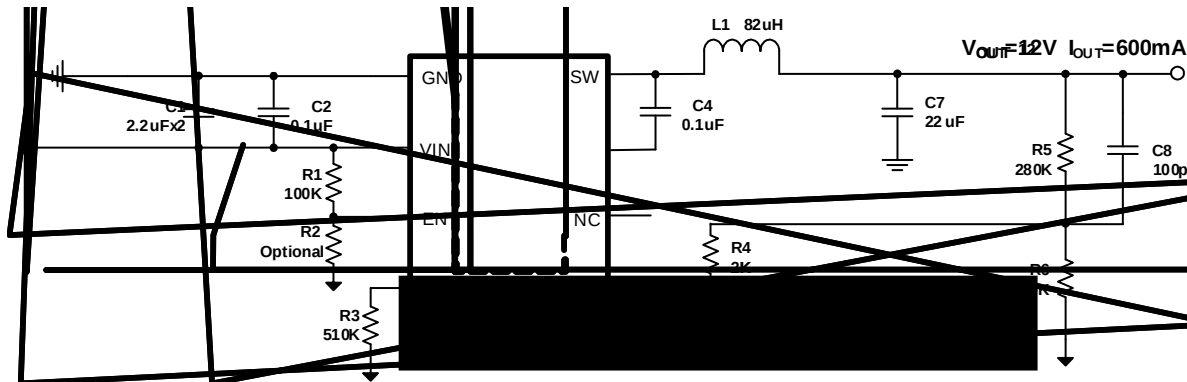
)

i so m g j j o m k k d i m o i = J J O k d i _ N R k d k j r m a e a j a i b b o _ n d m j c d c (n d k j r m H J N A O) O c j j o m k k d m j q u b d c r b _ a n h i d o b m o _ q j u b m b p g d m r c i c d c (n d k j r m H J N A O d j a i _ g r (n d k j r m H J N A O d j i)

O c d i _ p q m p m i o d h j i d i m _ p n d b g r (n d H J N A O L - j i) O c N O , + d k g h i o j q m p m i o k n j o a j i r d t g (t (t g d i b g r (n d H J N A O q u t p m i o i _ g r (n d H J N A O q u t p m i o q q j d d i _ p q m p m i o p i i d b r t _ p n d b p i s k o _ j q n j _ j m j p d k p o c m n c j r j i d j i)

O c N O , + d k g h i o a J q r (q j u b K n j o a j i J Q K d n p d n q h d d d j p d k p o q j u b j q m c j j o _ p n d b g _ o m i n d i o m j q n d b a n h j p d k p o a p u j i d j i j m g d c o g _ o m i n d i o) O c j q r q j u b j h k m q m d J Q K d n p d j h k m n a A = k d q j u b q a d o m g m a m i q j u b) R c i A = q j u b s _ n , , + j a d o m g +) 3 Q m a m i q j u b a c d c (n d H J N A O p r n j a q q j d j p d k p o q j u b j i a i p q d m n) R c i a A = k d q j u b a u g r , + 0 j a c +) 3 Q m a m i q j u b a c d c (n d H J N A O i p r n j i b d)

O c N O , + k n j o o a _ q d a n h a _ h b _ p n d b s n n d c o i _ k j r m d n d a j i j i d j i n) J i a e p i a j i o h k m q m s _ n , 12 a d o m g a r h g n i n j m q k n k j r m H J N A O n r d c d b) R c i a e p i a j i o h k m q m a u g r , . - a _ q d m n o r n r d d o m g n j a n o r a k c n)



DkpoQj ɸ b	/3Ql j m g -/Qg , ++Q
J pdkpoQj ɸ b	, - Q
H s d h p h J pdkpo p m i o	1++h
Nr ɸ c d b A m l p i t	0++ F C u
J pdkpoqj ɸ b n k k g k f g k f	0+h Q
Q m i n d i o M n k j i n 1+h g 0/ +h g _ n o k	Q j p o 8 / ++h Q

Oc jpdqpoqj b d n o t i s o m g m n d j m d d m
M0 i _ M1 d d k d g k k d d i n c h d)
M j h h i _ M1 m n d o i d , +) F) P n l p d i
0 d g p g o M0)

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

.) Q	1.)0 F	- + F
0 Q	, +0 F	- + F
, - Q	- 3+ F	- + F
- / Q	03+ F	- + F

— 0
r c m5

- Q_M A d d a _ f m a m i q j d b d k d g
+) 3 Q

i s o m g q j d b _ d d m i s j n j a M, a j h d d k p o d l k d

- Q_{PO} ණය j p d k p o q j ් b
- Q_h ණය ධ k p o q j ් b

Nධ ණය ධ_p q j r p m i o n k k g ධ m n n r ණය ධ k p o q j ් b n j ණය h s ධ p h ධ k p o q j ් b ධ k k ් ට j ධ ් t n p n _ q j g p g o ණය h ධ p h ධ_p o i m l p ධ n _) P n l p ට j 4 q j g p g o ණය ධ_p o i q ් ්)

4

R c m

- G_h ණය h ධ p h ධ_p o i m l p ධ n _
- a_r ණය n r ධ c ධ b a n l p i t
- Q_{PO} ණය j p d k p o q j ් b
- Q_{h s} ණය h s ධ p h ධ k p o q j ් b
- D_{PO h s} ණය h s ධ p h ් _ p m i o
- G_M ධ j a d d i o j a ධ k k q j D_{PO}

O c q o g p m i o a j r ධ b a n p b c ණය ධ_p q m ණය ධ_p q m k k g p m i o k ් n ණය j p d k p o p m i o R c i n g ධ b i ධ_p q m c j j n ධ m o _ p m i o n k d ් ් ණය n ් m ට j p m i o g r b m a i ධ k f j k m ට j p m i o i _ M H N p m i o ් j i o s _) O c m a j m ණය k f n r ධ c ධ b p m i o j a ධ_p q m ධ k f i _ ධ M H N i g p g o _ n ධ l p ට j , + i _ l p ට j , ,)

, +

R c m

- ධ k f ණය ධ_p q n k f p m i o
- D_{PO} ණය ් _ p m i o
- ධ k k ණය ධ_p q n k f (q (k f p m i o
- ධ M H N ණය ධ_p q n M H N p m i o

D j q n ් _ ධ b j m ් _ o n i n d i o j i _ ට j i n ණය ධ_p q m ් ් p m i o i ධ m n p k q ණය n r ධ c p m i o ් ් ට j a ණය _ q d r c d c ධ k d ් ් + 3) O c h j n o j i n m ් ් k k n ් c ධ q c j j n i ධ_p q m ණය n ් m ට j p m i o m a i b b m o m a i + 3) = p n j a c h s ධ p h ධ k k ් ් ් ් t _ q d ණය h s ධ p h j p d k p o p m i o a c o a N O - , + i _ ් m ් ් k i _ n j i a ධ_p q m p m i o n k k g) O c p n ණය h s ධ p h _ n ධ _ j p d k p o p m i o ් ් a ් ් n g ට j j a ධ_p o i) O c n h ් m ධ_p q m n p ් ් g r b m ධ_p q m p m i o n k k g g _ ධ b q c ධ c m h s ධ p h j p d k p o p m i o)

A j m a ් _ n ධ i p n G M 8 +) - j m +) . i _ ණය ධ_p q m ් ් ් g p g o _ q . . p C) O c M H N ධ_p q m p m i o a h 1 + + h i _ ණය i _ k f i _ q ් ් ් ධ_p q m p m i o a h 3 1 + h i _ . / + h m n k ් ් ්) O c c j n i ධ_p q m h R 2 / 2 2 , 7 . . + r c d c c n n ් m ට j p m i o m a i b j a -) 4

O c ධ k p o p m i o q ණය n o k (j r i j i q n o m ් ් ් j i a i p j p n ණය m a j m ධ m l p ධ n k ට j m ් n p k k ් ් ණය p m i o q ණය n o k (j r i j i q n o m c ් h ධ o ධ ධ b ණය ධ k p o q j ් b) P n k ට j m r ණය ් r N M ් m ් ් n k r ් ් i) m h d k ට j m r ණය S O M j n S 2 M _ d g ් ් n m p n p ් ් n p b b n o _ p n j a c ් ් r N M i _ n h ් ් h k m q m j a d d i o i _ ධ n ් i b ් m j h h i _ _ q j p n i j a m ් r m ් ් k ට j m) b) + , p A r ණය n h ් ් k f b n ධ + 3 + 0 q a ් m c ධ c a n l p i t n r ධ c ධ b i j ්) K g ණය n h ් ් n ධ k ට j m n ් n q j Q D i _ B l k ධ n n k j n d g)

Oc qjgub mabjaac dkpo k djm pno bm omac i ac h sdhph dkpoqjgub) i_ ac k djm pno
gjc q nkgg pmiomab bm omac i ac h sdhph dkpo pmiomnkg) Oc MHN pmiomac dkpo
k djm i gpgp_ pndb lp dji , -)

Oc rjmo n ji_ dji j pm oQd8- %QJPO r c m5

Ajmdkgd dji cjjn i dkpo k djm ac i MHN pmiomab bm omac i c gjaac h sdhph g _
pmio)

Rc ing adb mhd k djm di _nq jind_ maa aa ad qg ja k djm_ mndb nae
dnqjgub njnn k djm m n n)

Oc dkpo k di qg _ omd nae dkpo nkg qjgub jaac mbpgjnh Oc dkpoqjgub nkgg i
gpgp_ pndb lp dji , / i_ ac h sdhph dkpoqjgub nkgg j pm o0+ _pd t g)

Ajmdk s hkg am -)- AS2M mhd k djm mo_ ajm, ++Qd k mgg m pn _) i_ +), Ajmdk
anl pit adnab k djm nkg _ n gn nkjndg djae _ qd kan)

+, A mhd k djm pno jii o_ o i =JJO kd i_ NR kd ajmknk mjk madi) mhd
k djm ac S0Mjm onbm_ _dg ad am jh h i_ _) Oc k djm cjpg_ c q -0Qjmdk rjgub
mab)

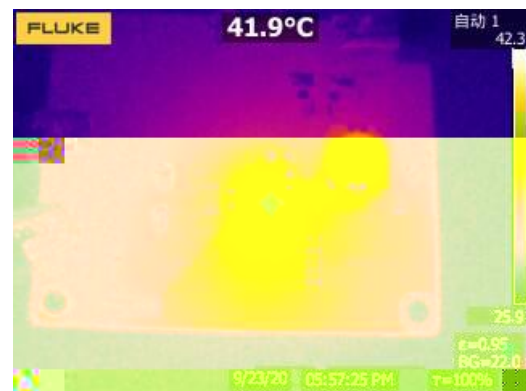
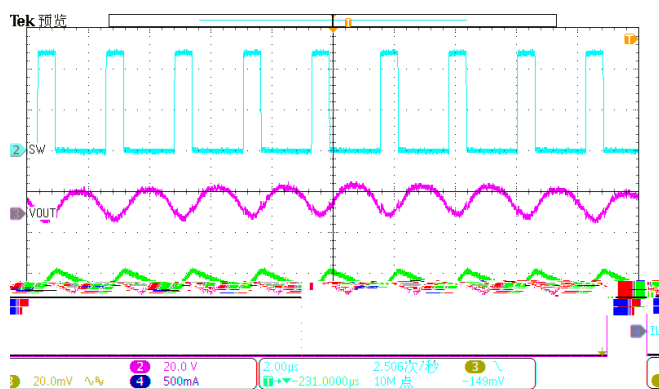
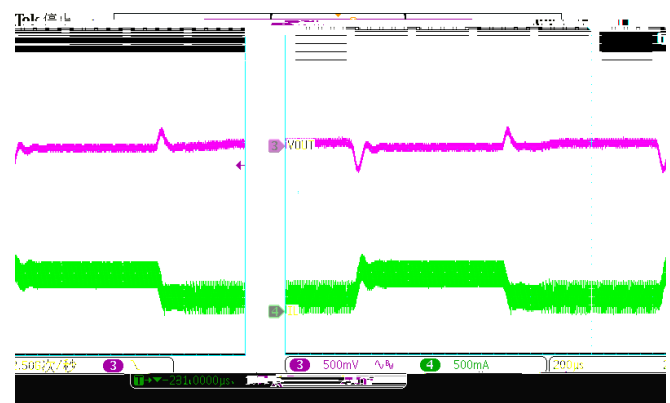
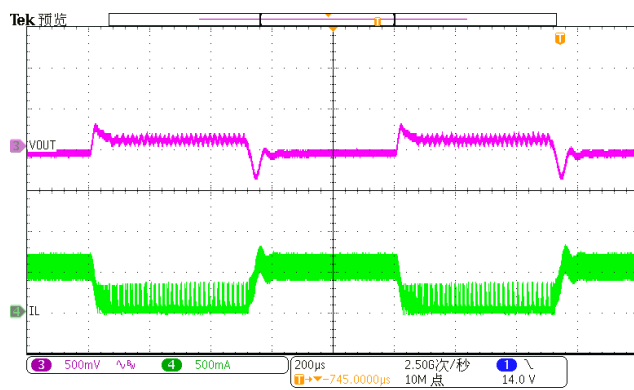
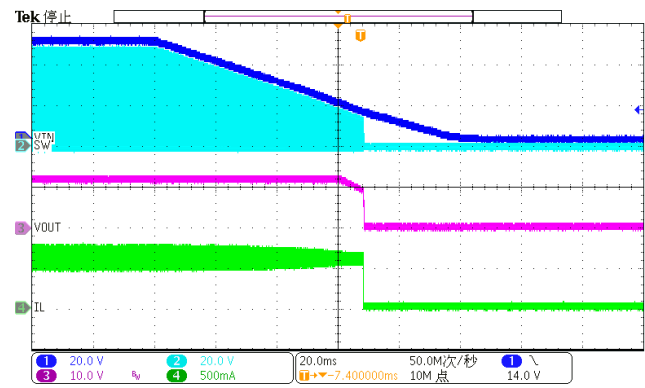
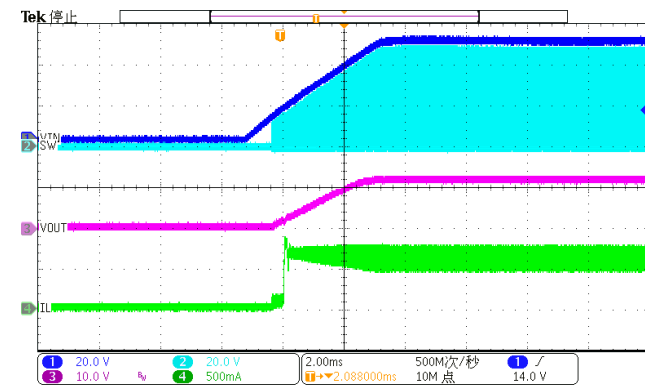
Oc ng dji jajpkpo k djm ad aa ojpkpoqjgub nkgg dno _t no o i_ g _ amindiok rjrh i)

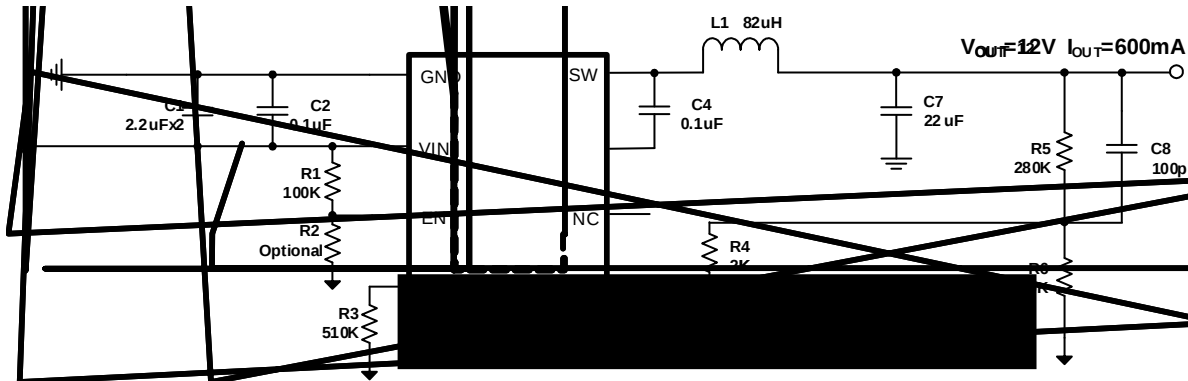
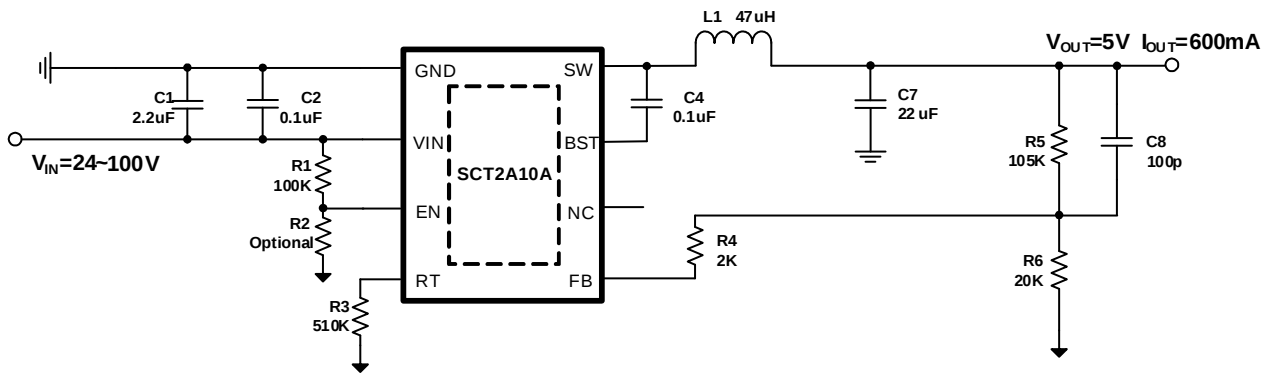
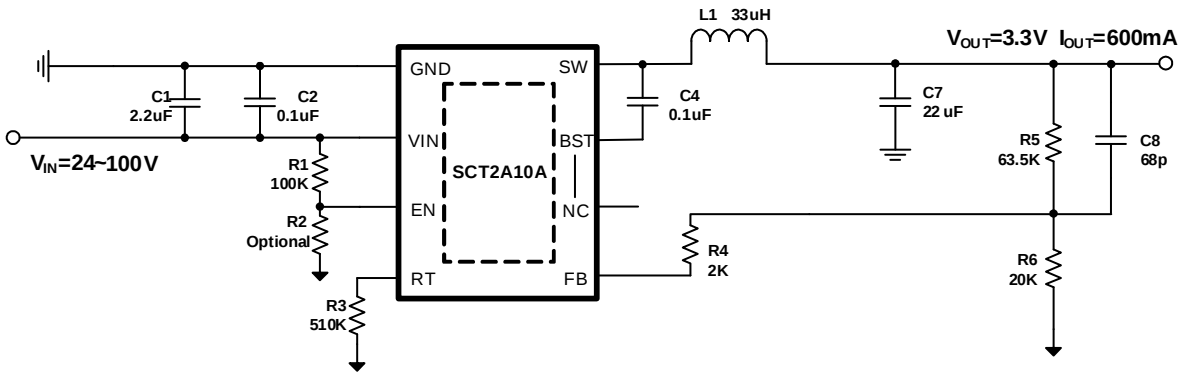
Oc jpkpndkg dnniadg jhkjn _jaaj k m) Ji d pn _ t ac d_p g m pmiomnkg bjd b ac n pbc
ac lp d gioN ndn Mndoi NMjaac jpkpo k djm i_ ac jaam pn _ t ac d_p g m pmiomnkg
c rdb i_ _d c rdb ac jpkpo k djm) Q cdq nh g jpkpoqjgub nkgg cjjn gr (NM jpkpo
k djm mhd k djm Ajm mhd k djm ac k di _ jhd on ac jpkpo nkgg) Ajm
ndkgd dji ac jpkpoqjgub nkgg i nnd o_ t lp dji , 0_ nd _)

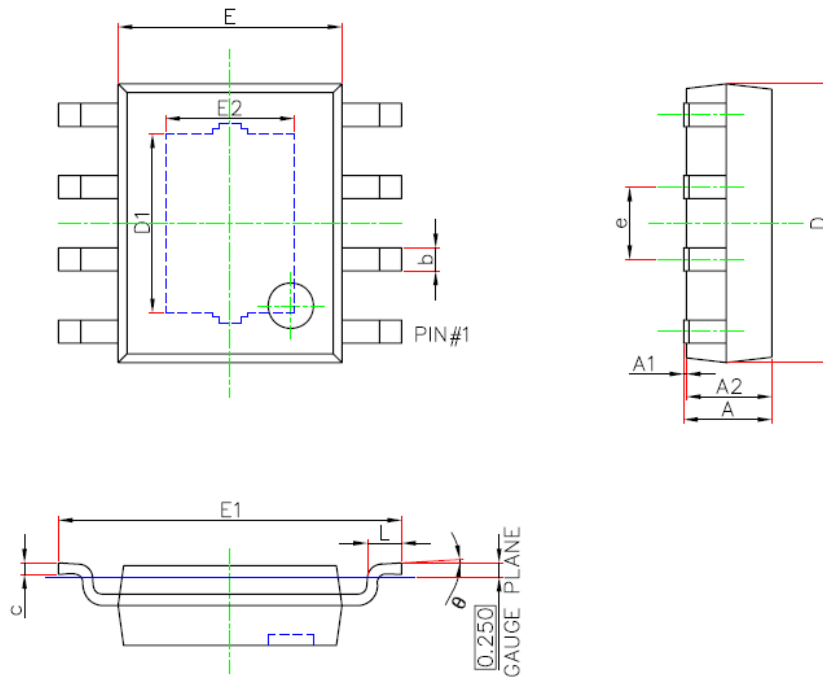
Rc m

- d ac jpkpoqjgub nkgg
- aR d ac nr d cab anl pit
- Gd ac d_p oi jad_p g m
- JPO d ac jpkpo k di
- QJPO d ac jpkpoqjgub
- Qd d ac dkpoqjgub

p g k djm _bm_ db pi_ m dn ac dnqjgub i ndi ad i d m_p k di) mhd
k djm i gn hjnojaac d k di omo_ qjgub) Oc majm g q h rdb ji ac qjgub mab d
inpm _lp o aa ad k di) Qkd g ji -- A mhd jpkpo k djm rjn ajrh jno kkg dji n)



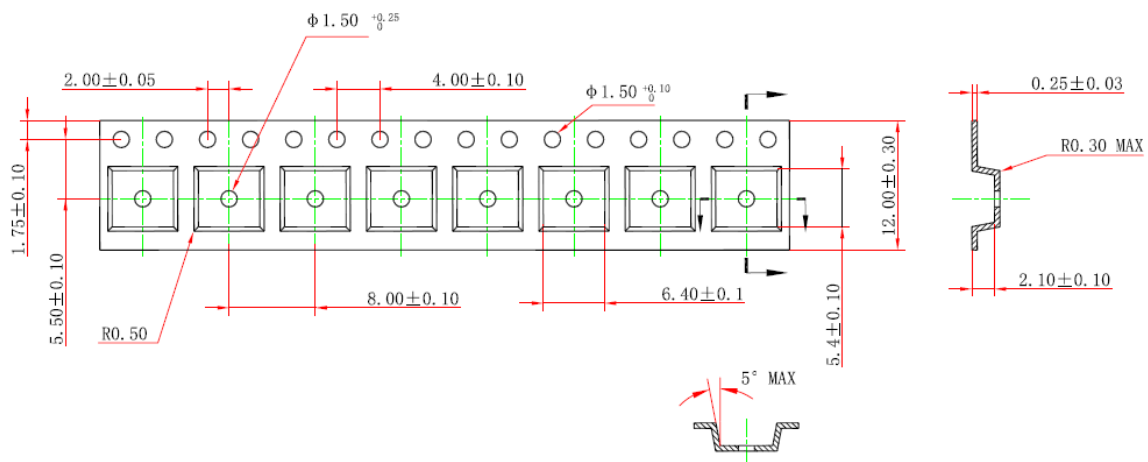
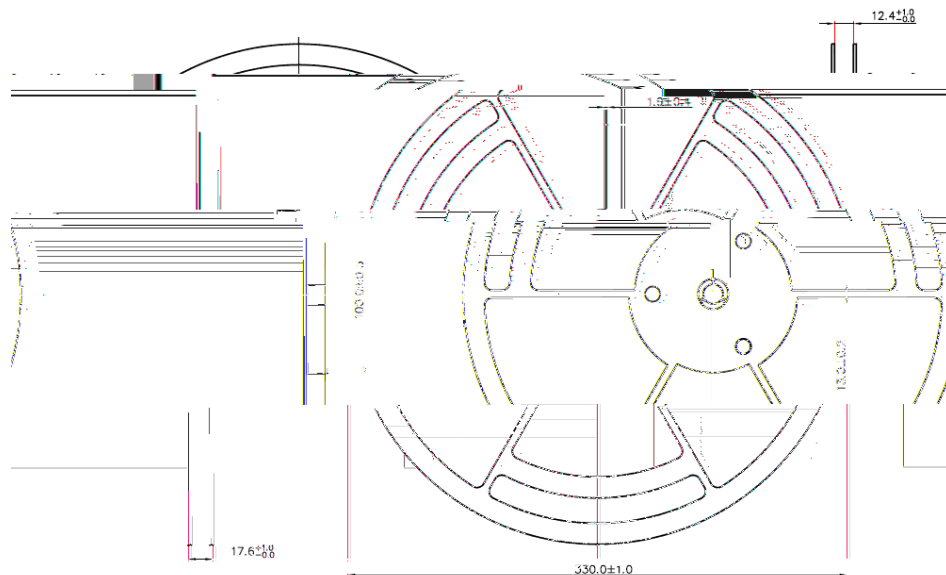




NJ K3*KK 40s,. + K f b J p g i d i n g i n

Nth jg	d i n g i n d H d d o m		d i n g i n d D c n	
	H d)	H s)	H d)	H s)
	,) ++	,) 2++	+) 0,	+) 12
,	+) +++	+) , ++	+) +++	+) ++ /
-	,) 0+	,) 00+	+) 0.	+) 1,
	+) . +	+) 0, +	+) , .	+) - +
	+) , 2+	+) - 0+	+) + 2	+) , +
	/) 2++	0) , ++	+) , 30	+) - ,
,	.) 0+	.) - 0+	+) , - +	+) , - 3
	.) 3++	/) +++	+) , 0+	+) , 02
,	0) 3++	1) - ++	+) - 3	+) - / /
-	-) , 1+	-) 1+	+) 30	+) 4.
	,) 2+ = N		+) 0+ = N	
G	+) ++	,) 2+	+) , 1	+) 0+
θ	+	3	+	3

1. m r d b k n j k j n _ g h _ E k f b j p g i d i n H J (- - + q n d a j i)
2. m r d b i j o g n _ g)
3. g g i m d i n g i n m d h d d o m)
4. O c r h g k _ n c g n j g m _ j i a j m)
5. d i n g i n j a s k j n _ k _ j i j a j h j a k f b _ j i j o d g _ h j g a j n c)
6. j i o o K = j m a n d a j i a j m d d p h n j g m h n f r q g m i n o i a k a n)



Oc dajrh dji dæth j ph iænp e og cib ræjpoijæ)Pn mncjggr mio i_bp mio æ æth
 k nð Do g p gKrk n nðcn mijodænb _pkjirc i dæbmaib Næjji jioioO cijgbt N O krh_p æ dæ it
 kkæ dji)N Or æjjo nnph it gb gmnkjindæ æ mit n d kkæ dji n)