. / 4% 0AGE NUMBERS FOR PREVIOUS REVISIONS MAY DIFFER FROM PAGE NUMBERS IN THE CURRENT VERSION
2EVISION USTOMER3AMPLES

ORDERABLE DEVICE	PACKAGING TYPE	STANDARD PACK QTY	PACKAGE MARKING	PINS	PACKAGE DESCRIPTION	MSL
3 4 544 2	4APE 2EEL		5		& 3/ 4	4

/ VER OPERATING FREE AIR TEMPERATURE UNLESS OTHERWISE NOTED

&		)NVERTING INPUT OF THE TRANS CONDUCTANCE ERROR AMPLIFIER 4HE TAP OF EXTERNAL FEEDBACK RESISTOR DIVIDER FROM THE OUTPUT TO . SETS THE OUTPUT VOLTAGE 4HE DEVICE REGULATES & VOLTAGE TO THE INTERNAL REFERENCE VALUE OF 6 TYPICAL

/ VER OPERATING FREE AIR TEMPERATURE RANGE UNLESS OTHERWISE NOTED

PARAMETER	DEFINITION	MIN	MAX	UNIT
6).	)NPUT VOLTAGE RANGE			6
6 / 54	/ UTPUT VOLTAGE RANGE			6
4 *	/ PERATING JUNCTION TEMPERATURE			

PARAMETER	DEFINITION	MIN	MAX	UNIT
6 %3	(UMAN CODY - ODEL (- PER . 3) * % % *3 SPECIFICATION ALL PINS			K6
	HARGED EVICE - ODEL - PER . 3) * % % *3 SPECIFICATION ALL PINS			K6

(1) * % % DOCUMENT * %0 STATES THAT 6 (- ALLOWS SAFE MANUFACTURING WITH A STANDARD %3 CONTROL PROCESS
(2) * % % DOCUMENT * %0 STATES THAT 6 - ALLOWS SAFE MANUFACTURING WITH A STANDARD %3 CONTROL PROCESS

PARAMETER	THERMAL METRIC	FCSOT583	UNIT
2 *	* UNCTION TO AMBIENT THERMAL RESISTANCE		7
*4	* UNCTION TO TOP CHARACTERIZATION PARAMETER		
*	* UNCTION TO BOARD CHARACTERIZATION PARAMETER		
2 * TOP	* UNCTION TO CASE THERMAL RESISTANCE		
2 *	* UNCTION TO BOARD THERMAL RESISTANCE		
2 * %6 -	* UNCTION TO AMBIENT THERMAL RESISTANCE %6 -		
*4 %6 -	* UNCTION TO TOP CHARACTERIZATION PARAMETER %6 -		

3 4 PROVIDES 2 * AND 2 * NUMBERS ONLY AS REFERENCE TO ESTIMATE JUNCTION TEMPERATURES OF THE DEVICES 2 * AND 2 * ARE NOT A CHARACTERISTIC OF PACKAGE ITSELF BUT OF MANY OTHER SYSTEM LEVEL CHARACTERISTICS SUCH AS THE DESIGN AND LAYOUT OF THE PRINTED CIRCUIT BOARD 0 ON WHICH THE 3 4 5 IS MOUNTED AND EXTERNAL ENVIRONMENTAL FACTORS 4HE 0 BOARD IS A HEATSINK THAT IS SOLDERED TO THE LEADS OF THE 3 4 5 HANGING THE DESIGN OR CONFIGURATION OF THE 0 BOARD CHANGES THE EFFICIENCY OF THE HEATSINK AND THEREFORE THE ACTUAL 2 * AND 2 *

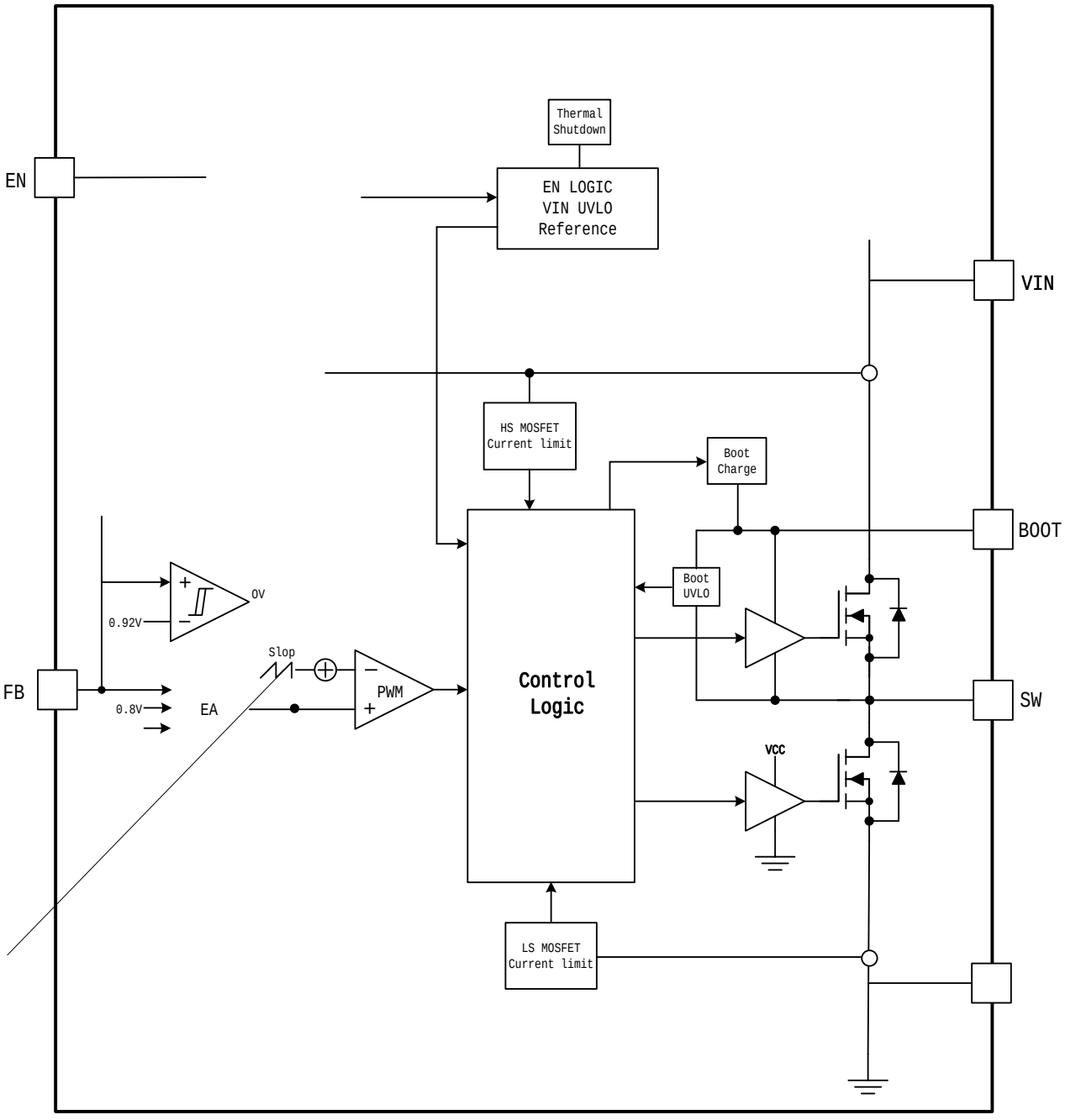
- EASURED ON * %3 LAYER 0 4HE VALUES GIVEN IN THIS TABLE ARE ONLY VALID FOR COMPARISON WITH OTHER PACKAGES AND CANNOT BE USED FOR DESIGN PURPOSES 4HESE VALUES WERE CALCULATED IN ACCORDANCE WITH * %3 AND SIMULATED ON A SPECIFIED * % % BOARD 4HEY DO NOT REPRESENT THE PERFORMANCE OBTAINED IN AN ACTUAL APPLICATION

- EASURED ON 3 4 STANDARD %6 - 3 4 5 EMO OARD / UTER LAYER OZ AND INNER LAYER OZ COPPER THICKNESS MM X MM LAYER 0

6). 6 4* TYPICAL VALUE IS TESTED UNDER

SYMBOL	PARAMETER	TEST CONDITION	MIN	TYP	MAX	UNIT
Power Supply						
6).	/ PER ATING INPUT VOLTAGE				6	

SYMBOL	PARAMETER	TEST CONDITION	MIN	TYP	MAX	UNIT
&53- -).	- INIMUM SWITCHING FREQUENCY IN 53 - MODE					K(Z
T. -).	- INIMUM ON TIME					NS
T&& -).	- INIMUM OFF TIME					NS
T. - 8	- AX ON TIME					US
Power Good						
60 56	0 OWER GOOD FLAG UNDER VOLTAGE TRIPPING THRESHOLD	POWER GOOD (% of FB voltage)				
		POWER BAD (% of FB voltage)				
60 /6	0 OWER GOOD FLAG OVER VOLTAGE TRIPPING THRESHOLD	POWER BAD (% of FB voltage)				
		POWER GOOD (% of FB voltage)				



&IGURE &UNCTIONAL LOCK IAGRAM

Overview

4HE 3 4 5 IS A 6 6 INPUT OUTPUT %-) FRIENDLY SYNCHRONOUS BUCK CONVERTER WITH BUILT IN M 2DSON HIGH SIDE AND M 2DSON LOW SIDE POWER- / 3 &%4S) TIMPLEMENTS CONSTANT FREQUENCY PEAK CURRENT MODE CONTROL TO REGULATE OUTPUT VOLTAGE PROVIDING EXCELLENT LINE AND LOAD TRANSIENT RESPONSE AND SIMPLIFYING THE EXTERNAL FREQUENCY COMPENSATION DESIGN

4HE SWITCHING FREQUENCY IS ADJUSTABLE FROM K(Z TO - (Z THROUGH RESISTOR TO OPTIMIZE EITHER THE POWER EFFICIENCY OR THE EXTERNAL COMPONENTS SIZES 4HE 3 4 5 FEATURES M S SOFT START TIME TO AVOID LARGE INRUSH CURRENT 4HE DEVICE ALSO SUPPORTS MONOLITHIC STARTUP WITH PRE BIASED OUTPUT CONDITION

4HE % PIN WITH A PRECISION THRESHOLD THAT CAN BE USED TO ADJUST THE INPUT VOLTAGE LOCKOUT THRESHOLDS WITH TWO EXTERNAL RESISTORS TO MEET ACCURATE HIGHER 56 , / SYSTEM REQUIREMENTS

3 4 5 ACHIEVES RANDOM SPREAD SPECTRUM MODULATION EXPANSION CENTERED ON THE SET SWITCHING FREQUENCY 4HE PURPOSE OF SPREAD SPECTRUM IS TO ELIMINATE PEAK EMISSIONS AT SPECIFIC FREQUENCIES BY SPREADING THESE EMISSIONS ACROSS A WIDER RANGE OF FREQUENCIES RATHER THAN APART WITH FIXED FREQUENCY OPERATION

4HE 3 4 5 FULL PROTECTION FEATURES INCLUDE THE INPUT UNDER VOLTAGE LOCKOUT THE OUTPUT OVER VOLTAGE PROTECTION OVER CURRENT PROTECTION WITH CYCLE BY CYCLE CURRENT LIMITING AND HICCUP MODE OUTPUT HARD SHORT PROTECTION AND THERMAL SHUTDOWN PROTECTION

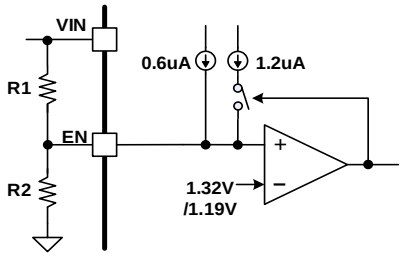
Peak

BEHAVIOR 2 7.4 0 SE (EF SPREAD BD 10 EAT J ET >BT /0000091-048>4<005 Tm 0 g 0 G [<0010>] TJ ET O 1 TJ ET O EMC /Span <</M

7 HERE

6 RISE IS RISING THRESHOLD OF 6 IN 56 , /

6 FALL IS FALLING THRESHOLD OF 6 IN 56 , /



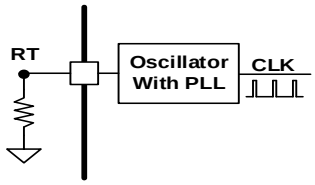
&IGURE 3YSTEM 56 , / BY ENABLE DIVIDE

Output Voltage

4HE 3 4 5 REGULATES THE INTERNAL REFERENCE VOLTAGE AT 6 WITH TOLERANCE OVER THE OPERATING TEMPERATURE AND VOLTAGE RANGE 4HE OUTPUT VOLTAGE IS SET BY A RESISTOR DIVIDER FROM THE OUTPUT NODE TO THE & PIN)T IS RECOMMENDED TO USE TOLERANCE OR BETTER RESISTORS 5SE %QUATION TO CALCULATE RESISTANCE OF RESISTOR DIVIDERS 4O

)N RESISTOR SETTING FREQUENCY MODE A RESISTOR PLACED BETWEEN 24 PIN TO THE GROUND SETS THE SWITCHING FREQUENCY OVER A WIDE RANGE FROM K(Z TO - (Z 7HEN 24 IS FLOATING THE FREQUENCY IS K(Z AND WHEN 24 IS CONNECTED TO THE GROUND THE FREQUENCY IS - (Z 5SE %QUATON OR THE PLOT IN &IGURE TO DETERMINE THE RESISTANCE FOR A SWITCHING FREQUENCY NEEDED

WHERE &SW IS SWITCHING CLOCK FREQUENCY



&IGURE 3ETTING &REQUENCY AND LOCK 3YNCHRONIZATON

Frequency Spread Spectrum

4O REDUCE %-) THE 3 4 5 IMPLEMENTS &REQUENCY 3PREAD 3PECTRUM &33 4HE PURPOSE OF SPREAD SPECTRUM IS TO ELIMINATE PEAK EMISSIONS AT SPECIFIC FREQUENCIES BY SPREADING THESE EMISSIONS ACROSS A WIDER RANGE OF FREQUENCIES RATHER THAN APART WITH FIXED FREQUENCY FUNCTON)N MOST SYSTEMS CONTAINING THE 3 4 5 LOW FREQUENCY CONDUCTED EMISSIONS FROM THE FIRST FEW HARMONICS OF THE SWITCHING FREQUENCY CAN BE EASILY FILTERED

4HE &33 CIRCUIT USES PSEUDO RANDOM FREQUENCY HOPPING TO VARY THE SWITCHING FREQUENCY WITHIN A SPECIFIC RANGE 4HE JITTERING SPAN IS OF THE SWITCHING FREQUENCY 4HE SPREAD SPECTRUM IS ONLY AVAILABLE WHILE THE CLOCK OF THE 3 4 5 DEVICES IS FREE RUNNING AT THEIR NATURAL FREQUENCY NY OF THE FOLLOWING CONDITONS OVERRIDES SPREAD SPECTRUM TURNING IT OFF

4HE CLOCK IS REDUCED DURING , / FUNCTON

4HE CLOCK IS REDUCED AT LIGHT LOAD IN 53-

4HE CLOCK IS REDUCED DURING MINIMUM ON TIME FUNCTON

Bootstrap Voltage Regulator and BOOT UVLO

N EXTERNAL BOOTSTRAP CAPACITOR BETWEEN / / 4 PIN AND 37 PIN POWERS THE FLOATING GATE DRIVER TO HIGH SIDE POWER - / 3&%4 4HE BOOTSTRAP CAPACITOR VOLTAGE IS CHARGED FROM AN INTEGRATED VOLTAGE REGULATOR WHEN HIGH SIDE POWER - / 3&%4 IS OFF AND LOW SIDE POWER - / 3&%4 IS ON BOOT DIODE IS INTEGRATED ON THE 3 4 5 DIE

Minimum On Time Function

%VEN IF THE DUTY CYCLE AT THE SET FREQUENCY IS LIMITED BY THE MINIMUM ON TIME 3 4 5 CAN STILL MAINTAIN STABLE ADJUSTMENT OF THE OUTPUT VOLTAGE DURING THE TRANSITION FROM HIGH INPUT VOLTAGE TO LOW OUTPUT VOLTAGE

)F THE INPUT OUTPUT VOLTAGE RATIO IS TOO HIGH EVEN IF THE CURRENT EXCEEDS THE COMPENSATION SPECIFIED PEAK THE HIGH SIDE - / 3 &%4 CANNOT SHUTDOWN QUICKLY ENOUGH TO ADJUST THE OUTPUT VOLTAGE 4HIS WILL CAUSE THE OUTPUT VOLTAGE TO CONTINUOUSLY INCREASE UNTIL OVER VOLTAGE PROTECTION IS TRIGGERED 4O AVOID THIS SITUATION WHEN THE CONDUCTION TIME OF THE HIGH SIDE - / 3 &%4 TOUCHES THE MINIMUM ON TIME DUE TO THE INCREASE IN INPUT AND OUTPUT VOLTAGE DIFFERENCE 3 4 5 WILL SWITCH TO VALLEY CURRENT CONTROL MODE FTER THE HIGH SIDE - / 3 &%4 IS TURNED OFF THE LOW SIDE - / 3 &%4 WILL REMAIN OPEN UNTIL THE INDUCTOR CURRENT DROPS BELOW THE REQUIRED VALLEY CURRENT URING THIS PERIOD THE NEXT CLOCK CYCLE WILL BE BLOCKED FROM STARTING SO THE SWITCHING FREQUENCY WILL DECREASE 3INCE ON TIME OF HIGH SIDE - / 3 &%4 IS FIXED AT ITS MINIMUM VALUE THIS TYPE OF FUNCTION RESEMBLES THAT OF A DEVICE USING A CONSTANT/ N 4IME / 4 CONTROL SCHEME

Over Current Limit and Hiccup Mode

4HE INDUCTOR CURRENT IS MONITORED DURING HIGH SIDE - / 3 &%4 1 AND LOW SIDE - / 3 &%4 1 ON 4HE 3 4 5 IMPLEMENTS OVER CURRENT PROTECTION WITH CYCLE BY CYCLE LIMITING HIGH SIDE - / 3 &%4 PEAK CURRENT AND LOW SIDE - / 3 &%4 VALLEY CURRENT TO AVOID INDUCTOR CURRENT RUNNING AWAY DURING UNEXPECTED OVERLOAD OR OUTPUT HARD SHORT CONDITION

7HEN OVERLOAD OR HARD SHORT HAPPENS THE INDUCTOR CURRENT IS CLAMPED AT OVER CURRENT LIMITATION THE CONVERTER CANNOT PROVIDE OUTPUT CURRENT TO SATISFY LOADING REQUIREMENT 4HUS THE OUTPUT CAPACITOR IS DISCHARGED AND THE OUTPUT VOLTAGE DROPS BELOW REGULATED VOLTAGE WITH & VOLTAGE LESS THAN INTERNAL REFERENCE VOLTAGE CONTINUOUSLY 4HE / - 0 VOLTAGE RAMPS UP TO HIGH CLAMP VOLTAGE 7HEN & VOLTAGE IS BELOW OF THE REFERENCE VOLTAGE AND AFTER CYCLES OF LOW SIDE CURRENT LIMIT THE CONVERTER STOPS SWITCHING FTER REMAINING / && FOR T_{SS} THE DEVICE RESTARTS FROM SOFT START PHASE)F OVERLOAD OR HARD SHORT CONDITION STILL EXISTS DURING T_{SS} AND MAKE / - 0 VOLTAGE CLAMPED AT HIGH AFTER T_{SS} AND & VOLTAGE KEEP BELOW OF THE REFERENCE VOLTAGE FOR CYCLES THE DEVICE ENTERS TURNING OFF MODE AGAIN 7HEN OVERLOAD OR HARD SHORT CONDITION IS REMOVED THE DEVICE AUTOMATICALLY RECOVERS TO ENTERS NORMAL REGULATING FUNCTION

)F THE & VOLTAGE DROPS BELOW OF THE REFERENCE VOLTAGE DUE TO , / FUNCTION HICCUP MODE WILL BE DISABLED

4HE HICCUP PROTECTION MODE ABOVE MAKES THE AVERAGE SHORT CIRCUIT CURRENT TO ALLEVIATE THERMAL ISSUES AND PROTECT THE REGULATOR

Over voltage Protection

4HE 3 4 5 IMPLEMENTS THE / VER VOLTAGE 0ROTECTION / 6 0 CIRCUITRY TO MINIMIZE OUTPUT VOLTAGE OVERSHOOT DURING LOAD TRANSIENT RECOVERING FROM OUTPUT FAULT CONDITION OR LIGHT LOAD TRANSIENT 4HE OVER VOLTAGE COMPARATOR IN / 6 0 CIRCUIT COMPARES THE & PIN VOLTAGE TO THE INTERNAL REFERENCE VOLTAGE 7HEN & VOLTAGE EXCEEDS OF INTERNAL 6 REFERENCE VOLTAGE THE HIGH SIDE - / 3 &%4 TURNS OFF TO AVOID OUTPUT VOLTAGE CONTINUE TO INCREASE 7HEN THE & PIN VOLTAGE FALLS BELOW OF THE 6 REFERENCE VOLTAGE THE HIGH SIDE - / 3 &%4 CAN TURN ON AGAIN

Power Good

4HE 0 PIN IS AN OPEN DRAIN OUTPUT ONNECT THE PIN TO 6 / 54 OR OTHER VOLTAGE SOURCE THROUGH A PULL UP RESISTOR BETWEEN K AND K 0LEASE ENSURE THAT THE VOLTAGE CONNECTED TO THE 0 PIN DOES NOT EXCEED 6 / NCE THE & PIN IS BETWEEN AND OF THE INTERNAL VOLTAGE REFERENCE THE 0 / / PIN IS DE ASSERED AND THE PIN FLOATS WITH US DELAY 4HE 0 PIN IS PULLED LOW WHEN THE & IS LOWER THAN OR GREATER THAN OF THE NOMINAL INTERNAL REFERENCE VOLTAGE WITH US DEGLITCHING TIME LSO THE 0 IS PULLED LOW IF 6 IN 56 , / OR THERMAL SHUTDOWN ARE ASSERED OR THE % PIN PULLED LOW / UTPUT VOLTAGE EXCURSIONS THAT ARE SHORTER THAN US DEGLITCHING TIME DO NOT TRIP THE 0 FLAG

Thermal Shutdown

4HE 3 4 5 PROTECTS THE DEVICE FROM THE DAMAGE DURING EXCESSIVE HEAT AND POWER DISSIPATION CONDITIONS / NCE THE JUNCTION TEMPERATURE EXCEEDS THE INTERNAL THERMAL SENSOR STOPS POWER- / 3 &%4S SWITCHING 7HEN THE

JUNCTION TEMPERATURE FALLS BELOW THE DEVICE RESTARTS WITH INTERNAL SOFT START PHASE

Typical Application

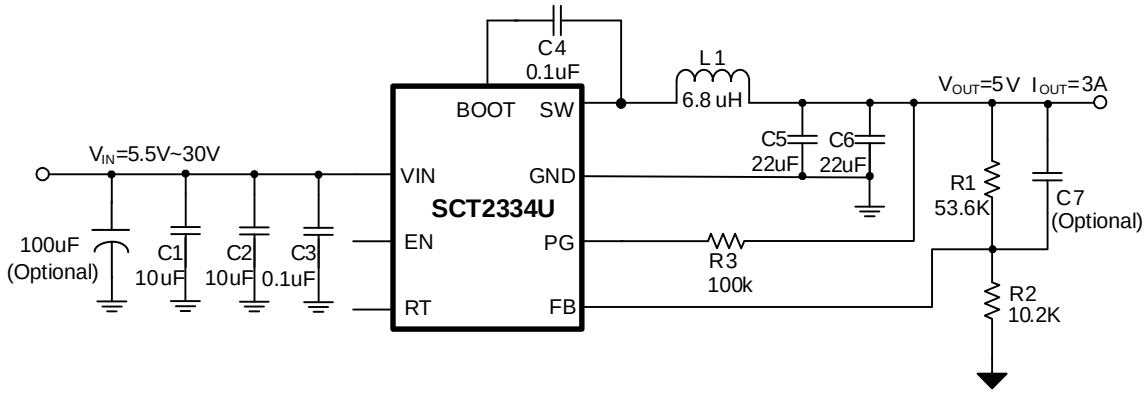


Figure 11. SCT2334U Design Example, 5V Output

Design Parameters

Design Parameters	Example Value
)NPUT6 OLTAGE	6 . ORMAL 6 TO 6
/ UTPUT6 OLTAGE	6
- AXIMUM / UTPUT URRENT	
3WITCHING &REQUENCY	K(Z
/ UTPUTVOLTAGE RIPPLE PEAK TO PEAK	M6
4RANSIENT 2ESPONSE TO LOAD STEP	M6

Output Voltage

4HE OUTPUT VOLTAGE IS SET BY AN EXTERNAL RESISTOR DIVIDER 2 AND 2 IN TYPICAL APPLICATION SCHEMATIC 2ECOMMENDED 2 RESISTANCE IS K 5SE %QUATION TO CALCULATE 2

VOUT	R1	R2
6	+	K
6	+	K
6	+	K

WHERE

6 2%& IS THE FEEDBACK REFERENCE VOLTAGE TYPICAL 6

Switching Frequency

(IGHER SWITCHING FREQUENCIES SUPPORT SMALLER PROFILES OF OUTPUT INDUCTORS AND OUTPUT CAPACITORS RESULTING IN LOWER VOLTAGE AND CURRENT RIPPLES (OWEVER THE HIGHER SWITCHING FREQUENCY CAUSES EXTRA SWITCHING LOSS WHICH DOWNGRADES CONVERTERS OVERALL POWER EFFICIENCY AND THERMAL PERFORMANCE)N THIS DESIGN A MODERATE SWITCHING FREQUENCY OF K(Z IS SELECTED TO ACHIEVE BOTH SMALL SOLUTION SIZE AND HIGH EFFICIENCY OPERATION

Inducto t smaller pr)fiuct prof5 lt. In thitc' ex

4HE TOTAL CURRENT FLOWING THROUGH THE INDUCTOR IS THE INDUCTOR RIPPLE CURRENT PLUS THE OUTPUT CURRENT 7 HEN SELECTING AN INDUCTOR CHOOSE ITS RATED CURRENT ESPECIALLY THE SATURATION CURRENT LARGER THAN ITS PEAK OPERATION CURRENT AND 2 - 3 CURRENT ALSO NOT BE EXCEEDED 4HEREFORE THE PEAK SWITCHING CURRENT OF INDUCTOR), 0% + AND), 2 - 3 CAN BE CALCULATED AS IN %QUATION AND %QUATION

7 HERE

), 0% + IS THE INDUCTOR PEAK CURRENT
)/ 54 IS THE LOAD CURRENT
), 00 IS THE INDUCTOR PEAK TO PEAK CURRENT
), 2 - 3 IS THE INDUCTOR 2 - 3 CURRENT

)N OVERLOADING OR LOAD TRANSIENT CONDITIONS THE INDUCTOR PEAK CURRENT CAN INCREASE UP TO THE SWITCH CURRENT LIMIT OF THE DEVICE WHICH IS TYPICALLY 4HE MOST CONSERVATIVE APPROACH IS TO CHOOSE AN INDUCTOR WITH A SATURATION CURRENT RATING GREATER THAN ECAUSE OF THE MAXIMUM), 0% + LIMITED BY DEVICE THE MAXIMUM OUTPUT CURRENT THAT THE 3 4 5 CAN DELIVER ALSO DEPENDS ON THE INDUCTOR CURRENT RIPPLE 4HUS THE MAXIMUM DESIRED OUTPUT CURRENT ALSO AFFECTS THE SELECTION OF INDUCTANCE 4HE SMALLER INDUCTOR RESULTS IN LARGER INDUCTOR CURRENT RIPPLE LEADING TO A LOWER MAXIMUM OUTPUT CURRENT

Input Capacitor Selection

4HE INPUT CURRENT TO THE STEP DOWN CONVERTER IS DISCONTINUOUS THEREFORE IT REQUIRES A CAPACITOR TO SUPPLY THE CURRENT TO THE STEP DOWN CONVERTER WHILE MAINTAINING THE INPUT VOLTAGE 5SE CAPACITORS WITH LOW %3 2 FOR BETTER PERFORMANCE ERAMIC CAPACITORS WITH 8 2 OR 8 2 DIELECTRICS ARE USUALLY SUGGESTED BECAUSE OF THEIR LOW %3 2 AND SMALL TEMPERATURE COEFFICIENTS AND IT IS STRONGLY RECOMMENDED TO USE ANOTHER LOWER VALUE CAPACITOR E G U& WITH SMALL PACKAGE SIZE TO FILTER HIGH FREQUENCY SWITCHING NOISE 0LACE THE SMALL SIZE CAPACITOR AS CLOSE TO 6). AND . PINS AS POSSIBLE

4HE VOLTAGE RATING OF THE INPUT CAPACITOR MUST BE GREATER THAN THE MAXIMUM INPUT VOLTAGE ND THE CAPACITOR MUST ALSO HAVE A RIPPLE CURRENT RATING GREATER THAN THE MAXIMUM INPUT CURRENT RIPPLE 4HE 2 - 3 CURRENT IN THE INPUT CAPACITOR CAN BE CALCULATED USING %QUATION

4HE WORST CASE CONDITION OCCURS AT 6). 6 / 54 WHERE

&OR SIMPLIFICATION CHOOSE AN INPUT CAPACITOR WITH AN 2 - 3 CURRENT RATING GREATER THAN HALF OF THE MAXIMUM LOAD CURRENT

7 HEN SELECTING CERAMIC CAPACITORS IT NEEDS TO CONSIDER THE EFFECTIVE VALUE OF A CAPACITOR DECREASING AS THE BIAS VOLTAGE ACROSS A CAPACITOR INCREASING

4HE INPUT CAPACITANCE VALUE DETERMINES THE INPUT RIPPLE VOLTAGE OF THE REGULATOR 4HE INPUT VOLTAGE RIPPLE CAN BE CALCULATED USING %QUATION AND THE MAXIMUM INPUT VOLTAGE RIPPLE OCCURS AT DUTY CYCLE

&OR THIS EXAMPLE TWO & 8 2 CERAMIC CAPACITORS RATED FOR 6 IN PARALLEL ARE USED ND A & FOR HIGH FREQUENCY FILTERING CAPACITOR IS PLACED AS CLOSE AS POSSIBLE TO THE DEVICE PINS

)F YOU WANT TO MAKE THE 53- WORK MORE STABLE UNDER LOW DROP OUT HIGH DUTY CYCLE IT IS RECOMMENDED TO ADD A LARGE ELECTROLYTIC CAPACITOR TO THE INPUT TO STABILIZE THE INPUT VOLTAGE

Bootstrap Capacitor Selection

& CERAMIC CAPACITOR MUST BE CONNECTED BETWEEN / / 4 PIN AND 37 PIN FOR PROPER OPERATION CERAMIC CAPACITOR WITH 8 2 OR BETTER GRADE DIELECTRIC IS RECOMMENDED 4HE CAPACITOR SHOULD HAVE A 6 OR HIGHER VOLTAGE RATING

Output Capacitor Selection

4HE SELECTION OF OUTPUT CAPACITOR WILL AFFECT OUTPUT VOLTAGE RIPPLE IN STEADY STATE AND LOAD TRANSIENT PERFORMANCE

4HE OUTPUT RIPPLE IS ESSENTIALLY COMPOSED OF TWO PARTS / NE IS CAUSED BY THE INDUCTOR CURRENT RIPPLE GOING THROUGH THE %QUIVALENT 3ERIES 2ESISTANCE %32 OF THE OUTPUT CAPACITORS AND THE OTHER IS CAUSED BY THE INDUCTOR CURRENT RIPPLE CHARGING AND DISCHARGING THE OUTPUT CAPACITORS 4O ACHIEVE SMALL OUTPUT VOLTAGE RIPPLE CHOOSE A LOW %32 OUTPUT CAPACITOR LIKE CERAMIC CAPACITOR &OR CERAMIC CAPACITORS THE CAPACITANCE DOMINATES THE OUTPUT RIPPLE &OR SIMPLIFICATION THE OUTPUT VOLTAGE RIPPLE CAN BE ESTIMATED BY %QUATION DESIRED

7 HERE

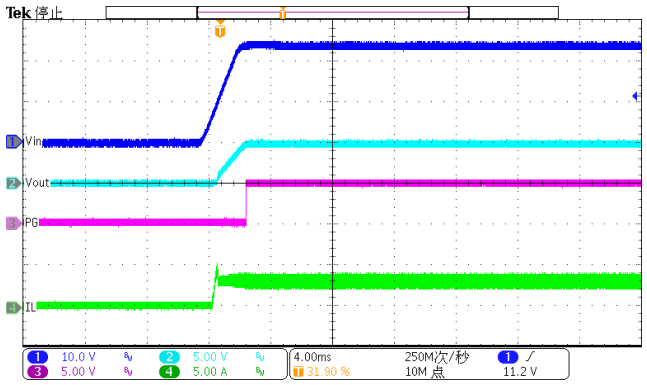
IS THE OUTPUT VOLTAGE RIPPLE
F37 IS THE SWITCHING FREQUENCY
, IS THE INDUCTANCE OF INDUCTOR
/54 IS THE OUTPUT CAPACITANCE
6/54 IS THE OUTPUT VOLTAGE
6). IS THE INPUT VOLTAGE

UE TO CAPACITORS DEGRADING UNDER BIAS THE BIAS VOLTAGE CAN SIGNIFICANTLY REDUCE CAPACITANCE ERAMIC CAPACITORS CAN LOSE MOST OF THEIR CAPACITANCE AT RATED VOLTAGE 4HEREFORE LEAVE MARGIN ON THE VOLTAGE RATING TO ENSURE ADEQUATE EFFECTIVE CAPACITANCE 4YPICALLY TWO & CERAMIC OUTPUT CAPACITORS WORK FOR MOST APPLICATIONS

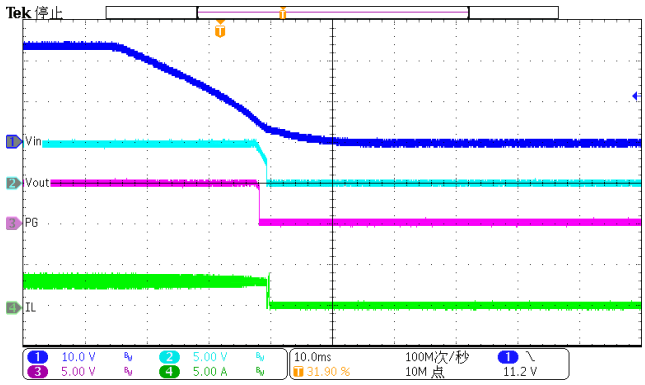
Table 3: Typical External Component Values

Application Waveforms

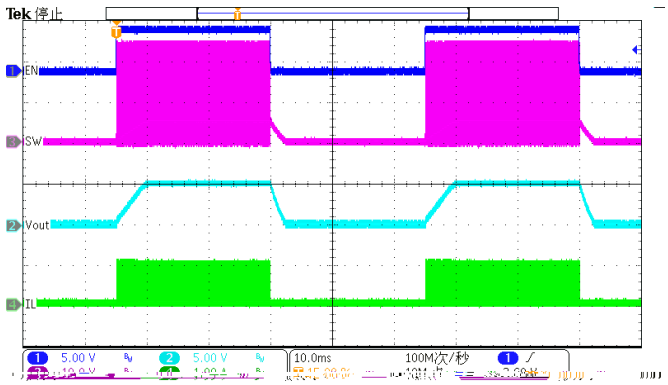
6). 6 6 / 54 6 &37 K UNLESS OTHERWISE NOTED



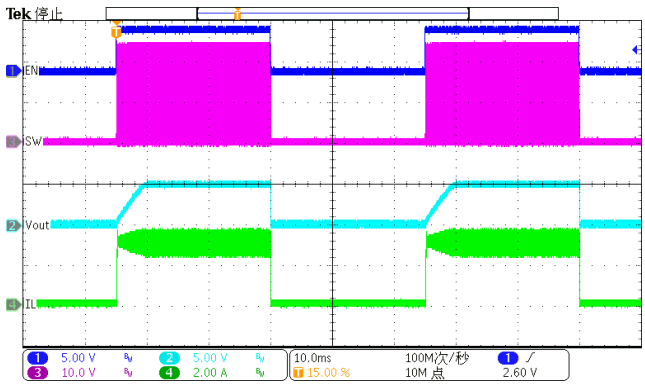
&IGURE 0OWERUP), /



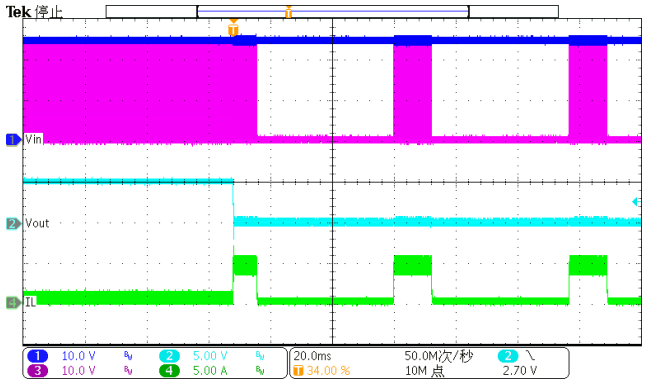
&IGURE 0OWERDOWN), /



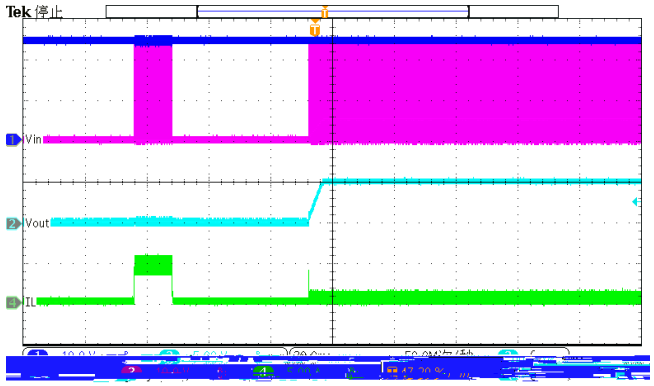
&IGURE % TOGGLE), /



&IGURE % TOGGLE), /

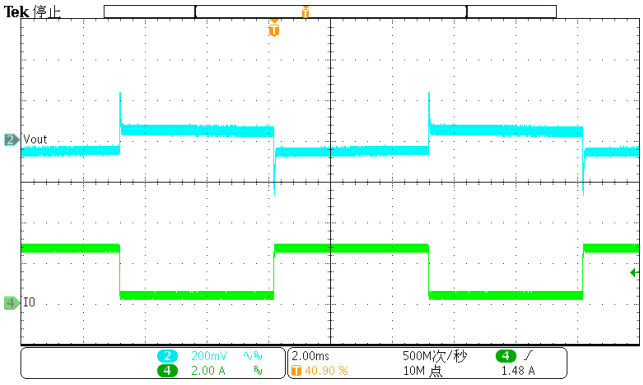


&IGURE / VER URRENT0ROTECTION TO HARD SHORT

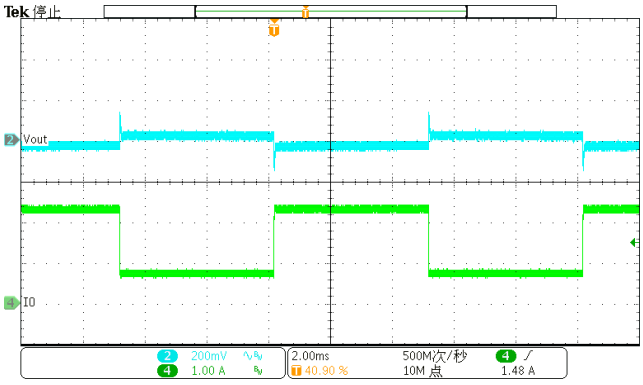


&IGURE / VER URRENT2ELEASE HARD SHORTTO

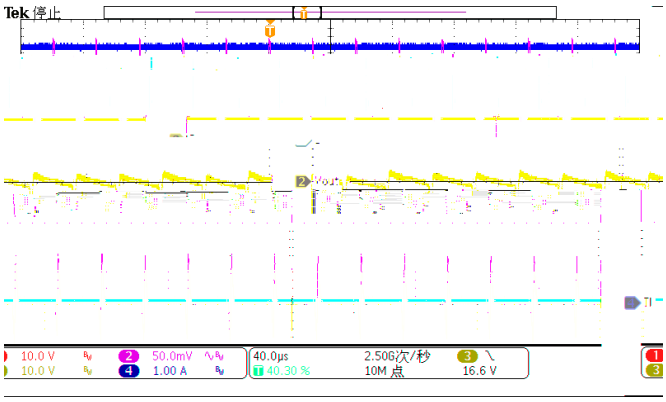
Application Waveforms



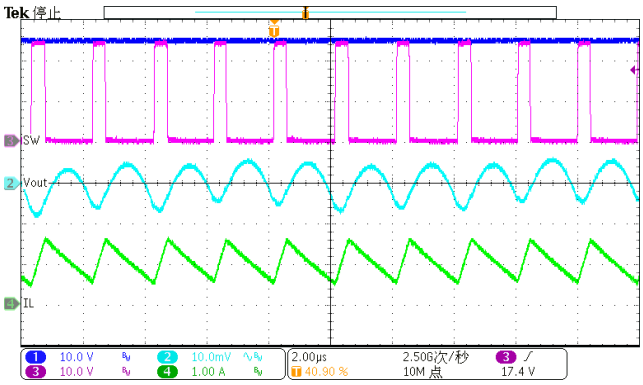
&IGURE , OAD 4RANSIENT US



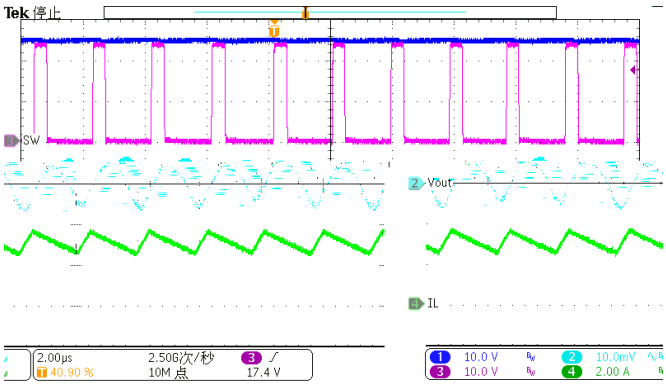
&IGURE , OAD 4RANSIENT US



&IGURE / UTPUT2IPPLE), /



&IGURE / UTPUT2IPPLE), /



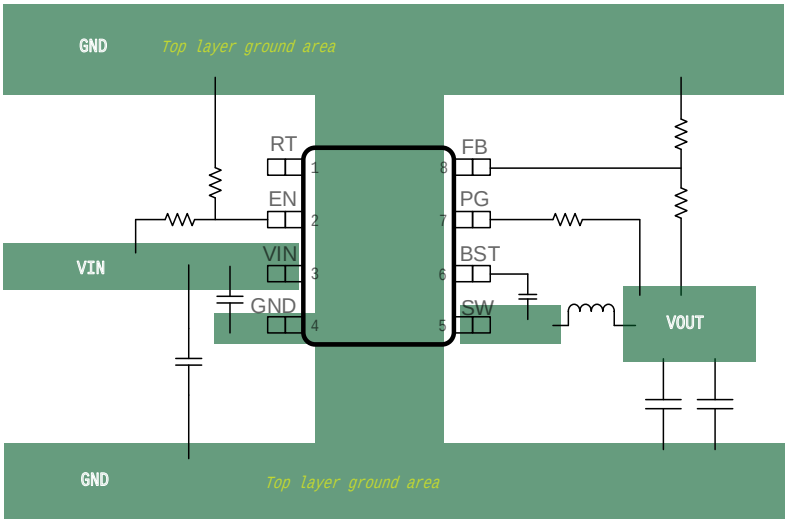
&IGURE / UTPUT2IPPLE), /

&IGURE 4HERMAL 6), 6 / 54

Layout Guideline

0ROPER0 LAYOUTIS A CRITICALFOR3 4 5 S STABLE AND EFFICIENTOPERATION 4HE TRACES CONDUCTING FASTSWITCHING CURRENTS OR VOLTAGES ARE EASY TO INTERACT WITH STRAY INDUCTANCE AND PARASITIC CAPACITANCE TO GENERATE NOISE AND DEGRADE PERFORMANCE &ORBETTERRESULTS FOLLOW THESE GUIDELINES AS BELOW

1. 0OWER GROUNDING SCHEME IS VERY CRITICAL BECAUSE OF CARRYING POWER THERMAL AND GLITCH BOUNCING NOISE ASSOCIATED WITH CLOCK FREQUENCY 4HE THUMB OF RULE IS TO MAKE GROUND TRACE LOWEST IMPENDENCE AND POWER ARE DISTRIBUTED EVENLY ON 0 3UFFICIENTLY PLACING GROUND AREA WILLOPTIMIZE THERMALAND NOTCAUSING OVERHEAT AREA
2. 0LACE A LOW %3 2 CERAMIC CAPACITORAS CLOSE TO 6). PIN AND THE GROUND AS POSSIBLE TO REDUCE PARASITIC EFFECT
3. &OROPERATION ATFULLRATED LOAD THE TOP SIDE GROUND AREA MUST PROVIDE ADEQUATE HEATDISSIPATING AREA - AKE SURE THE TOP SWITCHING LOOP WITH POWERHAVE LOWERIMPENDENCE OF GROUNDING
4. 4HE BOTTOM LAYERIS A LARGE GROUND PLANE CONNECTED TO THE GROUND PLANE ON TOP LAYERBY VIAS 4HE POWERPAD SHOULD BE CONNECTED TO THE BOTTOM 0 GROUND PLANES USING MULTIPLE VIAS DIRECTLY UNDERTHE))TIS RECOMMENDED MILDIAMETERDRILL HOLES OF THERMALVIAS BUTA SMALLERVIA OFFERS LESS RISK OF SOLDERVOLUME LOSS / N APPLICATIONS WHERE SOLDERVOLUME LOSS THRU THE VIAS IS OF CONCERN PLUGGING OR TENTING CAN BE USED TO ACHIEVE A REPEATABLE PROCESS
5. / UTPUTINDUCTORSHOULD BE PLACED CLOSE TO THE 37 PIN 4HE SWITCHING AREA OF THE 0 CONDUCTORMINIMIZED TO PREVENTEXCESSIVE CAPACITIVE COUPLING
6. 4HE 24 TERMINALIS SENSITIVE TO NOISE SO THE 24 RESISTORSHOULD BE LOCATED AS CLOSE AS POSSIBLE TO THE) AND ROUTED WITH MINIMALLENGTHS OF TRACE
7. 56, / ADJUSTAND 24 RESISTORS 33 AND FEEDBACK COMPONENTS SHOULD CONNECTTO SMALLSIGNALGROUND WHICH MUST RETURN TO THE . PIN WITHOUTANY INTERLEAVING WITH POWERGROUND
8. &ORACHIEVING BETTERTHERMALPERFORMANCE A FOURLAYERLAYOUTIS STRONGLY RECOMMENDED



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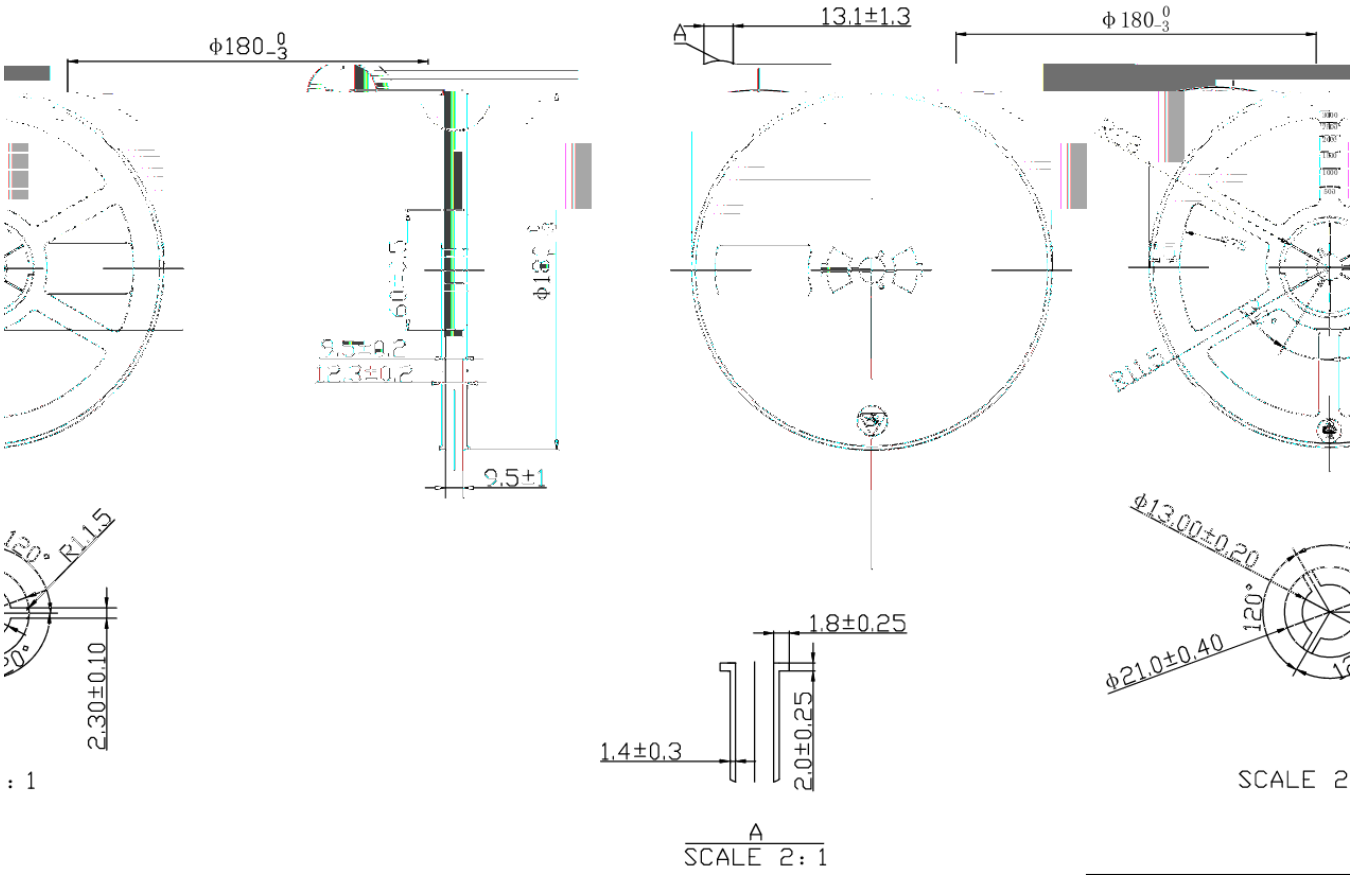
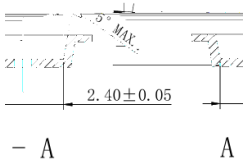

Φ180
13.1±1.3
Φ180
9.5±0.2
12.3±0.2
9.5±1
R1.5
120°
2.30±0.10
1.8±0.25
1.4±0.3
2.0±0.25
Φ13.00±0.20
Φ21.0±0.40
120°
: 1
SCALE 2
A
SCALE 2 : 1


Φ1.50
±0.10
0.20±0.03
Φ0.50±0.15
0.70±0.05
B - B


MAX.
2.40±0.05
- A
A