Over operating free-air temperature range unless otherwise noted

V_{IN}	Input voltage range	4.5	60	V
V_{OUT}	Output voltage range	0.765	57	V
T_J	Operating junction temperature	-40	150	°C

V_{ESD}	Human Body Model(HBM), per ANSI-JEDEC-JS-001-2014 specification, all pins(1)	-2	+2	kV
	Charged Device Model(CDM), per ANSI-JEDEC-JS-002-2014 specification, all pins(2)	-0.5	+0.5	kV

V_{IN}=12

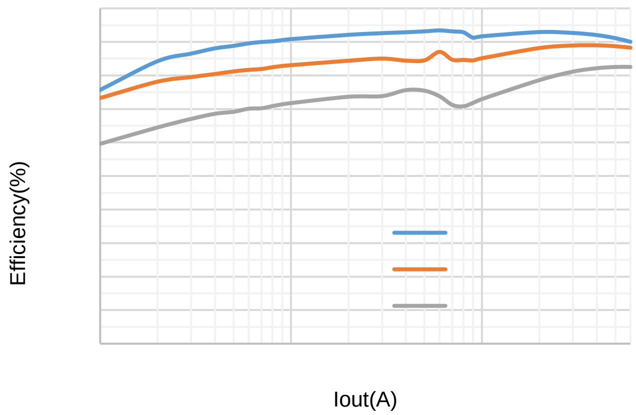


Figure 2. Efficiency vs Load Current, Vout=5V

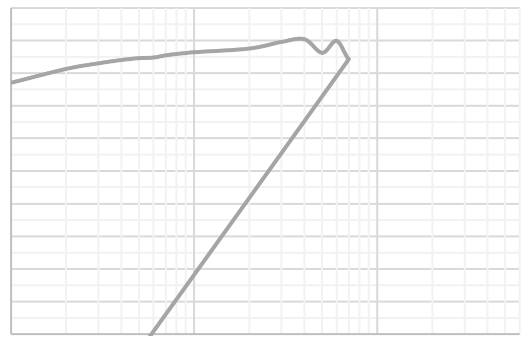


Figure 3. Efficiency vs Load Current, Vout=12V

Figure 4. Load Regulation, Vin=12V, Vout=5V

Figure 5. Load Regulation, Vin=24V, Vout=12V

Figure 6. Line Regulation

Figure 7. HS Current Limit VS Temperature

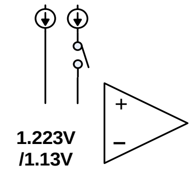
(1)

(2)

where

V_{rise} is rising threshold of Vin UVLO

V_{fall} is falling threshold of Vin UVLO



V

Figure 9. System UVLO by enable divide

The SCT2600 regulates the internal reference voltage at 0.765V with 2.5% tolerance over the operating temperature and voltage range. The output voltage is set by a resistor divider from th power-up and power-down application, the off-time of the high side MOSFET starts to approach the minimum value. Without LDO operation mode, beyond this point the switching may become erratic and/or the output voltage will fall out of regulation. To avoid this problem the SCT2600 LDO mode automatically reduces the switching frequency to increase the effective duty cycle and maintain regulation.

The SCT2600 implements over current protection with fold back current limit. The SCT2600 cycle-by-cycle limits high-side MOSFET peak current to avoid inductor current running away during unexpected overload or output hard short condition.

When overload or hard short happens, the converter cannot provide output current to satisfy loading requirement. The inductor current is clamped at over current limitation. Thus, the output voltage drops below regulated voltage with FB voltage less than internal reference voltage continuously.

The SCT2600 implements frequency fold back to protect the converter in unexpected overload or output hard short condition at higher switching frequencies and input voltages. The oscillator frequency is divided by 1, 4, 8, and 32 as the FB pin voltage falls from 0.765 V to 0 V. The SCT2600 uses a digital frequency fold back to enable synchronization to an external clock during normal start-up and fault conditions. During short-circuit events, the inductor current can exceed the peak current limit because of the high input voltage and the minimum on-time. When the output voltage is forced low by the shorted load, the inductor current decreases slowly during the switch off-time. The frequency fold back effectively increases the off-time by increasing the period of the switching cycle providing more time for the inductor current to ramp down.

With a maximum frequency fold back ratio of 32, there is a maximum frequency at which the inductor current can be controlled by frequency fold back protection. Equation 4 calculates the maximum switching frequency at which the inductor current remains under control when V_{OUT} is forced to V_{OUT_SHORT}. The selected operating frequency must not exceed the calculated value.

(4)

where

the junction temperature exceeds 173 , the internal thermal sensor stops power MOSFETs swịtching. When the junct] D

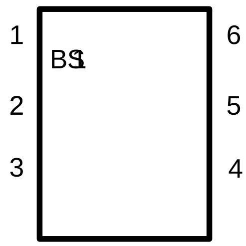


Figure 10. SCT2600 Design Example, 5V Output with Programmable UVLO

Input Voltage	24V Normal
Output Voltage	5V
Maximum Output Current	0.6A
Switching Frequency	2.1 MHz
Output voltage ripple (peak to peak)	10mV
Transient Response 0.15A to 0.45A load step	ΔVout = 180mV
Start Input Voltage (rising VIN)	8V
Stop Input Voltage (falling VIN)	7V

The output voltage is set by an external resistor divider R5 and R6 in typical application schematic. Recommended R6 resistance is 10.2KΩ. Use equation 5 to calculate R5.

—— (5)

where:

V_{REF} is the feedback reference voltage, typical 0.765V

Table

(9)

Where

L_{MIN} is the minimum inductance required
f_{sw} is the switching frequency
V_{OUT} is the output voltage
$V_{IN(max)}$ is the maximum input voltage
$I_{OUT(max)}$ is the maximum DC load current
LIR is coefficient of I_{LPP} to I_{OUT}

The total current flowing through the inductor is the inductor ripple current plus the output current. When selecting an inductor, choose its rated current especially the saturation current larger than its peak operation current and RMS current also not be exceeded. Therefore, the peak switching current of inductor, I_{LPEAK} and I_{LRMS} can be calculated as in equation 10 and equation 11.

(10)

(11)

Where

I_{LPEAK} is the inductor peak current
I_{OUT} is the DC load current
I_{LPP} is the inductor peak-to-peak current
I_{LRMS} is the inductor RMS current

In overloading or load transient conditions, the inductor peak current can increase up to the switch current limit of the device which is typically 1.6A. The most conservative approach is to choose an inductor with a saturation current rating greater than 1.6A. Because of the maximum I_{LPEAK} limited by device, the maximum output current that the SCT2600 can deliver also depends on the inductor current ripple. Thus, the maximum desired output current also affects the selection of inductance. The smaller inductor results in larger inductor current ripple leading to a lower maximum output current.

The SCT2600 requires an external catch diode between the SW pin and GND. The selected diode must have a reverse voltage rating equal to or greater than VIN(max). The peak current rating of the diode must be greater than the maximum inductor current. Schottky diodes are typically a good choice for the catch diode due to their low forward voltage. The lower the forward voltage of the diode, the higher the efficiency of the regulator.

Typically, diodes with higher voltage and current ratings have higher forward voltages. A diode with a minimum of 60-V reverse voltage is preferred to allow input voltage transients up to the rated voltage of the SCT2600.

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The B360A-13-F diode has a junction capacitance of 200 pF. Using Equation 12, the total loss in the diode at the maximum input voltage is 0.39 W.

If the power supply spends a significant amount of time at light load currents or in sleep mode, consider using a diode which has a low leakage current and slightly higher forward voltage drop.

capacitor like ceramic capacitor. For ceramic capacitors, the capacitance dominates the output ripple. For simplification, the output voltage ripple can be estimated by Equation 16 desired.

(16)

Where

Δ is the output voltage ripple

f_{SW}

Vin=24V, Vout=5V, unless otherwise noted

Figure 11. Power up(Iload=0.6A)

Figure 12. Power down(Iload=0.6A)

Figure 13.EN toggle (Iload=0.6A)

Figure 14. EN toggle (Iload=10mA)

Figure 15. Over Current Protection(

Vin=12V, Vout=5V, unless otherwise noted

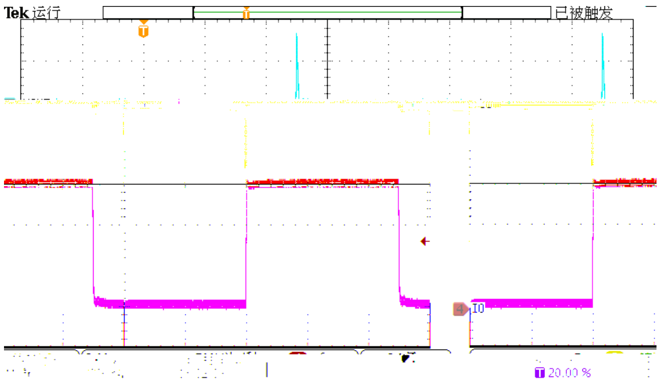


Figure 17. Load Transient (0.06A-0.54A, 1.6A/us)

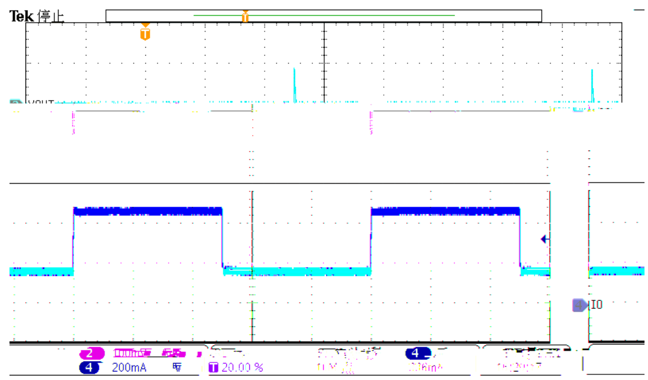


Figure 18. Load Transient (0.15A-0.45A, 1.6A/us)

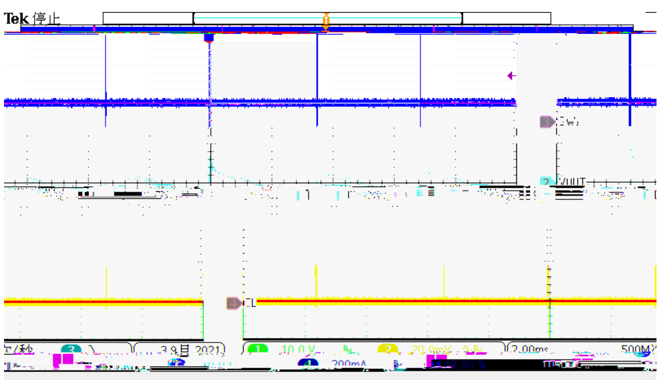


Figure 19. Output Ripple (Iload=0A)

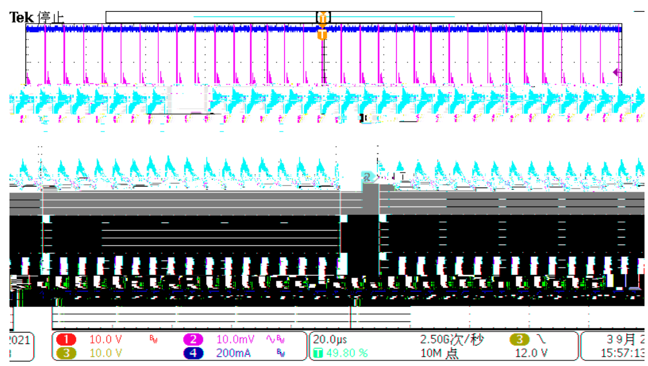


Figure 20. Output Ripple (Iload=10mA)

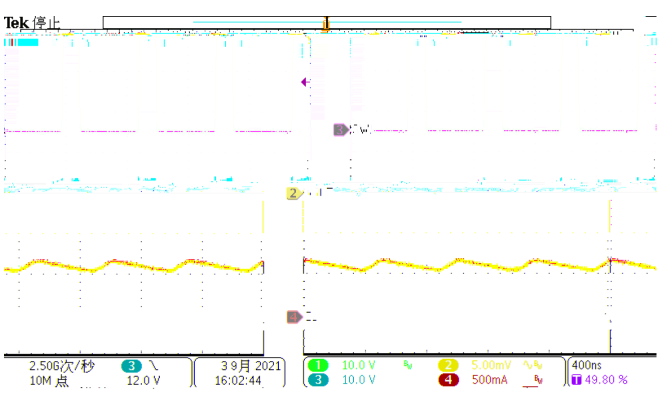


Figure 21. Output Ripple (Iload=0.6A)

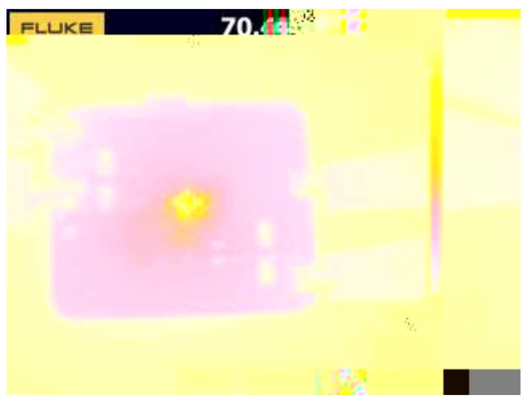


Figure 22. Thermal, 24VIN, 5Vout, 0.6A

The maximum IC junction temperature should be restricted to 125°C under normal operating conditions. Calculate the maximum allowable dissipation, $P_{D(max)}$, and keep the actual power dissipation less than or equal to $P_{D(max)}$. The maximum-power-dissipation limit is determined using Equation 14.

———————— (14)

where

T_A is the maximum ambient temperature for the application.

$R_{\theta JA}$ is the junction-to-ambient thermal resistance given in the Thermal Information table.

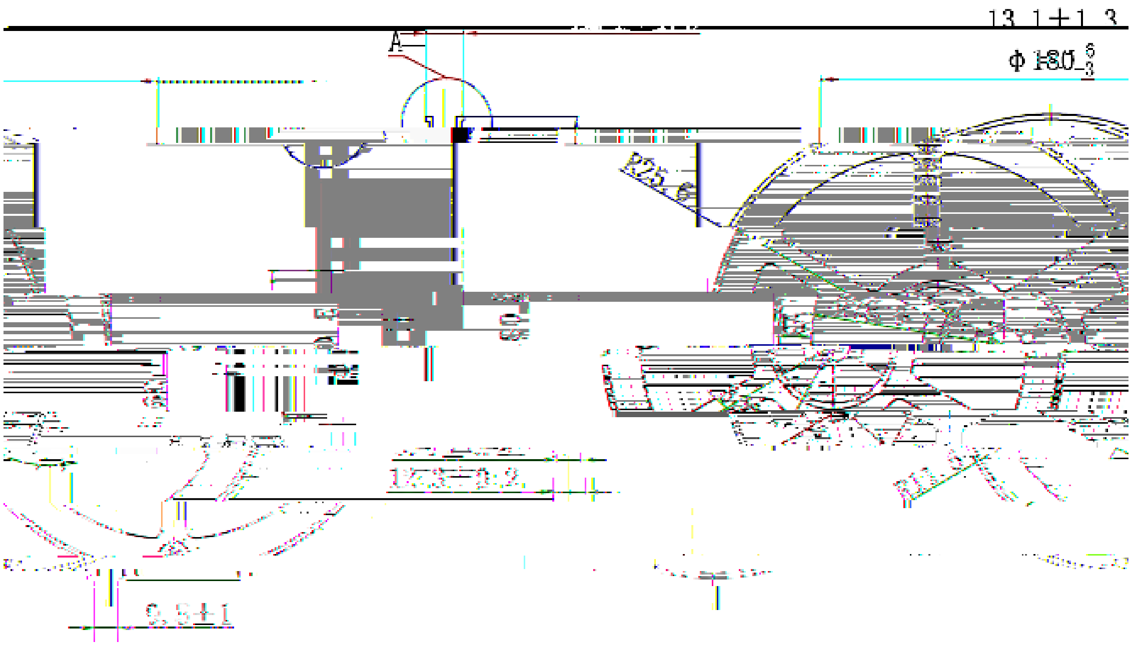
The real junction-

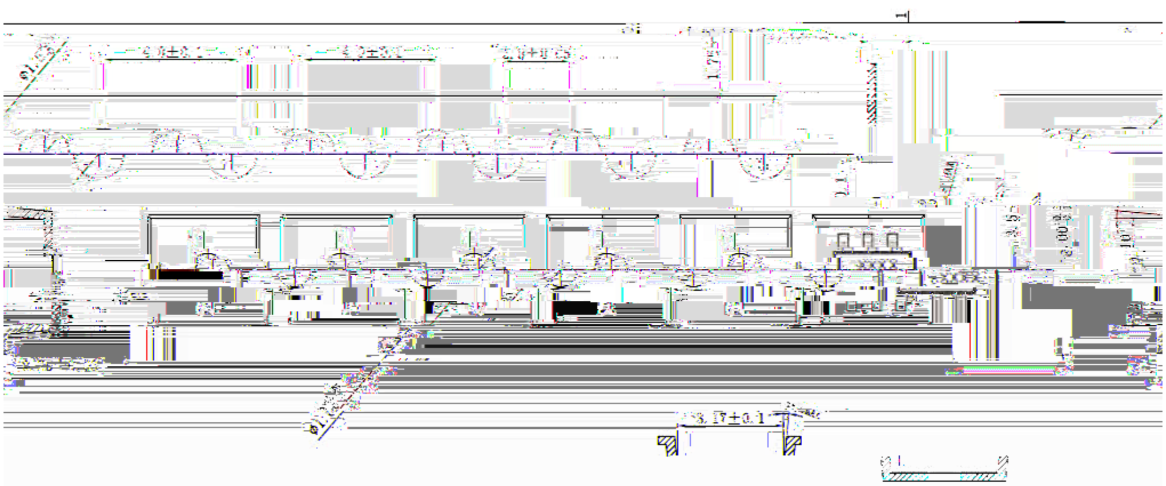
TOP VIEW

BOTTOM VIEW

SIDE VIEW

1. Drawing proposed to be made a JEDEC package outline MO-220 variation.
2. Drawing not to scale.


13.1±1.3
Φ 180
R25.6
12.8±0.2
9.5±1


3.17±0.1