

SCM3421ASA High-speed CAN Transceiver

Features

- Compatible with the "ISO 11898-24 V" standard fully
- Can be applied to 24V power system
- Rs foot slope control to reduce RFI
- Thermal Shutdown Protection
- Over current protection
- Low current standby mode
- An unpowered node does not disturb the bus lines
- The bus supports maximum 110 nodes

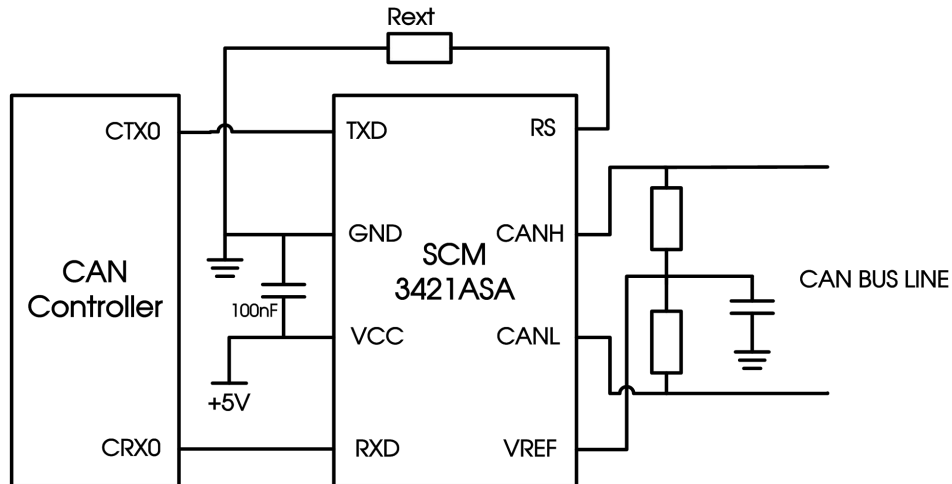
Applications

- Industrial automation
- Building automation
- Smart meter
- Long-distance signal interaction and transmission

Functional Description

The SCM3421ASA is an interface chip used between the CAN protocol controller and the physical bus. It can be used in many fields such as trucks buses, cars, industrial control. It can reach speeds up to 1Mbps. The SCM3421ASA has the ability to differentially transmit between the bus and the CAN protocol controller.

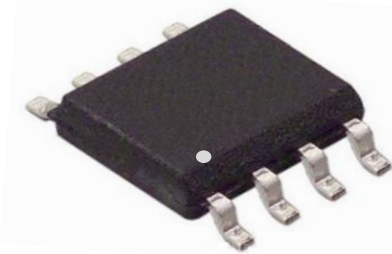
Typical Application



Note: If there is no slope control requirement, $R_{ext}=0$;

Figure 1. Typical application circuit (typical CAN transceiver application diagram)

Package

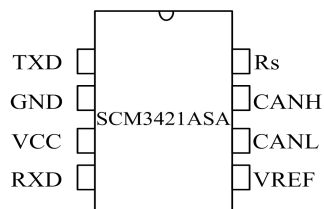


Product optional package: SOP-8, Screen Printing information please see "Ordering Information"

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Pin Package



Truth Table

TABLE 1 CAN Transceiver Truth Table

VCC	TXD	CANH	CANL	Bus State	RXD
4.5~5.5V	1(Or left floating)	Left floating	Left floating	Recessive	1 ⁽²⁾
4.5~5.5V	X ⁽¹⁾	Left floating, if V _{RS} >0.75VCC	Left floating, if V _{RS} >0.75VCC	Left floating	1 ⁽²⁾
0<VCC<4.5V	Left floating	Left floating	Left floating	Left floating	X ⁽¹⁾

(1) Any level;

(2) If other nodes on the bus are transmitting dominant bits, then RXD=0.

TABLE 2 Rs pin summary

Rs Pin Input Conditions	Mode	Current and Voltage Results of the Rs Pin
V _{RS} >0.75VCC	Standby	-I _{RS} <10uA
10uA<-I _{RS} <200uA	Slope control	0.4VCC<V _{RS} <0.6VCC
V _{RS} <0.3 VCC	High speed	-I _{RS} <500uA

Pin Configurations and Functions

Pins	Name	Pin Functions
1	TXD	Transmit data input
2	GND	Ground supply
3	VCC	Supply voltage
4	RXD	Receive data output; reads out data from the bus lines
5	VREF	Reference output voltage
6	CANL	LOW-level CAN bus line
7	CANH	HIGH-level CAN bus line
8	Rs	Slope control input pin

Absolute Maximum Ratings

Parameters	Sym.	Value	Units
Supply Voltage	VCC	-0.3 ~ +7	V
MCU Side Port	TXD, RXD, VREF, Rs	-0.3 ~ VCC+0.3	V
Bus Side Input Voltage	CANL, CANH	-36 ~ 36	V
Transient Voltage on 6, 7 Pin (See Figure 7)	Vtr	-200 ~ +200	V
Storage Temperature Range		-55 ~ 150	°C
Operating Ambient Temperature Range		-40 ~ 125	°C
Welding Temperature Range		300	°C
Continuous Power Dissipation	SOP8	400	mW
	DIP8	700	mW

(1)The above data was measured in a naturally ventilated, normal operating temperature range (unless otherwise stated).

(2)The maximum limit parameter value means that exceeding these values may cause irreparable damage to the device. Under these conditions, it is not conducive to the normal operation of the device. Continuous operation of the device at the maximum allowable rating may affect device reliability. The reference point for all voltages is ground.

Recommended Operating Conditions

Sym.	Parameters	Test Conditions	Min.	Max.	Units
V _{CC}	Supply voltage		4.5	5.5	V
1/tbit	Maximum baud rate	Non-return to zero code	1		Mbaud
V _{can}	CANH, CANL input voltage		-36	+36	V
T _{amb}	Operating ambient temperature range		-40	125	°C

Electrical Characteristics

Unless otherwise stated, V_{CC}=5V±10%, Temp=T_{MIN}~T_{MAX}, typical value is V_{CC}=+5V, Temp=25°C

Driver Electrical Characteristics						
Sym.	Parameters	Test Conditions	Min.	Typ.	Max.	Units
V _{IH}	High-level Input voltage	Output: recessive	0.7V _{CC}		V _{CC} +0.3	V
V _{IL}	Low-level Input voltage	Input: recessive	-0.3		0.3V _{CC}	V
I _{IH}	High-level input leakage current	V ₁ =4V	-200		+30	uA
I _{IL}	Low-level input leakage current	V ₁ =1V	-100		-600	uA
V _{6,7}	Bus output voltage (recessive)	V ₁ =4V, RL=open	2.0		3.0	V
I _{LO}	Off-state output leakage current	-2V < (V ₆ , V ₇) < -7V	-2		+2	mA
		-5V < (V ₆ , V ₇) < 36V	-10		+10	mA
V ₇	Bus output voltage(CANH)	V ₁ =1V, V _{CC} =4.75~5.5V	3.0		4.5	V
		V ₁ =1V, V _{CC} =4.75~5.5V	2.75		4.5	V
V ₆	Bus output voltage(CANL)	V ₁ =1V	0.5		2.0	V
		V ₁ =1V	1.5		3.0	V
ΔV _{6,7}	Differential output voltage	V ₁ =1V, RL=45Ω	1.5			V
		V ₁ =4V, RL=open	-500		+50	mV
I _{sc7}	Short-circuit current (CANH)	V ₇ =-36V		-100	-200	mA
I _{sc6}	Short-circuit current (CANL)	V ₆ =+36V			200	mA
Receiver Electrical Characteristics						
Sym.	Parameters	Test Conditions	Min.	Typ.	Max.	Units
V _{diff(r)}	Differential input voltage (recessive)	NOTE1	-1		0.5	V
		-7V < (V ₆ , V ₇) < 12V ; NOTE1	-1		0.4	V
V _{diff(d)}	Differential input voltage (dominant)		0.9		5.0	V
		-7V < (V ₆ , V ₇) < 12V, Not stanby mode	1.0		5.0	V
		Stanby mode	0.97		5.0	V
		V _{CC} =4.5~5.1V, Stanby mode	0.91		5.0	V
V _{diff(hys)}	Hysteresis differential input voltage	See Figure 4		150		mV
V _{OH, Pin4}	High-level output voltage	I ₄ =100uA	0.8V _{CC}		V _{CC}	V
V _{OL, Pin4}	Low-level output voltage	I ₄ =1mA	0		0.2 V _{CC}	V
		I ₄ =10mA	0		1.5	V
R _i	Input resistance (CANH or CANL)		5		25	KΩ
R _{diff}	Differential input resistance		20		100	KΩ

(Pin6 and Pin7 are driven externally, -2V < (V_{6,7}) < 7V)

NOTE 1 : Including high speed, slope control and standby mode.

Power supply features						
Sym.	Parameters	Test Conditions	Min.	Typ.	Max.	Units
I _s	Supply curren	Dominant; V ₁ =1V; V _{CC} <5.1V			78	mA
		dominant ; V ₁ =1V; V _{CC} <5.25V			80	mA
		dominant ; V ₁ =1V; V _{CC} <5.5V			85	mA
		dominant ; V ₁ =4V; R ₈ =47kΩ			10	mA
		Stanby mode; NOTE2			275	uA

NOTE2 : I₁=I₄=I₅=0mA; 0V<V₆, V₇<V_{CC};V₈=V_{CC};T_{amb}<90°C

Reference output voltage						
Sym.	Parameters	Test Conditions	Min.	Typ.	Max.	Units
V _{ref}	Reference output voltage	V ₈ =1V; I _s <50uA	0.45V _{CC}		0.55V _{CC}	V
		V ₈ =4V; I _s <5uA	0.4V _{CC}		0.6V _{CC}	V

Sym.	Parameters	Test Conditions	Min.	Typ.	Max.	Units
t_{bit}	Minimum bit time	$R_8=0\Omega$			1	us
t_{onTXD}	Delay time from TXD to bus activation	$R_8=0\Omega$			50	ns
t_{offTXD}	Delay time from TXD to bus inactivation	$R_8=0\Omega$		40	80	ns
t_{onRXD}	Delay time from TXD to receiver activation	$R_8=0\Omega$		55	120	ns
t_{offRXD}	Delay Time from TXD to Receiver inactivation	$R_8=0\Omega$		100	190	ns
		$R_8=47K\Omega$		300	400	ns
SR	CANH, CANL slew rate	$R_8=47K\Omega$		7		V/us
t_{wake}	Delay time from standby mode to wake-up (by pin8)	See Figure 5			20	us
t_{dRXDL}	Delay Time from Bus dominant to RXD output low under standby mode	$V_8=4V$; See Figure 6			3	us
Standby and slope control (pin8)						
Sym.	Parameters	Test Conditions	Min.	Typ.	Max.	Units
V_{stb}	Input voltage under standby mode		$0.75V_{CC}$			V
I_{slope}	Current under Slope control mode		-10		-200	uA
V_{slope}	Voltage under Slope control mode		$0.4V_{CC}$		$0.6V_{CC}$	V

(1)If not stated otherwise, RL = 60 Ω; CL = 100 pF; see Figure 2, Figure 3.

Parameter Test Circuit

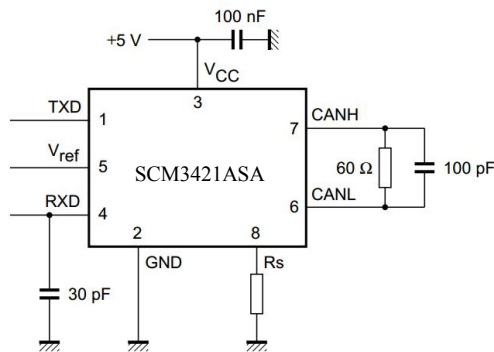


Figure 2. Dynamic characteristic test circuit

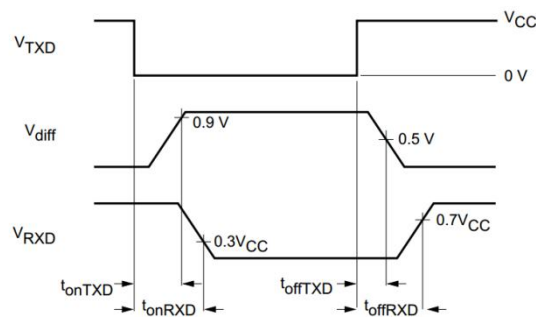


Figure 3. Dynamic characteristic timing diagram

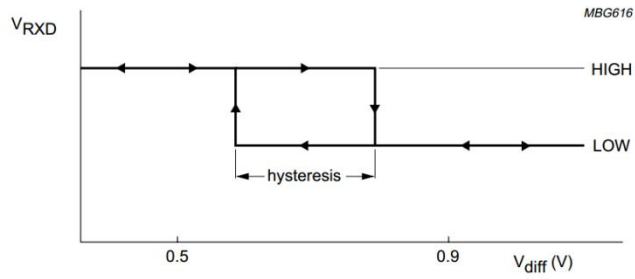
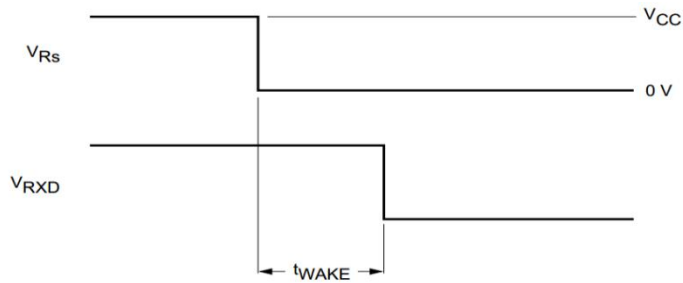
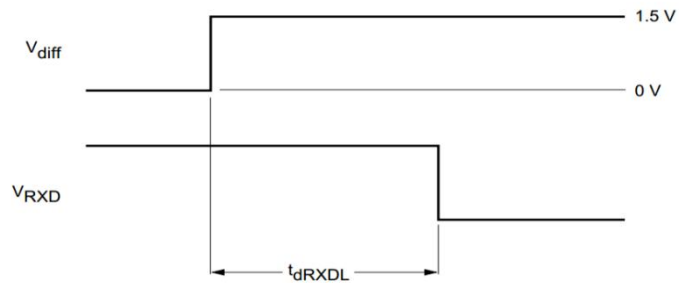


Figure 4. Hysteresis



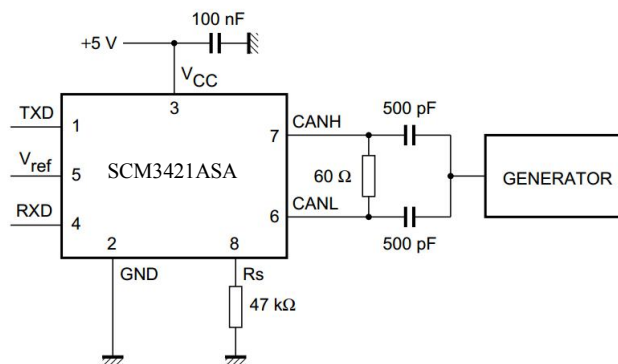
$V_{TXD} = 1 \text{ V}$.

Figure 5. Wake up timing diagram from standby



$V_{R8} = 4 \text{ V}$; $V_{TXD} = 4 \text{ V}$.

Figure 6. Bus dominant to RXD output low timing diagram



Apply waveforms according to ISO7637 part1, test pulses 1, 2, 3a and 3b

Figure 7. Automotive application transient test circuit

General Description

The SCM3421ASA is an interface chip used between the CAN protocol controller and the physical bus. It can be used in many fields such as trucks, buses, cars, industrial control. It can reach speeds up to 1Mbps. The SCM3421ASA has the ability to differentially transmit between the bus and the CAN protocol controller. SCM3421ASA is compatible with the "ISO 11898-24V" standard

Short-circuit protection: The drive stage of the SCM3421ASA has current-limiting protection to prevent the drive circuit from short-circuiting to positive and negative supply voltages. The power dissipation increases when a short circuit occurs. The short-circuit protection function protects the driver stage from damage.

Over-temperature protection: The SCM3421ASA has over-temperature protection. When the junction temperature exceeds 160°C, the current in the driver stage will decrease. Because the drive tube is the primary energy consuming component, current reduction can reduce power consumption and reduce chip temperature. At the same time, the rest of the chip remains functional.

Electrical transient protection: Electrical transients often occur in automotive applications. The CANH and CANL of the SCM3421ASA have the function of preventing electrical transient damage.

Control mode: The operating mode can be changed by controlling the state of pin8 (Rs pin). There are three modes available: high speed mode, slope control mode and standby mode.

Pin8 is grounded to form a high speed mode. In this mode, no measures are taken to limit the slope of the transmitter. In this mode, cables with shielded wires are recommended to avoid RFI problems.

Pin8 forms a slope control mode through resistor grounding. This mode can be used without a twisted pair or parallel line with shielded wires as the bus. The slope is proportional to the current of pin8. By controlling the slope of the transmitter, the RFI can be reduced.

When pin8 is tied high, the chip enters a low-power standby mode. In this mode, the transmitter is turned off and the receiver enters a low current state. If the receiver detects bus dominant (bus differential voltage >0.9V), RXD will switch to low level, and the MCU needs to respond to this action at this time, and control pin8 to enter normal operation state. Because the current is small and the response time is long in the standby state, the first signal may be lost at a higher baud rate.

Design Circuit Expansion

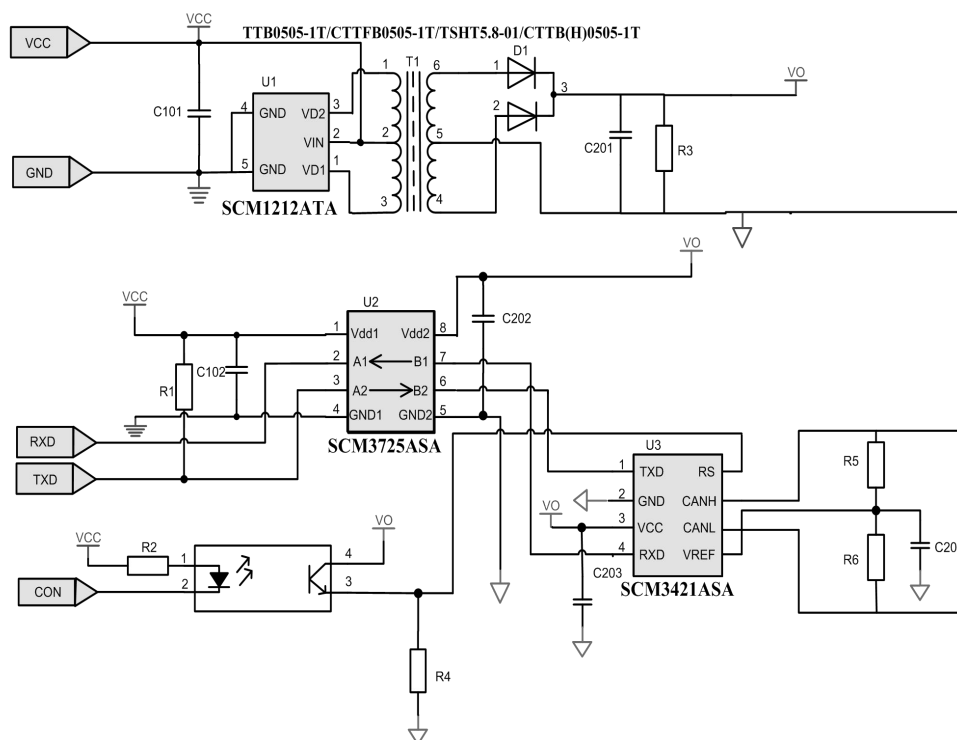


Figure 8. Isolated Application Circuit Schematic for Converting TTL/CMOS to CAN Bus

Power Usage Recommendations

Connecting the 0.1μF bypass capacitor as close as possible to the VCC pin of the device.

Ordering Information

Product number	Package Type	Pins	Screen Printing	package
SCM3421ASA	SOP	8	SCM 3421ASA YM	2.5K/reel

Product model and Screen Printing instructions:

SCM3421XYZ :

(1)SCM3421, Product Code.

(2)X = A-Z, Version code.

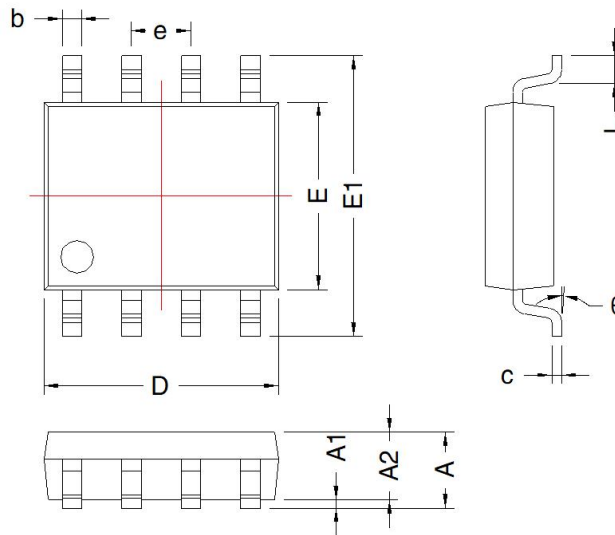
(3)Y = S Package code ; S : SOP package.

(4)Z = C, I, A, M, Temperature class code ; C : 0°C-70°C, I : -40°C-85°C, A : -40°C-125°C, M : -55°C-125°C.

(5)YM : Product traceability code ; Y: Product year code, M: Product production month code.

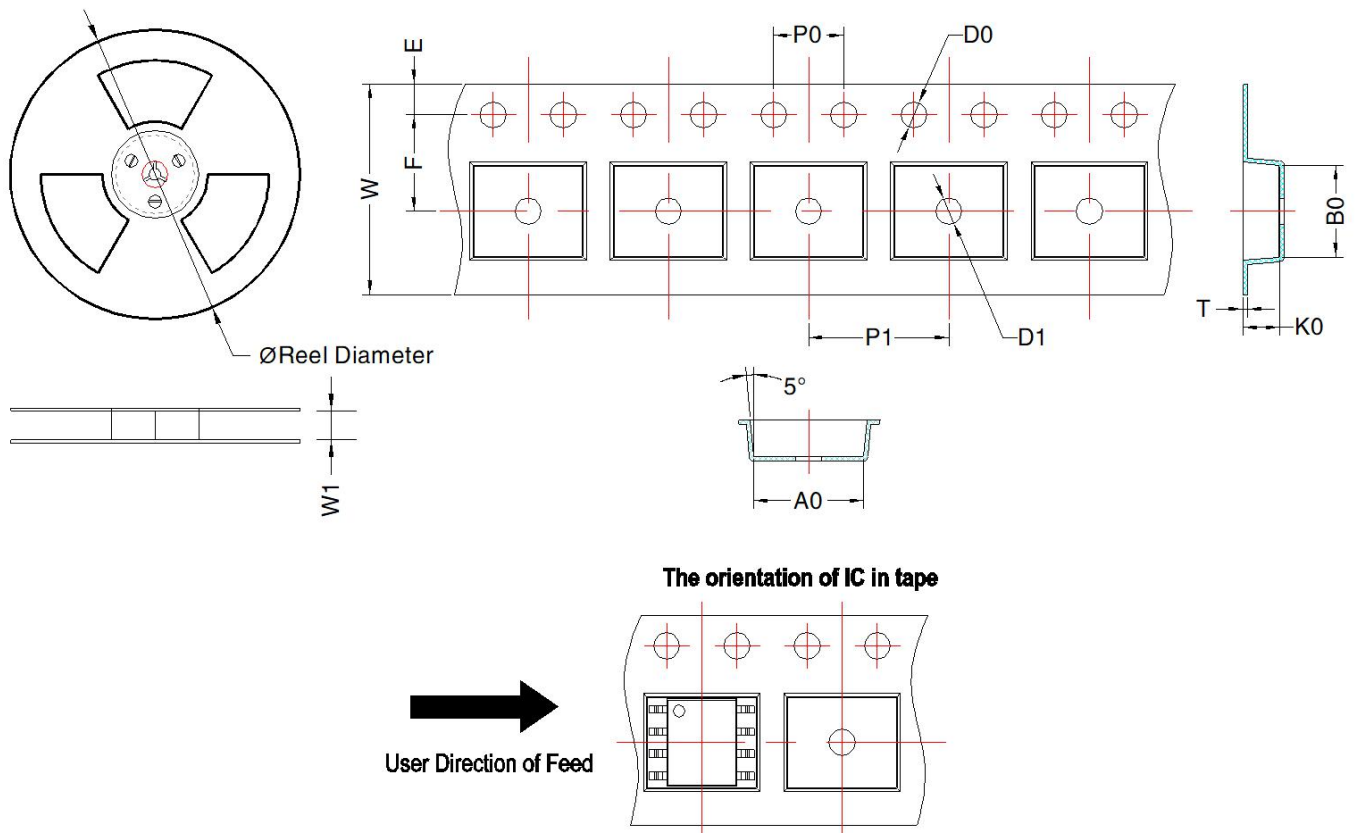
Packaging Information

THIRD ANGLE PROJECTION 



Mark	SOP-8			
	Dimension(mm)		Dimension(inch)	
	Min	Max	Min	Max
A	1.5	1.7	0.059	0.067
A1	0.1	0.2	0.004	0.008
A2	1.35	1.55	0.004	Min
D	4.8	5.0	0.053	0.197
E	3.78	3.98	0.149	0.157
E1	5.8	6.2	0.228	0.244
L	0.4	0.8	0.016	0.031
b	0.355	0.455	0.014	0.018
e	1.27 TYP		0.05 TYP	
c	0.153	0.253	0.006	0.001
theta	2°	6°	2°	6°

Tape & Reel Information



Device	Package Type	MPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	T (mm)	W (mm)	E (mm)	F (mm)	P1 (mm)	P0 (mm)	D0 (mm)	D1 (mm)
SCM3421ASA	SOP-8	2500	330.0	12.4	6.4±0.1	5.3±0.1	2.1±0.1	0.25±0.03	12.0±0.1	1.75±0.1	5.5±0.1	8±0.1	4±0.1	1.5±0.1	1.5±0.1

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