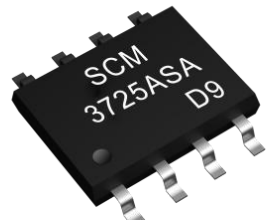
MORNSUN®

SCM3725ASA/SCM3728ASA Dual-Channel Digital Isolators

Features

- 3 V to 5.5 V level translation
- High common-mode transient immunity: 75 kV/μs typical
- High robustness to radiated and conducted noise
- High ESD rating
- Ultra low power consumption 0.58mA/channel(1Mbps)
- Wide temperature range: -40°C ~ 125°C
- Isolation voltages: AC 3kVrms
- High data rate:10Mbps

Package



Mechanical package: SOP-8
(see “Ordering information” for details).

Applications

- General-purpose multichannel isolation
- Industrial field bus isolation

Functional

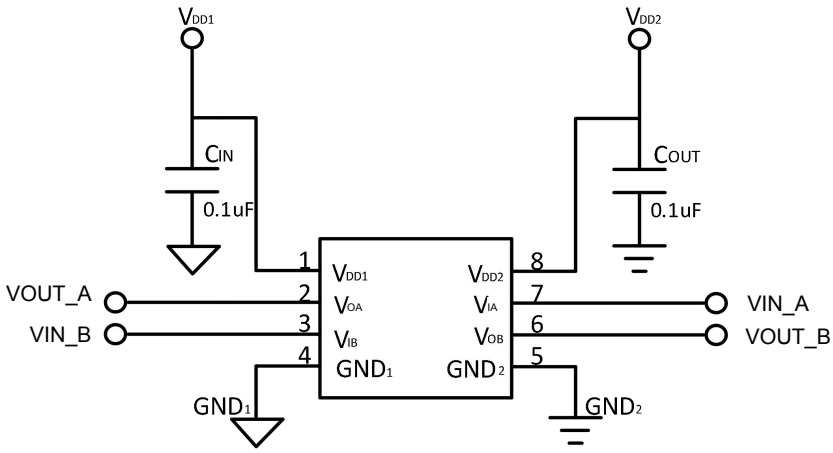
The SCM3725ASA/SCM3728ASA digital isolators by using maturated standard semiconductor CMOS technology and Capacitance pulse isolation technology, these isolation components provide outstanding performance characteristics and reliability superior to alternatives such as optocoupler devices and other integrated isolators.

Capacitance pulse isolation technology is a new generation digital isolator technology . It uses the principle of capacitor voltage divider to transmit voltage signal directly cross the isolator capacitor without signal modulation and demodulation.

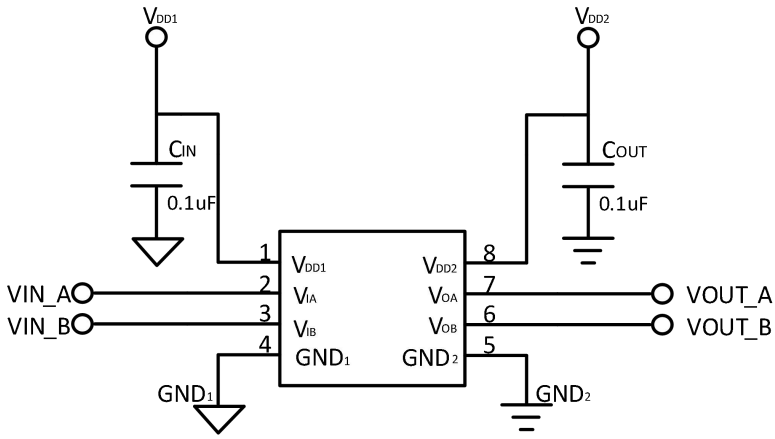
The SCM3725ASA/SCM3728ASA isolator data channels are independent and different models have different transmission directions with a withstand voltage rating of 3 kV rms and the data rate from DC up to 10Mbps . The devices operate with the supply voltage on either side ranging from 3.0 V to 5.5 V, providing compatibility with lower voltage systems as well as enabling voltage translation functionality across the isolation barrier. The fail-safe state is available in which the outputs transition to a preset state when the input power supply is not applied.

Product model

Model	Power supply range (V)	Data rate	Channel number	Output channel number	Withstand voltage(kV rms)	Default output	Package option	Pin number
SCM3725ASA	3.0~5.5	10Mbps	2	1	3	high	SOP	8
SCM3728ASA	3.0~5.5	10Mbps	2	2	3	low	SOP	8



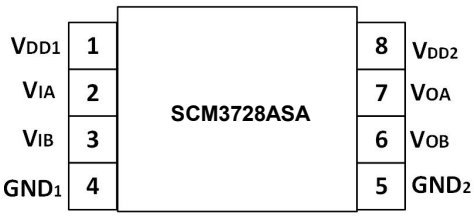
Typical Circuit: 1 SCM3725ASA Application Diagram



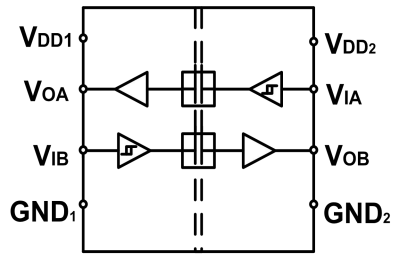
Typical Circuit: 2 SCM3728ASA Application Diagram

Contents

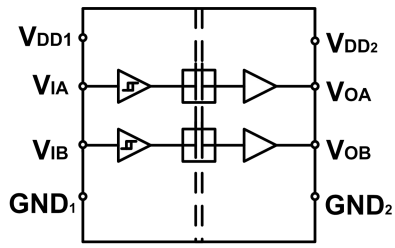
Pin Connection



Internal Block



SCM3725ASA



SCM3728ASA

Function table

VI	VDDI	VDDO	Default Low VOx Output[1]	Default High VOx Output[1]	Test Conditions /Comments
Low	Powered[2]	Powered[2]	Low	Low	Normal operation
High	Powered[2]	Powered[2]	High	High	Normal operation
Open	Powered[2]	Powered[2]	Low	High	Default output
Don't Care[4]	Unpowered[3]	Powered[2]	Low	High	Default output[5]
Don't Care[4]	Powered[2]	Unpowered[3]	High Impedance	High Impedance	

Notes:

1. VIx/VOx are the input/output signals of a given channel (A or B). VDDI/VDDO are the supply voltages on the input/output signal sides of this given channel.
2. Powered means VDDx≥ 2.9 V
3. Unpowered means VDDx < 2.3V
4. Input signal (VIx) must be in a low state to avoid powering the given VDDI1 through its ESD protection circuitry.
5. If the VDDI goes into unpowered status, the channel outputs the default logic signal after around 1us. If the VDDI goes into powered status, the channel outputs the input status logic signal after around 3us.

Pin descriptions

SCM3725ASA		
Pin No.	**Name**	**Description**
1	VDD1	Supply Voltage for Isolator Side 1.
2	VOA	Logic Output A.
3	VIB	Logic Input B.
4	GND1	Ground 1. This pin is the ground reference for Isolator Side 1.
5	GND2	Ground 2. This pin is the ground reference for Isolator Side 2.
6	VOB	Logic Output B.
7	VIA	Logic Input A.
8	VDD2	Supply Voltage for Isolator Side 2.

SCM3728ASA		
Pin No.	**Name**	**Description**
1	VDD1	Supply Voltage for Isolator Side 1.
2	VIA	Logic Input A.
3	VIB	Logic Input B.
4	GND1	Ground 1. This pin is the ground reference for Isolator Side 1.
5	GND2	Ground 2. This pin is the ground reference for Isolator Side 2.
6	VOB	Logic Output B.
7	VOA	Logic Output A.
8	VDD2	Supply Voltage for Isolator Side 2.

Absolute Maximum Ratings

General test conditions: Free-air, normal operating temperature range (unless otherwise specified).

Parameter	**Symbol**	**Range**	**Unit**
Supply Voltages	V_{DD1}-GND_1, V_{DD2}-GND_2	−0.5 V to +7.0 V	V
Input Voltages	V_{IA}, V_{IB}	−0.5 V to V_{DDx} + 0.5 V	V
Output Voltages	V_{OA}, V_{OB}	−0.5 V to V_{DDx} + 0.5 V	V
Average Output Current per Pin Side 1 Output Current	I_{O1}	−10 mA to +10 mA	mA
Average Output Current per Pin Side 2 Output Current	I_{O2}	−10 mA to +10 mA	mA
Common-Mode Transients Immunity		−150 kV/μs to +150 kV/μs	kV/μs
Storage Temperature Range	T_{ST}	−65°C to +150°C	°C
Ambient Operating Temperature Range	T_A	−40°C to +125°C	°C

Notes:

1. VDDx is the side voltage power supply VDD, where x = 1 or 2.
2. See Figure3 for the maximum rated current values for various temperatures.
3. See Figure13 for Common-mode transient immunity (CMTI) measurement.
4. Pressures at or above those listed in the absolute maximum ratings may cause permanent conditions to the equipment, and operating conditions of the equipment beyond the limits may affect the function of the product.

Recommended Operating Conditions

Parameter	**Symbol**	**Min**	**Typ**	**Max**	**Unit**
Supply Voltage	V_{DDx} [1]	3		5.5	V
High Level Input Signal Voltage	V_{IH}	0.7*V_{DDx}[1]		V_{DDx}[1]	V
Low Level Input Signal Voltage	V_{IL}	0		0.3*V_{DDx}[1]	V
High Level Output Current	IOH	-6			mA
Low Level Output Current	IOL			6	mA
Maximum Data Rate		0		10	Mbps
Junction Temperature	T_J	-40		150	°C
Ambient Operating Temperature	T_A	-40		125	°C

Notes:
1. VDDx is the side voltage power supply VDD, where x = 1 or 2.

Switching Specifications						
Parameter	**Symbol**	**Test Conditions/Comments**	**Min**	**Typ**	**Max**	**Unit**
Minimum Pulse Width	PW	Within pulse width distortion (PWD) limit			100	ns
Maximum Data Rate		Within PWD limit	10			Mbps
Propagation Delay Time[1,4]	tpHL, tpLH	The different time between 50% input signal to 50% output signal 50% @ 5VDC supply	5.5	8	12.5	ns
		@ 3.3VDC supply	6.5	9	13.5	ns
Pulse Width Distortion[4]	PWD	The max different time between tpHL and tpLH@ 5VDC supply. And The value is | tpHL - tpLH |	0	0.3	0.8	ns
		@ 3.3VDC supply	0	0.3	0.8	ns
Part to Part Propagation Delay Skew[4]	tPSK	The max different propagation delay time between any two devices at the same temperature, load and voltage @ 5VDC supply			1	ns
		@ 3.3VDC supply			1	ns
Channel to Channel Propagation Delay Skew[4]	tCSK	The max amount propagation delay time differs between any two output channels in the single device @ 5VDC supply.		0	1	ns
		@ 3.3VDC supply		0	0.8	ns
Output Signal Rise/Fall Time[4]	t_r/t_f	10% to 90% signal terminated 50Ω ,See figure 9		23		ns
Dynamic Input Supply Current per Channel	IDDI (D)	Inputs switching, 50% duty cycle square wave, CL = 0 pF @ 5VDC Supply		1.5		μA /Mbps
Dynamic Output Supply Current per Channel	IDDO (D)	Inputs switching, 50% duty cycle square wave, CL = 0 pF @ 5VDC Supply		9		μA /Mbps
Dynamic Input Supply Current per Channel	IDDI (D)	Inputs switching, 50% duty cycle square wave, CL = 0 pF @ 3.3VDC Supply		38		μA /Mbps
Dynamic Output Supply Current per Channel	IDDO (D)	Inputs switching, 50% duty cycle square wave, CL = 0 pF @ 3.3VDC Supply		5		μA /Mbps
Common-Mode Transient Immunity[3]	CMTI	V_{IN} = V_{DDx}[2] or 0V, V_{CM} = 1000 V.		75		kV/μs
Jitter		See the Jitter Measurement section		120		Ps p-p
		See the Jitter Measurement section		20		Ps rms
ESD（HBM - Human body model）	ESD	All pins		±8		kV
DC Specifications						
Parameter	**Symbol**	**Test Conditions/Comments**	**Min**	**Typ**	**Max**	**Unit**
Rising Input Signal Voltage Threshold	V_{IT+}			0.6*V_{DDx}	0.7*V_{DDx}	V
Falling Input Signal Voltage Threshold	V_{IT-}		0.3* V_{DDX}	0.4* V_{DDX}		V
High Level Output Voltage	VOH	−20 μA output current	V_{DDx} − 0.1	V_{DDx}		V
		−2 mA output current	V_{DDx} − 0.2	V_{DDx} − 0.1		V
Low Level Output Voltage	VOL	20 μA output current		0	0.1	V
		2 mA output current		0.1	0.2	V
Input Current per Signal Channel	I_{IN}	0 V ≤ Signal voltage ≤ V_{DDX}[1]	−10	0.5	10	μA
V_{DDx}[1] Undervoltage Rising Threshold	VDDxUV+		2.45	2.65	2.9	V
V_{DDx}[1] Undervoltage Falling Threshold	VDDxUV−		2.3	2.5	2.75	V
V_{DDx}[1] Hysteresis	VDDxUVH			0.15		V
Quiescent Supply Current						
Parameter	**Symbol**	**Test Conditions**	**Min**	**Typ**	**Max**	**Unit**
SCM3725ASA Quiescent Supply	IDD1 (Q)	0V Input signal	419	524	681	μA
	IDD2 (Q)	0V Input signal	419	524	681	μA

Current @ 5VDC Supply	IDD1 (Q)	5V Input signal	436	545	709	μA
	IDD2 (Q)	5V Input signal	436	545	709	μA
SCM3725ASA Quiescent Supply Current@ 3.3VDC Supply	IDD1 (Q)	0V Input signal	414	518	673	μA
	IDD2 (Q)	0V Input signal	414	518	673	μA
	IDD1 (Q)	3.3V Input signal	408	510	663	μA
	IDD2 (Q)	3.3V Input signal	408	510	663	μA
SCM3728ASA Quiescent Supply Current @ 5VDC Supply	IDD1 (Q)	0V Input signal	64	80	104	μA
	IDD2 (Q)	0V Input signal	781	976	1269	μA
	IDD1 (Q)	5V Input signal	158	197	256	μA
	IDD2 (Q)	5V Input signal	738	923	1200	μA
SCM3728ASA Quiescent Supply Current@ 3.3VDC Supply	IDD1 (Q)	0V Input signal	63	79	103	μA
	IDD2 (Q)	0V Input signal	772	965	1255	μA
	IDD1 (Q)	3.3V Input signal	116	145	189	μA
	IDD2 (Q)	3.3V Input signal	709	886	1152	μA

Total Supply Current vs. Data Throughput (CL = 0 pF)

V_{DD1} - V_{GND1} = V_{DD2} - V_{GND2} = 3.3VDC±10% or 5VDC±10%, T_A=25°C, CL = 0 pF, unless otherwise noted.

Parameter	Symbol	150kbps			1Mbps			10Mbps			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
SCM3725ASA Supply Current @ 5VDC	IDD1		0.54	0.81		0.58	0.86		0.97	1.60	mA
	IDD2		0.54	0.81		0.58	0.86		0.97	1.60	mA
SCM3725ASA Supply Current @ 3.3VDC	IDD1		0.52	0.78		0.54	0.81		0.77	1.20	mA
	IDD2		0.52	0.78		0.54	0.81		0.77	1.20	mA
SCM3728ASA Supply Current @ 5VDC	IDD1		0.14	0.21		0.15	0.22		0.24	0.36	mA
	IDD2		0.95	1.43		1.02	1.52		1.76	2.63	mA
SCM3728ASA Supply Current @ 3.3VDC	IDD1		0.11	0.17		0.12	0.17		0.18	0.27	mA
	IDD2		0.93	1.40		0.97	1.46		1.43	2.14	mA

Insulation And Safety Related Specifications

Insulation Specifications

Parameter	Symbol	Value	Unit	Test Conditions/Comments
		SCM3725ASA/SCM3728ASA		
Rated Dielectric Insulation Voltage		3000	V rms	1-minute duration
Minimum External Air Gap (Clearance)	L (CLR)	4	mm min	Measured from input terminals to output terminals, shortest distance through air
Minimum External Tracking (Creepage)	L (CRP)	4	mm min	Measured from input terminals to output terminals, shortest distance path along body
Minimum Internal Gap (Internal Clearance)		11	μm min	Insulation distance through insulation
Tracking Resistance (Comparative Tracking Index)	CTI	>400	V	DIN IEC 112/VDE 0303 Part 1
Material Group		II		Material Group (DIN VDE 0110, 1/89, Table 1)

Package Characteristics

Package Characteristics

Parameter	Symbol	Typical Value	Unit	Test Conditions/Comments
		SCM3725ASA/SCM3728ASA		
Resistance (Input to Output)	RI-O	10 [11]	Ω	
Capacitance (Input to Output)	CI-O	0.6	pF	@1MHz
Input Capacitance[2]	C_I	3	pF	@1MHz
IC Junction to Ambient Thermal Resistance	θJA	100	°C/W	Thermocouple located at center of package underside

Regulatory Information

See the Table and the Insulation Lifetime section for details regarding recommended maximum working voltages for specific cross isolation waveforms and insulation levels.

Regulatory	SCM3725ASA/SCM3728ASA
UL	Recognized under UL 1577 Component Recognition Program[1] Single Protection, 3000 V rms Isolation Voltage
CSA	Approved under CSA Component Acceptance Notice 5A CSA 60950-1-07+A1+A2 and IEC 60950-1, second edition, +A1+A2: Basic insulation at 500 V rms (707 V peak) Reinforced insulation at 250 V rms (353 V peak)
VDE	DIN V VDE V 0884-10 (VDE V 0884-10):2006-122 Basic insulation, V_{IORM} = 707 V peak, V_{IOSM} = 4615 V peak
CQC	Certified under CQC11-471543-2012 GB4943.1-2011 Basic insulation at 500 V rms (707 V peak) working voltage Reinforced insulation at 250 V rms (353 V peak)

Insulation Characteristics CS

Description	Test Conditions/Comments	Symbol	Characteristic	Unit
			SCM3725ASA SCM3728ASA	
Installation Classification per DIN VDE 0110				
For Rated Mains Voltage ≤ 150 V rms			I to IV	
For Rated Mains Voltage ≤ 300 V rms			I to III	
For Rated Mains Voltage ≤ 400 V rms			I to III	
Climatic Classification			40/105/21	
Pollution Degree per DIN VDE 0110, Table 1			2	
Maximum Working Insulation Voltage		VIORM	707	V peak
Input to Output Test Voltage, Method B1	V_{IORM} × 1.875 = $V_{pd\ (m)}$, 100% production test, tini = t_m = 1 sec, partial discharge < 5 pC	Vpd (m)	1326	V peak
After Environmental Tests Subgroup 1	V_{IORM} × 1.5 = $V_{pd\ (m)}$, t_{ini} = 60 sec, t_m = 10 sec, partial discharge < 5 pC	Vpd (m)	1061	V peak
After Input and/or Safety Test Subgroup 2 and Subgroup 3	V_{IORM} × 1.2 = $V_{pd\ (m)}$, t_{ini} = 60 sec, t_m = 10 sec, partial discharge < 5 pC		849	V peak
Highest Allowable Overvoltage		VIOTM	4200	V peak
Surge Isolation Voltage Basic	Basic insulation, 1.2 µs rise time, 50 µs, 50% fall time	VIOSM	4615	V peak
Safety Limiting Values	Maximum value allowed in the event of a failure (see Figure 3)			
Maximum Junction Temperature		T_S	150	°C
Total Power Dissipation	25°C	P_S	1.56	W
Insulation Resistance at T_S	V_{IO} = 800 V	R_S	>10^9	Ω

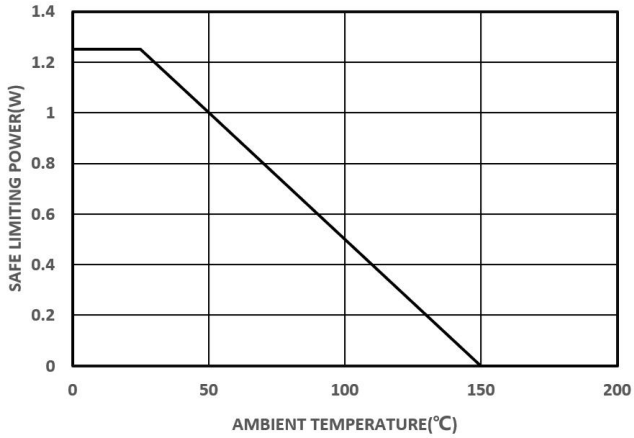


Figure3. Thermal derating Curve, obtained according to DIN V VDE V 0884-10safety limit valued versus ambient temperature

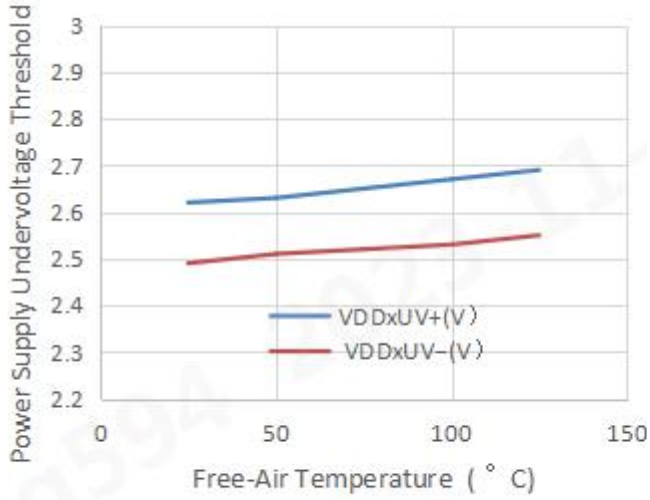


Figure4. UVLO vs. Free-Air Temperature

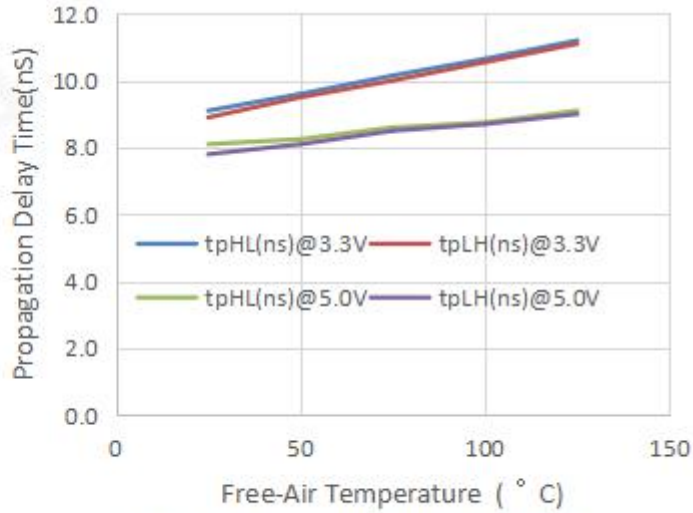


Figure5. Propagation Delay Time vs. Free-Air Temperature

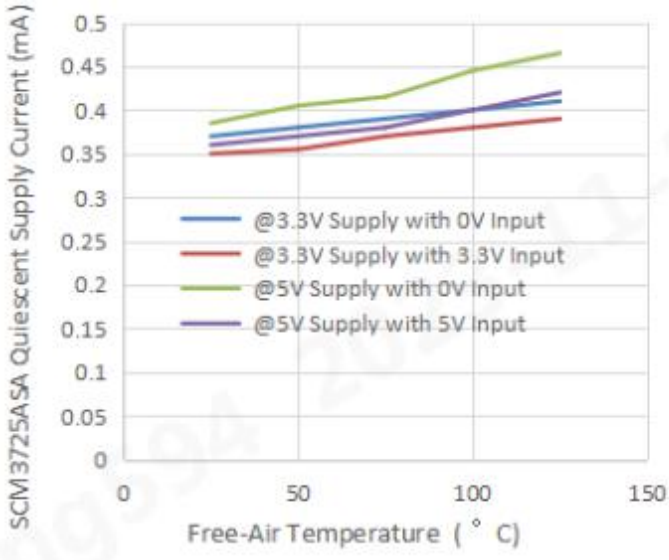


Figure6. SCM3725ASA Quiescent Supply Current vs. Free-Air Temperature

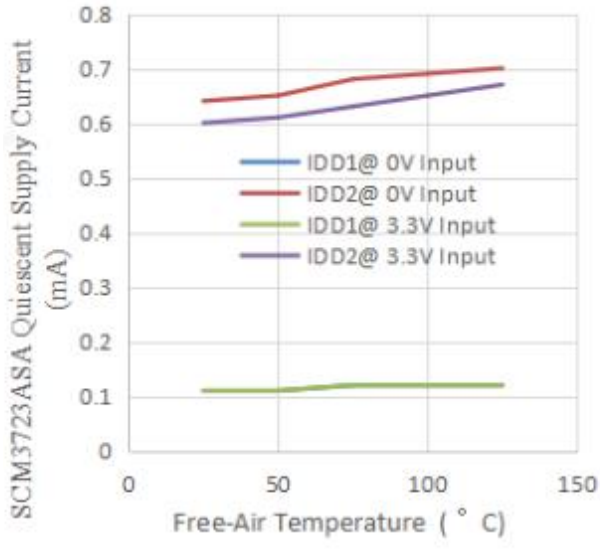


Figure7. SCM3728ASA Quiescent Supply Current with 3.3V Supply vs. Free-Air Temperature

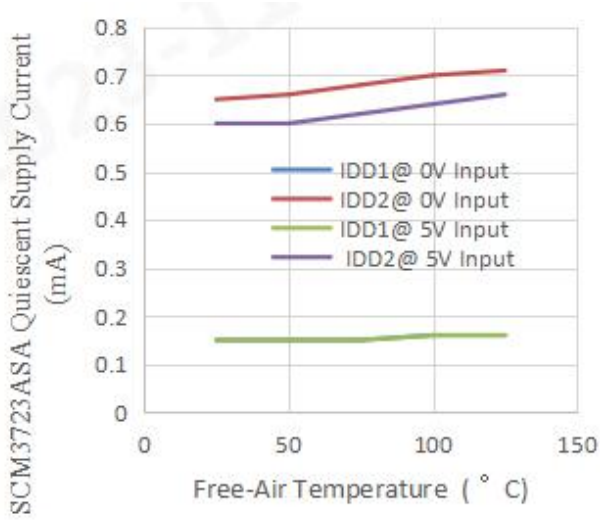


Figure8. SCM3728ASA Quiescent Supply Current with 5V Supply vs. Free-Air Temperature

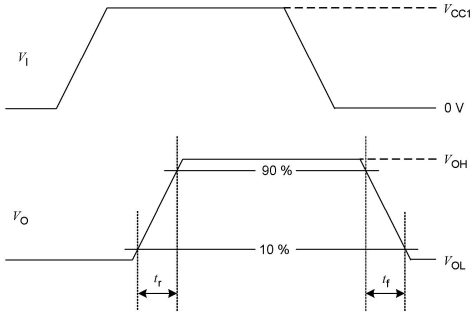


Figure 9. Transition time waveform measurement

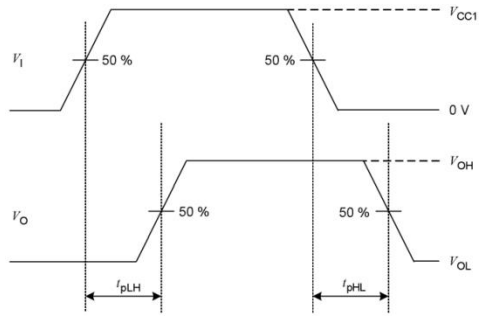


Figure10. Propagation delay time waveform measurement

Applications Information

Overview

The SCM3725ASA/SCM3728ASA are digital isolators based on a unique capacitive pulse isolation technology. Capacitive pulse isolation technology is a new type of digital isolation transmission technology. It uses the principle of capacitive voltage division to transmit signals directly through the isolation capacitor without signal modulation and demodulation. Compared with the traditional Opto-couple technology, icoupler technology, OOK technology, capacitive pulse isolation technology is a more important and simple isolated signal transmission, which greatly simplifies the circuit design and significantly improves the performance of the device. For example: low power consumption, fast transmission rate, strong anti-interference ability and low noise. Designed using semiconductor complementary metal oxide semiconductor technology and innovative capacitive pulse isolation technology, these isolation devices offer excellent performance characteristics and reliability, outperforming similar products such as optocoupler devices and other integrated isolators.

The SCM3725ASA/SCM3728ASA are dual, one-input, one-output, and two-output, channel independent digital isolators with enhanced ESD protection with isolation voltages from 1.5 kV rms to 3.0 kV rms, and maximum transfer rates up to 10Mbps. Input/output design techniques allow for a 3.0 V to 5.5 V supply voltage range, providing conversion between 3.3 V and 5 V logic. With relatively low transmission delay and high transmission speed. The structure is designed for high common mode transient immunity and high immunity to electrical noise and magnetic interference.

PCB Layout

Between VDD1 and GND1, and between VDD2 and GND2, a low ESR bypass capacitor should be connected as close to the isolator as possible, with a recommended capacitance of 0.1 μF to 10 μF. If the system noise is too large, in order to enhance the anti-jamming ability of the design, the user can also be resistors (50-300 Ω) in series with the inputs and outputs. Avoid degrading isolation capabilities by keeping the space below the isolator device away from metal, such as flat pad alignments and vias. To minimize signal loop impedance, keep a solid ground plane directly below the high-speed signal path, as close as possible. The return path will couple between the grounding layer and the signal path. Maintain proper alignment width to control impedance transmission line interconnections.

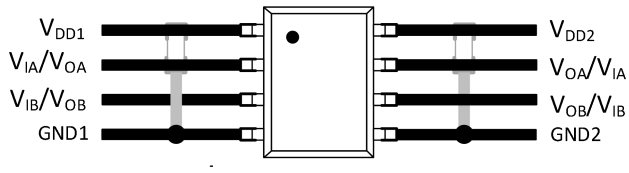


Figure 11.Recommended Printed Circuit Board Layout

Jitter Measurement

The eye diagram shown in Figure 12 shows the jitter test results of the SCM3725ASA/SCM3728ASA. The Keysight 81160A Pulse Function Arbitrator is used as the signal source for the SCM3725ASA/SCM3728ASA to generate a 10Mbps pseudo-random bit sequence (PRBS). Oscilloscope captures the output waveform of the SCM3725ASA/SCM3728ASA and recovers the eye diagram using the SDA jitter tool and eye diagram analysis tool. The results show typical measurements of 120ps p-p jitter.

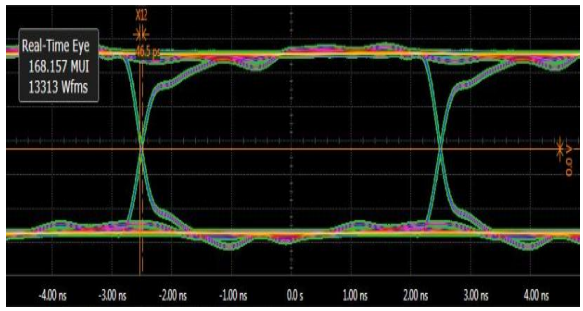


Figure 12. SCM3725ASA/SCM3728ASA Eye Diagram

CMTI Measurement

Measure the common-mode transient immunity of the isolator SCM3725ASA/SCM3728ASA at a specified common-mode pulse amplitude and a specified common-mode pulse slew rate, as well as other specified tests or environments. The common-mode pulse generator will be able to provide fast rising and falling pulses of specified multiplicity and duration of the common-mode pulse, and the maximum common-mode swing rate can be applied to the SCM3725ASA/SCM3728ASA measurements. The common-mode pulses are applied to the SCM3725ASA/SCM3728ASA isolator primary and secondary grounds and provide both positive and negative transients.

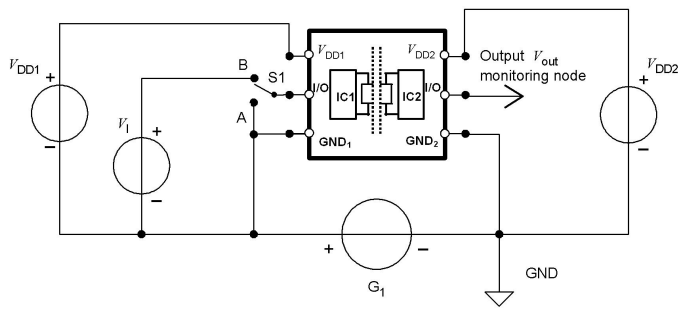


Figure 13. Common-mode transient immunity (CMTI) measurement

Ordering Information

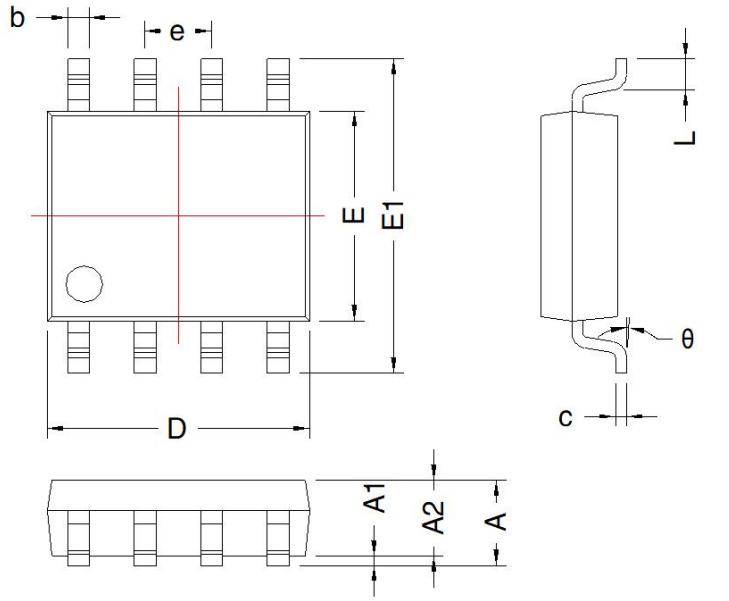
Part number	Temperature Range	Withstand Voltage Rating (kV rms)	Package	Number of pins	Product Marking	Tape & Reel
SCM3725ASA	−40°C ~ +125°C	3	SOP	8	SCM3725ASA YM	4k/REEL
SCM3728ASA	−40°C ~ +125°C	3	SOP	8	SCM3728ASA YM	4k/REEL

Product marking and date code
SCM3401XYZ:
(1) SCM3401 = Product designation.
(2) X = Version code information (A-Z).
(3) Y = Packaging definition code; S for SOP package,

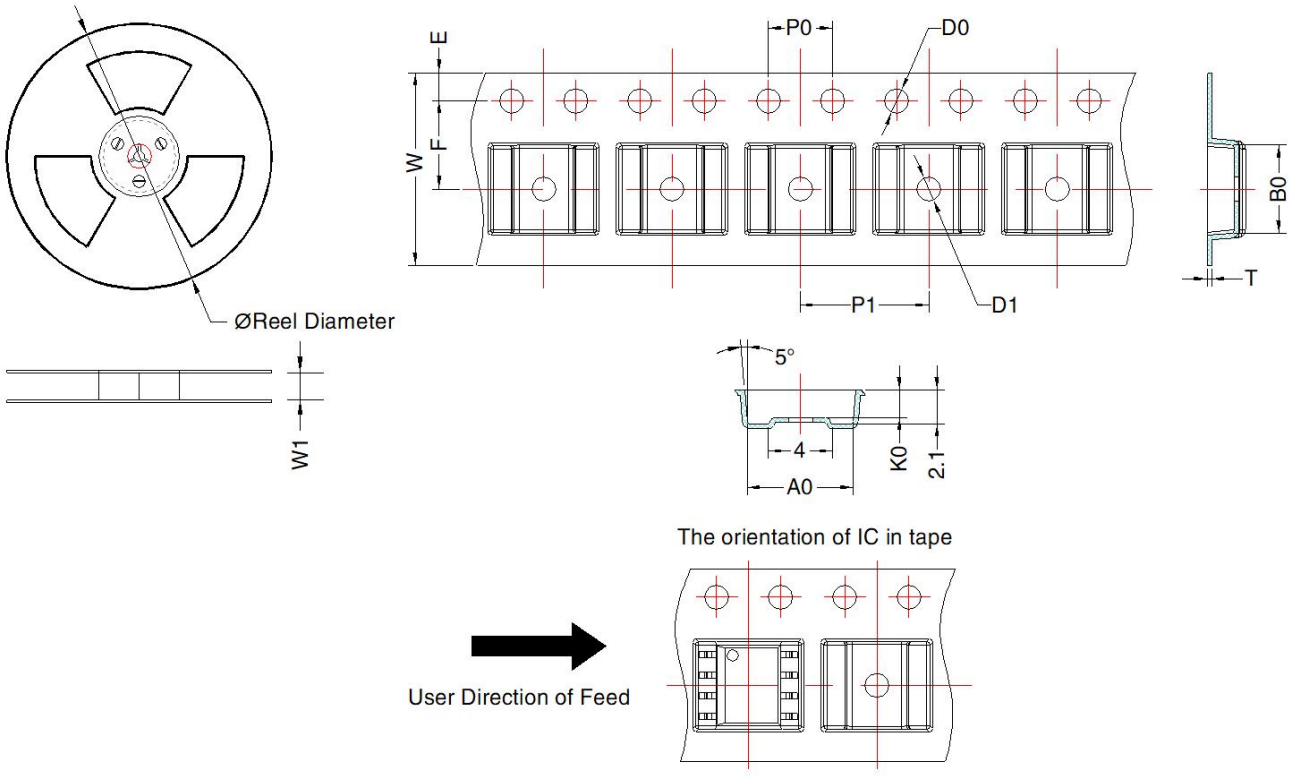
(4)Z = Operating temperature range (C = 0℃ to +70℃, I =-40℃ to +85℃, A =-40℃ to +125℃, M = -55℃ to +125℃) .
(5) YM = Date code for product traceability; Y = code for production year; M = code for production month.

Package Information

THIRD ANGLE PROJECTION



SOP–8				
Mark	Dimension(mm)		Dimension(inch)	
	Min	Max	Min	Max
A	1.35	1.75	0.053	0.069
A1	0.1	0.25	0.004	0.010
A2	1.3	1.5	0.005	0.059
D	4.8	5.0	0.189	0.197
E	3.8	4.0	0.150	0.157
E1	5.8	6.2	0.228	0.244
L	0.45	0.8	0.018	0.031
b	0.38	0.47	0.015	0.018
e	1.27TYP		0.05TYP	
c	0.17	0.25	0.007	0.001
θ	0°	8°	0°	8°



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)
SCM3725ASA	SOP-8	4000	330.0	12.4	6.6 ± 0.1	5.5 ± 0.1	1.7 ± 0.1	0.3 ± 0.05	12.0 ± 0.3	1.75 ± 0.1	5.5 ± 0.1	8 ± 0.1	4 ± 0.1	1.5 ± 0.1	1.5 ± 0.1
SCM3728ASA	SOP-8	4000	330.0	12.4	6.6 ± 0.1	5.5 ± 0.1	1.7 ± 0.1	0.3 ± 0.05	12.0 ± 0.3	1.75 ± 0.1	5.5 ± 0.1	8 ± 0.1	4 ± 0.1	1.5 ± 0.1	1.5 ± 0.1

Note: The minimum order quantity is the minimum packaging quantity the order should be an integer multiple of MPQ.

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