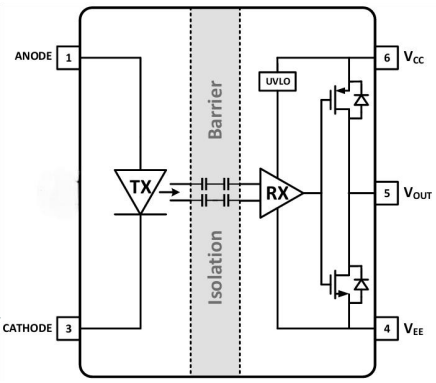
SCLATRIC

5 KV LED EMULATOR INPUT,LOGIC OUTPUT ISOLATORS

Features

- High Speed:dc to 15 Mbps
- 2.5 to 5.5V logic output
- Pin-compatible,drop-in upgrades for popular high-speed digital optocouplers
- Performance and reliability advantages vs.optocouplers
  - Resistant to temperature,age and forward current effects
  - 10x lower FIT rate for longer service life
  - Higher common-mode transient immunity:>50 kV/us typical
  - Lower power and forward input diode current
- Wide range of product options
  ·Inverting and non-inverting
  - Disable output high,low or tri-state
  1 channel diode emulator input
- Propagation delay 30 ns
  Up to 5000 VRMs isolation
- 10 kV surge withstand capability
  AEC-Q100 qualified
  Wide operatng temperature range
  ·-40 to +125℃
  RoHS-compliant packages
  BGA-8
- Automotive-grade OPNs available
  - AIAG compliant PPAP documentation support
  ·IMDs and CAMDs listing support



Applications

- Industrial automation
- Motor controls and drives
- Isolated switch mode power supplies
- Isolated data acquisition
- Test and measurement equipment
- EV traction inverters

Safety Regulatory Approvals(Pending)

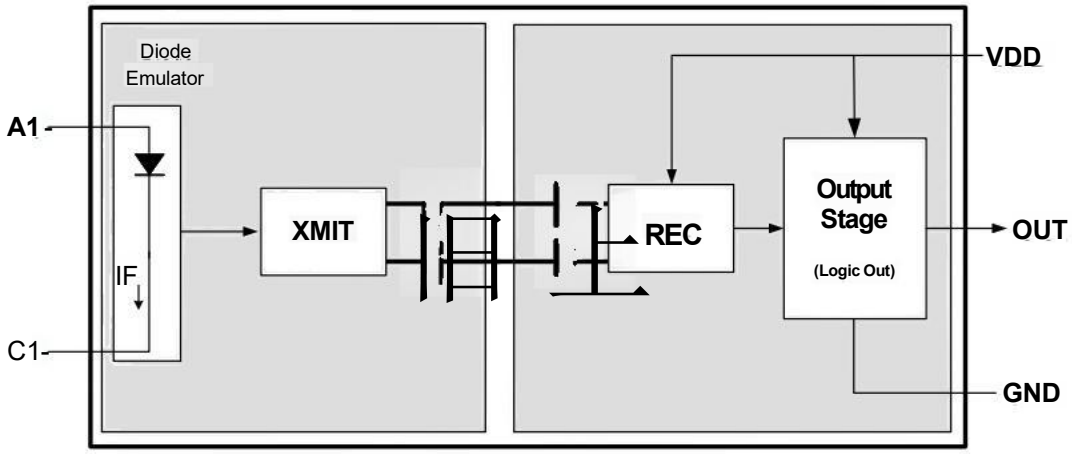
- UL 1577 recognized
  - Up to 5000 Vrms for 1 minute
- CSA component notice 5A approval
  - IEC 60950-1,61010-1,60601-1 (reinforced insulation)
- VDE certification conformity
  - IEC60747-5-2/VDE0884-10 (basic/reinforced insulation)
  CQC certification approval
  ·GB4943.1

Description

The STC2521D isolators are pin-compatible,single-channel,drop-in replacements for popular optocouplers with data rates up to 15 Mbps.These devices isolate high-speed digital signals and offer performance,reliability,and flexibility advantages not available with optocoupler solutions.The STC2521D series is based on Skyworks Solutions'proprietary CMOS isolation technology for low- power and high-speed operation and are resistant to the wear-out effects found in optocouplers that degrade performance with increasing temperature,forward current,and device age.As a resultthe STC2521D series offer longer service life and dramatically higher reliability compared to optocouplers.Ordering options include logic output with and without output enable options.

Automotive Grade is available for certain part numbers.These products are built using automotive-specific flows at all steps in the manufacturing process to ensure the robustness and low defectivity required for automotive applications.

Functional Block Diagram



1.Electrical Specifications

Table 1.Recommended Operating Conditions

Parameter	Symbol	Min	Typ	Max	Unit
VDD Supply Voltage	VDD	2.5	—	5.5	V
Input Current	1F(ON) (See Figure 1)	6	—	30	mA
Operating Temperature(Ambient)	TA	-40	—	125	℃

Table 2.Electrical Characteristics

VDD=5V;GND=0V;TA=-40 to+125℃;typical specs at 25℃

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
DC Parameters						
Supply Voltage	VDD	(VDD-GND)	2.5	—	5.5	V
Supply Current	IDD	Output high or low (VDD=2.5 to 5.5V)	—	1.5	—	mA
Input Current Threshold	F(TH)		—	—	3.6	mA
Input Current Hysteresis	HYS		—	0.34	—	mA
Input Forward Voltage (OFF)	VF(OFF)	Measured at ANODE with respect to CATHODE.	—	—	1	V
Input Forward Voltage (ON)	VF(ON)	Measured at ANODE with respect to CATHODE.	1.4	—	2.8	V
Input Capacitance	CI	f=100 kHz, VF=0V, VF=2V	— —	15 15	— —	所告
Logic Low Output Voltage	VoL	loL=4 mA	—	0.2	0.4	V
Logic High Output Voltage	VoH	loH=-4 mA	VDD-0.4	VDD-0.2	—	V
Output Impedance	Zo		—	50	—	Ω
Enable High Min	VEH		VDD-0.4	—	—	V
Enable Low Max	VEL		—	—	0.4	V
Enable High Current Draw	1EH	VDD=VEH=5V	—	0	—	μA
Enable Low Current Draw	EL	VDD=5V,VEL=0V	—	-30	0	μA
UVLO Threshold+	VDDuv+	See Figure 8 on page 16. VDD rising	—	2.2	2.35	V
UVLO Threshold-	VDDuv-	See Figure 8 on page 16. VDD falling	—	2	2.25	V
UVLO lockout hysteresis	VDDHYS		50	100	—	mV

Table 2.Electrical Characteristics(Continued)

VDD=5V;GND=0V;TA=-40 to+125℃;typical specs at 25℃

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
AC Switching Parameters(VDD=5V,CL=15 pF)						
Maximum Data Rate	FDATA		DC	—	15	MBPS
Minimum Pulse Width	MPW		66	—	—	ns
Propagation Delay (Low-to-High)	tPLH	CL=15 pF	5	—	50	ns
Propagation Delay (High-to-Low)	tPHL	CL=15 pF	5	—	50	ns
Pulse Width Distortion	PWD	tPLH-tPHLI	—	—	25	ns
Propagation Delay Skew	tpSK(p-p)	tpsK(P-P)is the magnitude of the difference in prop delays between different units operating at same supply voltage,load,and ambient temp.	—	—	25	ns
Rise Time*	tR	CL=15 pF	—	2.5	4	ns
FallTime*	tF	CL=15 pF	—	2.5	4	ns
Device Startup Time	tSTART		—	—	40	μs
Common Mode Transient Immunity	CMTI	Output =low or high VcM=1500 V (See Figure 2) IF=6mA	35	50	—	kV/μs
*Note:Guaranteed by design and/or characterization						

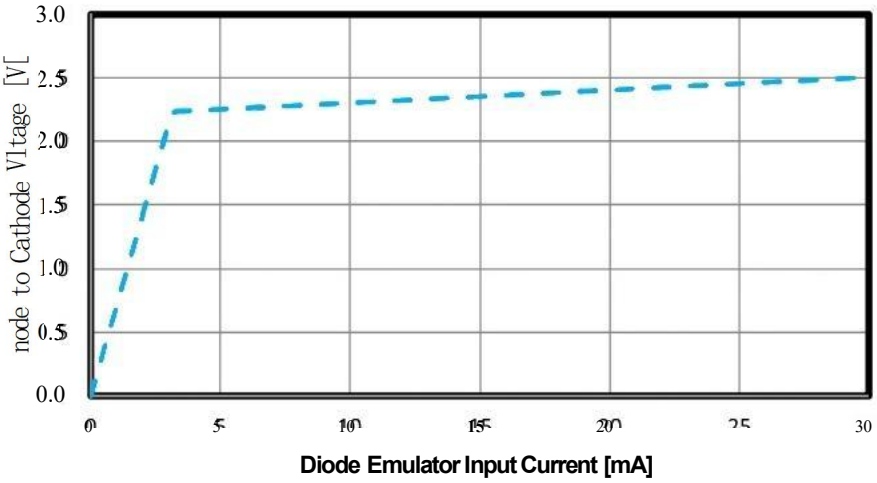


Figure 1.Diode Emulator Model and I-V Curve

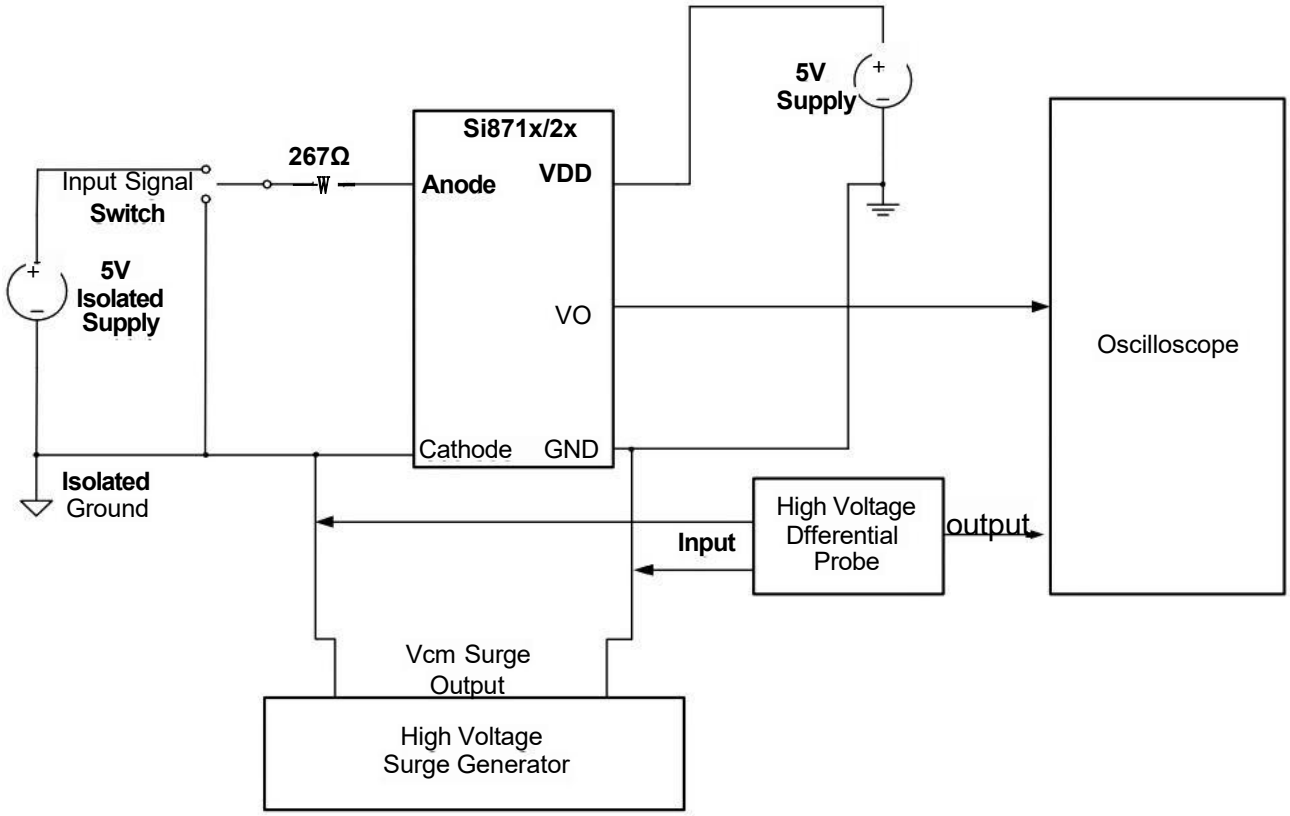


Figure 2.Common Mode Transient Immunity Characterization Circuit

Table 3.Insulation and Safety-Related Specifications

Parameter	Symbol	Test Condition	Value			Unit
				BGA-8		
Nominal Air Gap(Clearance)	L(IO1)			7.2 min		mm
Nominal External Tracking (Creepage)	L(IO2)			7.0 min		mm
Minimum Internal Gap (Internal Clearance)				0.016		mm
Tracking Resistance (Proof Tracking Index)	PTI	IEC60112		600		V
Erosion Depth	ED			0.031		mm
Resistance(Input-Output)*	Rio			10'2		Ω
Capacitance (Input-Output)*	Cio	f=1 MHz		1		pF

Table 5.IEC 60664-1(VDE 0884)Ratings

Parameter	Test Condition	Specification		
		SOIC-8	DIP8	SDIP6
Basic Isolation Group	Material Group	1	I	I
Installation Classification	Rated Mains Voltages≤ 150 VRMS	I-IV	I-IV	I-IV
	Rated Mains Voltages≤ 300 VRMS	I-IV	I-IV	HIV
	Rated Mains Voltages≤ 450 VRMS	I-III	IIII	I-IV
	Rated Mains Voltages≤ 600 VRMS	I-III	H-III	I-IV
	Rated Mains Voltages≤ 1000 VRMS	I-II	HII	I-II

Table 6.IEC 60747-5-2(VDE 0884-10)Insulation Characteristics*

Parameter	Symbol	Test Condition	Characteristic			Unit
			SOIC-8	DIP8	SDIP6	
Maximum Working Insulation Voltage	VIORM		630	891	1140	V peak
Input to Output Test Voltage	VpR	Method b1 (VIORM×1.875=VpR,100% Production Test,tm=1 sec, Partial Discharge<5 pC)	1181	1671	2138	V peak
Transient Overvoltage	VIOTM	t=60 sec	6000	6000	8000	V peak
Pollution Degree (DIN VDE 0110,Table 1)			2	2	2	
Insulation Resistance at Ts,Vio=500 V	Rs		$>10^9$	$>10^9$	$>10^9$	Ω

*Note:This isolator is suitable for reinforced electrical isolation only within the safety limit data.Maintenance of the safety data is ensured by protective circuits.The STC2521D provides a climate classification of 40/125/21.

Table 7.IEC Safety Limiting Values

Parameter	Symbol	Test Condition	Max			Unit
				BGA-8		
Case Temperature	Ts			140		℃
Input Current	Is	θJA=110℃/W(BGA-8), VF=2.8 V,Tj=140℃, TA=25℃		370		mA
Output Powerr	Ps			1		W
Note: Maximum value allowed in the event of a failure;also see the thermal derating curve in Figures 3						

Table 8.Thermal Characteristics

Parameter	Symbol	Typ			Unit
			BGA-8		
IC Junction-to-Air Thermal Resistance	θJA		110		℃/W

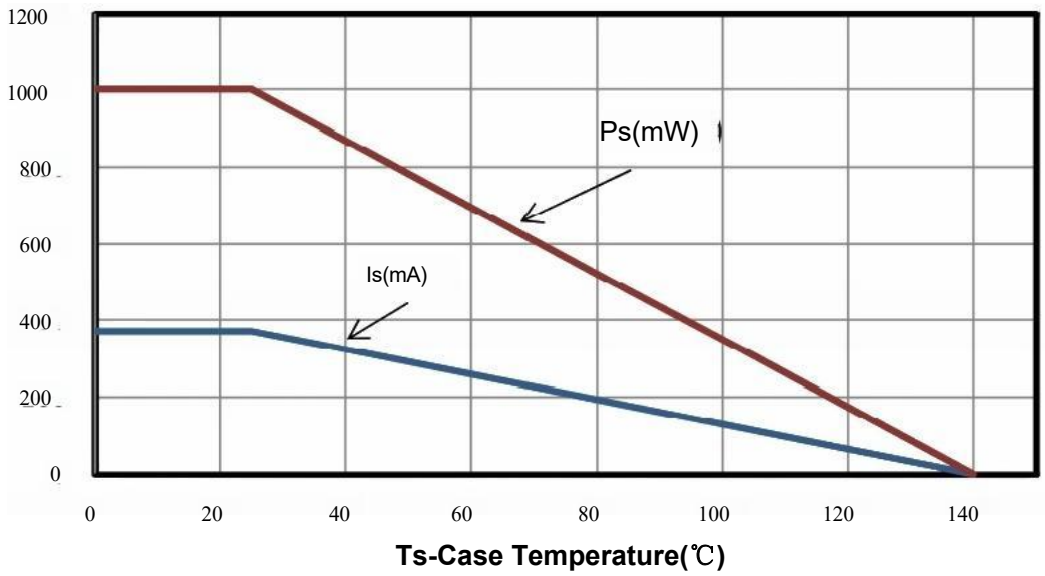


Figure 3 .(BGA-8)Thermal Derating Curve,Dependence of Safety Limiting Values with Case Temperature per DIN EN 60747-5-2 and VDE0884-10

Table 9.Absolute Maximum Ratings*

Parameter	Symbol	Min	Max	Unit
Storage Temperature	TsTG	-65	+150	℃
Operating Temperature	TA	-40	+125	℃
Junction Temperature	TJ	—	+140	℃
Average Forward Input Current	F(AVG)	—	30	mA
Peak Transient Input Current (<1μs pulse width,300 pps)	1FTR	—	1	A
Reverse Input Voltage	VR	—	0.3	V
Supply Voltage	VDD	-0.5	7	V
Output Voltage	VoUT	-0.5	VDD+0.5	V
Enable Voltage	VEOUT	-0.5	VDD+0.5	V
Output Source or Sink Current	Io	—	22	mA
Input Power Dissipation	PI	—	90	mW
Output Power Dissipation		—	163	mW
Total Power Dissipation	PT	—	253	mW
Lead Solder Temperature(10 s)		—	260	℃
HBM Rating ESD		3	—	kV
Machine Model ESD		250	—	V
CDM		2	—	kV
Maximum Isolation Voltage(1 s)BGA-8		—	4500	VRMS

2.Application Information

2.1.Theory of Operation

The STC2521D are pin-compatible,single-channel,drop-in replacements for popular optocouplers with data rates up to 15 Mbps.The operation of an STC2521D channel is analogous to that of an opto coupler,except an RF carrier is modulated instead of light.This simple architecture provides a robust isolated data path and requires no special considerations or initialization at start-up.A simplified block diagram for the STC2521D is shown in Figure 6.

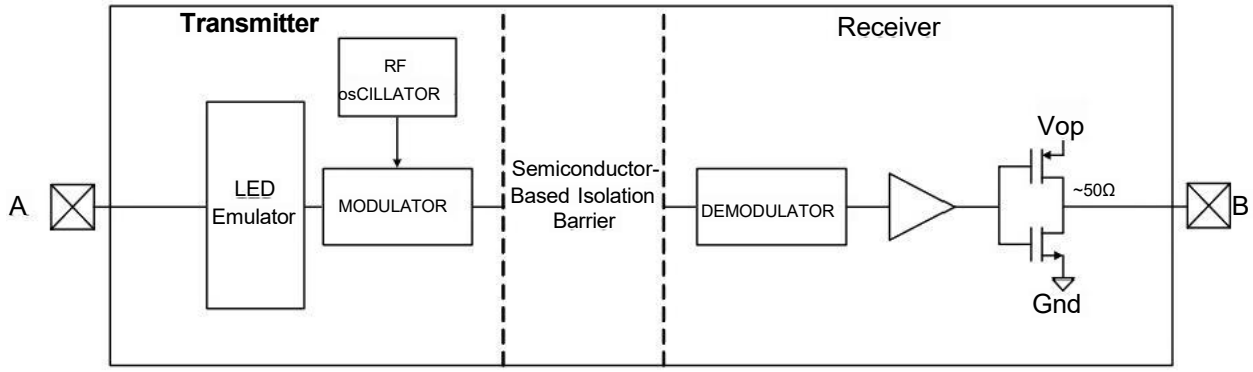


Figure 6.Simplified Channel Diagram

3.Technical Description

3.1.Device Startup

During startup-up,for the Si8716,Output Vo is high until VDo rises above the UVLO+threshold for a minimum time period of tsTART.Following this,the output is low when the current flowing from anode to cathode is>IF(ON).Device startup,normal operation,and shutdown behavior for the Si8716 is shown in Figure 7.Note that Figure 7 assumes that Enable is asserted and that the outputs are operating in their normal operating condition (inverting for the Si8716).See Table 10 for more details on the Enable function.

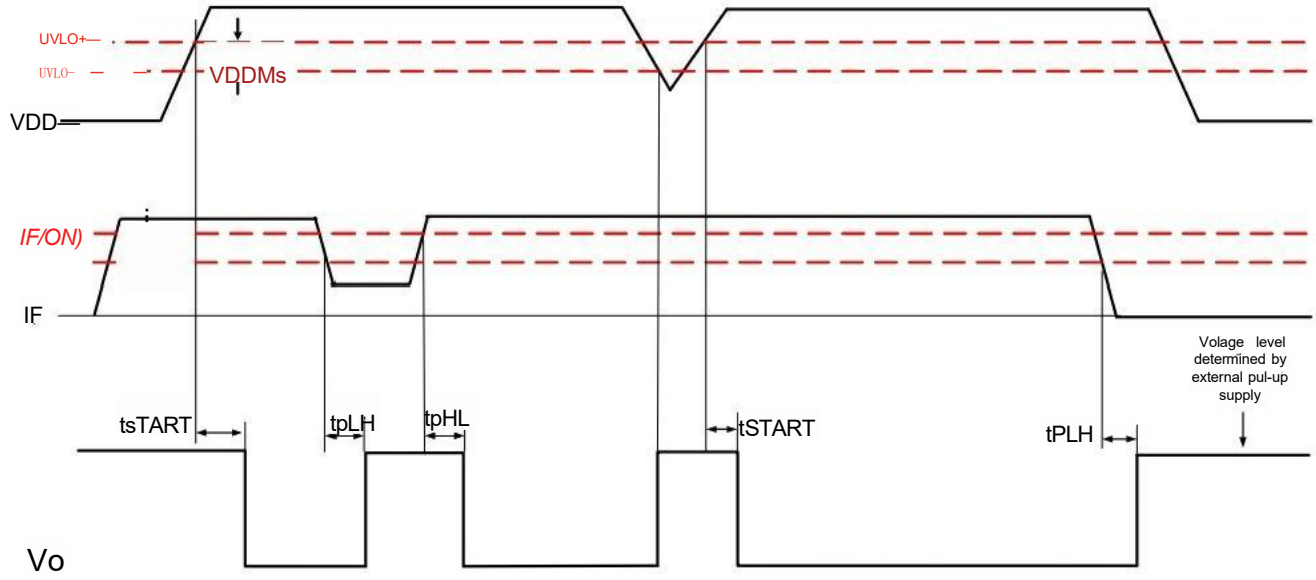


Figure 7.Si8716 Operating Behavior(IF≥|F(MIN)when VF≥VF(MIN)

3.3.Under Voltage Lockout (UVLO)

The UVLO circuit unconditionally drives Vo to its default state when VDD is below the lockout threshold.Referring to Figure 8,upon power up,the STC2521D is maintained in UVLO until VDD rises above VDDuv+.During power down,the STC2521D enters UVLO when VDD falls below the UVLO threshold plus hysteresis (i.e.,VDD≤VDDuv+ -VDDHYs).

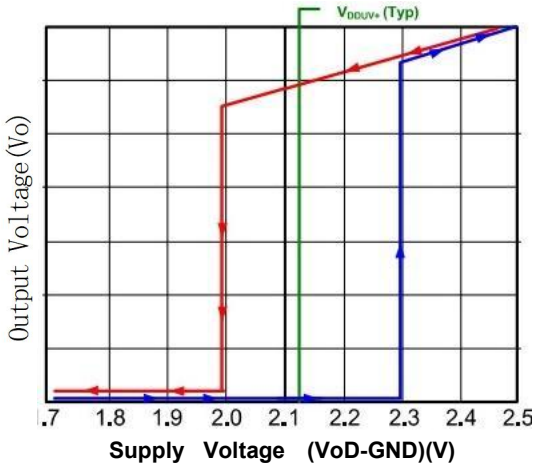


Figure 8.STC2521D UVLO

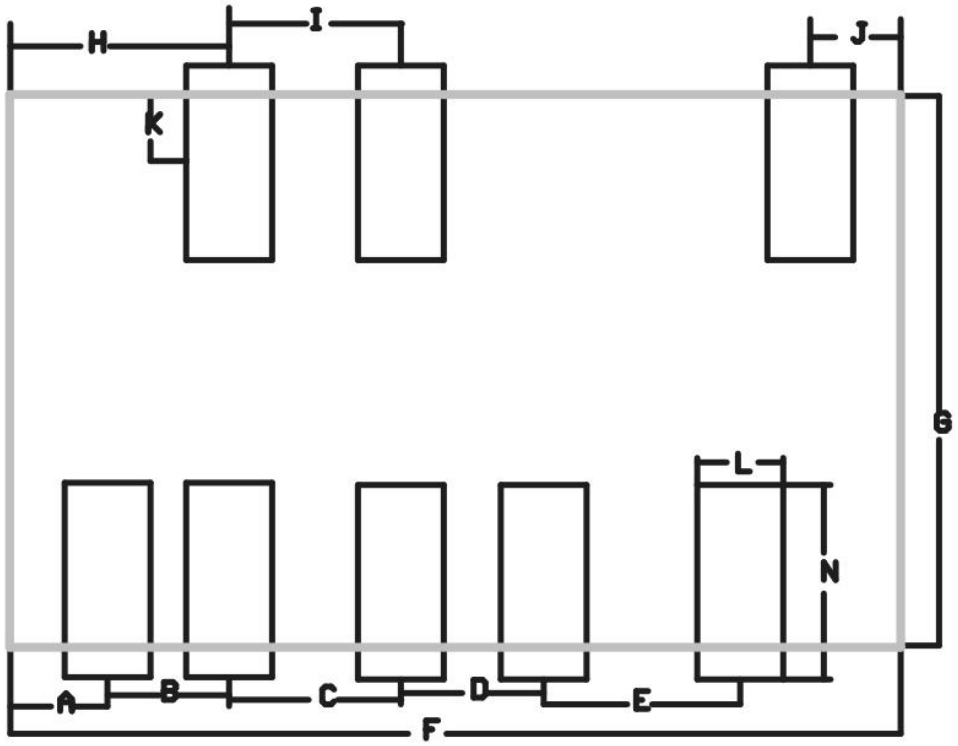
4.Pin Descriptions (BGA-8)

Table 11.Pin Descriptions(BGA-8)

Pin	Name	Description
1	TEST	Ground1
2	VCC1	power supply
3	RST	Enable the device if this pin is set to high ,or set to low to reset the fault signal under DESAT condition.
4	VO+	Output signal.
5	VO-	Driver sink output pin
6	IN+	Anode of LED emulator.Vo follows the signal applied to this input with respect to theCATHODE input.
7	VCC2	power supply
8	GND	Ground

5.Package Outline:8-Pin BGA

Figure 15 illustrates the package details for the STC2521Din an 8-pin narrow-body BGA package.Table 16 lists the values for the dimensions shown in the illustration.



Dim	Min	Typ	Max
A	/	1.92	/
B	/	1.37	/
C	/	1.93	/
D	/	1.61	/
E	/	2.21	/
F	9.9	10	10.1
G	6.1	6.17	6.25
H	/	2.46	/
I	/	1.93	/
J	/	1.02	/
K	0.7	0.76	0.82
L	0.95	0.965	0.98
N	2.05	2.185	2.3
All Dimensions in mm			