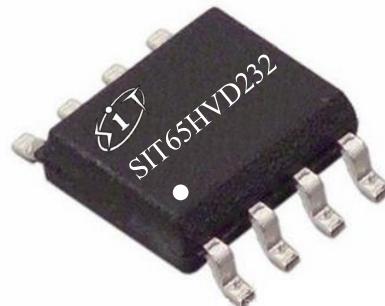


**FEATURES**

- Operates with a single 3.3V supply;
- Compatible with ISO 11898-2 standard;
- Bus pin ESD protection exceeds  $\pm 16$  kV HBM;
- High input impedance allows for up to 120 nodes;
- Adjustable driver transition times for improved emissions performance;
- Designed for data rates up to 1 Mbps;
- Thermal Shutdown Protection;
- Open circuit fail-safe design;
- Glitch free power up and power down protection for hot plugging applications

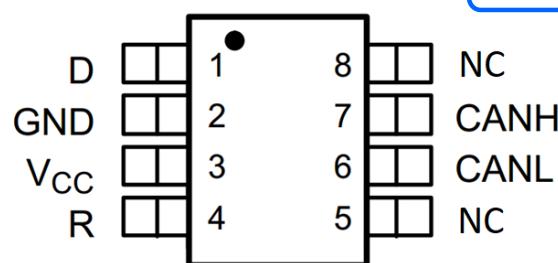
**OUTLINE**


Provide green and environmentally friendly lead-free package

**DESCRIPTION**

The SIT65HVD232 is the interface between the Controller Area Network (CAN) protocol controller and the physical bus. It is designed for use with the 3.3V  $\mu$ Ps, MCUs and DSPs with CAN controllers, or with equivalent protocol controller devices. It is used in industrial automation, control, sensors and drive systems, motor and robotic control, building and climate control (HVAC), telecom and basestation control and status. The devices are intended for use in applications employing the CAN serial communication physical layer in accordance with the ISO 11898 standard.

PARAMETER	SYMBOL	CONDITION	MIN.	MAX.	UNIT
<b>Supply voltage</b>	$V_{cc}$		3	3.6	V
<b>Maximum transmission rate</b>	$1/t_{bit}$	Non return to zero code	1		Mbaud
<b>CANH/CANL input or output voltage</b>	$V_{can}$		-16	+16	V
<b>Bus differential voltage</b>	$V_{diff}$		1.5	3.0	V
<b>Virtual junction temperature</b>	$T_{amb}$		-40	125	°C

**PIN CONFIGURATION**


**LIMITING VALUES**

PARAMETER	SYMBOL	VALUE	UNIT
<b>Supply voltage</b>	V <sub>CC</sub>	-0.3~+6	V
<b>DC voltage on D/R pins</b>	D, R	-0.5~VCC+0.5	V
<b>Voltage range at any bus terminal (CANH, CANL)</b>	CANL, CANH	-18~18	V
<b>Transient voltage on pins 6, 7</b>	V <sub>tr</sub>	-25~+25	V
<b>Receiver output current, I<sub>o</sub></b>		-11~11	mA
<b>Storage temperature</b>		-40~150	°C
<b>Virtual junction temperature</b>		-40~125	°C
<b>Welding temperature range</b>		300	°C
<b>Continuous total power dissipation</b>	SOP8	400	mW
	DIP8	700	mW

The maximum limit parameters means that exceeding these values may cause irreversible damage to the device. Under these conditions, it is not conducive to the normal operation of the device. The continuous operation of the device at the maximum allowable rating may affect the reliability of the device. The reference point for all voltages is ground.

**PINNING**

PIN	SYMBOL	DESCRIPTION
1	D	CAN transmit data input (LOW for dominant and HIGH for recessive bus states), also called TXD, driver input
2	GND	Ground connection
3	VCC	Transceiver 3.3V supply voltage
4	R	CAN receive data output (LOW for dominant and HIGH for recessive bus states), also called RXD, receiver output
5	-	Not connected
6	CANL	Low level CAN bus line
7	CANH	High level CAN bus line
8	-	Not connected



芯力特

3.3V, High ESD Protected, 1Mbps High Speed CAN Transceiver

SIT65HVD232

## BUS TRANSMITTER DC CHARACTERISTICS

SYMBOL	PARAMETER		CONDITION	MIN.	TYP.	MAX.	UNIT
$V_{O(D)}$	Output voltage (Dominant)	CANH	$V_I=0V, R_L=60\Omega$ (Figure 1, Figure 2)	2.45		VCC	V
		CANL		0.5		1.25	
$V_{OD(D)}$	Differential output voltage (Dominant)		$V_I=0V, R_L=60\Omega$ (Figure 1)	1.5	2	3	V
			$V_I=0V, R_L=60\Omega, R_s=0V$ (Figure 3)	1.2	2	3	V
$V_{O(R)}$	Output voltage (Recessive)	CANH	$V_I=3V, R_L=60\Omega$ (Figure 1)		2.3		V
		CANL			2.3		
$V_{OD(R)}$	Differential output voltage (Recessive)		$V_I=3V$	-0.12		0.012	V
			$V_I=3V, NO LOAD$	-0.5		0.05	V
$I_{IH}$	High level input current		$V_I=2V$	-30			$\mu A$
$I_{IL}$	Low level input current		$V_I=0.8V$	-30			$\mu A$
$I_{os}$	Short circuit output current		CANH=-2V	-250			mA
			CANH=7V			1	
			CANL=-2V	-1			
			CANL=7V			250	
$C_o$	Output capacitance		See receiver				
$I_{cc}$	Supply current		$V_I=0V$ (Dominant), NO LOAD		10	17	mA
			$V_I=VCC$ (Recessive), NO LOAD		10	17	mA

(If not otherwise specified,  $V_{cc}=3.3V \pm 10\%$ , Temp= $T_{min} \sim T_{max}$ , typical:  $V_{cc}=+3.3V$ , Temp= $25^\circ C$ )

## BUS TRANSMITTER SWITCHING CHARACTERISTICS

SYMBOL	PARAMETER	CONDITION	MIN.	TYP.	MAX.	UNIT
$t_{PLH}$	Propagation delay time (low-to-high level)	$R=0$ , short circuit (Fig. 4)		35	85	ns
		$R=10 k\Omega$		70	125	
		$R=100 k\Omega$		500	870	
$t_{PHL}$	Propagation delay time (high-to-low level)	$R=0$ , short circuit (Fig. 4)		70	120	ns
		$R=10 k\Omega$		130	180	
		$R=100 k\Omega$		870	1200	
$t_{sk(p)}$	Pulse skew ( $ t_{PLH} - t_{PHL} $ )	$R=0$ , short circuit (Fig. 4)		35		
		$R=10 k\Omega$		60		
		$R=100 k\Omega$		370		

<b>tr</b>	Differential output signal rise time	R=0, short circuit (Fig. 4)	25	50	100	
		R=10 kΩ	80	120	160	
		R=100 kΩ	600	800	1200	
<b>tf</b>	Differential output signal fall time	R=0, short circuit (Fig. 4)	40	55	80	
		R=10 kΩ	80	125	150	
		R=100 kΩ	600	825	1000	

(If not otherwise specified,  $V_{CC}=3.3V\pm10\%$ , Temp= $T_{MIN}\sim T_{MAX}$ , typical:  $V_{CC}=+3.3V$ , Temp= $25^{\circ}C$ )

### BUS RECEIVER DC CHARACTERISTICS

<b>SYMBOL</b>	<b>PARAMETER</b>	<b>CONDITION</b>	<b>MIN.</b>	<b>TYP.</b>	<b>MAX.</b>	<b>UNIT</b>
$V_{IT+}$	Positive-going input threshold voltage	See Table 1		750	900	mV
$V_{IT-}$	Negative-going input threshold voltage	See Table 1	500	650		mV
$V_{hys}$	Hysteresis voltage	$V_{IT+}$ - $V_{IT-}$		100		mV
$V_{OH}$	High-level output voltage	$-6V < V_{ID} < 500mV$ $I_O=-8mA$ (see Fig. 5)	2.4			V
$V_{OL}$	Low-level output voltage	$900mV < V_{ID} < 6V$ $I_O=8mA$ (see Fig. 5)			0.4	V
$I_i$	Bus input current	VIH=7V, VCC=0V	100		350	μA
$I_i$		VIH=7V, VCC=3.3V	100		250	μA
$I_i$		VIH=-2V, VCC=0V	-100		-20	μA
$I_i$		VIH=-2V, VCC=3.3V	-200		-30	μA
$R_i$	Input resistance	ISO 11898-2 standard	20	35	50	KΩ
$R_{diff}$	Differential input resistance	ISO 11898-2 standard	40		100	KΩ
$C_i$	Input capacitance	ISO 11898-2 standard		40		pF
$C_{diff}$	Differential input capacitance	ISO 11898-2 standard		20		pF
$I_{CC}$	Supply current	See driver				

(If not otherwise specified,  $V_{CC}=3.3V\pm10\%$ , Temp= $T_{MIN}\sim T_{MAX}$ , typical:  $V_{CC}=+3.3V$ , Temp= $25^{\circ}C$ )

**BUS RECEIVER SWITCHING CHARACTERISTICS**

SYMBOL	PARAMETER	CONDITION	MIN.	TYP.	MAX.	UNIT
$t_{PLH}$	Propagation delay time (low-to-high level)	Figure 6		35	50	ns
$t_{PHL}$	Propagation delay time (high-to-low level)	Figure 6		35	50	ns
$t_{sk}$	Pulse skew	$ t_{PHL} - t_{PLH} $			10	ns
$t_r$	Output signal rise time	Figure 6		1.5		ns
$t_f$	Output signal fall time	Figure 6		1.5		ns

(If not otherwise specified,  $V_{CC}=3.3V\pm10\%$ ,  $\text{Temp}=T_{MIN}\sim T_{MAX}$ , typical:  $V_{CC}=+3.3V$ ,  $\text{Temp}=25^\circ C$ )

**DEVICE SWITCHING CHARACTERISTICS**

SYMBOL	PARAMETER	CONDITION	MIN.	TYP.	MAX.	UNIT
$t_{(LOOP1)}$	Loop delay 1, driver input to receiver output, Recessive to Dominant	R=0, short circuit (Figure 7)		70	115	ns
		R=10 kΩ		105	175	
		R=100 kΩ		535	920	
$t_{(LOOP2)}$	Loop delay 2, driver input to receiver output, Dominant to Recessive	R=0, short circuit (Figure 7)		100	135	ns
		R=10 kΩ		155	185	
		R=100 kΩ		830	990	

(If not otherwise specified,  $V_{CC}=3.3V\pm10\%$ ,  $\text{Temp}=T_{MIN}\sim T_{MAX}$ , typical:  $V_{CC}=+3.3V$ ,  $\text{Temp}=25^\circ C$ )

**OVER TEMPERATURE PROTECTION**

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Shutdown junction temperature	$T_j(\text{sd})$		155	165	180	°C

(If not otherwise specified,  $V_{CC}=3.3V\pm10\%$ ,  $\text{Temp}=T_{MIN}\sim T_{MAX}$ , typical:  $V_{CC}=+3.3V$ ,  $\text{Temp}=25^\circ C$ )

**SUPPLY CURRENT**

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Dominant power consumption		$V_I=0V$ , LOAD=60Ω		50	70	mA
Recessive power consumption		$V_I=VCC$ , NO LOAD		6	10	mA

(If not otherwise specified,  $V_{CC}=3.3V\pm10\%$ , Temp= $T_{MIN}\sim T_{MAX}$ , typical:  $V_{CC}=+3.3V$ , Temp= $25^{\circ}C$ )

**FUNCTION TABLE**

Table 1. Receiver characteristics over common mode ( $V_{(RS)}=1.2V$ )

$V_{IC}$	$V_{ID}$	$V_{CANH}$	$V_{CANL}$	<b>R OUTPUT</b>	
-2 V	900mV	-1.55V	-2.45V	L	VOL
7 V	900mV	8.45V	6.55V	L	
1 V	6V	4V	-2V	L	
4 V	6V	7V	1V	L	
-2 V	500mV	-1.75V	-2.25V	H	VOH
7 V	500mV	7.25V	6.75V	H	
1 V	-6V	-2V	4V	H	
4 V	-6V	1V	7V	H	
X	X	Open	Open	H	

(1) H=high level; L=low level; X=irrelevant

Table 2. Driver functions

<b>INPUT D</b>	<b>OUTPUTS</b>		<b>Bus state</b>
	<b>CANH</b>	<b>CANL</b>	
L	H	L	Dominant
H	Z	Z	Recessive
X	Z	Z	Recessive

(1) H=high level; L=low level; Z=high impedance

Table 2. Receiver functions

$V_{ID}=CANH-CANL$	$R_S$	<b>OUTPUT R</b>
$V_{ID}\geq 0.9V$	X	L
$0.5 < V_{ID} < 0.9V$	X	?
$V_{ID}\leq 0.5V$	X	H
Open	X	H

(1) H=high level; L=low level; ?=uncertain; X=irrelevant

**TEST CIRCUIT**

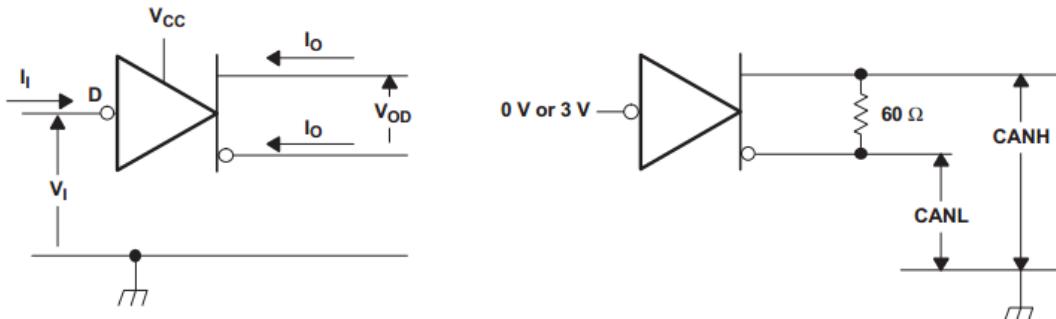


Fig.1 Driver Voltage And Current Definition

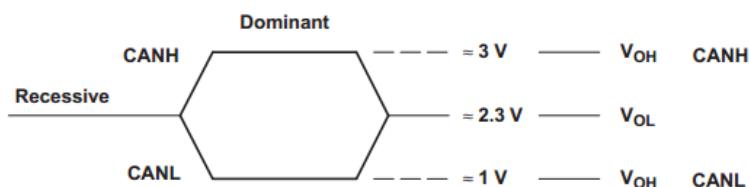


Fig.2 Bus Logic State Voltage Definition

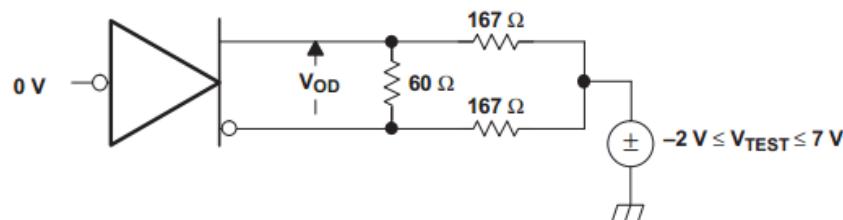
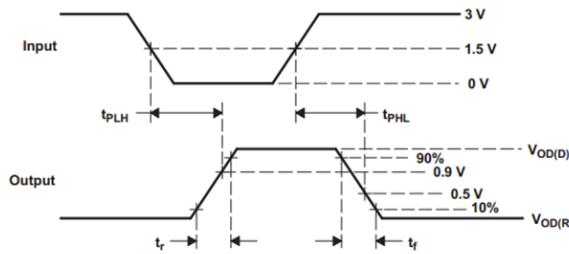
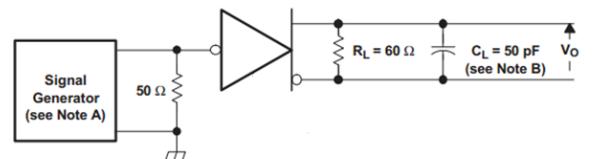


Fig.3 Driver  $V_{OD}$  Test Circuit

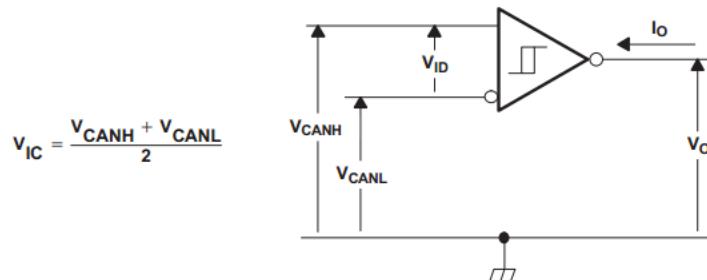


A. The input pulse is supplied by a generator having the following characteristics

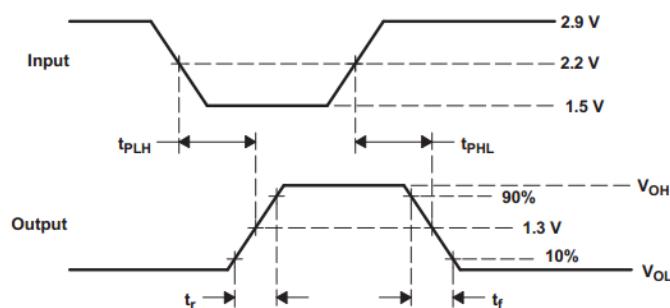
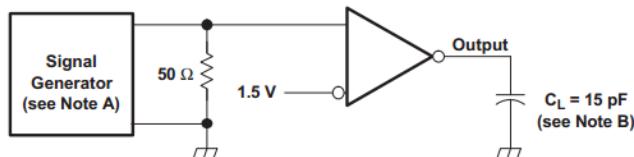
PRR  $\leq$  500 kHz, 50% duty cycle,  $t_r < 6$  ns,  $t_f < 6$  ns,  $Z_0=50\Omega$

B. CL includes instrumentation and fixture capacitance within  $\pm 20\%$ .

**Fig.4 Driver Test Circuit and Waveform**



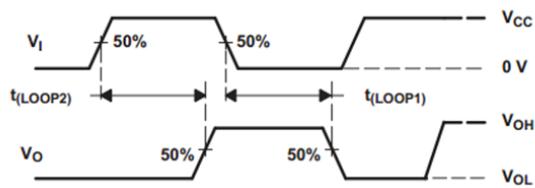
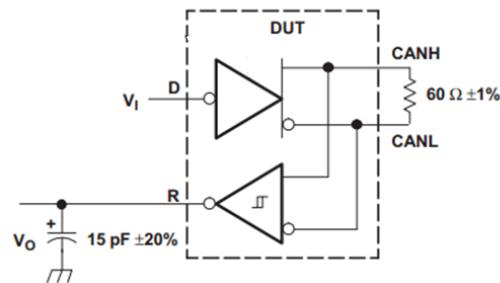
**Fig.5 Receiver Voltage and Current Definition**



A. The input pulse is supplied by a generator having the following characteristics

PRR  $\leq$  500 kHz, 50% duty cycle,  $t_r < 6$  ns,  $t_f < 6$  ns,  $Z_0=50\Omega$

B. CL includes instrumentation and fixture capacitance within  $\pm 20\%$ .

**Fig.6 Receiver Test Circuit and Waveform**


A. The input pulse is supplied by a generator having the following characteristics

PRR  $\leq$  125 kHz, 50% duty cycle,  $t_r < 6$  ns,  $t_f < 6$  ns,  $Z_0=50\Omega$

**Fig.7  $t_{(LOOP)}$  Test Circuit and Waveform**

## DESCRIPTION

### 1 Brief description

The SIT65HVD232 is the interface between the Controller Area Network (CAN) protocol controller and the physical bus. It is designed for use with the 3.3V μPs, MCUs and DSPs with CAN controllers, or with equivalent protocol controller devices. It is used in industrial automation, control, sensors and drive systems, motor and robotic control, building and climate control (HVAC), telecom and basestation control and status. The devices are designed for data rates up to 1 Mbps, and are intended for use in applications employing the CAN serial communication physical layer in accordance with the ISO 11898 standard.

### 2 Short-circuit protection

A current-limiting circuit protects the driver output stage of the SIT65HVD232 against short-circuits to positive and negative supply voltage. When short-circuit occurs the power dissipation increases but the short-circuit protection function will prevent destruction of the driver output stage.

### 3 Over-temperature protection

The SIT65HVD232 has an integrated over-temperature protection circuit. If the junction temperature exceeds approximately 160°C, the current in the driver stage will decrease. Because the driver stage dissipates most of the power, the power dissipation and temperature of the IC is reduced. All other parts of the chip remain operational.

### 4 Electrical transient protection

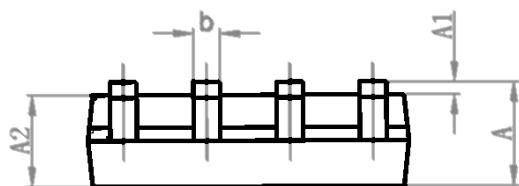
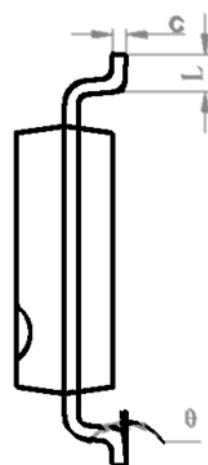
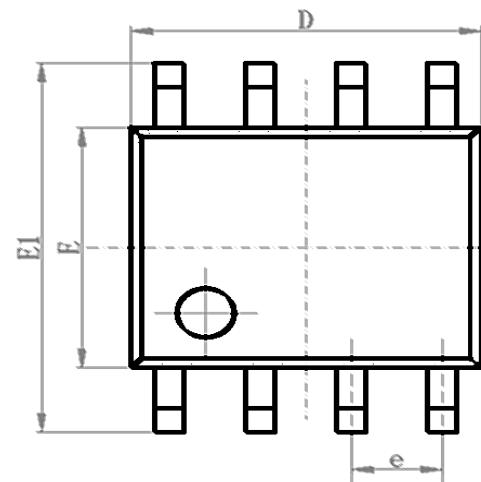
Electrical transients often occur in automotive applications. The CANH and CANL of the SIT65HVD232 are also protected against electrical transients.

### 5 Control mode

The SIT65HVD232 provides a default operation mode: high-speed mode. The high-speed mode of operation is commonly employed in industrial applications. High-speed allows the output to switch as fast as possible with no internal limitation on the output rise and fall slopes.

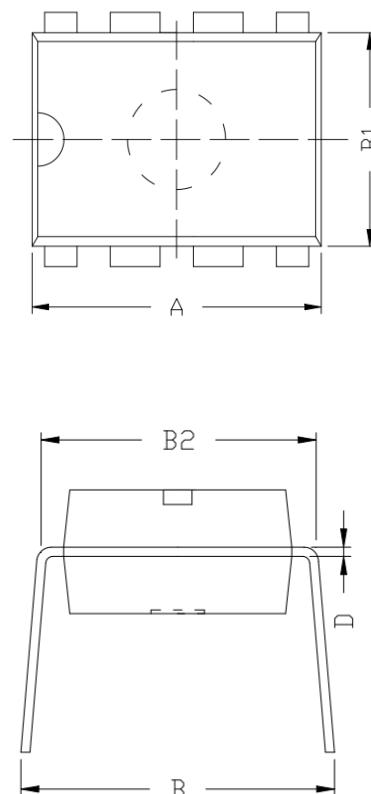
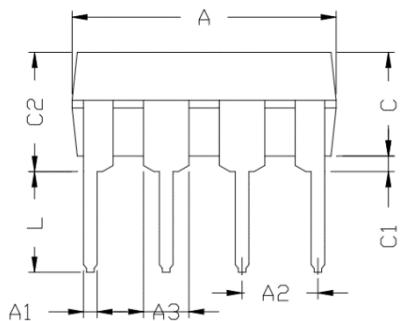
**SOP8 DIMENSIONS**
**PACKAGE SIZE**

SYMBOL	MIN./mm	TYP./mm	MAX./mm
A	1.50	1.60	1.70
A1	0.1	0.15	0.2
A2	1.35	1.45	1.55
b	0.355	0.400	0.455
D	4.800	4.900	5.00
E	3.780	3.880	3.980
E1	5.800	6.000	6.200
e		1.270BSC	
L	0.40	0.60	0.80
c	0.153	0.203	0.253
$\theta$	-2°	-4°	-6°



**DIP8 DIMENSIONS**
**PACKAGE SIZE**

SYMBOL	MIN./mm	TYP./mm	MAX./mm
A	9.00	9.20	9.40
A1	0.33	0.45	0.51
A2	2.54TYP		
A3	1.525TYP		
B	8.40	8.70	9.10
B1	6.20	6.40	6.60
B2	7.32	7.62	7.92
C	3.20	3.40	3.60
C1	0.50	0.60	0.80
C2	3.71	4.00	4.31
D	0.20	0.28	0.36
L	3.00	3.30	3.60


**ORDERING INFORMATION**

TYPE NUMBER	TEMPERATURE	PACKAGE
SIT65HVD232DR	-40°C~125°C	SOP8
SIT65HVD232P	-40°C~125°C	DIP8

Tape/reel package is 2500 pieces