UMW TS5A3157

One out of two analog switch circuit

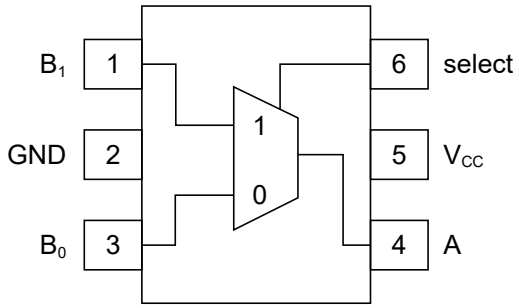
1.Description

TS5A3157 is an analog switch based on CMOS technology.It has low power consumption, low transmission delay and low output impedance. The voltage output range of analog signal and digital signal can be from V_{CC} or GND.The select input terminal has over-voltage protection, which allows the input voltage to be higher than V_{CC}, up to 7V, and the pin will not be burned.

2.Features

- low power consumption
- High transmission speed
- Flip standard CMOS logic level
- High bandwidth, high linearity
- Switch for NTSC / PAL video, audio, SPDIF and HDTV
- It can be used for clock switch and data selection switch
- Low output impedance
- First break and then open protection to prevent short circuit
- Working temperature - 55°C ~ + 125°C
- Package form SC70-6 / SOT23-6

3.Pinning Information



SC70-6/SOT23-6

Pin Description

Pin	I/O	Function
A, B_0, B_1	I/O	Data Port
Select	I	Control Selection
V_{CC}	-	Power Supply Terminal
GND	-	Land

Function Description

Select Input	Function
L	B_0 to A
H	B_1 to A

4.Thermal Resistance Data

Parameter	Symbol	Numerical Value	Units
Thermal Resistance	θ_{JA}	270	°C/W

5.Limit Parameter

Parameter	Symbol	Rating	Units
supply voltage	V_{CC}	-0.5 to 7	V
Switching voltage (Note 1)	V_S	-0.5 to V_{CC}+0.5	V
Input voltage (Note 1)	V_{IN}	-0.5 to 7	V
V_{IN} @ 0V input current clamp diode	I_{IK}	-50	mA
Output current	I_{OUT}	128	mA
Power to ground current	I_{CC}/I_{GND}	100	mA
Storage temperature range	T_{STG}	-65 to 150	°C
Maximum junction temperature	T_J	150	°C
Wire temperature (welding, 10 seconds)	T_L	260	°C
Total power consumption (85°C)	P_D	180	mW

Exceeding the maximum value of DC limit parameters may cause irreparable damage to the circuit.If there is no special case, ensure that the power supply voltage, operating temperature and load characteristics of input / output of the whole working system are within the above range.

Note 1: the negative voltage of I / O can be exceeded according to the clamping diode current range of input / output.

6.Working Environment (Note 2)

Parameter	Symbol	Mid	Max	Units
Supply Voltage	V_{CC}	1.65	5.5	V
Select Terminal Input Voltage	V_{IN}	0	V_{CC}	V
Switch Input Voltage	V_{OUT}	0	V_{CC}	V
Output Voltage	T_A	0	V_{CC}	V
Working Temperature	T_J	-40	125	°C

Note: The input voltage of 2:Select terminal must be set to a high level or a low level, and cannot be left floating.

7.1 DC Electrical Characteristics

Parameter	Symbol	Condition	V_{CC}(V)	T_A=25°C			T_A=-40°C~85°C		Units
				Min	Typ	Max	Min	Max	
High level input	V_{IH}		1.65-1.95	0.75*V_{CC}			0.75V_{CC}		V
			2.3-2.8	1.5			1.5		V
			3-4.2	2.4			2.4		V
			4.5-5.5	0.6*V_{CC}			0.6V_{CC}		V
Input low level	V_{IL}		1.65-1.95			0.25*V_{CC}		0.25V_{CC}	V
			2.3-2.8			0.4		0.4	V
			3-5.5			0.3*V_{CC}		0.3V_{CC}	V
Leakage current input	I_{IN}	0<V_{IN}<5.5V	0-5.5		±0.05	±0.1		±1	μA
Closed state leakage electric current	I_{OFF}	0<A, B<V_{CC}	1.65-5.5		±0.05	±0.1		±1	μA
Quiescent current	I_{CC}	V_{IN}=V_{CC} or GND, I_{OUT}=0	5.5			1		10	μA
Analog level input Into the scope			V_{CC}	0		V_{CC}	0	V_{CC}	V
Switch on resistance (Note 3)	R_{ON}	V_{IN}=0V, I_O=30mA	4.5		3			7	Ω
		V_{IN}=2.4V, I_O=-30mA			5			12	Ω
		V_{IN}=4.5V, I_O=30mA			7			15	Ω
		V_{IN}=0V, I_O=24mA	3		4			9	Ω
		V_{IN}=3V, I_O=-24mA			10			20	Ω
		V_{IN}=0V, I_O=8mA	2.3		5			12	Ω
		V_{IN}=2.3V, I_O=-8mA			13			30	Ω
		V_{IN}=0V, I_O=4mA	1.65		6.5			20	Ω
		V_{IN}=1.65V, I_O=-4mA			17			50	Ω
Full signal range on resistance (Note 3) (Note 7)	R_{RANGE}	I_A=-30mA, 0≤V_{Bn}≤V_{CC}	4.5					25	Ω
		I_A=-24mA, 0≤V_{Bn}≤V_{CC}	3					50	Ω
		I_A=-8mA, 0≤V_{Bn}≤V_{CC}	2.3					100	Ω
		I_A=-4mA, 0≤V_{Bn}≤V_{CC}	1.65					300	Ω

Parameter	Symbol	Condition	V_{CC}(V)	T_A=25°C			T_A=-40°C~85°C		Units
				Min	Typ	Max	Min	Max	
On resistance matching between channels (Note 3, 4, 5)	ΔR_{ON}	I_A=-30mA, V_{Bn}=3.15	4.5		0.15			0.3	Ω
		I_A=-24mA, V_{Bn}=2.1	3		0.2			0.4	Ω
		I_A=-8mA, V_{Bn}=1.6	2.3		0.5			0.7	Ω
		I_A=-4mA, V_{Bn}=1.15	1.65		0.5			0.75	Ω
On-resistance flatness (Note 3, 4, 6)	R_{FLAT}	I_A=-30mA, 0≤V_{Bn}≤V_{CC}	5		6			10	Ω
		I_A=-24mA, 0≤V_{Bn}≤V_{CC}	3.3		12			18	Ω
		I_A=-8mA, 0≤V_{Bn}≤V_{CC}	2.5		28			35	Ω
		I_A=-4mA, 0≤V_{Bn}≤V_{CC}	1.8		125			150	Ω

7.2 AC Electrical Characteristics

Parameter	Symbol	Condition	V_{CC}(V)	T_A=25°C			T_A=-40°C~85°C		Units
				Min	Typ	Max	Min	Max	
Transmission Delay (Note 8)	t_{PHL} t_{PLH}	Fig. 1, V_I=OPEN	1.65-1.95					1.5	nS
			2.3-2.7					1.2	nS
			3.0-3.5					0.8	nS
			4.5-5.5					0.3	nS
Open time (a to Bn)	t_{PZL} t_{PZH}	Fig. 1, V_I=2*V_{CC} for t_{PZL} V_I=0V for t_{PZH}	1.65-1.95			23	7	24	nS
			2.3-2.7			13	3.5	14	nS
			3.0-3.5			6.9	2.5	7.6	nS
			4.5-5.5			5.2	1.7	5.7	nS
turn - off time (port a to port b)	t_{PLZ} t_{PHZ}	Fig. 1, V_I=2*V_{CC} for t_{PLZ} V_I=0V for t_{PHZ}	1.65-1.95			12.5	3	13	nS
			2.3-2.7			7	2	7.5	nS
			3.0-3.5			5	1.5	5.3	nS
			4.5-5.5			3.5	0.8	3.8	nS
Break before connect time (Note 7)	t_{B-M}	Fig. 2, C_L=50pF, R_L=600Ω	1.65-1.95				0.5		nS
			2.3-2.7				0.5		nS
			3.0-3.5				0.5		nS
			4.5-5.5				0.5		nS
Charge injection (Note 7)	Q	Fig. 3, C_L=0.1nF V_{GEN}=0V R_{GEN}=0Ω	5		7				pC
			3.3		3				pC
Close (note 9) Release	OIRR	Fig. 4, r_L=50ω, f=10MHz	1.65-5.5		-57				dB
Cross talk	Xtalk	Fig. 5, r_L=50ω, f=10MHz	1.65-5.5		-54				dB
- 3dB bandwidth	BW	Fig. 8, r_L=50ω	1.65-5.5		350M				Hz
Total harmonic distortion (Note 7)	THD	R_L=600Ω, 0.5V_{P-P} f=600Hz - 20kHz	5		0.011				%
Input terminal capacitance (Note 10)	C_{IN}		0		2.3				pF

Parameter	Symbol	Condition	V_{CC}(V)	T_A=25°C			T_A=-40°C~85°C		Units
				Min	Typ	Max	Min	Max	
B disconnection capacitance when the port is turned off (Note 10)	C_{IO-B}	Figure 6	5		5				pF
A conduction capacitance when the port is open (Note 10)	C_{IOA-ON}	Figure 7	5		15.5				pF

Note3: It is obtained by measuring the ratio of the voltage difference between the two ports A and B to the current flowing through the two ports. On-resistance is determined by the lower voltage port of port A and B

Note4: The load characteristics introduced by encapsulation are not included.

Note5: ΔR_{ON}= R_{ONmax}- R_{ON} min in the given V_{CC}, temperature and level range.

Note6: On-resistance flatness refers to the difference between the maximum value and the minimum value of on-resistance under specified conditions.

Note 7: Design simulation value.

Note 8: This parameter is the design simulation value rather than the measured value. In the case of an ideal voltage source (zero output load), the transmission delay will be better than that of a 50pF load capacitor.

Note 9: Turn off isolation =20log10 [VA/V_{Bn}].

Note 10: T_A=+25°C, f=1MHz, excluding the load capacitance introduced by packaging.

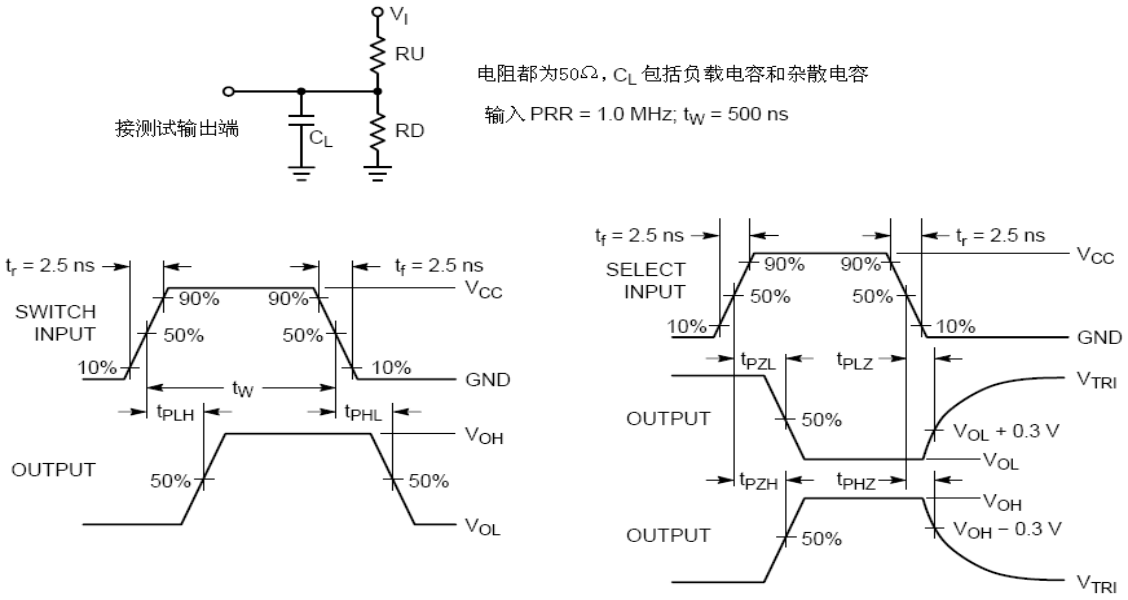


Figure 1: Transmission delay



Figure 2: Break first and

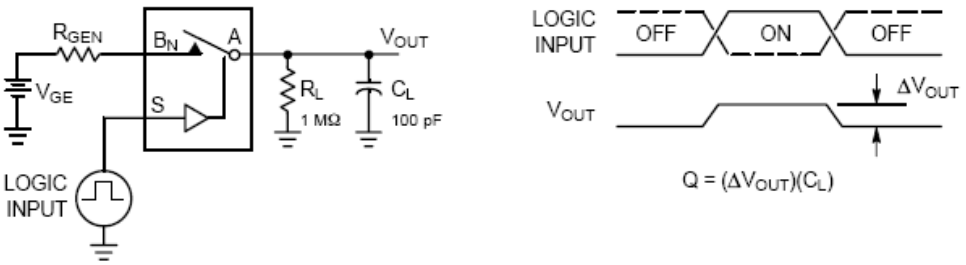


Figure 3: Charge

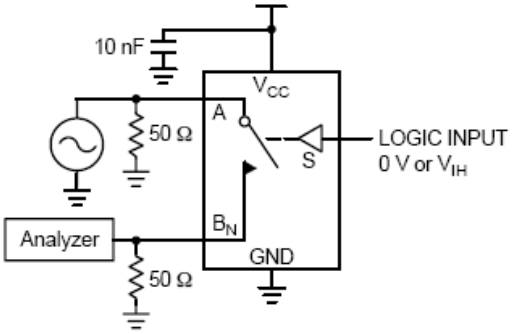


Figure 4: Turning off

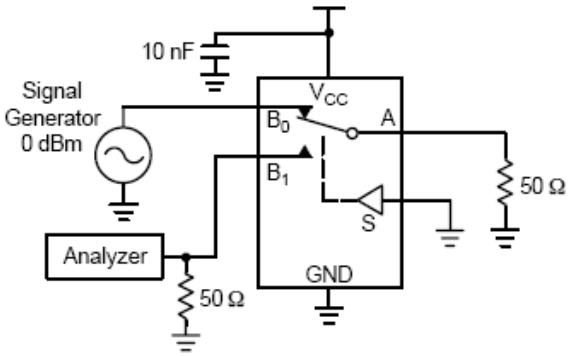


Figure 5: Crosstalk

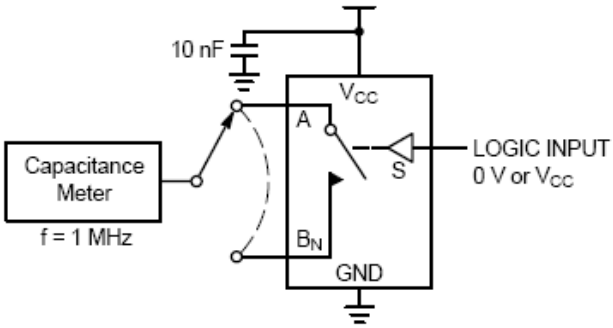


Figure 6: Output

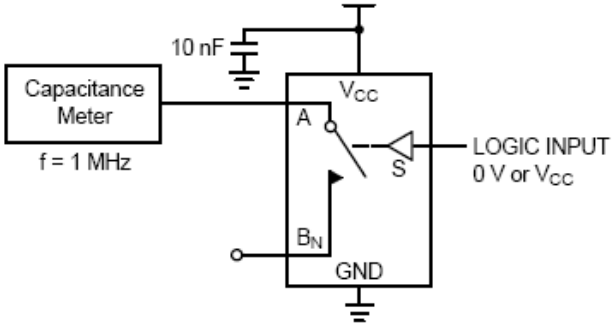


Figure 7: Output

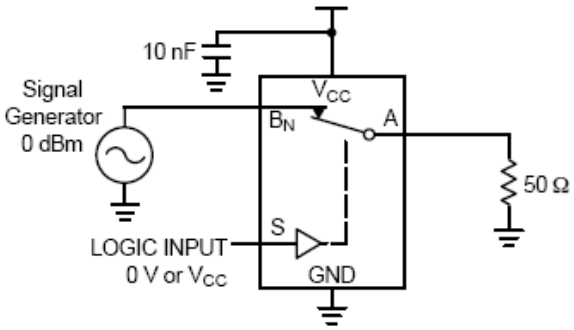


Figure 8: Bandwidth

8.Typical Characteristic

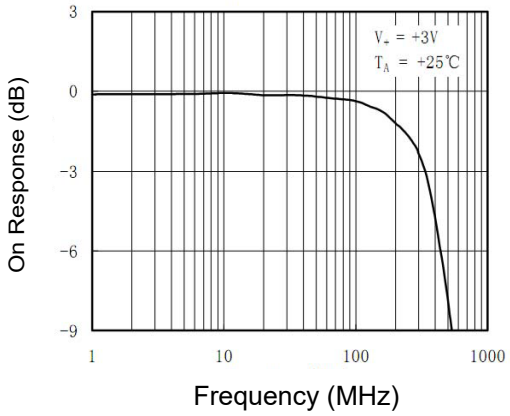


Figure 1: On Response vs.Frequency

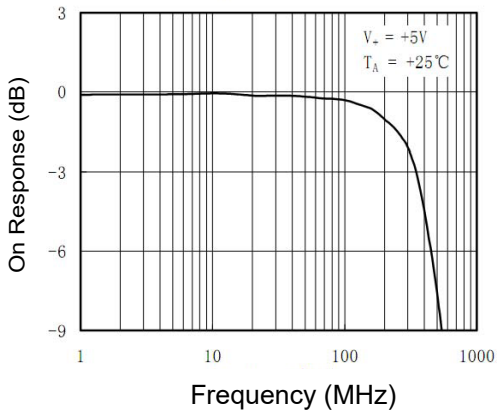


Figure 2: On Response vs.Frequency

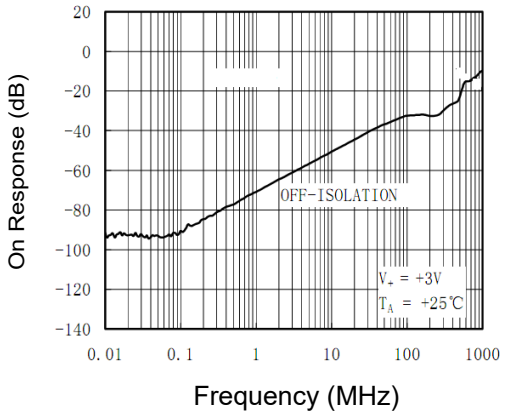


Figure 3: Response vs.Frequency

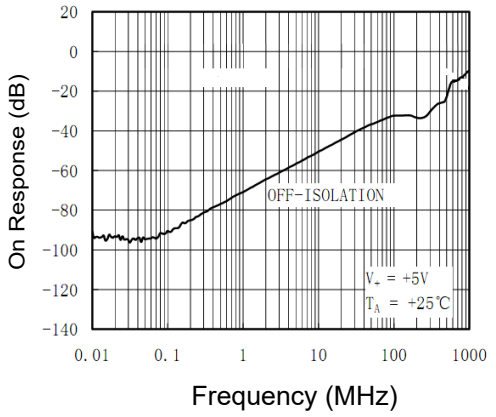
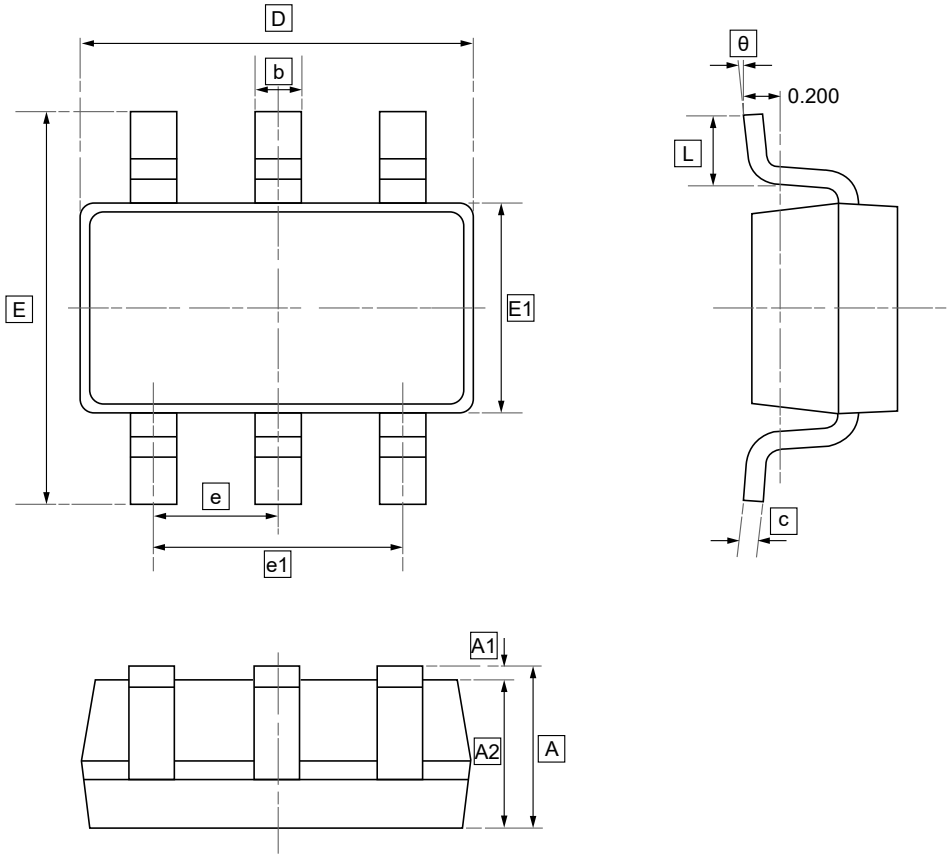


Figure 4: Response vs.Frequency

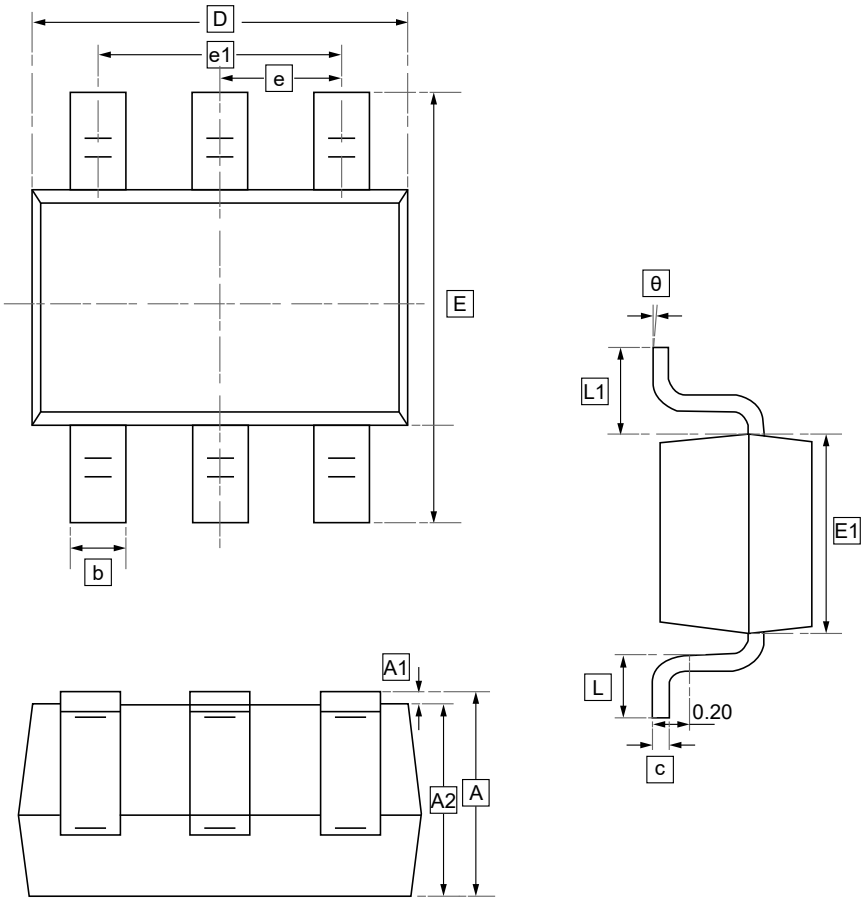
9.1 SOT23-6 Package Outline Dimensions



DIMENSIONS (mm are the original dimensions)

Symbol	A	A1	A2	b	c	D	E1	E	e	e1	L	θ
Min	1.050	0.000	1.050	0.300	0.100	2.820	1.500	2.650	0.950	1.800	0.300	0°
Max	1.250	0.100	1.150	0.500	0.200	3.020	1.700	2.950	BSC	2.000	0.600	8°

9.2 SC70-6 Package Outline Dimensions

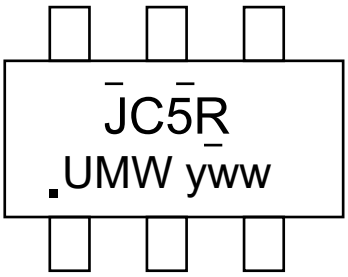


DIMENSIONS (mm are the original dimensions)

Symbol	A	A1	A2	b	c	D	E	E1	e	e1	L	L1
Min	0.90	0.00	0.90	0.15	0.08	2.05	2.15	1.15	0.65	1.2	0.26	0.525
Max	1.10	0.10	1.00	0.35	0.15	2.25	2.45	1.35	TYP.	1.4	0.46	REF.

Symbol	θ
Min	0°
Max	8°

10.Ordering Information



yww: Batch Code

Order Code	Marking	Package	Base QTY	Delivery Mode
UMW TS5A3157DBVR	JC5R	SOT23-6	3000	Tape and reel
UMW TS5A3157DCKR	JC5	SC70-6	3000	Tape and reel

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