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**WH251E****Micropower CMOS Output Hall Effect Switch**

WH251E Hall-effect sensor is a temperature stable, stress-resistant, Low Tolerance of Sensitivity micro-power switch. Superior high-temperature performance is made possible through a dynamic offset cancellation that utilizes chopper-stabilization. This method reduces the offset voltage normally caused by device over molding, temperature dependencies, and thermal stress.

WH251E is special made for low operation voltage, 1.65V, to active the chip which includes the following on a single silicon chip: voltage regulator, Hall voltage generator, small-signal amplifier, chopper stabilization, Schmitt trigger, CMOS output driver. Advanced CMOS wafer fabrication processing is used to take advantage of low-voltage requirements, component matching, very low input-offset errors, and small component geometries. This device requires the presence of omni-polar magnetic fields for operation.

The package type is in a Halogen Free version has been verified by third party Lab.

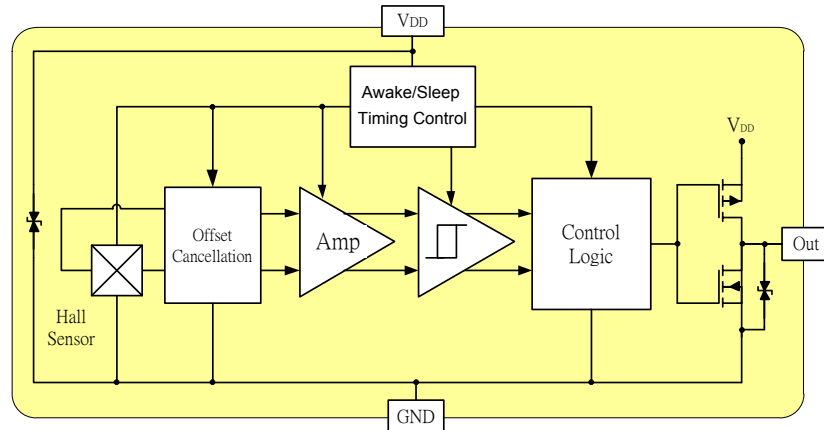
***Features and Benefits***

- CMOS Hall IC Technology
- Strong RF noise protection
- 1.65 to 3.5V for battery-powered applications
- Omni polar, output switches with absolute value of North or South pole from magnet
- Operation down to 1.65V, Micro power consumption
- High Sensitivity for reed switch replacement applications
- Multi Small Size option
- Low sensitivity drift in crossing of Temp. range
- Ultra Low power consumption at 5uA (Avg)
- High ESD Protection, HMB > ±4KV( min )
- Totem-pole output

***Applications***

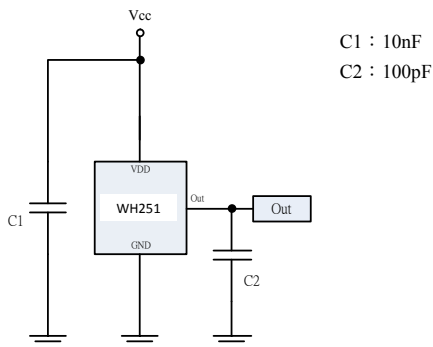
- Solid state switch
- Handheld Wireless Handset Awake Switch ( Flip Cell/PHS Phone/Note Book/Flip Video Set)
- Lid close sensor for battery powered devices
- Magnet proximity sensor for reed switch replacement in low duty cycle applications
- Water Meter
- Floating Meter
- PDVD
- NB

### Functional Diagram



**Note:** Static sensitive device; please observe ESD precautions. Reverse  $V_{DD}$  protection is not included. For reverse voltage protection, a  $100\Omega$  resistor in series with  $V_{DD}$  is recommended. **WH 251E, HBM >  $\pm 4KV$  which is verified by third party lab.**

### Typical Application circuit



### Order information

Device	Package	Shipping
WH251E-3/TR	TSOT-23-3L	3000/Reel&Tape

**Absolute Maximum Ratings** At( $T_a=25^\circ\text{C}$ )

Characteristics	Values	Unit	
Supply voltage, ( $V_{DD}$ )	6	V	
Output Voltage, ( $V_{out}$ )	6	V	
Reverse Voltage , ( $V_{DD}$ ) ( $V_{out}$ )	-0.3	V	
Magnetic flux density	Unlimited	Gauss	
Output current, ( $I_{out}$ )	1	mA	
Operating temperature range, ( $T_a$ )	-40 to +85	$^\circ\text{C}$	
Storage temperature range, ( $T_s$ )	-65 to +150	$^\circ\text{C}$	
Maximum Junction Temp, ( $T_J$ )	150	$^\circ\text{C}$	
Thermal Resistance	( $\theta_{JA}$ )	310	$^\circ\text{C}/\text{W}$
	( $\theta_{JC}$ )	223	$^\circ\text{C}/\text{W}$
Package Power Dissipation, ( $P_D$ )	400	mW	

**Note:** Exceeding the absolute maximum ratings may cause permanent damage. Exposure to absolute maximum-

rated conditions for extended periods may affect device reliability.

**Electrical Specifications**

DC Operating Parameters :  $T_a=25^\circ\text{C}$ ,  $V_{DD}=3.3\text{V}$

Parameters	Test Conditions	Min	Typ	Max	Units
Supply Voltage, ( $V_{DD}$ )	Operating	1.65	3.3	5	V
Supply Current, ( $I_{DD}$ )	Awake State		1.4	3	mA
	Sleep State		3.6	7	$\mu\text{A}$
	Average		5	10	$\mu\text{A}$
Output Leakage	Output off			1	$\mu\text{A}$
Output High Voltage, ( $V_{OH}$ )	$I_{OUT}=0.5\text{mA}$ (Source)	$V_{DD}-0.2$			V
Output Low Voltage, ( $V_{OL}$ )	$I_{OUT}=0.5\text{mA}$ (Sink)			0.2	V
Awake mode time, ( $T_{aw}$ )	Operating		40	80	$\mu\text{S}$
Sleep mode time, ( $T_{sl}$ )	Operating		40	80	mS
Duty Cycle, ( $D, C$ )			0.1		%
Electro-Static Discharge	HBM	4			KV

**WH251E Magnetic Specifications**

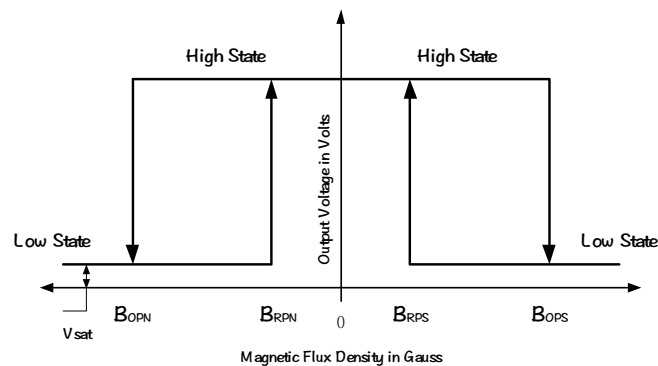
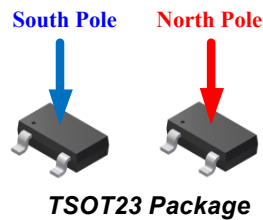
DC Operating Parameters :  $T_a=25\text{ }^\circ\text{C}$ ,  $V_{DD}=3.3\text{V}$

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Operating Point	B <sub>OPS</sub>	N pole to branded side, B > BOP, Vout On	20	30	40	Gauss
	B <sub>OPN</sub>	S pole to branded side, B > BOP, Vout On	-40	-30	-20	Gauss
Release Point	B <sub>RPS</sub>	N pole to branded side, B < BRP, Vout Off	10	20	30	Gauss
	B <sub>RPN</sub>	S pole to branded side, B < BRP, Vout Off	-30	-20	-10	Gauss
Hysteresis	B <sub>HYS</sub>	BOPx - BRPx		10		Gauss

### WH251E Output Behavior versus Magnetic Polar

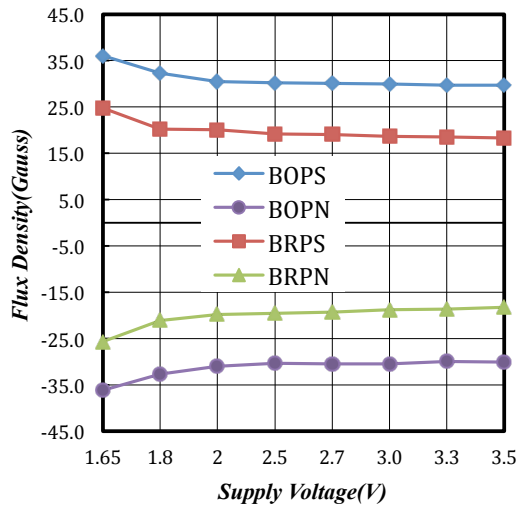
DC Operating Parameters:  $T_a = -40\text{ to }85\text{ }^\circ\text{C}$ ,  $V_{dd} = 1.65\text{V to }5\text{V}$

Parameter	Test condition	OUT
South pole	$B < B_{op} [(-40) \sim (-20)]$	Low
Null or weak magnetic field	$B = 0$ or $B < B_{RP}$	High
North pole	$B > B_{op} (40 \sim 20)$	Low

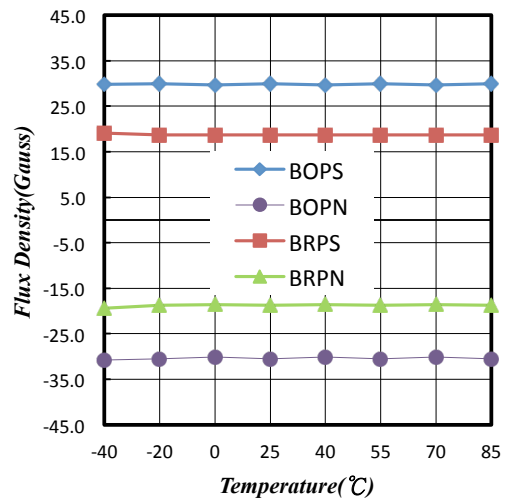


## Performance Graph

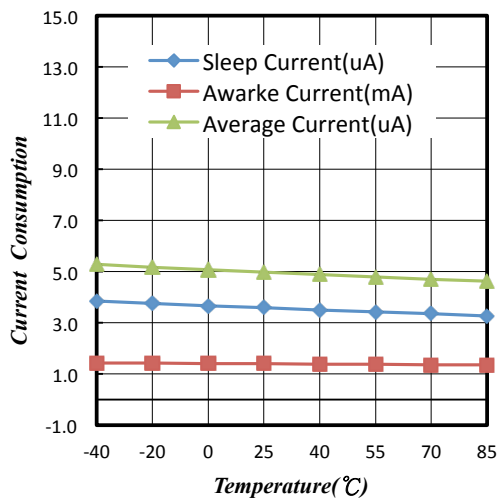
Typical Supply Voltage ( $V_{DD}$ ) Versus Flux Density



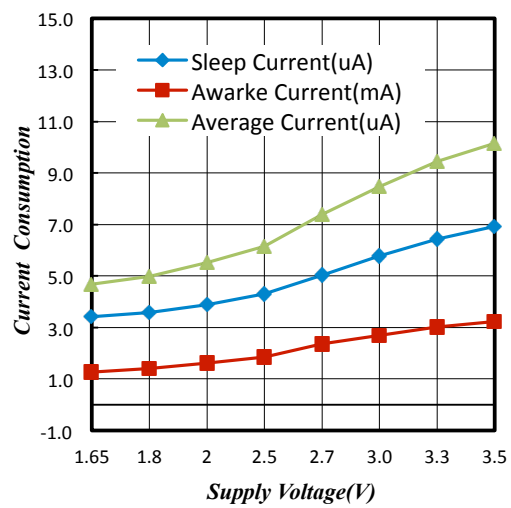
Typical Temperature ( $T_A$ ) Versus Flux Density



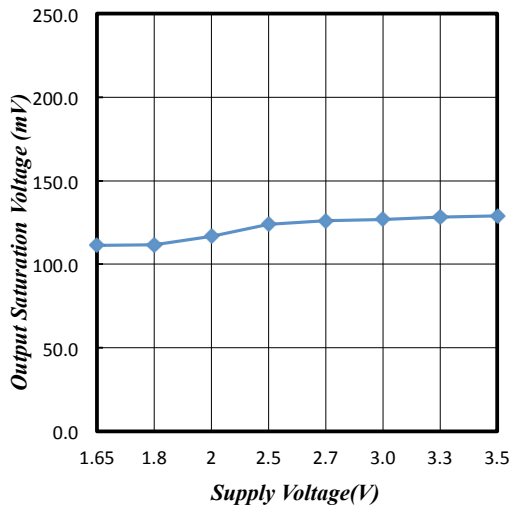
Typical Temperature ( $T_A$ ) Versus Supply Current ( $I_{DD}$ )



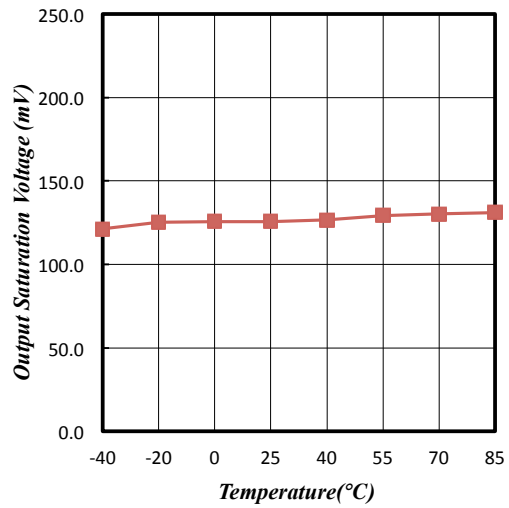
Typical Supply Voltage ( $V_{DD}$ ) Versus Supply Current ( $I_{DD}$ )



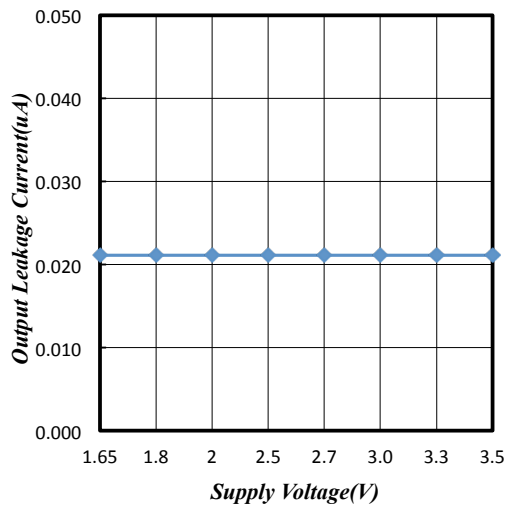
Typical Supply Voltage ( $V_{DD}$ ) Versus Output Voltage ( $V_{DSON}$ )



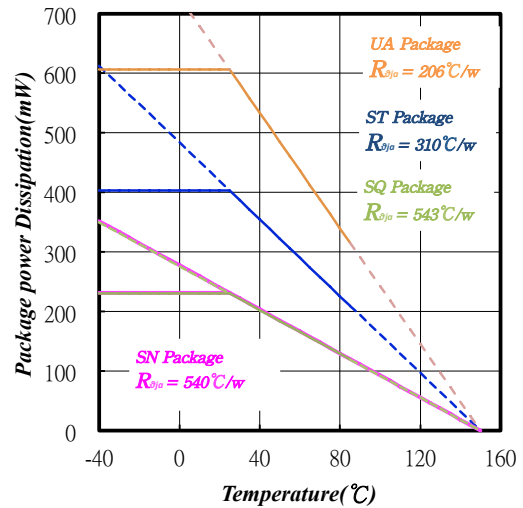
Typical Temperature ( $T_A$ ) Versus Output Voltage ( $V_{DSON}$ )



Typical Supply Voltage ( $V_{DD}$ ) Versus Leakage Current ( $I_{OFF}$ )



Power Dissipation versus Temperature ( $T_A$ )



## Package Power Dissipation

The power dissipation of the Package is a function of the pad size. This can vary from the minimum pad size for soldering to a pad size given for maximum power dissipation. Power dissipation for a surface mount device is determined by  $T_{J(max)}$ , the maximum rated junction temperature of the die,  $R_{\theta JA}$ , the thermal resistance from the device junction to ambient, and the operating temperature,  $T_a$ . Using the values provided on the data sheet for the package, PD can be calculated as follows:

$$P_D = \frac{T_{J(max)} - T_a}{R_{\theta ja}}$$

The values for the equation are found in the maximum ratings table on the data sheet. Substituting these values into the equation for an ambient temperature  $T_a$  of 25°C, one can calculate the power dissipation of the device which in this case is 400 milliwatts.

$$P_D(ST) = \frac{150^\circ\text{C} - 25^\circ\text{C}}{310^\circ\text{C}/\text{W}} = 400\text{mW}$$

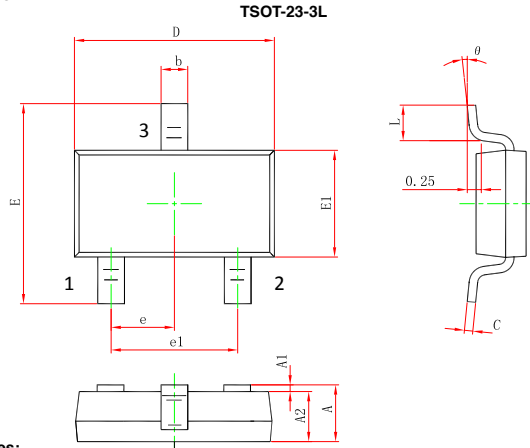
The 310°C/W for the ST package assumes the use of the recommended footprint on a glass epoxy printed circuit board to achieve a power dissipation of 400 milliwatts. There are other alternatives to achieving higher power dissipation from the Package. Another alternative would be to use a ceramic substrate or an aluminum core board such as Thermal Clad. Using a board material such as Thermal Clad, an aluminum core board, the power dissipation can be doubled using the same footprint.

## Sensor Location, package dimension and marking

### WH251E Package

#### Package(TSOT-23) (Top View)

Package outline dimensions

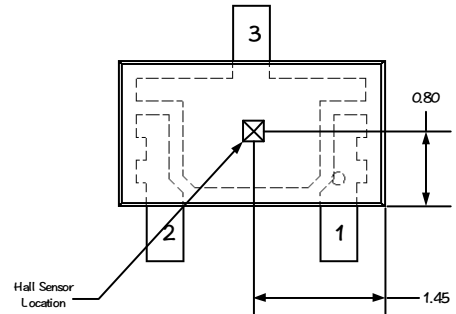


Notes:

All dimensions meet jedec standard MO-19 AA  
Do not include mold flash or protrusions.

Symbol	Dimensions in Millimeters		Dimensions in Inches	
	Min	Max	Min	Max
A	0.700	0.900	0.028	0.035
A1	0.000	0.100	0.000	0.004
A2	0.700	0.800	0.028	0.031
b	0.350	0.500	0.014	0.020
c	0.080	0.200	0.003	0.008
D	2.820	3.020	0.111	0.119
E1	1.600	1.700	0.063	0.067
E	2.650	2.950	0.104	0.116
e	0.95 (BSC)		0.037(BSC)	
e1	1.90 (BSC)		0.075(BSC)	
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

#### Hall Plate Chip Location (Bottom view)

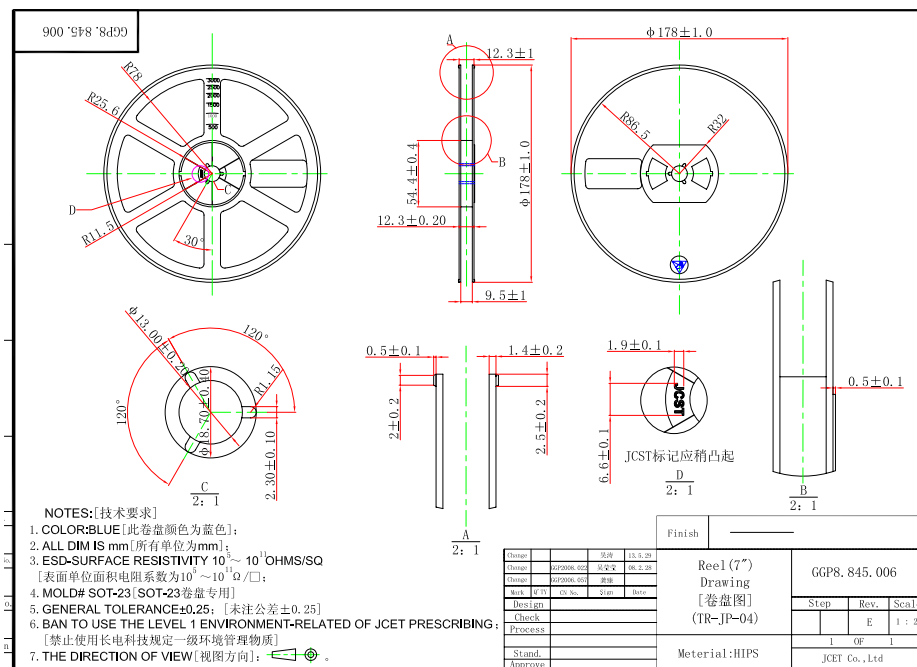
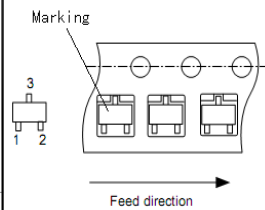
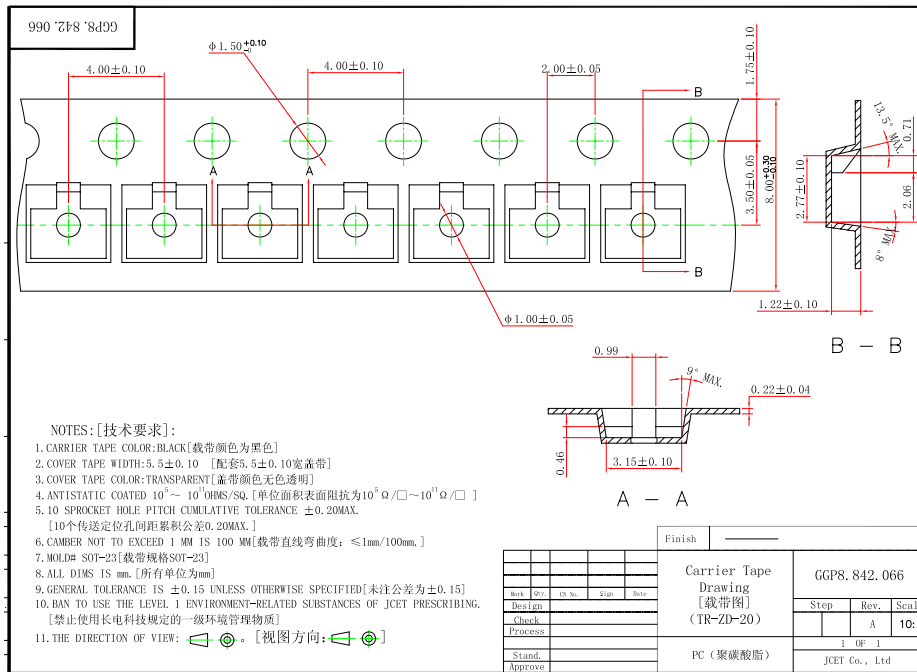


#### NOTES:

- PINOUT (See Top View at left:)  
Pin 1 VDD  
Pin 2 Output  
Pin 3 GND



### Tape On Reel Dimension

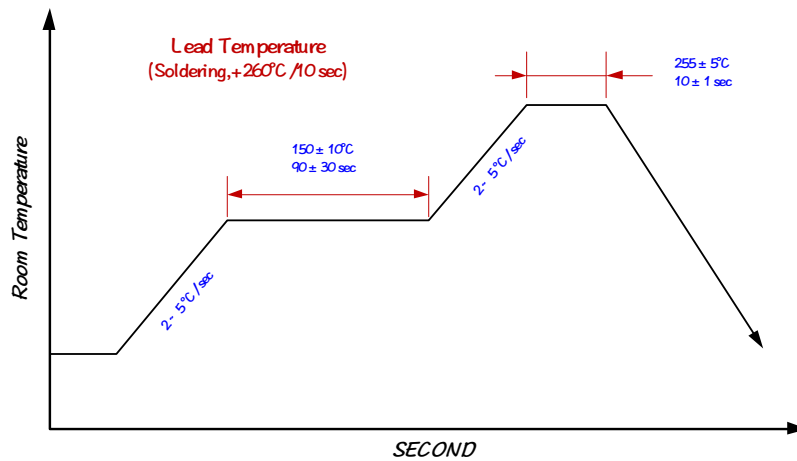


## Reliability Test

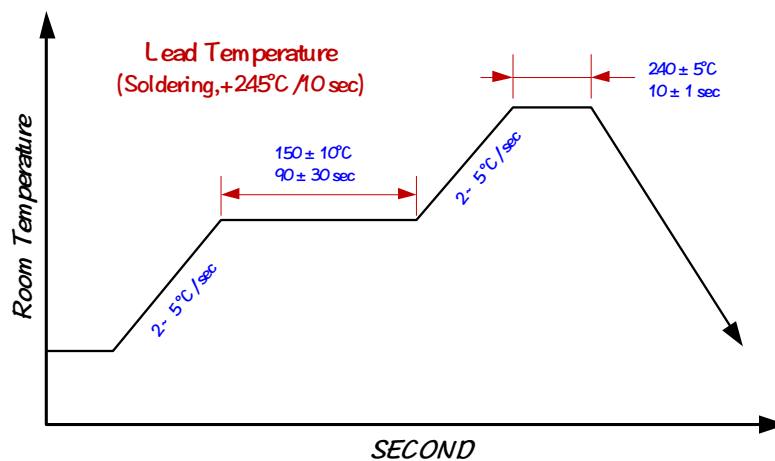
品名	WH251E	
Product Name		
包裝方式	TSOT23-3	
Package Type		
引腳電鍍方式	銀	
Lead Plating Type	Ag	
可靠度測試項目	條件	結果
Item	Test Condition	Result
高溫儲存測試	在 150° C 下,經過 168 小時測試零件的電氣特性。 測試樣品數 32pcs。參考 JESD22-A103 標準規範。	通過
High Temperature Storage Test	Samples stored in 150° C for 168 hrs, then test electrical characteristics. Sample quantity: 32pcs. Based on JESD22-A103 standard.	PASS
恆溫恆濕測試	在 85° C/85%RH 條件下,經過 168hrs 測試零件的電氣特性。 測試樣品數 32pcs。參考 JESD22-A101 標準規範。	通過
Temperature and Humidity Test	Samples stored in 85° C/85%RH for 168hrs, then test electrical characteristics. Sample quantity: 32pcs. Based on JESD22-A101 standard.	PASS
溫度循環測試	在 -65° C~150° C 的溫度循環下,經過 200hrs 測試零件的電氣特性。 測試樣品數 32pcs。參考 JESD22-A104 標準規範。	通過
Temperature Cycling Test	Samples stored in -65° C~150° C for 200hrs, then test electrical characteristics. Sample quantity: 32pcs. Based on JESD22-A104 standard.	PASS
無偏壓加速壽命測試	在 130° C/85%RH 條件下,經過 96hrs 測試零件的電氣特性。 測試樣品數 32pcs。參考 JESD22-A118 標準規範。	通過
Highly Accelerated Stress Test	Sample stored in 130° C/85%RH for 96hrs, then test electrical characteristics. Sample quantity: 32pcs. Based on JESD22-A118 standard.	PASS
壓力鍋測試	在 121° C/100%RH 條件下,經過 96hrs 測試零件的電氣特性。 測試樣品數 32pcs。參考 JESD22-A102 標準規範。	通過
Pressure Cook Test	Samples stored in 121° C/100%RH for 96hrs, then test electrical characteristics. Sample quantity: 32pcs. Based on JESD22-A102 standard.	PASS
耐焊性測試	回焊爐曲線圖如 IR reflow curve 所示。測試樣品數 22pcs。手焊時,電烙鐵最高溫度 350° C,使用時間最多 5 秒。	通過
Resistance of solder heat	Reflow set in IR reflow curve. Sample quantity: 22pcs. The temperature of soldering iron is under 350° C and less than 5 seconds.	PASS
濕度敏感等級	依上述可靠性實驗製訂 MSL 等級。	MSL3
Moisture Sensitivity Levels	In accordance with above reliability test to determine this device MSL level.	

壽命測試 Life Test	在 85° C 下,經過 1008hrs 測試零件的電氣特性。 測試樣品數 1000pcs。 DUT work in set 85° C during 1008hrs. Period testing 1000pcs DUT's electrical function.	MTTF 1,000,000hrs@85° C
靜電防護測試 ESD	人體放電模式依據 MIL-STD-883H Method 3015.8 規範測試。 機器放電模式依據 JEDEC EIA/JESD22-A115 規範測試。 HBM: MIL-STD-883H Method 3015.8 MM: JEDEC EIA/JESD22-A115	HBM Class: 3 MM Class: 2

### IR reflow curve

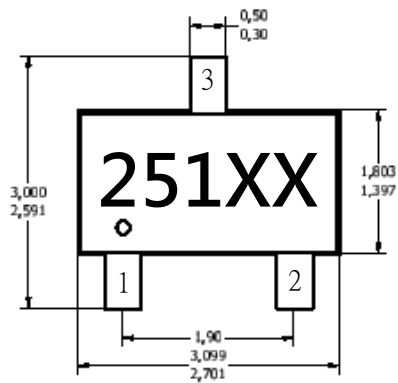


**Soldering Condition**



**UA Soldering Condition**

## Marking information



XX

Week Code

Week	1	2	3	4	5	6	7	8	9	10	11	12	13
Code	SA	SB	SC	SD	SE	SF	SG	SH	SI	SJ	SK	SL	SM
Week	14	15	16	17	18	19	20	21	22	23	24	25	26
Code	SN	SO	SP	SQ	SR	SS	ST	SU	SV	SW	SX	SY	SZ
Week	27	28	29	30	31	32	33	34	35	36	37	38	39
Code	TA	TB	TC	TD	TE	TF	TG	TH	TI	TJ	TK	TL	TM
Week	40	41	42	43	44	45	46	47	48	49	50	51	52
Code	TN	TO	TP	TQ	TR	TS	TT	TU	TV	TW	TX	TY	TZ

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[TLE9852QXXUMA1](#) [TLE5046ICAKLRHALA1](#) [AH1903-FA-EVM](#) [AH49FNTR-EVM](#) [AH8502-FDC-EVM](#) [AH3774-P-EVM](#)  
[TLE4998S3XALA1](#) [TLE5011FUMA1](#) [TLE5027CE6747HAMA1](#) [TLE5109A16E1210XUMA1](#) [TLI4966GHTSA1](#) [TLI4906KHTSA1](#)  
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[57A1NSL1A-M3T2U](#) [S-57K1RBL1A-M3T2U](#) [S-57P1NBH9S-M3T4U](#) [S-57P1NBH0S-M3T4U](#) [S-57A1NSH1A-M3T2U](#)