

Micropower CMOS Output Hall Effect Switch

DESCRIPTION

TSH251 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. TSH251 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. This device requires the presence of omni-polar magnetic fields for operation.

FEATURES

- 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
- High Sensitivity for reed switch replacement applications
- Low sensitivity drift in crossing of Temp. range
- Ultra-Low power consumption at 5 μ A (Avg)
- High ESD Protection, HBM > $\pm$ 4kV (min)
- Totem-pole output
- RoHS Compliant
- Halogen-free

APPLICATION

- Solid state switch
- Handheld Wireless Handset Awake Switch (Flip Cell/PHS Phone/NoteBook/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



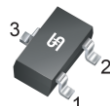
TO-92S



Pin Definition:

1. Vcc
2. Ground
3. Output

TSOT-23

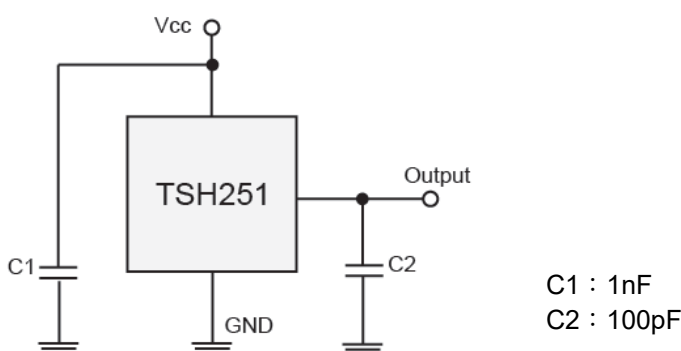


Pin Definition:

1. Vcc
2. Output
3. Ground

Notes: TSOT-23 MSL 1 (Moisture Sensitivity Level) per J-STD-020

TYPICAL APPLICATION CIRCUIT



ABSOLUTE MAXIMUM RATINGS ($T_A = 25^\circ\text{C}$ unless otherwise noted)

PARAMETER		SYMBOL	LIMIT	UNIT
Supply voltage		V _{DD}	4.5	V
Output Voltage		V _{OUT}	4.5	V
Reverse voltage		V _{DD/OUT}	-0.3	V
Magnetic flux density			Unlimited	Gauss
Output current		I _{OUT}	1	mA
Operating Temperature Range		T _{OPR}	-40 to +85	°C
Storage temperature range		T _{STG}	-65 to +150	°C
Maximum Junction Temp		T _J	150	°C
Package Power Dissipation	TO-92S	P _D	606	mW
	TSOT-23		230	

THERMAL PERFORMANCE

PARAMETER		SYMBOL	LIMIT	UNIT
Thermal Resistance - Junction to Case	TO-92S	R _{θJC}	148	°C/W
	TSOT-23		410	
Thermal Resistance - Junction to Ambient	TO-92S	R _{θJA}	206	°C/W
	TSOT-23		543	

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 : $T_A = 25^\circ\text{C}$, $V_{DD} = 5\text{V}$)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
Supply Voltage	Operating	1.65	--	3.5	V
Supply Current	Awake State	--	1.4	3	mA
	Sleep State	--	3.6	7	μA
	Average	--	5	10	μA
Output Leakage Current	Output off	--	--	1	μA
Output High Voltage	$I_{OUT} = 0.5\text{mA}$ (Source)	V_{DD} -0.2	--	--	V
Output Low Voltage	$I_{OUT} = 0.5\text{mA}$ (Sink)	--	--	0.2	V
Awake mode time	Operating	--	40	80	μS
Sleep mode time	Operating	--	40	80	mS
Duty Cycle		--	0.1	--	%
Electro-Static Discharge	HBM	4	--	--	kV

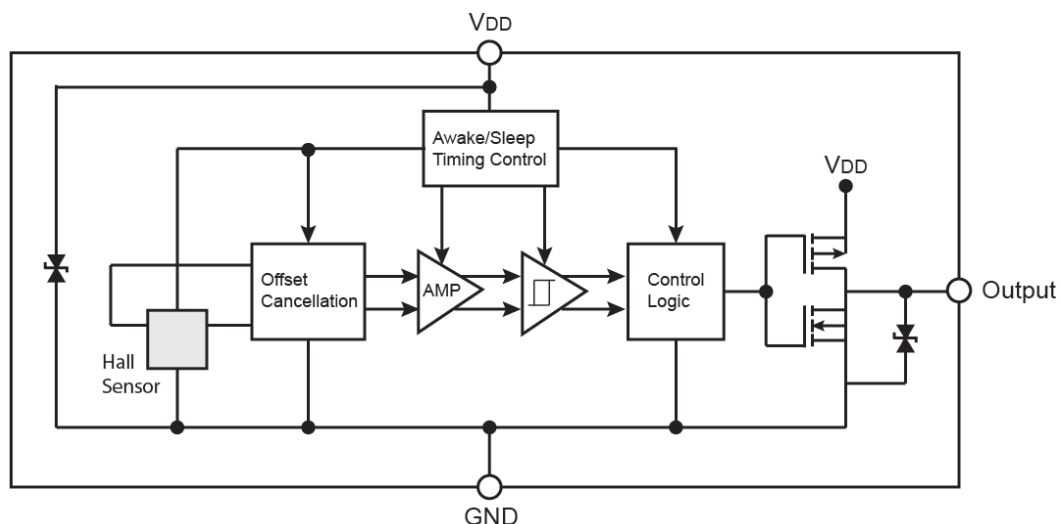
MAGNETIC SPECIFICATIONS (DC Operating Parameters : $T_A=25^{\circ}\text{C}$, $V_{CC}=5\text{V}$)						
PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
TSH251CT TO-92S						
Operating Point	BOPS	S pole to branded side, $B > B_{OP}$, V_{OUT} On	--	30	55	Gauss
	BOPN	N pole to branded side, $B > B_{OP}$, V_{OUT} On	-55	-30	--	Gauss
Release Point	BRPS	S pole to branded side, $B < B_{RP}$, V_{OUT} Off	10	20	--	Gauss
	BRPN	N pole to branded side, $B < B_{RP}$, V_{OUT} Off	--	-20	-10	Gauss
Hysteresis	BHYS	$ B_{OPX} - B_{RPX} $	--	10	--	Gauss

Note: 1G (gauss) = 0.1mT (millitesla)

MAGNETIC SPECIFICATIONS (DC Operating Parameters : $T_A=25^{\circ}\text{C}$, $V_{CC}=5\text{V}$)						
PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
TSH251CX TSOT-23						
Operating Point	BOPS	N pole to branded side, $B > B_{OP}$, V_{OUT} On	--	30	55	Gauss
	BOPN	S pole to branded side, $B > B_{OP}$, V_{OUT} On	-55	-30	--	Gauss
Release Point	BRPS	N pole to branded side, $B < B_{RP}$, V_{OUT} Off	10	20	--	Gauss
	BRPN	S pole to branded side, $B < B_{RP}$, V_{OUT} Off	--	-20	-10	Gauss
Hysteresis	BHYS	$ B_{OPX} - B_{RPX} $	--	10	--	Gauss

Note: 1G (gauss) = 0.1mT (millitesla)

BLOCK DIAGRAM

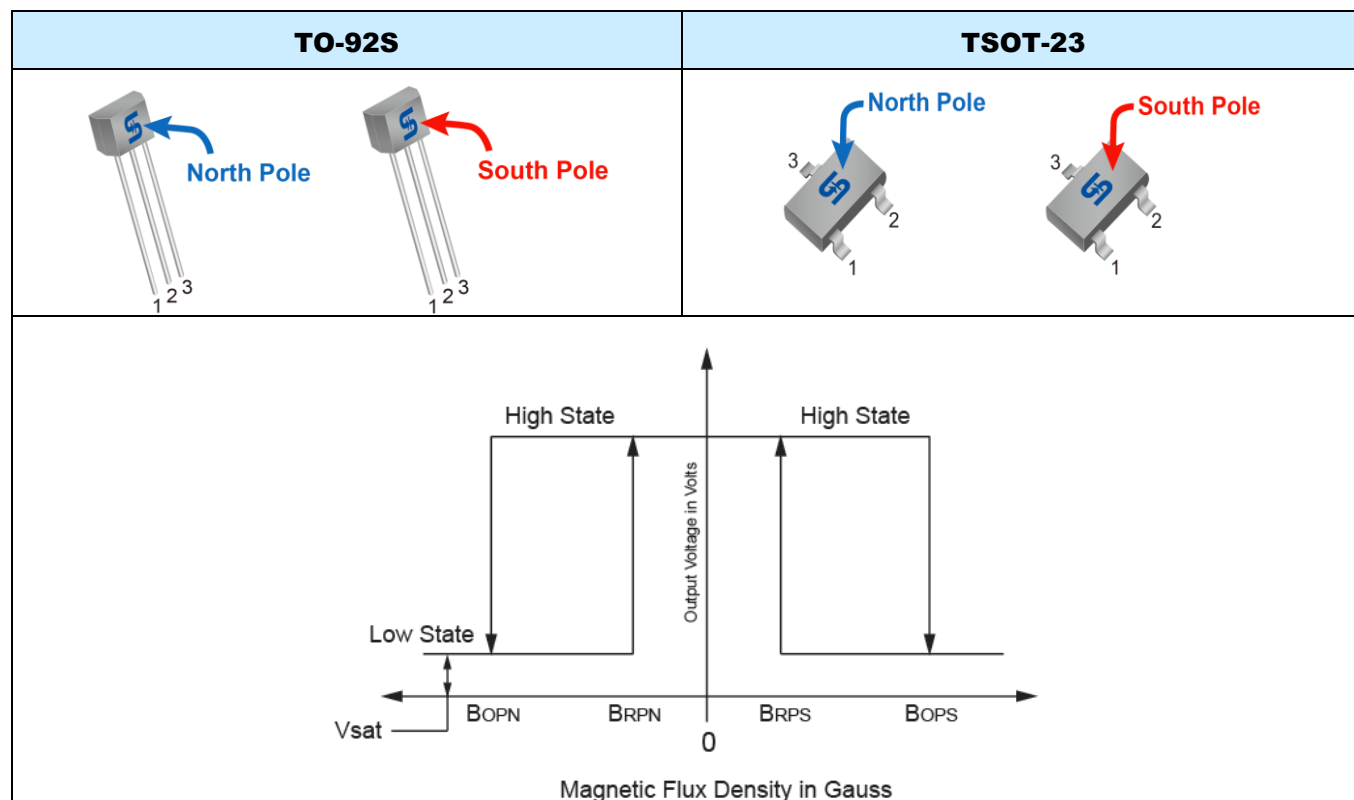


Note: Static sensitive device; please observe ESD precautions. Reverse V_{DD} protection is not included. For reverse voltage protection, a 100 Ω resistor in series with V_{DD} is recommended.

OUTPUT BEHAVIOR vs. MAGNETIC POLE

DC Operating Parameters: $T_A = -40$ to 125°C , $V_{CC} = 1.8\text{V} \sim 6\text{V}$

PARAMETER	TEST CONDITION	OUT
South pole	$B < B_{OP} [(-55) \sim (-10)]$	Low
Null or weak magnetic field	$B = 0$ or $B < B_{RP}$	High
North pole	$B > B_{OP} (55 \sim 10)$	Low



ORDERING INFORMATION

ORDERING CODE	PACKAGE	PACKING
TSH251CT B0G	TO-92S	1Kpcs / Bulk Bag
TSH251CX RFG	TSOT-23	3Kpcs / 7" Reel

CHARACTERISTIC PERFORMANCE

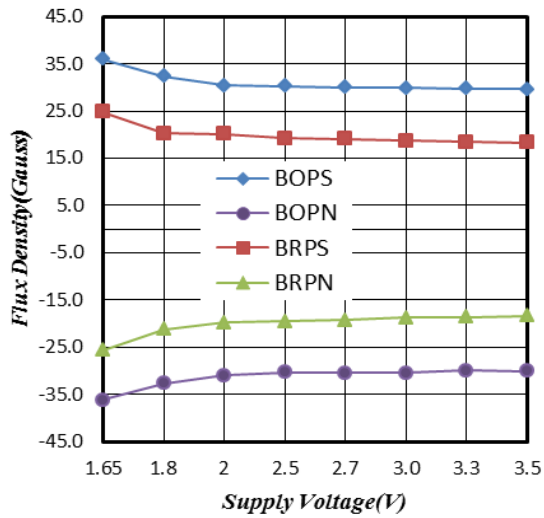


Figure 1. Supply Voltage vs. Flux Density

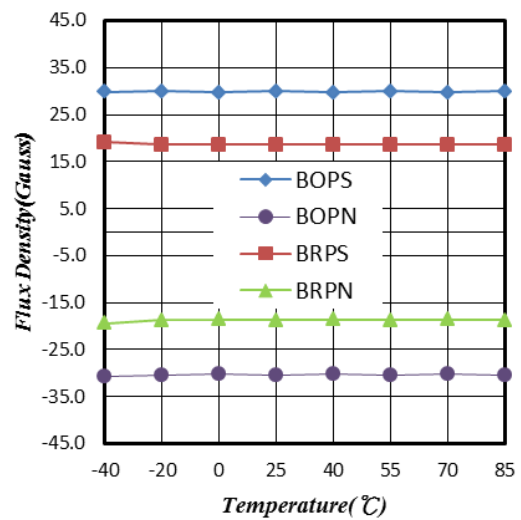


Figure 2. Temperature vs. Flux Density

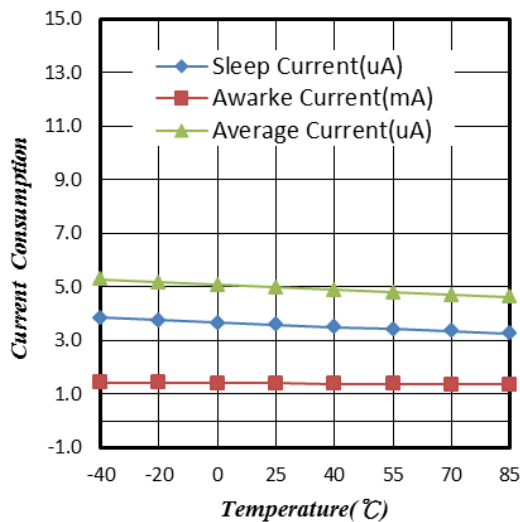


Figure 3. Supply Current vs. Temperature

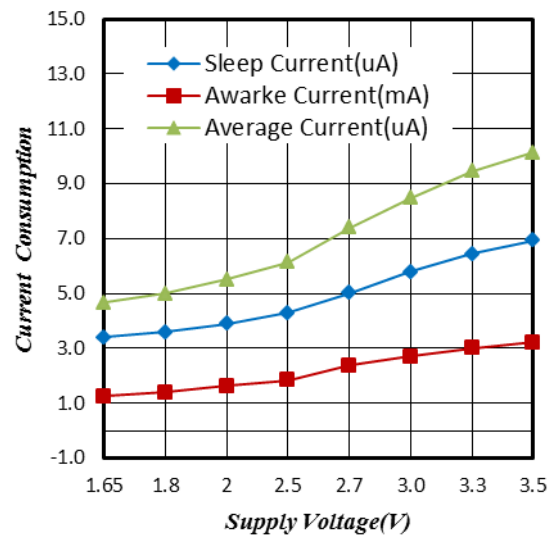


Figure 4. Supply Current vs. Supply Voltage

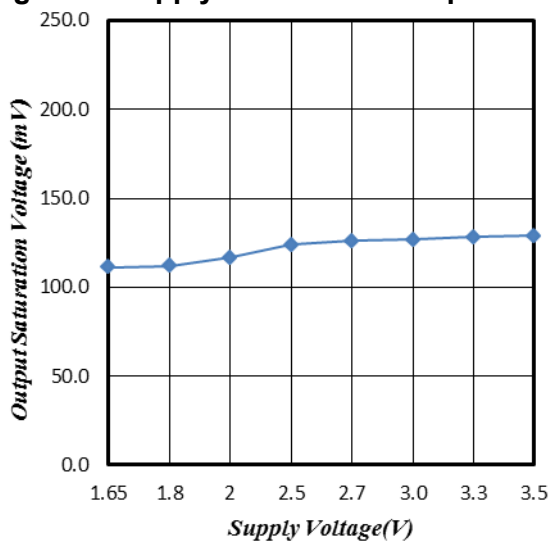


Figure 5. Output Saturation Voltage vs. Supply Voltage

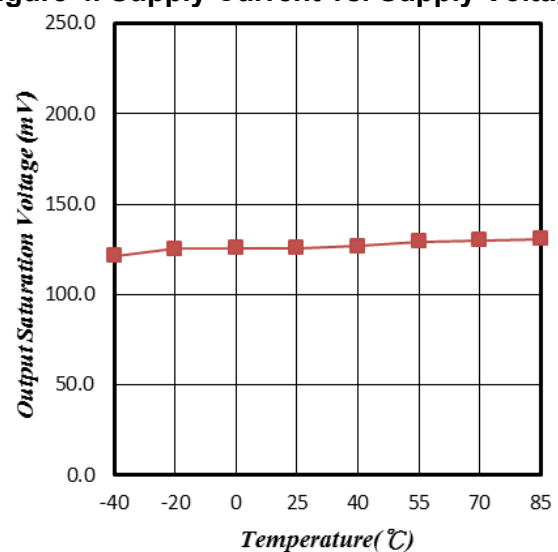


Figure 6. Output Saturation Voltage vs. Temperature

CHARACTERISTIC PERFORMANCE (CONTINUE)

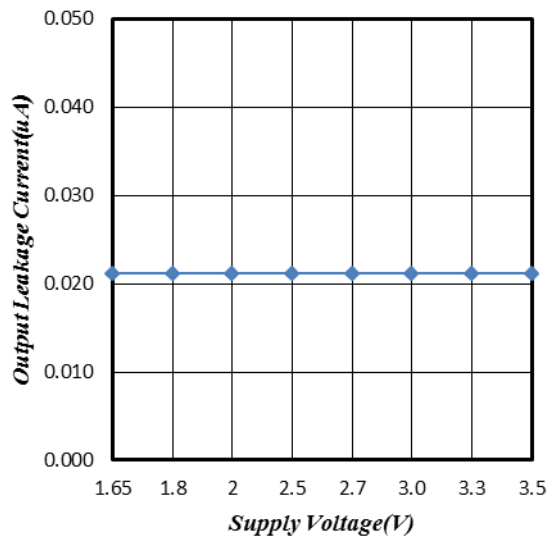


Figure 7. Output Leakage Current vs. Supply Voltage

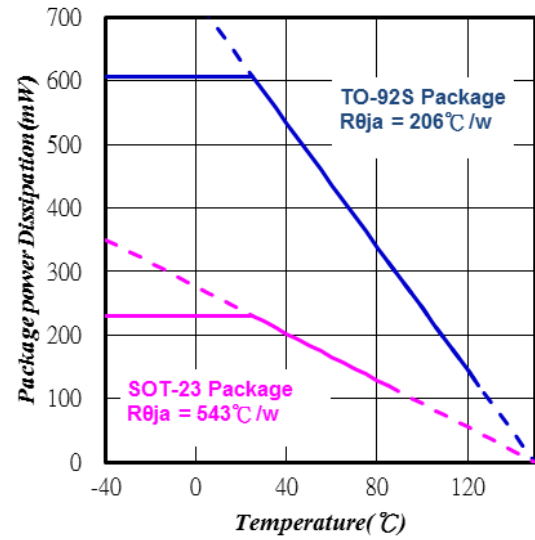
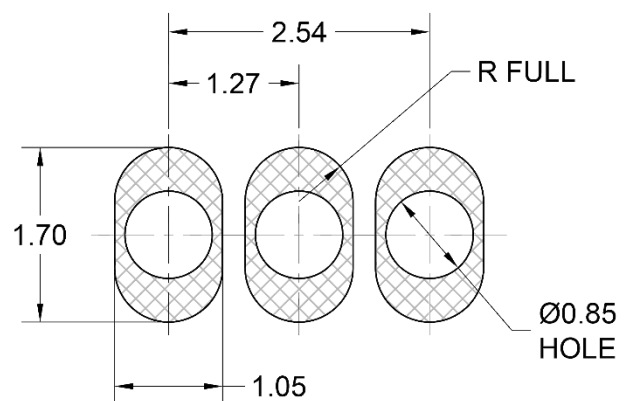
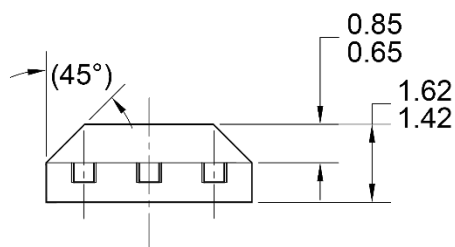
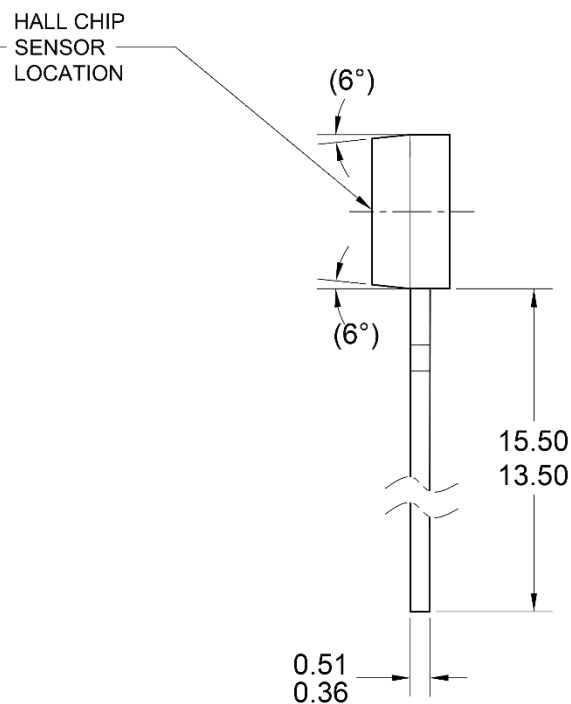
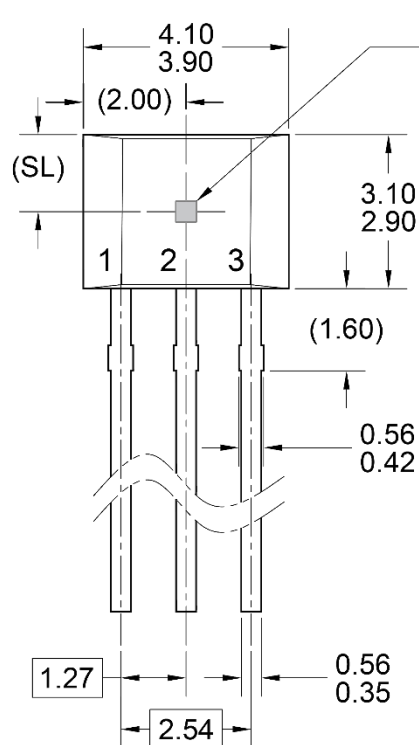


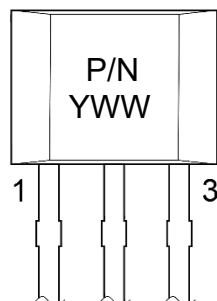
Figure 8. Power Dissipation vs. Temperature

PACKAGE OUTLINE DIMENSIONS (Unit: Millimeters)

TO-92S



SUGGESTED PAD LAYOUT



MARKING DIAGRAM

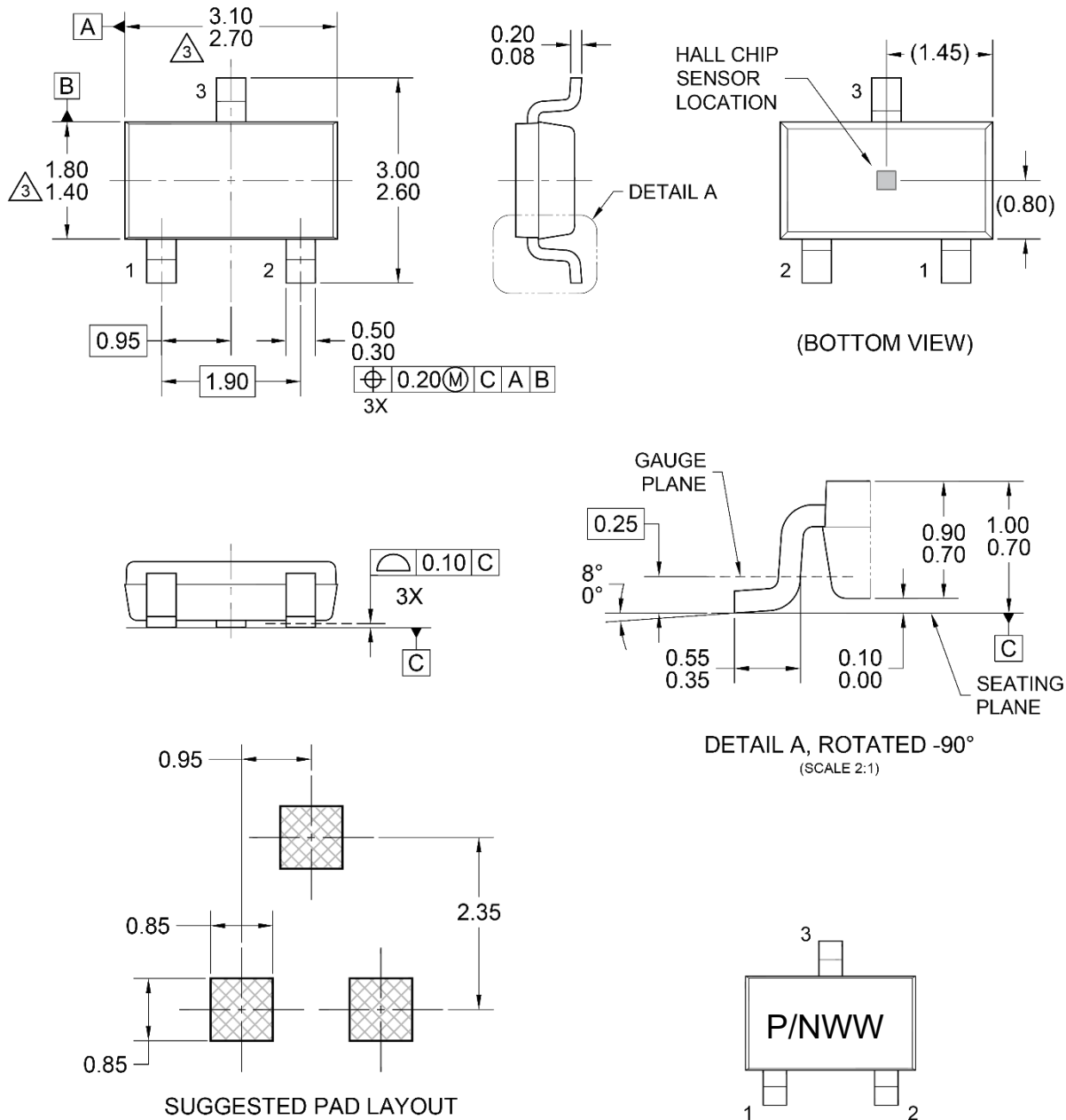
P/N = 251
Y = Year code
WW = Week code (01~52)

NOTES: UNLESS OTHERWISE SPECIFIED

1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994.
3. SENSOR LOCATION (SL) :0.90 REF
4. DWG NO REF: HQ2SD07-TO92S-010 REV B.

PACKAGE OUTLINE DIMENSIONS (Unit: Millimeters)

TSOT-23



NOTES: UNLESS OTHERWISE SPECIFIED

1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994.
3. MOLDED PLASTIC BODY DIMENSIONS DO NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.
4. DWG NO REF:HQ2SD07-TSOT23SL-147 REV A.

P/N = 251
WW = Date code (Refer to coding table)

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