High Sensitivity Omni-Polar Hall Effect Switch

DESCRIPTION

TSH253 Hall-effect sensor is a temperature stable, stress-resistant 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. TSH253 includes the following on a single silicon chip: voltage regulator, Hall voltage generator, small-signal amplifier, chopper stabilization, Schmitt trigger, open-drain output. 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.

FEATURES

- CMOS Hall IC Technology
- Solid-State Reliability much better than reed switch
- Omni polar output switches with absolute value of North or South pole from magnet
- High Sensitivity for reed switch replacement
- Operation down to 1.8 V and Max at 6V.
- ESD HBM ±4kV Min
- RoHS Compliant
- Halogen-free according to IEC 61249-2-21

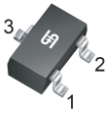
APPLICATION

- Solid state switch, Revolution counter
- Lid close sensor for power supply devices
- Magnet proximity sensor for reed switch replacement in high duty cycle applications.
- Safety Key on sporting equipment
- Speed sensor, Position Sensor, Rotation Sensor

TO-92S

Pin Definition:
1. V_{CC}
2. Ground
3. Output

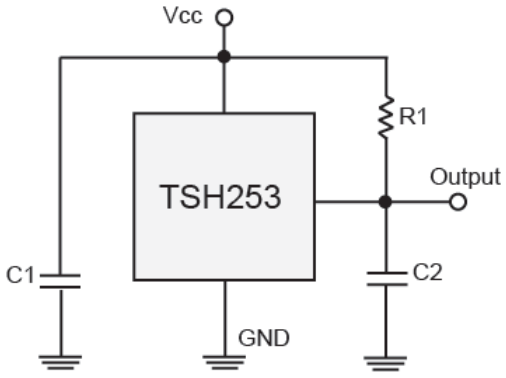
SOT-23



Pin Definition:
1. V_{CC}
2. Output
3. Ground

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

TYPICAL APPLICATION CIRCUIT



C1：10nF
C2：100pF
R1：10kΩ

ABSOLUTE MAXIMUM RATINGS (T_A = 25°C unless otherwise noted)

PARAMETER		SYMBOL	LIMIT	UNIT
Supply voltage		V_{CC}	6	V
Output Voltage		V_{OUT}	6	V
Reverse voltage		$V_{CC/OUT}$	-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}	-55 to +150	°C
Maximum Junction Temp		T_J	150	°C
Package Power Dissipation	TO-92S	P_D	606	mW
	SOT-23		230	

THERMAL PERFORMANCE

PARAMETER		SYMBOL	LIMIT	UNIT
Thermal Resistance - Junction to Case	TO-92S	$R_{\Theta JC}$	148	°C/W
	SOT-23		410	
Thermal Resistance - Junction to Ambient	TO-92S	$R_{\Theta JA}$	206	°C/W
	SOT-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°C, V_{CC}=5V)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
Supply Voltage	Operating	1.8	--	6	V
Supply Current	Average	--	2.6	6.0	mA
Output Low Voltage	I_{OUT} = 0.5mA	--	--	200	mV
Output Leakage Current	I_{OFF} B<B_{RP}, V_{OUT} = 3V	--	--	10	μA
Output Rise Time	R_L = 10kΩ, C_L = 20pF	--	--	0.45	μs
Output Fall Time	R_L = 10kΩ; C_L = 20pF	--	--	0.45	μs
Electro-Static Discharge	HBM	4	--	--	kV

MAGNETIC SPECIFICATIONS (DC Operating Parameters：T_A=25°C, V_{CC}=5V)

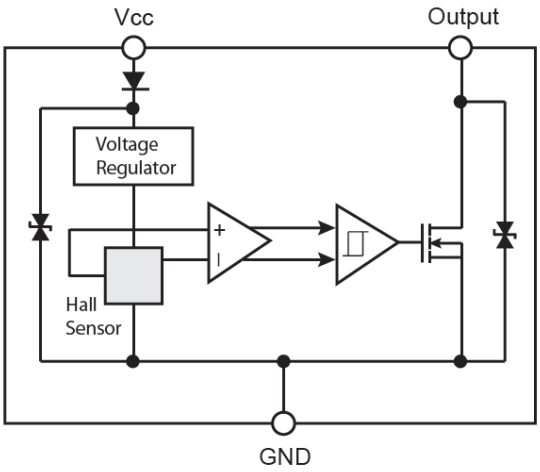
PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
TSH253CT TO-92S						
Operating Point	B_{OPS}	S pole to branded side, B > B_{OP}, V_{OUT} On	--	30	60	Gauss
	B_{OPN}	N pole to branded side, B > B_{OP}, V_{OUT} On	-60	-30	--	Gauss
Release Point	B_{RPS}	S pole to branded side, B < B_{RP}, V_{OUT} Off	5	25	--	Gauss
	B_{RPN}	N pole to branded side, B < B_{RP}, V_{OUT} Off	--	-25	-5	Gauss
Hysteresis	B_{HYS}	|BOPx - BRPx|	--	5	--	Gauss

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

MAGNETIC SPECIFICATIONS (DC Operating Parameters：T_A=25°C, V_{CC}=5V)						
PARAMETER	**SYMBOL**	**CONDITIONS**	**MIN**	**TYP**	**MAX**	**UNIT**
TSH253CX SOT-23						
Operating Point	B_{OPS}	N pole to branded side, B > B_{OP}, V_{OUT} On	--	30	60	Gauss
	B_{OPN}	S pole to branded side, B > B_{OP}, V_{OUT} On	-60	-30	--	Gauss
Release Point	B_{RPS}	N pole to branded side, B < B_{RP}, V_{OUT} Off	5	25	--	Gauss
	B_{RPN}	S pole to branded side, B < B_{RP}, V_{OUT} Off	--	-25	-5	Gauss
Hysteresis	B_{HYS}	|BOPx - BRPx|	--	5	--	Gauss

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

BLOCK DIAGRAM

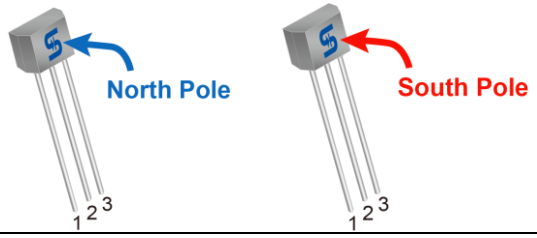
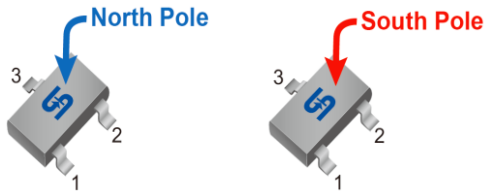


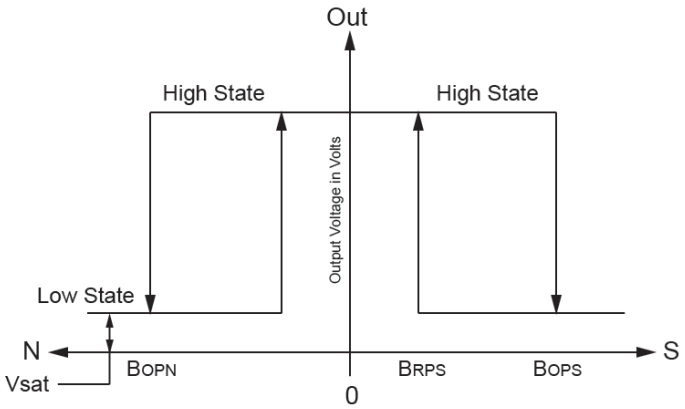
Note: Static sensitive device; please observe ESD precautions. Reverse V_{DD} protection is not included. For reverse voltage protection, a 100Ω resistor in series with V_{DD} is recommended.

OUTPUT BEHAVIOR vs. MAGNETIC POLE

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

PARAMETER	TEST CONDITION	OUT
South pole	B < Bop [(-60)~(-5)]	Low
Null or weak magnetic field	B = 0 or B < BRP	Open (Pull-up Voltage)
North pole	B > Bop (60~5)	Low

TO-92S	SOT-23
	



ORDERING INFORMATION

ORDERING CODE	PACKAGE	PACKING
TSH253CT B0G	TO-92S	1Kpcs / Bulk Bag
TSH253CX RFG	SOT-23	3kpcs / 7” Reel

CHARACTERISTIC PERFORMANCE

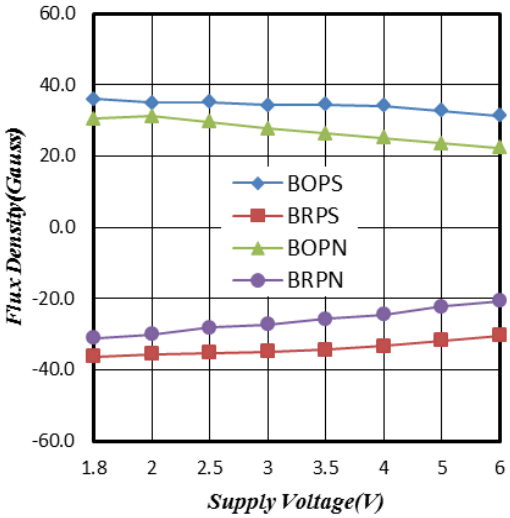


Figure 1. Supply Voltage vs. Flux Density

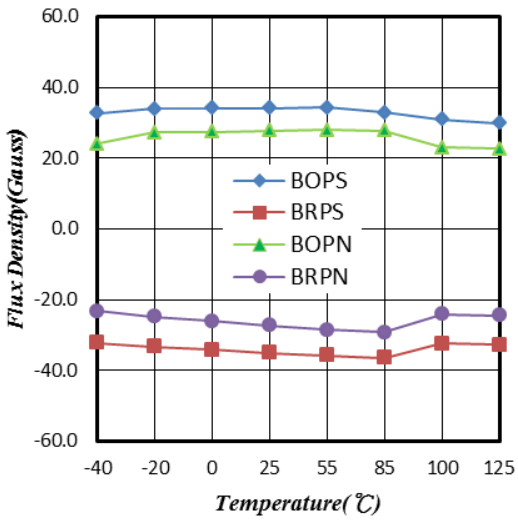


Figure 2. Temperature vs. Flux Density

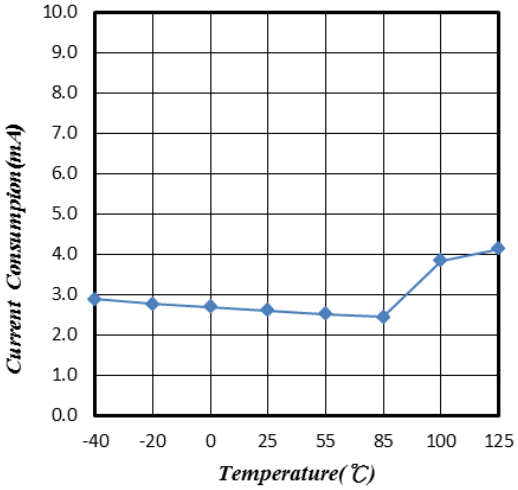


Figure 3. Supply Current vs. Temperature

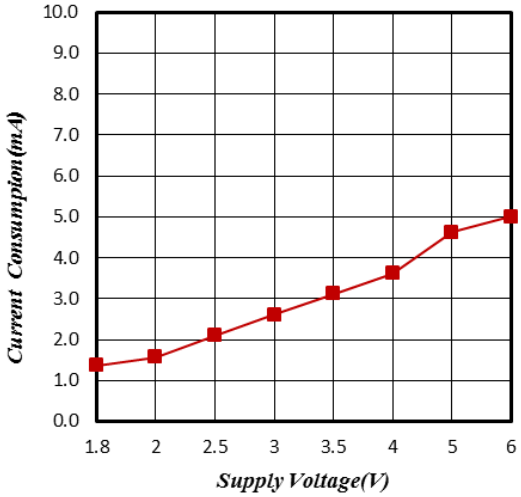


Figure 4. Supply Current vs. Supply Voltage

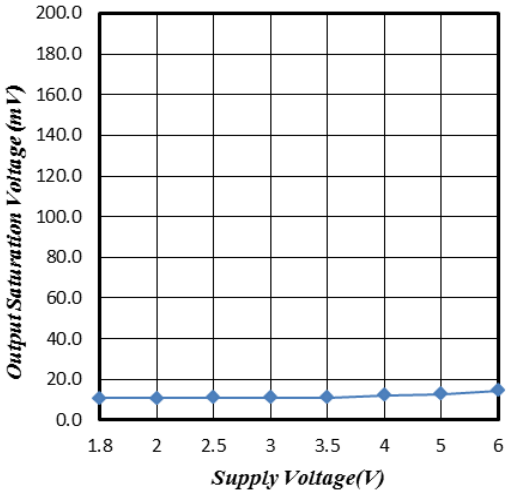


Figure 5. Output Saturation Voltage vs. Supply Voltage

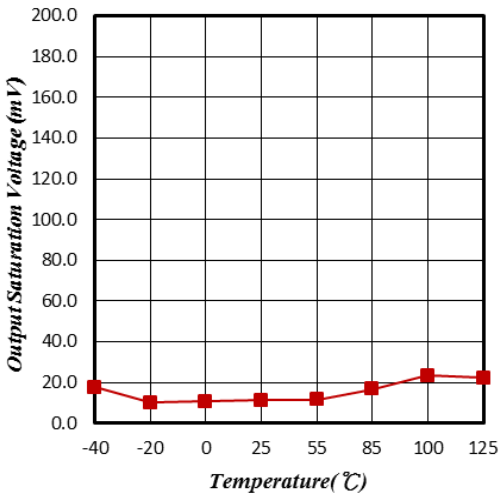


Figure 6. Output Saturation Voltage vs. Temperature

CHARACTERISTIC PERFORMANCE (CONTINUE)

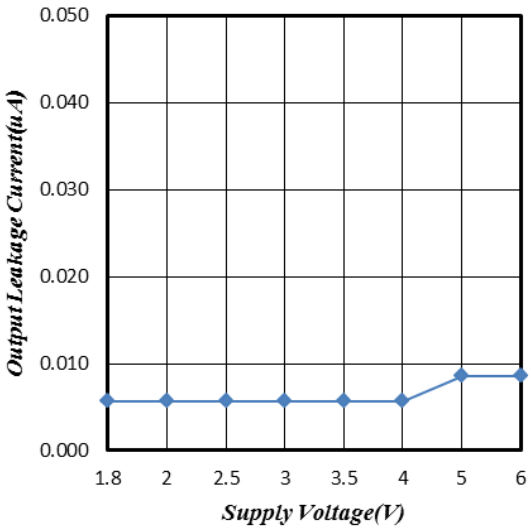


Figure 7. Output Leakage Current vs. Supply Voltage

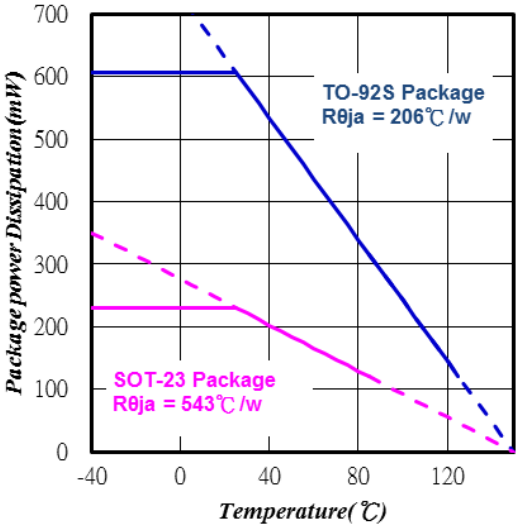
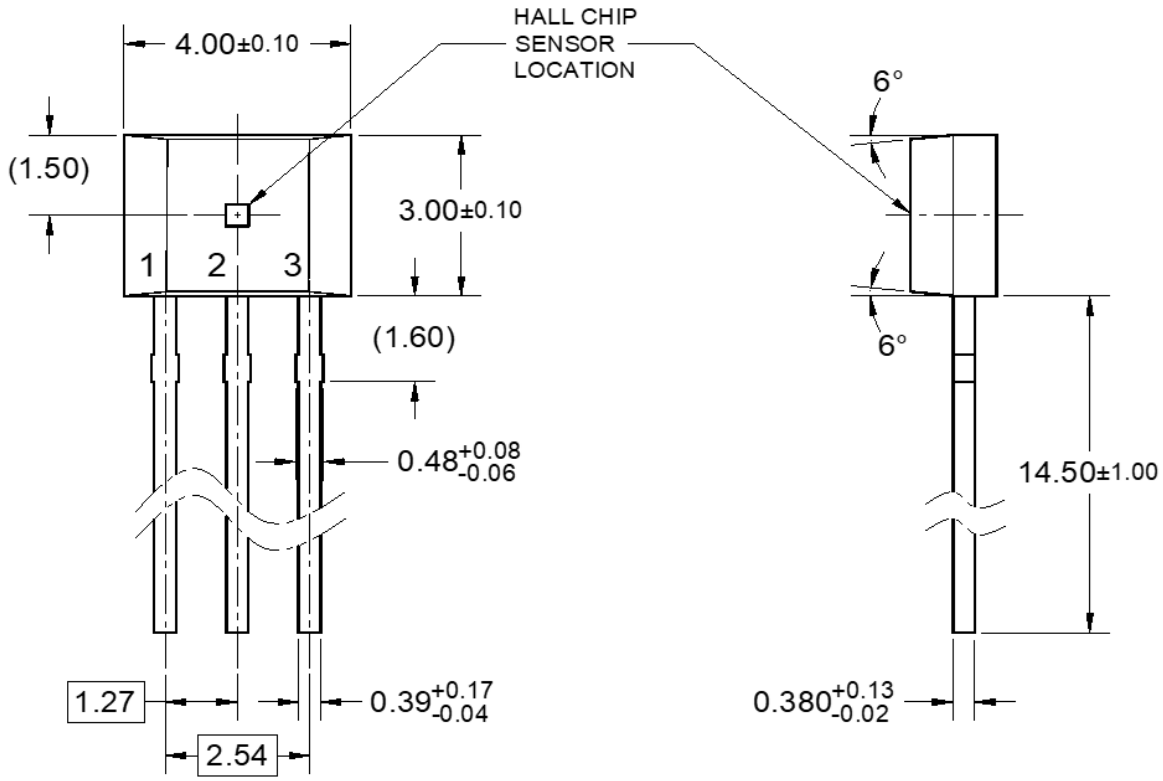
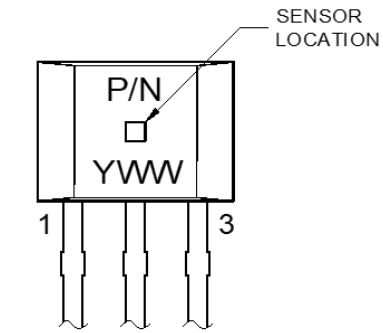


Figure 8. Power Dissipation vs. Temperature

PACKAGE OUTLINE DIMENSIONS (Unit: Millimeters)

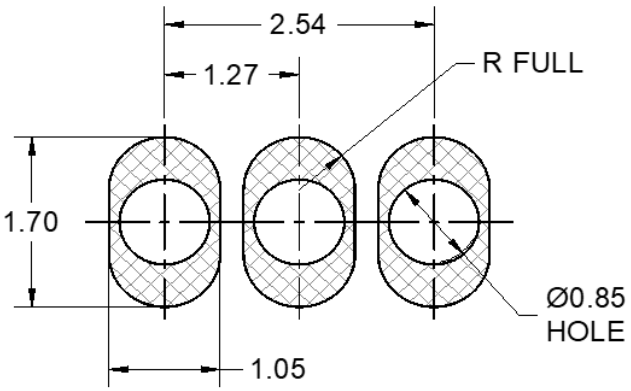
TO-92S





MARKING DIAGRAM

P/N = 253
Y = Year Code
WW = Week Code (01~52)



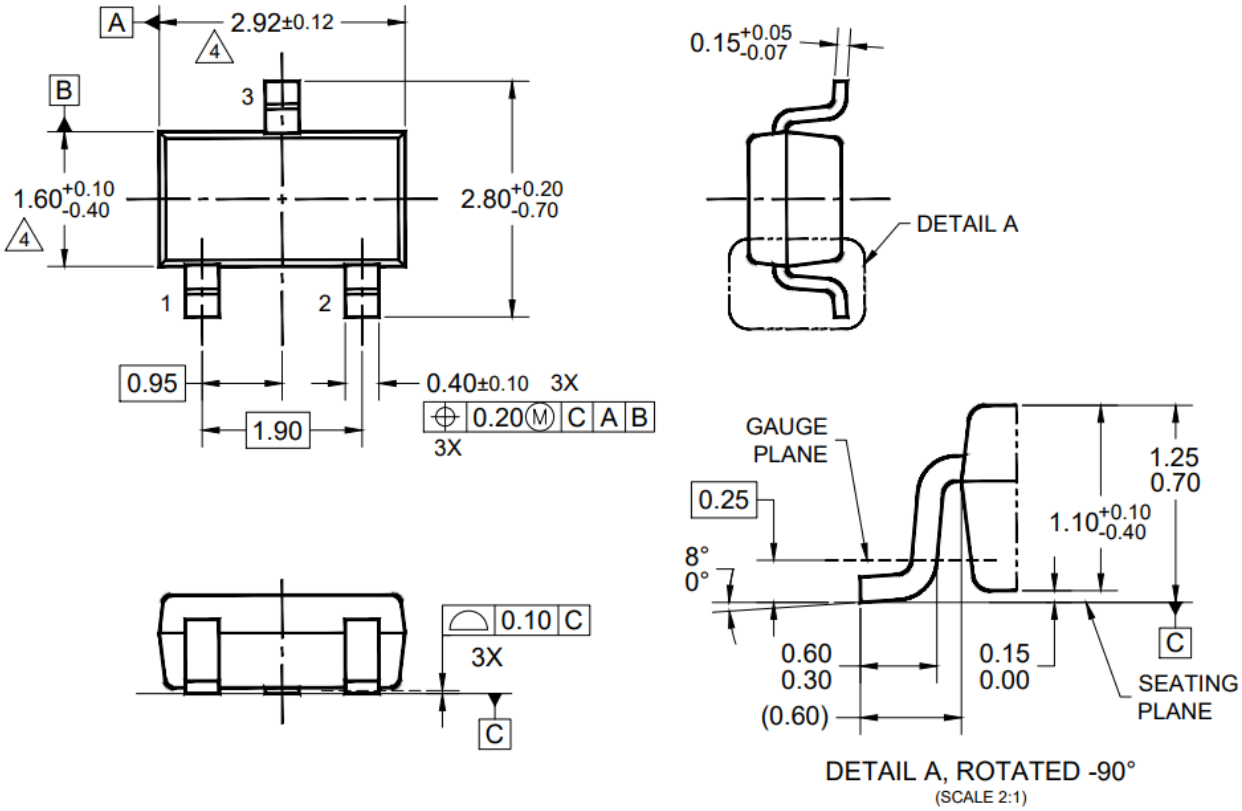
SUGGESTED PAD LAYOUT
(SCALE: 2X)

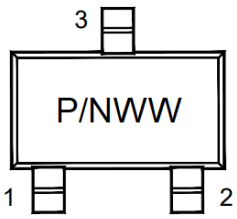
NOTES: UNLESS OTHERWISE SPECIFIED

1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994.
3. DWG NO REF: HQ2SD07-TO92S-010 REV A.

PACKAGE OUTLINE DIMENSIONS (Unit: Millimeters)

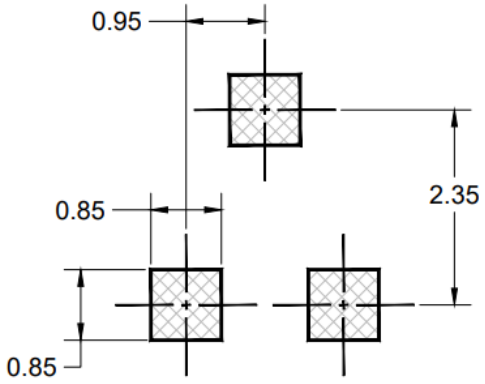
SOT-23





MARKING DIAGRAM

P/N = 253
WW = Weekly Code



SUGGESTED PAD LAYOUT

NOTES: UNLESS OTHERWISE SPECIFIED

1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994.
3. PACKAGE OUTLINE REFERENCE: JEDEC TO-236, ISSUE H, VARIATION AA.
4. MOLDED PLASTIC BODY DIMENSIONS DO NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.
5. DWG NO REF: HQ2SD07-SOT23-025 REV A.

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