Integrated AMR for Cylinder Position Detection

DESCRIPTION

The TSHA2101 is produced with SIP (System in Package) technology，which builds AMR sensor & ASIC in one IC. It supports both 2-wire & 3-wire applications for cylinder position detection.

The TSHA2101 is an AMR (Anisotropic Magneto Resistance) based magnetic sensor, when combined with a magnet, it becomes a non-contact switch with low power consumption, high sensitivity and high reliability device. A horizontal magnetic field parallel to the electrode of the package can be detected by an arbitrary polarity.

TSHA2101 can be used in both pull-up load and pull-down load applications.

FEATURES

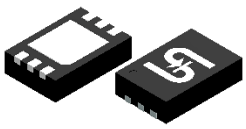
- Omni-polar
- Supply voltage range 3.3V to 30V
- Operating frequency ≥4kHz
- -30V Reversed power supply protection
- Output over-current protection
- -40°C~105°C operating temperature
- Open-drain output with self-adaptation of Pull-up or Pull-down load (Equivalent loading ≤50kΩ @ 3-Wire)
- RoHS compliant
- Halogen-Free

APPLICATION

- 2-wire & 3-wire Cylinder position detection
- Pull-up & Pull-down load applications

Pb-Free RoHS COMPLIANT HALOGEN FREE

TDFN2x3-6L



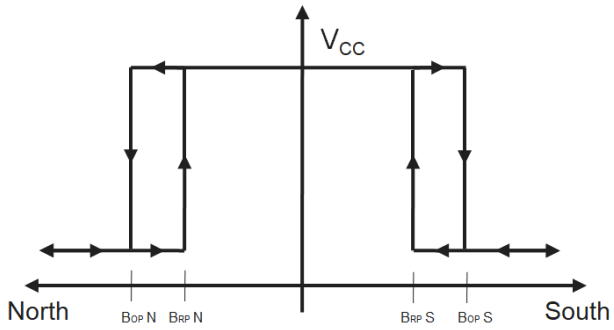
Pin Definition:

1. LED	6. OUT
2. LED	5. OUT
3. SEL	4. V_{CC}

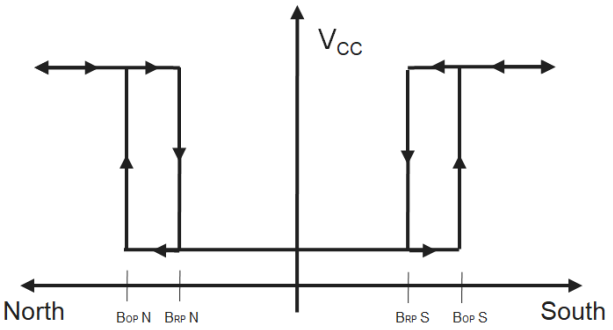
Exposed pad connected to ground

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

DEFINITION OF SWITCHING FUNCTION



Pull-up load



Pull-down load

ABSOLUTE MAXIMUM RATINGS (T_A = 25°C unless otherwise specified) (Note)			
PARAMETER	**SYMBOL**	**LIMIT**	**UNIT**
Supply voltage	V_{CC}	-30 ~ 36	V
Output current	I_{OUT}	-500 ~ 500	mA
Output voltage	V_{OUT}	-30 ~ 36	V
LED output voltage	V_{LED}	-0.7 ~ 6	V
SEL output voltage	V_{SEL}	-0.7 ~ 6	V
Magnetic flux	B	3000	G_S
Operating ambient temperature	T_A	-40 to +105	°C
Storage temperature range	T_{STG}	-50 to +150	°C
ESD rating (Human Body Mode)	HBM	±4.5	kV
ESD rating (Charged Device Model)	CDM	±1	kV

Note: Absolute maximum ratings are limited values to be applied individually, and beyond which the serviceability of the circuit may be impaired. Functional operability is not necessarily implied. Exposure to absolute maximum rating conditions for an extended period of time may affect device reliability. All voltages listed are referenced to GND.

ELECTRICAL SPECIFICATIONS (T_A= -40~105°C, V_{CC}= 3.3V~30V unless otherwise noted)						
PARAMETER	**CONDITIONS**	**SYMBOL**	**MIN**	**TYP**	**MAX**	**UNIT**
Supply voltage		V_{CC}	3.3	--	30	V
Supply current	V_{CC}=24V; |B|<|B_{OP}|	I_{CC}	--	60	100	µA
Output saturation voltage (3-wire)	V_{CC}=24V; I_{OUT}=100mA; |B|>|B_{OP}|; Pull-up load	V_{SAT}	--	--	0.5	V
	V_{CC}=24V; I_{OUT}=-100mA; |B|>|B_{OP}|; Pull-down load		V_{CC}-0.5V;	--	--	
Output over-current protection limit	|B|>|B_{OP}|; Pull-up load	I_{OCP}	--	200	--	mA
	|B|>|B_{OP}|; Pull-down load		--	-200	--	
Output leakage current (2-wire or 3-wire)	|B|<|B_{RP}|; V_{OUT}=24V; Pull-up load	I_{OUT}	--	--	10	µA
	|B|<|B_{RP}|; V_{CC}=24V; V_{OUT}=0V;Pull-down load		-10	--	--	
LED/SEL pin output current	|B|>|B_{OP}|	I_{LED}	-0.8	-0.6	-0.4	mA
Switching frequency		F_{SW}	--	4	--	kHz
Output rise time	V_{CC}=24V; C_L=100nf; Pull-down load, 2-wire	T_R	--	--	20	µs
	V_{CC}=24V; C_L=1nf; Pull-up load, 3-wire		--	--	10	
Output fall time	V_{CC}=24V; C_L=100nf; Pull-up load, 2-wire	T_F	--	--	20	µs
	V_{CC}=24V; C_L=1nf; Pull-up load, 3-wire		--	--	10	
Power on time Refer to figure.17	Including Pull-up/Pull-down load detection time dV_{CC}/dt>5V/µs	T_{PO}	--	--	1	ms
Output over-current protection delay time		T_{OCPD}	--	--	0.2	ms
Output over-current protection recovery time		T_{OCPR}	--	--	200	ms

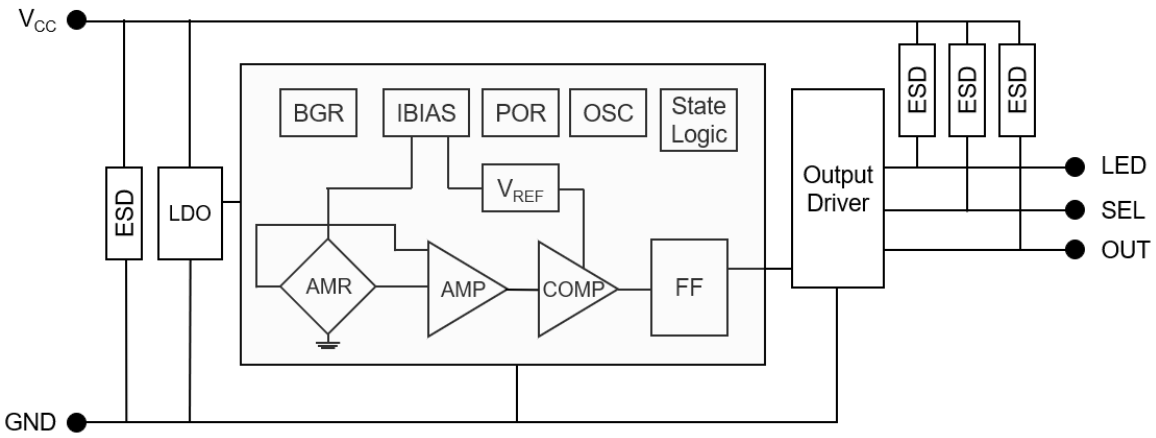
ELECTRICAL SPECIFICATIONS (T_A= -40~105°C, V_{CC}= 3.3V~30V unless otherwise noted)						
PARAMETER	**CONDITIONS**	**SYMBOL**	**MIN**	**TYP**	**MAX**	**UNIT**
Over temperature protection point	Junction temperature	T_{OTPR}	--	140	--	°C
Over temperature recovery point	Junction temperature	T_{OTRC}	--	130	--	°C
Sensitivity L3	B_{OP}, T_A =25°C	G_S	±23	±31	±40	G_S
	B_{RP}, T_A =25°C		±19	±26	±36	
	B_{HYST}, T_A =25°C		--	4	--	

Note:
Magnetic operating/releasing point (B_{OP}& B_{RP}) is configurable in applications (refer to Typical Application Circuit). We provide two options of B_{OP}& B_{RP} with different application circuit.

ORDERING INFORMATION

ORDERING CODE	PACKAGE	PACKING
TSHA2101CQ-L3 M3G	TDFN2x3-6L	3,000pcs / 7” Reel

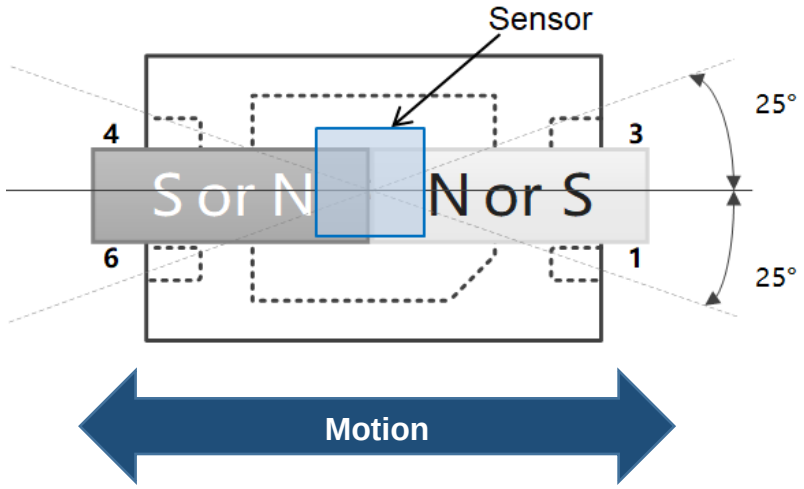
FUNCTION BLOCK



PIN DESCRIPTION

PIN NO.	NAME	FUNCTION
1	LED	LED driver output
2	LED	LED driver output
3	SEL	Magnetic Sensitivity Selection
4	V_{CC}	Supply voltage
5	OUT	Output
6	OUT	Output
Exposed Pad		Ground

DETECTION OF MAGNETIC FIELD



The device is sensitive to the magnetic field that is parallel to the package.

FUNCTION DESCRIPTION

- B_{OP}: Operating Point, Magnetic flux density applied on the branded side of the package which turns the output driver ON (V_{OUT}=Low, pull-up load; V_{OUT}=High, pull-down load)
- B_{RP}: Releasing Point, Magnetic flux density applied on the branded side of the package which turns the output driver OFF (V_{OUT}=High, pull-up load; V_{OUT}=Low, pull-down load)
- B_{HYST}: Hysteresis Window, $|B_{OP} - B_{RP}|$

CHARACTERISTICS CURVES

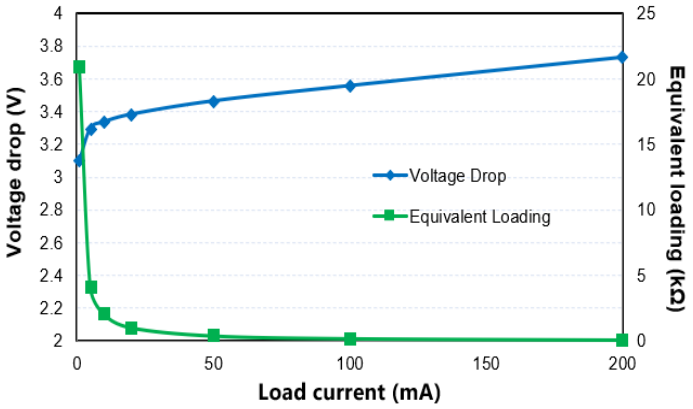


Figure 1. Voltage Drop vs. Loading Current (2-wire application)

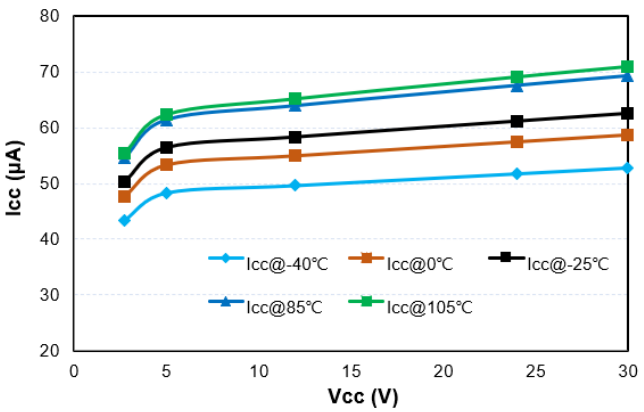


Figure 2. Supply Current vs. Temperature & V_{CC}

CHARACTERISTICS CURVES

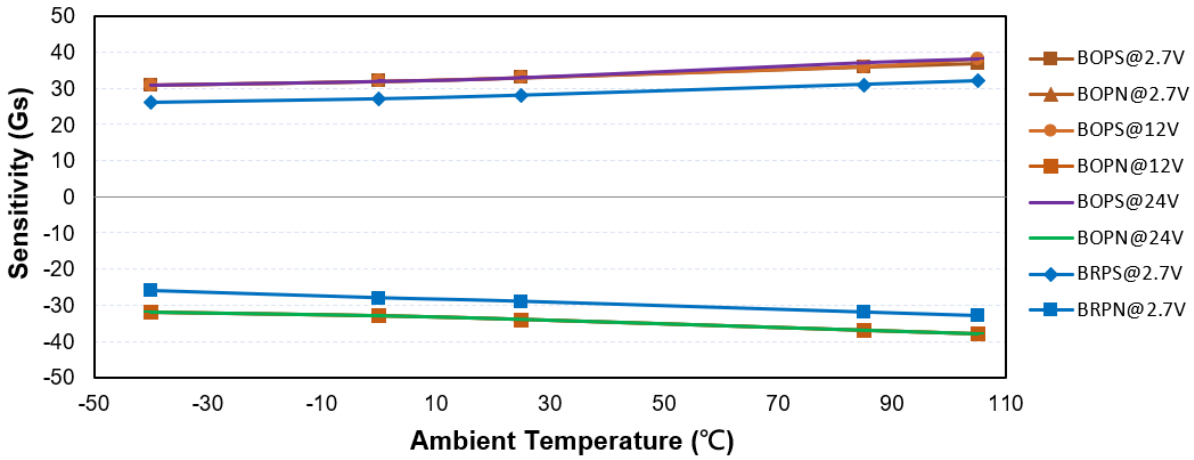
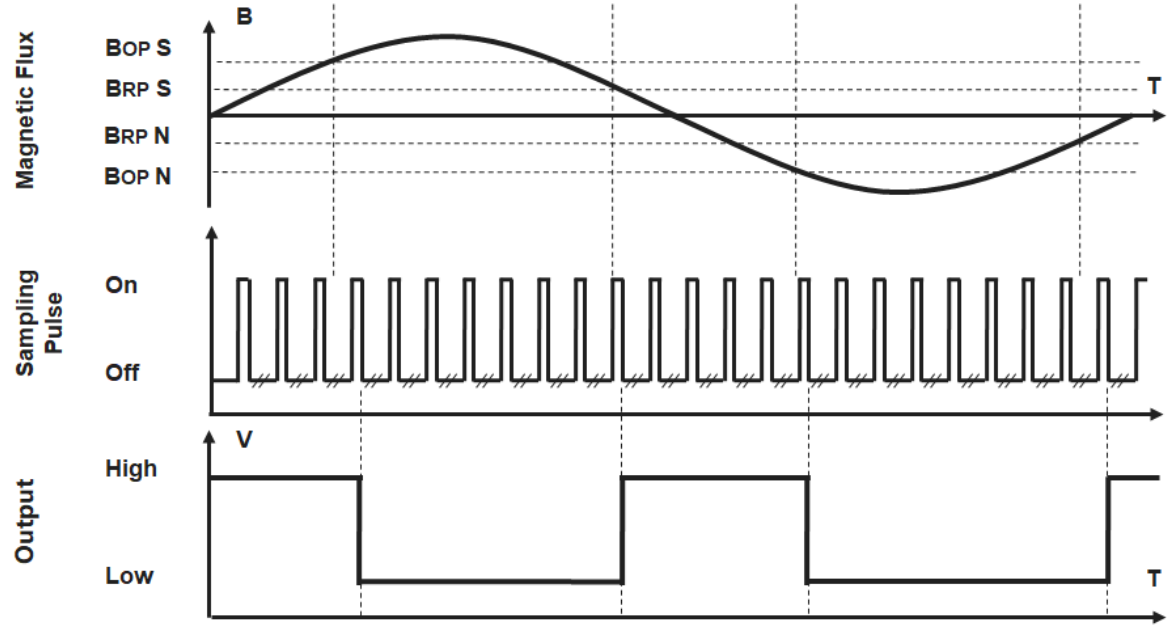


Figure 3. Magnetic Characteristics vs. Ambient Temperature & V_{CC} (B_{OP}& B_{RP})

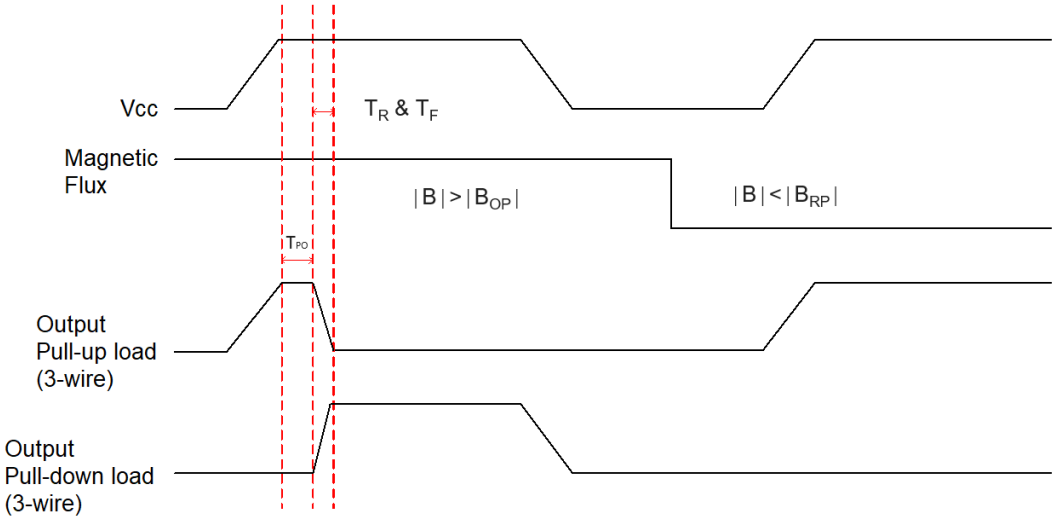
TYPICAL OUTPUT WAVEFORM



Digital Output vs. Magnetic Flux Density & Sampling Pulse (Pull-up load with 3-wire)

POWER ON OUTPUT WAVEFORM

T_{PO} is the time from the stable point of V_{CC} to the valid point of output

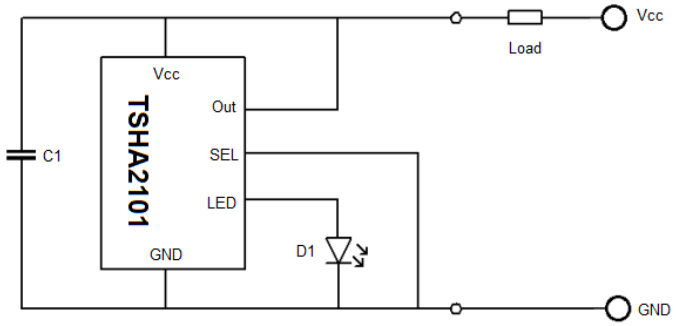


Power-On Output Waveform

TYPICAL APPLICATION CIRCUIT

SYMBOL	RECOMMEND
C1	0.1μF

2-Wire Applications



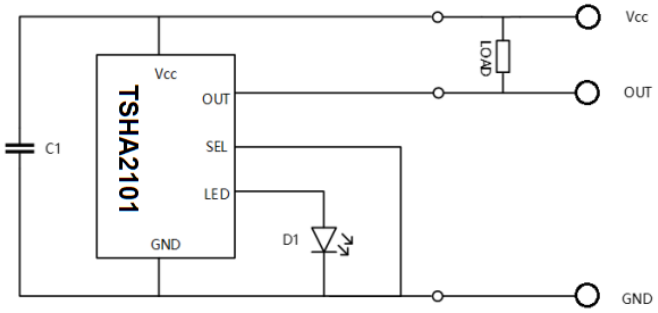
2-wire application circuit with Pull-up load

TYPICAL APPLICATION CIRCUIT

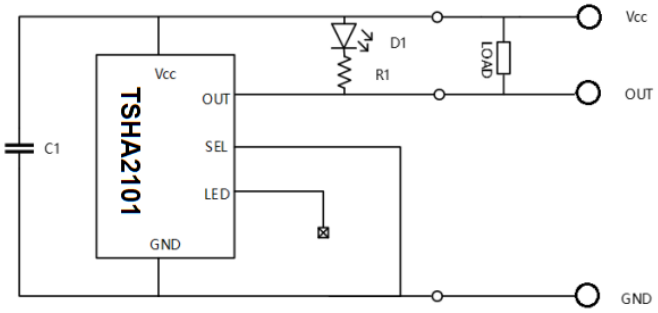
3-Wire Applications

For both pull-up and pull-down load in 3-wire applications, we recommend two kinds of connections, i.e. Type-I and Type-II

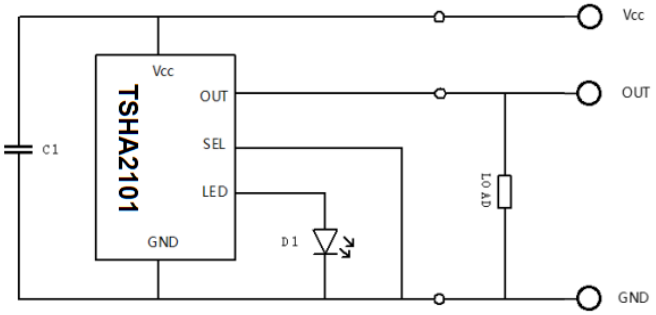
In Type-I connection, a constant current will be provided to D1.
In Type-II connection, user are allowed to tune the current of D1 by changing the value of R1



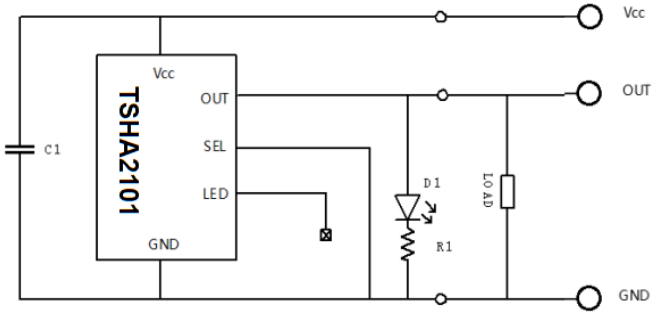
3-wire with pull-up load, Type I



3-wire with pull-up load, Type II



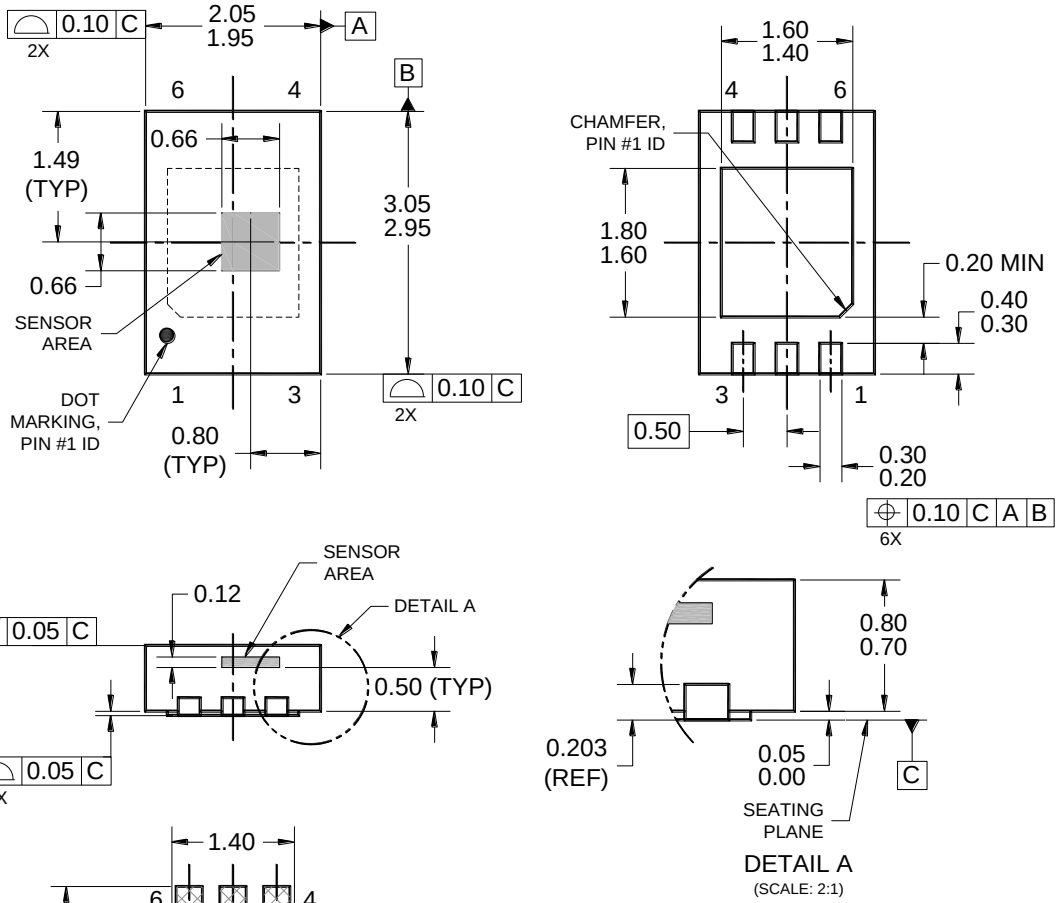
3-wire with pull-down load, Type I



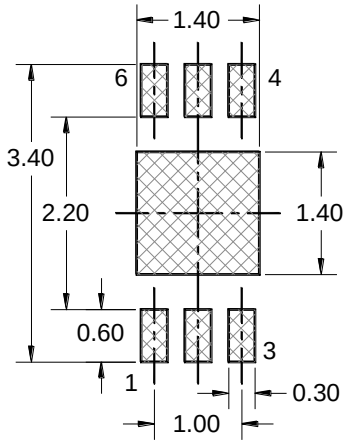
3-wire with pull-down load, Type II

PACKAGE OUTLINE DIMENSIONS (Unit: Millimeters)

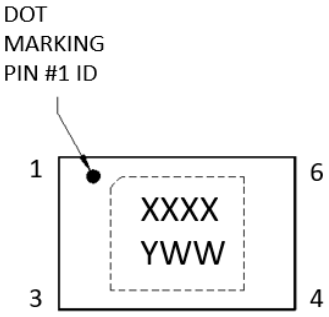
TDFN2x3-6L



DETAIL A
(SCALE: 2:1)



SUGGESTED PAD LAYOUT



MARKING DIAGRAM
(TOP VIEW)

NOTES: UNLESS OTHERWISE SPECIFIED

1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994.
3. SEATING PLANE IS DEFINED BY TERMINAL BOTTOM SURFACE ONLY.
4. SUGGESTED PAD LAYOUT IS FOR REFERENCE PURPOSE ONLY.
5. DWG NO. REF: HQ2SD07-TDFN2X3_6L-081 REV A

2101	= DEVICE CODE
Y	= YEAR CODE
WW	= WEEK CODE

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