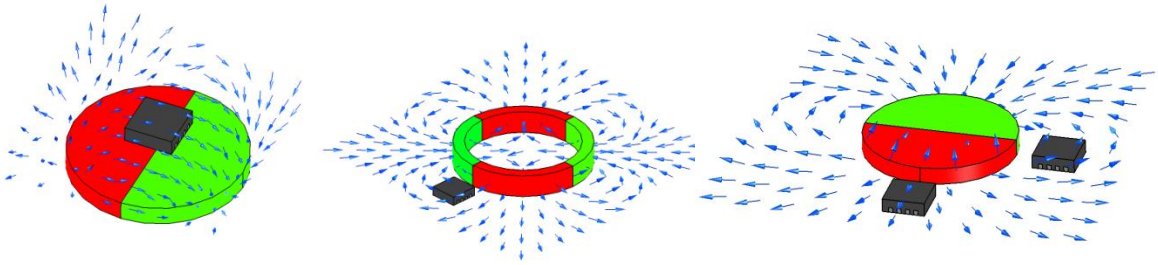
KMT32B Magnetic Angle Sensor

TDFN SO8 SM8

- **AMR Sensor with 180° period**
- **for the use at moderate field strengths**
- **high accuracy**
- **tiny TDFN package**
- **various packages available**

DESCRIPTION

The KMT32B is a magnetic field sensor based on the anisotropic magneto resistance effect, i.e. it is sensing the **magnetic field direction** independently on the magnetic field strength for applied field strengths H>25 kA/m. The sensor contains two parallel supplied Wheatstone bridges, which enclose a sensitive angle of 45 degrees.



A rotating magnetic field in the surface parallel to the chip (x-y plane) will deliver two independent sinusoidal output signals, one following a cos(2α) and the second following a sin(2α) function, α being the angle between sensor and field direction (see Figure 2).

FEATURES

- Contactless angular position
- Design optimized linearity
- High accuracy
- Low cost, low power
- Self diagnosis feature
- User has complete control over signal evaluation
- Attractive SMD packages
- High rotational speed up to 30,000 rpm
- Extended operating temperature range (-40 °C to +150 °C, +160°C on request)
- Ideal for harsh environments due to magnetic sensing principle
- RoHS compliant (lead free)

APPLICATIONS

- Absolute and incremental angle measurement
- Motor motion control
- Robotics
- Camera positioning
- Potentiometer replacement
- Position measurement in medical applications
- Automotive (steering angle, torque)

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CHARACTERISTIC VALUES

Parameter	Symbol	Condition	Min	Typ	Max	Unit
A. Operating Limits						
Max. supply voltage	$Vcc_{,max}$				**10**	V
Max. current (single bridge)	$Icc_{,max}$				**4**	mA
Operating temperature	T_{op}		**-40**		**+150**	°C
Storage temperature	T_{st}		**-40**		**+150**	°C
B. Sensor Specifications (T=25 °C)						
Supply voltage	Vcc			**5**		V
Resistance (single bridge)	R_b		**2400**	**3000**	**3600**	Ω
Output signal range	$\Delta V_n/Vcc$	Condition A, B	**16**	**20**		mV/V
Offset voltage	Voff/Vcc	Condition A, B	**-1**	**0**	**+1**	mV/V
Angular inaccuracy	$\Delta\alpha$	Condition A, B		**0.05**	**0.2**	deg
Angular hysteresis	$\Delta\alpha H$	Condition A, B			**0.1**	deg
C. Sensor Specifications						
TC of amplitude	TCSV	Condition A, C	**-0.36**	**-0.32**	**-0.28**	%/K
TC of resistance	TCBR	Condition A, C	**+0.27**	**+0.32**	**+0.37**	%/K
TC of offset	TCVoff	Condition A, C	**-4**	**0**	**+4**	µV/V/K

Stress above one or more of the limiting values may cause permanent damage to the device. Exposure to limiting values for extended periods may affect device reliability.

MEASUREMENT CONDITIONS

Parameter	Symbol	Unit	Condition
Condition A: Set Up Conditions			
Ambient temperature	T	°C	T = 23±5 °C (unless otherwise noted)
Supply voltage	*Vcc*	V	Vcc = 5 V
Applied magnetic field	H	kA/m	H = 25 kA/m
Condition B: Sensor Specifications (T=25 °C, 360° turn , H=25 kA/m , Vo_{max}>0, Vo_{min}<0)			
Output signal range	$\Delta V_n/Vcc$	mV/V	$\Delta V_n/Vcc = (Vo_{max} - Vo_{min})/Vcc$
Offset voltage	Voff/Vcc	mV/V	$Voff = (Vo_{max} + Vo_{min})/Vcc$
Angular inaccuracy	$\Delta\alpha$	deg	$\Delta\alpha = MAX\lvert\alpha_0-\alpha\rvert$ max. angular difference between actual value α_0 and measured angle; offset voltage error contributions not included
Angular hysteresis	$\Delta\alpha H$	deg	$\Delta\alpha H = MAX\lvert\alpha_{left\ turn} - \alpha_{right\ turn}\rvert$ max. angular difference between left and right turn

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MEASUREMENT CONDITIONS

Parameter	Symbol	Unit	Condition
Condition C: Sensor Specifications (T=-25°C, +125°C)			
Ambient temperatures	T	°C	T_1 = -25 °C, T_0 = +25 °C, T_2 = +125 °C
TC of amplitude	*TCSV*	%/K	$TCV = \frac{1}{(T_2 - T_1)} \cdot \frac{\frac{\Delta Vn}{Vcc}(T_2) - \frac{\Delta Vn}{Vcc}(T_1)}{\frac{\Delta Vn}{Vcc}(T_1)} \cdot 100\%$
TC of resistance	*TCBR*	%/K	$TCR = \frac{1}{(T_2 - T_1)} \cdot \frac{R(T_2) - R(T_1)}{R(T_1)} \cdot 100\%$
TC of offset	*TCVoff*	(µV/V)/ K	$TCVoff = \frac{Voff(T_2) - Voff(T_1)}{(T_2 - T_1)}$

BLOCK DIAGRAM

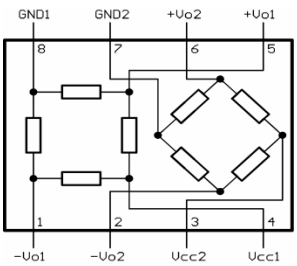
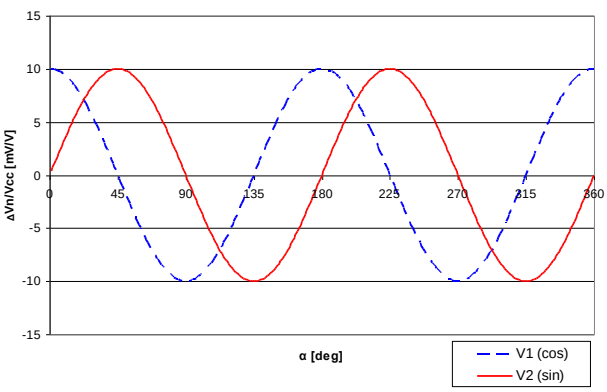


Figure 1: Circuit Diagram

The KMT32B magnetic field sensor is suited for high precision angle measurement applications under low field conditions (regularly H_0 = 25 kA/m, for example generated with reference magnet 67.044 Magnetfabrik Bonn @ 5,2 mm distance. With reduced accuracy the applicable down to H_0 = 8 kA/m; beware of earth's magnetic field!).

TYPICAL PERFORMANCE CURVES



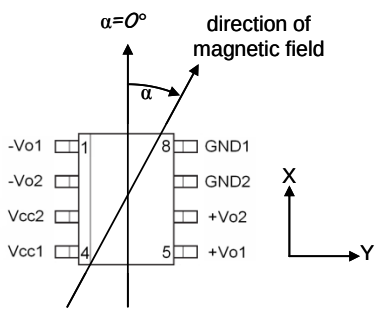


Figure 2: Characteristic curves for KMT32B

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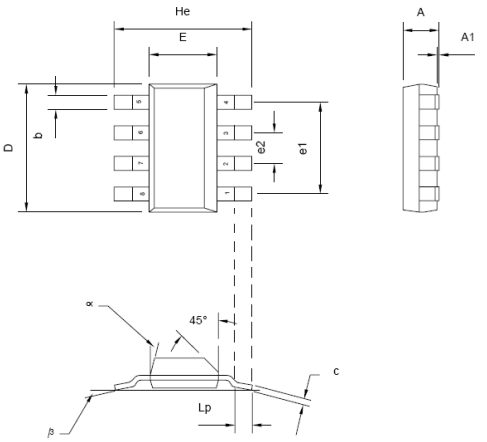
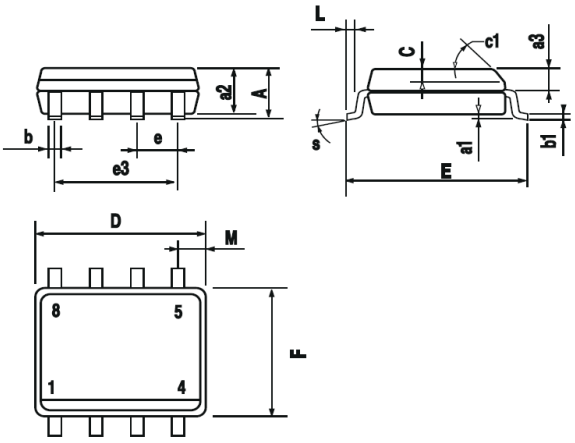
PACKAGES

SM-8



Dim	Millimetres			Inches		
	Min	Typ	Max	Min	Typ	Max
A	–	–	1.7	–	–	0.067
A1	0.02	–	0.1	0.0008	–	0.004
b	–	0.7	–	–	0.028	–
c	0.24	–	0.32	0.009	–	0.013
D	6.3	–	6.7	0.248	–	0.264
E	3.3	–	3.7	0.130	–	0.145
e1	–	4.59	–	–	0.180	–
e2	–	1.53	–	–	0.060	–
He	6.7	–	7.3	0.264	–	0.287
Lp	0.9	–	–	0.035	–	–
α	–	–	15°	–	–	15°
β	–	10°	–	–	10°	–

SO-8



DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			1.75			0.069
a1	0.1		0.25	0.004		0.010
a2			1.65			0.065
a3	0.65		0.85	0.026		0.033
b	0.35		0.48	0.014		0.019
b1	0.19		0.25	0.007		0.010
C	0.25		0.5	0.010		0.020
c1	45° (typ.)					
D (1)	4.8		5.0	0.189		0.197
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		3.81			0.150	
F (1)	3.8		4.0	0.15		0.157
L	0.4		1.27	0.016		0.050
M			0.6			0.024
S	8° (max.)					

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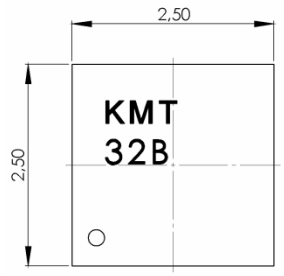
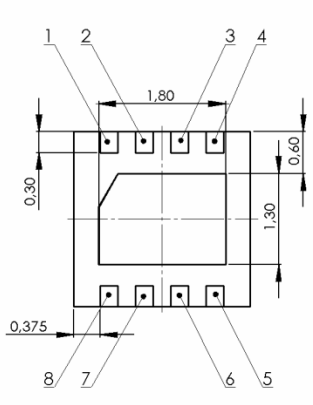
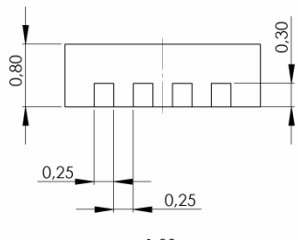
unit: mm

The bottom plate is designated to be a heat sink. It has no electrical connection to any pin.

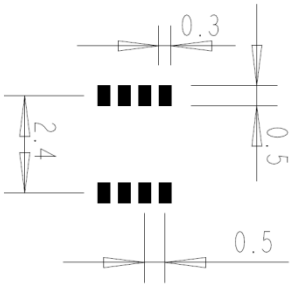
The sensitive area is positioned in the center of the housing.







RECOMMENDED SOLDER PAD LAYOUT FOR TDFN



PIN ASSIGNMENT (DIE, SO8, SM8, TDFN)

Pin	Symbol	Function
1	$-V_{o1}$	negative output bridge 1
2	$-V_{o2}$	negative output bridge 2
3	V_{cc2}	positive supply voltage bridge 2
4	V_{cc1}	positive supply voltage bridge 1
5	$+V_{o1}$	positive output bridge 1
6	$+V_{o2}$	positive output bridge 2
7	GND_2	negative supply voltage bridge 2
8	GND_1	negative supply voltage bridge 1

SOLDER PROFILE

Recommended solder reflow process according to IPC/JEDEC J-STD-020D (Pb-Free Process)

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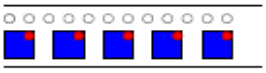
TAPE AND REEL PACKAGING INFORMATION

Description	Reel size	Units/reel	Pin 1 orientation	Note
KMT32B/TD	7”	3,000	Top-right of sprocket hole side	
KMT32B/SO	13”	2,500	Top-left of sprocket hole side	
KMT 32B/SM	7”	1,000	Top-right of sprocket hole side	

ORDERING CODE

Device	Package	MOQ	Part Number
KMT 32B	die	1 wafer	*on request*
KMT 32B/SM	SM-8	1 reel	*on request*
KMT 32B/SO	SO-8	1 reel	**G-MRCO-015**
KMT 32B/TD	TDFN 2.5 x 2.5	1 reel	**G-MRCO-016**

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