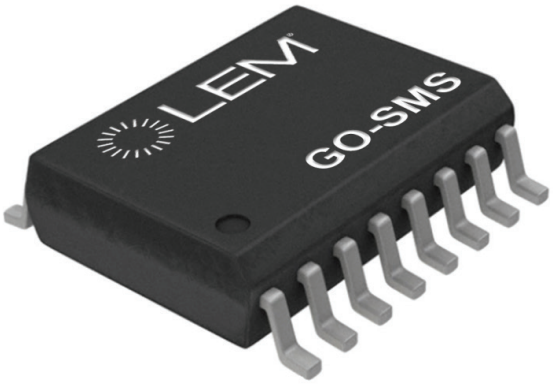
Current Transducer GO-SMS series

I_{PN} = 10 ... 30 A

Ref: GO 10-SMS, GO 20-SMS, GO 30-SMS

For the electronic measurement of current: DC, AC, pulsed..., with galvanic separation between the primary and the secondary circuit.



Features

- Hall effect measuring principle
- Galvanic separation between primary and secondary circuit
- Insulated test voltage 3000 V RMS
- Low power consumption
- Extremely low profile
- Single power supply +5 V
- Double overcurrent detection
- Fixed offset & sensitivity
- Delay time 2 µs.

Advantages

- Small size and space saving
- High immunity to external interference
- High insulation capability
- Low electrical resistance (0.75 mΩ)
- No magnetic hysteresis
- Robust against external fields.

Applications

- Small drives
- HVAC
- Appliances
- E-Bikes
- Solar.

Standards

- IEC 61800-5-1: 2007
- IEC 62109-1: 2010
- IEC 60950-1: 2005
- UL 1577: 2014.

Application Domain

- Industrial.

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Absolute maximum ratings

Parameter	Symbol	Unit	Min	Typ	Max	Conditions
Maximum supply voltage (not destructive)	$U_{C\ max}$	V			8	
Maximum supply voltage (not entering non-standard modes)					6.5	
Primary withstand peak current (maximum)	$\hat{I}_{P\ max}$	A			±200	T_A = 25 °C, 1 ms pulse
Maximum electrostatic discharge voltage (HMB-Human Body Model)	$U_{ESD\ HBM}$	V			2000	AEC-Q100-002 REV D
Maximum electrostatic discharge voltage (CDM-Charged Device Model)	$U_{ESD\ CDM}$	V			500	AEC-Q100-011 REV B
Maximum output current source	$I_{out\ max}$	mA			25	
Maximum output current sink		mA			50	
Maximum junction temperature	$T_{J\ max}$	°C			150	

Insulation coordination

Parameter	Symbol	Unit	Value	Comment
RMS voltage for AC insulation test, 50 Hz, 1 min	U_d	V	3000	According to IEC 60664-1
RMS voltage for AC insulation test, 60 Hz, 1 min	U_d	V	2500	According to IEC 60950-1
RMS voltage for AC insulation test, 50 Hz, 1 min	U_d	V	2500	According to IEC 60950-1
Impulse withstand voltage 1.2/50 µs	U_{Ni}	V	4000	According to IEC 61800-5-1 , IEC 62109-1, IEC 60950-1
Partial discharge RMS test voltage (q_m < 5 pC)	U_t	V	900	According to IEC 61800-5-1, IEC 62109-1
Clearance (pri. - sec.)	d_{Cl}	mm	7.5	Shortest distance through air
Creepage distance (pri. - sec.)	d_{Cp}			Shortest path along body
Comparative tracking index	CTI		600	
Application example		V RMS	300	Basic insulation according to IEC 61800-5-1, IEC 62109-1, IEC 60950-1, CAT III, PD2
Application example		V RMS	515, 728 peak-to peak	Basic insulation according to IEC 61800-5-1 IEC 62109-1, IEC 60950-1, CAT II, PD2

UL 1577 Non Optical isolating devices - Component

File # E486776, Vol 1
Single protection, non-optical isolators, 2500 vac insulation.

Standards

- UL 1577, Optical Isolators;
- CSA Component Acceptance Service Notice N°. 5 A, Component Acceptance Service for Optocouplers and Related Devices.

Marking

Only those products bearing the UL or UR Mark should be considered to be Listed or Recognized and covered under UL's Follow-Up Service. Always look for the Mark on the product.

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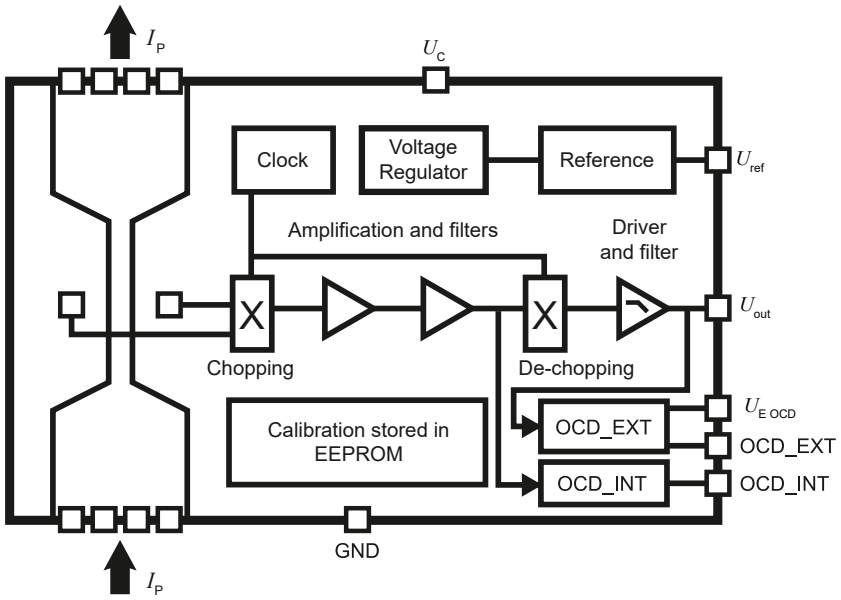
Environmental and mechanical characteristics

Parameter	Symbol	Unit	Min	Typ	Max	Conditions
Ambient operating temperature	T_A	°C	−40		125	
Ambient storage temperature	$T_{A\,st}$	°C	−55		165	
Resistance of the primary @ T_A = 25 °C	R_P	mΩ		0.75		
Thermal resistance junction to board [1)]	$R_{th\,JB}$	K/W		9		
Time constant	t	s		1		To reach steady state

Note: [1)] Done on LEM evaluation board PCB2325.

Block diagram



Connection diagram

Pin#	Name	Function
From 1 to 4	I_{P+}	Input of the primary current
From 5 to 8	I_{P-}	Output of the primary current
9	GND	Ground
10	U_{ref}	Reference voltage (output)
11	NC	No connected pin, leave floating
12	U_{out}	Output voltage
13	OCD_EXT	Output of the external over current detection
14	U_C	Supply voltage
15	$U_{E\,OCD}$	Setting of the external over current detection
16	OCD_INT	Output of the internal over current detection, factory setting

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Electrical data GO 10-SMS

At T_A = −40 °C … 125 °C, U_C = +5 V, R_L = 10 kΩ unless otherwise noted (see Definition of typical, minimum and maximum values paragraph in page 7).

Parameter	Symbol	Unit	Min	Typ	Max	Conditions
Primary nominal RMS current	I_{PN}	A		10		
Primary current, measuring range	I_{PM}	A	−25		25	
Supply voltage	U_C	V	4.5	5	5.5	
Current consumption	I_C	mA		20	26	
Reference voltage (output)	U_{ref}	V		2.5		@ 25 °C, internal ref.
Reference voltage (input)	U_{ref}	V	0.5		2.6	External ref.
Output voltage range @ I_{PM}	$U_{out} - U_{ref}$	V	−2		2	
Output internal resistance	R_{out}	Ω			5	Up to 10 kHz
Internal series resistance of reference voltage source	R_{ref}	Ω	120	200	333	
Load capacitance	C_L	nF	0		6	
Nominal sensitivity	S_N	mV/A		80		
Electrical offset voltage @ I_{PN} = 0	U_{OE}	mV	−5		5	T_A = 25 °C, $U_{out} - U_{ref}$ @ U_{ref} = 2.5 V
Electrical offset current referred to I_{PN}	I_{OE}	mA	−62.5		62.5	T_A = 25 °C
Temperature coefficient of U_{ref}	TCU_{ref}	ppm/K	−170		170	U_{ref} = 2.5 V
Temperature coefficient of U_{OE}	TCU_{OE}	mV/K	−0.075		0.075	
Temperature coefficient of I_{OE}	TCI_{OE}	mA/K	−0.94		0.94	
Temperature coefficient of S	TCS	ppm/K	−150		150	
Delay time to 90 % of the final output value for I_{PN} step	$t_{D\,90}$	µs			2	
Delay time to 10 % of the final output value for I_{PN} step	$t_{D\,10}$	µs			1.5	
Frequency bandwidth −3 dB, T_A = 25 °C	BW	KHz		300		
Noise voltage spectral density	u_{no}	µV/Hz$^{1/2}$		14.5		NBW = 1 kHz … 100 kHz
Internal OCD detection threshold	$I_{I\,OCD\,Th}$	A		2.93 × I_{PN}		Factory setting EEPROM
Internal OCD threshold error	$\varepsilon_{I\,OCD\,Th}$	%	−8		8	of peak value
Internal OCD output on resistance	$R_{on\,I\,OCD}$	Ω	70	95	100	open drain output, active low
Internal OCD output current sink	$I_{I\,OCD\,sink}$	mA	10			For 2.5 V on pin
Internal OCD output hold time	$t_{hold\,I\,OCD}$	µs	7	10	14	
Internal OCD delay time	$t_{D\,I\,OCD}$	µs	1.4		2.1	
Sensitivity error	ε_S	%	−1		1	Factory adjustment
Long-term sensitivity drift	ε_{St}	%	−0.5		0.5	
Linearity error 0 … I_{PN}	ε_L	% of I_{PN}	−0.3		0.3	
Linearity error 0 … I_{PM}	ε_L	% of I_{PM}	−0.6		0.6	
Sum of sensitivity and linearity error @ I_{PN} @ T_A = 25 °C	$\varepsilon_{S\,L\,25}$	% of I_{PN}	−1.3		1.3	
Sum of sensitivity and linearity error @ I_{PN} @ T_A = 85 °C [1)]	$\varepsilon_{S\,L\,85}$	% of I_{PN}	−2.76		2.76	
Sum of sensitivity and linearity error @ I_{PN} @ T_A = 105 °C [1)]	$\varepsilon_{S\,L\,105}$	% of I_{PN}	−3.25		3.25	
Sum of sensitivity and linearity error @ I_{PN} @ T_A = 125 °C [1)]	$\varepsilon_{S\,L\,125}$	% of I_{PN}	−3.74		3.74	

Note: [1)] Error @ T:

$$\varepsilon_{S\,L}(T_A) = \varepsilon_{S\,L\,25} + \left(TCS + \frac{TCI_{OE}}{I_{PN}} \right) \times |T_A - 25|$$

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Electrical data GO 20-SMS

At T_A = −40 °C … 125 °C, U_C = +5 V, R_L = 10 kΩ unless otherwise noted (see Definition of typical, minimum and maximum values paragraph in page 7).

Parameter	Symbol	Unit	Min	Typ	Max	Conditions
Primary nominal RMS current	I_{PN}	A		20		
Primary current, measuring range	I_{PM}	A	−50		50	
Supply voltage	U_C	V	4.5	5	5.5	
Current consumption	I_C	mA		20	26	
Reference voltage (output)	U_{ref}	V		2.5		@ 25 °C, internal ref.
Reference voltage (input)	U_{ref}	V	0.5		2.6	External ref.
Output voltage range @ I_{PM}	$U_{out} - U_{ref}$	V	−2		2	
Output internal resistance	R_{out}	Ω			5	Up to 10 kHz
Internal series resistance of reference voltage source	R_{ref}	Ω	120	200	333	
Load capacitance	C_L	nF	0		6	
Nominal sensitivity	S_N	mV/A		40		
Electrical offset voltage @ I_{PN} = 0	U_{OE}	mV	−5		5	T_A = 25 °C, $U_{out} - U_{ref}$ @ U_{ref} = 2.5 V
Electrical offset current referred to I_{PN}	I_{OE}	mA	−125		125	T_A = 25 °C
Temperature coefficient of U_{ref}	TCU_{ref}	ppm/K	−170		170	U_{ref} = 2.5 V
Temperature coefficient of U_{OE}	TCU_{OE}	mV/K	−0.075		0.075	
Temperature coefficient of I_{OE}	TCI_{OE}	mA/K	−1.88		1.88	
Temperature coefficient of S	TCS	ppm/K	−150		150	
Delay time to 90 % of the final output value for I_{PN} step	$t_{D\,90}$	µs			2	
Delay time to 10 % of the final output value for I_{PN} step	$t_{D\,10}$	µs			1.5	
Frequency bandwidth −3 dB, T_A = 25 °C	BW	KHz		300		
Noise voltage spectral density	u_{no}	µV/Hz$^{1/2}$		7		NBW = 1 kHz … 100 kHz
Internal OCD detection threshold	$I_{I\,OCD\,Th}$	A		2.93 × I_{PN}		Factory setting EEPROM
Internal OCD threshold error	$\varepsilon_{I\,OCD\,Th}$	%	−8		8	of peak value
Internal OCD output on resistance	$R_{on\,I\,OCD}$	Ω	70	95	100	open drain output, active low
Internal OCD output current sink	$I_{I\,OCD\,sink}$	mA	10			For 2.5 V on pin
Internal OCD output hold time	$t_{hold\,I\,OCD}$	µs	7	10	14	
Internal OCD delay time	$t_{D\,I\,OCD}$	µs	1.4		2.1	
Sensitivity error	ε_S	%	−1		1	Factory adjustment
Long-term sensitivity drift	ε_{St}	%	−0.5		0.5	
Linearity error 0 … I_{PN}	ε_L	% of I_{PN}	−0.3		0.3	
Linearity error 0 … I_{PM}	ε_L	% of I_{PM}	−0.6		0.6	
Sum of sensitivity and linearity error @ I_{PN} @ T_A = 25 °C	$\varepsilon_{S\,L\,25}$	% of I_{PN}	−1.3		1.3	T_A = 25 °C
Sum of sensitivity and linearity error @ I_{PN} @ T_A = 85 °C [1)]	$\varepsilon_{S\,L\,85}$	% of I_{PN}	−2.76		2.76	
Sum of sensitivity and linearity error @ I_{PN} @ T_A = 105 °C [1)]	$\varepsilon_{S\,L\,105}$	% of I_{PN}	−3.25		3.25	
Sum of sensitivity and linearity error @ I_{PN} @ T_A = 125 °C [1)]	$\varepsilon_{S\,L\,125}$	% of I_{PN}	−3.74		3.74	

Note: [1)] Error @ T:

$$\varepsilon_{S\,L}(T_A) = \varepsilon_{S\,L\,25} + \left(TCS + \frac{TCI_{OE}}{I_{PN}}\right) \times |T_A - 25|$$

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Electrical data GO 30-SMS

At T_A = −40 °C … 125 °C, U_C = +5 V, R_L = 10 kΩ unless otherwise noted (see Definition of typical, minimum and maximum values paragraph in page 7).

Parameter	Symbol	Unit	Min	Typ	Max	Conditions
Primary nominal RMS current	I_{PN}	A		30		
Primary current, measuring range	I_{PM}	A	−75		75	
Supply voltage	U_C	V	4.5	5	5.5	
Current consumption	I_C	mA		20	26	
Reference voltage (output)	U_{ref}	V		2.5		@ 25 °C, internal ref.
Reference voltage (input)	U_{ref}	V	0.5		2.6	External ref.
Output voltage range @ I_{PM}	$U_{out} - U_{ref}$	V	−2		2	
Output internal resistance	R_{out}	Ω			5	Up to 10 kHz
Internal series resistance of reference voltage source	R_{ref}	Ω	120	200	333	
Load capacitance	C_L	nF	0		6	
Nominal sensitivity	S_N	mV/A		26.7		
Electrical offset voltage @ I_{PN} = 0	U_{OE}	mV	−5		5	T_A = 25 °C, $U_{out} - U_{ref}$ @ U_{ref} = 2.5 V
Electrical offset current referred to I_{PN}	I_{OE}	mA	−187.5		187.5	T_A = 25 °C
Temperature coefficient of U_{ref}	TCU_{ref}	ppm/K	−170		170	U_{ref} = 2.5 V
Temperature coefficient of U_{OE}	TCU_{OE}	mV/K	−0.075		0.075	
Temperature coefficient of I_{OE}	TCI_{OE}	mA/K	−2.8		2.8	
Temperature coefficient of S	TCS	ppm/K	−150		150	
Delay time to 90 % of the final output value for I_{PN} step	$t_{D\,90}$	µs			2	
Delay time to 10 % of the final output value for I_{PN} step	$t_{D\,10}$	µs			1.5	
Frequency bandwidth −3 dB, T_A = 25 °C	BW	KHz		300		
Noise voltage spectral density	u_{no}	µV/Hz$^{1/2}$		5.5		NBW = 1 kHz … 100 kHz
Internal OCD detection threshold	$I_{I\,OCD\,Th}$	A		2.93 × I_{PN}		Factory setting EEPROM
Internal OCD threshold error	$\varepsilon_{I\,OCD\,Th}$	%	−8		8	of peak value
Internal OCD output on resistance	$R_{on\,I\,OCD}$	Ω	70	95	100	open drain output, active low
Internal OCD output current sink	$I_{I\,OCD\,sink}$	mA	10			For 2.5 V on pin
Internal OCD output hold time	$t_{hold\,I\,OCD}$	µs	7	10	14	
Internal OCD delay time	$t_{D\,I\,OCD}$	µs	1.4		2.1	
Sensitivity error	ε_S	%	−1		1	Factory adjustment
Long-term sensitivity drift	ε_{St}	%	−0.5		0.5	
Linearity error 0 … I_{PN}	ε_L	% @ I_{PN}	−0.3		0.3	
Linearity error 0 … I_{PM}	ε_L	% @ I_{PM}	−0.6		0.6	
Sum of sensitivity and linearity error @ I_{PN} @ T_A = 25 °C	$\varepsilon_{S\,L\,25}$	% of I_{PN}	−1.3		1.3	
Sum of sensitivity and linearity error @ I_{PN} @ T_A = 85 °C [1]	$\varepsilon_{S\,L\,85}$	% of I_{PN}	−2.76		2.76	
Sum of sensitivity and linearity error @ I_{PN} @ T_A = 105 °C [1]	$\varepsilon_{S\,L\,105}$	% of I_{PN}	−3.25		3.25	
Sum of sensitivity and linearity error @ I_{PN} @ T_A = 125 °C [1]	$\varepsilon_{S\,L\,125}$	% of I_{PN}	−3.74		3.74	

Note: [1] Error @ T:

$$\varepsilon_{S\,L}(T_A) = \varepsilon_{S\,L\,25} + \left(TCS + \frac{TCI_{OE}}{I_{PN}}\right) \times |T_A - 25|$$

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Definition of typical, minimum and maximum values

Minimum and maximum values for specified limiting and safety conditions have to be understood as such as well as values shown in “typical” graphs.
On the other hand, measured values are part of a statistical distribution that can be specified by an interval with upper and lower limits and a probability for measured values to lie within this interval.
Unless otherwise stated (e.g. “100 % tested”), the LEM definition for such intervals designated with “min” and “max” is that the probability for values of samples to lie in this interval is 99.73 %.
For a normal (Gaussian) distribution, this corresponds to an interval between −3 sigma and +3 sigma. If “typical” values are not obviously mean or average values, those values are defined to delimit intervals with a probability of 68.27 %, corresponding to an interval between −sigma and +sigma for a normal distribution.
Typical, maximal and minimal values are determined during the initial characterization of the product.

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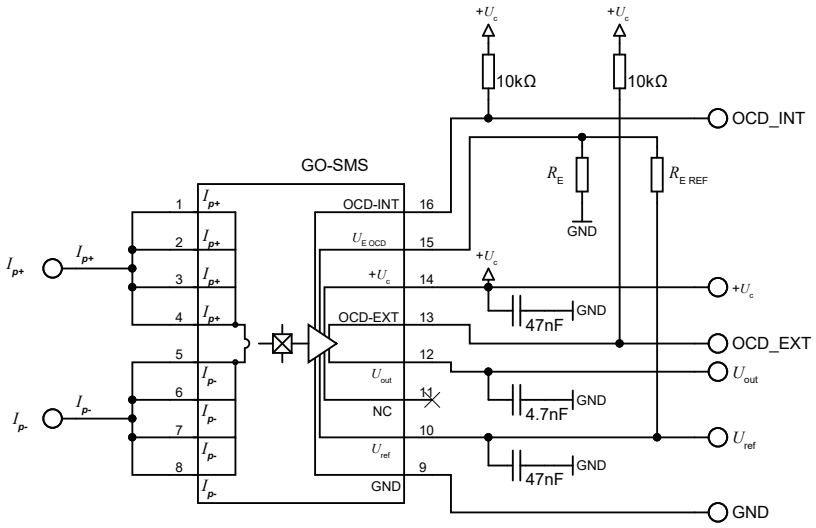
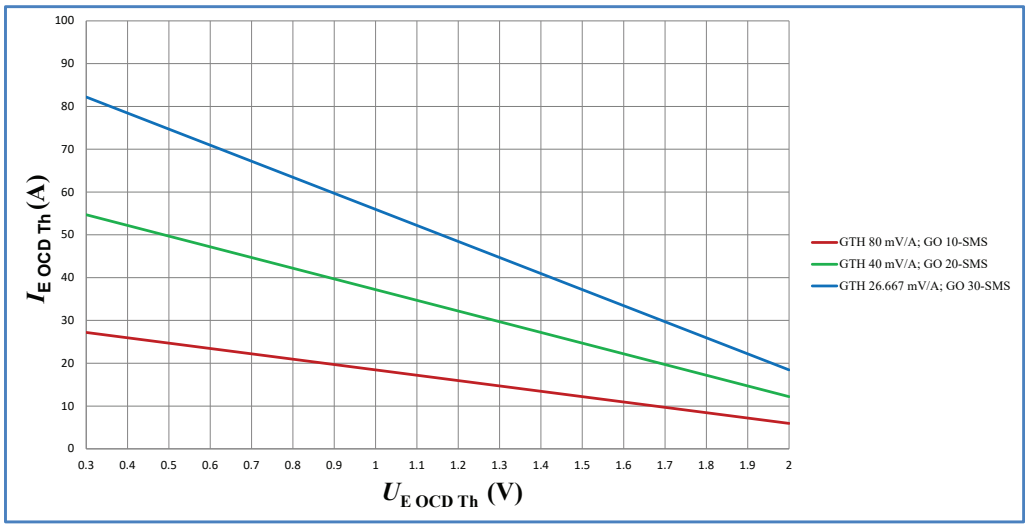
External overcurrent detection

At U_C = 5 V and U_{ref} = 2.5 V

Parameter	Symbol	Unit	Specification			Conditions
			Min	Typical	Max	
External OCD voltage	$U_{E\ OCD}$	V	0.3		2	
External OCD output on resistance to ground	$R_{on\ E\ OCD}$	Ω	35	200	300	2.5 on pin
External OCD delay time	$t_{D\ E\ OCD}$	µs		10		To be added to the sensor delay time
External OCD output hold time	$t_{hold\ E\ OCD}$	µs		10		
External OCD threshold error	$\varepsilon_{E\ OCD\ Th}$	%		±5		Switch point error between U_{out} and $U_{E\ OCD}$



External OCD detection threshold $I_{E\ OCD\ Th}$:



$$I_{E\ OCD\ Th} = \frac{(U_{ref} - U_{E\ OCD})}{S_N} \times 1000 \qquad U_{E\ OCD\ Th} = \frac{R_E}{R_E + R_{ref}} \times U_{ref}$$

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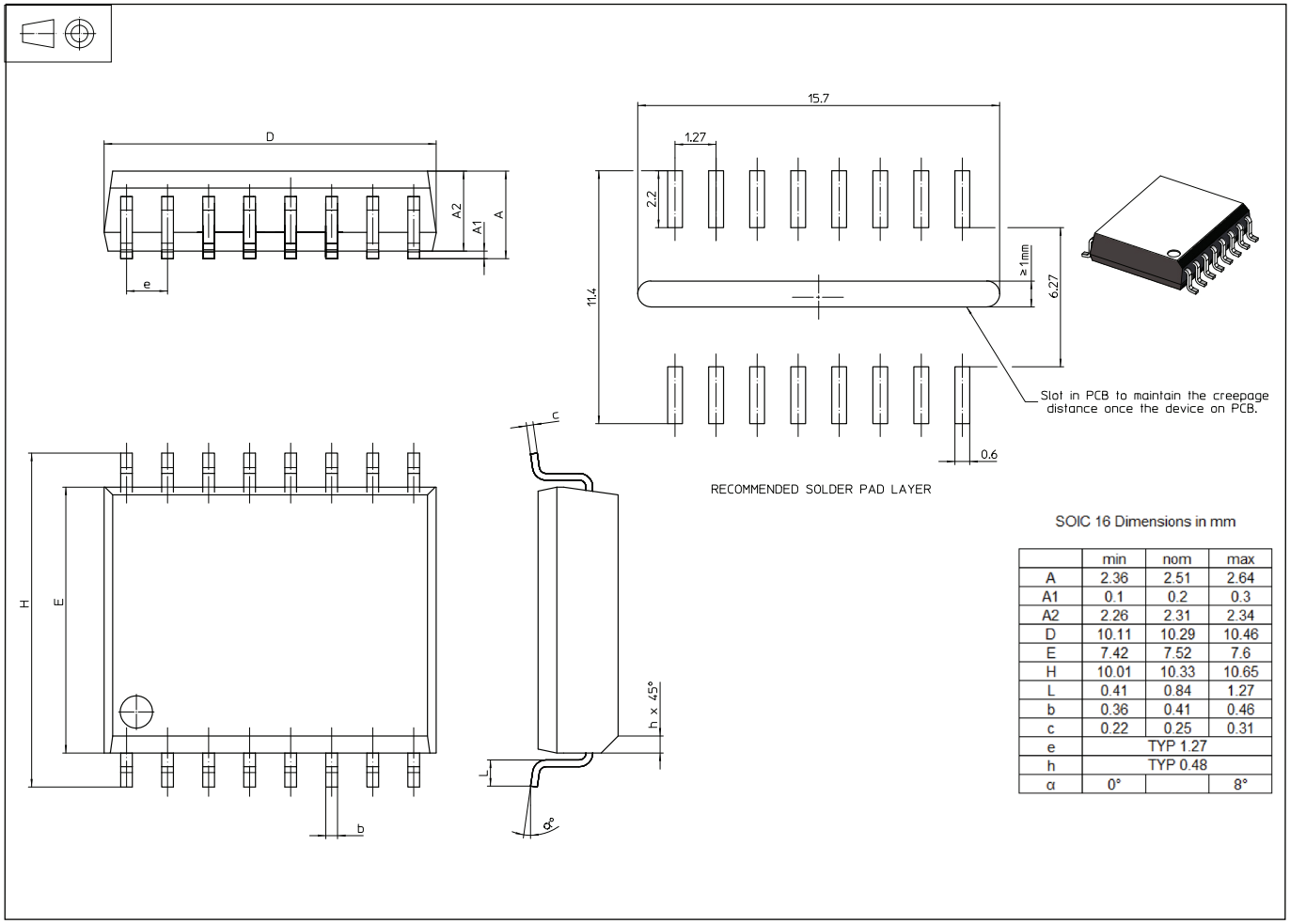
Dimensions and PCB foot-print (in mm)



SOIC 16 Dimensions in mm

	min	nom	max
A	2.36	2.51	2.64
A1	0.1	0.2	0.3
A2	2.26	2.31	2.34
D	10.11	10.29	10.46
E	7.42	7.52	7.6
H	10.01	10.33	10.65
L	0.41	0.84	1.27
b	0.36	0.41	0.46
c	0.22	0.25	0.31
e		TYP 1.27	
h		TYP 0.48	
α	0°		8°

Soldering requirements

MSL3, 260 °C - IPC/JEDEC J-STD-020

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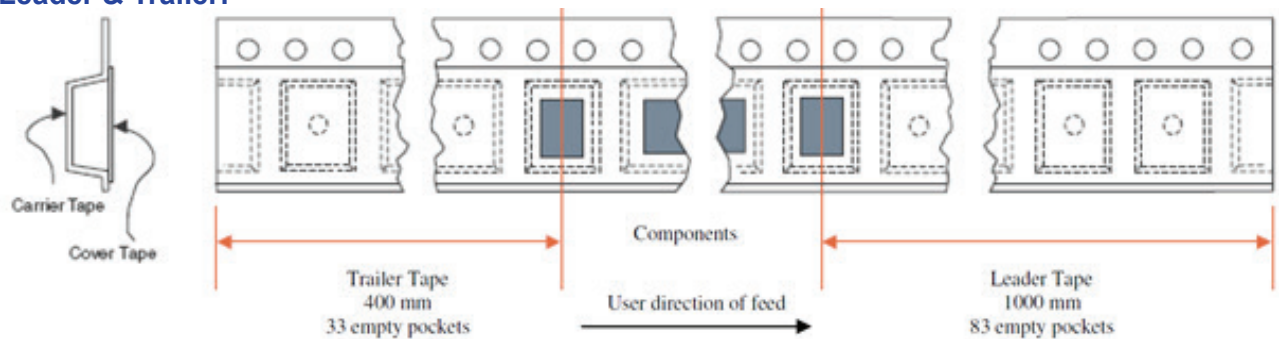
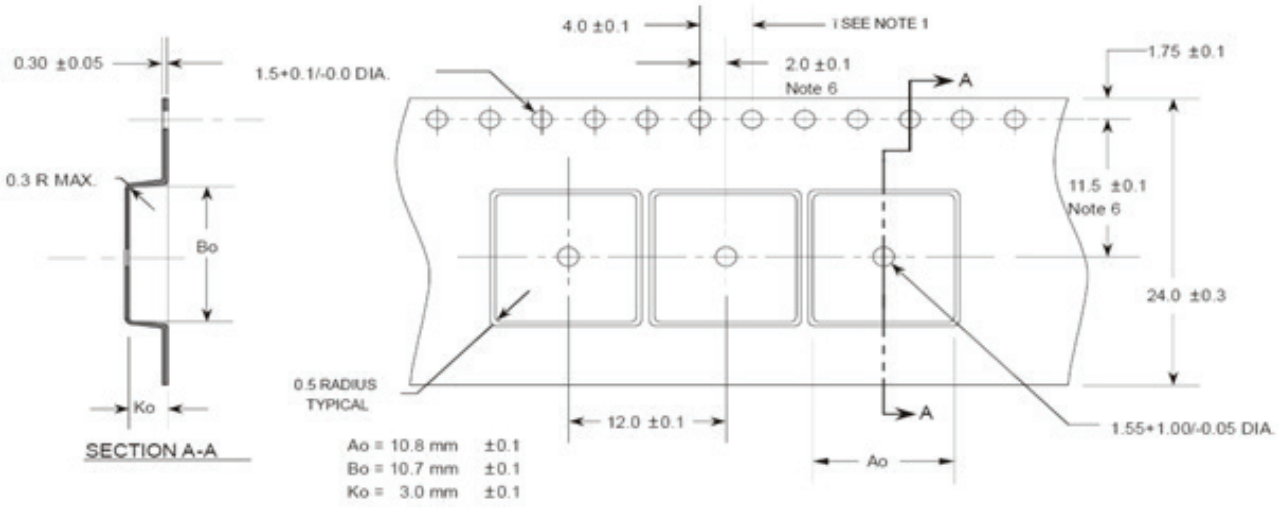
Tape and reel dimensions (in mm)

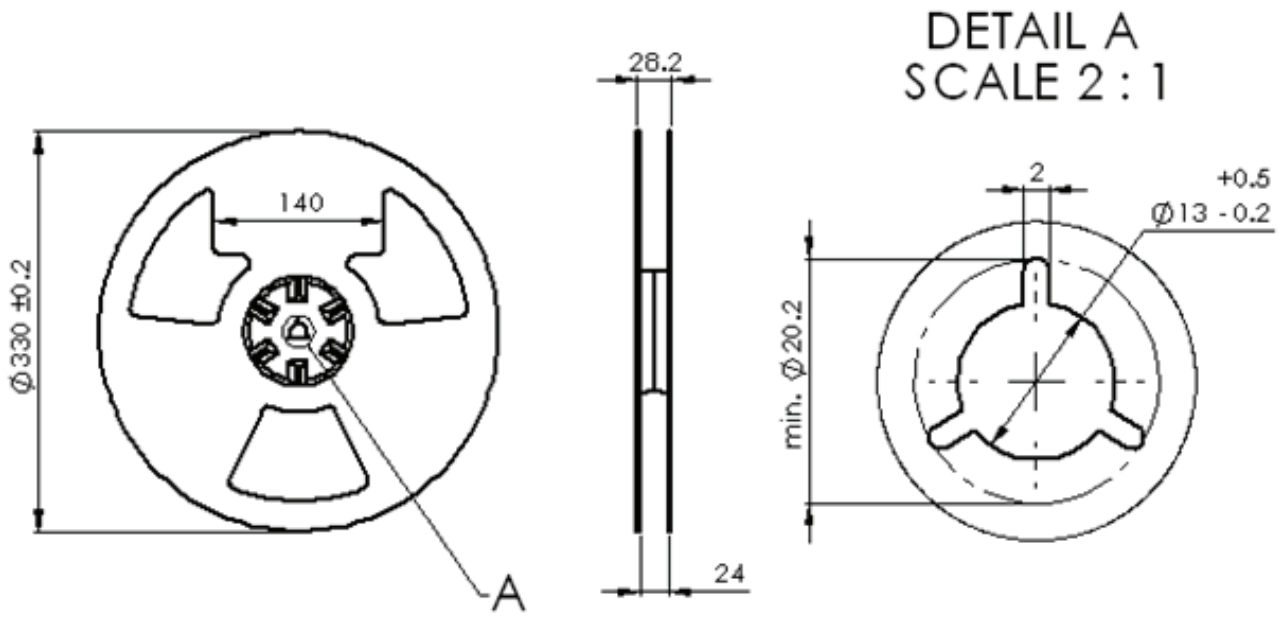
Leader & Trailer:



Carrier Tape Data:



Plastic Reel Data:



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Ordering information

Item number	Description	Package type	Package quantity
G2.07.13.000.0	GO 10-SMS	Reel	1500
G2.07.13.100.0	GO 10-SMS KIT 5P	Blister	5
G2.07.13.300.0	GO 10-SMS SET OF 50 PCS	SMD Bag	50
G2.07.17.000.0	GO 20-SMS	Reel	1500
G2.07.17.100.0	GO 20-SMS KIT 5P	Blister	5
G2.07.17.300.0	GO 20-SMS SET OF 50 PCS	SMD Bag	50
G2.07.20.000.0	GO 30-SMS	Reel	1500
G2.07.20.100.0	GO 30-SMS KIT 5P	Blister	5
G2.07.20.300.0	GO 30-SMS SET OF 50 PCS	SMD Bag	50

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