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TLE 4206-4G

H-Bridge Driver
Headlight Beam Controller

Data Sheet

Rev. 1.0, 2010-08-05

Automotive Power

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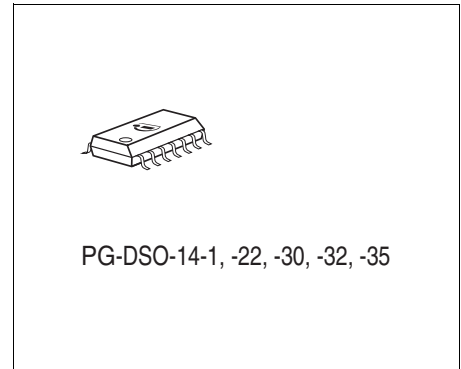
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1 Overview

Features

- Ideal for manual and automatic-static headlight beam control applications with DC motor loads
- Delivers up to 0.8 A continuous
- Range low-voltage detection with hysteresis; Lower switch-off threshold @ 1.34V typ
- Low saturation voltage; typ. 1.2 V total @ 25 °C; 0.4 A
- Output protected against short circuit
- Over temperature protection with hysteresis
- Over- and under voltage lockout
- Internal clamp diodes
- Thermally enhanced SO package
- Green Product (RoHS compliant)
- AEC Qualified



PG-DSO-14-22

Description

The TLE 4206-4G is a protected H-Bridge Driver designed specifically for automotive headlight beam control applications with DC-brush motor loads. The part is built using Infineon's bipolar high voltage power technology DOPL.

The standard enhanced power PG-DSO-14-22 package meets the application requirements and saves PCB-board space and costs.

The servo-loop-parameter pos.- and neg. Hysteresis, pos.- and neg. deadband and angle-amplification are programmable with external resistors. An internal window-comparator controls the input line. In case of fault conditions, like short circuit to GND, short circuit to supply-voltage, and broken wire, the TLE 4206-4G stops the motor immediately and enters active braking (brake high). The device also incorporates integrated features like over- and under voltage-lockout, short-circuit-protection and over-temperature-protection.

The TLE 4206-4G is a derivate of the TLE 4206-2G. The Range pin not only offers short circuit protection at the reference potentiometer but also determines the potentiometer's voltage range of operation. The TLE 4206-4G considers a smaller window of operation by way of increasing the lower Range Switch off and on thresholds to serve a larger variety of reference potentiometer strokes.

Type	Package	Marking
TLE 4206-4G	PG-DSO-14-22	TLE4206-4G

2 Block Diagram

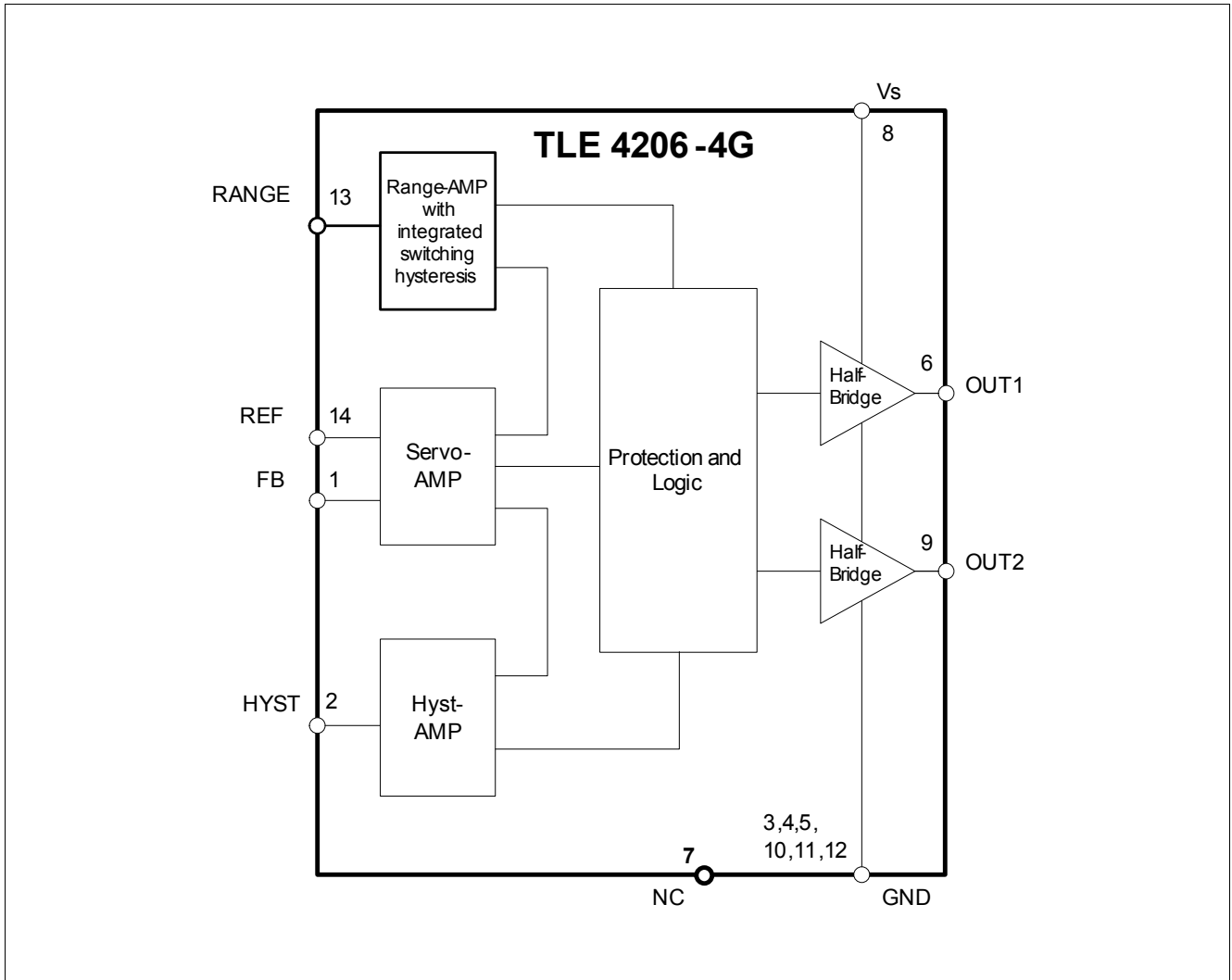


Figure 1 Block Diagram

3 Pin Configuration

3.1 Pin Assignment

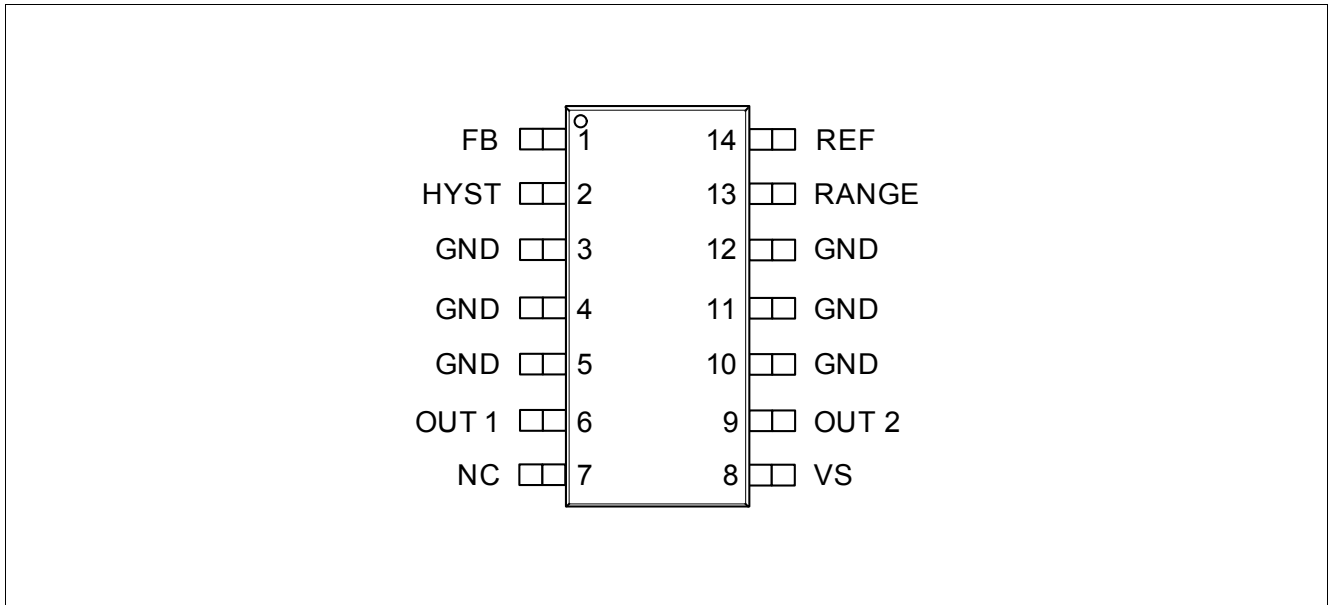


Figure 2 Pin Configuration

3.2 Pin Definitions and Functions

Pin	Symbol	Function
1	FB	Feedback Input
2	HYST	Hysteresis I/O
3, 4, 5, 10, 11, 12	GND	Ground
6	OUT1	Power Output 1
7	NC	Not Connected. This pin can be left open or connected to ground.
8	V_s	Power Supply Voltage
9	OUT2	Power Output 2
13	RANGE	Range Input
14	REF	Reference Input

4 General Product Characteristics

4.1 Absolute Maximum Ratings

Absolute Maximum Ratings ¹⁾

$T_j = -40\text{ °C}$ to $+150\text{ °C}$; all voltages with respect to ground, positive current flowing into pin (unless otherwise specified)

Pos.	Parameter	Symbol	Limit Values		Unit	Conditions
			Min.	Max.		
Voltages						
4.1.1	Supply voltage	V_{S1}	-0.3	45	V	–
4.1.2	Supply voltage	V_{S2}	-1	–	V	$t < 0.5\text{ s}$; $I_S > -2\text{ A}$
4.1.3	Logic input voltages (FB, REF, RANGE, HYST)	V_I	-0.3	20	V	–
Currents						
4.1.4	Output current (OUT1, OUT2)	I_{OUT}	–	–	A	internally limited
4.1.5	Output current (Diode)	I_{OUT_DIODE}	-1	1	A	–
4.1.6	Input current (FB, REF, RANGE, HYST)	I_{IN}	-2 -6	2 6	mA mA	– $t < 2\text{ ms}$; $t/T < 0.1$
Temperatures						
4.1.7	Junction Temperature	T_j	-40	150	°C	–
4.1.8	Storage Temperature	T_{stg}	-50	150	°C	–
ESD Susceptibility						
4.1.9	ESD resistivity of OUT and V_S pin to GND	V_{ESD}	-2	2	kV	HBM ²⁾
4.1.10	ESD Resistivity logic pins to GND	$V_{ESD5,7}$	-2	2	kV	HBM ²⁾

1) Not subject to production test, specified by design.

2) ESD susceptibility, HBM according to EIA/JESD 22-A114B

Note: Stresses above the ones listed here may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Note: Integrated protection functions are designed to prevent IC destruction under fault conditions described in the data sheet. Fault conditions are considered as “outside” normal operating range. Protection functions are not designed for continuous repetitive operation.

4.2 Operating Range

Pos.	Parameter	Symbol	Limit Values		Unit	Conditions
			Min.	Max.		
4.2.1	Supply voltage	V_{S_OP}	8	18	V	After V_S rising above $V_{UV\ ON}$
4.2.2	Supply voltage increasing	V_{S_INC}	-0.3	$V_{UV\ ON}$	V	Outputs in tristate
4.2.3	Supply voltage decreasing	V_{S_DEC}	-0.3	$V_{UV\ OFF}$	V	Outputs in tristate
4.2.4	Output current	I_{OUT1-2}	-0.8	0.8	A	–
4.2.5	Input current (FB, REF)	I_{IN_op}	-50	500	μA	–
4.2.6	Junction temperature	T_j	-40	150	$^{\circ}C$	–

Note: Within the functional range the IC operates as described in the circuit description. The electrical characteristics are specified within the conditions given in the related electrical characteristics table.

4.3 Thermal Resistance

Note: This thermal data was generated in accordance with JEDEC JESD51 standards. For more information, go to www.jedec.org.

Pos.	Parameter	Symbol	Limit Values			Unit	Conditions
			Min.	Typ.	Max.		
4.3.1	Junction to Soldering Point ¹⁾	R_{thJSP}	–	25	–	K/W	measured to pin 5
4.3.2	Junction to Ambient ¹⁾ minimal-footprint	$R_{thJA_minfoot}$	–	130	–	K/W	²⁾
4.3.3	Junction to Ambient ¹⁾ additional 600 mm ² CU area	R_{thJA_600mm2}	–	65	–	K/W	³⁾

1) Not subject to production test, specified by design.

2) JESD 51-2, 51-3, FR4 76.2 mm × 114.3 mm × 1.5 mm, 70 μm Cu, minimal footprint; Ta=27°C

3) JESD 51-2, 51-3, FR4 76.2 mm × 114.3 mm × 1.5 mm, 70 μm Cu, 600 mm² CU cooling area connected to Pins: 3, 4, 5, 10, 11, 12; Ta=27°C

4.4 Electrical Characteristics

Electrical Characteristics

$V_S = 8\text{ V to }18\text{ V}$, $T_j = -40\text{ °C to }+150\text{ °C}$, $I_{OUT1-2} = 0\text{ A}$, all voltages with respect to ground, positive current flowing into pin (unless otherwise specified)

Pos.	Parameter	Symbol	Limit Values			Unit	Conditions
			Min.	Typ.	Max.		

Current Consumption

4.4.1	Supply current	$I_{S_no\ load}$	–	12	20	mA	no load connected
4.4.2	Supply current	$I_{S_0.4A}$	–	20	30	mA	$I_{OUT1} = 0.4\text{ A};$ $I_{OUT2} = -0.4\text{ A}$
4.4.3	Supply current	$I_{S_0.8A}$	–	35	50	mA	$I_{OUT1} = 0.8\text{ A};$ $I_{OUT2} = -0.8\text{ A}$

Over- and Under Voltage Lockout

4.4.4	UV Switch ON voltage	$V_{UV\ ON}$	–	7.4	8	V	V_S increasing
4.4.5	UV Switch OFF voltage	$V_{UV\ OFF}$	6.3	6.9	–	V	V_S decreasing
4.4.6	UV ON/OFF Hysteresis	V_{UVHY}	–	0.5	–	V	$V_{UV\ ON} - V_{UV\ OFF}$
4.4.7	OV Switch OFF voltage	$V_{OV\ OFF}$	–	20.5	23	V	V_S increasing
4.4.8	OV Switch ON voltage	$V_{OV\ ON}$	17.5	20	–	V	V_S decreasing
4.4.9	OV ON/OFF Hysteresis	V_{OVHY}	–	0.5	–	V	$V_{OV\ OFF} - V_{OV\ ON}$

Outputs OUT1-2, Saturation Voltages

4.4.10	Source (upper) $I_{OUT} = -0.2\text{ A}$	$V_{SAT\ U\ 0.2A}$	–	0.85	1.15	V	$T_j = 25\text{ °C}$
4.4.11	Source (upper) $I_{OUT} = -0.4\text{ A}$	$V_{SAT\ U\ 0.4A}$	–	0.90	1.20	V	
4.4.12	Sink (upper) $I_{OUT} = -0.8\text{ A}$	$V_{SAT\ U\ 0.8A}$	–	1.10	1.50	V	
4.4.13	Sink (lower) $I_{OUT} = 0.2\text{ A}$	$V_{SAT\ L\ 0.2A}$	–	0.15	0.23	V	
4.4.14	Sink (lower) $I_{OUT} = 0.4\text{ A}$	$V_{SAT\ L\ 0.4A}$	–	0.25	0.40	V	
4.4.15	Sink (lower) $I_{OUT} = 0.8\text{ A}$	$V_{SAT\ L\ 0.8A}$	–	0.45	0.75	V	
4.4.16	Total drop, $I_{OUT} = 0.2\text{ A}$	$V_{SAT\ 0.2A}$	–	1.0	1.4	V	$V_{SAT} = V_{SAT\ U} + V_{SAT\ L}$
4.4.17	Total drop, $I_{OUT} = 0.4\text{ A}$	$V_{SAT\ 0.4A}$	–	1.2	1.7	V	
4.4.18	Total drop, $I_{OUT} = 0.8\text{ A}$	$V_{SAT\ 0.8A}$	–	1.6	2.5	V	

Outputs OUT1-2, Clamp Diodes

4.4.19	Forward voltage; upper	V_{FU}	–	1	1.5	V	$I_F = 0.4\text{ A}$
4.4.20	Upper leakage current	I_{LKU}	–	–	5	mA	
4.4.21	Forward voltage; lower	V_{FL}	–	0.9	1.4	V	

Input-Interface, Input REF

4.4.22	Quiescent voltage	V_{REFq}	–	200	–	mV	$I_{REF} = 0\text{ }\mu\text{A}$
4.4.23	Input resistance	R_{REF}	–	6	–	k Ω	$0\text{ V} < V_{REF} < 0.5\text{ V}$

General Product Characteristics

Electrical Characteristics (cont'd)

$V_S = 8\text{ V to }18\text{ V}$, $T_j = -40\text{ °C to }+150\text{ °C}$, $I_{OUT1-2} = 0\text{ A}$, all voltages with respect to ground, positive current flowing into pin (unless otherwise specified)

Pos.	Parameter	Symbol	Limit Values			Unit	Conditions
			Min.	Typ.	Max.		

Input-Interface, Input FB

4.4.24	Quiescent voltage	V_{FBq}	–	200	–	mV	$I_{FB} = 0\text{ }\mu\text{A}$
4.4.25	Input resistance	R_{FB}	–	6	–	k Ω	$0\text{ V} < V_{FB} < 0.5\text{ V}$

Input-Interface, Input/Output HYST

4.4.26	Current Amplification $A_{HYST} = I_{HYST} / (I_{REF} - I_{FB})$	A_{HYST}	0.8	0.95	1.1	–	$-20\text{ }\mu\text{A} < I_{HYST} < -10\text{ }\mu\text{A}$; $10\text{ }\mu\text{A} < I_{HYST} < 20\text{ }\mu\text{A}$; $I_{REF} = 250\text{ }\mu\text{A}$; $V_{HYST} = V_S / 2$
4.4.27	Current Offset	I_{HYSTIO}	-2	0.35	3	μA	$I_{REF} = I_{FB} = 250\text{ }\mu\text{A}$; $V_{HYST} = V_S / 2$
4.4.28	Threshold voltage High	V_{HYH} / V_S	–	52	–	%	–
4.4.29	Deadband voltage High	V_{DBH} / V_S	–	50.4	–	%	–
4.4.30	Deadband voltage Low	V_{DBL} / V_S	–	49.6	–	%	–
4.4.31	Threshold voltage Low	V_{HYL} / V_S	–	48	–	%	–
4.4.32	Hysteresis Window	V_{HYW} / V_S	3	4	5	%	$(V_{HYH} - V_{HYL}) / V_S$
4.4.33	Deadband Window	V_{DBW} / V_S	0.4	0.8	1.2	%	$(V_{DBH} - V_{DBL}) / V_S$

Input-Interface, Input RANGE

4.4.34	Input current	I_{RANGE}	-1	–	1	μA	$0\text{ V} < V_{RANGE} < V_S$
4.4.35	Switch-OFF voltage High	V_{OFFH}	-25	0	100	mV	refer to V_S
4.4.36	Switch-OFF voltage Low	V_{OFFL}	1240	1340	1440	mV	refer to GND, V_{RANGE} decreasing
4.4.37	Switch-ON voltage Low	V_{ONL}	1320	1424	1520	mV	refer to GND, V_{RANGE} increasing
4.4.38	Low-threshold hysteresis	$V_{OFFLHYS}$	–	84	–	mV	see Figure 6

Thermal Shutdown

4.4.39	Thermal shutdown junction temperature ¹⁾	T_{jSD}	150	175	200	$^{\circ}\text{C}$	–
4.4.40	Thermal switch-on junction temperature	T_{jSO}	120	–	170	$^{\circ}\text{C}$	–
4.4.41	Temperature hysteresis	ΔT	–	30	–	K	–

1) Not subject to production test, specified by design.

5 Application Information

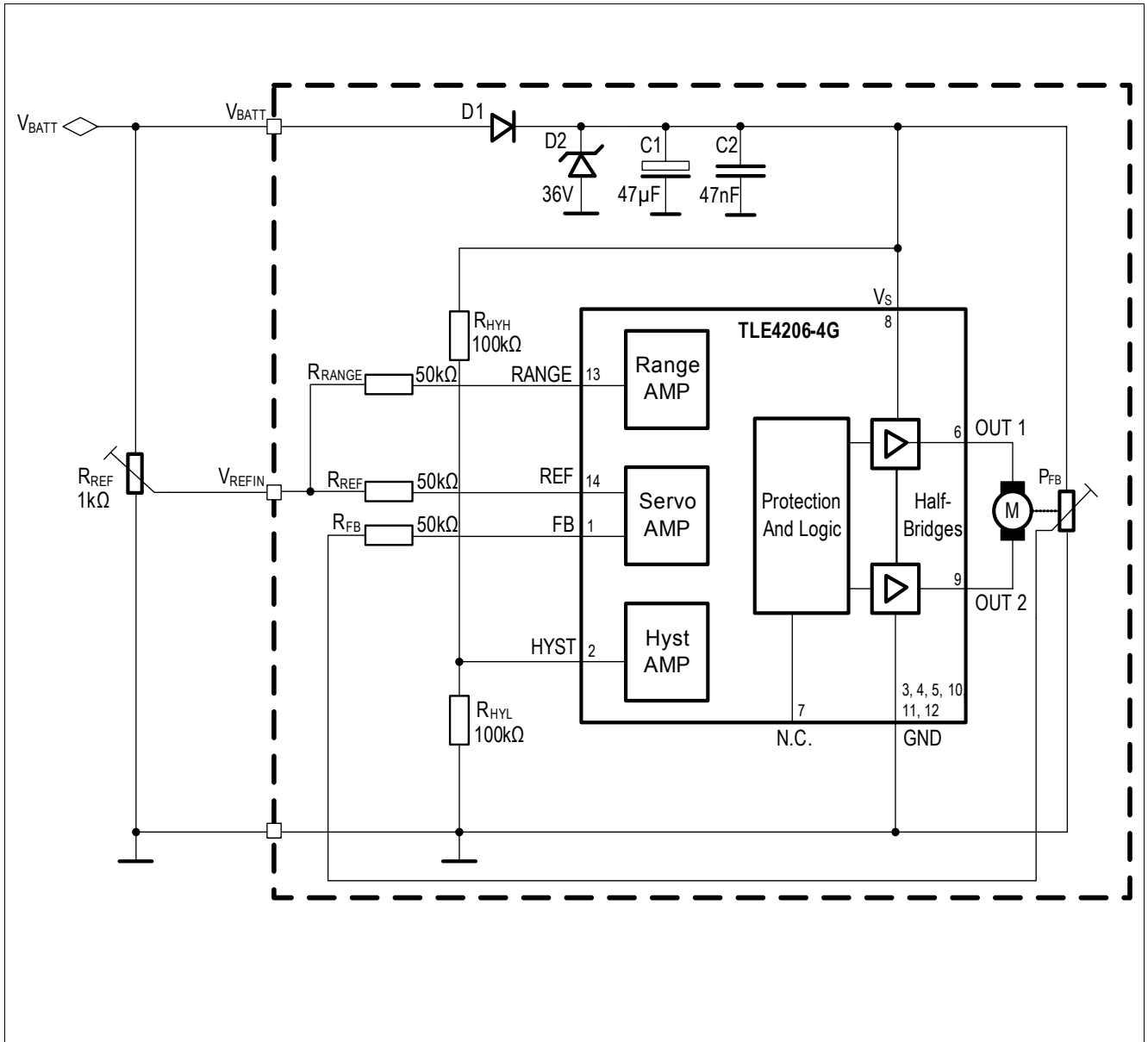


Figure 3 Application Circuit for Manual Headlight Beam Adjustment

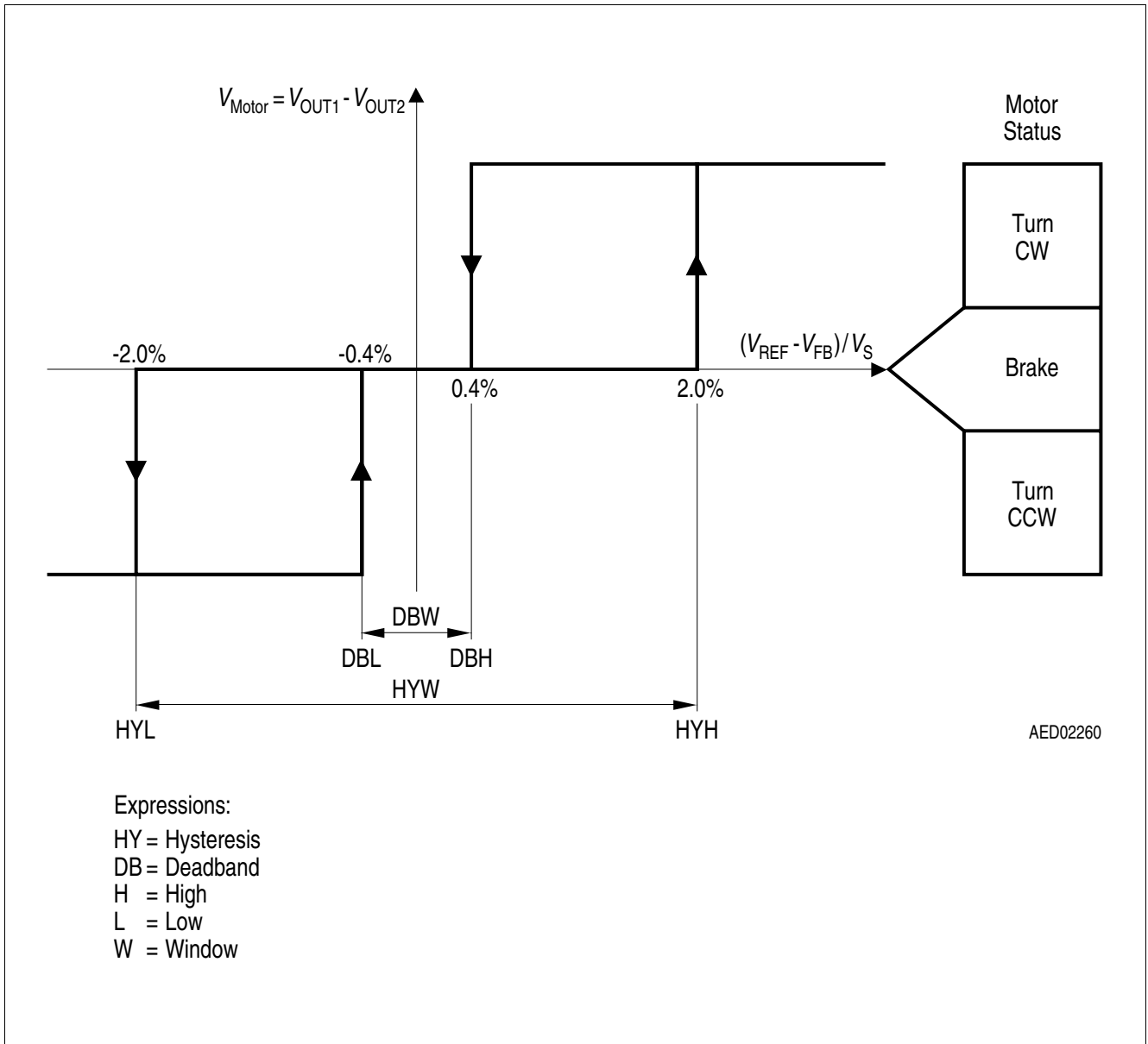


Figure 4 Hysteresis, Phaselag and Deadband-Definitions

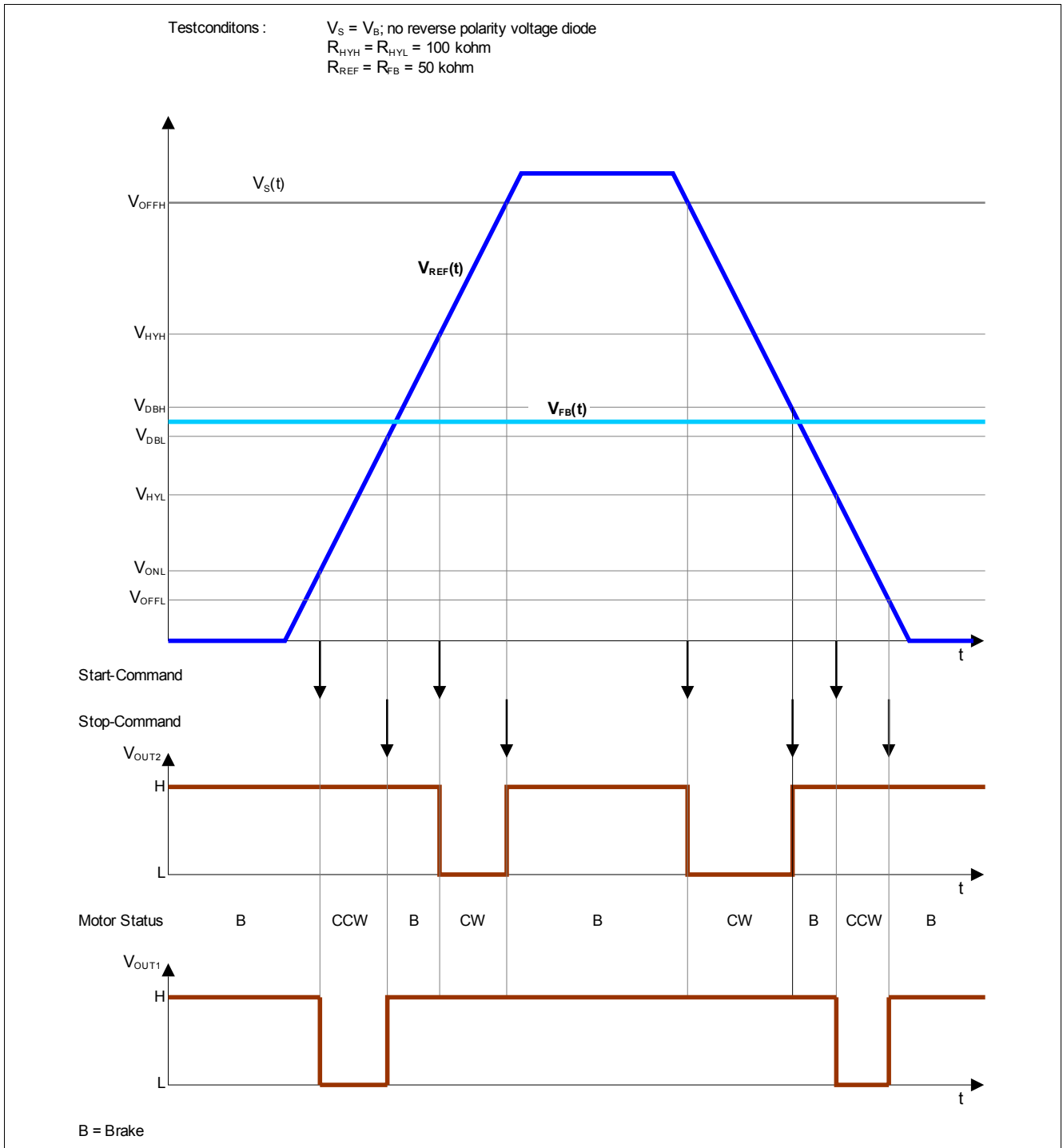


Figure 5 Motor Operation

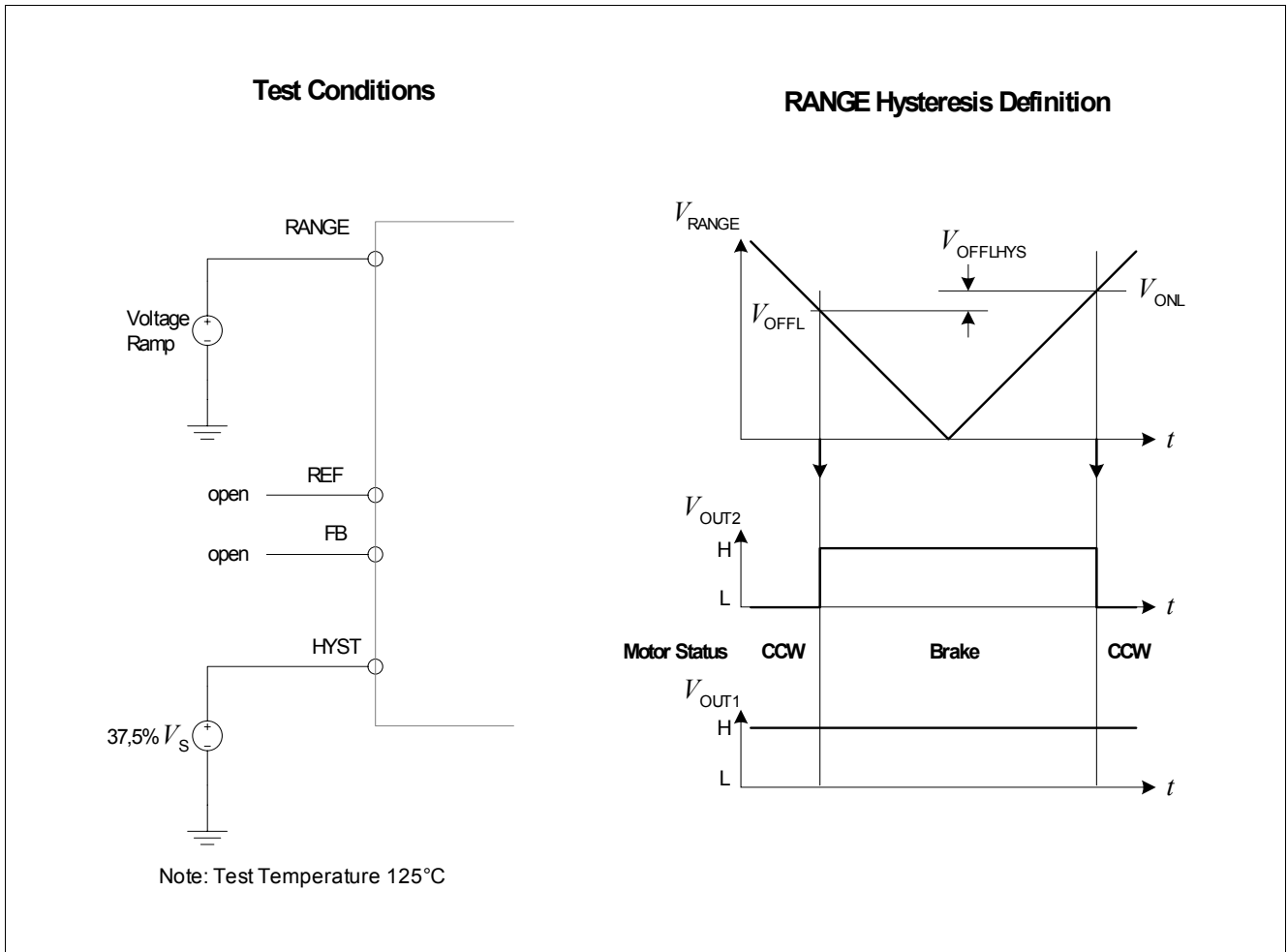


Figure 6 RANGE Hysteresis and Test Conditions

6 Package Outlines

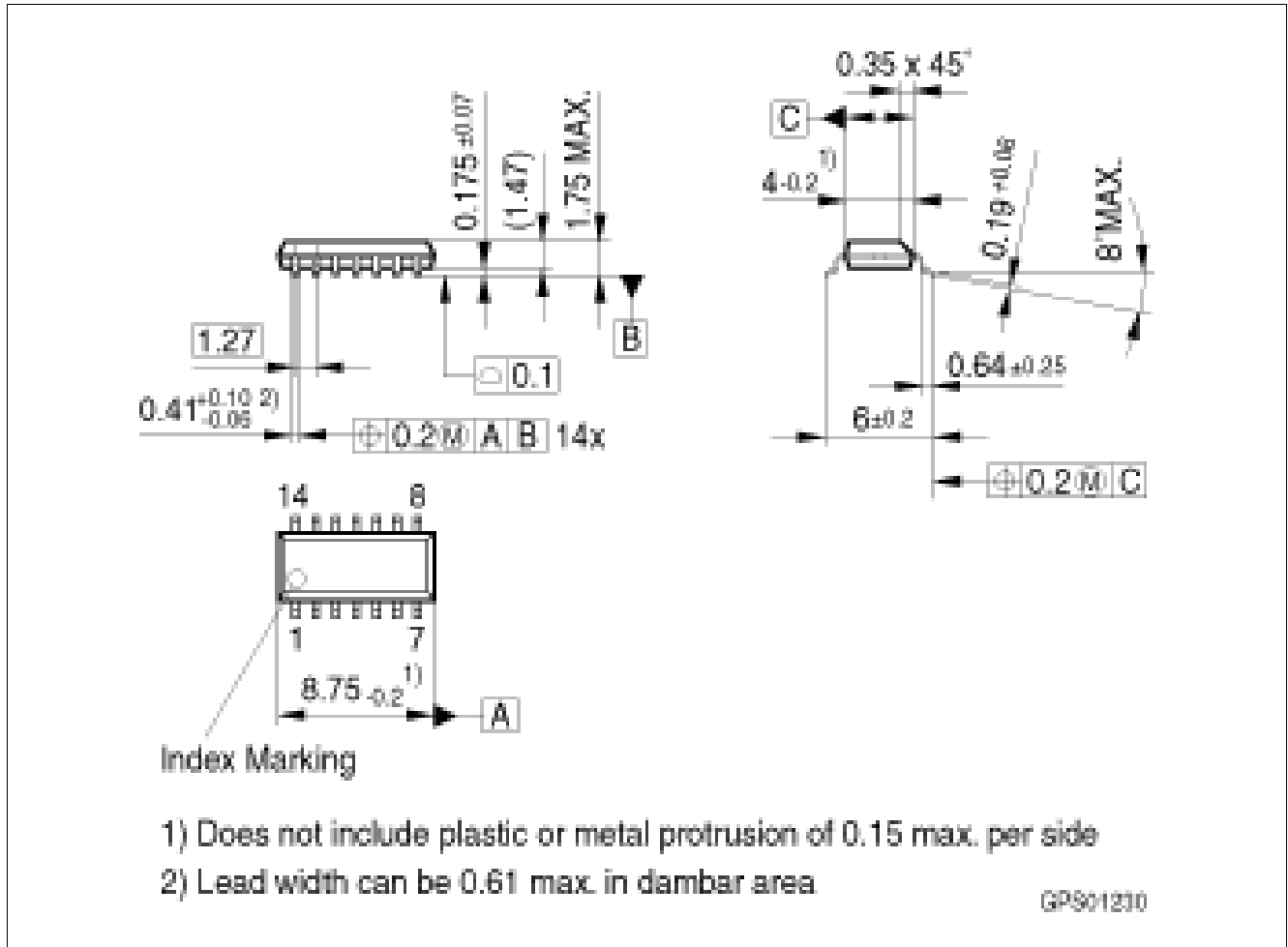


Figure 7 PG-DSO-14-22 (Plastic/Plastic Green - Dual Small Outline Package)

Green Product (RoHS compliant)

To meet the world-wide customer requirements for environmentally friendly products and to be compliant with government regulations the device is available as a green product. Green products are RoHS-Compliant (i.e. Pb-free finish on leads and suitable for Pb-free soldering according to IPC/JEDEC J-STD-020).

7 Revision History

TLE 4206-4G

Revision History: Rev. 1.0, 2010-08-05

Previous Version(s): None

Revision	Page	Subjects (major changes since last revision)
1.0	All	Final Data Sheet Release

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