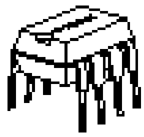
DC Motor Driver for Servo Driver Applications **TLE 4209**

1 Overview

1.1 Features

- Optimized for headlight beam control applications
- Delivers up to 0.8 A
- Low saturation voltage;
  typ. 1.2 V total @ 25 °C; 0.4 A
- Output protected against short circuit
- Overtemperature protection with hysteresis
- Over- and undervoltage lockout
- No crossover current
- Internal clamp diodes



P-DIP-8-4

1.2 Description

The TLE 4209 is a fully protected H-Bridge Driver designed specifically for automotive headlight beam control and industrial servo control applications.
The part is built using Infineons bipolar high voltage power technology DOPL.

The device is available in a P-DIP-8-4 package.

The servo-loop-parameter pos.- and neg. Hysteresis, pos.- and neg. deadband and angle-amplification are programmable with external resitors.

An internal window-comparator controls the input line. In the case of a fault condition, like short circuit to GND, short circuit to supply-voltage, and broken wire, the TLE 4209 stops the motor immediately (brake condition).

Furthermore the built in features like over- and undervoltage-lockout, short-circuit-protection and over-temperature-protection will open a wide range of automotive- and industrial applications.

Type	Package
TLE 4209	P-DIP-8-4

1.3 Pin Definitions and Functions

Pin No. P-DIP-8-4	Symbol	Function
1	FB	Feedback Input
2	HYST	Hysteresis I/O
3	OUT1	Power Output 1
4	V_S	Power Supply Voltage
5	OUT2	Power Output 2
6	GND	Ground
7	RANGE	Range Input
8	REF	Reference Input

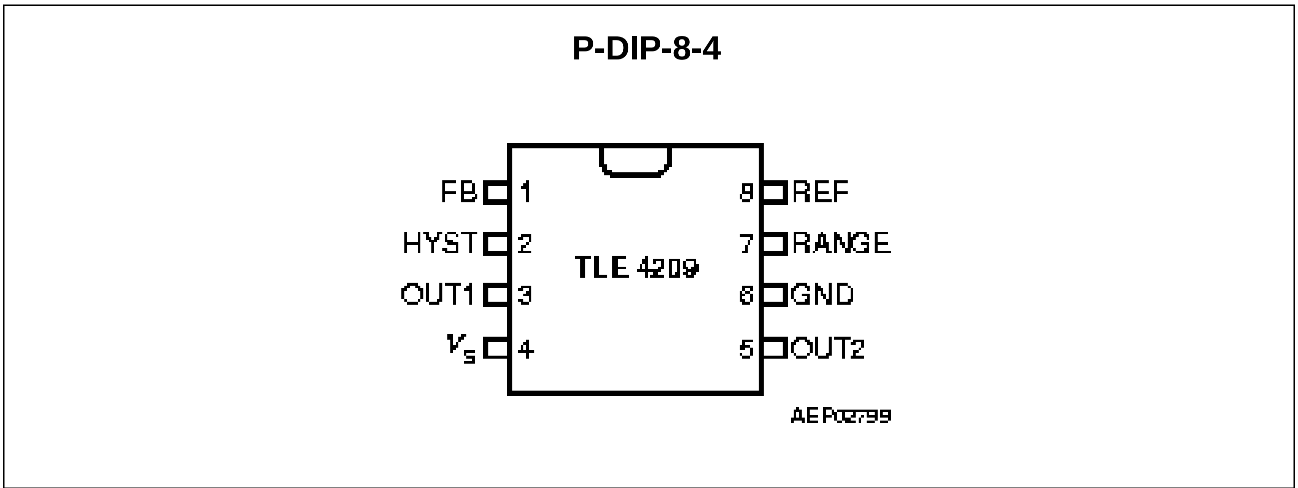


Figure 1 Pin Configuration
(top view)

1.4 Functional Block Diagram

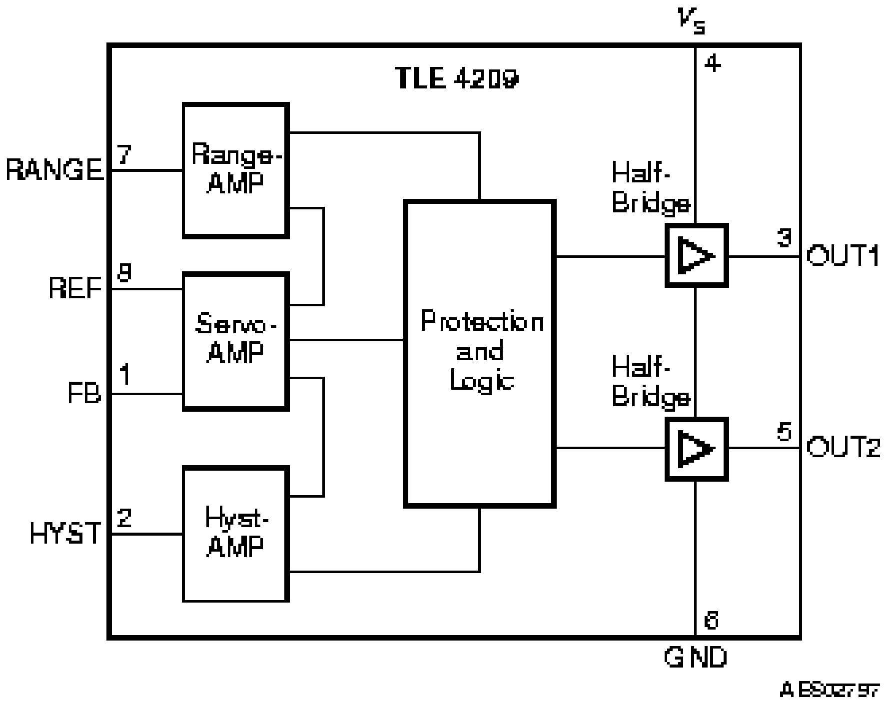


Figure 2 Block Diagram

1.5 Absolute Maximum Ratings

Parameter	Symbol	Limit Values		Unit	Remarks
		min.	max.		
Voltages					
Supply voltage	V_S	– 0.3	45	V	–
Supply voltage	V_S	– 1	–	V	$t < 0.5$ s; $I_S > -2$ A
Logic input voltages (FB, REF, RANGE, HYST)	V_I	– 0.3	20	V	–
Currents					
Output current (OUT1, OUT2)	I_{OUT}	–	–	A	internally limited
Output current (Diode)	I_{OUT}	– 1	1	A	–
Input current (FB, REF, RANGE, HYST)	I_{IN}	– 2 – 6	2 6	mA mA	 $t < 2$ ms; $t/T < 0.1$
Temperatures					
Junction temperature	T_j	– 40	150	°C	–
Storage temperature	T_{stg}	– 50	150	°C	–
Thermal Resistances					
Junction ambient (P-DIP-8-4)	R_{thjA}		100	K/W	–

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

1.6 Operating Range

Parameter	Symbol	Limit Values		Unit	Remarks
		min.	max.		
Supply voltage	V_S	8	18	V	After V_S rising above $V_{UV\ ON}$
Supply voltage increasing	V_S	– 0.3	$V_{UV\ ON}$	V	Outputs in tristate
Supply voltage decreasing	V_S	– 0.3	$V_{UV\ OFF}$	V	Outputs in tristate
Output current	I_{OUT1-2}	– 0.8	0.8	A	–
Input current (FB, REF)	I_{IN}	– 50	500	µA	–
Junction temperature	T_j	– 40	150	°C	–

Note: In the operating range, the functions given in the circuit description are fulfilled.

1.7 Electrical Characteristics

8 V < V_S < 18 V; I_{OUT1-2} = 0 A; – 40 °C < T_j < 150 °C (unless otherwise specified)

Parameter	Symbol	Limit Values			Unit	Test Condition
		min.	typ.	max.		
Current Consumption						
Supply current	I_S	–	12	20	mA	–
Supply current	I_S	–	20	30	mA	I_{OUT1} = 0.4 A I_{OUT2} = – 0.4 A
Supply current	I_S	–	30	50	mA	I_{OUT1} = 0.8 A I_{OUT2} = – 0.8 A
Over- and Under Voltage Lockout						
UV Switch ON voltage	$V_{UV\ ON}$	–	7.4	8	V	V_S increasing
UV Switch OFF voltage	$V_{UV\ OFF}$	6.3	6.9	–	V	V_S decreasing
UV ON/OFF Hysteresis	V_{UVHY}	–	0.5	–	V	$V_{UV\ ON} - V_{UV\ OFF}$
OV Switch OFF voltage	$V_{OV\ OFF}$	–	20.5	23	V	V_S increasing
OV Switch ON voltage	$V_{OV\ ON}$	17.5	20	–	V	V_S decreasing
OV ON/OFF Hysteresis	V_{OVHY}	–	0.5	–	V	$V_{OV\ OFF} - V_{OV\ ON}$

1.7 Electrical Characteristics (cont'd)

8 V < V_S < 18 V; I_{OUT1-2} = 0 A; – 40 °C < T_j < 150 °C (unless otherwise specified)

Parameter	Symbol	Limit Values			Unit	Test Condition
		min.	typ.	max.		
Outputs OUT1-2						
Saturation Voltages						
Source (upper) I_{OUT} = – 0.2 A	$V_{SAT\ U}$	–	0.85	1.15	V	T_j = 25 °C
Source (upper) I_{OUT} = – 0.4 A	$V_{SAT\ U}$	–	0.90	1.20	V	T_j = 25 °C
Sink (upper) I_{OUT} = – 0.8 A	$V_{SAT\ U}$	–	1.10	1.50	V	T_j = 25 °C
Sink (lower) I_{OUT} = 0.2 A	$V_{SAT\ L}$	–	0.15	0.23	V	T_j = 25 °C
Sink (lower) I_{OUT} = 0.4 A	$V_{SAT\ L}$	–	0.25	0.40	V	T_j = 25 °C
Sink (lower) I_{OUT} = 0.8 A	$V_{SAT\ L}$	–	0.45	0.75	V	T_j = 25 °C
Total drop I_{OUT} = 0.2 A	V_{SAT}	–	1.0	1.4	V	$V_{SAT} = V_{SAT\ U} + V_{SAT\ L}$
Total drop I_{OUT} = 0.4 A	V_{SAT}	–	1.2	1.7	V	$V_{SAT} = V_{SAT\ U} + V_{SAT\ L}$
Total drop I_{OUT} = 0.8 A	V_{SAT}	–	1.6	2.5	V	$V_{SAT} = V_{SAT\ U} + V_{SAT\ L}$
Clamp Diodes						
Forward voltage; upper	V_{FU}	–	1.0	1.5	V	I_F = 0.4 A
Upper leakage current	I_{LKU}	–		5	mA	I_F = 0.4 A
Forward voltage; lower	V_{FL}	–	0.9	1.4	V	I_F = 0.4 A

1.7 Electrical Characteristics (cont'd)

8 V < V_S < 18 V; $I_{OUT1\text{-}2}$ = 0 A; – 40 °C < T_j < 150 °C (unless otherwise specified)

Parameter	Symbol	Limit Values			Unit	Test Condition
		min.	typ.	max.		
Input-Interface						
Input REF						
Quiescent voltage	V_{REFq}	–	200	240	mV	I_{REF} = 0 µA
Input resistance	R_{REF}	4.5	6.0	7.5	kΩ	0 V < V_{REF} < 0.5 V
Input FB						
Quiescent voltage	V_{FBq}	–	200	240	mV	I_{FB} = 0 µA
Input resistance	R_{FB}	4.5	6.0	7.5	kΩ	0 V < V_{FB} < 0.5 V
Input/Output HYST						
Current Offset	I_{HYSTIO} 250	– 2	0.35	3	µA	I_{REF} = I_{FB} = 250 µA V_{HYST} = V_S / 2
	I_{HYSTIO} 40	– 1.3	0	1.3	µA	I_{REF} = I_{FB} = 40 µA V_{HYST} = V_S / 2
Current Amplification $A_{HYST} = I_{HYST} / (I_{REF} - I_{FB})$	A_{HYST}	0.8	0.95	1.1	–	– 20 µA < I_{HYST} < – 10 µA; 10 µA < I_{HYST} < 20 µA; I_{REF} = 250 µA V_{HYST} = V_S / 2
Current Gain $G_{HYST} = (I_{HYST} - I_{HYSTIO40}) / (I_{REF} - I_{FB})$	G_{HYST}	0.8	0.95	1.1	-	I_{HYST} = +/- 2 µA; I_{REF} = 40 µA; V_{HYST} = V_S / 2
Threshold voltage High	V_{HYH} / V_S	51	52	54	%	–
Deadband voltage High	V_{DBH} / V_S	50	50.4	51	%	–

1.7 Electrical Characteristics (cont'd)

8 V < V_S < 18 V; I_{OUT1-2} = 0 A; – 40 °C < T_j < 150 °C (unless otherwise specified)

Parameter	Symbol	Limit Values			Unit	Test Condition
		min.	typ.	max.		
Deadband voltage Low	V_{DBL} / V_S	49	49.6	50	%	–
Threshold voltage Low	V_{HYL} / V_S	46	48	49	%	–
Hysteresis Window	V_{HYW} / V_S	3.0	4.0	5.0	%	$(V_{HYH} - V_{HYL})/ V_S$
Deadband Window	V_{DBW} / V_S	0.4	0.8	1.2	%	$(V_{DBH} - V_{DBL})/ V_S$

Input RANGE

Input current	I_{RANGE}	– 1	–	1	µA	0 V < V_{RANGE} < V_S
Switch-OFF voltage High	V_{OFFH}	– 25	0	100	mV	refer to V_S
Switch-OFF voltage Low	V_{OFFL}	300	400	500	mV	refer to GND

Thermal Shutdown

Thermal shutdown junction temperature	T_{jSD}	150	175	200	°C	–
Thermal switch-on junction temperature	T_{jSO}	120	–	170	°C	–
Temperature hysteresis	ΔT	–	30		K	–

Note: The listed characteristics are ensured over the operating range of the integrated circuit. Typical characteristics specify mean values expected over the production spread. If not otherwise specified, typical characteristics apply at T_A = 25 °C and the given supply voltage.

2 Diagrams

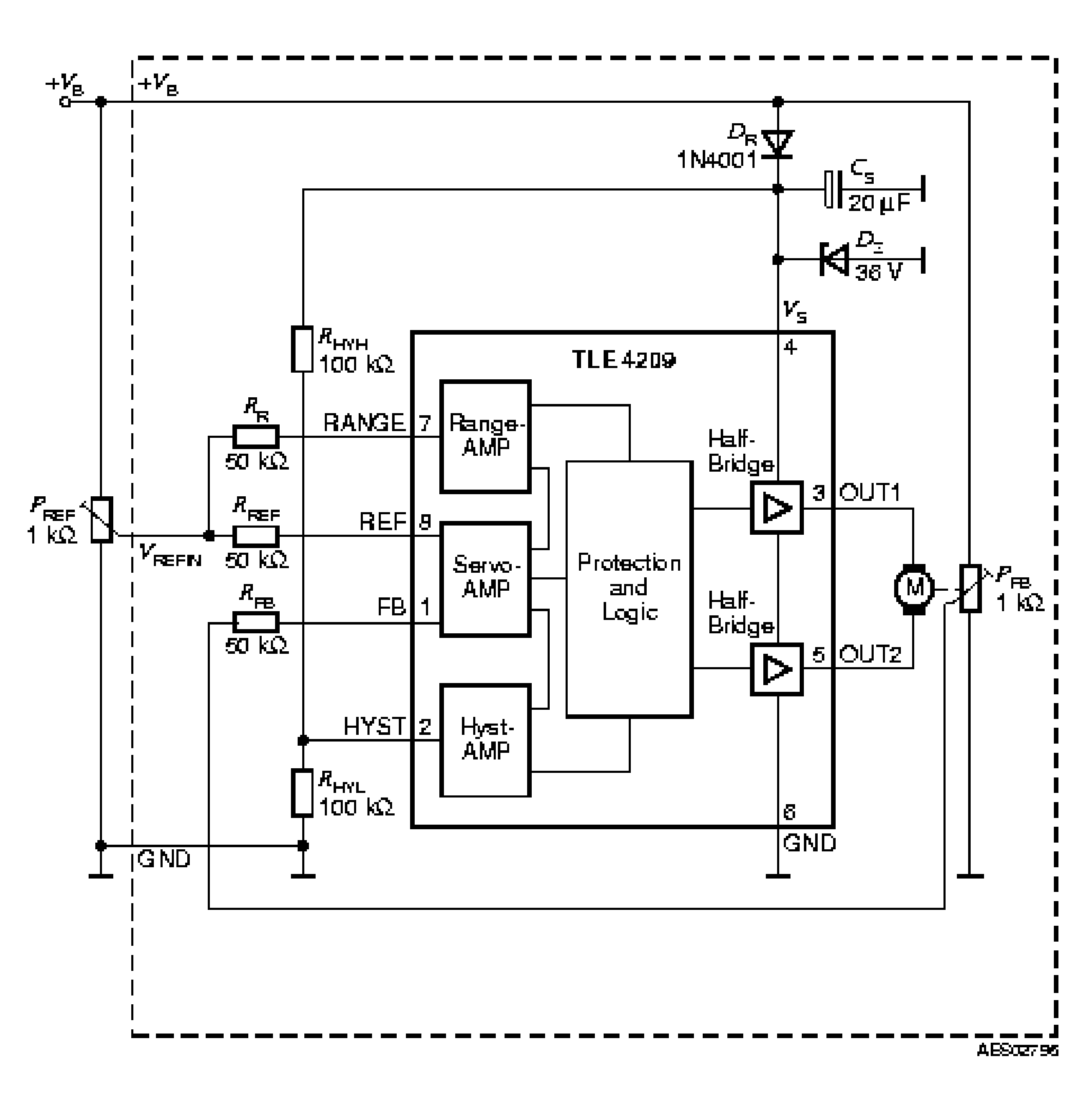


Figure 3 Application Circuit

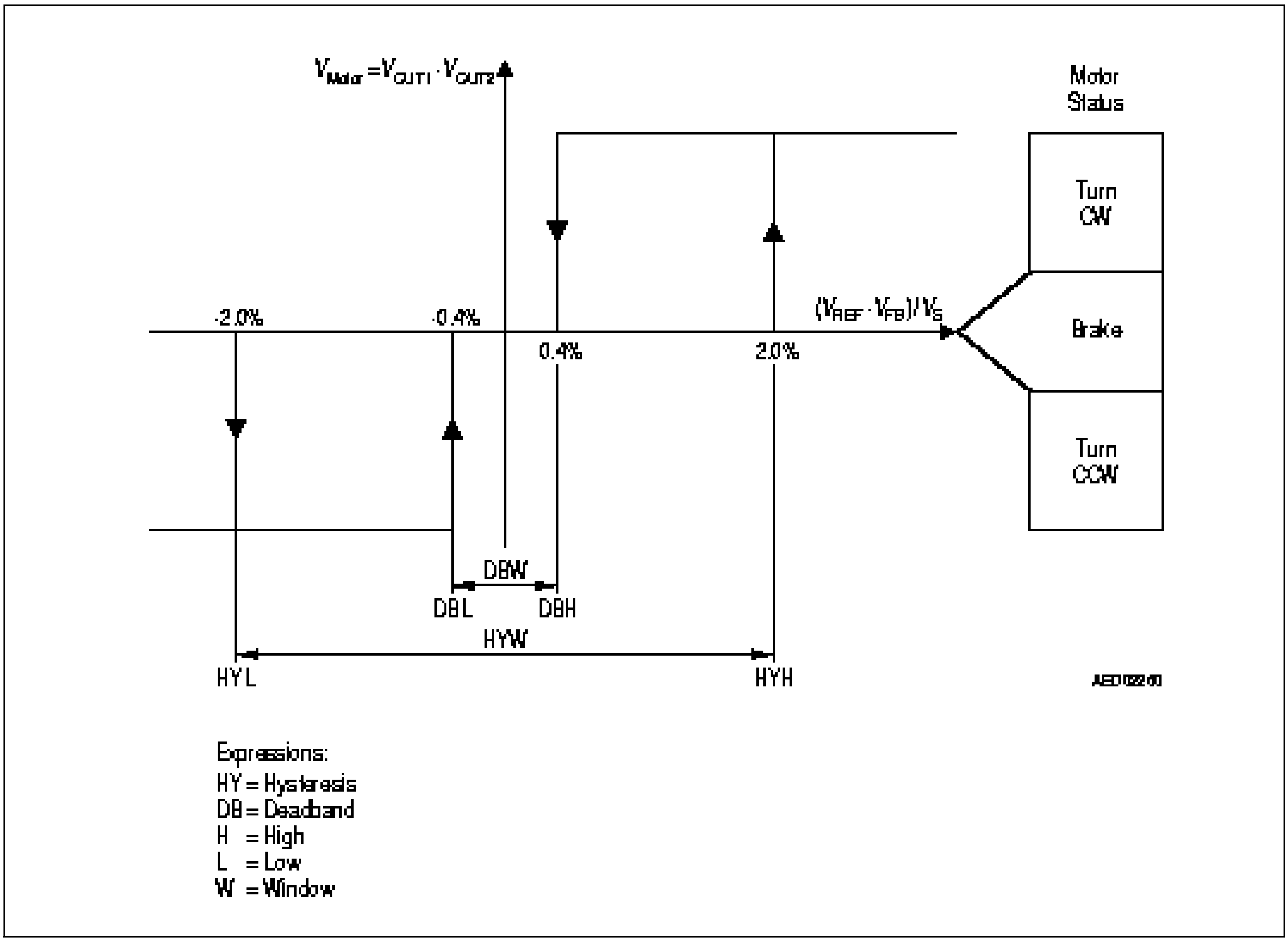


Figure 4 **Hysteresis, Phaselag and Deadband-Definitions**

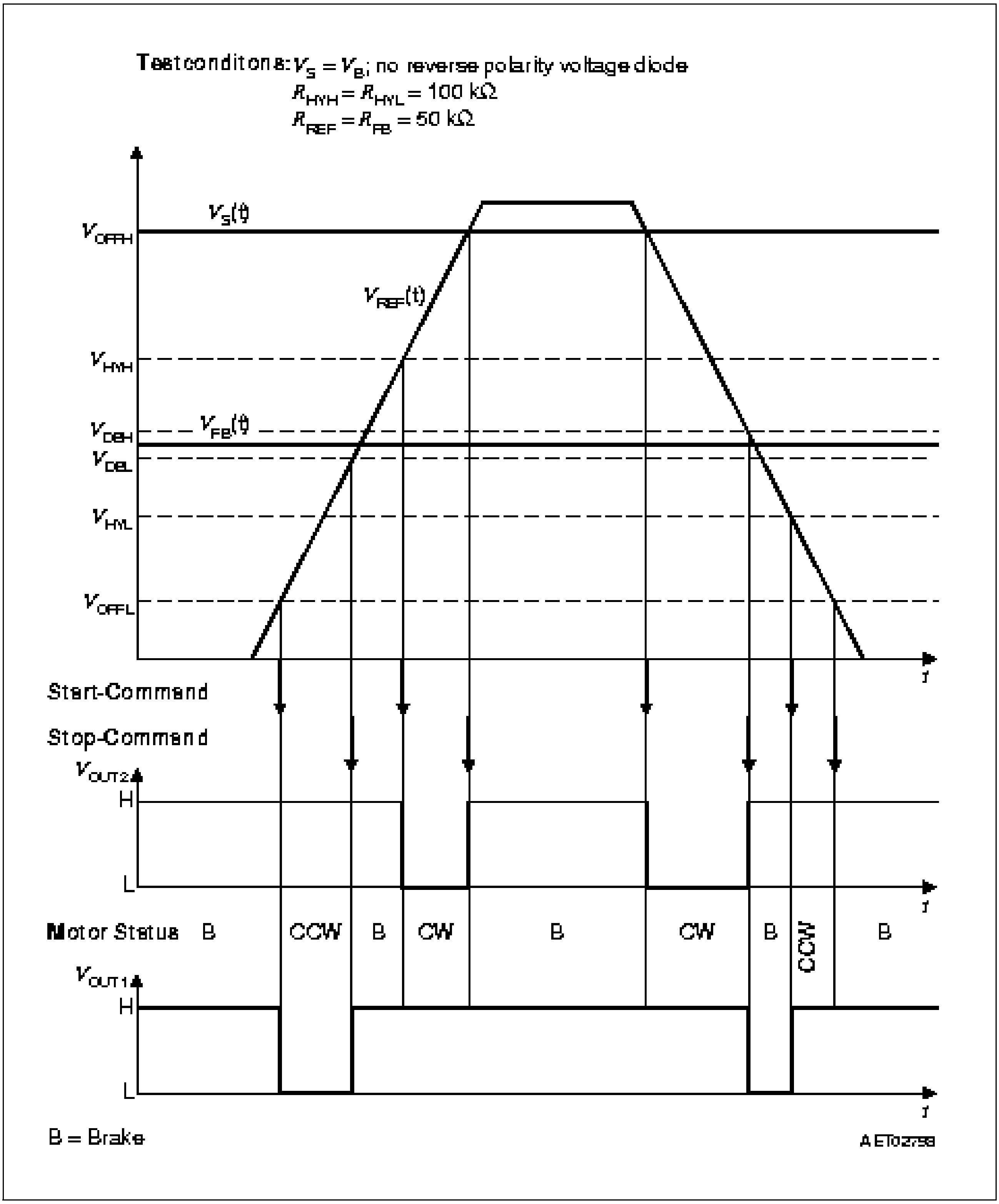
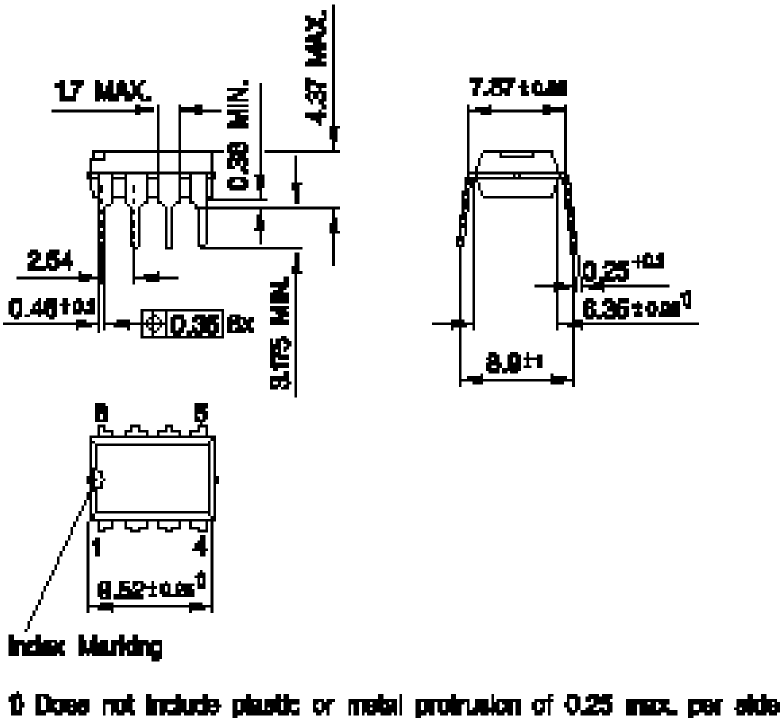


Figure 5 Timing and Phase-Lag

3 Package Outlines

P-DIP-8-4
(Plastic Dual In-line Package)



Sorts of Packing
Package outlines for tubes, trays etc. are contained in our Data Book “Package Information”.

SMD = Surface Mounted Device

Dimensions in mm