

TLE 6258-2

LIN Transceiver

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Automotive Power



Never stop thinking.

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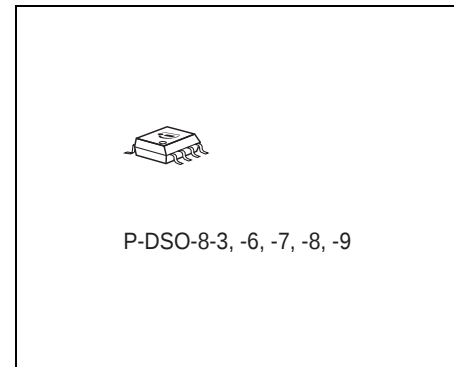
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LIN Transceiver

TLE 6258-2

Features

- Single-wire transceiver, suitable for **LIN** protocol
- Compatible to LIN specification 1.2, 1.3 and 2.0
- Compatible to ISO 9141 functions
- Transmission rate up to 20 kBaud
- Very low current consumption in stand-by mode
- Wake-up from Bus
- Short circuit proof to ground and battery
- Overtemperature protection



Description

The single wire transceiver TLE 6258-2 is a monolithic integrated circuit in a P-DSO-8-3 package. It works as an interface between the protocol controller and the physical bus. The TLE 6258-2 is especially suitable to drive the bus line in LIN systems in automotive and industrial applications. Further it can be used in standard ISO9141 systems.

In order to reduce the current consumption the TLE 6258-2 offers a stand-by mode. A wake-up caused by a message on the bus sets the RxD output low until the device is switched to normal operation mode.

The IC is based on the Smart Power Technology SPT[®] which allows bipolar and CMOS control circuitry in accordance with DMOS power devices existing on the same monolithic circuit.

The TLE 6258-2 is designed to withstand the severe conditions of automotive applications.

Type	Ordering Code	Package
TLE 6258-2 G	Q67006-A9695	P-DSO-8-3

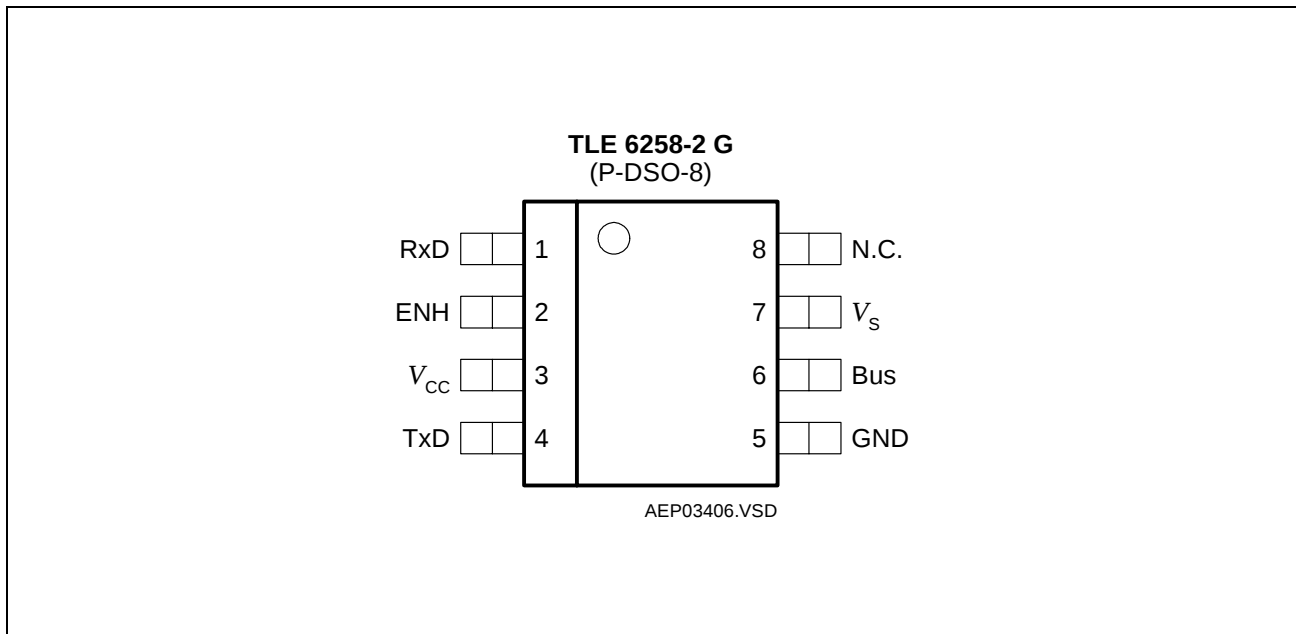


Figure 1 Pin Configuration (top view)

Table 1 Pin Definitions and Functions

Pin No.	Symbol	Function
1	RxD	Receive data output ; integrated pull-up, LOW in dominant state
2	ENN	Enable not input ; integrated 30 k Ω pull-up, transceiver in normal operation mode when LOW
3	V _{CC}	5 V supply input
4	TxD	Transmit data input ; integrated pull-up, LOW in dominant state
5	GND	Ground
6	Bus	Bus output/input ; internal 30 k Ω pull-up, LOW in dominant state
7	V _S	Battery supply input
8	n.c.	Not connected

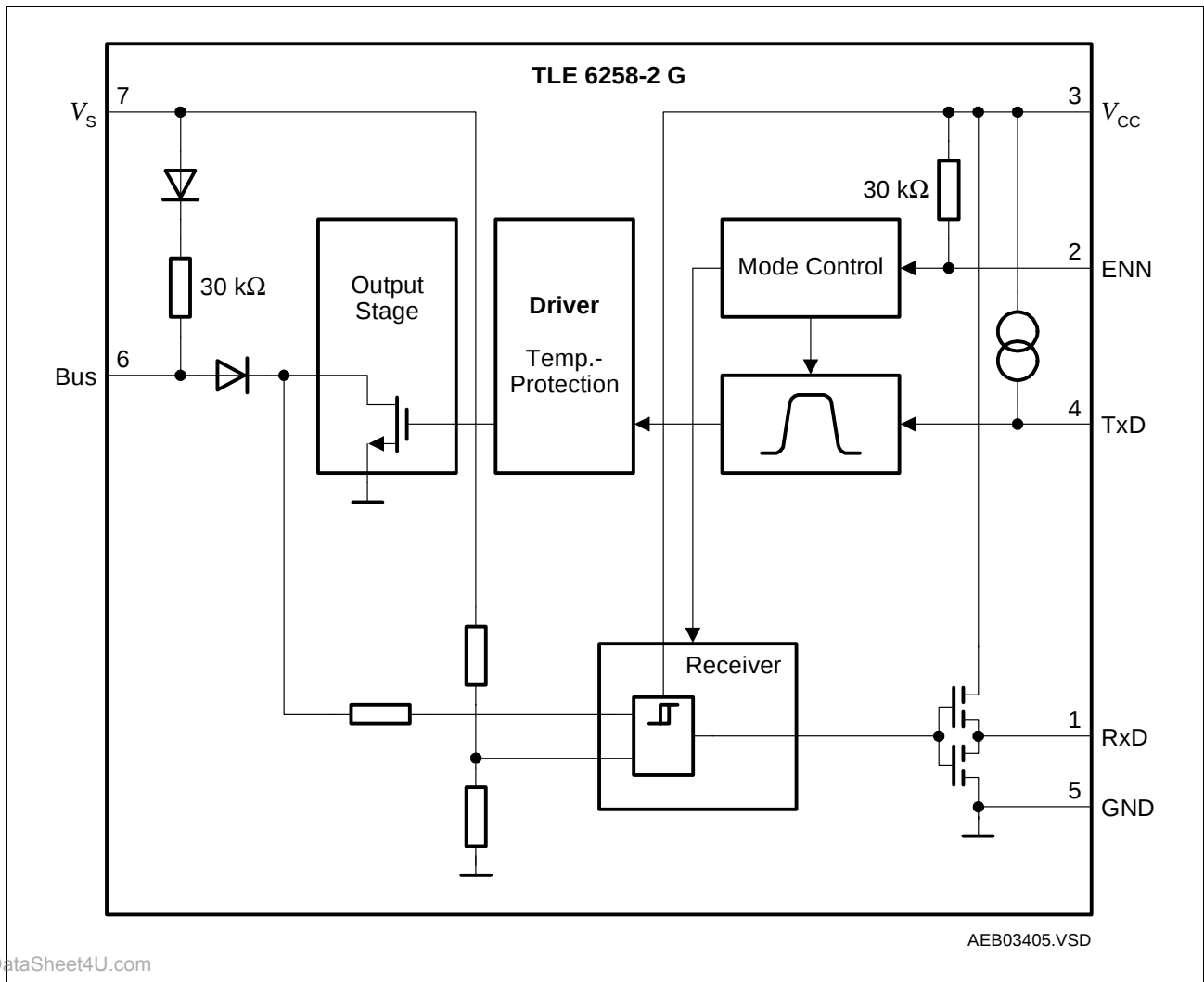


Figure 2 Functional Block Diagram

Application Information

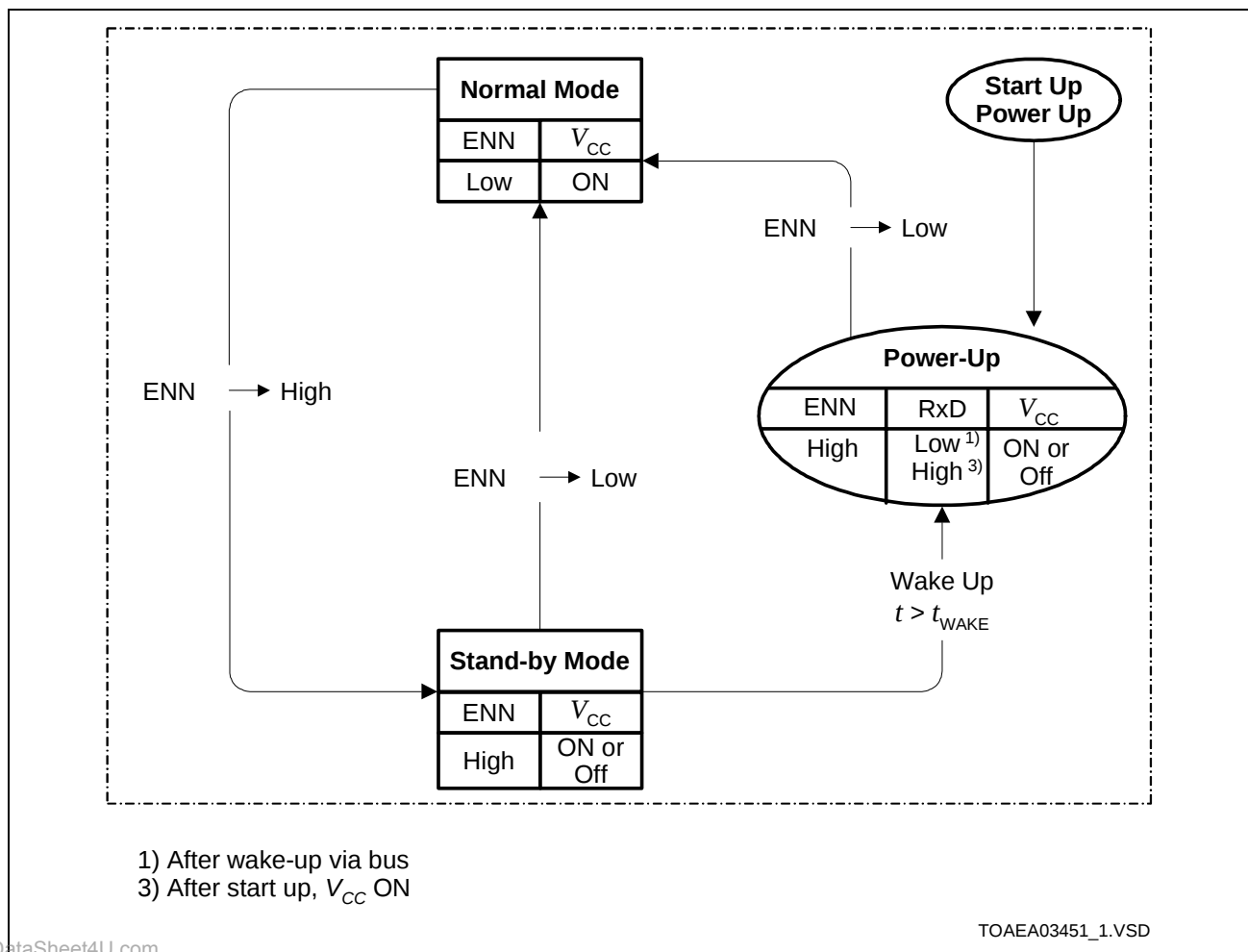


Figure 3 State Diagram

For fail safe reasons the TLE 6258-2 has already a pull-up resistor of 30 k Ω implemented. To achieve the required timings for the dominant to recessive transition of the bus signal an additional external termination resistor of 1 k Ω is required. It is recommended to place this resistor in the master node. To avoid reverse currents from the bus line into the battery supply line in case of an unpowered node, it is recommended to place a diode in series to the external pull-up. For small systems (low bus capacitance) the EMC performance of the system is supported by an additional capacitor of at least 1 nF in the master node (see [Figure 6](#)).

In order to reduce the current consumption the TLE 6258-2 offers a stand-by mode. This mode is selected by switching the Enable Not (ENN) input high (see [Figure 3](#)). In the stand-by mode a wake-up caused by a message on the bus is indicated by setting the RxD output low. When entering the normal mode this wake-up flag is reset and the RxD output is released to transmit the bus data.

Table 2 Absolute Maximum Ratings

Parameter	Symbol	Limit Values		Unit	Remarks
		Min.	Max.		
Voltages					
Supply voltage	V_{CC}	-0.3	6	V	–
Battery supply voltage	V_S	-0.3	40	V	–
Bus input voltage	V_{bus}	-20	32	V	–
Bus input voltage	V_{bus}	-20	40	V	$t < 1\text{ s}$
Logic voltages at EN, TxD, RxD	V_I	-0.3	$V_{CC} + 0.3$	V	$0\text{ V} < V_{CC} < 5.5\text{ V}$
Electrostatic discharge voltage at V_S , Bus	V_{ESD}	-4	4	kV	human body model (100 pF via 1.5 kΩ)
Electrostatic discharge voltage	V_{ESD}	-2	2	kV	human body model (100 pF via 1.5 kΩ)
Temperatures					
Junction temperature	T_i	-40	150	°C	–

Note: Maximum ratings are absolute ratings; exceeding any one of these values may cause irreversible damage to the integrated circuit

Table 3 Operating Range

Parameter	Symbol	Limit Values		Unit	Remarks
		Min.	Max.		
Supply voltage	V_{CC}	4.5	5.5	V	–
Battery Supply Voltage	V_S	6	35	V	–
Junction temperature	T_j	-40	150	°C	–
Thermal Shutdown (junction temperature)					
Thermal shutdown temp.	T_{jSD}	150	170	190	°C
Thermal shutdown hyst.	ΔT	–	10	–	K
Thermal Resistances					
Junction ambient	R_{thj-a}	–	185	K/W	–

Table 4 Electrical Characteristics

4.5 V < V_{CC} < 5.5 V; 6.0 V < V_S < 27 V; $R_L = 500 \Omega$; $V_{ENN} < V_{ENN,ON}$; -40 °C < T_j < 125 °C; all voltages with respect to ground; positive current flowing into pin; unless otherwise specified.

Parameter	Symbol	Limit Values			Unit	Remark
		Min.	Typ.	Max.		
Current Consumption						
Current consumption	I_{CC}	–	0.4	0.7	mA	recessive state; $V_{TxD} = V_{CC}$
Current consumption	I_S	–	0.5	1.0	mA	recessive state; $V_{TxD} = V_{CC}$
Current consumption	I_{CC}	–	0.4	0.8	mA	dominant state; $V_{TxD} = 0\text{ V}$; without R_L
Current consumption	I_S	–	1.3	2.0	mA	dominant state; $V_{TxD} = 0\text{ V}$; without R_L
Current consumption	I_{CC}		0.4	0.7	mA	power-up mode
Current consumption	I_S	–	0.5	1.0	mA	power-up mode, $V_{CC} = 0\text{ V}$, $V_S = 13.5\text{ V}$
Current consumption	I_{CC}	1	3	10	μA	stand-by mode
Current consumption	I_S	–	18	40	μA	stand-by mode

Table 4 Electrical Characteristics (cont'd)

4.5 V < V_{CC} < 5.5 V; 6.0 V < V_S < 27 V; $R_L = 500 \Omega$; $V_{ENN} < V_{ENN,ON}$; -40 °C < T_j < 125 °C; all voltages with respect to ground; positive current flowing into pin; unless otherwise specified.

Parameter	Symbol	Limit Values			Unit	Remark
		Min.	Typ.	Max.		
Enable Not Input (pin ENN)						
HIGH level input voltage threshold	$V_{\text{ENN,off}}$	—	2.8	$0.7 \times V_{\text{CC}}$	V	low power mode
LOW level input voltage threshold	$V_{\text{ENN,on}}$	$0.3 \times V_{\text{CC}}$	2.2	—	V	normal operation mode
ENN input hysteresis	$V_{\text{ENN,hys}}$	300	600	900	mV	—
ENN pull-up resistance	R_{ENN}	15	30	60	kΩ	—
Receiver Output RxD						
HIGH level output current	$I_{\text{RD,H}}$	-1.2	-0.8	-0.5	mA	$V_{\text{RD}} = 0.8 \times V_{\text{CC}}$
LOW level output current	$I_{\text{RD,L}}$	0.5	0.8	1.2	mA	$V_{\text{RD}} = 0.2 \times V_{\text{CC}}$
Transmission Input TxD						
HIGH level input voltage threshold	$V_{\text{TD,H}}$	—	2.9	$0.7 \times V_{\text{CC}}$	V	recessive state
TxD input hysteresis	$V_{\text{TD,hys}}$	300	700	900	mV	—
LOW level input voltage threshold	$V_{\text{TD,L}}$	$0.3 \times V_{\text{CC}}$	2.1	—	V	dominant state
TxD pull-up current	I_{TD}	-150	-110	-70	μA	$V_{\text{TxD}} < 0.3 \times V_{\text{CC}}$

Table 4 Electrical Characteristics (cont'd)

4.5 V < V_{CC} < 5.5 V; 6.0 V < V_S < 27 V; $R_L = 500 \Omega$; $V_{ENN} < V_{ENN,ON}$; -40 °C < T_j < 125 °C; all voltages with respect to ground; positive current flowing into pin; unless otherwise specified.

Parameter	Symbol	Limit Values			Unit	Remark
		Min.	Typ.	Max.		
Bus Receiver						
Receiver threshold voltage, recessive to dominant edge	$V_{bus,rd}$	$0.44 \times V_S$	$0.48 \times V_S$	—	V	$-8 \text{ V} < V_{bus} < V_{bus,dom}$
Receiver threshold voltage, dominant to recessive edge	$V_{bus,dr}$	—	$0.56 \times V_S$	$0.6 \times V_S$	V	$V_{bus,rec} < V_{bus} < 20 \text{ V}$
Receiver hysteresis	$V_{bus,hys}$	$0.02 \times V_S$	$0.04 \times V_S$	$0.1 \times V_S$	mV	$V_{bus,hys} = V_{bus,rec} - V_{bus,dom}$
Receiver threshold center voltage	$V_{bus,cnt}$	$0.475 \times V_S$	$0.5 \times V_S$	$0.525 \times V_S$		LIN2.0 table 3.1
Input leakage current	$I_{bus,lek}$	-1			mA	$V_{bus} = 0\text{V}$, $V_{bat} = 12\text{V}$, pull-up resistor as specified in LIN2.0
Wake-up threshold voltage	V_{wake}	$0.40 \times V_S$	$0.5 \times V_S$	$0.6 \times V_S$	V	—
Bus Transmitter						
Bus recessive output voltage	$V_{bus,rec}$	$0.9 \times V_S$	—	V_S	V	$V_{TxD} = V_{CC}$
Bus dominant output voltage	$V_{bus,dom}$	0	—	2	V	$V_{TxD} = 0 \text{ V}$ $7.3\text{V} < V_S < 27\text{V}$
		0	—	1.2	V	$V_{TxD} = 0 \text{ V}$ $6\text{V} < V_S < 7.3\text{V}$
Bus short circuit current	$I_{bus,sc}$	40	100	150	mA	$V_{bus,short} = 13.5 \text{ V}$
Leakage current	$I_{bus,lk}$	-1	-	—	mA	$V_{CC} = 0 \text{ V}$, $V_S = 0 \text{ V}$, $V_{bus} = -8 \text{ V}$,
		—	10	20	μA	$V_{CC} = 0 \text{ V}$, $V_S = 13.5\text{V}$, $V_{bus} = 20 \text{ V}$,
Bus pull-up resistance	R_{bus}	20	30	47	kΩ	—

Table 4 Electrical Characteristics (cont'd)

4.5 V < V_{CC} < 5.5 V; 6.0 V < V_S < 27 V; $R_L = 500 \Omega$; $V_{ENN} < V_{ENN,ON}$; -40 °C < T_j < 125 °C; all voltages with respect to ground; positive current flowing into pin; unless otherwise specified.

Parameter	Symbol	Limit Values			Unit	Remark
		Min.	Typ.	Max.		
Dynamic Transceiver Characteristics						
Falling edge slew rate	$S_{bus(L)}$	-3	-2.0	-1	V/ μ s	¹⁾ 60% > V_{bus} > 40% $1\mu s < (\tau = R_L \times C_{BUS}) < 5\mu s$; $V_{CC} = 5\text{ V}$; $V_S = 13.5\text{ V}$
Rising edge slew rate	$S_{bus(H)}$	1	1.5	3	V/ μ s	¹⁾ 40% < V_{bus} < 60% $1\mu s < (\tau = R_L \times C_{BUS}) < 5\mu s$; $V_{CC} = 5\text{ V}$; $V_S = 13.5\text{ V}$
Slope symmetry	$t_{slopesym}$	5		-5	μ s	$t_{fslope} - t_{rslope}$ $V_S = 18\text{ V}$
Propagation delay TxD LOW to bus	$t_{d(L),T}$	—	1	3	μ s	$V_{CC} = 5\text{ V}$
Propagation delay TxD HIGH to bus	$t_{d(H),T}$	—	1	3	μ s	$V_{CC} = 5\text{ V}$
Propagation delay bus dominant to RxD LOW	$t_{d(L),R}$	—	1	6	μ s	$V_{CC} = 5\text{ V}$; $C_{RxD} = 20\text{ pF}$
Propagation delay bus recessive to RxD HIGH	$t_{d(H),R}$	—	1	6	μ s	$V_{CC} = 5\text{ V}$; $C_{RxD} = 20\text{ pF}$
Receiver delay symmetry	$t_{sym,R}$	-2	—	2	μ s	$t_{sym,R} = t_{d(L),R} - t_{d(H),R}$
Transmitter delay symmetry	$t_{sym,T}$	-2	—	2	μ s	$t_{sym,T} = t_{d(L),T} - t_{d(H),T}$
Duty cycle D1	t_{duty1}	0.396	—	—	μ s	duty cycle ¹⁾ $TH_{Rec(max)} = 0.744 \times V_S$; $TH_{Dom(max)} = 0.581 \times V_S$; $V_S = 7.0 \dots 18\text{ V}$; $t_{bit} = 50\mu s$; $D1 = t_{bus_rec(min)}/2 t_{bit}$;
Duty cycle D2	t_{duty2}	—	—	0.581	μ s	duty cycle ²⁾ $TH_{Rec(max)} = 0.422 \times V_S$; $TH_{Dom(max)} = 0.264 \times V_S$; $V_S = 7.6 \dots 18\text{ V}$; $t_{bit} = 50\mu s$; $D2 = t_{bus_rec(max)}/2 t_{bit}$;

Table 4 Electrical Characteristics (cont'd)

4.5 V < V_{CC} < 5.5 V; 6.0 V < V_S < 27 V; $R_L = 500 \Omega$; $V_{ENN} < V_{ENN,ON}$; -40 °C < T_j < 125 °C; all voltages with respect to ground; positive current flowing into pin; unless otherwise specified.

Parameter	Symbol	Limit Values			Unit	Remark
		Min.	Typ.	Max.		
Wake-up delay time	t_{wake}	30	100	150	μs	$T_j < 125 \text{ }^\circ C$
				170	μs	$T_j < 150 \text{ }^\circ C$
Delay time for mode change	t_{snorm}			50	μs	

1) Bus load conditions concerning LIN spec 2.0 C_{bus} , $R_{bus} = 1 \text{ nF}$, 1 k Ω / 6.8 nF, 660 Ω / 10 nF, 500 Ω

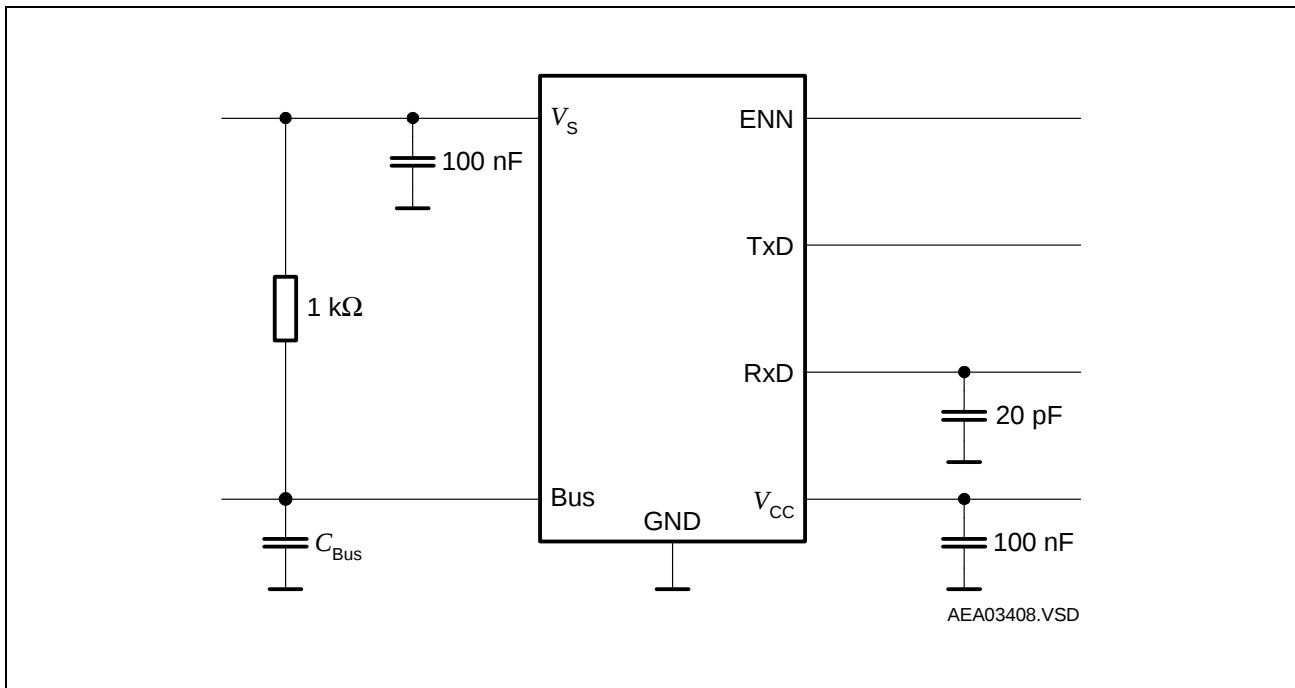


Figure 4 Test Circuits

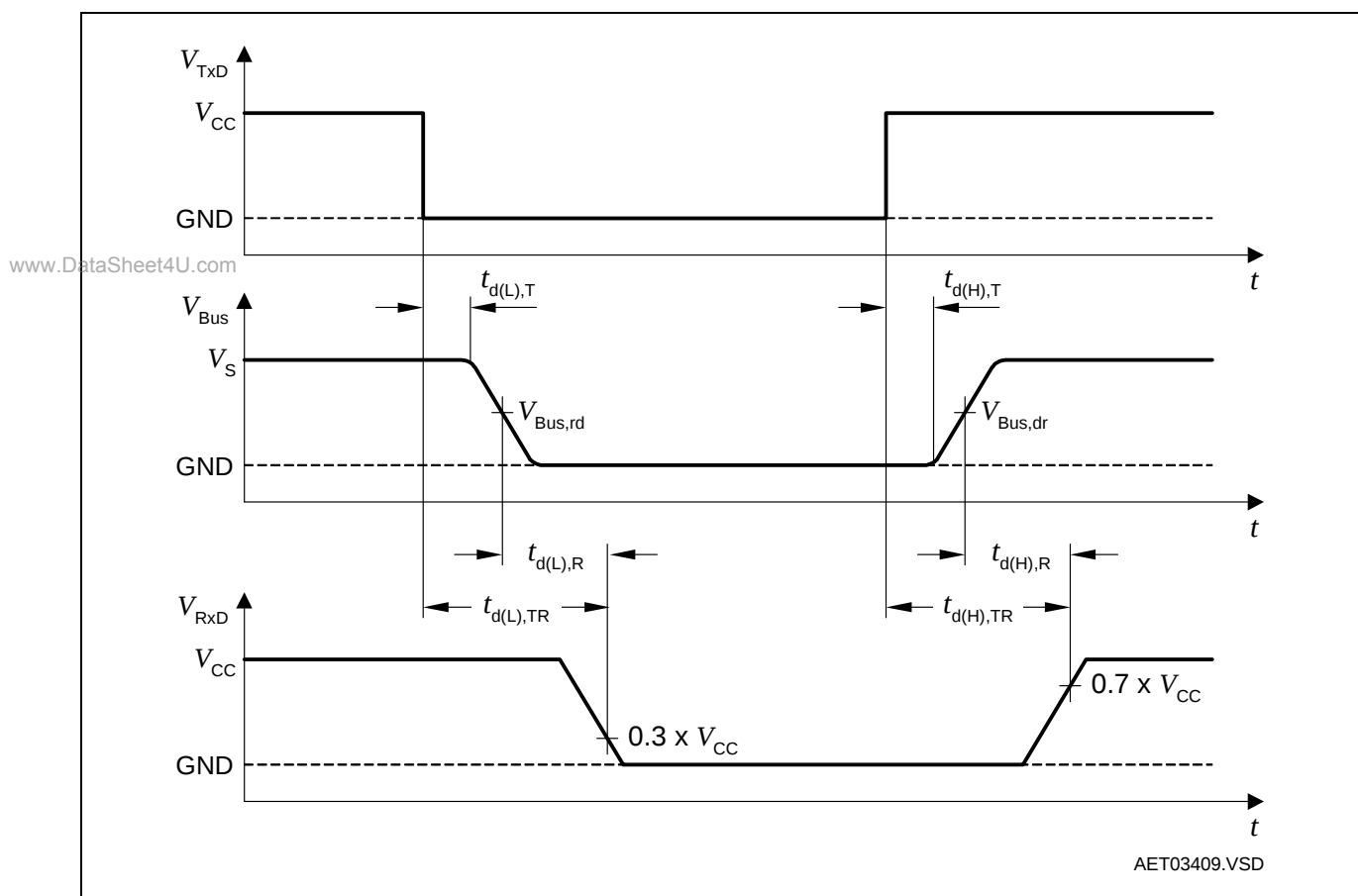
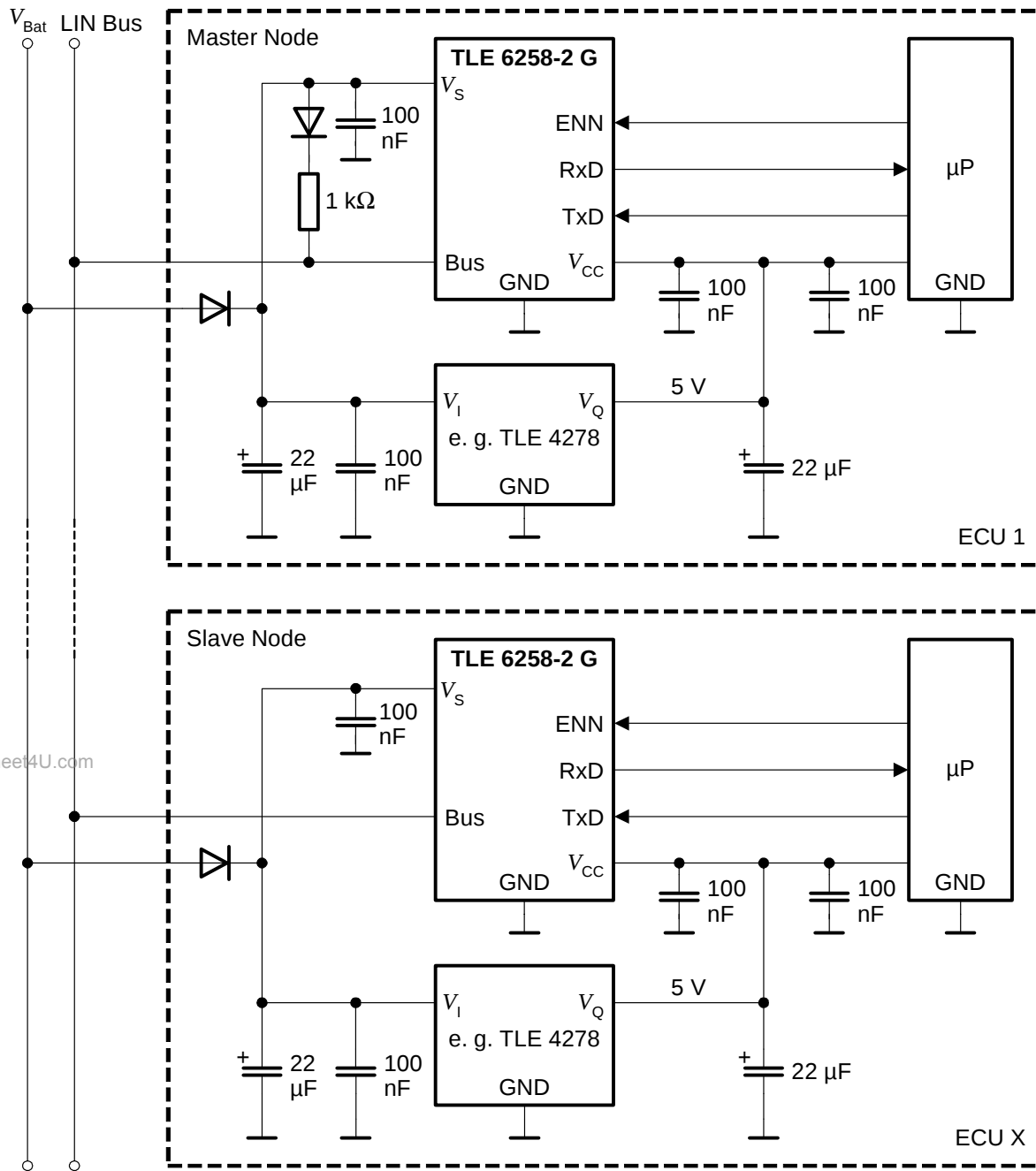


Figure 5 Timing Diagram for Dynamic Characteristics

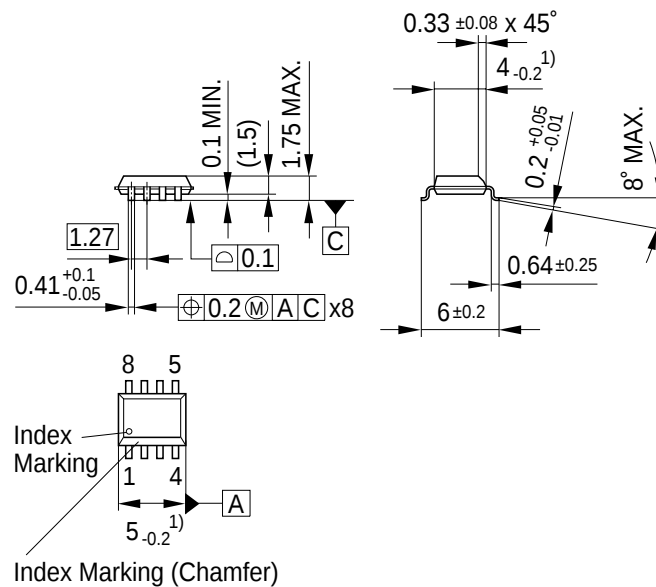
Application



AEA03404.VSD

Figure 6 Application Circuit

Package Outlines



¹⁾ Does not include plastic or metal protrusion of 0.15 max. per side

GPS09032

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Figure 7 P-DSO-8-3 (Plastic Dual Small Outline)

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SMD = Surface Mounted Device

Dimensions in mm