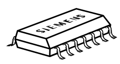
SIEMENS

Single Wire CAN-Transceiver — TLE 6255 G

Target Data Sheet

Features

- Single wire Transceiver
- Ambient operation range – 40 °C to 125 °C
- Supply voltage operation range 5.5 V to 28 V
- Very low current consumption in sleep mode
- CAN-Bus, Load and V_{batt} pins 4 kV ESD protected
- Short circuit and overtemperature protected
- Input bilevel feature for controller wake-up
- Output bilevel feature for wake up call
- Loss of Ground protection
- Bus dominant timeout feature
- Programmable bus out slewrate
- Under- and over-voltage-lockout
- High speed mode up to 100 Kbit/s



P-DSO-14

Type	Ordering Code	Package
▼ TLE 6255 G	Q67006-A9352	P-DSO-14 (SMD)

▼ New type

Functional Description

The TLE 6255 G is a special featured low speed Single-Wire-Bus Transceiver.
The device is designed primarily for use in single wire CAN systems operating with various CSMA/CR (carrier sense multiple access/collision resolution) protocols such as the BOSCH Controler Area Network (CAN) version 2.0.
The normal communication bit rate is typically 25 Kbit/s. For software or diagnosic data download the bitrate may be increased to 100 Kbit/s.
With many integrated features such as slewrate controlled output, loss of ground circuit, bi-level wake-up and sleep mode the TLE 6255 G is optimized for use in most all automotive applications.
The device is based on Siemens power technology SPT® which allows bipolar and CMOS control circuitry to be integrated with DMOS power devices on the same monolithic circuitry.
Additional features like short circuit and overtemperature protection, over- and undervoltage lockout, wide operational temperature and supply voltage ranges and an enhanced power SO-package with high thermal capacity and low thermal resistance will enhance the realibility and robustness of the TLE 6255 G.

Mode Control

Two mode control pins (M0: and M1) makes it possible to enter the following modes:

1.) Sleep-Mode (M1 = L; M0 = L):

Device in sleepmode with very low current consumption. Wakeup can be done by the mode control pins or if the device recognizes a high voltage wake-up signal on the bus.
If there is no modification on the mode inputs the device will return to sleep mode after the wakeup signal is removed from the bus.
The transceiver's loss of ground protection circuit connection to ground is not interrupted when in the sleep mode.

2.) High-Speed-Mode (M1 = L; M0 = H):

Device in high speed mode for software or diagnosic data download with bitrates up to 100 Kbit/s. The slewrate control feature is deactivated in this mode.

3.) Wakeup-Call Mode (M1 = H; M0 = L):

In this mode the TLE 6255 GG will send a high voltage wake-up message waveform on the bus.
The bus includes a special node wake up capability which allows normal communication to take place among some nodes while leaving the other nodes in an undisturbed sleep state. This is accomplished by controlling the level of the signal voltages such that all nodes must wake up when they receive a higher voltage message signal waveform.
Communication at the lower, normal voltage levels shall not disturb the sleeping nodes (V_{batt} > 9 V).

4.) Normal Mode (M1 = H; M0 = H):

In this mode the TLE 6255 GG will send a normal voltage message waveform on the bus. Transmission bit rate in normal communication is typically 25 Kbits/sec.
In Normal transmission mode the waveform rise times are controlled.
Waveform trailing edge control is required to assure that high frequency components are minimized at the beginning of the downward voltage slope. The remaining fall time occurs after the bus is inactive with drivers off and is determined by the RC time constant of the total bus load.

Slew-Rate Control

Output voltage and current is controlled by an internal waveshaping circuit; programmable by an external resistor connected from pin RSL to V_{CC}.

Transmitter

The TLE 6255 GG contains a high current fully short circuit and overtemperature protected highside-driver (pin CANH). To minimise spectral content the CANH-output waveform in normal and wakeup-mode is slewrate controlled.
Logic low (TxD = L) on pin TxD will command the output stage to switch to dominant high potential; TxD = H to recessive low on the bus.
To avoid a dominant bus, blocked by a faulty TxD input signal, the TLE 6255 GG incorporates a timeout feature. In case of TxD = L for longer than the internal fixed timeout the CANH output is switched to recessive state automatically. The timeout is resetted by a H-signal at TxD without a delay.
The loss of an ECU ground may cause the ECU to source current through the various ECU circuits to the communications bus instead of to the vehicle system ground. Therefore the unit-load resistor of any ECU is connected to the LOAD-pin. The TLE 6255 G incorporates a reverse protected switch from LOAD to ground potential. This switch is automatically switched off in a loss of ground state.

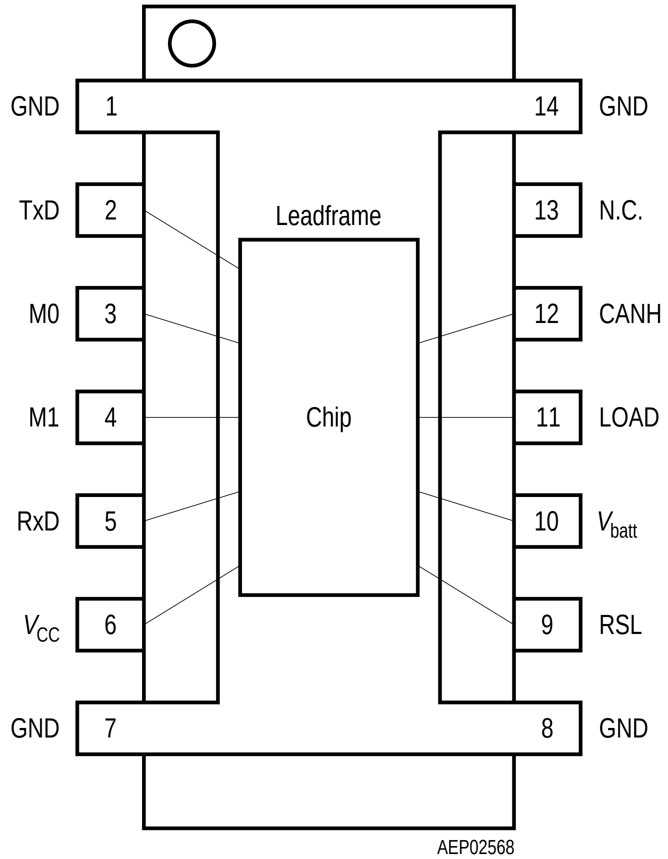
Receiver

In normal, high speed and wakeup-mode all logic data on the bus is sensed by the receive comparator and sent to the microcontroller. In sleep mode no data is transfered. The receive threshold is set to the wakeup level. So a wakeup interrupt is sent only in case of a wakeup call on the bus. An internal fixed filter time avoids false triggering.
RxD = H indicates a bus recessive state, RxD = L a bus normal or high voltage dominant state.

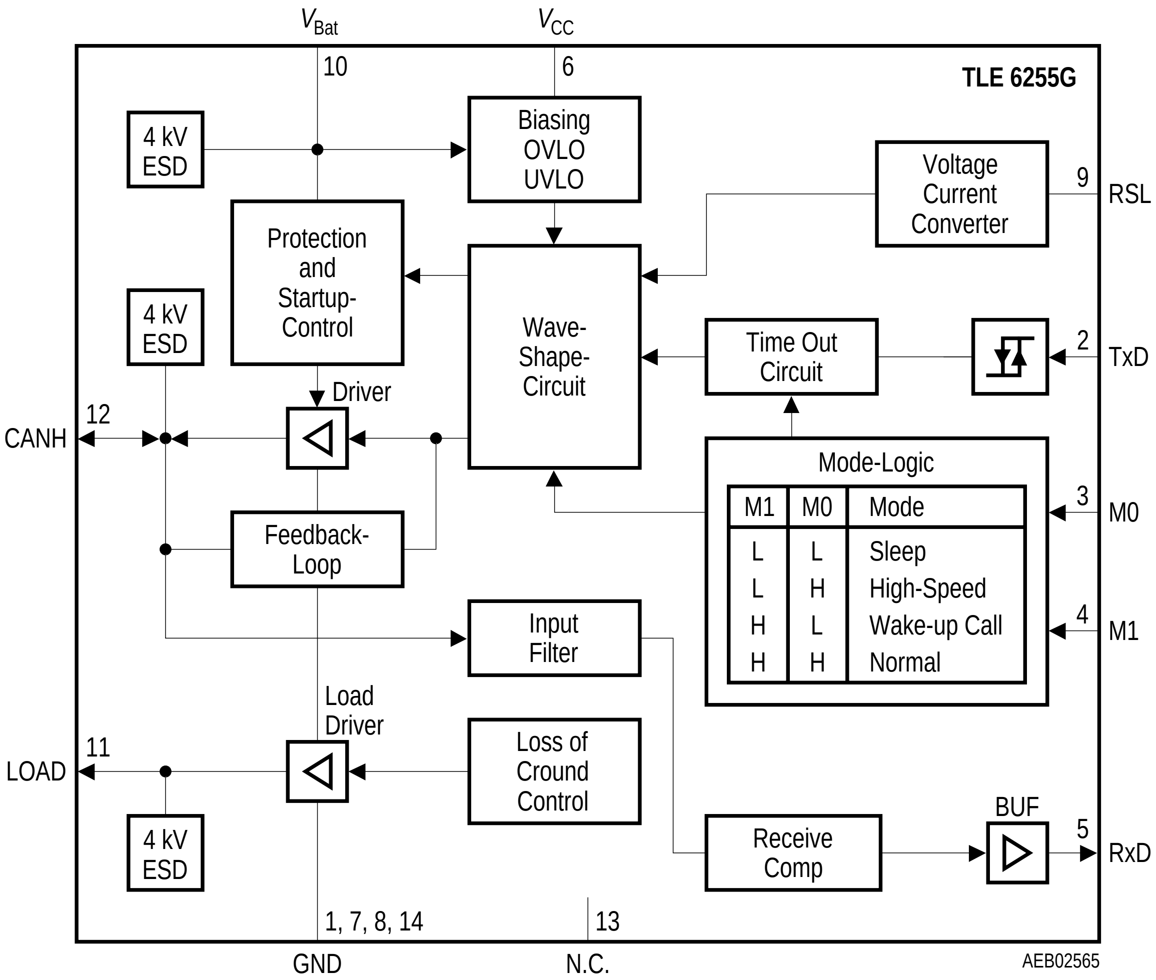
Pin Definitions and Functions

Pin No.	Symbol	Function
1, 7, 8, 14	GND	**Ground**; internally connected to leadframe
2	TxD	**Transceive-Input**; logic command to transmit on the single wire CAN bus; inverting (L = CANH is dominant); external pull up
3	M0	**Mode-Input 0**; to program the device operating mode; internal pull down
4	M1	**Mode-Input 1**; to program the device operating mode; internal pull down
5	RxD	**Receive-Output**; logic data as sensed on the single wire CAN bus; inverting (RxD = L when CANH is dominant); open drain
6	V_{CC}	**Supply Voltage**; input for logic supply voltage
9	RSL	**Slewrate- Program-Input**; an external resistor to V_{CC} on this pin will program the bus output slewrate
10	V_{batt}	**Battery Supply Voltage**; external blocking capacitor necessary (see application circuit)
11	LOAD	**Unit-Load Resistor Ground Input**; contains the loss of ground low side switch to GND
12	CANH	**CAN Bus Input/Output**; single wire bus input and output; short circuit protected
13	N.C.	**Not Connected**

Pin Configuration
(top view)



Block Diagram



Absolute Maximum Ratings

Parameter	Symbol	Limit Values		Unit	Remarks
		min.	max.		
Voltages					
Supply voltage	V_{batt}	– 0.3	40	V	–
CAN bus input/output voltage	V_{CANH}	– 28	28	V	–
Load voltage	V_{LOAD}	– 28	28	V	–
Logic supply voltage	V_{CC}	– 0.3	7	V	–
Logic voltages (V_{RxD}; V_{TxD}; V_{M0}; V_{M1}; V_{RSL})	V_{logic}	– 0.3	7	V	–
Currents					
CAN Bus current	I_{CANH}	–	–	mA	internally limited
Load current	I_{LOAD}	–	–	mA	internally limited
ESD-Protection (Human Body Model; According to MIL STD 833 D)					
pin CANH, Load, V_{batt}	V_{ESD}	– 4000	4000	V	–
other pins	V_{ESD}	– 2000	2000	V	–
Temperatures					
Junction temperature	T_j	– 40	150	°C	–
Junction temperature	T_j	–	175	°C	t < 1000 h
Junction temperature	T_j	–	200	°C	t < 10 h
Storage temperature	T_{stg}	– 50	150	°C	–
Thermal Resistances					
Junction to pin	$R_{thj\text{-}pin}$	–	40	K/W	junction to pin 1
Junction ambient	$R_{thj\text{-}a}$	–	65	K/W	–

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

Operating Range

Parameter	Symbol	Limit Values		Unit	Remarks
		min.	max.		
Supply voltage	V_{batt}	V_{UVOFF}	28	V	After V_{batt} rising above $V_{UV\ ON}$
Supply voltage increasing	V_{batt}	– 0.3	$V_{UV\ ON}$	V	Outputs in tristate
Supply voltage decreasing	V_{batt}	– 0.3	$V_{UV\ OFF}$	V	Outputs in tristate
Output current	I_{CANH}	– 0.8	150	mA	–
Logic supply voltage	V_{CC}	V_{POROF}	5.5	V	After V_{CC} rising above V_{PORON}
Logic supply voltage; increasing	V_{CC}	– 0.3	V_{PORON}	V	Outputs in tristate
Logic supply voltage; decreasing	V_{CC}	– 0.3	V_{POROF}	V	Outputs in tristate
Junction temperature	T_j	– 40	150	°C	–

Electrical Characteristics

5.5 V < V_{batt} < 16 V; 4.75 V < V_{CC} < 5.25 V; – 40 °C < T_j < 150 °C; M0 = M1 = H; R_{UL} = 10k7 Ω (connected between CANH and LOAD); R_{RSL} = 100 kΩ; all voltages with respect to ground; positive current defined flowing into pin; unless otherwise specified

Parameter	Symbol	Limit Values			Unit	Test Condition
		min.	typ.	max.		
Current Consumption						
Supply current at V_{batt}; sleep mode	I_{batt}	–	–	60	µA	M0 = M1 = L; T_j < 125 °C
Supply current at V_{CC}; sleep mode	I_{CC}	–	–	40	µA	M0 = M1 = L; T_j < 125 °C
Supply current at V_{batt}	I_{batt}	–	2	6	mA	TxD = L
Supply current at V_{batt}	I_{batt}	–	1	3	mA	TxD = H
Supply current at V_{batt}	I_{batt}	–	3	8	mA	TxD = L; M0 = L
Supply current at V_{batt}	I_{batt}	–	2	4	mA	TxD = H; M0 = L
Supply current at V_{CC}	I_{CC}	–	2	5	mA	TxD = H or L; M0 = H or L

Electrical Characteristics (cont'd)

5.5 V < V_{batt} < 16 V; 4.75 V < V_{CC} < 5.25 V; – 40 °C < T_j < 150 °C; M0 = M1 = H;
R_{UL} = 10k7 Ω (connected between CANH and LOAD); R_{RSL} = 100 kΩ; all voltages with respect to ground; positive current defined flowing into pin; unless otherwise specified

Parameter	Symbol	Limit Values			Unit	Test Condition
		min.	typ.	max.		
Over- and Under Voltage Lockout						
UV Switch ON voltage	V_{UVON}	–	6	7	V	V_{batt} increasing
UV Switch OFF voltage	V_{UVOFF}	4.00	4.75	5.50	V	V_{batt} decreasing
UV ON/OFF Hysteresis	V_{UVHY}	–	1.25	–	V	$V_{UVON} - V_{UVOFF}$
OV Switch OFF voltage	V_{OVOFF}	30	34	38	V	V_{batt} increasing
OV Switch ON voltage	V_{OVON}	28	32	36	V	V_{batt} decreasing
OV ON/OFF Hysteresis	V_{OVHY}	–	2	–	V	$V_{OVOFF} - V_{OVON}$
Power ON/OFF Reset at V_{CC}						
Power ON Reset voltage	V_{PORON}	4.00	4.25	4.50	V	V_{CC} increasing
Power OFF Reset voltage	V_{POROF}	3.50	3.75	4.00	V	V_{CC} decreasing
POR ON/OFF Hysteresis	V_{PORHY}	–	0.5	–	V	$V_{PORON} - V_{POROF}$
Transceive Input TxD						
H-input voltage threshold	V_{TxDH}	–	–	$0.7 \times V_{CC}$	V	–
L-input voltage threshold	V_{TxDL}	$0.3 \times V_{CC}$	–	–	V	–
Hysteresis of input voltage	V_{TxDHY}	50	200	500	mV	–
Pull up current	I_{TxD}	5	10	20	µA	0 V < V_{TxD} < 4 V
Timeout reaction time	t_{TOR}	5	10	30	ms	–

Electrical Characteristics (cont'd)

5.5 V < V_{batt} < 16 V; 4.75 V < V_{CC} < 5.25 V; – 40 °C < T_j < 150 °C; M0 = M1 = H; R_{UL} = 10k7 Ω (connected between CANH and LOAD); R_{RSL} = 100 kΩ; all voltages with respect to ground; positive current defined flowing into pin; unless otherwise specified

Parameter	Symbol	Limit Values			Unit	Test Condition
		min.	typ.	max.		
Receive Output RxD						
Output leakage current	I_{RxDLK}	–	–	10	µA	V_{RxD} = 5 V
Output low voltage level	V_{RxDL}	–	0.2	0.4	V	I_{RxDL} = 2 mA
Falltime	t_{FRxD}	–	–	200	ns	C_{RxD} = 25 pF to GND; R_{RxD} = 2k5 Ω
Mode Input M0 and M1						
H-input voltage threshold	$V_{M0,1H}$	–	–	0.7 × V_{CC}	V	–
L-input voltage threshold	$V_{M0,1L}$	0.3 × V_{CC}	–	–	V	–
Hysteresis of input voltage	$V_{M0,1HY}$	50	200	500	mV	–
Pull down current	$I_{M0,1}$	10	25	100	µA	1 V < $V_{M0,1}$ < 5 V
Mode Change Delaytimes						
Normal to high-speed	t_{DNH}	–	–	30	µs	M1 H to L
Normal to wakeup call	t_{DNW}	–	–	30	µs	M0 H to L
Normal to sleep	t_{DNS}	–	–	500	µs	M0 and M1 H to L
Sleep to normal	t_{DSN}	–	–	50	µs	M0 and M1 L to H
Slewrate Input RSL						
Output voltage	V_{RSL}	–	3	–	V	I_{RSL} = 20 µA

Electrical Characteristics (cont'd)

5.5 V < V_{batt} < 16 V; 4.75 V < V_{CC} < 5.25 V; – 40 °C < T_j < 150 °C; M0 = M1 = H; R_{UL} = 10k7 Ω (connected between CANH and LOAD); R_{RSL} = 100 kΩ; all voltages with respect to ground; positive current defined flowing into pin; unless otherwise specified

Parameter	Symbol	Limit Values			Unit	Test Condition
		min.	typ.	max.		
CANH as Bus Input						
Wake up offset threshold	V_{IHWUO}	V_{batt} – 4.30	–	V_{batt} – 3.25	V	see Note
Wake up fixed threshold	V_{IHWUF}	6.15	–	8.10	V	see Note
Wakeup dead time	t_{DWU}	5	–	50	µs	–
Wakeup minimal pulse time	t_{WUMIN}	1	–	10	µs	–
Receive threshold; in normal, high-speed and wakeup mode	V_{IH}	1.8	–	2.2	V	–
Receive hysteresis	V_{RHY}	50	100	200	mV	–
Receive propagation time	t_{CRF}	–	–	1	µs	RxD = H to L; 8 V < V_{batt} < 16 V
Receive propagation time; high speed	t_{CRF}	–	–	0.5	µs	RxD = H to L; M1 = L, 8 V < V_{batt} < 16 V
Receive propagation time	t_{CRR}	–	–	1	µs	RxD = L to H; R_{RxD} = 2k5 Ω 8 V < V_{batt} < 16 V
Receive propagation time; high speed	t_{CRR}	–	–	0.5	µs	RxD = L to H; M1 = L; R_{RxD} = 2k5 Ω 8 V < V_{batt} < 16 V
Receive blanking time after CANH H to L transition	t_{CRB}	1.5	3.0	5.0	µs	see diagram 2.5

Electrical Characteristics (cont'd)

5.5 V < V_{batt} < 16 V; 4.75 V < V_{CC} < 5.25 V; – 40 °C < T_j < 150 °C; M0 = M1 = H; R_{UL} = 10k7 Ω (connected between CANH and LOAD); R_{RSL} = 100 kΩ; all voltages with respect to ground; positive current defined flowing into pin; unless otherwise specified

Parameter	Symbol	Limit Values			Unit	Test Condition
		min.	typ.	max.		
CANH as Bus Output						
Offset wakeup output high voltage	V_{OHWUO}	V_{batt} – 1.5	–	V_{batt}	V	100 Ω < R_{UL} < 10k7 Ω,TxD = L; M0 = L; 8 V < V_{batt} < 16 V
Fixed wakeup output high voltage	V_{OHWUF}	9.8	–	V_{batt}	V	100 Ω < R_{UL} < 10k7 Ω TxD = L; M0 = L
Bus output high voltage; normal and high speed	V_{OH}	3.60	–	4.55	V	100 Ω < R_{UL} < 10k7 Ω TxD = L; 8 V < V_{batt} < 16 V
Bus output current limit	I_{OLI}	150	220	300	mA	TxD = L; V_{CANH} = 0 V
Bus output leakage current	I_{OLK}	–	–	10	µA	TxD = H; T_j < 85 °C; – 20 V < V_{CANH}< V_{batt}
Bus output leakage current (loss of ground)	I_{OLK}	–	–	50	µA	0 V < V_{batt} < V_{UVOFF}; – 20 V < V_{CANH}< V_{batt}
Slew rate rising edge	S_{CANH}	–	0.8	–	V/µs	30% < V_{CANH} < 70% 100 Ω < R_{UL} < 10k7 Ω
Slew rate rising edge; high speed; M1 = L	S_{CANH}	–	5	–	V/µs	30% < V_{CANH} < 70% 100 Ω < R_{UL} < 10k7 Ω
Transmit propagation time	t_{TCF}	–	5.5	7.0	µs	TxD = H to L; 8 V < V_{batt} < 16 V
Transmit propagation time; high speed	t_{TCF}	–	0.5	1.0	µs	TxD = H to L; M1 = L; 8 V < V_{batt} < 16 V
Transmit propagation time	t_{TCR}	–	5.5	7.0	µs	TxD = L to H; 8 V < V_{batt} < 16 V
Transmit propagation time high speed	t_{TCR}	–	0.5	1.0	µs	TxD = L to H; M1 = L; 8 V < V_{batt} < 16 V
Bus output transition time; rising edge	t_{tR}	–	3	6	µs	8 V < V_{batt} < 16 V

Electrical Characteristics (cont'd)

5.5 V < V_{batt} < 16 V; 4.75 V < V_{CC} < 5.25 V; – 40 °C < T_j < 150 °C; M0 = M1 = H; R_{UL} = 10k7 Ω (connected between CANH and LOAD); R_{RSL} = 100 kΩ; all voltages with respect to ground; positive current defined flowing into pin; unless otherwise specified

Parameter	Symbol	Limit Values			Unit	Test Condition
		min.	typ.	max.		
Bus output transition time; rising edge; high speed	t_{tR}	–	0.5	1.0	µs	M1 = L; 8 V < V_{batt} < 16 V
Bus output transition time; falling edge	t_{tF}	–	3	6	µs	8 V < V_{batt} < 16 V
Bus output transition time; falling edge; high speed	t_{tF}	–	0.5	1.0	µs	M1 = L; 8 V < V_{batt} < 16 V

Unit-Load Resistor Ground Input LOAD

Parameter	Symbol	min.	typ.	max.	Unit	Test Condition
Output low voltage level	V_{LOAD}	–	50	100	mV	I_{LOAD}= 2 mA; 8 V < V_{batt} < 16 V
Output leakage current (loss of ground)	I_{LOADLK}	–	–	50	µA	0 V < V_{bat} < V_{UVOFF} – 20 V < V_{LOAD} < 20 V

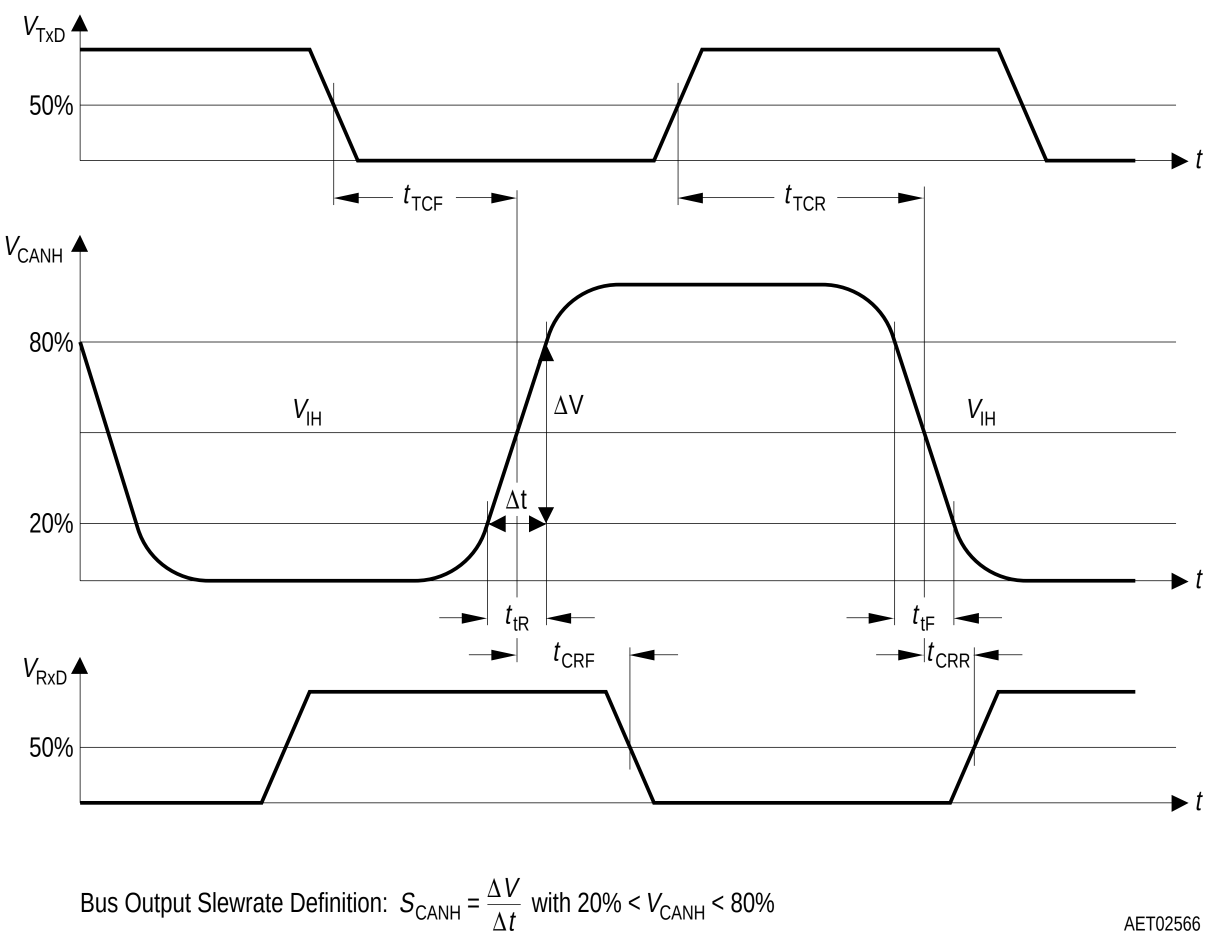
Thermal Shutdown

Parameter	Symbol	min.	typ.	max.	Unit	Test Condition
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 device will send a wake up call to the microcontroller at the minimum of V_{IHWUO} *or* V_{IHWUF}

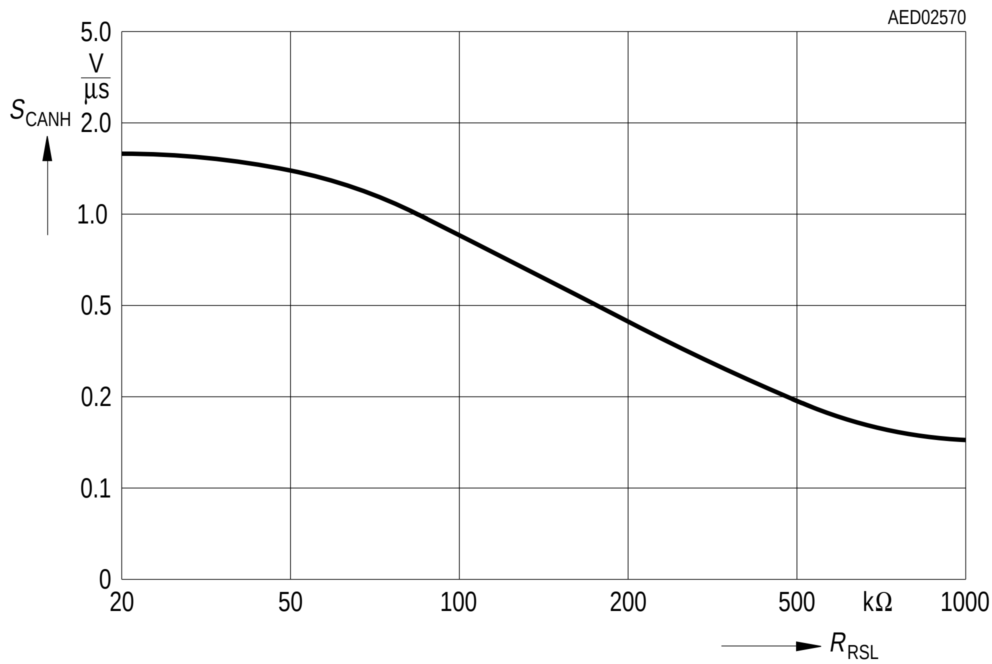
Diagrams

Input/Output-Timing (Pin CANH, TxD and RxD)

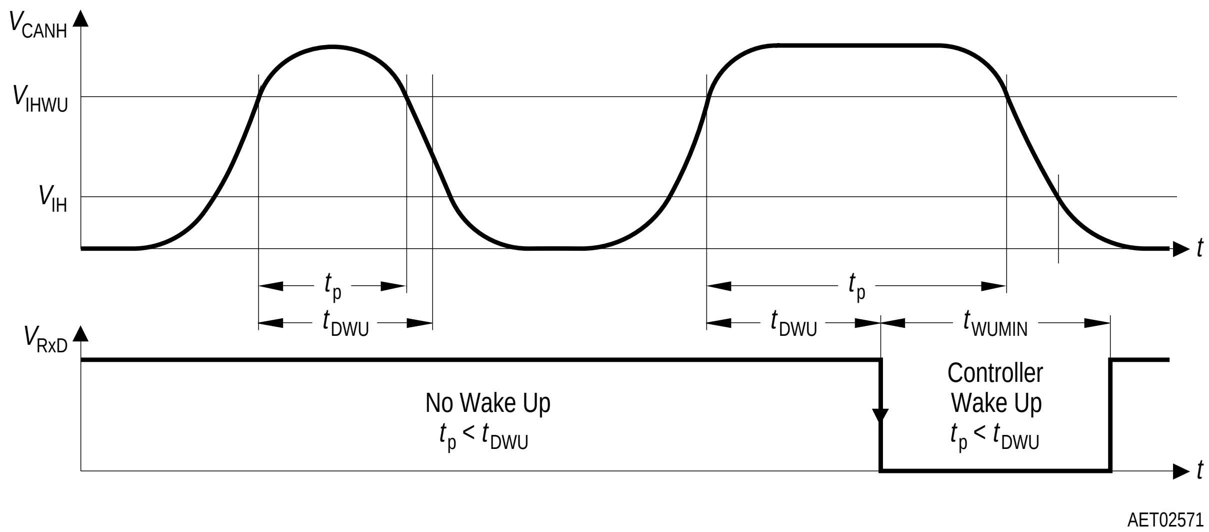


Bus Output Slewrate Definition: $S_{CANH} = \frac{\Delta V}{\Delta t}$ with $20\% < V_{CANH} < 80\%$

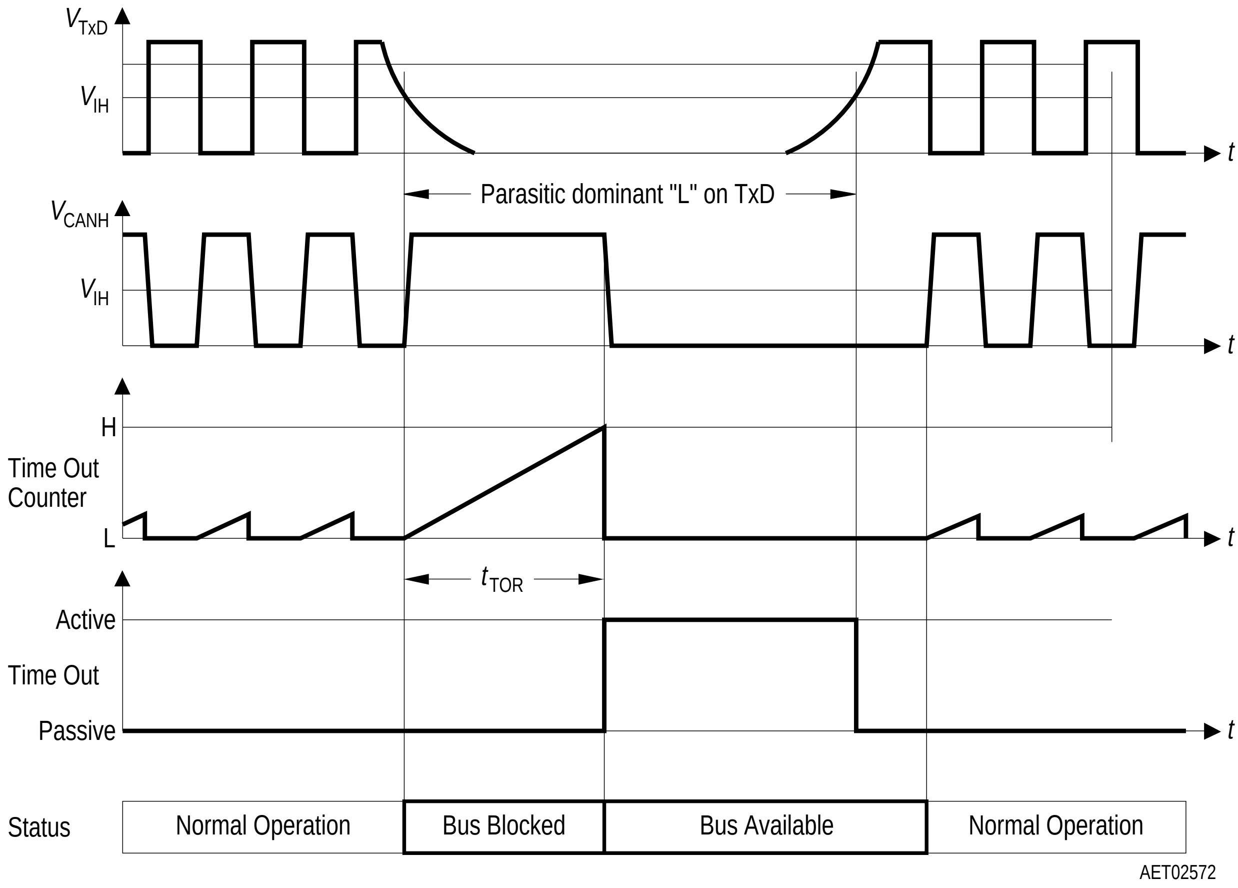
Slewrate S_{CANH} vs. Programming Resistor R_{RSL} (Pin RSL)



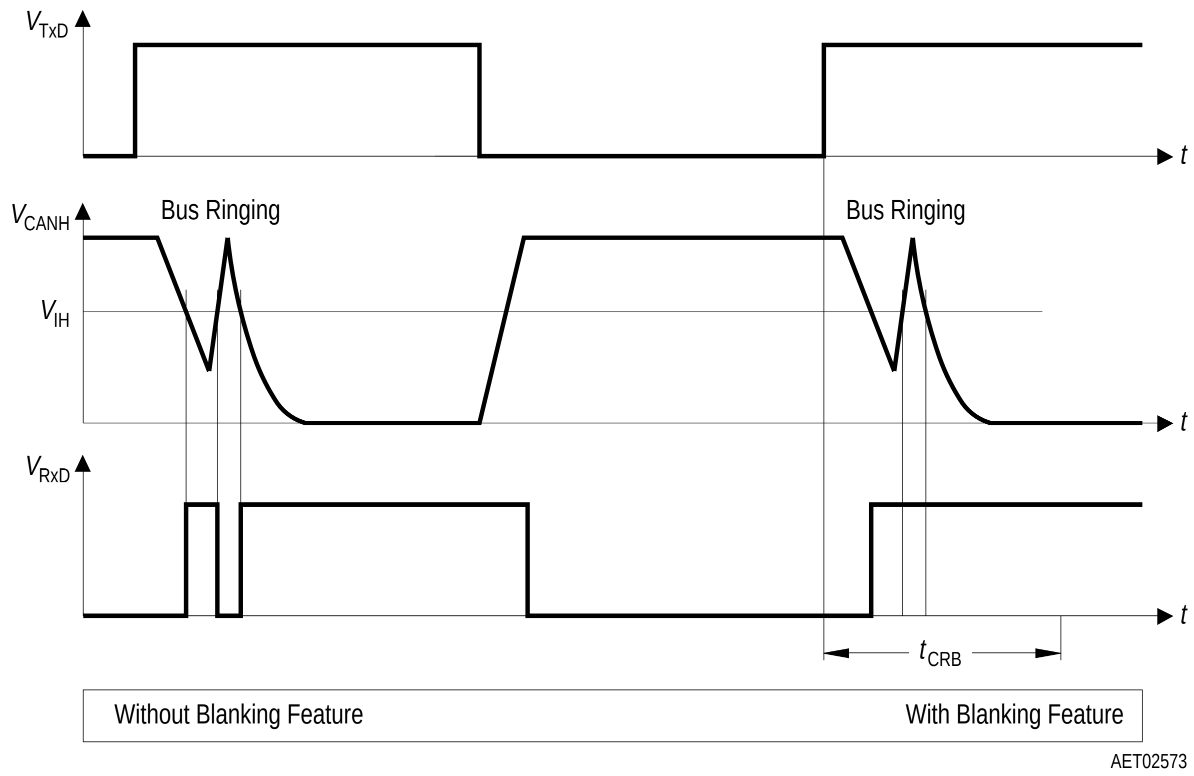
Wakeup Deadtime t_{DWU}



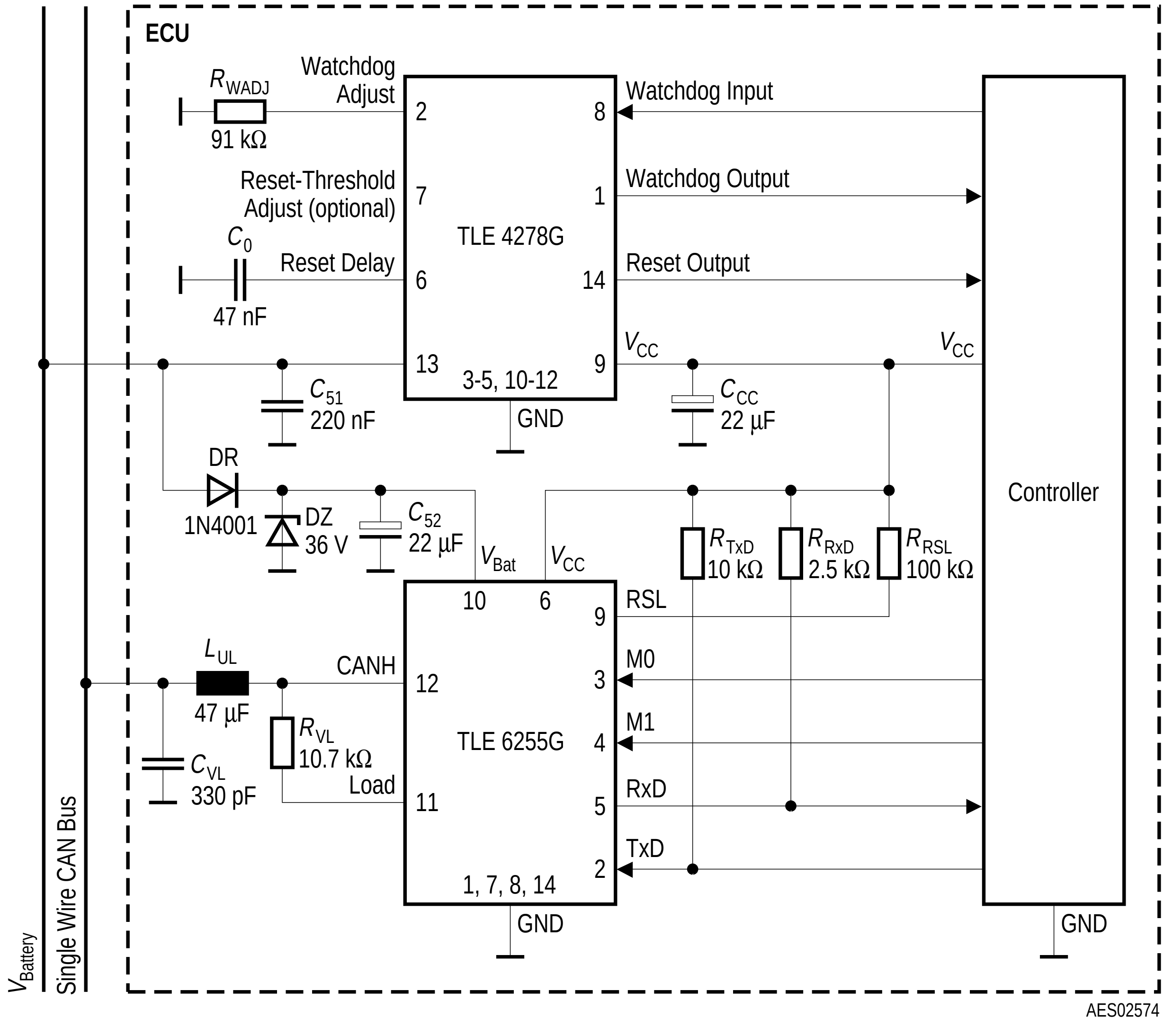
Bus Dominant Blanking Time t_{TOR}



RxD Blanking Time t_{CRB}

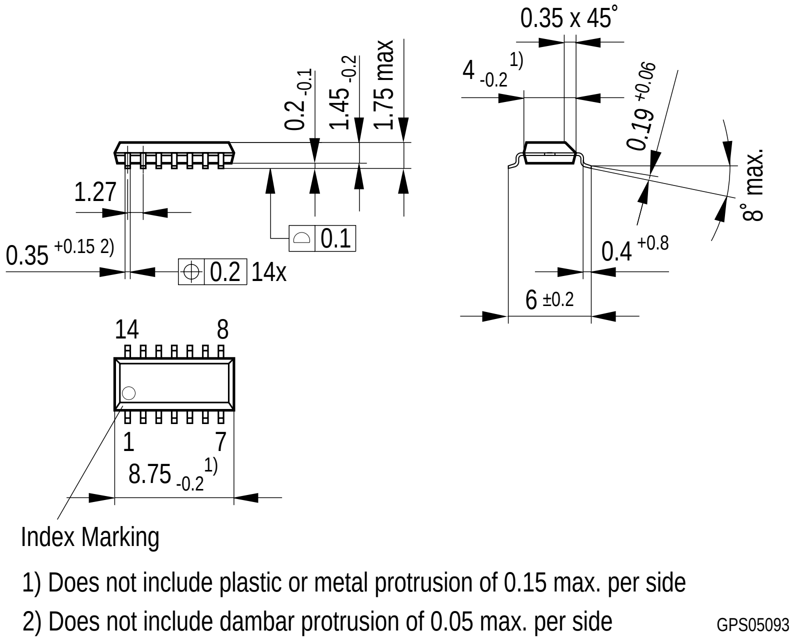


Application Circuit



Package Outlines

P-DSO-14-4
(Plastic Dual Small Outline)



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

SMD = Surface Mounted Device

Dimensions in mm