CAN-LDO ASIC

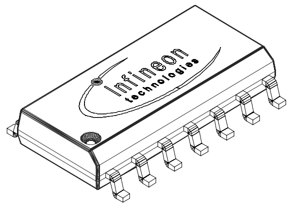
TLE 6272

Preliminary Data Sheet

1 Overview

1.1 Features

- High speed CAN transceiver for data transmission rate up to 1 Mbaud
- Very low drop voltage regulator 5V ±2%
- 150mA output currentr
- Excellent EMC behaviour
- Very low quiescent current voltage regulator, typ. 65µA
- Separate enable/inhibit input for transceiver and voltage regulator
- Power-on and under-voltage reset
- CAN outputs short circuit proof to ground and battery
- Reverse polarity proof
- Over-temperatur protection
- Over-load and short circuit protected
- Wide temperature range



P-DSO-14-14

Type	Ordering Code	Package
TLE 6272	on request	P-DSO-14-14

Description

The TLE 6272 is an integration of a high speed CAN-tansceiver functionality together with a low dropout fixed 5V regulator in an enhanced Power P-DSO-14-14 package. The 5V output is designed loads up to 150 mA.

In addition the device offers a reset circuitry as well as separate mode control inputs for the transceiver and the voltage regulator to minimize power consumption. The power-on delay time of the reset feature can be adjusted via a delay input.

By this the TLE 6272 is optimized to support high speed differential mode data transmission in automotive and industrial applications.

The TLE 6272 is designed to withstand the severe conditions of automotive applications.

1.2 Pin Configuration (top view)

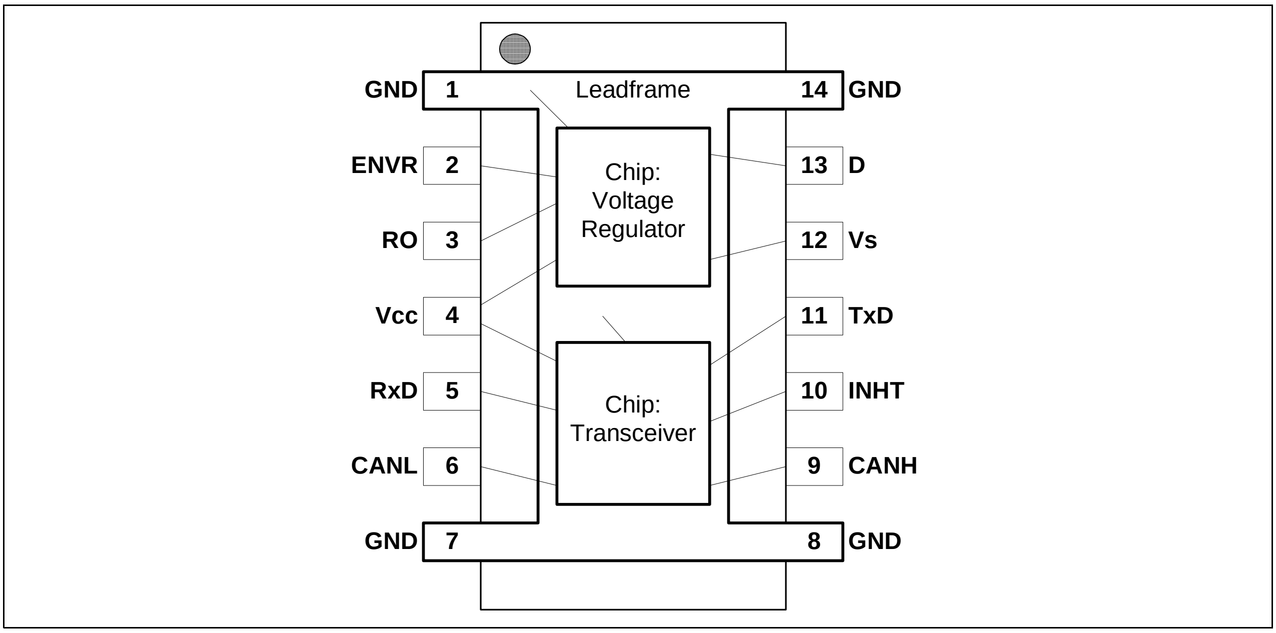


Figure 1

1.3 Pin Definitions and Functions: 5V-version

Pin No.	Symbol	Function
1, 7, 8, 14	GND	**Ground;** directly connected to chip carrier, place to cooling tabs to improve thermal behaviour
2	ENVR	**Enable input voltage regulator;** high active, if not needed connect to Vs, 1 MΩ pull down resistor
3	RO	**Reset output;** open collector output, 20 kΩ pull up
4	V_{CC}	**5V Output;** connect ot GND with a 22µF capacitor, ESR < 3Ω,
5	RxD	**CAN receive data output;** LOW in dominant state
6	CANL	**Low line input;** LOW in dominant state
9	CANH	**High line output;** HIGH in dominant state
10	INHT	**Inhibit Transceiver;** 20 kΩ pull up, set LOW for CAN normal mode
11	TxD	**CAN transmit data input;** 20 kΩ pull up, LOW in dominant state
12	Vs	**Battery supply input;** block to ground with ceramic capacitor of 100nF
13	D	**Reset Delay;** to adjust power-on delay time connect to ground via ceramic capacitor

1.4 Functional Block Diagram

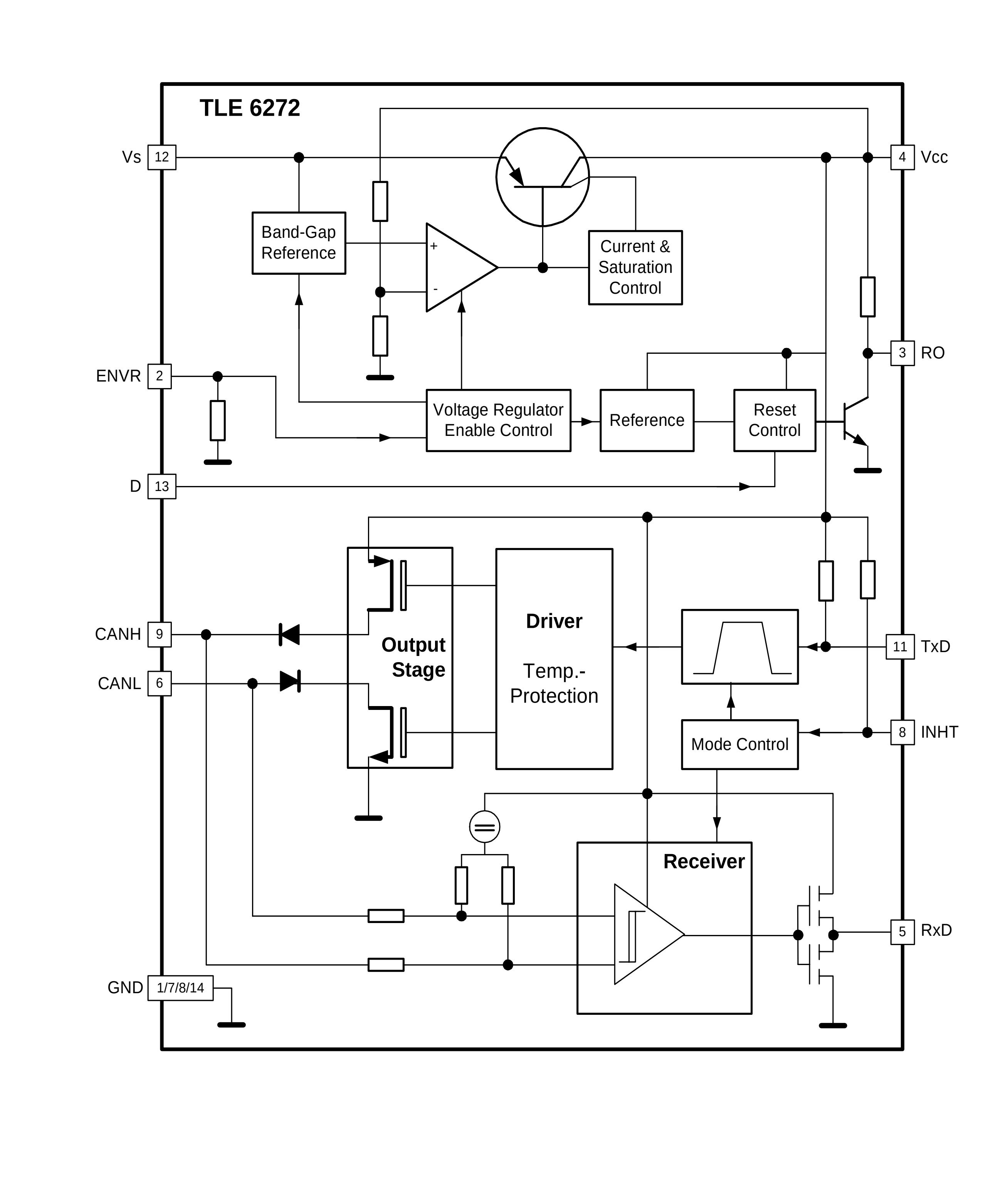


Figure 2

2 Application Information

The TLE 6272 is a dual chip IC that offers features of the CAN-transceiver TLE 6250 and the voltage regulator TLE 4299 in one package.

The voltage regulator of the TLE 6272 is a PNP based very low drop linear voltage regulator. It regulates the output voltage $V_{CC} = 5V$ at an input voltage range of $5.5V \leq V_S \leq 45V$. The control circuirtry protects the device against damages like overcurrent and overtemperature.

The internal control circuit achieves a 5V output voltage with a tolerance of ± 2%.

The device includes a power-on reset and an under-voltage reset function with adjustable reset delay time. Further there is implemented a separate enable / inhibit function for both, the voltage regulator (including reset circuitry) and the CAN-transceiver. By this the CAN-transceiver circuitry can be switched off to reduce the power consumption while the voltage regulator still supplies other loads. When the voltage regulator is disabled via the ENVR input also the CAN-transceiver is automatically switched off due to the missing supply voltage via V_{CC}.

The reset logic compares the output voltage V_{CC} to an internal threshold. If the output voltage drops below this level, the external reset delay capacitor C_D is discharged. When V_D is lower than V_{st}, the output reset is switched Low . If the output voltage drop is very short, the V_{st} level is not reached and no reset-signal is asserted. This feature avoids resets at short negative spikes at the output voltage e. g. caused by load changes. Please see figure 3, reset timing diagram.

As soon as the output voltage is more positive than the reset threshold, the delay capacitor is charged with constant current. When the voltage reaches V_{DU} the reset output RO is set High again. (Reset-hysteresis)

The reset threshold V_{RT} is internally defined (typical 4.65V). The reset delay time is defined by the external capacitor C_D that is charged by a constant current I_d up to a certain threshold V_{dt} during power on phase. Please see figure 3, reset timing diagram.

The reset function is active down to V_{cc} = 1V.

When the INHT is low while V_{CC} is present, the CAN-transceiver circuitry is in the normal operation mode. Then messages can be transmitted or received respectively via the RxD and TxD pin. The CAN stand-by mode is a low power mode that disables both, the receiver as well as the transmitter within the CAN-transceiver.

A message sent by the microcontroller to the TxD input is transformed to a differential mode signal and sent to other CAN nodes via the CANH and CANL output. Differential mode data on the bus lines is reported to the microcontroller via the RxD ouput.

Application description

The input capacitor C_{VS} compenstates line influences. A resistor of approx. 1 Ω in series with C_{VS}, damps the oscillating circuit of input inductivity and input capacitance. The output capacitor C_Q stabilizes the regulating circuit. Stability is guaranteed at values $C_{VCC} \geq 22\ \mu F$ and an ESR $\leq 3\ \Omega$ within the operating temperature range. Please consider the capacitance-tolerance and temperature coefficient of the reset delay capacitor when calculating the timings.

The reset timing and its calculation is shown in figure 3.

3 Electrical Characteristics

3.1 Absolute Maximum Ratings

Parameter	Symbol	Limit Values		Unit	Remarks
		min.	max.		
Voltages					
Supply voltage	V_S	- 40	42		$I_{Load} \geq$ 1mA
Supply voltage	V_S	- 40	40		
Output voltage	V_{CC}	- 0.3	6.5	V	
Output current	I_{CC}	– 5	*)	mA	*) internally limited
ENVR input voltage	V_{ENVR}	- 40	42		
CAN input voltage (CANH, CANL)	$V_{CANH/L}$	-20	40	V	
Logic voltages at INHT, TxD, RxD, RO, D	V_I	-0.3	V_{CC} + 0.3	V	0 V < V_{CC} < 5.5 V
Electrostatic discharge voltage at CANH, CANL	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_j	- 40	150	°C	
Storage temperature	T_{Stg}	- 50	150	°C	

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

3.2 Operating Range

Parameter	Symbol	Limit Values		Unit	Remarks
		min.	max.		
Supply voltage	V_S	5.5	42	V	
Junction temperature	T_j	– 40	150	°C	–

Thermal Resistances

Parameter	Symbol	min.	max.	Unit	Remarks
Junction ambient	$R_{thj\text{-}a}$	–	70	K/W	–

Thermal Shut Down (junction temperature)

Parameter	Symbol	min.	max.	Unit	Remarks
Thermal shutdown temp. CAN	$T_{jSD,CAN}$	150	190	°C	10°K hysteresis
Thermal shutdown temp. voltage regulator	$T_{jSD,VR}$	150	190	°C	10°K hysteresis

3.3 Electrical Characteristics

V_S = 13.5 V; R_L = 60 Ω; $V_{ENVR} > V_{ENVR,ON}$; $V_{INHT} < V_{INHT,ON}$; –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	Test Condition
		min.	typ.	max.		
Current Consumption						
Current consumption $(I_q+I_{TR}) = I_S - I_{LOAD}$	I_q+I_{TR}		6	10	mA	$I_{CC} \le$ 1mA; CAN recessive state; $V_{TxD} = V_{CC}$
Current consumption $(I_q+I_{TR}) = I_S - I_{LOAD}$	I_q+I_{TR}		45	70	mA	$I_{CC} \le$ 1mA; CAN dominant state; V_{TxD} = 0V
Current consumption $(I_q+I_{TR}) = I_S - I_{LOAD}$	I_q+I_{TR}			130	µA	$V_{INHT} > V_{INHT,off}$ $I_{CC} \le$ 1mA; Tj < 85°C
Current consumption; $(I_q+I_{TR}) = I_S - I_{LOAD}$	I_q+I_{TR}	–	250	500	µA	$V_{INHT} > V_{INHT,off}$ I_{CC} = 10mA
Current consumption; $(I_q+I_{TR}) = I_S - I_{LOAD}$	I_q+I_{TR}	–	2	8	mA	$V_{INHT} > V_{INHT,off}$ I_{CC} = 100mA
Current consumption; $(I_q+I_{TR}) = I_S - I_{LOAD}$	I_q+I_{TR}			15	µA	$V_{ENVR} < V_{ENVR,off}$ Tj < 85°C
Voltage Regulator						
Output voltage	V_{CC}	4.90	5.00	5.10	V	1mA $\le I_{CC} \le$ 100mA 6V $\le V_S \le$ 16V
Current limit	I_{CC}	250	300	500	mA	$I_{CC} = I_{TR} + I_{LOAD}$
Drop voltage	V_{dr}	–	0.25	0.5	V	I_{CC} = 100mA *)
Load regulation	ΔV_{CC}	–	10	30	mV	1mA $\le I_{CC} \le$ 100mA
Line regulation	ΔV_{CC}	–	10	40	mV	V_S = 6V to 26V I_{CC} = 1mA
Power Supply Ripple rejection	$PSRR$	–	50	–	dB	fr= 100Hz; Vr = 0,5 V_{PP}; guaranteed by design

*) Drop voltage = $V_S - V_{CC}$ (measured when the output voltage has dropped 100 mV from the nominal value obtained at 13.5 V input.)

3.3 Electrical Characteristics (cont'd)

V_S = 13.5 V; R_L = 60 Ω; $V_{ENVR} > V_{ENVR,ON}$; $V_{INHT} < V_{INHT,ON}$; –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	Test Condition
		min.	typ.	max.		
Enable Voltage Regulator ENVR						
Enable VR OFF voltage range	$V_{ENVR,off}$			0.8	V	
Enable VR ON voltage range	$V_{ENVR,on}$	4.0			V	
Enable current ON	$I_{ENVR,on}$	1		5	µA	
Reset Generator						
Switching threshold	V_{rt}	4.50	4.65	4.80	V	
Reset pull up	R_{RO}	10	20	40	kΩ	
Reset low voltage	V_R	–	0.1	0.4	V	V_{CC} < 4.5V,
Reset current	I_R	5			mA	$V_{RO(Low)}$ < 400 mV, Reset operational down to 1V
Delay switching threshold	V_{dt}	1.5	1.8	2.2	V	
Switching threshold	V_{st}	0.3	0.45	0.60	V	
Reset delay low voltage	V_D	–		0.1	V	$V_{CC} < V_{RT}$
Charge current	I_d	4.0	8.0	12.0	µA	V_D = 1V
Delay time L → H	t_d	0.5	28	35	ms	C_D = 100nF
Delay time H → L	t_{rr}	0.5	1	3	µs	C_D = 100nF

3.3 Electrical Characteristics (cont'd)

V_S = 13.5 V; R_L = 60 Ω; $V_{ENVR} > V_{ENVR,ON}$; $V_{INHT} < V_{INHT,ON}$; –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	Test Condition
		min.	typ.	max.		
CAN-Transceiver						
Receiver Output R×D						
HIGH level output current	$I_{RD,H}$		-4	-2	mA	V_{RD} > 0.8 x V_{CC}, V_{diff} < 0.4 V
LOW level output current	$I_{RD,L}$	2	4		mA	V_{RD} < 0.2 x V_{CC}, V_{diff} > 1V
Bus receiver						
Differential receiver threshold voltage, recessive to dominant edge	$V_{diff,d}$		0.75	0.9	V	-20V < (V_{CANH},V_{CANL}) < 25V V_{diff} = V_{CANH} - V_{CANL}
Differential receiver threshold voltage dominant to recessive edge	$V_{diff,r}$	0.5	0.6		V	-20V < (V_{CANH},V_{CANL}) < 25V V_{diff} = V_{CANH} - V_{CANL}
Differential receiver hysteresis	$V_{diff,hys}$		150		mV	
CANH, CANL input resistance	R_i	10	20	30	kΩ	recessive state
Differential input resistance	R_{diff}	20	40	60	kΩ	recessive state
Transmission Input T×D						
HIGH level input voltage threshold	$V_{TD,H}$		0.5x V_{CC}	0.7x V_{CC}	V	recessive state;
LOW level input voltage threshold	$V_{TD,L}$	0.3x V_{CC}	0.4x V_{CC}		V	dominant state
TxD pull up resistance	R_{TD}	10	25	50	kΩ	

3.3 Electrical Characteristics (cont'd)

V_S = 13.5 V; R_L = 60 Ω; $V_{ENVR} > V_{ENVR,ON}$; $V_{INHT} < V_{INHT,ON}$; –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	Test Condition
		min.	typ.	max.		
Bus transmitter						
CANL/CANH recessive output voltage	$V_{CANL/H}$	0.4x V_{CC}		0.6x V_{CC}	V	$V_{TxD} = V_{CC}$
CANH, CANL recessive output voltage difference	V_{diff}	–1		0.05	V	$V_{TxD} = V_{CC}$; no load $V_{diff} = V_{CANH} - V_{CANL}$ (see note below)
CANL dominant output voltage	V_{CANL}			2.0	V	V_{TxD} = 0V;
CANH dominant output voltage	V_{CANH}	3.0			V	V_{TxD} = 0V
CANH, CANL dominant output voltage difference	V_{diff}	1.5		3.0	V	V_{TxD} = 0V; $V_{diff} = V_{CANH} - V_{CANL}$
CANL short circuit current	I_{CANLsc}	50	120		mA	$V_{CANLshort}$ = 18V
			150		mA	$V_{CANLshort}$ = 36V
CANH short circuit current	I_{CANHsc}		-120	-50	mA	$V_{CANHshort}$ = 0V
			-120		mA	$V_{CANHshort}$ = - 5V
Leakage current	$I_{CANH,lk}$ $I_{CANL,lk}$		-300		µA	V_{CC} = 0V, V_{CANH} = V_{CANL} = -7V
Leakage current	$I_{CANH,lk}$ $I_{CANL,lk}$		300		µA	V_{CC} = 0V, V_{CANH} = V_{CANL} = 7V
Inhibit transceiver input INHT						
HIGH level input voltage threshold	$V_{INHT,H}$		0.5x V_{CC}	0.7x V_{CC}	V	CAN stand-by mode;
LOW level input voltage threshold	$V_{INHT,L}$	0.3x V_{CC}	0.4x V_{CC}		V	CAN normal mode
INHT pull up resistance	R_{INHT}	10	25	50	kΩ	

Note: deviation from ISO/DIS 11898

3.3 Electrical Characteristics (cont'd)

V_S = 13.5 V; R_L = 60 Ω; $V_{ENVR} > V_{ENVR,ON}$; $V_{INHT} < V_{INHT,ON}$; –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	Test Condition
		min.	typ.	max.		
Dynamic CAN-Transceiver Characteristics						
Propagation delay TxD-to-RxD LOW (recessive to dominant)	$t_{d(L),TR}$		150	280	ns	C_L = 47pF; R_L = 60Ω; C_{RxD} = 20pF
Propagation delay TxD-to-RxD HIGH (dominant to recessive)	$t_{d(H),TR}$		150	280	ns	C_L = 47pF; R_L = 60Ω; C_{RxD} = 20pF
Propagation delay TxD LOW to bus dominant	$t_{d(L),T}$		100		ns	C_L = 47pF; R_L = 60Ω;
Propagation delay TxD HIGH to bus recessive	$t_{d(H),T}$		100		ns	C_L = 47pF; R_L = 60Ω;
Propagation delay bus dominant to RxD LOW	$t_{d(L),R}$		50		ns	C_L = 47pF; R_L = 60 Ω; C_{RxD} = 20pF
Propagation delay bus recessive to RxD HIGH	$t_{d(H),R}$		50		ns	C_L = 47pF; R_L = 60Ω; C_{RxD} = 20pF

4 Diagrams

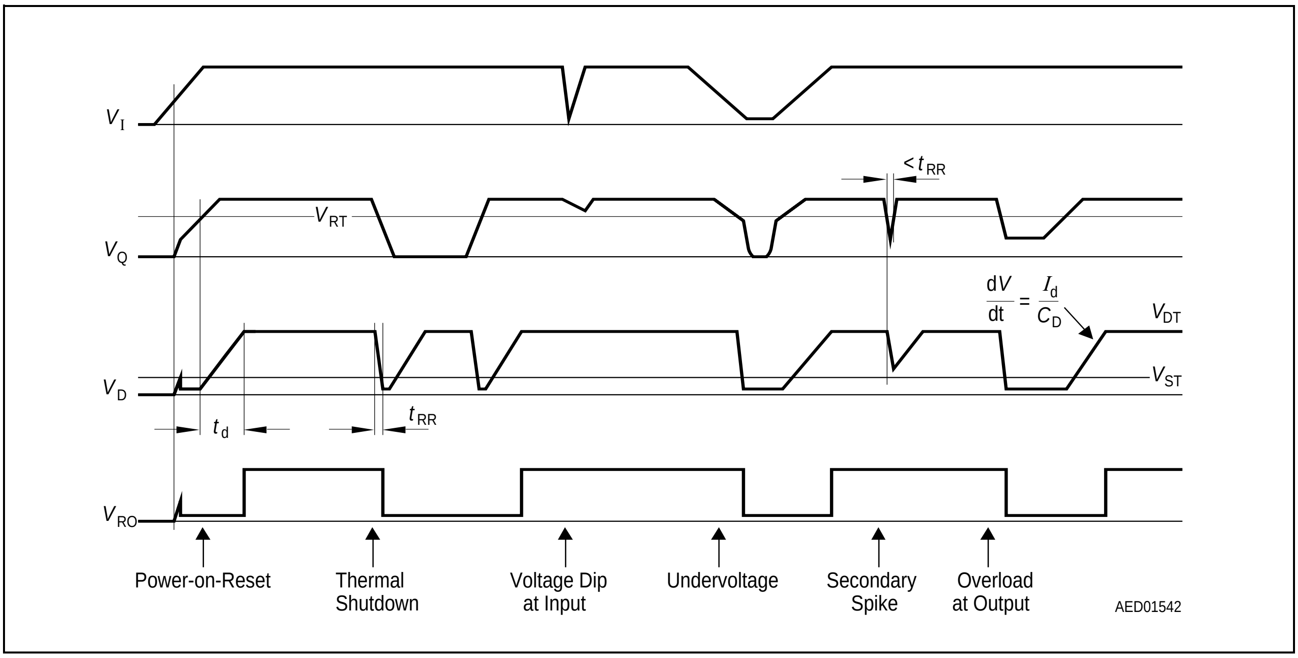


Figure 3: reset timing diagram

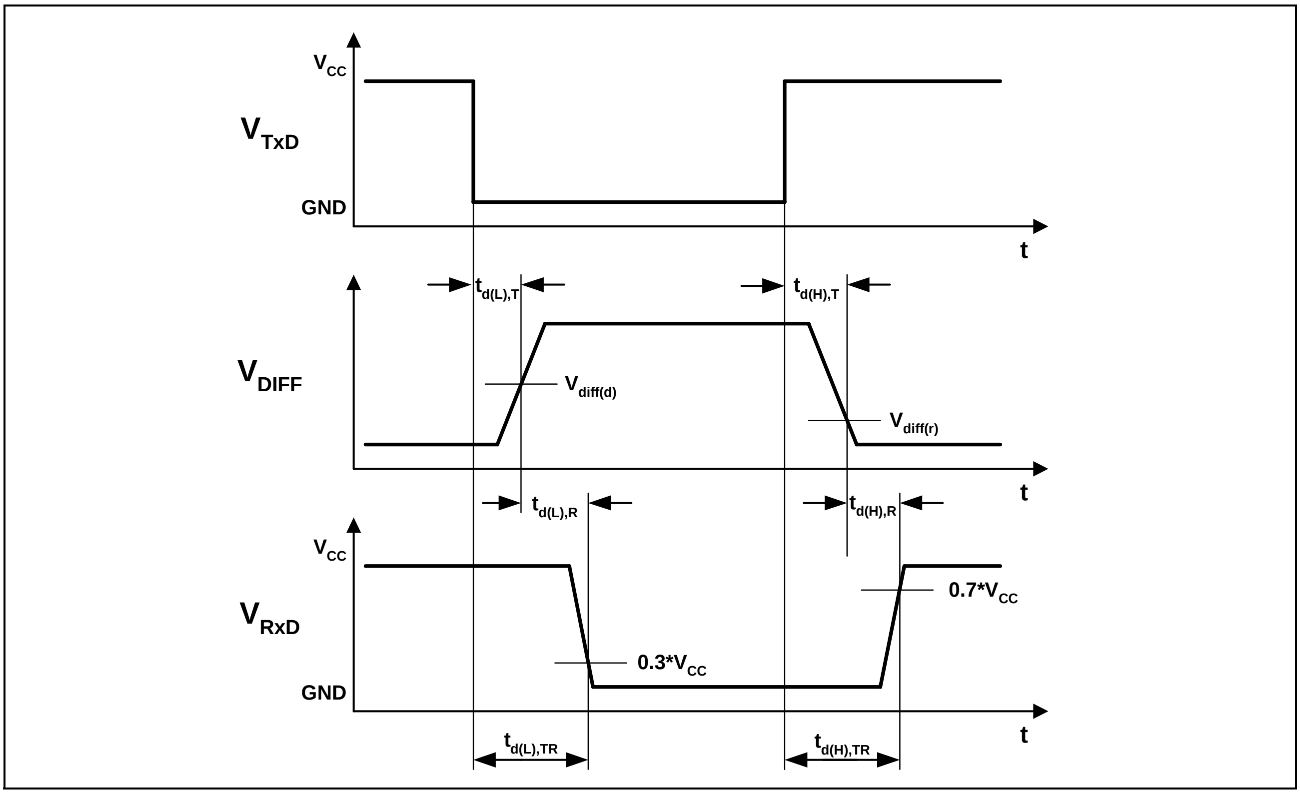


Figure 4: Timing diagrams for dynamic characteristics

5 Application

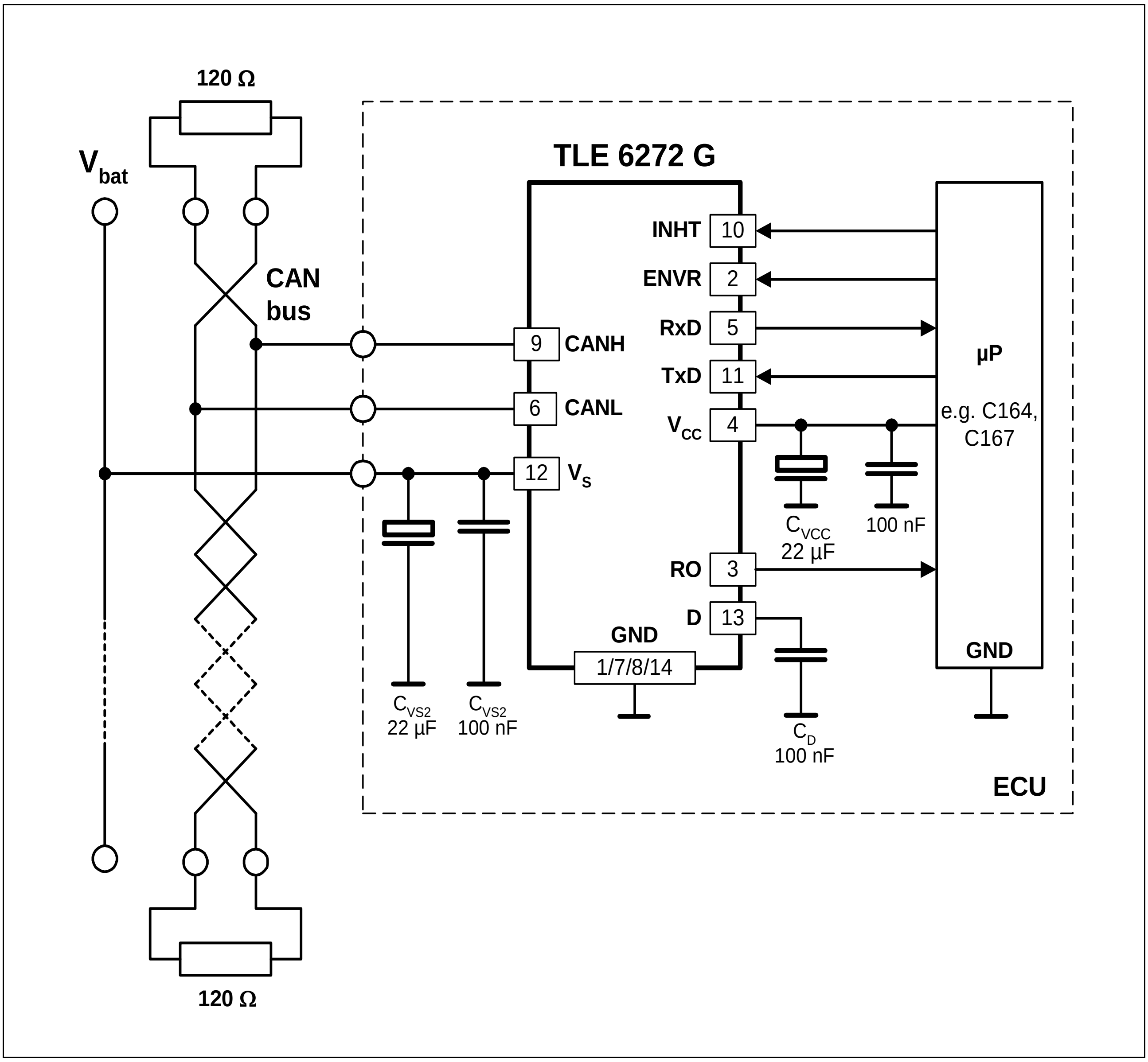
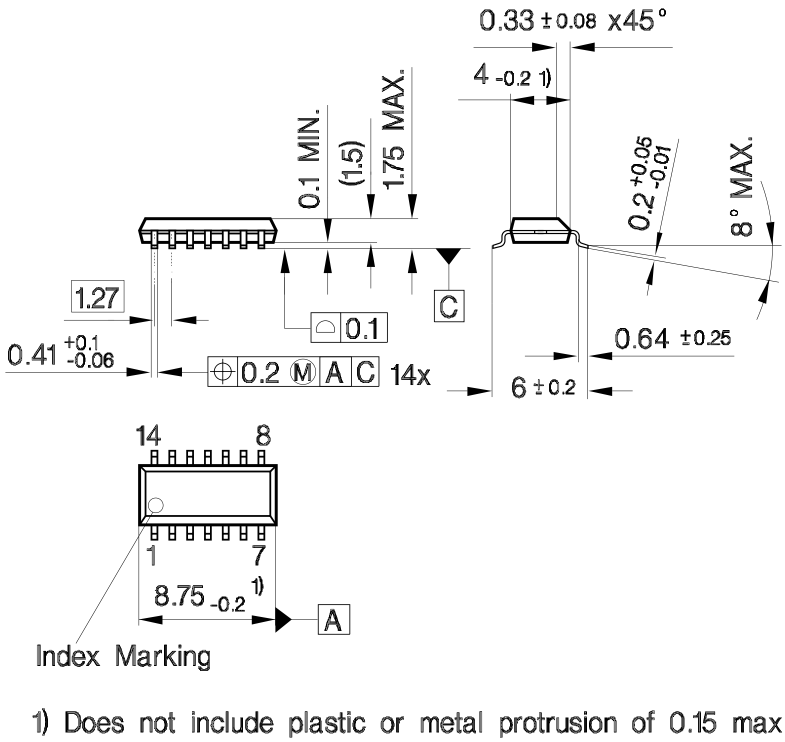


Figure 5
Application Circuit

6 Package Outlines

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



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

SMD = Surface MountedDevice

Dimensions in mm

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