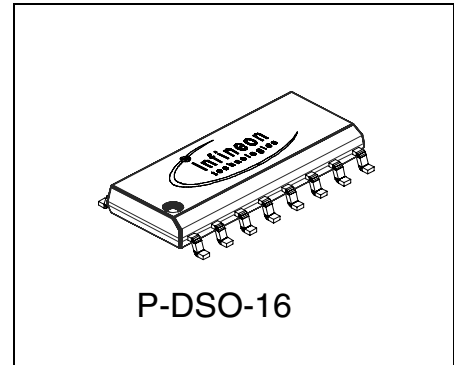


Target Data Sheet

Features

- CAN data transmission rate up to 1 MBaud
- Suitable for 12 V and 24 V applications
- Excellent EMC performance (very high immunity and very low emission)
- Version for 5 V and 3,3V micro controllers
- Bus pins are short circuit proof to ground and battery voltage
- Over-temperature protection
- Very wide temperature range (- 40°C up to 150°C)



Type	Ordering Code	Package
TLE 6253 G		P-DSO-16
TLE 6253 G V33		P-DSO-16

Description

The CAN-transceiver TLE 6253 is a monolithic integrated circuit that is available as bare die as well as in a P-DSO-16 package. The IC is optimized for high speed differential mode data transmission in automotive and industrial applications and is compatible to ISO/DIS 11898 (see page 12). It works as an interface between the CAN protocol controller and the physical differential bus in both, 12 V and 24 V systems.

The TLE 6253 offers three operation modes: normal, stand-by and receive-only mode. This can be controlled by the input pins INH and RM.

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 6253 is designed to withstand the severe conditions of automotive applications and provides excellent EMC performance.

Pin Configuration

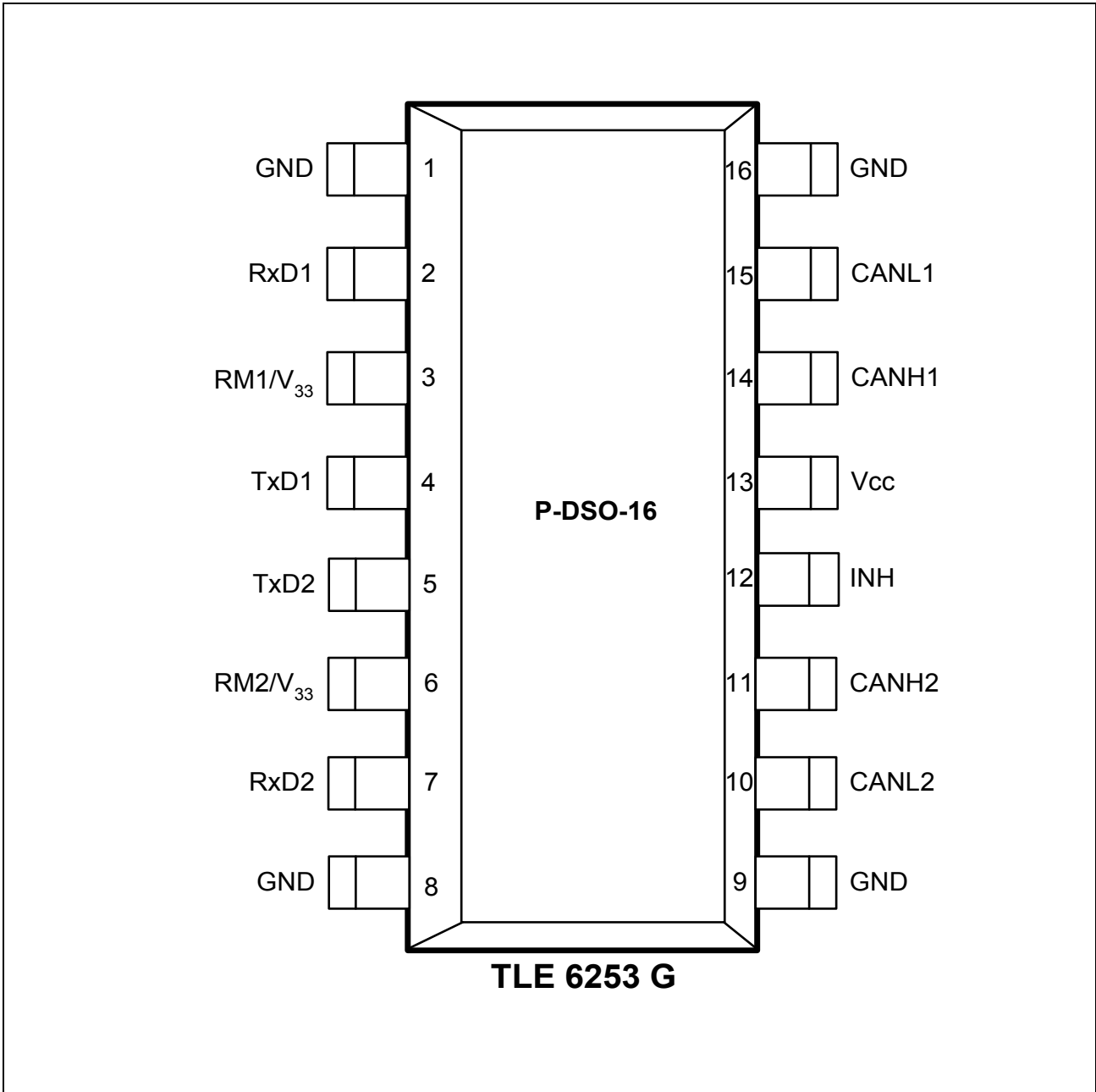


Figure 1 Pin Configuration (top view)

Pin Definitions and Functions

Pin No.	Symbol	Function
1,8,9,16	GND	Ground;
2	RxD1	CAN receive data output; LOW in dominant state, integrated pull up
3	RM1/ V33	Receive-only input; 20 kΩ pull up, set low to activate RxD-only mode
4	TxD1	CAN transmit data input; 20 kΩ pull up, LOW in dominant state
5	TxD2	CAN transmit data input; 20 kΩ pull up, LOW in dominant state
6	RM2/ V33	Receive-only input; 20 kΩ pull up, set low to activate RxD-only mode
7	RxD2	CAN receive data output; LOW in dominant state, integrated pull up
10	CANL2	Low line input; LOW in dominant state
11	CANH2	High line output; HIGH in dominant state
12	INH	Control input; 10 kΩ pull, set LOW for normal mode
13	V _{CC}	5 V Supply;
14	CANH1	High line output; HIGH in dominant state
15	CANL1	Low line input; LOW in dominant state

Functional Block Diagram

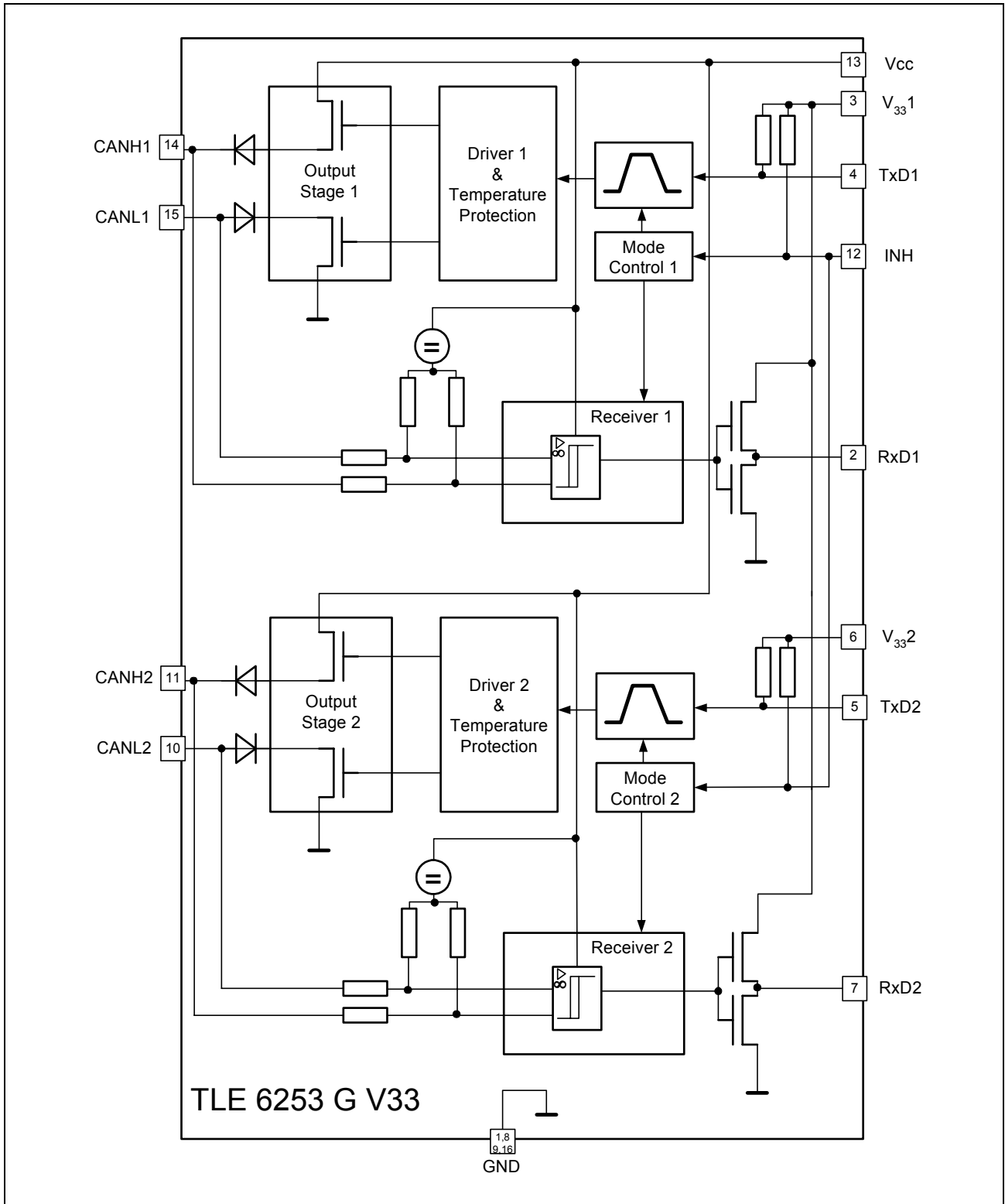


Figure 3 Block Diagram TLE 6253 G V33

Application Information

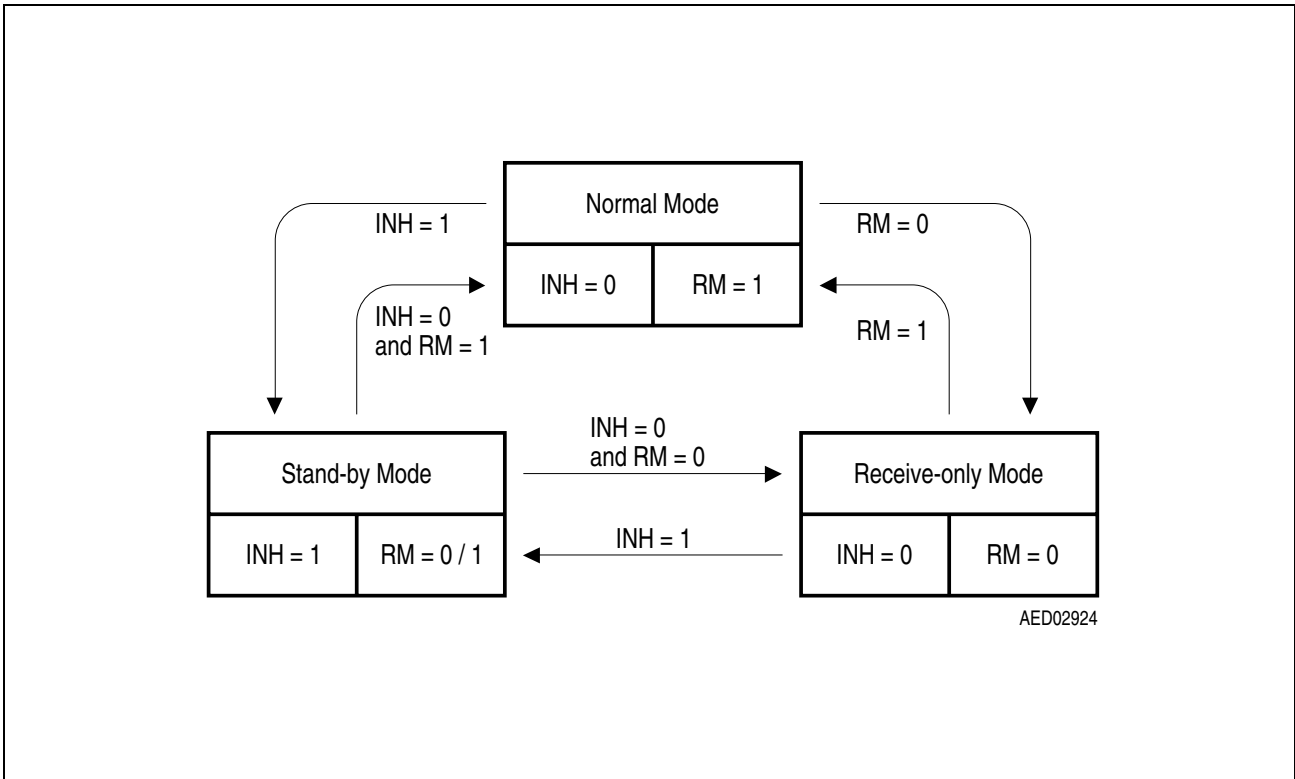


Figure 4 Mode State Diagram

The TLE 6253 G offers three different operation modes (see **Figure 4**), controlled by the INH and RM pin. The TLE 6253 G V33 has two different operation modes, normal and stand-by, controlled by the INH pin like in **Figure 4**. In the normal mode the device is able to receive and to transmit messages whereas in the receive-only mode signals at the TxD input are not transmitted to the CAN bus. The receive-only mode can be used for diagnostic purposes as well as to prevent the bus being blocked by a faulty permanent dominant TxD input signal. The stand-by mode is a low power mode that disables both, the receiver as well as the transmitter. The receive only mode feature for the TLE 6253 G V33 is not available. The inhibit feature for this version works in the same way as for the 5V version.

In case the receive-only feature is not used the RM pin has to be left open. When the stand-by mode is not used the INH pin has to be connected to ground level in order to switch the TLE 6253 in normal mode.

Electrical Characteristics
Absolute Maximum Ratings

Parameter	Symbol	Limit Values		Unit	Remarks
		min.	max.		

Voltages

Supply voltage	V_{CC}	- 0.3	6.5	V	-
3.3 V supply	V_{33V}	- 0.3	5.5	V	3.3 V version
CAN input voltage (CANH, CANL)	$V_{CANH/L}$	- 40	40	V	-
Logic voltages at INH, RM, TxD, RxD	V_I	- 0.3	V_{CC}	V	$0\text{ V} < V_{CC} < 5.5\text{ V}$
Electrostatic discharge voltage at CANH,CANL	V_{ESD}	- 6	6	kV	human body model (100 pF via 1.5 k Ω)
Electrostatic discharge voltage	V_{ESD}	- 2	2	kV	human body model (100 pF via 1.5 k Ω)

Temperatures

Junction temperature	T_j	- 40	160	°C	-
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Note: Maximum ratings are absolute ratings; exceeding any one of these values may cause irreversible damage to the integrated circuit.

Electrical Characteristics
Operating Range

Parameter	Symbol	Limit Values		Unit	Remarks
		min.	max.		
Supply voltage	V_{CC}	4.5	5.5	V	–
3.3 V supply voltage	V_{33V}	3.0	3.6	V	3.3 V-version
Junction temperature	T_j	– 40	150	°C	–

Thermal Resistances

Junction ambient	R_{thj-a}	–	60	K/W	–
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Thermal Shutdown (junction temperature)

Thermal shutdown temperature	T_{jSD}	160	200	°C	10 °C hysteresis
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Electrical Characteristics

4.5 V < V_{CC} < 5.5 V; $R_L = 60 \Omega$; $V_{INH} < V_{INH,ON}$; $-40 \text{ }^\circ\text{C} < T_j < 150 \text{ }^\circ\text{C}$; all voltages with respect to ground; positive current flowing into pin; unless otherwise specified.

Parameter	Symbol	Limit Values			Unit	Remarks
		min.	typ.	max.		

Current Consumption

Current consumption	I_{CC}	–	12	20	mA	recessive state; $V_{TxD} = V_{CC}$
Current consumption	I_{CC}	–	90	140	mA	dominant state; $V_{TxD} = 0 \text{ V}$
Current consumption	I_{CC}	–	12	20	mA	receive-only mode; RM = low
Current consumption	I_{33V}	–	–	4	mA	(3.3 V-version only)
Current consumption	$I_{CC, stb}$	–	2	20	μA	stand-by mode; TxD = RM = high
Current consumption	$I_{CC+33V, stb}$	–	2	20	μA	stand-by mode TxD = high (3.3 V-version only)

Receiver Output (pin RxD1, RxD2)

HIGH level output current	$I_{RD,H}$	–	-4	-2	mA	$V_{RD} = 0.8 \times V_{CC}$, $V_{diff} < 0.4 \text{ V}^{\text{note 1}}$
		2	4	–	mA	$V_{RD} = 0.2 \times V_{CC}$, $V_{diff} > 1 \text{ V}^{\text{note 1}}$
LOW level output current	$I_{RD,L}$	2	4	–	mA	$V_{RD} = 0.2 \times V_{CC}$, $V_{diff} > 1 \text{ V}^{\text{note 1}}$
		1	2	–	mA	3.3 V-version $V_{RD} = 0.2 \times V_{33V}$, $V_{diff} > 1 \text{ V}^{\text{note 1}}$

note1) $V_{diff} = V_{CANH} - V_{CANL}$

Electrical Characteristics (cont'd)

4.5 V < V_{CC} < 5.5 V; $R_L = 60 \Omega$; $V_{INH} < V_{INH,ON}$; $-40 \text{ }^\circ\text{C} < T_j < 150 \text{ }^\circ\text{C}$; all voltages with respect to ground; positive current flowing into pin; unless otherwise specified.

Parameter	Symbol	Limit Values			Unit	Remarks
		min.	typ.	max.		

Transmission Input (pin TxD1, TxD2)

HIGH level input voltage threshold	$V_{TD,H}$	–	2.5	3.5	V	recessive state; 5.0 V-version
		–	1.6	2.4	V	recessive state; 3.3 V-version
TxD input hysteresis	$V_{TD,hys}$	–	0.1	–	V	–
LOW level input voltage threshold	$V_{TD,L}$	1.5	2.4	–	V	dominant state
		0.9	1.5	–	V	dominant state 3.3 V-version
TxD pull up resistance	R_{TD}	10	25	50	k Ω	–

Inhibit Input (pin INH)

HIGH level input voltage threshold	$V_{INH,H}$	–	2.5	3.5	V	stand-by mode; 5.0 V-version
		–	1.6	2.4	V	stand-by mode; 3.3 V-version
LOW level input voltage threshold	$V_{INH,L}$	1.5	2.4	–	V	normal mode
		0.9	1.5	–	V	normal mode; 3.3 V-version
INH pull up resistance	R_{INH}	5	12.5	25	k Ω	–

Receive only Input (pin RM1, RM2)

HIGH level input voltage threshold	$V_{RM,H}$	–	2.5	3.5	V	normal mode; 5.0 V-version
LOW level input voltage threshold	$V_{RM,L}$	1.5	2.4	–	V	receive-only mode
RM pull up resistance	R_{RM}	10	25	50	k Ω	–

Electrical Characteristics (cont'd)

4.5 V < V_{CC} < 5.5 V; $R_L = 60 \Omega$; $V_{INH} < V_{INH,ON}$; $-40 \text{ }^\circ\text{C} < T_j < 150 \text{ }^\circ\text{C}$; all voltages with respect to ground; positive current flowing into pin; unless otherwise specified.

Parameter	Symbol	Limit Values			Unit	Remarks
		min.	typ.	max.		

Bus Receiver

Differential receiver threshold voltage, recessive to dominant edge	$V_{diff,d}$	–	0.75	0.90	V	$-20 \text{ V} < (V_{CANH}, V_{CANL}) < 25 \text{ V}$ $V_{diff} = V_{CANH} - V_{CANL}$
Differential receiver threshold voltage dominant to recessive edge	$V_{diff,r}$	0.50	0.60	–	V	$-20 \text{ V} < (V_{CANH}, V_{CANL}) < 25 \text{ V}$ $V_{diff} = V_{CANH} - V_{CANL}$
Common Mode Range	CMR	-20	–	25	V	$V_{CC} = 5\text{V}$
Differential receiver hysteresis	$V_{diff,hys}$	–	150	–	mV	–
CANH, CANL input resistance	R_i	–	20	–	k Ω	recessive state
Differential input resistance	R_{diff}	–	40	–	k Ω	recessive state

Electrical Characteristics (cont'd)

4.5 V < V_{CC} < 5.5 V; $R_L = 60 \Omega$; $V_{INH} < V_{INH,ON}$; $-40 \text{ }^\circ\text{C} < T_j < 150 \text{ }^\circ\text{C}$; all voltages with respect to ground; positive current flowing into pin; unless otherwise specified.

Parameter	Symbol	Limit Values			Unit	Remarks
		min.	typ.	max.		

Bus Transmitter

CANL/CANH recessive output voltage	$V_{CANL/H}$	$0.4 \times V_{CC}$	–	$0.6 \times V_{CC}$	V	$V_{TXD} = V_{CC}$ (5 V-version) $V_{TXD} = V_{33V}$ (3.3 V-version)
CANH, CANL recessive output voltage difference $V_{diff} = V_{CANH} - V_{CANL}$	V_{diff}	- 1	–	0.05	V	$V_{TXD} = V_{CC}$ (5 V-version) $V_{TXD} = V_{33V}$ (3.3 V-version); no load; (see note 2)
CANL dominant output voltage	V_{CANL}	–	–	2.0	V	$V_{TXD} = 0 \text{ V}$; $V_{CC} = 5 \text{ V}$
CANH dominant output voltage	V_{CANH}	2.8	–	–	V	$V_{TXD} = 0 \text{ V}$; $V_{CC} = 5 \text{ V}$
CANH, CANL dominant output voltage difference $V_{diff} = V_{CANH} - V_{CANL}$	V_{diff}	1.5	–	3.0	V	$V_{TXD} = 0 \text{ V}$; $V_{CC} = 5 \text{ V}$
CANL short circuit current	I_{CANLsc}	50	120	200	mA	$V_{CANLshort} = 18 \text{ V}$
		–	150	–	mA	$V_{CANLshort} = 36 \text{ V}$
CANH short circuit current	I_{CANHsc}	-200	-120	-50	mA	$V_{CANHshort} = 0 \text{ V}$
CANH short circuit current	I_{CANHsc}	–	-120	–	mA	$V_{CANHshort} = -5 \text{ V}$
Output current	$I_{CANH,ik}$ $I_{CANL,ik}$	–	-300	–	μA	$V_{CC} = 0 \text{ V}$, $V_{CANH} =$ $V_{CANL} = -7 \text{ V}$
Output current	$I_{CANH,ik}$ $I_{CANL,ik}$	–	280	–	μA	$V_{CC} = 0 \text{ V}$, $V_{CANH} =$ $V_{CANL} = 7 \text{ V}$

note 2) deviation from ISO/DIS 11898

Electrical Characteristics (cont'd)

4.5 V < V_{CC} < 5.5 V; R_L = 60 Ω; V_{INH} < V_{INH,ON}; - 40 °C < T_j < 150 °C; all voltages with respect to ground; positive current flowing into pin; unless otherwise specified.

Parameter	Symbol	Limit Values			Unit	Remarks
		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 = 47 pF; R _L = 60 Ω; V _{CC} = 5 V; C _{RxD} = 20 pF
Propagation delay TxD-to-RxD HIGH (dominant to recessive)	t _{d(H),TR}	–	150	280	ns	C _L = 47 pF; R _L = 60 Ω; V _{CC} = 5 V; C _{RxD} = 20 pF
Propagation delay TxD LOW to bus dominant	t _{d(L),T}	–	100	–	ns	C _L = 47 pF; R _L = 60 Ω; V _{CC} = 5 V
Propagation delay TxD HIGH to bus recessive	t _{d(H),T}	–	100	–	ns	C _L = 47 pF; R _L = 60 Ω; V _{CC} = 5 V
Propagation delay bus dominant to RxD LOW	t _{d(L),R}	–	50	–	ns	C _L = 47 pF; R _L = 60 Ω; V _{CC} = 5 V; C _{RxD} = 20 pF
Propagation delay bus recessive to RxD HIGH	t _{d(H),R}	–	50	–	ns	C _L = 47 pF; R _L = 60 Ω; V _{CC} = 5 V; C _{RxD} = 20 pF

Diagrams

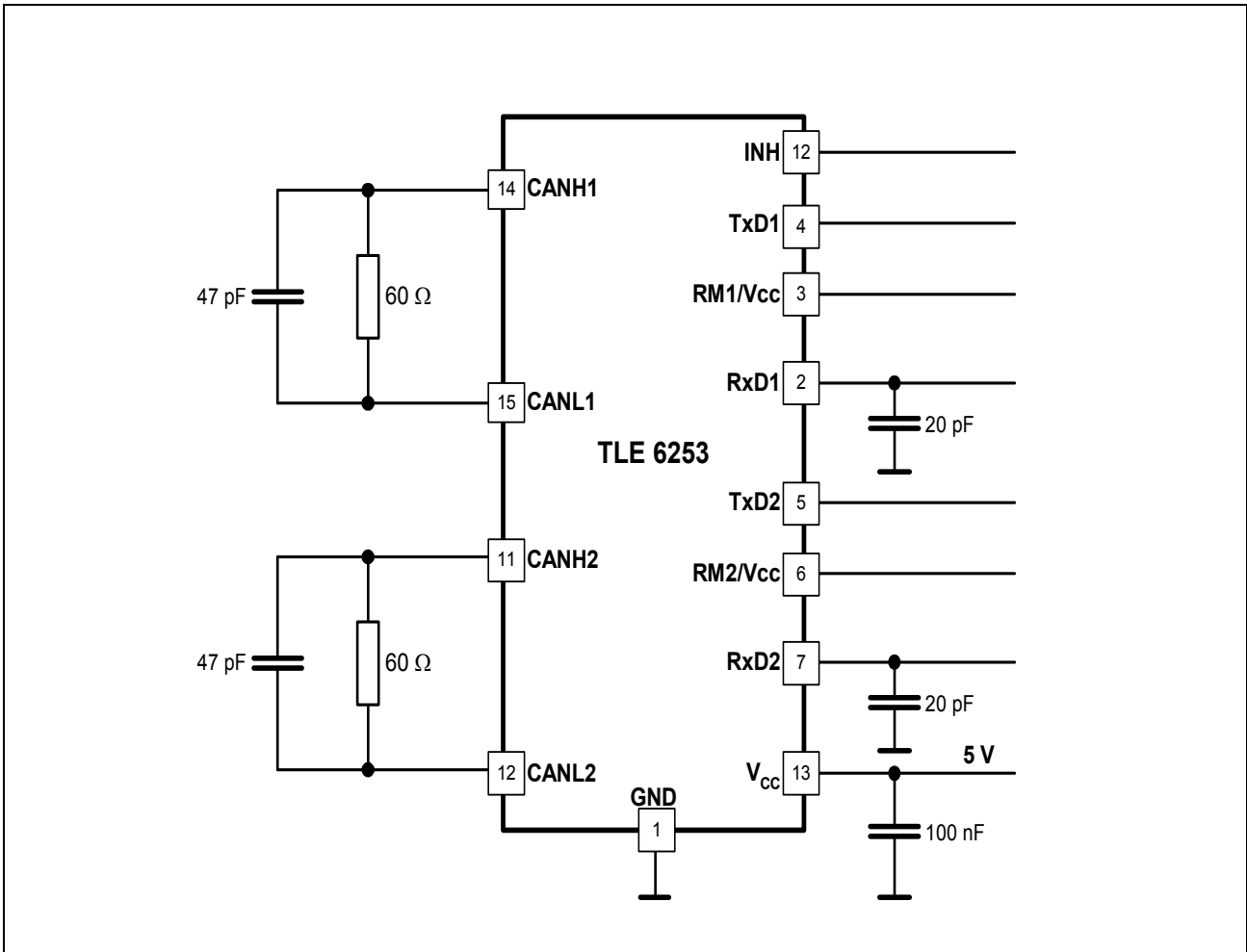


Figure 5 Test Circuits for Dynamic Characteristics

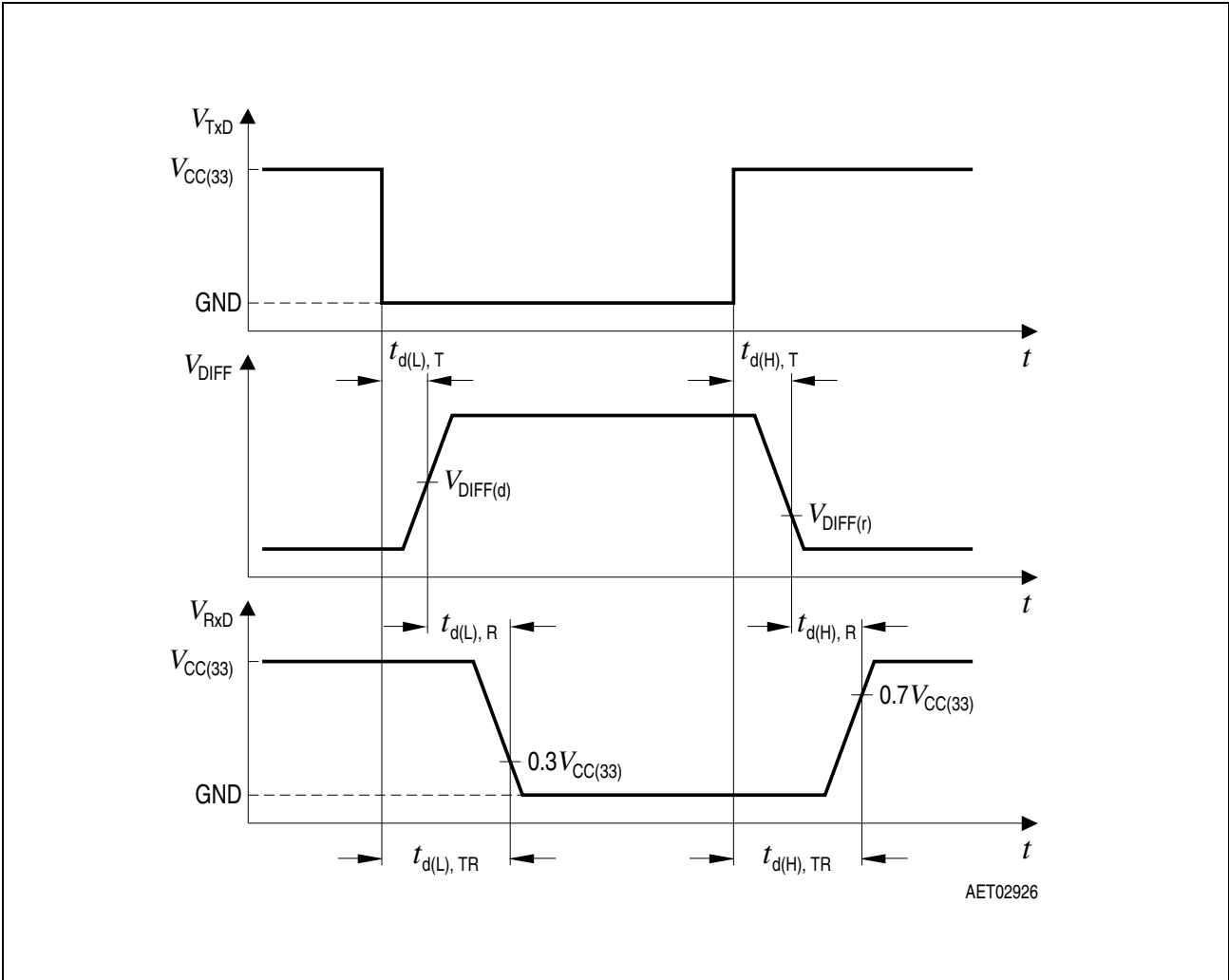


Figure 6 Timing Diagrams for Dynamic Characteristics

Application

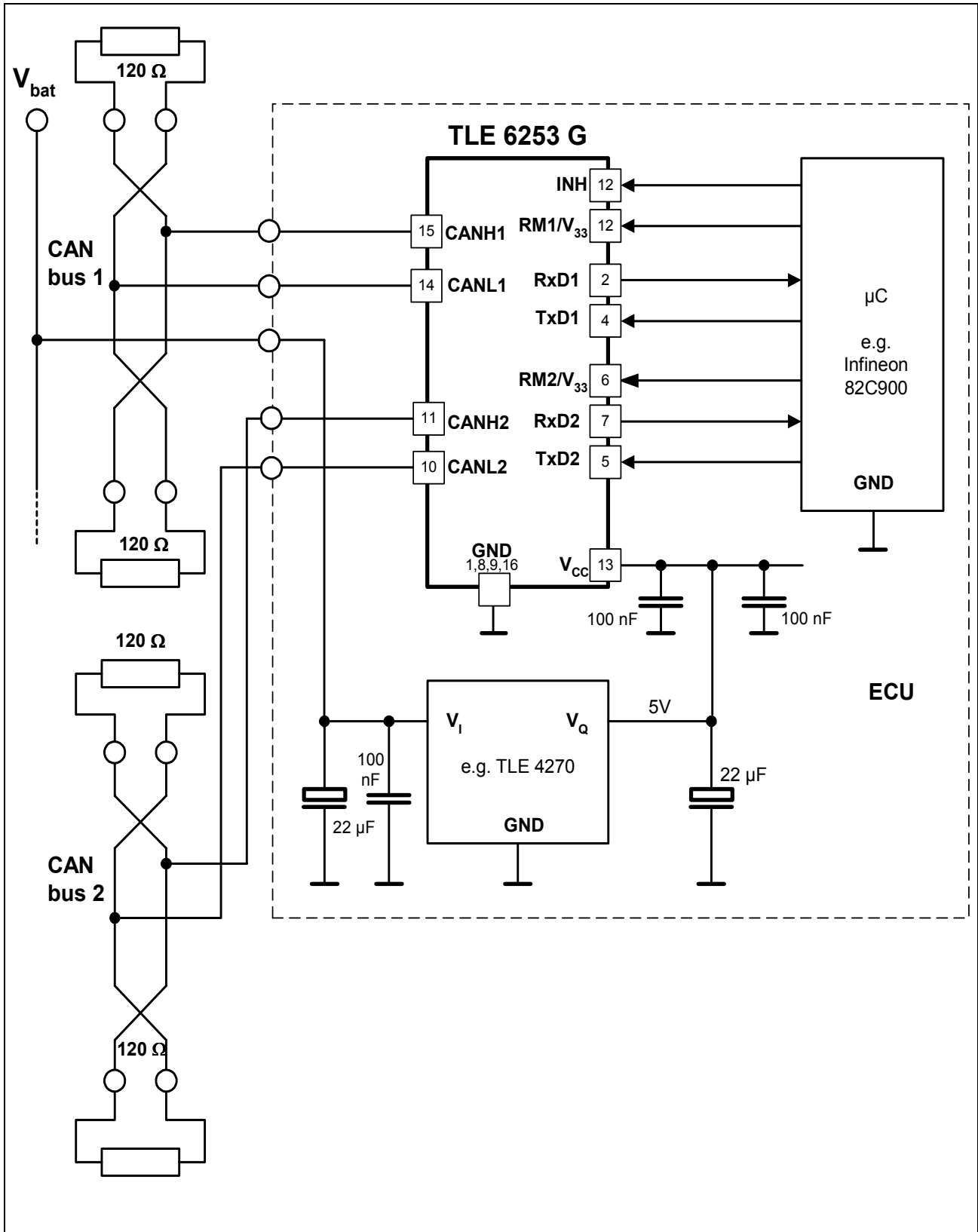


Figure 7 Application Circuit: Twin CAN used as gateway

Edition 2002-03-05

**Published by Infineon Technologies AG,
St.-Martin-Strasse 53,
D-81541 München, Germany**

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