

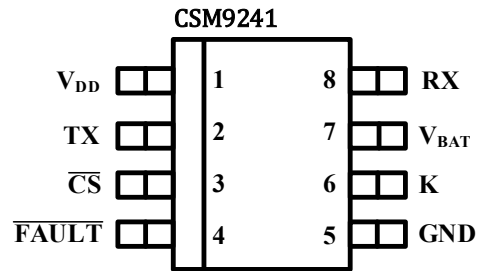
Single-end K Bus Transceiver

Key Features

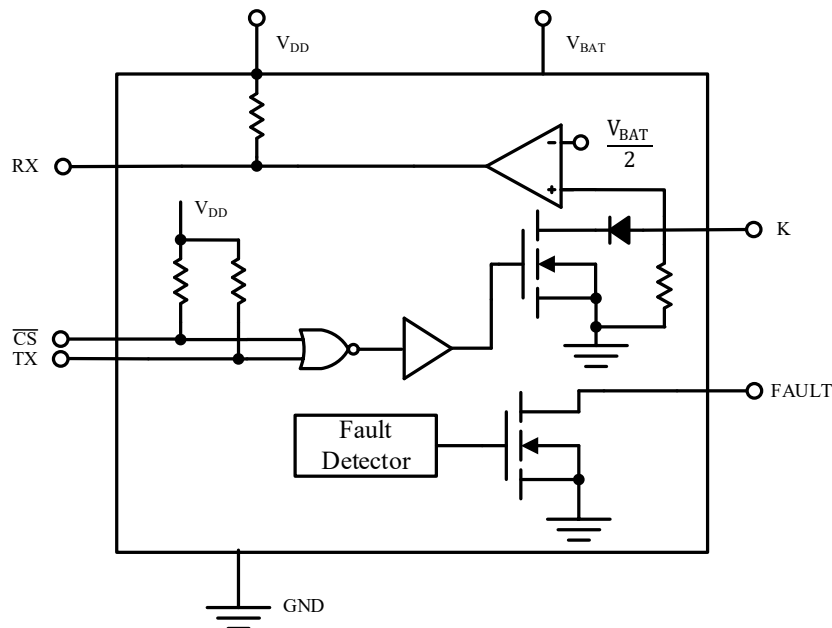
- Operating Power Supply range:
 $6V \leq V_{BAT} \leq 36V$
- Ultra low standby current:
 $I_{BAT(SB)} = 0.18\mu A @ V_{DD} = 0.5V$
- Low Quiescent Current in shutdown
Condition:
 $I_{BAT} = 110\mu A @ I_{DD} \leq 3\mu A$
- ISO 9141 Compatible
- Overtemperature Warning Function
- K bus short Warning Function
- Typical transmit speeds of 200 kBaud
- Automotive diagnostic communication

Application Range

Package Diagram



Block diagram





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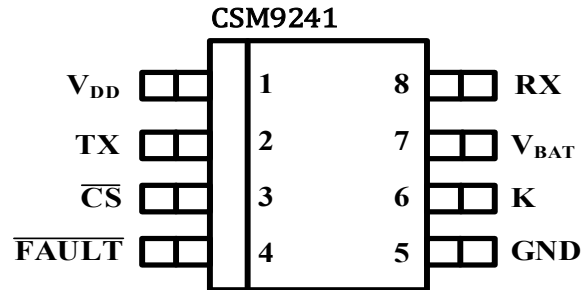


1 Introduction

CSM9241 is a monolithic bus transceiver designed to provide bidirectional serial communication in automotive diagnostic systems. CSM9241 can be either in transmit or receive mode and it contains over temperature, and short circuit detection circuits.

CSM9241 chip adopts 8-pin SO package. It operates reliably over the automotive temperature range -40 to 125°C. In addition, the RX output is capable of driving CMOS or 1xLSTTL load.

2 Pin Information



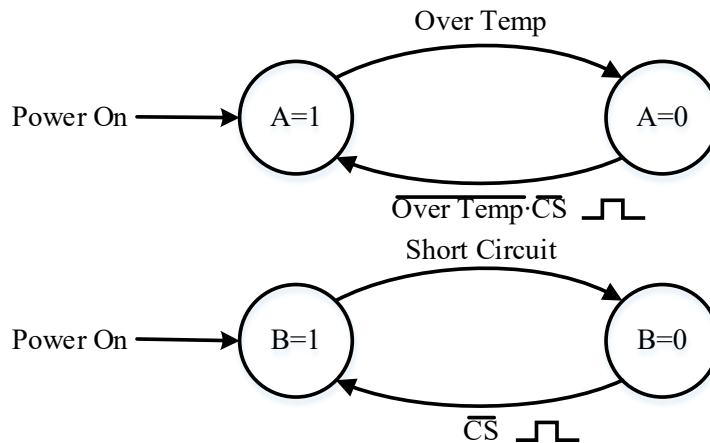
Figur 2-1 CSM9241 pin information diagram

Table2-1 pin function description

Pin	Pin name	Type	Pin function
1	V _{DD}	Supply	Power Supply (+4.5V ~ +5.5V, DC)
2	TX	Input	Transmit
3	$\overline{CS}$	Input	Chip Select
4	$\overline{FAULT}$	Output	Fault detection
5	GND	Supply	Ground (0V)
6	K	Inout	Transmit/Receive
7	V _{BAT}	Supply	Battery Power Supply (+6V ~ +36V, DC)
8	RX	Output	Receiver

3 Operational modes

3.1 State Control Diagram and Truth Table



Note: Over Temp is an internal condition, not meant to be a logic signal

Figure 3.1 State diagram

Table 3.1 Output Table

INPUTS		STATE VARIABLE		OUTPUT TABLE			
CS	TX	A	B	RX	K	FAULT	Comments
0	0	1	1	0	0	1	Over Temp Short Circuit Receive Mode
0	1	1	1	1	1	1	
X	X	0	1	K	HiZ	0	
0	1	1	0	K	HiZ	0	
1	X	1	1	0	0	1	
1	X	1	1	1	1	1	
X= “1” or “0” HiZ=High Impedance State							

3.2 Function Description

CSM9241 can be either in transmit or receive mode and it contains over temperature, and short circuit detection circuits.

When the chip is powered, the voltage on K is internally terminal compare to $V_{BAT}/2$. If the voltage on the K pin is less than $V_{BAT}/2$ then the RX output will be low. If the voltage on the K pin is greater than $V_{BAT}/2$ then the RX output will be high.

In order to be in transmit mode, $\overline{CS}$ must be set low. When $\overline{CS}$ and TX are set low the



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internal MOSFET will turn on, causing the K pin to be low. When $\overline{CS}$ is set high the CSM9241 is in receive mode and the internal MOSFET is turned off. The RX output will follow the K pin to be high. In the event of over temperature, or short circuit to V_{BAT} , the CSM9241 will turn off the K output to protect the IC and the $\overline{FAULT}$ pin will be asserted. The fault will be reset when $\overline{CS}$ is toggled high.

$\overline{RX}$, $\overline{CS}$ and TX pins have an internal pull up resistor to VDD while the K pin has internal pull down resistors. When any one of the TX, V_{BAT} or GND pins is open the K output is off.

4 Main Parameter Specification

Table 4.1 Limit Parameter

Parameter	Limit	Unit
Voltages Referenced to Ground		
Voltage On V_{BAT}	- 24 to 45	V
Voltage K	- 16 to ($V_{BAT} + 1$)	
Voltage Difference V(V_{BAT} , K)	55	
Voltage or Max. Current On Any Pin (Except V_{BAT} , K)	- 0.3 to ($V_{DD} + 0.3$ V) or 10	mA
Voltage on V_{DD}	7	V
K Pin Only, Short Circuit Duration (to V_{BAT} or GND)	Continuous	
Operating Temperature (T_A)	- 40 to 125	°C
Junction and Storage Temperature	- 55 to 150	
Thermal Impedance	125	°C/W

Table 4.2 Typical Parameter

Parameter	Operating range	Unit
Reference Voltage Connected to Ground		
V_{DD}	4.5-5.5	V
V_{BAT}	6-36	
K	6-36	
Digital inputs	0- V_{DD}	



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Table 4.3 Electrical specification

Parameter	Symbol	Test Conditions Unless Specified VDD = 4.5 V to 5.5 V VBAT = 6 V to 36 V		Temp	Temperature range: -40~125°C			Unit
					Min	Typical	Max	
Transmitter and Logic Levels								
$\overline{CS}$,TX Input Low Voltage	V _{ILT}			Full			1.5	V
$\overline{CS}$,TX Input High Voltage	V _{IHT}			Full	3.5			
TX Input Capacitance	C _{INT}			Full			10	pF
$\overline{CS}$,TX Input Pull-up Resistance	R _{TX}	V _{DD} = 5.5 V, or $\overline{CS}$ =1.5V, 3.5 V		Full	10	20	40	kΩ
K Transmit								
K Output Low Voltage	V _{OLK}	R _L = 510Ω ± 5 %, V _{BAT} = 6 to 18V		Full			0.2V _{BAT}	V
		R _L = 1 kΩ ± 5 %, V _{BAT} = 16 to 36V		Full			0.2V _{BAT}	
		R _L = 510Ω ± 5 %, V _{BAT} = 4.5V		Full			1.2	
K Output High Voltage	V _{OHK}	R _L = 510Ω ± 5 %, V _{BAT} = 6 to 18V		Full	0.95V _{BAT}			
		R _L = 1 kΩ ± 5 %, V _{BAT} = 16 to 36V		Full	0.95V _{BAT}			
K Rise Times	t _r	See Test Circuit		Full			9	μs
K Fall Times	t _f	See Test Circuit		Full			1	μs
K Output Sink Resistance	R _{si}	$\overline{CS}$ = 0 V, TX = 0 V		Full			110	Ω
K Output Capacitance	C _O			Full			20	pF
Receiver								
K Input Low Voltage	V _{ILK}			Full			0.35V _{BAT}	V
K Input High Voltage	V _{IHK}			Full	0.65V _{BAT}			
K Input Hysteresis	V _{HYS}			Full		0.05V _{BAT}		
K Input Currents	I _{IHK}	$\overline{CS}$ =Hi gh	V _{IHK} = V _{BAT}	Full		3	20	μA
RX Output Low Voltage	V _{OLR}		V _{ILK} =0.35V _{BAT} I _{OLR} = 1 mA	Full			0.4	V
RX Pull-up Resistance	R _{RX}			Full	5		20	kΩ
RX Turn On Delay	t _{d(on)}	R _L = 510Ω ± 5 %, V _{BAT} = 6 to 18 V C _L = 10 nF, See TestCircuit		Full		1	10	μs
		R _L = 1 kΩ ± 5 %, V _{BAT} = 16 to 36 V C _L = 4.7 nF,See TestCircuit		Full		1	10	



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RX Turn Off Delay	$t_{d(off)}$	$R_L = 510\Omega \pm 5 \%$, $V_{BAT} = 6 \text{ to } 18 \text{ V}$ $C_L = 10 \text{ nF}$, See TestCircuit	Full		6	10	
		$R_L = 1 \text{ k}\Omega \pm 5 \%$, $V_{BAT} = 16 \text{ to } 36 \text{ V}$ $C_L = 4.7 \text{ nF}$,See TestCircuit	Full		6	10	
Supplies							
Bat Supply Current On	$I_{BAT(on)}$	$\overline{CS}=TX=0 \text{ V}$, $V_{BAT} \leq 16 \text{ V}$	Full		0.06	3	mA
Bat Supply Current Off	$I_{BAT(off)}$	$\overline{CS}$ =High, $V_{BAT} \leq 12 \text{ V}$, $TX = \text{High}$	Full		60	220	μA
Bat Supply Current Standby	$I_{BAT(SB)}$	$V_{DD} \leq 0.5 \text{ V}$, $V_{BAT} \leq 12 \text{ V}$	Full		<1	10	
Logic Supply Current On	$I_{DD(on)}$	$V_{DD} \leq 5.5 \text{ V}$, $TX = 0 \text{ V}$	Full		0.9	2.3	mA
Logic Supply Current Off	$I_{DD(off)}$	$\overline{CS}$ =High, $V_{BAT} \leq 12\text{V}$, $TX = \text{High}$	Full		2.5	10	μA
Miscellaneous							
TX Transmit Baud Rate	BR_T	$R_L = 510\Omega$, $C_L = 10 \text{ nF}$	Full	10.4			kBaud
RX Receive Baud Rate	BR_R	$6 \text{ V} < V_{BAT} < 16 \text{ V}$, $C_{RX} = 20 \text{ pF}$	Full		200		
Transmission Frequency	f_{K-RXK}	$6 \text{ V} < V_{BAT} < 16 \text{ V}$, $R_K = 510 \Omega$, $C_K \leq 1.3 \text{ nF}$	Full	50	200		kHz
Fault Output Low Voltage	V_{OLF}	$\overline{CS}=TX=0$, $K = V_{BAT}$, $I_{OLF} = 1 \text{ mA}$	Full			0.4	V
CS Minimum Pulse Width	τ_{CS}		Full	1			μs
Over Temperature Shutdown	T_{SHUT}	Temperature Rising		160	180		$^{\circ}\text{C}$
Temperature Shutdown Hysteresis	T_{HYST}				30		

5 Package

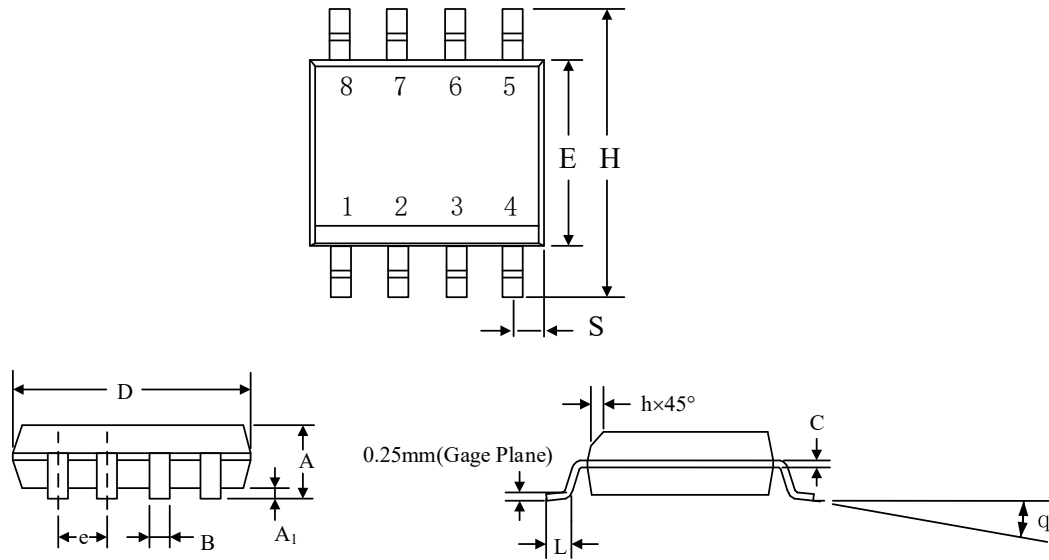


Figure5-1

Table 5.1

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	1.35	1.75	0.053	0.069
A1	0.10	0.20	0.004	0.008
B	0.35	0.51	0.014	0.020
C	0.19	0.25	0.0075	0.010
D	4.80	5.00	0.189	0.196
E	3.80	4.00	0.150	0.157
e	1.27BSC		0.050BSC	
H	5.80	6.20	0.228	0.244
h	0.25	0.50	0.010	0.020
L	0.50	0.93	0.020	0.037
q	0°	8°	0°	8°
S	0.44	0.64	0.018	0.026

6 Typical Application Schematic

6.1 Test Circuit and Timing Diagram

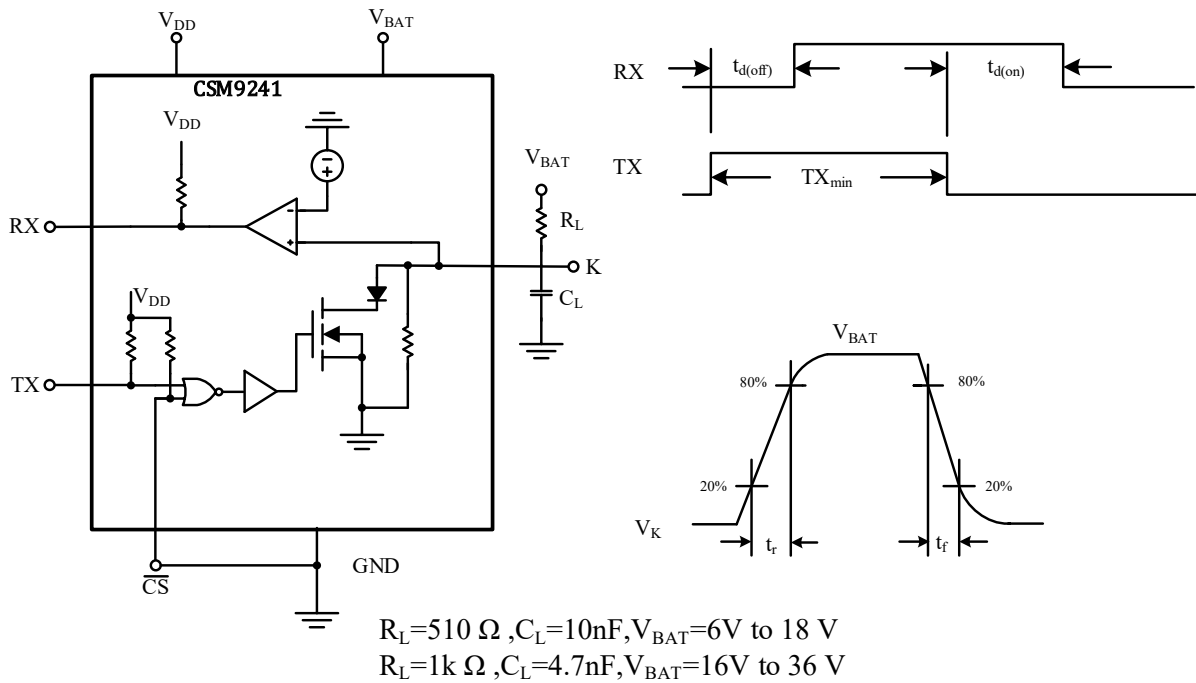
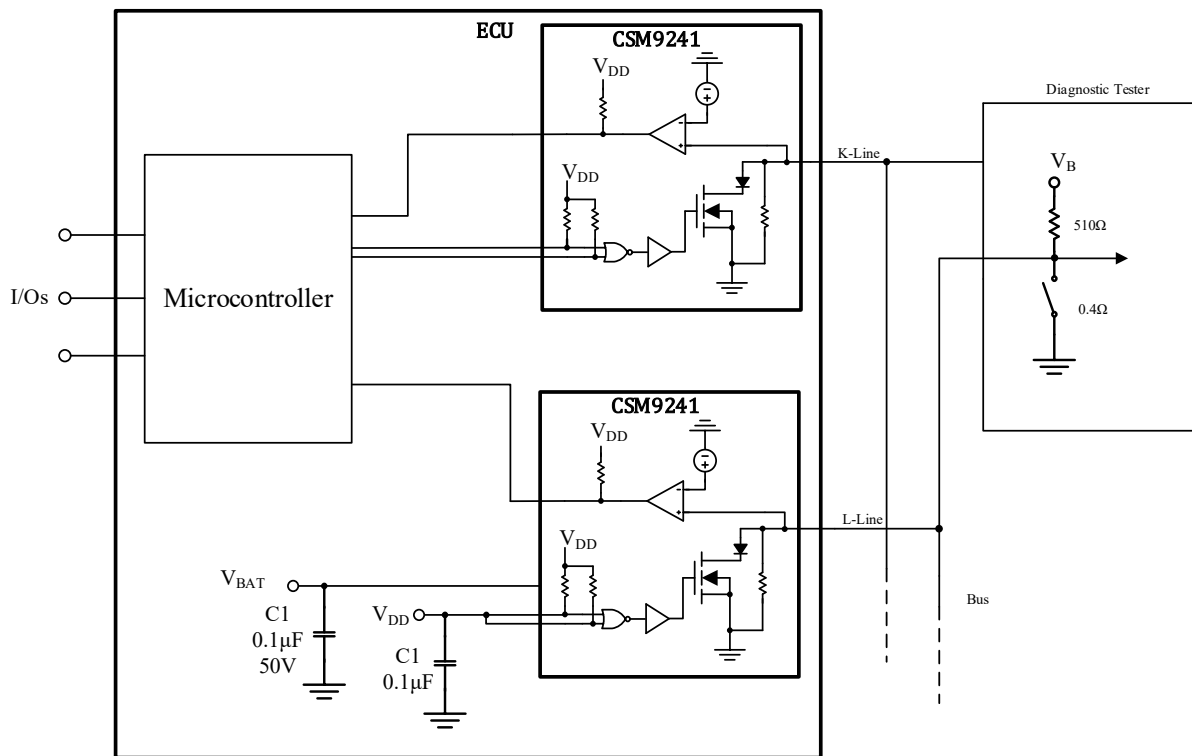


Figure 6-1

6.2 Application Circuit



ECU = Electronic Control Unit

Figure 6-2



7 Version Information

Version	Modify date	Modified content
V1.0	2023/11/13	First draft



8 Order Information

Package marking

CSM9241 ABBCDEE

CSM9241: chip code

A: package date code, 5 represents year 2020

BB: week of sending out processing, 42 represents in the year A the 42th week

C: package factory code, A、HT、NJ or WA, can also abbreviated as A、H、N or W

D: test factory code, A、Z or H

EE: production batch code

Table 11-1 Si24R2F+ order example

order code	package	container	minimum
CSM9241-Sample	SOP-8	Box/Tube	5
CSM9241	SOP-8	Tape and reel	3K



9 Technical Support and Contact Information

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