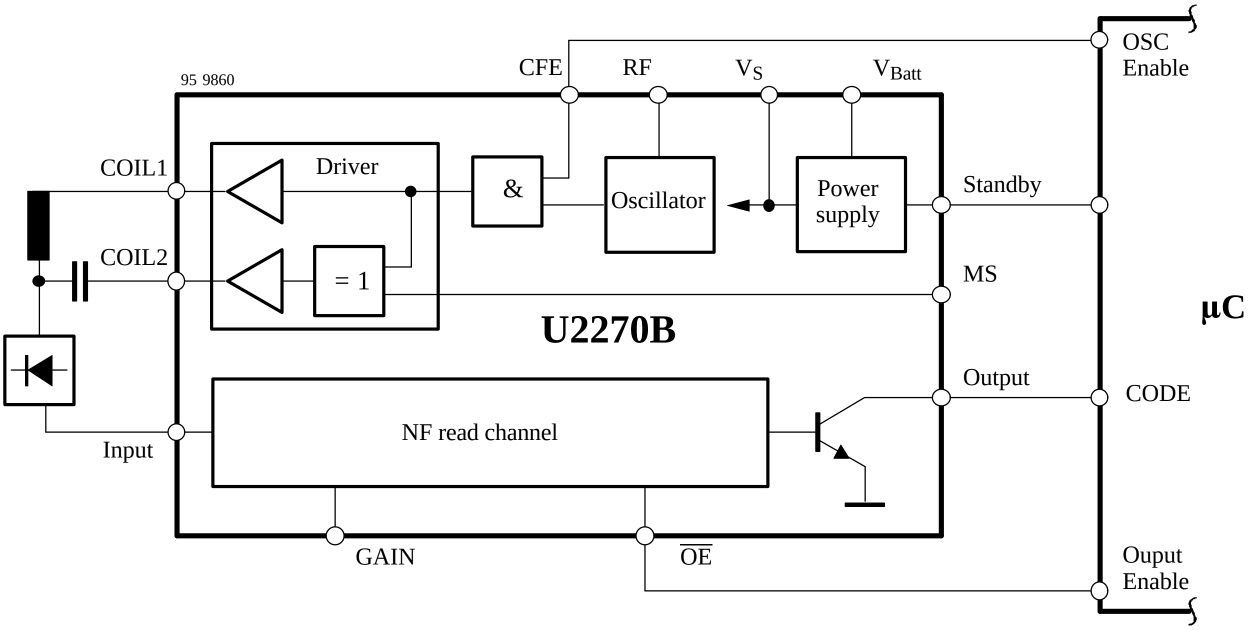
Reader IC U2270B



The U2270B serves as interface between the transponder and the microcontroller that compares the received data. This interface operates bidirectional.

One direction is the energy transfer from the reader to the transponder. The reader creates a magnetic field via a reader air coil. This coil is operated by a special driver circuit. The driver consists of two output stages that can be operated in common or in differential mode via the Pin MS. Using this feature, the user is flexible in the design of the antenna. The driver is controlled by an on-chip oscillator. The operating frequency is programmed by an external resistor. This enables the user to externally adjust the frequency to the relevant circumstances. This feature is important to compensate frequency tolerances of the antenna and the transponder. The oscillator can be disabled through pin CFE to enable read-write operation.

The other direction is the data transfer from the transponder to the microcontroller. The transponder modulates the magnetic field with its internal data. This leads to a tiny voltage modulation at the reader coil. Via a rectifier, this signal is fed into the input pin of the reader IC. The NF read channel amplifies and conditions the signal to convert it to the appropriate digital output data. The gain of the amplifier can be programmed through Pin GAIN to adopt to the relevant reading distance. An open-collector output serves as interface to the connected controller. With a logic signal at Pin OE, the data output can be disabled.

The reader IC also incorporates an internal power supply. This enables the user to operate the system from a 12-V supply but also from an existing 5-V supply rail. Via the Pin Standby, the U2270B can be set to power-down mode where the supply current is very low.

Extended Reading Range with Large Reader Antennas with U2270B

Theoretical coupling factor via reading distance, optimized reader antenna diameter (r = a)

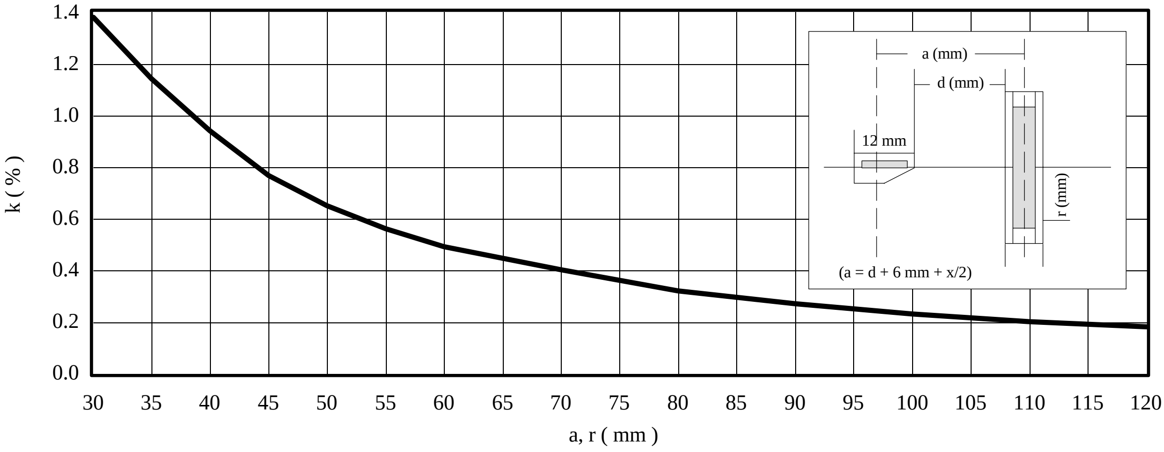


Figure 1. Coupling factor vs. coil radius and distance

Example

Reader antenna: r = 127 mm
Measured coupling factor, k, with the TTC (test transponder coil)

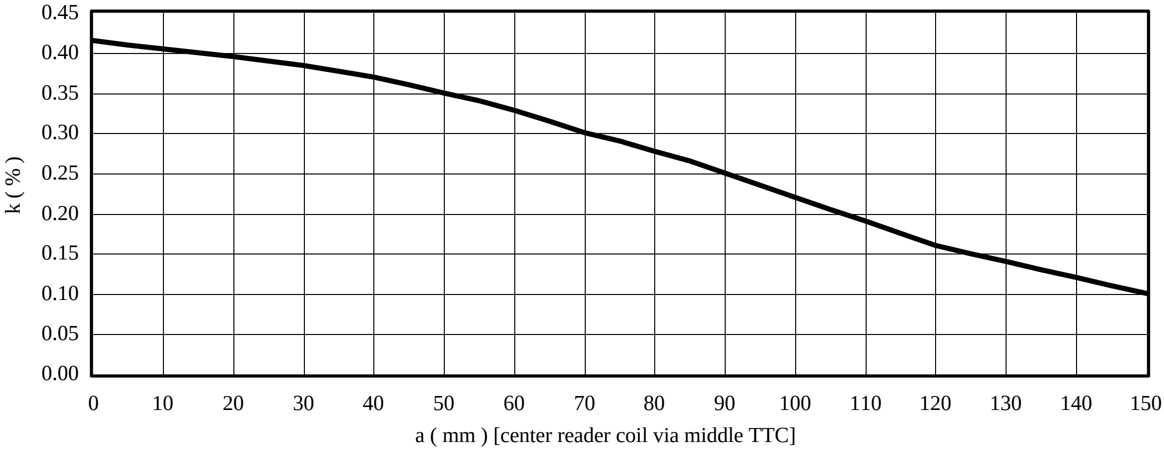


Figure 2. Coupling factor via TTC for a big reader coil (r = 127 mm, L = 688 µH)

Calculation

Maximal U2270B output current
(see chapter "Antenna Design Hints")

$$V_{DS} = V_{EXT} = 8\ V$$

$$V_{DRVpp} = 14.8\ Vpp$$

$$V_{DRVss} = \frac{4}{\pi} \times V_{DRVpp} = 18.8\ V$$

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$$V_{DRVss} = 400\ mAss$$

$$Q_R = 12$$

$$V_{Rss} = V_{DRVss} \times Q = 226\ V$$

$$X_L = \frac{V_{Rss}}{I_{DRVss}} = 565\ \Omega$$

$$L_{opt} = \frac{X_L}{2 \times \pi \times f_0} = 719\ \mu H$$

Test conditions

Reader antenna: radius r = 127 mm
L_1 = 680 µH (N = 32), L_2 = 900 µH (N = 36) and
L_3 = 1450 µH (N = 47)

$$C_R = \frac{1}{(2 \times \pi \times f_0)^2 \times L_R}$$

Results

Reading distance for Atmel Wireless & Microcontrollers' TK5530 transponder (f_0 = 125 kHz, rf/32), reader resonance frequency tuned on transponder resonance frequency (total frequency tolerance max. ± 1%).

- $L_R = L_1$ = 680 µH , C_R = 2.35 nF, V_{EXT} = 8 V,
  V_R = 226 Vss, Q = 12, ΔV_R = 44 mVss
  reading distance a = 100 mm
- $L_R = L_2$ = 900 µH , C_R = 1.8 nF, V_{EXT} = 8 V,
  V_R = 226 Vss, Q = 12, ΔV_R = 44 mVss
  reading distance a = 90 mm
- $L_R = L_2$ = 1450 µH , C_R = 1.1 nF, V_{EXT} = 8 V,
  V_R = 226 Vss, Q = 12, ΔV_R = 44 mVss
  reading distance a = 85 mm

Application

U2270B demo board, 12-V application with diode feedback, differential output mode, two rail operation (driver voltage V_{DVS} = 8 V).

The application is suitable for the mentioned conditions only (transponder frequency of tolerance ±1% to base station). The TK5561 has a multistep frequency self adaption already implemented. For the TK5530 and TK5551, an additional multistep frequency self adaption has to be implemented in the base station. Refering to the chapter "Electronic Immobilizers for the Automotive Industry", figure 8, the frequency self adaption should be realized in an extended application.

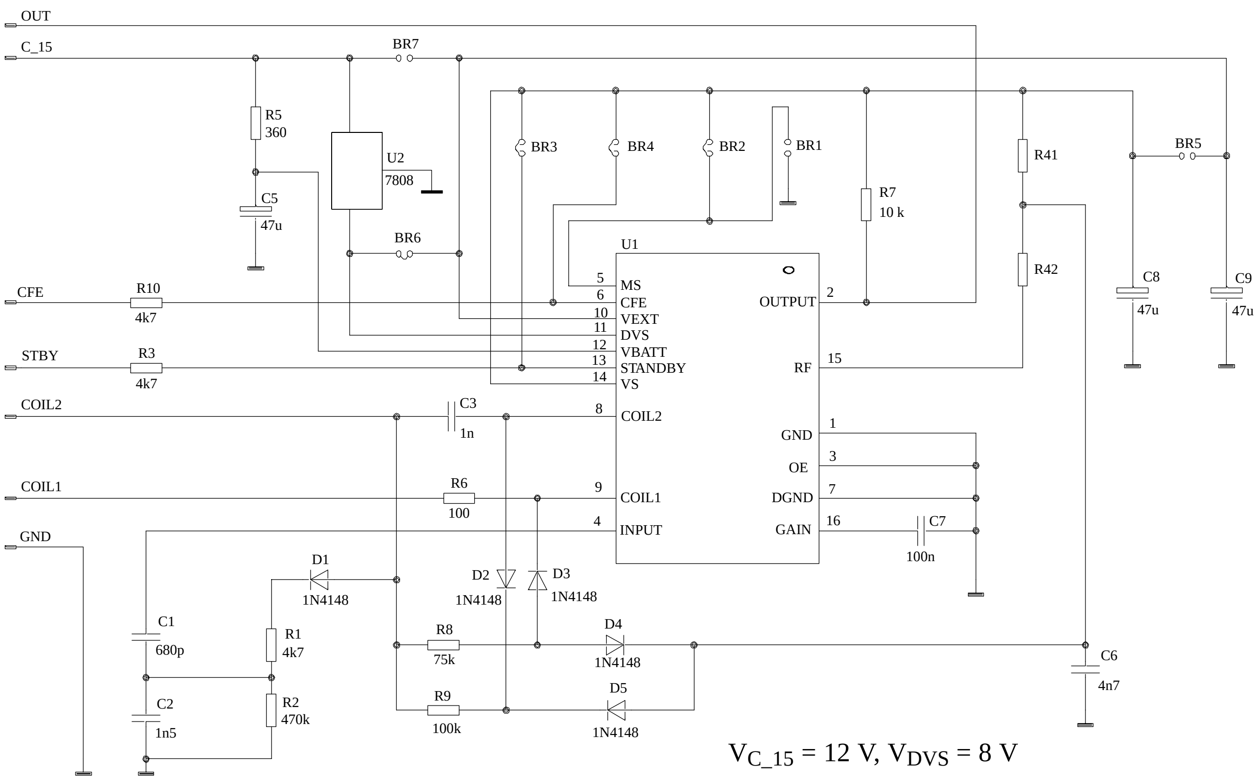

Figure 3. Application schematic

Distance Measurements Using Application Kit TMEB8704

(Best case results @ 25 degrees)

Transponder Type	Reading Distance				Writing Distance
	without Autotuning		**with** Autotuning		
	RF/32	**RF/64**	**RF/32**	**RF/64**	
TK5530	8 cm		8 cm		
TK5551	7.5 cm	8.5 cm	8 cm	8.5 cm	6.5 cm
TK5552	8 cm		8 cm		11 cm
TK5561	6.5 cm	7.0 cm	7 cm	7 cm	7 cm

Order address of the transceiver coil:

Part no. V–31013–30001

Company
Wagner Elektrogeraete GmbH
Sulzbacher Str. 4–8
71577 Grosserlach
Germany

TMEB8704 Description

TK5552A–PP	Same READ / WRITE distance > 8 cm, WRITE distance up to 11 cm
TK5551A–PP TK5561A–PP	Extended READ distance 8 cm
Windows 95 / NT	

Programmable Transponder IC / with Interface to an Active RF/IR Channel

To this offering, Atmel Wireless & Microcontrollers has added the U9280M, a device with intelligent power management, integrating a 4-bit microcontroller incl. EEPROM and a transponder front end. This fully programmable device combines transponder and remote control functions, offering the highest flexibility on the market for implementing transponder algorithms and IR/RF protocols.

The U9280M provides extremely low power consumption: 2.0 V, < 300 µA typ. in active mode, or < 1 µA in power-down mode.

Applications U9280M:

- Car immobilizer / RKE
- Access control / alarm technics
- Telemetery / wireless sensor

System Solution for Immobilizer in Combination with RKE