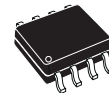


ISO 9141 INTERFACE

- OPERATING POWER SUPPLY VOLTAGE RANGE $4.5V \leq V_S \leq 36V$ (40V FOR TRANSIENTS)
- REVERSE SUPPLY (BATTERY) PROTECTED DOWN TO $V_S \geq -24V$
- STANDBY MODE WITH VERY LOW CURRENT CONSUMPTION $I_{SSB} 1\mu A @ V_{CC} 0.5V$
- LOW QUIESCENT CURRENT IN OFF CONDITION $I_{OFF} = 120\mu A$
- TTL COMPATIBLE TX INPUT
- BIDIRECTIONAL K-I/O PIN WITH SUPPLY VOLTAGE DEPENDENT INPUT THRESHOLD
- OVERTEMPERATURE SHUT DOWN FUNCTION SELECTIVE TO K-I/O PIN
- WIDE INPUT AND OUTPUT VOLTAGE RANGE $-24V \leq V_K \leq V_S$
- K OUTPUT CURRENT LIMITATION, TYP $I_K = 60mA$
- DEFINED OFF OUTPUT STATUS IN UNDERVOLTAGE CONDITION AND V_S OR GND INTERRUPTION
- CONTROLLED OUTPUT SLOPE FOR LOW EMI
- HIGH INPUT IMPEDANCE FOR OPEN V_S OR GND CONNECTION



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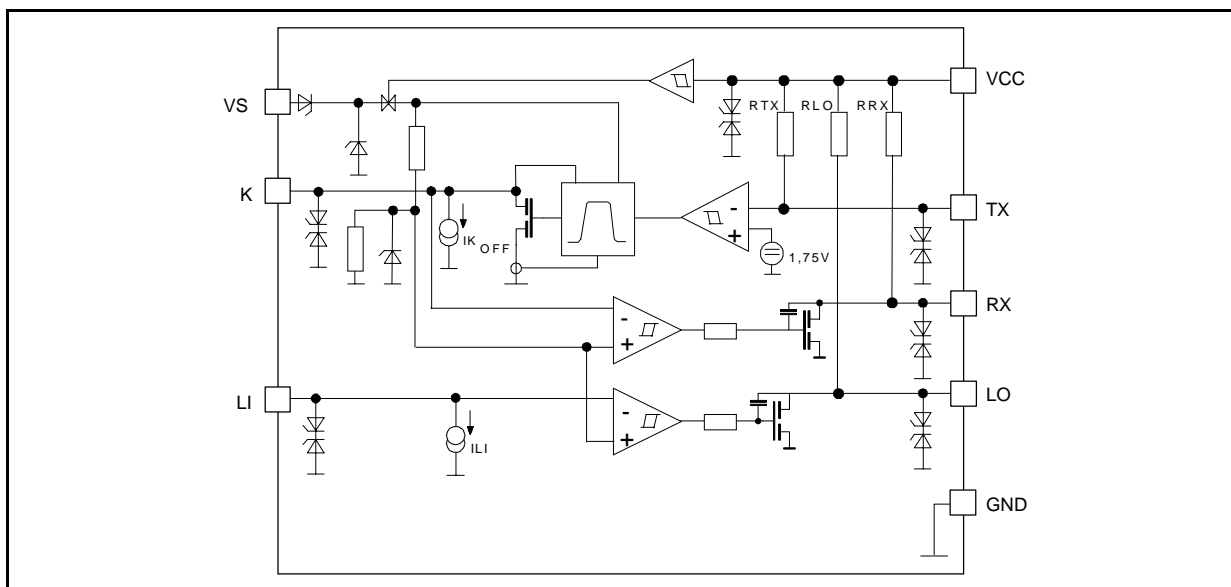
ORDERING NUMBER: L9637D

- DEFINED OUTPUT ON STATUS OF LO OR RX FOR OPEN LI OR K INPUTS
- DEFINED K OUTPUT OFF FOR TX INPUT OPEN
- INTEGRATED PULL UP RESISTORS FOR TX, RX AND LO
- EMI ROBUSTNESS OPTIMIZED

DESCRIPTION

The L9637D is a monolithic integrated circuit containing standard ISO 9141 compatible interface functions.

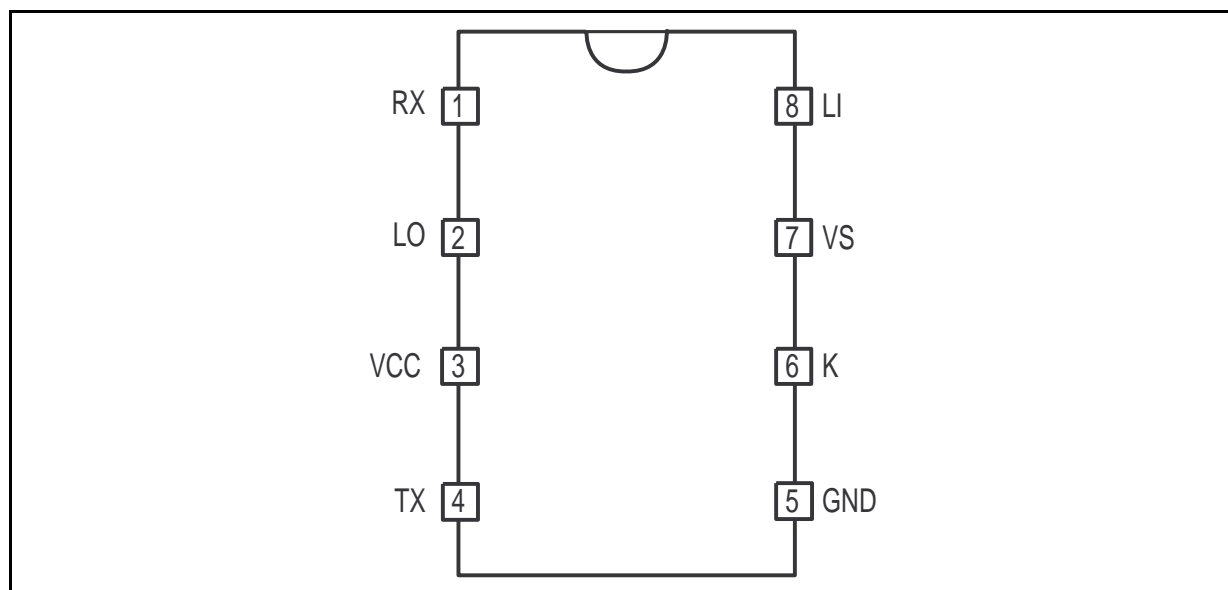
BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS (No damage or latch)

Symbol	Parameter	Value	Unit
V_S	Supply Voltage	-24 to +36	V
	ISO transients $t = 400\text{ms}$	-24 to +40	V
V_{CC}	Stabilized Voltage	-0.3 to +7	V
$\Delta V_S/dt$	Supply Voltage transient	-10 to +10	V/ μs
$V_{LI, K}$	Pin Voltage	-24 to V_S	V
$V_{LO, RX, TX}$	Pin Voltage	-24 to V_{CC}	V

Note: Max. ESD voltages are $\pm 2\text{kV}$ with human body model $C = 100\text{pF}$, $R = 1.5\text{k}$ corresponds to maximum energy dissipation 0.2mJ according to MIL883C.

PIN CONNECTION (Top view)**THERMAL DATA**

Symbol	Parameter	Min.	Typ.	Max.	Unit
T_{JSDon}	Temperature K shutdown switch on threshold	160		200	$^{\circ}\text{C}$
T_{JSDoff}	Temperature K shutdown switch off threshold	150		200	$^{\circ}\text{C}$
$R_{th j-amb}$	Thermal steady state junction to ambient resistance	130	155	180	$^{\circ}\text{C/W}$

PIN DESCRIPTION

N.	Name	Function
1	RX	Output for K as input
2	LO	Output L comparator
3	VCC	Stabilized voltage supply
4	TX	Input for K as output
5	GND	Common GND
6	K	Bidirectional I/O
7	VS	Supply voltage
8	LI	Input L comparator

ELECTRICAL CHARACTERISTICS (The electrical characteristics are valid within the below defined operating conditions, unless otherwise specified. The function is guaranteed by design until T_{JSDon} temperature shutdown switch-on-threshold.)

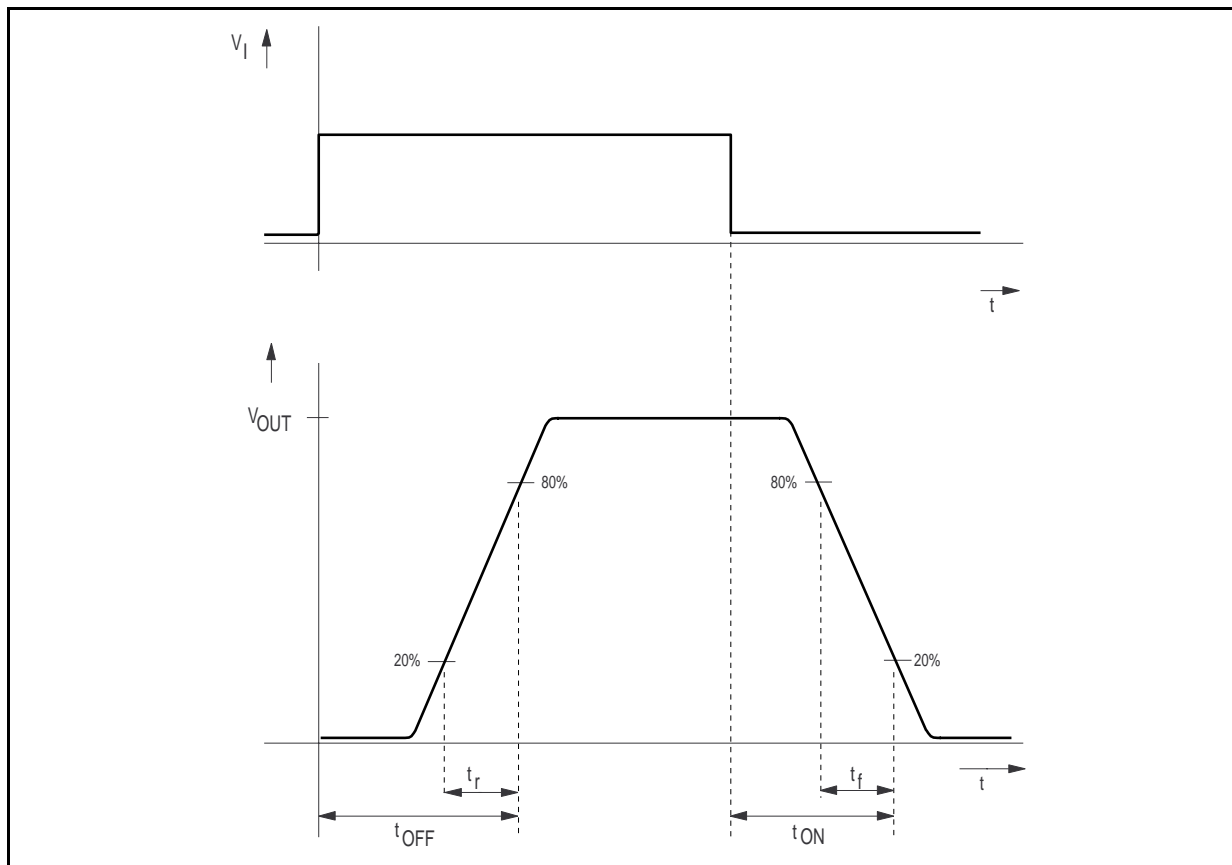
Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
V_S	Supply Voltage		4.5		36	V
V_{CC}	Stabilized Voltage		3		7	V
T_j	Junction temperature		-40		150	°C
I_{CC}	Supply V_{CC} Current	$V_{CC} \leq 5.5V$; $V_{LI}, V_{TX} = 0V$		1.4	2.3	mA
		$V_K \geq V_{K_{high}}$; $V_{LI} \geq V_{LI_{high}}$ $V_{TX} = V_{CC}$ @ $V_{CC} \leq 5.5V$	-5	<1	5	μA
I_{SON}	Supply V_S Current	$V_S \leq 16V$; $V_{LI}, V_{TX} = 0V$		1.2	3	mA
I_{SOFF}		$V_K \geq V_{K_{high}}$; $V_{LI} \geq V_{LI_{high}}$ $V_{TX} \geq V_{TX_{high}}$ @ $V_S \leq 12V$		120	220	μA
I_{SB}		$V_{CC} \leq 0.5V$ @ $V_S \leq 12V$		<1		μA
$V_{K_{low}}$	Input Voltage Low state	RX output status LOW $4.5V \leq V_S \leq 18V$	-24		$0.45V_S$	V
		RX output status LOW $18V < V_S$	-24		8	V
$V_{K_{high}}$	Input Voltage High state	RX output status HIGH $4.5V \leq V_S \leq 18V$	$0.55V_S$		V_S	V
		RX output status HIGH $18V < V_S$	12		V_S	V
$V_{K_{hys}}$	Input Threshold Hysteresis	$V_{K_{high}} - V_{K_{low}}$		$0.025V_S$	0.8	V
$I_{K_{off}}$	Input Current	@ $V_{TX} \geq V_{TX_{high}}$ $V_K \leq V_S$ $V_S, V_{CC} \geq 0$ or $V_S, V_{CC} = \text{open}$	-5	4	25	μA
$R_{K_{ON}}$	Output ON Impedance	@ $V_S \geq 6.5V$ $V_{TX} \leq V_{TX_{low}}$ $I_K \geq 7mA$ 1)		10	30	Ω
$I_{K_{SC}}$	Short Circuit Current		30	60	100	mA
$V_{TX_{low}}$	Input voltage LOW state		-24		1	V
$V_{TX_{high}}$	Input voltage HIGH state		2.5		V_{CC}	V
$R_{RX_{ON}}$ $R_{LO_{ON}}$	Output ON Impedance	$V_K \leq V_{K_{low}}$; $V_{LI} \leq V_{LI_{low}}$ $V_S \geq 6.5V$ $I_{RX, LO} \geq 1mA$ 1)		40	90	Ω
$I_{RX_{SC}}$ $I_{LO_{SC}}$	Output Short Circuit Current		9	20	35	mA
V_{RX_H} V_{LO_H}	Output Voltage HIGH state	$10M\Omega \leq R_{LRX}$ $10M\Omega \leq R_{LLO}$	$V_{CC} - 0.25$	$V_{CC} - 0.1$	V_{CC}	V
R_{LO} R_{RX}	Output pull-up resistance	Output status = (HIGH) $-0.15V \leq V_{LO} \leq V_{CC} + 0.15V$ $-0.15V \leq V_{RX} \leq V_{CC} + 0.15V$	5	10	20	K Ω
R_{TX}	Input pull up resistance	$-0.15V \leq V_{TX} \leq V_{CC} + 0.15V$	10	20	40	K Ω
$V_{LI_{low}}$	Input voltage LOW state	LO output status LOW $4.5V \leq V_S \leq 18V$	-24		$0.45V_S$	V
		LO output status LOW $18V < V_S$	-24		8	V
$V_{L_{high}}$	Input voltage HIGH state	LO output status HIGH $4.5V \leq V_S \leq 18V$	$0.55V_S$		V_S	V
		LO output status HIGH $18V < V_S$	12		V_S	V
$V_{L_{hys}}$	Input threshold hysteresis	$V_{L_{high}} - V_{L_{low}}$		$0.025V_S$	0.8	V
I_{LI}	Input current	$V_{LI} \leq V_S$ $V_S, V_{CC} \geq 0$ or $V_S, V_{CC} = \text{open}$	-5	4	25	μA

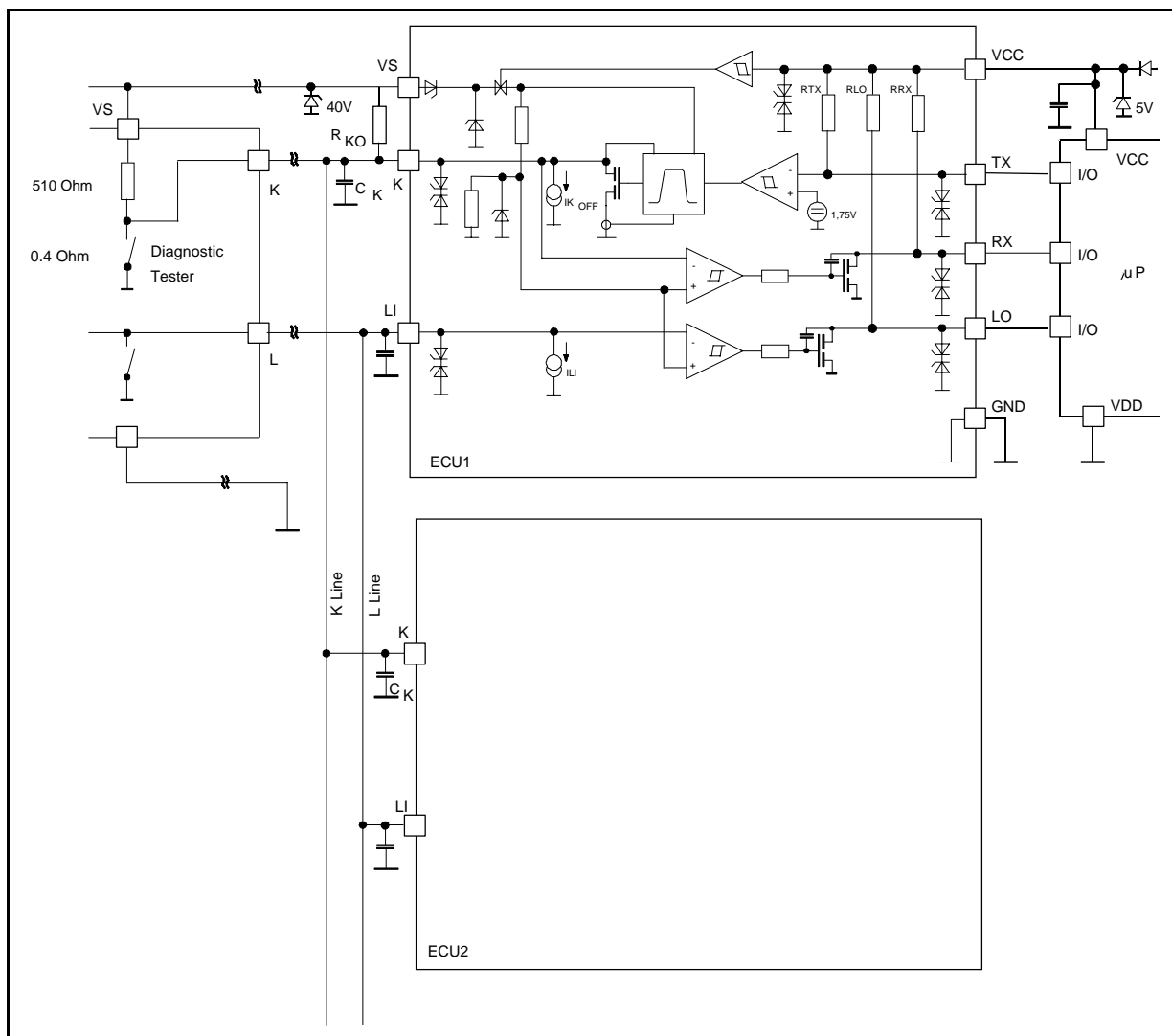
ELECTRICAL CHARACTERISTIC (continued)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
$C_{KI, LO, RX}$	Internal output capacities				20	pF
f_{LI-LO} f_{K-RX} f_{TX-K}	Transmission Frequency	$9V < V_S < 16V$ (external loads) $R_{KO} = 510\Omega$, $C_K \leq 1.3nF$ in active mode see Fig. 3	50	100		kHz
t_{rLI-LO} t_{rK-RX} t_{rTX-K}	Rise Time	for the definition of t_r , t_f see Fig.1.		2	6	μs
t_{fLI-LO} t_{fK-RX} t_{fTX-K}	Fall Time	$9V < V_S < 16V$ (external loads) $R_{KO} = 510\Omega$, $C_K \leq 1.3nF$		2	6	μs
$t_{OFF, LI-LO}$ $t_{OFF, K-RX}$ $t_{OFF, TX-K}$	Switch OFF time	for the definition of t_{on} , t_{OFF} see Fig.1.		4	17	μs
$t_{ON, LI-LO}$ $t_{ON, K-RX}$ $t_{ON, TX-K}$	Switch ON time	$9V < V_S < 16V$ (external loads) $R_{KO} = 510\Omega$, $C_K \leq 1.3nF$ (inactive mode see Fig. 3)		4	17	μs

1) For output currents lower than this value a series protection diode can become active. See also Fig. 4 and 5.

Figure 1: Input to Output Timings and Output Pulse Shape.





All V_{Bat} bus defined inputs LI and K have supply voltage dependent thresholds together with suf-



Suppressing all 4 classes of "Schaffner" signals all pins can be load with short energy pulses of max. $\pm 0.2\text{mJ}$. All these features together with a high possible baud rate $>50\text{Kbaud}$, controlled output slopes for low EMI, a wide power supply voltage range and a very small quiescent current during OFF (TX LI K=High) condition $I_{\text{Soff typ}} \leq 120\mu\text{A}$, and a real standby function with zero power consumption $I_{\text{Ssb typ}} \leq 1\mu\text{A}$ during system depowering $V_{\text{CC}} \leq 0.5\text{V}$ make this device high efficient for automotive bus system.

After wake up of the system from OFF or SB condition the first output signal will have an additional delay time $t_{\text{dtyp}} \leq 5\mu\text{s}$ see also Fig. 3.

The typical output voltage behaviour for the K, LO, RX outputs as a function of the output current is shown in Fig.4. Fig.5 shows a waveform of the output signal when the low level changes from $R_{\text{ON}} * I_{\text{OUT}}$ to $I_{\text{OUT}} * 2 * R_{\text{ON}} + U_{\text{BE}}$ state. This variation occurs due to too low output current or after a negative transient forced to the output or to the supply voltage line.

Figure 3: Typical timing for mode transitions.

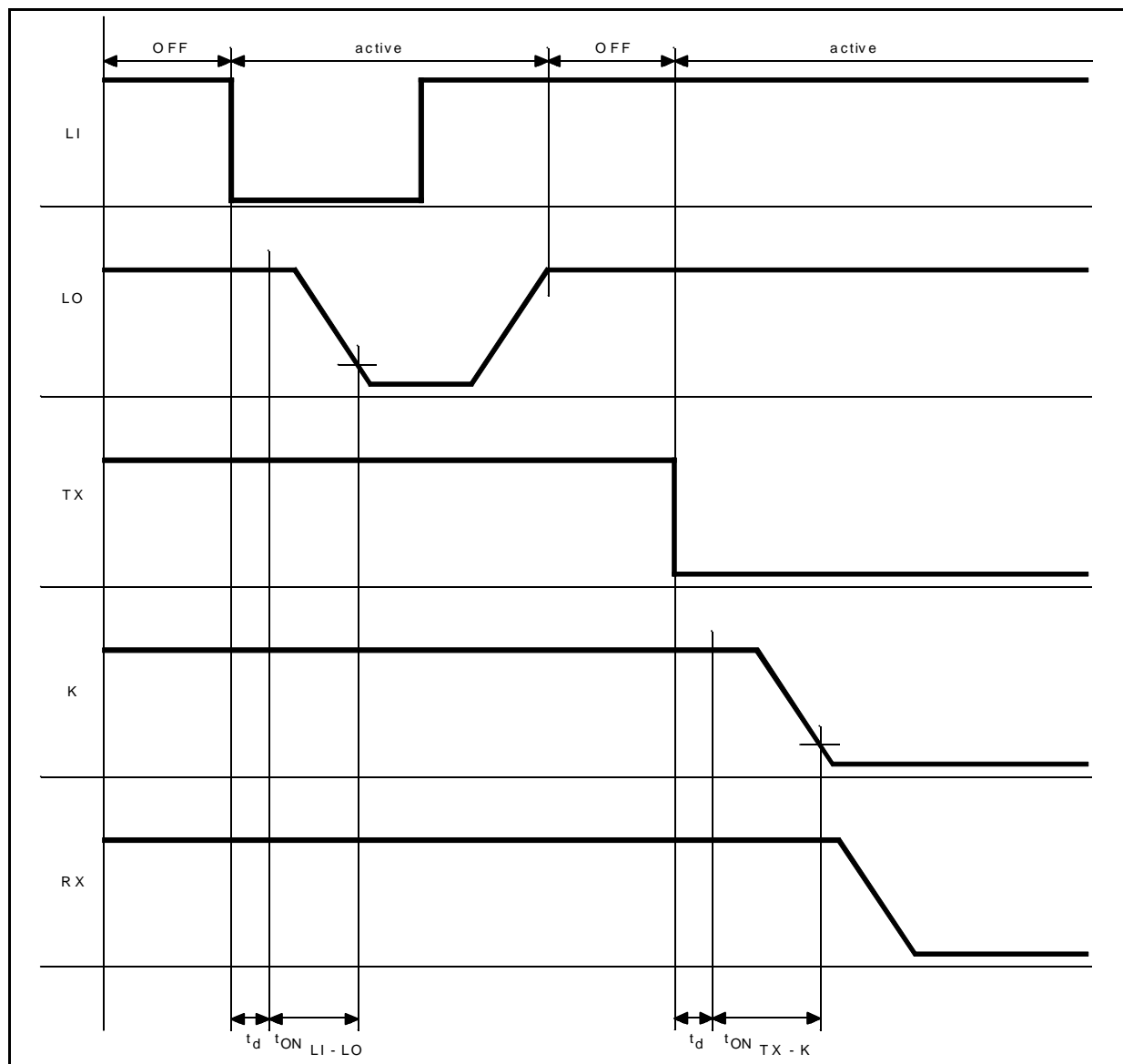


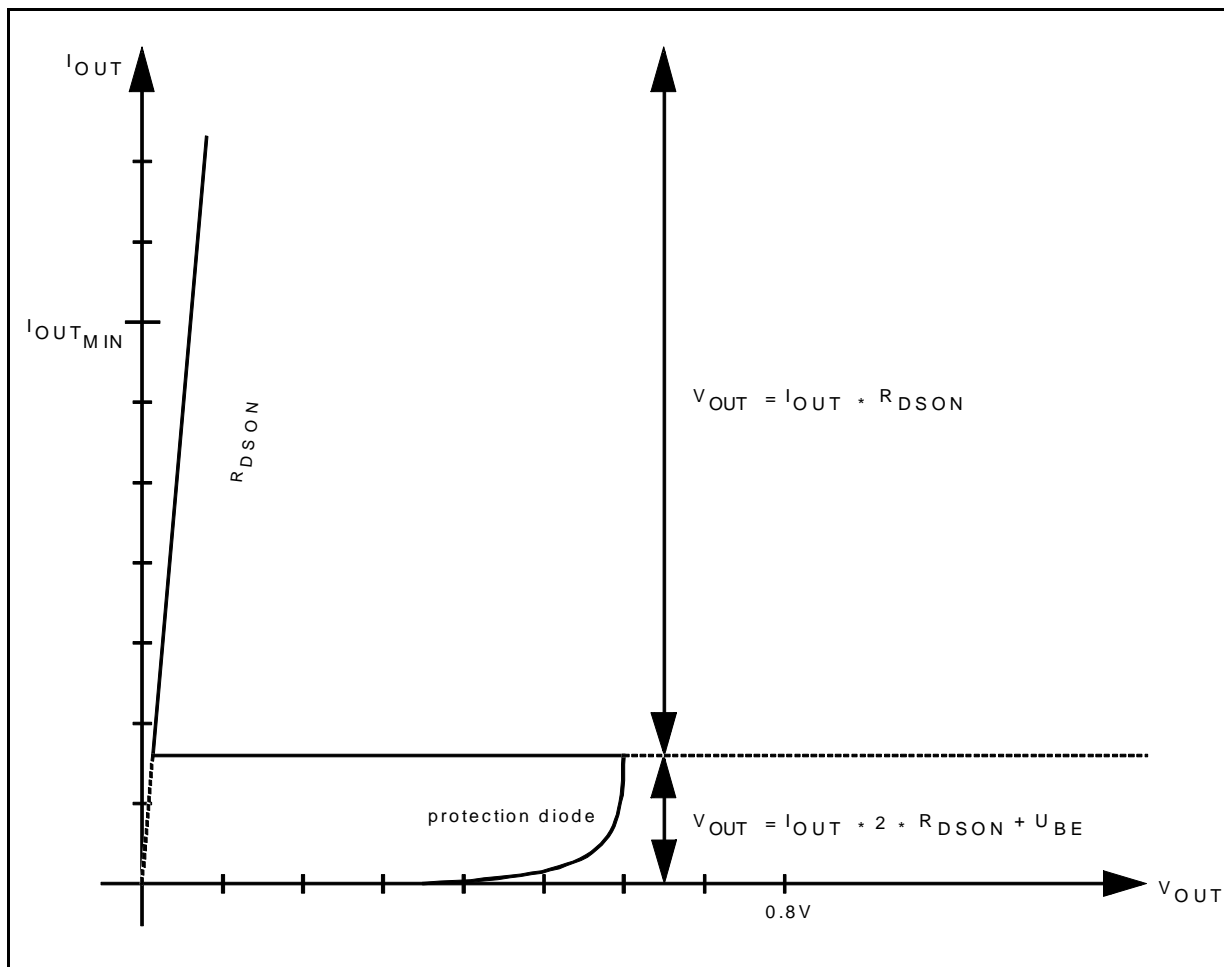
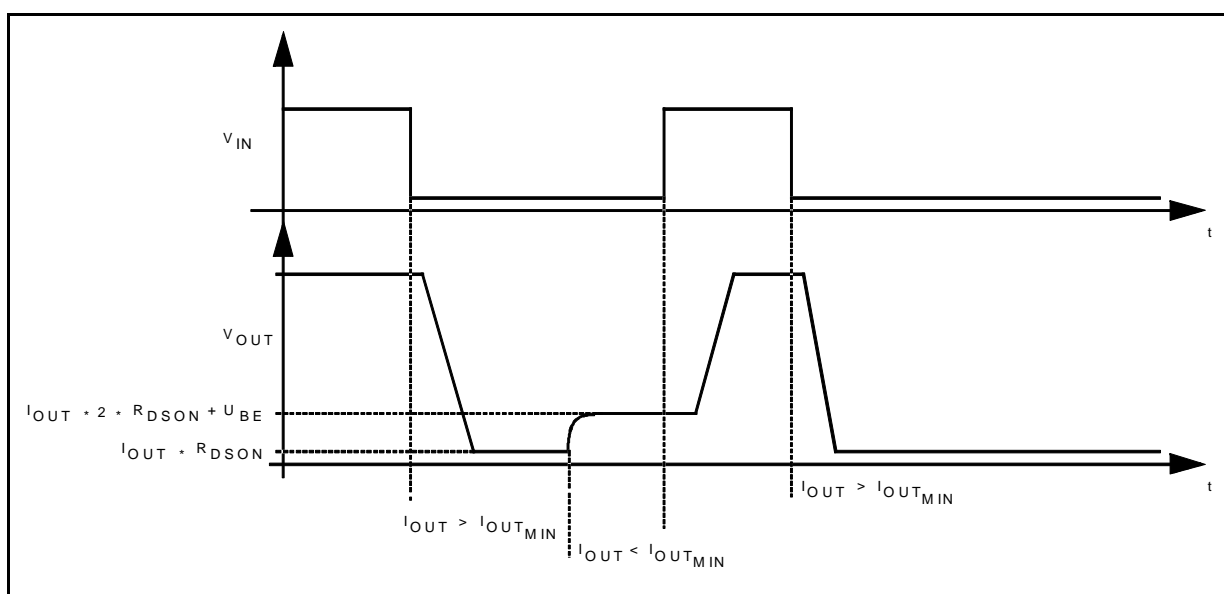
Figure 4: Output Characteristics at K, LO, RX.**Figure 5:** Output Signal Shape Related to Output Current.

Figure 6: EMS Performance (ISO 9141 BUS system).

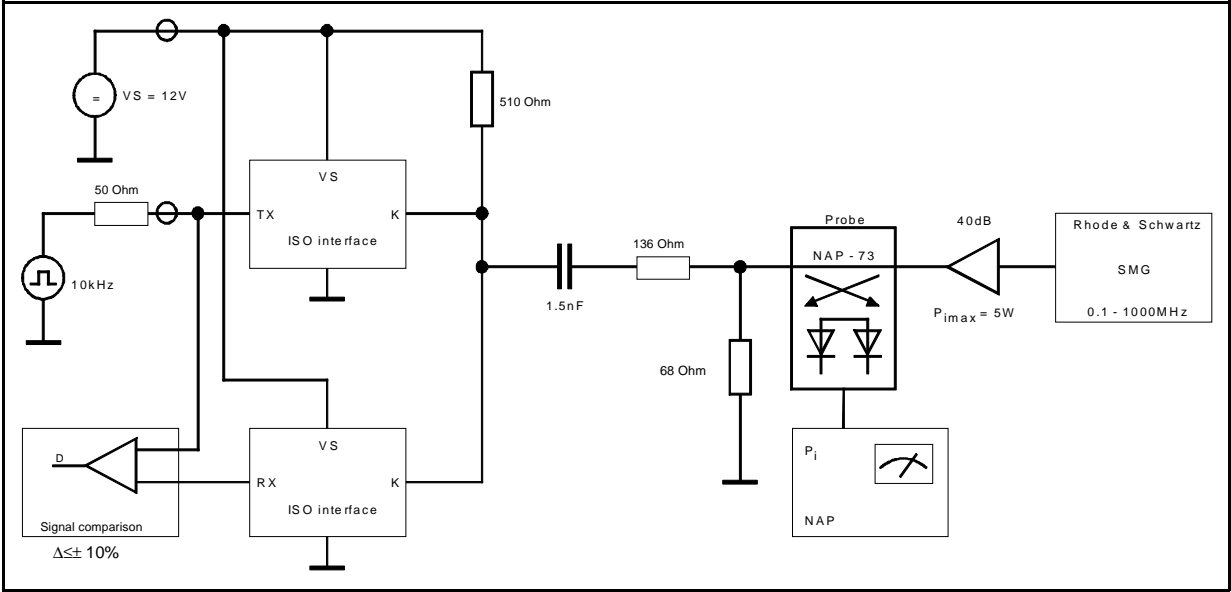
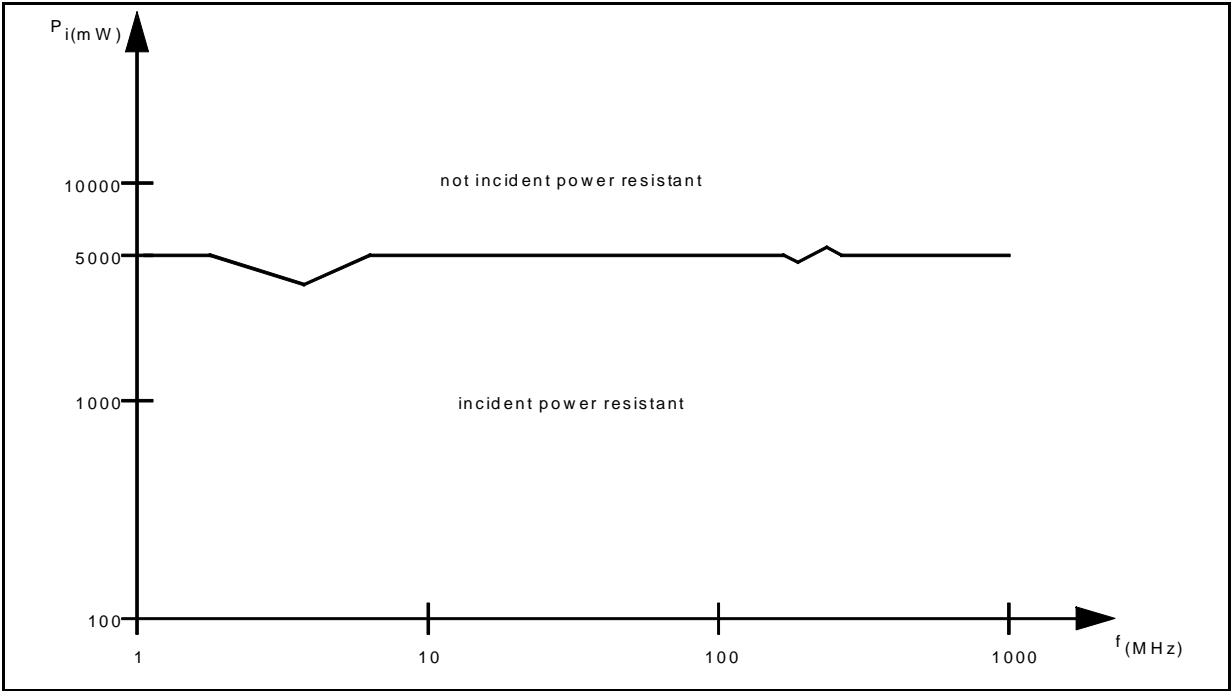


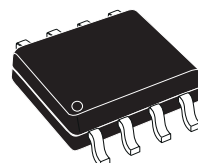
Figure 7.



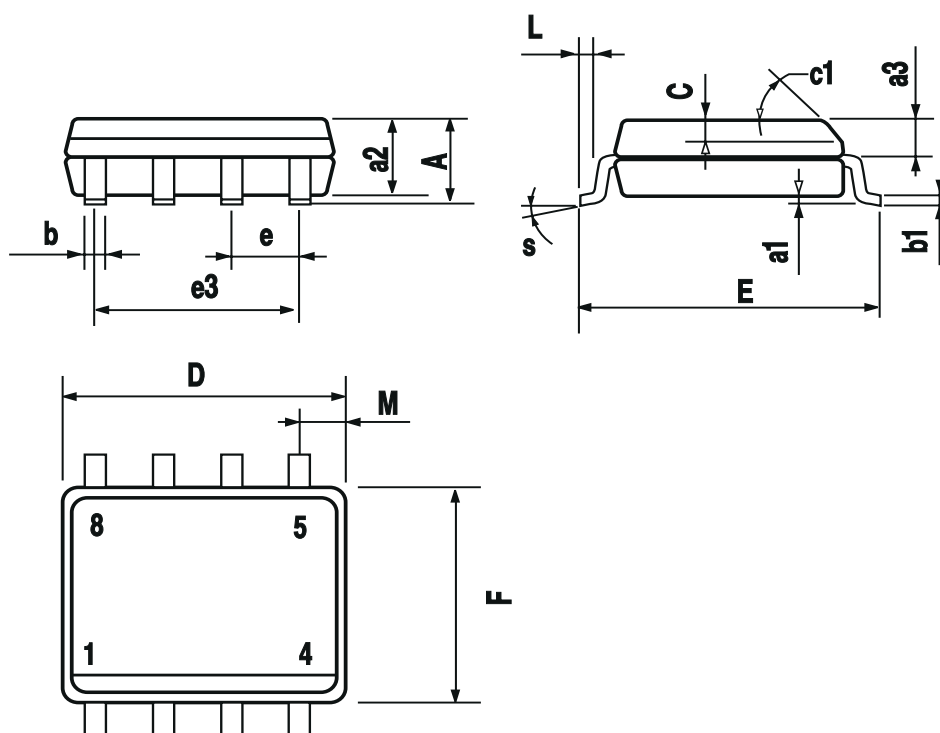
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			1.75			0.069
a1	0.1		0.25	0.004		0.010
a2			1.65			0.065
a3	0.65		0.85	0.026		0.033
b	0.35		0.48	0.014		0.019
b1	0.19		0.25	0.007		0.010
C	0.25		0.5	0.010		0.020
c1	45° (typ.)					
D (1)	4.8		5.0	0.189		0.197
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		3.81			0.150	
F (1)	3.8		4.0	0.15		0.157
L	0.4		1.27	0.016		0.050
M			0.6			0.024
S	8° (max.)					

(1) D and F do not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.15mm (.006inch).

OUTLINE AND MECHANICAL DATA



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