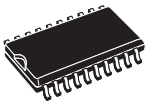
ST75185C

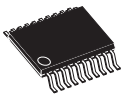
Multiple RS-232 drivers and receivers

Features

- Meets and exceeds the requirements of EIA/TIA-232-E and ITUV.28 standard
- Single chip with easy interface between UART and serial port connector of IBM PC/AT™ and compatibles
- Designed to support data rates up to 120 kbps
- Pinout compatible with ST75C185



SO-20



TSSOP20

Description

The ST75185C contains three drivers and five receivers. The pinout matches the DB9S connector design in order to decrease the part count, reduce the board space required and allow easy interconnection of the UART and serial port connector of IBM PC/AT™ and compatibles. The bipolar circuits and processing of the ST75185C provides a rugged low-cost solution for this function at the expense of quiescent power and external passive components relative to the ST75C185.

The ST75185C complies with the requirements of the EIA/TIA 232-E and ITU (formally CCITT) v.28 standards. These standards are for data interchange between a host computer and peripheral at signalling rates up to 20 k-bits/s. The switching speeds of the ST75185C are fast enough to support rates up to 120 K-bits/s with lower capacitive loads (shorter cables). Inter-operability at the higher signalling rates cannot be assured unless the designer has design control of the cable and the interface circuits at the both ends. For inter-operability at signalling rates to 120 k-bits/s, use of EIA/ITA-423-B (ITU v.10) and EIA/ITA-422-B (ITU v.11) standards are recommended.

The ST75185C is characterized for operation over the range of 0°C to 70 °C.

Table 1. Device summary

Order codes	Temperature range	Packages	Packaging
ST75185CTR	0 to 70 °C	TSSOP20 (tape and reel)	2500 parts per reel
ST75185CDR	0 to 70 °C	SO-20 (tape and reel)	1000 parts per reel

Contents

1 Pin configuration

Figure 1. Pin connection IEC logic symbol and logic diagram

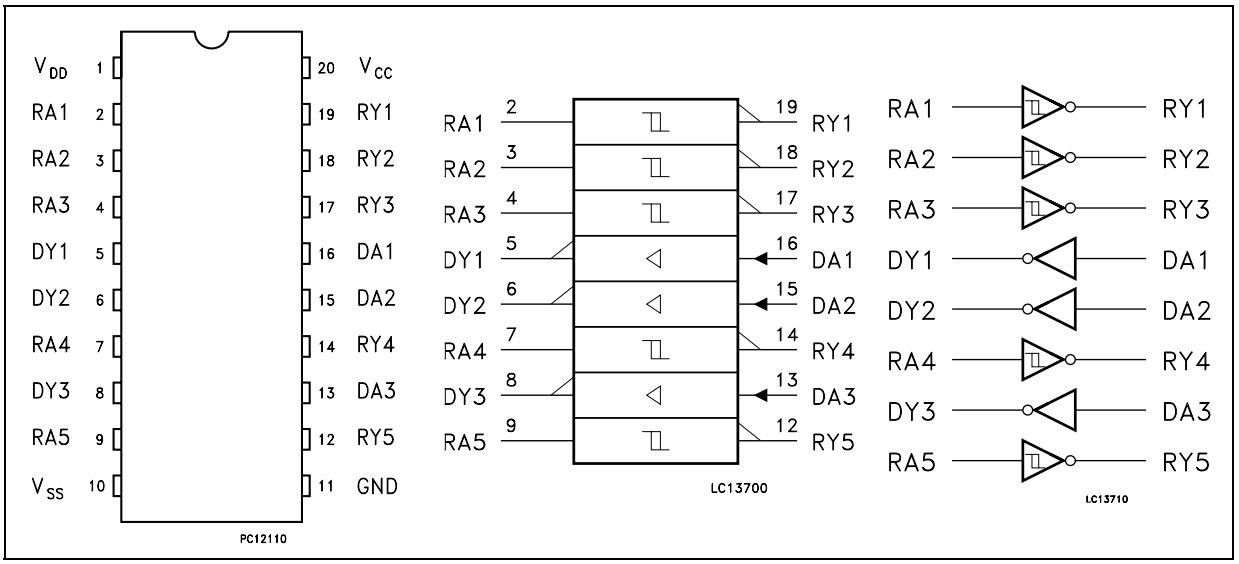


Table 2. Pin description

Pin n°	Symbol	Name and function
1	V_{DD}	Supply voltage (+12 V)
2	RA1	First receiver input
3	RA2	Second receiver input
4	RA3	Third receiver input
5	DY1	First driver output
6	DY2	Second driver output
7	RA4	Fourth receiver input
8	DY3	Third driver output
9	RA5	Fifth receiver input
10	V_{SS}	Supply voltage (-12V)
11	GND	Ground
12	RY5	Fifth receiver output
13	DA3	Third driver input
14	RY4	Fourth receiver output
15	DA2	Second driver input
16	DA1	First driver input
17	RY3	Third receiver output
18	RY2	Second receiver output
19	RY1	First receiver output
20	V_{CC}	Supply voltage (+5 V)

2 Maximum ratings

Table 3. Absolute maximum ratings over operating free-air temperature range

Symbol	Parameter	Value	Unit
V_{DD}	Supply voltage (1)	15	V
V_{SS}	Supply voltage (1)	-15	V
V_{CC}	Supply voltage (1)	10	V
V_I	Input voltage range (Driver)	-15 to 7	V
V_I	Input voltage range (Receiver)	-30 to 30	V
V_O	Output voltage range (Driver)	-15 to 15	V
I_O	Receiver low level output current	20	mA
P_D	Continuous total power dissipation	See dissipation rating table	
T_A	Operating free-air temperature range	0 to 70	°C
T_{STG}	Storage temperature range	-65 to + 150	°C
T_L	Lead temperature 1.6 mm. from case for 10 sec.	260	°C

1. All voltage are with respect to the network ground terminal.

Note: Absolute maximum ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied.

Table 4. Dissipation rating table

Package	Power rating at $T_A \leq 25°C$	Derating factor above $T_A = 25°C$	Power rating at $T_A \leq 70°C$
MICROPACKAGE (D)	1125 mW	9.0 mW/°C	720 mW

Table 5. Thermal data

Symbol	Parameter	TSSOP20	Unit
R_{thJC}	Thermal resistance junction-case	27.22	°C/W
R_{thJA}	Thermal resistance junction-ambient	114.5 (1)	°C/W

1. This value is referred to single-layer PCB, JEDEC standard test board.

Table 6. Recommended operating conditions

Symbol	Parameter		Min.	Max.	Unit.
V_{DD}	Supply voltage		7.5	15	V
V_{SS}	Supply voltage		-7.5	-15	V
V_{CC}	Supply voltage		4.5	5.5	V
V_I	Driver input voltage		0	V_{CC}	V
I_{OH}	High level output current	Driver		-6	mA
		Receiver		-0.5	
I_{OL}	Low level output current	Driver		6	mA
		Receiver		16	
T_A	Operating free-air temperature range		0	70	°C

3 Electrical characteristics

Table 7. Supply currents

Symbol	Parameter	Test conditions			Value			Unit
		V_{DD}	V_{SS}		Min.	Typ.	Max.	
I_{DD}	Supply current from V_{DD}	9	-9	No load. all inputs at 1.9V			15	mA
		12	-12				19	
		15	-15				25	
		9	-9	No load. all inputs at 0.8V			4.5	mA
		12	-12				5.5	
		15	-15				9	
I_{SS}	Supply current from V_{SS}	9	-9	No load. all inputs at 1.9V			-15	mA
		12	-12				-19	
		15	-15				-25	
		9	-9	No load. all inputs at 0.8V			-3.2	mA
		12	-12				-3.2	
		15	-15				-3.2	
I_{CC}	Supply current from V_{CC}	No load. All inputs at 5V V_{CC} = 5V					30	mA

V_{DD} = 9 V, V_{SS} = -9 V, V_{CC} = 5 V, unless otherwise specified.

Table 8. Driver electrical characteristics over operating free-air temperature range

Symbol	Parameter	Test conditions	Value			Unit
			Min.	Typ.	Max.	
V_{OH}	High level output voltage	V_{IL} = 0.8 V, R_L = 3kΩ (See *Figure 3*)	6	7.5		V
V_{OL}	Low level output voltage (*Note 3*)	V_{IH} = 1.9 V, R_L = 3kΩ (See *Figure 3*)		-7.5	-6	V
I_{IH}	High level input current	V_I = 5 V (See *Figure 4*)			10	µA
I_{IL}	Low level input current	V_I = 0 V (See *Figure 4*)			–1.6	mA
$I_{OS(H)}$	High level short circuit output current (*Note 4*)	V_{IL} = 0.8 V, V_O = 0 V (See *Figure 3*)	-4.5	–12	–19.5	mA
$I_{OS(L)}$	Low level short circuit output current	V_{IH} = 2 V V_O = 0 V (See *Figure 3*)	4.5	12	19.5	mA
R_O	Output resistance	$V_{DD} = V_{SS} = V_{CC}$ = 0 V V_O = -2 to 2 V (*Note 3*)	300			Ω

Note: 1 The algebraic convention, where the more positive (less negative) limits designated as maximum, is used in this datasheet for logic levels only (e.g. if - 10 V is a maximum, the typical value is a more negative voltage).

2 Output short circuit conditions must maintain the total power dissipation below absolute maximum ratings.

3 Test conditions are those specified by EIA-232-E and as listed above.

V_{DD} = 12 V, V_{SS} = -12 V, V_{CC} = 5 V, T_A = 25 °C

Table 9. Driver switching characteristics

Symbol	Parameter	Test conditions	Value			Unit
			Min.	Typ.	Max.	
t_{PLH}	Propagation Delay Time, Low to High Level Output	R_L = 3 to 7 kΩ C_L = 15 pF (See *Figure 5*, *Figure 6*)		315	500	ns
t_{PHL}	Propagation Delay Time, High to Low Level Output	R_L = 3 to 7 kΩ C_L = 15 pF (See *Figure 5*, *Figure 6*)		75	175	ns
t_{TLH}	Transition Time Low to High Level Output	R_L = 3 to 7 kΩ C_L = 15 pF (See *Figure 5*, *Figure 6*)		60	100	ns
		R_L = 3 to 7 kΩ C_L = 2500 pF (*Note 4*, *Figure 5*, *Figure 6*)		1.7	2.5	µs
t_{THL}	Transition Time High to Low Level Output	R_L = 3 to 7 kΩ C_L = 15 pF (See *Figure 5*, *Figure 6*)		40	7.5	ns
		R_L = 3 to 7 kΩ C_L = 2500 pF (*Note 4*, *Figure 5*, *Figure 6*)		1.5	2.5	µs

4 Measured between -3 V and 3 V points of output waveform (EIA-232-E conditions), all unused inputs are tied.

Table 10. Receiver electrical characteristics over operating conditions

Symbol	Parameter	Test conditions		Value			Unit
				Min.	Typ.	Max.	
V_{T+}	Positive going threshold voltage	(See *Figure 9*)			2.2	2.4	V
V_{T-}	Negative going threshold voltage	T_A = 25 °C (See *Figure 9*)		0.75	0.97		V
V_{hys}	Input hysteresis (V_{T+} - V_{T-})			0.5			V
V_{OH}	High level output voltage	I_{OH} = -0.5mA	V_{IH} = 0.75 V	2.6	4	5	V
			Inputs Open	2.6			
V_{OL}	Low level output voltage	V_I = 3 V I_{OL} = 10 mA			0.2	0.45	V
I_{IH}	High level input current	V_I = 25 V (See *Figure 9*)		3.6		8.3	mA
		V_I = 3 V (See *Figure 9*)		0.43			
I_{IL}	Low level input current	V_I = -25 V (See *Figure 9*)		-3.6		-8.3	mA
		V_I = -3 V (See *Figure 9*)		-0.43			
I_{OS}	Short-circuit output current	V_I = 0 V V_O = 0 V (See *Figure 7*)			-3.4	-12	mA

Note: All typical values are at T_A = 25 °C, V_{CC} = 5 V, V_{DD} = 9 V and V_{SS} = -9 V

V_{DD} = 12 V, V_{SS} = -12 V, V_{CC} = 5 V T_A = 25 °C

Table 11. Receiver switching characteristics

Symbol	Parameter	Test conditions	Value			Unit
			Min.	Typ.	Max.	
t_{PLH}	Propagation delay time low to high level output	R_L = 5 kΩ C_L = 50 pF (See *Figure 9*)		400	1000	ns
t_{PHL}	Propagation delay time high to low level output	R_L = 5 kΩ C_L = 50 pF (See *Figure 9*)		70	150	ns
t_{TLH}	Transition time low to high level output	R_L = 5 kΩ C_L = 50 pF (See *Figure 9*)		200	525	ns
t_{THL}	Transition time high to low level output	R_L = 5 kΩ C_L = 50 pF (See *Figure 9*)		20	60	ns

4 Typical application

Figure 2. Application circuits

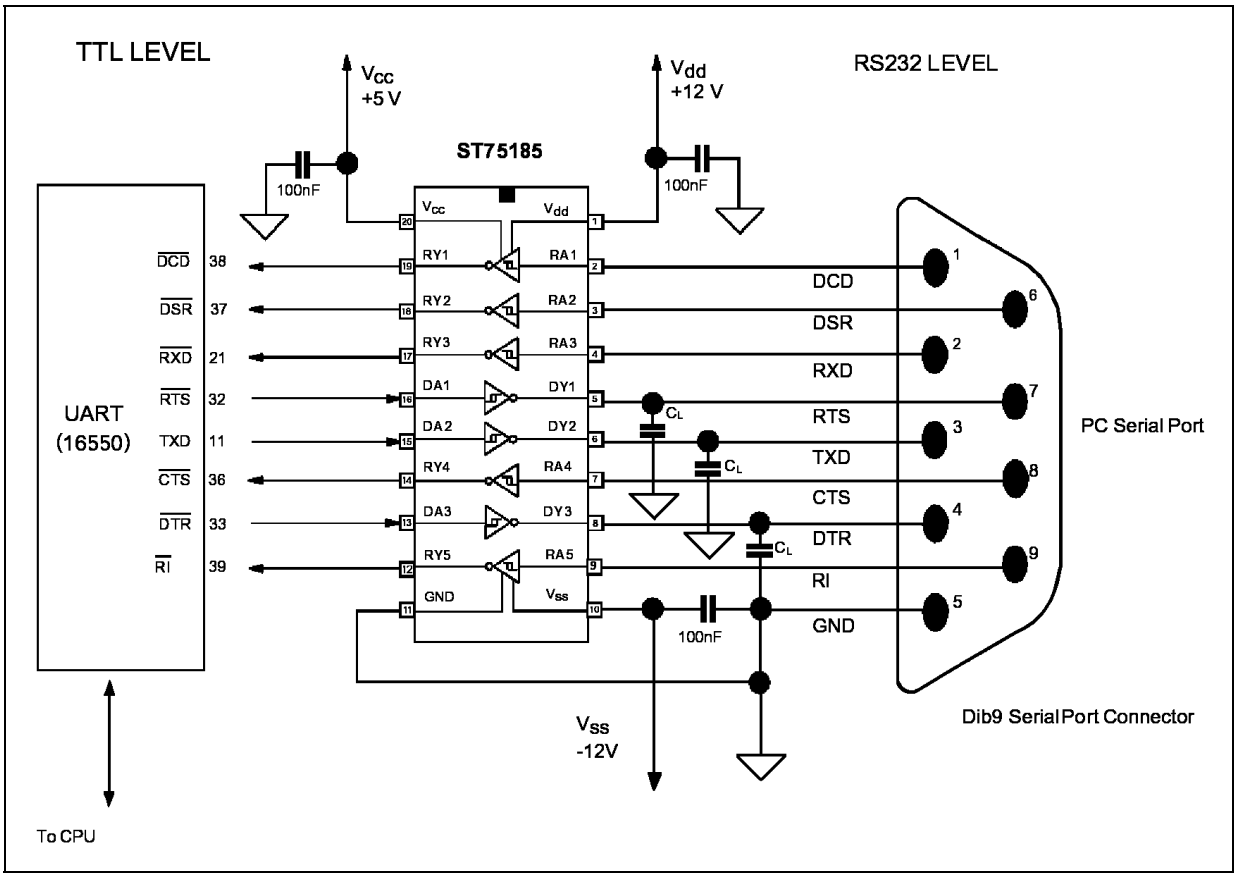


Figure 3. Driver test circuit for V_{OH}, $I_{SO(H)}$ and $I_{SO(L)}$

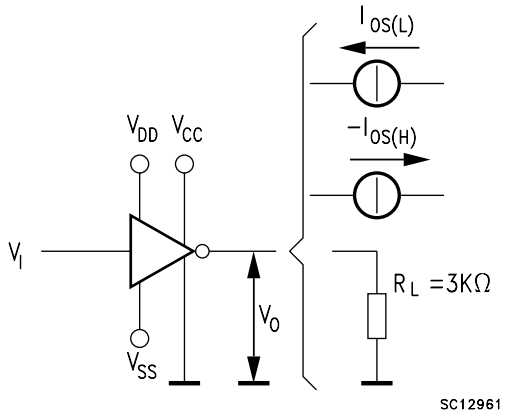


Figure 4. Driver test circuit for I_{IH} and I_{IL}

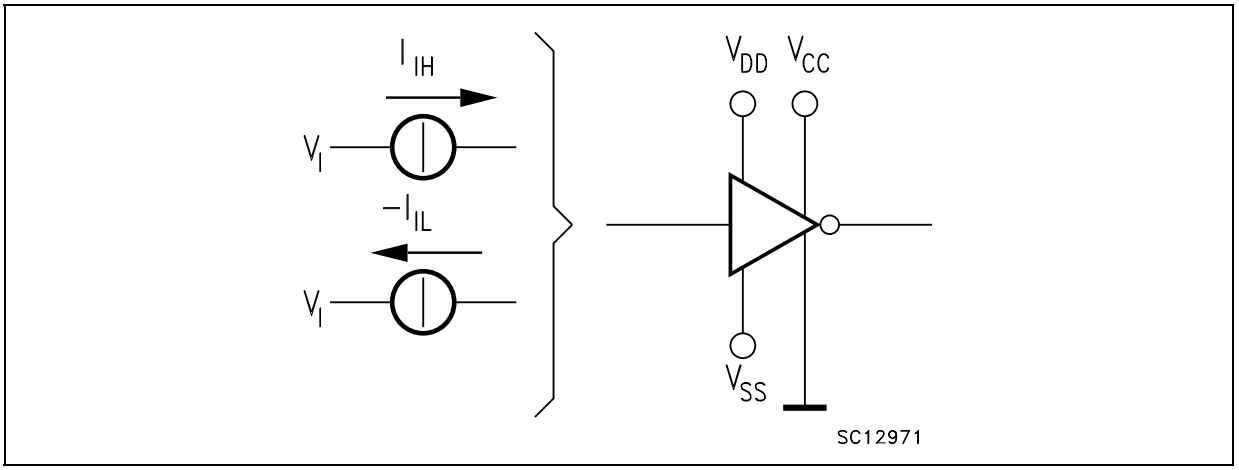


Figure 5. Driver test circuit

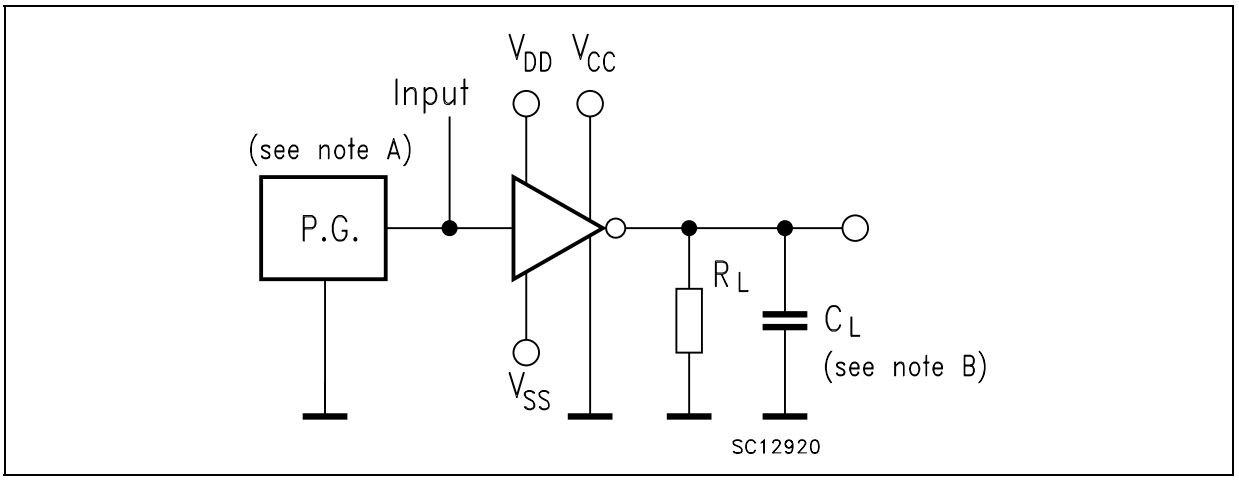


Figure 6. Driver voltage waveforms

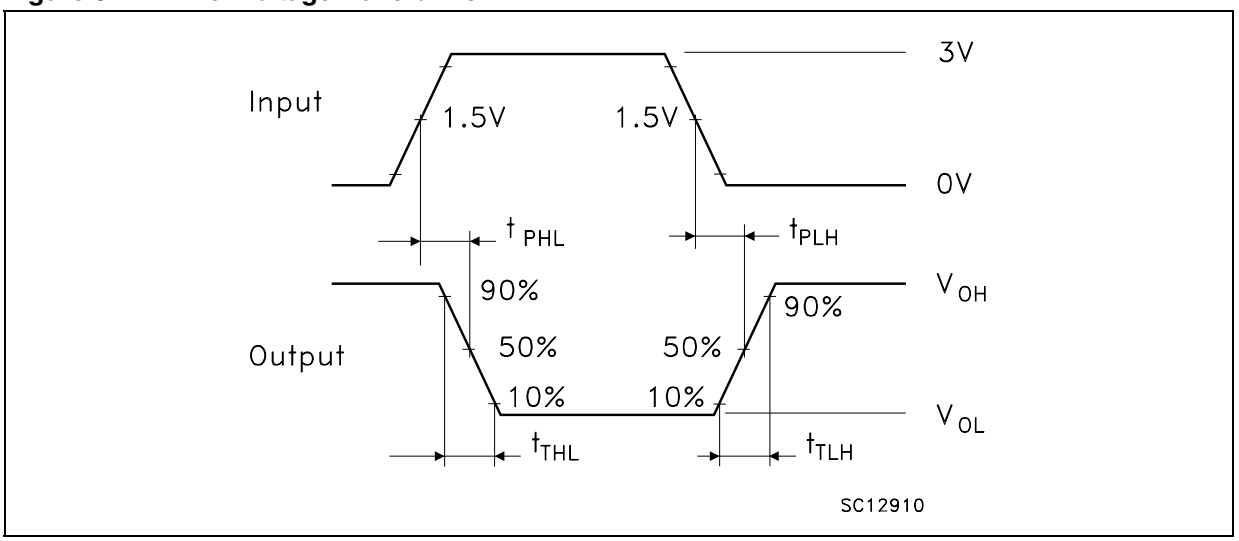


Figure 7. Receiver test circuit for I_{OS}

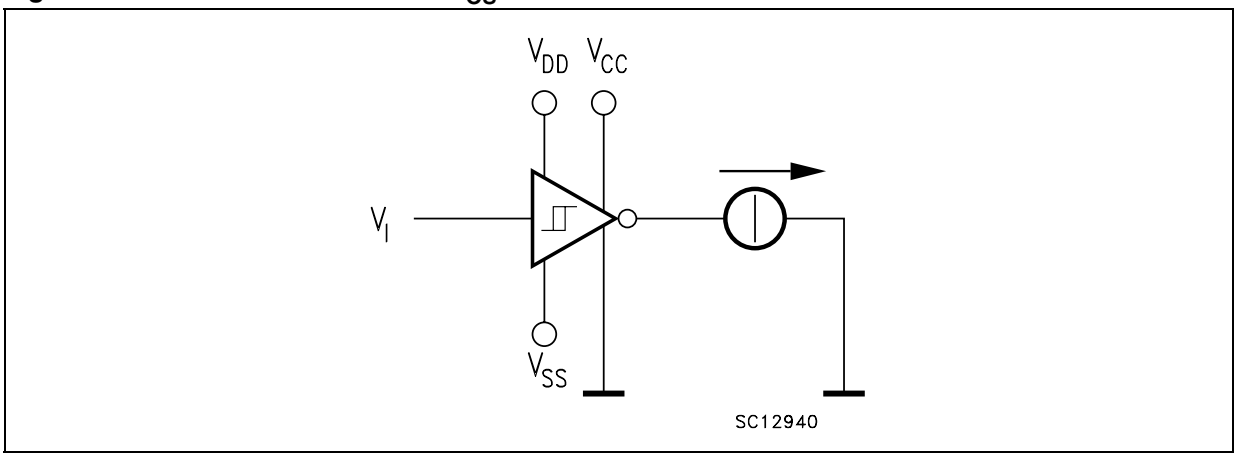


Figure 8. Receiver test circuit for V_T, V_{OH}, V_{OL}

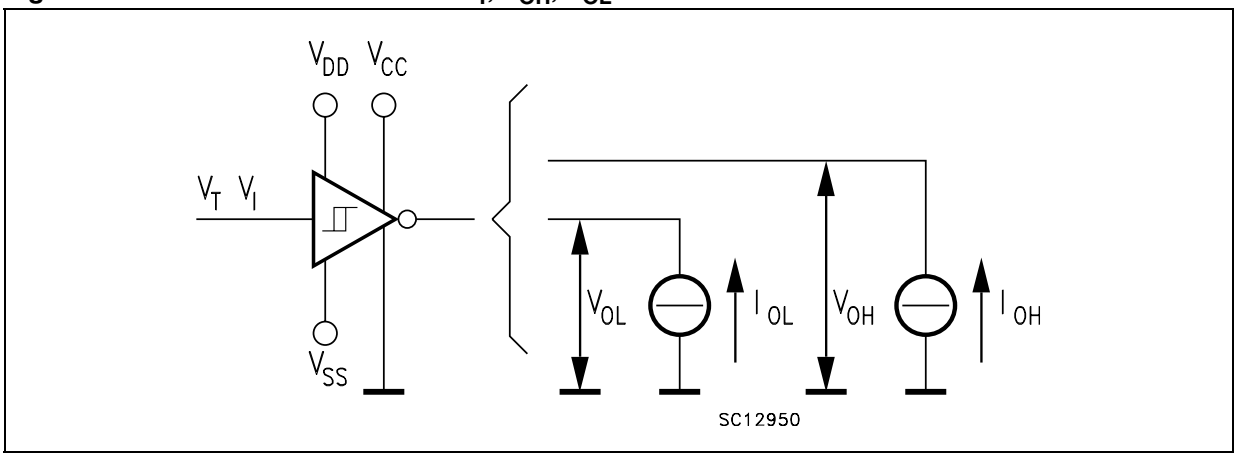


Figure 9. Receiver test circuit

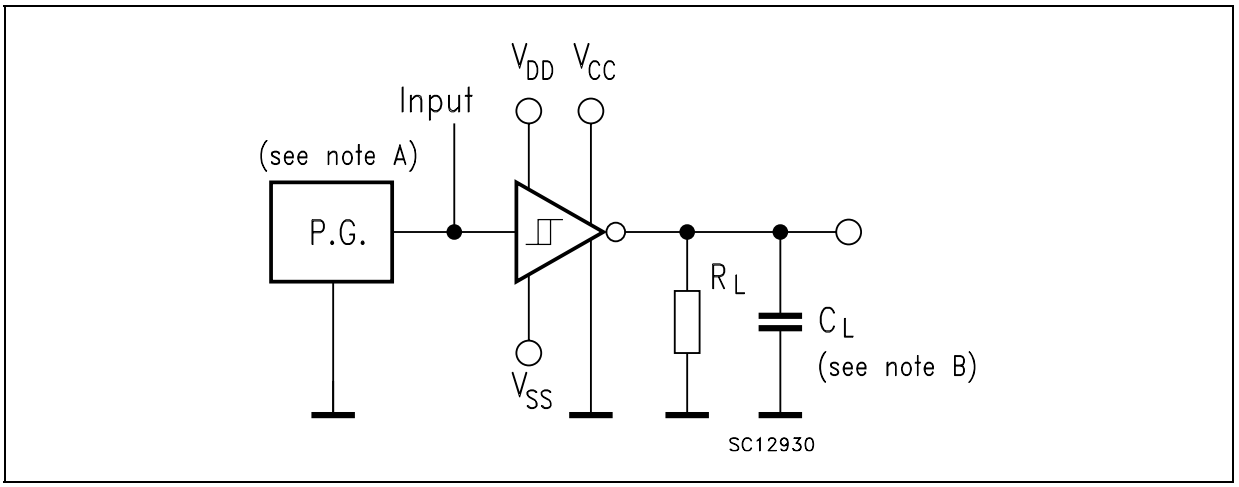
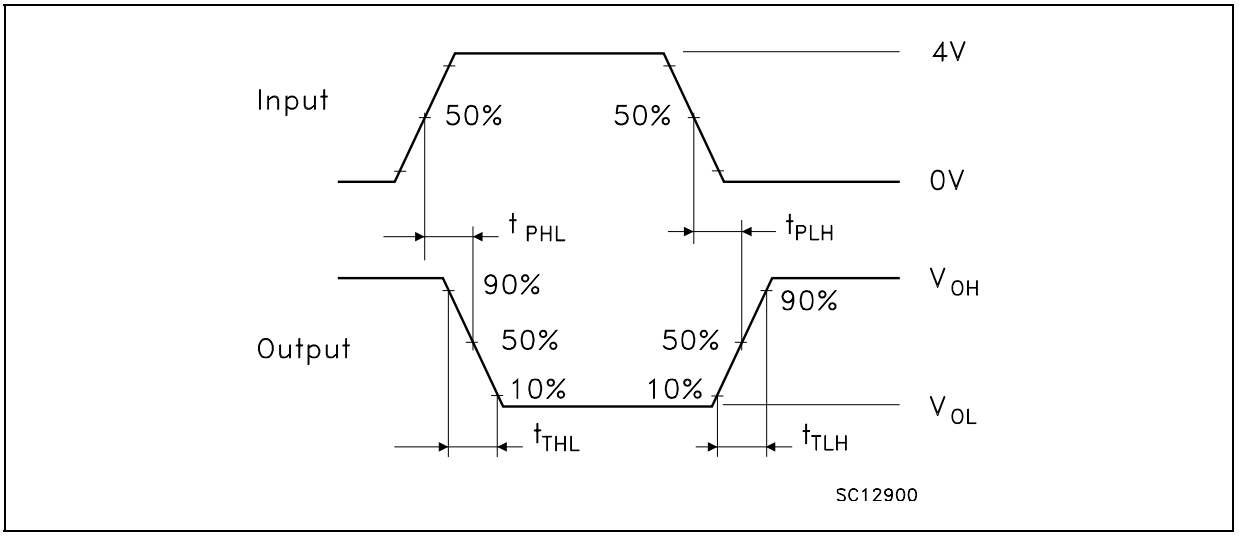


Figure 10. Receiver voltage waveforms



Note: 1 The pulse generator has the following characteristics: t_W = 25 µs, PRR = 20 kHz, Z_O = 50 Ω, $t_r = t_f < 50$ ns

2 C_L includes probe and jig capacitance.

5 Typical characteristics

Figure 11. Driver voltage transfer characteristics

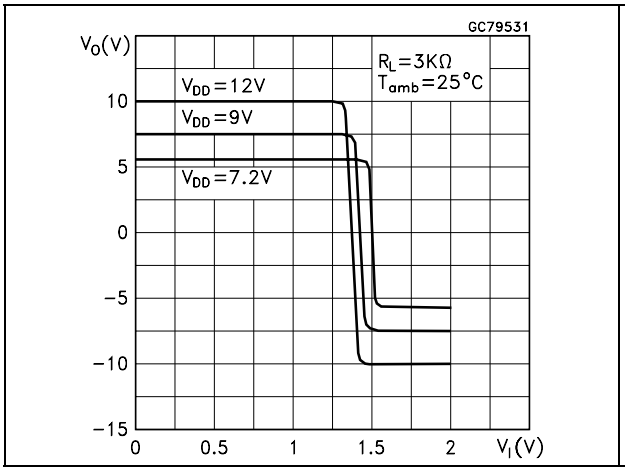


Figure 12. Driver short circuit output current vs. free-air temperature

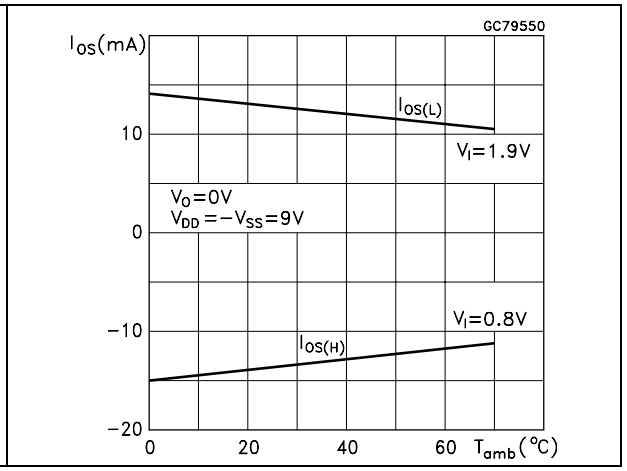


Figure 13. Device supply current vs. temperature

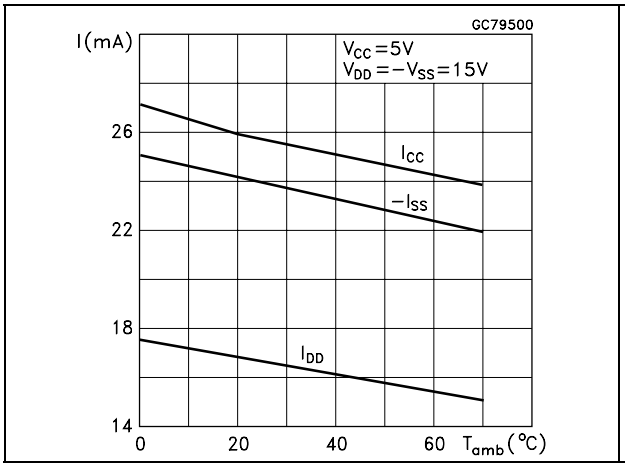


Figure 14. Driver output current vs. output voltage

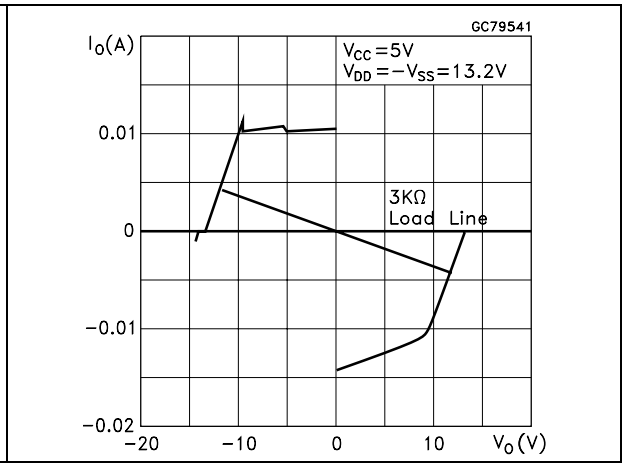


Figure 15. Driver output slew rate vs. load capacitance

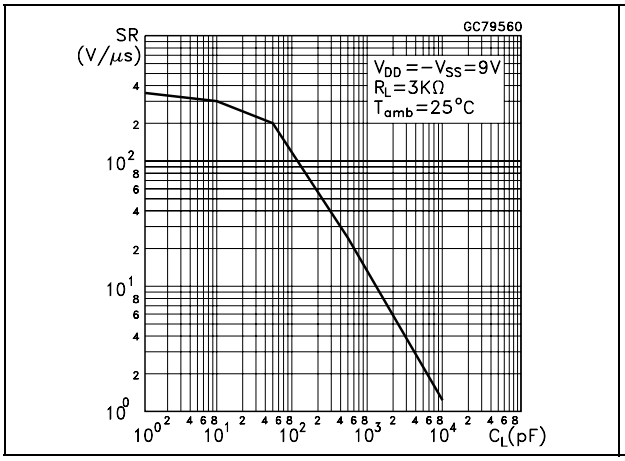


Figure 16. Receiver threshold vs. temperature

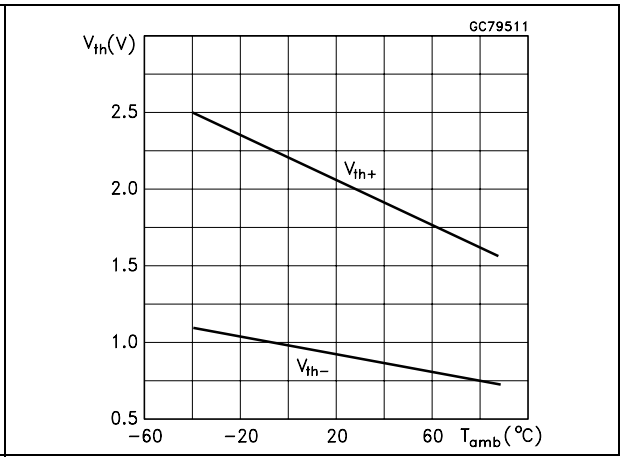
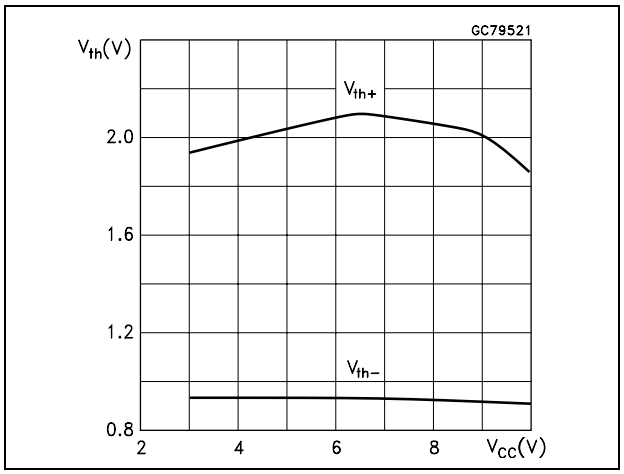


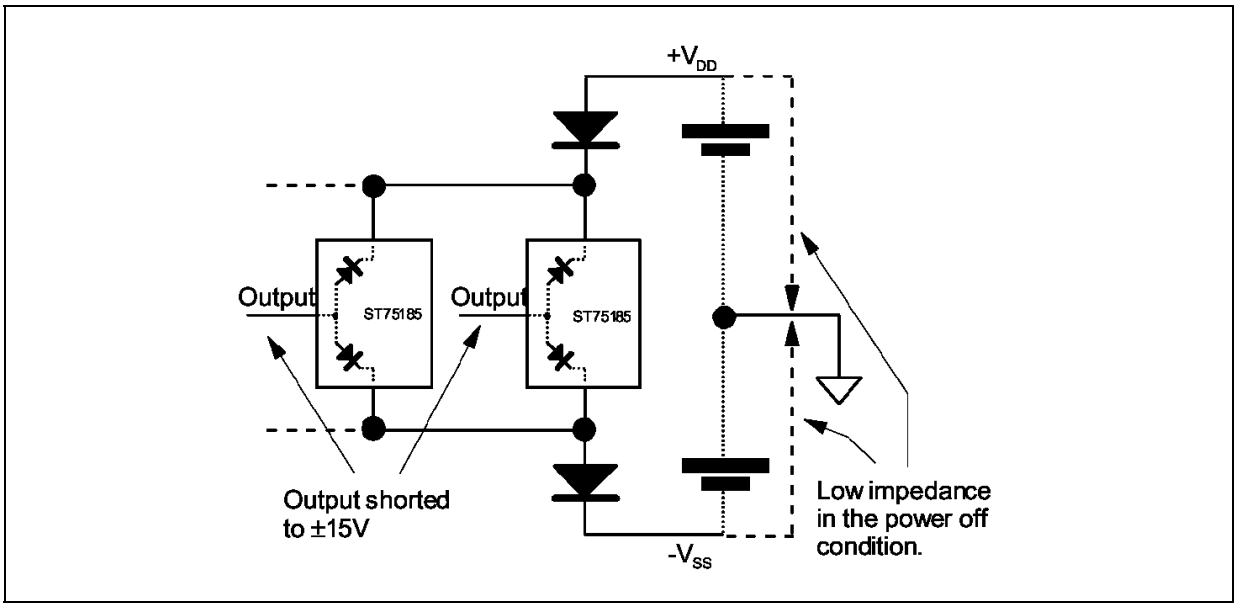
Figure 17. Receiver threshold vs. supply voltage



6 Application information: diodes on power supply

Diodes placed in series with the V_{DD} and V_{SS} leads protect the ST75185C in the fault condition in which the devices output are shorted to ±15 V and the power supplies are at low state and provide low-impedance path to ground (see *Figure 18*).

Figure 18. Diodes on power supply

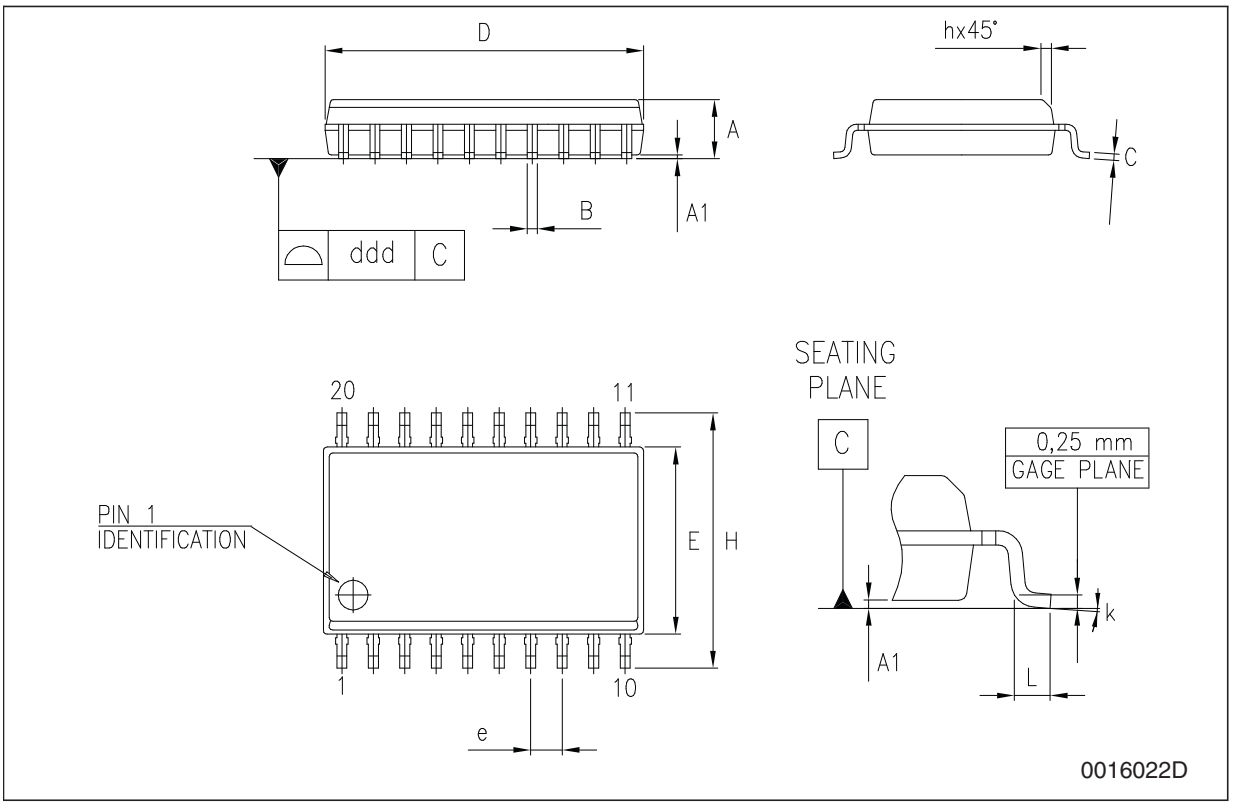


7 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: *www.st.com*.
ECOPACK® is an ST trademark.

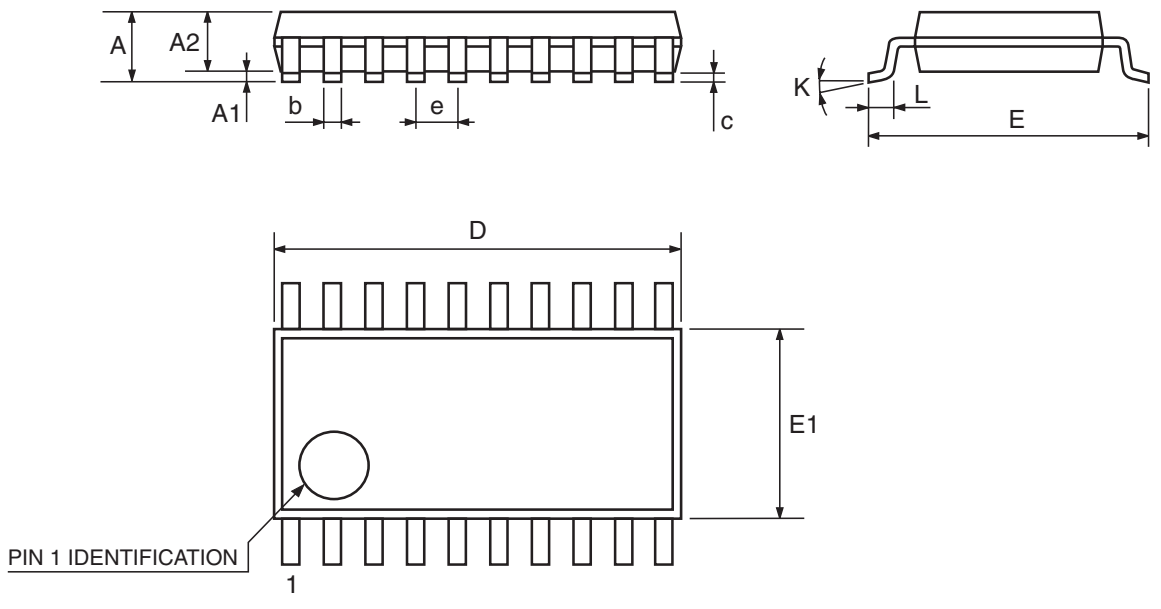
SO-20 mechanical data

Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	2.35		2.65	0.093		0.104
A1	0.1		0.30	0.004		0.012
B	0.33		0.51	0.013		0.020
C	0.23		0.32	0.009		0.013
D	12.60		13.00	0.496		0.512
E	7.4		7.6	0.291		0.299
e		1.27			0.050	
H	10.00		10.65	0.394		0.419
h	0.25		0.75	0.010		0.030
L	0.4		1.27	0.016		0.050
k	0°		8°	0°		8°
ddd			0.100			0.004



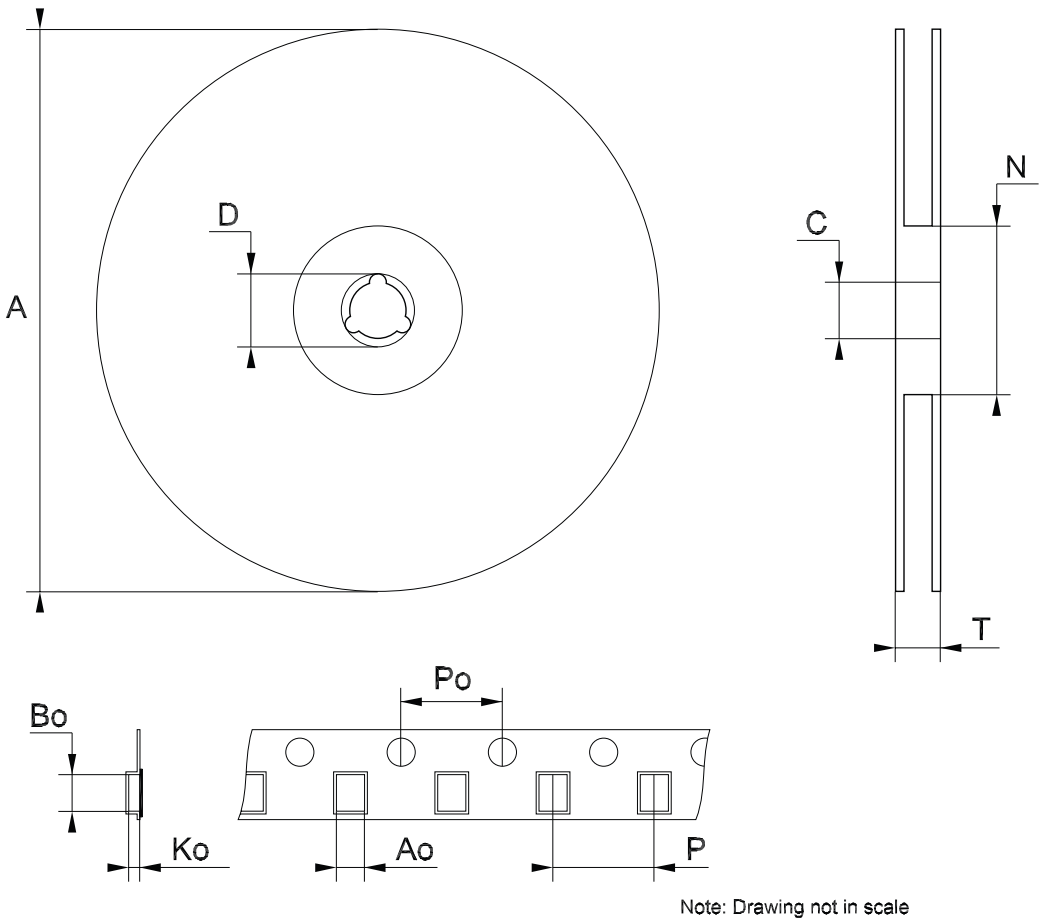
TSSOP20 mechanical data

Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.2			0.047
A1	0.05		0.15	0.002	0.004	0.006
A2	0.8	1	1.05	0.031	0.039	0.041
b	0.19		0.30	0.007		0.012
c	0.09		0.20	0.004		0.0079
D	6.4	6.5	6.6	0.252	0.256	0.260
E	6.2	6.4	6.6	0.244	0.252	0.260
E1	4.3	4.4	4.48	0.169	0.173	0.176
e		0.65 BSC			0.0256 BSC	
K	0°		8°	0°		8°
L	0.45	0.60	0.75	0.018	0.024	0.030



Tape & reel SO-20 mechanical data

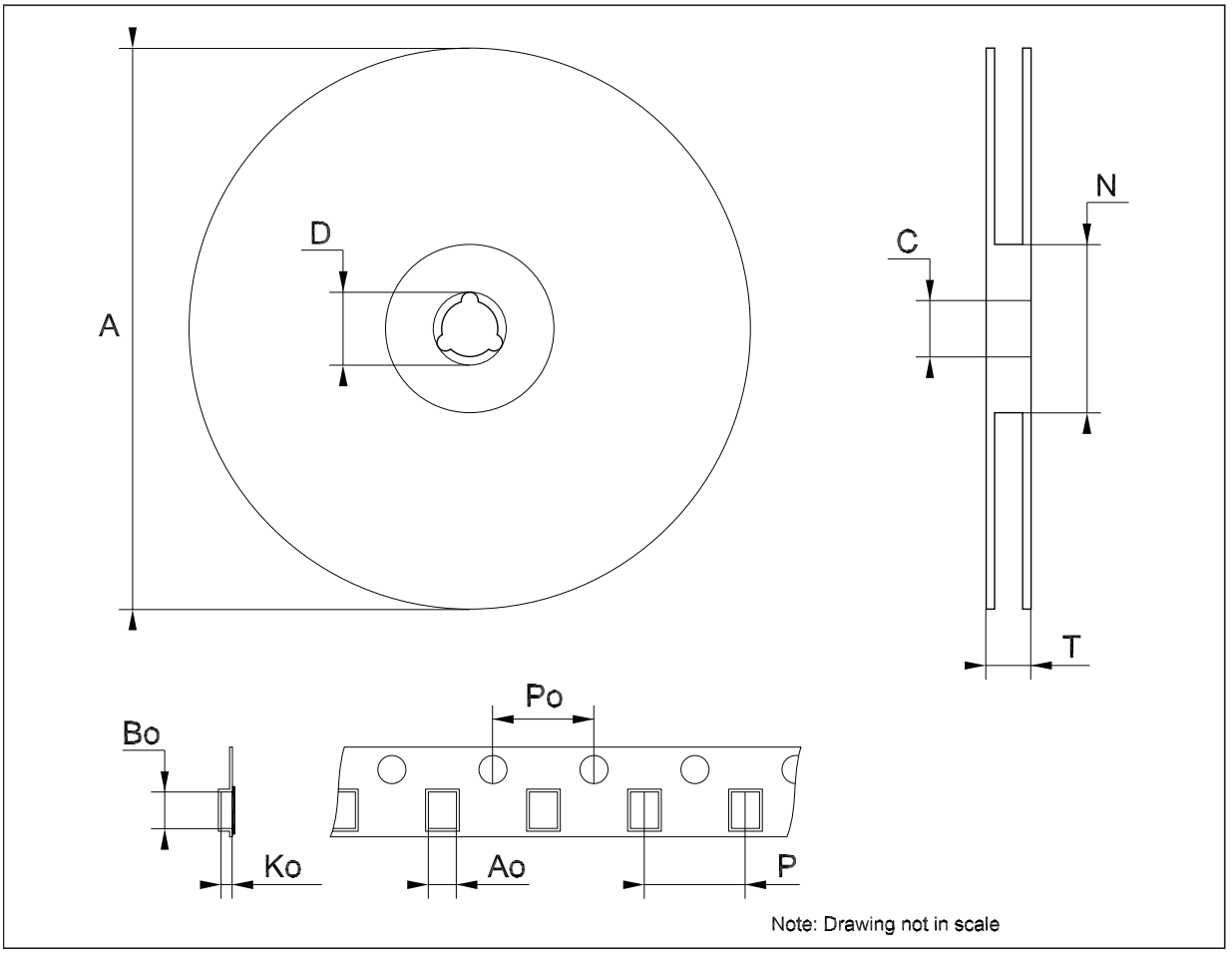
Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			330			12.992
C	12.8		13.2	0.504		0.519
D	20.2			0.795		
N	60			2.362		
T			30.4			1.197
Ao	10.8		11	0.425		0.433
Bo	13.2		13.4	0.520		0.528
Ko	3.1		3.3	0.122		0.130
Po	3.9		4.1	0.153		0.161
P	11.9		12.1	0.468		0.476



Note: Drawing not in scale

Tape & reel TSSOP20 mechanical data

Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			330			12.992
C	12.8		13.2	0.504		0.519
D	20.2			0.795		
N	60			2.362		
T			22.4			0.882
Ao	6.8		7	0.268		0.276
Bo	6.9		7.1	0.272		0.280
Ko	1.7		1.9	0.067		0.075
Po	3.9		4.1	0.153		0.161
P	11.9		12.1	0.468		0.476



Note: Drawing not in scale

8 Revision history

Table 12. Document revision history

Date	Revision	Changes
28-Apr-2006	15	Order codes updated.
01-Jun-2006	16	Modified: *Figure 2*.
19-Dec-2007	17	Added: *Table 5*.
07-Apr-2009	18	Modified *Table 5 on page 4*.

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