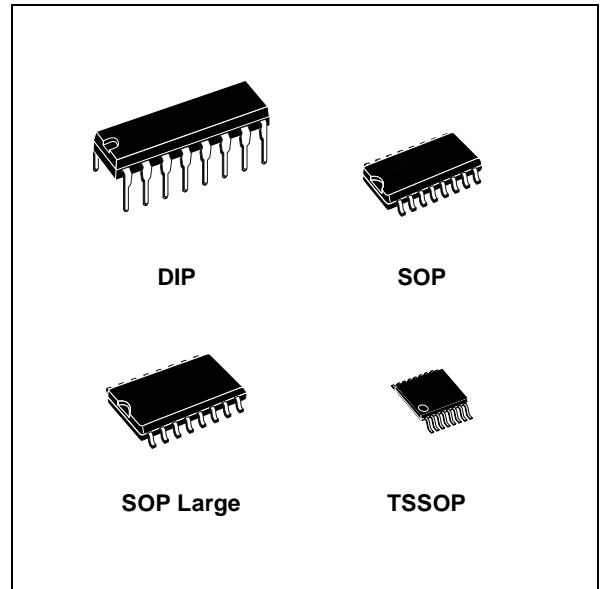


## 5V POWERED MULTI-CHANNEL RS-232 DRIVERS AND RECEIVERS

- SUPPLY VOLTAGE RANGE: 4.5 TO 5.5V
- SUPPLY CURRENT NO LOAD (TYP): 5mA
- TRANSMITTER OUTPUT VOLTAGE SWING (TYP):  $\pm 7.8V$
- CONTROLLED OUTPUT SLEW RATE
- RECEIVER INPUT VOLTAGE RANGE:  $\pm 30V$
- DATA RATE (TYP): 220Kbps
- OPERATING TEMPERATURE RANGE:  
-40 TO 85°C, 0 TO 70°C
- COMPATIBLE WITH MAX232 AND MAX202

### DESCRIPTION

The ST232 is a 2 driver, 2 receiver device following EIA/TIA-232 and V.28 communication standard. It is particularly suitable for applications where  $\pm 12V$  is not available. The ST232 uses a single 5V power supply and only four external capacitors (0.1 $\mu F$ ). Typical applications are in: Portable Computers, Low Power Modems, Interfaces Translation, Battery Powered RS-232 System, Multi-Drop RS-232 Networks.



**Table 1: Order Codes**

Type	Temperature Range	Package	Comments
ST232CN	0 to 70 °C	DIP-16	25parts per tube / 40tube per box
ST232BN	-40 to 85 °C	DIP-16	25parts per tube / 40tube per box
ST232CD	0 to 70 °C	SO-16 (Tube)	50parts per tube / 20tube per box
ST232BD	-40 to 85 °C	SO-16 (Tube)	50parts per tube / 20tube per box
ST232CDR	0 to 70 °C	SO-16 (Tape & Reel)	2500 parts per reel
ST232BDR	-40 to 85 °C	SO-16 (Tape & Reel)	2500 parts per reel
ST232CW	0 to 70 °C	SO-16 Large (Tube)	49 parts per tube / 25 tube per box
ST232BW	-40 to 85 °C	SO-16 Large (Tube)	49 parts per tube / 25 tube per box
ST232CWR	0 to 70 °C	SO-16 Large (Tape & Reel)	1000 parts per reel
ST232BWR	-40 to 85 °C	SO-16 Large (Tape & Reel)	1000 parts per reel
ST232CT	0 to 70 °C	TSSOP16 (Tube)	only for samples
ST232BT	-40 to 85 °C	TSSOP16 (Tube)	only for samples
ST232CTR	0 to 70 °C	TSSOP16 (Tape & Reel)	2500 parts per reel
ST232BTR	-40 to 85 °C	TSSOP16 (Tape & Reel)	2500 parts per reel

Figure 1: Pin Configuration

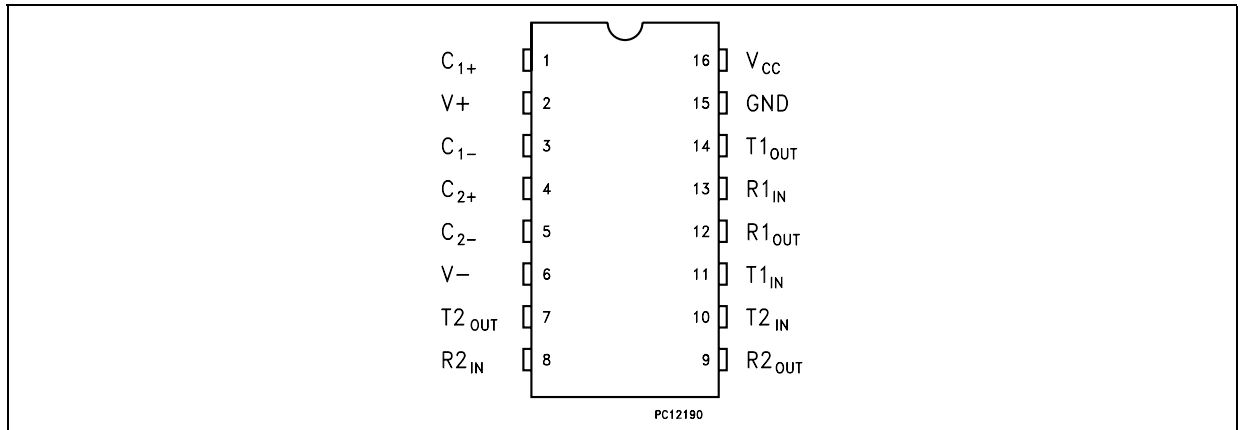


Table 2: Pin Description

PIN N°	SYMBOL	NAME AND FUNCTION
1	C <sub>1+</sub>	Positive Terminal for the first Charge Pump Capacitor
2	V+	Doubled Voltage Terminal
3	C <sub>1-</sub>	Negative Terminal for the first Charge Pump Capacitor
4	C <sub>2+</sub>	Positive Terminal for the second Charge Pump Capacitor
5	C <sub>2-</sub>	Negative Terminal for the second Charge Pump Capacitor
6	V-	Inverted Voltage Terminal
7	T <sub>2</sub> OUT	Second Transmitter Output Voltage
8	R <sub>2</sub> IN	Second Receiver Input Voltage
9	R <sub>2</sub> OUT	Second Receiver Output Voltage
10	T <sub>2</sub> IN	Second Transmitter Input Voltage
11	T <sub>1</sub> IN	First Transmitter Input Voltage
12	R <sub>1</sub> OUT	First Receiver Output Voltage
13	R <sub>1</sub> IN	First Receiver Input Voltage
14	T <sub>1</sub> OUT	First Transmitter Output Voltage
15	GND	Ground
16	V <sub>CC</sub>	Supply Voltage

Table 3: Absolute Maximum Ratings

Symbol	Parameter	Value	Unit
V <sub>CC</sub>	Supply Voltage	-0.3 to 6	V
T <sub>IN</sub>	Transmitter Input Voltage Range	-0.3 to (V <sub>CC</sub> + 0.3)	V
R <sub>IN</sub>	Receiver Input Voltage Range	± 30	V
T <sub>OUT</sub>	Transmitter Output Voltage Range	(V <sub>+</sub> + 0.3) to (V <sub>-</sub> - 0.3)	V
R <sub>OUT</sub>	Receiver Output Voltage Range	-0.3 to (V <sub>CC</sub> + 0.3)	V
T <sub>SCTOUT</sub>	Short Circuit Duration on T <sub>OUT</sub>	infinite	
T <sub>stg</sub>	Storage Temperature Range	-65 to + 150	°C

Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied.

Note 1: No external supply can be applied to V+ terminal and V- terminal.

**Table 4: Electrical Characteristics**(C<sub>1</sub> - C<sub>4</sub> = 0.1μF, V<sub>CC</sub> = 5V ± 10%, T<sub>A</sub> = -40 to 85°C, unless otherwise specified.Typical values are referred to T<sub>A</sub> = 25°C)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I <sub>SUPPLY</sub>	V <sub>CC</sub> Power Supply Current	No Load, T <sub>A</sub> = 25°C		5	10	mA

**Table 5: Transmitter Electrical Characteristics**(C<sub>1</sub> - C<sub>4</sub> = 0.1μF, V<sub>CC</sub> = 5V ± 10%, T<sub>A</sub> = -40 to 85°C, unless otherwise specified.Typical values are referred to T<sub>A</sub> = 25°C)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V <sub>TOUT</sub>	Output Voltage Swing	All Transmitter outputs are loaded with 3KΩ to GND	± 5	± 7.8		V
I <sub>TIL</sub>	Input Leakage Current				± 40	μA
V <sub>TIL</sub>	Input Logic Threshold Low		0.8			V
V <sub>TIH</sub>	Input Logic Threshold High				2	V
SR <sub>T</sub>	Transition Slew Rate	T <sub>A</sub> = 25°C, V <sub>CC</sub> = 5V R <sub>L</sub> = 3 to 7KΩ, C <sub>L</sub> = 50 to 2500pF (Note1)		7	30	V/μs
D <sub>R</sub>	Data Rate	(Note 2)	120	220		Kbits/s
R <sub>TOUT</sub>	Transmitter Output Resistance	V <sub>CC</sub> = V <sub>+</sub> = V <sub>-</sub> = 0V V <sub>OUT</sub> = ± 2V	300			Ω
I <sub>SC</sub>	Transmitter Output Short Circuit Current	One T <sub>XOUT</sub> to GND		±10	±60	mA

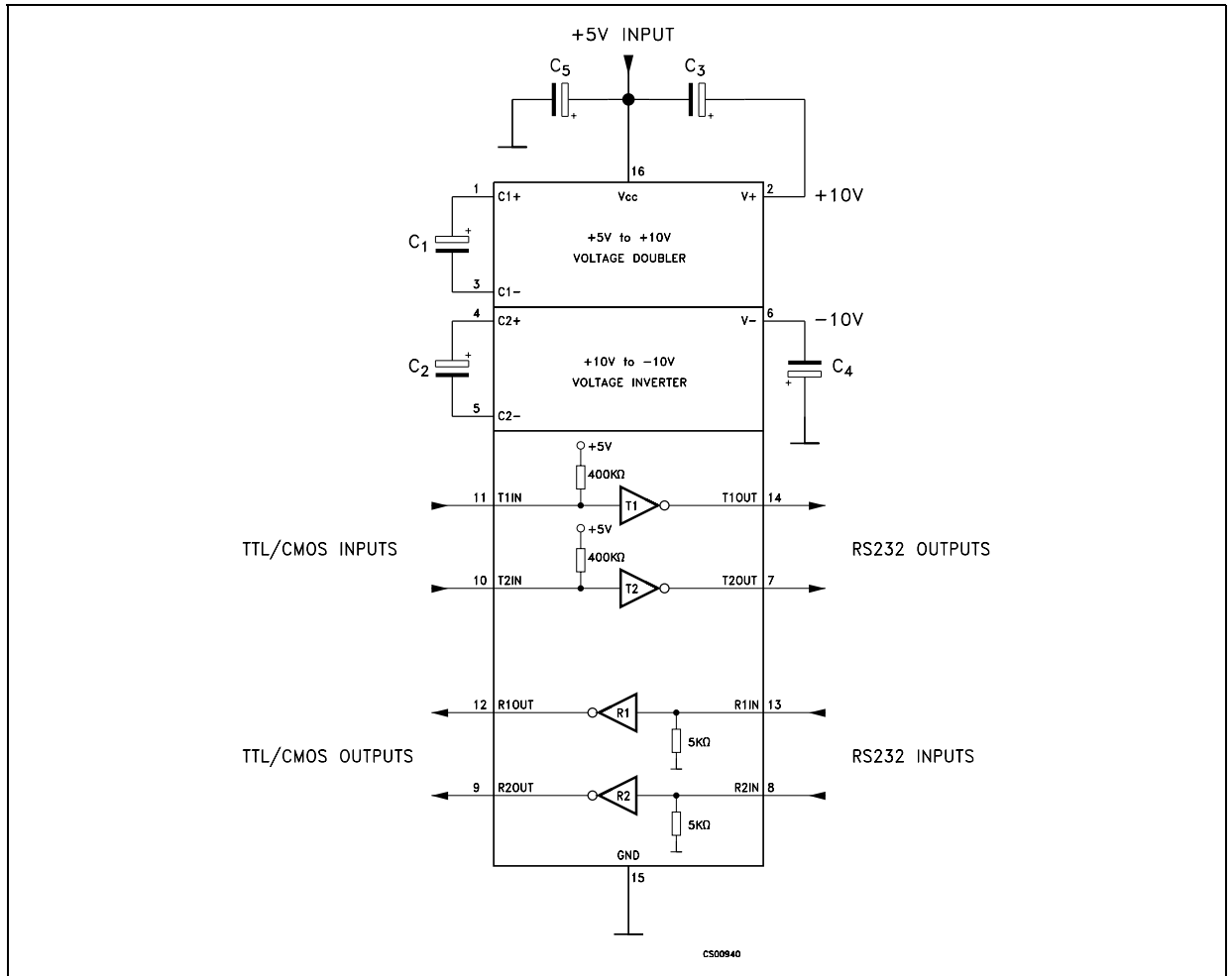
Note 1: Measured from 3V to -3V or from -3V to 3V.

Note2: One transmitter output is loaded with R<sub>L</sub> = 3KΩ to 7KΩ, C<sub>L</sub> = 50 to 1000pF**Table 6: Receiver Electrical Characteristics**(C<sub>1</sub> - C<sub>4</sub> = 0.1μF, V<sub>CC</sub> = 5V ± 10%, T<sub>A</sub> = -40 to 85°C, unless otherwise specified.Typical values are referred to T<sub>A</sub> = 25°C)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V <sub>RIN</sub>	Receiver Input Voltage Operating Range		-30		30	V
R <sub>RIN</sub>	RS-232 Input Resistance	T <sub>A</sub> = 25°C, V <sub>CC</sub> = 5 V, V <sub>RIN</sub> = 5V	3	5	7	KΩ
V <sub>RIL</sub>	RS-232 Input Logic Threshold Low	T <sub>A</sub> = 25°C, V <sub>CC</sub> = 5 V	0.8	1.2		V
V <sub>RIH</sub>	RS-232 Input Logic Threshold High	T <sub>A</sub> = 25°C, V <sub>CC</sub> = 5 V		1.7	2.4	V
V <sub>RIHYS</sub>	RS-232 Input Hysteresis	V <sub>CC</sub> = 5V	0.2	0.5	1	V
V <sub>ROL</sub>	TTL/CMOS Output Voltage Low	I <sub>OUT</sub> = 3.2mA (to V <sub>CC</sub> )			0.4	V
V <sub>ROH</sub>	TTL/CMOS Output Voltage High	I <sub>OUT</sub> = -1mA (to GND)	3.5	V <sub>CC</sub> -0.4		V
t <sub>DR</sub>	Receiver Propagation Delay	C <sub>L</sub> = 150pF (Note 1)		0.3	1	μs
I <sub>SCR</sub>	Receiver Output Short Circuit Current			±10		mA

Note 1: RS-232 IN to TTL-CMOS OUT (from 50% to 50%)

Figure 2: Application Circuits (note 1, note 2)



Note 1: C<sub>1-4</sub> capacitors can even be 1μF ones.

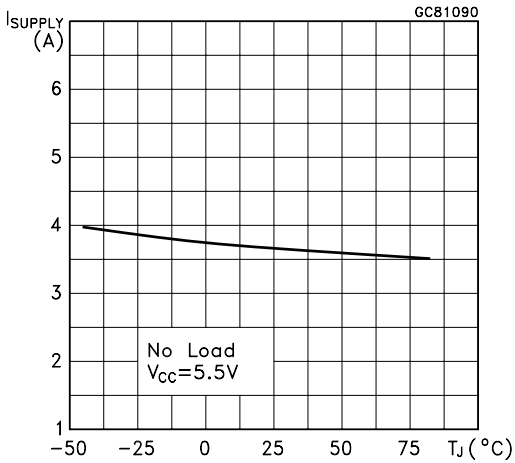
Note 2: C<sub>1-4</sub> can be common or biased capacitors.

Table 7: Capacitance Value (μF)

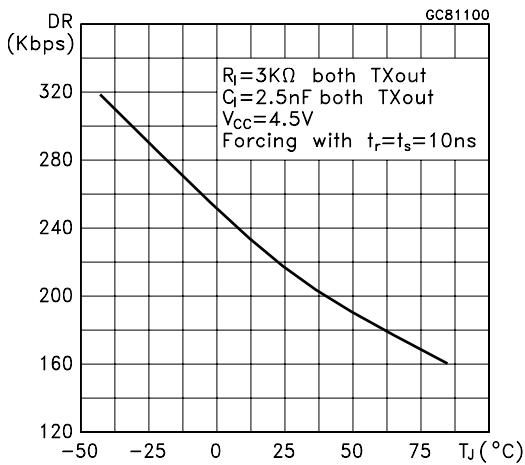
C1	C2.	C3	C4	C5
0.1	0.1	0.1	0.1	0.1

**TYPICAL PERFORMANCE CHARACTERISTICS** (unless otherwise specified  $T_j = 25^\circ\text{C}$ )

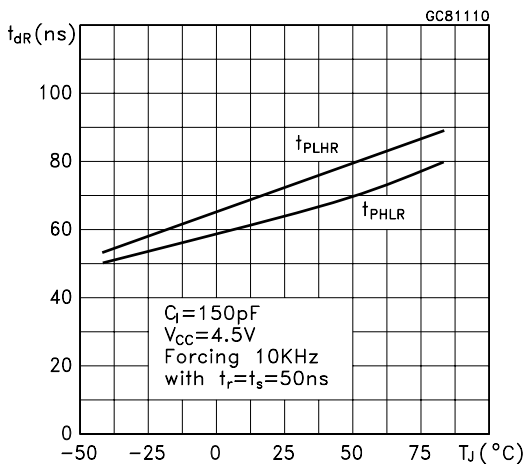
**Figure 3: Supply Current vs Temperature**



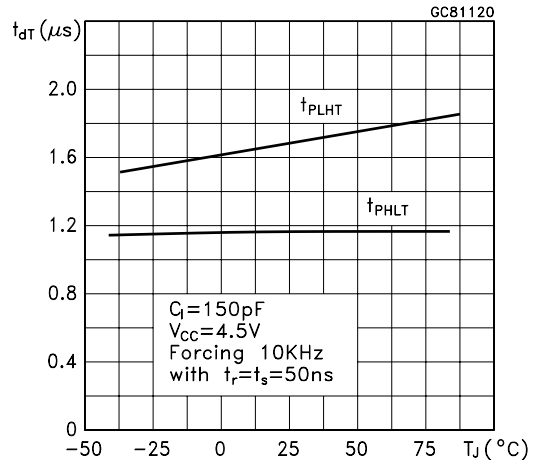
**Figure 4: Data Rate vs Temperature**



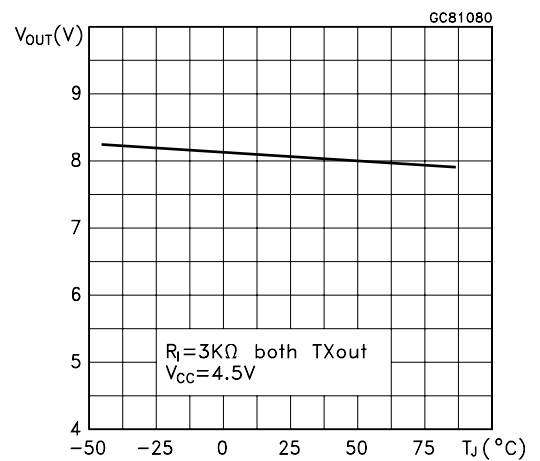
**Figure 5: Receiver Propagation Delay**



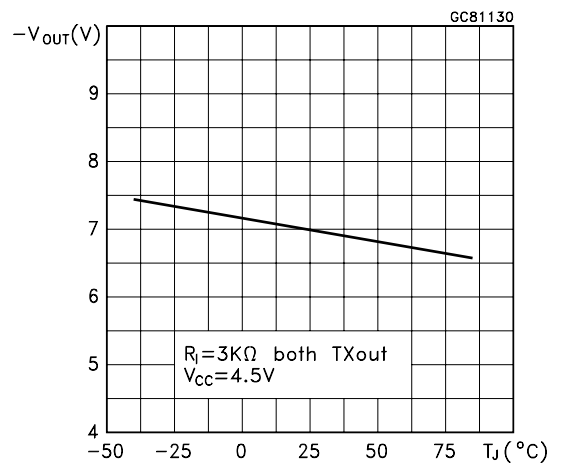
**Figure 6: Driver Propagation Delay**



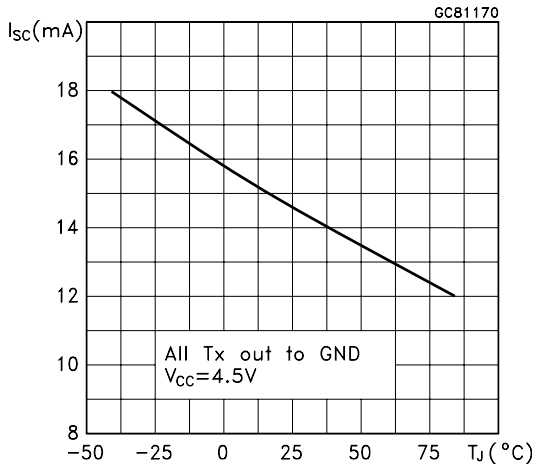
**Figure 7: High Level Output Voltage Swing vs Temperature**



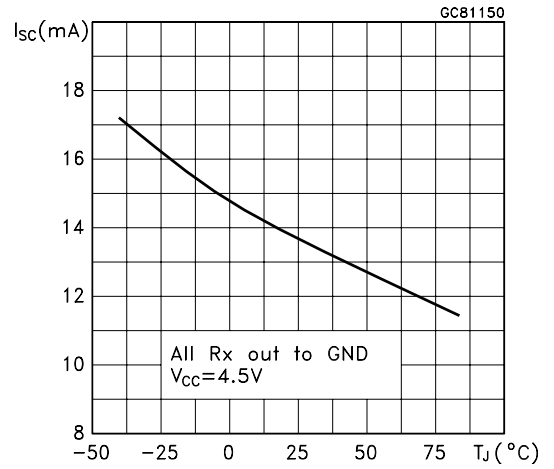
**Figure 8: Low Level Output Voltage Swing vs Temperature**



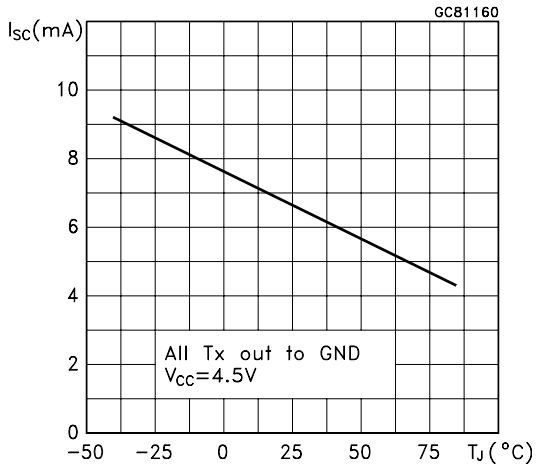
**Figure 9:** High Level Transmitter Output Short Circuit Current vs Temperature



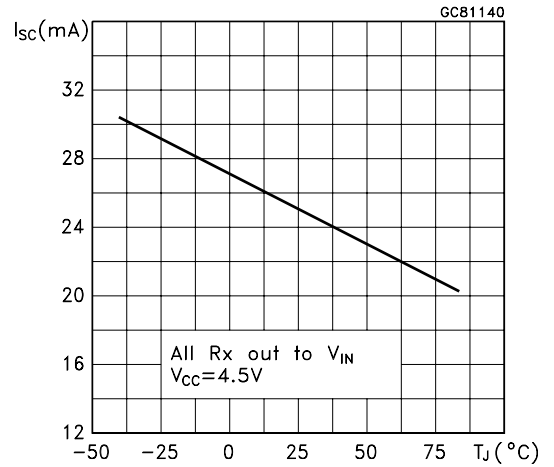
**Figure 11:** High Level Receiver Output Short Circuit Current vs Temperature



**Figure 10:** Low Level Transmitter Output Short Circuit Current vs Temperature

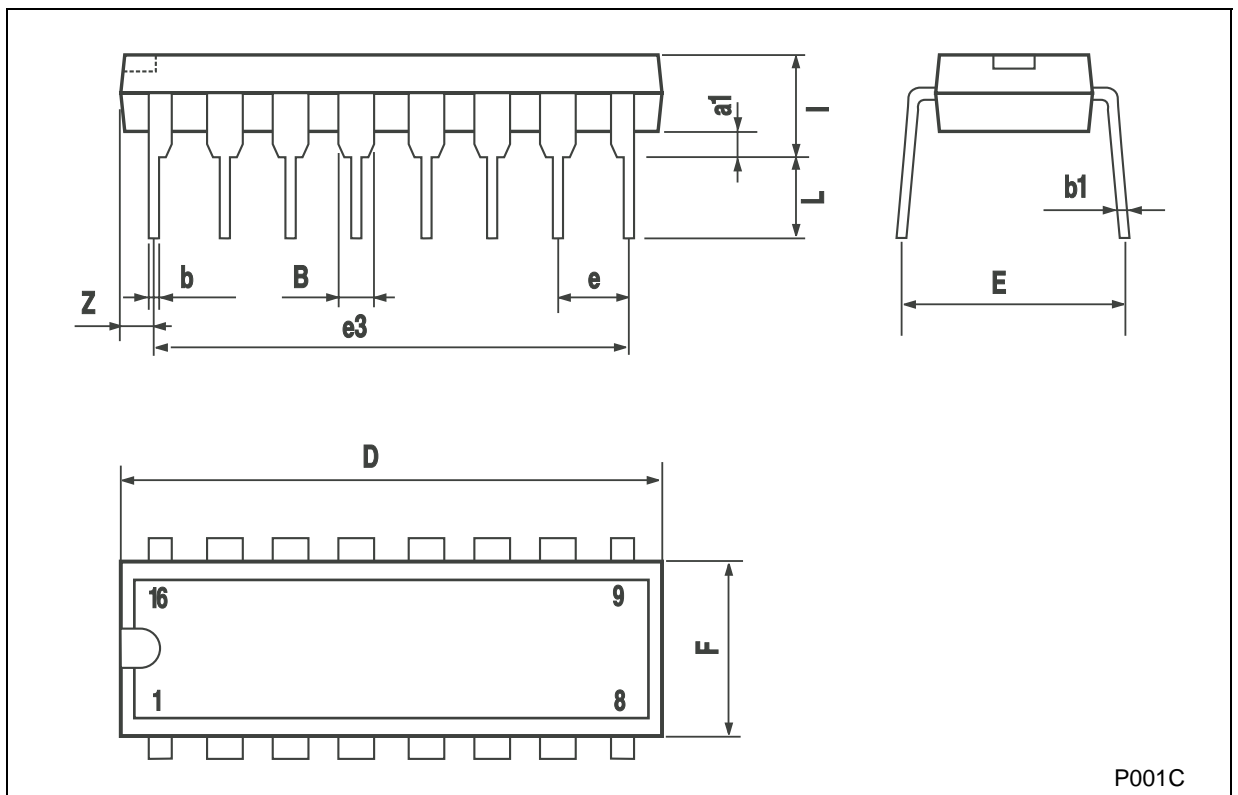


**Table 8:** Low Level Receiver Output Short Circuit Current vs Temperature



### Plastic DIP-16 (0.25) MECHANICAL DATA

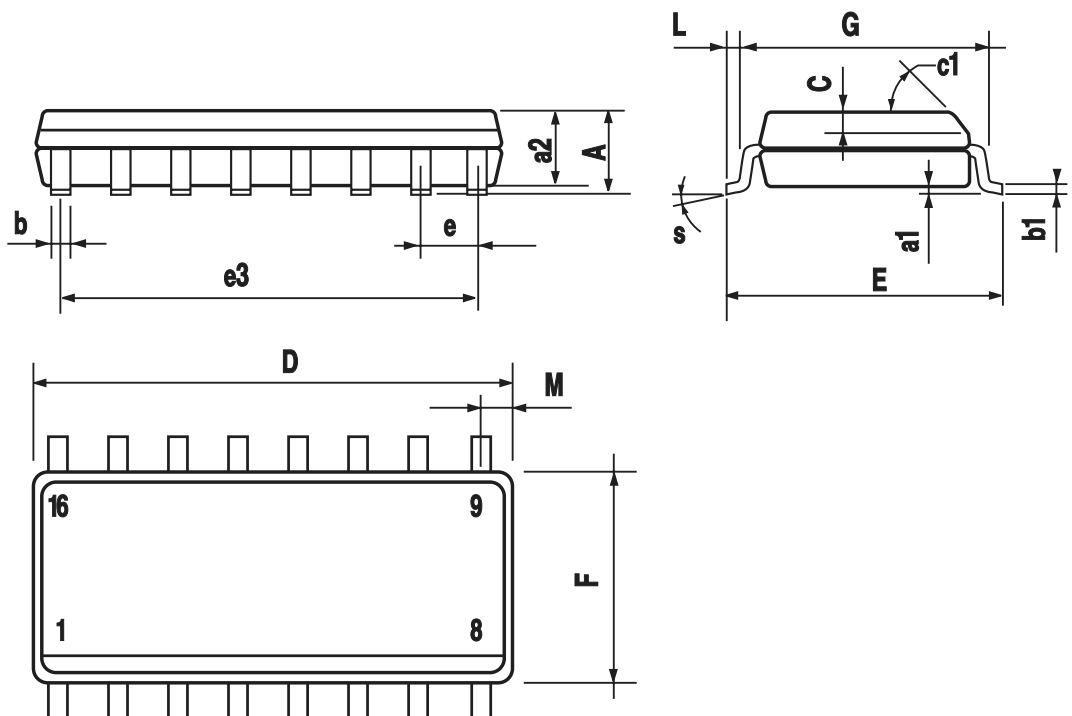
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
a1	0.51			0.020		
B	0.77		1.65	0.030		0.065
b		0.5			0.020	
b1		0.25			0.010	
D			20			0.787
E		8.5			0.335	
e		2.54			0.100	
e3		17.78			0.700	
F			7.1			0.280
I			5.1			0.201
L		3.3			0.130	
Z			1.27			0.050



P001C

## SO-16 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			1.75			0.068
a1	0.1		0.25	0.004		0.010
a2			1.64			0.063
b	0.35		0.46	0.013		0.018
b1	0.19		0.25	0.007		0.010
C		0.5			0.019	
c1	45° (typ.)					
D	9.8		10	0.385		0.393
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		8.89			0.350	
F	3.8		4.0	0.149		0.157
G	4.6		5.3	0.181		0.208
L	0.5		1.27	0.019		0.050
M			0.62			0.024
S	8° (max.)					

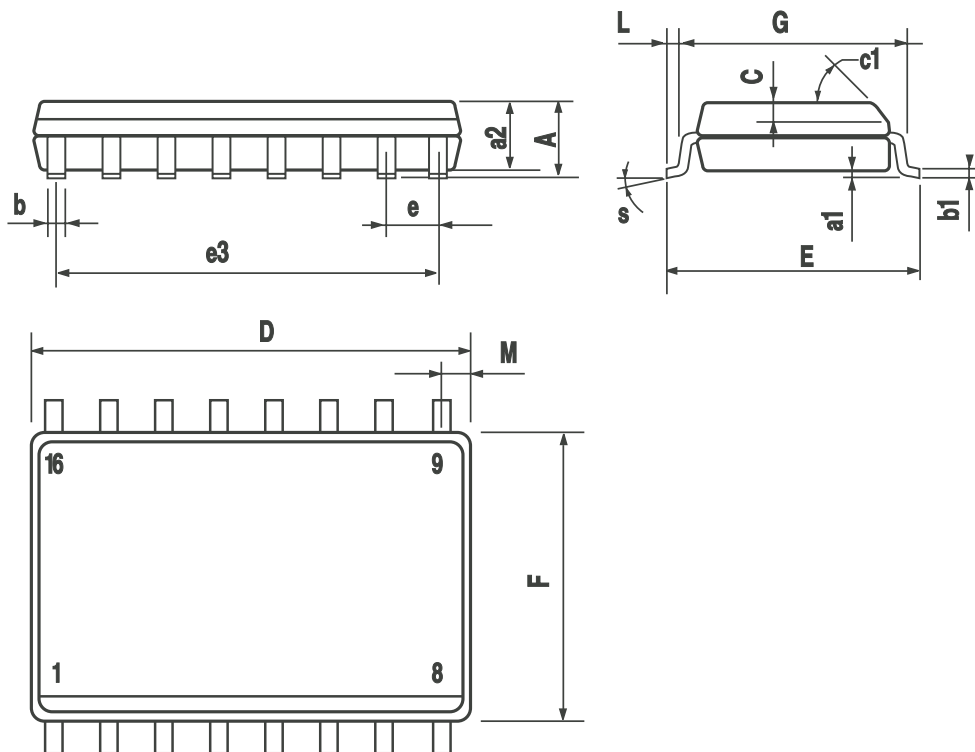


0016020D



## SO-16L MECHANICAL DATA

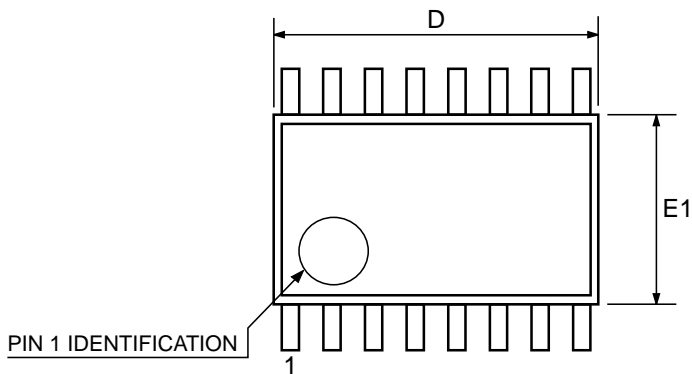
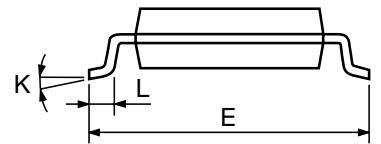
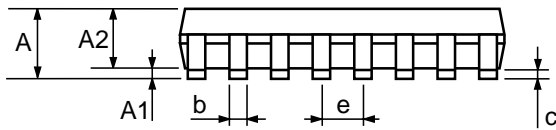
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A			2.65			0.104
a1	0.1		0.2	0.004		0.008
a2			2.45			0.096
b	0.35		0.49	0.014		0.019
b1	0.23		0.32	0.009		0.012
C		0.5			0.020	
c1	45° (typ.)					
D	10.1		10.5	0.397		0.413
E	10.0		10.65	0.393		0.419
e		1.27			0.050	
e3		8.89			0.350	
F	7.4		7.6	0.291		0.300
G						
L	0.5		1.27	0.020		0.050
M			0.75			0.029
S	8			° (max.)		



PO131

## TSSOP16 MECHANICAL DATA

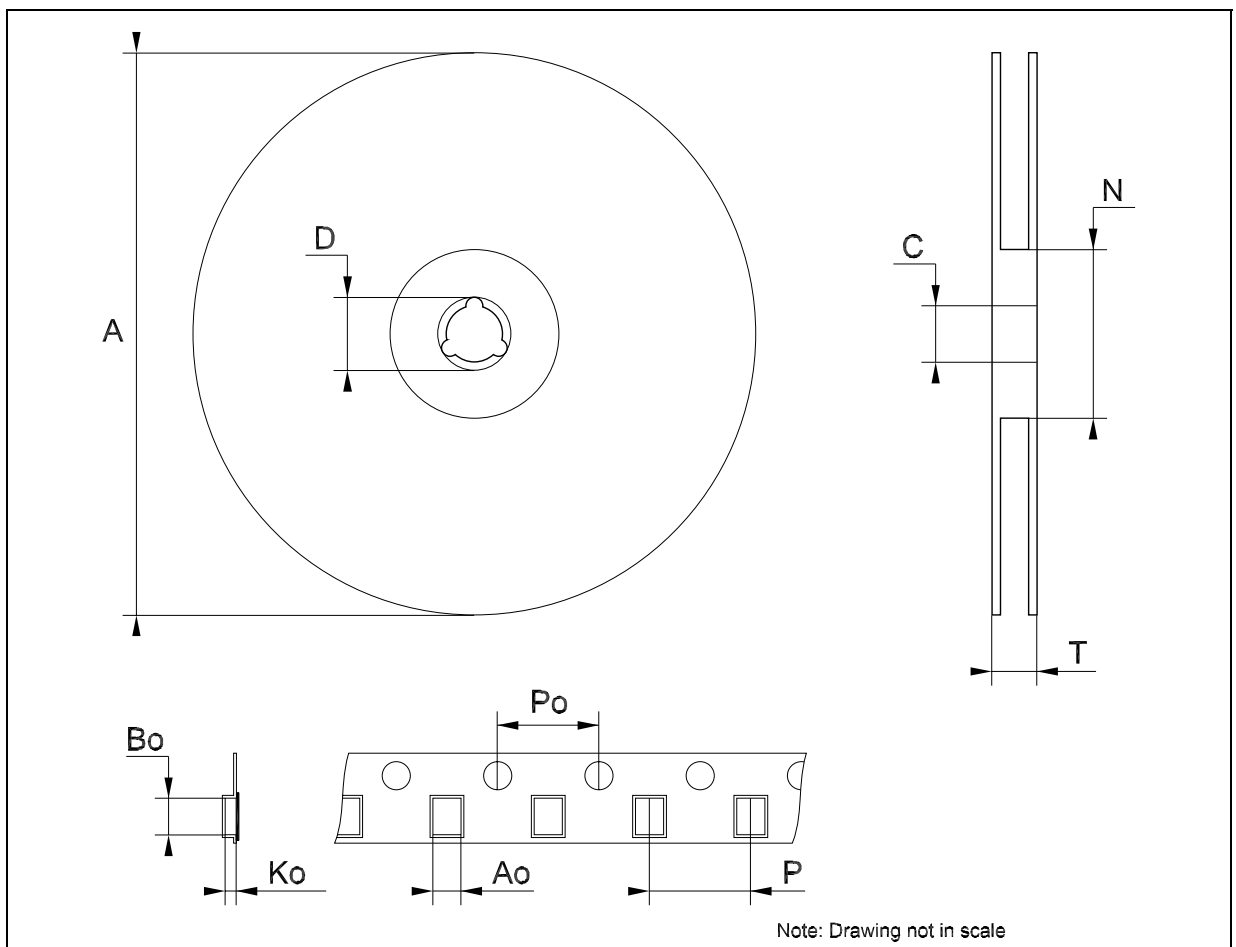
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A			1.2			0.047
A1	0.05		0.15	0.002	0.004	0.006
A2	0.8	1	1.05	0.031	0.039	0.041
b	0.19		0.30	0.007		0.012
c	0.09		0.20	0.004		0.0079
D	4.9	5	5.1	0.193	0.197	0.201
E	6.2	6.4	6.6	0.244	0.252	0.260
E1	4.3	4.4	4.48	0.169	0.173	0.176
e		0.65 BSC			0.0256 BSC	
K	0°		8°	0°		8°
L	0.45	0.60	0.75	0.018	0.024	0.030



0080338D

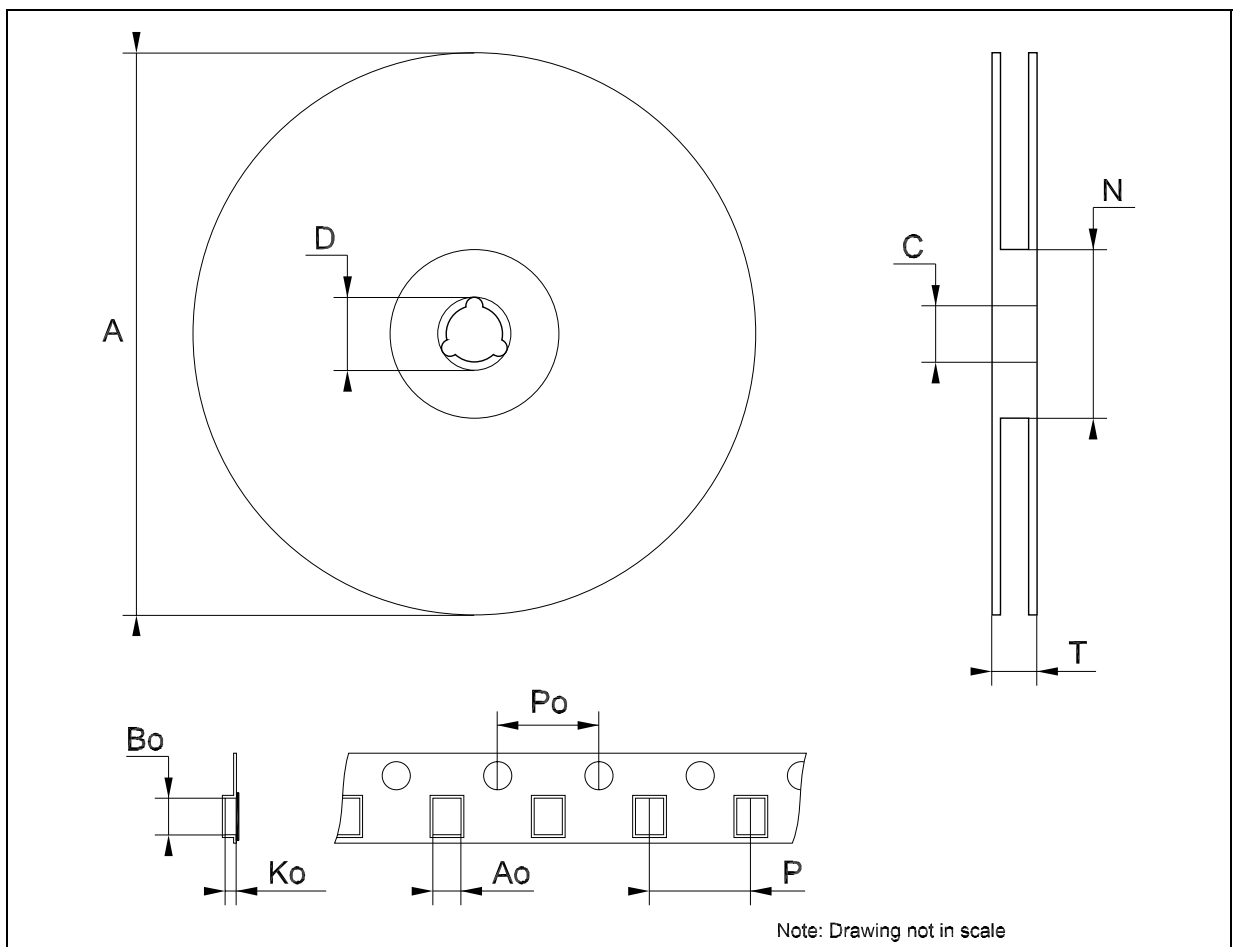
## Tape & Reel SO-16 MECHANICAL DATA

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	6.45		6.65	0.254		0.262
Bo	10.3		10.5	0.406		0.414
Ko	2.1		2.3	0.082		0.090
Po	3.9		4.1	0.153		0.161
P	7.9		8.1	0.311		0.319



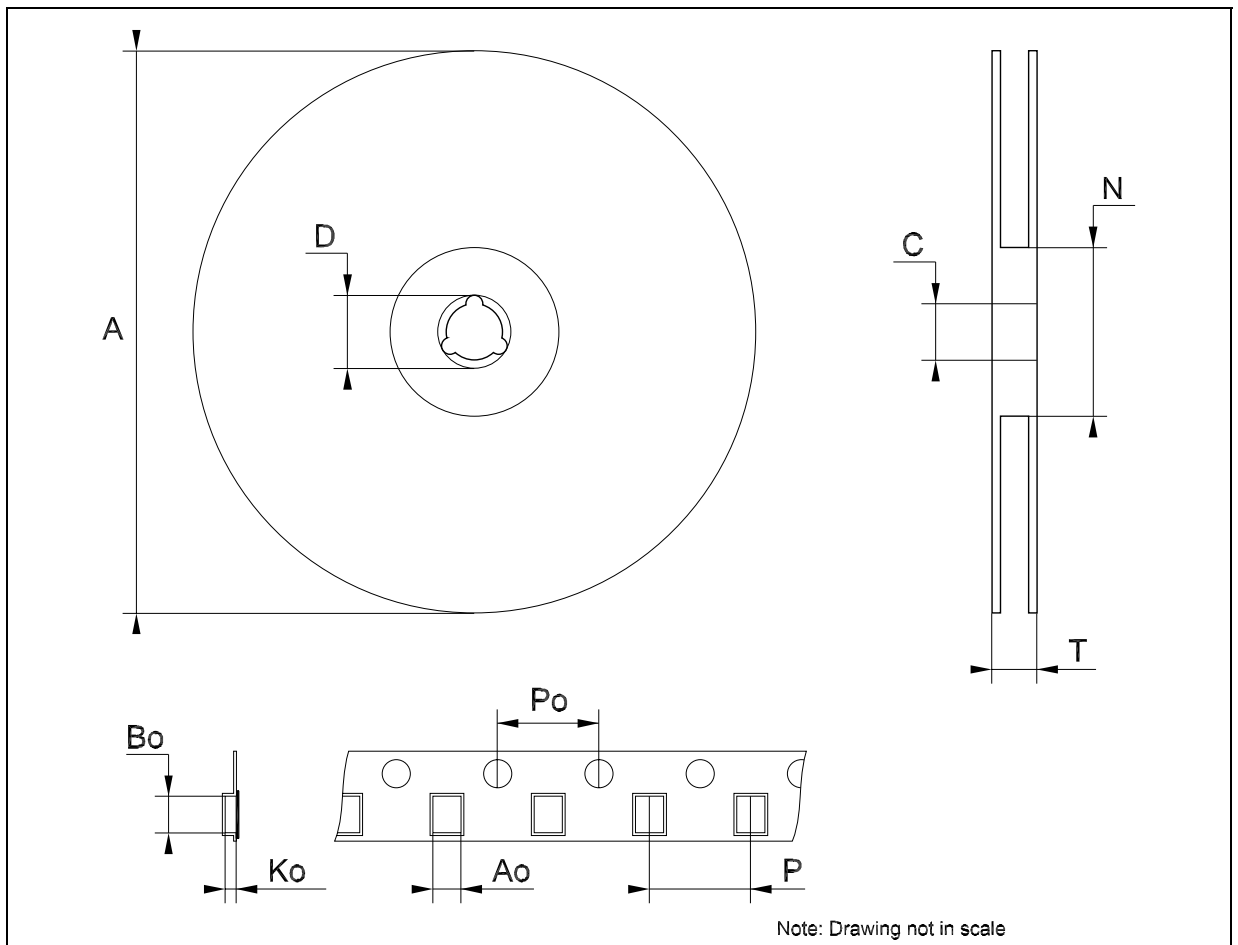
## Tape & Reel SO-16L MECHANICAL DATA

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	10.8		11.0	0.425		0.433
Bo	10.7		10.9	0.421		0.429
Ko	2.9		3.1	0.114		0.122
Po	3.9		4.1	0.153		0.161
P	11.9		12.1	0.468		0.476



## Tape & Reel TSSOP16 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	6.7		6.9	0.264		0.272
Bo	5.3		5.5	0.209		0.217
Ko	1.6		1.8	0.063		0.071
Po	3.9		4.1	0.153		0.161
P	7.9		8.1	0.311		0.319



**Table 9: Revision History**

<b>Date</b>	<b>Revision</b>	<b>Description of Changes</b>
02-Sep-2005	11	Mistake $I_{TIL}$ max. on table 5.

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