

**SCOPE: +5V-POWERED MULTI-CHANNEL RS-232 DRIVERS/RECEIVERS**

<u>Device Type</u>	<u>Generic Number</u>	<u>Pkg Code</u>
01	MAX220(x)/883B	J16 & L20
02	MAX222(x)/883B	J18 & L20
03	MAX232A(x)/883B	J16 & L20
04	MAX242(x)/883B	J18 & L20
05	MAX243(x)/883B	J16 & L20

**Case Outline(s).** The case outlines shall be designated in Mil-Std-1835 and as follows:

<u>Outline Letter</u>		<u>Mil-Std-1835</u>	<u>Case Outline</u>	<u>Package Code</u>
<b>MAXIM</b>	<b>SMD</b>			
JE	E	GDIP1-T16 OR CDIP2-T16	16 LEAD CERDIP	J16
JN	V	GDIP1-T18 OR CDIP2-T18	18 LEAD CERDIP	J18
LP	2	CQC1-N20	20 Leadless Chip Carrier	L20

**Absolute Maximum Ratings**

V <sub>CC</sub> .....	-0.3V to +6V
Input Voltages:	
T <sub>IN</sub> .....	-0.3V to (V <sub>CC</sub> -0.3V)
R <sub>IN</sub> .....	±25V
Output Voltages:	
T <sub>OUT</sub> $\frac{1}{2}$ .....	±15V
T <sub>OUT</sub> (MAX220) $\frac{1}{2}$ .....	±13.2V
R <sub>OUT</sub> .....	-0.3 to (V <sub>CC</sub> +0.3V)
Driver/Receiver Output Short Circuit to GND.....	Continuous
Lead Temperature (soldering, 10 seconds).....	+300°C
Storage Temperature.....	-65°C to +160°C
Continuous Power Dissipation.....	T <sub>A</sub> =+70 °C
16 pin CERDIP(derate 10mW/°C above +70 °C).....	800mW
18 pin CERDIP(derate 10.5mW/°C above +70 °C).....	842mW
20 pin LCC(derate 9.1mW/°C above +70 °C).....	727mW
Junction Temperature T <sub>J</sub> .....	+150 °C
Thermal Resistance, Junction to Case, $\theta_{JC}$	
16 pin CERDIP.....	50 °C/W
18 pin CERDIP.....	45 °C/W
20 pin LCC.....	20 °C/W
Thermal Resistance, Junction to ambient, $\theta_{JA}$	
16 pin CERDIP.....	100 °C/W
18 pin CERDIP.....	95 °C/W
20 pin LCC.....	110 °C/W

**Recommended Operating Conditions**

Ambient Operating Range (T <sub>A</sub> ).....	-55 °C to +125 °C
Supply Voltage Range (V <sub>CC</sub> ).....	+4.5V to +5.5V

NOTE 1: Input voltage measured with T<sub>OUT</sub> in high-impedance state,  $\overline{\text{SHDN}}$  or V<sub>CC</sub>=0V

NOTE 2: For the MAX220, V+ and V- can have a maximum magnitude of 7V, but their absolute difference cannot exceed 13V.

Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability

**TABLE 1. ELECTRICAL TESTS:**

TEST	Symbol	CONDITIONS -55 °C ≤ T <sub>A</sub> ≤ +125 °C $\frac{3}{}$ Unless otherwise specified	Group A Subgroup	Device Type	Limits Min	Limits Max	Units
<b>RS-232 TRANSMITTERS</b>							
Output voltage swing	V <sub>OLTOUT</sub>	All transmitter outputs loaded with 3kΩ to GND	1,2,3	All	±5.0		V
Input Logic Threshold low	V <sub>ILTOUT</sub>		1,2,3	All		0.8	V
Input Logic Threshold high	V <sub>IHTIN</sub>	MAX220: V <sub>CC</sub> = 5.0V	1,2,3	2-5 1	2.0 2.4		V
Logic Pull-up/ Input Current	I <sub>ILTIN</sub>	Normal Mode	1,2,3	2-5		40	μA
		$\overline{\text{SHDN}}=0\text{V}$ , Shutdown Mode		01,02,04		±1	
Output Leakage Current	I <sub>ILTOUT</sub>	V <sub>CC</sub> =5.5V V <sub>OUT</sub> =±15V, $\overline{\text{SHDN}}=0\text{V}$	1,2,3	02,04		±10	μA
		V <sub>CC</sub> = $\overline{\text{SHDN}}=0\text{V}$ , V <sub>OUT</sub> = ±15V		02,04		±10	
		V <sub>CC</sub> = 0V V <sub>OUT</sub> = ±12V		01		±25	
		V <sub>CC</sub> = 0V V <sub>OUT</sub> = ±15V		03,05		±10	
Output Short-Circuit Current	I <sub>OST</sub>	V <sub>OUT</sub> =0V	1,2,3	1 2-5		±60 ±7	mA
Transition Slew Rate	t <sub>SLEW</sub>	C <sub>L</sub> =50pF to 2500pF, R <sub>L</sub> =3kΩ to 7kΩ, V <sub>CC</sub> =5V, measured from +3V to -3V or -3V to +3V	9	01 02,03, 04,05	1.5 6.0	30 30	V/μs
Data Rate	f <sub>MAX</sub>	Normal Mode	1,2,3	01 02,03,04, 05		20 116	kbits/sec
Transmitter Output Resistance	R <sub>TOUT</sub>	V <sub>CC</sub> =V+=V-=0V, V <sub>OUT</sub> =±2V	1,2,3	All	300		Ω
<b>RS-232 RECEIVERS</b>							
RS-232 Input Voltage Operating Range			1,2,3	01 02,03,04, 05		±25 ±30	V
RS-232 Input Threshold Low	V <sub>ILRINP</sub> V <sub>ILRINN</sub>	V <sub>CC</sub> =5V, Except MAX243 R <sub>2IN</sub> V <sub>CC</sub> =5V, MAX243 R <sub>2IN</sub> , Note 4	1,2,3	01,02, 03,04 05	0.8 -3.0		V
RS-232 Input Threshold High	V <sub>IHRINP</sub> V <sub>IHRINN</sub>	V <sub>CC</sub> =5V, Except MAX243 R <sub>2IN</sub> V <sub>CC</sub> =5V, MAX243 R <sub>2IN</sub> , Note 4	1,2,3	01,02, 03,04 05		2.4 -0.1	V
RS-232 Input Hysteresis	HYSR <sub>IN</sub>	V <sub>CC</sub> =5V, Normal Mode. All receiver inputs except MAX243 R <sub>2IN</sub> V <sub>CC</sub> =5V, MAX243 R <sub>2IN</sub> , Note 5	1,2,3	01 02,03,04 05		1.0 0.2 1.0	V

TEST	Symbol	CONDITIONS -55 °C ≤ T <sub>A</sub> ≤ +125 °C 2/ Unless otherwise specified	Group A Subgroup	Device Type	Limits Min	Limits Max	Units
RS-232 Input Resistance	R <sub>IN</sub>		1	01	3.0	7.0	KΩ
			1,2,3	02,03,04, 05	3.0	7.0	
TTL/CMOS Output Voltage Low	V <sub>OLROUT</sub>	I <sub>OUT</sub> =1.6mA	1,2,3	01		0.4	V
		I <sub>OUT</sub> =3.2mA		02,03,04, 05		0.4	
TTL/CMOS Output Voltage High	V <sub>OHRROUT</sub>	I <sub>OUT</sub> =-1.0mA	1,2,3	All	3.5		V
TTL/CMOS Output Short Circuit Current	I <sub>OSROUT</sub>	Sourcing V <sub>OUT</sub> =GND	1,2,3	All	-2.0		mA
		Sinking V <sub>OUT</sub> =V <sub>CC</sub>			10		
TTL/CMOS Output Leakage Current	I <sub>ILROUT</sub>	0V ≤ V <sub>OUT</sub> ≤ V <sub>CC</sub> , SHDN=0V	1,2,3	02,04		±10	μA
		0V ≤ V <sub>OUT</sub> ≤ V <sub>CC</sub> , EN= V <sub>CC</sub>		04		±10	
EN Input Threshold Low	V <sub>IL</sub> EN		1,2,3	04		0.8	V
EN Input Threshold High	V <sub>IH</sub> EN		1,2,3	04	2.0		V
SHDN Input Leakage Current	I <sub>IL</sub> SHDN		1,2,3	02,04		±1	μA
SHDN Threshold Low	V <sub>IL</sub> SHDN		1,2,3	02,04		0.8	V
SHDN Threshold High	V <sub>IH</sub> SHDN		1,2,3	02,04	2.0		V
<b>POWER SUPPLY</b>							
Operating Supply Voltage			1,2,3	All	4.5	5.5	V
V <sub>CC</sub> Supply Current	I <sub>CC</sub>	No load, Normal Mode	1,2,3	01		2.0	mA
SHDN= V <sub>CC</sub>				02,03, 04,05		10	
Shutdown Supply Current	I <sub>CC</sub> SHDN	Shutdown mode SHDN= 0V	1	02,04		10	μA
			2,3			100	
<b>AC CHARACTERISTICS</b>							
Receiver Output Enable Time	t <sub>ER</sub>	See Figure 3 in Commercial datasheet	9,10,11	04		500	ns
Receiver Output Disable Time	t <sub>DR</sub>	See Figure 3 in Commercial datasheet	9,10,11	04		500	ns
Receiver Propagation Delay RS-232 to TTL	t <sub>PHLR</sub> t <sub>PLHR</sub>	Normal mode. See Figure 3 in Commercial datasheet	9,10,11	01		3.0	μs
	t <sub>PHLS</sub> t <sub>PLHS</sub>			02,03, 04,05		1.0	
		See Figure 3. Shutdown mode, SHDN=0V		04		10	
Transmitter Propagation Delay TTL to RS-232	t <sub>PHLT</sub> t <sub>PLHT</sub>	Normal mode. See Figure 1 in Commercial datasheet	9,10,11	01		10	μs
				02,03, 04,05		3.5	

NOTE 3: For device types 02,03,04,05, all external capacitors=0.1  $\mu$ F. For device type 01, external capacitor C1=0.047 $\mu$ F; C2-C4=0.33 $\mu$ F.

NOTE 4: For device type 05, R2<sub>OUT</sub> is low when the receiver R2<sub>IN</sub> is  $\geq$ 0V or is floating.

NOTE 5: For design purposes only, not tested.

**TERMINAL CONNECTIONS:**

	01,03,05	01,03,05	02	02	04	04
	J16	L20	J18	L20	J18	L20
1	C1+	NC	NC	NC	$\overline{\text{EN}}$	$\overline{\text{EN}}$
2	V+	C1+	C1+	C1+	C1+	C1+
3	C1-	V+	V+	V+	V+	V+
4	C2+	C1-	C1-	C1-	C1-	C1-
5	C2-	C2+	C2+	C2+	C2+	C2+
6	V-	NC	C2-	NC	C2-	NC
7	T2 <sub>OUT</sub>	C2-	V-	C2-	V-	C2-
8	R2 <sub>IN</sub>	V-	T2 <sub>OUT</sub>	V-	T2 <sub>OUT</sub>	V-
9	R2 <sub>OUT</sub>	T2 <sub>OUT</sub>	R2 <sub>IN</sub>	T2 <sub>OUT</sub>	R2 <sub>IN</sub>	T2 <sub>OUT</sub>
10	T2 <sub>IN</sub>	R2 <sub>IN</sub>	R2 <sub>OUT</sub>	R2 <sub>IN</sub>	R2 <sub>OUT</sub>	R2 <sub>IN</sub>
11	T1 <sub>IN</sub>	NC	T2 <sub>IN</sub>	NC	T2 <sub>IN</sub>	NC
12	R1 <sub>OUT</sub>	R2 <sub>OUT</sub>	T1 <sub>IN</sub>	R2 <sub>OUT</sub>	T1 <sub>IN</sub>	R2 <sub>OUT</sub>
13	R1 <sub>IN</sub>	T2 <sub>IN</sub>	R1 <sub>OUT</sub>	T2 <sub>IN</sub>	R1 <sub>OUT</sub>	T2 <sub>IN</sub>
14	T1 <sub>OUT</sub>	T1 <sub>IN</sub>	R1 <sub>IN</sub>	T1 <sub>IN</sub>	R1 <sub>IN</sub>	T1 <sub>IN</sub>
15	GND	R1 <sub>OUT</sub>	T1 <sub>OUT</sub>	R1 <sub>OUT</sub>	T1 <sub>OUT</sub>	R1 <sub>OUT</sub>
16	V <sub>CC</sub>	NC	GND	R1 <sub>IN</sub>	GND	R1 <sub>IN</sub>
17		R1 <sub>IN</sub>	V <sub>CC</sub>	T1 <sub>OUT</sub>	V <sub>CC</sub>	T1 <sub>OUT</sub>
18		T1 <sub>OUT</sub>	$\overline{\text{SHDN}}$	GND	$\overline{\text{SHDN}}$	GND
19		GND		V <sub>CC</sub>		V <sub>CC</sub>
20		V <sub>CC</sub>		$\overline{\text{SHDN}}$		$\overline{\text{SHDN}}$

	Package	ORDERING INFORMATION	SMD Number
01	16 pin CERDIP	MAX220MJE/883B	5962-9456501MEA
01	20 pin LCC	MAX220MLP/883B	5962-9456501M2C
02	18 pin CERDIP	MAX222MJN/883B	5962-9456502MVA
02	20 pin LCC	MAX222MLP/883B	5962-9456502M2C
03	16 pin CERDIP	MAX232AMJE/883B	5962-9456503MEA
03	20 pin LCC	MAX232AML/883B	5962-9456503M2C
04	18 pin CERDIP	MAX242MJN/883B	5962-9456504MVA
04	20 pin LCC	MAX242MLP/883B	5962-9456504M2C
05	16 pin CERDIP	MAX243MJE/883B	5962-9456505MEA
05	20 pin LCC	MAX243MLP/883B	5962-9456505M2C

**TRUTH TABLE: FOR DEVICE TYPE 05, MAX243**

RECEIVER INPUT	R1 OUTPUT	R2 OUTPUT
$\leq -3\text{V}$	HIGH	HIGH
OPEN	HIGH	LOW
$\geq +3\text{V}$	LOW	LOW

**SELECTION TABLE:**

PART NUMBER	PART NUMBER	MAX KBITS/SEC	EXTERNAL CAPACITORS	MAX SUPPLY	SHUTDOWN AND TRI-STATE	FEATURES
01	MAX220	20	0.047/0.33	2	NO	Lowest power
02	MAX222	116	0.1	10	YES/NO	$\overline{\text{SHDN}}$
03	MAX232A	116	0.1	10	NO	High Speed
04	MAX242	116	0.1	10	YES/YES	$\overline{\text{EN}}, \overline{\text{SHDN}}$
05	MAX243	116	0.1	10	NO	Open-Line Detect

**QUALITY ASSURANCE**

Sampling and inspection procedures shall be in accordance with MIL-Prf-38535, Appendix A as specified in Mil-Std-883.

Screening shall be in accordance with Method 5004 of Mil-Std-883. Burn-in test Method 1015:

1. Test Condition, A, B, C, or D.
2.  $T_A = +125^\circ\text{C}$  minimum.
3. Interim and final electrical test requirements shall be specified in Table 2.

Quality conformance inspection shall be in accordance with Method 5005 of Mil-Std-883, including Groups A, B, C, and D inspection.

Group A inspection:

1. Tests as specified in Table 2.
2. Selected subgroups in Table 1, Method 5005 of Mil-Std-883 shall be omitted.

Group C and D inspections:

- a. End-point electrical parameters shall be specified in Table 1.
- b. Steady-state life test, Method 1005 of Mil-Std-883:
  1. Test condition A, B, C, D.
  2.  $T_A = +125^\circ\text{C}$  minimum.
  3. Test duration, 1000 hours, except as permitted by Method 1005 of Mil-Std-883.

**TABLE 2. ELECTRICAL TEST REQUIREMENTS**

Mil-Std-883 Test Requirements	Subgroups per Method 5005, Table 1
Interim Electrical Parameters Method 5004	1
Final Electrical Parameters Method 5005	1*, 2, 3, 9, 10, 11
Group A Test Requirements Method 5005	1, 2, 3, 9, 10, 11
Group C and D End-Point Electrical Parameters Method 5005	1

\* PDA applies to Subgroup 1 only.