General Description

The KY232 series devices are EIA/TIA-232 and V.28/V.24 communication interfaces achieves 1μA supply current. A proprietary, high-efficiency, dual charge-pump regulated voltage converters and a low-dropout transmitter combine to deliver true RS-232 performance.

These devices can operate from a single 5V supply at the guaranteed data rate of 250k bits/sec with enhanced electrostatic discharge (ESD) protection in all RS232 I/O pins exceeding ±15kV EN61000-4-2 Air Gap Discharge and ±8kV EN61000-4-2 Contact Discharge.

Features

- Meets EIA/TIA-232F and CCITT V.28/V.24specifications for V_{CC} at +5V ±10%
- Low Quiescent Current 3mA typical , 5mA max
- Guaranteed Standard Data Rate 250kbps
- Extended ESD Protection for RS-232 I/O Pins ±15kV HBM

Applications

- Battery-Powered And Hand-Held Applications
- Peripherals interface
- Portable Diagnostics Equipment
- Terminal Adapters and POS terminals
- Notebooks, Subnotebooks, and Palmtops
- Industrial and Embedded PCs

Absolute Maximum Ratings (All voltages referenced to GND.)

Supply Voltage V_{CC} ..... -0.3V to +6V
V+ ..... -0.3V to +7V
V- ..... -0.3V to +7V
|V+| + |V-| ..... +13V
Input Voltages
TxIN ..... -0.3V to +6V
R_IN ..... ±15V
Output Voltages
TxOUT ..... ±13.2V
RxOUT .....-0.3V to (V_{CC} + 0.3V)
Short-Circuit Duration
TxOUT .....Continuous
Continuous Power Dissipation (TA = +70°C)

Power Dissipation Per Package

16-pin nSOIC (derate 10.00mW/°C above +70°C…….....720mW

Operating Temperature Range ..... 0°C to +70°C
Junction Temperature.....+150°C
Storage Temperature Range .....-65°C to +150°C
Lead Temperature (soldering 10s) .....+300°C

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.

Product Selection Guide

PART	Tx	Rx	Data Rate (kbps)	Receiver Enable	SHUTDOWN Enable	POWERSAVE	Number of Pins	Package Type
KY202E	2	2	250	No	No	No	16	NSOIC
KY232E	2	2	250	No	No	No	16	NSOIC

Electrical Characteristics

(C1–C4 = 0.1μF, TA = TMIN to TMAX, unless otherwise noted, Typical values apply at V_{CC} = +5.0V and T_A = 25°C.)

Parameters	Conditions	typical V_{CC}	Min	Typ	Max	Unit
General InfolTypes						
TTL Logic Input	T_XIN, $\overline{PWRSAVE}$, $\overline{SD}$, $\overline{EN}$	high Z_{IN}				
TTL Logic Output	R_XOUT, $\overline{STATE}$					
RS-232 Input	R_XIN					
RS-232 Output	T_XOUT					
Charge Pump Pin	C_1P, C_1N, C_2P, C_2N					
Power Pin	V_{CC}, V_{GND}, V_{DD}, V_{SS}					
Charge Pump Caps	C_1P, C_1N, C_2P, C_2N			0.1		μF
V_{CC} Voltage Range		5.0	4.5	5.0	5.5	V
DC Characteristics						
Supply Current Quiescent	TTL Inputs = V_{CC} /GND, RS-232 Input = float, TA = 25°V_{CC} = +5.0V ±10%, No load on transmitter outputs	5.0		3	5	mA
Supply Current, Transmitters Loaded	TTL Inputs = V_{CC} /GND, RS-232 Input = float, TA = 25° V_{CC} = +5.0V , All transmitter outputs loaded with R_L = 3kΩ	5.0		15		mA
LOGIC Input						
Input Threshold Low		5.0			0.8	V
Input Threshold High		5.0	2.4			V
Input Hysteresis		5.0		0.3		V
Input Leakage Current	TTL I/P=GND (TTL Logic Input per pin measure)	5.0			±200	μA
LOGIC Output						
Output Voltage Low	I_{OUT}=3.2mA	5.0			0.4	V
Output voltage High	I_{OUT} =-1mA	5.0	3.5			V
Receiver Input						
Input Voltage Range		5.0	-15		+15	V
Input Threshold Low		5.0	0.8	1.2		V
Input Threshold High		5.0		1.7	2.4	V
Input Hysteresis		5.0		0.3		V
Input Resistance		5.0	3		7	kΩ
Transmitter Output						
Output Voltage Swing	R_L=3-7kΩ, all loaded	5.0	±5	±7		V
Output Resistance	V_{CC} = V_{DD} = V_{SS} =GND, V_{OUT} =±2V	0	300			Ω
Output Short-circuit Current	V_{OUT} =GND	5.0			±60	mA
Timing Characteristics						
Maximum Data Rate						
< standard speed >	R_L =3-7k, C_L =50pF-1000pF, 1 DR/RC switching	5.0	250			kbps
Transition-Region Slew Rate						V/μs
< standard speed >	R_L =3-7k, C_L =50pF-1000pF, 1 DR/RC switching	5.0		30		V/μs
Transmitter Propatation t_{PLH}	3k+1000pF, all loaded	5.0		2		μs
Transmitter Propatation t_{PHL}	3k+1000pF, all loaded	5.0		2		μs
Transmitter Skew	t_{PHL} - t_{PLH}	5.0		100		ns
Receiver Propagation t_{PLH}	C_L=150pF	5.0		0.15		μs
Receiver Propagation t_{PHL}	C_L =150pF	5.0		0.15		μs
Receiver Skew	t_{PHL} - t_{PLH}	5.0		50		ns
ESD Tolerance						
ESD HBM		5.0		±15		kV
ESD 1000-4-2 Contact		5.0		±8		kV
ESD 1000-4-2 Air		5.0		±15		kV

Detailed Description

Charge-Pump

The KY232's family utilizes regulated on-chip dual charge pumps that provides output voltages of +5.5V(doubling charge pump) and -5.5V (inverting charge pump), regardless of the input voltage (V_{CC}) over the +4.5V to +5.5V range. The charge pumps operate in a discontinuous mode: if the output voltages are less than 5.5V, the charge pumps are enabled; if the output voltages exceed 5.5V, the charge pumps are disabled. Each charge pump requires a flying capacitor (C1, C2) and a reservoir capacitor (C3, C4) to generate the V+ and V- supplies.

RS-232 Transmitters

The transmitters are proprietary, low dropout, inverting level translators that convert TTL/CMOS inputs to EIA/TIA-232 output levels. Coupled with the on-chip 5.5V supplies, these transmitters deliver true RS-232 levels over a wide range of single supply system voltages.

RS-232 Receive

The KY232's family receivers convert RS-232 signals to CMOS-logic output levels. They are contain standard inverting receivers.

ESD Immunity

The KY232 series incorporates ruggedized ESD cells on all driver output and receiver input pins.

The ESD structure is improved for more rugged applications and environments sensitive to electro-static discharges and associated transients.

The improved ESD tolerance is at least +15kV without damage nor latch-up.

There are two methods within EN61000-4-2, the Air Discharge method and the Contact Discharge method.

With the Air Discharge Method, an ESD voltage is applied to the equipment under test through air, which simulates an electrically charged person ready to connect a cable onto the rear of the system and the high energy potential on the person discharges through an arcing path to the rear panel of the system before he or she even touches the system.

The Contact Discharge Method applies the ESD current directly to the EUT.

This method was devised to reduce the unpredictability of the ESD arc.

The discharge current rise time is constant since the energy is directly transferred without the air-gap arc inconsistencies.

KEYSEMI 's RS232 transceivers meets and exceeds the minimum criteria for EN61000-4-2 with ±15kV for Air Gap Discharge and ±8kV for Contact Discharge.

The circuit models in following Figures represent the typical ESD testing circuit.

The CS is initially charged with the DC power supply when the first switch (SW1) is on.

Now that the capacitor is charged, the second switch (SW2) is on while SW1 switches off.

The voltage stored in the capacitor is then applied through RS, the current limiting resistor, onto the device under test (DUT).

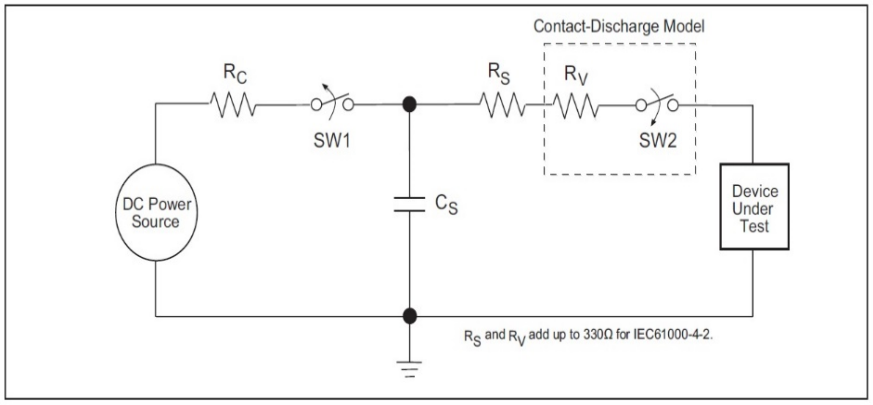
In ESD tests, the SW2 switch is pulsed so that the device under test receives a duration of voltage.

For the Human Body Model, the current limiting resistor (RS) and the source capacitor (CS) are 1.5kΩ and 100pF, respectively. For IEC-61000-4-2, the current limiting resistor (RS) and the source capacitor (CS) are 330Ω and 150pF, respectively.

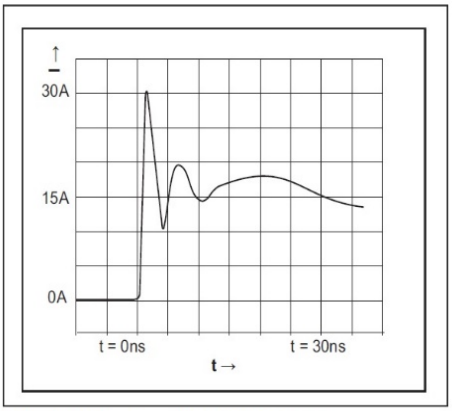
The higher CS value and lower RS value in the IEC61000-4-2 model are more stringent than the Human Body Model.

The larger storage capacitor injects a higher voltage to the test point when SW2 is switched on.

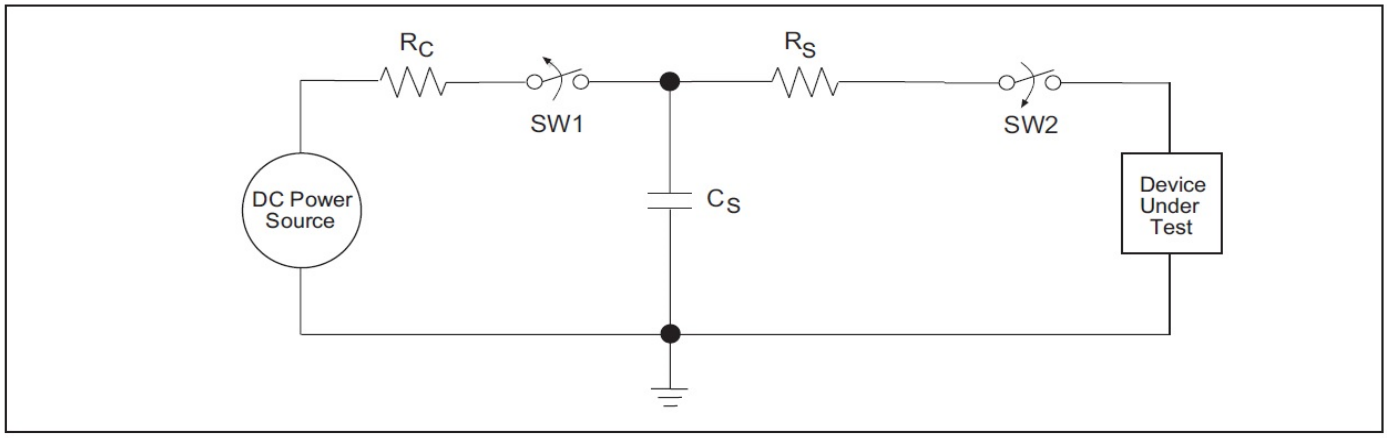
The lower current limiting resistor increases the current charge onto the test point.



ESD Test Circuit for IEC61000-4-2



ESD Test Waveform for IEC61000-4-2



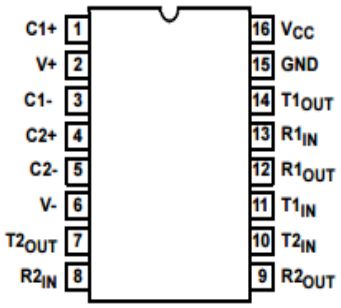
ESD Test Circuit for Human Body Model

DEVICE PIN TESTED	HUMAN BODY MODEL	IEC61000-4-2		
		Air Discharge	Direct Contact	Level
Driver Outputs	±15kV	±15kV	±8kV	4
Receiver Inputs	±15kV	±15kV	±8kV	4

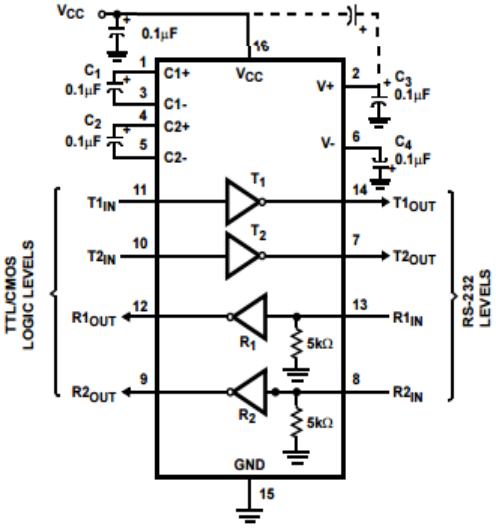
Transceiver ESD Tolerance Levels

Typical Application Circuits and Pin Configuration

KY202,KY232(nSOIC)
TOP VIEW



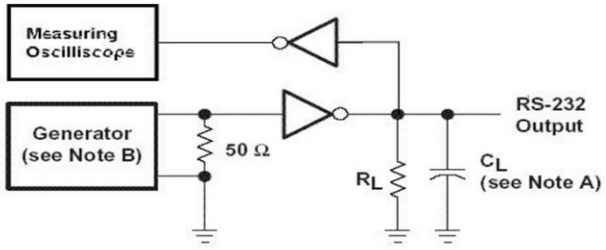
KY202,KY232
C_3(OPTIONAL CONNECTION,NOTE)



NOTE: The negative terminal of C_3 can be connected to either V_{CC} or GND

PIN		TYPE	DESCRIPTION
NAME	NO.		
C1+	1	—	Positive lead of C1 capacitor
VS+	2	O	Positive charge pump output for storage capacitor only
C1-	3	—	Negative lead of C1 capacitor
C2+	4	—	Positive lead of C2 capacitor
C2-	5	—	Negative lead of C2 capacitor
VS-	6	O	Negative charge pump output for storage capacitor only
T2OUT, T1OUT	7, 14	O	RS232 line data output (to remote RS232 system)
R2IN, R1IN	8, 13	I	RS232 line data input (from remote RS232 system)
R2OUT, R1OUT	9, 12	O	Logic data output (to UART)
T2IN, T1IN	10, 11	I	Logic data input (from UART)
GND	15	—	Ground
V_{CC}	16	—	Supply Voltage, Connect to external 5V power supply

Typical Test Circuits

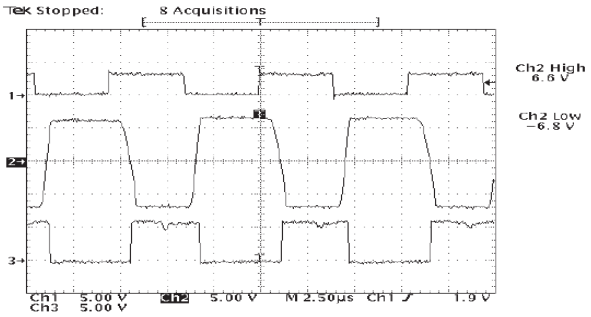


TEST CIRCUIT

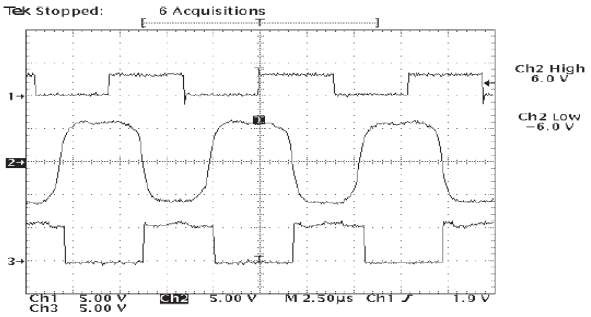
Maximum Data Rate Test Circuit

Notes:

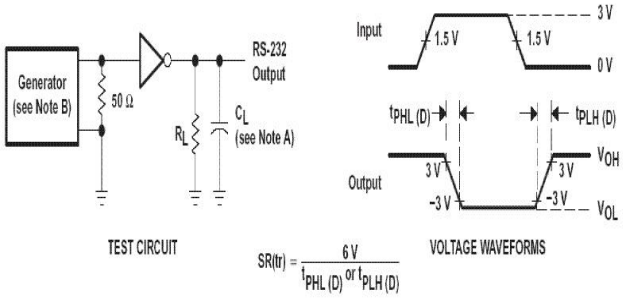
A. R_L=3kΩ,C_L= 1000pF,T_A = 25°C, One Driver Switching.
B. The pulse generator had the following characteristics: PRR = 250 kbps, Zo = 50Ω, 50% duty cycle, T_r & T_f < 10ns.



KY232 TxIN to TxOut (no load) at 250kbps waveform



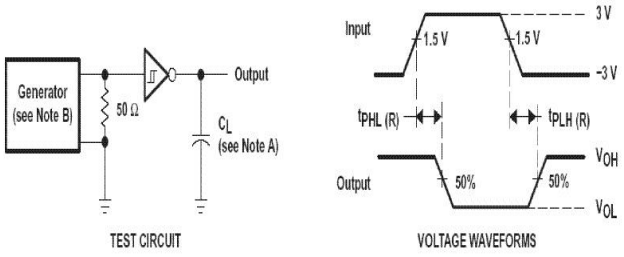
KY232 TxIN to TxOut to RxOut (loopback to Rx with 1000pF load) at 250kbps waveform



Driver Transition-Region Slew Rate Test Circuit

Notes:

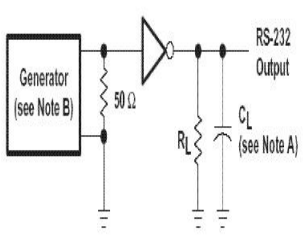
A. R_L=3k~7kΩ,C_L= 150~1000pF,T_A = 25°C
One Driver Switching, Measured from +3V to -3V or -3V to +3V.
B. The pulse generator had the following characteristics: PRR = 250 kbps, Zo = 50Ω, 50% duty cycle, T_r & T_f < 10ns.
C. $\overline{SD}$ = Vcc when applicable.



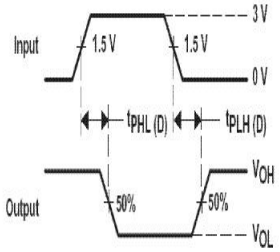
Driver Propagation (t_{PHL} & t_{PLH}) Test Circuit

Notes:

A. All drivers loaded with R_L=3kΩ,C_L= 1000pF.
B. The pulse generator had the following characteristics: PRR = 250 kbps, Zo = 50Ω, 50% duty cycle, T_r & T_f < 10ns.
C. $\overline{SD}$ = Vcc when applicable.



TEST CIRCUIT



VOLTAGE WAVEFORMS

Receiver Propagation Delay Times Test Circuit

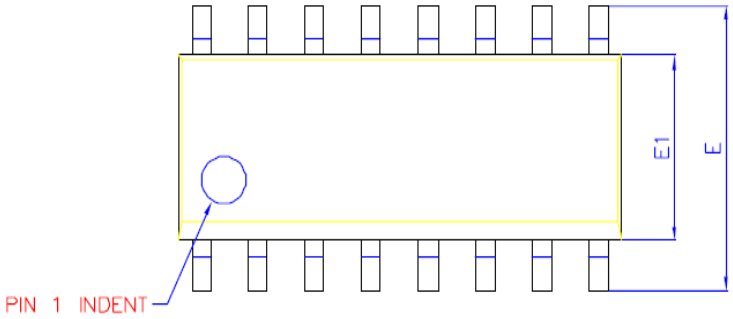
Notes:

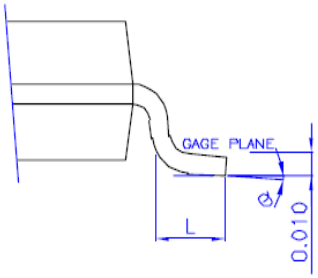
A. C_L= 150pF, including probe and jig capacitance.

B. The pulse generator had the following characteristics: PRR = 250 kbps, Zo = 50Ω, 50% duty cycle, T_r & T_f < 10ns.

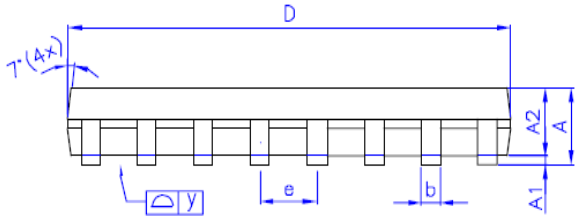
C. $\overline{SD}$ = Vcc when applicable.

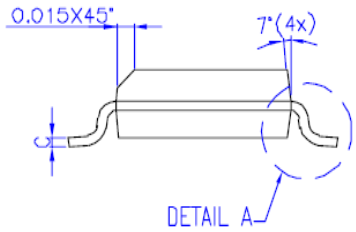
Package Information





DETAIL A





DETAIL A

NOTE .
1. CONTROLLING DIMENSION : INCH
2. LEAD FRAME MATERIAL : COPPER 194
3. DIMENSION "D" DOES NOT INCLUDE MOLD FLASH, TIE BAR BURRS AND GATE BURRS. MOLD FLASH, TIE BAR BURRS AND GATE BURRS SHALL NOT EXCEED 0.006"[0.15mm] PER END DIMENSION "E1" DOES NOT INCLUDE INTERLEAD FLASH. INTERLEAD FLASH SHALL NOT EXCEED 0.010"[0.25mm] PER SIDE.
4. DIMENSION "b" DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.003"[0.08mm] TOTAL IN EXCESS OF THE "b" DIMENSION AT MAXIMUM MATERIAL CONDITION. DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OR THE FOOT. MINIMUM SPACE BETWEEN PROTRUSION AND AN ADJACENT LEAD TO BE 0.0028"[0.07mm]
5. TOLERANCE : ±0.010"[0.25mm] UNLESS OTHERWISE SPECIFIED
6. OTHERWISE DIMENSION FOLLOW ACCEPTABLE SPEC.
7 REFERENCE DOCUMENT : JEDEC SPEC MS-012

SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	1.47	1.60	1.73	0.058	0.063	0.068
A1	0.10	—	0.25	0.004	—	0.010
A2	—	1.45	—	—	0.057	—
b	0.33	0.41	0.51	0.013	0.016	0.020
C	0.19	0.20	0.25	0.0075	0.008	0.0098
D	9.80	9.91	10.01	0.386	0.390	0.394
E	5.79	5.99	6.20	0.228	0.236	0.244
E1	3.81	3.91	3.99	0.150	0.154	0.157
e	—	1.27	—	—	0.050	—
L	0.38	0.71	1.27	0.015	0.028	0.050
y	—	—	0.076	—	—	0.003
θ	0°	—	8°	0°	—	8°

16-pin nSOIC

CUSTOMER :		
APPROVED BY	DATE	TITLE: 16L SMALL OUTLINE PACKAGE DRAWING(0.150")
DRAW BY:		
CHECK BY:		
APPROVAL:		DWG. NO. PO-SOP-003 REV. 0
APPROVAL:		UNIT : INCH SCALE : 12/1 SHEET 1 OF 1

Ordering Information

Part Number	Temperature Range	Package Type
KY202LEEN	-40°C to +85°C	16-pin nSOIC
KY232LEEN	-40°C to +85°C	16-pin nSOIC

Please contact the factory for pricing, availability on Tape-and-Reel, and Green Package options.

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