

7 E 1 CHANNELS SWITCH ARRAY

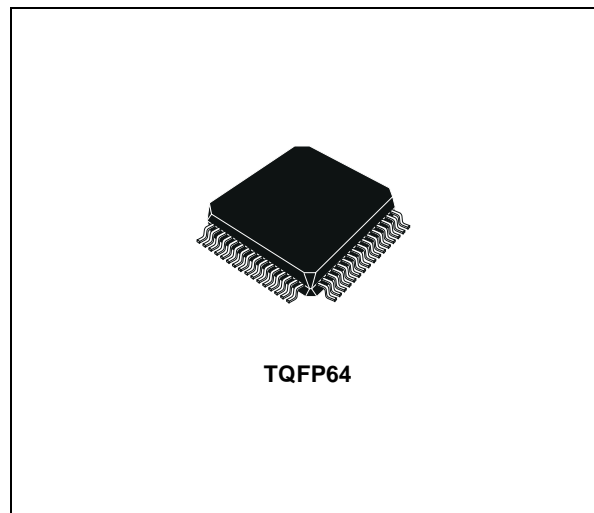
- MAIN SWITCHES MAX. R_{ON} LESS THAN 2Ω
- PROVIDES 7 AUXILIARY SWITCHES WITH $R_{ON} < 75\Omega$
- $6V_{PP}$ AMPLITUDE OF ANALOG INPUT SIGNAL
- DIGITAL INPUTS ARE TTL LEVELS COMPATIBLE

DESCRIPTION

The STM7E1 consists in 7 identical ISDN E1 channels, each channel corresponding to 4 main low-resistant switches (a and b) and 2 auxiliary switches (c and d). The switches positions in all the channels are identical and controlled by a unique control resource driven by the digital inputs Lm, Ls and Sc.

In each channel, the TX and RX lines can be switched between a Main port or a Spare-port by the main switches: if both "a" switches are closed and both "b" switches are open, the Main port is connected to the line, while if both "a" switches are open and both "b" switches are closed, the spare port is connected to the line.

The 2 auxiliary switches enable to close a local loop between the TX and RX access of a port: if "c" is closed, the Spare port RX and TX access is connected between each other to form a local loop, while if "d" is closed, the Main port RX and TX access is connected between each other to form a local loop.



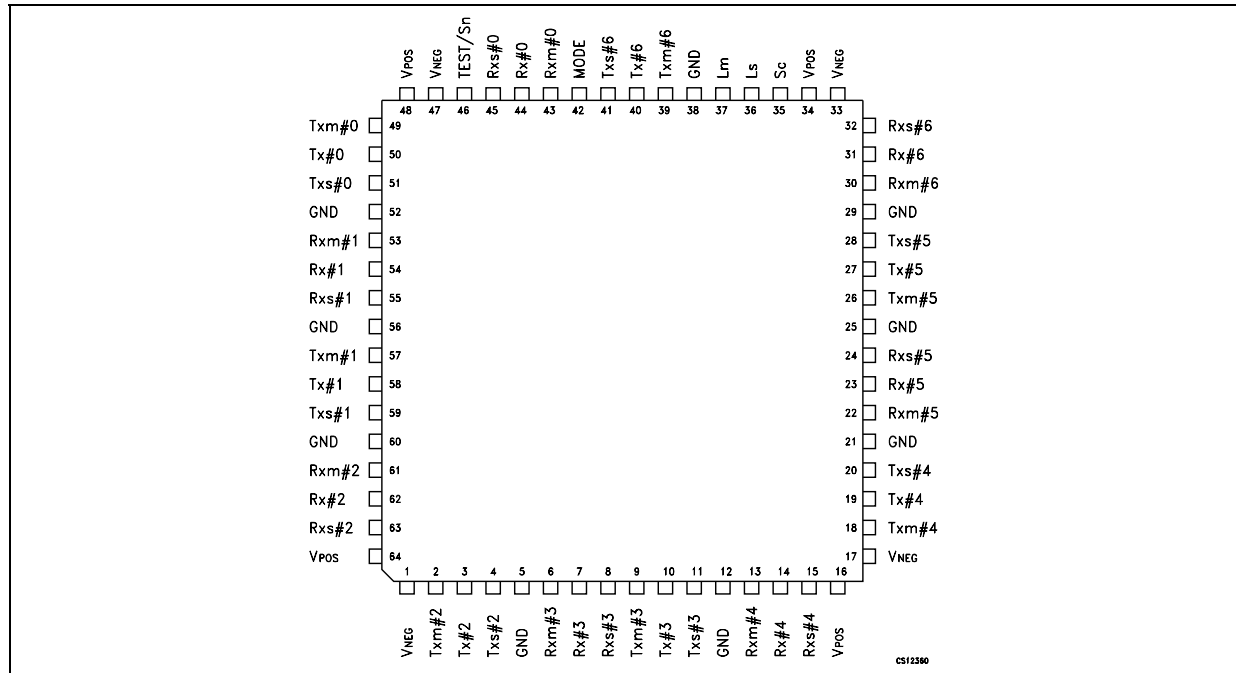
The Spare port is only used for test purpose on the system board while the Main port is the communication channel. Consequently, a switching from the Main port to the Spare port occurs very rarely (<10 times a day).

The power supplies of the chip need to be decoupled properly. This means that at least one external capacitor C1 must be connected in between GND and VPOS, one external capacitor C2 between GND and VNEG, and one external capacitor C3 between each pair of VNEG and VPOS.

ORDERING CODES

| Type | Temperature Range | Package | Comments |
|----------|-------------------|----------------------|---------------------|
| STM7E1A | -40 to 85 °C | TQFP64 (Tray) | 160 parts per Tray |
| STM7E1AR | -40 to 85 °C | TQFP64 (Tape & Reel) | 1000 parts per reel |

PIN CONFIGURATION



PIN DESCRIPTION

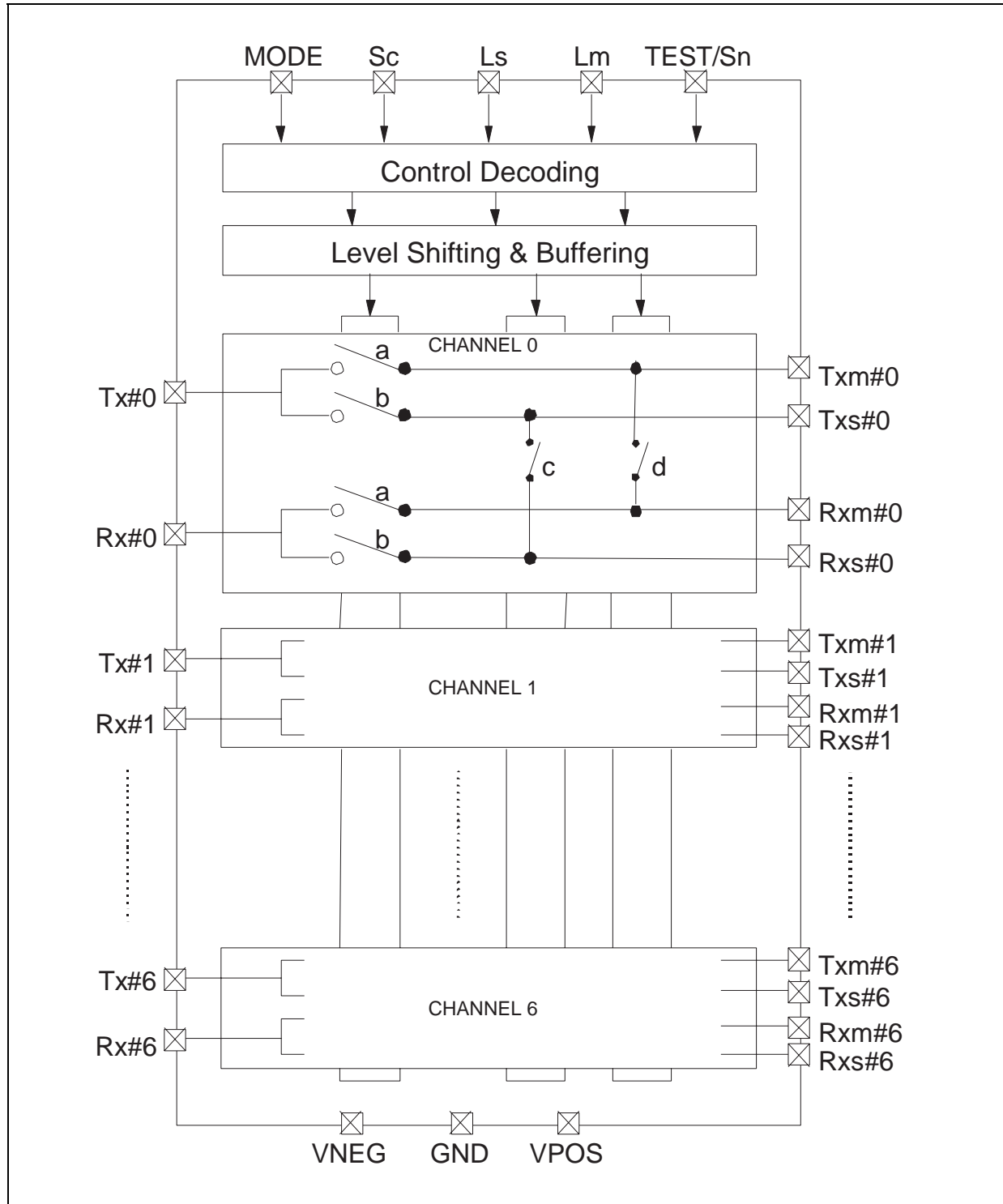
| PIN N° | SYMBOL | TYPE | NAME AND FUNCTION |
|-----------------------------------|----------------------|------|--------------------------------------|
| 1, 17, 33, 47 | V _{NEG} (1) | P | Negative Power Supply |
| 2 | Txm#2 | IOA | Channel 2: TX main port |
| 3 | Tx#2 | IOA | Channel 2: TX line |
| 4 | Txs#2 | IOA | Channel 2: TX spare port |
| 5, 12, 21, 25, 29, 38, 52, 56, 60 | GND | G | Voltage Reference for digital inputs |
| 6 | Rxm#3 | IOA | Channel 3: RX main port |
| 7 | Rx#3 | IOA | Channel 3: RX line |
| 8 | Rxs#3 | IOA | Channel 3: RX spare port |
| 9 | Txm#3 | IOA | Channel 3: TX main port |
| 10 | Tx#3 | IOA | Channel 3: TX line |
| 11 | Txs#3 | IOA | Channel 3: TX spare port |
| 13 | Rxm#4 | IOA | Channel 4: RX main port |
| 14 | Rx#4 | IOA | Channel 4: RX line |
| 15 | Rxs#4 | IOA | Channel 4: RX spare port |
| 16, 34, 48, 64 | V _{POS} (2) | P | Positive Power Supply |
| 18 | Txm#4 | IOA | Channel 4: TX main port |
| 19 | Tx#4 | IOA | Channel 4: TX line |
| 20 | Txs#4 | IOA | Channel 4: TX spare port |
| 22 | Rxm#5 | IOA | Channel 5: RX main port |
| 23 | Rx#5 | IOA | Channel 5: RX line |
| 24 | Rxs#5 | IOA | Channel 5: RX spare port |
| 26 | Txm#5 | IOA | Channel 5: TX main port |
| 27 | Tx#5 | IOA | Channel 5: TX line |
| 28 | Txs#5 | IOA | Channel 5: TX spare port |
| 30 | Rxm#6 | IOA | Channel 6: RX main port |

| PIN N° | SYMBOL | TYPE | NAME AND FUNCTION |
|--------|---------|------|--------------------------|
| 31 | Rx#6 | IOA | Channel 6: RX line |
| 32 | Rxs#6 | IOA | Channel 6: RX spare port |
| 35 | Sc | I | Control digital input |
| 36 | Ls | I | Control digital input |
| 37 | Lm | I | Control digital input |
| 39 | Txm#6 | IOA | Channel 6: TX main port |
| 40 | Tx#6 | IOA | Channel 6: TX line |
| 41 | Txs#6 | IOA | Channel 6: TX spare port |
| 42 | Mode | I | Control Digital Input |
| 43 | Rxm#0 | IOA | Channel 0: RX main port |
| 44 | Rx#0 | IOA | Channel 0: RX line |
| 45 | Rxs#0 | IOA | Channel 0: RX spare port |
| 46 | TEST/Sn | I | Channel 6: RX main port |
| 49 | Txm#0 | IOA | Channel 0: TX main port |
| 50 | Tx#0 | IOA | Channel 0: TX line |
| 51 | Txs#0 | IOA | Channel 0: TX spare port |
| 53 | Rxm#1 | IOA | Channel 1: RX main port |
| 54 | Rx#1 | IOA | Channel 1: RX line |
| 55 | Rxs#1 | IOA | Channel 1: RX spare port |
| 57 | Txm#1 | IOA | Channel 1: TX main port |
| 58 | Tx#1 | IOA | Channel 1: TX line |
| 59 | Txs#1 | IOA | Channel 1: TX spare port |
| 61 | Rxm#2 | IOA | Channel 2: RX main port |
| 62 | Rx#2 | IOA | Channel 2: RX line |
| 63 | Rxs#2 | IOA | Channel 2: RX spare port |

NOTE 1: All VNEG pins to be connected together on board.

NOTE 2: All VPOS pins to be connected together on board.

TYPICAL OPERATING CIRCUIT



DECODING OF FUNCTIONAL MODE 1 (MODE = L)

| | | | |
|--------------------|---------|------------------|-------------------------------------|
| Main Switches | Sc low | a closed, b open | Main port is connected to the line |
| | Sc high | a open, b closed | Spare port is connected to the line |
| Auxiliary Switches | Lm low | d open | Main port local loop open |
| | Lm high | d closed | Main port local loop closed |
| | Ls low | c open | Spare port local loop open |
| | Ls high | c closed | Spare port local loop closed |

When closing the main port local loop (Lm high), it is external system responsibility to ensure that the main port has previously been disconnected from the line (Sc has to be high). There is no internal mechanism to ensure this.

When closing the spare port local loop (Ls high), it is external system responsibility to ensure that the spare port has previously been disconnected from the line (Sc has to be high). There is no internal mechanism to ensure this.

DECODING OF FUNCTIONAL MODE 2 (MODE = H)

| INPUT | | OUTPUTS | |
|---------|--|---------|------|
| TEST/Sn | | A_TX | B_TX |
| L | | O | C |
| H | | C | O |

C = Closed
O = Open

| INPUTS | | | OUTPUTS | | | |
|--------|----|----|---------|------|---|---|
| Sc | Lm | Ls | A_RX | B_RX | c | d |
| L | L | L | C | C | O | O |
| L | L | H | C | O | C | O |
| L | H | L | O | C | O | C |
| L | H | H | C | O | O | O |
| H | L | L | O | C | O | O |

C = Closed
O = Open

TEST MODE DESCRIPTION (MODE = 0, TEST = 1)

In order to test the main switches (4-point measurement), test modes are foreseen where the main switches can be controlled independently from each other. One can enter in test mode by controlling the Sc, Lm and Ls pins according to the following table.

The digital part and auxiliary switches can be tested in functional mode.

| Signification | Sc | Lm | Ls |
|------------------------|----|----|----|
| A_TX closed | H | H | L |
| A_RX closed | L | H | L |
| B_TX closed | H | L | H |
| B_RX closed | L | L | H |
| B_TX & c closed | H | L | L |
| A_RX & d closed | L | L | L |
| All main switches open | H | H | H |
| | L | H | H |

Note 1: Although there is an internal pull down in the TEST pin, an external hardware connection from TEST to GND is required on the board to work in functional mode.

ABSOLUTE MAXIMUM RATINGS

| Symbol | Description | Min | Max | Unit |
|------------------|---|------------------------|----------------------|------|
| V _{POS} | Positive Power Supply Voltage | V _{NEG} - 0.3 | V _{NEG} + 7 | V |
| GND | Reference Ground | V _{NEG} - 0.3 | V _{NEG} + 7 | V |
| V _{IN} | Input Voltage for Digital Inputs and Analog Input/Output Pins | V _{NEG} - 0.3 | V _{NEG} + 7 | V |

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

RECOMMENDED OPERATING CONDITIONS

| Symbol | Parameter | Min | TYP | Max | Unit |
|---------------------------|-------------------------------------|-----------|-----|-----------|------|
| V _{POS} | Positive Power Supply Voltage | 3.3 - 5% | | 3.3 + 5% | V |
| V _{NEG} | Negative Power Supply Voltage | -3.3 - 5% | | -3.3 + 5% | V |
| T _{amb} | Ambient Temperature | -25 | | 85 | °C |
| T _J | Junction Temperature | -25 | | 120 | °C |
| I _{peak, switch} | Admissible peak Current in 1 Switch | | | 300 | mA |
| C _{la} | Load Capacitance on ASIC output | | | 70 | pF |

DIGITAL PART SPECIFICATIONS

| Symbol | Parameter | Value | | | Unit |
|-------------------|--------------------------------------|-------|------|------------------|------|
| | | Min. | Typ. | Max. | |
| V _{IL} | Low Input Level | 0 | | 0.8 | V |
| V _{IH} | High Input Level | 2 | | V _{POS} | V |
| V _{IT} | Low-High Switching Threshold Voltage | | 1.6 | | V |
| I _{leak} | Input Leakage Current | -3 | | 3 | |

ANALOG PART SPECIFICATIONS

| Symbol | Parameter | Test Condition | Value | | | Unit |
|-----------------------------|--|---------------------------------|-------|------|-------|------------|
| | | | Min. | Typ. | Max. | |
| $R_{ON(main)}^{(1)}$ | On-resistance of the main switches | | | 1.6 | 2 | Ω |
| $R_{ON(aux)}^{(1)}$ | On-resistance of the auxiliary switches | | | 50 | 75 | Ω |
| $\Delta R_{ON(main)}^{(1)}$ | Difference of R_{ON} between devices | $V_{IN} = 2V, T_A = 25^\circ C$ | | 0.5 | | Ω |
| $\Delta R_{ON(main)}^{(1)}$ | Difference of R_{ON} between switches of the same device | $V_{IN} = 2V, T_A = 25^\circ C$ | | | 0.8 | Ω |
| $R_{off}^{(1,2)}$ | Off-resistance of the main and auxiliary switches | | 100 | | | $k\Omega$ |
| $C_{pin}^{(3)}$ | Capacitance at any switch pin, switch ON | | | 50 | 120 | μF |
| $A_{peak,signal}^{(1)}$ | Peak amplitude of the signal at switch pins | | -3 | | 3 | V_p |
| $f_{signal}^{(1,4)}$ | Frequency of the signal at switch pins (3dB bandwidth) | | 50 | | 12000 | KHz |
| Cross-talk ^(1,5) | Cross-talk between lines | | | 4 | 8 | mV_{rms} |
| t | Switch time of the main switches (a and b) | | | 0.15 | 1 | μs |

NOTE 1: all the parameters are valid only with a 75Ω ($\pm 5\%$) load to GND.

NOTE 2: measured with a 5V DC voltage applied to a closed switch.

NOTE 3: not tested in production.

NOTE 4: measured with a 2Vpp signal.

NOTE 5: measured with the line connected to GND at one side with a 75Ω resistor and all the other lines driven by a 1MHz, 2Vpp sine wave signal.

NOTE 6: during the switching between the main and spare ports, the behaviour of the component is not guaranteed: both main switches can be open (break before make).

NOTE 7: measured with the line switching from a 2.5V DC level (main or spare port) to a -2.5V DC level (spare or main port).

CURRENT CONSUMPTION SPECIFICATIONS

| Symbol | Parameter | Value | | | Unit |
|---------------------------|---|-------|------|------|---------|
| | | Min. | Typ. | Max. | |
| $P_{main}^{(1)}$ | Maximal average power dissipation in the main switches | | | 40 | mW |
| $P_{aux}^{(1)}$ | Maximal average power dissipation in the auxiliary switches | | | 150 | mW |
| $I_{STDBY(VNEG)}^{(1,3)}$ | Standby (no switching) current of VNEG | -500 | | 500 | μA |
| $I_{STDBY(VPOS)}^{(1,3)}$ | Standby (no switching) current of VPOS | -500 | | 500 | μA |
| $E_{SWITCH(VNEG)}^{(1)}$ | Energy to be delivered to by VPOS when switching | -100 | | 100 | nJ |
| $E_{SWITCH(VPOS)}^{(1)}$ | Energy to be delivered to by VPOS when switching | -100 | | 100 | nJ |

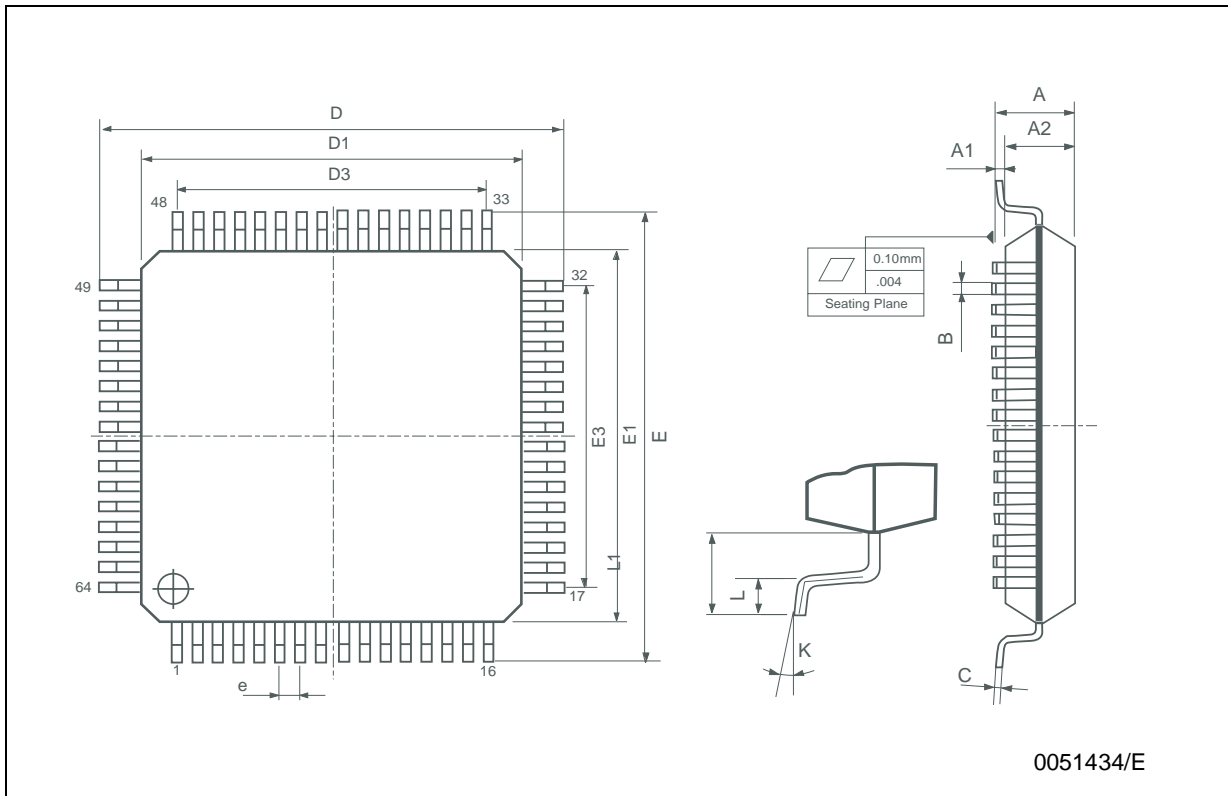
NOTE 1: these parameters are not tested in production.

NOTE 2: this power is not delivered by V_{POS} and V_{NEG} supplies but by the signal sources.

NOTE 3: only valid with digital inputs to GND or V_{POS} levels.

TQFP64 MECHANICAL DATA

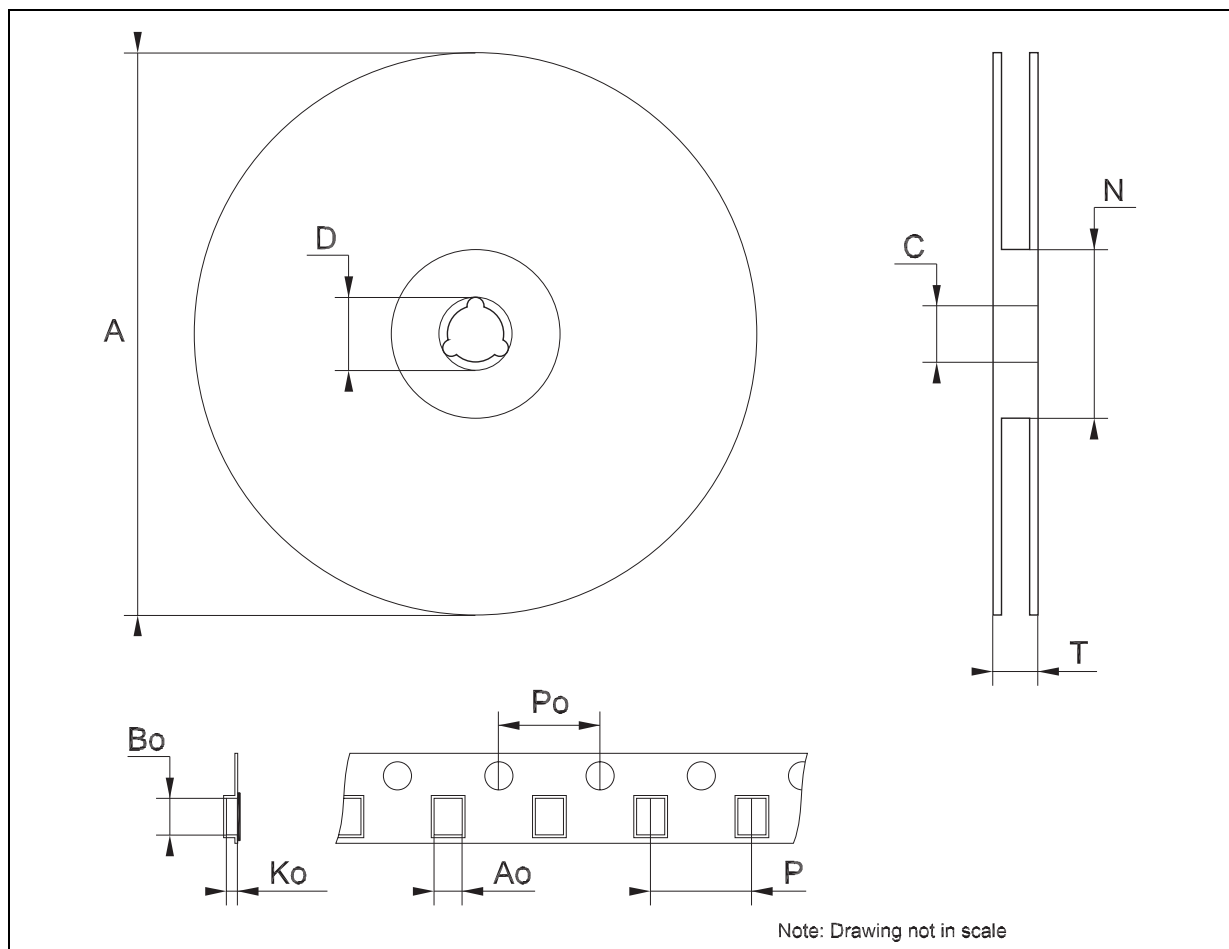
| DIM. | mm. | | | inch | | |
|------|-------|-------|-------|-------|-------|-------|
| | MIN. | TYP | MAX. | MIN. | TYP. | MAX. |
| A | | | 1.6 | | | 0.063 |
| A1 | 0.05 | | 0.15 | 0.002 | | 0.006 |
| A2 | 1.35 | 1.40 | 1.45 | 0.053 | 0.055 | 0.057 |
| B | 0.17 | 0.22 | 0.27 | 0.007 | 0.009 | 0.011 |
| C | 0.09 | | 0.20 | 0.004 | | 0.008 |
| D | 11.80 | 12.00 | 12.20 | 0.465 | 0.472 | 0.480 |
| D1 | 9.80 | 10.00 | 10.20 | 0.386 | 0.394 | 0.402 |
| D3 | | 7.50 | | | 0.295 | |
| E | 11.80 | 12.00 | 12.20 | 0.465 | 0.472 | 0.480 |
| E1 | 9.80 | 10.00 | 10.20 | 0.386 | 0.394 | 0.402 |
| E3 | | 7.50 | | | 0.295 | |
| e | | 0.50 | | | 0.020 | |
| L | 0.45 | 0.60 | 0.75 | 0.018 | 0.024 | 0.030 |
| L1 | | 1.00 | | | 0.039 | |
| K | 0° | 3.5° | 7° | 0° | 3.5° | 7° |



0051434/E

Tape & Reel TQFP64 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 | | | 1.196 |
| Ao | 12.25 | | 12.45 | 0482 | | 0.490 |
| Bo | 12.25 | | 12.45 | 0482 | | 0.490 |
| Ko | 2.1 | | 2.3 | 0.083 | | 0.091 |
| Po | 3.9 | | 4.1 | 0.153 | | 0.161 |
| P | 15.9 | | 16.1 | 0.626 | | 0.639 |



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