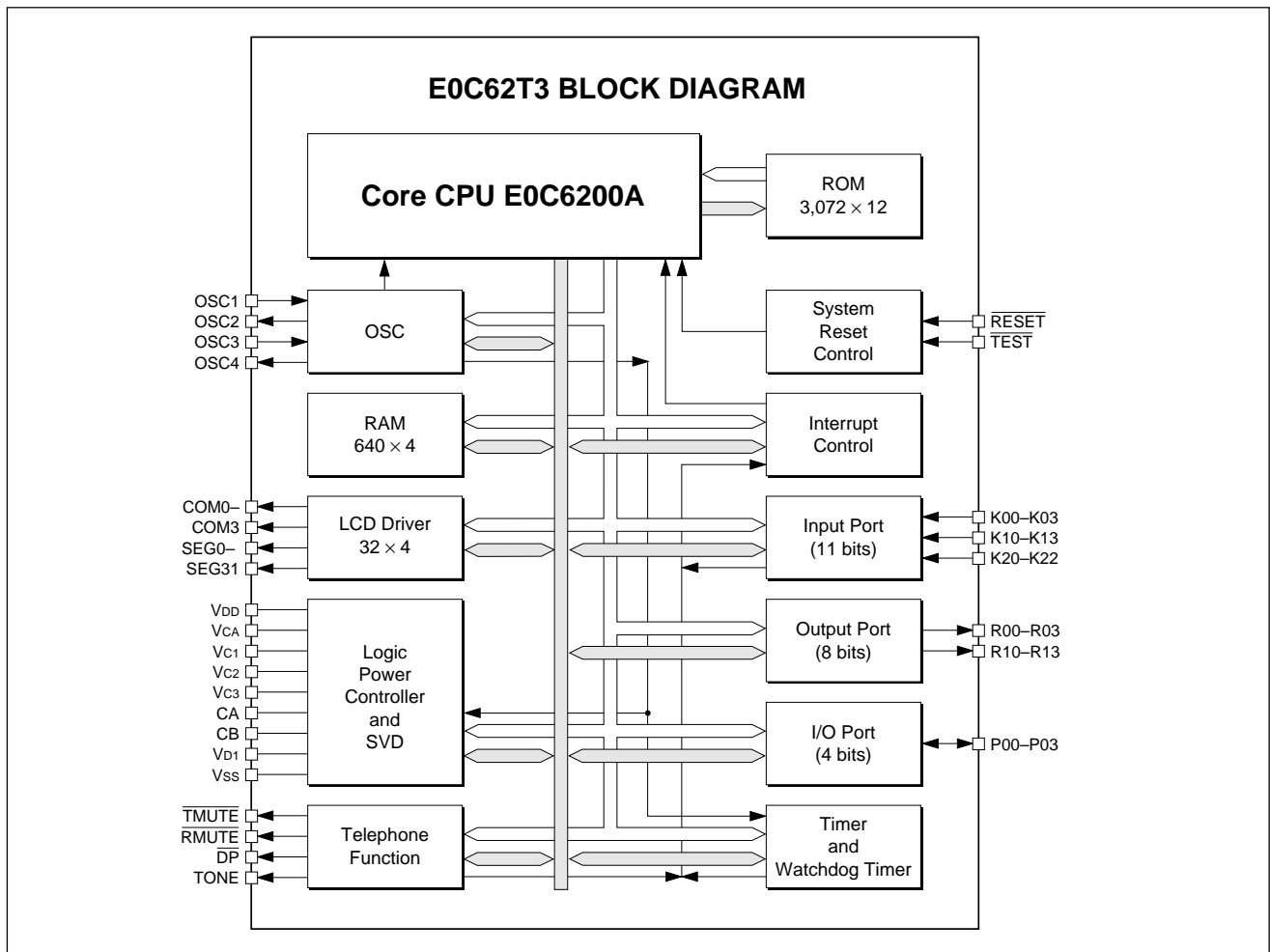
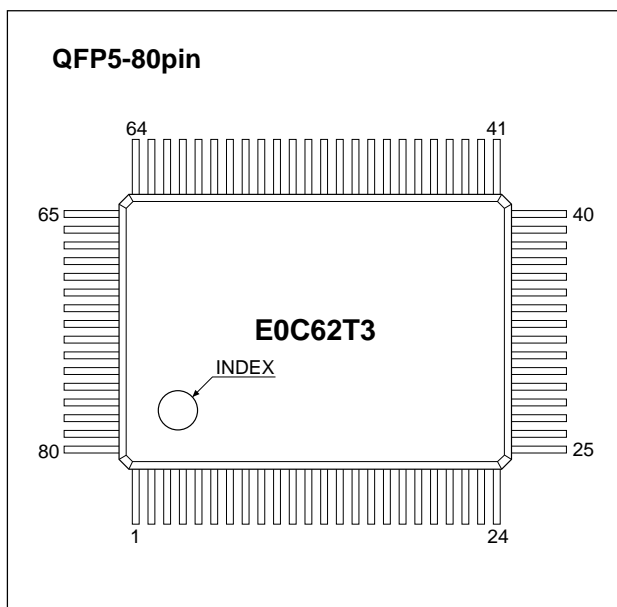


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■ BLOCK DIAGRAM

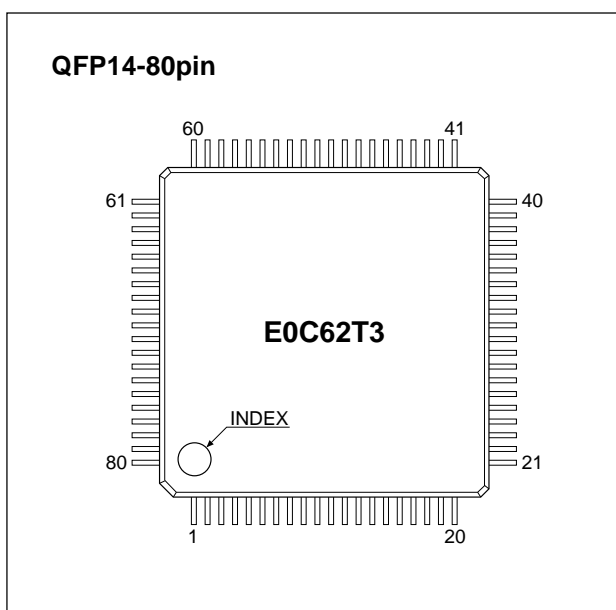


■ PIN CONFIGURATION



| Pin No. | Pin Name | Pin No. | Pin Name | Pin No. | Pin Name | Pin No. | Pin Name |
|---------|----------|---------|----------|---------|----------|---------|----------|
| 1 | SEG14 | 21 | P02 | 41 | R12 | 61 | Vc3 |
| 2 | SEG15 | 22 | P03 | 42 | R13 | 62 | Vc2 |
| 3 | SEG16 | 23 | TEST | 43 | RESET | 63 | COM0 |
| 4 | SEG17 | 24 | K00 | 44 | VDD | 64 | COM1 |
| 5 | SEG18 | 25 | K01 | 45 | RMUTE | 65 | COM2 |
| 6 | SEG19 | 26 | K02 | 46 | TMUTE | 66 | COM3 |
| 7 | SEG20 | 27 | K03 | 47 | DP | 67 | SEG0 |
| 8 | SEG21 | 28 | K10 | 48 | Vss | 68 | SEG1 |
| 9 | SEG22 | 29 | K11 | 49 | OSC1 | 69 | SEG2 |
| 10 | SEG23 | 30 | K12 | 50 | OSC2 | 70 | SEG3 |
| 11 | SEG24 | 31 | K13 | 51 | OSC3 | 71 | SEG4 |
| 12 | SEG25 | 32 | K20 | 52 | OSC4 | 72 | SEG5 |
| 13 | SEG26 | 33 | K21 | 53 | Vd1 | 73 | SEG6 |
| 14 | SEG27 | 34 | K22 | 54 | TONE | 74 | SEG7 |
| 15 | SEG28 | 35 | R00 | 55 | N.C. | 75 | SEG8 |
| 16 | SEG29 | 36 | R01 | 56 | N.C. | 76 | SEG9 |
| 17 | SEG30 | 37 | R02 | 57 | CA | 77 | SEG10 |
| 18 | SEG31 | 38 | R03 | 58 | CB | 78 | SEG11 |
| 19 | P00 | 39 | R10 | 59 | Vc1 | 79 | SEG12 |
| 20 | P01 | 40 | R11 | 60 | VCA | 80 | SEG13 |

N.C. : No Connection



| Pin No. | Pin Name | Pin No. | Pin Name | Pin No. | Pin Name | Pin No. | Pin Name |
|---------|-----------------|---------|----------|---------|----------|---------|----------|
| 1 | N.C. | 21 | COM0 | 41 | SEG16 | 61 | TEST |
| 2 | RESET | 22 | COM1 | 42 | SEG17 | 62 | K00 |
| 3 | V _{DD} | 23 | COM2 | 43 | SEG18 | 63 | K01 |
| 4 | RMUTE | 24 | COM3 | 44 | SEG19 | 64 | K02 |
| 5 | TMUTE | 25 | SEG0 | 45 | SEG20 | 65 | K03 |
| 6 | DP | 26 | SEG1 | 46 | SEG21 | 66 | K10 |
| 7 | V _{SS} | 27 | SEG2 | 47 | SEG22 | 67 | K11 |
| 8 | OSC1 | 28 | SEG3 | 48 | SEG23 | 68 | K12 |
| 9 | OSC2 | 29 | SEG4 | 49 | SEG24 | 69 | K13 |
| 10 | OSC3 | 30 | SEG5 | 50 | SEG25 | 70 | K20 |
| 11 | OSC4 | 31 | SEG6 | 51 | SEG26 | 71 | K21 |
| 12 | V _{D1} | 32 | SEG7 | 52 | SEG27 | 72 | K22 |
| 13 | TONE | 33 | SEG8 | 53 | SEG28 | 73 | R00 |
| 14 | N.C. | 34 | SEG9 | 54 | SEG29 | 74 | R01 |
| 15 | CA | 35 | SEG10 | 55 | SEG30 | 75 | R02 |
| 16 | CB | 36 | SEG11 | 56 | SEG31 | 76 | R03 |
| 17 | V _{C1} | 37 | SEG12 | 57 | P00 | 77 | R10 |
| 18 | V _{CA} | 38 | SEG13 | 58 | P01 | 78 | R11 |
| 19 | V _{C3} | 39 | SEG14 | 59 | P02 | 79 | R12 |
| 20 | V _{C2} | 40 | SEG15 | 60 | P03 | 80 | R13 |

N.C. : No Connection

PIN DESCRIPTION

| Pin name | Pin No. | | I/O | Function |
|-----------------|---------|----------|-----|---|
| | QFP5-80 | QFP14-80 | | |
| V _{DD} | 44 | 3 | | Power supply (+) |
| V _{SS} | 48 | 7 | | Power supply (-) |
| V _{D1} | 53 | 12 | O | Internal logic system regulated voltage output terminal |
| V _{CA} | 60 | 18 | I | LCD system voltage adjustment terminal |
| V _{C1} | 59 | 17 | O | LCD system regulated voltage output terminal |
| V _{C2} | 62 | 20 | O | LCD system booster voltage output terminal (V _{C1} ×2) |
| V _{C3} | 61 | 19 | O | LCD system booster voltage output terminal (V _{C1} ×3) |
| CA, CB | 57, 58 | 15, 16 | - | LCD system voltage booster capacitor connecting terminals |
| OSC1 | 49 | 8 | I | 32.768kHz crystal oscillator input terminal |
| OSC2 | 50 | 9 | O | 32.768kHz crystal oscillator output terminal |
| OSC3 | 51 | 10 | I | 3.58MHz crystal or ceramic oscillator input terminal (selected by mask option) |
| OSC4 | 52 | 11 | O | 3.58MHz crystal or ceramic oscillator output terminal (selected by mask option) |
| K00-K03 | 24-27 | 62-65 | I | Input terminals |
| K10-K13 | 28-31 | 66-69 | I | Input terminals |
| K20-K22 | 32-34 | 70-72 | I | Input terminals |
| P00-P03 | 19-22 | 57-60 | I/O | I/O terminals (at input mode, pull-up resistors are selected by software) |
| R00-R03 | 35-38 | 73-76 | O | Output terminals |
| R10-R13 | 39-42 | 77-80 | O | Output terminals (buzzer, hold-line and handfree are selected by software) |
| SEG0-SEG31 | 67-18 | 25-56 | O | LCD segment output terminals (DC output is selected by mask option) |
| COM0-COM3 | 63-66 | 21-24 | O | LCD common output terminals (1/4, 1/3, 1/2, 1/1 duty programmable) |
| RESET | 43 | 2 | I | Initial setting input terminal |
| TEST | 23 | 61 | I | Test input terminal |
| RMUTE | 45 | 4 | O | Receiver mute output terminal |
| TMUTE | 46 | 5 | O | Transmitter mute output terminal |
| DP | 47 | 6 | O | Dialing pulse output terminal |
| TONE | 54 | 13 | O | DTMF output terminal |

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■ ELECTRICAL CHARACTERISTICS

● Absolute Maximum Ratings

(V_{SS}=0V)

| Rating | Symbol | Value | Unit |
|-------------------------------------|--------------------|-------------------------------|------|
| Supply voltage | V _{DD} | -0.5 to 7.0 | V |
| Input voltage (1) | V _I | -0.5 to V _{DD} + 0.3 | V |
| Input voltage (2) | V _I OSC | -0.5 to V _{D1} + 0.3 | V |
| Permissible total output current *1 | ΣI _{VDD} | 10 | mA |
| Operating temperature | T _{OP} | -20 to 70 | °C |
| Storage temperature | T _{STG} | -65 to 150 | °C |
| Soldering temperature / Time | T _{SOL} | 260°C, 10sec (lead section) | — |
| Permissible dissipation *2 | P _D | 250 | mW |

*1: The permissible total output current is the sum total of the current (average current) that simultaneously flows from the output pins (or is drawn in).

*2: In case of plastic package (QFP5-80pin, QFP14-80pin).

● Recommended Operating Conditions

| Condition | Symbol | Remark | Min. | Typ. | Max. | Unit |
|---------------------------|-------------------|--|------|----------|------|------|
| Supply voltage | V _{DD} | V _{SS} =0V, OSC1=32kHz, OSC3=stop | 1.6 | 3.0 | 5.5 | V |
| | | V _{SS} =0V, when DTMF is used | 2.5 | | 5.5 | V |
| Oscillation frequency (1) | f _{OSC1} | | | 32.768 | | kHz |
| Oscillation frequency (2) | f _{OSC3} | | | 3.579545 | | MHz |

● DC Characteristics

(Unless otherwise specified: V_{SS}=0V, V_{DD}=3.0V, f_{OSC1}=32.768kHz, T_a=25°C, V_{D1}/V_{C1}-V_{C3} are internal voltage, C₁-C₅=0.1μF)

| Characteristic | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---|------------------|--|---------------------|------|---------------------|------|
| High level input voltage (1) | V _{IH1} | K00-K03, K10-K13, K20-K22 P00-P03 | 0.8·V _{DD} | | V _{DD} | V |
| High level input voltage (2) | V _{IH2} | RESET, TEST | 0.9·V _{DD} | | V _{DD} | V |
| Low level input voltage (1) | V _{IL1} | K00-K03, K10-K13, K20-K22 P00-P03 | 0 | | 0.2·V _{DD} | V |
| Low level input voltage (2) | V _{IL2} | RESET, TEST | 0 | | 0.1·V _{DD} | V |
| High level input current (1) | I _{IH1} | V _{IH1} =3.0V No pull-up resistor | 0 | | 0.5 | μA |
| High level input current (2) | I _{IH2} | V _{IH2} =3.0V With pull-up resistor | | | 0.5 | μA |
| Low level input current (1) | I _{IL1} | V _{IL1} =V _{SS} No pull-up resistor | -0.5 | | 0 | μA |
| Low level input current (2) | I _{IL2} | V _{IL1} =V _{SS} With pull-up resistor | -20 | -10 | -5 | μA |
| High level output current (1) | I _{OH1} | V _{OH1} =0.9·V _{DD} R00-R03, R10-R13, P00-P03 | | | -1 | mA |
| High level output current (2) | I _{OH2} | V _{OH2} =0.9·V _{DD} DP, TMUTE, RMUTE | | | -1 | mA |
| Low level output current (1) | I _{OL1} | V _{OL1} =0.1·V _{DD} R00-R03, R10-R13, P00-P03 | 3 | | | mA |
| Low level output current (2) | I _{OL2} | V _{OL2} =0.1·V _{DD} DP, TMUTE, RMUTE | 3 | | | mA |
| Common output current | I _{OH3} | V _{OH3} =V _{C3} -0.05V COM0-COM3 | | | -3 | μA |
| | I _{OL3} | V _{OL3} =V _{SS} +0.05V | 3 | | | μA |
| Segment output current (during LCD output) | I _{OH4} | V _{OH4} =V _{C3} -0.05V SEF0-SEG31 | | | -3 | μA |
| | I _{OL4} | V _{OL4} =V _{SS} +0.05V | 3 | | | μA |
| Segment output current (during DC output) | I _{OH5} | V _{OH5} =0.9·V _{DD} SEG0-SEG31 | | | -300 | μA |
| | I _{OL5} | V _{OL5} =0.1·V _{DD} | 300 | | | μA |

● Analog Circuit Characteristics and Current Consumption

(Unless otherwise specified: V_{SS}=0V, V_{DD}=3.0V, f_{OSC1}=32.768kHz, f_{OSC3}=3.579545MHz/crystal, C_G=25pF, T_a=25°C, V_{D1}/V_{C1}-V_{C3} are internal voltage, C₁-C₅=0.1μF)

| Characteristic | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---------------------------|------------------|--|------------------------|------|------------------------|------|
| LCD drive voltage | V _{C1} | Connect 1MΩ load resistor between V _{SS} and V _{C1} V _{CA} =V _{C1} , (without panel load) | 0.95 | 1.05 | 1.15 | V |
| | V _{C2} | Connect 1MΩ load resistor between V _{SS} and V _{C2} (without panel load) | 2·V _{C1} ×0.9 | | 2·V _{C1} +0.1 | V |
| | V _{C3} | Connect 1MΩ load resistor between V _{SS} and V _{C3} (without panel load) | 3·V _{C1} ×0.9 | | 3·V _{C1} +0.1 | V |
| SVD voltage | V _{SVD} | | 1.65 | 1.8 | 1.95 | V |
| SVD circuit response time | t _{SVD} | | | | 100 | μS |
| Current consumption | I _{OP} | During HALT (32kHz) | Without panel load | 2 | 5 | μA |
| | | During execution (32kHz) *1 | | 5 | 12 | μA |
| | | During execution (3.58MHz) *1 | | 200 | 500 | μA |
| | | During execution (3.58MHz) *2 | | 1.3 | 4 | mA |

*1: The SVD and DTMF generator are OFF status.

*2: The DTMF generator is ON status. The SVD is OFF status.

● Oscillation Characteristics

The oscillation characteristics change depending on the conditions (components used, board pattern, etc.). Use the following characteristics as reference values.

OSC1 crystal oscillation circuit

(Unless otherwise specified: $V_{SS}=0V$, $V_{DD}=3.0V$, Crystal: C-002R, $C_1=35k\Omega$, $C_G=25pF$, C_D =built-in, $T_a=25^\circ C$)

| Characteristic | Symbol | Condition | Min. | Typ. | Max. | Unit |
|------------------------------------|---------------------------|--|------|------|------|------------|
| Oscillation start voltage | V_{sta} | $t_{sta} \leq 3sec$ (V_{DD}) | 1.6 | | | V |
| Oscillation stop voltage | V_{stp} | $t_{stp} \leq 10sec$ (V_{DD}) | 1.6 | | | V |
| Built-in capacitance (drain) | C_D | Including the parasitic capacity inside the IC | | 18.5 | | pF |
| Frequency/voltage deviation | $\partial f/\partial V$ | $V_{DD}=2.0$ to $5.5V$ | | | 5 | ppm |
| Frequency/IC deviation | $\partial f/\partial IC$ | | -10 | | 10 | ppm |
| Frequency adjustment range | $\partial f/\partial C_G$ | $C_G=5$ to $25pF$ | 35 | | | ppm |
| Harmonic oscillation start voltage | V_{hho} | $C_G=5pF$ (V_{DD}) | | | 5.5 | V |
| Permitted leak resistance * | R_{leak} | Between OSC1 and V_{SS} | 200 | | | M Ω |

*: The shielding plate for OSC1 and OSC2 should be connected to V_{SS} .

OSC3 crystal oscillation circuit

(Unless otherwise specified: $V_{SS}=0V$, $V_{DD}=3.0V$, Crystal: CA-301, $C_G=5pF$, C_D =built-in, $T_a=25^\circ C$)

| Characteristic | Symbol | Condition | Min. | Typ. | Max. | Unit |
|------------------------------------|---------------------------|--|------|------|------|------------|
| Oscillation start voltage | V_{sta} | $t_{sta} \leq 30msec$ (V_{DD}) | 1.6 | | | V |
| Oscillation stop voltage | V_{stp} | $t_{stp} \leq 10sec$ (V_{DD}) | 1.6 | | | V |
| Built-in capacitance (drain) | C_D | Including the parasitic capacity inside the IC | | 14 | | pF |
| Frequency/voltage deviation | $\partial f/\partial V$ | $V_{DD}=2.0$ to $5.5V$ | | | 5 | ppm |
| Frequency/IC deviation | $\partial f/\partial IC$ | | -10 | | 10 | ppm |
| Frequency adjustment range | $\partial f/\partial C_G$ | $C_G=5$ to $25pF$ | | 35 | | ppm |
| Harmonic oscillation start voltage | V_{hho} | $C_G=5pF$ (V_{DD}) | | | 5.5 | V |
| Permitted leak resistance | R_{leak} | Between OSC3 and V_{DD} , V_{SS} | 200 | | | M Ω |

OSC3 ceramic oscillation circuit

(Unless otherwise specified: $V_{SS}=0V$, $V_{DD}=3.0V$, Ceramic oscillator: 3.579545MHz, $C_{GC}=C_{DC}=30pF$, $R_F=1M\Omega$, $T_a=25^\circ C$)

| Characteristic | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---------------------------|-----------|--------------|------|------|------|------|
| Oscillation start voltage | V_{sta} | (V_{DD}) | 2.0 | | | V |
| Oscillation start time | t_{sta} | | | | 3 | mS |
| Oscillation stop voltage | V_{stp} | (V_{DD}) | 2.0 | | | V |

● Telephone Function Characteristics

(Unless otherwise specified: $V_{SS}=0V$, $V_{DD}=3.0V$, $f_{osc1}=32.768kHz$, $f_{osc3}=3.579545MHz$, $T_a=25^\circ C$, $V_{D1}/V_{C1}-V_{C3}$ are internal voltage, $C_1-C_5=0.1\mu F$)

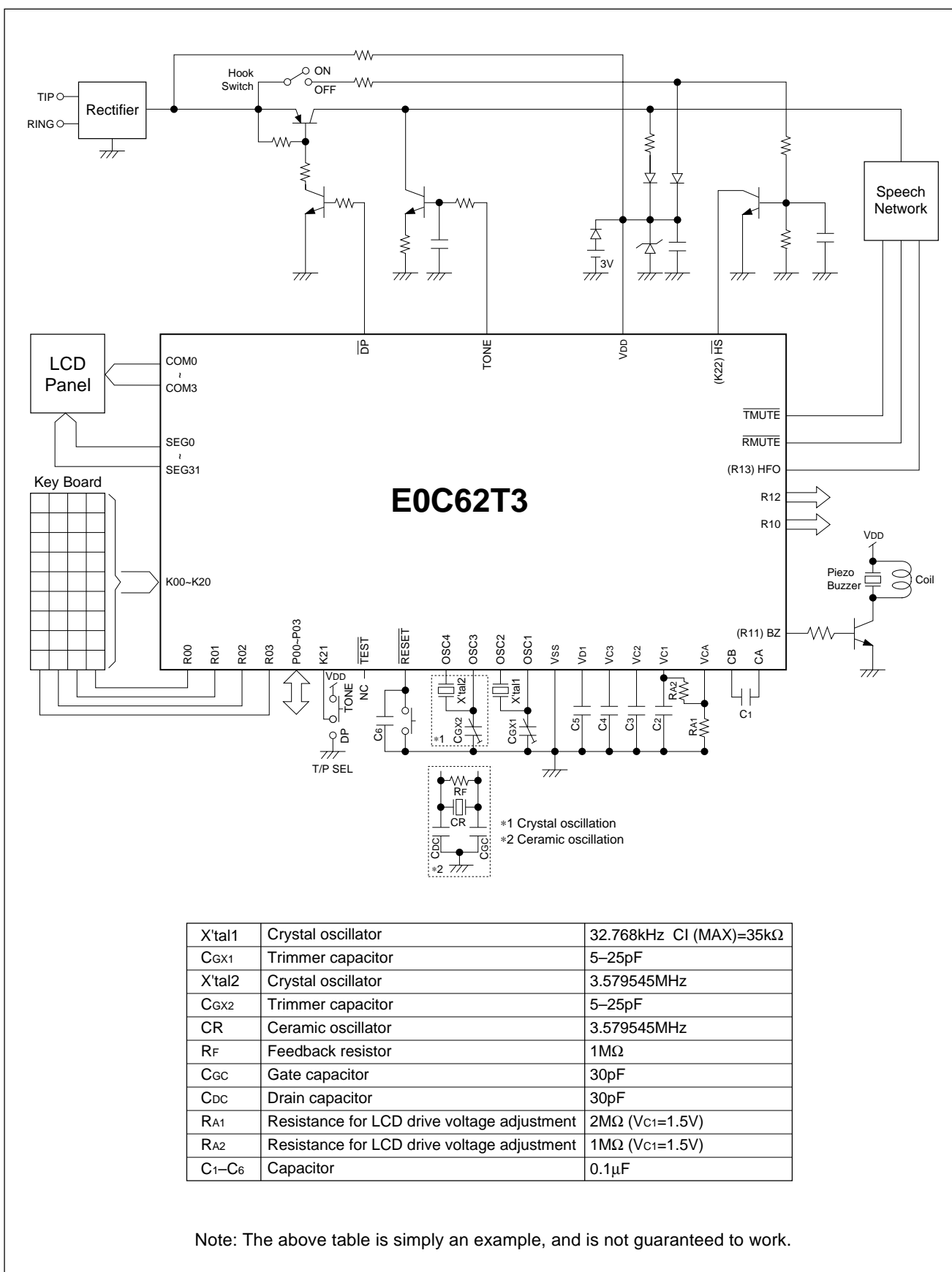
| Characteristic | Symbol | Condition | | | | Min. | Typ. | Max. | Unit |
|------------------|-----------|-----------|------|------|------|------|------|------|------|
| | | FTS3 | FTS2 | FTS1 | FTS0 | | | | |
| Flash time | t_{FL} | | | | | | - | | mS |
| | | 0 | 0 | 0 | 1 | | 94 | | |
| | | 0 | 0 | 1 | 0 | | 188 | | |
| | | 0 | 0 | 1 | 1 | | 281 | | |
| | | 0 | 1 | 0 | 0 | | 375 | | |
| | | 0 | 1 | 0 | 1 | | 469 | | |
| | | 0 | 1 | 1 | 0 | | 563 | | |
| | | 0 | 1 | 1 | 1 | | 656 | | |
| | | 1 | 0 | 0 | 0 | | 750 | | |
| | | 1 | 0 | 0 | 1 | | 844 | | |
| | | 1 | 0 | 1 | 0 | | 938 | | |
| | | 1 | 0 | 1 | 1 | | 1031 | | |
| | | 1 | 1 | 0 | 0 | | 1125 | | |
| | | 1 | 1 | 0 | 1 | | 1219 | | |
| 1 | 1 | 1 | 0 | | 1313 | | | | |
| 1 | 1 | 1 | 1 | | 1406 | | | | |
| Flash pause time | t_{FLP} | | | | | 938 | | mS | |

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(Unless otherwise specified: V_{SS}=0V, V_{DD}=3.0V, f_{osc1}=32.768kHz, f_{osc3}=3.579545MHz, T_a=25°C, V_{D1}/V_{C1}-V_{C3} are internal voltage, C₁-C₅=0.1μF)

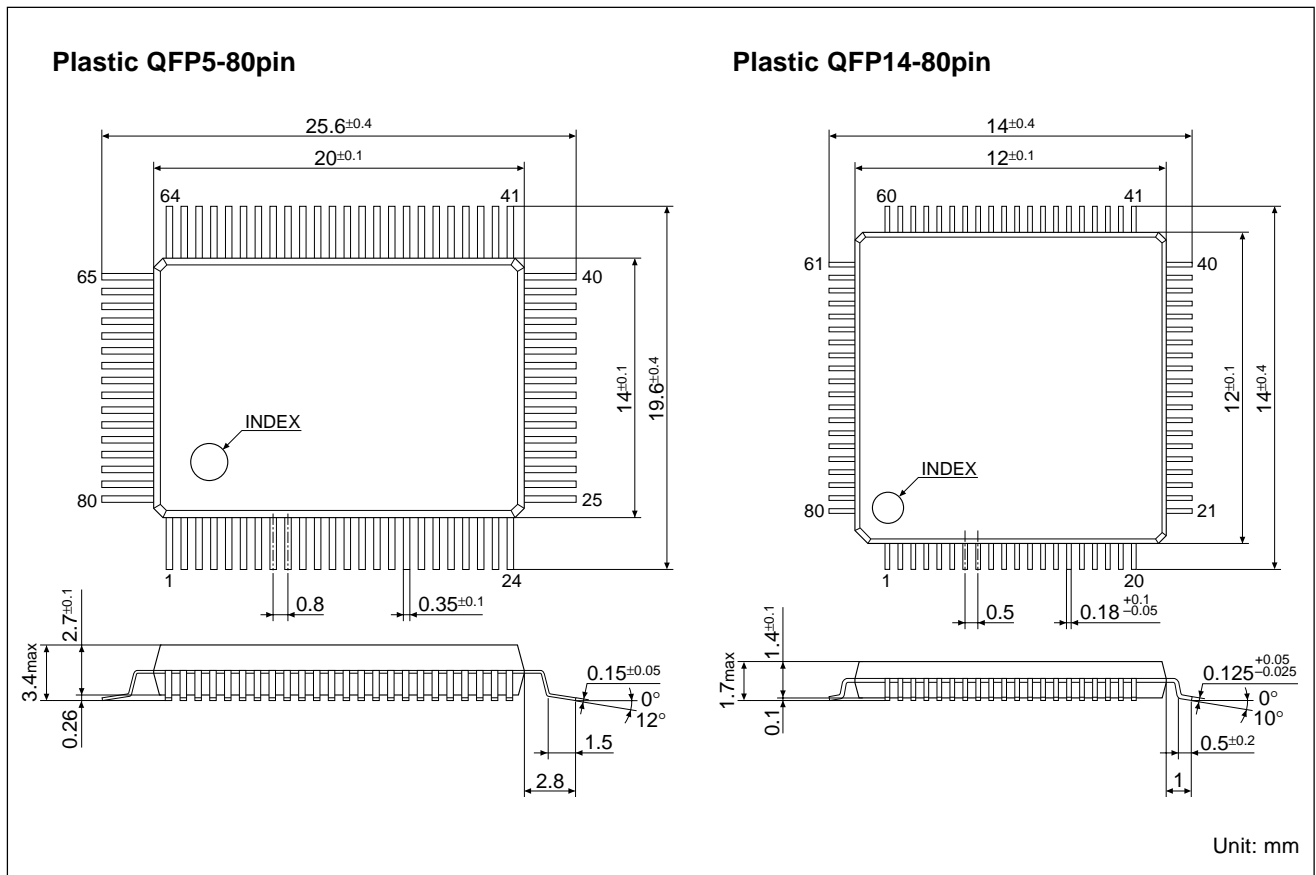
| Characteristic | Symbol | Condition | Min. | Typ. | Max. | Unit |
|-------------------------------------|-------------------|---|------|--|------|-------|
| Pause time | t _{PS} | PTS3 PTS2 PTS1 PTS0 | | – | | sec |
| | | 0 0 0 1 | | 1 | | |
| | | 0 0 1 0 | | 2 | | |
| | | 0 0 1 1 | | 3 | | |
| | | 0 1 0 0 | | 4 | | |
| | | 0 1 0 1 | | 5 | | |
| | | 0 1 1 0 | | 6 | | |
| | | 0 1 1 1 | | 7 | | |
| | | 1 0 0 0 | | 8 | | |
| | | 1 0 0 1 | | 9 | | |
| | | 1 0 1 0 | | 10 | | |
| | | 1 0 1 1 | | 11 | | |
| | | 1 1 0 0 | | 12 | | |
| | | 1 1 0 1 | | 13 | | |
| 1 1 1 0 | | 14 | | | | |
| 1 1 1 1 | | 15 | | | | |
| Mute hold time | t _{MH} | | – | 4 | – | mS |
| Inter-digit pause time | t _{IDP} | IDP3 IDP2 IDP1 IDP0 | | – | | mS |
| | | 0 0 0 1 | | 94 | | |
| | | 0 0 1 0 | | 188 | | |
| | | 0 0 1 1 | | 281 | | |
| | | 0 1 0 0 | | 375 | | |
| | | 0 1 0 1 | | 469 | | |
| | | 0 1 1 0 | | 563 | | |
| | | 0 1 1 1 | | 656 | | |
| | | 1 0 0 0 | | 750 | | |
| | | 1 0 0 1 | | 844 | | |
| | | 1 0 1 0 | | 938 | | |
| | | 1 0 1 1 | | 1031 | | |
| | | 1 1 0 0 | | 1125 | | |
| | | 1 1 0 1 | | 1219 | | |
| 1 1 1 0 | | 1313 | | | | |
| 1 1 1 1 | | 1406 | | | | |
| Make/Break ratio | M/B | Software–selected | – | 1/2 2/3 | – | – |
| Dialing pulse rate | DR | Software–selected | – | 10 20 | – | pps |
| Make time | t _M | 10pps, M/B=1/2 | – | 33.2 | – | mS |
| | | 20pps, M/B=1/2 | – | 16.6 | – | |
| | | 10pps, M/B=2/3 | – | 39.1 | – | |
| | | 20pps, M/B=2/3 | – | 19.5 | – | |
| Break time | t _B | 10pps, M/B=1/2 | – | 66.4 | – | mS |
| | | 20pps, M/B=1/2 | – | 33.2 | – | |
| | | 10pps, M/B=2/3 | – | 58.6 | – | |
| | | 20pps, M/B=2/3 | – | 29.3 | – | |
| Tone output DC level | V _{TDC} | | – | 0.5(V _{DD} -V _{SS}) | – | V |
| Single Row tone output amplitude | V _R | V _{DD} =3V, R _L =10kΩ | – | 92 | – | mVrms |
| | | V _{DD} =5.5V, R _L =10kΩ | – | 168 | – | mVrms |
| Single Column tone output amplitude | V _C | V _{DD} =3V, R _L =10kΩ | – | 122 | – | mVrms |
| | | V _{DD} =5.5V, R _L =10kΩ | – | 224 | – | mVrms |
| Tone output voltage ratio | dB _{CR} | V _{DD} =3V, R _L =10kΩ | – | 2.5 | – | dB |
| | | V _{DD} =5.5V, R _L =10kΩ | – | 2.5 | – | dB |
| Tone load impedance | R _{TL} | V _{DD} =2–5.5V | 7 | – | – | kΩ |
| Total harmonic distortion | THD | V _{DD} =2–5.5V, R _L =10kΩ | – | – | 6 | % |
| Tone output frequency | f _{ROW1} | | – | 701.32 | – | Hz |
| | f _{ROW2} | | – | 771.45 | – | |
| | f _{ROW3} | | – | 857.17 | – | |
| | f _{ROW4} | | – | 935.10 | – | |
| | f _{COL1} | | – | 1215.88 | – | |
| | f _{COL2} | | – | 1331.68 | – | |
| | f _{COL3} | | – | 1471.85 | – | |
| | f _{COL4} | | – | 1645.01 | – | |
| Tone duration time | t _{TD} | | 94 | – | – | mS |
| Tone inter-digit pause | t _{TIP} | | – | 94 | – | mS |
| Maximum dial rate | t _T | t _{TD} + t _{TIP} | 188 | – | – | mS |

■ BASIC EXTERNAL CONNECTION DIAGRAM



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■ PACKAGE DIMENSIONS



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