

ABSOLUTE MAXIMUM RATINGS

V_{DD} to AGND -0.5V to 17V
 V_{DD} to DGND -0.5V to 17V
 AGND to DGND -0.5V to V_{DD} + 0.5V
 DGND to AGND -0.5V to V_{DD} + 0.5V
 V_{REF} to AGND, DGND ±25V
 R_{FB} to AGND, DGND ±25V
 Digital Inputs to DGND -0.5V to V_{DD} + 0.5V
 V_{OUT1} to AGND, DGND -0.5V to V_{DD} + 0.5V
 Maximum Junction Temperature 150°C
 Operating Temperature Range
 Commercial (K, L Versions) 0°C to 70°C
 Industrial (B, C Versions) -40°C to 85°C
 Storage Temperature Range -65°C to 150°C
 Lead Temperature (Soldering, 10 sec) 300°C

PACKAGE/ORDER INFORMATION

ORDER PART NUMBER

LTC7545ABN
 LTC7545ABSW
 LTC7545ACN
 LTC7545ACSW
 LTC7545AKN
 LTC7545AKSW
 LTC7545ALN
 LTC7545ALSW

N PACKAGE SW PACKAGE
 20-LEAD PDIP 20-LEAD PLASTIC SO WIDE

T_{JMAX} = 150°C, θ_{JA} = 100°C/W (N)
 T_{JMAX} = 150°C, θ_{JA} = 130°C/W (SW)

Consult factory for Military grade parts.

ELECTRICAL CHARACTERISTICS

V_{DD} = 5V or 15V, V_{REF} = 10V, V_{OUT1} = AGND = 0V, T_A = T_{MIN} to T_{MAX}, unless otherwise noted.

| SYMBOL | PARAMETER | CONDITIONS | LTC7545AK/AB | | | LTC7545AL/AC | | | UNITS | |
|------------------------|---|--|--------------|-----|--------|--------------|--------|-----|-------------------|----|
| | | | MIN | TYP | MAX | MIN | TYP | MAX | | |
| Accuracy | | | | | | | | | | |
| | Resolution | | ● | 12 | | 12 | | | Bits | |
| INL | Integral Nonlinearity (Relative Accuracy) | (Note 1) T _A = 25°C T _{MIN} to T _{MAX} | ● | | ±0.5 | | ±0.5 | | LSB | |
| | | | ● | | ±0.5 | | ±0.5 | | LSB | |
| DNL | Differential Nonlinearity | Guaranteed Monotonic T _A = 25°C T _{MIN} to T _{MAX} | ● | | ±1 | | ±0.5 | | LSB | |
| | | | ● | | ±1 | | ±0.5 | | LSB | |
| GE | Gain Error | (Note 2) T _A = 25°C T _{MIN} to T _{MAX} | ● | | ±2 | | ±1 | | LSB | |
| | | | ● | | ±3 | | ±2 | | LSB | |
| | Gain Temperature Coefficient | (Note 3) ΔGain/ΔTemperature | ● | 1 | 5 | | 1 | 5 | ppm/°C | |
| I _{LKG} | OUT1 Leakage Current | (Note 4) T _A = 25°C T _{MIN} to T _{MAX} | ● | | ±10 | | ±10 | | nA | |
| | | | ● | | ±50 | | ±50 | | nA | |
| PSRR | Power Supply Rejection | | ● | | ±0.002 | | ±0.002 | | %/% | |
| Reference Input | | | | | | | | | | |
| R _{REF} | V _{REF} Input Resistance | (Note 5) | ● | 8 | 11 | 15 | 8 | 11 | 15 | kΩ |
| AC Performance | | | | | | | | | | |
| | Output Current Settling Time | (Notes 3, 6, 7) | ● | | 1 | | 1 | | μs | |
| | Propagation Delay | (Notes 3, 6, 8) | ● | | 150 | | 150 | | ns | |
| | Digital-to-Analog Glitch Impulse | (Notes 6, 9) | ● | 5 | | | 5 | | nV-sec | |
| | Multiplying Feedthrough Error | V _{REF} = ±10V, 10kHz Sine Wave | ● | 5 | | | 5 | | mV _{P-P} | |
| Analog Outputs | | | | | | | | | | |
| C _{OUT} | Output Capacitance (Note 3) | DB0 to DB11 = 0V, C _{OUT1} WR, CS = 0V | ● | 30 | 70 | | 30 | 70 | | pF |
| | | DB0 to DB11 = V _{DD} , C _{OUT1} WR, CS = 0V | ● | 60 | 150 | | 60 | 150 | | pF |

ELECTRICAL CHARACTERISTICS

$V_{DD} = 5V$, $V_{REF} = 10V$, $V_{OUT1} = AGND = 0V$, $T_A = T_{MIN}$ to T_{MAX} , unless otherwise noted.

| SYMBOL | PARAMETER | CONDITIONS | ALL GRADES | | | UNITS | |
|--|---|--|------------|-------|-----|----------|----------|
| | | | MIN | TYP | MAX | | |
| Digital Inputs | | | | | | | |
| V_{IH} | Digital Input High Voltage | | ● | 2.4 | | V | |
| V_{IL} | Digital Input Low Voltage | | ● | | 0.8 | V | |
| I_{IN} | Digital Input Current | | ● | 0.001 | ±1 | μA | |
| C_{IN} | Digital Input Capacitance | (Note 3) $V_{IN} = 0V$ | ● | | 8 | pF | |
| Timing Characteristics (Note 3) | | | | | | | |
| t_{CS} | \overline{CS} to \overline{WR} Setup Time | | ● | 100 | | ns | |
| t_{CH} | \overline{CS} to \overline{WR} Hold Time | | ● | 0 | | ns | |
| t_{WR} | Write Pulse Width | | ● | 100 | | ns | |
| t_{DS} | Data Setup Time | | ● | 100 | | ns | |
| t_{DH} | Data Hold Time | | ● | 5 | | ns | |
| Power Supply | | | | | | | |
| V_{DD} | Supply Voltage | | ● | 4.75 | 5 | 5.25 | V |
| I_{DD} | Supply Current | All Digital Inputs = V_{IH} or V_{IL} All Digital Inputs = $0V$ or V_{DD} | ● ● | | | 2 100 | mA μA |

$V_{DD} = 15V$, $V_{REF} = 10V$, $V_{OUT1} = AGND = 0V$, $T_A = T_{MIN}$ to T_{MAX} , unless otherwise noted.

| SYMBOL | PARAMETER | CONDITIONS | ALL GRADES | | | UNITS | |
|--|---|--|------------|-------|-----|----------|----------|
| | | | MIN | TYP | MAX | | |
| Digital Inputs | | | | | | | |
| V_{IH} | Digital Input High Voltage | | ● | 13.5 | | V | |
| V_{IL} | Digital Input Low Voltage | | ● | | 1.5 | V | |
| I_{IN} | Digital Input Current | | ● | | ±1 | μA | |
| C_{IN} | Digital Input Capacitance | (Note 3) $V_{IN} = 0V$ | ● | | 8 | pF | |
| Timing Characteristics (Note 3) | | | | | | | |
| t_{CS} | \overline{CS} to \overline{WR} Setup Time | | ● | 75 | | ns | |
| t_{CH} | \overline{CS} to \overline{WR} Hold Time | | ● | 0 | | ns | |
| t_{WR} | Write Pulse Width | | ● | 75 | | ns | |
| t_{DS} | Data Setup Time | | ● | 60 | | ns | |
| t_{DH} | Data Hold Time | | ● | 5 | | ns | |
| Power Supply | | | | | | | |
| V_{DD} | Supply Voltage | | ● | 14.25 | 15 | 15.75 | V |
| I_{DD} | Supply Current | All Digital Inputs = V_{IH} or V_{IL} All Digital Inputs = $0V$ or V_{DD} | ● ● | | | 2 100 | mA μA |

The ● denotes specifications which apply over the full operating temperature range.

Note 1: $\pm 0.5LSB = \pm 0.012\%$ of full scale.

Note 2: Using internal feedback resistor.

Note 3: Guaranteed by design, not subject to test.

Note 4: I_{OUT1} with DAC register loaded to all 0s.

Note 5: Typical temperature coefficient is 100ppm/°C.

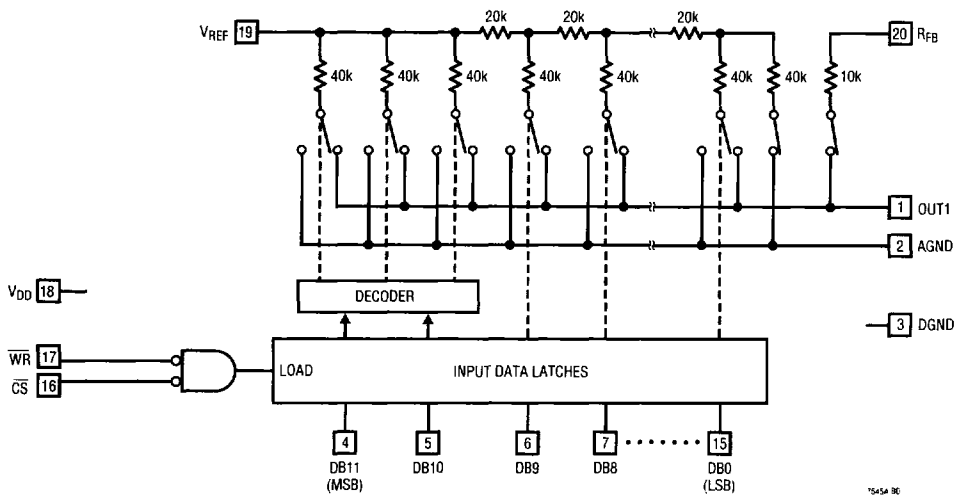
Note 6: I_{OUT1} load = 100Ω in parallel with 13pF.

Note 7: To 0.01% for a full-scale change, measured from the falling edge of \overline{WR} , $\overline{CS} = 0V$.

Note 8: From digital input change to 90% of final analog output.

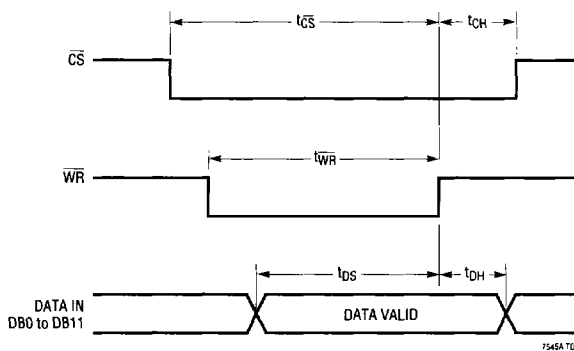
Note 9: $V_{REF} = 0V$, DAC register contents changed from all 0s to all 1s or all 1s to all 0s.

BLOCK DIAGRAM



7545A 96

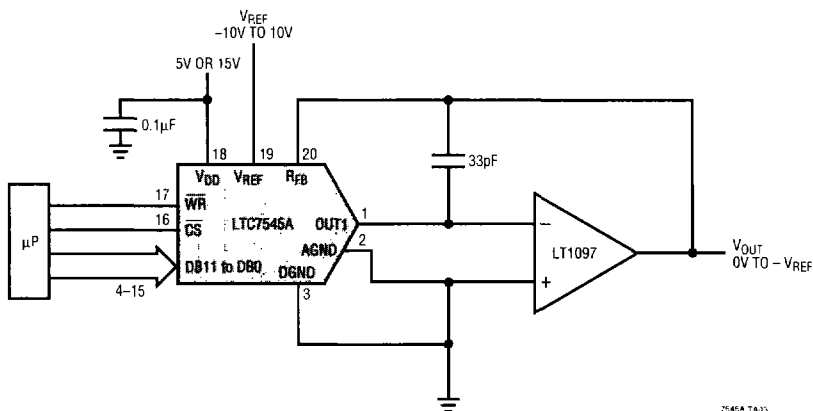
TIMING DIAGRAM



7545A T0

TYPICAL APPLICATIONS

Unipolar Operation (2-Quadrant Multiplication)



7545A TA33

Table 1. Unipolar Binary Code Table

| DIGITAL INPUT BINARY NUMBER IN DAC LATCH | | | ANALOG OUTPUT V_{OUT} |
|--|------|------|---------------------------------------|
| MSB | | LSB | |
| 1111 | 1111 | 1111 | $-V_{REF}$ (4095/4096) |
| 1000 | 0000 | 0000 | $-V_{REF}$ (2048/4096) = $-V_{REF}/2$ |
| 0000 | 0000 | 0001 | $-V_{REF}$ (1/4096) |
| 0000 | 0000 | 0000 | 0V |

TYPICAL APPLICATIONS

Bipolar Operation (4-Quadrant Multiplication)

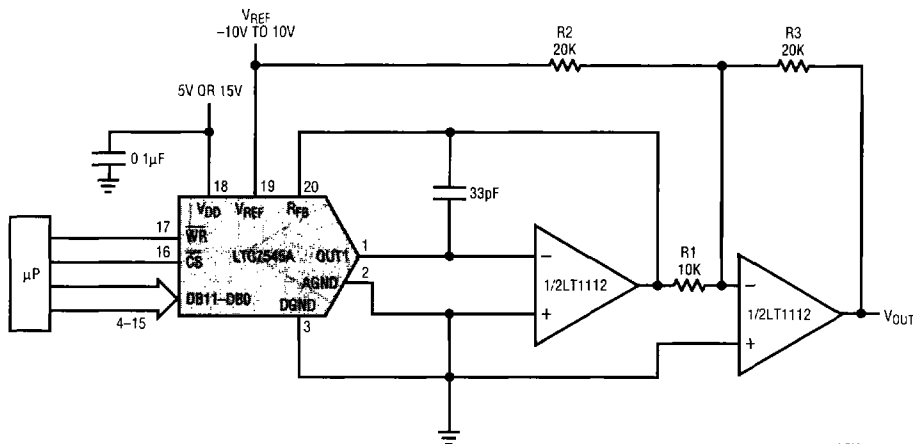


Table 2. Bipolar Offset Binary Code Table

| DIGITAL INPUT BINARY NUMBER IN DAC LATCH | | | ANALOG OUTPUT V_{OUT} |
|--|------|------|-------------------------------------|
| MSB | | LSB | |
| 1111 | 1111 | 1111 | V_{REF} (2047/2048) |
| 1000 | 0000 | 0001 | V_{REF} (1/2048) |
| 1000 | 0000 | 0000 | 0V |
| 0111 | 1111 | 1111 | $-V_{REF}$ (1/2048) |
| 0000 | 0000 | 0000 | $-V_{REF}$ (2048/2048) = $-V_{REF}$ |

RELATED PARTS

| PART NUMBER | DESCRIPTION | COMMENTS |
|-------------------------|---|---|
| LTC1257 | Complete Serial I/O V_{OUT} 12-Bit DAC | 5V to 15V Single Supply in 8-Pin SO and PDIP |
| LTC1450/LTC1450L | Complete Parallel Input V_{OUT} 12-Bit DACs | Rail-to-Rail V_{OUT} , 3V/5V Single Supply, 12-Bit or (8 + 4) Bit Loading |
| LTC1451/LTC1452/LTC1453 | Complete Serial I/O V_{OUT} 12-Bit DACs | Rail-to-Rail V_{OUT} , 3V/5V Single Supply in 8-Pin SO and PDIP |
| LTC7541A | Parallel I/O Multiplying I_{OUT} 12-Bit DAC | 12-Bit Wide Parallel Input |
| LTC7543/LTC8143 | Serial I/O Multiplying I_{OUT} 12-Bit DACs | Clear Pin and Serial Data Output (LTC8143) |
| LTC8043 | Serial I/O Multiplying I_{OUT} 12-Bit DAC | 8-Pin SO and PDIP |