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APPLICATION NOTE 351

# T1/E1 and T3/E3 Transformer Selection Guide

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*Abstract: This application note lists vendor transformers that meet the specifications required for use with Maxim Single-Chip Transceivers (SCTs) and Line Interface Units (LIUs). Recommended transformers are made based on the following transformer specifications: turns ratio, primary inductance, leakage inductance, interwinding capacitance, and DC resistance for both 5V and 3.3V operation. Actual results are dependant on the integrity of the PCB design and other termination circuitry and should be verified by the customer.*

## Introduction

This application note applies to the following products:

| T1/E1 LIUs | T1 SCTs  | E1 SCTs  | T1/E1 SCTs | T1/E1 Ethernet/Serial TDM | T3/E3 LIUs | T3/E3 SCTs |
|------------|----------|----------|------------|---------------------------|------------|------------|
| DS2148     | DS2151   | DS2153   | DS2156     | DS33R11                   | DS3150     | DS3170     |
| DS21348    | DS2152   | DS2154   | DS2155     | DS33R41                   | DS3151     | DS3171     |
| DS21Q48    | DS21352  | DS21354  | DS21Q55    |                           | DS3152     | DS3172     |
| DS21Q348   | DS21552  | DS21554  | DS21455    |                           | DS3153     | DS3173     |
| DS21448    | DS21Q552 | DS21Q554 | DS21458    |                           | DS3154     | DS3174     |
| DS2149     | DS21Q352 | DS21Q354 | DS26502    |                           | DS3251     | DS3181     |
| DS21349    | DS2196   | DS21Q59  | DS26503    |                           | DS3252     | DS3182     |
| DS26303    |          | DS21Q58  | DS26504    |                           | DS3253     | DS3183     |
| DS26324    |          | DS21Q50  | DS26518    |                           | DS3254     | DS3184     |
| DS26334    |          |          | DS26519    |                           | DS32504    |            |
|            |          |          | DS26521    |                           | DS32506    |            |
|            |          |          | DS26522    |                           | DS32508    |            |
|            |          |          | DS26524    |                           | DS32512    |            |
|            |          |          | DS26528    |                           |            |            |

**Table 1** shows the specifications for our 5V devices and **Table 2** shows the specifications for our 3.3V devices. The specifications for selecting an appropriate transformer are given in the data sheets for each device and repeated below for simplicity. **Table 3** lists the transformer part numbers from multiple vendors and matches them with the parts listed above.

**Table 1. Transformer Specifications for 5V Operation**

| Specification                      | Recommended Value                          |
|------------------------------------|--|
| Turns Ratio, 5V Applications       | 1:1 (RX) and 1:15 or 1:1.36 (TX) $\pm 5\%$ |
| Primary Inductance                 | 600 $\mu$ H minimum                        |
| Leakage Inductance                 | 1.0 $\mu$ H maximum                        |
| Interwinding Capacitance           | 40pF maximum                               |
| Transmit Transformer DC Resistance |  |
| Primary (Device Side)              | 1.2 $\Omega$ maximum                       |
| Secondary                          | 1.2 $\Omega$ maximum                       |
| Receive Transformer DC Resistance  |  |
| Primary (Device Side)              | 1.2 $\Omega$ maximum                       |
| Secondary                          | 1.2 $\Omega$ maximum                       |

**Table 2. Transformer Specifications for 3.3V Operation**

| Specification                      | Recommended Value               |
|------------------------------------|---------------------------------|
| Turns Ratio, 3.3V Applications     | 1:1 (RX) and 1:2 (TX) $\pm 2\%$ |
| Primary Inductance                 | 600 $\mu$ H minimum             |
| Leakage Inductance                 | 1.0 $\mu$ H maximum             |
| Interwinding Capacitance           | 40pF maximum                    |
| Transmit Transformer DC Resistance |                                 |
| Primary (Device Side)              | 1.0 $\Omega$ maximum            |
| Secondary                          | 2.0 $\Omega$ maximum            |
| Receive Transformer DC Resistance  |                                 |
| Primary (Device Side)              | 1.5 $\Omega$ maximum            |
| Secondary                          | 1.2 $\Omega$ maximum            |

**Table 3. Transformer Part Information**

| Vendor | Part     | Turns Ratio | No. of Ports | Package Type | No. of Pins | Temp Range   | Hierarchy | Maxim Device  |
|--------|----------|-------------|--------------|--------------|-------------|--------------|-----------|---|
| Pulse  | PE-65388 | 1:1.15CT    | TX only      | Through Hole | 6           | 0°C to +70°C | T1/E1     | DS2151,<br>DS2152,<br>DS2153,<br>DS2154,<br>DS21552,<br>DS21Q552,<br>DS21554, |

|          |                    |         |              |   |              |       |  |
|----------|--------------------|---------|--------------|---|--------------|-------|--|
|          |                    |         |              |   |              |       | DS21Q554   |
| PE-65586 | 1:1.36CT           | TX only | Through Hole | 6 | 0°C to +70°C | T1/E1 | DS2151,<br>DS2152,<br>DS2153,<br>DS2154,<br>DS21352,<br>DS21Q352,<br>DS21354,<br>DS21Q354,<br>DS21552,<br>DS21Q552,<br>DS21554,<br>DS21Q554  |
| PE-65351 | 1:2CT              | TX only | Through Hole | 6 | 0°C to +70°C | T1/E1 | DS2196,<br>DS21348,<br>DS21Q348,<br>DS21448,<br>DS21352,<br>DS21Q352,<br>DS21354,<br>DS21Q354  |
| PE-64936 | 1CT:1              | RX only | Through Hole | 6 | 0°C to +70°C | T1/E1 | DS2196,<br>DS2151,<br>DS2152,<br>DS2153,<br>DS2154,<br>DS21348,<br>DS21Q348,<br>DS21448,<br>DS2148,<br>DS21Q48,<br>DS21352,<br>DS21Q352,<br>DS21354,<br>DS21Q354,<br>DS21552,<br>DS2121Q552,<br>DS21554,<br>DS21Q554 |
| PE-65565 | 1:1.15CT and 1:2CT | 1       | Through Hole | 6 | 0°C to +70°C | T1/E1 | DS2151,<br>DS2152,<br>DS2153,<br>DS2154,<br>DS21552,<br>DS21Q552,<br>DS21554,<br>DS21Q554  |
|          |                    |         |              |   |              |       | DS2196,<br>DS2151,<br>DS2152,<br>DS2153,   |

|          |                        |         |               |    |                |       |   |
|----------|------------------------|---------|---------------|----|----------------|-------|---|
| TX1315   | 1CT:1CT                | RX only | Surface Mount | 6  | -40°C to +85°C | T1/E1 | DS2154, DS21348, DS21Q348, DS21448, DS2148, DS21Q48, DS21352, DS21Q352, DS21354, DS21Q354, DS21552, DS21Q552, DS21554, DS21Q554 |
| TX1320   | 1CT:1.36CT             | TX Only | Surface Mount | 6  | -40°C to +85°C | T1/E1 | DS2151, DS2152, DS2153, DS2154, DS21352, DS21Q352, DS21354, DS21Q354, DS21552, DS21Q552, DS21554, DS21Q554                      |
| TX1277   | 1CT:1CT and 1CT:2CT    | 1       | Surface Mount | 14 | -40°C to +85°C | T1/E1 | DS2155, DS2156, DS21Q55, DS21455, DS21458, DS21Q50, DS21Q58, DS21Q59, DS33R11, DS33R41  |
| PE-68882 | 1CT:1.15CT and 1CT:1CT | 1       | Surface Mount | 14 | -40°C to +85°C | T1/E1 | DS2151, DS2152, DS2153, DS2154, DS21552, DS21Q552, DS21554, DS21Q554  |
| PE-64952 | 1:2CT and 1:1.36       | 1       | Through Hole  | 14 | 0°C to +70°C   | T1/E1 | DS2151, DS2152, DS2153, DS2154, DS2148, DS21Q48, DS21552,   |

|          |                              |   |                  |    |                   |       |  |  |
|----------|------------------------------|---|------------------|----|-------------------|-------|--|--|
|          |                              |   |                  |    |                   |       |  | DS21Q552,<br>DS21554,<br>DS21Q554  |
| PE-64953 | 1:2CT and<br>1:2CT           | 1 | Through<br>Hole  | 14 | 0°C to<br>+70°C   | T1/E1 |  | DS2155,<br>DS2156,<br>DS21Q55,<br>DS21455,<br>DS21458,<br>DS21Q50,<br>DS21Q58,<br>DS21Q59                        |
| PE-65865 | 1:1.15CT<br>and<br>1CT:2CT   | 1 | Surface<br>Mount | 16 | 0°C to<br>+70°C   | T1/E1 |  | DS2151,<br>DS2152,<br>DS2153,<br>DS2154,<br>DS21552,<br>DS21Q552,<br>DS21554,<br>DS21Q554                        |
| T1076    | 1:1.15CT<br>and<br>1CT:2CT   | 1 | Surface<br>Mount | 16 | -40°C to<br>+85°C | T1/E1 |  | DS2151,<br>DS2152,<br>DS2153,<br>DS2154,<br>DS21552,<br>DS21Q552,<br>DS21554,<br>DS21Q554                        |
| T1136    | 1CT:1CT<br>and<br>1CT:1.36CT | 1 | Surface<br>Mount | 16 | 0°C to<br>+70°C   | T1/E1 |  | DS2151,<br>DS2152,<br>DS2153,<br>DS2154,<br>DS2148,<br>DS21Q48,<br>DS21552,<br>DS21Q552,<br>DS21554,<br>DS21Q554 |
| PE-68678 | 1CT:1CT<br>and<br>1CT:2CT    | 1 | Surface<br>Mount | 16 | 0°C to<br>+70°C   | T1/E1 |  | DS2196,<br>DS21348,<br>DS21Q348,<br>DS21448,<br>DS21352,<br>DS21Q352,<br>DS21354,<br>DS21Q354                    |
| PE-68877 | 1CT:1CT<br>and<br>1CT:2CT    | 1 | Surface<br>Mount | 12 | -40°C to<br>+85°C | T1/E1 |  | DS33R11,<br>DS33R41  |
|          |                              |   |                  |    |                   |       |  | DS2155,<br>DS2156,   |

|        |                               |   |                  |    |                      |       |  |
|--------|-------------------------------|---|------------------|----|----------------------|-------|--|
| T1094  | 1CT:1CT<br>and<br>1CT:2CT     | 1 | Surface<br>Mount | 16 | -40°C to<br>+85°C    | T1/E1 | DS21Q55,<br>DS21455,<br>DS21458,<br>DS21Q50,<br>DS21Q58,<br>DS21Q59  |
| TX1099 | 1CT:1:0.8<br>and<br>1CT:1:0.8 | 1 | Surface<br>Mount | 16 | -40°C to<br>+85°C    | T1/E1 | DS2155,<br>DS2156,<br>DS21Q55,<br>DS21455,<br>DS21458,<br>DS21348,<br>DS21Q348,<br>DS21448,<br>DS26502,<br>DS26503,<br>DS26504,<br>DS26521,<br>DS26522,<br>DS33R11 |
| TX1467 | 1CT:1:1<br>and<br>1CT:1:1     | 1 | Surface<br>Mount | 16 | -40°C to<br>+85°C    | T1/E1 | DS2155,<br>DS2156,<br>DS21Q55,<br>DS21455,<br>DS21458,<br>DS21Q50,<br>DS21Q58,<br>DS21Q59  |
| TX1473 | 1:2 and 1:1                   | 4 | Surface<br>Mount | 32 | -40°C to<br>+85°C    | T1/E1 | DS2155,<br>DS2156,<br>DS21Q55,<br>DS21455,<br>DS21458,<br>DS21Q50,<br>DS21Q58,<br>DS21Q59  |
| T1068  | 1:2CT and<br>1:1CT            | 4 | Surface<br>Mount | 40 | 0°C to<br>+70°C      | T1/E1 | DS2155,<br>DS2156,<br>DS21Q55,<br>DS21455,<br>DS21458,<br>DS21Q50,<br>DS21Q58,<br>DS21Q59  |
| TX1475 | 1CT:1CT<br>and<br>1CT:2CT     | 4 | Surface<br>Mount | 32 | -40°C<br>to<br>+85°C | T1/E1 | DS26324,<br>DS26334,<br>DS26518,<br>DS26519,<br>DS26524,<br>DS26528  |

|              |                           |             |                  |    |                   |       |   |
|--------------|---------------------------|-------------|------------------|----|-------------------|-------|---|
| T1114        | 1CT:1CT<br>and<br>1CT:2CT | 4           | Surface<br>Mount | 40 | -40°C to<br>+85°C | T1/E1 | DS26303   |
| T1108        | 1:2CT and<br>1:1CT        | 4           | Surface<br>Mount | 40 | -40°C to<br>+85°C | T1/E1 | DS2155,<br>DS2156,<br>DS21Q55,<br>DS21455,<br>DS21458,<br>DS21Q50,<br>DS21Q58,<br>DS21Q59   |
| TX1292       | 1:1.36 and<br>1:1         | 4           | Surface<br>Mount | 40 | -40°C to<br>+85°C | T1/E1 | DS2151,<br>DS2152,<br>DS2153,<br>DS2154,<br>DS2148,<br>DS21Q48,<br>DS21552,<br>DS21Q552,<br>DS21554,<br>DS21Q554                                      |
| PE-<br>65968 | 1:2CT                     | RX or<br>TX | Surface<br>Mount | 6  | 0°C to<br>+70°C   | T3/E3 | DS3150,<br>DS3151,<br>DS3152,<br>DS3153,<br>DS3154,<br>DS3181,<br>DS3182,<br>DS3183,<br>DS3184,<br>DS3251,<br>DS3252,<br>DS3253,<br>DS3254            |
| PE-<br>65969 | 1:2CT                     | RX or<br>TX | Through<br>Hole  | 6  | 0°C to<br>+70°C   | T3/E3 | DS3150,<br>DS3151,<br>DS3152,<br>DS3153,<br>DS3154,<br>DS3170,<br>DS3171,<br>DS3172,<br>DS3173,<br>DS3174,<br>DS3181,<br>DS3182,<br>DS3183,<br>DS3184 |
|              |                           |             |                  |    |                   |       | DS3150,<br>DS3151,<br>DS3152,   |

|                         |            |                 |          |               |    |                |       |  |
|-------------------------|------------|-----------------|----------|---------------|----|----------------|-------|--|
|                         | T3002      | 1:2CT           | RX or TX | Surface Mount | 6  | -40°C to +85°C | T3/E3 | DS3153, DS3154, DS3181, DS3182, DS3183, DS3184   |
|                         | T3012      | 1:2CT           | RX or TX | Surface Mount | 6  | -40°C to +85°C | T3/E3 | DS3150, DS3151, DS3152, DS3153, DS3154, DS3181, DS3182, DS3183, DS3184   |
|                         | T3021      | 1:2CT and 1:2CT | 1        | Surface Mount | 16 | -40°C to +85°C | T3/E3 | DS3150, DS3151, DS3152, DS3153, DS3154, DS3181, DS3182, DS3183, DS3184   |
|                         | T3047      | 1:1             | 4        | Surface Mount | 32 | -40°C to +85°C | T3/E3 | DS32501, DS32502, DS32503, DS32504, DS32512  |
|                         | T3049      | 1:2             | 4        | Surface Mount | 32 | -40°C to +85°C | T3/E3 | DS3150, DS3151, DS3152, DS3153, DS3154, DS3170, DS3171, DS3172, DS3173, DS3174, DS3181, DS3182, DS3183, DS3184 |
| <b>HALO Electronics</b> | TG38-1505A | 1:1.15CT        | TX only  | Through Hole  | 6  | -40°C to +85°C | T1/E1 | DS2151, DS2152, DS2153, DS2154, DS21552, DS21Q552, DS21554,  |



|             |          |         |               |   |                |       |  |
|-------------|----------|---------|---------------|---|----------------|-------|--|
|             |          |         |               |   |                |       | DS21Q554   |
| TD70-1205A  | 1:1.36CT | TX only | Through Hole  | 6 | 0°C to +70°C   | T1/E1 | DS2151,<br>DS2152,<br>DS2153,<br>DS2154,<br>DS21552,<br>DS21Q552,<br>DS21554,<br>DS21Q554  |
| TD15-1205A  | 1:2CT    | TX only | Through Hole  | 6 | 0°C to +70°C   | T1/E1 | DS2196,<br>DS21348,<br>DS21Q348,<br>DS21448,<br>DS21352,<br>DS21Q352,<br>DS21354,<br>DS21Q354  |
| TD02-1205A  | 1CT:1    | RX only | Through Hole  | 6 | 0°C to +70°C   | T1/E1 | DS2196,<br>DS2151,<br>DS2152,<br>DS2153,<br>DS2154,<br>DS21348,<br>DS21Q348,<br>DS21448,<br>DS2148,<br>DS21Q48,<br>DS21352,<br>DS21Q352,<br>DS21354,<br>DS21Q354,<br>DS21552,<br>DS2121Q552,<br>DS21554,<br>DS21Q554 |
| TG04-1505NS | 1CT:1CT  | RX only | Surface Mount | 6 | -40°C to +85°C | T1/E1 | DS2196,<br>DS2151,<br>DS2152,<br>DS2153,<br>DS2154,<br>DS21348,<br>DS21Q348,<br>DS21448,<br>DS2148,<br>DS21Q48,<br>DS21352,<br>DS21Q352,<br>DS21354,<br>DS21Q354,<br>DS21552,<br>DS2121Q552,                         |

|             |                        |         |               |    |                |       |  |   |
|-------------|------------------------|---------|---------------|----|----------------|-------|--|---|
|             |                        |         |               |    |                |       |  | DS21554,<br>DS21Q554  |
| TG15-1505NS | 1CT:2CT                | TX only | Surface Mount | 6  | -40°C to +85°C | T1/E1 |  | DS2196,<br>DS21348,<br>DS21Q348,<br>DS21448,<br>DS21352,<br>DS21Q352,<br>DS21354,<br>DS21Q354 |
| TG38-1505NS | 1:1.15CT               | TX only | Surface Mount | 6  | -40°C to +85°C | T1/E1 |  | DS2151,<br>DS2152,<br>DS2153,<br>DS2154,<br>DS21552,<br>DS21Q552,<br>DS21554,<br>DS21Q554     |
| TG70-1505NS | 1:1.36CT               | TX only | Surface Mount | 6  | -40°C to +85°C | T1/E1 |  | DS2151,<br>DS2152,<br>DS2153,<br>DS2154,<br>DS21552,<br>DS21Q552,<br>DS21554,<br>DS21Q554     |
| TD63-1505D  | 1:1.15CT and 1:2CT     | 1       | Through Hole  | 14 | -40°C to +85°C | T1/E1 |  | DS2151,<br>DS2152,<br>DS2153,<br>DS2154,<br>DS21552,<br>DS21Q552,<br>DS21554,<br>DS21Q554     |
| TG63-1505N1 | 1:1.15CT and 1CT:2CT   | 1       | Surface Mount | 16 | -40°C to +85°C | T1/E1 |  | DS2151,<br>DS2152,<br>DS2153,<br>DS2154,<br>DS21552,<br>DS21Q552,<br>DS21554,<br>DS21Q554     |
| TG35-1505N1 | 1CT:1.15CT and 1CT:1CT | 1       | Surface Mount | 16 | -40°C to +85°C | T1/E1 |  | DS2151,<br>DS2152,<br>DS2153,<br>DS2154,<br>DS21552,<br>DS21Q552,<br>DS21554,<br>DS21Q554     |

|             |                       |               |               |    |                |       |  |
|-------------|-----------------------|---------------|---------------|----|----------------|-------|--|
| TGSP-1467N1 | 1CT:1:1 and 1CT:1:1   | 1             | Surface Mount | 16 | -40°C to +85°C | T1/E1 | DS2155, DS2156, DS21Q55, DS21455, DS21458, DS21Q50, DS21Q58, DS21Q59                                       |
| TG28-1505N1 | 1CT:1CT and 1CT:1.36C | 1             | Surface Mount | 16 | -40°C to +85°C | T1/E1 | DS2151, DS2152, DS2153, DS2154, DS21352, DS21Q352, DS21354, DS21Q354, DS21552, DS21Q552, DS21554, DS21Q554 |
| TG74-1205N1 | 1CT:1CT and 1CT:2CT   | 1             | Surface Mount | 16 | 0°C to +70°C   | T1/E1 | DS2196, DS21348, DS21Q348, DS21448, DS21352, DS21Q352, DS21354, DS21Q354                                   |
| TG83-S006NU | 1:2 and 1:1           | 4             | Surface Mount | 32 | -40°C to +85°C | T1/E1 | DS2155, DS2156, DS21Q55, DS21455, DS21458, DS21Q50, DS21Q58, DS21Q59                                       |
| TG74-1205N1 | 1CT:1CT and 1CT:2CT   | 1             | Surface Mount | 16 | 0°C to +70°C   | T1/E1 | DS2196, DS21348, DS21Q348, DS21448, DS21352, DS21Q352, DS21354, DS21Q354                                   |
| TG07-0206NS | 1:2CT                 | TX or RX only | Surface Mount | 6  | 0°C to +70°C   | T3/E3 | DS3150, DS3151, DS3152, DS3153, DS3154   |
|             |                       |               |               |    |                |       | DS3150,  |

|            |              |                      |               |               |    |                |       |   |
|------------|--------------|----------------------|---------------|---------------|----|----------------|-------|---|
|            | TD07-0206NE  | 1:2CT                | TX or RX only | Through Hole  | 6  | 0°C to +70°C   | T3/E3 | DS3151, DS3152, DS3153, DS3154  |
|            | TG07-0356NS  | 1:2CT                | TX or RX only | Surface Mount | 6  | 0°C to +70°C   | T3/E3 | DS3150, DS3151, DS3152, DS3153, DS3154  |
|            | TG07-0406N1  | 1:2CT and 1:2CT      | 1             | Surface Mount | 16 | -40°C to +85°C | T3/E3 | DS3150, DS3151, DS3152, DS3153, DS3154  |
|            | TG05-0206NU  | 1:2                  | 4             | Surface Mount | 32 | -40°C to +85°C | T3/E3 | DS3150, DS3151, DS3152, DS3153, DS3154  |
| <b>Bel</b> | S553-3855-02 | 1:1.15CT and 1CT:2CT | 1             | Surface Mount | 16 | 0°C to +70°C   | T1/E1 | DS2151, DS2152, DS2153, DS2154, DS21552, DS21554, DS21Q552, DS21Q554                  |
|            | S553-0013-02 | 1:2CT and 1:1.36     | 1             | Surface Mount | 16 | 0°C to +70°C   | T1/E1 | DS2151, DS2152, DS2153, DS2154, DS2148, DS21Q48, DS21552, DS21Q552, DS21554, DS21Q554 |
|            | S553-0013-01 | 1CT:2CT and 1:1      | 1             | Surface Mount | 16 | 0°C to +70°C   | T1/E1 | DS21352, DS21354, DS2148, DS2155, DS2196, DS21Q352, DS21Q354, DS21Q48                 |
|            | S554-        | 1:2CT                | 1             | Surface       | 6  | 0°C to         | T3/E3 | DS3150, DS3151, DS3152, DS3153, DS3154,   |

|  |              |                     |         |               |    |                |       |  |
|--|--------------|---------------------|---------|---------------|----|----------------|-------|--|
|  | 3184-01      |                     |         | Mount         |    | +70°C          |       | DS3181,<br>DS3182,<br>DS3183,<br>DS3184  |
|  | 0554-3184-01 | 1:2CT               | 1       | Through Hole  | 6  | 0°C to +70°C   | T3/E3 | DS3150,<br>DS3151,<br>DS3152,<br>DS3153,<br>DS3154,<br>DS3181,<br>DS3182,<br>DS3183,<br>DS3184 |
|  | S553-6500-H5 | 1CT:1:1 and 1CT:1:1 | 4       | Surface Mount | 32 | -40°C to +85°C | T1/E1 | DS2151,<br>DS2152,<br>DS2153,<br>DS2154,<br>DS21552,<br>DS21554,<br>DS21Q552,<br>DS21Q554      |
|  | S554-6500-21 | 1:2                 | 4       | Surface Mount | 32 | -40°C to +85°C | T3/E3 | DS3150,<br>DS3151,<br>DS3152,<br>DS3153,<br>DS3154,<br>DS3181,<br>DS3182,<br>DS3183,<br>DS3184 |
|  | S553-6500-C8 | 1:2 and 1:1         | 4       | Surface Mount | 32 | -40°C to +85°C | T1/E1 | DS2155,<br>DS2156,<br>DS21Q55,<br>DS21455,<br>DS21458,<br>DS21Q50,<br>DS21Q58,<br>DS21Q59      |
|  | 0553-0013-RC | 1:1.15CT            | TX only | Through Hole  | 6  | 0°C to +70°C   | T1/E1 | DS2151,<br>DS2152,<br>DS2153,<br>DS2154,<br>DS21552,<br>DS21Q552,<br>DS21554,<br>DS21Q554      |
|  |              |                     |         |               |    |                |       | DS2196,<br>DS2151,<br>DS2152,<br>DS2153,   |

|              |                        |         |               |    |                |       |  |
|--------------|------------------------|---------|---------------|----|----------------|-------|--|
| 0553-0013-BC | 1CT:1                  | RX only | Through Hole  | 6  | 0°C to +70°C   | T1/E1 | DS2154,<br>DS21348,<br>DS21Q348,<br>DS21448,<br>DS2148,<br>DS21Q48,<br>DS21352,<br>DS21Q352,<br>DS21354,<br>DS21Q354,<br>DS21552,<br>DS2121Q552,<br>DS21554,<br>DS21Q554 |
| 0553-0013-1J | 1:2CT and 1:2CT        | 1       | Through Hole  | 14 | 0°C to +70°C   | T1/E1 | DS2155,<br>DS2156,<br>DS21Q55,<br>DS21455,<br>DS21458,<br>DS21Q50,<br>DS21Q58,<br>DS21Q59  |
| 0553-0013-2J | 1:2CT and 1:1.36       | 1       | Through Hole  | 14 | 0°C to +70°C   | T1/E1 | DS2151,<br>DS2152,<br>DS2153,<br>DS2154,<br>DS2148,<br>DS21Q48,<br>DS21552,<br>DS21Q552,<br>DS21554,<br>DS21Q554   |
| T2099S       | 1CT:1CT and 1CT:1.36CT | 1       | Surface Mount | 16 | -40°C to +85°C | T1/E1 | DS2151,<br>DS2152,<br>DS2153,<br>DS2154,<br>DS2148,<br>DS21Q48,<br>DS21552,<br>DS21Q552,<br>DS21554,<br>DS21Q554   |
| T2006        | 1:1.15CT               | TX only | Through Hole  | 6  | 0°C to +70°C   | T1/E1 | DS2151,<br>DS2152,<br>DS2153,<br>DS2154,<br>DS21552,<br>DS21Q552,<br>DS21554,<br>DS21Q554  |
|              |                        |         |               |    |                |       | DS2151,  |

|             |              |                         |         |               |    |                |       |  |
|-------------|--------------|-------------------------|---------|---------------|----|----------------|-------|--|
|             | T2007        | 1:1.36CT                | TX only | Through Hole  | 6  | 0°C to +70°C   | T1/E1 | DS2152, DS2153, DS2154, DS21352, DS21Q352, DS21354, DS21Q354, DS21552, DS21Q552, DS21554, DS21Q554 |
|             | T2028S       | 1:1.15CT and 1CT:2CT    | 1       | Surface Mount | 16 | 0°C to +70°C   | T1/E1 | DS2151, DS2152, DS2153, DS2154, DS21552, DS21Q552, DS21554, DS21Q554                               |
|             | T0034        | 1:2CT                   | TX only | Through Hole  | 6  | 0°C to +70°C   | T1/E1 | DS2196, DS21348, DS21Q348, DS21448, DS21352, DS21Q352, DS21354, DS21Q354                           |
|             | S553-6500-76 | 1CT:1CT and 1CT:2CT     | 1       | Surface Mount | 16 | 0°C to +70°C   | T1/E1 | DS2196, DS21348, DS21Q348, DS21448, DS21352, DS21Q352, DS21354, DS21Q354                           |
|             | S553-6500-E6 | 1CT:1CT and 1CT:2CT     | 1       | Surface Mount | 16 | -40°C to +85°C | T1/E1 | DS21348, DS2155, DS2156, DS21Q55, DS21455, DS21458, DS21Q50, DS21Q58, DS21Q59                      |
|             | S553-6500-H6 | 1CT:1:0.8 and 1CT:1:0.8 | 1       | Surface Mount | 32 | -40°C to +85°C | T1/E1 | DS21348, DS21Q348, DS21448, DS2155, DS2156   |
| <b>Coev</b> |              |                         |         |               |    |                |       | DS2151,  |

|          |          |         |              |   |                |       |   |
|----------|----------|---------|--------------|---|----------------|-------|---|
| PT-311   | 1:1.36CT | TX only | Through Hole | 6 | 0°C to +70°C   | T1/E1 | DS2152,<br>DS2153,<br>DS2154,<br>DS21352,<br>DS21Q352,<br>DS21354,<br>DS21Q354,<br>DS21552,<br>DS21Q552,<br>DS21554,<br>DS21Q554            |
| PT-311ET | 1:1.36CT | TX only | Through Hole | 6 | -40°C to +85°C | T1/E1 | DS2151,<br>DS2152,<br>DS2153,<br>DS2154,<br>DS21352,<br>DS21Q352,<br>DS21354,<br>DS21Q354,<br>DS21552,<br>DS21Q552,<br>DS21554,<br>DS21Q554 |
| PT-306   | 1:2CT    | TX only | Through Hole | 6 | 0°C to +70°C   | T1/E1 | DS2155,<br>DS2156,<br>DS21Q55,<br>DS21455,<br>DS21458,<br>DS21Q50,<br>DS21Q58,<br>DS21Q59   |
| PT-306ET | 1:2CT    | TX only | Through Hole | 6 | -40°C to +85°C | T1/E1 | DS2155,<br>DS2156,<br>DS21Q55,<br>DS21455,<br>DS21458,<br>DS21Q50,<br>DS21Q58,<br>DS21Q59   |
| PT-312   | 1CT:1    | RX only | Through Hole | 6 | 0°C to +70°C   | T1/E1 | DS2196,<br>DS2151,<br>DS2152,<br>DS2153,<br>DS2154,<br>DS21348,<br>DS21Q348,<br>DS21448,<br>DS2148,<br>DS21Q48,<br>DS21352,<br>DS21Q352,    |



|          |       |         |              |   |                |       |  |  |
|----------|-------|---------|--------------|---|----------------|-------|--|--|
|          |       |         |              |   |                |       |  | DS21354,<br>DS21Q354,<br>DS21552,<br>DS2121Q552,<br>DS21554,<br>DS21Q554 |
| PT-312ET | 1CT:1 | RX only | Through Hole | 6 | -40°C to +85°C | T1/E1 | DS2196,<br>DS2151,<br>DS2152,<br>DS2153,<br>DS2154,<br>DS21348,<br>DS21Q348,<br>DS21448,<br>DS2148,<br>DS21Q48,<br>DS21352,<br>DS21Q352,<br>DS21354,<br>DS21Q354,<br>DS21552,<br>DS2121Q552,<br>DS21554,<br>DS21Q554 |  |
| PT-323   | 1:1   | RX only | Through Hole | 6 | 0°C to +70°C   | T1/E1 | DS2196,<br>DS2151,<br>DS2152,<br>DS2153,<br>DS2154,<br>DS21348,<br>DS21Q348,<br>DS21448,<br>DS2148,<br>DS21Q48,<br>DS21352,<br>DS21Q352,<br>DS21354,<br>DS21Q354,<br>DS21552,<br>DS2121Q552,<br>DS21554,<br>DS21Q554 |  |
| PT-      | 1:1   | RX      | Through      | 6 | -40°C to       | T1/E1 | DS2196,<br>DS2151,<br>DS2152,<br>DS2153,<br>DS2154,<br>DS21348,<br>DS21Q348,<br>DS21448,<br>DS2148,  |  |

|             |                      |      |               |    |                |       |   |
|-------------|----------------------|------|---------------|----|----------------|-------|---|
| 323ET       |                      | only | Hole          |    | +85°C          |       | DS21Q48,<br>DS21352,<br>DS21Q352,<br>DS21354,<br>DS21Q354,<br>DS21552,<br>DS2121Q552,<br>DS21554,<br>DS21Q554 |
| SMD601-05   | 1:1.15CT and 1CT:2CT | 1    | Surface Mount | 16 | 0°C to +70°C   | T1/E1 | DS2151,<br>DS2152,<br>DS2153,<br>DS2154,<br>DS21552,<br>DS21Q552,<br>DS21554,<br>DS21Q554                     |
| SMD601-05ET | 1:1.15CT and 1CT:2CT | 1    | Surface Mount | 16 | -40°C to +85°C | T1/E1 | DS2151,<br>DS2152,<br>DS2153,<br>DS2154,<br>DS21552,<br>DS21Q552,<br>DS21554,<br>DS21Q554                     |
| SMD606-05   | 1CT:1CT and 1CT:2CT  | 1    | Surface Mount | 16 | 0°C to +70°C   | T1/E1 | DS21352,<br>DS21354   |
| SMD606-05ET | 1CT:1CT and 1CT:2CT  | 1    | Surface Mount | 16 | -40°C to +85°C | T1/E1 | DS21352,<br>DS21354   |
| SM01-T304M  | 1:2CT                | 1    | Surface Mount | 6  | -40°C to +85°C | T3/E3 | DS3150,<br>DS3151,<br>DS3152,<br>DS3153,<br>DS3154,<br>DS3181,<br>DS3182,<br>DS3183,<br>DS3184                |
| MGBBT-00019 | 1:2                  | 4    | Surface Mount | 32 | -40°C to +85°C | T3/E3 | DS3150,<br>DS3151,<br>DS3152,<br>DS3153,<br>DS3154,<br>DS3181,<br>DS3182,<br>DS3183,<br>DS3184                |

## T1/E1 and T3/E3 Transformer Selection Information

If you have further questions on T1/E1 or T3/E3 transformer selection for our devices, please contact the [Telecommunication Applications support team](#). For more information about specific transformers, please consult the manufacturers using the information listed below.

### Vendor List

| Address  | Phone        | Fax          | Website  |
|--|--------------|--------------|--|
| Pulse Engineering Inc.<br>12220 World Trade Drive<br>San Diego, CA 92128 | 858-674-8100 | 858-674-8262 | <a href="http://www.pulseeng.com">www.pulseeng.com</a>               |
| HALO Electronics Inc.<br>1861 Landings Drive<br>Mountain View, CA 94043  | 650-903-3800 | 650-903-9300 | <a href="http://www.haloelectronics.com">www.haloelectronics.com</a> |
| Bel Fuse Inc.<br>206 Van Vorst Street<br>Jersey City, NJ 07302           | 201-432-0463 | 201-432-9542 | <a href="http://www.belfuse.com">www.belfuse.com</a>                 |
| Coev Magnetics (Tyco)<br>3003 9th Avenue SW<br>Watertown, SD 57201       | 605-886-3326 | 605-884-3640 | <a href="http://www.coev.net">www.coev.net</a>                       |

| Related Parts           |   |                              |
|-------------------------|---|------------------------------|
| <a href="#">DS21348</a> | 3.3V E1/T1/J1 Line Interface                            | <a href="#">Free Samples</a> |
| <a href="#">DS21349</a> | 3.3V T1/J1 Line Interface Unit                          | <a href="#">Free Samples</a> |
| <a href="#">DS21352</a> | 3.3V DS21352 and 5V DS21552 T1 Single Chip Transceivers |                              |
| <a href="#">DS21354</a> | 3.3V/5V E1 Single Chip Transceivers (SCT)               |                              |
| <a href="#">DS21448</a> | 3.3V E1/T1/J1 Quad Line Interface                       | <a href="#">Free Samples</a> |
| <a href="#">DS21455</a> | Quad T1/E1/J1 Transceivers                              | <a href="#">Free Samples</a> |
| <a href="#">DS21458</a> | Quad T1/E1/J1 Transceivers                              | <a href="#">Free Samples</a> |
| <a href="#">DS2148</a>  | 5V E1/T1/J1 Line Interface                              |                              |
| <a href="#">DS2149</a>  | 5V T1/J1 Line Interface Unit                            |                              |
| <a href="#">DS2152</a>  | Enhanced T1 Single Chip Transceiver                     |                              |
| <a href="#">DS2154</a>  | Enhanced E1 Single Chip Transceiver                     |                              |
| <a href="#">DS2155</a>  | T1/E1/J1 Single-Chip Transceiver                        | <a href="#">Free Samples</a> |
| <a href="#">DS21552</a> | 3.3V DS21352 and 5V DS21552 T1 Single Chip Transceivers |                              |
| <a href="#">DS21554</a> | 3.3V/5V E1 Single Chip Transceivers (SCT)               | <a href="#">Free Samples</a> |

|          |   |              |
|----------|---|--------------|
| DS2156   | T1/E1/J1 Single-Chip Transceiver TDM/UTOPIA II Interface  | Free Samples |
| DS2196   | T1 Dual Framer LIU  |              |
| DS21Q348 | 3.3V E1/T1/J1 Line Interface                              |              |
| DS21Q352 | Quad T1/E1 Transceiver (3.3V, 5.0V)                       |              |
| DS21Q354 | Quad T1/E1 Transceiver (3.3V, 5.0V)                       |              |
| DS21Q48  | 5V E1/T1/J1 Line Interface                                |              |
| DS21Q50  | Quad E1 Transceiver                                       |              |
| DS21Q55  | Quad T1/E1/J1 Transceiver                                 |              |
| DS21Q552 | Quad T1/E1 Transceiver (3.3V, 5.0V)                       |              |
| DS21Q554 | Quad T1/E1 Transceiver (3.3V, 5.0V)                       |              |
| DS21Q58  | E1 Quad Transceiver                                       |              |
| DS21Q59  | E1 Quad Transceiver                                       |              |
| DS26521  | Single T1/E1/J1 Transceiver                               | Free Samples |
| DS26522  | Dual T1/E1/J1 Transceiver                                 | Free Samples |
| DS26524  | Quad T1/E1/J1 Transceiver                                 | Free Samples |
| DS26528  | Octal T1/E1/J1 Transceiver                                | Free Samples |
| DS3150   | 3.3V, DS3/E3/STS-1 Line Interface Unit                    | Free Samples |
| DS3151   | Single/Dual/Triple/Quad DS3/E3/STS-1 LIUs                 |              |
| DS3152   | Single/Dual/Triple/Quad DS3/E3/STS-1 LIUs                 |              |
| DS3153   | Single/Dual/Triple/Quad DS3/E3/STS-1 LIUs                 |              |
| DS3154   | Single/Dual/Triple/Quad DS3/E3/STS-1 LIUs                 | Free Samples |
| DS3181   | Single/Dual/Triple/Quad ATM/Packet PHYs with Built-In LIU | Free Samples |
| DS3182   | Single/Dual/Triple/Quad ATM/Packet PHYs with Built-In LIU | Free Samples |
| DS3183   | Single/Dual/Triple/Quad ATM/Packet PHYs with Built-In LIU |              |
| DS3184   | Single/Dual/Triple/Quad ATM/Packet PHYs with Built-In LIU | Free Samples |

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#### More Information

For Technical Support: <http://www.maximintegrated.com/support>

For Samples: <http://www.maximintegrated.com/samples>  
Other Questions and Comments: <http://www.maximintegrated.com/contact>

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Application Note 351: <http://www.maximintegrated.com/an351>  
APPLICATION NOTE 351, AN351, AN 351, APP351, Appnote351, Appnote 351  
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