

Application Note 351

T1/E1 and T3/E3 Transformer Selection Guide

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INTRODUCTION

This application note applies to the following products:

T1/E1 LIUs	T1 SCTs	E1 SCTs	T1/E1 SCTs	T3/E3 LIUs	T3/E3 SCTs
DS2148	DS2151	DS2153	DS2156	DS3150	DS3181
DS21348	DS2152	DS2154	DS2155	DS3151	DS3182
DS21Q48	DS21352	DS21354	DS21Q55	DS3152	DS3183
DS21Q348	DS21552	DS21554	DS21455	DS3153	DS3184
DS21448	DS21Q552	DS21Q554	DS21458	DS3154	
DS2149	DS21Q352	DS21Q354			
DS21349	DS2196	DS21Q59			
		DS21Q58			
		DS21Q50			

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 are repeated below for simplicity. Table 3 lists the transformer part numbers from a variety of vendors for use 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 μ H minimum
Leakage Inductance	1.0 μ H maximum
Interwinding Capacitance	40pF maximum
TRANSMIT TRANSFORMER DC RESISTANCE	
Primary (Device Side)	1.2 Ω maximum
Secondary	1.2 Ω maximum
RECEIVE TRANSFORMER DC RESISTANCE	
Primary (Device Side)	1.2 Ω maximum
Secondary	1.2 Ω 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 μ H minimum
Leakage Inductance	1.0 μ H maximum
Interwinding Capacitance	40pF maximum
TRANSMIT TRANSFORMER DC RESISTANCE	
Primary (Device Side)	1.0 Ω maximum
Secondary	2.0 Ω maximum
RECEIVE TRANSFORMER DC RESISTANCE	
Primary (Device Side)	1.5 Ω maximum
Secondary	1.2 Ω maximum

Table 3. Transformer Part Information

VENDOR	PART	TURNS RATIO	NUMBER OF PORTS	PACKAGE TYPE	NUMBER OF PINS	TEMP RANGE	HIERARCHY	Dallas Semiconductor PART NUMBER
Pulse	PE-65388	1:1.15CT	TX only	Through Hole	6	0°C to +70°C	T1/E1	DS2151, DS2152, DS2153, DS2154, DS21552, DS21Q552, DS21554, DS21Q554
	PE-65586	1:1.36CT	TX only	Through Hole	6	0°C to +70°C	T1/E1	DS2151, DS2152, DS2153, DS2154, DS21352, DS21Q352, DS21354, DS21Q354, DS21552, DS21Q552, DS21554, DS21Q554
	PE-65351	1:2CT	TX only	Through Hole	6	0°C to +70°C	T1/E1	DS2196, DS21348, DS21Q348, DS21448, DS21352, DS21Q352, DS21354, DS21Q354
	PE-64936	1CT:1	RX only	Through Hole	6	0°C to +70°C	T1/E1	DS2196, DS2151, DS2152, DS2153, DS2154, DS21348, DS21Q348, DS21448, DS2148, DS21Q48, DS21352, DS21Q352, DS21354, DS21Q354, DS21552, DS2121Q552, DS21554, DS21Q554
	PE-65565	1:1.15CT & 1:2CT	1	Through Hole	6	0°C to +70°C	T1/E1	DS2151, DS2152, DS2153, DS2154, DS21552, DS21Q552, DS21554, DS21Q554
	TX1315	1CT:1CT	RX only	Surface Mount	6	-40°C to +85°C	T1/E1	DS2196, DS2151, DS2152, DS2153, 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 & 1CT:2CT	1	Surface Mount	14	-40°C to +85°C	T1/E1	DS2155, DS2156, DS21Q55, DS21455, DS21458, DS21Q50, DS21Q58, DS21Q59
	PE-68882	1CT:1.15CT & 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 & 1:1.36	1	Through Hole	14	0°C to +70°C	T1/E1	DS2151, DS2152, DS2153, DS2154, DS2148, DS21Q48, DS21552, DS21Q552, DS21554, DS21Q554
PE-64953	1:2CT & 1:2CT	1	Through Hole	14	0°C to +70°C	T1/E1	DS2155, DS2156, DS21Q55, DS21455, DS21458, DS21Q50, DS21Q58, DS21Q59	

VENDOR	PART	TURNS RATIO	NUMBER OF PORTS	PACKAGE TYPE	NUMBER OF PINS	TEMP RANGE	HIERARCHY	Dallas Semiconductor PART NUMBER
Pulse	PE-65865	1:1.15CT & 1CT:2CT	1	Surface Mount	16	0°C to +70°C	T1/E1	DS2151, DS2152, DS2153, DS2154, DS21552, DS21Q552, DS21554, DS21Q554,
	T1076	1:1.15CT & 1CT:2CT	1	Surface Mount	16	-40°C to +85°C	T1/E1	DS2151, DS2152, DS2153, DS2154, DS21552, DS21Q552, DS21554, DS21Q554
	T1136	1CT:1CT & 1CT:1.36CT	1	Surface Mount	16	0°C to +70°C	T1/E1	DS2151, DS2152, DS2153, DS2154, DS2148, DS21Q48, DS21552, DS21Q552, DS21554, DS21Q554
	PE-68678	1CT:1CT & 1CT:2CT	1	Surface Mount	16	0°C to +70°C	T1/E1	DS2196, DS21348, DS21Q348, DS21448, DS21352, DS21Q352, DS21354, DS21Q354
	T1094	1CT:1CT & 1CT:2CT	1	Surface Mount	16	-40°C to +85°C	T1/E1	DS2155, DS2156, DS21Q55, DS21455, DS21458, DS21Q50, DS21Q58, DS21Q59
	TX1099	1CT:1:0.8 & 1CT:1:0.8	1	Surface Mount	16	-40°C to +85°C	T1/E1	DS2155, DS2156, DS21Q55, DS21455, DS21458, DS21348, DS21Q348, DS21448
	TX1467	1CT:1:1 & 1CT:1:1	1	Surface Mount	16	-40°C to +85°C	T1/E1	DS2155, DS2156, DS21Q55, DS21455, DS21458, DS21Q50, DS21Q58, DS21Q59
	TX1473	1:2 & 1:1	4	Surface Mount	32	-40°C to +85°C	T1/E1	DS2155, DS2156, DS21Q55, DS21455, DS21458, DS21Q50, DS21Q58, DS21Q59
	T1068	1:2CT & 1:1CT	4	Surface Mount	40	0°C to +70°C	T1/E1	DS2155, DS2156, DS21Q55, DS21455, DS21458, DS21Q50, DS21Q58, DS21Q59
	T1108	1:2CT & 1:1CT	4	Surface Mount	40	-40°C to +85°C	T1/E1	DS2155, DS2156, DS21Q55, DS21455, DS21458, DS21Q50, DS21Q58, DS21Q59
	TX1292	1:1.36 & 1:1	4	Surface Mount	40	-40°C to +85°C	T1/E1	DS2151, DS2152, DS2153, DS2154, DS2148, DS21Q48, DS21552, DS21Q552, DS21554, DS21Q554
	PE-65968	1:2CT	RX or TX	Surface Mount	6	0°C to +70°C	T3/E3	DS3150, DS3151, DS3152, DS3153, DS3154, DS3181, DS3182, DS3183, DS3184
	PE-65969	1:2CT	RX or TX	Through Hole	6	0°C to +70°C	T3/E3	DS3150, DS3151, DS3152, DS3153, DS3154, DS3181, DS3182, DS3183, DS3184
	T3002	1:2CT	RX or TX	Surface Mount	6	-40°C to +85°C	T3/E3	DS3150, DS3151, DS3152, DS3153, DS3154, DS3181, DS3182, DS3183, DS3184

VENDOR	PART	TURNS RATIO	NUMBER OF PORTS	PACKAGE TYPE	NUMBER OF PINS	TEMP RANGE	HIERARCHY	Dallas Semiconductor PART NUMBER
HALO Electronics	T3021	1:2CT & 1:2CT	1	Surface Mount	16	-40°C to +85°C	T3/E3	DS3150, DS3151, DS3152, DS3153, DS3154, DS3181, DS3182, DS3183, DS3184
	T3049	1:2	4	Surface Mount	32	-40°C to +85°C	T3/E3	DS3150, DS3151, DS3152, DS3153, DS3154, DS3181, DS3182, DS3183, DS3184
	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, DS2152, DS2153, DS2154, DS21552, DS21Q552, DS21554, DS21Q554
	TD15-1205A	1:2CT	TX Only	Through Hole	6	0°C to +70°C	T1/E1	DS2196, DS21348, DS21Q348, DS21448, DS21352, DS21Q352, DS21354, DS21Q354
	TD02-1205A	1CT:1	RX Only	Through Hole	6	0°C to +70°C	T1/E1	DS2196, DS2151, DS2152, DS2153, DS2154, DS21348, DS21Q348, DS21448, DS2148, DS21Q48, DS21352, DS21Q352, DS21354, DS21Q354, DS21552, DS2121Q552, DS21554, DS21Q554
	TG04-1505NS	1CT:1CT	RX Only	Surface Mount	6	-40°C to +85°C	T1/E1	DS2196, DS2151, DS2152, DS2153, DS2154, DS21348, DS21Q348, DS21448, DS2148, DS21Q48, DS21352, DS21Q352, DS21354, DS21Q354, DS21552, DS2121Q552, DS21554, DS21Q554
	TG15-1505NS	1CT:2CT	TX Only	Surface Mount	6	-40°C to +85°C	T1/E1	DS2196, DS21348, DS21Q348, DS21448, DS21352, DS21Q352, DS21354, DS21Q354
	TG38-1505NS	1:1.15CT	TX Only	Surface Mount	6	-40°C to +85°C	T1/E1	DS2151, DS2152, DS2153, DS2154, DS21552, DS21Q552, DS21554, DS21Q554
	TG70-1505NS	1:1.36CT	TX Only	Surface Mount	6	-40°C to +85°C	T1/E1	DS2151, DS2152, DS2153, DS2154, DS21552, DS21Q552, DS21554, DS21Q554
	TD63-1505D	1:1.15CT & 1:2CT	1	Through Hole	14	-40°C to +85°C	T1/E1	DS2151, DS2152, DS2153, DS2154, DS21552, DS21Q552, DS21554, DS21Q554
	TG63-1505N1	1:1.15CT & 1CT:2CT	1	Surface Mount	16	-40°C to +85°C	T1/E1	DS2151, DS2152, DS2153, DS2154, DS21552, DS21Q552, DS21554, DS21Q554

VENDOR	PART	TURNS RATIO	NUMBER OF PORTS	PACKAGE TYPE	NUMBER OF PINS	TEMP RANGE	HIERARCHY	Dallas Semiconductor PART NUMBER
	TG35-1505N1	1CT:1.15CT & 1CT:1CT	1	Surface Mount	16	-40°C to +85°C	T1/E1	DS2151, DS2152, DS2153, DS2154, DS21552, DS21Q552, DS21554, DS21Q554
	TGSP-1467N1	1CT:1:1 & 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 & 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 & 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 & 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 & 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
	TD07-0206NE	1:2CT	TX or RX only	Through Hole	6	0°C to +70°C	T3/E3	DS3150, 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 & 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
Bel	S553-3855-02	1:1.15CT & 1CT:2CT	1	Surface Mount	16	0°C to +70°C	T1/E1	DS2151, DS2152, DS2153, DS2154, DS21552, DS21Q552, DS21554, DS21Q554
	S553-0013-02	1:2CT & 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 & 1:1	1	Surface Mount	16	0°C to +70°C	T1/E1	DS21352, DS21354, DS2148, DS2155, DS2196, DS21Q352, DS21Q354, DS21Q48
	S554-3184-01	1:2CT	1	Surface Mount	6	0°C to +70°C	T3/E3	DS3150, DS3151, DS3152, DS3153, DS3154, DS3181, DS3182, DS3183, DS3184

VENDOR	PART	TURNS RATIO	NUMBER OF PORTS	PACKAGE TYPE	NUMBER OF PINS	TEMP RANGE	HIERARCHY	Dallas Semiconductor PART NUMBER
	0554-3184-01	1:2CT	1	Through Hole	6	0°C to +70°C	T3/E3	DS3150, DS3151, DS3152, DS3153, DS3154, DS3181, DS3182, DS3183, DS3184 DS2151, DS2152, DS2153, DS2154, DS21552, DS21554, DS21Q552, DS21Q554
	S553-6500-H5	1CT:1:1 & 1CT:1:1	4	Surface Mount	32	-40°C to +85°C	T1/E1	
Bel	S554-6500-21	1:2	4	Surface Mount	32	-40°C to +85°C	T3/E3	DS3150, DS3151, DS3152, DS3153, DS3154, DS3181, DS3182, DS3183, DS3184 DS2155, DS2156, DS21Q55, DS21455, DS21458, DS21Q50, DS21Q58, DS21Q59 DS2151, DS2152, DS2153, DS2154, DS21552, DS21Q552, DS21554, DS21Q554 DS2196, DS2151, DS2152, DS2153, DS2154, DS21348, DS21Q348, DS21448, DS2148, DS21Q48, DS21352, DS21Q352, DS21354, DS21Q354, DS21552, DS2121Q552, DS21554, DS21Q554 DS2155, DS2156, DS21Q55, DS21455, DS21458, DS21Q50, DS21Q58, DS21Q59 DS2151, DS2152, DS2153, DS2154, DS2148, DS21Q48, DS21552, DS21Q552, DS21554, DS21Q554 DS2151, DS2152, DS2153, DS2154, DS2148, DS21Q48, DS21552, DS21Q552, DS21554, DS21Q554
	S553-6500-C8	1:2 & 1:1	4	Surface Mount	32	-40°C to +85°C	T1/E1	
	0553-0013-RC	1:1.15CT	TX only	Through Hole	6	0°C to +70°C	T1/E1	
	0553-0013-BC	1CT:1	RX only	Through Hole	6	0°C to +70°C	T1/E1	
	0553-0013-1J	1:2CT & 1:2CT	1	Through Hole	14	0°C to +70°C	T1/E1	
	0553-0013-2J	1:2CT & 1:1.36	1	Through Hole	14	0°C to +70°C	T1/E1	
	T2099S	1CT:1CT & 1CT:1.36CT	1	Surface Mount	16	-40°C to +85°C	T1/E1	
	T2006	1:1.15CT	TX only	Through Hole	6	0°C to +70°C	T1/E1	
	T2007	1:1.36CT	TX only	Through Hole	6	0°C to +70°C	T1/E1	
	T2028S	1:1.15CT & 1CT:2CT	1	Surface Mount	16	0°C to +70°C	T1/E1	

VENDOR	PART	TURNS RATIO	NUMBER OF PORTS	PACKAGE TYPE	NUMBER OF PINS	TEMP RANGE	HIERARCHY	Dallas Semiconductor PART NUMBER
	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 & 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 & 1CT:2CT	1	Surface Mount	16	-40°C to +85°C	T1/E1	DS2155, DS2156, DS21Q55, DS21455, DS21458, DS21Q50, DS21Q58, DS21Q59
	S553-6500-H6	1CT:1:0.8 & 1CT:1:0.8	1	Surface Mount	32	-40°C to +85°C	T1/E1	DS21348, DS21Q348, DS21448, DS2155, DS2156
	PT-311	1:1.36CT	TX only	Through Hole	6	0°C to +70°C	T1/E1	DS2151, DS2152, DS2153, DS2154, DS21352, DS21Q352, DS21354, DS21Q354, DS21552, DS21Q552, DS21554, DS21Q554
	PT-311ET	1:1.36CT	TX only	Through Hole	6	-40°C to +85°C	T1/E1	DS2151, DS2152, DS2153, DS2154, DS21352, DS21Q352, DS21354, DS21Q354, DS21552, DS21Q552, DS21554, DS21Q554
	PT-306	1:2CT	TX only	Through Hole	6	0°C to +70°C	T1/E1	DS2155, DS2156, DS21Q55, DS21455, DS21458, DS21Q50, DS21Q58, DS21Q59
	PT-306ET	1:2CT	TX only	Through Hole	6	-40°C to +85°C	T1/E1	DS2155, DS2156, DS21Q55, DS21455, DS21458, DS21Q50, DS21Q58, DS21Q59
Coev	PT-312	1CT:1	RX only	Through Hole	6	0°C to +70°C	T1/E1	DS2196, DS2151, DS2152, DS2153, DS2154, DS21348, DS21Q348, DS21448, DS2148, DS21Q48, DS21352, DS21Q352, DS21354, DS21Q354, DS21552, DS2121Q552, DS21554, DS21Q554
	PT-312ET	1CT:1	RX only	Through Hole	6	-40°C to +85°C	T1/E1	DS2196, DS2151, DS2152, DS2153, DS2154, DS21348, DS21Q348, DS21448, DS2148, DS21Q48, DS21352, DS21Q352, DS21354, DS21Q354, DS21552, DS2121Q552, DS21554, DS21Q554
Coev	PT-323	1:1	RX only	Through Hole	6	0°C to +70°C	T1/E1	DS2196, DS2151, DS2152, DS2153, DS2154, DS21348, DS21Q348, DS21448, DS2148, DS21Q48, DS21352, DS21Q352, DS21354, DS21Q354, DS21552, DS2121Q552, DS21554, DS21Q554

VENDOR	PART	TURNS RATIO	NUMBER OF PORTS	PACKAGE TYPE	NUMBER OF PINS	TEMP RANGE	HIERARCHY	Dallas Semiconductor PART NUMBER
	PT-323ET	1:1	RX only	Through Hole	6	-40°C to +85°C	T1/E1	DS2196, DS2151, DS2152, DS2153, DS2154, DS21348, DS21Q348, DS21448, DS2148, DS21Q48, DS21352, DS21Q352, DS21354, DS21Q354, DS21552, DS2121Q552, DS21554, DS21Q554
	SMD601-05	1:1.15CT & 1CT:2CT	1	Surface Mount	16	0°C to +70°C	T1/E1	DS2151, DS2152, DS2153, DS2154, DS21552, DS21Q552, DS21554, DS21Q554
	SMD601-05ET	1:1.15CT & 1CT:2CT	1	Surface Mount	16	-40°C to +85°C	T1/E1	DS2151, DS2152, DS2153, DS2154, DS21552, DS21Q552, DS21554, DS21Q554
	SMD606-05	1CT:1CT & 1CT:2CT	1	Surface Mount	16	0°C to +70°C	T1/E1	DS21352, DS21354
	SMD606-05ET	1CT:1CT & 1CT:2CT	1	Surface Mount	16	-40°C to +85°C	T1/E1	DS21352, DS21354
	SM01-T304	1:2CT	1	Surface Mount	6	-40°C to +85°C	T3/E3	DS3150, DS3151, DS3152, DS3153, DS3154, DS3181, DS3182, DS3183, DS3184
	MGBBT-00019	1:2	4	Surface Mount	32	-40°C to +85°C	T3/E3	DS3150, DS3151, DS3152, DS3153, DS3154, DS3181, DS3182, DS3183, 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 via email telecom.support@dalsemi.com or call 972-371-6555.

For more information about specific transformers, please consult the manufacturer at the information listed below.

VENDOR LIST

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