19-3560; Rev 0; 1/05

Video Switch for Dual SCART Connectors

General Description

The MAX7457 4-channel video switch is ideal for anti-aliasing and DAC-smoothing video applications or wherever analog video is reconstructed from a digital data stream such as cable/satellite/terrestrial set-top boxes (STBs), DVD players, hard disk recorders (HDRs), and personal video recorders (PVRs). The MAX7457 filters and buffers CVBS and RGB video signals, making it ideal for dual SCART (peritelevision) STBs with an auxiliary CVBS input. The MAX7457 operates from a single +5V supply and has a flat passband out to 5MHz with a stopband attenuation of 43dB at 27MHz, making it ideal for NTSC, PAL, and standard-definition digital TV (SDTV) video systems.

The MAX7457 output buffers have a fixed gain of +6dB and are capable of driving two standard 150Ω video loads. The channel for CVBS video has high-frequency boost circuitry that enhances picture sharpness with up to +1.2dB of gain boost without degradation in the stopband. The video output drivers can be disabled by an external control input.

The MAX7457 is available in a 16-pin, 5mm x 5mm x 0.8mm TQFN package, and is specified over the extended (-40°C to +85°C) temperature range.

Applications

STBs/HDRs
Game Consoles
Desktop Video Editors
DVD Players
Digital VCRs

Features

- **4-Channel Video Filter/Buffer for RGB and CVBS Signals with Auxiliary Input**
- **Allows Auxiliary Input for CVBS Video Loop-Through Applications**
- **Filter Response Ideal for NTSC, PAL, and Interlaced SDTV Video Signals**
- **43dB (typ) Stopband Attenuation at 27MHz**
- **±0.75dB (max) Passband Ripple Out to 5MHz**
- **Blanking Level Voltage on Cable <1V**
- **Each Channel Drives Two 150Ω Video Loads**
- **+5V Single-Supply Operation**
- **Available in 5mm x 5mm x 0.8mm, 16-Pin TQFN**

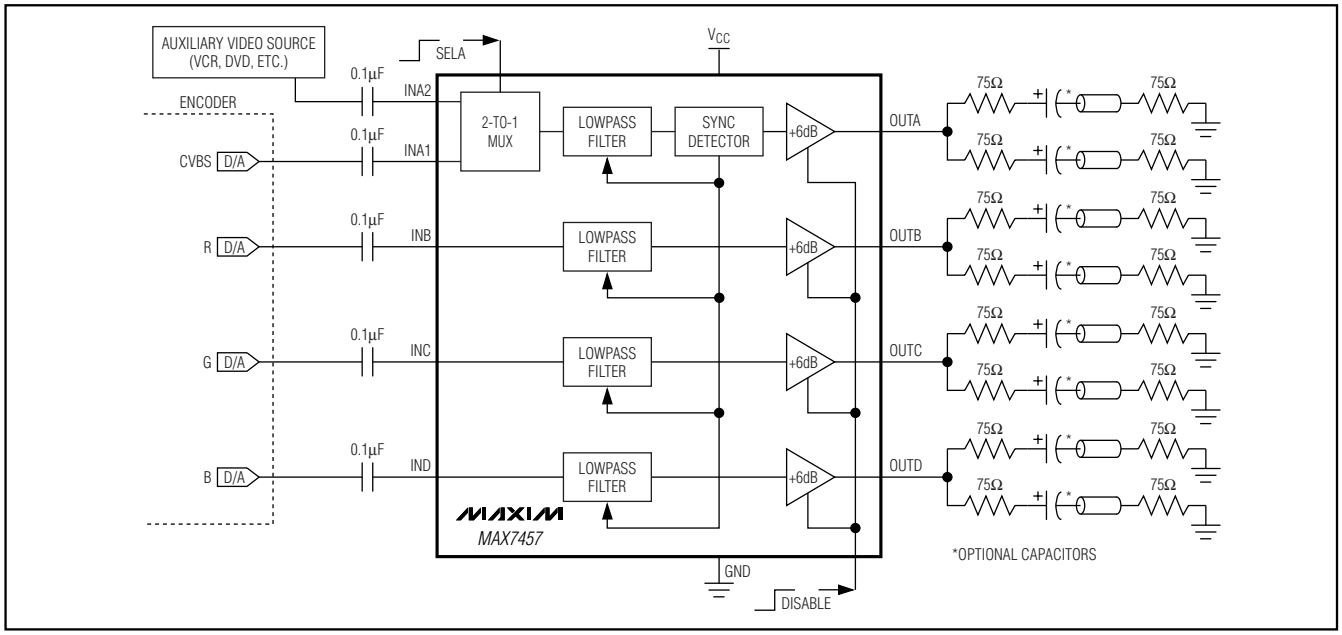
Ordering Information

PART	TEMP RANGE	PIN-PACKAGE	PKG CODE
MAX7457ETE	-40°C to +85°C	16 TQFN-EP*	T1655-2

*EP = Exposed pad.

Pin Configuration appears at end of data sheet.

Typical Operating Circuit



Video Switch for Dual SCART Connectors

ABSOLUTE MAXIMUM RATINGS

V_{CC} to GND .....-0.3V to +6V
INA1, INA2, INB, INC, IND to GND .....-0.3V to (V_{CC} + 0.3V)
OUTA, OUTB, OUTC, OUTD to GND .....-0.3V to (V_{CC} + 0.3V)
SELA, DISABLE to GND .....-0.3V to (V_{CC} + 0.3V)
Maximum Current into Any Pin Except V_{CC} and GND .....±50mA
Continuous Power Dissipation (T_A = +70°C)
16-Pin TQFN (derate 20.8mW/°C above +70°C).....1666.7mW

Operating Temperature Range .....-40°C to +85°C
Storage Temperature Range .....-65°C to +150°C
Junction Temperature .....+150°C
Lead Temperature (soldering, 10s) .....+300°C

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

ELECTRICAL CHARACTERISTICS

(V_{CC} = +5V ±5%, C_L = 0 to 20pF, R_L = 75Ω to GND for DC-coupled load, R_L = 75Ω to V_{CC}/2 for AC-coupled load, T_A = T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at V_{CC} = 5V, T_A = +25°C.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Passband Flatness		f = 100kHz to 5MHz, relative to 100kHz	Channel INA_	+0.9	+1.2	+1.5	dB
			Channels INB, INC, IND	-0.75	+0.15	+0.75	
Stopband Attenuation	A_{SB}	f ≥ 27MHz		40	43		dB
Differential Gain	dG	5-step modulated staircase			0.15	0.5	%
Differential Phase	dθ	5-step modulated staircase			0.15	0.5	Degrees
Signal-to-Noise Ratio	SNR	Peak signal ($2V_{P-P}$) to RMS noise, f = 100Hz to 50MHz			80		dB
Group Delay Deviation	Δt_g	Deviation from 100kHz to 4.1MHz	Channel INA_		17	30	ns
			Channels INB, INC, IND		11	20	
Line-Time Distortion	H_{DIST}	18µs, 100 IRE bar				0.3	%
Field-Time Distortion	V_{DIST}	130 lines, 18µs, 100 IRE bar				0.5	%
Clamp Settling Time	t_{CLAMP}	To ±1%			300		Lines
Output DC Clamp Level		Channel INA_		0.6	0.9	1.1	V
		Channel INB, INC, IND		1.1	1.5	1.8	
Low-Frequency Gain Accuracy	A_V	f = 100kHz, relative to gain of +6dB		-3		+3	%
Low-Frequency Gain Matching	$A_{V(MATCH)}$	Low-frequency channel-to-channel matching, f = 100kHz				4	%
Group Delay Matching	$t_{g(MATCH)}$	Low-frequency channel-to-channel matching, f = 100kHz			2		ns
Channel-to-Channel Crosstalk	X_{TALK}	f = 100kHz to 3.58MHz			-60		dB
Disabled Output Impedance	$Z_{DISABLE}$	At 5MHz			2		kΩ
Output Short-Circuit Current	I_{SC}	OUT_ shorted to GND or V_{CC}			70		mA

ELECTRICAL CHARACTERISTICS (continued)

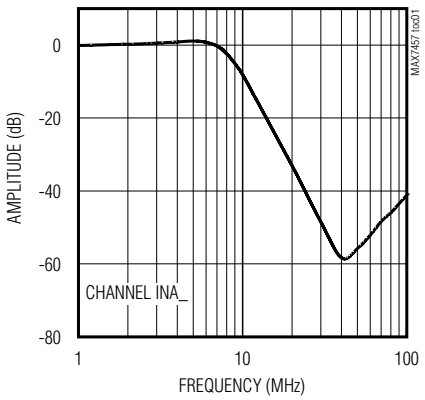
(V_{CC} = +5V ±5%, C_L = 0 to 20pF, R_L = 75Ω to GND for DC-coupled load, R_L = 75Ω to V_{CC}/2 for AC-coupled load, T_A = T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at V_{CC} = 5V, T_A = +25°C.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Input Leakage Current	I_{IN}				10	µA
Input Dynamic Swing		Channel INA_			1.2	V_{P-P}
		Channels INB, INC, IND			0.9	
Mux Crosstalk		f = 100kHz to 4.1MHz		-60		dB
SUPPLY						
Supply Voltage Range	V_{CC}		4.75		5.25	V
Supply Current	I_{CC}	No load		100	140	mA
Power-Supply Rejection Ratio	PSRR	V_{IN} = 100mV_{P-P}, f = 0 to 3.5MHz		40		dB
LOGIC INTERFACE						
Logic Input High Voltage	V_{IH}		2.0			V
Logic Input Low Voltage	V_{IL}				0.8	V
Logic Input Current		V_{IL} = 0 (sink), V_{IH} = V_{CC} (source)			±10	µA

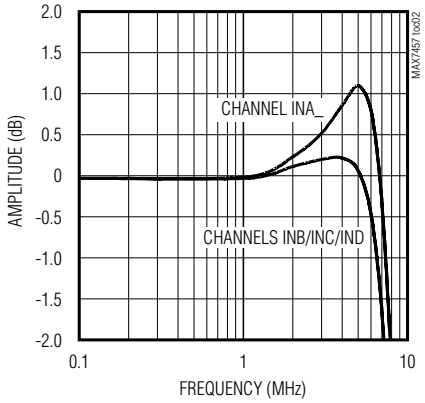
Typical Operating Characteristics

(V_{CC} = +5V, T_A = +25°C, unless otherwise noted.)

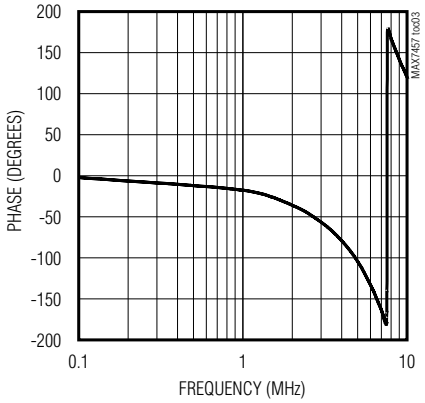
AMPLITUDE vs. FREQUENCY



PASSBAND AMPLITUDE vs. FREQUENCY



PHASE RESPONSE vs. FREQUENCY

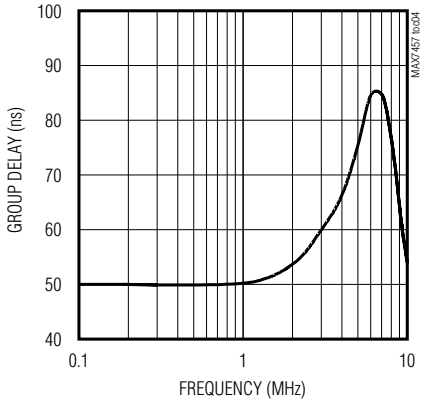


Video Switch for Dual SCART Connectors

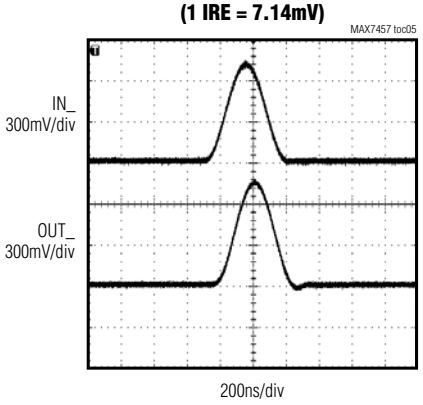
Typical Operating Characteristics (continued)

(V_{CC} = +5V, T_A = +25°C, unless otherwise noted.)

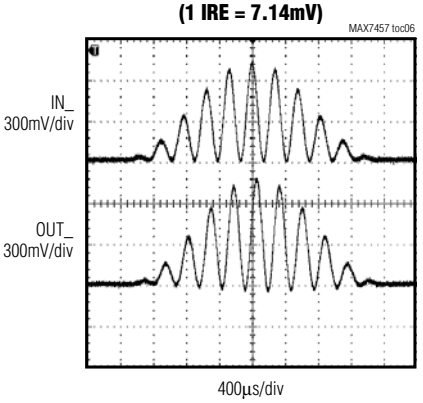
GROUP DELAY vs. FREQUENCY



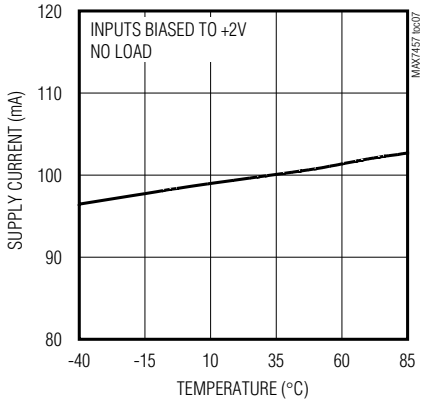
2T RESPONSE (1 IRE = 7.14mV)



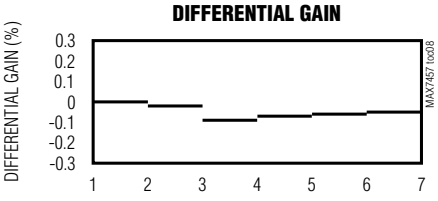
MODULATED 12.5T RESPONSE (1 IRE = 7.14mV)



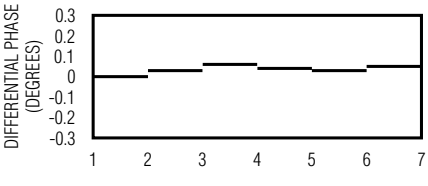
SUPPLY CURRENT vs. TEMPERATURE



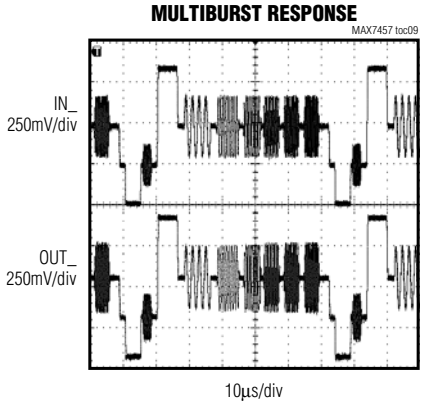
DIFFERENTIAL GAIN



DIFFERENTIAL PHASE



MULTIBURST RESPONSE



Pin Description

PIN	NAME	FUNCTION
1	INB	Channel INB Video Input. Use channel INB for the red (R) signal. AC-couple INB with a series 0.1µF capacitor.
2	INC	Channel INC Video Input. Use channel INC for the green (G) signal. AC-couple INC with a series 0.1µF capacitor.
3	IND	Channel IND Video Input. Use channel IND for the blue (B) signal. AC-couple IND with a series 0.1µF capacitor.
4	DISABLE	Disable Logic Input. A logic low on DISABLE enables the output buffers. A logic high on DISABLE disables all buffer outputs and puts them in a high-impedance state.
5	SELA	Select A Input. A logic low on SELA selects INA1 and a logic high on SELA selects INA2.
6, 8, 14	N.C.	No Connection. Not internally connected.
7	GND	Ground
9	V_{CC}	+5V Supply Input
10	OUTD	Channel D Video Output. OUTD can be either AC- or DC-coupled.
11	OUTC	Channel C Video Output. OUTC can be either AC- or DC-coupled.
12	OUTB	Channel B Video Output. OUTB can be either AC- or DC-coupled.
13	OUTA	Channel A Video Output. OUTA can be either AC- or DC-coupled.
15	INA2	Channel INA2 Video Input. Connect auxiliary CVBS to INA2. AC-couple INA2 with a series 0.1µF capacitor.
16	INA1	Channel INA1 Video Input. Connect CVBS to INA1. AC-couple INA1 with a series 0.1µF capacitor.
—	EP	Exposed Pad. Connect to GND for improved thermal heat sinking.

Detailed Description

The MAX7457 4-channel video switch filters and buffers video encoder DAC outputs in applications such as STBs, HDRs, DVD players, and digital VCRs. The MAX7457 offers an auxiliary CVBS loop-through feature required in dual SCART applications. Audio and video switching in SCART STBs utilize a costly integrated A/V switch offering high-end features such as volume control and high audio-drive capability. A more cost-effective solution uses the MAX7457 for the video switching along with low-cost standard passive analog switches for the audio switching.

The MAX7457 reconstructs and cleans up analog video signals from the video encoder's DAC output. Each channel consists of a lowpass filter and an output video buffer that drives two standard 150Ω video loads. The MAX7457 operates from a single +5V supply and has a nominal cutoff frequency of 5MHz, optimized for NTSC, PAL, and SDTV.

Filter

Filter Response

The reconstruction filter consists of two 2nd-order Sallen-Key stages. The Butterworth-type response features a maximally flat passband for NTSC and PAL bandwidths. The stopband offers at least 43dB (typ) of attenuation at the video encoder's DAC sampling frequency of 27MHz (see the *Typical Operating Characteristics*).

High-Frequency Boost

INA1/INA2 have +1.2dB of high-frequency boost that increases image sharpness by compensating for signal degradation and rolloff in the video encoder. Channels INB/INC/IND (RGB) do not boost high-frequency signals and have a flat response over the video bandwidth.

Video Switch for Dual SCART Connectors

Output Buffers

Each output buffer has a fixed gain of +6dB and can drive two 150Ω video loads with a $2V_{P-P}$ signal. The MAX7457 can drive an AC-coupled load or drive a DC-coupled load, eliminating the large coupling capacitors. The output buffers drive DC loads with an output blanking level of less than 1V.

Output Clamp Level

The video signal processed by channel INA_ (CVBS video signal) must include a sync pulse. This sync pulse provides the required timing to all four channels. When channel INA_ detects a sync pulse, the DC restore loop is activated. The function of the loop is to set the DC level of the video signal to a specified voltage. See Table 1 for clamp levels.

Table 1. Output Clamp Level

CHANNEL	CLAMP LEVEL (V)
A	0.9
B	1.5
C	1.5
D	1.5

Input Multiplexer

The MAX7457 has a 2-to-1 input multiplexer at channel INA_. The input to the CVBS channel comes from either a DAC output or from a CVBS source and is selected by SELA. Pull SELA low to select INA1 or high to select INA2.

Applications Information

Input Considerations

Use 0.1µF ceramic capacitors to AC-couple the inputs. The input capacitors store a DC level so the outputs are clamped to an appropriate DC voltage level.

Output Considerations

The outputs are typically connected to a 75Ω series back-match resistor followed by the video cable. Because of the inherent divide-by-two of this configuration, the voltage on the video cable is always less than 1V, complying with industry-standard video requirements such as the European SCART standard (which allows up to 2V of DC on the video cable). The video buffer can also drive an AC-coupled video load. An output capacitor as low as 220µF provides good video performance.

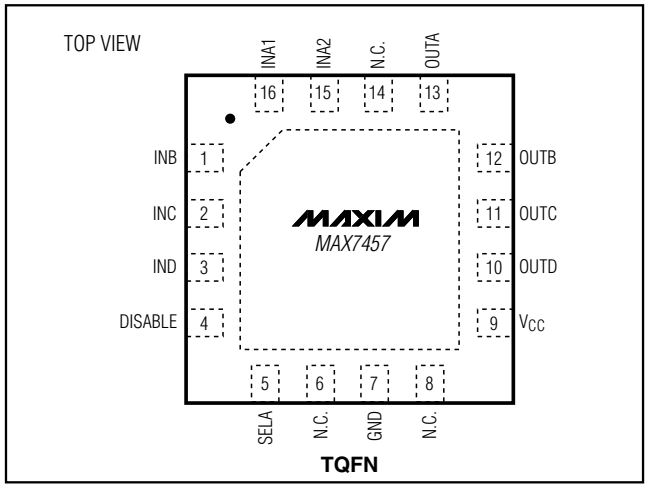
Power-Supply Bypassing and Layout

The MAX7457 operates from a single +5V supply. Bypass V_{CC} to GND with a 0.1µF capacitor. Place all external components as close to the device as possible.

Exposed Pad

The TQFN package has an exposed pad on the bottom of the package. This pad is electrically connected to GND and should be connected to the ground plane for improved thermal conductivity. Do not route signals under this package.

Pin Configuration



TQFN

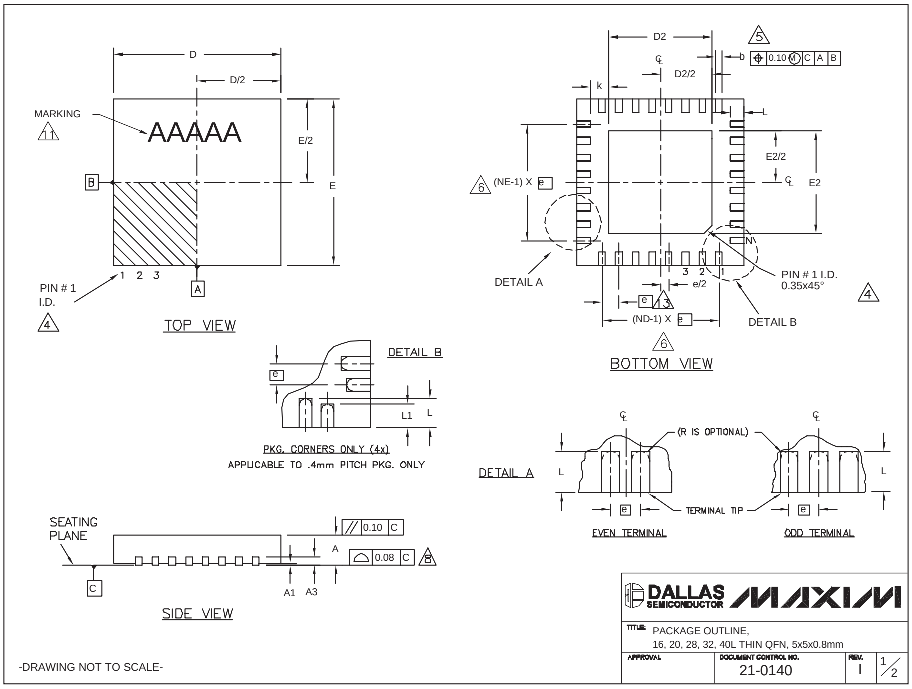
Chip Information

TRANSISTOR COUNT: 4579

PROCESS: BiCMOS

Package Information

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information go to **www.maxim-ic.com/packages**.)



COMMON DIMENSIONS															
PKG.	16L 5x5			20L 5x5			28L 5x5			32L 5x5			40L 5x5		
SYMBOL	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.70	0.75	0.80	0.70	0.75	0.80	0.70	0.75	0.80	0.70	0.75	0.80	0.70	0.75	0.80
A1	0	0.02	0.05	0	0.02	0.05	0	0.02	0.05	0	0.02	0.05	0	0.02	0.05
A3	0.20 REF.			0.20 REF.			0.20 REF.			0.20 REF.			0.20 REF.		
b	0.25	0.30	0.35	0.25	0.30	0.35	0.20	0.25	0.30	0.20	0.25	0.30	0.15	0.20	0.25
D	4.90	5.00	5.10	4.90	5.00	5.10	4.90	5.00	5.10	4.90	5.00	5.10	4.90	5.00	5.10
E	4.90	5.00	5.10	4.90	5.00	5.10	4.90	5.00	5.10	4.90	5.00	5.10	4.90	5.00	5.10
e	0.80 BSC.			0.65 BSC.			0.50 BSC.			0.50 BSC.			0.40 BSC.		
k	0.25	-	-	0.25	-	-	0.25	-	-	0.25	-	-	0.25	0.35	0.45
L	0.30	0.40	0.50	0.45	0.55	0.65	0.45	0.55	0.65	0.30	0.40	0.50	0.40	0.50	0.60
L1	-	-	-	-	-	-	-	-	-	-	-	-	0.30	0.40	0.50
N	16			20			28			32			40		
ND	4			5			7			8			10		
NE	4			5			7			8			10		
JEDEC	WHHB			WHHC			WHHD-1			WHHD-2			-----		

EXPOSED PAD VARIATIONS								
PKG. CODES	D2			E2			L exceptions	DOWN BONDS ALLOWED
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.	±0.15	
T1655-2	3.00	3.10	3.20	3.00	3.10	3.20	**	YES
T1655-3	3.00	3.10	3.20	3.00	3.10	3.20	**	NO
T1655N-1	3.00	3.10	3.20	3.00	3.10	3.20	**	NO
T2055-3	3.00	3.10	3.20	3.00	3.10	3.20	**	YES
T2055-4	3.00	3.10	3.20	3.00	3.10	3.20	**	NO
T2055-5	3.15	3.25	3.35	3.15	3.25	3.35	0.40	YES
T2855-3	3.15	3.25	3.35	3.15	3.25	3.35	**	YES
T2855-4	2.60	2.70	2.80	2.60	2.70	2.80	**	YES
T2855-5	2.60	2.70	2.80	2.60	2.70	2.80	**	NO
T2855-6	3.15	3.25	3.35	3.15	3.25	3.35	**	NO
T2855-7	2.60	2.70	2.80	2.60	2.70	2.80	**	YES
T2855-8	3.15	3.25	3.35	3.15	3.25	3.35	0.40	YES
T2855N-1	3.15	3.25	3.35	3.15	3.25	3.35	**	NO
T3255-3	3.00	3.10	3.20	3.00	3.10	3.20	**	YES
T3255-4	3.00	3.10	3.20	3.00	3.10	3.20	**	NO
T3255-5	3.00	3.10	3.20	3.00	3.10	3.20	**	YES
T3255N-1	3.00	3.10	3.20	3.00	3.10	3.20	**	NO
T4055-1	3.20	3.30	3.40	3.20	3.30	3.40	**	YES

**SEE COMMON DIMENSIONS TABLE

NOTES:

1. DIMENSIONING & TOLERANCING CONFORM TO ASME Y14.5M-1994.
2. ALL DIMENSIONS ARE IN MILLIMETERS. ANGLES ARE IN DEGREES.
3. N IS THE TOTAL NUMBER OF TERMINALS.
4. THE TERMINAL #1 IDENTIFIER AND TERMINAL NUMBERING CONVENTION SHALL CONFORM TO JESD 95-1 SPP-012. DETAILS OF TERMINAL #1 IDENTIFIER ARE OPTIONAL, BUT MUST BE LOCATED WITHIN THE ZONE INDICATED. THE TERMINAL #1 IDENTIFIER MAY BE EITHER A MOLD OR MARKED FEATURE.
5. DIMENSION b APPLIES TO METALLIZED TERMINAL AND IS MEASURED BETWEEN 0.25 mm AND 0.30 mm FROM TERMINAL TIP.
6. ND AND NE REFER TO THE NUMBER OF TERMINALS ON EACH D AND E SIDE RESPECTIVELY.
7. DEPOPULATION IS POSSIBLE IN A SYMMETRICAL FASHION.
8. COPLANARITY APPLIES TO THE EXPOSED HEAT SINK SLUG AS WELL AS THE TERMINALS.
9. DRAWING CONFORMS TO JEDEC MO220, EXCEPT EXPOSED PAD DIMENSION FOR T2855-3 AND T2855-6.
10. WARPAGE SHALL NOT EXCEED 0.10 mm.
11. MARKING IS FOR PACKAGE ORIENTATION REFERENCE ONLY.
12. NUMBER OF LEADS SHOWN ARE FOR REFERENCE ONLY.
13. LEAD CENTERLINES TO BE AT TRUE POSITION AS DEFINED BY BASIC DIMENSION "e", ±0.05.

-DRAWING NOT TO SCALE-

DALLAS SEMICONDUCTOR MAXIM

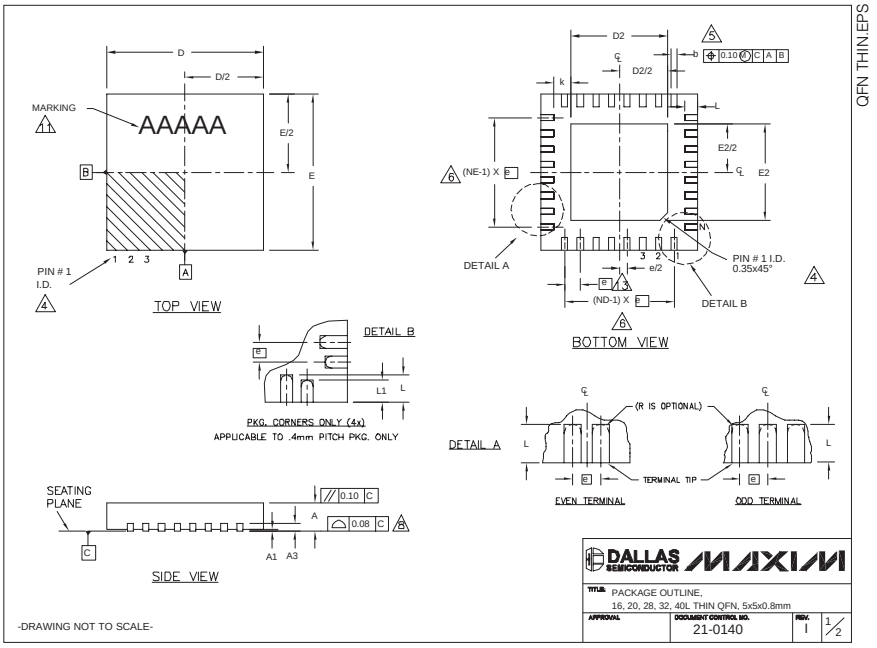
TITLE: PACKAGE OUTLINE, 16, 20, 28, 32, 40L THIN QFN, 5x5x0.8mm

APPROVAL	DOCUMENT CONTROL NO.	REV.	
	21-0140	I	2/2

Video Switch for Dual SCART Connectors

Package Information (continued)

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information go to **www.maxim-ic.com/packages**.)



COMMON DIMENSIONS															
PKG.	16L 5x5			20L 5x5			28L 5x5			32L 5x5			40L 5x5		
SYMBOL	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.70	0.75	0.80	0.70	0.75	0.80	0.70	0.75	0.80	0.70	0.75	0.80	0.70	0.75	0.80
A1	0	0.02	0.05	0	0.02	0.05	0	0.02	0.05	0	0.02	0.05	0	0.02	0.05
A3	0.20 REF.			0.20 REF.			0.20 REF.			0.20 REF.			0.20 REF.		
b	0.25	0.30	0.35	0.25	0.30	0.35	0.20	0.25	0.30	0.20	0.25	0.30	0.15	0.20	0.25
D	4.90	5.00	5.10	4.90	5.00	5.10	4.90	5.00	5.10	4.90	5.00	5.10	4.90	5.00	5.10
E	4.90	5.00	5.10	4.90	5.00	5.10	4.90	5.00	5.10	4.90	5.00	5.10	4.90	5.00	5.10
e	0.80 BSC.			0.65 BSC.			0.50 BSC.			0.50 BSC.			0.40 BSC.		
k	0.25	-	-	0.25	-	-	0.25	-	-	0.25	-	-	0.25	0.35	0.45
L	0.30	0.40	0.50	0.45	0.55	0.65	0.45	0.55	0.65	0.30	0.40	0.50	0.40	0.50	0.60
L1	-	-	-	-	-	-	-	-	-	-	-	-	0.30	0.40	0.50
N	16			20			28			32			40		
ND	4			5			7			8			10		
NE	4			5			7			8			10		
JEDEC	WHHB			WHHC			WHHD-1			WHHD-2			-----		

EXPOSED PAD VARIATIONS								
PKG. CODES	D2			E2			L	DOWN BONDS ALLOWED
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.	±0.15	
T1655-2	3.00	3.10	3.20	3.00	3.10	3.20	**	YES
T1655-3	3.00	3.10	3.20	3.00	3.10	3.20	**	NO
T1655N-1	3.00	3.10	3.20	3.00	3.10	3.20	**	NO
T2055-3	3.00	3.10	3.20	3.00	3.10	3.20	**	YES
T2055-4	3.00	3.10	3.20	3.00	3.10	3.20	**	NO
T2055-5	3.15	3.25	3.35	3.15	3.25	3.35	0.40	YES
T2855-3	3.15	3.25	3.35	3.15	3.25	3.35	**	YES
T2855-4	2.60	2.70	2.80	2.60	2.70	2.80	**	YES
T2855-5	2.60	2.70	2.80	2.60	2.70	2.80	**	NO
T2855-6	3.15	3.25	3.35	3.15	3.25	3.35	**	NO
T2855-7	2.60	2.70	2.80	2.60	2.70	2.80	**	YES
T2855-8	3.15	3.25	3.35	3.15	3.25	3.35	0.40	YES
T2855N-1	3.15	3.25	3.35	3.15	3.25	3.35	**	NO
T3255-3	3.00	3.10	3.20	3.00	3.10	3.20	**	YES
T3255-4	3.00	3.10	3.20	3.00	3.10	3.20	**	NO
T3255-5	3.00	3.10	3.20	3.00	3.10	3.20	**	YES
T3255N-1	3.00	3.10	3.20	3.00	3.10	3.20	**	NO
T4055-1	3.20	3.30	3.40	3.20	3.30	3.40	**	YES

** SEE COMMON DIMENSIONS TABLE

NOTES:

1. DIMENSIONING & TOLERANCING CONFORM TO ASME Y14.5M-1994.
2. ALL DIMENSIONS ARE IN MILLIMETERS. ANGLES ARE IN DEGREES.
3. N IS THE TOTAL NUMBER OF TERMINALS.
4. THE TERMINAL #1 IDENTIFIER AND TERMINAL NUMBERING CONVENTION SHALL CONFORM TO JESD 95-1 SPP-012. DETAILS OF TERMINAL #1 IDENTIFIER ARE OPTIONAL, BUT MUST BE LOCATED WITHIN THE ZONE INDICATED. THE TERMINAL #1 IDENTIFIER MAY BE EITHER A MOLD OR MARKED FEATURE.
5. DIMENSION b APPLIES TO METALLIZED TERMINAL AND IS MEASURED BETWEEN 0.25 mm AND 0.30 mm FROM TERMINAL TIP.
6. ND AND NE REFER TO THE NUMBER OF TERMINALS ON EACH D AND E SIDE RESPECTIVELY.
7. DEPOPULATION IS POSSIBLE IN A SYMMETRICAL FASHION.
8. COPLANARITY APPLIES TO THE EXPOSED HEAT SINK SLUG AS WELL AS THE TERMINALS.
9. DRAWING CONFORMS TO JEDEC MO220, EXCEPT EXPOSED PAD DIMENSION FOR T2855-3 AND T2855-6.
10. WARPAGE SHALL NOT EXCEED 0.10 mm.
11. MARKING IS FOR PACKAGE ORIENTATION REFERENCE ONLY.
12. NUMBER OF LEADS SHOWN ARE FOR REFERENCE ONLY.
13. LEAD CENTERLINES TO BE AT TRUE POSITION AS DEFINED BY BASIC DIMENSION "e", ±0.05.

-DRAWING NOT TO SCALE-

DALLAS SEMICONDUCTOR MAXIM
PACKAGE OUTLINE, 16, 20, 28, 32, 40L THIN QFN, 5x5x0.8mm
APPROVAL
DOCUMENT CONTROL NO. 21-0140
REV. I
2/2

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