

## Low On-Resistance Wideband/Video Switches

### FEATURES

- Wide Bandwidth: 500 MHz
- Low Crosstalk at 5 MHz: -85 dB
- Low r<sub>DS(on)</sub>: 5 Ω, DG642
- TTL Logic Compatible
- Fast Switching: t<sub>ON</sub> 50 ns
- Single Supply Compatibility
- High Current: 100 mA, DG642

## BENEFITS

- High Precision
- Improved Frequency Response
- Low Insertion Loss
- Improved System Performance
- Reduced Board Space
- Low Power Consumption

### APPLICATIONS

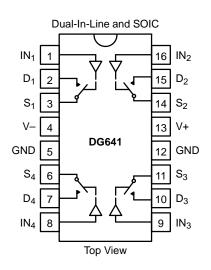
- RF and Video Switching
- RGB Switching
- Video Routing
- Cellular Communications
- ATE
- Radar/FLIR Systems
- Satellite Receivers
- Programmable Filters

### DESCRIPTION

The DG641/642/643 are high performance monolithic video switches designed for switching wide bandwidth analog and digital signals. DG641 is a quad SPST, DG642 is a single SPDT, and DG643 is a dual SPDT function. These devices have exceptionally low on-resistances (5  $\Omega$  typ—DG642), low capacitance and high current handling capability.

To achieve TTL compatibility, low channel capacitances and fast switching times, the DG641/642/643 are built on the Vishay Siliconix proprietary D/CMOS process. Each switch conducts equally well in both directions when on, and blocks up to 14 V<sub>p-p</sub> when off. An epitaxial layer prevents latchup.

## FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION



	Dual-In-Lir	e and SOI	C	
S <sub>1</sub> 1 D <sub>1</sub> 2 V- 3 GND 4			8 7 6	IN V+ D <sub>2</sub> S <sub>2</sub>
Ľ	DG	642	Ľ	-
	Тор	View		

	Dual-In-Line and SOIC	
IN <sub>1</sub> D <sub>1</sub> GND S <sub>1</sub> V– S <sub>4</sub> GND	Dual-In-Line and SOIC	IN <sub>2</sub> D <sub>2</sub> GND S <sub>2</sub> V+ S <sub>3</sub> GND
$D_4$	B DG643 9	$D_3$
	Top View	

TRUTH TABLE—DG641			
Switch			
OFF			
ON			

 $\begin{array}{l} \text{Logic "0"} \leq 0.8 \text{ V} \\ \text{Logic "1"} \geq 2.4 \text{ V} \end{array}$ 

TRUTH TABLE—DG642				
Logic	SW <sub>1</sub> SW <sub>2</sub>			
0	OFF	ON		
1	ON	OFF		

 $\begin{array}{l} \mbox{Logic "0"} \leq 0.8 \ \mbox{V} \\ \mbox{Logic "1"} \geq 2.4 \ \mbox{V} \end{array}$ 

 TRUTH TABLE—DG643

 Logic
 SW1, SW2
 SW3, SW4

 0
 OFF
 ON

 1
 ON
 OFF

 $\begin{array}{l} \text{Logic "0"} \leq 0.8 \text{ V} \\ \text{Logic "1"} \geq 2.4 \text{ V} \end{array}$ 

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ORDERING INFORMATION							
Temp Range Package Part Number							
DG641							
40.4- 0500	16-Pin Plastic DIP	DG641DJ					
–40 to 85°C	16-Pin Narrow SOIC	DG641DY					
DG642							
40.4- 0500	8-Pin Plastic DIP	DG642DJ					
–40 to 85°C	8-Pin Narrow SOIC	DG642DY					
DG643							
–40 to 85°C	16-Pin Plastic DIP	DG643DJ					
	16-Pin Narrow SOIC	DG643DY					

## **ABSOLUTE MAXIMUM RATINGS**

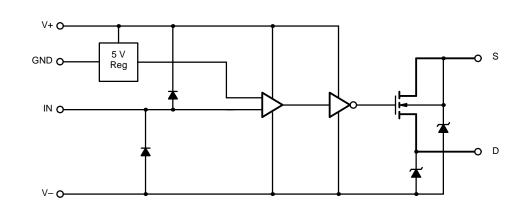
V+ to V0.3 V to 21 V
V+ to GND $\ldots$ 0.3 V to 21 V
V– to GND $\hfill $ 19 V to +0.3 V
Digital Inputs
or 20 mA, whichever occurs first
V <sub>S</sub> , V <sub>D</sub>
or 20 mA, whichever occurs first
Continuous Current (Any Terminal Except S or D) 20 mA
Continuous Current S or D: DG641/643 75 mA
DG642 100 mA
Current, S or D (Pulsed 1 ms, 10% duty cycle max)
DG641/643 200 mA
DG642 300 mA

Storage Temperature	
Power Dissipation (Package) <sup>b</sup>	
8-Pin Plastic DIP and Narrow SOIC <sup>c</sup> 300 mW	
16-Pin Plastic DIP <sup>d</sup>	
16-Pin Narrow SOIC <sup>e</sup> 600 mW	

#### Notes:

- Signals on  $S_X$ ,  $D_X$ , or  $IN_X$  exceeding V+ or V– will be clamped by internal diodes. Limit forward diode current to maximum current ratings. a.
- b. All leads welded or soldered to PC Board.
- Derate 7.6 mW/°C above 75°C c. d.
- Derate 6 mW/°C above 75°C Derate 80 mW/°C above 75°C
- e.

## SCHEMATIC DIAGRAM (TYPICAL CHANNEL)





		Test Conditions Unless Otherwise Specified V+=15 V, V-=-3 V $V_{INH}=2.4 V, V_{INL}=0.8 V^{e}$		-	Limits -40 to 85°C		
Parameter	Symbol		Temp <sup>a</sup>	Min <sup>b</sup>	Тур <sup>с</sup>	Max <sup>b</sup>	Unit
Analog Switch							
Analog Signal Dangedd	N	V-=-5 V, V+=12 V	Full	-5		8	
Analog Signal Range <sup>dd</sup>	V <sub>ANALOG</sub>	V– = GND, V+ = 12 V	Full	0		8	V
Drain-Source On-Resistance	r <sub>DS(on)</sub>	I <sub>S</sub> = –10 mA, V <sub>D</sub> = 0 V	Room Full		8	15 20	Ω
r <sub>DS(on)</sub> Match	$\Delta r_{DS(on)}$	-	Room		1	2	
Source Off Leakage Current	I <sub>S(off)</sub>	$V_{S} = 0 V, V_{D} = 10 V$	Room Full	-10 -100	-0.02	10 100	
Drain Off Leakage Current	I <sub>D(off)</sub>	$V_{S} = 10 \text{ V}, V_{D} = 0 \text{V}$	Room Full	-10 -100	-0.02	10 100	nA
Channel On Leakage Current	I <sub>D(on)</sub>	$V_{S} = V_{D} = 0 V$	Room Full	-10 -100	-0.1	10 100	
Digital Control							
Input Voltage High	V <sub>INH</sub>		Full	2.4			V
Input Voltage Low	V <sub>INL</sub>		Full			0.8	V
Input Current	I <sub>IN</sub>	$V_{IN} = GND \text{ or } V+$	Room Full	-1 -20	0.05	1 20	μΑ
Dynamic Characteristics						-	
On State Input Capacitanced	C <sub>S(on)</sub>	$V_{S} = V_{D} = 0 V$	Room		10	20	
Off State Input Capacitance <sup>d</sup>	C <sub>S(off)</sub>	$V_{S} = 0 V$	Room		4	12	pF
Off State Output Capacitanced	C <sub>D(off)</sub>	$V_D = 0 V$	Room		4	12	
Bandwidth	BW	$R_L = 50 \Omega$ , See Figure 6	Room		500		MHz
Turn On Time	t <sub>ON</sub>	$R_L$ = 1 k $\Omega$ , $C_L$ = 35 pF, See Figure 2	Room Full		50	70 140	ns
Turn Off Time	tOFF		Room Full		28	50 85	113
Charge Injection	Q	$C_L$ = 1000 pF, $V_D$ = 0 V, See Figure 3	Room		-19		рС
Off Isolation	OIRR	$R_{IN}$ = 75 $\Omega$ , $R_L$ = 75 $\Omega$ , f = 5 MHz See Figure 4	Room		-60		dB
All Hostile Crosstalk	X <sub>TALK(AH)</sub>	$R_{IN}$ = 10 $\Omega$ , $R_L$ = 75 $\Omega$ , f = 5 MHz See Figure 5	Room		-87		
Power Supplies			-				
Positive Supply Current	l+		Room Full		3.5	6 9	
Negative Supply Current	I–	$V_{IN} = 0 V \text{ or } V_{IN} = 5 V$	Room Full	6 9	-3	1	mA

Notes:

a.

b.

Room = 25 °C, Full = as determined by the operating temperature suffix. Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing. The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this data sheet. c.

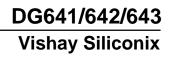
Guaranteed by design, not subject to production test.  $V_{\text{IN}}$  = input voltage to perform proper function. d.

e.



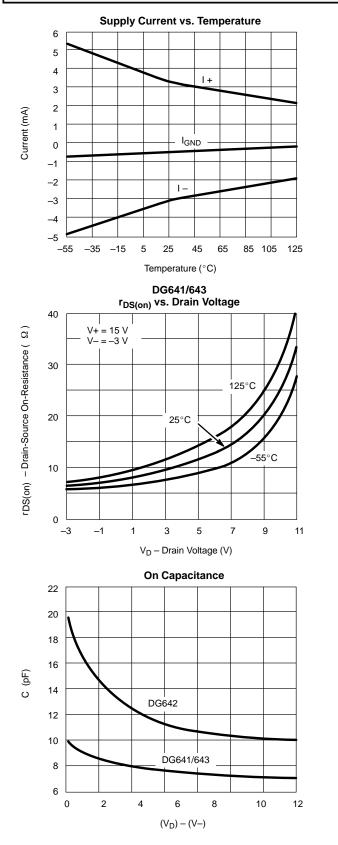
$ \begin{array}{ c c c c c c } \hline \mbox{Test Conditions} \\ \hline \mbox{Unless Otherwise Specified} \\ \hline \mbox{Parameter} & Symbol & V = 15 V, V = 3 V, \\ V_{NH1} = 2.4 V, V_{NL} = 0.8 V^{\circ} & Temp^{3} & Min^{5} & Typ^{6} & Max^{5} & Unit \\ \hline \mbox{Analog Signal Ranged} & V_{AHALOO} & V = -5 V, V + 12 V & Full & 0 & 8 & V \\ \hline \mbox{Value - 0.8 V^{\circ}} & -10 & 0 & 0 & 8 & V \\ \hline \mbox{Value - 0.8 V^{\circ}} & V_{-1} = 0 V, V_{+} = 12 V & Full & 0 & 0 & 8 & V \\ \hline \mbox{Drain-Source On-Resistance} & fp_{S(m)} & I_{S} = -10 mA, V_{p} = 0 V & Full & 0 & 5 & 4 & 9 & \Omega \\ \hline \mbox{Tosico_OMatch} & \Delta r_{DS(m)} & I_{S} = -10 mA, V_{p} = 0 V & Full & -5 & 0 & 4 & 0 & 200 \\ \hline \mbox{Tosico_OMatch} & \Delta r_{DS(m)} & I_{S} = -10 mA, V_{p} = 0 V & Full & -10 & -0.04 & 10 & 200 \\ \hline \mbox{Tosico_OMatch} & I_{D(m)} & V_{S} = 0 V, V_{p} = 0 V & Room & -10 & -0.04 & 10 & 200 \\ \hline \mbox{Tosico_OMatch} & I_{D(m)} & V_{S} = V_{p} = 0 V & Full & -10 & -0.04 & 10 & 200 \\ \hline \mbox{Tosico_OMatch} & I_{D(m)} & V_{S} = V_{p} = 0 V & Room & -10 & -0.04 & 10 & 200 \\ \hline \mbox{Tosico_OMatch} & I_{D(m)} & V_{S} = V_{p} = 0 V & Room & -10 & -0.04 & 10 & 200 \\ \hline \mbox{Tosico_OMatch} & I_{D(m)} & V_{S} = V_{p} = 0 V & Room & -10 & -0.04 & 10 & 200 \\ \hline \mbox{Tosico_OMatch} & I_{D(m)} & V_{S} = V_{p} = 0 V & Room & -10 & -0.04 & 10 & 200 \\ \hline \mbox{Tosico_OMatch} & I_{D(m)} & V_{S} = V_{p} = 0 V & Room & -10 & 0 & 0.05 & 1 & 0.05 \\ \hline \mbox{Topul Current} & I_{D(m)} & V_{NL} & V_{NL} & Full & -0 & 0.05 & 1 & 0.05 & 1 & 0.05 \\ \hline \mbox{Turent} & I_{NN} & V_{NL} & V_{N} = GN V & Room & 19 & 40 & 0.05 & 1 & 0.05 \\ \hline \mbox{Of State Input Capacitance^{d} & C_{S(m)} & V_{S} = 0 V & Room & 19 & 40 & 0.05 & 1 & 0.05 \\ \hline \mbox{Of State Optic Capacitance^{d} & C_{S(m)} & V_{S} = 0 V & Room & 19 & 40 & 0.05 & 1 & 0.05 \\ \hline \mbox{Of State Optic Capacitance^{d} & C_{S(m)} & V_{S} = 0 V & Room & 19 & 40 & 0.05 & 100 \\ \hline \mbox{Of State Optic Capacitance^{d} & C_{S(m)} & V_{S} = 0 V & Room & 19 & 40 & 0.05 & 100 \\ \hline \mbox{Of State Optic Capacitance^{d} & C_{S(m)} & V_{S} = 75, S_{S} = Figure 3 & Room$	SPECIFICATIONS FO	R DG642						
$\begin{array}{ c c c c c } \hline Parameter & Symbol & $V_{INH} = 0.8 \ V^{} & Temp^{a} & Min^{b} & Typ^{c} & Max^{b} & Unit \\ \hline \begin{tabular}{ c c c c } \hline Analog Switch & $V = -0 \ V, V_{H} = 12 \ V & $Full & -5 & $ & $ & $ & $V$ \\ \hline \begin{tabular}{ c c c c } \hline \begin{tabular}{ c c c c } \hline \begin{tabular}{ c c c } \hline \begin{tabular}{ c c c } \hline \begin{tabuar}{ c c c c } \hline \hline \$								
Analog Signal Ranged $V_{AMALOG}$ $V = -5 V, V + 12 V$ Full $-5$ $8$ $V$ Drain-Source On-Resistance         fpS(on) $I_S = -10 mA, V_D = 0 V$ Room $5$ $8$ $Q$ Taskown Match $\Delta T_{DS(on)}$ $I_S = -10 mA, V_D = 0 V$ Room $-0.04$ $10$ $Q$ Source Off Leakage Current $I_{S(off)}$ $V_S = 0 V, V_D = 10 V$ Room $-10$ $-0.04$ $10$ $Q$ Drain Off Leakage Current $I_{D(off)}$ $V_S = 10 V, V_D = 0V$ Room $-10$ $-0.2$ $10$ $10$	Parameter	Symbol		Temp <sup>a</sup>	Min <sup>b</sup>	Тур <sup>с</sup>	Max <sup>b</sup>	Unit
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Analog Switch							
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Appleg Signal Panged		V-=-5 V, V+=12 V	Full	-5		8	v
$\begin{array}{ c c c c c c c c c c c c c }  c c c c c $	Analog Signal Ranges	VANALOG	V– = GND, V+ = 12 V	Full	0		8	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Drain-Source On-Resistance	r <sub>DS(on)</sub>	I <sub>S</sub> = –10 mA, V <sub>D</sub> = 0 V			5		Ω
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	r <sub>DS(on)</sub> Match	$\Delta r_{DS(on)}$		Room		0.5	1	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	Source Off Leakage Current	I <sub>S(off)</sub>	$V_{S} = 0 V, V_{D} = 10 V$			-0.04		
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	Drain Off Leakage Current	I <sub>D(off)</sub>	$V_{S} = 10 \text{ V}, V_{D} = 0 \text{V}$			-0.04		nA
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Channel On Leakage Current	I <sub>D(on)</sub>	$V_{S} = V_{D} = 0 V$			-0.2		
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Digital Control	•		•		•	•	
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	Input Voltage High	V <sub>INH</sub>		Full	2.4			V
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Input Voltage Low	V <sub>INL</sub>		Full			0.8	v
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Input Current	I <sub>IN</sub>	V <sub>IN</sub> = GND or V+			0.05		μΑ
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Dynamic Characteristics							
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	On State Input Capacitanced	C <sub>S(on)</sub>	$V_{S} = V_{D} = 0 V$	Room		19	40	
BandwidthBW $R_L = 50 \Omega$ , See Figure 6Room500MHzTurn On Time $t_{ON}$ $R_L = 1 k\Omega$ , $C_L = 35 pF$ , See Figure 2 $Room$ $60$ $100$ 160 $ns$ Turn Off Time $t_{OFF}$ $t_{OFF}$ $C_L = 1000 pF$ , $V_D = 0$ V, See Figure 3 $Room$ $40$ $60$ 100 $ns$ Charge InjectionQ $C_L = 1000 pF$ , $V_D = 0$ V, See Figure 3 $Room$ $-40$ $pC$ Off IsolationRiN = 75 \Omega, $R_L = 75 \Omega$ , $f = 5$ MHz See Figure 4 $Room$ $-63$ $d$ All Hostile Crosstalk $X_{TALK(AH)}$ $R_{IN} = 10 \Omega$ , $R_L = 75 \Omega$ , $f = 5$ MHz See Figure 5 $Room$ $-85$ $d$ Positive Supply CurrentI+Negative Supply CurrentI+ $V_{IN} = 0$ V or $V_{IN} = 5$ V $Room$ $3.5$ $6$ 9 $mA$	Off State Input Capacitanced		$V_{S} = 0 V$	Room		8	20	pF
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Off State Output Capacitanced	C <sub>D(off)</sub>	$V_D = 0 V$	Room		8	20	
Turn Off TimetoN toFF $R_L = 1 k\Omega, C_L = 35 pF, See Figure 2$ FullImage: Constant of the second secon	Bandwidth	BW	$R_L = 50 \Omega$ , See Figure 6	Room		500		MHz
Turn Off Time $t_{OFF}$ RoomRoom4060Charge InjectionQ $C_L = 1000 \text{ pF}, V_D = 0 \text{ V}, \text{ See Figure 3}$ Room-40pCOff IsolationRIN = 75 $\Omega, R_L = 75 \Omega, f = 5 \text{ MHz}$ See Figure 4Room-63All Hostile Crosstalk $X_{TALK(AH)}$ $R_{IN} = 10 \Omega, R_L = 75 \Omega, f = 5 \text{ MHz}$ See Figure 5Room-85Power SuppliesPower Supply CurrentI+ $V_{IN} = 0 \text{ V or } V_{IN} = 5 \text{ V}$ Room3.56 9Nagative Supply CurrentII $V_{IN} = 0 \text{ V or } V_{IN} = 5 \text{ V}$ Room-6-3	Turn On Time	t <sub>ON</sub>	Ri = 1 kQ Ci = 35 pE. See Figure 2			60		ns
Off Isolation $R_{IN} = 75 \Omega, R_L = 75 \Omega, f = 5 MHz$ See Figure 4Room-63dBAll Hostile Crosstalk $X_{TALK(AH)}$ $R_{IN} = 10 \Omega, R_L = 75 \Omega, f = 5 MHz$ See Figure 5Room-85dBPower SuppliesPositive Supply CurrentI+ $V_{IN} = 0 V \text{ or } V_{IN} = 5 V$ $Room$ -6-3mA	Turn Off Time	t <sub>OFF</sub>	$R_{L} = 1 \text{ ks}_{2}, O_{L} = 30 \text{ pr}, 3ee Figure 2$			40		
On isolation     See Figure 4     Round     -63     dB       All Hostile Crosstalk $X_{TALK(AH)}$ $R_{IN} = 10 \Omega, R_L = 75 \Omega, f = 5 MHz$ See Figure 5     Room     -85     dB       Power Supplies       Positive Supply Current     I+ $V_{IN} = 0 V \text{ or } V_{IN} = 5 V$ $Room$ $3.5$ $6$ Room     -6     -3     mA	Charge Injection	Q	$C_L$ = 1000 pF, $V_D$ = 0 V, See Figure 3	Room		-40		рС
All Hostile Crosstalk $X_{TALK(AH)}$ $R_{IN} = 10 \Omega, R_L = 75 \Omega, f = 5 MHz$ See Figure 5     Room     -85       Power Supplies       Positive Supply Current     I+ $V_{IN} = 0 V \text{ or } V_{IN} = 5 V$ $Room$ $See Figure 5$ Room     -85 $Room$ Room $Room$ $Room$ Full $Room$ $Room$ Room $Room$ $Room$	Off Isolation		$R_{IN} = 75 \Omega$ , $R_L = 75 \Omega$ , $f = 5 MHz$ See Figure 4	Room		-63		dB
Positive Supply Current I+ $V_{IN} = 0 \forall \text{ or } V_{IN} = 5 \forall$ Room Full Room $-6$ $-3$ MA	All Hostile Crosstalk	X <sub>TALK(AH)</sub>	$R_{IN} = 10 \Omega$ , $R_L = 75 \Omega$ , $f = 5 MHz$ See Figure 5	Room		-85		
Positive Supply Current I+ $V_{IN} = 0 \text{ V or } V_{IN} = 5 \text{ V}$ Full Room $-6$ $-3Max$	Power Supplies							
Nogative Supply Current Room -6 -3	Positive Supply Current	l+	$V_{IN} = 0 V \text{ or } V_{IN} = 5 V$			3.5		- A
	Negative Supply Current	I–				-3		- mA

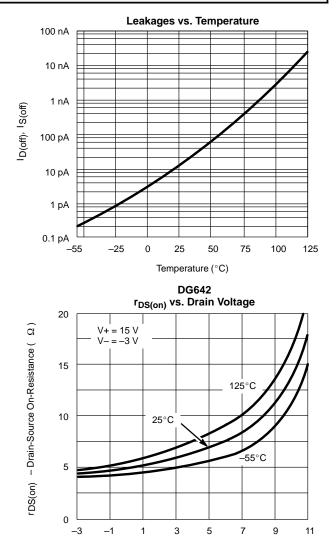
Notes:
a. Room = 25°C, Full = as determined by the operating temperature suffix.
b. The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this data sheet.
c. Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing.
d. Guaranteed by design, not subject to production test.
e. V<sub>IN</sub> = input voltage to perform proper function.



## TYPICAL CHARACTERISTICS (25°C UNLESS NOTED)

VISHA





V<sub>D</sub> – Drain Voltage (V) Off Isolation

-110 -100

-90

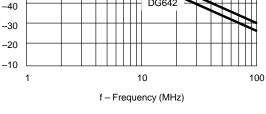
-80

-70

-60

-50

OIRR (dB)



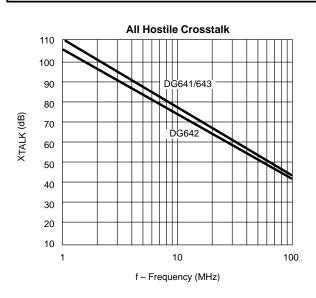
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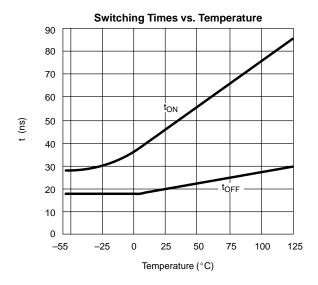
# DG641/642/643

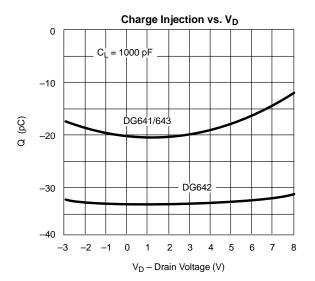
## **Vishay Siliconix**

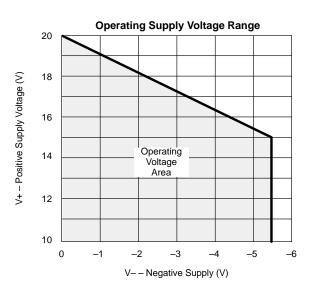


## TYPICAL CHARACTERISTICS (25°C UNLESS NOTED)





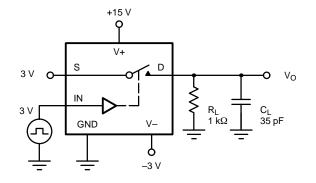


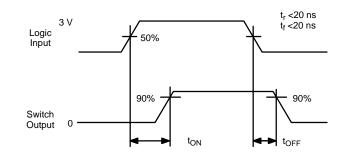




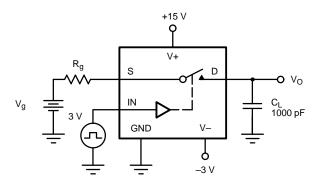
# DG641/642/643 Vishay Siliconix

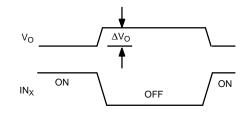
## **TEST CIRCUITS**





#### FIGURE 2. Switching Time





 $\Delta V_O$  = measured voltage error due to charge injection The charge injection in coulombs is Q = C<sub>L</sub> x  $\Delta V_O$ 



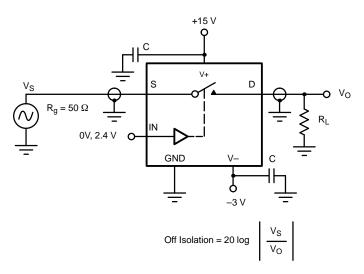


FIGURE 4. Off Isolation

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## **TEST CIRCUITS**

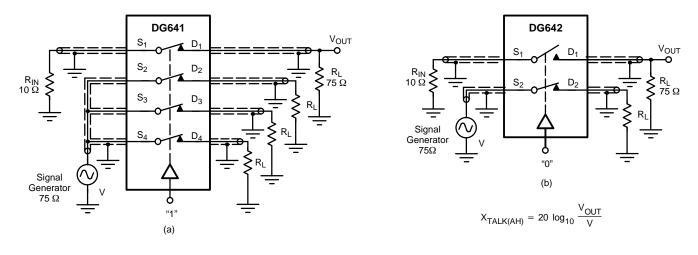


FIGURE 5. All Hostile Crosstalk - XTALK(AH)

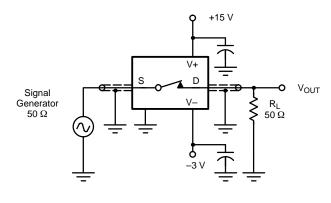


FIGURE 6. Bandwidth

## **APPLICATIONS**

#### **Device Description**

The DG641/642/643 switches offer true bidirectional switching of high frequency analog or digital signals with minimum signal crosstalk, low insertion loss, and negligible non-linearity distortion and group delay.

Built on the Siliconix D/CMOS process, these switches provide excellent off-isolation with a bandwidth of around 500 MHz. The silicon-gate D/CMOS processing also yields fast switching speeds.

An on-chip regulator circuit maintains TTL input compatibility over the whole operating supply voltage range shown, easing control logic interfacing. Circuit layout is facilitated by the interchangeability of source and drain terminals.

#### **Frequency Response**

A single switch on-channel exhibits both resistance  $[r_{DS(on)}]$  and capacitance  $[C_{S(on)}]$ . This RC combination has an attenuation effect on the analog signal – which is frequency dependent (like an RC low-pass filter). The –3 dB bandwidth of the DG641/642/643 is typically 500 MHz (into 50  $\Omega$ ).



### **APPLICATIONS**

#### **Power Supplies**

Power supply flexibility is a useful feature of the DG641/642/643 series. It can be operated from a single positive supply (V+) if required (V– connected to ground).

Note that the analog signal must not exceed V– by more than -0.3 V to prevent forward biasing the substrate p-n junction. The use of a V– supply has a number of advantages:

- 1. It allows flexibility in analog signal handling, i.e., with V-= -5 V and V+ = 12 V; up to  $\pm 5$ -V ac signals can be controlled.
- 2. The value of on capacitance  $[C_{S(on)}]$  may be reduced. A property known as 'the body-effect' on the DMOS switch devices causes various parametric effects to occur. One of these effects is the reduction in  $C_{S(on)}$  for an increasing V body-source. Note however that to increase V-normally requires V+ to be reduced (since V+ to V-=21 V max.). A reduction in V+ causes an increase in  $r_{DS(on)}$ , hence a compromise has to be achieved. It is also useful to note that tests indicate that optimum video linearity performance (e.g., differential phase and gain) occurs when V- is around -3 V.
- V- eliminates the need to bias the analog signal using potential dividers and large coupling capacitors.

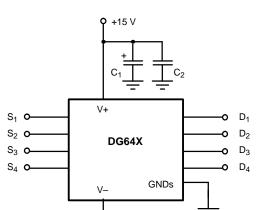
#### Decoupling

It is an established rf design practice to incorporate sufficient bypass capacitors in the circuit to decouple the power supplies to all active devices in the circuit. The dynamic performance of the DG641/642/643 series is adversely affected by poor decoupling of power supply pins. Also, of even more significance, since the substrate of the device is connected to the negative supply, adequate decoupling of this pin is essential. Suitable decoupling capacitors are 1- to  $10\text{-}\mu\text{F}$  tantalum bead, plus 10- to 100-nF ceramic or polyester.

#### Rules:

- 1. Decoupling capacitors should be incorporated on all power supply pins (V+, V–). (See Figure 7).
- 2. They should be mounted as close as possible to the device pins.
- Capacitors should be of a suitable type with good high frequency characteristics – tantalum bead and/or ceramic disc types are adequate.

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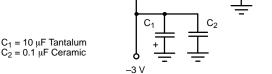


FIGURE 7. Supply Decoupling

#### **Board Layout**

PCB layout rules for good high frequency performance must also be observed to achieve the performance boasted by these analog switches. Some tips for minimizing stray effects are:

- 1. Use extensive ground planes on double sided PCB, separating adjacent signal paths. Multilayer PCB is even better.
- 2. Keep signal paths as short as practically possible, with all channel paths of near equal length.
- 3. Careful arrangement of ground connections is also very important. Star connected system grounds eliminate signal current, flowing through ground path parasitic resistance, from coupling between channels.

Figure 8 shows a 4-channel video multiplexer using a DG641.

In Figure 9, two coax cables terminated on 75  $\Omega$  bring two video signals to the DG642 switch. The two drains tied together lower the on-state capacitance. An Si582 video amplifier drives a double terminated 75- $\Omega$  cable. The double terminated coax cable eliminates line reflections.

## DG641/642/643 Vishay Siliconix



## APPLICATIONS

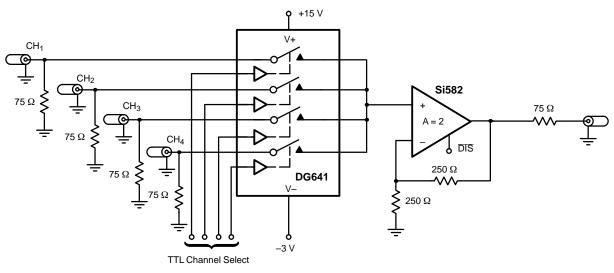


FIGURE 8. 4 by 1 Video Multiplexing Using the DG641

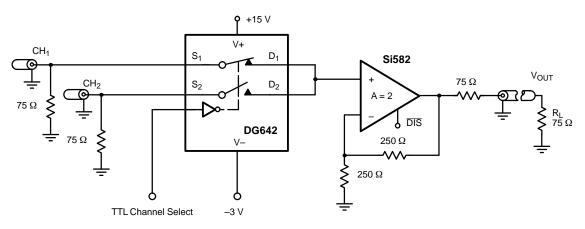


FIGURE 9. 2-Channel Video Selector Using the DG642

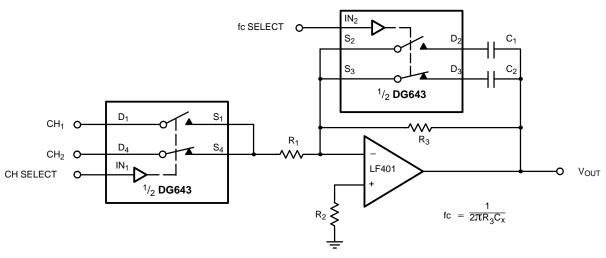


FIGURE 10. Active Low Pass Filter with Selectable Inputs and Break Frequencies

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