



## 4066

## CMOS IC

### QUAD BILATERAL SWITCH

#### DESCRIPTION

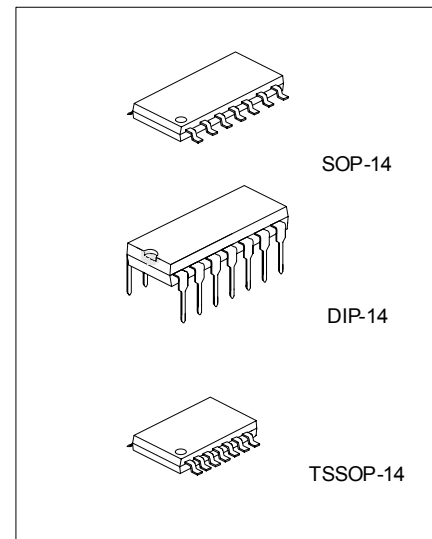
The UTC **4066** is a quad bilateral switch intended for the transmission or multiplexing of analog or digital signals.

#### FEATURES

- \* Wide supply voltage range: 3V ~ 15V.
- \* High noise immunity : 0.45V<sub>DD</sub> (typ.)
- \* Wide range of digital and ± 7.5V<sub>PEAK</sub> analog switching
- \* "ON" resistance for 15V operation : 80Ω
- \* Matched "ON" resistance : R<sub>ON</sub>=5Ω (typ.) over 15V signal input
- \* "ON" resistance flat over peak-to-peak signal range
- \* High "ON" / "OFF" : 65 dB (typ.) output voltage ratio @ f<sub>IS</sub>=10kHz, R<sub>L</sub>=10kΩ
- \* High degree linearity: 0.1% distortion (typ.) @ f<sub>IS</sub>=1kHz, V<sub>IS</sub>=5Vp-p. V<sub>DD</sub>-V<sub>SS</sub>=10V, R<sub>L</sub>=10kΩ
- \* Extremely low "OFF" : 0.1nA (typ.) switch leakage @V<sub>DD</sub>-V<sub>SS</sub>=10V, Ta=25
- \* Extremely high control input impedance : 10<sup>12</sup>Ω (typ.)
- \* Low crosstalk : -50dB (typ.) between switches @ f<sub>IS</sub>=0.9MHz, R<sub>L</sub>=1kΩ
- \* Frequency response, switch "ON" : 40MHz (typ.)

#### ORDERING INFORMATION

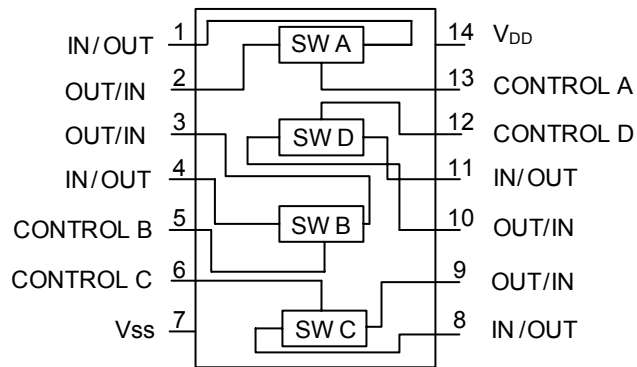
Ordering Number		Package	Packing
Normal	Lead Free Plating		
4066-D14-T	4066L-D14-T	DIP-14	Tube
4066-S14-R	4066L-S14-R	SOP-14	Tape Reel
4066-S14-T	4066L-S14-T	SOP-14	Tube
4066-P14-R	4066L-P14-R	TSSOP-14	Tape Reel
4066-P14-T	4066L-P14-T	TSSOP-14	Tube



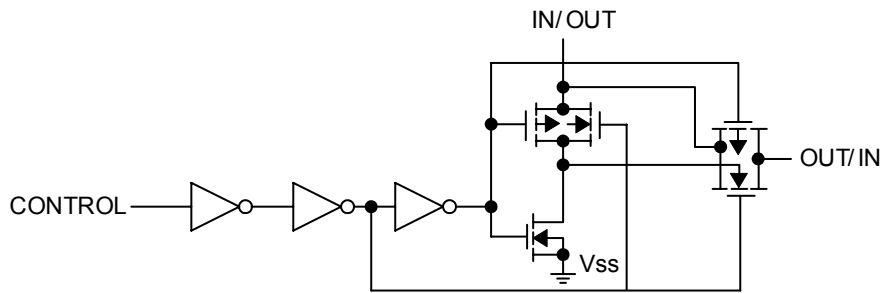
\*Pb-free plating product number: 4066L

<p>4066L-D14-T</p> <p>(1)Packing Type (2)Package Type (3)Lead Plating</p>	<p>(1) R: Tape Reel, T: Tube (2) D14: DIP-14, S14: SOP-14, P14: TSSOP-14 (3) L: Lead Free Plating Blank: Pb/Sn</p>
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■ PIN CONFIGURATION



■ SCHEMATIC DIAGRAM



■ ABSOLUTE MAXIMUM RATINGS ( $V_{SS}=0V$ , unless otherwise specified)

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	$V_{DD}$	-0.5 ~ +18	V
Input Voltage	$V_{IN}$	-0.5 ~ $V_{CC}+0.5$	V
Power Dissipation	DIP-14	700	mW
	SOP-14	500	mW
	TSSOP-14	500	mW
Junction Temperature	$T_J$	+125	°C
Storage Temperature	$T_{STG}$	-40 ~ +150	°C

Note Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.

■ RECOMMENDED OPERATING CONDITIONS ( $V_{SS}=0V$ , unless otherwise specified)

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	$V_{DD}$	3 ~ 15	V
Input Voltage	$V_{IN}$	0 ~ $V_{DD}$	V
Operating Temperature Range	$T_{OPR}$	-40 ~ +85	°C

■ DC ELECTRICAL CHARACTERISTICS ( $V_{SS}=0V$ , unless otherwise specified)

PARAMETER	SYMBOL	CONDITIONS	-40°C		+25°C			+85°C		UNITS
			MIN	MAX	MIN	TYP	MAX	MIN	MAX	
Quiescent Device Current	$I_{DD}$	$V_{DD}=5V$		1.0		0.01	1.0		7.5	$\mu A$
		$V_{DD}=10V$		2.0		0.01	2.0		15	$\mu A$
		$V_{DD}=15V$		4.0		0.01	4.0		30	$\mu A$
<b>SIGNAL INPUTS AND OUTPUTS</b>										
Input or Output Leakage Switch "OFF"	$I_{IS}$	$V_C=0$		$\pm 50$		$\pm 0.1$	$\pm 50$		$\pm 200$	nA
"ON" Resistance	$R_{ON}$	$R_L=10k\Omega \sim (V_{DD}-V_{SS}/2)$ $V_C=V_{DD}, V_{SS} \sim V_{DD}$								
		$V_{DD}=5V$		850		270	1050		1200	$\Omega$
		$V_{DD}=10V$		330		120	400		520	$\Omega$
		$V_{DD}=15V$		210		80	240		300	$\Omega$
"ON" Resistance Between Any 2 of 4 Switches	$R_{ON}$	$R_L=10k\Omega \sim (V_{DD}-V_{SS}/2)$ $V_C=V_{DD}, V_{IS}=V_{SS} \sim V_{DD}$								
		$V_{DD}=10V$				10				$\Omega$
		$V_{DD}=15V$				5				$\Omega$
<b>CONTROL INPUTS</b>										
Low Level Input Voltage	$V_{ILC}$	$V_{IS}=V_{SS}$ and $V_{DD}$ $V_{OS}=V_{DD}$ and $V_{SS}$ $I_{IS}=\pm 10\mu A$								
		$V_{DD}=5V$		1.5		2.25	1.5		1.5	V
		$V_{DD}=10V$		3.0		4.5	3.0		3.0	V
		$V_{DD}=15V$		4.0		6.75	4.0		4.0	V
HIGH Level Input Voltage	$V_{IHC}$	$V_{DD}=5V$	3.5		3.5	2.75		3.5		V
		$V_{DD}=10V$ (Note 4)	7.0		7.0	5.5		7.0		V
		$V_{DD}=15V$	11.0		11.0	8.25		11.0		V
Input Current	$I_{IN}$	$V_{DD}-V_{SS}=15V$ $V_{DD} \quad V_{IS} \quad V_{SS}$ $V_{DD} \quad V_C \quad V_{SS}$		$\pm 0.3$		$\pm 10^{-5}$	$\pm 0.3$		$\pm 1.0$	$\mu A$

■ AC ELECTRICAL CHARACTERISTICS (AC Parameters are guaranteed by DC correlated testing)

( $T_a=25^\circ\text{C}$ ,  $t_r=t_f=20\text{ ns}$  and  $V_{ss}=0\text{V}$  unless otherwise)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Propagation Delay Time Signal Input to Signal Output	$T_{PHL}, T_{PLH}$	$V_c=V_{DD}, C_L=50\text{pF}$ , (Figure 1) $R_L=200\text{k}$	$V_{DD}=5\text{V}$	25	55	ns
			$V_{DD}=10\text{V}$	15	35	ns
			$V_{DD}=15\text{V}$	10	25	ns
Propagation Delay Time Control Input to Signal Output High Impedance to Logical Level	$t_{PZH}, t_{PLZ}$	$R_L=1.0\text{k}\Omega, C_L=50\text{pF}$ (Figure 2, Figure 3)	$V_{DD}=5\text{V}$		125	ns
			$V_{DD}=10\text{V}$		60	ns
			$V_{DD}=15\text{V}$		50	ns
Propagation Delay Time Control Input to Signal Output Logical Level to High Impedance	$t_{PHZ}, t_{PLZ}$	$R_L=1.0\text{k}\Omega, C_L=50\text{pF}$ , (Figure 2, Figure 3) $V_{DD}=5\text{V}$ $V_{DD}=10\text{V}$ $V_{DD}=15\text{V}$			125	ns
					60	ns
Sine Wave Distortion	$t_{PHZ}, t_{PLZ}$	$V_c=V_{DD}=5\text{V}, V_{ss}=-5\text{V}$ $R_L=10\text{k}\Omega, V_{IS}=5\text{V}_{P-P}, f=1\text{kHz}$ , (Figure 4)		0.1	50	%
Frequency Response -Switch "ON" (Frequency at -3dB)	$t_{PHZ}, t_{PLZ}$	$V_c=V_{DD}=5\text{V}, V_{ss}=-5\text{V}$ $R_L=1\text{k}\Omega, V_{IS}=5\text{V}_{P-P}$ $20 \text{ Log}_{10} V_{OS}/V_{OS} (1\text{kHz})\text{-dB}$ (Figure 4)		40		MHz
Feedthrough - Switch "OFF" (Frequency at -50 dB)		$V_{DD}=5.0\text{V}, V_{CC}=V_{SS}=-5.0\text{V}$ , $R_L=1\text{k}\Omega, V_{IS}=5.0\text{V}_{P-P}, 20\text{Log}_{10}$ , $V_{OS}/V_{IS}=-50\text{dB}$ , (Figure 4)		1.25		
Crosstalk Between Any Two Switches(Frequency at -50dB)		$V_{DD}=V_C(A)=5.0\text{V}; V_{SS}=V_C(B)=5.0\text{V}$ , $R_L=1\text{k}\Omega, V_{IS}(A)=5.0\text{V}_{P-P}, 20\text{Log}_{10}$ , $V_{OS}(B)/V_{IS}(A)=-50\text{dB}$ (Figure 5)		0.9		MHz
Crosstalk; Control Input to Signal Output		$V_{DD}=10\text{V}, R_L=10\text{k}\Omega, R_{IN}=1.0\text{k}\Omega$ $V_{CC}=10\text{V}$ Square Wave, $C_L=50\text{pF}$ (Figure 6)		150		$\text{mV}_{P-P}$
Maximum Control Input		$R_L=1.0\text{k}\Omega, C_L=50\text{pF}$ , (Figure 7) $V_{OS}(f)=1/2V_{OS} (1.0\text{kHz})$	$V_{DD}=5.0\text{V}$		6.0	MHz
			$V_{DD}=10\text{V}$		8.0	MHz
			$V_{DD}=15\text{V}$		8.5	MHz
Signal Input Capacitance	$C_{IS}$			8.0		pF
Signal Output Capacitance	$C_{OS}$	$V_{DD}=10\text{V}$		8.0		pF
Feedthrough Capacitance	$C_{IOS}$	$V_C=0\text{V}$		0.5		pF
Control Input Capacitance	$C_{IN}$			5.0	7.5	pF

Note 1: These devices should not be connected to circuits with the power "ON"

Note 2: In all cases, there is approximately 5pF of probe and jig capacitance in the output; however, this capacitance is included in  $C_L$  wherever it is specified.

Note 3:  $V_{IS}$  is the voltage at the in/out pin and  $V_{OS}$  is the voltage at the out/in pin.  $V_c$  is the voltage at the control input.

Note 4: Conditions for  $V_{IHC}$ : (a)  $V_{IS}=V_{DD}$ ,  $I_{OS}$ =standard B series  $I_{OH}$ . (b)  $V_{IS}=0\text{V}$ ,  $I_{OL}$ =standard B series  $I_{OL}$

■ SPECIAL CONSIDERATIONS

In applications where separate power sources are used to drive  $V_{DD}$  and the signal input, the  $V_{DD}$  current capability should exceed  $V_{DD}/R_L$  ( $R_L$ =effective external load of the UTC 4066 bilateral switches).This provision avoids any permanent current flow or clamp action of the  $V_{DD}$  supply when power is applied or removed from UTC 4066.

In certain applications, the external load-resistor current may include both  $V_{DD}$  and Signal-line components. To avoid drawing  $V_{DD}$  current when switch current flows into terminals 1,4,8 or 11,the voltage drop across the bidirectional swith must not exceed 0.6V at  $T_a \leq 25$  , or 0.4V at  $T_a > 25$  (calculated from  $R_{ON}$  values shown).

NO  $V_{DD}$  current will flow through  $R_L$  if the switch current flows into terminals 2, 3, 9 or 10.

■ AC TEST CIRCUITS AND SWITCHING TIME WAVEFORMS

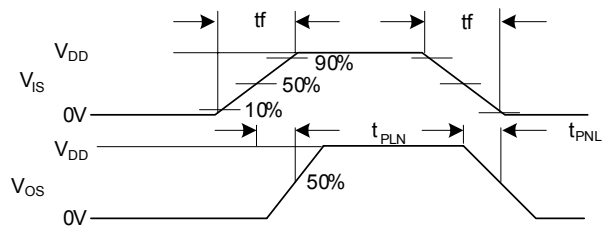
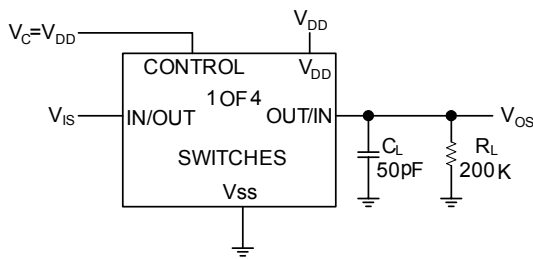


FIGURE 1.  $t_{PHL}$ ,  $t_{PLH}$  Propagation Delay Time Signal Input to Signal Output

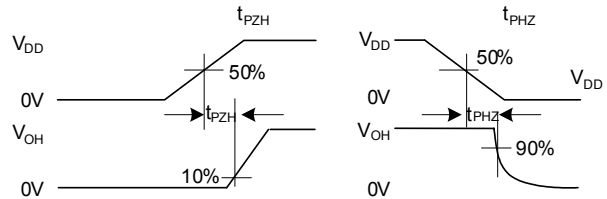
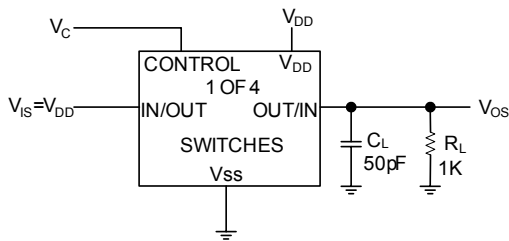


FIGURE 2.  $t_{PZH}$ ,  $t_{PHZ}$  Propagation Delay Time Control to Signal Output

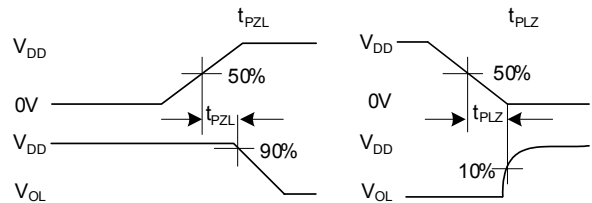
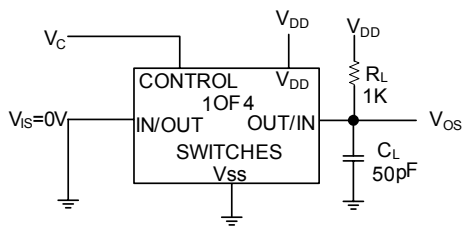
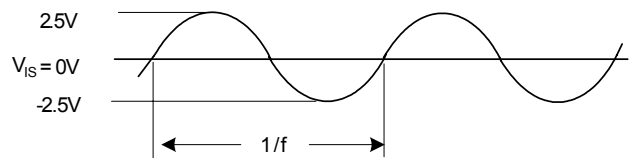
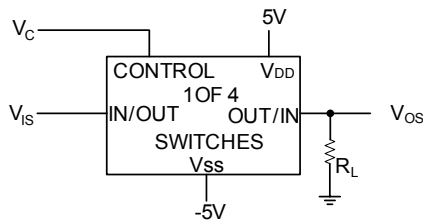


FIGURE 3.  $t_{PZL}$ ,  $t_{PLZ}$  Propagation Delay Time Control to Signal Output



$V_c = V_{DD}$  for distortion and frequency response tests  
 $V_c = V_{SS}$  for feedthrough test

FIGURE 4. Sine Wave Distortion, Frequency Response and Feedthrough

■ AC TEST CIRCUITS AND SWITCHING TIME WAVEFORMS(Cont.)

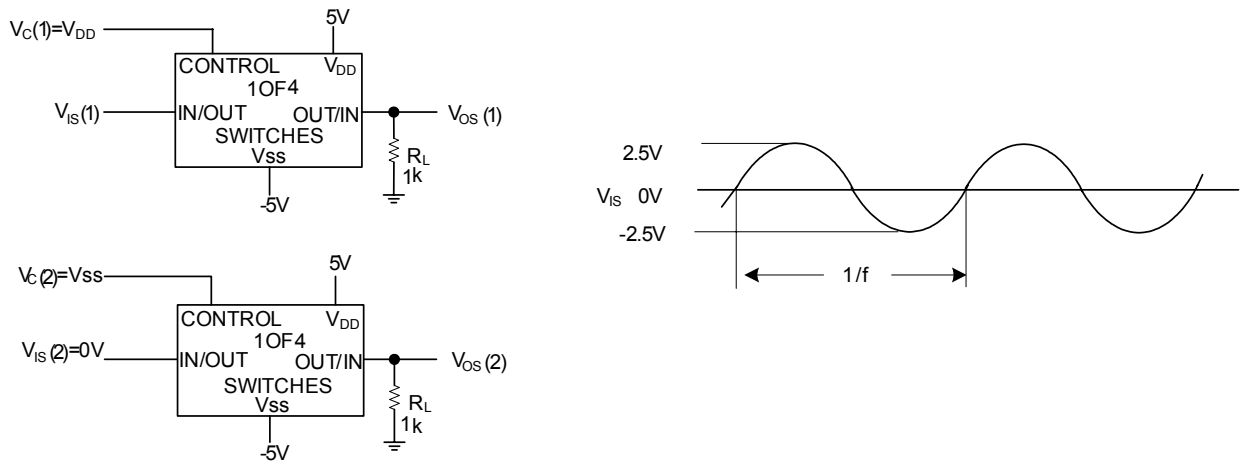


FIGURE 5. Crosstalk Between Any Two Switches

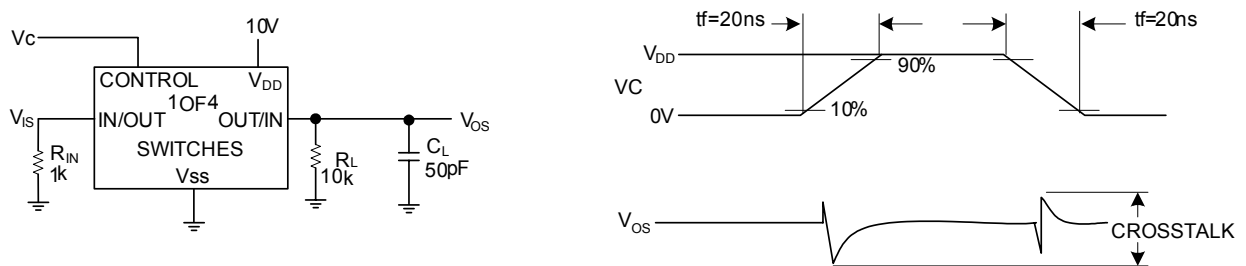


FIGURE 6. Crosstalk: Control Input to Signal Output

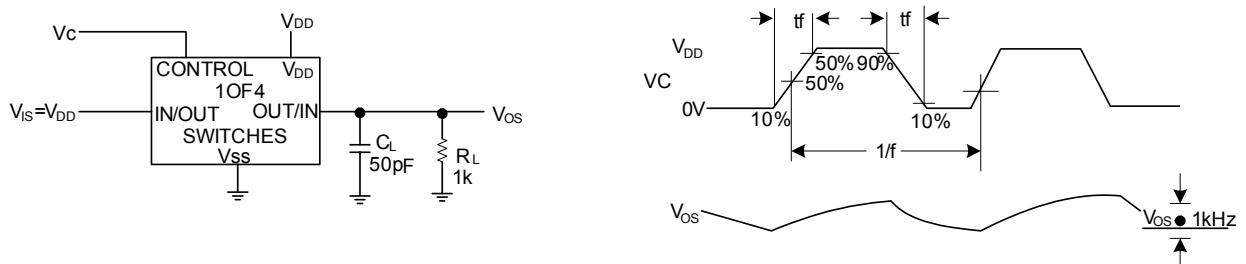
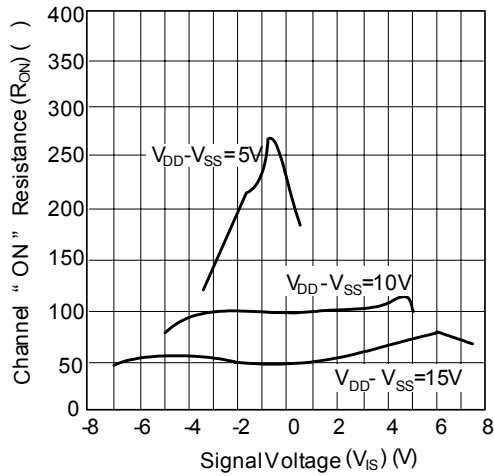


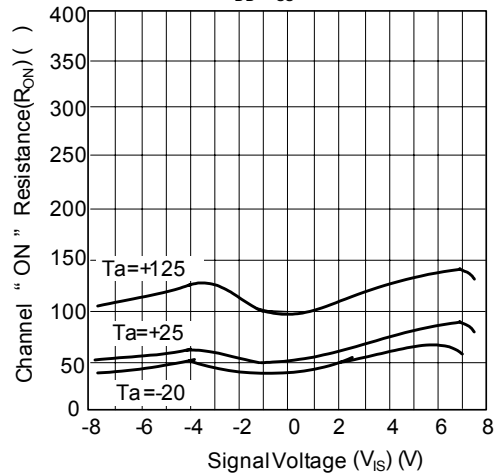
FIGURE 7. Maximum Control Input Frequency

■ TYPICAL PERFORMANCE CHARACTERISTICS

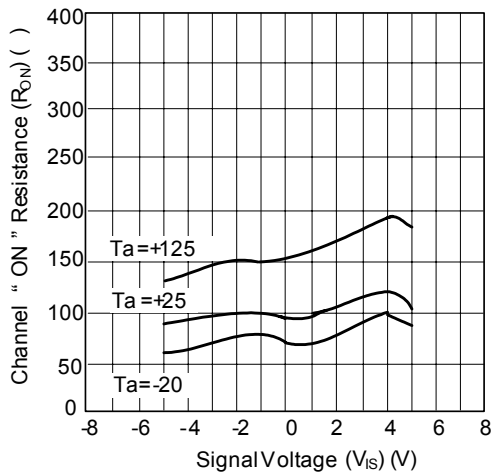
"ON" Resistance vs Signal Voltage for  $T_a=25$



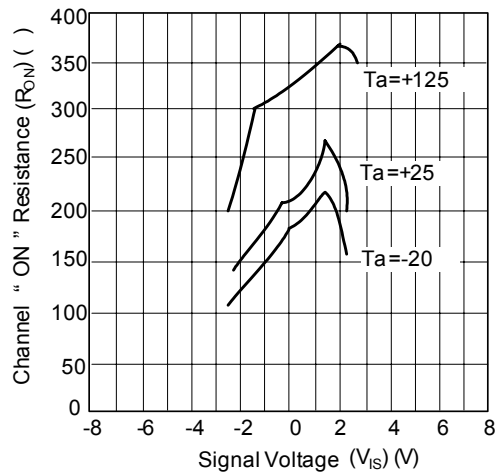
"ON" Resistance as a Function of emperature for  $V_{DD}-V_{SS}=15V$



"ON" Resistance as a Function of Temperature for  $V_{DD}-V_{SS}=10V$



"ON" Resistance as a Function of Temperature for  $V_{DD}-V_{SS}=15V$



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