Level Shifter

General Description

The RT8900 is an 8-Channel level shifter suitable for TFT-LCD row drivers. The RT8900 will level shift a digital input signal to an output voltage nearly equal to its output supply voltages. The RT8900 has 3 supplies : VGH1 and VGH2 are positive supplies with a voltage range from 20V to 35V and VGL is the negative supply with a voltage range from –5V to –10V. Outputs 0 to 5 are supplied from VGH1 and VGL. Outputs 6 and 7 are supplied from VGH2 and VGL. This configuration enables outputs 0 to 5 to provide slicing to the TFT-LCD row drivers to reduce flicker. VGH2 should be remained constant. The RT8900 is available in TSSOP-20 and WQFN-20L 4x4 packages.

Ordering Information

RT8900□□

- Package Type
  C : TSSOP-20
- Lead Plating System
  P : Pb Free
  G : Green (Halogen Free and Pb Free)

RT8900□□

- Package Type
  QW : WQFN-20L 4x4 (W-Type)
  (Exposed Pad-Option 1)
- Lead Plating System
  Z : ECO (Ecological Element with Halogen Free and Pb free)

Note :

Richtek products are :

- RoHS compliant and compatible with the current requirements of IPC/JEDEC J-STD-020.
- Suitable for use in SnPb or Pb-free soldering processes.

Features

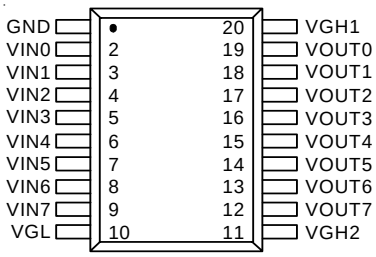
- **0V to 6V Input Logic level Range**
- **–10V to 35V Output Voltage Range**
- **15mA Output Continuous Current (per channel)**
- **150mA Output Peak Current (per channel)**
- **Rise/Fall Times 9ns/10ns**
- **Propagation Delay 55ns**
- **100kHz Input Frequency**
- **15μA Ultra-low Quiescent Current**
- **20-Lead TSSOP and WQFN 4x4 Packages**
- **RoHS Compliant and Halogen Free**

Applications

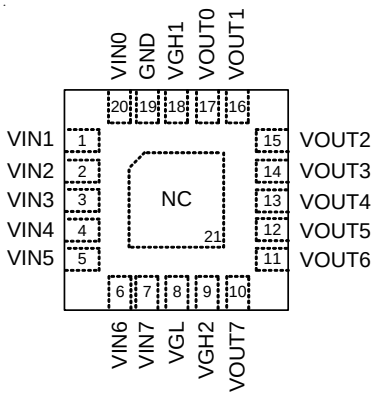
- **TFT-LCD Panels**

Pin Configurations

(TOP VIEW)



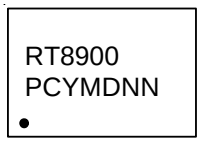
TSSOP-20



WQFN-20L 4x4

Marking Information

RT8900PC



RT8900PC : Product Number

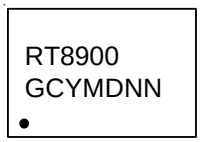
YMDNN : Date Code

RT8900ZQW

DJ : Product Code

YMDNN : Date Code

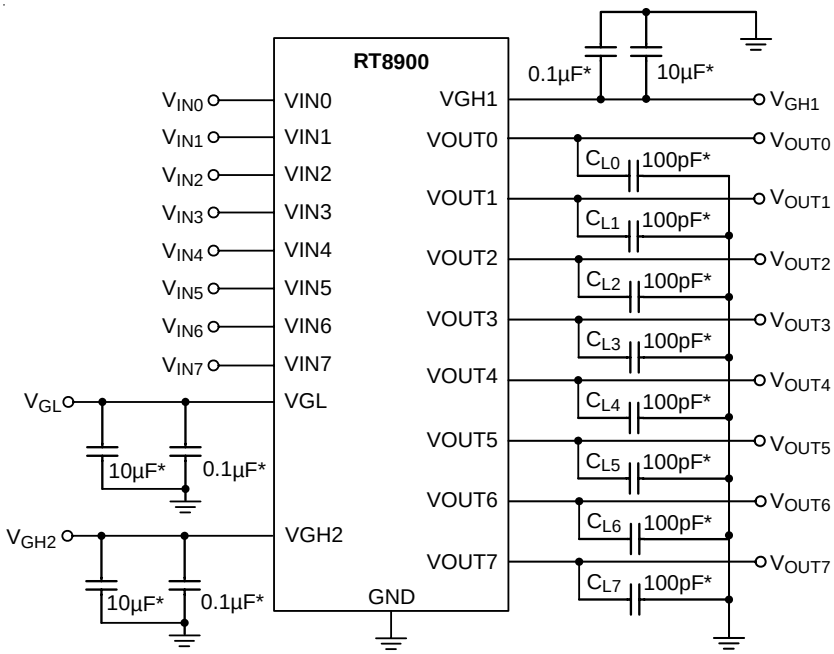
RT8900GC



RT8900GC : Product Number

YMDNN : Date Code

Typical Application Circuit

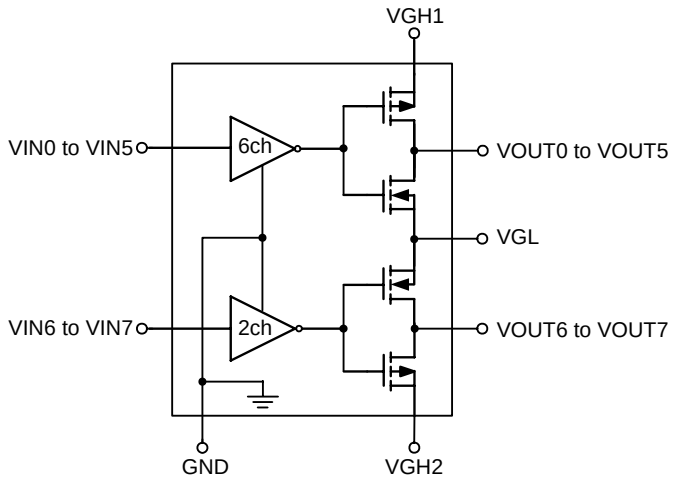


* Rated Voltage = 50V

Functional Pin Description

Pin Number		Pin Name	Pin Function
TSSOP-20	WQFN-20L 4x4		
1	19	GND	Ground.
2 to 9	20, 1 to 7	VIN0 to VIN7	Low-Voltage Input.
10	8	VGL	Negative Power Input for Channel 0 to 7.
11	9	VGH2	Positive Power Input for Channel 6 and 7.
12 to 19	10 to 17	VOUT7 to VOUT0	High-Voltage Output.
20	18	VGH1	Positive Power Input for Channel 0 to 5. (VGH1 ≤ VGH2)
--	21 (Exposed Pad)	NC	No Internal Connection. The Exposed Pad must be soldered to a large PCB for maximum power dissipation.

Function Block Diagram



Absolute Maximum Ratings (Note 1)

- Positive Supply Voltage, VGH2 to GND ---------- –0.3V to 40V
- Positive Supply Voltage, VGH1 to GND ---------- –0.3V to VGH2
- Positive Supply Voltage, VGH1, VGH2 to VGL ---------- –0.3V to 50V
- Negative Supply Voltage, VGL to GND ---------- –40V to 0.3V
- Input Voltage Range, VIN0...VIN7 to GND ---------- –0.3V to 7V
- Output Voltage Range, VOUT0...VOUT7 to GND ---------- –40V to 40V
- Output Voltage Range, VOUT0...VOUT7 to VGL ---------- –0.3V to 50V
- Power Dissipation, P_D @ T_A = 25°C
  - TSSOP-20 ---------- 0.813W
  - WQFN-20L 4x4 ---------- 1.852W
- Package Thermal Resistance (Note 2)
  - TSSOP-20, θ_{JA} ---------- 123°C/W
  - WQFN-20L 4x4, θ_{JA} ---------- 54W
  - WQFN-20L 4x4, θ_{JC} ---------- 7W
- Lead Temperature (Soldering, 10 sec.) ---------- 260°C
- Storage Temperature Range ---------- –65°C to 150°C
- Junction Temperature ---------- 150°C
- ESD Susceptibility (Note 3)
  - HBM (Human Body Mode) ---------- 2kV
  - MM (Machine Mode) ---------- 200V

Recommended Operating Conditions (Note 4)

- VGH1, VGH2 to VGL ---------- 10.8V to 45V
- VGH1, VGH2 to GND ---------- 10.8V to 35V
- VGL to GND ---------- –35V to 0V
- Junction Temperature Range ---------- –40°C to 125°C
- Ambient Temperature Range ---------- –40°C to 85°C

Electrical Characteristics

(VGH1 = VGH2 = 25V to 30V, VGL= –5V to –10V, GND = 0V, T_A = 25°C, unless otherwise specified.)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Input High Threshold Voltage	V_{INxH}		1.7	--	6	V
Input Low Threshold Voltage	V_{INxL}		0	--	0.8	V
Input leakage Current	I_{IL}	$V_{VIN0\ to\ 7}$ = 0V or 5.5V	–1	--	1	μA
Output High Voltage	V_{OH}	V_{VGH1} = V_{VGH2} = 27V, V_{VGL} = –7V, I_{OH} = –10mA	$V_{VGH1,2}$ –1	--	--	V
Output Low Voltage	V_{OL}	V_{VGH1} = V_{VGH2} = 27V, V_{VGL} = –7V, I_{OL} = 10mA	--	--	VGL + 1	V
Output Impedance	R_O	V_{VGH1} = V_{VGH2} = 27V, V_{VGL} = –7V, I_{OH} = –10mA/I_{OL} = 10mA	--	16	--	Ω
Low to High Transition (Note 5)	t_{PLH}	V_{VGH1} = V_{VGH2} = 27V, V_{VGL} = –7V	--	47	--	ns

To be continued

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
High to Low Transition (Note 5)	t_{PHL}	V_{VGH1} = V_{VGH2} = 27V, V_{VGL} = −7V	--	55	--	ns
Rise Time (Note 5)	t_R	V_{VGH1} = V_{VGH2} = 27V, V_{VGL} = −7V	--	9	--	ns
Fall Time (Note 5)	t_F	V_{VGH1} = V_{VGH2} = 27V, V_{VGL} = −7V	--	10	--	ns
Maximum Operation Frequency	f_O	V_{VGH1} = V_{VGH2} = 27V, V_{VGL} = −7V	50	100	--	kHz
Quiescent I_{VGH1}	I_{VGH1}	$V_{VIN0\ to\ 7}$ = 0 or 6V, No Load	--	0	--	μA
Quiescent I_{VGH2}	I_{VGH2}	$V_{VIN0\ to\ 7}$ = 0 or 6V, No Load	--	15	--	μA
Quiescent I_{VGL}	I_{VGL}	$V_{VIN0\ to\ 7}$ = 0 or 6V, No Load	--	0	--	μA

Note 1. Stresses listed as the above "Absolute Maximum Ratings" may cause permanent damage to the device. These are for stress ratings. 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 remain possibility to affect device reliability.

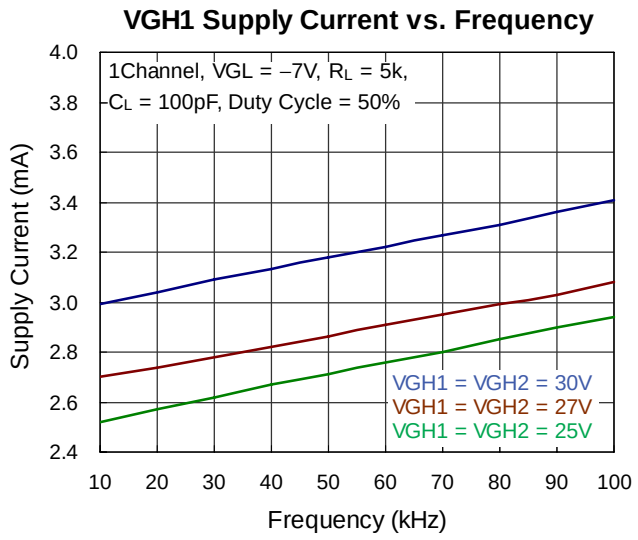
Note 2. For WQFN-20L 4x4, θ_{JA} is measured in natural convection at T_A = 25°C on a high-effective thermal conductivity four-layer test board of JEDEC 51-7 thermal measurement standard. The measurement case position of θ_{JA} is on the exposed pad of the package. For TSSOP-20, θ_{JA} is measured in natural convection at T_A = 25°C on a low-effective thermal conductivity single-layer test board of JEDEC 51-3 thermal measurement standard.

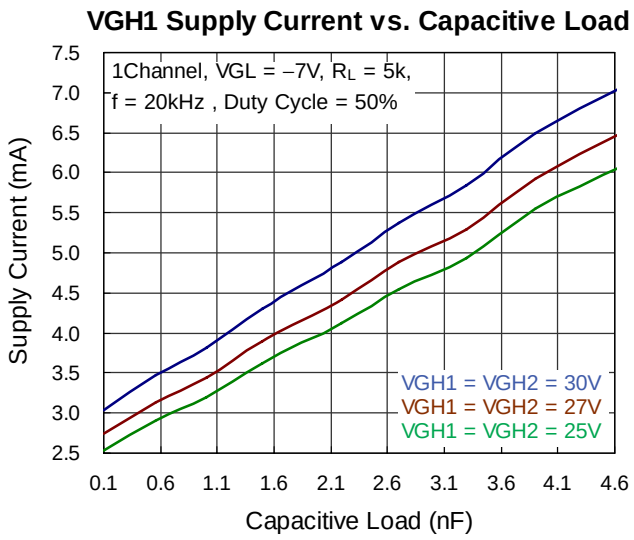
Note 3. Devices are ESD sensitive. Handling precaution is recommended.

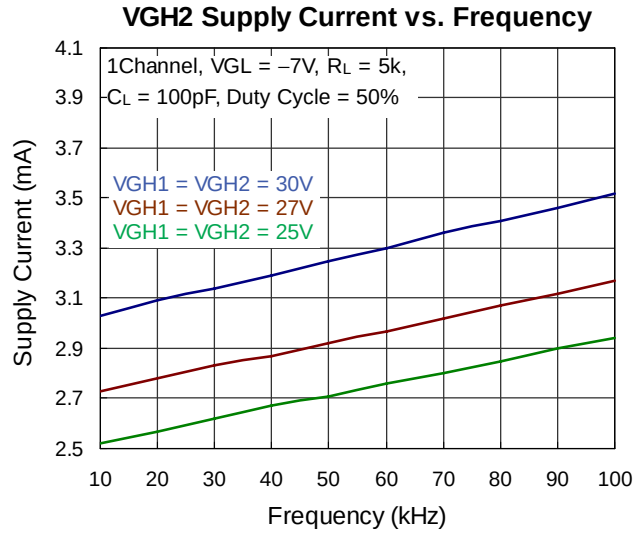
Note 4. The device is not guaranteed to function outside its operating conditions.

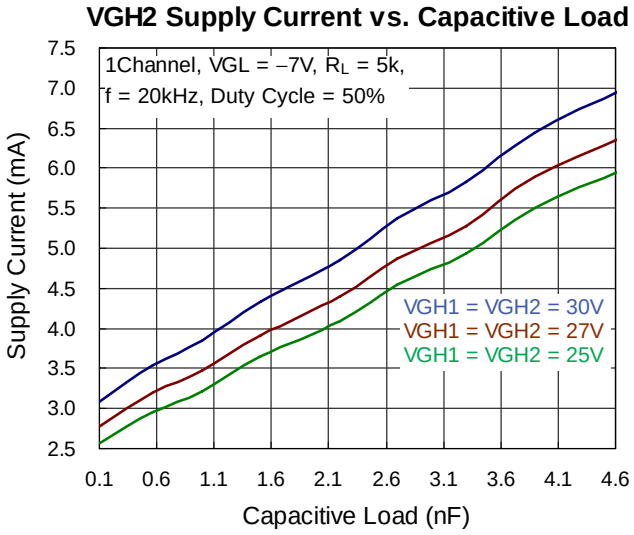
Note 5. Switch characteristics are guaranteed by design; not subject to production testing.

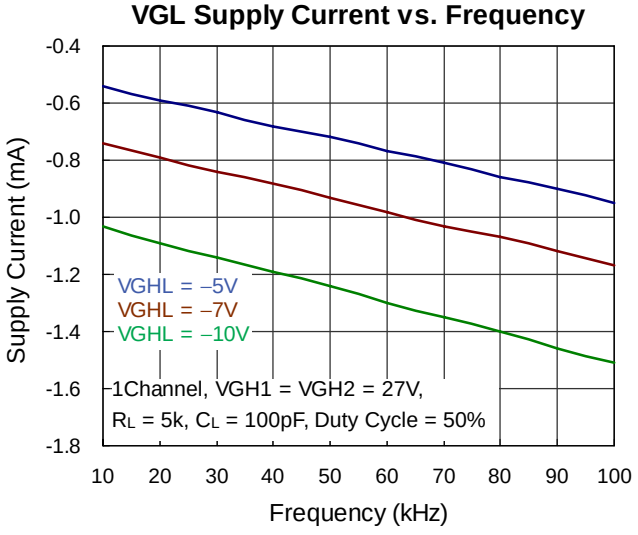
Typical Operating Characteristics

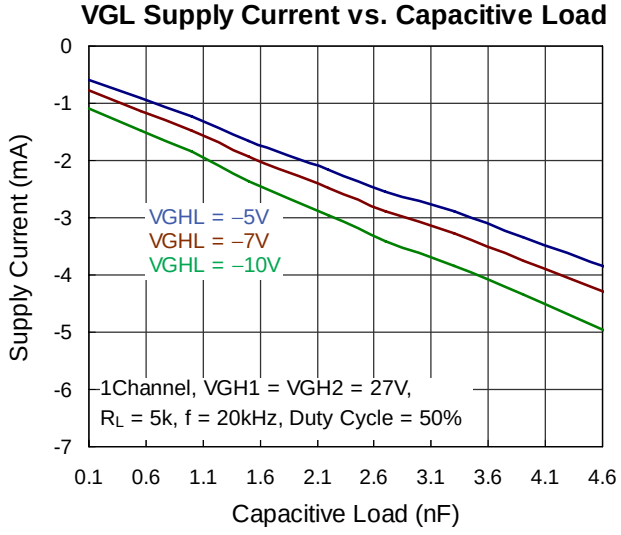




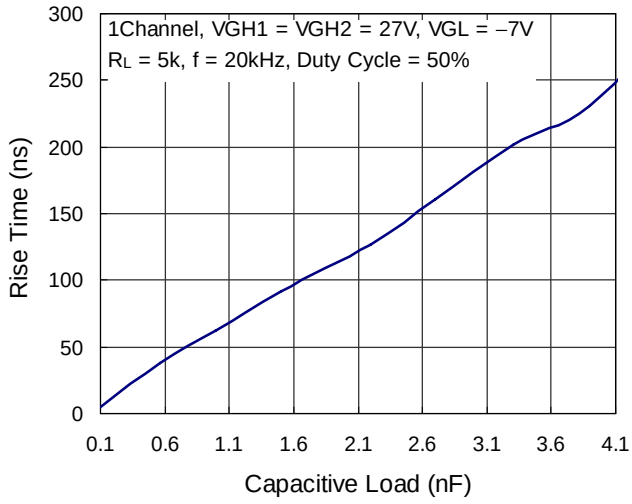




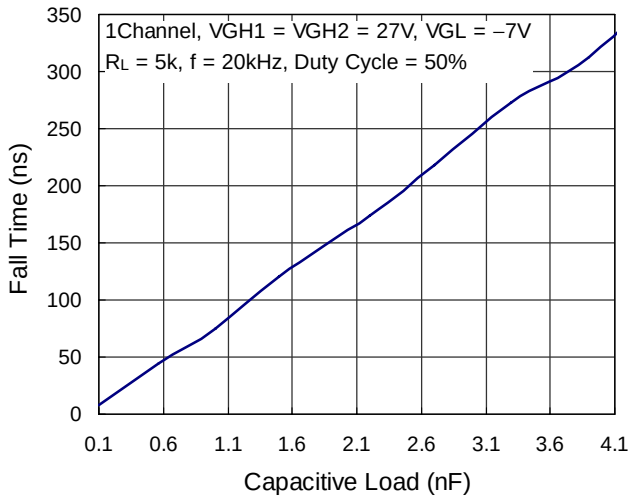




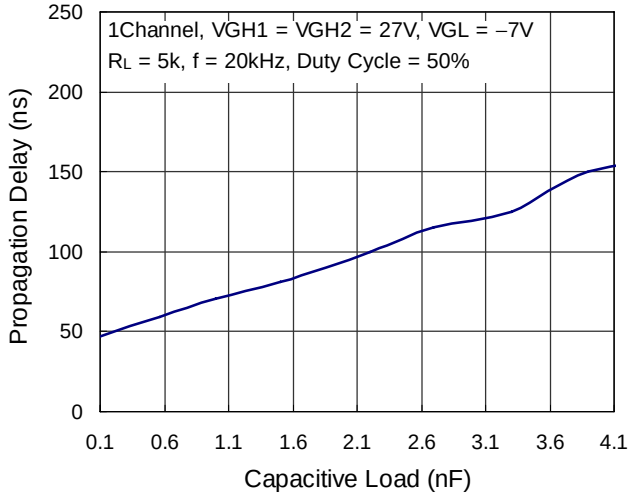
Rise Time vs. Capacitive Load



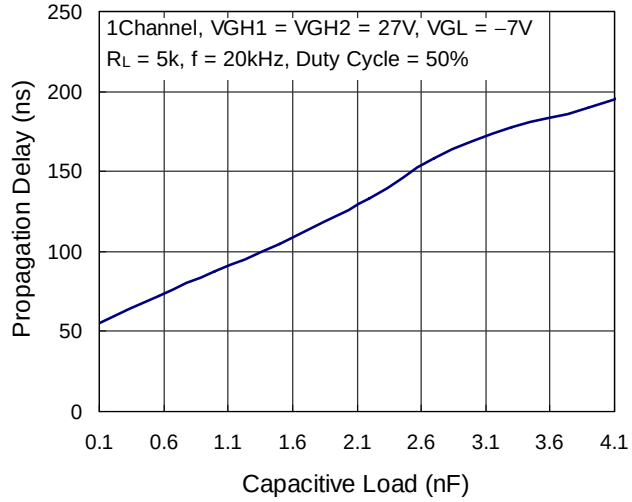
Fall Time vs. Capacitive Load



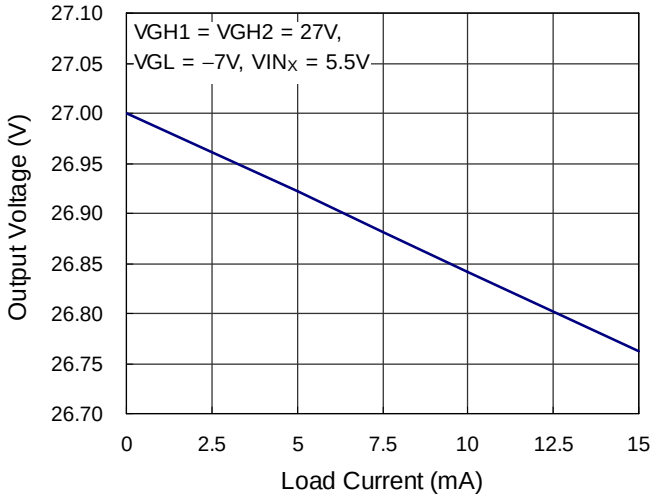
t_{PLH} Propagation Delay vs. Capacitive Load



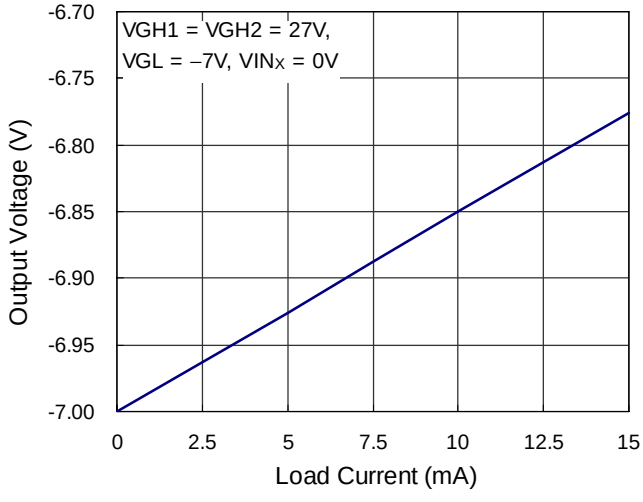
t_{PHL} Propagation Delay vs. Capacitive Load



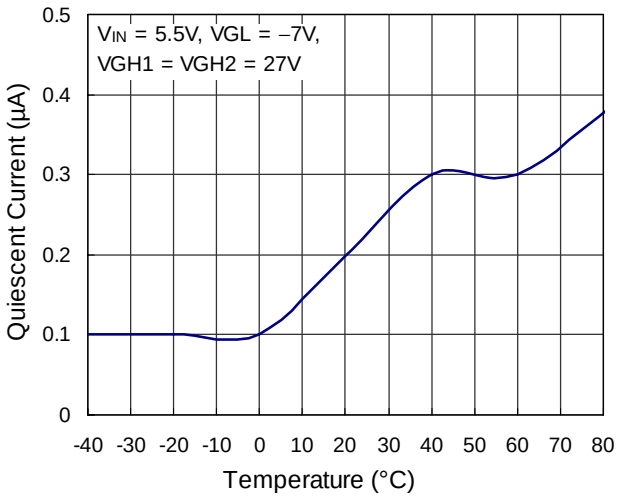
VOH Output Voltage vs. Load Current



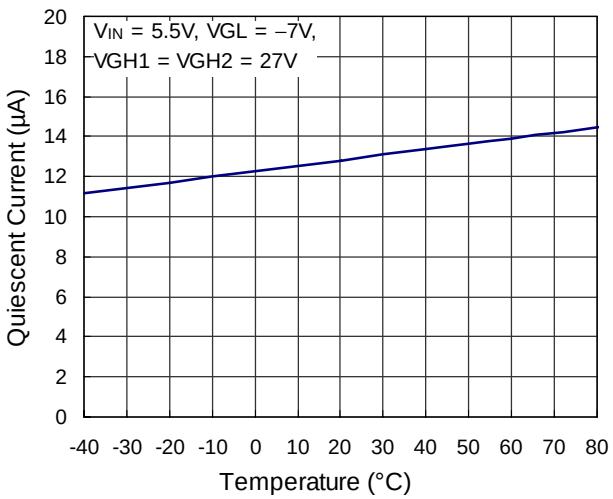
VOL Output Voltage vs. Load Current



VGH1 Quiescent Current vs. Temperature



VGH2 Quiescent Current vs. Temperature

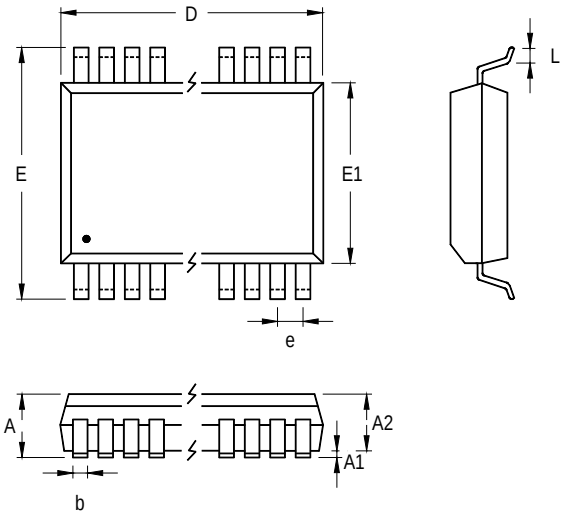


Application information

RT8900 is an 8-channel level shifter operating at high supply and maintaining low power consumption. The device requires three supply voltages VGH1, VGH2 and VGL to supply all logic levels for outputs. VGH1 applies to the high output level for VOUT0 to VOUT6 and VGH2 is for VOUT7 to VOUT8. VGL sets the low output level for all channels. VGH2 must always be larger than or equal to VGH1. Logic input signals at VIN0 to VIN7 operate from supply voltages from 0V to 6V.Connect the unused logic input signal to high or low logic level.

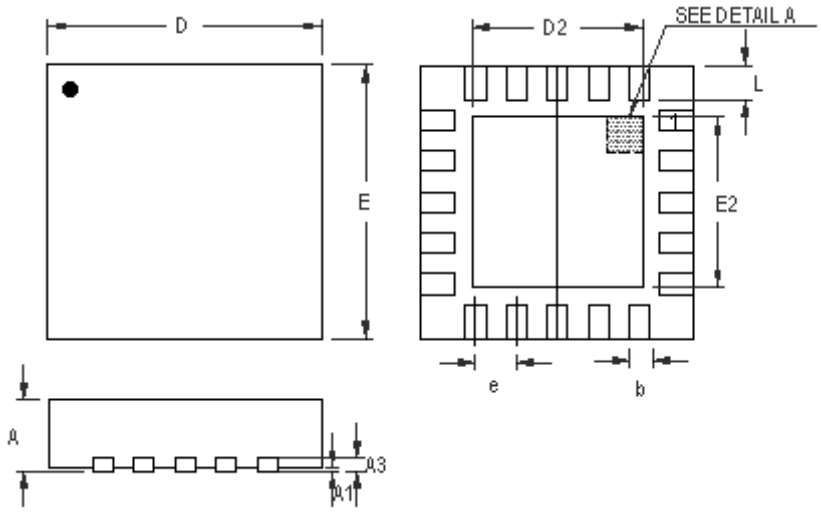
RT8900 with high driving capability is ideal for TFT LCD panels. In general applications, the input signal for VIN0 to VIN7 supplied from the timing controller of TFT LCD system; the panel operates in high voltage supplied from the output signal VOUT0 to VOUT7. RT8900 translates the timing controller's signal into high-low level signal to drive the panel. Fast rising / falling time and low propagation delay makes RT8900 being suitable for driving TFT LCD panels.

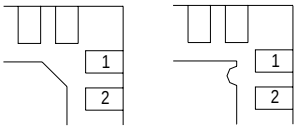
Outline Dimension



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.000	1.200	0.039	0.047
A1	0.050	0.150	0.002	0.006
A2	0.800	1.050	0.031	0.041
b	0.190	0.300	0.007	0.012
D	6.400	6.600	0.252	0.260
e	0.650		0.026	
E	6.300	6.500	0.248	0.256
E1	4.300	4.500	0.169	0.177
L	0.450	0.750	0.018	0.030

20-Lead TSSOP Plastic Package





DETAIL A

Pin #1 ID and Tie Bar Mark Options

Note : The configuration of the Pin #1 identifier is optional, but must be located within the zone indicated.

Symbol		Dimensions In Millimeters		Dimensions In Inches	
		Min	Max	Min	Max
A		0.700	0.800	0.028	0.031
A1		0.000	0.050	0.000	0.002
A3		0.175	0.250	0.007	0.010
b		0.150	0.300	0.006	0.012
D		3.900	4.100	0.154	0.161
D2	Option 1	2.650	2.750	0.104	0.108
	Option 2	2.100	2.200	0.083	0.087
E		3.900	4.100	0.154	0.161
E2	Option 1	2.650	2.750	0.104	0.108
	Option 2	2.100	2.200	0.083	0.087
e		0.500		0.020	
L		0.350	0.450	0.014	0.018

W-Type 20L QFN 4x4 Package

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