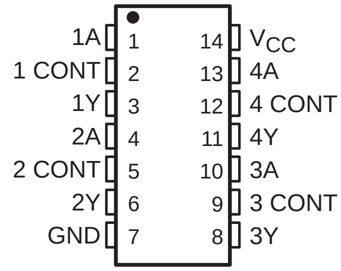
- **Meet or Exceed the Requirements of ANSI EIA/TIA-232-E and ITU Recommendation V.28**
- **Low Supply Current . . . 420 µA Typ**
- **Preset On-Chip Input Noise Filter**
- **Built-in Input Hysteresis**
- **Response and Threshold Control Inputs**
- **Push-Pull Outputs**
- **Functionally Interchangeable and Pin Compatible With Texas Instruments SN75189/SN75189A, Motorola MC1489/MC1489A, and National Semiconductor DS14C88A**

D OR N PACKAGE
(TOP VIEW)



description

The SN75C189 and SN75C189A are low-power bipolar quadruple line receivers that are used to interface data terminal equipment (DTE) with data circuit-terminating equipment (DCE). These devices have been designed to conform with ANSI Standard EIA/TIA-232-E.

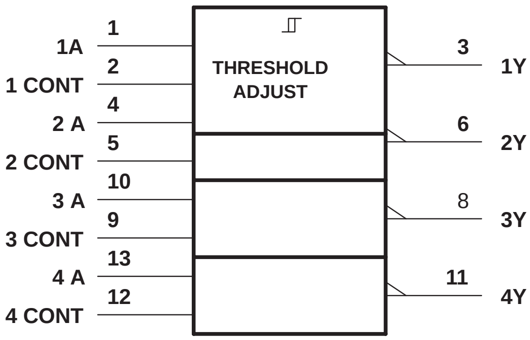
The SN75C189 has a 0.33 V typical hysteresis compared with 0.97 V for the SN75C189A. Each receiver has provision for adjustment of the overall input threshold levels. This is achieved by choosing external series resistors and voltages to provide bias levels for the response control pins. The output is in the high logic state if the input is left open circuited or shorted to ground.

These devices have an on-chip filter that rejects input pulses of shorter than 1-µs minimum duration. An external capacitor may be connected from the control pins to ground to provide further input noise filtering for each receiver.

The SN75C189 and SN75C189A have been designed using low-power techniques in a bipolar technology. In most applications, these receivers will interface to single inputs of peripheral devices such as UARTs, ACEs, or microprocessors. By using sampling, such peripheral devices are usually insensitive to the transition times of the input signals. If this is not the case or for other uses, it is recommended that the SN75C189 and SN75C189A outputs be buffered by single Schmitt input gates or single gates of the HCMOS, ALS, or 74F logic families.

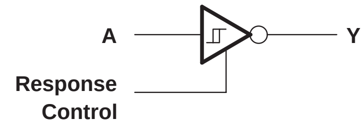
The SN75C189 and SN75C189A are characterized for operation from 0°C to 70°C.

logic symbol†

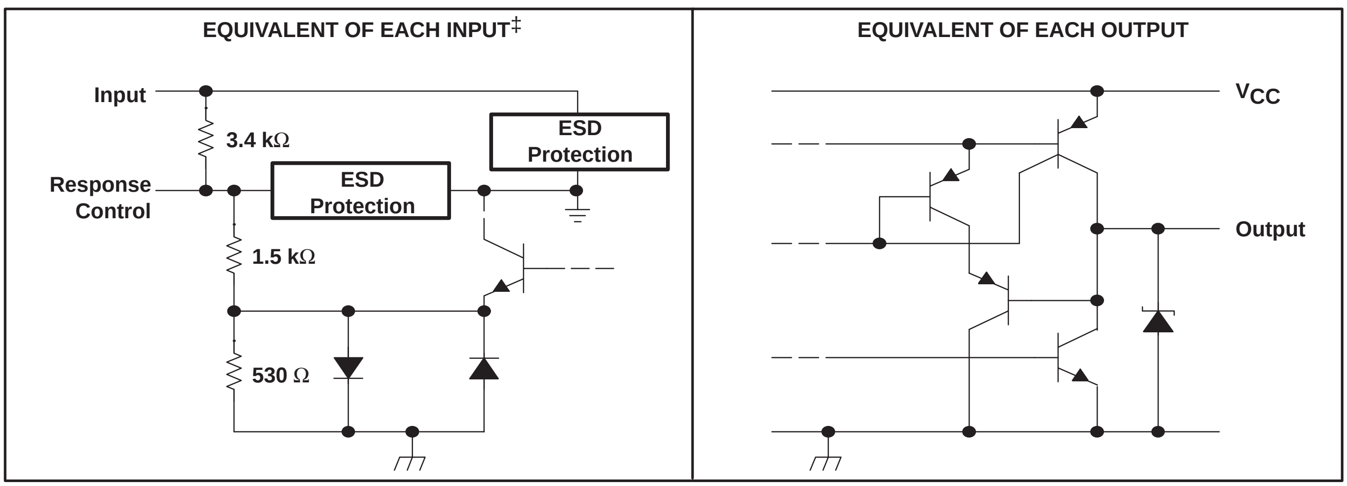


† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

logic diagram (each receiver)



schematic of inputs and outputs



‡ All resistor values shown are nominal.

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)§

Supply voltage, V_{CC} (see Note 1)	7 V
Input voltage range, V_I	–30 V to 30 V
Output voltage range, V_O	–0.3 V to V_{CC} + 0.3 V
Continuous total dissipation	See Dissipation Rating Table
Operating free-air temperature range, T_A: SN75C189, SN75C189A	0°C to 70°C
Storage temperature range, T_{stg}	–65°C to 150°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	260°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 under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTE 1: All voltages are with respect to the network ground terminal.

DISSIPATION RATING TABLE

PACKAGE	$T_A = 25°C$ POWER RATING	DERATING FACTOR ABOVE $T_A = 25°C$	$T_A = 70°C$ POWER RATING
D	950 mW	7.6 mW/°C	608 mW
DB	525 mW	4.2 mW/°C	336 mW
N	1150 mW	9.2 mW/°C	736 mW
NS	500 mW	4.0 mW/°C	320 mW

recommended operating conditions

	MIN	NOM	MAX	UNIT
Supply voltage, V_{CC}	4.5	5	6	V
Input voltage, V_I (see Note 2)	–25		25	V
High-level output current, I_{OH}			–3.2	mA
Low-level output current, I_{OL}			3.2	mA
Response control current			±1	mA
Operating free-air temperature, T_A	0		70	°C

NOTE 2: The algebraic convention, where the more positive (less negative) limit is designated as maximum, is used in this data sheet for logic levels only, e.g., if –10 V is a maximum, the typical value is a more negative voltage.

electrical characteristics over recommended free-air temperature range, V_{CC} = 5 V ±10% (unless otherwise noted) (see Note 3)

PARAMETER			TEST CONDITIONS		MIN	TYP†	MAX	UNIT
V_{IT+}	Positive-going input threshold voltage	’C189	See Figure 1		1		1.5	V
		’C189A			1.6		2.25	
V_{IT-}	Negative-going input threshold voltage	’C189	See Figure 1		0.75		1.25	V
		’C189A			0.75	1	1.25	
V_{hys}	Input hysteresis voltage ($V_{IT+} - V_{IT-}$)	’C189	See Figure 1		0.15	0.33		V
		’C189A			0.65	0.97		
V_{OH}	High-level output voltage		V_{CC} = 4.5 V to 6 V, V_I = 0.75 V, I_{OH} = –20 μA		3.5			V
			V_{CC} = 4.5 V to 6 V, V_I = 0.75 V, I_{OH} = –3.2 mA		2.5			
V_{OL}	Low-level output voltage		V_{CC} = 4.5 V to 6 V, V_I = 3 V, I_{OL} = 3.2 mA				0.4	V
I_{IH}	High-level input current		See Figure 2	V_I = 25 V	3.6		8.3	mA
				V_I = 3 V	0.43		1	
I_{IL}	Low-level input current		See Figure 2	V_I = –25 V	–3.6		–8.3	mA
				V_I = –3 V	–0.43		–1	
I_{OS}	Short-circuit output current		See Figure 3				–35	mA
I_{CC}	Supply current		V_I = 5 V, No load, See Figure 2			420	700	μA

† All typical values are at T_A = 25°C.
NOTE 3: All characteristics are measured with response control terminal open.

switching characteristics, V_{CC} = 5 V ±10%, T_A = 25°C

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{PLH}	Propagation delay time, low- to high-level output	R_L = 5 kΩ, C_L = 50 pF, See Figure 4			6	µs
t_{PHL}	Propagation delay time, high- to low-level output				6	µs
t_{TLH}	Transition time, low- to high-level output†				500	ns
t_{THL}	Transition time, high- to low-level output†				300	ns
$t_{w(N)}$	Duration of longest pulse rejected as noise‡		1		6	µs

† Measured between 10% and 90% points of output waveform.
‡ The receiver ignores any positive- or negative-going pulse that is less than the minimum value of $t_{w(N)}$ and accepts any postive- or negative-going pulse greater than the maximum of $t_{w(N)}$.

PARAMETER MEASUREMENT INFORMATION†

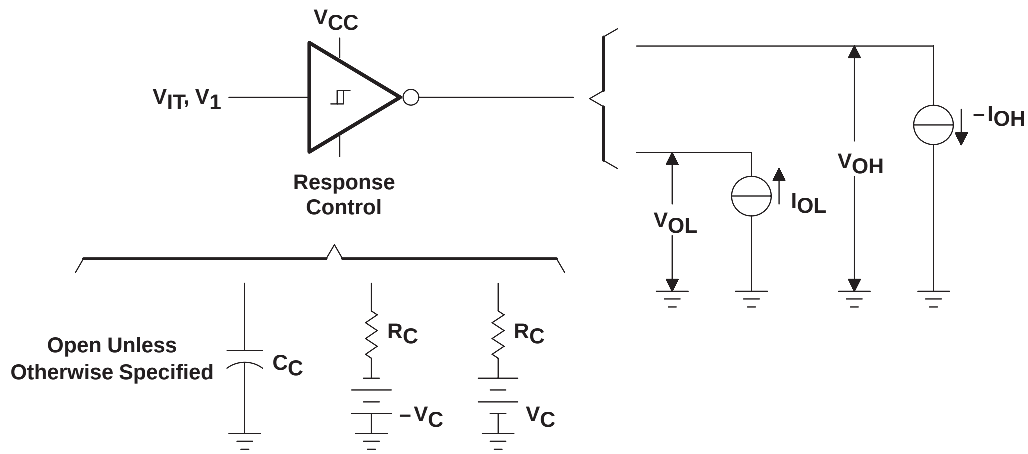


Figure 1. V_{T+}, V_{IT-}, V_{OH}, V_{OL}

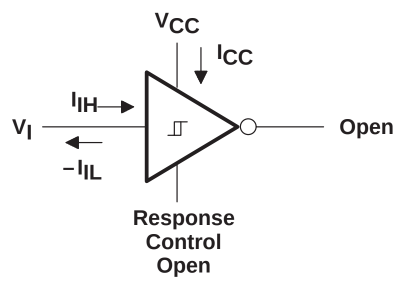


Figure 2. I_{IH}, I_{IL}, I_{CC}

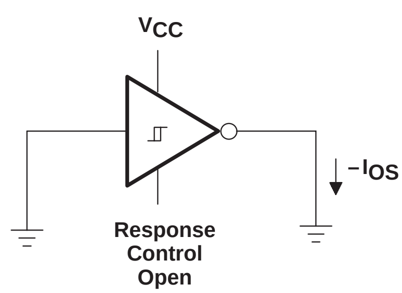
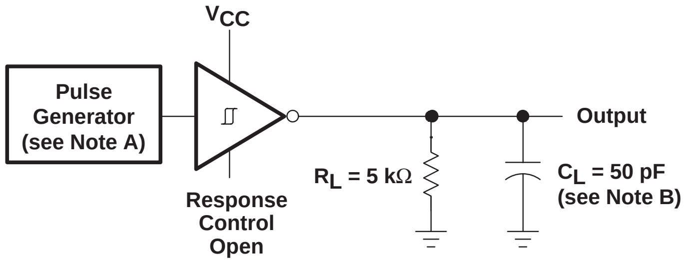


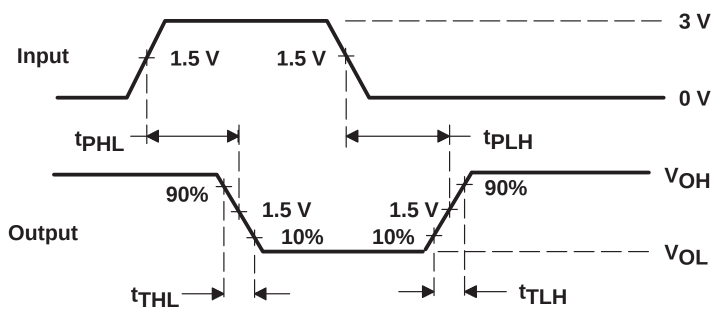
Figure 3. I_{OS}

† Arrows indicate actual direction of current flow. Current into a terminal is a positive value.

PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT



VOLTAGE WAVEFORMS

NOTES: A. The pulse generator has the following characteristics: Z_O = 50 Ω, t_W = 25 µs.
B. C_L includes probe and jig capacitances.

Figure 4. Test Circuit and Voltage Waveforms

TYPICAL CHARACTERISTICS

SN75C189
INPUT THRESHOLD VOLTAGE (POSITIVE-GOING)
vs
FREE-AIR TEMPERATURE

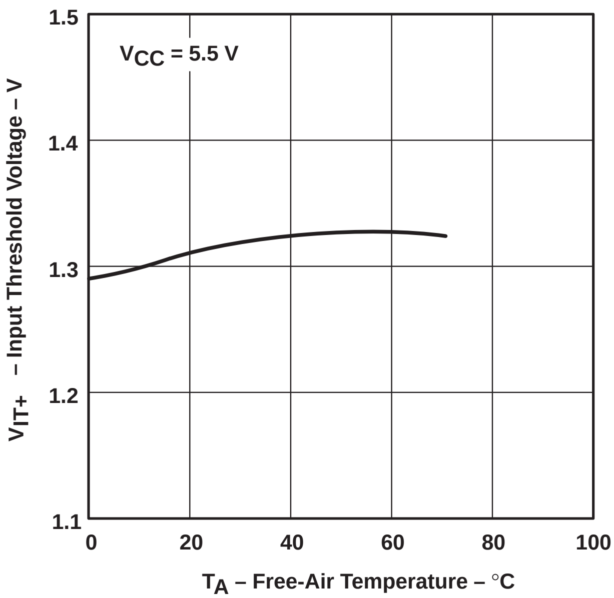


Figure 5

SN75C189A
INPUT THRESHOLD VOLTAGE (POSITIVE-GOING)
vs
FREE-AIR TEMPERATURE

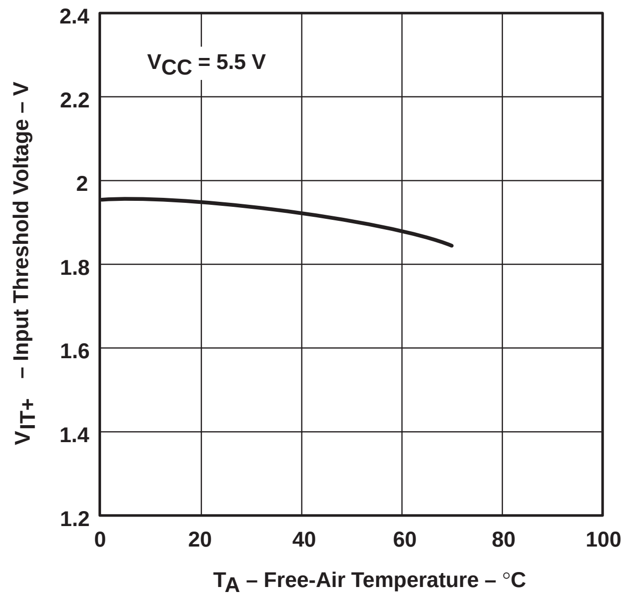


Figure 6

SN75C189
INPUT THRESHOLD VOLTAGE (NEGATIVE-GOING)
vs
FREE-AIR TEMPERATURE

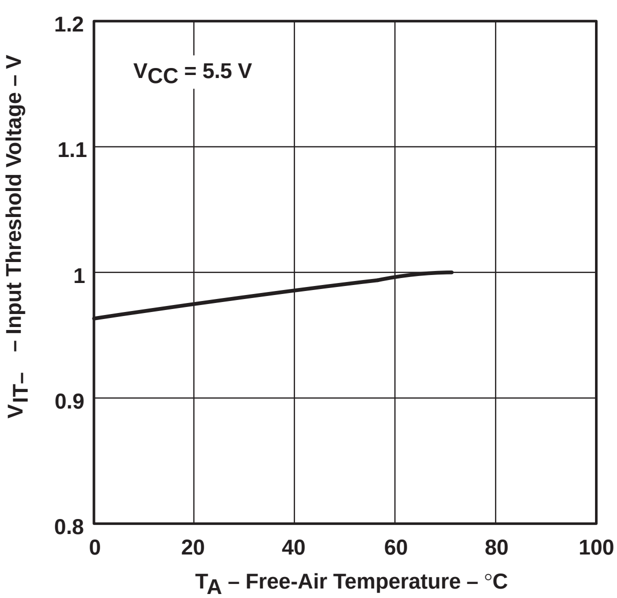


Figure 7

SN75C189A
INPUT THRESHOLD VOLTAGE (NEGATIVE-GOING)
vs
FREE-AIR TEMPERATURE

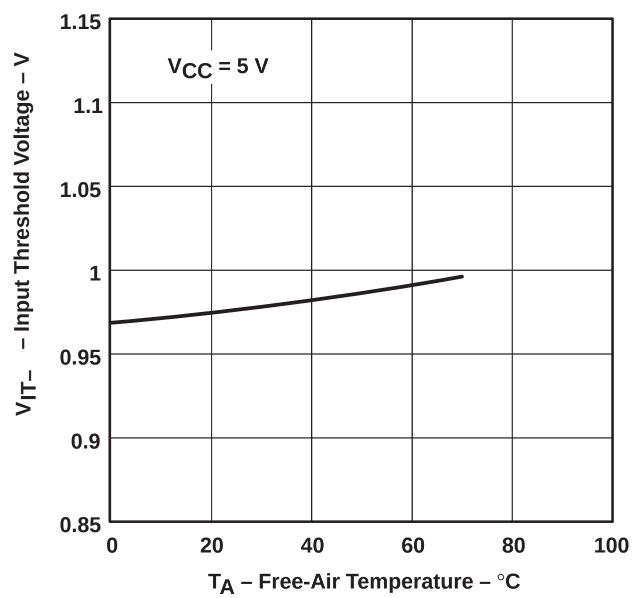


Figure 8

TYPICAL CHARACTERISTICS

SN75C189
INPUT HYSTERESIS
vs
FREE-AIR TEMPERATURE

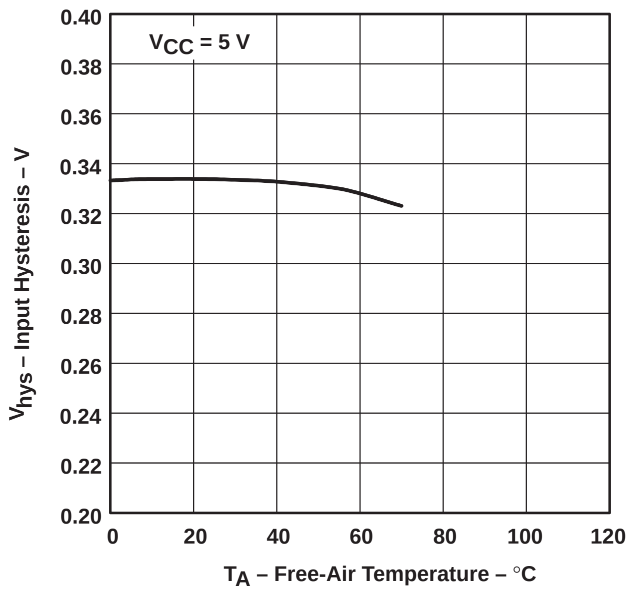


Figure 9

SN75C189A
INPUT HYSTERESIS
vs
FREE-AIR TEMPERATURE

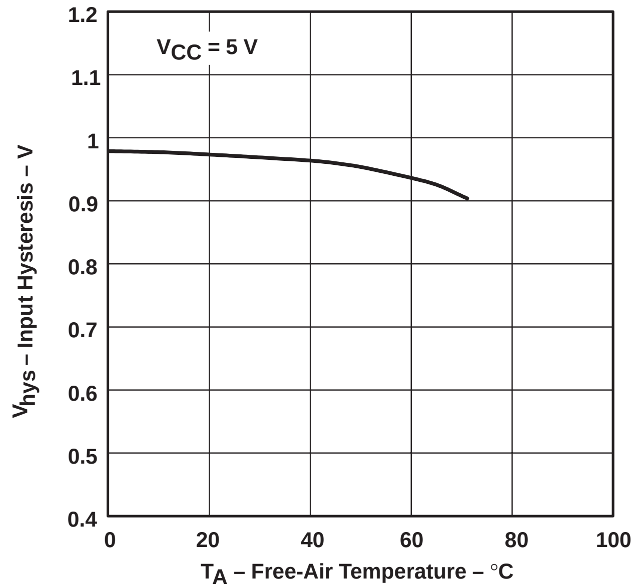


Figure 10

HIGH-LEVEL OUTPUT VOLTAGE
vs
FREE-AIR TEMPERATURE

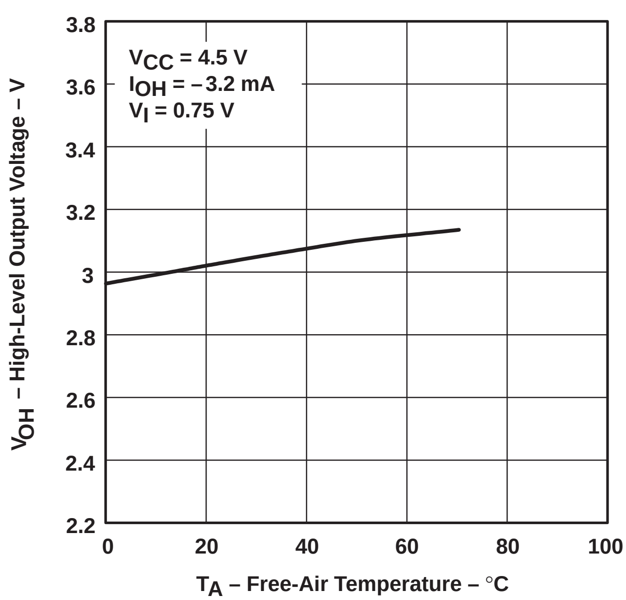


Figure 11

LOW-LEVEL OUTPUT VOLTAGE
vs
FREE-AIR TEMPERATURE

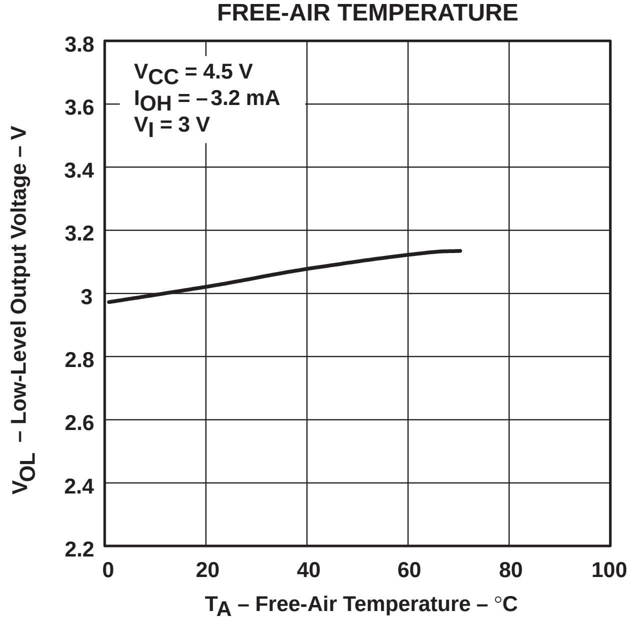


Figure 12

TYPICAL CHARACTERISTICS

**SN75C189
HIGH-LEVEL INPUT CURRENT
vs
FREE-AIR TEMPERATURE**

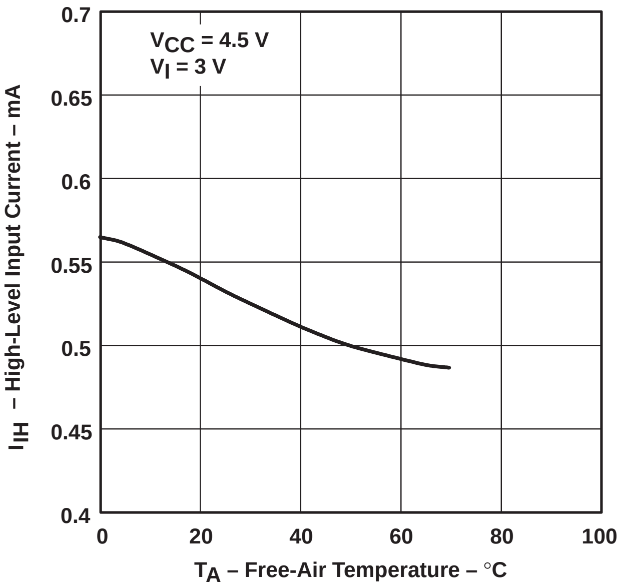


Figure 13

**SN75C189A
HIGH-LEVEL INPUT CURRENT
vs
FREE-AIR TEMPERATURE**

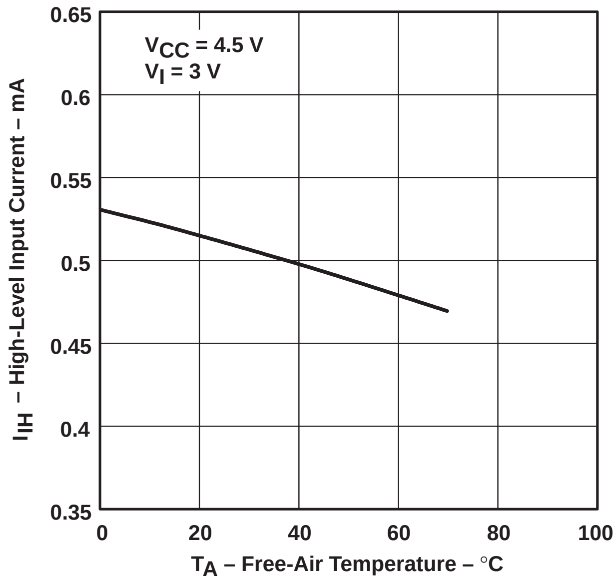


Figure 14

**SN75C189
LOW-LEVEL INPUT CURRENT
vs
FREE-AIR TEMPERATURE**

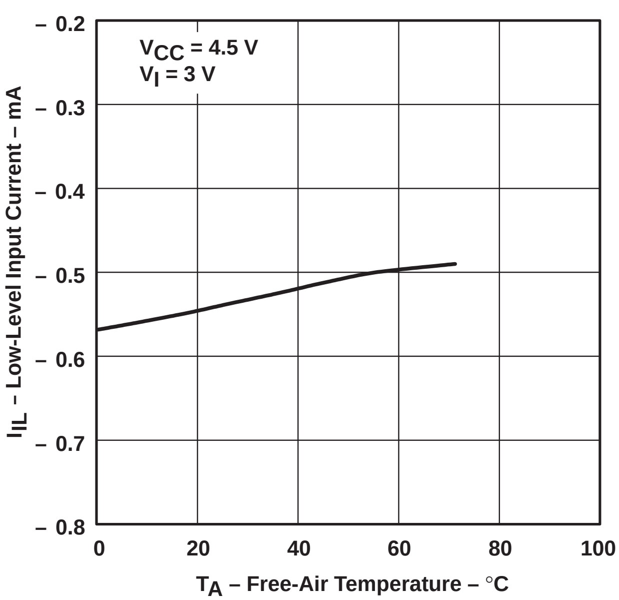


Figure 15

**SN75C189A
LOW-LEVEL INPUT CURRENT
vs
FREE-AIR TEMPERATURE**

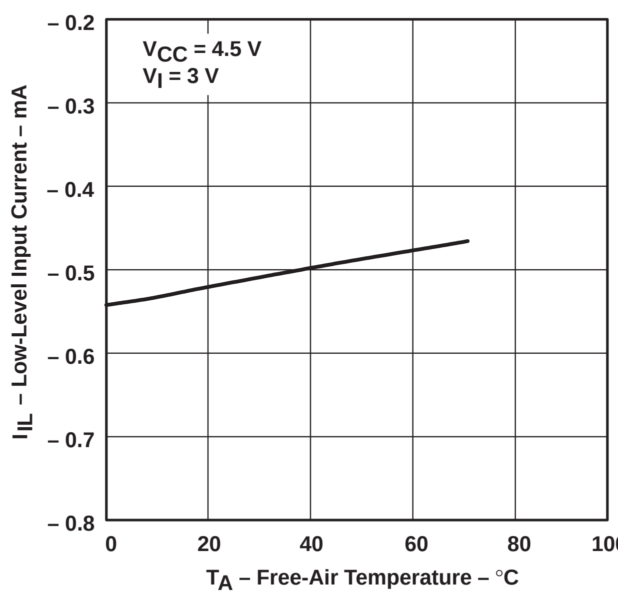


Figure 16

TYPICAL CHARACTERISTICS

HIGH-LEVEL SHORT-CIRCUIT OUTPUT CURRENT vs FREE-AIR TEMPERATURE

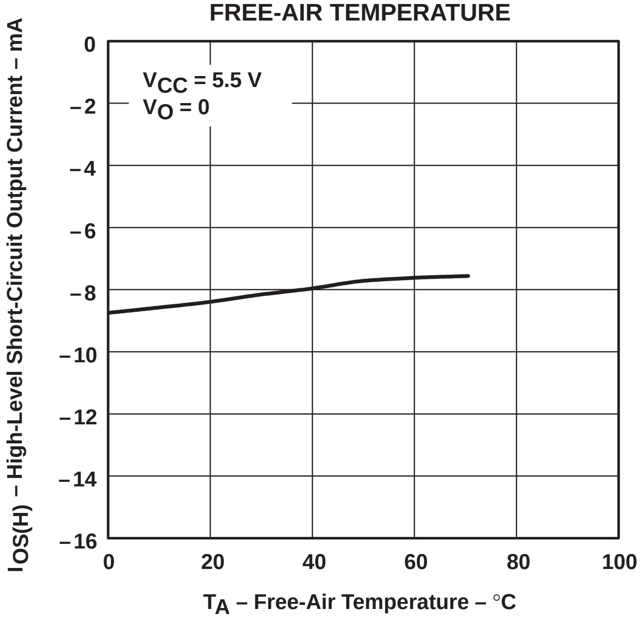


Figure 17

LOW-LEVEL SHORT-CIRCUIT OUTPUT CURRENT vs FREE-AIR TEMPERATURE

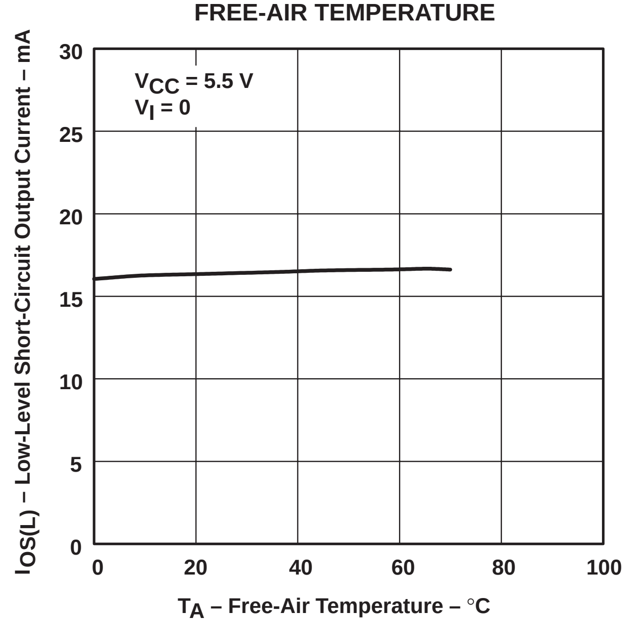


Figure 18

SUPPLY CURRENT vs FREE-AIR TEMPERATURE

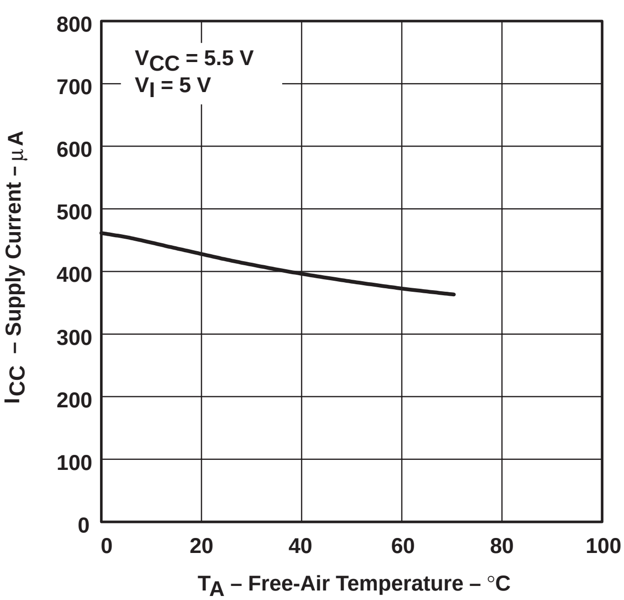


Figure 19

PROPAGATION DELAY TIME, LOW-TO-HIGH LEVEL OUTPUT vs FREE-AIR TEMPERATURE

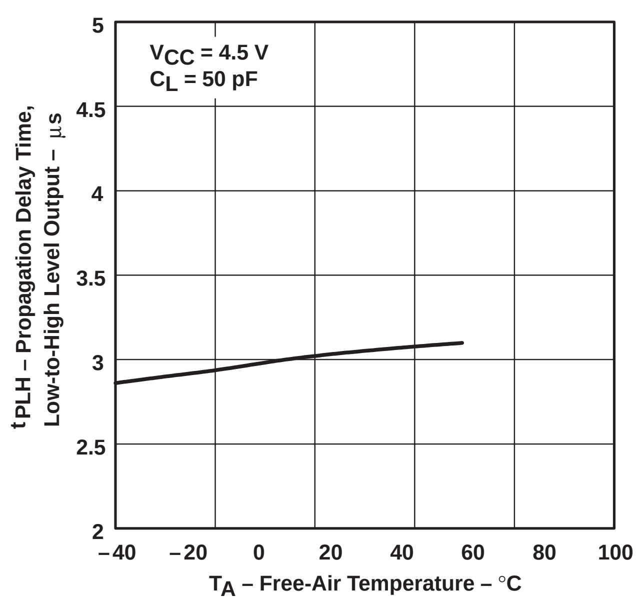


Figure 20

TYPICAL CHARACTERISTICS

PROPAGATION DELAY TIME, HIGH-TO-LOW-LEVEL OUTPUT vs FREE-AIR TEMPERATURE

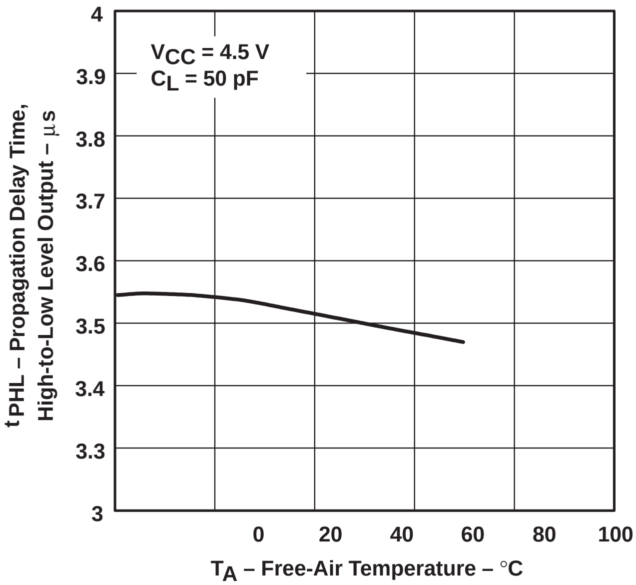


Figure 21

TRANSITION TIME, LOW-TO-HIGH-LEVEL vs FREE-AIR TEMPERATURE

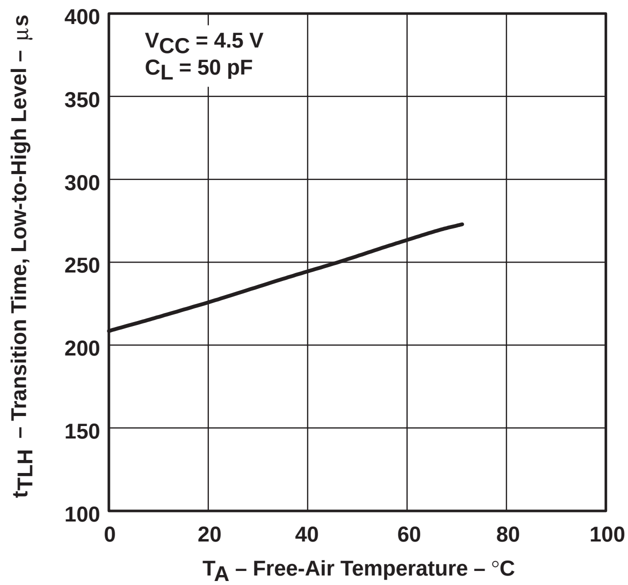


Figure 22

TRANSITION TIME, HIGH-TO-LOW-LEVEL OUTPUT vs FREE-AIR TEMPERATURE

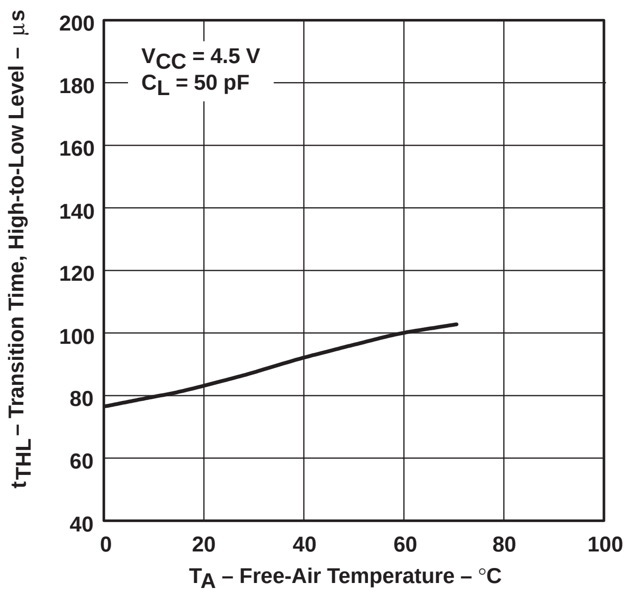


Figure 23

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