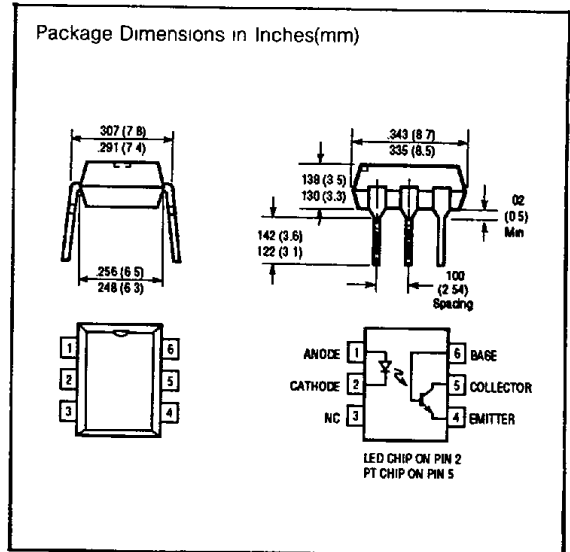
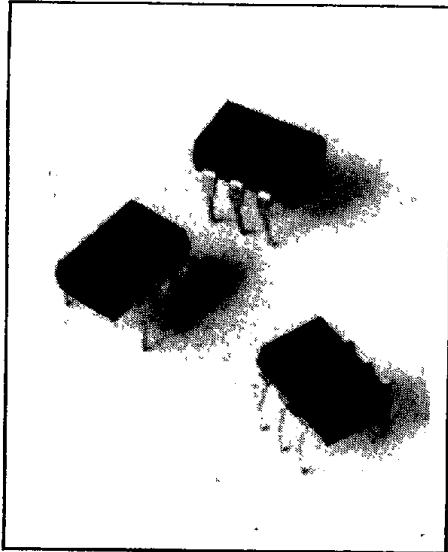


**SIEMENS**

T-41-83  
**SFH609 SERIES**

**HIGH RELIABILITY  
PHOTOTRANSISTOR  
OPTOCOUPLER**



**FEATURES**

- Highest Quality Premium Device
- Built to Conform to VDE Requirements
- Long Term Stability
- High Current Transfer Ratios, 3 Groups  
 SFH 609-1, 40 to 80%  
 SFH 609-2, 63 to 125%  
 SFH 609-3, 100 to 200%
- 5300 Volt Isolation (1 Minute)
- Storage Temperature - 40° to +150°C
- $V_{CEsat}$  0.25 (< 0.4) Volt  
 $I_F = 10$  mA,  $I_C = 2.5$  mA
- $V_{CEO}$  90V
- UL Approval #E52744
- VDE Approval #0883

**DESCRIPTION**

The optically coupled isolator SFH 609 features a high current transfer ratio as well as high isolation voltage, and uses as emitter a GaAs infrared emitting diode which is optically coupled with a silicon planar photo-transistor acting as detector. The component is incorporated in a plastic plug-in package 20 A 6 DIN 41866.

The coupling device is suitable for signal transmission between two electrically separated circuits. The potential difference between the circuits to be coupled is not allowed to exceed the maximum permissible isolation voltage.

**Maximum Ratings**

**Emitter** (GaAs infrared emitter)

Reverse voltage	$V_R$	6	V
DC forward current	$I_F$	60	mA
Surge forward current ( $t \leq 10 \mu s$ )	$I_{FSM}$	2.5	A
Total power dissipation	$P_{tot}$	100	mW

**Detector** (silicon phototransistor)

Collector-emitter voltage ( $I_s = 0$ )	$V_{CEO}$	90	V
Emitter-base voltage ( $I_C = 0$ )	$V_{EBO}$	7	V
Collector current	$I_C$	50	mA
Collector current ( $t \leq 1$ ms)	$I_{CSM}$	100	mA
Total power dissipation	$P_{tot}$	150	mW

**Optocoupler**

Storage temperature range	$T_{stg}$	- 40 to + 150	°C
Ambient temperature range	$T_{amb}$	- 40 to + 100	°C
Junction temperature	$T_j$	100	°C
Soldering temperature (max. 10 sec) <sup>1)</sup>	$T_{sold}$	260	°C
Isolation voltage (1 min) <sup>2)</sup> between emitter and detector referred to standard climate 23/50 DIN 50014	$V_{is}$	5300	Vdc

AC reference voltage } in acc. with  
 DC reference voltage } DIN 57883, 6.80  
 and/or VDE 0883, 6.80

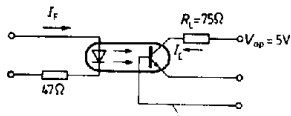
Leakage path	min 8.2	mm
Air path	min 7.3	mm

<sup>1)</sup> Dip soldering Insertion depth 3.6 mm  
<sup>2)</sup> DC test voltage in accordance with DIN 57883 draft 4/78

CHARACTERISTICS @ 25°C				
<b>Emitter</b>				
Forward voltage ( $I_F = 60 \text{ mA}$ )	$V_F$	1.25 ( $\leq 1.65$ )	V	
Breakdown voltage ( $I_R = 10 \mu\text{A}$ )	$V_{(BR)}$	30 ( $\geq 6$ )	V	
Reverse current ( $V_R = 6 \text{ V}$ )	$I_R$	0.01 ( $\leq 10$ )	$\mu\text{A}$	
Capacitance ( $V_R = 0 \text{ V}, f = 1 \text{ MHz}$ )	$C_O$	40	pF	
Thermal resistance	$R_{thJA}$	750	K/W	
<b>Detector (silicon phototransistor)</b>				
Capacitance ( $V_{CE} = 5 \text{ V}; f = 1 \text{ MHz}$ )	$C_{CE}$	6.8	pF	
( $V_{CB} = 5 \text{ V}, f = 1 \text{ MHz}$ )	$C_{CB}$	8.5	pF	
( $V_{EB} = 5 \text{ V}; f = 1 \text{ MHz}$ )	$C_{EB}$	11	pF	
Thermal resistance	$R_{thJA}$	500	K/W	
<b>Optocoupler</b>				
Collector-emitter saturation voltage ( $I_F = 10 \text{ mA}, I_C = 2.5 \text{ mA}$ )	$V_{CEsat}$	0.25 ( $\leq 0.4$ )	V	
Coupling capacitance	$C_K$	0.30	pF	
The optocouplers are grouped according to their current transfer ratio $I_C/I_F$ at $V_{CE}=5 \text{ V}$ and marked by dash numbers				
<b>Group</b>	<b>-1</b>	<b>-2</b>	<b>-3</b>	
$I_C/I_F$ ( $I_F=10 \text{ mA}$ )	40-80	63-125	100-200	%
$I_C/I_F$ ( $I_F=1 \text{ mA}$ )	30 (>13)	45 (>22)	70 (>34)	%
Collector-Emitter Leakage Current ( $I_{CEO}$ ) ( $V_{CE}=10 \text{ V}$ )	2 ( $\leq 50$ )	2 ( $\leq 50$ )	5 ( $\leq 100$ )	nA

Optocouplers (Optoisolators)

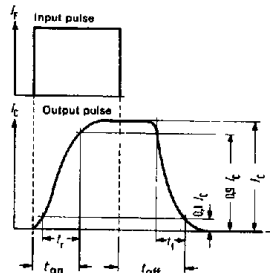
**Linear operation (without saturation)**



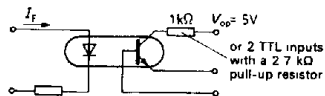
$I_F = 10 \text{ mA}$   
 $V_{op} = 5 \text{ V}$   
 $T_{amb} = 25^\circ\text{C}$

Load resistance	$R_L$	75	$\Omega$
Turn-on time	$t_{on}$	3.0 ( $\leq 5.6$ )	$\mu\text{s}$
Rise time	$t_r$	2.0 ( $\leq 4.0$ )	$\mu\text{s}$
Turn-off time	$t_{off}$	2.3 ( $\leq 4.1$ )	$\mu\text{s}$
Fall time	$t_f$	2.0 ( $\leq 3.5$ )	$\mu\text{s}$
Cut-off frequency	$f_{co}$	250	kHz

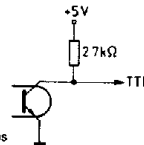
**Switching times**



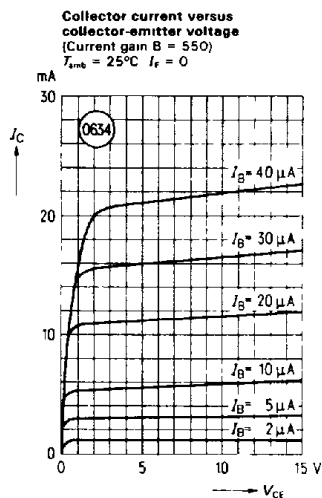
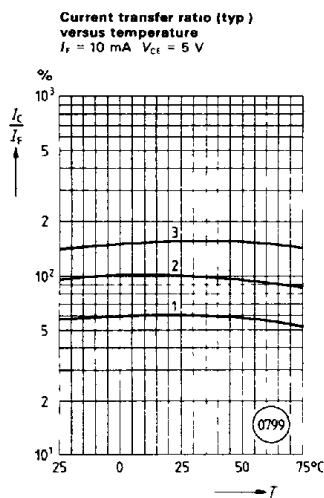
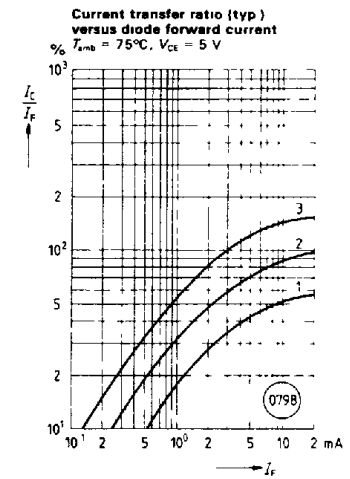
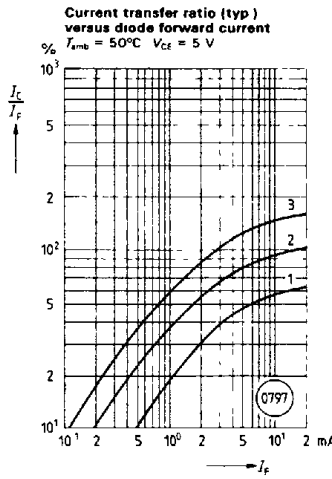
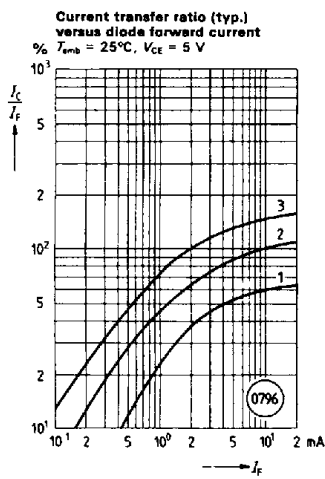
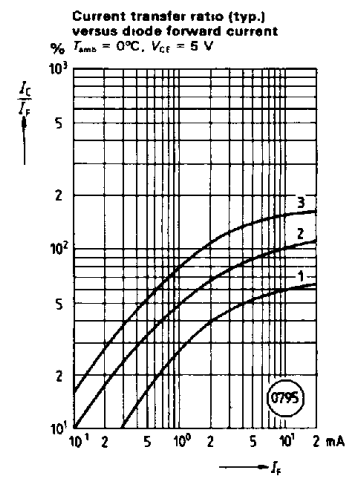
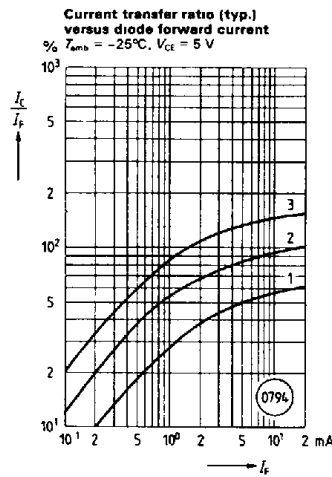
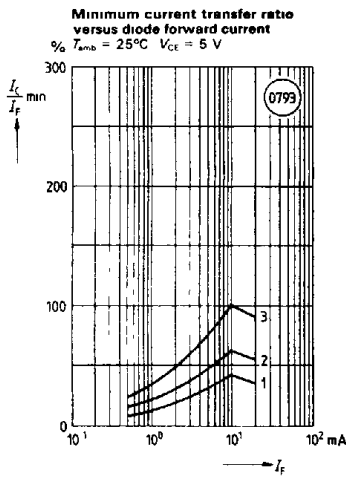
**Switching operation (with saturation)**

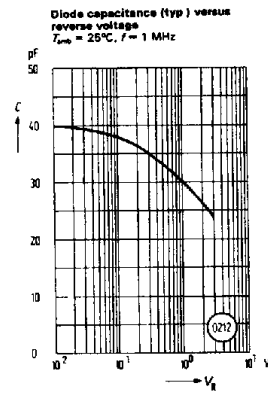
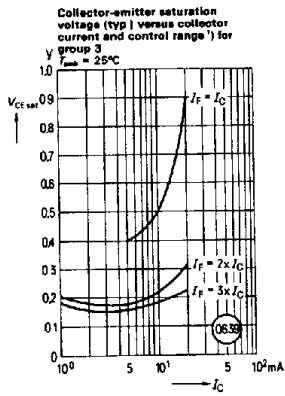
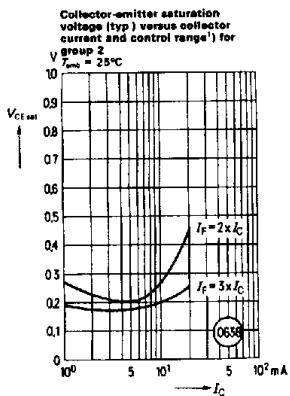
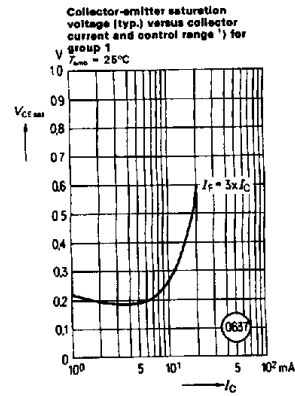
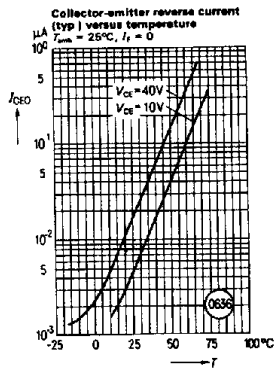
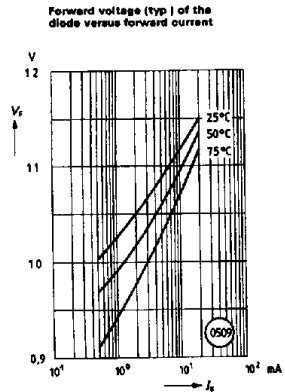
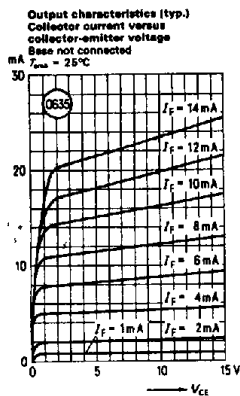


TTL level is observed but no TTL switching times

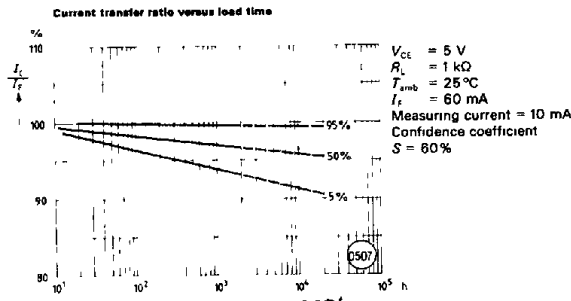
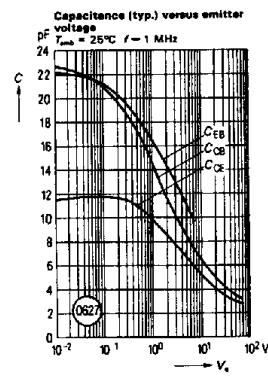
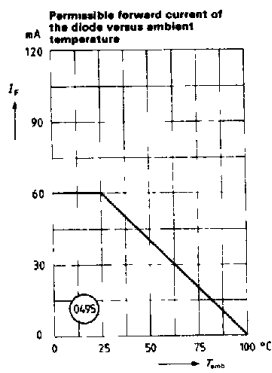
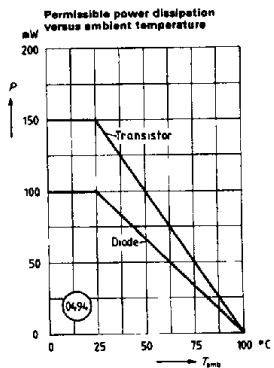
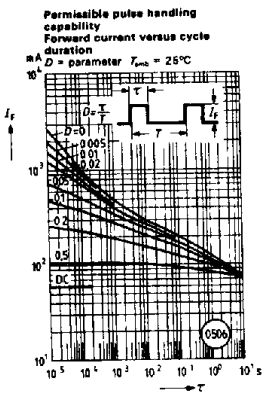


Group	1		2 and 3	
	$I_F = 20 \text{ mA}$	$I_F = 10 \text{ mA}$	$I_F = 20 \text{ mA}$	$I_F = 10 \text{ mA}$
Turn-on time	$t_{on}$	3.0 ( $\leq 5.5$ )	4.2 ( $\leq 8.0$ )	$\mu\text{s}$
Rise time	$t_r$	2.0 ( $\leq 4.0$ )	3.0 ( $\leq 6.0$ )	$\mu\text{s}$
Turn-off time	$t_{off}$	18 ( $\leq 34$ )	23 ( $\leq 39$ )	$\mu\text{s}$
Fall time	$t_f$	11 ( $\leq 20$ )	14 ( $\leq 24$ )	$\mu\text{s}$
	$V_{CEsat}$	0.25 ( $\leq 0.4$ )		V





<sup>1)</sup>  $I_F = 2 \times I_C$  means that the current flow of the diode has to be adjusted to the doubled value of the collector current.



Optocouplers (Optoisolators)