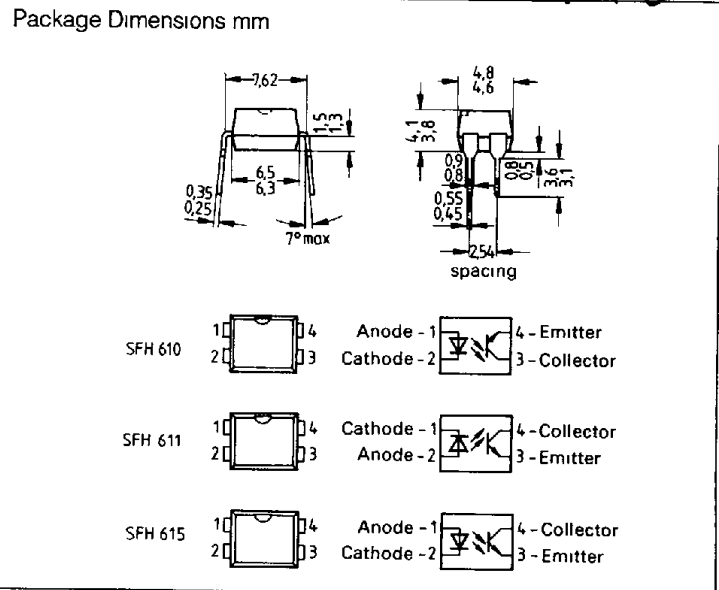


**SIEMENS**

**SFH 610  
SFH 611  
SFH 615**

**2.8 kV TRIOS® OPTOCOUPLERS  
HIGH RELIABILITY**

T-4-83



**FEATURES**

- Isolation Test Voltage: 2800 V
- High Current Transfer Ratios  
at 10 mA: 40-320%  
at 1 mA: 60% typical (>13)
- Fast Switching Times
- Minor CTR Degradation
- 100% Burn-In
- Field-Effect Stable by TRIOS
- Temperature Stable
- Good CTR Linearity Depending on Forward Current
- High Collector-Emitter Voltage  
 $V_{CE0}=70\text{ V}$
- Low Saturation Voltage
- Low Coupling Capacitance
- End-Stackable in 2.54 mm Spacing
- High Common-Mode Interference Immunity (Unconnected Base)
- UL Approval #52744
- VDE Approval 0883
- VDE Approval 0884 (Optional with Option 1)

**DESCRIPTION**

The optically coupled isolators SFH 610, SFH 611 and SFH 615 feature a high current transfer ratio, low coupling capacitance and high isolation test voltage. They employ a GaAs LED as emitter, which is optically coupled with a silicon planar phototransistor as detector.

The components are incorporated in a plastic plug-in DIP-4 package.

The coupling devices are designed 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 reference voltages.

The couplers are end-stackable in a 2.54 mm spacing and are considered as successor types for the couplers in metal case. The SFH 610, SFH 611 and SFH 615 differ in their arrangement of the terminal pins. Multicouplers can thus easily be implemented and conventional multicouplers can be replaced.

\*Transparent IO Shield

**Maximum Ratings**

**Emitter (GaAs LED)**  
 Reverse Voltage ..... 6 V  
 DC Forward Current ..... 60 mA  
 Surge Forward Current ( $t \leq 10 \mu s$ ) ..... 2.5 A  
 Total Power Dissipation ..... 100 mW

**Detector (Silicon Phototransistor)**  
 Collector-Emitter Voltage ..... 70 V  
 Collector Current ..... 50 mA  
 Collector Current ( $t \leq 1 ms$ ) ..... 100 mA  
 Total Power Dissipation ..... 150 mW

**Optocoupler**  
 Storage Temperature Range ..... -55°C to +150°C  
 Ambient Temperature Range ..... -55°C to +100°C  
 Junction Temperature ..... 100°C  
 Soldering Temperature (max. 10 s)<sup>1)</sup> ..... 260°C  
 Isolation Test Voltage<sup>2)</sup>  
 (between emitter and detector referred  
 to standard climate 23/50 DIN 50014) ..... 2800 VDC  
 Isolation Resistance ( $V_{io}=500 V$ ) .....  $10^{11} \Omega$

**Notes:**  
 1 Dip soldering minimum clearance from bottom edge of package 1.5 mm. Special soldering conditions apply when through-contacted circuit boards are used. Please request appropriate specification.  
 2 DC test voltage in accordance with DIN 57883, draft 4/78

**Characteristics ( $T_A=25^\circ C$ )**

**Emitter (GaAs LED)**  
 Forward Voltage ( $I_F=60 mA$ )  $V_F$  1.25 ( $\leq 1.65$ ) V  
 Breakdown Voltage ( $I_R=10 \mu A$ )  $V_{BR}$  30 ( $\geq 6$ ) V  
 Reverse Current ( $V_R=6 V$ )  $I_R$  0.01 ( $\leq 10$ )  $\mu A$   
 Capacitance ( $V_a=0 V, f=1 MHz$ )  $C_0$  25 pF  
 Thermal Resistance  $R_{th-LA}$  750 K/W

**Detector (Silicon Phototransistor)**  
 Capacitance  
 ( $V_{CE}=5 V, f=1 MHz$ )  $C_{CE}$  6.8 pF  
 Thermal Resistance  $R_{th-LA}$  500 K/W

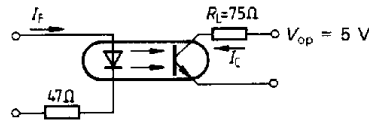
**Optocoupler**  
 Collector-Emitter Saturation Voltage  
 ( $I_F=10 mA, I_C=2.5 mA$ )  $V_{CESAT}$  0.25 ( $\leq 0.4$ ) V  
 Coupling Capacitance  $C_K$  0.25 pF

The optocouplers are grouped according to their current transfer ratio  $I_C/I_F$  at  $V_{CE}=5 V$ , marked by dash numbers

	-1	-2	-3	-4	
$I_C/I_F$ ( $I_F=10 mA$ )	40-80	63-125	100-200	160-320	%
$I_C/I_F$ ( $I_F=1 mA$ )	30 (>13)	45 (>22)	70 (>34)	90 (>56)	%
Collector-Emitter Leakage Current ( $V_{CE}=10 V$ ) ( $I_{CEO}$ )	2 ( $\leq 50$ )	2 ( $\leq 50$ )	5 ( $\leq 100$ )	5 ( $\leq 100$ )	nA

**SWITCHING TIMES**

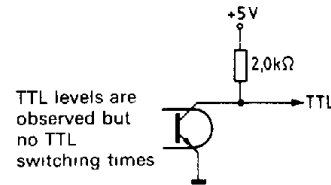
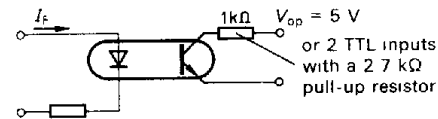
**Linear Operation (without saturation)**



$I_F=10 mA, V_{OP}=5 V, T_A=25^\circ C$

Load Resistance	$R_L$	75	$\Omega$
Turn-On Time	$t_{ON}$	3.0 ( $\leq 5.6$ )	$\mu s$
Rise Time	$t_r$	2.0 ( $\leq 4.0$ )	$\mu s$
Turn-Off Time	$t_{OFF}$	2.3 ( $\leq 4.1$ )	$\mu s$
Fall Time	$t_f$	2.0 ( $\leq 3.5$ )	$\mu s$
Cut-Off Frequency	$F_{CO}$	250	kHz

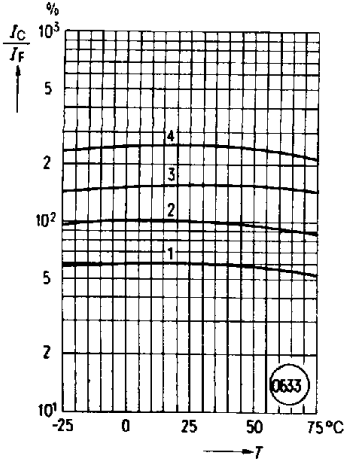
**Switching Operation (with saturation)**



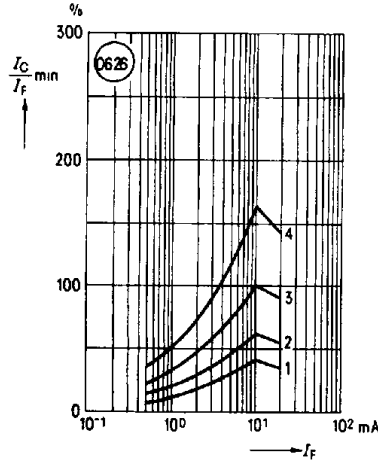
Group	-1 ( $I_F=20 mA$ )	-2 and -3 ( $I_F=10 mA$ )	-4 ( $I_F=5 mA$ )	
Turn-On Time $t_{ON}$	3.0 ( $\leq 5.5$ )	4.2 ( $\leq 8.0$ )	6.0 ( $\leq 10.5$ )	$\mu s$
Rise Time $t_r$	2.0 ( $\leq 4.0$ )	3.0 ( $\leq 6.0$ )	4.6 ( $\leq 8.0$ )	$\mu s$
Turn-Off Time $t_{OFF}$	18 ( $\leq 34$ )	23 ( $\leq 39$ )	25 ( $\leq 43$ )	$\mu s$
Fall Time $t_f$	11 ( $\leq 20$ )	14 ( $\leq 24$ )	15 ( $\leq 26$ )	$\mu s$
$V_{CESAT}$	0.25 ( $\leq 0.4$ )			V

Optocouplers (Optoisolators)

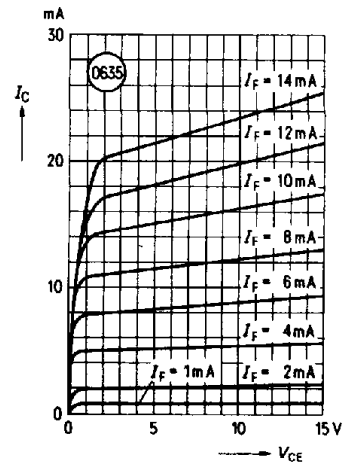
**Current transfer ratio (typ.) versus temperature**  
 ( $I_F = 10 \text{ mA}$ ,  $V_{CE} = 5 \text{ V}$ )



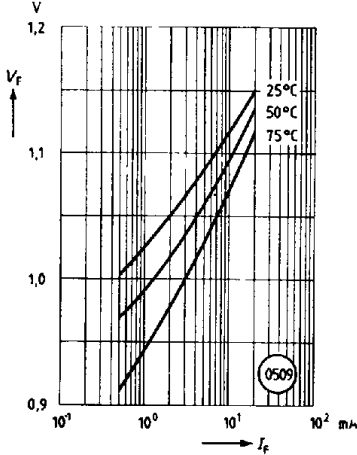
**Minimum current transfer ratio versus diode forward current**  
 ( $T_A = 25^\circ\text{C}$ ,  $V_{CE} = 5 \text{ V}$ )



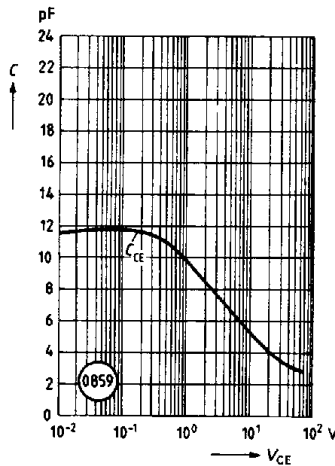
**Output characteristics (typ.) Collector current versus collector-emitter voltage**  
 ( $T_A = 25^\circ\text{C}$ )



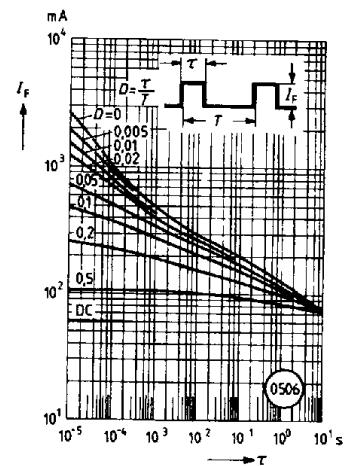
**Diode forward voltage (typ.) versus forward current**



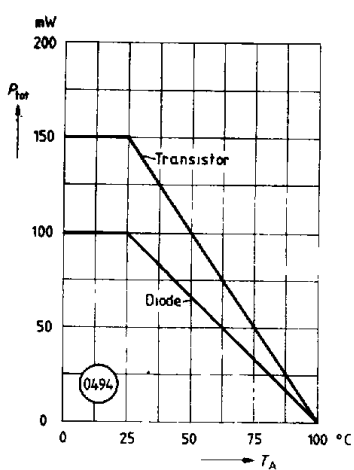
**Transistor capacitance (typ.) versus collector-emitter voltage**  
 ( $T_A = 25^\circ\text{C}$ ,  $f = 1 \text{ MHz}$ )



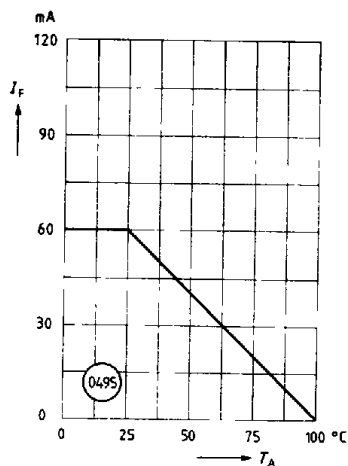
**Permissible pulse handling capability Forward current versus pulse width**  
 ( $D = \text{parameter}$ ,  $T_A = 25^\circ\text{C}$ )



**Permissible power dissipation versus ambient temperature**



**Permissible forward current of the diode versus ambient temperature**



**Current transfer ratio versus load time**  
 ( $V_{CE} = 5 \text{ V}$ ,  $R_L = 1 \text{ k}\Omega$ ,  $T_A = 60^\circ\text{C}$ ,  $I_C = 60 \text{ mA}$ , Measuring current = 10 mA, Confidence coefficient  $S = 60\%$ )

