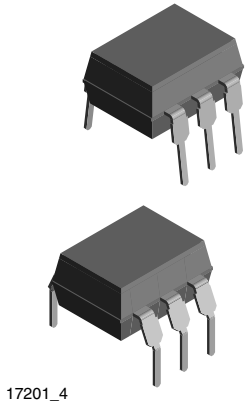
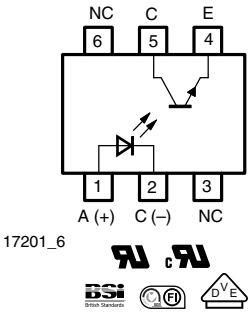
Optocoupler, Phototransistor Output



17201_4



17201_6

FEATURES

- High common mode rejection
- Four CTR groups available
- V_{IORM} = 850 V
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free

e3

RoHS COMPLIANT

APPLICATIONS

- Switch-mode power supplies
- Line receiver
- Computer peripheral interface
- Microprocessor system interface
- Reinforced isolation provides circuit protection against electrical shock (safety class II)
- Circuits for safe protective separation against electrical shock according to safety class II (reinforced isolation):
  - for application class I to IV at mains voltage ≤ 300 V
  - for application class I to III at mains voltage ≤ 600 V according to DIN EN 60747-5-2

AGENCY APPROVALS

- UL1577, file no. E52744, double protection
- BSI IEC 60950-1:2006 IEC 60065
- DIN EN 60747-5-5 (VDE 0884-5)
- FIMKO
- cUL tested to CSA 22.2 bulletin 5A

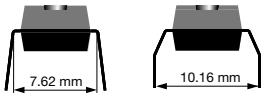
DESCRIPTION

The TCDT1120, TCDT1120G series consists of a phototransistor optically coupled to a gallium arsenide infrared emitting diode in a 6 lead plastic dual in line package.

ORDERING INFORMATION

T	C	D	T	1	1	2	#	#

PART NUMBER



AGENCY CERTIFIED/PACKAGE	CTR (%)			
UL, cUL, VDE, BSI, FIMKO	> 40	63 to 125	100 to 200	160 to 320
DIP-6	TCDT1120	TCDT1122	TCDT1123	TCDT1124
DIP-6, 400 mil	TCDT1120G	TCDT1122G	TCDT1123G	TCDT1124G

Note

- G = leadform 10.16 mm; G is not marked on the body

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)				
PARAMETER	**CONDITION**	**SYMBOL**	**VALUE**	**UNIT**
INPUT				
Reverse voltage		V_R	5	V
Forward current		I_F	60	mA
Forward surge current	$t_p \leq 10$ µs	I_{FSM}	3	A
Power dissipation		P_{diss}	100	mW
Junction temperature		T_j	125	°C
OUTPUT				
Collector emitter voltage		V_{CEO}	70	V
Emitter collector voltage		V_{ECO}	7	V
Collector current		I_C	50	mA
Collector peak current	$t_p/T = 0.5$, $t_p \leq 10$ ms	I_{CM}	100	mA
Power dissipation		P_{diss}	150	mW
Junction temperature		T_j	125	°C
COUPLER				
Total power dissipation		P_{tot}	250	mW
Ambient temperature range		T_{amb}	-55 to +100	°C
Storage temperature range		T_{stg}	-55 to +125	°C
Soldering temperature [1]	2 mm from case, t ≤ 10 s	T_{sld}	260	°C

Notes

- Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operational sections of this document. Exposure to absolute maximum ratings for extended periods of the time can adversely affect reliability.

(1) Refer to wave profile for soldering conditions for through hole devices (DIP).

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)						
PARAMETER	**TEST CONDITION**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
INPUT						
Forward voltage	I_F = 50 mA	V_F	-	1.25	1.6	V
Junction capacitance	V_R = 0 V, f = 1 MHz	C_j	-	50	-	pF
OUTPUT						
Collector emitter voltage	I_C = 1 mA	V_{CEO}	70	-	-	V
Emitter collector voltage	I_E = 100 µA	V_{ECO}	7	-	-	V
Collector ermitter cut-off current	V_{CE} = 20 V, I_F = 0 A	I_{CEO}	-	-	150	nA
COUPLER						
Collector emitter saturation voltage	I_F = 10 mA, I_C = 1 mA	V_{CEsat}	-	-	0.3	V
Cut-off frequency	V_{CE} = 5 V, I_F = 10 mA, R_L = 100 Ω	f_c	-	110	-	kHz
Coupling capacitance	f = 1 MHz	C_k	-	0.3	-	pF

Note

- Minimum and maximum values are tested requirements. Typical values are characteristics of the device and are the result of engineering evaluations. Typical values are for information only and are not part of the testing requirements.

CURRENT TRANSFER RATIO (T_{amb} = 25 °C, unless otherwise specified)							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
I_C/I_F	V_{CE} = 5 V, I_F = 1 mA	TCDT1120	CTR	10	-	-	%
		TCDT1120G					
		TCDT1122	CTR	15	-	-	%
		TCDT1122G					
		TCDT1123	CTR	30	-	-	%
		TCDT1123G					
		TCDT1124	CTR	60	-	-	%
		TCDT1124G					
	V_{CE} = 5 V, I_F = 10 mA	TCDT1120	CTR	40	-	-	%
		TCDT1120G					
		TCDT1122	CTR	63	-	125	%
		TCDT1122G					
		TCDT1123	CTR	100	-	200	%
		TCDT1123G					
		TCDT1124	CTR	160	-	320	%
		TCDT1124G					

SAFETY AND INSULATION RATINGS				
PARAMETER	**TEST CONDITION**	**SYMBOL**	**VALUE**	**UNIT**
Climatic classification	According to IEC 68 part 1		55 / 110 / 21	
Pollution degree	According to DIN VDE 0109		2	
Comparative tracking index	Insulation group IIIa	CTI	175	
Maximum rated withstanding isolation voltage	According to UL1577, t = 1 min	V_{ISO}	5000	V_{RMS}
Tested withstanding isolation voltage	According to UL1577, t = 1 s	V_{ISO}	6000	V_{RMS}
Maximum transient isolation voltage	According to DIN EN 60747-5-5	V_{IOTM}	6000	V_{peak}
Maximum repetitive peak isolation voltage	According to DIN EN 60747-5-5	V_{IORM}	850	V_{peak}
Isolation resistance	T_{amb} = 25 °C, V_{IO} = 500 V	R_{IO}	≥ 1012	Ω
	T_{amb} = 100 °C, V_{IO} = 500 V	R_{IO}	≥ 1011	Ω
	T_{amb} = T_S, V_{IO} = 500 V	R_{IO}	≥ 109	Ω
Output safety power		P_{SO}	265	mW
Input safety current		I_{SI}	130	mA
Input safety temperature		T_S	150	°C
Creepage distance (standard 300 mil lead spread)			≥ 7	mm
Clearance distance (standard 300 mil lead spread)			≥ 7	mm
Creepage distance (400 mil lead spread)			≥ 8	mm
Clearance distance (400 mil lead spread)			≥ 8	mm
Input to output test voltage, method B	V_{IORM} x 1.875 = V_{PR}, 100 % production test with t_M = 1 s, partial discharge < 5 pC	V_{PR}	1600	V_{peak}
Input to output test voltage, method A	V_{IORM} x 1.6 = V_{PR}, 100 % sample test with t_M = 10 s, partial discharge < 5 pC	V_{PR}	1360	V_{peak}

Note

- According to DIN EN 60747-5-2. This optocoupler is suitable for safe electrical isolation only within the safety ratings. Compliance with the safety ratings shall be ensured by means of suitable protective circuits.

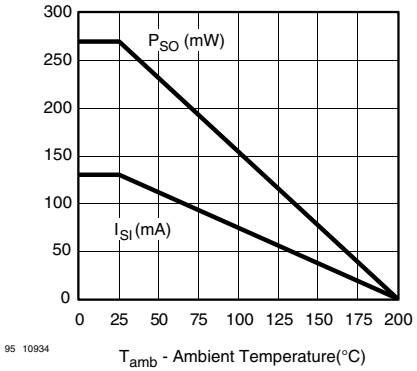


Fig. 1 - Derating Diagram

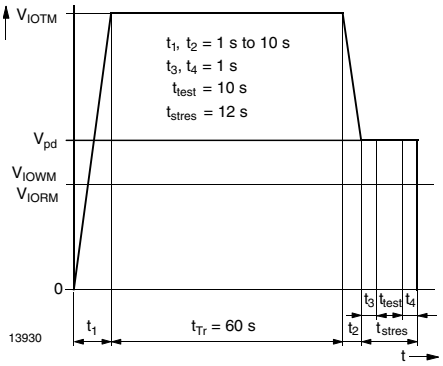


Fig. 2 - Test Pulse Diagram for Sample Test According to DIN EN 60747-5-2 (VDE 0884) / IEC 60747-5-5

SWITCHING CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
Current time	V_S = 5 V, R_L = 100 Ω, (see fig. 4)	TCDT1120	I_F	-	10	-	mA
		TCDT1120G					
		TCDT1122	I_F	-	10	-	mA
		TCDT1122G					
		TCDT1123	I_F	-	10	-	mA
		TCDT1123G					
		TCDT1124	I_F	-	10	-	mA
		TCDT1124G					
Delay time	V_S = 5 V, R_L = 100 Ω, (see fig. 4)	TCDT1120	t_D	-	2.5	-	µs
		TCDT1120G					
		TCDT1122	I_F	-	-	-	µs
		TCDT1122G					
		TCDT1123	t_D	-	2.8	-	µs
		TCDT1123G					
		TCDT1124	t_D	-	2	-	µs
		TCDT1124G					
Rise time	V_S = 5 V, R_L = 100 Ω, (see fig. 4)	TCDT1120	t_r	-	3	-	µs
		TCDT1120G					
		TCDT1122	I_F	-	-	-	µs
		TCDT1122G					
		TCDT1123	t_r	-	4.2	-	µs
		TCDT1123G					
		TCDT1124	t_r	-	4	-	µs
		TCDT1124G					
Storage time	V_S = 5 V, R_L = 100 Ω, (see fig. 4)	TCDT1120	t_s	-	0.3	-	µs
		TCDT1120G					
		TCDT1122	t_s	-	0.3	-	µs
		TCDT1122G					
		TCDT1123	t_s	-	0.3	-	µs
		TCDT1123G					
		TCDT1124	t_s	-	0.3	-	µs
		TCDT1124G					

SWITCHING CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
Fall time	V_S = 5 V, R_L = 100 Ω, (see fig. 4)	TCDT1120	t_f	-	3.7	-	µs
		TCDT1120G					
		TCDT1122	t_s	-	-	-	µs
		TCDT1122G					
		TCDT1123	t_f	-	4.7	-	µs
		TCDT1123G					
		TCDT1124	t_f	-	4.7	-	µs
		TCDT1124G					
Turn-on time	V_S = 5 V, R_L = 100 Ω, (see fig. 4)	TCDT1120	t_{on}	-	5.5	-	µs
		TCDT1120G					
		TCDT1122	t_s	-	-	-	µs
		TCDT1122G					
		TCDT1123	t_{on}	-	7	-	µs
		TCDT1123G					
		TCDT1124	t_{on}	-	6	-	µs
		TCDT1124G					
Turn-off time	V_S = 5 V, R_L = 100 Ω, (see fig. 4)	TCDT1120	t_{off}	-	4	-	µs
		TCDT1120G					
		TCDT1122	t_s	-	-	-	µs
		TCDT1122G					
		TCDT1123	t_{off}	-	5	-	µs
		TCDT1123G					
		TCDT1124	t_{off}	-	5	-	µs
		TCDT1124G					
Turn-on time	V_S = 5 V, R_L = 1 kΩ, (see fig. 5)	TCDT1120	t_{on}	-	16.5	-	µs
		TCDT1120G					
		TCDT1122	t_s	-	-	-	µs
		TCDT1122G					
		TCDT1123	t_{on}	-	21.5	-	µs
		TCDT1123G					
		TCDT1124	t_{on}	-	20	-	µs
		TCDT1124G					
Turn-off time	V_S = 5 V, R_L = 1 kΩ, (see fig. 5)	TCDT1120	t_{off}	-	22.5	-	µs
		TCDT1120G					
		TCDT1122	t_s	-	-	-	µs
		TCDT1122G					
		TCDT1123	t_{off}	-	37.5	-	µs
		TCDT1123G					
		TCDT1124	t_{off}	-	50	-	µs
		TCDT1124G					

TYPICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

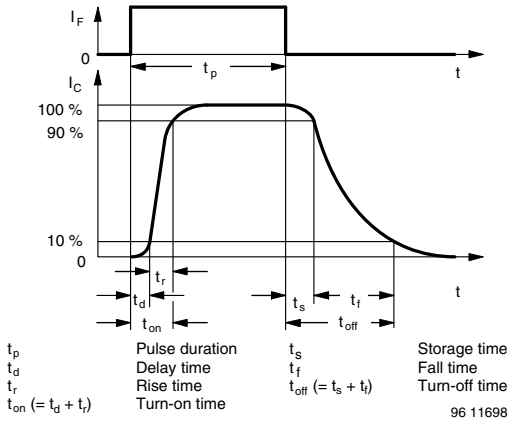


Fig. 3 - Switching Times

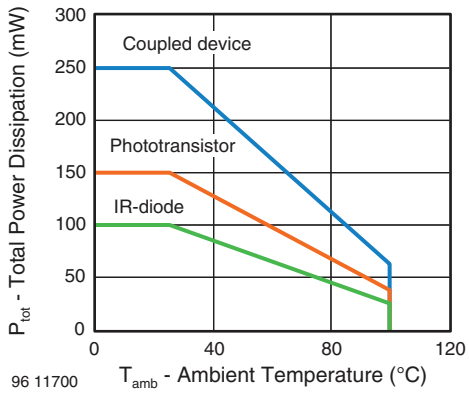


Fig. 6 - Total Power Dissipation vs. Ambient Temperature

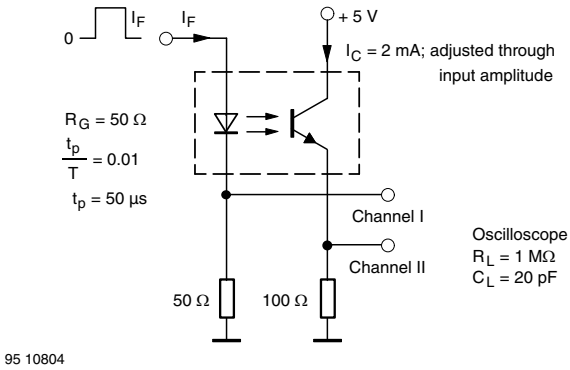


Fig. 4 - Test Circuit, Non-Saturated Operation

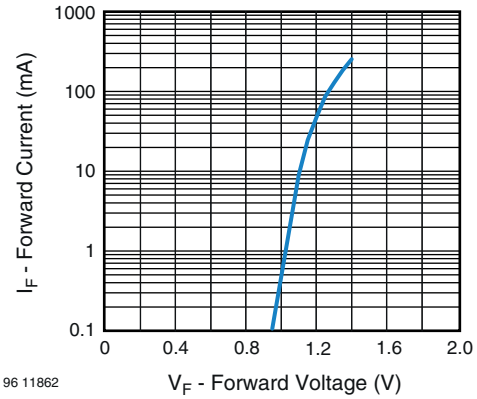


Fig. 7 - Forward Current vs. Forward Voltage

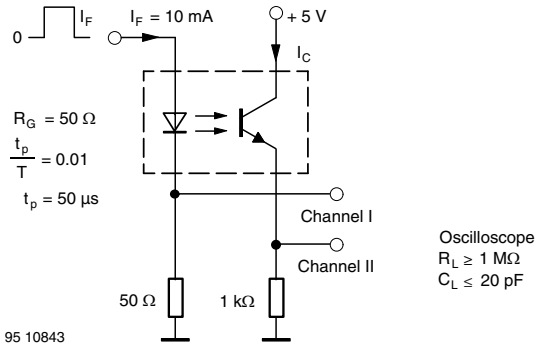


Fig. 5 - Test Circuit, Saturated Operation

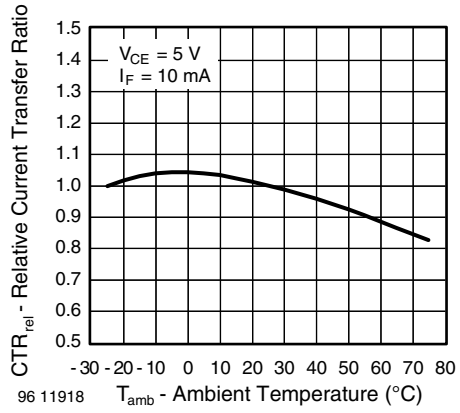


Fig. 8 - Relative Current Transfer Ratio vs. Ambient Temperature

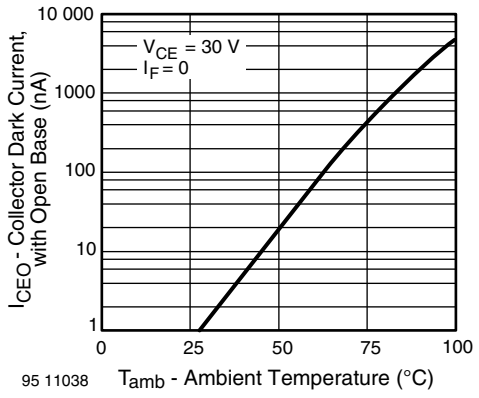


Fig. 9 - Collector Dark Current vs. Ambient Temperature

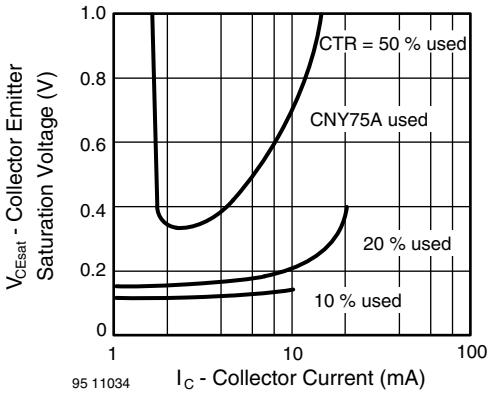


Fig. 12 - Collector Emitter Saturation Voltage vs. Collector Current

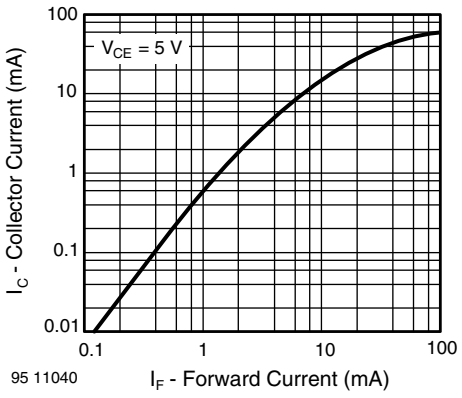


Fig. 10 - Collector Current vs. Forward Current

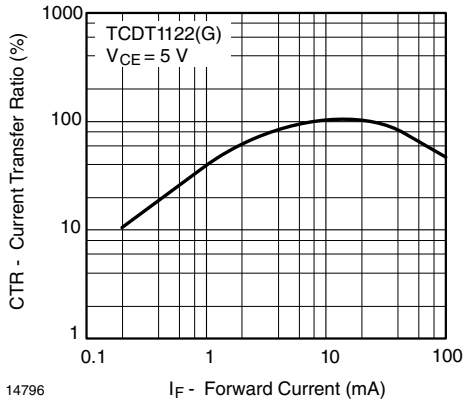


Fig. 13 - Current Transfer Ratio vs. Forward Current

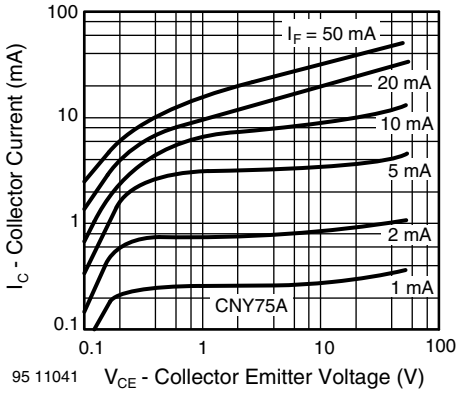


Fig. 11 - Collector Current vs. Collector Emitter Voltage

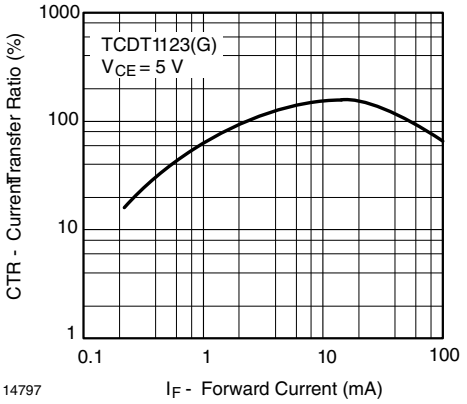


Fig. 14 - Current Transfer Ratio vs. Forward Current

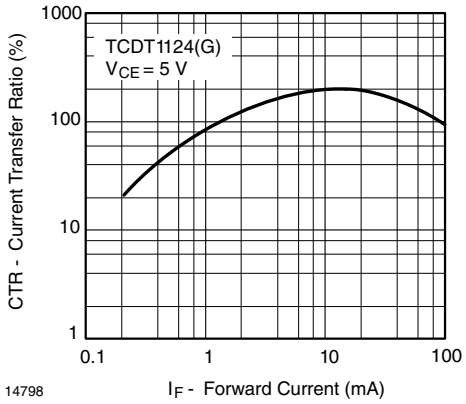


Fig. 15 - Current Transfer Ratio vs. Forward Current

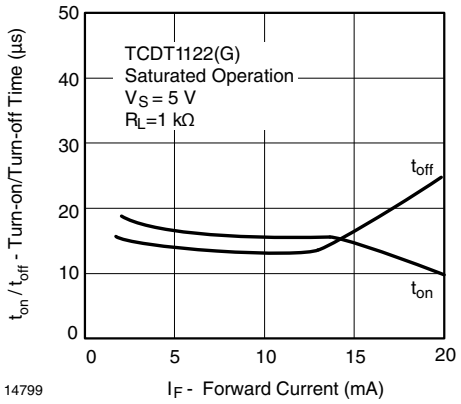


Fig. 16 - Turn-On / Turn-Off Time vs. Forward Current

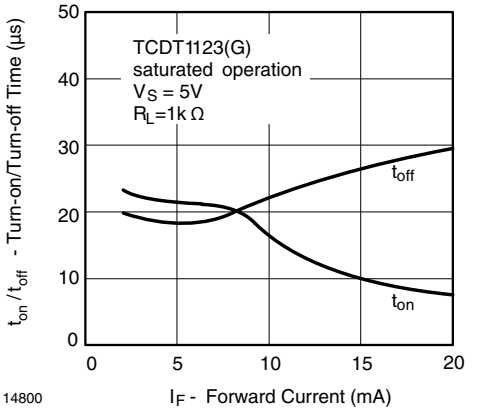


Fig. 17 - Turn-On / Turn-Off Time vs. Forward Current

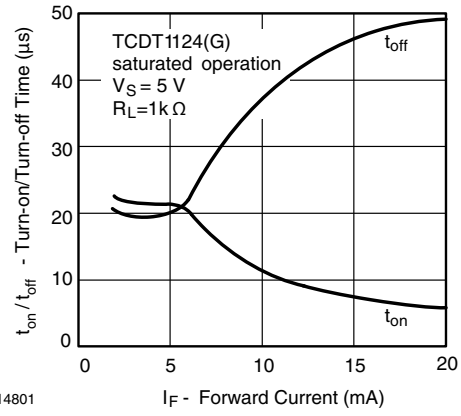


Fig. 18 - Turn-On / Turn-Off Time vs. Forward Current

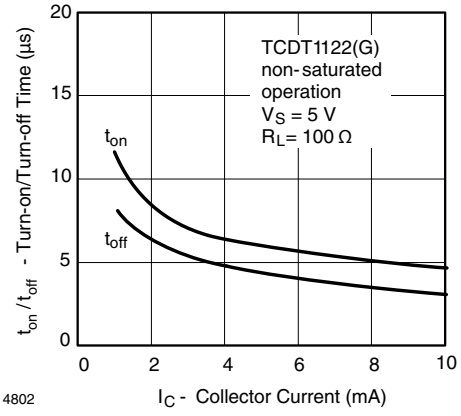


Fig. 19 - Turn-On / Turn-Off Time vs. Collector Current

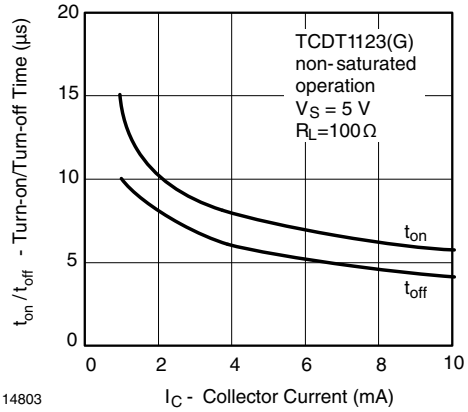


Fig. 20 - Turn-On / Turn-Off Time vs. Collector Current

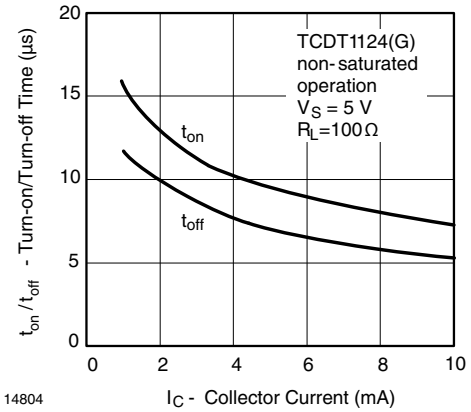
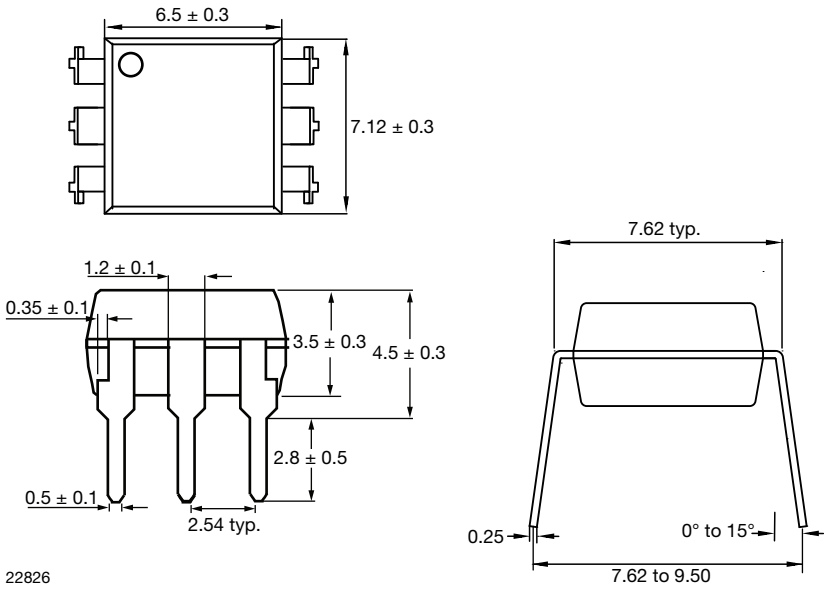


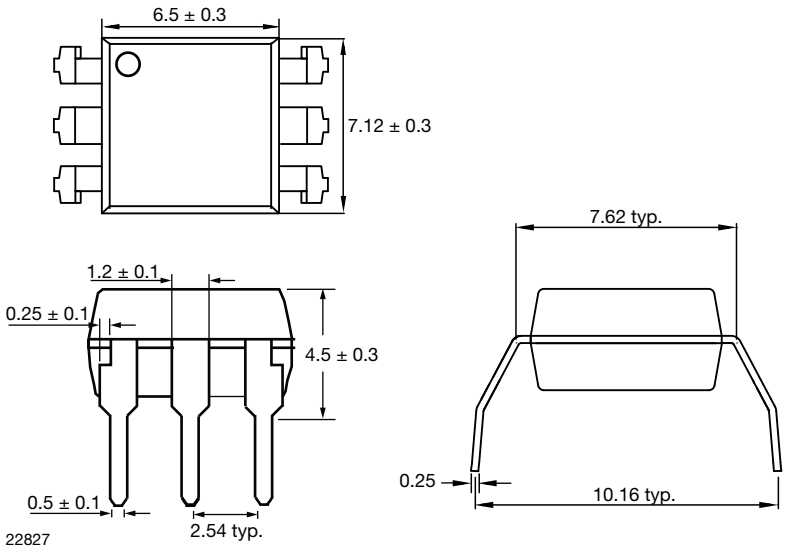
Fig. 21 - Turn-On / Turn-Off Time vs. Collector Current

PACKAGE DIMENSIONS (in millimeters)

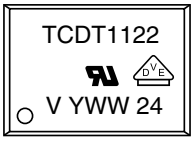
DIP-6



DIP-6, 400 mil



PACKAGE MARKING



Note

- Example of making used for the TCDT1122 and TCDT1122G

SOLDER PROFILES

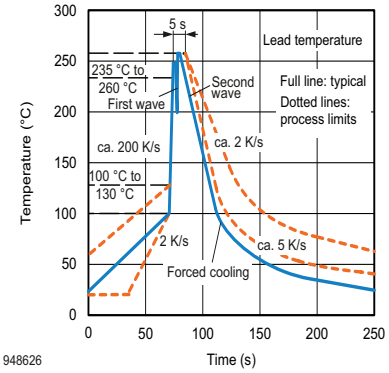


Fig. 22 - Wave Soldering Double Wave Profile According to J-STD-020 for DIP Devices

HANDLING AND STORAGE CONDITIONS

ESD level: HBM class 2

Floor life: unlimited

Conditions: T_{amb} < 30 °C, RH < 85 %

Moisture sensitivity level 1, according to J-STD-020

Disclaimer

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