
Photocouplers Photorelay

TLP3543A, TLP3543AF

1. Applications

- Mechanical relay replacements
- Heating, ventilation and air conditioning (HVAC)
- Security Systems
- Factory Automation (FA)
- Measuring Instruments

2. General

The TLP3543A and TLP3543AF photorelay consist of a photo MOSFET optically coupled to an infrared light emitting diode. It is housed in a 6-pin DIP package. The low ON-state resistance and the high permissible ON-state current of the TLP3543A and TLP3543AF make it suitable for power line control applications.

3. Features

- (1) Normally opened (1-Form-A)
- (2) OFF-state output terminal voltage: 30 V (min)
- (3) Trigger LED current: 3 mA (max)
- (4) ON-state current: 5 A (max) (A connection)
- (5) ON-state resistance: 40 mΩ (max) (A connection)
- (6) Isolation voltage: 2500 Vrms (min)
- (7) Safety standards

UL-approved: UL1577, File No.E67349

cUL-approved: CSA Component Acceptance Service No.5A File No.E67349

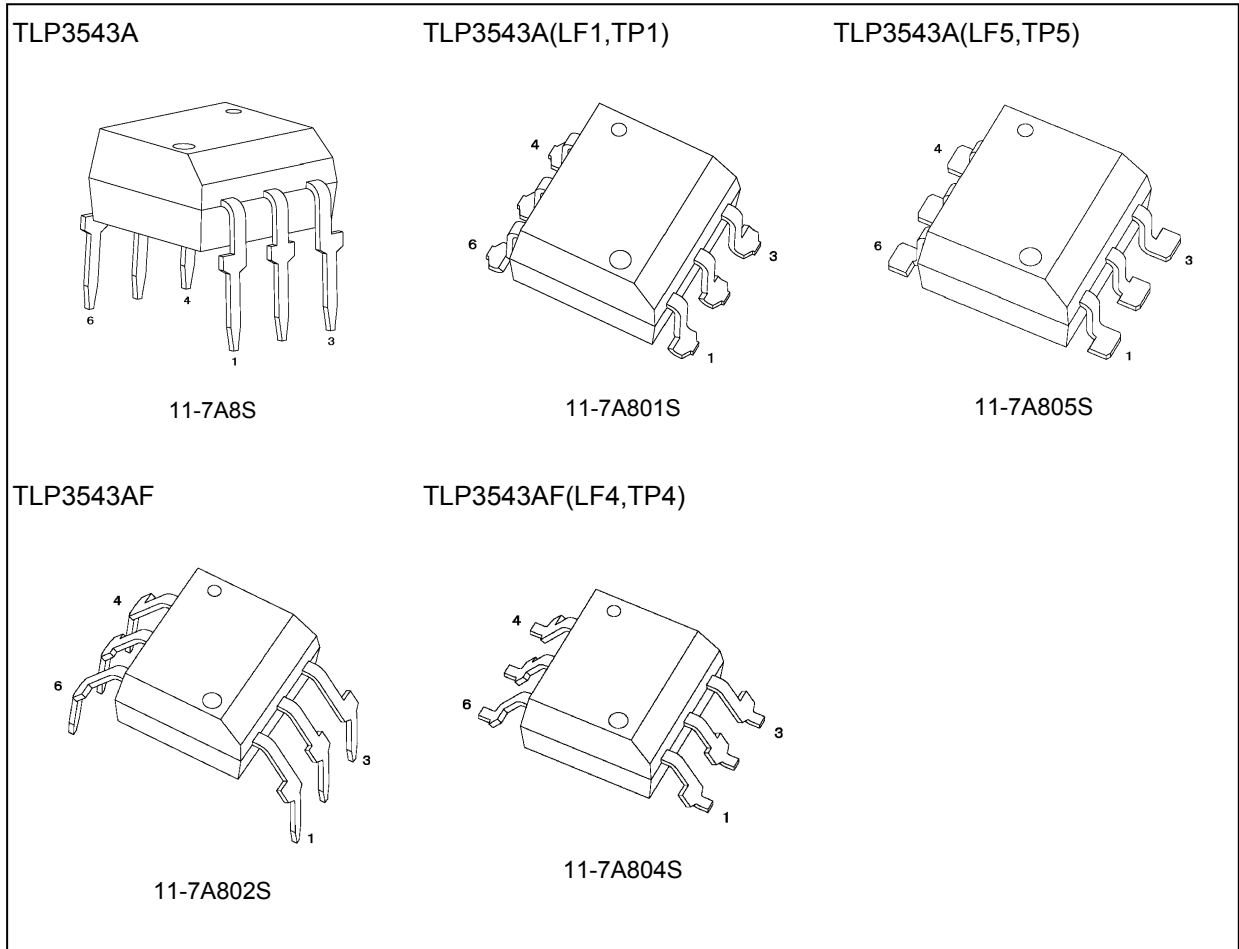
VDE-approved: EN60747-5-5 (Pending) **(Note 1)**

(Note 1):When a VDE approved type is needed, please designate the **Option (D4)**.

Start of commercial production

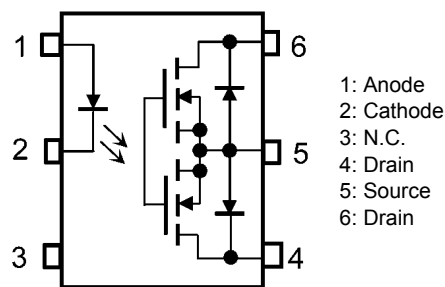
2017-12

4. Packaging (Note)

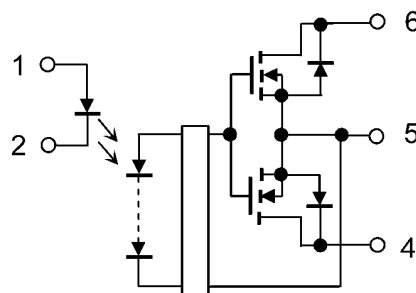


Note: Through-hole type: TLP3543A, TLP3543AF
 Lead forming option: (LF1), (LF4), (LF5)
 Taping option: (TP1), (TP4), (TP5)

5. Pin Assignment



6. Internal Circuit



7. Absolute Maximum Ratings (Note) (Unless otherwise specified, $T_a = 25\text{ }^\circ\text{C}$)

	Characteristics	Symbol	Note	Rating	Unit
LED	Input forward current	I_F		30	mA
	Input forward current derating ($T_a \geq 25\text{ }^\circ\text{C}$)	$\Delta I_F/\Delta T_a$		-0.3	mA/ $^\circ\text{C}$
	Input forward current (pulsed) (100 μs pulse, 100 pps)	I_{FP}		1	A
	Input reverse voltage	V_R		6	V
	Input power dissipation	P_D		50	mW
	Input power dissipation derating	$\Delta P_D/\Delta T_a$		-0.5	mW/ $^\circ\text{C}$
	Junction temperature	T_j		125	$^\circ\text{C}$
Detector	OFF-state output terminal voltage	V_{OFF}		30	V
	ON-state current (A connection)	I_{ON}	(Note 1)	5	A
	ON-state current (B connection)	I_{ON}	(Note 1)	5	
	ON-state current (C connection)	I_{ON}	(Note 1)	10	
	ON-state current derating (A connection) ($T_a \geq 25\text{ }^\circ\text{C}$)	$\Delta I_{ON}/\Delta T_a$	(Note 1)	-50	mA/ $^\circ\text{C}$
	ON-state current derating (B connection) ($T_a \geq 25\text{ }^\circ\text{C}$)	$\Delta I_{ON}/\Delta T_a$	(Note 1)	-50	
	ON-state current derating (C connection) ($T_a \geq 25\text{ }^\circ\text{C}$)	$\Delta I_{ON}/\Delta T_a$	(Note 1)	-100	
	ON-state current (pulsed) ($t = 100\text{ ms}$, Duty = 1/10)	I_{ONP}		15	A
	Output power dissipation	P_O		700	mW
	Output power dissipation derating	$\Delta P_O/\Delta T_a$		-7.0	mW/ $^\circ\text{C}$
	Junction temperature	T_j		125	$^\circ\text{C}$
Common	Storage temperature	T_{stg}		-55 to 125	
	Operating temperature	T_{opr}		-40 to 110	
	Lead soldering temperature (10 s)	T_{sol}		260	
	Isolation voltage AC, 60 s, R.H. $\leq 60\%$	BV_S	(Note 2)	2500	

Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings.

Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Note 1: For an application circuit example, see Chapter 13.2.

Note 2: This device is considered as a two-terminal device: Pins 1, 2 and 3 are shorted together, and pins 4, 5 and 6 are shorted together.

8. Recommended Operating Conditions (Note)

Characteristics	Symbol	Note	Min	Typ.	Max	Unit
Supply voltage	V_{DD}		—	—	24	V
Input forward current	I_F		5	10	25	mA
ON-state current (A connection)	I_{ON}		—	—	5	A
Operating temperature	T_{opr}		-40	—	85	$^\circ\text{C}$

Note: The recommended operating conditions are given as a design guide necessary to obtain the intended performance of the device. Each parameter is an independent value. When creating a system design using this device, the electrical characteristics specified in this datasheet should also be considered.

9. Electrical Characteristics (Unless otherwise specified, $T_a = 25\text{ }^\circ\text{C}$)

	Characteristics	Symbol	Note	Test Condition	Min	Typ.	Max	Unit
LED	Input forward voltage	V_F		$I_F = 10\text{ mA}$	1.50	1.64	1.80	V
	Input reverse current	I_R		$V_R = 5\text{ V}$	—	—	10	μA
	Input capacitance	C_t		$V = 0\text{ V}, f = 1\text{ MHz}$	—	70	—	pF
Detector	OFF-state current	I_{OFF}		$V_{OFF} = 30\text{ V}$	—	0.01	1	μA
	Output capacitance	C_{OFF}		$V = 0\text{ V}, f = 1\text{ MHz}$	—	1100	—	pF

10. Coupled Electrical Characteristics (Unless otherwise specified, $T_a = 25\text{ }^\circ\text{C}$)

Characteristics	Symbol	Note	Test Condition	Min	Typ.	Max	Unit
Trigger LED current	I_{FT}		$I_{ON} = 1\text{ A}$	—	0.2	3	mA
Return LED current	I_{FC}		$I_{OFF} = 10\text{ }\mu\text{A}$	0.01	—	—	
ON-state resistance (A connection)	R_{ON}	(Note 1)	$I_{ON} = 3\text{ A}, I_F = 5\text{ mA}, t < 1\text{ s}$	—	20	40	m Ω
ON-state resistance (B connection)			$I_{ON} = 5\text{ A}, I_F = 5\text{ mA}, t < 1\text{ s}$	—	10	—	
ON-state resistance (C connection)			$I_{ON} = 10\text{ A}, I_F = 5\text{ mA}, t < 1\text{ s}$	—	5	—	

Note 1: For an application circuit example, see Chapter 13.2.

11. Isolation Characteristics (Unless otherwise specified, $T_a = 25\text{ }^\circ\text{C}$)

Characteristics	Symbol	Note	Test Condition	Min	Typ.	Max	Unit
Total capacitance (input to output)	C_S	(Note 1)	$V_S = 0\text{ V}, f = 1\text{ MHz}$	—	0.8	—	pF
Isolation resistance	R_S	(Note 1)	$V_S = 500\text{ V}, \text{R.H.} \leq 60\%$	5×10^{10}	10^{14}	—	Ω
Isolation voltage	BV_S	(Note 1)	AC, 60 s	2500	—	—	Vrms
			AC, 1 s in oil	—	5000	—	
			DC, 60 s, in oil	—	5000	—	Vdc

Note 1: This device is considered as a two-terminal device: Pins 1, 2 and 3 are shorted together, and pins 4, 5 and 6 are shorted together.

12. Switching Characteristics (Unless otherwise specified, $T_a = 25\text{ }^\circ\text{C}$)

Characteristics	Symbol	Note	Test Condition	Min	Typ.	Max	Unit
Turn-on time	t_{ON}		See Fig. 12.1. $R_L = 200\text{ }\Omega, V_{DD} = 20\text{ V}, I_F = 5\text{ mA}$	—	0.8	5	ms
Turn-off time	t_{OFF}			—	0.1	0.5	
Turn-on time	t_{ON}		See Fig. 12.1. $R_L = 200\text{ }\Omega, V_{DD} = 20\text{ V}, I_F = 10\text{ mA}$	—	0.4	3	
Turn-off time	t_{OFF}			—	0.2	0.5	

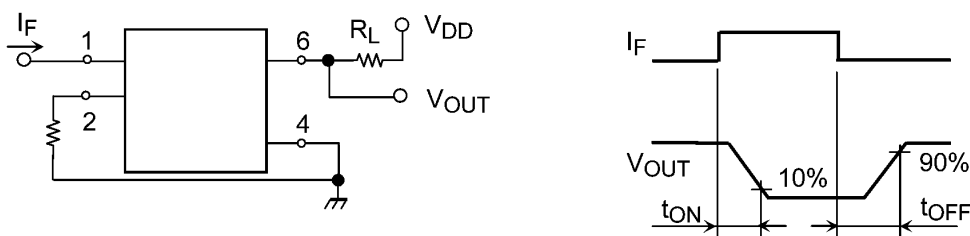


Fig. 12.1 Switching Time Test Circuit and Waveform

13. Characteristics Curves and Circuit Connections

13.1. Characteristics Curves (Note)

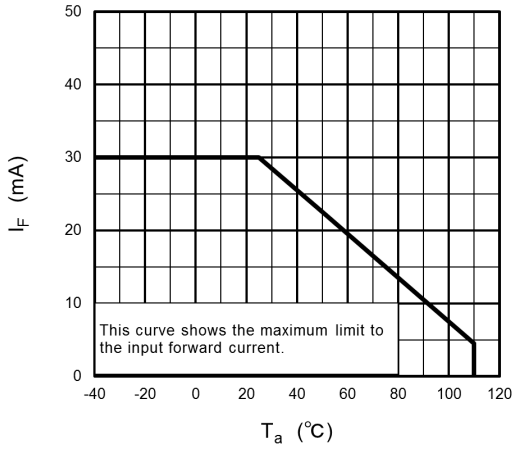


Fig. 13.1.1 $I_F - T_a$

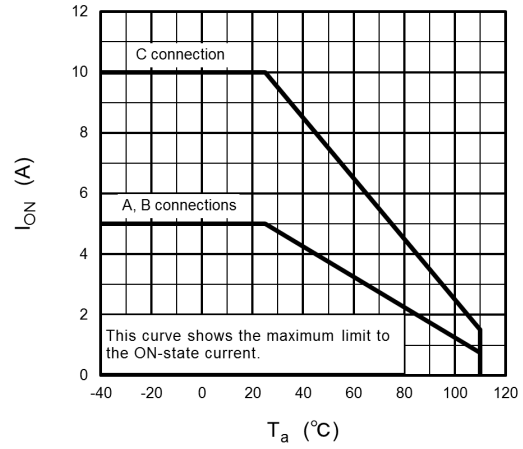


Fig. 13.1.2 $I_{ON} - T_a$

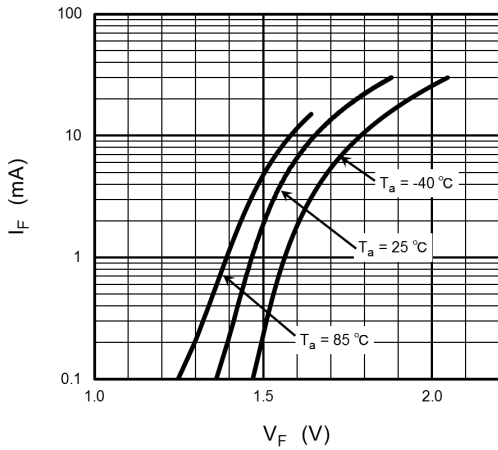


Fig. 13.1.3 $I_F - V_F$

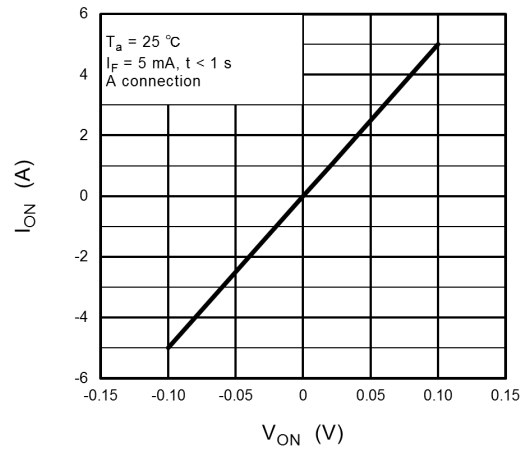


Fig. 13.1.4 $I_{ON} - V_{ON}$

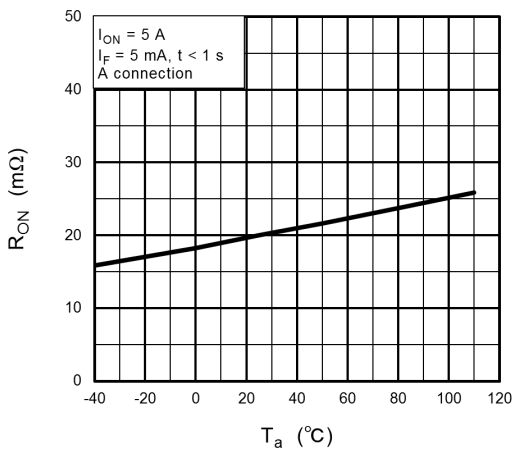


Fig. 13.1.5 $R_{ON} - T_a$

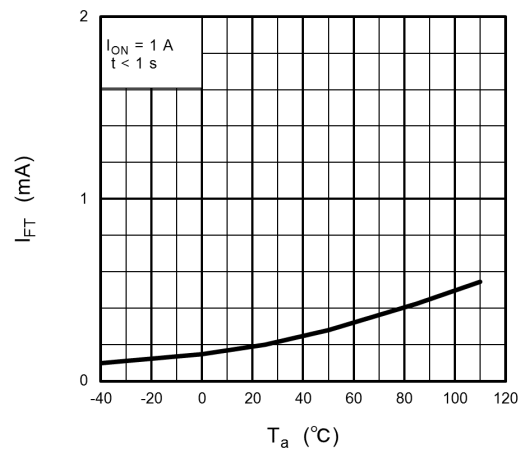


Fig. 13.1.6 $I_{FT} - T_a$

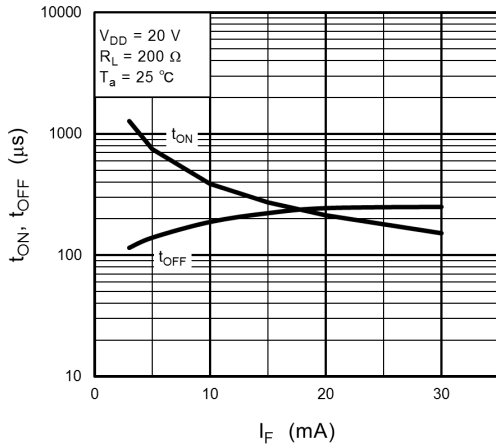


Fig. 13.1.7 $t_{ON}, t_{OFF} - I_F$

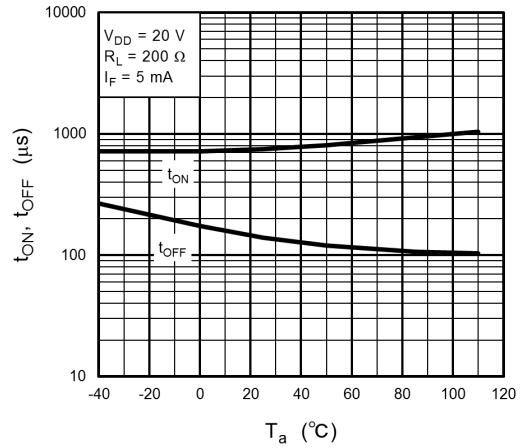


Fig. 13.1.8 $t_{ON}, t_{OFF} - T_a$

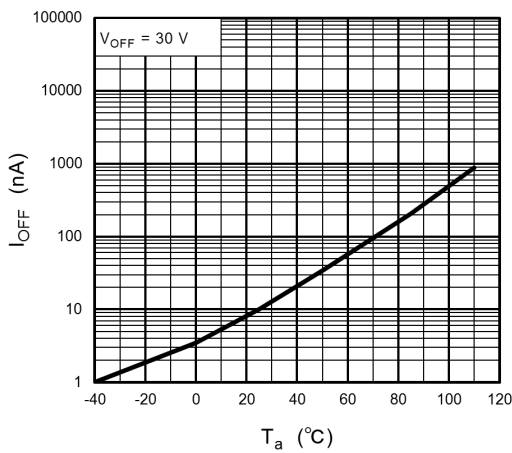


Fig. 13.1.9 $I_{OFF} - T_a$

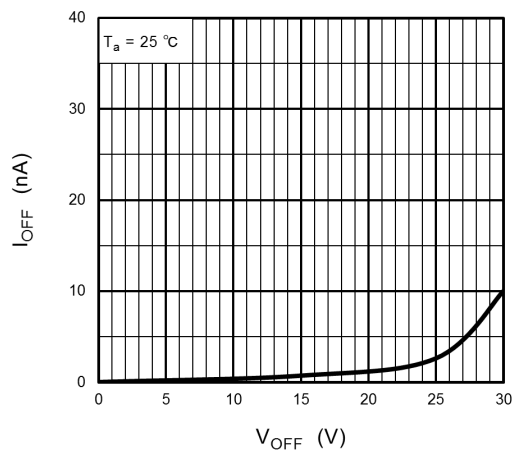


Fig. 13.1.10 $I_{OFF} - V_{OFF}$

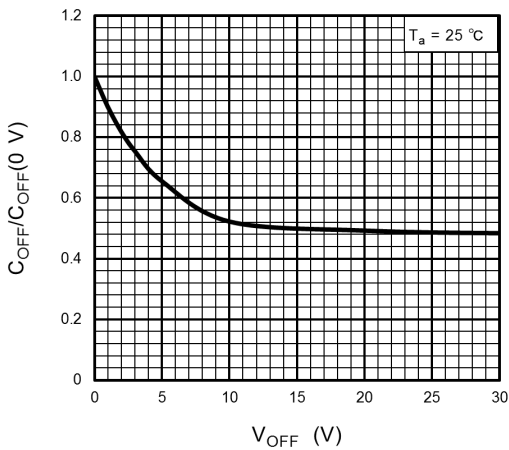


Fig. 13.1.11 $C_{OFF}/C_{OFF} - V_{OFF}$

Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

13.2. Circuit Connections

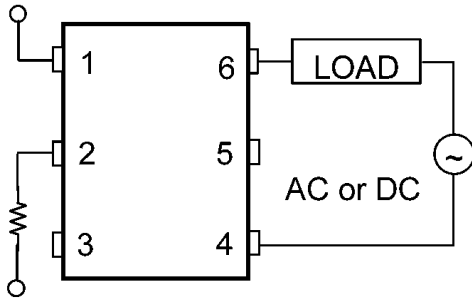


Fig. 13.2.1 A Connection

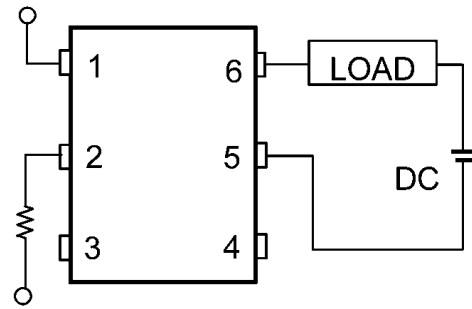


Fig. 13.2.2 B Connection

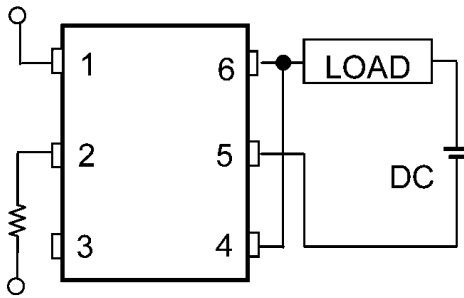


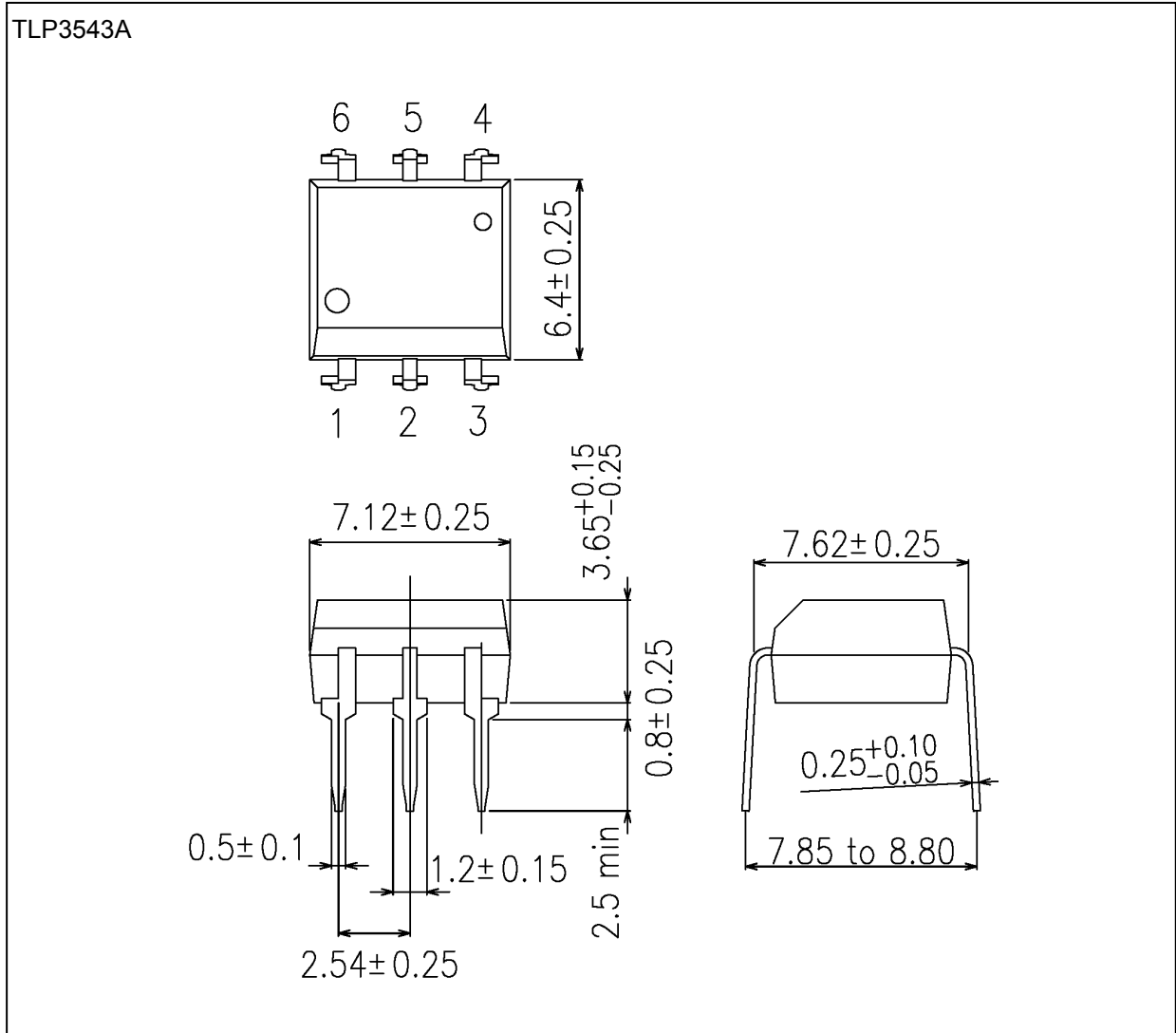
Fig. 13.2.3 C Connection

14. Ordering Information (Example of Item Name)

Item Name	Packaging	VDE Option	Packing (MOQ)
TLP3543A(F(O	TH		Magazine (50 pcs)
TLP3543A(LF1,F(O	LF1		Magazine (50 pcs)
TLP3543A(LF5,F(O	LF5		Magazine (50 pcs)
TLP3543A(TP1,F(O	LF1		Tape and reel (1500 pcs)
TLP3543A(TP5,F(O	LF5		Tape and reel (1500 pcs)
TLP3543A(D4,F(O	TH	EN60747-5-5	Magazine (50 pcs)
TLP3543A(D4LF1,F(O	LF1	EN60747-5-5	Magazine (50 pcs)
TLP3543A(D4LF5,F(O	LF5	EN60747-5-5	Magazine (50 pcs)
TLP3543A(D4TP1,F(O	LF1	EN60747-5-5	Tape and reel (1500 pcs)
TLP3543A(D4TP5,F(O	LF5	EN60747-5-5	Tape and reel (1500 pcs)
TLP3543AF(F(O	TH, Wide forming		Magazine (50 pcs)
TLP3543AF(LF4,F(O	LF4, Wide forming		Magazine (50 pcs)
TLP3543AF(TP4,F(O	LF4, Wide forming		Tape and reel (1000 pcs)
TLP3543AF(D4,F(O	TH, Wide forming	EN60747-5-5	Magazine (50 pcs)
TLP3543AF(D4LF4F(O	LF4, Wide forming	EN60747-5-5	Magazine (50 pcs)
TLP3543AF(D4TP4F(O	LF4, Wide forming	EN60747-5-5	Tape and reel (1000 pcs)

Package Dimensions

Unit: mm

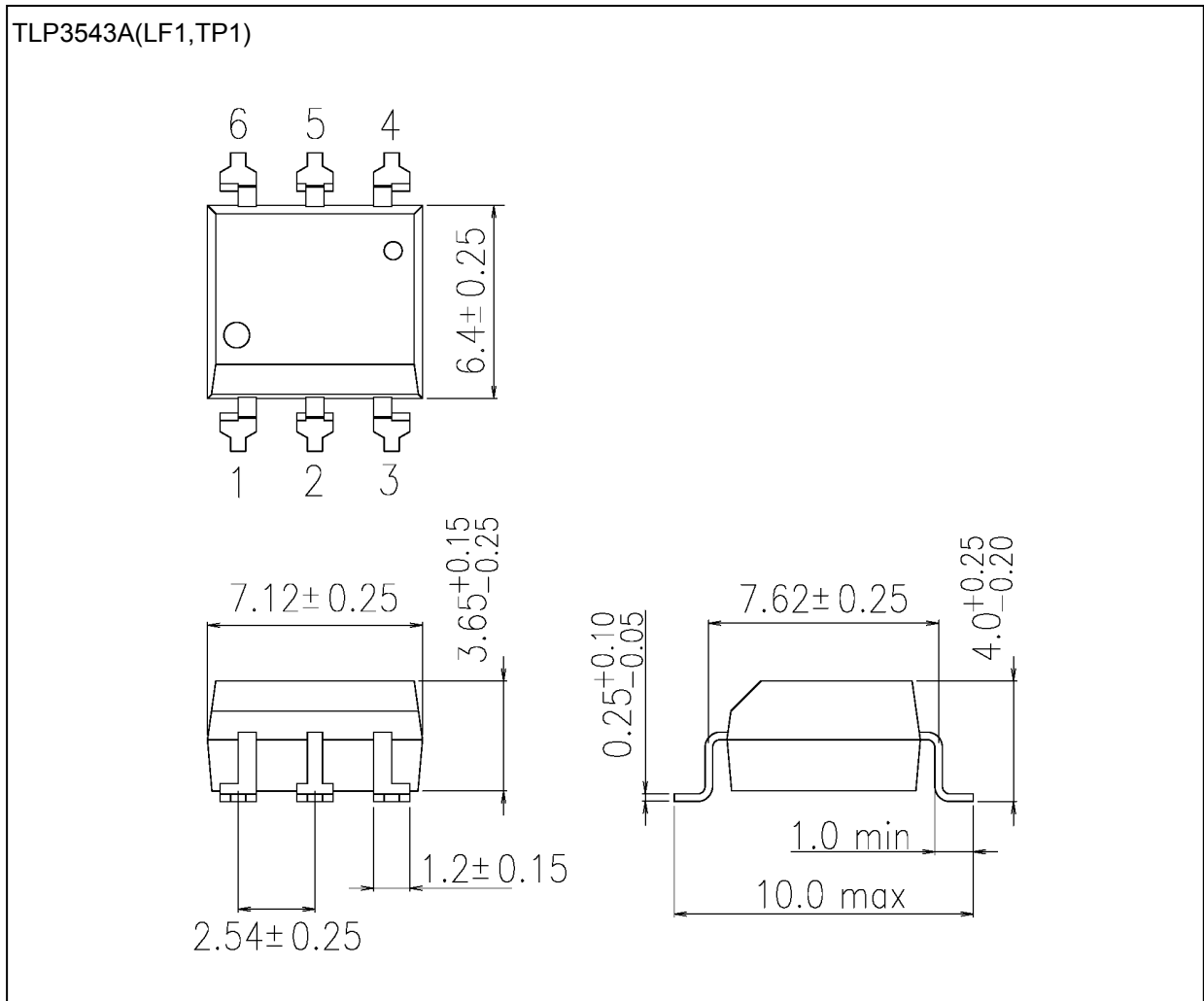


Weight: 0.4 g (typ.)

Package Name(s)
TOSHIBA: 11-7A8S

Package Dimensions

Unit: mm

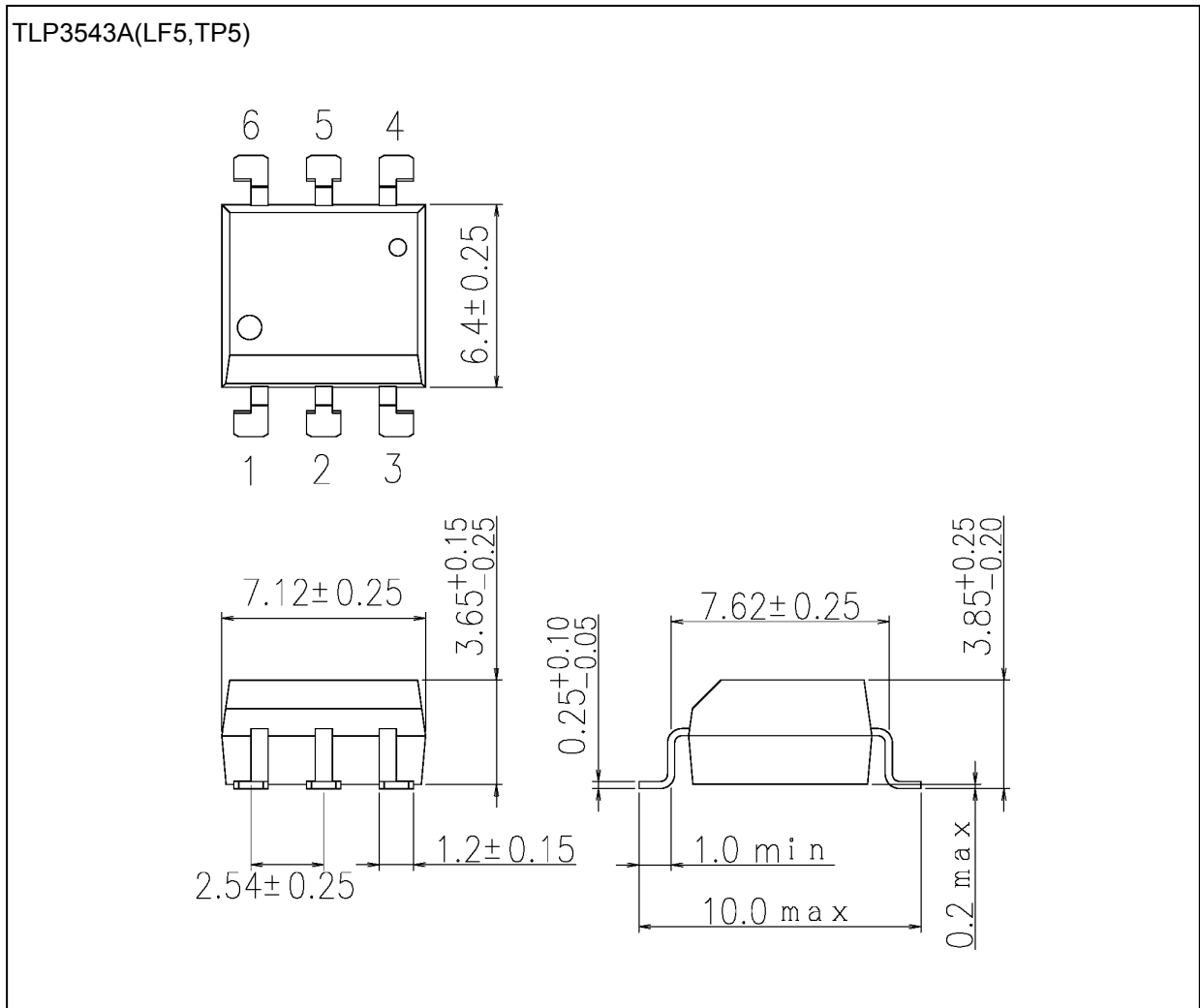


Weight: 0.39 g (typ.)

Package Name(s)
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Package Dimensions

Unit: mm

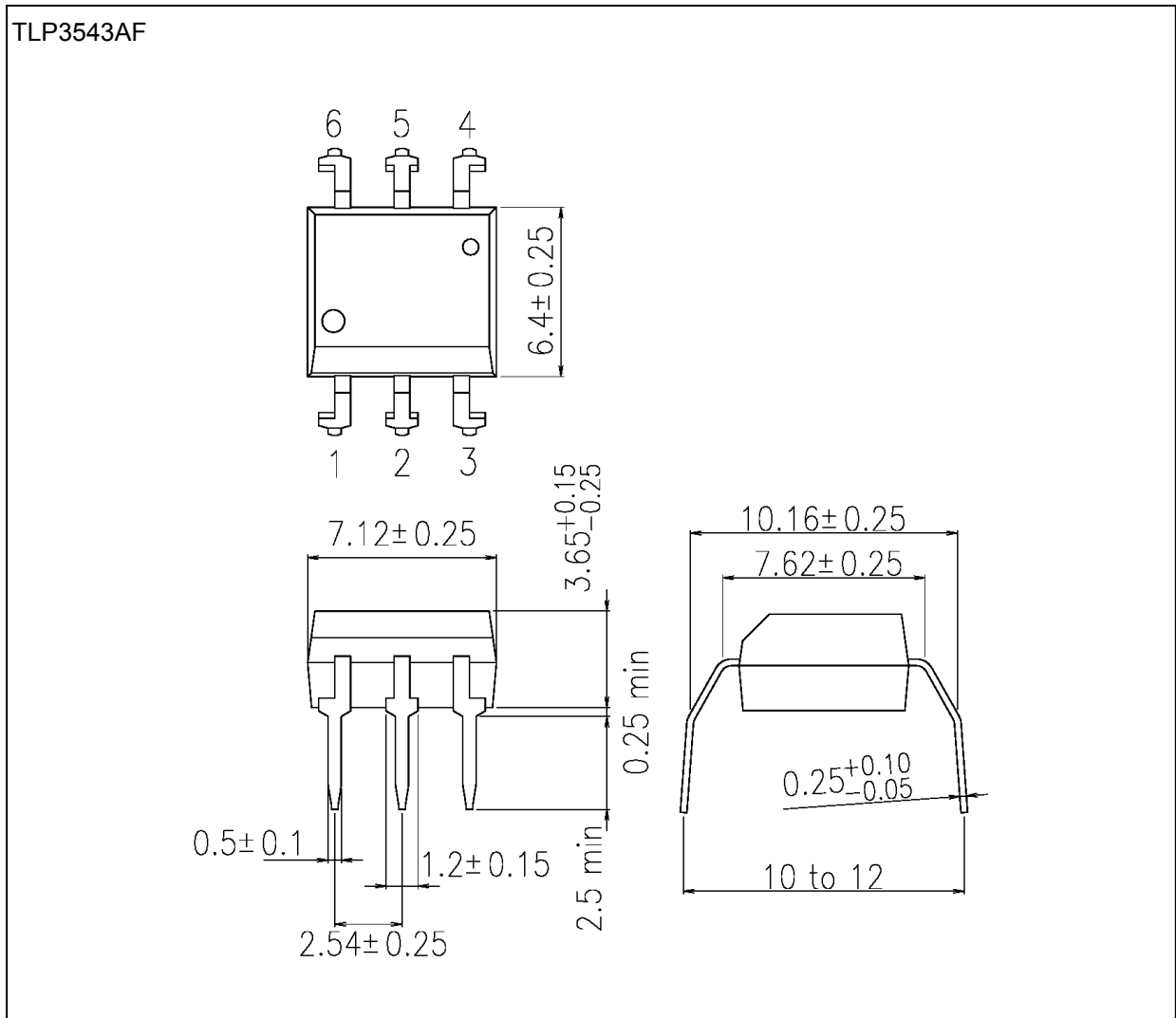


Weight: 0.39 g (typ.)

Package Name(s)
TOSHIBA: 11-7A805S

Package Dimensions

Unit: mm

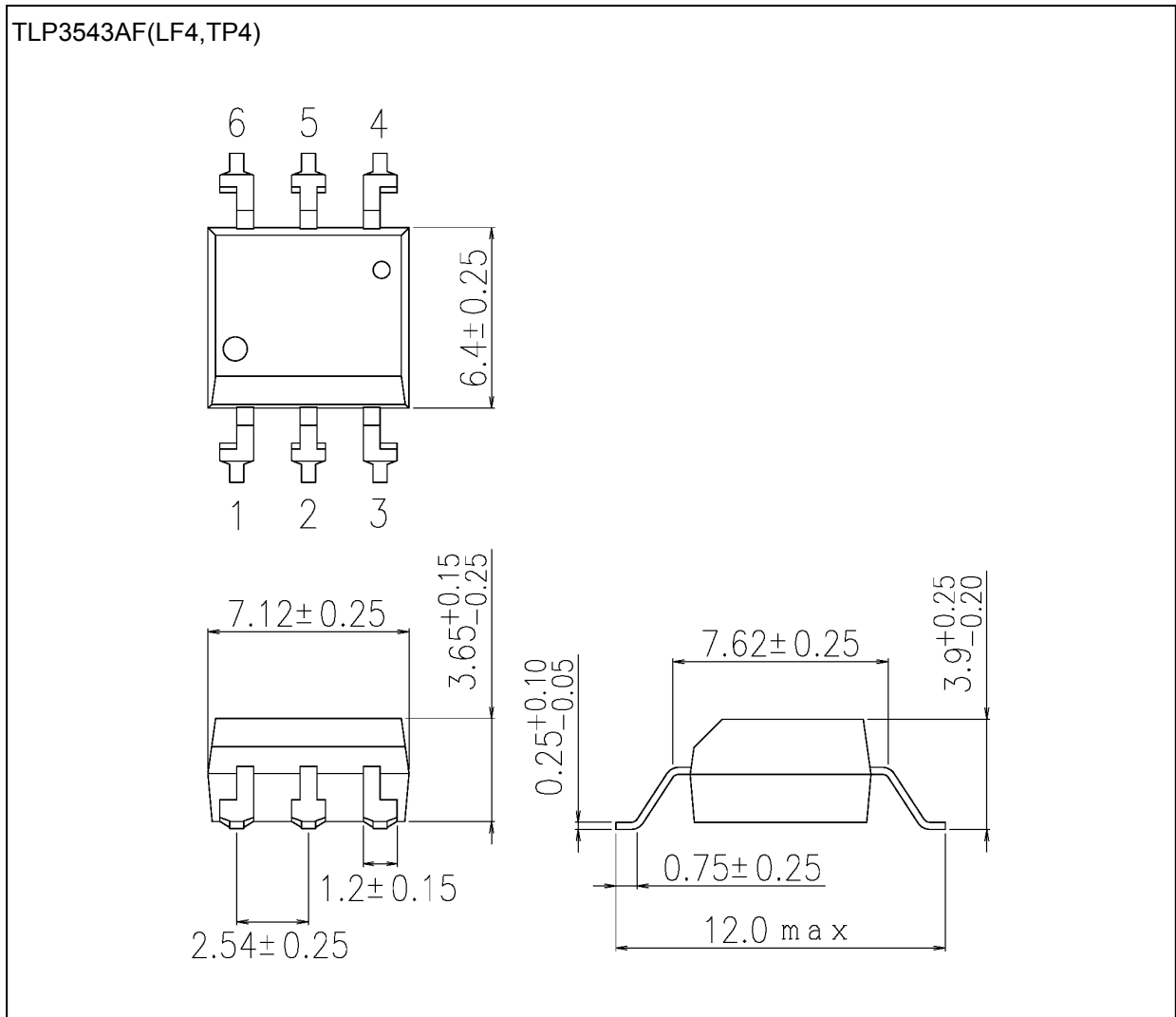


Weight: 0.4 g (typ.)

Package Name(s)
TOSHIBA: 11-7A802S

Package Dimensions

Unit: mm



Weight: 0.39 g (typ.)

Package Name(s)
TOSHIBA: 11-7A804S

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