CT4504

High CMR, 1Mbit/s High Speed Optocoupler

Features

- High speed 1Mbit/s
- High isolation voltage between input and output (Viso=5000 Vrms)
- Guaranteed CTR performance from 0℃ to 70℃
- Wide operating temperature range of -55℃ to 100℃
- Regulatory Approvals
  - UL - UL1577 (E364000)
  - VDE - EN60747-5-5(VDE0884-5)
  - CQC – GB4943.1, GB8898
  - IEC60065, IEC60950

Applications

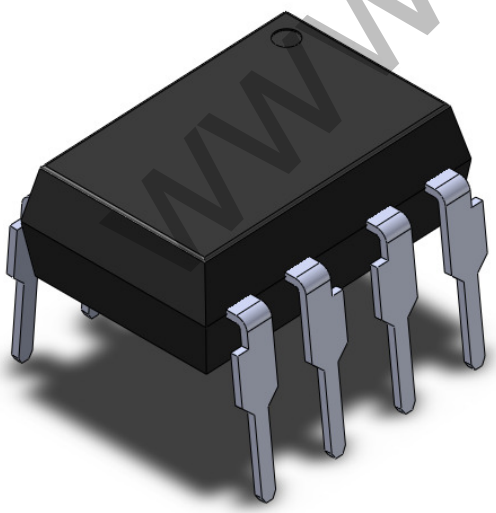
- Line receivers
- Telecommunication equipment
- Feedback loop in switch-mode power supplies
- Home appliances
- High speed logic ground isolation

Description

The CT4504 series devices consist of an infrared emitting diode, optically coupled to a high speed photo detector transistor. A separate connection for the photodiode bias and output-transistor collector increase the speed by several orders of magnitude over conventional phototransistor couplers by reducing the base-collector capacitance of the input transistor.

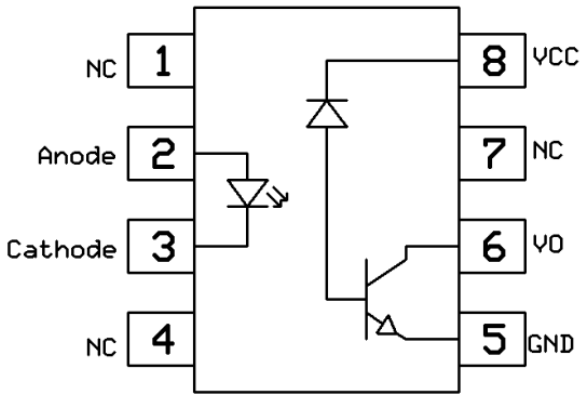
The devices are packaged in an 8-pin DIP package and also available in gullwing (400mil) and surface mount lead forming.

Package Outline



Note: Different bending options available. See package dimension.

Schematic



Absolute Maximum Rating at 25°C

Symbol	*Parameters*	*Ratings*	*Units*	*Notes*
V_{ISO}	Isolation voltage *1	5000	V_{RMS}	
T_{OPR}	Operating temperature	-55 ~ +100	°C	
T_{STG}	Storage temperature	-55 ~ +125	°C	
T_{SOL}	Soldering temperature *2	260	°C	
Emitter				
I_F	Forward current	25	mA	
I_{FP}	Peak forward current (50% duty, 1ms P.W)	50	mA	
$I_{F(TRANS)}$	Peak transient current (≤1μs P.W,300pps)	1	A	
V_R	Reverse voltage	5	V	
P_D	Power dissipation	45	mW	
Detector				
P_D	Power dissipation	100	mW	
V_{EBR}	Emitter-Base reverse voltage	5	V	
I_B	Base current	5	mA	
$I_{O(AVG)}$	Average Output current	8	mA	
$I_{O\ (Peak)}$	Peak Output current	16	mA	
V_O	Output voltage	-0.5 to 20	V	
V_{CC}	Supply voltage	-0.5 to 30	V	

Electrical Characteristics

T_A = 0 - 70℃ (unless otherwise specified). Typical values are measured at T_A = 25^{0}C and V_{CC}=5V

Emitter Characteristics

Symbol	Parameters	Test Conditions	Min	Typ	Max	Units	Notes
V_F	Forward voltage	IF = 16mA	-	1.45	1.6	V	
V_R	Reverse Voltage	IR = 10μA	5.0	-	-	V	
$\Delta V_F/\Delta T_A$	Temperature coefficient of forward voltage	IF =16mA	-	-1.8	-	mV/℃	

Detector Characteristics

Symbol	Parameters	Test Conditions	Min	Typ	Max	Units	Notes
I_{OH}	Logic High Output Current	I_F=0mA, V_O=V_{CC}=5.5V, T_A=25℃	-	0.001	0.5	μA	
		I_F=0mA, V_O=V_{CC}=15V, T_A=25℃	-	0.01	1		
		I_F=0mA, V_O=V_{CC}=15V	-	-	50		
I_{CCL}	Logic Low Supply Current	I_F=16mA, V_O=Open, V_{CC}=15V	-	140	200	μA	
I_{CCH}	Logic High Supply Current	I_F=0mA, V_O=Open, V_{CC}=15V, T_A=25℃	-	0.01	1	μA	
		IF=0mA, VO=Open, VCC=15V	-	-	2		

Transfer Characteristics

Symbol	Parameters	Test Conditions	Min	Typ	Max	Units	Notes
CTR	Current Transfer Ratio	I_F=16mA, V_O=0.4V, V_{CC}=4.5V, T_A=25℃	25	35	60	%	
		I_F=16mA, V_O=0.5V,V_{CC}=4.5V	21	40	-		
		I_F=12mA, V_O=0.4V, V_{CC}=4.5V, T_A=25℃	26	38	65		
		I_F=12mA, V_O=0.5V,V_{CC}=4.5V	22	43	-		
V_{OL}	Logic Low Output Voltage	I_F=16mA,I_O=4.0mA, V_{CC}=4.5V, T_A=25℃	-	0.2	0.4	V	
		I_F=16mA, I_O=3.3mA, V_{CC}=4.5V	-	-	0.5		

Switching Characteristics

Symbol	Parameters	Test Conditions	Min	Typ	Max	Units	Notes
T_{PHL}	Propagation Delay Time Logic High to Logic Low	I_F=16mA, V_{CC}=5.0V, R_L=1.9kΩ, C_L=15pF, V_{THHL}=1.5V, T_A=25℃	-	0.24	0.3	μs	
		I_F=16mA, V_{CC}=5.0V, R_L=1.9kΩ, C_L=15pF,V_{THHL}=1.5V	-	0.24	0.5		
		I_F=12mA, V_{CC}=15.0V, R_L=20kΩ, C_L=100pF, V_{THHL}=1.5V, T_A=25℃	-	0.58	0.7		
		I_F=12mA, V_{CC}=15.0V, R_L=20kΩ, C_L=100pF, V_{THHL}=1.5V	-	-	1.0		
T_{PLH}	Propagation Delay Time Logic Low to Logic High	I_F=16mA, V_{CC}=5.0V, R_L=1.9kΩ, C_L=15pF, V_{THLH}=1.5V ,T_A=25℃	-	0.21	0.5	μs	
		I_F=16mA, V_{CC}=5.0V, R_L=1.9kΩ, C_L=15pF, V_{THLH}=1.5V	-	0.21	0.7		
		I_F=12mA, V_{CC}=15.0V, R_L=20kΩ, C_L=100pF, V_{THLH}=2.0V,T_A=25℃	-	0.76	1.1		
		I_F=12mA, V_{CC}=15.0V, R_L=20kΩ, C_L=100pF, V_{THLH}=2.0V	-	0.76	1.4		
T_{PLH}-T_{PHL}	Propagation Delay Difference	I_F=12mA, V_{CC}=15.0V, R_L=20kΩ, C_L=100pF,V_{THHL}=1.5V ,V_{THLH}=2.0V , T_A=25℃	-0.4	0.3	0.9	μs	
		I_F=12mA, V_{CC}=15.0V, R_L=20kΩ, C_L=100pF	-0.7	0.3	1.3		
CM_H	Common Mode Transient Immunity at Logic High	I_F = 0mA , V_{CM}=1.5kVp-p,V_{CC}=5V, R_L=1.9kΩ, C_L=15pF, T_A =25℃	15000	30000	-	V/μs	
		I_F = 0mA , V_{CM}=1.5kVp-p, V_{CC}=15V, R_L=20kΩ, C_L=100pF, T_A =25℃	15000	30000	-		
CM_L	Common Mode Transient Immunity at Logic Low	I_F = 12mA , V_{CM}=1.5kVp-p,V_{CC}=5V, R_L=1.9kΩ, C_L=15pF, T_A =25℃	15000	30000	-	V/μs	
		I_F = 16mA , V_{CM}=1.5kVp-p, V_{CC}=15V, R_L=20kΩ, C_L=100pF, T_A =25℃	15000	30000	-		

Typical Characteristic Curves

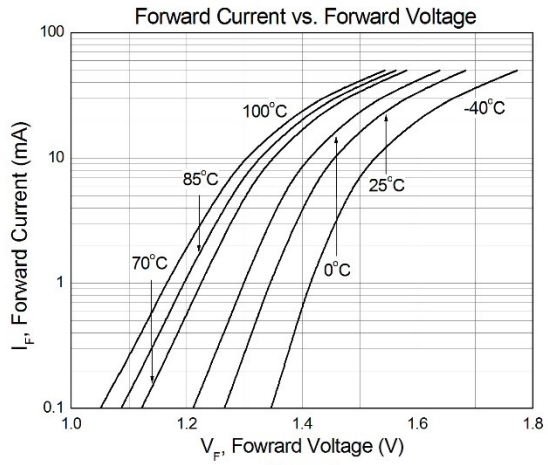


Figure 1

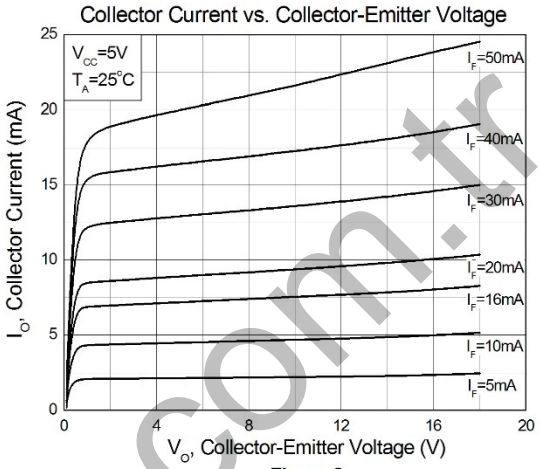


Figure 2

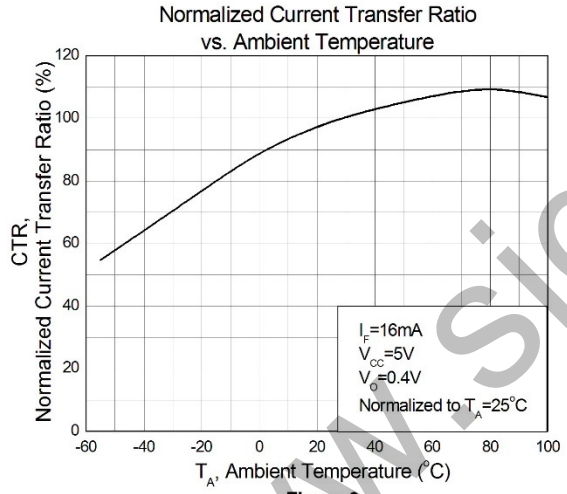


Figure 3

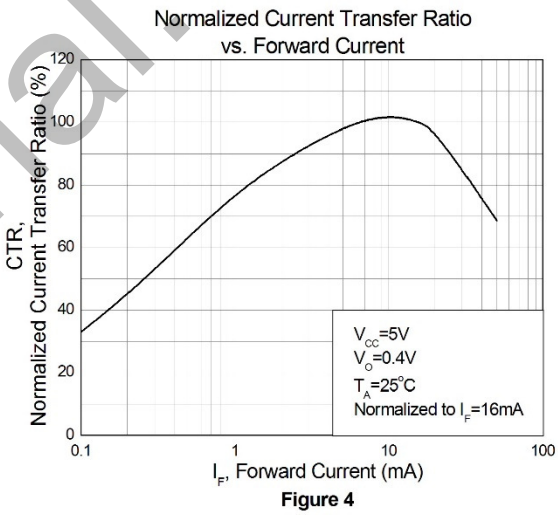
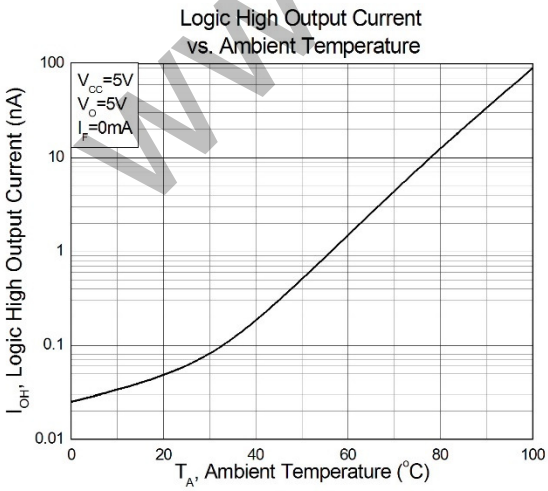


Figure 4



Figrue 5

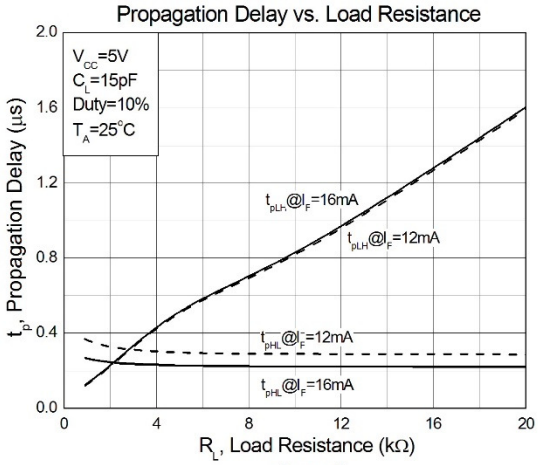


Figure 6

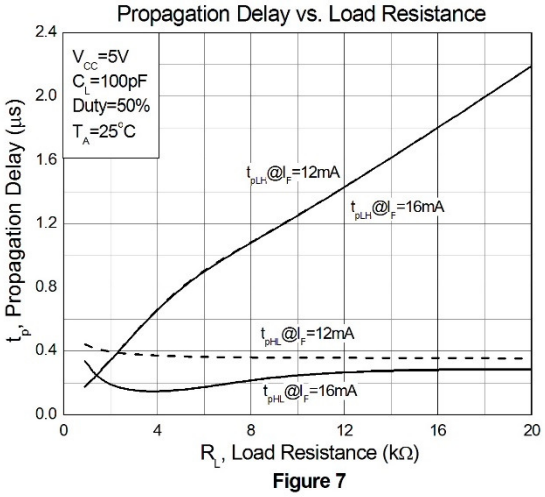


Figure 7

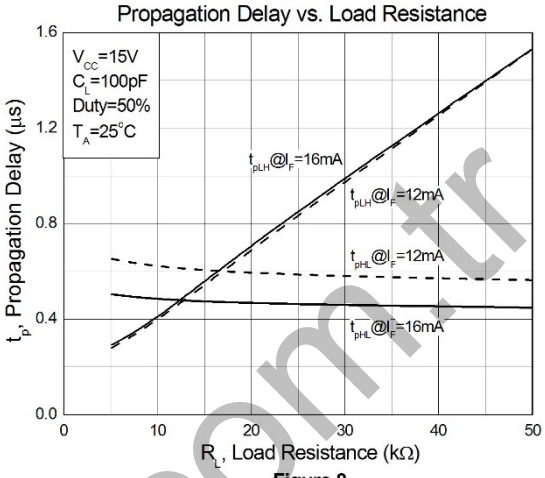


Figure 8

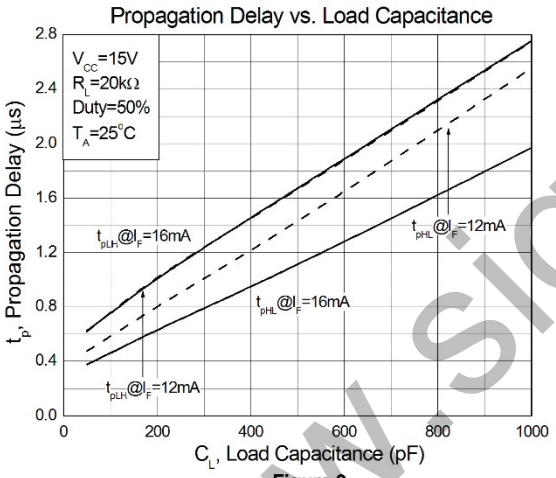


Figure 9

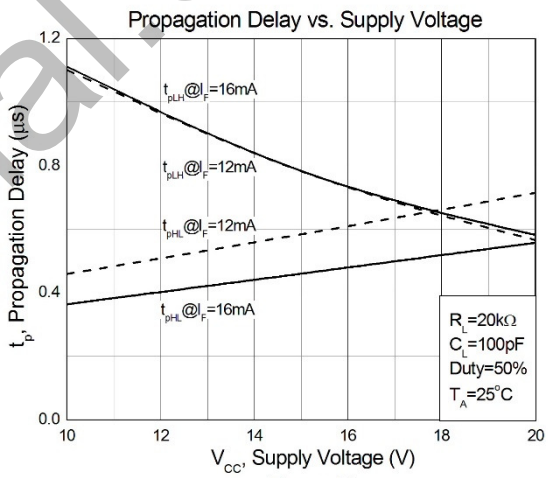


Figure 10

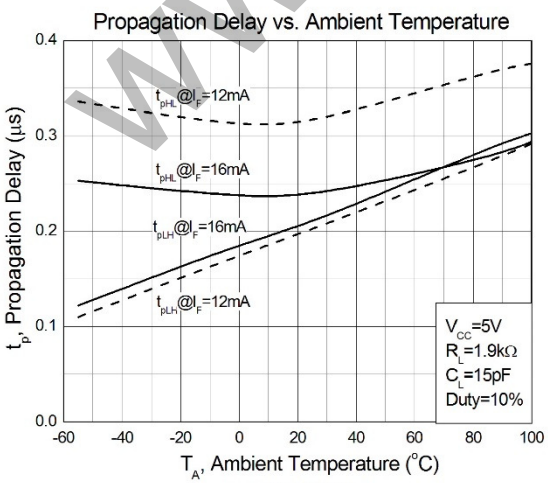


Figure 11

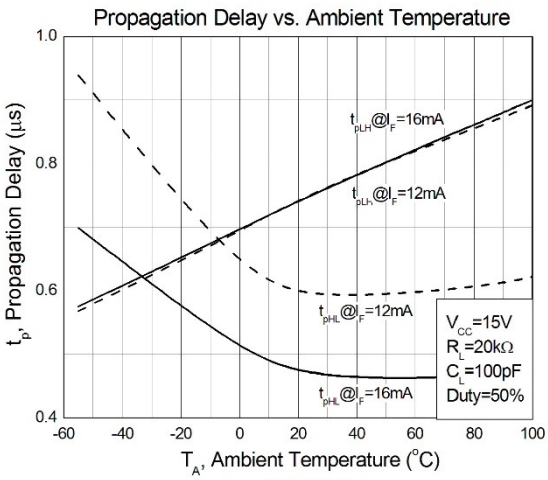
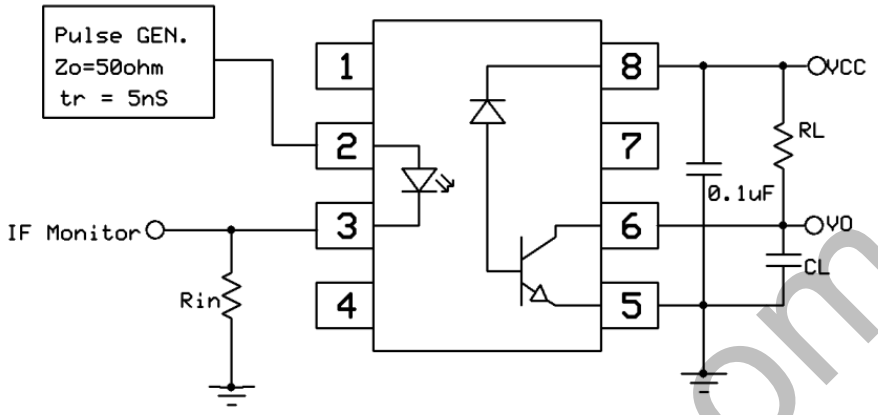
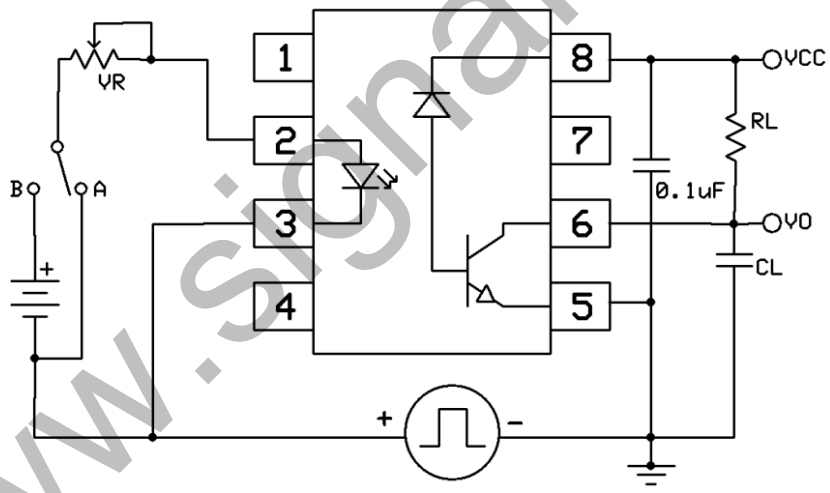


Figure 12

Test Circuits



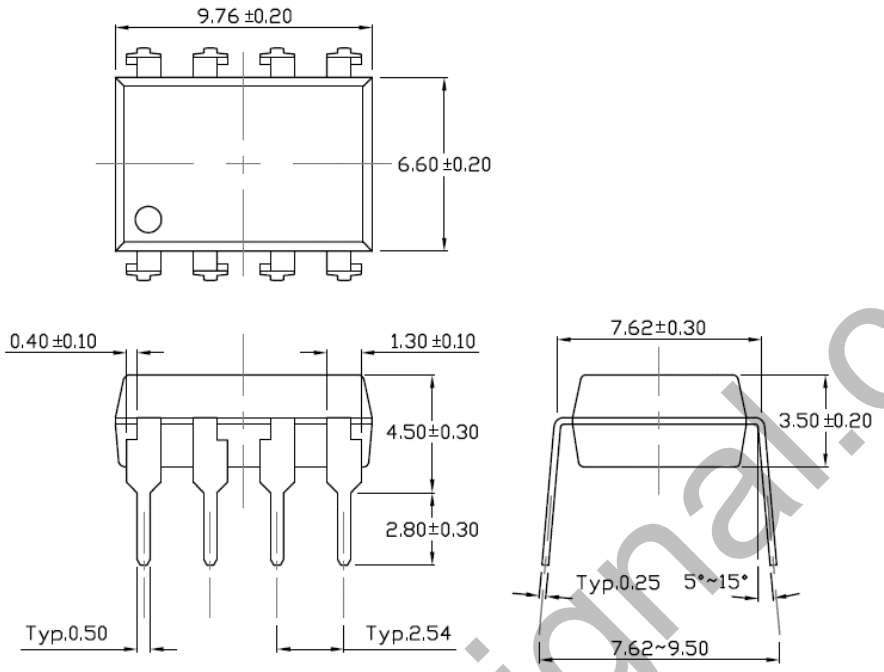
Switching Time Test Circuit



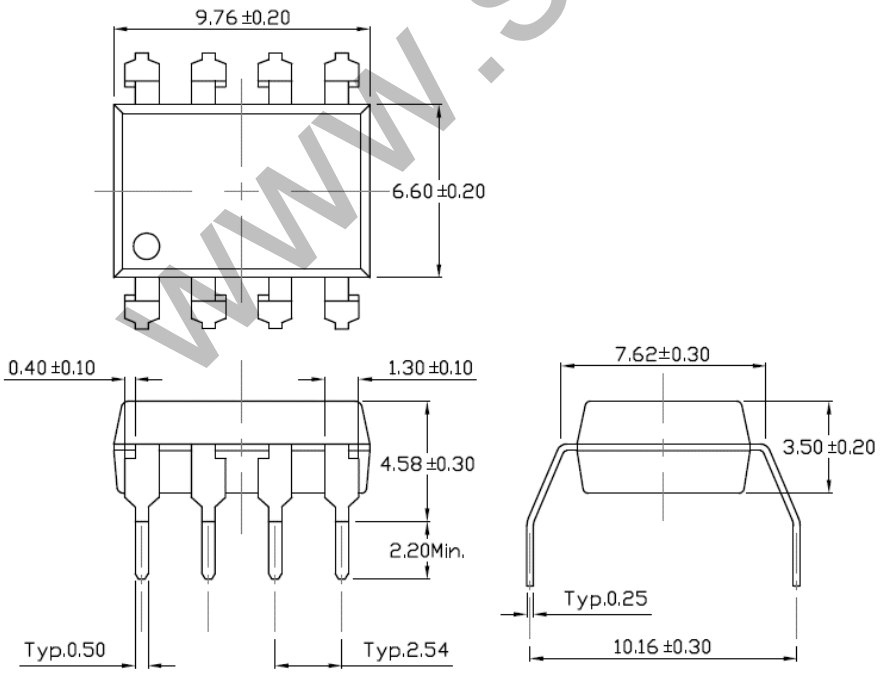
CMR Test Circuit

Package Dimension *Dimensions in mm unless otherwise stated*

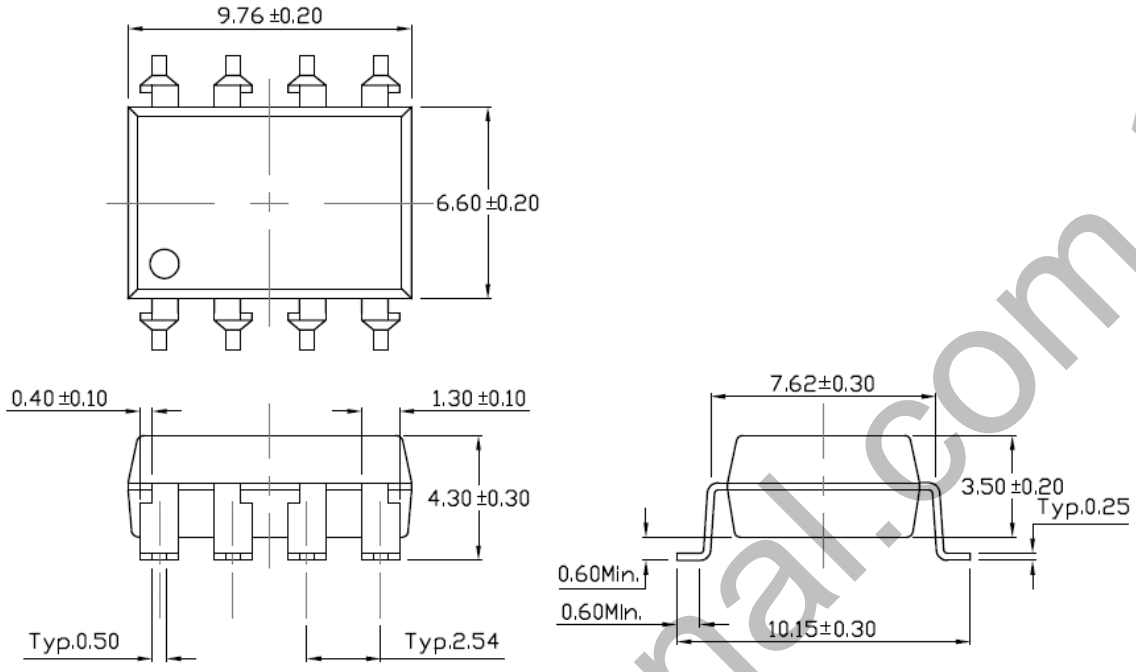
Standard DIP – Through Hole



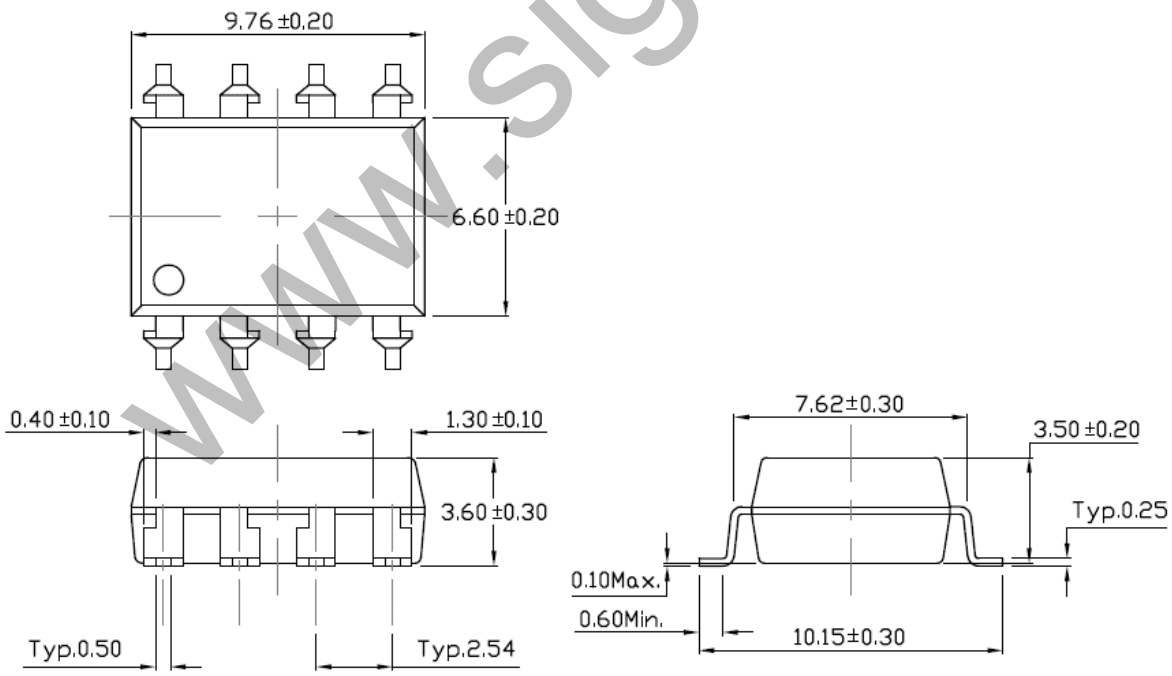
Gullwing (400mil) Lead Forming – Through Hole (M Type)



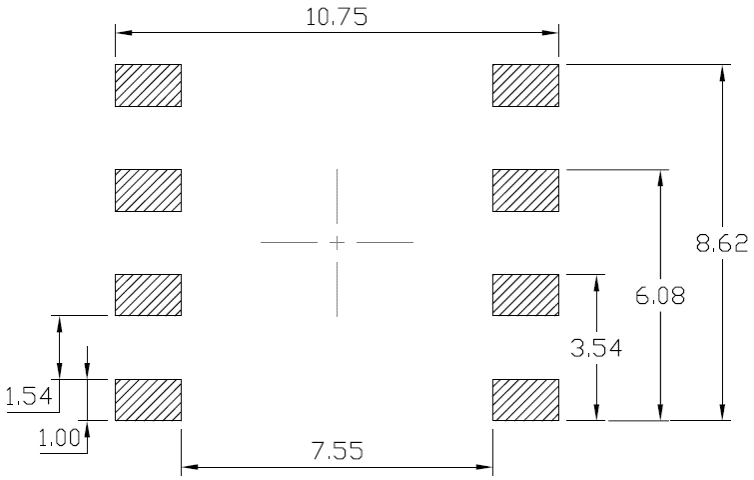
Surface Mount Lead Forming (S Type)



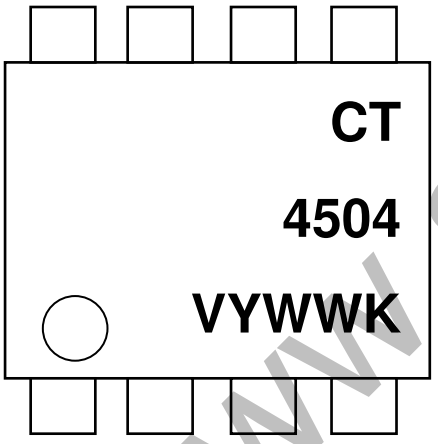
Surface Mount (Low Profile) Lead Forming (SL Type)



Recommended Solder Mask *Dimensions in mm unless otherwise stated*



Device Marking



CT : Denotes “CT Micro”
4504 : Product Number
V : VDE Option
Y : Fiscal Year
WW : Work Week
K : Production Code

Ordering Information

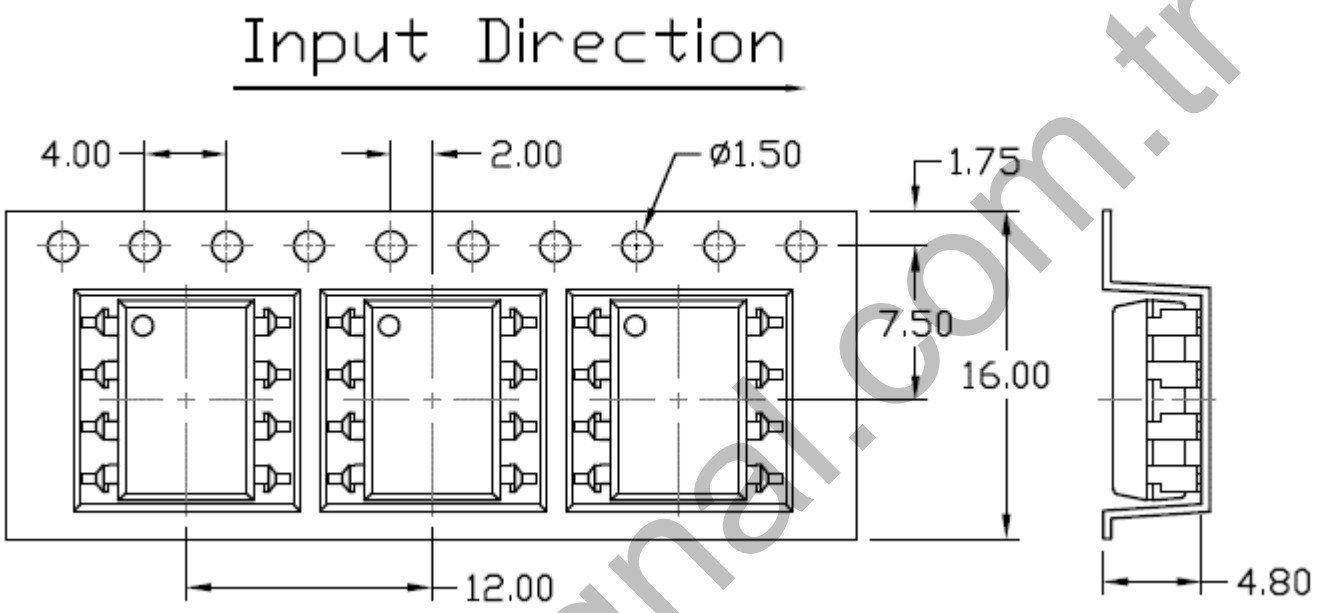
CT4504(V)(Y)(Z)

V = VDE option (V or None)
Y = Lead form option (S, SL, M or none)
Z = Tape and reel option (T1, T2 or none)

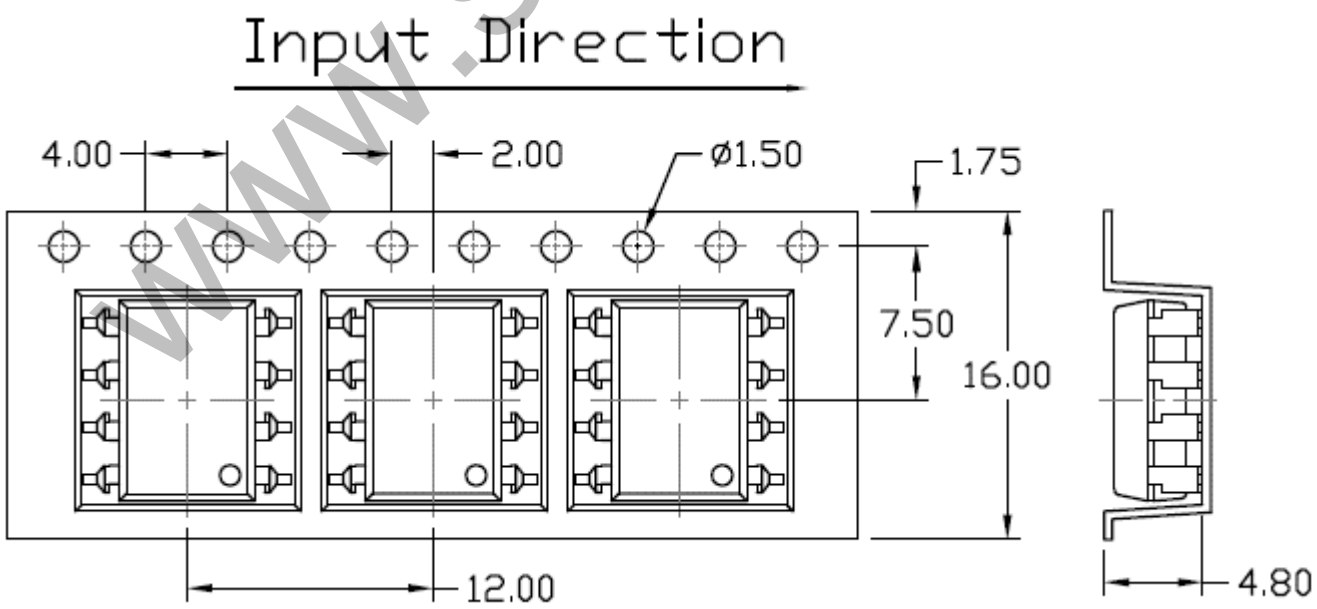
Option	*Description*	*Quantity*
None	Standard 8 Pin Dip	40 Units/Tube
M	Gullwing (400mil) Lead Forming	40 Units/Tube
S(T1)	Surface Mount Lead Forming – With Option 1 Taping	1000 Units/Reel
S(T2)	Surface Mount Lead Forming – With Option 2 Taping	1000 Units/Reel
SL(T1)	Surface Mount (Low Profile) Lead Forming– With Option 1 Taping	1000 Units/Reel
SL(T2)	Surface Mount (Low Profile) Lead Forming– With Option 2 Taping	1000 Units/Reel

Carrier Tape Specifications *Dimensions in mm unless otherwise stated*

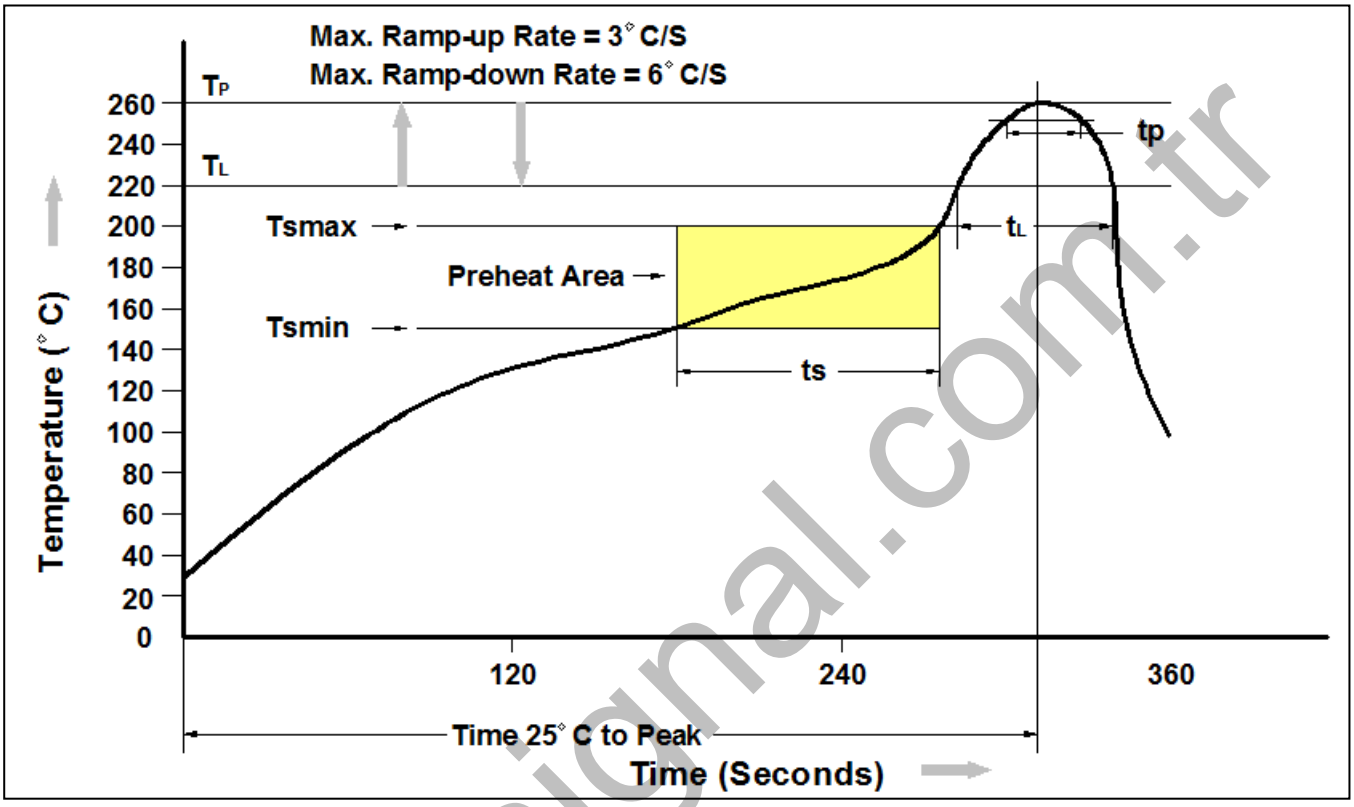
Option S(T1) & SL(T1)



Option S(T2) & SL(T2)



Reflow Profile



Profile Feature	Pb-Free Assembly Profile
Temperature Min. (Tsmin)	150℃
Temperature Max. (Tsmax)	200℃
Time (ts) from (Tsmin to Tsmax)	60-120 seconds
Ramp-up Rate (t_L to t_P)	3℃/second max.
Liquidous Temperature (T_L)	217℃
Time (t_L) Maintained Above (T_L)	60 – 150 seconds
Peak Body Package Temperature	260℃ +0℃ / -5℃
Time (t_P) within 5℃ of 260℃	30 seconds
Ramp-down Rate (T_P to T_L)	6℃/second max
Time 25℃ to Peak Temperature	8 minutes max.

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2. *A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.*