

## AC Input, Half-Pitch Phototransistor Optocoupler

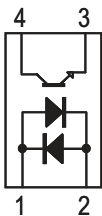
## Data Sheet

## Description

The ACPL-214 is an AC-input single channel half-pitch phototransistor optocoupler that contains two light-emitting diodes connected inversely parallel and optically coupled to a phototransistor. It is packaged in a 4-pin SO package.

The input-output isolation voltage is rated at 3750  $V_{RMS}$ . Response time,  $t_r$ , is 2  $\mu s$  typically, while minimum CTR is 20 percent at input current of 1 mA.

## ACPL-214 Pin Layout



Pin 1	Anode
Pin 2	Cathode
Pin 3	Emitter
Pin 4	Collector

## Features

- Current transfer ratio  
(CTR: 20% (min) at  $I_F = \pm 1$  mA,  $V_{CC} = 5V$ )
- High input-output isolation voltage  
( $V_{ISO} = 3750 V_{RMS}$ )
- Non-saturated response time  
( $t_r$ : 2  $\mu s$  (typ) at  $V_{CC} = 10V$ ,  $I_C = 2$  mA,  $R_L = 100\Omega$ )
- SO package
- CMR 10 kV/ $\mu s$  (typical)
- Safety and regulatory approvals
  - cUL
  - IEC/EN/DIN EN 60747-5-5
- Options available:
  - CTR Ranks 0, A

## Applications

- I/O Interface for programmable controllers, computers
- Sequence controllers
- System appliances, measuring instruments
- Signal transmission between circuits of different potentials and impedances.

## Ordering Information

ACPL-214-xxxx is UL Recognized with 3750 V<sub>RMS</sub> for 1 minute per UL1577 and Canadian Component Acceptance Notice #5.

Part Number	RoHS Compliant Option		Package	Surface Mount	Tape and Reel	IC Orientation	IEC/EN/DIN EN 60747-5-5	Quantity
	Rank 0 20% < CTR < 400% I <sub>F</sub> = ±1 mA, V <sub>CE</sub> = 5V	Rank A 50% < CTR < 250% I <sub>F</sub> = ±1 mA, V <sub>CE</sub> = 5V						
ACPL-214	-500E	-50AE	SO-4	X	X	0°		3000 pcs per reel
	-560E	-56AE	SO-4	X	X	0°	X	3000 pcs per reel
	-700E	-70AE	SO-4	X	X	180°		3000 pcs per reel
	-760E	-76AE	SO-4	X	X	180°	X	3000 pcs per reel

To order, choose a part number from the part number column and combine with the desired option from the option column to form an order entry.

Example 1:

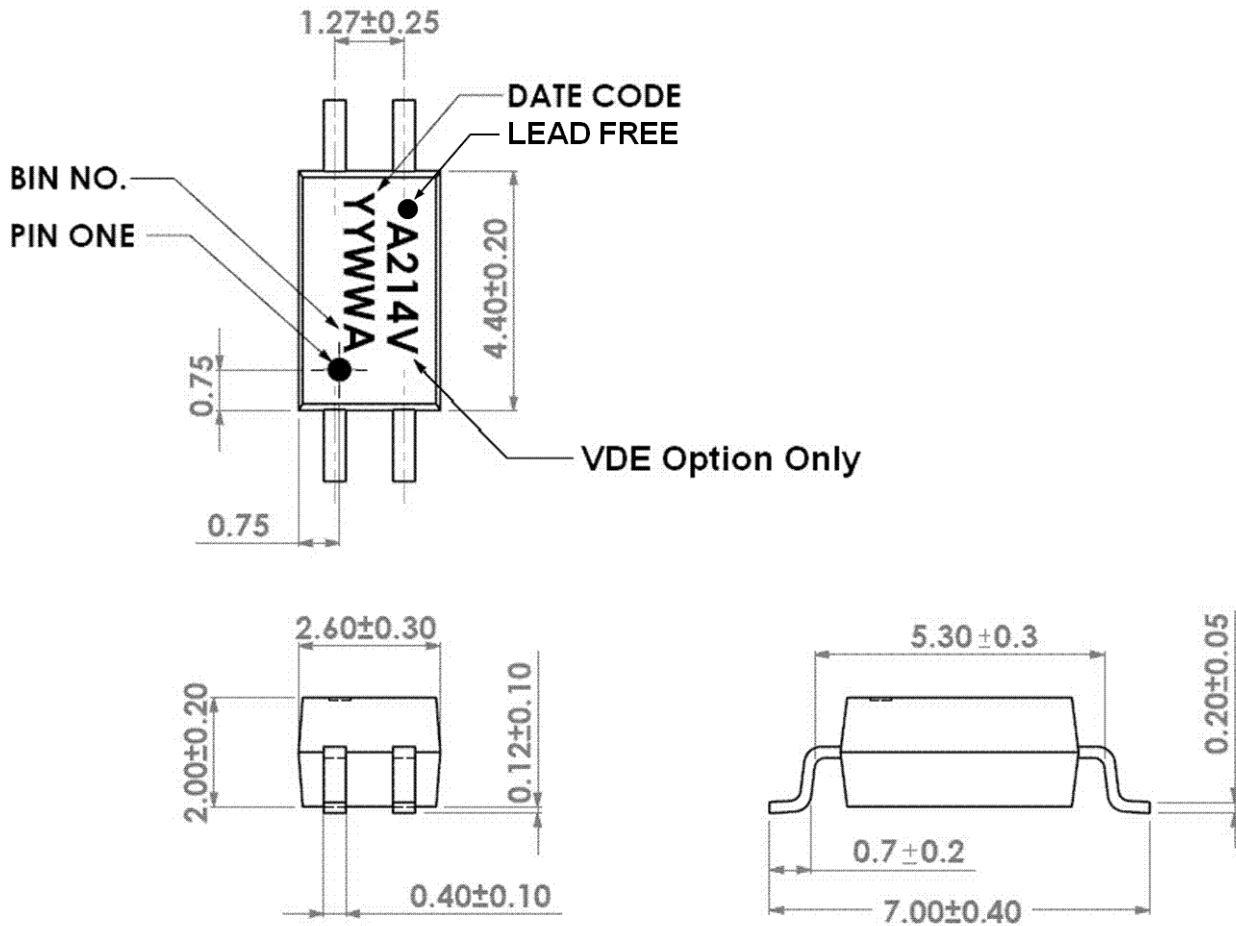
ACPL-214-560E to order product of SO-4 Surface Mount package in Tape and Reel packaging with IEC/EN/DIN EN 60767-5-5 Safety Approval, 20% < CTR < 400% and RoHS compliant.

Example 2:

ACPL-214-50AE to order product of SO-4 Surface Mount package in Tape and Reel packaging with 50% < CTR < 250% and RoHS compliant.

Option data sheets are available. Contact your Broadcom sales representative or authorized distributor for information.

## Package Outline Drawings



## Solder Reflow Temperature Profile

Recommended reflow condition as per JEDEC Standard, J-STD-020 (latest revision). Non-Halide Flux should be used.

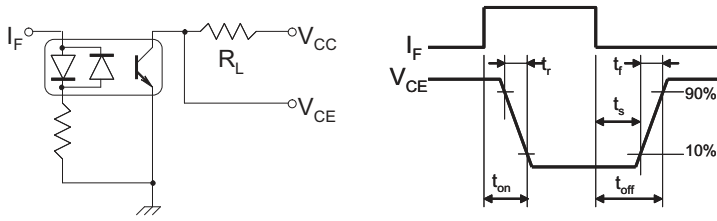
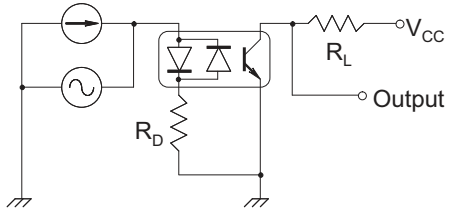
## Absolute Maximum Ratings

Parameter	Symbol	ACPL-214	Unit	Note
Storage Temperature	$T_S$	-55~125	°C	
Operating Temperature	$T_A$	-55~110	°C	
Average Forward Current	$I_{F(AVG)}$	±50	mA	
Pulse Forward Current	$I_{FSM}$	±1	A	
LED Power Dissipation	$P_I$	65	mW	
Collector Current	$I_C$	50	mA	
Collector-Emitter Voltage	$V_{CEO}$	80	V	
Emitter-Collector Voltage	$V_{ECO}$	7	V	
Isolation Voltage (AC for 1 minute, R.H. 40%~60%)	$V_{ISO}$	3750	$V_{RMS}$	1 minute
Collector Power Dissipation	$P_C$	150	mW	
Total Power Dissipation	$P_{TOT}$	200	mW	
Lead Solder Temperature		260°C for 10 seconds		

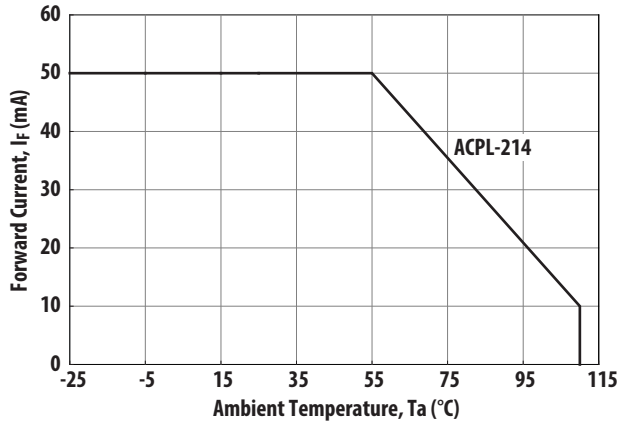
## Electrical Specifications

Over recommended ambient temperature at 25°C unless otherwise specified.

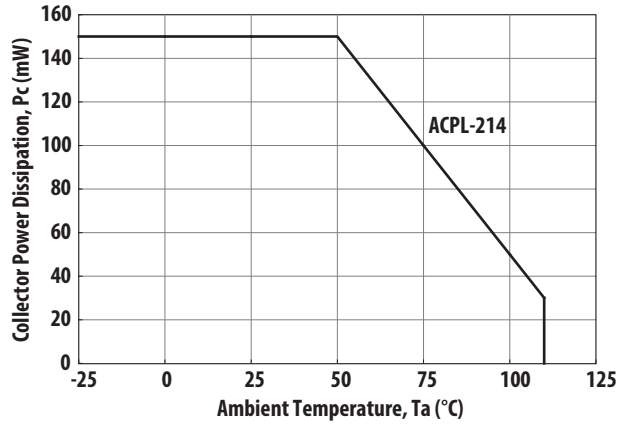
Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Conditions	Note
Forward Voltage	$V_F$	—	1.2	1.4	V	$I_F = \pm 20 \text{ mA}$	Figure 6
Terminal Capacitance	$C_t$	—	60	—	pF	$V = 0, f = 1 \text{ MHz}$	
Collector Dark Current	$I_{CEO}$	—	—	100	nA	$V_{CE} = 48\text{V}, I_F = 0 \text{ mA}$	Figure 12
Collector-Emitter Breakdown Voltage	$BV_{CEO}$	80	—	—	V	$I_C = 0.5 \text{ mA}, I_F = 0 \text{ mA}$	
Emitter-Collector Breakdown Voltage	$BV_{ECO}$	7	—	—	V	$I_E = 100 \mu\text{A}, I_F = 0 \text{ mA}$	
Current Transfer Ratio	CTR	20	—	400	%	$I_F = \pm 1 \text{ mA}, V_{CE} = 5\text{V}$	$CTR = (I_C / I_F) \times 100\%$
Saturated CTR	$CTR_{(sat)}$	—	100	—	%	$I_F = \pm 1 \text{ mA}, V_{CE} = 0.4\text{V}$	
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	—	—	0.4	V	$I_F = \pm 8 \text{ mA}, I_C = 2.4 \text{ mA}$	Figure 14
Isolation Resistance	$R_{iso}$	$5 \times 10^{10}$	$1 \times 10^{11}$	—	$\Omega$	DC500V, R.H. 40%~60%	
Floating Capacitance	$C_F$	—	0.8	1	pF	$V = 0, f = 1 \text{ MHz}$	
Cut-off Frequency (-3dB)	$F_C$	—	80	—	kHz	$V_{CC} = 5\text{V}, I_C = 2 \text{ mA},$ $R_L = 100\Omega$	Figure 2, Figure 19
Response Time (Rise)	$t_r$	—	2	—	$\mu\text{s}$	$V_{CC} = 10\text{V}, I_C = 2 \text{ mA},$ $R_L = 100\Omega$	Figure 1
Response Time (Fall)	$t_f$	—	3	—	$\mu\text{s}$		
Turn-on Time	$t_{on}$	—	3	—	$\mu\text{s}$		
Turn-off Time	$t_{off}$	—	3	—	$\mu\text{s}$		
Turn-ON Time	$t_{ON}$	—	2	—	$\mu\text{s}$	$V_{CC} = 5\text{V}, I_F = 16 \text{ mA},$ $R_L = 1.9 \text{ k}\Omega$	Figure 1, Figure 17
Storage Time	$T_S$	—	25	—	$\mu\text{s}$		
Turn-OFF Time	$t_{OFF}$	—	40	—	$\mu\text{s}$		
Common Mode Rejection Voltage	CMR	—	10	—	kV/ $\mu\text{s}$	$T_A = 25^\circ\text{C}, R_L = 470\Omega,$ $V_{CM} = 1.5 \text{ kV(peak)},$ $I_F = 0 \text{ mA}, V_{CC} = 9\text{V},$ $V_{np} = 100 \text{ mV}$	Figure 20

**Figure 1 Switching Time Test Circuit****Figure 2 Frequency Response Test Circuit**

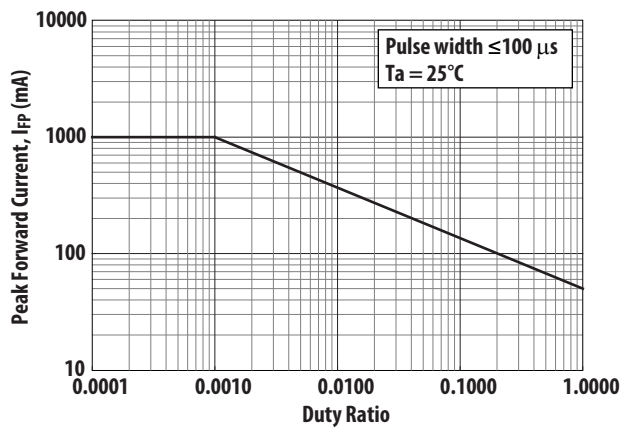
**Figure 3 Forward Current vs. Ambient Temperature**



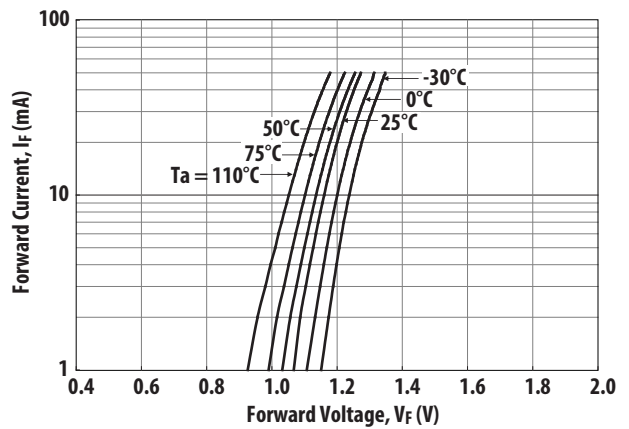
**Figure 4 Collector Power Dissipation vs. Ambient Temperature**



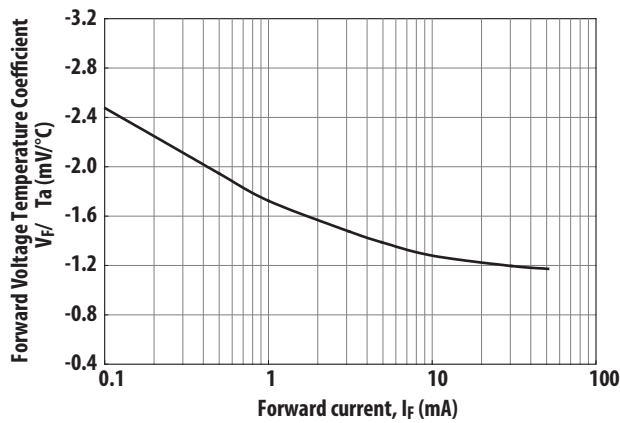
**Figure 5 Pulse Forward Current vs. Duty Cycle Ratio**



**Figure 6 Forward Current vs. Forward Voltage**



**Figure 7 Forward Voltage Temperature Coefficient vs. Forward Current**



**Figure 8 Pulse Forward Current vs. Pulse Forward Voltage**

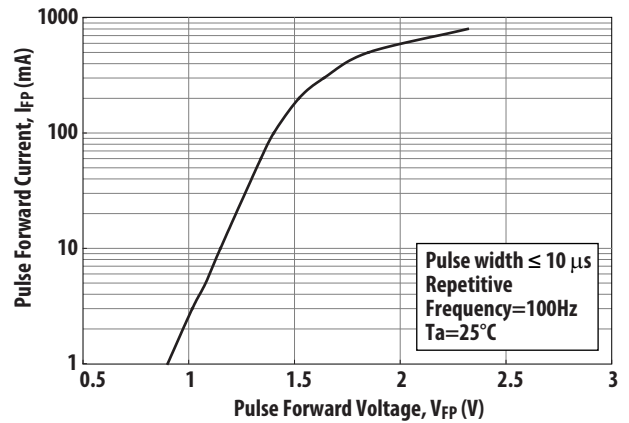


Figure 9 Collector Current vs. Collector-Emitter Voltage

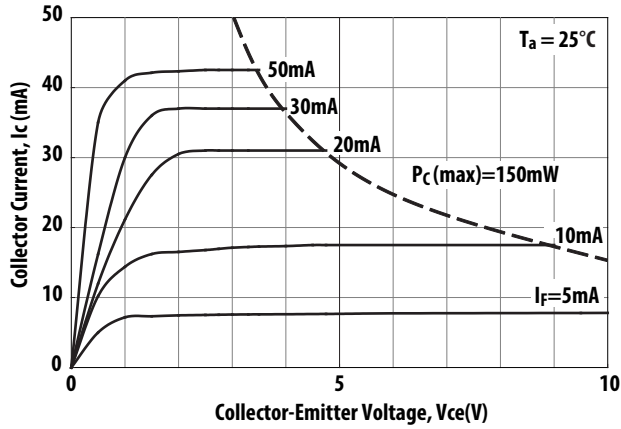


Figure 10 Collector Current vs. Small Collector-Emitter Voltage

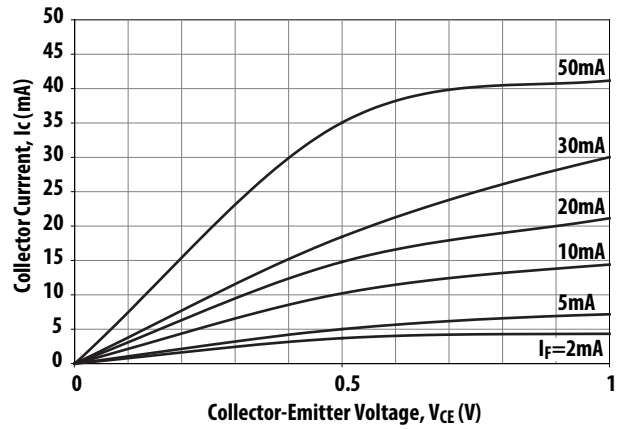


Figure 11 Collector Current vs. Forward Current

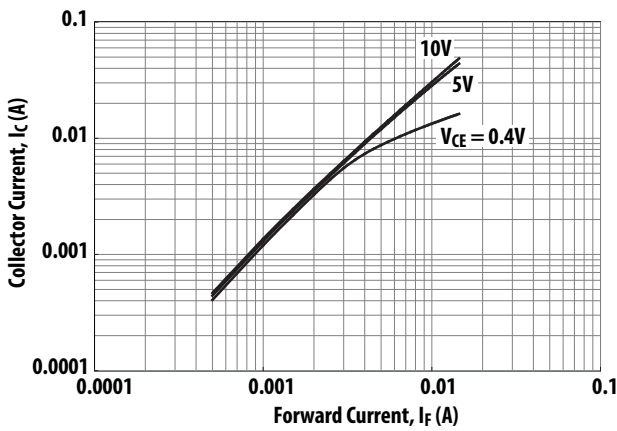


Figure 12 Collector Dark Current vs. Ambient Temperature

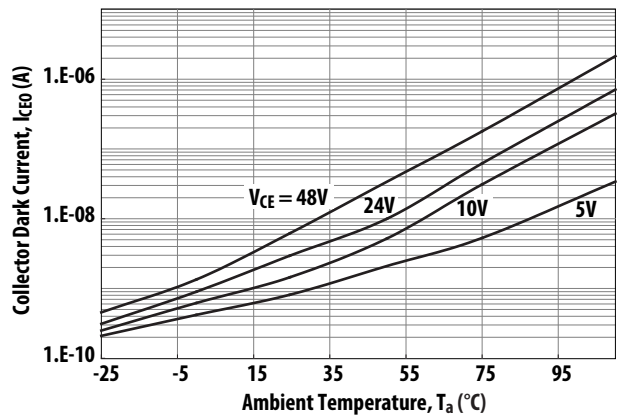


Figure 13 Current Transfer Ratio vs. Forward Current

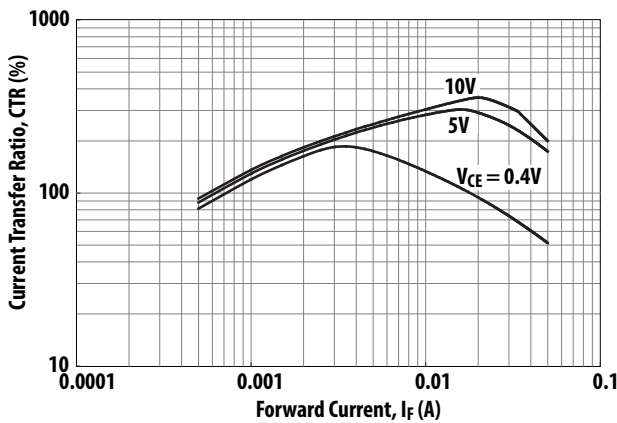


Figure 14 Collector-Emitter Saturation Voltage vs. Ambient Temperature

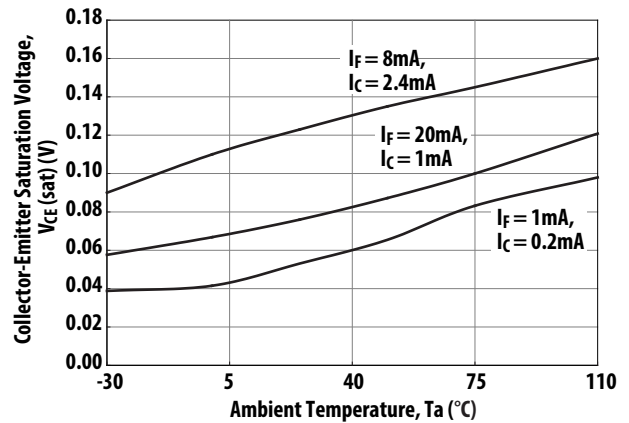




Figure 15 Collector Current vs. Ambient Temperature

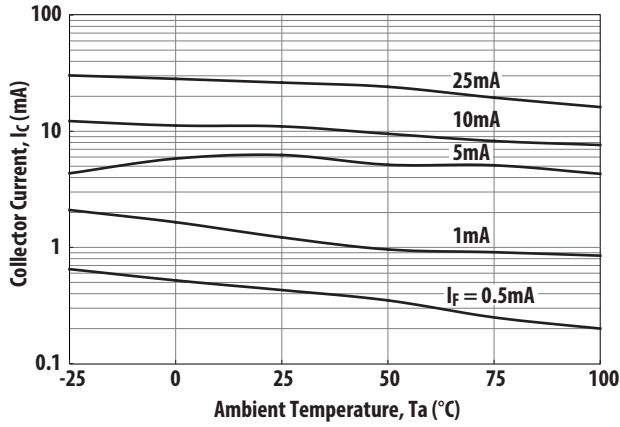


Figure 16 Switching Time vs. Load Resistance

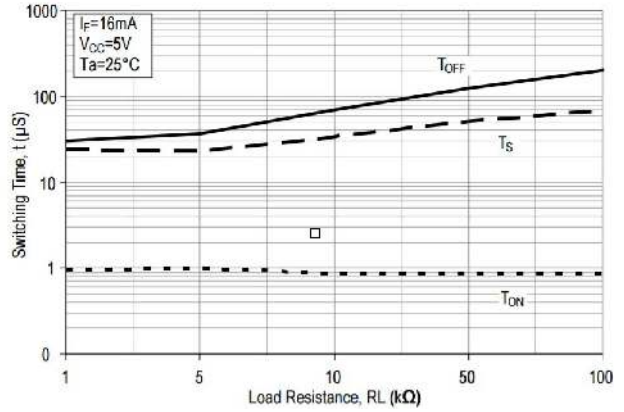


Figure 17 Switching Time vs. Ambient Temperature

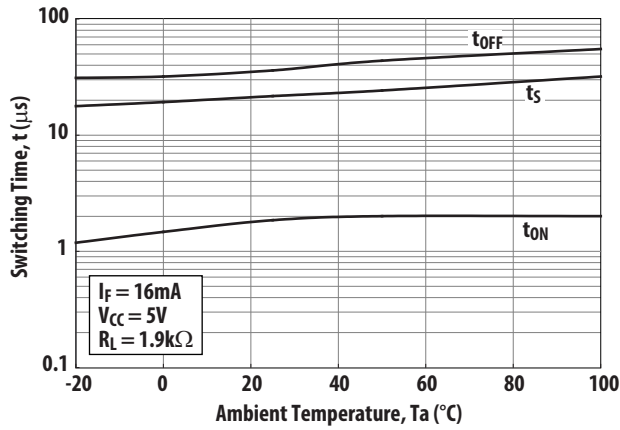


Figure 18 Collector-Emitter Saturation Voltage vs. Forward Current

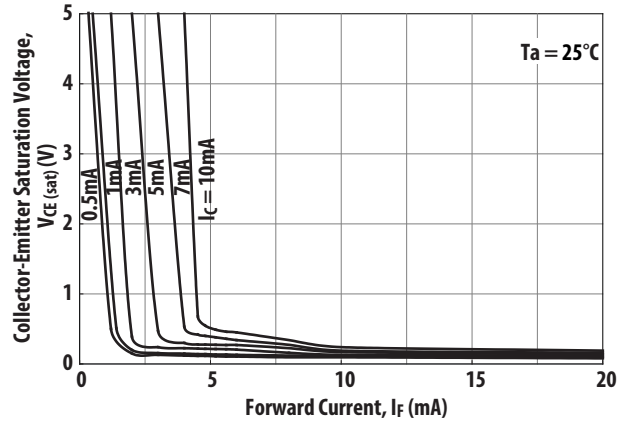


Figure 19 Frequency Response

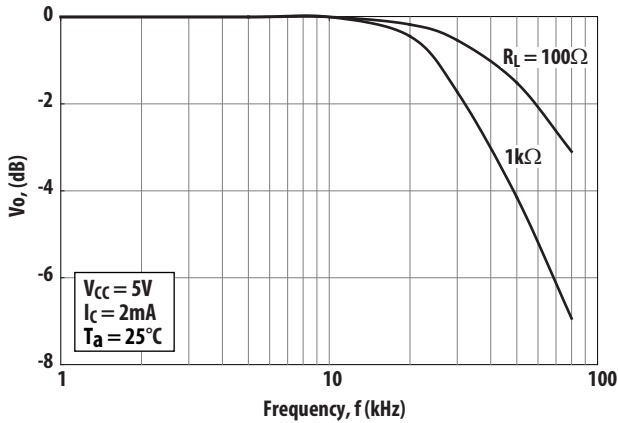
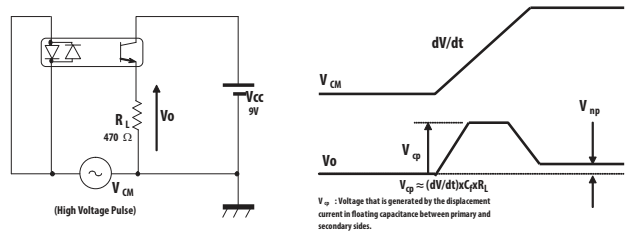


Figure 20 CMR Test Circuit



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