



# T-1 (3mm) RESISTOR LAMPS

LTL-4201-R1/R2 RED                      LTL-4251-R1/R2 YELLOW  
 LTL-4211-R1/R2 BRIGHT RED        LTL-4291-R1/R2 ORANGE  
 LTL-4231-R1/R2 GREEN

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## FEATURES

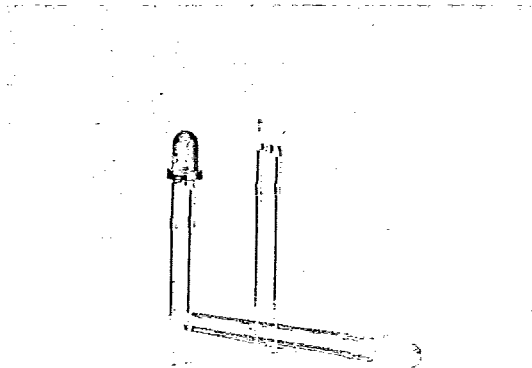
- INTEGRAL CURRENT LIMITING RESISTOR.
- COST EFFECTIVE.  
Saves Spaces and Resistor Cost.
- EXTERNAL RESISTOR REQUIRED WITH 5 VOLT/12 VOLT SUPPLY.
- AVAILABLE IN ALL COLORS.  
Red, High Efficiency Red, Yellow and Green in T-1 Packages.

## DESCRIPTION

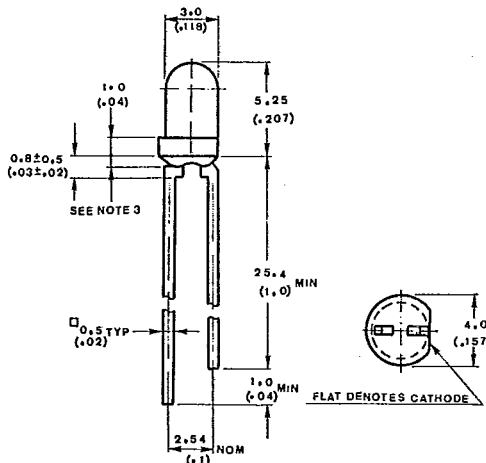
The RESISTOR LAMP contains an integral current limiting resistor in series with the LED. This allows the lamp to be driven from a high volt source without an external current limiter. The Red source color devices are made with Gallium Arsenide Phosphide on Gallium Arsenide Red Light Emitting Diode. The Bright Red source color devices are made with Gallium Phosphide on Gallium Phosphide Red Light Emitting Diode. The Orange source color devices are made with Gallium Arsenide Phosphide on Gallium Phosphide Orange Light Emitting Diode.

The Green source color devices are made with Gallium Phosphide on Gallium Phosphide Green Light Emitting Diode.

The Yellow source color devices are made with Gallium Arsenide Phosphide on Gallium Phosphide Yellow Light Emitting Diode.



## PACKAGE DIMENSION



## DEVICES

PART NO. LTL-	LENS		SOURCE COLOR
	COLOR	DIFFUSION	
4201-R1/R2	Red	Diffused	Red
4211-R1/R2	Red	Diffused	Bright Red
4231-R1/R2	Green	Diffused	Green
4251-R1/R2	Yellow	Diffused	Yellow
4291-R1/R2	Orange	Diffused	Orange

### NOTES:

1. All dimensions are in millimeters (inches).
2. Tolerance is  $\pm 0.25\text{mm}$  (.010") unless otherwise noted.
3. Protrued resin under flange is 1.5mm (.059") max.
4. Lead spacing is measured where the leads emerge from the package.
5. Specifications are subject to change without notice.

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ABSOLUTE MAXIMUM RATINGS AT TA = 25°C

PARAMETER	RED/BRIGHT RED/ GREEN/YELLOW/ORANGE 5V LAMPS	RED/BRIGHT RED/ GREEN/YELLOW/ORANGE 12V LAMPS	UNIT
DC Forward Voltage (TA = 25°C)	7.5	15	volts
Reverse Voltage	5	5	volts
Operating Temperature Range	-40°C to +85°C		
Storage Temperature Range	-55°C to +100°C		
Lead Soldering Temperature [1.6mm (0.063in) From Body]	260°C for 5 Seconds		

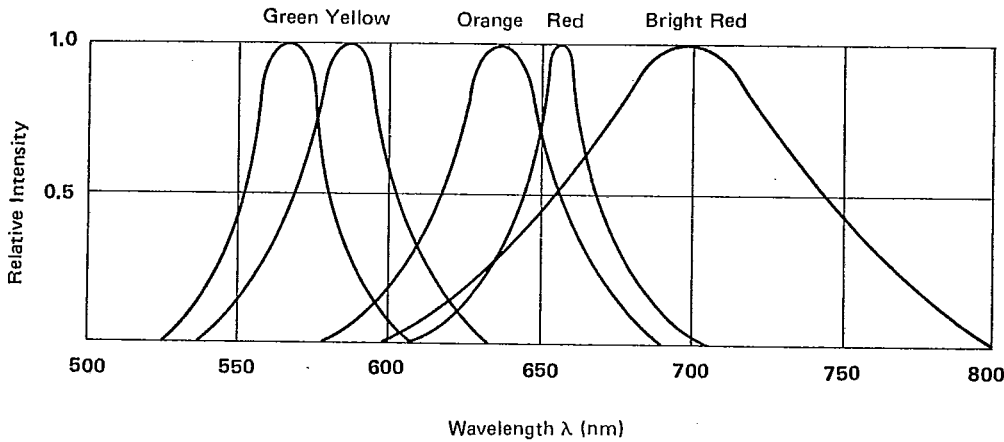
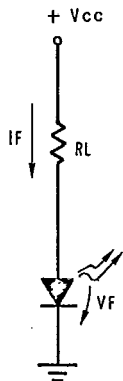


FIG. 1 RELATIVE INTENSITY VS. WAVELENGTH

EQUIVALENT CIRCUIT:



V<sub>CC</sub> = 5 volts  
(R<sub>L</sub> = 250 ohms ± 20%)

V<sub>CC</sub> = 12 volts  
(R<sub>L</sub> = 800 ohms ± 20%)

$$I_F = \frac{V_{CC} - V_F}{R_L}$$



ELECTRICAL/OPTICAL CHARACTERISTICS AND CURVES AT  $T_A = 25^\circ\text{C}$

PARAMETER	SYMBOL	PART NO. (LTL-)	MIN.	TYP.	MAX.	UNIT	TEST CONDITION
Luminous Intensity	$I_v$	4201-R1	0.3	0.8		mcd	VF=5V
		4201-R2	0.3	0.9			VF=12V
Viewing Angle	$2\theta_{1/2}$	4201-R1/R2		40		deg	Note 2 (Fig. 6)
Peak Emission Wavelength	$\lambda_{\text{PEAK}}$	4201-R1/R2		655		nm	Measurement @Peak (Fig. 1)
Spectral Line Half - Width	$\Delta\lambda$	4201-R1/R2		24		nm	
Forward Current 5V Devices	$I_F$	4201-R1		10	20	mA	VF = 5V
Forward Current 12V Devices	$I_F$	4201-R2		12	20	mA	VF = 12V
Reverse Current	$I_R$	4201-R1/R2			100	$\mu\text{A}$	VR = 5V

NOTES: 1. Luminous intensity is measured with a light sensor and filter combination that approximates the CIE (Commission Internationale De L'Eclairage) eye-response curve.  
 2.  $\theta_{1/2}$  is the off-axis angle at which the luminous intensity is half the axial luminous intensity.

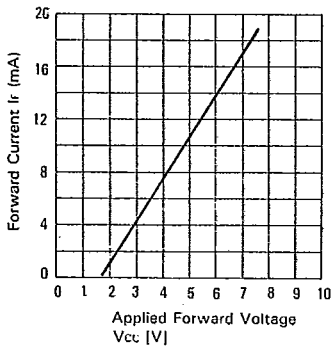


FIG. 2 FORWARD CURRENT VS. APPLIED FORWARD VOLTAGE. 5 VOLT DEVICES

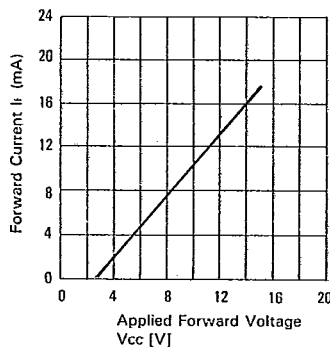


FIG. 3 FORWARD CURRENT VS. APPLIED FORWARD VOLTAGE. 12 VOLT DEVICES

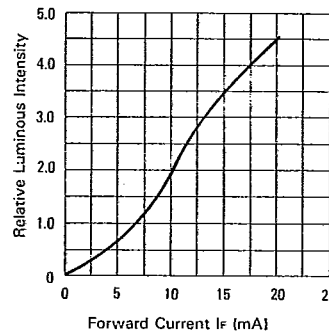


FIG. 4 RELATIVE LUMINOUS INTENSITY VS. FORWARD CURRENT

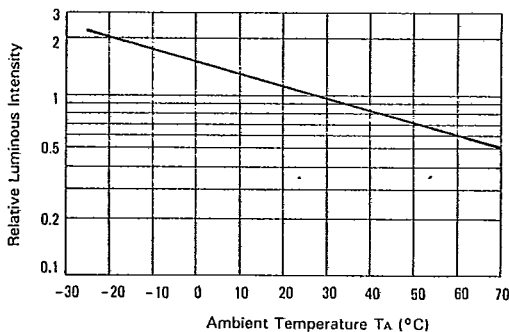


FIG. 5 LUMINOUS INTENSITY VS. AMBIENT TEMPERATURE

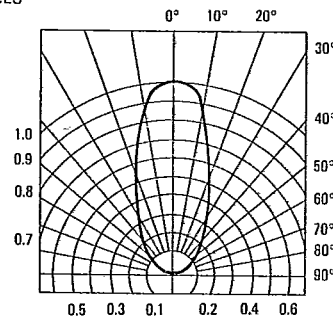


FIG. 6 SPATIAL DISTRIBUTION

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ELECTRICAL/OPTICAL CHARACTERISTICS AND CURVES AT TA = 25°C

PARAMETER	SYMBOL	PART NO. (LTL-)	MIN.	TYP.	MAX.	UNIT	TEST CONDITION
Luminous Intensity	Iv	4211-R1	1.1	3.8		mcd	VF=5V
		4211-R2	1.1	4.0			VF=12V
Viewing Angle	2θ½	4211-R1/R2		40		deg	Note 2 (Fig. 11)
Peak Emission Wavelength	λ PEAK	4211-R1/R2		697		nm	Measurement @Peak (Fig. 1)
Spectral Line Half - Width	Δλ	4211-R1/R2		90		nm	
Forward Current 5V Devices	IF	4211-R1		10	20	mA	VF = 5V
Forward Current 12V Devices	IF	4211-R2		12	20	mA	VF = 12V
Reverse Current	IR	4211-R1/R2			100	μA	VR = 5V

NOTES: 1. Luminous intensity is measured with a light sensor and filter combination that approximates the CIE (Commission Internationale De L. Eclairage) eye-response curve.

2. θ½ is the off-axis angle at which the luminous intensity is half the axial luminous intensity.

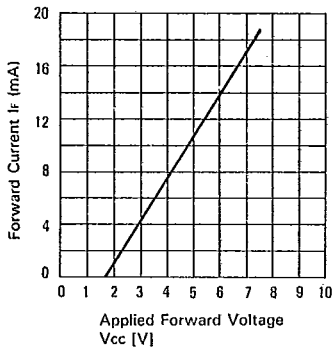


FIG. 7 FORWARD CURRENT VS. APPLIED FORWARD VOLTAGE. 5 VOLT DEVICES

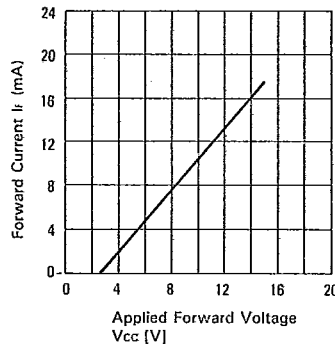


FIG. 8 FORWARD CURRENT VS. APPLIED FORWARD VOLTAGE. 12 VOLT DEVICES

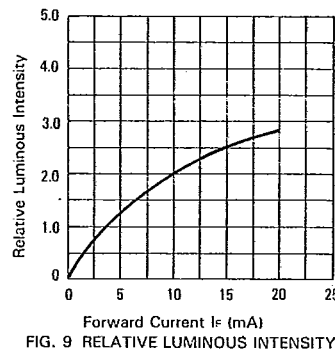


FIG. 9 RELATIVE LUMINOUS INTENSITY VS. FORWARD CURRENT

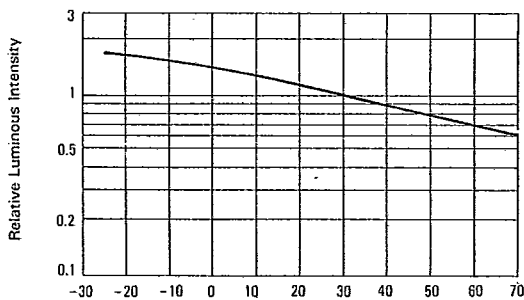


FIG. 10 LUMINOUS INTENSITY VS. AMBIENT TEMPERATURE

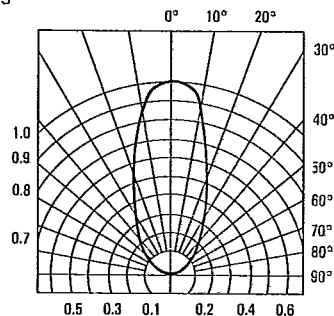


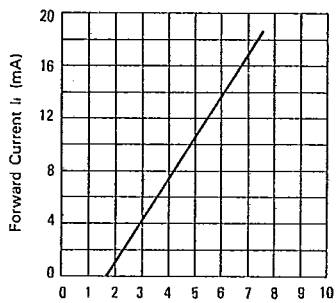
FIG. 11 SPATIAL DISTRIBUTION



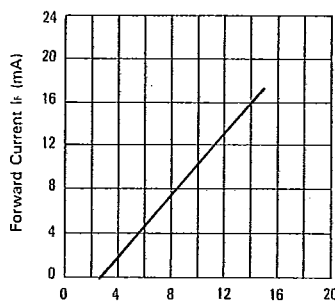
ELECTRICAL/OPTICAL CHARACTERISTICS AND CURVES AT TA = 25°C

PARAMETER	SYMBOL	PART NO. (LTL)	MIN.	TYP.	MAX.	UNIT	TEST CONDITION
Luminous Intensity	Iv	4231-R1	2.5	5.6		mcd	VF=5V
		4231-R2	2.5	5.8			VF=12V
Viewing Angle	2θ½	4231-R1/R2		40		deg	Note 2 (Fig. 16)
Peak Emission Wavelength	λ PEAK	4231-R1/R2		565		nm	Measurement @Peak (Fig. 1)
Spectral Line Half – Width	Δλ	4231-R1/R2		30		nm	
Forward Current 5V Devices	IF	4231-R1		10	20	mA	VF = 5V
Forward Current 12V Devices	IF	4231-R2		12	20	mA	VF = 12V
Reverse Current	IR	4231-R1/R2			100	μA	VR = 5V

NOTES: 1. Luminous intensity is measured with a light sensor and filter combination that approximates the CIE (Commission Internationale De L'Eclairage) eye-response curve.  
 2. θ½ is the off-axis angle at which the luminous intensity is half the axial luminous intensity.



Applied Forward Voltage Vcc [V]  
 FIG. 12 FORWARD CURRENT VS. APPLIED FORWARD VOLTAGE. 5 VOLT DEVICES



Applied Forward Voltage Vcc [V]  
 FIG. 13 FORWARD CURRENT VS. APPLIED FORWARD VOLTAGE. 12 VOLT DEVICES

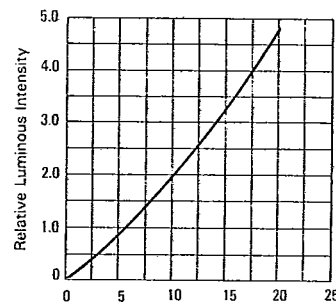
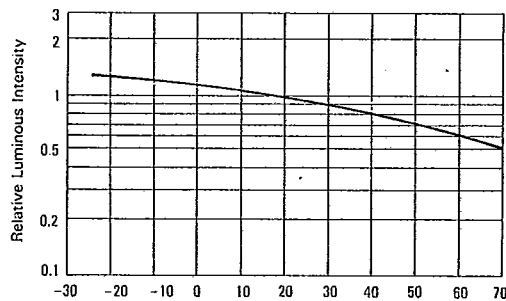


FIG. 14 RELATIVE LUMINOUS INTENSITY VS. FORWARD CURRENT



Ambient Temperature TA (°C)  
 FIG. 15 LUMINOUS INTENSITY VS. AMBIENT TEMPERATURE

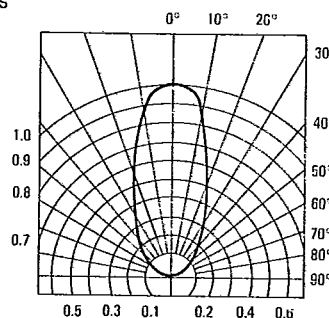


FIG. 16 SPATIAL DISTRIBUTION

ELECTRICAL/OPTICAL CHARACTERISTICS AND CURVES AT TA = 25°C

PARAMETER	SYMBOL	PART NO. (LTL-)	MIN.	TYP.	MAX.	UNIT	TEST CONDITION
Luminous Intensity	Iv	4251-R1	2.5	5.6		mcd	VF=5V
		4251-R2	2.5	5.7			VF=12V
Viewing Angle	2θ½	4251-R1/R2		40		deg	Note 2 (Fig. 21)
Peak Emission Wavelength	λ PEAK	4251-R1/R2		585		nm	Measurement @Peak (Fig. 1)
Spectral Line Half - Width	Δλ	4251-R1/R2		35		nm	
Forward Current 5V Devices	IF	4251-R1		10	20	mA	VF = 5V
Forward Current 12V Devices	IF	4251-R2		12	20	mA	VF = 12V
Reverse Current	IR	4251-R1/R2			100	μA	VR = 5V

NOTES: 1. Luminous intensity is measured with a light sensor and filter combination that approximates the CIE (Commission Internationale De L'Eclairage) eye-response curve.  
 2. θ½ is the off-axis angle at which the luminous intensity is half the axial luminous intensity.

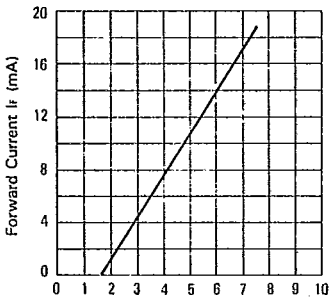


FIG. 17 FORWARD CURRENT VS. APPLIED FORWARD VOLTAGE. 5 VOLT DEVICES

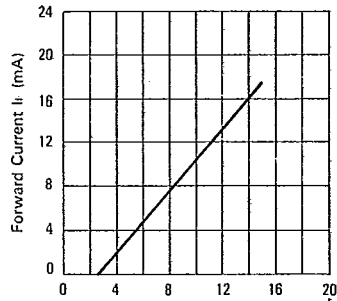


FIG. 18 FORWARD CURRENT VS. APPLIED FORWARD VOLTAGE. 12 VOLT DEVICES

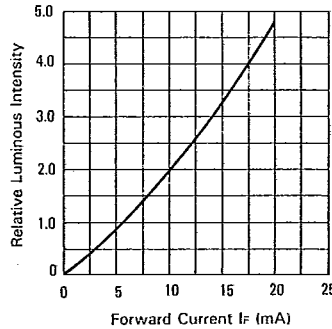


FIG. 19 RELATIVE LUMINOUS INTENSITY VS. FORWARD CURRENT

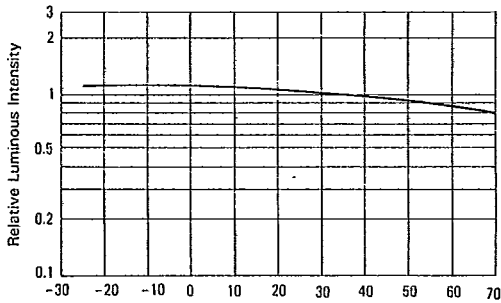


FIG. 20 LUMINOUS INTENSITY VS. AMBIENT TEMPERATURE

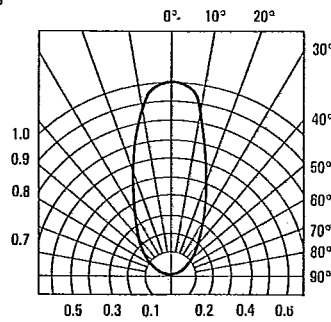


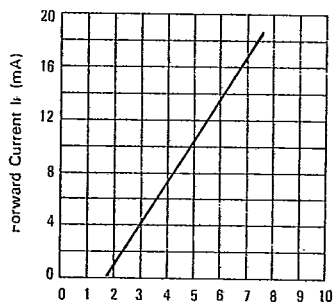
FIG. 21 SPATIAL DISTRIBUTION



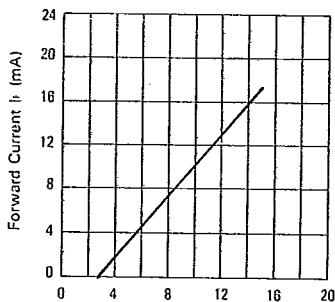
ELECTRICAL/OPTICAL CHARACTERISTICS AND CURVES AT TA = 25°C

PARAMETER	SYMBOL	PART NO. (LTL-)	MIN.	TYP.	MAX.	UNIT	TEST CONDITION
Luminous Intensity	Iv	4291-R1	2.5	5.6		mcd	VF=5V
		4291-R2	2.5	5.7			VF=12V
Viewing Angle	2θ½	4291-R1/R2		40		deg	Note 2 (Fig. 26)
Peak Emission Wavelength	λ PEAK	4291-R1/R2		630		nm	Measurement @Peak (Fig. 1)
Spectral Line Half - Width	Δλ	4291-R1/R2		40		nm	
Forward Current 5V Devices	IF	4291-R1		10	20	mA	VF = 5V
Forward Current 12V Devices	IF	4291-R2		12	20	mA	VF = 12V
Reverse Current	IR	4291-R1/R2			100	μA	VR = 5V

NOTES: 1. Luminous intensity is measured with a light sensor and filter combination that approximates the CIE (Commission Internationale De L'Eclairage) eye-response curve.  
 2. θ½ is the off-axis angle at which the luminous intensity is half the axial luminous intensity.



Applied Forward Voltage Vcc [V]  
 FIG. 22 FORWARD CURRENT VS. APPLIED FORWARD VOLTAGE. 5 VOLT DEVICES



Applied Forward Voltage Vcc [V]  
 FIG. 23 FORWARD CURRENT VS. APPLIED FORWARD VOLTAGE. 12 VOLT DEVICES

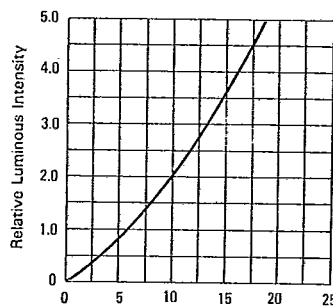
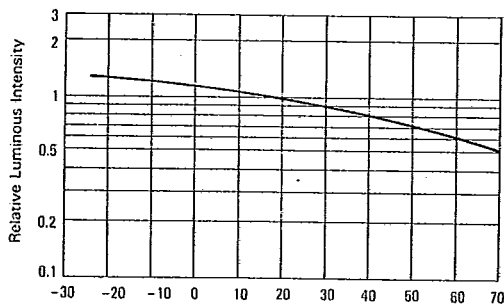


FIG. 24 RELATIVE LUMINOUS INTENSITY VS. FORWARD CURRENT



Ambient Temperature Ta (°C)  
 FIG. 25 LUMINOUS INTENSITY VS. AMBIENT TEMPERATURE

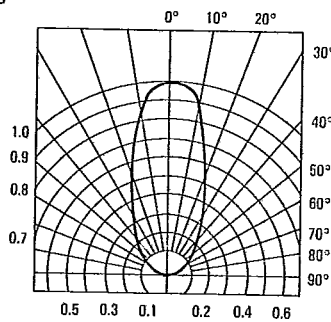


FIG. 26 SPATIAL DISTRIBUTION

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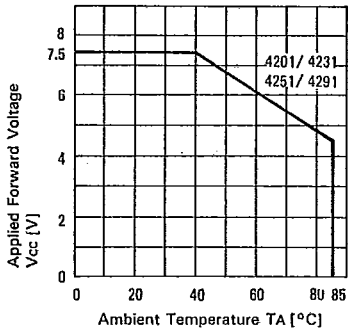


FIG. 27 MAXIMUM ALLOWED APPLIED FORWARD VOLTAGE VS. AMBIENT TEMPERATURE [5 VOLT DEVICES]

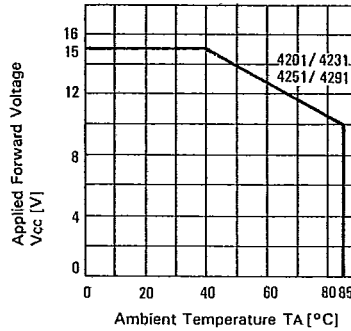


FIG. 28 MAXIMUM ALLOWED APPLIED FORWARD VOLTAGE VS. AMBIENT TEMPERATURE [12 VOLT DEVICES]

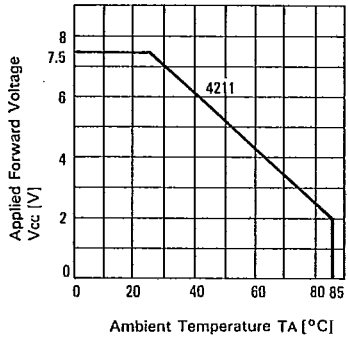


FIG. 29 MAXIMUM ALLOWED APPLIED FORWARD VOLTAGE VS. AMBIENT TEMPERATURE [5 VOLT DEVICES]

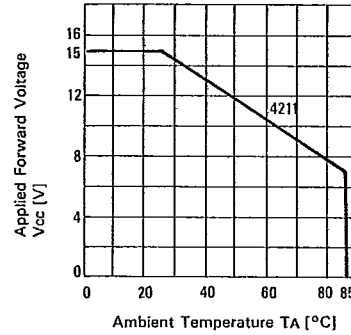


FIG. 30 MAXIMUM ALLOWED APPLIED FORWARD VOLTAGE VS. AMBIENT TEMPERATURE [12 VOLT DEVICES]

