VISHAY INTERTECHNOLOGY, INC.

AGING OF INFRARED EMITTER COMPONENTS

TECHNICAL INFORMATION

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Aging of Infrared Emitter Components

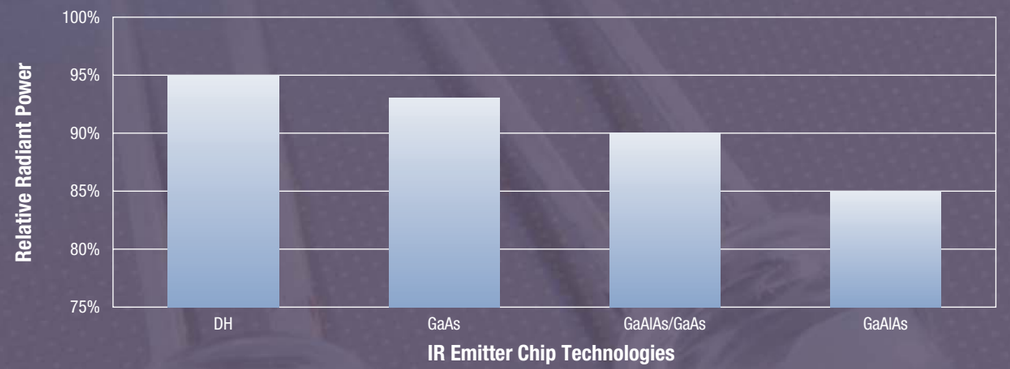
INTRODUCTION

Over its lifetime, an infrared emitter gradually loses its radiant power. This type of aging or degradation has three main causes:
· Mechanical stress deforms the crystal structure, causing loss of efficiency
· Delamination occurs between epoxy and chip, causing loss of optical coupling
· Thermal stress inflicts damage on the crystal structure

The rate of device aging is determined by:
· Chip technology: GaAs and GaAlAs Double Hetero (DH) technologies result in lower rates, while GaAlAs and GaAlAs/GaAs technologies result in higher rates of aging
· Package technology: metal can and chip on board (COB) packaging technologies result in lower rates, and epoxy packaging technologies result in higher rates of aging
· Chip size: The smaller the chip, the higher the current density. A higher current density results in faster aging.

TYPICAL DEGRADATION OF RADIANT POWER AFTER 4000 h OPERATION

Comparison of Major IR Emitter Chip Technologies Assembled Using T-1 3/4" Plastic Package



DEVICE AGING AND DEVICE SELECTION

Degradation rate is an important feature to consider when selecting an emitter. State-of-the-art chip technologies and high quality standards in the assembly process are essential for low degradation rate. Further different aging behavior is given for certain chip technologies. For example, GaAS and DH emitter chips show typically low aging and are thus best suited for long-term DC applications. GaAlAs and GaAlAs/GaAs chips typically degrade more. Thus, inherent outstanding radiant power makes them ideal for remote control (RC) applications. In fact, because of the extremely low duty cycles that are so typical of an RC system, the expected useful lifetime of GaAlAs/GaAs chips used in this application averages 10 or more years.

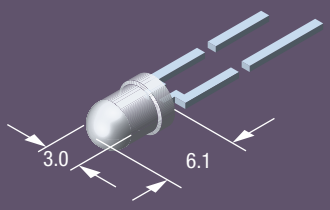
CHIP TECHNOLOGY, DEVICES AND DEDICATED APPLICATION

Technology:	DH	GaAs	GaAlAs/GaAs	GaAlAs
Performance @ Test Condition I_F = 100 mA				
Typ. 4000 h-Degradation	**-5%**	**-7%**	**-10%**	**-15%**
Radiant Power	**45 mW**	**15 mW**	**35 mW**	**25 mW**
Cut-Off Frequency	12 MHz / 35 MHz	450 kHz	450 kHz	600 kHz
Rise/Fall Time t_r, t_f	30 ns / 10 ns	800 ns	800 ns	600 ns
Wavelength	870 nm	950 nm	950 nm	870 nm
Product Series				
Package Forms				
T 1	-	TSUS4xxx	TSAL4400	TSHA4400
T 1 3/4	TSHF5xxx/TSFF5xxx	TSUS5xxx	TSAL5xxx/6xxx/7xxx	TSHA5xxx
Side View	TSSF4500	TSKS5400	-	-
Dome SMD	TSMF1xxx	-	TSML1xxx	-
PLCC2	TSMF3700	TSMS3700	TSML3710	-
Metal Can	-	TSTS7xxx	-	TSTA7xxx
Application				
	High Reliability	**High Reliability**	**Standard Application**	**Standard Application**
	Data Transmission	Photo Interrupter	Remote Control	Keyless Entry
	IrDC	IR Curtain	Low Duty Cycle	Low Duty Cycle
	Encoder	Encoder	Burst Mode	Burst Mode
	DC Mode	DC Mode	Pulse Mode	Pulse Mode

INFRARED EMITTER SELECTION

Part Number	Angle of Half Intensity ±φ (deg)	Radiant Intensity I_e (mW/sr)	Forward Voltage V_F (V)	Rise/Fall-Time t_r, t_f (µs)	Package Form
TSUS4300	16	18 (>7)	1.3 (<1.7)	0.8	A
TSKS5400S	30	4.5 (>2)	1.3 (<1.7)	0.8	B
TSUS5202	15	30 (>20)	1.3 (<1.7)	0.8	C
TSUS5402	22	20 (>15)	1.3 (<1.7)	0.8	C
TSHA4400	20	20 (>12)	1.5 (<1.8)	0.6	A
TSHA5203	12	65 (>50)	1.5 (<1.8)	0.6	C
TSHA5503	24	35 (>24)	1.5 (<1.8)	0.6	C
TSFF5200	10	160 (>80)	1.45 (<1.6)	0.01	C
TSFF5400	22	60 (>35)	1.45 (<1.6)	0.01	C
TSHF5200	10	100 (>50)	1.45 (<1.6)	0.03	C
TSHF5400	22	40 (>25)	1.45 (<1.6)	0.03	C
TSAL4400	25	30 (>16)	1.35 (<1.6)	0.8	A
TSAL5100	10	130 (>80)	1.35 (<1.6)	0.8	C
TSAL6200	17	60 (>40)	1.35 (<1.6)	0.8	C
TSAL6400	25	40 (>25)	1.35 (<1.6)	0.8	C
TSAL7600	30	25 (>15)	1.35 (<1.6)	0.8	C
TSML3710	60	8 (>4)	1.35 (<1.6)	0.8	D
TSML1000/1020	12	35	1.35 (<1.6)	0.8	E/F
TSML1030/1040	12	35	1.35 (<1.6)	0.8	G/H
TSMF1000/1020	17	25	1.45 (<1.6)	0.03	E/F
TSMF1030/1040	17	25	1.45 (<1.6)	0.03	G/H
TSMF3700	60	7	1.4 (<1.7)	0.03	D
TSTA7100	5	50 (>20)	1.5 (<1.8)	0.6	I
TSTA7500	40	6 (>3.2)	1.5 (<1.8)	0.6	K
TSTS7100	6	>10	1.3 (<1.7)	0.8	I
TSTS7300	12	6.3 (>4)	1.3 (<1.7)	0.8	J
TSTS7500	40	1.6 (>1.25)	1.3 (<1.7)	0.8	K

PACKAGE FORMS AND DIMENSIONS



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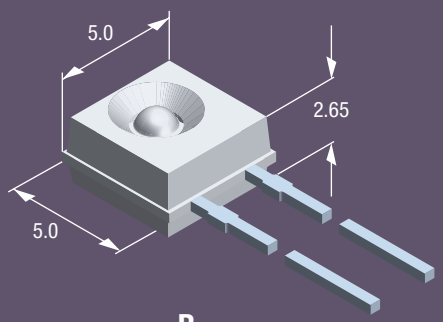

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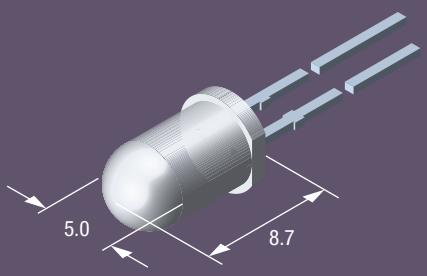

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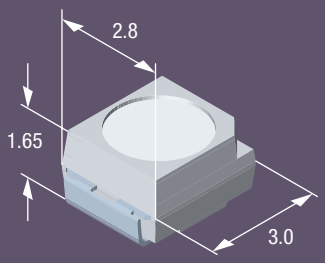

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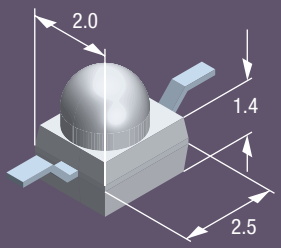

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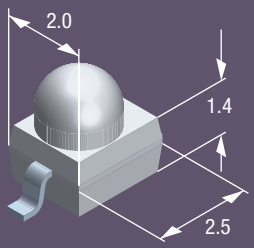

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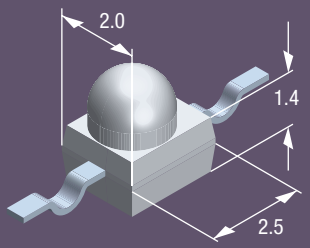

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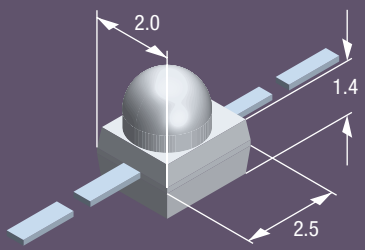

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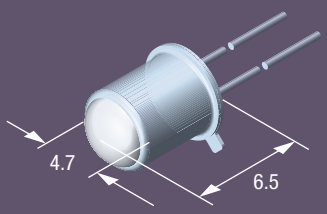

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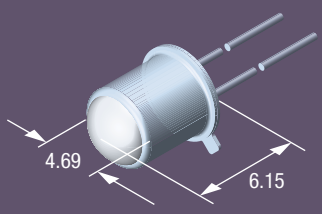

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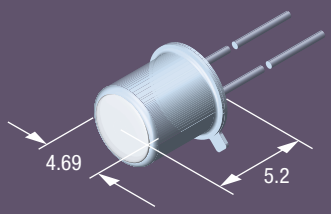

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