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: GaAlAs Double Hetero (DH), bulk, and surface emitter technologies result in lower rates, while GaAlAs and 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.

RESOURCES

- Optoelectronis Portfolio: http://www.vishay.com/optoelectronics/
- For technical questions, contact emittertechnicalsupport@vishay.com
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 to maintain a low degradation rate. Aging behavior varies, moreover, for the various infrared chip technologies. For example, DH, bulk, and surface emitter chips age slowly even when used in applications with high duty cycles and are thus best suited for long-term DC mode applications. GaAlAs and GaAs chips typically degrade more depending on their usage. This combined with their inherent outstanding radiant power makes them ideal for remote control (RC) applications, which of course have extremely low duty cycles. In the typical RC system in fact, the expected useful lifetime of the GaAlAs/GaAs emitter chips averages 10 or more years.

APPLICATIONS

- Data Transmission
- IrDC
- Photo Interrupter
- IR Curtain
- Encoder
- DC Mode
- Remote Control
- Low Duty Cycle
- Burst Mode
- Pulse Mode
- Keyless Entry

TYPICAL DEGRADATION OF RADIANT POWER AFTER 4000 h OPERATION

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

![PACKAGE FORMS](image)

**TABLE 1: CHARACTERISTICS DATA OF IRED CHIPS**

<table>
<thead>
<tr>
<th>TECHNOLOGY</th>
<th>TYPICAL CHIP DATA</th>
<th>TYPICAL DEVICE</th>
<th>TYPICAL DEVICE DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\Phi_e$ at 0.1 A(mW)</td>
<td>$\lambda_p$ (nm)</td>
<td>$\Delta \lambda$ (nm)</td>
</tr>
<tr>
<td>GaAs</td>
<td>7.7</td>
<td>950</td>
<td>50</td>
</tr>
<tr>
<td>GaAlAs</td>
<td>12.8</td>
<td>875</td>
<td>80</td>
</tr>
<tr>
<td>GaAlAs (DH)</td>
<td>20</td>
<td>890</td>
<td>40</td>
</tr>
<tr>
<td>GaAlAs (DH)</td>
<td>26</td>
<td>870</td>
<td>40</td>
</tr>
<tr>
<td>Bulk Emitter</td>
<td>21</td>
<td>940</td>
<td>30</td>
</tr>
<tr>
<td>GaAlAs MQW</td>
<td>22</td>
<td>940</td>
<td>30</td>
</tr>
<tr>
<td>Surface Emitter</td>
<td>30</td>
<td>850</td>
<td>25</td>
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</table>

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CHIP TECHNOLOGY, DEVICES AND DEDICATED APPLICATION

<table>
<thead>
<tr>
<th>Performance @ Test Condition IF = 100 mA</th>
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<tbody>
<tr>
<td>Typ. 4000 h-Degradation</td>
</tr>
<tr>
<td>Radiant Power</td>
</tr>
<tr>
<td>Cut-off Frequency</td>
</tr>
<tr>
<td>Rise/Fall Time tr, tf</td>
</tr>
<tr>
<td>Wavelength</td>
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Product Series

<table>
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<tr>
<th>Package Forms</th>
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<tbody>
<tr>
<td>T1</td>
</tr>
<tr>
<td>T1 3/4</td>
</tr>
<tr>
<td>Side View / SMD</td>
</tr>
<tr>
<td>Dome SMD</td>
</tr>
<tr>
<td>PLCC-2</td>
</tr>
<tr>
<td>0805</td>
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<tr>
<td>Metal Can</td>
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APPLICATONS

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<tr>
<th>Data Transmission</th>
<th>Photo Interrupter</th>
<th>Keyless Entry</th>
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<td>IR Curtain</td>
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<td>Burst Mode</td>
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<tr>
<td>DC Mode</td>
<td>DC Mode</td>
<td>Pulse Mode</td>
<td>DC Mode</td>
<td>DC Mode</td>
</tr>
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</table>

(*) and GaAlAs MQW
SEMICONDUCTORS

MOSFETs Segment

MOSFETs
- Low-Voltage TrenchFET® Power MOSFETs
- Medium-Voltage Power MOSFETs
- High-Voltage Planar MOSFETs
- High-Voltage Super Junction MOSFETs
- Automotive-Grade MOSFETs

ICs
- Power Management and Power Control ICs
- Smart Load Switches
- Analog Switches and Multiplexers

Diodes Segment

Rectifiers
- Schottky Rectifiers
- Ultrafast Recovery Rectifiers
- Standard and Fast Recovery Rectifiers
- High-Power Rectifiers/Diodes
- Bridge Rectifiers

Small-Signal Diodes
- Schottky and Switching Diodes
- Zener Diodes
- Tuner/Capacitance Diodes
- Bandswitching Diodes
- RF PIN Diodes

Protection Diodes
- TVS Diodes or TRANSZORB® (unidirectional, bidirectional)
- ESD Protection Diodes (including arrays)

Thyristors/SCRs
- Phase-Control Thyristors
- Fast Thyristors

IGBTs

Power Modules
- Input Modules (diodes and thyristors)
- Output and Switching Modules (contain MOSFETs, IGBTs, and diodes)
- Custom Modules

Optoelectronic Components Segment

Infrared Emitters and Detectors

Optocouplers
- Phototransistor, Photodarlington
- Linear
- Phototriac
- High-Speed
- IGBT and MOSFET Driver

Solid-State Relays

LEDs and 7-Segment Displays

Infrared Data Transceiver Modules

Custom Products

PASSIVE COMPONENTS

Resistors and Inductors Segment

Film Resistors
- Metal Film Resistors
- Thin Film Resistors
- Thick Film Resistors
- Power Thin Film Resistors
- Metal Oxide Film Resistors
- Carbon Film Resistors

Wirewound Resistors
- Vitreous, Cemented, and Housed Resistors
- Braking and Neutral Grounding Resistors
- Custom Load Banks

Power Metal Strip® Resistors

Battery Management Shunts

Crowbar and Steel Blade Resistors

Thermo Fuses

Chip Fuses

Pyrotechnic Initiators/Igniters

Variable Resistors
- Cermet Variable Resistors
- Wirewound Variable Resistors
- Conductive Plastic Variable Resistors
- Contactless Potentiometers
- Hall Effect Position Sensors
- Precision Magnetic Encoders

Networks/Arrays

Non-Linear Resistors
- NTC Thermistors
- PTC Thermistors
- Varistors

Magnetics

Inductors
- Wireless Charging Coils
- Transformers

Connectors

Capacitors Segment

Tantalum Capacitors
- Molded Chip Tantalum Capacitors
- Molded Chip Polymer Tantalum Capacitors
- Coated Chip Tantalum Capacitors
- Solid Through-Hole Tantalum Capacitors
- Wet Tantalum Capacitors

Ceramic Capacitors
- Multilayer Chip Capacitors
- Multilayer Chip RF Capacitors
- Disc Capacitors

Film Capacitors

Power Capacitors

Heavy-Current Capacitors

Aluminum Capacitors

ENYCAP™ Energy Storage Capacitors

Wireless Charging Coils

Transformers