TELEDYNE RELAYS
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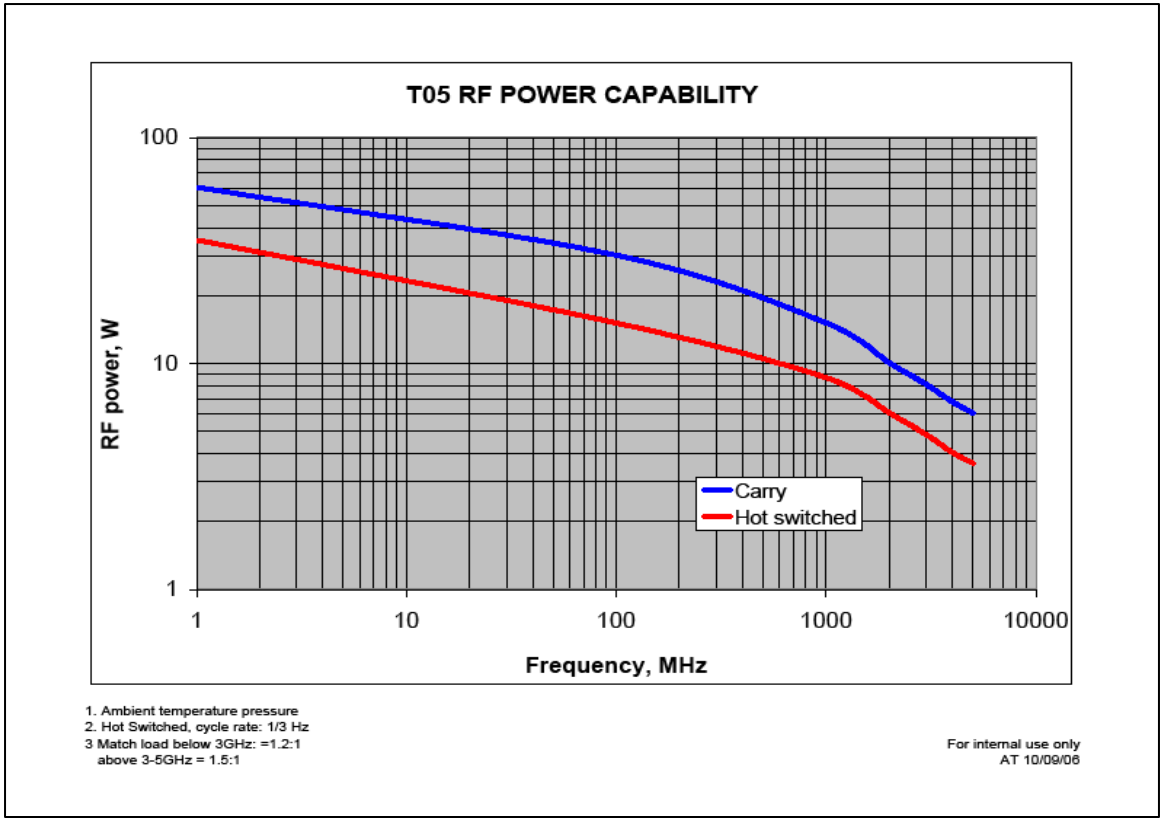
Electromechanical Relays - Frequently Asked Questions

Q: What is the contact carry rating?
A: Our EMR are capable of hot switching 28W load plus 100 cycles of overload condition at 56W. Therefore at a minimum, the EMR relays (except the 421/RF341/RF170 relays which are rated @ 50% power) are capable of carrying 56W at dc. At higher frequency, please use the following chart to estimated RF handling power. Teledyne Relays have subjected sample EMR to 3A contact-carry only for 96 hr at 125C and the relays survived the steady state current for our moving contact material. For contact-carry application, per the NEY handbook, equation 3.35: Steady State Current Capability = 3.31 Amps. For pulse durations less than 0.5 s, it can carry up to 16.55A, factor of 5. For 50 ms, it can carry up to 33.1A, factor of 10.

Q: What are the RF power hot switching and carry ratings? See Chart.



Q: Do you have a peak power vs. time chart?
A: No. Teledyne Relays does not recommend peak power greater than 28W at dc. Teledyne Relays routinely performs life tests by hot switching and carrying 28W power at dc using duty cycle of 3-second on time and 3-second off time for 100K and 1M cycles. Teledyne Relays also subjects the EMR to 100 cycles of 56W of power at dc as an overload condition.

Q: What is the difference between chatter and bounce?
A: Chattering of contacts occurs when contacts open and/or close when the relay is subjected to vibration, mechanical shock, or acceleration. Contact bounce occurs when contacts open and/or closed when the relay is actuated (turn on/ turn off conditions).

Q: Can I apply a coil voltage higher than the maximum voltage for short duration?
A: Even though it is not a recommended practice, typically the user can apply up to 20% to 30% above rated coil voltage. Applying higher than rated coil voltage over long duration can heat up the relay, may cause out-gassing, and thus degrade the reliability of the relay. Need to define "short duration" to evaluate the effect of an overheating condition.

Q: Can you offer custom coil voltages not listed on the data sheet?
A: Yes. Teledyne Relays can evaluate the possibilities of providing customer coil voltages for specific applications.

Q: What are the materials and plating thickness of your parts?
A: The base material of the relay is iron/nickel/cobalt sealing alloy (Kovar). The base material has an under-plating layer of Palladium Nickel (40 – 65 µ in) and a gold plating layer on the surface. Gold plating is 25 – 40 µ in. The leads, if requested, can be coated with tin/lead solder or lead-free solder at approximate thickness of 200-400 µ in, Sn/Pb (60/40). Lead free solder composition is Sn/Cu (99.3/0.7). The cover is nickel.

Q: What is the coil inductance of the relay?

Coil Voltage	Coil Inductance 412 Relay	Coil Inductance 422 Relay
Vdc	Henry	Henry
5	0.02	0.004
6	0.064	0.018
9	0.145	0.043
12	0.29	0.056
18	0.663	0.14
26	1.053	0.251

Q: Are your relays ESD sensitive, especially parts with transistors?
A: Teledyne Relays' EMR products are not ESD sensitive. Once the CMOS components are mounted on the header and are protected by the Zener diode, they are no longer ESD sensitive. Only relays with semiconductors (Diodes, Transistor, and CMOS) are considered to be ESD sensitive. On the transistor, we have tested the "T" headers and relays to ESD voltage of 9000 Volts per MIL-STD-883, method 3015; therefore they are classified as Class 3 device in the ESD classification (ETR 7621). On the CMOS and diodes, we have tested the devices to ESD voltage of 16000 Volts per MIL-STD-883, method 3015; therefore they are better than Class 3 device in the ESD classification (ETR 7587 and ETR 7621). Our GRF303-5 has no semiconductor components within the relays; therefore at the very least they are better than ESD voltage of 16000 Volts or better than Class 3 device in the ESD classification.

Q: What effect do transients have on the relay contacts?
A: Any transient contact load exceeding the rated contact load (1A@28Vdc) may be detrimental to the reliability of the relay. The duration of transient pulse is also a factor. Regarding transient voltage to the coil input, any transient pulses shorter than 130 µsec and amplitude less than 30% above rated coil voltage are not likely to affect the function of magnetic latching relay. Teledyne Relays also has test data to demonstrate that the Centigrid® relays would not transfer when subjected to transient pulses 740 µsec at rated coil voltage.

Q: Define and quantify the effects of dry switching currents and voltages on contact resistance over time?
A: Teledyne Relays typically performs low level-load life and mechanical life tests using 50uA@50mV contact load to monitor contact continuity. However, because the Teledyne Relays' EMR products are hermitically sealed, metal construction, and the contacts have noble metal alloy and are gold plated, it is designed for low level signal applications, including no-contact load cycling, while still retain stable dc resistance and high repeatability of insertion loss.

Q: What magnetic field strength will affect the magnetic relays?
A: Per MIL- specifications, EMR products are subjected to magnetic interference test by surrounding the subjected relays with similar relays, while still operating it normally. Teledyne Relays also subjected the relays to magnetic field to verify its functions. For the 722 relays (magnetic latching relays), based on (2) samples, both relays began to exhibit "miss" events at approximately 200 Gauss magnetic field, especially when the field is applied in the +X direction (direction from top of the can). No problem when 300 Gauss magnetic field is applied on the Y and Z directions. For the 712 relays (non-latching relays), based on (2) samples, both relays began to exhibit "miss" events at approximately 550-600 Gauss magnetic field when the field is applied in the +X direction (direction from top of the can). One possible explanation for the difference between the two limits for the latching relays versus the non-latching relays is the fact that the 722 relays (magnetic latching) has a permanent magnet, while the 712 relays do not.

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Q: Are your parts RoHS?
A: Teledyne Relays T0-5 and Centigrid® Relays with gold-plated leads and lead-free soldered leads (Sn99.3/Cu0.7) are RoHS compliant products. When requested, Teledyne Relays can also provide relays with tin/lead solder coating on leads. These relays are not RoHS compliant products.

Q: What is the maximum soldering temperature of your surface mount relays?
A: Teledyne Relays' T0-5 and Centigrid® Relays with gold-plated leads can withstand reflow peak temperature up to 270°C for 1 minute. Tin/lead solder reflows at 183°C, lead-free solder reflows at 220°C-230°C.

Q: What's the longest time a relay can be non-operative and still function?
A: Teledyne Relays has tested relays that have been in prolonged period of inactivity between 540 to 700 weeks (10 - 13 1/2 years) and relays will still operate on first pulse and were fully functional.

Q: Can the contacts be paralleled to handle twice the current?
A: The dual poles of our DPDT configuration can be used to carry the load in parallel. However, users should be aware that the two poles have a maximum of 1 millisecond differential in operate time.

Q: What are the shock limits for the 422 latching relays?
A: Teledyne Relays performed mechanical shock tests on 422 relays and found that in the +X direction, the 422 relays chattered at 1500G's, and transferred at 1800G's. In the (-X) direction, the relay chattered at 1800G's yet no contact transfer up to 2100G's.

Q: How hot does the relay get?
A: Typically, the relay may get up to 35°C above room ambient temperature and up to 55°C above 125°C ambient when the coil is energized for extended duration.

Q: How hot does 422-26 relay get when one coil is energized with 42V?
A: The temperature reached as high as 120°C within 5 minutes and remained at steady state thereafter.

Q: Do you have any thermal resistance values for your electromechanical relays?
A: Need to clarify the question further. EMR products are not resistance to the flow of heat. Heat sink is not required to be used with T0-5 and Centigrid® relays.

Q: Do you have sockets for your relays?
A: Typically, Teledyne Relays does not manufacture test socket for outside uses. However, Teledyne Relays has accommodated special requests for test socket/jigs to support custom applications.

Q: Do contacts chatter in excess of 10µs and or transfer in excess of 1us?
A: Yes. Contact can chatter in excess of 10 µsec and transfer in excess of 1 µsec when subjected to excessive mechanical shock/vibration/acceleration. Teledyne Relays typically defines these limits as threshold for failures when contacts chatter in excess of 10us and or transfer in excess of 1us, meaning the signal is interrupted.

Q: Explain the date code and how to find it?
A: The lot number contains 10 digits. The first four digits are for the year and the week that the relays were sealed. The fifth digit designates the build location. The remaining five digits are the sequential lot number that is assigned to each specific lot.

Q: Which relay has the longest life?
A: In general, the smaller relays have longer mechanical life and can handle lower level load for more number of cycles than the larger relays. However, the larger relays can handle more power, thus they can withstand higher contact load for more number of cycles.

Q: Which relay offers the best Isolation?
A: In general, the larger the relay, the higher (better) isolation. For example, coaxial switches have higher isolation than crystal can relays, and crystal can relays have higher isolation than T0-5, Centigrid® relays.

Q: Which relay offers the best insertion loss?
A: From DC to 1 GHz frequency range, all of Teledyne Relays' EMR products have comparable insertion loss.

Q: Which relay can handle the most power?
A: In general, the larger relays can handle higher power because they have larger contacts to conduct and carry power. For example, coaxial switches have higher power capability than crystal can relays, and crystal can relays have higher power capability than T0-5, Centigrid® relays. Within the T0-5 and Centigrid® relay families, the RF341, 421, RF180/RF170 relays have lowest power handling capabilities.

Q: Do you have a QPL cross reference?
A: See link: http://www.teledynerelays.com/QPL/searchqpl.asp

Q: What are ground pins, spacer pads, and spreader pads?
A: See link: http://www.teledynerelays.com/pdf/electromechanical/GNDPINS.pdf

Q: What's the difference between JAN and ER relays?
A: JAN relays are built and tested to MIL-PRF-39016/28776 specifications. ER relays are built and tested to a Teledyne Relays' Established Reliability Program. Both relay types are built with same materials and manufacturing processes. However, Teledyne Relays developed an Established Reliability program to remove non-value added tests and pass on the savings to the customers.

Q: What are A, B, L, and M reliability levels?
A: The A reliability level relays are relays with failure rate of 1.5% per 10,000 unit cycles. The B reliability level relays are relays with failure rate of 0.75% per 10,000 unit cycles. Both A/B rated relays are ER relays. The L reliability level relays are relays with failure rate of 3% per 10,000 unit cycles. The M reliability level relays are relays with failure rate of 1% per 10,000 unit cycles. Both L/M rated relays are JAN relays.

Q: What is the magnetic moment for a 422 relay?
A: The measured magnetic moment is 0.165 micro-Weber-cm or 0.001313 Am^2

Q: What is the thickness of the solder on the solder-dipped leads?
A: .020" max for the leads at the tip, .018" the length of (without the dip they are .017")

Q: What is the max solder time and temperature for the relays?
A: Do not exceed either higher than 270°C or longer than 1 minute.

Q: What is the maximum DWV threshold for the 412 relays?
A: Between 650Vrms to 700Vrms. ER412-5A, lot no. 0743121710 - 5/5 pass DWV on the Slaughter Tester at 630 Vrms/60Hz on all points.

Q: How is an electromechanical relay reset when its armature is stuck in a neutral position?
A: Typically this neutral position can be cleared by pulsing one coil with rated coil voltage. These relays require greater than rated coil voltage to clear the neutral position. Once the relay is out of the neutral position the relays operate normally.

Q: What are the Intermodulation (IMD) measurements for EMR products?
A: Data was measured by one of our customer s. GRF300-5 relays have 110dBc with 2x30dBm CW carrier at 869MHz and 894MHz and spurious at 844MHz.

Q: Questions about the internal moisture content of Teledyne Relays' EMR products?
A: Teledyne Relays has not been able to quantify the amount of moisture (% of moisture inside sealed relay) from the Residual Gas Analysis (RGA) method because of the small internal volume of our relays. The resolution of the RGA method is not reliable enough to accurately measure the internal gases inside the T0-5 package. Therefore, Teledyne Relays elected to control moisture level of the backfilled gas and the type of inert gas to backfill rather than any measurements of the gas contents inside of the relay.
Teledyne Relays maintains a dew point of the backfilled gas to ensure the relays' functionality across the temperature range (-65°C to +125°C) and for long-term reliability.
Teledyne Relays has evaluated sealing relays with backfilled gas with higher dew point, as high as +15°C and with air as backfilled gas, without experiencing internal moisture or DWV/Insulation Resistance failures.
Sealing procedure is controlled and documented in specification 0-35-542.
Teledyne Relays maintains a database of RGA results as referenced points, but not as acceptance criteria.

Q: Even though the relays are rated to operate at -65°C, are the relays operational at temperature lower than rated temperature?
A: There is a Customer Test Report, CTR 165, where they tested an RF170 relay at 77K (-196°C). The report indicated that "The relay performed reliably at both room temperature and at 77K (-196°C). There were no signs of hesitation or sticking, even after a 30 minute cold soak in liquid nitrogen."

Q: What is the minimum coil voltage necessary for reliable switching? What is the difference between "Coil Voltage" and "Set & Reset Voltage" listed in the datasheet?
A: The minimum coil voltage for reliable switching is the part's rated coil voltage. For example, the voltage would be 5 volts for a relay with 5-volt control. The use of any coil voltage less than the rated coil voltage will compromise the operation of the relay. The "Set & Reset Voltage" listed in the datasheet pertains to the MIL-PRF-39016 requirement described in "Specified pickup or latch/reset, hold, and dropout values." This voltage is the value at which the relay must actuate in qualification testing, not during general operation throughout the life of the relay.

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Q: Does your company have formal documentation of lead-free tin* contamination/mitigation plan mandated for use by all internal Divisions and suppliers/sub-tiers?
A: Teledyne Relays manufactures miniature electromechanical relays (T0-5 and Centigrid,1/2 Crystal Can etc…) These relays have no lead-free tin element internally. The relay leads can be coated with SN60/PB40 solder as a standard pre-tin coating when requested.

Q: Why is the contact life for a Hi-Rel relay different than the contact life for a similar commercial or standard relay?
A: The performance and characteristics of standard and commercial parts remain the same throughout the stated contact life of the relay. Due to the high reliability required of Hi-Rel relays, the contact life is de-rated to ensure that relay will operate each time it is actuated throughout its stated contact life.

Q: What kind of magnetic field levels can TO-5 relays withstand?
A: There is a customer test report (CTR 184), in which various TO-5 relays were exposed to levels up to ±6mT. The relays continued to operate correctly, pull-in and pull-out times were monitored at different field levels; the operation time of all relays were well below the maximum operation times.

Q: Can the 412 and 422 relays (26V coil) withstand a worst case scenario voltage of 40Vdc for 100ms (Assuming PCB temperature of 86°C)?
A: For the 412 and 422 relays we have a short pulse rating of two times the rated coil voltage for a pulse length of 75 to 150 msec. The duty cycle of the pulse is 5% and at a maximum temperature of 125C.
The 412-26 and 422-26 the maximum voltage is 53Vdc for 75 to 150ms at 125°C. Depending on the customer's duty cycle it looks like the 40V, 110ms pulse is acceptable.

Q: What are the maximum vibration and shock levels that the J255 relay can withstand?
A: One of our customers has performed vibration and shock testing on the J255 relays with the following results:
Samples pass 10-1000 Hz, 50 g's; 1000-2000 Hz, 30 g's sine vibration without chatter or transfer.
Samples pass 400 g's, 0.5 ms, ½ sine shock without chatter or transfer. Samples begin to chatter at 450 g's.

Q: What is the maximum load current that the 114 series can handle at 100Vdc (Resistive)?
A: The maximum current the 114 relay can handle is 280mA with a typical life cycle of 100,000 cycles.

Q: Will the 422-18 be damaged if it sees 34Vdc for 2 seconds @ +80°C?
A: We have tested relays with a 150ms pulse @ twice the rated coil voltage (36V for the 422-18 relay) and we found no decrease in reliability. The duty cycle for the pulse was 5% per coil.