Description

The Smart Power Relay E-1048-8D is a remotely controllable electronic load disconnecting relay with two functions in a single unit:
- electronic relay
- electronic overcurrent protection

The 4 pin DICE version is designed for use with standard automotive relay sockets. A choice of current ratings is available from 1 A through 30 A. An operating voltage range of DC 9…32 V allows the connection of DC 12 V and DC 24 V loads.

In order to switch and protect loads remotely, it has until now been necessary to connect several discreet components together:
- an electro-mechanic relay, control cable and integral contact to close the load circuit
- an additional protective element (circuit breaker or fuse) for cable or equipment protection

Now type E-1048-8D combines these two functions in a single unit, thus minimising the number of connections in the circuit and thereby reducing the risk of failures.

Applications

Type E-1048-8D is suited to all applications with DC 12 V or DC 24 V circuits, where magnetic valves, motors or lamp loads have to be switched and protected:
- road vehicles (utility vehicles, buses, special vehicles)
- construction and agricultural machinery
- rail vehicles
- marine industry (ships, boats, yachts etc.)

The Power Relay is also suitable for industrial use (process control, machine-building, engineering) as an electronic coupling relay between PLC and DC 12 V or DC 24 V load

Features

- Integral power electronics provide a wear-resistant switching function, insensitive to shock, vibration and dust.
- Compared to electro-mechanical relays, only a fraction of the closed-circuit current or switching current is needed. This is important for battery buffered load circuits which have to remain controlled even with the generator off line.
- The extremely low induced current consumption of less than 50 µA is absolutely necessary for battery buffered applications.
- The load circuit is disconnected in the event of a short circuit (ENTRY version) or overload/short circuit (ENTRYprotect version).
- For switching and monitoring loads of 30 A plus it is possible to connect several units in parallel. Uniform power distribution between units must be ensured by symmetrical design of the supply cables (length and cross section).
- Coloured label, for the identification the rated current (e. g. red = 10 A).

Approvals

<table>
<thead>
<tr>
<th>Authority</th>
<th>Approval mark</th>
<th>Regulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>KBA</td>
<td>E1</td>
<td>ECE R 10</td>
</tr>
</tbody>
</table>

Technical Data (TA= 25 °C at U_N)

<table>
<thead>
<tr>
<th>Power supply LINE +</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>DC power supply with small R_i battery and generator etc.</td>
</tr>
<tr>
<td>Voltage ratings U_N</td>
<td>DC 12 V/DC 24 V</td>
</tr>
<tr>
<td>Operating voltage U_S</td>
<td>DC 9...32 V</td>
</tr>
<tr>
<td>Closed-circuit current I_0 in the OFF condition 1)</td>
<td>50 µA</td>
</tr>
</tbody>
</table>

Load circuit LOAD

<table>
<thead>
<tr>
<th>Load output</th>
<th>Power MOSFET, High Side Switch (HSS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current rating range I_N</td>
<td>1 A ... 30 A (fixed ratings) without load reduction up to 85° C (1 A ... 25 A), 30 A up to 60 °C ambient temp.</td>
</tr>
<tr>
<td>Types of loads</td>
<td>resistive, inductive, capacitive, lamp loads, motors (depending on duration of inrush current)</td>
</tr>
<tr>
<td>ENTRY version</td>
<td>Load output with short circuit protection</td>
</tr>
<tr>
<td>ENTRYprotect version</td>
<td>Load output with short circuit and overload protection (typically 200 ms at I_{Load} typically 1.3 x I_N)</td>
</tr>
</tbody>
</table>

Typical voltage drop U_ON at rated current I_N 1)

<table>
<thead>
<tr>
<th>I_N (A)</th>
<th>U_ON (mV)</th>
<th>I_N (A)</th>
<th>U_ON (mV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50</td>
<td>10</td>
<td>110</td>
</tr>
<tr>
<td>2</td>
<td>55</td>
<td>15</td>
<td>70</td>
</tr>
<tr>
<td>3</td>
<td>60</td>
<td>20</td>
<td>90</td>
</tr>
<tr>
<td>5</td>
<td>80</td>
<td>25</td>
<td>120</td>
</tr>
<tr>
<td>7.5</td>
<td>90</td>
<td>30</td>
<td>140</td>
</tr>
</tbody>
</table>

only ENTRYprotect

Switching point 1) typically 1.3 x I_N

Trip time (standard curve) 1) typically 200 ms with switch-on onto overload and/or load increase on duty

Max. overload

<table>
<thead>
<tr>
<th>I_N (A)</th>
<th>U_ON (mV)</th>
<th>I_N (A)</th>
<th>U_ON (mV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - 10</td>
<td>60</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>15 - 30</td>
<td>200</td>
<td>200</td>
<td>200</td>
</tr>
</tbody>
</table>

Parallel connection of channels for loads of 30 A plus, several units of identical current ratings may be connected in parallel. To ensure equal distribution of current between units, symmetrical design of the supply feed is necessary (length and cross section).

1) typically
## Technical Data (T_A= 25 °C at U_N)

**Free-wheeling diode**  
for connected load  
\( I_{D} = 1 \text{A}...10 \text{A} \) at 40 A  
\( I_{D} = 15 \text{A}...30 \text{A} \) at 100 A  

**Delay time**  
\( t_{on} \) 0.5 ms, \( t_{off} \) 1.5 ms  

**Short circuit, overload**  
in load circuit  
- disconnection of load  
- no automatic re-start  
- after remedy of the fault unit has to be reset via control input IN+  

**Control input IN+**  
Control voltage \( V_{IN+} \)  
0...5 V = "OFF", 8.5...32 V = "ON"  
Control current \( I_{E} \)  
typically 1 mA at 12 V  
typically 5 mA at 24 V  
Reset in the event of a failure  
- via external control signal (low-high) at control input IN+  
- via reset of supply voltage  

**Control input IN-**  
Control voltage \( V_{IN-} \)  
relay energised when IN- connected to ground; tolerance range 12 V system:  
0...6 V = "ON" 8.5...12 V = "OFF"  
tolerance range 24 V system:  
0...18 V = "ON" 20.5...24 V = "OFF"  
Reset in the event of a failure  
- re-settable via external control signal (High-Low) at control input IN-  
- via reset of supply voltage  

**Control input IN+ / IN-**  
Switching frequency  
at resistive or inductive load max. 60 Hz  
Edge of IN  
< 5 ms  

**General data**  
Reverse polarity protection  
Control circuit  
yes  
Load circuit  
no (due to integral free-wheeling diode)  

**Temperature range**  
ambient temperature  
30 A: -40 °C...+60 °C without derating  

**Temperature shutdown**  
power transistor > 150 °C  

**Tests**  
Humid heat  
combined test, 9 cycles with functional test  
test to DIN EN 60686-2-30, Z/AD  
Temperature change  
min. temperature -40 °C,  
max. temperature +90 °C  
Vibration (random)  
in operation, with temperature change  
6 g eff. (10 Hz...2,000 Hz)  
test to DIN EN60686-2-64  
Vibration was tested with standard sockets for PCB mounting. Behaviour at vibrations depends on design, quality and age (number of push-in cycles) of the socket particularly regarding duration of the vibration and the mounting position.  
Shock  
25 g/11 ms, 10 shocks  
test to DIN EN 60686-2-27  
Corrosion  
test to DIN EN 60686-2-52, severity 3  
Protection class  
housing -8D4 IP30 to DIN 40050  
housing -8DS IP65 to DIN 40050, higher protection class upon request  
EMC requirements  
EMC directive:  
emitted interference EN 50081-1  
noise immunity EN 61000-6-2  
Automotive directive:  
emitted interference, noise immunity; 72/245/EWG and 2006/28/EG  

**Terminals**  
4 blade terminals 6.3 mm x 0.8 mm  
contact material CuZn37F44  
Mounting:  
on automotive relay socket 4-pole

### Ordering Information

**Type**  
E-1048-8D Smart Power Relay DC 12 V/24 V, 1 A...30 A in DICE version  

**Housing / temperature range**  
with housing -40 °C...85 °C (for rated current up to 20 A)  
with housing -40 °C...85 °C (60 °C at IN = 30 A)  
improved ambient req. (IP protection class etc.)  

**Options**  
A0 without options  

**Characteristic curve**  
Voltage rating  
U3 DC 12-24 V  
Current ratings / colour of label  
1 A / black  
2 A / grey  
3 A / purple  
5 A / light-brown  
7.5 A / brown  
10 A / red  
15 A / blue  
20 A / yellow  
25 A / white  
30 A / green  

**Dimensions DICE version (4 pin version)**  
2, 4, 6 and 8 - blade terminals 6.3 x 0.8  
Footprint to ISO 7588  
This is a metric design and millimeter dimensions take precedence (0.2 mm)  

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1) typically
Smart Power Relay E-1048-8D...

Typical time/current characteristics (TA = 25 °C)

**Trip curve 1 “ENTRYprotect”**
1 A, 2 A, 3 A, 5 A, 7.5 A and 10 A (standard 200 ms)

**Trip curve 2 “ENTRYprotect”**
15 A, 20 A, 25 and 30 A (standard 200 ms)

Connection diagrams DICE version

Pin selection DICE version (4 pin)

E-1048-8D DICE version

- **LINE**: 30 2 U5 (DC 12 V/24 V)
- **IN**: 86 4 control input
- **GND**: 31 5 ground U5
- **LOAD**: 88a 8 load output

Preferred types

<table>
<thead>
<tr>
<th>Preferred types</th>
<th>Standard current ratings (A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-1048-8D4-C0A0-4U3-</td>
<td>1 2 3 5 7.5 10 15 20</td>
</tr>
</tbody>
</table>

All dimensions without tolerances are for reference only. In the interest of improved design, performance and cost effectiveness the right to make changes in these specifications without notice is reserved. Product markings may not be exactly as the ordering codes. Errors and omissions excepted.