

SMCLCE-HR Series

1500 W Low Capacitance Surface Mount in DO-214AB



Uni-directional

Agency Approvals

| Agency | Agency File Number |
|--------|--------------------|
| | E230531 |

Maximum Ratings & Thermal Characteristics (T_A = 25 °C unless otherwise noted)

| Parameter | Symbol | Value | Unit |
|--|------------------|------------|------|
| Peak Pulse Power Dissipation by 10/1000 μ s Waveform (Fig.1)(Note 1) | P _{PPM} | 1500 | W |
| Power Dissipation on Infinite Heat Sink at T _L = 50 °C | P _D | 6.5 | W |
| Operating Temperature Range | T _J | -65 to 150 | °C |
| Storage Temperature Range | T _{STG} | -65 to 175 | °C |

Notes:1. Non-repetitive current pulse, per Fig. 3 and derated above T_J (initial) = 25 °C per Fig. 2.

Description

SMCLCE-HR high reliability series is designed specifically to protect sensitive data line electronic equipment from voltage transients induced by lightning and other transient voltage events.

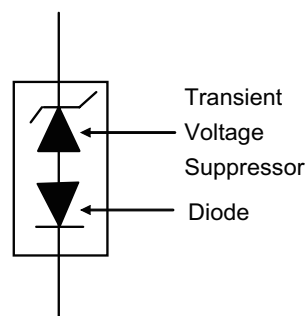
Features

- Low capacitance ≤ 50 pF, 1500 W peak pulse power capability at 10/1000 μ s waveform, repetition rate (duty cycles):0.01 %
- For surface mounted applications in order to optimize board space
- Low profile package
- Built-in strain relief
- Typical failure mode is short from over-specified voltage or current
- Whisker test is conducted based on JEDEC JESD201A per its table 4a and 4c
- ESD protection of data lines in accordance with IEC 61000-4-2 ESD 30 kV (Air), 30 kV (Contact)
- EFT protection of data lines in accordance with IEC 61000-4-4
- Glass passivated chip junction
- Low incremental surge resistance
- Fast response and excellent clamping capability
- UL recognized compound meeting flammability rating V-0
- Meet MSL level1, per J-STD-020, high temperature soldering guaranteed:260 °C/10 seconds at terminals
- Matte tin lead-free plated
- Halogen free and RoHS compliant
- Pb-free E3 means 2nd level interconnect is Pb-free and the terminal finish material is tin(Sn) (IPC/JEDEC J-STD-609A.01)

Applications

- I/O Interfaces for avionics applications, such as flight control, FADEC, radar, and etc.
- Protection for aircraft fast data line


Schematic



SMCLCE-HR Series

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Electrical Characteristics

| Part Number (Uni) | Marking Code | Stand-Off Voltage V_R (V) | Minimum Breakdown Voltage $V_{BR}(V)$ @ I_T | | Test Current I_T (mA) | Maximum Reverse Leakage at I_R @ V_R (μA) | Maximum Clamping Voltage @ I_{PP} V_C (V) | Maximum Peak Pulse Current per (Fig.3) I_{PP} (A) | Maximum Junction Capacitance at 0 Volts $f = 1$ MHz (pF) | Working Inverse Blocking Voltage V_{WIB} (V) | Inverse Blocking Leakage Current at I_{IB} @ V_{WIB} (mA) | Peak Inverse Blocking Voltage V_{PIB} (V) | Agency Approval  |
|-------------------|--------------|-----------------------------|---|------|-------------------------|--|---|---|--|--|---|---|---|
| | | | Min | Max | | | | | | | | | |
| SMCLCE12-HR | SGEE | 12 | 13.3 | 14.7 | 1 | 5 | 20.9 | 75.4 | 50 | 75 | 1.0 | 100 | X |
| SMCLCE13-HR | SGEG | 13 | 14.4 | 15.9 | 1 | 3 | 22.5 | 69.8 | 50 | 75 | 1.0 | 100 | X |
| SMCLCE14-HR | SGEK | 14 | 15.6 | 17.2 | 1 | 3 | 24.2 | 64.7 | 50 | 75 | 1.0 | 100 | X |
| SMCLCE15-HR | SGEM | 15 | 16.7 | 18.5 | 1 | 0.96 | 25.4 | 61.5 | 50 | 75 | 1.0 | 100 | X |
| SMCLCE16-HR | SGEP | 16 | 17.8 | 19.7 | 1 | 0.96 | 27.0 | 57.7 | 50 | 75 | 1.0 | 100 | X |
| SMCLCE17-HR | SGER | 17 | 18.9 | 20.9 | 1 | 0.96 | 28.6 | 54.4 | 50 | 75 | 1.0 | 100 | X |
| SMCLCE18-HR | SGET | 18 | 20.0 | 22.1 | 1 | 0.96 | 30.2 | 51.4 | 50 | 75 | 1.0 | 100 | X |
| SMCLCE20-HR | SGEV | 20 | 22.2 | 24.5 | 1 | 0.96 | 33.4 | 46.3 | 50 | 75 | 1.0 | 100 | X |
| SMCLCE22-HR | SGEX | 22 | 24.4 | 26.9 | 1 | 0.96 | 36.5 | 42.3 | 50 | 75 | 1.0 | 100 | X |
| SMCLCE24-HR | SGEZ | 24 | 26.7 | 29.5 | 1 | 0.96 | 39.9 | 38.6 | 50 | 75 | 1.0 | 100 | X |
| SMCLCE26-HR | SGFE | 26 | 28.9 | 31.9 | 1 | 0.96 | 43.1 | 35.7 | 50 | 75 | 1.0 | 100 | X |
| SMCLCE28-HR | SGFG | 28 | 31.1 | 34.4 | 1 | 0.96 | 46.5 | 33.1 | 50 | 75 | 1.0 | 100 | X |
| SMCLCE30-HR | SGFK | 30 | 33.3 | 36.8 | 1 | 0.96 | 49.4 | 31.0 | 50 | 75 | 1.0 | 100 | X |
| SMCLCE33-HR | SGFM | 33 | 36.7 | 40.6 | 1 | 0.96 | 53.3 | 28.2 | 50 | 75 | 1.0 | 100 | X |
| SMCLCE36-HR | SGFP | 36 | 40.0 | 44.2 | 1 | 0.96 | 58.1 | 25.9 | 50 | 75 | 1.0 | 100 | X |
| SMCLCE40-HR | SGFR | 40 | 44.4 | 49.1 | 1 | 0.96 | 64.5 | 23.3 | 50 | 75 | 1.0 | 100 | X |
| SMCLCE43-HR | SGFT | 43 | 47.8 | 52.8 | 1 | 0.96 | 69.4 | 21.7 | 50 | 75 | 1.0 | 100 | X |
| SMCLCE45-HR | SGFV | 45 | 50.0 | 55.3 | 1 | 0.96 | 72.7 | 20.6 | 50 | 75 | 1.0 | 100 | X |
| SMCLCE48-HR | SGFX | 48 | 53.3 | 58.9 | 1 | 0.96 | 77.4 | 19.4 | 50 | 75 | 1.0 | 100 | X |
| SMCLCE51-HR | SGFZ | 51 | 56.7 | 62.7 | 1 | 0.96 | 82.4 | 18.2 | 50 | 75 | 1.0 | 100 | X |
| SMCLCE54-HR | SGGE | 54 | 60.0 | 66.3 | 1 | 0.96 | 87.1 | 17.3 | 50 | 100 | 1.0 | 125 | X |
| SMCLCE58-HR | SGGG | 58 | 64.4 | 71.2 | 1 | 0.96 | 93.6 | 16.1 | 50 | 100 | 1.0 | 125 | X |
| SMCLCE60-HR | SGGK | 60 | 66.7 | 73.7 | 1 | 0.96 | 96.8 | 15.5 | 50 | 100 | 1.0 | 125 | X |
| SMCLCE64-HR | SGGM | 64 | 71.1 | 78.6 | 1 | 0.96 | 103.0 | 14.6 | 50 | 100 | 1.0 | 125 | X |
| SMCLCE70-HR | SGGP | 70 | 77.8 | 86.0 | 1 | 0.96 | 113.0 | 13.3 | 50 | 125 | 1.0 | 150 | X |

Note: Each lot of parts will pass group B test requirement.

Screen Process

| | |
|---|-----------------------------------|
| 100 % vision inspection | MIL-STD-750 method 2074 |
| 100 % X-RAY inspection | MIL-STD-750 method 2076 |
| 100 % temperature cycle test (-55 °C to 150 °C, 20 cycles, dwell time 15 min) | MIL-STD-750 method 1051 |
| 100 % reflow (2x) | JEDEC J-STD-020 |
| 100 % surge test (2x) | MIL-STD-750 method 4066 |
| 100 % HTRB 150 °C bias = V_R (80 % breakdown voltage, 96 hrs) | MIL-STD-750 method 1038 |
| Final electrical test (100 % 3 sigma limit, 100 % dynamic test and PAT limit) | MIL-STD-750 method 4016.4021.4011 |

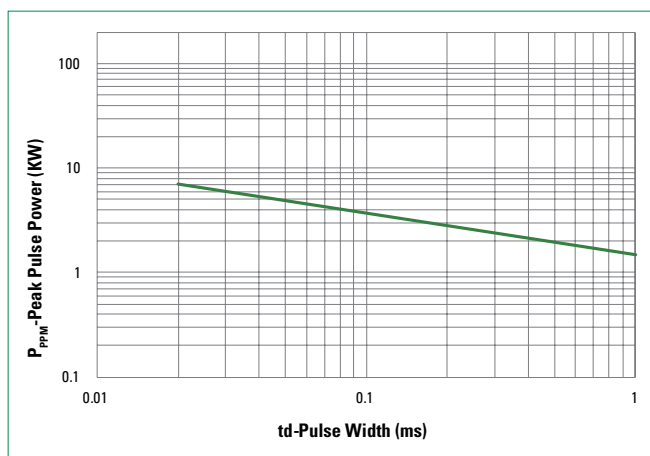
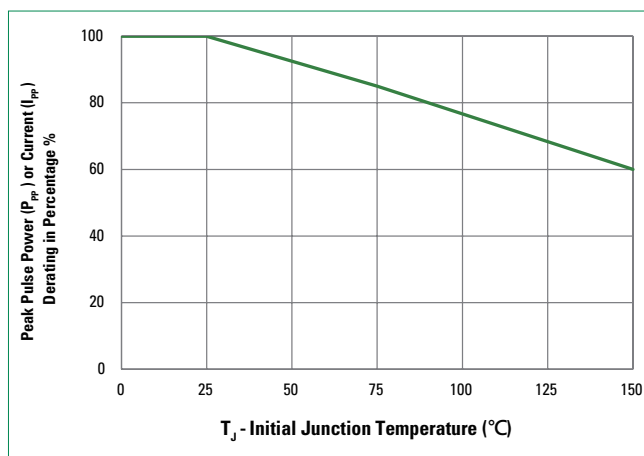
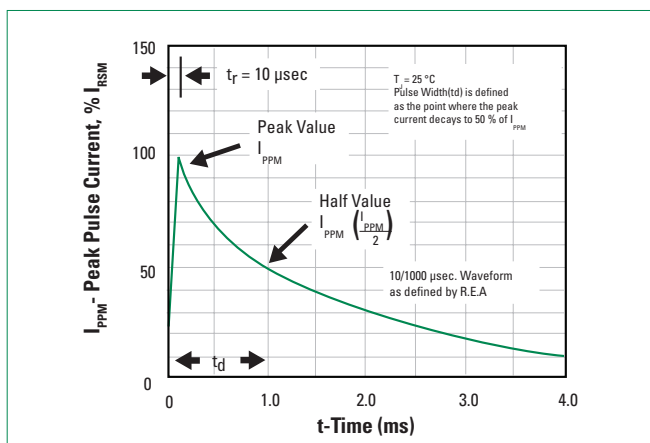
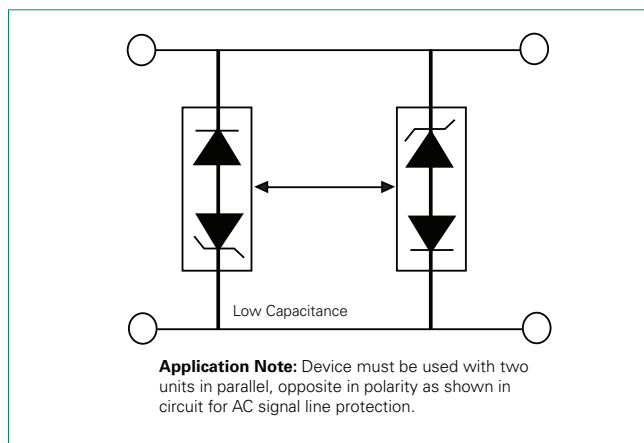
Note: Up-screen program can be specified by customer's request by contacting Littelfuse customer service

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Group B Test Requirement

| Screen | Method | Condition | Requirement |
|-----------------|-------------------------------------|---|--|
| Surge test | 10/1000 μ s peak pulse waveform | Maximum clamping voltage (V_C) @ peak pulse current (I_{PP}) | Sample size 45 perform 10x Accept 0 failures |
| Burn-in (HTRB) | MIL-STD-750, method 1038.5 | Applied voltage 100 % V_R @150 °C | Sample size 45 340 hours Accept 0 failures |
| Electrical test | -- | I_R @ V_R , $V_{(BR)}$ @ I_T | Sample size 45 Accept 0 failures |

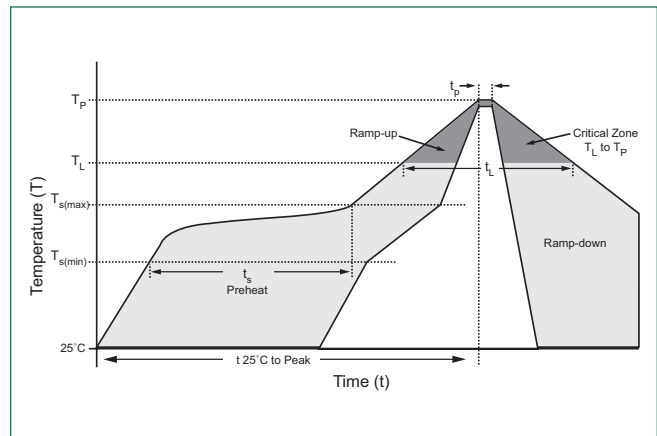
Ratings and Characteristic Curves ($T_A = 25\text{ }^\circ\text{C}$ unless otherwise noted)**Figure 1 - Peak Pulse Power Rating Curve****Figure 2 - Peak Pulse Power Derating Curve****Figure 3 - Pulse Waveform****Figure 4 - AC Line Protection Application**

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Soldering Parameters

| | | |
|--|------------------------------------|------------------------|
| Reflow Condition | | Lead-free assembly |
| Pre Heat | - Temperature Min ($T_{s(min)}$) | 150 °C |
| | - Temperature Max ($T_{s(max)}$) | 200 °C |
| | - Time (min to max) (t_s) | 60 – 180 seconds |
| Average Ramp Up Rate (Liquidus Temp (T_L) to Peak) | | 3 °C/second max |
| $T_{s(max)}$ to T_L - Ramp-up Rate | | 3 °C/second max |
| Reflow | - Temperature (T_L) (Liquidus) | 217 °C |
| | - Time (min to max) (t_s) | 60 – 150 seconds |
| Peak Temperature (T_p) | | 260 ^{+0/5} °C |
| Time Within 5 °C of Actual Peak Temperature (t_p) | | 20 – 40 seconds |
| Ramp-down Rate | | 6 °C/second max |
| Time 25 °C to Peak Temperature (T_p) | | 8 minutes max |
| Do Not Exceed | | 260 °C |



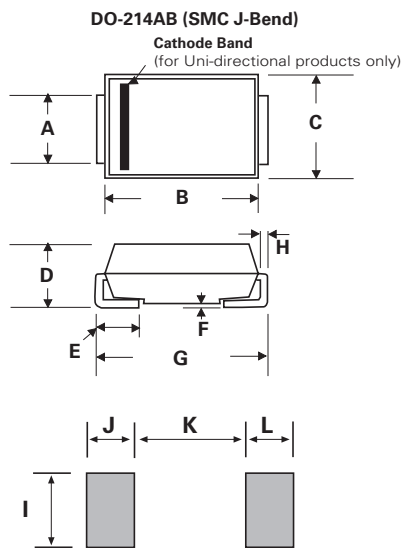
Physical Specifications

| | |
|-----------------|--|
| Weight | 0.003oz., 0.093g |
| Case | JEDEC DO-214AB molded plastic body over glass passivated junction. |
| Polarity | Color band denotes cathode except bidirectional |
| Terminal | Matte Tin-plated leads. Solderable per JESD22-B102 |

Environmental Specifications

| | |
|---------------------------------|--------------------------|
| High Temperature Storage | JESD22-A103 |
| HTRB | JESD22-A108 |
| Temperature Cycling | JESD22-A104 |
| MSL | JEDEC-J-STD-020, Level 1 |
| H3TRB | JESD22-A101 |
| RSH | JESD22-A111 |

Dimensions



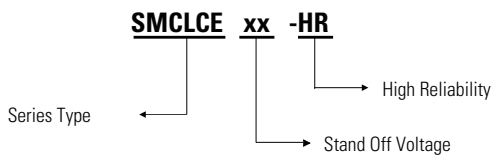
Recommended Soldering Pad Layout

| Dimensions | Inches | | Millimeters | |
|------------|--------|-------|-------------|-------|
| | Min | Max | Min | Max |
| A | 0.114 | 0.126 | 2.900 | 3.200 |
| B | 0.260 | 0.280 | 6.600 | 7.110 |
| C | 0.220 | 0.245 | 5.590 | 6.220 |
| D | 0.079 | 0.103 | 2.060 | 2.620 |
| E | 0.030 | 0.060 | 0.760 | 1.520 |
| F | - | 0.008 | - | 0.203 |
| G | 0.305 | 0.320 | 7.750 | 8.130 |
| H | 0.006 | 0.012 | 0.152 | 0.305 |
| I | 0.129 | - | 3.300 | - |
| J | 0.094 | - | 2.400 | - |
| K | - | 0.165 | - | 4.200 |
| L | 0.094 | - | 2.400 | - |

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Part Numbering System



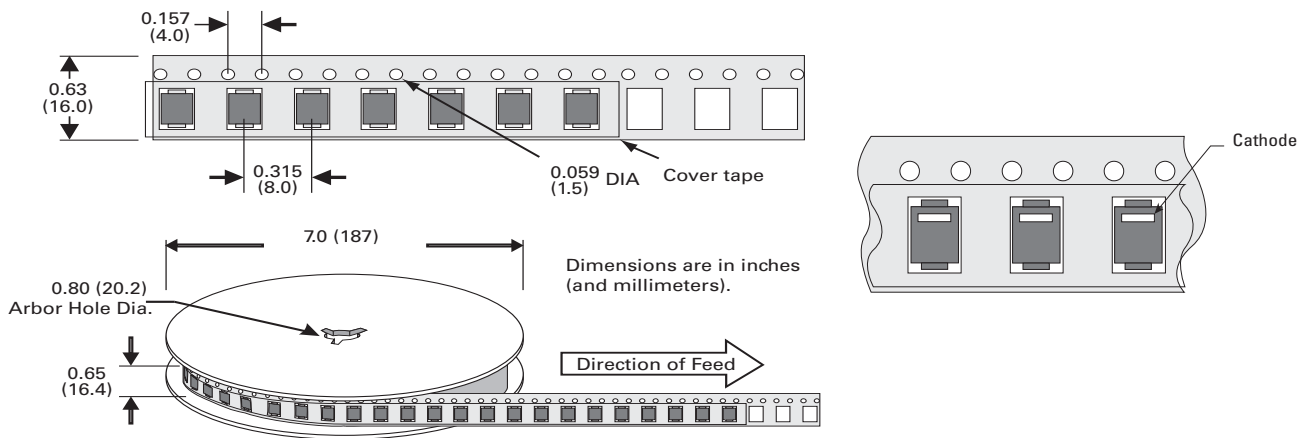
Part Marking System



Packaging

| Part number | Component Package | Quantity | Packaging Option | Packaging Specification |
|-------------|-------------------|----------|----------------------------------|-------------------------|
| SMCLCExx-HR | DO-214AB | 500 | Tape & Reel - 16 mm tape/7" reel | EIA STD RS-481 |

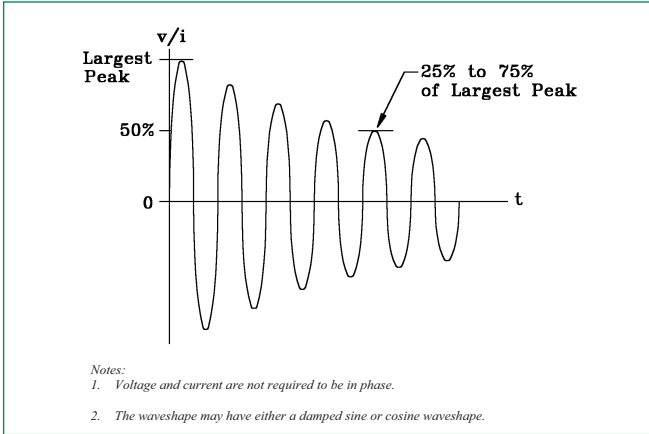
Tape and Reel Specification



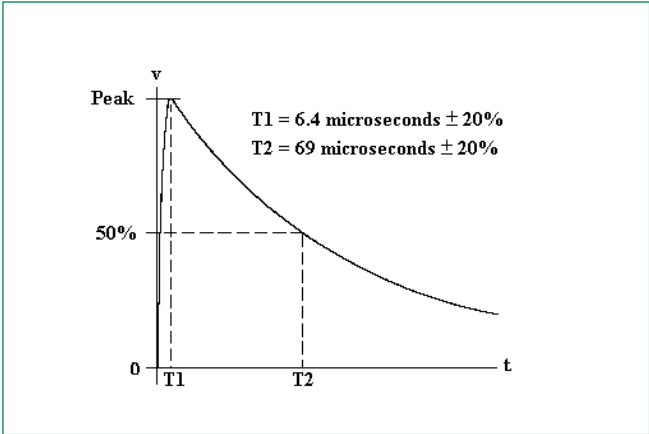
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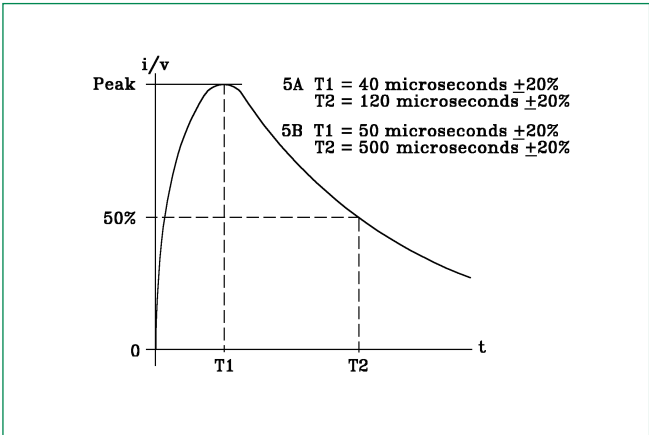
RTCA/DO-160G Wave 3



RTCA/DO-160G Wave 4



RTCA/DO-160G Wave 5



Pin Injection Protection Per RTCA/DO-160G

| Part Number | 25 °C | | | | | | 70 °C | | | | | | 120 °C | | | | | | | | | | | |
|-------------|--------|------|--------------------|------|------|------|---------------------|------|--------|------|--------------------|------|--------|------|---------------------|------|--------|------|--------------------|----|----|----|---------------------|--|
| | Wave 3 | | Wave 4 (6.4/69 μs) | | | | Wave 5a (40/120 μs) | | Wave 3 | | Wave 4 (6.4/69 μs) | | | | Wave 5a (40/120 μs) | | Wave 3 | | Wave 4 (6.4/69 μs) | | | | Wave 5a (40/120 μs) | |
| | L5 | L3 | L4 | L5 | L3 | L4 | L5 | L3 | L4 | L5 | L3 | L4 | L5 | L3 | L4 | L5 | L3 | L4 | L5 | L3 | L4 | L5 | | |
| SMCLCE12-HR | pass | pass | pass | pass | pass | pass | - | pass | pass | pass | pass | pass | pass | - | pass | pass | pass | pass | pass | - | - | - | | |
| SMCLCE13-HR | pass | pass | pass | pass | pass | pass | - | pass | pass | pass | pass | pass | pass | - | pass | pass | pass | pass | pass | - | - | - | | |
| SMCLCE28-HR | pass | pass | pass | - | - | - | pass | pass | pass | - | - | - | pass | pass | pass | - | - | - | - | - | - | - | | |

Note:
 1. L1 = Level 1, L2 = Level 2, L3 = Level 3, L4 = Level 4, L5 = Level 5

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