

# SMCLCE-HRA Series

## 1500 W Low Capacitance Surface Mount in DO-214AB



### Agency Approvals

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

### Maximum Ratings & Thermal Characteristics ( $T_A = 25\text{ }^\circ\text{C}$ unless otherwise noted)

| Parameter  | Symbol    | Value      | Unit             |
|--|-----------|------------|------------------|
| Peak Pulse Power Dissipation by 10/1000 $\mu\text{s}$ Waveform (Fig.1)(Note 1) | $P_{PPM}$ | 1500       | W                |
| Power Dissipation on Infinite Heat Sink at $T_L = 50\text{ }^\circ\text{C}$    | $P_D$     | 6.5        | W                |
| Operating Temperature Range  | $T_J$     | -65 to 150 | $^\circ\text{C}$ |
| Storage Temperature Range  | $T_{STG}$ | -65 to 175 | $^\circ\text{C}$ |

#### Notes:

1. Non-repetitive current pulse, per Fig. 3 and derated above  $T_J$  (initial) =  $25\text{ }^\circ\text{C}$  per Fig. 2.

## Description

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

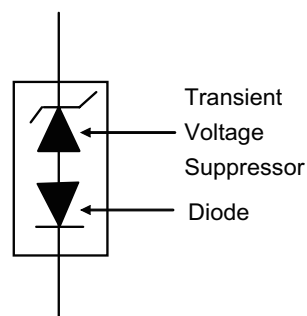
## Features

- Low capacitance  $\leq 50\text{ pF}$ , 1500 W peak pulse power capability at 10/1000  $\mu\text{s}$  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  $^\circ\text{C}/10$  seconds at terminals
- Matte tin lead-free plated
- Halogen free and RoHS compliant
- Pb-free E3 means 2<sup>nd</sup> 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



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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 $I_R$ @ $V_R$ ( $\mu A$ ) | 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-HRA      | SGEEH        | 12                          | 13.3  | 14.7 | 1                       | 5.00   | 20.9  | 75.4  | 50   | 75   | 1.0   | 100   | X   |
| SMCLCE13-HRA      | SGEGH        | 13                          | 14.4  | 15.9 | 1                       | 3.00   | 22.5  | 69.8  | 50   | 75   | 1.0   | 100   | X   |
| SMCLCE14-HRA      | SGEKH        | 14                          | 15.6  | 17.2 | 1                       | 3.00   | 24.2  | 64.7  | 50   | 75   | 1.0   | 100   | X   |
| SMCLCE15-HRA      | SGEMH        | 15                          | 16.7  | 18.5 | 1                       | 0.96   | 25.4  | 61.5  | 50   | 75   | 1.0   | 100   | X   |
| SMCLCE16-HRA      | SGEPH        | 16                          | 17.8  | 19.7 | 1                       | 0.96   | 27.0  | 57.7  | 50   | 75   | 1.0   | 100   | X   |
| SMCLCE17-HRA      | SGERH        | 17                          | 18.9  | 20.9 | 1                       | 0.96   | 28.6  | 54.4  | 50   | 75   | 1.0   | 100   | X   |
| SMCLCE18-HRA      | SGETH        | 18                          | 20.0  | 22.1 | 1                       | 0.96   | 30.2  | 51.4  | 50   | 75   | 1.0   | 100   | X   |
| SMCLCE20-HRA      | SGEVH        | 20                          | 22.2  | 24.5 | 1                       | 0.96   | 33.4  | 46.3  | 50   | 75   | 1.0   | 100   | X   |
| SMCLCE22-HRA      | SGEXH        | 22                          | 24.4  | 26.9 | 1                       | 0.96   | 36.5  | 42.3  | 50   | 75   | 1.0   | 100   | X   |
| SMCLCE24-HRA      | SGEZH        | 24                          | 26.7  | 29.5 | 1                       | 0.96   | 39.9  | 38.6  | 50   | 75   | 1.0   | 100   | X   |
| SMCLCE26-HRA      | SGFEH        | 26                          | 28.9  | 31.9 | 1                       | 0.96   | 43.1  | 35.7  | 50   | 75   | 1.0   | 100   | X   |
| SMCLCE28-HRA      | SGFGH        | 28                          | 31.1  | 34.4 | 1                       | 0.96   | 46.5  | 33.1  | 50   | 75   | 1.0   | 100   | X   |
| SMCLCE30-HRA      | SGFKH        | 30                          | 33.3  | 36.8 | 1                       | 0.96   | 49.4  | 31.0  | 50   | 75   | 1.0   | 100   | X   |
| SMCLCE33-HRA      | SGFMH        | 33                          | 36.7  | 40.6 | 1                       | 0.96   | 53.3  | 28.2  | 50   | 75   | 1.0   | 100   | X   |
| SMCLCE36-HRA      | SGFPH        | 36                          | 40.0  | 44.2 | 1                       | 0.96   | 58.1  | 25.9  | 50   | 75   | 1.0   | 100   | X   |
| SMCLCE40-HRA      | SGFRH        | 40                          | 44.4  | 49.1 | 1                       | 0.96   | 64.5  | 23.3  | 50   | 75   | 1.0   | 100   | X   |
| SMCLCE43-HRA      | SGFTH        | 43                          | 47.8  | 52.8 | 1                       | 0.96   | 69.4  | 21.7  | 50   | 75   | 1.0   | 100   | X   |
| SMCLCE45-HRA      | SGFVH        | 45                          | 50.0  | 55.3 | 1                       | 0.96   | 72.7  | 20.6  | 50   | 75   | 1.0   | 100   | X   |
| SMCLCE48-HRA      | SGFXH        | 48                          | 53.3  | 58.9 | 1                       | 0.96   | 77.4  | 19.4  | 50   | 75   | 1.0   | 100   | X   |
| SMCLCE51-HRA      | SGFZH        | 51                          | 56.7  | 62.7 | 1                       | 0.96   | 82.4  | 18.2  | 50   | 75   | 1.0   | 100   | X   |
| SMCLCE54-HRA      | SGGEH        | 54                          | 60.0  | 66.3 | 1                       | 0.96   | 87.1  | 17.3  | 50   | 100  | 1.0   | 125   | X   |
| SMCLCE58-HRA      | SGGGH        | 58                          | 64.4  | 71.2 | 1                       | 0.96   | 93.6  | 16.1  | 50   | 100  | 1.0   | 125   | X   |
| SMCLCE60-HRA      | SGGKH        | 60                          | 66.7  | 73.7 | 1                       | 0.96   | 96.8  | 15.5  | 50   | 100  | 1.0   | 125   | X   |
| SMCLCE64-HRA      | SGGMH        | 64                          | 71.1  | 78.6 | 1                       | 0.96   | 103.0                                       | 14.6  | 50   | 100  | 1.0   | 125   | X   |
| SMCLCE70-HRA      | SGGPH        | 70                          | 77.8  | 86.0 | 1                       | 0.96   | 113.0                                       | 13.3  | 50   | 125  | 1.0   | 150   | X   |

### 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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Ratings and Characteristic Curves ( $T_A = 25\text{ }^\circ\text{C}$  unless otherwise noted)

Figure 1 - Peak Pulse Power Rating Curve

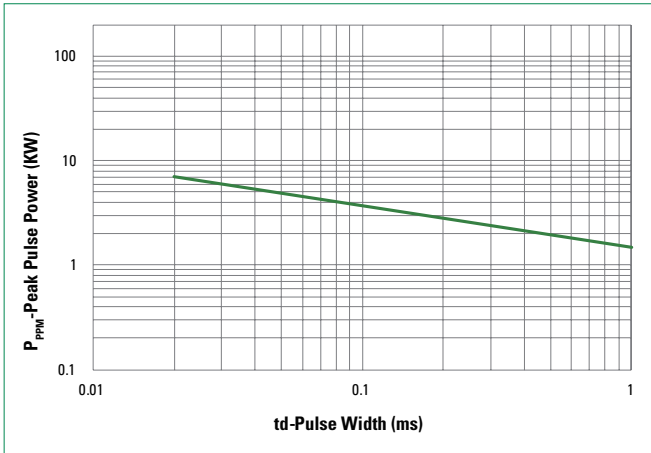


Figure 2 - Peak Pulse Power Derating Curve

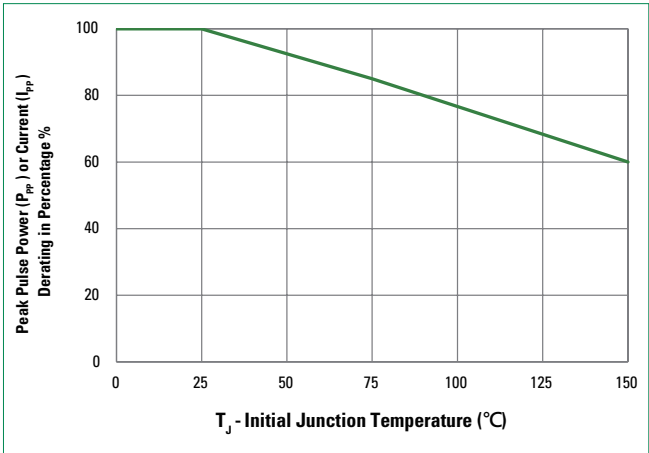


Figure 3 - Pulse Waveform

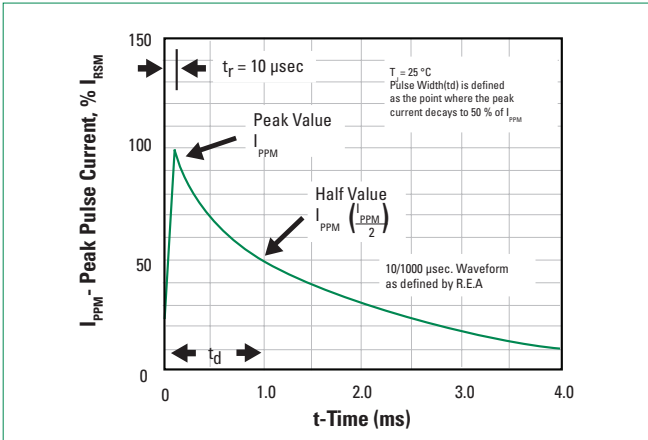
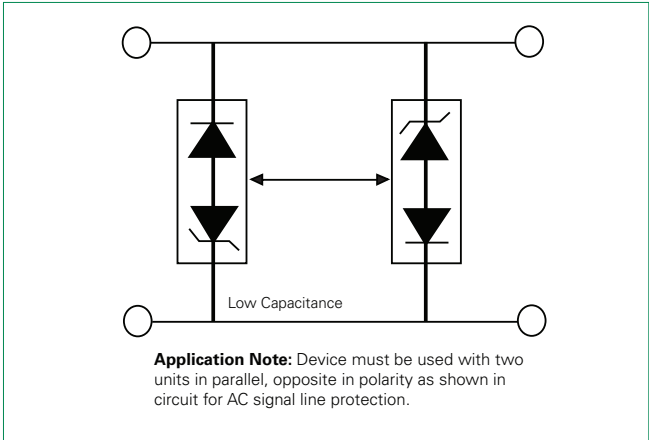


Figure 4 - AC Line Protection Application



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### Soldering Parameters

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



### Physical Specifications

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

### Environmental Specifications

|                                 |                          |
|---------------------------------|--------------------------|
| <b>High Temperature Storage</b> | JESD22-A103              |
| <b>HTRB</b>                     | JESD22-A108              |
| <b>Temperature Cycling</b>      | JESD22-A104              |
| <b>MSL</b>                      | JEDEC-J-STD-020, Level 1 |
| <b>H3TRB</b>                    | JESD22-A101              |
| <b>RSH</b>                      | 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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## 1500 W Low Capacitance Surface Mount in DO-214AB

### Part Numbering System



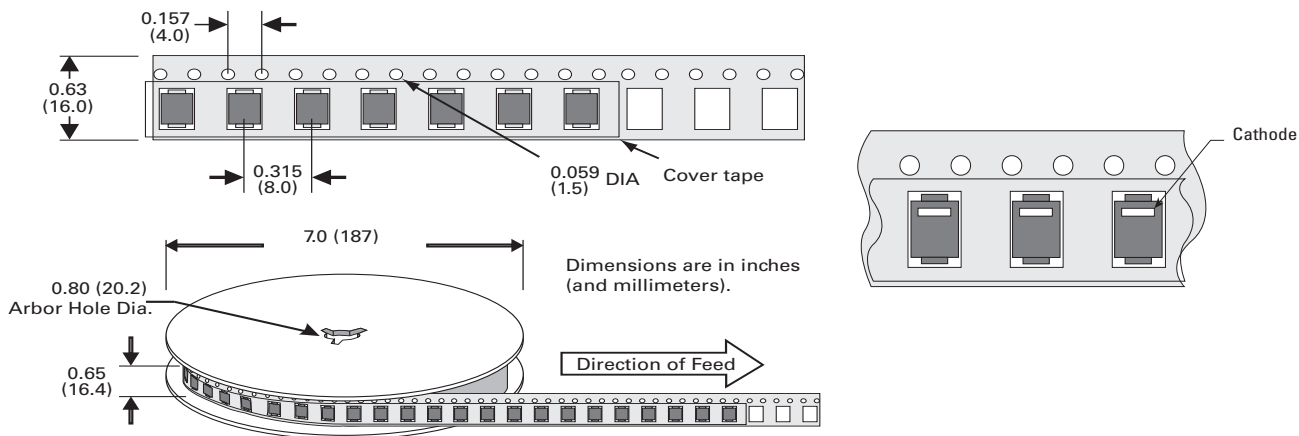
### Part Marking System



### Packaging

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

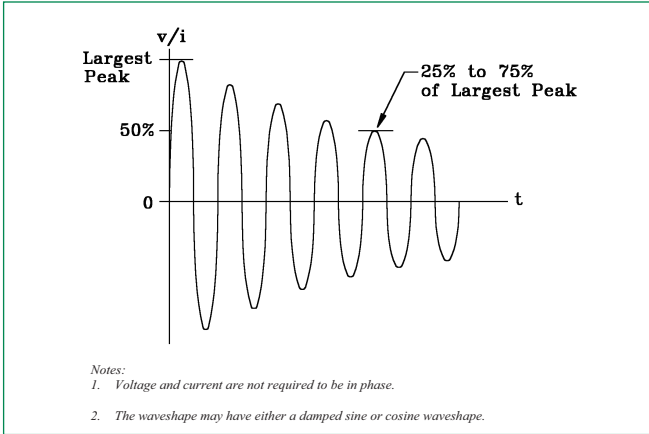
### Tape and Reel Specification



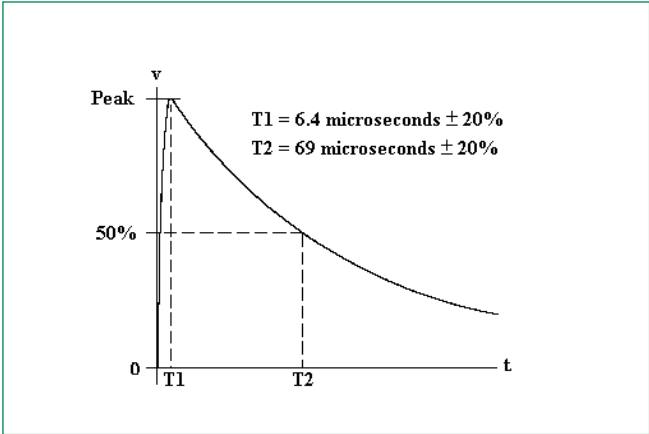
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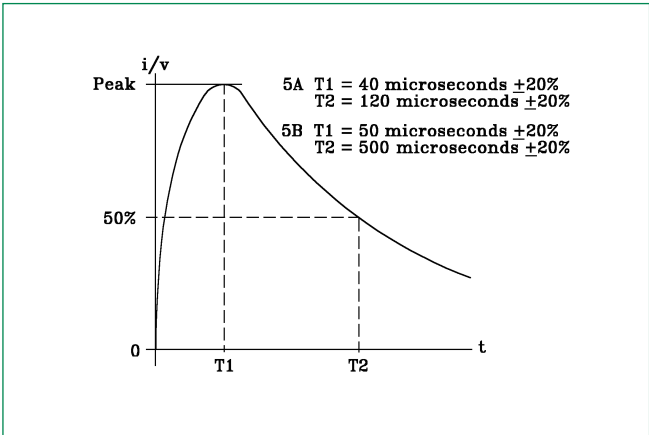
RTCA/DO-160G Wave 3



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   |                     |      |
|              | 128A   | 60A  | 150A               | 320A | 300A | 750A | 128A                | 60A  | 150A   | 320A | 300A               | 750A | 128A   | 60A  | 150A                | 320A | 300A   | 750A | 128A               | 60A | 150A | 320A | 300A                | 750A |
| SMCLCE12-HRA | pass   | pass | pass               | pass | pass | -    | pass                | pass | pass   | pass | pass               | pass | -      | pass | pass                | pass | pass   | pass | -                  | -   | -    | -    | -                   | -    |
| SMCLCE13-HRA | pass   | pass | pass               | pass | pass | -    | pass                | pass | pass   | pass | pass               | pass | -      | pass | pass                | pass | pass   | pass | -                  | -   | -    | -    | -                   | -    |
| SMCLCE28-HRA | 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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