

# SMCLCE-HR Series

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



### Agency Approvals

Agency	Agency File Number
	E230531

### Maximum Ratings & Thermal Characteristics (T<sub>A</sub> = 25 °C unless otherwise noted)

Parameter	Symbol	Value	Unit
Peak Pulse Power Dissipation by 10/1000 $\mu$ s Waveform (Fig.1)(Note 1)	P <sub>PPM</sub>	1500	W
Power Dissipation on Infinite Heat Sink at T <sub>L</sub> = 50 °C	P <sub>D</sub>	6.5	W
Operating Temperature Range	T <sub>J</sub>	-65 to 150	°C
Storage Temperature Range	T <sub>STG</sub>	-65 to 175	°C

**Notes:**

1. Non-repetitive current pulse, per Fig. 3 and derated above T<sub>J</sub> (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.

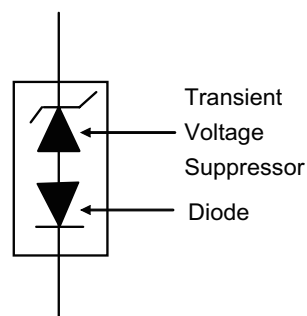
## Features

- Low capacitance  $\leq 50$  pF, 1500 W peak pulse power capability at 10/1000  $\mu$ 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 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-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 $\mu$ 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

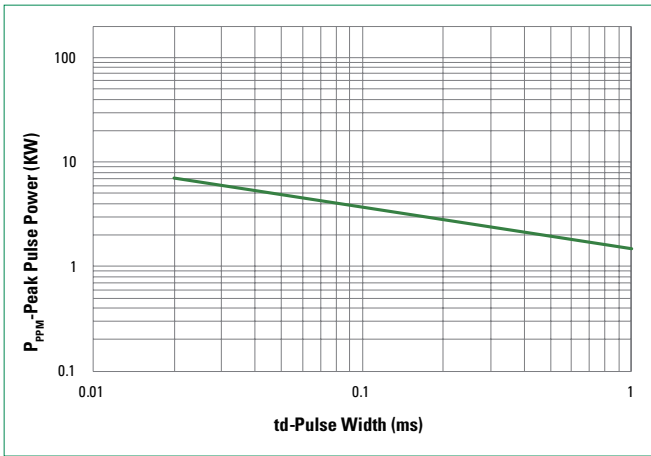


Figure 2 - Peak Pulse Power Derating Curve

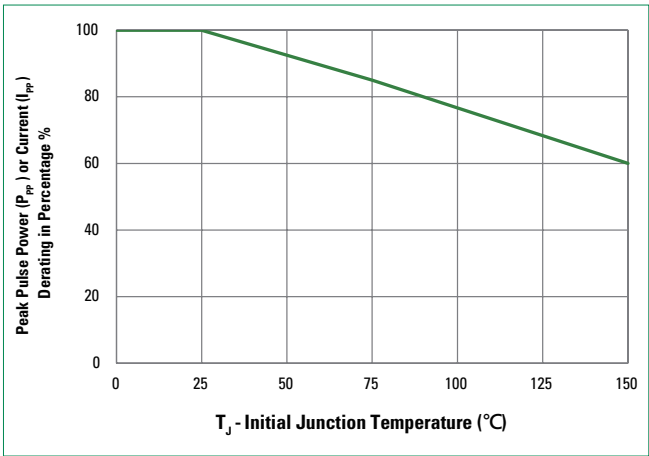


Figure 3 - Pulse Waveform

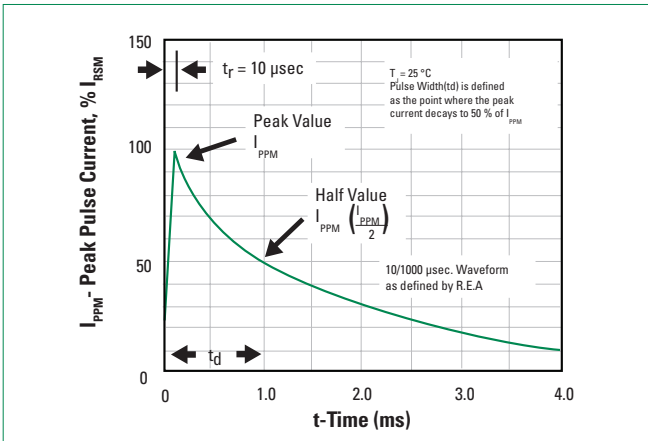
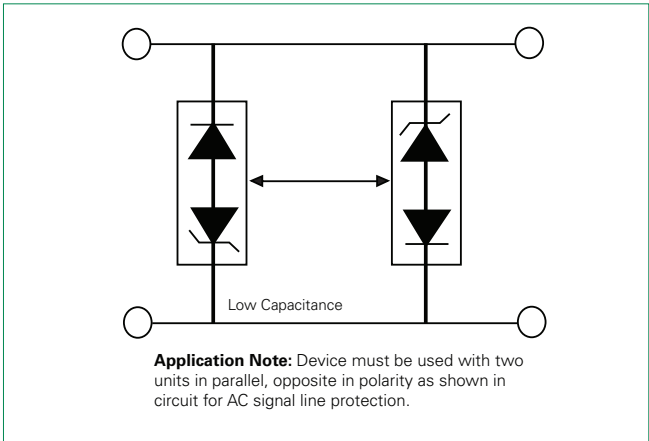


Figure 4 - AC Line Protection Application



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### Soldering Parameters

<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



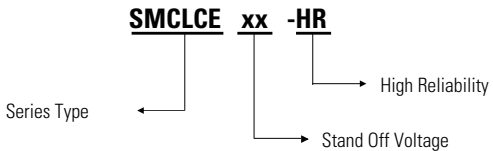
Recommended Soldering Pad Layout

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	-

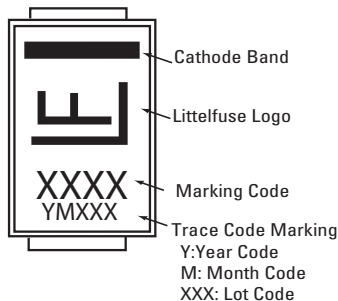
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### Part Numbering System



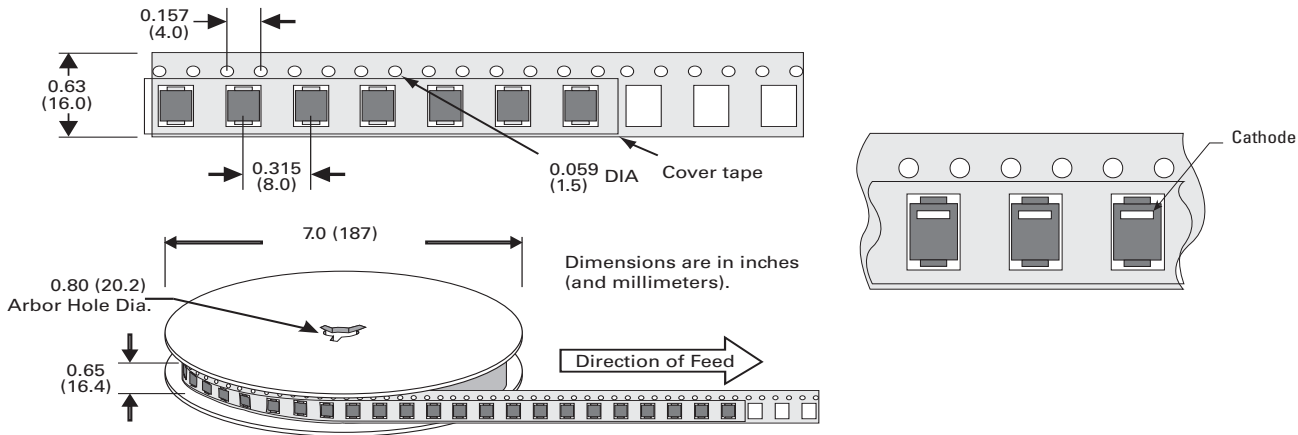
### Part Marking System



### 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

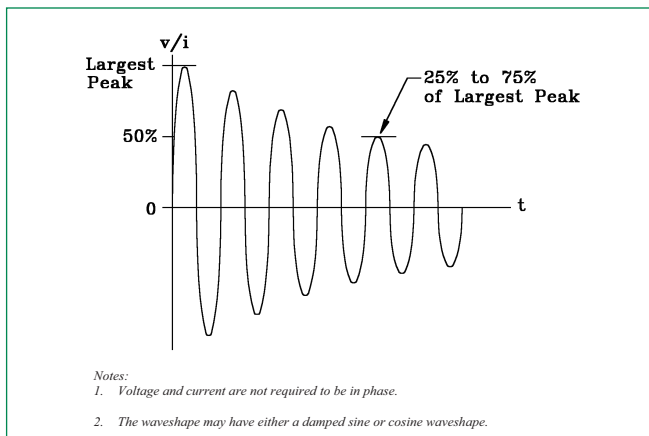
### Tape and Reel Specification



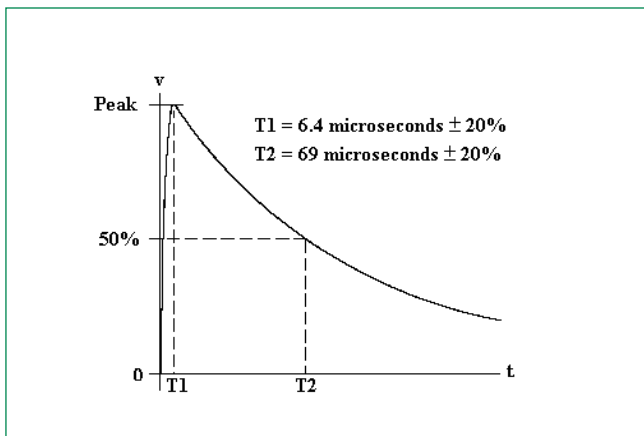
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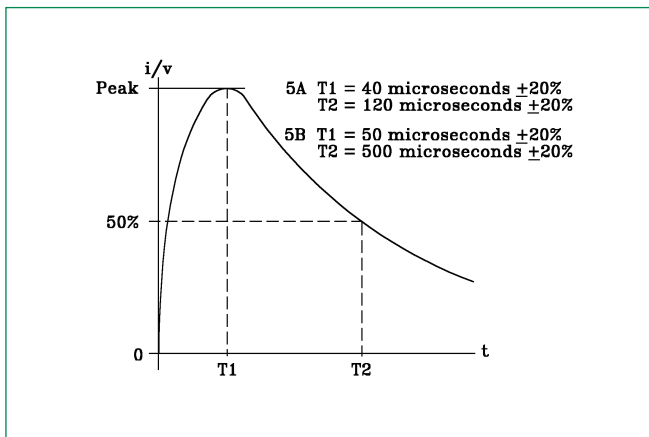
RTCA/DO-160G Wave 3



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 $\mu$ s)				Wave 5a (40/120 $\mu$ s)		Wave 3		Wave 4 (6.4/69 $\mu$ s)				Wave 5a (40/120 $\mu$ s)		Wave 3		Wave 4 (6.4/69 $\mu$ s)				Wave 5a (40/120 $\mu$ s)	
	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-HR	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	-	-	-	-	-	-	-
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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