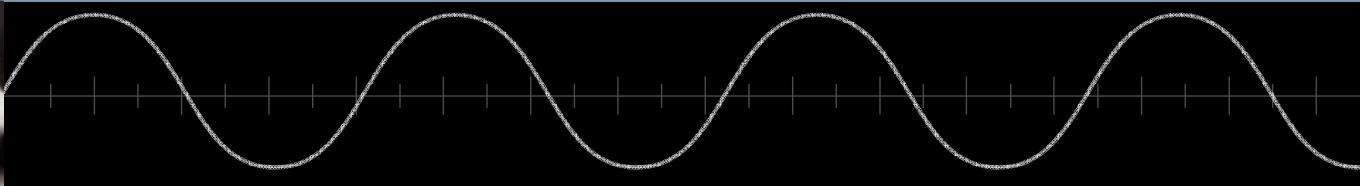


Whisker Growth Reliability Test Result

Reliability Engineering

Linear Technology Corporation



MONITOR PROGRAM

- Tin Whisker Monitor Program is by package type and assembly location
- All devices assembled at LTC Penang come from the same tin plating line

FAILURE CRITERIA

- Temperature cycling (-40°C / $+85^{\circ}\text{C}$ for 2000 T/C): $<45\mu\text{m}$, measurement method in accordance to JEDEC standard JESD201
- Hi-temp/Humidity storage ($60^{\circ}\text{C}/85\%\text{RH}$) and ambient temperature/humidity storage ($30^{\circ}\text{C}/60\%\text{RH}$): $<40\mu\text{m}$, measurement method in accordance to JEDEC standard JESD201
- Preconditions, storage conditions, failure criteria, inspection method conform to JEDEC standard JESD201

INSPECTION METHOD

- SEM measurement taken on the longest whisker of any samples

CONCLUSION

- No whisker growth exceeding JEDEC JESD201 spec criteria as monitor devices completed 2000TC and 4000hrs HT/humidity storage evaluation

Tin Whisker Growth Evaluation (Q3 FY'2015)

Temperature Cycle Storage (+85'C/-40'C)

Device	Lot	Date Code	L/F	Assembly	1000C			2000C		
					Without IR	IR @ 215'C	IR @ 260'C	Without IR	IR @ 215'C	IR @ 260'C
LT3080EST#TRPBF	744984.1	1401	CU	Car-M	0/96	0/96	0/96	0/96	0/96	0/96
LTC2634IMSE-LZ12#PBF	746660.1	1403	CU	PG	0/100	0/100	0/100	0/100	0/100	0/100
LT3505EDD#TRPBF	747160.1	1403	CU	PG	0/96	0/96	0/96	0/96	0/96	0/96
LT3082ETS8#TRPBF	747694.1	1404	CU	PG	0/96	0/96	0/96	0/96	0/96	0/96
LT1571EGN-2#TRPBF	747845.1	1404	CU	UTL	0/112	0/112	0/112	0/112	0/112	0/112
LT1939EDD#TRPBF	748058.1	1404	CU	UTL	0/96	0/96	0/96	0/96	0/96	0/96
LTC3412AFE#TRPBF	749457.1	1406	CU	PG	0/96	0/96	0/96	0/96	0/96	0/96
LTC2226HLX#3HCPBF	Z25664.1	1346	CU	ASE(G)	0/96	0/96	0/96	0/96	0/96	0/96

Temperature Humidity Storage (60'C / 85%RH)

Device	Lot	Date Code	L/F	Assembly	1000hrs			2000hrs			3000hrs			4000hrs		
					Without IR	IR @ 215'C	IR @ 260'C	Without IR	IR @ 215'C	IR @ 260'C	Without IR	IR @ 215'C	IR @ 260'C	Without IR	IR @ 215'C	IR @ 260'C
LT3080EST#TRPBF	744984.1	1401	CU	Car-M	0/96	0/96	0/96	0/96	0/96	0/96	0/96	0/96	0/96	0/96	0/96	0/96
LTC2634IMSE-LZ12#PBF	746660.1	1403	CU	PG	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100
LT3505EDD#TRPBF	747160.1	1403	CU	PG	0/96	0/96	0/96	0/96	0/96	0/96	0/96	0/96	0/96	0/96	0/96	0/96
LT3082ETS8#TRPBF	747694.1	1404	CU	PG	0/96	0/96	0/96	0/96	0/96	0/96	0/96	0/96	0/96	0/96	0/96	0/96
LT1571EGN-2#TRPBF	747845.1	1404	CU	UTL	0/112	0/112	0/112	0/112	0/112	0/112	0/112	0/112	0/112	0/112	0/112	0/112
LT1939EDD#TRPBF	748058.1	1404	CU	UTL	0/96	0/96	0/96	0/96	0/96	0/96	0/96	0/96	0/96	0/96	0/96	0/96
LTC3412AFE#TRPBF	749457.1	1406	CU	PG	0/96	0/96	0/96	0/96	0/96	0/96	0/96	0/96	0/96	0/96	0/96	0/96
LTC2226HLX#3HCPBF	Z25664.1	1346	CU	ASE(G)	0/96	0/96	0/96	0/96	0/96	0/96	0/96	0/96	0/96	0/96	0/96	0/96

FAILURE CRITERIA

Temperature cycling : < 45um, measurement method in accordance to JEDEC standard No.201

Ambient and Hi-temp/Humidity storage : < 40um, measurement method in accordance to JEDEC standard No.201

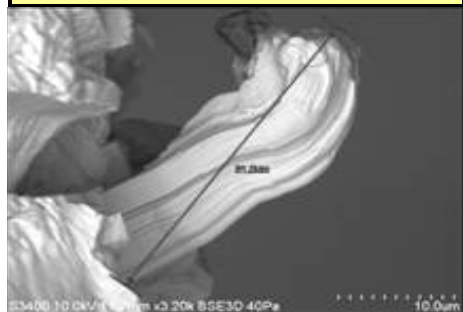
Temperature Cycle Storage (+85'C/-40'C) @ 1000C

Device : LT3080EST#TRPBF
Lot : 744984.1

Leadframe : Cu
Assembly : Carsem(M)

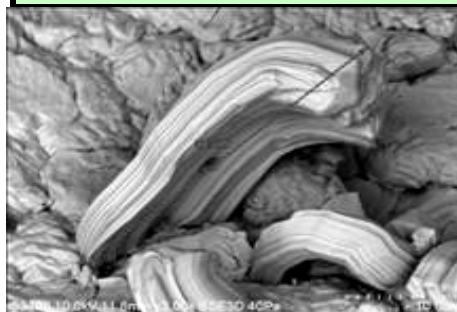
Date Code : 1401

Without IR



31.0um

IR @ 215C



34.3um

IR @ 260C



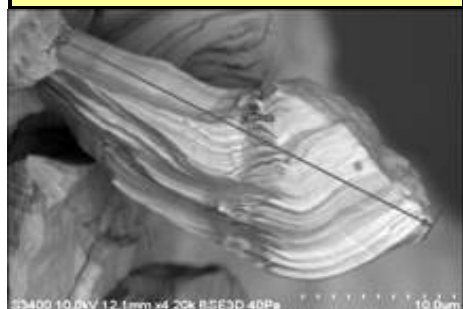
28.1um

Device : LTC2634IMSE-LZ12#PBF
Lot : 746660.1

Leadframe : Cu
Assembly : PG

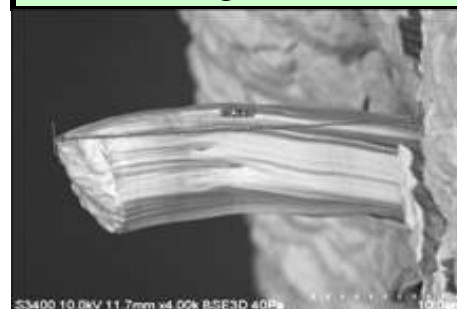
Date Code : 1403

Without IR



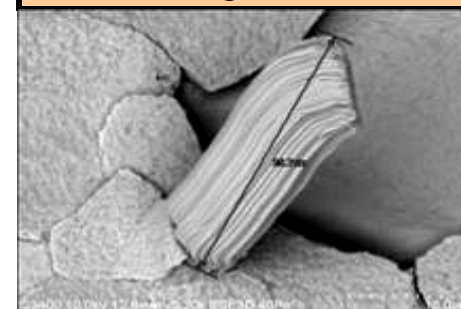
28.5um

IR @ 215C



25.6um

IR @ 260C



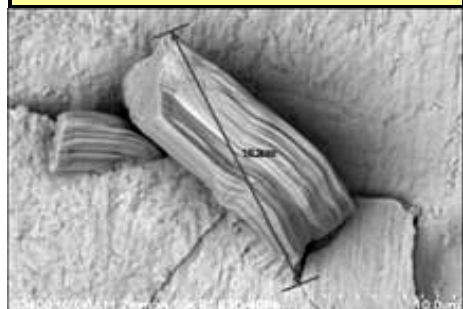
25.7um

Device : LT3505EDD#TRPBF
Lot : 747160.1

Leadframe : Cu
Assembly : PG

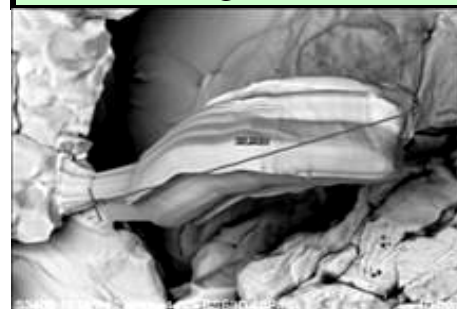
Date Code : 1403

Without IR



19.2um

IR @ 215C



23.9um

IR @ 260C



18.1um

Device : LT3082ETS8#TRPBF
Lot : 747694.1

Leadframe : Cu
Assembly : PG

Date Code : 1404

Without IR



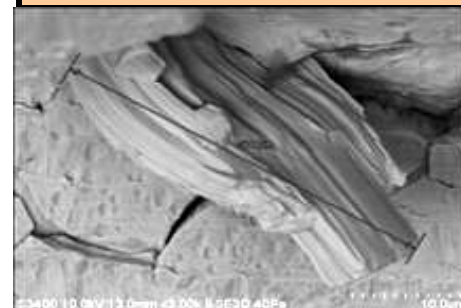
29.6um

IR @ 215C



34.3um

IR @ 260C



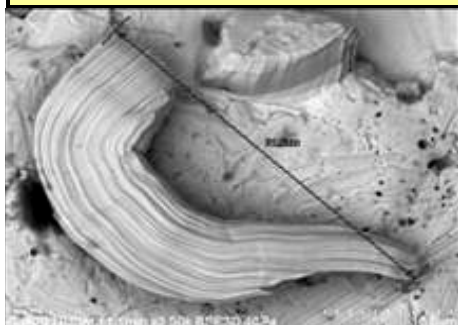
37.1um

Device : LT1571EGN-2#TRPBF
Lot : 747845.1

Leadframe : Cu
Assembly : UTL

Date Code : 1404

Without IR



31.6um

IR @ 215C



32.1um

IR @ 260C



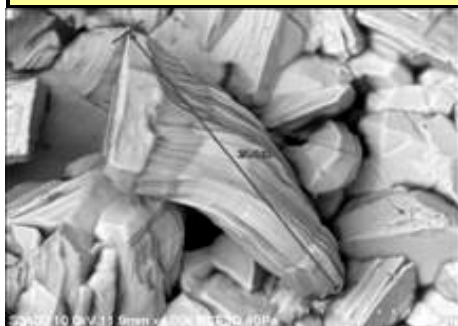
29.5um

Device : LT1939EDD#TRPBF
Lot : 748058.1

Leadframe : Cu
Assembly : UTL

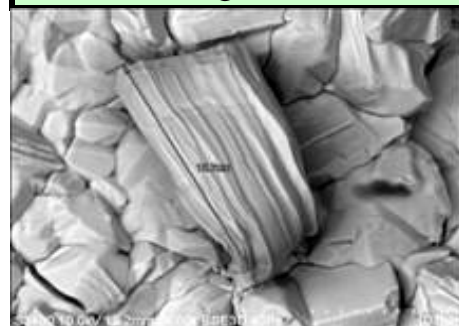
Date Code : 1404

Without IR



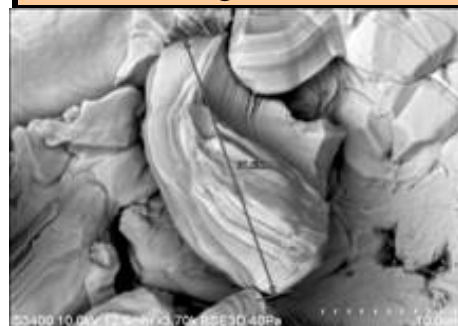
24.4um

IR @ 215C



18.7um

IR @ 260C



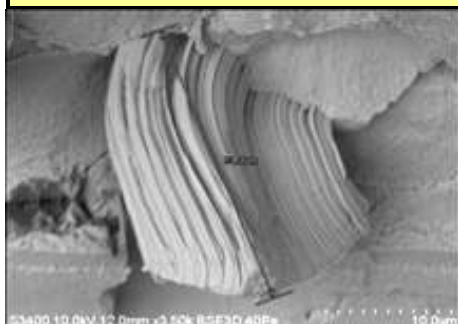
21.6um

Device : LTC3412AEFE#TRPBF
Lot : 749457.1

Leadframe : Cu
Assembly : PG

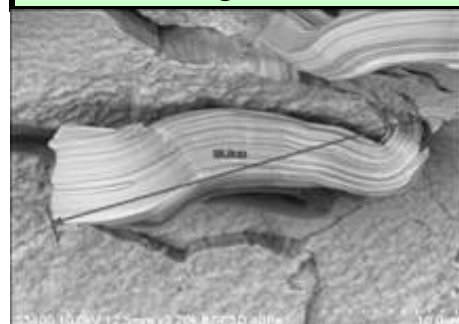
Date Code : 1406

Without IR



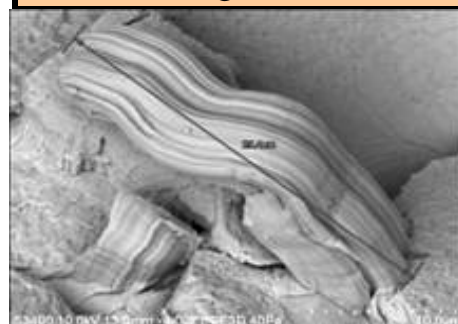
24.4um

IR @ 215C



28.8um

IR @ 260C



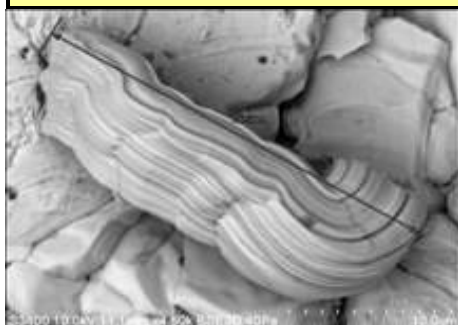
29.4um

Device : LTC2226HLX#3HCPBF
Lot : Z25664.1

Leadframe : Cu
Assembly : ASE(G)

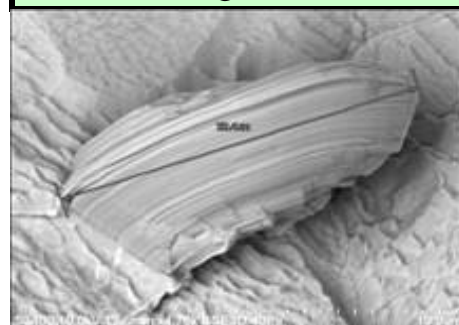
Date Code : 1346

Without IR



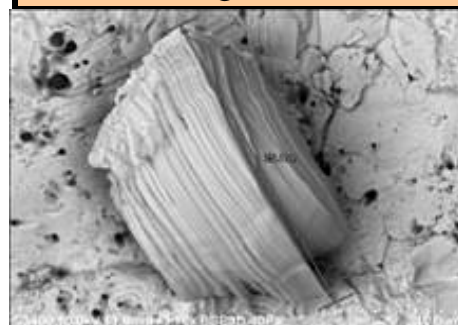
26.3um

IR @ 215C



22.4um

IR @ 260C



25.1um

Temperature Cycle Storage (+85'C/-40'C) @ 2000C

Device : LT3080EST#TRPBF
Lot : 744984.1

Leadframe : Cu
Assembly : Carsem(M)

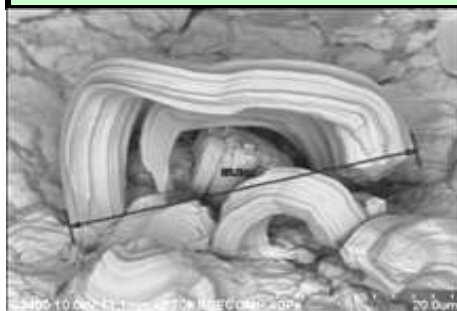
Date Code : 1401

Without IR



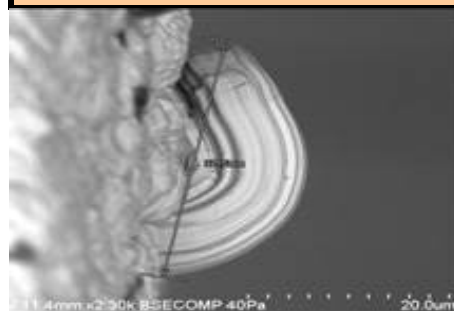
44.1um

IR @ 215C



36.8um

IR @ 260C



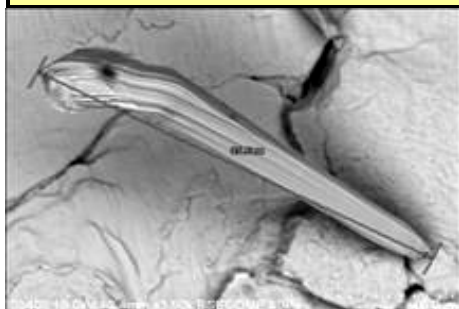
32.5um

Device : LTC2634IMSE-LZ12#PBF
Lot : 746660.1

Leadframe : Cu
Assembly : PG

Date Code : 1403

Without IR



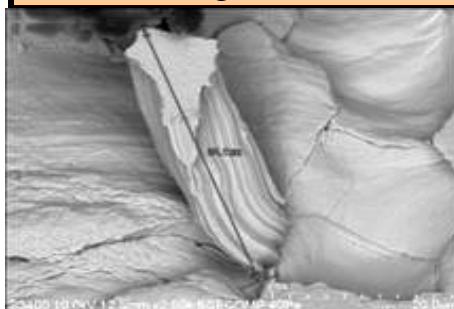
35.5um

IR @ 215C



34.0um

IR @ 260C



34.1um

Device : LT3505EDD#TRPBF
Lot : 747160.1

Leadframe : Cu
Assembly : PG

Date Code : 1403

Without IR



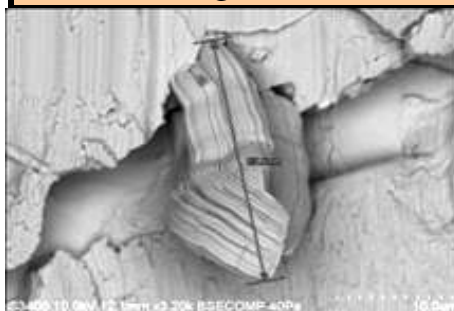
22.0um

IR @ 215C



32.0um

IR @ 260C



23.8um

Device : LT3082ETS8#TRPBF
Lot : 747694.1

Leadframe : Cu
Assembly : PG

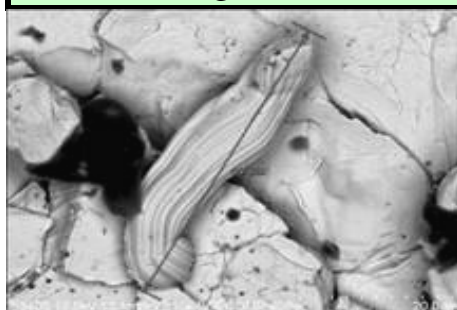
Date Code : 1404

Without IR



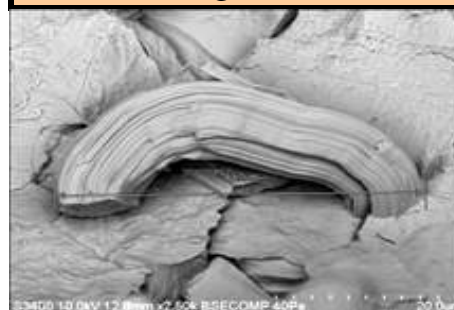
38.5um

IR @ 215C



44.4um

IR @ 260C



41.2um

Device : LT1571EGN-2#TRPBF
Lot : 747845.1

Leadframe : Cu
Assembly : UTL

Date Code : 1404

Without IR



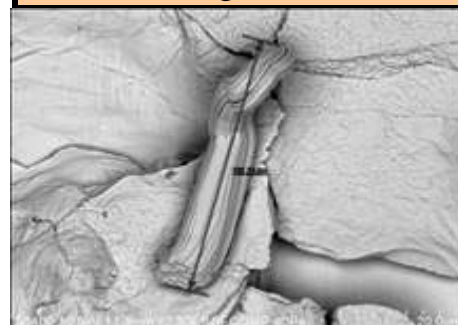
37.8um

IR @ 215C



34.8um

IR @ 260C



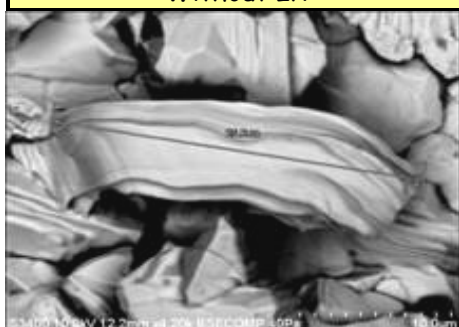
33.3um

Device : LT1939EDD#TRPBF
Lot : 748058.1

Leadframe : Cu
Assembly : UTL

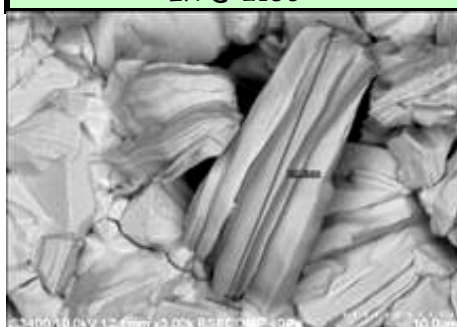
Date Code : 1404

Without IR



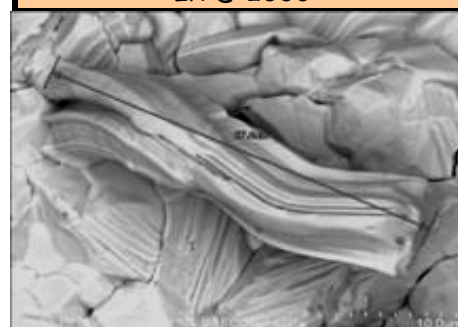
25.0um

IR @ 215C



29.2um

IR @ 260C



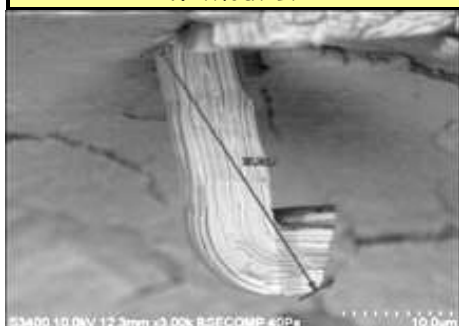
27.4um

Device : LTC3412AEFE#TRPBF
Lot : 749457.1

Leadframe : Cu
Assembly : PG

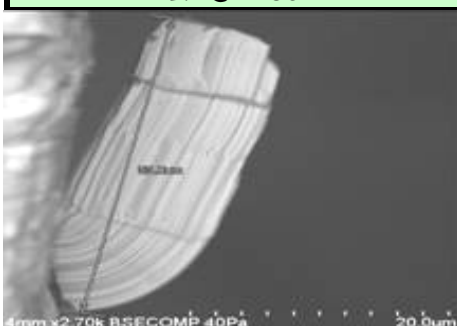
Date Code : 1406

Without IR



28.2um

IR @ 215C



33.0um

IR @ 260C



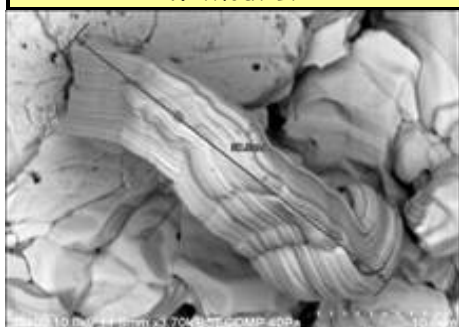
37.2um

Device : LTC2226HLX#3HCPBF
Lot : Z25664.1

Leadframe : Cu
Assembly : ASE(G)

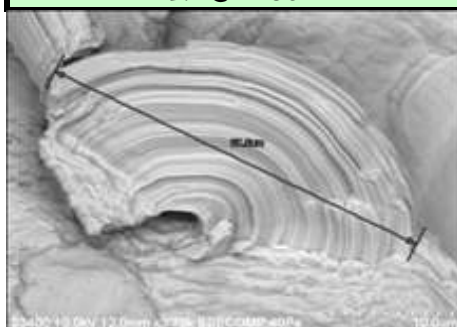
Date Code : 1346

Without IR



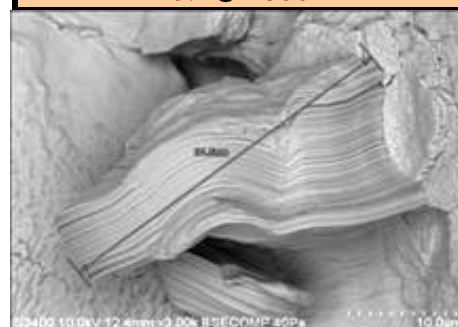
30.5um

IR @ 215C



30.5um

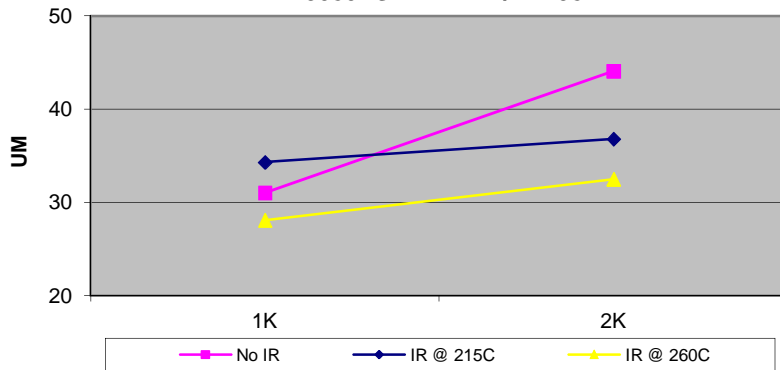
IR @ 260C



34.5um

Temperature Cycle Storage (+85'C/-40'C)

LT3080EST#TRPBF / 744984.1

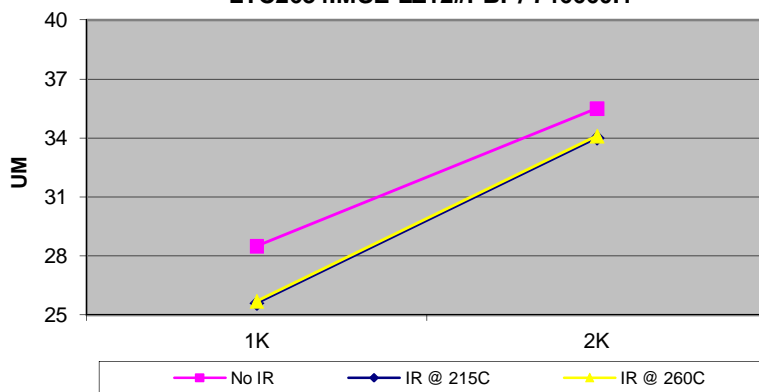


Device : LT3080EST#TRPBF

Lot : 744984.1

	1K	2K
No IR	31	44.1
IR @ 215C	34.3	36.8
IR @ 260C	28.1	32.5

LTC2634IMSE-LZ12#PBF / 746660.1

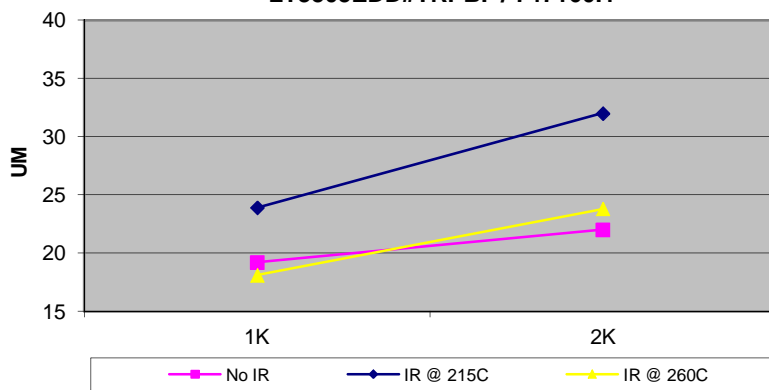


Device : LTC2634IMSE-LZ12#PBF

Lot : 746660.1

	1K	2K
No IR	28.5	35.5
IR @ 215C	25.6	34
IR @ 260C	25.7	34.1

LT3505EDD#TRPBF / 747160.1

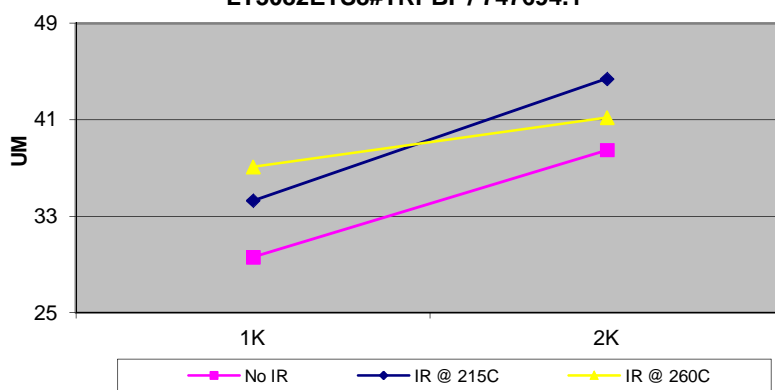


Device : LT3505EDD#TRPBF

Lot : 747160.1

	1K	2K
No IR	19.2	22
IR @ 215C	23.9	32
IR @ 260C	18.1	23.8

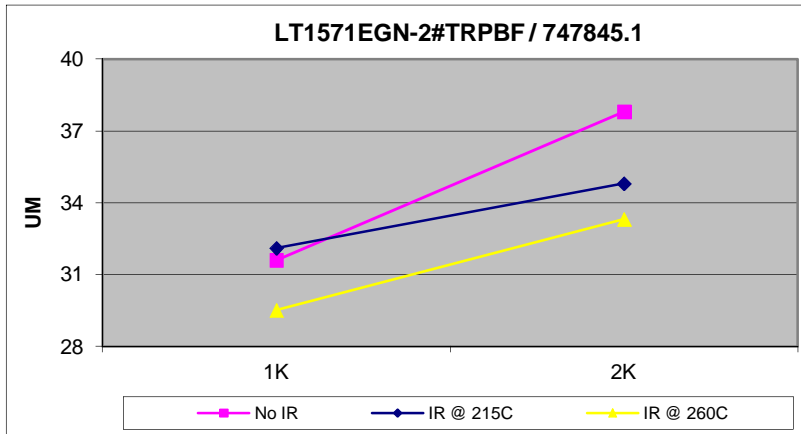
LT3082ETS8#TRPBF / 747694.1



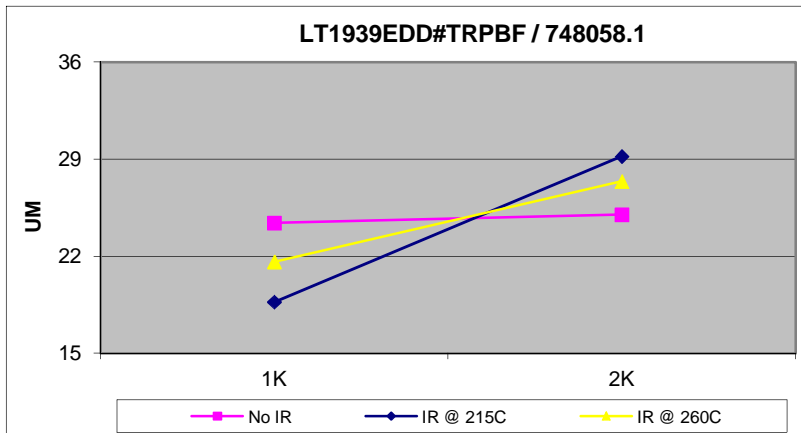
Device : LT3082ETS8#TRPBF

Lot : 747694.1

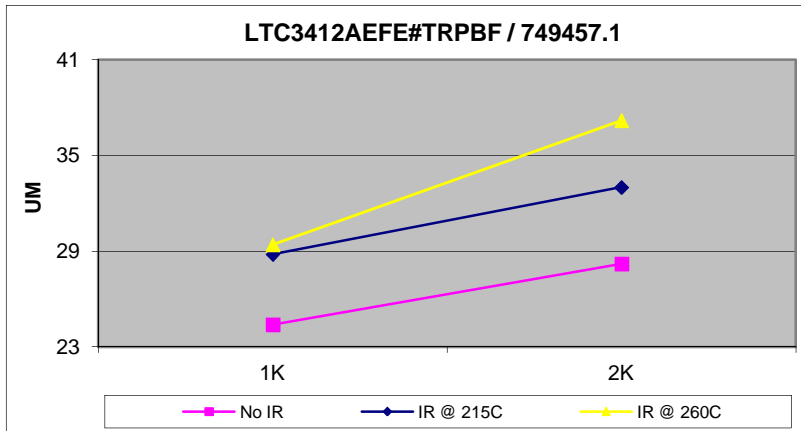
	1K	2K
No IR	29.6	38.5
IR @ 215C	34.3	44.4
IR @ 260C	37.1	41.2



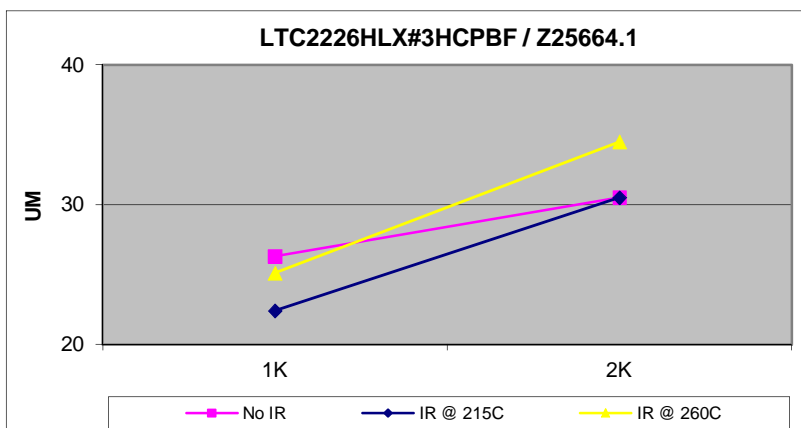
Device : LT1571EGN-2#TRPBF		
Lot : 747845.1		
	1K	2K
No IR	31.6	37.8
IR @ 215C	32.1	34.8
IR @ 260C	29.5	33.3



Device : LT1939EDD#TRPBF		
Lot : 748058.1		
	1K	2K
No IR	24.4	25
IR @ 215C	18.7	29.2
IR @ 260C	21.6	27.4



Device : LTC3412AEFE#TRPBF		
Lot : 749457.1		
	1K	2K
No IR	24.4	28.2
IR @ 215C	28.8	33
IR @ 260C	29.4	37.2



Device : LTC2226HLX#3HCPBF		
Lot : Z25664.1		
	1K	2K
No IR	26.3	30.5
IR @ 215C	22.4	30.5
IR @ 260C	25.1	34.5

Tin Whisker Growth Evaluation (Q3 FY'2015)

Evaluation Flow: 24hrs bake @ 125C - 2XIR@260C - 100TC (+150C/ -60C)

48hrs PCT - 4000hrs storage at ambient (30 ±2 °C and 60 ±3% RH)

Source:UTL FR0274 LF QUAL

Device	Lot	Date Code	L/F	Assembly	Start Date	4000hrs	SEM result
LT1341CG	764866.1	1422	CU	N	11-Aug-14	30-Jan-15	0/112



FAILURE CRITERIA

Ambient and Hi-temp/Humidity storage : < 40um, measurement method in accordance to JEDEC standard No.201