



Remedy for comment #385 D2.2

January 2017
Yair Darshan

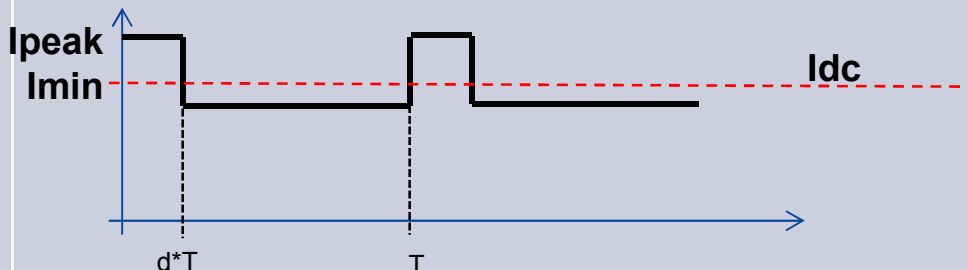
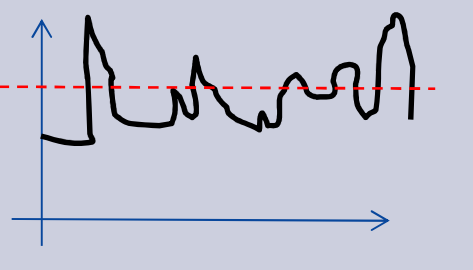
ydarshan@microsemi.com

About comment #385 D2.2



- Comment #385 suggests to remove the parts that define requirements for I_{port_RMS}
- The argument used: I_{port_DC} requirements are sufficient due to small error between I_{dc} and I_{rms}

Introduction

#	Parameter	Simple case	Complex case
1	I _{dc}	$I_{peak} \cdot d + I_{min} \cdot (1-d)$	$\frac{1}{T} \cdot \int_0^T i(t) dt$
2	I _{rms}	$\sqrt{(I_{peak} \cdot d)^2 + (I_{min} \cdot (1-d))^2}$	$\sqrt{\frac{1}{T} \cdot \int_0^T i^2(t) dt}$
			

Discussion-The issue is RMS current.

- When we specify requirements, we need to guarantee that we can test it in a reliable way.
- The focus of the discussion is on PD requirements and not if PSE can police it or not.
- The discussion is not about RMS power or DC power. Both has always the same value.
- We have DC component and AC component for I_{port} , this will require us to consider its RMS value which is the source for power loss at the PSE and the PD.
- As long as I_{port_DC} , I_{peak} and duty cycle limits IN THE SPEC are met then the error between I_{port_RMS} and I_{port_DC} will be small → Resistive losses $I_{dc}^2 \approx I_{rms}^2$.
- ***The problem is: if PD doesn't meet the spec, how we verify it???***
- If PD $I_{peak} > 1.11 * P_{class} / V_{pse}$ the RMS content will increase significantly while the average current I_{port_DC} may remain unchanged. As a result, I_{port_DC} measurement is not sufficient.
- If the AC wave shape is complex, measurement of I_{dc} , I_{peak} and duty are useless.
- If $I_{port_RMS} \leq I_{port_DC}$ than we 100% can verify that PD meets requirements.
- I_{port_RMS} , I_{port_DC} and I_{peak} are easily testable with a single measurement (Not 3 measurements).
- Measuring I_{peak} and duty may be not possible in many applications due to the random nature of I_{peak} and Duty.
- This is why the RMS term was invented many years ago; to make the wave shape transparent to the measurement for power loss considerations.

Calculation Example

	PD meets Ipeak requirements			PD doesn't meets Ipeak requirements		
Vpse [V]	52.00	50.00	50.00	52.00	50.00	50.00
Pclass [W]	90.00	51.00	30.00	90.00	51.00	30.00
K=Ppeak_PD/Pclass_PD	1.05	1.05	1.11	2.00	2.00	2.00
Ppeak[W]	94.50	53.55	33.30	180.00	102.00	60.00
Duty cycle=duty	0.05	0.05	0.05	0.05	0.05	0.05
Spec: Iport_dc [A]	1.73	1.02	0.60	1.73	1.02	0.60
Actual: Iport_dc [A]	1.74	1.02	0.60	1.82	1.07	0.63
Iport_dc_actual-Iport_dc	0.00	0.00	0.00	0.09	0.05	0.03
Ipeak [A]	1.82	1.07	0.67	3.46	2.04	1.20
Iport_rms [Arms]	1.74	1.02	0.60	1.86	1.09	0.64
PD PASS/FAIL based on Idc	PASS	PASS	PASS	FAIL	FAIL	PASS
PD PASS/FAIL based on Irms	PASS	PASS	PASS	FAIL	FAIL	FAIL
Increase in power loss	0.5%	0.5%	1.2%	15.0%	15.0%	15.0%
(Iport_rms-Iport_dc) [A]	0.004	0.003	0.003	0.125	0.074	0.043
(Iport_rms-Iport_dc) /Iport_dc	0.3%	0.3%	0.6%	7.2%	7.2%	7.2%

Conclusions:

- The current spec is:
- Accurate and is a legacy text
- Ensures that the $I_{rms} \leq I_{dc}$ → Power loss on PSE/PD/Channel is controlled if PD doesn't meet the spec for I_{peak} and the duty cycle
- Power loss in PSE or PD is function of the RMS value only
 $= (DC^2 + AC^2)^{0.5}$.
- Compliance of complex wave shape is achieved by measuring I_{rms} .
- The only way to verify PD behaves correctly is to measure its I_{peak} and I_{rms} value. Measuring I_{dc} and I_{peak} alone is not sufficient.
- The small error that we get between I_{rms} and I_{dc} is when we obey the spec.
- If I_{peak} , I_{min} , duty deviate from the spec, I_{rms} will find it. I_{dc} may not.

Summary and Recommendation

- **The requirements are:**
- Ipeak, duty, Pclass, Vpse

- **Testing tools:**
- Always available : Idc, Irms.
- Some times available : Ipeak, Imin and duty

- **Criteria for PASS:** $I_{rms} \leq I_{dc} = P_{class} / V_{pse}$
- If PD consumn $I_{peak} > 1.11 * P_{class} / V_{pse}$ or $duty > 0.05$ we can't know based on Idc only!!!
- It is irrelevant if PSE can sample if Ipeak is to high or not. Ths issue is how to test the PD if it meets requirements.
- We do need the Irms spec to ensure PD meets its requirements.

- **Reject the comment**



Thank You