

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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INTEL CORPORATION,  
Petitioner,

v.

R2 SEMICONDUCTOR, INC.,  
Patent Owner.

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Case IPR2017-00705

Case IPR2017-00706

Case IPR2017-01123

Patent 8,233,250 B2

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Before JAMESON LEE, JEAN R. HOMERE, and JENNIFER S. BISK,  
*Administrative Patent Judges.*

BISK, *Administrative Patent Judge.*

FINAL WRITTEN DECISION  
*Inter Partes* Review  
35 U.S.C. § 318(a) and 37 C.F.R. § 42.73

Case IPR2017-00705  
Case IPR2017-00706  
Case IPR2017-01123  
Patent 8,233,250 B2

## I. INTRODUCTION

Intel Corporation (“Petitioner”) filed three petitions requesting *inter partes* review of U.S. Patent No. 8,233,250 B2 (Ex. 1001, “the ’250 patent”). IPR2017-00705, Paper 4 (“Pet.”); IPR2017-00706, Paper 4 (“’706 Pet.”); IPR2017-01123, Paper 4 (“’1123 Pet.”). In each case we instituted a trial on all challenged claims resulting in review of all claims, 1–31, of the ’250 patent.<sup>1</sup> IPR2017-00705, Paper 10 (“Inst. Dec.”); IPR2017-00706, Paper 10 (“’706 Inst. Dec.”); IPR2017-01123, Paper 10 (“’1123 Inst. Dec.”).

Patent Owner filed a Patent Owner Response in each case. IPR2017-00705, Paper 35 (“PO Resp.”); IPR2017-00706, Paper 35 (“’706 PO Resp.”); IPR2017-01123, Paper 35 (“’1123 PO Resp.”). Similarly, Petitioner filed a Reply in each case. IPR2017-00705, Paper 62 (“Reply”); IPR2017-00706, Paper 62 (“’706 Reply”); IPR2017-01123, Paper 58 (“’1123 Reply”).<sup>2</sup>

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<sup>1</sup> Claims 1–4, 7–9, 13–17, 20–22, and 29 were reviewed in IPR2017-00705, claims 10–12, 23–26, 28, and 31 were reviewed in IPR2017-00706, and claims 5, 6, 18, 19, 27, and 30 were reviewed in IPR2017-01123.

<sup>2</sup> Both parties also filed in each case a Motion to Exclude Evidence, each of which was fully briefed. IPR2017-00705, Papers 70, 71, 73, 74, 77, 78; IPR2017-00706, Papers 71, 72, 74, 75, 78, 79; IPR2017-01123, Papers 71, 72, 74, 75, 78, 79. Subsequently, the parties withdrew each of these motions. IPR2017-00705, Paper 83; IPR2017-00706, Paper 84; IPR2017-01123, Paper 84.

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In each case, Patent Owner filed a Contingent Motion to Amend, each of which was fully briefed.<sup>3</sup> IPR2017-00705, Papers 30, 49, 58, 69; IPR2017-00706, Papers 66, 49, 58, 70; IPR2017-01123, Papers 30, 49, 58, 69.

A transcript of the consolidated oral hearing held on February 8, 2018, has been entered into the record as Paper 84<sup>4</sup> (“Tr.”).

Because of the substantial overlap in substance, we exercise our discretion and consolidate pursuant to 35 U.S.C. § 315(d), for purposes of this Final Written Decision only, the three proceedings.<sup>5</sup> For the reasons that follow, Petitioner has demonstrated by a preponderance of the evidence that claims 1–31 of the ’250 patent are unpatentable.

#### *A. Related Matters*

The parties indicate that the ’250 patent is involved in *R2 Semiconductor, Inc. v. Intel Corp. et al.*, Civil Action No. 2:16-cv-01011

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<sup>3</sup> Upon authorization, Patent Owner filed a corrected motion to amend in IPR2017-00706 and Petitioner filed a surreply in all three cases.

<sup>4</sup> For purposes of this Decision, unless otherwise indicated, a citation to “Paper XX” or “Ex. XXXX” will refer to documents filed in IPR2017-00705. Similarly, “’706 Paper XX” or “’706 Ex. XXXX” will refer to documents filed in IPR2017-00706 and “’1123 Paper XX” or “’1123 Ex. XXXX” will refer to documents filed in IPR2017-01123. Moreover, for efficiency and clarity, unless there is a relevant difference between the cases, we will cite only to documents in IPR2017-00705.

<sup>5</sup> The parties are authorized to file a consolidated request for rehearing in the three cases.

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(E.D. Tex.) and *Certain Integrated Circuits with Voltage Regulators and Products Containing Same*, Investigation No. 337-TA-1024 (USITC). Pet. 3; Paper 7, 1–2. Petitioner has also challenged the '250 patent in 3 additional petitions (IPR2017-00707, -00708, and -01124). Pet. 3; Paper 7, 1–2.

### *B. The '250 Patent*

The '250 patent relates to voltage regulators, which are “universally used to convert the battery voltage to the desired fixed value to be supplied to the integrated circuit, and to ensure that value remains constant as the battery ages and the current used by the integrated circuit changes.” Ex. 1001, 1:11–24. The '250 patent describes two types of voltage regulators – linear or switched—“switched regulator[s],” in particular,

convert[] a DC input voltage to a time-varying voltage or current, and then make[] use of rectifying or switching elements and passive components such as inductors and capacitors, in conjunction with a control circuit, to re-convert this time-varying signal to a DC voltage at a fixed value differing from the input voltage.

*Id.* at 1:25–36. According to the '250 patent, “switched mode converters are used for many electronic applications, particularly those where energy efficiency and/or battery life are of critical importance.” *Id.* at 1:57–61. A conventional switched voltage regulator, as described in the '250 patent, is shown in Figure 2 below:

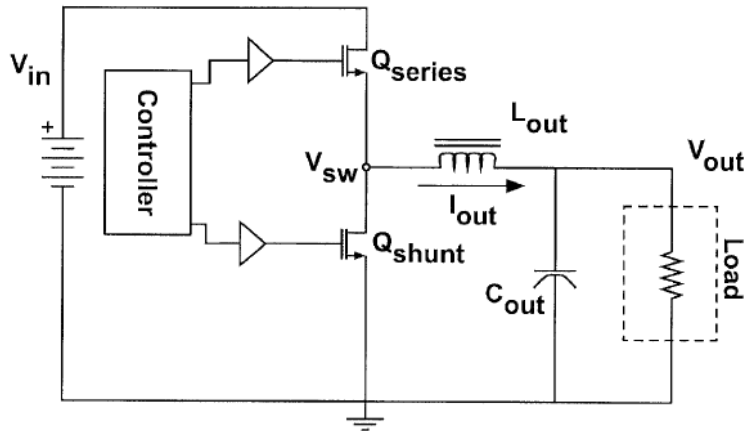


Figure 2 depicts a conventional switched mode regulator having transistor  $Q_{series}$  and transistor  $Q_{shunt}$  connected at common switching node  $V_{sw}$ .

As shown in Figure 2 above, the '250 patent explains that the transistors are alternately turned on and off such that current  $I_{out}$  flows from source terminal  $V_{in}$ , through operating transistor  $Q_{series}/Q_{shunt}$ , and through inductor  $L_{out}$  to charge up capacitor  $C_{out}$ . *Id.* at 2:2–36.<sup>6</sup> According to the '250 patent, the intermittent switching of the transistors causes rapid switching in the capacitive load and “voltage spikes will occur in any

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<sup>6</sup> The '250 patent explains that “[w]hen the series switch 301 is rapidly turned off, this parasitic inductor tries to maintain the same output current, causing the voltage  $V_{hi}$  to increase rapidly in the absence of any preventive measures . . . [T]he parasitic inductance may interact with parasitic capacitances to form a high frequency resonant circuit, which will create a persistent ringing condition as a result of the initial rapid voltage transition.” Ex. 1001, 16:5–13.

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