Intracortical Multiplication of Thalamocortical Signals in Mouse Auditory Cortex

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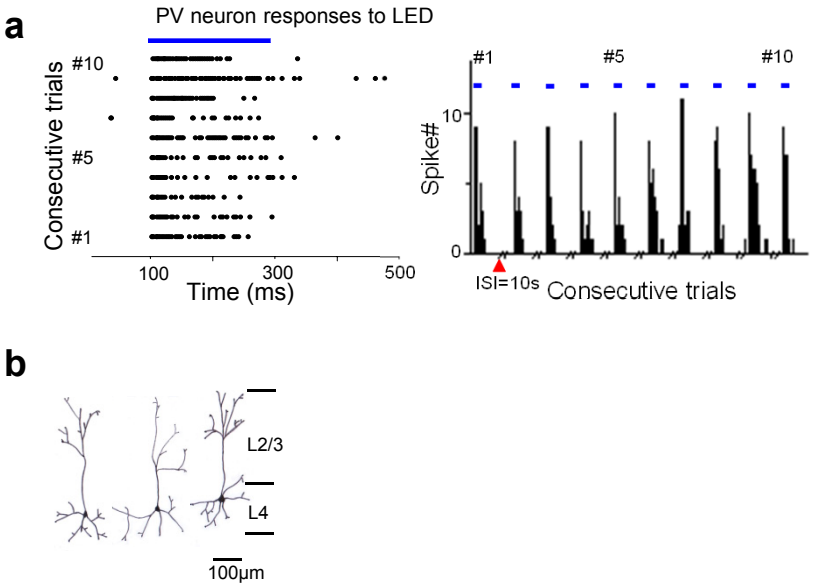
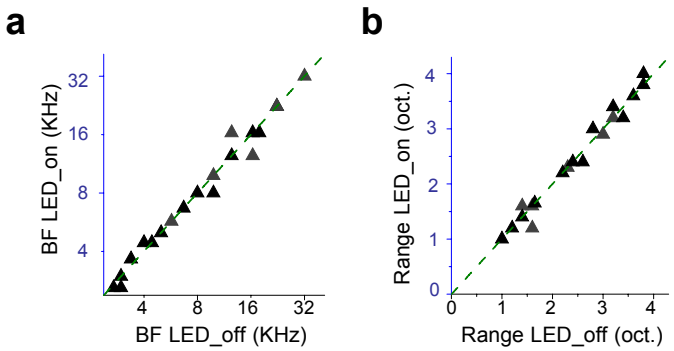
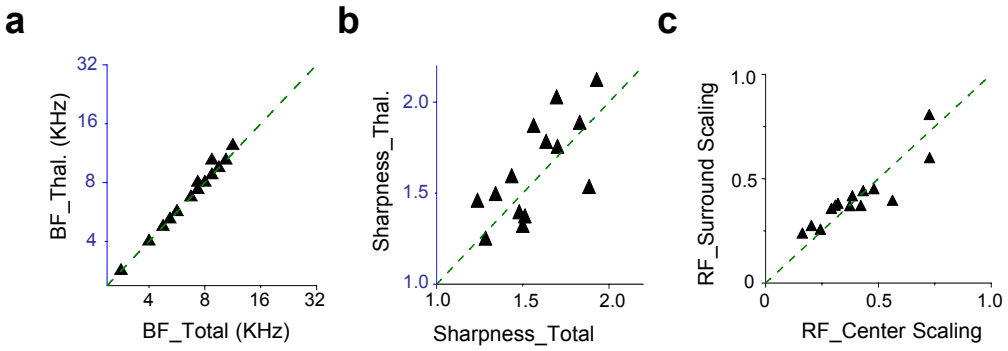


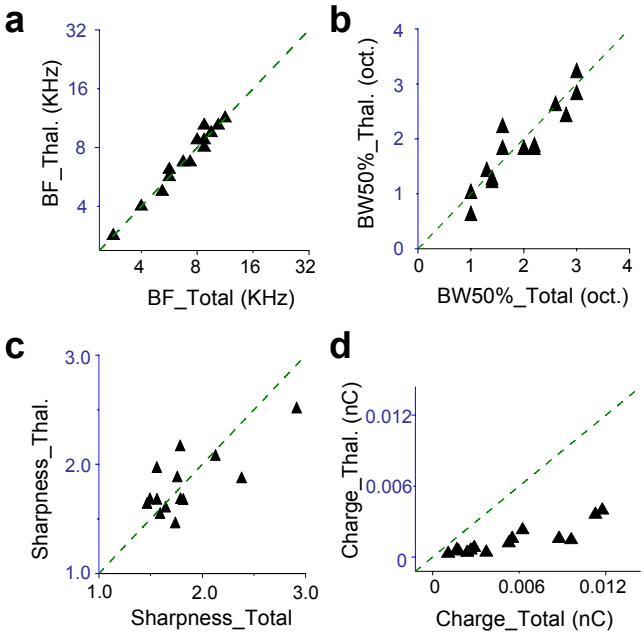
Supplementary Figure 1. Optogenetic activation of PV neurons. (**a**) A PV neuron's spike responses to LED illumination. Left, raster plot of spikes in 10 consecutive trials. The duration of LED illumination is marked by the blue bar. The inter- stimulus interval (ISI) is 10 sec. Right, peri-stimulus spike time histogram (PSTH) for the spikes of the same neuron in 10 consecutive trials. Within each trial, bin size = 25 ms. Blue bar indicates the duration of LED illumination (200 ms). (**b**) The reconstructed morphologies of three example cells in our recorded population showing that they were pyramidal neurons located in layer 4.



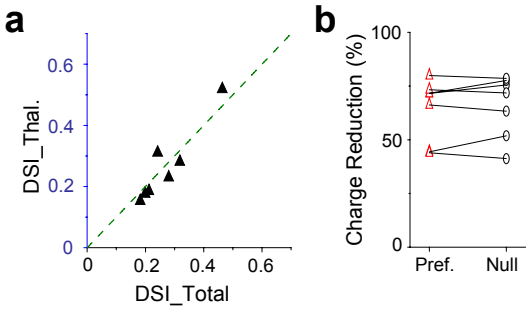
Supplementary Figure 2. Tuning properties of responses in MGBv. (**a**) Plot of best frequency (BF) of MGBv responses in LED on versus control trials (P = 0.63, Wilcoxon signed rank test, n = 19). Here BF was defined as the tone frequency that evoked the excitatory current of maximal amplitude. (**b**) Plot of total effective frequency range of MGBv responses in LED on versus control trials (2.42 $\pm$ 0.93 vs. 2.43 $\pm$ 0.90 octave, P = 1, Wilcoxon signed rank test, n = 19).



Supplementary Figure 3. Tuning properties of excitatory inputs in layer4 neurons. (**a**) Plot of BF of thalamocortical input versus that of total excitation (P = 0.25, Wilcoxon signed-rank test, n = 14). (**b**) Plot of tuning sharpness of thalamocortical input versus that of total excitation (1.62 $\pm$ 0.27 vs. 1.57 $\pm$ 0.22, P = 0.36, paired *t*-test). Tuning sharpness was measured as the ratio of the largest response amplitude over the average amplitude of all the responses within the effective frequency range. (**c**) Comparison of the scaling factors between weak (at the receptive field boundary) and strong (at the receptive field center) inputs. The responses to three testing frequencies at the receptive field boundary and around the BF were averaged for the analysis. The scaling factors for the weak and strong inputs are not different (0.40 $\pm$ 0.17 v.s. 0.41 $\pm$ 0.14, P = 0.63, Wilcoxon signed-rank test, n = 14).



Supplementary Figure 4. Frequency tuning of thalamcortical input and total excitation. (**a**) Plot of BF of thalamocortical input versus that of total excitation. Here BF was defined as the tone frequency that evoked the excitatory current of maximal charge. There is no significant difference (P = 0.27, Wilcoxon signed-rank test, n = 14). (**b**) Plot of BW50% of tuning of thalamocortical input versus that of total excitation (1.94 $\pm$ 0.68 vs. 1.84 $\pm$ 0.71 octave, P = 0.26, paired *t*-test, n = 14). (**c**) Plot of tuning sharpness of thalamocortical excitation versus that of total excitation (1.83 $\pm$ 0.38 vs. 1.81 $\pm$ 0.27, P = 0.91, paired *t*-test, n = 14). Here the sharpness of tuning was measured as the ratio of the largest response charge over the average charge of all the responses within the effective frequency range. (**d**) Plot of average charge of all effective tone-evoked responses for thalamocortical excitation versus that for total excitation (4.4e-3 $\pm$ 2.9e-3 vs. 1.1e-3 $\pm$ 9.5e-4 nC, P = 1.2e-4, Wilcoxon signed-rank test, n = 14).



Supplementary Figure 5. Direction selectivity of thalamic inputs and total excitation. (**a**) Left, plot of DSI of thalamocortical input versus that of total excitation (0.27 $\pm$ 0.09 vs. 0.26 $\pm$ 0.12; P = 0.7, paired *t*-test, n = 7). (**b**) Percentage reduction of integrated charge after cortical silencing for the preferred and null directional stimuli (0.64 $\pm$ 0.13 vs. 0.66 $\pm$ 0.13, P = 0.44, paired *t*-test, n = 7). Data points for the same cell are connected by a line.

Supplementary Table 1. Linear regression test for Fig.2

Cell	Correlation coefficient (r)	p-value(one tail)
#1	0.786	0.002
#2	0.888	4.0e-8
#3	0.890	3.0e-8
#4	0.951	<1.0e-8
#5	0.914	3.7e-7
#6	0.886	5.0e-8
#7	0.896	2.0e-8
#8	0.933	1.2e-4
#9	0.815	3.4e-6
#10	0.740	6.3e-5
#11	0.911	<1.0e-8
#12	0.923	<1.0e-8
#13	0.980	3.0e-4
#14	0.882	6.0e-8