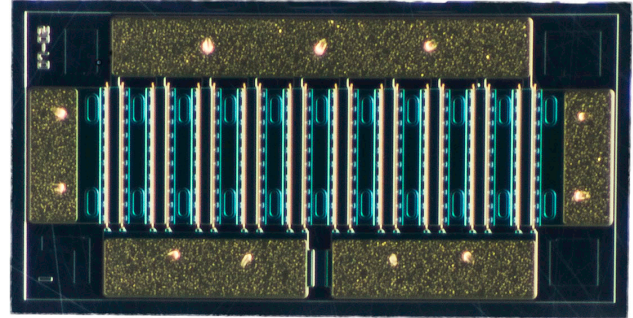


# CG2H80030D

30 W, 8.0 GHz, GaN HEMT Die

## Description

Cree's CG2H80030D is a gallium nitride (GaN) High Electron Mobility Transistor (HEMT). GaN has superior properties compared to silicon or gallium arsenide, including higher breakdown voltage, higher saturated electron drift velocity, and higher thermal conductivity. GaN HEMTs offer greater power density and wider bandwidths compared to Si and GaAs transistors



PN: CG2H80030D

## Features

- 17 dB Typical Small Signal Gain at 4 GHz
- 12 dB Typical Small Signal Gain at 8 GHz
- 30 W Typical  $P_{SAT}$
- 28 V Operation
- High Breakdown Voltage
- High Temperature Operation
- Up to 8 GHz Operation
- High Efficiency

## Applications

- 2-Way Private Radio
- Broadband Amplifiers
- Cellular infrastructure
- Test Instrumentation
- Class A, AB, Linear amplifiers suitable for OFDM, W-CDMA, EDGE, CDMA waveforms

## Packaging Information



- Bare die are shipped in Gel-Pak® containers
- Non-adhesive tacky membrane immobilizes die during shipment

 Large Signal Models Available for ADS and MWO

**RoHS**  
COMPLIANT



### Absolute Maximum Ratings (not simultaneous) at 25 °C Case Temperature

Parameter	Symbol	Rating	Units	Conditions
Drain-Source Voltage	$V_{DS}$	120	Volts	25 °C
Gate-to-Source Voltage	$V_{GS}$	-10, +2	Volts	25 °C
Storage Temperature	$T_{STG}$	-65, +150	°C	
Operating Junction Temperature	$T_J$	225	°C	
Maximum Forward Gate Current	$I_{GMAX}$	7.0	mA	25 °C
Maximum Drain Current <sup>1</sup>	$I_{DMAX}$	3.0	A	25 °C
Thermal Resistance, Junction to Case (packaged) <sup>2</sup>	$R_{\theta JC}$	4.9	°C/W	85 °C, 28.8 W Dissipation
Thermal Resistance, Junction to Case (die only)	$R_{\theta JC}$	2.74	°C/W	85 °C, 28.8 W Dissipation
Mounting Temperature (30 seconds)	$T_S$	320	°C	30 seconds

Notes:

<sup>1</sup> Current limit for long term, reliable operation

<sup>2</sup> Eutectic die attach using 80/20 AuSn mounted to a 10 mil thick Cu15Mo85 carrier

### Electrical Characteristics (Frequency = 4 GHz unless otherwise stated; $T_c = 25$ °C)

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
<b>DC Characteristics</b>						
Gate Threshold Voltage	$V_{GS(th)}$	-3.6	-3.0	-2.4	$V_{DC}$	$V_{DS} = 10$ V, $I_D = 7.2$ mA
Gate Quiescent Voltage	$V_{GS(Q)}$	-	-2.7	-	$V_{DC}$	$V_{DD} = 28$ V, $I_{DQ} = 200$ mA
Drain-Source Breakdown Voltage	$V_{BD}$	84	-	-	$V_{DC}$	$V_{GS} = -8$ V, $I_D = 7.2$ mA
On Resistance	$R_{ON}$	0.26	0.33	0.41	$\Omega$	$V_{DS} = 0.1$ V
<b>RF Characteristics</b>						
Small Signal Gain	$G_{SS}$	-	17	-	dB	$V_{DD} = 28$ V, $I_{DQ} = 200$ mA
Output Power <sup>1</sup>	$P_{SAT}$	-	30	-	W	$V_{DD} = 28$ V, $I_{DQ} = 200$ mA
Drain Efficiency <sup>2</sup>	$\eta$	-	65	-	%	$V_{DD} = 28$ V, $I_{DQ} = 200$ mA, $P_{SAT} = 30$ W
Output Mismatch Stress <sup>3</sup>	VSWR	-	-	10 : 1	$\Psi$	$V_{DD} = 28$ V, $I_{DQ} = 200$ mA, $P_{OUT} = 30$ W (CW)
<b>Dynamic Characteristics</b>						
Input Capacitance	$C_{GS}$	-	7.3	-	pF	$V_{DS} = 28$ V, $V_{GS} = -8$ V, $f = 1$ MHz
Output Capacitance	$C_{DS}$	-	2.2	-	pF	$V_{DS} = 28$ V, $V_{GS} = -8$ V, $f = 1$ MHz
Feedback Capacitance	$C_{GD}$	-	0.37	-	pF	$V_{DS} = 28$ V, $V_{GS} = -8$ V, $f = 1$ MHz

Notes:

<sup>1</sup>  $P_{SAT}$  is defined as  $I_G = 0.7$  mA

<sup>2</sup> Drain Efficiency =  $P_{OUT} / P_{DC}$

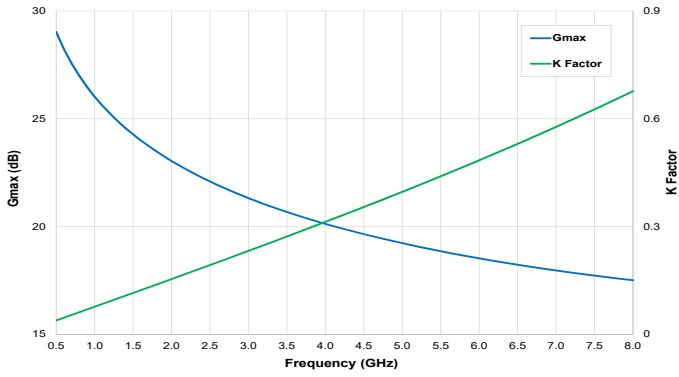
<sup>3</sup> No damage at all phase angles



Typical Performance

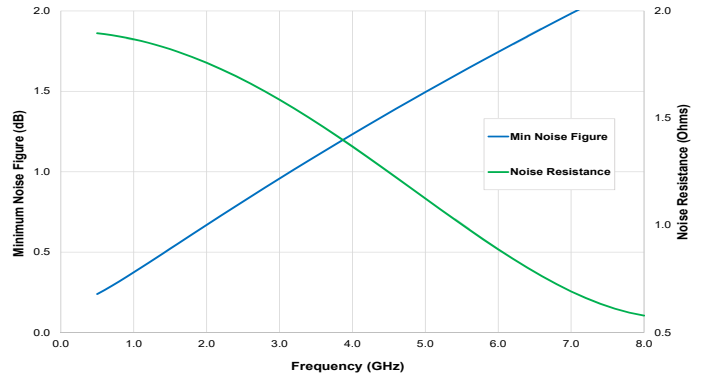
Simulated Maximum Available Gain and K Factor

$V_{DD} = 28\text{ V}, I_{DQ} = 200\text{ mA}$



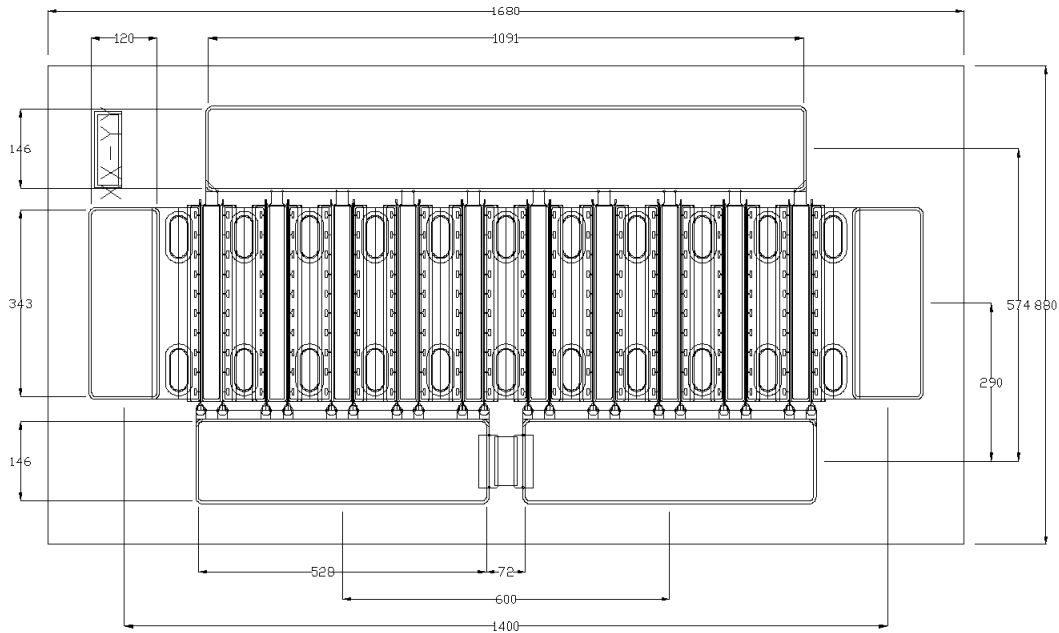
Simulated Minimum Noise Figure and Noise Resistance vs. Frequency

$V_{DD} = 28\text{ V}, I_{DQ} = 200\text{ mA}$



Intrinsic die parameters - reference planes at centers of gate and drain bonding pads. No wire bonds assumed.

Die Dimensions (units in microns)



Assembly Notes:

- Recommended solder is AuSn (80/20) solder. Refer to Cree’s website for the Eutectic Die Bond Procedure application note at <https://www.wolfspeed.com/rf/document-library>
- Vacuum collet is the preferred method of pick-up.
- The backside of the die is the Source (ground) contact.
- Die back side gold plating is 5 microns thick minimum.
- Thermosonic ball or wedge bonding are the preferred connection methods.
- Gold wire must be used for connections.
- Use the die label (XX-YY) for correct orientation.



**Typical Package S-Parameters for CG2H80030D**  
 (Small Signal,  $V_{DS} = 28\text{ V}$ ,  $I_{DQ} = 100\text{ mA}$ , magnitude / angle)

Frequency	Mag S11	Ang S11	Mag S21	Ang S21	Mag S12	Ang S12	Mag S22	Ang S22
0.5	0.896	-144.83	14.54	99.06	0.028	9.74	0.489	-142.29
0.6	0.893	-150.27	12.23	95.00	0.029	5.81	0.494	-146.11
0.7	0.892	-154.23	10.53	91.65	0.029	2.60	0.500	-148.62
0.8	0.892	-157.23	9.23	88.78	0.029	-0.14	0.506	-150.31
0.9	0.892	-159.57	8.20	86.22	0.029	-2.56	0.512	-151.46
1.0	0.892	-161.45	7.36	83.90	0.029	-4.75	0.519	-152.26
1.1	0.893	-162.99	6.67	81.75	0.029	-6.76	0.526	-152.81
1.2	0.894	-164.27	6.09	79.74	0.029	-8.63	0.533	-153.19
1.3	0.895	-165.35	5.60	77.84	0.028	-10.40	0.541	-153.46
1.4	0.896	-166.28	5.17	76.03	0.028	-12.07	0.549	-153.65
1.5	0.897	-167.08	4.80	74.29	0.028	-13.67	0.558	-153.79
1.6	0.898	-167.79	4.47	72.62	0.028	-15.21	0.566	-153.90
1.8	0.901	-168.98	3.92	69.45	0.027	-18.11	0.584	-154.09
2.0	0.903	-169.94	3.47	66.47	0.027	-20.82	0.602	-154.26
2.2	0.906	-170.74	3.10	63.64	0.027	-23.37	0.619	-154.48
2.4	0.909	-171.43	2.79	60.96	0.026	-25.78	0.637	-154.73
2.6	0.912	-172.03	2.53	58.40	0.025	-28.07	0.654	-155.04
2.8	0.915	-172.57	2.31	55.96	0.025	-30.23	0.671	-155.40
3.0	0.918	-173.06	2.11	53.63	0.024	-32.29	0.687	-155.80
3.2	0.921	-173.51	1.94	51.40	0.024	-34.25	0.702	-156.24
3.4	0.924	-173.94	1.79	49.26	0.023	-36.12	0.717	-156.70
3.6	0.927	-174.33	1.65	47.22	0.023	-37.89	0.731	-157.19
3.8	0.929	-174.71	1.53	45.25	0.022	-39.58	0.744	-157.70
4.0	0.932	-175.07	1.43	43.37	0.022	-41.19	0.757	-158.21
4.2	0.934	-175.42	1.33	41.57	0.021	-42.72	0.769	-158.74
4.4	0.937	-175.75	1.24	39.83	0.021	-44.18	0.780	-159.27
4.6	0.939	-176.08	1.16	38.17	0.020	-45.57	0.790	-159.80
4.8	0.941	-176.39	1.09	36.57	0.020	-46.90	0.800	-160.33
5.0	0.943	-176.70	1.03	35.02	0.019	-48.16	0.809	-160.85
5.2	0.945	-177.00	0.97	33.54	0.019	-49.37	0.818	-161.37
5.4	0.947	-177.29	0.91	32.11	0.018	-50.53	0.826	-161.89
5.6	0.948	-177.58	0.86	30.73	0.018	-51.63	0.834	-162.39
5.8	0.950	-177.86	0.82	29.40	0.018	-52.69	0.841	-162.89
6.0	0.951	-178.13	0.77	28.11	0.017	-53.70	0.848	-163.37
6.2	0.953	-178.41	0.74	26.87	0.017	-54.66	0.855	-163.85
6.4	0.954	-178.67	0.70	25.66	0.016	-55.59	0.861	-164.32
6.6	0.955	-178.93	0.67	24.50	0.016	-56.47	0.866	-164.77
6.8	0.957	-179.19	0.63	23.37	0.016	-57.32	0.872	-165.22
7.0	0.958	-179.45	0.61	22.27	0.015	-58.14	0.877	-165.66
7.2	0.959	-179.70	0.58	21.21	0.015	-58.92	0.881	-166.09
7.4	0.960	-179.95	0.55	20.18	0.015	-59.67	0.886	-166.5
7.6	0.961	-179.81	0.53	19.18	0.014	-60.39	0.890	-166.91
7.8	0.9615	-179.57	0.51	18.20	0.014	-61.08	0.894	-167.31
8.0	0.9623	-179.33	0.49	17.25	0.014	-61.74	0.898	-167.70

To download the s-parameters in s2p format, go to the [CG2H80030D](#) product page and click on the documentation tab.



**Typical Package S-Parameters for CG2H80030D**  
**(Small Signal,  $V_{DS} = 28\text{ V}$ ,  $I_{DQ} = 200\text{ mA}$ , magnitude / angle)**

Frequency	Mag S11	Ang S11	Mag S21	Ang S21	Mag S12	Ang S12	Mag S22	Ang S22
0.5	0.916	-151.73	16.08	97.77	0.020	8.51	0.571	-158.18
0.6	0.915	-156.27	13.49	94.46	0.020	5.35	0.577	-160.60
0.7	0.914	-159.56	11.60	91.75	0.020	2.79	0.581	-162.18
0.8	0.914	-162.05	10.17	89.43	0.020	0.62	0.585	-163.25
0.9	0.914	-164.00	9.03	87.38	0.020	-1.29	0.589	-163.96
1.0	0.914	-165.56	8.12	85.51	0.020	-3.01	0.593	-164.45
1.1	0.914	-166.84	7.37	83.79	0.020	-4.58	0.597	-164.76
1.2	0.915	-167.92	6.74	82.17	0.020	-6.05	0.600	-164.95
1.3	0.915	-168.83	6.21	80.64	0.020	-7.44	0.604	-165.06
1.4	0.915	-169.61	5.75	79.17	0.020	-8.75	0.608	-165.10
1.5	0.916	-170.29	5.35	77.77	0.020	-10.01	0.613	-165.10
1.6	0.916	-170.89	5.00	76.41	0.020	-11.22	0.617	-165.06
1.8	0.918	-171.89	4.40	73.81	0.020	-13.52	0.626	-164.93
2.0	0.919	-172.71	3.93	71.34	0.020	-15.69	0.636	-164.76
2.2	0.920	-173.39	3.54	68.98	0.019	-17.76	0.645	-164.58
2.4	0.922	-173.96	3.21	66.71	0.019	-19.73	0.656	-164.42
2.6	0.923	-174.47	2.93	64.52	0.019	-21.62	0.666	-164.29
2.8	0.925	-174.92	2.68	62.41	0.019	-23.43	0.676	-164.19
3.0	0.927	-175.32	2.47	60.36	0.018	-25.18	0.687	-164.13
3.2	0.928	-175.69	2.29	58.38	0.018	-26.86	0.697	-164.11
3.4	0.930	-176.03	2.13	56.46	0.018	-28.48	0.707	-164.13
3.6	0.932	-176.35	1.98	54.60	0.017	-30.04	0.717	-164.18
3.8	0.933	-176.65	1.85	52.79	0.017	-31.54	0.727	-164.27
4.0	0.935	-176.94	1.73	51.04	0.017	-32.99	0.737	-164.38
4.2	0.937	-177.22	1.62	49.34	0.017	-34.38	0.746	-164.53
4.4	0.938	-177.48	1.53	47.69	0.016	-35.73	0.755	-164.69
4.6	0.940	-177.74	1.44	46.09	0.016	-37.02	0.764	-164.88
4.8	0.941	-177.99	1.36	44.54	0.016	-38.27	0.772	-165.09
5.0	0.943	-178.24	1.29	43.03	0.015	-39.47	0.780	-165.31
5.2	0.944	-178.48	1.22	41.56	0.015	-40.63	0.788	-165.54
5.4	0.945	-178.72	1.15	40.14	0.015	-41.75	0.796	-165.79
5.6	0.947	-178.95	1.10	38.76	0.015	-42.82	0.803	-166.05
5.8	0.948	-179.18	1.04	37.41	0.014	-43.85	0.810	-166.31
6.0	0.949	-179.41	0.99	36.10	0.014	-44.85	0.816	-166.58
6.2	0.950	-179.63	0.95	34.83	0.014	-45.81	0.823	-166.86
6.4	0.951	-179.85	0.90	33.59	0.013	-46.73	0.829	-167.14
6.6	0.953	-179.93	0.86	32.38	0.013	-47.62	0.834	-167.42
6.8	0.954	-179.71	0.83	31.21	0.013	-48.47	0.840	-167.70
7.0	0.955	-179.49	0.79	30.06	0.013	-49.30	0.845	-167.99
7.2	0.955	-179.27	0.76	28.94	0.012	-50.09	0.850	-168.28
7.4	0.956	-179.06	0.73	27.86	0.012	-50.85	0.855	-168.56
7.6	0.957	-178.85	0.70	26.79	0.012	-51.59	0.860	-168.85
7.8	0.958	-178.64	0.672	25.7570	0.012	-52.30	0.864	-169.13
8.0	0.959	-178.42	0.646	24.7440	0.011	-52.98	0.868	-169.42

To download the s-parameters in s2p format, go to the [CG2H80030D](#) product page and click on the documentation tab.



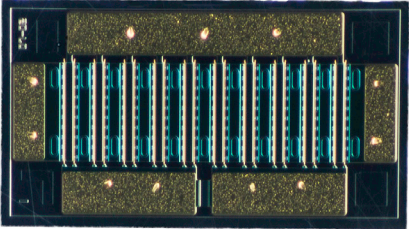
**Typical Package S-Parameters for CG2H80030D**  
**(Small Signal,  $V_{DS} = 28\text{ V}$ ,  $I_{DQ} = 500\text{ mA}$ , magnitude / angle)**

Frequency	Mag S11	Ang S11	Mag S21	Ang S21	Mag S12	Ang S12	Mag S22	Ang S22
0.5	0.927	-154.58	16.26	96.98	0.017	7.77	0.599	-162.76
0.6	0.926	-158.72	13.63	93.94	0.017	4.89	0.604	-164.66
0.7	0.926	-161.72	11.71	91.46	0.017	2.57	0.608	-165.90
0.8	0.925	-163.98	10.26	89.33	0.017	0.60	0.611	-166.73
0.9	0.925	-165.76	9.12	87.45	0.017	-1.12	0.614	-167.28
1.0	0.925	-167.19	8.20	85.73	0.017	-2.68	0.617	-167.64
1.1	0.926	-168.36	7.45	84.15	0.017	-4.11	0.620	-167.87
1.2	0.926	-169.35	6.81	82.66	0.017	-5.44	0.623	-168.00
1.3	0.926	-170.18	6.28	81.24	0.017	-6.69	0.626	-168.05
1.4	0.926	-170.90	5.81	79.89	0.017	-7.89	0.630	-168.06
1.5	0.927	-171.53	5.41	78.59	0.017	-9.03	0.633	-168.02
1.6	0.927	-172.08	5.06	77.33	0.017	-10.13	0.636	-167.96
1.8	0.928	-173.02	4.46	74.92	0.017	-12.22	0.644	-167.79
2.0	0.929	-173.78	3.99	72.62	0.016	-14.20	0.651	-167.57
2.2	0.930	-174.41	3.59	70.41	0.016	-16.09	0.659	-167.35
2.4	0.931	-174.95	3.27	68.28	0.016	-17.90	0.667	-167.14
2.6	0.932	-175.43	2.99	66.22	0.016	-19.64	0.676	-166.94
2.8	0.933	-175.85	2.74	64.22	0.016	-21.31	0.684	-166.78
3.0	0.934	-176.23	2.53	62.28	0.016	-22.93	0.693	-166.64
3.2	0.936	-176.58	2.35	60.40	0.015	-24.49	0.702	-166.54
3.4	0.937	-176.90	2.18	58.56	0.015	-26.00	0.710	-166.48
3.6	0.938	-177.20	2.04	56.78	0.015	-27.45	0.719	-166.44
3.8	0.939	-177.48	1.91	55.05	0.015	-28.86	0.727	-166.44
4.0	0.941	-177.75	1.79	53.36	0.014	-30.22	0.736	-166.46
4.2	0.942	-178.01	1.68	51.71	0.014	-31.54	0.744	-166.51
4.4	0.943	-178.26	1.59	50.11	0.014	-32.81	0.752	-166.59
4.6	0.944	-178.50	1.50	48.55	0.014	-34.04	0.760	-166.69
4.8	0.946	-178.74	1.42	47.03	0.014	-35.22	0.768	-166.81
5.0	0.947	-178.97	1.34	45.55	0.013	-36.37	0.775	-166.95
5.2	0.948	-179.19	1.27	44.11	0.013	-37.47	0.782	-167.10
5.4	0.949	-179.41	1.21	42.71	0.013	-38.54	0.789	-167.27
5.6	0.950	-179.63	1.15	41.34	0.013	-39.57	0.796	-167.46
5.8	0.951	-179.85	1.10	40.01	0.012	-40.56	0.802	-167.65
6.0	0.952	179.94	1.04	38.71	0.012	-41.52	0.809	-167.85
6.2	0.953	179.73	1.00	37.44	0.012	-42.44	0.815	-168.06
6.4	0.954	179.52	0.95	36.20	0.012	-43.33	0.821	-168.28
6.6	0.955	179.31	0.91	35.00	0.012	-44.18	0.826	-168.51
6.8	0.956	179.11	0.87	33.82	0.011	-45.01	0.832	-168.73
7.0	0.957	178.9	0.84	32.67	0.011	-45.80	0.837	-168.97
7.2	0.957	178.70	0.80	31.55	0.011	-46.57	0.842	-169.2
7.4	0.958	178.5	0.77	30.45	0.011	-47.30	0.846	-169.44
7.6	0.959	178.29	0.74	29.38	0.010	-48.01	0.851	-169.69
7.8	0.960	178.09	0.72	28.3310	0.010	-48.69	0.855	-169.93
8.0	0.960	177.89	0.69	27.3060	0.010	-49.35	0.859	-170.17

To download the s-parameters in s2p format, go to the [CG2H80030D](#) product page and click on the documentation tab.



### Product Ordering Information

Order Number	Description	Unit of Measure	Image
CG2H80030D	GaN HEMT Bare Die	Each	 A microscopic image of a GaN HEMT bare die, showing a series of vertical, parallel structures on a dark substrate.



For more information, please contact:

4600 Silicon Drive  
Durham, North Carolina, USA 27703  
[www.wolfspeed.com/rf](http://www.wolfspeed.com/rf)

Sales Contact  
[rfsales@cree.com](mailto:rfsales@cree.com)

## Notes & Disclaimer

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