



## N-Channel Super Junction Power MOSFET III

### General Description

The series of devices use advanced trench gate super junction technology and design to provide excellent  $R_{DS(ON)}$  with low gate charge. This super junction MOSFET fits the industry's AC-DC SMPS requirements for PFC, AC/DC power conversion, and industrial power applications.

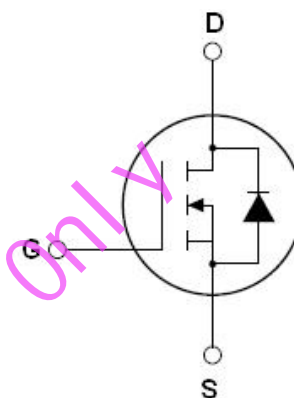
### Features

- Optimized body diode reverse recovery performance
- Low on-resistance and low conduction losses
- Small package
- Ultra Low Gate Charge cause lower driving requirements
- 100% Avalanche Tested
- ROHS compliant

### Application

- Power factor correction (PFC)
- Switched mode power supplies(SMPS)
- Uninterruptible Power Supply (UPS)
- LLC Half-bridge

$V_{DS}$	650	V
$R_{DS(ON)TYP}$	120	m $\Omega$
$I_D$	28	A

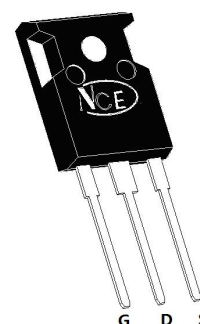


Schematic diagram

☆ Intrinsic fast-recovery body diode

### Package Marking And Ordering Information

Device	Device Package	Marking
NCE65TF130T	TO-247	NCE65TF130T



TO-247

Table 1. Absolute Maximum Ratings ( $T_c=25^\circ\text{C}$ )

Parameter	Symbol	Value	Unit
Drain-Source Voltage ( $V_{GS}=0V$ )	$V_{DS}$	650	V
Gate-Source Voltage ( $V_{DS}=0V$ ) AC ( $f>1$ Hz)	$V_{GS}$	$\pm 30$	V
Continuous Drain Current at $T_c=25^\circ\text{C}$	$I_D(DC)$	28	A
Continuous Drain Current at $T_c=100^\circ\text{C}$	$I_D(DC)$	18	A
Pulsed drain current (Note 1)	$I_{DM(pluse)}$	112	A
Maximum Power Dissipation( $T_c=25^\circ\text{C}$ )	$P_D$	260	W
Derate above $25^\circ\text{C}$		2.08	W/ $^\circ\text{C}$
Single pulse avalanche energy (Note 2)	$E_{AS}$	676	mJ
Avalanche current (Note 1)	$I_{AR}$	5.2	A
Repetitive Avalanche energy , $t_{AR}$ limited by $T_{jmax}$ (Note 1)	$E_{AR}$	3.2	mJ



# NCE65TF130T

Parameter	Symbol	Value	Unit
Drain Source voltage slope, $V_{DS} \leq 480V$ ,	dv/dt	50	V/ns
Reverse diode dv/dt, $V_{DS} \leq 480V, I_{SD} < I_D$	dv/dt	50	V/ns
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55...+150	°C

\* limited by maximum junction temperature

**Table 2. Thermal Characteristic**

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case (Maximum)	$R_{thJC}$	0.48	°C/W
Thermal Resistance, Junction-to-Ambient (Maximum)	$R_{thJA}$	62	°C/W

**Table 3. Electrical Characteristics (TA=25°C unless otherwise noted)**

Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>On/off states</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=250\mu A$	650			V
Zero Gate Voltage Drain Current( $T_c=25^\circ C$ )	$I_{DSS}$	$V_{DS}=650V, V_{GS}=0V$			3	$\mu A$
Zero Gate Voltage Drain Current( $T_c=125^\circ C$ )	$I_{DSS}$	$V_{DS}=650V, V_{GS}=0V$			300	$\mu A$
Gate-Body Leakage Current	$I_{GSS}$	$V_{GS}=\pm 20V, V_{DS}=0V$			$\pm 100$	nA
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	2.6	3.5	4.3	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS}=10V, I_D=14A$		120	149	m $\Omega$
<b>Dynamic Characteristics</b>						
Input Capacitance	$C_{iss}$	$V_{DS}=50V, V_{GS}=0V,$ $F=1.0MHz$		2070		pF
Output Capacitance	$C_{oss}$			120		pF
Reverse Transfer Capacitance	$C_{rss}$			0.5		pF
Total Gate Charge	$Q_g$	$V_{DS}=480V, I_D=28A,$ $V_{GS}=10V$		37.5		nC
Gate-Source Charge	$Q_{gs}$			13		nC
Gate-Drain Charge	$Q_{gd}$			11.5		nC
Intrinsic gate resistance	$R_G$	$f = 1 MHz$ open drain		10		$\Omega$
<b>Switching times</b>						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=380V, I_D=14A,$ $R_G=2.3\Omega, V_{GS}=10V$		14		nS
Turn-on Rise Time	$t_r$			12		nS
Turn-Off Delay Time	$t_{d(off)}$			65		nS
Turn-Off Fall Time	$t_f$			11		nS
<b>Source- Drain Diode Characteristics</b>						
Source-drain current(Body Diode)	$I_{SD}$	$T_c=25^\circ C$			28	A
Pulsed Source-drain current(Body Diode)	$I_{SDM}$				112	A
Forward On Voltage	$V_{SD}$	$T_J=25^\circ C, I_{SD}=28A, V_{GS}=0V$		0.9	1.2	V
Reverse Recovery Time	$t_{rr}$	$T_J=25^\circ C, I_F=14A, di/dt=100A/\mu s$		190		nS
Reverse Recovery Charge	$Q_{rr}$			2		$\mu C$
Peak Reverse Recovery Current	$I_{rrm}$			21		A

Notes 1.Repetitive Rating: Pulse width limited by maximum junction temperature

2.  $T_J=25^\circ C, V_{DD}=50V, V_G=10V, R_G=25\Omega$



TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (curves)

Figure1. Safe operating area

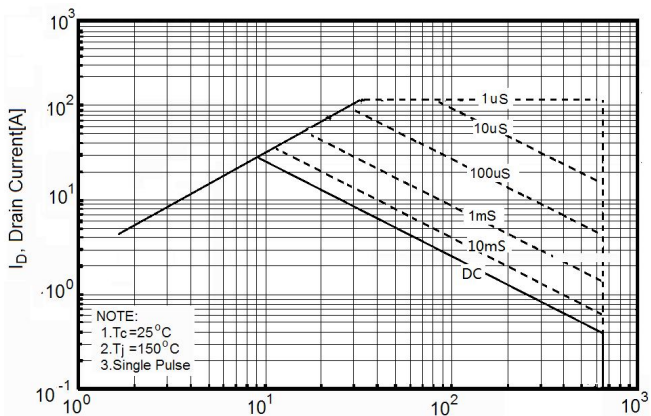


Figure2. Transient Thermal Impedance

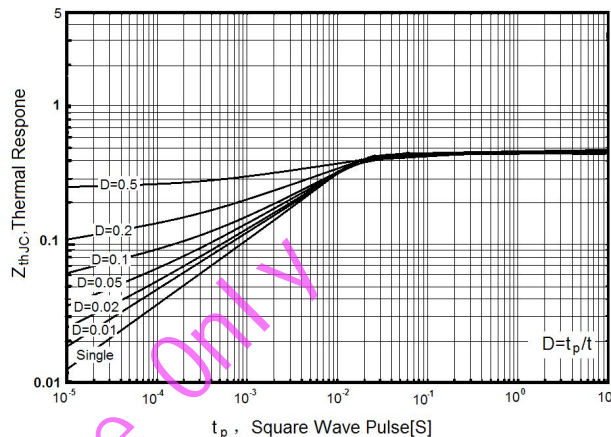


Figure3. Source-Drain Diode Forward Voltage

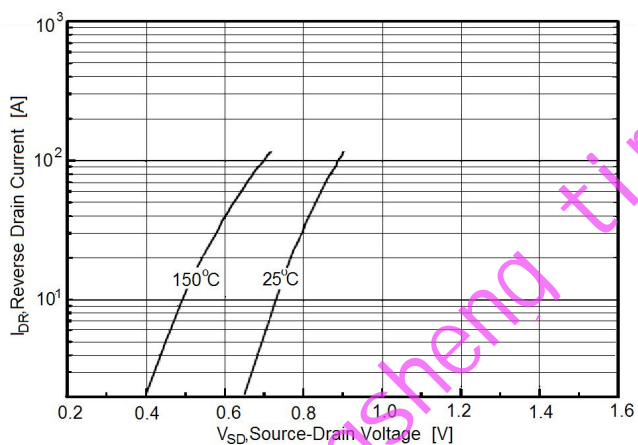


Figure4. Output characteristics

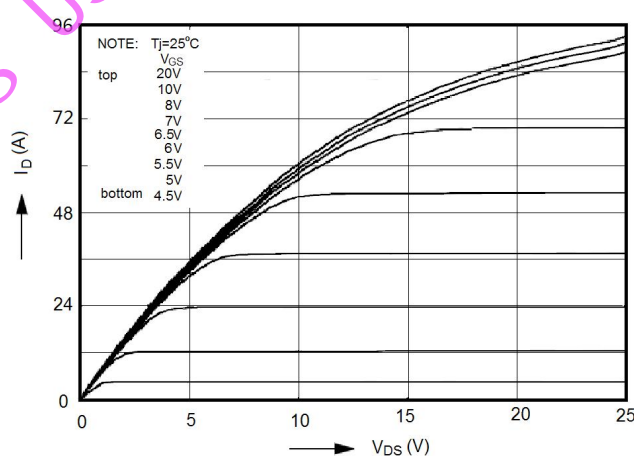


Figure5. Transfer characteristics

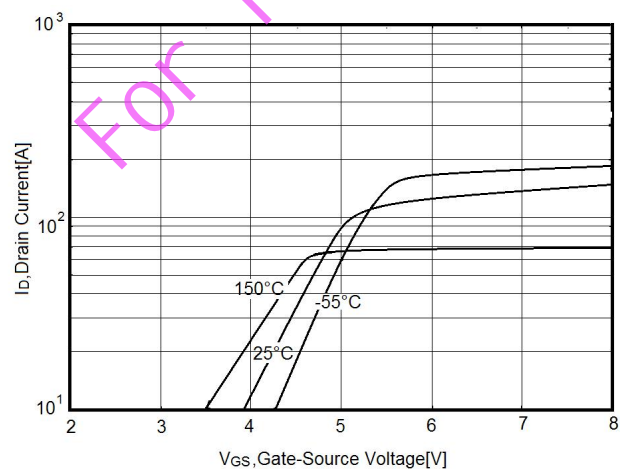
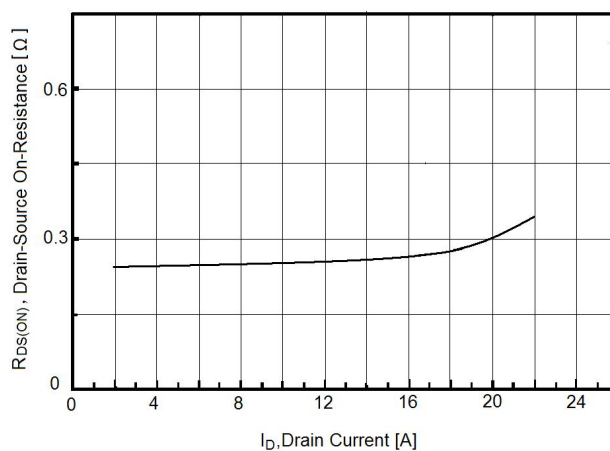
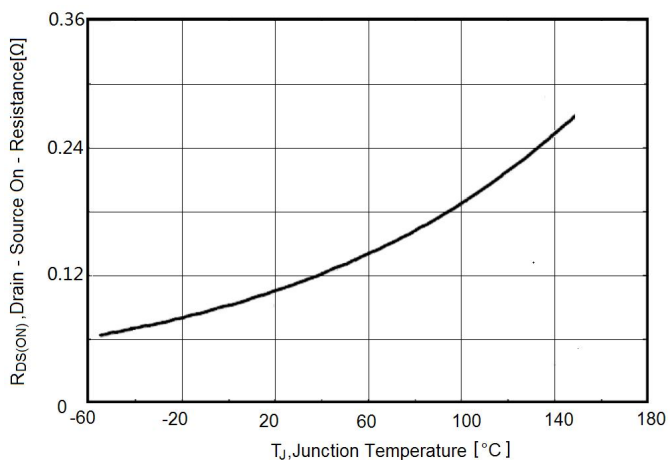


Figure6. Static drain-source on resistance

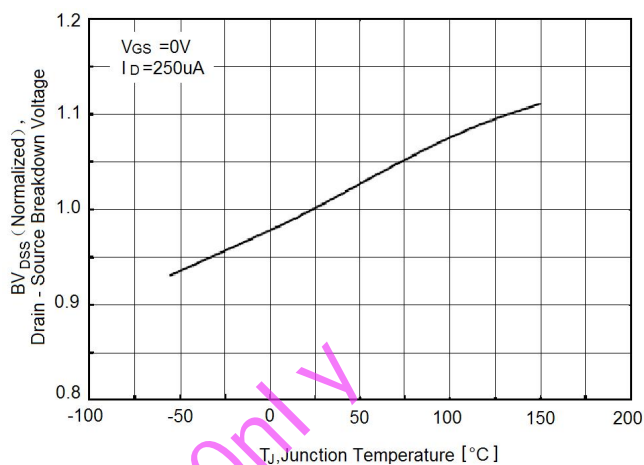




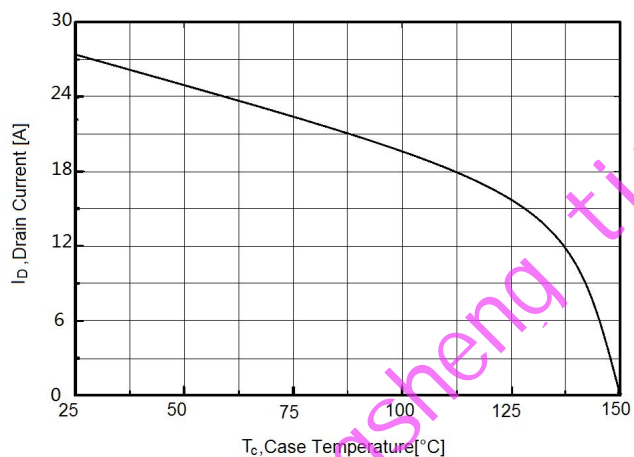
**Figure7.  $R_{DS(on)}$  vs Junction Temperature**



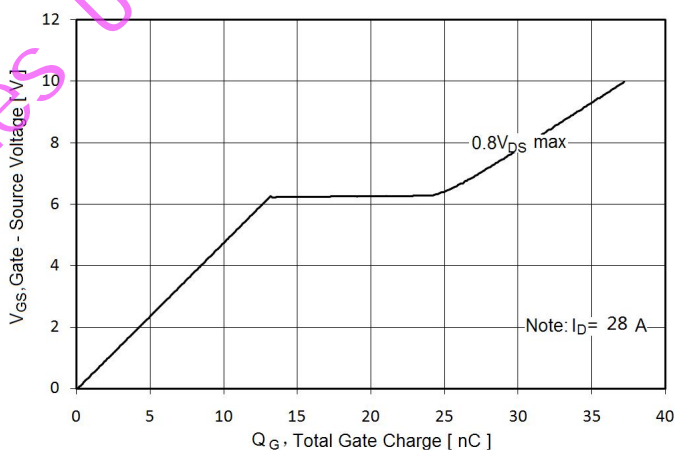
**Figure8.  $BV_{DSS}$  vs Junction Temperature**



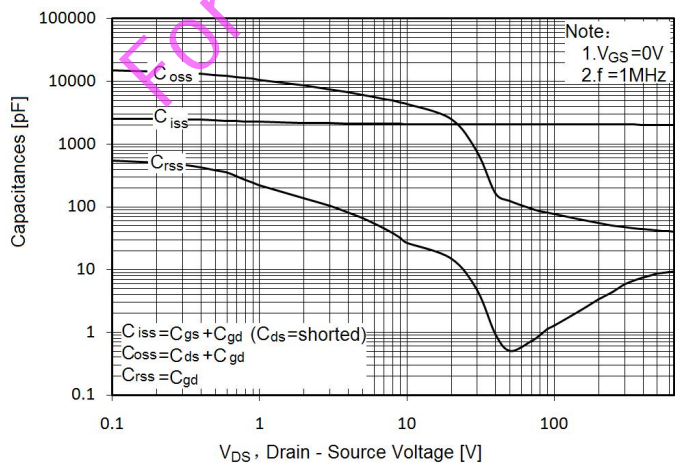
**Figure9. Maximum  $I_D$  vs Junction Temperature**



**Figure10. Gate charge waveforms**



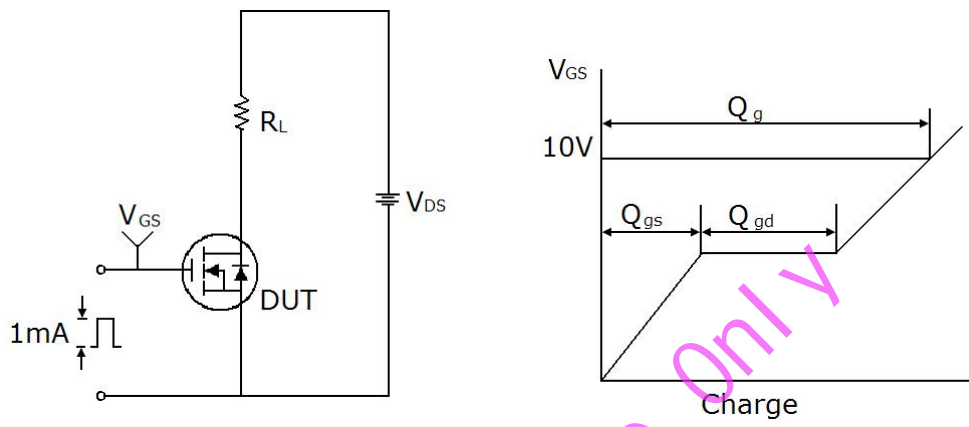
**Figure11. Capacitance**



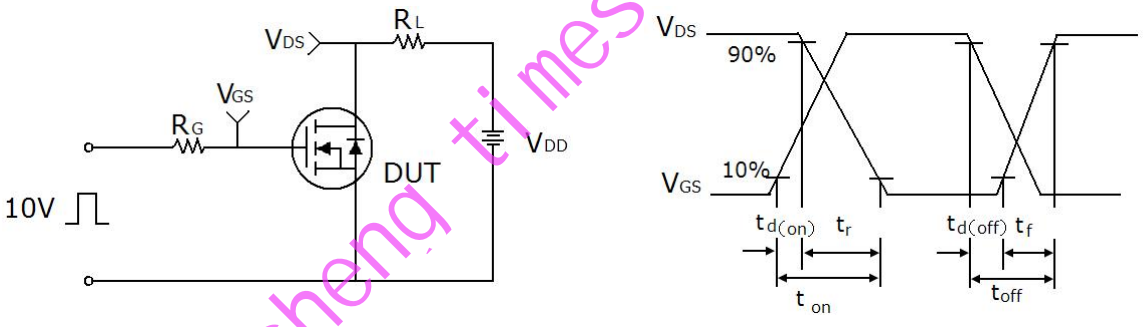


Test circuit

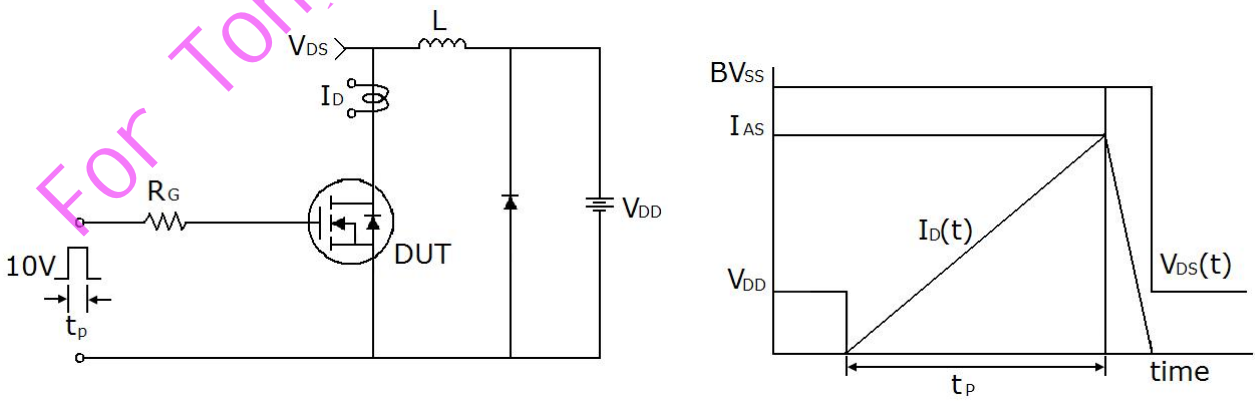
1) Gate charge test circuit & Waveform



2) Switch Time Test Circuit:

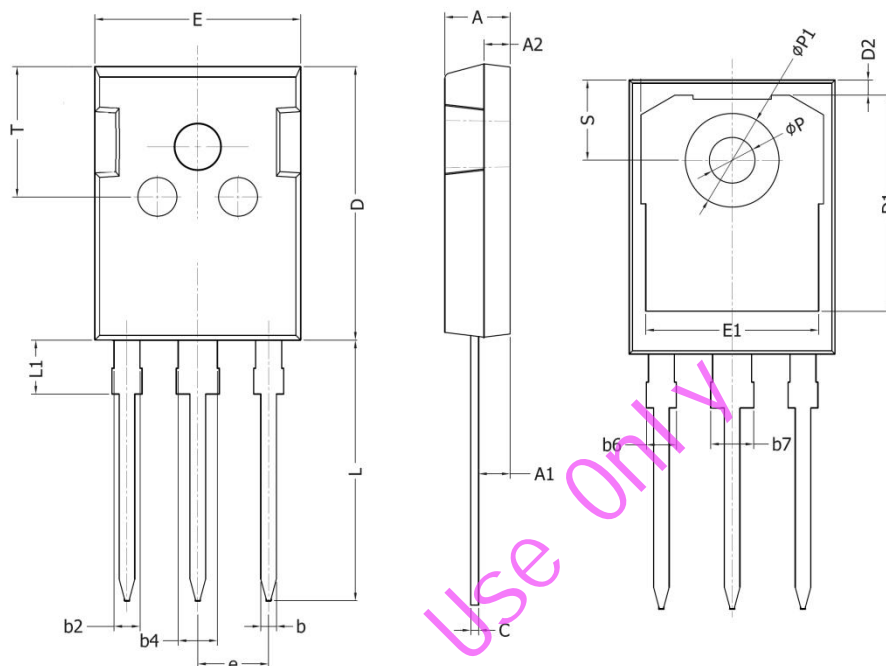


3) Unclamped Inductive Switching Test Circuit & Waveforms





TO-247 (集佳) Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.90	5.10	0.193	0.201
A1	2.31	2.51	0.091	0.099
A2	1.90	2.10	0.075	0.083
b	1.16	1.26	0.046	0.050
b2	1.96	2.06	0.077	0.081
b4	2.96	3.06	0.117	0.120
b6	-	2.25	-	0.089
b7	-	3.25	-	0.128
C	0.59	0.66	0.023	0.026
D	20.90	21.10	0.823	0.831
D1	16.25	16.85	0.640	0.663
D2	1.05	1.35	0.041	0.053
E	15.70	15.90	0.618	0.626
E1	13.10	13.50	0.516	0.531
e	5.436 BSC		0.214 BSC	
L	19.80	20.10	0.780	0.791
L1	-	4.30	-	0.169
P	3.40	3.60	0.134	0.142
P1	7.00	7.40	0.276	0.291
S	6.05	6.25	0.238	0.246
T	9.80	10.20	0.386	0.402

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