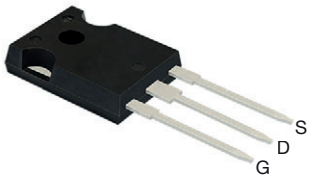
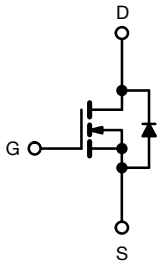
MaxSiC® 1200 V N-Channel SiC MOSFET

TO-247AD 3L





N-Channel MOSFET

Marking Code: Q120C040W

FEATURES

- MaxSiC® 1200 V Gen3 Trench MOSFET
- Fast switching speed
- Short circuit withstand time 2 µs
- AEC-Q101 qualified
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

AUTOMOTIVE GRADE

RoHS COMPLIANT

HALOGEN FREE

APPLICATIONS

- Automotive on board charger
- Automotive DC/DC converter for EV/HEV
- Main inverter (electric traction)

PRODUCT SUMMARY		
V_{DS} (V) at T_J max.	1200	
$R_{DS(on)}$ typ. (mΩ) at 25 °C	V_{GS} = 18 V	40
Q_g typ. (nC)	69	
I_D (A)	53	
C_{oss} typ. (pF)	72	
P_D (W)	288	
Configuration	Single	

ORDERING INFORMATION	
Package	TO-247AD 3L
Lead (Pb)-free and halogen-free	MXPQ120C040W-GE3

ABSOLUTE MAXIMUM RATINGS (T_C = 25 °C, unless otherwise noted)				
PARAMETER		SYMBOL	LIMIT	UNIT
Drain-source voltage		V_{DS}	1200	V
Gate-source voltage		V_{GS}	-10 / +22	
Recommended operation voltage of gate-source		V_{GSOP}	0 / +18	
Continuous drain current	T_C = 25 °C	I_D	53	A
Pulsed drain current [a]		I_{DM}	106	
Short-circuit withstand time [b]		T_{SC}	2	µs
Maximum power dissipation	T_C = 25 °C	P_D	288	W
Operating junction and storage temperature range		T_J, T_{stg}	-55 to +175	°C
Soldering recommendations (peak temperature)	For 10 s		260	°C

Notes

a. Repetitive rating; pulse width limited by maximum junction temperature

b. V_{GS} = 18 V, V_{DS} = 800 V, $R_{g(ext)}$ = 20 Ω, verified by the design / characterization

THERMAL RESISTANCE RATINGS				
PARAMETER	**SYMBOL**	**TYP.**	**MAX.**	**UNIT**
Maximum junction-to-ambient	R_{thJA}	-	40	°C/W
Maximum junction-to-case (drain)	R_{thJC}	-	0.52	

SPECIFICATIONS (T_J = 25 °C, unless otherwise noted)							
PARAMETER	**SYMBOL**	**TEST CONDITIONS**		**MIN.**	**TYP.**	**MAX.**	**UNIT**
Static							
Drain-source breakdown voltage	V_{DS}	V_{GS} = 0 V, I_D = 1 mA		1200	-	-	V
Gate-source threshold voltage (N)	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 5 mA		-	2.9	-	V
		V_{DS} = V_{GS}, I_D = 5 mA, T_J = 175 °C		-	1.8	-	V
Gate-source leakage	I_{GSS}	V_{GS} = 22 V, V_{DS} = 0 V		-	-	100	nA
		V_{GS} = -10 V, V_{DS} = 0 V		-	-	-100	
Zero gate voltage drain current	I_{DSS}	V_{DS} = 1200 V, V_{GS} = 0 V		-	-	10	µA
Drain-source on-state resistance	$R_{DS(on)}$	V_{GS} = 18 V, I_D = 24 A		-	40	54	mΩ
		V_{GS} = 18 V, I_D = 24 A, T_J = 175 °C		-	76	-	
Transconductance	gfs	V_{DS} = 10 V, I_D = 24 A		-	12	-	S
Dynamic							
Input capacitance	C_{iss}	V_{GS} = 0 V, V_{DS} = 800 V, f = 100 KHz		-	1436	-	pF
Output capacitance	C_{oss}			-	72	-	
Reverse transfer capacitance	C_{rss}			-	23	-	
Total gate charge	Q_g	V_{GS} = 0 V ~ 18 V, I_D = 24 A, V_{DS} = 800 V		-	69	-	nC
Gate-source charge	Q_{gs}			-	14	-	
Gate-drain charge	Q_{gd}			-	28	-	
Gate Resistance	R_g	V_{DS} = 0 V, f = 1 MHz		-	3.5	-	Ω
Switching Characteristics							
Turn-on delay time	$t_{d(on)}$	V_{GS} = 0 V ~ 18 V, I_D = 24 A, V_{DS} = 800 V, $R_{g(ext)}$ = 4.4 Ω	T_J = 25 °C	-	24	-	ns
			T_J = 175 °C	-	23	-	
Rise time	t_r		T_J = 25 °C	-	23	-	
			T_J = 175 °C	-	21	-	
Turn-off delay time	$t_{d(off)}$		T_J = 25 °C	-	24	-	
			T_J = 175 °C	-	28	-	
Fall time	t_f		T_J = 25 °C	-	18	-	
			T_J = 175 °C	-	20	-	
Turn-on switching energy	E_{on}		T_J = 25 °C	-	453	-	µJ
			T_J = 175 °C	-	418	-	
Turn-off switching energy	E_{off}		T_J = 25 °C	-	233	-	
			T_J = 175 °C	-	281	-	
Body Diode Ratings and Characteristic							
Forward diode voltage	V_{SD}	V_{GS} = 0 V, I_{SD} = 12 A, T_J = 25 °C		-	3.2	-	V
Continuous diode forward current	I_{SD}	V_{GS} = 0 V, T_J = 25 °C		-	-	50	A
Pulsed diode forward current	I_{SDM}			-	-	106	
Reverse recovery time	t_{rr}	V_{GS} = -5 V, I_{SD} = 24 A, V_R = 800 V, di/dt = 1000 A/µs		-	65	-	ns
Reverse recovery charge	Q_{rr}			-	19	-	nC
Reverse recovery current	I_{RRM}			-	5	-	A

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

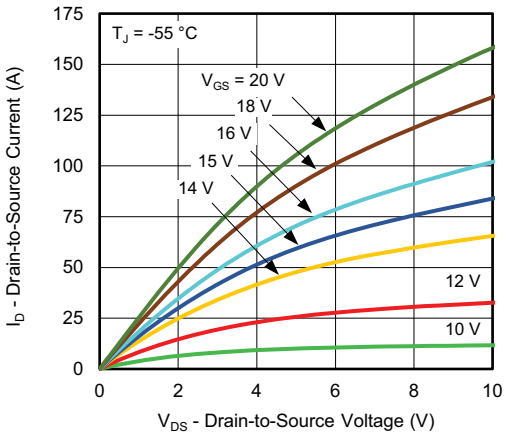


Fig. 1 - Typical Output Characteristics

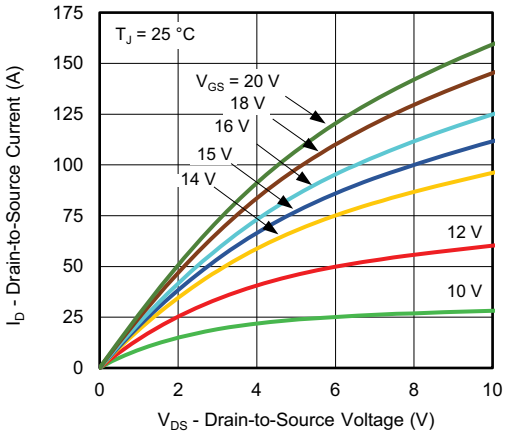


Fig. 2 - Typical Output Characteristics

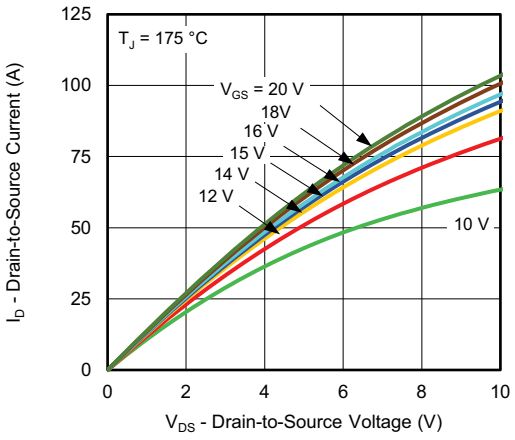


Fig. 3 - Typical Output Characteristics

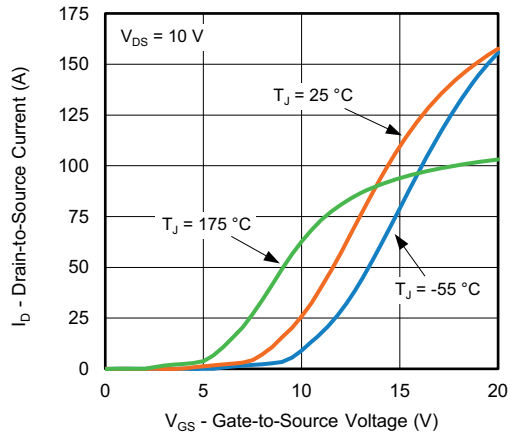


Fig. 4 - Typical Transfer Characteristics

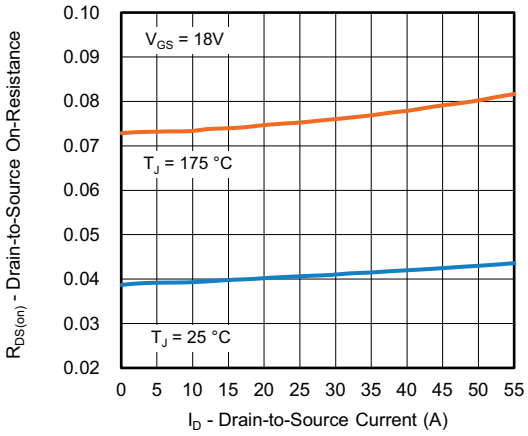


Fig. 5 - Normalized On-Resistance vs. Drain Current

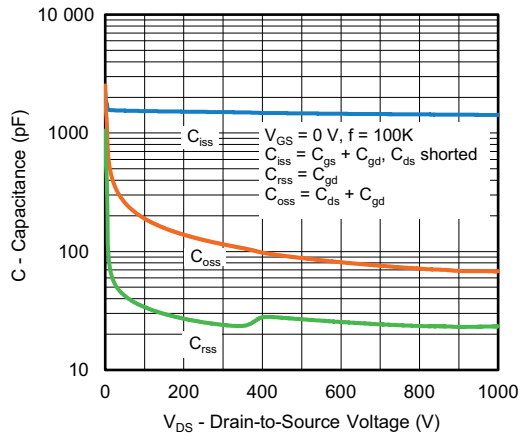


Fig. 6 - Typical Capacitance vs. Drain-to-Source Voltage

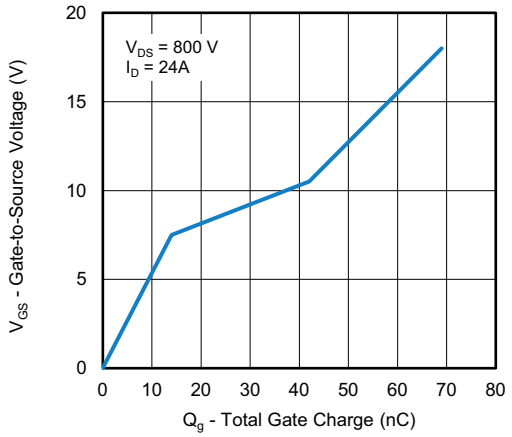


Fig. 7 - Typical Gate Charge vs. Gate-to-Source Voltage

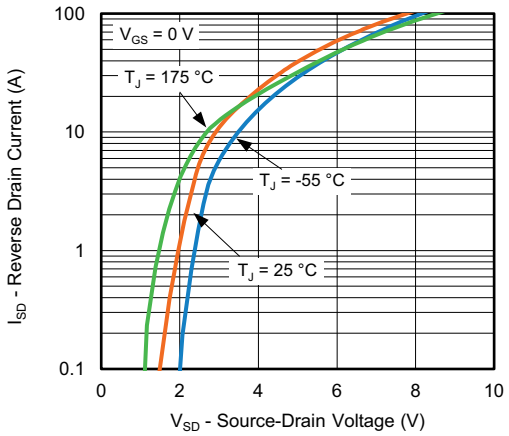


Fig. 10 - Typical Source-Drain Diode Forward Voltage

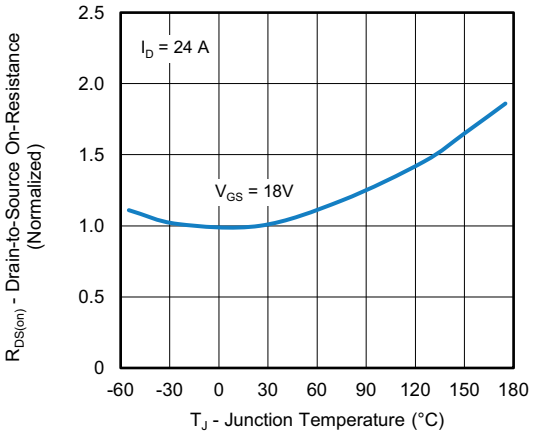


Fig. 8 - Normalized On-Resistance vs. Temperature

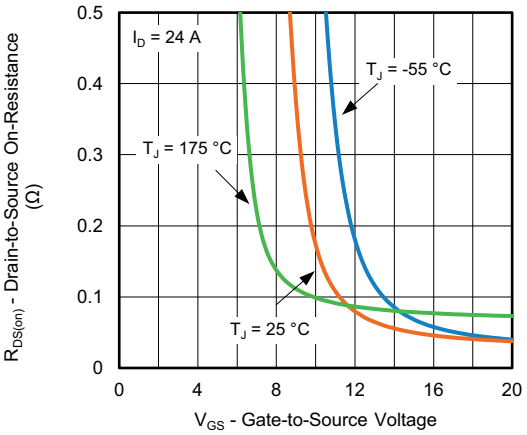


Fig. 11 - On-Resistance vs. Gate-to-Source Voltage

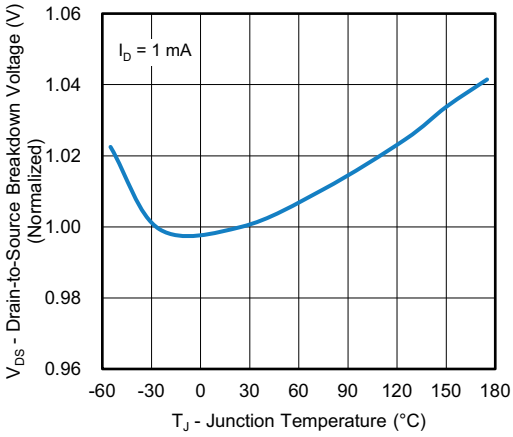


Fig. 9 - Drain-to-Source Voltage vs. Temperature

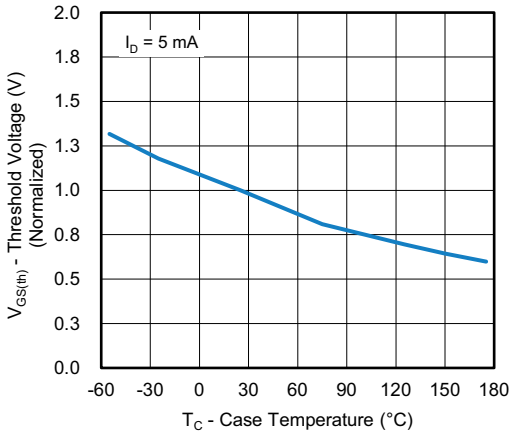


Fig. 12 - Threshold Voltage vs. Case Temperature

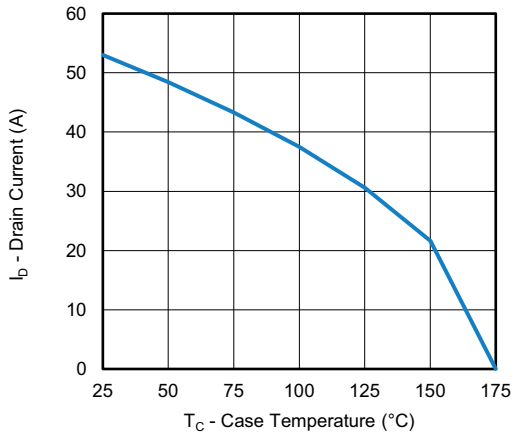


Fig. 13 - Drain Current vs. Case Temperature

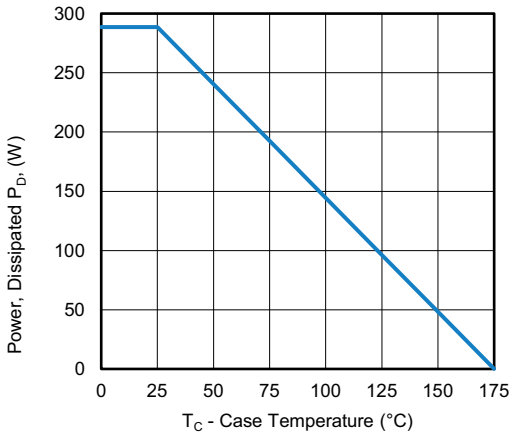


Fig. 15 - Power, Dissipated P_D vs. Case Temperature

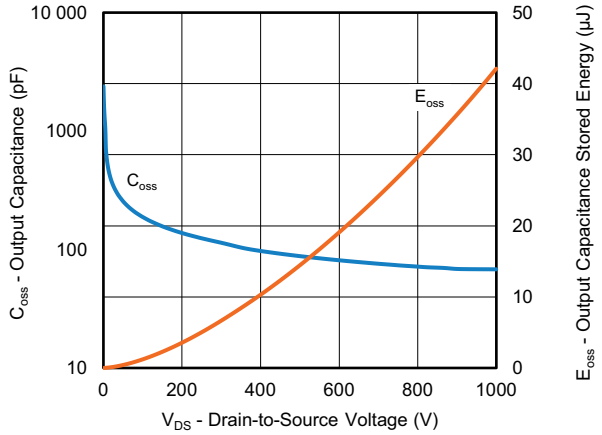


Fig. 14 - Output Capacitance and its Stored Energy vs. Drain-to-Source Voltage

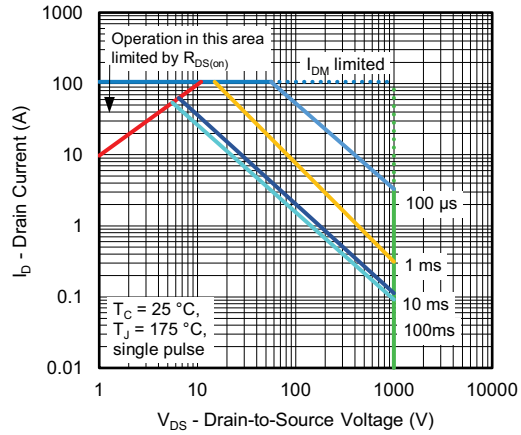


Fig. 16 - Safe Operating Area

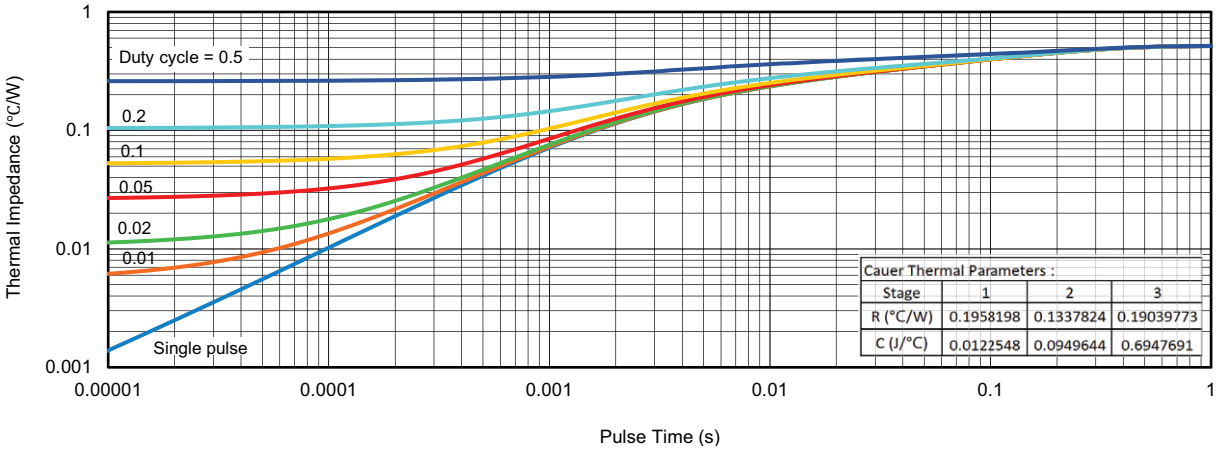


Fig. 17 - Transient Thermal Impedance

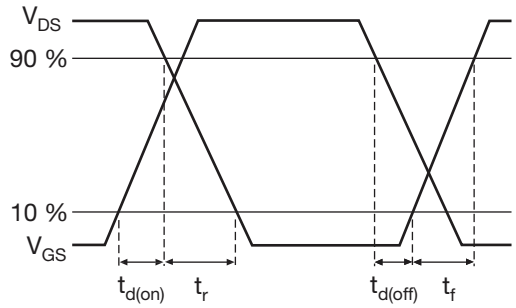


Fig. 18 - Waveforms of Switching Time

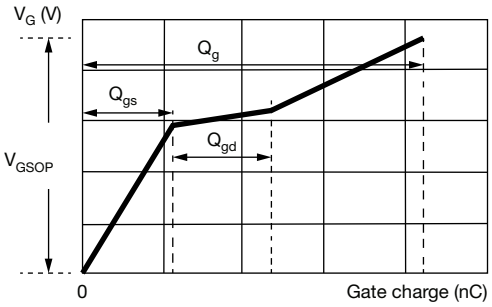


Fig. 21 - Waveforms for Gate Charge

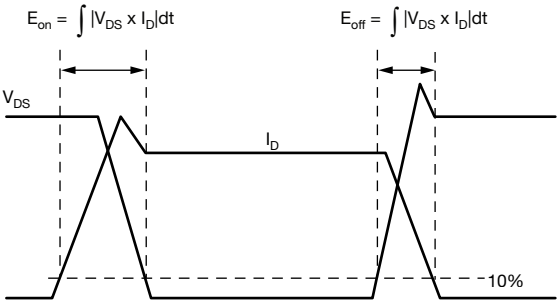


Fig. 19 - Waveforms for Switching Energy

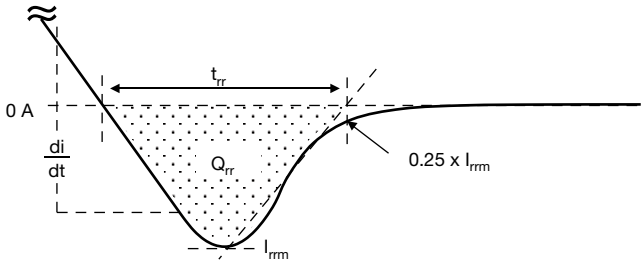


Fig. 22 - Waveforms for Reverse Recovery

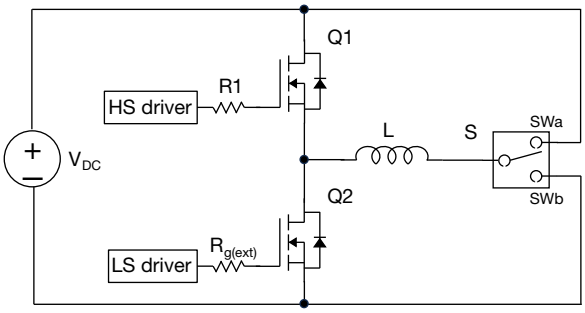


Fig. 20 - Switching and Reverse Diode Characteristics Measurement Circuit

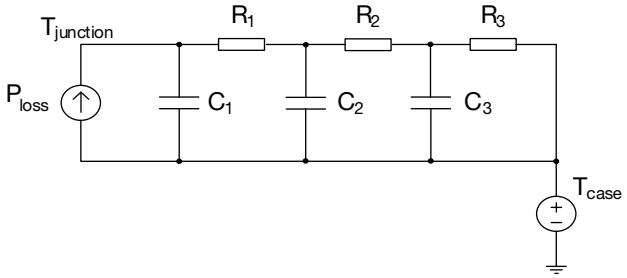


Fig. 23 - Thermal Equivalent Circuit

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