IceMOS Technology

Preliminary
ICE31M120W4

ICE31M120W4
Silicon Carbide Power MOSFET

Product Summary			
I_D	T_A=25°C	57A	Max
$V_{(BR)DSS}$	T_C=25°C	1200V	Min
$r_{DS(on)}$	V_{GS}=18V	30.4mΩ	Typ
Q_g	V_{DS}=800V	63nC	Typ

Features

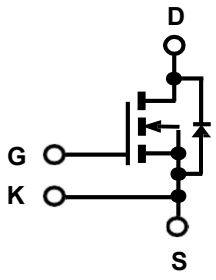
- 1200V 30.4mohm SiC MOSFET
- High blocking voltage with low on resistance
- High-speed switching with low capacitances
- Fast Reverse Recovery
- Optimized design for high performance power systems

RoHS COMPLIANT RoHS (EU) 2015/863

CE

HALOGEN FREE

Pb Lead Free



TO247-4L

1: D, 2: S, 3: K, 4: G

Maximum ratings [a] , at T_j=25°C, unless otherwise specified

Parameter	*Symbol*	*Conditions*	*Value*	*Unit*
Continuous drain current	I_D	T_c=25°C	57	A
		T_c=100°C	40	
Pulsed drain current	$I_{D, pulse}$		198	A
Maximum gate source voltage	$V_{GS(max)}$		-10/+22	V
Operational gate source voltage	$V_{GS\ op}$		-5/+18	V
Power dissipation	P_{tot}	T_c=25°C	234	W
		T_c=100°C	117	
Storage temperature	T_{stg}		-55 to +150	°C
Operating temperature	T_j		-55 to +175	°C

a Pulse width limited by Tjmax

Parameter	Symbol	Conditions	Values			Unit
			Min	Typ	Max	
Thermal characteristics						
Thermal resistance, junction-case	R_{thJC}		-	-	0.64	°C/W
Soldering temperature, wave soldering only allowed at leads	T_{sold}	1.6mm (0.063in.) from case for 10 s	-	-	260	°C

Electrical characteristics [a], at T_j=25°C, unless otherwise specified

Static characteristics						
Drain-source breakdown voltage	$V_{(BR)DSS}$	V_{GS}=0V, I_D=250μA	1200	-	-	V
Gate threshold voltage	$V_{GS(th)}$	V_{DS}=V_{GS}, I_D=11mA, T_j=25°C	2	3.0	4	V
		V_{DS}=V_{GS}, I_D=11mA, T_j=175°C	-	2.2	-	V
Zero gate voltage drain current	I_{DSS}	V_{DS}=1200V, V_{GS}=0V, T_j=25°C	-	0.1	50	μA
		V_{DS}=1200V, V_{GS}=0V, T_j=175°C	-	1	-	μA
Gate source leakage current	I_{GSS}	V_{GS}=-10/+22V, V_{DS}=0V	-	-	±100	nA
Drain-source on-state resistance	$R_{DS\ (on)}$	V_{GS}=18V, I_D=40A, T_j=25°C	-	30.4	40	mΩ
		V_{GS}=18V, I_D=40A, T_j=175°C	-	54	-	mΩ
Gate resistance	R_G	f=1 MHz, V_{AC}=30mV	-	2.4	-	Ω
Dynamic characteristics						
Input capacitance	C_{iss}	V_{DS}=800V, V_{GS}=0V, f=100 kHz, V_{AC}=30mV	-	2338	-	pF
Output capacitance	C_{oss}		-	96	-	pF
Reverse transfer capacitance	C_{rss}		-	4.1	-	pF
C_{OSS} stored energy	E_{oss}		-	37	-	μJ
Forward transconductance	g_{FS}	V_{DS}=20V, I_D=40A	-	28	-	S
Turn-on delay time	$t_{d(on)}$	V_{DS}=800V, V_{GS}=-5/+18V, I_D=40A, R_G=4.7Ω (External), T_j=25°C	-	10	-	ns
Rise time	t_r		-	15	-	ns
Turn-off delay time	$t_{d(off)}$		-	19	-	ns
Fall time	t_f		-	10	-	ns
Turn-on switching energy	E_{ON}		-	293	-	μJ
Turn-off switching energy	E_{OFF}		-	15	-	μJ

Parameter	Symbol	Conditions	Values			Unit
			Min	Typ	Max	
Dynamic characteristics						
Turn-on delay time	$t_{d(on)}$	V_{DS}=800V, V_{GS}=-5/+18V, I_D=40A, R_G=4.7Ω (External), T_j=175°C	-	9	-	ns
Rise time	t_r		-	19	-	
Turn-off delay time	$t_{d(off)}$		-	23	-	
Fall time	t_f		-	10	-	
Turn-on switching energy	E_{ON}		-	456	-	µJ
Turn-off switching energy	E_{OFF}		-	15	-	
Gate Charge Characteristics						
Gate to source charge	Q_{gs}	V_{DS}=800V, I_D=40A, V_{GS}=-5 to +18V	-	19	-	nC
Gate to drain charge	Q_{gd}		-	21	-	
Gate charge total	Q_g		-	63	-	
Reverse Diode						
Continuous forward current	I_S	V_{GS}=-5V	-	57	-	A
Diode forward voltage	V_{SD}	V_{GS}=-5V, I_{SD}=20A, T_j=25°C	-	4.0	-	V
		V_{GS}=-5V, I_{SD}=20A, T_j=175°C	-	3.5	-	
Reverse recovery time	t_{rr}	V_{GS}=-5V, V_{RR}=800V, I_{SD}=40A, d_{iF}/d_t=10.7 kA/µs, T_j=25°C	-	8	-	ns
Reverse recovery charge	Q_{rr}		-	217	-	nC
Peak reverse recovery current	I_{rm}		-	42	-	A
Reverse recovery time	t_{rr}	V_{GS}=-5V, V_{RR}=800V, I_{SD}=40A, d_{iF}/d_t=12.6 kA/µs, T_j=175°C	-	15	-	ns
Reverse recovery charge	Q_{rr}		-	806	-	nC
Peak reverse recovery current	I_{rm}		-	78	-	A

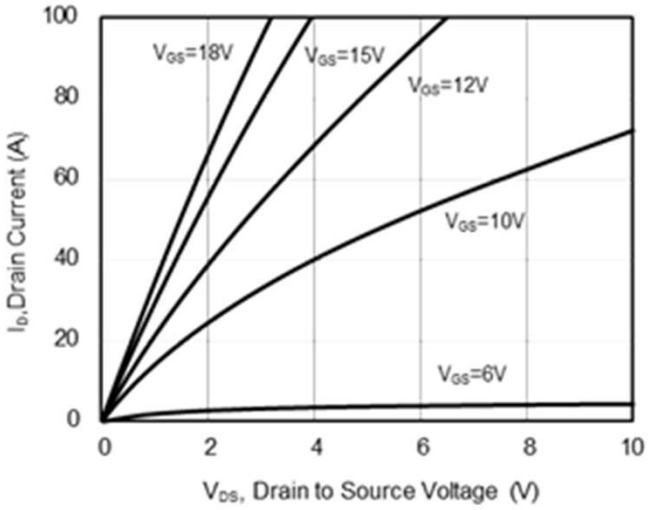


Fig 1. Output Characteristics, T_j=25°C

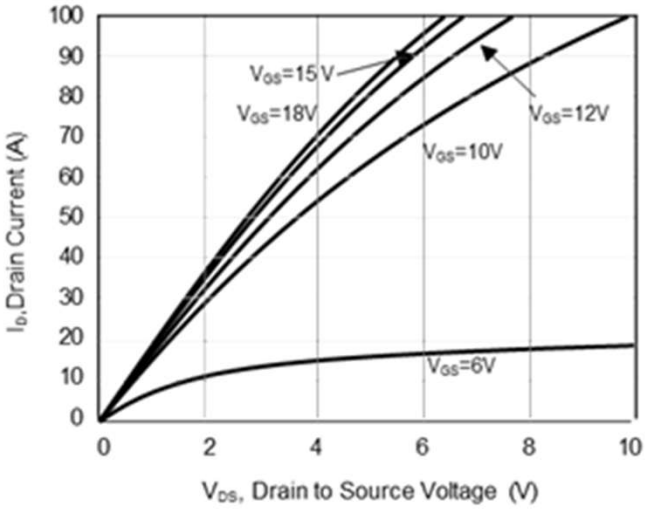


Fig 2. Output Characteristics, T_j=175°C

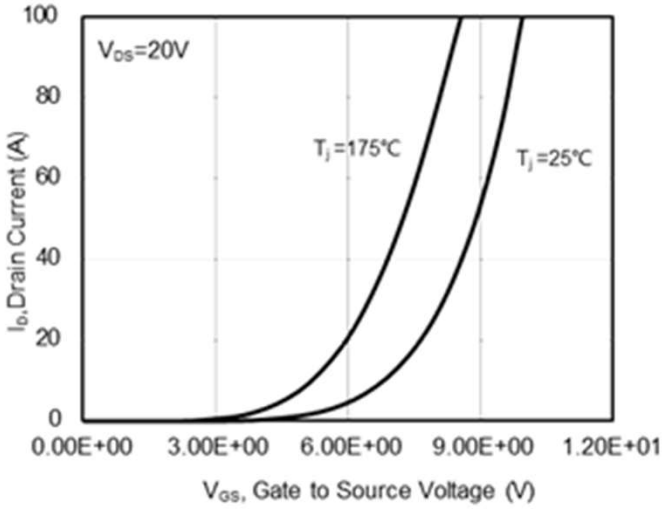


Fig 3. Transfer Characteristics

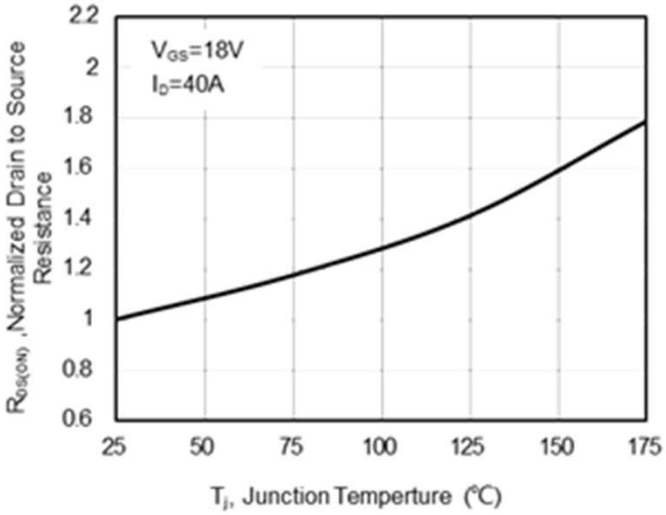


Fig 4. On-Resistance Variation with Temperature

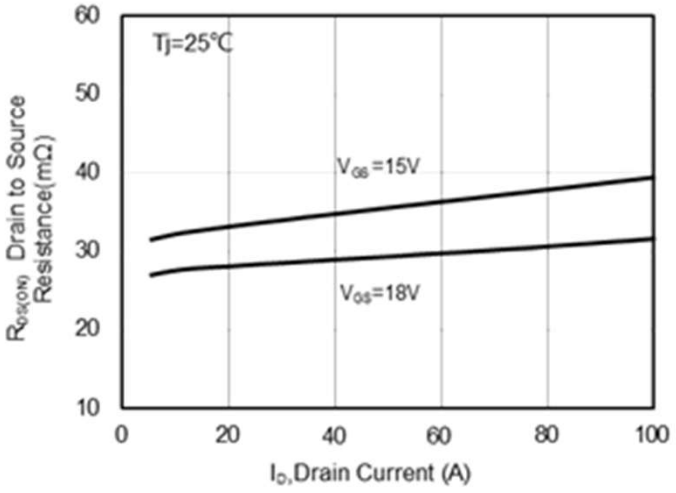


Fig 5. On-Resistance vs Drain Current

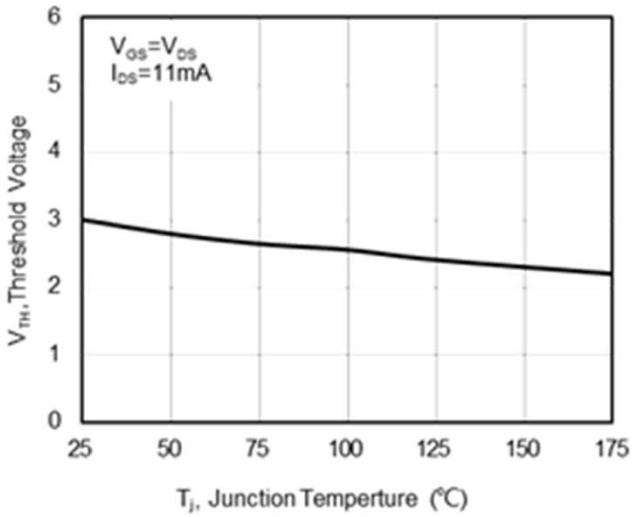


Fig 6. Gate Threshold vs Temperature

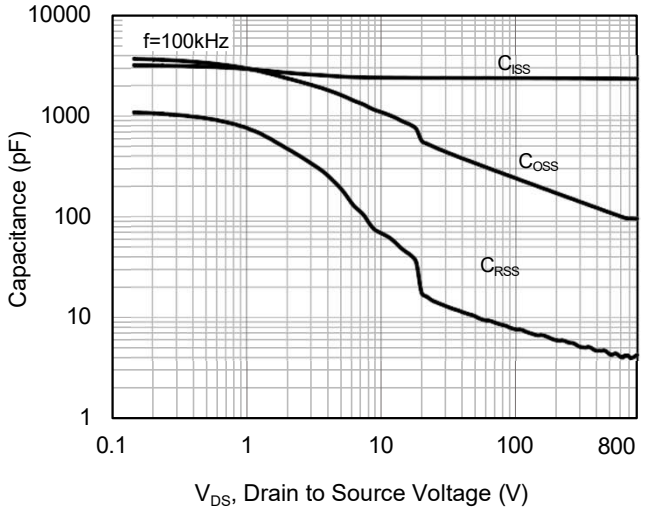


Fig 7. Capacitance Characteristics

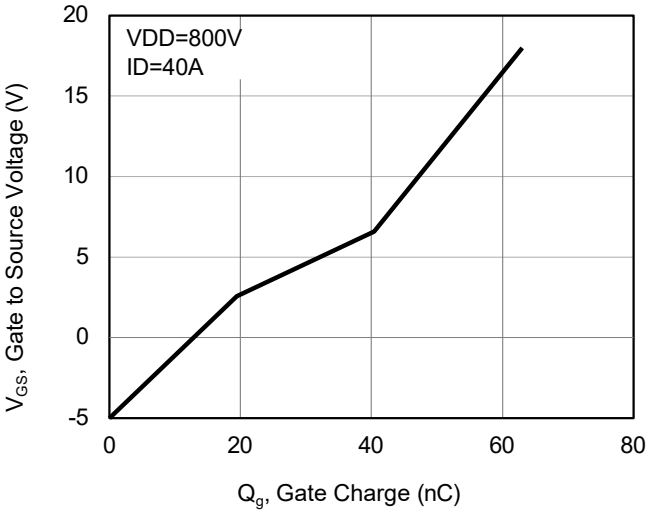


Fig 8. Gate Charge Characteristics

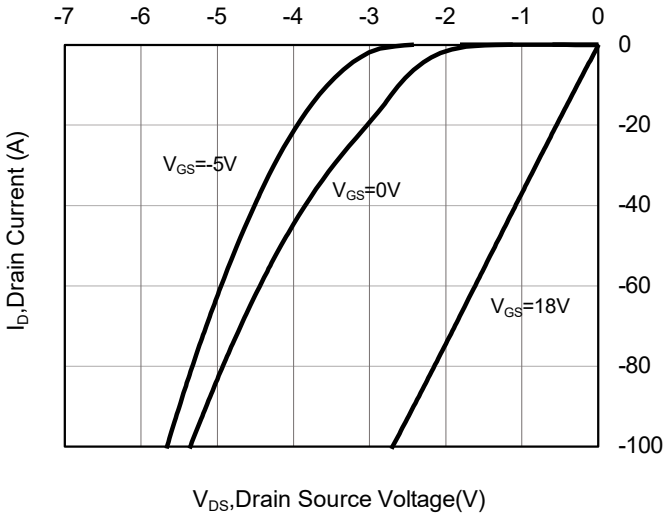


Fig 9. 3rd Quadrant Characteristic at 25 ºC

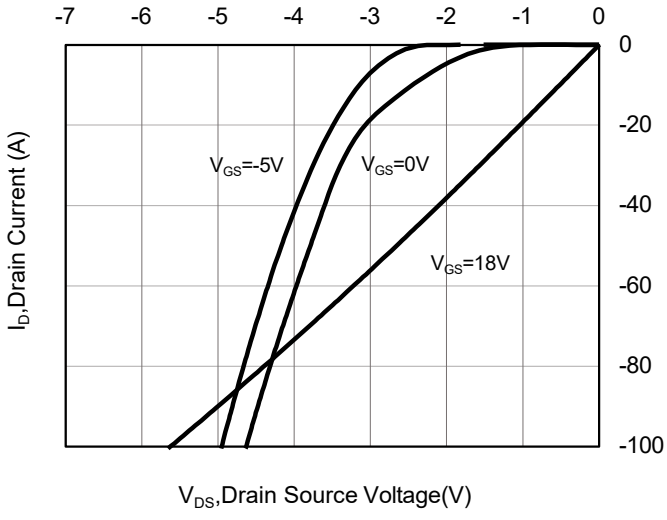
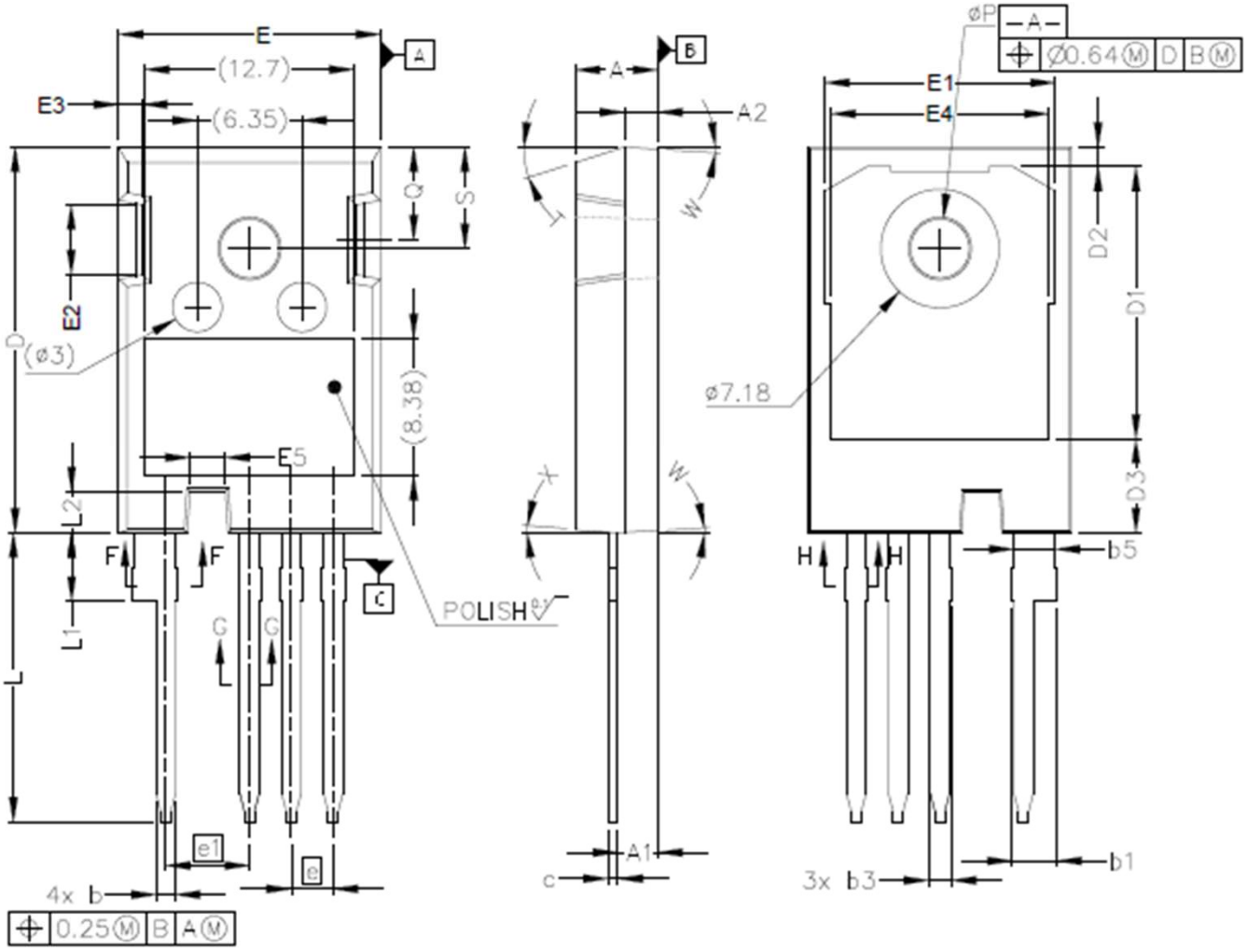
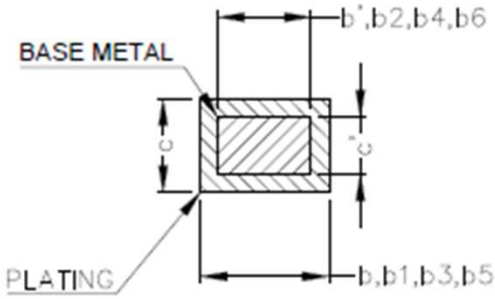


Fig 10. 3rd Quadrant Characteristic at 175 ºC

Package Outline: TO-247-4L





SECTION "F-F", "G-G" AND "H-H"
SCALE: NONE

Package Outline: TO-247-4L

NOTE ;
1. ALL METAL SURFACES: TIN PLATED,EXCEPT AREA OF CUT
2. DIMENSIONING & TOLERANCEING CONFIRM TO ASME Y14.5M-1994.
3. ALL DIMENSIONS ARE IN MILLIMETERS. ANGLES ARE IN DEGREES.

SYMBOL	MILLIMETERS	
	MIN	MAX
A	4.83	5.21
A1	2.29	2.54
A2	1.91	2.16
b'	1.07	1.28
b	1.07	1.33
b1	2.39	2.94
b2	2.39	2.84
b3	1.07	1.60
b4	1.07	1.50
b5	2.39	2.69
b6	2.39	2.64
c'	0.55	0.65
c	0.55	0.68
D	23.30	23.60
D1	16.25	17.65
D2	0.95	1.25
D3	5.55	6.15
E	15.75	16.13
E1	13.10	14.15
E2	3.68	5.10
E3	1.00	1.90
E4	12.38	13.43
E5	1.95	2.35
e	2.54 BSC	
e1	5.08 BSC	
N	4	
L	17.31	17.82
L1	3.97	4.37
L2	2.35	2.65
øP	3.51	3.65
Q	5.49	6.00
S	6.04	6.30
T	17.5° REF.	
W	3.5 ° REF.	
X	4° REF.	

Marking Information

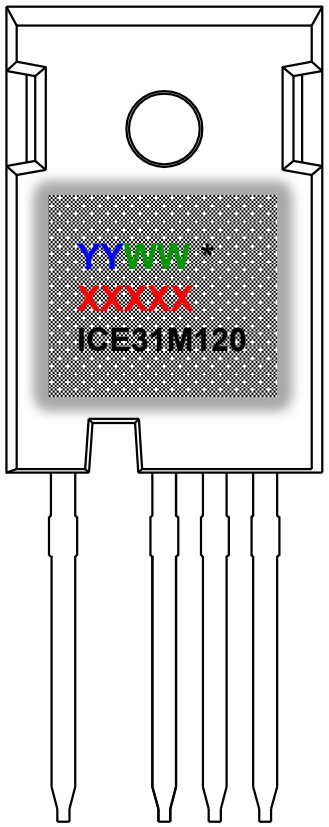
YY = Last two digits of the year

WW = Work week

***** = Site ID

XXXXX = Lot ID

ICE31M120 = ICE is IceMOS logo and 31M120 is a designated device part number



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