

C2M0040120D

Transition Guide

Wolfspeed  SEPTEMBER 2024

C2M → C3M | TRANSITION BENEFITS

- C3M family of SiC MOSFETs offer a range of improvements over the older C2M family.
- For existing designs, a recommended C3M replacement part is provided along with parameter comparisons and application considerations
- New designs can utilize C3M devices in a wide array of packages to offer increased design flexibility and system optimization

Performance Benefits

- Reduction in reverse recovery charge
- Reduced gate oscillation due to improved C_{iss}/C_{rss} ratio
- Comparable switching losses
- Improved/comparable thermal performance
- Improved/comparable efficiency

MOSFETs

D



TO-247-3
(Std. Package)

K



TO-247-4
(Kelvin Lead)

K1



TO-247-4 LP
(Kelvin Lead Low Profile)

J



TO-263-7
(Smaller Drain Footprint)

J1



TO-263-7 XL
(Larger Drain Footprint)

J2



TO-263-7 XL
(Automotive Qualified Pkg.)

L



TOLL
(Small Footprint)

T



TOLT
(TSC TOLL)

U2

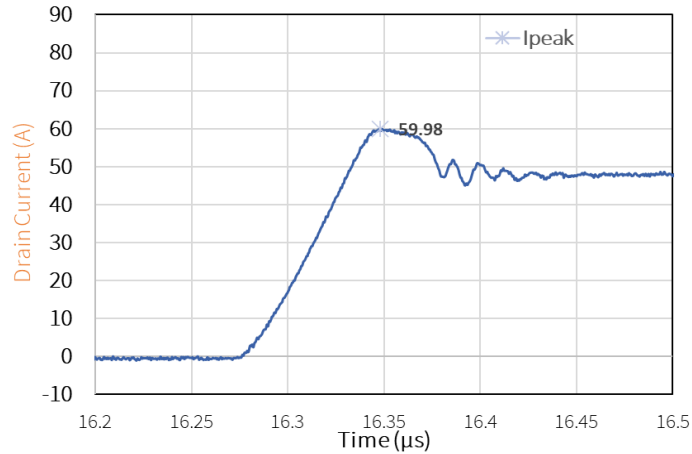
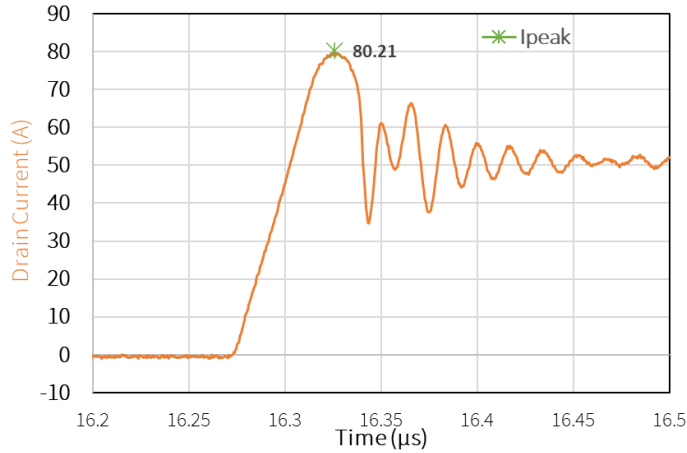


Top Side Cooled
(TSC Medium Profile)

Versatile package availability in C3M. C2M only available in TO-247-3 package

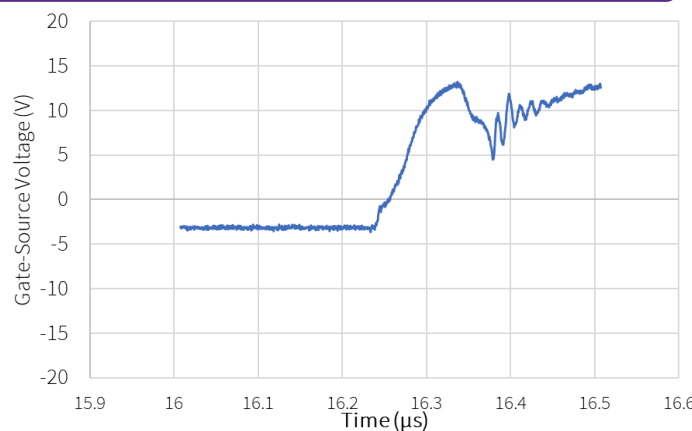
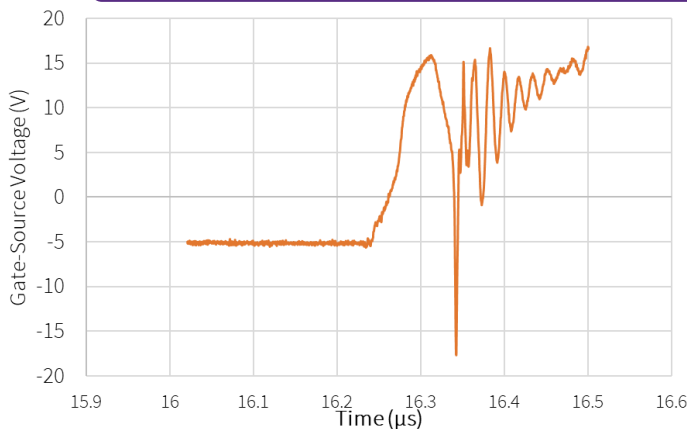
C2M → C3M | TRANSITION BENEFITS

I_{DS} at turn-on



- ✓ Reduced peak recovery current
- ✓ Reduced Q_{rr}
- ✓ Softer body diode
- ✓ Reduction in ringing
- ✓ Improved EMI performance

V_{GS} at turn-on



- ✓ Ciss/Crss ratio improvement reduces gate oscillation
- ✓ Increased margin allows for more aggressive switching speeds to reduce E_{ON} & E_{OFF}

C2M


C3M

GATE DRIVE VOLTAGE CHANGE

- C3M generation has been optimized for 15V gate operation
 - **Do not operate C3M devices with 18 or 20V gate drive levels**
- Improved capacitance ratios and body diode performance result in lower gate voltage transients during switching
- Application note [PRD-04814](#) provides a detailed design guide for gate bias supplies to support multiple gate voltage levels
- The gate drive circuit should be adjusted to meet the recommended levels for the C3M family when transitioning to the new MOSFET

	C2M Family	C3M Family	Notes
Recommended Turn-On V_{GS} (V)	+20	+15	
Recommended Turn-Off V_{GS} (V)	-5	-4..-2 -4..0	For half-bridge based topologies For single switch topologies (flyback, buck, boost)
Absolute max V_{GS} (V)	25	19	For transient overshoots
Absolute min V_{GS} (V)	-10	-8	For transient overshoots

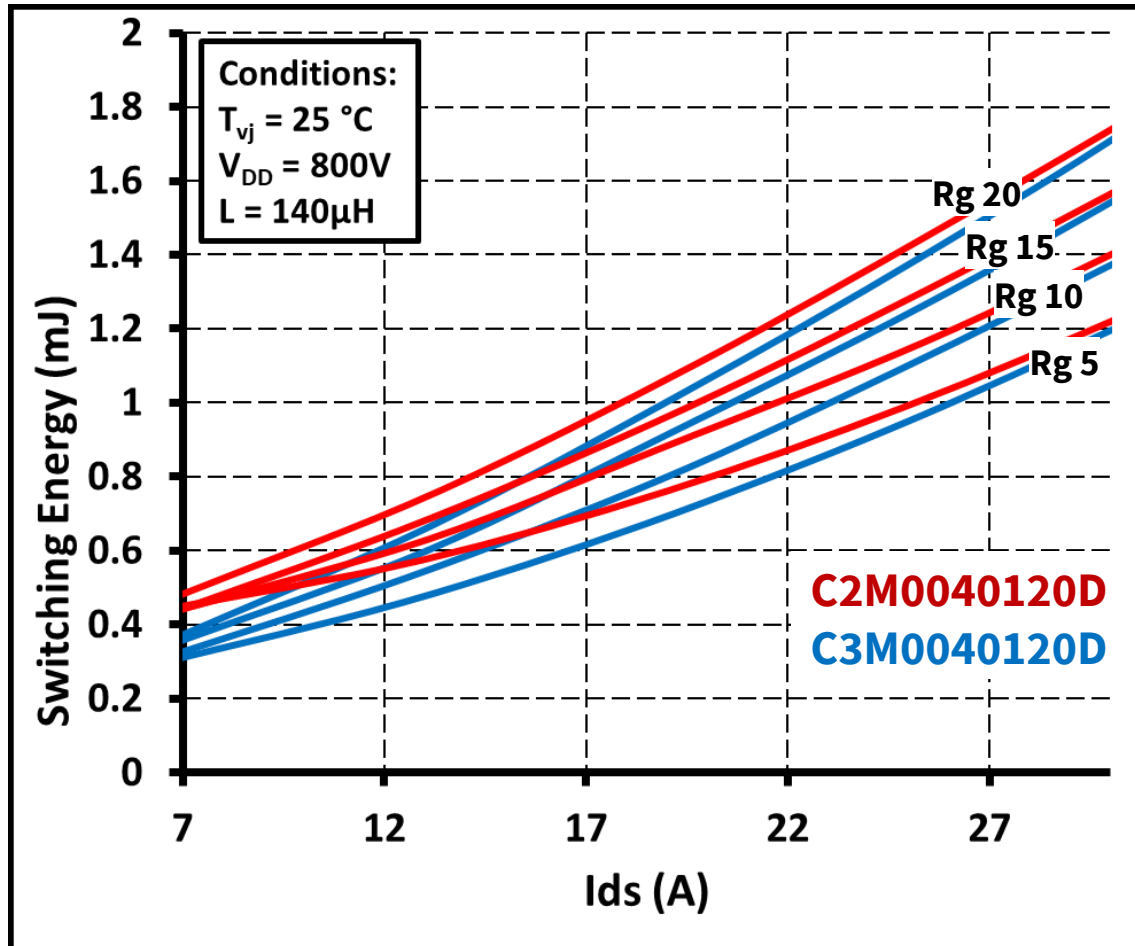
SUGGESTED REPLACEMENT

	C2M0040120D	C3M0040120D	Notes
Status	EOL issued Oct 2024	Active	C3M part qualified on 200mm. Samples & production available now.
$V_{DS\ max}$ (V)	1200	1200	
V_{GS} (V)	-5/+20	-4/+15	See following slide for gate voltage recommendations
I_D (A)	55	66	
$R_{DS(ON)}$ (m Ω)	44	40	
C_{OSS} (pF)	171	103	Reduced output capacitance improves switching speed
C_{iss}/C_{rss}	222	580	Reduced impact of miller capacitance
Q_G (nC)	120	101	Reduced gate drive power
$R_{G(int)}$ (Ω)	1.8	3.5	
$R_{\theta JC}$ (C/W)	0.33	0.46	Higher thermal impedance may be offset with improved efficiency
Package	TO-247-3	TO-247-3	Fully Compatible
Pricing			Improved price

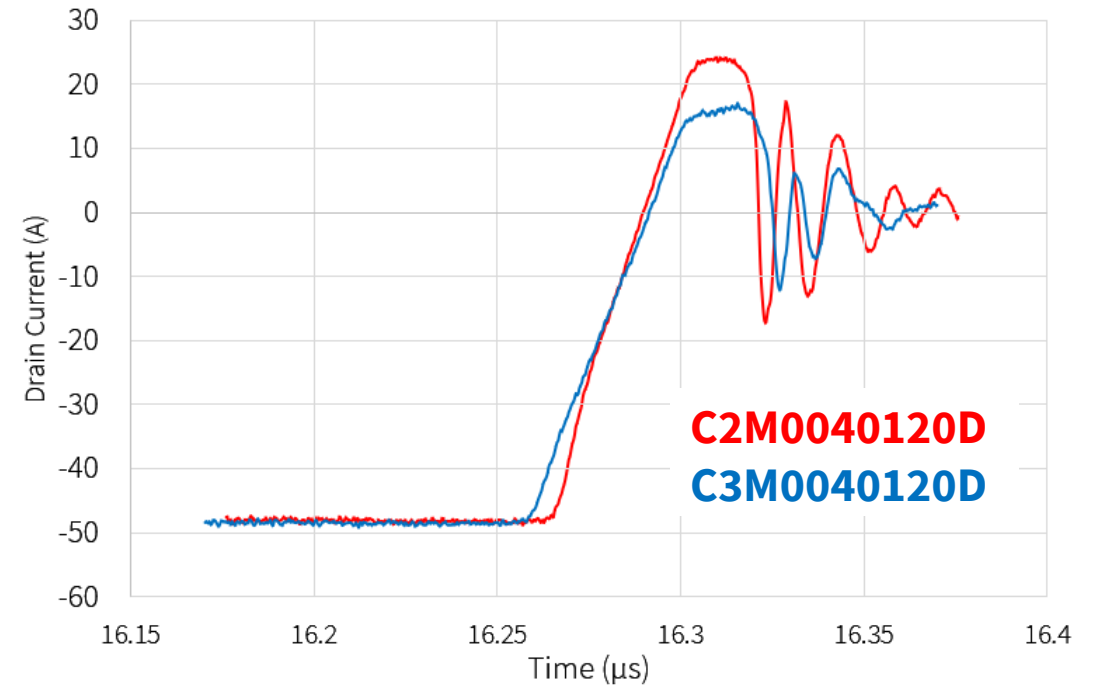
All parameters are typical values at 25 °C unless noted

SWITCHING COMPARISON

Switching loss data shows improved losses for all values of $R_{G(EXT)}$ with the most improvement at low to moderate current levels



Improved body diode behavior on C3M0040120D demonstrates lower Q_{rr} and improved softness for lower EMI



NEXT STEPS

- Samples of recommended replacements available through your [Wolfspeed sales team](#), or at our online [Sample Center](#)
- Ask any technical questions to your Wolfspeed FAE or through our [Power Applications Forum](#)
- Utilize [SpeedFit™](#) to simulate the performance of the recommended replacement devices
 - Keep in mind, dynamic behavior may be different, requiring a different gate resistor value
- The [SpeedVal™ Kit](#) evaluation platform may be utilized to compare the performance and switching behavior

A large, stylized grey graphic of a wolf's head in profile, facing right, serves as a background for the text. The graphic is composed of several overlapping, angular shapes that define the snout, eye, and ear area.

THANK YOU