

C2M0025120D

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



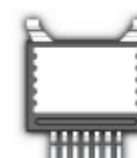
TOLL
(Small Footprint)

T



TOLT
(TSC TOLL)

U2

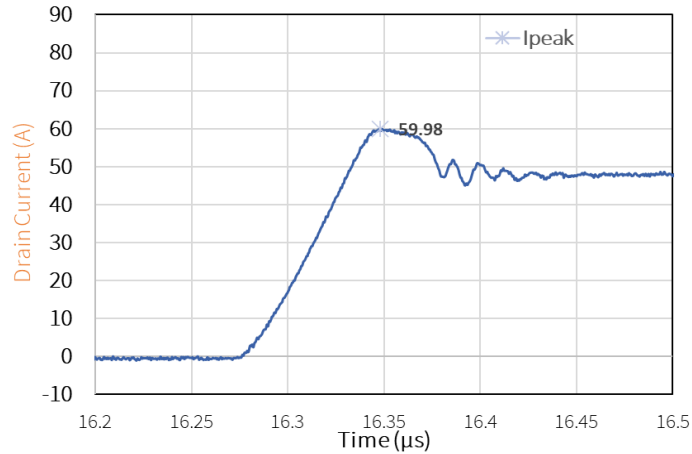
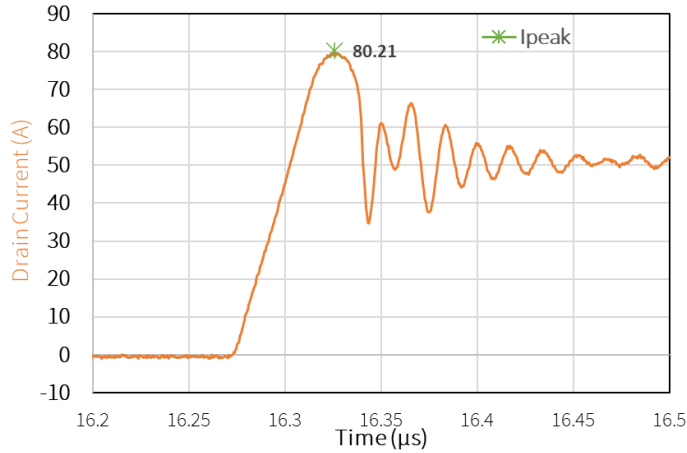


Top Side Cooled
(TSC Medium Profile)

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

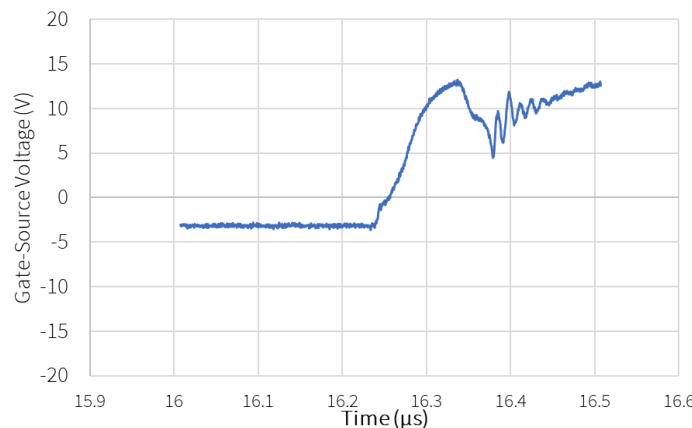
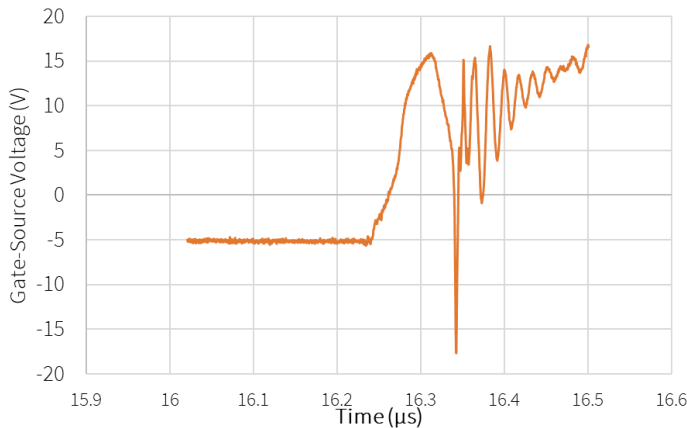
C2M → C3M | TRANSITION BENEFITS

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

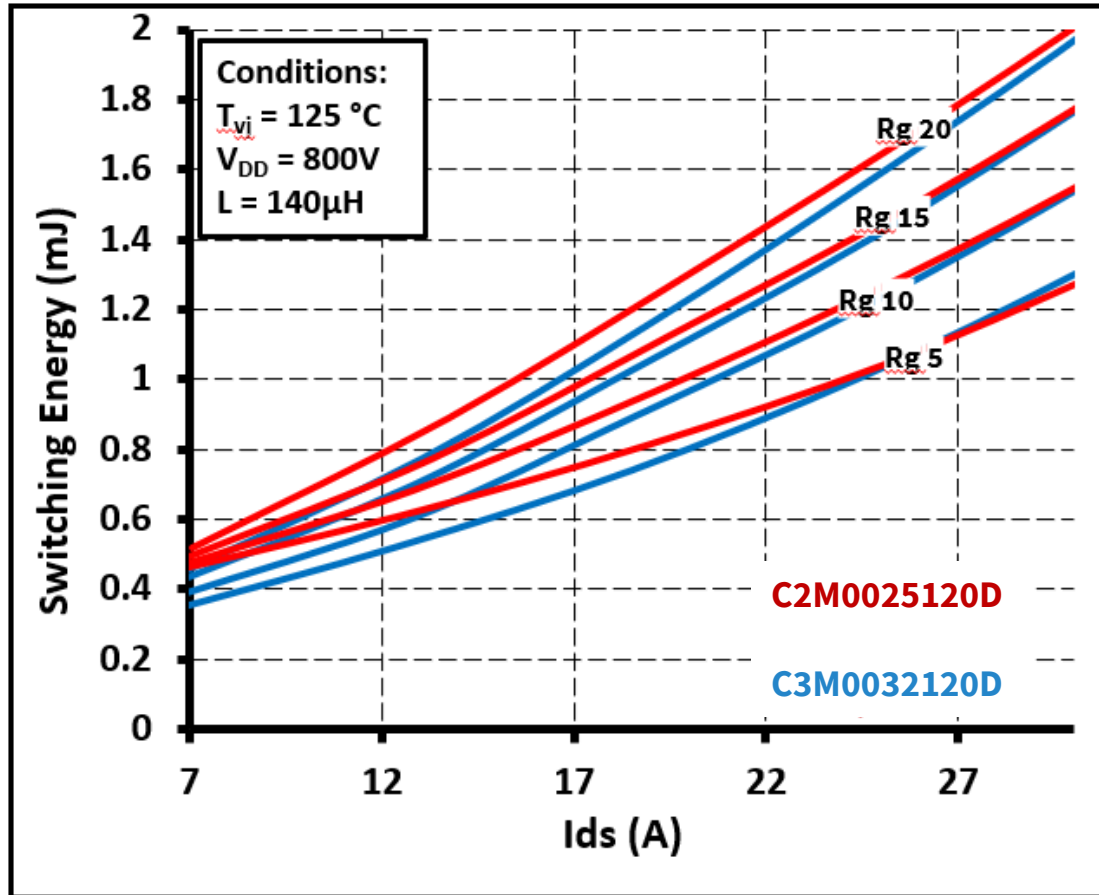
	C2M0025120D	C3M0032120D	Notes
Status	NRND	Active	C3M part qualified on 200mm. Samples & production available now.
$V_{DS\ max}$ (V)	1200	1200	
V_{GS} (V)	-5/+20	-4/+15	See following slide for gate voltage recommendations
I_D (A)	63	63	
$R_{DS(on)}$ (m Ω)	25	32	Increased conduction loss
C_{oss} (pF)	224	129	Reduced output capacitance improves switching speed
C_{iss}/C_{rss}	349	420	Reduced impact of miller capacitance
Q_G (nC)	194	114	Reduced gate drive power
$R_{G(int)}$ (Ω)	1	1.7	
$R_{\theta JC}$ (C/W)	0.24	0.45	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

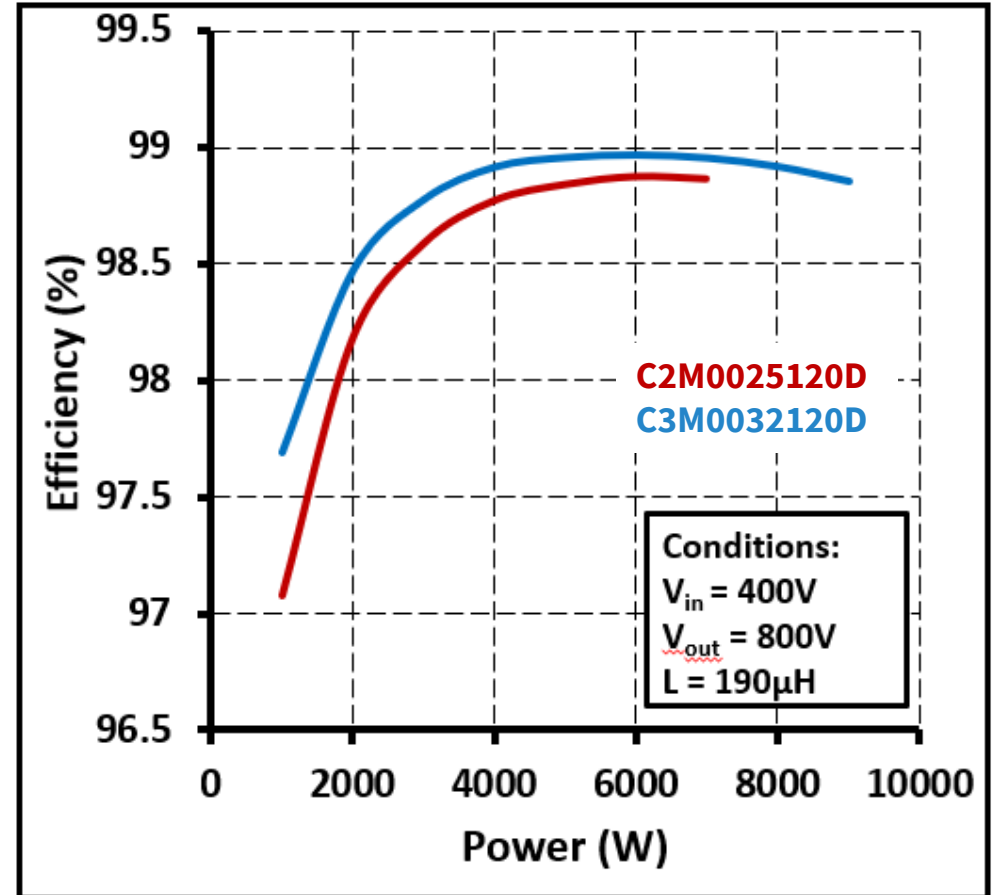
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PERFORMANCE COMPARISON

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



Improved switching performance and lower Q_{rr} results in higher efficiency when tested in a synchronous boost converter operating at 66kHz



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 silhouette of a wolf's head is positioned in the background, facing right. The silhouette is composed of several sharp, angular shapes that define the wolf's profile, including its ears and snout. The text "THANK YOU" is centered over the wolf's snout area.

THANK YOU