C2M0080120D
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 Ciss/Crss ratio**
- **Comparable switching losses**
- **Improved/comparable thermal performance**
- **Improved/comparable efficiency**

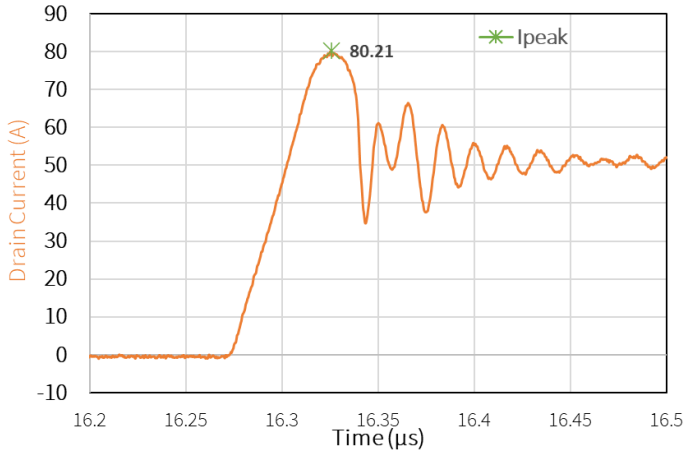
MOSFETs

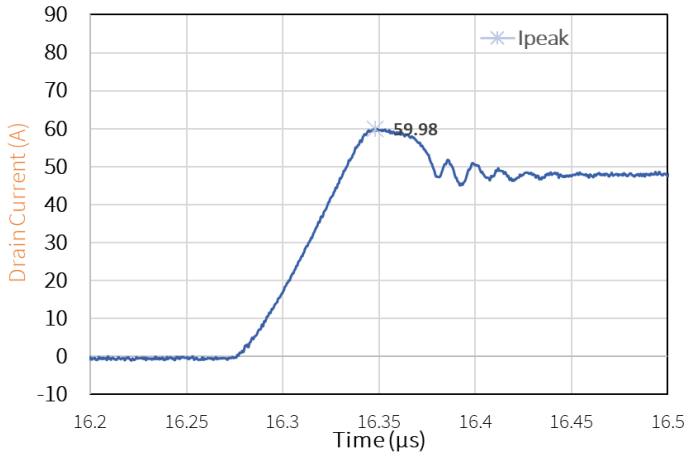
TO-247-3 (Std. Package)
TO-247-4 (Kelvin Lead)
TO-247-4 LP (Kelvin Lead Low Profile)
TO-263-7 (Smaller Drain Footprint)
TO-263-7 XL (Larger Drain Footprint)
TO-263-7 XL (Automotive Qualified Pkg.)
TOLL (Small Footprint)
TOLT (TSC TOLL)
Top Side Cooled (TSC Medium Profile)

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

C2M → C3M | TRANSITION BENEFITS

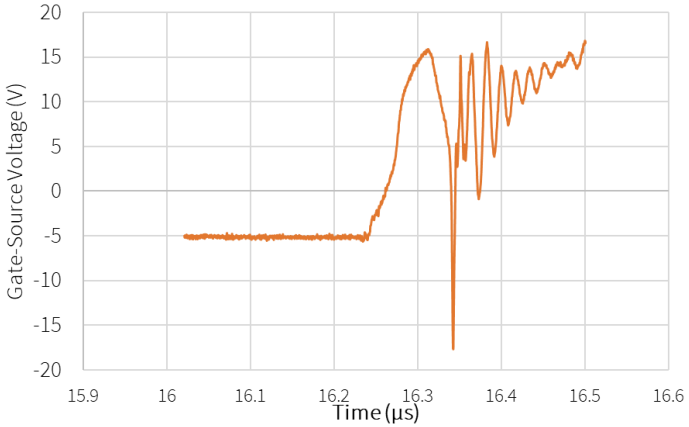
I_{DS} at turn-on

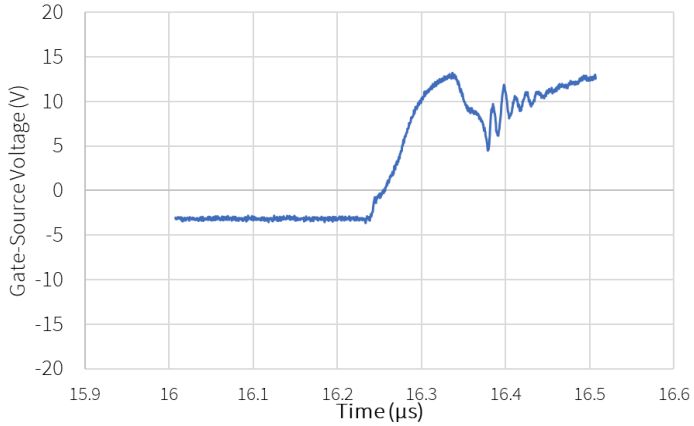




- ✓ Reduced peak recovery current
- ✓ Reduced Qrr
- ✓ Softer body diode
- ✓ Reduction in ringing
- ✓ Improved EMI performance

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**

Example data shown for C2M0025120D compared to C3M0032120D

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

	C2M0080120D	C3M0075120D	Notes
Status	EOL issued Oct 2024	Active	C3M part qualified on 200mm. Samples available. Production October 2024
$V_{DS\ max}$ (V)	1200	1200	
V_{GS} (V)	-5/+20	-4/+15	See following slide for gate voltage recommendations
I_D (A)	36	32	
$R_{DS(ON)}$ (mΩ)	80	75	Reduced conduction loss
C_{oss} (pF)	92	58	Reduced output capacitance improves switching speed
C_{iss}/C_{rss}	151	695	Reduced impact of miller capacitance
Q_G (nC)	71	54	Reduced gate drive power
$R_{G(int)}$ (Ω)	3.9	9	Higher internal R_G → use lower R_G in gate drive circuit with C3M
$R_{\theta JC}$ (C/W)	0.6	0.97	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 PERFORMANCE COMPARISON

- Due to higher internal R_G on C3M0075120D, a smaller external gate resistance should be used when replacing a C2M0080120D
- Test data shown indicates improved overall switching losses with the C3M device with appropriate gate resistance

<u>Test Conditions</u>

Vbus = 800V

C2M0080120D $R_{G(ext)}$ = 10Ω

C3M0075120D $R_{G(ext)}$ = 2.5Ω

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

THANK YOU