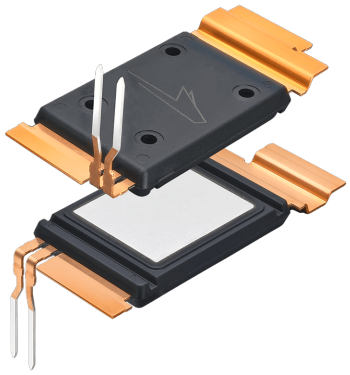
EDB003M06TM3, EDB003M06TM3L

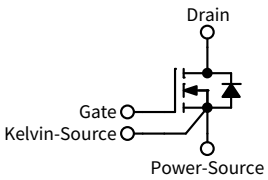
V_{DS}	650 V
$R_{DS(on)}$	3.3 mΩ

Automotive 650 V, 3.3 mΩ, Silicon Carbide, Single Switch Power Module

Technical Features

- AQG 324 Qualified
- Very low On-State Resistance
- Baseplateless Module with High Performance Si_3N_4 Insulator
- Laser Weldable Power Terminals
- Sinterable and Solderable Backside (Silver Plated)
- Solderable Signal Pins (Silver Plated)
- Package with Extended Creepage
- Comparative Tracking Index (CTI) > 600 (Material Group I)
- Limited Extended Operation ($T_{VJ(op)}$ = 200 °C for 100 h)





Typical Applications

- Automotive Traction Inverters

System Benefits

- Ultra-Low Loss
- High Performance in a small Footprint
- Design Flexibility
- Enables high Reliability Interconnects

Maximum Parameters (Verified by Design)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions	Note
Drain-Source Voltage	V_{DS}			650	V		
Gate-Source Voltage, Maximum Value	$V_{GS(max)}$	-8		+19		Transient	Note 1 Fig. 27
Gate-Source Voltage, Recommended	$V_{GS(op)}$		-4/+15			Static	
DC Continuous Drain Current	I_D		440		A	V_{GS} = 15 V, T_C = 100 °C, T_{VJ} = 175 °C	Note 2
Virtual Junction Temperature	$T_{VJ(op)}$	-40		175	°C	Continuous operation	
				200		100 hours over lifetime	
Sinter Temperature	T_L		230				
Sinter Pressure	P_S		14		Mpa		

Note (1): Recommended turn-on gate voltage is 15 V with ±5 % regulation tolerance
Note (2): Current limit calculated by $I_{D(max)} = \sqrt{(P_D/R_{DS(typ)}(T_{VJ(max)}))}$ where $P_D = (T_{VJ} - T_C)/R_{th(JC,typ)}$

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MOSFET Characteristics (T_{VJ} = 25 °C Unless Otherwise Specified)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions	Note
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	650			V	V_{GS} = 0 V, T_{VJ} = -40 °C	
Gate Threshold Voltage	$V_{GS(th)}$	1.8	2.5	3.6		V_{DS} = V_{GS}, I_D = 60 mA	Fig. 10
			2.0			V_{DS} = V_{GS}, I_D = 60 mA, T_{VJ} = 175 °C	
Zero Gate Voltage Drain Current	I_{DSS}		4	200	µA	V_{GS} = 0 V, V_{DS} = 650 V	
Gate-Source Leakage Current	I_{GSS}		40	1000	nA	V_{GS} = 15 V, V_{DS} = 0 V	
Drain-Source On-State Resistance (Devices Only)	$R_{DS(on)}$		3.3	4.1	mΩ	V_{GS} = 15 V, I_D = 320 A	Note 3 Figs. 2, 3
			4.6	5.9		V_{GS} = 15 V, I_D = 320 A, T_{VJ} = 175 °C	
			5.1			V_{GS} = 15 V, I_D = 320 A, T_{VJ} = 200 °C	
Transconductance	g_{fs}		270		S	V_{DS} = 20 V, I_D = 320 A	Fig. 4
			255			V_{DS} = 20 V, I_D = 320 A, T_{VJ} = 175 °C	
Turn-On Switching Energy	E_{ON}		7.4		mJ	T_{VJ} = 25 °C; V_{DS} = 400 V, I_D = 325 A, V_{GS} = -4 V/15 V, $R_{G(ON)}$ = 3 Ω, $R_{G(OFF)}$ = 1 Ω, L_σ = 18.3 nH	Figs. 11, 12, 13, 24, 25
			7.1			T_{VJ} = 175 °C	
			7.2			T_{VJ} = 200 °C	
Turn-Off Switching Energy	E_{OFF}		3.9			T_{VJ} = 25 °C	
			4.4			T_{VJ} = 175 °C	
			4.4			T_{VJ} = 200 °C	
Internal Gate Resistance	$R_{G(int)}$		2.0		Ω	f = 100 kHz, V_{AC} = 250 mV	
Input Capacitance	C_{iss}		22.7		nF	V_{GS} = 0 V, V_{DS} = 400 V, V_{AC} = 250 mV, f = 100 kHz	Fig. 9
Output Capacitance	C_{oss}		1.18				
Reverse Transfer Capacitance	C_{rss}		104		pF		
Gate to Source Charge	Q_{GS}		240		nC	V_{DS} = 400 V, V_{GS} = -4 V/15 V, I_D = 320 A, per IEC60747-8-4	
Gate to Drain Charge	Q_{GD}		232				
Total Gate Charge	Q_G		832				
Thermal Resistance, Junction to Case	$R_{th(JC)}$		0.08		K/W		Fig. 16

Note (3): Total effective resistance = MOSFET $R_{DS(on)}$ + package resistance

Diode Characteristics (T_{VJ} = 25 °C Unless Otherwise Specified)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions		Note
Body Diode Forward Voltage (Devices Only)	V_{SD}		6.2		V	V_{GS} = -4 V, I_{SD} = 320 A		Fig. 7
			5.7			V_{GS} = -4 V, I_{SD} = 320 A, T_{VJ} = 175 °C		
Reverse Recovery Time	t_{RR}		32		ns	V_{GS} = -4 V, I_{SD} = 325 A , V_R = 400 V, di/dt = 6.7 A/ns, T_{VJ} = 175 °C		Fig. 26
Reverse Recovery Charge	Q_{RR}		2.1		µC			
Peak Reverse Recovery Current	I_{RRM}		108		A			
Reverse Recovery Energy	E_{RR}		0.2		mJ	T_{VJ} = 25 °C	V_{DS} = 400 V, I_D = 325 A, V_{GS} = -4 V/15 V, $R_{G(ON)}$ = 3 Ω, L_σ = 18.3 nH	Figs. 11, 12, 13, 14, 26
			0.3			T_{VJ} = 175 °C		
			0.3			T_{VJ} = 200 °C		

Module Physical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions		Note
Package Resistance	R_{pkg}		0.15		mΩ	T_C = 25 °C	Drain to power-source	Note 3
			0.25			T_C = 175 °C		
Stray Inductance	L_{stray}		5.1		nH	Drain to power-source, f = 10 MHz		
Storage Temperature	T_{stg}	-40		125	°C			
Weight	W		8.6		g			
Case Isolation Voltage	V_{isol}	4.3			kV	DC, t = 1 s		
Comparative Tracking Index	CTI	600						
Creepage Distance		6.3			mm	Terminal to thermal pad		

Note (3): Total effective resistance = MOSFET $R_{DS(on)}$ + package resistance

Typical Performance

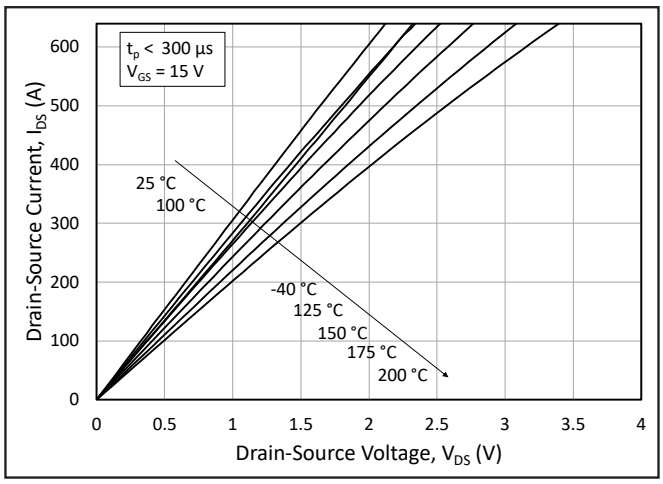


Figure 1. Output Characteristics for Various Junction Temperatures

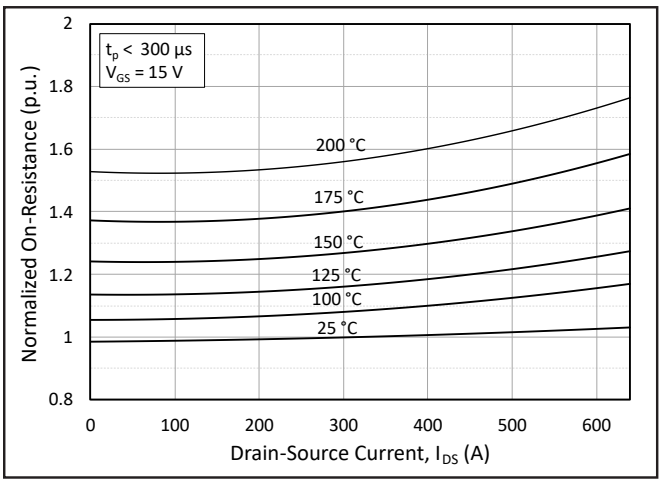


Figure 2. Normalized On-State Resistance vs. Drain Current for Various Junction Temperatures

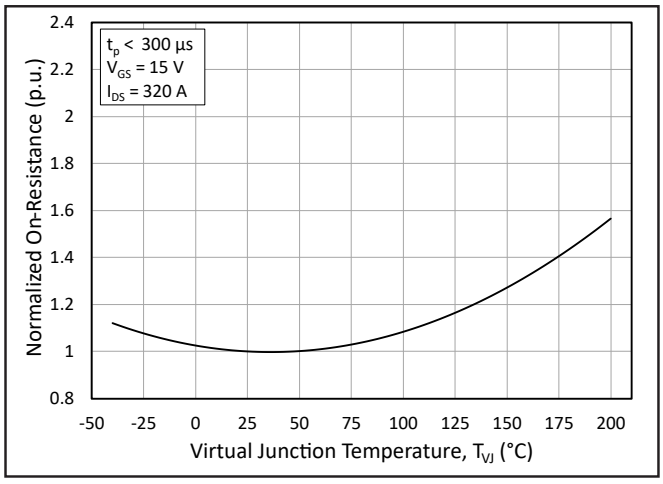


Figure 3. Normalized On-State Resistance vs. Junction Temperature

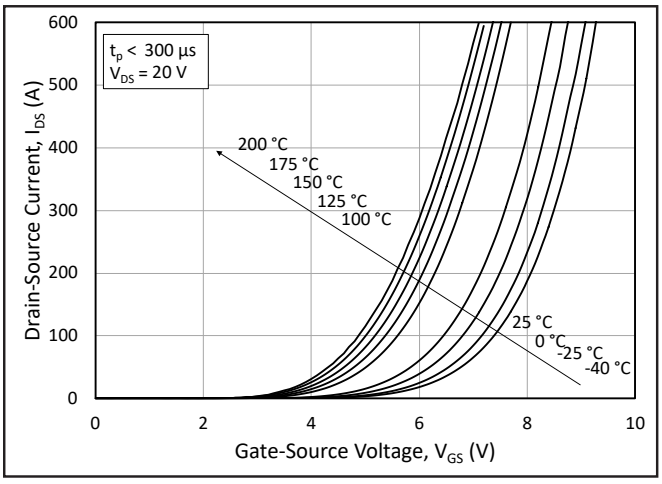


Figure 4. Transfer Characteristic for Various Junction Temperatures

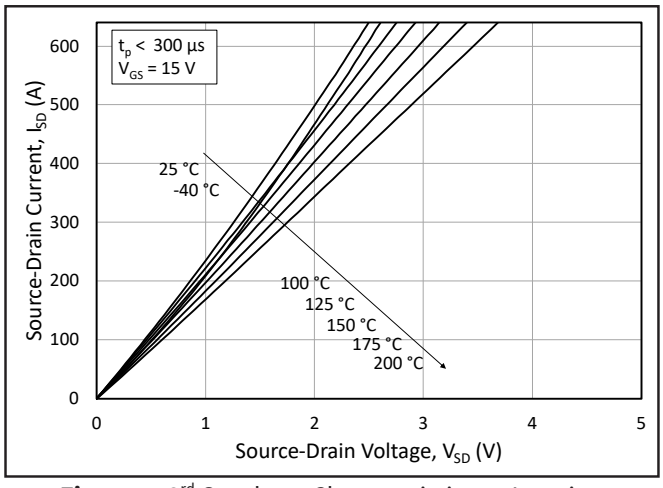


Figure 5. 3rd Quadrant Characteristic vs. Junction Temperatures at V_{GS} = 15 V

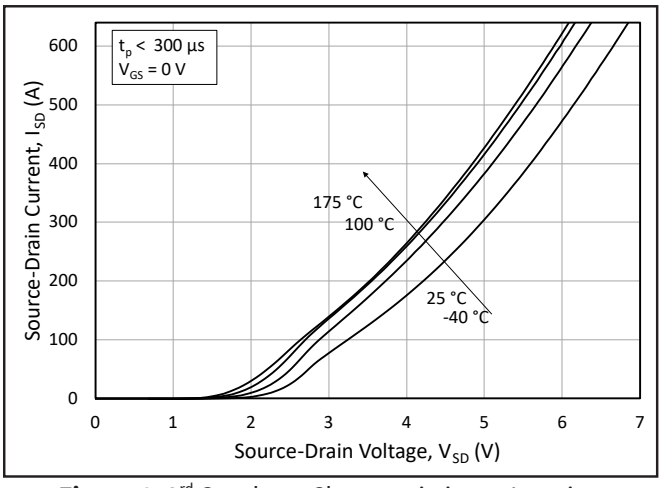


Figure 6. 3rd Quadrant Characteristic vs. Junction Temperatures at V_{GS} = 0 V (Body Diode)

Typical Performance

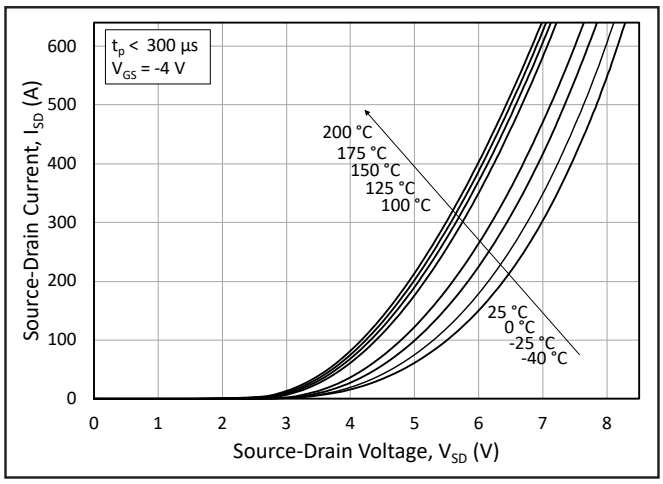


Figure 7. 3rd Quadrant Characteristic vs. Junction Temperatures at V_{GS} = -4 V (Body Diode)

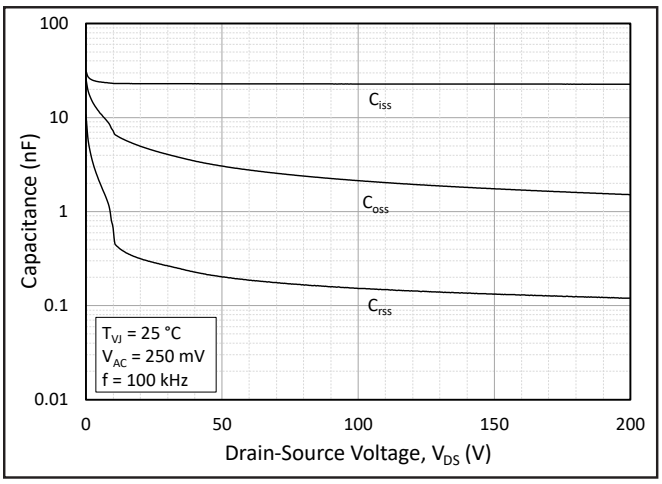


Figure 8. Typical Capacitances vs. Drain to Source Voltage (0 - 200 V)

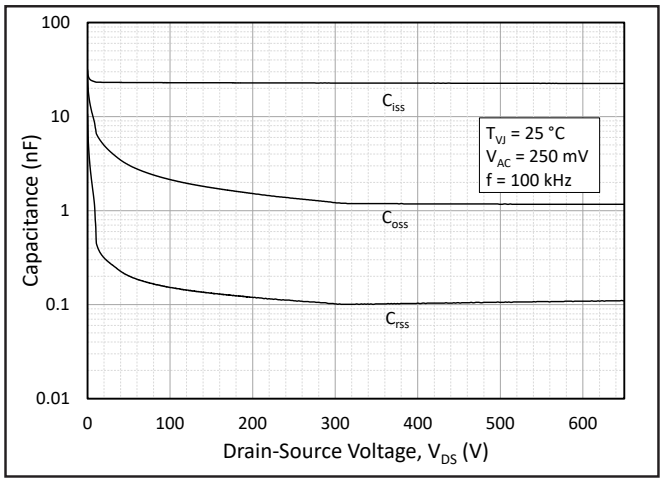


Figure 9. Typical Capacitances vs. Drain to Source Voltage (0 - 650V)

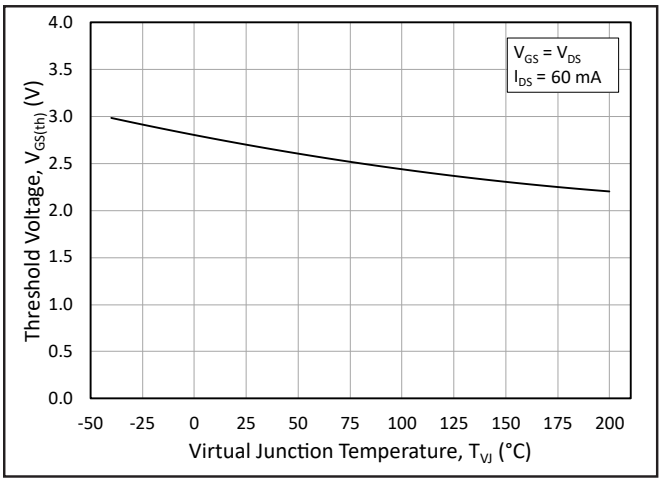


Figure 10. Threshold Voltage vs. Junction Temperature

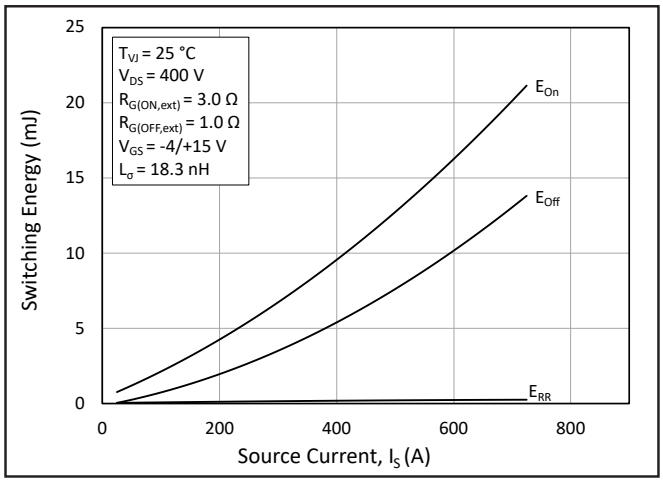


Figure 11. Switching Energy vs. Drain Current (T_{VJ} = 25 °C)

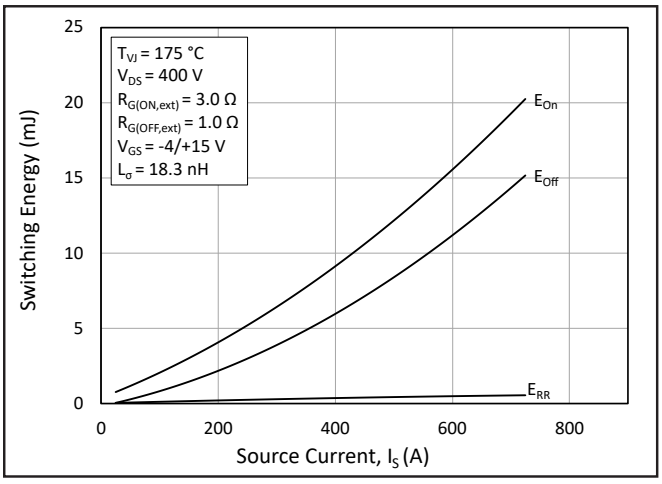


Figure 12. Switching Energy vs. Drain Current (T_{VJ} = 175 °C)

Typical Performance

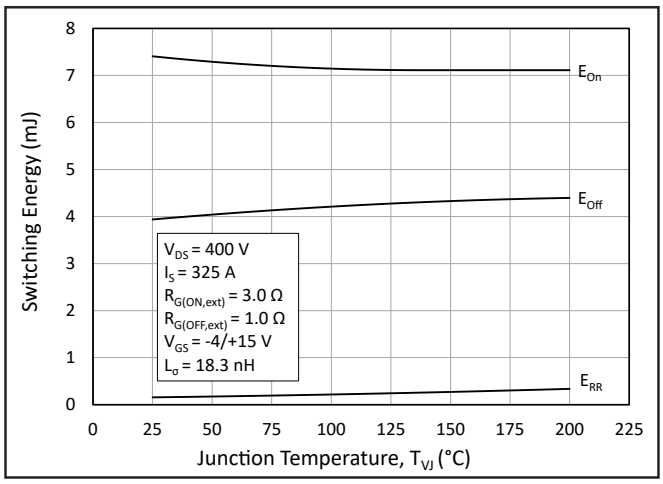


Figure 13. Switching Energy vs. Junction Temperature

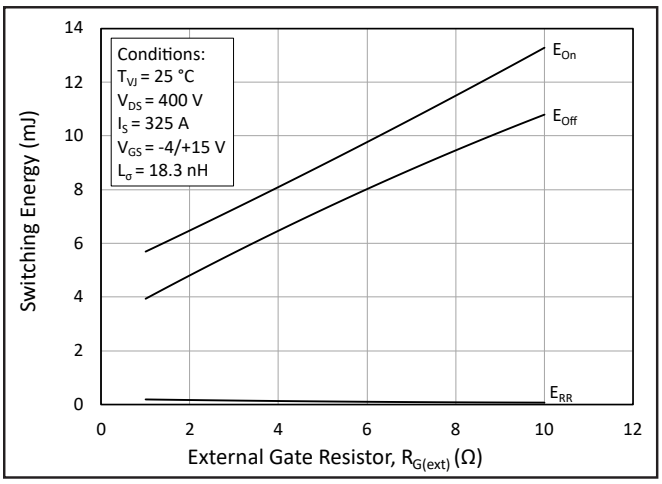


Figure 14. Switching Energy vs. External Gate Resistance

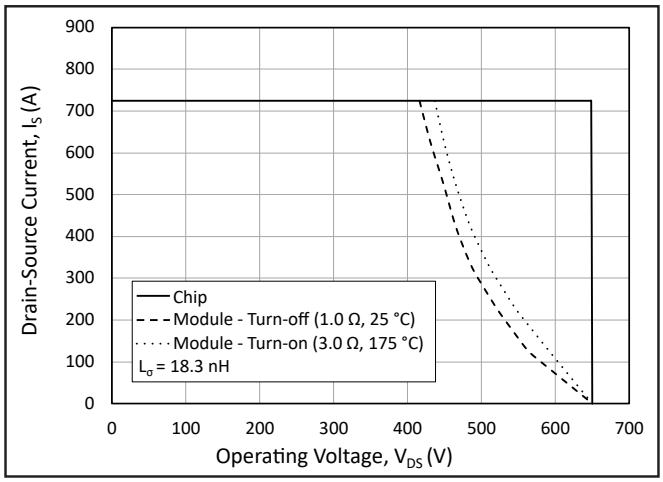


Figure 15. Switching Safe Operating Area

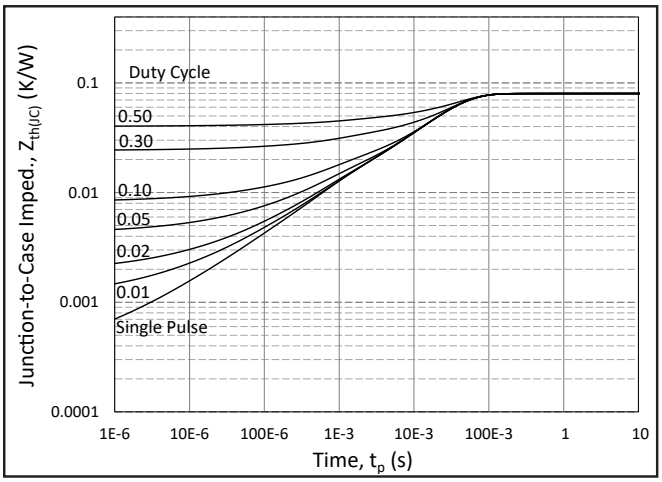


Figure 16. Junction to Case Transient Thermal Impedance

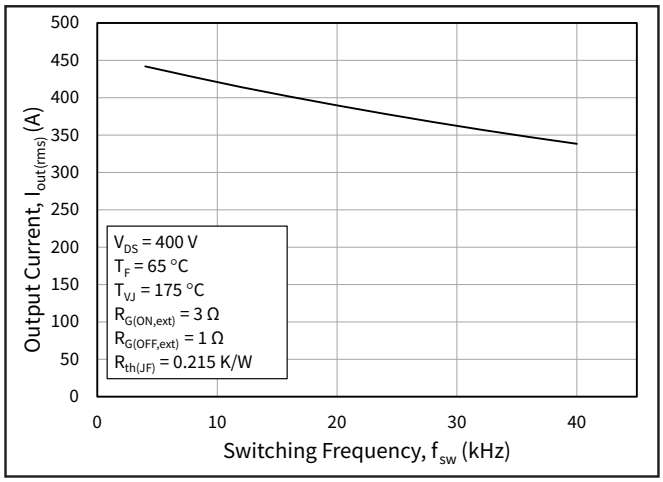


Figure 17. Typical Output Current Capability vs. Switching Frequency (Inverter Application)

Timing Characteristics

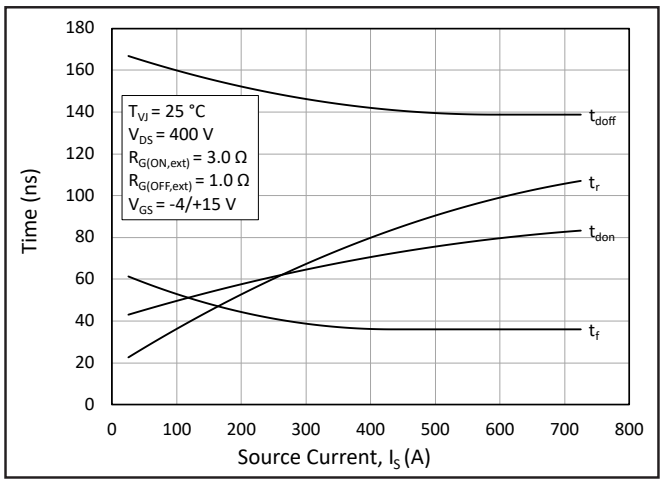


Figure 18. Timing vs. Source Current

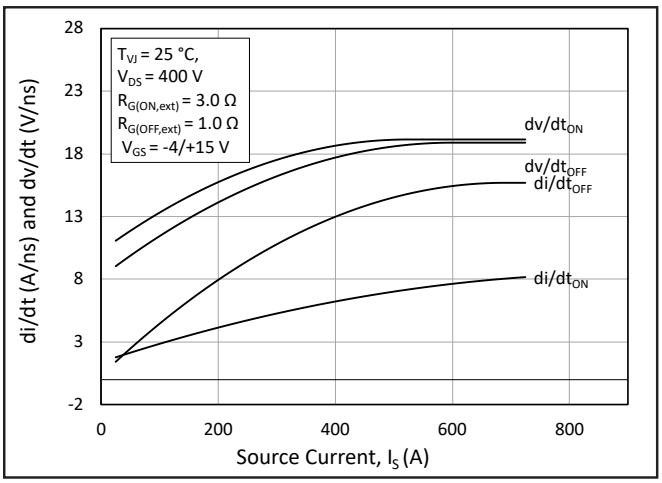


Figure 19. dv/dt and di/dt vs. Source Current

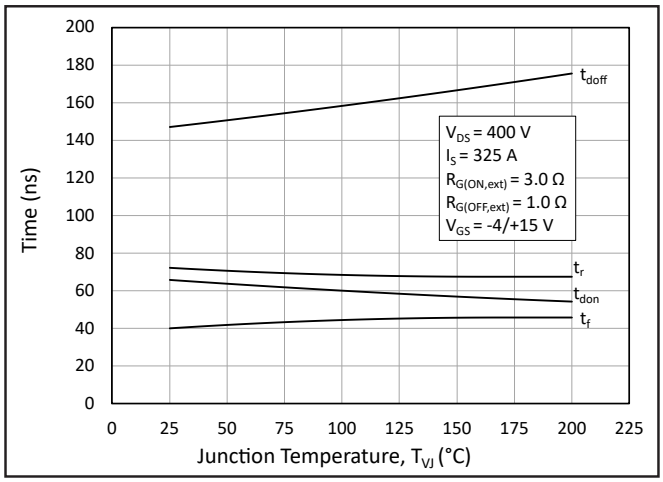


Figure 20. Timing vs. Junction Temperature

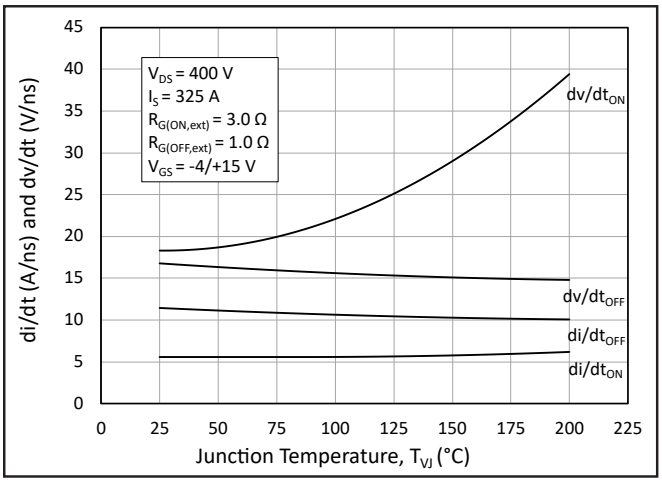


Figure 21. dv/dt and di/dt vs. Junction Temperature

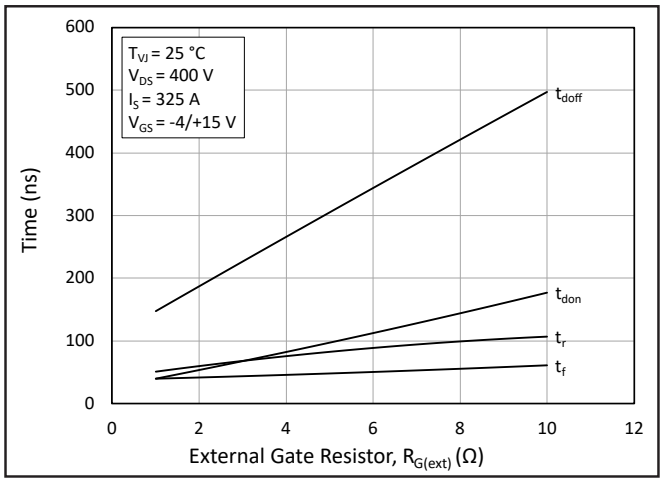


Figure 22. Timing vs. External Gate Resistance

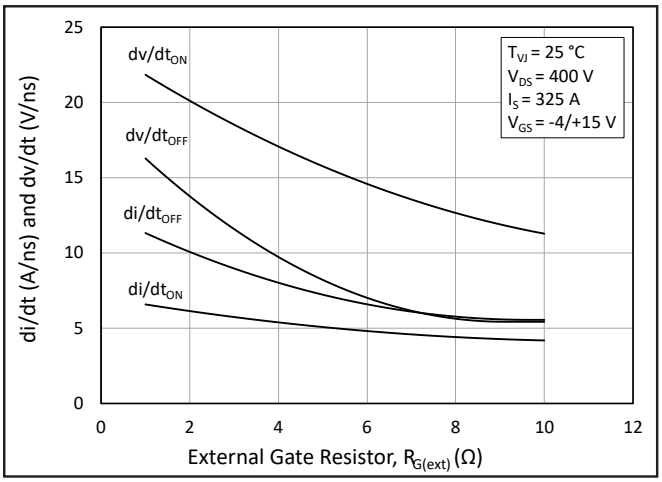


Figure 23. dv/dt and di/dt vs. External Gate Resistance

Definitions

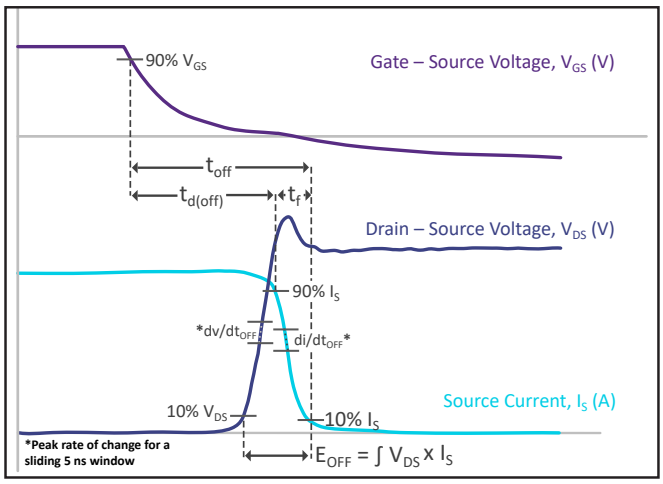


Figure 24. Turn-Off Transient Definitions

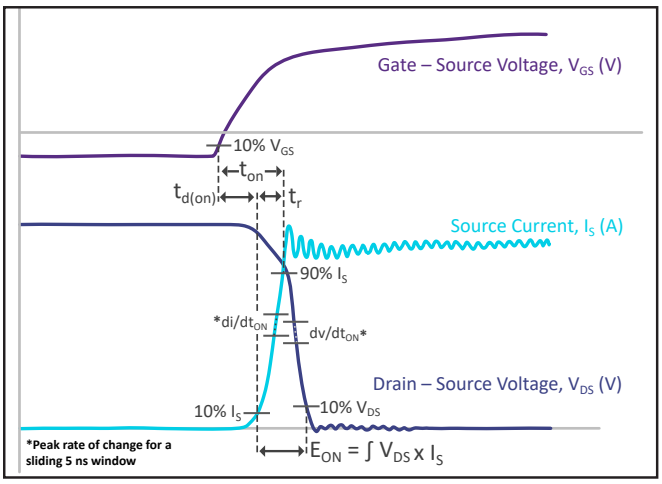


Figure 25. Turn-On Transient Definitions

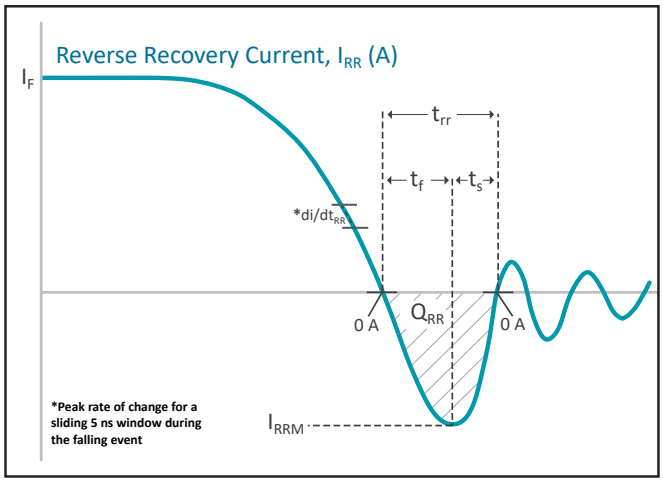


Figure 26. Reverse Recovery Definitions

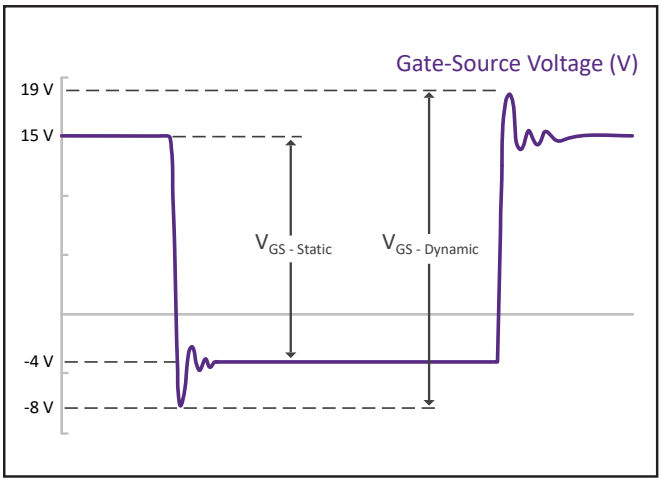
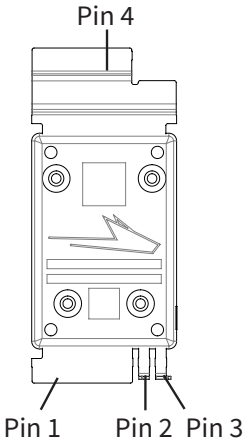
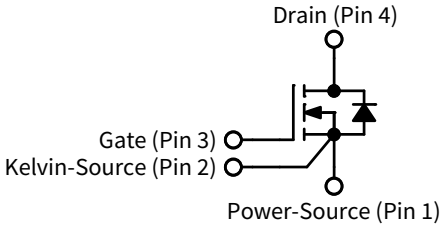


Figure 27. V_{GS} Transient Definitions

Schematic and Pin Out

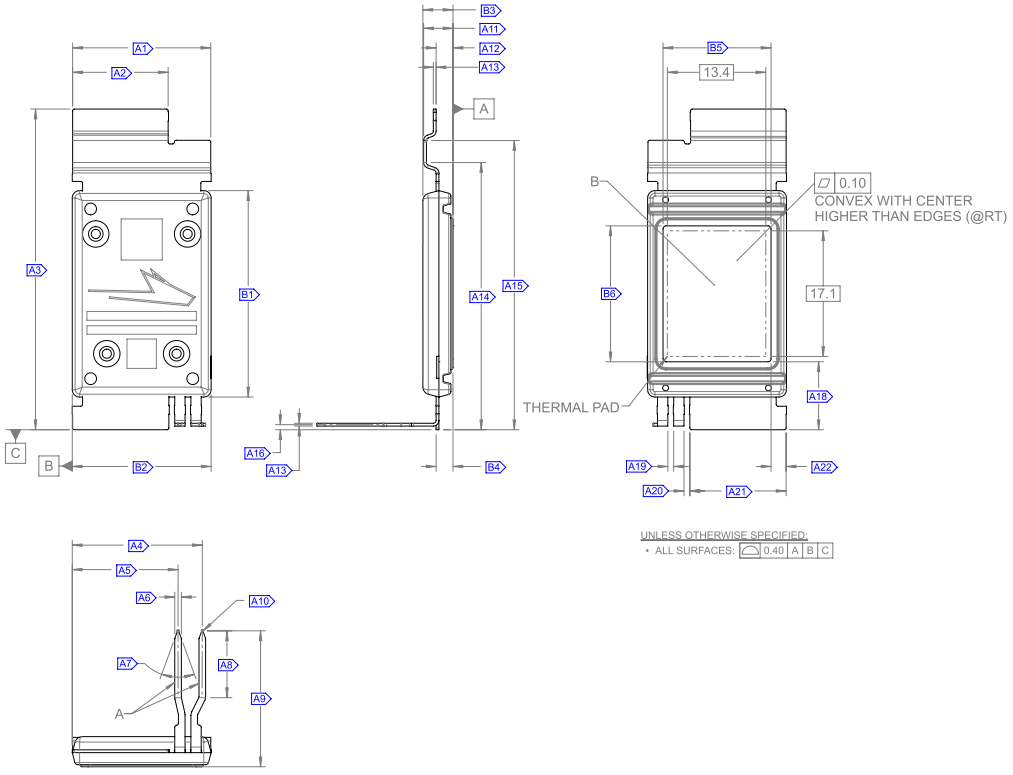




Package Dimensions (mm)

DIMENSION TABLE	
SYM.	DIMENSION/TOLERANCE
A1	18.8±0.20
A2	13±0.20
A3	43.65±0.30
B1	28.1±0.20
B2	18.9±0.30
A4	17.7±0.40
A5	14.4±0.40
A6	2× 0.9±0.10
A7	2× 40°
A8	9.1 - Short pin version 9.6 - Long pin version
A9	18.5±0.50 - Short pin version 19.0±0.50 - Long pin version
A10	2× R0.1±0.10
B3	4.1±0.10
A11	4±0.30
A12	2.3±0.30
A13	0.381
A14	36.37±0.30
A15	39.37±0.30
A16	0.69±0.65
B4	2.3±0.30
B5	14.7
B6	18.5
A18	9.5 MAX
A19	0.8
A20	0.8
A21	13.1±0.20
A22	2.3 MAX

NOTE	
A	Ag Plating, Signal Pins
B	Ag Plating, Thermal Pad



Product Ordering Code

Part Number	Description
EDB003M06TM3	Short gate and Kelvin-source pin length
EDB003M06TM3L	Long gate and Kelvin-source pin length

Revision History

Revision History	Date	Brief Summary
Rev. 1	October 2025	Initial release
Rev. 2	December 2025	Updated drawing

Supporting Links & Tools

Evaluation Tools & Support

- PLECS Circuit Model
- 3D CAD Model
- FEA Thermal Model - Available Upon Request
- KIT-CRD-CIL-12N-TMA: Dynamic Performance Evaluation Kit for TM Power Modules

Application Notes

- PRD-04814: Design Options for Wolfspeed® Silicon Carbide MOSFET Gate Bias Power Supplies
- PRD-06379: Environmental Considerations for Power Electronics Systems
- PRD-08333: Wolfspeed Module CIL Evaluation Kits User Guide
- PRD-08376: Thermal Characterization Methods and Applications
- PRD-08710: Measuring Stray Inductance in Power Electronics Systems
- PRD-08911: Considerations for Current Balancing in Paralleled SiC Power Modules

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REACh Compliance

REACh substances of high concern (SVHCs) information is available for this product. Since the European Chemical Agency (ECHA) has published notice of their intent to frequently revise the SVHC listing for the foreseeable future, please contact your Wolfspeed representative to ensure you get the most up-to-date REACh SVHC Declaration. REACh banned substance information (REACh Article 67) is also available upon request.

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