

EDB005M12TM4, EDB005M12TM4L

V_{DS}	1200 V
R_{DS(on)}	4.6 mΩ

Automotive 1200 V, 4.6 mΩ, Silicon Carbide, Single Switch Power Module

Technical Features

- AQS 324 Qualified
- Soft Body Diode Recovery
- Baseplateless Module with High Performance Si₃N₄ 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}			1200	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		320		A	V _{GS} = 15 V, T _C = 100 °C, T _{VJ} = 175 °C	Note 2
Virtual Junction Temperature	T _{VJ(op)}	-40		175		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 $\pm 5\%$ regulation tolerance

Note (2): Current limit calculated by $I_{D(max)} = \sqrt{(P_D / R_{DS(typ)})(T_{VJ(max)} - T_C) / R_{th(JC,typ)}}$ where $P_D = (T_{VJ} - T_C) / R_{th(JC,typ)}$


MOSFET Characteristics ($T_{VJ} = 25^\circ\text{C}$ Unless Otherwise Specified)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions	Note
Drain-Source Breakdown Voltage	$V_{(\text{BR})\text{DSS}}$	1200			V	$V_{GS} = 0 \text{ V}, T_{VJ} = -40^\circ\text{C}$	Fig. 10
Gate Threshold Voltage	$V_{GS(\text{th})}$	1.8	2.5	3.6		$V_{DS} = V_{GS}, I_D = 60 \text{ mA}$	
		2.0				$V_{DS} = V_{GS}, I_D = 60 \text{ mA}, T_{VJ} = 175^\circ\text{C}$	
Zero Gate Voltage Drain Current	I_{DSS}		4	128	μA	$V_{GS} = 0 \text{ V}, V_{DS} = 1200 \text{ V}$	
Gate-Source Leakage Current	I_{GSS}		40	400	nA	$V_{GS} = 15 \text{ V}, V_{DS} = 0 \text{ V}$	
Drain-Source On-State Resistance (Devices Only)	$R_{DS(\text{on})}$		4.6	6.3	$\text{m}\Omega$	$V_{GS} = 15 \text{ V}, I_D = 220 \text{ A}$	Note 3 Figs. 2, 3
			9.2	11.2		$V_{GS} = 15 \text{ V}, I_D = 220 \text{ A}, T_{VJ} = 175^\circ\text{C}$	
			10.3			$V_{GS} = 15 \text{ V}, I_D = 220 \text{ A}, T_{VJ} = 200^\circ\text{C}$	
Transconductance	g_{fs}		191		S	$V_{DS} = 20 \text{ V}, I_D = 220 \text{ A}$	Fig. 4
			188			$V_{DS} = 20 \text{ V}, I_D = 220 \text{ A}, T_{VJ} = 175^\circ\text{C}$	
Turn-On Switching Energy	E_{ON}		8.8		mJ	$T_{VJ} = 25^\circ\text{C}$	Figs. 11, 12, 13, 24, 25
			11.0			$T_{VJ} = 175^\circ\text{C}$	
			11.8			$T_{VJ} = 200^\circ\text{C}$	
Turn-Off Switching Energy	E_{OFF}		4.1			$T_{VJ} = 25^\circ\text{C}$	
			4.2			$T_{VJ} = 175^\circ\text{C}$	
			4.4			$T_{VJ} = 200^\circ\text{C}$	
Internal Gate Resistance	$R_{G(\text{int})}$		0.7		Ω	$f = 100 \text{ kHz}, V_{AC} = 250 \text{ mV}$	
Input Capacitance	C_{iss}		19.8		nF	$V_{GS} = 0 \text{ V}, V_{DS} = 800 \text{ V}, V_{AC} = 250 \text{ mV}, f = 100 \text{ kHz}$	Fig. 9
Output Capacitance	C_{oss}		0.66				
Reverse Transfer Capacitance	C_{rss}		54		PF		
Gate to Source Charge	Q_{GS}		212		nC	$V_{DS} = 800 \text{ V}, V_{GS} = -4 \text{ V}/15 \text{ V}, I_D = 220 \text{ A}, \text{per IEC60747-8-4}$	
Gate to Drain Charge	Q_{GD}		200				
Total Gate Charge	Q_G		748				
Thermal Resistance, Junction to Case	$R_{th(JC)}$		0.08		K/W		Fig. 16

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



Diode Characteristics ($T_{vj} = 25^\circ\text{C}$ Unless Otherwise Specified)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions		Note
Body Diode Forward Voltage (Devices Only)	V_{SD}		5.9		V	$V_{GS} = -4\text{ V}$, $I_{SD} = 220\text{ A}$		Fig. 7
			5.2			$V_{GS} = -4\text{ V}$, $I_{SD} = 220\text{ A}$, $T_{vj} = 175^\circ\text{C}$		
Reverse Recovery Time	t_{RR}		121		ns	$V_{GS} = -4\text{ V}$, $I_{SD} = 250\text{ A}$, $V_R = 800\text{ V}$, $di/dt = 8.5\text{ A/ns}$, $T_{vj} = 175^\circ\text{C}$		Fig. 26
Reverse Recovery Charge	Q_{RR}		6.5		μC			
Peak Reverse Recovery Current	I_{RRM}		170		A			
Reverse Recovery Energy	E_{RR}		0.4		mJ	$T_{vj} = 25^\circ\text{C}$	$V_{DS} = 800\text{ V}$, $I_D = 250\text{ A}$, $V_{GS} = -4\text{ V}/15\text{ V}$, $R_{G(ON)} = 3\Omega$, $L_\sigma = 18.3\text{ nH}$	Figs. 11, 12, 13, 14, 26
			3.0			$T_{vj} = 175^\circ\text{C}$		
			3.7			$T_{vj} = 200^\circ\text{C}$		

Module Physical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions		Note	
Package Resistance	R_{pkg}		0.15		m Ω	$T_c = 25^\circ\text{C}$	Drain to power-source	Note 3	
			0.25			$T_c = 175^\circ\text{C}$			
Stray Inductance	L_{stray}		5.1		nH	Drain to power-source, $f = 10\text{ MHz}$			
Storage Temperature	T_{stg}	-40		125	°C				
Weight	W		8.6		g				
Case Isolation Voltage	V_{isol}	4.3			kV	DC, $t = 1\text{ s}$			
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

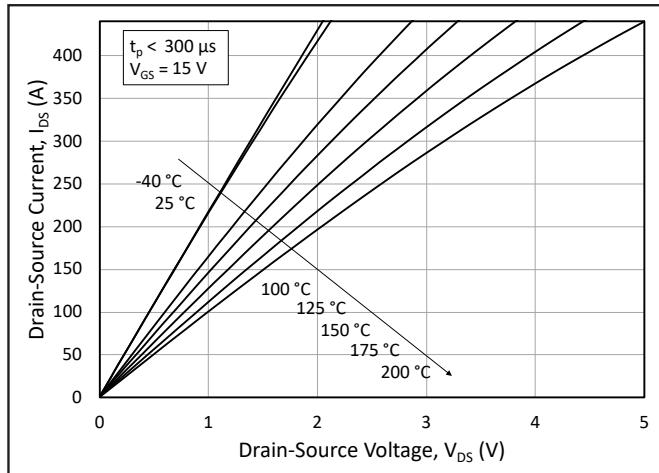


Figure 1. Output Characteristics for Various Junction Temperatures

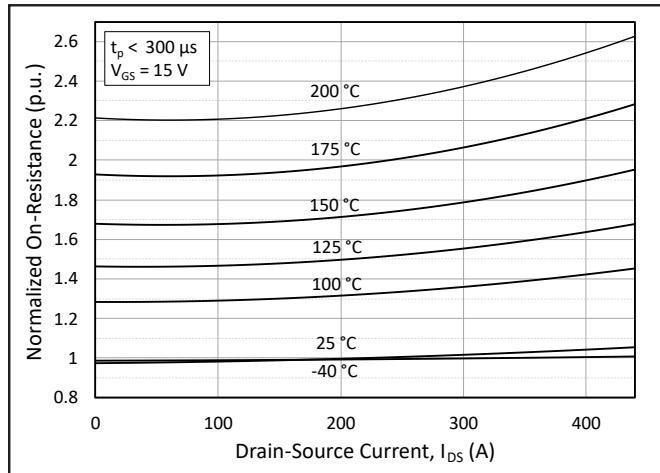


Figure 2. Normalized On-State Resistance vs. Drain Current for Various Junction Temperatures

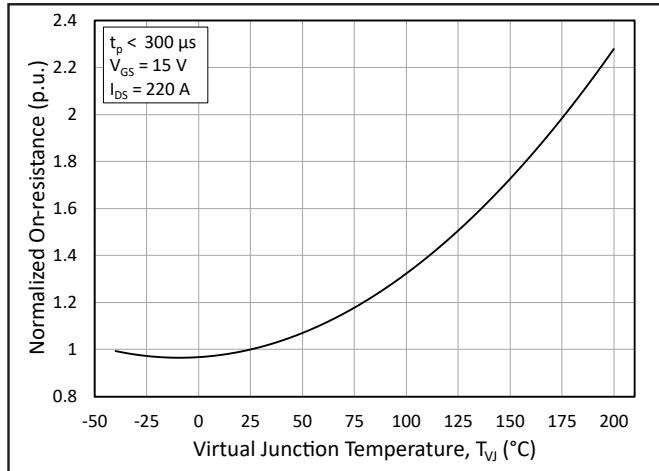


Figure 3. Normalized On-State Resistance vs. Junction Temperature

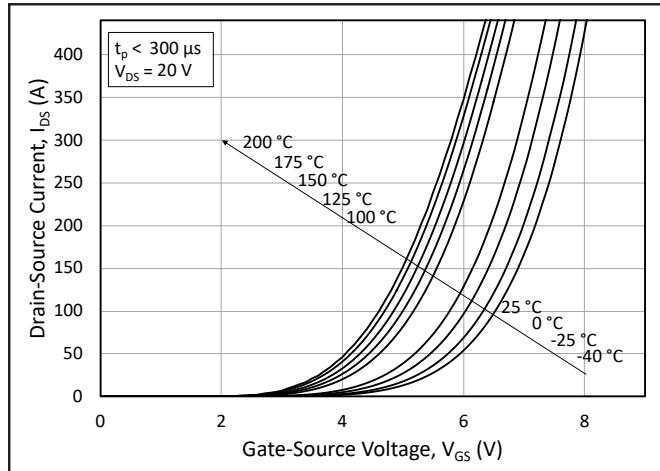


Figure 4. Transfer Characteristic for Various Junction Temperatures

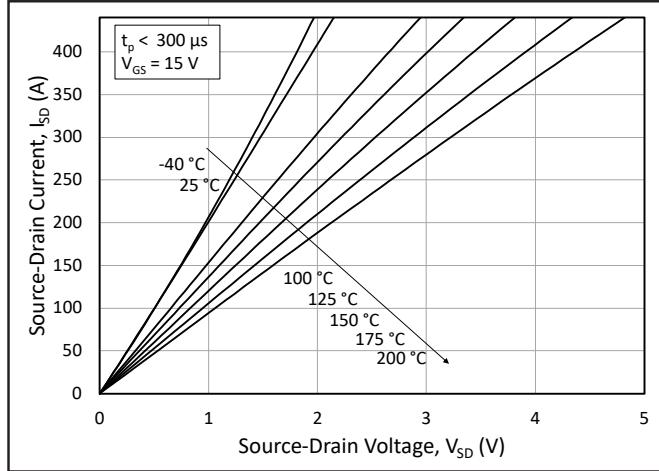


Figure 5. 3rd Quadrant Characteristic vs. Junction Temperatures at $V_{GS} = 15$ V

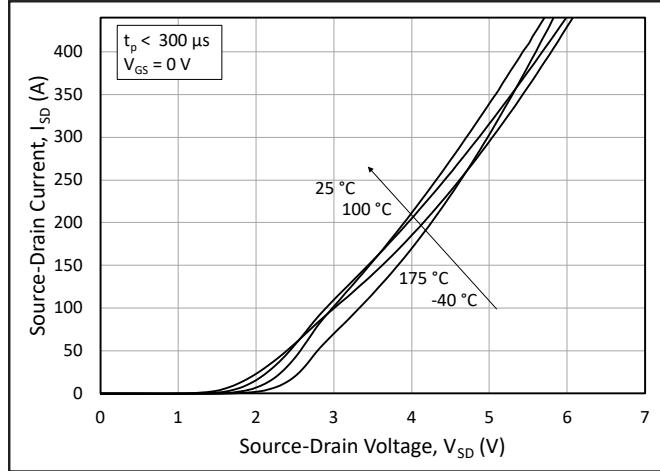


Figure 6. 3rd Quadrant Characteristic vs. Junction Temperatures at $V_{GS} = 0$ V (Body Diode)

Typical Performance

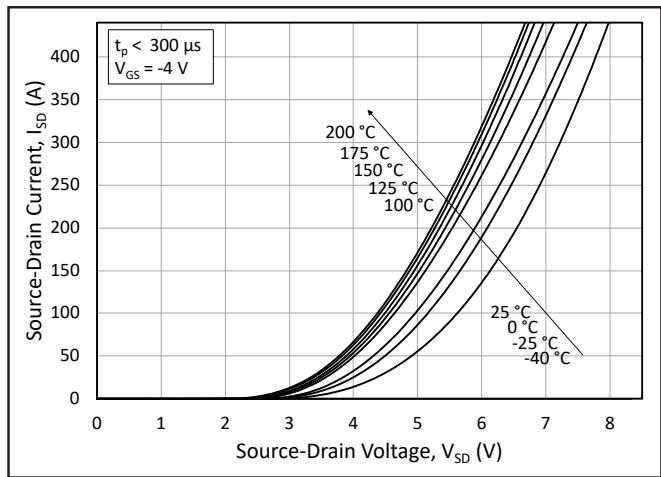


Figure 7. 3rd Quadrant Characteristic vs. Junction Temperature at $V_{GS} = -4 \text{ V}$ (Body Diode)

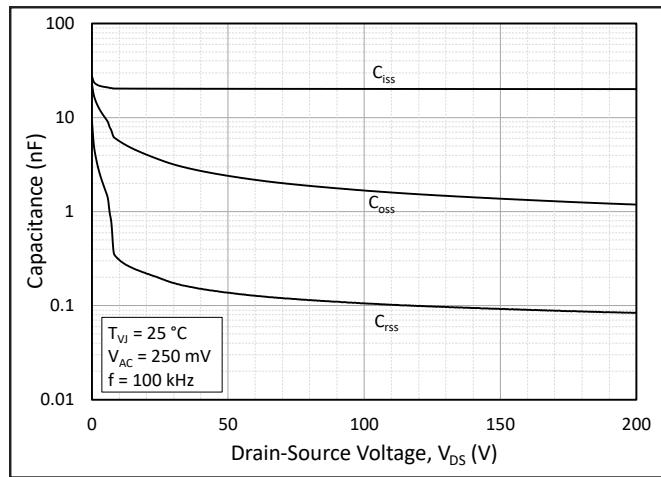


Figure 8. Typical Capacitances vs. Drain to Source Voltage (0 - 200 V)

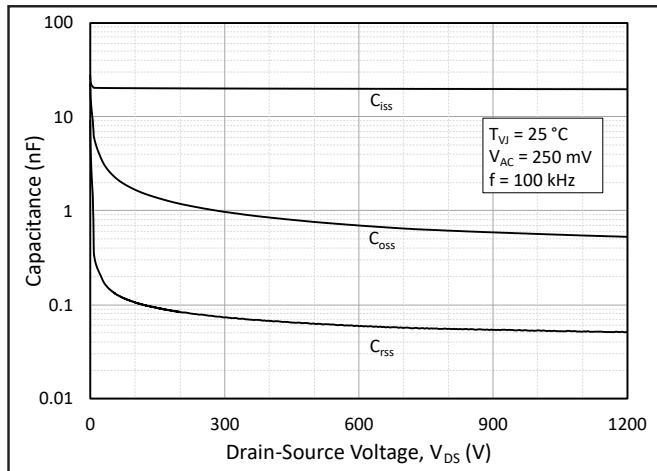


Figure 9. Typical Capacitances vs. Drain to Source Voltage (0 - 1200V)

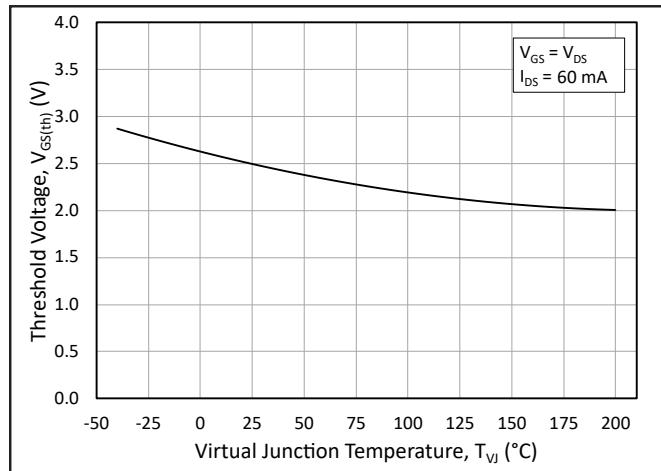


Figure 10. Threshold Voltage vs. Junction Temperature

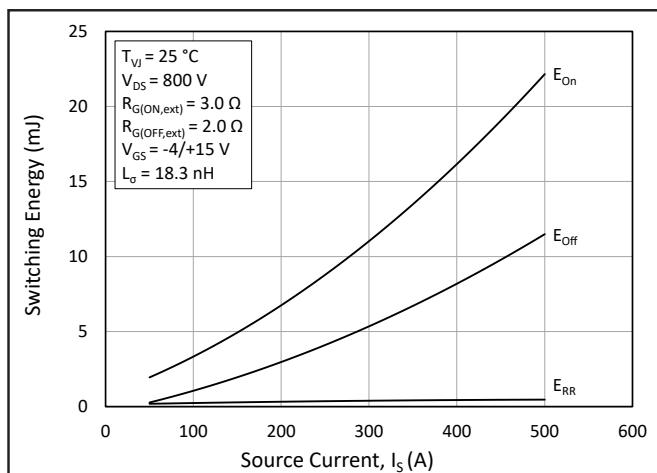


Figure 11. Switching Energy vs. Drain Current ($T_{VJ} = 25 \text{ }^\circ\text{C}$)

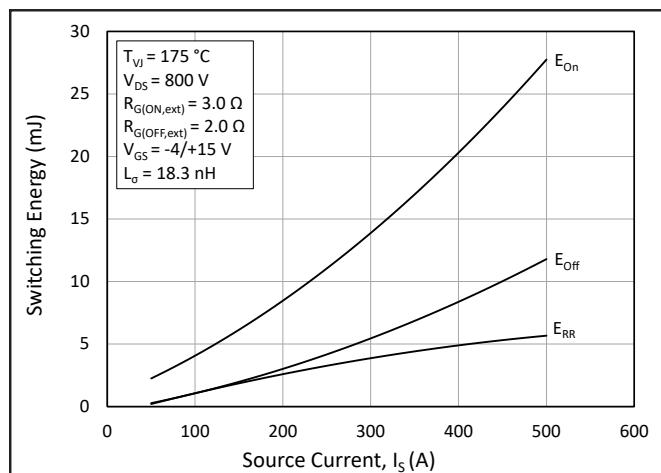


Figure 12. Switching Energy vs. Drain Current ($T_{VJ} = 175 \text{ }^\circ\text{C}$)

Typical Performance

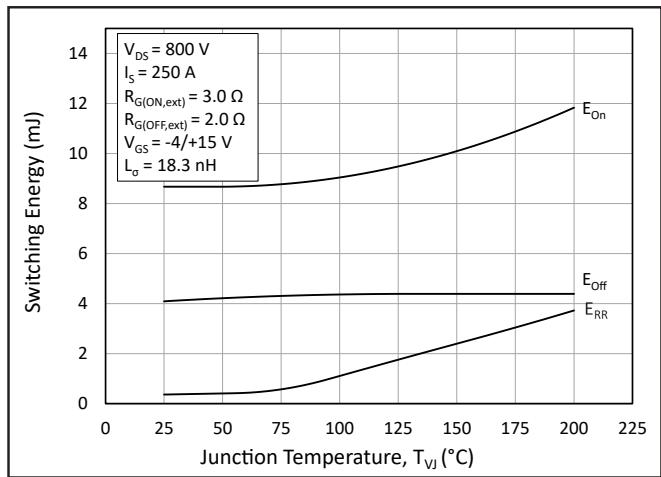


Figure 13. Switching Energy vs. Junction Temperature

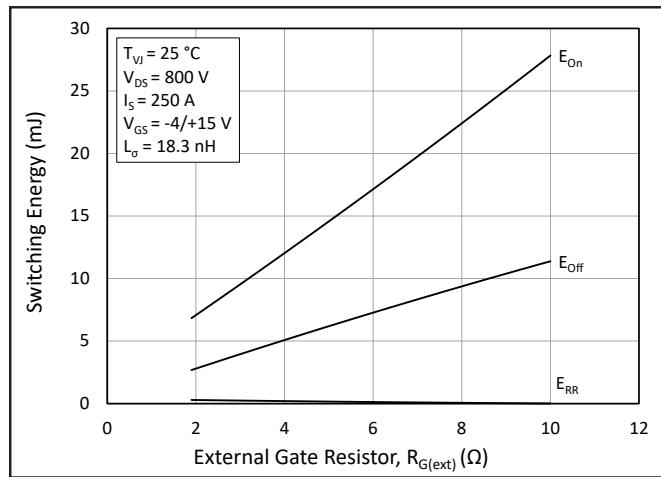


Figure 14. Switching Energy vs. External Gate Resistance

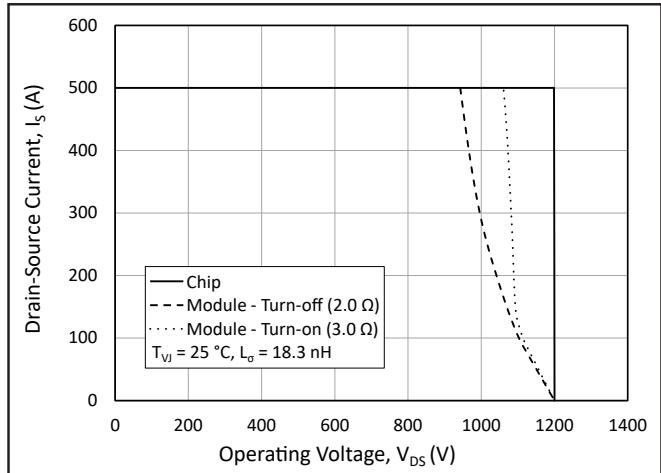


Figure 15. Switching Safe Operating Area

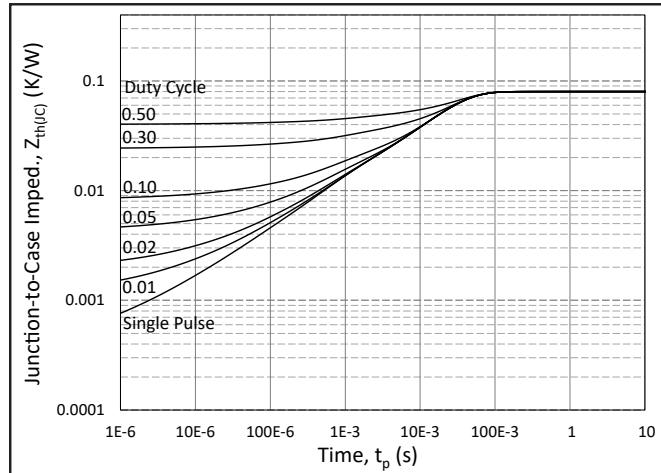


Figure 16. Junction to Case Transient Thermal Impedance

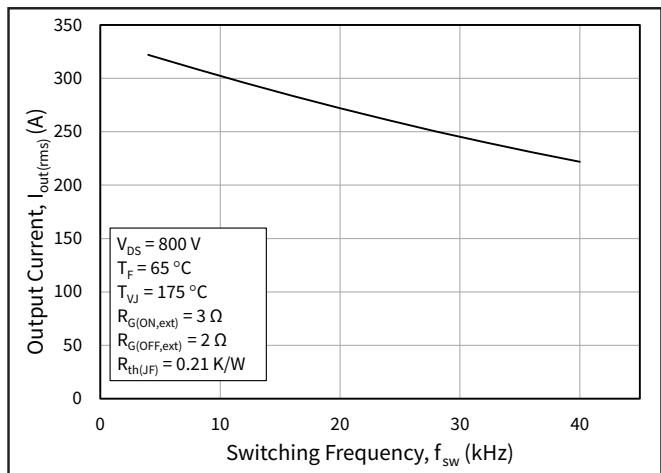


Figure 17. Typical Output Current Capability vs. Switching Frequency (Inverter Application)

Timing Characteristics

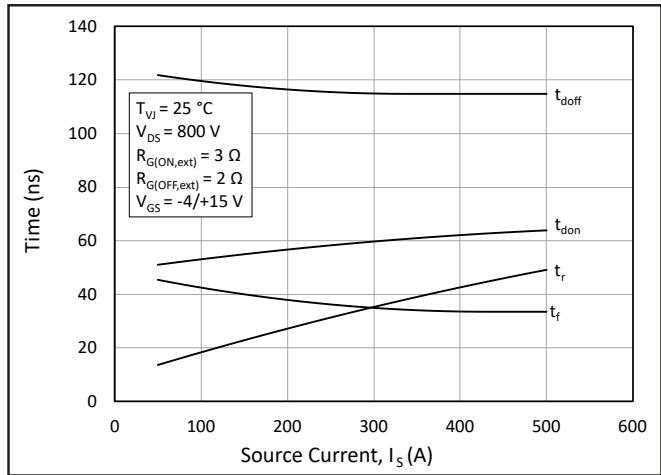


Figure 18. Timing vs. Source Current

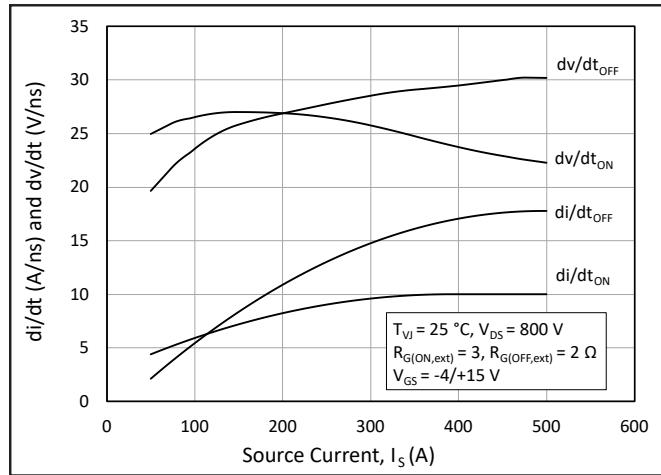


Figure 19. dv/dt and di/dt vs. Source Current

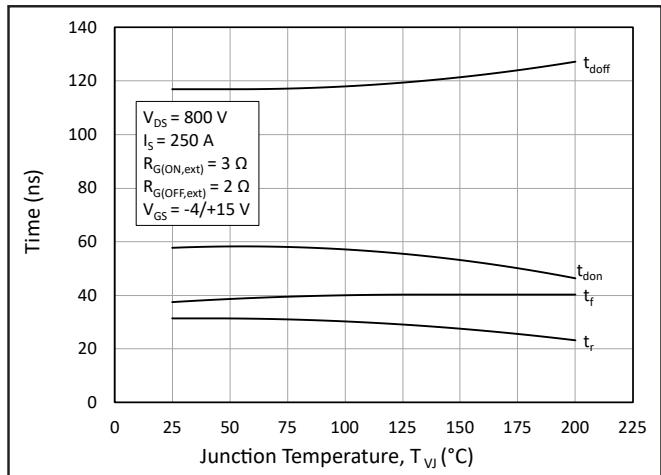


Figure 20. Timing vs. Junction Temperature

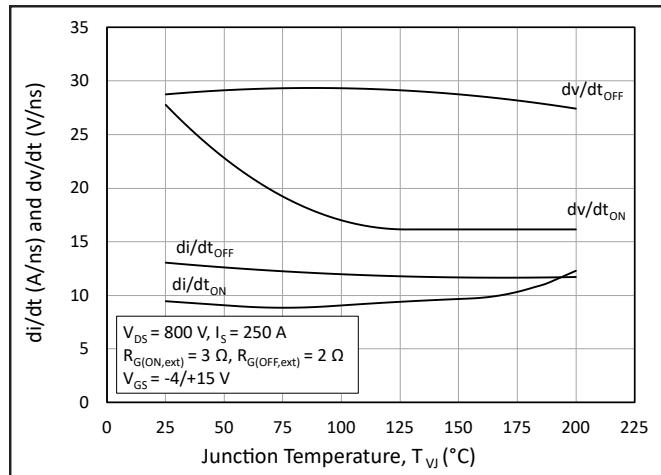


Figure 21. dv/dt and di/dt vs. Junction Temperature

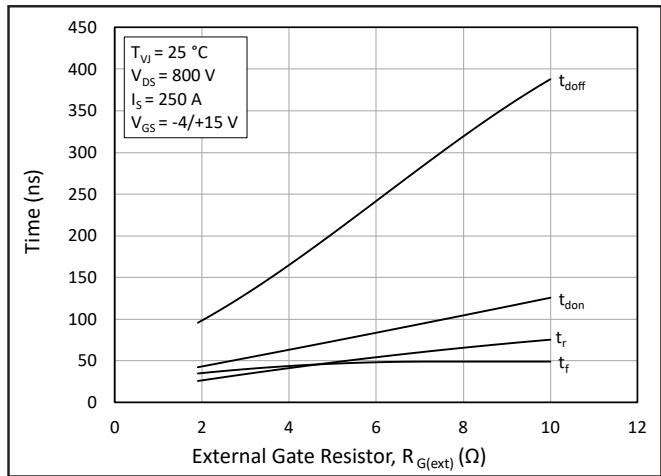


Figure 22. Timing vs. External Gate Resistance

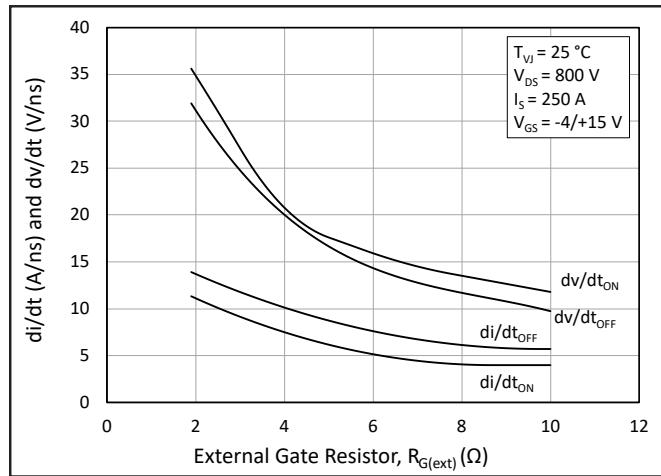


Figure 23. dv/dt and di/dt vs. External Gate Resistance

Definitions

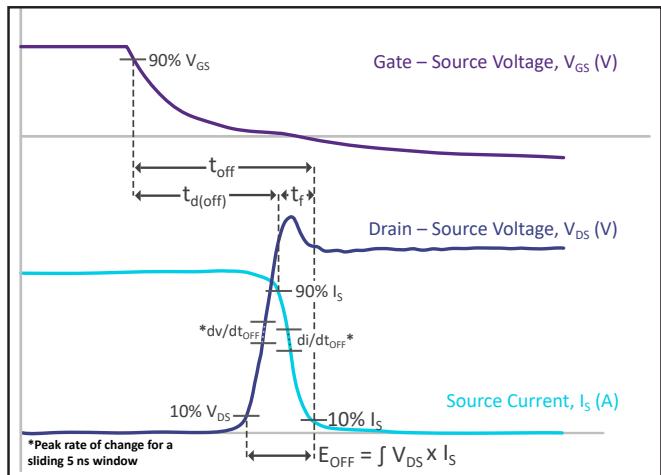


Figure 24. Turn-Off Transient Definitions

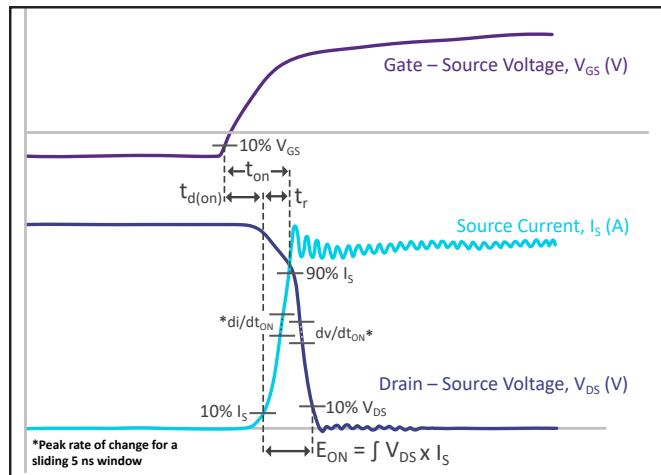


Figure 25. Turn-On Transient Definitions

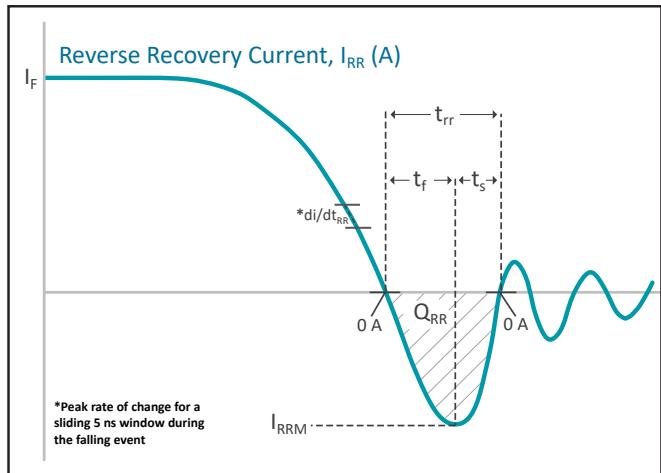


Figure 26. Reverse Recovery Definitions

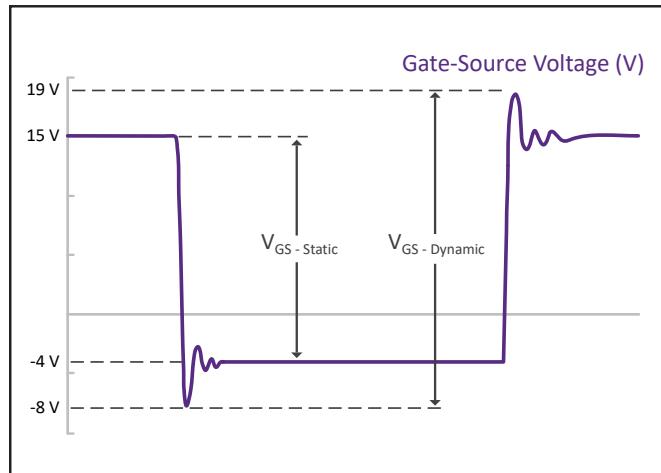


Figure 27. V_{GS} Transient Definitions



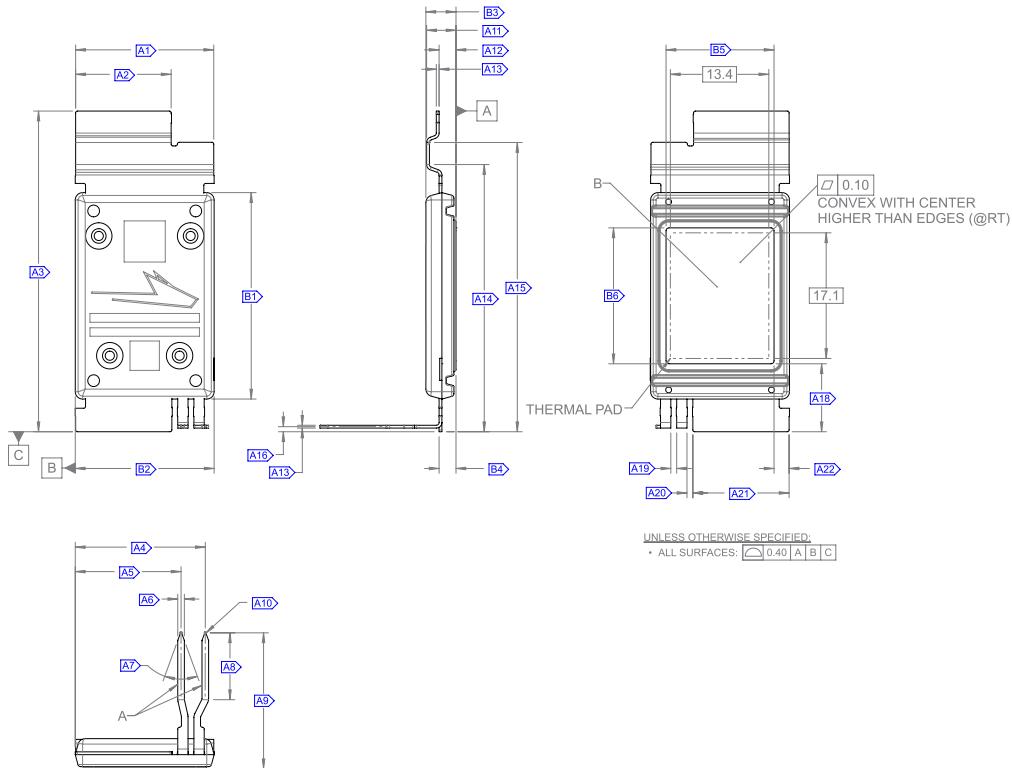
Schematic and Pin Out



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
B3	2±0.9±0.10
A6	2× [40°] [9.1] - Short pin version 9.6 - Long pin version
A7	18.5±0.50 - Short pin version
A8	19.0±0.50 - Long pin version
A9	2× R0.1±0.10
B4	4.1±0.10
A10	4±0.30
A11	2.3±0.30
A12	[0.38±1]
A13	36.37±0.30
A14	39.37±0.30
A15	0.69±0.65
B5	2.3±0.30
B6	[14.7]
A16	[18.5]
A17	9.5 MAX
A18	[0.8]
A19	[0.8]
A20	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
EDB005M12TM4	Short gate and Kelvin-source pin length
EDB005M12TM4L	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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