E4MS025120U2

Silicon Carbide Power MOSFET
Switching Optimized 1200V 25mΩ Automotive
N-Channel Enhancement Mode

Features

- Industry compatible drive voltage 15V...18V/-5V...0V
- Soft body diode with low Vds overshoot and ringing
- Low Rds(on) at high operating temperatures
- Improved device capacitances ratio (Ciss/Crss)
- High transient voltage robustness with improved lifetime
- Halogen free, RoHS compliant
- Automotive Qualified (AEC-Q101) and PPAP Capable

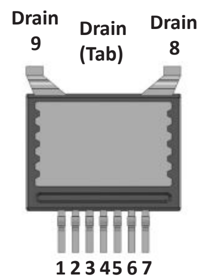
Benefits

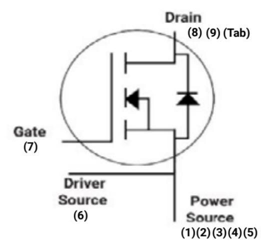
- Higher efficiency with lower switching losses and EMI
- Faster switching operation enabling high power density
- Enables system level price performance optimization
- Reduction in system level cooling requirements

Typical Applications

- Motor Control
- EV On Board Battery Chargers (OBC)
- Automotive DC/DC Converters for EV/HEV

Package





Orderable Part number	Package type	Marking
E4MS025120U2-TR	TO-263-7XL	E4MS025120U2

Key Parameters

Parameter	Symbol	Min.	Typ.	Max	Unit	Conditions	Note
Drain - Source Voltage	V_{DS}			1200	V		
Maximum Gate - Source Voltage	$V_{GS(max)}$	-10		+23			
DC Continuous Drain Current	I_D			82	A	V_{GS} = 18 V, T_C = 25 °C, T_J ≤175 °C	Note 1
				61		V_{GS} = 18 V, T_C = 100 °C, T_J ≤175 °C	
Pulsed Drain Current	I_{DM}			274		t_{Pmax} limited by T_{jmax} V_{GS} = 18V, T_C = 25 °C	
Power Dissipation	P_D			350	W	T_C = 25˚C, T_J = 175 °C	Note 2
Operating Junction and Storage Temperature	T_J, T_{stg}	-55		+175	°C		
Solder Temperature	T_L			260			

Note (1): Current limit calculated by $I_{D(max)}=\sqrt{(P_D/R_{DS(typ)}(T_{J(max)},I_{D(max)}))}$
Note (2): $P_D=(T_J-T_C)/R_{th(JC,max)}$

Electrical Characteristics (T_C = 25˚C unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions	Note
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	1200			V	V_{GS} = 0 V, I_D = 100 μA	
$V_{GS(th)}$	Gate Threshold Voltage	2	2.6	3.9	V	V_{DS} = V_{GS}, I_D = 10.8 mA	Fig. 11
			2.0		V	V_{DS} = V_{GS}, I_D = 10.8 mA, T_J = 175ºC	
I_{DSS}	Zero Gate Voltage Drain Current		1	50	μA	V_{DS} = 1200 V, V_{GS} = 0 V	
I_{GSS}	Gate-Source Leakage Current		10	250	nA	V_{GS} = 18 V, V_{DS} = 0 V	
$V_{GS(op)}$	Recommended Turn on Gate-Source Voltage		+15...+18		V		Refer to PRD-09634
	Recommended Turn off Gate-Source Voltage		-5...0				
$R_{DS(on)}$	Drain-Source On-State Resistance		25	33	mΩ	V_{GS} = 18 V, I_D = 39.2 A	Fig. 4, 5, 6
			47			V_{GS} = 18 V, I_D = 39.2 A, T_J = 175ºC	
			28			V_{GS} = 15 V, I_D = 39.2 A	
g_{fs}	Transconductance		28		S	V_{DS} = 20 V, I_D = 39.2 A, T_J = 25ºC	Fig. 7
			27			V_{DS} = 20 V, I_D = 39.2 A, T_J = 175ºC	
$R_{DS(on)Tempco}$	On resistance temperature coefficient		1.88			V_{GS} = 18 V, I_D = 39.2 A	Note 3
C_{iss}	Input Capacitance		3087		pF	V_{GS} = 0 V, V_{DS} = 1000 V f = 100 kHz V_{AC} = 25 mV	Fig. 17, 18
C_{oss}	Output Capacitance		103				
C_{rss}	Reverse Transfer Capacitance		4.7				
C_{iss}/C_{rss}	Capacitance Ratio		630				Note 4
E_{oss}	C_{oss} Stored Energy		63		μJ		Fig. 16
$C_{o(er)}$	Effective Output Capacitance (Energy Related)		145		pF	V_{GS}= 0V, V_{DS}= 0...800V	
$C_{o(tr)}$	Effective Output Capacitance (Time Related)		238				
E_{on}	Turn-On Switching Energy (Body Diode FWD) Tj=25C Tj=175C		 394 470		μJ	V_{DS} = 800 V, V_{GS} = -4 V/18 V, I_D = 39.2A, $R_{G(ext)}$ = 1Ω, Lσ =25nH	Fig. 26, 29, 31
E_{off}	Turn-Off Switching Energy (Body Diode FWD) Tj=25C Tj=175C		 57 64				Fig. 26, 29, 32
$t_{d(on)}$	Turn-On Delay Time		12		ns	V_{DD} = 800 V, V_{GS} = -4 V/18 V I_D = 39.2 A, $R_{G(ext)}$ = 1 Ω, Timing relative to V_{DS} Inductive load	Fig. 27, 28
t_r	Rise Time		4				
$t_{d(off)}$	Turn-Off Delay Time		36				
t_f	Fall Time		11				
$R_{G(int)}$	Internal Gate Resistance		2.6		Ω	f = 1 MHz	
Q_{gs}	Gate to Source Charge		35		nC	V_{DS} = 800 V, V_{GS} = -4 V/18 V I_D = 39.2 A, T_J = 25ºC Per IEC60747-8-4 pg 21	Fig. 12
Q_{gd}	Gate to Drain Charge		30				
Q_g	Total Gate Charge		125				

Note (3): $R_{DS(on)Tempco}$ refers to $R_{DS(on)}$ at 175 C/ $R_{DS(on)}$ at 25C, E4MS 1200V product family value
Note (4): Capacitance ratio is a FOM for Partial turn-on immunity PRD-06933, E4MS 1200V product family value

Co(er), a lumped capacitance that gives the same stored energy as Coss while Vds is rising from 0 to 800V
Co(tr), a lumped capacitance that gives the same charging time as Coss while Vds is rising from 0 to 800V

Reverse Diode Characteristics (T_C = 25˚C unless otherwise specified)

Symbol	Parameter	Typ.	Max.	Unit	Test Conditions	Note
V_{SD}	Diode Forward Voltage	5.1		V	V_{GS} = -4 V, I_{SD} = 19.6 A, T_J = 25 °C	Fig. 8, 9, 10
		4.6		V	V_{GS} = -4 V, I_{SD} = 19.6 A, T_J = 175 °C	
I_S	Continuous Diode Forward Current		56	A	V_{GS} = -4 V, T_C = 25˚C	
I_{SM}	Diode Pulse Current		274	A	V_{GS} = -4 V, pulse width t_p limited by T_{jmax} max	
t_{rr}	Reverse Recovery Time	14		ns	V_{GS}=-4 V, I_S=39.2 A, V_{SD}=800V T_J=175ºC, diF/dt= 13.8 A/ns	
Q_{rr}	Reverse Recovery Charge	742		nC		
I_{RRM}	Peak Reverse Recovery current	94		A		
E_{RR}	Reverse recovery Energy Tj=25C Tj= 175C	 102 256		µJ	V_{DS}=800 V, I_D=39.2 A, V_{GS}=-4V/18V, $R_{G(on)}$=1 Ω, Lσ =25nH	

Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Unit	Test Conditions	Note
$R_{\theta JC}$	Thermal Resistance from Junction to Case	0.33	0.43	°C/W		

Typical Performance

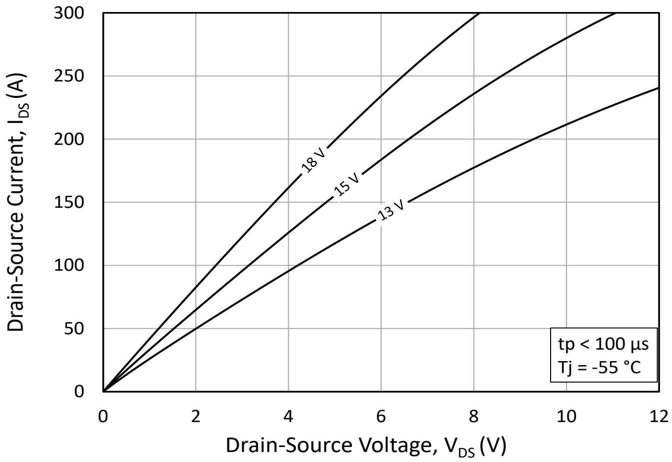


Figure 1. Output Characteristics T_J = -55°C

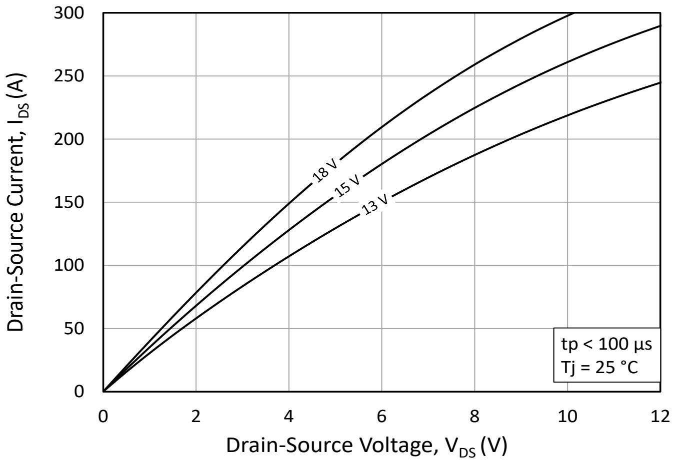


Figure 2. Output Characteristics T_J = 25°C

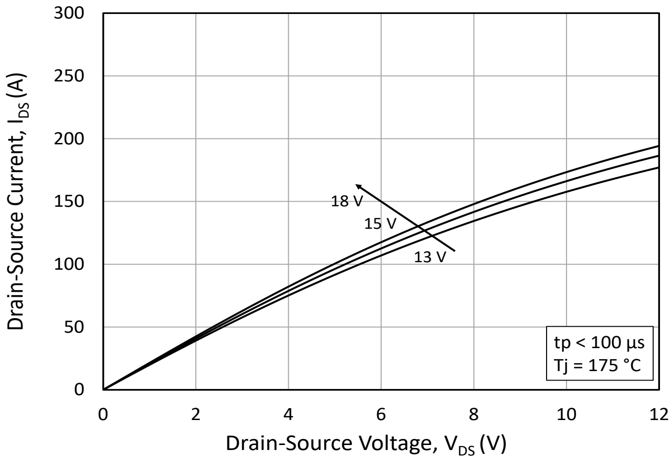


Figure 3. Output Characteristics T_J = 175°C

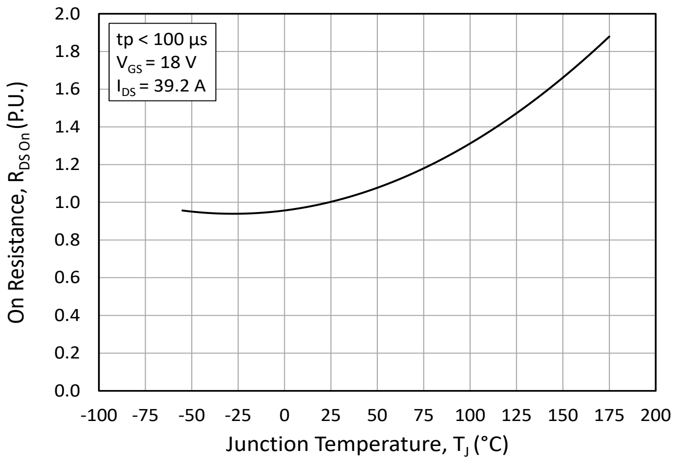


Figure 4. Normalized On-Resistance vs. Temperature

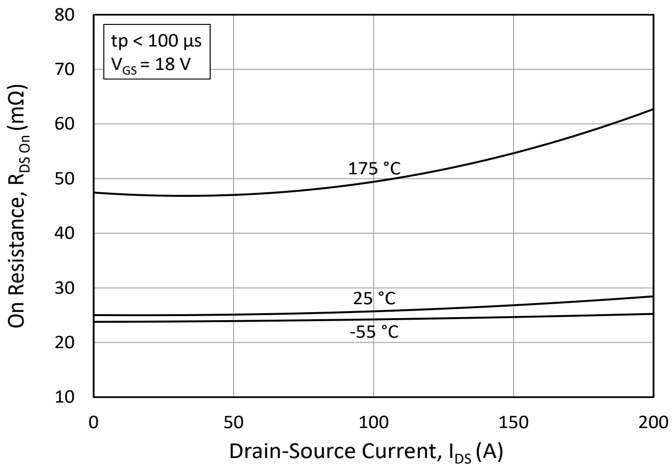


Figure 5. On-Resistance vs. Drain Current For Various Temperatures

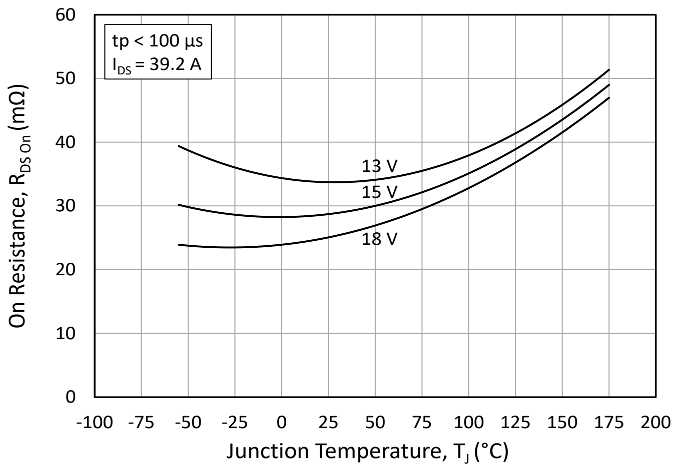


Figure 6. On-Resistance vs. Temperature For Various Gate Voltage

Typical Performance

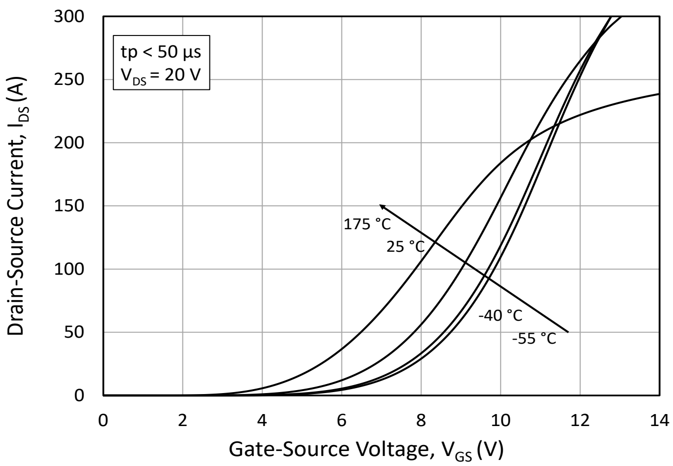


Figure 7. Transfer Characteristic for Various Junction Temperatures

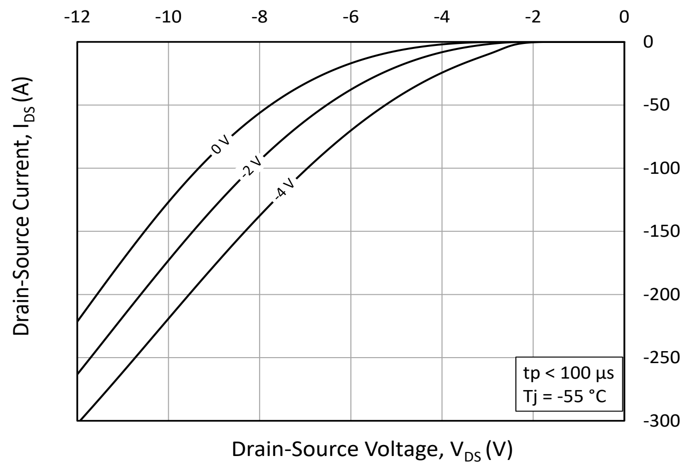


Figure 8. Body Diode Characteristic at -55ºC

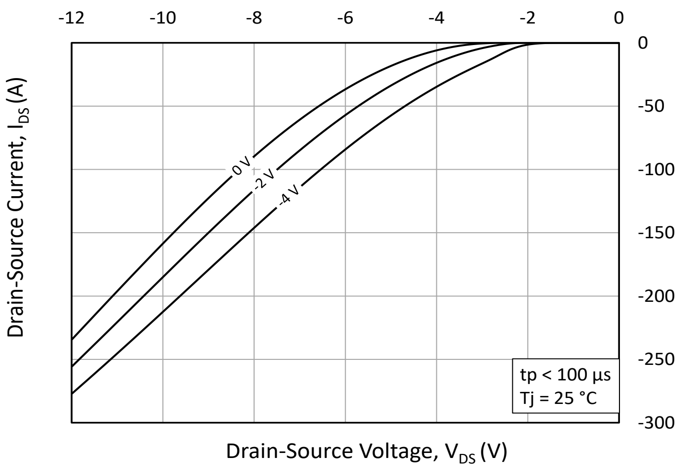


Figure 9. Body Diode Characteristic at 25ºC

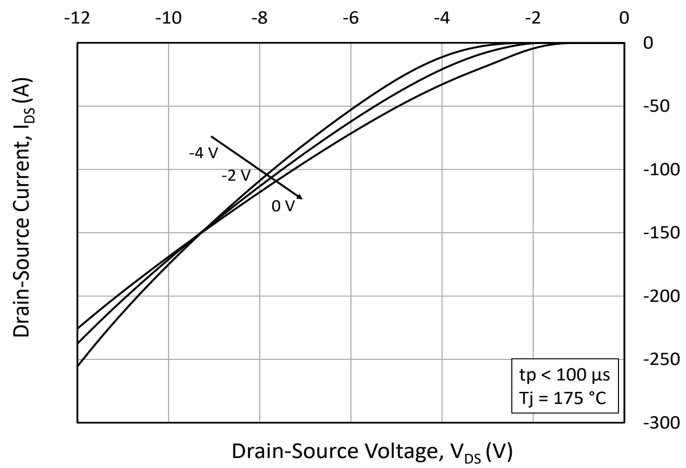


Figure 10. Body Diode Characteristic at 175ºC

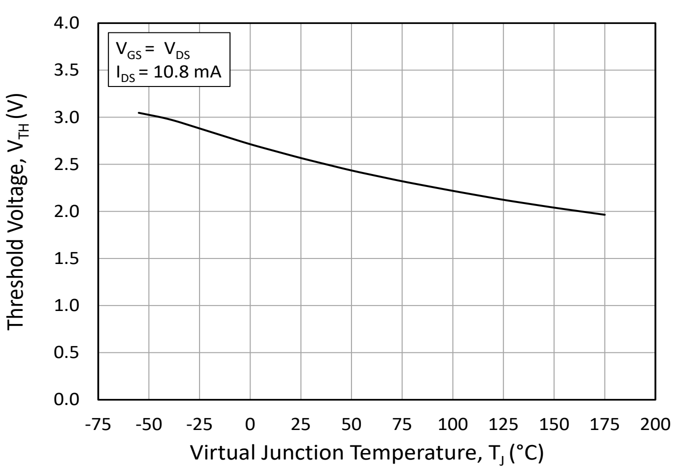


Figure 11. Threshold Voltage vs. Temperature

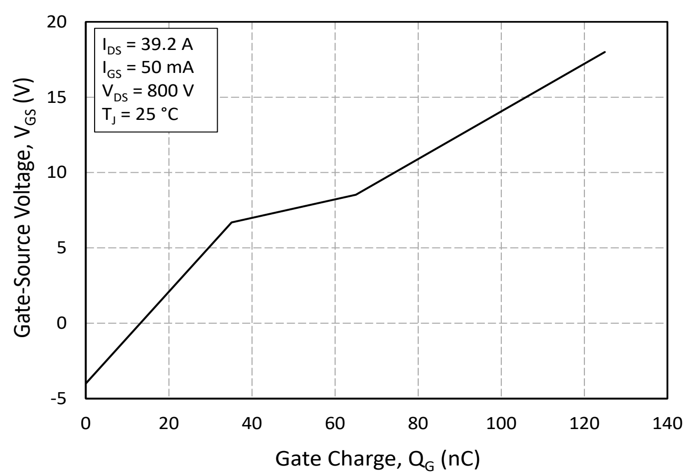


Figure 12. Gate Charge Characteristics

Typical Performance

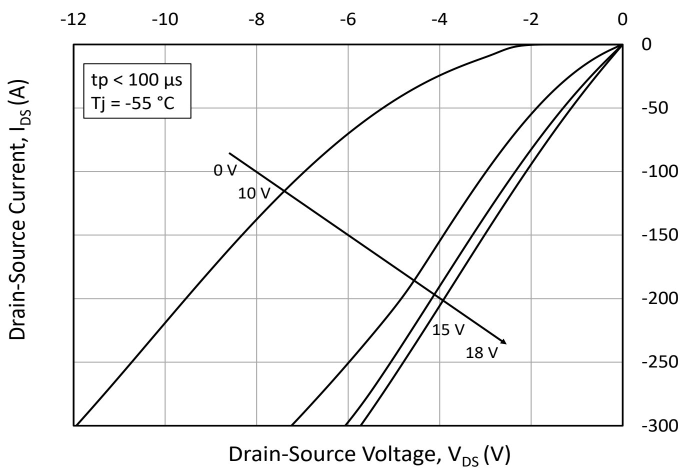


Figure 13. 3rd Quadrant Characteristic at -55ºC

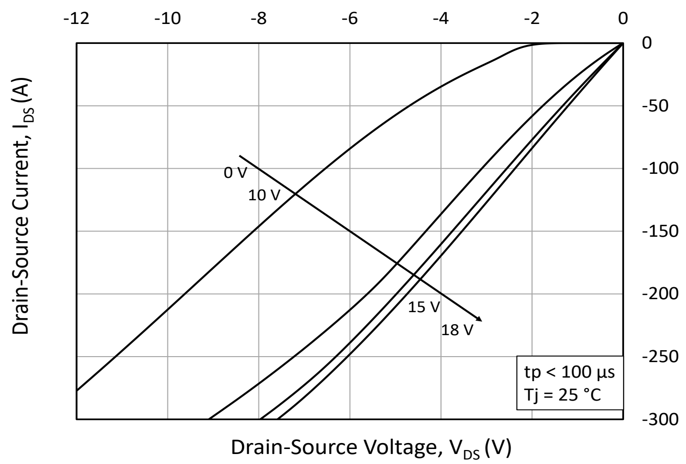


Figure 14. 3rd Quadrant Characteristic at 25ºC

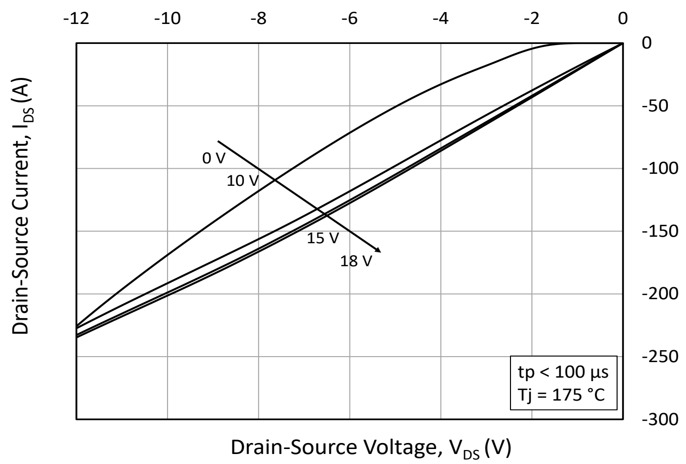


Figure 15. 3rd Quadrant Characteristic at 175ºC

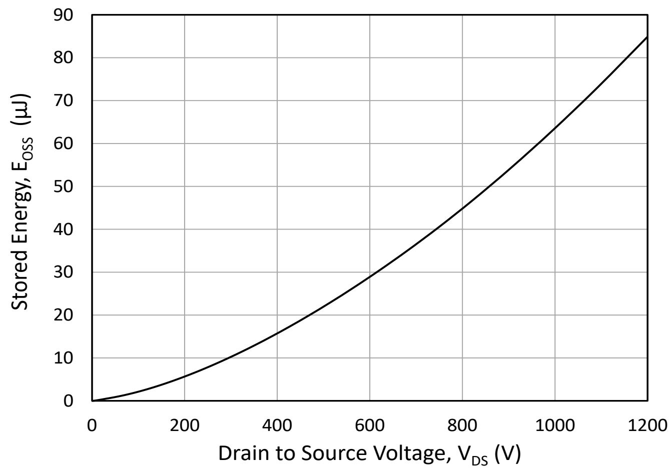


Figure 16. Output Capacitor Stored Energy

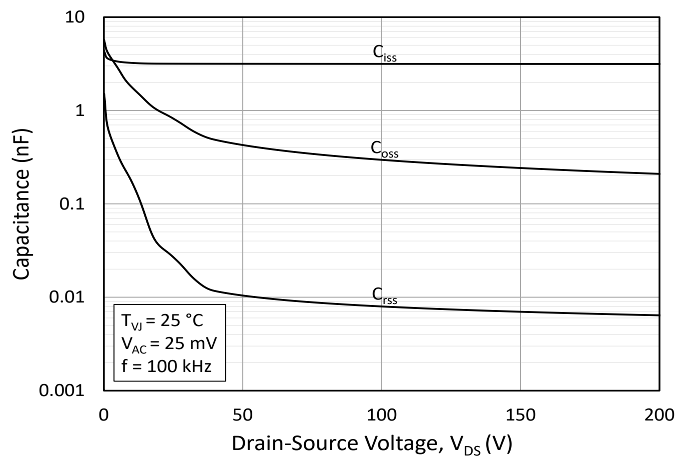


Figure 17. Capacitances vs. Drain-Source Voltage (0 - 200 V)

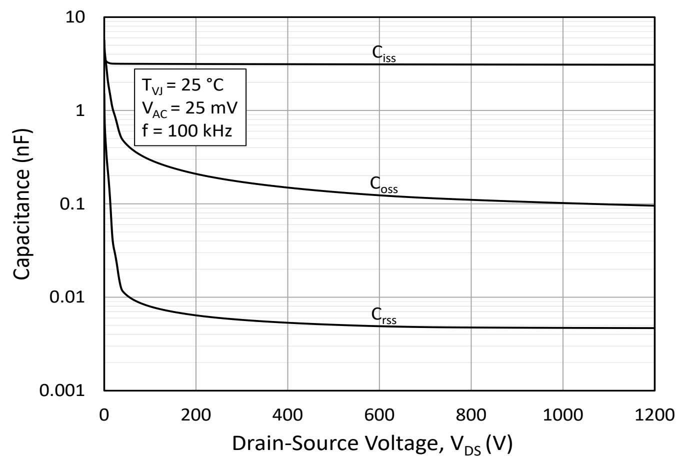


Figure 18. Capacitances vs. Drain-Source Voltage (0 - 1200 V)

Typical Performance

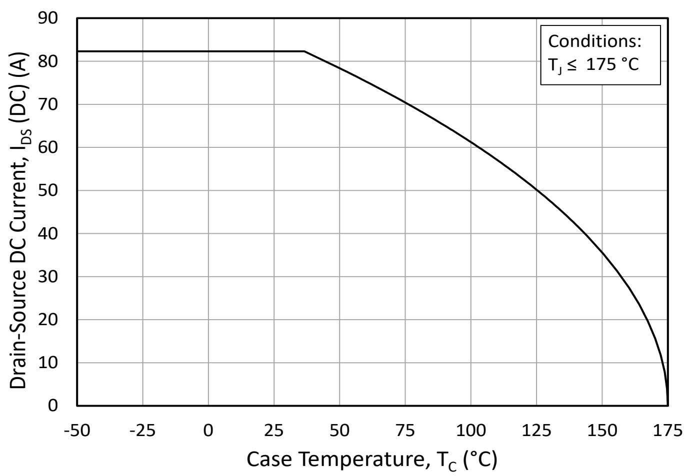


Figure 19. Continuous Drain Current Derating vs. Case Temperature

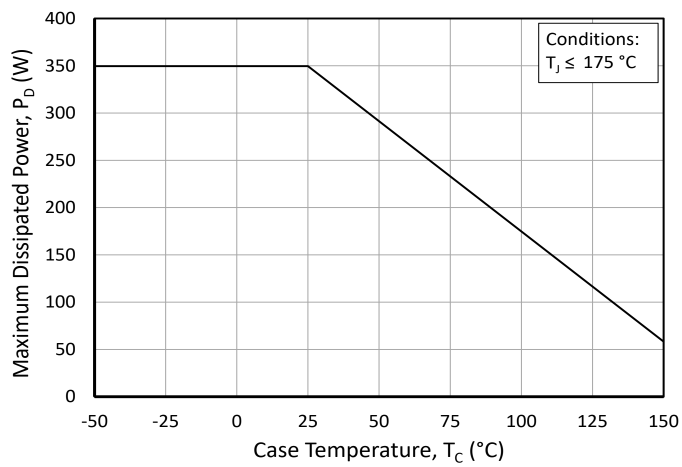


Figure 20. Maximum Power Dissipation Derating vs. Case Temperature

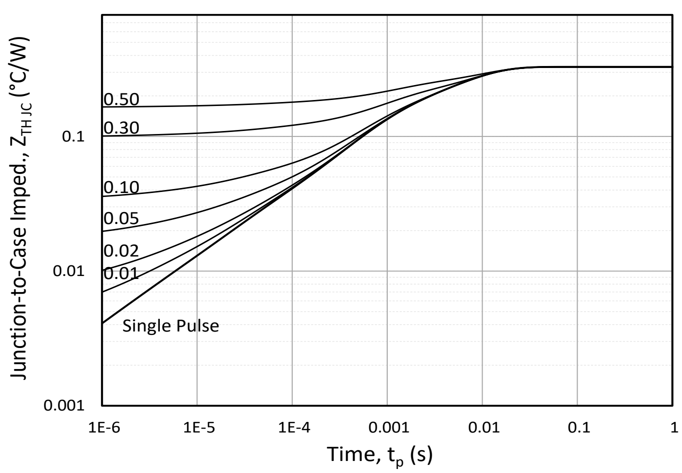


Figure 21. Transient Thermal Impedance (Junction - Case)

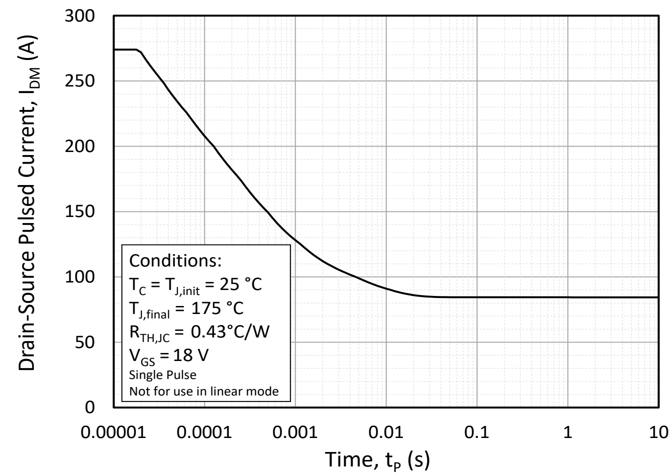


Figure 22. Safe Operating Area

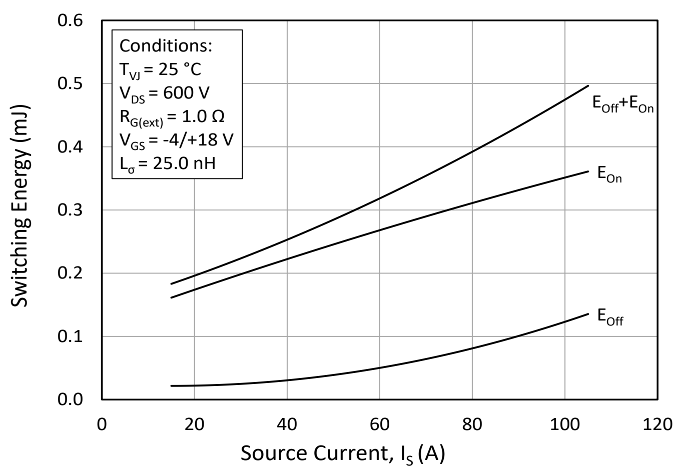


Figure 23. Clamped Inductive Switching Energy vs. Drain Current (V_{DD} = 600 V)

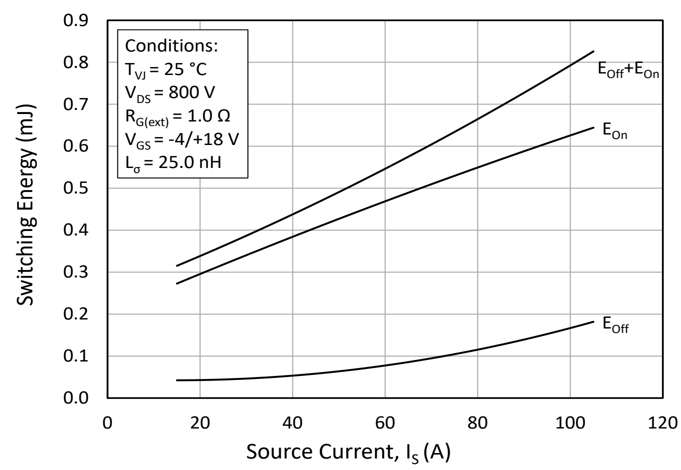


Figure 24. Clamped Inductive Switching Energy vs. Drain Current (V_{DD} = 800 V)

Typical Performance

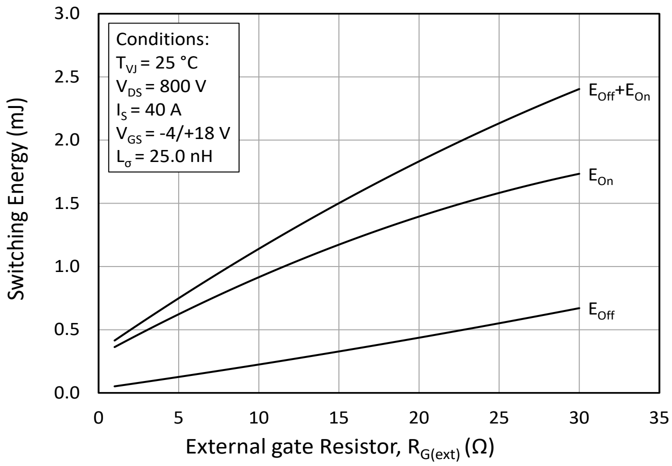


Figure 25. Clamped Inductive Switching Energy vs. $R_{G(ext)}$

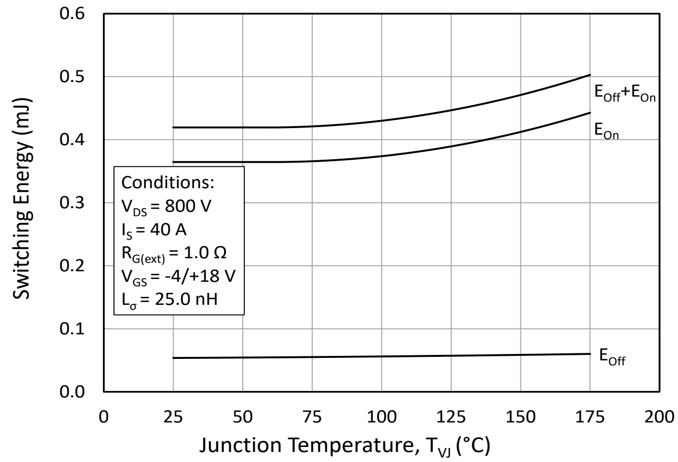


Figure 26. Clamped Inductive Switching Energy vs. Temperature

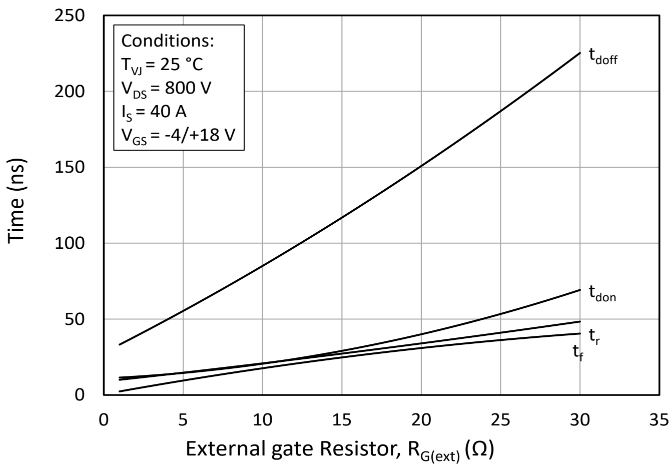


Figure 27. Switching Times vs. $R_{G(ext)}$

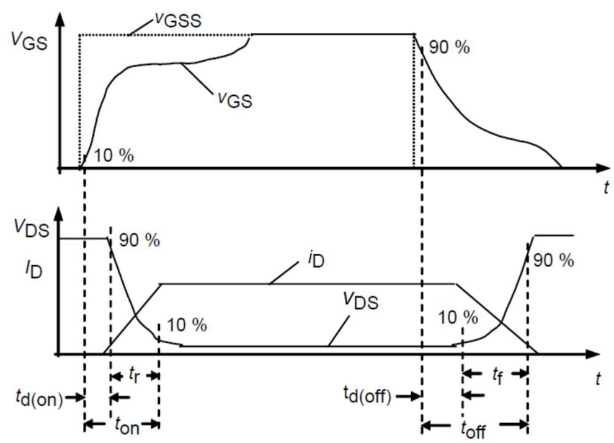


Figure 28. Switching Times Definition

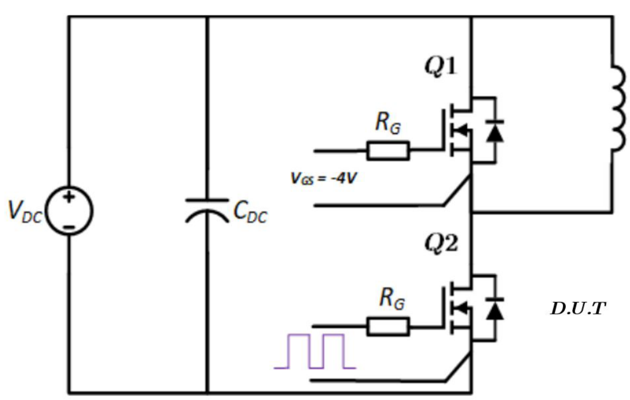


Figure 29. Clamped Inductive MOSFET Switching Waveform Test Circuit

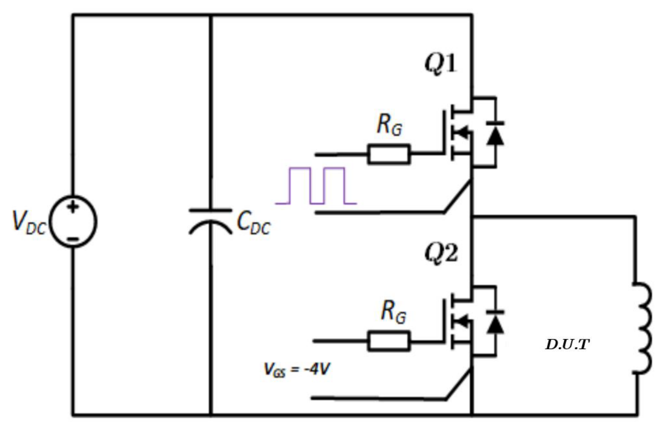
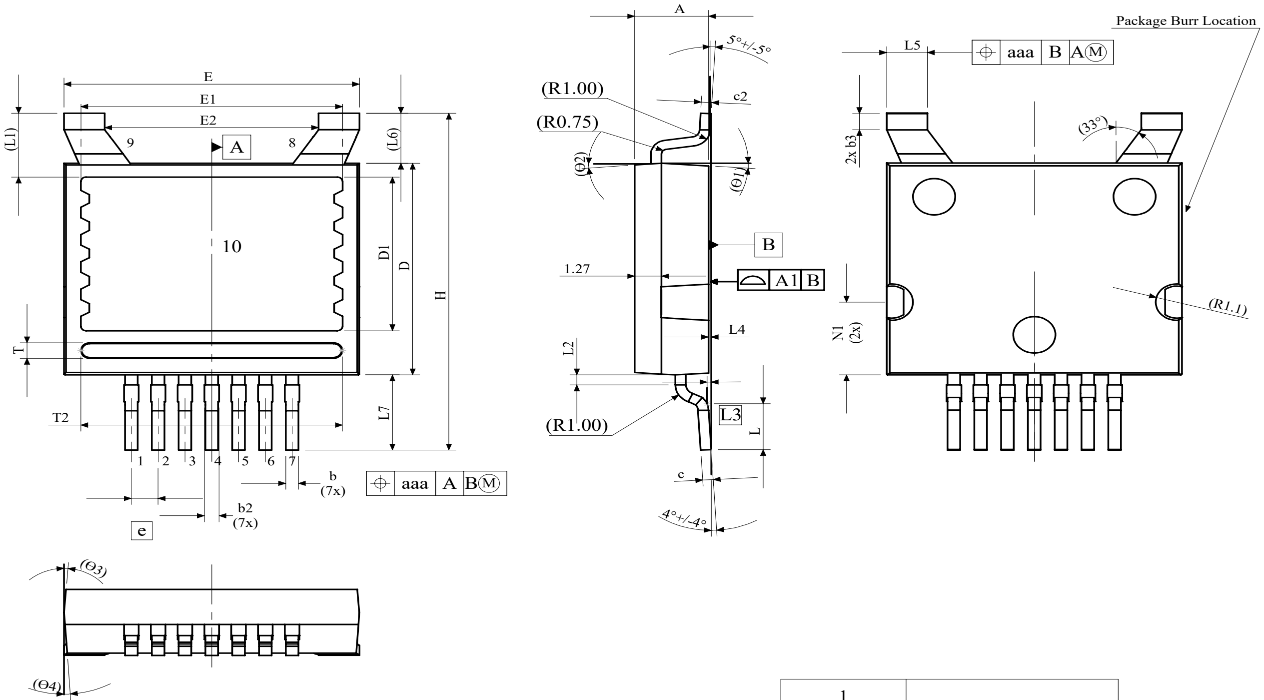


Figure 30. Clamped Inductive Body diode Switching Waveform Test Circuit

Package Dimensions



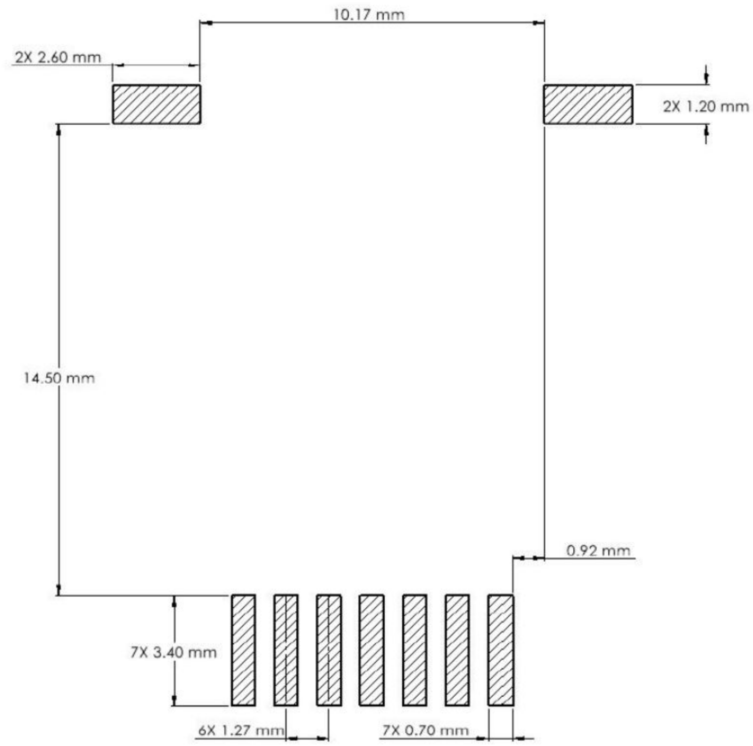
SYMBOL	MIN (mm)	MAX (mm)
A	3.40	3.60
A1	---	0.05
b	0.50	0.70
b2	0.50	1.00
b3	0.85	1.05
c	0.40	0.60
c2	0.40	0.60
D	11.55	11.75
D1	8.30	8.50
E	13.92	14.12
E1	12.22	12.42
E2	9.92	10.22
e	BSC 1.27	
H	18.00	19.00
L	2.47	2.67
L1	BSC 3.51	
L2	0.3	0.73
L3	BSC 0.26	
L4	0.09	0.2
L5	1.83	2.13
L6	BSC 2.75	
L7	4.03	4.23
T	0.75	0.95
T2	12.30	12.50
N1	3.90	4.10
Θ1	0°	8°
Θ2	0°	8°
Θ3	0°	8°
Θ4	0°	8°
aaa	---	0.10

1	SOURCE
2	
3	
4	
5	
6	DRIVER SOURCE
7	GATE
8	DRAIN
9	DRAIN
10	DRAIN

NOTE
1. ALL METAL SURFACES ARE TIN PLATED (MATTE), EXCEPT AREA OF CUT.
2. DIMENSIONING & TOLERANCING CONFORM TO ASME Y14.5M-1994.
3. ALL DIMENSIONS ARE LISTED IN MILLIMETERS. ANGLES ARE IN DEGREES.
4. PACKAGE BURR FLASH SIZE (0.5 mm) IS NOT INCLUDED IN THE DIMENSIONS

Recommended Solder Pad Layout

All dimensions in mm



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Revision history

Document Version	Date of release	Description of changes
1	October 2025	Initial release

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The levels of RoHS restricted materials in this product are below the maximum concentration values (also referred to as the threshold limits) permitted for such substances, or are used in an exempted application, in accordance with EU Directive 2011/65/EC (RoHS2), as implemented February 2, 2013. RoHS Declarations for this product can be obtained from your Wolfspeed representative or from the Product Documentation sections of www.wolfspeed.com.

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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