

# C4MS045075K1

## Switching Optimized 750V 45mΩ Industrial Silicon Carbide Power MOSFET

### 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 capacitance ratio (Ciss/Crss)
- High transient voltage robustness with improved lifetime
- Halogen free, RoHS compliant

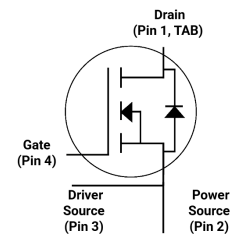
### Benefits

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

### Typical Applications

- Data Center Power Supplies
- EV Chargers
- Solar/ESS
- Motor Control
- Industrial Power Supplies
- High Voltage DC/DC Converters

### Package



Orderable Part Number	Package Type	Marking
C4MS045075K1	TO-247-4 LP	C4MS045075K1

### Key Parameters

Parameter	Symbol	Min.	Typ.	Max	Unit	Conditions	Note
Drain-Source Voltage	$V_{DS}$			750	V		
Maximum Gate-Source Voltage	$V_{GS(max)}$	-10		+23			Note 1
DC Continuous Drain Current	$I_D$		52		A	$V_{GS} = 18V, T_c = 25^\circ C, T_J \leq 175^\circ C$	Note 2
			37			$V_{GS} = 18V, T_c = 100^\circ C, T_J \leq 175^\circ C$	
Pulsed Drain Current	$I_{DM}$			102		$t_{Pmax}$ limited by $T_{Jmax}$ $V_{GS} = 18V, T_c = 25^\circ C$	
Power Dissipation	$P_D$		197		W	$T_c = 25^\circ C, T_J = 175^\circ C$	Note 3
Operating Junction and Storage Temperature	$T_J, T_{stg}$	-55		+175	°C		
Solder Temperature	$T_L$			260		According to JEDEC J-STD-020	

Note (1): When applying IPC-9592B or OCP M-CRPS derating standards, a maximum Gate-Source voltage ( $V_{GS}$ ) of +25V is permissible.

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

Note (3):  $P_D = (T_J - T_c) / R_{th(JC, typ)}$



## Electrical Characteristics ( $T_c = 25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions	Note
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	750			V	$V_{GS} = 0\text{ V}, I_D = 100\ \mu\text{A}$	
$V_{GS(th)}$	Gate Threshold Voltage	2.0	2.6	3.9	V	$V_{DS} = V_{GS}, I_D = 4.0\ \text{mA}$	Fig. 11
			2.0		V	$V_{DS} = V_{GS}, I_D = 4.0\ \text{mA}, T_J = 175^\circ\text{C}$	
$I_{DSS}$	Zero Gate Voltage Drain Current		1	50	$\mu\text{A}$	$V_{DS} = 750\ \text{V}, V_{GS} = 0\ \text{V}$	
$I_{GSS}$	Gate-Source Leakage Current		10	250	nA	$V_{GS} = 18\ \text{V}, V_{DS} = 0\ \text{V}$	
$V_{GS(op)}$	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		45	58.5	m $\Omega$	$V_{GS} = 18\ \text{V}, I_D = 14.5\ \text{A}$	Fig. 4, 5, 6
			66.2			$V_{GS} = 18\ \text{V}, I_D = 14.5\ \text{A}, T_J = 175^\circ\text{C}$	
			54.9			$V_{GS} = 15\ \text{V}, I_D = 14.5\ \text{A}$	
$g_{fs}$	Transconductance		10.2		S	$V_{DS} = 20\ \text{V}, I_D = 14.5\ \text{A}$	Fig. 7
			10			$V_{DS} = 20\ \text{V}, I_D = 14.5\ \text{A}, T_J = 175^\circ\text{C}$	
$R_{DS(on)Tempco}$	On resistance temperature coefficient		1.47			$V_{GS} = 18\ \text{V}, I_D = 14.5\ \text{A}$	Note 4
$C_{iss}$	Input Capacitance		1201		pF	$V_{GS} = 0\ \text{V}, V_{DS} = 500\ \text{V}$ $f = 100\ \text{kHz}$ $V_{AC} = 25\ \text{mV}$	Fig. 17, 18
$C_{oss}$	Output Capacitance		77				
$C_{rss}$	Reverse Transfer Capacitance		2.8				
$C_{iss}/C_{rss}$	Capacitance Ratio		430				Note 5
$E_{oss}$	$C_{oss}$ Stored Energy		12.2		$\mu\text{J}$		Fig. 16
$C_{o(er)}$	Effective Output Capacitance (Energy Related)		97		pF	$V_{GS} = 0\ \text{V}, V_{DS} = 0...500\ \text{V}$	Note 6
$C_{o(tr)}$	Effective Output Capacitance (Time Related)		151				
$E_{on}$	Turn-On Switching Energy (Body Diode FWD) $T_J = 25^\circ\text{C}$ $T_J = 175^\circ\text{C}$		51		$\mu\text{J}$	$V_{DS} = 500\ \text{V}, V_{GS} = -4\ \text{V}/18\ \text{V}$ $I_D = 14.5\ \text{A}, R_{G(ext)} = 2\ \Omega, L_\sigma = 25\ \text{nH}$	Fig. 25, 27, 29
			51				Fig. 25, 28, 29
$E_{off}$	Turn-Off Switching Energy (Body Diode FWD) $T_J = 25^\circ\text{C}$ $T_J = 175^\circ\text{C}$		10		$\mu\text{J}$	$V_{DS} = 500\ \text{V}, V_{GS} = -4\ \text{V}/18\ \text{V}$ $I_D = 14.5\ \text{A}, R_{G(ext)} = 2\ \Omega, L_\sigma = 25\ \text{nH}$	Fig. 25, 28, 29
			10				Fig. 25, 28, 29
$t_{d(on)}$	Turn-On Delay Time		9.1		ns	$V_{DD} = 500\ \text{V}, V_{GS} = -4\ \text{V}/18\ \text{V}$ $I_D = 14.5\ \text{A}, R_{G(ext)} = 2\ \Omega, L_\sigma = 25\ \text{nH}$ Inductive load	Fig. 26, 27, 28, 29
$t_r$	Rise Time		2.5				
$t_{d(off)}$	Turn-Off Delay Time		18.5				
$t_f$	Fall Time		8.5				
$R_{G(int)}$	Internal Gate Resistance		2.3		$\Omega$	$f = 1\ \text{MHz}$	
$Q_{gs}$	Gate to Source Charge		14		nC	$V_{DS} = 500\ \text{V}, V_{GS} = -4\ \text{V}/18\ \text{V}$	Fig. 12
$Q_{gd}$	Gate to Drain Charge		13.5			$I_D = 14.5\ \text{A}$	
$Q_g$	Total Gate Charge		48.6			Per IEC60747-8-4	

Note (4):  $R_{DS(on)Tempco}$  refers to  $R_{DS(on)}$  at  $175^\circ\text{C}$  /  $R_{DS(on)}$  at  $25^\circ\text{C}$ , C4MS 750V product family value

Note (5): Capacitance ratio is a FOM for Partial turn-on immunity PRD-06933, C4MS 750V product family value

Note (6):  $C_{o(er)}$  a lumped capacitance that gives the same stored energy as  $C_{oss}$  while  $V_{ds}$  is rising from 0 to 500 V

$C_{o(tr)}$  a lumped capacitance that gives the same charging time as  $C_{oss}$  while  $V_{ds}$  is rising from 0 to 500 V



## Reverse Diode Characteristics ( $T_c = 25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter	Typ.	Max.	Unit	Test Conditions	Note
$V_{SD}$	Diode Forward Voltage	5.1		V	$V_{GS} = -4\text{ V}, I_{SD} = 7.3\text{ A}$	Fig. 8, 9, 10
		4.5		V	$V_{GS} = -4\text{ V}, I_{SD} = 7.3\text{ A}, T_J = 175^\circ\text{C}$	
$I_S$	Continuous Diode Forward Current	29		A	$V_{GS} = -4\text{ V}$	
$I_{SM}$	Diode Pulse Current		102	A	$V_{GS} = -4\text{ V}$ , pulse width $t_p$ limited by $T_{Jmax}$	
$t_{rr}$	Reverse Recovery Time	7.3		ns	$V_{SD} = 500\text{ V}, V_{GS} = -4\text{ V}, T_J = 175^\circ\text{C}$ $I_S = 14.5\text{ A}, di_F/dt = 9.1\text{ A/ns}$	Fig. 30
$Q_{rr}$	Reverse Recovery Charge	171		nC		
$I_{RRM}$	Peak Reverse Recovery Current	38		A		
$E_{RR}$	Reverse recovery Energy $T_J = 25^\circ\text{C}$ $T_J = 175^\circ\text{C}$	71.3 62		$\mu\text{J}$	$V_{DS} = 500\text{ V}, V_{GS} = -4\text{ V}/18\text{ V}$ $I_D = 14.5\text{ A}, R_{G(on)} = 2\ \Omega, L_\sigma = 25\text{ nH}$	

## Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Unit	Test Conditions	Note
$R_{\theta JC}$	Thermal Resistance from Junction to Case	0.76		$^\circ\text{C/W}$		



Typical Performance

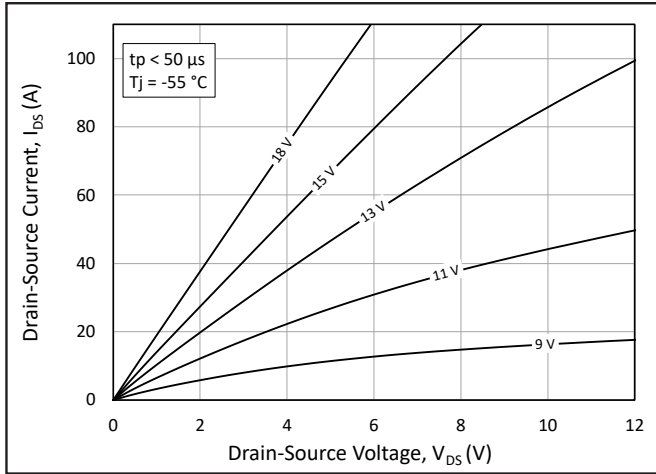


Figure 1. Output Characteristics  $T_J = -55^\circ\text{C}$

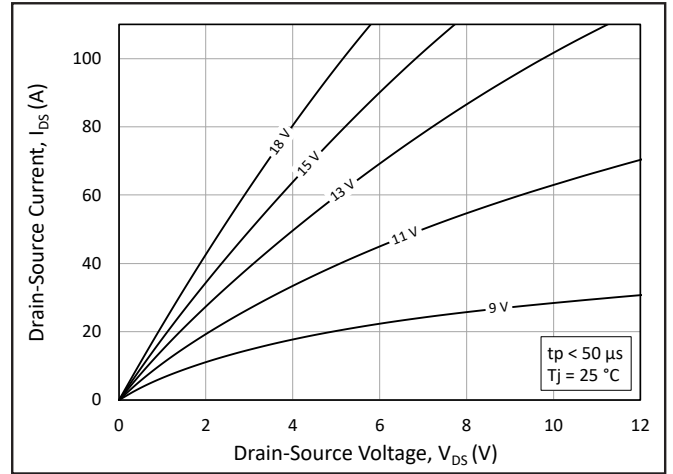


Figure 2. Output Characteristics  $T_J = 25^\circ\text{C}$

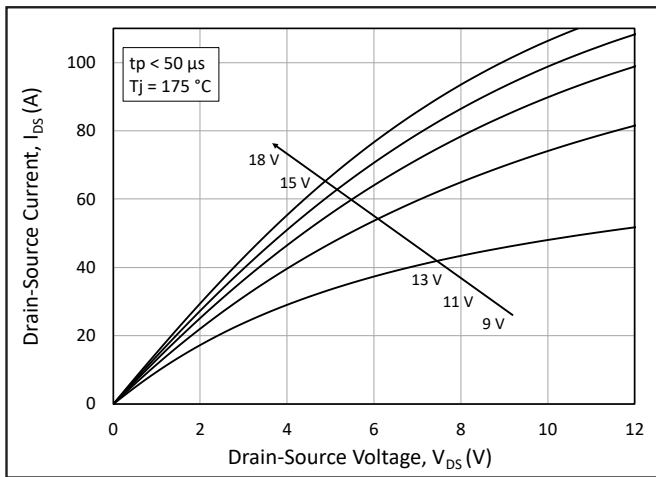


Figure 3. Output Characteristics  $T_J = 175^\circ\text{C}$

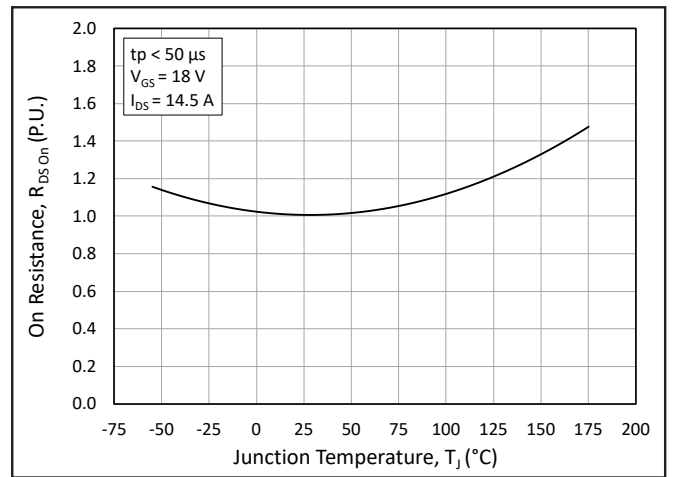


Figure 4. Normalized On-Resistance vs. Temperature

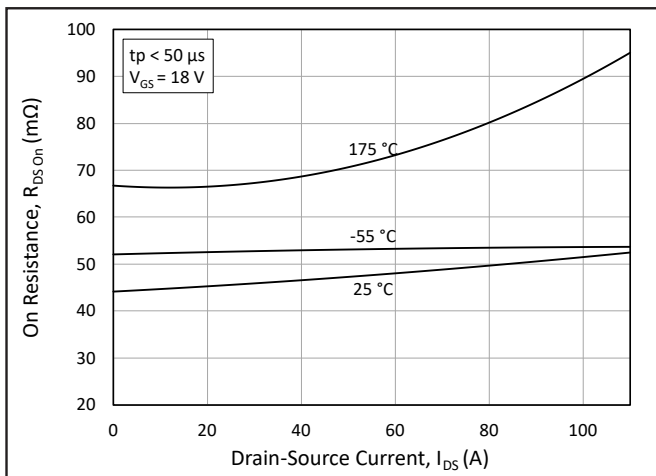


Figure 5. On-Resistance vs. Drain Current For Various Temperatures

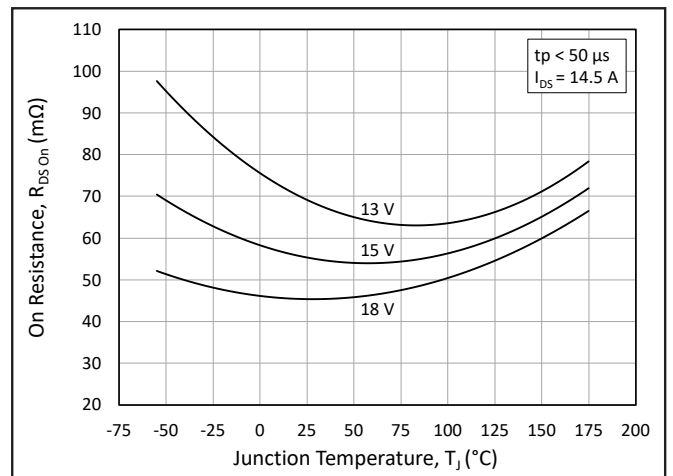


Figure 6. On-Resistance vs. Temperature For Various Gate Voltage



Typical Performance

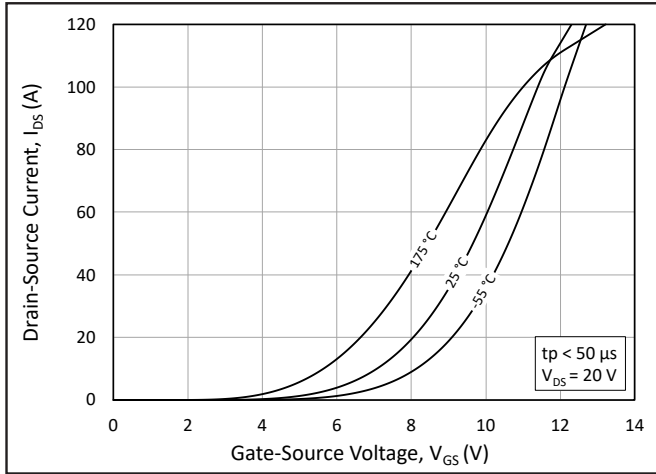


Figure 7. Transfer Characteristic for Various Junction Temperatures

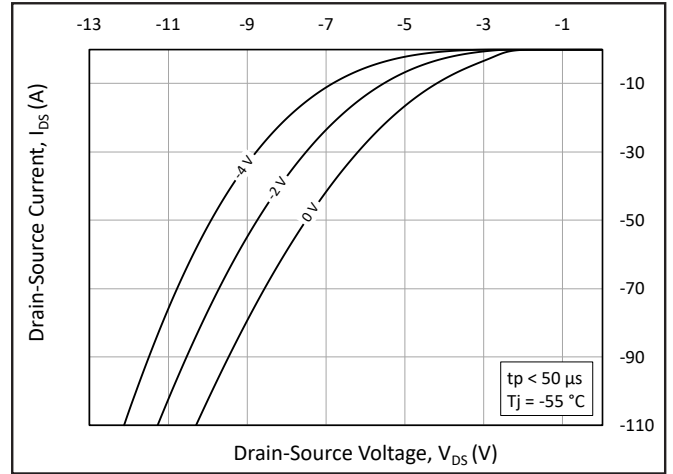


Figure 8. Body Diode Characteristic at -55°C

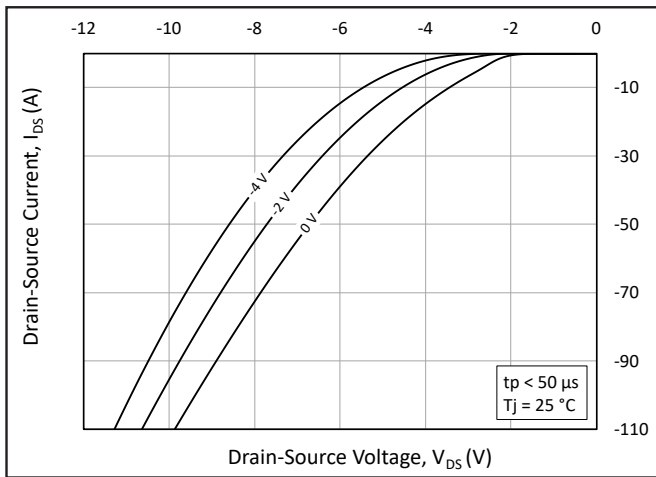


Figure 9. Body Diode Characteristic at 25°C

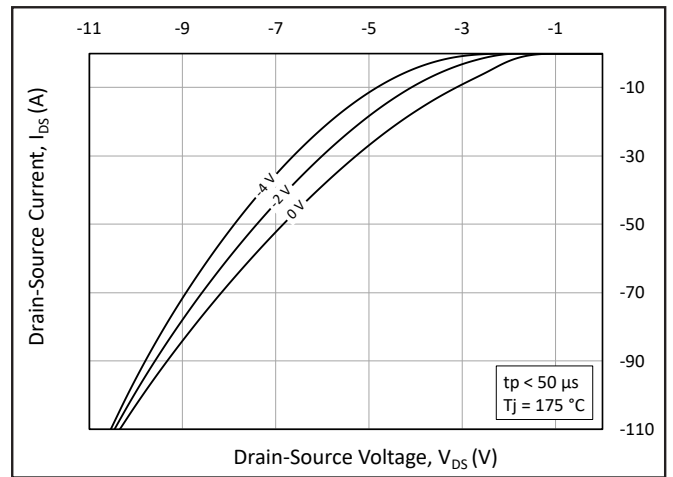


Figure 10. Body Diode Characteristic at 175°C

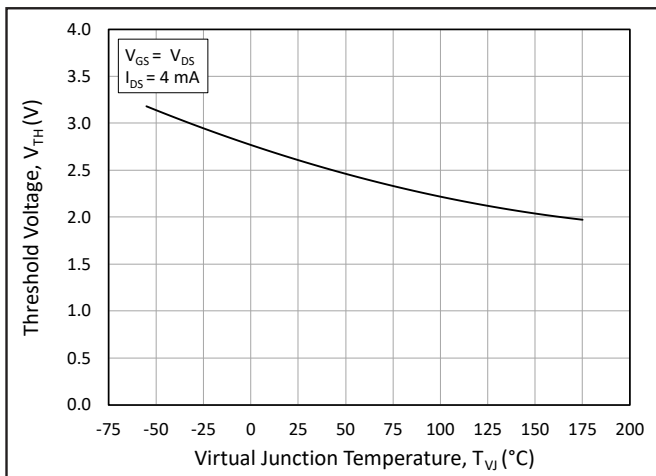


Figure 11. Threshold Voltage vs. Temperature

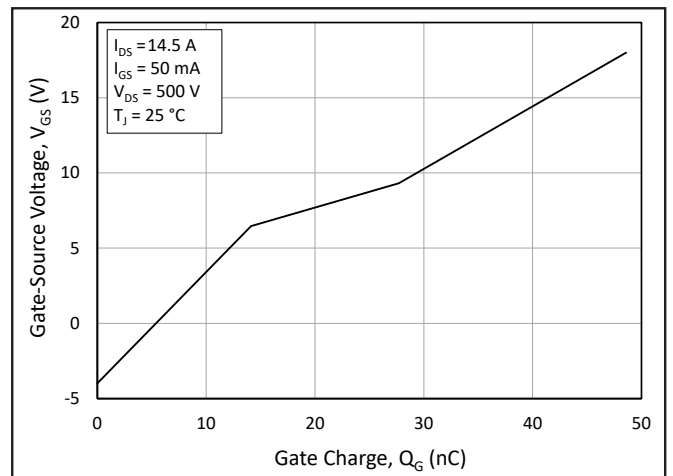


Figure 12. Gate Charge Characteristics



Typical Performance

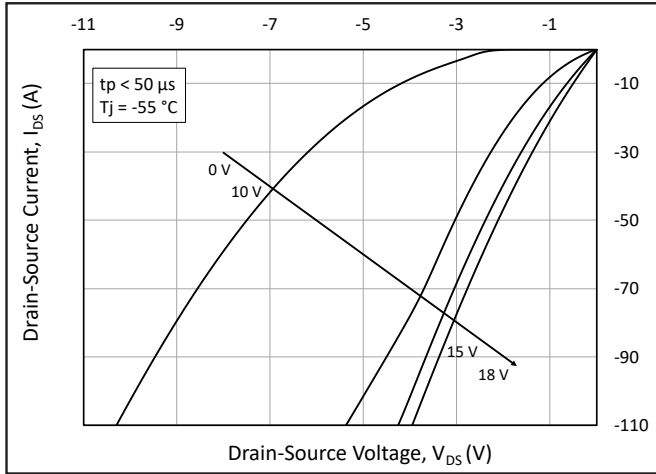


Figure 13. 3rd Quadrant Characteristic at -55°C

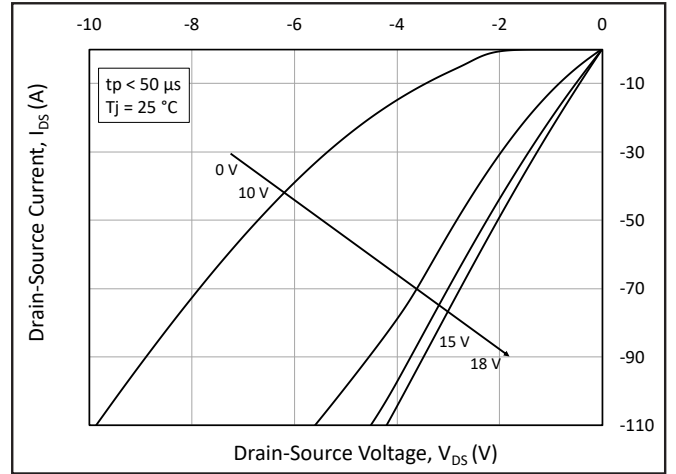


Figure 14. 3rd Quadrant Characteristic at 25°C

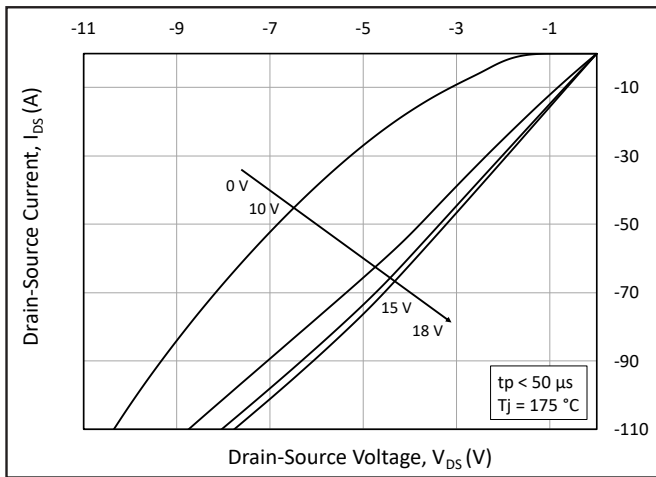


Figure 15. 3rd Quadrant Characteristic at 175°C

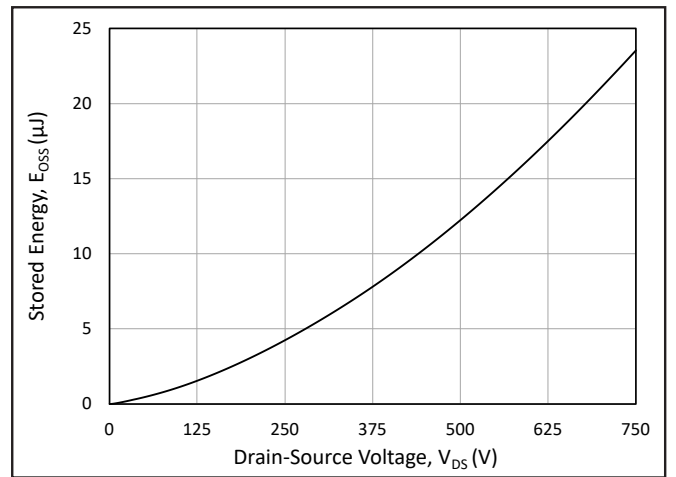


Figure 16. Output Capacitor Stored Energy

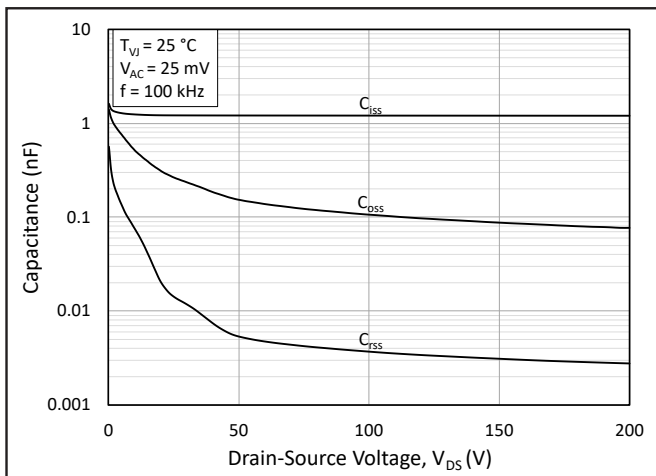


Figure 17. Capacitances vs. Drain-Source Voltage (0 - 200 V)

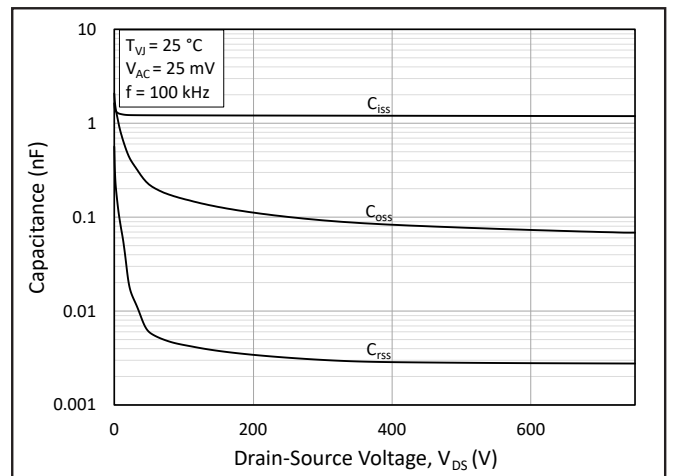


Figure 18. Capacitances vs. Drain-Source Voltage (0 - 750 V)



Typical Performance

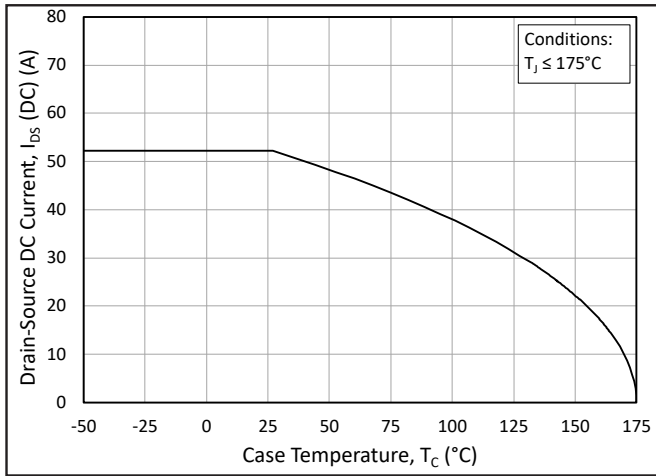


Figure 19. Continuous Drain Current Derating vs. Case Temperature

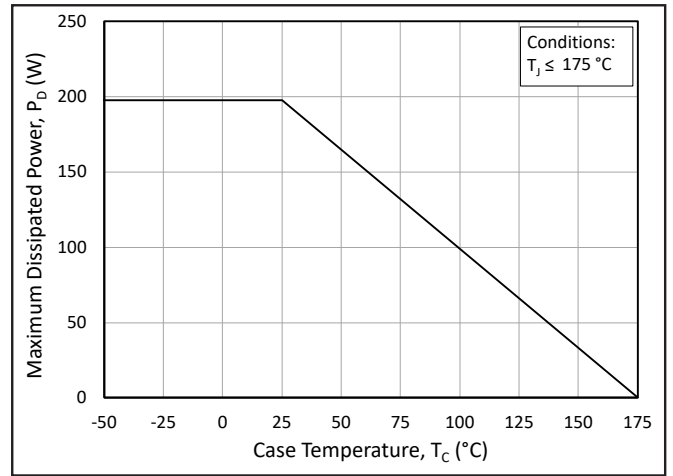


Figure 20. Maximum Power Dissipation Derating vs. Case Temperature

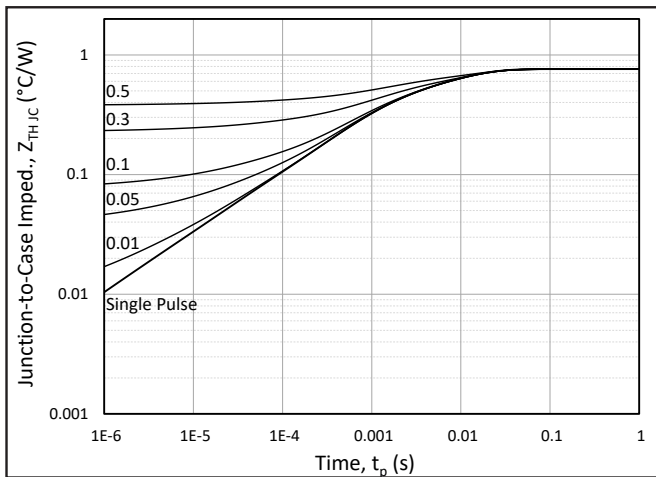


Figure 21. Transient Thermal Impedance (Junction - Case)

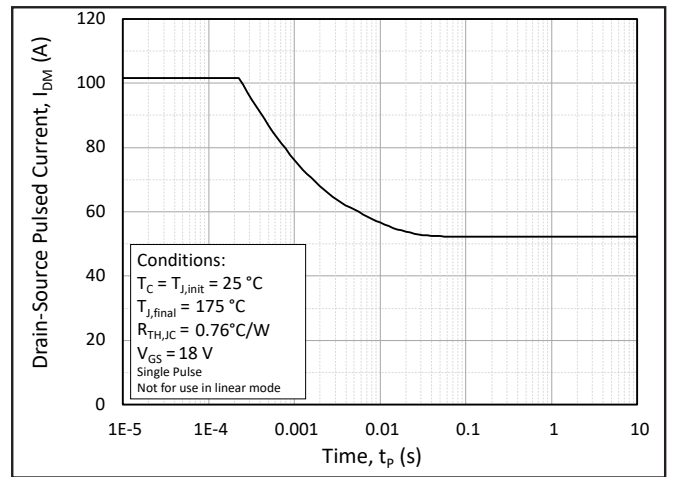


Figure 22. Pulse Current Safe Operating Area

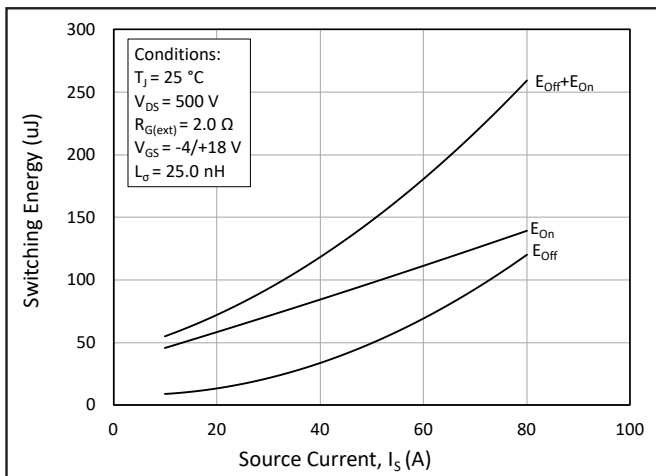


Figure 23. Clamped Inductive Switching Energy vs. Current

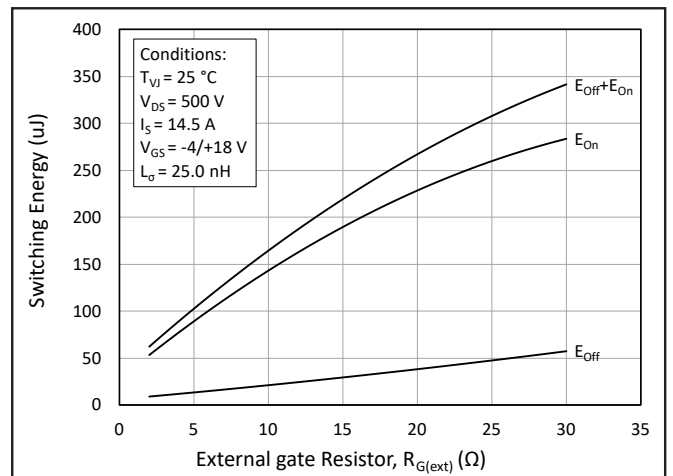


Figure 24. Clamped Inductive Switching Energy vs.  $R_{G(ext)}$



Typical Performance

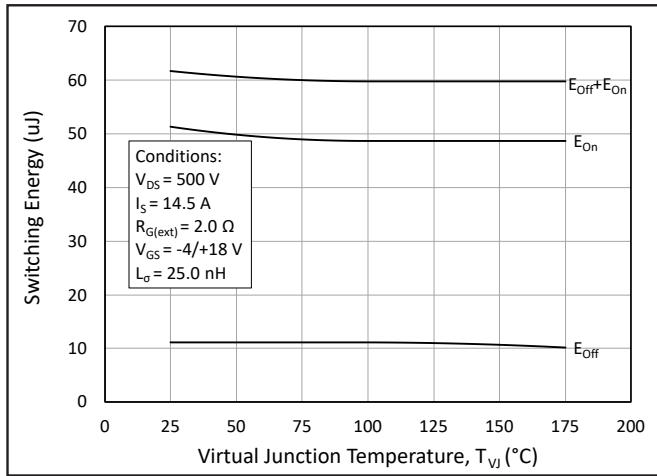


Figure 25. Clamped Inductive Switching Energy vs. Temperature

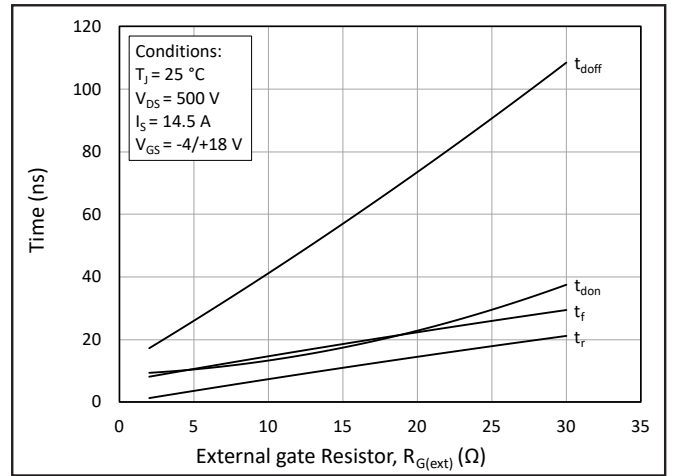


Figure 26. Switching Times vs.  $R_{G(ext)}$

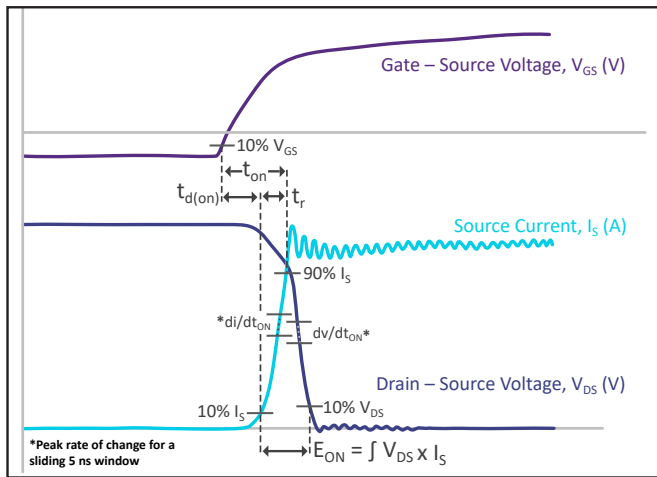


Figure 27. Turn On Switching Times Definition

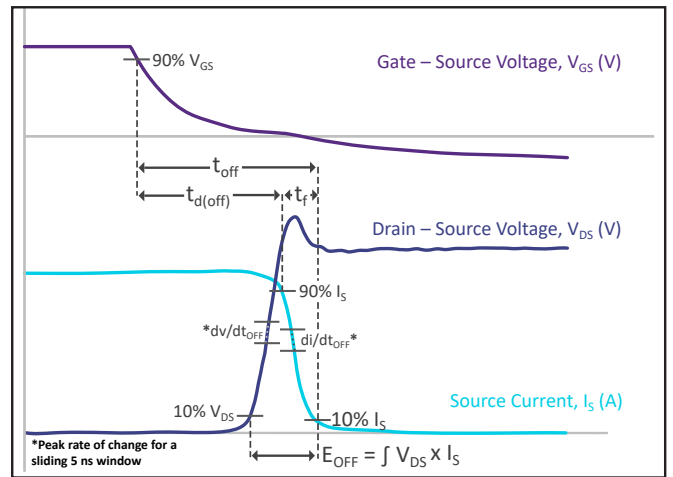


Figure 28. Turn Off Switching Times Definition

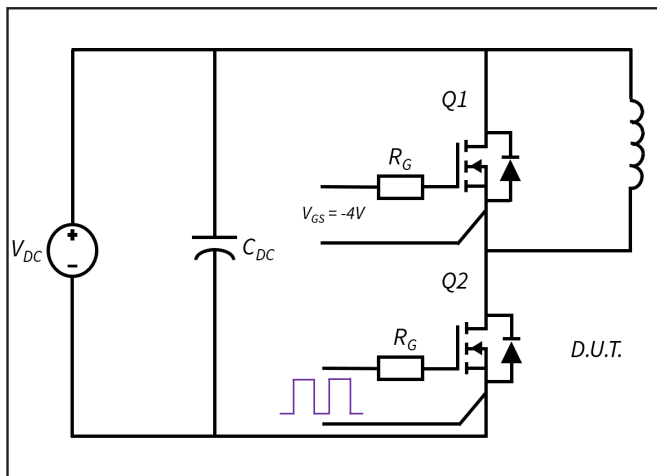


Figure 29. Clamped Inductive MOSFET Switching Waveform Test Circuit

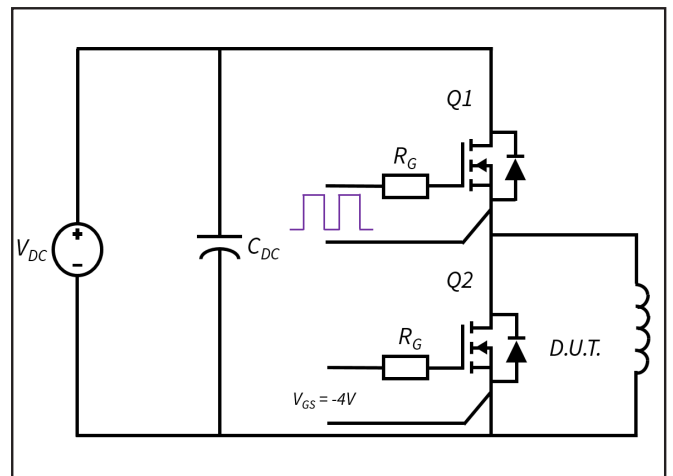
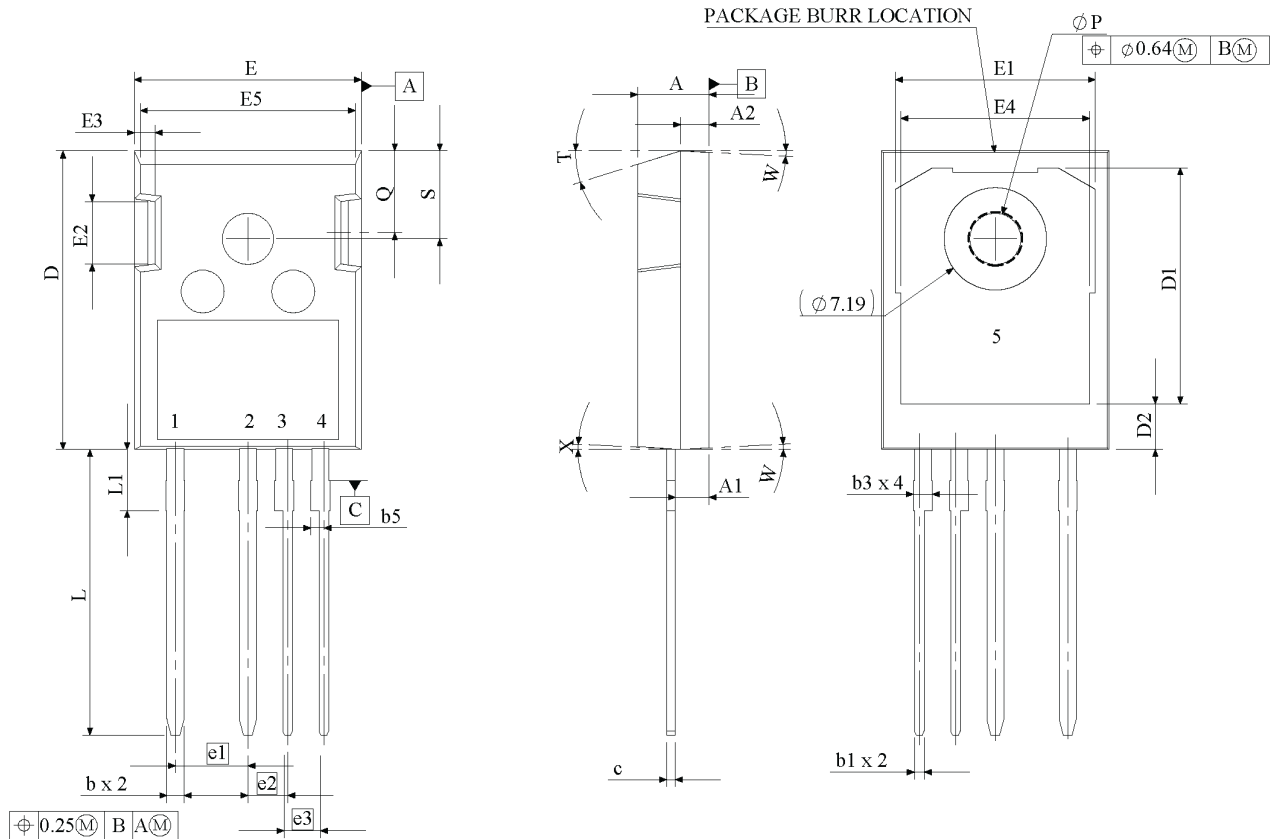


Figure 30. Clamped Inductive Body Diode Switching Waveform Test Circuit

Package Dimensions



SYMBOL	MIN (mm)	MAX (mm)
A	4.83	5.21
A1	2.22	2.6
A2	1.91	2.16
b	1.10	1.30
b1	0.65	0.79
b3	1.34	1.44
b5	0.74	1.14
c	0.55	0.68
D	20.76	21.14
D1	16.25	17.65
D2	2.95	3.35
E	15.75	16.13
E1	13.1	14.15
E2	3.68	5.10
E3	1.00	1.90
E4	12.38	13.43
E5	14.65	15.05
e1	5.08 BSC	
e2	2.79 BSC	
e3	2.54 BSC	
L	19.72	20.32
L1	3.87	4.47
phi P	3.51	3.65
Q	5.49	6.00
S	6.04	6.30
T	17.5° REF.	
W	3.5° REF.	
X	4° REF.	

1	DRAIN
2	SOURCE
3	DRIVER SOURCE
4	GATE
5	DRAIN

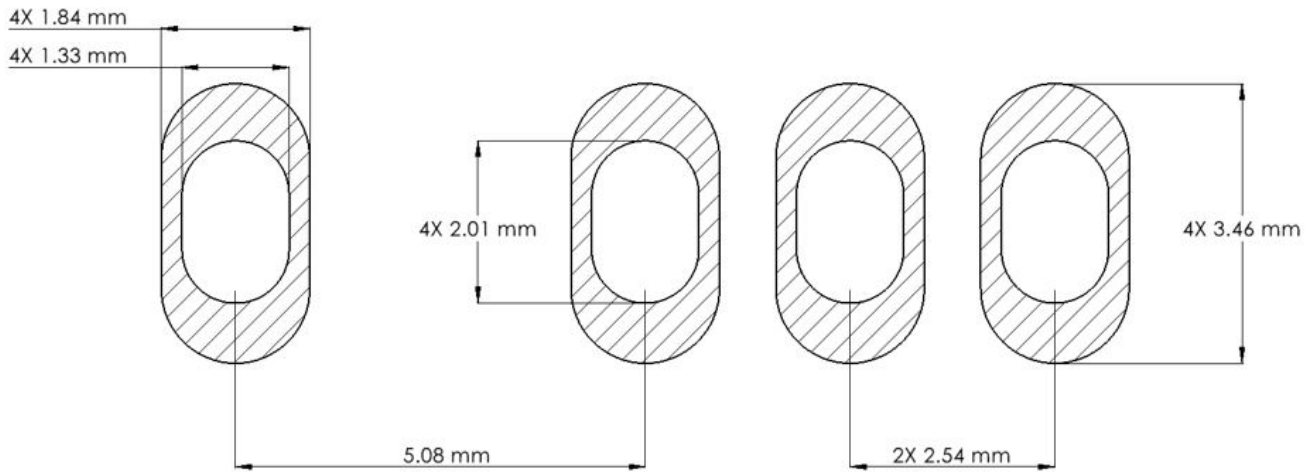
NOTE:

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. BURR OR MOLD FLASH SIZE (0.5 mm) IS NOT INCLUDED IN THE DIMENSIONS



### Recommended Solder Pad Layout

All dimensions in mm





## Revision History

Document Version	Date of Change	Description of Changes
1	June 2026	Initial Release

## Appendix

Document Version	Description of Changes
A1	<p>The following are recommendations for turning off the MOSFET with 0 V :</p> <ul style="list-style-type: none"><li>• Measure the <math>V_{GS}</math> spike accurately using high -CMRR probes and low common mode noise measurements.</li><li>• For the safe operation of the device, the voltage spike shall remain &lt; 5 V for a time duration of &lt; 40 ns.</li></ul>



## Notes & Disclaimers

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