

E3M0016120U2

1200V 16mΩ Automotive Silicon Carbide Power MOSFET
N-Channel Enhancement Mode



Features

- Industry standard Top Side Cooled (TSC) Package
- High power dissipation capability
- Optimized package with separate driver source pin
- High-speed switching with low capacitances
- Fast intrinsic diode with low reverse recovery (Q_{rr})
- Halogen free, RoHS compliant
- Automotive Qualified (AEC-Q101) and PPAP Capable

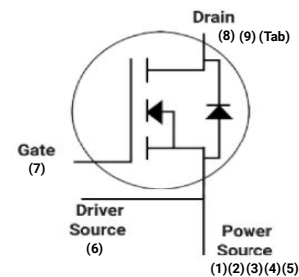
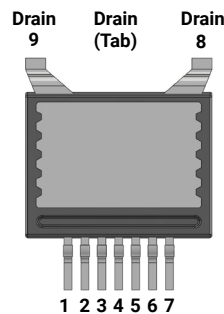
Benefits

- Increase power density
- Reduce cooling requirements
- Reduce switching losses and minimize gate ringing
- Higher system efficiency
- Increase system switching frequency

Typical Applications

- Motor Control
- EV Battery Chargers
- High Voltage DC/DC Converters

Package



Orderable Part Number	Package	Marking
E3M0016120U2-TR	U2	E3M0016120U2

Key Parameters

Parameter	Symbol	Min.	Typ.	Max	Unit	Conditions	Note
Drain - Source Voltage	V_{DS}			1200	v	$T_c = 25^\circ\text{C}$	
Maximum Gate - Source Voltage	$V_{GS(max)}$	-8		+19		Transient	
Operational Gate-Source Voltage	$V_{GS op}$		-4/15			Static	Note 1
DC Continuous Drain Current	I_D			140	A	$V_{GS} = 15\text{ V}, T_c = 25^\circ\text{C}, T_J \leq 175^\circ\text{C}$	Fig. 19
				101		$V_{GS} = 15\text{ V}, T_c = 100^\circ\text{C}, T_J \leq 175^\circ\text{C}$	Note 2
Pulsed Drain Current	I_{DM}			562		t_{Pmax} limited by T_{Jmax} $V_{GS} = 15\text{ V}, T_c = 25^\circ\text{C}$	Fig. 22
Power Dissipation	P_D			607	W	$T_c = 25^\circ\text{C}, T_J = 175^\circ\text{C}$	Fig. 20
Operating Junction and Storage Temperature	T_J, T_{stg}			-55 to +175	°C		
Solder Temperature	T_L			260		According to JEDEC J-STD-020	

Note (1): Recommended turn-on gate voltage is 15V with $\pm 5\%$ regulation tolerance, see Application Note PRD-04814 for additional details

Note (2): Verified by design


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	1200			V	$V_{GS} = 0\text{ V}, I_D = 100\ \mu\text{A}$	
$V_{GS(th)}$	Gate Threshold Voltage	1.8	2.5	3.8		$V_{DS} = V_{GS}, I_D = 22.08\ \text{mA}$	Fig. 11
			2.1			$V_{DS} = V_{GS}, I_D = 22.08\ \text{mA}, T_J = 175^\circ\text{C}$	
I_{DSS}	Zero Gate Voltage Drain Current		1	50	μA	$V_{DS} = 1200\ \text{V}, V_{GS} = 0\ \text{V}$	
I_{GSS}	Gate-Source Leakage Current		10	250	nA	$V_{GS} = 15\ \text{V}, V_{DS} = 0\ \text{V}$	
$R_{DS(on)}$	Drain-Source On-State Resistance		16	22	m Ω	$V_{GS} = 15\ \text{V}, I_D = 80.3\ \text{A}$	Fig. 4, 5, 6
			29			$V_{GS} = 15\ \text{V}, I_D = 80.3\ \text{A}, T_J = 175^\circ\text{C}$	
g_{fs}	Transconductance		54		S	$V_{DS} = 20\ \text{V}, I_{DS} = 80.3\ \text{A}$	Fig. 7
			49			$V_{DS} = 20\ \text{V}, I_{DS} = 80.3\ \text{A}, T_J = 175^\circ\text{C}$	
C_{iss}	Input Capacitance		6922		pF	$V_{GS} = 0\ \text{V}, V_{DS} = 0\ \text{V to } 1000\ \text{V}$ $F = 100\ \text{kHz}$ $V_{AC} = 25\ \text{mV}$	Fig. 17, 18
C_{oss}	Output Capacitance		231				
C_{rss}	Reverse Transfer Capacitance		13				
E_{oss}	C_{oss} Stored Energy		127		μJ		Fig. 16
$C_{o(er)}$	Effective Output Capacitance (Energy Related)		268		pF	$V_{GS} = 0\ \text{V}, V_{DS} = 0... 800\text{V}$	Note: 3
$C_{o(tr)}$	Effective Output Capacitance (Time Related)		404				
E_{oN}	Turn-On Switching Energy (MOSFET FWD)		1175		μJ	$V_{DS} = 800\ \text{V}, V_{GS} = -4\ \text{V}/15\ \text{V}, I_D = 80.3\ \text{A},$ $R_{G(ext)} = 2.5\ \Omega, L = 99\ \mu\text{H}, T_J = 175^\circ\text{C}$ FWD = Internal Body Diode	Fig. 26, 28
E_{oFF}	Turn-Off Switching Energy (MOSFET FWD)		570				
$t_{d(on)}$	Turn-On Delay Time		18		ns	$V_{DD} = 800\ \text{V}, V_{GS} = -4\ \text{V}/15\ \text{V}$ $I_D = 80.3\ \text{A}, R_{G(ext)} = 2.5\ \Omega,$ Timing relative to V_{DS} Inductive load	Fig. 27, 28
t_r	Rise Time		26				
$t_{d(off)}$	Turn-Off Delay Time		62				
t_f	Fall Time		14				
$R_{G(int)}$	Internal Gate Resistance		2.6		Ω	$f = 1\ \text{MHz}$	
Q_{gs}	Gate to Source Charge		70		nC	$V_{DS} = 800\ \text{V}, V_{GS} = -4\ \text{V}/15\ \text{V}$ $I_D = 80.3\ \text{A}$ Per IEC60747-8-4 pg 21	Fig. 12
Q_{gd}	Gate to Drain Charge		65				
Q_g	Total Gate Charge		223				

Note (3): $C_{o(er)}$, a lumped capacitance that gives same stored energy as C_{oss} while V_{ds} is rising from 0 to 800V

$C_{o(tr)}$, a lumped capacitance that gives same charging time as C_{oss} while V_{ds} is rising from 0 to 800V


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	4.9		V	$V_{GS} = -4\text{ V}, I_{SD} = 40.1\text{ A}, T_J = 25^\circ\text{C}$	Fig. 8, 9, 10
		4.4			$V_{GS} = -4\text{ V}, I_{SD} = 40.1\text{ A}, T_J = 175^\circ\text{C}$	
I_S	Continuous Diode Forward Current		105	A	$V_{GS} = -4\text{ V}, T_c = 25^\circ\text{C}$	
I_{SM}	Diode pulse Current		562		$V_{GS} = -4\text{ V}$, pulse width t_p limited by T_{Jmax}	
t_{rr}	Reverse Recovery time	25		ns	$V_{GS} = -4\text{ V}, I_{SD} = 80.3\text{ A}, V_R = 800\text{ V}$ $dif/dt = 7751\text{ A}/\mu\text{s}, T_J = 175^\circ\text{C}$	
Q_{rr}	Reverse Recovery Charge	1905		nC		
I_{rrm}	Peak Reverse Recovery Current	117		A		
t_{rr}	Reverse Recovery time	43		ns	$V_{GS} = -4\text{ V}, I_{SD} = 80.3\text{ A}, V_R = 800\text{ V}$ $dif/dt = 2622\text{ A}/\mu\text{s}, T_J = 175^\circ\text{C}$	
Q_{rr}	Reverse Recovery Charge	1402		nC		
I_{rrm}	Peak Reverse Recovery Current	50		A		

Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Unit	Test Conditions	Note
$R_{\theta JC}$	Thermal Resistance from Junction to Case	0.19	0.25	$^\circ\text{C}/\text{W}$		Fig. 21



Typical Performance

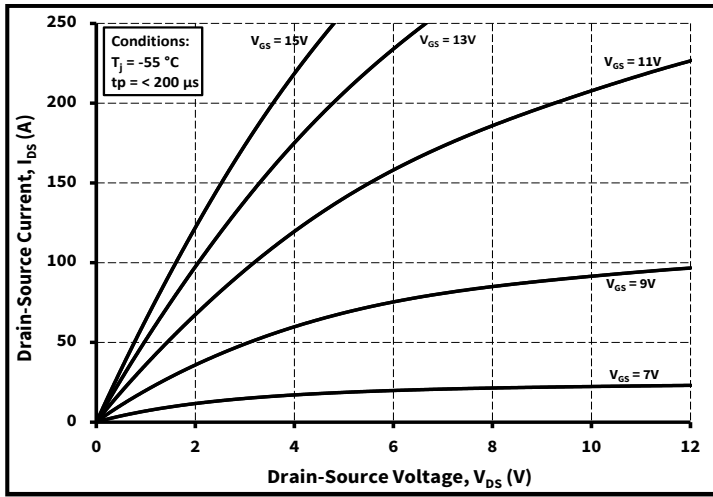


Figure 1. Output Characteristics $T_J = -55\text{ }^\circ\text{C}$

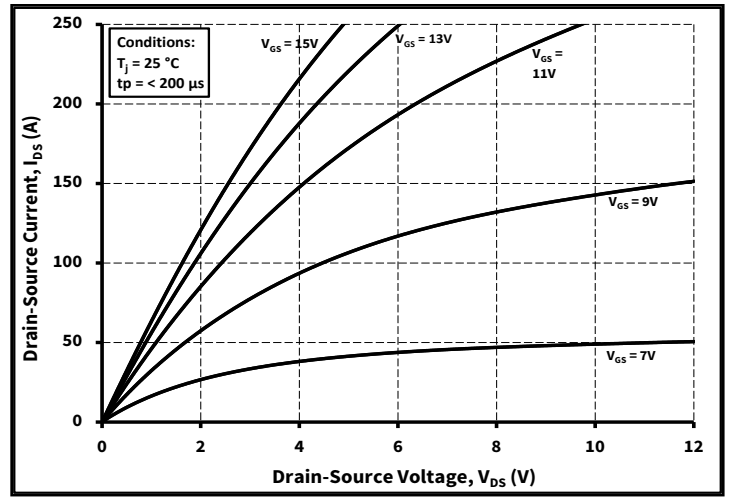


Figure 2. Output Characteristics $T_J = 25\text{ }^\circ\text{C}$

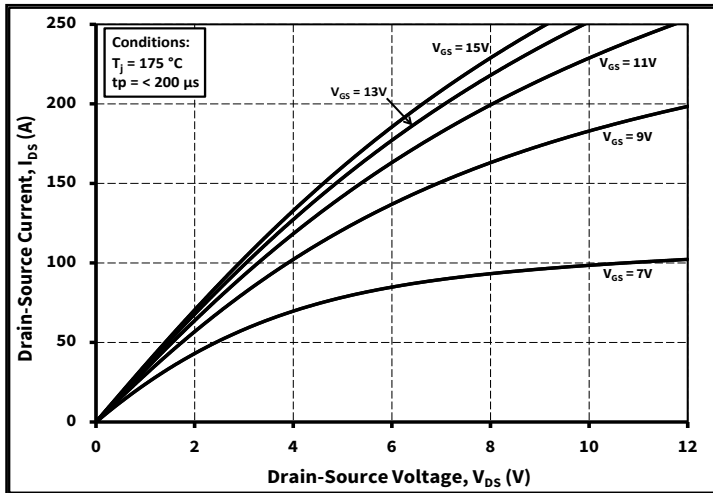


Figure 3. Output Characteristics $T_J = 175\text{ }^\circ\text{C}$

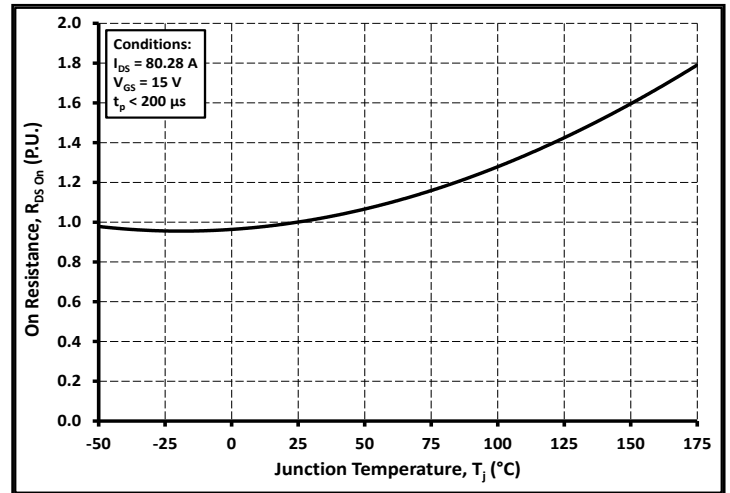


Figure 4. Normalized On-Resistance vs. Temperature

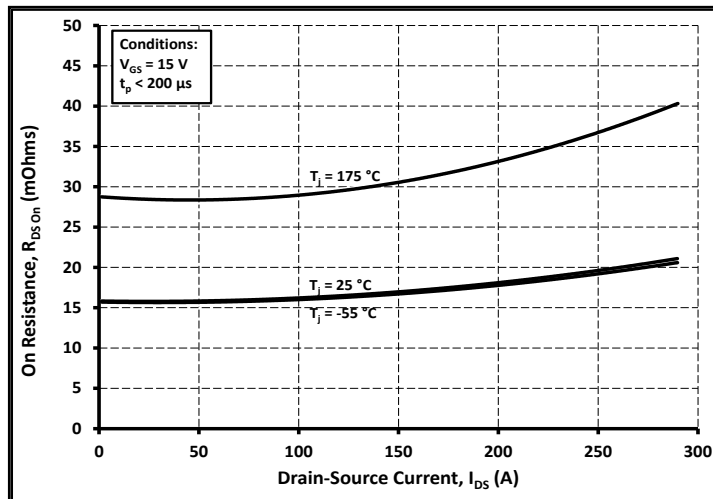


Figure 5. On-Resistance vs. Drain Current For Various Temperatures

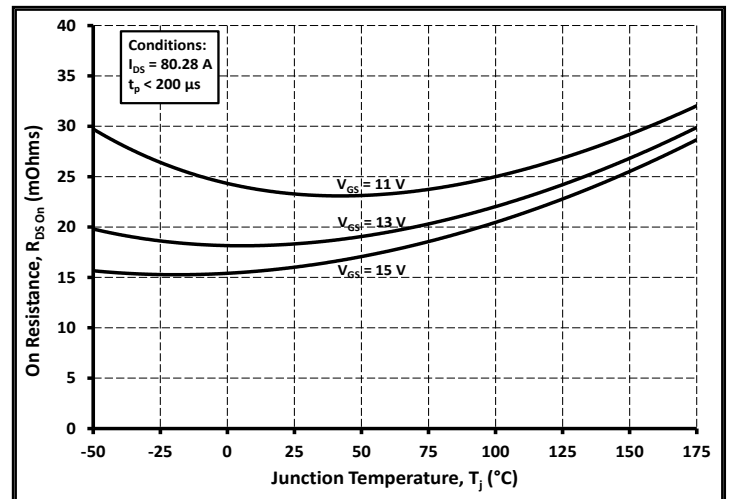


Figure 6. On-Resistance vs. Temperature For Various Gate Voltage



Typical Performance

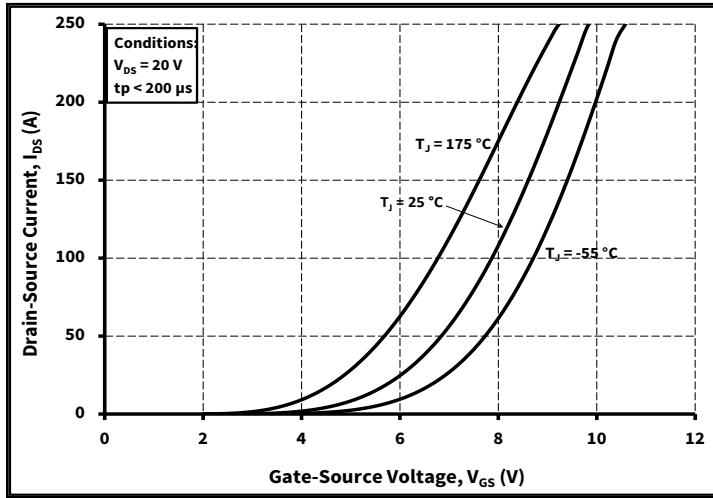


Figure 7. Transfer Characteristic for Various Junction Temperatures

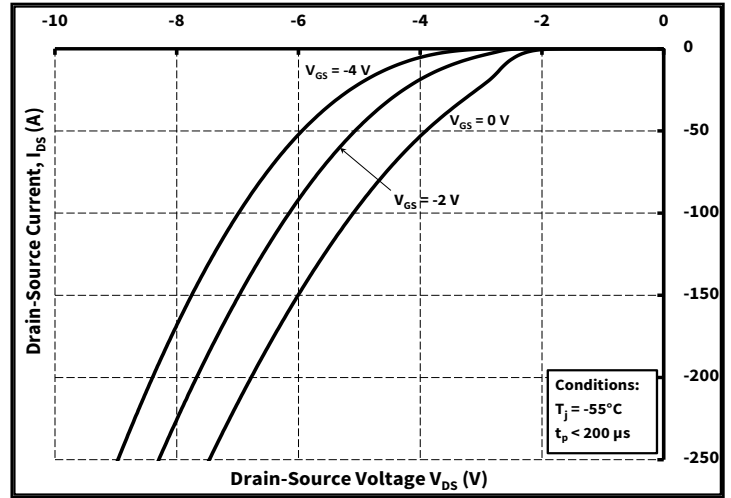


Figure 8. Body Diode Characteristic at -55 °C

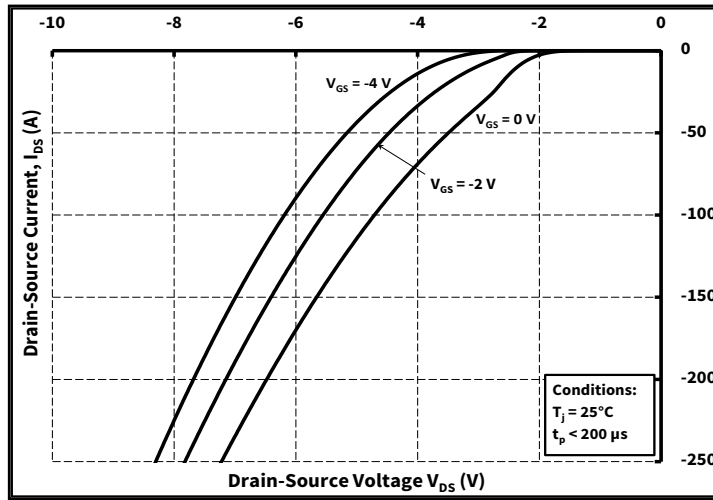


Figure 9. Body Diode Characteristic at 25 °C

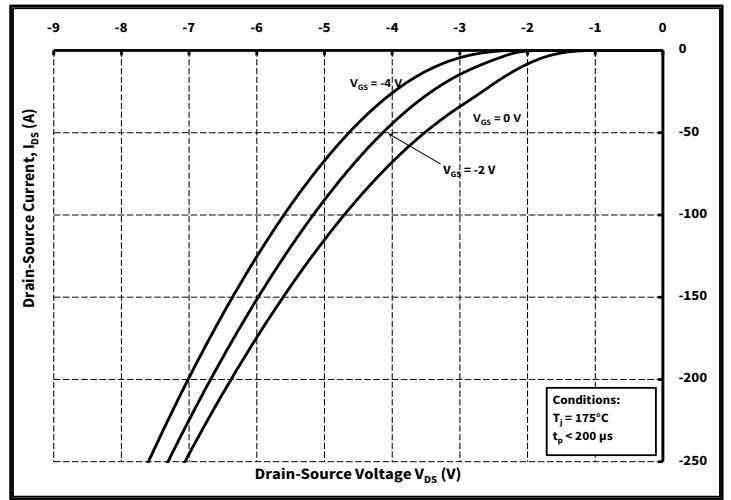


Figure 10. Body Diode Characteristic at 175 °C

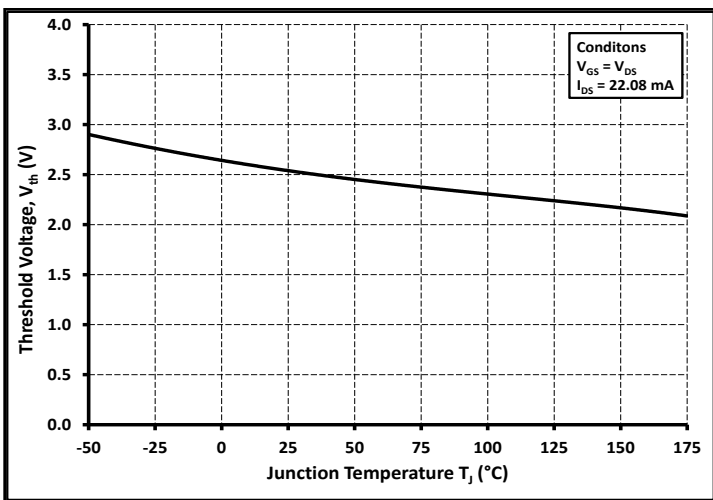


Figure 11. Threshold Voltage vs. Temperature

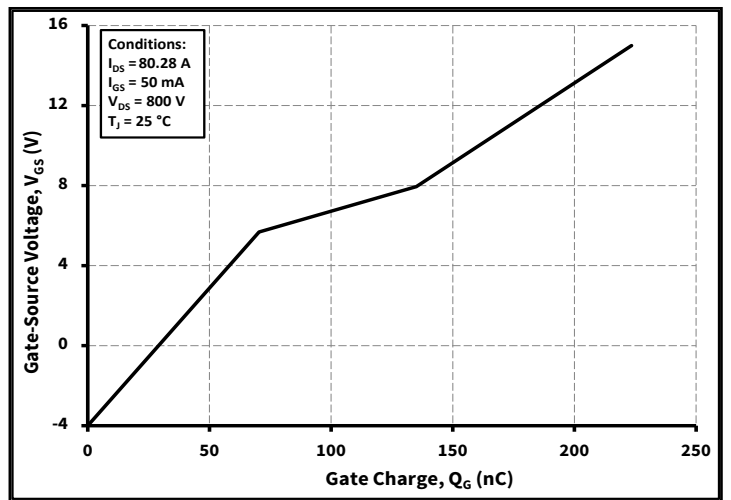


Figure 12. Gate Charge Characteristics



Typical Performance

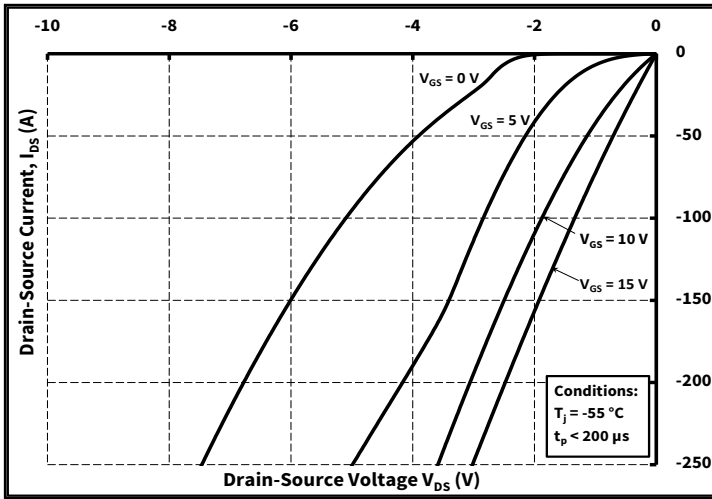


Figure 13. 3rd Quadrant Characteristic at -55 °C

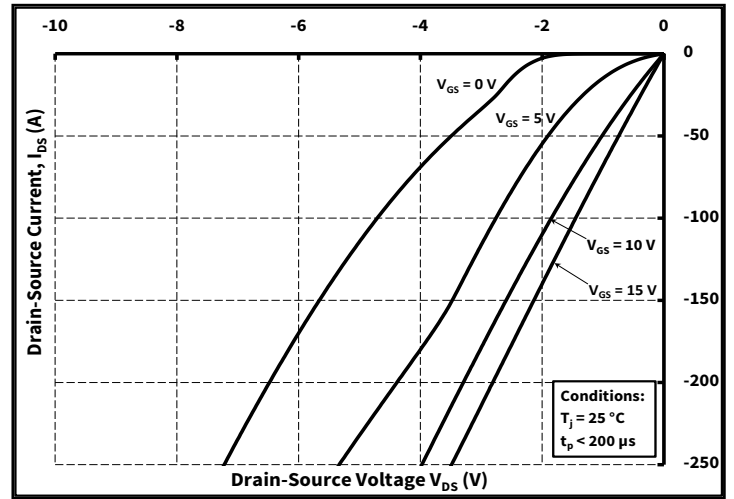


Figure 14. 3rd Quadrant Characteristic at 25 °C

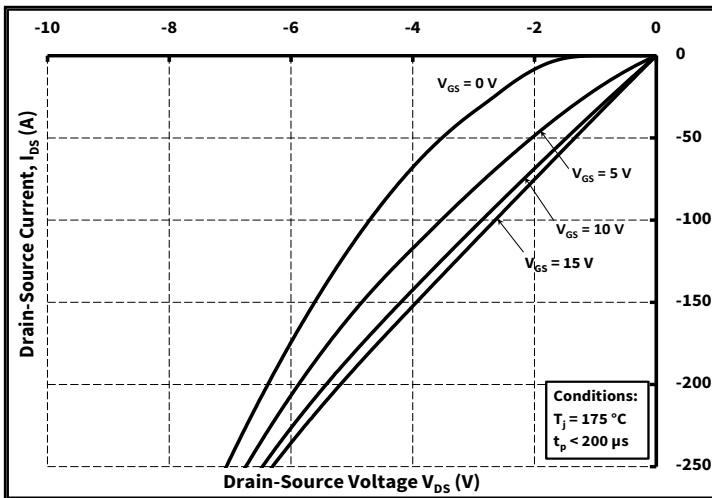


Figure 15. 3rd Quadrant Characteristic at 175 °C

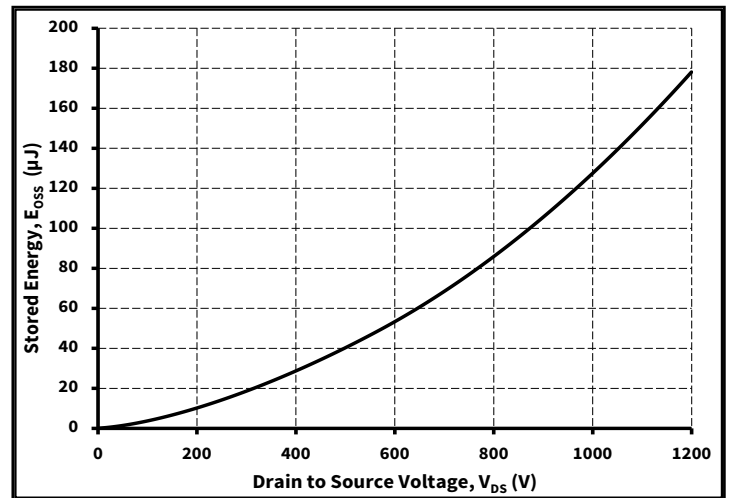


Figure 16. Output Capacitor Stored Energy

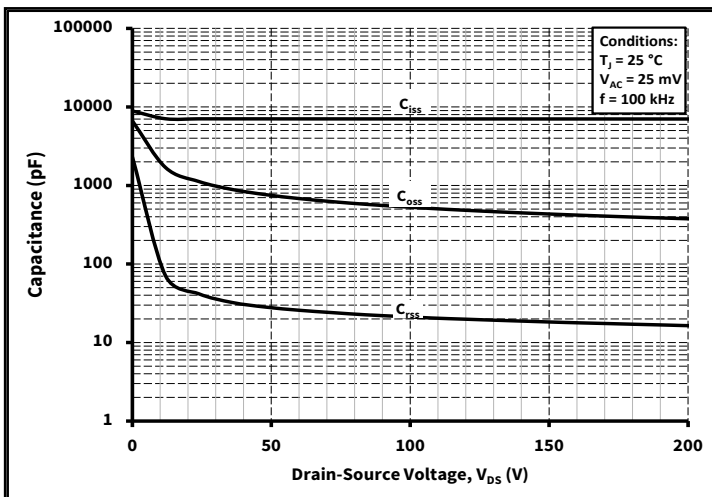


Figure 17. Capacitances vs. Drain-Source Voltage (0 - 200V)

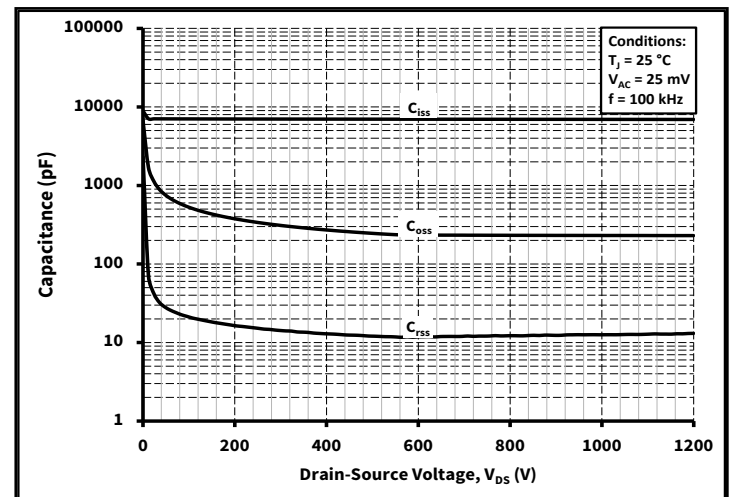


Figure 18. Capacitances vs. Drain-Source Voltage (0 - 1200V)



Typical Performance

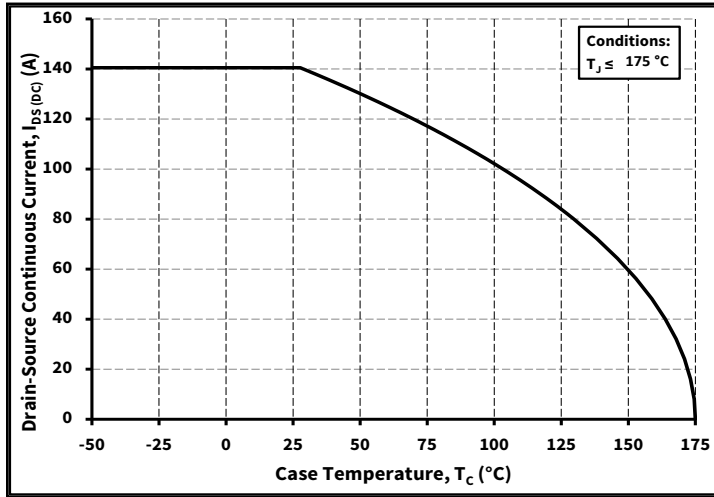


Figure 19. Continuous Drain Current Derating vs. Case Temperature

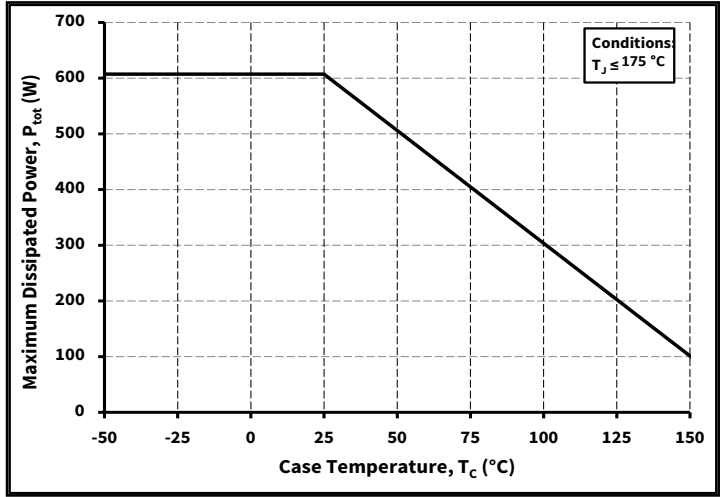


Figure 20. Maximum Power Dissipation Derating vs. Case Temperature

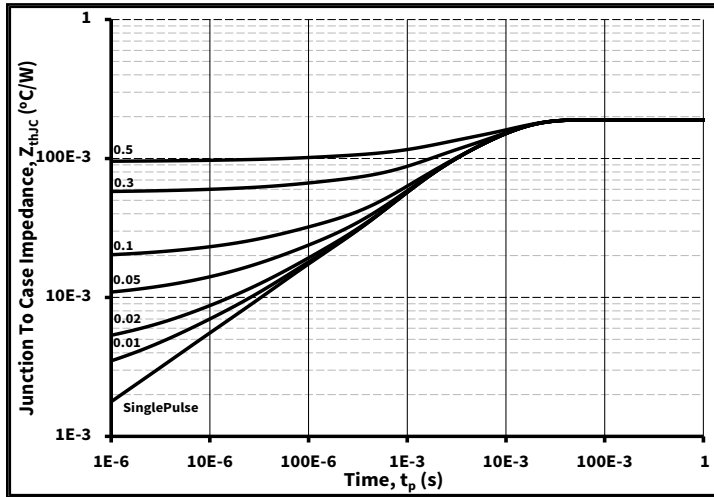


Figure 21. Transient Thermal Impedance (Junction - Case)

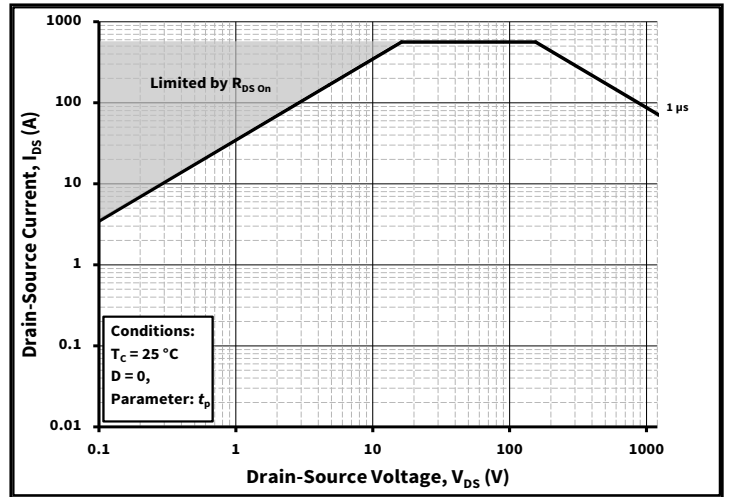


Figure 22. Safe Operating Area

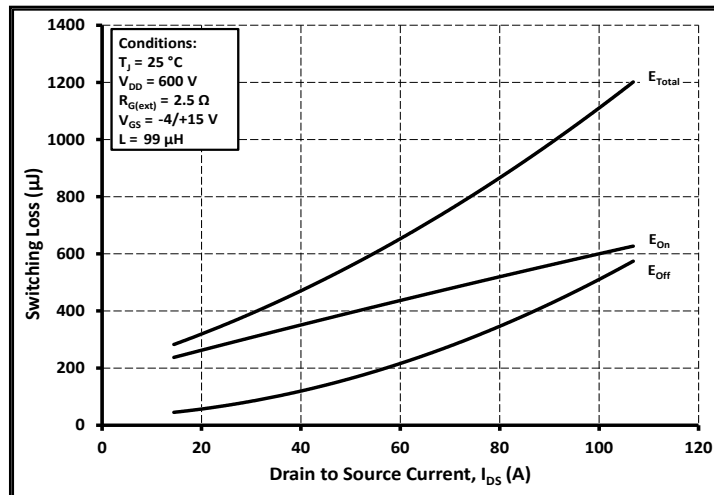


Figure 23. Clamped Inductive Switching Energy vs. Drain Current ($V_{DD} = 600V$)

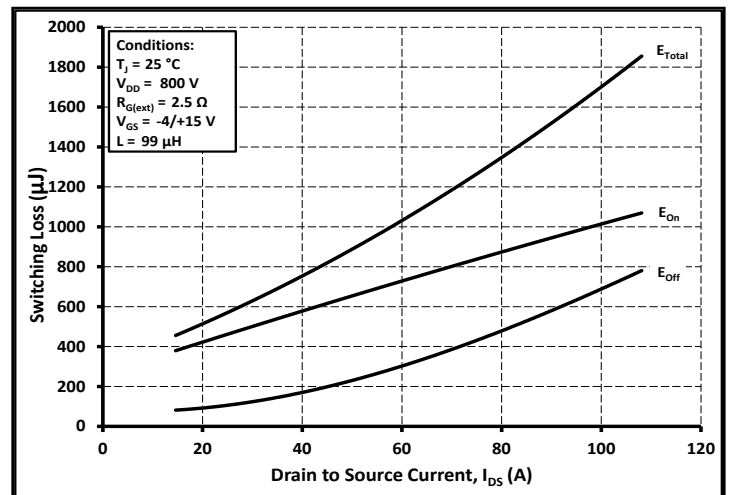


Figure 24. Clamped Inductive Switching Energy vs. Drain Current ($V_{DD} = 800V$)

Typical Performance

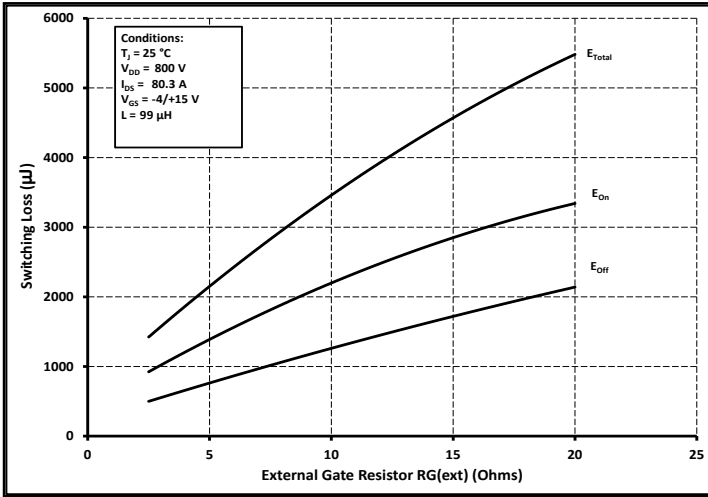


Figure 25. Clamped Inductive Switching Energy vs. $R_{G(ext)}$

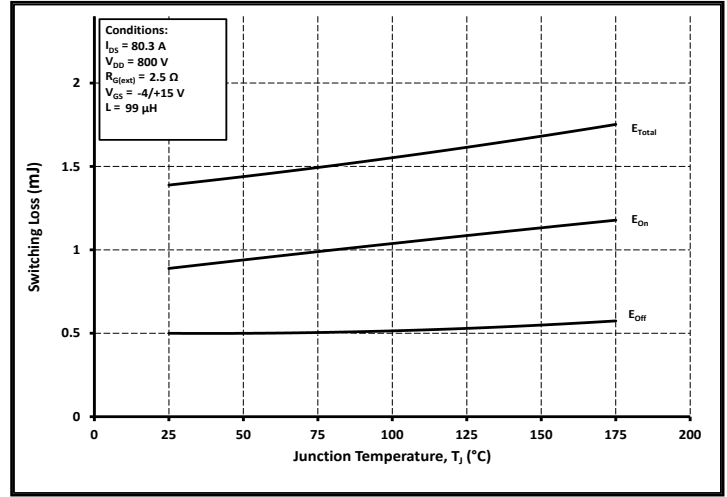


Figure 26. Clamped Inductive Switching Energy vs. Temperature

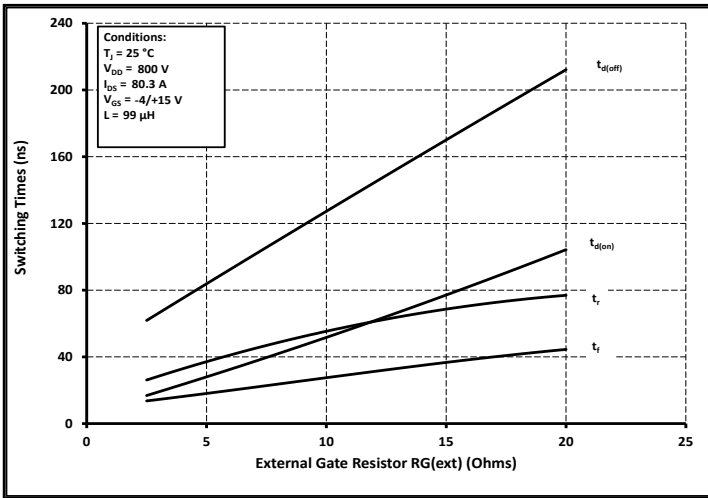


Figure 27. Switching Times vs. $R_{G(ext)}$

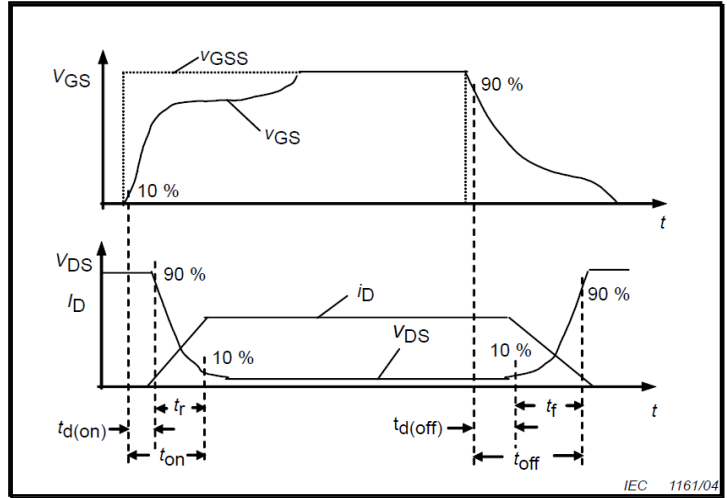


Figure 28. Switching Times Definition

Test Circuit Schematic

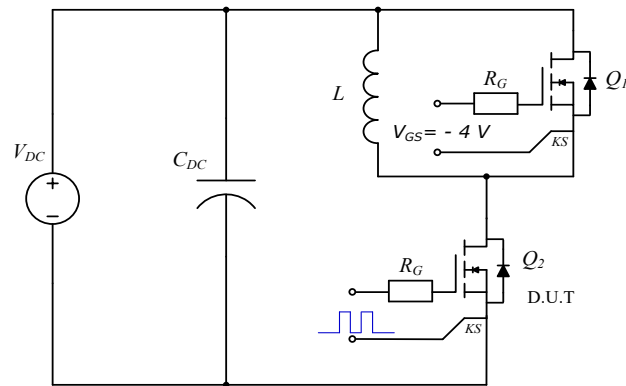
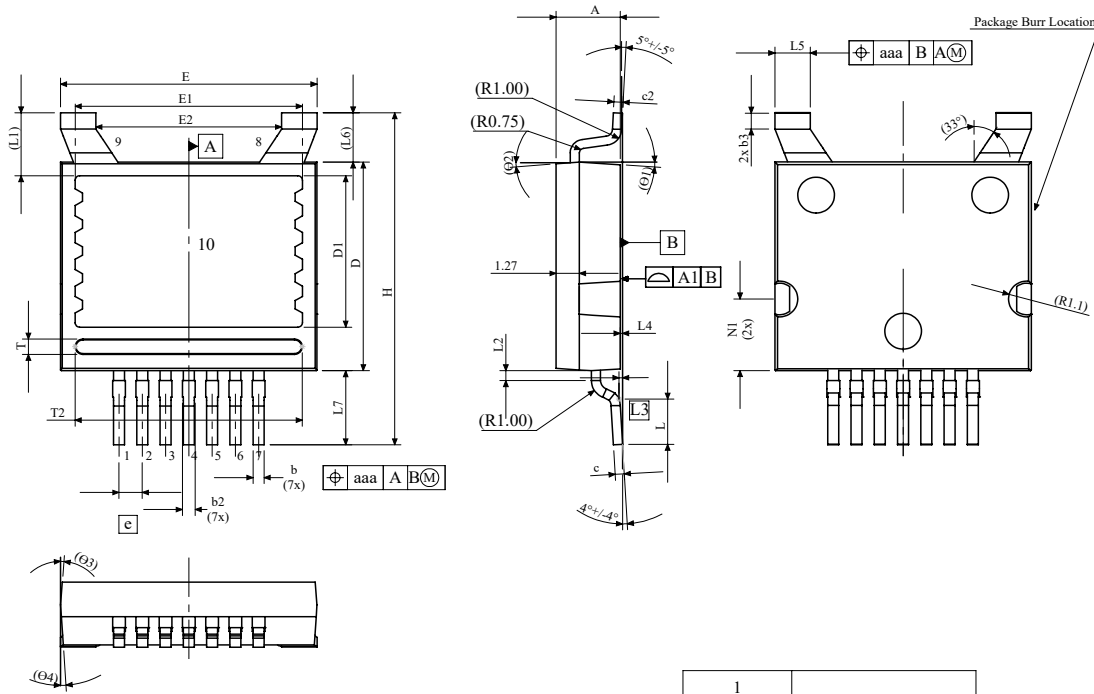


Figure 29. Clamped Inductive Switching Waveform Test Circuit

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
c	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
Ø1	0°	8°
Ø2	0°	8°
Ø3	0°	8°
Ø4	0°	8°
aaa	---	0.10

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

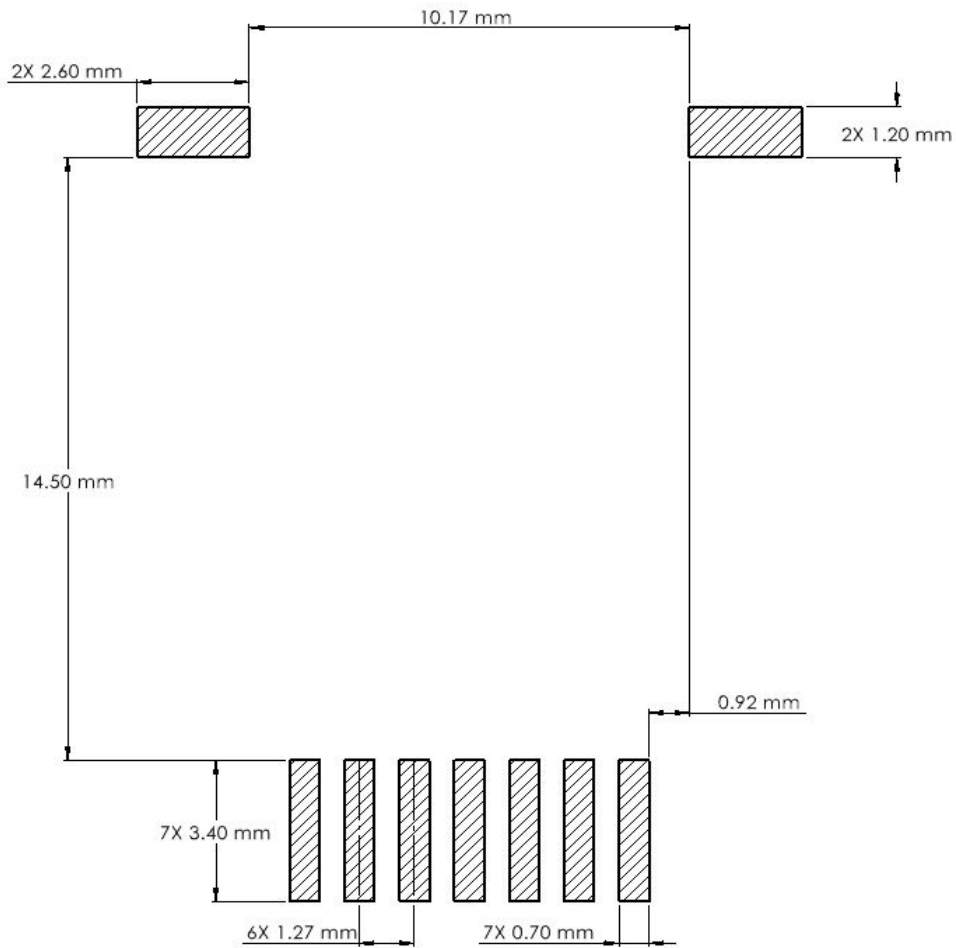
NOTE

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





Revision history

Document Version	Date of release	Descriptiion of changes
1.0	November - 2025	Initial datasheet



Notes & Disclaimer

WOLFSPEED PROVIDES TECHNICAL AND RELIABILITY DATA, DESIGN RESOURCES, APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, AND OTHER RESOURCES “AS IS” AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, WITH RESPECT THERETO, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, SUITABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR NON-INFRINGEMENT OF THIRD-PARTY INTELLECTUAL PROPERTY RIGHTS.

This document and the information contained herein are subject to change without notice. Any such change shall be evidenced by the publication of an updated version of this document by Wolfspeed. No communication from any employee or agent of Wolfspeed or any third party shall effect an amendment or modification of this document. No responsibility is assumed by Wolfspeed for any infringement of patents or other rights of third parties which may result from use of the information contained herein. No license is granted by implication or otherwise under any patent or patent rights of Wolfspeed.

The information contained in this document (excluding examples, as well as figures or values that are labeled as “typical”) constitutes Wolfspeed’s sole published specifications for the subject product. “Typical” parameters are the average values expected by Wolfspeed in large quantities and are provided for informational purposes only. Any examples provided herein have not been produced under conditions intended to replicate any specific end use. Product performance can and does vary due to a number of factors.

This product has not been designed or tested for use in, and is not intended for use in, any application in which failure of the product would reasonably be expected to cause death, personal injury, or property damage. For purposes of (but without limiting) the foregoing, this product is not designed, intended, or authorized for use as a critical component in equipment implanted into the human body, life-support machines, cardiac defibrillators, and similar emergency medical equipment; air traffic control systems; or equipment used in the planning, construction, maintenance, or operation of nuclear facilities. Notwithstanding any application-specific information, guidance, assistance, or support that Wolfspeed may provide, the buyer of this product is solely responsible for determining the suitability of this product for the buyer’s purposes, including without limitation (1) selecting the appropriate Wolfspeed products for the buyer’s application, (2) designing, validating, and testing the buyer’s application, and (3) ensuring the buyer’s application meets applicable standards and any other legal, regulatory, and safety-related requirements.

RoHS Compliance

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 January 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.

Contact info:

4600 Silicon Drive
Durham, NC 27703 USA
Tel: +1.919.313.5300
www.wolfspeed.com/power