

# QORVO

## SiC JFET Division

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# Silicon Carbide (SiC) JFET - EliteSiC, Power N-Channel, TOLL, 750 V, 4.3 mohm

## DATASHEET

# UJ4N075004L8S

Rev. C, January 2025

### Description

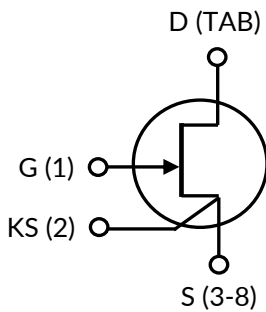
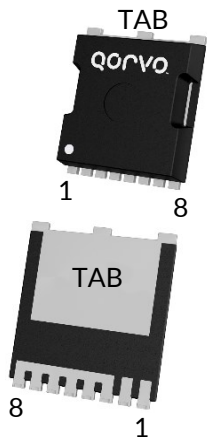
Qorvo's UJ4N075004L8S is a 750 V, 4.3mΩ high-performance Gen 4 normally-on SiC JFET transistor. This device exhibits ultra-low on resistance ( $R_{DS(on)}$ ) in a compact TOLL package, making it an ideal fit to address the challenging thermal and space constraints of solid-state circuit breakers and relay applications. Additionally, the JFET is a robust device technology capable of the high-energy switching required in circuit protection applications.

### Features

- ◆ Single digit on-resistance in a TOLL SMD package
- ◆ Operating temperature: 175°C (max)
- ◆ High pulse current capability
- ◆ Excellent device robustness
- ◆ Silver-sintered die attach for excellent thermal resistance
- ◆ Short circuit rated
- ◆ RoHS compliant
- ◆ AECQ Qualified

### Typical applications

- ◆ Solid State / Semiconductor Circuit Breaker
- ◆ Solid State / Semiconductor Relay
- ◆ Battery Disconnects
- ◆ Surge Protection
- ◆ Inrush Current Control



Part Number	Package	Marking
UJ4N075004L8S	MO-229	UJ4N075004



## Maximum Ratings

Parameter	Symbol	Test Conditions	Value	Units
Drain-source voltage	$V_{DS}$		750	V
Gate-source voltage	$V_{GS}$	DC	-30 to +3	V
		AC <sup>1</sup>	-30 to +30	V
Continuous drain current <sup>2</sup>	$I_D$	$T_C < 145^\circ\text{C}$	120	A
Pulsed drain current <sup>3</sup>	$I_{DM}$	$T_C = 25^\circ\text{C}$	588	A
Short circuit withstand time	$t_{SC}$	$V_{DS} = 400\text{V}, T_{J(\text{START})} = 175^\circ\text{C}$	5	$\mu\text{s}$
Power dissipation	$P_{tot}$	$T_C = 25^\circ\text{C}$	1153	W
Maximum junction temperature	$T_{J,max}$		175	$^\circ\text{C}$
Operating and storage temperature	$T_J, T_{STG}$		-55 to 175	$^\circ\text{C}$
Reflow soldering temperature	$T_{solder}$	reflow MSL 1	260	$^\circ\text{C}$

- +30V AC rating applies for turn-on pulses <200ns applied with external  $R_G > 1\Omega$ .
- Limited by bondwires
- Pulse width  $t_p$  limited by  $T_{J,max}$

## Thermal Characteristics

Parameter	Symbol	Test Conditions	Value			Units
			Min	Typ	Max	
Thermal resistance, junction-to-case	$R_{\theta JC}$			0.10	0.13	$^\circ\text{C}/\text{W}$

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

### Typical Performance - Static

Parameter	Symbol	Test Conditions	Value			Units
			Min	Typ	Max	
Drain-source breakdown voltage	$BV_{DS}$	$V_{GS} = -20\text{V}, I_D = 2\text{mA}$	750			V
Total drain leakage current	$I_{DSS}$	$V_{DS} = 750\text{V}, V_{GS} = -20\text{V}, T_J = 25^\circ\text{C}$		13	120	$\mu\text{A}$
		$V_{DS} = 750\text{V}, V_{GS} = -20\text{V}, T_J = 175^\circ\text{C}$		65		
Total gate leakage current	$I_{GSS}$	$V_{GS} = -20\text{V}, T_J = 25^\circ\text{C}$		0.1	100	$\mu\text{A}$
		$V_{GS} = -20\text{V}, T_J = 175^\circ\text{C}$		0.3		$\mu\text{A}$
Drain-source on-resistance	$R_{DS(on)}$	$V_{GS} = 2\text{V}, I_D = 80\text{A}, T_J = 25^\circ\text{C}$		4.3		$\text{m}\Omega$
		$V_{GS} = 0\text{V}, I_D = 80\text{A}, T_J = 25^\circ\text{C}$		4.9	6.6	
		$V_{GS} = 2\text{V}, I_D = 80\text{A}, T_J = 175^\circ\text{C}$		9.9		
		$V_{GS} = 0\text{V}, I_D = 80\text{A}, T_J = 175^\circ\text{C}$		11.5		
Gate threshold voltage	$V_{G(th)}$	$V_{DS} = 5\text{V}, I_D = 180\text{mA}$	-8.3	-6.0	-3.7	V
Gate resistance	$R_G$	$f = 1\text{MHz}, \text{open drain}$		0.8		$\Omega$

### Typical Performance - Dynamic

Parameter	Symbol	Test Conditions	Value			Units
			Min	Typ	Max	
Input capacitance	$C_{iss}$	$V_{DS} = 400\text{V}, V_{GS} = -20\text{V}, f = 100\text{kHz}$		3028		$\text{pF}$
Output capacitance	$C_{oss}$			364		
Reverse transfer capacitance	$C_{rss}$			360		
Effective output capacitance, energy related	$C_{oss(er)}$	$V_{DS} = 0\text{V to } 400\text{V}, V_{GS} = -20\text{V}$		448		$\text{pF}$
$C_{OSS}$ stored energy	$E_{oss}$	$V_{DS} = 400\text{V}, V_{GS} = -20\text{V}$		36		$\mu\text{J}$
Total gate charge	$Q_G$	$V_{DS} = 400\text{V}, I_D = 80\text{A}, V_{GS} = -18\text{V to } 0\text{V}$		400		$\text{nC}$
Gate-drain charge	$Q_{GD}$			270		
Gate-source charge	$Q_{GS}$			60		

Typical Performance Diagrams

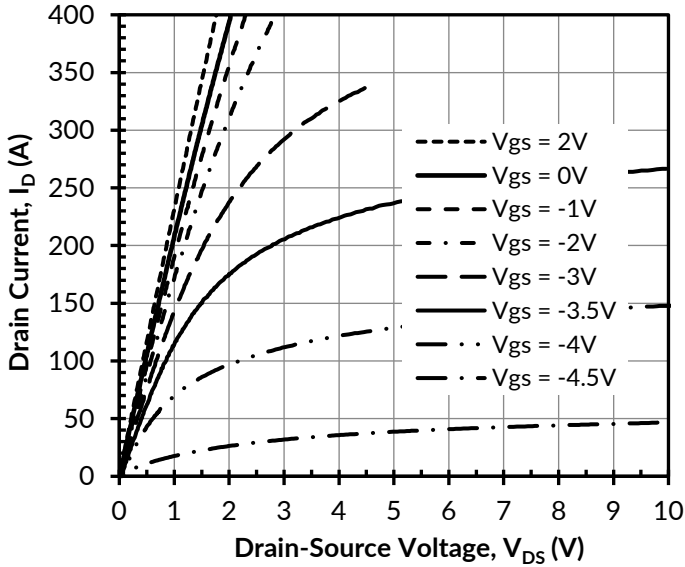


Figure 1. Typical output characteristics at  $T_j = -55^\circ\text{C}$ ,  $t_p < 250\mu\text{s}$

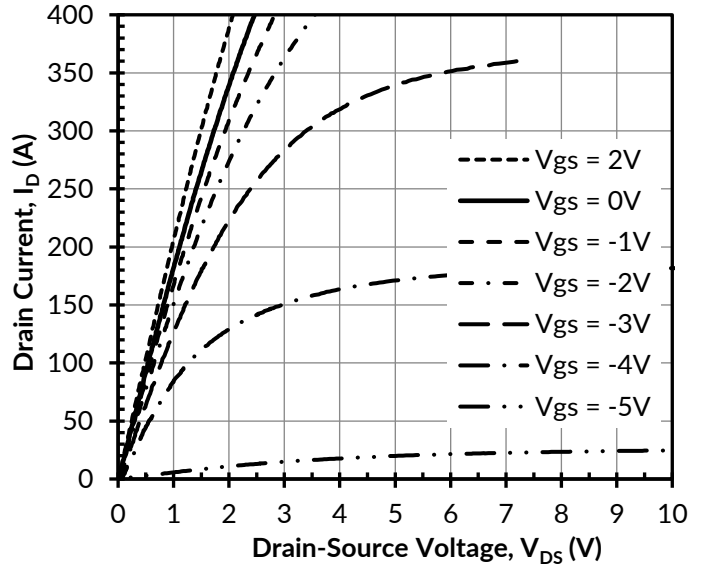


Figure 2. Typical output characteristics at  $T_j = 25^\circ\text{C}$ ,  $t_p < 250\mu\text{s}$

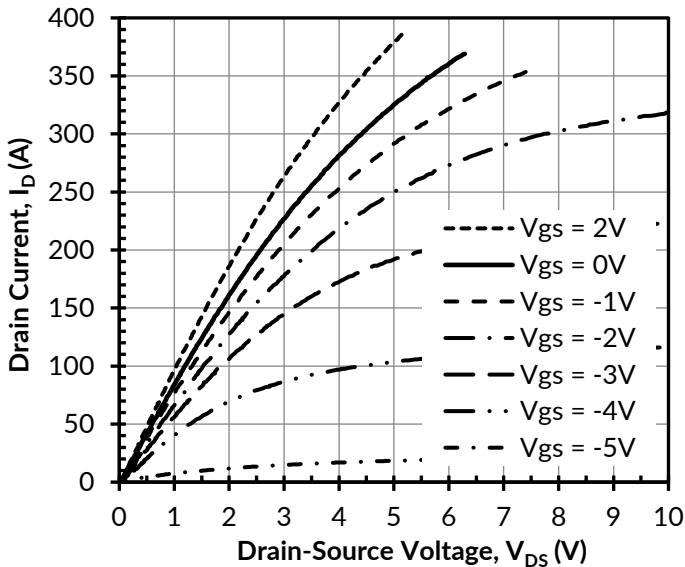


Figure 3. Typical output characteristics at  $T_j = 175^\circ\text{C}$ ,  $t_p < 250\mu\text{s}$

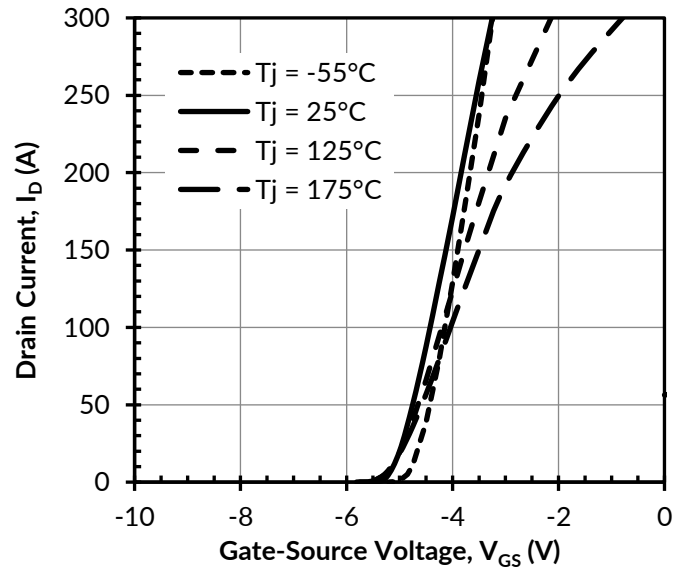


Figure 4. Typical transfer characteristics at  $V_{DS} = 5\text{V}$

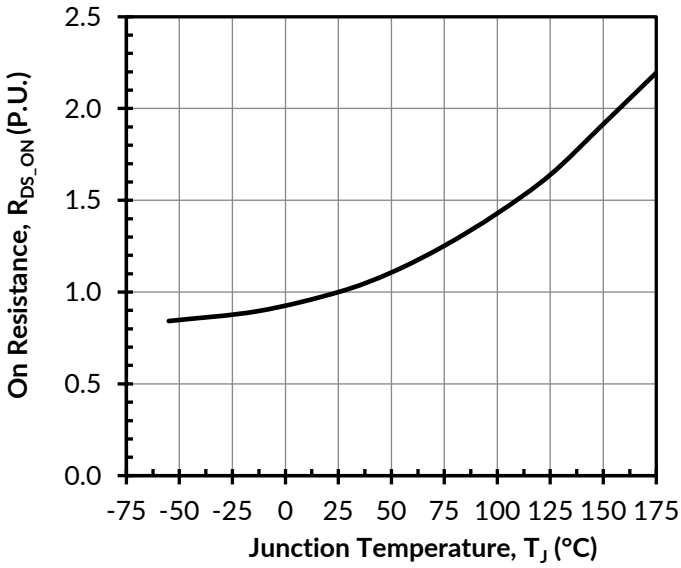


Figure 5. Normalized on-resistance vs. temperature at  $V_{GS} = 0V$  and  $I_D = 80A$

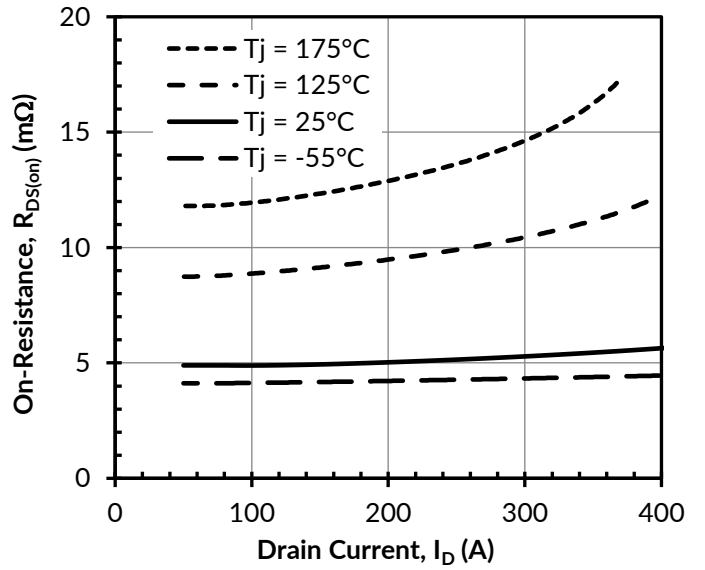


Figure 6. Typical drain-source on-resistances at  $V_{GS} = 0V$

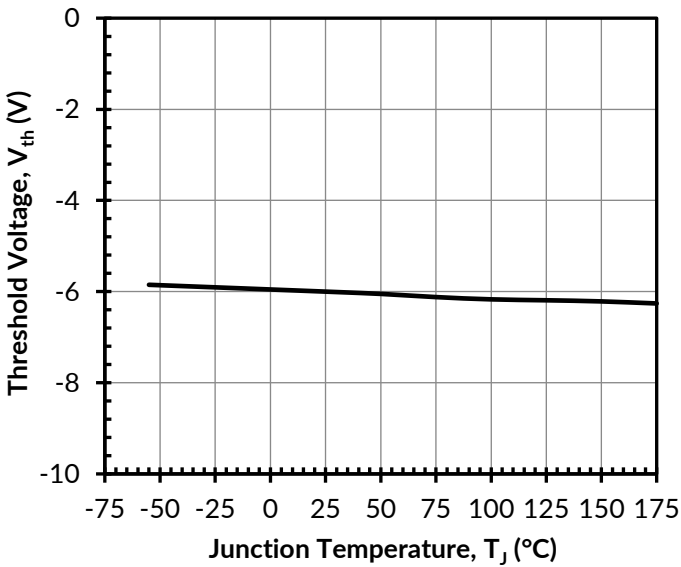


Figure 7. Threshold voltage vs. junction temperature at  $V_{DS} = 5V$  and  $I_D = 180mA$

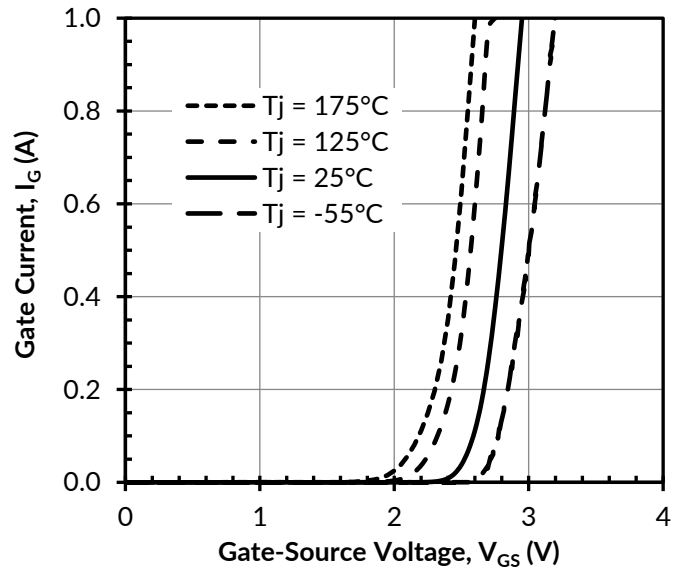


Figure 8. Typical gate forward current at  $V_{DS} = 0V$

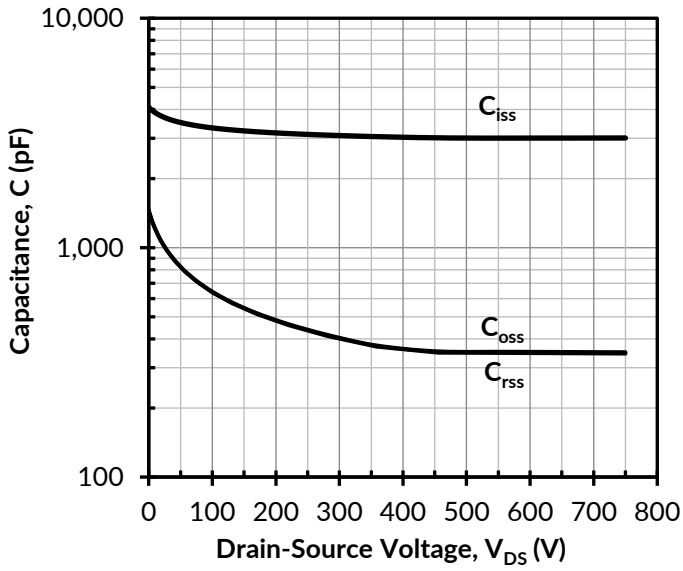


Figure 9. Typical capacitances at  $f = 100\text{kHz}$  and  $V_{GS} = -20\text{V}$

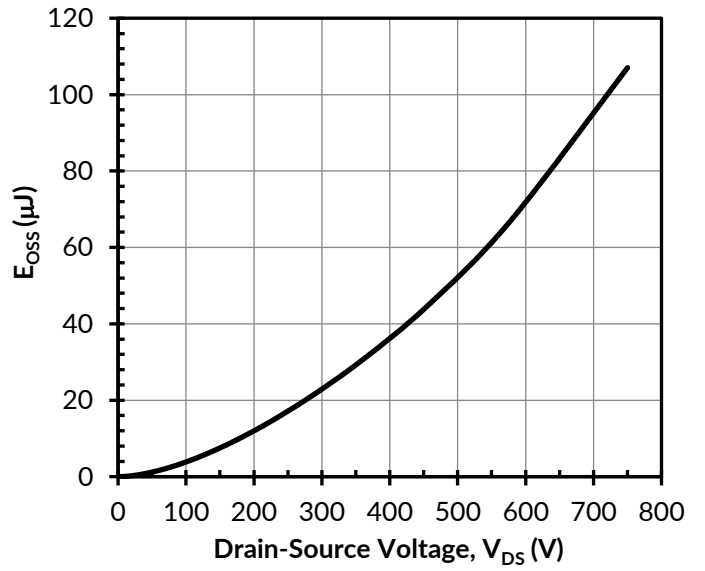


Figure 10. Typical stored energy in  $C_{OSS}$  at  $V_{GS} = -20\text{V}$

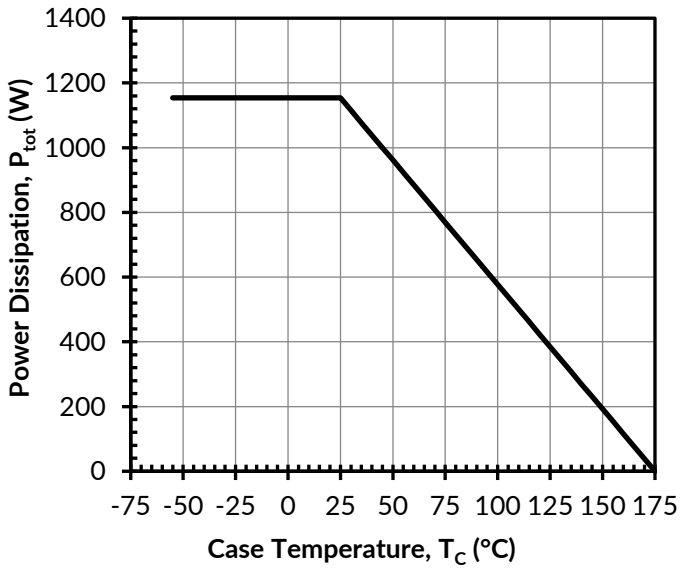


Figure 11. Total power Dissipation

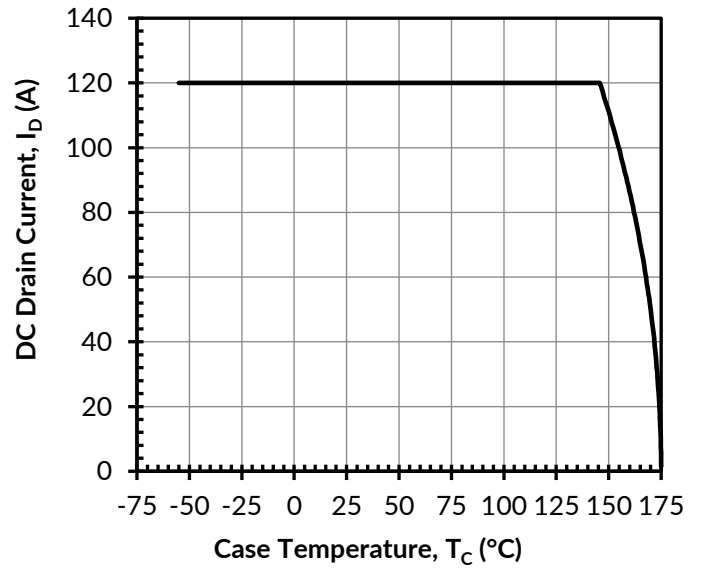


Figure 12. DC drain current derating

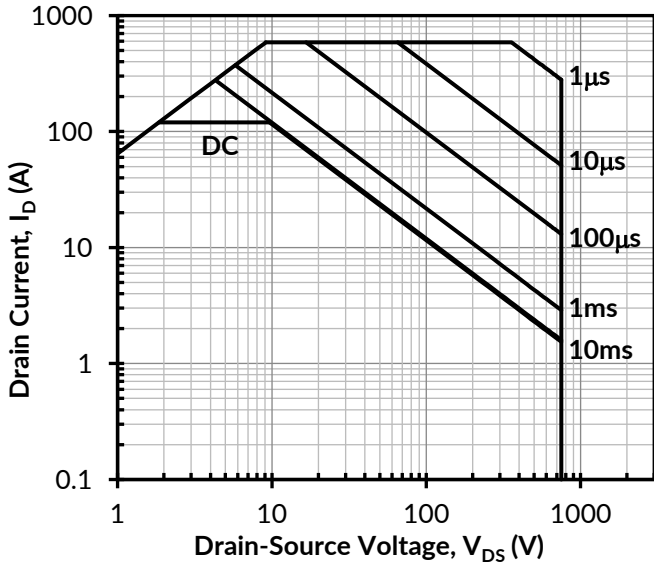


Figure 13. Safe operation area at  $T_C = 25^\circ\text{C}$ , Parameter  $t_p$

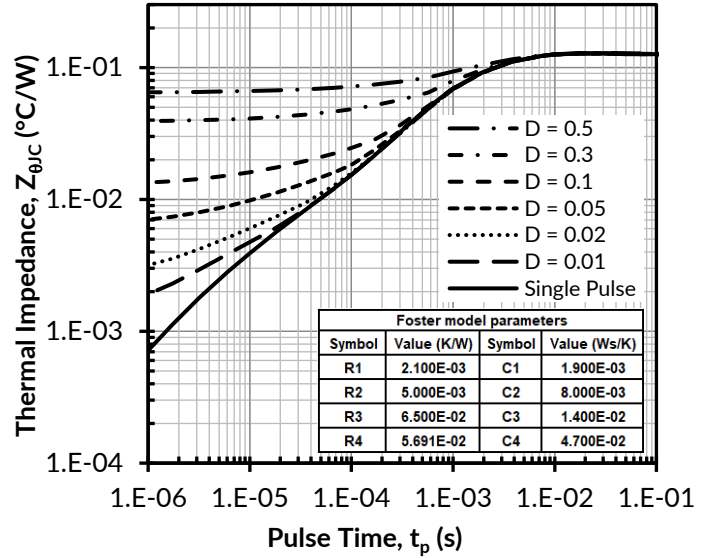


Figure 14. Maximum transient thermal impedance

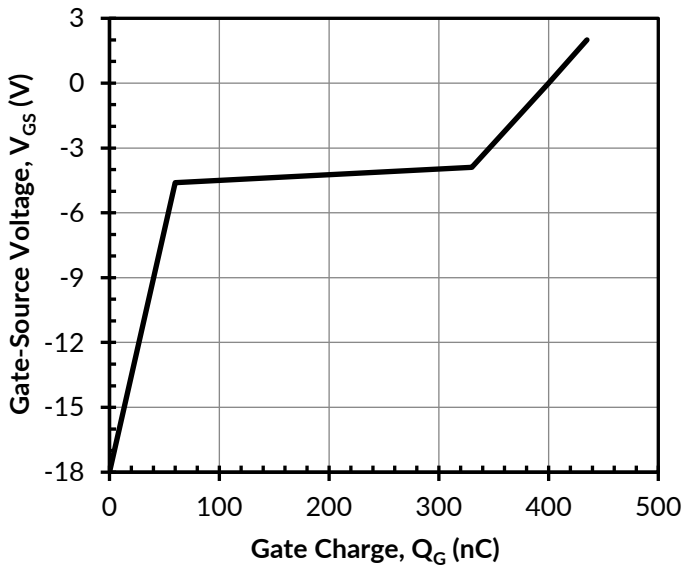
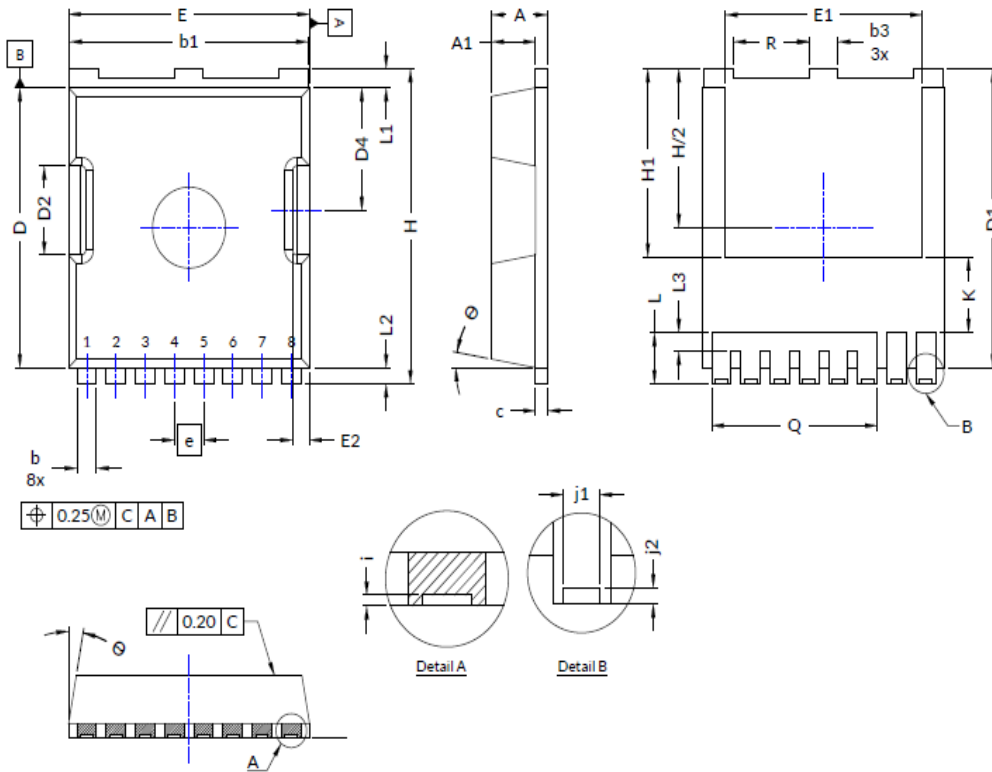


Figure 15. Typical gate charge at  $V_{DS} = 400\text{V}$  and  $I_D = 80\text{A}$



## Package Outlines



SYMBOL	TO-LL		
	Min	Nom	Max
A	2.15	2.30	2.45
A1	1.80 REF		
b	0.70	0.80	0.90
b1	9.65	9.80	9.95
b3	1.10	1.20	1.30
c	0.40	0.50	0.60
D	10.18	10.38	10.58
D1	10.98	11.08	11.18
D2	3.15	3.30	3.45
D4	4.40	4.55	4.70
E	9.70	9.90	10.10
E1	7.95	8.10	8.25
E2	0.60	0.70	0.80
e	1.20 BSC		
H	11.48	11.68	11.88
H1	6.80	6.95	7.10
i	0.10 REF		
j1	0.46 REF		
j2	0.20 REF		
K	2.80 REF		
L	1.40	1.90	2.10
L1	0.50	0.70	0.90
L2	0.48	0.60	0.72
L3	0.30	0.70	0.80
Q	6.80 REF		
R	3.00	3.10	3.20
theta	10°		

**Note:**

1. All dimensions in millimeters
2. Dimensions does not include Burrs and Mold Flashes
3. Dimensions in compliance with JEDEC MO-299B except for backside heatsink exposed pad dimension, E1 and H1

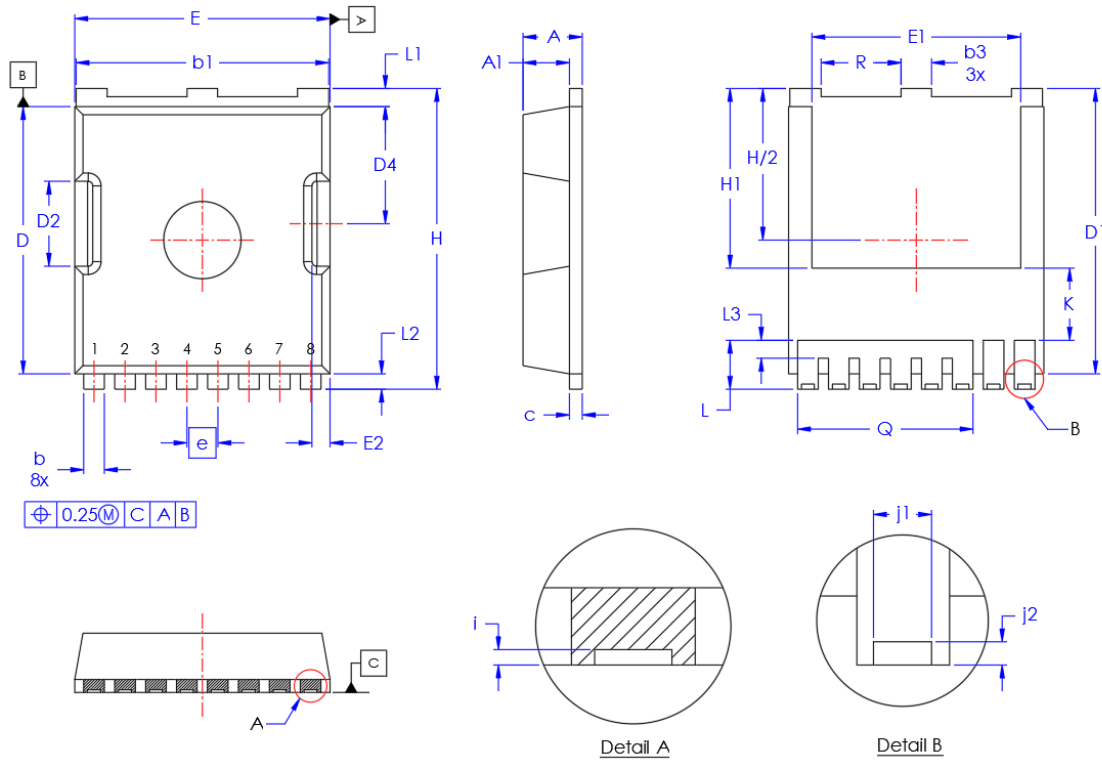
**Pin Designations:**

- 1 : Gate
- 2 : Source Kelvin
- 3-8 : Source

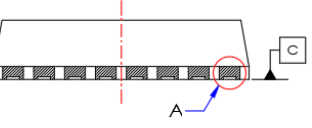
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**PACKAGE OUTLINE**



⊕ 0.25(M) C A B

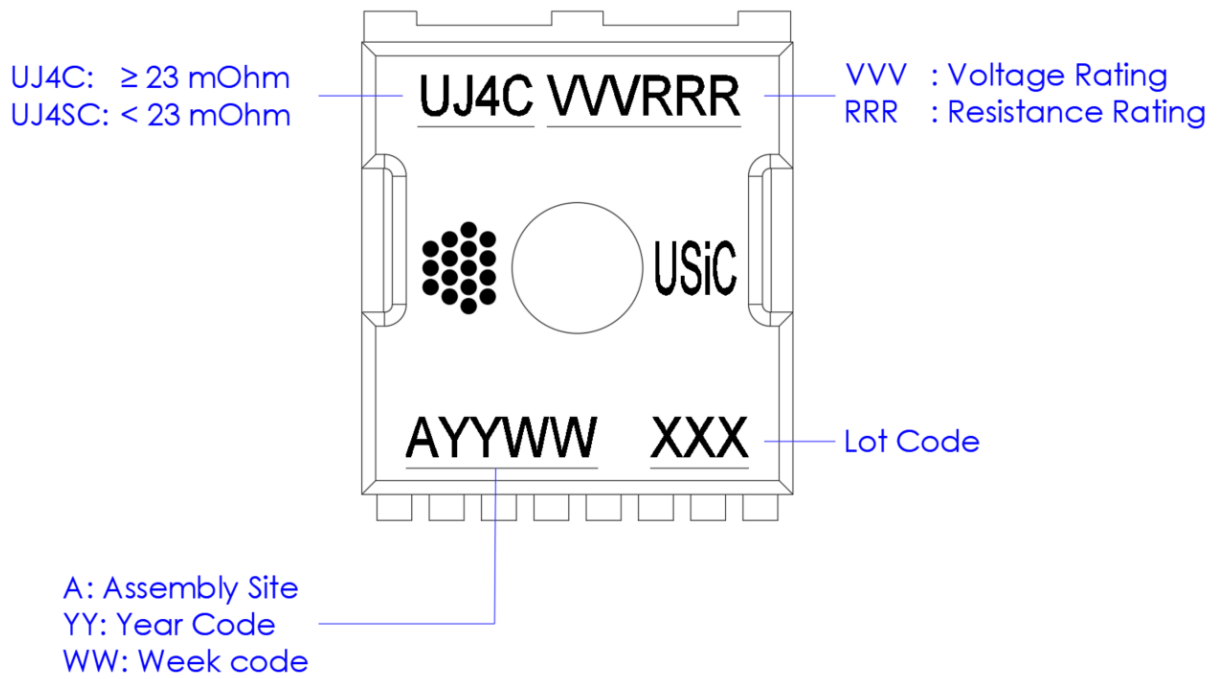


SYMBOL	TO-LL Value	
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D1	10.88	11.28
D2	3.15	3.45
D4	4.40	4.70
E	9.70	10.10
E1	7.95	8.25
E2	0.60	0.80
e	1.20 BSC	
H	11.48	11.88
H1	6.80	7.10
i	0.10 REF	
j1	0.46 REF	
j2	0.20 REF	
K	2.80 REF	
L	1.40	2.10
L1	0.50	0.90
L2	0.48	0.72
L3	0.30	0.80
Q	6.80 REF	
R	3.00	3.20

**Note:**

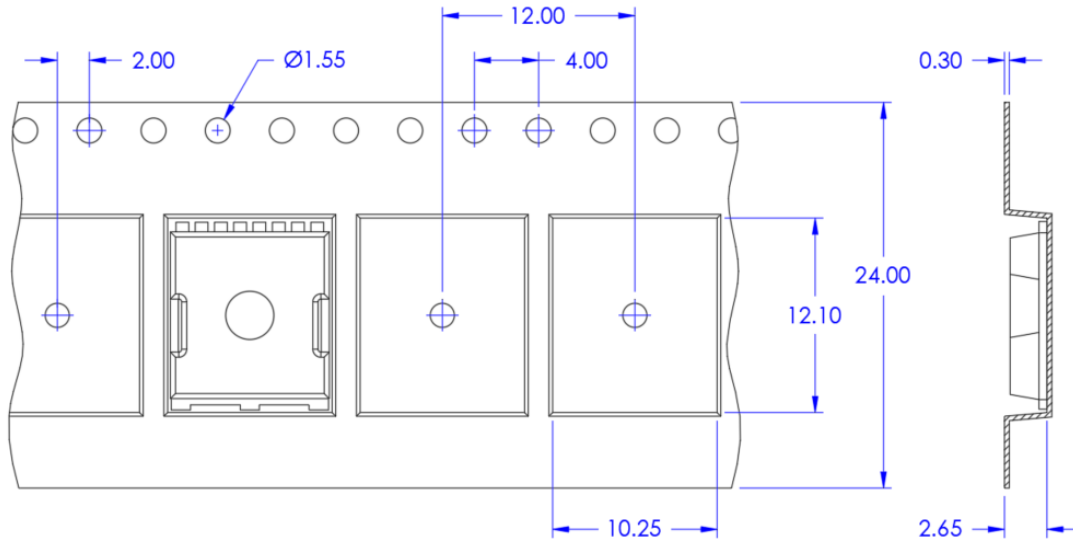
1. All dimensions in millimeters
2. Dimensions does not include Burrs and Mold Flashes

**PART MARKING**

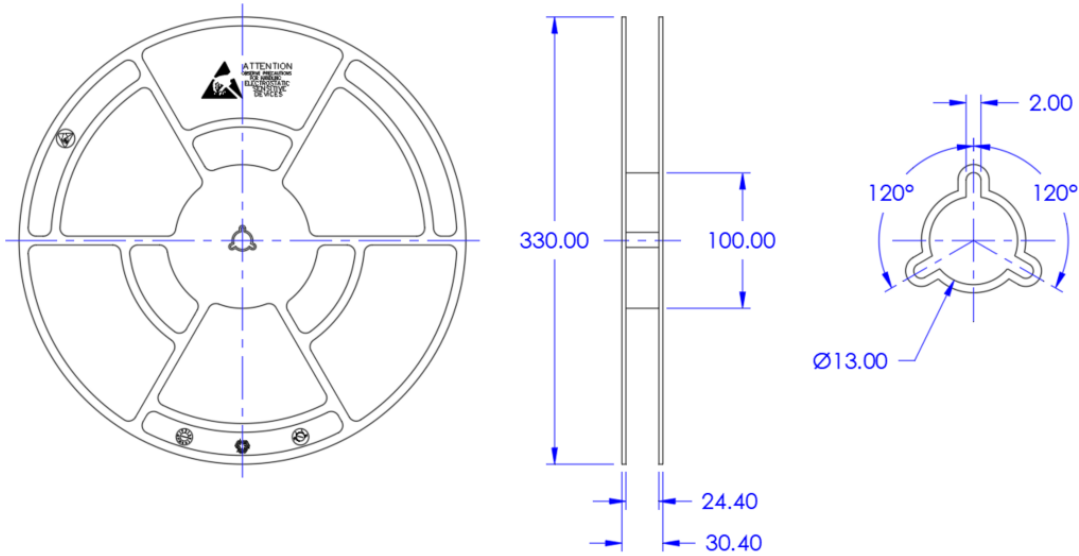


**PACKING TYPE**

*Carrier Tape*



*Reel*



All dimensions in millimeters  
Quantity per Reel: 2000 units



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**REVISION HISTORY**

Revision	Create Date (mm/dd/yyyy)	Description of Change	Initiator of Change
A	10/13/2023	Initial Production Release	Glenn Galang
B	01/31/2024	Corrected device orientation inside carrier tape pocket (Page 3)	Glenn Galang

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