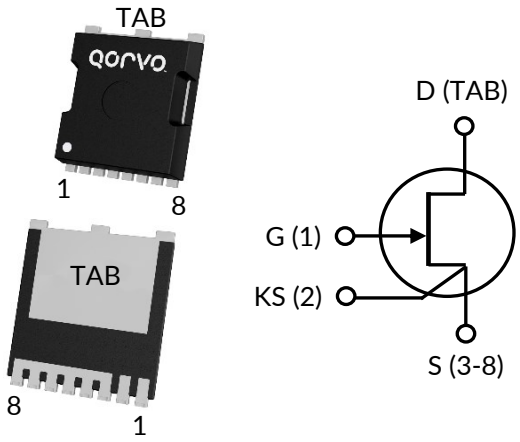
Silicon Carbide (SiC) JFET - EliteSiC, Power N-Channel, TOLL, 750 V, 4.3 mohm

DATASHEET

UJ4N075004L8S

Rev. C, January 2025



Part Number	Package	Marking
UJ4N075004L8S	MO-229	UJ4N075004

RoHS COMPLIANT | Pb LEAD FREE | HF HALOGEN FREE

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

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 [1]	-30 to +30	V
Continuous drain current [2]	I_D	T_C < 145°C	120	A
Pulsed drain current [3]	I_{DM}	T_C = 25°C	588	A
Short circuit withstand time	t_{SC}	V_{DS} = 400V, $T_{J(START)}$ = 175°C	5	µs
Power dissipation	P_{tot}	T_C = 25°C	1153	W
Maximum junction temperature	$T_{J,max}$		175	°C
Operating and storage temperature	T_J,T_{STG}		-55 to 175	°C
Reflow soldering temperature	T_{solder}	reflow MSL 1	260	°C

1. +30V AC rating applies for turn-on pulses <200ns applied with external R_G > 1Ω.
2. Limited by bondwires
3. 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	°C/W

Electrical Characteristics (T_J = +25°C unless otherwise specified)

Typical Performance - Static

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

Typical Performance - Dynamic

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

Typical Performance Diagrams

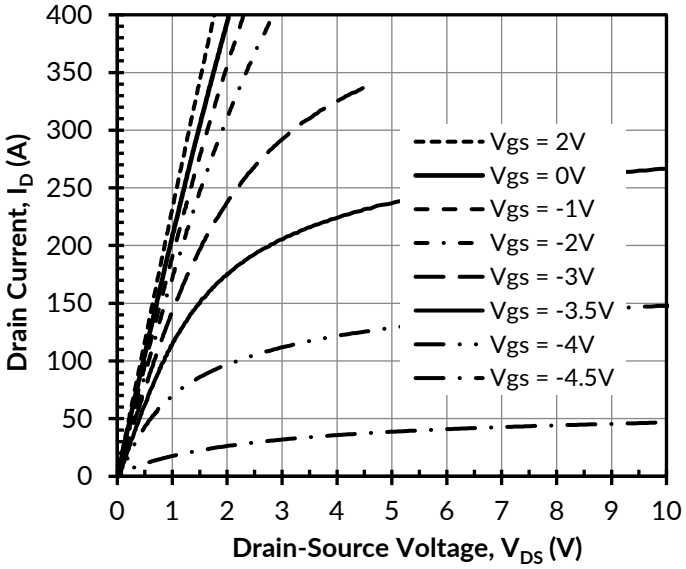


Figure 1. Typical output characteristics at T_J = - 55°C, tp < 250µs

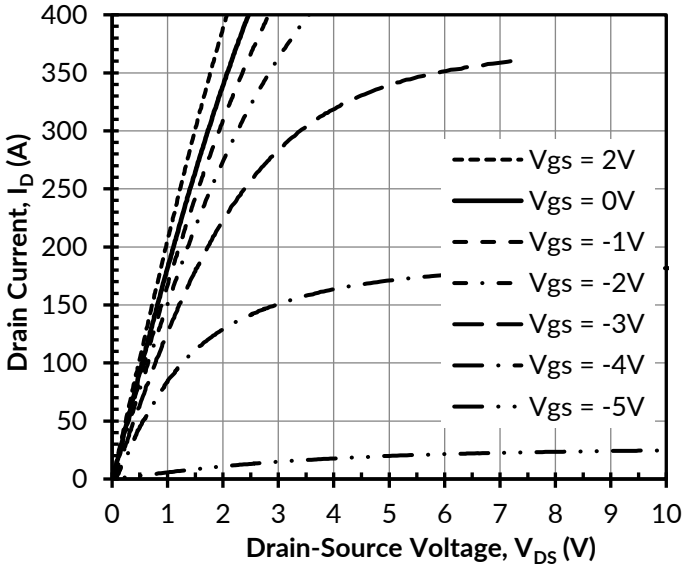


Figure 2. Typical output characteristics at T_J = 25°C, tp < 250µs

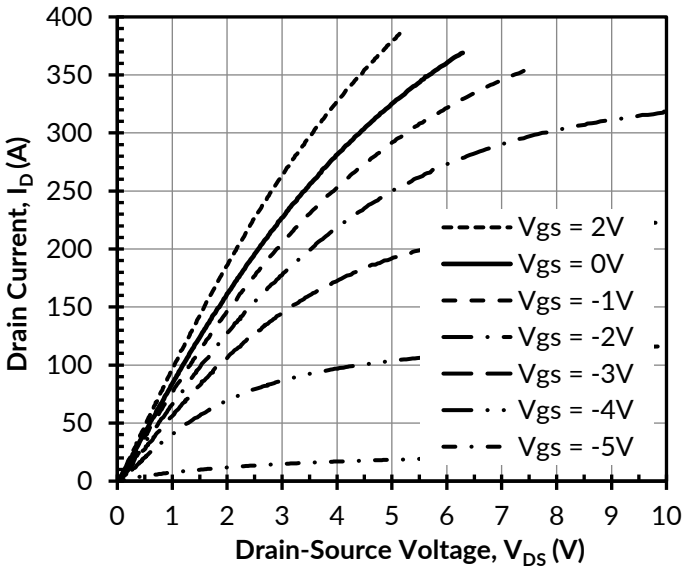


Figure 3. Typical output characteristics at T_J = 175°C, tp < 250µs

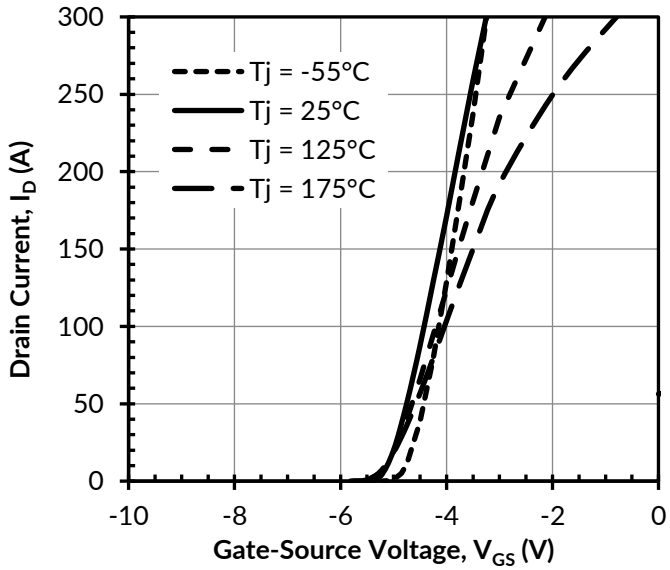


Figure 4. Typical transfer characteristics at V_{DS} = 5V

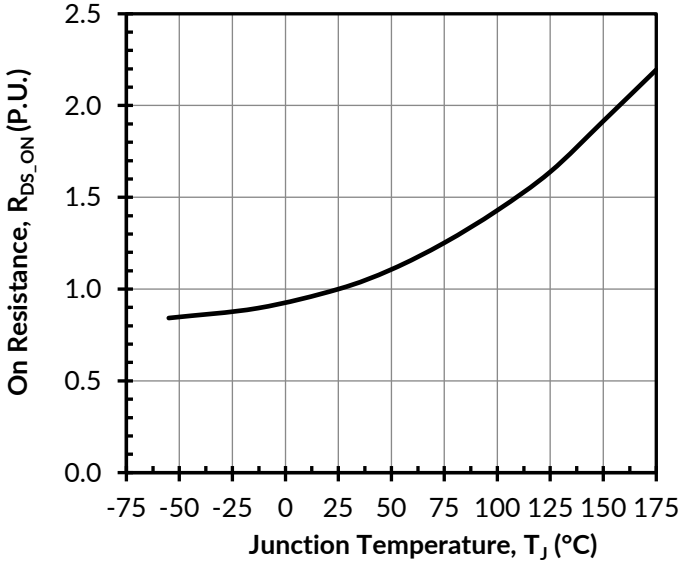


Figure 5. Normalized on-resistance vs. temperature at V_{GS} = 0V and I_D = 80A

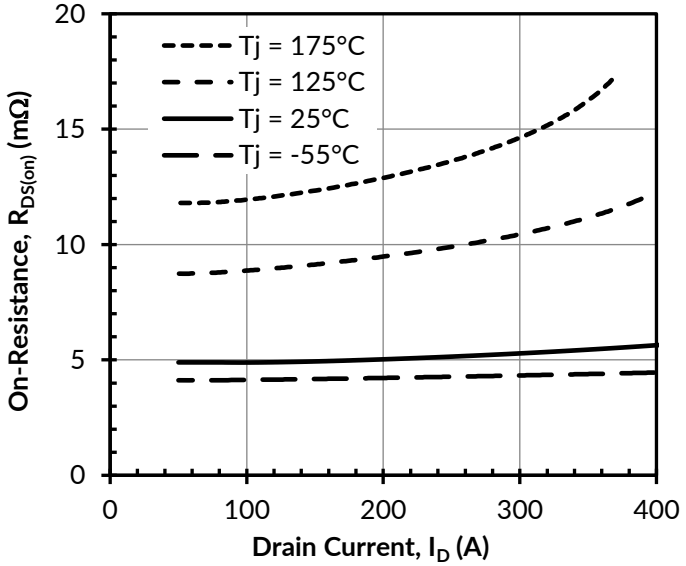


Figure 6. Typical drain-source on-resistances at V_{GS} = 0V

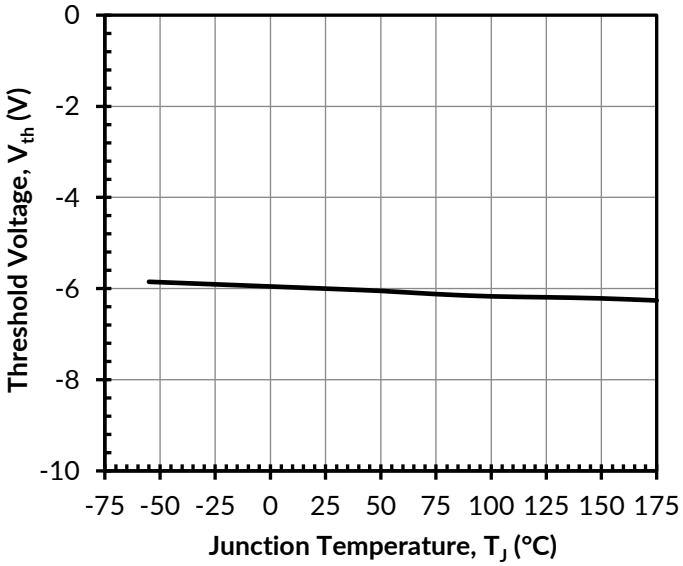


Figure 7. Threshold voltage vs. junction temperature at V_{DS} = 5V and I_D = 180mA

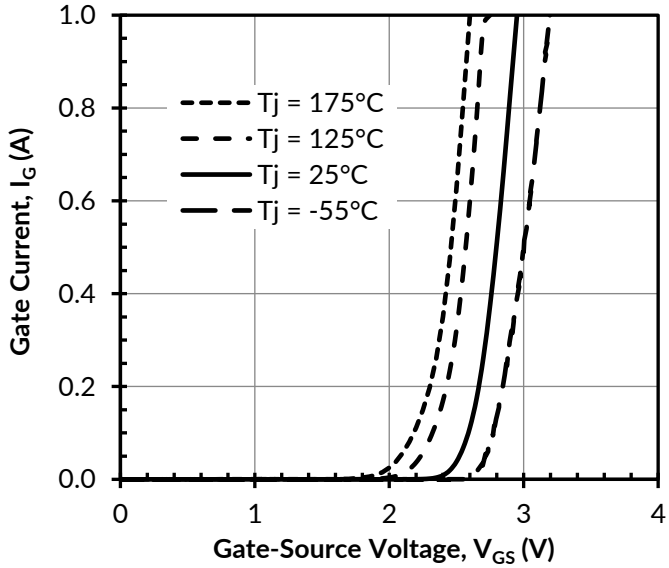


Figure 8. Typical gate forward current at V_{DS} = 0V

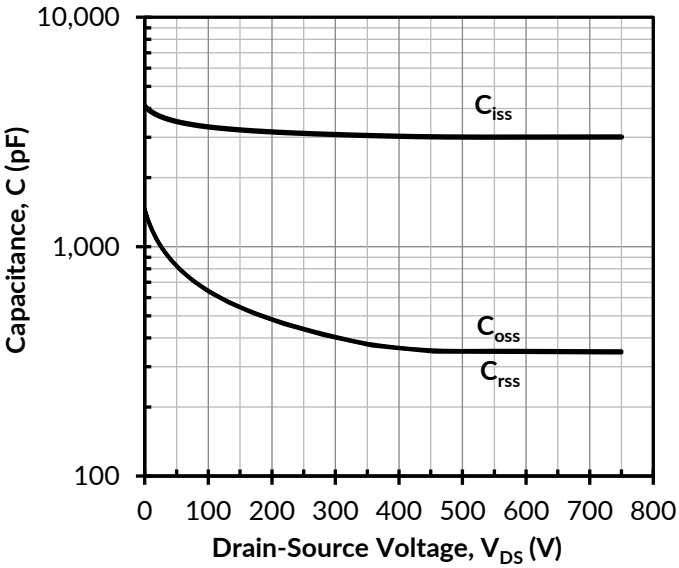


Figure 9. Typical capacitances at f = 100kHz and V_{GS} = -20V

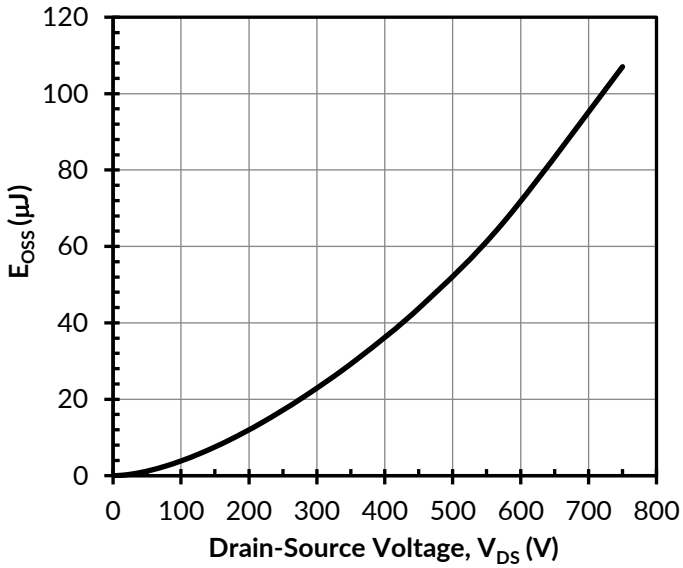


Figure 10. Typical stored energy in C_{OSS} at V_{GS} = -20V

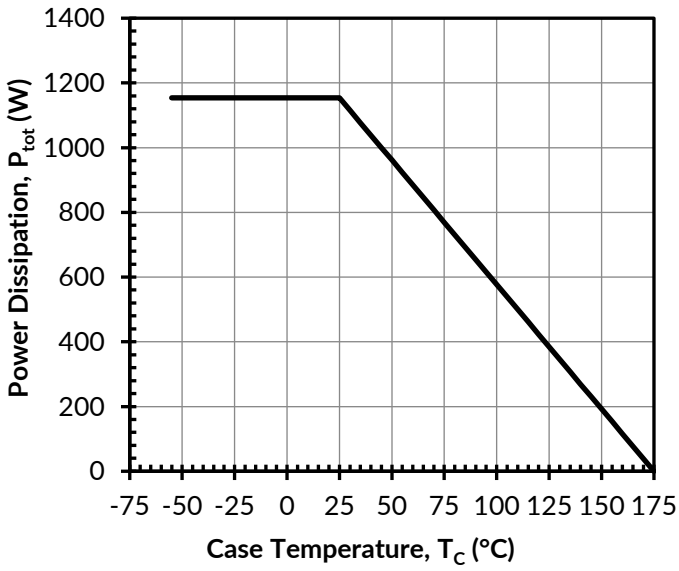


Figure 11. Total power Dissipation

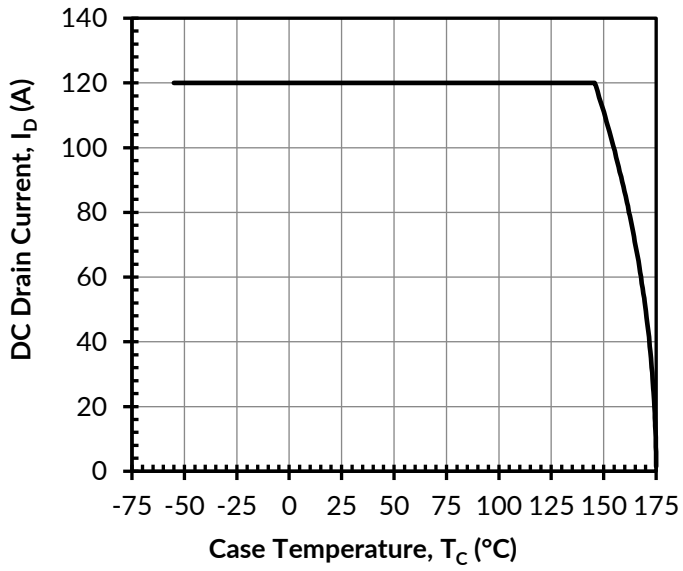


Figure 12. DC drain current derating

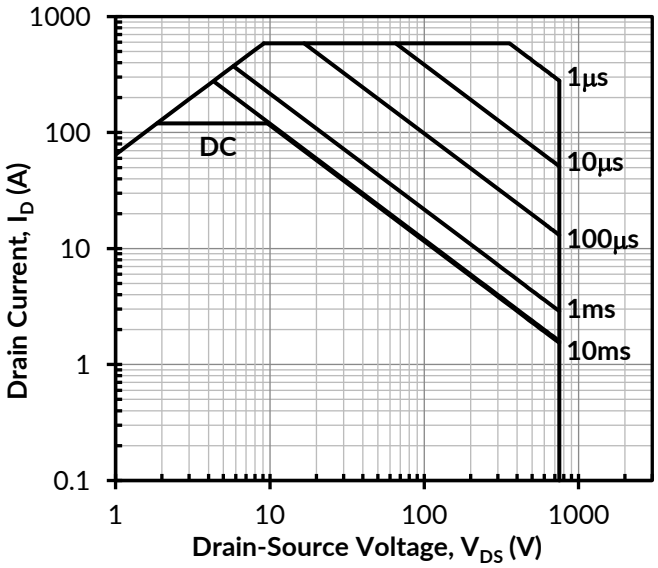


Figure 13. Safe operation area at T_C =25°C, Parameter t_p

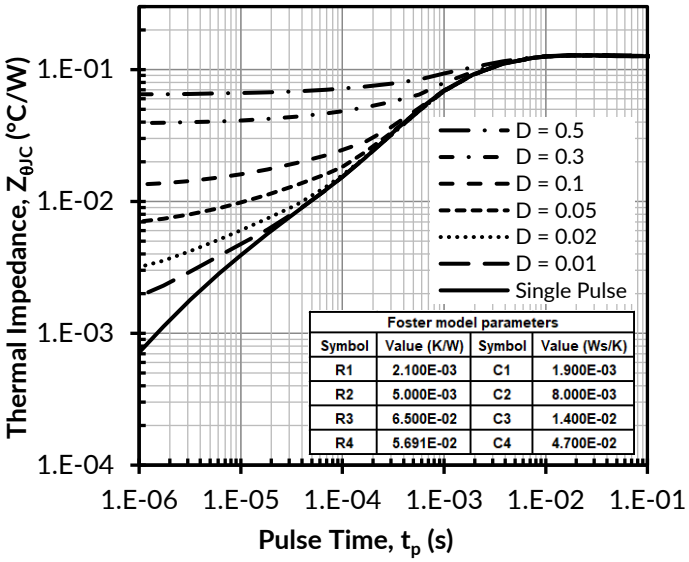


Figure 14. Maximum transient thermal impedance

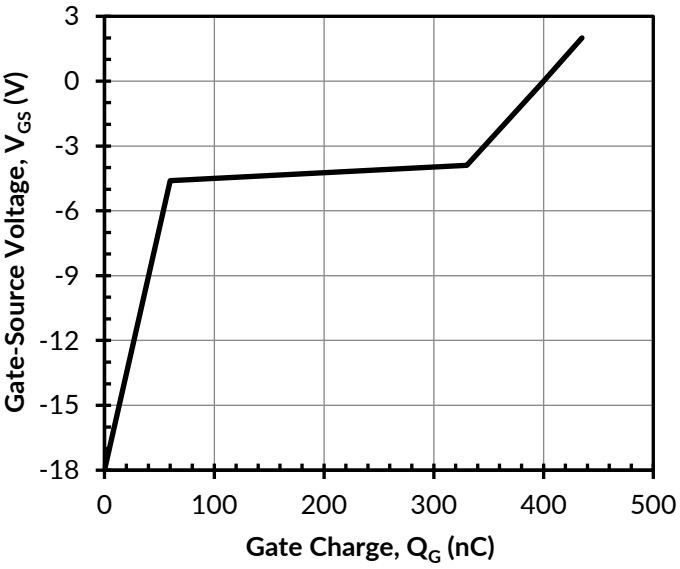
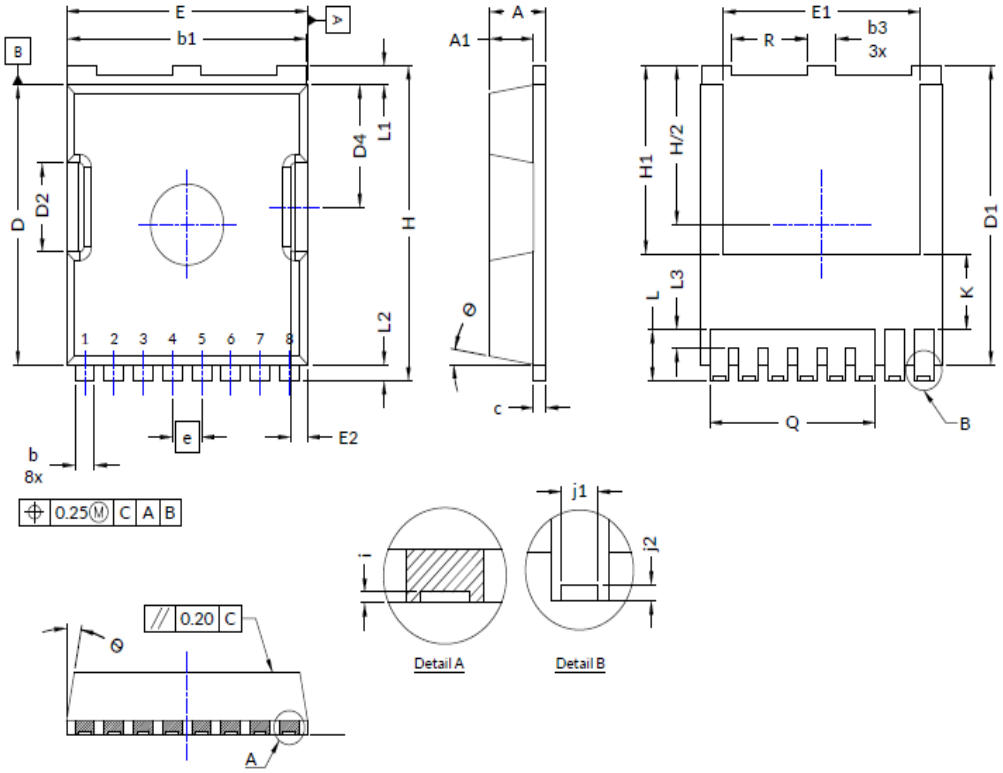


Figure 15. Typical gate charge at V_{DS} = 400V and I_D = 80A

Package Outlines



SYMBOL	TO-LL		
	Value		
	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
θ		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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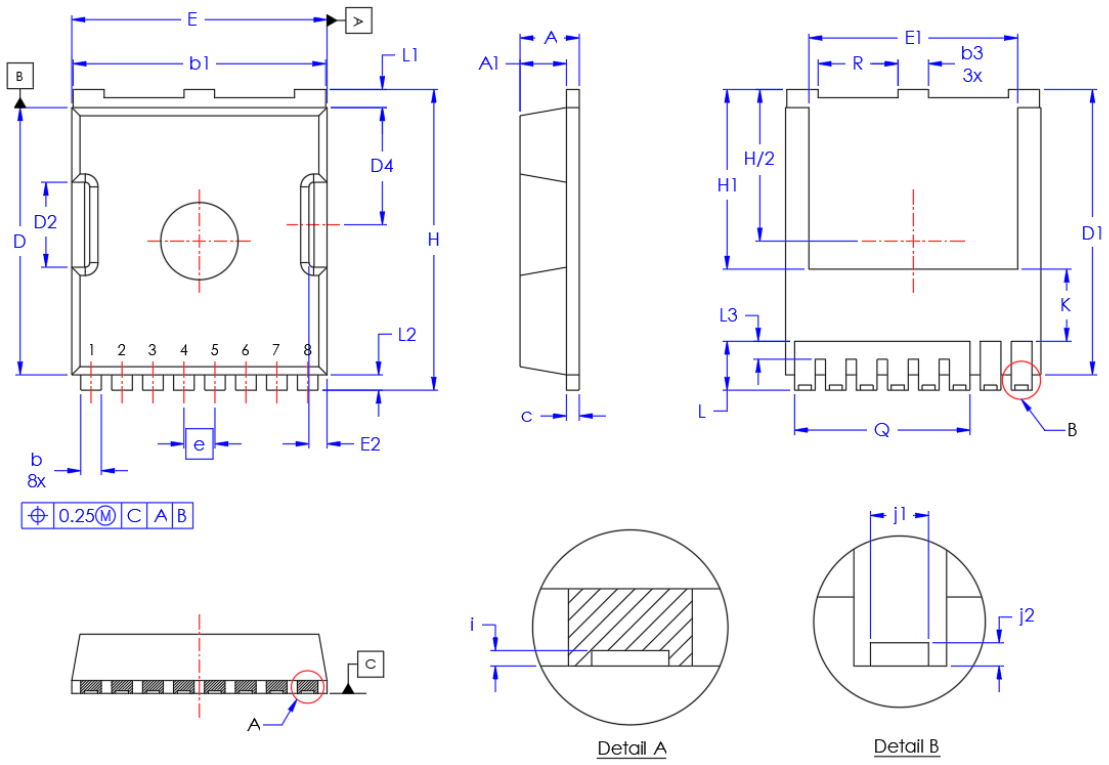
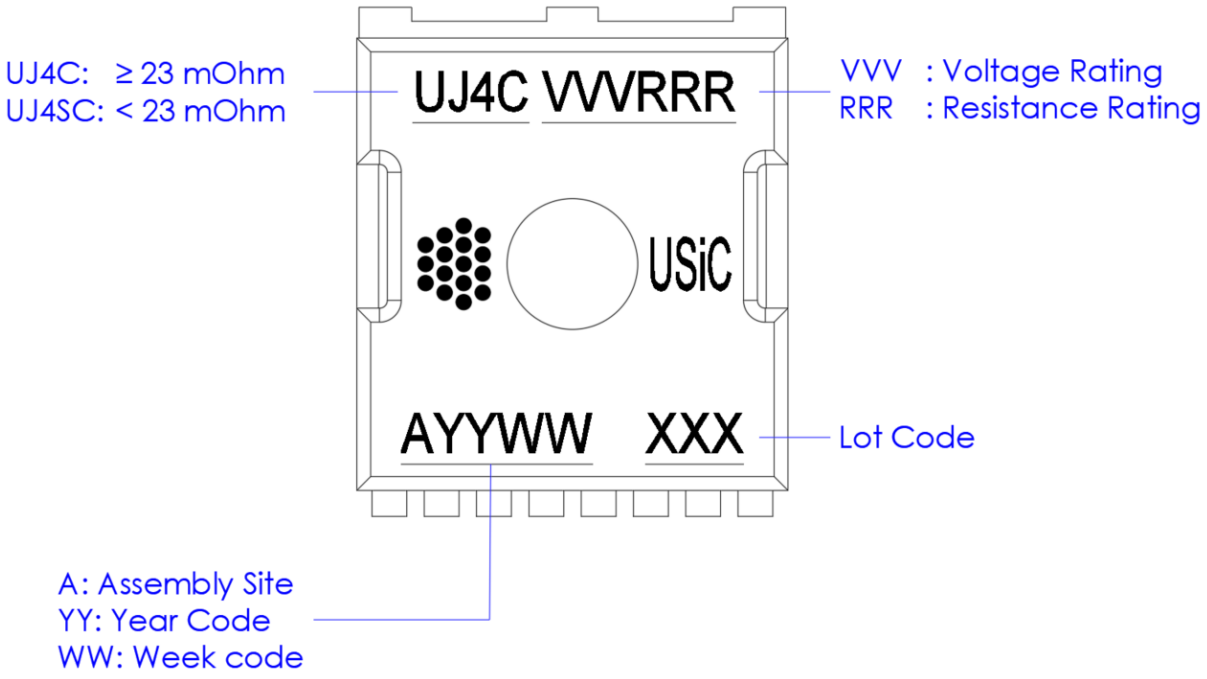
PACKAGE OUTLINE



SYMBOL	TO-LL Value	
	Min	Max
A	2.15	2.45
A1	1.80 REF	
b	0.65	0.90
b1	9.65	9.95
b3	1.10	1.30
c	0.40	0.60
D	10.18	10.58
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

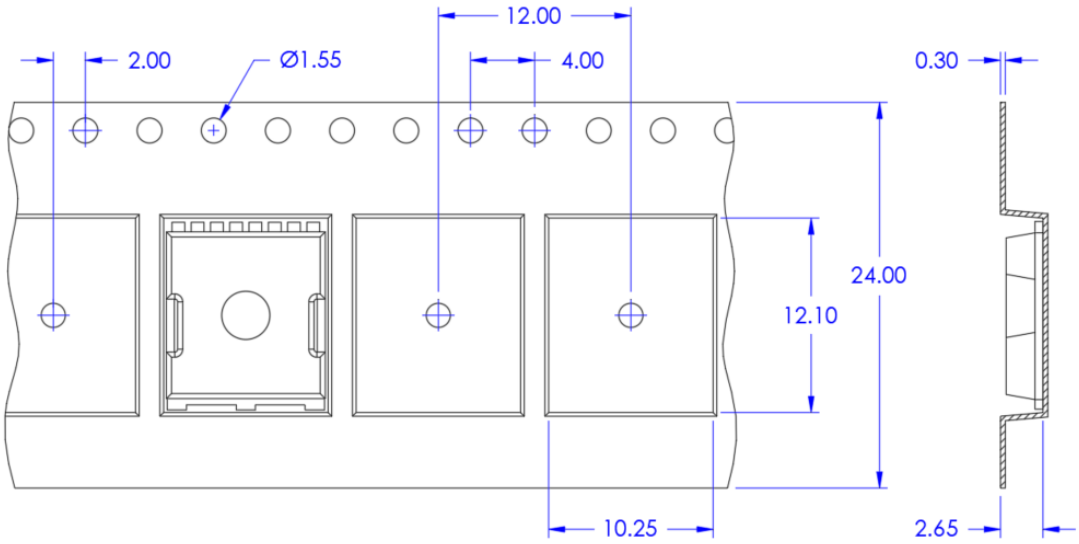
Note:
1. All dimensions in millimeters
2. Dimensions does not include Burrs and Mold Flashes

PART MARKING

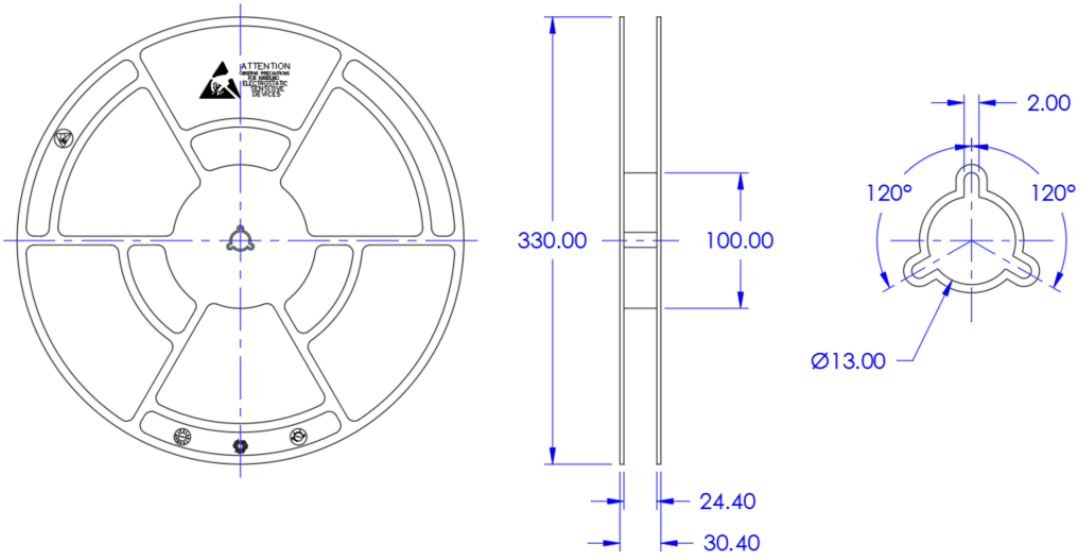


PACKING TYPE

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

ADDITIONAL INFORMATION

TECHNICAL PUBLICATIONS:
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