

Silicon Carbide (SiC) JFET – EliteSiC, Power N-Channel, TO247-4, 1200 V, 7.1 mohm

UF3N120007K4S

Description

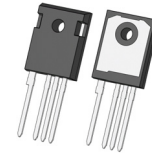
onsemi's UF3N120007K4S is a 1200 V, 7.1 mΩ High-Performance Gen 3 Normally-On SiC JFET Transistor. This device exhibits Ultra-low On resistance ($R_{DS(ON)}$) in a TO247-4 Package, making it an ideal fit to address the Challenging Thermal Constraints of Solid-state Circuit Breakers and Relay Applications. Additionally, the JFET is a Robust Device Technology Capable of the High-Energy Switching Required in Circuit Protection Applications.

Features

- Single Digit On-Resistance
- Operating Temperature: 175 °C (Max)
- High Pulse Current Capability
- Excellent Device Robustness
- Silver-Sintered Die Attach for Excellent Thermal Resistance
- This Device is Pb-Free, Halogen Free and is RoHS Compliant

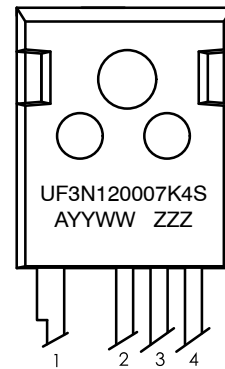
Typical Applications

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



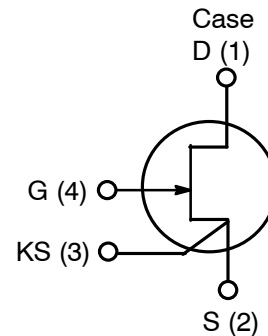
TO247-4
CASE 340AN

MARKING DIAGRAM



UF3N120007K4S = Specific Device Code
A = Assembly Location
YY = Year
WW = Work Week
ZZZ = Lot ID

PIN CONNECTIONS



ORDERING INFORMATION

See detailed ordering and shipping information on page 6 of this data sheet.

UF3N120007K4S

MAXIMUM RATINGS

Parameter	Symbol	Test Conditions	Value	Unit
Drain-Source Voltage	V_{DS}		1200	V
Gate-Source Voltage	V_{GS}	DC	-30 to +3	V
		AC (Note 1)	-30 to +30	
Continuous Drain Current (Note 2)	I_D	$T_C < 112\text{ }^{\circ}\text{C}$	120	A
Pulsed Drain Current (Note 3)	I_{DM}	$T_C = 25\text{ }^{\circ}\text{C}$	550	A
Power Dissipation	P_{TOT}	$T_C = 25\text{ }^{\circ}\text{C}$	789	W
Maximum Junction Temperature	$T_{J,max}$		175	$^{\circ}\text{C}$
Operating and Storage Temperature	T_J, T_{STG}		-55 to 175	$^{\circ}\text{C}$
Max. Lead Temperature for Soldering, 1/8" from Case for 5 seconds	T_L		250	$^{\circ}\text{C}$

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. +30 V AC Rating Applies for Turn-on Pulses <200 ns applied with external $R_G > 1\Omega$.
2. Limited by Bondwires
3. Pulse width t_p limited by $T_{J,max}$

THERMAL CHARACTERISTICS

Parameter	Symbol	Test Conditions	Value			
			Min	Typ	Max	Unit
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$		-	0.15	0.19	$^{\circ}\text{C/W}$

UF3N120007K4S

ELECTRICAL CHARACTERISTICS (T_J = +25 °C Unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
TYPICAL PERFORMANCE – STATIC						
Drain-Source Breakdown Voltage	BV _{DS}	V _{GS} = -20 V, I _D = 1 mA	1200	–	–	V
Total Drain Leakage Current	I _{DSS}	V _{DS} = 1200 V, V _{GS} = -20 V, T _J = 25 °C	–	20	300	μA
		V _{DS} = 1200 V, V _{GS} = -20 V, T _J = 175 °C	–	100	–	
Total Gate Leakage Current	I _{GSS}	V _{GS} = -20 V, T _J = 25 °C	–	15	300	μA
		V _{GS} = -20 V, T _J = 175 °C	–	55	–	μA
Drain-Source On-Resistance	R _{DS(on)}	V _{GS} = 2 V, I _D = 100 A, T _J = 25 °C	–	7.1	–	mΩ
		V _{GS} = 0 V, I _D = 100 A, T _J = 25 °C	–	8.6	11	
		V _{GS} = 2 V, I _D = 100 A, T _J = 175 °C	–	15.5	–	
		V _{GS} = 0 V, I _D = 100 A, T _J = 175 °C	–	17.8	–	
Gate Threshold Voltage	V _{G(th)}	V _{DS} = 5 V, I _D = 320 mA	–9.3	–7	–4.7	V
Gate Resistance	R _G	f = 1 MHz, Open Drain	–	0.54	–	Ω

TYPICAL PERFORMANCE – DYNAMIC

Input Capacitance	C _{iss}	V _{DS} = 800 V, V _{GS} = -20 V, f = 100 kHz	–	8110	–	pF
Output Capacitance	C _{oss}		–	368	–	
Reverse Transfer Capacitance	C _{rss}		–	358	–	
Effective Output Capacitance, Energy Related	C _{oss(er)}	V _{DS} = 0 V to 800 V, V _{GS} = -20 V	–	403	–	pF
C _{oss} Stored Energy	E _{OSS}	V _{DS} = 800 V, V _{GS} = -20 V	–	130	–	μJ
Total Gate Charge	Q _G	V _{DS} = 800 V, I _D = 100 A, V _{GS} = -18 V to 0 V	–	830	–	nC
Gate-Drain Charge	Q _{GD}		–	520	–	
Gate-Source Charge	Q _{GS}		–	120	–	

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

TYPICAL PERFORMANCE DIAGRAM

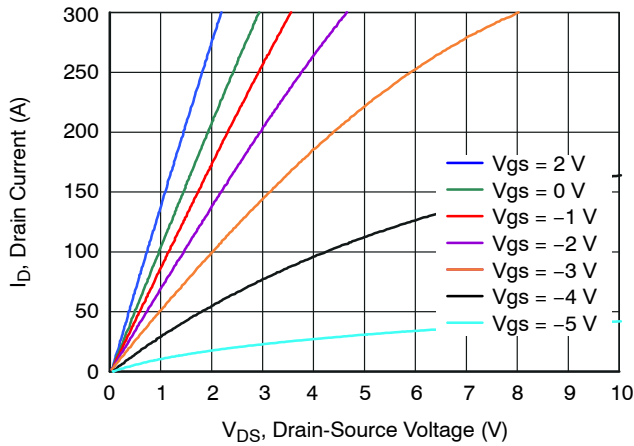


Figure 1. Typical Output Characteristics at $T_J = -55\text{ }^{\circ}\text{C}$, $t_p < 250\text{ }\mu\text{s}$

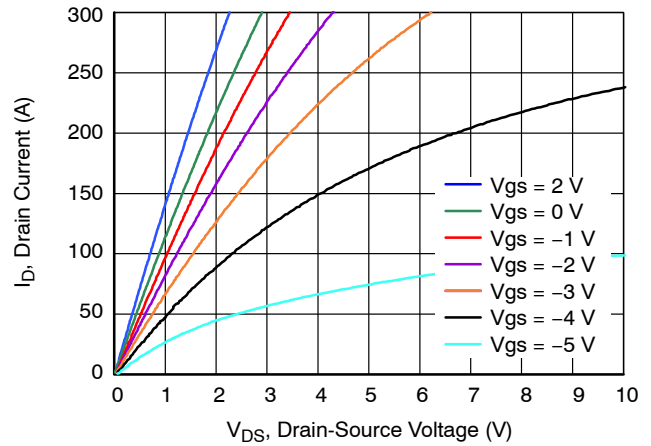


Figure 2. Typical Output Characteristics at $T_J = 25\text{ }^{\circ}\text{C}$, $t_p < 250\text{ }\mu\text{s}$

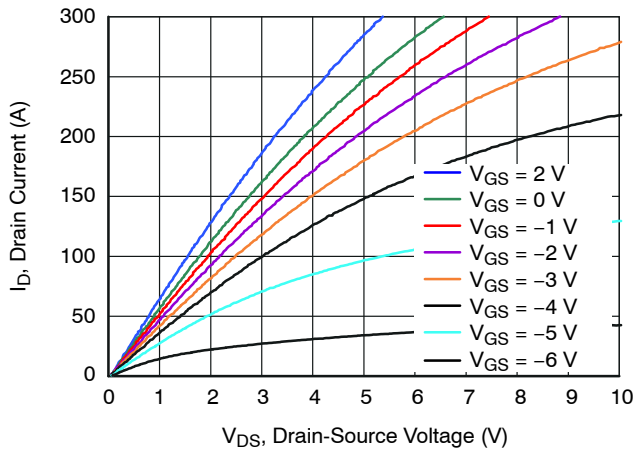


Figure 3. Typical Output Characteristics at $T_J = 175\text{ }^{\circ}\text{C}$, $t_p < 250\text{ }\mu\text{s}$

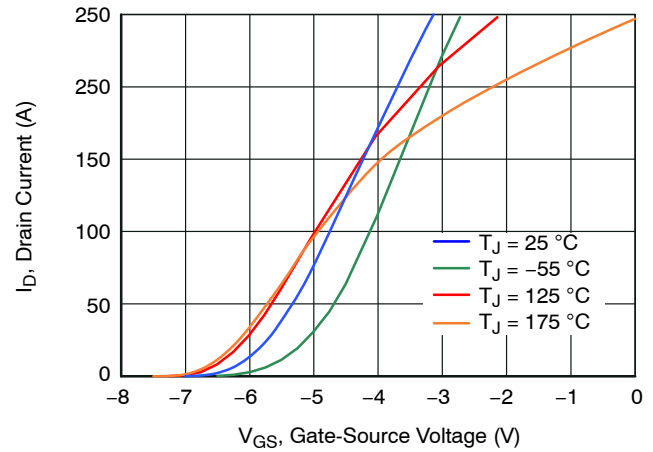


Figure 4. Typical Transfer Characteristics at $V_{DS} = 5\text{ V}$

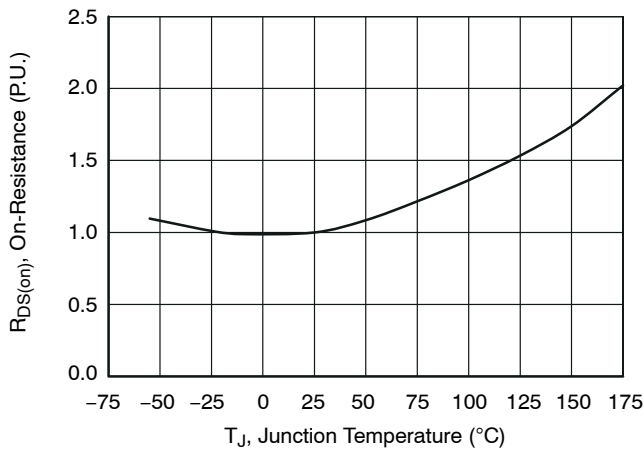


Figure 5. Normalized On-Resistance Vs. Temperature at $V_{GS} = 0\text{ V}$ and $I_D = 100\text{ A}$

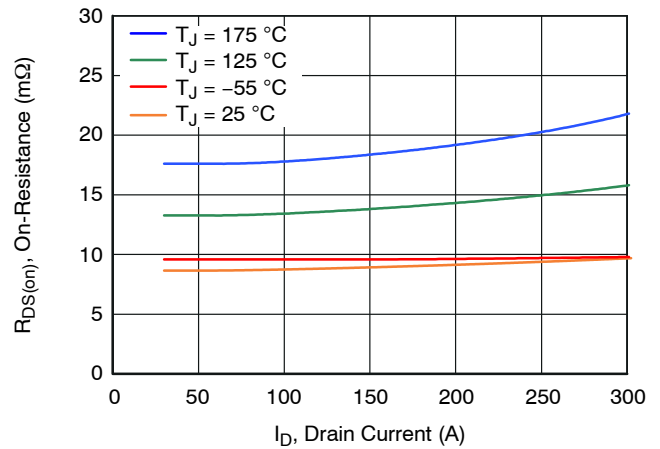


Figure 6. Typical Drain-Source On-Resistance $V_{GS} = 0\text{ V}$

TYPICAL PERFORMANCE DIAGRAMS (CONTINUED)

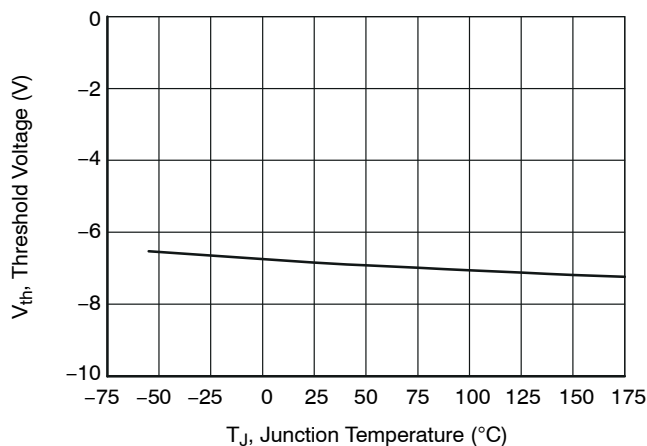


Figure 7. Threshold Voltage vs. Junction Temperature at $V_{DS} = 5\text{ V}$ and $I_D = 320\text{ mA}$

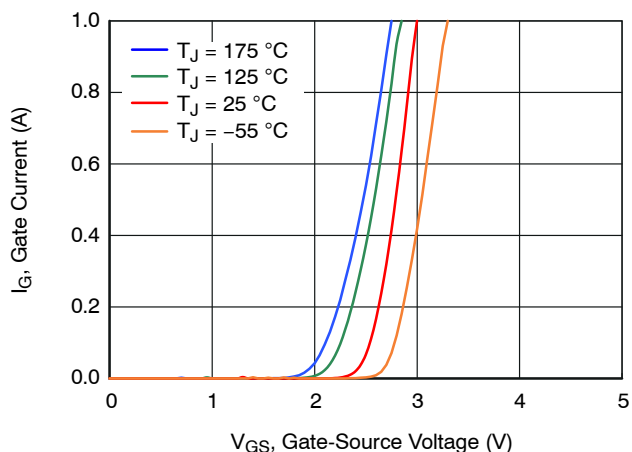


Figure 8. Typical Gate Forward Current at $V_{DS} = 0\text{ V}$

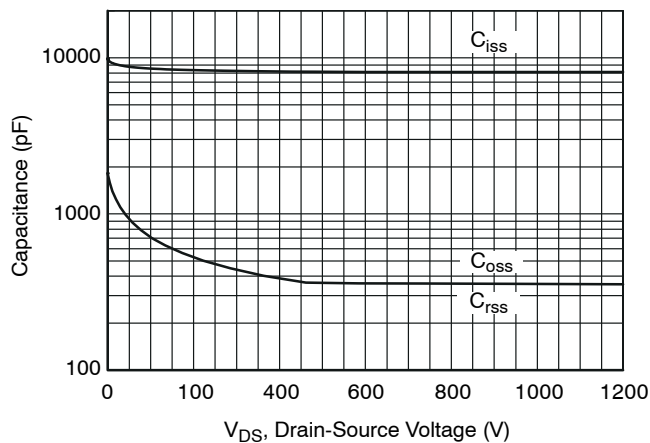


Figure 9. Typical Capacitances at $f = 100\text{ KHz}$ and $V_{GS} = -20\text{ V}$

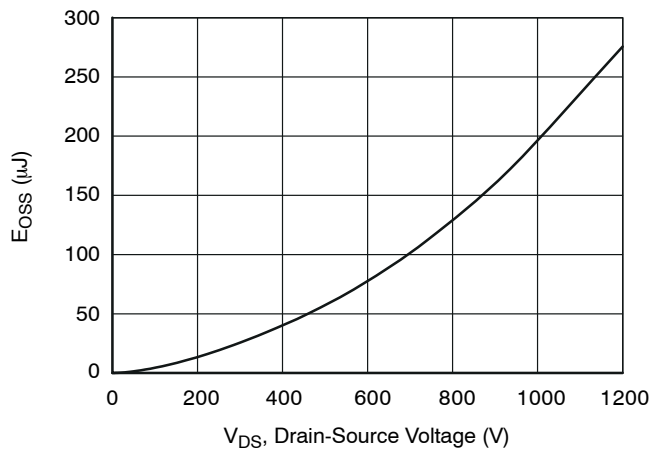


Figure 10. Typical Stored Energy in C_{OSS} at $V_{GS} = -20\text{ V}$

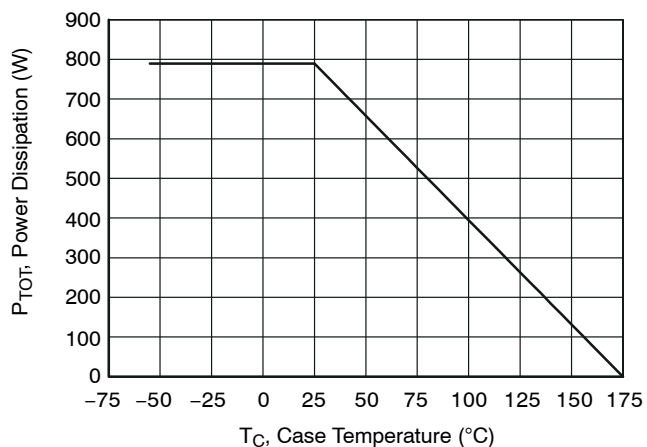


Figure 11. Total Power Dissipation

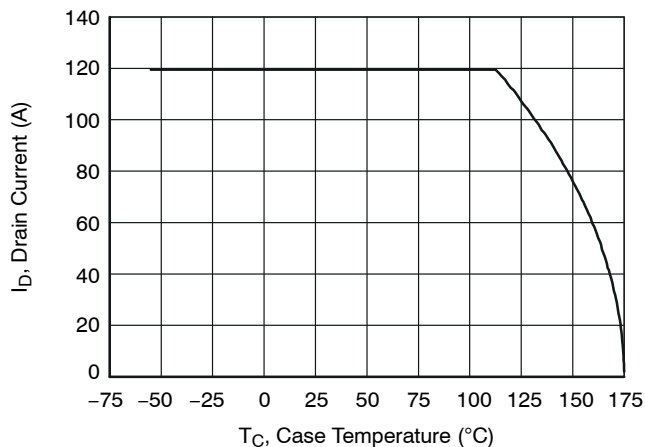


Figure 12. DC Drain Current Derating

TYPICAL PERFORMANCE DIAGRAMS (CONTINUED)

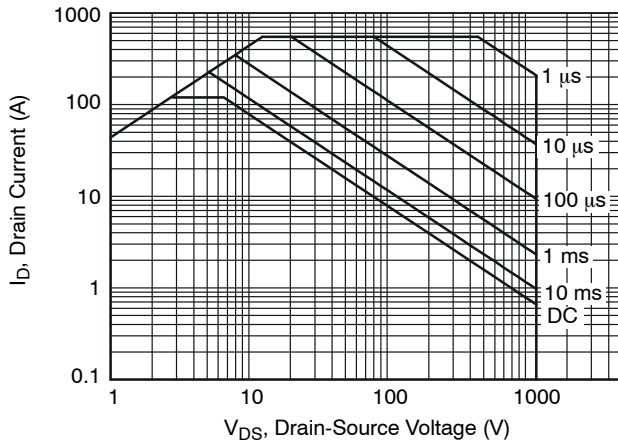


Figure 13. Safe Operation Area at $T_C = 25\text{ }^{\circ}\text{C}$, Parameter t_p

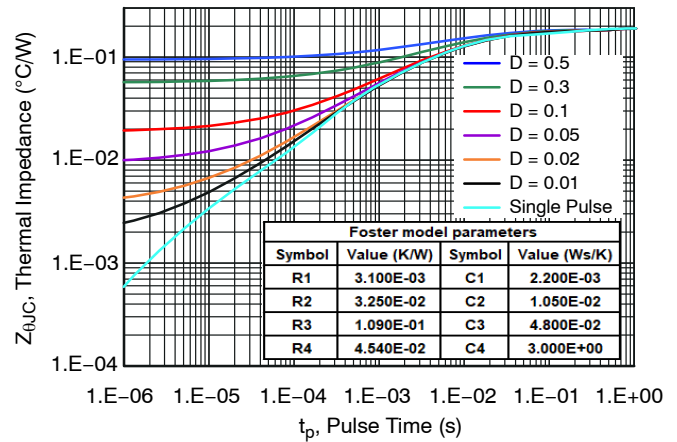


Figure 14. Maximum Transient Thermal Impedance

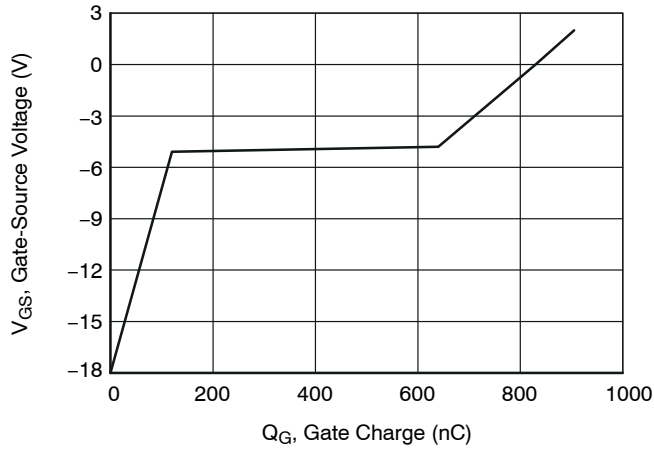
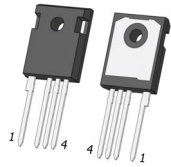


Figure 15. Typical Gate Charge at $V_{DS} = 800\text{ V}$ and $I_D = 100\text{ A}$

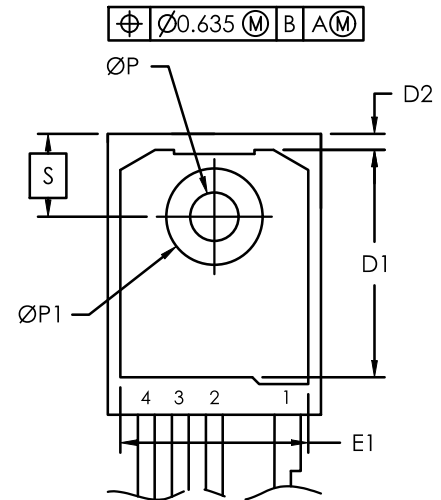
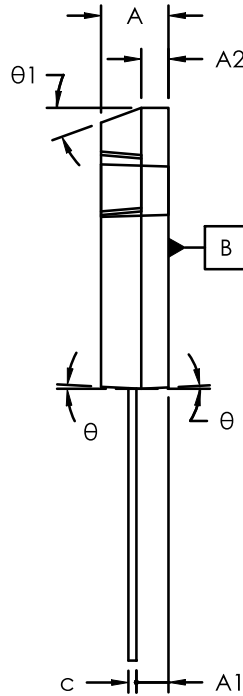
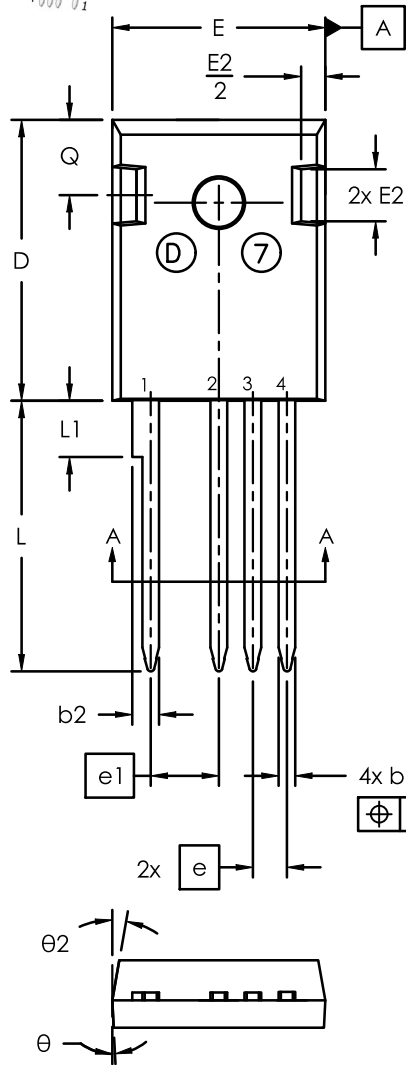
ORDERING INFORMATION

Part Number	Marking	Package	Shipping
UF3N120007K4S	UF3N120007K4S	TO247-4 (Pb-Free, Halogen Free)	600 Units / Tube



TO247-4 15.90x20.96x5.03, 5.44P
CASE 340AN
ISSUE D

DATE 14 APR 2025



SYM	millimeters		
	MIN	NOM	MAX
A	4.70	5.03	5.31
A1	2.21	2.40	2.59
A2	1.50	2.03	2.49
b	0.99	1.20	1.40
b2	1.65	2.03	2.39
c	0.38	0.60	0.89
D	20.80	20.96	21.46
D1	13.08	—	—
D2	0.51	1.19	1.35
E	15.49	15.90	16.26
e	2.54 BSC		
e1	5.08 BSC		
E1	13.46	—	—
E2	3.43	3.89	5.20
L	19.81	20.17	20.32
L1	—	—	4.50
ØP	3.40	3.60	3.80
ØP1	7.06	7.19	7.39
Q	5.38	5.62	6.20
S	6.17 BSC		
θ	3°		
θ1	20°		
θ2	10°		

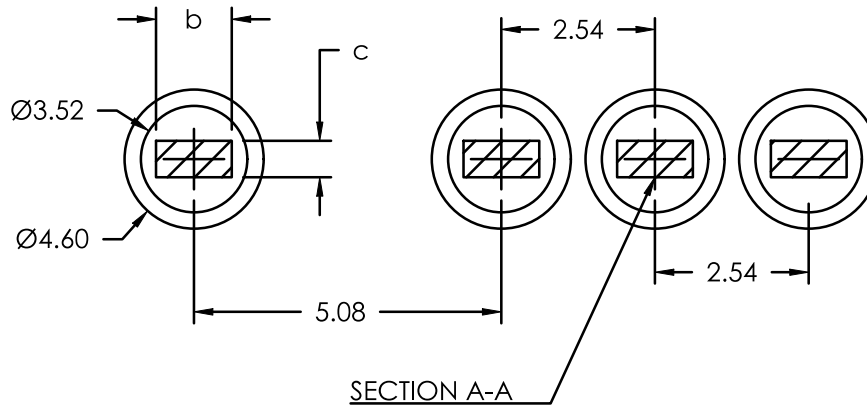
NOTE:

1. Dimensioning and tolerancing as per ASME Y14.5 - 2018
2. Controlling dimension : millimeters
3. Package Outline in compliance with JEDEC standard var. AD.
4. Dimensions D & E does not include mold flash.
5. ØP to have max draft angle of 1.7° to the top with max. hole diameter of 3.91mm.
5. Through Hole diameter value = End Hole diameter
6. PCB Through Hole pattern as per IPC-2221/IPC-2222

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RECOMMENDED PCB THROUGH HOLE



NOTE: LAND PATTERN AND THROUGH HOLE DIMENSIONS SERVE ONLY AS AN INITIAL GUIDE.
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