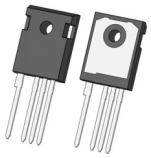
Silicon Carbide (SiC) JFET – EliteSiC, Power N-Channel, TO247-4, 1200 V, 7.1 mohm

UF3N120007K4S



TO247-4
CASE 340AN

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.

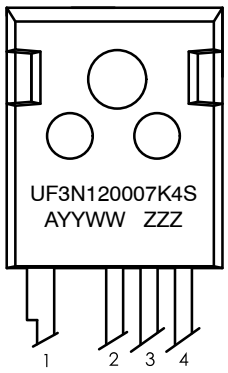
Features

- 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

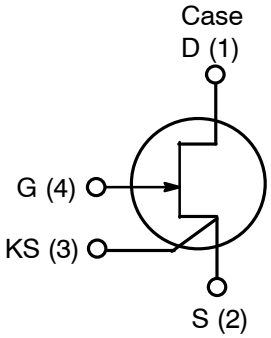
- Solid State / Semiconductor Circuit Breaker
- Solid State / Semiconductor Relay
- Battery Disconnects
- Surge Protection
- Inrush Current Control
- Induction Heating

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.

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 °C	120	A
Pulsed Drain Current (Note 3)	I_{DM}	T_C = 25 °C	550	A
Power Dissipation	P_{TOT}	T_C = 25 °C	789	W
Maximum Junction Temperature	$T_{J,max}$		175	°C
Operating and Storage Temperature	T_J, T_{STG}		−55 to 175	°C
Max. Lead Temperature for Soldering, 1/8” from Case for 5 seconds	T_L		250	°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	°C/W

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

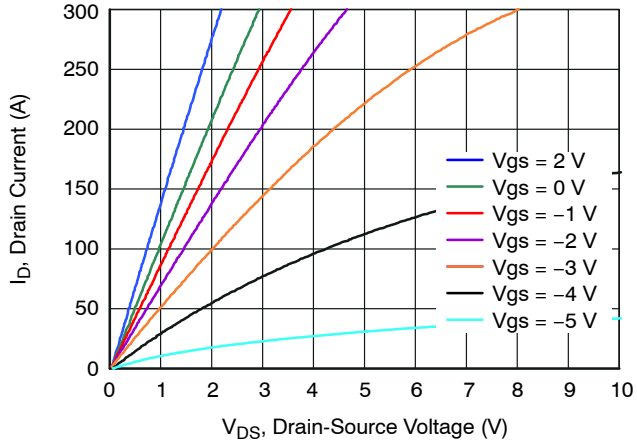


Figure 1. Typical Output Characteristics at T_J = −55 °C, t_p < 250 μs

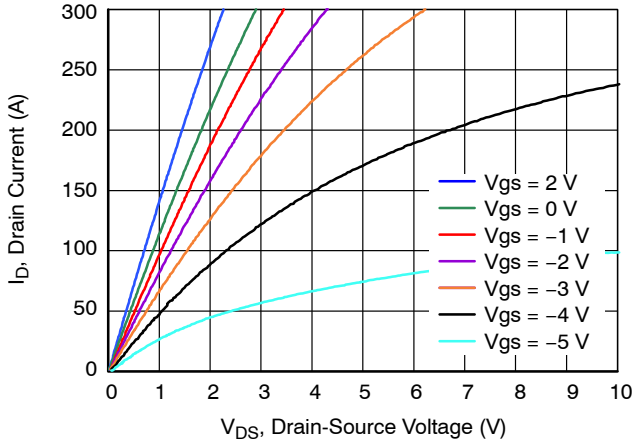


Figure 2. Typical Output Characteristics at T_J = 25 °C, t_p < 250 μs

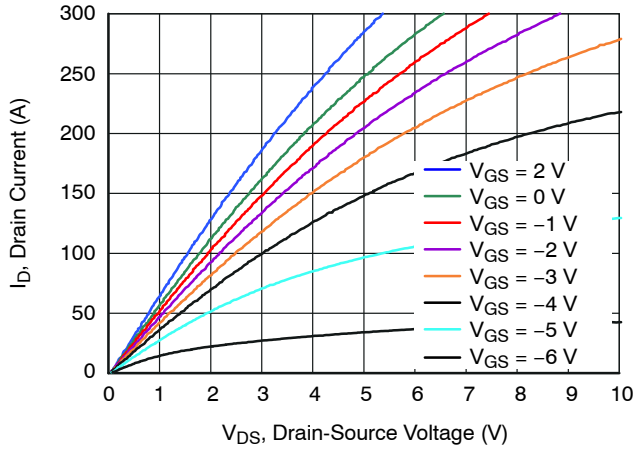


Figure 3. Typical Output Characteristics at T_J = 175 °C, t_p < 250 μs

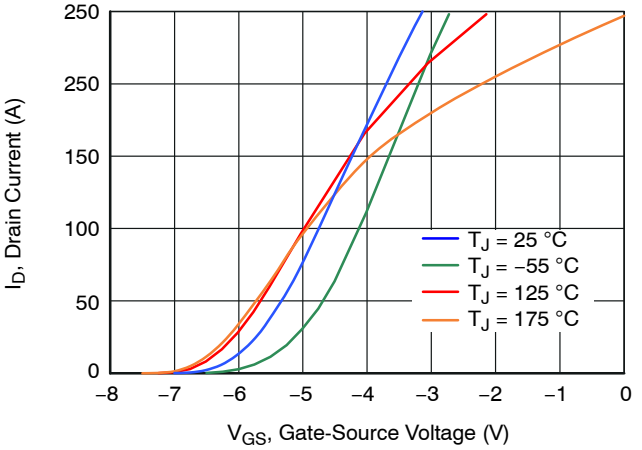


Figure 4. Typical Transfer Characteristics at V_{DS} = 5 V

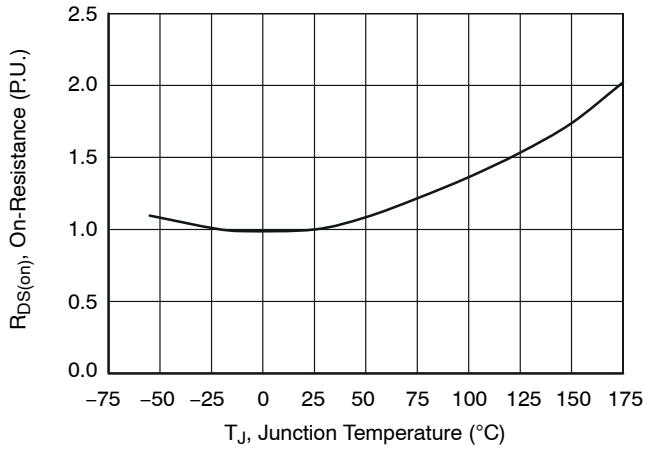


Figure 5. Normalized On-Resistance Vs. Temperature at V_{GS} = 0 V and I_D = 100 A

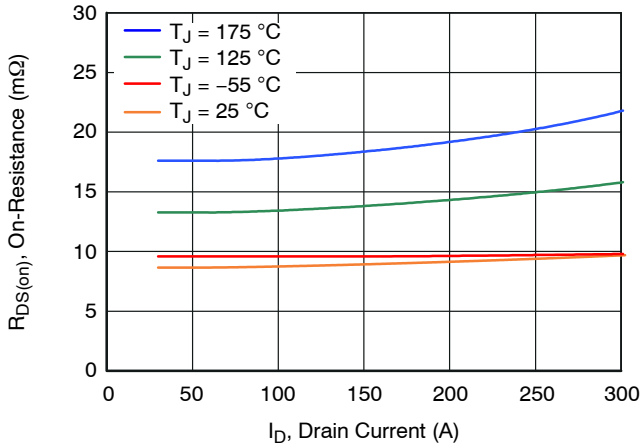


Figure 6. Typical Drain-Source On-Resistance V_{GS} = 0 V

TYPICAL PERFORMANCE DIAGRAMS (CONTINUED)

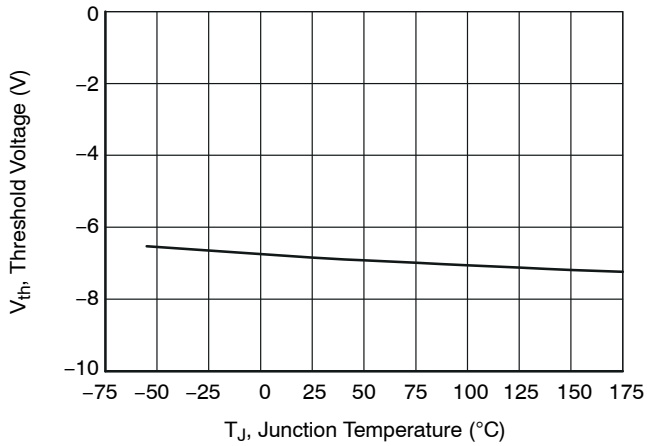


Figure 7. Threshold Voltage vs. Junction Temperature at V_{DS} = 5 V and I_D = 320 mA

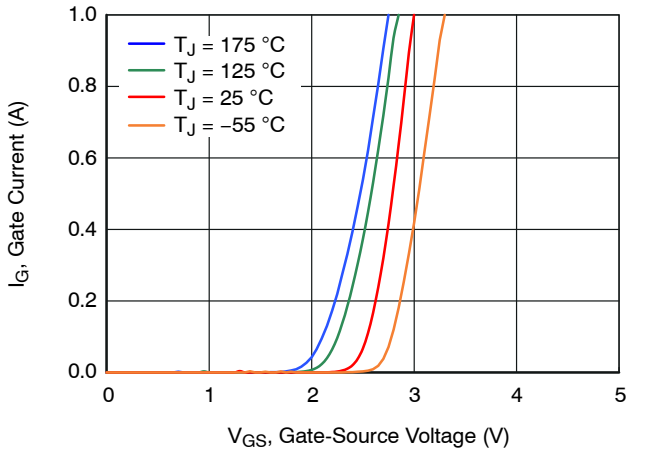


Figure 8. Typical Gate Forward Current at V_{DS} = 0 V

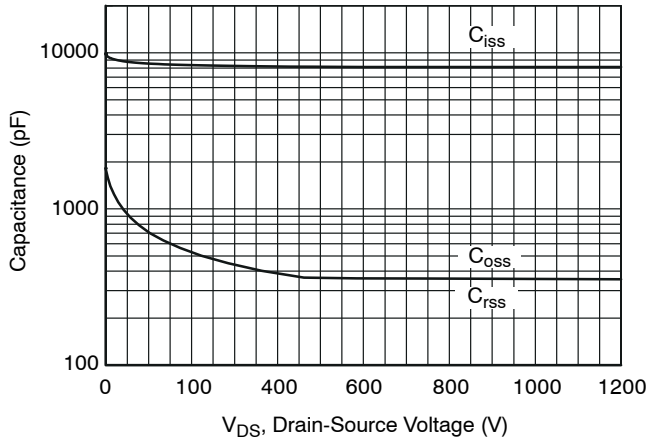


Figure 9. Typical Capacitances at f = 100 KHz and V_{GS} = −20 V

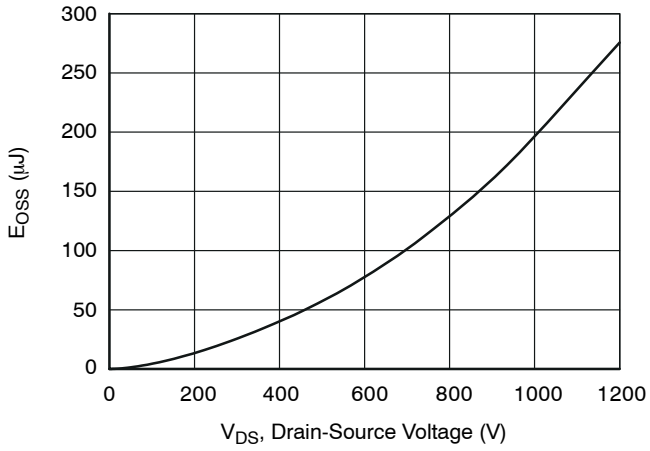


Figure 10. Typical Stored Energy in C_{OSS} at V_{GS} = −20 V

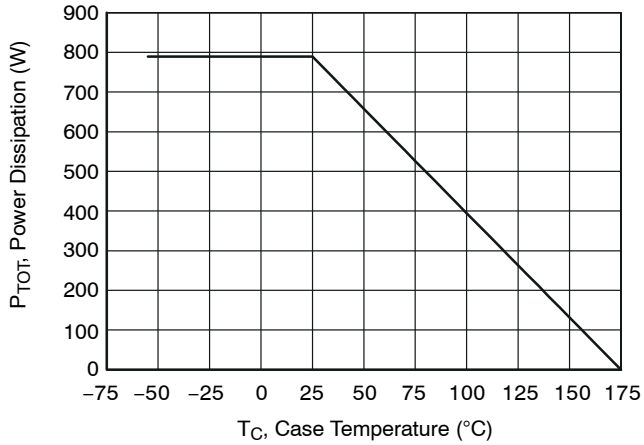


Figure 11. Total Power Dissipation

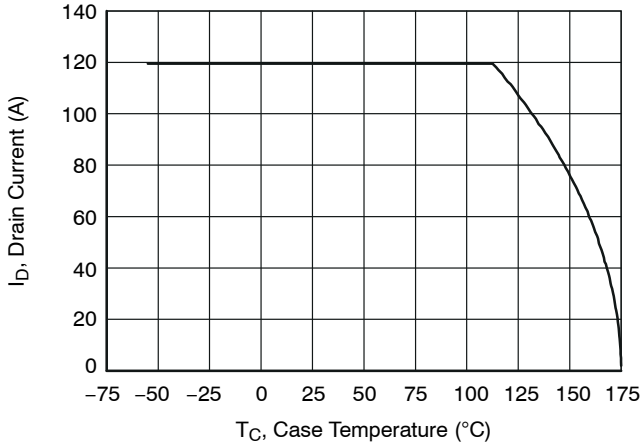


Figure 12. DC Drain Current Derating

TYPICAL PERFORMANCE DIAGRAMS (CONTINUED)

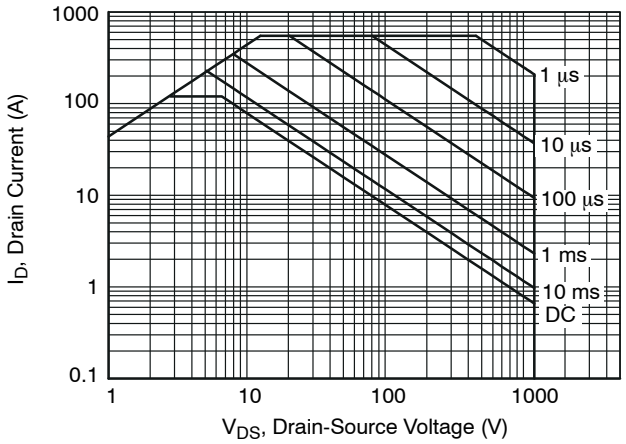


Figure 13. Safe Operation Area at T_C = 25 °C, Parameter t_p

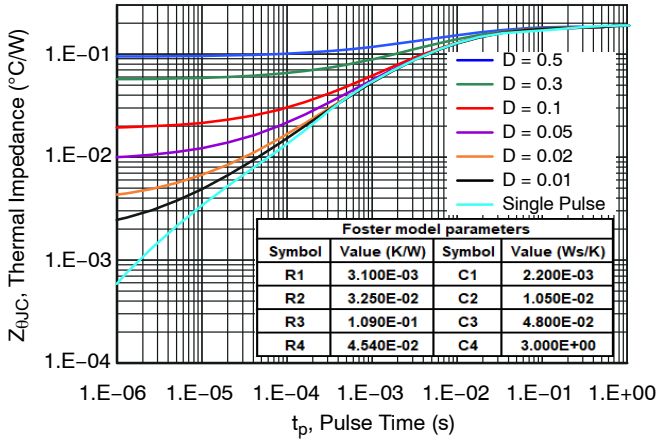


Figure 14. Maximum Transient Thermal Impedance

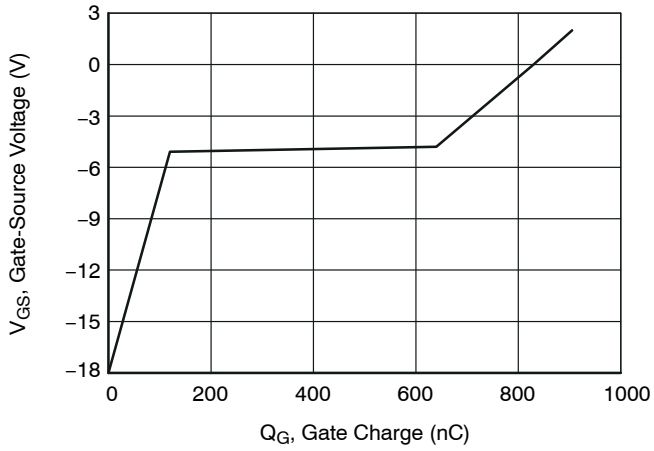
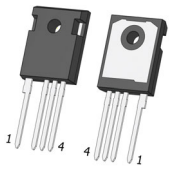


Figure 15. Typical Gate Charge at V_{DS} = 800 V and I_D = 100 A

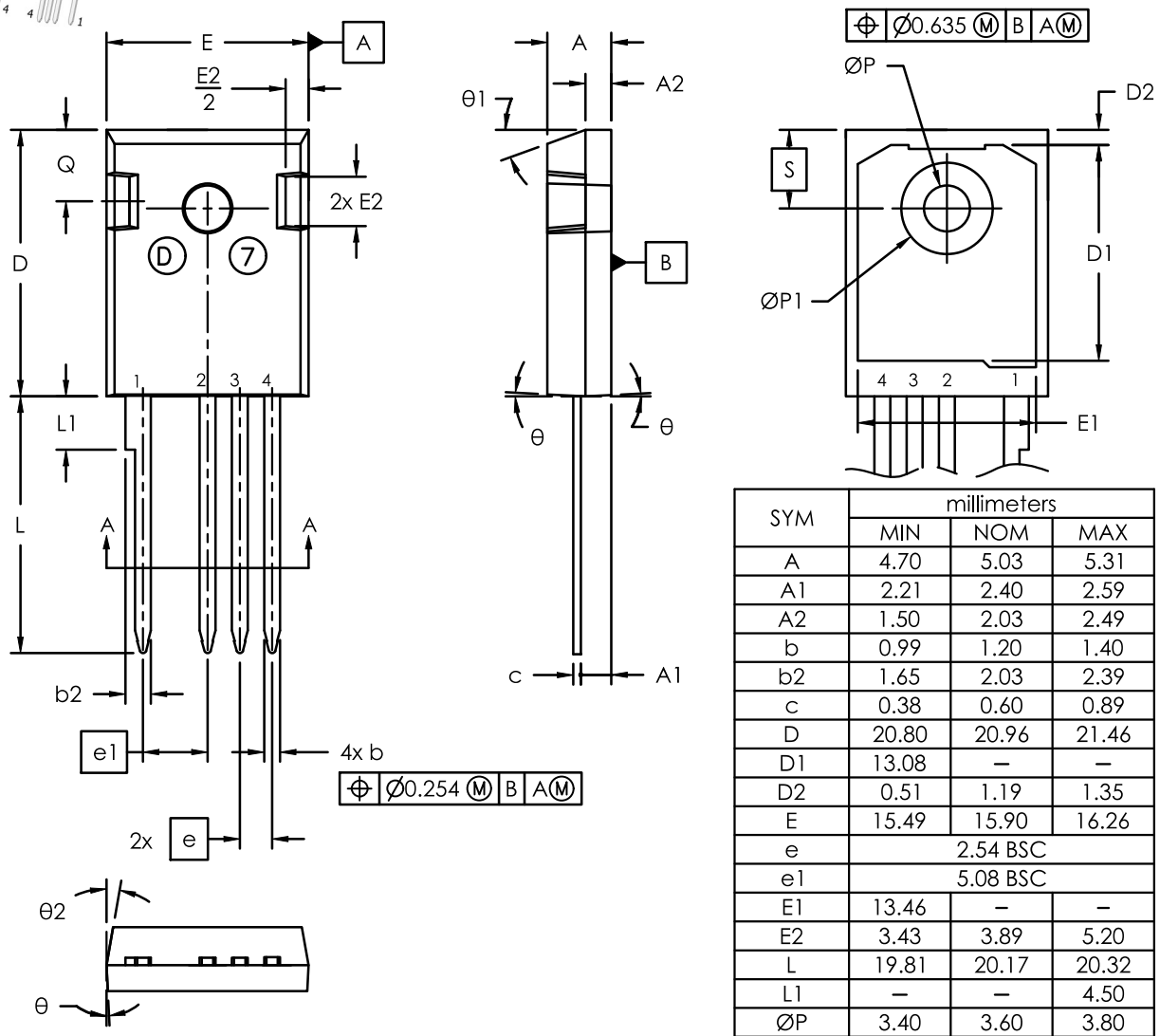
ORDERING INFORMATION

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



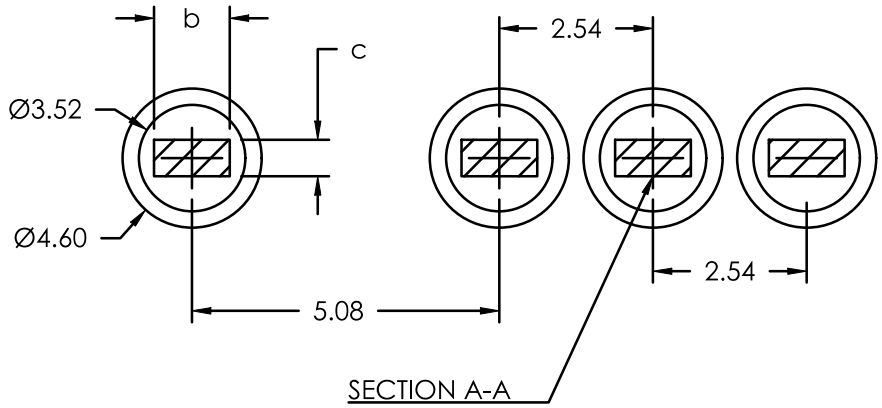
SYM	millimeters		
	MIN	NOM	MAX
A	4.70	5.03	5.31
A1	2.21	2.40	2.59
A2	1.50	2.03	2.49
b	0.99	1.20	1.40
b2	1.65	2.03	2.39
c	0.38	0.60	0.89
D	20.80	20.96	21.46
D1	13.08	–	–
D2	0.51	1.19	1.35
E	15.49	15.90	16.26
e	2.54 BSC		
e1	5.08 BSC		
E1	13.46	–	–
E2	3.43	3.89	5.20
L	19.81	20.17	20.32
L1	–	–	4.50
ØP	3.40	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

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

DATE 14 APR 2025

RECOMMENDED PCB THROUGH HOLE



NOTE: LAND PATTERN AND THROUGH HOLE DIMENSIONS SERVE ONLY AS AN INITIAL GUIDE.
END-USER PCB DESIGN RULES AND TOLERANCES SHOULD ALWAYS PREVAIL.

ADDITIONAL INFORMATION

TECHNICAL PUBLICATIONS:
Technical Library: www.onsemi.com/design/resources/technical−documentation
onsemi Website: www.onsemi.com

ONLINE SUPPORT: www.onsemi.com/support
For additional information, please contact your local Sales Representative at www.onsemi.com/support/sales