



YOUSHANG SEMICONDUCTOR

**设计研发新型功率器件**

**各类小信号开关**

**中低压及高压大电流等场效应管**

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## Product Summary

BV <sub>DSS</sub>	R <sub>DS(ON)</sub> Max	I <sub>D</sub> Max T <sub>A</sub> = +25°C
40V	11.5mΩ @ V <sub>GS</sub> = 10V	11.6A
	18mΩ @ V <sub>GS</sub> = 4.5V	9.3A

## Description

This MOSFET is designed to meet the stringent requirements of automotive applications. It is qualified to AEC-Q101, supported by a PPAP and is ideal for use in:

- Power-management functions
- DC-DC converters
- Backlighting

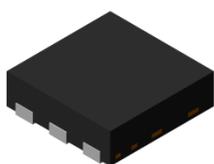
## Features

- Rated to +175°C – Ideal for High Ambient Temperature Environments
- 100% Unclamped Inductive Switching – Ensures More Reliable and Robust End Application
- Low R<sub>DS(ON)</sub> – Ensures On State Losses Are Minimized
- 0.6mm Profile – Ideal for Low Profile Applications
- PCB Footprint of 4mm<sup>2</sup>

## Mechanical Data

- Package: U-DFN2020-6
- Package Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish – Matte Tin Annealed over Copper Leadframe; Solderable per MIL-STD-202, Method 208 <sup>Ⓒ</sup><sub>3</sub>
- Weight: 0.0065 grams (Approximate)

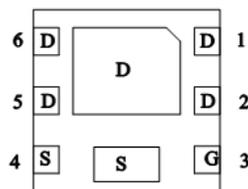
U-DFN2020-6 (SWP) (Type F)



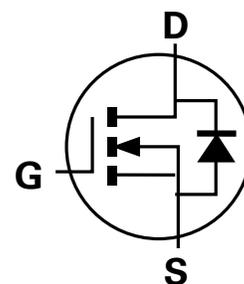
Top View



Bottom View



Pin Out  
Bottom View



Internal Schematic

**Maximum Ratings** (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

Characteristic	Symbol	Value	Unit
Drain-Source Voltage	$V_{DSS}$	40	V
Gate-Source Voltage	$V_{GSS}$	$\pm 20$	V
Continuous Drain Current (Note 5) $V_{GS} = 10\text{V}$	$I_D$	$T_A = +25^\circ\text{C}$ 11.6	A
		$T_A = +100^\circ\text{C}$ 8.2	
Pulsed Drain Current (10 $\mu\text{s}$ Pulse, Duty Cycle = 1%)	$I_{DM}$	80	A
Continuous Source-Drain Diode Current (Note 5)	$I_S$	2.55	A
Pulsed Source-Drain Diode Current (10 $\mu\text{s}$ Pulse, Duty Cycle = 1%)	$I_{SM}$	80	A
Avalanche Current, $L = 0.3\text{mH}$ (Note 6)	$I_{AS}$	14.7	A
Avalanche Energy, $L = 0.3\text{mH}$ (Note 6)	$E_{AS}$	32.4	mJ

Notes: 5. Device mounted on FR-4 substrate PC board, 2oz copper, with 1inch square copper plate.  
 6.  $I_{AS}$  and  $E_{AS}$  ratings are based on low frequency and duty cycles to keep  $T_J = +25^\circ\text{C}$ .

## Thermal Characteristics

Characteristic		Symbol	Value	Unit
Total Power Dissipation (Note 7)	$T_A = +25^\circ\text{C}$	$P_D$	0.99	W
Thermal Resistance, Junction to Ambient (Note 7)	Steady State	$R_{\theta JA}$	153	$^\circ\text{C/W}$
Total Power Dissipation (Note 5)	$T_A = +25^\circ\text{C}$	$P_D$	2.35	W
Thermal Resistance, Junction to Ambient (Note 5)	Steady State	$R_{\theta JA}$	64.5	$^\circ\text{C/W}$
Thermal Resistance, Junction to Case (Note 5)	$T_C = +25^\circ\text{C}$	$R_{\theta JC}$	14.8	$^\circ\text{C/W}$
Operating and Storage Temperature Range		$T_J, T_{STG}$	-55 to +175	$^\circ\text{C}$

## Electrical Characteristics (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
<b>OFF CHARACTERISTICS (Note 8)</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	40	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
Zero Gate Voltage Drain Current	$I_{DSS}$	—	—	1	$\mu A$	$V_{DS} = 32V, V_{GS} = 0V$
Gate-Source Leakage	$I_{GSS}$	—	—	$\pm 100$	nA	$V_{GS} = \pm 20V, V_{DS} = 0V$
<b>ON CHARACTERISTICS (Note 8)</b>						
Gate Threshold Voltage	$V_{GS(TH)}$	1	1.7	3	V	$V_{DS} = V_{GS}, I_D = 250\mu A$
Static Drain-Source On-Resistance	$R_{DS(ON)}$	—	9.1	11.5	m $\Omega$	$V_{GS} = 10V, I_D = 10A$
			12.9	18		$V_{GS} = 4.5V, I_D = 8.5A$
Diode Forward Voltage	$V_{SD}$	—	0.8	1.0	V	$V_{GS} = 0V, I_S = 10A$
<b>DYNAMIC CHARACTERISTICS (Note 9)</b>						
Input Capacitance	$C_{iss}$	—	1030	—	pF	$V_{DS} = 20V, V_{GS} = 0V, f = 1MHz$
Output Capacitance	$C_{oss}$	—	324	—		
Reverse Transfer Capacitance	$C_{rss}$	—	27	—		
Gate Resistance	$R_g$	—	1.82	—	$\Omega$	$V_{DS} = 0V, V_{GS} = 0V, f = 1MHz$
Total Gate Charge ( $V_{GS} = 4.5V$ )	$Q_g$	—	6.8	—	nC	$V_{DD} = 20V, I_D = 10A$
Total Gate Charge ( $V_{GS} = 10V$ )	$Q_g$	—	14.2	—		
Gate-Source Charge	$Q_{gs}$	—	2.0	—		
Gate-Drain Charge	$Q_{gd}$	—	2.7	—		
Turn-On Delay Time	$t_{D(ON)}$	—	3.1	—	ns	$V_{DD} = 20V, V_{GS} = 10V, R_g = 6\Omega, I_D = 10A$
Turn-On Rise Time	$t_r$	—	3.1	—		
Turn-Off Delay Time	$t_{D(OFF)}$	—	14.2	—		
Turn-Off Fall Time	$t_f$	—	5.8	—		
Reverse Recovery Time	$t_{RR}$	—	19.6	—	ns	$I_F = 10A, di/dt = 100A/\mu s$
Reverse Recovery Charge	$Q_{RR}$	—	8.2	—	nC	

- Notes:
- Device mounted on FR-4 substrate PC board, 2oz copper, with minimum recommended pad layout.
  - Device mounted on FR-4 substrate PC board, 2oz copper, with 1inch square copper plate.
  - $I_{AS}$  and  $E_{AS}$  ratings are based on low frequency and duty cycles to keep  $T_J = +25^\circ\text{C}$ .
  - Short duration pulse test used to minimize self-heating effect.
  - Guaranteed by design. Not subject to product testing.

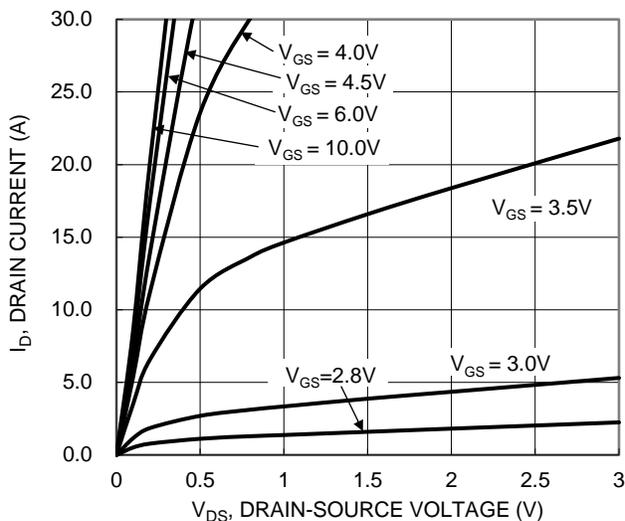


Figure 1. Typical Output Characteristic

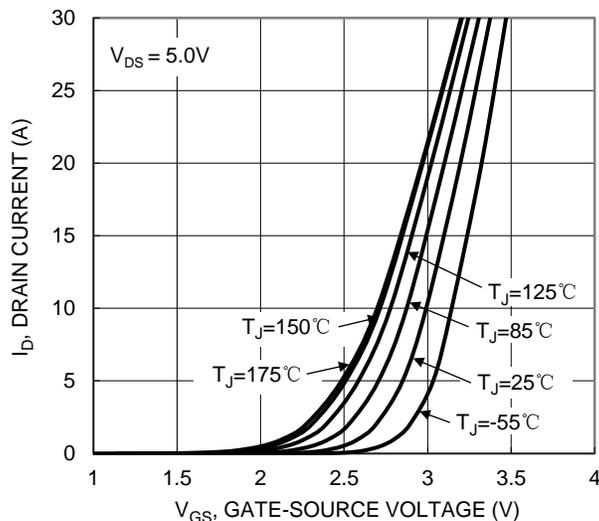


Figure 2. Typical Transfer Characteristic

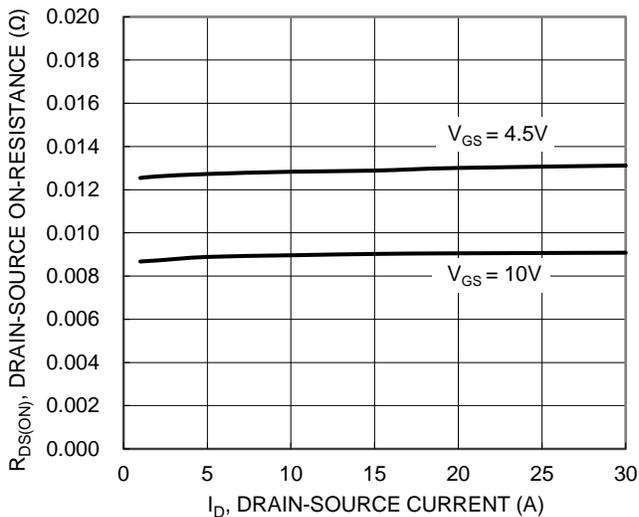


Figure 3. Typical On-Resistance vs. Drain Current and Gate Voltage

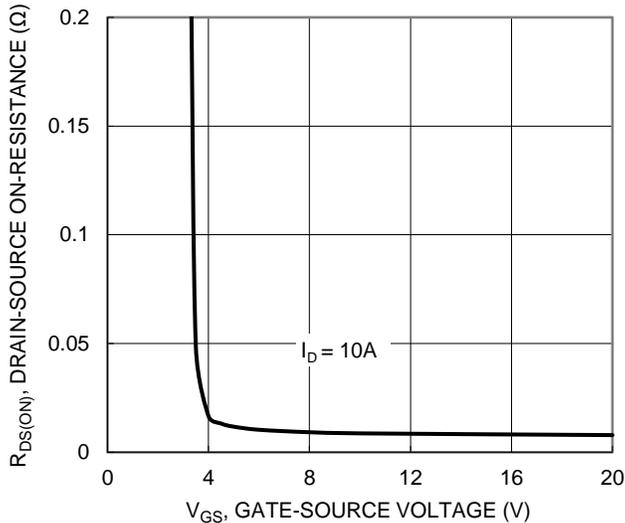


Figure 4. Typical Transfer Characteristic

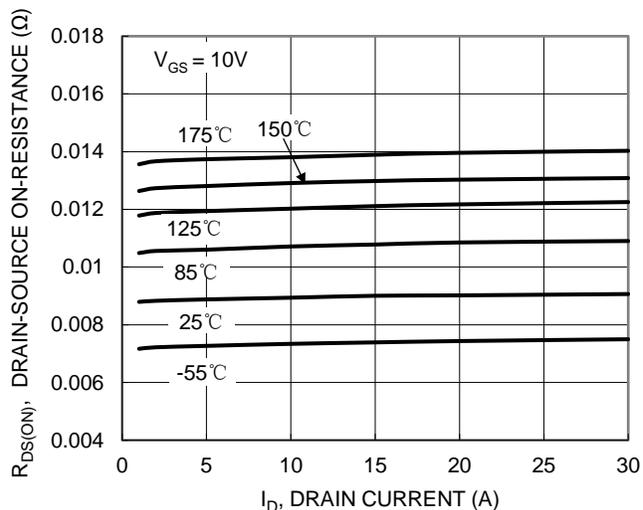


Figure 5. Typical On-Resistance vs. Drain Current and Temperature

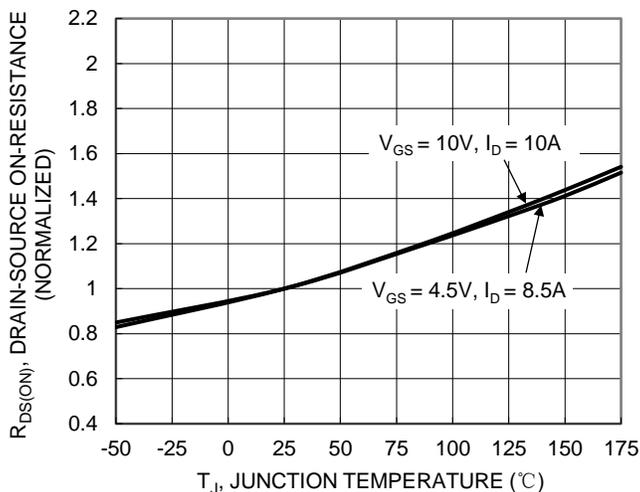


Figure 6. On-Resistance Variation with Temperature

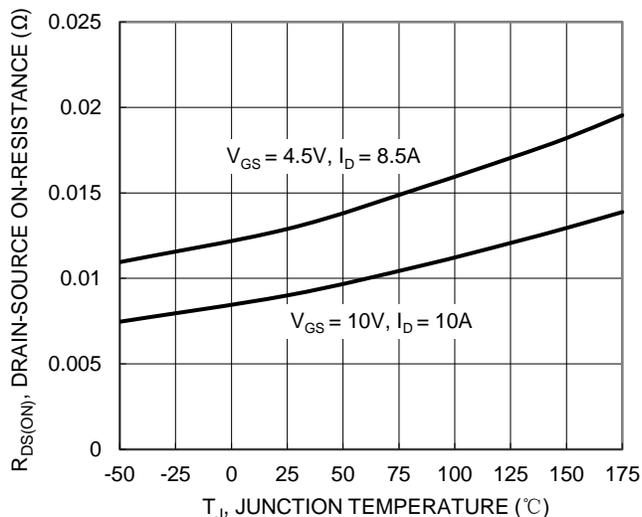


Figure 7. On-Resistance Variation with Temperature

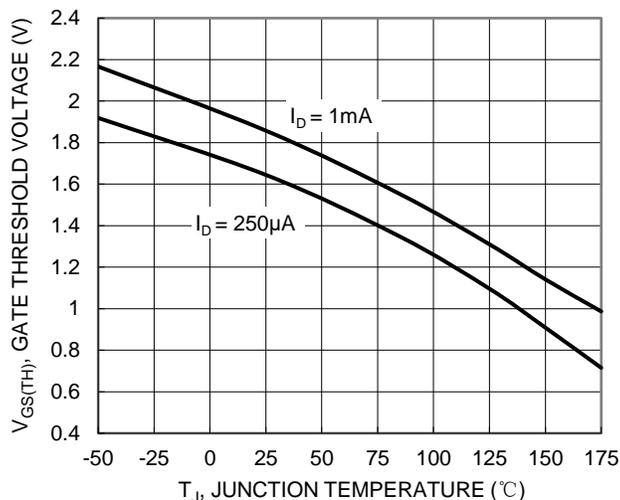


Figure 8. Gate Threshold Variation vs. Junction Temperature

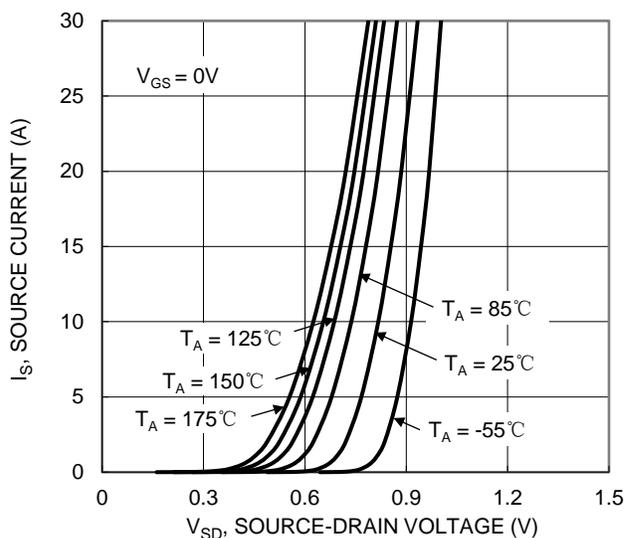


Figure 9. Diode Forward Voltage vs. Current

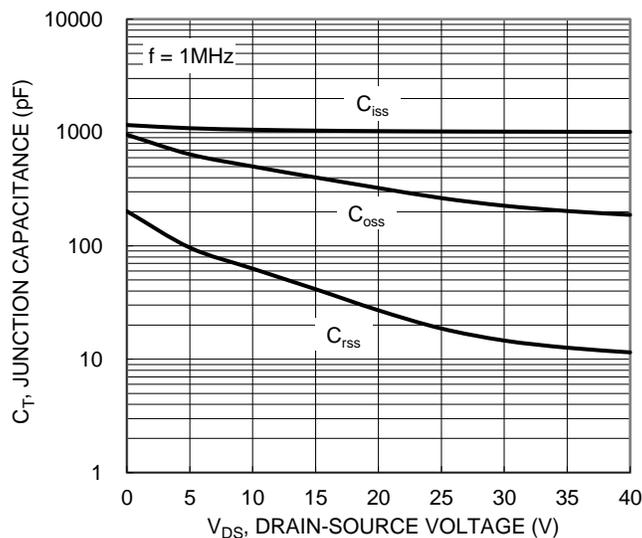


Figure 10. Typical Junction Capacitance

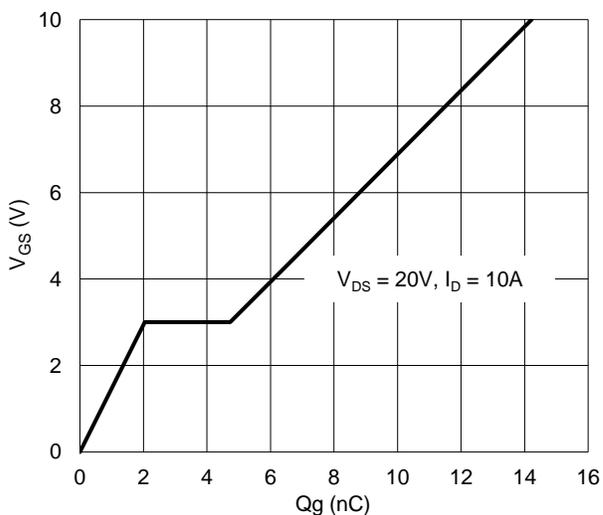


Figure 11. Gate Charge

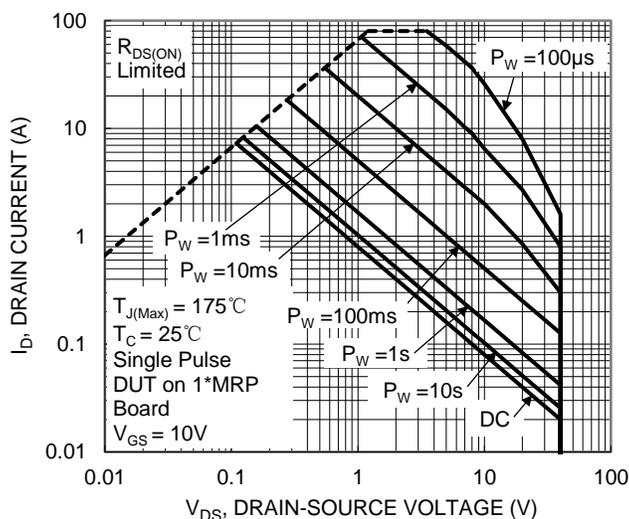


Figure 12. SOA, Safe Operation Area

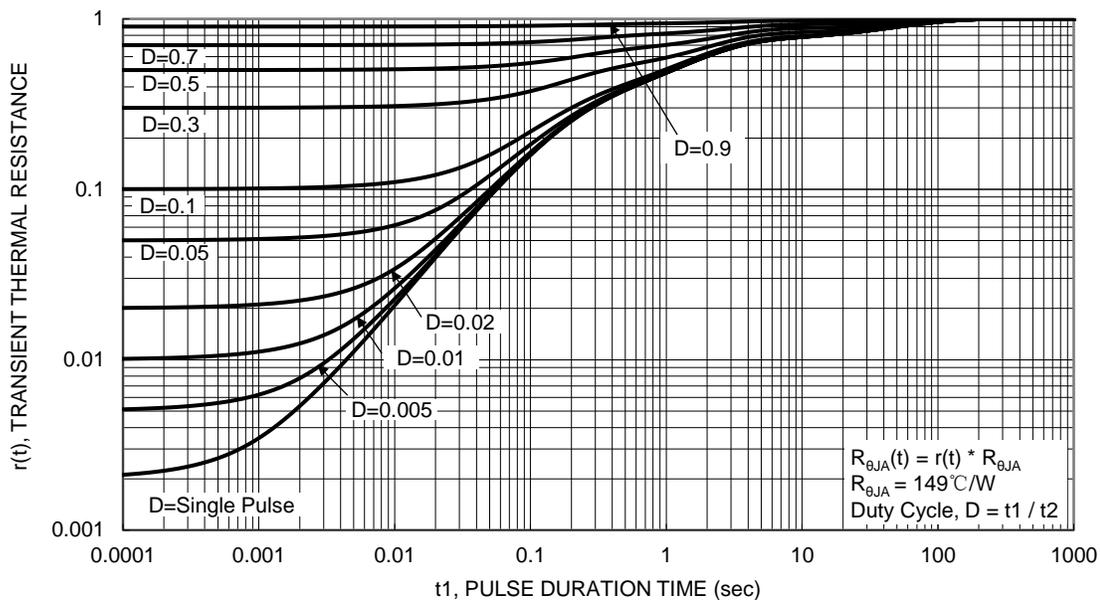
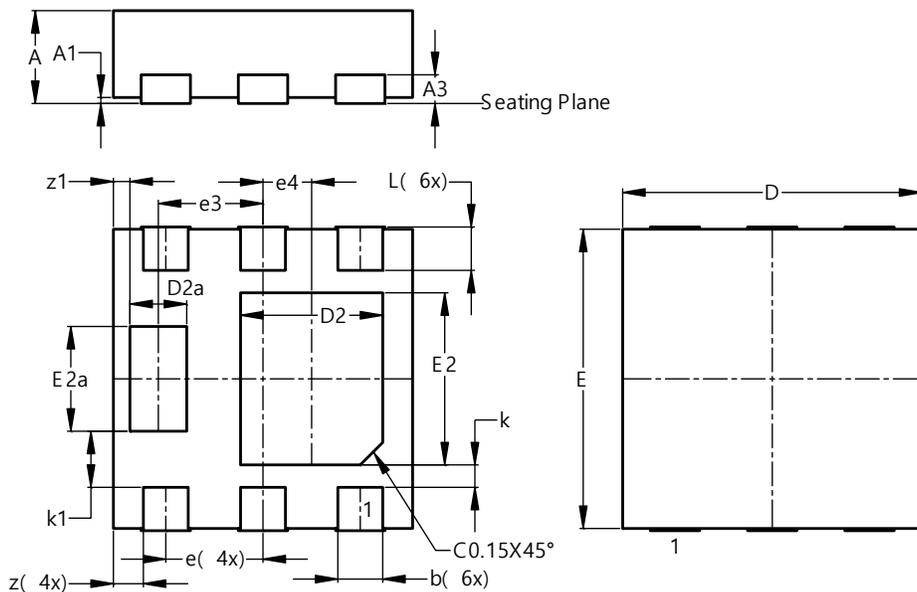


Figure 13. Transient Thermal Resistance

### Package Outline Dimensions

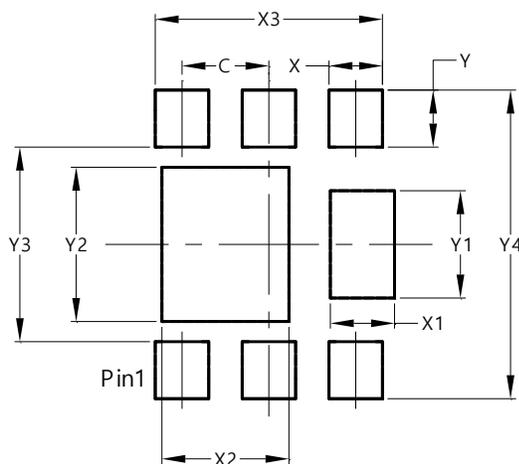
U-DFN2020-6 (SWP) (Type F)



U-DFN2020-6 (SWP) (Type F)			
Dim	Min	Max	Typ
A	0.59	0.65	0.62
A1	0.00	0.05	0.03
A3	-	-	0.192
b	0.28	0.38	0.33
D	1.95	2.05	2.00
D2	0.87	1.07	0.97
D2a	0.35	0.45	0.40
E	1.95	2.05	2.00
E2	1.07	1.27	1.17
E2a	0.67	0.77	0.72
e	0.65 BSC		
e3	0.70 BSC		
e4	0.325 BSC		
k	--	--	0.15
k1	--	--	0.375
L	0.225	0.355	0.305
z	--	--	0.20
z1	--	--	0.11
All Dimensions in mm			

### Suggested Pad Layout

U-DFN2020-6 (SWP) (Type F)



Dimensions	Value (in mm)
C	0.650
X	0.400
X1	0.480
X2	0.950
X3	1.700
Y	0.425
Y1	0.800
Y2	1.150
Y3	1.450
Y4	2.300