



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

<b>BV<sub>DSS</sub></b>	<b>R<sub>DS(ON)</sub> max</b>	<b>I<sub>D</sub> max T<sub>A</sub> = +25°C</b>
40V	21mΩ @ V <sub>GS</sub> = 10V	8.6A
	28mΩ @ V <sub>GS</sub> = 4.5V	6.9A

## Features and Benefits

- 0.6mm Profile – Ideal for Low Profile Applications
- PCB Footprint of 4mm<sup>2</sup>
- Low Gate Threshold Voltage
- Low On-Resistance

## Description and Applications

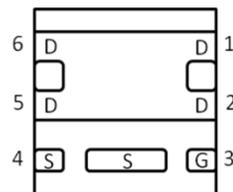
This MOSFET is designed to meet the stringent requirements of automotive applications. It is AEC-Q101 qualified, supported by a PPAP, and is ideal for use in:

- General Purpose Interfacing Switch
- Power Management Functions

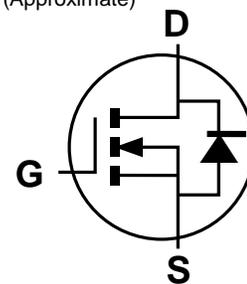
U-DFN2020-6 (Type E)



Bottom View



Pin Out



Equivalent Circuit

## Mechanical Data

- Case: U-DFN2020-6
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish – NiPdAu over Copper Lead-Frame. Solderable per MIL-STD-202, Method 208 ④
- Weight: 0.0065 grams (Approximate)

**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 6) $V_{GS} = 10\text{V}$	Steady State	$T_A = +25^\circ\text{C}$	$I_D$	8.6	A
		$T_A = +70^\circ\text{C}$		6.9	
Pulsed Drain Current (10 $\mu\text{s}$ Pulse, Duty Cycle = 1%)			$I_{DM}$	40	A
Maximum Body Diode Continuous Current			$I_S$	8.6	A
Pulsed Body Diode Forward Current (10 $\mu\text{s}$ Pulse, Duty Cycle = 1%)			$I_{SM}$	40	A
Avalanche Current (Note 7) $L = 0.1\text{mH}$			$I_{AS}$	22.4	A
Avalanche Energy (Note 7) $L = 0.1\text{mH}$			$E_{AS}$	25	mJ

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

Characteristic		Symbol	Value	Unit
Total Power Dissipation (Note 5)	$T_A = +25^\circ\text{C}$	$P_D$	0.85	W
	$T_A = +70^\circ\text{C}$		0.54	
Thermal Resistance, Junction to Ambient (Note 5)		$R_{\theta JA}$	147.6	$^\circ\text{C/W}$
Total Power Dissipation (Note 6)	$T_A = +25^\circ\text{C}$	$P_D$	2.35	W
	$T_A = +70^\circ\text{C}$		1.5	
Thermal Resistance, Junction to Ambient (Note 6)		$R_{\theta JA}$	53.3	$^\circ\text{C/W}$
Thermal Resistance, Junction to Case (Note 6)		$R_{\theta JC}$	6.9	
Operating and Storage Temperature Range		$T_J, T_{STG}$	-55 to +150	$^\circ\text{C}$

**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	$V_{GS} = 0\text{V}, I_D = 250\mu\text{A}$
Zero Gate Voltage Drain Current $T_J = +25^\circ\text{C}$	$I_{DSS}$	—	—	1	$\mu\text{A}$	$V_{DS} = 40\text{V}, V_{GS} = 0\text{V}$
Gate-Source Leakage	$I_{GSS}$	—	—	$\pm 100$	nA	$V_{GS} = \pm 20\text{V}, V_{DS} = 0\text{V}$
<b>ON CHARACTERISTICS (Note 8)</b>						
Gate Threshold Voltage	$V_{GS(TH)}$	1.4	—	2.4	V	$V_{DS} = V_{GS}, I_D = 250\mu\text{A}$
Static Drain-Source On-Resistance	$R_{DS(ON)}$	—	15	21	m $\Omega$	$V_{GS} = 10\text{V}, I_D = 8\text{A}$
			20	28		$V_{GS} = 4.5\text{V}, I_D = 4\text{A}$
Diode Forward Voltage	$V_{SD}$	—	0.7	1	V	$V_{GS} = 0\text{V}, I_S = 1\text{A}$
<b>DYNAMIC CHARACTERISTICS (Note 9)</b>						
Input Capacitance	$C_{ISS}$	—	1201	—	pF	$V_{DS} = 20\text{V}, V_{GS} = 0\text{V}, f = 1.0\text{MHz}$
Output Capacitance	$C_{OSS}$	—	87	—	pF	
Reverse Transfer Capacitance	$C_{RSS}$	—	58	—	pF	
Gate Resistance	$R_g$	—	1.3	—	$\Omega$	$V_{DS} = 0\text{V}, V_{GS} = 0\text{V}, f = 1\text{MHz}$
Total Gate Charge ( $V_{GS} = 4.5\text{V}$ )	$Q_g$	—	12.7	—	nC	
Total Gate Charge ( $V_{GS} = 10\text{V}$ )	$Q_g$	—	25.3	—	nC	
Gate-Source Charge	$Q_{gs}$	—	5.6	—	nC	
Gate-Drain Charge	$Q_{gd}$	—	4.4	—	nC	
Turn-On Delay Time	$t_{D(ON)}$	—	8	—	ns	$V_{DS} = 20\text{V}, R_L = 2.5\Omega$ $V_{GS} = 10\text{V}, R_G = 3\Omega$
Turn-On Rise Time	$t_R$	—	2.6	—	ns	
Turn-Off Delay Time	$t_{D(OFF)}$	—	17	—	ns	
Turn-Off Fall Time	$t_F$	—	8.9	—	ns	
Reverse Recovery Time	$t_{RR}$	—	17.5	—	ns	$I_F = 8\text{A}, di/dt = 100\text{A}/\mu\text{s}$
Reverse Recovery Charge	$Q_{RR}$	—	8.9	—	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 pad layout.
  - $I_{AS}$  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 production testing.

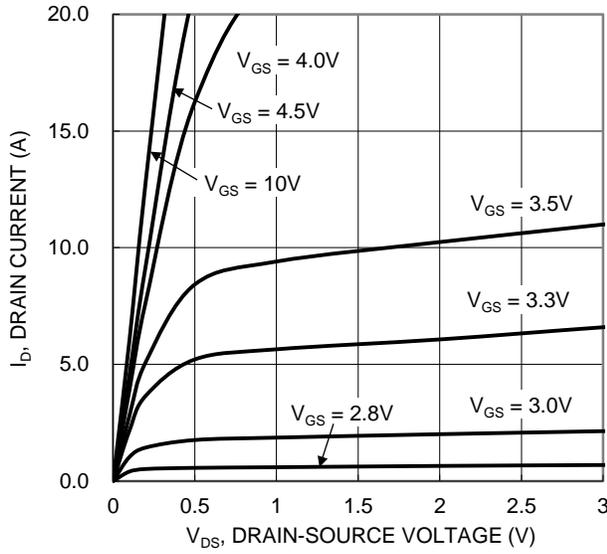


Figure 1. Typical Output Characteristic

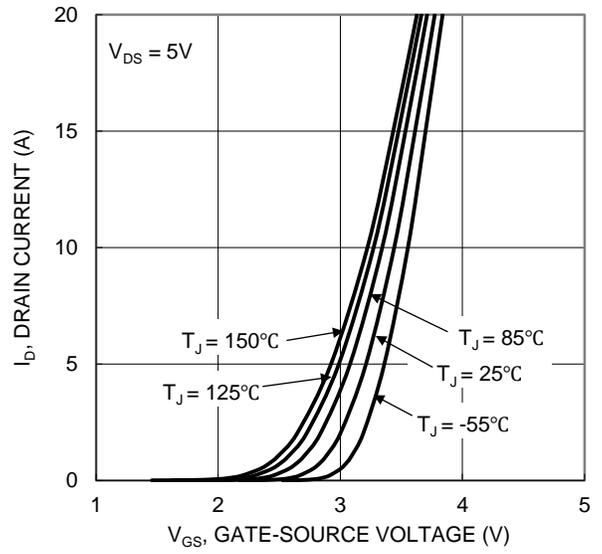


Figure 2. Typical Transfer Characteristic

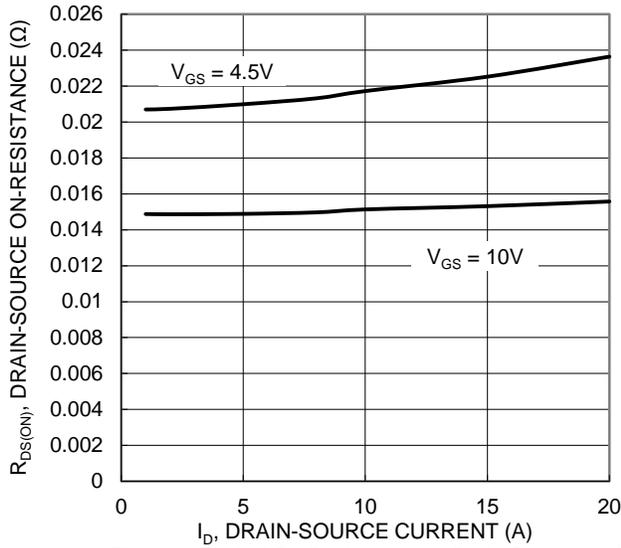


Figure 3. Typical On-Resistance vs. Drain Current and Gate Voltage

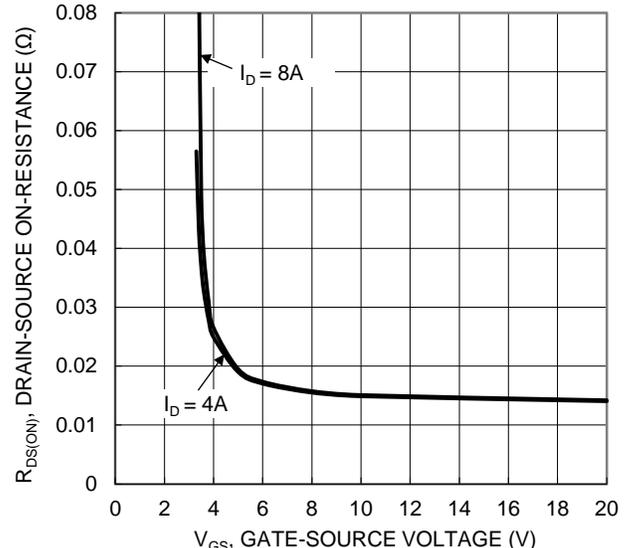


Figure 4. Typical Transfer Characteristic

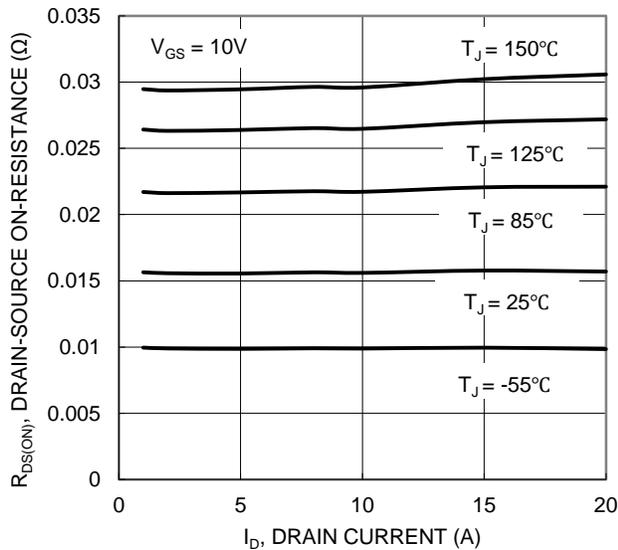


Figure 5. Typical On-Resistance vs. Drain Current and Junction Temperature

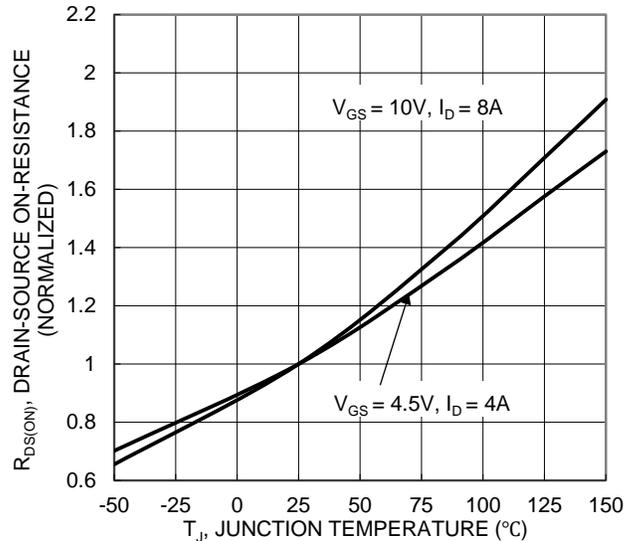


Figure 6. On-Resistance Variation with Junction Temperature

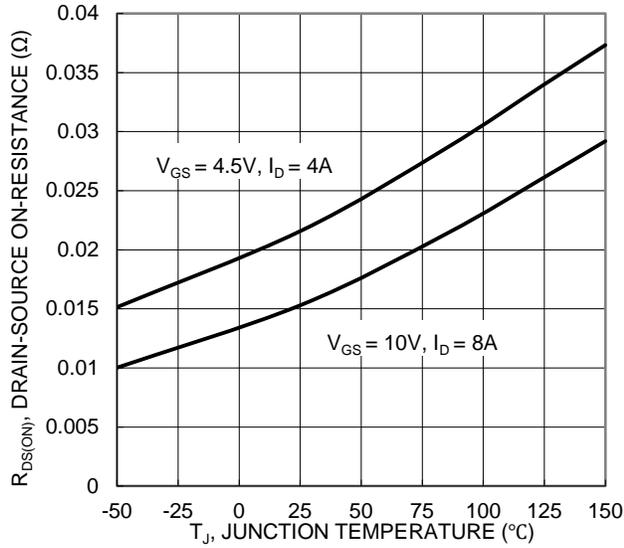


Figure 7. On-Resistance Variation with Junction Temperature

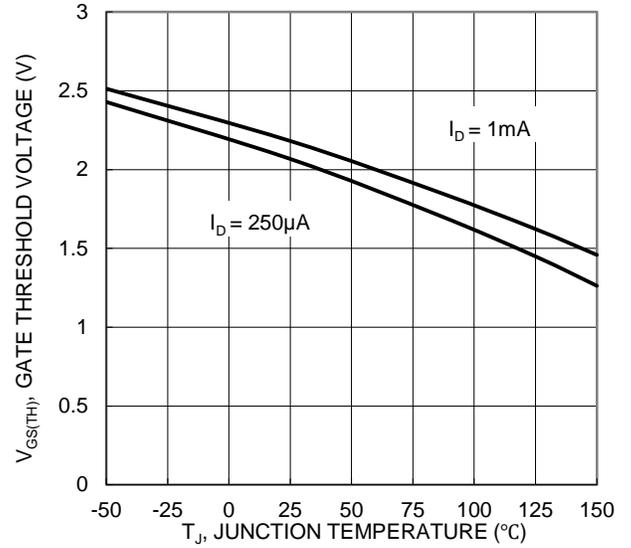


Figure 8. Gate Threshold Variation vs. Junction Temperature

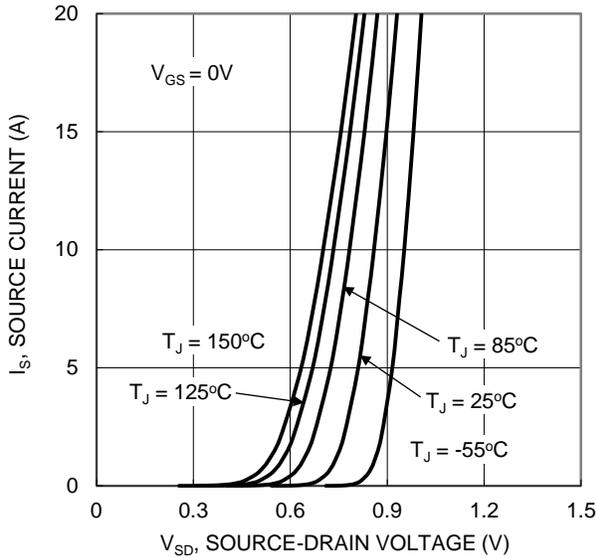


Figure 9. Diode Forward Voltage vs. Current

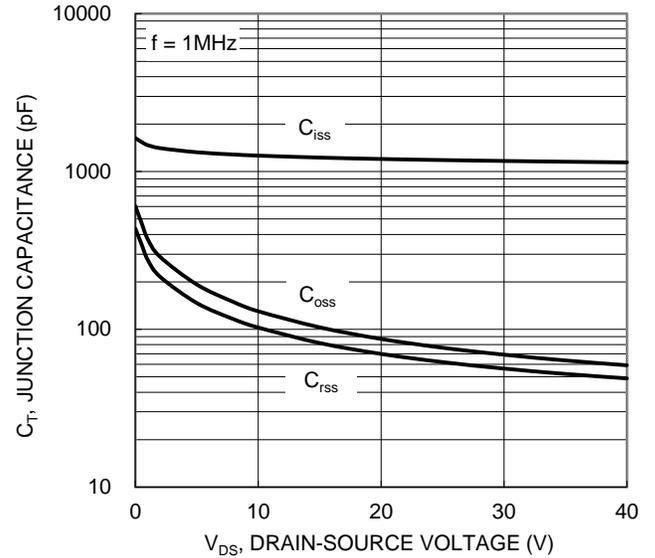


Figure 10. Typical Junction Capacitance

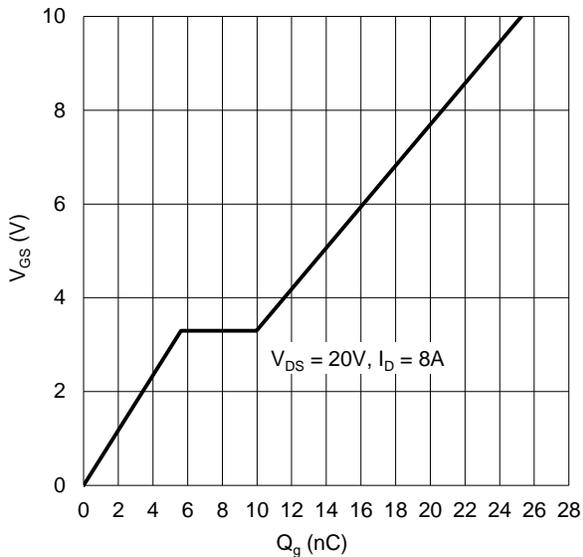


Figure 11. Gate Charge

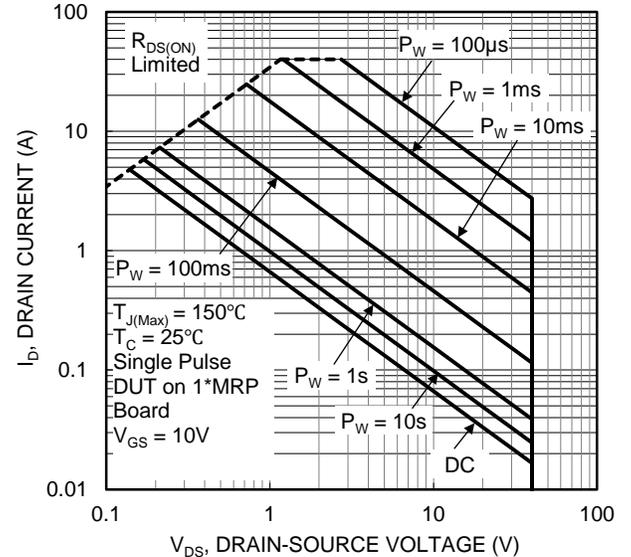


Figure 12. SOA, Safe Operation Area

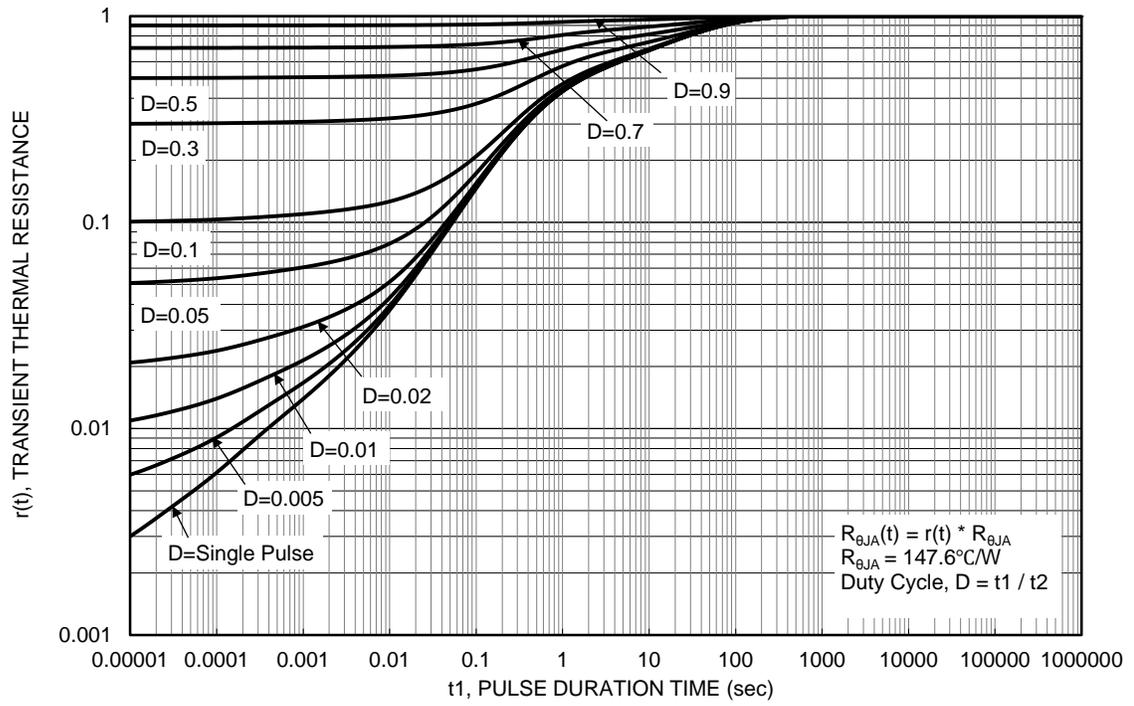
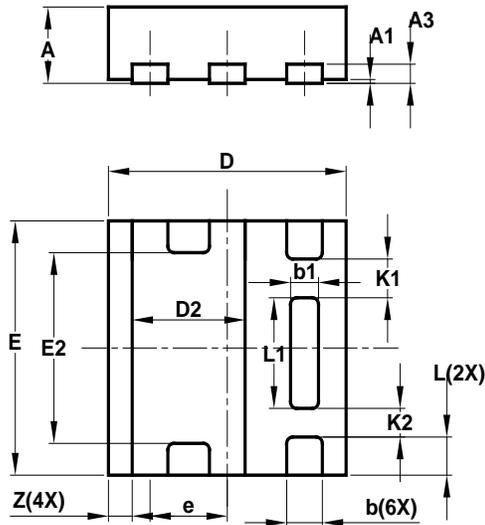


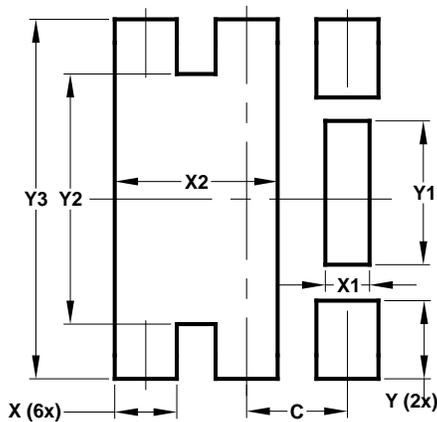
Figure 13. Transient Thermal Resistance

### Package Outline Dimensions



U-DFN2020-6 Type E			
Dim	Min	Max	Typ
A	0.57	0.63	0.60
A1	0	0.05	0.03
A3	—	—	0.15
b	0.25	0.35	0.30
b1	0.185	0.285	0.235
D	1.95	2.05	2.00
D2	0.85	1.05	0.95
E	1.95	2.05	2.00
E2	1.40	1.60	1.50
e	—	—	0.65
L	0.25	0.35	0.30
L1	0.82	0.92	0.87
K1	—	—	0.305
K2	—	—	0.225
Z	—	—	0.20
All Dimensions in mm			

### Suggested Pad Layout



Dimensions	Value (in mm)
C	0.650
X	0.400
X1	0.285
X2	1.050
Y	0.500
Y1	0.920
Y2	1.600
Y3	2.300