



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**

0755-83047638

ysbdt@szyoushang.cn

www.szyoushang.cn



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## Product Summary

$BV_{DSS}$	$R_{D1D2\ max}$	$I_D$ $T_A = +25^\circ C$
-20V	90m $\Omega$ @ $V_{GS} = -4.5V$	-3.2A
	120m $\Omega$ @ $V_{GS} = -2.5V$	-2.7A

## Features

- PCB Footprint of 4mm<sup>2</sup>
- Low On-Resistance
- Low Input Capacitance
- Low Profile, 0.6mm Maximum Height

## Description and Applications

This MOSFET is designed to minimize the on-state resistance ( $R_{DS(ON)}$ ) yet maintain superior switching performance, which makes it ideal for high-efficiency power management applications.

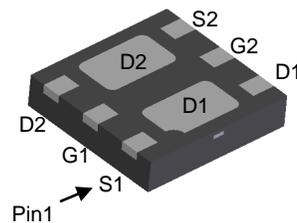
- Load Switch
- Power Management Functions
- Portable Power Adaptors

## Mechanical Data

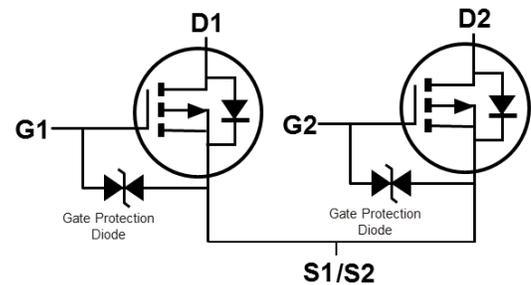
- Case: U-DFN2020-6
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish NiPdAu over Copper Leadframe. Solderable per MIL-STD-202, Method 208 (e4)
- Terminals Connections: See Diagram Below
- Weight: 0.0065 grams (Approximate)



U-DFN2020-6 (Type B)



Bottom View



Internal Schematic

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

Characteristic			Symbol	Value	Unit
Drain-Source Voltage			$V_{DSS}$	-20	V
Gate-Source Voltage			$V_{GSS}$	$\pm 8$	V
Continuous Drain Current (Note 6) $V_{GS} = -4.5\text{V}$	Steady State	$T_A = +25^\circ\text{C}$ $T_A = +70^\circ\text{C}$	$I_D$	-3.2 -2.5	A
Maximum Continuous Body Diode Forward Current (Note 6)			$I_S$	-1.9	A
Pulsed Drain Current (10 $\mu\text{s}$ Pulse, Duty Cycle = 1%)			$I_{DM}$	-22	A
Avalanche Current (Note 7) $L = 0.1\text{mH}$			$I_{AS}$	-11	A
Avalanche Energy (Note 7) $L = 0.1\text{mH}$			$E_{AS}$	7	mJ

**Thermal Characteristics**

Characteristic		Symbol	Value	Unit
Total Power Dissipation (Note 5)	$T_A = +25^\circ\text{C}$	$P_D$	0.79	W
Thermal Resistance, Junction to Ambient (Note 5)	Steady State	$R_{\theta JA}$	159	$^\circ\text{C/W}$
Total Power Dissipation (Note 6)	$T_A = +25^\circ\text{C}$	$P_D$	1.39	W
Thermal Resistance, Junction to Ambient (Note 6)	Steady State	$R_{\theta JA}$	90	$^\circ\text{C/W}$
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	$BV_{DSS}$	-20	—	—	V	$V_{GS} = 0\text{V}, I_D = -250\mu\text{A}$
Zero Gate Voltage Drain Current $T_J = +25^\circ\text{C}$	$I_{DSS}$	—	—	-1.0	$\mu\text{A}$	$V_{DS} = -20\text{V}, V_{GS} = 0\text{V}$
Gate-Source Leakage	$I_{GSS}$	—	—	$\pm 10$	$\mu\text{A}$	$V_{GS} = \pm 8\text{V}, V_{DS} = 0\text{V}$
<b>ON CHARACTERISTICS (Note 8)</b>						
Gate Threshold Voltage	$V_{GS(TH)}$	-0.3	—	-1.0	V	$V_{DS} = V_{GS}, I_D = -250\mu\text{A}$
Static Drain1-Drain2 On-Resistance	$R_{D1D2}$	—	37	90	m $\Omega$	$V_{GS} = -4.5\text{V}, I_D = -4\text{A}$
		—	50	120		$V_{GS} = -2.5\text{V}, I_D = -3.5\text{A}$
Diode Forward Voltage	$V_{SD}$	—	-0.7	-1.2	V	$V_{GS} = 0\text{V}, I_S = -1.0\text{A}$
<b>DYNAMIC CHARACTERISTICS (Note 9)</b>						
Input Capacitance	$C_{iss}$	—	634	—	pF	$V_{DS} = -10\text{V}, V_{GS} = 0\text{V}, f = 1.0\text{MHz}$
Output Capacitance	$C_{oss}$	—	81	—	pF	
Reverse Transfer Capacitance	$C_{rss}$	—	66	—	pF	
Gate Resistance	$R_g$	—	20	—	$\Omega$	$V_{DS} = 0\text{V}, V_{GS} = 0\text{V}, f = 1\text{MHz}$
Total Gate Charge ( $V_{GS} = -4.5\text{V}$ )	$Q_g$	—	6.8	—	nC	$V_{DS} = -4.5\text{V}, I_D = -4\text{A}, V_{DS} = -10\text{V}$
Gate-Source Charge	$Q_{gs}$	—	0.7	—	nC	
Gate-Drain Charge	$Q_{gd}$	—	1.6	—	nC	
Turn-On Delay Time	$t_{D(ON)}$	—	4.2	—	ns	$V_{DS} = -10\text{V}, V_{GS} = -4.5\text{V}, R_L = 3.3\Omega, R_g = 1\Omega$
Turn-On Rise Time	$t_R$	—	3.4	—	ns	
Turn-Off Delay Time	$t_{D(OFF)}$	—	23	—	ns	
Turn-Off Fall Time	$t_F$	—	9.6	—	ns	
Body Diode Reverse Recovery Time	$t_{RR}$	—	1.8	—	ns	$I_S = -1.0\text{A}, dI/dt = 100\text{A}/\mu\text{s}$
Body Diode Reverse Recovery Charge	$Q_{RR}$	—	9.4	—	nC	$I_S = -1.0\text{A}, dI/dt = 100\text{A}/\mu\text{s}$

- Notes:
- Device mounted on FR-4 substrate PCB, 2oz copper, with minimum recommended pad layout.
  - Device mounted on FR-4 substrate PCB, 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.

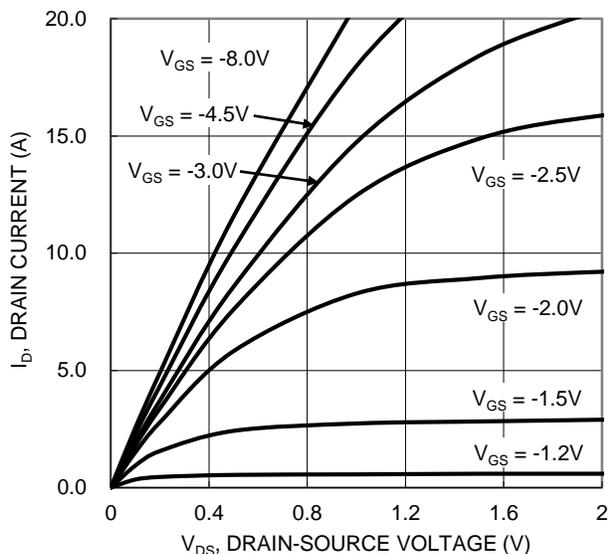


Figure 1. Typical Output Characteristic

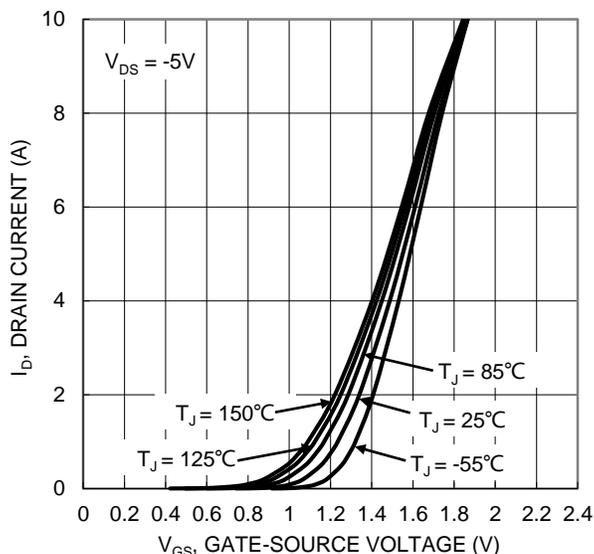


Figure 2. Typical Transfer Characteristic

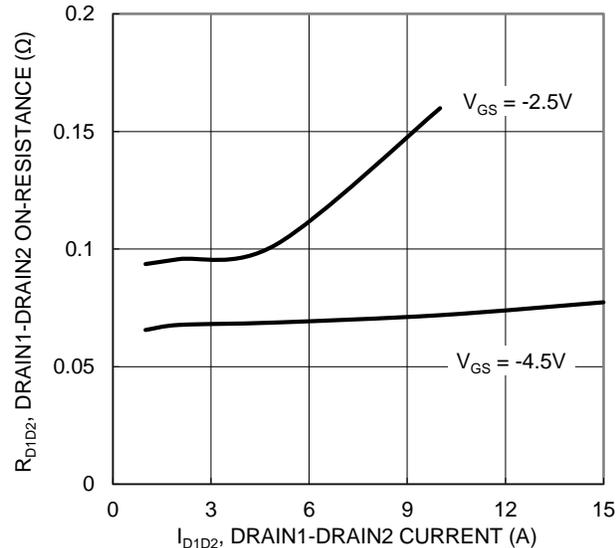


Figure 3. Typical On-Resistance vs. Drain Current and Gate Voltage

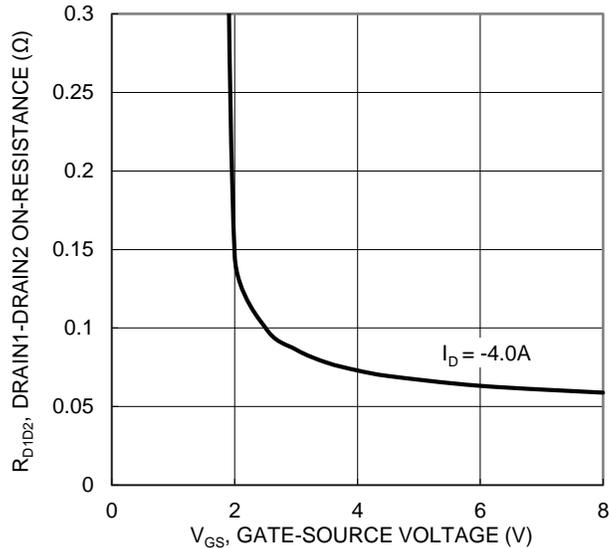


Figure 4. Typical Transfer Characteristic

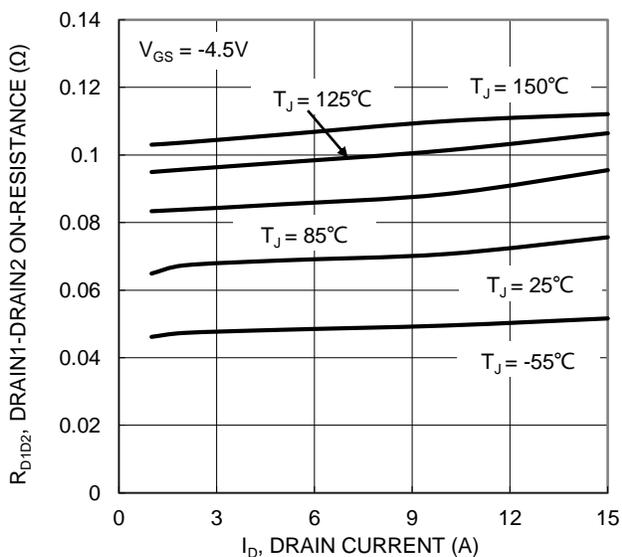


Figure 5. Typical On-Resistance vs. Drain Current and Junction Temperature

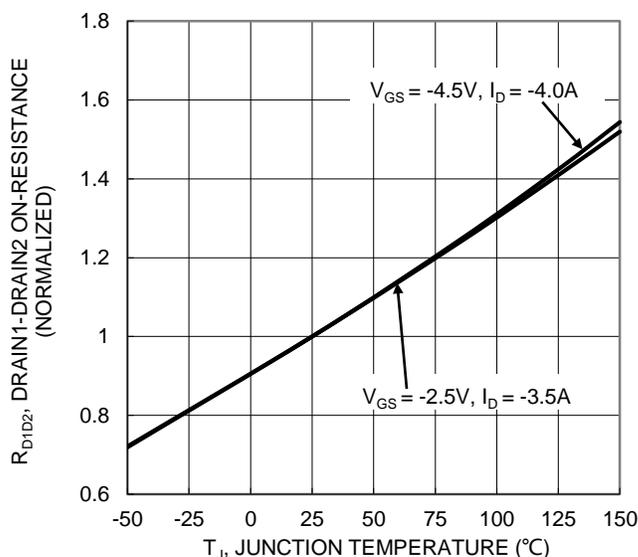


Figure 6. On-Resistance Variation with Junction Temperature

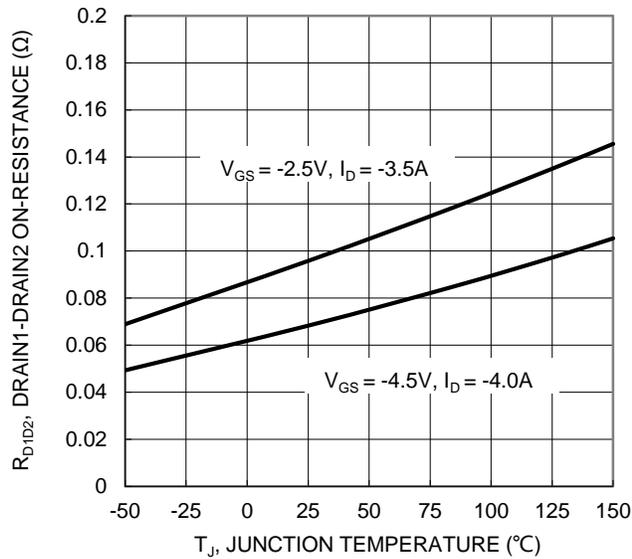


Figure 7. On-Resistance Variation with Junction Temperature

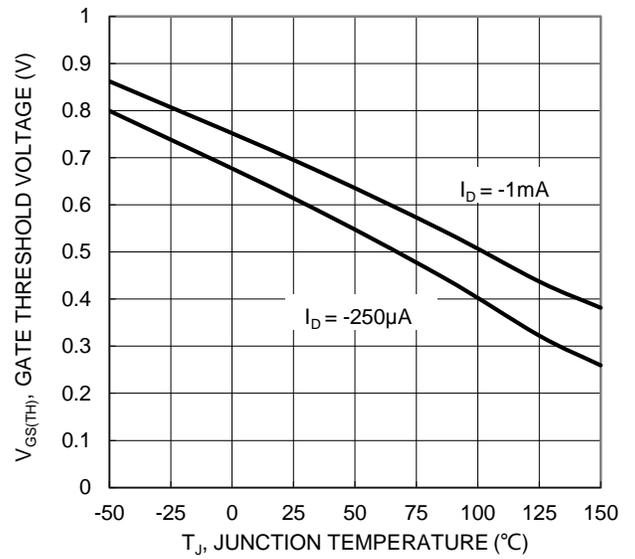


Figure 8. Gate Threshold Variation vs. Junction Temperature

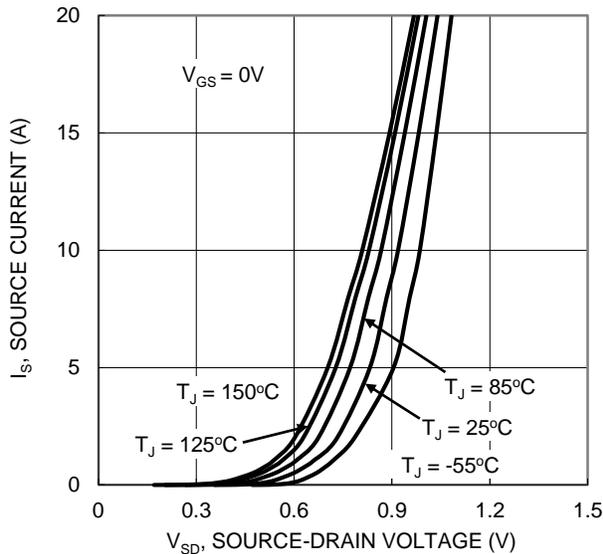


Figure 9. Diode Forward Voltage vs. Current

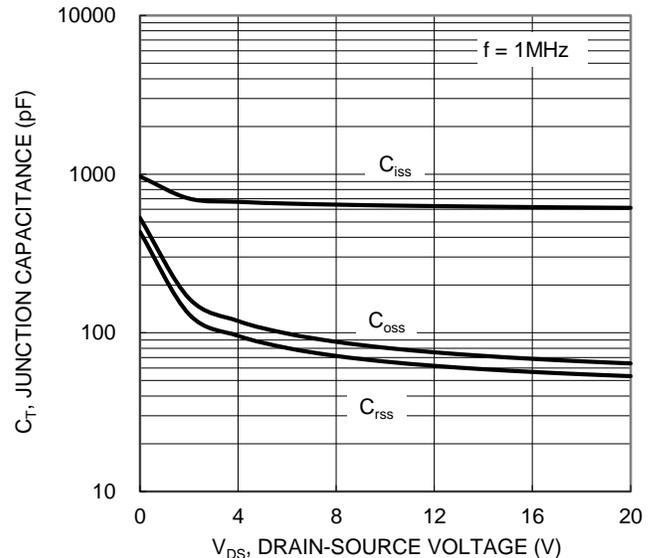


Figure 10. Typical Junction Capacitance

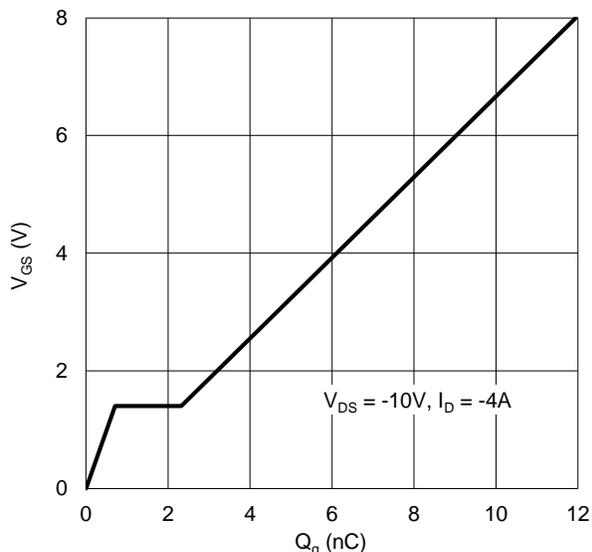


Figure 11. Gate Charge

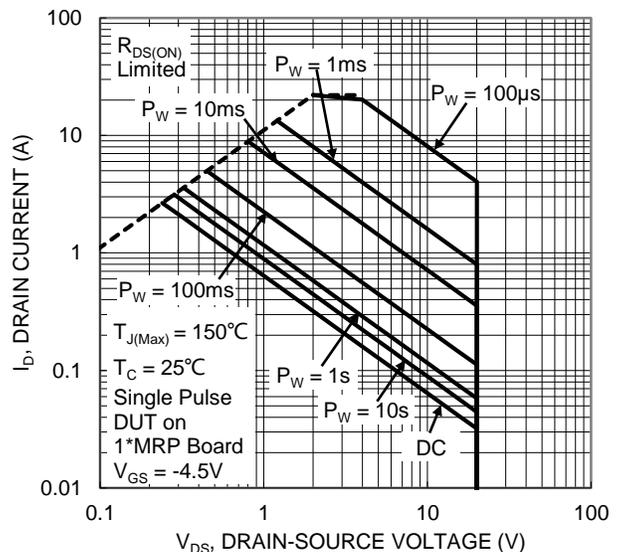


Figure 12. SOA, Safe Operation Area

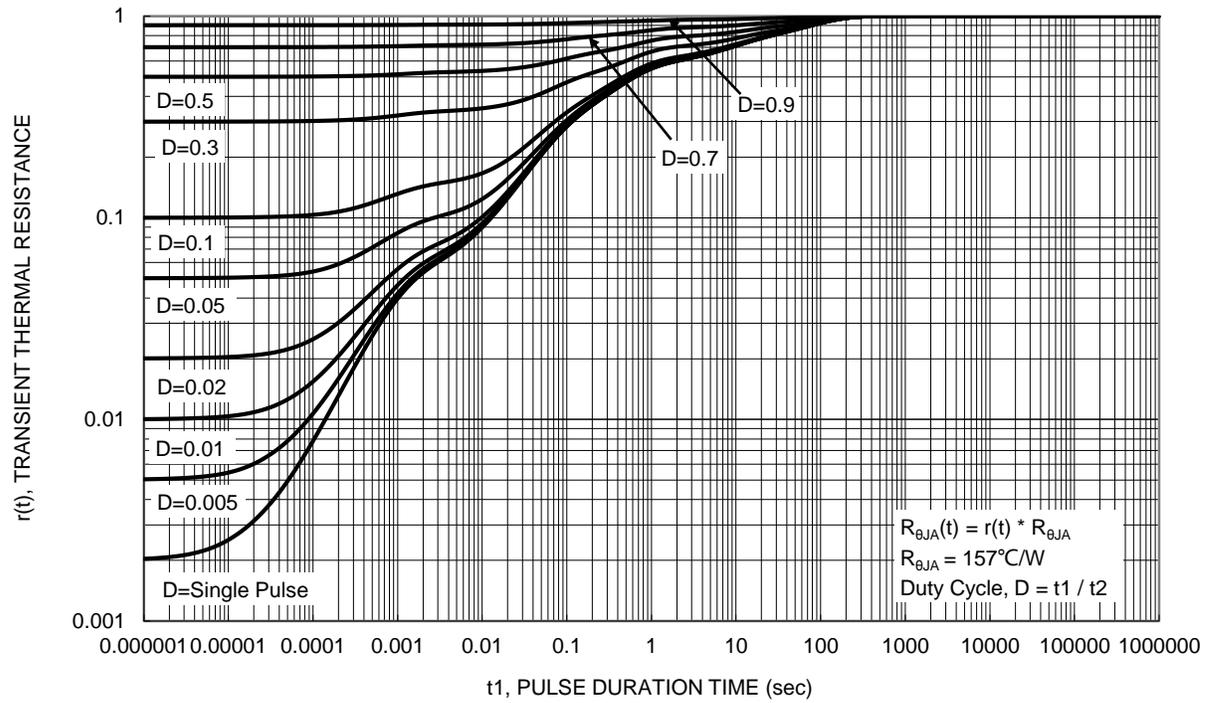
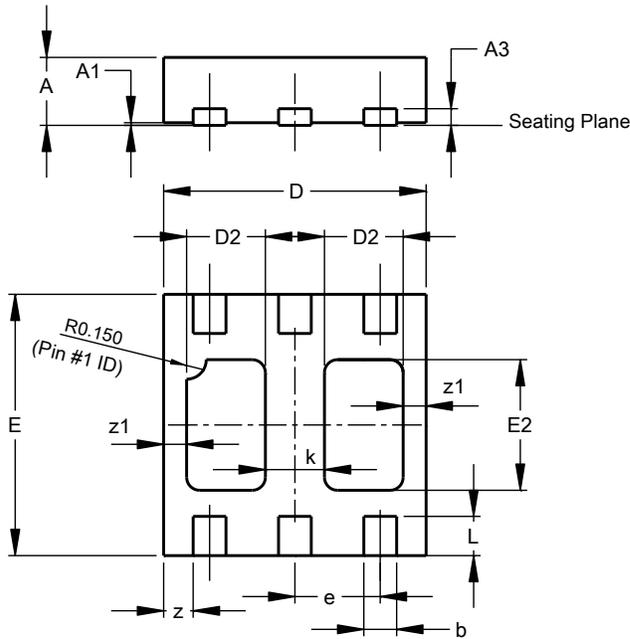


Figure 13. Transient Thermal Resistance

## Package Outline Dimensions

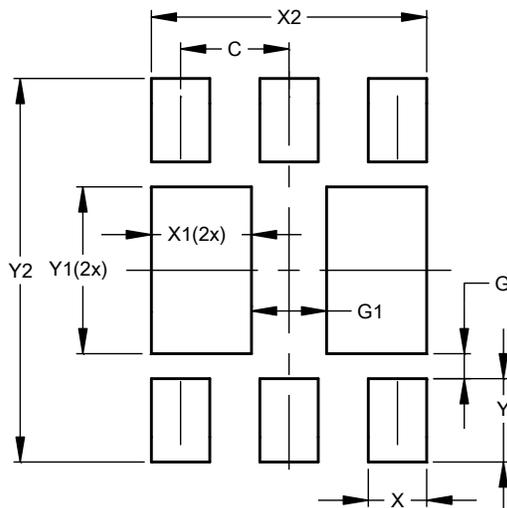
U-DFN2020-6 (Type B)



U-DFN2020-6 Type B			
Dim	Min	Max	Typ
A	0.545	0.605	0.575
A1	0.00	0.05	0.02
A3	-	-	0.13
b	0.20	0.30	0.25
D	1.95	2.075	2.00
D2	0.50	0.70	0.60
e	-	-	0.65
E	1.95	2.075	2.00
E2	0.90	1.10	1.00
k	-	-	0.45
L	0.25	0.35	0.30
z	-	-	0.225
z1	-	-	0.175
All Dimensions in mm			

## Suggested Pad Layout

U-DFN2020-6 (Type B)



Dimensions	Value (in mm)
C	0.650
G	0.150
G1	0.450
X	0.350
X1	0.600
X2	1.650
Y	0.500
Y1	1.000
Y2	2.300