

## Product Summary

$V_{(BR)DSS}$	$R_{DS(ON) MAX}$	$I_D$ $T_A = +25^\circ C$
20V	11mΩ @ $V_{GS} = 4.5V$	10.5A
	13mΩ @ $V_{GS} = 2.5V$	9.4A
	30mΩ @ $V_{GS} = 1.8V$	6.5A
	50mΩ @ $V_{GS} = 1.5V$	5.5A

## Description

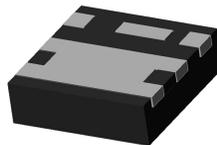
This MOSFET is designed to minimize the on-state resistance ( $R_{DS(ON)}$ ) and yet maintain superior switching performance, making it ideal for high-efficiency, power-management applications.

## Applications

- General Purpose Interfacing Switch
- Power Management Functions



U-DFN2020-6/SWP



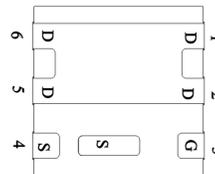
Bottom View

## Features

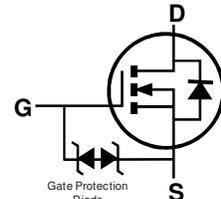
- 0.6mm Profile – Ideal for Low Profile Applications
- Low Gate Threshold Voltage
- ESD Protected Gate
- Additional Tin-Plated on Sidewall Pads for Optical Solder Inspection
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **Qualified to AEC-Q101 Standards for High Reliability**
- **PPAP Capable (Note 4)**

## Mechanical Data

- Case: U-DFN2020-6/SWP
- Case 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 208③
- Weight: 0.0065 grams (Approximate)



Pin Out



Equivalent Circuit

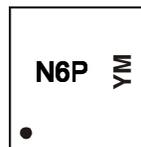
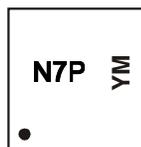
## Ordering Information (Notes 4 & 5)

Part Number	Compliance	Case	Quantity per reel
DMW2013UFDEQ-7	Automotive	U-DFN2020-6/SWP	3,000
DMW2013UFDEQ-13	Automotive	U-DFN2020-6/SWP	10,000

- Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
  2. See [http://www.diodes.com/quality/lead\\_free.html](http://www.diodes.com/quality/lead_free.html) for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
  3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
  4. Automotive products are AEC-Q101 qualified and are PPAP capable. Automotive, AEC-Q101 and standard products are electrically and thermally the same, except where specified. For more information, please refer to [http://www.diodes.com/quality/product\\_grade\\_definitions/](http://www.diodes.com/quality/product_grade_definitions/).
  5. For packaging details, go to our website at <http://www.diodes.com/products/packages.html>.

## Marking Information

U-DFN2020-6/SWP



N6P / N7P = Product Type Marking Code  
 YM = Date Code Marking  
 Y = Year (ex: A = 2013)  
 M = Month (ex: 9 = September)

### Date Code Key

Year	2013	2014	2015	2016	2017	2018	2019
Code	A	B	C	D	E	F	G

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Code	1	2	3	4	5	6	7	8	9	O	N	D

**Maximum Ratings** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Characteristic	Symbol	Value	Units
Drain-Source Voltage	V <sub>DSS</sub>	20	V
Gate-Source Voltage	V <sub>GSS</sub>	±8	V
Continuous Drain Current (Note 6) V <sub>GS</sub> = 4.5V	I <sub>D</sub>	T <sub>A</sub> = +25°C	10.5
		T <sub>A</sub> = +70°C	8.5
Pulsed Drain Current (10µs pulse, duty cycle = 1%)	I <sub>DM</sub>	T <sub>A</sub> = +25°C	12.5
		T <sub>A</sub> = +70°C	10.0
Maximum Body Diode Continuous Current	I <sub>S</sub>	2.5	A
Avalanche Current (Notes 7) L = 0.1mH	I <sub>AS</sub>	28	A
Single Pulse Avalanche Energy (Notes 8) L = 0.1mH	E <sub>AS</sub>	39.2	mJ

**Thermal Characteristics**

Characteristic	Symbol	Value	Units
Total Power Dissipation (Note 5)	P <sub>D</sub>	T <sub>A</sub> = +25°C	0.81
		T <sub>A</sub> = +70°C	0.57
Thermal Resistance, Junction to Ambient (Note 5)	R <sub>θJA</sub>	Steady State	185
		t < 10s	127
Total Power Dissipation (Note 6)	P <sub>D</sub>	T <sub>A</sub> = +25°C	2.3
		T <sub>A</sub> = +70°C	1.6
Thermal Resistance, Junction to Ambient (Note 6)	R <sub>θJA</sub>	Steady State	65
		t < 10s	45
Thermal Resistance, Junction to Case (Note 6)	R <sub>θJC</sub>	7	°C/W
Operating and Storage Temperature Range	T <sub>J</sub> , T <sub>STG</sub>	-55 to +175	°C

**Electrical Characteristics** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
<b>OFF CHARACTERISTICS (Note 8)</b>						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	20	—	—	V	V <sub>GS</sub> = 0V, I <sub>D</sub> = 250µA
Zero Gate Voltage Drain Current T <sub>J</sub> = +25°C	I <sub>DSS</sub>	—	—	1	µA	V <sub>DS</sub> = 16V, V <sub>GS</sub> = 0V
Gate-Source Leakage	I <sub>GSS</sub>	—	—	±5	µA	V <sub>GS</sub> = ±8V, V <sub>DS</sub> = 0V
<b>ON CHARACTERISTICS (Note 8)</b>						
Gate Threshold Voltage	V <sub>GS(th)</sub>	0.5	—	1.1	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250µA
Static Drain-Source On-Resistance	R <sub>DS(ON)</sub>	—	8.4	11	mΩ	V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 8.5A
			9.8	13		V <sub>GS</sub> = 2.5V, I <sub>D</sub> = 8.5A
			12	30		V <sub>GS</sub> = 1.8V, I <sub>D</sub> = 1A
			15	50		V <sub>GS</sub> = 1.5V, I <sub>D</sub> = 0.5A
Diode Forward Voltage	V <sub>SD</sub>	—	—	1.2	V	V <sub>GS</sub> = 0V, I <sub>S</sub> = 8.5A
<b>DYNAMIC CHARACTERISTICS (Note 9)</b>						
Input Capacitance	C <sub>iss</sub>	—	2,508	—	pF	V <sub>DS</sub> = 10V, V <sub>GS</sub> = 0V, f = 1MHz
Output Capacitance	C <sub>oss</sub>	—	259	—	pF	
Reverse Transfer Capacitance	C <sub>rss</sub>	—	242	—	pF	
Gate Resistance	R <sub>g</sub>	—	1.2	—	Ω	V <sub>DS</sub> = 0V, V <sub>GS</sub> = 0V, f = 1MHz
Total Gate Charge (V <sub>GS</sub> = 4.5V)	Q <sub>g</sub>	—	28.7	—	nC	V <sub>DS</sub> = 10V, I <sub>D</sub> = 8.5A
Total Gate Charge (V <sub>GS</sub> = 8V)	Q <sub>g</sub>	—	52.6	—	nC	
Gate-Source Charge	Q <sub>gs</sub>	—	3.3	—	nC	
Gate-Drain Charge	Q <sub>gd</sub>	—	5.8	—	nC	
Turn-On Delay Time	t <sub>D(on)</sub>	—	5.8	—	ns	V <sub>DS</sub> = 10V, I <sub>D</sub> = 8.5A V <sub>GS</sub> = 4.5V, R <sub>G</sub> = 1.8Ω
Turn-On Rise Time	t <sub>r</sub>	—	7.8	—	ns	
Turn-Off Delay Time	t <sub>D(off)</sub>	—	33.3	—	ns	
Turn-Off Fall Time	t <sub>f</sub>	—	9.4	—	ns	
Body Diode Reverse Recovery Time	t <sub>rr</sub>	—	11.6	—	ns	I <sub>F</sub> = 8.5A, di/dt = 100A/µs
Body Diode Reverse Recovery Charge	Q <sub>rr</sub>	—	4.6	—	nC	I <sub>F</sub> = 8.5A, di/dt = 100A/µs

- Notes:
- Device mounted on FR-4 PC board, with minimum recommended pad layout, single sided.
  - Device mounted on FR-4 substrate PC board, 2oz copper, with thermal bias to bottom layer 1-inch square copper plate.
  - I<sub>AS</sub> and E<sub>AS</sub> rating are based on low frequency and duty cycles to keep T<sub>J</sub> = +25°C.
  - Short duration pulse test used to minimize self-heating effect.
  - Guaranteed by design. Not subject to production testing.

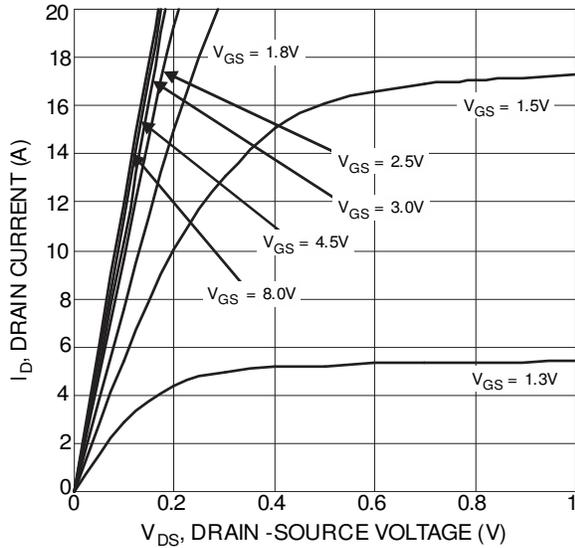


Figure 1 Typical Output Characteristics

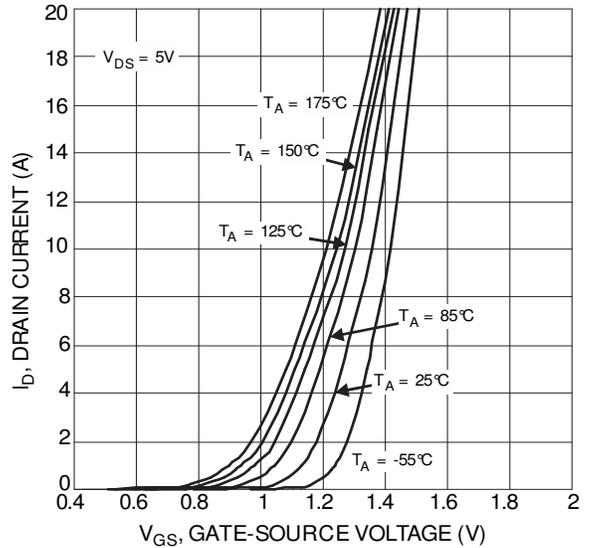


Figure 2 Typical Transfer Characteristics

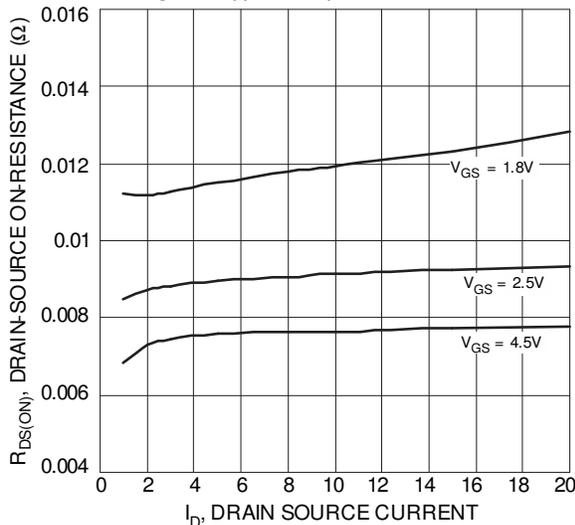


Figure 3 Typical On-Resistance vs. Drain Current and Gate Voltage

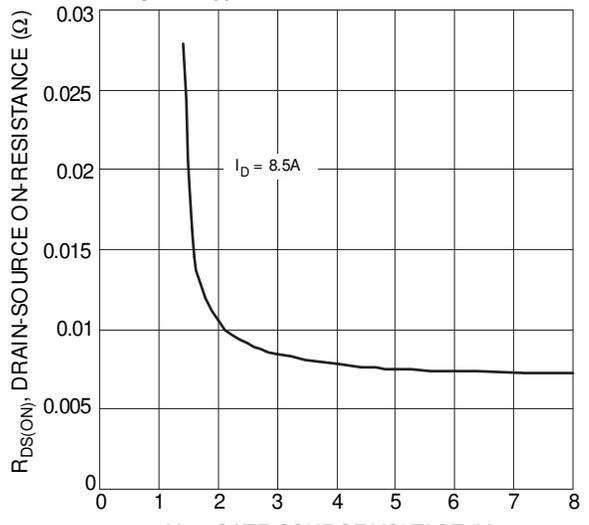


Figure 4 Typical Transfer Characteristic

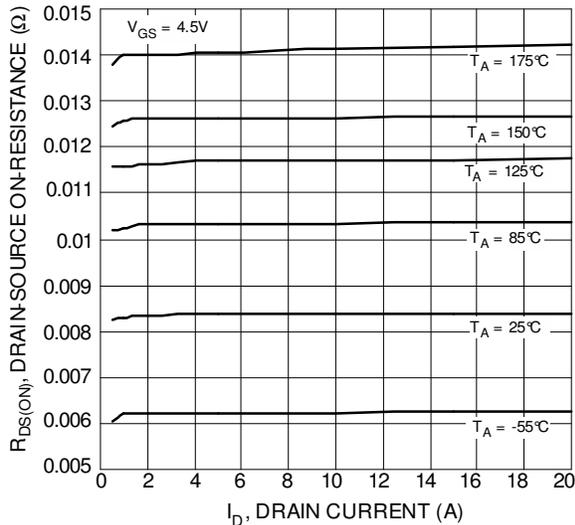


Figure 5 Typical On-Resistance vs. Drain Current and Temperature

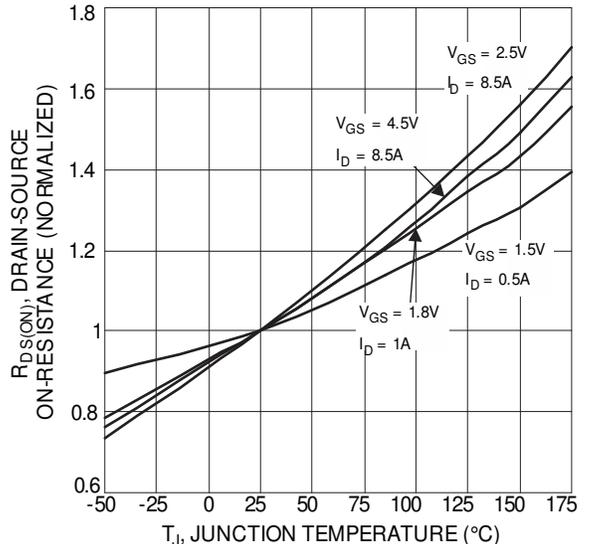


Figure 6 On-Resistance Variation with Temperature

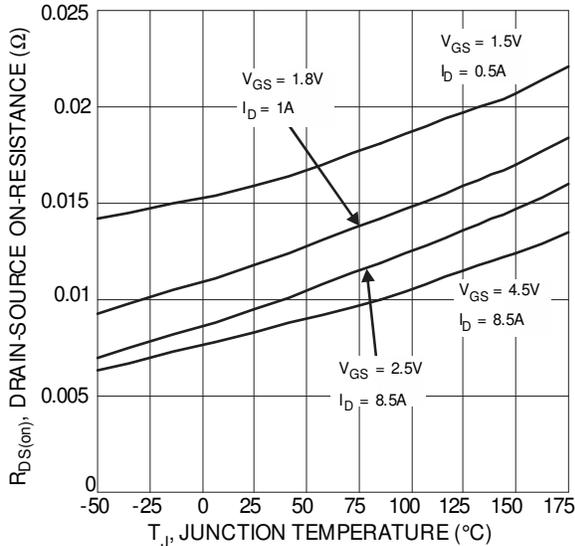


Figure 7 On-Resistance Variation with Temperature

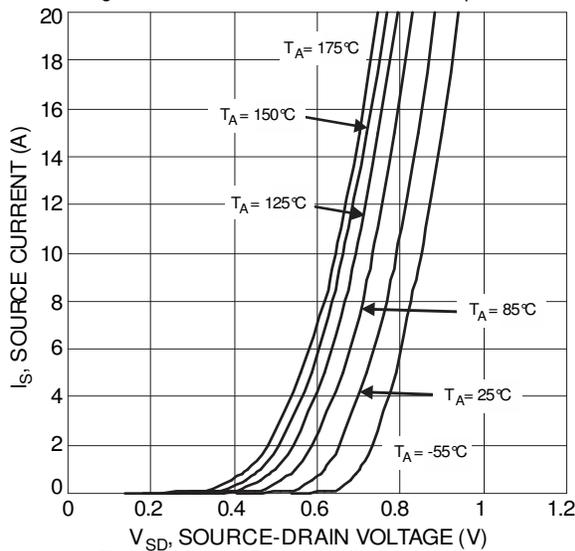


Figure 9 Diode Forward Voltage vs. Current

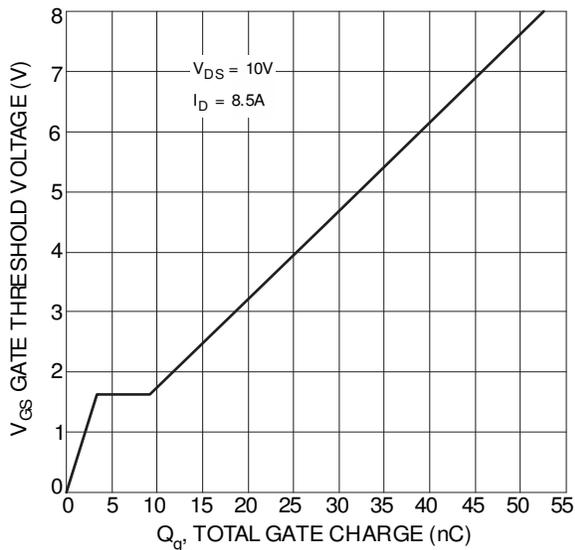


Figure 11 Gate Charge

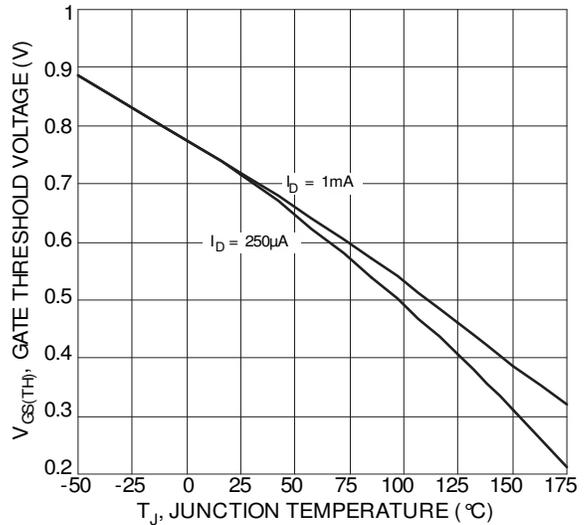


Figure 8 Gate Threshold Variation vs. Ambient Temperature

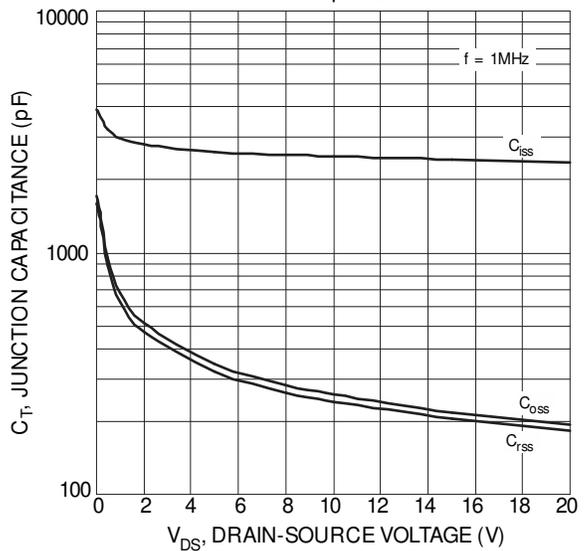


Figure 10 Typical Junction Capacitance

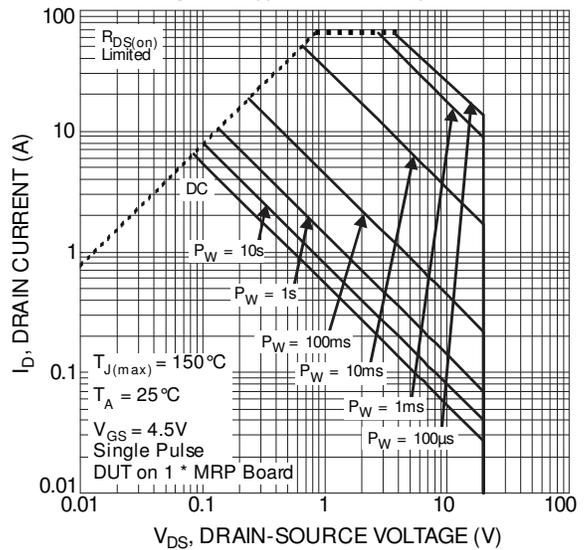


Figure 12 SOA, Safe Operation Area

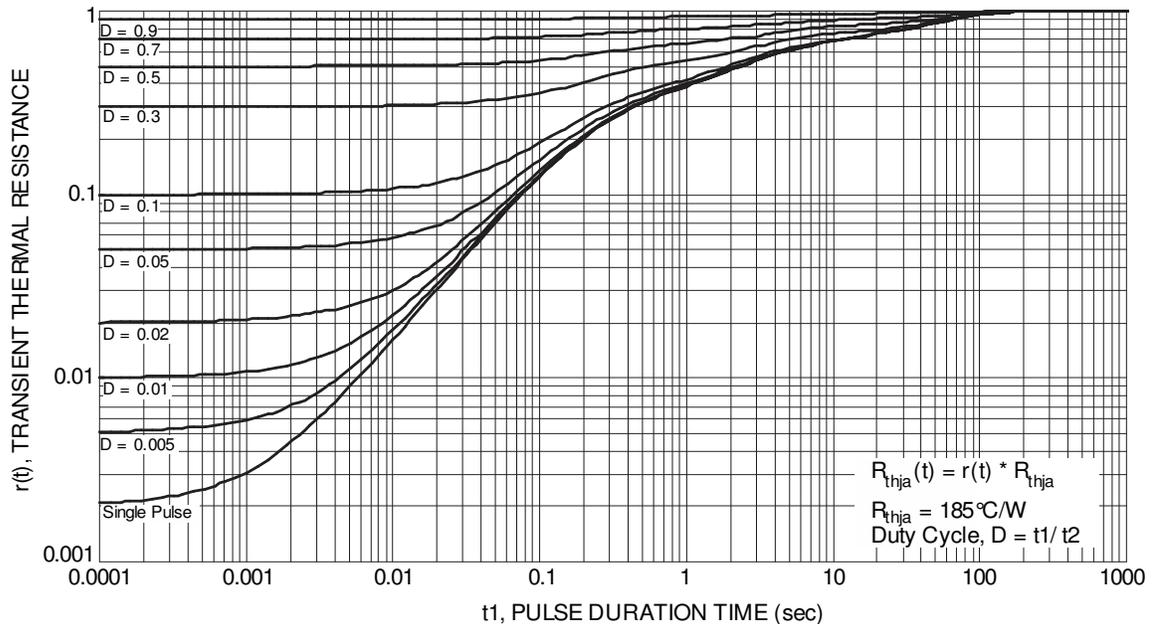
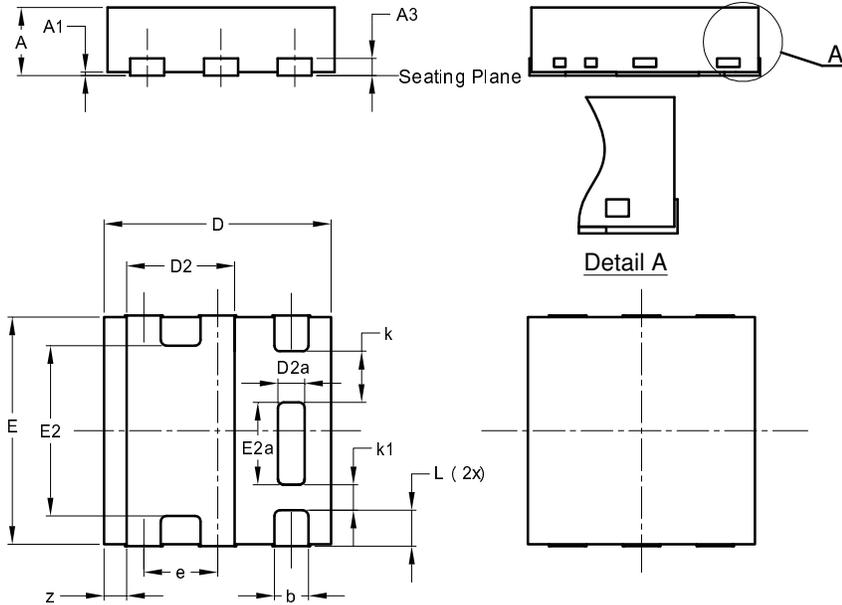


Figure 13 Transient Thermal Resistance

**Package Outline Dimensions**

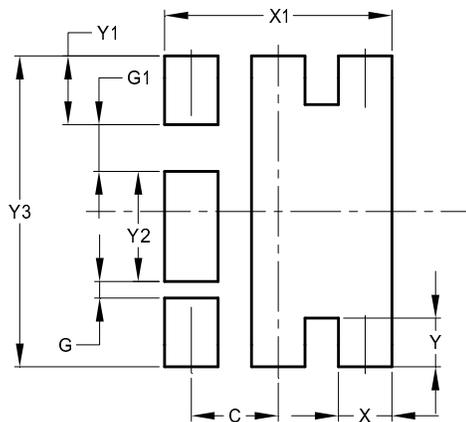
Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for the latest version.



U-DFN2020-6/SWP			
Dim	Min	Max	Typ
A	0.59	0.65	0.62
A1	0	0.05	0.03
A3	-	-	0.19
b	0.28	0.38	0.33
D	1.95	2.05	2.00
D2	0.87	1.07	0.97
D2a	0.205	0.305	0.255
E	1.95	2.05	2.00
E2	1.42	1.62	1.52
E2a	0.69	0.79	0.74
e	0.65 BSC		
L	0.28	0.38	0.33
k	0.450 BSC		
k1	0.225 BSC		
Z	-	-	0.20
All Dimensions in mm			

**Suggested Pad Layout**

Please see AP02001 at <http://www.diodes.com/datasheets/ap02001.pdf> for the latest version.



Dimensions	Value (in mm)
C	0.650
G	0.125
G1	0.350
X	0.400
X1	1.700
Y	0.365
Y1	0.515
Y2	0.825
Y3	2.330

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