60V N-CHANNEL ENHANCEMENT MODE MOSFET

Product Summary

BV_{DSS}	$R_{DS(ON)\ MAX}$	$I_{D\ MAX}$ T_A = +25°C
60V	38mΩ @ V_{GS} = 10V	6.5A
	47mΩ @ V_{GS} = 4.5V	5.2A

Description and Applications

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

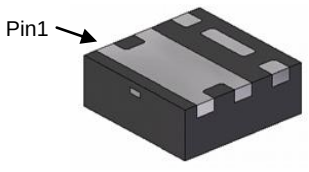
Features and Benefits

- 100% Unclamped Inductive Switch (UIS) Test in Production
- 0.6mm Profile – Ideal for Low Profile Applications
- PCB Footprint of 4mm^2
- Low On-Resistance
- **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)**

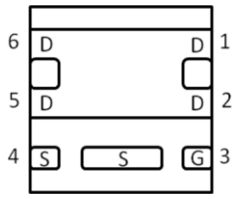
Mechanical Data

- Case: U-DFN2020-6 (Type E)
- 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
- Weight: 0.0065 grams (Approximate)

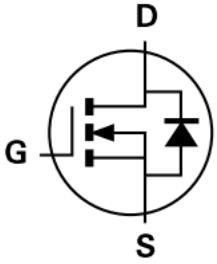
U-DFN2020-6 (Type E)



Bottom View



Pin Out
Bottom View



Equivalent Circuit

Ordering Information (Note 5)

Part Number	Case	Packaging
DMN6040SFDEQ-7	U-DFN2020-6 (Type E)	3,000 / Tape & Reel
DMN6040SFDEQ-13	U-DFN2020-6 (Type E)	10,000 / Tape & Reel

Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
2. See http://www.diodes.com/quality/lead_free/ 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. Refer to https://www.diodes.com/quality/.
5. For packaging details, go to our website at https://www.diodes.com/design/support/packaging/diodes-packaging/.

Marking Information

N8 = Product Type Marking Code
YM = Date Code Marking
Y = Year (ex: F = 2018)
M = Month (ex: 9 = September)

Date Code Key

Year	2018	2019	2020	2021	2022	2023	2024
Code	F	G	H	I	J	K	L

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_A = +25°C, unless otherwise specified.)

Characteristic			Symbol	Value	Unit
Drain-Source Voltage			V_{DSS}	60	V
Gate-Source Voltage			V_{GSS}	±20	V
Continuous Drain Current (Note 7) V_{GS} = 10V	Steady State	T_A = +25°C T_A = +70°C	I_D	5.3 4.1	A
	t<10s	T_A = +25°C T_A = +70°C	I_D	6.5 5.1	A
Pulsed Drain Current (10µs Pulse, Duty Cycle = 1%)			I_{DM}	30	A
Maximum Body Diode Continuous Current			I_S	2.5	A
Avalanche Current (Note 8) L = 0.1mH			I_{AR}	14.2	A
Avalanche Energy (Note 8) L = 0.1mH			E_{AR}	10	mJ

Thermal Characteristics

Characteristic		Symbol	Value	Unit
Total Power Dissipation (Note 6)	T_A = +25°C	P_D	0.66	W
	T_A = +70°C		0.42	
Thermal Resistance, Junction to Ambient (Note 6)	Steady State	$R_{\theta JA}$	189	°C/W
	t<10s		132	
Total Power Dissipation (Note 7)	T_A = +25°C	P_D	2.03	W
	T_A = +70°C		1.31	
Thermal Resistance, Junction to Ambient (Note 7)	Steady State	$R_{\theta JA}$	61	°C/W
	t<10s		43	
Thermal Resistance, Junction to Case (Note 7)		$R_{\theta JC}$	9.3	
Operating and Storage Temperature Range		T_J, T_{STG}	-55 to +150	°C

Electrical Characteristics (@T_A = +25°C, unless otherwise specified.)

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
OFF CHARACTERISTICS (Note 9)						
Drain-Source Breakdown Voltage	BV_{DSS}	60	—	—	V	V_{GS} = 0V, I_D = 250µA
Zero Gate Voltage Drain Current	I_{DSS}	—	—	100	nA	V_{DS} = 60V, V_{GS} = 0V
Gate-Source Leakage	I_{GSS}	—	—	±100	nA	V_{GS} = ±20V, V_{DS} = 0V
ON CHARACTERISTICS (Note 9)						
Gate Threshold Voltage	$V_{GS(TH)}$	1	—	3	V	V_{DS} = V_{GS}, I_D = 250µA
Static Drain-Source On-Resistance	$R_{DS(ON)}$	—	30	38	mΩ	V_{GS} = 10V, I_D = 4.3A
		—	35	47		V_{GS} = 4.5V, I_D = 4A
Forward Transfer Admittance	$\|Y_{fs}\|$	—	4.5	—	S	V_{DS} = 10V, I_D = 4.3A
Diode Forward Voltage	V_{SD}	—	0.7	1.2	V	V_{GS} = 0V, I_S = 1A
DYNAMIC CHARACTERISTICS (Note 10)						
Input Capacitance	C_{iss}	—	1287	—	pF	V_{DS} = 25V, V_{GS} = 0V f = 1.0MHz
Output Capacitance	C_{oss}	—	57	—		
Reverse Transfer Capacitance	C_{rss}	—	44	—		
Gate Resistance	R_g	—	1.2	—	Ω	V_{DS} = 0V, V_{GS} = 0V, f = 1.0MHz
Total Gate Charge (V_{GS} = 10V)	Q_g	—	22.4	—	nC	V_{DS} = 30V, I_D = 4.3A
Total Gate Charge (V_{GS} = 4.5V)	Q_g	—	10.4	—		
Gate-Source Charge	Q_{gs}	—	4.9	—		
Gate-Drain Charge	Q_{gd}	—	3.0	—		
Turn-On Delay Time	$t_{D(ON)}$	—	6.6	—	ns	V_{GS} = 10V, V_{DD} = 30V, R_g = 6Ω, I_D = 4.3A
Turn-On Rise Time	t_R	—	8.1	—		
Turn-Off Delay Time	$t_{D(OFF)}$	—	20.1	—		
Turn-Off Fall Time	t_F	—	4.0	—		
Body Diode Reverse Recovery Time	t_{RR}	—	18	—	ns	I_S = 4.3A, dI/dt = 100A/µs
Body Diode Reverse Recovery Charge	Q_{RR}	—	11.9	—	nC	I_S = 4.3A, dI/dt = 100A/µs

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

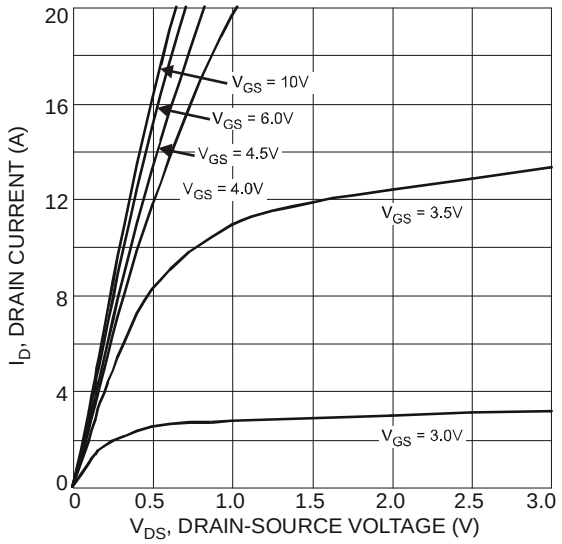


Fig. 1 Typical Output Characteristic

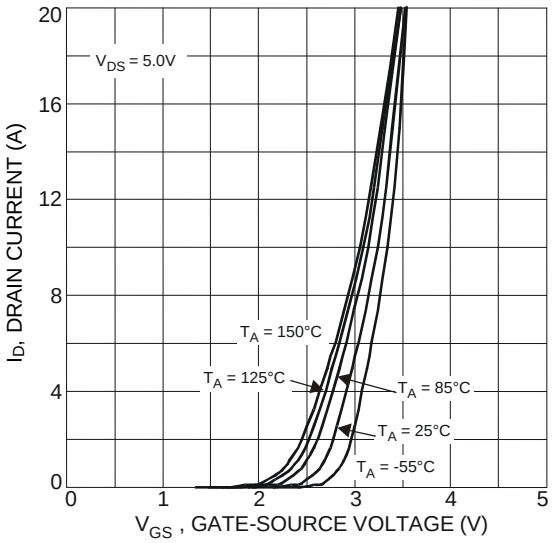


Fig. 2 Typical Transfer Characteristics

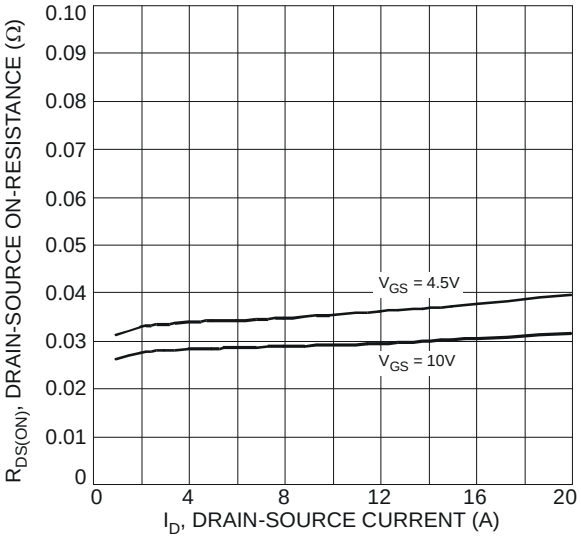


Fig. 3 Typical On-Resistance vs. Drain Current and Gate Voltage

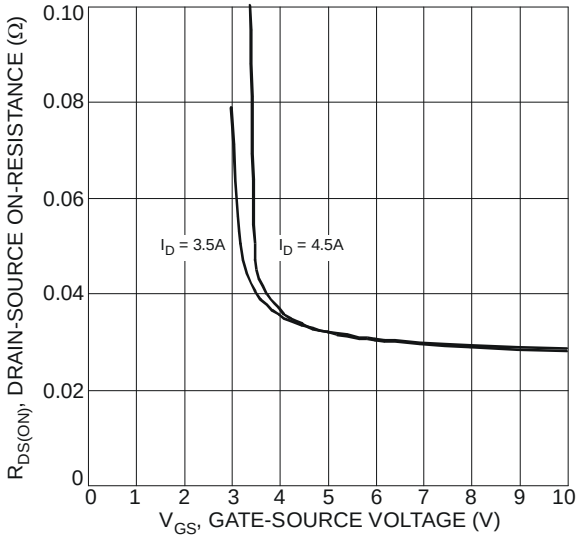


Fig. 4 Typical On-Resistance vs. Drain Current and Gate Voltage

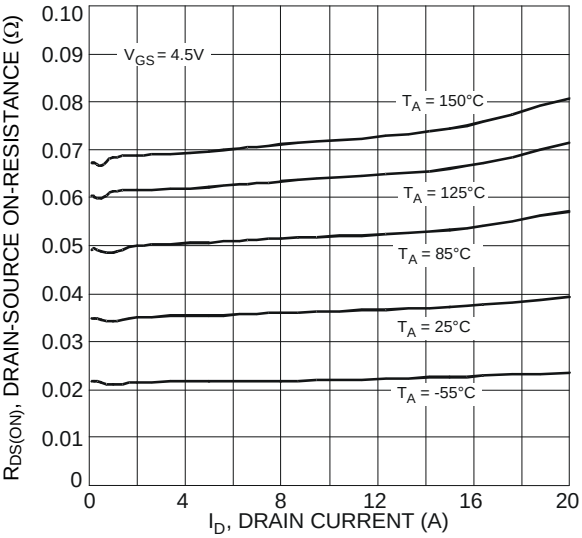


Fig. 5 Typical On-Resistance vs. Drain Current and Temperature

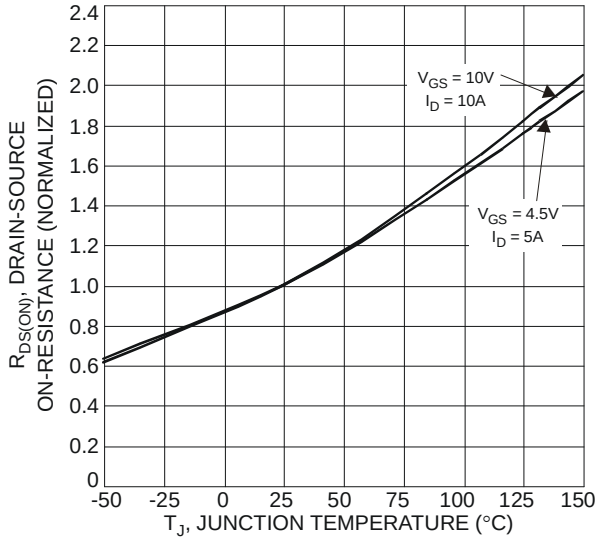


Fig. 6 On-Resistance Variation with Temperature

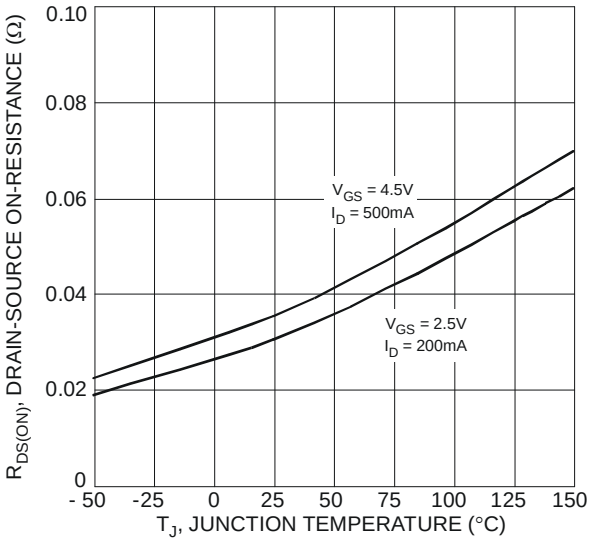


Fig. 7 On-Resistance Variation with Temperature

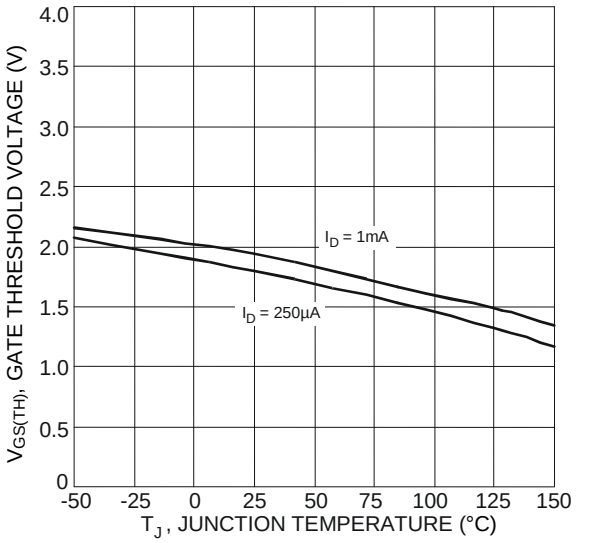


Fig. 8 Gate Threshold Variation vs. Junction Temperature

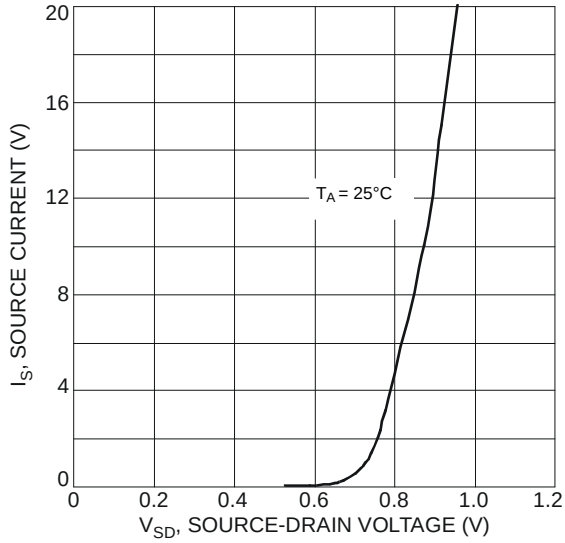


Fig. 9 Diode Forward Voltage vs. Current

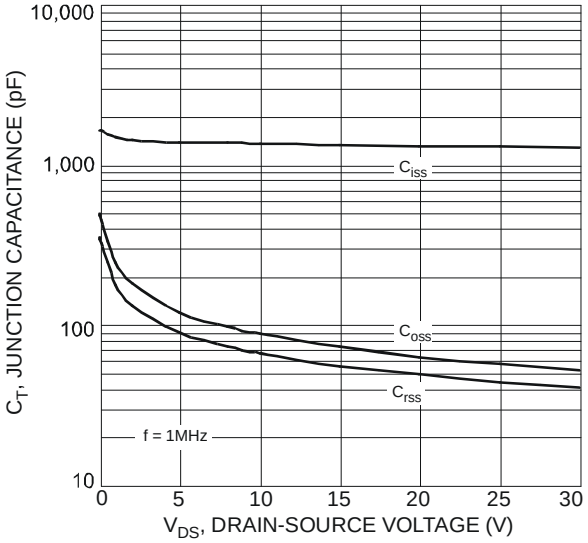


Fig. 10 Typical Junction Capacitance

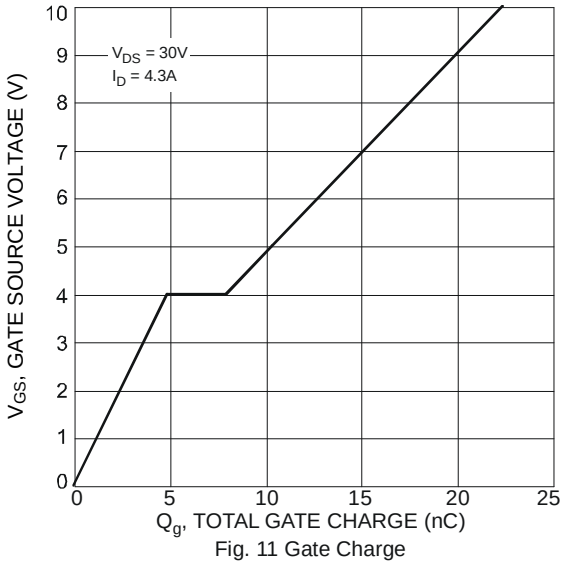


Fig. 11 Gate Charge

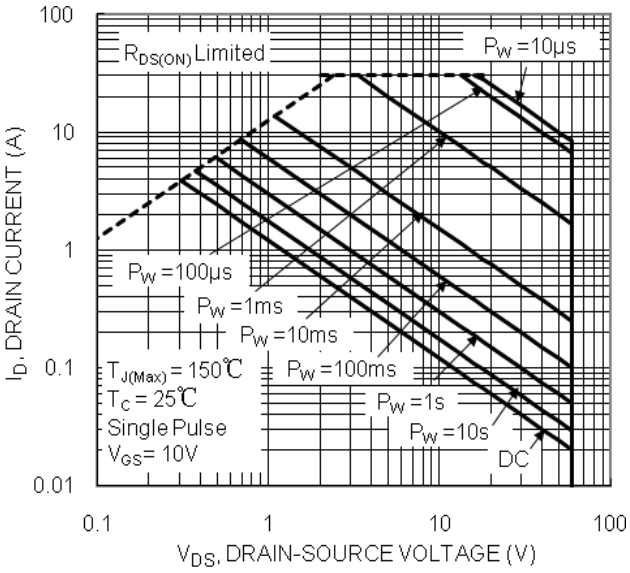


Fig 12. SOA, Safe Operation Area

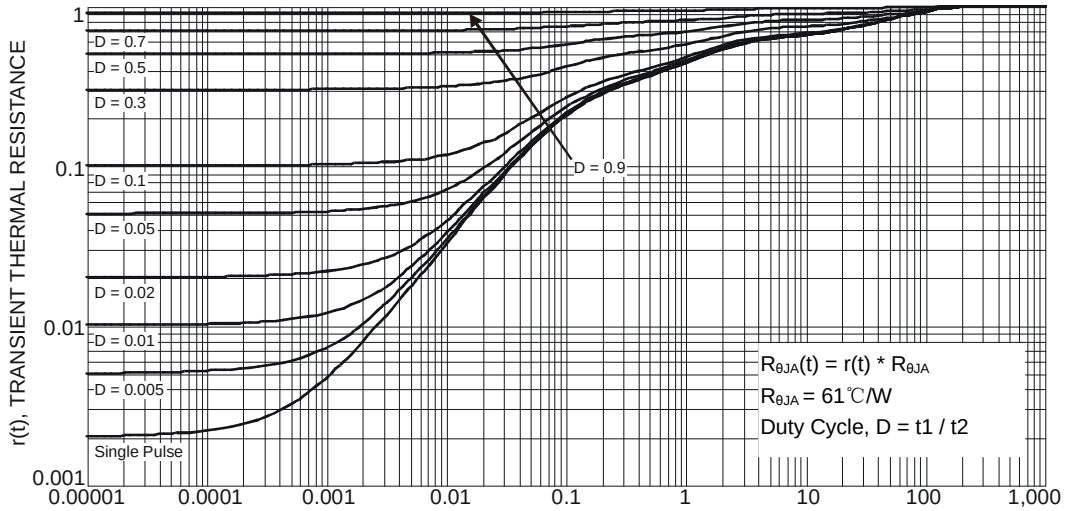
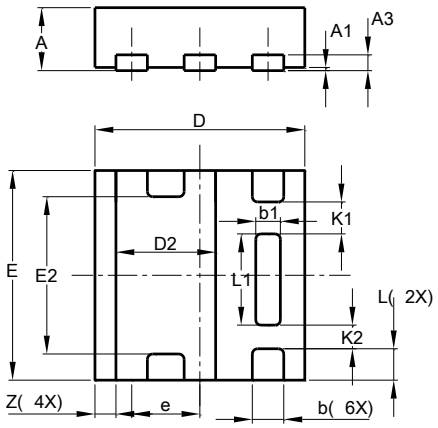


Fig. 13 Transient Thermal Resistance

Package Outline Dimensions

Please see http://www.diodes.com/package-outlines.html for the latest version.

U-DFN2020-6 (Type E)

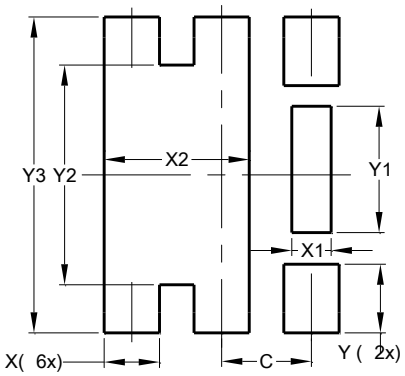


U-DFN2020-6 (Type E)			
Dim	**Min**	**Max**	**Typ**
A	0.57	0.63	0.60
A1	0	0.05	0.03
A3	–	–	0.15
b	0.2	0.35	0.30
b1	0.185	0.285	0.235
D	1.95	2.05	2.00
D2	0.85	1.05	0.95
E	1.95	2.05	2.00
E2	1.40	1.60	1.50
e	–	–	0.65
L	0.25	0.35	0.30
L1	0.82	0.92	0.87
K1	–	–	0.305
K2	–	–	0.225
Z	–	–	0.20
All Dimensions in mm			

Suggested Pad Layout

Please see http://www.diodes.com/package-outlines.html for the latest version.

U-DFN2020-6 (Type E)



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

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