20V N-CHANNEL ENHANCEMENT MODE MOSFET

Product Summary

BV_{DSS}	$R_{DS(ON)\ MAX}$	Package	I_D T_A = +25°C
20V	11mΩ @ V_{GS} = 4.5V	U-DFN2020-6 (Type E)	10.5A
	13mΩ @ V_{GS} = 2.5V	U-DFN2020-6 (Type E)	9.4A
	30mΩ @ V_{GS} = 1.8V	U-DFN2020-6 (Type E)	6.5A
	50mΩ @ V_{GS} = 1.5V	U-DFN2020-6 (Type E)	5.5A

Description

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

Applications

- General Purpose Interfacing Switch
- Power Management Functions

Features

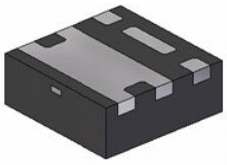
- 0.6mm Profile – Ideal for Low Profile Applications
- PCB Footprint of 4mm^2
- Low Gate Threshold Voltage
- ESD Protected Gate
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **For automotive applications requiring specific change control (i.e. parts qualified to AEC-Q100/101/200, PPAP capable, and manufactured in IATF 16949 certified facilities), please contact us or your local Diodes representative. https://www.diodes.com/quality/product-definitions/**
- **An Automotive-Compliant Part is Available Under Separate Datasheet (DMN2013UFDEQ)**

Mechanical Data

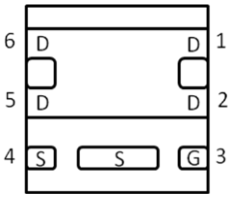
- Case: U-DFN2020-6
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish – NiPdAu over Copper Leadframe. Solderable per MIL-STD-202, Method 208 e4
- Weight: 0.0065 grams (Approximate)



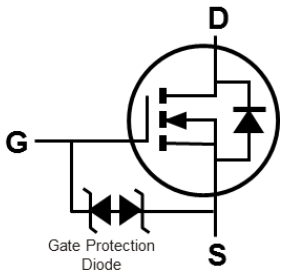
U-DFN2020-6 (Type E)



Bottom View



Pin Out



Equivalent Circuit

Ordering Information (Note 4)

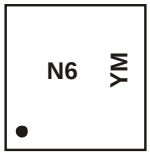
Part Number	Compliance	Case	Quantity per Reel
DMN2013UFDE-7	Standard	U-DFN2020-6 (Type E)	3,000
DMN2013UFDE-13	Standard	U-DFN2020-6 (Type E)	10,000

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 https://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. For packaging details, go to our website at https://www.diodes.com/design/support/packaging/diodes-packaging/.

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Marking Information

Site 1



N6 = Product Type Marking Code
YM = Date Code Marking
Y = Year (ex: I = 2021)
M = Month (ex: 9 = September)

Date Code Key

Year	2012	…	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Code	Z	…	I	J	K	L	M	N	O	P	R	S

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

Site 2



N6 = Product Type Marking Code
YWX = Date Code Marking
Y = Year (ex: 1 = 2021)
W = Week (ex: a = week 27; z Represents Week 52 and 53)
X = Internal Code (ex: U = Monday)

Date Code Key

Year	2012	…	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Code	2	…	1	2	3	4	5	6	7	8	9	0

Week	1-26	27-52	53
Code	A-Z	a-z	z

Internal Code	Sun	Mon	Tue	Wed	Thu	Fri	Sat
Code	T	U	V	W	X	Y	Z

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Maximum Ratings (@T_A = +25°C, unless otherwise specified.)

Characteristic			Symbol	Value	Unit
Drain-Source Voltage			V_{DSS}	20	V
Gate-Source Voltage			V_{GSS}	±8	V
Continuous Drain Current (Note 6) V_{GS} = 4.5V	Steady State	T_A = +25°C T_A = +70°C	I_D	10.5 8.5	A
	t < 10s	T_A = +25°C T_A = +70°C	I_D	12.5 10.0	A
Continuous Drain Current (Note 6) V_{GS} = 2.5V	Steady State	T_A = +25°C T_A = +70°C	I_D	9.4 7.5	A
	t < 10s	T_A = +25°C T_A = +70°C	I_D	11.2 8.8	A
Pulsed Drain Current (10µs Pulse, Duty Cycle = 1%)			I_{DM}	80	A
Maximum Body Diode Continuous Current			I_S	2.5	A

Thermal Characteristics

Characteristic		Symbol	Value	Unit
Total Power Dissipation (Note 5)	T_A = +25°C	P_D	0.66	W
	T_A = +70°C		0.42	
Thermal Resistance, Junction to Ambient (Note 5)	Steady State	$R_{\theta JA}$	189	°C/W
	t<10s		132	
Total Power Dissipation (Note 6)	T_A = +25°C	P_D	2.03	W
	T_A = +70°C		1.31	
Thermal Resistance, Junction to Ambient (Note 6)	Steady State	$R_{\theta JA}$	61	°C/W
	t<10s		43	
Thermal Resistance, Junction to Case (Note 6)		$R_{\theta JC}$	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 7)						
Drain-Source Breakdown Voltage	BV_{DSS}	20	—	—	V	V_{GS} = 0V, I_D = 250µA
Zero Gate Voltage Drain Current T_J = +25°C	I_{DSS}	—	—	1	µA	V_{DS} = 16V, V_{GS} = 0V
Gate-Source Leakage	I_{GSS}	—	—	±2	µA	V_{GS} = ±8V, V_{DS} = 0V
ON CHARACTERISTICS (Note 7)						
Gate Threshold Voltage	$V_{GS(TH)}$	0.5	—	1.1	V	V_{DS} = V_{GS}, I_D = 250µA
Static Drain-Source On-Resistance	$R_{DS(ON)}$	—	8.4	11	mΩ	V_{GS} = 4.5V, I_D = 8.5A
			9.8	13		V_{GS} = 2.5V, I_D = 8.5A
			12	30		V_{GS} = 1.8V, I_D = 1A
			15	50		V_{GS} = 1.5V, I_D = 0.5A
Forward Transfer Admittance	$\|Y_{fs}\|$	—	10	—	S	V_{DS} = 5V, I_D = 4A
Diode Forward Voltage	V_{SD}	—	—	1.2	V	V_{GS} = 0V, I_S = 8.5A
DYNAMIC CHARACTERISTICS (Note 8)						
Input Capacitance	C_{iss}	—	2453	—	pF	V_{DS} = 10V, V_{GS} = 0V, f = 1.0MHz
Output Capacitance	C_{oss}	—	275	—	pF	
Reverse Transfer Capacitance	C_{rss}	—	257	—	pF	
Gate Resistance	R_g	—	1.2	—	Ω	V_{DS} = 0V, V_{GS} = 0V, f = 1MHz
Total Gate Charge (V_{GS} = 4.5V)	Q_g	—	14.3	—	nC	V_{DS} = 10V, I_D = 8.5A
Total Gate Charge (V_{GS} = 8V)	Q_g	—	25.8	—	nC	
Gate-Source Charge	Q_{gs}	—	1.8	—	nC	
Gate-Drain Charge	Q_{gd}	—	2.1	—	nC	
Turn-On Delay Time	$t_{D(ON)}$	—	9.9	—	ns	V_{DS} = 10V, I_D = 8.5A V_{GS} = 4.5V, R_G = 1.8Ω
Turn-On Rise Time	t_R	—	24.5	—	ns	
Turn-Off Delay Time	$t_{D(OFF)}$	—	66.4	—	ns	
Turn-Off Fall Time	t_F	—	20.8	—	ns	

Notes:
5. Device mounted on FR-4 PC board, with minimum recommended pad layout, single sided.
6. Device mounted on FR-4 substrate PC board, 2oz copper, with thermal bias to bottom layer 1inch square copper plate.
7. Short duration pulse test used to minimize self-heating effect.
8. Guaranteed by design. Not subject to production testing.

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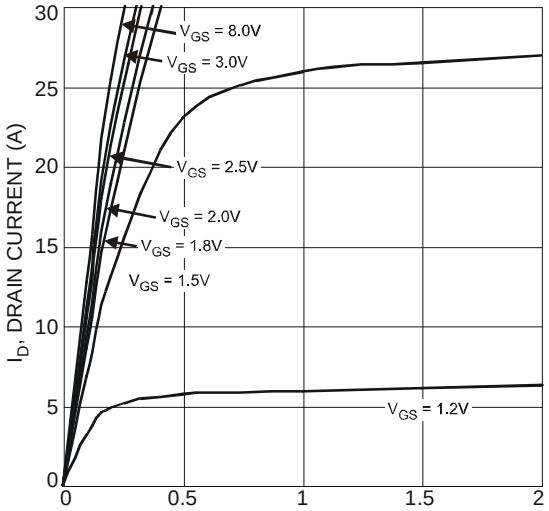


Fig.1 Typical Output Characteristic

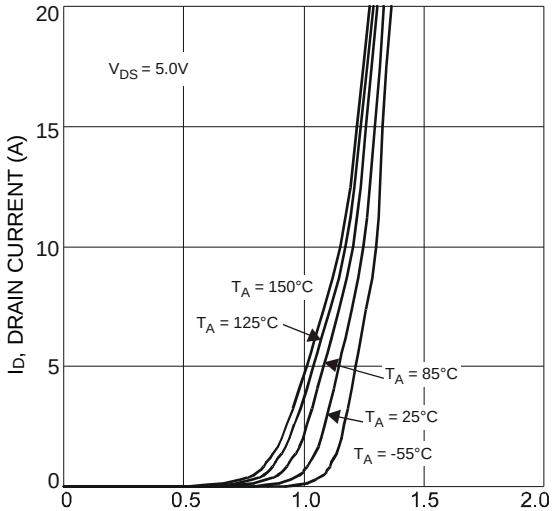


Fig.2 Typical Transfer Characteristics

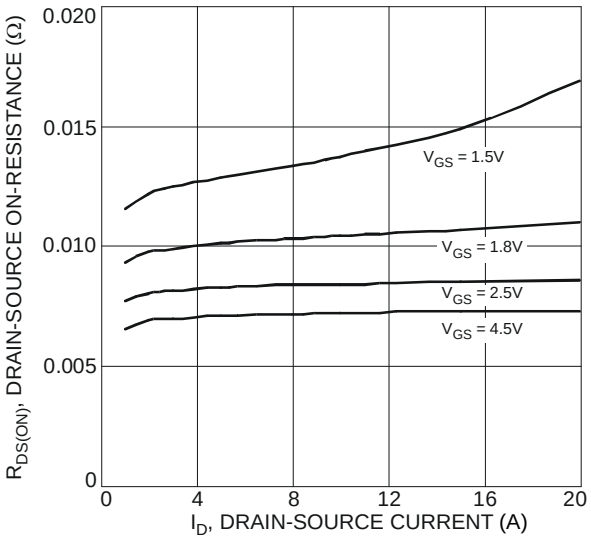


Fig. 3 Typical On-Resistance vs. Drain Current and Gate Voltage

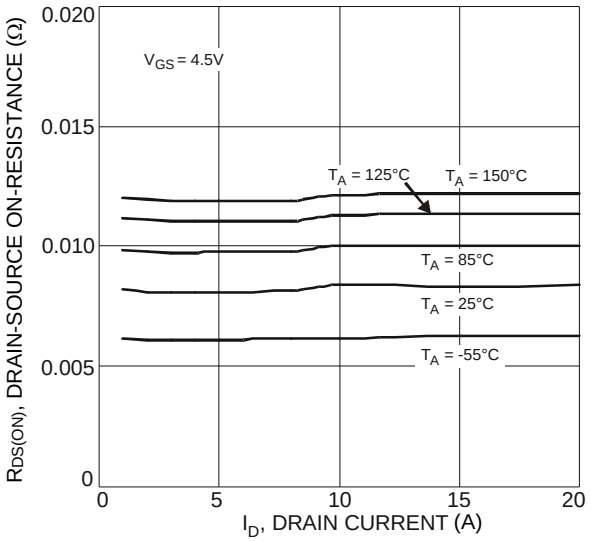


Fig. 4 Typical On-Resistance vs. Drain Current and Temperature

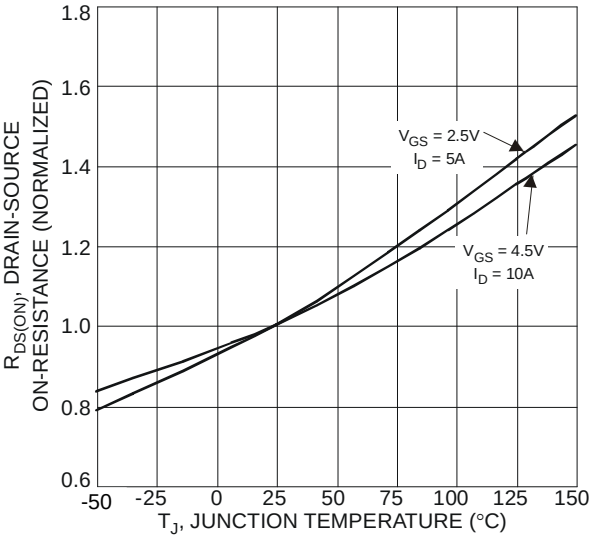


Fig. 5 On-Resistance Variation with Temperature

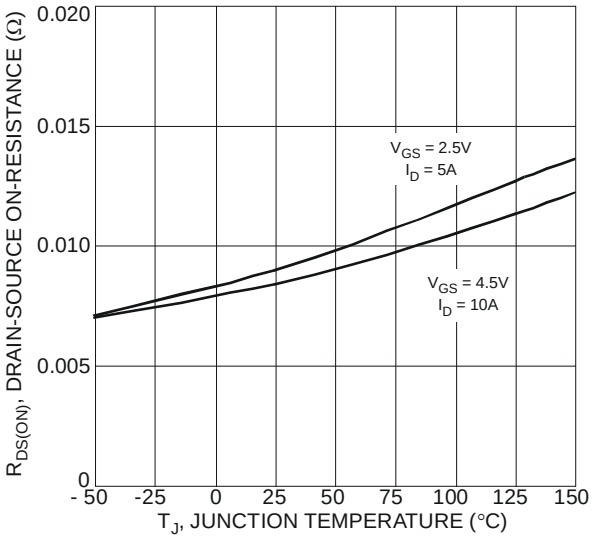


Fig. 6 On-Resistance Variation with Temperature

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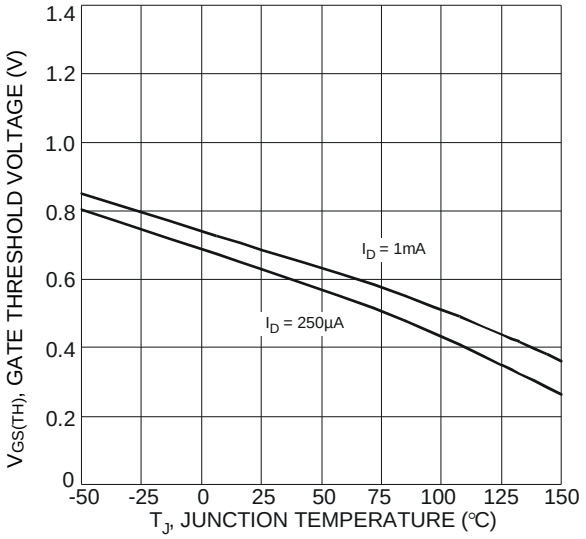


Fig. 7 Gate Threshold Variation vs. Junction Temperature

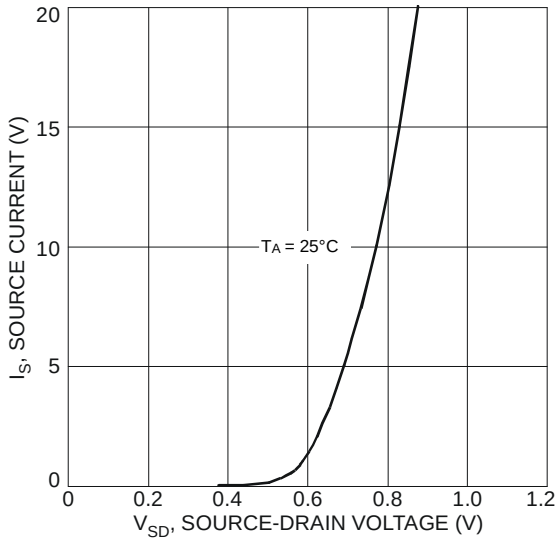


Fig. 8 Diode Forward Voltage vs. Current

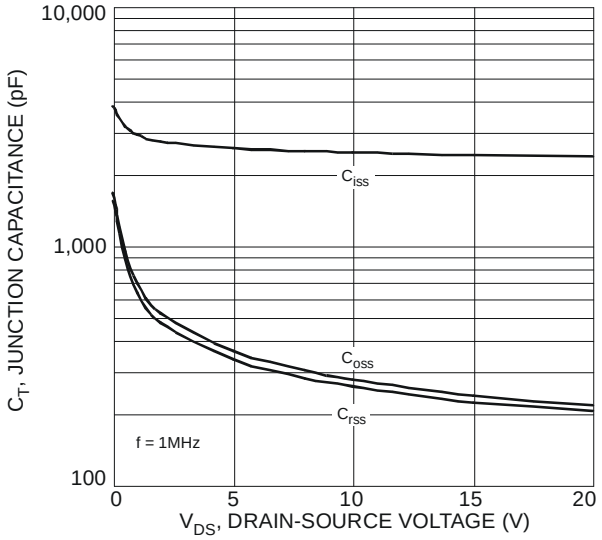


Fig. 9 Typical Junction Capacitance

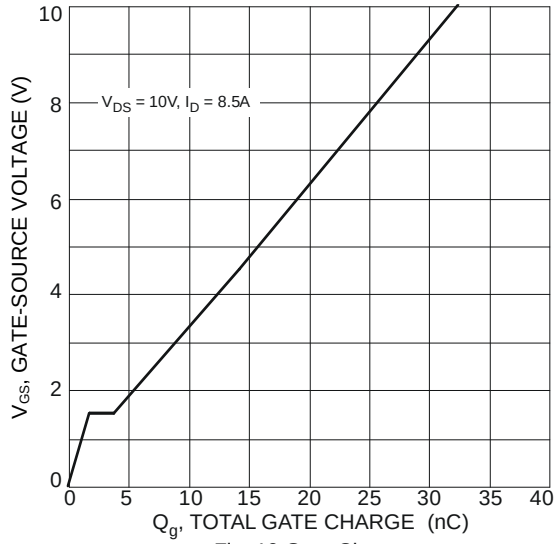


Fig. 10 Gate Charge

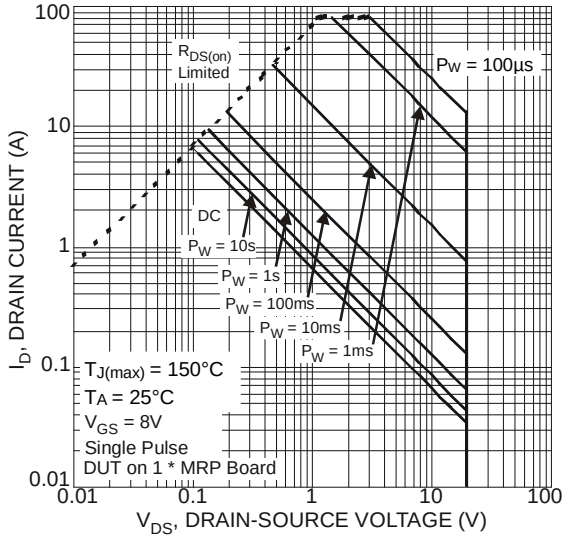


Fig. 11 SOA, Safe Operation Area

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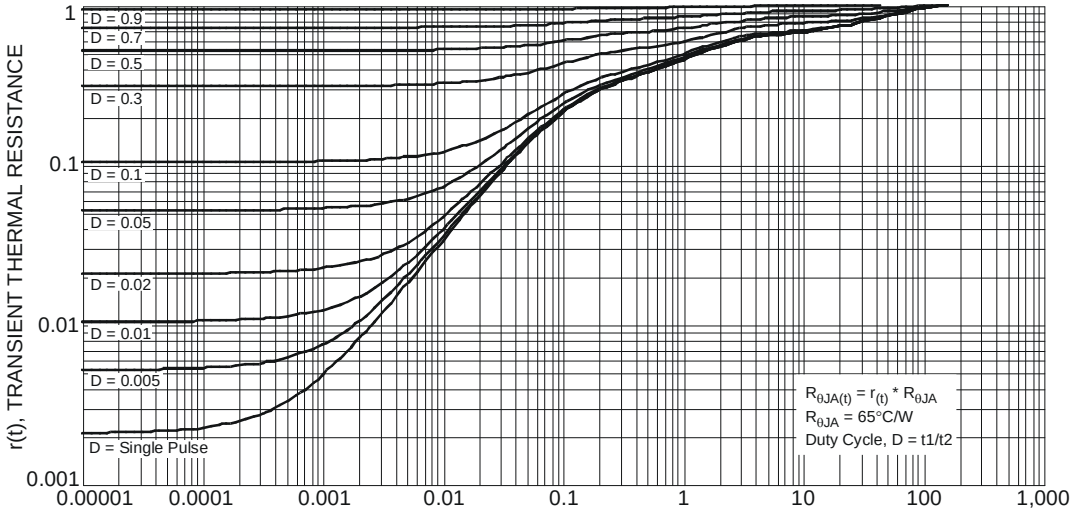


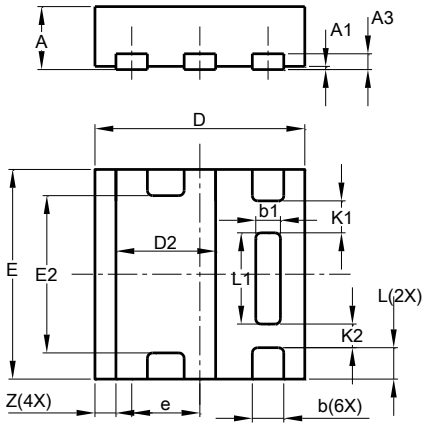
Fig. 12 Transient Thermal Resistance

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Package Outline Dimensions

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U-DFN2020-6 (Type E)

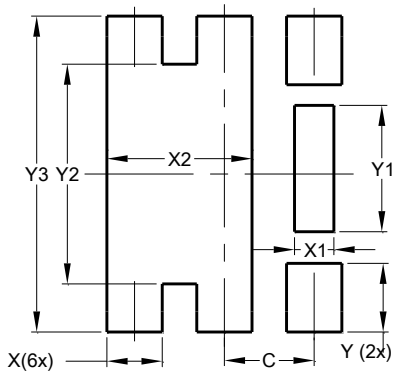


U-DFN2020-6 Type E			
Dim	**Min**	**Max**	**Typ**
A	0.57	0.63	0.60
A1	0	0.05	0.03
A3	–	–	0.15
b	0.25	0.35	0.30
b1	0.185	0.285	0.235
D	1.95	2.05	2.00
D2	0.85	1.05	0.95
E	1.95	2.05	2.00
E2	1.40	1.60	1.50
e	–	–	0.65
L	0.25	0.35	0.30
L1	0.82	0.92	0.87
K1	–	–	0.305
K2	–	–	0.225
Z	–	–	0.20
All Dimensions in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

Suggested Pad Layout

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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