20V N-CHANNEL ENHANCEMENT MODE MOSFET

Product Summary

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

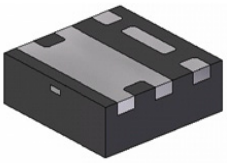
Description

This new generation MOSFET has been 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



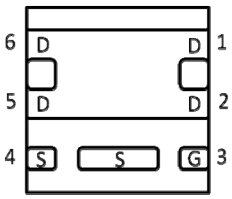
Bottom View

Features

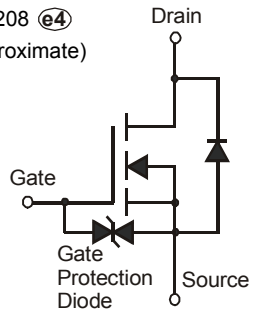
- 0.6mm profile – ideal for low profile applications
- PCB footprint of 4mm^2
- Low Gate Threshold Voltage
- ESD Protected Gate
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **Qualified to AEC-Q101 Standards for High Reliability**
- **PPAP Capable (Note 4)**

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)



Pin Out



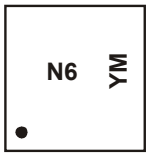
Equivalent Circuit

Ordering Information (Note 5)

Part Number	Compliance	Case	Quantity per reel
DMN2013UFDE-7	Standard	U-DFN2020-6	3,000
DMN2013UFDEQ-7	Automotive	U-DFN2020-6	3,000
DMN2013UFDE-13	Standard	U-DFN2020-6	10,000
DMN2013UFDEQ-13	Automotive	U-DFN2020-6	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 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/.
5. For packaging details, go to our website at http"//www.diodes.com/products/packages.html.

Marking Information



N6 = Product Type Marking Code
YM = Date Code Marking
Y = Year (ex: Y = 2011)
M = Month (ex: 9 = September)

Date Code Key

Year	2011	2012	2013	2014	2015	2016	2017
Code	Y	Z	A	B	C	D	E

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	Units
Drain-Source Voltage			V_{DSS}	20	V
Gate-Source Voltage			V_{GSS}	±8	V
Continuous Drain Current (Note 7) 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 7) V_{GS} = 2.5V	Steady State	T_A = +25°C T_A = +70°C	I_D	9.4 7.5	A
	t <1 0s	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	Units
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 8)						
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 8)						
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 9)						
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: 6. Device mounted on FR-4 PC board, with minimum recommended pad layout, single sided.
7. Device mounted on FR-4 substrate PC board, 2oz copper, with thermal bias to bottom layer 1inch square copper plate
8. Short duration pulse test used to minimize self-heating effect
9. Guaranteed by design. Not subject to production testing

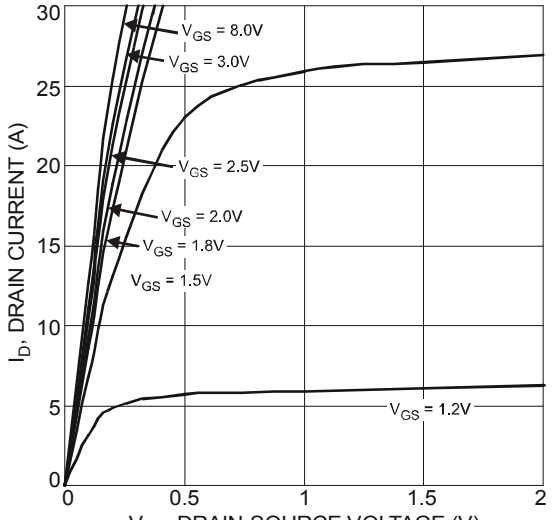


Fig.1 Typical Output Characteristic

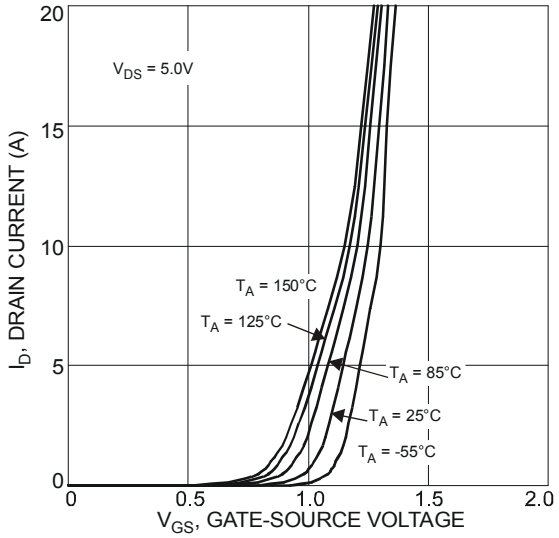


Fig.2 Typical Transfer Characteristics

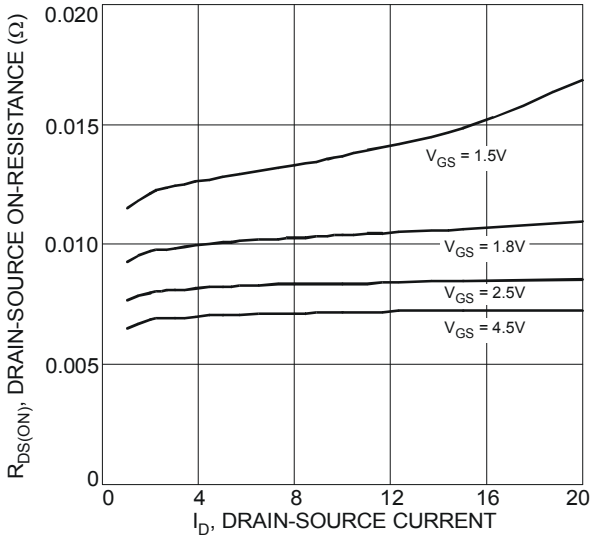


Fig. 3 Typical On-Resistance vs. Drain Current and Gate Voltage

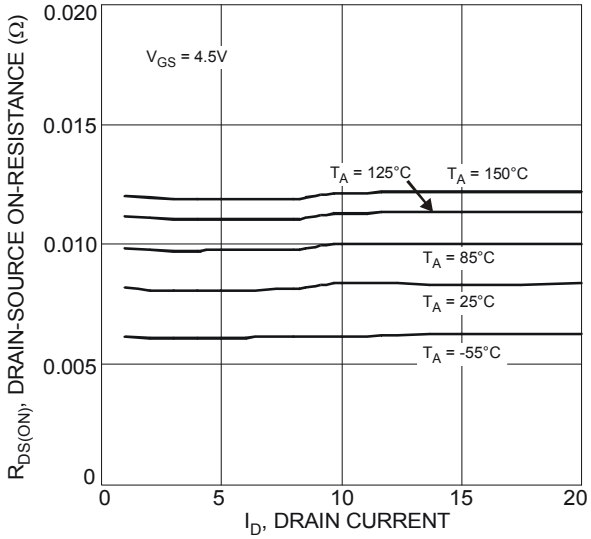


Fig. 4 Typical On-Resistance vs. Drain Current and Temperature

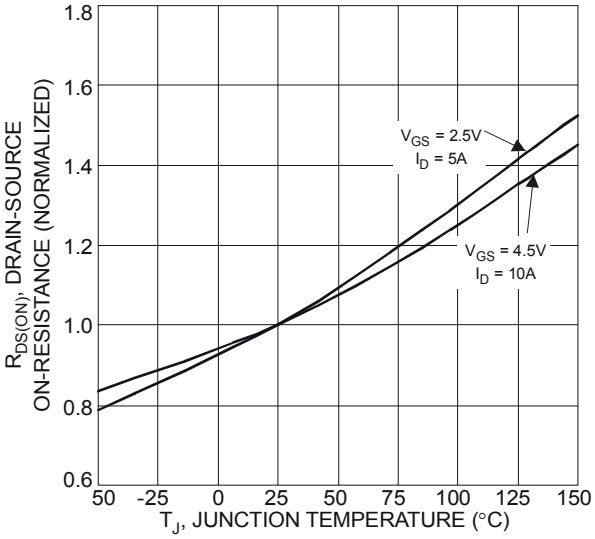


Fig. 5 On-Resistance Variation with Temperature

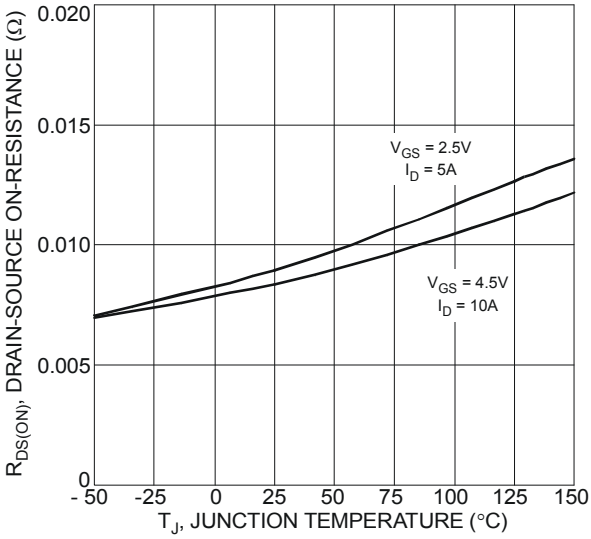


Fig. 6 On-Resistance Variation with Temperature

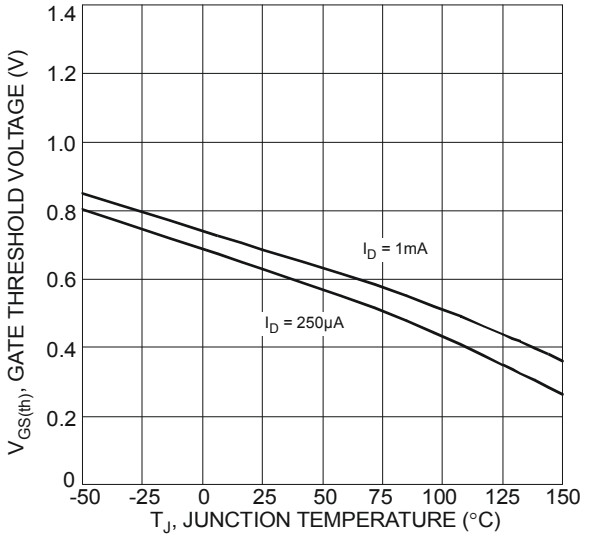


Fig. 7 Gate Threshold Variation vs. Ambient Temperature

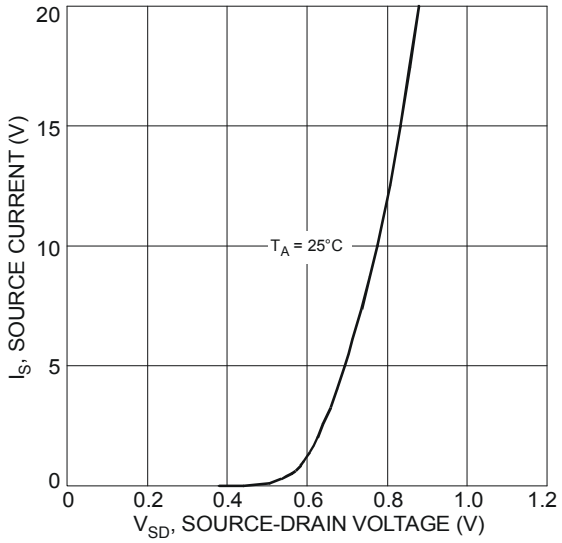


Fig. 8 Diode Forward Voltage vs. Current

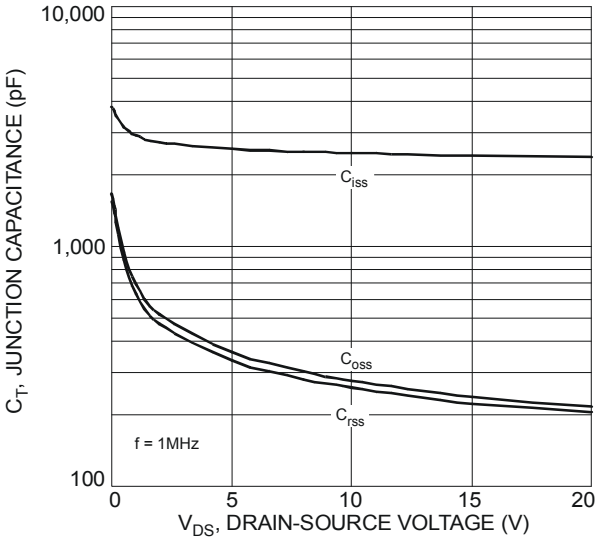


Fig. 9 Typical Junction Capacitance

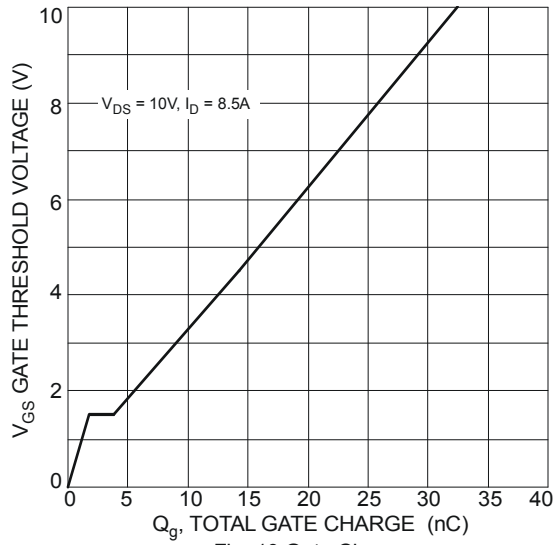


Fig. 10 Gate Charge

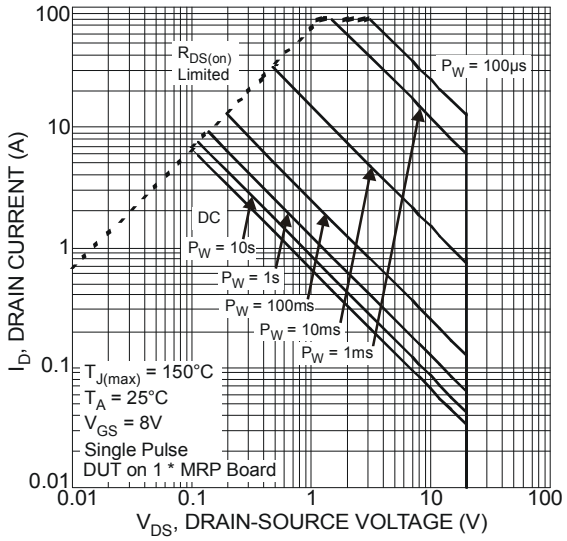


Fig. 11 SOA, Safe Operation Area

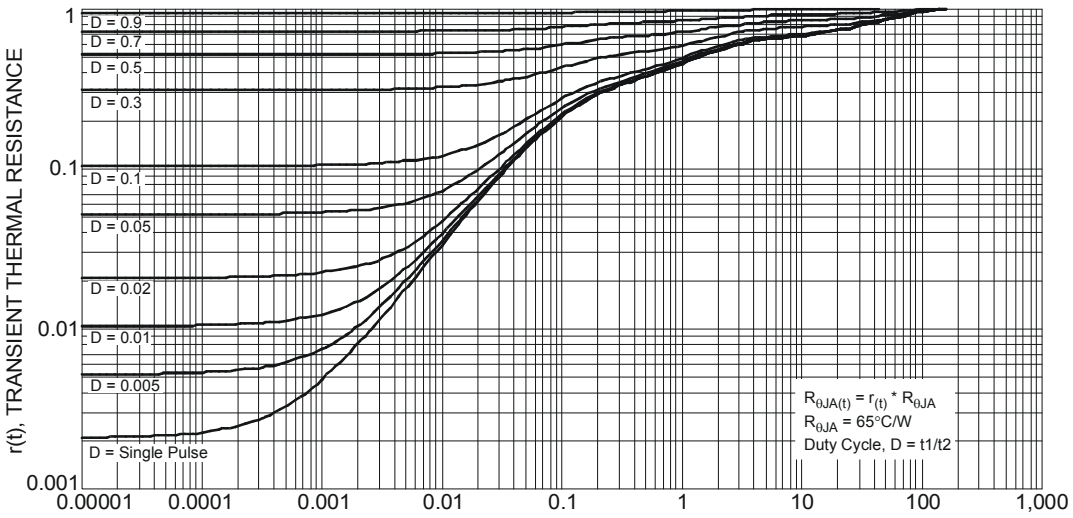
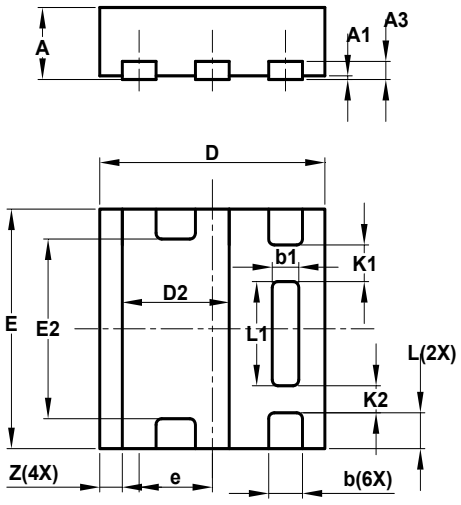


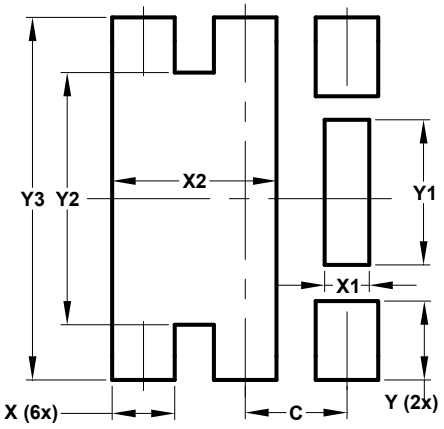
Fig. 12 Transient Thermal Resistance

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

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