

Product Summary

$V_{(BR)DSS}$	$R_{DS(ON)}$ max	I_D max $T_A = 25^\circ\text{C}$
20V	11m Ω @ $V_{GS} = 4.5\text{V}$	10.5A
	13m Ω @ $V_{GS} = 2.5\text{V}$	9.4A

Description and Applications

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.

- General Purpose Interfacing Switch
- Power Management Functions

Features and Benefits

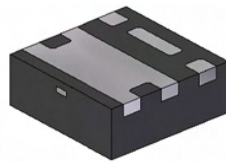
- 0.6mm profile – ideal for low profile applications
- PCB footprint of 4mm²
- Low Gate Threshold Voltage
- ESD Protected Gate
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **Qualified to AEC-Q101 Standards for High Reliability**

Mechanical Data

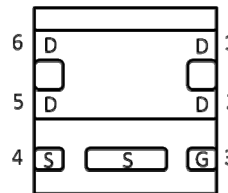
- Case: U-DFN2020-6 Type E
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish – NiPdAu over Copper leadframe. Solderable per MIL-STD-202, Method 208
- Weight: 0.0065 grams (approximate)



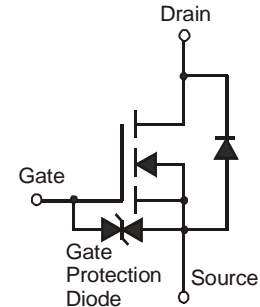
U-DFN2020-6 Type E



Bottom View



Pin Out



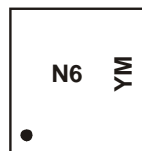
Equivalent Circuit

Ordering Information (Note 4)

Part Number	Marking	Reel size (inches)	Quantity per reel
DMN2013UFDE-7	N6	7	3,000
DMN2013UFDE-13	N6	13	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> 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 <http://www.diodes.com>.

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 @ $T_A = 25^\circ\text{C}$ 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 6) $V_{GS} = 4.5\text{V}$	Steady State	$T_A = 25^\circ\text{C}$ $T_A = 70^\circ\text{C}$	I_D	10.5 8.5	A
	$t < 10\text{s}$	$T_A = 25^\circ\text{C}$ $T_A = 70^\circ\text{C}$	I_D	12.5 10.0	A
Continuous Drain Current (Note 6) $V_{GS} = 2.5\text{V}$	Steady State	$T_A = 25^\circ\text{C}$ $T_A = 70^\circ\text{C}$	I_D	9.4 7.5	A
	$t < 10\text{s}$	$T_A = 25^\circ\text{C}$ $T_A = 70^\circ\text{C}$	I_D	11.2 8.8	A
Pulsed Drain Current (10 μs pulse, duty cycle = 1%)			I_{DM}	80	A
Maximum Body Diode Continuous Current			I_S	2.5	A

Thermal Characteristics @ $T_A = 25^\circ\text{C}$ unless otherwise specified

Characteristic		Symbol	Value	Units
Total Power Dissipation (Note 5)	$T_A = 25^\circ\text{C}$	P_D	0.66	W
	$T_A = 70^\circ\text{C}$		0.42	
Thermal Resistance, Junction to Ambient (Note 5)	Steady state	$R_{\theta JA}$	189	$^\circ\text{C/W}$
	$t < 10\text{s}$		132	
Total Power Dissipation (Note 6)	$T_A = 25^\circ\text{C}$	P_D	2.03	W
	$T_A = 70^\circ\text{C}$		1.31	
Thermal Resistance, Junction to Ambient (Note 6)	Steady state	$R_{\theta JA}$	61	$^\circ\text{C/W}$
	$t < 10\text{s}$		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	$^\circ\text{C}$

Electrical Characteristics @ $T_A = 25^\circ\text{C}$ unless otherwise specified

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
OFF CHARACTERISTICS (Note 7)						
Drain-Source Breakdown Voltage	BV_{DSS}	20	-	-	V	$V_{GS} = 0\text{V}, I_D = 250\mu\text{A}$
Zero Gate Voltage Drain Current $T_J = 25^\circ\text{C}$	I_{DSS}	-	-	1	μA	$V_{DS} = 16\text{V}, V_{GS} = 0\text{V}$
Gate-Source Leakage	I_{GSS}	-	-	± 2	μA	$V_{GS} = \pm 8\text{V}, V_{DS} = 0\text{V}$
ON CHARACTERISTICS (Note 7)						
Gate Threshold Voltage	$V_{GS(th)}$	0.5	-	1.1	V	$V_{DS} = V_{GS}, I_D = 250\mu\text{A}$
Static Drain-Source On-Resistance	$R_{DS(on)}$	-	8.4	11	$\text{m}\Omega$	$V_{GS} = 4.5\text{V}, I_D = 8.5\text{A}$
			9.8	13		$V_{GS} = 2.5\text{V}, I_D = 8.5\text{A}$
Forward Transfer Admittance	$ Y_{fs} $	-	10	-	S	$V_{DS} = 5\text{V}, I_D = 4\text{A}$
Diode Forward Voltage	V_{SD}	-	-	1.2	V	$V_{GS} = 0\text{V}, I_S = 8.5\text{A}$
DYNAMIC CHARACTERISTICS (Note 8)						
Input Capacitance	C_{iss}	-	2453	-	pF	$V_{DS} = 10\text{V}, V_{GS} = 0\text{V}, f = 1.0\text{MHz}$
Output Capacitance	C_{oss}	-	275	-	pF	
Reverse Transfer Capacitance	C_{rss}	-	257	-	pF	
Gate Resistance	R_g	-	1.2	-	Ω	$V_{DS} = 0\text{V}, V_{GS} = 0\text{V}, f = 1\text{MHz}$
Total Gate Charge ($V_{GS} = 4.5\text{V}$)	Q_g	-	14.3	-	nC	$V_{DS} = 10\text{V}, I_D = 8.5\text{A}$
Total Gate Charge ($V_{GS} = 8\text{V}$)	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	$V_{DS} = 10\text{V}, I_D = 8.5\text{A}$ $V_{GS} = 4.5\text{V}, R_G = 1.8\Omega$
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:
- 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 1inch square copper plate
 - Short duration pulse test used to minimize self-heating effect
 - Guaranteed by design. Not subject to production testing

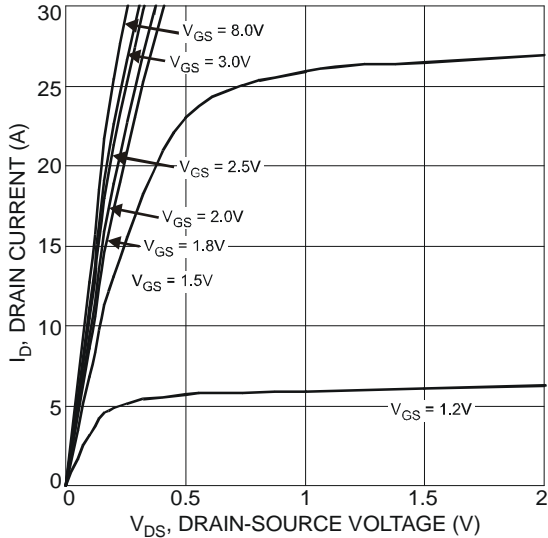


Fig. 1 Typical Output Characteristic

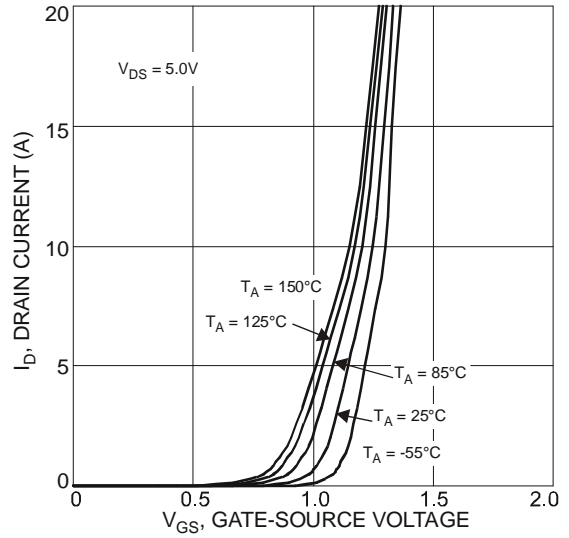


Fig. 2 Typical Transfer Characteristics

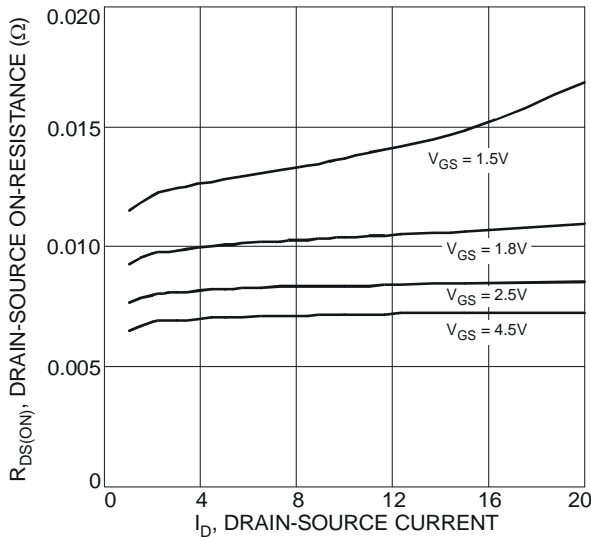


Fig. 3 Typical On-Resistance vs. Drain Current and Gate Voltage

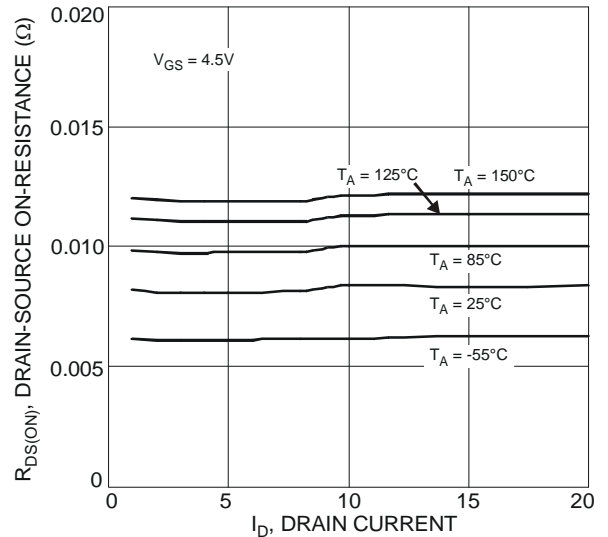


Fig. 4 Typical On-Resistance vs. Drain Current and Temperature

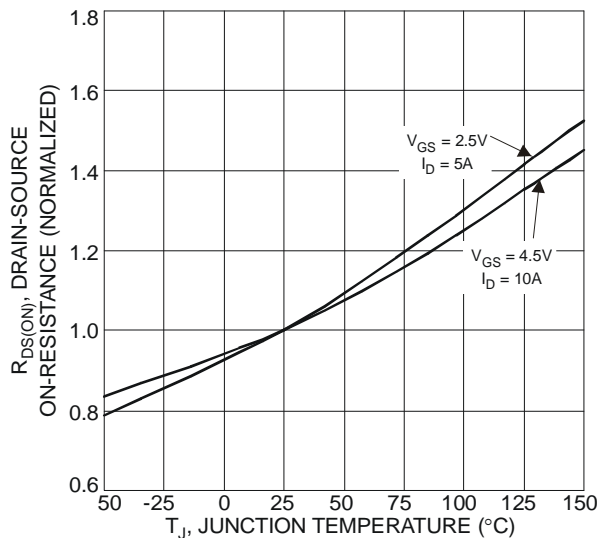


Fig. 5 On-Resistance Variation with Temperature

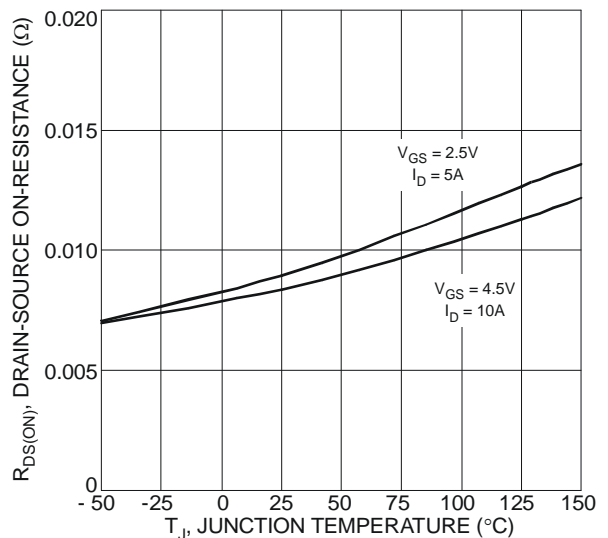


Fig. 6 On-Resistance Variation with Temperature

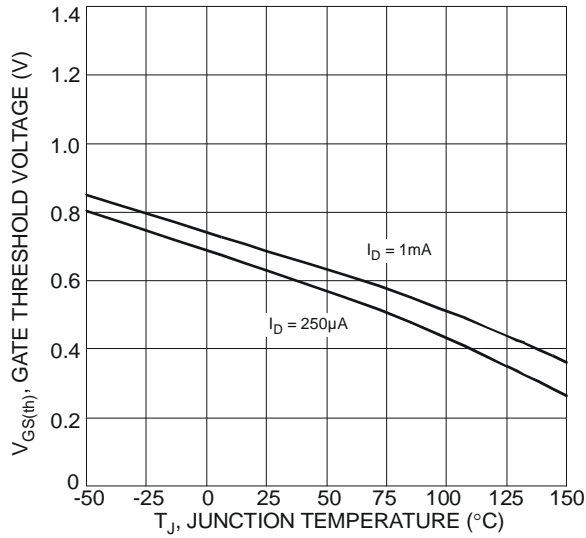


Fig. 7 Gate Threshold Variation vs. Ambient Temperature

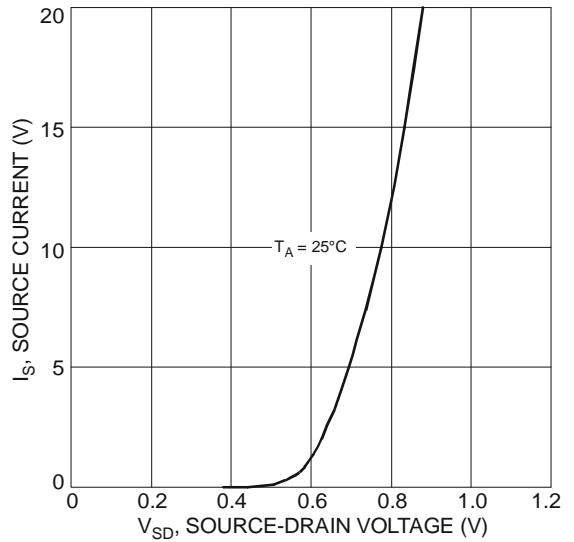


Fig. 8 Diode Forward Voltage vs. Current

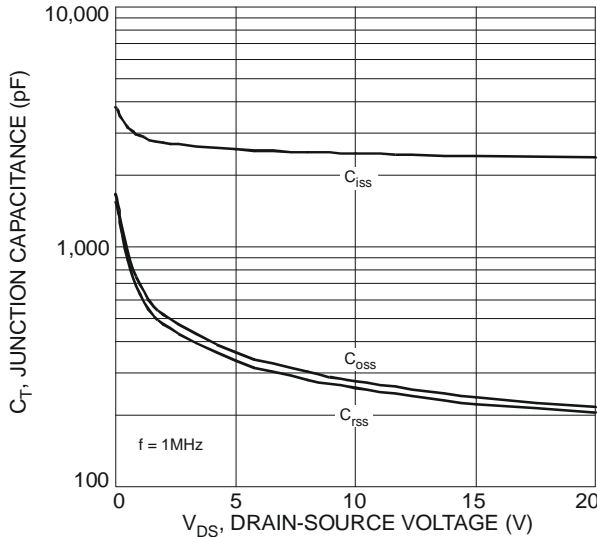


Fig. 9 Typical Junction Capacitance

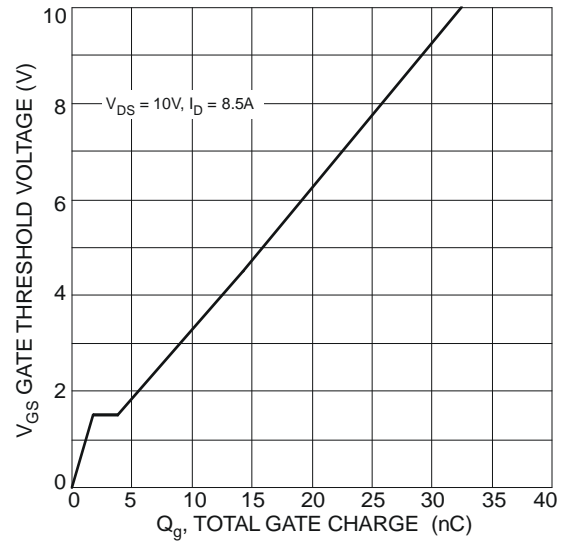


Fig. 10 Gate Charge

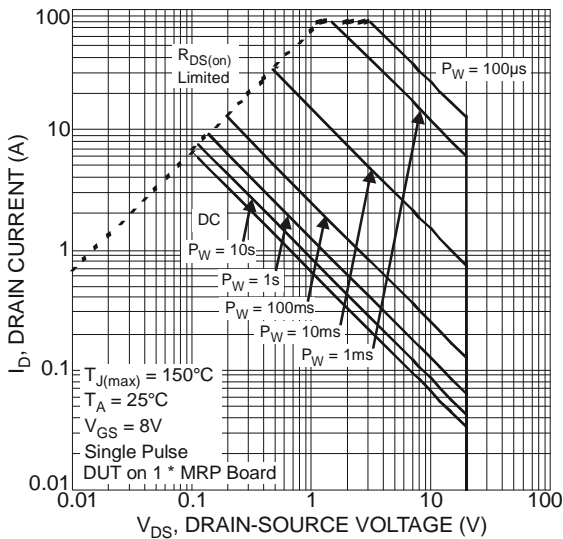


Fig. 11 SOA, Safe Operation Area

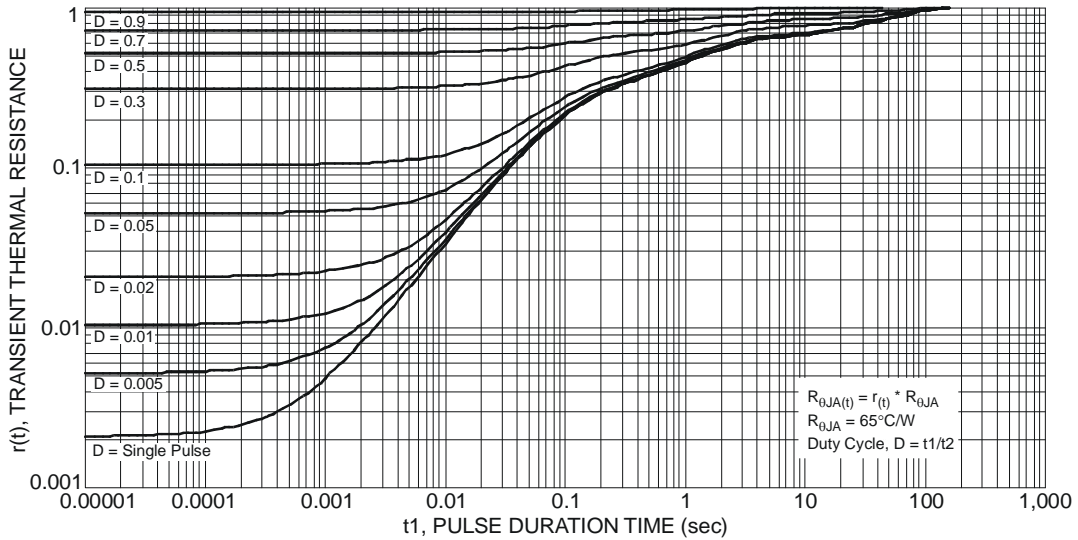
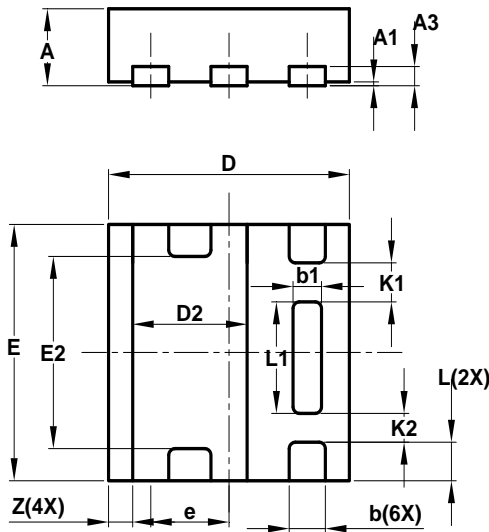


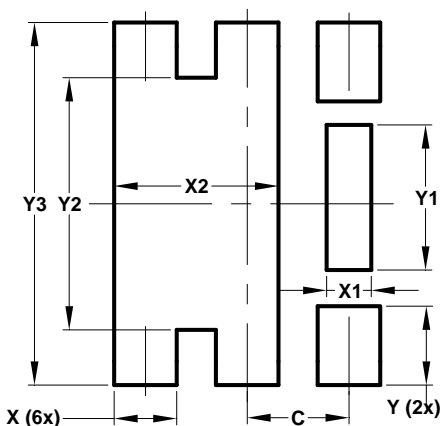
Fig. 12 Transient Thermal Resistance

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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