12V P-CHANNEL ENHANCEMENT MODE MOSFET

Product Summary

$V_{(BR)DSS}$	$R_{DS(ON)}$ max	I_D max $T_A = 25°C$
-12V	16mΩ @ V_{GS} = -4.5V	-9.1A
	21.5mΩ @ V_{GS} = -2.5V	-7.9A
	26mΩ @ V_{GS} = -1.8V	-7.0A
	32mΩ @ V_{GS} = -1.5V	-6.3A

Description

This MOSFET has been designed specifically for use in battery management applications.

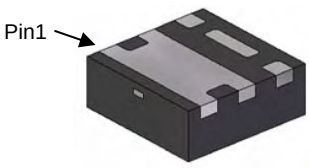
Features

- 0.6mm profile – ideal for low profile applications
- PCB footprint of 4mm^2
- Low Gate Threshold Voltage
- Fast Switching Speed
- ESD Protected to 3KV
- **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

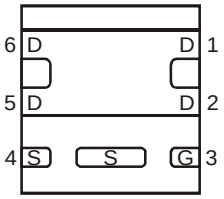
- Case: U-DFN2020-6 Type E
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish – NiPdAu over Copper leadframe. Solderable per MIL-STD-202, Method 208
- Weight: 0.0065 grams (approximate)

U-DFN2020-6
Type E

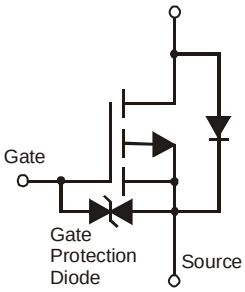


ESD PROTECTED

Bottom View



Pin Out
Bottom View



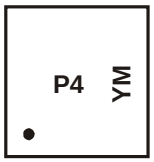
Internal Schematic

Ordering Information (Note 4)

Part Number	Marking	Reel size (inches)	Quantity per reel
DMP1022UFDE-7	P4	7	3,000

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



P4 = 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

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

Characteristic			Symbol	Value	Units
Drain-Source Voltage			V_{DSS}	-12	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	-9.1 -7.2	A
	t<5s	T_A = +25°C T_A = +70°C	I_D	-11.2 -9.0	A
Pulsed Drain Current (10µs pulse, duty cycle = 1%)			I_{DM}	-90	A
Continuous Source-Drain Diode Current		T_A = +25°C T_C = +25°C	I_S	-2.5 -7.1	A
Pulsed Source-Drain Diode Current (10µs pulse, duty cycle = 1%)			I_{SM}	-50	A

Thermal Characteristics

Characteristic		Symbol	Value	Units
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<5s		123	
Total Power Dissipation (Note 6)	T_A = +25°C	P_D	2.03	W
	T_A = +70°C		1.3	
Thermal Resistance, Junction to Ambient (Note 6)	Steady state	$R_{\theta JA}$	61	°C/W
	t<5s		40	
Thermal Resistance, Junction to Case (Note 6)	Steady state	$R_{\theta JC}$	9.3	
Operating and Storage Temperature Range		T_J, T_{STG}	-55 to +150	°C

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 vias to bottom layer 1inch square copper plate

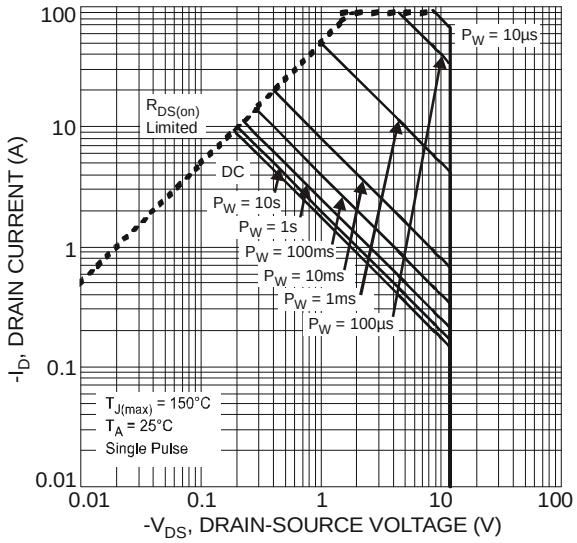

Fig. 1 SOA, Safe Operation Area

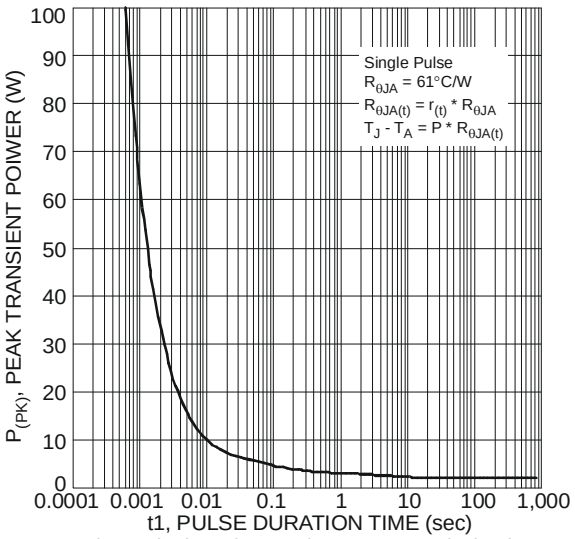

Fig. 2 Single Pulse Maximum Power Dissipation

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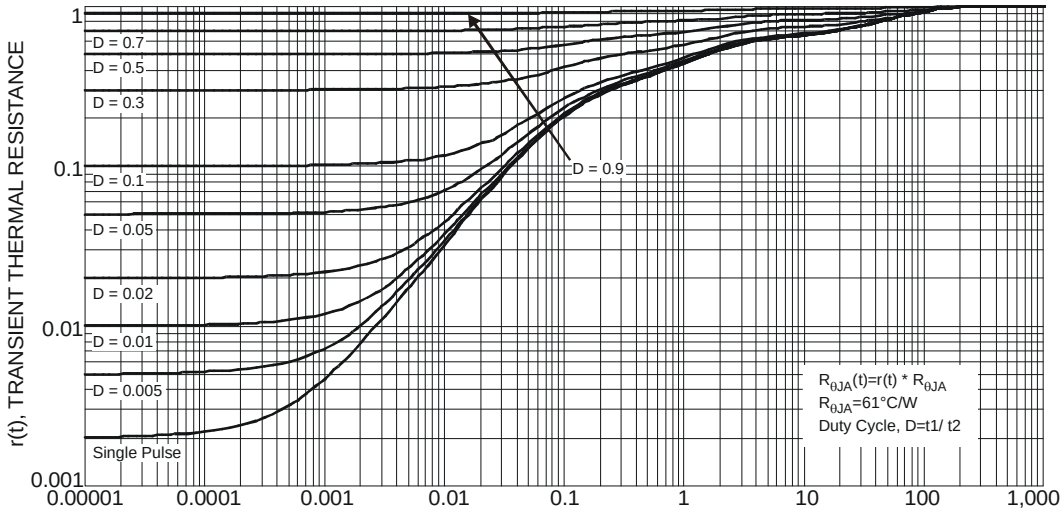

Fig. 3 Transient Thermal Resistance

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}	-12	—	—	V	V_{GS} = 0V, I_D = -250μA
Zero Gate Voltage Drain Current T_J = +25°C	I_{DSS}	—	—	-1	μA	V_{DS} = -12V, V_{GS} = 0V
Gate-Source Leakage	I_{GSS}	—	—	±2	μA	V_{GS} = ±5V, V_{DS} = 0V
ON CHARACTERISTICS (Note 7)						
Gate Threshold Voltage	$V_{GS(th)}$	-0.35	—	-0.8	V	V_{DS} = V_{GS}, I_D = -250μA
$V_{GS(th)}$Temperature Coefficient	$\Delta V_{GS(th)}/\Delta T_J$	-	2.5	—	mV/°C	I_D = -250μA
On-State Drain Current	$I_{D(ON)}$	-10	—	—	A	V_{GS} = -4.5V, V_{DS} < -5A
Static Drain-Source On-Resistance	$R_{DS\ (ON)}$	—	12	16	mΩ	V_{GS} = -4.5V, I_D = -8.2A
			15	21.5		V_{GS} = -2.5V, I_D = -7.2A
			20	26		V_{GS} = -1.8V, I_D = -6.6A
			23	32		V_{GS} = -1.5V, I_D = -1A
			46	95		V_{GS} = -1.2V, I_D = -1A
Forward Transfer Admittance	$\|Y_{fs}\|$	—	12	-	S	V_{DS} = -4V, I_D = -8.2A
Diode Forward Voltage	V_{SD}	—	-0.8	-1.2	V	V_{GS} = 0V, I_S = -8A
DYNAMIC CHARACTERISTICS (Note 8)						
Input Capacitance	C_{iss}	—	2953	—	pF	V_{DS} = -4V, V_{GS} = 0V, f = 1.0MHz
Output Capacitance	C_{oss}	—	756	—		
Reverse Transfer Capacitance	C_{rss}	—	678	—		
Gate Resistance	R_g	—	8.6	18	Ω	V_{DS} = 0V, V_{GS} = 0V, f = 1MHz
Total Gate Charge	Q_g	—	28.4	42.6	nC	V_{GS} = -5V, V_{DS} = -4, I_D = -10A
Total Gate Charge	Q_g	—	25.3	38		V_{GS} = -4.5V, V_{DS} = -4V, I_D = -10A
Gate-Source Charge	Q_{gs}	—	2.3	—		
Gate-Drain Charge	Q_{gd}	—	7.2	—		
Turn-On Delay Time	$t_{D(on)}$	—	20	30	ns	V_{DS} = -4V, V_{GS} = -4.5V, R_G = 1Ω, R_L = 0.4Ω, I_D = -9.8A
Turn-On Rise Time	t_r	—	28	42		
Turn-Off Delay Time	$t_{D(off)}$	—	117	176		
Turn-Off Fall Time	t_f	—	93	139		
BODY DIODE CHARACTERISTICS						
Diode Forward Voltage	V_{SD}	—	-0.8	-1.2	V	V_{GS} = 0V, I_S = -9.8A
Continuous Source-Drain Diode Current (Note 6)	I_S	—	—	-2.5	A	T_A = +25°C
		—	—	-7.1		T_C = +25°C
Pulse Diode Forward Current (Note 8)	I_{SM}	—	—	-50		—
Bodyy Diode Reverse Recovery Time (Note 8)	t_{rr}	—	28	56	ns	I_S = -9.8A, dI/dt = 100A/μs
Reverse Recovery Fall Time	t_a	—	10	—		
Reverse Recovery Rise Time	t_b	—	18	—		
Body Diode Reverse Recovery Charge (Note 8)	Q_{rr}	—	13	26	nC	

Notes: 7. Short duration pulse test used to minimize self-heating effect
8. Guaranteed by design. Not subject to production testing

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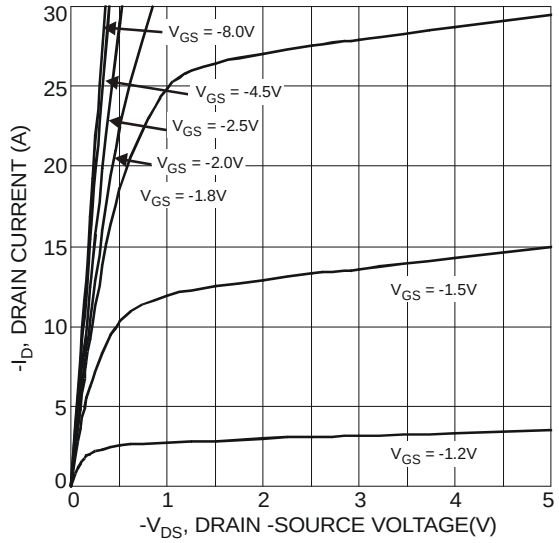

Fig. 4 Typical Output Characteristics

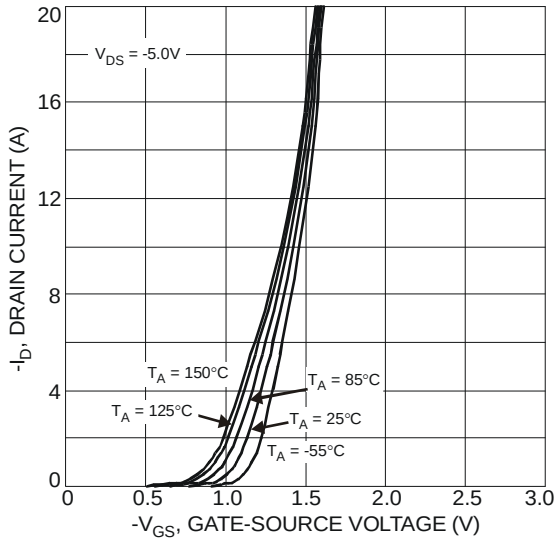

Fig. 5 Typical Transfer Characteristics

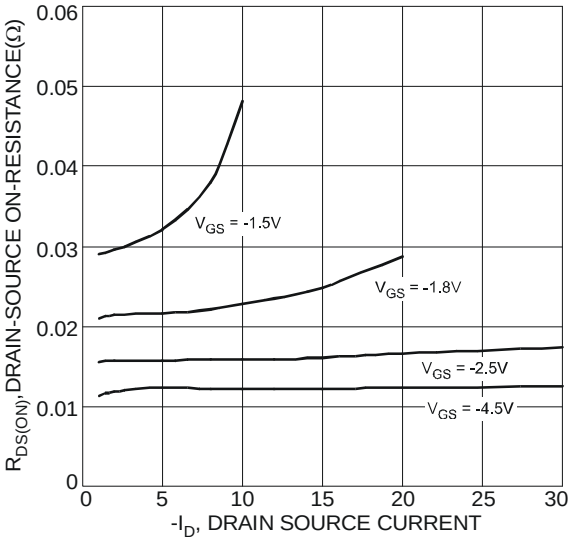

Fig. 6 Typical On-Resistance vs. Drain Current and Gate Voltage

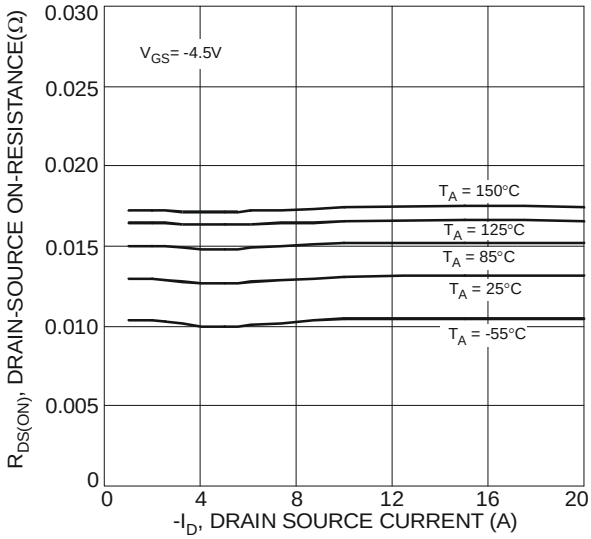

Fig. 7 Typical On-Resistance vs. Drain Current and Temperature

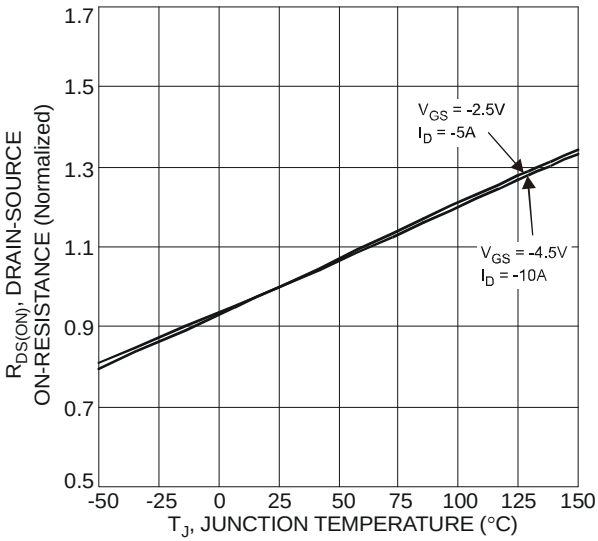

Fig. 8 On-Resistance Variation with Temperature

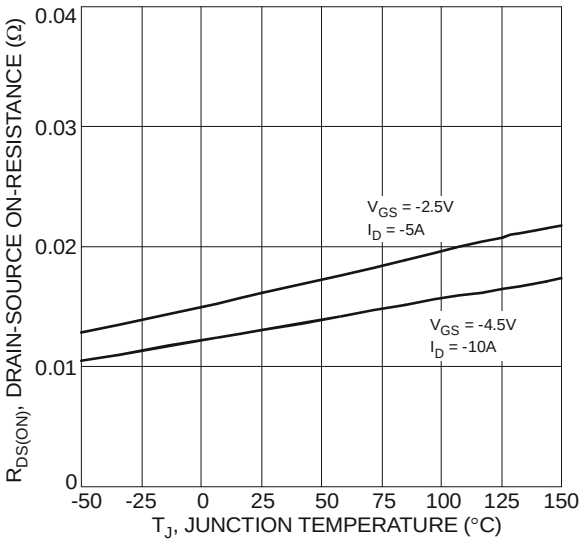

Fig. 9 On-Resistance Variation with Temperature

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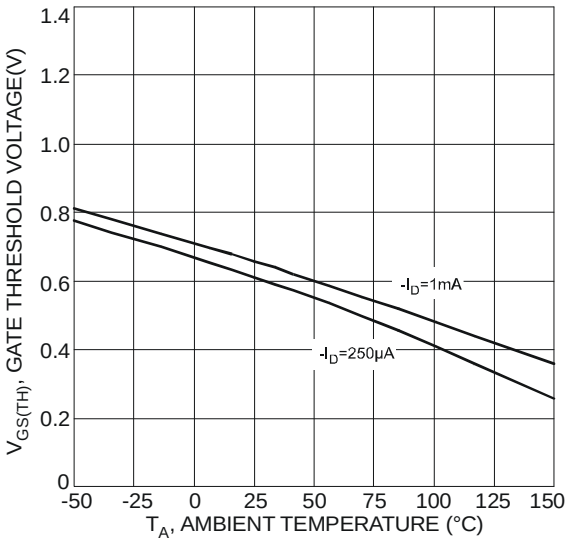

Fig. 10 Gate Threshold Variation vs. Ambient Temperature

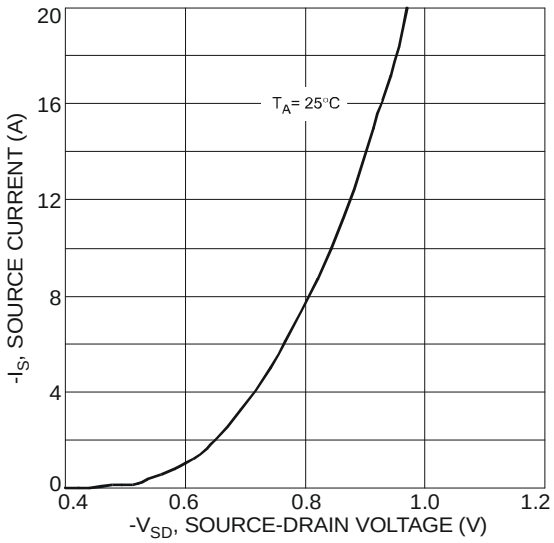

Fig. 11 Diode Forward Voltage vs. Current

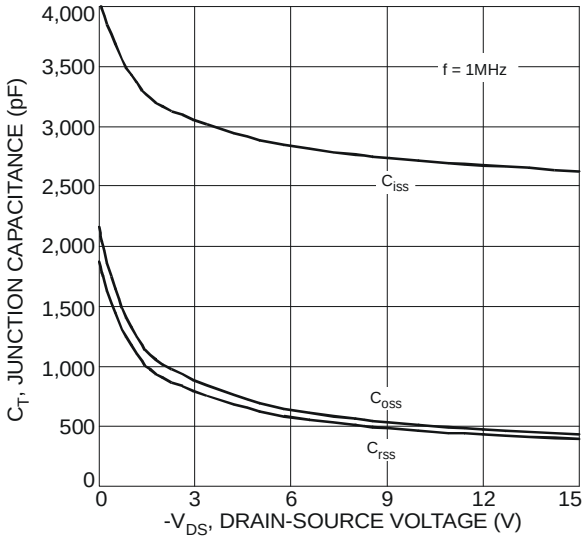

Fig. 12 Typical Junction Capacitance

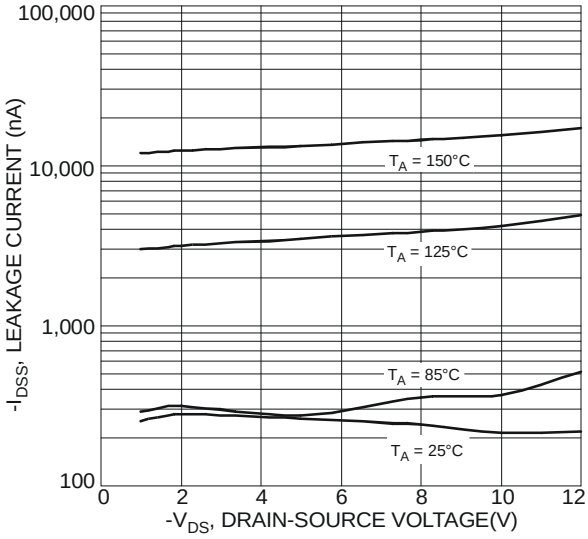

Fig. 13 Typical Drain-Source Leakage Current vs. Voltage

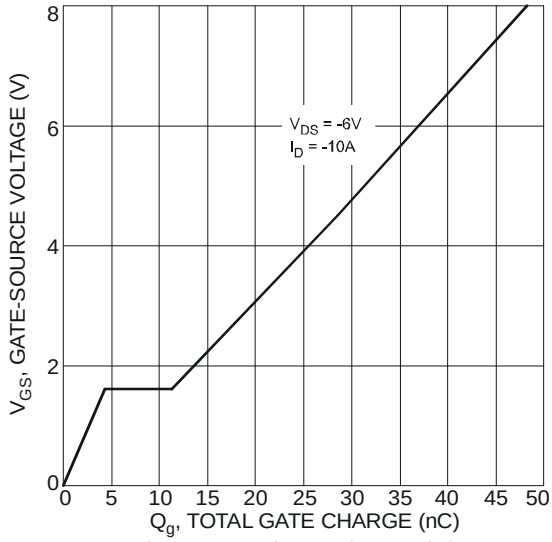

Fig. 14 Gate-Charge Characteristics

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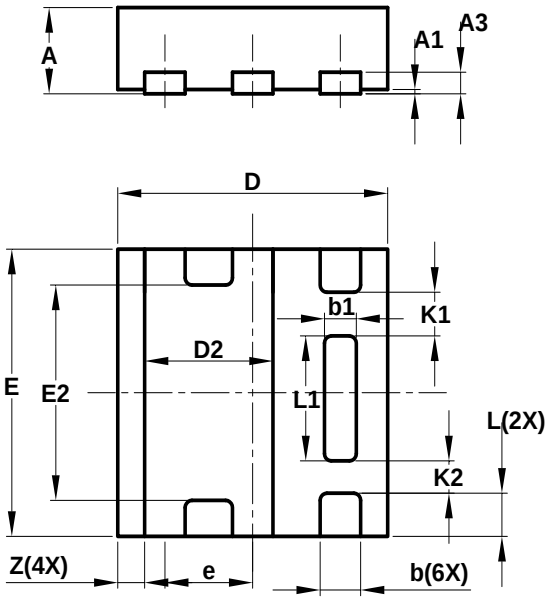
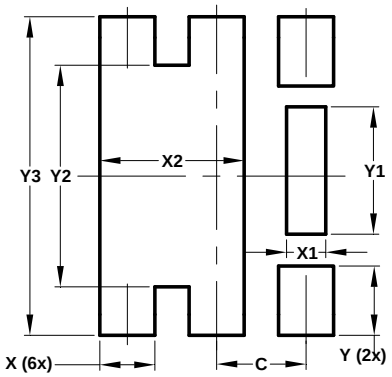
Package Outline Dimensions



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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