

COMPLEMENTARY PAIR ENHANCEMENT MODE MOSFET
Product Summary

Device	BV _{bss}	R _{DS(ON)} Max	I _D Max T _A = +25°C
Q1 N-Channel	20V	35mΩ @ V _{GS} = 4.5V	4.6A
		43mΩ @ V _{GS} = 2.5V	4.1A
Q2 P-Channel	-20V	75mΩ @ V _{GS} = -4.5V	-3.1A
		110mΩ @ V _{GS} = -2.5V	-2.6A

Features

- PCB Footprint of 4mm²
- Low On-Resistance
- Low Input Capacitance
- Low Profile, 0.6mm Maximum Height
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen- and Antimony-Free. "Green" Device (Note 3)**
- **The DMC2053UFDBQ is suitable for automotive applications requiring specific change control; This part is AEC-Q101 qualified, PPAP capable, and manufactured in IATF 16949 certified facilities.**

<https://www.diodes.com/quality/product-definitions/>

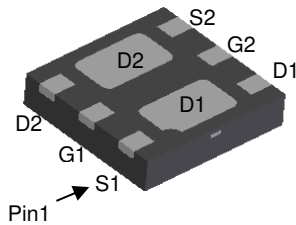
Description and Applications

This MOSFET is designed to minimize the on-state resistance (R_{DS(ON)}) yet maintain superior switching performance, which makes it ideal for high-efficiency power management applications.

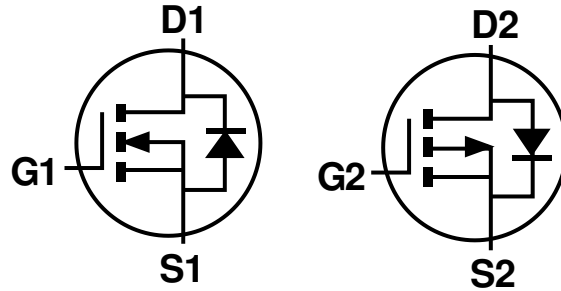
- Load switches
- Power management functions
- Portable power adaptors

Mechanical Data

- Package: U-DFN2020-6
- Package 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 Lead-Frame. Solderable per MIL-STD-202, Method 208 ⁽⁴⁾
- Terminals Connections: See Diagram Below
- Weight: 0.0065 grams (Approximate)

U-DFN2020-6 (Type B)


Bottom View



N-Channel MOSFET

P-Channel MOSFET

Internal Schematic

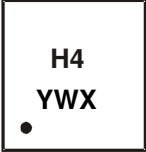
Ordering Information (Note 4)

Part Number	Package	Packing	
		Qty.	Carrier
DMC2053UFDBQ-7	U-DFN2020-6 (Type B)	3,000	Tape & Reel
DMC2053UFDBQ-13	U-DFN2020-6 (Type B)	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 <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/>.

Marking Information

U-DFN2020-6 (Type B)



H4 = Product Type Marking Code
 YWX = Date Code Marking
 Y = Year (ex: 3 = 2023)
 W = Week (ex: a = Week 27; z Represents Week 52 and 53)
 X = Internal Code (ex: U = Monday)

Date Code Key

Year	2020	-	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Code	0	-	3	4	5	6	7	8	9	0	1	2

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

Maximum Ratings (@ $T_A = +25^\circ\text{C}$, unless otherwise specified.)

Characteristic			Symbol	Q1 N-CHANNEL	Q2 P-CHANNEL	Unit
Drain-Source Voltage			V_{DSS}	20	-20	V
Gate-Source Voltage			V_{GSS}	± 12	± 12	V
Continuous Drain Current (Note 6) $V_{GS} = 4.5\text{V}$	Steady State	$T_A = +25^\circ\text{C}$	I_D	4.6	-3.1	A
		$T_A = +70^\circ\text{C}$		3.7	-2.5	
Maximum Continuous Body Diode Forward Current (Note 6)			I_S	1.1	-1.05	A
Pulsed Drain Current (10 μs Pulse, Duty Cycle = 1%)			I_{DM}	24	-15	A

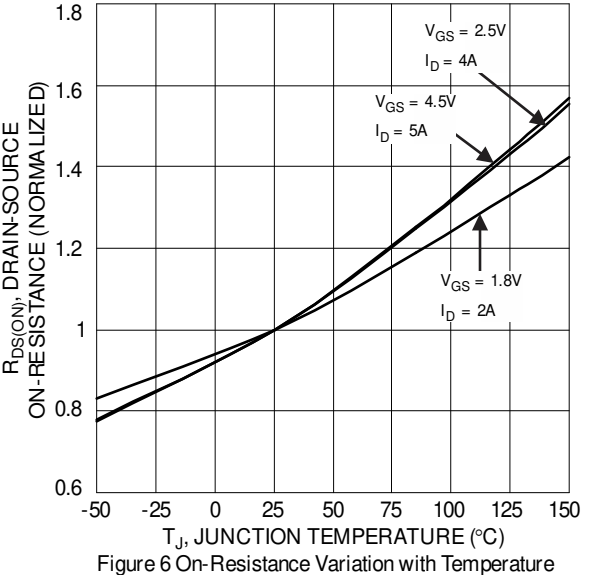
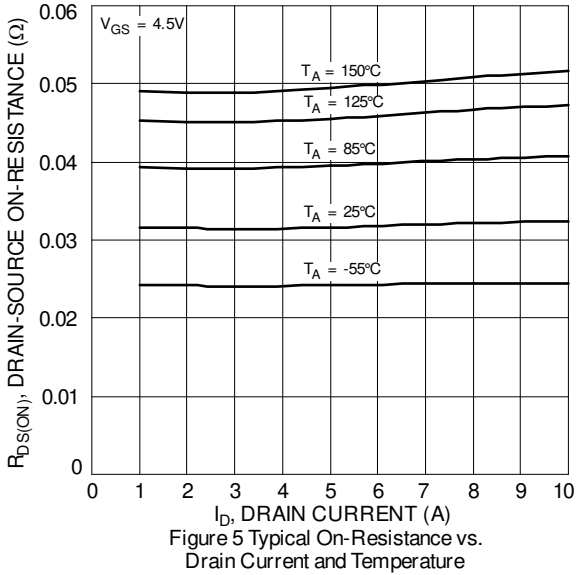
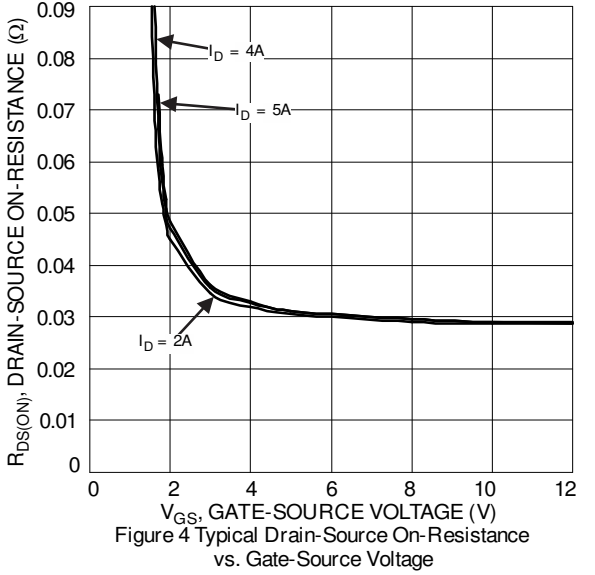
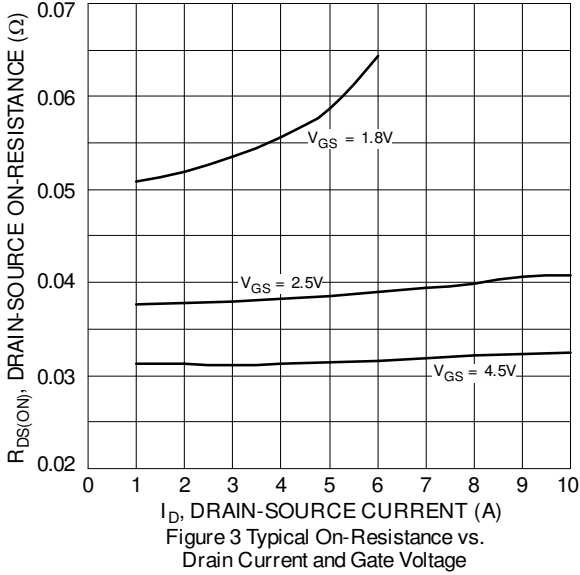
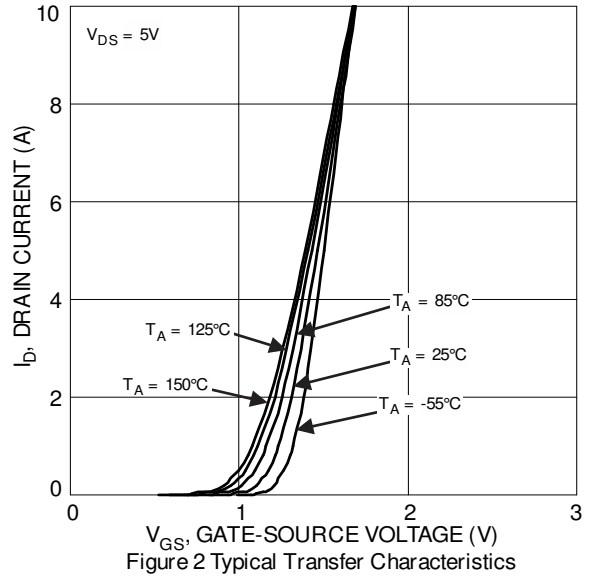
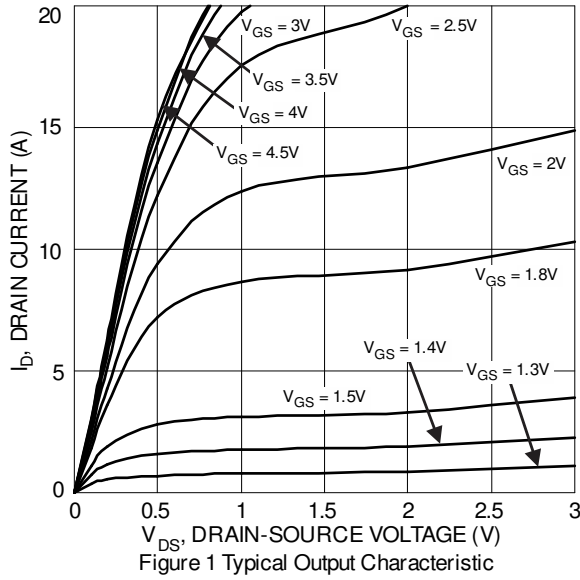
Thermal Characteristics

Characteristic	Symbol	Value	Unit
Total Power Dissipation (Note 5)	$T_A = +25^\circ\text{C}$ P_D	0.82	W
Thermal Resistance, Junction to Ambient (Note 5)	Steady State $R_{\theta JA}$	153	$^\circ\text{C/W}$
Total Power Dissipation (Note 6)	$T_A = +25^\circ\text{C}$ P_D	1.14	W
Thermal Resistance, Junction to Ambient (Note 6)	Steady State $R_{\theta JA}$	110	$^\circ\text{C/W}$
Operating and Storage Temperature Range		T_J, T_{STG}	-55 to +150 $^\circ\text{C}$

Electrical Characteristics Q1 N-CHANNEL (@ $T_A = +25^\circ\text{C}$, 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}	—	—	1.0	μA	$V_{DS} = 20\text{V}, V_{GS} = 0\text{V}$
Gate-Source Leakage	I_{GSS}	—	—	± 100	nA	$V_{GS} = \pm 12\text{V}, V_{DS} = 0\text{V}$
ON CHARACTERISTICS (Note 7)						
Gate Threshold Voltage	$V_{GS(TH)}$	0.4	—	1.0	V	$V_{DS} = V_{GS}, I_D = 250\mu\text{A}$
Static Drain-Source On-Resistance	$R_{DS(ON)}$	—	24	35	m Ω	$V_{GS} = 4.5\text{V}, I_D = 5\text{A}$
			30	43		$V_{GS} = 2.5\text{V}, I_D = 4\text{A}$
			44	56		$V_{GS} = 1.8\text{V}, I_D = 2\text{A}$
Diode Forward Voltage	V_{SD}	—	0.7	1.2	V	$V_{GS} = 0\text{V}, I_S = 1\text{A}$
DYNAMIC CHARACTERISTICS (Note 8)						
Input Capacitance	C_{iss}	—	369	—	pF	$V_{DS} = 10\text{V}, V_{GS} = 0\text{V}, f = 1.0\text{MHz}$
Output Capacitance	C_{oss}	—	54	—		
Reverse Transfer Capacitance	C_{rss}	—	32	—		
Gate Resistance	R_g	—	4.1	—	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	—	3.6	—	nC	$V_{DS} = 10\text{V}, I_D = 6\text{A}$
Total Gate Charge ($V_{GS} = 10\text{V}$)	Q_g	—	7.7	—		
Gate-Source Charge	Q_{gs}	—	0.4	—		
Gate-Drain Charge	Q_{gd}	—	1.0	—		
Turn-On Delay Time	$t_{D(ON)}$	—	2.6	—	ns	$V_{DS} = 10\text{V}, V_{GS} = 4.5\text{V}, R_g = 6\Omega, R_L = 10\Omega, I_D = 6\text{A}$
Turn-On Rise Time	t_r	—	3.0	—		
Turn-Off Delay Time	$t_{D(OFF)}$	—	12.5	—		
Turn-Off Fall Time	t_f	—	3.6	—		
Reverse Recovery Time	t_{RR}	—	6.0	—	ns	$I_F = 1\text{A}, di/dt = 100\text{A}/\mu\text{s}$
Reverse Recovery Charge	Q_{RR}	—	0.9	—	nC	$I_F = 1\text{A}, di/dt = 100\text{A}/\mu\text{s}$

- Notes:
- Device mounted on FR-4 substrate PCB, 2oz copper, with minimum recommended pad layout.
 - Device mounted on FR-4 substrate PCB, 2oz copper, with 1 inch square copper plate.
 - Short duration pulse test used to minimize self-heating effect.
 - Guaranteed by design. Not subject to product testing.



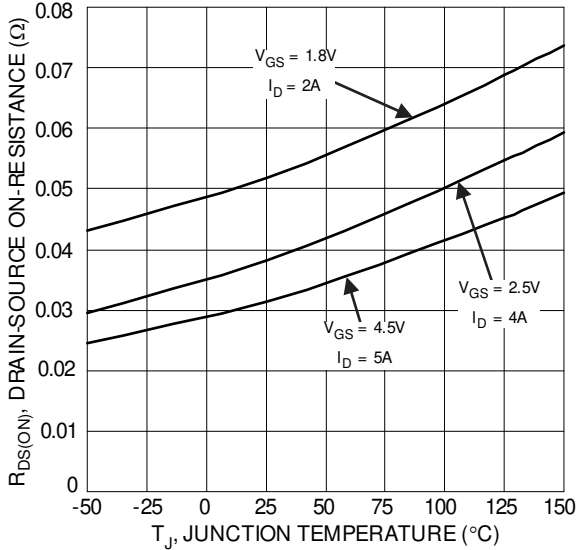


Figure 7 On-Resistance Variation with Temperature

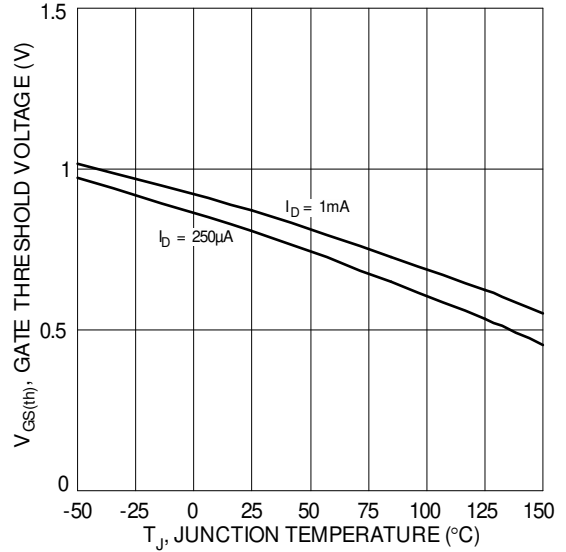


Figure 8 Gate Threshold Variation vs. Junction Temperature

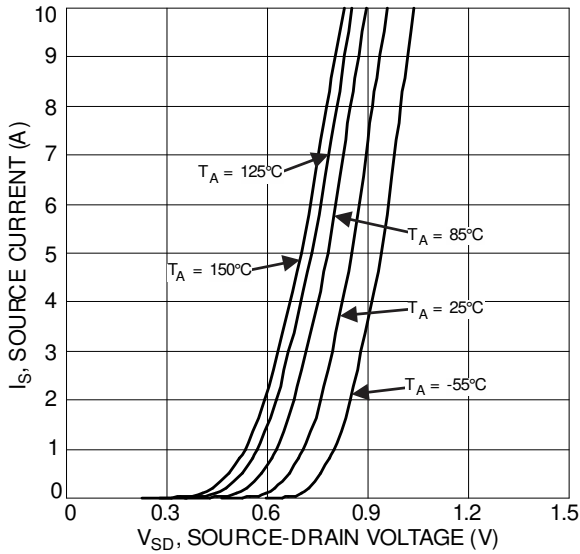


Figure 9 Diode Forward Voltage vs. Current

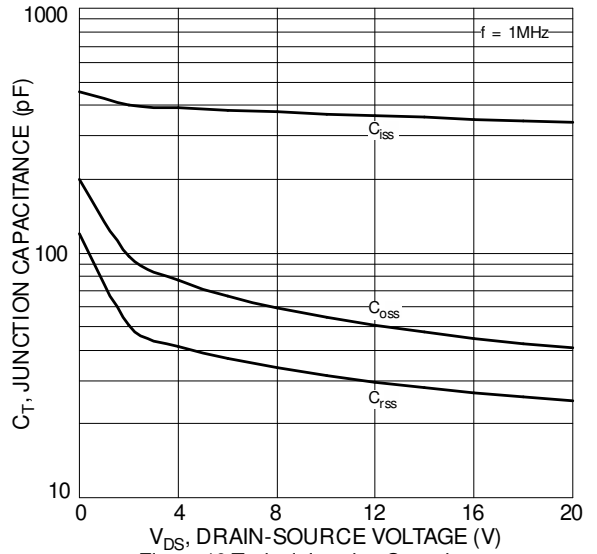


Figure 10 Typical Junction Capacitance

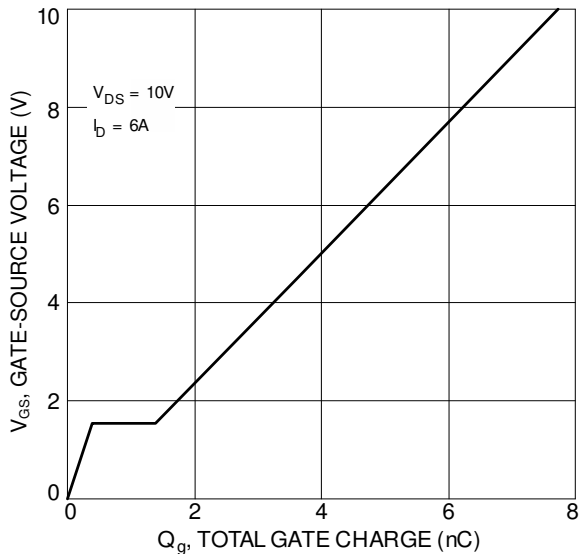


Figure 11 Gate Charge

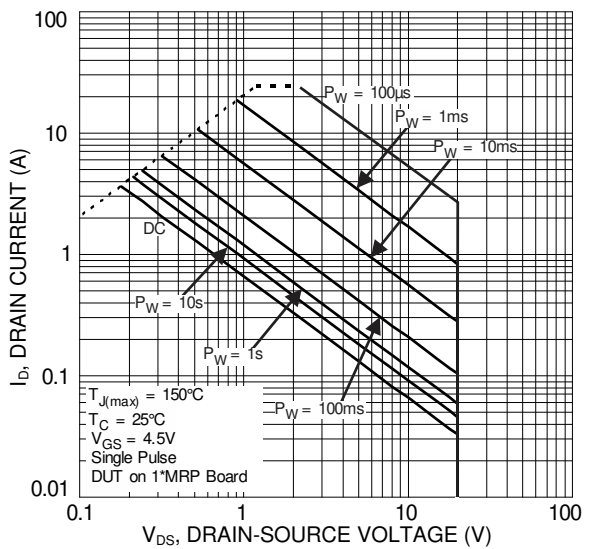
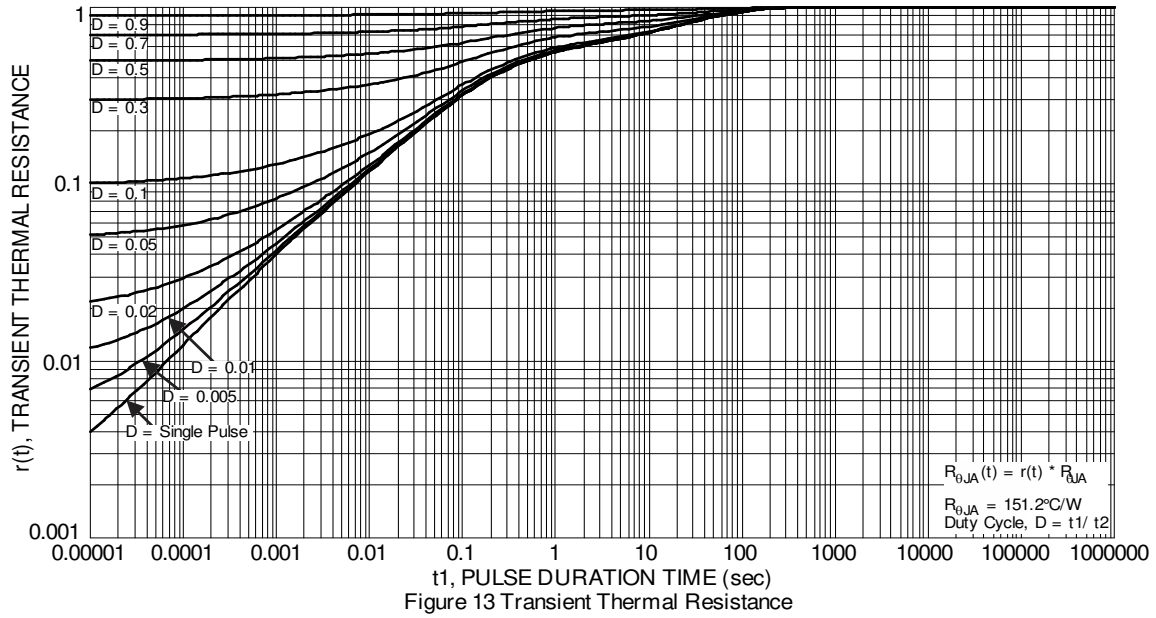


Figure 12 SOA, Safe Operation Area



Electrical Characteristics Q2 P-CHANNEL (@ 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}	—	—	-1.0	μA	V _{DS} = -20V, V _{GS} = 0V
Gate-Source Leakage	I _{GSS}	—	—	±100	nA	V _{GS} = ±12V, V _{DS} = 0V
ON CHARACTERISTICS (Note 7)						
Gate Threshold Voltage	V _{GS(TH)}	-0.45	—	-1.0	V	V _{DS} = V _{GS} , I _D = -250μA
Static Drain-Source On-Resistance	R _{DS(ON)}	—	57	75	mΩ	V _{GS} = -4.5V, I _D = -3.5A
		—	73	110		V _{GS} = -2.5V, I _D = -3.0A
		—	105	168		V _{GS} = -1.8V, I _D = -2.0A
Diode Forward Voltage	V _{SD}	—	-0.7	-1.2	V	V _{GS} = 0V, I _S = -1.0A
DYNAMIC CHARACTERISTICS (Note 8)						
Input Capacitance	C _{iss}	—	440	—	pF	V _{DS} = -10V, V _{GS} = 0V, f = 1.0MHz
Output Capacitance	C _{oss}	—	60	—	pF	
Reverse Transfer Capacitance	C _{rss}	—	48	—	pF	
Gate Resistance	R _g	—	8.5	—	Ω	V _{DS} = 0V, V _{GS} = 0V, f = 1MHz
Total Gate Charge (V _{GS} = -4.5V)	Q _g	—	5.9	—	nC	V _{DS} = -4V, I _D = -3.5A
Total Gate Charge (V _{GS} = -8V)		—	12.7	—	nC	
Gate-Source Charge	Q _{gs}	—	0.6	—	nC	
Gate-Drain Charge	Q _{gd}	—	2.1	—	nC	
Turn-On Delay Time	t _{D(ON)}	—	3.2	—	ns	V _{DS} = -4V, V _{GS} = -4.5V, R _L = 4Ω, R _g = 6Ω
Turn-On Rise Time	t _R	—	7.8	—	ns	
Turn-Off Delay Time	t _{D(OFF)}	—	31	—	ns	
Turn-Off Fall Time	t _F	—	18	—	ns	
Body Diode Reverse Recovery Time	t _{RR}	—	10.5	—	ns	I _S = -2.0A, dI/dt = 100A/μs
Body Diode Reverse Recovery Charge	Q _{RR}	—	3.0	—	nC	I _S = -2.0A, dI/dt = 100A/μs

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

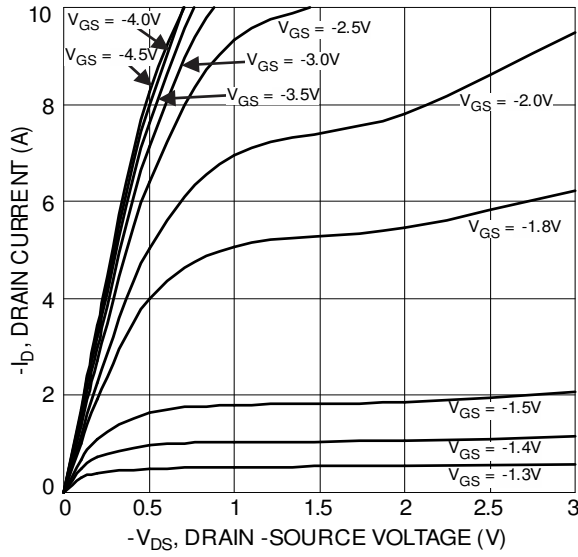


Figure 14 Typical Output Characteristics

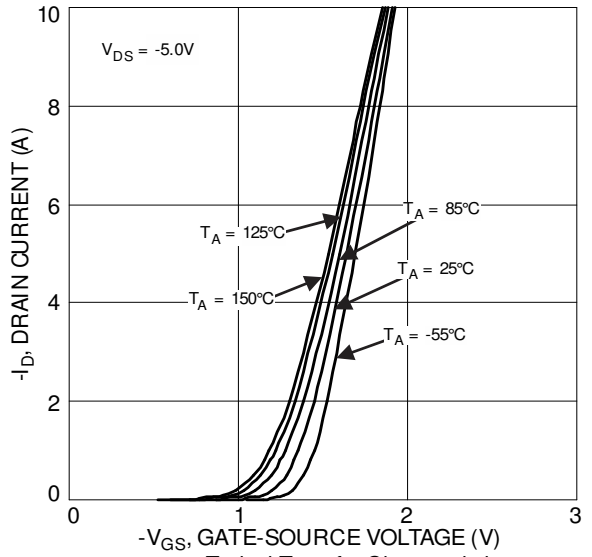


Figure 15 Typical Transfer Characteristics

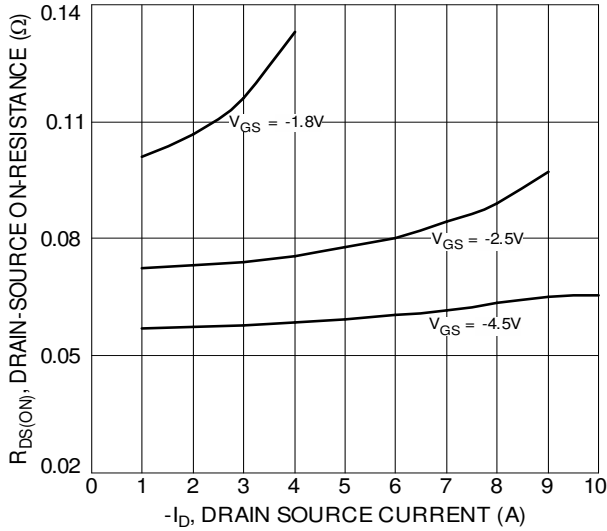


Figure 16 Typical On-Resistance vs. Drain Current and Gate Voltage

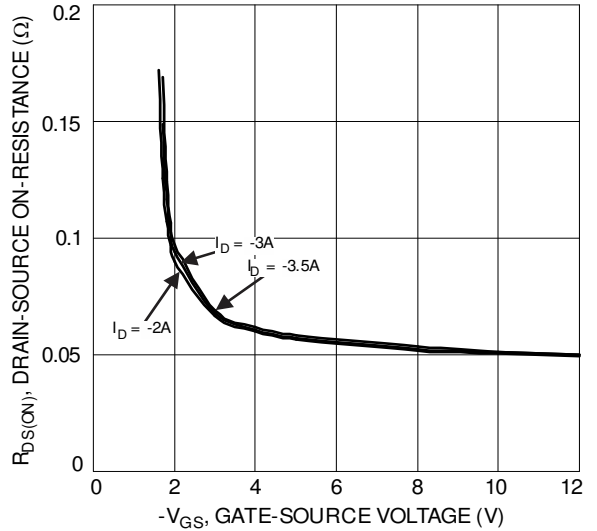


Figure 17 Typical Drain-Source On-Resistance vs. Gate-Source Voltage

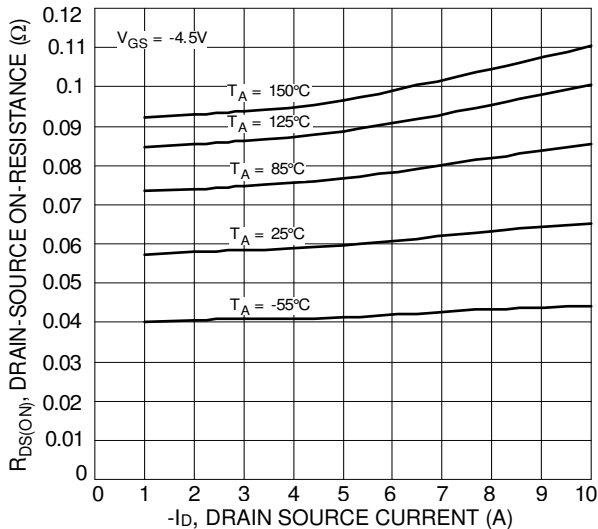


Figure 18 Typical On-Resistance vs. Drain Current and Temperature

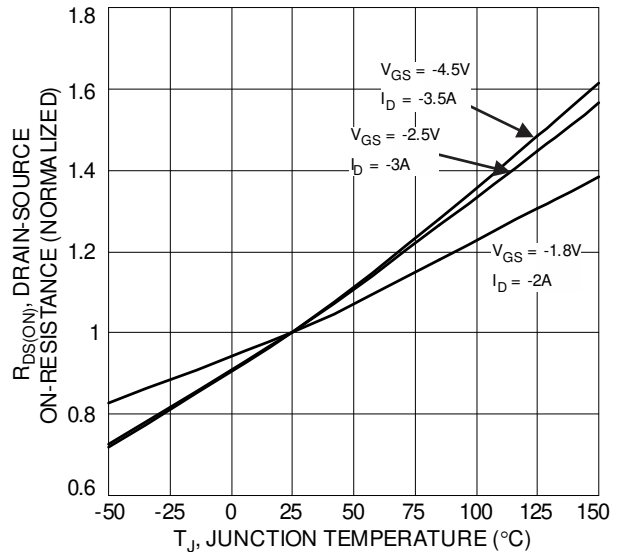


Figure 19 On-Resistance Variation with Temperature

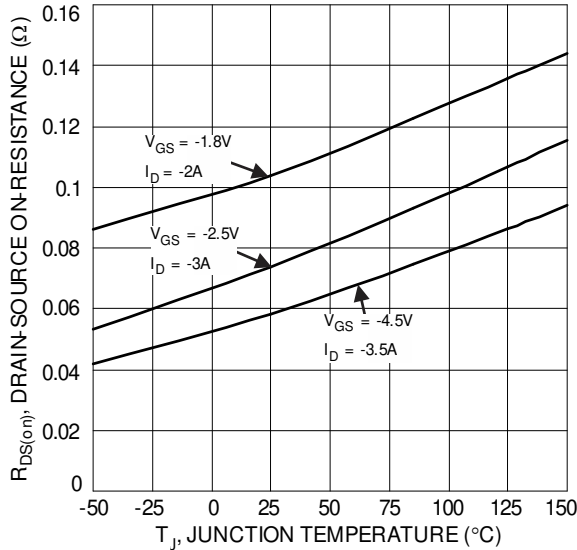


Figure 20 On-Resistance Variation with Temperature

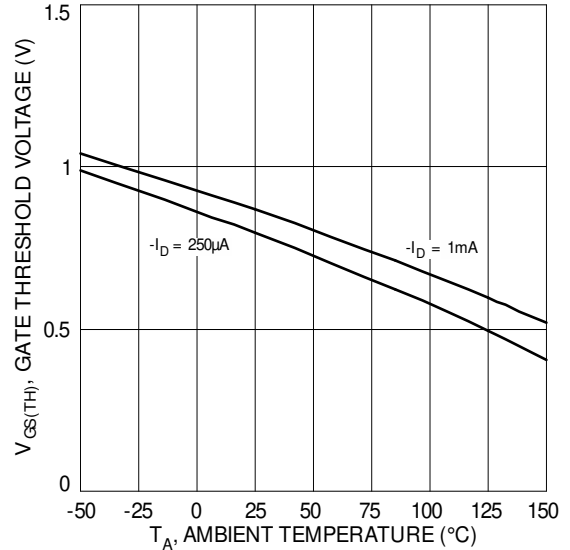


Figure 21 Gate Threshold Variation vs. Ambient Temperature

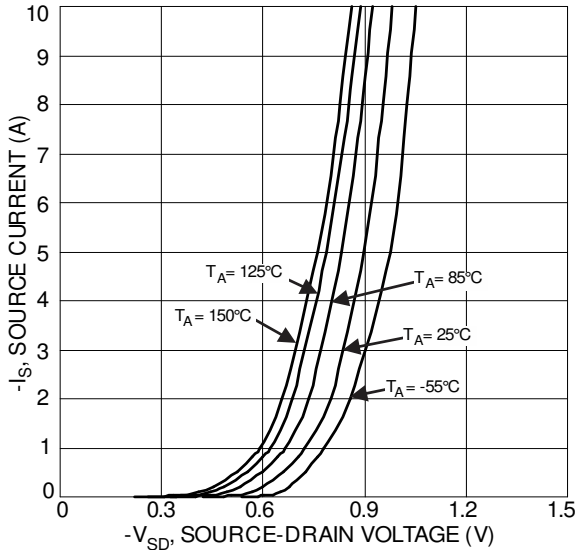


Figure 22 Diodes Forward Voltage vs. Current

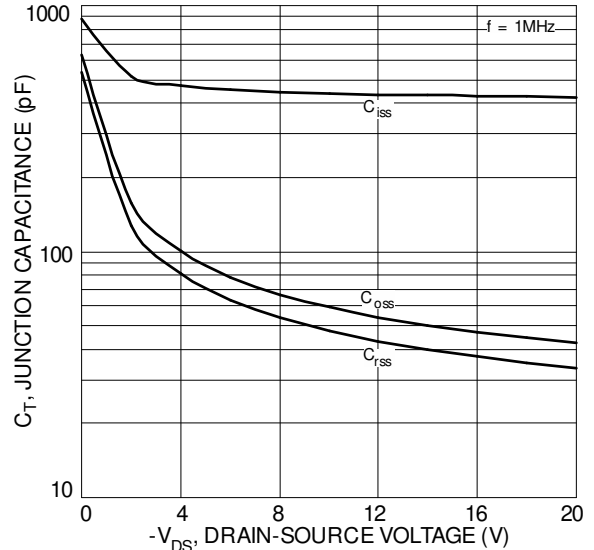


Figure 23 Typical Junction Capacitance

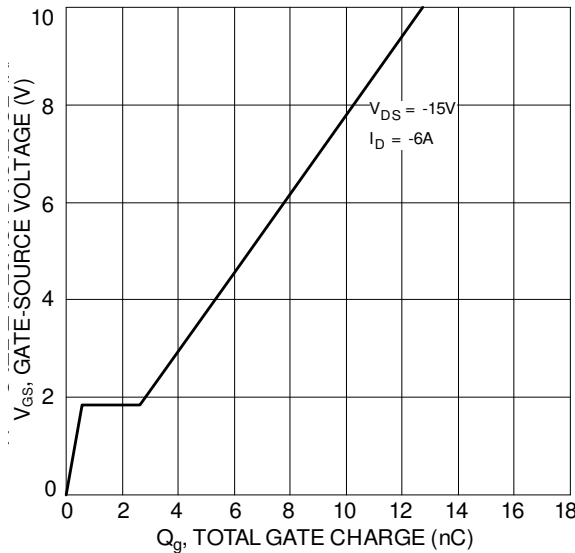


Figure 24 Gate Charge

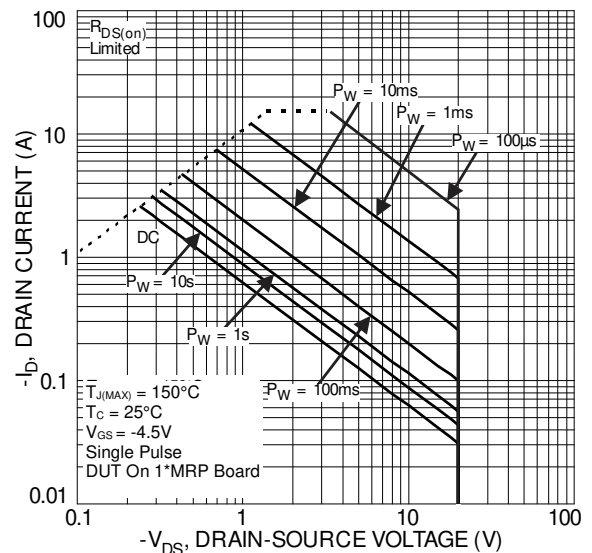
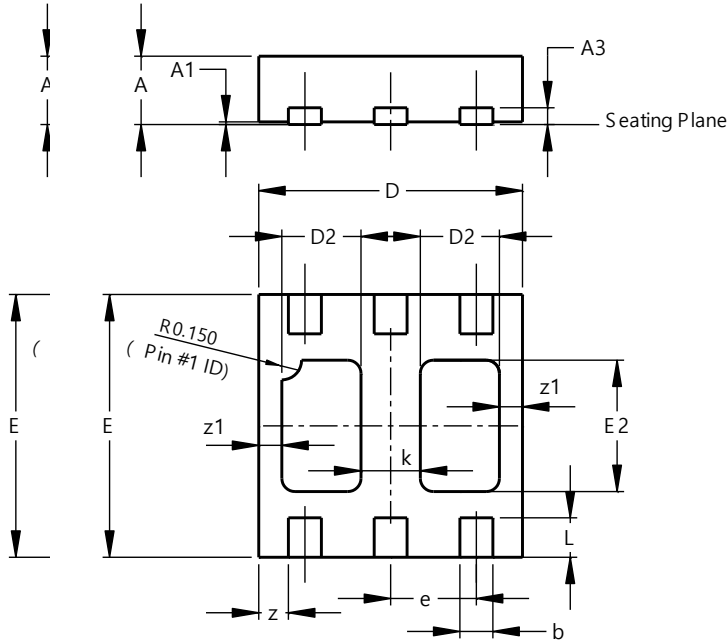


Figure 25 SOA, Safe Operation Area

Package Outline Dimensions

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

U-DFN2020-6 (Type B)

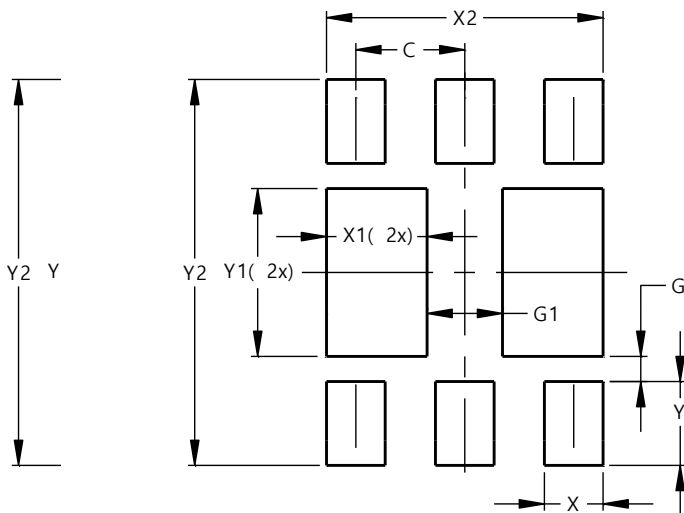


U-DFN2020-6 Type B			
Dim	Min	Max	Typ
A	0.545	0.605	0.575
A1	0.00	0.05	0.02
A3	-	-	0.13
b	0.20	0.30	0.25
D	1.95	2.075	2.00
D2	0.50	0.70	0.60
e	-	-	0.65
E	1.95	2.075	2.00
E2	0.90	1.10	1.00
k	-	-	0.45
L	0.25	0.35	0.30
z	-	-	0.225
z1	-	-	0.175
All Dimensions in mm			

Suggested Pad Layout

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

U-DFN2020-6 (Type B)



Dimensions	Value (in mm)
C	0.650
G	0.150
G1	0.450
X	0.350
X1	0.600
X2	1.650
Y	0.500
Y1	1.000
Y2	2.300

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