优尚

YOUSHANG SEMICONDUCTOR

设计研发新型功率器件

各类小信号开关

中低压及高压大电流等场效应管

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Product Summary

Device	$V_{(BR)DSS}$	$R_{DS(ON)\ Max}$	$I_{D\ Max}$ T_A = +25°C
Q1 N-Channel	60V	4.0Ω @ V_{GS} = 10V	0.39A
		4.1Ω @ V_{GS} = 5V	0.38A
		4.2Ω @ V_{GS} = 4V	0.37A
Q2 P-Channel	-20V	72mΩ @ V_{GS} = -4.5 V	-2.9A
		108mΩ @ V_{GS} = -2.7V	-2.3A
		123mΩ @ V_{GS} = -2.5V	-2.2A

Features

- Low On-Resistance
- Low Input Capacitance
- Low Profile, 0.6mm Maximum Height

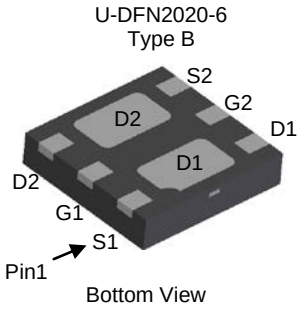
Description

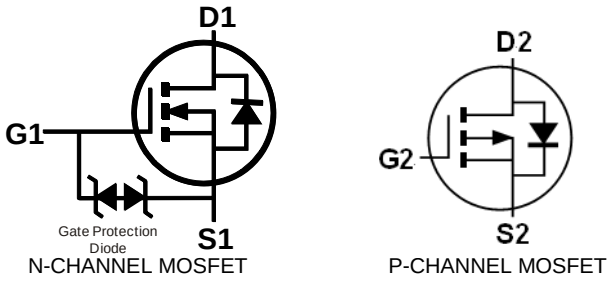
This MOSFET is designed to meet the stringent requirements of Automotive applications. It is qualified to AEC-Q101, supported by a PPAP, and is ideal for use in:

- Load Switch

Mechanical Data

- Case: U-DFN2020-6 Type B
- 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
- Terminals Connections: See Diagram Below
- Weight: 0.0065 grams (Approximate)





Internal Schematic

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

Characteristic			Symbol	Q1 N-Channel	Q2 P-Channel	Unit
Drain-Source Voltage			V_{DSS}	60	-20	V
Gate-Source Voltage			V_{GSS}	±20	±12	V
Continuous Drain Current (Note 7) N-Channel: V_{GS} = 10V P-Channel: V_{GS} = -4.5V	Steady State	T_A = +25°C T_A = +70°C	I_D	0.39 0.31	-2.9 -2.3	A
Maximum Continuous Body Diode Forward Current (Note 7)			I_S	0.39	-2.9	A
Pulsed Drain Current (10µs Pulse, Duty Cycle = 1%)			I_{DM}	0.8	-20	A
Pulsed Source Current (10µs Pulse, Duty Cycle = 1%)			I_{SM}	-0.8	-20	A

Thermal Characteristics

Characteristic		Symbol	Value	Unit
Total Power Dissipation (Note 6)	T_A = +25°C	P_D	0.58	W
Thermal Resistance, Junction to Ambient (Note 6)	Steady State	$R_{\Theta JA}$	215	°C/W
Total Power Dissipation (Note 7)	T_A = +25°C	P_D	0.89	W
Thermal Resistance, Junction to Ambient (Note 7)	Steady State	$R_{\Theta JA}$	140	°C/W
Thermal Resistance, Junction to Case (Note 7)		$R_{\Theta JC}$	35	
Operating and Storage Temperature Range		T_J, T_{STG}	-55 to +150	°C

Electrical Characteristics: Q1 N-Channel (@ 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}	60	—	—	V	V_{GS} = 0V, I_D = 10µA
Zero Gate Voltage Drain Current	I_{DSS}	—	—	1.0	µA	V_{DS} = 60V, V_{GS} = 0V
Gate-Source Leakage	I_{GSS}	—	—	±10	µA	V_{GS} = ±20V, V_{DS} = 0V
ON CHARACTERISTICS (Note 8)						
Gate Threshold Voltage	$V_{GS(TH)}$	1.0	—	2.5	V	V_{DS} = V_{GS}, I_D = 250µA
Static Drain-Source On-Resistance	$R_{DS(ON)}$	—	1.7 1.6 1.8	4.0 4.1 4.2	Ω	V_{GS} = 10V, I_D = 0.5A V_{GS} = 5V, I_D = 0.2A V_{GS} = 4V, I_D = 0.2A
Diode Forward Voltage	V_{SD}	—	0.8	1.1	V	V_{GS} = 0V, I_S = 115mA
DYNAMIC CHARACTERISTICS (Note 9)						
Input Capacitance	C_{iss}	—	41	—	pF	V_{DS} = 25V, V_{GS} = 0V f = 1.0MHz
Output Capacitance	C_{oss}	—	4.4	—	pF	
Reverse Transfer Capacitance	C_{rss}	—	2.6	—	pF	
Gate Resistance	R_g	—	900	—	Ω	f = 1MHz, V_{GS} = 0V, V_{DS} = 0V
Total Gate Charge	Q_g	—	0.4	—	pC	V_{GS} = 4.5V, V_{DS} = 10V, I_D = 250mA
Gate-Source Charge	Q_{gs}	—	0.2	—	pC	
Gate-Drain Charge	Q_{gd}	—	0.1	—	pC	
Turn-On Delay Time	$t_{D(ON)}$	—	3.7	—	ns	V_{DD} = 30V, V_{GS} = 10V, R_g = 25Ω, I_D = 200mA
Turn-On Rise Time	t_R	—	3.6	—	ns	
Turn-Off Delay Time	$t_{D(OFF)}$	—	102	—	ns	
Turn-Off Fall Time	t_F	—	22	—	ns	
Reverse Recovery Time	t_{RR}	—	20	—	ns	I_F = 1A, di/dt = 100A/µs
Reverse Recovery Charge	Q_{RR}	—	7.9	—	nC	I_F = 1A, di/dt = 100A/µs

Electrical Characteristics: Q2 P-Channel (@ 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	I_D = -250μA, V_{GS} = 0V
Zero Gate Voltage Drain Current	I_{DSS}	—	—	-1	μA	V_{DS} = -20V, V_{GS} = 0V
Gate-Body Leakage Current	I_{GSS}	—	—	±100	nA	V_{DS} = 0V, V_{GS} = ±12V
ON CHARACTERISTICS (Note 8)						
Gate Threshold Voltage	$V_{GS(th)}$	-0.6	—	-1.25	V	V_{DS} = V_{GS}, I_D = -250μA
Static Drain-Source On-Resistance	$R_{DS(ON)}$	—	51 87 99	72 108 123	mΩ	V_{GS} = -4.5V, I_D = -3.5A V_{GS} = -2.7V, I_D = -3.0A V_{GS} = -2.5V, I_D = -2.6A
Diode Forward Voltage	V_{SD}	—	-0.79	-1.26	V	I_S = -1.7A, V_{GS} = 0V
DYNAMIC PARAMETERS (Note 9)						
Total Gate Charge	Q_g	—	7.3	—	nC	V_{GS} = -4.5V, V_{DS} = -10V, I_D = -3.0A
Gate-Source Charge	Q_{gs}	—	2.0	—	nC	V_{GS} = -4.5V, V_{DS} = -10V, I_D = -3.0A
Gate-Drain Charge	Q_{gd}	—	1.9	—	nC	V_{GS} = -4.5V, V_{DS} = -10V, I_D = -3.0A
Turn-On Delay Time	$t_{D(on)}$	—	12	—	ns	V_{DS} = -10V, V_{GS} = -4.5V, R_L = 10Ω, R_G = 6Ω
Turn-On Rise Time	t_r	—	20	—	ns	
Turn-Off Delay Time	$t_{D(off)}$	—	38	—	ns	
Turn-Off Fall Time	t_f	—	41	—	ns	
Input Capacitance	C_{iss}	—	443	—	pF	V_{DS} = -16V, V_{GS} = 0V f = 1.0MHz
Output Capacitance	C_{oss}	—	128	—	pF	
Reverse Transfer Capacitance	C_{rss}	—	101	—	pF	

Notes: 6. Device mounted on FR-4 substrate PCB, 2oz copper, with minimum recommended pad layout.
7. Device mounted on FR-4 substrate PCB, 2oz copper, with 1inch square copper plate.
8. Short duration pulse test used to minimize self-heating effect.
9. Guaranteed by design. Not subject to product testing.

Typical Characteristics: N-Channel

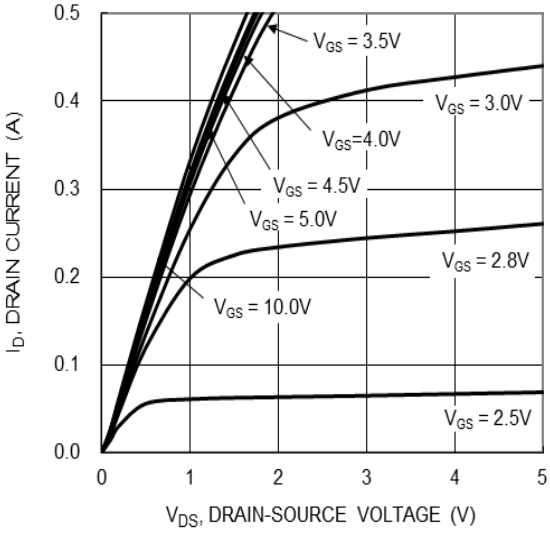


Figure 1. Typical Output Characteristic

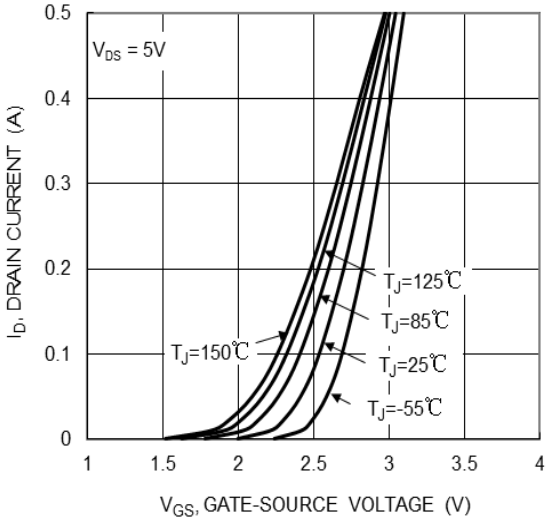


Figure 2. Typical Transfer Characteristic

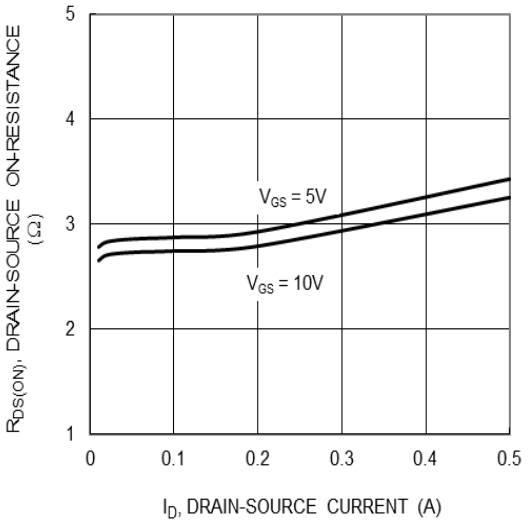


Figure 3. Typical On-Resistance vs. Drain Current and Gate Voltage

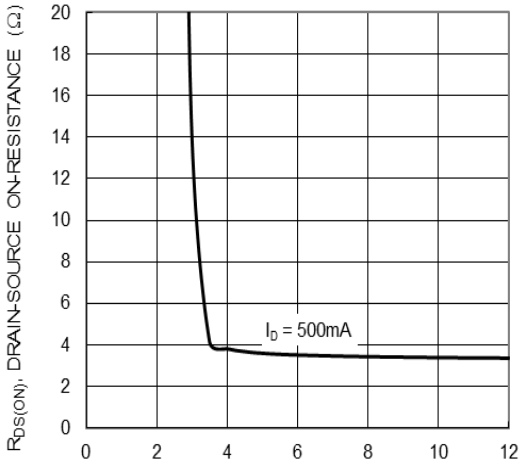


Figure 4. Typical Transfer Characteristic

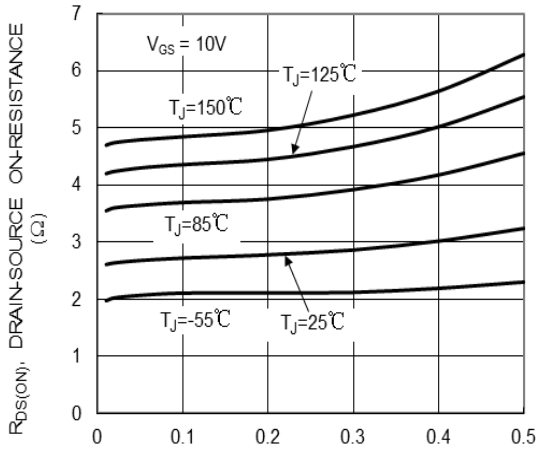


Figure 5. Typical On-Resistance vs. Drain Current and Junction Temperature

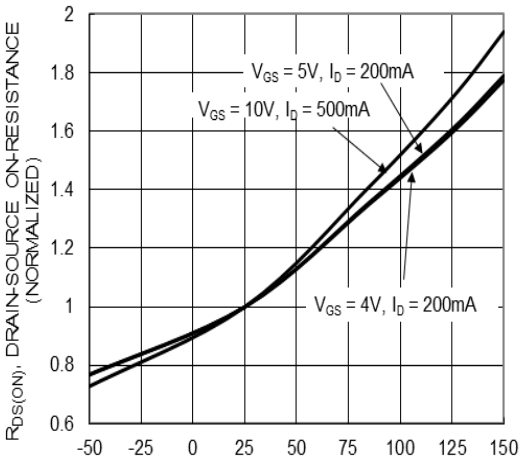


Figure 6. On-Resistance Variation with Junction Temperature

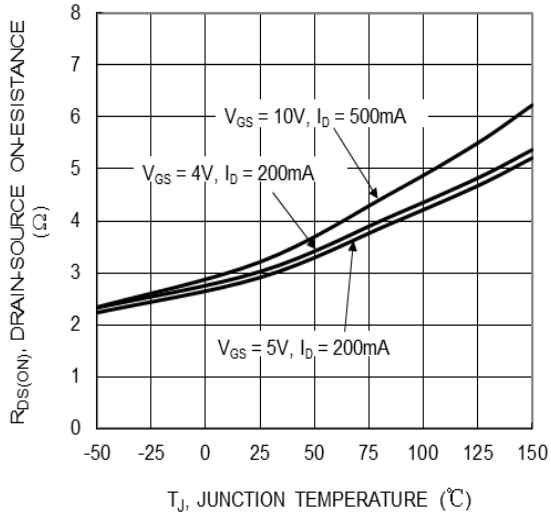


Figure 7. On-Resistance Variation with Junction Temperature

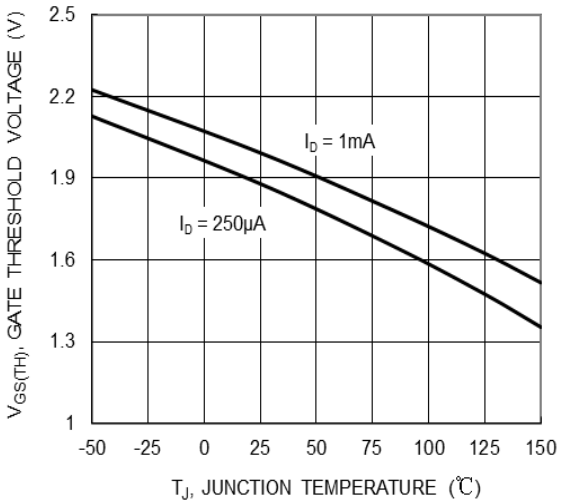


Figure 8. Gate Threshold Variation vs. Junction Temperature

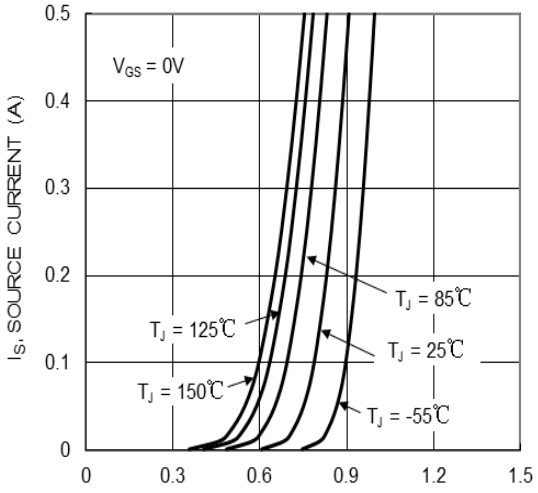


Figure 9. Diode Forward Voltage vs. Current

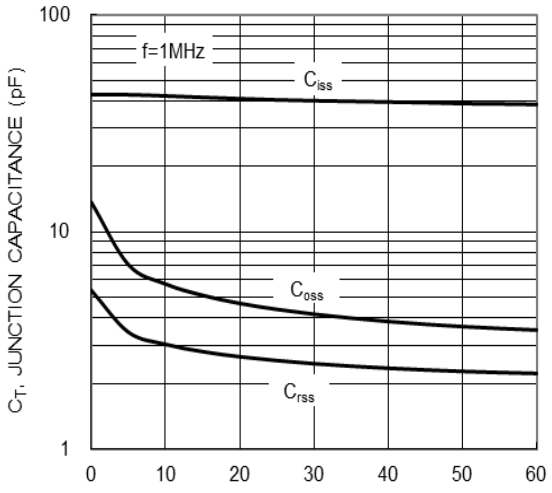


Figure 10. Typical Junction Capacitance

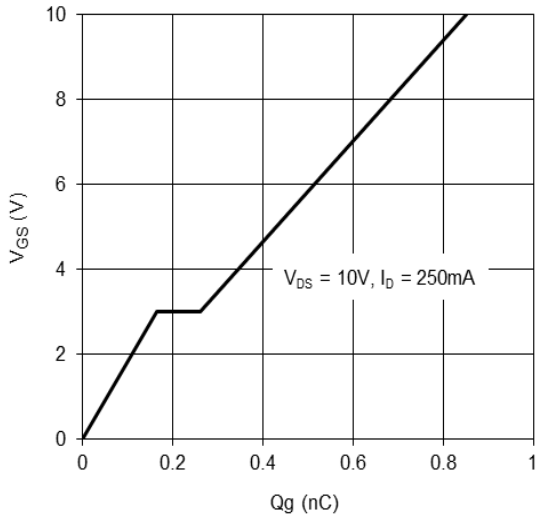


Figure 11. Gate Charge

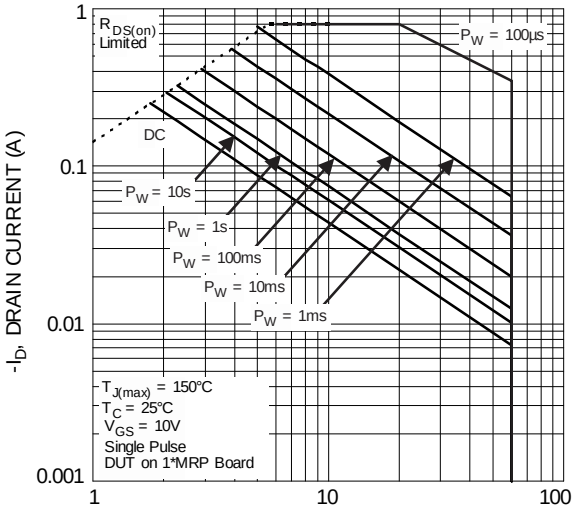


Figure 12 SOA, Safe Operation Area

Typical Characteristics: P-Channel

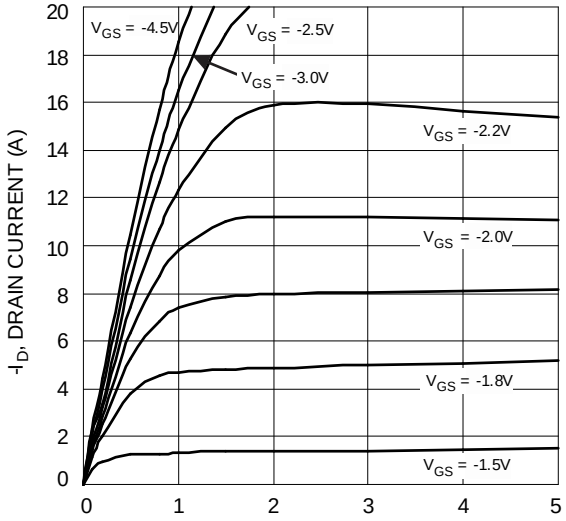


Figure 1 Typical Output Characteristics

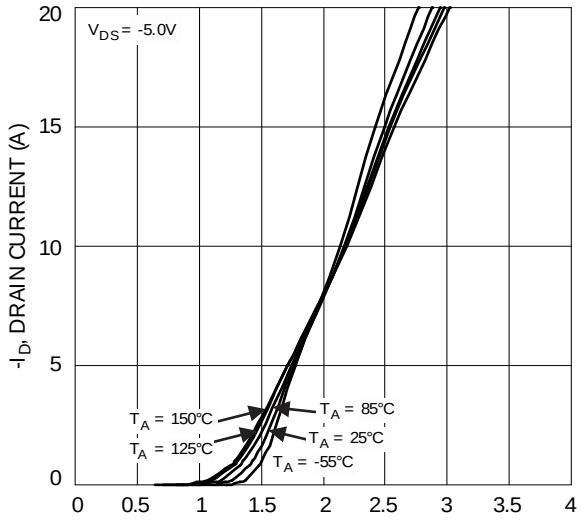


Figure 2 Typical Transfer Characteristics

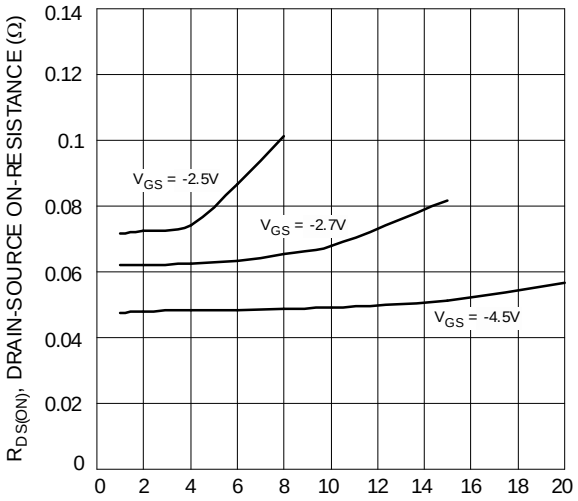


Figure 3 Typical On-Resistance vs.
Drain Current and Gate Voltage

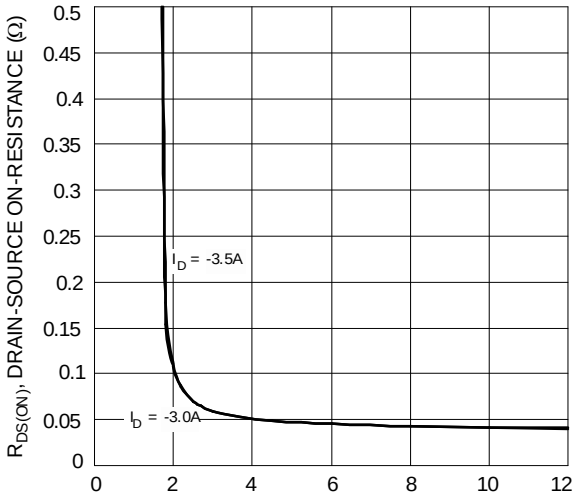


Figure 4 Typical Drain-Source On-Resistance
vs. Gate-Source Voltage

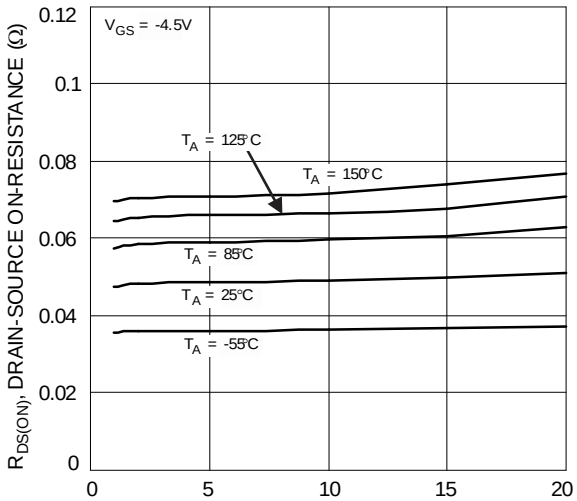


Figure 5 Typical On-Resistance vs.
Drain Current and Temperature

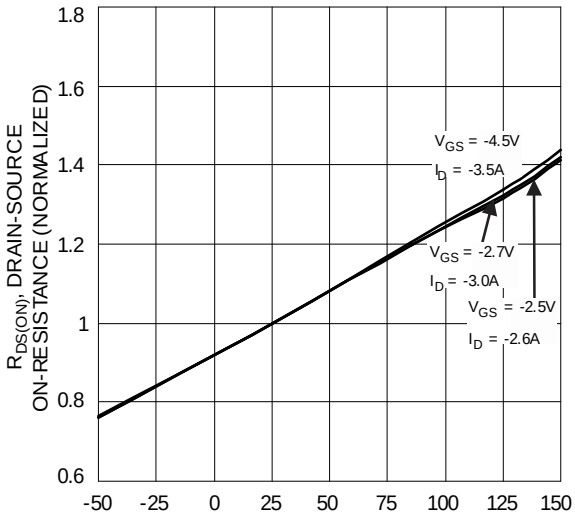


Figure 6 On-Resistance Variation with Temperature

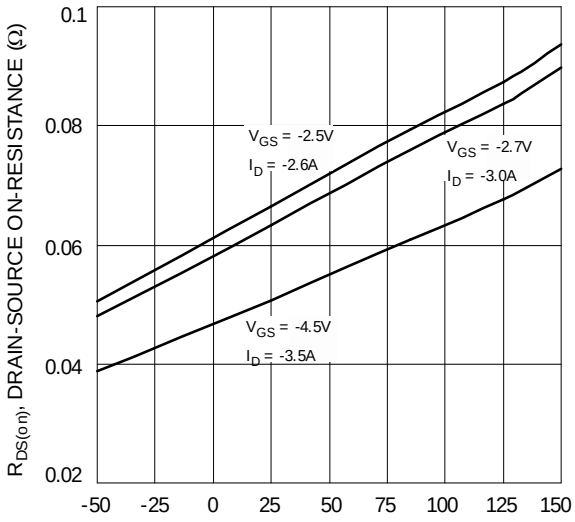


Figure 7 On-Resistance Variation with Temperature

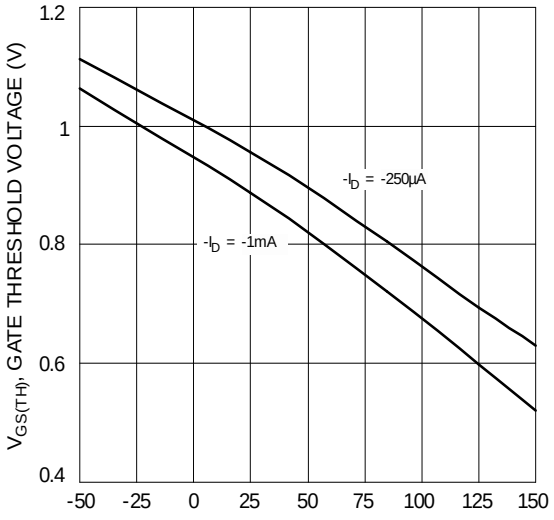


Figure 8 Gate Threshold Variation vs. Ambient Temperature

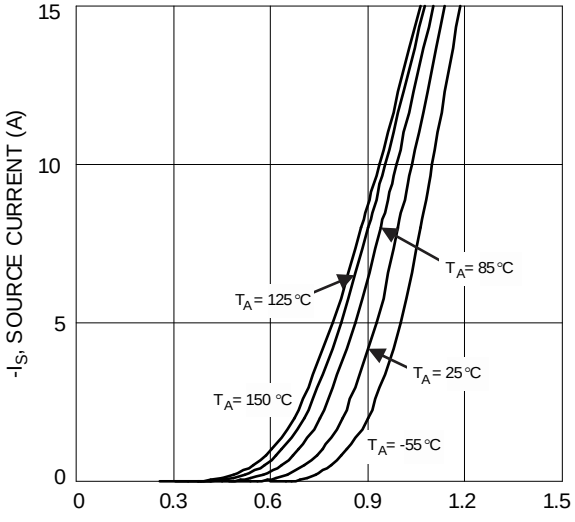


Figure 9 Diode Forward Voltage vs. Current

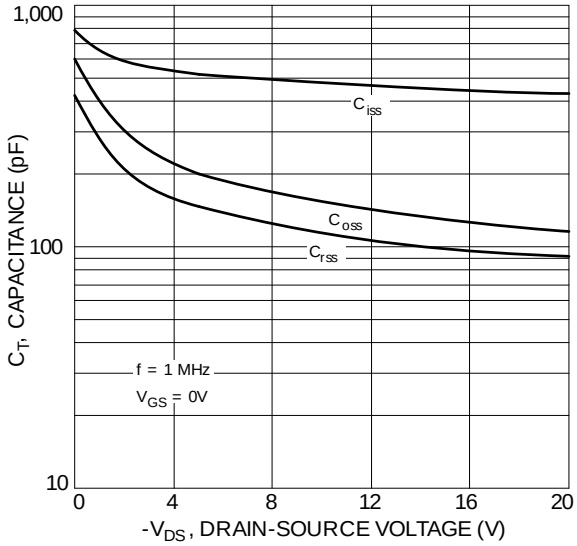


Fig. 10 Typical Total Capacitance

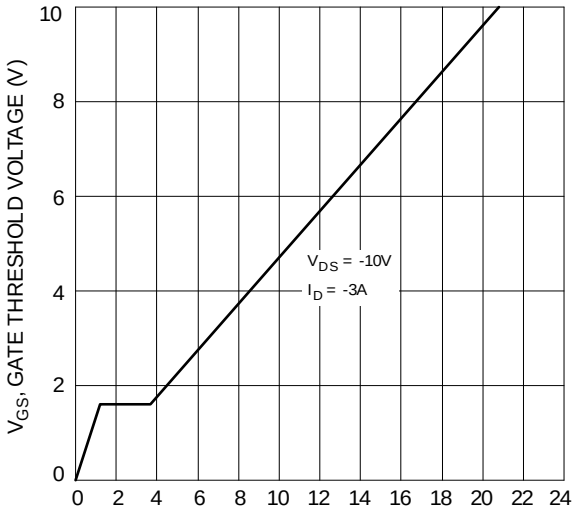


Figure 11 Gate Charge

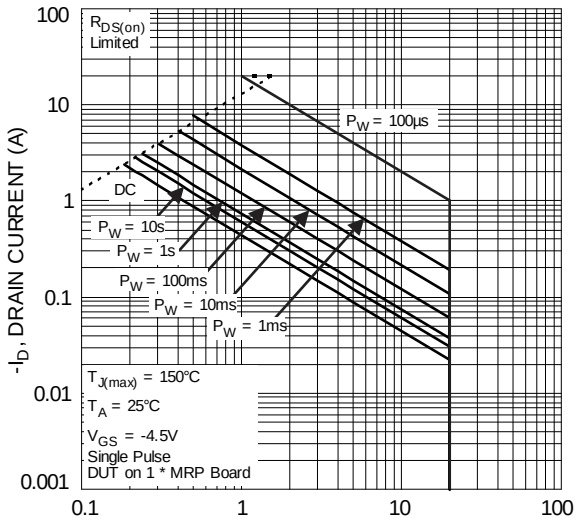


Figure 12 SOA, Safe Operation Area

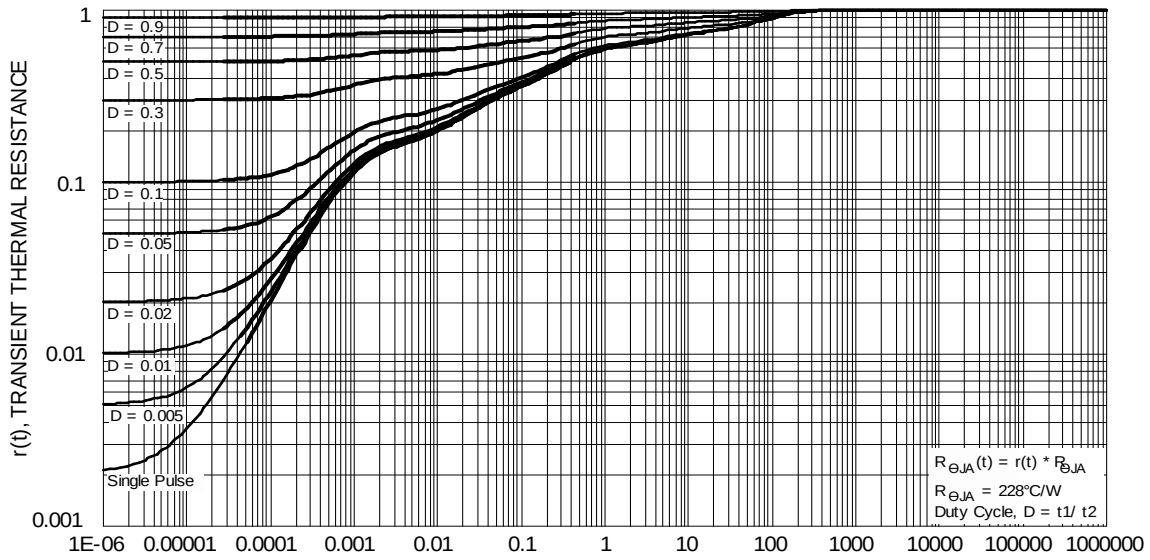
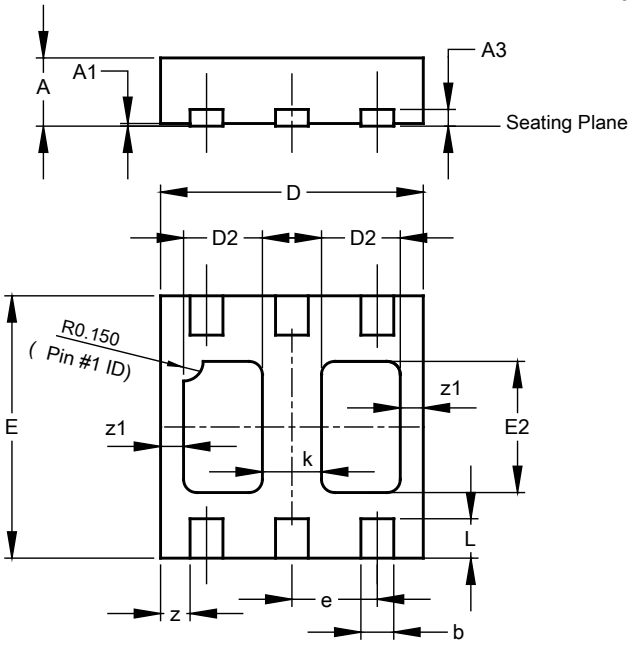


Figure 13 Transient Thermal Resistance

Package Outline Dimensions

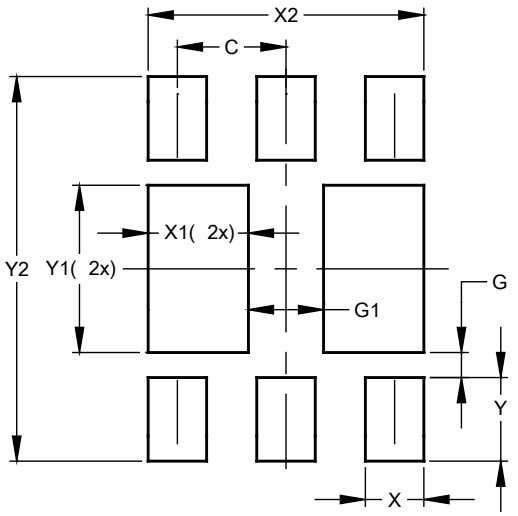
U-DFN2020-6 (Type B)



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

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