20V N-CHANNEL ENHANCEMENT MODE MOSFET

Product Summary

BV_{DSS}	$R_{DS(on)}$ max	I_D max T_A = +25°C
20V	38mΩ @ V_{GS} = 4.5V	4.0A
	45mΩ @ V_{GS} = 2.5V	3.7A

Features and Benefits

- Low On-Resistance
- Low Gate Threshold Voltage
- Low Input Capacitance
- Fast Switching Speed
- Low Input/Output Leakage
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **For automotive applications requiring specific change control (i.e.: parts qualified to AEC-Q100/101/200, PPAP capable, and manufactured in IATF 16949 certified facilities), please refer to the related automotive grade (Q-suffix) part. A listing can be found at https://www.diodes.com/products/automotive/automotive-products/.**
- **This part is qualified to JEDEC standards (as references in AEC-Q) for High Reliability. https://www.diodes.com/quality/product-definitions/**

Description and Applications

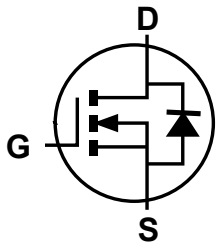
This MOSFET is designed to minimize the on-state resistance ($R_{DS(on)}$) and yet maintain superior switching performance, making it ideal for high-efficiency power management applications.

- Battery Charging
- Power Management Functions
- DC-DC Converters
- Portable Power Adaptors

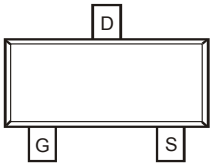
Mechanical Data

- Case: SOT23 (Standard)
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish—Matte Tin Annealed over Copper Leadframe. Solderable per MIL-STD-202, Method 208 e3
- Terminals Connections: See Diagram Below
- Weight: 0.009 grams (Approximate)

Top View



Internal Schematic



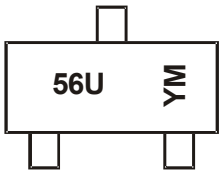
Top View

Ordering Information (Note 4)

Part Number	Case	Packaging
DMN2056U-7	SOT23 (Standard)	3000/Tape & Reel
DMN2056U-13	SOT23 (Standard)	10000/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



56U = Product Type Marking Code
YM = Date Code Marking
Y or $\overline{Y}$ = Year (ex: I = 2021)
M = Month (ex: 9 = September)

Date Code Key

Year	2016	.....	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Code	D	.....	I	J	K	L	M	N	O	P	R	S

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 6) V_{GS} = 4.5V	Steady State	T_A = +25°C T_A = +70°C	I_D	4.0 3.2	A
Maximum Body Diode Forward Current (Note 6)			I_S	1.0	A
Pulsed Drain Current (10µs pulse, duty cycle = 1%)			I_{DM}	22	A

Thermal Characteristics

Characteristic		Symbol	Value	Unit
Power Dissipation (Note 5)		P_D	0.66	W
Thermal Resistance, Junction to Ambient (Note 5)	Steady State	$R_{\theta JA}$	192	°C/W
Power Dissipation (Note 6)		P_D	0.94	W
Thermal Resistance, Junction to Ambient (Note 6)	Steady State	$R_{\theta JA}$	136	°C/W
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 7)						
Drain-Source Breakdown Voltage	BV_{DSS}	20	—	—	V	V_{GS} = 0V, I_D = 250µA
Zero Gate Voltage Drain Current	I_{DSS}	—	—	1	µA	V_{DS} = 20V, V_{GS} = 0V
Gate-Source Leakage	I_{GSS}	—	—	±100	nA	V_{GS} = ±8V, V_{DS} = 0V
ON CHARACTERISTICS (Note 7)						
Gate Threshold Voltage	$V_{GS(th)}$	0.4	0.6	1.0	V	V_{DS} = V_{GS}, I_D = 250µA
Static Drain-Source On-Resistance	$R_{DS(on)}$	—	30	38	mΩ	V_{GS} = 4.5V, I_D = 3.6A
		—	34	45		V_{GS} = 2.5V, I_D = 3.1A
		—	52	85		V_{GS} = 1.5V, I_D = 2.0A
Diode Forward Voltage	V_{SD}	—	0.7	1.2	V	V_{GS} = 0V, I_S = 1A
DYNAMIC CHARACTERISTICS (Note 8)						
Input Capacitance	C_{iss}	—	339	—	pF	V_{DS} = 10V, V_{GS} = 0V f = 1.0MHz
Output Capacitance	C_{oss}	—	47	—		
Reverse Transfer Capacitance	C_{rss}	—	34	—		
Gate Resistance	R_G	—	2.6	—	Ω	V_{DS} = 0V, V_{GS} = 0V, f = 1.0MHz
Total Gate Charge	Q_g	—	4.3	—	nC	V_{DS} = 10V, V_{GS} = 4.5V, I_D = 3.6A
Gate-Source Charge	Q_{gs}	—	0.5	—		
Gate-Drain Charge	Q_{gd}	—	0.8	—		
Turn-On Delay Time	$t_{D(on)}$	—	1.8	—	ns	V_{GS} = 4.5V, V_{DD} = 10V, R_G = 1Ω, I_D = 3.6A
Turn-On Rise Time	t_R	—	2.8	—		
Turn-Off Delay Time	$t_{D(off)}$	—	8.5	—		
Turn-Off Fall Time	t_F	—	1.7	—		
Body Diode Reverse Recovery Time	t_{RR}	—	4.7	—	ns	I_F = 3.6A, dI/dt = 100A/µs
Body Diode Reverse Recovery Charge	Q_{RR}	—	0.7	—	nC	I_F = 3.6A, dI/dt = 100A/µs

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

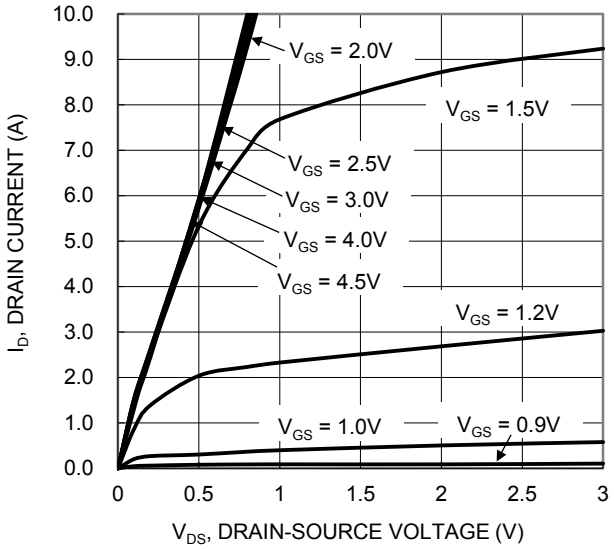


Figure 1. Typical Output Characteristic

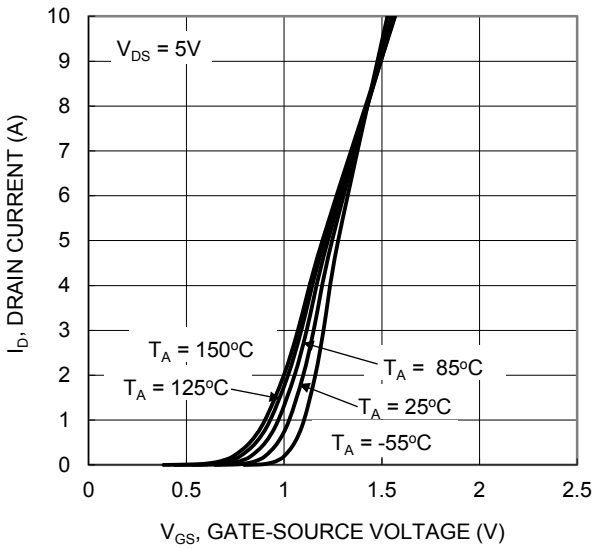


Figure 2. Typical Transfer Characteristic

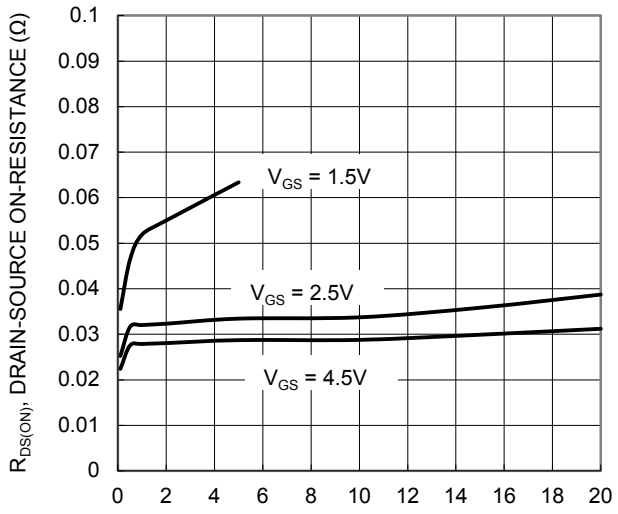


Figure 3. Typical On-Resistance vs Drain Current and Gate Voltage

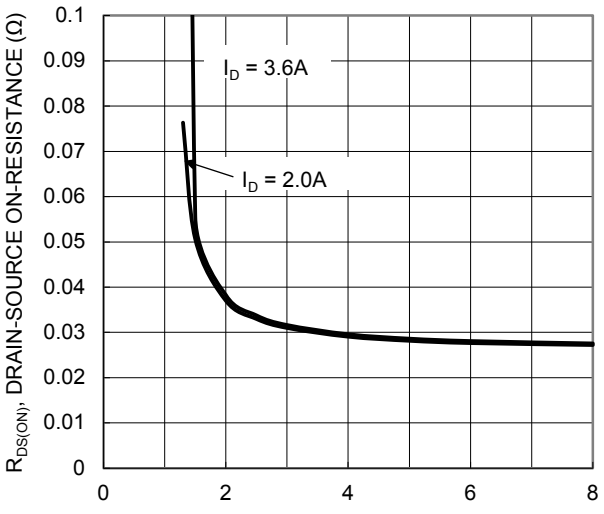


Figure 4. Typical Transfer Characteristic

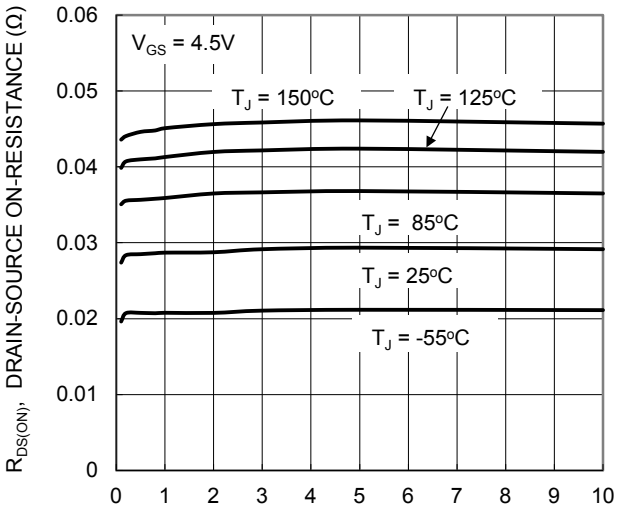


Figure 5. Typical On-Resistance vs Drain Current and Junction Temperature

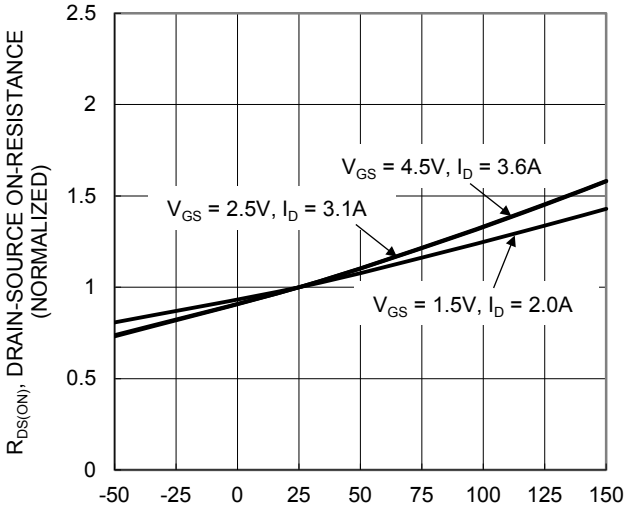


Figure 6. On-Resistance Variation with Junction Temperature

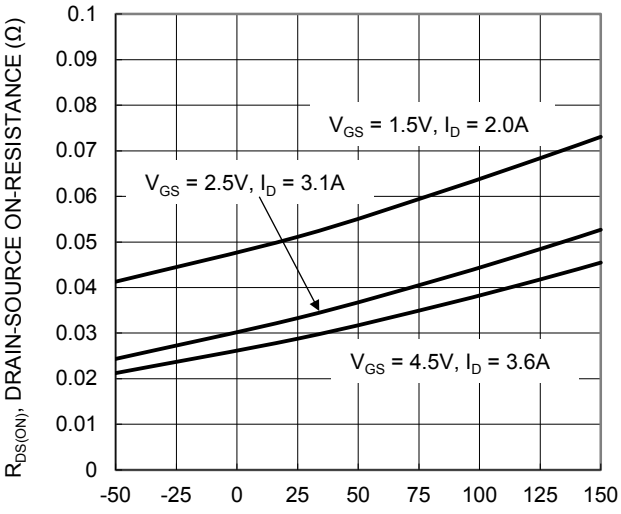


Figure 7. On-Resistance Variation with Junction Temperature

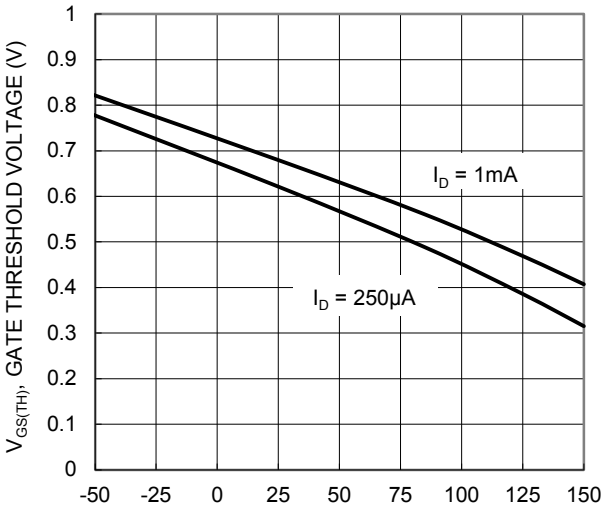


Figure 8. Gate Threshold Variation vs Junction Temperature

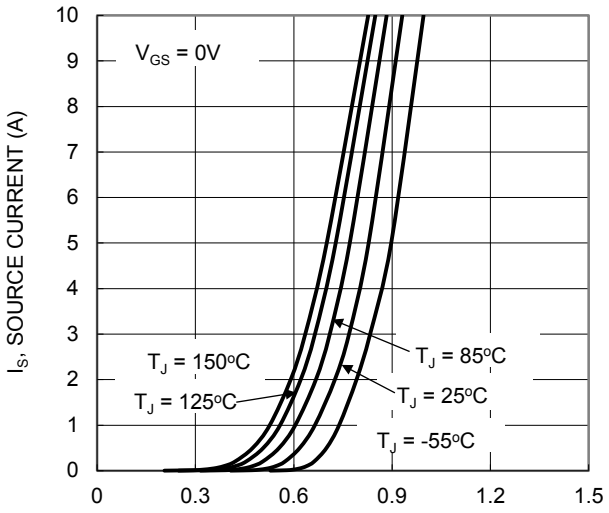


Figure 9. Diode Forward Voltage vs Current

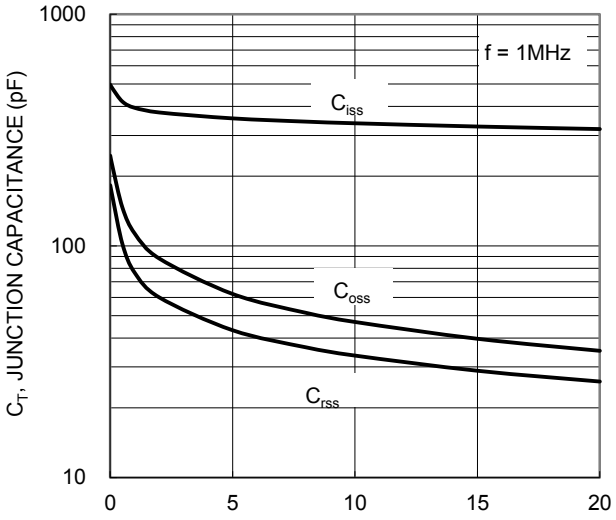


Figure 10. Typical Junction Capacitance

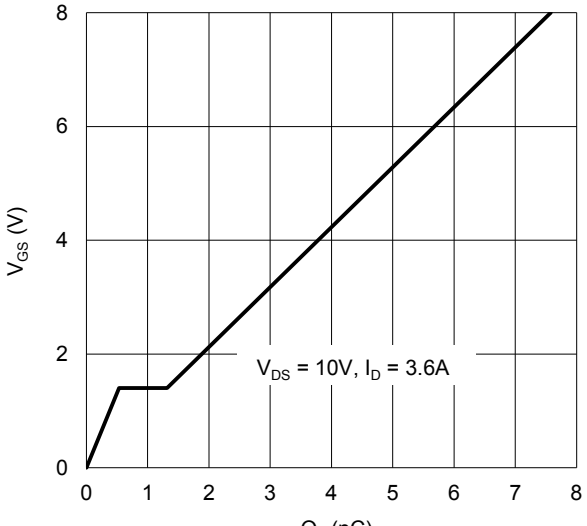


Figure 11. Gate Charge

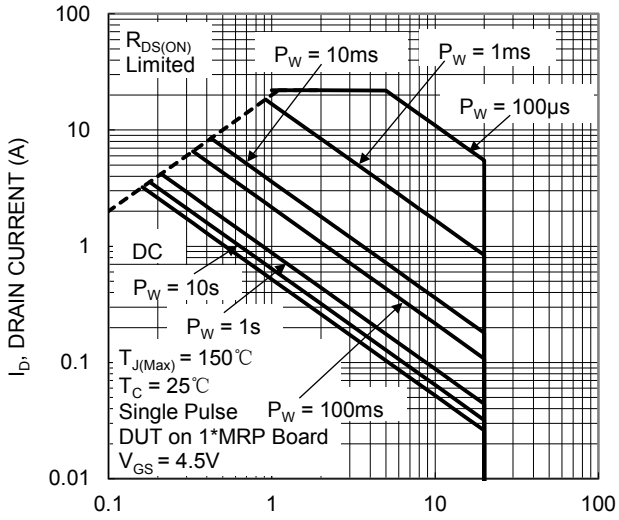


Figure 12. SOA, Safe Operation Area

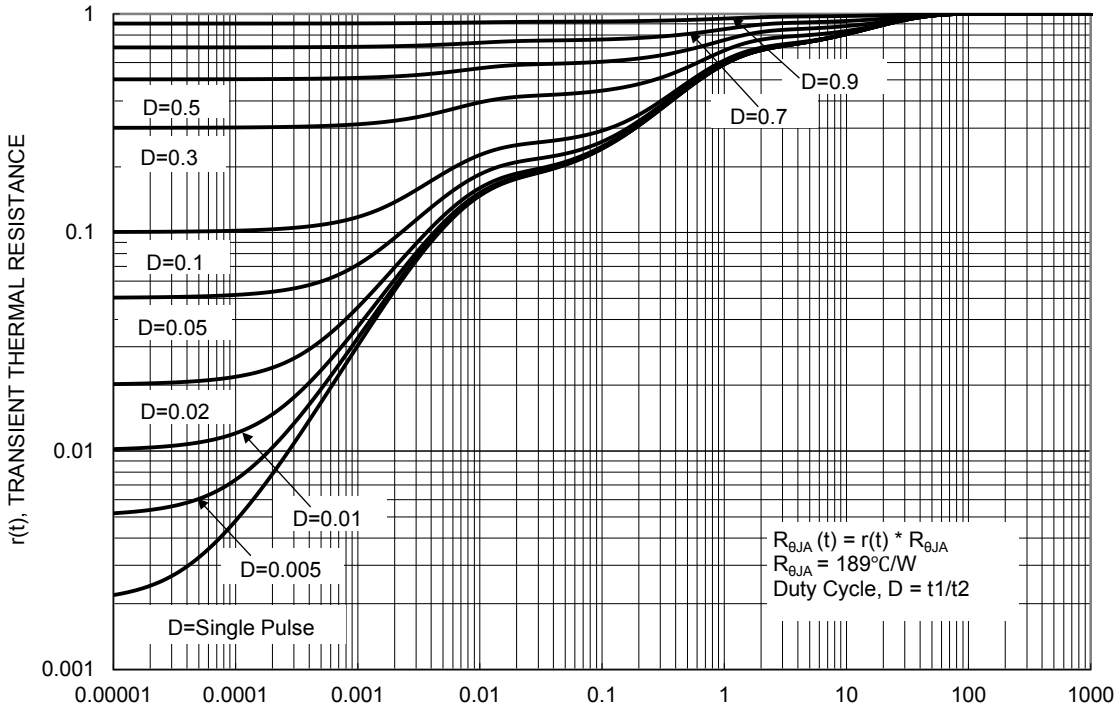
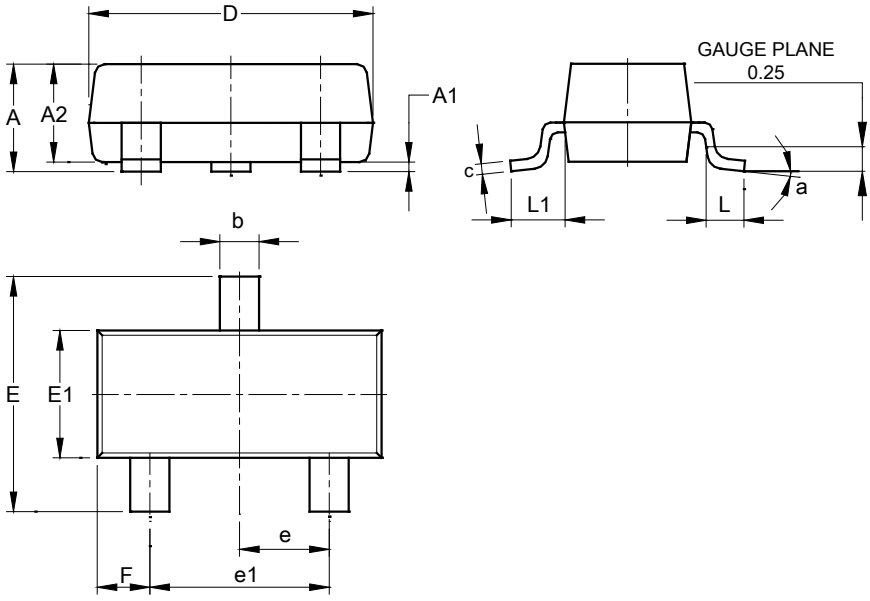


Figure 13. Transient Thermal Resistance

Package Outline Dimensions

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

SOT23 (Standard)

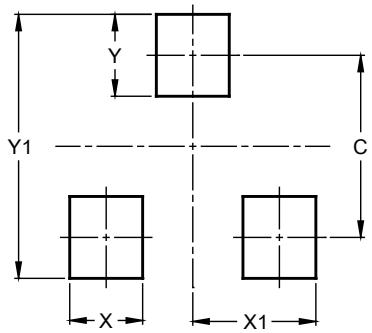


SOT23 (Standard)			
Dim	**Min**	**Max**	**Typ**
A	0.90	1.15	1.025
A1	0.00	0.10	0.05
A2	0.85	1.10	0.975
b	0.30	0.51	0.40
c	0.080	0.202	0.11
D	2.80	3.00	2.90
E	2.25	2.55	2.40
E1	1.20	1.40	1.30
e	0.89	1.03	0.915
e1	1.78	2.05	1.83
F	0.40	0.60	0.535
L1	0.45	0.61	0.55
L	0.25	0.55	0.40
a	0°	8°	--
All Dimensions in mm			

Suggested Pad Layout

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

SOT23 (Standard)



Dimensions	Value (in mm)
C	2.0
X	0.8
X1	1.35
Y	0.9
Y1	2.9

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