60V +175°C P-CHANNEL ENHANCEMENT MODE MOSFET

Product Summary

BV_{DSS}	$R_{DS(ON)}$ max	I_D max T_C = +25°C
-60V	50mΩ @ V_{GS} = -10V	-23.6A
	70mΩ @ V_{GS} = -4.5V	-20A

Features

- Rated to +175°C – Ideal for High Ambient Temperature Environments
- 100% Unclamped Inductive Switching – Ensures More Reliable and Robust End Application
- Low Qg – Minimizes Switching Loss
- Low $R_{DS(ON)}$ – Minimizes On State Loss
- **Lead-Free Finish; RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **Qualified to AEC-Q101 Standards for High Reliability**
- **PPAP Capable (Note 4)**

Description and Applications

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:

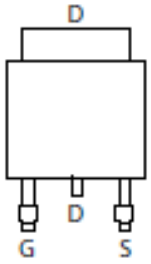
- Engine Management Systems
- Body Control Electronics
- DC-DC Converters

Mechanical Data

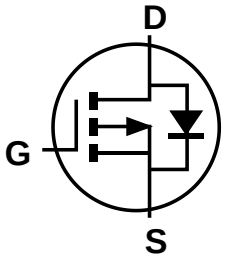
- Case: TO252 (DPAK)
- Case Material: Molded Plastic, "Green" Molding Compound; UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminal Finish - Matte Tin annealed over Copper Leadframe. Solderable per MIL-STD-202, Method 208 e3
- Weight: 0.315 grams (Approximate)

TO252

Top View



Pin Out Top View



Equivalent Circuit

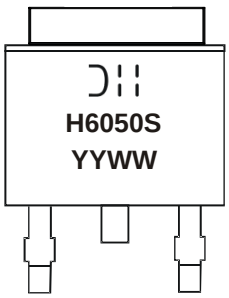
Ordering Information (Note 5)

Part Number	Case	Packaging
DMPH6050SK3Q-13	TO252	2,500/Tape & Reel

Notes:
1. EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant. All applicable RoHS exemptions applied.
2. See http://www.diodes.com/quality/lead_free.html 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. Automotive products are AEC-Q101 qualified and are PPAP capable. Automotive, AEC-Q101 and standard products are electrically and thermally the same, except where specified. For more information, please refer to http://www.diodes.com/quality/product_grade_definitions/.
5. For packaging details, go to our website at http://www.diodes.com/products/packages.html.

Marking Information

TO252



=Manufacturer's Marking
H6050S = Product Type Marking Code
YYWW = Date Code Marking
YY = Last Digit of Year (ex: 15 = 2015)
WW = Week Code (01 to 53)

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

Characteristic			Symbol	Value	Units
Drain-Source Voltage			V_{DSS}	-60	V
Gate-Source Voltage			V_{GSS}	±20	V
Continuous Drain Current (Note 7) V_{GS} = -10V	Steady State	T_C = +25°C T_C = +70°C	I_D	-23.6 -19	A
	Steady State	T_A = +25°C T_A = +70°C	I_D	-7.2 -6.0	A
Pulsed Drain Current (10µs pulse, duty cycle = 1%)			I_{DM}	-40	A
Maximum Continuous Body Diode Forward Current (Note 7)			I_S	-3.8	A
Avalanche Current (Note 8) L = 0.1mH			I_{AS}	-25	A
Avalanche Energy (Note 8) L = 0.1mH			E_{AS}	31	mJ

Thermal Characteristics (@T_A = +25°C, unless otherwise specified.)

Characteristic		Symbol	Value	Units
Total Power Dissipation (Note 6)		P_D	1.9	W
Thermal Resistance, Junction to Ambient (Note 6)	Steady State	$R_{\theta JA}$	80	°C/W
Total Power Dissipation (Note 7)		P_D	3.8	W
Thermal Resistance, Junction to Ambient (Note 7)	Steady State	$R_{\theta JA}$	39	°C/W
Thermal Resistance, Junction to Case (Note 7)		$R_{\theta JC}$	3	
Operating and Storage Temperature Range		T_J, T_{STG}	-55 to +175	°C

Electrical Characteristics (@T_A = +25°C, unless otherwise specified.)

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
OFF CHARACTERISTICS (Note 9)						
Drain-Source Breakdown Voltage	BV_{DSS}	-60	—	—	V	V_{GS} = 0V, I_D = -250µA
Zero Gate Voltage Drain Current T_J = +25°C	I_{DSS}	—	—	-1	µA	V_{DS} = -60V, V_{GS} = 0V
Gate-Source Leakage	I_{GSS}	—	—	±100	nA	V_{GS} = ±20V, V_{DS} = 0V
ON CHARACTERISTICS (Note 9)						
Gate Threshold Voltage	$V_{GS(th)}$	-1	—	-3	V	V_{DS} = V_{GS}, I_D = -250µA
Static Drain-Source On-Resistance	$R_{DS\ (ON)}$	—	—	50	mΩ	V_{GS} = -10V, I_D = -7A
			—	70		V_{GS} = -4.5V, I_D = -7A
Diode Forward Voltage	V_{SD}	—	-0.7	-1.2	V	V_{GS} = 0V, I_S = -1A
DYNAMIC CHARACTERISTICS (Note 10)						
Input Capacitance	C_{iss}	—	1,377	—	pF	V_{DS} = -30V, V_{GS} = 0V, f = 1MHz
Output Capacitance	C_{oss}	—	87	—	pF	
Reverse Transfer Capacitance	C_{rss}	—	68	—	pF	
Gate Resistance	R_g	—	12	—	Ω	V_{DS} = 0V, V_{GS} = 0V, f = 1MHz
Total Gate Charge (V_{GS} = -4.5V)	Q_g	—	12	—	nC	V_{DS} = -30V, I_D = -5A
Total Gate Charge (V_{GS} = -10V)	Q_g	—	25	—	nC	
Gate-Source Charge	Q_{gs}	—	3.8	—	nC	
Gate-Drain Charge	Q_{gd}	—	4.9	—	nC	
Turn-On Delay Time	$t_{D(on)}$	—	5.3	—	ns	V_{DS} = -30V, V_{GS} = -10V, R_G = 3Ω, I_D = -5A
Turn-On Rise Time	t_r	—	8.6	—	ns	
Turn-Off Delay Time	$t_{D(off)}$	—	49.4	—	ns	
Turn-Off Fall Time	t_f	—	29.7	—	ns	
Body Diode Reverse Recovery Time	t_{rr}	—	14.2	—	nS	I_F = -5A, di/dt = 100A/µs
Body Diode Reverse Recovery Charge	Q_{rr}	—	7.9	—	nC	

Notes:
6. Device mounted on FR-4 substrate PC board, 2oz copper, with minimum recommended pad layout.
7. Device mounted on FR-4 substrate PC board, 2oz copper, with 1-inch square copper plate.
8. I_{AS} and E_{AS} rating are based on low frequency and duty cycles to keep TJ = +25°C.
9. Short duration pulse test used to minimize self-heating effect.
10. Guaranteed by design. Not subject to product testing.

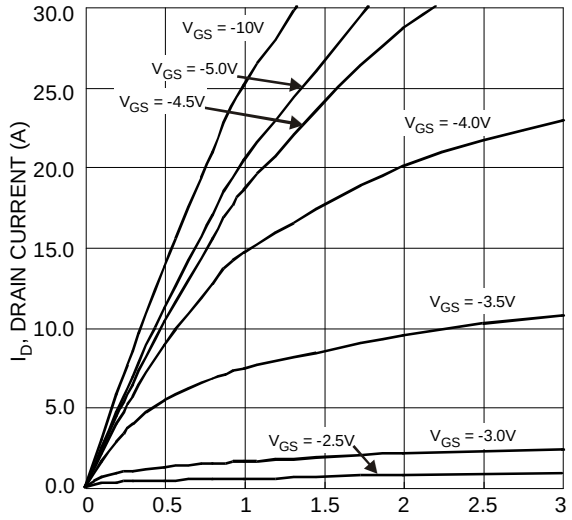


Figure 1 Typical Output Characteristics

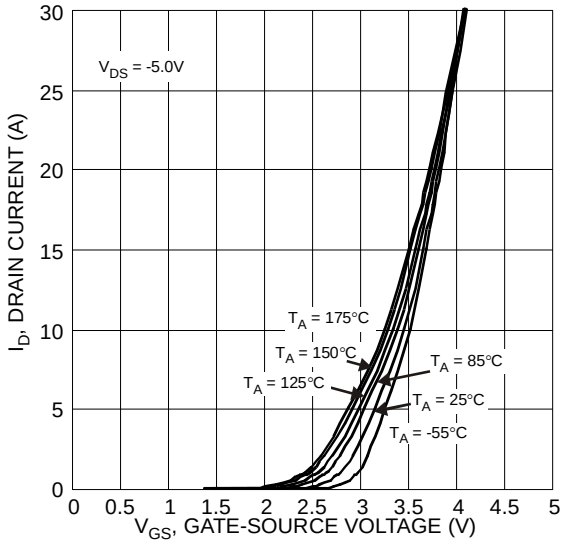


Figure 2 Typical Transfer Characteristics

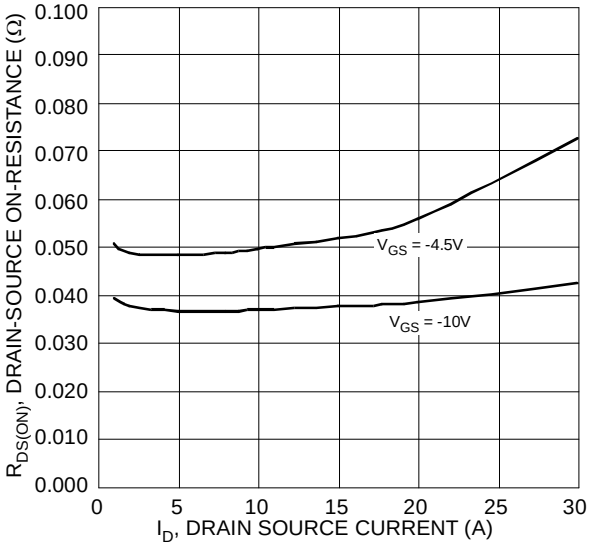


Figure 3 Typical On-Resistance vs. Drain Current and Gate Voltage

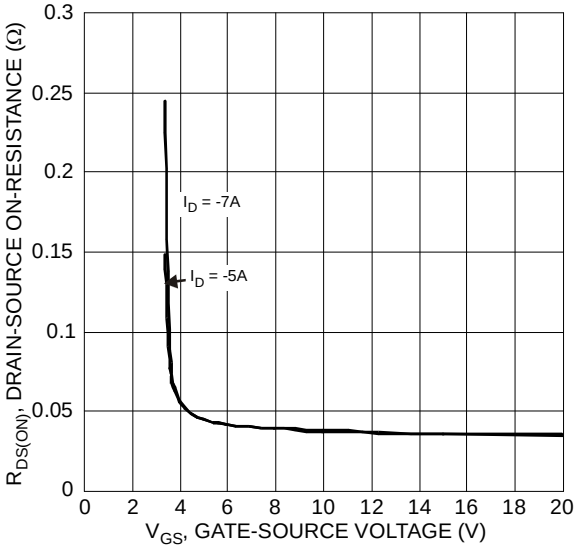


Figure 4 Typical Transfer Characteristic

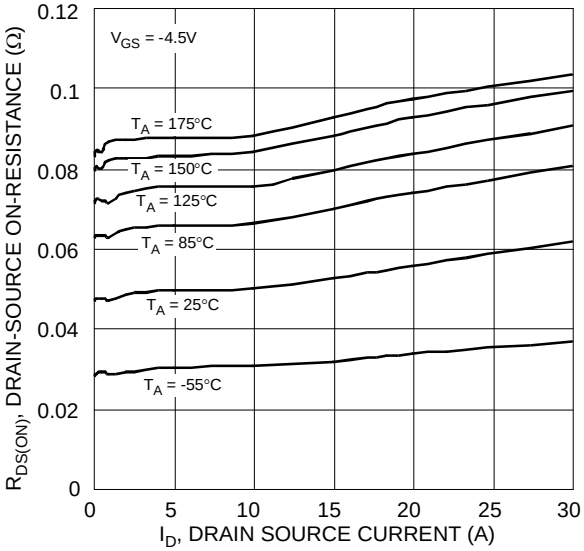


Figure 5 Typical On-Resistance vs. Drain Current and Temperature

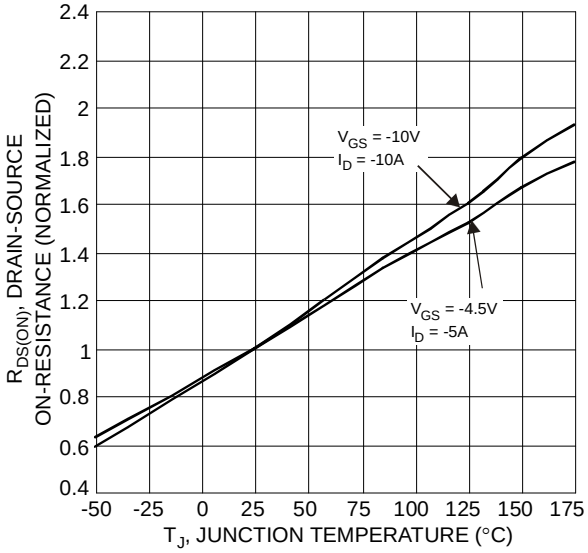


Figure 6 On-Resistance Variation with Temperature

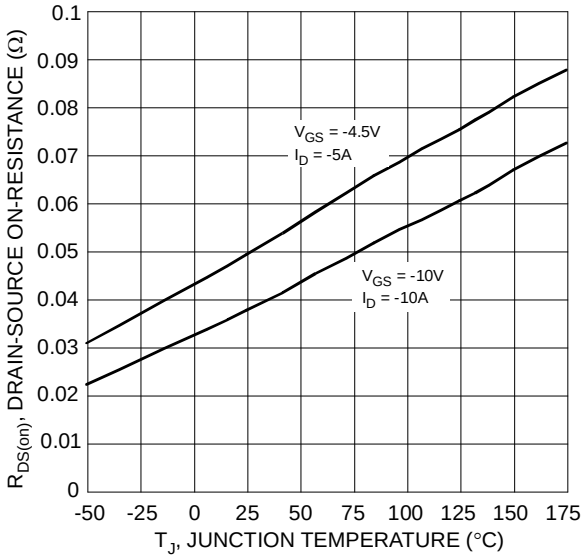


Figure 7 On-Resistance Variation with Temperature

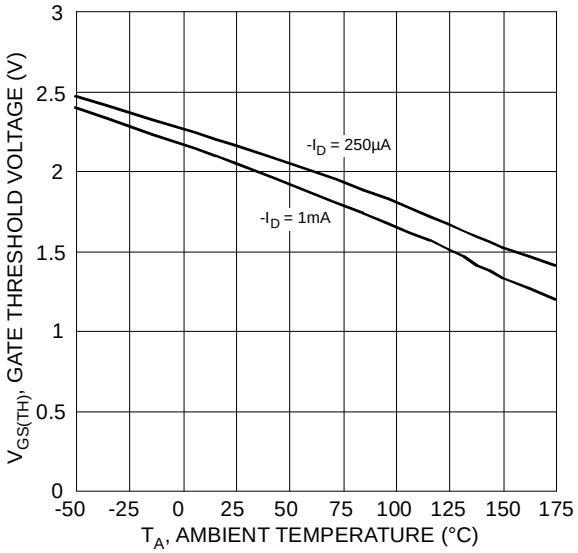


Figure 8 Gate Threshold Variation vs. Ambient Temperature

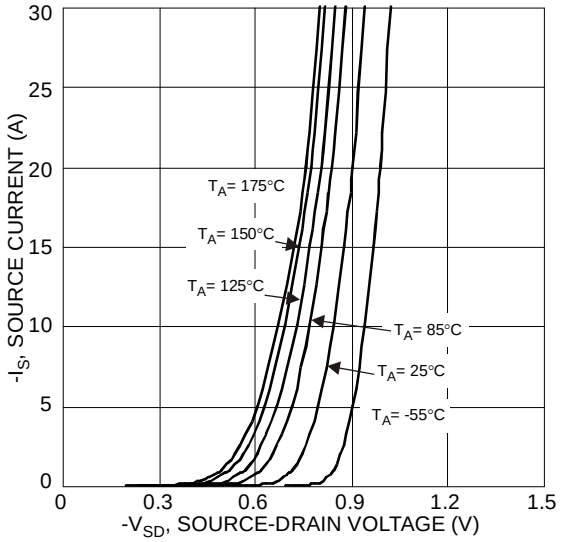


Figure 9 Diode Forward Voltage vs. Current

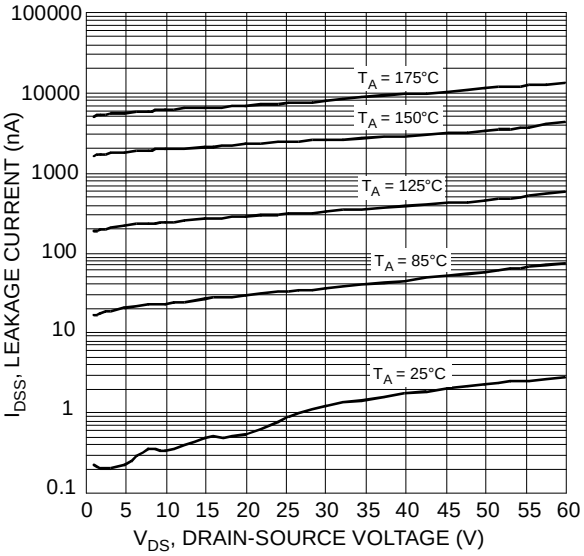


Figure 10 Typical Drain-Source Leakage Current vs. Voltage

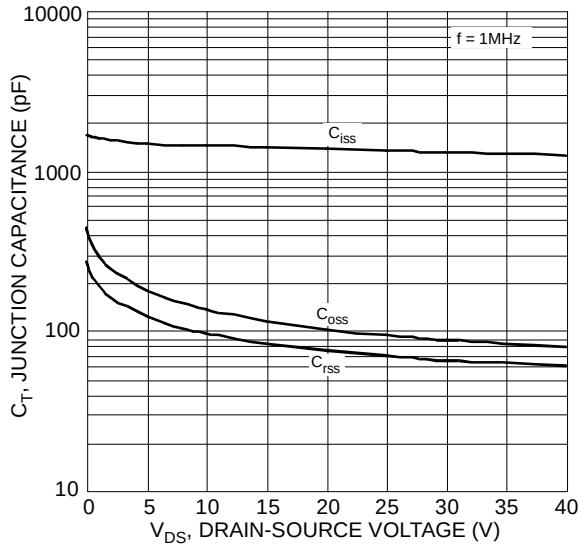


Figure 11 Typical Junction Capacitance

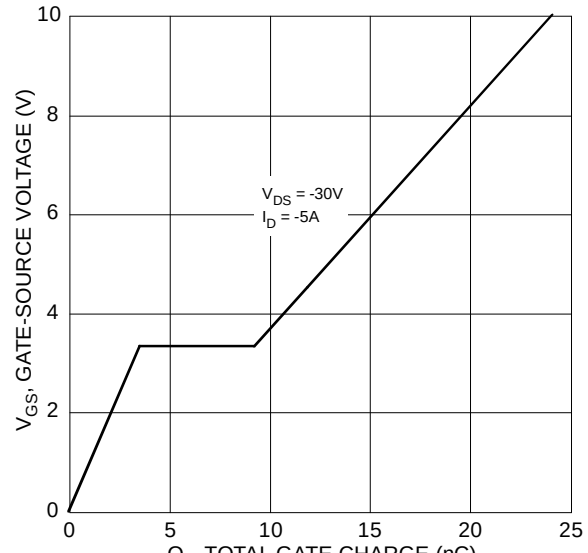


Figure 12 Gate-Charge Characteristics

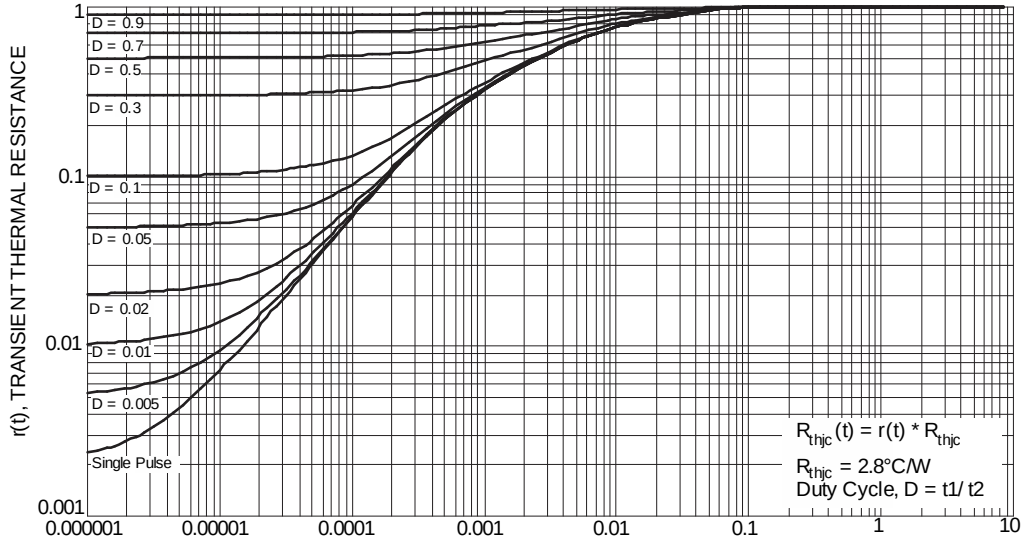


Figure 13 Transient Thermal Resistance

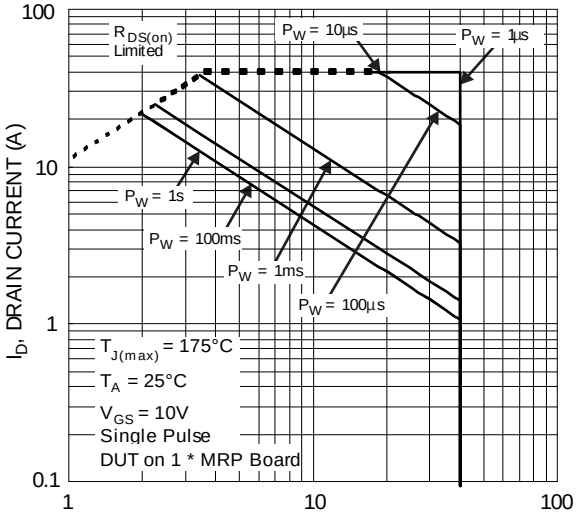
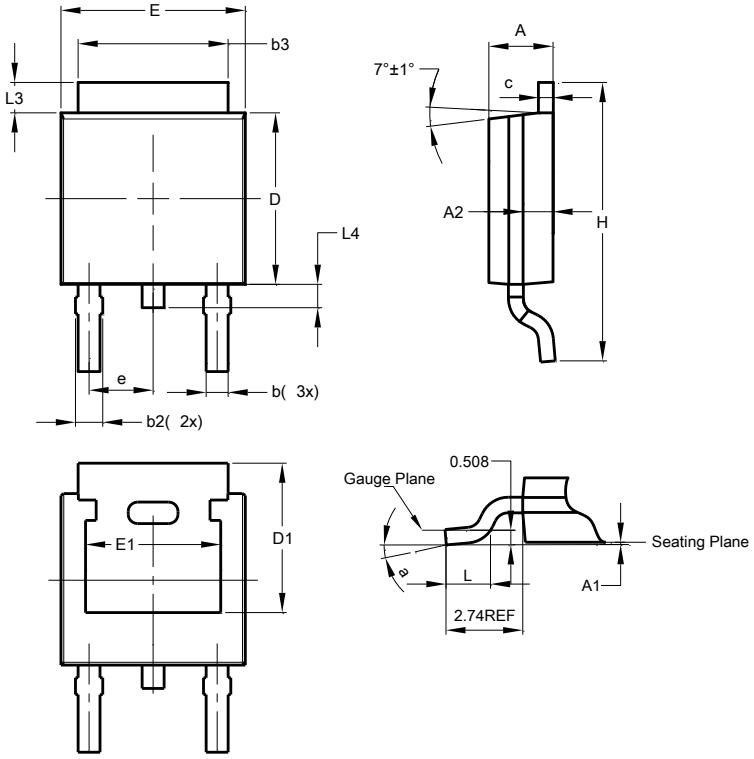


Figure 14 SOA, Safe Operation Area

Package Outline Dimensions

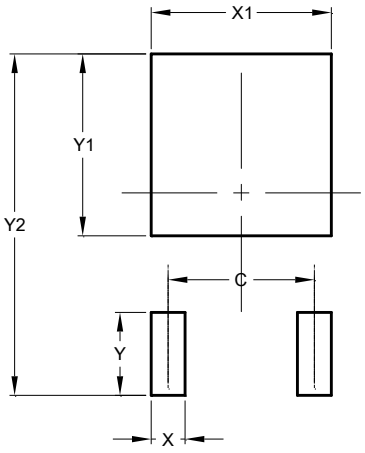
Please see AP02002 at http://www.diodes.com/datasheets/ap02002.pdf for the latest version.



TO252 (DPAK)			
Dim	**Min**	**Max**	**Typ**
A	2.19	2.39	2.29
A1	0.00	0.13	0.08
A2	0.97	1.17	1.07
b	0.64	0.88	0.783
b2	0.76	1.14	0.95
b3	5.21	5.46	5.33
c	0.45	0.58	0.531
D	6.00	6.20	6.10
D1	5.21	-	-
e	-	-	2.286
E	6.45	6.70	6.58
E1	4.32	-	-
H	9.40	10.41	9.91
L	1.40	1.78	1.59
L3	0.88	1.27	1.08
L4	0.64	1.02	0.83
a	0°	10°	-
All Dimensions in mm			

Suggested Pad Layout

Please see AP02001 at http://www.diodes.com/datasheets/ap02001.pdf for the latest version.



Dimensions	Value (in mm)
C	4.572
X	1.060
X1	5.632
Y	2.600
Y1	5.700
Y2	10.700

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