60V 175°C N-CHANNEL ENHANCEMENT MODE MOSFET

Product Summary

BV_{DSS}	$R_{DS(ON)}$ Max	I_D Max T_C = +25°C
60V	10mΩ @ V_{GS} = 10V	59A
	12.8mΩ @ V_{GS} = 4.5V	52A

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:

- Power Management Functions
- DC-DC Converters
- Backlighting

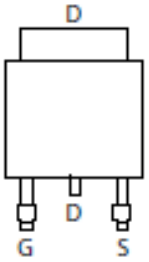
Features

- Rated to +175°C – ideal for high ambient temperature environments
- Low $R_{DS(ON)}$ – Ensures On State Losses Are Minimized
- Excellent Q_{gd} x $R_{DS(ON)}$ Product (FOM)
- Advanced Technology for DC/DC Converters
- Small Form Factor Thermally Efficient Package Enables Higher Density End Products
- **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)**

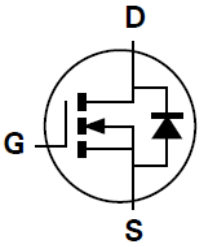
Mechanical Data

- Case: TO252
- 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: 0.33 grams (Approximate)

Top View



Pin Out Top View



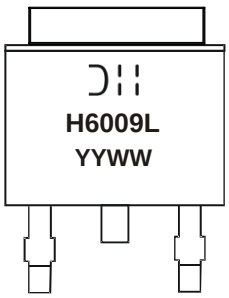
Equivalent Circuit

Ordering Information (Note 5)

Part Number	Case	Packaging
DMTH6009LK3Q-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



=Manufacturer's Marking
H6009L = Product Type Marking Code
YYWW = Date Code Marking
YY = Last Two Digits of Year (ex: 15 = 2015)
WW = Week Code (01 to 53)

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

Characteristic		Symbol	Value	Unit
Drain-Source Voltage		V_{DSS}	60	V
Gate-Source Voltage		V_{GSS}	±20	V
Continuous Drain Current (Note 6) V_{GS} = 10V	T_A = +25°C T_A = +70°C	I_D	14.2 11.9	A
Continuous Drain Current (Note 7) V_{GS} = 10V	T_C = +25°C T_C = +70°C	I_D	59 49	A
Maximum Continuous Body Diode Forward Current (Note 7)		I_S	80	A
Pulsed Drain Current (10µs Pulse, Duty Cycle = 1%)		I_{DM}	90	A
Avalanche Current, L=0.1mH		I_{AS}	20.3	A
Avalanche Energy, L=0.1mH		E_{AS}	20.6	mJ

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

Characteristic	Symbol	Value	Unit
Total Power Dissipation (Note 6)	P_D	3.2	W
Thermal Resistance, Junction to Ambient (Note 6)	$R_{\theta JA}$	47	°C/W
Total Power Dissipation (Note 7)	P_D	60	W
Thermal Resistance, Junction to Case (Note 7)	$R_{\theta JC}$	2.5	°C/W
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 8)						
Drain-Source Breakdown Voltage	BV_{DSS}	60	-	-	V	V_{GS} = 0V, I_D = 1mA
Zero Gate Voltage Drain Current	I_{DSS}	-	-	1	µA	V_{DS} = 48V, V_{GS} = 0V
Gate-Source Leakage	I_{GSS}	-	-	±100	nA	V_{GS} = ±16V, V_{DS} = 0V
ON CHARACTERISTICS (Note 8)						
Gate Threshold Voltage	$V_{GS(TH)}$	0.7	1.4	2	V	V_{DS} = V_{GS}, I_D = 250µA
Static Drain-Source On-Resistance	$R_{DS(ON)}$	-	8.3	10	mΩ	V_{GS} = 10V, I_D = 13.5A
		-	9.6	12.8	mΩ	V_{GS} = 4.5V, I_D = 11.5A
Diode Forward Voltage	V_{SD}	-	0.9	1.2	V	V_{GS} = 0V, I_S = 20A
DYNAMIC CHARACTERISTICS (Note 9)						
Input Capacitance	C_{iss}	-	1,925	-	pF	V_{DS} = 30V, V_{GS} = 0V, f = 1MHz
Output Capacitance	C_{oss}	-	438	-		
Reverse Transfer Capacitance	C_{rss}	-	41	-		
Gate Resistance	R_g	-	1.7	-	Ω	V_{DS} = 0V, V_{GS} = 0V, f = 1MHz
Total Gate Charge (V_{GS} = 4.5V)	Q_g	-	15.6	-	nC	V_{DS} = 30V, I_D = 13.5A
Total Gate Charge (V_{GS} = 10V)	Q_g	-	33.5	-		
Gate-Source Charge	Q_{gs}	-	4.7	-		
Gate-Drain Charge	Q_{gd}	-	5.3	-		
Turn-On Delay Time	$t_{D(ON)}$	-	4.5	-	ns	V_{DD} = 30V, V_{GS} = 10V, R_G = 6Ω, I_D = 13.5A
Turn-On Rise Time	t_R	-	8.6	-		
Turn-Off Delay Time	$t_{D(OFF)}$	-	35.9	-		
Turn-Off Fall Time	t_F	-	15.7	-		
Body Diode Reverse Recovery Time	t_{RR}	-	18.2	-	ns	I_F = 13.5A, di/dt = 400A/µs
Body Diode Reverse Recovery Charge	Q_{RR}	-	33.1	-	nC	

Notes: 6. Device mounted on FR-4 substrate PC board, 2oz copper, with 1inch square copper pad layout.
7. Device mounted on infinite heat sink and measured by thermal couple attached on bottom heat sink of package.
8. Short duration pulse test used to minimize self-heating effect.
9. Guaranteed by design. Not subject to product testing.

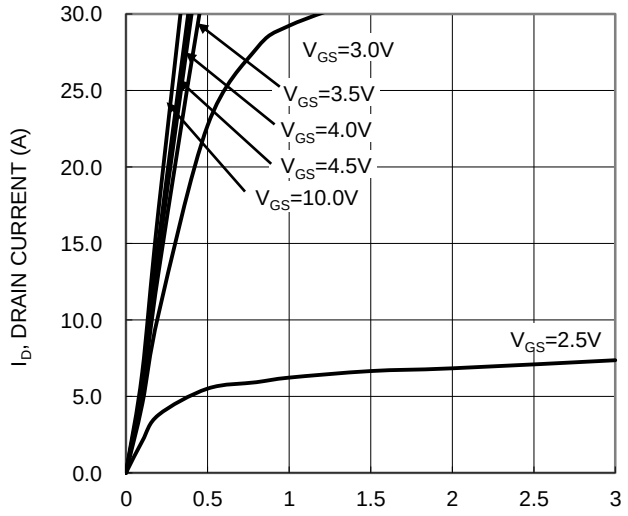


Figure 1. Typical Output Characteristic

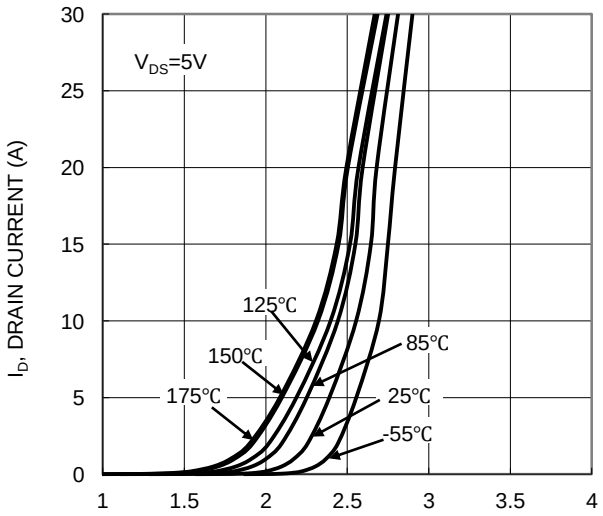


Figure 2. Typical Transfer Characteristic

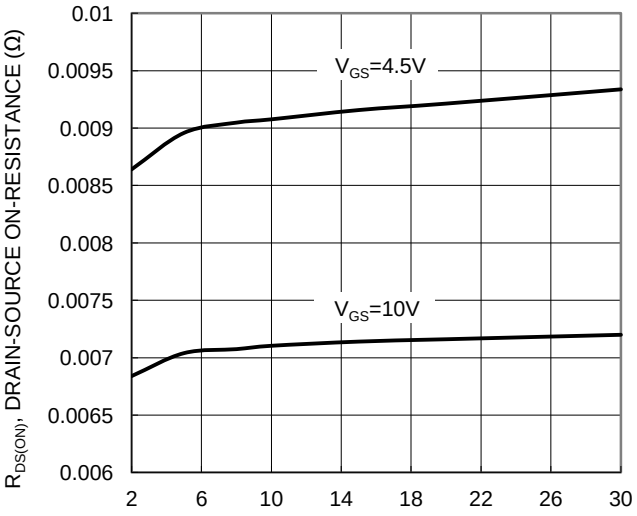


Figure 3. Typical On-Resistance vs. Drain Current and Gate Voltage

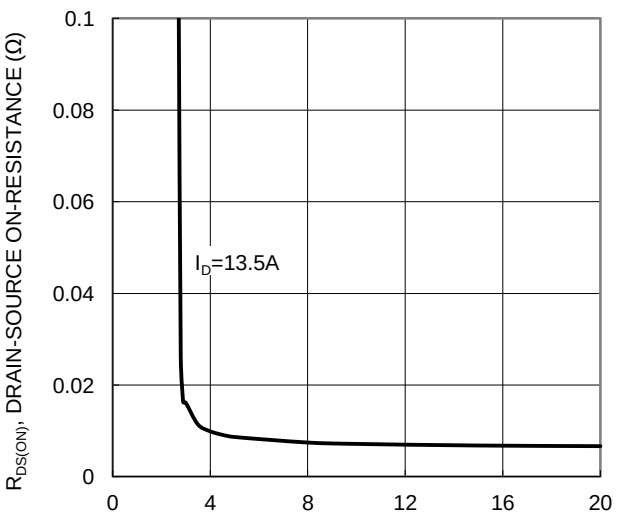


Figure 4. Typical Transfer Characteristic

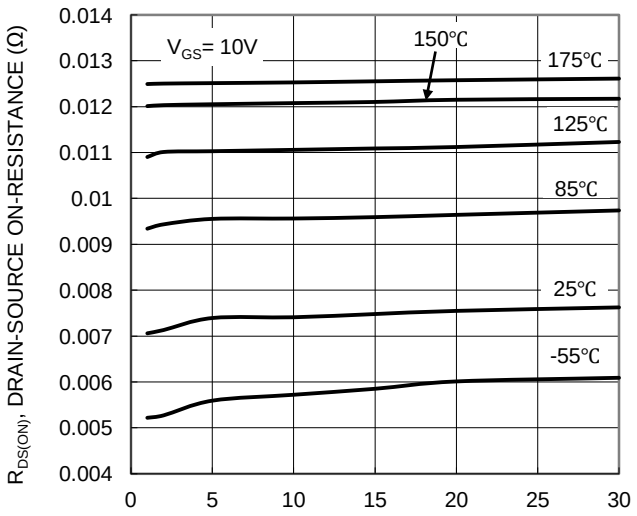


Figure 5. Typical On-Resistance vs. Drain Current and Junction Temperature

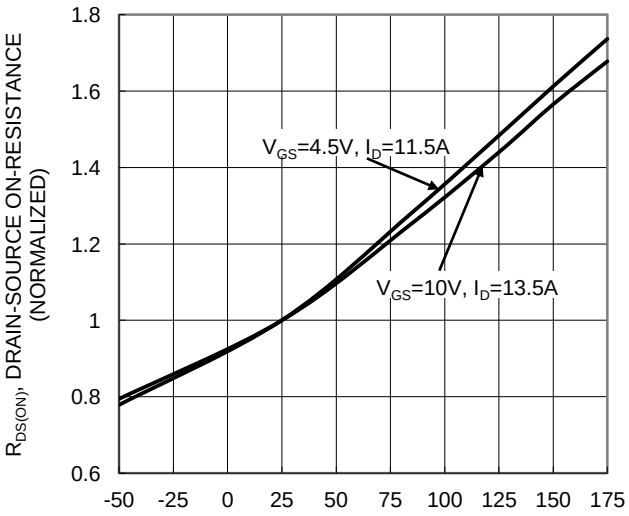


Figure 6. On-Resistance Variation with Junction Temperature

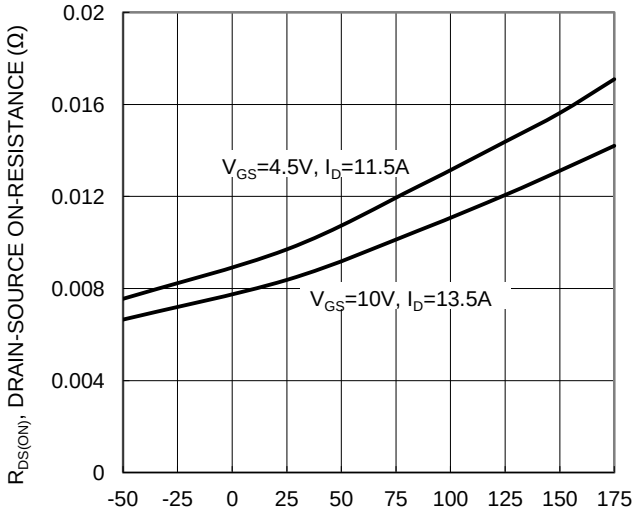


Figure 7. On-Resistance Variation with Junction Temperature

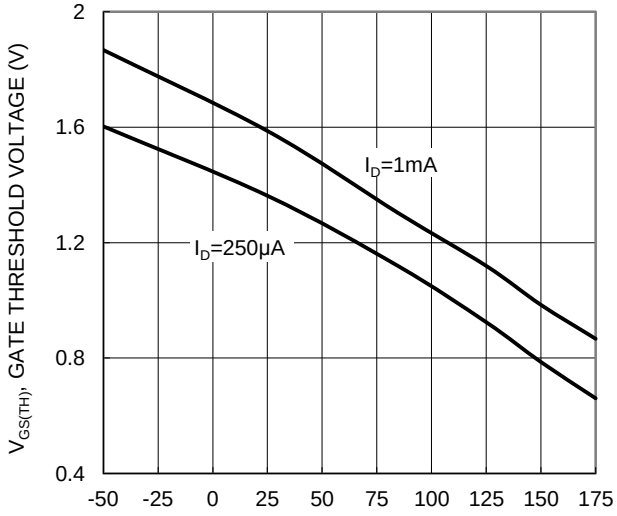


Figure 8. Gate Threshold Variation vs. Junction Temperature

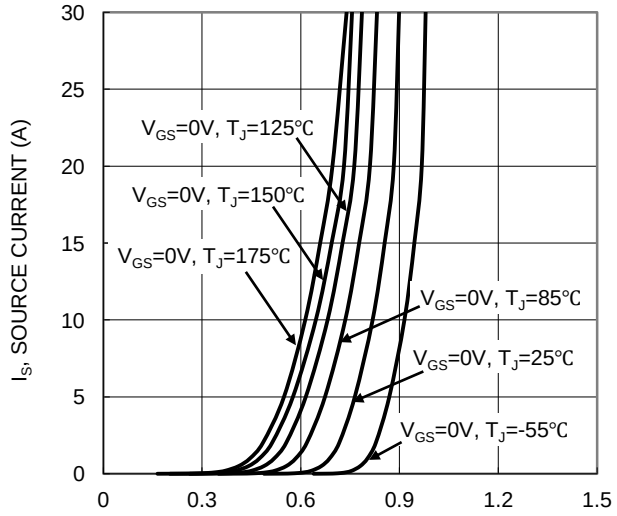


Figure 9. Diode Forward Voltage vs. Current

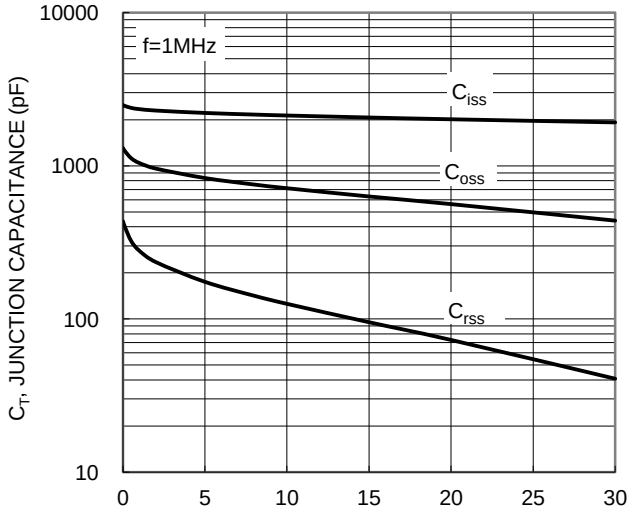


Figure 10. Typical Junction Capacitance

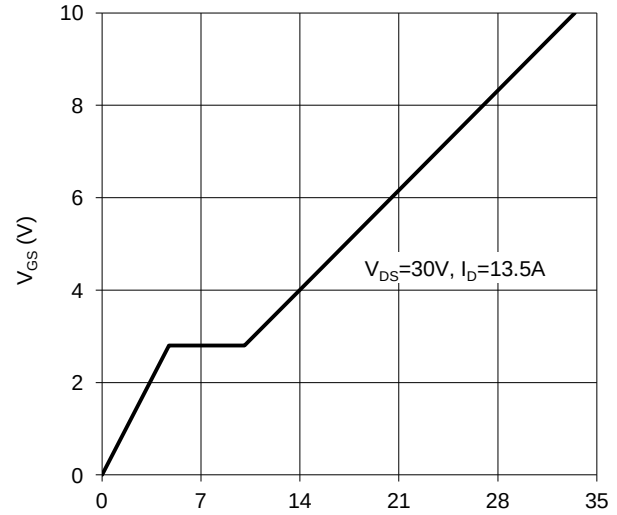


Figure 11. Gate Charge

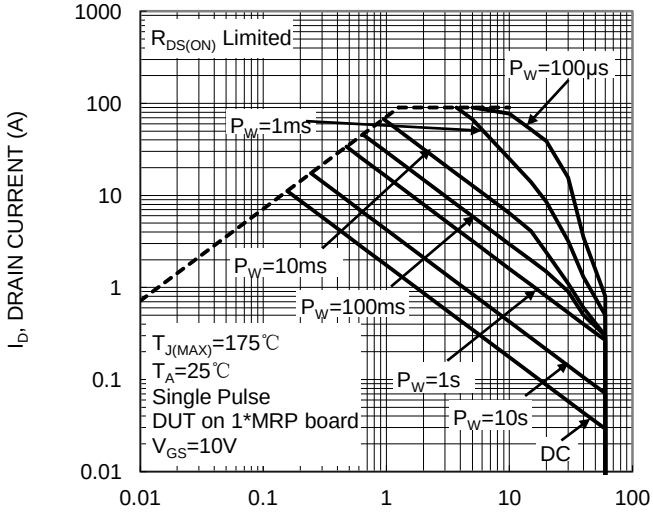


Figure 12. SOA, Safe Operation Area

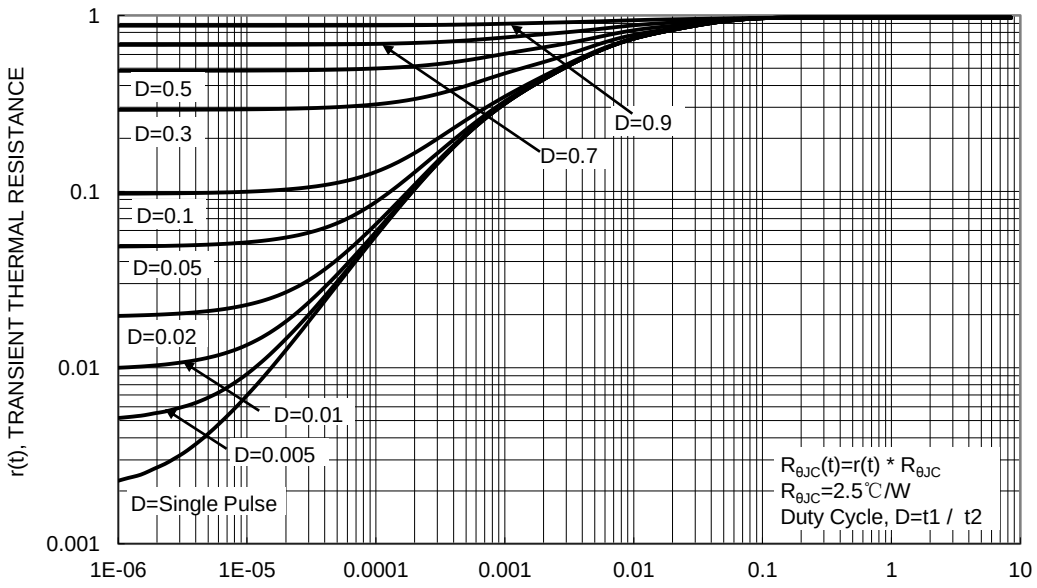
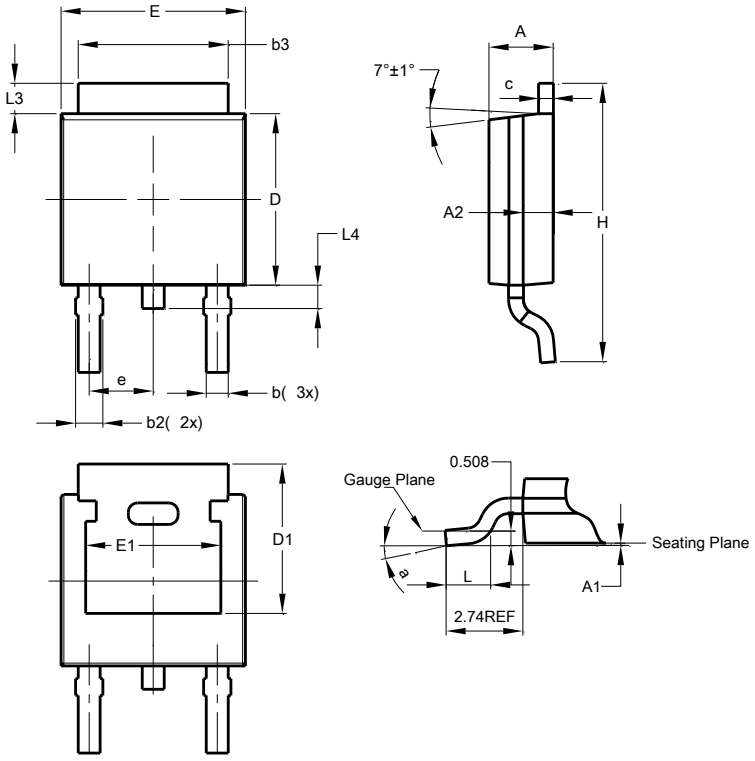


Figure 13. Transient Thermal Resistance

Package Outline Dimensions

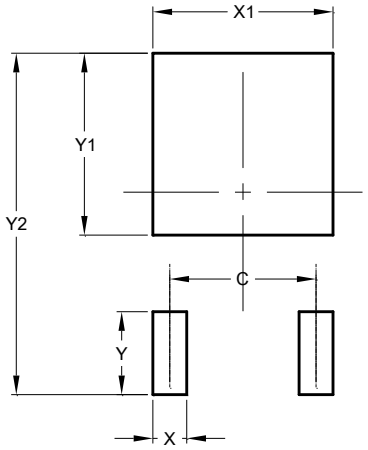
Please see AP02002 at http://www.diodes.com/datasheets/ap02002.pdf for the latest version.



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