175°C P-CHANNEL ENHANCEMENT MODE MOSFET

Product Summary

BV_{DSS}	$R_{DS(ON)}$ MAX	I_D T_C = +25°C
-40V	11mΩ @ V_{GS} = -10V	-79A
	19mΩ @ V_{GS} = -4.5V	-61A

Features and Benefits

- Rated to +175°C – Ideal for High Ambient Temperature Environments
- 100% Unclamped Inductive Switch (UIS) Test in Production
- Low On-resistance
- Fast Switching Speed
- **Lead-Free Finish; 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

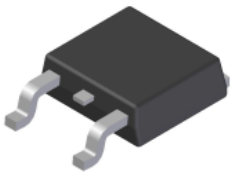
This new generation MOSFET is designed to minimize the on-state resistance ($R_{DS(ON)}$) yet maintain superior switching performance, making it ideal for high efficiency power management applications.

- DC-DC Converters
- Power Management Functions
- Backlighting

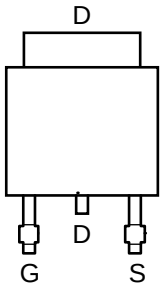
Mechanical Data

- Case: TO252
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminal Connections: See Diagram
- Terminals: Finish – Matte Tin Finish Annealed over Copper Leadframe. Solderable per MIL-STD-202, Method 208 e3
- Weight: 0.33 grams (Approximate)

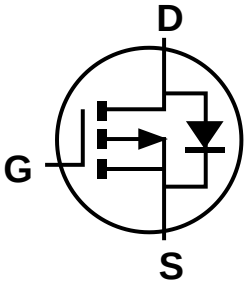
TO252 (DPAK)



Top View



Top View
Pin-Out



Equivalent Circuit

Ordering Information (Note 4)

Part Number	Case	Packaging
DMPH4011SK3-13	TO252 (DPAK)	2,500/Tape & Reel

Notes:
1. EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant. All applicable RoHS exemptions applied.
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/.

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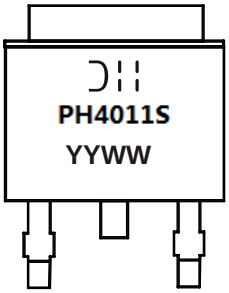
Marking Information



= Manufacturer's Marking
PH4011S = Product Type Marking Code
YYWW = Date Code Marking
YY = Year (ex: 21 = 2021)
WW = Week (01 to 53)

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

Characteristic			Symbol	Value	Unit
Drain-Source Voltage			V_{DSS}	-40	V
Gate-Source Voltage			V_{GSS}	±20	V
Continuous Drain Current (Note 6) V_{GS} = -10V	Steady State	T_C = +25°C T_C = +100°C	I_D	-79 -56	A
Pulsed Drain Current (10µs Pulse, Duty Cycle = 1%)			I_{DM}	-316	A
Maximum Body Diode Forward Current (Note 6)			I_S	-79	A
Avalanche Current, L = 1mH			I_{AS}	-20	A
Avalanche Energy, L = 1mH			E_{AS}	202	mJ

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

Characteristic		Symbol	Value	Unit
Total Power Dissipation (Note 5)	T_A= +25°C	P_D	3.7	W
Thermal Resistance, Junction to Ambient (Note 5)	Steady State	$R_{\theta JA}$	40	°C/W
Total Power Dissipation (Note 6)	T_C = +25°C	P_D	115	W
Thermal Resistance, Junction to Case (Note 6)		$R_{\theta JC}$	1.3	°C/W
Operating and Storage Temperature Range		T_J, T_{STG}	-55 to +175	°C

Notes: 5. Device mounted on FR-4 substrate PC board, 2oz copper, with 1inch square copper plate.
6. Thermal resistance from junction to soldering point (on the exposed drain pad).

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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}	-40	—	—	V	V_{GS} = 0V, I_D = -250µA
Zero Gate Voltage Drain Current	I_{DSS}	—	—	-1	µA	V_{DS} = -32V, V_{GS} = 0V
Gate-Source Leakage	I_{GSS}	—	—	±100	nA	V_{GS} = ±20V, V_{DS} = 0V
ON CHARACTERISTICS (Note 7)						
Gate Threshold Voltage	$V_{GS(TH)}$	-1.0	—	-2.5	V	V_{DS} = V_{GS}, I_D = -250µA
Static Drain-Source On-Resistance	$R_{DS(ON)}$	—	6.5	11	mΩ	V_{GS} = -10V, I_D = -9.8A
		—	9.1	19		V_{GS} = -4.5V, I_D = -9.8A
Diode Forward Voltage	V_{SD}	—	-0.7	-1	V	V_{GS} = 0V, I_S = -1A
DYNAMIC CHARACTERISTICS (Note 8)						
Input Capacitance	C_{iss}	—	4497	—	pF	V_{DS} = -20V, V_{GS} = 0V f = 1MHz
Output Capacitance	C_{oss}	—	555	—		
Reverse Transfer Capacitance	C_{rss}	—	416	—		
Gate Resistance	R_g	—	11.7	—	Ω	V_{DS} = 0V, V_{GS} = 0V, f = 1MHz
Total Gate Charge (V_{GS} = -4.5V)	Q_g	—	53	—	nC	V_{DS} = -20V, I_D = -9.8A
Total Gate Charge (V_{GS} = -10V)	Q_g	—	104	—		
Gate-Source Charge	Q_{gs}	—	14	—		
Gate-Drain Charge	Q_{gd}	—	25	—		
Turn-On Delay Time	$t_{D(ON)}$	—	8	—	ns	V_{GS} = -10V, V_{DD} = -20V, R_g = 6Ω, I_D = -1A
Turn-On Rise Time	t_R	—	7.8	—		
Turn-Off Delay Time	$t_{D(OFF)}$	—	328	—		
Turn-Off Fall Time	t_F	—	147	—		
Reverse Recovery Time	t_{RR}	—	37	—	ns	I_F = -9.8A, di/dt = -100A/µs
Reverse Recovery Charge	Q_{RR}	—	29	—	nC	I_F = -9.8A, 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.

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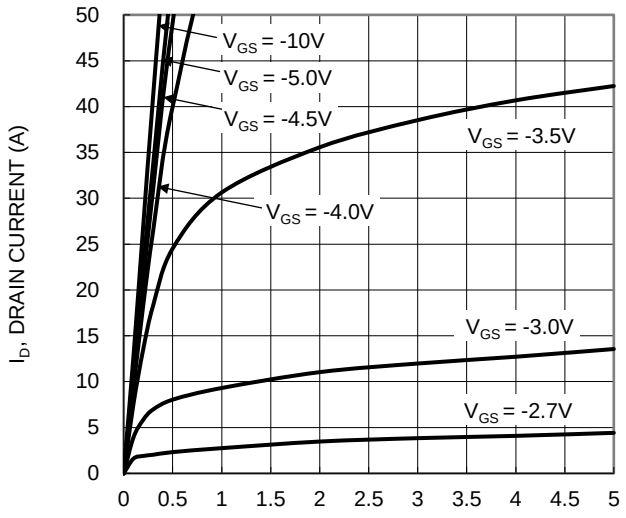

Figure 1. Typical Output Characteristic

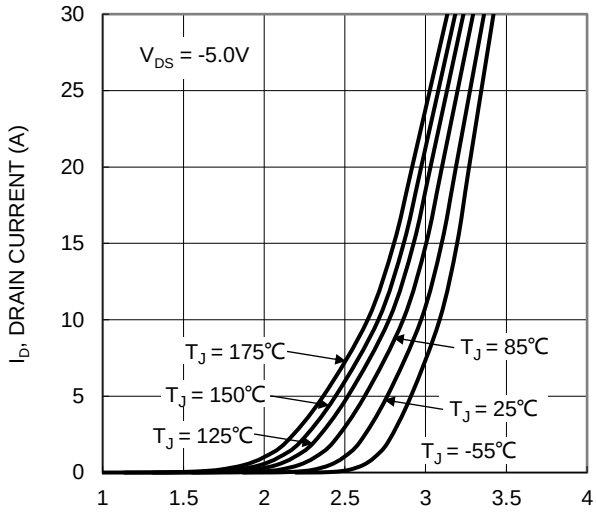

Figure 2. Typical Transfer Characteristic

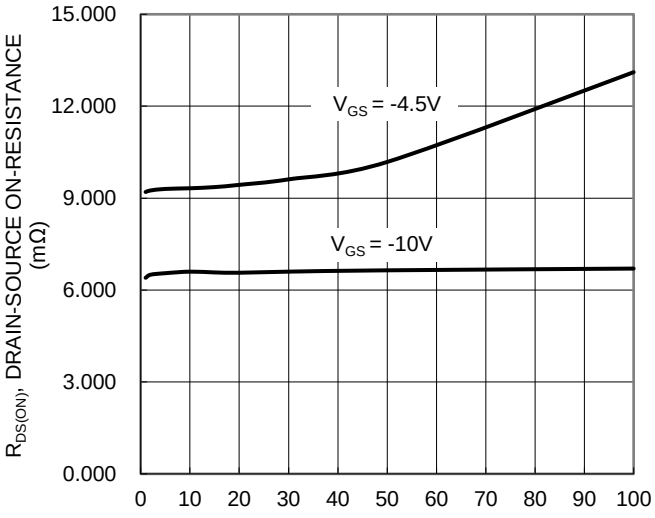

Figure 3. Typical On-Resistance vs. Drain Current and Gate Voltage

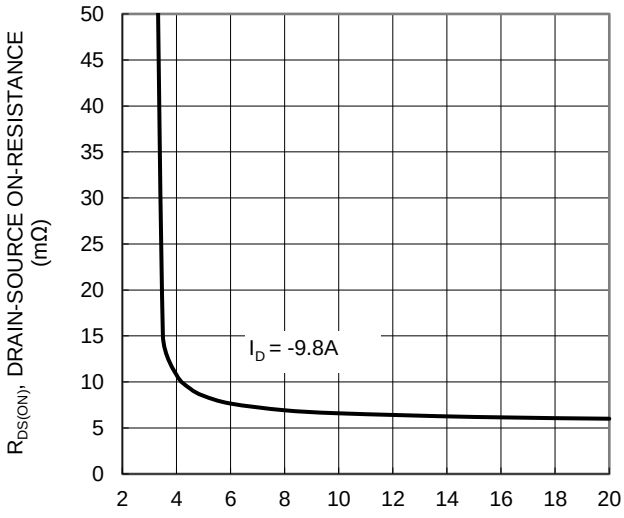

Figure 4. Typical Transfer Characteristic

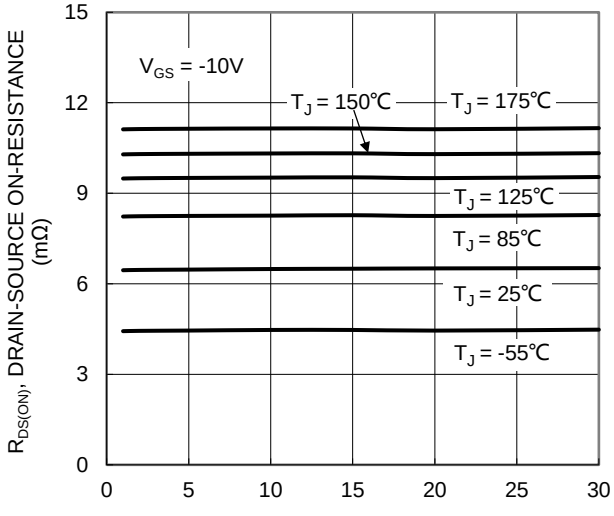

Figure 5. Typical On-Resistance vs. Drain Current and Temperature

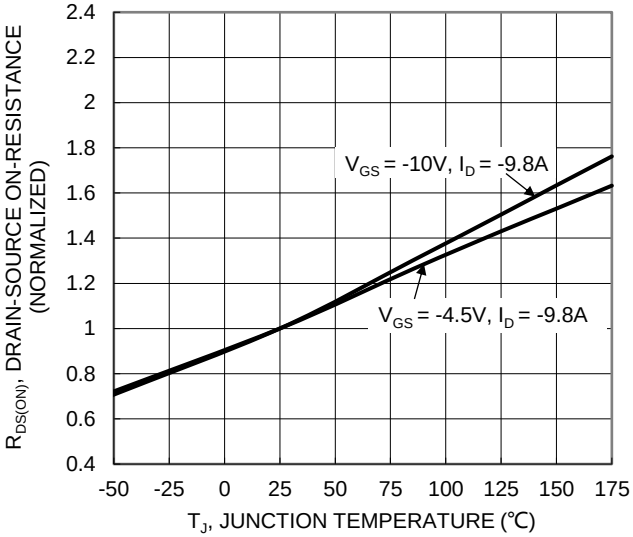

Figure 6. On-Resistance Variation with Temperature

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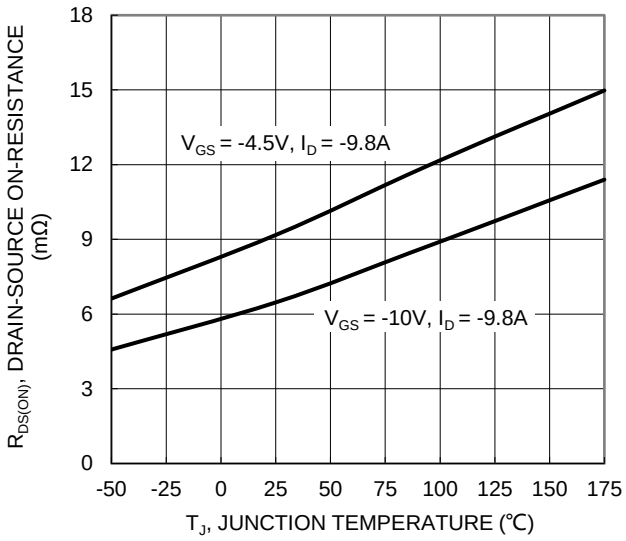

Figure 7. On-Resistance Variation with Temperature

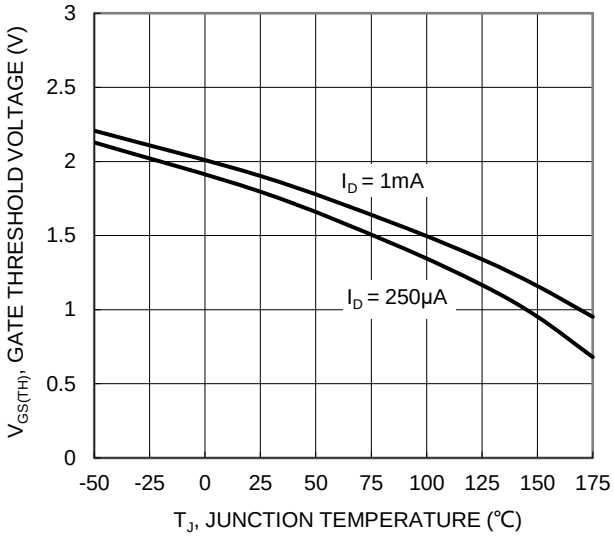

Figure 8. Gate Threshold Variation vs. Junction Temperature

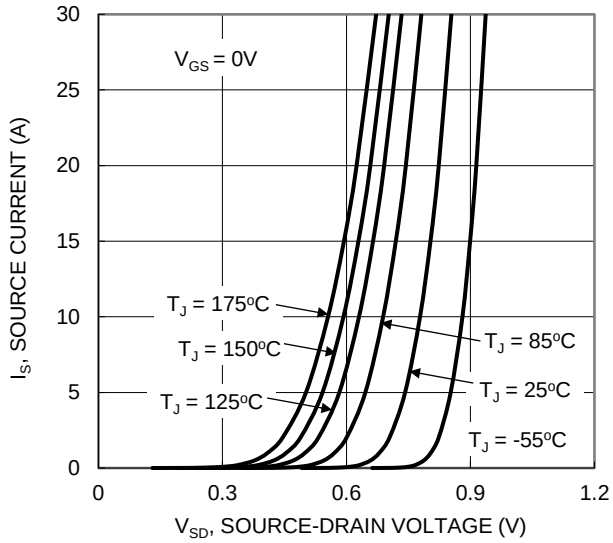

Figure 9. Diode Forward Voltage vs. Current

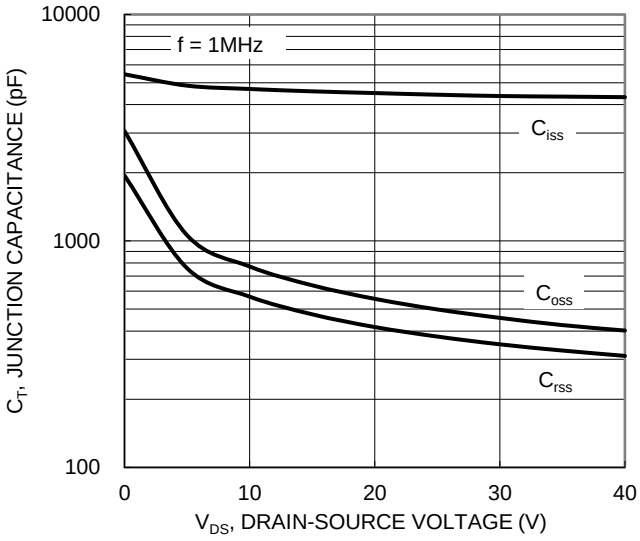

Figure 10. Typical Junction Capacitance

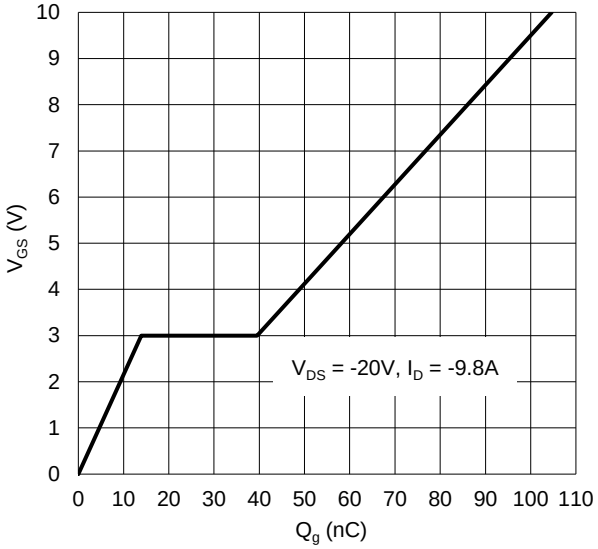

Figure 11. Gate Charge

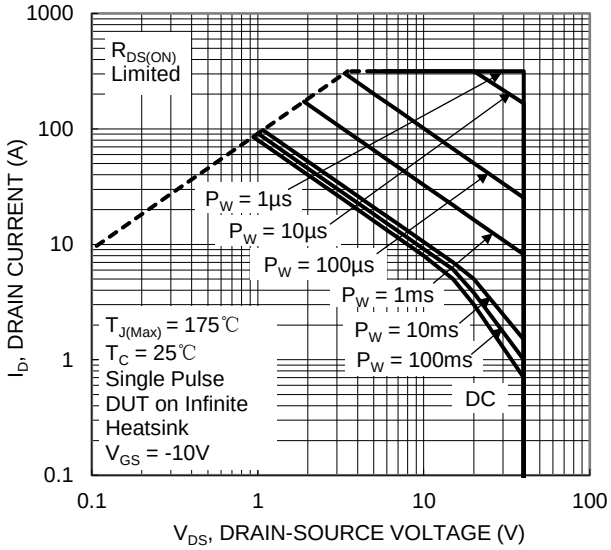

Figure 12. SOA, Safe Operation Area

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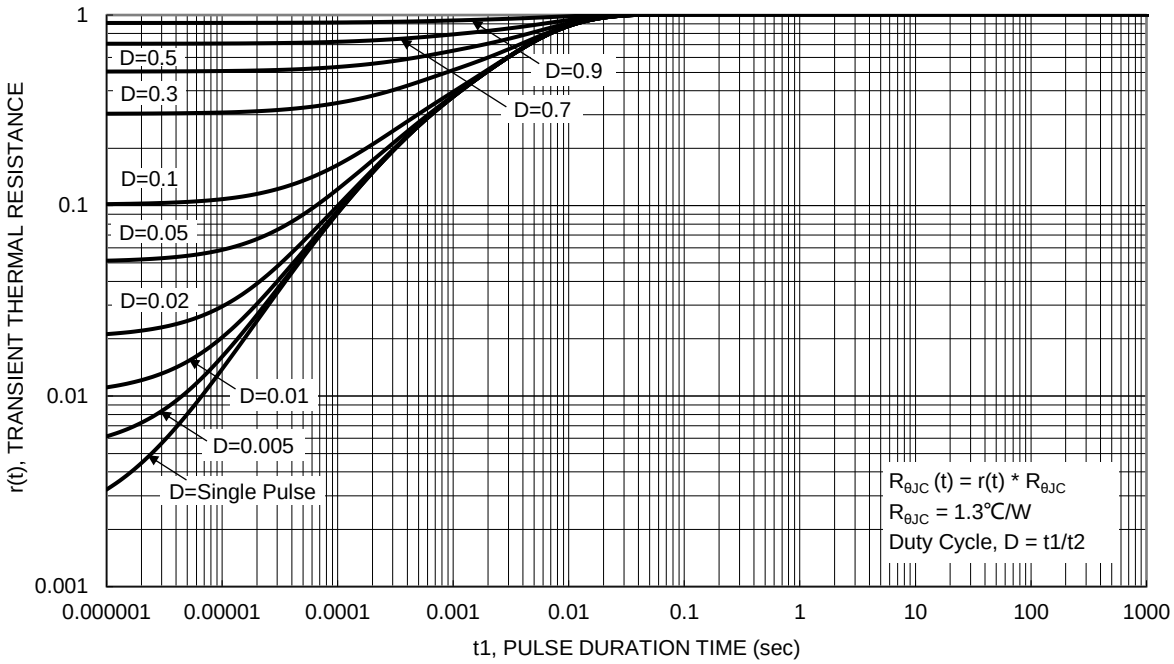

Figure 13. Transient Thermal Resistance

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Package Outline Dimensions

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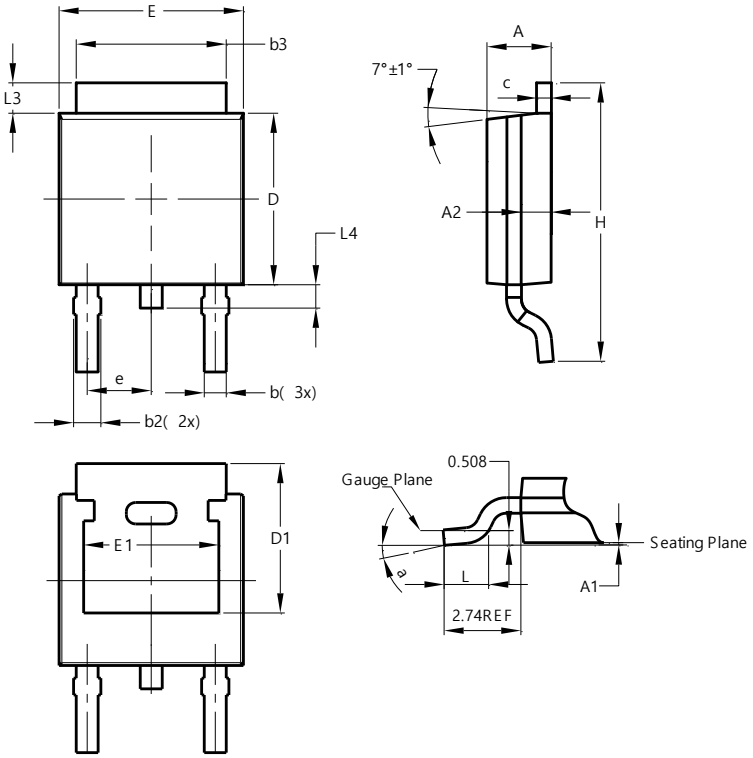
TO252 (DPAK)

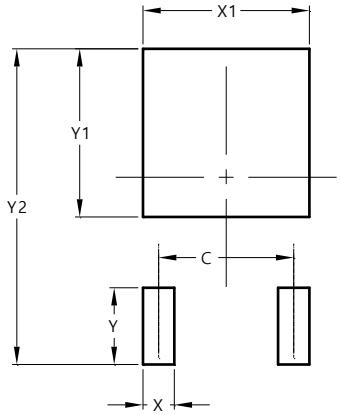


TO252 (DPAK)			
Dim	**Min**	**Max**	**Typ**
A	2.19	2.39	2.29
A1	0.00	0.13	0.08
A2	0.97	1.17	1.07
b	0.64	0.88	0.783
b2	0.76	1.14	0.95
b3	5.21	5.46	5.33
c	0.45	0.58	0.531
D	6.00	6.20	6.10
D1	5.21	-	-
e	-	-	2.286
E	6.45	6.70	6.58
E1	4.32	-	-
H	9.40	10.41	9.91
L	1.40	1.78	1.59
L3	0.88	1.27	1.08
L4	0.64	1.02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

Suggested Pad Layout

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

TO252 (DPAK)



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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