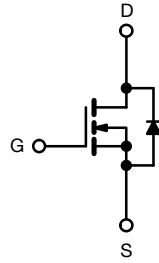
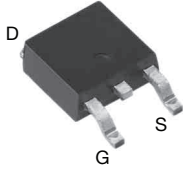


## D Series Power MOSFET

**DPAK (TO-252)**


N-Channel MOSFET

### FEATURES

- Optimal design
  - Low area specific on-resistance
  - Low input capacitance ( $C_{iss}$ )
  - Reduced capacitive switching losses
  - High body diode ruggedness
  - Avalanche energy rated (UIS)
- Optimal efficiency and operation
  - Low cost
  - Simple gate drive circuitry
  - Low figure-of-merit (FOM):  $R_{on} \times Q_g$
  - Fast switching
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS**  
 COMPLIANT  
 HALOGEN  
**FREE**  
 Available

### PRODUCT SUMMARY

$V_{DS}$ (V) at $T_J$ max.	550	
$R_{DS(on)}$ max. ( $\Omega$ ) at 25 °C	$V_{GS} = 10$ V	3.2
$Q_g$ max. (nC)	12	
$Q_{gs}$ (nC)	2	
$Q_{gd}$ (nC)	3	
Configuration	Single	

### APPLICATIONS

- Consumer electronics
  - Displays (LCD or plasma TV)
- Server and telecom power supplies
  - SMPS
- Industrial
  - Welding
  - Induction heating
  - Motor drives
- Battery chargers

### ORDERING INFORMATION

Package	DPAK (TO-252)	DPAK (TO-252)	DPAK (TO-252)
Lead (Pb)-free and halogen-free	SiHD3N50D-GE3	SiHD3N50DT1-GE3	SiHD3N50DT4-GE3
	SiHD3N50DT5-GE3	SiHD3N50D-BE3	-
Lead (Pb)-free	SiHD3N50D-E3	-	-


### ABSOLUTE MAXIMUM RATINGS ( $T_C = 25$ °C, unless otherwise noted)

PARAMETER	SYMBOL	LIMIT	UNIT	
Drain-source voltage	$V_{DS}$	500	V	
Gate-source voltage	$V_{GS}$	$\pm 30$		
Gate-source voltage AC ( $f > 1$ Hz)		30		
Continuous drain current ( $T_J = 150$ °C)	$V_{GS}$ at 10 V	$T_C = 25$ °C	A	
		$T_C = 100$ °C		1.9
Pulsed drain current <sup>a</sup>	$I_{DM}$	5.5		
Linear derating factor		0.56	W/°C	
Single pulse avalanche energy <sup>b</sup>	$E_{AS}$	10.4	mJ	
Maximum power dissipation	$P_D$	69	W	
Operating junction and storage temperature range	$T_J, T_{stg}$	-55 to +150	°C	
Drain-source voltage slope	$dV/dt$	$T_J = 125$ °C	V/ns	
Reverse diode $dV/dt$ <sup>d</sup>				0.22
Soldering recommendations (peak temperature) <sup>c</sup>		For 10 s		300

#### Notes

- Repetitive rating; pulse width limited by maximum junction temperature
- $V_{DD} = 50$  V, starting  $T_J = 25$  °C,  $L = 2.3$  mH,  $R_g = 25$   $\Omega$ ,  $I_{AS} = 3$  A
- 1.6 mm from case
- $I_{SD} \leq I_D$ , starting  $T_J = 25$  °C

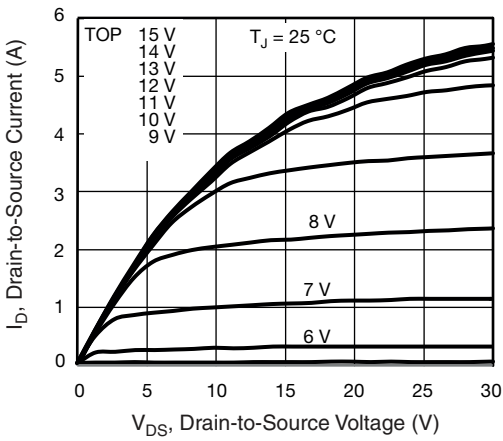
THERMAL RESISTANCE RATINGS				
PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum junction-to-ambient	$R_{thJA}$	-	62	°C/W
Maximum junction-to-case (drain)	$R_{thJC}$	-	1.8	

SPECIFICATIONS ( $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
<b>Static</b>						
Drain-source breakdown voltage	$V_{DS}$	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	500	-	-	V
$V_{DS}$ temperature coefficient	$\Delta V_{DS}/T_J$	Reference to $25\text{ }^\circ\text{C}$ , $I_D = 250\text{ }\mu\text{A}$	-	0.56	-	V/°C
Gate-source threshold voltage (N)	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	3	-	5	V
Gate-source leakage	$I_{GSS}$	$V_{GS} = \pm 30\text{ V}$	-	-	$\pm 100$	nA
Zero gate voltage drain current	$I_{DSS}$	$V_{DS} = 500\text{ V}, V_{GS} = 0\text{ V}$	-	-	1	$\mu\text{A}$
		$V_{DS} = 400\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$	-	-	10	
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 1.5\text{ A}$	-	2.6	3.2	$\Omega$
Forward transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = 8\text{ V}, I_D = 1.5\text{ A}$	-	1	-	S
<b>Dynamic</b>						
Input capacitance	$C_{iss}$	$V_{GS} = 0\text{ V}, V_{DS} = 100\text{ V}, f = 1\text{ MHz}$	-	175	-	pF
Output capacitance	$C_{oss}$		-	21	-	
Reverse transfer capacitance	$C_{rss}$		-	5	-	
Effective output capacitance, energy related <sup>b</sup>	$C_{o(er)}$	$V_{DS} = 0\text{ V to } 400\text{ V}, V_{GS} = 0\text{ V}$	-	21	-	
Effective output capacitance, time related <sup>c</sup>	$C_{o(tr)}$		-	26	-	
Total gate charge	$Q_g$	$V_{GS} = 10\text{ V}, I_D = 1.5\text{ A}, V_{DS} = 400\text{ V}$	-	6	12	nC
Gate-source charge	$Q_{gs}$		-	2	-	
Gate-drain charge	$Q_{gd}$		-	3	-	
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 400\text{ V}, I_D = 1.5\text{ A}, R_g = 9.1\text{ }\Omega, V_{GS} = 10\text{ V}$	-	12	24	ns
Rise time	$t_r$		-	9	18	
Turn-off delay time	$t_{d(off)}$		-	11	22	
Fall time	$t_f$		-	13	26	
Gate input resistance	$R_g$	$f = 1\text{ MHz}, \text{open drain}$	-	3.3	-	$\Omega$
<b>Drain-Source Body Diode Characteristics</b>						
Continuous source-drain diode current	$I_S$	MOSFET symbol showing the integral reverse P - N junction diode 	-	-	3	A
Pulsed diode forward current	$I_{SM}$		-	-	12	
Diode forward voltage	$V_{SD}$	$T_J = 25\text{ }^\circ\text{C}, I_S = 1.5\text{ A}, V_{GS} = 0\text{ V}$	-	-	1.2	V
Reverse recovery time	$t_{rr}$	$T_J = 25\text{ }^\circ\text{C}, I_F = I_S = 1.5\text{ A}, di/dt = 100\text{ A}/\mu\text{s}, V_R = 20\text{ V}$	-	293	-	ns
Reverse recovery charge	$Q_{rr}$		-	0.74	-	$\mu\text{C}$
Reverse recovery current	$I_{RRM}$		-	5	-	A

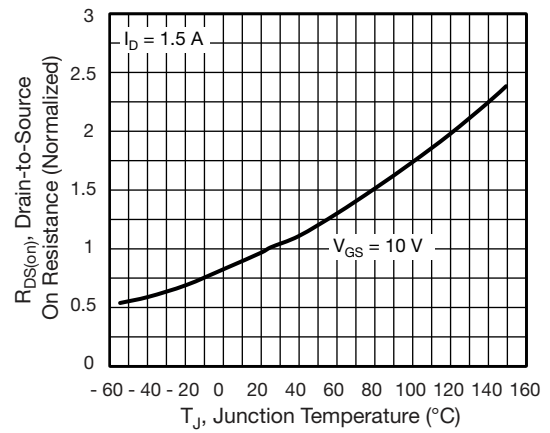
**Notes**

- Repetitive rating; pulse width limited by maximum junction temperature
- $C_{oss(er)}$  is a fixed capacitance that gives the same energy as  $C_{oss}$  while  $V_{DS}$  is rising from 0 % to 80 %  $V_{DSS}$
- $C_{oss(tr)}$  is a fixed capacitance that gives the same charging time as  $C_{oss}$  while  $V_{DS}$  is rising from 0 % to 80 %  $V_{DSS}$

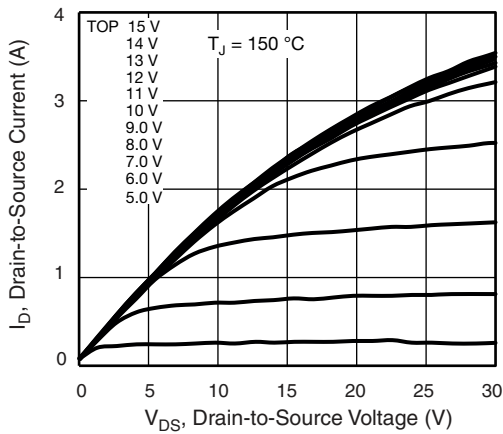
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



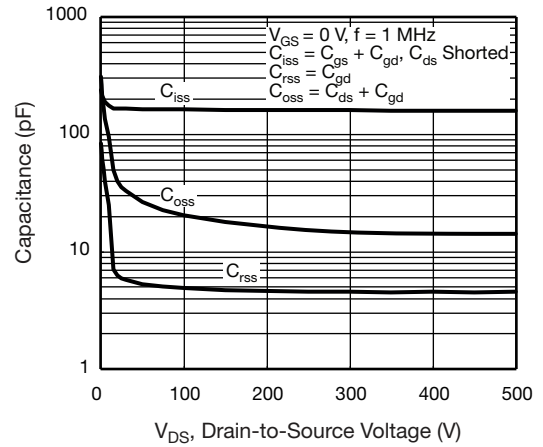
**Fig. 1 - Typical Output Characteristics**



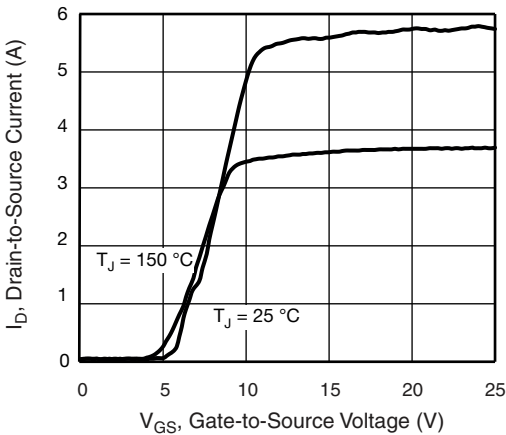
**Fig. 4 - Normalized On-Resistance vs. Temperature**



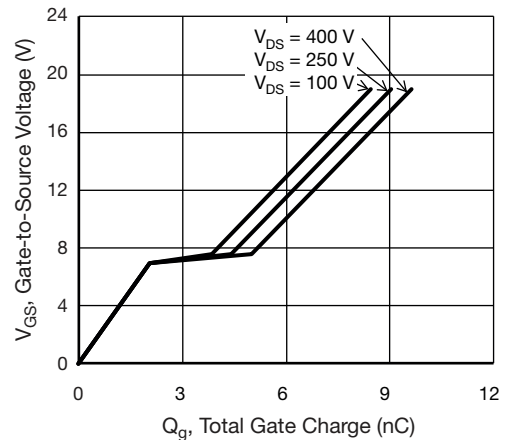
**Fig. 2 - Typical Output Characteristics**



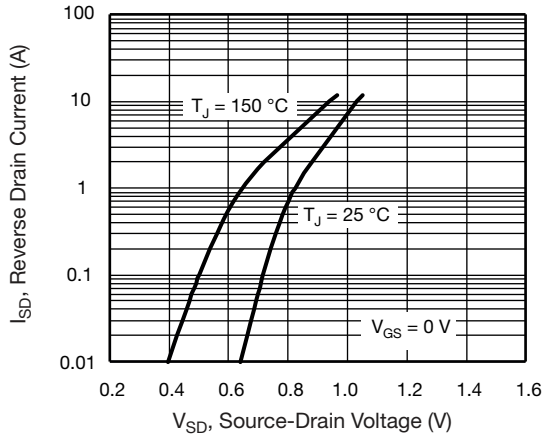
**Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage**



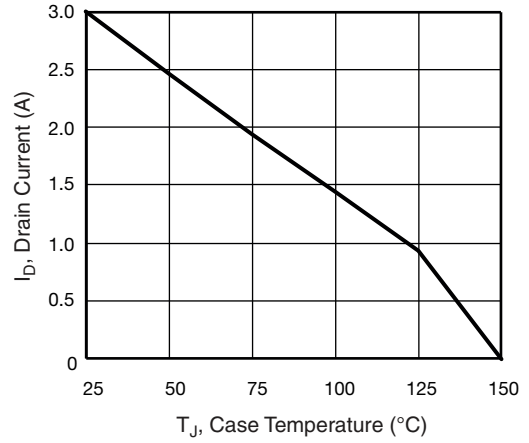
**Fig. 3 - Typical Transfer Characteristics**



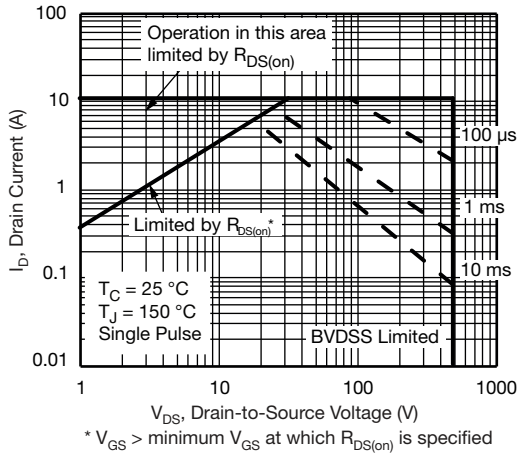
**Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage**



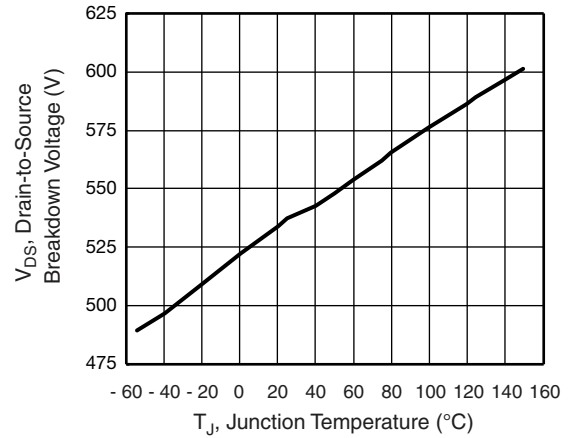
**Fig. 7 - Typical Source-Drain Diode Forward Voltage**



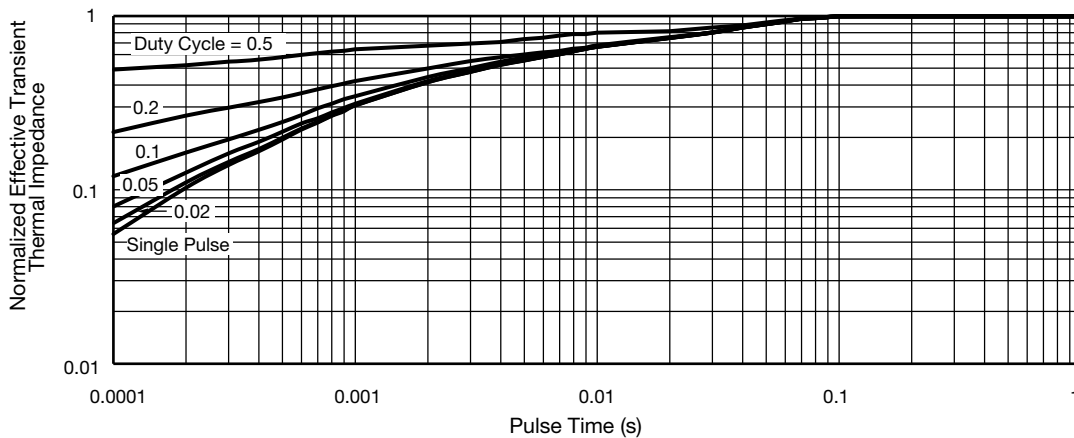
**Fig. 9 - Maximum Drain Current vs. Case Temperature**



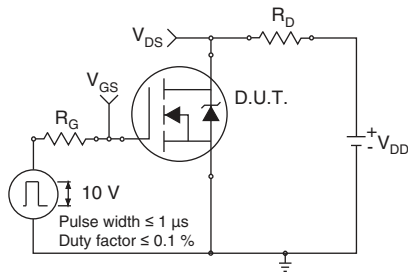
**Fig. 8 - Maximum Safe Operating Area**



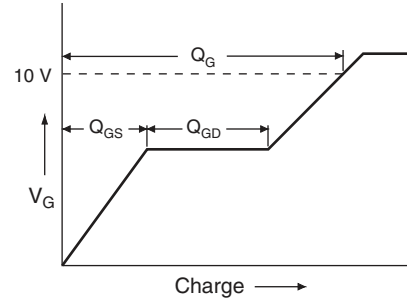
**Fig. 10 - Typical Drain-to-Source Voltage vs. Temperature**



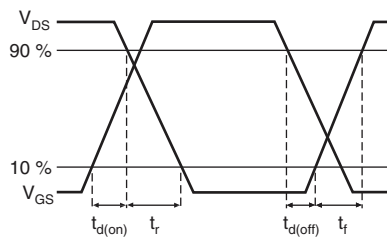
**Fig. 11 - Normalized Thermal Transient Impedance, Junction-to-Case**



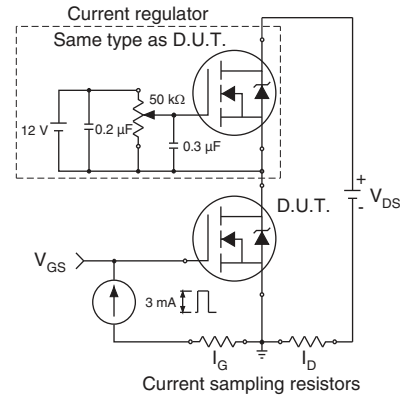
**Fig. 12 - Switching Time Test Circuit**



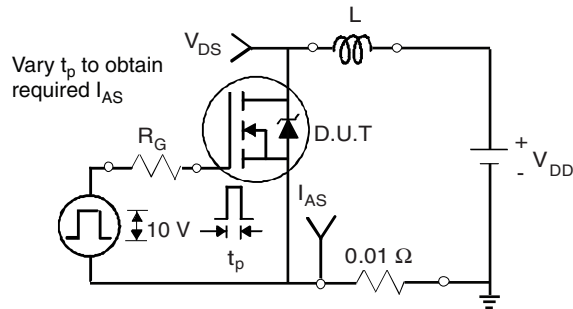
**Fig. 16 - Basic Gate Charge Waveform**



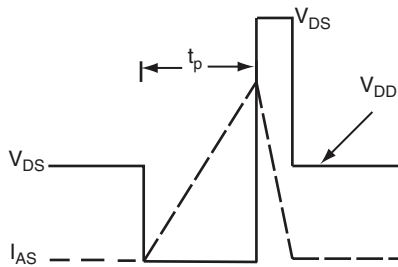
**Fig. 13 - Switching Time Waveforms**



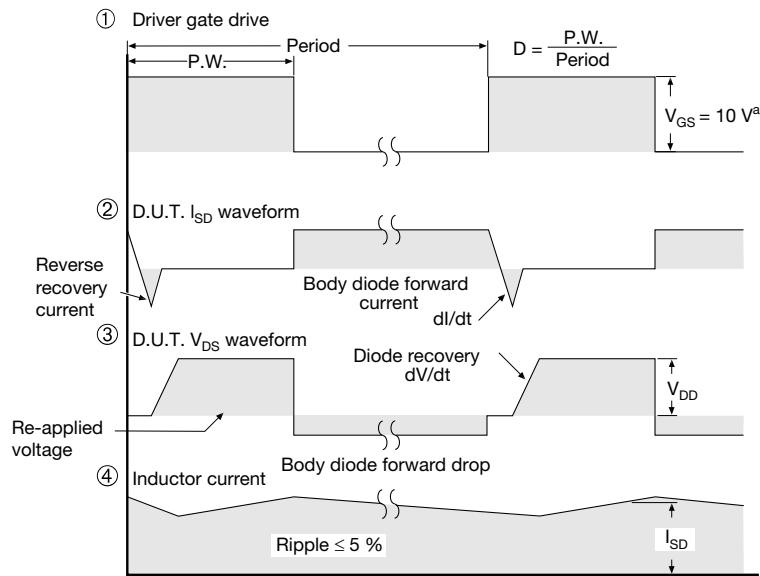
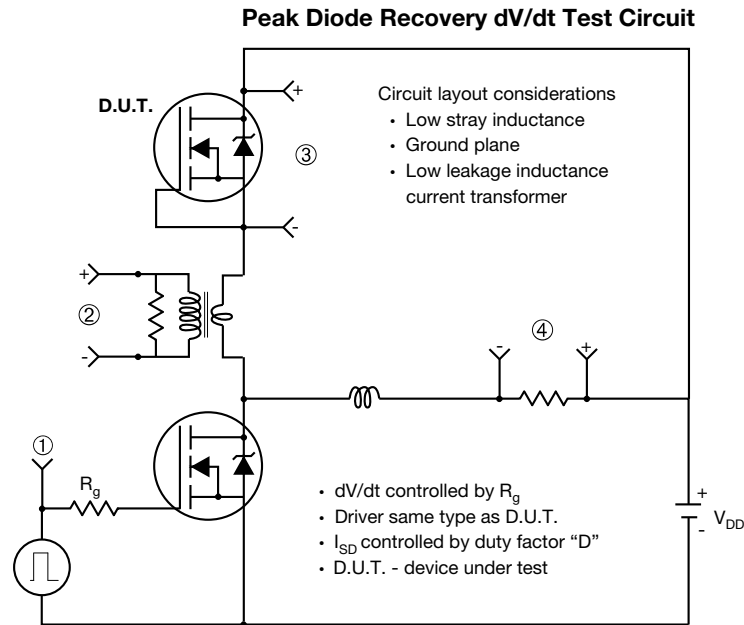
**Fig. 17 - Gate Charge Test Circuit**



**Fig. 14 - Unclamped Inductive Test Circuit**



**Fig. 15 - Unclamped Inductive Waveforms**



**Note**

a.  $V_{GS} = 5\text{ V}$  for logic level devices

**Fig. 18 - For N-Channel**

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# TO-252AA Case Outline

## VERSION 1: FACILITY CODE = Y



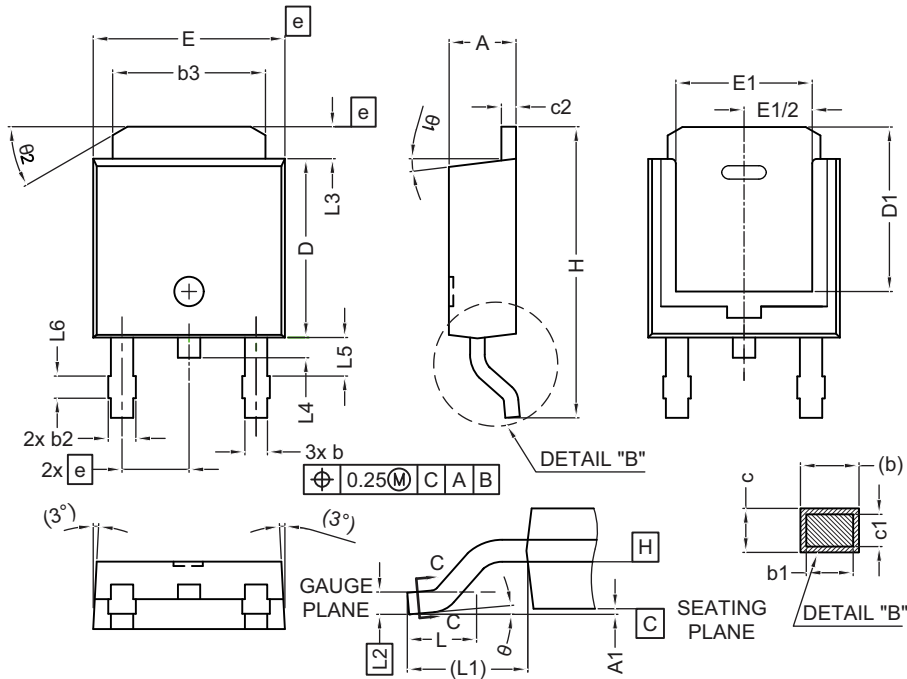
MILLIMETERS		
DIM.	MIN.	MAX.
A	2.18	2.38
A1	-	0.127
b	0.64	0.88
b2	0.76	1.14
b3	4.95	5.46
C	0.46	0.61
C2	0.46	0.89
D	5.97	6.22
D1	4.10	-
E	6.35	6.73
E1	4.32	-
H	9.40	10.41
e	2.28 BSC	
e1	4.56 BSC	
L	1.40	1.78
L3	0.89	1.27
L4	-	1.02
L5	1.01	1.52

### Note

- Dimension L3 is for reference only



VERSION 2: FACILITY CODE = N



MILLIMETERS		
DIM.	MIN.	MAX.
A	2.18	2.39
A1	-	0.13
b	0.65	0.89
b1	0.64	0.79
b2	0.76	1.13
b3	4.95	5.46
c	0.46	0.61
c1	0.41	0.56
c2	0.46	0.60
D	5.97	6.22
D1	5.21	-
E	6.35	6.73
E1	4.32	-
e	2.29 BSC	
H	9.94	10.34

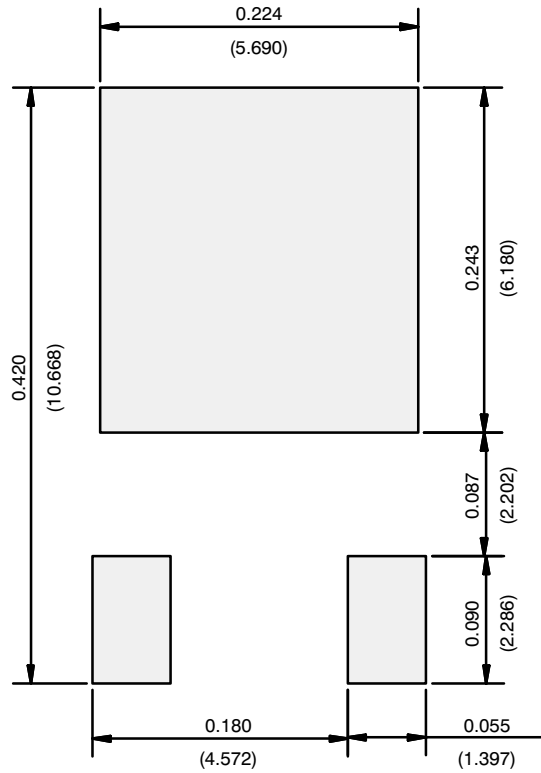
MILLIMETERS		
DIM.	MIN.	MAX.
L	1.50	1.78
L1	2.74 ref.	
L2	0.51 BSC	
L3	0.89	1.27
L4	-	1.02
L5	1.14	1.49
L6	0.65	0.85
θ	0°	10°
θ1	0°	15°
θ2	25°	35°

Notes

- Dimensioning and tolerance confirm to ASME Y14.5M-1994
- All dimensions are in millimeters. Angles are in degrees
- Heat sink side flash is max. 0.8 mm
- Radius on terminal is optional

ECN: E19-0649-Rev. Q, 16-Dec-2019  
 DWG: 5347

## RECOMMENDED MINIMUM PADS FOR DPAK (TO-252)



Recommended Minimum Pads  
Dimensions in Inches/(mm)

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