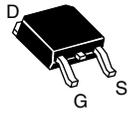
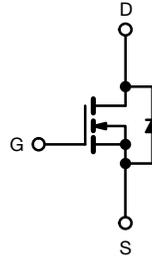
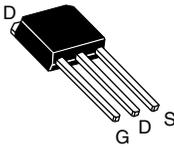


Power MOSFET

PRODUCT SUMMARY	
V_{DS} (V)	500
$R_{DS(on)}$ (Ω)	$V_{GS} = 10\text{ V}$ 3.0
Q_g max. (nC)	17
Q_{gs} (nC)	4.3
Q_{gd} (nC)	8.5
Configuration	Single

DPAK (TO-252)

IPAK (TO-251)


N-Channel MOSFET

FEATURES

- Low gate Charge Q_g results in simple drive requirement
- Improved gate, avalanche and dynamic dV/dt ruggedness
- Fully characterized capacitance and avalanche voltage and current
- Effective C_{oss} specified
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912


RoHS
 COMPLIANT
 HALOGEN
FREE
 Available

APPLICATIONS

- Switch mode power supply (SMPS)
- Uninterruptible power supply
- High speed power switching

ORDERING INFORMATION				
Package	DPAK (TO-252)	DPAK (TO-252)	DPAK (TO-252)	IPAK (TO-251)
Lead (Pb)-free and Halogen-free	SiHFR420A-GE3	SiHFR420ATR-GE3 ^a	SiHFR420ATRL-GE3	SiHFU420A-GE3
Lead (Pb)-free	IRFR420APbF	IRFR420ATRPbF ^a	IRFR420ATRLPbF	IRFU420APbF

Note

a. See device orientation.

ABSOLUTE MAXIMUM RATINGS ($T_C = 25\text{ }^\circ\text{C}$, unless otherwise noted)				
PARAMETER	SYMBOL		LIMIT	UNIT
Drain-Source Voltage	V_{DS}		500	V
Gate-Source Voltage	V_{GS}		± 30	
Continuous Drain Current	V_{GS} at 10 V	$T_C = 25\text{ }^\circ\text{C}$	3.3	A
		$T_C = 100\text{ }^\circ\text{C}$	2.1	
Pulsed Drain Current ^a	I_{DM}		10	
Linear Derating Factor			0.67	$W/^\circ\text{C}$
Single Pulse Avalanche Energy ^b	E_{AS}		140	mJ
Repetitive Avalanche Current ^a	I_{AR}		2.5	A
Repetitive Avalanche Energy ^a	E_{AR}		5.0	mJ
Maximum Power Dissipation	$T_C = 25\text{ }^\circ\text{C}$		P_D 83	W
Peak Diode Recovery dV/dt ^c			dV/dt 3.4	V/ns
Operating Junction and Storage Temperature Range	T_J, T_{stg}		-55 to +150	$^\circ\text{C}$
Soldering Recommendations (Peak temperature) ^d	for 10 s		300	

Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- Starting $T_J = 25\text{ }^\circ\text{C}$, $L = 45\text{ mH}$, $R_g = 25\text{ }\Omega$, $I_{AS} = 2.5\text{ A}$ (see fig. 12).
- $I_{SD} \leq 2.5\text{ A}$, $dI/dt \leq 270\text{ A}/\mu\text{s}$, $V_{DD} \leq V_{DS}$, $T_J \leq 150\text{ }^\circ\text{C}$.
- 1.6 mm from case.



THERMAL RESISTANCE RATINGS				
PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient	R_{thJA}	-	62	°C/W
Case-to-Sink, Flat, Greased Surface	R_{thCS}	0.50	-	
Maximum Junction-to-Case (Drain)	R_{thJC}	-	1.5	

SPECIFICATIONS ($T_J = 25\text{ }^\circ\text{C}$, unless otherwise noted)							
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT	
Static							
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 $25\text{ }^\circ\text{C}, I_D = 1\text{ mA}$	-	0.60	-	V/°C	
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	2.0	-	4.5	V	
Gate-Source Leakage	I_{GSS}	$V_{GS} = \pm 30\text{ V}$	-	-	± 100	nA	
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 500\text{ V}, V_{GS} = 0\text{ V}$	-	-	25	μA	
		$V_{DS} = 400\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$	-	-	250		
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 1.5\text{ A}^b$	-	-	3.0	Ω	
Forward Transconductance	g_{fs}	$V_{DS} = 50\text{ V}, I_D = 1.5\text{ A}$	1.4	-	-	S	
Dynamic							
Input Capacitance	C_{iss}	$V_{GS} = 0\text{ V}, V_{DS} = 25\text{ V}, f = 1.0\text{ MHz}, \text{ see fig. 5}$	-	340	-	pF	
Output Capacitance	C_{oss}		-	53	-		
Reverse Transfer Capacitance	C_{rss}		-	2.7	-		
Output Capacitance	C_{oss}	$V_{GS} = 0\text{ V}$	$V_{DS} = 1.0\text{ V}, f = 1.0\text{ MHz}$	-	490	pF	
Effective Output Capacitance	$C_{oss\text{ eff.}}$		$V_{DS} = 400\text{ V}, f = 1.0\text{ MHz}$	-	15		-
Total Gate Charge	Q_g	$V_{GS} = 10\text{ V}$	$V_{DS} = 0\text{ V to } 400\text{ V}^c$	-	28	nC	
Gate-Source Charge	Q_{gs}		$I_D = 2.5\text{ A}, V_{DS} = 400\text{ V}, \text{ see fig. 6 and 13}^b$	-	-		17
Gate-Drain Charge	Q_{gd}			-	-		4.3
Turn-On Delay Time	$t_{d(on)}$		$V_{DD} = 250\text{ V}, I_D = 2.5\text{ A}, R_g = 21\text{ }\Omega, R_D = 97\text{ }\Omega, \text{ see fig. 10}^b$	-	-		8.5
Rise Time	t_r	-		8.1	-	ns	
Turn-Off Delay Time	$t_{d(off)}$	-		12	-		
Fall Time	t_f	-		16	-		
Drain-Source Body Diode Characteristics							
Continuous Source-Drain Diode Current	I_S	MOSFET symbol showing the integral reverse p - n junction diode 	-	-	3.3	A	
Pulsed Diode Forward Current ^a	I_{SM}		-	-	10		
Body Diode Voltage	V_{SD}	$T_J = 25\text{ }^\circ\text{C}, I_S = 2.5\text{ A}, V_{GS} = 0\text{ V}^b$	-	-	1.6	V	
Body Diode Reverse Recovery Time	t_{rr}	$T_J = 25\text{ }^\circ\text{C}, I_F = 2.5\text{ A}, dI/dt = 100\text{ A}/\mu\text{s}^b$	-	330	500	ns	
Body Diode Reverse Recovery Charge	Q_{rr}		-	760	1140	μC	
Forward Turn-On Time	t_{on}	Intrinsic turn-on time is negligible (turn-on is dominated by L_S and L_D)					

Notes

- a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- b. Pulse width $\leq 300\text{ }\mu\text{s}$; duty cycle $\leq 2\%$.
- c. $C_{oss\text{ eff.}}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 % to 80 % V_{DS} .



TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

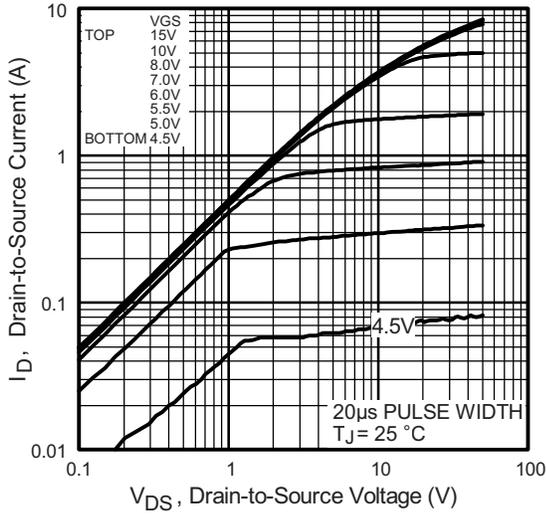


Fig. 1 - Typical Output Characteristics

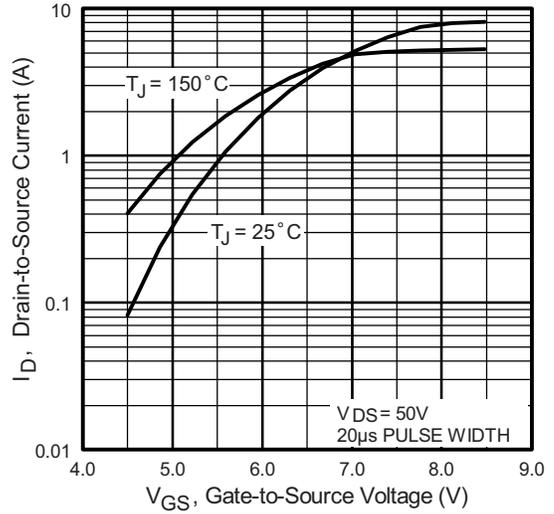


Fig. 3 - Typical Transfer Characteristics

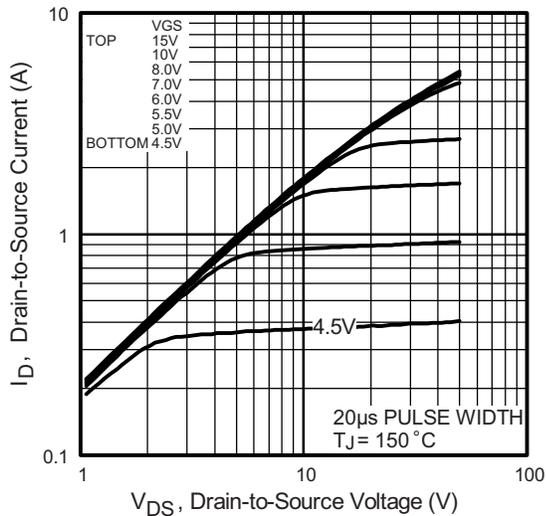


Fig. 2 - Typical Output Characteristics

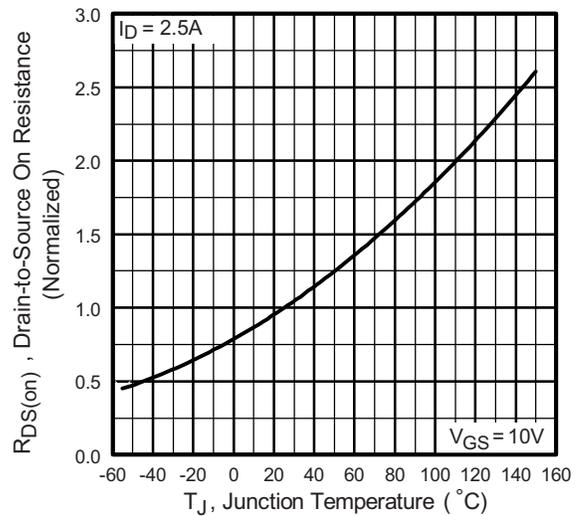


Fig. 4 - Normalized On-Resistance vs. Temperature

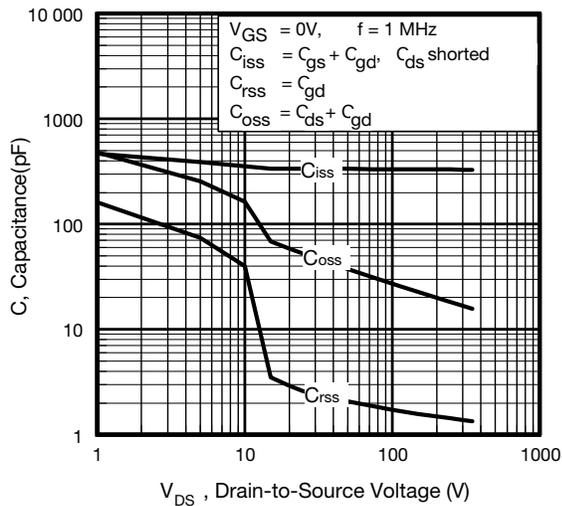


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

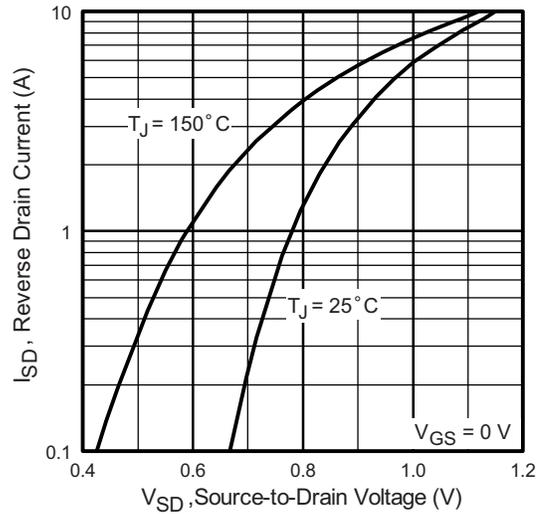


Fig. 7 - Typical Source-Drain Diode Forward Voltage

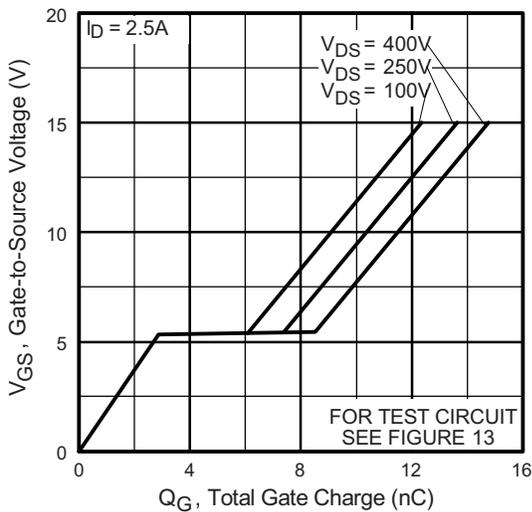


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

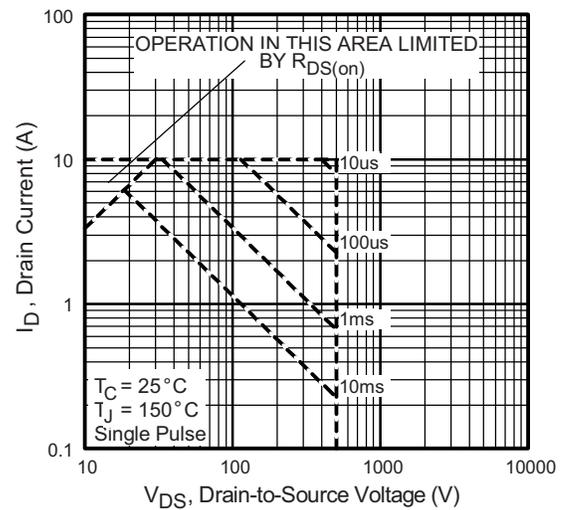


Fig. 8 - Maximum Safe Operating Area

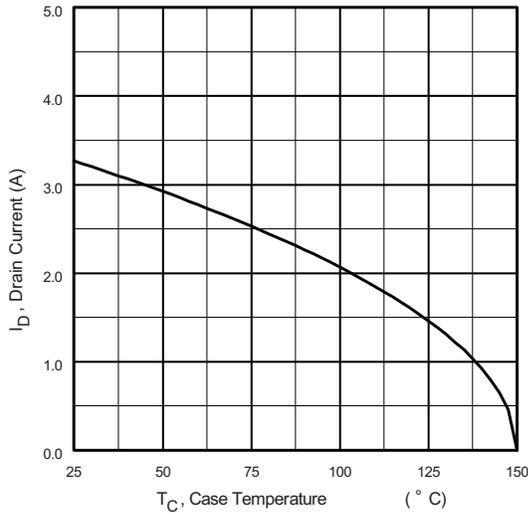


Fig. 9 - Maximum Drain Current vs. Case Temperature

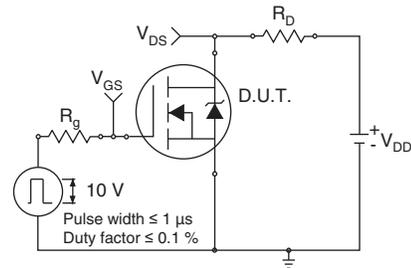


Fig. 10a - Switching Time Test Circuit

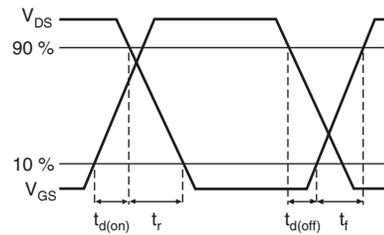


Fig. 10b - Switching Time Waveforms

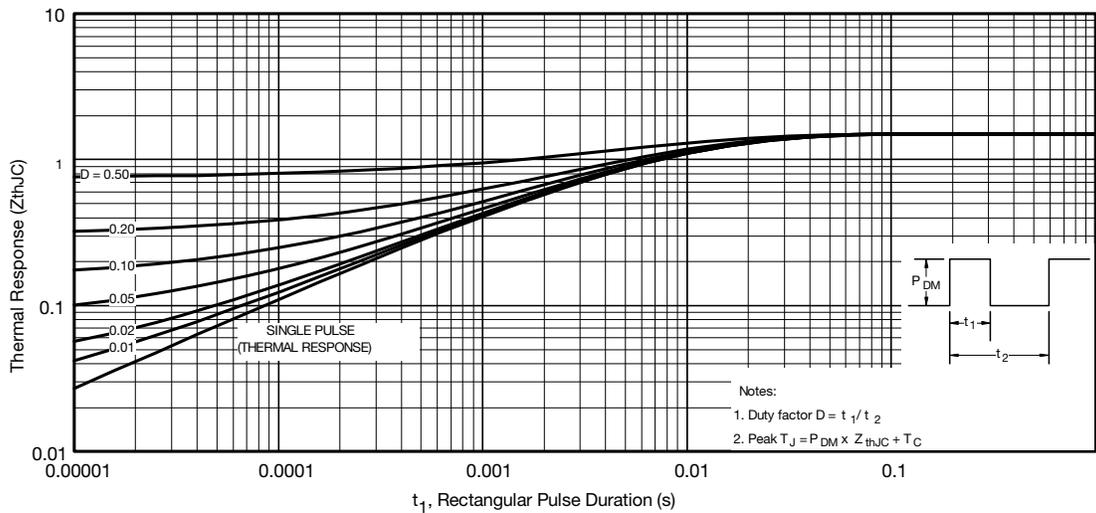


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

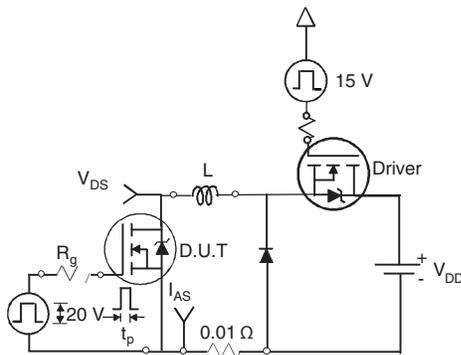


Fig. 12a - Unclamped Inductive Test Circuit

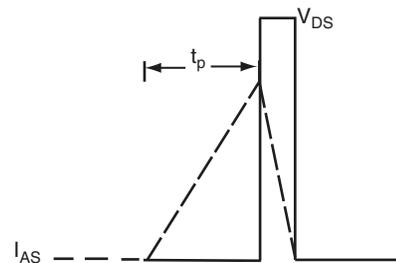


Fig. 12b - Unclamped Inductive Waveforms

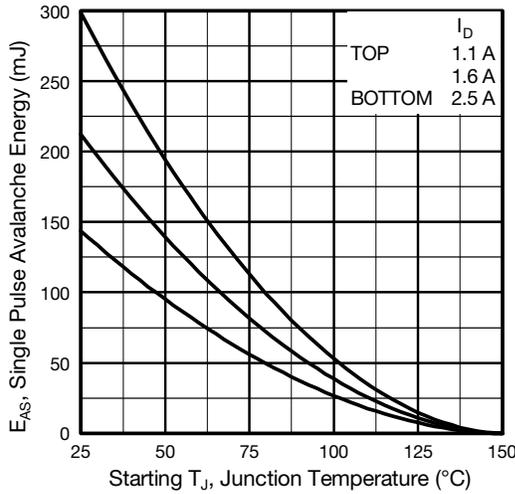


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

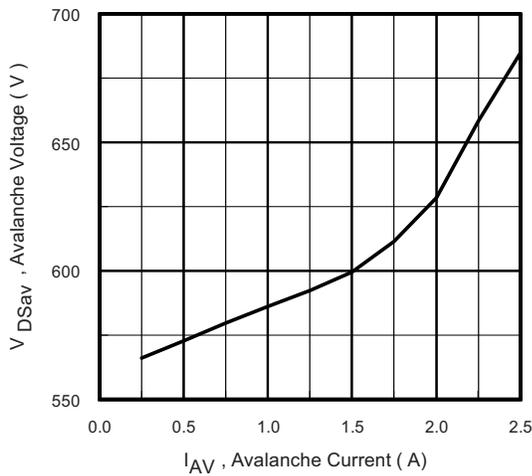


Fig. 12d - Maximum Avalanche Energy vs. Drain Current

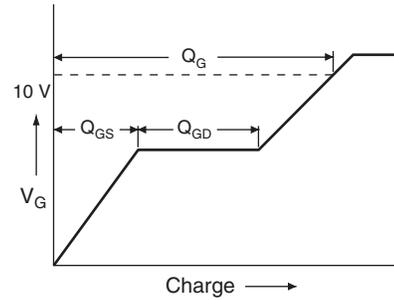


Fig. 13a - Basic Gate Charge Waveform

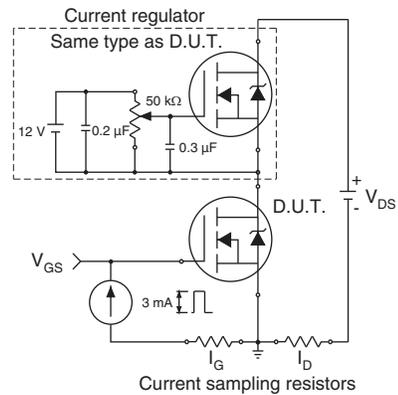
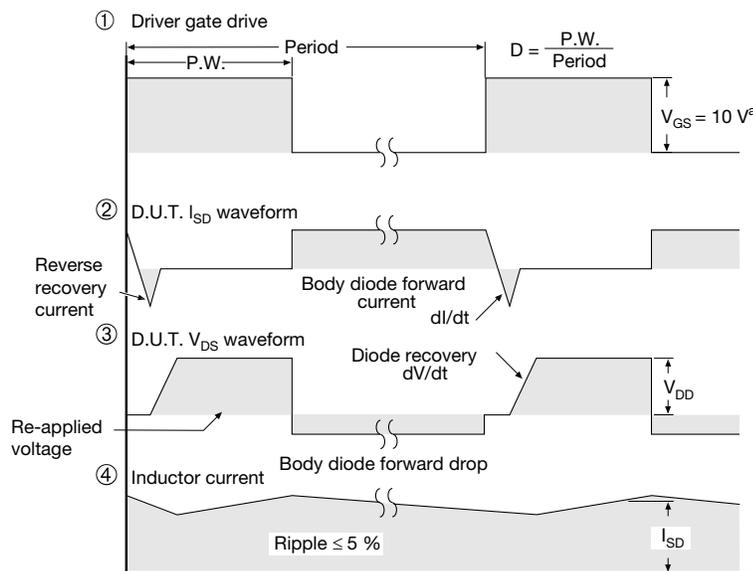
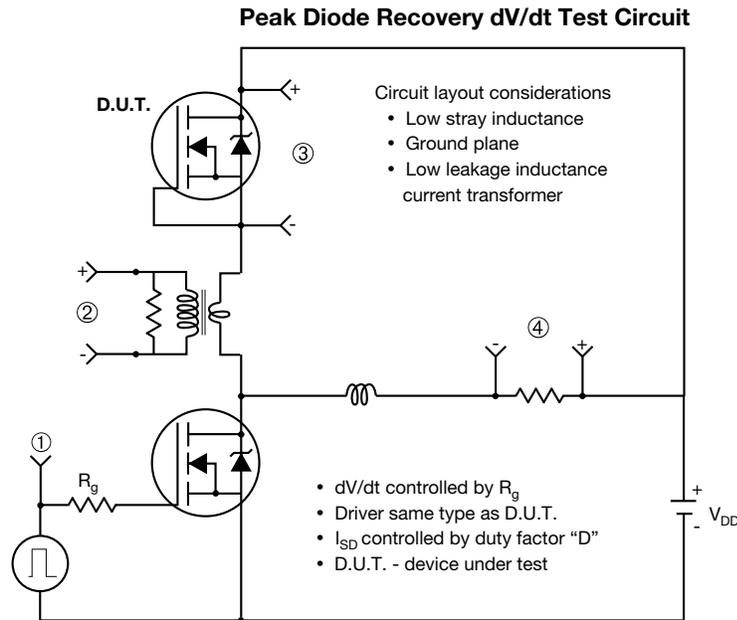


Fig. 13b - Gate Charge Test Circuit



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

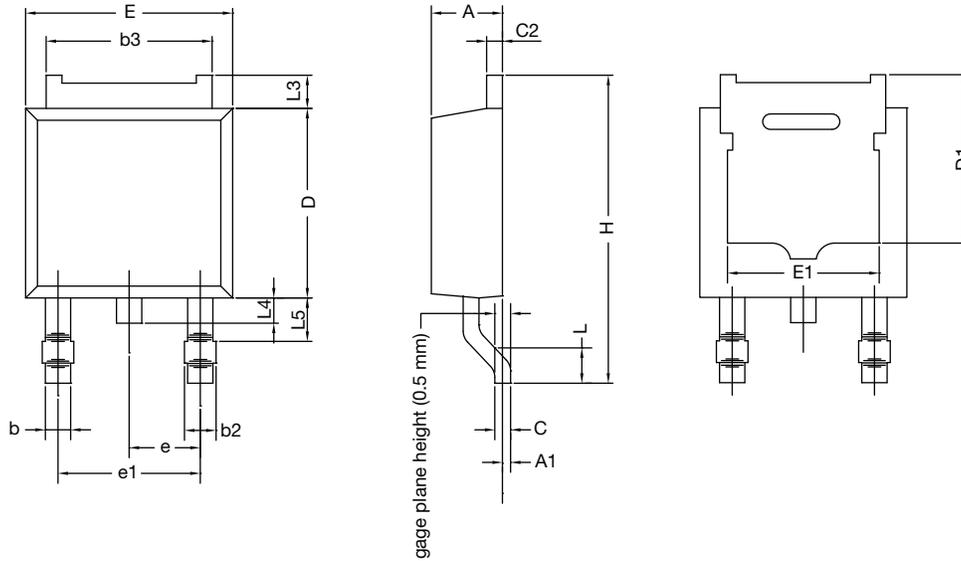
Fig. 14 - For N-Channel

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TO-252AA Case Outline

VERSION 1: FACILITY CODE = Y



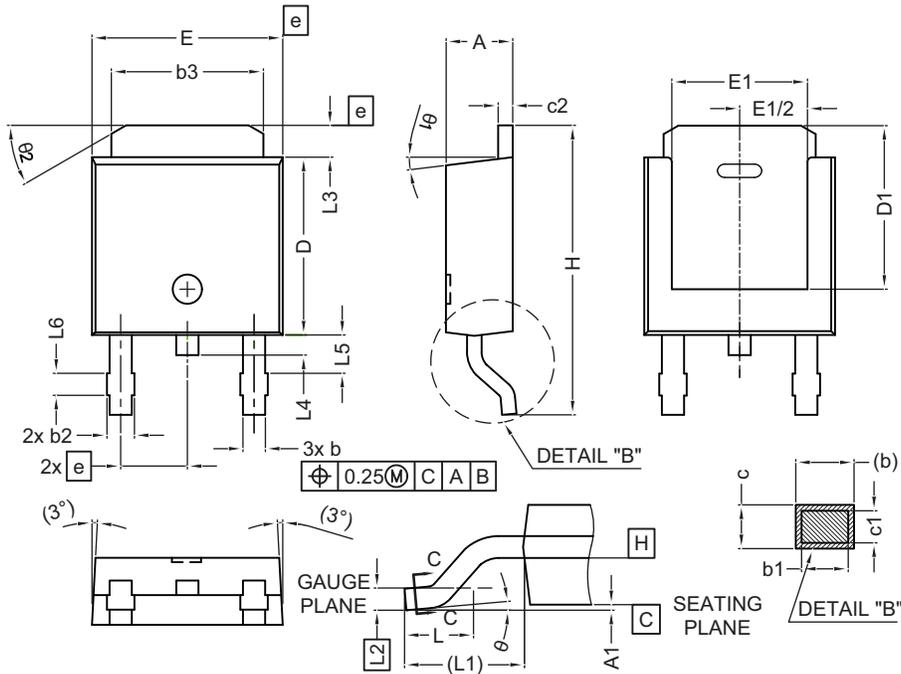
MILLIMETERS		
DIM.	MIN.	MAX.
A	2.18	2.38
A1	-	0.127
b	0.64	0.88
b2	0.76	1.14
b3	4.95	5.46
C	0.46	0.61
C2	0.46	0.89
D	5.97	6.22
D1	4.10	-
E	6.35	6.73
E1	4.32	-
H	9.40	10.41
e	2.28 BSC	
e1	4.56 BSC	
L	1.40	1.78
L3	0.89	1.27
L4	-	1.02
L5	1.01	1.52

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°

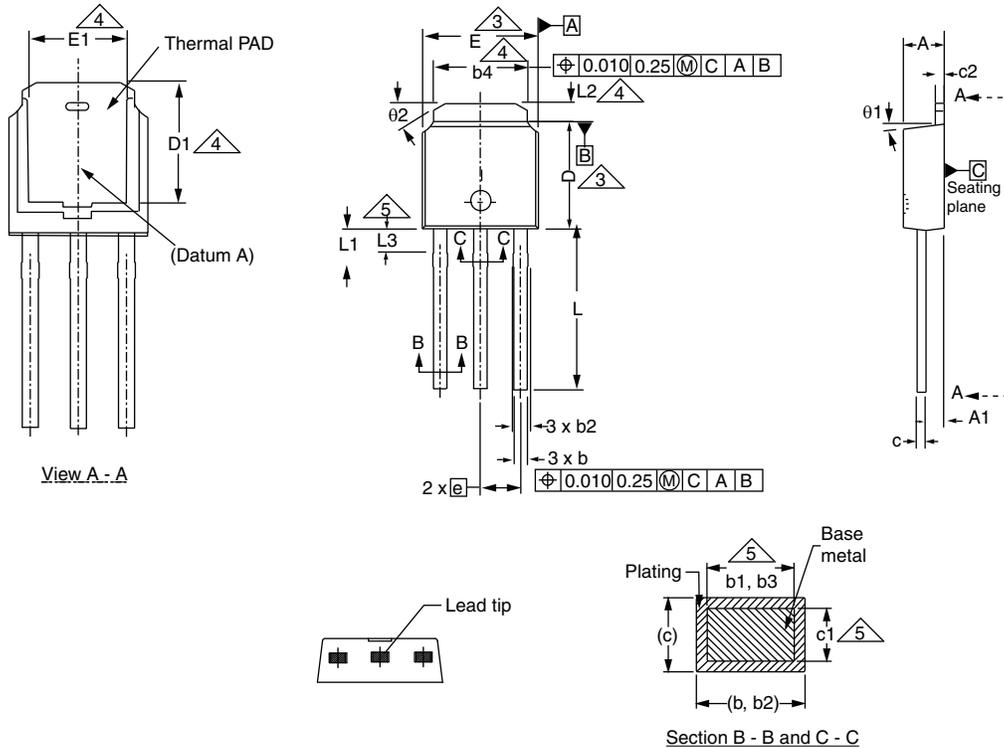
Notes

- 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: E22-0399-Rev. R, 03-Oct-2022
 DWG: 5347

Case Outline for TO-251AA (High Voltage)

OPTION 1:



DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	2.18	2.39	0.086	0.094
A1	0.89	1.14	0.035	0.045
b	0.64	0.89	0.025	0.035
b1	0.65	0.79	0.026	0.031
b2	0.76	1.14	0.030	0.045
b3	0.76	1.04	0.030	0.041
b4	4.95	5.46	0.195	0.215
c	0.46	0.61	0.018	0.024
c1	0.41	0.56	0.016	0.022
c2	0.46	0.86	0.018	0.034
D	5.97	6.22	0.235	0.245

DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
D1	5.21	-	0.205	-
E	6.35	6.73	0.250	0.265
E1	4.32	-	0.170	-
e	2.29 BSC		2.29 BSC	
L	8.89	9.65	0.350	0.380
L1	1.91	2.29	0.075	0.090
L2	0.89	1.27	0.035	0.050
L3	1.14	1.52	0.045	0.060
θ1	0°	15°	0°	15°
θ2	25°	35°	25°	35°

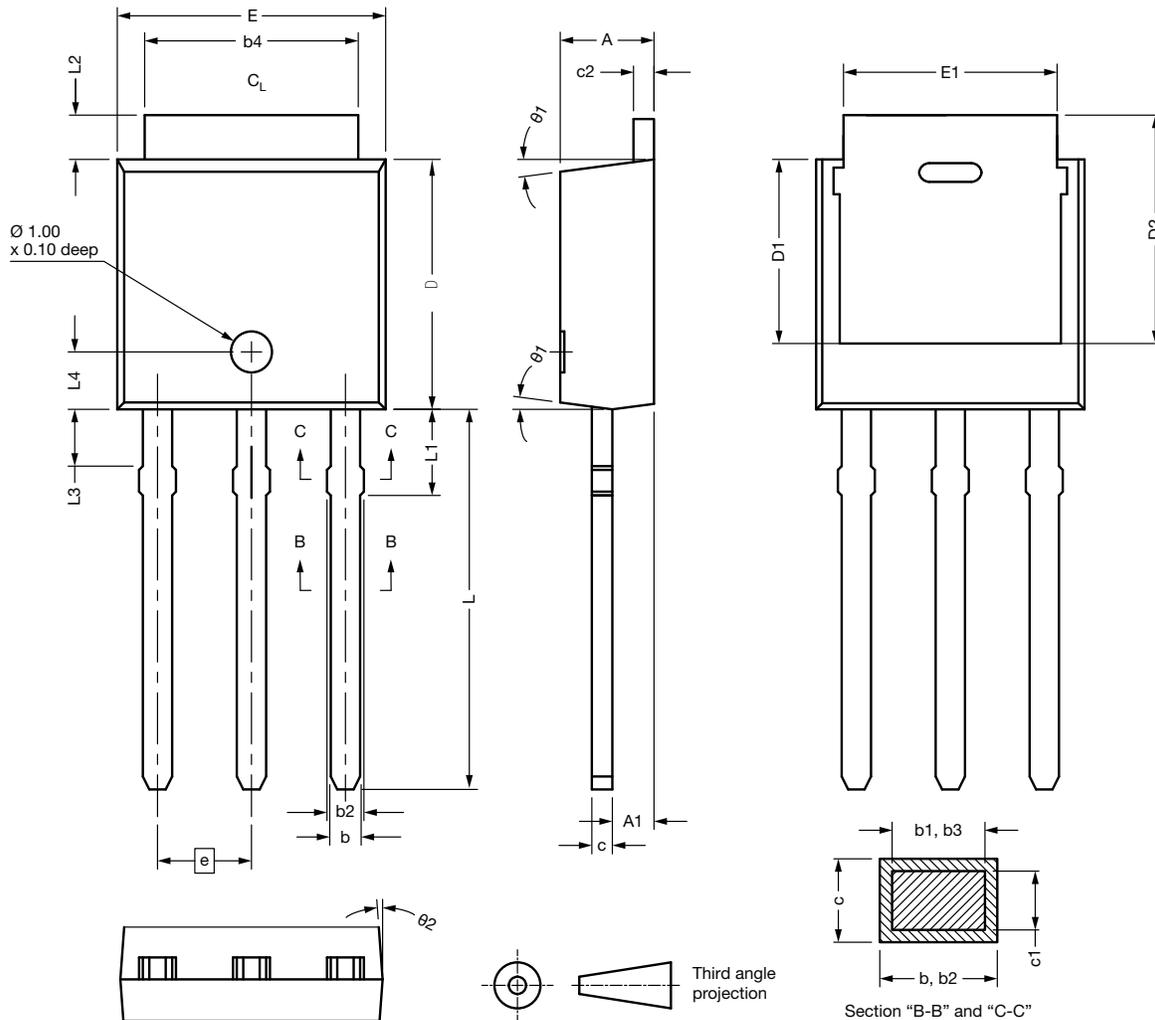
ECN: E21-0682-Rev. C, 27-Dec-2021
DWG: 5968

Notes

- Dimensioning and tolerancing per ASME Y14.5M-1994
- Dimension are shown in inches and millimeters
- Dimension D and E do not include mold flash. Mold flash shall not exceed 0.13 mm (0.005") per side. These dimensions are measured at the outermost extremes of the plastic body
- Thermal pad contour optional with dimensions b4, L2, E1 and D1
- Lead dimension uncontrolled in L3
- Dimension b1, b3 and c1 apply to base metal only
- Outline conforms to JEDEC® outline TO-251AA



OPTION 2: FACILITY CODE = N



DIM.	MIN.	NOM.	MAX.
A	2.180	2.285	2.390
A1	0.890	1.015	1.140
b	0.640	0.765	0.890
b1	0.640	0.715	0.790
b2	0.760	0.950	1.140
b3	0.760	0.900	1.040
b4	4.950	5.205	5.460
c	0.460	-	0.610
c1	0.410	-	0.560
c2	0.460	-	0.610
D	5.970	6.095	6.220
D1	4.300	-	-

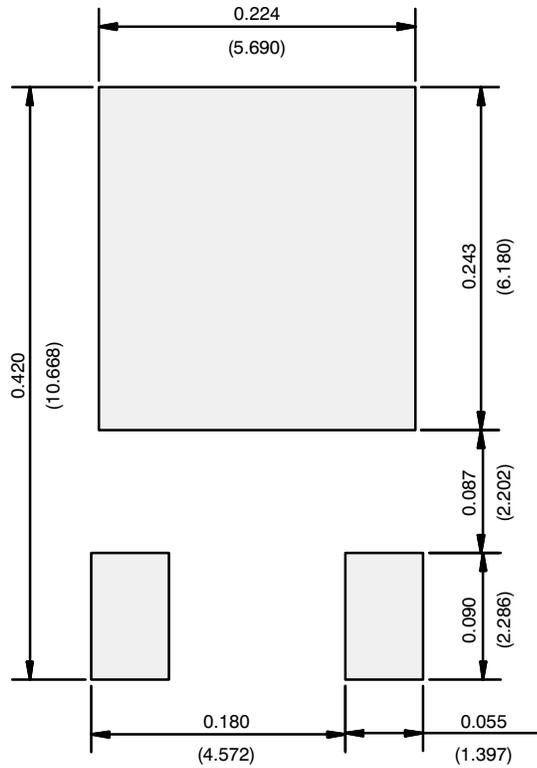
DIM.	MIN.	NOM.	MAX.
D2	5.380	-	-
E	6.350	6.540	6.730
E1	4.32	-	-
e	2.29 BSC		
L	8.890	9.270	9.650
L1	1.910	2.100	2.290
L2	0.890	1.080	1.270
L3	1.140	1.330	1.520
L4	1.300	1.400	1.500
θ_1	0°	7.5°	15°
θ_2	4°	-	-

ECN: E21-0682-Rev. C, 27-Dec-2021
DWG: 5968

Notes

- Dimensioning and tolerancing per ASME Y14.5M-1994
- All dimension are in millimeters, angles are in degrees
- Heat sink side flash is max. 0.8 mm

RECOMMENDED MINIMUM PADS FOR DPAK (TO-252)



Recommended Minimum Pads
Dimensions in Inches/(mm)

[Return to Index](#)



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