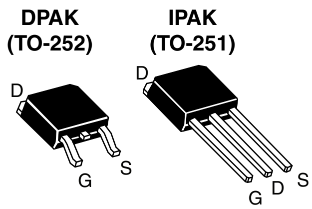
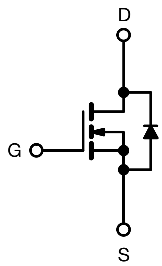
Power MOSFET





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

PRODUCT SUMMARY		
V_{DS} (V)	500	
$R_{DS(on)}$ (Ω)	V_{GS} = 10 V	1.7
Q_g (Max.) (nC)	24	
Q_{gs} (nC)	6.5	
Q_{gd} (nC)	13	
Configuration	Single	

ORDERING INFORMATION					
Package	DPAK (TO-252)	DPAK (TO-252)	DPAK (TO-252)	DPAK (TO-252)	IPAK (TO-251)
Lead (Pb)-free and halogen-free	SiHFR430A-GE3	SiHFR430ATR-GE3 [a]	SiHFR430ATRL-GE3 [a]	SiHFR430ATRR-GE3 [a]	SiHFU430A-GE3
Lead (Pb)-free	IRFR430APbF	IRFR430ATRPbF[a]	IRFR430ATRLPbF[a]	-	IRFU430APbF

Note

a. See device orientation

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}	± 30	
Continuous drain current	V_{GS} at 10 V	T_C = 25 °C	I_D	5.0	A
		T_C = 100 °C		3.2	
Pulsed drain current [a]			I_{DM}	20	
Linear derating factor				0.91	W/°C
Single pulse avalanche energy [b]			E_{AS}	130	mJ
Repetitive avalanche current [a]			I_{AR}	5.0	A
Repetitive avalanche energy [a]			E_{AR}	11	mJ
Maximum power dissipation	T_C = 25 °C		P_D	110	W
Peak diode recovery dV/dt [c]			dV/dt	3.0	V/ns
Operating junction and storage temperature range			T_J, T_{stg}	-55 to +150	°C
Soldering recommendations (peak temperature) [d]	For 10 s			300	

Notes

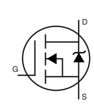
a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11)

b. Starting T_J = 25 °C, L = 11 mH, R_g = 25 Ω, I_{AS} = 5.0 A (see fig. 12)

c. $I_{SD} \leq 5.0$ A, dI/dt ≤ 320 A/μs, $V_{DD} \leq V_{DS}$, $T_J \leq 150$ °C

d. 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}	-	1.1	

SPECIFICATIONS (T_J = 25 °C, unless otherwise noted)						
PARAMETER	**SYMBOL**	**TEST CONDITIONS**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Static						
Drain-source breakdown voltage	V_{DS}	V_{GS} = 0 V, I_D = 250 μA	500	-	-	V
V_{DS} temperature coefficient	$\Delta V_{DS}/T_J$	Reference to 25 °C, I_D = 1 mA	-	0.60	-	V/°C
Gate-source threshold voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 250 μA	2.0	-	4.5	V
Gate-source leakage	I_{GSS}	V_{GS} = ± 30 V	-	-	± 100	nA
Zero gate voltage drain current	I_{DSS}	V_{DS} = 500 V, V_{GS} = 0 V	-	-	25	μA
		V_{DS} = 400 V, V_{GS} = 0 V, T_J = 125 °C	-	-	250	
Drain-source on-state resistance	$R_{DS(on)}$	V_{GS} = 10 V; I_D = 3.0 A[b]	-	-	1.7	Ω
Forward transconductance	g_{fs}	V_{DS} = 50 V, I_D = 3.0 A	2.3	-	-	S
Dynamic						
Input capacitance	C_{iss}	V_{GS} = 0 V, V_{DS} = 25 V, f = 1.0 MHz, see fig. 5	-	490	-	pF
Output capacitance	C_{oss}		-	75	-	
Reverse transfer capacitance	C_{rss}		-	4.5	-	
Output capacitance	C_{oss}	V_{GS} = 10 V; V_{DS} = 1.0 V, f = 1.0 MHz	-	750	-	pF
		V_{GS} = 10 V; V_{DS} = 400 V, f = 1.0 MHz	-	25	-	
Effective output capacitance	C_{oss} eff.	V_{GS} = 10 V; V_{DS} = 0 V to 400 V[c]	-	51	-	
Total gate charge	Q_g	V_{GS} = 10 V; I_D = 5.0 A, V_{DS} = 400 V, see fig. 6 and 13[b]	-	-	24	nC
Gate-source charge	Q_{gs}		-	-	6.5	
Gate-drain charge	Q_{gd}		-	-	13	
Turn-on delay time	$t_{d(on)}$	V_{DD} = 250 V, I_D = 5.0 A, R_g = 15 Ω, R_D = 50 Ω, see fig. 10[b]	-	8.7	-	ns
Rise time	t_r		-	27	-	
Turn-off delay time	$t_{d(off)}$		-	17	-	
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 	-	-	5.0	A
Pulsed diode forward current[a]	I_{SM}		-	-	20	
Body diode voltage	V_{SD}	T_J = 25 °C, I_S = 5.0 A, V_{GS} = 0 V[b]	-	-	1.5	V
Body diode reverse recovery time	t_{rr}	T_J = 25 °C, I_F = 5.0 A, dI/dt = 100 A/μs[b]	-	410	620	ns
Body diode reverse recovery charge	Q_{rr}		-	1.4	2.1	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 ≤ 300 μs; duty cycle ≤ 2 %

c. C_{oss} 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)

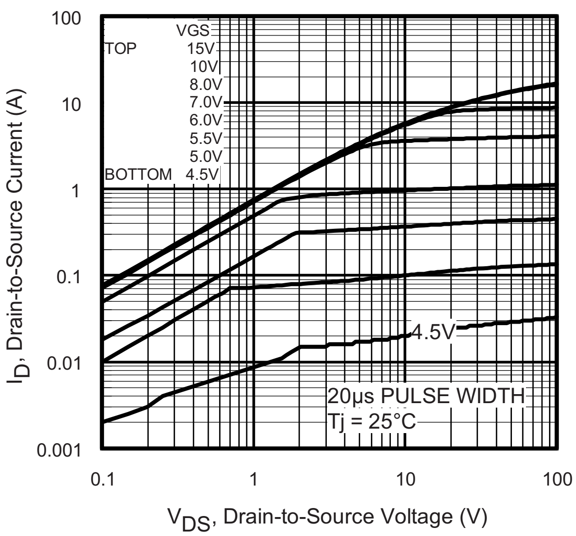


Fig. 1 - Typical Output Characteristics

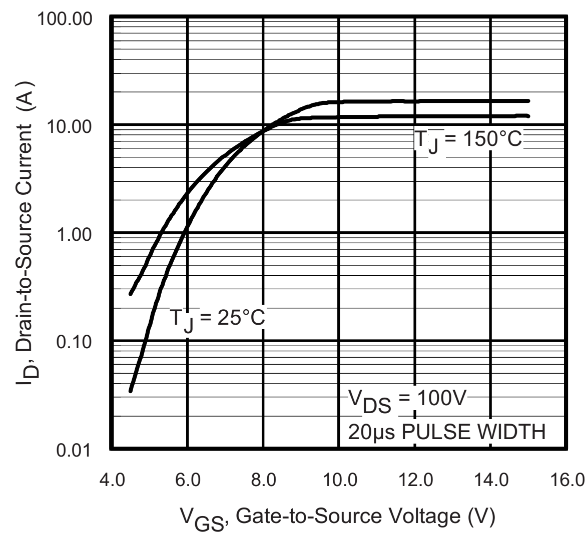


Fig. 2 - Typical Transfer Characteristics

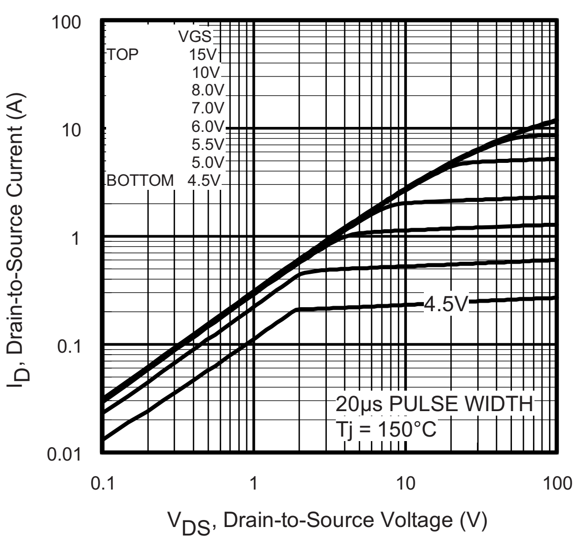


Fig. 1 - Typical Output Characteristics

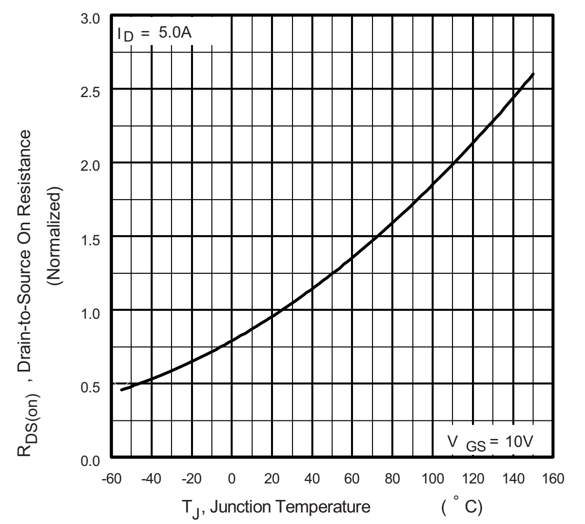


Fig. 3 - Normalized On-Resistance vs. Temperature

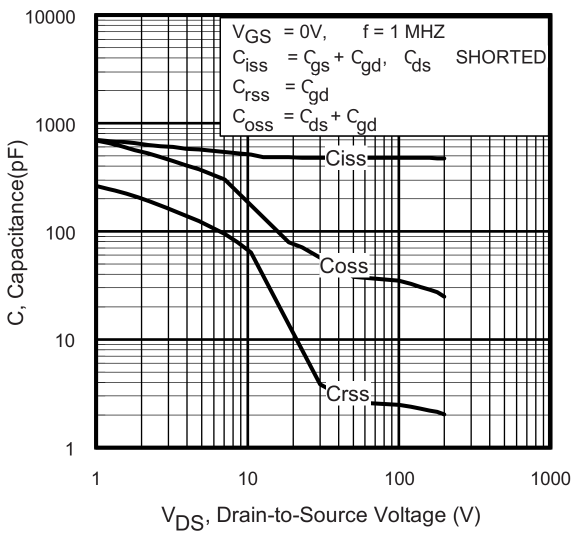


Fig. 4 - Typical Capacitance vs. Drain-to-Source Voltage

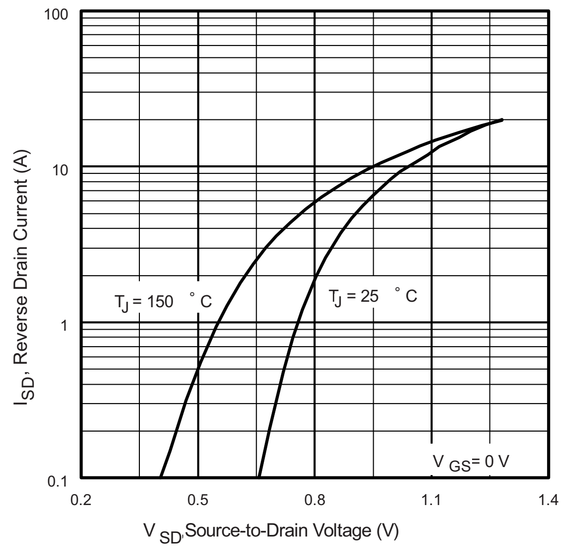


Fig. 6 - Typical Source-Drain Diode Forward Voltage

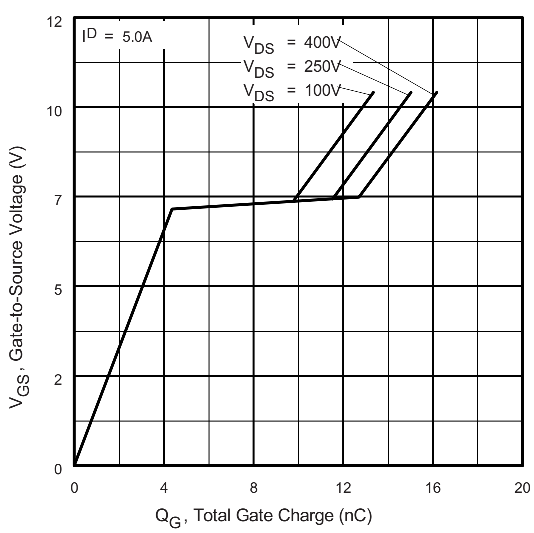


Fig. 5 - Typical Gate Charge vs. Gate-to-Source Voltage

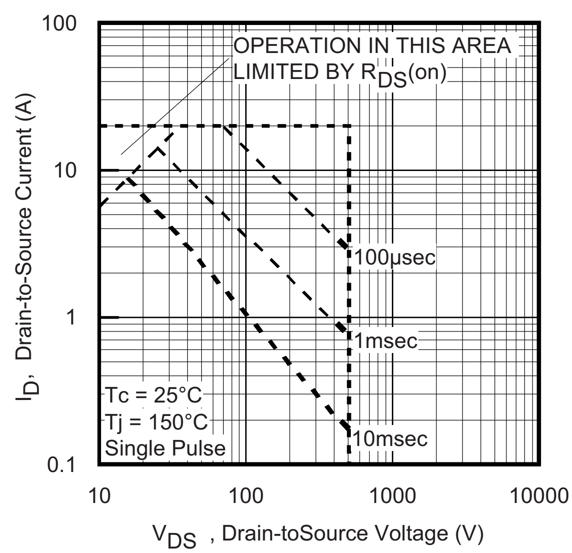


Fig. 7 - Maximum Safe Operating Area

For technical questions, contact: hvm@vishay.com

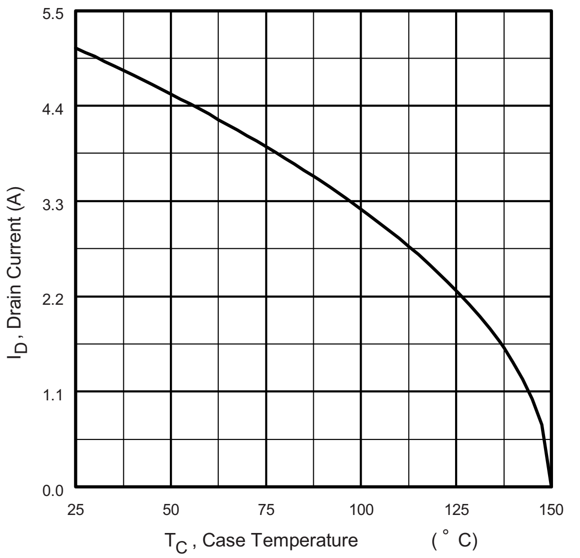


Fig. 8 - Maximum Drain Current vs. Case Temperature

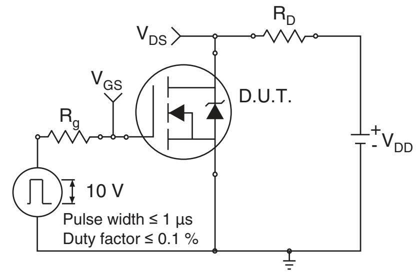


Fig. 10a - Switching Time Test Circuit

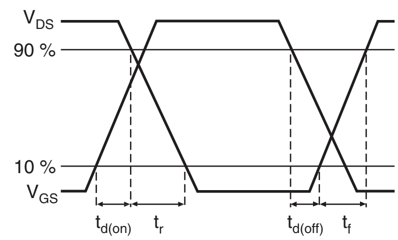


Fig. 10b - Switching Time Waveforms

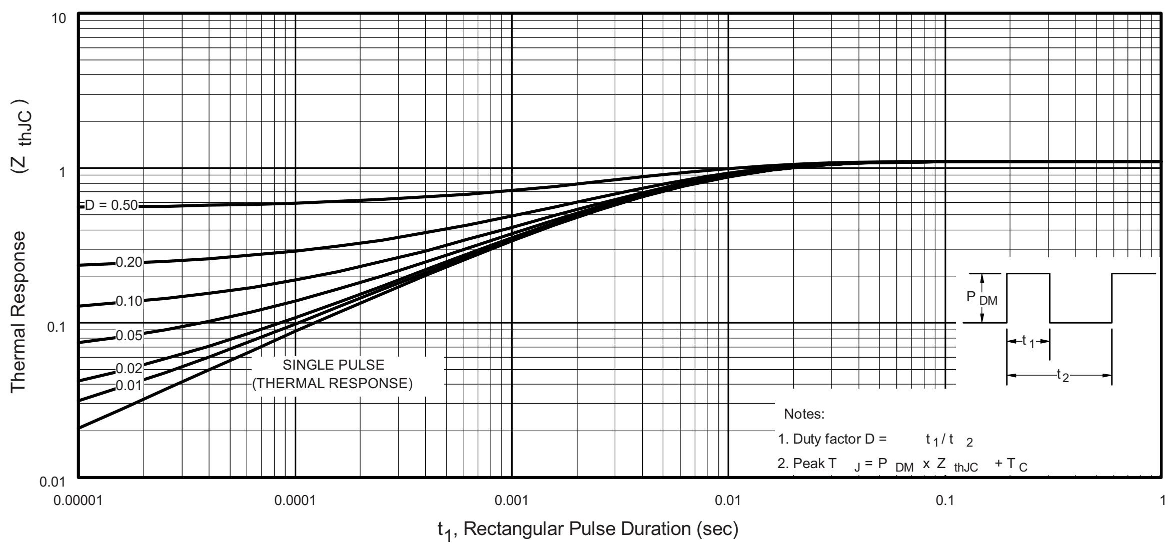


Fig. 9 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

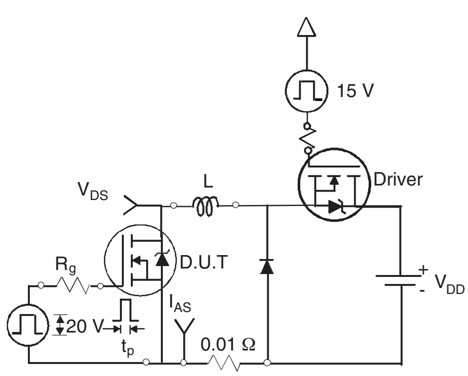


Fig. 12a - Unclamped Inductive Test Circuit

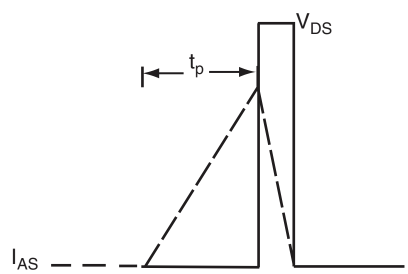


Fig. 12b - Unclamped Inductive Waveforms

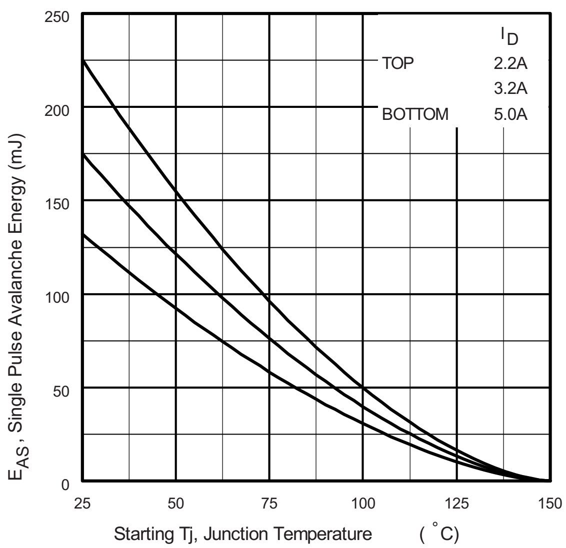


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

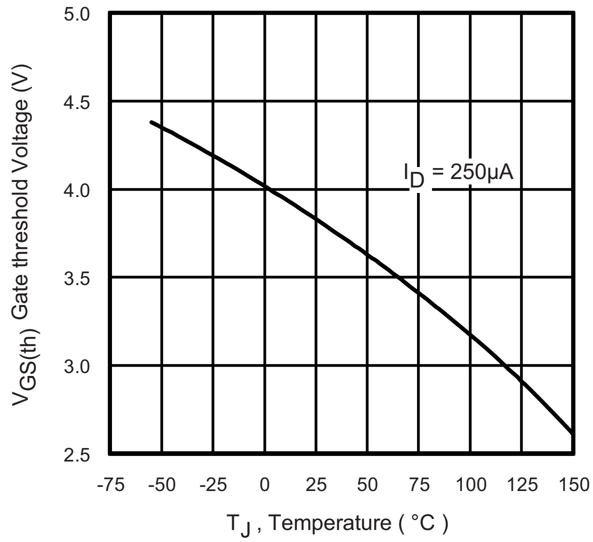


Fig. 12d - Threshold Voltage vs. Temperature

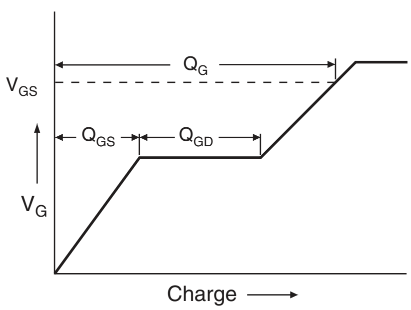


Fig. 13a - Basic Gate Charge Waveform

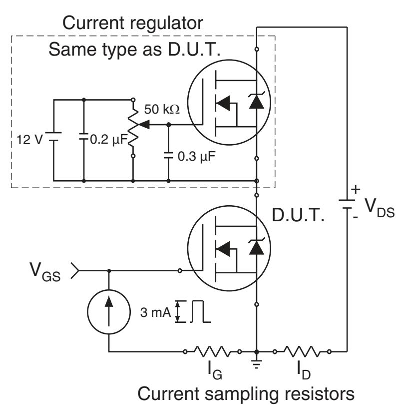
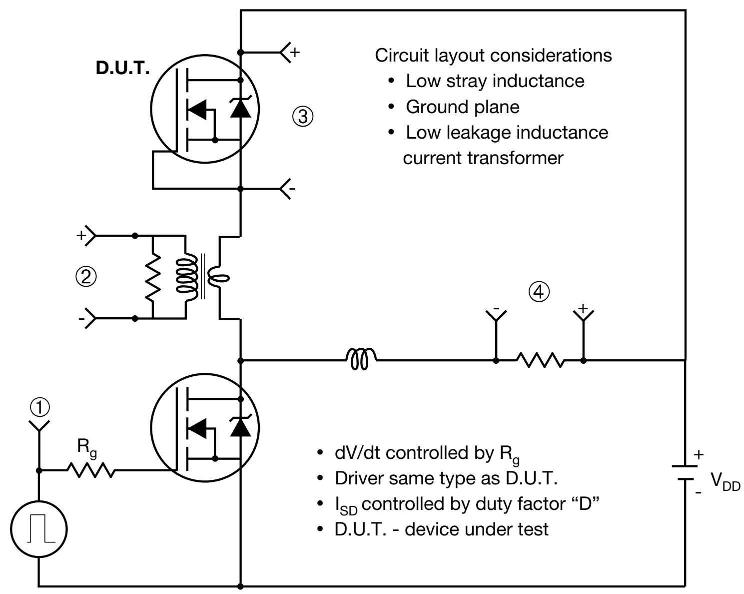
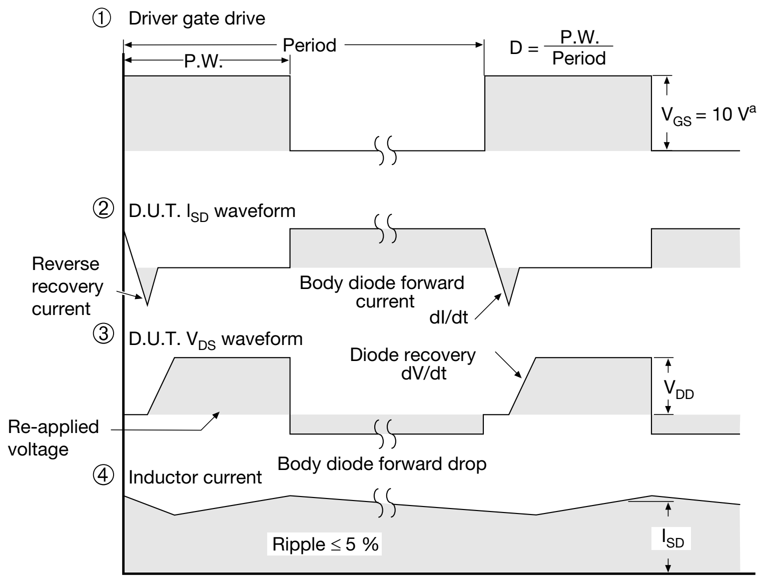


Fig. 13b - Gate Charge Test Circuit

Peak Diode Recovery dV/dt Test Circuit





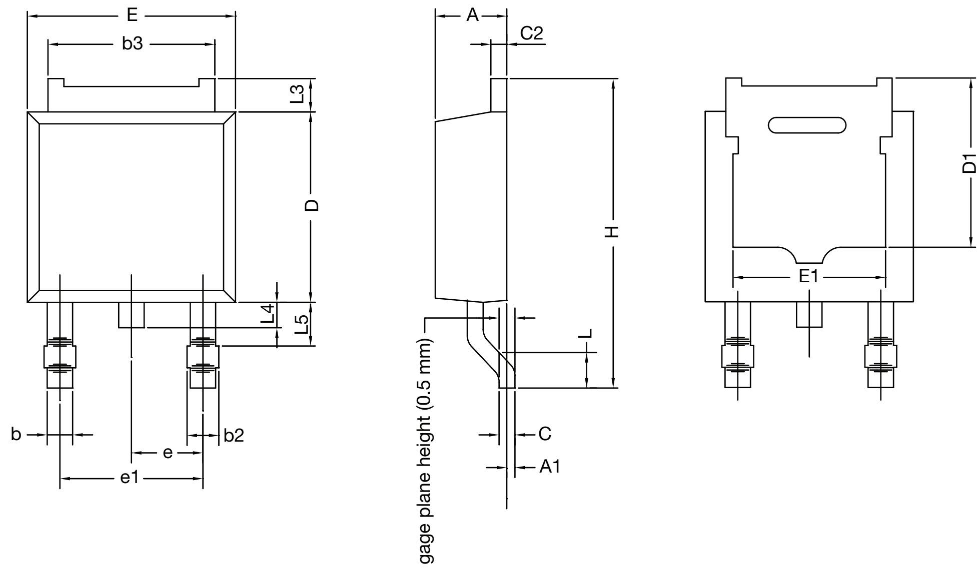
Note

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

Fig. 10 - For N-Channel

TO-252AA Case Outline

VERSION 1: FACILITY CODE = Y

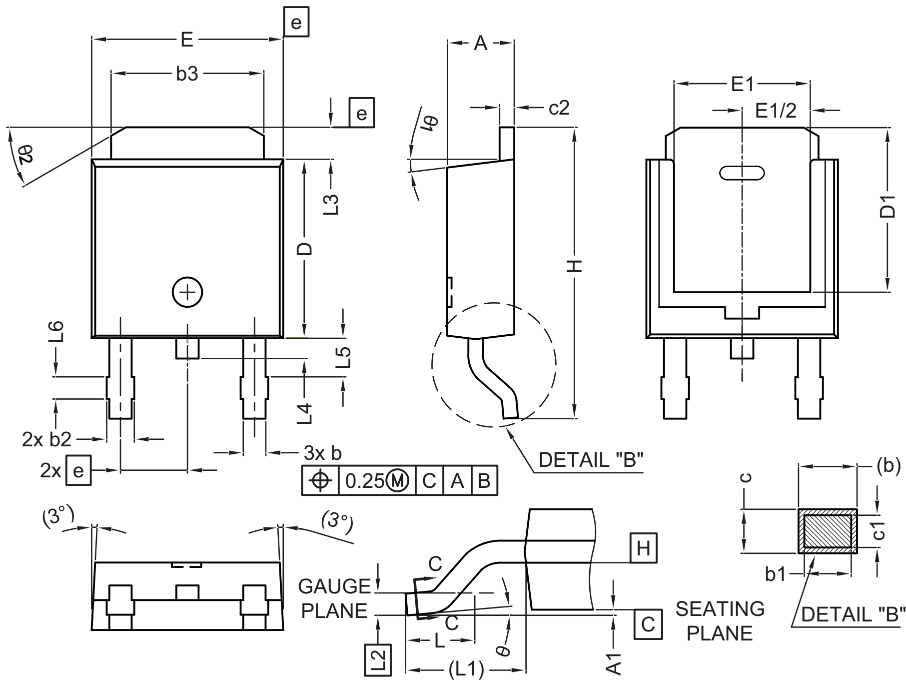


	MILLIMETERS	
DIM.	MIN.	MAX.
A	2.18	2.38
A1	-	0.127
b	0.64	0.88
b2	0.76	1.14
b3	4.95	5.46
C	0.46	0.61
C2	0.46	0.89
D	5.97	6.22
D1	4.10	-
E	6.35	6.73
E1	4.32	-
H	9.40	10.41
e	2.28 BSC	
e1	4.56 BSC	
L	1.40	1.78
L3	0.89	1.27
L4	-	1.02
L5	1.01	1.52

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

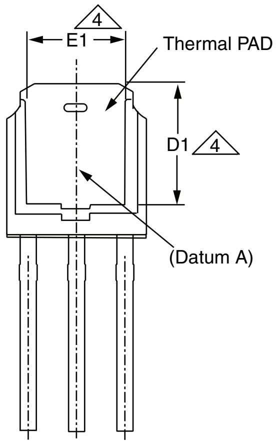
	MILLIMETERS	
DIM.	MIN.	MAX.
L	1.50	1.78
L1	2.74 ref.	
L2	0.51 BSC	
L3	0.89	1.27
L4	-	1.02
L5	1.14	1.49
L6	0.65	0.85
θ	0°	10°
θ1	0°	15°
θ2	25°	35°

Notes

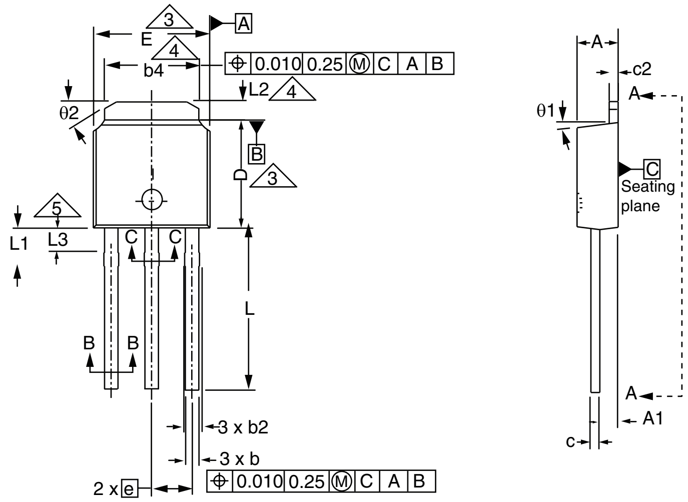
- Dimensioning and tolerance confirm to ASME Y14.5M-1994
- All dimensions are in millimeters. Angles are in degrees
- Heat sink side flash is max. 0.8 mm
- Radius on terminal is optional

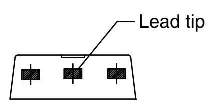
ECN: E19-0649-Rev. Q, 16-Dec-2019
DWG: 5347

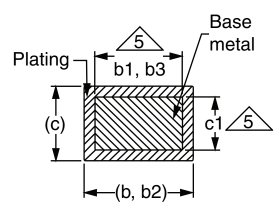
TO-251AA (HIGH VOLTAGE)



View A - A







Section B - B and C - C

	MILLIMETERS		INCHES	
DIM.	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

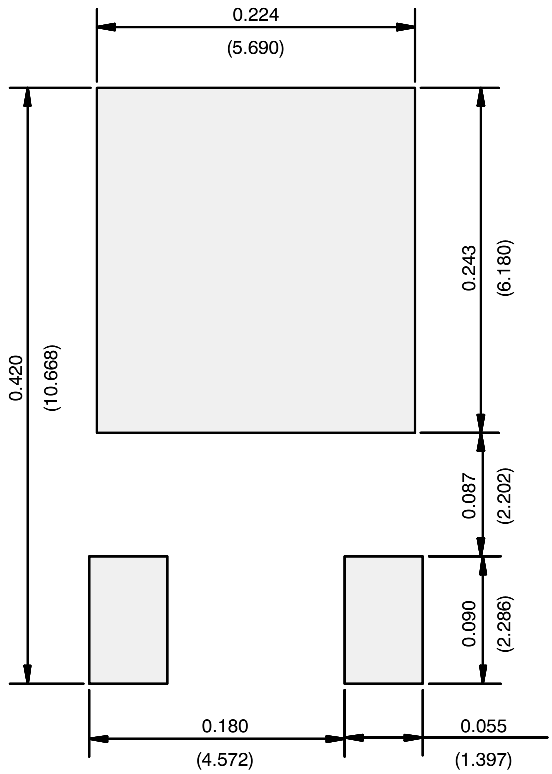
	MILLIMETERS		INCHES	
DIM.	MIN.	MAX.	MIN.	MAX.
D1	5.21	-	0.205	-
E	6.35	6.73	0.250	0.265
E1	4.32	-	0.170	-
e	2.29 BSC		2.29 BSC	
L	8.89	9.65	0.350	0.380
L1	1.91	2.29	0.075	0.090
L2	0.89	1.27	0.035	0.050
L3	1.14	1.52	0.045	0.060
θ1	0'	15'	0'	15'
θ2	25'	35'	25'	35'

ECN: S-82111-Rev. A, 15-Sep-08
DWG: 5968

Notes

1. Dimensioning and tolerancing per ASME Y14.5M-1994.
2. Dimension are shown in inches and millimeters.
3. 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.
4. Thermal pad contour optional with dimensions b4, L2, E1 and D1.
5. Lead dimension uncontrolled in L3.
6. Dimension b1, b3 and c1 apply to base metal only.
7. Outline conforms to JEDEC outline TO-251AA.

RECOMMENDED MINIMUM PADS FOR DPAK (TO-252)



Recommended Minimum Pads
Dimensions in Inches/(mm)

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