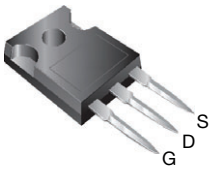
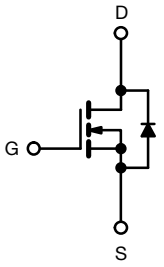
Power MOSFET

TO-247AC





N-Channel MOSFET

FEATURES

- Dynamic dV/dt rating
- Repetitive avalanche rated
- Isolated central mounting hole
- Fast switching
- Ease of paralleling
- Simple drive requirements
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

RoHS* Available

Note

* This datasheet provides information about parts that are RoHS-compliant and / or parts that are non RoHS-compliant. For example, parts with lead (Pb) terminations are not RoHS-compliant. Please see the information / tables in this datasheet for details

DESCRIPTION

Third generation Power MOSFETs from Vishay provide the designer with the best combination of fast switching, ruggedized device design, low on-resistance and cost-effectiveness.

The TO-247AC package is preferred for commercial-industrial applications where higher power levels preclude the use of TO-220AB devices. The TO-247AC is similar but superior to the earlier TO-218 package because of its isolated mounting hole. It also provides greater creepage distance between pins to meet the requirements of most safety specifications.

PRODUCT SUMMARY		
V_{DS} (V)	600	
$R_{DS(on)}$ (Ω)	V_{GS} = 10 V	0.60
Q_g (max.) (nC)	140	
Q_{gs} (nC)	20	
Q_{gd} (nC)	69	
Configuration	Single	

ORDERING INFORMATION	
Package	TO-247AC
Lead (Pb)-free	IRFPC50PbF

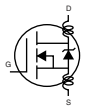
ABSOLUTE MAXIMUM RATINGS (T_C = 25 °C, unless otherwise noted)

PARAMETER			SYMBOL	LIMIT	UNIT
Drain-source voltage			V_{DS}	600	V
Gate-source voltage			V_{GS}	± 20	
Continuous drain current	V_{GS} at 10 V	T_C = 25 °C	I_D	11	A
		T_C = 100 °C		7.0	
Pulsed drain current [a]			I_{DM}	44	
Linear derating factor				1.4	W/°C
Single pulse avalanche energy [b]			E_{AS}	920	mJ
Repetitive avalanche current [a]			I_{AR}	10	A
Repetitive avalanche energy [a]			E_{AR}	18	mJ
Maximum power dissipation	T_C = 25 °C		P_D	180	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)	for 10 s			300 [d]	
Mounting torque	6-32 or M3 screw			10	lbf · in
				1.1	N · m

Notes

a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11)
b. V_{DD} = 50 V, starting T_J = 25 °C, L = 13 mH, R_g = 25 Ω, I_{AS} = 11 A (see fig. 12)
c. I_{SD} ≤ 11 A, dI/dt ≤ 100 A/µs, V_{DD} ≤ V_{DS}, T_J ≤ 150 °C
d. 1.6 mm from case

THERMAL RESISTANCE					
PARAMETER	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Maximum junction-to-ambient	R_{thJA}	-	-	40	°C/W
Case-to-sink, flat, greased surface	R_{thCS}	-	0.24	-	
Maximum junction-to-case (drain)	R_{thJC}	-	-	0.65	

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	600	-	-	V
V_{DS} temperature coefficient	$\Delta V_{DS}/T_J$	Reference to 25 °C, I_D = 1 mA	-	0.78	-	V/°C
Gate-source threshold voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 250 µA	2.0	-	4.0	V
Gate-source leakage	I_{GSS}	V_{GS} = ± 20 V	-	-	± 100	nA
Zero gate voltage drain current	I_{DSS}	V_{DS} = 600 V, V_{GS} = 0 V	-	-	100	µA
		V_{DS} = 480 V, V_{GS} = 0 V, T_J = 125 °C	-	-	500	
Drain-source on-state resistance	$R_{DS(on)}$	V_{GS} = 10 V; I_D = 6.0 A [b]	-	-	0.60	Ω
Forward transconductance	g_{fs}	V_{DS} = 100 V, I_D = 6.0 A [b]	5.7	-	-	S
Dynamic						
Input capacitance	C_{iss}	V_{GS} = 0 V, V_{DS} = 25 V, f = 1.0 MHz, see fig. 5	-	2700	-	pF
Output capacitance	C_{oss}		-	300	-	
Reverse transfer capacitance	C_{rss}		-	61	-	
Output capacitance	Q_g	V_{GS} = 10 V; I_D = 11 A, V_{DS} = 360 V see fig. 6 and 13 [b]	-	-	140	nC
	Q_{gs}		-	-	20	
Effective output capacitance	Q_{gd}		-	-	69	
Total gate charge	$t_{d(on)}$	V_{DD} = 300 V, I_D = 11 A, R_g = 6.2 Ω, R_D = 30 Ω, see fig. 10 [b]	-	18	-	ns
Gate-source charge	t_r		-	37	-	
Gate-drain charge	$t_{d(off)}$		-	88	-	
Turn-on delay time	t_f		-	36	-	
Internal drain inductance	L_D	Between lead, 6 mm (0.25") from package and center of die contact 	-	5.0	-	nH
Internal source inductance	L_S		-	13	-	
Drain-Source Body Diode Characteristics						
Continuous source-drain diode current	I_S	MOSFET symbol showing the integral reverse p - n junction diode 	-	-	11	A
Pulsed diode forward current [a]	I_{SM}		-	-	44	
Body diode voltage	V_{SD}	T_J = 25 °C, I_S = 11 A, V_{GS} = 0 V [b]	-	-	1.4	V
Body diode reverse recovery time	t_{rr}	T_J = 25 °C, I_F = 11 A, dI/dt = 100 A/µs [b]	-	550	830	ns
Body diode reverse recovery charge	Q_{rr}		-	3.9	5.9	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 %

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

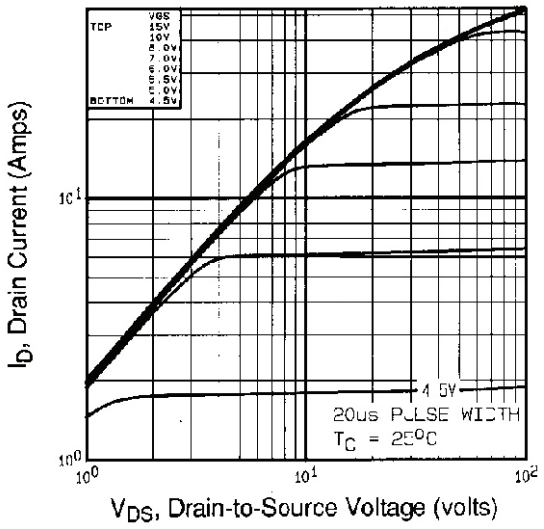


Fig. 1 - Typical Output Characteristics, T_C = 25 °C

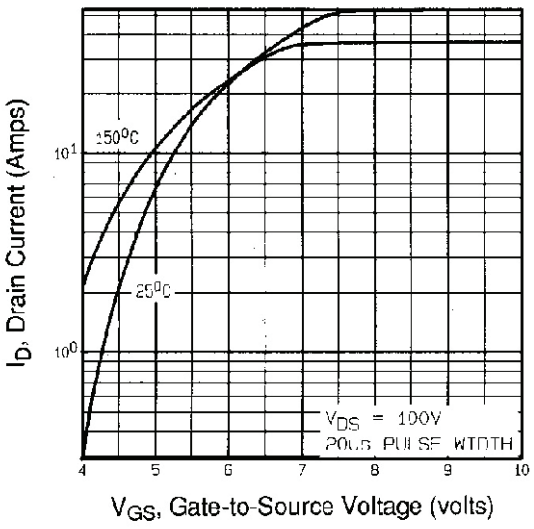


Fig. 3 - Typical Transfer Characteristics

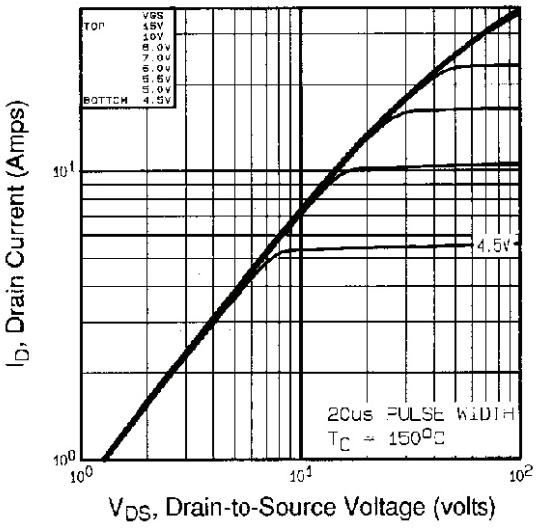


Fig. 2 - Typical Output Characteristics, T_C = 150 °C

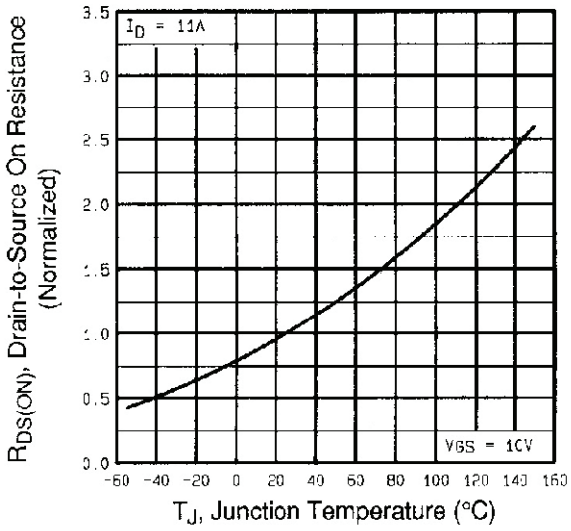


Fig. 4 - Normalized On-Resistance vs. Temperature

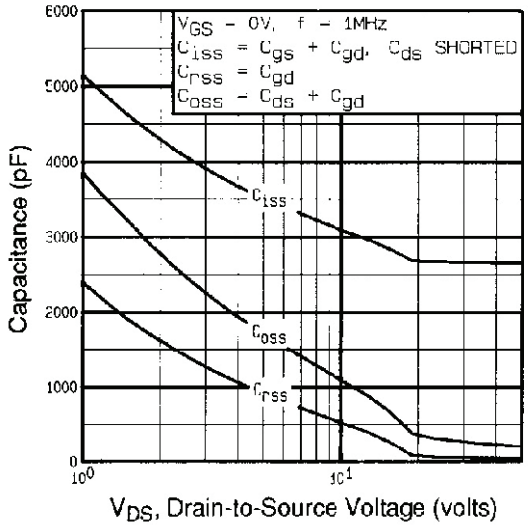


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

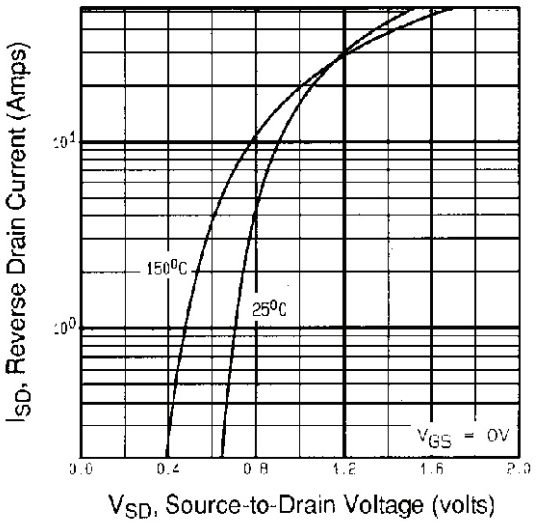


Fig. 7 - Typical Source-Drain Diode Forward Voltage

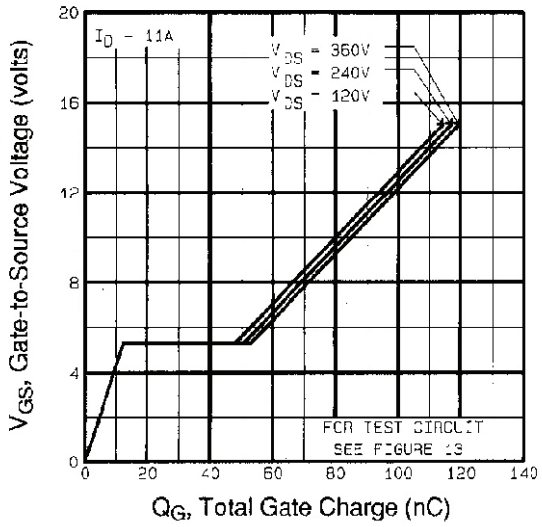


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

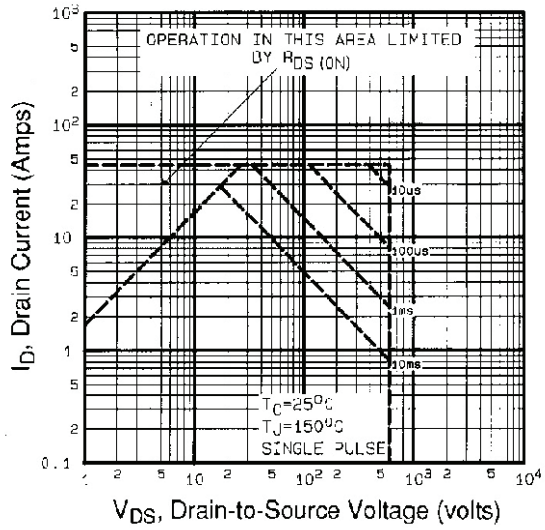


Fig. 8 - Maximum Safe Operating Area

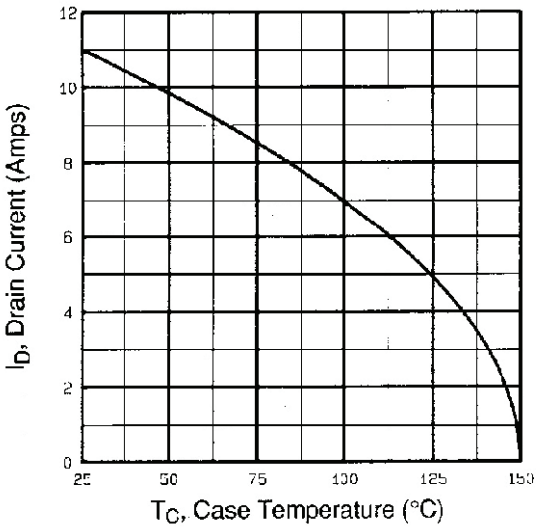


Fig. 9 - Maximum Drain Current vs. Case Temperature

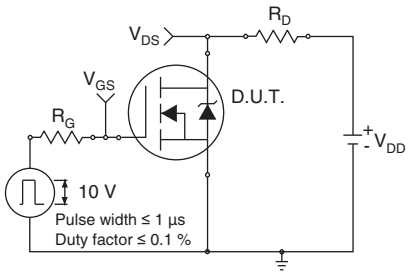


Fig. 10 - Switching Time Test Circuit

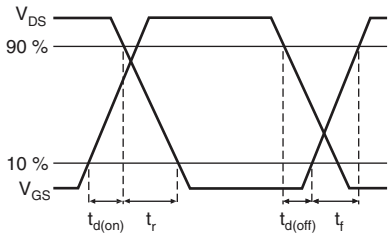


Fig. 11 - Switching Time Waveforms

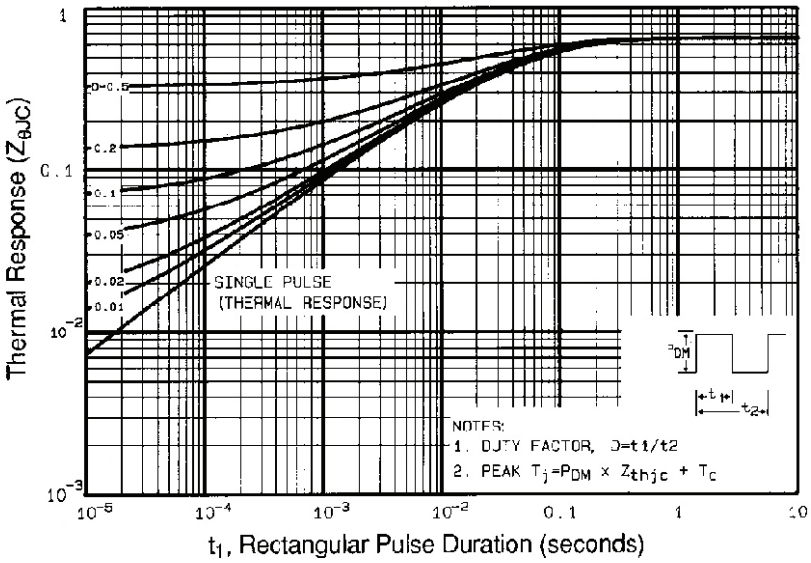


Fig. 12 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

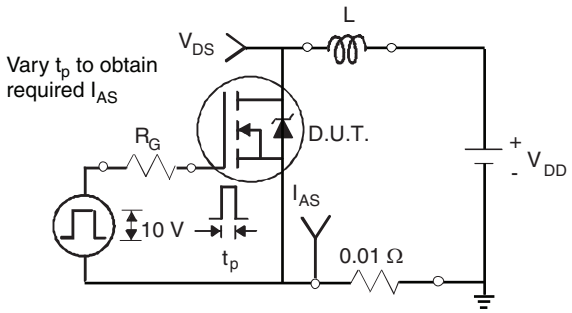


Fig. 13 - Unclamped Inductive Test Circuit

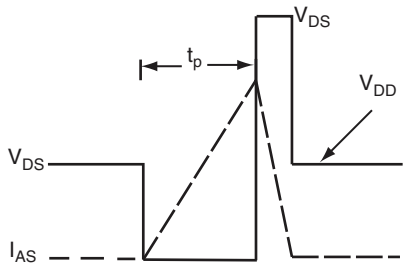


Fig. 14 - Unclamped Inductive Waveforms

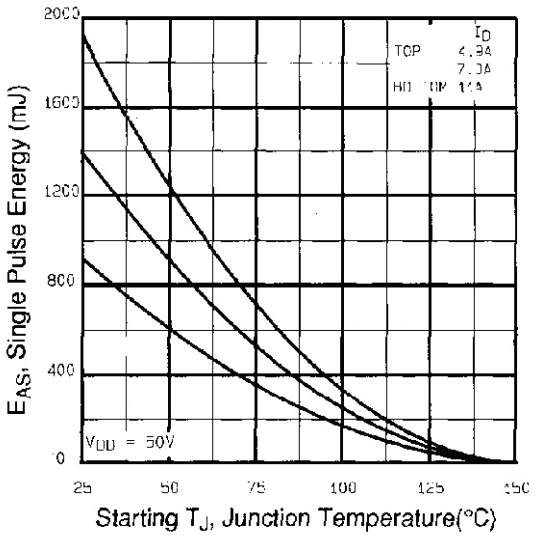


Fig. 15 - Maximum Avalanche Energy vs. Drain Current

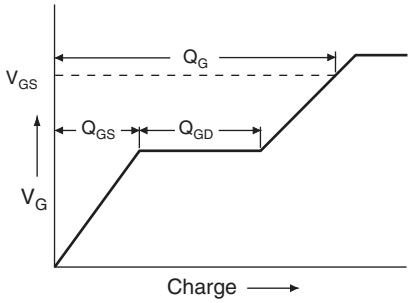


Fig. 16 - Basic Gate Charge Waveform

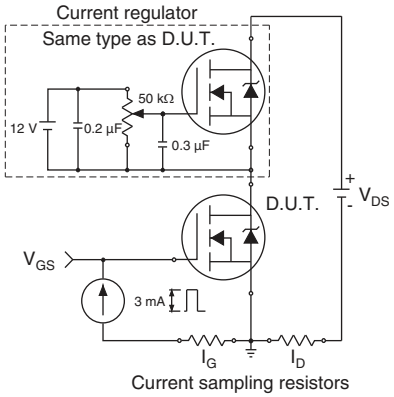
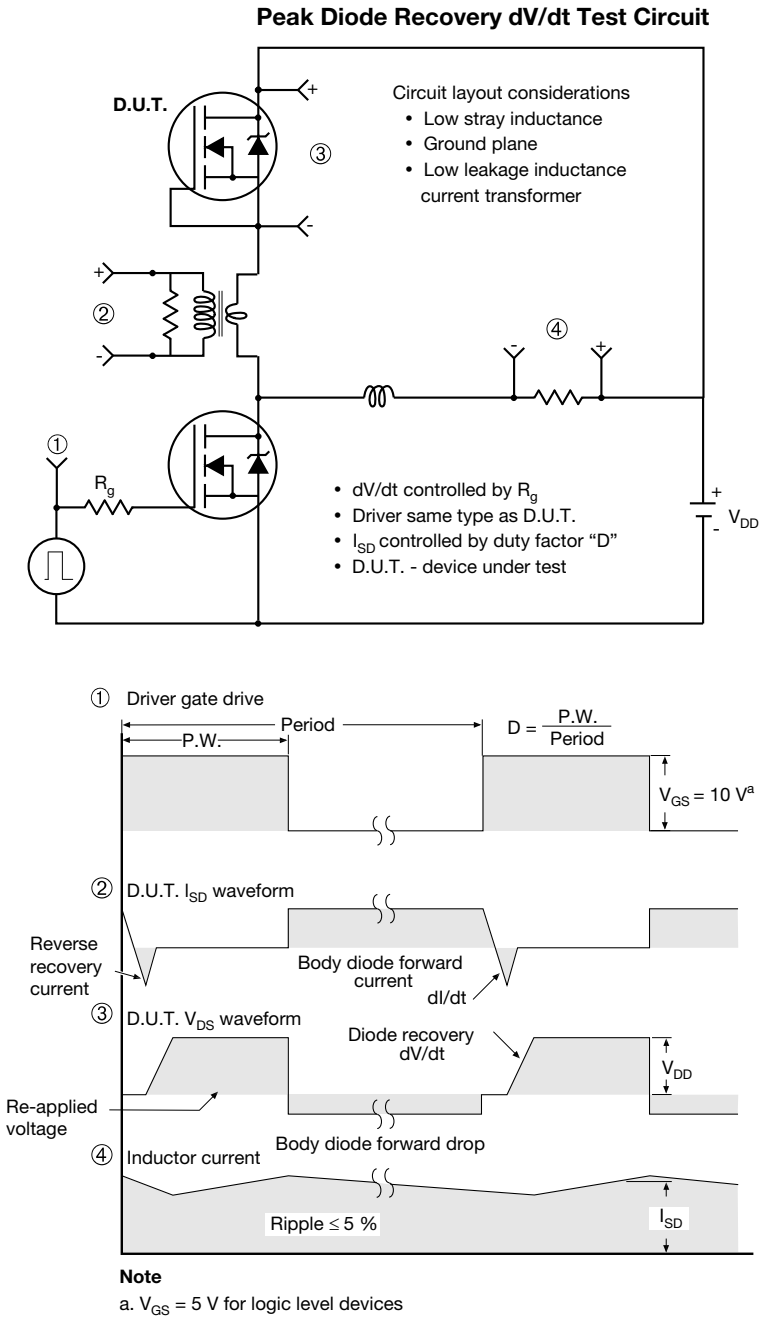


Fig. 17 - Gate Charge Test Circuit



Note

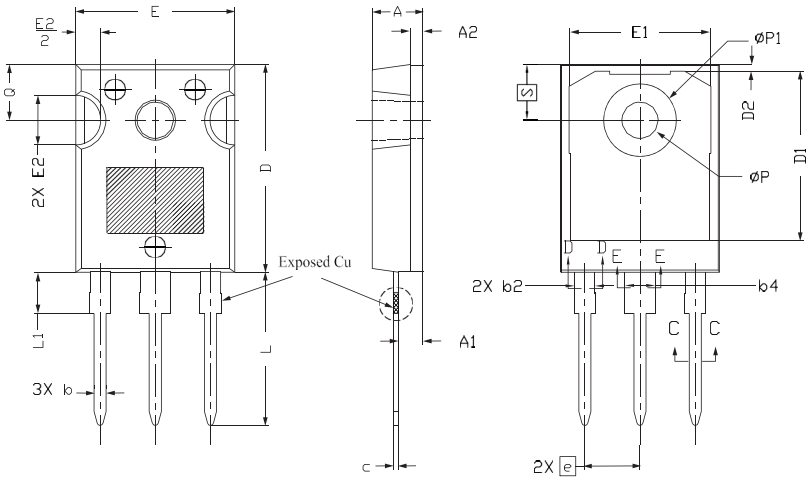
a. V_{GS} = 5 V for logic level devices

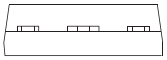
Fig. 18 - For N-Channel

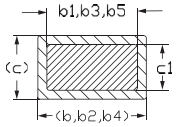
Vishay Siliconix maintains worldwide manufacturing capability. Products may be manufactured at one of several qualified locations. Reliability data for Silicon Technology and Package Reliability represent a composite of all qualified locations. For related documents such as package/tape drawings, part marking, and reliability data, see www.vishay.com/ppg?91243.

TO-247AC (High Voltage)

VERSION 1: FACILITY CODE = 9







Section C--C,D–D,E–E

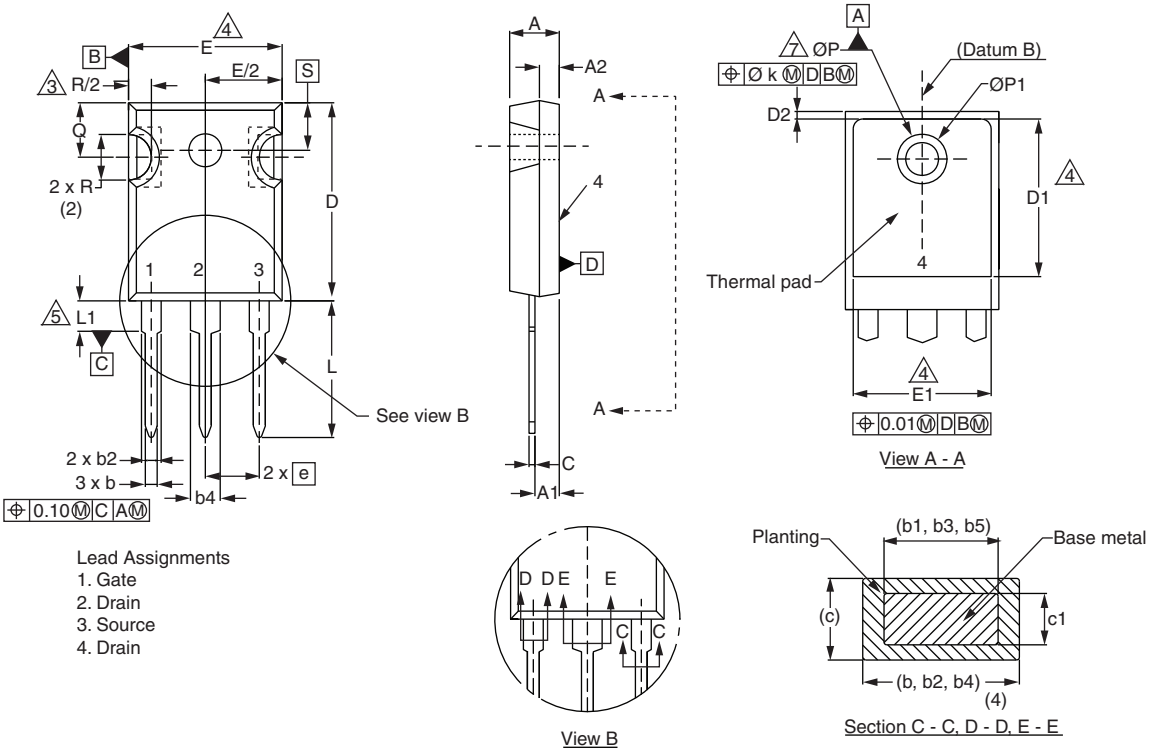
	MILLIMETERS			
DIM.	MIN.	NOM.	MAX.	NOTES
A	4.83	5.02	5.21	
A1	2.29	2.41	2.55	
A2	1.17	1.27	1.37	
b	1.12	1.20	1.33	
b1	1.12	1.20	1.28	
b2	1.91	2.00	2.39	6
b3	1.91	2.00	2.34	
b4	2.87	3.00	3.22	6, 8
b5	2.87	3.00	3.18	
c	0.40	0.50	0.60	6
c1	0.40	0.50	0.56	
D	20.40	20.55	20.70	4

	MILLIMETERS			
DIM.	MIN.	NOM.	MAX.	NOTES
D1	16.46	16.76	17.06	5
D2	0.56	0.66	0.76	
E	15.50	15.70	15.87	4
E1	13.46	14.02	14.16	5
E2	4.52	4.91	5.49	3
e	5.46 BSC			
L	14.90	15.15	15.40	
L1	3.96	4.06	4.16	6
Ø P	3.56	3.61	3.65	7
Ø P1	7.19 ref.			
Q	5.31	5.50	5.69	
S	5.51 BSC			

Notes

(1) Package reference: JEDEC® TO247, variation AC
(2) All dimensions are in mm
(3) Slot required, notch may be rounded
(4) Dimension D and E do not include mold flash. Mold flash shall not exceed 0.127 mm per side. These dimensions are measured at the outermost extremes of the plastic body
(5) Thermal pad contour optional with dimensions D1 and E1
(6) Lead finish uncontrolled in L1
(7) Ø P to have a maximum draft angle of 1.5° to the top of the part with a maximum hole diameter of 3.91 mm
(8) Dimension b2 and b4 does not include dambar protrusion. Allowable dambar protrusion shall be 0.1 mm total in excess of b2 and b4 dimension at maximum material condition

VERSION 2: FACILITY CODE = Y



Lead Assignments
1. Gate
2. Drain
3. Source
4. Drain

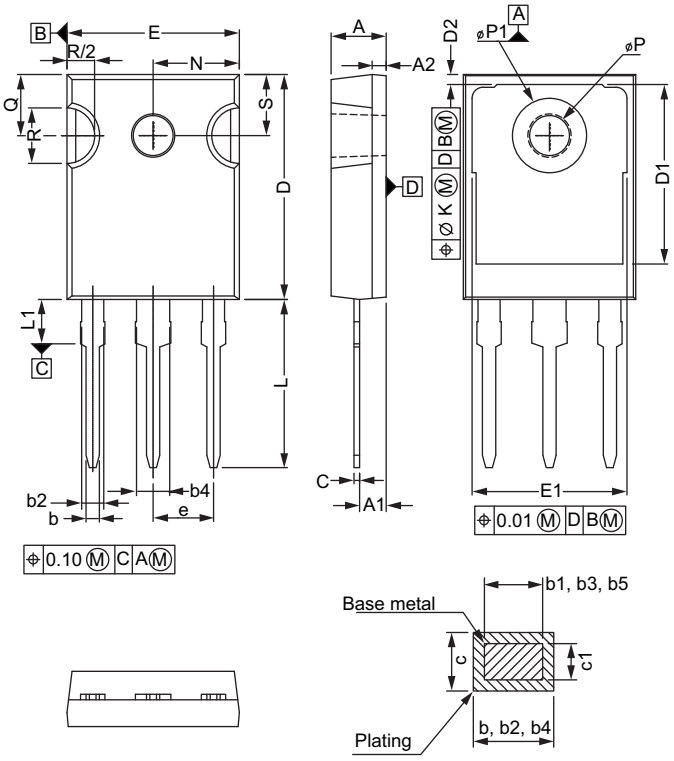
	MILLIMETERS		
DIM.	MIN.	MAX.	NOTES
A	4.58	5.31	
A1	2.21	2.59	
A2	1.17	2.49	
b	0.99	1.40	
b1	0.99	1.35	
b2	1.53	2.39	
b3	1.65	2.37	
b4	2.42	3.43	
b5	2.59	3.38	
c	0.38	0.86	
c1	0.38	0.76	
D	19.71	20.82	
D1	13.08	-	

	MILLIMETERS		
DIM.	MIN.	MAX.	NOTES
D2	0.51	1.30	
E	15.29	15.87	
E1	13.72	-	
e	5.46 BSC		
Ø k	0.254		
L	14.20	16.25	
L1	3.71	4.29	
Ø P	3.51	3.66	
Ø P1	-	7.39	
Q	5.31	5.69	
R	4.52	5.49	
S	5.51 BSC		

Notes

(1) Dimensioning and tolerancing per ASME Y14.5M-1994
(2) Contour of slot optional
(3) Dimension D and E do not include mold flash. Mold flash shall not exceed 0.127 mm (0.005") per side. These dimensions are measured at the outermost extremes of the plastic body
(4) Thermal pad contour optional with dimensions D1 and E1
(5) Lead finish uncontrolled in L1
(6) Ø P to have a maximum draft angle of 1.5 to the top of the part with a maximum hole diameter of 3.91 mm (0.154")
(7) Outline conforms to JEDEC outline TO-247 with exception of dimension c

VERSION 3: FACILITY CODE = N



	MILLIMETERS	
DIM.	MIN.	MAX.
A	4.65	5.31
A1	2.21	2.59
A2	1.17	1.37
b	0.99	1.40
b1	0.99	1.35
b2	1.65	2.39
b3	1.65	2.34
b4	2.59	3.43
b5	2.59	3.38
c	0.38	0.89
c1	0.38	0.84
D	19.71	20.70
D1	13.08	-

	MILLIMETERS	
DIM.	MIN.	MAX.
D2	0.51	1.35
E	15.29	15.87
E1	13.46	-
e	5.46 BSC	
k	0.254	
L	14.20	16.10
L1	3.71	4.29
N	7.62 BSC	
P	3.56	3.66
P1	-	7.39
Q	5.31	5.69
R	4.52	5.49
S	5.51 BSC	

ECN: E22-0452-Rev. G, 31-Oct-2022
DWG: 5971

Notes

(1) Dimensioning and tolerancing per ASME Y14.5M-1994
(2) Contour of slot optional
(3) Dimension D and E do not include mold flash. Mold flash shall not exceed 0.127 mm (0.005") per side. These dimensions are measured at the outermost extremes of the plastic body
(4) Thermal pad contour optional with dimensions D1 and E1
(5) Lead finish uncontrolled in L1
(6) Ø P to have a maximum draft angle of 1.5 to the top of the part with a maximum hole diameter of 3.91 mm (0.154")

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