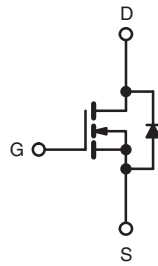
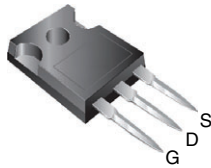


Power MOSFET

TO-247


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

APPLICATIONS

- Switch Mode Power Supply (SMPS)
- Uninterruptable Power Supply
- High Speed Power Switching

TYPICAL SMPS TOPOLOGIES

- Two Transistor Forward
- Half Bridge, Full Bridge
- PFC Boost

PRODUCT SUMMARY

V_{DS} (V)	500	
$R_{DS(on)}$ (Ω)	$V_{GS} = 10$ V	0.40
Q_g (Max.) (nC)	64	
Q_{gs} (nC)	16	
Q_{gd} (nC)	26	
Configuration	Single	

ORDERING INFORMATION

Package	TO-247
Lead (Pb)-free	IRFP450APbF


ABSOLUTE MAXIMUM RATINGS $T_C = 25^\circ\text{C}$, 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	$T_C = 25^\circ\text{C}$	A	
		$T_C = 100^\circ\text{C}$		
Pulsed Drain Current ^a	I_{DM}	56		
Linear Derating Factor		1.5	W/ $^\circ\text{C}$	
Single Pulse Avalanche Energy ^b	E_{AS}	760	mJ	
Repetitive Avalanche Current ^a	I_{AR}	14	A	
Repetitive Avalanche Energy ^a	E_{AR}	19	mJ	
Maximum Power Dissipation	$T_C = 25^\circ\text{C}$	P_D	190	W
Peak Diode Recovery dV/dt^c	dV/dt	4.1	V/ns	
Operating Junction and Storage Temperature Range	T_J, T_{stg}	- 55 to + 150	$^\circ\text{C}$	
Soldering Recommendations (Peak Temperature)	For 10 s	300 ^d		
Mounting Torque	6-32 or M3 screw	10		lbf · in
		1.1	N · m	

Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11)
- Starting $T_J = 25^\circ\text{C}$, $L = 7.8$ mH, $R_G = 25 \Omega$, $I_{AS} = 14$ A (see fig. 12)
- $I_{SD} \leq 14$ A, $dI/dt \leq 130$ A/ μs , $V_{DD} \leq V_{DS}$, $T_J \leq 150^\circ\text{C}$
- 1.6 mm from case

THERMAL RESISTANCE RATINGS				
PARAMETER	SYMBOL	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 $T_J = 25\text{ }^\circ\text{C}$, 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 $25\text{ }^\circ\text{C}$, $I_D = 1\text{ mA}$		-	0.58	-	V/°C
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$		2.0	-	4.0	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	$R_{DS(on)}$	$V_{GS} = 10\text{ V}$	$I_D = 8.4\text{ A}^b$	-	-	0.40	Ω
Forward Transconductance	g_{fs}	$V_{DS} = 50\text{ V}, I_D = 8.4\text{ A}^b$		7.8	-	-	S
Dynamic							
Input Capacitance	C_{iss}	$V_{GS} = 0\text{ V},$ $V_{DS} = 25\text{ V},$ $f = 1.0\text{ MHz}$, see fig. 5		-	2038	-	μF
Output Capacitance	C_{oss}			-	307	-	
Reverse Transfer Capacitance	C_{rss}			-	10	-	
Output Capacitance	C_{oss}	$V_{GS} = 0\text{ V}; V_{DS} = 1.0\text{ V}, f = 1.0\text{ MHz}$		-	2859	-	
Output Capacitance	C_{oss}	$V_{GS} = 0\text{ V}; V_{DS} = 400\text{ V}, f = 1.0\text{ MHz}$		-	81	-	
Effective Output Capacitance	$C_{oss\text{ eff.}}$	$V_{GS} = 0\text{ V}; V_{DS} = 0\text{ V to } 400\text{ V}^c$		-	96	-	
Total Gate Charge	Q_g	$V_{GS} = 10\text{ V}$	$I_D = 14\text{ A}, V_{DS} = 400\text{ V},$ see fig. 6 and 13 ^b	-	-	64	nC
Gate-Source Charge	Q_{gs}			-	-	16	
Gate-Drain Charge	Q_{gd}			-	-	26	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 250\text{ V}, I_D = 14\text{ A},$ $R_G = 6.2\text{ }\Omega, R_D = 17\text{ }\Omega$, see fig. 10 ^b		-	15	-	ns
Rise Time	t_r			-	36	-	
Turn-Off Delay Time	$t_{d(off)}$			-	35	-	
Fall Time	t_f			-	29	-	
Drain-Source Body Diode Characteristics							
Continuous Source-Drain Diode Current	I_S	MOSFET symbol showing the integral reverse p-n junction diode 	-	-	14	A	
Pulsed Diode Forward Current ^a	I_{SM}		-	-	56		
Body Diode Voltage	V_{SD}	$T_J = 25\text{ }^\circ\text{C}, I_S = 14\text{ A}, V_{GS} = 0\text{ V}^b$		-	-	1.4	V
Body Diode Reverse Recovery Time	t_{rr}	$T_J = 25\text{ }^\circ\text{C}, I_F = 14\text{ A}, dI/dt = 100\text{ A}/\mu\text{s}^b$		-	487	731	ns
Body Diode Reverse Recovery Charge	Q_{rr}			-	3.9	5.8	μC
Forward Turn-On Time	t_{on}	Intrinsic turn-on time is negligible (turn-on is dominated by L_S and L_D)					

Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11)
- Pulse width $\leq 300\text{ }\mu\text{s}$; duty cycle $\leq 2\%$
- $C_{oss\text{ eff.}}$ 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

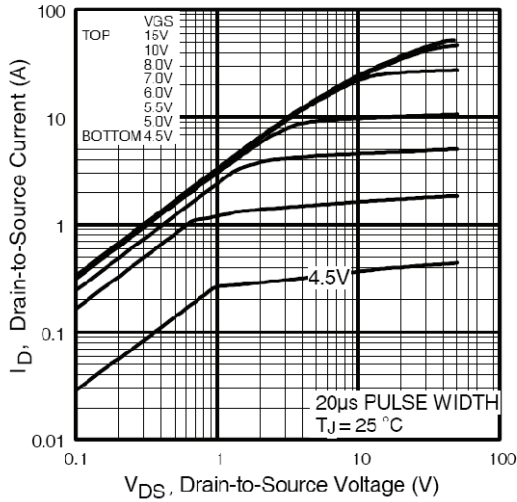


Fig. 1 - Typical Output Characteristics

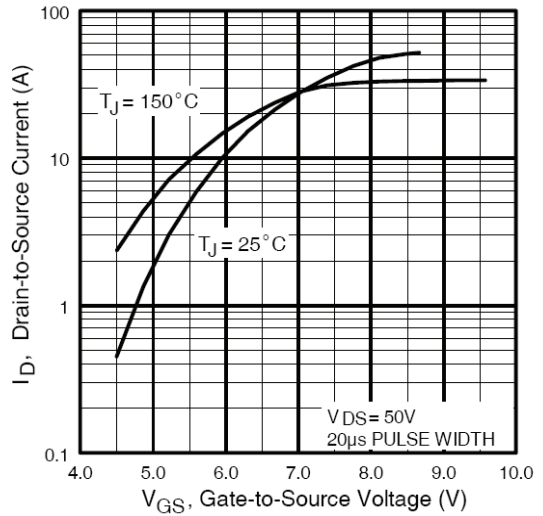


Fig. 3 - Typical Transfer Characteristics

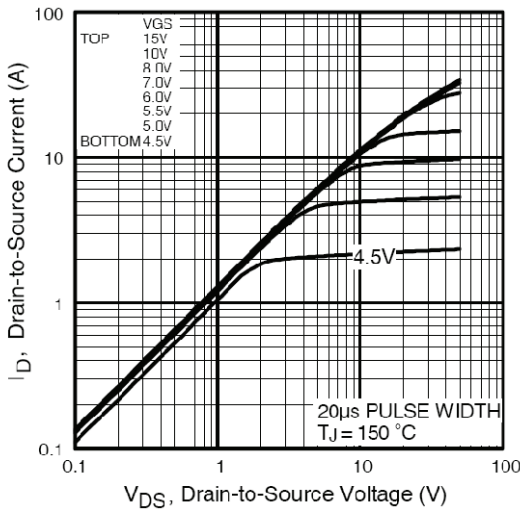


Fig. 2 - Typical Output Characteristics

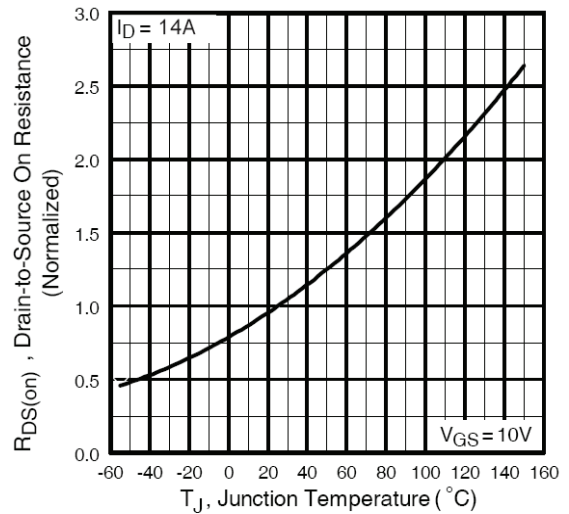


Fig. 4 - Normalized On-Resistance vs. Temperature

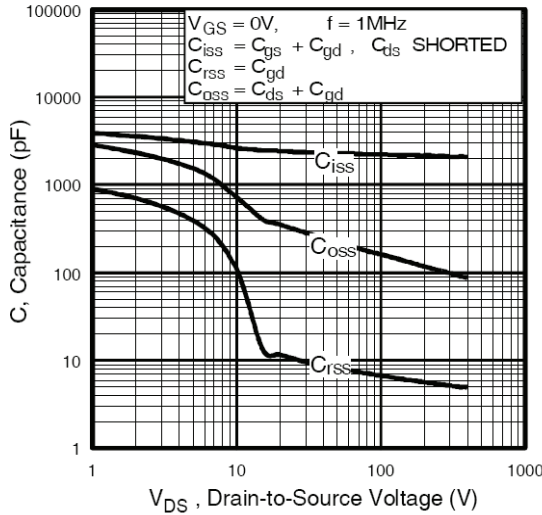


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

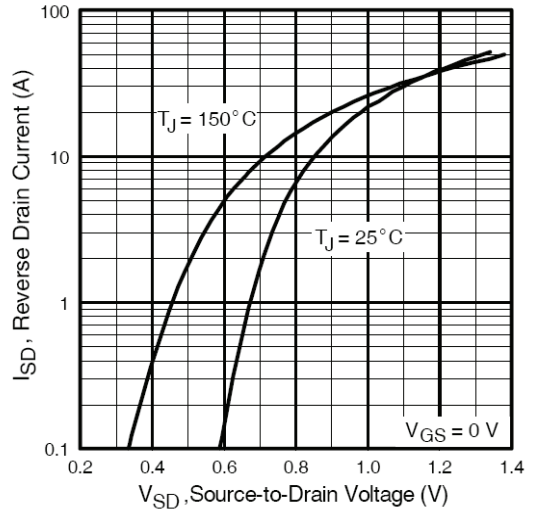


Fig. 7 - Typical Source-Drain Diode Forward Voltage

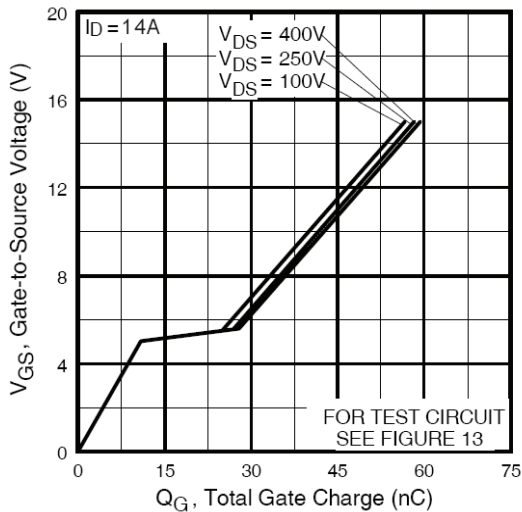


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

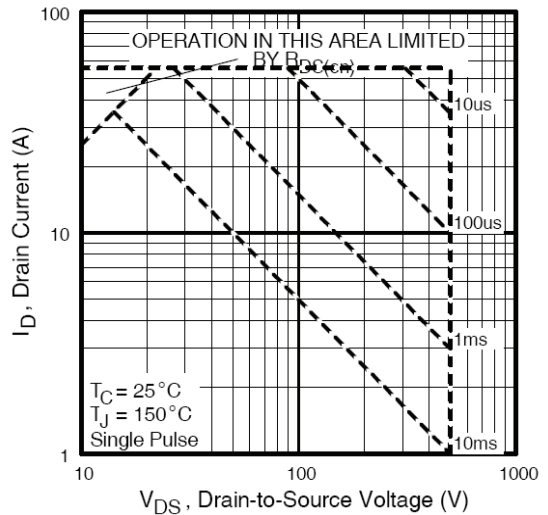


Fig. 8 - Maximum Safe Operating Area

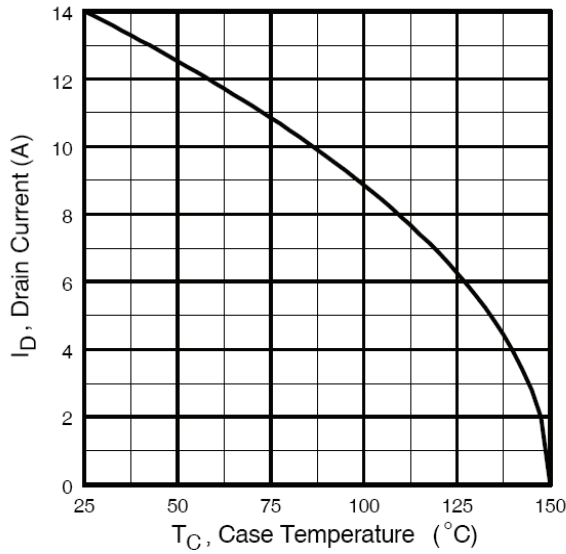


Fig. 9 - Maximum Drain Current vs. Case Temperature

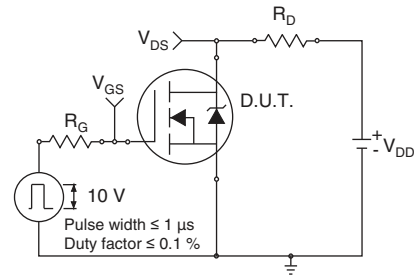


Fig. 10a - Switching Time Test Circuit



Fig. 10b - Switching Time Waveforms

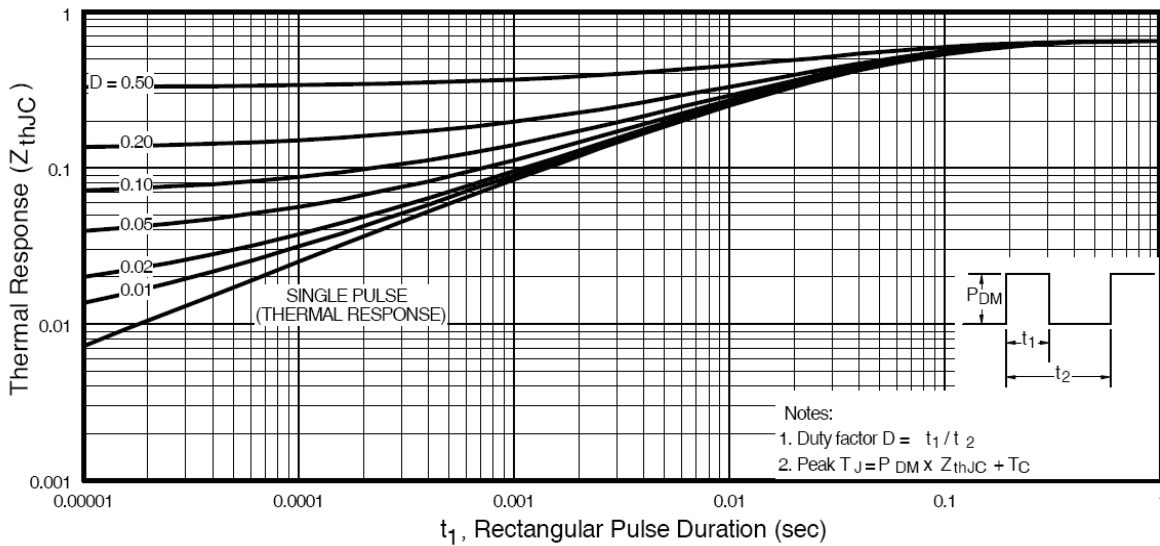


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

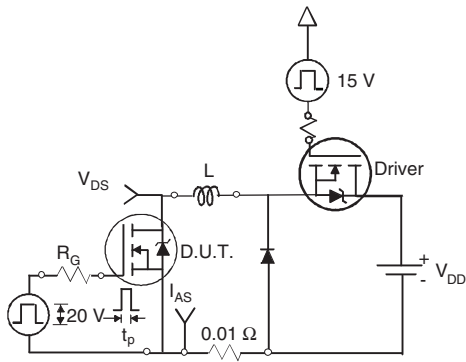


Fig. 12a - Unclamped Inductive Test Circuit

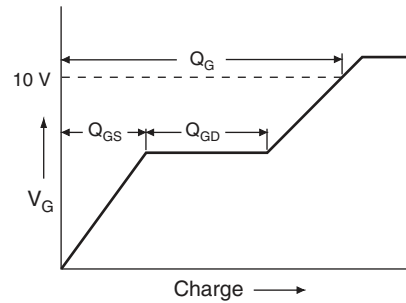


Fig. 13a - Basic Gate Charge Waveform

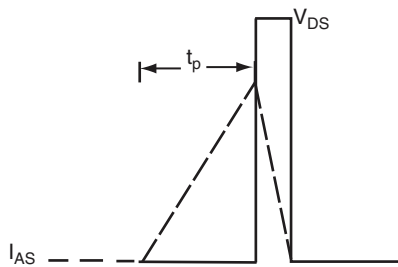


Fig. 12b - Unclamped Inductive Waveforms

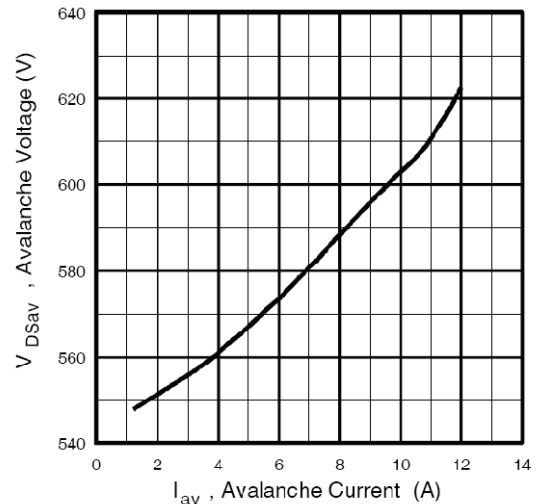


Fig. 12d - Typical Drain-to-Source Voltage vs. Avalanche Current

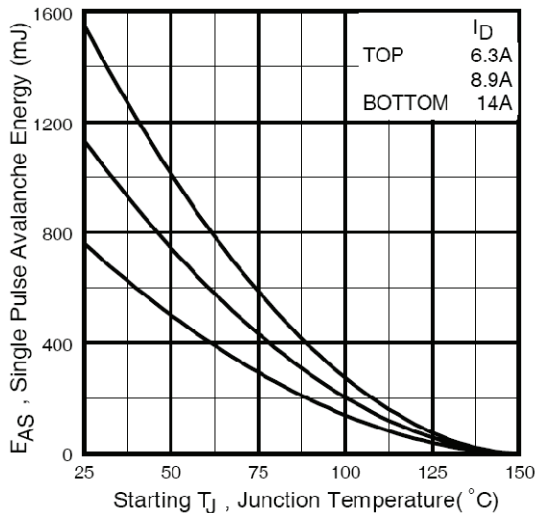


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

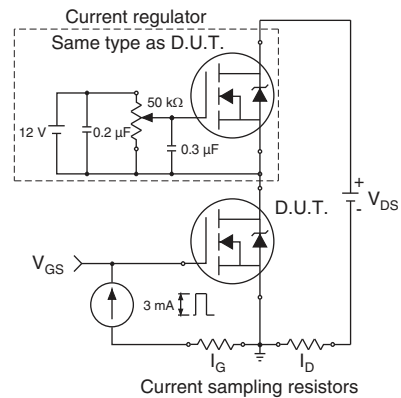
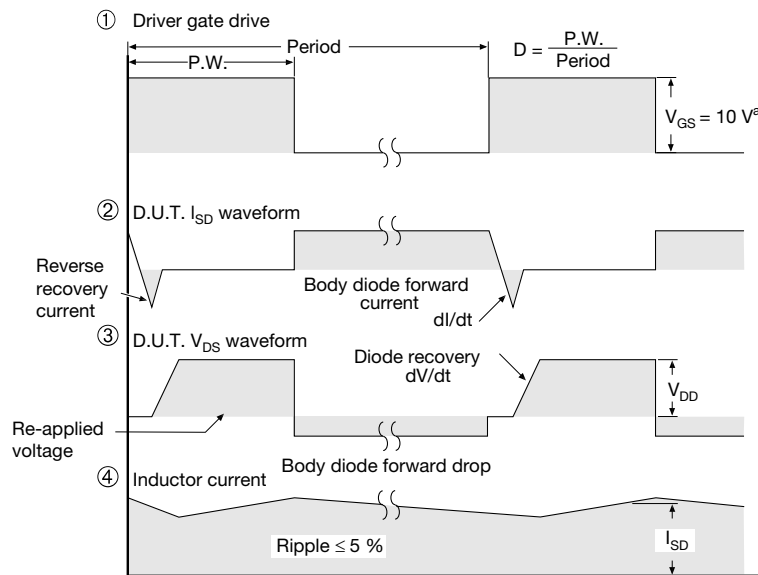
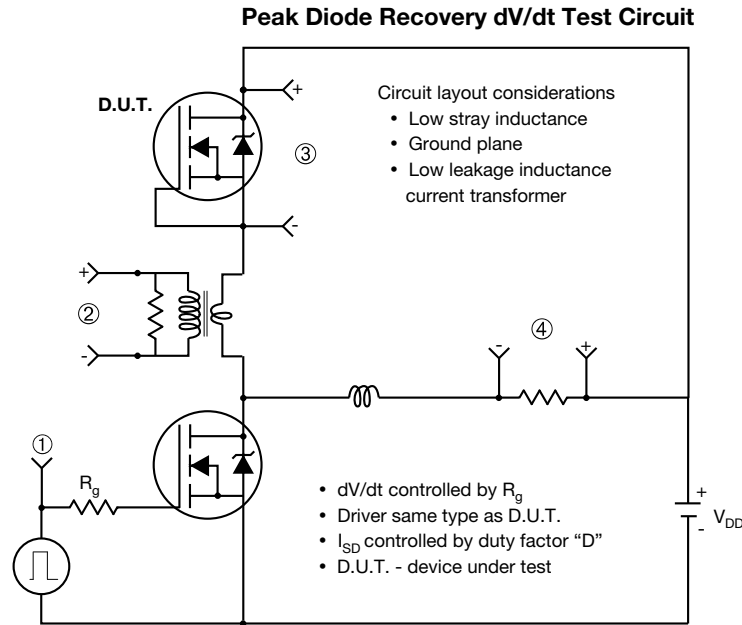


Fig. 13b - Gate Charge Test Circuit



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

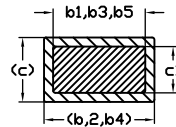
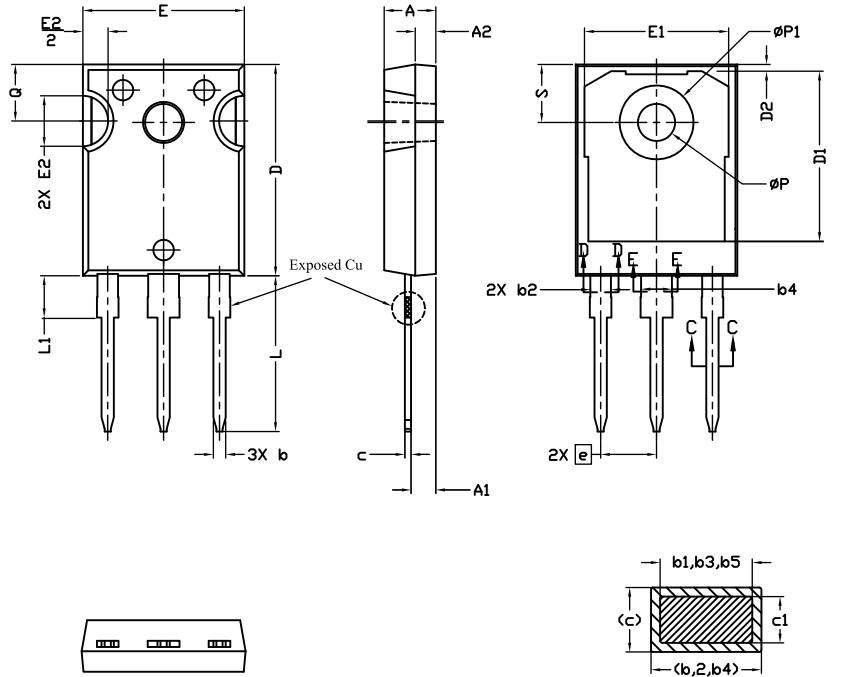
Fig. 14 - For N-Channel

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TO-247AC (High Voltage)

VERSION 1: FACILITY CODE = 9



Section C--C, D---D, E--E

DIM.	MILLIMETERS		NOTES
	MIN.	MAX.	
A	4.83	5.21	
A1	2.29	2.55	
A2	1.50	2.49	
b	1.12	1.33	
b1	1.12	1.28	
b2	1.91	2.39	6
b3	1.91	2.34	
b4	2.87	3.22	6, 8
b5	2.87	3.18	
c	0.55	0.69	6
c1	0.55	0.65	
D	20.40	20.70	4

DIM.	MILLIMETERS		NOTES
	MIN.	MAX.	
D1	16.25	16.85	5
D2	0.56	0.76	
E	15.50	15.87	4
E1	13.46	14.16	5
E2	4.52	5.49	3
e	5.44 BSC		
L	14.90	15.40	
L1	3.96	4.16	6
Ø P	3.56	3.65	7
Ø P1	7.19 ref.		
Q	5.31	5.69	
S	5.54	5.74	

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



DIM.	MILLIMETERS		NOTES
	MIN.	MAX.	
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	-	

DIM.	MILLIMETERS		NOTES
	MIN.	MAX.	
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: E20-0545-Rev. F, 19-Oct-2020
 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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