International
IOR Rectifier

SMPS MOSFET

IRFP460AS

HEXFET® Power MOSFET

V_{DSS}	Rds(on) max	I_D
500V	0.27Ω	20A

Applications

- SMPS, UPS, Welding and High Speed Power Switching

Benefits

- Dynamic dv/dt Rating
- Repetitive Avalanche Rated
- Isolated Central Mounting Hole
- Fast Switching
- Ease of Paralleling
- Simple Drive Requirements
- Solder plated and leadformed for surface mounting

SMD-247

Description

Third Generation HEXFET®s from International Rectifier provide the designer with the best combination of fast switching, ruggedized device design, low on-resistance and cost-effectiveness.

The TO-247 package is preferred for commercial-industrial applications where higher power levels preclude the use of TO-220 devices. The TO-247 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.

This plated and leadformed version of the TO-247 package allows the package to be surface mounted in an application.

Absolute Maximum Ratings

	Parameter	Max.	Units
I_D @ T_C = 25°C	Continuous Drain Current, V_{GS} @ 10V	20	A
I_D @ T_C = 100°C	Continuous Drain Current, V_{GS} @ 10V	13	
I_{DM}	Pulsed Drain Current ①	80	
P_D @T_C = 25°C	Power Dissipation	280	W
	Linear Derating Factor	2.2	W/°C
V_{GS}	Gate-to-Source Voltage	± 30	V
dv/dt	Peak Diode Recovery dv/dt ③	3.8	V/ns
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to + 150	°C
	Mounting torqe, 6-32 or M3 screw	10 lbf•in (1.1N•m)	
	Maximum Reflow Temperature	230 (Time above 183 °C should not exceed 100s)	°C

Typical SMPS Topologies:

- Full Bridge
- PFC Boost

Notes ① through ⑤ are on page 8

Static @ T_J = 25°C (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	500	——	——	V	V_{GS} = 0V, I_D = 250µA
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	——	0.61	——		V/°C Reference to 25°C, I_D = 1mA
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	——	——	0.27	Ω	V_{GS} = 10V, I_D = 12A ④
$V_{GS(th)}$	Gate Threshold Voltage	2.0	——	4.0	V	V_{DS} = V_{GS}, I_D = 250µA
I_{DSS}	Drain-to-Source Leakage Current	——	——	25	µA	V_{DS} = 500V, V_{GS} = 0V
		——	——	250		V_{DS} = 400V, V_{GS} = 0V, T_J = 125°C
I_{GSS}	Gate-to-Source Forward Leakage	——	——	100	nA	V_{GS} = 30V
	Gate-to-Source Reverse Leakage	——	——	-100		V_{GS} = -30V

Dynamic @ T_J = 25°C (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
g_{fs}	Forward Transconductance	11	——	——	S	V_{DS} = 50V, I_D = 12A
Q_g	Total Gate Charge	——	——	105	nC	I_D = 20A
Q_{gs}	Gate-to-Source Charge	——	——	26		V_{DS} = 400V
Q_{gd}	Gate-to-Drain ("Miller") Charge	——	——	42		V_{GS} = 10V, See Fig. 6 and 13 ④
$t_{d(on)}$	Turn-On Delay Time	——	18	——	ns	V_{DD} = 250V
t_r	Rise Time	——	55	——		I_D = 20A
$t_{d(off)}$	Turn-Off Delay Time	——	45	——		R_G = 4.3Ω
t_f	Fall Time	——	39	——		R_D = 13Ω, See Fig. 10 ④
C_{iss}	Input Capacitance	——	3100	——	pF	V_{GS} = 0V
C_{oss}	Output Capacitance	——	480	——		V_{DS} = 25V
C_{rss}	Reverse Transfer Capacitance	——	18	——		ƒ = 1.0MHz, See Fig. 5
C_{oss}	Output Capacitance	——	4430	——		V_{GS} = 0V, V_{DS} = 1.0V, ƒ = 1.0MHz
C_{oss}	Output Capacitance	——	130	——		V_{GS} = 0V, V_{DS} = 400V, ƒ = 1.0MHz
C_{oss} eff.	Effective Output Capacitance	——	140	——		V_{GS} = 0V, V_{DS} = 0V to 400V ⑤

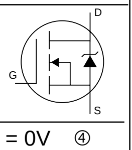
Avalanche Characteristics

	Parameter	Typ.	Max.	Units
E_{AS}	Single Pulse Avalanche Energy②	——	960	mJ
I_{AR}	Avalanche Current①	——	20	A
E_{AR}	Repetitive Avalanche Energy①	——	28	mJ

Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	——	0.45	°C/W
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface	0.24	——	
$R_{\theta JA}$	Junction-to-Ambient	——	40	

Diode Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	——	——	20	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I_{SM}	Pulsed Source Current (Body Diode) ①	——	——	80		
V_{SD}	Diode Forward Voltage	——	——	1.8	V	T_J = 25°C, I_S = 20A, V_{GS} = 0V ④
t_{rr}	Reverse Recovery Time	——	480	710	ns	T_J = 25°C, I_F = 20A
Q_{rr}	Reverse RecoveryCharge	——	5.0	7.5	µC	di/dt = 100A/µs ④
t_{on}	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by L_S+L_D)				

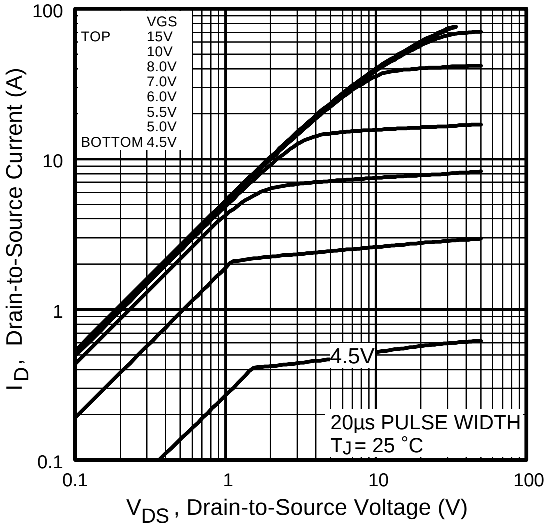


Fig 1. Typical Output Characteristics

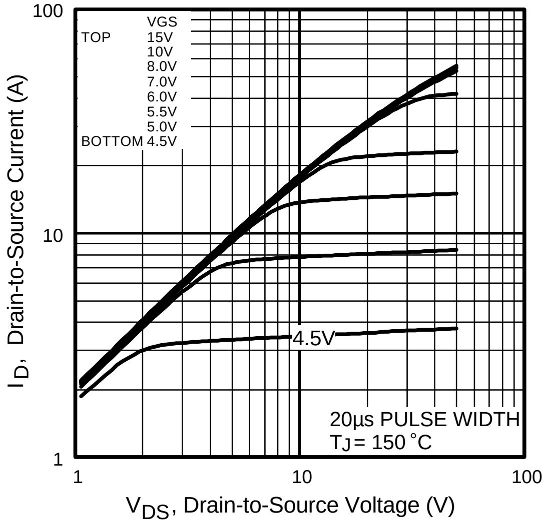


Fig 2. Typical Output Characteristics

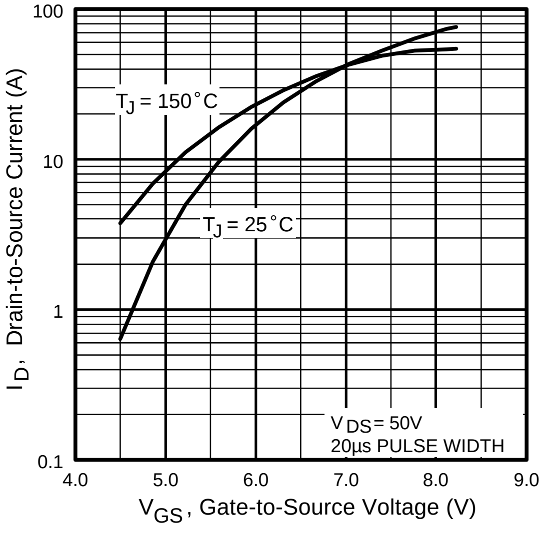


Fig 3. Typical Transfer Characteristics

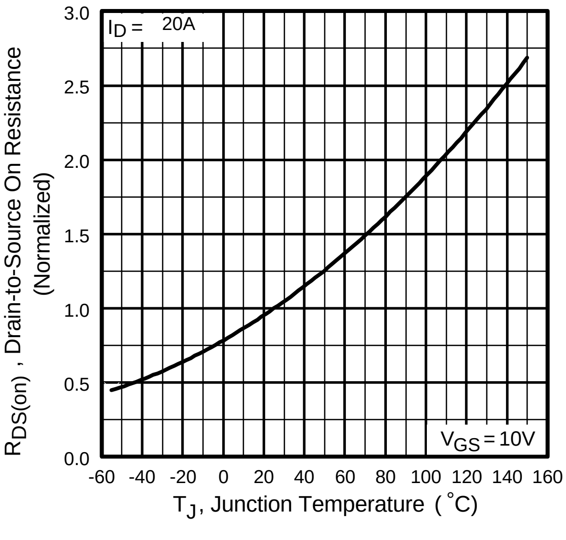


Fig 4. Normalized On-Resistance
Vs. Temperature

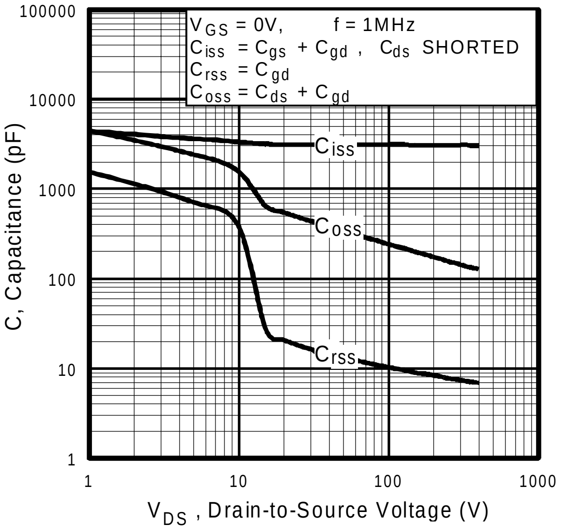


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

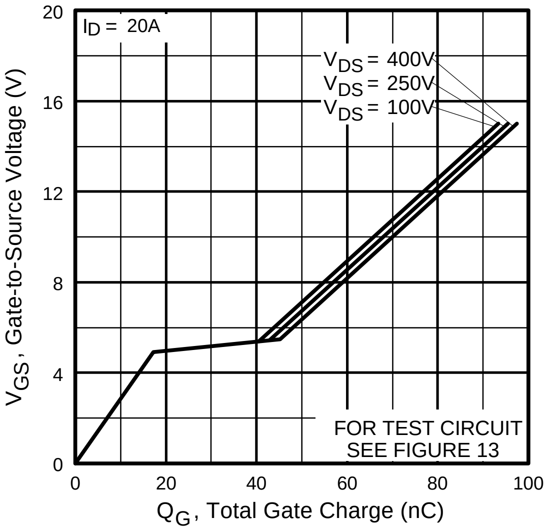


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

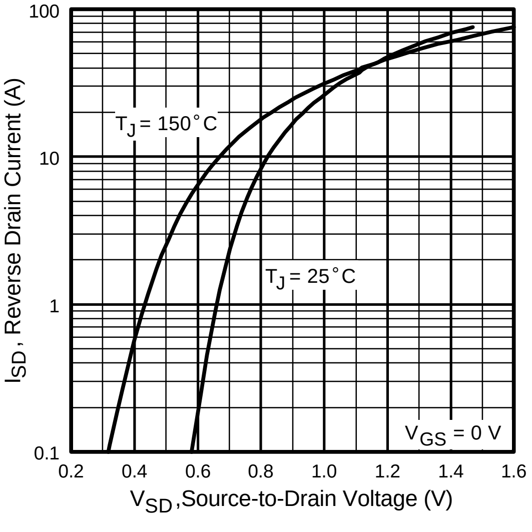


Fig 7. Typical Source-Drain Diode Forward Voltage

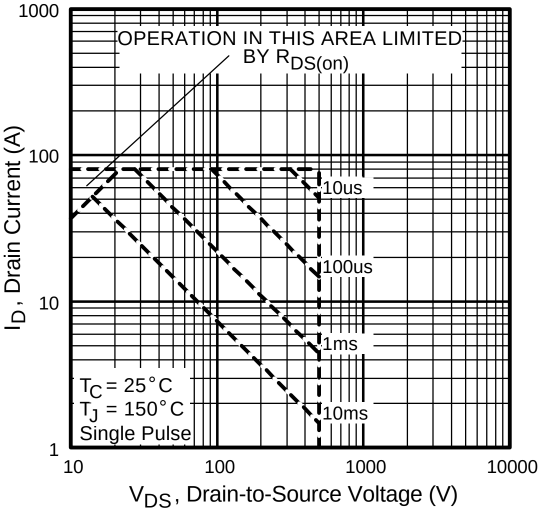


Fig 8. Maximum Safe Operating Area

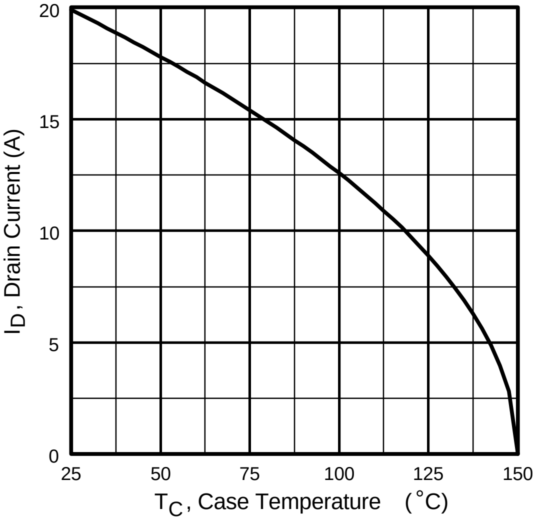


Fig 9. Maximum Drain Current Vs. Case Temperature

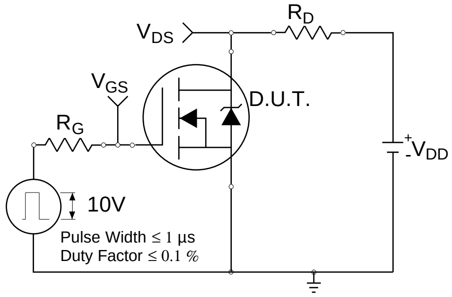


Fig 10a. Switching Time Test Circuit

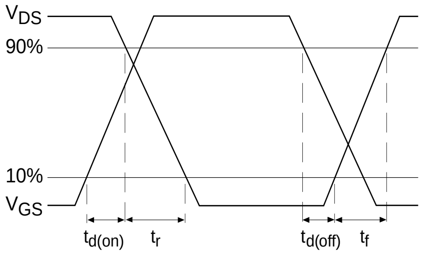


Fig 10b. Switching Time Waveforms

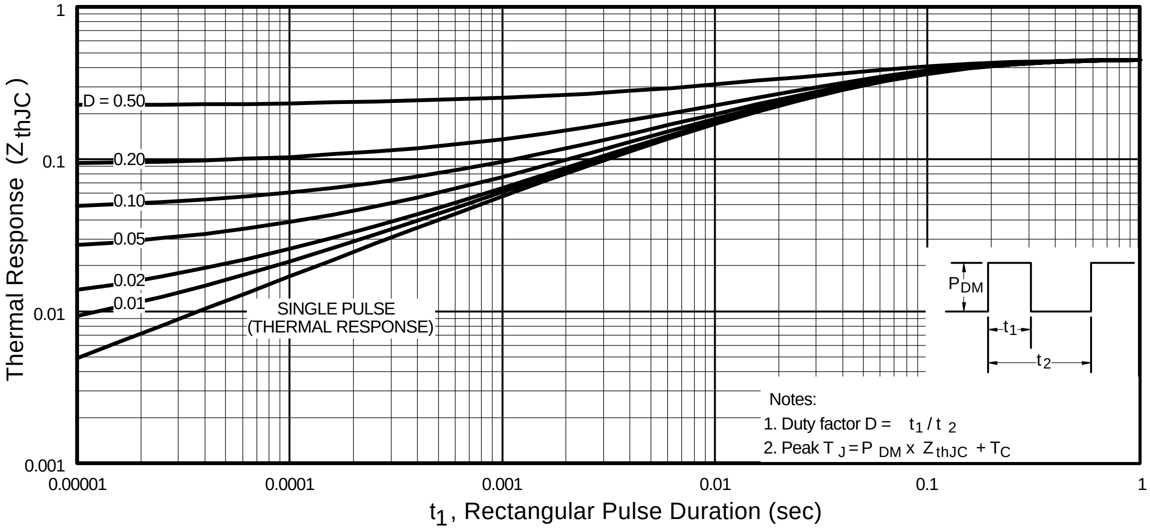


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

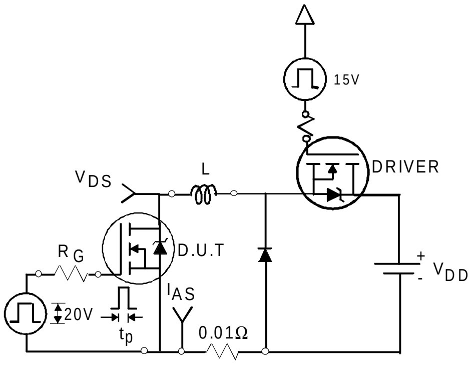


Fig 12a. Unclamped Inductive Test Circuit

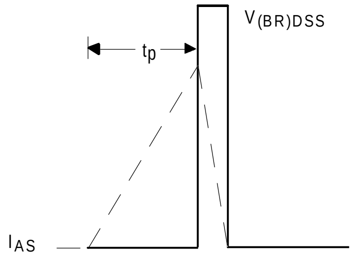


Fig 12b. Unclamped Inductive Waveforms

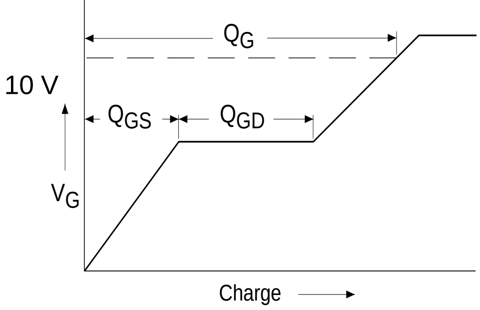


Fig 13a. Basic Gate Charge Waveform

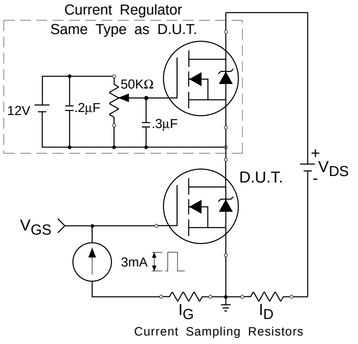


Fig 13b. Gate Charge Test Circuit

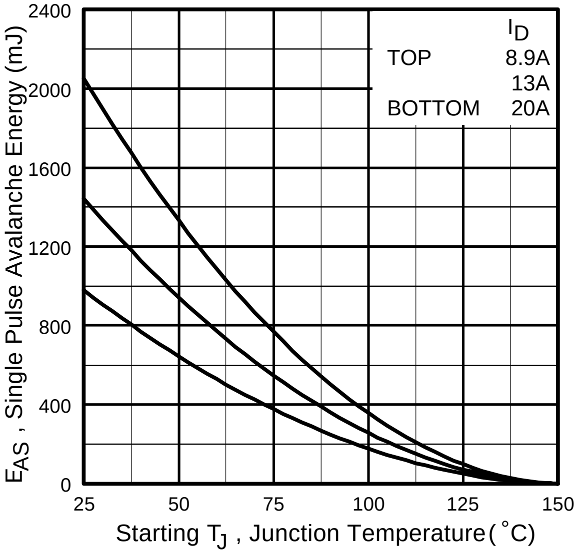


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

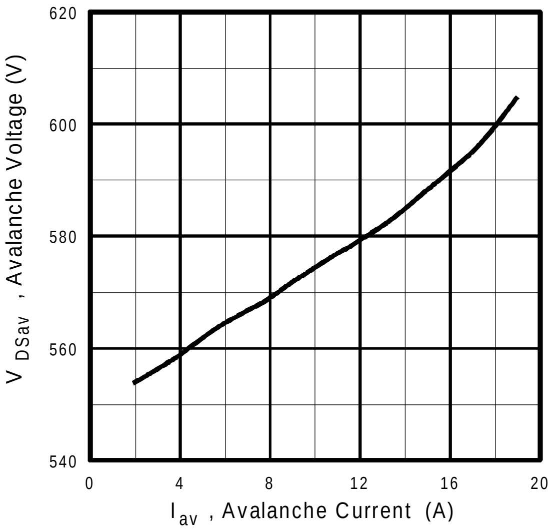
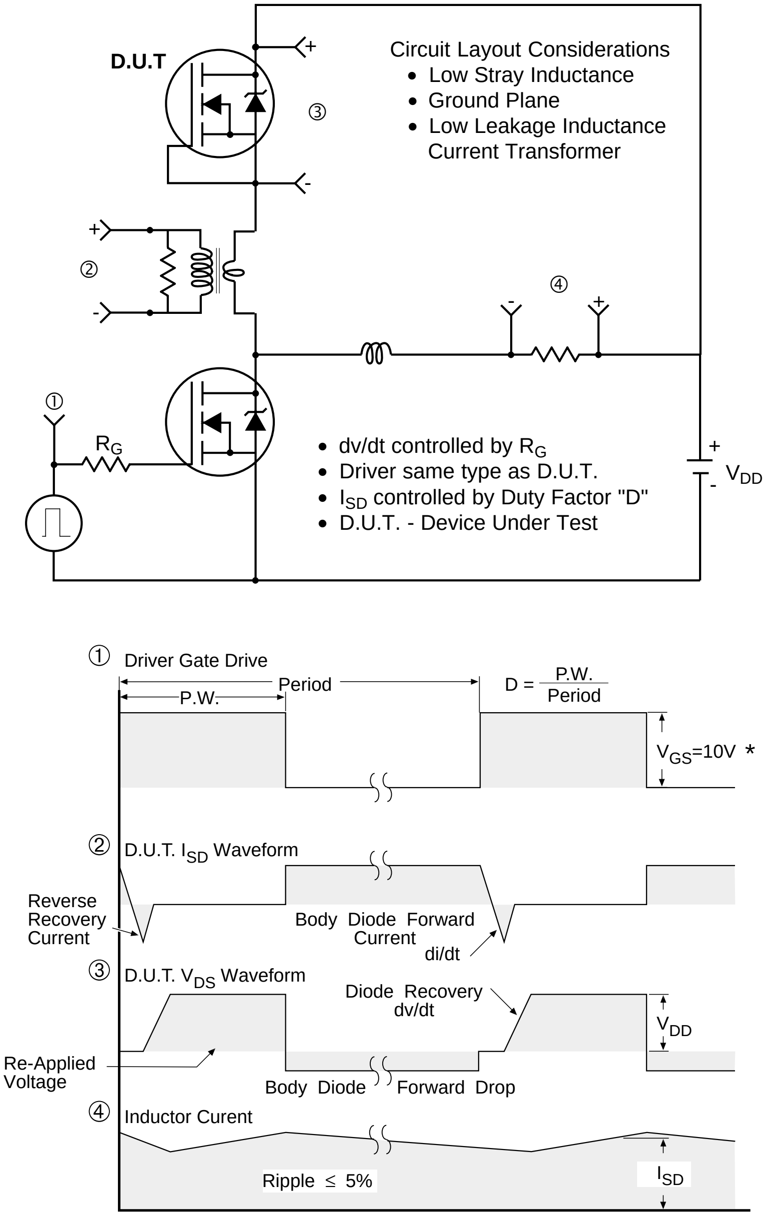


Fig 12d. Typical Drain-to-Source Voltage Vs. Avalanche Current

Peak Diode Recovery dv/dt Test Circuit

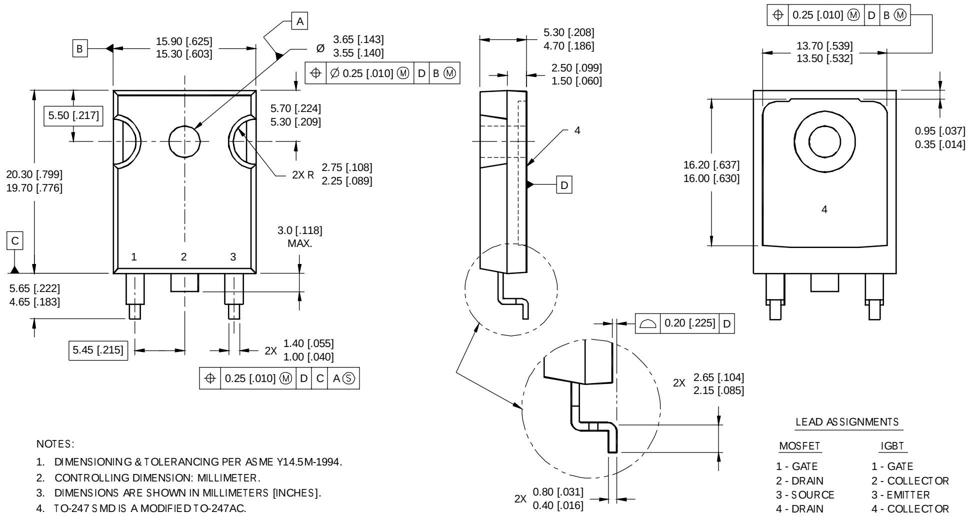

Circuit Layout Considerations
- Low Stray Inductance
- Ground Plane
- Low Leakage Inductance Current Transformer

- dv/dt controlled by R_G
- Driver same type as D.U.T.
- I_{SD} controlled by Duty Factor "D"
- D.U.T. - Device Under Test

* V_{GS} = 5V for Logic Level Devices

Fig 14. For N-Channel HEXFETS

SMD-247 Package Outline



NOTES:

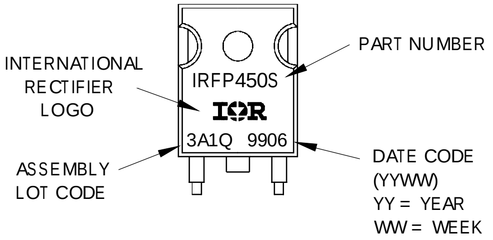
1. DIMENSIONING & TOLERANCING PER ASME Y14.5M-1994.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
4. TO-247 SMD IS A MODIFIED TO-247AC.

LEAD ASSIGNMENTS

MOSFET	IGBT
1 - GATE	1 - GATE
2 - DRAIN	2 - COLLECTOR
3 - SOURCE	3 - EMITTER
4 - DRAIN	4 - COLLECTOR

SMD-247 Part Marking Information

EXAMPLE: THIS IS AN IRFP450S WITH
ASSEMBLY LOT CODE 3A1Q



Notes:

① Repetitive rating; pulse width limited by max. junction temperature. (See fig. 11)

② Starting $T_J = 25°C$, L = 4.3mH $R_G = 25\Omega$, $I_{AS} = 20A$. (See Figure 12)

③ $I_{SD} \leq 20A$, $di/dt \leq 125A/\mu s$, $V_{DD} \leq V_{(BR)DSS}$, $T_J \leq 150°C$

④ Pulse width ≤ 300µs; duty cycle ≤ 2%.

⑤ 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_{DSS}

Data and specifications subject to change without notice.
This product has been designed and qualified for the industrial market.
Qualification Standards can be found on IR's Web site.

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IR WORLD HEADQUARTERS: 233 Kansas St., El Segundo, California 90245, USA Tel: (310) 252-7105
TAC Fax: (310) 252-7903
Visit us at www.irf.com for sales contact information.12/00