International **IOR** Rectifier

SMPS MOSFET   IRFP27N60K

HEXFET® Power MOSFET

Applications
- Hard Switching Primary or PFC Switch
- Switch Mode Power Supply (SMPS)
- Uninterruptible Power Supply
- High Speed Power Switching
- Motor Drive

Benefits
- Low Gate Charge Qg results in Simple Drive Requirement
- Improved Gate, Avalanche and Dynamic dv/dt Ruggedness
- Fully Characterized Capacitance and Avalanche Voltage and Current
- Enhanced Body Diode dv/dt Capability

V_{DSS}	$R_{DS(on)}$ typ.	I_D
600V	180mΩ	27A

TO-247AC
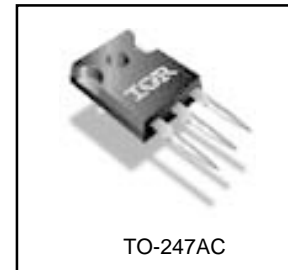
Absolute Maximum Ratings

	Parameter	Max.	Units
I_D @ T_C = 25°C	Continuous Drain Current, V_{GS} @ 10V	27	
I_D @ T_C = 100°C	Continuous Drain Current, V_{GS} @ 10V	18	A
I_{DM}	Pulsed Drain Current ①	110	
P_D @T_C = 25°C	Power Dissipation	500	W
	Linear Derating Factor	4.0	W/°C
V_{GS}	Gate-to-Source Voltage	± 30	V
dv/dt	Peak Diode Recovery dv/dt ③	13	V/ns
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to + 150	
	Soldering Temperature, for 10 seconds (1.6mm from case)	300	°C
	Mounting torqe, 6-32 or M3 screw	10 lbf•in (1.1N•m)	

Avalanche Characteristics

Symbol	Parameter	Typ.	Max.	Units
E_{AS}	Single Pulse Avalanche Energy②	——	530	mJ
I_{AR}	Avalanche Current①	——	27	A
E_{AR}	Repetitive Avalanche Energy①	——	50	mJ

Thermal Resistance

Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	——	0.29	
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface	0.24	——	°C/W
$R_{\theta JA}$	Junction-to-Ambient	——	40	

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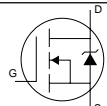
Static @ T_J = 25°C (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	600	—	—	V	V_{GS} = 0V, I_D = 250µA
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.64	—	V/°C	Reference to 25°C, I_D = 1mA⑥
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	180	220	mΩ	V_{GS} = 10V, I_D = 16A ④
$V_{GS(th)}$	Gate Threshold Voltage	3.0	—	5.0	V	$V_{DS} = V_{GS}$, I_D = 250µA
I_{DSS}	Drain-to-Source Leakage Current	—	—	50	µA	V_{DS} = 600V, V_{GS} = 0V
		—	—	250		V_{DS} = 480V, 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)

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
g_{fs}	Forward Transconductance	14	—	—	S	V_{DS} = 50V, I_D = 16A
Q_g	Total Gate Charge	—	—	180	nC	I_D = 27A
Q_{gs}	Gate-to-Source Charge	—	—	56		V_{DS} = 480V
Q_{gd}	Gate-to-Drain ("Miller") Charge	—	—	86		V_{GS} = 10V, See Fig. 6 and 13 ④
$t_{d(on)}$	Turn-On Delay Time	—	27	—	ns	V_{DD} = 300V
t_r	Rise Time	—	110	—		I_D = 27A
$t_{d(off)}$	Turn-Off Delay Time	—	43	—		R_G = 4.3Ω
t_f	Fall Time	—	38	—		V_{GS} = 10V, See Fig. 10 ④
C_{iss}	Input Capacitance	—	4660	—	pF	V_{GS} = 0V
C_{oss}	Output Capacitance	—	460	—		V_{DS} = 25V
C_{rss}	Reverse Transfer Capacitance	—	41	—		f = 1.0MHz, See Fig. 5
C_{oss}	Output Capacitance	—	5490	—		V_{GS} = 0V, V_{DS} = 1.0V, f = 1.0MHz
C_{oss}	Output Capacitance	—	120	—		V_{GS} = 0V, V_{DS} = 480V, f = 1.0MHz
C_{oss} eff.	Effective Output Capacitance	—	250	—		V_{GS} = 0V, V_{DS} = 0V to 480V ⑤

Diode Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	27	A	MOSFET symbol showing the integral reverse p-n junction diode.
I_{SM}	Pulsed Source Current (Body Diode) ①	—	—	110		
V_{SD}	Diode Forward Voltage	—	—	1.5	V	T_J = 25°C, I_S = 27A, V_{GS} = 0V ④
t_{rr}	Reverse Recovery Time	—	620	920	ns	T_J = 25°C, I_F = 27A
Q_{rr}	Reverse RecoveryCharge	—	11	16	µC	di/dt = 100A/µs ④
I_{RRM}	Reverse RecoveryCurrent	—	36	53	A	
t_{on}	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by L_S+L_D)				

Notes:

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

② Starting T_J = 25°C, L = 1.4mH, R_G = 25Ω, I_{AS} = 27A, dv/dt = 13V/ns. (See Figure 12a)

③ $I_{SD} \leq$ 27A, di/dt $\leq$ 390A/µs, $V_{DD} \leq V_{(BR)DSS}$, $T_J \leq$ 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}.
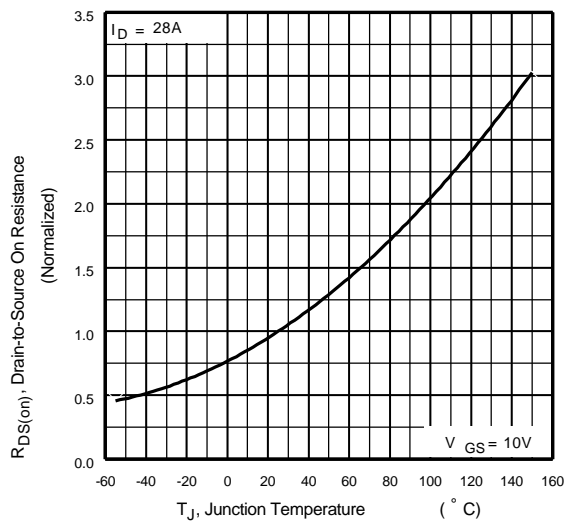
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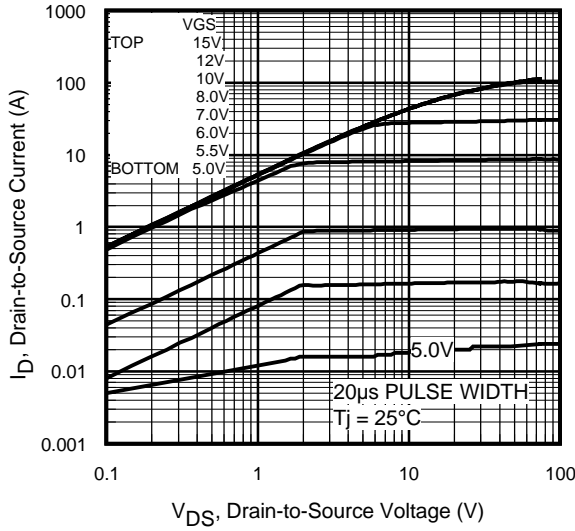
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Fig 1. Typical Output Characteristics
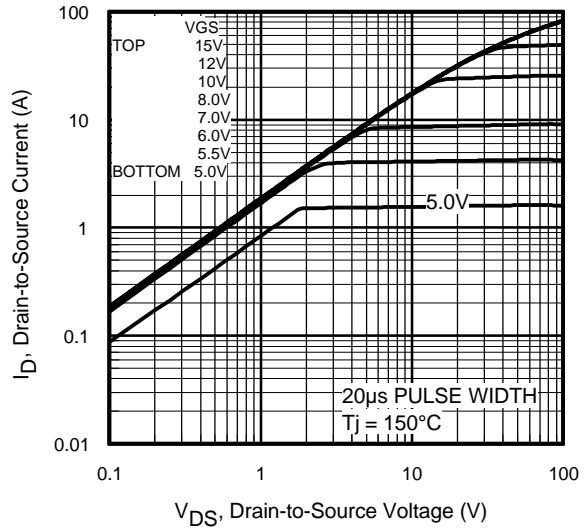
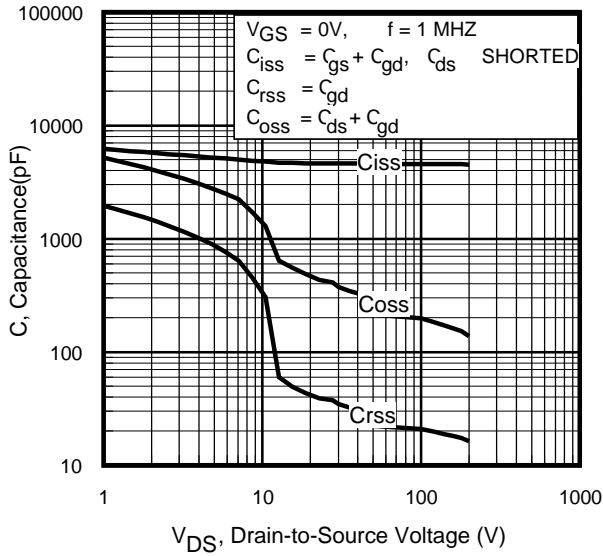**Fig 2.** Typical Output Characteristics
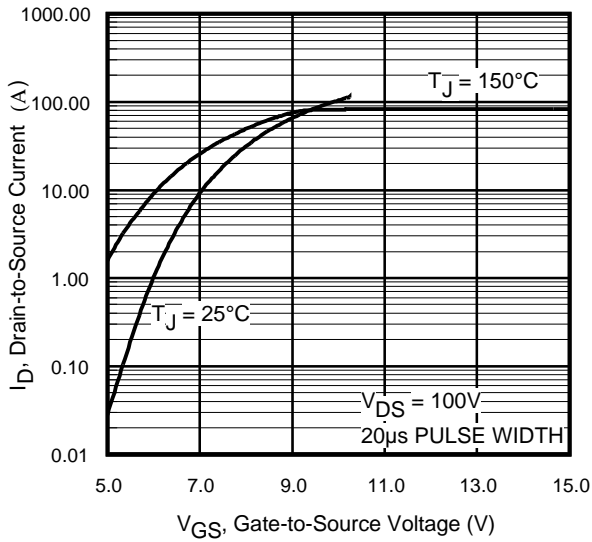
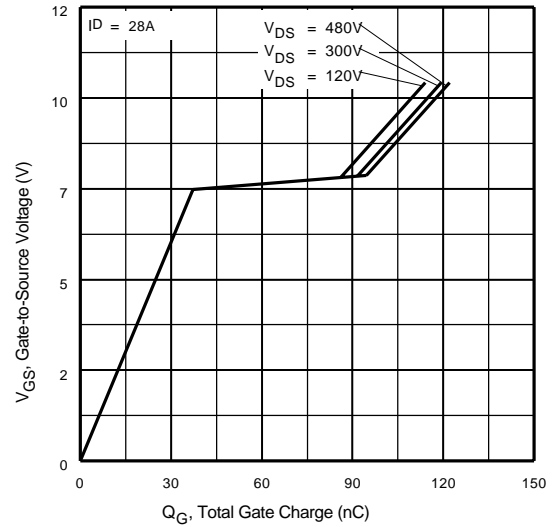

Fig 3. Typical Transfer Characteristics

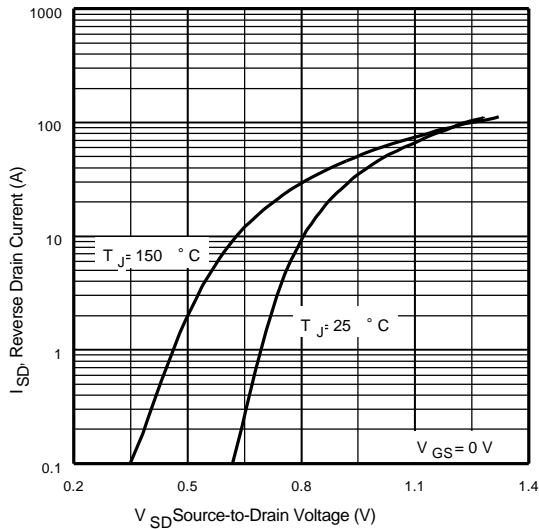**Fig 4.** Normalized On-Resistance
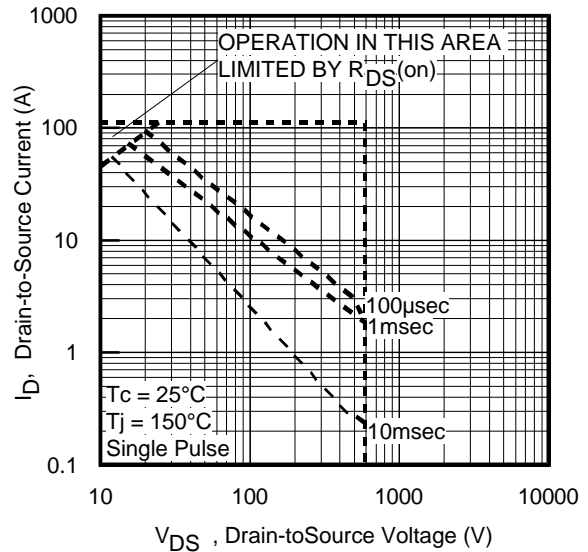Vs. Temperature

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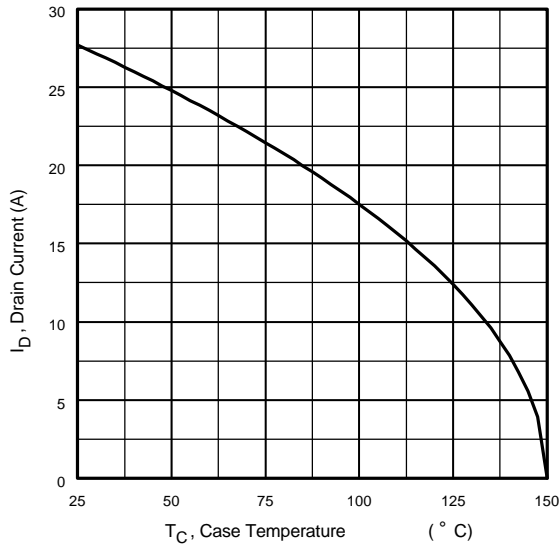Drain-to-Source Voltage

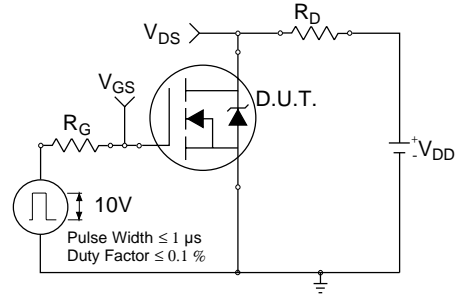

Fig 6. Typical Gate Charge Vs.
Gate-to-Source Voltage

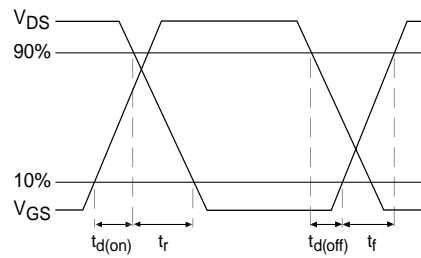

Fig 7. Typical Source-Drain Diode
Forward Voltage

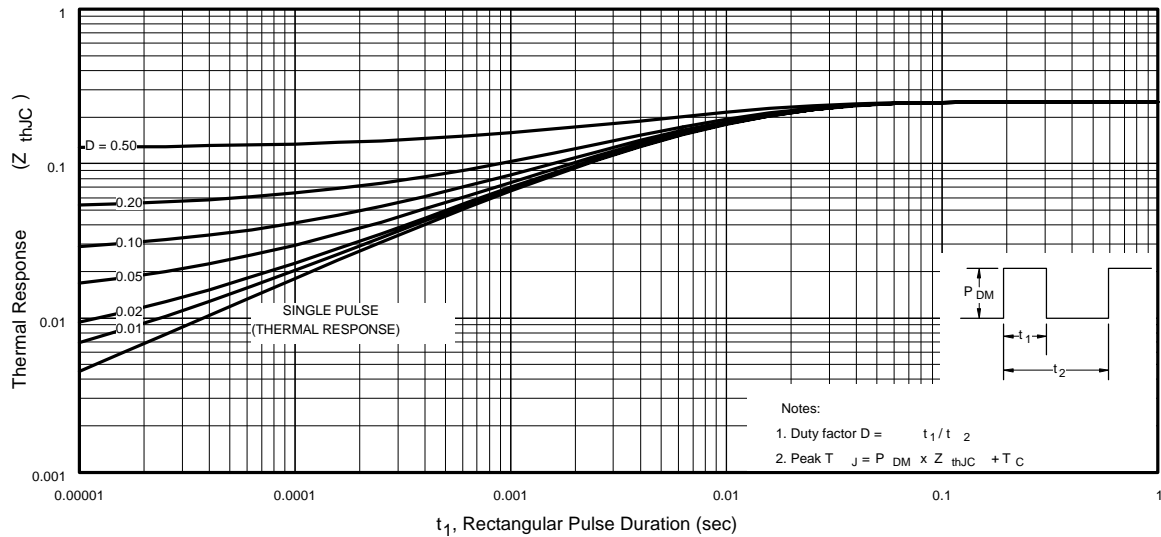**Fig 8.** Maximum Safe Operating Area

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Fig 9. Maximum Drain Current Vs. Case Temperature

The x-axis is labeled T_C, Case Temperature ($^\circ$C) and the y-axis is labeled I_D, Drain Current (A).

Fig 10a. Switching Time Test Circuit

Pulse Width ≤ 1 μs
Duty Factor ≤ 0.1 %

Fig 10b. Switching Time Waveforms

$t_{d(on)}$ t_r $t_{d(off)}$ t_f

The plot y-axis is labeled Thermal Response (Z_{thJC}) and x-axis is t_1, Rectangular Pulse Duration (sec). Curves labeled D = 0.50, 0.20, 0.10, 0.05, 0.02, 0.01 and SINGLE PULSE (THERMAL RESPONSE).
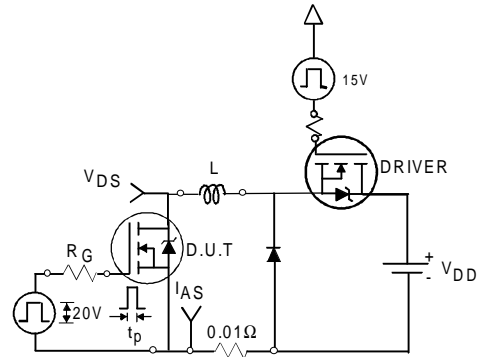
Notes:
1. Duty factor D = t_1 / t_2
2. Peak $T_J = P_{DM} \times Z_{thJC} + T_C$

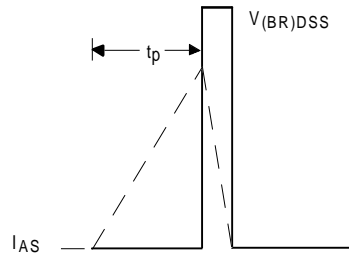**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Case
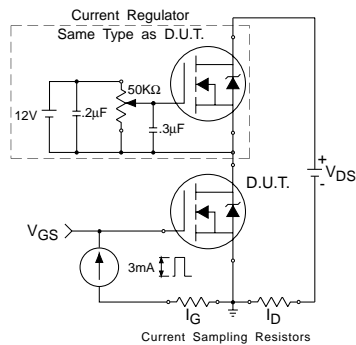
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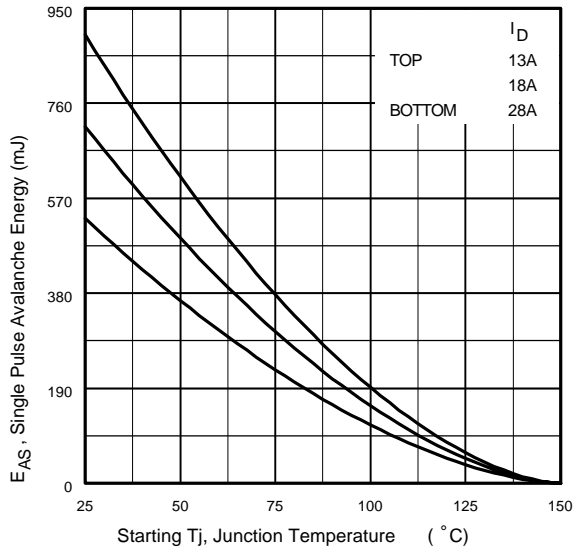
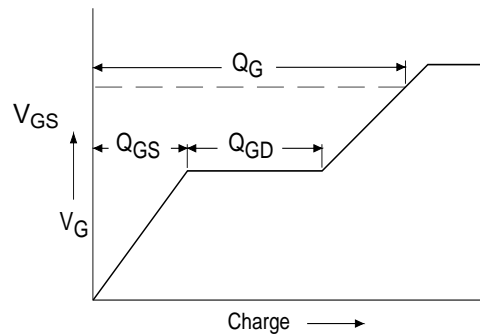**Fig 12a.** Maximum Avalanche Energy Vs. Drain Current

Fig 12c. Unclamped Inductive Test Circuit
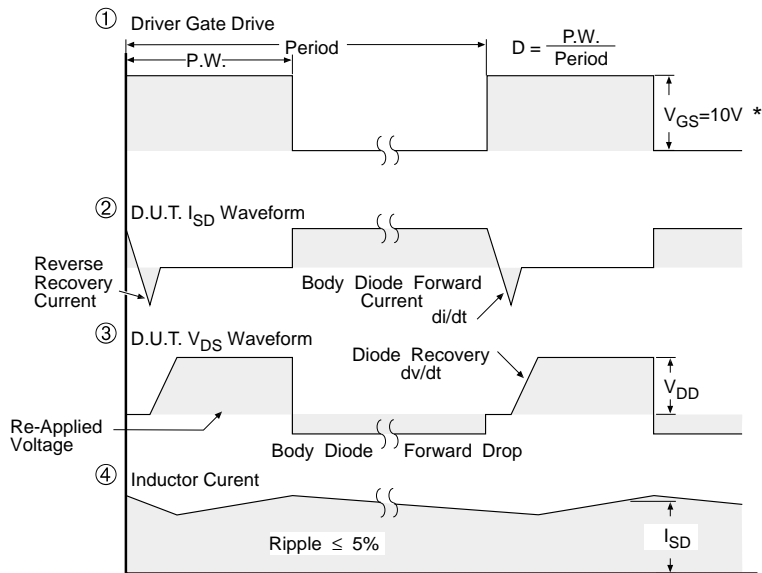

Fig 12d. Unclamped Inductive Waveforms

Fig 13a. Gate Charge Test Circuit

Fig 13b. Basic Gate Charge Waveform

Peak Diode Recovery dv/dt Test Circuit

D.U.T

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_{DD}

① Driver Gate Drive

$D = \dfrac{P.W.}{Period}$

P.W.

Period

$V_{GS} = 10V$ *

② D.U.T. I_{SD} Waveform

Reverse Recovery Current

Body Diode Forward Current

di/dt

③ D.U.T. V_{DS} Waveform

Diode Recovery dv/dt

V_{DD}

Re-Applied Voltage

Body Diode Forward Drop

④ Inductor Curent

Ripple ≤ 5%

I_{SD}

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

Fig 14. For N-Channel HEXFET® Power MOSFETs

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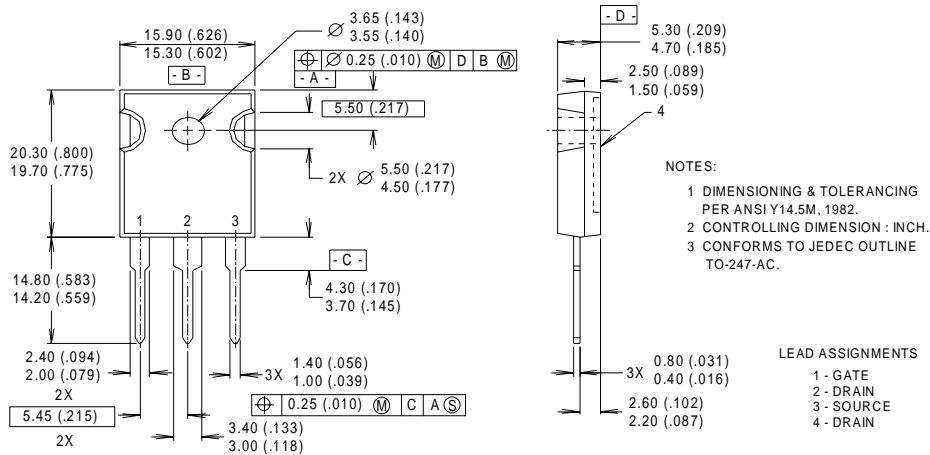## TO-247AC Package Outline
Dimensions are shown in millimeters (inches)

15.90 (.626)
15.30 (.602)
- B -

20.30 (.800)
19.70 (.775)

3.65 (.143)
3.55 (.140)

⊕ ⌀ 0.25 (.010) Ⓜ D B Ⓜ
- A -

5.50 (.217)

2X ⌀ 5.50 (.217)
4.50 (.177)

- C -

14.80 (.583)
14.20 (.559)

4.30 (.170)
3.70 (.145)

2.40 (.094)
2.00 (.079)
2X

5.45 (.215)
2X

3X 1.40 (.056)
1.00 (.039)

⊕ 0.25 (.010) Ⓜ C A Ⓢ

3.40 (.133)
3.00 (.118)

- D -
5.30 (.209)
4.70 (.185)

2.50 (.089)
1.50 (.059)

4

3X 0.80 (.031)
0.40 (.016)

2.60 (.102)
2.20 (.087)

NOTES:

1 DIMENSIONING & TOLERANCING
   PER ANSI Y14.5M, 1982.
2 CONTROLLING DIMENSION : INCH.
3 CONFORMS TO JEDEC OUTLINE
   TO-247-AC.

LEAD ASSIGNMENTS
   1 - GATE
   2 - DRAIN
   3 - SOURCE
   4 - DRAIN

TO-247AC Part Marking Information

EXAMPLE : THIS IS AN IRFPE30
           WITH ASSEMBLY
           LOT CODE 3A1Q

INTERNATIONAL
RECTIFIER
LOGO

PART NUMBER

IRFPE30
IGR
3A1Q 9302

ASSEMBLY
LOT CODE

DATE CODE
(YYWW)
YY = YEAR
WW WEEK
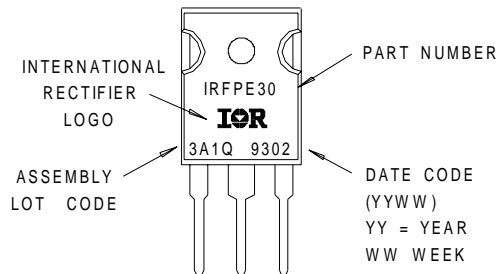
Data and specifications subject to change without notice.
This product has been designed and qualified for the Industrial market.
Qualification Standards can be found on IR's Web site.

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