

HEXFET® Power MOSFET

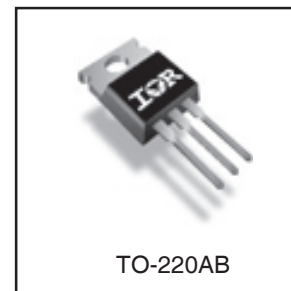
Applications

- Synchronous Rectification
- Active ORing
- Lead-Free

Benefits

- Ultra Low On-Resistance
- Low Gate Impedance to Reduce Switching Losses
- Fully Avalanche Rated

V_{DSS}	$R_{DS(on) \text{ max}}$	I_D
30V	2.8m Ω	210A ^⑥



Absolute Maximum Ratings

	Parameter	Max.	Units
I_D @ $T_C = 25^\circ\text{C}$	Continuous Drain Current, V_{GS} @ 10V	210 ^⑥	A
I_D @ $T_C = 100^\circ\text{C}$	Continuous Drain Current, V_{GS} @ 10V	100 ^⑥	
I_{DM}	Pulsed Drain Current ^①	1000	
P_D @ $T_C = 25^\circ\text{C}$	Power Dissipation	230	W
P_D @ $T_A = 25^\circ\text{C}$	Power Dissipation	3.8	
	Linear Derating Factor	1.5	W/ $^\circ\text{C}$
V_{GS}	Gate-to-Source Voltage	± 20	V
dv/dt	Peak Diode Recovery dv/dt ^③	5.0	V/ns
T_J, T_{STG}	Junction and Storage Temperature Range	-55 to + 175	$^\circ\text{C}$

Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	0.65	$^\circ\text{C/W}$
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface	0.5	—	
$R_{\theta JA}$	Junction-to-Ambient	—	62	

Notes ^① through ^⑥ are on page 8

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Static @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	30	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.028	—	V/ $^\circ\text{C}$	Reference to 25°C , $I_D = 1\text{mA}$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	2.3	2.8	$m\Omega$	$V_{GS} = 10V, I_D = 76A$ ④
		—	2.8	3.9		$V_{GS} = 7.0V, I_D = 76A$ ④
$V_{GS(th)}$	Gate Threshold Voltage	2.0	—	4.0	V	$V_{DS} = V_{GS}, I_D = 250\mu A$
I_{DSS}	Drain-to-Source Leakage Current	—	—	20	μA	$V_{DS} = 24V, V_{GS} = 0V$
		—	—	250		$V_{DS} = 24V, V_{GS} = 0V, T_J = 150^\circ\text{C}$
I_{GSS}	Gate-to-Source Forward Leakage	—	—	200	nA	$V_{GS} = 20V$
	Gate-to-Source Reverse Leakage	—	—	-200		$V_{GS} = -20V$

Dynamic @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
g_{fs}	Forward Transconductance	150	—	—	S	$V_{DS} = 24V, I_D = 76A$
Q_g	Total Gate Charge	—	209	—	nC	$I_D = 76A$
Q_{gs}	Gate-to-Source Charge	—	62	—		$V_{DS} = 24V$
Q_{gd}	Gate-to-Drain ("Miller") Charge	—	42	—		$V_{GS} = 10V$, ④
$t_{d(on)}$	Turn-On Delay Time	—	18	—	ns	$V_{DD} = 15V, V_{GS} = 10V$
t_r	Rise Time	—	123	—		$I_D = 76A$
$t_{d(off)}$	Turn-Off Delay Time	—	53	—		$R_G = 1.8\Omega$
t_f	Fall Time	—	24	—		$V_{GS} = 10V$ ④
C_{iss}	Input Capacitance	—	8250	—	pF	$V_{GS} = 0V$
C_{oss}	Output Capacitance	—	3000	—		$V_{DS} = 25V$
C_{rss}	Reverse Transfer Capacitance	—	290	—		$f = 1.0\text{MHz}$
C_{oss}	Output Capacitance	—	10360	—		$V_{GS} = 0V, V_{DS} = 1.0V, f = 1.0\text{MHz}$
C_{oss}	Output Capacitance	—	3060	—		$V_{GS} = 0V, V_{DS} = 24V, f = 1.0\text{MHz}$
$C_{oss \text{ eff.}}$	Effective Output Capacitance	—	2590	—		$V_{GS} = 0V, V_{DS} = 0V \text{ to } 24V$ ⑤

Avalanche Characteristics

	Parameter	Typ.	Max.	Units
E_{AS}	Single Pulse Avalanche Energy②	—	1700	mJ
I_{AR}	Avalanche Current③	—	76	A
E_{AR}	Repetitive Avalanche Energy③	—	23	mJ

Diode Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	210⑥	A	MOSFET symbol showing the integral reverse p-n junction diode.
I_{SM}	Pulsed Source Current (Body Diode) ①	—	—	1000		
V_{SD}	Diode Forward Voltage	—	0.8	1.3	V	$T_J = 25^\circ\text{C}, I_S = 76A, V_{GS} = 0V$ ④
t_{rr}	Reverse Recovery Time	—	80	120	ns	$T_J = 25^\circ\text{C}, I_F = 76A, V_{DS} = 16V$
Q_{rr}	Reverse Recovery Charge	—	185	275	nC	$di/dt = 100A/\mu s$ ④

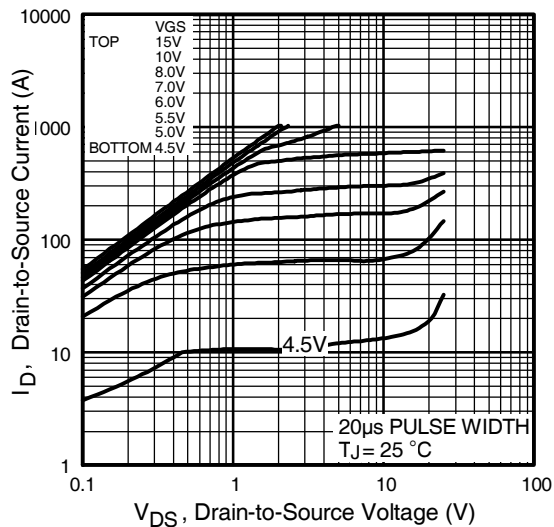


Fig 1. Typical Output Characteristics

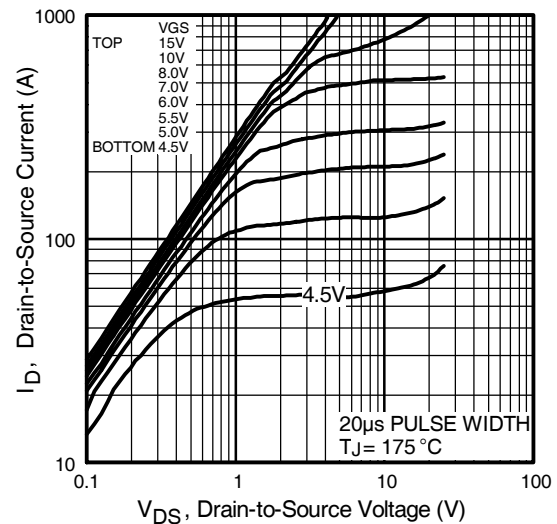


Fig 2. Typical Output Characteristics

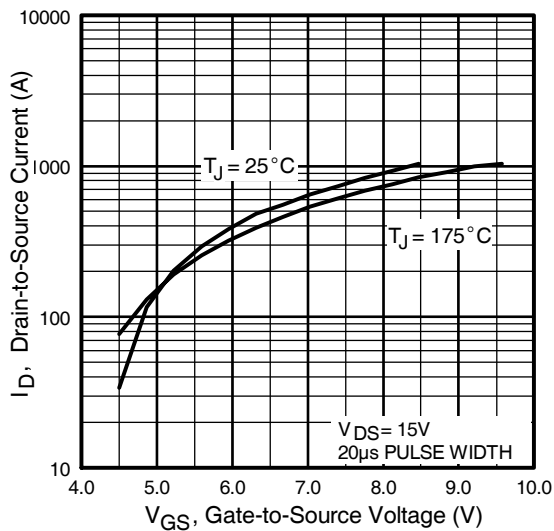


Fig 3. Typical Transfer Characteristics

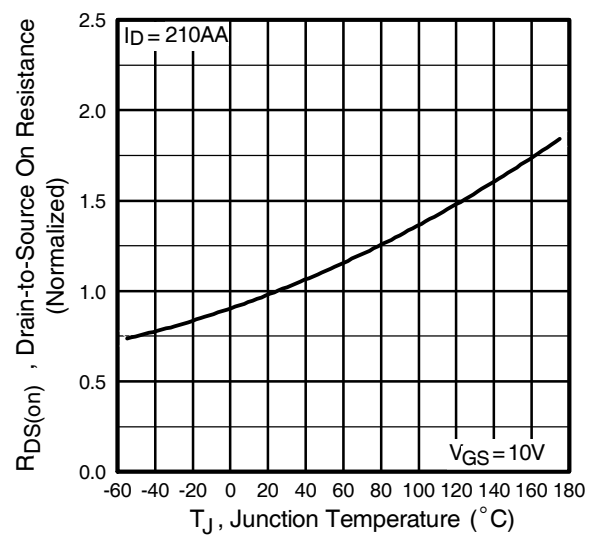


Fig 4. Normalized On-Resistance Vs. Temperature

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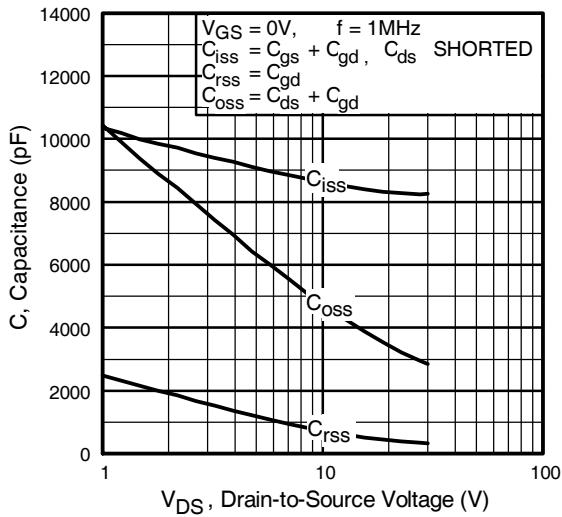


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

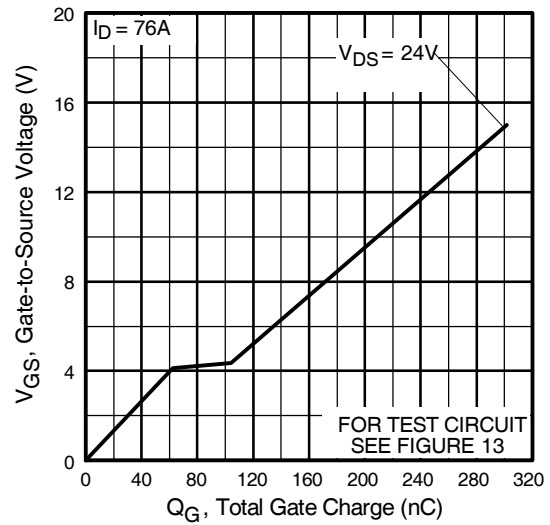


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

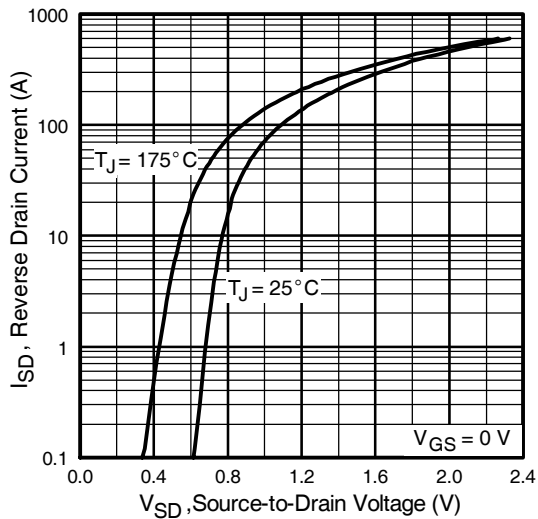


Fig 7. Typical Source-Drain Diode Forward Voltage

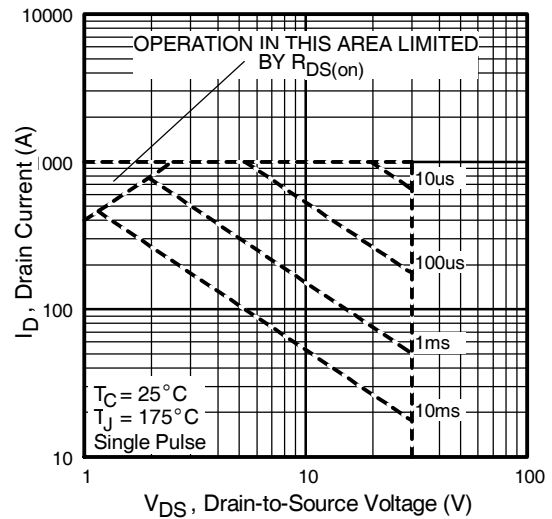


Fig 8. Maximum Safe Operating Area

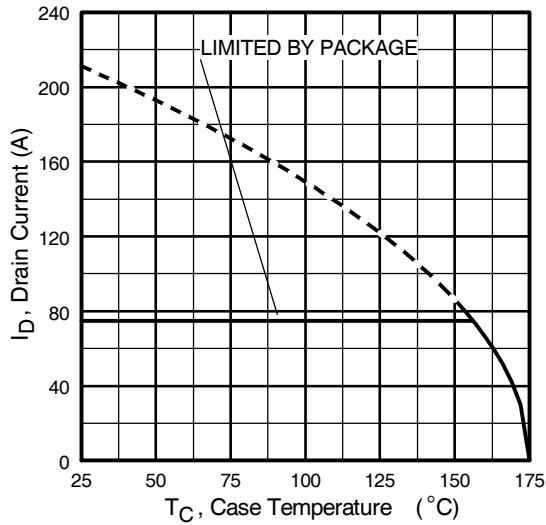


Fig 9. Maximum Drain Current Vs. Case Temperature

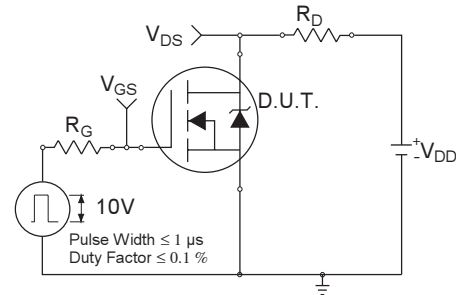


Fig 10a. Switching Time Test Circuit

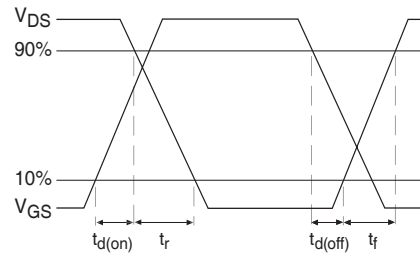


Fig 10b. Switching Time Waveforms

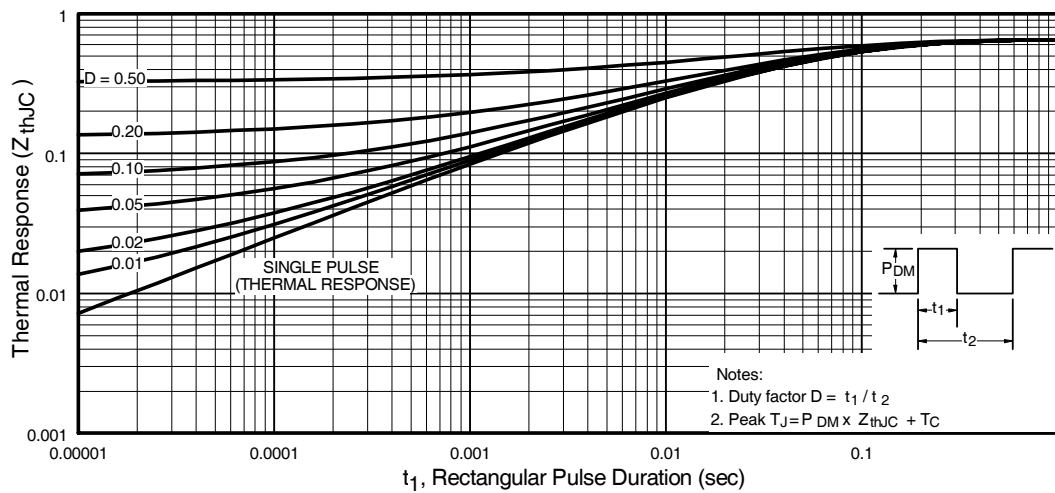


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

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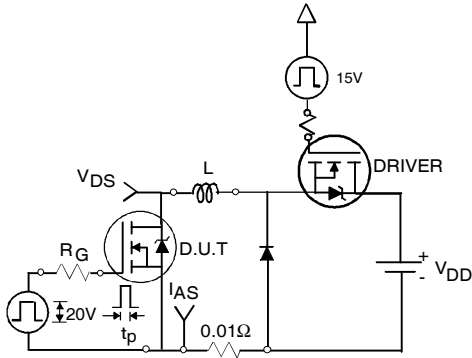


Fig 12a. Unclamped Inductive Test Circuit

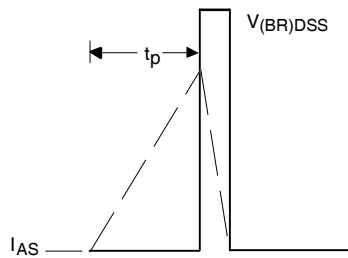


Fig 12b. Unclamped Inductive Waveforms

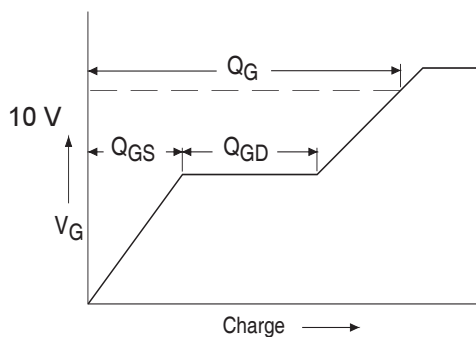


Fig 13a. Basic Gate Charge Waveform

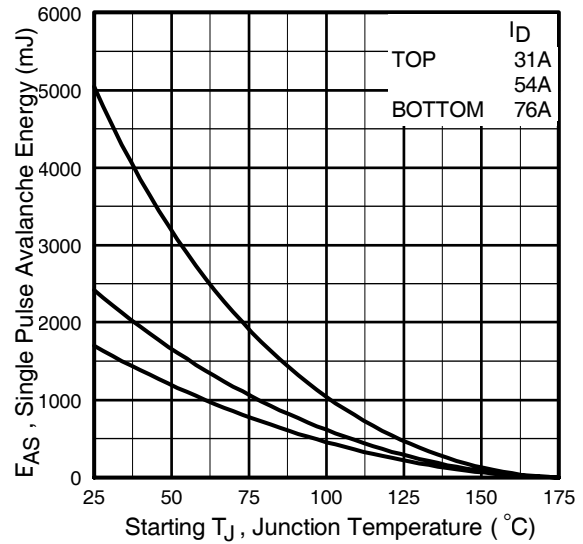


Fig 12c. Maximum Avalanche Energy
Vs. Drain Current

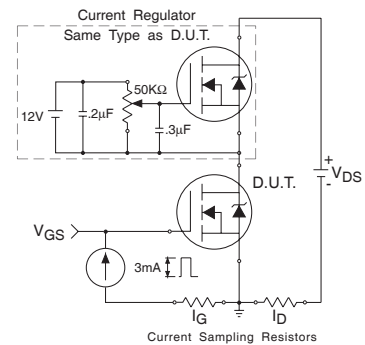
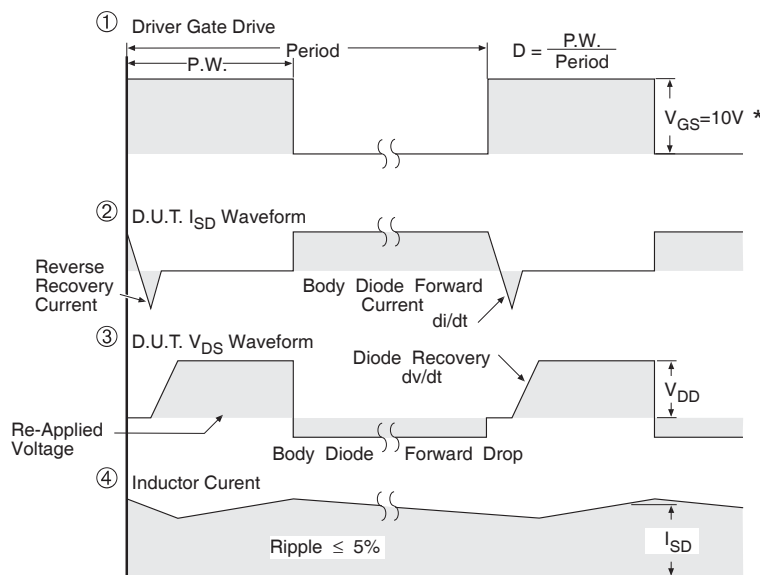
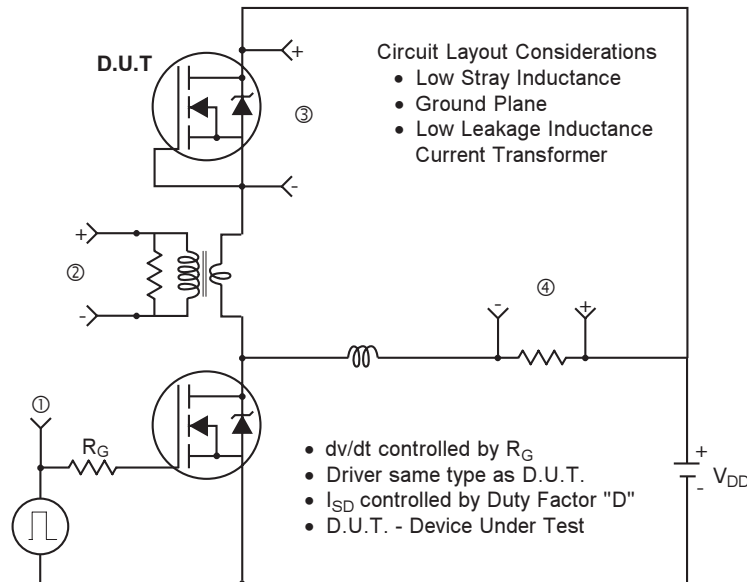


Fig 13b. Gate Charge Test Circuit

Peak Diode Recovery dv/dt Test Circuit



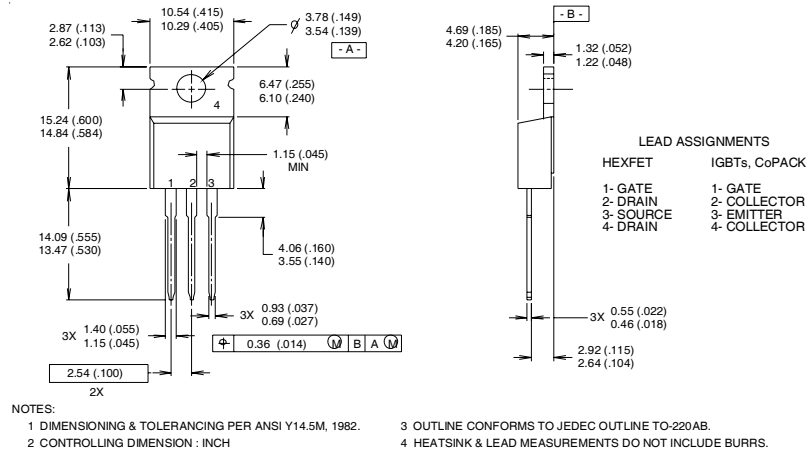
* $V_{GS} = 5V$ for Logic Level Devices

Fig 14. For N-Channel HEXFET® Power MOSFET

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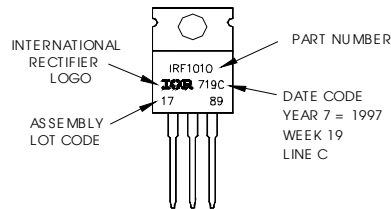
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TO-220AB Package Outline



TO-220AB Part Marking Information

EXAMPLE: THIS IS AN IRF1010
 LOT CODE 1789
 ASSEMBLED ON WW 19, 1997
 IN THE ASSEMBLY LINE "C"
Note: "P" in assembly line
 position indicates "Lead-Free"



Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Starting $T_J = 25^\circ\text{C}$, $L = 0.6\text{mH}$
 $R_G = 25\Omega$, $I_{AS} = 76\text{A}$.
- ③ $I_{SD} \leq 76\text{A}$, $di/dt \leq 100\text{A}/\mu\text{s}$, $V_{DD} \leq V_{(BR)DSS}$,
 $T_J \leq 175^\circ\text{C}$
- ④ Pulse width $\leq 300\mu\text{s}$; duty cycle $\leq 2\%$.
- 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}
- ⑥ Calculated continuous current based on maximum allowable junction temperature. Package limitation current is 75A

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 Rectifier

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Visit us at www.irf.com for sales contact information.02/04

Note: For the most current drawings please refer to the IR website at:
<http://www.irf.com/package/>