

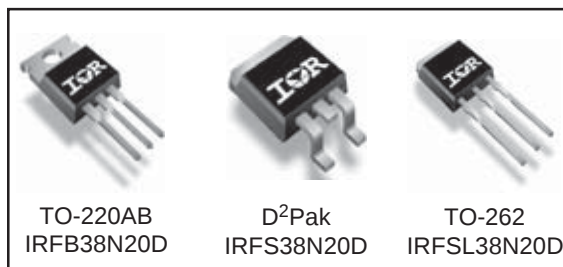
Applications

- High frequency DC-DC converters

V_{DSS}	$R_{DS(on)}$ max	I_D
200V	0.054 Ω	44A

Benefits

- Low Gate-to-Drain Charge to Reduce Switching Losses
- Fully Characterized Capacitance Including Effective C_{OSS} to Simplify Design, (See App. Note AN1001)
- Fully Characterized Avalanche Voltage and Current



Absolute Maximum Ratings

	Parameter	Max.	Units
I_D @ $T_C = 25^\circ\text{C}$	Continuous Drain Current, V_{GS} @ 10V	44	A
I_D @ $T_C = 100^\circ\text{C}$	Continuous Drain Current, V_{GS} @ 10V	32	
I_{DM}	Pulsed Drain Current ①	180	
P_D @ $T_A = 25^\circ\text{C}$	Power Dissipation ②	3.8	W
P_D @ $T_C = 25^\circ\text{C}$	Power Dissipation	320	
	Linear Derating Factor	2.1	W/ $^\circ\text{C}$
V_{GS}	Gate-to-Source Voltage	± 30	V
dv/dt	Peak Diode Recovery dv/dt ③	9.5	V/ns
T_J	Operating Junction and	-55 to + 175	$^\circ\text{C}$
T_{STG}	Storage Temperature Range		
	Soldering Temperature, for 10 seconds	300 (1.6mm from case)	
	Mounting torque, 6-32 or M3 screw④	10 lbf•in (1.1N•m)	

Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	0.47	$^\circ\text{C}/\text{W}$
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface ⑤	0.50	—	
$R_{\theta JA}$	Junction-to-Ambient⑥	—	62	
$R_{\theta JA}$	Junction-to-Ambient⑦	—	40	

Notes ① through ⑦ are on page 11

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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	200	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.22	—	V/ $^\circ\text{C}$	Reference to 25°C , $I_D = 1mA$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	—	0.054	Ω	$V_{GS} = 10V, I_D = 26A$ ④
$V_{GS(th)}$	Gate Threshold Voltage	3.0	—	5.0	V	$V_{DS} = V_{GS}, I_D = 250\mu A$
I_{DSS}	Drain-to-Source Leakage Current	—	—	25	μA	$V_{DS} = 200V, V_{GS} = 0V$
		—	—	250		$V_{DS} = 160V, V_{GS} = 0V, T_J = 150^\circ\text{C}$
I_{GSS}	Gate-to-Source Forward Leakage	—	—	100	nA	$V_{GS} = 30V$
	Gate-to-Source Reverse Leakage	—	—	-100		$V_{GS} = -30V$

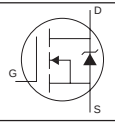
Dynamic @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
g_{fs}	Forward Transconductance	17	—	—	S	$V_{DS} = 50V, I_D = 26A$
Q_g	Total Gate Charge	—	60	91	nC	$I_D = 26A$
Q_{gs}	Gate-to-Source Charge	—	17	25		$V_{DS} = 100V$
Q_{gd}	Gate-to-Drain ("Miller") Charge	—	28	42		$V_{GS} = 10V$, ④
$t_{d(on)}$	Turn-On Delay Time	—	16	—	ns	$V_{DD} = 100V$
t_r	Rise Time	—	95	—		$I_D = 26A$
$t_{d(off)}$	Turn-Off Delay Time	—	29	—		$R_G = 2.5\Omega$
t_f	Fall Time	—	47	—		$V_{GS} = 10V$ ④
C_{iss}	Input Capacitance	—	2900	—	pF	$V_{GS} = 0V$
C_{oss}	Output Capacitance	—	450	—		$V_{DS} = 25V$
C_{rss}	Reverse Transfer Capacitance	—	73	—		$f = 1.0MHz$
C_{oss}	Output Capacitance	—	3550	—		$V_{GS} = 0V, V_{DS} = 1.0V, f = 1.0MHz$
C_{oss}	Output Capacitance	—	180	—		$V_{GS} = 0V, V_{DS} = 160V, f = 1.0MHz$
$C_{oss \text{ eff.}}$	Effective Output Capacitance	—	380	—		$V_{GS} = 0V, V_{DS} = 0V \text{ to } 160V$ ⑤

Avalanche Characteristics

	Parameter	Typ.	Max.	Units
E_{AS}	Single Pulse Avalanche Energy②⑥	—	460	mJ
I_{AR}	Avalanche Current①	—	26	A
E_{AR}	Repetitive Avalanche Energy①	—	32	mJ

Diode Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	44	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I_{SM}	Pulsed Source Current (Body Diode) ①⑥	—	—	180		
V_{SD}	Diode Forward Voltage	—	—	1.5	V	$T_J = 25^\circ\text{C}, I_S = 26A, V_{GS} = 0V$ ④
t_{rr}	Reverse Recovery Time	—	160	240	nS	$T_J = 25^\circ\text{C}, I_F = 26A$
Q_{rr}	Reverse Recovery Charge	—	1.3	2.0	μC	$di/dt = 100A/\mu s$ ④
t_{on}	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by $L_S + L_D$)				

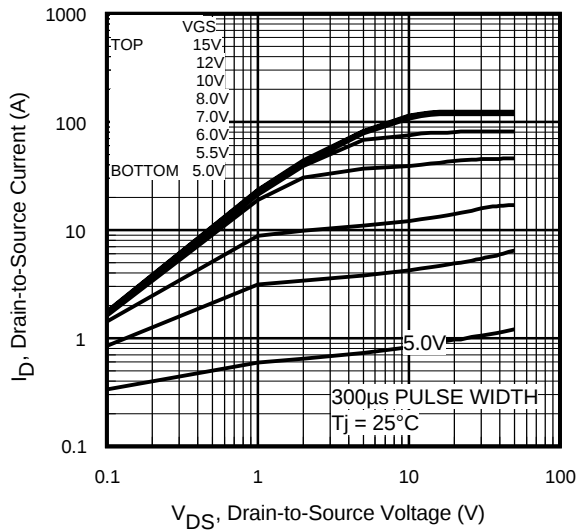


Fig 1. Typical Output Characteristics

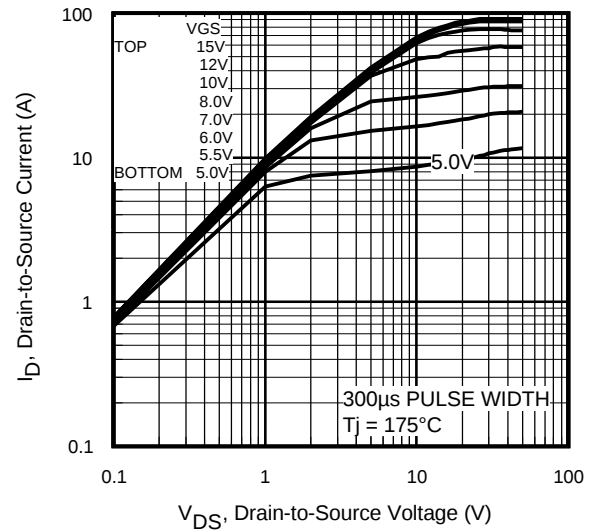


Fig 2. Typical Output Characteristics

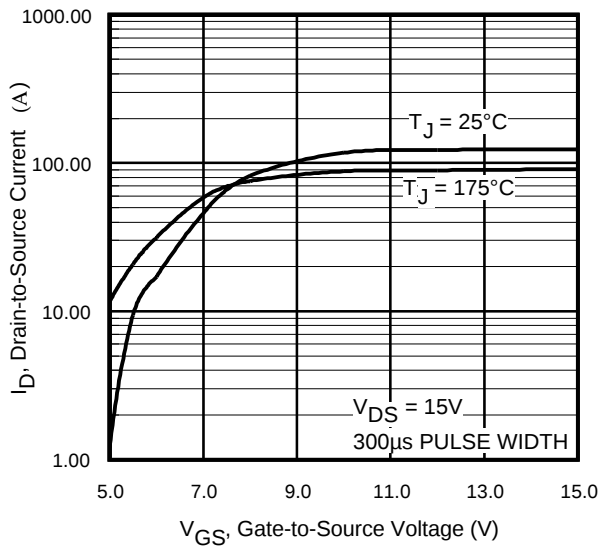


Fig 3. Typical Transfer Characteristics

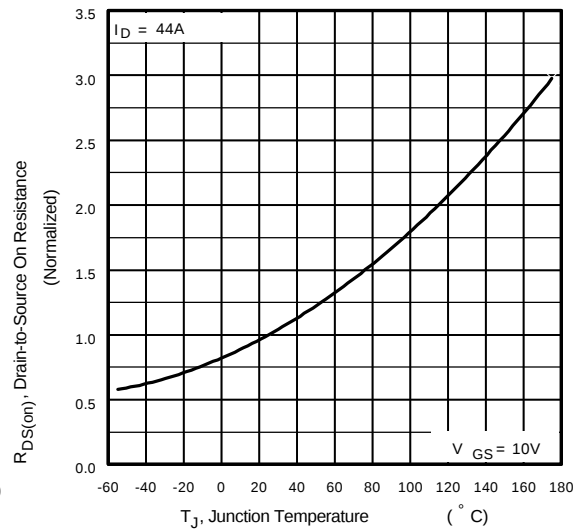
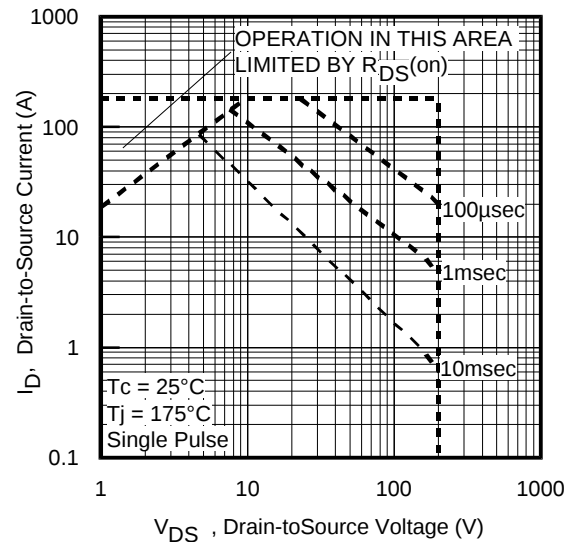
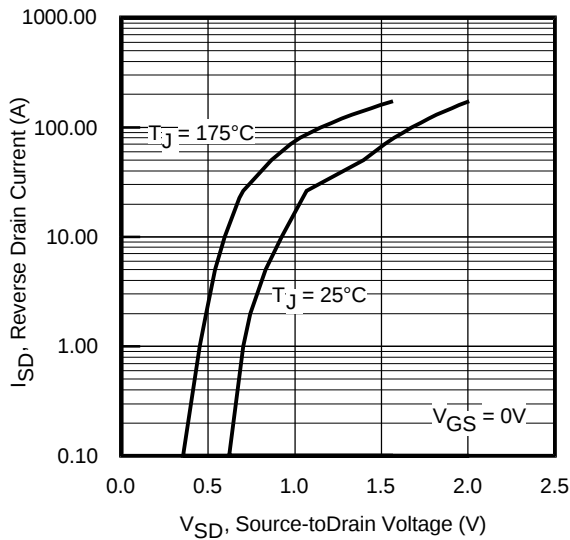
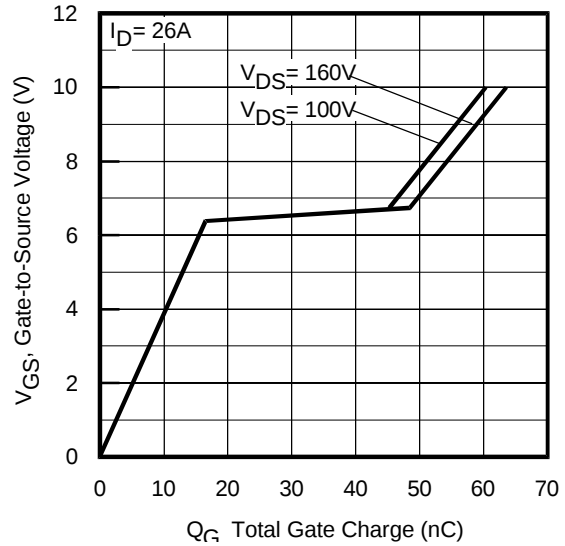
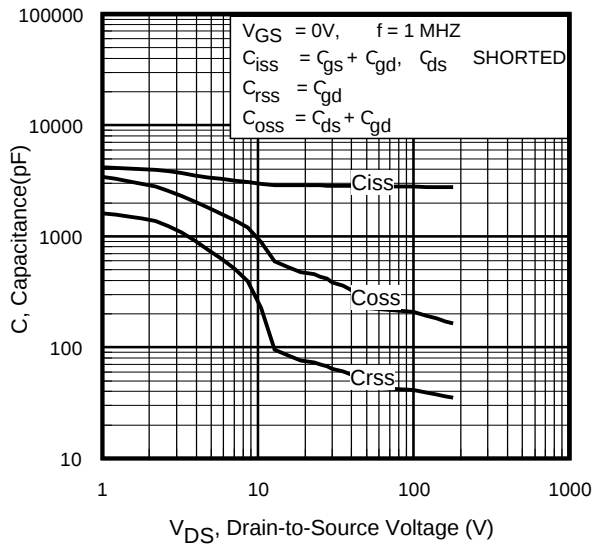


Fig 4. Normalized On-Resistance Vs. Temperature



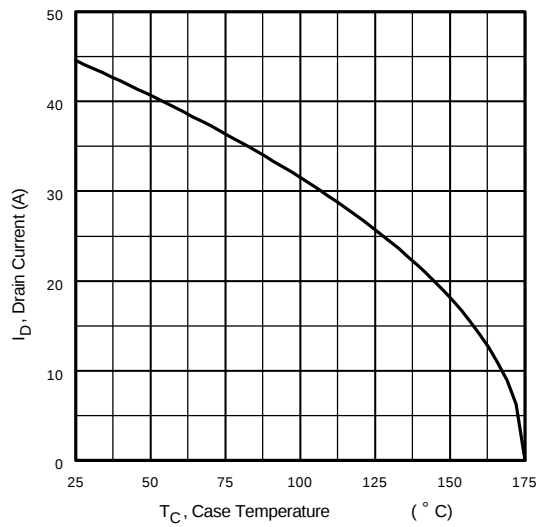


Fig 9. Maximum Drain Current Vs. Case Temperature

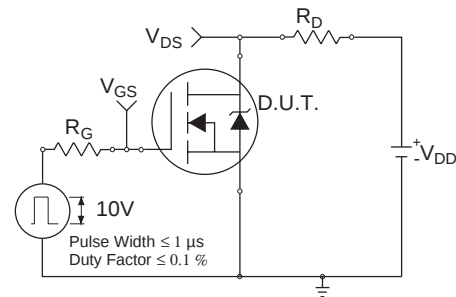


Fig 10a. Switching Time Test Circuit

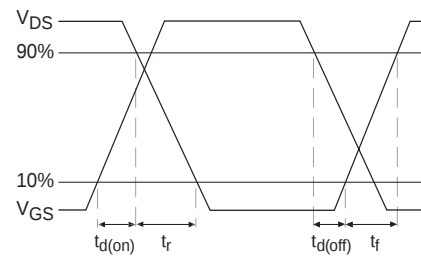


Fig 10b. Switching Time Waveforms

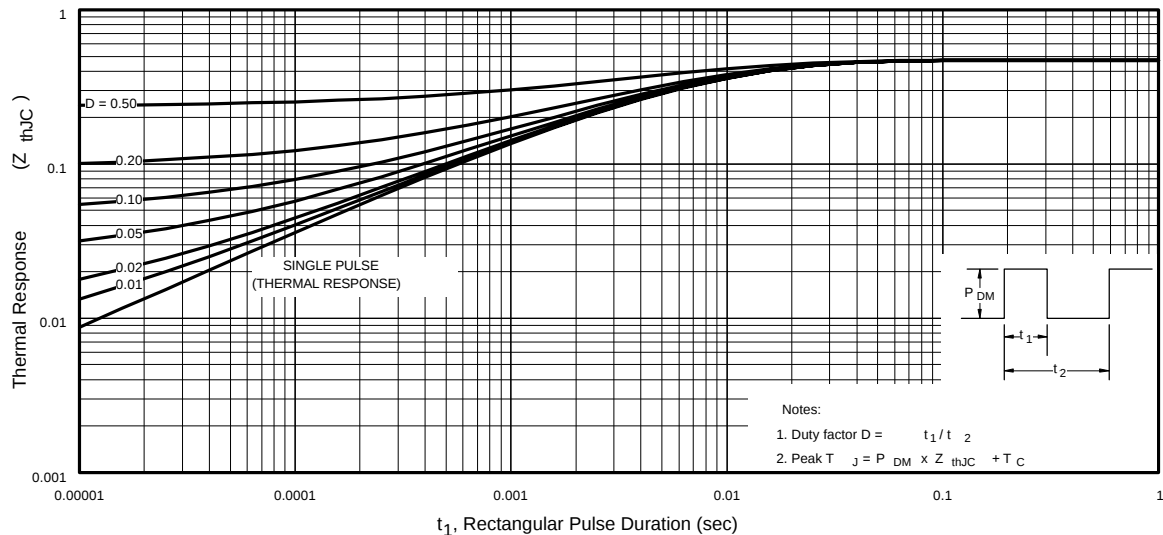


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

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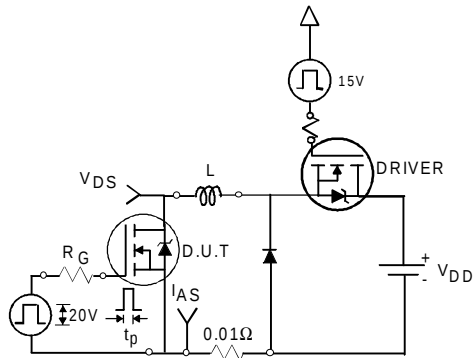


Fig 12a. Unclamped Inductive Test Circuit



Fig 12b. Unclamped Inductive Waveforms

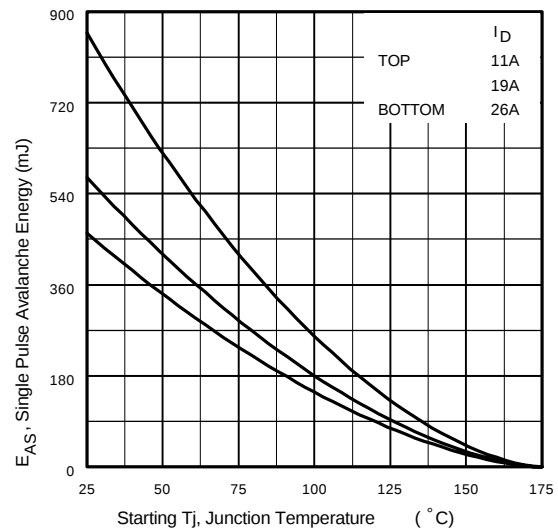


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

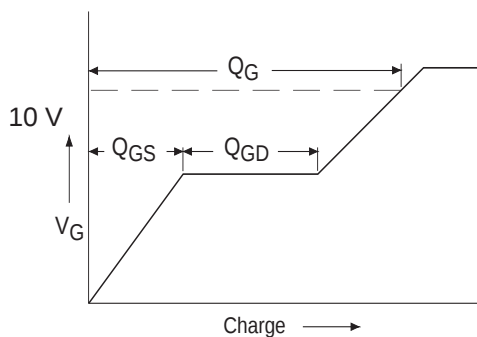


Fig 13a. Basic Gate Charge Waveform

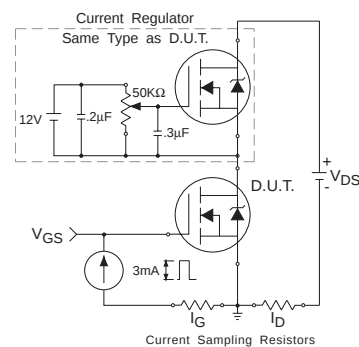
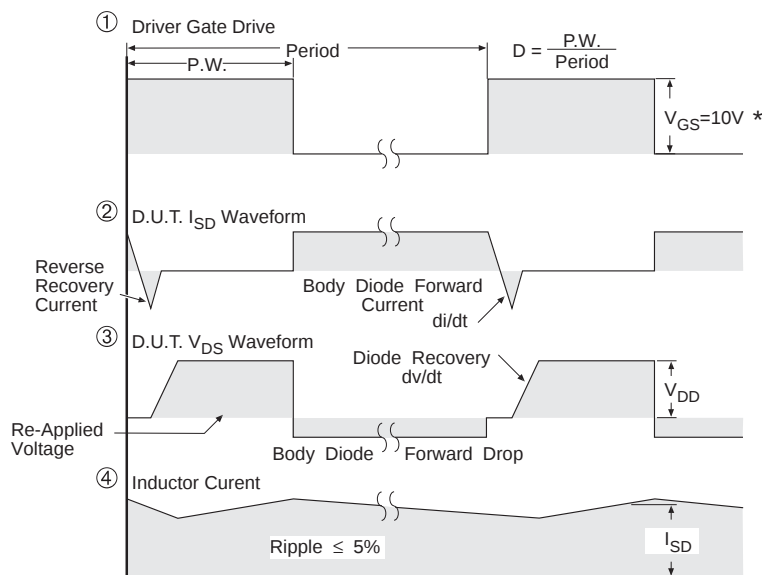
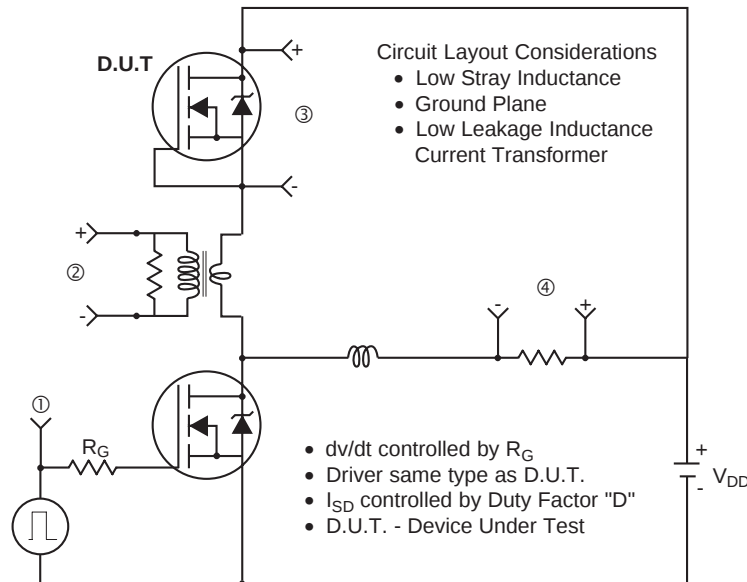


Fig 13b. Gate Charge Test Circuit

Peak Diode Recovery dv/dt Test Circuit



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

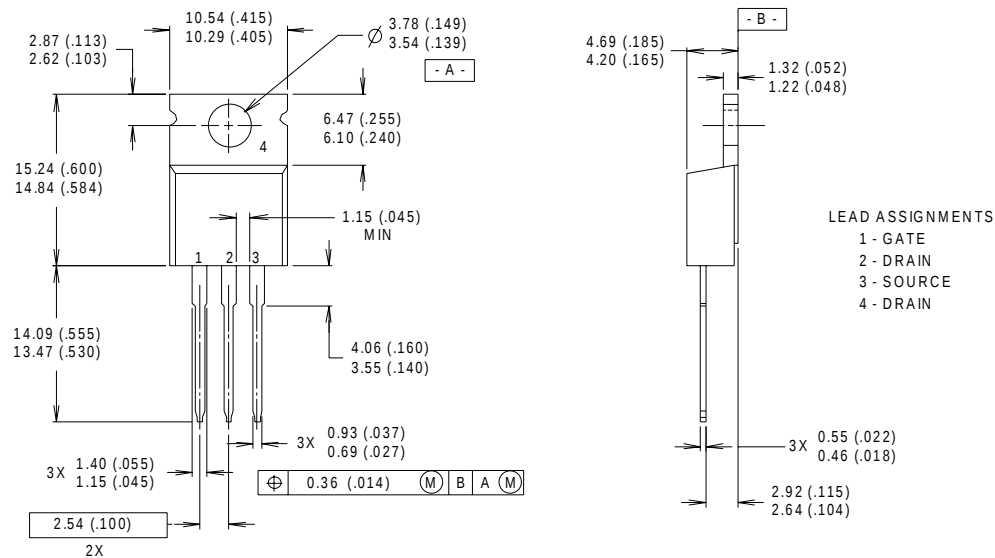
Fig 14. For N-Channel HEXFET® Power MOSFETs

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TO-220AB Package Outline

Dimensions are shown in millimeters (inches)



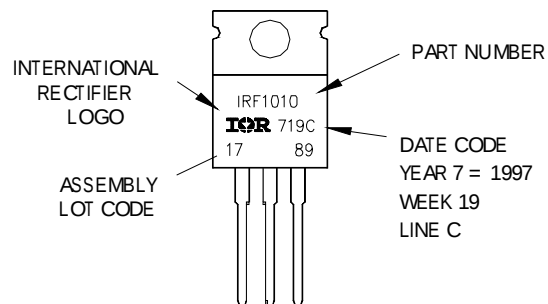
NOTES:

- 1 DIMENSIONING & TOLERANCING PER ANSI Y14.5M, 1982.
- 2 CONTROLLING DIMENSION : INCH

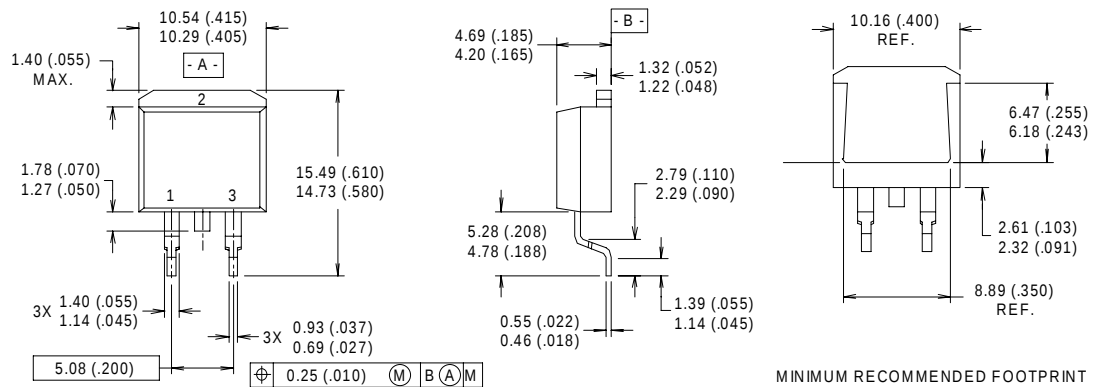
- 3 OUTLINE CONFORMS TO JEDEC OUTLINE TO-220AB.
- 4 HEATSINK & LEAD MEASUREMENTS DO NOT INCLUDE BURRS.

TO-220AB Part Marking Information

EXAMPLE: THIS IS AN IRF1010
LOT CODE 1789
ASSEMBLED ON WW19, 1997
IN THE ASSEMBLY LINE "C"



D²Pak Package Outline



NOTES:

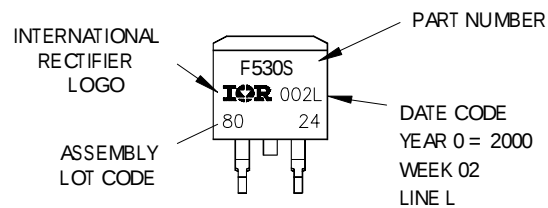
- 1 DIMENSIONS AFTER SOLDER DIP.
- 2 DIMENSIONING & TOLERANCING PER ANSI Y14.5M, 1982.
- 3 CONTROLLING DIMENSION : INCH.
- 4 HEATSINK & LEAD DIMENSIONS DO NOT INCLUDE BURRS.

LEAD ASSIGNMENTS

- 1 - GATE
- 2 - DRAIN
- 3 - SOURCE

D²Pak Part Marking Information

EXAMPLE: THIS IS AN IRF530S WITH
LOT CODE 8024
ASSEMBLED ON WW02, 2000
IN THE ASSEMBLY LINE "L"



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Technical drawing of a 3-flute end mill. The drawing shows the tool with dimensions in inches and millimeters in brackets. Key dimensions include:

- Overall length: 10.54 [.415]
- Length to start of flutes: 10.29 [.405]
- Flute length: 1.15 [.045] MIN.
- Flute width: 1.40 [.055] (3X) and 1.15 [.045] (2X)
- Flute depth: 4.06 [.160] and 3.55 [.140]
- Flute tip radius: 0.93 [.037] and 0.69 [.027] (3X)
- Flute tip diameter: 2.54 [.100]
- Flute tip diameter tolerance: ± 0.36 [.014]
- Flute tip diameter material: M B A M

Technical drawing of a shaft with the following dimensions and tolerances:

- Top diameter: 4.69 [.185]
- Second diameter from top: 4.20 [.165]
- Third diameter from top: 1.32 [.052]
- Fourth diameter from top: 1.22 [.048]
- Bottom diameter: 2.92 [.115]
- Bottom diameter: 2.64 [.104]
- Length of the bottom section: 3X
- Length of the bottom section: 0.55 [.022]
- Length of the bottom section: 0.46 [.018]

1. DIMENSIONING & TOLERANCING PER ANSI Y14.5M-1982
2. CONTROLLING DIMENSION: INCH.
3. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
4. HEATSINK & LEAD DIMENSIONS DO NOT INCLUDE BURRS.

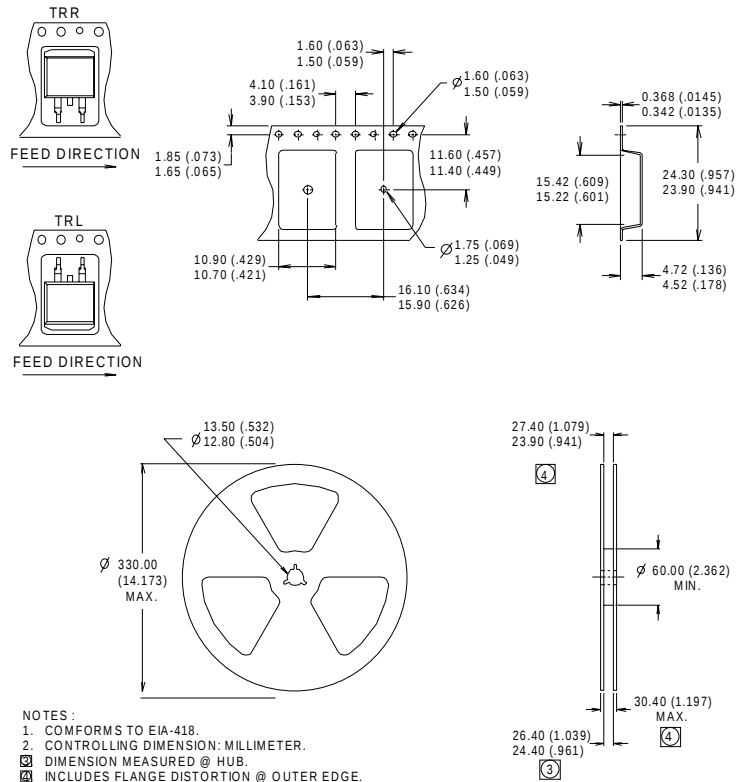
Diagram illustrating the marking on a 719C diode package:

- PART NUMBER:** IRL3103L
- INTERNATIONAL RECTIFIER LOGO:** IR
- DATE CODE:** 719C
- ASSEMBLY LOT CODE:** 17 89

Additional information provided in the diagram:

- YEAR 7 = 1997
- WEEK 19
- LINE C

D²Pak Tape & Reel Information



Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Starting $T_J = 25^\circ\text{C}$, $L = 1.3\text{mH}$
 $R_G = 25\Omega$, $I_{AS} = 26\text{A}$.
- ③ $I_{SD} \leq 26\text{A}$, $di/dt \leq 390\text{A}/\mu\text{s}$, $V_{DD} \leq V_{(BR)DSS}$,
 $T_J \leq 175^\circ\text{C}$.
- 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 This is only applied to TO-220AB package.
- ⑦ This is applied to D²Pak, when mounted on 1" square PCB (FR-4 or G-10 Material). For recommended footprint and soldering techniques refer to application note #AN-994.

TO-220 package is not recommended for Surface Mount Application.

Data and specifications subject to change without notice.
This product has been designed and qualified for the Automotive [Q101] (IRFB38N20D),
& Industrial (IRFS/SL38N20D) market.
Qualification Standards can be found on IR's Web site.

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