

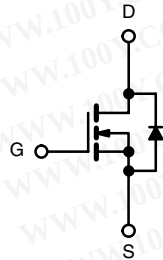
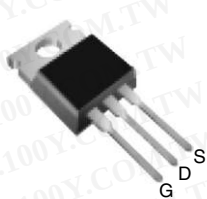
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Power MOSFET

PRODUCT SUMMARY

V_{DS} (V)	500	
$R_{DS(on)}$ (Ω)	$V_{GS} = 10\text{ V}$	0.21
Q_g (Max.) (nC)	110	
Q_{gs} (nC)	33	
Q_{gd} (nC)	54	
Configuration	Single	

TO-220



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
- Low $R_{DS(on)}$
- Compliant to RoHS Directive 2002/95/EC



RoHS*
COMPLIANT

APPLICATIONS

- Switch Mode Power Supply (SMPS)
- Uninterruptible Power Supply
- High Speed Power Switching
- Hard Switched and High Frequency Circuits

ORDERING INFORMATION

Package	TO-220
Lead (Pb)-free	IRFB20N50KPbF
	SiHFB20N50K-E3
SnPb	IRFB20N50K
	SiHFB20N50K

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	I_D	$T_C = 25^\circ\text{C}$	A
		$T_C = 100^\circ\text{C}$	
Pulsed Drain Current ^a	I_{DM}	80	
Linear Derating Factor		2.2	W/ $^\circ\text{C}$
Single Pulse Avalanche Energy ^b	E_{AS}	330	mJ
Repetitive Avalanche Current ^a	I_{AR}	20	A
Repetitive Avalanche Energy ^a	E_{AR}	28	mJ
Maximum Power Dissipation	P_D	280	W
Peak Diode Recovery dV/dt ^c	dV/dt	10	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	

Notes

- Repetitive rating; pulse width limited by maximum junction temperature.
- Starting $T_J = 25^\circ\text{C}$, $L = 1.6\text{ mH}$, $R_g = 25\ \Omega$, $I_{AS} = 20\text{ A}$.
- $I_{SD} \leq 20\text{ A}$, $dI/dt \leq 350\text{ A}/\mu\text{s}$, $V_{DD} \leq V_{DS}$, $T_J \leq 150^\circ\text{C}$.
- 1.6 mm from case.

* Pb containing terminations are not RoHS compliant, exemptions may apply

THERMAL RESISTANCE RATINGS

PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient	R_{thJA}	-	58	°C/W
Case-to-Sink, Flat, Greased Surface	R_{thCS}	0.50	-	
Maximum Junction-to-Case (Drain)	R_{thJC}	-	0.45	

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 $25\text{ }^\circ\text{C}$, $I_D = 1\text{ mA}$		-	0.61	-	V/ $^\circ\text{C}$
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$, $I_D = 250\text{ }\mu\text{A}$		3.0	-	5.0	V
Gate-Source Leakage	I_{GSS}	$V_{GS} = \pm 30\text{ V}$		-	-	± 100	nA
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 500\text{ V}$, $V_{GS} = 0\text{ V}$		-	-	50	μA
		$V_{DS} = 400\text{ V}$, $V_{GS} = 0\text{ V}$, $T_J = 125\text{ }^\circ\text{C}$		-	-	250	
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}$	$I_D = 12\text{ A}^b$	-	0.21	0.25	Ω
Forward Transconductance	g_{fs}	$V_{DS} = 50\text{ V}$, $I_D = 12\text{ A}$		11	-	-	S
Dynamic							
Input Capacitance	C_{iss}	$V_{GS} = 0\text{ V}$, $V_{DS} = 25\text{ V}$, $f = 1.0\text{ MHz}$, see fig. 5		-	2870	-	pF
Output Capacitance	C_{oss}			-	320	-	
Reverse Transfer Capacitance	C_{rss}			-	34	-	
Output Capacitance	C_{oss}	$V_{GS} = 0\text{ V}$	$V_{DS} = 1.0\text{ V}$, $f = 1.0\text{ MHz}$	-	3480	-	pF
			$V_{DS} = 400\text{ V}$, $f = 1.0\text{ MHz}$	-	85	-	
Effective Output Capacitance	$C_{oss\text{ eff.}}$		$V_{DS} = 0\text{ V to } 400\text{ V}$	-	160	-	
Total Gate Charge	Q_g	$V_{GS} = 10\text{ V}$	$I_D = 20\text{ A}$, $V_{DS} = 400\text{ V}$ see fig. 6 and 13 ^b	-	-	110	nC
Gate-Source Charge	Q_{gs}			-	-	33	
Gate-Drain Charge	Q_{gd}			-	-	54	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 250\text{ V}$, $I_D = 20\text{ A}$ $R_g = 7.5\text{ }\Omega$, $V_{GS} = 10\text{ V}$, see fig. 10 ^b		-	22	-	ns
Rise Time	t_r			-	74	-	
Turn-Off Delay Time	$t_{d(off)}$			-	45	-	
Fall Time	t_f			-	33	-	
Drain-Source Body Diode Characteristics							
Continuous Source-Drain Diode Current	I_S	MOSFET symbol showing the integral reverse p - n junction diode 	-	-	20	A	
Pulsed Diode Forward Current ^a	I_{SM}		-	-	80		
Body Diode Voltage	V_{SD}	$T_J = 25\text{ }^\circ\text{C}$, $I_S = 20\text{ A}$, $V_{GS} = 0\text{ V}^b$		-	-	1.5	V
Body Diode Reverse Recovery Time	t_{rr}	$T_J = 25\text{ }^\circ\text{C}$, $I_F = 20\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}^b$		-	520	780	ns
Body Diode Reverse Recovery Charge	Q_{rr}			-	5.3	8.0	μC
Forward Turn-On Time	t_{on}	Intrinsic turn-on time is negligible (turn-on is dominated by L_S and L_D)					

Notes

- a. Repetitive rating; pulse width limited by maximum junction temperature.
b. Pulse width $\leq 400\text{ }\mu\text{s}$; duty cycle $\leq 2\%$.

TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

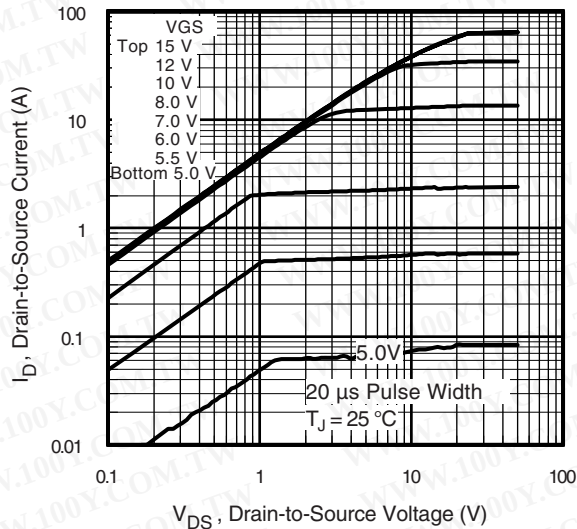


Fig. 1 - Typical Output Characteristics

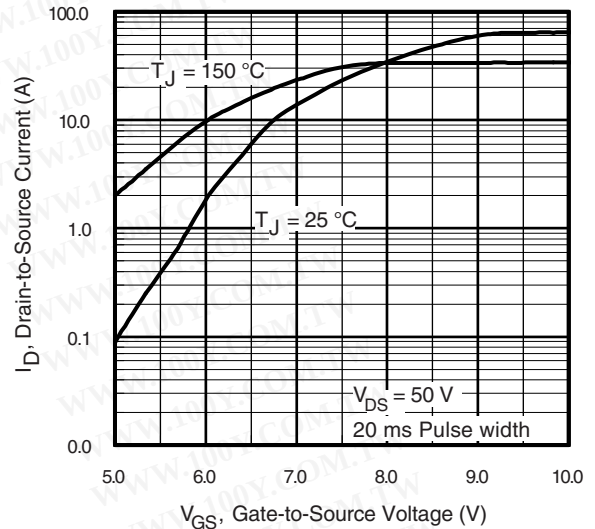


Fig. 3 - Typical Transfer Characteristics

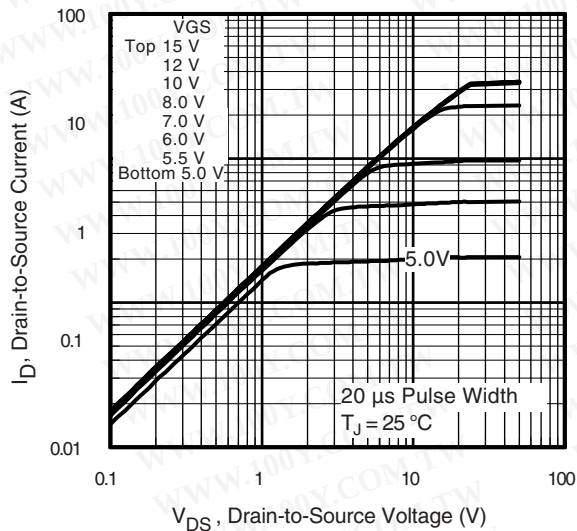


Fig. 2 - Typical Output Characteristics

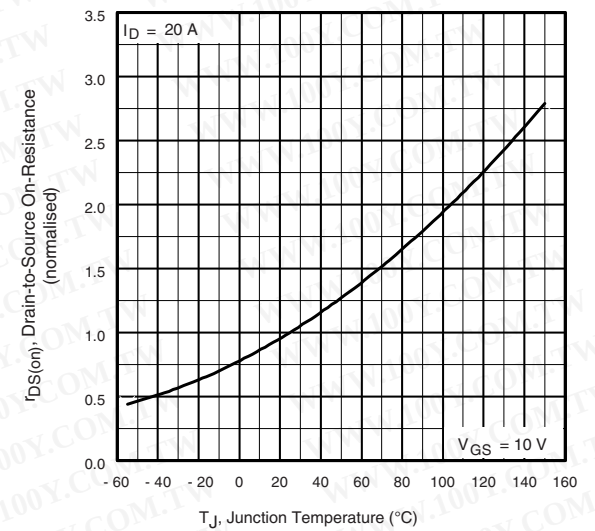


Fig. 4 - Normalized On-Resistance vs. Temperature

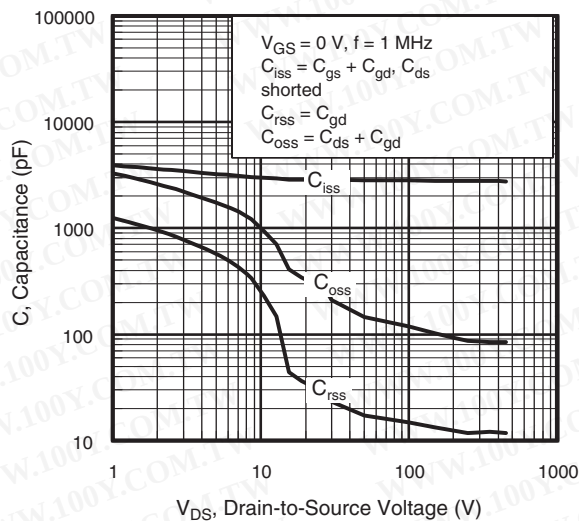


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

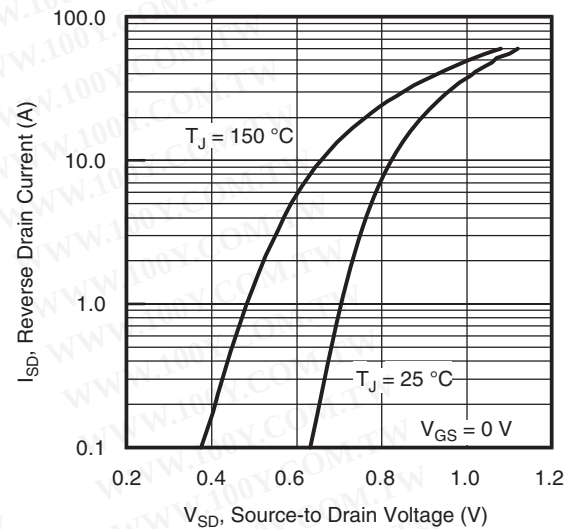


Fig. 7 - Typical Source-Drain Diode Forward Voltage

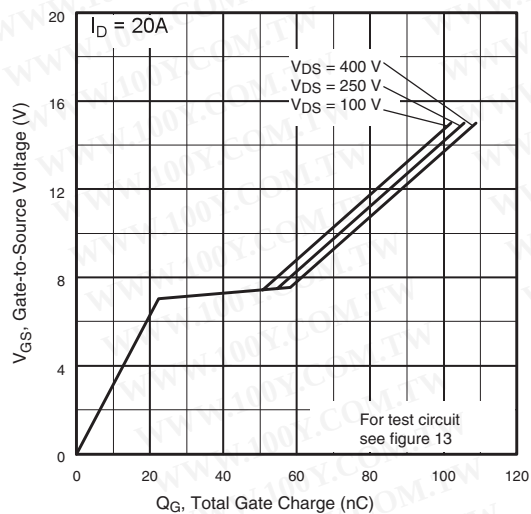


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

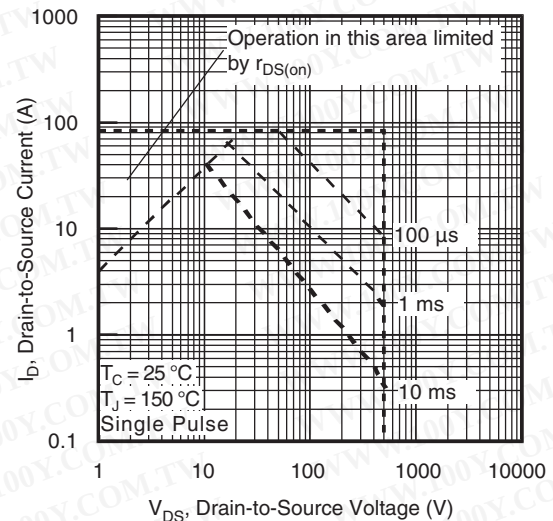


Fig. 8 - Maximum Safe Operating Area

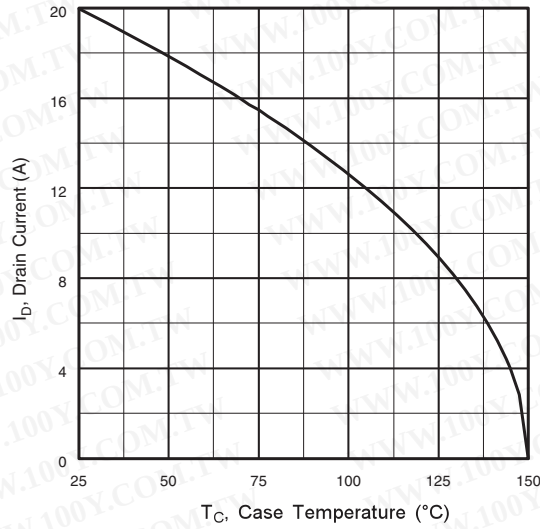


Fig. 9 - Maximum Drain Current vs. Case Temperature

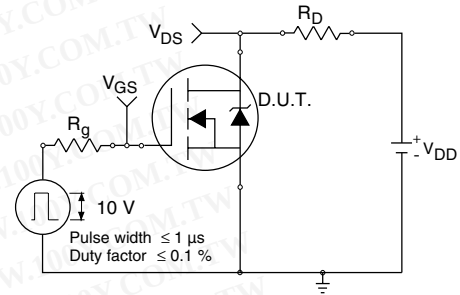


Fig. 10a - Switching Time Test Circuit

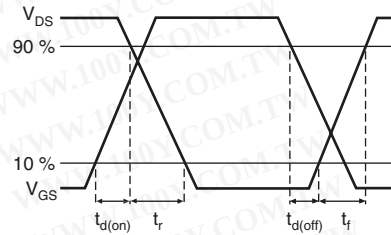


Fig. 10b - Switching Time Waveforms

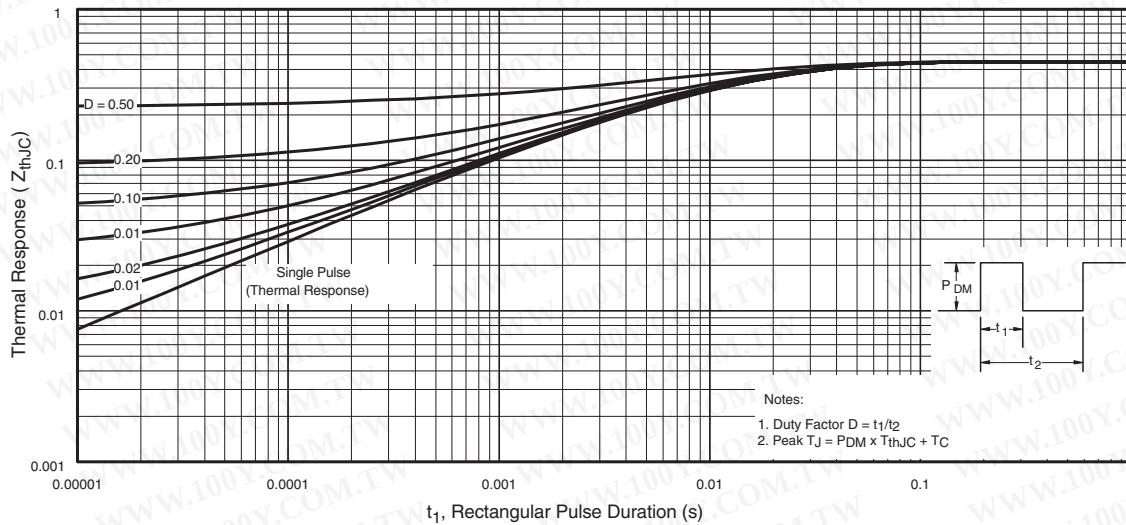


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

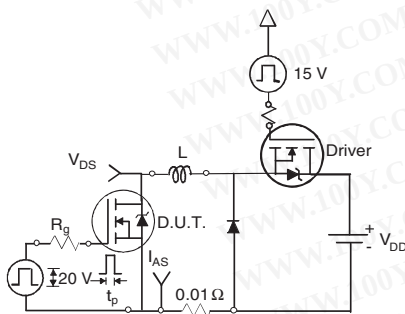


Fig. 12a - Unclamped Inductive Test Circuit

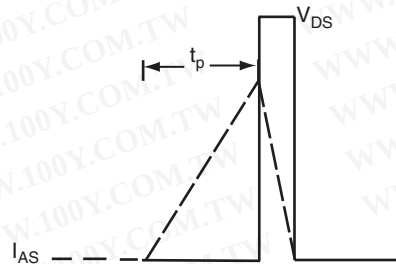


Fig. 12b - Unclamped Inductive Waveforms

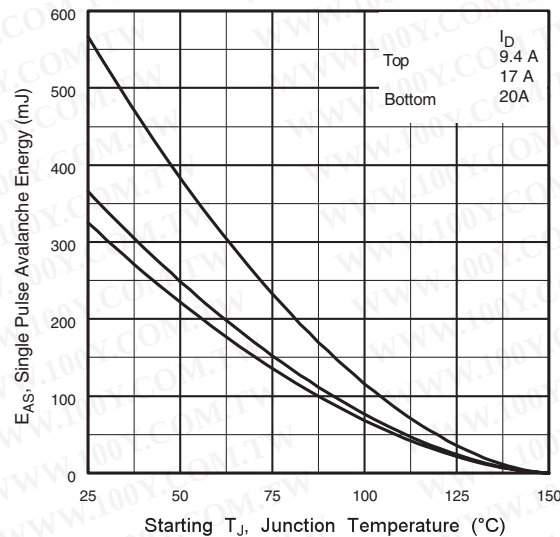


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

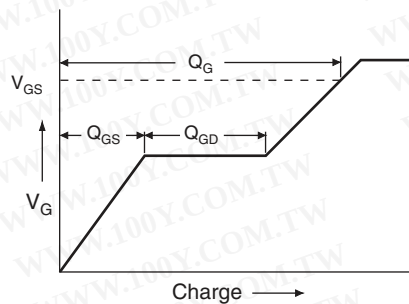


Fig. 13a - Basic Gate Charge Waveform

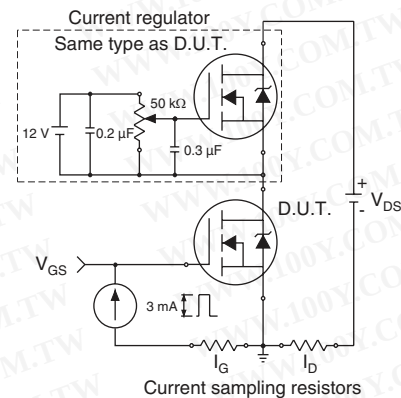
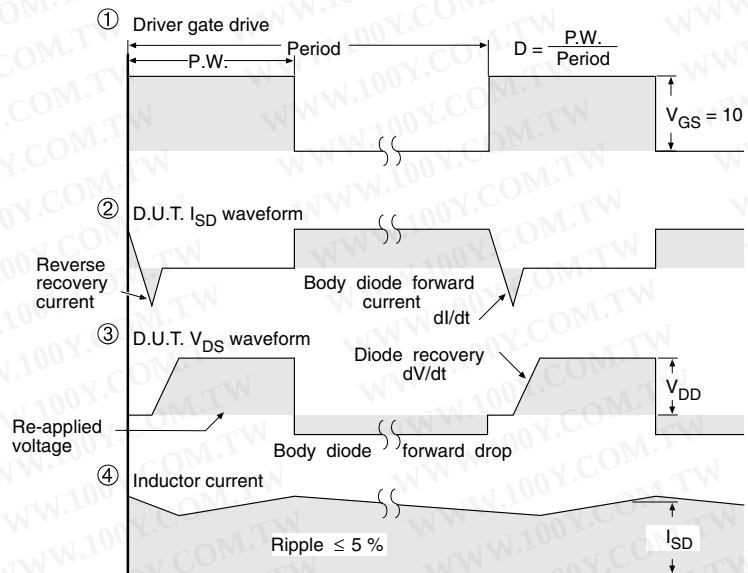
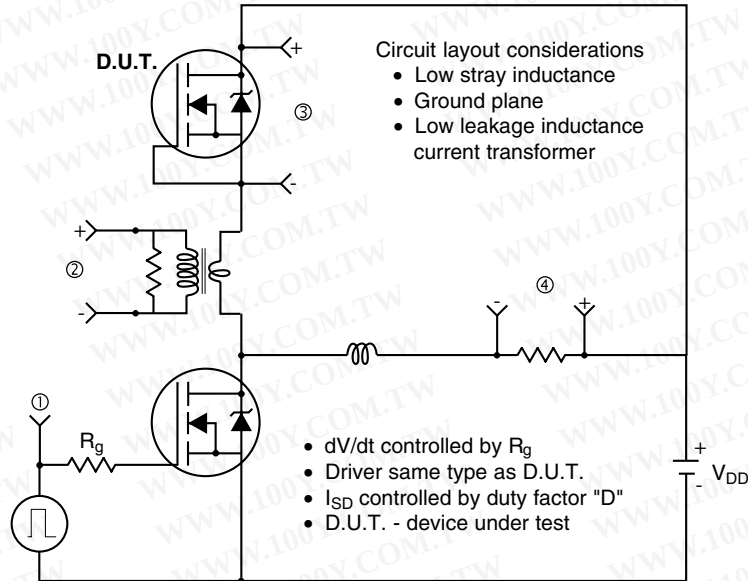


Fig. 13b - Gate Charge Test Circuit

Peak Diode Recovery dV/dt Test Circuit



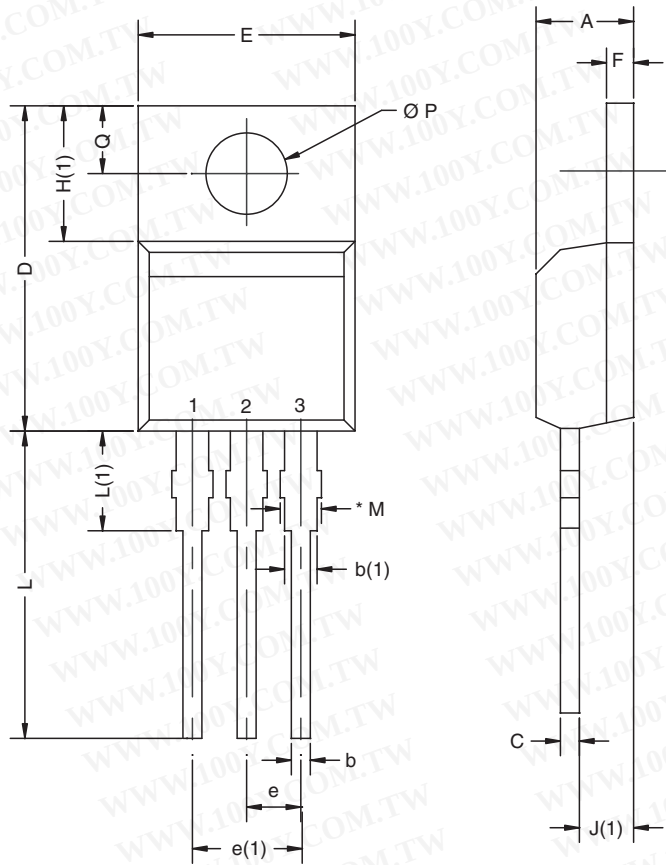
* $V_{GS} = 5\text{ V}$ for logic level devices

Fig. 14 - For N-Channel

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TO-220AB



DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.25	4.65	0.167	0.183
b	0.69	1.01	0.027	0.040
b(1)	1.20	1.73	0.047	0.068
c	0.36	0.61	0.014	0.024
D	14.85	15.49	0.585	0.610
E	10.04	10.51	0.395	0.414
e	2.41	2.67	0.095	0.105
e(1)	4.88	5.28	0.192	0.208
F	1.14	1.40	0.045	0.055
H(1)	6.09	6.48	0.240	0.255
J(1)	2.41	2.92	0.095	0.115
L	13.35	14.02	0.526	0.552
L(1)	3.32	3.82	0.131	0.150
Ø P	3.54	3.94	0.139	0.155
Q	2.60	3.00	0.102	0.118

ECN: X10-0416-Rev. M, 01-Nov-10
DWG: 5471

Note

* M = 1.32 mm to 1.62 mm (dimension including protrusion)
Heatsink hole for HVM



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