IRF730B

RoHS

COMPLIANT



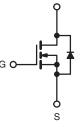
Vishay Siliconix

D Series Power MOSFET

PRODUCT SUMMARY					
V_{DS} (V) at T_J max.	450				
R _{DS(on)} max. at 25 °C (Ω)	V _{GS} = 10 V 1.0				
Q _g max. (nC)	18				
Q _{gs} (nC)	3				
Q _{gd} (nC)	4				
Configuration	Single				

TO-220AB





N-Channel MOSFET

D

FEATURES

- Optimal Design
 - Low Area Specific On-Resistance
 - Low Input Capacitance (Ciss)
 - Reduced Capacitive Switching Losses
 - High Body Diode Ruggedness
 - Avalanche Energy Rated (UIS)
- Optimal Efficiency and Operation
 - Low Cost
 - Simple Gate Drive Circuitry
 - Low Figure-of-Merit (FOM): Ron x Qa
 - Fast Switching
- Material categorization: For definitions of compliance please see <u>www.vishav.com/doc?99912</u>

Note

Lead (Pb)-containing terminations are not RoHS-compliant. Exemptions may apply.

APPLICATIONS

- Consumer Electronics
- Displays (LCD or Plasma TV)
- Server and Telecom Power Supplies

 SMPS
- Industrial
 - Welding
 - weiding
 - Induction Heating
- Motor Drives
- Battery Chargers

ORDERING INFORMATION	
Package	TO-220AB
Lead (Pb)-free	IRF730BPbF

ABSOLUTE MAXIMUM RATINGS ($T_c = 25 \degree C$, unless otherwise noted)						
PARAMETER	SYMBOL	LIMIT	UNIT			
Drain-Source Voltage	V _{DS}	400				
Gate-Source Voltage		N/	± 30	V		
Gate-Source Voltage AC (f > 1 Hz)	V _{GS}	30				
Continuous Drain Current (T _J = 150 °C)	V_{GS} at 10 V $T_C = 25 °C$	I _D	6			
	V_{GS} at 10 V $T_C = 100 \text{ °C}$		4	A		
Pulsed Drain Current ^a	I _{DM}	13				
Linear Derating Factor		0.8	W/°C			
Single Pulse Avalanche Energy ^b	E _{AS}	104	mJ			
Maximum Power Dissipation	PD	104	W			
Operating Junction and Storage Temperature Range	T _J , T _{stg}	- 55 to + 150	°C			
Drain-Source Voltage Slope	n-Source Voltage Slope T _J = 125 °C		24	V/ns		
Reverse Diode dV/dt ^d	dV/dt	0.48	v/IIS			
Soldering Recommendations (Peak Temperature) for 10 s			300 ^c	°C		

Notes

a. Repetitive rating; pulse width limited by maximum junction temperature.

b. V_{DD} = 50 V, starting T_J = 25 °C, L = 2.3 mH, R_g = 25 Ω , I_{AS} = 9.5 A.

c. 1.6 mm from case.

d. $I_{SD} \leq I_D,$ starting T_J = 25 °C.

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Vishay Siliconix

Static V _{GS} = 0 V, I _D = 250 µA 400 - - V_{DS} Imperature Coefficient $AV_{DS}T_J$ Reference to 25 °C, I _D = 250 µA - 0.53 - Gate-Source Threshold Voltage (N) V_{OS} (m) $V_{OS} = 250 µA$ 3 - 5 Gate-Source Leakage I GSS $V_{OS} = 30 V$ - - 1 Zero Gate Voltage Drain Current I DSS $V_{OS} = 400 V, V_{GS} = 0 V$ - - 1 Drain-Source On-State Resistance R DSIemi $V_{OS} = 10 V$ Is 3 A - 0.85 1.0 Drain-Source On-State Resistance R DSIemi $V_{OS} = 10 V$ Is 3 A - 1.7 - Dynamic Input Capacitance Ciss $V_{OS} = 0 V, V_{OS} = 0 V, V_{OS} = 10 V$ - 38 - Reverse Transfer Capacitance Cres $V_{OS} = 0 V, V_{OS} = 0 V to 320 V$ - 54 - Total Gate Charge Qg Qg V_{OS} = 10 V, R_{O} = 3 A, V_{OS} = 320 V - 12 24	THERMAL RESISTANCE RATINGS								
Maximum Junction-to-Case (Drain) R_{HJC} - 1.2 $^{9}C/W$ SPECIFICATIONS (T _J = 25 °C, unless otherwise noted) PARAMETER SYMBOL TEST CONDITIONS MIN. TYP. MAX. Static Drain-Source Breakdown Voltage V _{DS} V _{GS} = 0 V, I ₂ = 250 µA 400 - - - Gate-Source Threshold Voltage (N) VOS V _{DS} = 400 V, I ₂ = 250 µA 400 - - + 100 Zero Gate-Source Leakage I _{QSS} V _{DS} = 400 V, V _{QS} = 0 V - - + 100 Zero Gate Voltage Drain Current I _{DSS} V _{DS} = 400 V, V _{QS} = 0 V, V - - 10 Drain-Source On-State Resistance R _{DS(m)} V _{DS} = 10 V I = 3 A - 1.7 - Dynamic Uput Capacitance C _{Gas} V _{QS} = 0 V, V _{DS} = 0 V to 320 V - 38 - Input Capacitance C _{Qas} V _{DS} = 10 V, V _{DS} = 10 V, V _{DS} = 30 V, V_{DS} = 320 V - 44 - Intro- Delaya Time	PARAMETER	SYMBOL	TYP. MAX.			UNIT			
Maximum Junction-to-Case (Drain) R_{thJC} - 1.2 SPECIFICATIONS (T _J = 25 °C, unless otherwise noted) PARAMETER SYMBOL TEST CONDITIONS MIN TYP. MAX. Static Vos $V_{0S} = 0 V, I_D = 250 \mu A$ 400 - - Org. Temperature Coefficient $\Delta V_{DS}/T_J$ Reference to 25 °C, $I_D = 250 \mu A$ 3 - 5 Gate-Source Threshold Voltage (N) VOS VOS $V_{0S} = 250 \mu A$ 3 - 5 Gate-Source Threshold Voltage (N) VOS $V_{0S} = 30 V$ - - ± 100 Zaro Gate Voltage Drain Current IDSS $V_{0S} = 320 V, V_{0S} = 0 V$ - - 10 Drain-Source On-State Resistance $R_{DS(m)}$ $V_{0S} = 300 V, I_D = 3 A$ - 0.85 1.0 Output Capacitance C_{cos} $V_{DS} = 100 V, I_D = 3 A$ - 0.85 1.0 Dynamic Vos = 100 V, I_D = 3 A - 0.85 1.0 - 38 - Input Capacitance C_{cos} $V_{OS} = 100 V, I_D = 3 A$ - 1.7 - 38 -	Maximum Junction-to-Ambient	R _{thJA}	- 62			0000			
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Static VGS VGS VGS VGS 400 - - Drain-Source Breakdown Voltage VDS VDS VDS VDS - 0.53 - Gate-Source Threshold Voltage (N) VGS(th) VDS VDS 250 µA - 0.53 - Gate-Source Leakage IGSS VDS 250 µA 3 - 5 Gate-Source Leakage IGSS VDS 200 V - - 1 Zero Gate Voltage Drain Current IDSS VDS 400 V, VGS = 0 V, VDS = 3 A - 0.85 1.0 Drain-Source Con-State Resistance PCS VDS 10 V ID = 3 A - 0.85 1.0 Droward Transconductance Ges VDS = 100 V, ID = 3 A - 1.7 - Reverse Transfer Capacitance Cres VDS = 0 V, VDS =						MIN	тур	ΜΑΥ	UNIT
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$		STNIBOL	IES	CONDIT	10113	IVIIIN.		IVIAA.	UNIT
			1 v	0.1/1		400	T		
	•	-							V
Gate-Source Leakage I_{GSS} $V_{GS} = \pm 30 V$ - - ± 100 Zero Gate Voltage Drain Current I_{DSS} $V_{GS} = 400 V, V_{GS} = 0 V$ - - 1 Drain-Source On-State Resistance $R_{DS(on)}$ $V_{GS} = 10 V$ $I_D = 3 A$ - 0.85 1.0 Forward Transconductance g_{fs} $V_{DS} = 50 V, I_D = 3 A$ - 1.7 - Dynamic - $V_{GS} = 10 V$ $V_{SS} = 0 V, V_{DS} = 30 V, V_{DS} = 30 V$ - 311 - Output Capacitance C_{ciss} $V_{GS} = 0 V, V_{DS} = 100 V, I_D = 3 A$ - 311 - Output Capacitance C_{ciss} $V_{GS} = 0 V, V_{DS} = 100 V, I_D = 3 A$ - 311 - Reverse Transfer Capacitance, energy related ^a $C_{ci(r)}$ $V_{GS} = 0 V, V_{DS} = 0 V to 320 V$ - 44 - Effective output capacitance, time related ^b $C_{o(tr)}$ $V_{GS} = 10 V, V_{DS} = 320 V$ - 54 - Total Gate Charge Q_{gd} $V_{GS} = 10 V, I_D = 3 A, V_{DS} = 320 V$ - 11 22 <td>56 1</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>V/°C</td>	56 1								V/°C
Zero Gate Voltage Drain Current IDSS $V_{DS} = 400 V, V_{GS} = 0 V$ - - 1 Drain-Source On-State Resistance $R_{DS(on)}$ $V_{GS} = 10 V$ Ip = 3 A - 0.85 1.0 Forward Transconductance g_{fs} $V_{DS} = 50 V, I_{D} = 3 A$ - 1.7 - Dynamic Iput Capacitance C_{ciss} $V_{DS} = 100 V, T_{D} = 0 V to 320 V$ - 311 - Effective output capacitance, time related ¹⁰ $C_{o(tr)}$ $V_{GS} = 0 V, V_{DS} = 0 V to 320 V$ - 44 - Total Gate Charge Q_{gd} $V_{GS} = 10 V$ $I_{D} = 3 A, V_{DS} = 320 V$ - 9 18 Gate-Drain Charge Q_{gd} $V_{GS} = 10 V, R_{g} = 9, 1 \Omega$ - 11 22 - Turn-On Delay Time t_{10} $V_{GS} = 10 V, R_{g} = 9, 1 \Omega$ - 11 22 - 14 28 - 11 22 <td>3 ()</td> <td>V_{GS(th)}</td> <td></td> <td></td> <td></td> <td>-</td> <td></td> <td>-</td> <td>V</td>	3 ()	V _{GS(th)}				-		-	V
Zero Gate Voltage Drain CurrentIDSS $V_{DS} = 320 \vee, V_{GS} = 0 \vee, T_J = 125 °C$ 10Drain-Source On-State Resistance $R_{DS(on)}$ $V_{GS} = 10 \vee$ $I_D = 3 A$ -0.851.0Forward Transconductance g_{fs} $V_{DS} = 50 \vee, I_D = 3 A$ -0.851.0DynamicInput Capacitance C_{itss} $V_{GS} = 0 \vee, V_D = 3 A$ -1.7-DynamicUnput Capacitance C_{ciss} $V_{GS} = 0 \vee, V_D = 3 A$ -311-Reverse Transfer Capacitance C_{ciss} $V_{GS} = 0 \vee, V_D = 100 \vee, V_D = 0 \vee, V_$	Gate-Source Leakage	I _{GSS}				-	-		nA
Vos 320 V, V _{GS} = 0 V, T _J = 125 °C - - 10 Drain-Source On-State Resistance $R_{DS(cn)}$ $V_{GS} = 10 V$ $I_D = 3 A$ - 0.85 1.0 Forward Transconductance g_{fs} $V_{GS} = 10 V$ $I_D = 3 A$ - 0.85 1.0 Dynamic Input Capacitance C_{iss} $V_{GS} = 0 V$, $V_{DS} = 50 V$, $I_D = 3 A$ - 1.7 - Output Capacitance C_{iss} $V_{GS} = 0 V$, $V_{DS} = 100 V$, $f = 1 MHz$ - 38 - Reverse Transfer Capacitance, energy related ³ $C_{o(tr)}$ $V_{GS} = 0 V$, $V_{DS} = 0 V$ to 320 V - 44 - Effective output capacitance, time $C_{o(tr)}$ $V_{GS} = 10 V$ $V_{GS} = 320 V$ - 54 - Total Gate Charge Q_{gd} $V_{GS} = 10 V$ $I_D = 3 A$, $V_{DS} = 320 V$ - 44 - Gate-Drain Charge Q_{gd} $V_{GS} = 10 V$, $V_{GS} = 10 V$, $R_g = 9.1 \Omega$ - 11 22 Turn-Off Delay Time tr t V_{GS} = 10 V, $R_g = 9.1 \Omega$ -	Zero Gate Voltage Drain Current	IDSS				-	-		μA
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	-	200				-			-
DynamicInput Capacitance C_{iss} $V_{GS} = 0 V$, $V_{DS} = 100 V$, $f = 1 MHz$ $ 311$ $-$ Output Capacitance C_{coss} $V_{DS} = 100 V$, $f = 1 MHz$ $ 38$ $-$ Reverse Transfer Capacitance C_{rss} $V_{GS} = 0 V$, $V_{DS} = 0 V to 320 V$ $ 444$ $-$ Effective output capacitance, time related ⁰ $C_{o(tr)}$ $V_{GS} = 0 V$, $V_{DS} = 0 V to 320 V$ $ 54$ $-$ Total Gate Charge Q_g $V_{GS} = 10 V$ $I_D = 3 A$, $V_{DS} = 320 V$ $ 9$ 18 Gate-Drain Charge Q_{gd} $V_{GS} = 10 V$ $I_D = 3 A$, $V_{DS} = 320 V$ $ 44$ $-$ Turn-On Delay Time $t_{d(on)}$ t_r $V_{GS} = 10 V$ $I_D = 3 A$, $V_{DS} = 320 V$ $ 44$ $-$ Fall Time t_r T_r $ 44$ $ 44$ $-$ Turn-On Delay Time $t_{d(orf)}$ $V_{GS} = 10 V$ $I_D = 3 A$, $V_{DS} = 320 V$ $ 44$ $-$ Turn-Off Delay Time t_q T_r $ 44$ $ 111$ 22 Turn-Off Delay Time t_q T_r $ 14$ 28 $ 114$ 28 Fall Time t_r T_r $ 14$ 28 $ 14$ 28 Fall Time T_r T_r $ 1.9$ $ 1.9$ $ 24$ Diale Diode Forward Current I_S MO		R _{DS(on)}			_			-	Ω
Input Capacitance C_{iss} $V_{GS} = 0 V$, $V_{DS} = 100 V$, $f = 1 MHz$ -311-Output Capacitance C_{oss} $V_{DS} = 100 V$, $f = 1 MHz$ -38-Reverse Transfer Capacitance, energy related ^a $C_{o(er)}$ $V_{GS} = 0 V$, $V_{DS} = 0 V to 320 V$ -44-Effective output capacitance, time related ^b $C_{o(tr)}$ $V_{GS} = 0 V$, $V_{DS} = 0 V to 320 V$ -44-Total Gate Charge Q_g Q_g $V_{GS} = 10 V$ $I_D = 3 A$, $V_{DS} = 320 V$ -918Gate-Drain Charge Q_{gd} $V_{GS} = 10 V$ $I_D = 3 A$, $V_{DS} = 320 V$ -918Gate-Drain Charge Q_{gd} $V_{GS} = 10 V$ $I_D = 3 A$, $V_{DS} = 320 V$ -918Gate-Drain Charge Q_{gd} $V_{GS} = 10 V$ $I_D = 3 A$, $V_{DS} = 320 V$ -918Gate-Drain Charge Q_{gd} $V_{GS} = 10 V$ $I_D = 3 A$, $V_{DS} = 320 V$ -918Gate-Drain Charge Q_{gd} $V_{GS} = 10 V$ $I_D = 3 A$, $V_{DS} = 320 V$ -1224Turn-On Delay Time $t_{d(off)}$ $V_{DS} = 400 V$, $I_D = 3 A$, $V_{GS} = 10 V$, $R_g = 9.1 \Omega$ -1122Fall Time t_f t_f -816Gate Input Resistance R_g $f = 1 MHz$, open drain-1.9-Drain-Source Body Diode Characteristics t_f -24Pulsed Diode Forward Current I_{SM} <td< td=""><td>Forward Transconductance</td><td>9_{fs}</td><td>V_{DS}</td><td>= 50 V, I_D</td><td>= 3 A</td><td>-</td><td>1.7</td><td>-</td><td>S</td></td<>	Forward Transconductance	9 _{fs}	V _{DS}	= 50 V, I _D	= 3 A	-	1.7	-	S
Output Capacitance C_{oss} $V_{DS} = 100 \text{ V},$ $f = 1 \text{ MHz}$ -38-Reverse Transfer Capacitance C_{rss} $V_{DS} = 100 \text{ V},$ $f = 1 \text{ MHz}$ -38-Effective output capacitance, energy related ^a $C_{o(er)}$ $V_{GS} = 0 \text{ V},$ $V_{DS} = 0 \text{ V to } 320 \text{ V}$ -44-Effective output capacitance, time related ^b $C_{o(tr)}$ $V_{GS} = 0 \text{ V},$ $V_{DS} = 0 \text{ V to } 320 \text{ V}$ -54-Total Gate Charge Q_g $Gate-Drain ChargeQ_{gd}Gate-Drain ChargeV_{GS} = 10 \text{ V}I_D = 3 \text{ A}, V_{DS} = 320 \text{ V}-918Gate-Drain ChargeQ_{gd}Turn-On Delay Timet_{d(on)}t_{gis}V_{GS} = 10 \text{ V}, R_g = 9.1 \Omega-1224Rise Timet_rV_{CS} = 10 \text{ V}, R_g = 9.1 \Omega-1428Fall Timet_f-1428Fall Timet_f-816Gate Input ResistanceR_gf = 1 \text{ MHz}, \text{ open drain}-1.9-Drain-Source Body Diode Characteristics-8166Pulsed Diode Forward CurrentI_{SM}MOSFET symbolshowing theintegral reversep - n junction diode24Diode Forward VoltageV_{SD}T_J = 25 ^{\circ}, I_S = 3 \text{ A}, V_{GS} = 0 \text{ V}1.2Reverse Recovery Timet_rT_H = 25 ^{\circ}, I_S = 1S = 3A,236-$,	1	1			1	T	I	1
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Input Capacitance			$V_{GS} = 0 V$	3	-	311	-	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Output Capacitance	C _{oss}	V _{DS} = 100 V,		-	38	-		
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Reverse Transfer Capacitance	C _{rss}			-	7	-		
Effective output capacitance, time relatedb $C_{o(tr)}$ $V_{DS} = 0 V \text{ to } 320 V$ $ 54$ $-$ Total Gate Charge Q_g Q_{gs} $V_{GS} = 10 V$ $I_D = 3 \text{ A}, V_{DS} = 320 V$ $ 9$ 18 Gate-Drain Charge Q_{gd} Q_{gd} $I_D = 3 \text{ A}, V_{DS} = 320 V$ $ 4$ $-$ Turn-On Delay Time $t_{d(on)}$ $V_{GS} = 10 V$ $I_D = 3 \text{ A}, V_{DS} = 320 V$ $ 4$ $-$ Rise Time t_r $V_{DD} = 400 V, I_D = 3 \text{ A}, V_{DS} = 10 V$ $ 11$ 22 Turn-Off Delay Time $t_{d(off)}$ $V_{GS} = 10 V, R_g = 9.1 \Omega$ $ 14$ 28 Fall Time t_f $ 14$ 28 Gate Input Resistance R_g $f = 1 \text{ MHz}, open drain$ $ 1.9$ $-$ Drain-Source Body Diode Characteristics R_g $f = 1 \text{ MHz}, open drain$ $ 1.9$ $-$ Pulsed Diode Forward Current I_S $MOSFET symbol$ showing the integral reverse $p - n$ junction diode $ 24$ Diode Forward Voltage V_{SD} $T_J = 25 ^\circ$, $I_S = 3 \text{ A}, V_{GS} = 0 V$ $ 1.2$ Reverse Recovery Time t_r $T_I = 25 ^\circ$, $I_S = 18 \text{ A}$ $ 1.4 \text{ C}$		C _{o(er)}			-	44	-	pF	
Gate-Source Charge Q_{gs} $V_{GS} = 10 \text{ V}$ $I_D = 3 \text{ A}, V_{DS} = 320 \text{ V}$ -3-Gate-Drain Charge Q_{gd} Q_{gd} -44-Turn-On Delay Time $t_{d(on)}$ T_r $V_{GS} = 10 \text{ V}, I_D = 3 \text{ A}, V_{DS} = 320 \text{ V}$ -1224Rise Time t_r $V_{OD} = 400 \text{ V}, I_D = 3 \text{ A}, V_{GS} = 10 \text{ V}, R_g = 9.1 \Omega$ -1122Fall Time t_f $V_{GS} = 10 \text{ V}, R_g = 9.1 \Omega$ -1428Fall Time t_f -1.9Gate Input Resistance R_g $f = 1 \text{ MHz}$, open drain-1.9-Drain-Source Body Diode Characteristics66Pulsed Diode Forward Current I_{SM} MOSFET symbol showing the integral reverse $p - n$ junction diode24Diode Forward Voltage V_{SD} $T_J = 25 \text{ °C}, I_S = 3 \text{ A}, V_{GS} = 0 \text{ V}$ 1.2Reverse Recovery Time t_{rr} $T_J = 25 \text{ °C}, I_S = 3 \text{ A}, V_{GS} = 0 \text{ V}$ 1.2Reverse Recovery Time t_{rr} $T_J = 25 \text{ °C}, I_S = 3 \text{ A}, V_{GS} = 0 \text{ V}$ 1.2Reverse Recovery Time t_{rr} $T_J = 25 \text{ °C}, I_S = 3 \text{ A}, V_{GS} = 0 \text{ V}$ 1.2Reverse Recovery Time t_{rr} $T_J = 25 \text{ °C}, I_S = 3 \text{ A}, V_{GS} = 0 \text{ V}$ 1.2		C _{o(tr)}			-	54	-		
Gate-Drain Charge Q_{gd} -4-Turn-On Delay Time $t_{d(on)}$ Rise Time t_r Turn-Off Delay Time $t_{d(off)}$ Fall Time t_{f} Gate Input Resistance R_g Gate Input Resistance R_g Continuous Source-Drain Diode Current I_S MOSFET symbol showing the integral reverse $p - n$ junction diodeDiode Forward Current I_S Diode Forward Voltage V_{SD} Turn-Off Delay Time t_{rr} L< 28	Total Gate Charge	Qg				-	9	18	
Gate-Drain Charge Q_{gd} -4-Turn-On Delay Time $t_{d(on)}$ r $V_{DD} = 400 \text{ V}, \text{ I}_D = 3 \text{ A},$ -1224Rise Time t_r $V_{DD} = 400 \text{ V}, \text{ I}_D = 3 \text{ A},$ -1122Turn-Off Delay Time $t_{d(off)}$ $V_{GS} = 10 \text{ V}, \text{ R}_g = 9.1 \Omega$ -1428Fall Time t_f -816Gate Input Resistance R_g $f = 1 \text{ MHz}, \text{ open drain}$ -1.9-Drain-Source Body Diode CharacteristicsContinuous Source-Drain Diode Current I_S MOSFET symbol showing the integral reverse $p - n$ junction diode6Diode Forward Voltage V_{SD} $T_J = 25 ^\circ$ C, $I_S = 3 \text{ A}, V_{GS} = 0 \text{ V}$ 24Diode Forward Voltage V_{SD} $T_J = 25 ^\circ$ C, $I_S = 3 \text{ A}, V_{GS} = 0 \text{ V}$ 1.2Reverse Recovery Time t_{rr} $T_{II} = 25 ^\circ$ C, $I_S = 3 \text{ A}, V_{GS} = 0 \text{ V}$ 1.2	Gate-Source Charge	Q _{qs}	V _{GS} = 10 V	$V_{GS} = 10 \text{ V}$ $I_D = 3 \text{ A}, V_{DS} = 320 \text{ V}$		-	3	-	nC
$\begin{tabular}{ c c c c c c c } \hline Turn-On Delay Time & t_{d(on)} & & & & & & & & & & & & & & & & & & &$	Gate-Drain Charge					-	4	-	
Rise Time t_r $V_{DD} = 400 \text{ V}, \text{ I}_D = 3 \text{ A}, V_{GS} = 10 \text{ V}, \text{ R}_g = 9.1 \Omega$ $ 11$ 22 Turn-Off Delay Time $t_{d(off)}$ $V_{GS} = 10 \text{ V}, \text{ R}_g = 9.1 \Omega$ $ 14$ 28 Fall Time t_f $ 8$ 16 Gate Input Resistance R_g $f = 1 \text{ MHz}$, open drain $ 1.9$ $-$ Drain-Source Body Diode CharacteristicsContinuous Source-Drain Diode Current I_S MOSFET symbol showing the integral reverse $p - n$ junction diode $ 6$ Diode Forward Current I_{SM} $T_J = 25 \text{ °C}, I_S = 3 \text{ A}, V_{GS} = 0 \text{ V}$ $ 24$ Diode Forward Voltage V_{SD} $T_J = 25 \text{ °C}, I_S = 3 \text{ A}, V_{GS} = 0 \text{ V}$ $ 1.2$ Reverse Recovery Time t_{rr} $T_L = 25 \text{ °C}, I_F = I_S = 3 \text{ A},$ $ 236$ $-$	Turn-On Delay Time					-	12	24	
Turn-Off Delay Time $t_{d(off)}$ $v_{DD} = 400 \text{ V}, \text{ ib} = 3 \text{ A},$ -1428Fall Time t_f r $R_g = 9.1 \Omega$ -816Gate Input Resistance R_g $f = 1 \text{ MHz}, \text{ open drain}$ -1.9-Drain-Source Body Diode CharacteristicsContinuous Source-Drain Diode Current I_S MOSFET symbol showing the integral reverse $p - n$ junction diode6Diode Forward Current I_{SM} $T_J = 25 \text{ °C}, I_S = 3 \text{ A}, V_{GS} = 0 \text{ V}$ 1.2Reverse Recovery Time t_{rr} $T_L = 25 \text{ °C}, I_F = I_S = 3 \text{ A},$ -236-	Rise Time	t _r	N .	400 \/ 1	- 2 A	-	11	22	
Fall Time t_f -816Gate Input Resistance R_g $f = 1 \text{ MHz}$, open drain-1.9-Drain-Source Body Diode CharacteristicsContinuous Source-Drain Diode Current I_S MOSFET symbol showing the integral reverse $p - n$ junction diode6Pulsed Diode Forward Current I_{SM} $P - n$ junction diode24Diode Forward Voltage V_{SD} $T_J = 25 °C$, $I_S = 3 A$, $V_{GS} = 0 V$ 1.2Reverse Recovery Time t_{rr} $T_J = 25 °C$, $I_F = I_S = 3 A$,-236-	Turn-Off Delay Time		V _{DD} V _{GS} =	= 400 v, 1 _D = 10 V, R _n =	= 9.1 Ω	-	14	28	ns
Gate Input Resistance R_g $f = 1 \text{ MHz}$, open drain-1.9-Drain-Source Body Diode CharacteristicsContinuous Source-Drain Diode CurrentIsMOSFET symbol showing the integral reverse $p - n$ junction diode6Pulsed Diode Forward CurrentIsM $\Gamma_J = 25 °C$, $I_S = 3 \text{ A}$, $V_{GS} = 0 \text{ V}$ 24Diode Forward Voltage V_{SD} $T_J = 25 °C$, $I_S = 3 \text{ A}$, $V_{GS} = 0 \text{ V}$ 1.2Reverse Recovery Time t_{rr} $T_J = 25 °C$, $I_S = 3 \text{ A}$, $V_{GS} = 0 \text{ V}$ -1.2	Fall Time			- do - ,y 2		-	8	16	1
Drain-Source Body Diode Characteristics Continuous Source-Drain Diode Current Is MOSFET symbol showing the integral reverse $p - n$ junction diode - - 6 Pulsed Diode Forward Current IsM IsM T_J = 25 °C, I_S = 3 A, V_{GS} = 0 V - - 24 Diode Forward Voltage V_{SD T_J = 25 °C, I_S = 3 A, V_{GS} = 0 V - - 1.2 Reverse Recovery Time trr T_L = 25 °C, I_F = I_S = 3 A, - 236 -	Gate Input Resistance	Ra	f = 1 MHz, open drain		-	1.9	-	Ω	
Continuous Source-Drain Diode CurrentIsMOSFET symbol showing the integral reverse p - n junction diode6Pulsed Diode Forward CurrentIsMIsM $r_{J} = 25 °C$, Is = 3 A, VGS = 0 V24Diode Forward VoltageVsDT_J = 25 °C, Is = 3 A, VGS = 0 V1.2Reverse Recovery TimetrrT_J = 25 °C, Is = 3 A,-236-	Drain-Source Body Diode Characterist		1	•					
Pulsed Diode Forward CurrentI I SMp - n junction diode24Diode Forward VoltageV SDT J = 25 °C, IS = 3 A, VGS = 0 V1.2Reverse Recovery TimetrrT J = 25 °C, IF = IS = 3 A,-236-			showing the integral reverse		-	-	6	_	
Reverse Recovery Time t_{rr} -236- $T_{L} = 25 \ ^{\circ}C, I_{F} = I_{S} = 3 \ A,$ -236-	Pulsed Diode Forward Current	I _{SM}			-	-	24	A	
Reverse Recovery Time t_{rr} -236- $T_{I} = 25 \ ^{\circ}C, I_{F} = I_{S} = 3 \ A,$ -236-	Diode Forward Voltage	V _{SD}	$T_{1} = 25 \text{ °C}, I_{S} = 3 \text{ A}, V_{GS} = 0 \text{ V}$		-	-	1.2	V	
$T_{1} = 25 \text{ °C}, I_{F} = I_{S} = 3 \text{ A},$	° °	-			-	236	-	ns	
$dI/dt = 100 \Delta/ue V_{B} = 20 V$,				-		-	μC	
Reverse Recovery Current I _{RBM}								A	

Notes

a. $C_{oss(er)}$ is a fixed capacitance that gives the same energy as C_{oss} while V_{DS} is rising from 0 % to 80 % V_{DS} .

b. $C_{oss(tr)}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 % to 80 % V_{DS} .



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TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

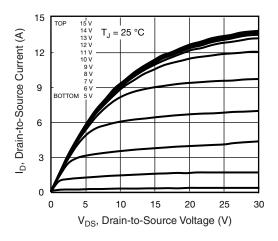


Fig. 1 - Typical Output Characteristics

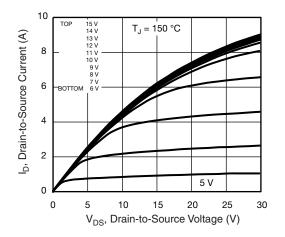


Fig. 2 - Typical Output Characteristics

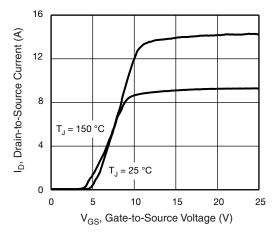


Fig. 3 - Typical Transfer Characteristics

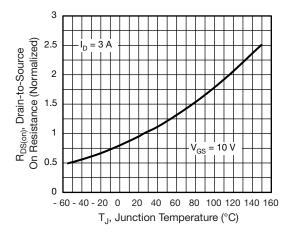


Fig. 4 - Normalized On-Resistance vs. Temperature

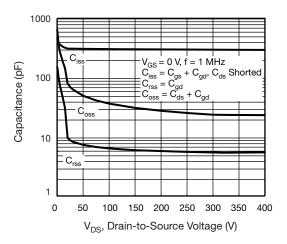
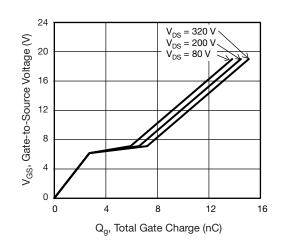


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

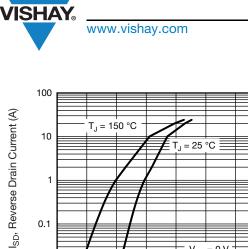




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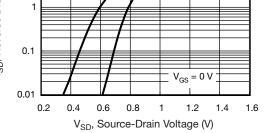


Fig. 7 - Typical Source-Drain Diode Forward Voltage

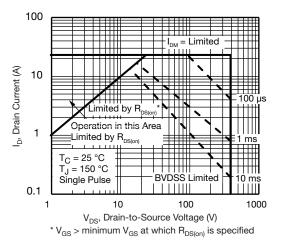


Fig. 8 - Maximum Safe Operating Area

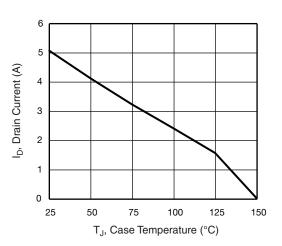


Fig. 9 - Maximum Drain Current vs. Case Temperature

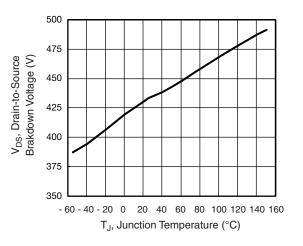


Fig. 10 - Temperature vs. Drain-to-Source Voltage

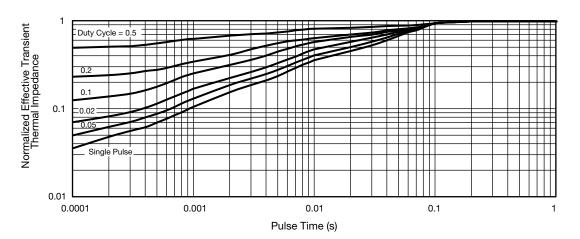


Fig. 11 - Normalized Thermal Transient Impedance, Junction-to-Case

S12-1392-Rev. A, 18-Jun-12

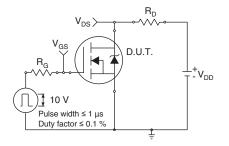
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Fig. 12 - Switching Time Test Circuit

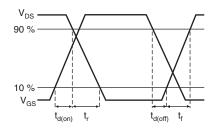


Fig. 13 - Switching Time Waveforms

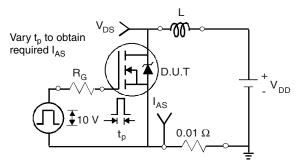


Fig. 14 - Unclamped Inductive Test Circuit

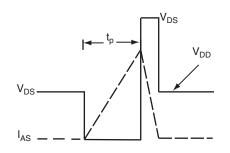


Fig. 15 - Unclamped Inductive Waveforms

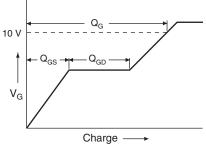


Fig. 16 - Basic Gate Charge Waveform

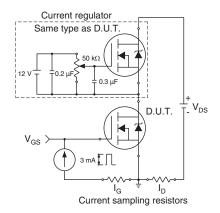
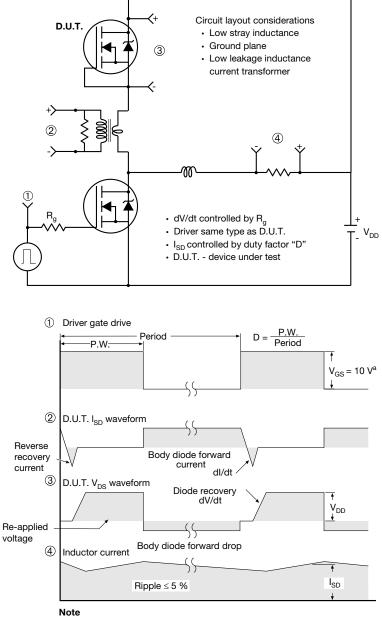


Fig. 17 - Gate Charge Test Circuit





Peak Diode Recovery dV/dt Test Circuit



a. $V_{GS} = 5 V$ for logic level devices

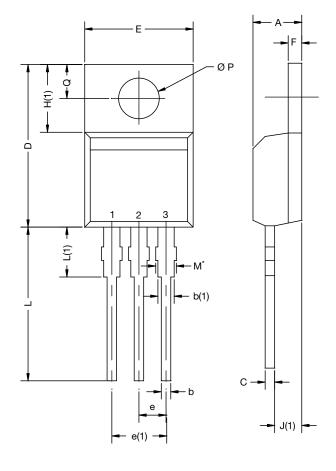
Fig. 18 - For N-Channel

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TO-220-1



DIM.	MILLIN	IETERS	INCHES			
DIIVI.	MIN.	MAX.	MIN.	MAX.		
А	4.24	4.65	0.167	0.183		
b	0.69	1.02	0.027	0.040		
b(1)	1.14	1.78	0.045	0.070		
С	0.36	0.61	0.014	0.024		
D	14.33	15.85	0.564	0.624		
Е	9.96	10.52	0.392	0.414		
е	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)	H(1) 6.10 6.71 0.240 0.264					
J(1)	2.41	2.92	0.095	0.115		
L	13.36	14.40	0.526	0.567		
L(1)	3.33	4.04	0.131	0.159		
ØΡ	3.53	3.94	0.139	0.155		
Q	2.54	3.00	0.100	0.118		
ECN: X15-0364-Rev. C, 14-Dec-15 DWG: 6031						

Note

• $M^* = 0.052$ inches to 0.064 inches (dimension including protrusion), heatsink hole for HVM

Package Picture					
ASE		Xi'an			
		IRF 9510 744K AB			

Revison: 14-Dec-15

Document Number: 66542

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