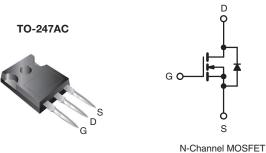




## **Power MOSFET**

PRODUCT SUMMARY					
V <sub>DS</sub> (V)	500				
R <sub>DS(on)</sub> (Ω)	V <sub>GS</sub> = 10 V 0.85				
Q <sub>g</sub> (Max.) (nC)	63				
Q <sub>gs</sub> (nC)	11				
Q <sub>gd</sub> (nC)	30				
Configuration	Single				



#### FEATURES

- Dynamic dV/dt Rating
- Repetitive Avalanche Rated
- Isolated Central Mounting Hole
- Fast Switching
- Ease of Paralleling
- Simple Drive Requirements
- Compliant to RoHS Directive 2002/95/EC

### DESCRIPTION

Third generation Power MOSFETs from Vishay provide the designer with the best combination of fast switching, ruggedized device design, low on-resistance and cost-effectiveness.

The TO-247AC package is preferred for commercial-industrial applications where higher power levels preclude the use of TO-220AB devices. The TO-247AC is similar but superior to the earlier TO-218 package because of its isolated mounting hole. It also provides greater creepage distances between pins to meet the requirements of most safety specifications.

ORDERING INFORMATION	
Package	TO-247AC
Lead (Pb)-free	IRFP440PbF
Lead (Fb)-liee	SiHFP440-E3
SnPb	IRFP440
	SiHFP440

ABSOLUTE MAXIMUM RATINGS ( $T_C$	= 25 °C, unl	ess otherwis	se noted)			
PARAMETER			SYMBOL	LIMIT	UNIT	
Drain-Source Voltage			V <sub>DS</sub>	500	M	
Gate-Source Voltage			V <sub>GS</sub>	± 20	V	
Continuous Drain Current	V <sub>GS</sub> at 10 V	$T_{C} = 25 \degree C$ $T_{C} = 100 \degree C$	1_	8.8		
Continuous Drain Current	VGS at 10 V	T <sub>C</sub> = 100 °C	I <sub>D</sub>	5.6	A	
Pulsed Drain Current <sup>a</sup>			I <sub>DM</sub>	35		
Linear Derating Factor		1.2	W/°C			
Single Pulse Avalanche Energy <sup>b</sup>			E <sub>AS</sub>	480	mJ	
Repetitive Avalanche Current <sup>a</sup>			I <sub>AR</sub>	8.8	A	
Repetitive Avalanche Energy <sup>a</sup>			E <sub>AR</sub>	15	mJ	
Maximum Power Dissipation T <sub>C</sub> = 25 °C			PD	150	W	
Peak Diode Recovery dV/dt <sup>c</sup>	dV/dt	3.5	V/ns			
Operating Junction and Storage Temperature Range			T <sub>J</sub> , T <sub>stg</sub>	- 55 to + 150	°C	
Soldering Recommendations (Peak Temperature) for 10 s				300 <sup>d</sup>		
Mounting Torque	6.20 or 1	12 oorour		10	lbf ∙ in	
Mounting Torque	0-32 OF 1	6-32 or M3 screw		1.1	N · m	

#### Notes

a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).

b.  $V_{DD}$  = 50 V, starting T<sub>J</sub> = 25 °C, L = 11 mH, R<sub>g</sub> = 25  $\Omega$ , I<sub>AS</sub> = 8.8 A (see fig. 12).

c.  $I_{SD} \leq 8.8$  A, dI/dt  $\leq 100$  A/µs,  $V_{DD} \leq V_{DS}$ ,  $T_J \leq 150$  °C.

d. 1.6 mm from case.

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

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Vishay Siliconix



$\begin{split} \text{Maximum Junction-to-Ambient} & \text{R}_{\text{th}_{A}} & - & 40 \\ \hline \\ \text{Case-to-Sink, Flat, Greased Surface} & \text{R}_{\text{th}_{DS}} & 0.24 & - & & & & & & & & & & & & & & & & & $	THERMAL RESISTANCE RATI	NGS							
Case-to-Sink, Flat, Greased Surface $R_{trics}$ $0.24$ -          °C/W           SPECIFICATIONS (T <sub>J</sub> = 25 °C, unless otherwise noted)           PARAMETER         SYMBOL         TEST CONDITIONS         Min.         TYP.         MAX.         UN           Gate-Source Dreakdown Voltage         V <sub>DOS</sub> V <sub>DOS</sub> = 250 µA         2.0         -         4.0         V           Zero Gate Voltage Drain Current         IDSS         VDS = 50 V. Ty = 125 °C         -         2.5         µA           India Charge         Qg         VDS         5.0         -	PARAMETER	SYMBOL	TYP. MAX.		UNIT		UNIT		
Maximum Junction-to-Case (Drain) $R_{PUC}$ -       0.83         SPECIFICATIONS (T <sub>J</sub> = 25 °C, unless otherwise noted)       TYP.       MAX.       UN         Static       Static       Vos       Vos       Vos       TYP.       MAX.       UN         Static       Vos       Vos       Vos       Vos       Est conditions       Min.       TYP.       MAX.       UN         Static       Vos       Vos       Vos       Vos       Static       Static       Vos       Static       Vos       Static       Vos       N.       TYP.       MAX.       UN         Gate-Source Treshold Votage       Vos       Vos       Static       Vos       Vos       Static       Vos       Static       Vos       Static       Vos       Static       Vos       Static       Vos	Maximum Junction-to-Ambient	R <sub>thJA</sub>	- 40						
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Case-to-Sink, Flat, Greased Surface	R <sub>thCS</sub>	0.24		-			°C/W	
PARAMETER         SYMBOL         TEST CONDITIONS         MIN.         TYP.         MAX.         UN           Static $V_{DS}$ Temperature Coefficient $\Delta V_{DS}/T_J$ Reference to 25 °C, $I_D = 1 \text{ mA}$ -         0.78         -         V/V           Gate-Source Threshold Voltage $V_{QS}(T)_J$ Reference to 25 °C, $I_D = 1 \text{ mA}$ -         0.78         -         4.0         V           Gate-Source Leakage $I_{QSS}(T)_J$ Nos = V_{QS}, $I_D = 250 \mu$ 2.0         -         4.0         V           Gate-Source Leakage $I_{QSS}(T)_J$ VDS = 500 V, V_{QS} = 0 V         -         -         2.50 $\mu$ Zero Gate Voltage Drain Current $I_{DSS}$ $V_{DS} = 500 V, V_{QS} = 0 V$ -         -         2.50 $\mu$ Drain-Source On-State Resistance $R_{DS(W)}$ $V_{DS} = 50 V, I_D = 5.3 A^D$ -         0.85 $\Omega$ -         0.85 $\Omega$ Portand Cata Charge $Q_g$ $V_{GS} = 10 V$ $I_D = 8.0 A, V_{DS} = 400 V$ -         -         63           Cata Sate Charge $Q_g$ $V_{GS} = 10 V$ $I_D = 8.0 A, V_{DS} = 400 V$ -         -         10	Maximum Junction-to-Case (Drain)	R <sub>thJC</sub>	-		0.83				
PARAMETER         SYMBOL         TEST CONDITIONS         MIN.         TYP.         MAX.         UN           Static $V_{DS}$ Temperature Coefficient $\Delta V_{DS}/T_J$ Reference to 25 °C, $I_D = 1 \text{ mA}$ -         0.78         -         V/V           Gate-Source Threshold Voltage $V_{QS}(T)_J$ Reference to 25 °C, $I_D = 1 \text{ mA}$ -         0.78         -         4.0         V           Gate-Source Leakage $I_{QSS}(T)_J$ Nos = V_{QS}, $I_D = 250 \mu$ 2.0         -         4.0         V           Gate-Source Leakage $I_{QSS}(T)_J$ VDS = 500 V, V_{QS} = 0 V         -         -         2.50 $\mu$ Zero Gate Voltage Drain Current $I_{DSS}$ $V_{DS} = 500 V, V_{QS} = 0 V$ -         -         2.50 $\mu$ Drain-Source On-State Resistance $R_{DS(W)}$ $V_{DS} = 50 V, I_D = 5.3 A^D$ -         0.85 $\Omega$ -         0.85 $\Omega$ Portand Cata Charge $Q_g$ $V_{GS} = 10 V$ $I_D = 8.0 A, V_{DS} = 400 V$ -         -         63           Cata Sate Charge $Q_g$ $V_{GS} = 10 V$ $I_D = 8.0 A, V_{DS} = 400 V$ -         -         10			·						
Static         VDS $V_{GS} = 0 V$ , $I_D = 250 \mu A$ 500         -         -         V           Orain-Source Breakdown Voltage $V_{DS}$ $V_{GS} = 0 V$ , $I_D = 250 \mu A$ 500         -         -         V           Gate-Source Threshold Voltage $V_{GS} = V_{GS}$ , $I_D = 250 \mu A$ -         0.78         -         V/v           Gate-Source Threshold Voltage $V_{GS} = V_{GS}$ , $I_D = 250 \mu A$ -         0.78         -         V/v           Gate-Source Leakage $I_{GSS}$ $V_{GS} = 250 \mu$ -         -         4.0         V/v           Gate-Source Leakage $I_{GSS}$ $V_{GS} = 500 V$ , $V_{GS} = 0 V$ -         -         2.50 $\mu^{\mu}$ Orain-Source On-State Resistance $R_{DS(cn)}$ $V_{GS} = 10 V$ $I_D = 5.3 A^D$ -         0.85         0           Porward Transconductance $G_{css}$ $V_{GS} = 0 V$ , $V_{DS} = 25 V$ , $I_D = 5.3 A^D$ -         1300         -           Input Capacitance $C_{css}$ $V_{GS} = 0 V$ , $V_{DS} = 25 V$ , $I_D = 8.0 A$ , $V_{DS} = 400 V$ -         1300         -           Gate-Source Charge $Q_{gd}$ $V_{GS} = 10 V$ I_D = 8.0 A, $V_{DS} = 400 V$	<b>SPECIFICATIONS</b> ( $T_J = 25 \text{ °C}$ , u	Inless otherw	ise noted)						
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT	
	Static		·						
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Drain-Source Breakdown Voltage	V <sub>DS</sub>	$V_{GS} = 0$	) V, I <sub>D</sub> = 2	250 µA	500	-	-	V
Gate-Source Leakage         IGSS $V_{GS} = \pm 20$ V         -         +         100         n/A           Zero Gate Voltage Drain Current         IDSS $V_{DS} = 500$ V, $V_{GS} = 0$ V         -         -         250         µ/A           Drain-Source On-State Resistance         RDS(on) $V_{GS} = 10$ V         Ip = 5.3 A <sup>b</sup> -         -         0.85 $\Omega$ Forward Transconductance         gts $V_{DS} = 500$ V, $V_{GS} = 0$ V, $U_{D} = 5.3$ A <sup>b</sup> -         -         0.85 $\Omega$ Dupanic         nput Capacitance $C_{GSS}$ $V_{DS} = 500$ V, $V_{DS} = 500$ V, $U_{D} = 5.3$ A <sup>b</sup> -         -	V <sub>DS</sub> Temperature Coefficient	$\Delta V_{DS}/T_{J}$	Reference	to 25 °C,	I <sub>D</sub> = 1 mA	-	0.78	-	V/°C
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Gate-Source Threshold Voltage	V <sub>GS(th)</sub>	$V_{DS} = V$	/ <sub>GS</sub> , I <sub>D</sub> = 2	250 µA	2.0	-	4.0	V
Zero Gate Voltage Drain Current         Ibss         VDS = 400 V, V0S = 0 V, TJ = 125 °C         -         -         250 $\mu^{\mu}$ Drain-Source On-State Resistance         RDS(ort)         VGS = 10 V         Ib = 5.3 Åb         -         -         0.85 $\Omega$ Forward Transconductance         gfs         VDS = 50 V, Ib = 5.3 Åb         5.3         -         -         S           Dynamic         VDS = 50 V, Ib = 5.3 Åb         5.3         -         -         S           Dutput Capacitance         Ciss         VDS = 25 V, Ib = 5.3 Åb         -         1300         -           Output Capacitance         Ciss         VDS = 25 V, Ib = 5.3 Åb         -         120         -           Total Gate Charge         Qg         VDS = 10 V         Ib = 8.0 A, VDS = 400 V         -         -         63           Gate-Drain Charge         Qgd         VDS = 10 V         Ib = 8.0 A, VDS = 400 V         -         -         11         nd           Gate-Drain Charge         Qgd         VDS = 250 V, Ib = 8.0 A, Ib = 8.0 A, Ib = 8.0 A, Ib = 7.2 3.0         -         14         -         -         23         -         -         14         -         -         23         -         -         14         -	Gate-Source Leakage	I <sub>GSS</sub>	Ve	<sub>as</sub> = ± 20	V	-	-	± 100	nA
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Zara Cata Valtaga Drain Currant	1	V <sub>DS</sub> = 5	600 V, V <sub>G</sub>	<sub>S</sub> = 0 V	-	-	25	
Forward Transconductance $g_{fs}$ $V_{DS} = 50 \text{ V}, I_D = 5.3 \text{ A}^b$ $5.3$ -         -         S           Dynamic         Input Capacitance $C_{685}$ $V_{DS} = 50 \text{ V}, I_D = 5.3 \text{ A}^b$ $5.3$ -         -         S           Output Capacitance $C_{085}$ $V_{DS} = 25 \text{ V},$ - $310$ -         pf           Reverse Transfer Capacitance $C_{rss}$ $f = 1.0 \text{ MHz}$ , see fig. 5         - $120$ -           Total Gate Charge $Q_{gg}$ $V_{GS} = 10 \text{ V}$ $I_D = 8.0 \text{ A}, V_{DS} = 400 \text{ V}$ -         -         633           Gate-Drain Charge $Q_{gd}$ $V_{GS} = 10 \text{ V}$ $I_D = 8.0 \text{ A}, V_{DS} = 400 \text{ V}$ -         -         11         nt           Gate-Drain Charge $Q_{gd}$ $V_{DD} = 250 \text{ V}, I_D = 8.0 \text{ A},$ -         23         -         -         14         -         -         230         -         -         14         -         -         230         -         -         14         -         -         230         -         -         14         -         -         200         -         -         130 \text{ -} <td>Zero Gate voltage Drain Current</td> <td>IDSS</td> <td>V<sub>DS</sub> = 400 V, V</td> <td>V<sub>GS</sub> = 0 V</td> <td>′, T<sub>J</sub> = 125 °C</td> <td>-</td> <td>-</td> <td>250</td> <td>μΑ</td>	Zero Gate voltage Drain Current	IDSS	V <sub>DS</sub> = 400 V, V	V <sub>GS</sub> = 0 V	′, T <sub>J</sub> = 125 °C	-	-	250	μΑ
DynamicInput Capacitance $C_{iss}$ $V_{GS} = 0$ V, $V_{DS} = 25$ V, f = 1.0 MHz, see fig. 5-1300-Output Capacitance $C_{css}$ $V_{DS} = 25$ V, f = 1.0 MHz, see fig. 5-1300-Total Gate Charge $Q_g$ Gate-Drain Charge $Q_{gd}$ Gate-Drain Charge $Q_{gd}$ Turn-On Delay Time $t_{d(on)}$ Rise Time $t_r$ Turn-Off Delay Time $t_{d(off)}$ Fall Time $t_r$ Internal Drain Inductance $L_D$ Between lead, 6 mm (0.25") from package and center of die contact-Drain-Source Body Diode CharacteristicsContinuous Source-Drain Diode Current $I_S$ Pulsed Diode Forward Currenta $I_S$ Body Diode Reverse Recovery Time $t_r$ $T_u = 25$ °C, $I_F = 8.0$ A, $dI/dt = 100$ A/µsb $T_u = 25$ °C, $I_F = 8.0$ A, $dI/dt = 100$ A/µsb	Drain-Source On-State Resistance	R <sub>DS(on)</sub>	$V_{GS} = 10 \text{ V}$ $I_D = 5.3 \text{ A}^{b}$		-	-	0.85	Ω	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	Forward Transconductance	9 <sub>fs</sub>	$V_{DS} = 50 \text{ V}, \text{ I}_{D} = 5.3 \text{ A}^{b}$		5.3	-	-	S	
Output Capacitance $C_{oss}$ $V_{DS} = 25 \text{ V}$ , f = 1.0 MHz, see fig. 5         -         310         -         pf           Reverse Transfer Capacitance $C_{rss}$ f = 1.0 MHz, see fig. 5         -         120         -         63         -         120         -         63           Gate-Source Charge $Q_{gs}$ $V_{GS} = 10 \text{ V}$ $I_D = 8.0 \text{ A}, V_{DS} = 400 \text{ V}$ see fig. 6 and 13 <sup>b</sup> -         -         63         -         -         63         -         -         63         -         -         63         -         -         63         -         -         -         63         -         -         -         63         -         -         -         10         -         -         30         -         -         -         11         no         -         -         30         -         -         14         -         -         -         14         -         -         20         -         -         14         -         -         20         -         -         14         -         -         20         -         -         14         -         -         5.0         -         -         13	Dynamic		•						
Reverse Transfer Capacitance $C_{rss}$ $f = 1.0 \text{ MHz}$ , see fig. 5- $120$ -Total Gate Charge $Q_g$ $Q_{gs}$ $V_{GS} = 10 \text{ V}$ $I_D = 8.0 \text{ A}, V_{DS} = 400 \text{ V}$ 63Gate-Source Charge $Q_{gd}$ $V_{GS} = 10 \text{ V}$ $I_D = 8.0 \text{ A}, V_{DS} = 400 \text{ V}$ 63Gate-Drain Charge $Q_{gd}$ $V_{GS} = 10 \text{ V}$ $I_D = 8.0 \text{ A}, V_{DS} = 400 \text{ V}$ 63Turn-On Delay Time $t_{d(on)}$ $R_{gg} = 9.1 \Omega, R_D = 31 \Omega$ , see fig. 10 <sup>b</sup> 14-Turn-Off Delay Time $t_{d(off)}$ $R_g = 9.1 \Omega, R_D = 31 \Omega$ , see fig. 10 <sup>b</sup> -20-Fall Time $t_f$ Between lead, 6 mm (0.25") from package and center of die contact-5.0Internal Source Inductance $L_S$ MOSFET symbol showing the integral reverse $\rho$ - n junction diode35APulsed Diode Forward Current <sup>a</sup> $I_{SM}$ $T_J = 25 \text{ °C}, I_F = 8.0 \text{ A}, dI/dt = 100 \text{ A}/\mu \text{s}^b$ 2.0VBody Diode Reverse Recovery Time $t_{rr}$ $T_J = 25 \text{ °C}, I_F = 8.0 \text{ A}, dI/dt = 100 \text{ A}/\mu \text{s}^b$ 2.0VBody Diode Reverse Recovery Charge $Q_{rr}$ $T_J = 25 \text{ °C}, I_F = 8.0 \text{ A}, dI/dt = 100 \text{ A}/\mu \text{s}^b$ 2.0V-3.57.6 $\mu$ 0.00.00.00.0 <td>Input Capacitance</td> <td>C<sub>iss</sub></td> <td>۱. ۱</td> <td>/<sub>GS</sub> = 0 V</td> <td>,</td> <td>-</td> <td>1300</td> <td>-</td> <td></td>	Input Capacitance	C <sub>iss</sub>	۱. ۱	/ <sub>GS</sub> = 0 V	,	-	1300	-	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Output Capacitance	C <sub>oss</sub>	V	<sub>DS</sub> = 25 V	Ι,	-	310	-	pF
Gate-Source Charge $Q_{gg}$ $V_{GS} = 10 \text{ V}$ $I_D = 8.0 \text{ A}, V_{DS} = 400 \text{ V}$ see fig. 6 and 13b $  11$ $nC$ Gate-Drain Charge $Q_{gd}$ $Q_{gd}$ $V_{GS} = 10 \text{ V}$ $I_D = 8.0 \text{ A}, V_{DS} = 400 \text{ V}$ see fig. 6 and 13b $  114$ $  30$ Turn-On Delay Time $t_{d(off)}$ $T_r$ $V_{DD} = 250 \text{ V}, I_D = 8.0 \text{ A},$ $R_g = 9.1 \Omega, R_D = 31 \Omega, see fig. 10b 23 14-Turn-Off Delay Timet_{d(off)}R_g = 9.1 \Omega, R_D = 31 \Omega, see fig. 10b 20 49-Fall Timet_fR_g = 9.1 \Omega, R_D = 31 \Omega, see fig. 10^b 5.0  13-Internal Drain InductanceL_DBetween lead,6 \text{ mm} (0.25") frompackage and center ofdie contact 13  13-Drain-Source Body Diode CharacteristicsMOSFET symbolshowing theintegral reversep - n junction diode  8.8   8.8-Body Diode VoltageV_{SD}T_J = 25 ^{\circ}C, I_S = 8.8 A, V_{GS} = 0 V^b  2.0VBody Diode Reverse Recovery ChargeQ_{rr}T_J = 25 ^{\circ}C, I_F = 8.0 A, dI/dt = 100 A/\mu s^b 460970nsR_{S} = 0 V_D Diode Reverse Recovery ChargeQ_{rr}T_J = 25 ^{\circ}C, I_F = 8.0 A, dI/dt = 100 A/\mu s^b  2.0V$	Reverse Transfer Capacitance	C <sub>rss</sub>	f = 1.0	MHz, see	e fig. 5	-	120	-	
Gate-Source Charge $Q_{gs}$ $V_{GS} = 10$ Vsee fig. 6 and 13b11nCGate-Drain Charge $Q_{gd}$ 11nCGate-Drain Charge $Q_{gd}$ 30Turn-On Delay Time $t_{d(on)}$ $V_{DD} = 250$ V, $I_D = 8.0$ A,-14-Rise Time $t_r$ $V_{DD} = 250$ V, $I_D = 8.0$ A,-23-Turn-Off Delay Time $t_{d(off)}$ $R_g = 9.1$ $\Omega$ , $R_D = 31$ $\Omega$ , see fig. 10b-20-Fall Time $t_r$ $L_D$ Between lead, 6 mm (0.25°) from package and center of die contact-5.0Internal Source Inductance $L_S$ MOSFET symbol showing the integral reverse $p - n$ junction diode8.8APulsed Diode Forward Current* $I_S$ MOSFET symbol showing the integral reverse $p - n$ junction diode3.5ABody Diode Voltage $V_{SD}$ $T_J = 25$ °C, $I_S = 8.8$ A, $V_{GS} = 0$ Vb2.0VBody Diode Reverse Recovery Time $t_{rr}$ $T_J = 25$ °C, $I_F = 8.0$ A, dl/dt = 100 A/µsb2.0VGate Diode Reverse Recovery Charge $Q_{rr}$ $T_J = 25$ °C, $I_F = 8.0$ A, dl/dt = 100 A/µsb3.57.6µC	Total Gate Charge	Qg				-	-	63	
Gate-Drain Charge $Q_{gd}$ 30Turn-On Delay Time $t_{d(on)}$ Rise Time $t_r$ Turn-Off Delay Time $t_r$ Turn-Off Delay Time $t_{d(off)}$ Fall Time $t_q$ Fall Time $t_f$ Internal Drain Inductance $L_D$ Between lead, 6 mm (0.25") from package and center of die contact-Internal Source Inductance $L_S$ Drain-Source Body Diode CharacteristicsContinuous Source-Drain Diode CurrentIs Is MMSFET symbol showing the integral reverse $p - n$ junction diodePulsed Diode Forward CurrentaIs $M_S$ Body Diode Voltage $V_{SD}$ T_J = 25 °C, I_S = 8.8 A, V_{GS} = 0 V^b-T_J = 25 °C, I_F = 8.0 A, dI/dt = 100 A/µs^b-36.8 <td>Gate-Source Charge</td> <td>Q<sub>gs</sub></td> <td>V<sub>GS</sub> = 10 V</td> <td></td> <td></td> <td>-</td> <td>-</td> <td>11</td> <td>nC</td>	Gate-Source Charge	Q <sub>gs</sub>	V <sub>GS</sub> = 10 V			-	-	11	nC
Rise Time $t_r$ $V_{DD} = 250 \text{ V}, \text{ I}_D = 8.0 \text{ A},$ $ 23$ $  23$ $   49$ $   49$ $   49$ $   20$ $  20$ $  20$ $  20$ $  20$ $  20$ $  20$ $  20$ $  20$ $  20$ $  20$ $  20$ $   20$ $   20$ $   20$ $   20$ $   20$ $  -$ <	Gate-Drain Charge	Q <sub>gd</sub>	-	see	lig. 6 and 135	-	-	30	1
Rise Time $t_r$ $V_{DD} = 250 \text{ V}, \text{ I}_D = 8.0 \text{ A},$ $ 23$ $  23$ $   49$ $   49$ $   49$ $   20$ $  20$ $  20$ $  20$ $  20$ $  20$ $  20$ $  20$ $  20$ $  20$ $  20$ $  20$ $   20$ $   20$ $   20$ $   20$ $   20$ $  -$ <	Turn-On Delay Time	t <sub>d(on)</sub>		L		-	14	-	
Turn-Off Delay Time $t_{d(off)}$ $R_g = 9.1 \Omega, R_D = 31 \Omega, see fig. 10^b$ $ 49$ $-$ Fall Time $t_f$ Internal Drain Inductance $L_D$ Internal Source Inductance $L_S$ Between lead, 6 mm (0.25") from package and center of die contact $ 5.0$ $-$ Internal Source Inductance $L_S$ Between lead, 6 mm (0.25") from package and center of die contact $ 13$ $-$ Drain-Source Body Diode Characteristics $ 13$ $ 13$ $-$ Continuous Source-Drain Diode Current $I_S$ MOSFET symbol showing the integral reverse $p - n$ junction diode $  8.8$ $A$ Pulsed Diode Forward Currenta $I_{SM}$ $T_J = 25$ °C, $I_S = 8.8$ A, $V_{GS} = 0$ Vb $  2.0$ VBody Diode Reverse Recovery Time $t_{rr}$ $T_J = 25$ °C, $I_F = 8.0$ A, dl/dt = $100$ A/µsb $ 460$ $970$ $ns$ Body Diode Reverse Recovery Charge $Q_{rr}$ $T_r = 25$ °C, $I_F = 8.0$ A, dl/dt = $100$ A/µsb $ 460$ $970$ $ns$	Rise Time		V <sub>DD</sub> = 2	50 V. In =	= 8.0 A.	-	23	-	
Fall Time $t_f$ -20-Internal Drain Inductance $L_D$ Between lead, 6 mm (0.25") from package and center of die contact-5.0Internal Source Inductance $L_S$ $L_S$ MOSFET symbol showing the integral reverse $p - n$ junction diode-13Pulsed Diode Forward Currenta $I_SM$ MOSFET symbol showing the integral reverse $p - n$ junction diode8.8ABody Diode Reverse Recovery Time $V_{SD}$ $T_J = 25$ °C, $I_S = 8.8$ A, $V_{GS} = 0$ Vb2.0VT_J = 25 °C, $I_F = 8.0$ A, dl/dt = 100 A/µsb-460970nsGody Diode Reverse Recovery Charge $Q_{rr}$ T_J = 25 °C, $I_F = 8.0$ A, dl/dt = 100 A/µsb-460970ns	Turn-Off Delay Time	t <sub>d(off)</sub>		. 5		-	49	-	ns
Internal Drain InductanceLD6 mm (0.25") from package and center of die contact-5.0nHInternal Source InductanceLs6 mm (0.25") from package and center of die contact-13-nHDrain-Source Body Diode CharacteristicsContinuous Source-Drain Diode CurrentIsMOSFET symbol showing the integral reverse p - n junction diode8.8APulsed Diode Forward CurrentaIsMOSFET symbol showing the integral reverse p - n junction diode8.8ABody Diode VoltageVsDTJ = 25 °C, Is = 8.8 A, VGS = 0 Vb2.0VBody Diode Reverse Recovery TimetrrTJ = 25 °C, IF = 8.0 A, dI/dt = 100 A/µsb-460970nsBody Diode Reverse Recovery ChargeQrrTJ = 25 °C, IF = 8.0 A, dI/dt = 100 A/µsb-460970ns-3.57.6µC1.5-1.5	Fall Time			0 - 01 32	, see lig. 10	-	20	-	
Internal Source InductanceLspackage and center of die contactImage: second secon	Internal Drain Inductance	L <sub>D</sub>		m		-	5.0	-	
Continuous Source-Drain Diode CurrentIsMOSFET symbol showing the integral reverse $p - n$ junction diode8.8Pulsed Diode Forward CurrentaIsMIsMTJ = 25 °C, Is = 8.8 A, VGS = 0 Vb35Body Diode VoltageVsDTJ = 25 °C, Is = 8.8 A, VGS = 0 Vb2.0VBody Diode Reverse Recovery TimetrrTJ = 25 °C, IF = 8.0 A, dI/dt = 100 A/µsb-460970nsBody Diode Reverse Recovery ChargeQrrTJ = 25 °C, IF = 8.0 A, dI/dt = 100 A/µsb-3.57.6µC	Internal Source Inductance	Ls		nter of		-	13	-	nH
Continuous Source-Drain Diode CurrentIs Is showing the integral reverse p - n junction diodeshowing the integral reverse p - n junction diode8.8 8.8 -APulsed Diode Forward CurrentaIs Is NIs Is P - n junction diode35ABody Diode VoltageVspTJ = 25 °C, Is = 8.8 A, Vgs = 0 Vb2.0VBody Diode Reverse Recovery Timetrr TJ = 25 °C, Is = 8.0 A, dI/dt = 100 A/µsb-460970nsBody Diode Reverse Recovery ChargeQrrTJ = 25 °C, Is = 8.0 A, dI/dt = 100 A/µsb-3.57.6µC	Drain-Source Body Diode Characteristic	cs							•
Pulsed Diode Forward Currenta $I_{SM}$ Integral reverse $\bullet$ $\bullet$ $ 35$ Body Diode Voltage $V_{SD}$ $T_J = 25 \text{ °C}, I_S = 8.8 \text{ A}, V_{GS} = 0 \text{ Vb}$ $  2.0 \text{ V}$ Body Diode Reverse Recovery Time $t_{rr}$ $T_J = 25 \text{ °C}, I_F = 8.0 \text{ A}, dI/dt = 100 \text{ A/µsb}$ $ 460$ $970$ $ns$ Body Diode Reverse Recovery Charge $Q_{rr}$ $T_J = 25 \text{ °C}, I_F = 8.0 \text{ A}, dI/dt = 100 \text{ A/µsb}$ $ 3.5$ $7.6 \text{ µC}$	Continuous Source-Drain Diode Current	I <sub>S</sub>	showing the	I		-	-	8.8	
Body Diode Reverse Recovery Time $t_{rr}$ $T_J = 25 \ ^{\circ}C$ , $I_F = 8.0 \ ^{\circ}A$ , $dI/dt = 100 \ ^{\circ}A/\mu s^b$ -460970nsBody Diode Reverse Recovery Charge $Q_{rr}$ $T_J = 25 \ ^{\circ}C$ , $I_F = 8.0 \ ^{\circ}A$ , $dI/dt = 100 \ ^{\circ}A/\mu s^b$ -3.57.6 $\mu C$	Pulsed Diode Forward Current <sup>a</sup>	I <sub>SM</sub>		ode		-	-	35	A
Body Diode Reverse Recovery Charge $Q_{rr}$ $T_J = 25 \text{ °C}, I_F = 8.0 \text{ A}, dI/dt = 100 \text{ A/}\mu\text{s}^b$ - 3.5 7.6 $\mu\text{C}$	Body Diode Voltage	V <sub>SD</sub>	T <sub>J</sub> = 25 °C, I	<sub>S</sub> = 8.8 A	, $V_{GS} = 0 V^{b}$	-	-	2.0	V
Body Diode Reverse Recovery Charge Q <sub>rr</sub> - 3.5 7.6 μC	Body Diode Reverse Recovery Time	t <sub>rr</sub>	T 25 °C I	מטע אי	/dt - 100 A/uch	-	460	970	ns
Forward Turn-On Time ton Intrinsic turn-on time is negligible (turn-on is dominated by L <sub>S</sub> and L <sub>D</sub> )	Body Diode Reverse Recovery Charge	Q <sub>rr</sub>	$I_{\rm J} = 23$ U, $I_{\rm F} =$	0.0 A, dl	$a_1 = 100 A \mu S^{0}$	-	3.5	7.6	μC
	Forward Turn-On Time	t <sub>on</sub>	Intrinsic turn	on time	is negligible (turn	-on is dor	minated b	y L <sub>S</sub> and	L <sub>D</sub> )

#### Notes

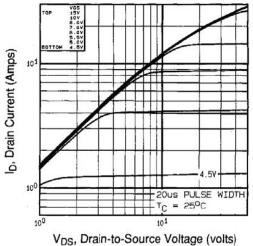
a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).

b. Pulse width  $\leq$  300 µs; duty cycle  $\leq$  2 %.

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### \_\_\_\_\_

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



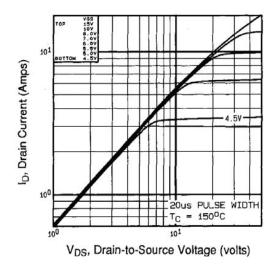
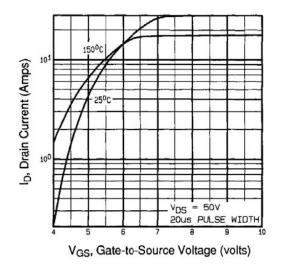


Fig. 2 - Typical Output Characteristics,  $T_C$  = 150  $^\circ C$ 

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#### Fig. 3 - Typical Transfer Characteristics

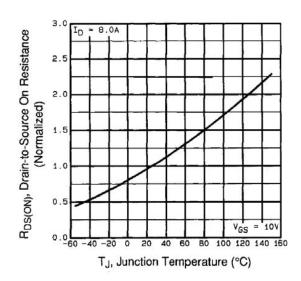


Fig. 4 - Normalized On-Resistance vs. Temperature

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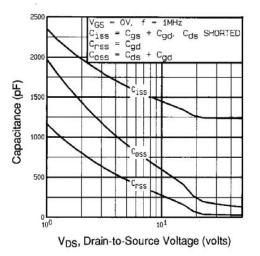


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

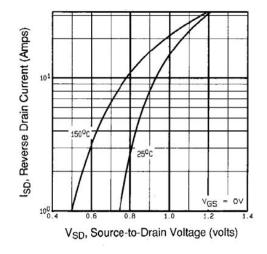


Fig. 7 - Typical Source-Drain Diode Forward Voltage

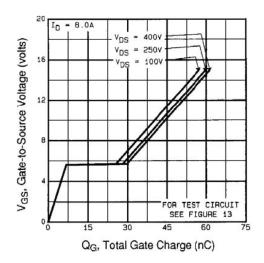


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

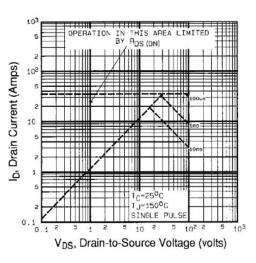


Fig. 8 - Maximum Safe Operating Area

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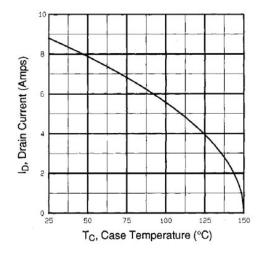


Fig. 9 - Maximum Drain Current vs. Case Temperature

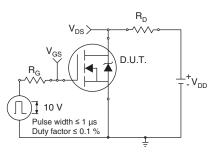


Fig. 10a - Switching Time Test Circuit

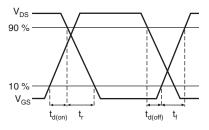


Fig. 10b - Switching Time Waveforms

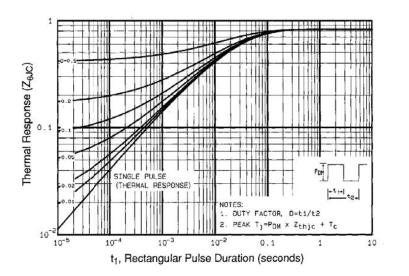


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

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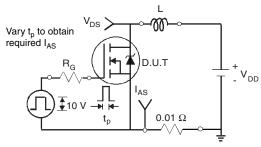


Fig. 12a - Unclamped Inductive Test Circuit

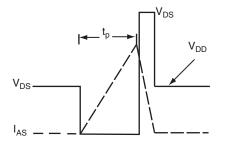


Fig. 12b - Unclamped Inductive Waveforms

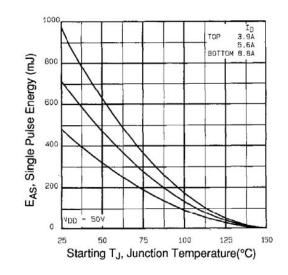


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

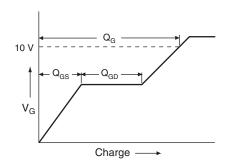
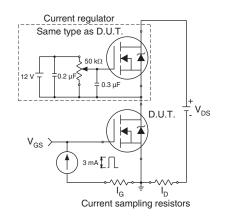


Fig. 13a - Basic Gate Charge Waveform

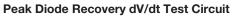


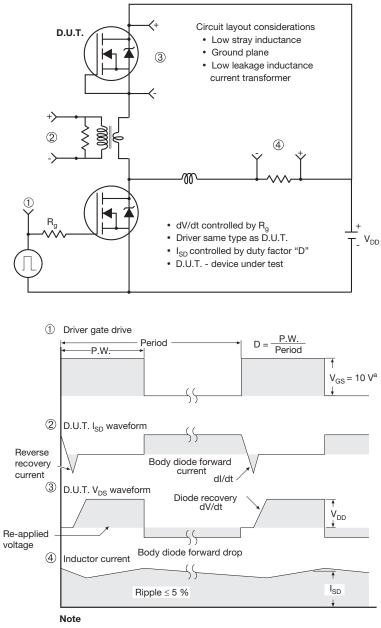


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a.  $V_{GS} = 5 V$  for logic level devices

Fig.14 - For N-Channel

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# **TO-247AC (High Voltage)**

### VERSION 1: FACILITY CODE = 9





Section C--C, D--D, E--E

	MILLIN	IETERS	
DIM.	MIN.	MAX.	NOTES
А	4.83	5.21	
A1	2.29	2.55	
A2	1.50	2.49	
b	1.12	1.33	
b1	1.12	1.28	
b2	1.91	2.39	6
b3	1.91	2.34	
b4	2.87	3.22	6, 8
b5	2.87	3.18	
С	0.55	0.69	6
c1	0.55	0.65	
D	20.40	20.70	4

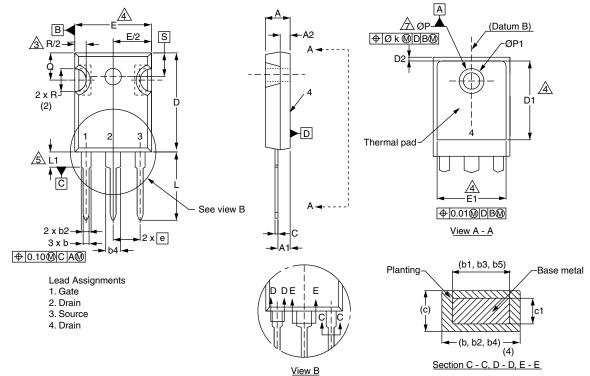
	MILLIN	MILLIMETERS			
DIM.	MIN.	MAX.	NOTES		
D1	16.25	16.85	5		
D2	0.56	0.76			
E	15.50	15.87	4		
E1	13.46	14.16	5		
E2	4.52	5.49	3		
е	5.44				
L	14.90	15.40			
L1	3.96	4.16	6		
ØP	3.56	3.65	7		
Ø P1	7.19				
Q	5.31	5.69			
S	5.54	5.74			

#### Notes

- <sup>(1)</sup> Package reference: JEDEC TO247, variation AC
- (2) All dimensions are in mm
- <sup>(3)</sup> Slot required, notch may be rounded
- (4) Dimension D and E do not include mold flash. Mold flash shall not exceed 0.127 mm per side. These dimensions are measured at the outermost extremes of the plastic body
- <sup>(5)</sup> Thermal pad contour optional with dimensions D1 and E1
- (6) Lead finish uncontrolled in L1
- (7) Ø P to have a maximum draft angle of 1.5° to the top of the part with a maximum hole diameter of 3.91 mm
- (8) Dimension b2 and b4 does not include dambar protrusion. Allowable dambar protrusion shall be 0.1 mm total in excess of b2 and b4 dimension at maximum material condition



### **VERSION 2: FACILITY CODE = Y**



MILLIMETERS		MILLIMETERS		MILLIMETERS			
DIM.	MIN.	MAX.	NOTES	DIM.	MIN.	MAX.	NOTE
А	4.58	5.31		D2	0.51	1.30	
A1	2.21	2.59		E	15.29	15.87	
A2	1.17	2.49		E1	13.72	-	
b	0.99	1.40		е	5.46	BSC	
b1	0.99	1.35		Øk	0.	254	
b2	1.53	2.39		L	14.20	16.25	
b3	1.65	2.37		L1	3.71	4.29	
b4	2.42	3.43		ØP	3.51	3.66	
b5	2.59	3.38		Ø P1	-	7.39	
С	0.38	0.86		Q	5.31	5.69	
c1	0.38	0.76		R	4.52	5.49	
D	19.71	20.82		S	5.51	BSC	
D1	13.08	-					

#### Notes

- <sup>(1)</sup> Dimensioning and tolerancing per ASME Y14.5M-1994
- (2) Contour of slot optional
- (3) Dimension D and E do not include mold flash. Mold flash shall not exceed 0.127 mm (0.005") per side. These dimensions are measured at the outermost extremes of the plastic body
- <sup>(4)</sup> Thermal pad contour optional with dimensions D1 and E1
- <sup>(5)</sup> Lead finish uncontrolled in L1
- (6) Ø P to have a maximum draft angle of 1.5 to the top of the part with a maximum hole diameter of 3.91 mm (0.154")
- <sup>(7)</sup> Outline conforms to JEDEC outline TO-247 with exception of dimension c
- <sup>(8)</sup> Xian and Mingxin actually photo



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