

IPW60R190E6FKSA1-VB Datasheet

N-Channel 600V (D-S) Super Junction Power MOSFET

PRODUCT SUMMARY		
V_{DS} (V) at T_J max.	600	
$R_{DS(on)}$ at 25 °C (Ω)	$V_{GS} = 10$ V	0.160

FEATURES

- Low figure-of-merit (FOM) $R_{on} \times Q_g$
- Low input capacitance (C_{iss})
- Reduced switching and conduction losses
- Ultra low gate charge (Q_g)
- Avalanche energy rated (UIS)



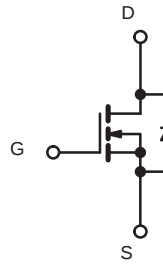
APPLICATIONS

- Server and telecom power supplies
- Switch mode power supplies (SMPS)
- Power factor correction power supplies (PFC)
- Lighting
 - High-intensity discharge (HID)
 - Fluorescent ballast lighting

TO-247



Top View



N-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS (T _C = 25 °C, unless otherwise noted)					
PARAMETER			SYMBOL	LIMIT	UNIT
Drain-Source Voltage			V _{DS}	600	V
Gate-Source Voltage			V _{GS}	± 30	
Continuous Drain Current (T _J = 150 °C)	V _{GS} at 10 V	T _C = 25 °C	I _D	20	A
		T _C = 100 °C		12	
Pulsed Drain Current ^a			I _{DM}	60	
Linear Derating Factor				1.67	W/°C
Single Pulse Avalanche Energy ^b			E _{AS}	1000	mJ
Maximum Power Dissipation			P _D	160	W
Operating Junction and Storage Temperature Range			T _J , T _{stg}	-55 to +150	°C
Drain-Source Voltage Slope	T _J = 125 °C		dV/dt	50	V/ns
Reverse Diode dV/dt ^d		15			
Soldering Recommendations (Peak Temperature) ^c	for 10 s			260	°C

Notes

- Repetitive rating; pulse width limited by maximum junction temperature.
- $V_{DD} = 100$ V, starting $T_J = 25$ °C, $L = 30$ mH, $R_g = 25$ Ω , $I_{AS} = 13$ A.
- 1.6 mm from case.
- $I_{SD} \leq I_D$, $dI/dt = 100$ A/ μ s, starting $T_J = 25$ °C.

THERMAL RESISTANCE RATINGS

PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient	R_{thJA}	-	62	°C/W
Maximum Junction-to-Case (Drain)	R_{thJC}	-	0.38	

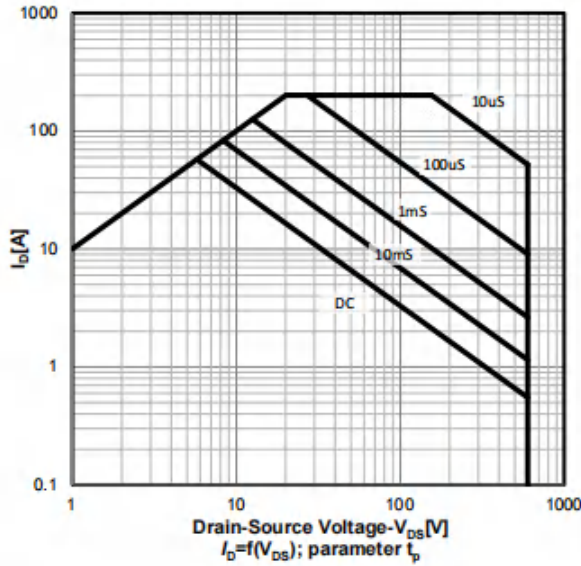
SPECIFICATIONS ($T_J = 25\text{ }^{\circ}\text{C}$, unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Static						
Drain-Source Breakdown Voltage	V_{DS}	$V_{GS} = 0\text{ V}$, $I_D = 1\text{ mA}$	600	-	-	V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to $25\text{ }^{\circ}\text{C}$, $I_D = 1\text{ mA}$	-	0.70	-	V/°C
Gate-Source Threshold Voltage (N)	$V_{GS(th)}$	$V_{DS} = V_{GS}$, $I_D = 250\text{ }\mu\text{A}$	2.5	-	4.5	V
Gate-Source Leakage	I_{GSS}	$V_{GS} = \pm 20\text{ V}$	-	-	± 100	nA
		$V_{GS} = \pm 30\text{ V}$	-	-	± 1	μA
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 600\text{ V}$, $V_{GS} = 0\text{ V}$	-	-	1	μA
		$V_{DS} = 480\text{ V}$, $V_{GS} = 0\text{ V}$, $T_J = 125\text{ }^{\circ}\text{C}$	-	-	100	
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}$, $I_D = 7\text{ A}$	-	0.160	-	Ω
Forward Transconductance	g_{fs}	$V_{DS} = 30\text{ V}$, $I_D = 7\text{ A}$	-	5.6	-	S
Dynamic						
Input Capacitance	C_{iss}	$V_{GS} = 0\text{ V}$, $V_{DS} = 100\text{ V}$, $f = 1\text{ MHz}$	-	2300	-	pF
Output Capacitance	C_{oss}		-	330	-	
Reverse Transfer Capacitance	C_{rss}		-	4	-	
Effective Output Capacitance, Energy Related ^a	$C_{o(er)}$	$V_{DS} = 0\text{ V to } 520\text{ V}$, $V_{GS} = 0\text{ V}$	-	63	-	
Effective Output Capacitance, Time Related ^b	$C_{o(tr)}$		-	213	-	
Total Gate Charge	Q_g	$V_{GS} = 10\text{ V}$, $I_D = 20\text{ A}$, $V_{DS} = 520\text{ V}$	-	62	-	nC
Gate-Source Charge	Q_{gs}		-	39	-	
Gate-Drain Charge	Q_{gd}		-	4.7	-	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 520\text{ V}$, $I_D = 20\text{ A}$, $V_{GS} = 10\text{ V}$, $R_g = 9.1\text{ }\Omega$	-	18	25	ns
Rise Time	t_r		-	24	55	
Turn-Off Delay Time	$t_{d(off)}$		-	8.0	-	
Fall Time	t_f		-	1.2	-	
Gate Input Resistance	R_g	$f = 1\text{ MHz}$, open drain	-	0.8	-	Ω
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	I_{SM}		-	-	60	
Diode Forward Voltage	V_{SD}	$T_J = 25\text{ }^{\circ}\text{C}$, $I_S = 8\text{ A}$, $V_{GS} = 0\text{ V}$	-	-	1.5	V
Reverse Recovery Time	t_{rr}	$T_J = 25\text{ }^{\circ}\text{C}$, $I_F = I_S = 8\text{ A}$, $dI/dt = 100\text{ A}/\mu\text{s}$, $V_R = 400\text{ V}$	-	520	-	ns
Reverse Recovery Charge	Q_{rr}		-	5.8	-	μC
Reverse Recovery Current	I_{RRM}		-	4.5	-	A

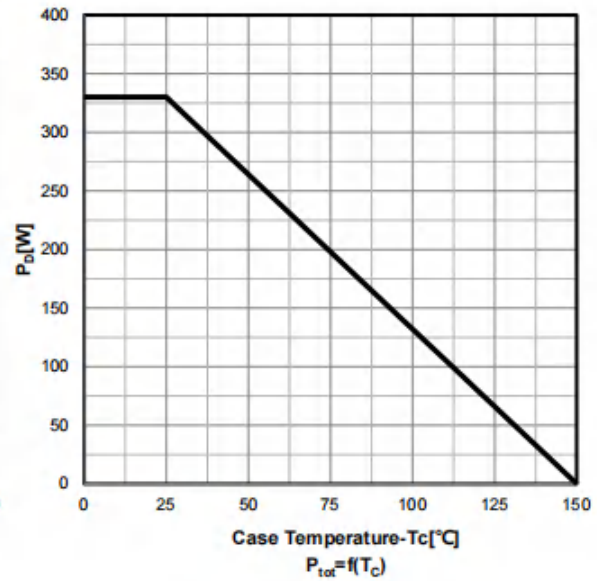
Notes

- 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_{DSS} .
 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_{DSS} .

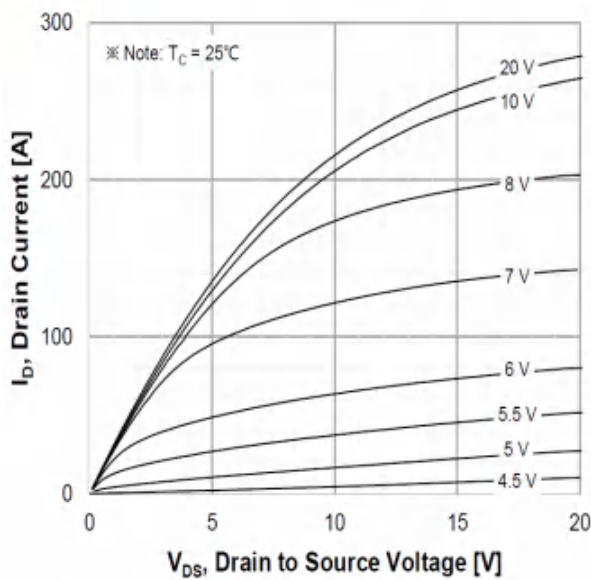
Safe operating area TC=25 °C
TO-247



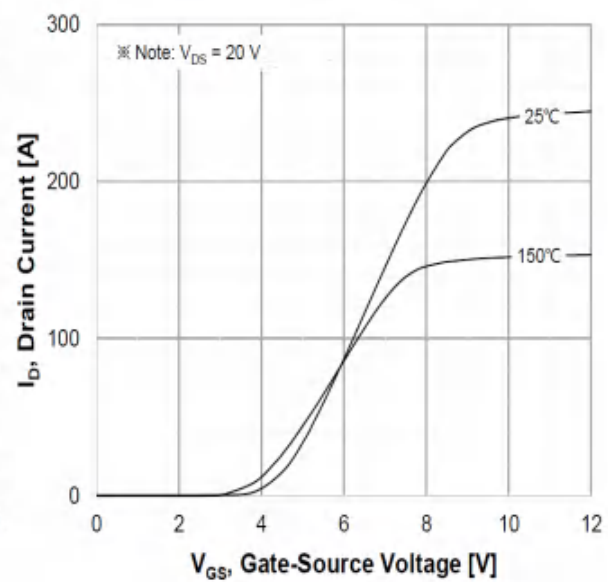
Power dissipation



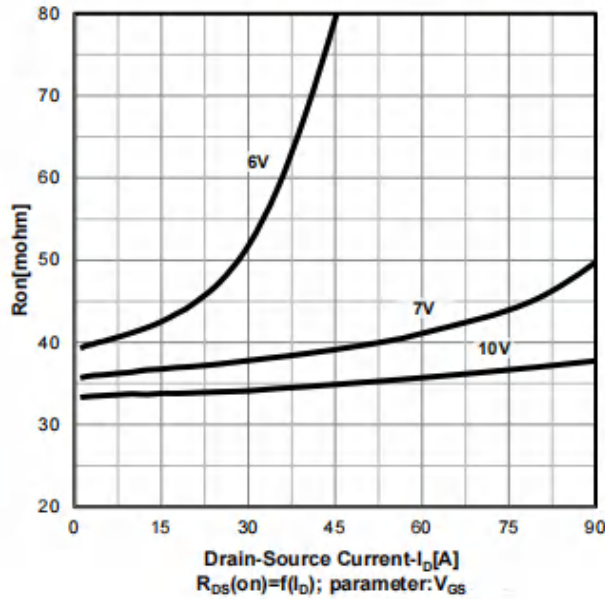
Typ. output characteristics $T_J=25$ °C



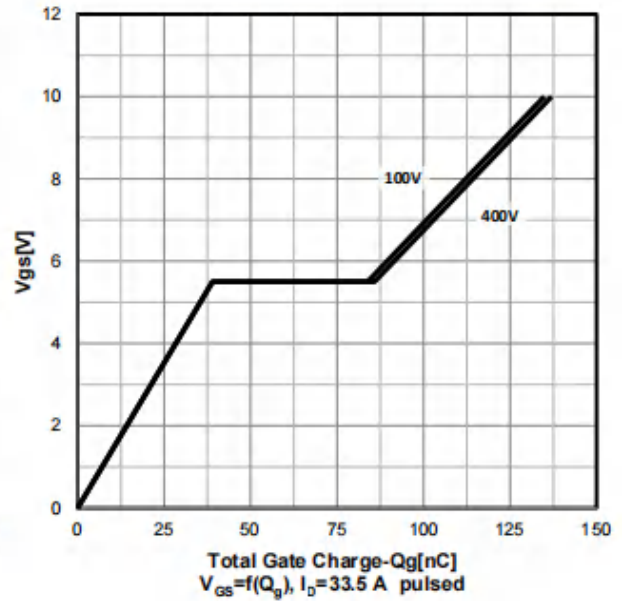
Transfer characteristics



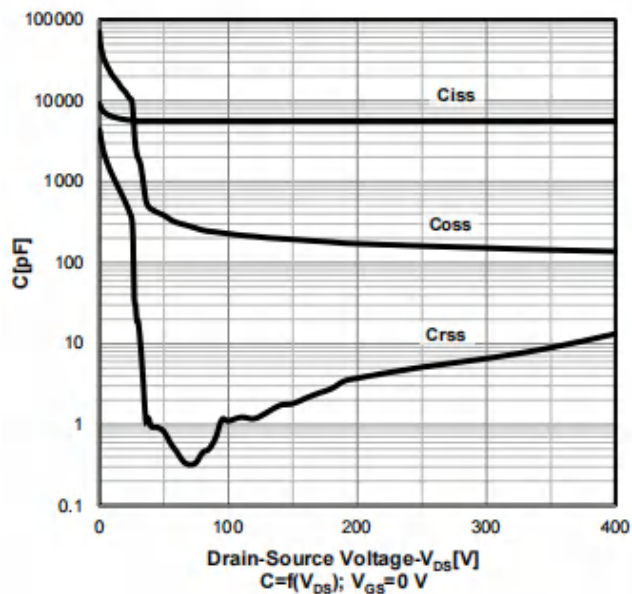
Typ. drain-source on-state resistance



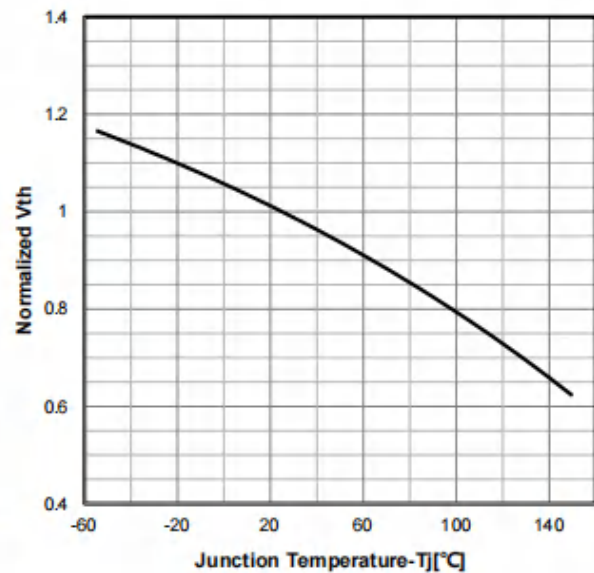
Typ. gate charge characteristics



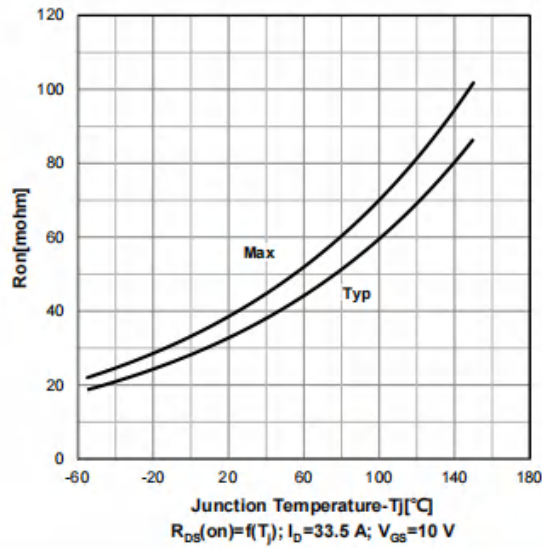
Typ. capacitances



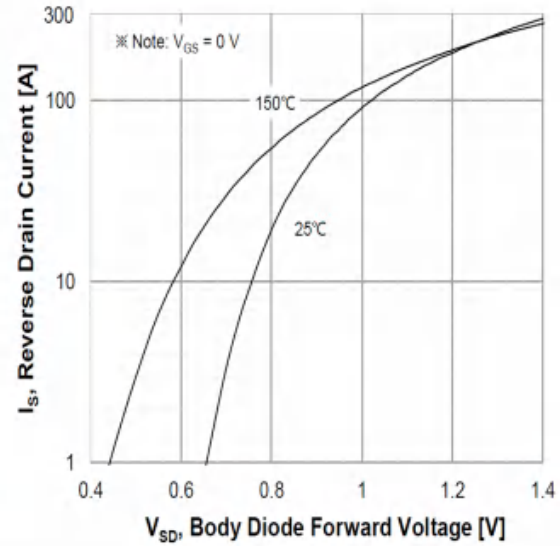
Normalized $V_{GS(th)}$ characteristics



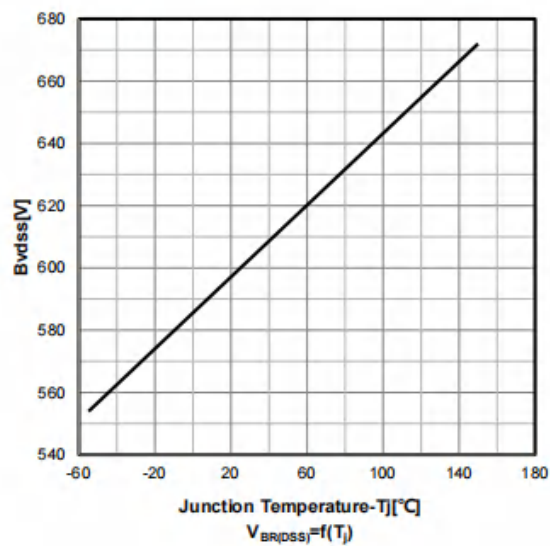
On-resistance vs temperature



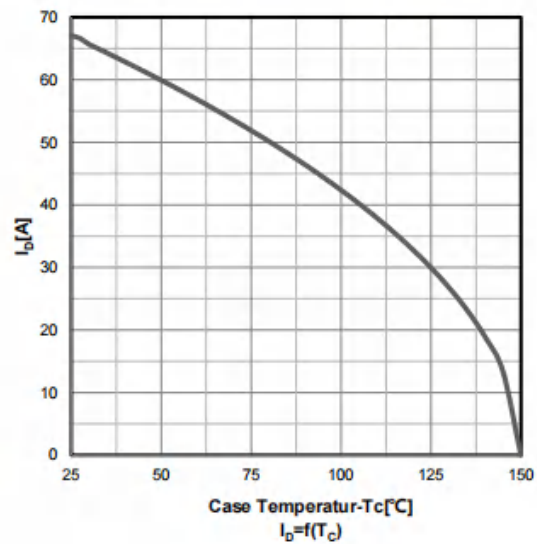
Forward characteristics of reverse diode



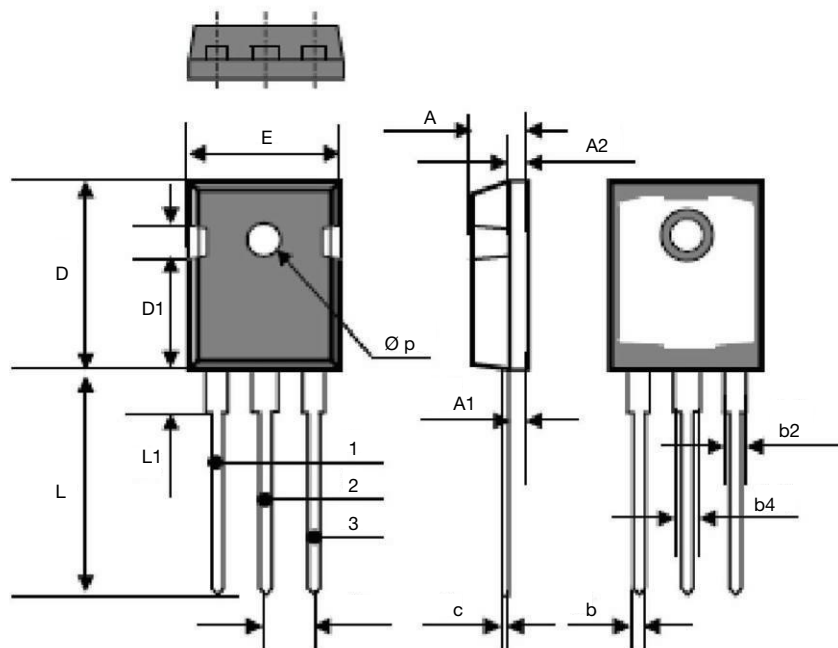
Drain-source breakdown voltage



Drain current vs temperature



TO-247



DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.70	5.31	0.185	0.209
A1	2.21	2.59	0.087	0.102
A2	1.50	2.49	0.059	0.098
b	0.99	1.40	0.039	0.055
b2	1.65	2.41	0.065	0.095
b4	2.59	3.43	0.102	0.135
c	0.61 BSC		0.024 BSC	
D	20.80	21.46	0.819	0.845
D1	3.68	5.49	0.145	0.216
(e)	5.46 BSC		0.215 BSC	
E	15.49	16.26	0.610	0.640
L	19.81	20.32	0.780	0.800
L1	4.06	4.50	0.160	0.177
$\varnothing p$	3.51	3.66	0.138	0.144

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