



I3JA60N65QS

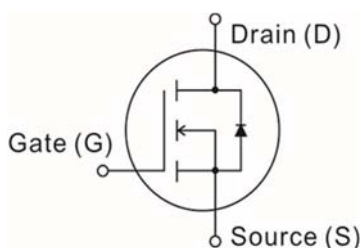
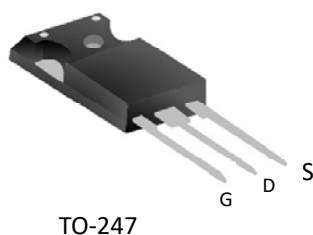
650V N-Channel Power MOSFET

Product Summary

Parameter	Value	Unit
$V_{DS} @ T_{jmax}$	650	V
$R_{DS(on),max} @ V_{GS} = 10\text{ V}$	48	m Ω
$I_D @ V_{GS} = 10\text{ V}$	60	A
P_{tot}	350	W

Features

- * Low on-resistance
- * Low switching losses
- * Excellent FOM
- * Excellent stability and uniformity



Application

- * PC power
- * Server power
- * EV charger
- * LED lighting
- * UPS

Maximum ratings $T_A = 25^\circ\text{C}$ unless otherwise noted				
Parameter		Symbol	Limit	Unit
Drain - source voltage		V_{DS}	650	V
Continuous drain current	$T_C @ 25^\circ\text{C}$	I_D	60	A
	$T_C @ 100^\circ\text{C}$		35	
Pulsed drain current tp limited by T_j max (Note 1)	$T_C @ 25^\circ\text{C}$	$I_{D \text{ pulsed}}$	240	A
Single pulse avalanche energy (Note 2)		E_{AS}	900	mJ
Gate-source voltage		V_{GS}	± 30	V
Power dissipation	$T_C @ 25^\circ\text{C}$	P_{tot}	350	W
Storage temperature range		T_{STG}	- 55 to +150	$^\circ\text{C}$
Operating junction temperature range		T_j	- 55 to +150	$^\circ\text{C}$



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Electrical characteristics $T_A = 25^\circ\text{C}$ unless otherwise specified						
Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
Off characteristics						
Drain-source breakdown voltage	$V_{GS} = 0V, I_D = 1mA$	BV_{DSS}	650	---	---	V
Gate-source leakage	$V_{GS} = \pm 30V, V_{DS}=0V$	I_{GSS}	---	---	± 100	nA
Zero gate voltage drain current	$V_{DS}= 650V, V_{GS}= 0V, T_J=25^\circ\text{C}$	I_{DSS}	---	---	1	μA
On characteristics						
Drain-source on-state resistance	$V_{GS} = 10V, I_D = 30A, T_J=25^\circ\text{C}$	$R_{DS(on)}$	---	43	48	$m\Omega$
Gate-source threshold voltage	$V_{DS} = V_{GS}, I_D = 250\mu\text{A}$	$V_{GS(th)}$	3	4	5	V
Gate resistance	$f = 1\text{MHz}$, open drain	R_G	---	3.2	---	Ω
Dynamic and switching characteristics-						
Gate-source charge	$V_{DD} = 400V, I_D = 30A$ $V_{GS} = 0 \text{ to } 10V$	Q_{gs}	---	35	---	nC
Gate-drain charge		Q_{gd}	---	45	---	
Gate charge total		Q_g	---	110	---	
Turn-on delay time	$V_{DD} = 400V, I_D = 30A$ $V_{GS} = 10V, R_G = 1.8\Omega$	$t_{d(on)}$	---	15	---	ns
Rise time		t_r	---	35	---	
Turn-off delay time		$t_{d(off)}$	---	87	---	
Fall time		t_f	---	6	---	
Input capacitance	$V_{GS} = 0V, V_{DS} = 35V$, $f = 1\text{MHz}$	C_{iss}	---	5300	---	pF
Output capacitance		C_{oss}	---	230	---	

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
Drain-source diode characteristics and maximum ratings						
Inverse diode forward voltage	$I_S = 30A, V_{GS} = 0V$	V_{SD}	---	0.95	1.5	V
Reverse recovery time	$V_R = 400V, I_F = 30A$, $di_F / dt = 100A / \mu\text{S}$	t_{rr}	---	180	---	ns
Reverse recovery charge		Q_{rr}	---	1.3	---	μC

Notes:

1. Repetitive rating : pulsed width limited by maximum junction temperature.
2. $V_{DD}=50V$, starting $T_J=25^\circ\text{C}$.



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Thermal characteristics			
Thermal resistance junction-to-case	R_{thJC}	0.36	$^{\circ}\text{C} / \text{W}$
Thermal resistance junction-to-ambient	R_{thJA}	40	

Package Marking and Ordering Information

Type / Ordering Code	Package	Packaging	Related Links
I3JA60N65QS	TO-247	Tube	see Package Outline

Electrical Characteristics Diagrams

Fig 1: Power dissipation

$$P_{tot} = f(T_C)$$

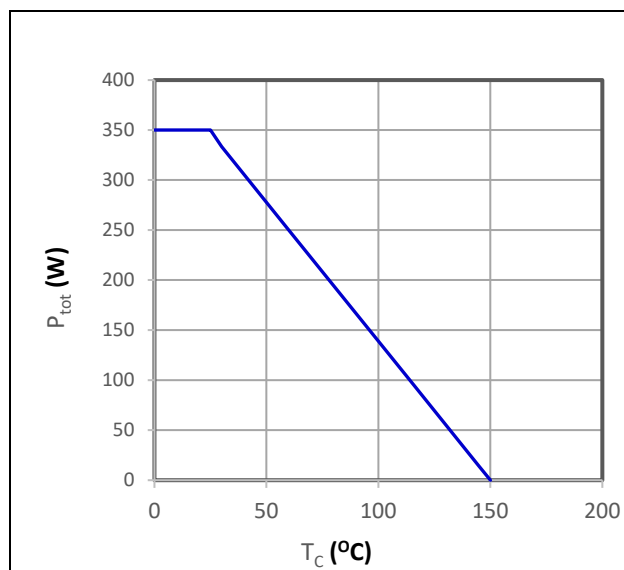
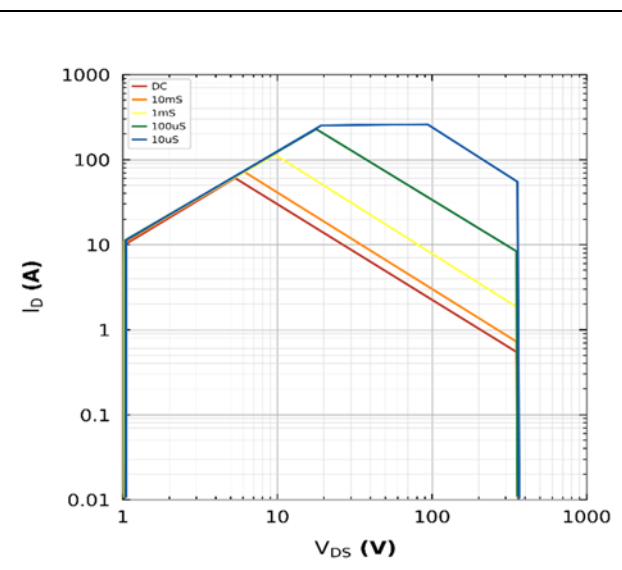


Fig 2: Safe operating area

$$I_D = f(V_{DS}); V_{GS} > 10\text{V}, D = 0, T_C = 25^{\circ}\text{C}; \text{parameter : } t_p$$





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Fig 3: Typ. transfer characteristics

$I_D = f(V_{GS})$; $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $T_j = 25^\circ\text{C}$

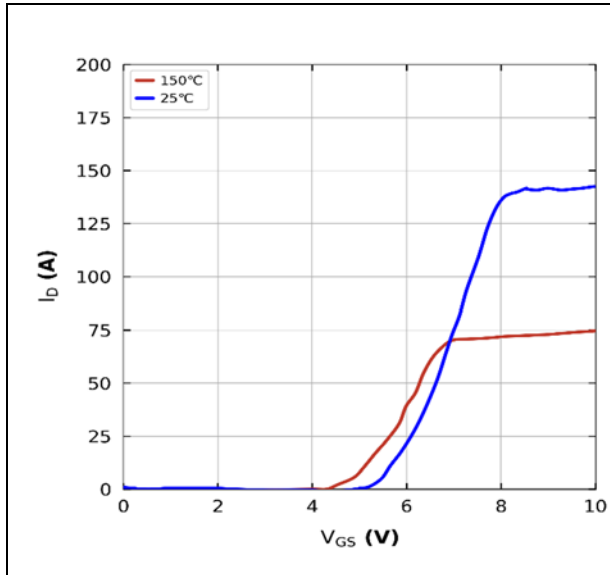


Fig 4: Typ. output characteristics

$I_D = f(V_{DS})$; $T_j = 25^\circ\text{C}$; parameter: V_{GS}

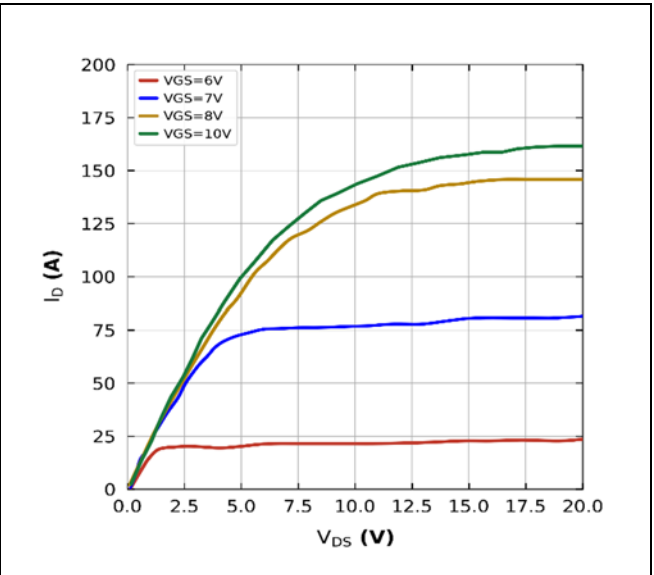


Fig 5: Forward characteristics of body diode

$I_F = f(V_{SD})$; parameter: T_j

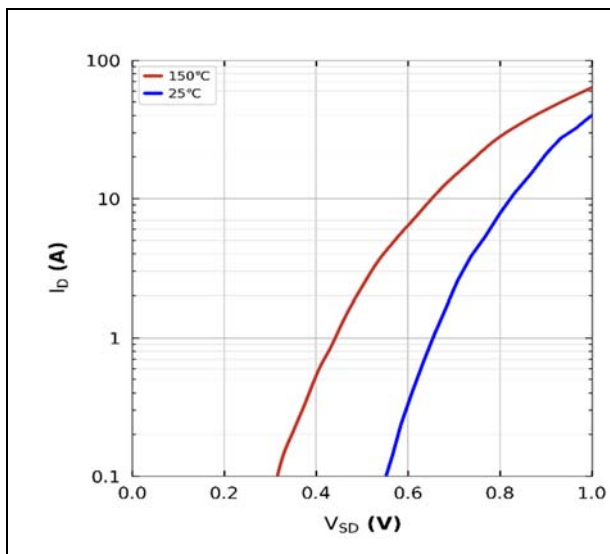
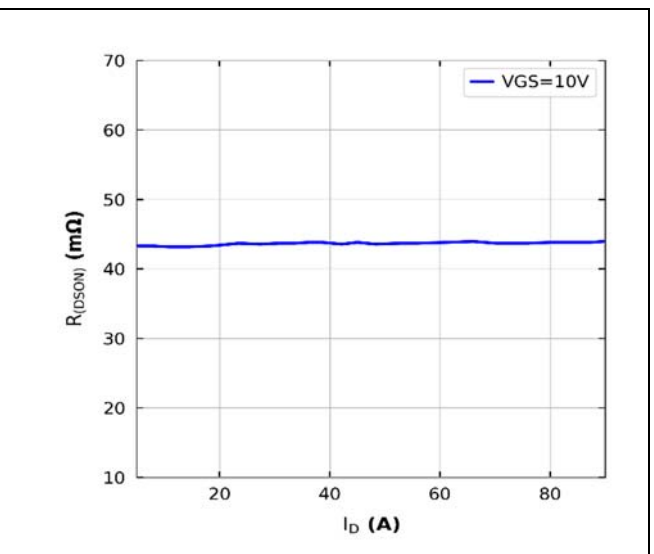


Fig 6: Typ. drain source on-resistance

$R_{DS(on)} = f(I_D)$; $T_j = 25^\circ\text{C}$; parameter: V_{GS}





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Fig 7: Drain-source on-state resistance

$R_{DS(on)} = f(T_J)$; $I_D = 30A$, $V_{GS} = 10V$

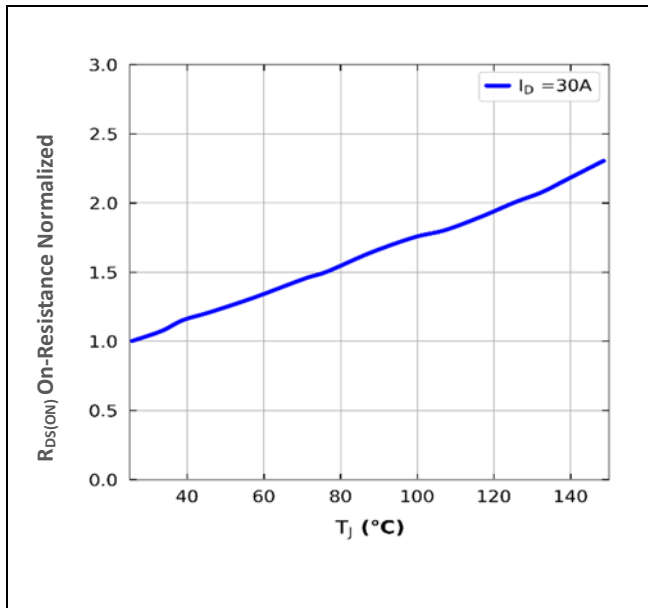


Fig 8: Typ. capacitances

$C = f(V_{DS})$; parameter: $V_{GS} = 0V$, $f = 1MHz$

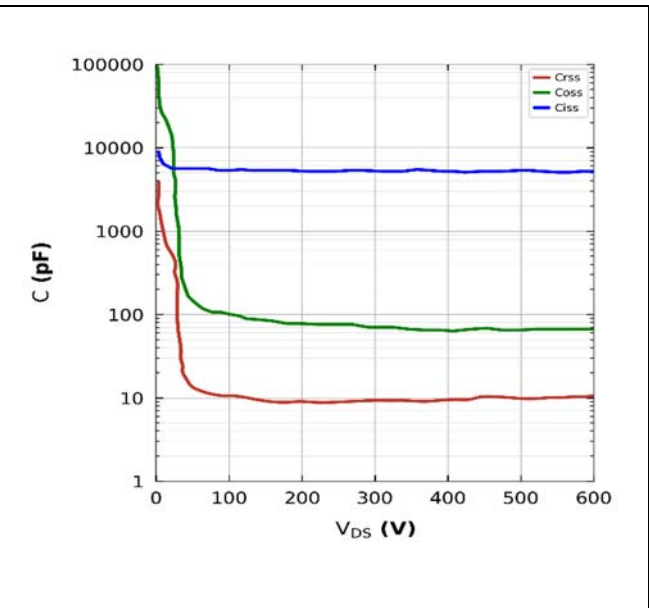
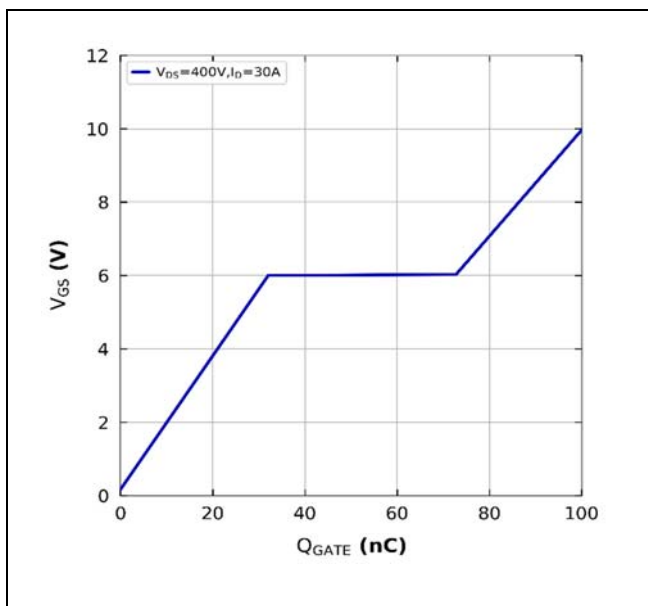


Fig 9: Typ. gate charge

$V_{GS} = f(Q_{GATE})$; $I_D = 30A$ pulsed

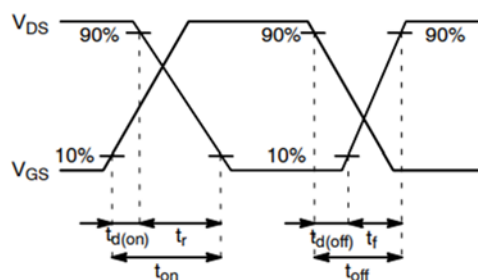




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Test Circuit

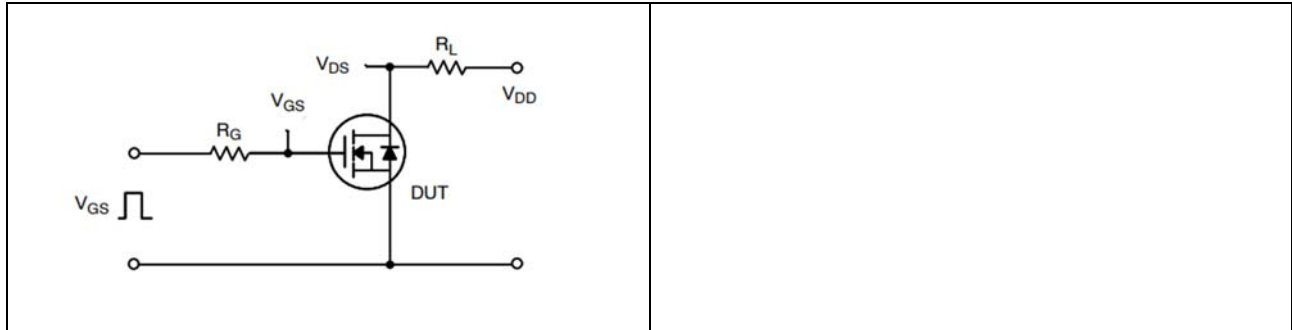
Unclamped test circuit	Unclamped test waveform
Gate charge test circuit	Basic gate charge waveform
Diode recovery test circuit	Diode recovery test waveform
Switching test circuit (resistor load)	Switching test waveform



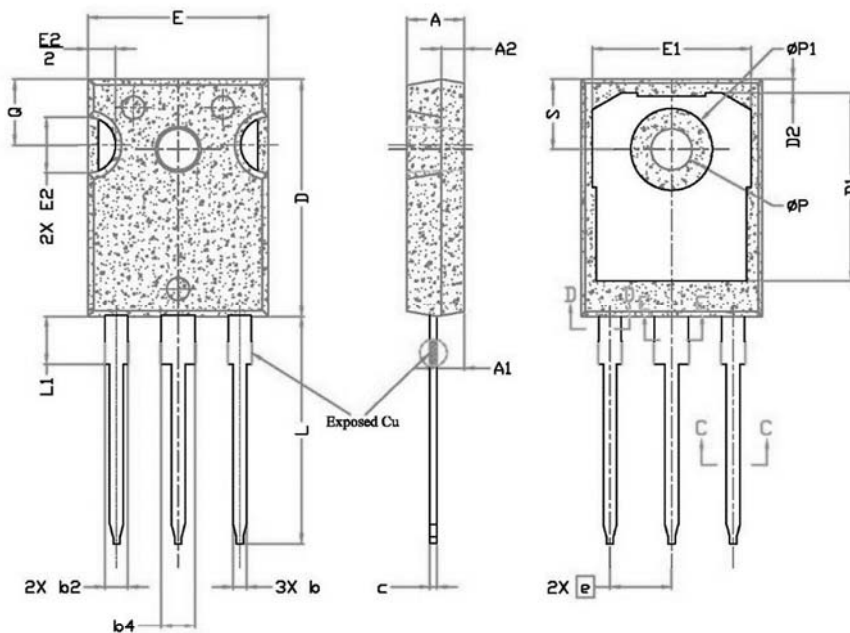


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Package Outline



SYMBOL	DIMENSIONS			NOTES
	MIN.	NOM.	MAX.	
A	4.83	5.02	5.21	
A1	2.29	2.41	2.55	
A2	1.50	2.00	2.49	
b	1.12	1.20	1.33	
b1	1.12	1.20	1.28	
b2	1.91	2.00	2.39	6
b3	1.91	2.00	2.34	
b4	2.87	3.00	3.22	6, 8
b5	2.87	3.00	3.18	
c	0.55	0.60	0.69	6
c1	0.55	0.60	0.65	
D	20.80	20.95	21.10	4
D1	16.25	16.55	17.65	5
D2	0.51	1.19	1.35	
E	15.75	15.94	16.13	4
E1	13.46	14.02	14.16	5
E2	4.32	4.91	5.49	3
a	5.44BSC			
L	19.81	20.07	20.32	
L1	4.10	4.18	4.40	6
ØP	3.56	3.61	3.65	7
ØP1	7.19REF.			
Q	5.39	5.79	6.20	
S	6.04	6.17	6.30	

Note:

1. Package Reference: JEDEC TO247, Variation AD.
2. All Dimensions Are In mm.
3. Slot Required, Notch May Be Rounded
4. Dimension D & E Do Not Include Mold Flash. Mold Flash Shall Not Exceed 0.127mm Per Side. These Dimensions Are Measured At The Outermost Extreme Of The Plastic Body.
5. Thermal Pad Contour Optional Within Dimension D1 & E1.
6. Lead Finish Uncontrolled In L1.
7. ØP To Have A Maximum Draft Angle Of 1.5° To The Top Of The Part With A Maximum Hole Diameter Of 3.91mm.
8. Dimension "b2" And "b4" Does Not Include Dambar Protrusion. Allowable Dambar Protrusion Shall Be 0.10mm Total In Excess Of "b2" And "b4" Dimension At Maximum Material Condition.