inVinci Semiconductor Corporation

I3JL40N65QS

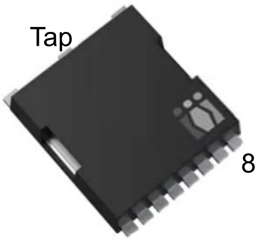
650V N-Channel Power MOSFET

Product Summary

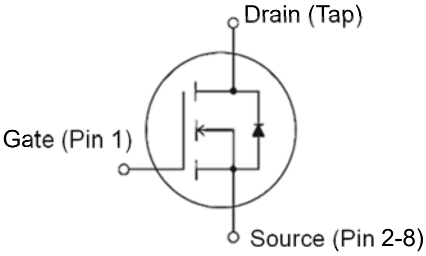
Parameter	Value	Unit
V_{DS} @ T_{jmax}	650	V
$R_{DS(on),max}$ @ V_{GS} = 10 V	65	mΩ
I_D @ V_{GS} = 10 V	40	A
P_{tot}	208	W

Features

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



TOLL



Application

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

Maximum ratings T_A = 25℃ unless otherwise noted

Parameter		Symbol	Limit	Unit
Drain - source voltage		V_{DS}	650	V
Continuous drain current	T_C @ 25℃	I_D	40	A
	T_C @ 100℃		25	
Pulsed drain current tp limited by T_j max (Note 1)	T_C @ 25℃	I_D pulsed	125	A
Single pulse avalanche energy (Note 2)		E_{AS}	700	mJ
Gate-source voltage		V_{GS}	± 30	V
Power dissipation	T_C @ 25℃	P_{tot}	208	W
Storage temperature range		T_{STG}	- 55 to +150	℃
Operating junction temperature range		T_j	- 55 to +150	℃

Electrical characteristics T_A = 25℃ 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} = ± 30V, V_{DS}=0V	I_{GSS}	---	---	± 1	uA
Zero gate voltage drain current	V_{DS}= 650V, V_{GS}= 0V, T_j=25℃	I_{DSS}	---	---	5	uA
On characteristics						
Drain-source on-state resistance	V_{GS} = 10V, I_D = 20A, T_j=25℃	$R_{DS(on)}$	---	58	65	mΩ
Gate-source threshold voltage	V_{DS} = V_{GS}, I_D = 250uA	$V_{GS(th)}$	3	4	5	V
Gate resistance	f = 1MHz, open drain	R_G	---	6	---	Ω
Dynamic and switching characteristics-						
Gate-source charge	V_{DD} = 400V, I_D = 20A V_{GS} = 0 to 10V	Q_{gs}	---	27	---	nC
Gate-drain charge		Q_{gd}	---	31	---	
Gate charge total		Q_g	---	81	---	
Turn-on delay time	V_{DD} = 400V, I_D = 20A V_{GS} = 10V, R_G = 5Ω	$t_{d(on)}$	---	23	---	ns
Rise time		t_r	---	14	---	
Turn-off delay time		$t_{d(off)}$	---	98	---	
Fall time		t_f	---	18	---	
Input capacitance	V_{GS} = 0V, V_{DS} = 50V , f = 1MHz	C_{iss}	---	3900	---	pF
Output capacitance		C_{oss}	---	130	---	

Parameter	**Test Conditions**	**Symbol**	**Min.**	**Typ.**	**Max.**	**Units**
Drain-source diode characteristics and maximum ratings						
Inverse diode forward voltage	I_S = 40A, V_{GS} = 0V	V_{SD}	---	0.95	1.4	V
Reverse recovery time	V_R = 400V, I_F = 20A, di_F / dt = 100A / uS	t_{rr}	---	155	---	ns
Reverse recovery charge		Q_{rr}	---	1.1	---	uC

Notes:

1. **Repetitive rating : pulsed width limited by maximum junction temperature.**
2. **V_{DD}=50V, starting T_j=25℃.**

Thermal characteristics			
Thermal resistance junction-to-case	R_{thJC}	0.6	℃ / W
Thermal resistance junction-to-ambient	R_{thJA}	40	

Package Marking and Ordering Information

Type / Ordering Code	Package	Packaging	Related Links
I3JL40N65QS	TOLL	Tape& Reel	see Package Outline

Electrical Characteristics Diagrams

Fig 1: Power dissipation

$P_{tot} = f (T_C)$

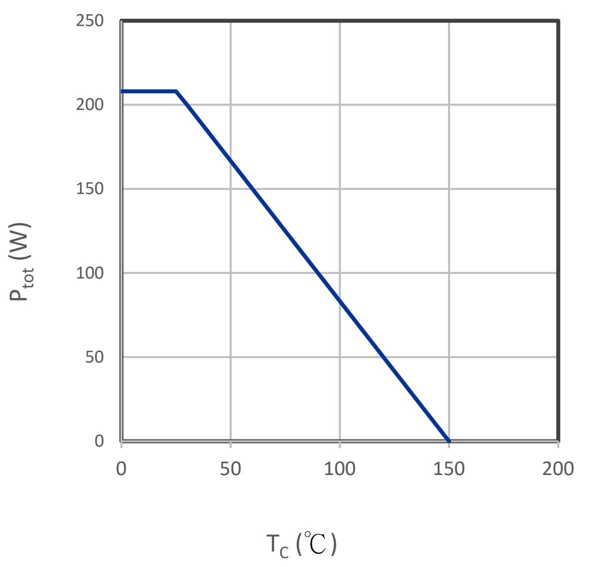


Fig 2: Safe operating area

$I_D = f (V_{DS})$; $V_{GS} > 10V$, D = 0, $T_C = 25℃$; parameter : tp

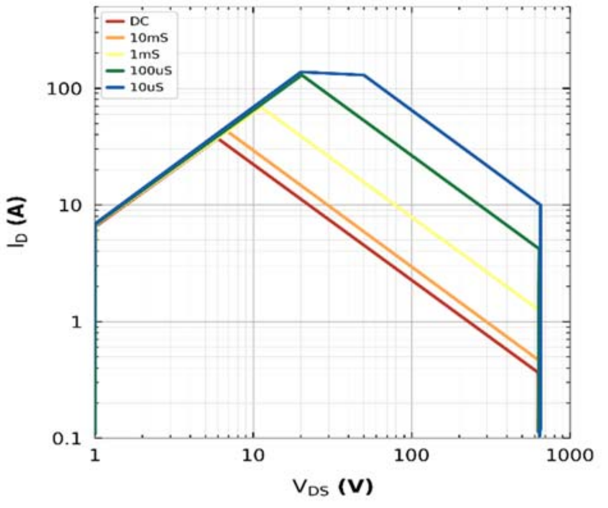


Fig 3: Typ. transfer characteristics

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

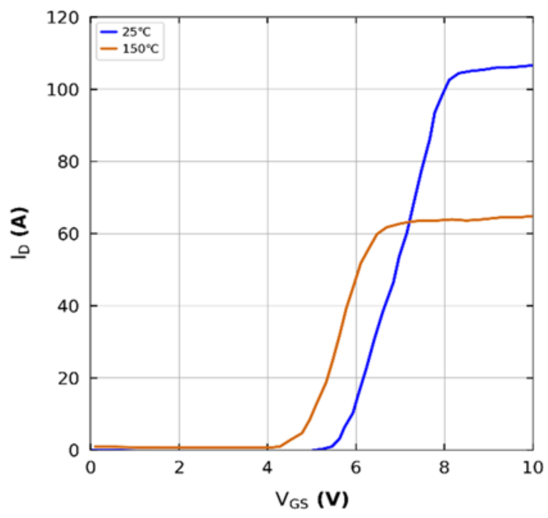


Fig 4: Typ. output characteristics

$I_D = f(V_{DS})$; $T_j = 25$℃ ; parameter : V_{GS}

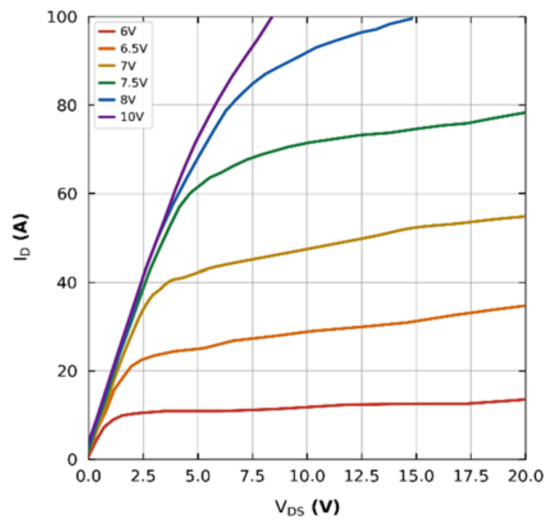


Fig 5: Forward characteristics of body diode

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

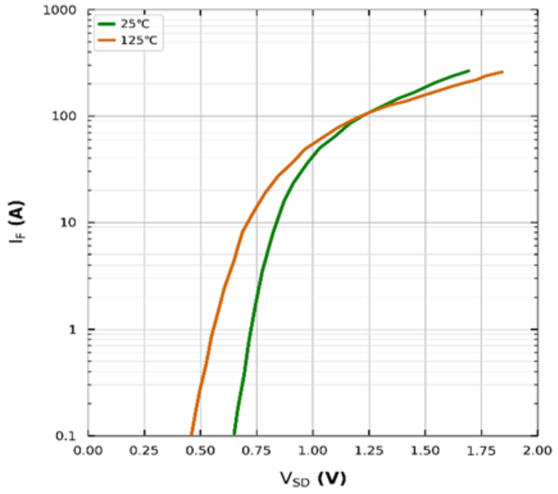


Fig 6: Typ. drain source on-resistance

$R_{DS(on)} = f(I_D)$; $T_j = 25$℃ ; parameter : V_{GS}

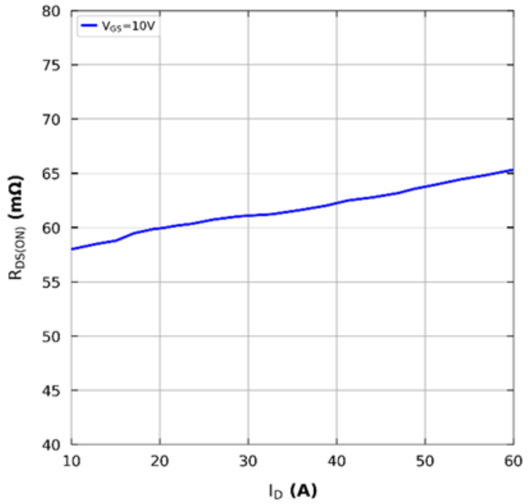


Fig 7: Drain-source on-state resistance

$R_{DS(on)} = f(T_j)$; $I_D = 21A$, $V_{GS} = 10V$

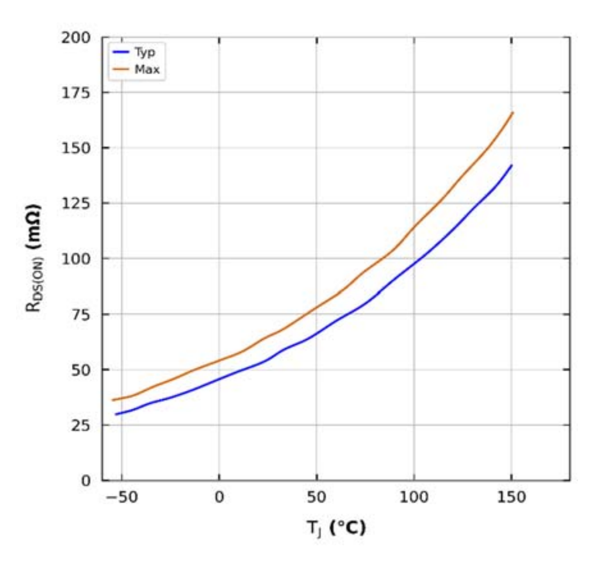


Fig 8: Typ. capacitances

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

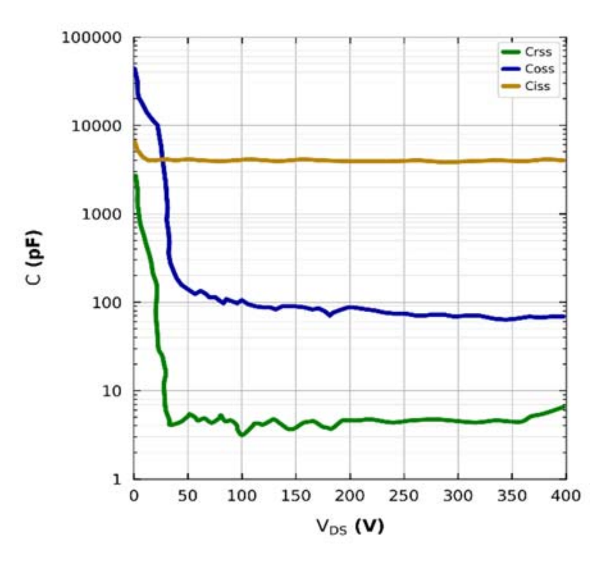
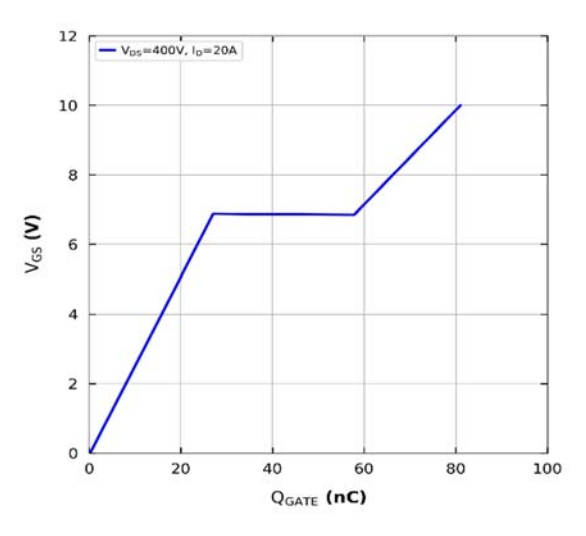


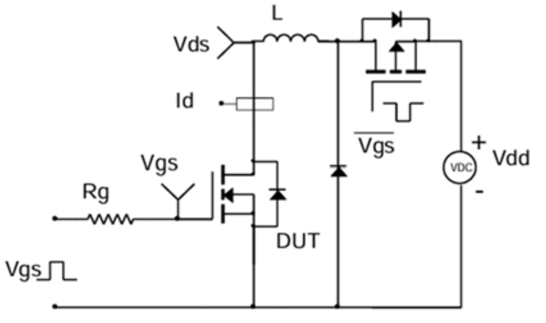
Fig 9: Typ. gate charge

$V_{GS} = f(Q_{GATE})$; $I_D = 20A$ pulsed

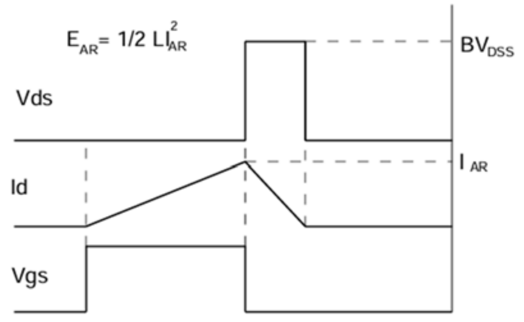


Test Circuit

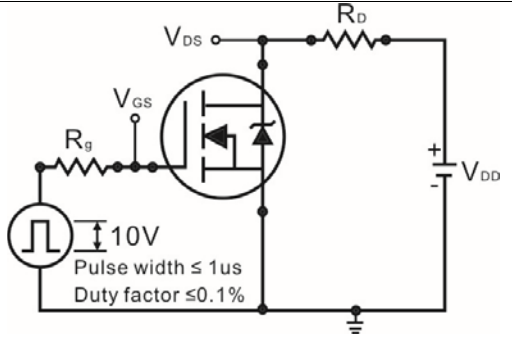
Unclamped test circuit



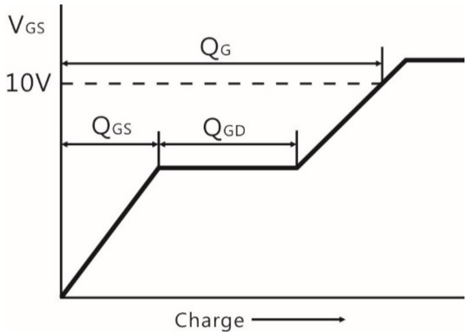
Unclamped test waveform



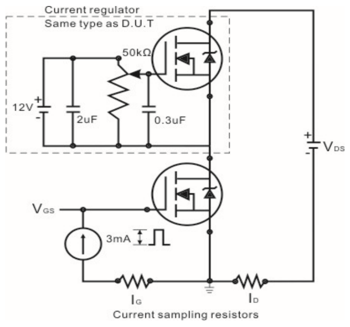
Gate charge test circuit



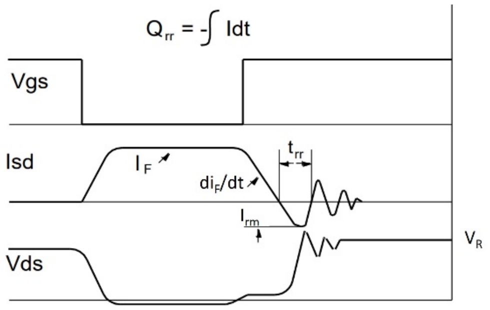
Basic gate charge waveform



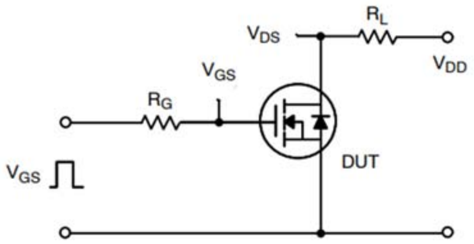
Diode recovery test circuit



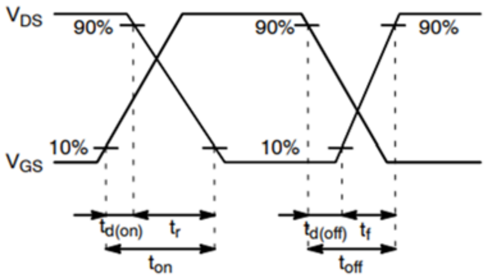
Diode recovery test waveform



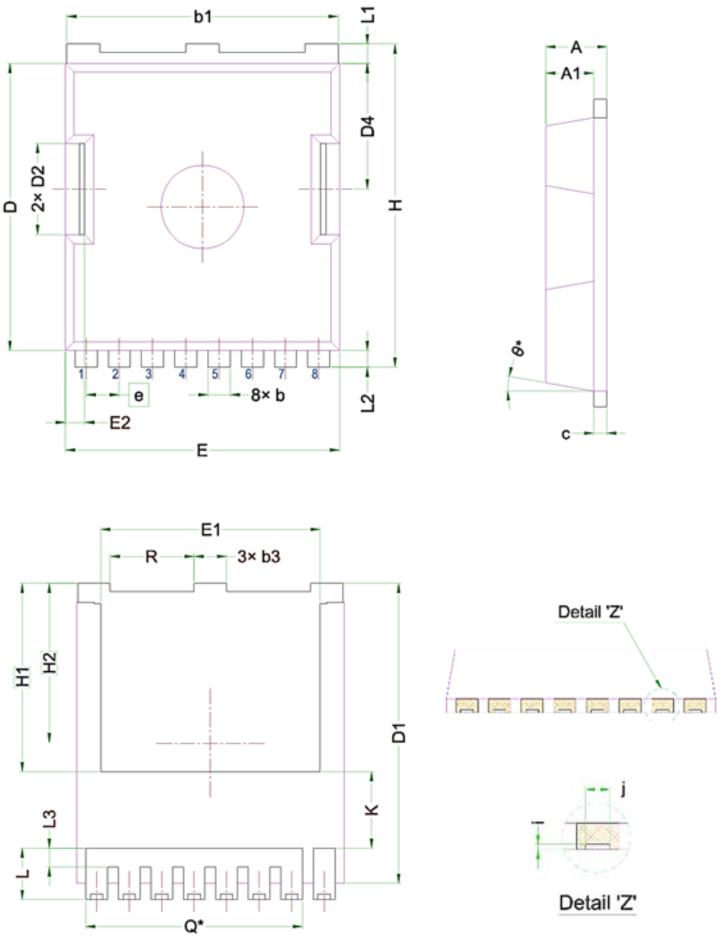
Switching test circuit (resistor load)



Switching test waveform



Package Outline



Ref.	Dimensions		
	Min.	Typ.	Max.
A	2.20	2.30	2.40
A1	1.70	1.80	1.90
b	0.70	0.80	0.90
b1	9.70	9.80	9.90
b3	1.10	1.20	1.30
c	0.40	0.50	0.60
D	10.28	10.38	10.48
D1	10.98	11.08	11.18
D2	3.20	3.30	3.40
D4	4.45	4.55	4.65
E	9.80	9.90	10.00
E1	8.00	8.10	8.20
E2	0.60	0.70	0.80
e	1.20 BSC		
H	11.58	11.68	11.78
H1	6.95 BSC		
H2	5.89 BSC		
i	0.10 REF.		
j	0.46 REF.		
K	2.80 REF.		
L	1.40	1.90	2.10
L1	0.60	0.70	0.80
L2	0.50	0.60	0.70
L3	0.30	0.70	0.80
N	8		
Q	8.00 REF.		
R	3.00	3.10	3.20
θ	10° REF.		