

N-Channel MOSFET

Features:

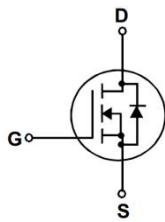
- ◆ RoHS Compliant
- ◆ Low ON Resistance
- ◆ Low Input Capacitance
- ◆ Low Miller Charge
- ◆ Low Input/Output Leakage

Applications:

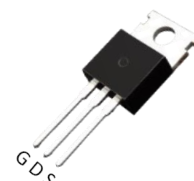
Lithium - Ion Secondary Batteries
Load Switch
DC-DC converters and Off line UPS

$V_{DSS}(\text{Min.})$	40 V
$R_{DS(ON)}(\text{Typ.})$	2.6mΩ
I_D	130 A

Schematic and Package Information:



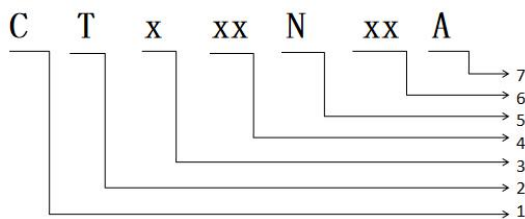
PDFN5*6
CSG02N04A



TO-220CB
CSP02N04A

Marking on the body:

MV/LV MOSFET tube naming rules



- 1: CYS for short
- 2: T: Trench S: SGT
- 3: Package
F: TO-220F P: TO-220 D: TO-252
U: TO-251 W: TO-247S/3P E: SOP-8
G: DFN5*6 K: DFN3.3*3.3
- 4: $R_{DS(on)}$ Typ
- 5: N: N channel P: P channel
- 6: Maximum breakdown voltage (10% of BV_{dss})
- 7: Series no.

Absolute Maximum Ratings $T_C=25^\circ\text{C}$ unless otherwise specified

Parameter	Symbol	CSx02N04A		Units
		PDFN5*6	TO-220CB	
Drain-to-Source Voltage	V_{DSS}	40		V
Gate-to-Source Voltage	V_{GS}	±20		V
Continuous Drain Current	I_D	130		A
Pulsed Drain Current, $V_{GS}@10V$ (NOTE *1)	I_{DM}	380		A
Power Dissipation	P_D	96		W
Derating Factor above 25°C		22		
Single Pulse Avalanche Energy ($L=0.5\text{mH}$)	E_{AS}	300		mJ
Peak Diode Recovery dv/dt	dv/dt	5		V/ns
Maximum Temperature for Soldering	T_L	300		$^\circ\text{C}$
Operating Junction and Storage Temperature Range (NOTE *2)	T_J and T_{STG}	-55 to 150		

Thermal Resistance

Parameter	Symbol	Typ.		Units
		PDFN5*6	TO-220CB	
Junction to Case	$R_{\theta JC}$	1.3		$^{\circ}\text{C}/\text{W}$
Junction to Ambient	$R_{\theta JA}$	60		$^{\circ}\text{C}/\text{W}$

Electrical Characteristics $T_J=25^{\circ}\text{C}$ unless otherwise specified

Parameter	Symbol	Min.	Typ.	Max.	Units	Test Conditions
Drain-to-Source Breakdown Voltage	BV_{DSS}	40	--	--	V	$V_{GS}=0\text{V}, I_D=250\mu\text{A}$
Gate Threshold Voltage	$V_{GS(TH)}$	1.0	1.5	2.0	V	$V_{DS}=V_{GS}, I_D=250\mu\text{A}$
Static Drain-to-Source On-Resistance	$R_{DS(ON)}$	--	2.6	3.0	m Ω	$V_{GS}=10\text{V}, I_D=20\text{A}$
		--	3.4	4.0		$V_{GS}=4.5\text{V}, I_D=20\text{A}$
Drain-to-Source Leakage Current	I_{DSS}	--	--	1	uA	$V_{DS}=40\text{V}, V_{GS}=0\text{V}$ $T_J=25^{\circ}\text{C}$
		--	--	25		$V_{DS}=40\text{V}, V_{GS}=0\text{V}$ $T_J=125^{\circ}\text{C}$
Gate-to-Source Forward Leakage	I_{GSS}	--	--	+100	nA	$V_{GS}=+20\text{V}$
Gate-to-Source Reverse Leakage		--	--	-100		$V_{GS}=-20\text{V}$

Dynamic Characteristics Essentially independent of operating temperature

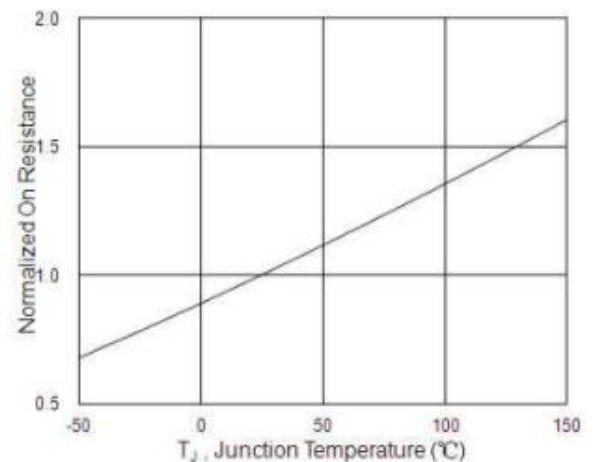
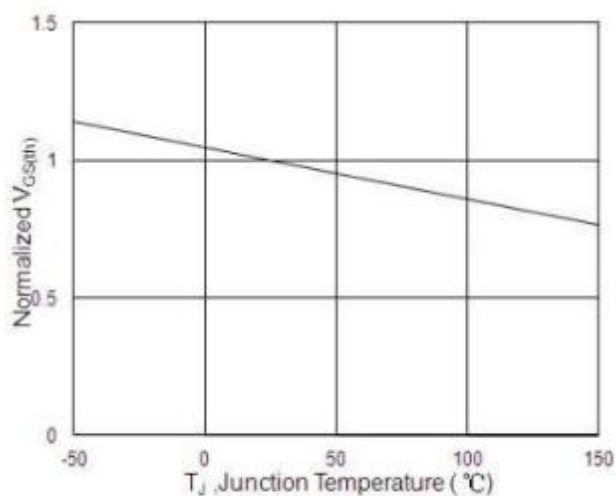
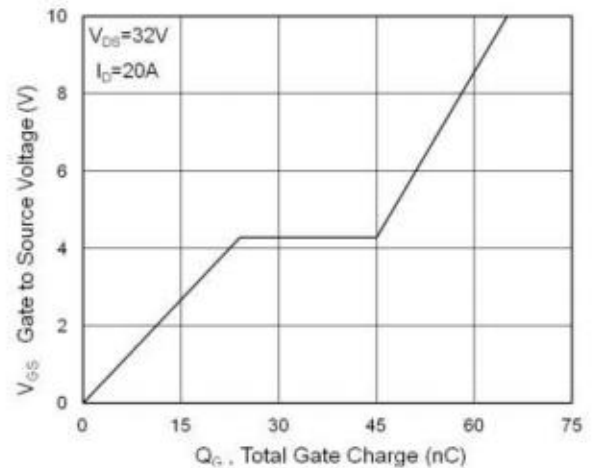
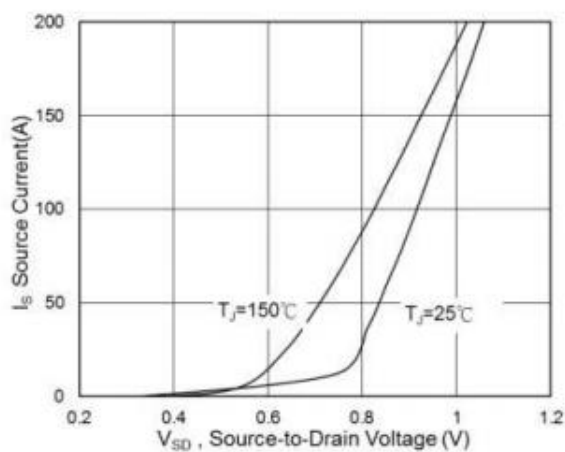
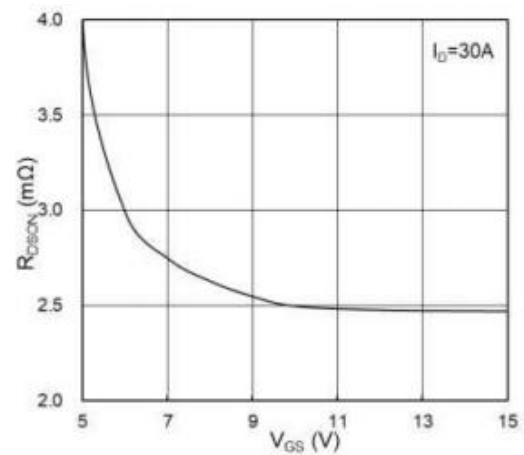
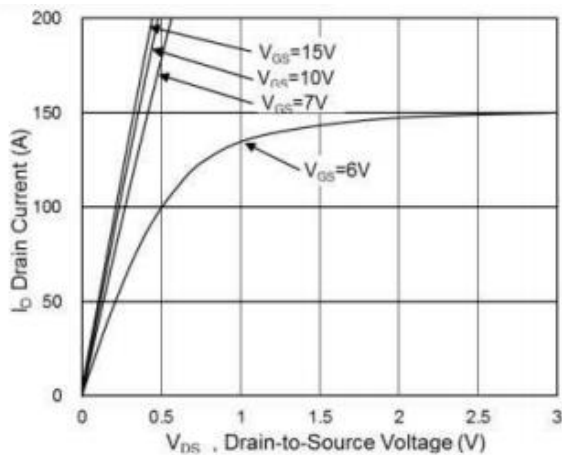
Parameter	Symbol	Min.	Typ.	Max.	Units	Test Conditions
Input Capacitance	C_{iss}	--	4711	--	pF	$V_{GS}=0\text{V}, V_{DS}=15\text{V}$ $f=1.0\text{MHz}$
Output Capacitance	C_{oss}	--	869	--		
Reverse Transfer Capacitance	C_{rss}	--	367	--		
Total Gate Charge	Q_g	--	65	--	nC	$I_D=20\text{A}, V_D=32\text{V}$ $V_{GS}=5\text{V}$
Gate-to-Source Charge	Q_{gs}	--	24	--		
Gate-to-Drain ("Miller") Charge	Q_{gd}	--	21	--		
Turn-on Delay Time	$t_{d(ON)}$	--	26	--	ns	$V_D=20\text{V}, I_D=30\text{A},$ $V_{GS}=10\text{V} R_G=5\Omega$
Rise Time	t_{rise}	--	38	--		
Turn-Off Delay Time	$t_{d(OFF)}$	--	63	--		
Fall Time	T_{fall}	--	20	--		

Source-Drain Diode Characteristics $T_C=25^{\circ}\text{C}$ unless otherwise specified

Parameter	Symbol	Min.	Typ.	Max.	Units	Test Conditions
Continuous Drain-Source Diode Forward Current	I_S	--	--	120	A	$T_C=25^{\circ}\text{C}$
Pulsed Drain-Source Diode Forward Current	I_{SM}	--	--	360		
Diode Forward Voltage	V_{SD}	--	--	1.0	V	$I_{SD}=30\text{A}, V_{GS}=0\text{V}$
Reverse Recovery Time	t_{rr}	--	21	--	ns	$I_F=I_S$ $di/dt=100\text{A/us}$
Reverse Recovery Charge	Q_{rr}	--	10	--	nC	

- Notes:
1. $T_J = +25^{\circ}\text{C}$ to $+150^{\circ}\text{C}$.
 2. Repetitive rating; pulse width limited by maximum junction temperature.
 3. Pulse width $< 300\mu\text{s}$; duty cycle $< 2\%$.

Typical Characteristics



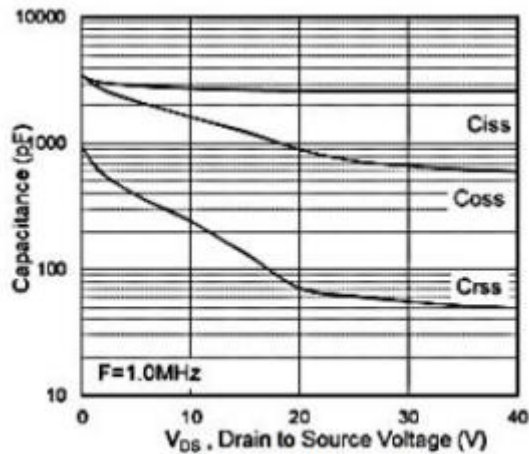


Fig.7 Capacitance

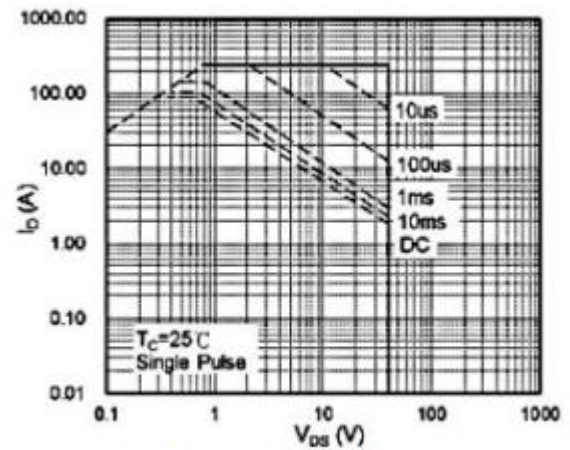


Fig.8 Safe Operating Area

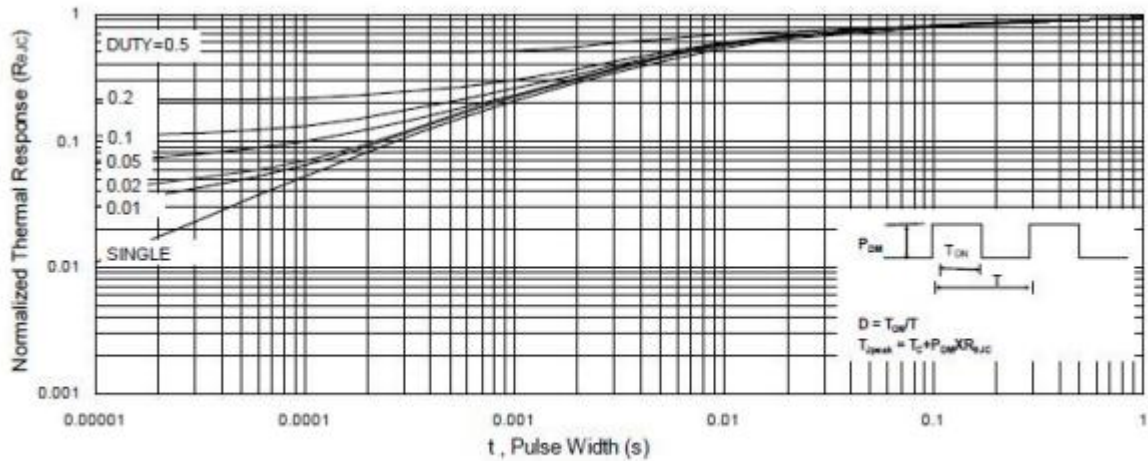
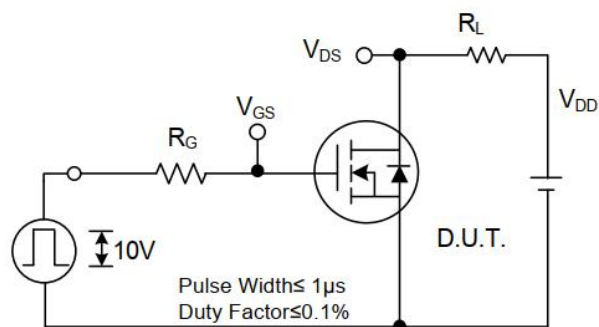
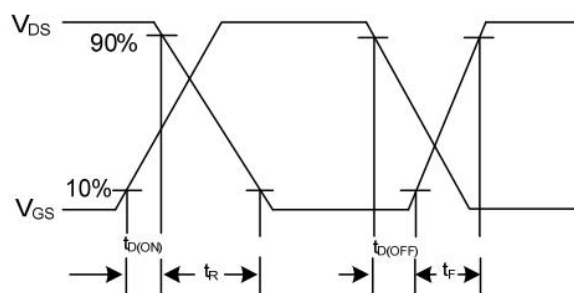


Fig.9 Normalized Maximum Transient Thermal Impedance

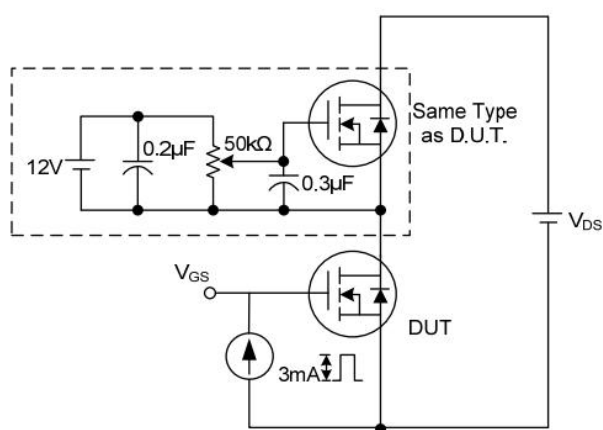
Test Circuits and Waveform



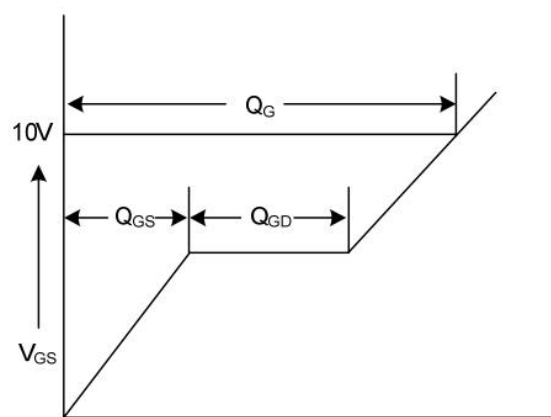
Switching Test Circuit



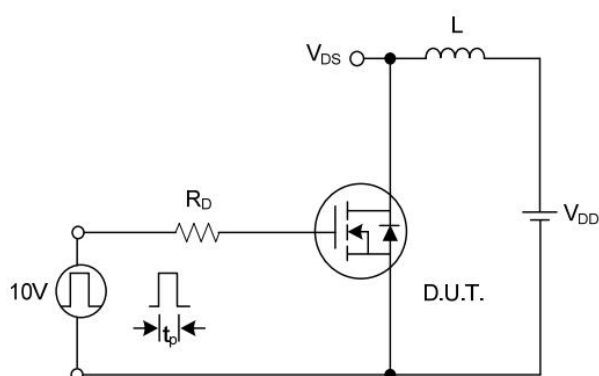
Switching Waveforms



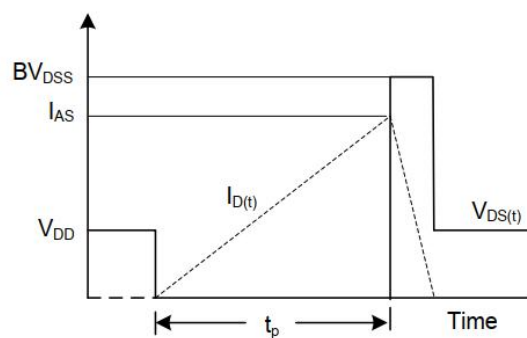
Gate Charge Test Circuit



Gate Charge Waveform



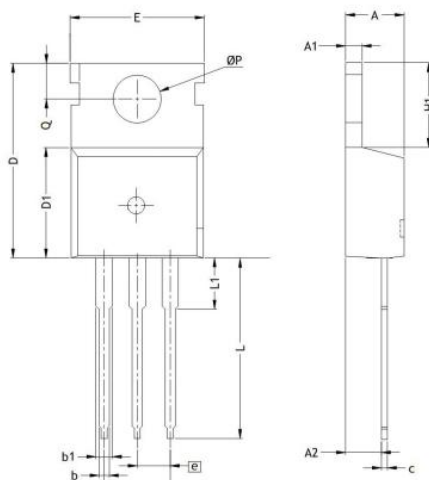
Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

PACKAGE MECHANICAL DATA (Unit: mm):

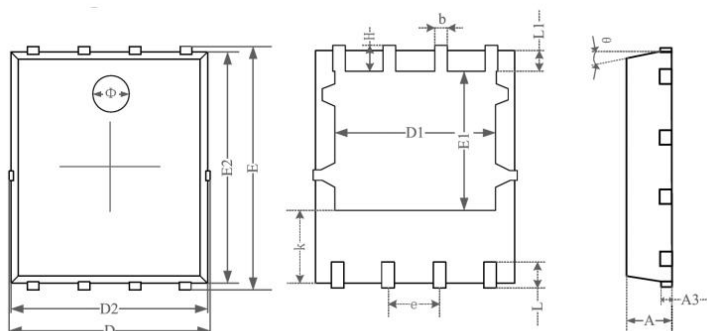
TO-220CB



DIM	Min.	Max.
A	4.25	4.65
A1	1.25	1.35
A2	2.35	2.55
b	0.7	0.9
b1	1.15	1.75
c	0.45	0.6
D	14.35	15.9
D1	8.8	9.5
E	9.9	10.3
e	Typ 2.54	
e1	Typ 5.08	
H1	6.3	6.5
L	12.85	13.5
L1	2.85	3.25
Q	2.7	2.9
φP	3.5	3.9

All Dimensions in millimeter

DFN5*6



DIM	Min.	Max.
A	0.8	1.0
A3	Typ 0.15	
D	4.9	5.1
E	6.0	6.1
D1	3.9	4.1
E1	3.3	3.5
D2	4.8	5.0
E2	5.7	5.8
K	1.2	1.4
b	0.3	0.4
e	Typ 1.27	
L	0.5	0.7
L1	0.4	0.6
H	0.5	0.7
θ	10°	12°
φ	1.1	1.3

All Dimensions in millimeter

Statement:

- ◆ We reserve the right to change the manual without prior notice! Customers should obtain the latest version of the information before placing an order, and verify that the relevant information is complete and up-to-date.
- ◆ Any semiconductor product has the possibility of failure or failure under specific conditions. The buyer has the responsibility to comply with safety standards and take safety measures when using Silan product for system design and complete machine manufacturing, so as to avoid the occurrence of personal injury or property loss caused by potential failure risk!
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