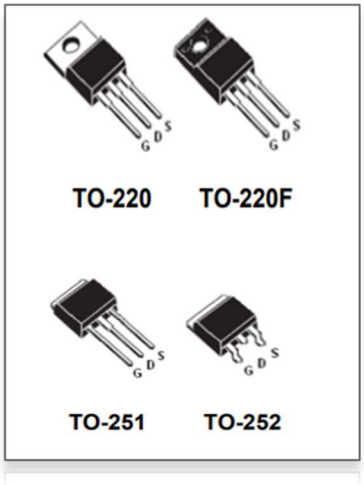
4A, 650V N-CHANNEL POWER MOSFET

DESCRIPTION

The **4N65** is a high voltage power MOSFET designed to have better characteristics, such as fast switching time, low gate charge ,low on-state resistance and have a high rugged avalanche characteristic. This power MOSFET is usually used in high speed switching applications including power supplies , PWM motor controls, high efficient DC to DC converters and bridge circuits.

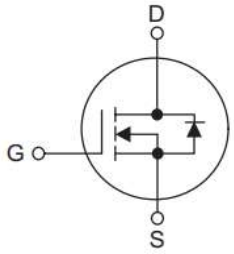


FEATURES

*$R_{DS(ON)}$ < 2.5Ω @V_{GS} = 10 V
*Fast Switching Capability
*Avalanche Energy Specified
*Improved dv/dt Capability, High Ruggedness

SYMBOL

1. Gate
2. Drain
3. Source



Package Description

Product Model	Package Type	Mark Name	Indentification Code	Package
CMN4N65P	TO-220	CMN4N65	P	Tube
CMN4N65F	TO-220F	CMN4N65	F	Tube
CMN4N65U	TO-251	CMN4N65	U	Tube
CMN4N65D	TO-252	CMN4N65	D	Tape Reel

CMN4N65P

(2) Package type

(1) Chip name

(1) CMN4N65: 650V 4A (2) F:TO-220F P:TO-220 D:TO-252 U:TO-251

ABSOLUTE MAXIMUM RATINGS (TC = 25°C, unless otherwise specified)

PARAMETER			SYMBOL	RATINGS	UNIT
Drain-Source Voltage			V_{DSS}	650	V
Gate-Source Voltage			V_{GSS}	±30	V
Avalanche Current (Note 2)			I_{AR}	4.4	A
Drain Current	Continuous(Tc=25℃)		I_D	4.0	A
	Continuous(Tc=100℃)			2.5	A
	Pulsed (Note 2)		I_{DM}	16	A
Avalanche Energy	Single Pulsed (Note 3)		E_{AS}	260	mJ
	Repetitive (Note 2)		E_{AR}	10.6	mJ
Peak Diode Recovery dv/dt (Note 4)			dv/dt	4.5	V/ns
Power Dissipation	Tc=25°C	TO-220	PD	106	W
		TO-220F		35	W
		TO-252/TO-251		50	W
Junction Temperature			T_J	+150	°C
Operating Temperature			T_{OPR}	-55~+150	°C
Storage Temperature			T_{STG}	-55~+150	°C

Note:
1. Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.
2. Repetitive Rating: Pulse width limited by maximum junction temperature.
3. L = 30mH, IAS = 4A, VDD = 50V, RG = 25 Ω, Starting TJ = 25°C
4. ISD≤4.4A, di/dt ≤200A/μs, VDD≤BVDSS, Starting TJ = 25°C

THERMAL CHARACTERISTICS

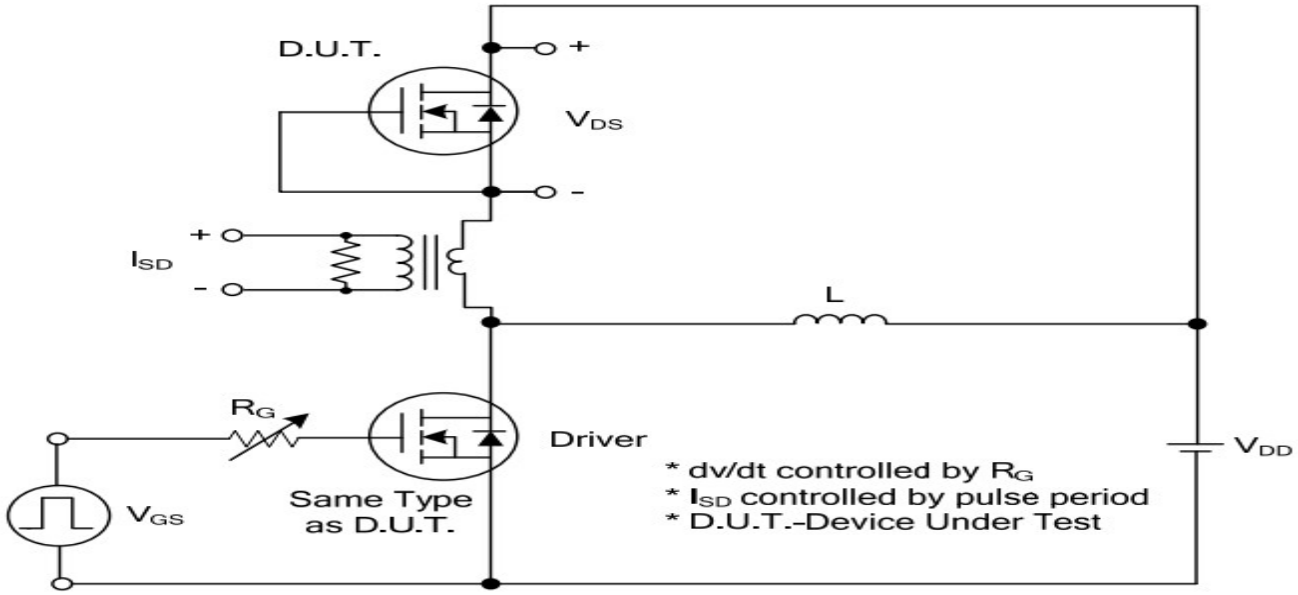
Symbol	Parameter	PACKAGE	RATINGS	Units
$R_{\theta JC}$	Junction-to-Case	TO-220	1.18	℃/W
		TO-220F	3.5	℃/W
		TO-252-TO-251	2.5	℃/W
$R_{\theta JA}$	Junction-to-Ambient	TO-220F/TO-220	62.5	℃/W
		TO-252-TO-251	110	℃/W

ELECTRICAL CHARACTERISTICS (T_C =25°C, unless otherwise specified)

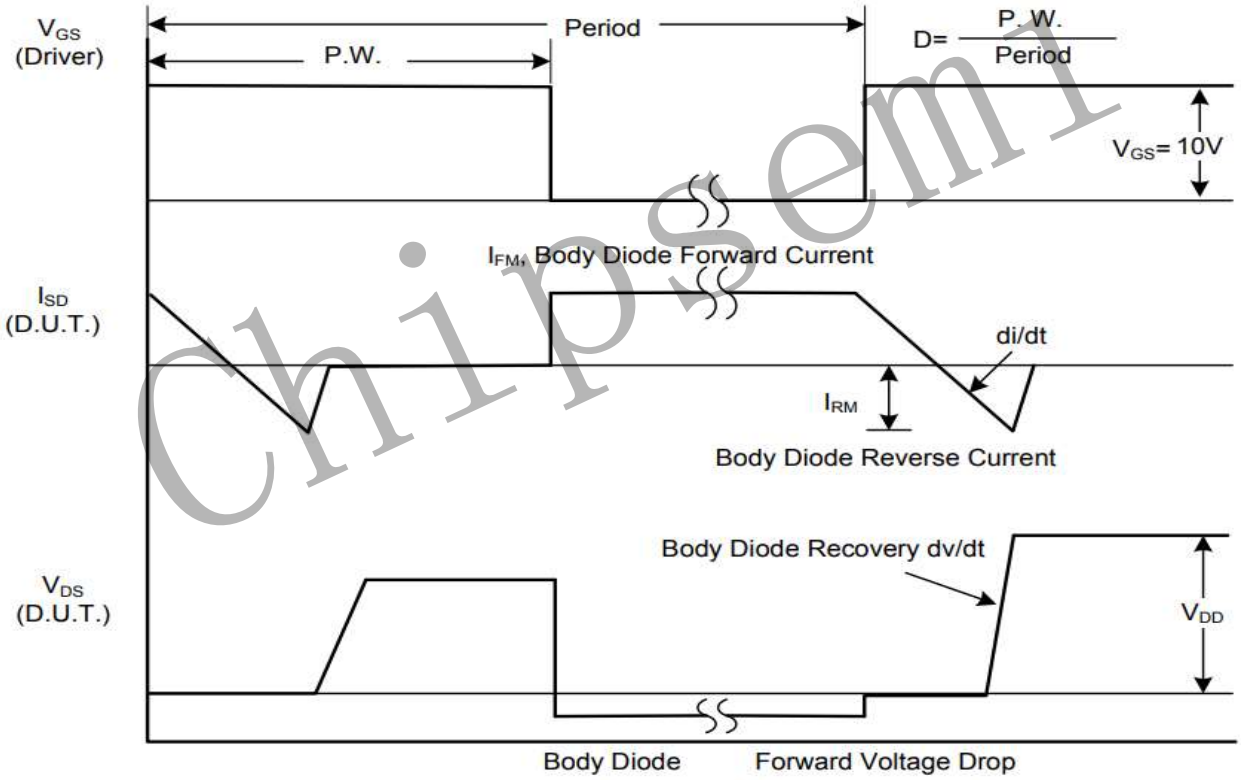
PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage		BV_{DSS}	V_{GS} = 0 V, I_D = 250μA	650		900	V
Drain-Source Leakage Current		I_{DSS}	V_{DS} = 650 V, VGS = 0 V			120	nA
Gate-Source Leakage Current	Forward	I_{GSS}	V_{GS} = 30 V, V_{DS} = 0 V			100	nA
	Reverse		V_{GS} = -30 V, V_{DS} = 0 V			-100	nA
ON CHARACTERISTICS							
Gate Threshold Voltage		$V_{GS(TH)}$	V_{DS} = V_{GS}, I_D = 250μA	2.3		3.8	V
Static Drain-Source On-State Resistance		$R_{DS(ON)}$	V_{GS} = 10 V, I_D = 2A	1.5		2.6	Ω
DYNAMIC CHARACTERISTICS							
Input Capacitance		C_{ISS}	V_{DS} = 25 V, V_{GS} = 0V , f = 1MHz	520	524	529	pF
Output Capacitance		C_{OSS}			62		pF
Reverse Transfer Capacitance		C_{RSS}			10		pF
SWITCHING CHARACTERISTICS							
Total Gate Charge		Q_G	V_{DS}= 520V, I_D= 4.0A, V_{GS}= 10V (Note 1, 2)		100	120	nC
Gate-Source Charge		Q_{GS}			17	19	nC
Gate-Drain Charge		Q_{GD}			20	26	nC
Turn-On Delay Time		$t_{D(ON)}$	V_{DS} = 325V, I_D = 4.0A, R_G = 25Ω (Note 1, 2)		45	85	ns
Turn-On Rise Time		t_R			100	140	ns
Turn-Off Delay Time		$t_{D(OFF)}$			200	240	ns
Turn-Off Fall Time		t_F			130	150	ns
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS							
Maximum Continuous Drain-Source Diode Forward Current		I_S				4.4	A
Maximum Pulsed Drain-Source Diode Forward Current		I_{SM}				17.6	A
Drain-Source Diode Forward Voltage		V_{SD}	V_{GS} = 0 V, I_S = 4A	0.7		1.4	V
Reverse Recovery Time		t_{rr}	V_{GS} = 0V, I_S = 4.4A, dI_F/dt = 100 A/μs (Note 1)		250		ns
Reverse Recovery Charge		Q_{rr}			1.5		μC

Note:
1. Pulse Test: Pulse width≤300μs, Duty cycle≤2%.
2. Essentially independent of operating temperature

TEST CIRCUITS AND WAVEFORMS

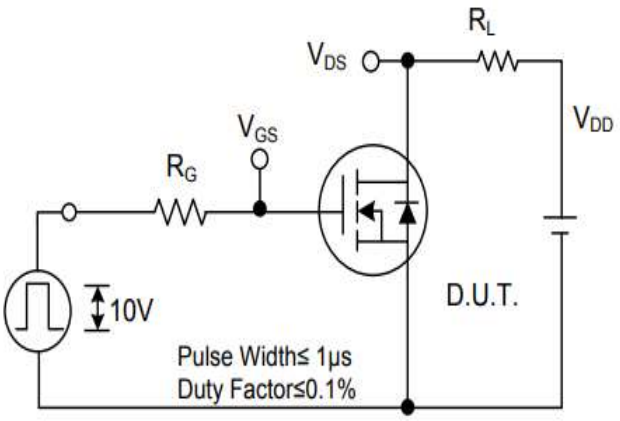


Peak Diode Recovery dv/dt Test Circuit

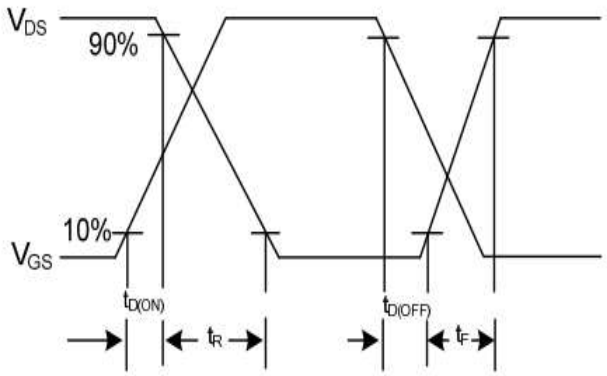


Peak Diode Recovery dv/dt Waveforms

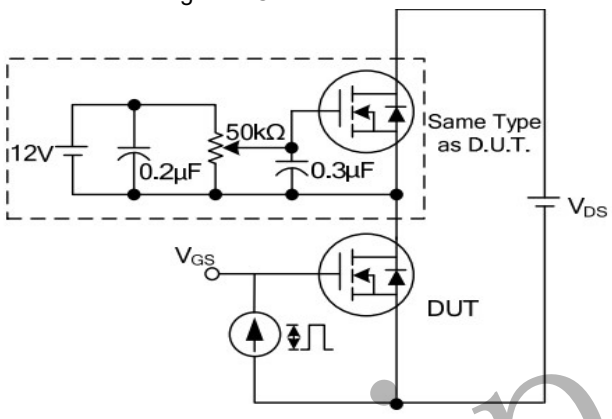
TEST CIRCUITS AND WAVEFORMS(Cont.)



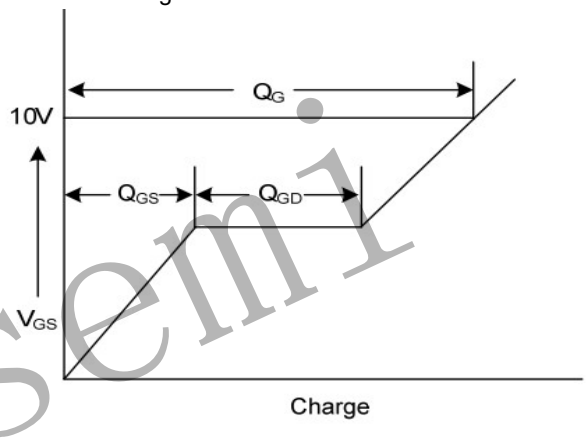
Switching Test Circuit



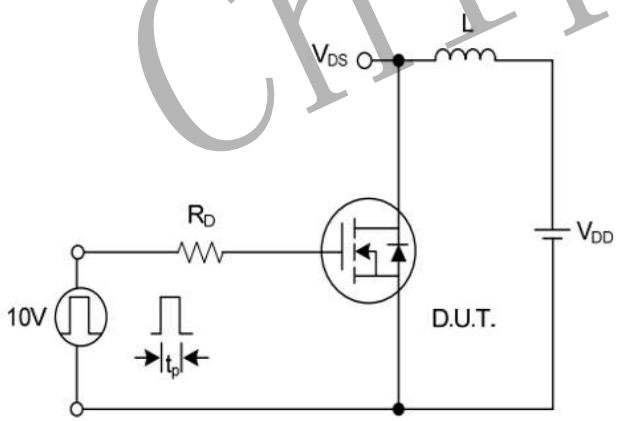
Switching Waveforms



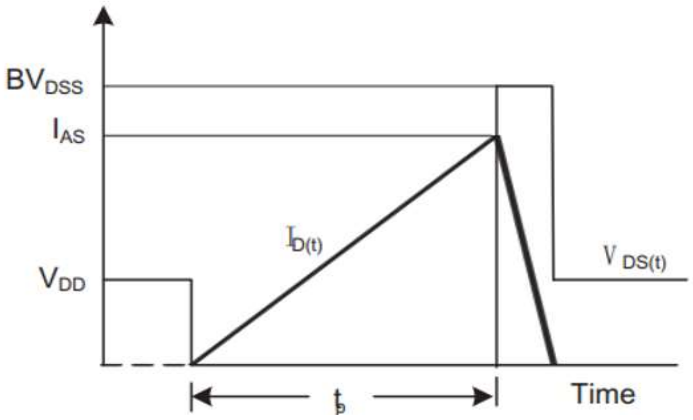
Gate Charge Test Circuit



Gate Charge Waveform



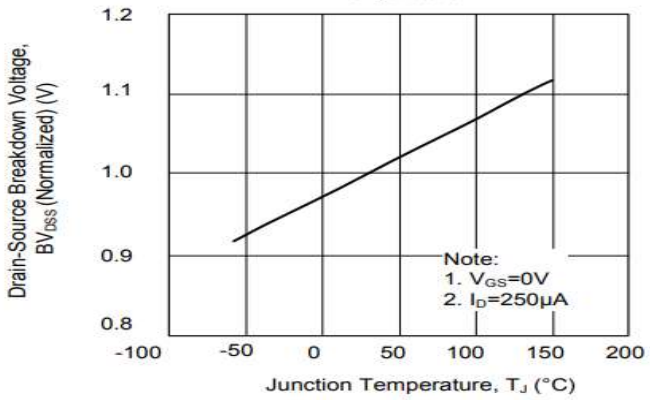
Unclamped Inductive Switching Test Circuit



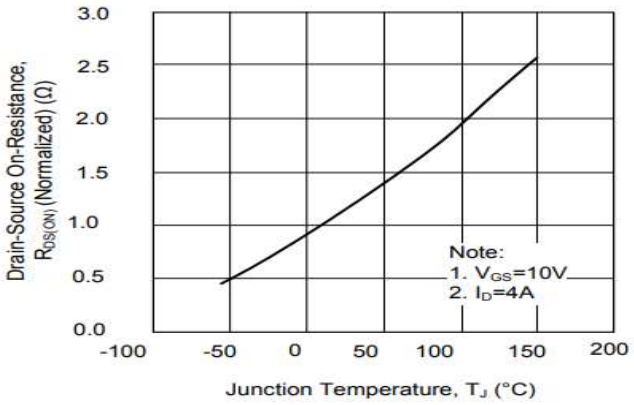
Unclamped Inductive Switching Waveforms

YPICAL CHARACTERISTICS

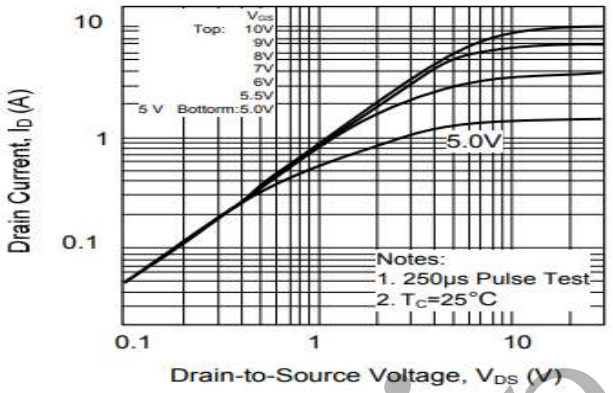
Breakdown Voltage Variation vs. Temperature



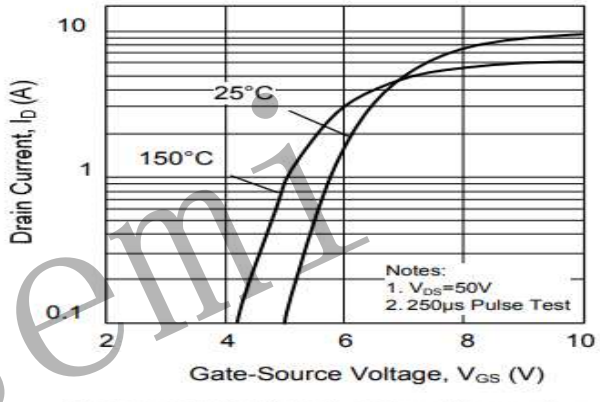
On-Resistance Junction Temperature



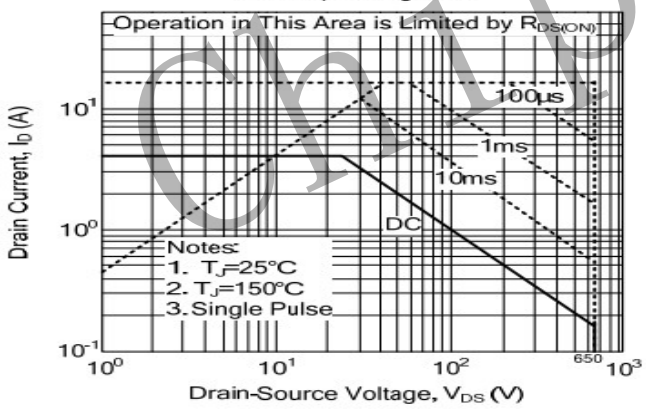
On-State Characteristics



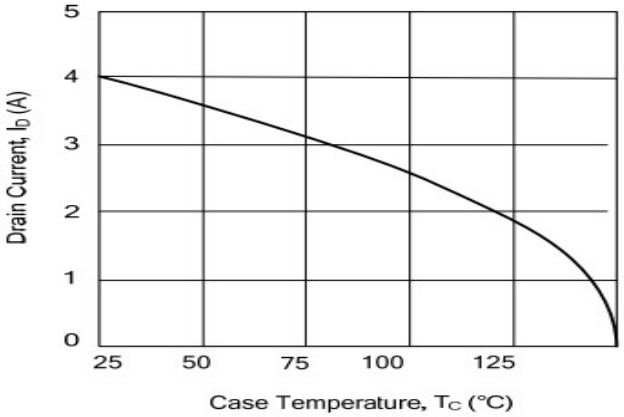
Transfer Characteristics



Safe Operating Area

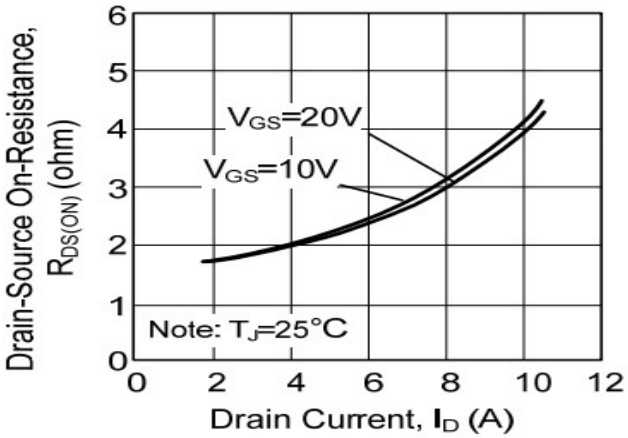


Maximum Drain Current vs. Case Temperature

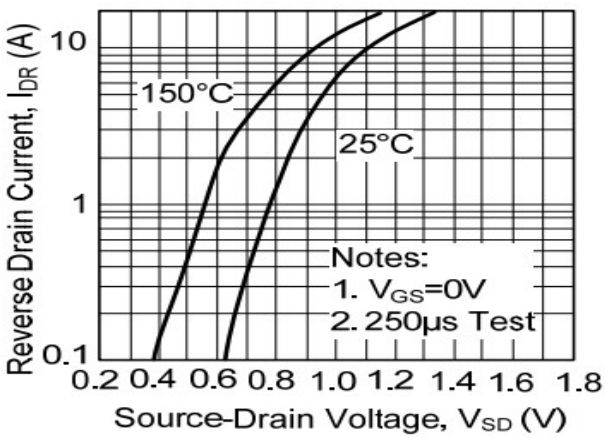


TYPICAL CHARACTERISTICS (Cont.)

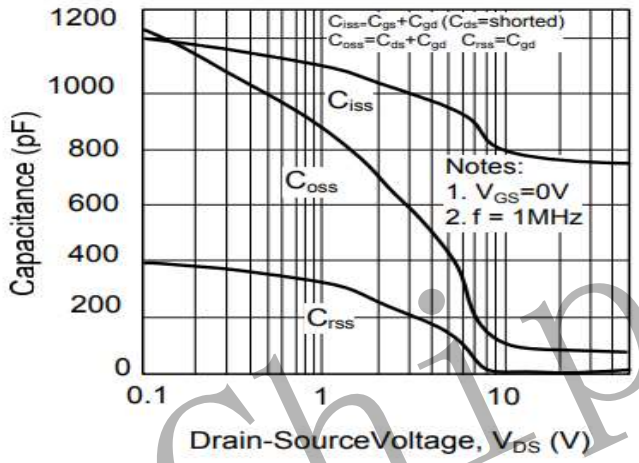
On-Resistance Variation vs. Drain Current and Gate Voltage



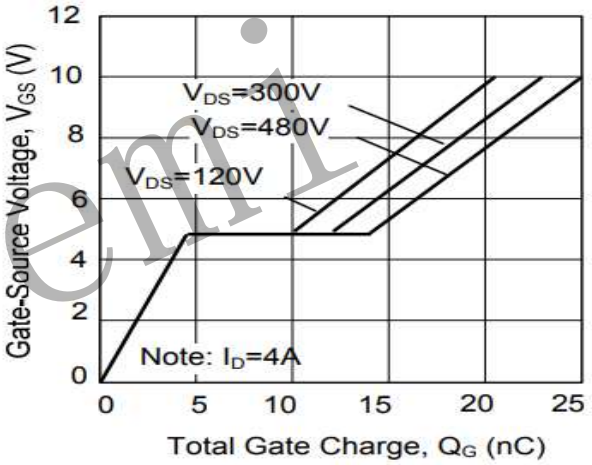
On State Current vs. Allowable Case Temperature



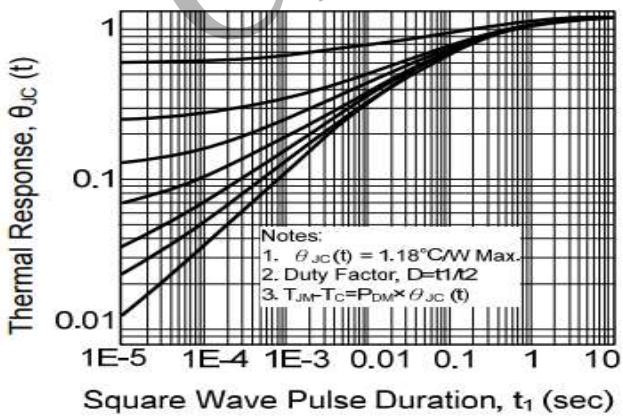
Capacitance Characteristics (Non-Repetitive)



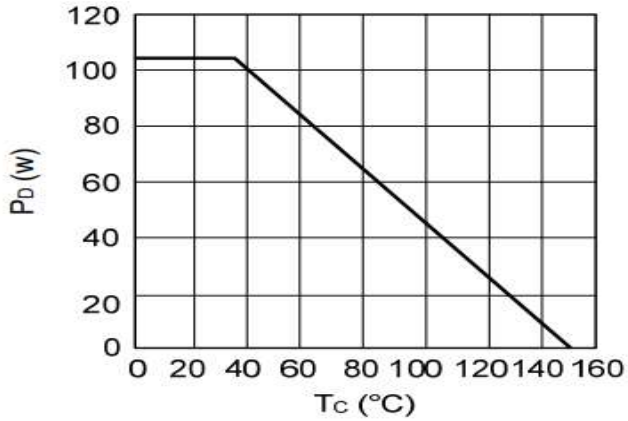
Gate Charge Characteristics



Transient Thermal Response Curve



Power Dissipation



Attentions

- Exceeding the maximum ratings of the device in performance may cause damage to the device, even the permanent failure, which may affect the dependability of the machine. Please do not exceed the absolute maximum ratings of the device when circuit designing.
- When installing the heat sink, please pay attention to the torsional moment and the smoothness of the heat sink.
- MOSFET is the device which is sensitive to the static electricity, it is necessary to protect the device from being damaged by the static electricity when using it.
- Chipsemi reserves the right to make changes in this specification sheet and is subject to change without prior notice.

Appendix

Revision history:

Date	REV.	Description	Page
2023.3	1.0	Original	8