PSM20N65CT

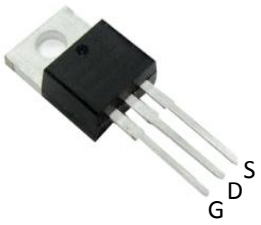
PFC Device Corporation

20A 650V Single N-Channel Power MOSFET

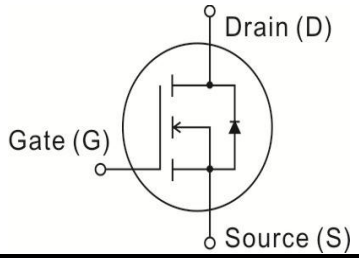
Major ratings and characteristics

Characteristics	Values	Units
V_{DS}@T_J max	650	**V**
$R_{DS(ON)}$,V_{GS}=10V	0.19	**Ω**
I_D	20	**A**

PSM20N65CT



TO-220AB



General Description

PFC MLSJ (Multi-Layer Super Junction) MOSFET technology is the ideal choice for the PFC and PWM application. PFC device provides practical advantages of higher pressure-resistance, lower on-resistance to achieve the ideal balance between the switching speed and on-resistance.

Typical Applications

PFC stages, hard switching PWM stages and resonant switching stages for PC, Adapter, LCD & PDP TV, Lighting, Server, Telecom and UPS.

Please note: For MOSFET paralleling the use of ferrite beads on the gate or separate totem poles is generally recommended.

Features

- Advanced High Voltage Technology
- Low On-Resistance
- Low Gate Threshold Voltage
- Low Input Capacitance
- Extreme dv/dt rated
- Lead Free Finish, RoHS Compliant

1. Characteristics

Maximum Ratings Characteristics (T_A = 25 °C unless otherwise specified)

Symbol	Parameter	Rating	Units
V_{DSS}	Drain-Source Voltage	650	V
I_D	Drain Current – Continuous (T_C=25°C)	20	A
	Drain Current – Continuous (T_C=100°C)	13	A
$I_{D\ pulsed}$	Pulsed Drain Current tp limited by T_J max (Note 1)	60	A
E_{AS}	Single Pulse Avalanche Energy (Noted 2)	300	mJ
E_{AR}	Avalanche Energy, repetitive t_{AR} limited by T_{imax} (Note 3) I_D=20A, V_{DD}=50V	1	mJ
I_{AR}	Avalanche Current, repetitive t_{AR} limited by T_{jmax}	20	A
V_{GS}	Gate-Source Voltage Static	±20	V
V_{GS}	Gate-Source Voltage AC (f>1Hz)	±30	V
P_{tot}	Power Dissipation	204	W
T_{STG}	Storage Temperature Range	-55 to 150	°C
T_J	Operating Junction Temperature Range	-55 to 150	°C
dv/dt	Peak Diode Recovery dv/dt (Note 4)	15	V/nS
dv/dt	MOSFET dvdt ruggedness, V_{DS}=480V	50	V/nS

Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Unit
$R_{\theta JA}$	Thermal Resistance Junction to ambient	---	62	°C/W
$R_{\theta JC}$	Thermal Resistance Junction to case (Drain)	---	0.61	°C/W

Electrical Characteristics (T_J = 25 °C unless otherwise specified)

Off Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS}=0V, I_D=250uA	650	---	---	V
I_{DSS}	Drain-Source Leakage Current	V_{DS}=600V, V_{GS}=0V, T_J=25℃	---	0.05	1	uA
		V_{DS}=600V, V_{GS}=0V, T_J=150℃	---	---	100	uA
I_{GSS}	Gate-Source Leakage Current	V_{GS}=±30V, V_{DS}=0V	---	---	±100	nA

On Characteristics

$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS}=10V, I_D=13A, T_J=25℃	---	0.165	0.190	Ω
		V_{GS}=10V, I_D=13A, T_J=150℃	---	0.45	---	Ω
$V_{GS(th)}$	Gate-Source Threshold Voltage	V_{GS}=V_{DS}, I_D=1000uA	2.8	3.2	3.9	V
R_G	Gate input resistance	f=1MHz, open Drain	---	0.54	---	Ω

Dynamic and switching Characteristics

Q_{gs}	Gate-Source Charge	V_{DD}=480V, I_D=20A, V_{GS}=0 to 10V	---	13	---	nC
Q_{gd}	Gate-Drain Charge		---	33	---	
Q_g	Gate charge total		---	75	110	
$V_{(plateau)}$	Gate plateau voltage		---	5.9	---	V
g_{fs}	Transecondtance	V_{DS}≧2*I_D*$R_{DS(on)max}$, I_D=13A	---	20.5	---	S
$T_{d(on)}$	Turn-On Delay Time	V_{DD}=380V, V_{GS}=0/13V, I_D=20A, R_g=3.6Ω, T_J=25℃	---	8	---	nS
T_r	Rise Time		---	34	---	
$T_{d(off)}$	Turn-Off Delay Time		---	42	---	
T_f	Fall Time		---	58	---	
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS} =100V f=1 MHz	---	2400	---	pF
C_{oss}	Output Capacitance		---	81	---	
C_{rss}	Reverse Transfer Capacitance		---	32	---	

Drain-Source Diode Characteristics and Maximum ratings

V_{SD}	Inverse diode forward voltage	I_S = 20A, V_{GS} = 0V	---	0.91	1.2	V
t_{rr}	Reverse Recovery Time	V_R=480V, I_F=I_S, di_F/dt=100A/uS	---	491	800	nS
Q_{rr}	Reverse Recovery Charge		---	10	---	uC
I_{rrm}	Peak reverse recovery current		---	42	---	A

Note :

1. Repetitive Rating: Pulsed width limited by maximum junction temperature.
2. V_{DD}=50V, I_D=10A, Starting T_J=25℃.
3. Repetitive avalanche cause additional power lose that can be calculated as P_{AV}=E_{AR}*f.
4. I_{SD}<=I_D, di/dt<=400A/us, T_J<T_J,max

2. Characteristics Curves

Ratings and Characteristics Curves (T_A = 25℃ unless otherwise specified)

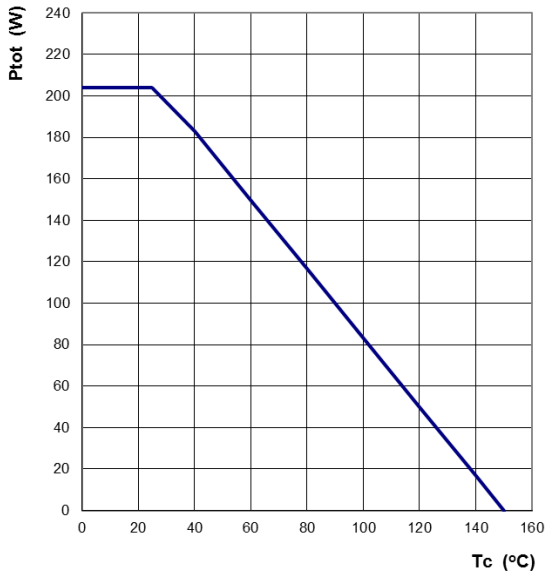


Figure 1: Power Dissipation
P_{tot} = f (T_C)

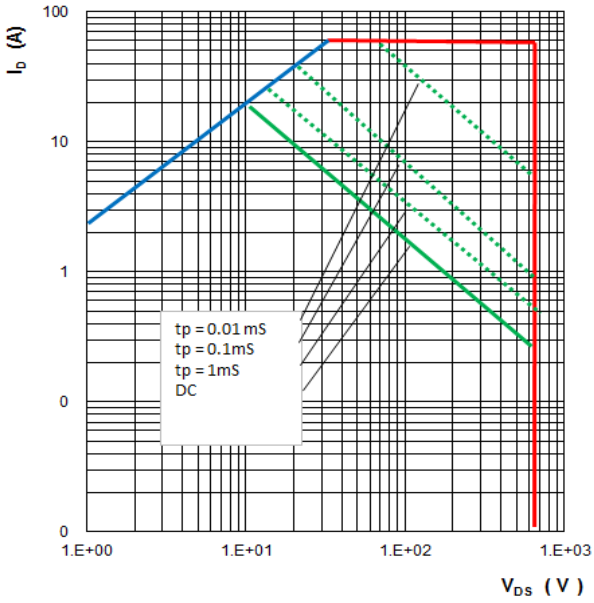


Figure 2: Safe operating area
I_D = f (V_{DS})
parameter : D = 0, T_C=25℃

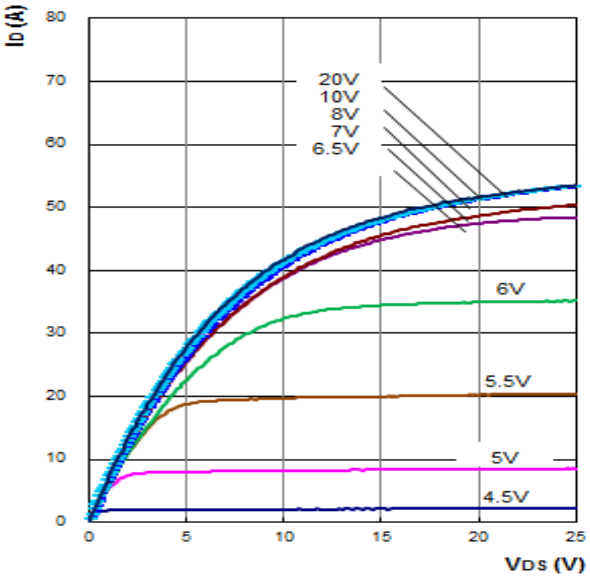


Figure 3: Typ. Output Characteristics
I_D = f (V_{DS}) ; T_J= 25℃
parameter : t_p = 100uS, V_{GS}

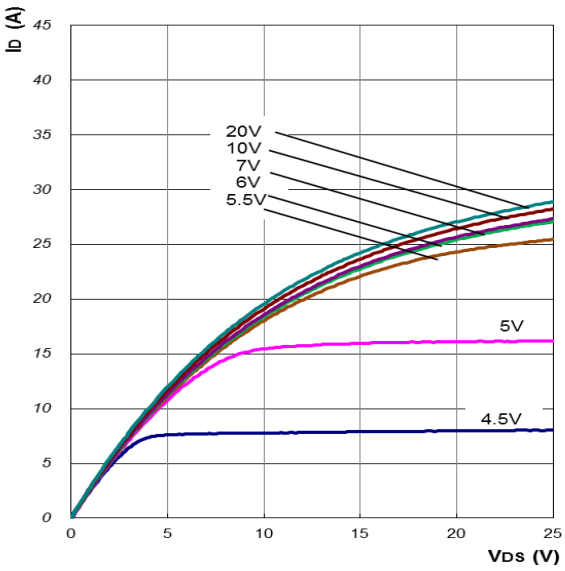


Figure 4: Typ. Output Characteristics
I_D = f (V_{DS}) ; T_J= 150℃
parameter : t_p = 100uS, V_{GS}

Ratings and Characteristics Curves (T_A = 25℃ unless otherwise specified)

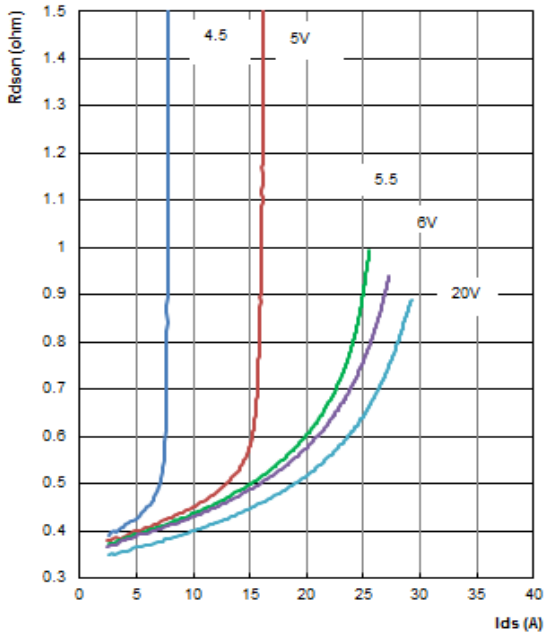


Figure 5: Typ. Drain Source On-Resistance
R_{DS}(on)= f (I_D)
parameter : t_p = 100uS, T_J = 150℃, V_{GS}

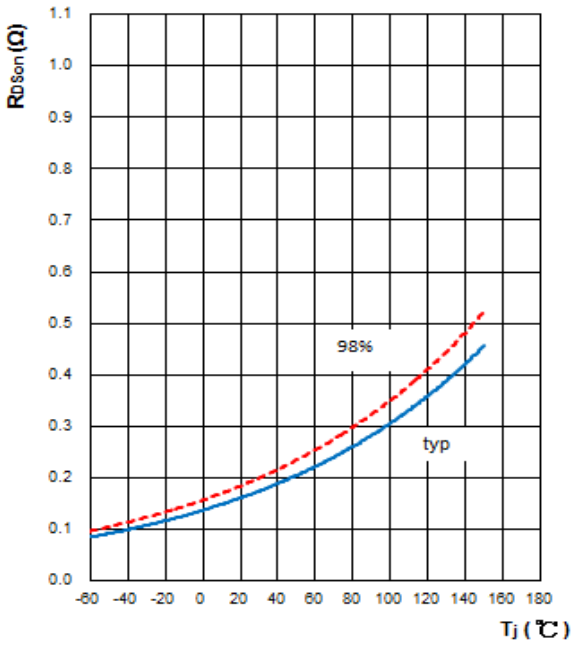


Figure 6: Drain-Source On-state Resistance
R_{DS}(on) = f (T_J)
parameter : I_D =13A, V_{GS}=10V

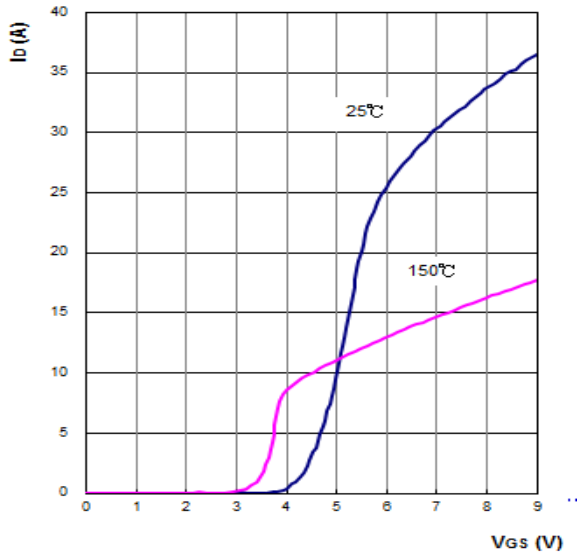


Figure 7: Typ. Transfer Characteristics
I_D = f (V_{GS}); V_{DS} ≧2 X I_D X R_{DS}(on) max
parameter : t_p=100 uS

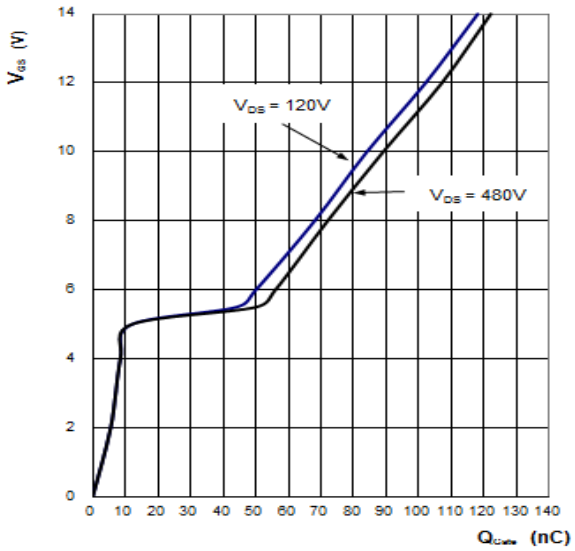


Figure 8: Typ. Gate Charge
V_{GS} = f(Q_{GATE})
parameter : I_D=20A pulsed

Ratings and Characteristics Curves (T_A = 25℃ unless otherwise specified)

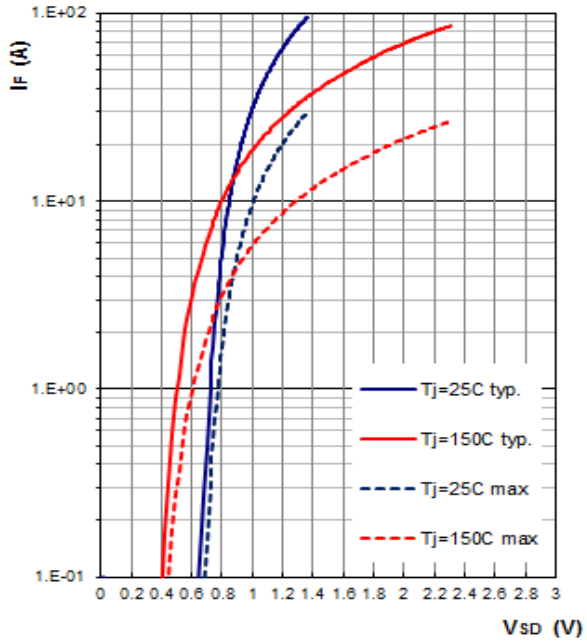


Figure 9: Forward characteristics of body diode
$I_F = f(V_{SD})$
parameter : T_J , t_p=100uS

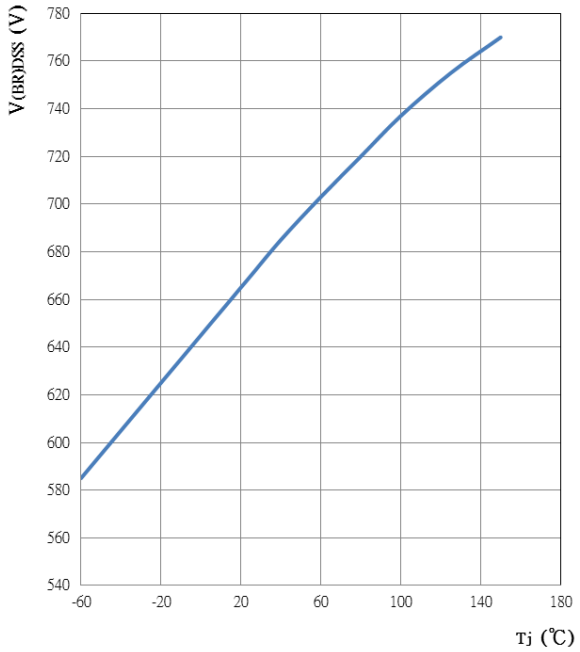


Figure 10: Drain-source breakdown voltage
$V_{(BR)DSS} = f(T_J)$

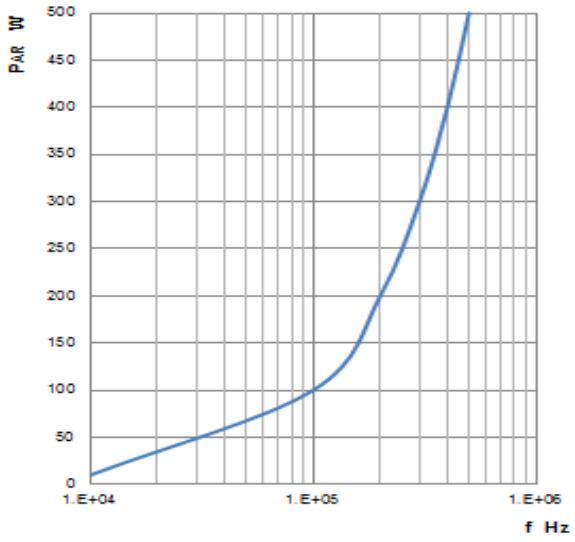


Figure 11: Avalanche power losses
$P_{AR} = f(f)$
parameter : E_{AR}=1mJ

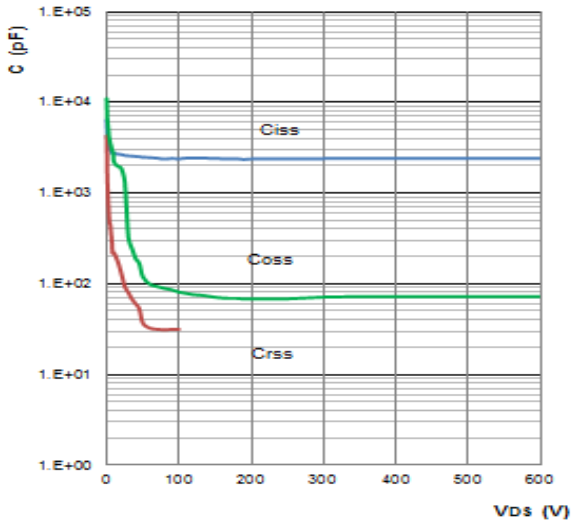


Figure 12: Typ. Capacitances
$C = f(V_{DS})$
parameter : V_{GS}=0V, f=1MHz

Ratings and Characteristics Curves (T_A = 25℃ unless otherwise specified)

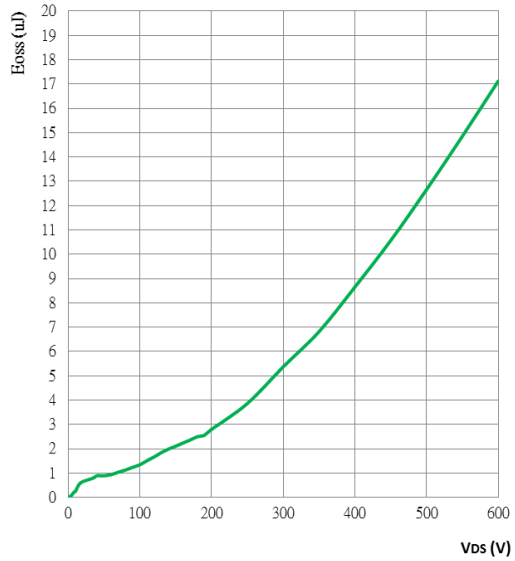


Figure 13: Typ. C_{oss} stored energy
E_{oss}=f (V_{DS})

3. Test Circuits and Waveforms

Test Circuits and Waveforms

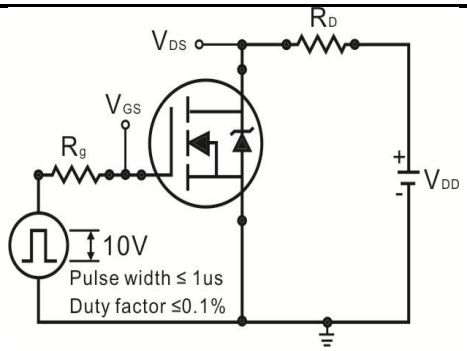


Figure 1: Switching times test circuit

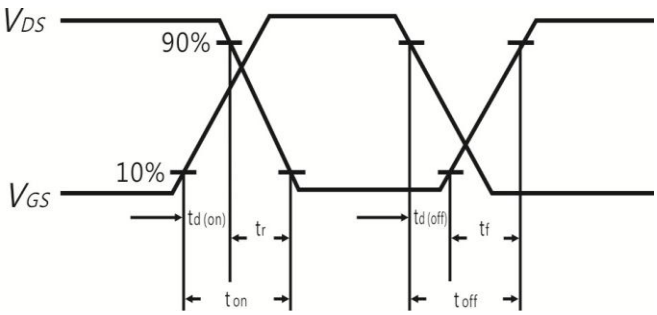


Figure 2: Switching time waveform

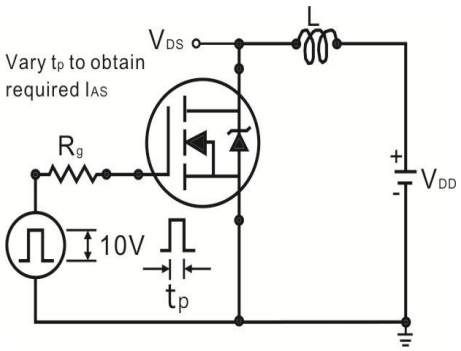


Figure 3:Unclamped test circuit

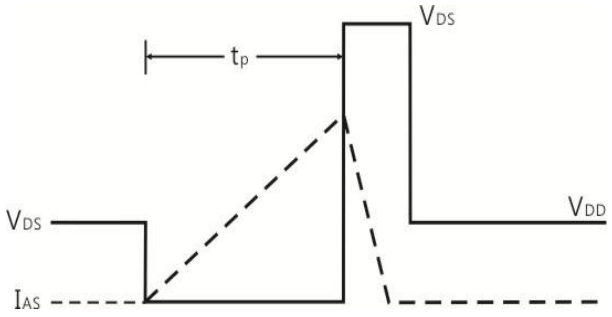


Figure 4: Unclamped test waveform

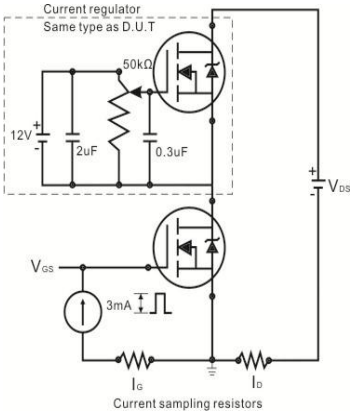


Figure 5:Gate charge test circuit

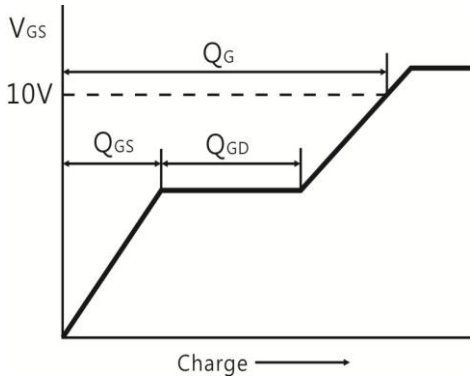


Figure 6: Basic gate charge waveform

4. Marking information

Top Marking Rule

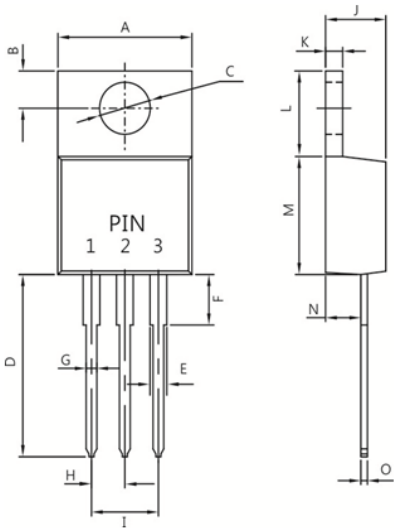
PFC PSM **20N65CT** **YYWW ABSH**

PSM20N65CT = Product Type Marking Code
YY = Last two digits of year
WW = Week code
ABS = Assembly code
H = Halogen Free (N/A = common molding compound)

5. Package information

Package Outline Dimensions millimeters

TO-220AB



Dim.	Min.	Max.
A	-----	10.50
B	2.50	3.50
C	3.50	4.10
D	13.10	13.90
E	1.15	1.49
F	-----	6.35
G	0.65	0.95
H	2.29	2.79
I	4.80	5.30
J	4.40	4.80
K	1.14	1.40
L	5.84	6.86
M	8.50	9.60
N	2.03	2.92
O	0.30	0.64
All Dimensions in millimeter		

6. Ordering information

Part Number	Package	Delivery mode
PSM20N65CT	TO-220AB	50 pieces / tube

Note: For Halogen Free molding compound, add "H" suffix to part number above.

Mechanical

- Molder Plastic: UL Flammability Classification Rating 94V-0
- Device Weight : 0.07 ounces (1.96grams) – TO-220AB
- Mounting Torque : Recommended 10 in-lbs maximum