TAIWAN SEMICONDUCTOR

N-Channel Power MOSFET

40V, 157A, 3.5mΩ

FEATURES

- Low $R_{DS(ON)}$ to minimize conductive losses
- Low gate charge for fast power switching
- 100% UIS and R_g Tested
- RoHS Compliant
- Halogen-free according to IEC 61249-2-21

APPLICATIONS

- BLDC Motor Control
- Battery Power Management
- DC-DC Converter

KEY PERFORMANCE PARAMETERS

PARAMETER		VALUE	UNIT
V_{DS}		40	V
$R_{DS(on)}$ (max)	V_{GS} = 10V	3.5	mΩ
	V_{GS} = 7V	4.6	
Q_g		110	nC

Pb-Free   RoHS COMPLIANT   HALOGEN FREE

TO-220
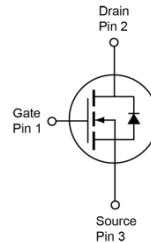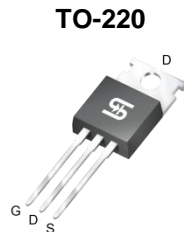
ABSOLUTE MAXIMUM RATINGS (T_A = 25°C unless otherwise noted)

PARAMETER		SYMBOL	LIMIT	UNIT
Drain-Source Voltage		V_{DS}	40	V
Gate-Source Voltage		V_{GS}	±20	V
Continuous Drain Current (Note 1)	T_C = 25°C	I_D	157	A
	T_A = 25°C		18	
Pulsed Drain Current		I_{DM}	628	A
Single Pulse Avalanche Current (Note 2)		I_{AS}	42	A
Single Pulse Avalanche Energy (Note 2)		E_{AS}	265	mJ
Total Power Dissipation	T_C = 25°C	P_D	156	W
	T_C = 125°C		31	
Total Power Dissipation	T_A = 25°C	P_D	2	W
	T_A = 125°C		0.4	
Operating Junction and Storage Temperature Range		T_J, T_{STG}	- 55 to +150	°C

THERMAL PERFORMANCE

PARAMETER	SYMBOL	MAXIMUM	UNIT
Junction to Case Thermal Resistance	$R_{\Theta JC}$	0.8	°C/W
Junction to Ambient Thermal Resistance	$R_{\Theta JA}$	62	°C/W

Thermal Performance Note: $R_{\Theta JA}$ is the sum of the junction-to-case and case-to-ambient thermal resistances. The case-thermal reference is defined at the solder mounting surface of the drain pins. $R_{\Theta JC}$ is guaranteed by design while $R_{\Theta CA}$ is determined by the user's board design.

ELECTRICAL SPECIFICATIONS (T_A = 25°C unless otherwise noted)

PARAMETER	CONDITIONS	SYMBOL	MIN	TYP	MAX	UNIT
Static						
Drain-Source Breakdown Voltage	V_{GS} = 0V, I_D = 250μA	BV_{DSS}	40	--	--	V
Gate Threshold Voltage	V_{GS} = V_{DS}, I_D = 250μA	$V_{GS(TH)}$	2	2.8	4	V
Gate-Source Leakage Current	V_{GS} = ±20V, V_{DS} = 0V	I_{GSS}	--	--	±100	nA
Drain-Source Leakage Current	V_{GS} = 0V, V_{DS} = 40V	I_{DSS}	--	--	1	μA
	V_{GS} = 0V, V_{DS} = 40V T_J = 125°C		--	--	100	
Drain-Source On-State Resistance (Note 3)	V_{GS} = 10V, I_D = 18A	$R_{DS(on)}$	--	2.5	3.5	mΩ
	V_{GS} = 7V, I_D = 16A		--	2.8	4.6	
Forward Transconductance (Note 3)	V_{DS} = 10V, I_D = 18A	g_{fs}	--	68	--	S
Dynamic (Note 4)						
Total Gate Charge	V_{GS} = 10V, V_{DS} = 20V, I_D = 18A	Q_g	--	110	--	nC
Total Gate Charge	V_{GS} = 7V, V_{DS} = 20V, I_D = 16A	Q_g	--	79	--	
Gate-Source Charge		Q_{gs}	--	33	--	
Gate-Drain Charge		Q_{gd}	--	26	--	
Input Capacitance	V_{GS} = 0V, V_{DS} = 20V, f = 1.0MHz	C_{iss}	--	6990	--	pF
Output Capacitance		C_{oss}	--	667	--	
Reverse Transfer Capacitance		C_{rss}	--	334	--	
Gate Resistance	f = 1.0MHz	R_g	0.6	2	4	Ω
Switching (Note 4)						
Turn-On Delay Time	V_{GS} = 10V, V_{DS} = 20V, I_D = 18A, R_G = 2Ω	$t_{d(on)}$	--	18	--	ns
Turn-On Rise Time		t_r	--	77	--	
Turn-Off Delay Time		$t_{d(off)}$	--	71	--	
Turn-Off Fall Time		t_f	--	60	--	
Source-Drain Diode						
Forward Voltage (Note 3)	V_{GS} = 0V, I_S = 18A	V_{SD}	--	--	1	V
Reverse Recovery Time	I_S = 18A, dI/dt = 100A/μs	t_{rr}	--	34	--	ns
Reverse Recovery Charge		Q_{rr}	--	31	--	nC

Notes:

1. Silicon limited current only.
2. L = 0.3mH, V_{GS} = 10V, V_{DD} = 25V, R_G = 25Ω, I_{AS} = 42A, Starting T_J = 25°C
3. Pulse test: Pulse Width ≤ 300μs, duty cycle ≤ 2%.
4. Switching time is essentially independent of operating temperature.

ORDERING INFORMATION
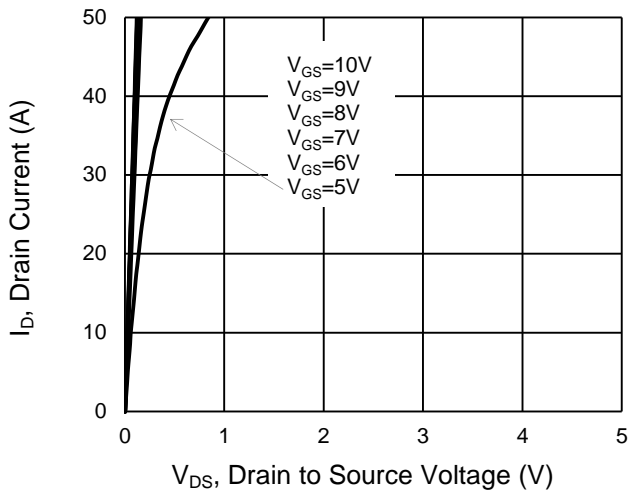
ORDERING CODE	PACKAGE	PACKING
TSM035NB04CZ C0G	TO-220	50pcs / Tube

Version: A2008

CHARACTERISTICS CURVES

(T_A = 25°C unless otherwise noted)

Output Characteristics

I_D, Drain Current (A)

V_{GS}=10V
V_{GS}=9V
V_{GS}=8V
V_{GS}=7V
V_{GS}=6V
V_{GS}=5V

V_{DS}, Drain to Source Voltage (V)

Transfer Characteristics

I_D, Drain Current (A)

25℃
150℃
-55℃

V_{GS}, Gate to Source Voltage (V)
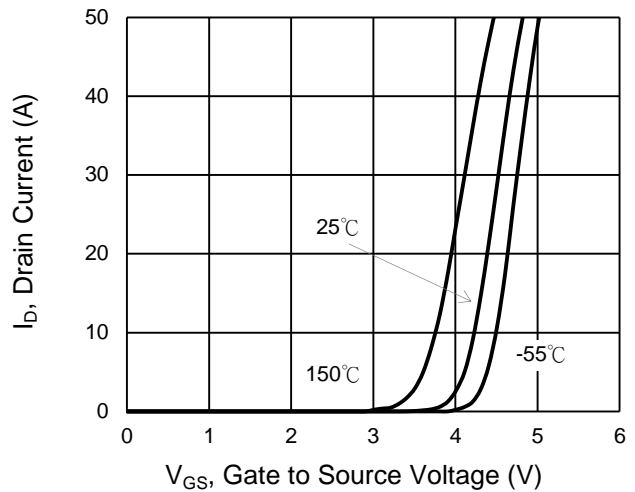
On-Resistance vs. Drain Current

$R_{DS(on)}$, Drain-Source On-Resistance (Ω)

V_{GS}=7V
V_{GS}=10V

I_D, Drain Current (A)
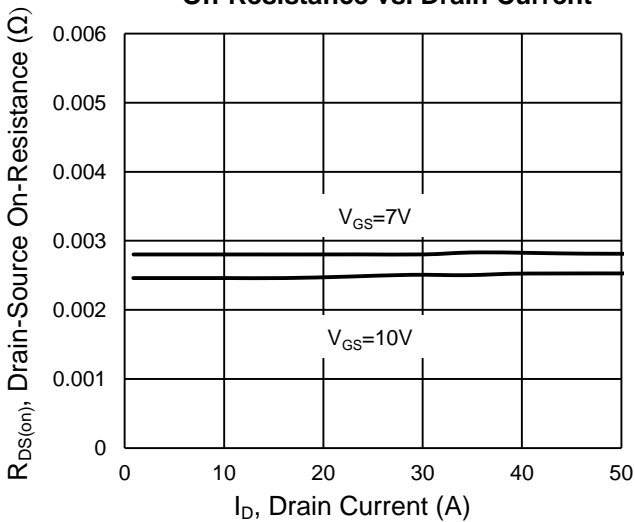
Gate-Source Voltage vs. Gate Charge

V_{GS}, Gate to Source Voltage (V)

V_{DS}=20V
I_D=18A

Q_g, Gate Charge (nC)
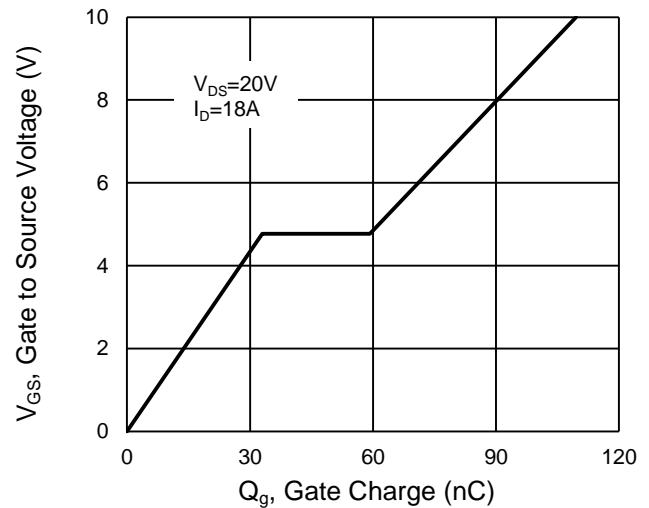
On-Resistance vs. Junction Temperature

$R_{DS(on)}$, Drain-Source On-Resistance (Normalized)
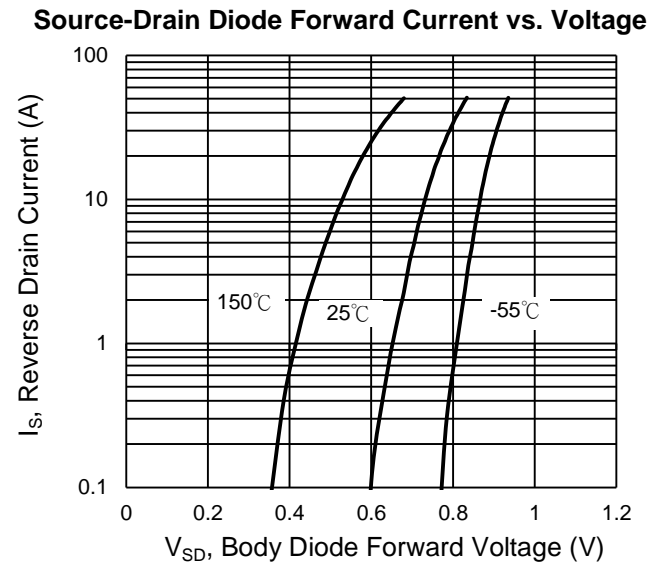
V_{GS}=10V
I_D=18A

T_J, Junction Temperature (°C)
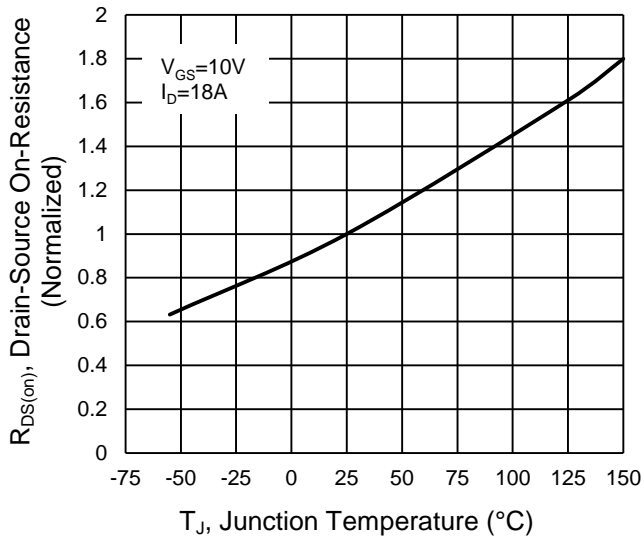
On-Resistance vs. Gate-Source Voltage

$R_{DS(on)}$, Drain-Source On-Resistance (Ω)

I_D=18A

V_{GS}, Gate to Source Voltage (V)

CHARACTERISTICS CURVES
(T_A = 25°C unless otherwise noted)

Capacitance vs. Drain-Source Voltage

BV$_{DSS}$ vs. Junction Temperature

Maximum Safe Operating Area, Junction-to-Case

Source-Drain Diode Forward Current vs. Voltage

Normalized Thermal Transient Impedance, Junction-to-Case

SINGLE PULSE
R$_{\theta JC}$=0.8°C/W

Duty=0.5
Duty=0.2
Duty=0.1
Duty=0.05
Duty=0.02
Duty=0.01
Single

Notes:
Duty = t_1 / t_2
T_J = T_C + P_{DM} x $Z_{\theta JC}$ x $R_{\theta JC}$

Version: A2008
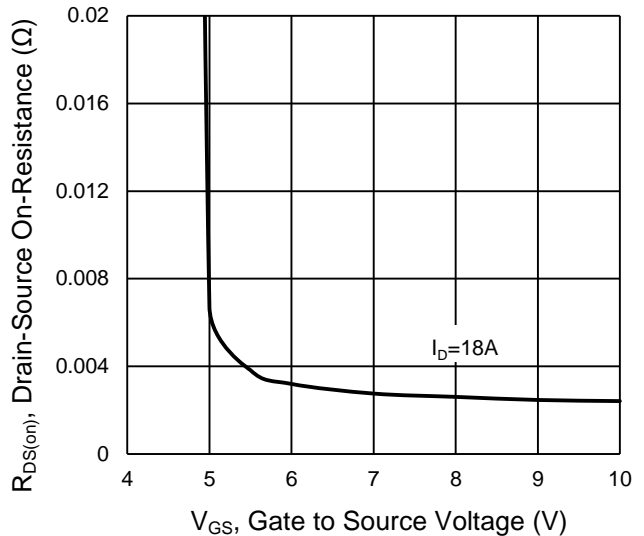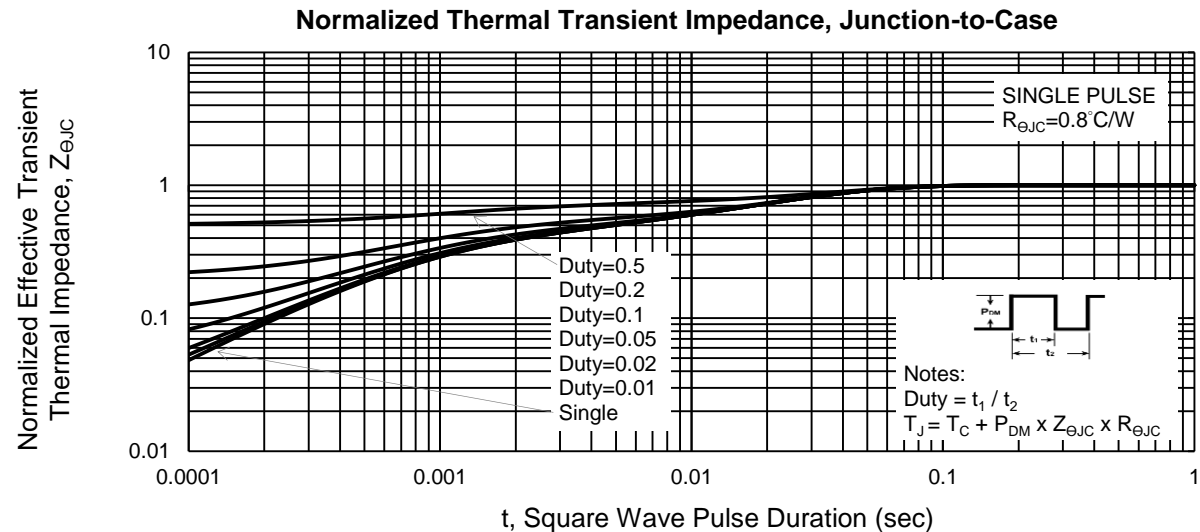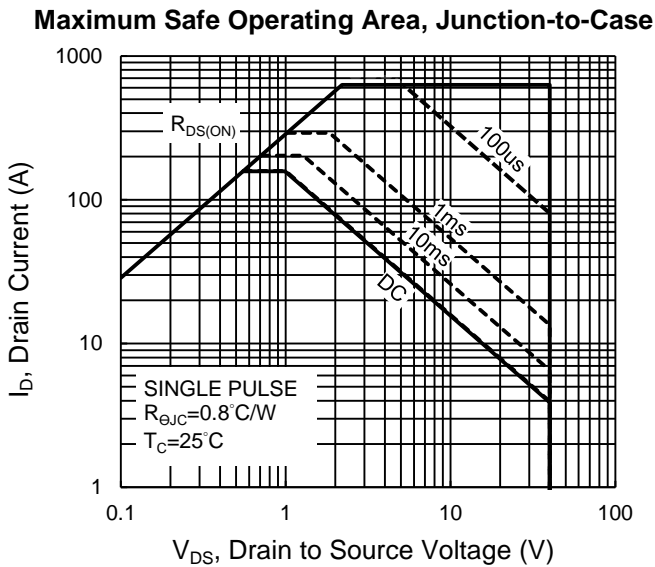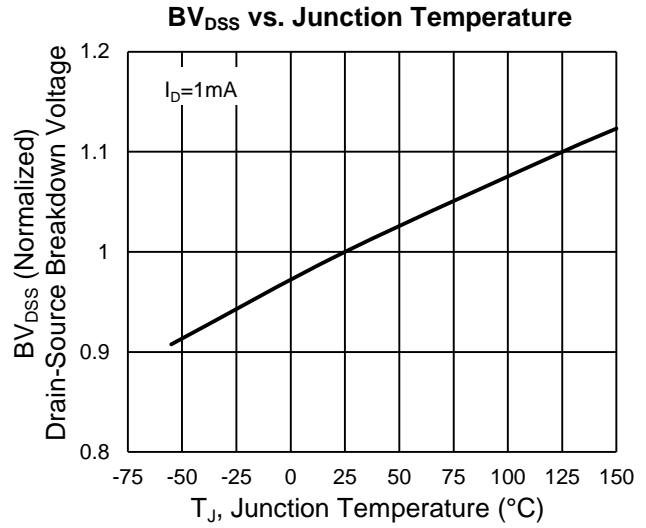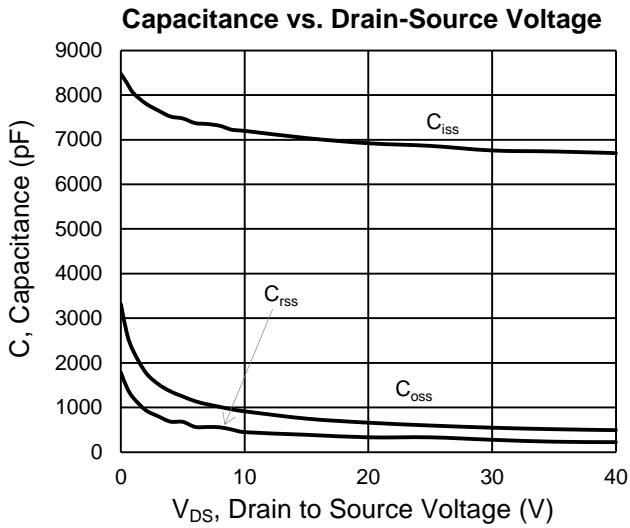
PACKAGE OUTLINE DIMENSIONS (Unit: Millimeters)

TO-220

MARKING DIAGRAM

TSC
035NB04
YWWLF
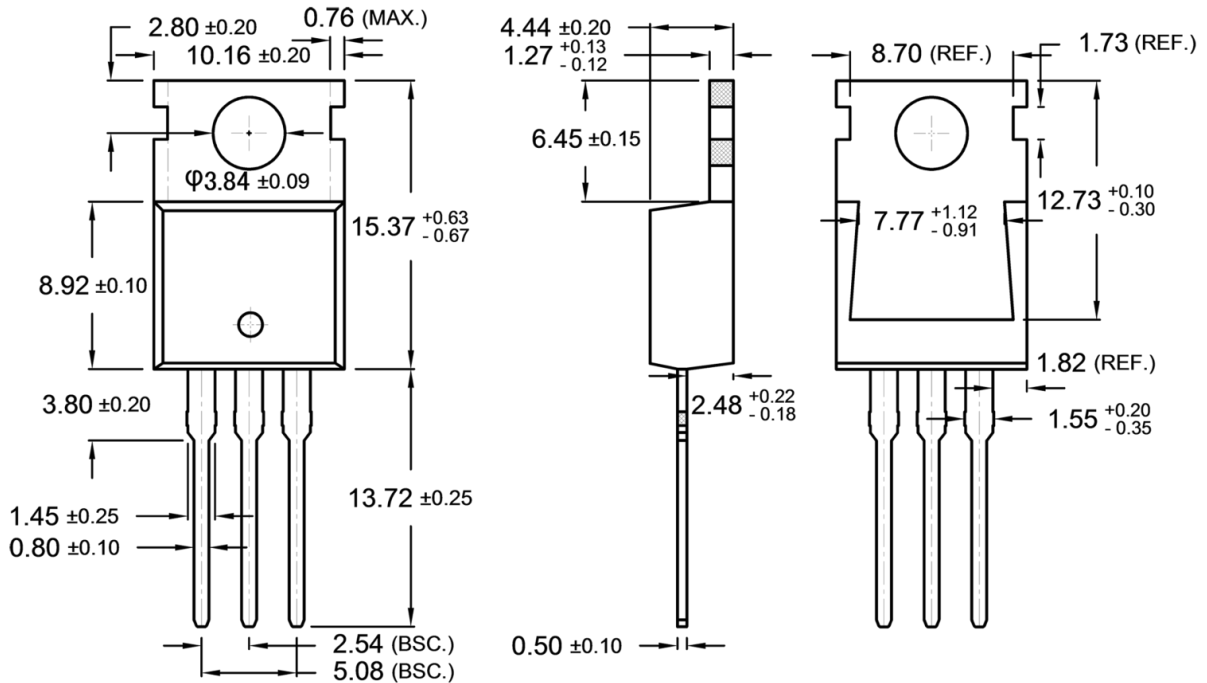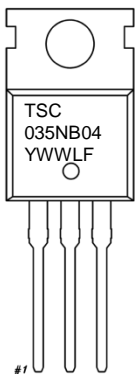
Y = Year Code

WW = Week Code (01~52)

L = Lot Code (1~9,A~Z)

F = Factory Code

Notice

Specifications of the products displayed herein are subject to change without notice. TSC or anyone on its behalf, assumes no responsibility or liability for any errors or inaccuracies.

Purchasers are solely responsible for the choice, selection, and use of TSC products and TSC assumes no liability for application assistance or the design of Purchasers' products.

Information contained herein is intended to provide a product description only. No license, express or implied, to any intellectual property rights is granted by this document. Except as provided in TSC's terms and conditions of sale for such products, TSC assumes no liability whatsoever, and disclaims any express or implied warranty, relating to sale and/or use of TSC products including liability or warranties relating to fitness for a particular purpose, merchantability, or infringement of any patent, copyright, or other intellectual property right.

The products shown herein are not designed for use in medical, life-saving, or life-sustaining applications. Customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify TSC for any damages resulting from such improper use or sale.

Version: A2008