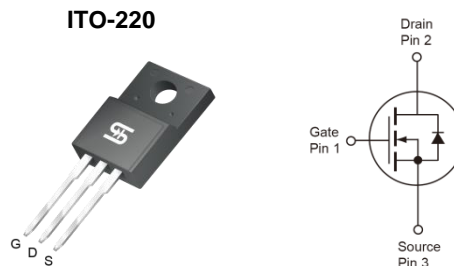# N-Channel Power MOSFET

600V, 7A, 0.62Ω

FEATURES

- Super-Junction technology
- High performance due to small figure-of-merit
- High commutation performance
- 100% UIS & Rg tested
- RoHS Compliant
- Halogen-free

APPLICATIONS

- Switching Power Supply
- Lighting

KEY PERFORMANCE PARAMETERS

PARAMETER	VALUE	UNIT
V_{DS}	600	V
$R_{DS(on)}$ (max)	0.62	Ω
Q_g	15	nC

ITO-220

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

PARAMETER		SYMBOL	LIMIT	UNIT
Drain-Source Voltage		V_{DS}	600	V
Gate-Source Voltage	static	V_{GS}	±20	V
	AC(f>1Hz)		±30	V
Continuous Drain Current [Note 1]	T_C = 25°C	I_D	7	A
Pulsed Drain Current [Note 1]		I_{DM}	21	A
Total Power Dissipation @ T_C = 25°C		P_D	46	W
Single Pulse Avalanche Energy [Note 2]		E_{AS}	145	mJ
Single Pulse Avalanche Current [Note 2]		I_{AS}	2.4	A
Operating Junction and Storage Temperature Range		T_J, T_{STG}	- 55 to +150	°C

THERMAL PERFORMANCE

PARAMETER	SYMBOL	LIMIT	UNIT
Junction to Case Thermal Resistance	$R_{\Theta JC}$	2.7	°C/W
Junction to Ambient Thermal Resistance	$R_{\Theta JA}$	62	°C/W

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. $R_{\Theta JA}$ shown below for single device operation on FR-4 PCB with a minimum recommended footprint in still air.

ELECTRICAL SPECIFICATIONS (T$_A$ = 25°C unless otherwise noted)

PARAMETER	CONDITIONS	SYMBOL	MIN	TYP	MAX	UNIT
Static (Note 3)						
Drain-Source Breakdown Voltage	V$_{GS}$ = 0V, I$_D$ = 1mA	BV$_{DSS}$	600	--	--	V
Gate Threshold Voltage	V$_{DS}$ = V$_{GS}$, I$_D$ = 1mA	V$_{GS(TH)}$	3	4.6	5	V
Gate Body Leakage	V$_{GS}$ = ± 20V, V$_{DS}$ = 0V	I$_{GSS}$	--	--	±100	nA
Zero Gate Voltage Drain Current	V$_{DS}$ = 600V, V$_{GS}$ = 0V	I$_{DSS}$	--	--	100	µA
Drain-Source On-State Resistance	V$_{GS}$ = 10V, I$_D$ = 2.4A	R$_{DS(on)}$	--	0.56	0.62	Ω
Dynamic (Note 4)						
Total Gate Charge	V$_{DS}$ = 300V, I$_D$ = 7A, V$_{GS}$ = 10V	Q$_g$	--	15	--	nC
Gate-Source Charge		Q$_{gs}$	--	4.3	--	
Gate-Drain Charge		Q$_{gd}$	--	5.6	--	
Input Capacitance	V$_{DS}$ = 300V, V$_{GS}$ = 0V, f = 1.0MHz	C$_{iss}$	--	506	--	pF
Output Capacitance		C$_{oss}$	--	20	--	
Reverse Transfer Capacitance		C$_{rss}$	--	11	--	
Gate Resistance	f = 1.0MHz	R$_g$	--	2.5	--	Ω
Switching (Note 5)						
Turn-On Delay Time	V$_{DD}$ = 300V, R$_G$ = 10Ω, I$_D$ = 3.5A, V$_{GS}$ = 10V	t$_{d(on)}$	--	16	--	ns
Turn-On Rise Time		t$_r$	--	16	--	
Turn-Off Delay Time		t$_{d(off)}$	--	36	--	
Turn-Off Fall Time		t$_f$	--	10	--	
Source-Drain Diode						
Body-Diode Continuous Forward Current		I$_S$	--	--	7	A
Body-Diode Pulsed Current (Note 1)		I$_{SM}$	--	--	21	A
Forward Voltage (Note 3)	I$_S$ = 2.4A, V$_{GS}$ = 0V	V$_{SD}$	--	--	1.5	V
Reverse Recovery Time (Note 4)	I$_S$ = 7A	t$_{rr}$	--	261	--	ns
Reverse Recovery Charge (Note 4)	dI$_F$/dt = 100A/µs	Q$_{rr}$	--	3.2	--	µC

Notes:

1. Pulse width limited by the maximum junction temperature.
2. L =50mH, V$_{DD}$ = 50V, R$_G$ = 25Ω, Starting T$_J$ = 25°C
3. Pulse test: PW ≤ 300µs, duty cycle ≤ 2%.
4. Defined by design. Not subject to production test.
5. Switching time is essentially independent of operating temperature.
6. These curves are based on the junction-to-case thermal impedance which is measured with the device mounted to a ideal heatsink, assuming a maximum junction temperature of T$_{J(MAX)}$=150°C. The SOA curve provides a single pulse rating.
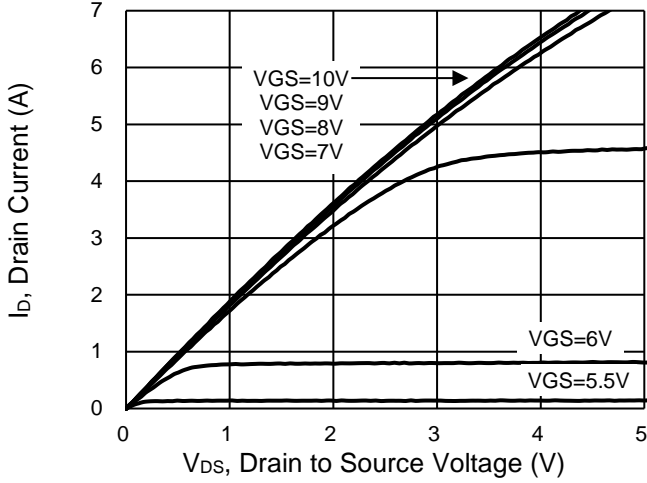
ORDERING INFORMATION

ORDERING CODE	PACKAGE	PACKING
TSM60NC620CI C0G	ITO-220	50pcs / Tube

CHARACTERISTICS CURVES

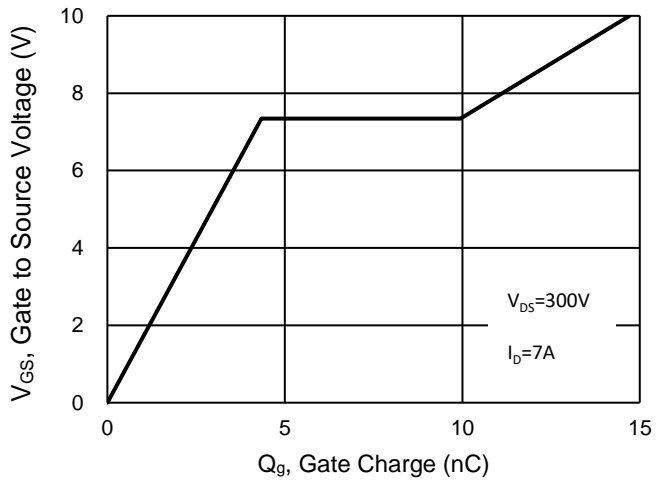(T_C = 25°C unless otherwise noted)

Output Characteristics

VGS=10V
VGS=9V
VGS=8V
VGS=7V

VGS=6V
VGS=5.5V

I_D, Drain Current (A)

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

Transfer Characteristics

25°C

125°C   -55°C

I_D, Drain Current (A)

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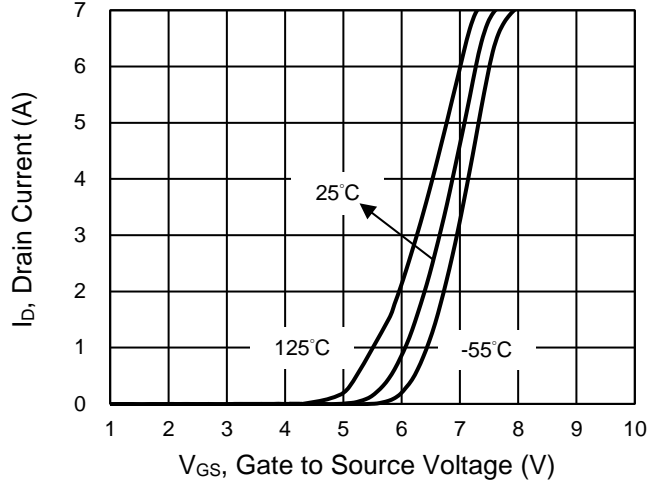
On-Resistance vs. Drain Current

V_{GS}= 10V

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

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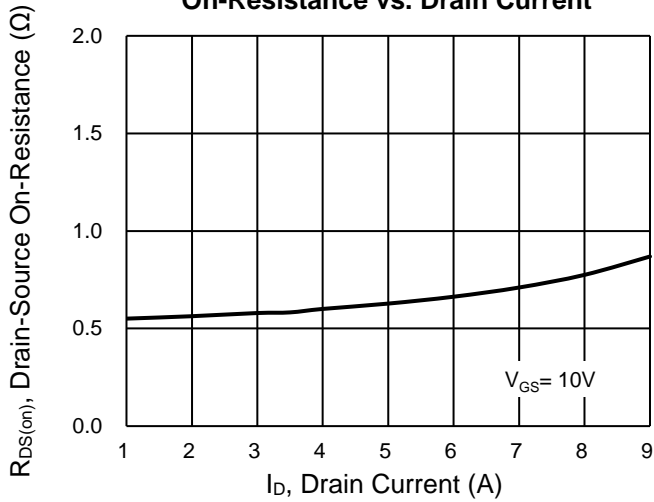
Gate-Source Voltage vs. Gate Charge

V_{DS}=300V

I_D=7A

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

Q_g, Gate Charge (nC)

On-Resistance vs. Junction Temperature

V_{GS}=10V

I_D=2.4A

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

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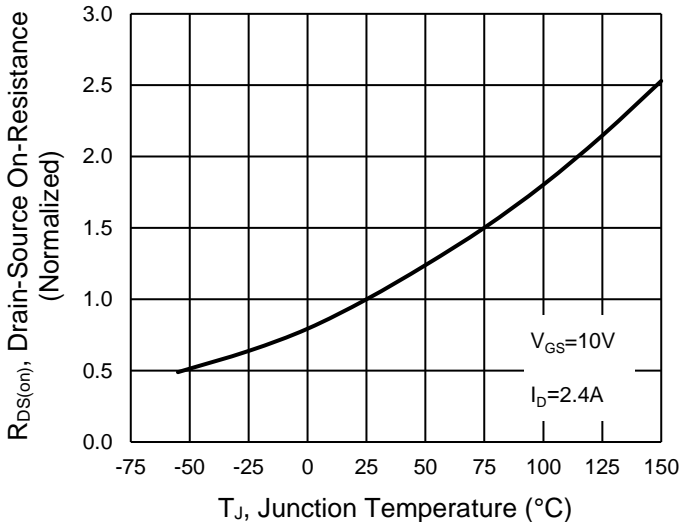
On-Resistance vs. Gate-Source Voltage

I_D=2.4A

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

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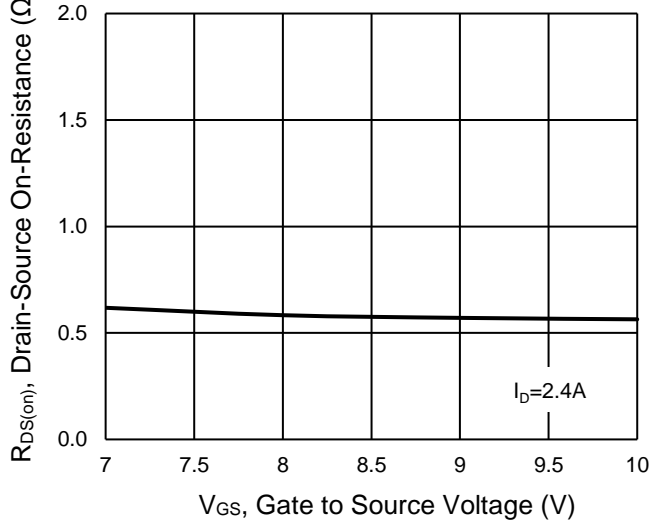
CHARACTERISTICS CURVES

(T_C = 25°C unless otherwise noted)

Capacitance vs. Drain-Source Voltage

V_{GS} = 0V

f = 1MHz

Ciss

Coss

Crss

C, Capacitance (pF)

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

BV_{DSS} vs. Junction Temperature

I_D=1mA

BV_{DSS} (Normalized) Drain-Source Breakdown Voltage
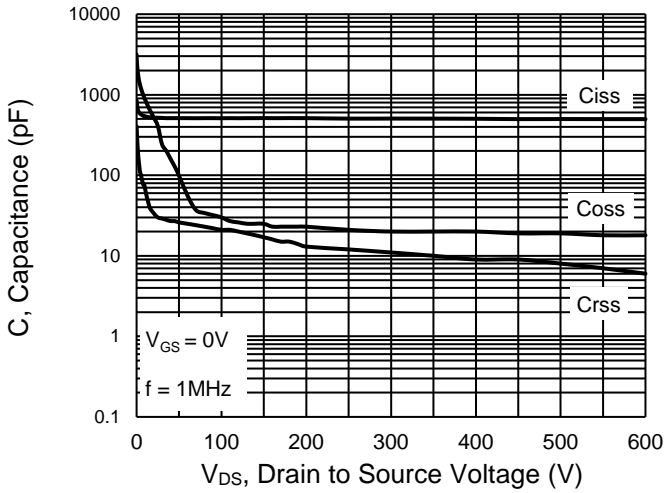
T_J, Junction Temperature (°C)
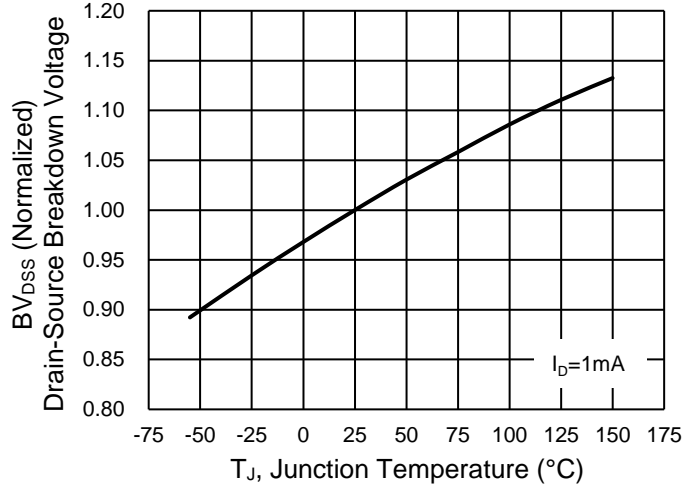
Maximum Safe Operating Area, Junction-to-Case [Note 6]

$R_{DS(ON)}$

100us

1ms

10ms

DC

SINGLE PULSE
$R_{\Theta JC}$=2.7°C/W
T_C=25°C

I_D, Drain Current (A)

V_{DS}, Drain to Source Voltage (V)
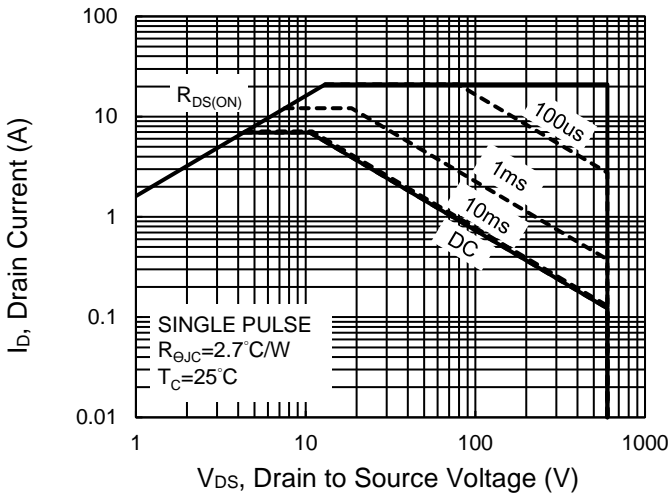
Source-Drain Diode Forward Current vs. Voltage

150°C   25°C   -55°C

I_S, Reverse Drain Current (A)

V_{SD}, Body Diode Forward Voltage (V)
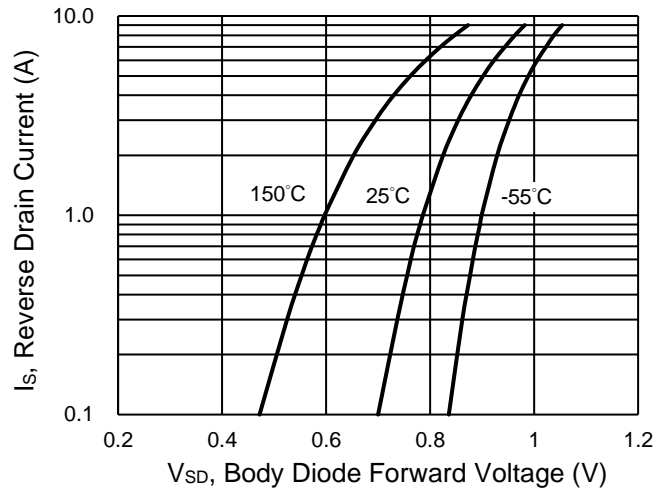
Normalized Thermal Transient Impedance, Junction-to-Case

SINGLE PULSE
$R_{\Theta JC}$=2.7°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 $R_{\Theta JC}$

P_{DM}

t_1

t_2

Normalized Effective Transient Thermal Impedance, $Z_{\Theta JC}$

t, Square Wave Pulse Duration (sec)
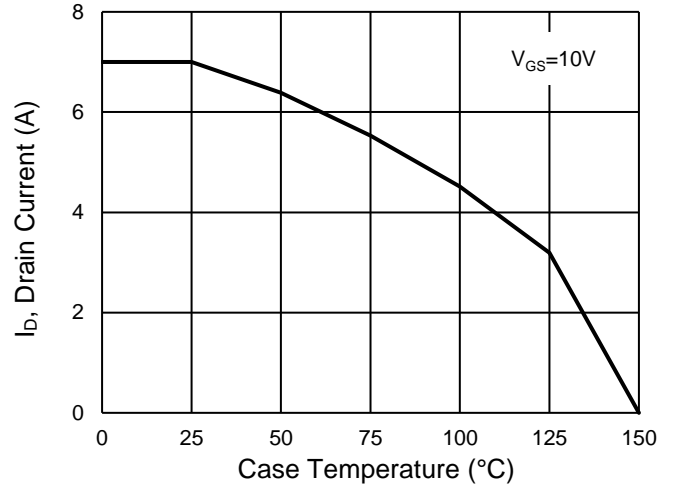
Version: A2303
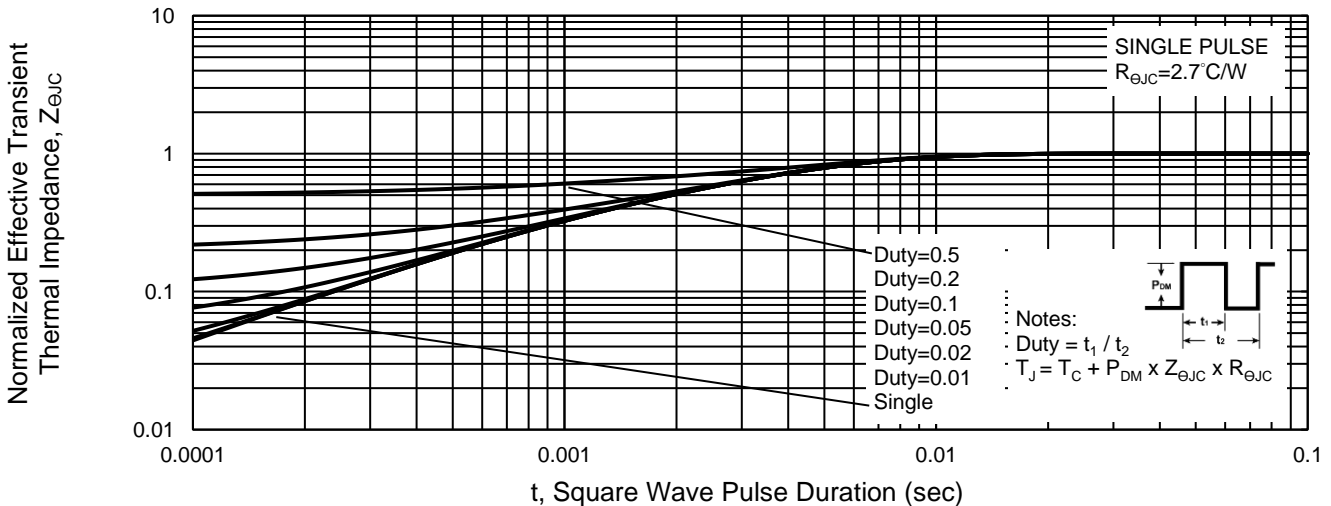
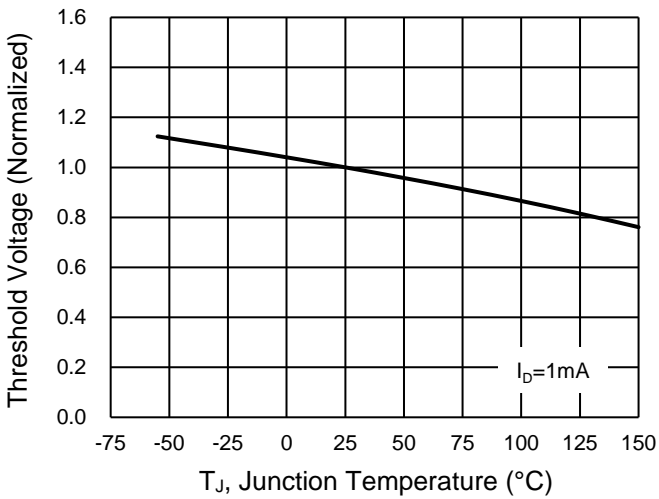## CHARACTERISTICS CURVES

(T_C = 25°C unless otherwise noted)
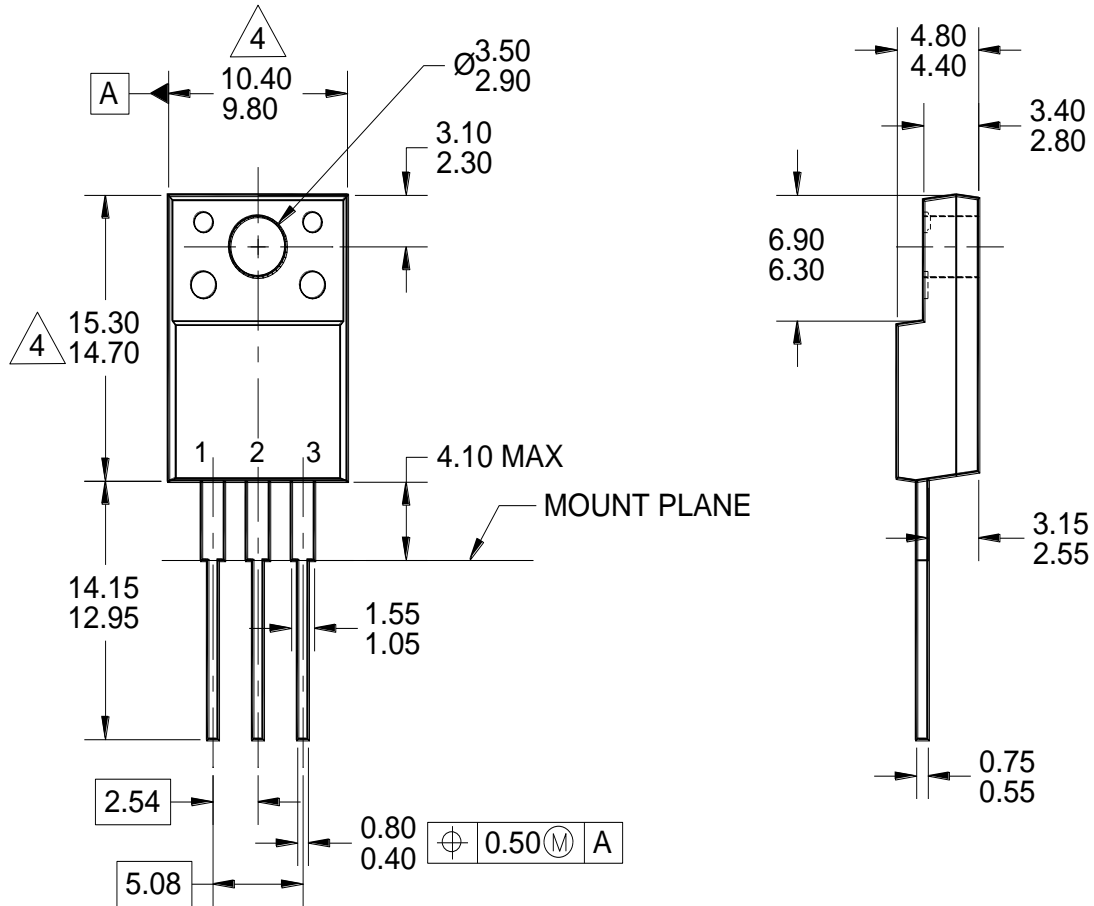
Power Dissipation
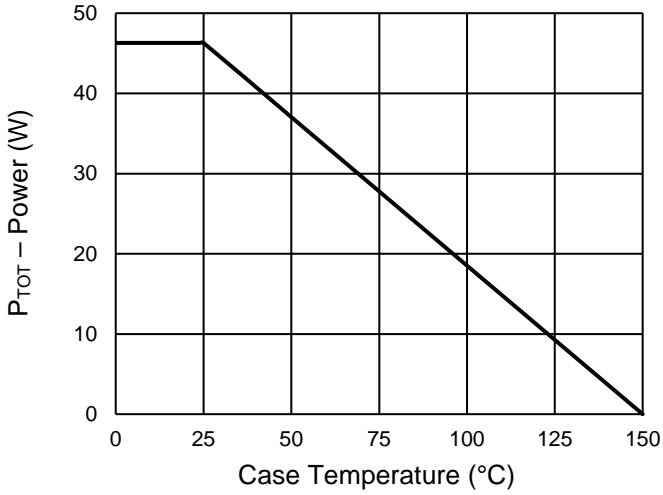
Drain Current(Note 6)

Normalized gate threshold voltage vs Temperature

PACKAGE OUTLINE DIMENSIONS (Unit: Millimeters)

ITO-220

NOTES: UNLESS OTHERWISE SPECIFIED

1. ALL DIMENSIONS ARE IN MILLIMETERS.

2. DIMENSIONING AND TOLERANCING
   PER ASME Y14.5M-1994.

3. PACKAGE OUTLINE REFERENCE:
   EIAJ ED-7500A-1, SC-91.

4. MOLDED PLASTIC BODY DIMENSIONS DO NOT
   INCLUDE MOLD FLASH. THESE DIMENSIONS
   ARE MEASURED AT THE OUTERMOST EXTREME
   OF THE PLASTIC BODY.

5. DWG NO. REF: HQ2SD07-ITO220-072 REV A.

MARKING DIAGRAM

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TSC
60NC620
YWWLF
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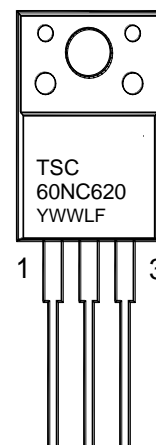
Y   = YEAR CODE
WW   = WEEK CODE (01 ~ 52)
L   = LOT CODE (1~9, A~Z)
F   = FACTORY CODE

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Version: A2303