P-Channel Power MOSFET

-60V, -18A, 68mΩ

FEATURES

- Improved dV/dt capability
- Fast switching
- 100% Eas Guaranteed
- Pb-free plating
- RoHS compliant
- Halogen-free mold compound

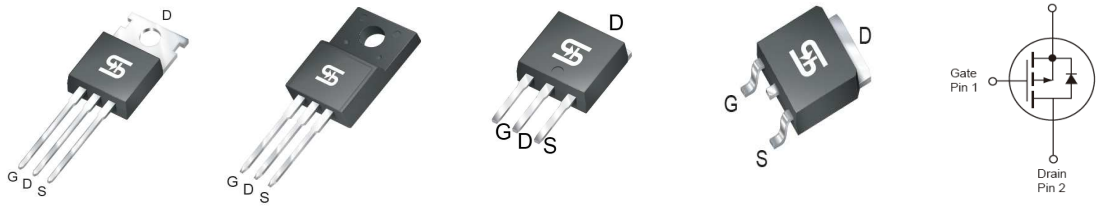
APPLICATION

- Motor Drive
- Power Tools
- LED Lighting

KEY PERFORMANCE PARAMETERS			
PARAMETER		**VALUE**	**UNIT**
V_{DS}		-60	V
$R_{DS(on)}$ (max)	V_{GS} = -10V	68	mΩ
	V_{GS} = -4.5V	110	
Q_g		16.4	nC

Pb-Free RoHS COMPLIANT HALOGEN FREE

TO-220 **ITO-220** **TO-251S (IPAK SL)** **TO-252 (DPAK)**



Notes: Moisture sensitivity level: level 3. Per J-STD-020

ABSOLUTE MAXIMUM RATINGS (T_C = 25°C unless otherwise noted)						
PARAMETER		**SYMBOL**	**IPAK/DPAK**	**ITO-220**	**TO-220**	**UNIT**
Drain-Source Voltage		V_{DS}	-60			V
Gate-Source Voltage		V_{GS}	±20			V
Continuous Drain Current (Note 1)	T_C = 25°C	I_D	-18			A
	T_C = 100°C		-11			
Pulsed Drain Current (Note 2)		I_{DM}	-72			A
Total Power Dissipation @ T_C = 25°C		P_{DTOT}	20	17	42	W
Single Pulsed Avalanche Energy (Note 3)		E_{AS}	12.8			mJ
Single Pulsed Avalanche Current (Note 3)		I_{AS}	-16			A
Operating Junction and Storage Temperature Range		T_J, T_{STG}	- 55 to +150			°C

THERMAL PERFORMANCE					
PARAMETER	**SYMBOL**	**IPAK/DPAK**	**ITO-220**	**TO-220**	**UNIT**
Junction to Case Thermal Resistance	$R_{\Theta JC}$	6.1	7.5	3	°C/W
Junction to Ambient Thermal Resistance	$R_{\Theta JA}$	62			°C/W

Notes: $R_{\Theta JA}$ 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. $R_{\Theta JA}$ is guaranteed by design while $R_{\Theta CA}$ is determined by the user's board design. $R_{\Theta JA}$ shown below for single device operation on FR-4 PCB in still air.

ELECTRICAL SPECIFICATIONS (T_C = 25°C unless otherwise noted)						
PARAMETER	**CONDITIONS**	**SYMBOL**	**MIN**	**TYP**	**MAX**	**UNIT**
Static (Note 4)						
Drain-Source Breakdown Voltage	V_{GS} = 0V, I_D = -250μA	BV_{DSS}	-60	--	--	V
Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = -250μA	$V_{GS(TH)}$	-1.2	-1.6	-2.2	V
Gate Body Leakage	V_{GS} = ±20V, V_{DS} = 0V	I_{GSS}	--	--	±100	nA
Zero Gate Voltage Drain Current	V_{DS} = -60V, V_{GS} = 0V	I_{DSS}	--	--	-1	μA
	V_{DS} = -48V, T_C = 125°C		--	--	-10	
Drain-Source On-State Resistance	V_{GS} = -10V, I_D = -6A	$R_{DS(on)}$	--	54	68	mΩ
	V_{GS} = -4.5V, I_D = -3A		--	72	110	
Forward Transconductance	V_{DS} = -10V, I_D = -6A	g_{fs}	--	8.5	--	S
Dynamic (Note 5)						
Total Gate Charge	V_{DS} = -30V, I_D = -6A, V_{GS} = -10V	Q_g	--	16.4	--	nC
Gate-Source Charge		Q_{gs}	--	2.8	--	
Gate-Drain Charge		Q_{gd}	--	3.6	--	
Input Capacitance	V_{DS} = -30V, V_{GS} = 0V, f = 1.0MHz	C_{iss}	--	870	--	pF
Output Capacitance		C_{oss}	--	70	--	
Reverse Transfer Capacitance		C_{rss}	--	42	--	
Gate Resistance	F = 1MHz, open drain	R_g	--	16	--	Ω
Switching (Note 6)						
Turn-On Delay Time	V_{DD} = -30V, R_{GEN} = 6Ω, I_D = -1A	$t_{d(on)}$	--	8.3	--	ns
Turn-On Rise Time		t_r	--	29.6	--	
Turn-Off Delay Time		$t_{d(off)}$	--	51.7	--	
Turn-Off Fall Time		t_f	--	15.6	--	
Source-Drain Diode (Note 3)						
Forward On Voltage	I_S = -1A, V_{GS} = 0V	V_{SD}	--	--	-1	V
Reverse Recovery Time	I_S =1A dI_F/dt = 100A/μs	t_{rr}	--	20	--	ns
Reverse Recovery Charge		Q_{rr}	--	10	--	nC
Maximum Continuous Forward Current	Integral reverse diode in the MOSFET	I_S	--	--	-13	A
Maximum Pulse Forward Current		I_{SM}	--	--	-52	A

Notes:

1. Current limited by package
2. Pulse width limited by the maximum junction temperature
3. L = 0.1mH, I_{AS} = -16A, V_{DD} = -25V, R_G = 25Ω, Starting T_J = 25°C
4. Pulse test: PW ≤ 300μs, duty cycle ≤ 2%
5. For DESIGN AID ONLY, not subject to production testing.
6. Switching time is essentially independent of operating temperature.

ORDERING INFORMATION

PART NO.	PACKAGE	PACKING
TSM680P06CZ C0G	TO-220	50pcs / Tube
TSM680P06CI C0G	ITO-220	50pcs / Tube
TSM680P06CH C5G	TO-251S (IPAK SL)	75pcs / Tube
TSM680P06CP ROG	TO-252 (DPAK)	2,500pcs / 13” Reel

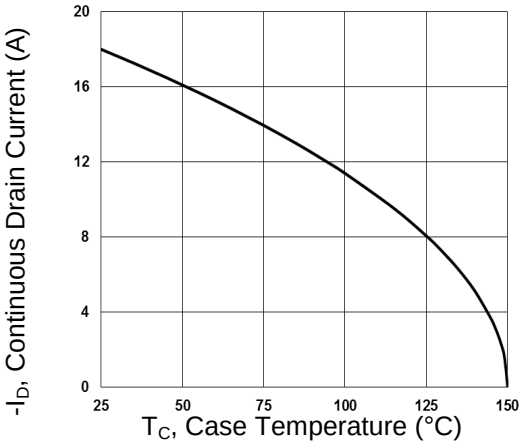
Note:

1. Compliant to RoHS Directive 2011/65/EU and in accordance to WEEE 2002/96/EC
2. Halogen-free according to IEC 61249-2-21 definition

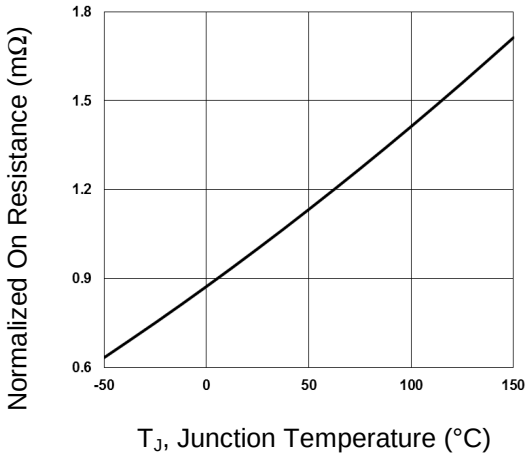
CHARACTERISTICS CURVES

(T_C = 25°C unless otherwise noted)

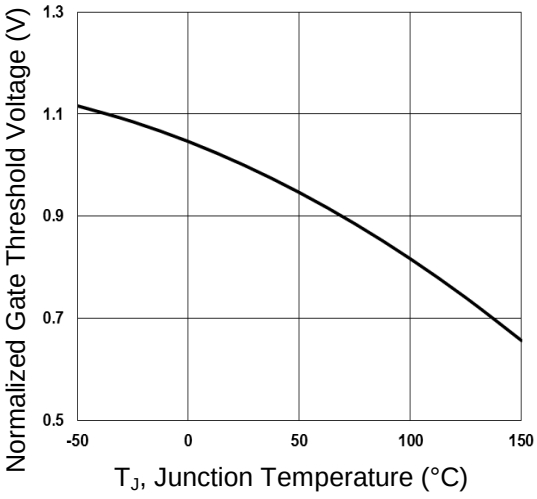
Continuous Drain Current vs. Tc



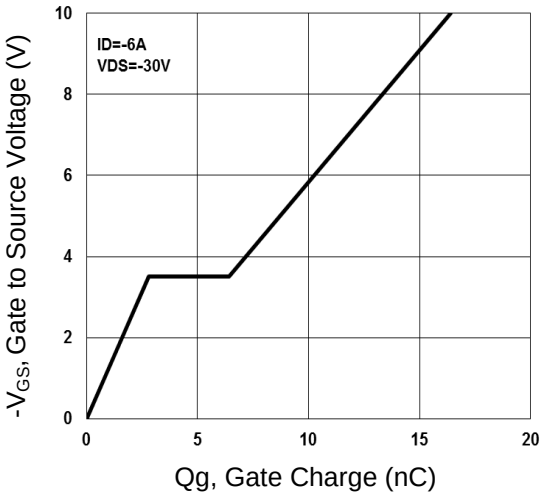
Normalized Rds(on) vs. Tj



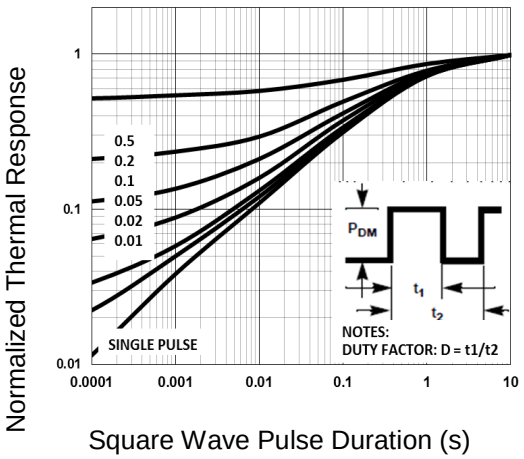
Normalized Vth vs. Tj



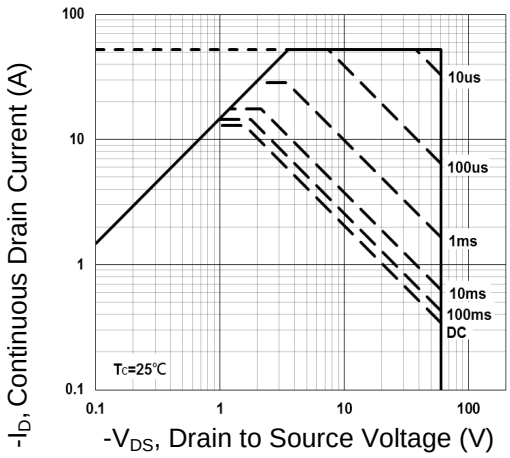
Gate Charge Waveform



Normalized Transient Impedance (TO-251S)



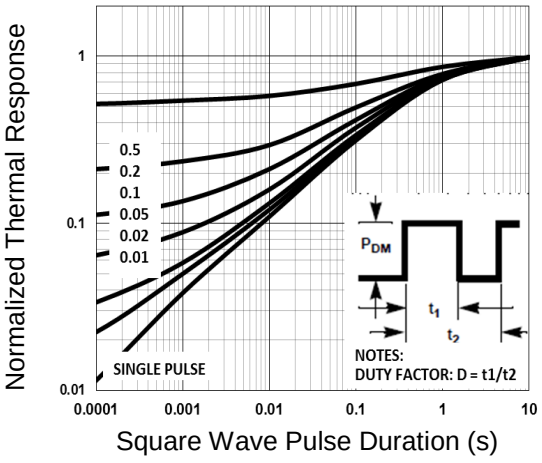
Maximum Safe Operation Area (TO-251S)



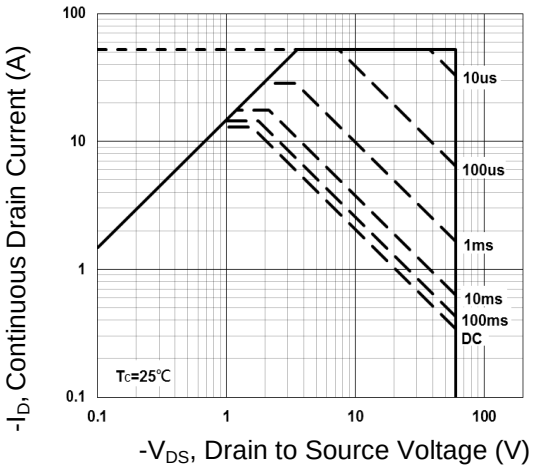
CHARACTERISTICS CURVES

(T_C = 25°C unless otherwise noted)

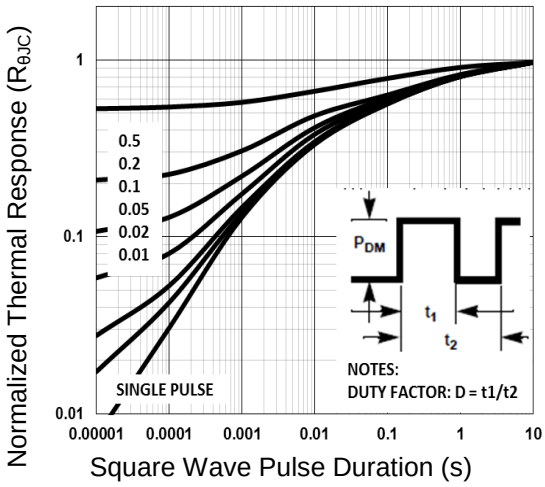
Normalized Transient Impedance (TO-252)



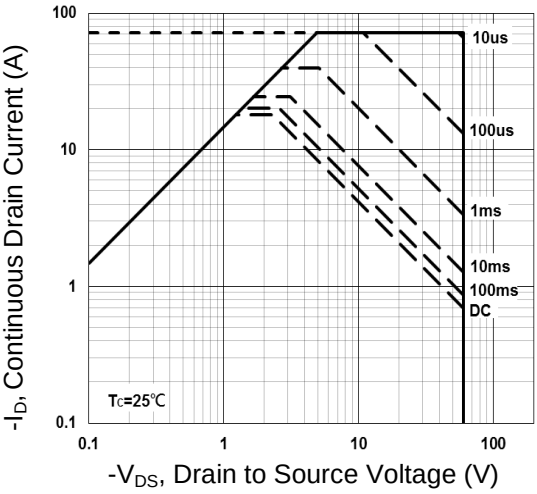
Maximum Safe Operation Area (TO-252)



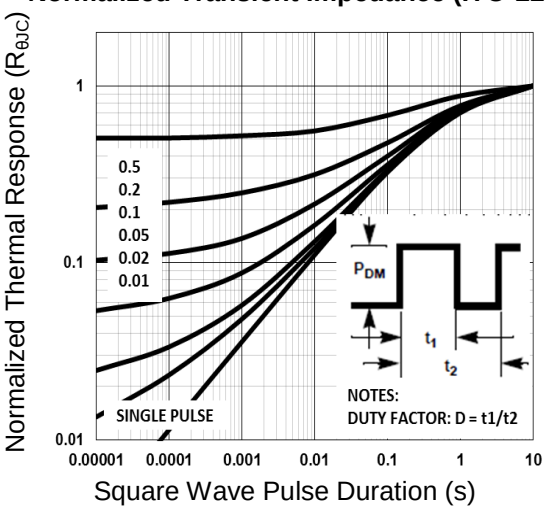
Normalized Transient Impedance (TO-220)



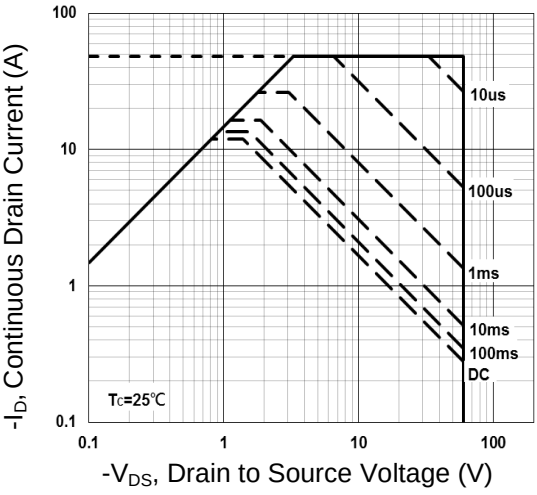
Maximum Safe Operation Area (TO-220)



Normalized Transient Impedance (ITO-220)

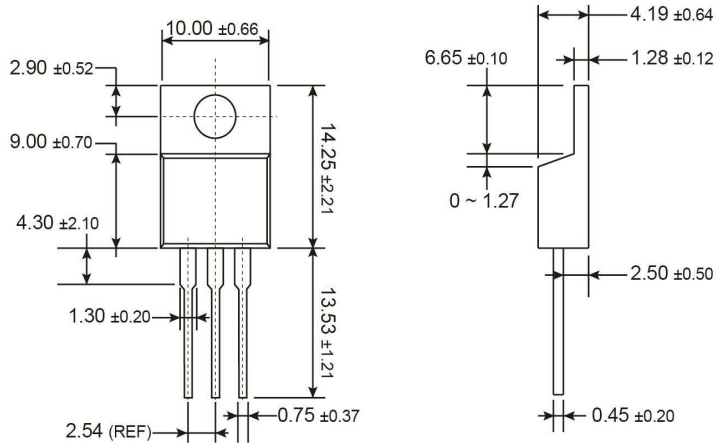


Maximum Safe Operation Area (ITO-220)

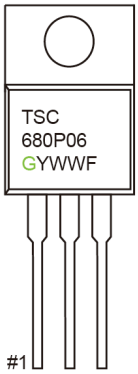


PACKAGE OUTLINE DIMENSIONS (Unit: Millimeters)

TO-220



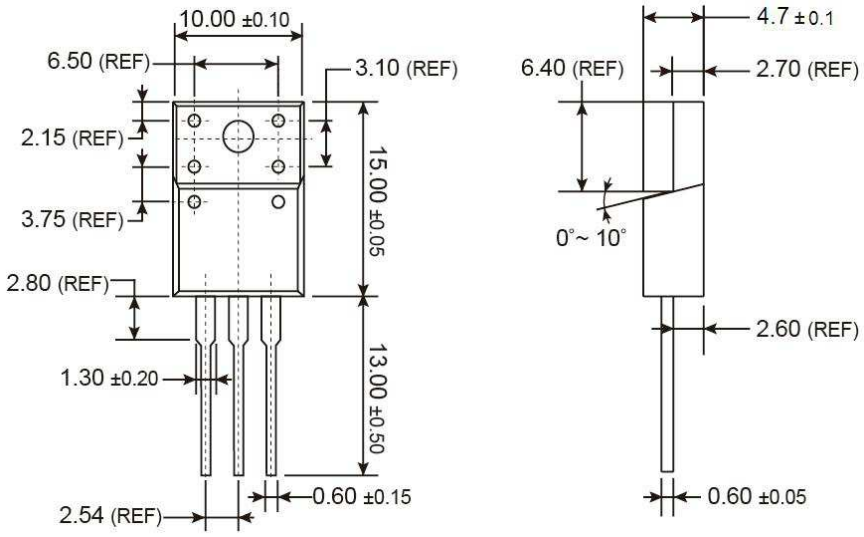
MARKING DIAGRAM



G = Halogen Free
Y = Year Code
WW = Week Code (01~52)
F = Factory Code

PACKAGE OUTLINE DIMENSIONS (Unit: Millimeters)

ITO-220



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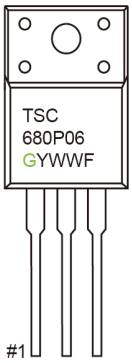

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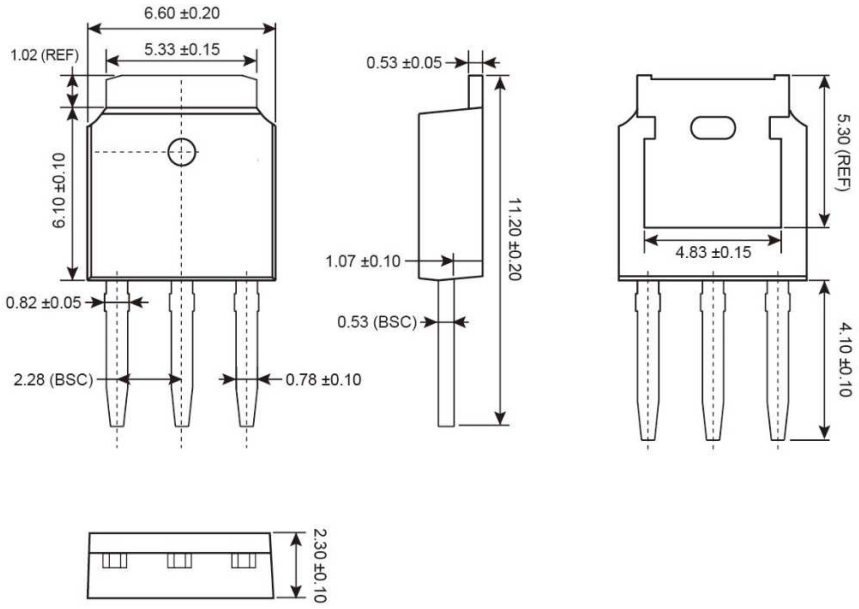
PACKAGE OUTLINE DIMENSIONS (Unit: Millimeters)

TO-251S



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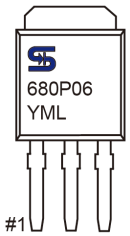

Y = Year Code

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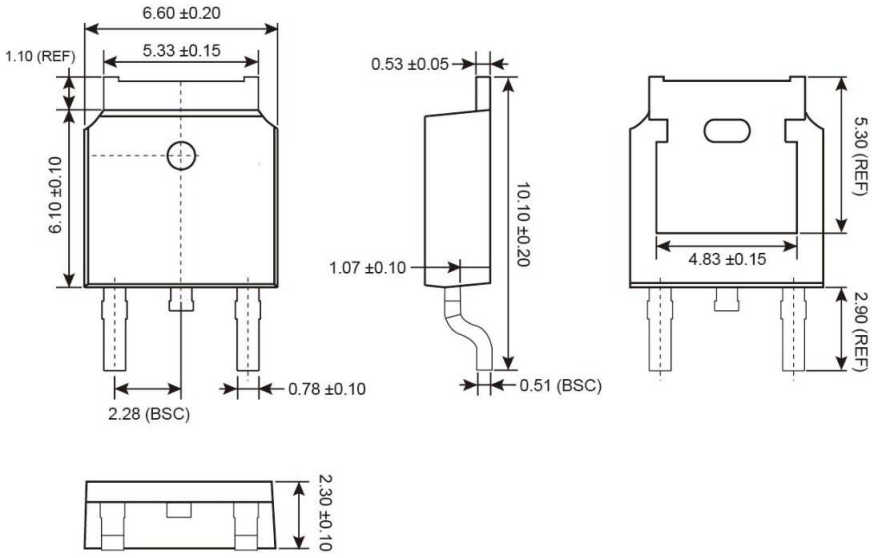
O	=Jan	**P**	=Feb	**Q**	=Mar	**R**	=Apr
S	=May	**T**	=Jun	**U**	=Jul	**V**	=Aug
W	=Sep	**X**	=Oct	**Y**	=Nov	**Z**	=Dec

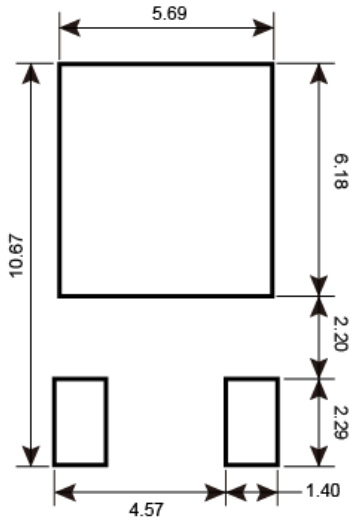
L = Lot Code (1~9, A~Z)

PACKAGE OUTLINE DIMENSIONS (Unit: Millimeters)

TO-252



SUGGESTED PAD LAYOUT



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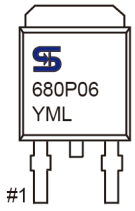

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