

## 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

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

### APPLICATION

- Motor Drive
- Power Tools
- LED Lighting



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

ABSOLUTE MAXIMUM RATINGS ( $T_C = 25^\circ\text{C}$ 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)	$I_D$	$T_C = 25^\circ\text{C}$			A
		$T_C = 100^\circ\text{C}$			
Pulsed Drain Current (Note 2)	$I_{DM}$	-72			A
Total Power Dissipation @ $T_C = 25^\circ\text{C}$	$P_{DTOT}$	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			$^\circ\text{C}$

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

**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.

<b>ELECTRICAL SPECIFICATIONS</b> ( $T_C = 25^\circ\text{C}$ unless otherwise noted)						
PARAMETER	CONDITIONS	SYMBOL	MIN	TYP	MAX	UNIT
<b>Static</b> (Note 4)						
Drain-Source Breakdown Voltage	$V_{GS} = 0V, I_D = -250\mu A$	$BV_{DSS}$	-60	--	--	V
Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = -250\mu A$	$V_{GS(TH)}$	-1.2	-1.6	-2.2	V
Gate Body Leakage	$V_{GS} = \pm 20V, V_{DS} = 0V$	$I_{GSS}$	--	--	$\pm 100$	nA
Zero Gate Voltage Drain Current	$V_{DS} = -60V, V_{GS} = 0V$	$I_{DSS}$	--	--	-1	$\mu A$
	$V_{DS} = -48V, T_C = 125^\circ\text{C}$		--	--	-10	
Drain-Source On-State Resistance	$V_{GS} = -10V, I_D = -6A$	$R_{DS(on)}$	--	54	68	m $\Omega$
	$V_{GS} = -4.5V, I_D = -3A$		--	72	110	
Forward Transconductance	$V_{DS} = -10V, I_D = -6A$	$g_{fs}$	--	8.5	--	S
<b>Dynamic</b> (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	$V_{DS} = -30V, V_{GS} = 0V, f = 1.0\text{MHz}$	$C_{iss}$	--	870	--	pF
Output Capacitance		$C_{oss}$	--	70	--	
Reverse Transfer Capacitance		$C_{rss}$	--	42	--	
Gate Resistance	$F = 1\text{MHz}, \text{open drain}$	$R_g$	--	16	--	$\Omega$
<b>Switching</b> (Note 6)						
Turn-On Delay Time	$V_{DD} = -30V, R_{GEN} = 6\Omega, I_D = -1A$	$t_{d(on)}$	--	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	--	
<b>Source-Drain Diode</b> (Note 3)						
Forward On Voltage	$I_S = -1A, V_{GS} = 0V$	$V_{SD}$	--	--	-1	V
Reverse Recovery Time	$I_S = 1A$	$t_{rr}$	--	20	--	ns
Reverse Recovery Charge	$dI_F/dt = 100A/\mu s$	$Q_{rr}$	--	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:**

- Current limited by package
- Pulse width limited by the maximum junction temperature
- $L = 0.1\text{mH}, I_{AS} = -16A, V_{DD} = -25V, R_G = 25\Omega, \text{Starting } T_J = 25^\circ\text{C}$
- Pulse test:  $PW \leq 300\mu s, \text{duty cycle} \leq 2\%$
- For DESIGN AID ONLY, not subject to production testing.
- Switching time is essentially independent of operating temperature.

**ORDERING INFORMATION**

<b>PART NO.</b>	<b>PACKAGE</b>	<b>PACKING</b>
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

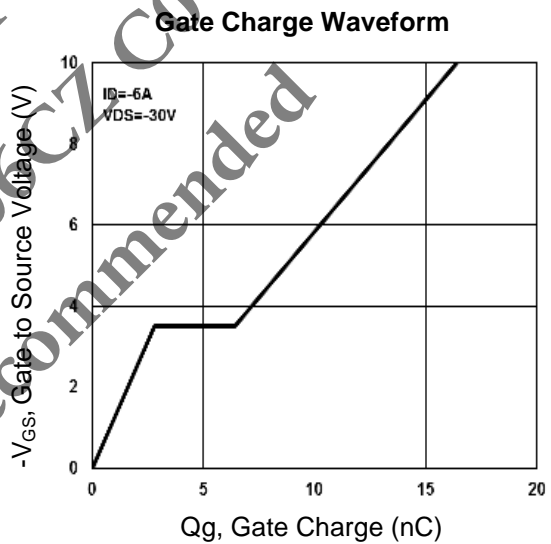
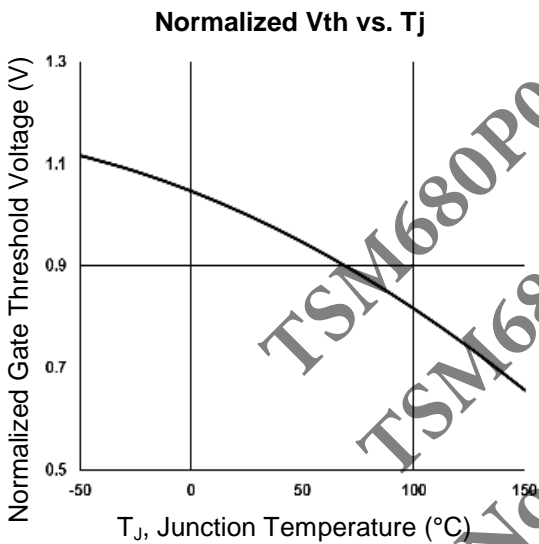
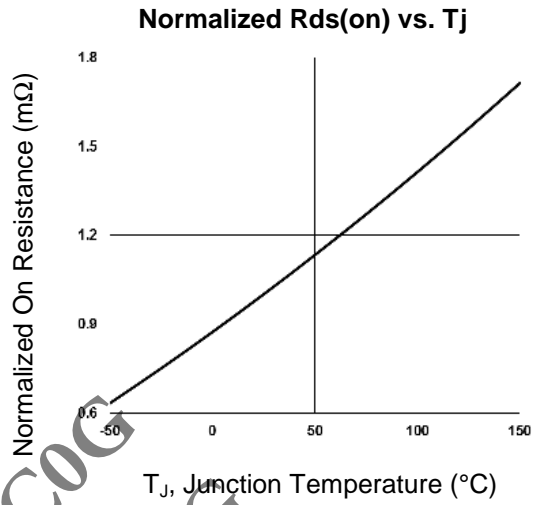
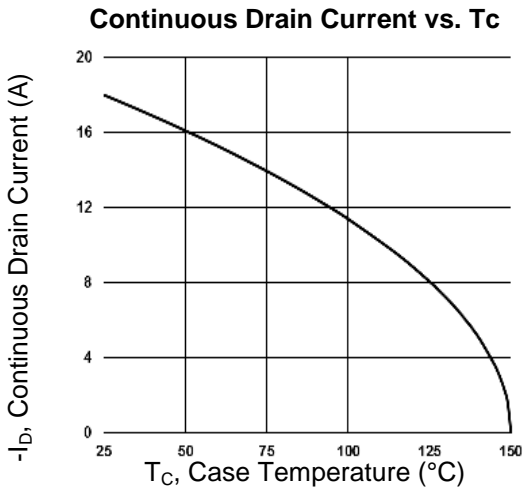
**Note:**

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

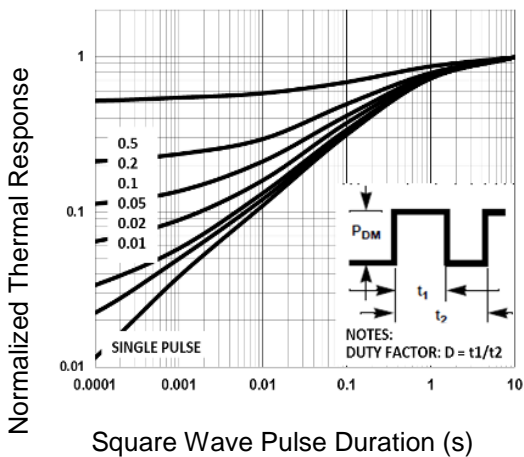
TSM680P06CI C0G  
 TSM680P06CZ C0G  
 Not Recommended

**CHARACTERISTICS CURVES**

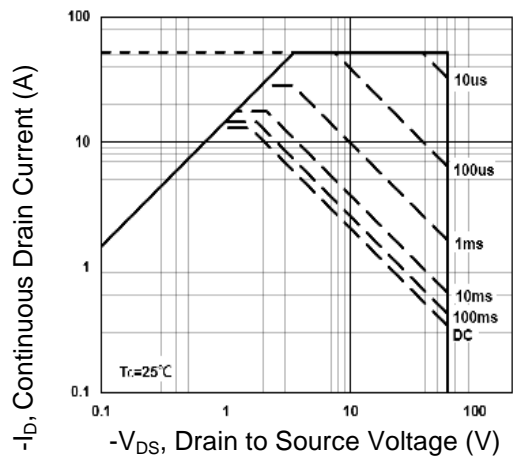
( $T_C = 25^\circ\text{C}$  unless otherwise noted)



**Normalized Transient Impedance (TO-251S)**



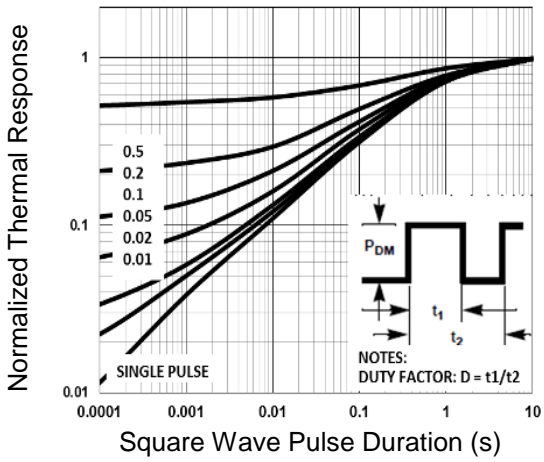
**Maximum Safe Operation Area (TO-251S)**



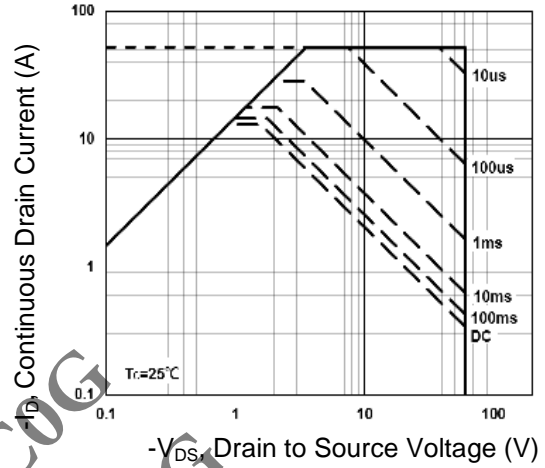
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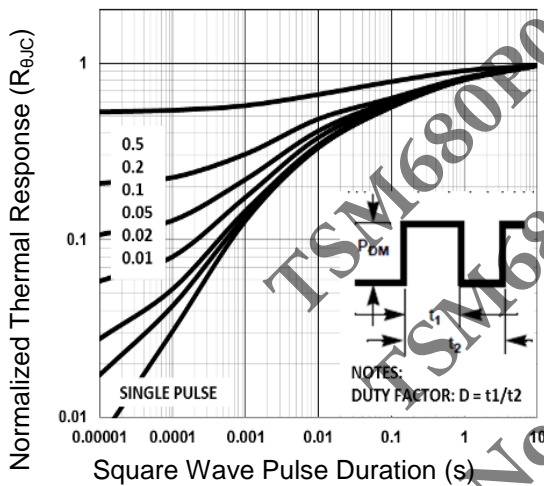
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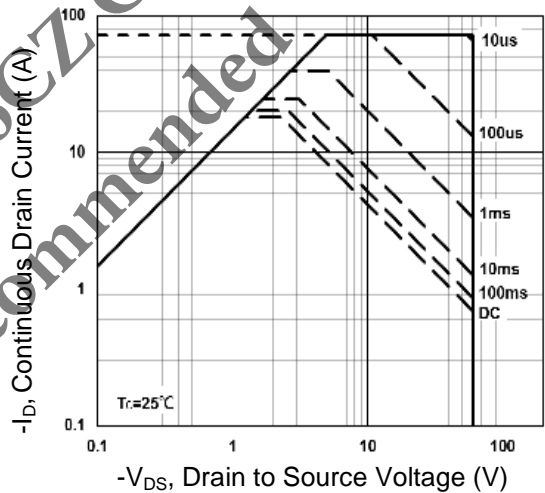
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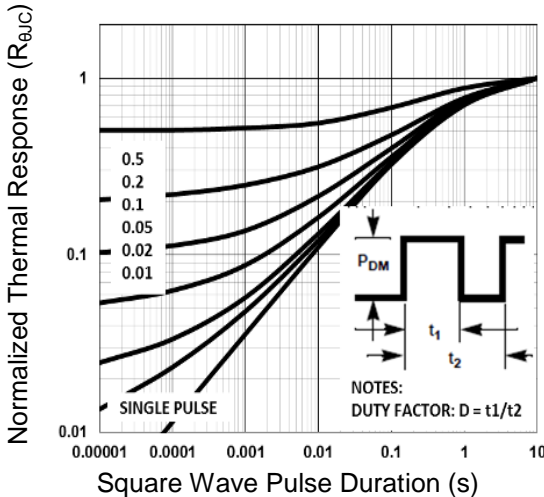
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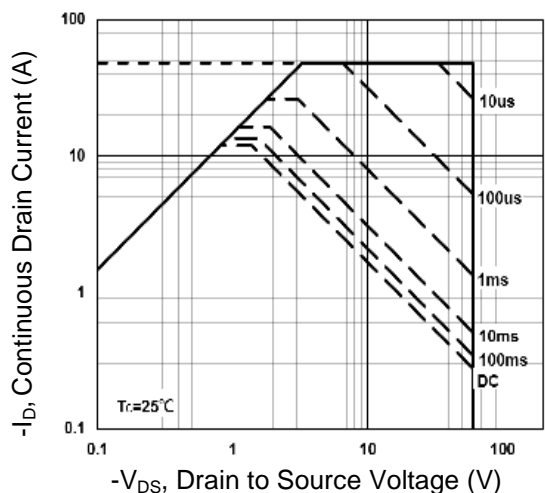
**Maximum Safe Operation Area (TO-220)**



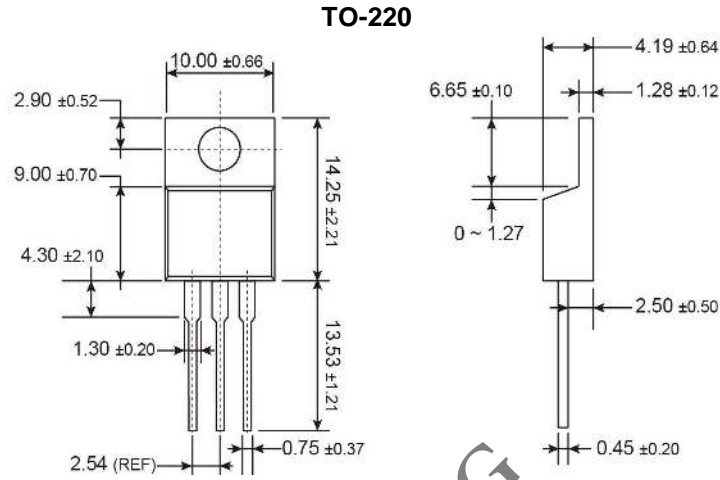
**Normalized Transient Impedance (ITO-220)**



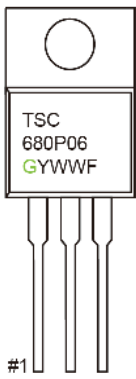
**Maximum Safe Operation Area (ITO-220)**



**PACKAGE OUTLINE DIMENSIONS** (Unit: Millimeters)



**MARKING DIAGRAM**



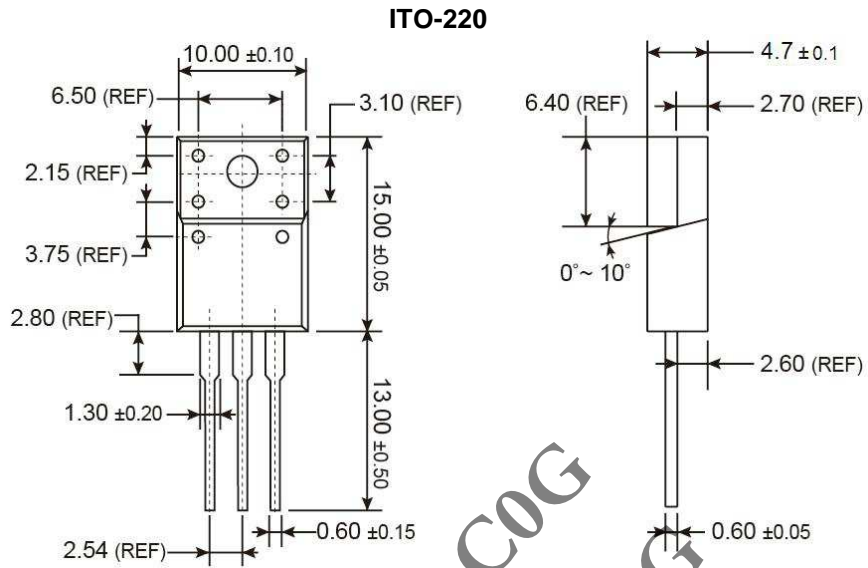
- G** = Halogen Free
- Y** = Year Code
- WW** = Week Code (01~52)
- F** = Factory Code

TSM680P06CI C0G

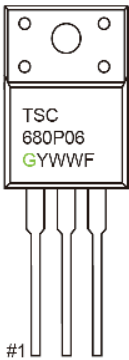
TSM680P06CZ C0G

Not Recommended

**PACKAGE OUTLINE DIMENSIONS** (Unit: Millimeters)



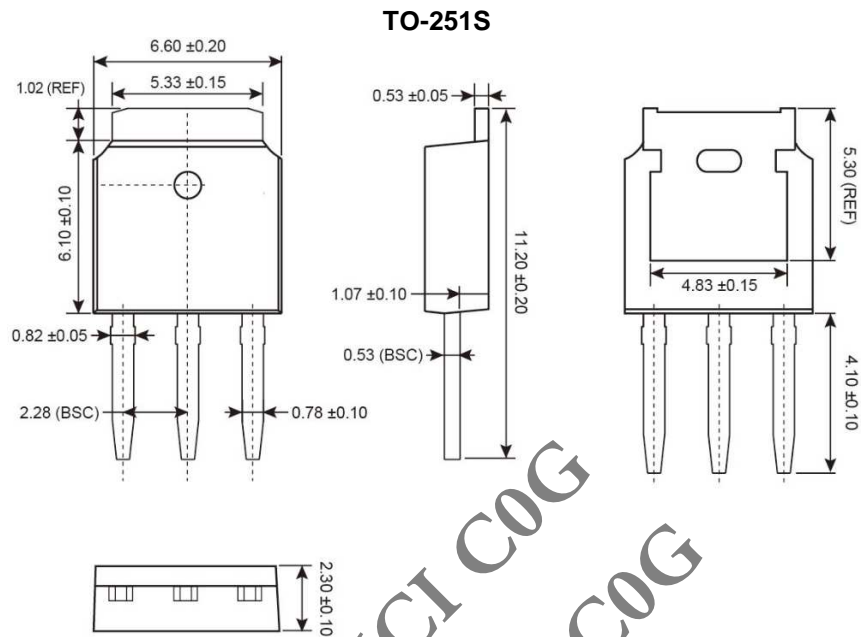
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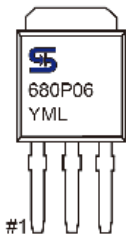
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TSM680P06CI COG  
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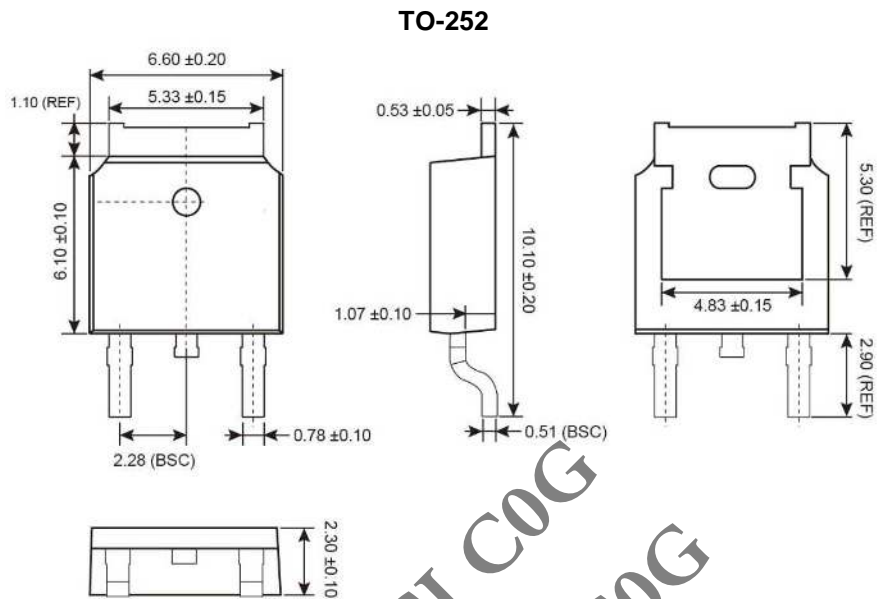


- Y** = Year Code
- M** = Month Code for Halogen Free Product
  - O** =Jan
  - P** =Feb
  - Q** =Mar
  - R** =Apr
  - S** =May
  - T** =Jun
  - U** =Jul
  - V** =Aug
  - W** =Sep
  - X** =Oct
  - Y** =Nov
  - Z** =Dec
- L** = Lot Code (1~9, A~Z)

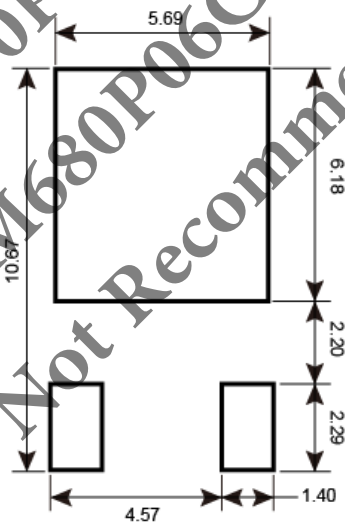
TSM680P06CI COG  
TSM680P06CZ COG  
Not Recommended



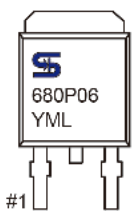
**PACKAGE OUTLINE DIMENSIONS** (Unit: Millimeters)



**SUGGESTED PAD LAYOUT**



**MARKING DIAGRAM**



- Y** = Year Code
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  - O** =Jan    **P** =Feb    **Q** =Mar    **R** =Apr
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TSM680P06CI COG  
TSM680P06CZ COG  
Not Recommended

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