

## P-Channel Power MOSFET

-60V, -14.5A, 68 mΩ

### FEATURES

- Improved dV/dt capability
- Fast switching
- 100% Eas Guaranteed
- Pb-free plating
- RoHS compliant
- Halogen-Free according to IEC 61249-2-21

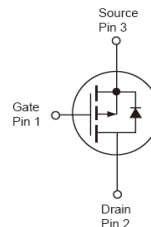
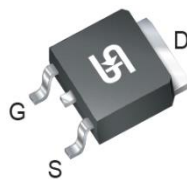
PRODUCT SUMMARY			
PARAMETER	VALUE	UNIT	
$V_{DS}$	-60	V	
$R_{DS(on)}$ (max)	$V_{GS} = -10V$	68	mΩ
	$V_{GS} = -4.5V$	110	
$Q_g$	$V_{GS} = -10V$	18	nC

### APPLICATIONS

- Motor Drive
- Power Tools
- LED Lighting



TO-252 (DPAK)



**Notes:** MSL 3 (Moisture Sensitivity Level) per J-STD-020

ABSOLUTE MAXIMUM RATINGS ( $T_A = 25^\circ\text{C}$ unless otherwise noted)			
PARAMETER	SYMBOL	LIMIT	UNIT
Drain-Source Voltage	$V_{DS}$	-60	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Continuous Drain Current <sup>(Note 1)</sup>	$I_D$	$T_C = 25^\circ\text{C}$	-14.5
		$T_C = 100^\circ\text{C}$	-9.2
Pulsed Drain Current <sup>(Note 2)</sup>	$I_{DM}$	-58	A
Single Pulse Avalanche Current <sup>(Note 3)</sup>	$I_{AS}$	-19.1	A
Single Pulse Avalanche Energy <sup>(Note 3)</sup>	$E_{AS}$	18.2	mJ
Total Power Dissipation	$P_D$	20.5	W
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 to +150	$^\circ\text{C}$

THERMAL RESISTANCE			
PARAMETER	SYMBOL	MAXIMUM	UNIT
Thermal Resistance – Junction to Case	$R_{\theta JC}$	6.1	$^\circ\text{C/W}$
Thermal Resistance – Junction to Ambient	$R_{\theta JA}$	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.  $R_{\theta JC}$  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 CHARACTERISTICS</b> ( $T_A = 25^\circ\text{C}$ 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	$V_{GS} = V_{DS}, I_D = -250\mu A$	$V_{GS(TH)}$	-1.2	-1.4	-2.2	V
Gate-Source Leakage Current	$V_{GS} = \pm 20V, V_{DS} = 0V$	$I_{GSS}$	--	--	$\pm 100$	nA
Drain-Source Leakage Current	$V_{GS} = 0V, V_{DS} = -60V$	$I_{DSS}$	--	--	-1	$\mu A$
	$V_{GS} = 0V, V_{DS} = -48V$ $T_J = 125^\circ\text{C}$		--	--	-10	
Drain-Source On-State Resistance (Note 3)	$V_{GS} = -10V, I_D = -6A$	$R_{DS(on)}$	--	53.2	68	m $\Omega$
	$V_{GS} = -4.5V, I_D = -3A$		--	67.4	110	
Forward Transconductance	$V_{DS} = -10V, I_D = -6A$	$g_{fs}$	--	15.3	--	S
<b>Dynamic</b> (Note 5)						
Total Gate Charge	$V_{GS} = -10V, V_{DS} = -30V,$ $I_D = -6A$	$Q_g$	--	18	--	nC
Gate-Source Charge		$Q_{gs}$	--	2.8	--	
Gate-Drain Charge		$Q_{gd}$	--	3.2	--	
Input Capacitance	$V_{GS} = 0V, V_{DS} = -30V,$ $f = 1.0\text{MHz}$	$C_{iss}$	--	929	--	pF
Output Capacitance		$C_{oss}$	--	68	--	
Reverse Transfer Capacitance		$C_{rss}$	--	55	--	
Gate Resistance	$f = 1.0\text{MHz}$	$R_g$	--	14	--	$\Omega$
<b>Switching</b> (Note 6)						
Turn-On Delay Time	$V_{GS} = -10V, V_{DS} = -30V,$ $I_D = -1A, R_G = 6\Omega$	$t_{d(on)}$	--	6.7	--	nS
Rise Time		$t_r$	--	8.5	--	
Turn-Off Delay Time		$t_{d(off)}$	--	53	--	
Fall Time		$t_f$	--	35	--	
<b>Source-Drain Diode</b>						
Diode Forward Voltage (Note 4)	$V_{GS} = 0V, I_S = -1A$	$V_{SD}$	--	--	-1	V
Reverse Recovery Time	$I_S = -1A,$ $di/dt = 100A/\mu s$	$t_{rr}$	--	11.9	--	nS
Reverse Recovery Charge		$Q_{rr}$	--	6.2	--	nC

**Notes:**

1. Current limited by package
2. Pulse width limited by the maximum junction temperature
3.  $L = 0.1\text{mH}, V_{GS} = -10V, R_G = 25\Omega, \text{Starting } T_J = 25^\circ\text{C}$
4. Pulse test:  $PW \leq 300\mu s, \text{duty cycle} \leq 2\%$
5. For DESIGN AID ONLY, not subject to production testing.
6. Switching time is essentially independent of operating temperature.

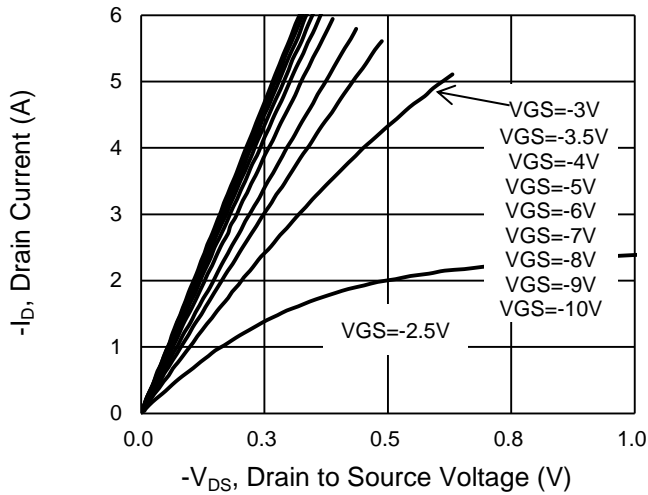
**ORDERING INFORMATION**

ORDERING CODE	PACKAGE	PACKING
TSM680P06CP ROG	TO-252 (DPAK)	2,500pcs / 13" Reel

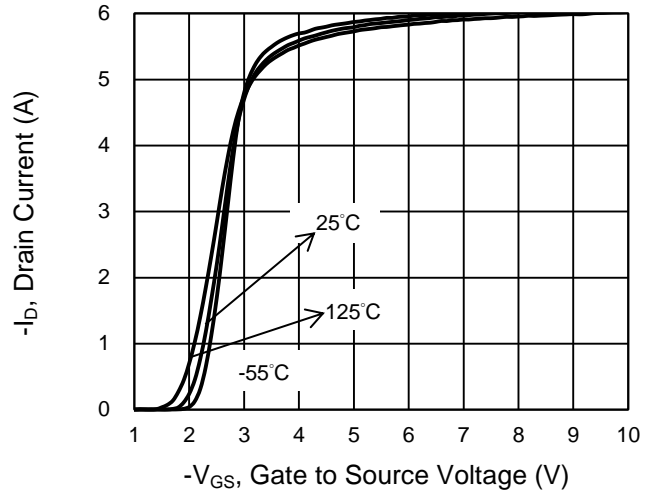
**CHARACTERISTICS CURVES**

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

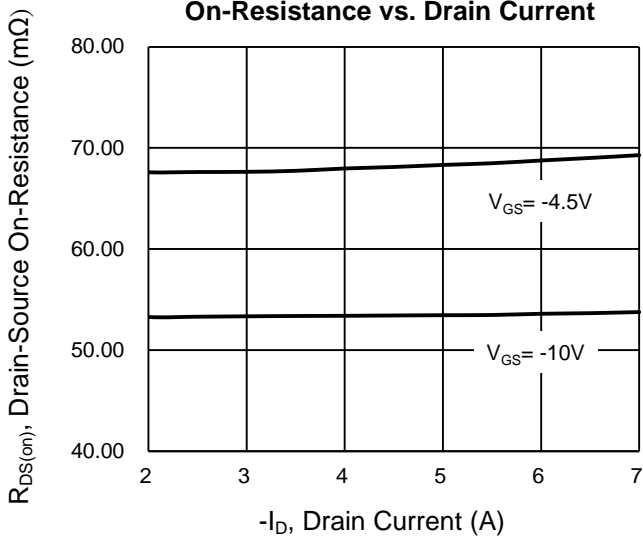
**Output Characteristics**



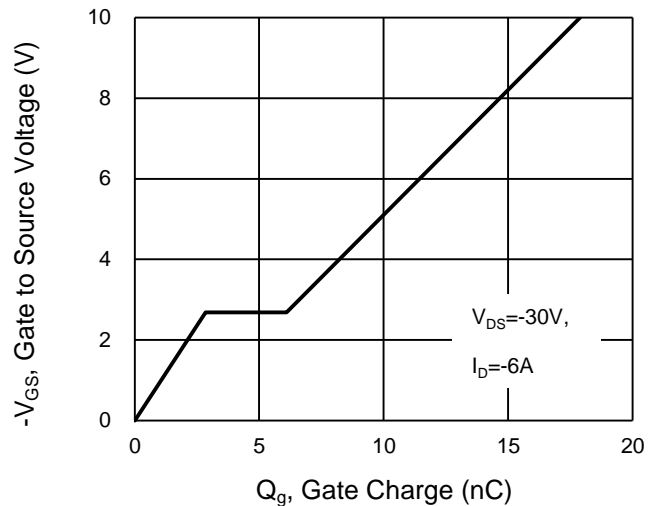
**Transfer Characteristics**



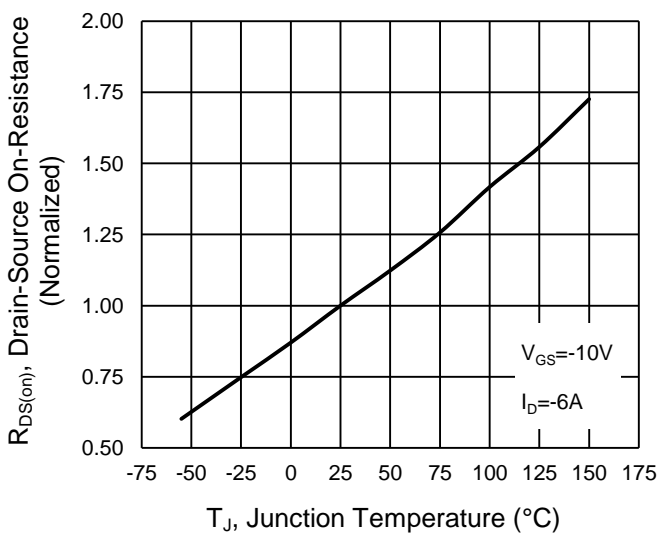
**On-Resistance vs. Drain Current**



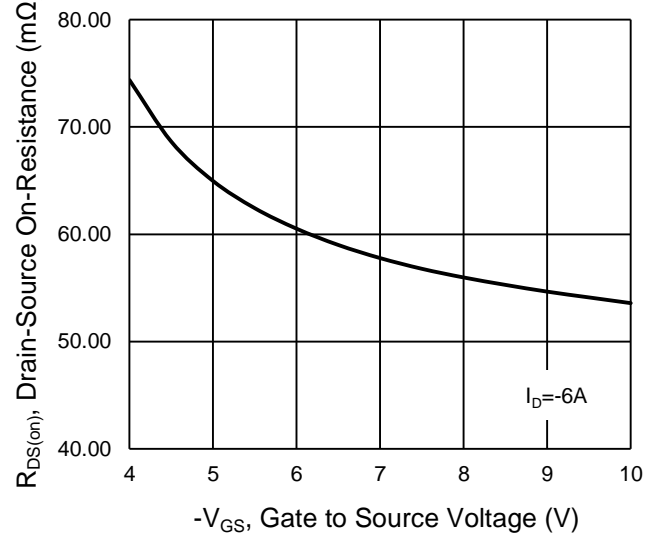
**Gate-Source Voltage vs. Gate Charge**



**On-Resistance vs. Junction Temperature**



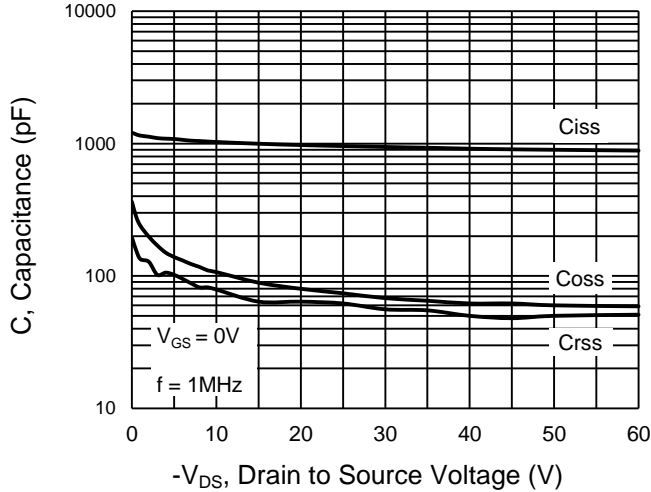
**On-Resistance vs. Gate-Source Voltage**



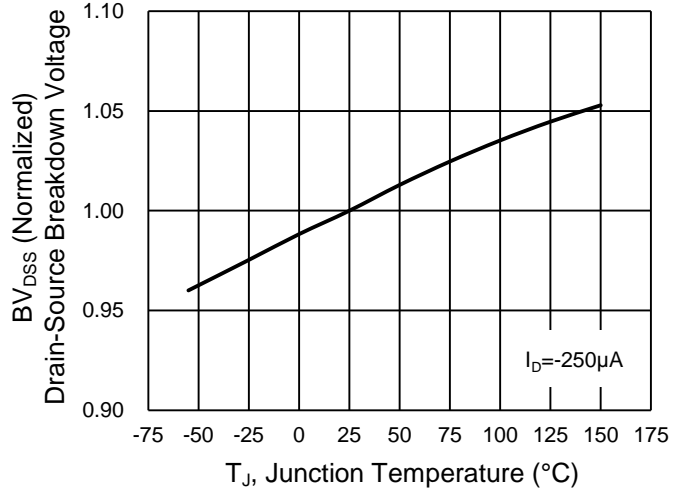
**CHARACTERISTICS CURVES**

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

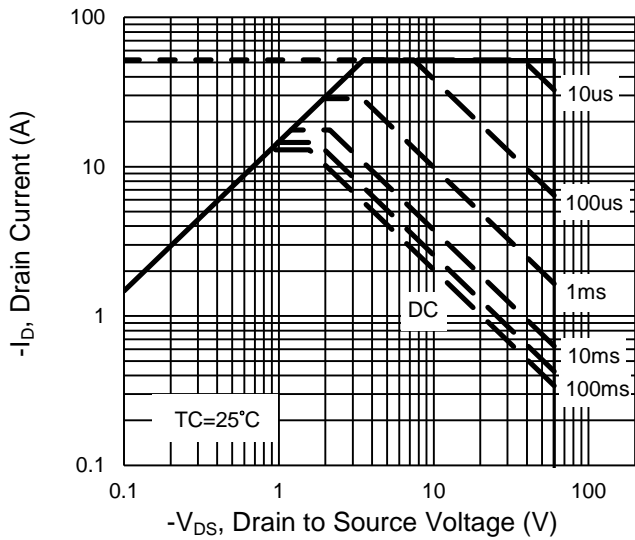
**Capacitance vs. Drain-Source Voltage**



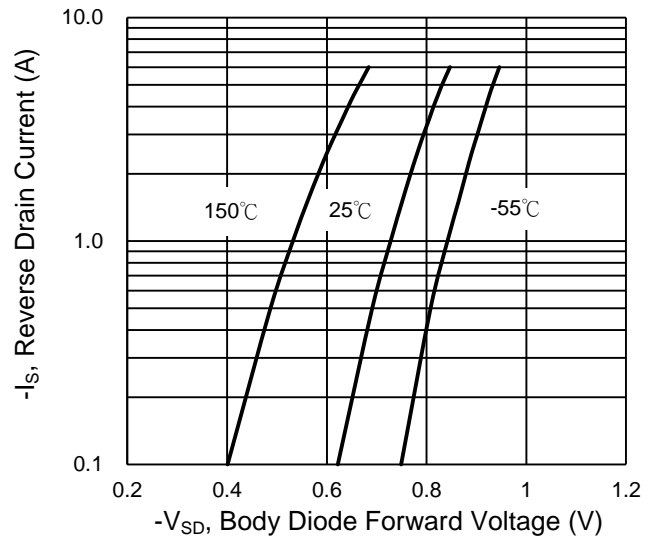
**$BV_{DSS}$  vs. Junction Temperature**



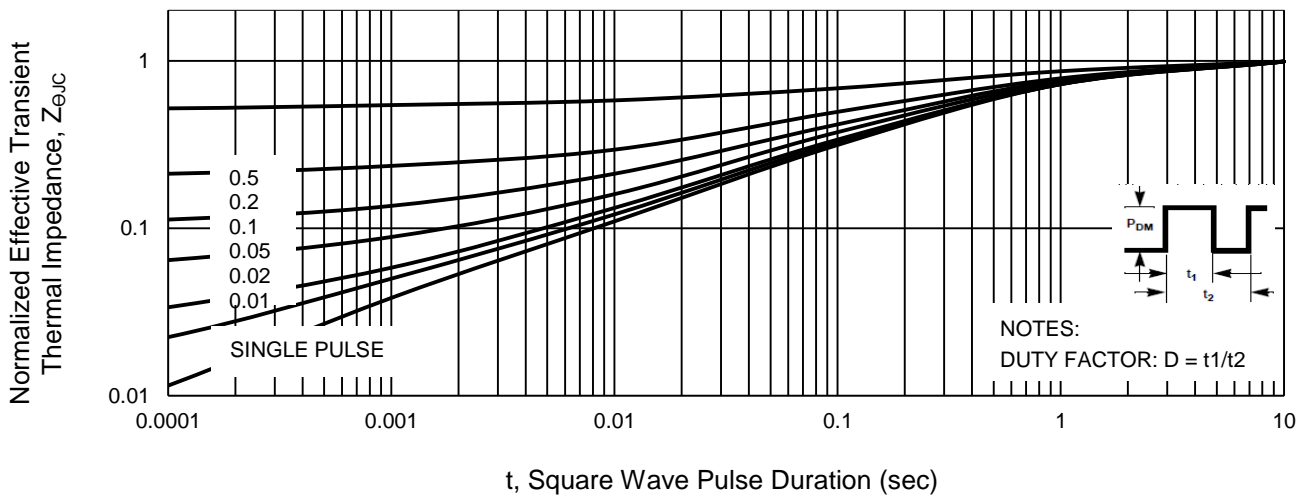
**Maximum Safe Operating Area, Junction-to-Case**



**Source-Drain Diode Forward Current vs. Voltage**

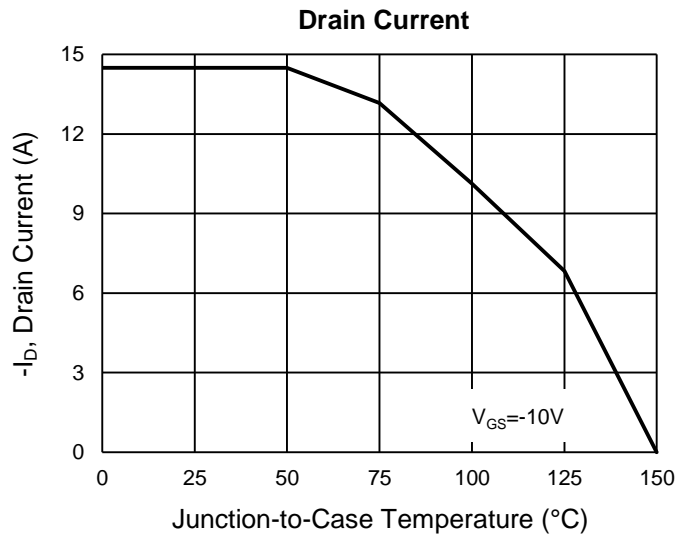
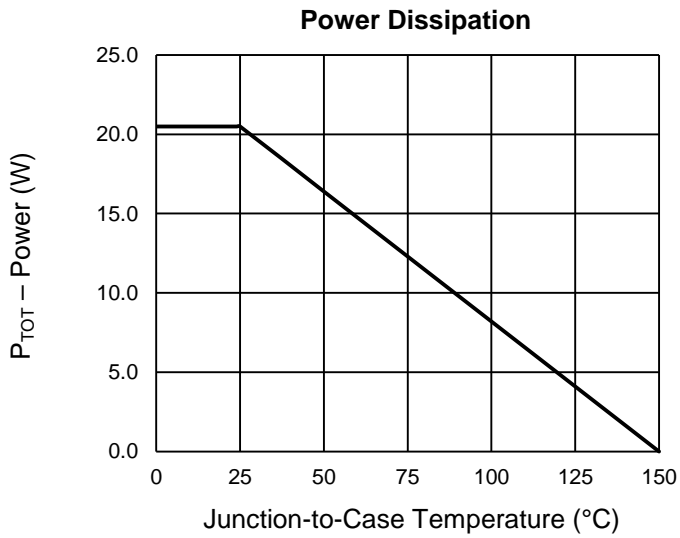


**Normalized Thermal Transient Impedance, Junction-to-Case**

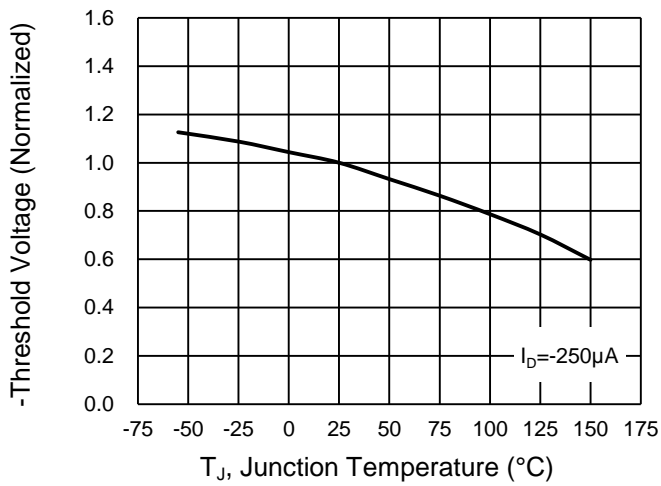


**CHARACTERISTICS CURVES**

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

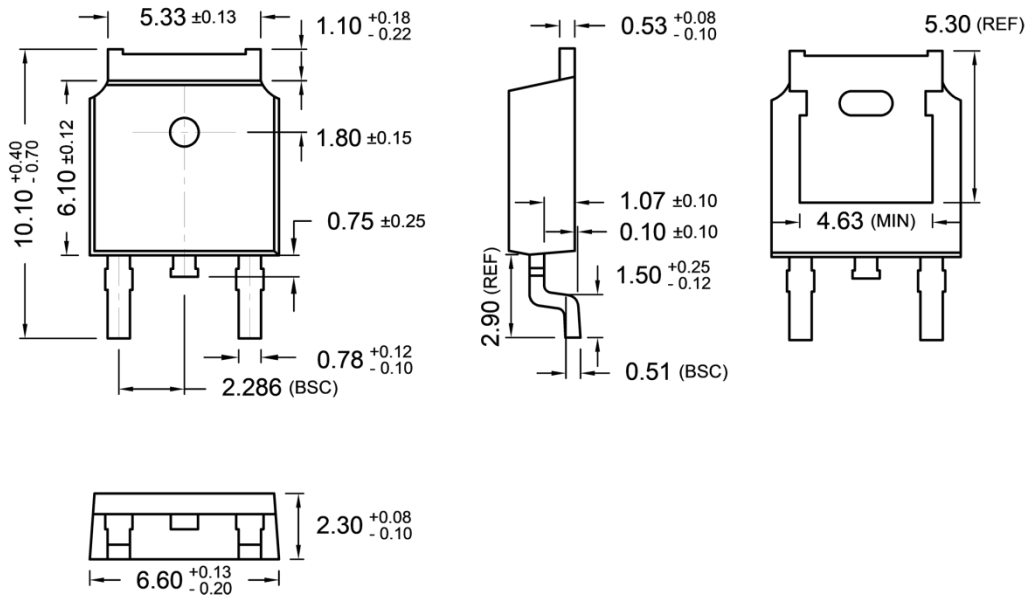


**Normalized gate threshold voltage vs Temperature**

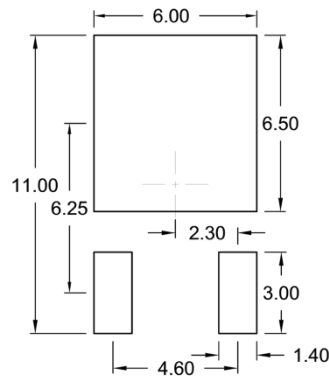


**PACKAGE OUTLINE DIMENSIONS** (Unit: Millimeters)

**TO-252 (DPAK)**



**SUGGESTED PAD LAYOUT** (Unit: Millimeters)



**MARKING DIAGRAM**



- Y** = Year Code
- M** = Month Code
  - 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)

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