

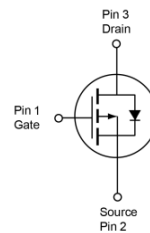
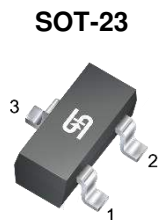
FEATURES

- RoHS Compliant
- Halogen-Free according to IEC 61249-2-21

APPLICATIONS

- Load Switch

PRODUCT SUMMARY			
PARAMETER		VALUE	UNIT
V_{DS}		-60	V
$R_{DS(on)}$ (max)	$V_{GS} = -10V$	190	mΩ
	$V_{GS} = -4.5V$	240	
Q_g	$V_{GS} = -10V$	8.2	nC



Note: MSL 1 (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}	± 20	V
Continuous Drain Current	I_D	$T_C = 25^\circ\text{C}$	-3.1
		$T_C = 100^\circ\text{C}$	-2
Pulsed Drain Current	I_{DM}	-12.4	A
Total Power Dissipation	$T_A = 25^\circ\text{C}$	P_D	1.56
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 Ambient	$R_{\theta JA}$	80	$^\circ\text{C/W}$

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. $R_{\theta JA}$ 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 with minimum recommended footprint in still air.

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise noted)						
PARAMETER	CONDITIONS	SYMBOL	MIN	TYP	MAX	UNIT
Static						
Drain-Source Breakdown Voltage	$V_{GS} = 0\text{V}, I_D = -250\mu\text{A}$	BV_{DSS}	-60	--	--	V
Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = -250\mu\text{A}$	$V_{GS(TH)}$	-1.2	-1.9	-2.5	V
Gate-Source Leakage Current	$V_{GS} = \pm 20\text{V}, V_{DS} = 0\text{V}$	I_{GSS}	--	--	± 100	nA
Drain-Source Leakage Current	$V_{GS} = 0\text{V}, V_{DS} = -60\text{V}$	I_{DSS}	--	--	-1	μA
	$V_{GS} = 0\text{V}, V_{DS} = -48\text{V}$ $T_J = 125^\circ\text{C}$		--	--	-10	
Drain-Source On-State Resistance (Note 1)	$V_{GS} = -10\text{V}, I_D = -3\text{A}$	$R_{DS(on)}$	--	160	190	m Ω
	$V_{GS} = -4.5\text{V}, I_D = -1.5\text{A}$		--	200	240	
Forward Transconductance (Note 1)	$V_{DS} = -10\text{V}, I_D = -3\text{A}$	g_{fs}	--	3.5	--	S
Dynamic						
Total Gate Charge	$V_{GS} = -10\text{V}, V_{DS} = -30\text{V}$ $I_D = -3\text{A}$	Q_g	--	8.2	--	nC
Gate-Source Charge		Q_{gs}	--	1.8	--	
Gate-Drain Charge		Q_{gd}	--	1.5	--	
Input Capacitance	$V_{GS} = 0\text{V}, V_{DS} = -30\text{V},$ $f = 1.0\text{MHz}$	C_{iss}	--	425	--	pF
Output Capacitance		C_{oss}	--	35	--	
Reverse Transfer Capacitance		C_{rss}	--	20	--	
Switching (Note 2)						
Turn-On Delay Time	$V_{GS} = -10\text{V}, V_{DS} = -30\text{V},$ $I_D = -1\text{A}, R_G = 6\Omega$	$t_{d(on)}$	--	5.2	--	ns
Rise Time		t_r	--	19	--	
Turn-Off Delay Time		$t_{d(off)}$	--	35	--	
Fall Time		t_f	--	10.6	--	
Source-Drain Diode						
Maximum Continuous Drain-Source Diode Forward Current	Integral reverse diode in the MOSFET	I_S	--	--	-3.1	A
Maximum Pulse Drain-Source Diode Forward Current		I_{SM}	--	--	-12.4	A
Diode Forward Voltage (Note 1)	$V_{GS} = 0\text{V}, I_S = -1\text{A}$	V_{SD}	--	--	-1	V

Notes:

1. Pulse test: Pulse Width $\leq 300\mu\text{s}$, duty cycle $\leq 2\%$.
2. Switching time is essentially independent of operating temperature.

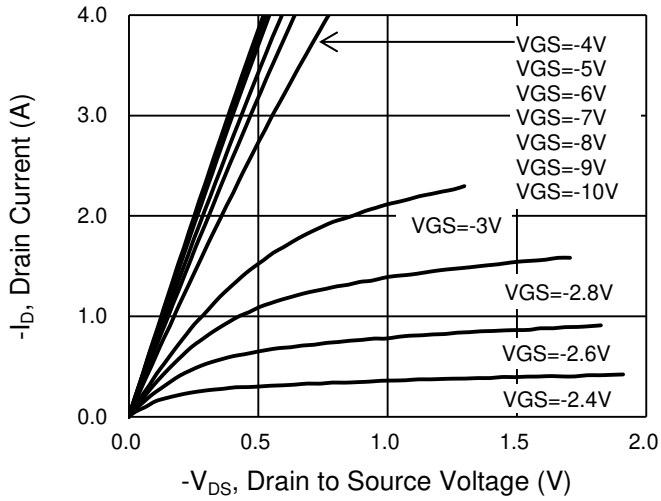
ORDERING INFORMATION

ORDERING CODE	PACKAGE	PACKING
TSM2309CX RFG	SOT-23	3kpcs / 7" Reel
TSM2309CX RKG	SOT-23	10kpcs / 13" Reel

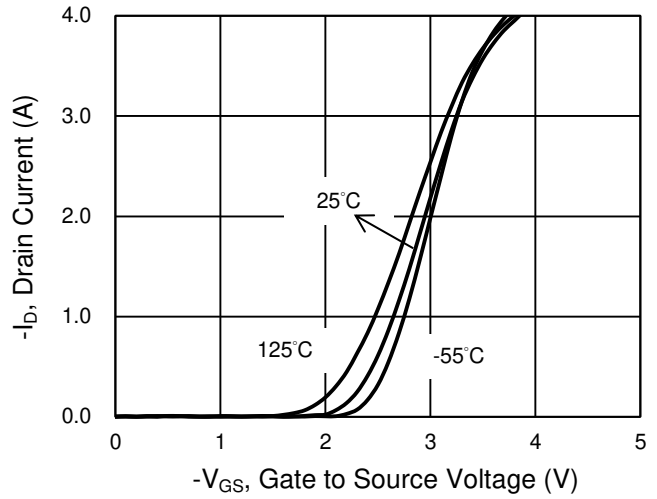
CHARACTERISTICS CURVES

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

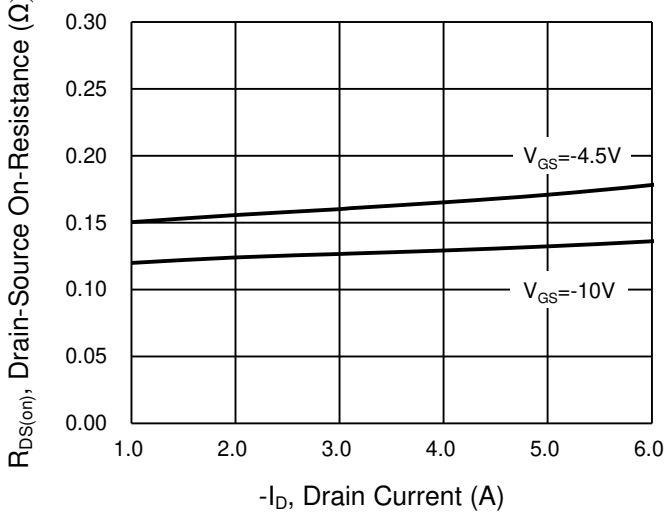
Output Characteristics



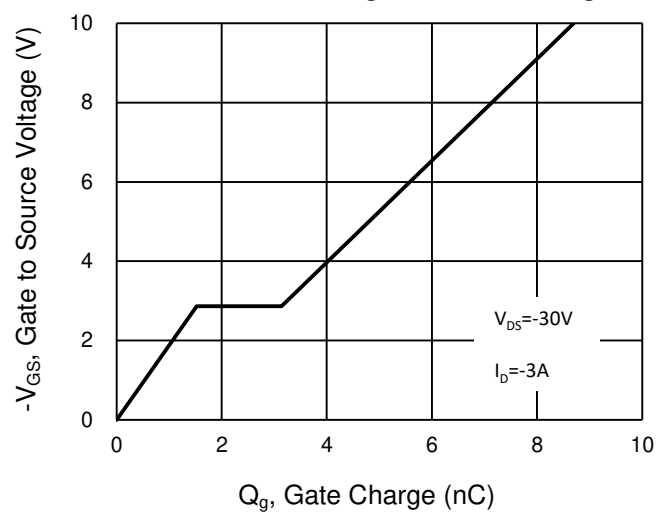
Transfer Characteristics



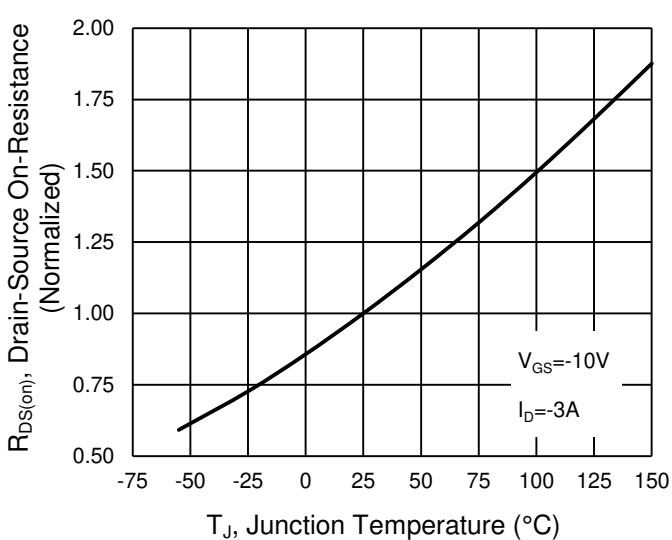
On-Resistance vs. Drain Current



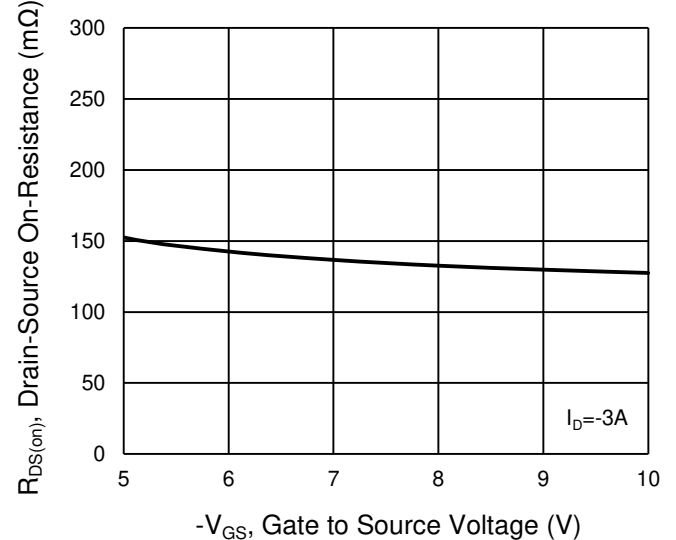
Gate-Source Voltage vs. Gate Charge



On-Resistance vs. Junction Temperature



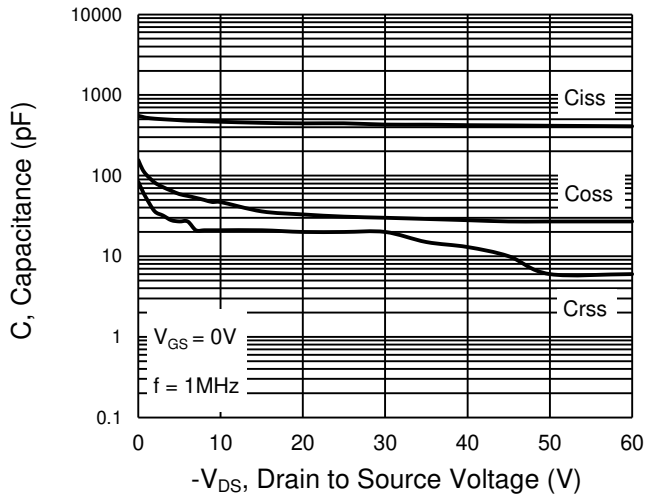
On-Resistance vs. Gate-Source Voltage



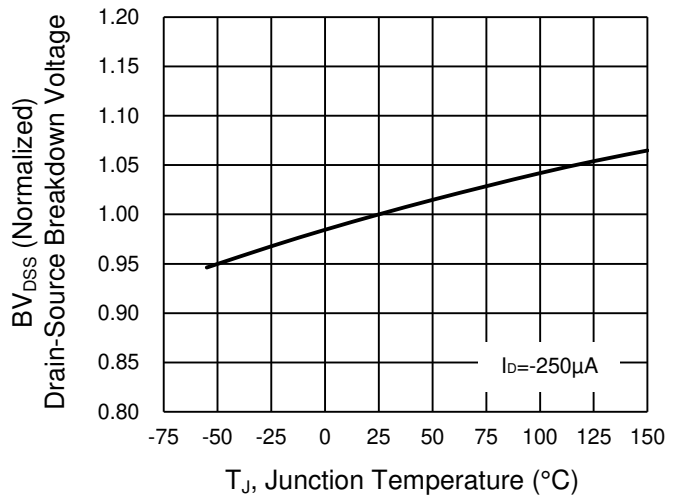
CHARACTERISTICS CURVES

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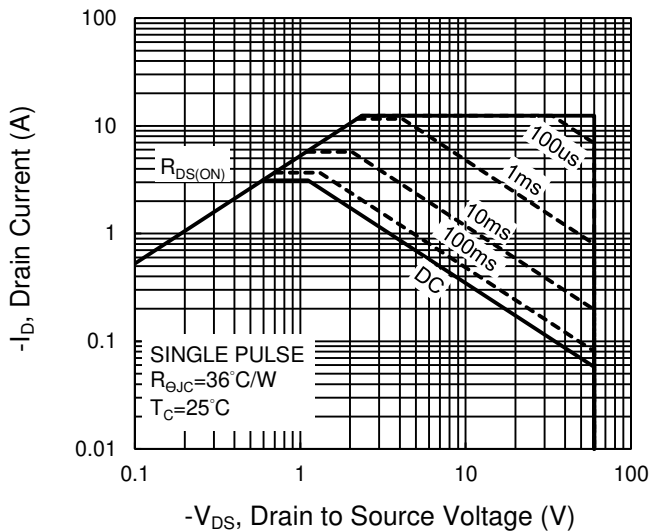
Capacitance vs. Drain-Source Voltage



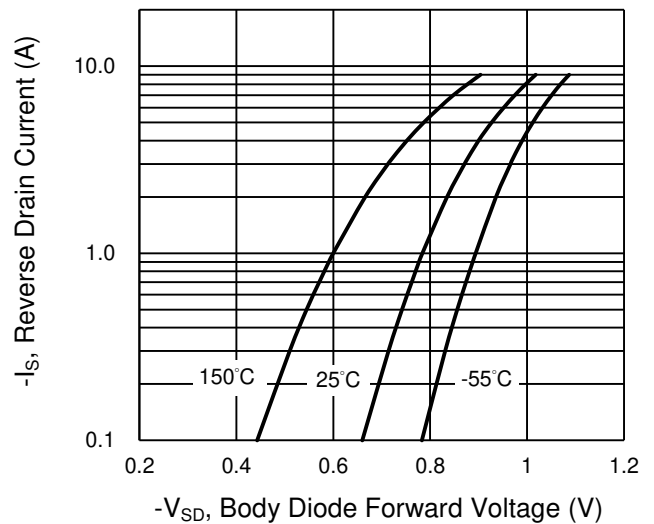
BV_{DSS} vs. Junction Temperature



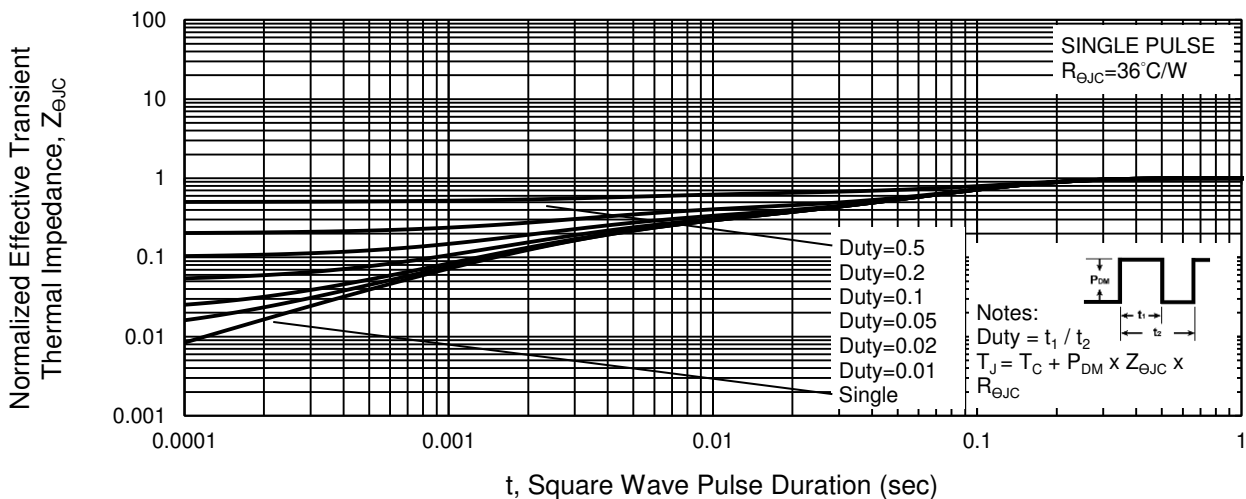
Maximum Safe Operating Area, Junction-to-Case



Source-Drain Diode Forward Current vs. Voltage

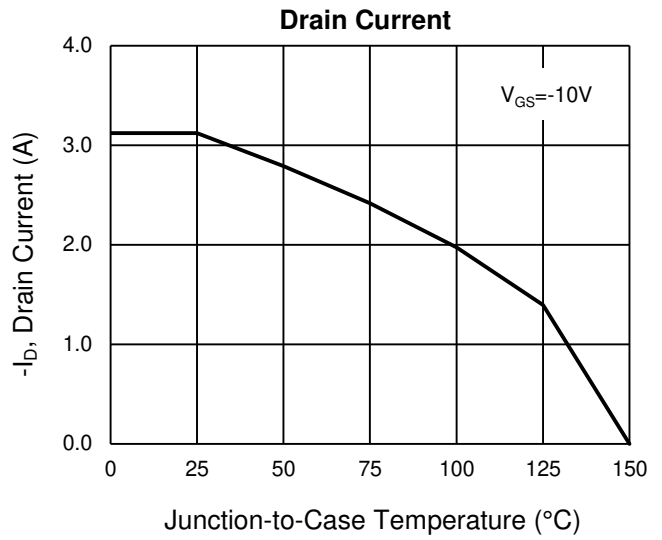
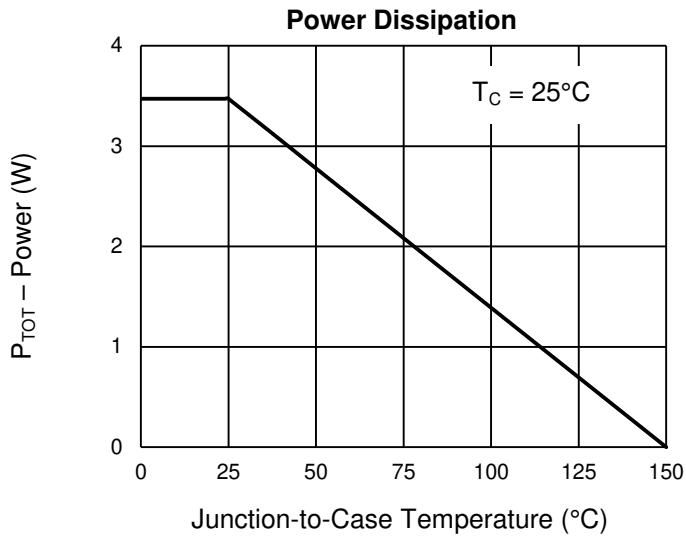


Normalized Thermal Transient Impedance, Junction-to-Case

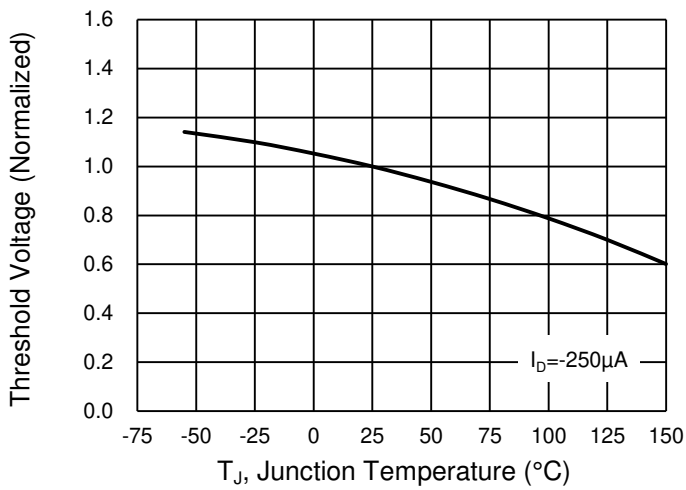


CHARACTERISTICS CURVES

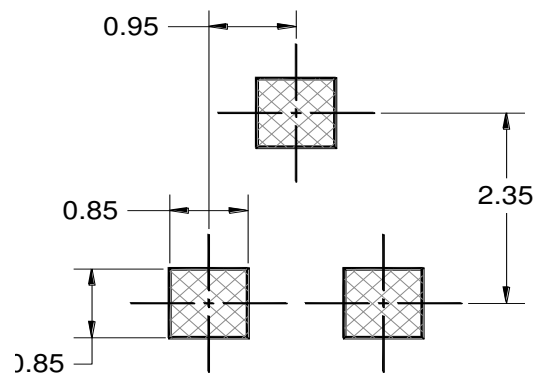
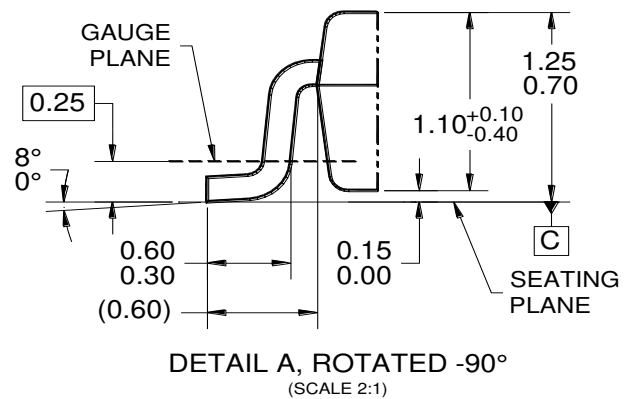
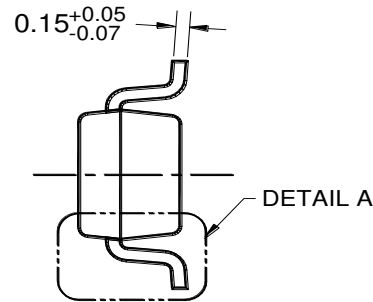
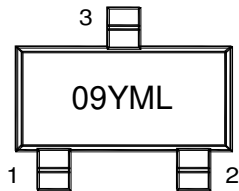
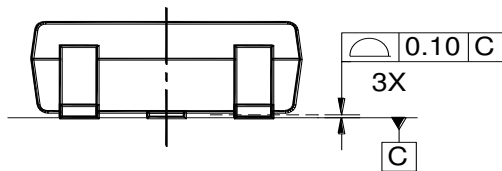
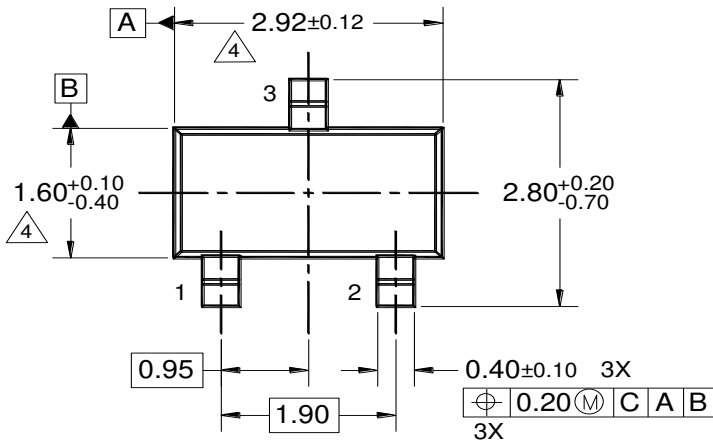
($T_A = 25^\circ\text{C}$ unless otherwise noted)



Normalized gate threshold voltage vs Temperature



SOT-23



- 09** = Device Code
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)

- NOTES: UNLESS OTHERWISE SPECIFIED**
1. ALL DIMENSIONS ARE IN MILLIMETERS.
 2. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994.
 3. PACKAGE OUTLINE REFERENCE: JEDEC TO-236, ISSUE H, VARIATION AA.
 4. MOLDED PLASTIC BODY DIMENSIONS DO NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.
 5. DWG NO REF: HQ2SD07-SOT23-025 REV A.

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