

## QM2401J-VB Datasheet

### P-Channel 30-V (D-S) MOSFET

#### PRODUCT SUMMARY

$V_{DS}$ (V)	$R_{DS(on)}$ ( $\Omega$ )	$I_D$ (A) <sup>d</sup>	$Q_g$ (Typ.)
- 30	0.050 at $V_{GS} = - 10$ V	- 7.6	13 nC
	0.056 at $V_{GS} = - 4.5$ V	- 6.0	

#### FEATURES

- Halogen-free According to IEC 61249-2-21 Definition
- Trench Power MOSFET
- 100 %  $R_g$  Tested



**RoHS**  
COMPLIANT  
**HALOGEN**  
**FREE**  
Available

#### APPLICATIONS

- Load Switch
- Battery Switch



P-Channel MOSFET

#### ABSOLUTE MAXIMUM RATINGS $T_A = 25$ °C, unless otherwise noted

Parameter		Symbol	Limit	Unit
Drain-Source Voltage		$V_{DS}$	- 30	V
Gate-Source Voltage		$V_{GS}$	$\pm 20$	
Continuous Drain Current ( $T_J = 150$ °C)	$T_C = 25$ °C	$I_D$	- 7.6	A
	$T_C = 70$ °C		- 5.8	
	$T_A = 25$ °C		- 6.0 <sup>a, b</sup>	
	$T_A = 70$ °C		- 5.2 <sup>a, b</sup>	
Pulsed Drain Current		$I_{DM}$	- 35	A
Continuous Source-Drain Diode Current	$T_C = 25$ °C	$I_S$	- 3.5	
	$T_A = 25$ °C		- 2.1 <sup>a, b</sup>	
Maximum Power Dissipation	$T_C = 25$ °C	$P_D$	6.5	W
	$T_C = 70$ °C		3.5	
	$T_A = 25$ °C		2.5 <sup>a, b</sup>	
	$T_A = 70$ °C		1.6 <sup>a, b</sup>	
Operating Junction and Storage Temperature Range		$T_J, T_{stg}$	- 55 to 150	°C

#### THERMAL RESISTANCE RATINGS

Parameter		Symbol	Typical	Maximum	Unit
Maximum Junction-to-Ambient <sup>a, c</sup>	$t \leq 10$ s	$R_{thJA}$	40	50	°C/W
Maximum Junction-to-Foot	Steady State	$R_{thJF}$	24	30	

Notes:

- Surface mounted on 1" x 1" FR4 board.
- $t = 10$  s.
- Maximum under Steady State conditions is 95 °C/W.
- Package limited.

SPECIFICATIONS $T_J = 25\text{ }^{\circ}\text{C}$ , unless otherwise noted						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Static						
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{GS} = 0\text{ V}$ , $I_D = -250\text{ }\mu\text{A}$	- 30			V
$V_{DS}$ Temperature Coefficient	$\Delta V_{DS}/T_J$	$I_D = -250\text{ }\mu\text{A}$		- 31		mV/ $^{\circ}\text{C}$
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$			4.5		
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$ , $I_D = -250\text{ }\mu\text{A}$	- 1.0		- 2.5	V
Gate-Source Leakage	$I_{GSS}$	$V_{DS} = 0\text{ V}$ , $V_{GS} = \pm 20\text{ V}$			$\pm 100$	nA
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = -30\text{ V}$ , $V_{GS} = 0\text{ V}$			- 1	$\mu\text{A}$
		$V_{DS} = -30\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_J = 55\text{ }^{\circ}\text{C}$			- 5	
On-State Drain Current <sup>a</sup>	$I_{D(on)}$	$V_{DS} \leq -5\text{ V}$ , $V_{GS} = -10\text{ V}$	- 20			A
Drain-Source On-State Resistance <sup>a</sup>	$R_{DS(on)}$	$V_{GS} = -10\text{ V}$ , $I_D = -7.0\text{ A}$		0.050		$\Omega$
		$V_{GS} = -4.5\text{ V}$ , $I_D = -5.6\text{ A}$		0.056		
Forward Transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = -15\text{ V}$ , $I_D = -7.0\text{ A}$		18		S
Dynamic <sup>b</sup>						
Input Capacitance	$C_{iss}$	$V_{DS} = -15\text{ V}$ , $V_{GS} = 0\text{ V}$ , $f = 1\text{ MHz}$		1355		pF
Output Capacitance	$C_{oss}$			180		
Reverse Transfer Capacitance	$C_{rss}$			145		
Total Gate Charge	$Q_g$	$V_{DS} = -15\text{ V}$ , $V_{GS} = -10\text{ V}$ , $I_D = -7.0\text{ A}$		25	38	nC
		$V_{DS} = -15\text{ V}$ , $V_{GS} = -4.5\text{ V}$ , $I_D = -7.0\text{ A}$		13	20	
Gate-Source Charge	$Q_{gs}$			3.5		
Gate-Drain Charge	$Q_{gd}$			5.5		
Gate Resistance	$R_g$	$f = 1\text{ MHz}$	0.4	2.0	4.0	$\Omega$
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = -15\text{ V}$ , $R_L = 2.7\text{ }\Omega$ $I_D \cong -5.6\text{ A}$ , $V_{GEN} = -10\text{ V}$ , $R_g = 1\text{ }\Omega$		10	20	ns
Rise Time	$t_r$			13	20	
Turn-Off DelayTime	$t_{d(off)}$			23	35	
Fall Time	$t_f$			9	18	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = -15\text{ V}$ , $R_L = 2.7\text{ }\Omega$ $I_D \cong -5.6\text{ A}$ , $V_{GEN} = -4.5\text{ V}$ , $R_g = 1\text{ }\Omega$		38	57	
Rise Time	$t_r$			89	134	
Turn-Off DelayTime	$t_{d(off)}$			22	33	
Fall Time	$t_f$			11	17	
Drain-Source Body Diode Characteristics						
Continous Source-Drain Diode Current	$I_S$	$T_C = 25\text{ }^{\circ}\text{C}$			- 6.5	A
Pulse Diode Forward Current	$I_{SM}$				- 30	
Body Diode Voltage	$V_{SD}$	$I_S = -5.6\text{ A}$ , $V_{GS} = 0\text{ V}$		- 0.71	- 1.2	V
Body Diode Reverse Recovery Time	$t_{rr}$	$I_F = -5.6\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ , $T_J = 25\text{ }^{\circ}\text{C}$		22	33	ns
Body Diode Reverse Recovery Charge	$Q_{rr}$			17	26	nC
Reverse Recovery Fall Time	$t_a$			13		ns
Reverse Recovery Rise Time	$t_b$			9		

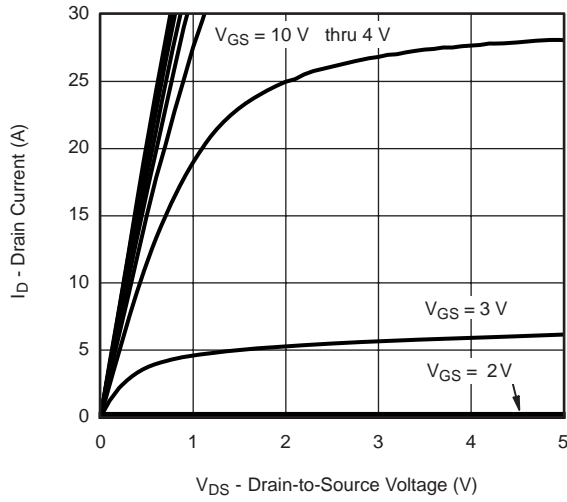
Notes:

a. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .

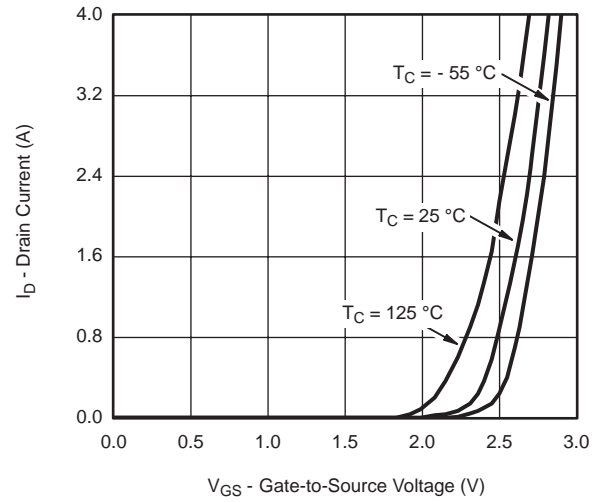
b. Guaranteed by design, not subject to production testing.

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

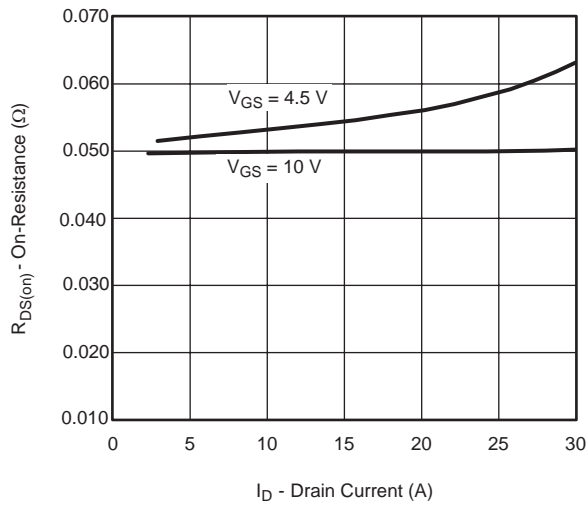
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



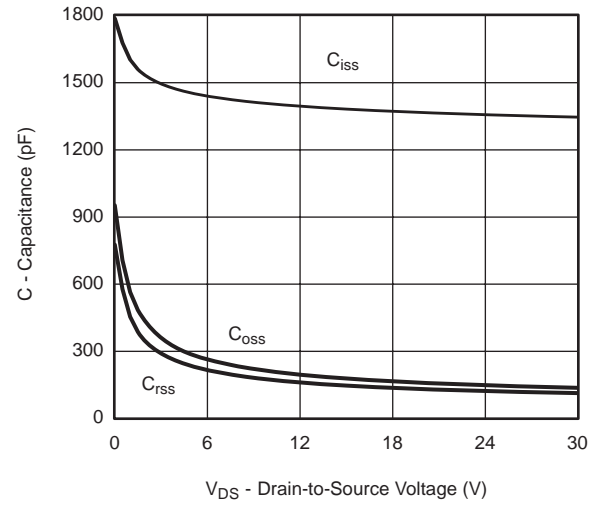
**Output Characteristics**



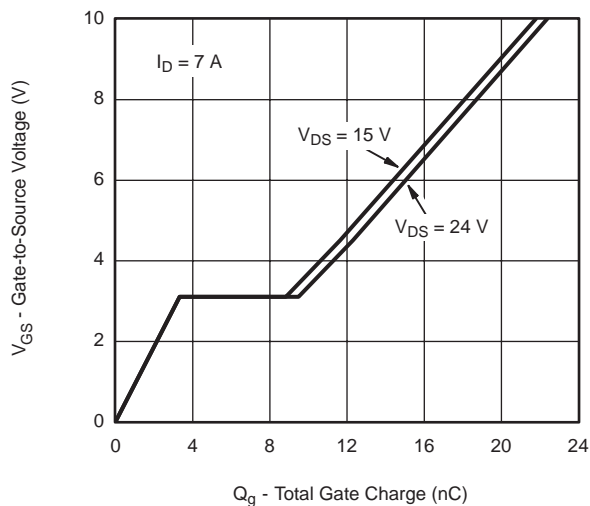
**Transfer Characteristics**



**On-Resistance vs. Drain Current**



**Capacitance**



**Gate Charge**



**On-Resistance vs. Junction Temperature**

**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



Source-Drain Diode Forward Voltage



On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage



Single Pulse Power, Junction-to-Ambient

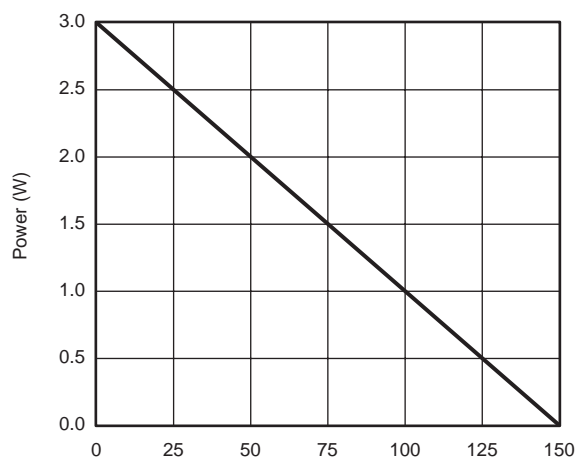


\*  $V_{GS} >$  minimum  $V_{GS}$  at which  $R_{DS(on)}$  is specified

Safe Operating Area

**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted

**Current Derating\***

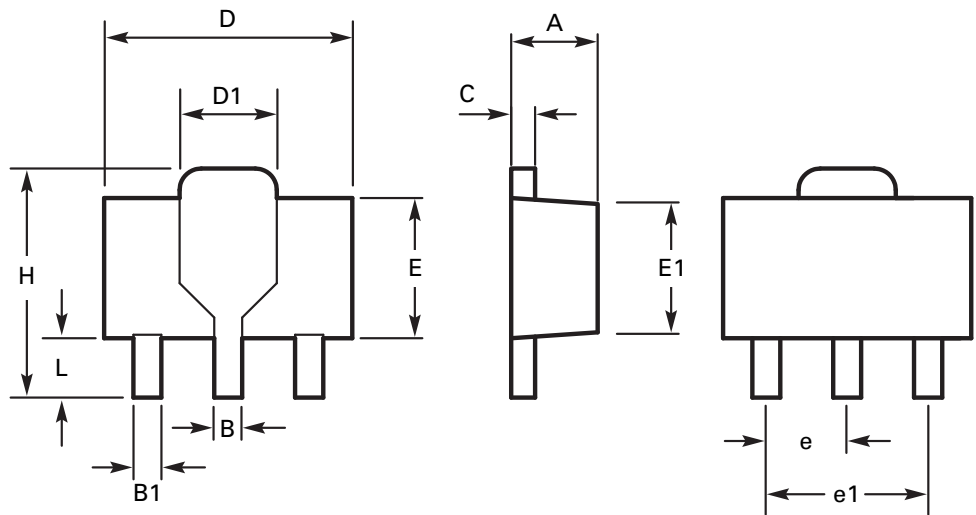
**Power, Junction-to-Foot**

**Power Derating, Junction-to-Ambient**

\* The power dissipation  $P_D$  is based on  $T_{J(max)} = 150$  °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.

**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



Package outline - SOT89



DIM	Millimeters		Inches		DIM	Millimeters		Inches	
	Min	Max	Min	Max		Min	Max	Min	Max
A	1.40	1.60	0.550	0.630	E	2.29	2.60	0.090	0.102
B	0.44	0.56	0.017	0.022	E1	2.13	2.29	0.084	0.090
B1	0.36	0.48	0.014	0.019	e	1.50 BSC		0.059 BSC	
C	0.35	0.44	0.014	0.017	e1	3.00 BSC		0.118 BSC	
D	4.40	4.60	0.173	0.181	H	3.94	4.25	0.155	0.167
D1	1.62	1.83	0.064	0.072	L	0.89	1.20	0.035	0.047

**Note:** Controlling dimensions are in millimeters. Approximate dimensions are provided in inches

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