

## EMB39P06A-VB Datasheet

### P-Channel 60 V (D-S) MOSFET

#### PRODUCT SUMMARY

$V_{DS}$ (V)	$R_{DS(on)}$ ( $\Omega$ )	$I_D$ (A)
- 60	0.020 at $V_{GS} = - 10$ V	- 50
	0.025 at $V_{GS} = - 4.5$ V	- 45

#### FEATURES

- Trench Power MOSFET
- Material categorization:

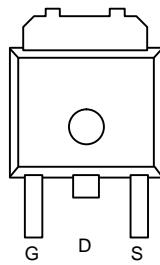


**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**

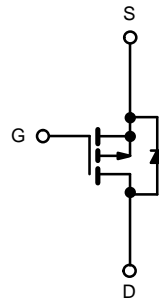
#### APPLICATIONS

- Load Switch

TO-252



Top View



P-Channel MOSFET

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

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	- 60	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	
Continuous Drain Current ( $T_J = 175$ °C)	$I_D$	$T_C = 25$ °C	A
		$T_C = 125$ °C	
Pulsed Drain Current	$I_{DM}$	- 160	
Avalanche Current	$I_{AS}$	- 50	
Single Pulse Avalanche Energy <sup>a</sup>	$E_{AS}$	125	mJ
Power Dissipation	$P_D$	$T_C = 25$ °C	W
		$T_A = 25$ °C	
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	- 55 to 150	°C

#### THERMAL RESISTANCE RATINGS

Parameter	Symbol	Typical	Maximum	Unit
Junction-to-Ambient <sup>b</sup>	$R_{thJA}$	$t \leq 10$ s	15	°C/W
		Steady State	40	
Junction-to-Case	$R_{thJC}$	0.82	1.1	

Notes:

- Duty cycle  $\leq 1$  %.
- When mounted on 1" square PCB (FR-4 material).
- See SOA curve for voltage derating.
- Package limited.

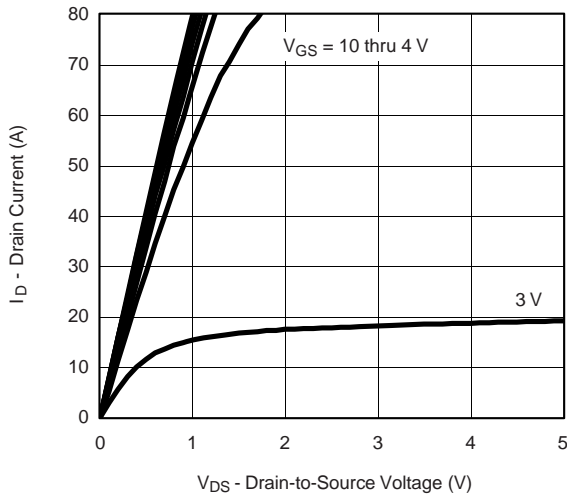
SPECIFICATIONS (T <sub>J</sub> = 25 °C, unless otherwise noted)						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Static						
Drain-Source Breakdown Voltage	V <sub>DS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = - 250 μA	- 60			V
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = - 250 μA	- 1.5		- 3	
Gate-Body Leakage	I <sub>GSS</sub>	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ± 20 V			± 100	nA
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> = - 60 V, V <sub>GS</sub> = 0 V			- 1	μA
		V <sub>DS</sub> = - 60 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 125 °C			- 50	
		V <sub>DS</sub> = - 60 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 150 °C			- 100	
On-State Drain Current <sup>a</sup>	I <sub>D(on)</sub>	V <sub>DS</sub> = - 5 V, V <sub>GS</sub> = - 10 V	- 50			A
Drain-Source On-State Resistance <sup>a</sup>	R <sub>DS(on)</sub>	V <sub>GS</sub> = - 10 V, I <sub>D</sub> = - 17 A		0.020		Ω
		V <sub>GS</sub> = - 10 V, I <sub>D</sub> = - 40 A, T <sub>J</sub> = 125 °C		0.030		
		V <sub>GS</sub> = - 10 V, I <sub>D</sub> = - 40 A, T <sub>J</sub> = 150 °C		0.035		
		V <sub>GS</sub> = - 4.5 V, I <sub>D</sub> = - 14 A		0.025		
Forward Transconductance <sup>a</sup>	g <sub>fs</sub>	V <sub>DS</sub> = - 15 V, I <sub>D</sub> = - 17 A		61		S
Dynamic <sup>b</sup>						
Input Capacitance	C <sub>iss</sub>	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = - 25 V, f = 1 MHz		2950		pF
Output Capacitance	C <sub>oss</sub>			380		
Reverse Transfer Capacitance	C <sub>rss</sub>			305		
Total Gate Charge <sup>c</sup>	Q <sub>g</sub>	V <sub>DS</sub> = - 30 V, V <sub>GS</sub> = - 10 V, I <sub>D</sub> = - 40 A		110	165	nC
Gate-Source Charge <sup>c</sup>	Q <sub>gs</sub>			19		
Gate-Drain Charge <sup>c</sup>	Q <sub>gd</sub>			28		
Turn-On Delay Time <sup>c</sup>	t <sub>d(on)</sub>	V <sub>DD</sub> = - 30 V, R <sub>L</sub> = 0.6 Ω I <sub>D</sub> ≡ - 40 A, V <sub>GEN</sub> = - 10 V, R <sub>G</sub> = 6 Ω		15	23	ns
Rise Time <sup>c</sup>	t <sub>r</sub>			70	105	
Turn-Off Delay Time <sup>c</sup>	t <sub>d(off)</sub>			175	260	
Fall Time <sup>c</sup>	t <sub>f</sub>			175	260	
Source-Drain Diode Ratings and Characteristics T <sub>C</sub> = 25 °C <sup>b</sup>						
Continuous Current	I <sub>S</sub>				- 40	A
Pulsed Current	I <sub>SM</sub>				- 80	
Forward Voltage <sup>a</sup>	V <sub>SD</sub>	I <sub>F</sub> = - 40 A, V <sub>GS</sub> = 0 V		- 1	- 1.6	V
Reverse Recovery Time	t <sub>rr</sub>	I <sub>F</sub> = - 40 A, dI/dt = 100 A/μs		45	70	ns

Notes:

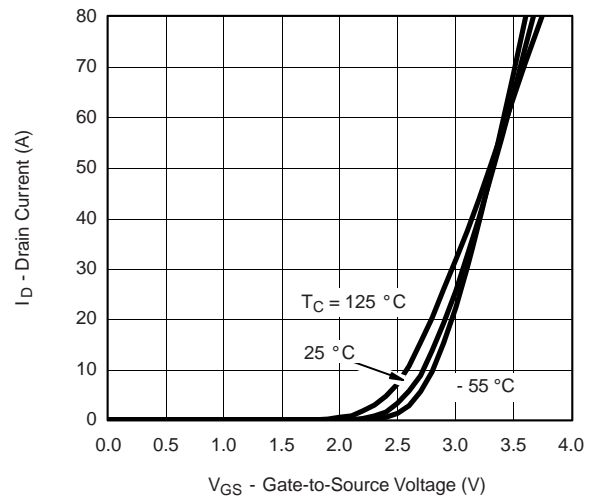
- a. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .  
 b. Guaranteed by design, not subject to production testing.  
 c. Independent of operating temperature.

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.

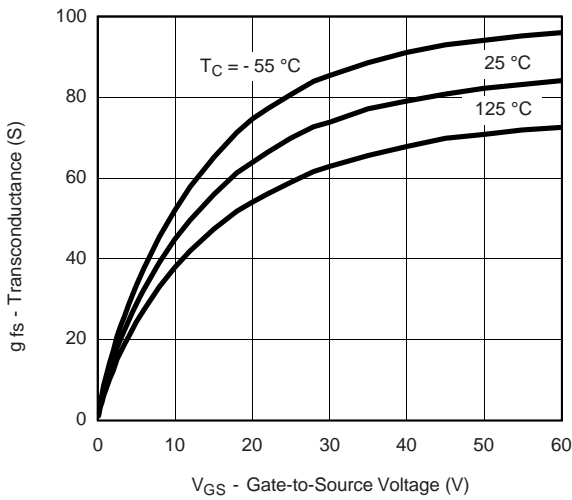
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



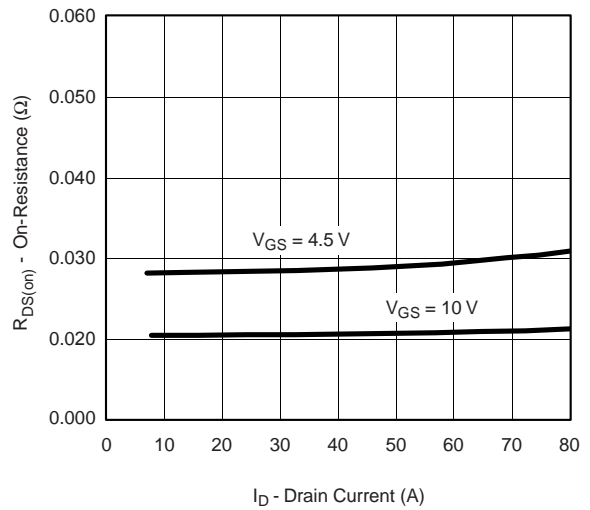
**Output Characteristics**



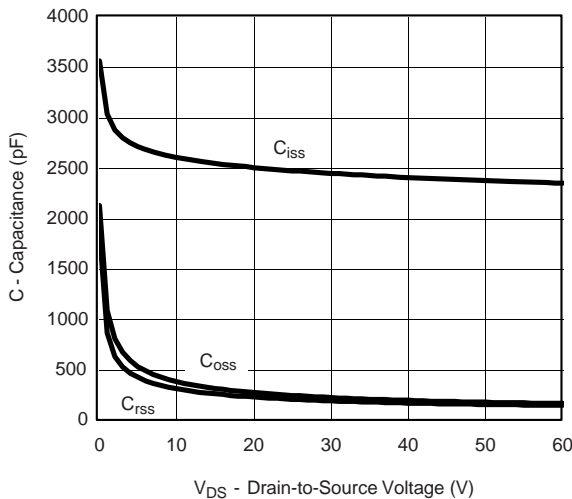
**Transfer Characteristics**



**Transconductance**



**On-Resistance vs. Drain Current**

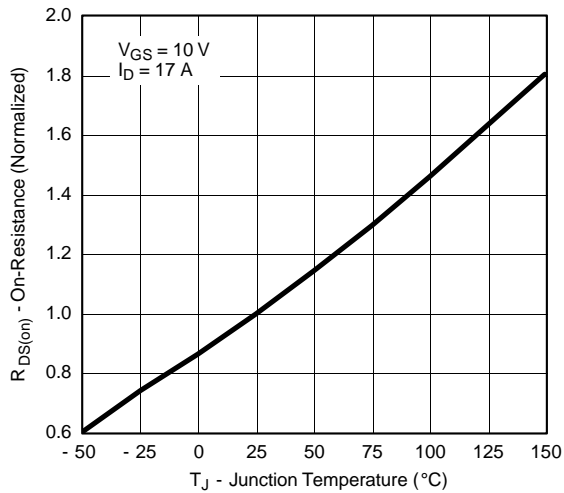


**Capacitance**

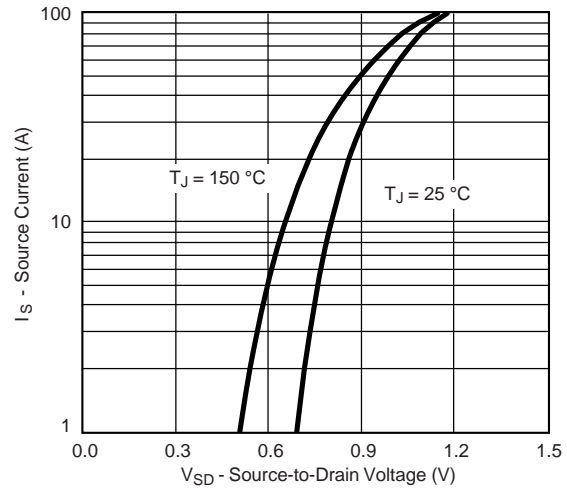


**Gate Charge**

## TYPICAL CHARACTERISTICS

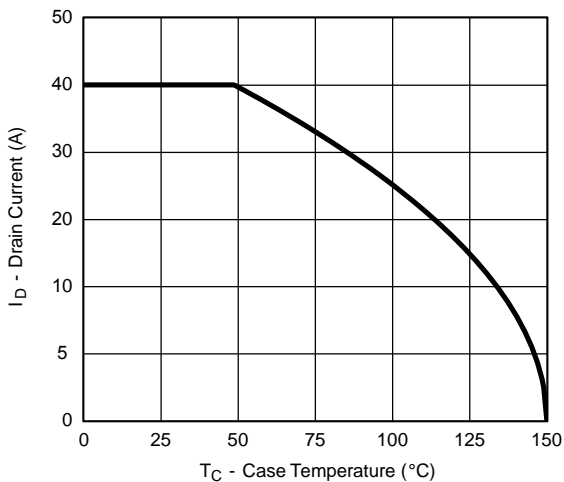


On-Resistance vs. Junction Temperature

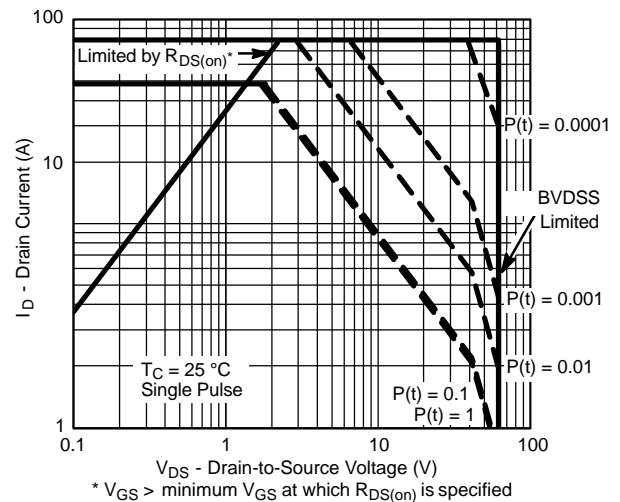


Source-Drain Diode Forward Voltage

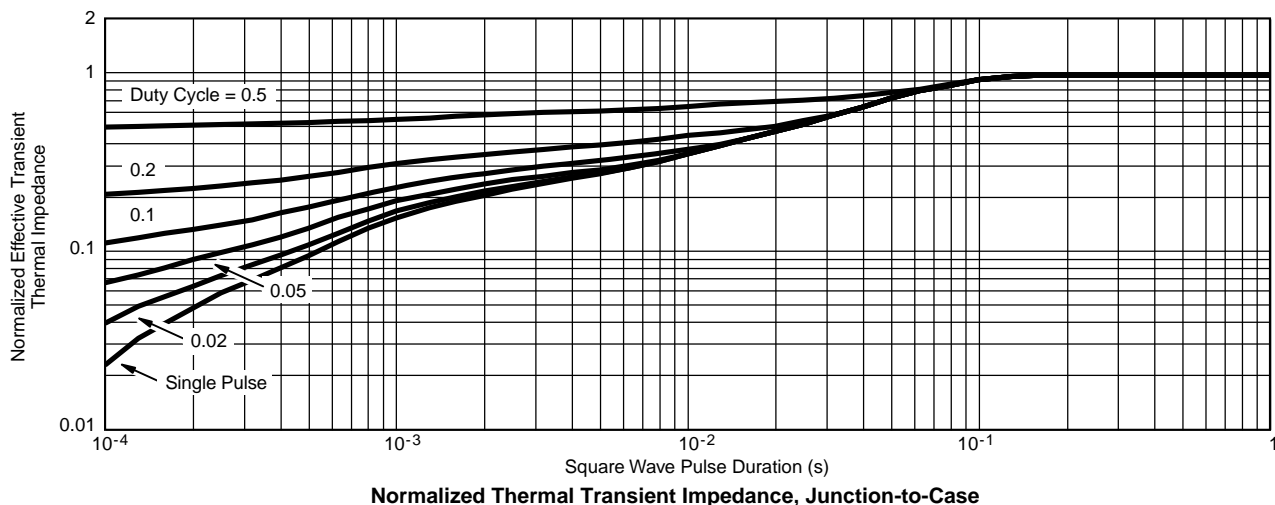
## THERMAL RATINGS (25 $^{\circ}C$ , unless otherwise noted)



Drain Current vs. Case Temperature



Safe Operating Area



Normalized Thermal Transient Impedance, Junction-to-Case

## TO-252AA CASE OUTLINE

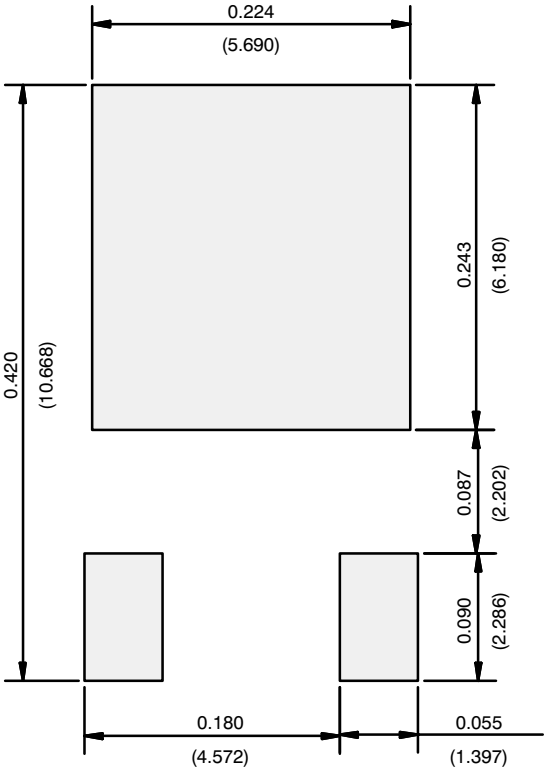


DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	2.18	2.38	0.086	0.094
A1	-	0.127	-	0.005
b	0.64	0.88	0.025	0.035
b2	0.76	1.14	0.030	0.045
b3	4.95	5.46	0.195	0.215
C	0.46	0.61	0.018	0.024
C2	0.46	0.89	0.018	0.035
D	5.97	6.22	0.235	0.245
D1	5.21	-	0.205	-
E	6.35	6.73	0.250	0.265
E1	4.32	-	0.170	-
H	9.40	10.41	0.370	0.410
e	2.28 BSC		0.090 BSC	
e1	4.56 BSC		0.180 BSC	
L	1.40	1.78	0.055	0.070
L3	0.89	1.27	0.035	0.050
L4	-	1.02	-	0.040
L5	1.14	1.52	0.045	0.060
ECN: X12-0247-Rev. M, 24-Dec-12				
DWG: 5347				

### Note

- Dimension L3 is for reference only.

RECOMMENDED MINIMUM PADS FOR DPAK (TO-252)



Recommended Minimum Pads  
Dimensions in Inches/(mm)

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