

# FDMS86581

## MOSFET, N-Channel, POWERTRENCH<sup>®</sup>, 60 V, 30 A, 15 mΩ

### Features

- Typical  $R_{DS(on)}$  = 12.5 mΩ at  $V_{GS} = 10$  V,  $I_D = 30$  A
- Typical  $Q_{G(tot)}$  = 13 nC at  $V_{GS} = 10$  V,  $I_D = 25$  A
- UIS Capability
- RoHS Compliant

### Applications

- DC–DC Power Supplies
- AC–DC Power Supplies
- Motor Control
- Load Switching

### MOSFET MAXIMUM RATINGS ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Ratings	Unit
$V_{DSS}$	Drain-to-Source Voltage	60	V
$V_{GS}$	Gate-to-Source Voltage	$\pm 20$	V
$I_D$	Drain Current – Continuous ( $V_{GS} = 10$ ) $T_C = 25^\circ\text{C}$ (Note 1)	30	A
	Pulsed Drain Current, $T_C = 25^\circ\text{C}$	See Figure 4	
$E_{AS}$	Single Pulse Avalanche Energy (Note 2)	13.5	mJ
$P_D$	Power Dissipation	50	W
	Derate Above $25^\circ\text{C}$	0.33	W/ $^\circ\text{C}$
$T_J, T_{STG}$	Operating and Storage Temperature	$-55$ to $+175$	$^\circ\text{C}$
$R_{\theta JC}$	Thermal Resistance, Junction to Case	3	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Maximum Thermal Resistance, Junction to Ambient (Note 3)	50	$^\circ\text{C}/\text{W}$

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

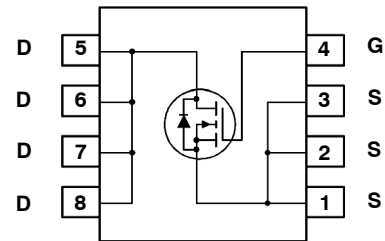
1. Current is limited by bondwire configuration.
2. Starting  $T_J = 25^\circ\text{C}$ ,  $L = 40$  μH,  $I_{AS} = 26$  A,  $V_{DD} = 60$  V during inductor charging and  $V_{DD} = 0$  V during time in avalanche.
3.  $R_{\theta JA}$  is the sum of the junction-to-case and case-to-ambient thermal resistance, where the case thermal reference is defined as the solder mounting surface of the drain pins.  $R_{\theta JC}$  is guaranteed by design, while  $R_{\theta JA}$  is determined by the board design. The maximum rating presented here is based on mounting on a 1 in<sup>2</sup> pad of 2 oz copper.



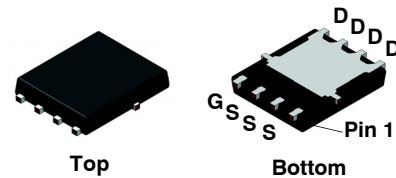
ON Semiconductor<sup>®</sup>

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### ELECTRICAL CONNECTION

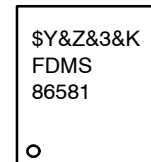


N-Channel MOSFET



Power 56  
(PQFN8 5x6)  
CASE 483AE

### MARKING DIAGRAM



- \$Y = ON Semiconductor Logo
- &Z = Assembly Plant Code
- &3 = Numeric Date Code
- &K = Lot Code
- FDMS86581 = Specific Device Code

### ORDERING INFORMATION

See detailed ordering and shipping information on page 2 of this data sheet.

# FDMS86581

## PACKAGE MARKING AND ORDERING INFORMATION

Device Marking	Device	Package	Shipping <sup>†</sup>
FDMS86581	FDMS86581	Power 56	3000 Units/ Tape & Reel

<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

## ELECTRICAL CHARACTERISTICS (T<sub>J</sub> = 25°C unless otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ.	Max.	Units
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### OFF CHARACTERISTICS

B <sub>VDSS</sub>	Drain-to-Source Breakdown Voltage	I <sub>D</sub> = 250 μA, V <sub>GS</sub> = 0 V	60	–	–	V	
I <sub>DSS</sub>	Drain-to-Source Leakage Current	V <sub>DS</sub> = 60 V, V <sub>GS</sub> = 0 V	T <sub>J</sub> = 25°C	–	–	1	A
			T <sub>J</sub> = 175°C (Note 4)	–	–	1	mA
I <sub>GSS</sub>	Gate-to-Source Leakage Current	V <sub>GS</sub> = ± 20 V	–	–	±100	nA	

### ON CHARACTERISTICS

V <sub>GS(th)</sub>	Gate to Source Threshold Voltage	V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = 250 μA	2.0	2.7	4.0	V	
R <sub>DS(on)</sub>	Drain to Source On Resistance	I <sub>D</sub> = 30 A, V <sub>GS</sub> = 10 V	T <sub>J</sub> = 25°C	–	12.5	15.0	mΩ
			T <sub>J</sub> = 175°C (Note 4)	–	25.1	30.1	mΩ

### DYNAMIC CHARACTERISTICS

C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 30 V, V <sub>GS</sub> = 0 V, f = 1 MHz	–	881	–	pF
C <sub>oss</sub>	Output Capacitance		–	281	–	pF
C <sub>rss</sub>	Reverse Transfer Capacitance		–	15	–	pF
R <sub>G</sub>	Gate Resistance	f = 1 MHz	–	3.1	–	Ω
Q <sub>g(ToT)</sub>	Total Gate Charge	V <sub>GS</sub> = 0 to 10 V, V <sub>DD</sub> = 30 V, I <sub>D</sub> = 25 A	–	13	19	nC
Q <sub>g(th)</sub>	Threshold Gate Charge	V <sub>GS</sub> = 0 to 2 V, V <sub>DD</sub> = 30 V, I <sub>D</sub> = 25 A	–	2	–	nC
Q <sub>gs</sub>	Gate-to-Source Gate Charge	V <sub>DD</sub> = 30 V, I <sub>D</sub> = 25 A	–	4	–	nC
Q <sub>gd</sub>	Gate-to-Drain "Miller" Charge		–	3	–	nC

### SWITCHING CHARACTERISTICS

t <sub>on</sub>	Turn-On Time	V <sub>DD</sub> = 30 V, I <sub>D</sub> = 30 A, V <sub>GS</sub> = 10 V, R <sub>GEN</sub> = 6 Ω	–	–	20	ns
t <sub>d(on)</sub>	Turn-On Delay		–	9	–	ns
t <sub>r</sub>	Rise Time		–	5	–	ns
t <sub>d(off)</sub>	Turn-Off Delay		–	15	–	ns
t <sub>f</sub>	Fall Time		–	4	–	ns
t <sub>off</sub>	Turn-Off Time		–	–	28	ns

### DRAIN-SOURCE DIODE CHARACTERISTICS

V <sub>SD</sub>	Source-to-Drain Diode Voltage	I <sub>SD</sub> = 30 A, V <sub>GS</sub> = 0 V	–	–	1.25	V
		I <sub>SD</sub> = 15 A, V <sub>GS</sub> = 0 V	–	–	1.2	V
t <sub>rr</sub>	Reverse-Recovery Time	I <sub>F</sub> = 30 A, di <sub>SD</sub> /dt = 100 A/μs, V <sub>DD</sub> = 48 V	–	37	55	ns
Q <sub>rr</sub>	Reverse Recovery Charge		–	22	33	nC

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

4. The maximum value is specified by design at T<sub>J</sub> = 175°C. Product is not tested to this condition in production.

TYPICAL CHARACTERISTICS

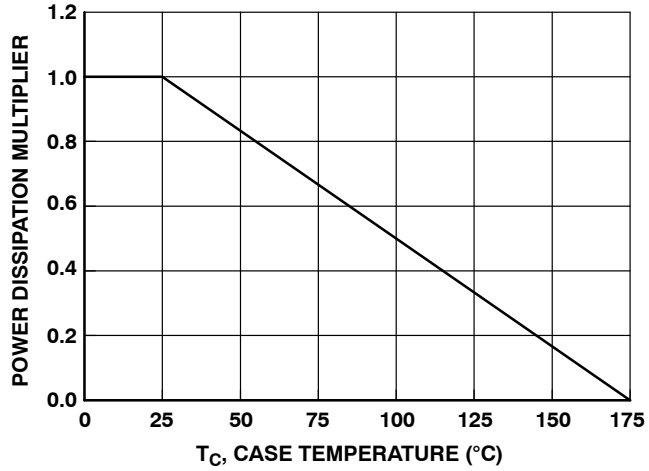


Figure 1. Normalized Power Dissipation vs. Case Temperature

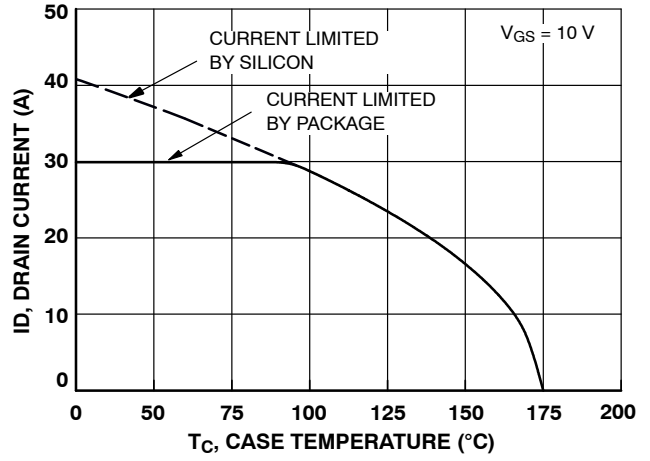


Figure 2. Maximum Continuous Drain Current vs. Case Temperature

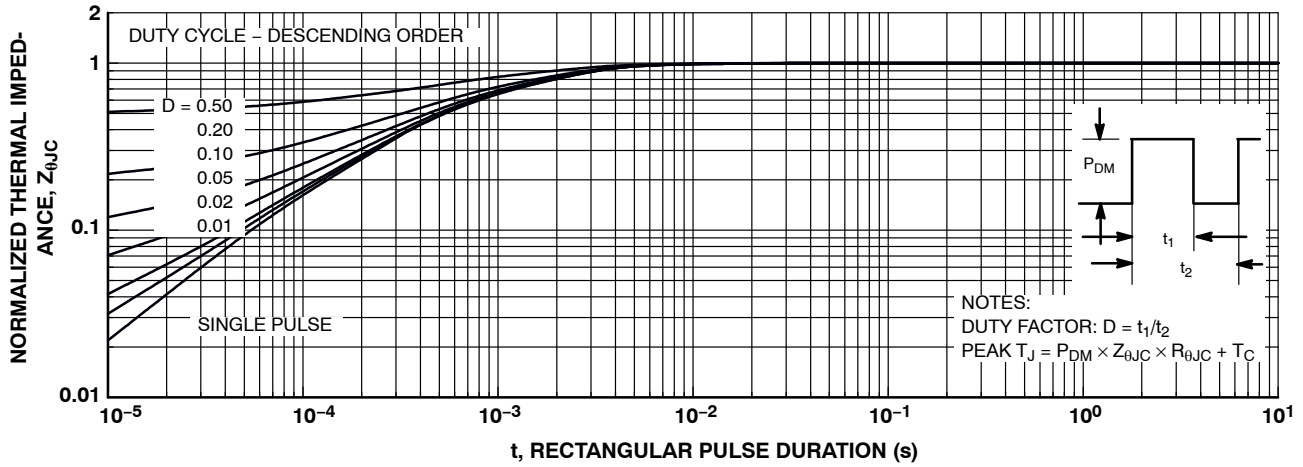


Figure 3. Normalized Maximum Transient Thermal Impedance

TYPICAL CHARACTERISTICS (continued)

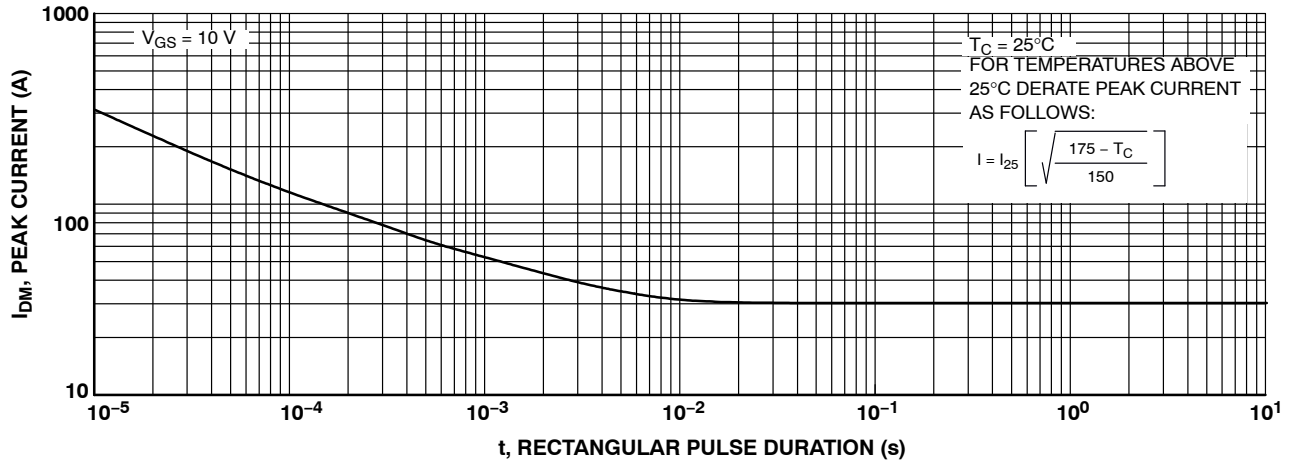


Figure 4. Peak Current Capability

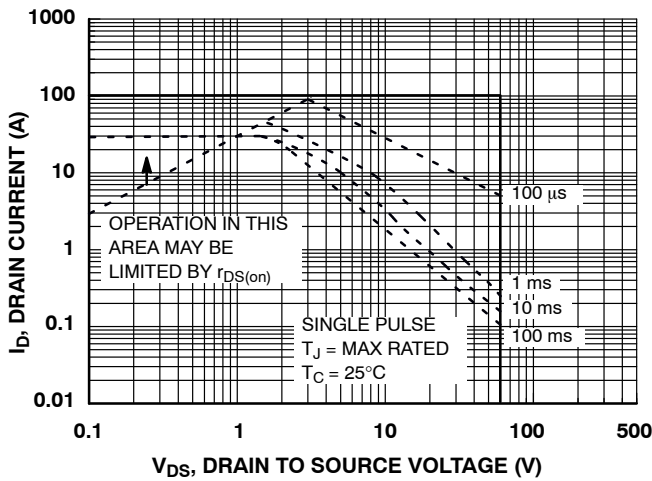
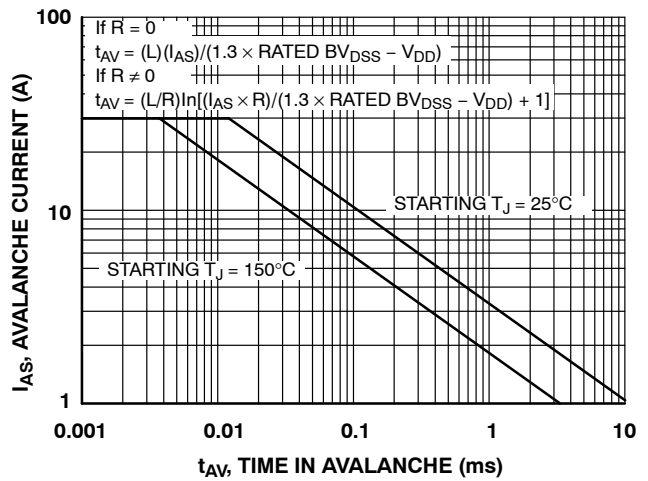


Figure 5. Forward Bias Safe Operating Area



NOTE: Refer to ON Semiconductor Application Notes [AN7514](#) and [AN7515](#).

Figure 6. Unclamped Inductive Switching Capability

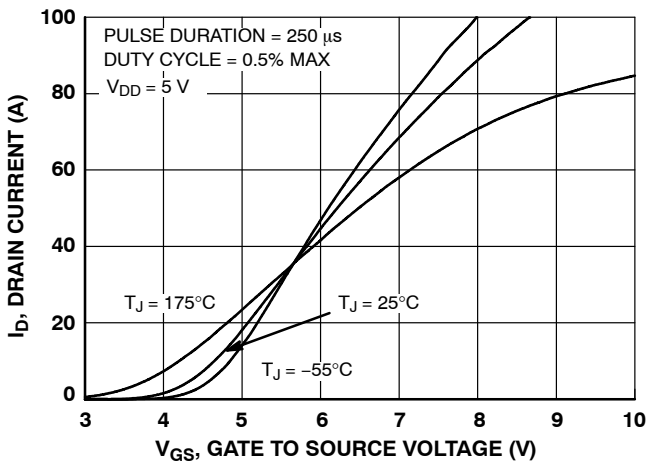


Figure 7. Transfer Characteristics

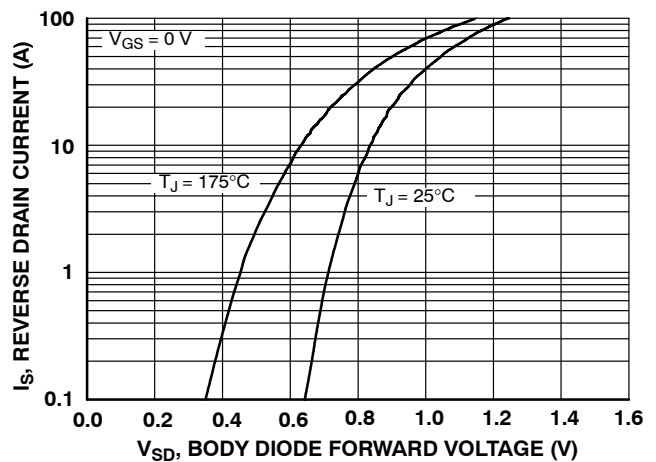


Figure 8. Forward Diode Characteristics

TYPICAL CHARACTERISTICS (continued)

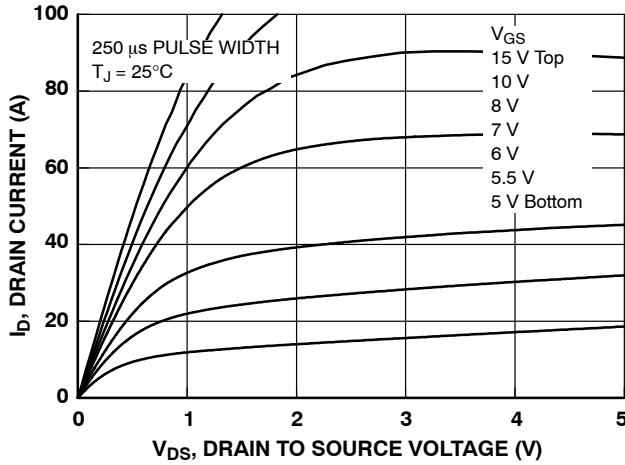


Figure 9. Saturation Characteristics

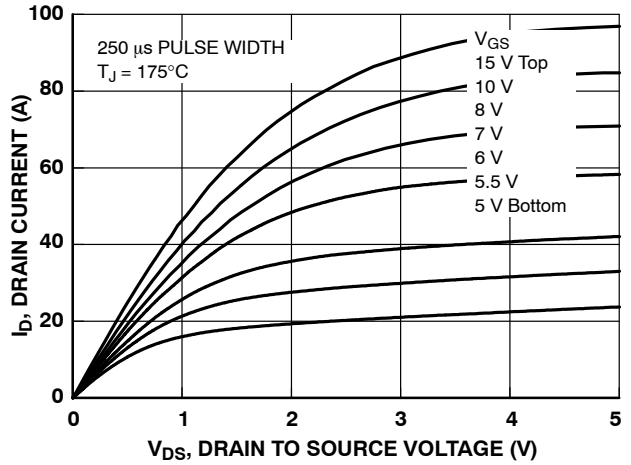


Figure 10. Saturation Characteristics

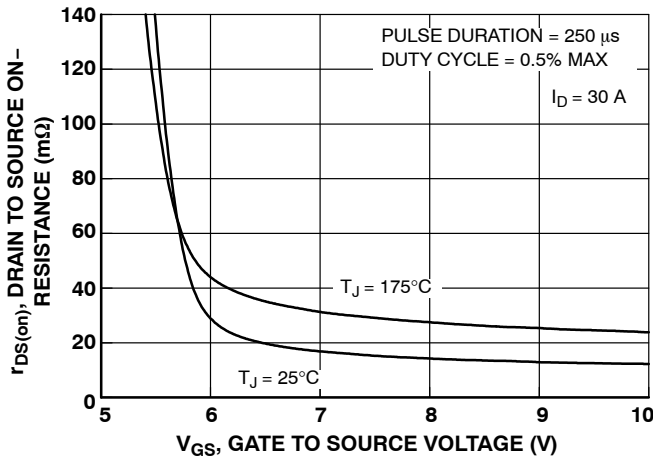


Figure 11.  $R_{DS(on)}$  vs. Gate Voltage

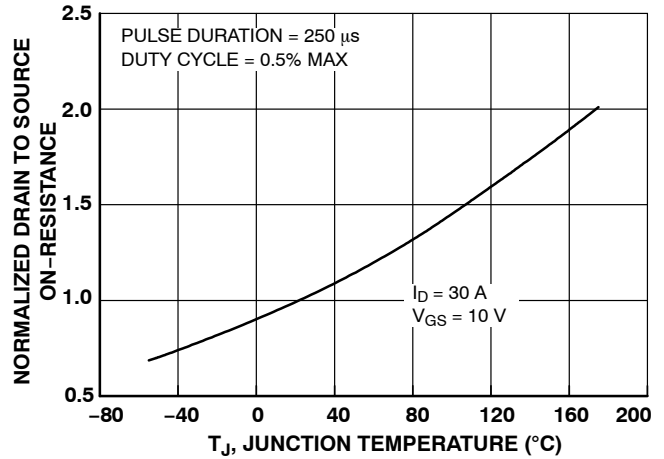


Figure 12. Normalized  $R_{DS(on)}$  vs. Junction Temperature

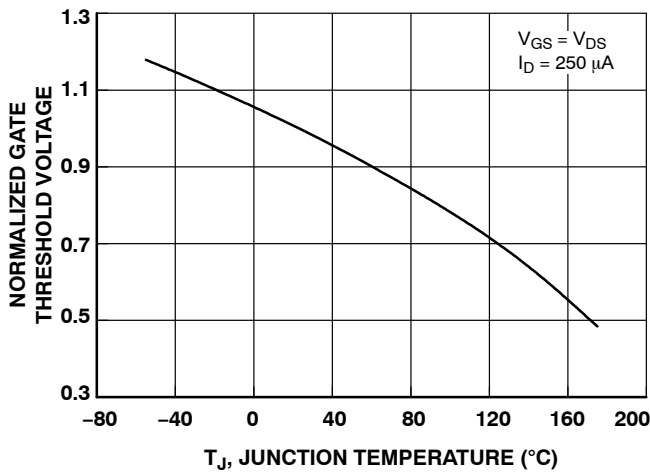


Figure 13. Normalized Gate Threshold Voltage vs. Temperature

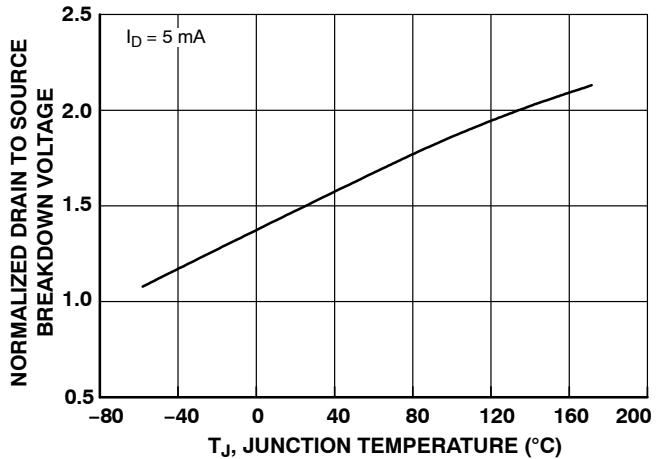


Figure 14. Normalized Drain to Source Breakdown Voltage vs. Junction Temperature

TYPICAL CHARACTERISTICS (continued)

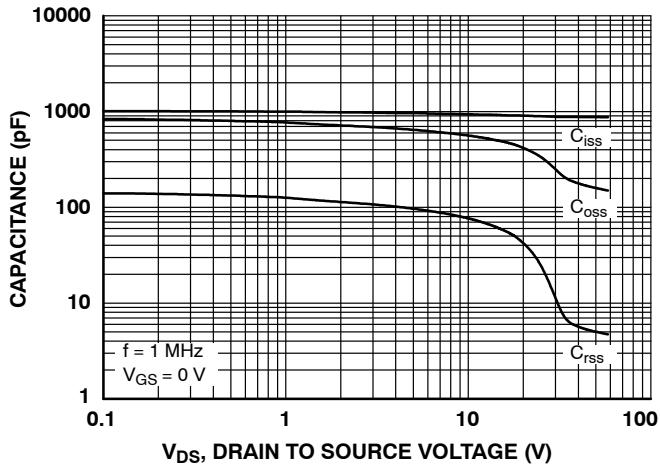


Figure 15. Capacitance vs. Drain to Source Voltage

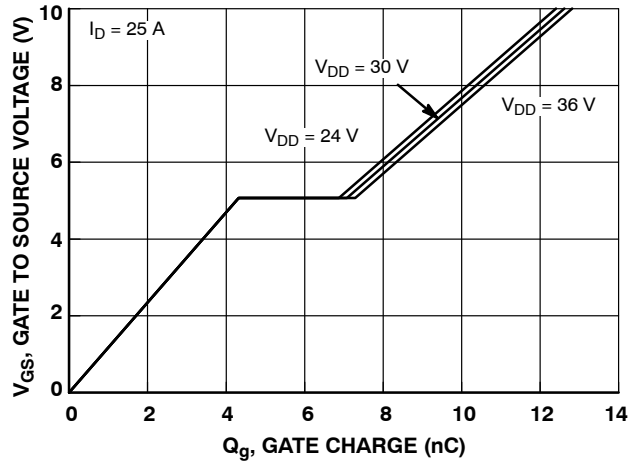


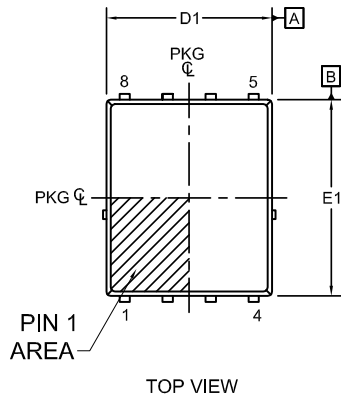
Figure 16. Gate Charge vs. Gate to Source Voltage

# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



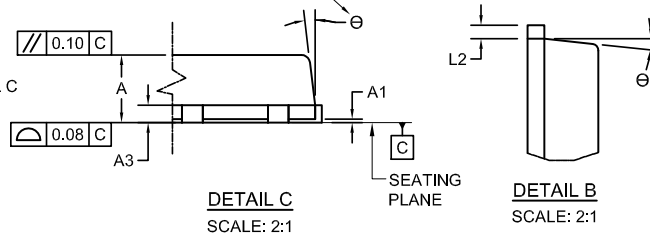
**PQFN8 5X6, 1.27P**  
CASE 483AE  
ISSUE C

DATE 21 JAN 2022

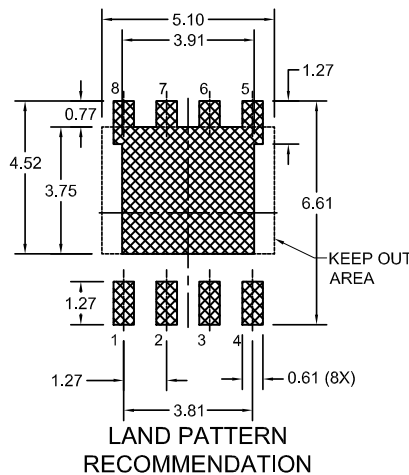
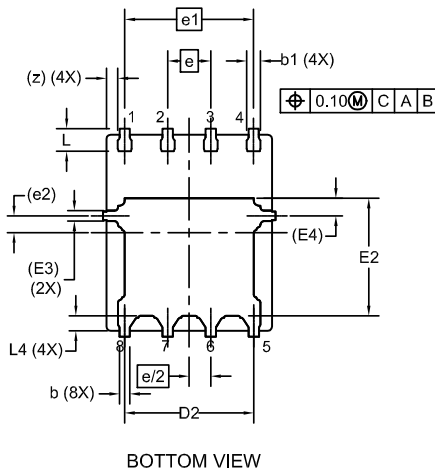


**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. COPLANARITY APPLIES TO THE EXPOSED PADS AS WELL AS THE TERMINALS.
4. DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.
5. SEATING PLANE IS DEFINED BY THE TERMINALS. "A1" IS DEFINED AS THE DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT ON THE PACKAGE BODY.
6. IT IS RECOMMENDED TO HAVE NO TRACES OR VIAS WITHIN THE KEEP OUT AREA.



DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.90	1.00	1.10
A1	0.00	-	0.05
b	0.21	0.31	0.41
b1	0.31	0.41	0.51
A3	0.15	0.25	0.35
D	4.90	5.00	5.20
D1	4.80	4.90	5.00
D2	3.61	3.82	3.96
E	5.90	6.15	6.25
E1	5.70	5.80	5.90
E2	3.38	3.48	3.78
E3	0.30 REF		
E4	0.52 REF		
e	1.27 BSC		
e/2	0.635 BSC		
e1	3.81 BSC		
e2	0.50 REF		
L	0.51	0.66	0.76
L2	0.05	0.18	0.30
L4	0.34	0.44	0.54
z	0.34 REF		
θ	0°	-	12°



\*FOR ADDITIONAL INFORMATION ON OUR PB-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ON SEMICONDUCTOR SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERRM/D.

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