

Integrated P-Channel PowerTrench® MOSFET and BJT

-30 V, -2.9 A, 90 mΩ

March 2013

Features

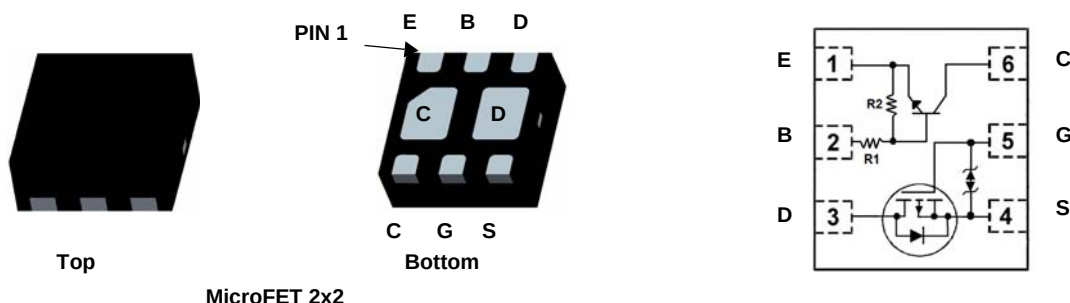
- Max $r_{DS(on)}$ = 90 mΩ at $V_{GS} = -4.5$ V, $I_D = -2.9$ A
- Max $r_{DS(on)}$ = 130 mΩ at $V_{GS} = -2.5$ V, $I_D = -2.6$ A
- Max $r_{DS(on)}$ = 170 mΩ at $V_{GS} = -1.8$ V, $I_D = -1.7$ A
- Max $r_{DS(on)}$ = 240 mΩ at $V_{GS} = -1.5$ V, $I_D = -1$ A
- Low profile - 0.8 mm maximum - in the new package MicroFET 2x2
- HBM ESD protection level > 2 kV typical (Note 3)
- RoHS Compliant

General Description

This device is designed specifically as a single package solution for loadswitching in cellular handset and other ultra-portable applications. It features a 50 V NPN BJT and a 30 V P-ch Trench MOSFET in the space saving MicroFET 2x2 package that offers exceptional thermal performance for it's physical size and is well suited to linear mode applications.

Application

- Loadswitching



Maximum Ratings $T_A = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Ratings	Units
V_{DS}	Drain to Source Voltage	-30	V
V_{GS}	Gate to Source Voltage	± 8	V
I_D	Drain Current -Continuous $T_A = 25^\circ\text{C}$ (Note 1a)	-2.9	A
	-Pulsed	-12	
V_{CBO}	Collector-Base Voltage (Note 4)	50	V
V_{CEO}	Collector-Emitter Voltage (Note 5)	50	V
V_{EBO}	Emitter-Base Voltage	10	V
I_C	Collector Current	100	mA
P_C	Collector Power Dissipation	200	mW
T_J	Junction Temperature	150	$^\circ\text{C}$
P_D	Power Dissipation $T_A = 25^\circ\text{C}$ (Note 1a)	1.5	W
	$T_A = 25^\circ\text{C}$ (Note 1b)	0.7	
T_J, T_{STG}	Operating and Storage Junction Temperature Range	-55 to +150	$^\circ\text{C}$

Thermal Characteristics

$R_{\theta JA}$	Thermal Resistance, Junction to Ambient(MOSFET) (Note 1a)	86	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient(MOSFET) (Note 1b)	173	

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
143	FDMA1430JP	MicroFET 2x2	7"	8 mm	5000 units

Electrical Characteristics $T_J = 25\text{ }^{\circ}\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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Off Characteristics

BV_{DSS}	Drain to Source Breakdown Voltage	$I_D = -250\text{ }\mu\text{A}$, $V_{GS} = 0\text{ V}$	-30			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = -250\text{ }\mu\text{A}$, referenced to $25\text{ }^{\circ}\text{C}$		-23		mV/ $^{\circ}\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = -24\text{ V}$, $V_{GS} = 0\text{ V}$			-1	μA
I_{GSS}	Gate to Source Leakage Current	$V_{GS} = \pm 8\text{ V}$, $V_{DS} = 0\text{ V}$			± 1	μA

On Characteristics

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}$, $I_D = -250\text{ }\mu\text{A}$	-0.4	-0.6	-1	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = -250\text{ }\mu\text{A}$, referenced to $25\text{ }^{\circ}\text{C}$		2.4		mV/ $^{\circ}\text{C}$
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = -4.5\text{ V}$, $I_D = -2.9\text{ A}$		67	90	m Ω
		$V_{GS} = -2.5\text{ V}$, $I_D = -2.6\text{ A}$		81	130	
		$V_{GS} = -1.8\text{ V}$, $I_D = -1.7\text{ A}$		98	170	
		$V_{GS} = -1.5\text{ V}$, $I_D = -1\text{ A}$		114	240	
		$V_{GS} = -4.5\text{ V}$, $I_D = -2.9\text{ A}$, $T_J = 125\text{ }^{\circ}\text{C}$		102	133	
g_{FS}	Forward Transconductance	$V_{DS} = -5\text{ V}$, $I_D = -2.9\text{ A}$		11		S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = -15\text{ V}$, $V_{GS} = 0\text{ V}$, $f = 1\text{ MHz}$		438	580	pF
C_{oss}	Output Capacitance			47	70	pF
C_{rss}	Reverse Transfer Capacitance			41	60	pF

Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = -15\text{ V}$, $I_D = -1\text{ A}$, $V_{GS} = -4.5\text{ V}$, $R_{GEN} = 6\text{ }\Omega$		4.8	10	ns
t_r	Rise Time			4.4	10	ns
$t_{d(off)}$	Turn-Off Delay Time			67	107	ns
t_f	Fall Time			21	33	ns
Q_g	Total Gate Charge	$V_{DD} = -15\text{ V}$, $I_D = -2.9\text{ A}$, $V_{GS} = -4.5\text{ V}$		7.2	10	nC
Q_{gs}	Gate to Source Charge			0.7		nC
Q_{gd}	Gate to Drain "Miller" Charge			1.6		nC

Drain-Source Diode Characteristics

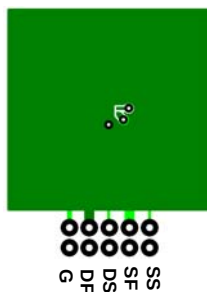
V_{SD}	Source to Drain Diode Forward Voltage	$V_{GS} = 0\text{ V}$, $I_S = -1.1\text{ A}$ (Note 2)		-0.7	-1.2	V
t_{rr}	Reverse Recovery Time	$I_F = -2.9\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$		16	29	ns
Q_{rr}	Reverse Recovery Charge			5	10	nC

BJT Characteristics

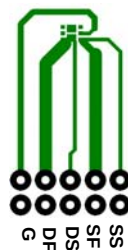
I_{CBO}	Collector Cut-off Current	$V_{CB} = 40\text{ V}$, $I_E = 0\text{ A}$			0.1	μA
h_{FE}	DC Current Gain	$V_{CE} = 5\text{ V}$, $I_C = 5\text{ mA}$	68			
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$I_C = 10\text{ mA}$, $I_B = 0.5\text{ mA}$			0.3	V
f_T	Current Gain Bandwidth Product	$V_{CE} = 10\text{ V}$, $I_C = 5\text{ mA}$		250		MHz
C_{ob}	Output Capacitance	$V_{CB} = 10\text{ V}$, $I_E = 0\text{ A}$, $f = 1\text{ MHz}$		3.7		pF
$V_{I(off)}$	Input Off Voltage	$V_{CE} = 5\text{ V}$, $I_C = 100\text{ }\mu\text{A}$	0.5			V
$V_{I(on)}$	Input On Voltage	$V_{CE} = 0.2\text{ V}$, $I_C = 5\text{ mA}$			1.3	V
R1	Input Resistor			4.7		k Ω
R1/R2	Resistor Ratio			0.1		

Notes:

1. $R_{\theta JA}$ is determined with the device mounted on a 1 in² oz. copper pad on a 1.5 x 1.5 in. board of FR-4 material. $R_{\theta JC}$ is guaranteed by design while $R_{\theta JA}$ is determined by the user's board design.



a. 86 °C/W when mounted on a 1 in² pad of 2 oz copper



b. 173 °C/W when mounted on a minimum pad of 2 oz copper

2. Pulse Test : Pulse Width < 300 us, Duty Cycle < 2.0%
3. The diode connected between the gate and source serves only as protection against ESD. No gate overvoltage rating is implied.
4. Guaranteed by Icbo
5. Guaranteed by Iceo

Typical Characteristics $T_J = 25^\circ\text{C}$ unless otherwise noted

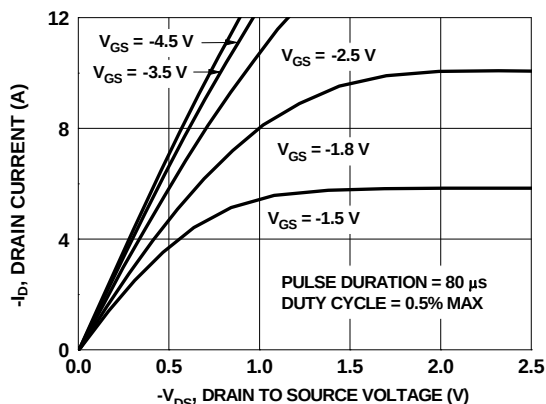


Figure 1. On-Region Characteristics

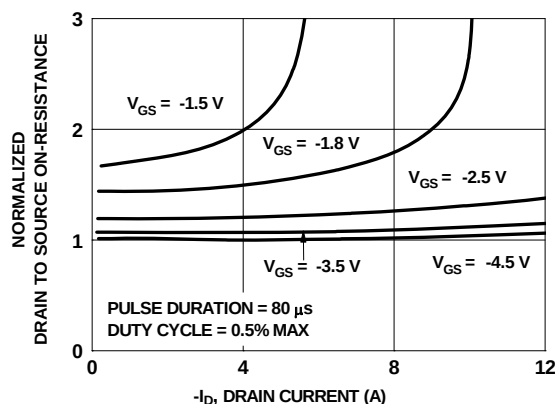


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

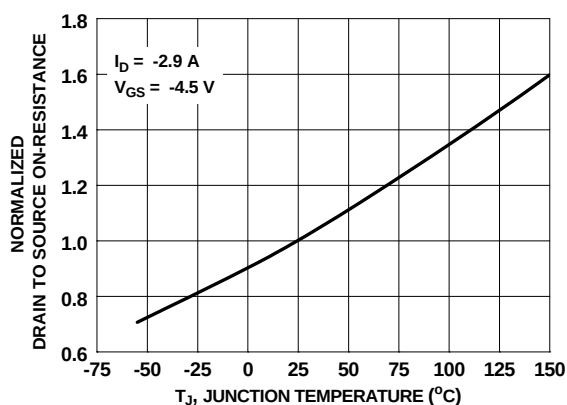


Figure 3. Normalized On-Resistance vs Junction Temperature

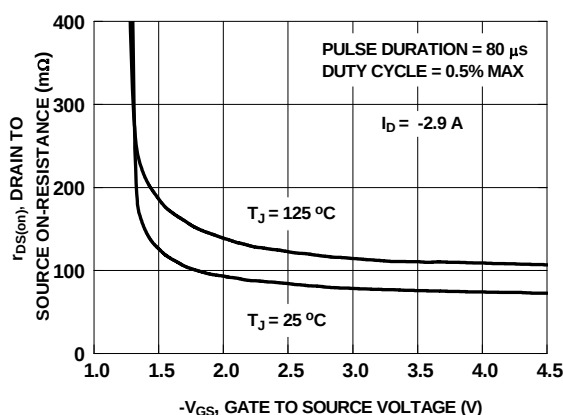


Figure 4. On-Resistance vs Gate to Source Voltage

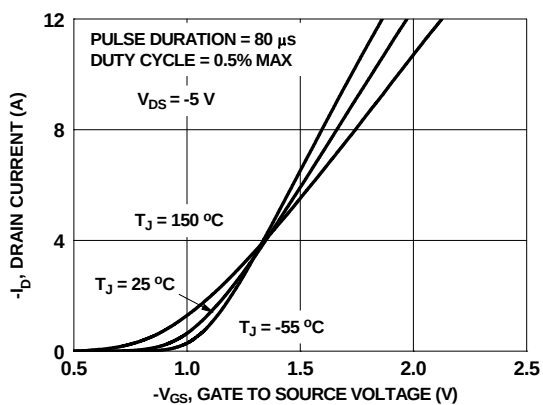


Figure 5. Transfer Characteristics

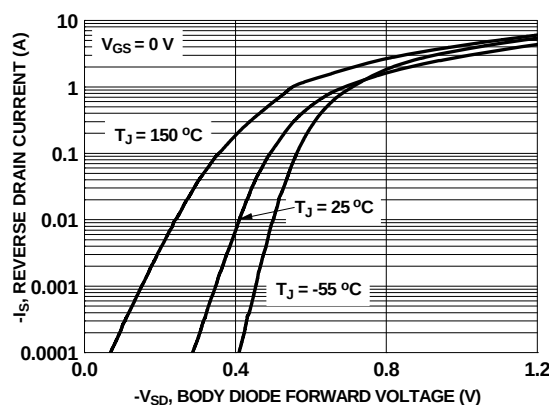


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

Typical Characteristics $T_J = 25^\circ\text{C}$ unless otherwise noted

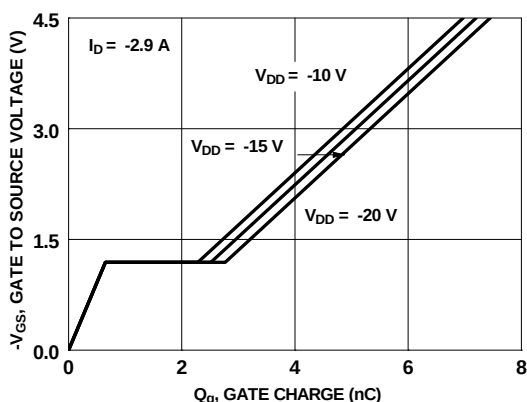


Figure 7. Gate Charge Characteristics

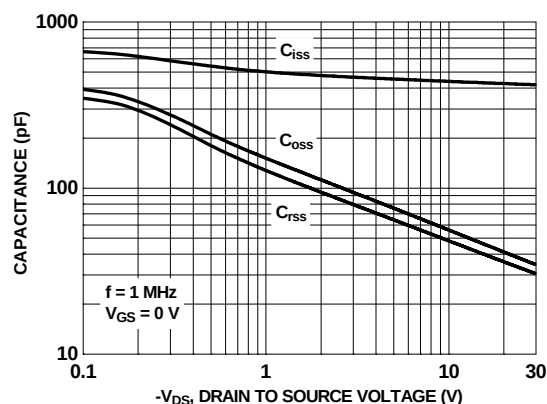


Figure 8. Capacitance vs Drain to Source Voltage

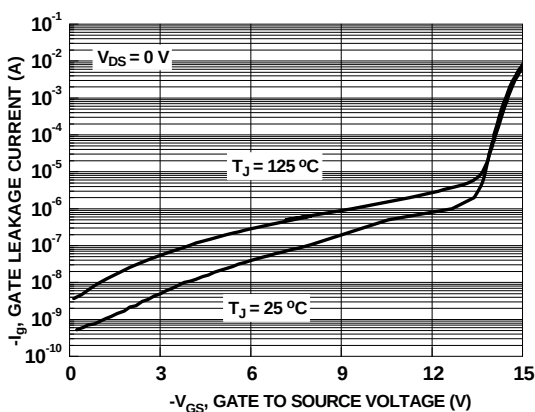


Figure 9. Gate Leakage vs Gate to Source Voltage

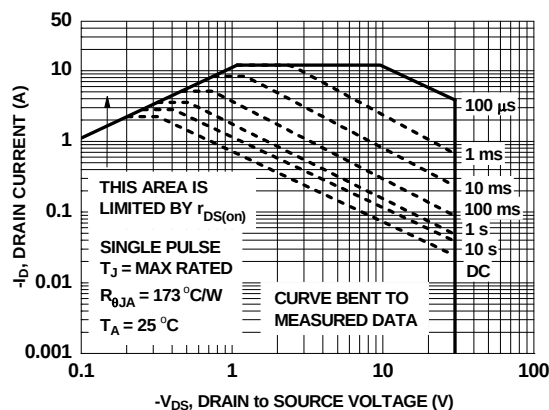


Figure 10. Forward Bias Safe Operating Area

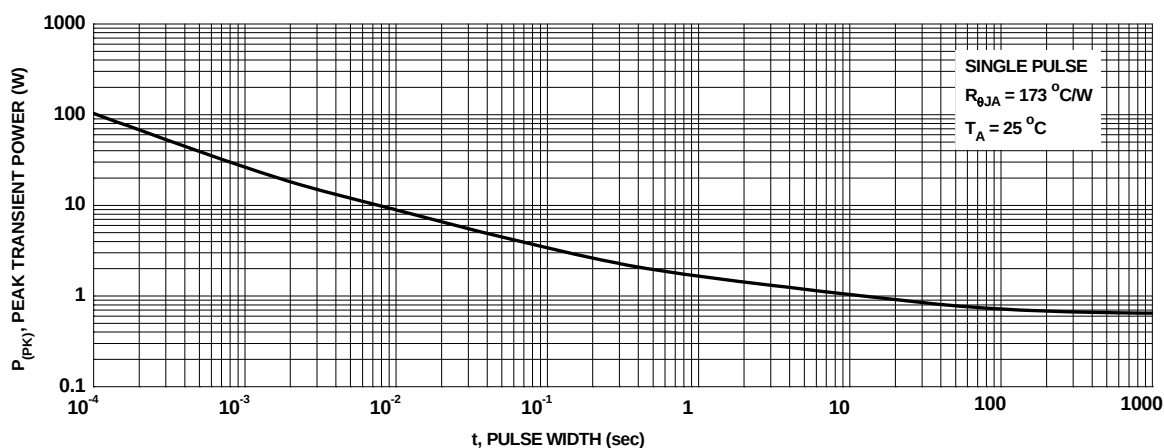


Figure 11. Single Pulse Maximum Power Dissipation

Typical Characteristics $T_J = 25^\circ\text{C}$ unless otherwise noted

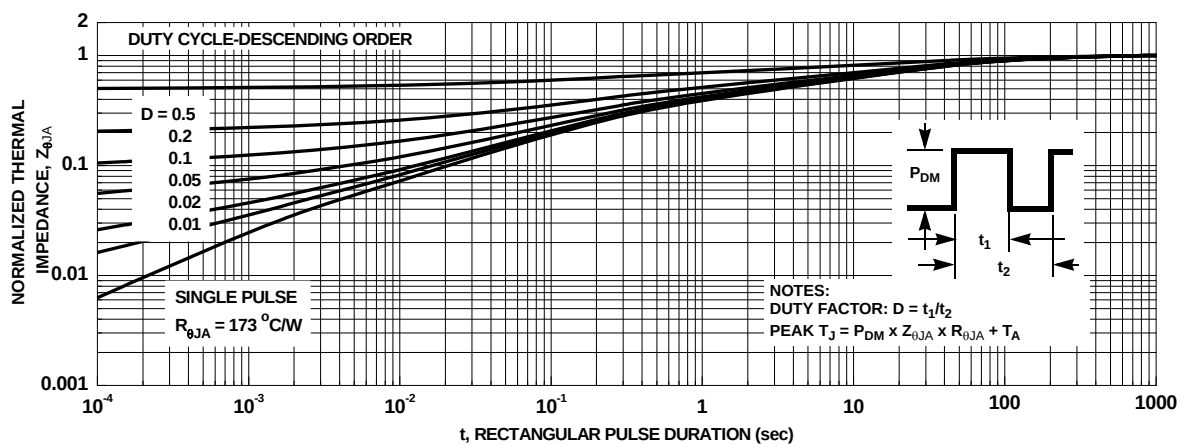
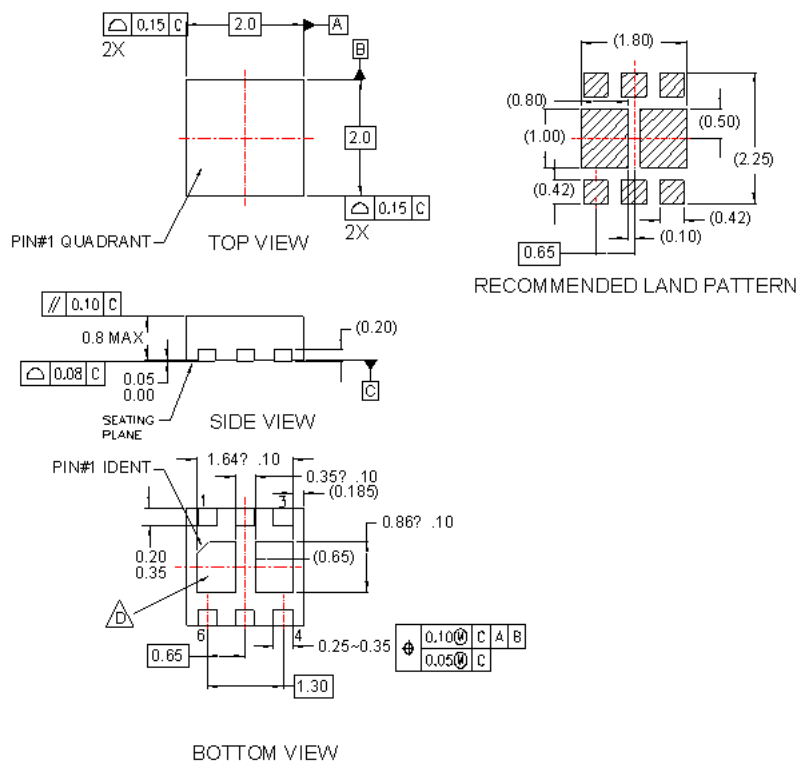


Figure 12. Junction-to-Ambient Transient Thermal Response Curve

Dimensional Outline and Pad Layout



NOTES:

- A. CONFORMS TO JEDEC REGISTRATION MO-229, VARIATION VCCC EXCEPT AS NOTED.
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994
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Rev. 164