



June 2002

Si3456DV

N-Channel PowerTrench[®] MOSFET

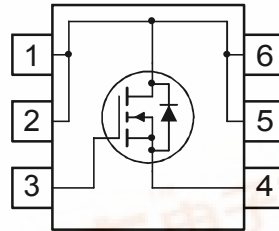
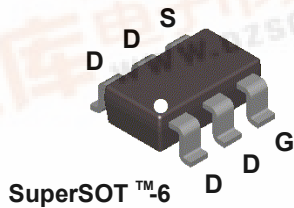
General Description

These N-Channel Logic Level MOSFETs are produced using Fairchild Semiconductor's advanced Power Trench process that has been especially tailored to minimize the on-state resistance and yet maintain superior switching performance.

These devices are well suited for low voltage and battery powered applications where low in-line power loss and fast switching are required.

Features

- 5.1 A, 30 V. $R_{DS(ON)} = 45\text{ m}\Omega @ V_{GS} = 10\text{ V}$
 $R_{DS(ON)} = 65\text{ m}\Omega @ V_{GS} = 4.5\text{ V}$
- High performance trench technology for extremely low $R_{DS(ON)}$
- Low gate charge
- High power and current handling capability



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

Symbol	Parameter	Ratings	Units
V_{DSS}	Drain-Source Voltage	30	V
V_{GSS}	Gate-Source Voltage	± 20	V
I_D	Drain Current – Continuous (Note 1a) – Pulsed	5.1	A
		20	
P_D	Maximum Power Dissipation (Note 1a) (Note 1b)	1.6	W
		0.8	
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 (Note 1a)	78	$^\circ\text{C/W}$
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case (Note 1)	30	

Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape width	Quantity
.456	SI3456DV	7"	8mm	3000 units



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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Off Characteristics						
BV_{DSS}	Drain–Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	30			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$, Referenced to 25°C		25		mV/ $^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 30\text{ V}, V_{GS} = 0\text{ V}$ $T_J = 70^\circ\text{C}$			1 5	μA
I_{GSS}	Gate–Body Leakage	$V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$			± 100	nA
On Characteristics (Note 2)						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$	1	1.5	2	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$, Referenced to 25°C		–4		mV/ $^\circ\text{C}$
$R_{DS(on)}$	Static Drain–Source On–Resistance	$V_{GS} = 10\text{ V}, I_D = 5.1\text{ A}$ $V_{GS} = 4.5\text{ V}, I_D = 4.3\text{ A}$ $V_{GS} = 10\text{ V}, I_D = 5.1\text{ A}, T_J = 125^\circ\text{C}$		33 44 49	45 65 71	m Ω
$I_{D(on)}$	On–State Drain Current	$V_{GS} = 10\text{ V}, V_{DS} = 5\text{ V}$	15			A
g_{FS}	Forward Transconductance	$V_{DS} = 10\text{ V}, I_D = 5.1\text{ A}$		12		S
Dynamic Characteristics						
C_{iss}	Input Capacitance	$V_{DS} = 15\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$		463		pF
C_{oss}	Output Capacitance			109		pF
C_{rss}	Reverse Transfer Capacitance			44		pF
R_G	Gate Resistance	$V_{GS} = 15\text{ mV}, f = 1.0\text{ MHz}$		1.1		Ω
Switching Characteristics (Note 2)						
$t_{d(on)}$	Turn–On Delay Time	$V_{DS} = 15\text{ V}, I_D = 1\text{ A},$ $V_{GS} = 10\text{ V}, R_{GEN} = 6\ \Omega$		6.3	13	nS
t_r	Turn–On Rise Time			6	12	nS
$t_{d(off)}$	Turn–Off Delay Time			20	36	nS
t_f	Turn–Off Fall Time			2.3	4.6	nS
Q_g	Total Gate Charge	$V_{DS} = 15\text{ V}, I_D = 5.1\text{ A},$ $V_{GS} = 10\text{ V}$		9	12.6	nC
Q_{gs}	Gate–Source Charge			1.4		nC
Q_{gd}	Gate–Drain Charge			1.6		nC
Drain–Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain–Source Diode Forward Current				1.3	A
V_{SD}	Drain–Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 1.3\text{ A}$ (Note 2)		0.77	1.2	V
t_{rr}	Diode Reverse Recovery Time	$I_F = 5.1\text{ A}$		18		nS
Q_{rr}	Diode Reverse Recovery Charge	$dI_F/dt = 100\text{ A}/\mu\text{s}$ (Note 2)		17		nC

Notes:

1. $R_{\theta JA}$ is the sum of the junction-to-case and case-to-ambient 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 $R_{\theta CA}$ is determined by the user's board design.

- 78°C/W when mounted on a 1in² pad of 2oz copper on FR-4 board.
- 156°C/W when mounted on a minimum pad.

2. Pulse Test: Pulse Width $\leq 300\ \mu\text{s}$, Duty Cycle $\leq 2.0\%$

Typical Characteristics

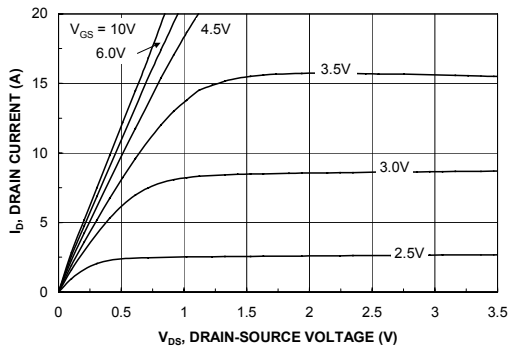


Figure 1. On-Region Characteristics.

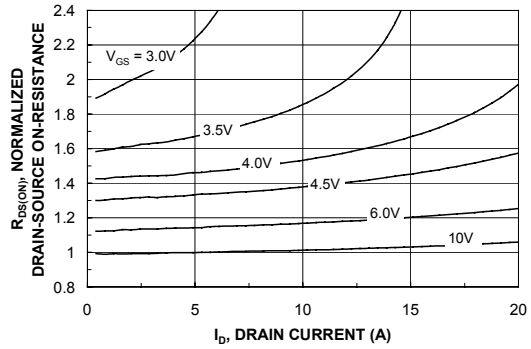


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

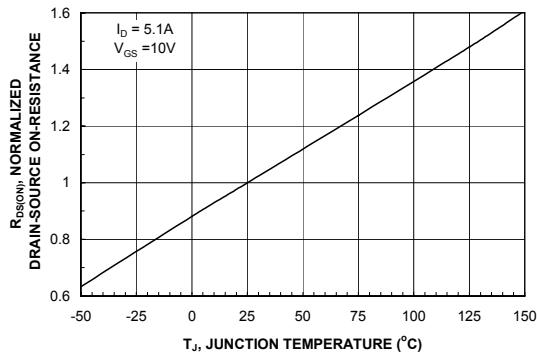


Figure 3. On-Resistance Variation with Temperature.

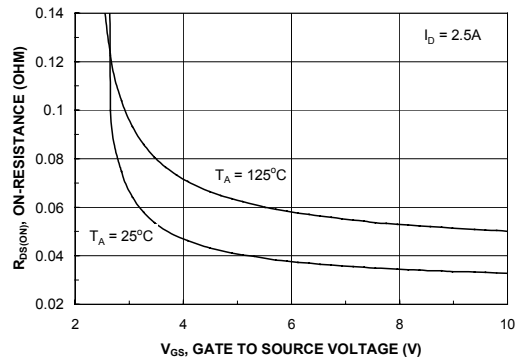


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

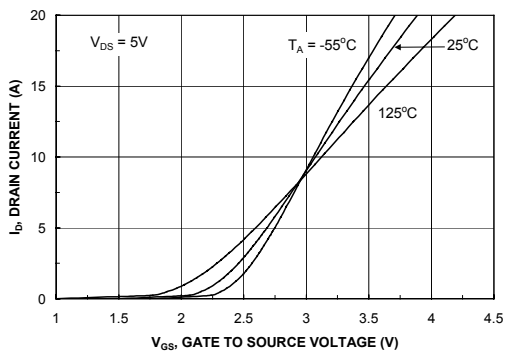


Figure 5. Transfer Characteristics.

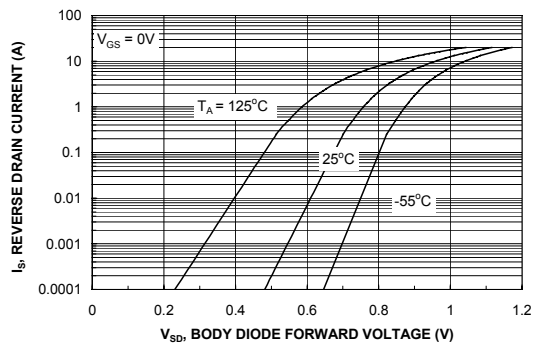


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics

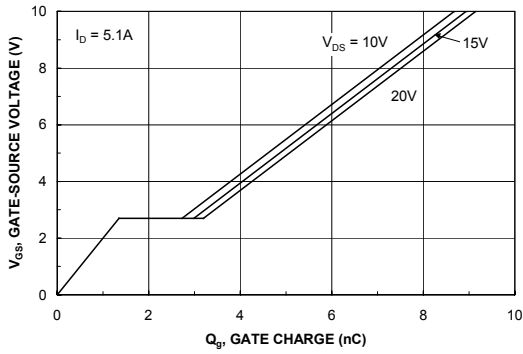


Figure 7. Gate Charge Characteristics.

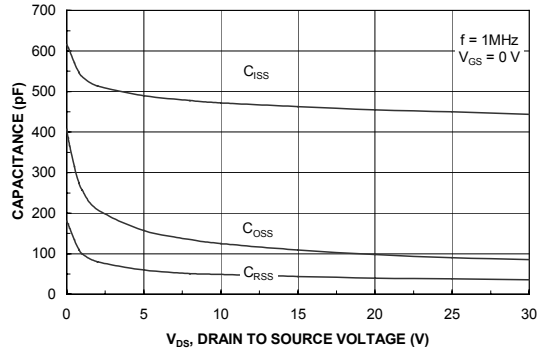


Figure 8. Capacitance Characteristics.

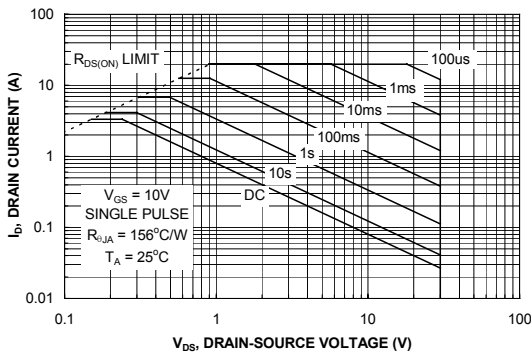


Figure 9. Maximum Safe Operating Area.

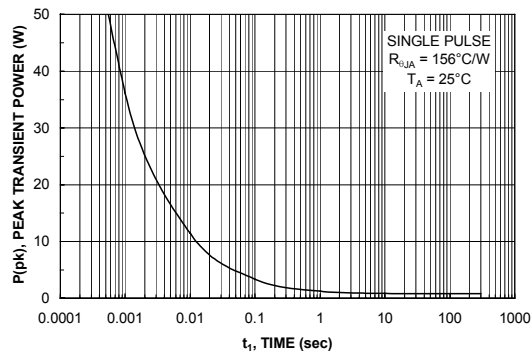


Figure 10. Single Pulse Maximum Power Dissipation.

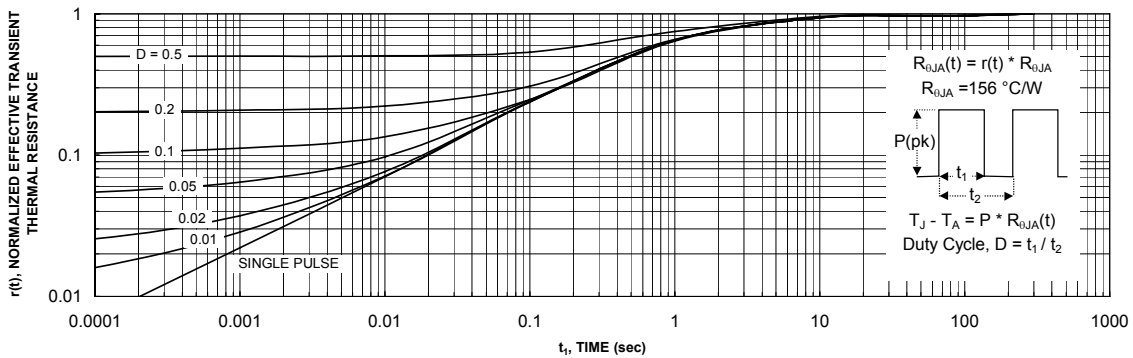


Figure 11. Transient Thermal Response Curve.

Thermal characterization performed using the conditions described in Note 1b. Transient thermal response will change depending on the circuit board design.

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