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Data Sheet

October 2013

N-Channel UltraFET Power MOSFET 55 V, 75 A, 8 m Ω

These N-Channel power MOSFETs are manufactured using the innovative UltraFET process. This advanced process technology achieves the lowest possible on-resistance per silicon area, resulting in outstanding performance. This device is capable of withstanding high energy in the avalanche mode and the diode exhibits very low reverse recovery time and stored charge. It was designed for use in applications where power efficiency is important, such as switching regulators, switching converters, motor drivers, relay drivers, low-voltage bus switches, and power management in portable and battery-operated products.

Formerly developmental type TA75344.

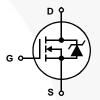
Ordering Information

PART NUMBER	PACKAGE	BRAND
HUF75344G3	TO-247	75344G
HUF75344P3	TO-220AB	75344P

Features

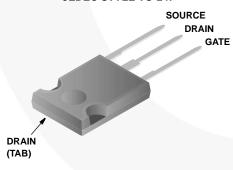
- 75A, 55V
- · Simulation Models
 - Temperature Compensated PSPICE® and SABER™ Models
 - Thermal Impedance PSPICE and SABER Models Available on the web at: www.fairchildsemi.com
- Peak Current vs Pulse Width Curve
- · UIS Rating Curve
- · Related Literature
 - TB334, "Guidelines for Soldering Surface Mount Components to PC Boards"

Symbol

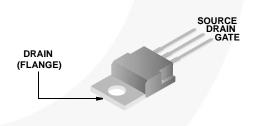


Packaging

JEDEC STYLE TO-247



JEDEC TO-220AB



Product reliability information can be found at http://www.fairchildsemi.com/products/discrete/reliability/index.html
For severe environments, see our Automotive HUFA series.

All Fairchild semiconductor products are manufactured, assembled and tested under ISO9000 and QS9000 quality systems certification.

HUF75344G3, HUF75344P3

Absolute Maximum Ratings $T_C = 25^{\circ}C$, Unless Otherwise Specified

		UNITS
Drain to Source Voltage (Note 1)VDSS	55	V
Drain to Gate Voltage ($R_{GS} = 20k\Omega$) (Note 1) V_{DGR}	55	V
Gate to Source Voltage	<u>+2</u> 0	V
Drain Current		
Continuous (Figure 2)	75	Α
Pulsed Drain Current	Figure 4	
Pulsed Avalanche Rating E _{AS}	Figure 6	
Power Dissipation	285	W
Derate Above 25°C	1.90	W/ ^o C
Operating and Storage Temperature	-55 to 175	°С
Maximum Temperature for Soldering		
Leads at 0.063in (1.6mm) from Case for 10sT _I	300	οС
Package Body for 10s, See Techbrief 334 T _{pkg}	260	°C
, 9		

CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

NOTE:

1. $T_J = 25^{\circ}C$ to $150^{\circ}C$.

Electrical Specifications $T_C = 25^{\circ}C$, Unless Otherwise Specified

PARAMETER	SYMBOL	TEST	CONDITIONS	MIN	TYP	MAX	UNITS
OFF STATE SPECIFICATIONS							
Drain to Source Breakdown Voltage	BV _{DSS}	$I_D = 250\mu A, V_{GS} = 0V \text{ (Figure 11)}$		55	-	-	V
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} = 50V, V _{GS} =	0V	-	-	1	μΑ
		$V_{DS} = 45V, V_{GS} = 0V, T_{C} = 150^{\circ}C$		-	-	250	μΑ
Gate to Source Leakage Current	I _{GSS}	$V_{GS} = \pm 20V$		-	-	±100	nA
ON STATE SPECIFICATIONS						I.	
Gate to Source Threshold Voltage	V _{GS(TH)}	$V_{GS} = V_{DS}$, $I_D = 25$	50μA (Figure 10)	2	-	4	V
Drain to Source On Resistance	r _{DS(ON)}	I _D = 75A, V _{GS} = 10	OV (Figure 9)	-	6.5	8.0	mΩ
THERMAL SPECIFICATIONS	,						
Thermal Resistance Junction to Case	$R_{\theta JC}$	(Figure 3)		-	-	0.52	oC/W
Thermal Resistance Junction to Ambient	$R_{\theta JA}$	TO-247		-	-	30	oC/W
		TO-220		/ -	-	62	oC/W
SWITCHING SPECIFICATIONS (V _{GS} = 10 ^V	/)						
Turn-On Time	t _{ON}	$V_{DD} = 30V, I_{D} \cong 75A,$ $R_{L} = 0.4\Omega, V_{GS} = 10V,$ $R_{GS} = 3.0\Omega$		-	-	187	ns
Turn-On Delay Time	t _{d(ON)}			-	13	// -	ns
Rise Time	t _r			-	125	-	ns
Turn-Off Delay Time	t _d (OFF)			-	46	-	ns
Fall Time	t _f			-	57	-	ns
Turn-Off Time	tOFF			-	-	147	ns
GATE CHARGE SPECIFICATIONS				49/	1		
Total Gate Charge	Q _{g(TOT)}	$V_{GS} = 0V \text{ to } 20V$	V _{DD} = 30V,	-	175	210	nC
Gate Charge at 10V	Q _{g(10)}	V _{GS} = 0V to 10V	$V_{GS} = 0V \text{ to } 10V$ $I_D \cong 75A$,		90	108	nC
Threshold Gate Charge	Q _{g(TH)}	$V_{GS} = 0V \text{ to } 2V$ $R_L = 0.4\Omega$ $I_{\alpha(REF)} = 1.0\text{mA}$	-	5.9	7.0	nC	
Gate to Source Gate Charge	Q _{gs}	(Figure 13)		-	14	-	nC
Reverse Transfer Capacitance	Q _{gd}			-	39	-	nC
CAPACITANCE SPECIFICATIONS		- I		I	I.	1	1
Input Capacitance	C _{ISS}	V _{DS} = 25V, V _{GS} =	0V,	-	3200	-	pF
Output Capacitance	C _{OSS}	f = 1MHz (Figure 12)		-	1170	-	pF
Reverse Transfer Capacitance	C _{RSS}			-	310	-	pF

Source to Drain Diode Specifications

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNITS
Source to Drain Diode Voltage	V_{SD}	I _{SD} = 75A	-	-	1.25	V
Reverse Recovery Time	t _{rr}	$I_{SD} = 75A$, $dI_{SD}/dt = 100A/\mu s$	-	-	105	ns
Reverse Recovered Charge	Q _{RR}	$I_{SD} = 75A$, $dI_{SD}/dt = 100A/\mu s$	-	-	210	nC

Typical Performance Curves

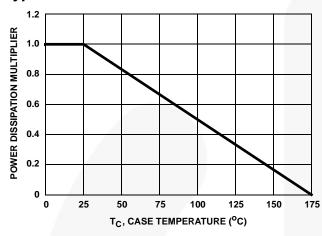


FIGURE 1. NORMALIZED POWER DISSIPATION vs CASE TEMPERATURE

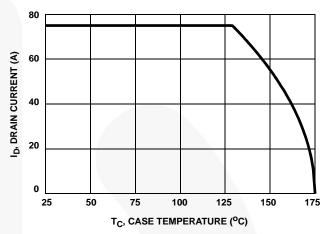


FIGURE 2. MAXIMUM CONTINUOUS DRAIN CURRENT vs CASE TEMPERATURE

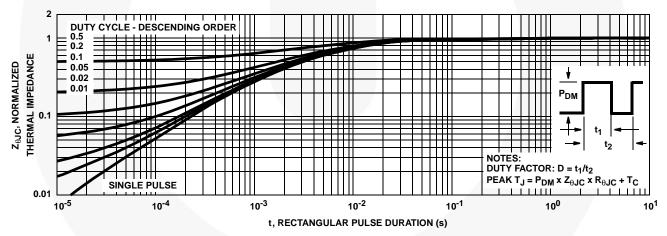


FIGURE 3. NORMALIZED MAXIMUM TRANSIENT THERMAL IMPEDANCE

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Typical Performance Curves (Continued)

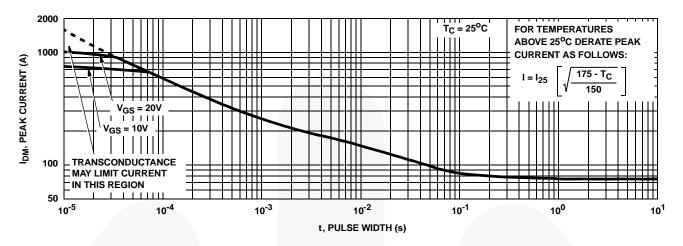


FIGURE 4. PEAK CURRENT CAPABILITY

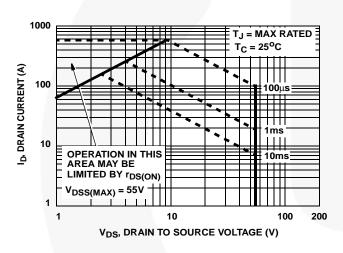


FIGURE 5. FORWARD BIAS SAFE OPERATING AREA

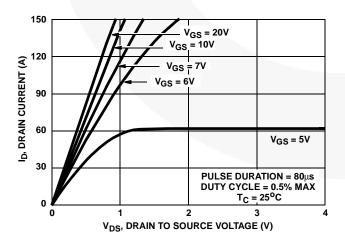
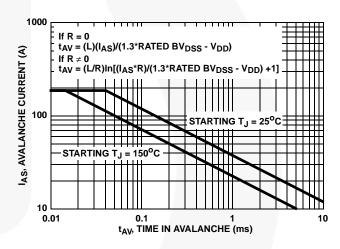


FIGURE 7. SATURATION CHARACTERISTICS



NOTE: Refer to Fairchild Application Notes AN9321 and AN9322. FIGURE 6. UNCLAMPED INDUCTIVE SWITCHING CAPABILITY

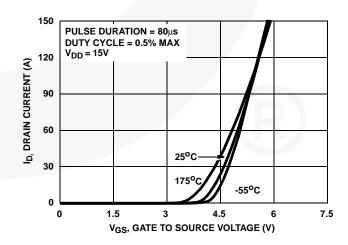


FIGURE 8. TRANSFER CHARACTERISTICS

Typical Performance Curves (Continued)

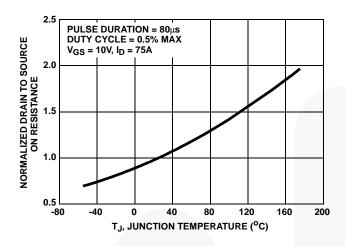


FIGURE 9. NORMALIZED DRAIN TO SOURCE ON RESISTANCE vs JUNCTION TEMPERATURE

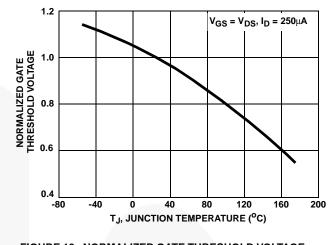


FIGURE 10. NORMALIZED GATE THRESHOLD VOLTAGE vs JUNCTION TEMPERATURE

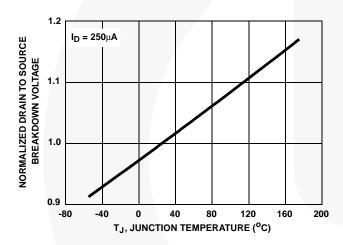


FIGURE 11. NORMALIZED DRAIN TO SOURCE BREAKDOWN VOLTAGE vs JUNCTION TEMPERATURE

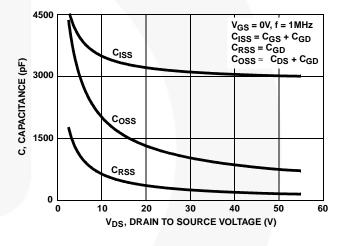
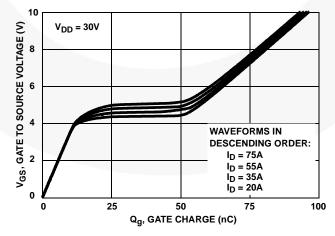


FIGURE 12. CAPACITANCE vs DRAIN TO SOURCE VOLTAGE



NOTE: Refer to Fairchild Application Notes AN7254 and AN7260.

FIGURE 13. GATE CHARGE WAVEFORMS FOR CONSTANT GATE CURRENT

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Test Circuits and Waveforms

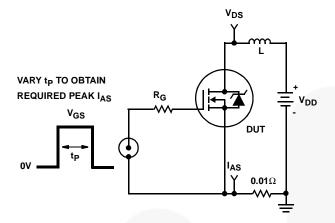


FIGURE 14. UNCLAMPED ENERGY TEST CIRCUIT

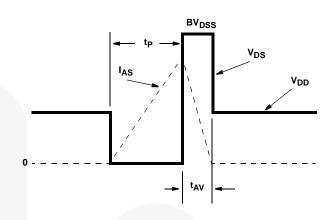


FIGURE 15. UNCLAMPED ENERGY WAVEFORMS

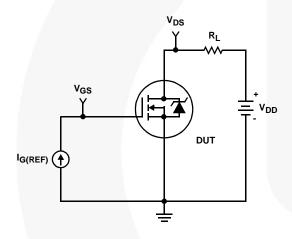


FIGURE 16. GATE CHARGE TEST CIRCUIT

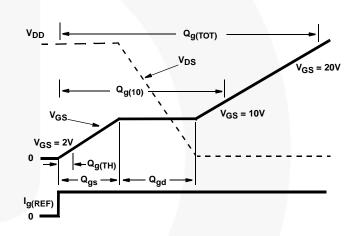


FIGURE 17. GATE CHARGE WAVEFORM

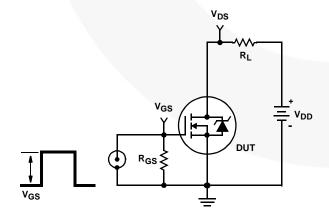


FIGURE 18. SWITCHING TIME TEST CIRCUIT

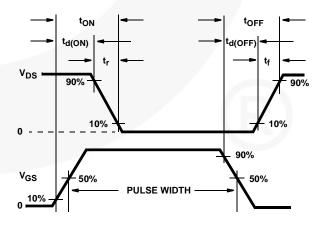


FIGURE 19. RESISTIVE SWITCHING WAVEFORMS

PSPICE Electrical Model

.SUBCKT HUF75337 2 1 3 : rev 3 Feb 1999 CA 12 8 4.9e-9 CB 15 14 4.75e-9 LDRAIN CIN 6 8 2.85e-9 **DPLCAP** DRAIN **-0** 2 **RLDRAIN DBODY 7 5 DBODYMOD** ≶RSLC1 DBREAK 5 11 DBREAKMOD DBREAK T 51 **DPLCAP 10 5 DPLCAPMOD** RSLC2 **ESLC** 11 EBREAK 11 7 17 18 59.7 50 EDS 14 8 5 8 1 <u>17</u> 18 EGS 13 8 6 8 1 **≷RDRAIN** ▲ DBODY 8 **EBREAK ESG** ESG 6 10 6 8 1 **EVTHRES** FVTHRES 6 21 19 8 1 16 21 EVTEMP 20 6 18 22 1 19 8 **MWEAK LGATE EVTEMP RGATE** GATE IT 8 17 1 20 MSTRO **RLGATE** LDRAIN 2 5 1e-9 **LSOURCE** LGATE 1 9 2.6e-9 CIN SOURCE 8 LSOURCE 3 7 1.1e-9 KGATE LSOURCE LGATE 0.0085 **RSOURCE** RLSOURCE MMED 16 6 8 8 MMEDMOD S1A MSTRO 16 6 8 8 MSTROMOD **RBREAK** <u>13</u> 8 15 MWEAK 16 21 8 8 MWEAKMOD 17 18 13 RBREAK 17 18 RBREAKMOD 1 S1B **RVTEMP** RDRAIN 50 16 RDRAINMOD 1.94e-3 CB 19 RGATE 9 20 0.36 CA IT 14 **RI DRAIN 2510** VRAT **RLGATE 1 9 26** EGS **EDS** RLSOURCE 3 7 11 RSLC1 5 51 RSLCMOD 1e-6 8 RSLC2 5 50 1e3 **RVTHRES** RSOURCE 8 7 RSOURCEMOD 3.5e-3 RVTHRES 22 8 RVTHRESMOD 1 **RVTEMP 18 19 RVTEMPMOD 1** S1A 6 12 13 8 S1AMOD S1B 13 12 13 8 S1BMOD S2A 6 15 14 13 S2AMOD S2B 13 15 14 13 S2BMOD VBAT 22 19 DC 1 ESLC 51 50 VALUE={(V(5,51)/ABS(V(5,51)))*(PWR(V(5,51)/(1e-6*400),3))} .MODEL DBODYMOD D (IS = 2.95e-12 RS = 2.6e-3 TRS1 = 1.05e-3 TRS2 = 5.0e-7 CJO = 5.19e-9 TT = 5.9e-8 M = 0.55) .MODEL DBREAKMOD D (RS = 1.65e-1 IKF = 30 TRS1 = 1.15e-4 TRS2 = 2.27e-6) .MODEL DPLCAPMOD D (CJO = 5.40e-9 IS = 1e-30 N=1 M = 0.88) .MODEL MMEDMOD NMOS (VTO = 3.29 KP = 5.5 IS = 1e-30 N = 10 TOX = 1 L = 1u W = 1u RG = 0.36) .MODEL MSTROMOD NMOS (VTO = 3.83 KP = 123 IS = 1e-30 N = 10 TOX = 1 L = 1u W = 1u) .MODEL MWEAKMOD NMOS (VTO = 2.90 KP =0.04 IS = 1e-30 N = 10 TOX = 1 L = 1u W = 1u RG = 3.6) MODEL RBREAKMOD RES (TC1 = 1.15e-3 TC2 = 2.0e-7) .MODEL RDRAINMOD RES (TC1 = 1.37e-2 TC2 = 3.85e-5) .MODEL RSLCMOD RES (TC1 = 1.45e-4 TC2 = 2.11e-6) .MODEL RSOURCEMOD RES (TC1 = 0 TC2 = 0) .MODEL RVTHRESMOD RES (TC1 = -3.7e-3 TC2 = -1.6e-5) .MODEL RVTEMPMOD RES (TC1 = -2.4e-3 TC2 = 7e-7) .MODEL S1AMOD VSWITCH (RON = 1e-5 ROFF = 0.1 VON = -6.9 VOFF= -3.9) .MODEL S1BMOD VSWITCH (RON = 1e-5 ROFF = 0.1 VON = -3.9 VOFF= -6.9) .MODEL S2AMOD VSWITCH (RON = 1e-5 ROFF = 0.1 VON = -2.99 VOFF= 2.39) .MODEL S2BMOD VSWITCH (RON = 1e-5 ROFF = 0.1 VON = 2.39 VOFF= -2.99) .ENDS

NOTE: For further discussion of the PSPICE model, consult **A New PSPICE Sub-Circuit for the Power MOSFET Featuring Global Temperature Options:** IEEE Power Electronics Specialist Conference Records, 1991, written by William J. Hepp and C. Frank Wheatley.

SABER Electrical Model

```
REV 3 February 1999
template huf75344 n2, n1, n3
electrical n2, n1, n3
var i iscl
d..model dbodymod = (is = 2.95e-12, cjo = 5.19e-9, tt = 5.90e-8, m = 0.55)
d..model dbreakmod = ()
                                                                                                                               LDRAIN
                                                                                 DPLCAP
d..model dplcapmod = (cjo = 5.40e-9, is = 1e-30, n = 1, m = 0.88)
                                                                                                                                          DRAIN
m..model mmedmod = (type=_n, vto = 3.29, kp = 5.5, is = 1e-30, tox = 1)
                                                                             10
m..model mstrongmod = (type=\_n, vto = 3.83, kp = 123, is = 1e-30, tox = 1)
                                                                                                                               RLDRAIN
m..model mweakmod = (type=_n, vto = 2.90, kp = 0.04, is = 1e-30, tox = 1)
                                                                                            ≻RSLC1
                                                                                                          RDBREAK
sw_vcsp..model s1amod = (ron = 1e-5, roff = 0.1, von = -6.9, voff = -3.9)
                                                                                              51
                                                                               RSLC2 €
sw_vcsp..model s1bmod = (ron = 1e-5, roff = 0.1, von = -3.9, voff = -6.9)
                                                                                                                   72
                                                                                                                               RDBODY
sw_vcsp..model s2amod = (ron = 1e-5, roff = 0.1, von = -2.99, voff = 2.39)
                                                                                                ISCL
sw_vcsp..model s2bmod = (ron = 1e-5, roff = 0.1, von = 2.39, voff = -2.99)
                                                                                                            DBREAK
                                                                                              50
c.ca n12 n8 = 4.9e-9
                                                                                             RDRAIN
c.cb n15 n14 = 4.75e-9
                                                                     ESG
                                                                                                                    11
c.cin n6 n8 = 2.85e-9
                                                                                  EVTHRES
                                                                                              21
                                                                                     19
8
                                                                                                             MWEAK
                                                                    EVTEMP
                                                  IGATE
d.dbody n7 n71 = model=dbodymod
                                                                                                                               DBODY
                                                           RGATE
                                         GATE
d.dbreak n72 n11 = model=dbreakmod
                                                                      18
22
                                                                                                              EBREAK
d.dplcap n10 n5 = model=dplcapmod
                                                                  20
                                                                                            MSTRO
                                                 RLGATE
i.it n8 n17 = 1
                                                                                                                               LSOURCE
                                                                                       CIN
                                                                                                                                         SOURCE
                                                                                                  8
I.ldrain n2 n5 = 1e-9
Ligate n1 \, n9 = 2.6e-9
                                                                                                             RSOURCE
                                                                                                                             RLSOURCE
I.Isource n3 n7 = 1.1e-9
k.kl i(l.lgate) i(l.lsource) = I(l.lgate), I(l.lsource), 0.0085
                                                                                                                  RBREAK
                                                                                                                    ₩
                                                                                                                            18
m.mmed n16 n6 n8 n8 = model=mmedmod, I = 1u, w = 1u
m.mstrong n16 n6 n8 n8 = model=mstrongmod, I = 1u, w = 1u
                                                                                                                            RVTEMP
                                                                               o S2B
                                                                    S<sub>1</sub>B
m.mweak n16 n21 n8 n8 = model=mweakmod, I = 1u, w = 1u
                                                                                       CB
                                                                                                                            19
                                                              CA
                                                                                                            IT
res.rbreak n17 n18 = 1, tc1 = 1.15e-3, tc2 = 2e-7
res.rdbody n71 n5 = 2.6e-3, tc1 = 1.05e-3, tc2 = 5e-7
                                                                                                                               VBAT
                                                                       FGS
                                                                                    FDS
res.rdbreak n72 n5 = 1.65e-1, tc1 = 1.15e-4, tc2 = 2.27e-6
res.rdrain n50 n16 = 1.94e-3, tc1 = 1.37e-2, tc2 = 3.85e-5
                                                                                                         8
res.rgate n9 n20 = 0.36
res.rldrain n2 n5 = 10
                                                                                                                 RVTHRES
res.rlgate n1 n9 = 26
res.rlsource n3 n7 = 11
res.rslc1 n5 n51 = 1e-6, tc1 = 1.45e-4, tc2 = 2.11e-6
res.rslc2 n5 n50 = 1e3
res.rsource n8 n7 = 3.5e-3, tc1 = 0, tc2 = 0
res.rvtemp n18 n19 = 1, tc1 = -2.4e-3, tc2 = 7e-7
res.rvthres n22 n8 = 1, tc1 = -3.7e-3, tc2 = -1.6e-5
spe.ebreak n11 n7 n17 n18 = 59.7
spe.eds n14 n8 n5 n8 = 1
spe.egs n13 n8 n6 n8 = 1
spe.esg n6 n10 n6 n8 = 1
spe.evtemp n20 n6 n18 n22 = 1
spe.evthres n6 n21 n19 n8 = 1
sw_vcsp.s1a n6 n12 n13 n8 = model=s1amod
sw_vcsp.s1b n13 n12 n13 n8 = model=s1bmod
sw_vcsp.s2a n6 n15 n14 n13 = model=s2amod
sw_vcsp.s2b n13 n15 n14 n13 = model=s2bmod
v.vbat n22 n19 = dc = 1
equations {
i (n51->n50) + = iscl
iscl: v(n51,n50) = ((v(n5,n51)/(1e-9+abs(v(n5,n51))))*((abs(v(n5,n51)*1e6/400))**3))
```

SPICE Thermal Model

REV 5 February 1999

HUF75344

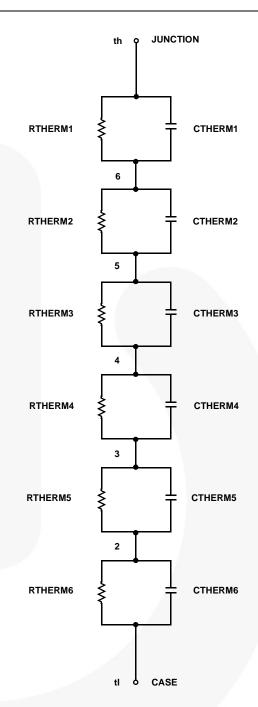
CTHERM1 th 6 5.0e-3
CTHERM2 6 5 1.0e-2
CTHERM3 5 4 1.3e-2
CTHERM4 4 3 1.5e-2
CTHERM5 3 2 2.2e-2
CTHERM6 2 tl 8.5e-2

RTHERM1 th 6 6.0e-4
RTHERM2 6 5 3.5e-3
RTHERM3 5 4 2.5e-2
RTHERM4 4 3 4.8e-2
RTHERM5 3 2 1.6e-1
RTHERM6 2 tl 1.8e-1

SABER Thermal Model

SABER thermal model HUF75344

template thermal_model th tl thermal_c th, tl { ctherm.ctherm1 th 6=5.0e-3 ctherm.ctherm2 6.5=1.0e-2 ctherm.ctherm3 5.4=1.3e-2 ctherm.ctherm4 4.3=1.5e-2 ctherm.ctherm5 3.2=2.2e-2 ctherm.ctherm6 2.1=5.5e-2 rtherm.rtherm1 th 6=6.0e-4 rtherm.rtherm2 6.5=3.5e-3 rtherm.rtherm3 5.4=2.5e-2 rtherm.rtherm4 5.4=2.5e-2 rtherm.rtherm5 5.4=2.5e-2 rtherm.rtherm6 5.3=2.5e-1 rtherm.rtherm6 5.3=2.5e-1 rtherm.rtherm6 5.3=2.5e-1





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Fairchild® Fairchild Semiconductor® FACT Quiet Series™

FACT[®] FAST® FastvCore™ FETBench™ **FPS™**

FRFFT®

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