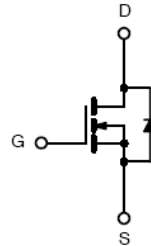


ICE15N60FP N-Channel Enhancement Mode MOSFET

Product Summary			
I_D	$T_A=25^\circ\text{C}$	15A	Max
$V_{(BR)DSS}$	$I_D=250\mu\text{A}$	600V	Min
$r_{DS(on)}$	$V_{GS}=10\text{V}$	0.23 Ω	Typ

Features

- Low $r_{DS(on)}$
- Ultra Low Gate Charge
- High dV/dt capability
- High Unclamped Inductive Switching (UIS) capability
- High peak current capability
- Increased transconductance performance
- Optimized design for high performance power systems



ICEMOS HAS THE LEADERSHIP PATENT PORTFOLIO FOR SUPERJUNCTION MOSFETS (see page 9). ICEMOS AND ITS SISTER COMPANY 3D SEMI OWN THE FUNDAMENTAL PATENTS FOR SUPERJUNCTION MOSFETS. THE MAJORITY OF THESE PATENTS HAVE 17 to 20 YEARS OF REMAINING LIFE. THIS PORTFOLIO HAS GRANTED PATENTS ISSUED IN USA, CHINA, KOREA, JAPAN, TAIWAN, EUROPE.

**T0220
Full-PAK
Isolated
(T0-220)**

Maximum Ratings and Thermal Characteristics^b ($T_A=25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Limit	Unit	
Drain-Source Voltage	VDS	600	V	
Gate-Source Voltage (Static)	VGS	± 20		
Gate-Source Voltage AC ($f > 1\text{Hz}$)	VGS	± 30		
Drain Current	- Continuous ($T_c = 25^\circ\text{C}$)	ID	15	A
	- Pulsed (limited by T_{jmax})	IDM	35	
Repetitive Avalanche Current (limited by T_{jmax})	IAR	7.5	A	
Energy in Avalanche (single pulse, $I_D = 7.5\text{A}$)	EAS	460	mJ	
Maximum Power Dissipation ($T_c = 25^\circ\text{C}$)	PD	35	W	
Operating Junction and Storage Temperature Range	T_J, T_{stg}	-55 to 150	$^\circ\text{C}$	
dV/dt voltage slope ($V_{ds}=480\text{V}, I_D=15\text{A}, T_j = 125^\circ\text{C}$)	dV/dt	50	V/ns	
Thermal Resistance ^a - Junction-to-Ambient	RthJA	72.00	$^\circ\text{C/W}$	
Thermal Resistance ^a - Junction-to-Case	RthJC	2.50	$^\circ\text{C/W}$	

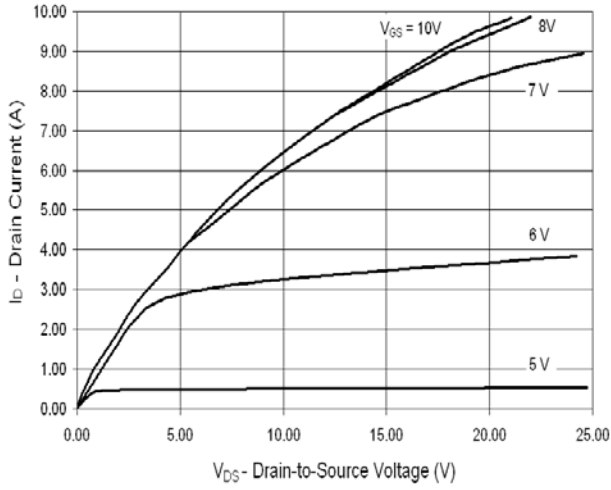
a When mounted on 1 inch square 2oz copper clad FR-4

b Preliminary Data Sheet - Specifications subject to change.

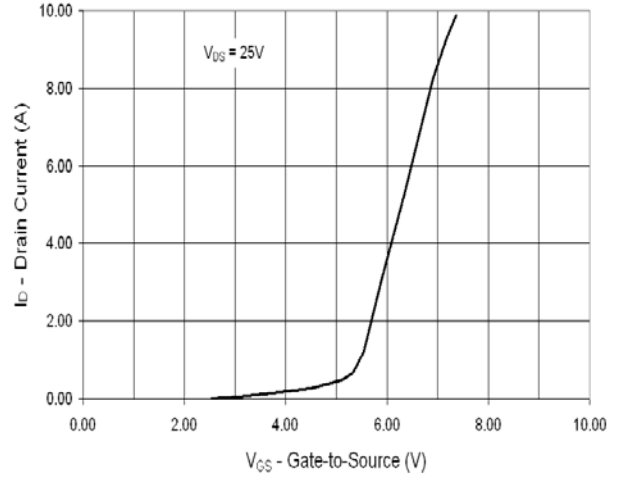
Electrical Characteristics^b (T_J=25°C unless otherwise specified)

Symbol	Parameter	Test Condition	Min	Typ	Max	Units
V _{(BR)DSS}	Drain-to-Source Breakdown Voltage	V _{GS} =0V, I _D =250uA	600	640		V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} =600V, V _{GS} =0V T _J = 150°C		0.1	1	μA
I _{GSS}	Gate-Source Leakage	V _{GS} =±20V, V _{DS} =0V			100	nA
V _{GS(th)}	Gate Threshold Voltage	V _{DS} =V _{GS} , I _D =250uA	2.1	3	3.9	V
r _{DS(on)}	Drain-to-Source On-State Resistance	V _{GS} =10V, I _D =7.5A T _J = 150°C	210	230	250	mΩ
R _G	Gate Resistance	f = 1MHz,	0.2	0.5	0.7	Ω
g _{fs}	Transconductance	V _{DS} > 2*I _D *R _{DS} , I _D = 7.5A	9	14	19	S
C _{iss}	Input Capacitance	V _{DS} =25V, V _{GS} =0V, f=1MHz	1200	1400	1600	pF
C _{oss}	Output Capacitance		480			pF
C _{rss}	Reverse Transfer Capacitance		31			pF
t _{d(on)}	Turn-On Delay Time	V _{GS} =10V, I _D =15A, V _{DS} =380V R _G = 4Ω (External)	17	39	58	nS
t _r	Rise Time		5	10	15	nS
t _{d(off)}	Turn-Off Delay Time		35	55	75	nS
t _f	Fall Time		4	6	9	nS
Q _g	Total Gate Charge	V _{GS} =10V, I _D =15A, V _{DS} =480V	29	54	73	nC
Q _{gs}	Gate-to-Source Charge		7	11	17	nC
Q _{gd}	Gate-to-Drain Charge		11	15	32	nC
V _(plateau)	Gate Plateau voltage		1.9	4.7	6.8	V
t _{rr}	Source-to-Drain Reverse Recovery Time	I _S =I _F , di/dt=100A/uS, V _{rr} =480V	150	300	500	nS
Q _{rr}	Reverse recovery charge		7	9	11	μC
I _{rm}	Peak reverse recovery current		40	50	60	A
V _{SD}	Diode Forward Voltage	I _S =I _F , V _{GS} =0V	0.7	0.9	1.2	V

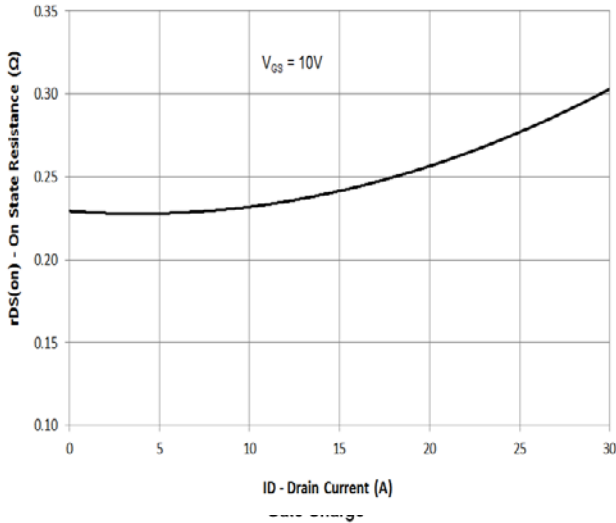
Output Characteristics



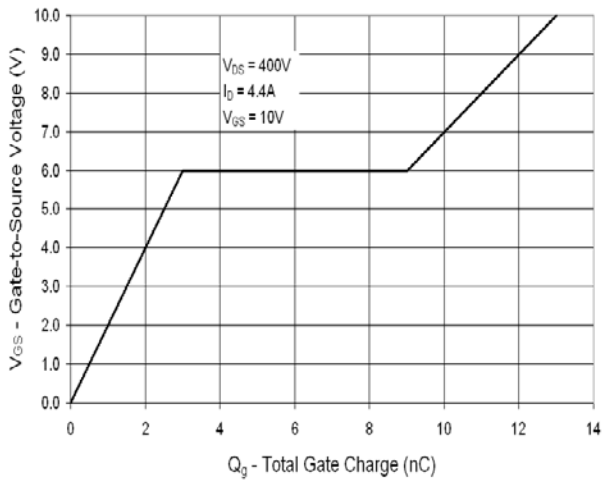
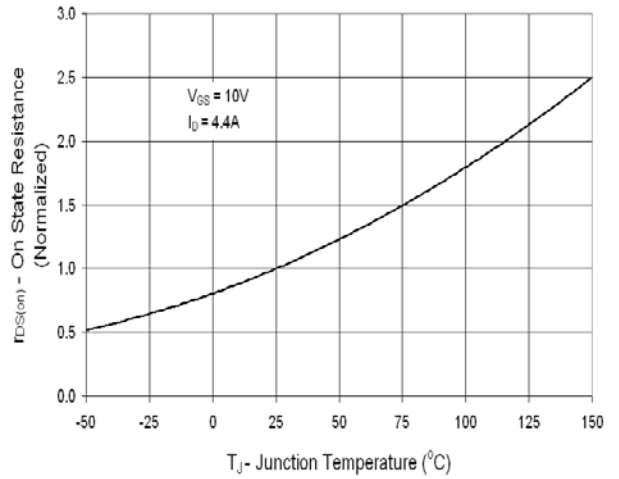
Transfer Characteristics



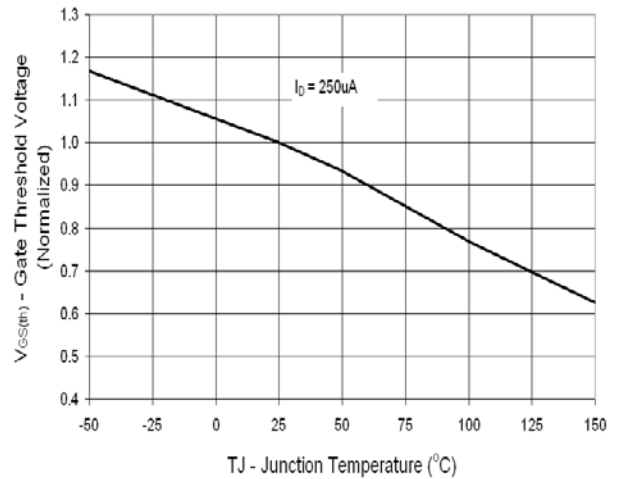
On State Resistance vs. Drain Current



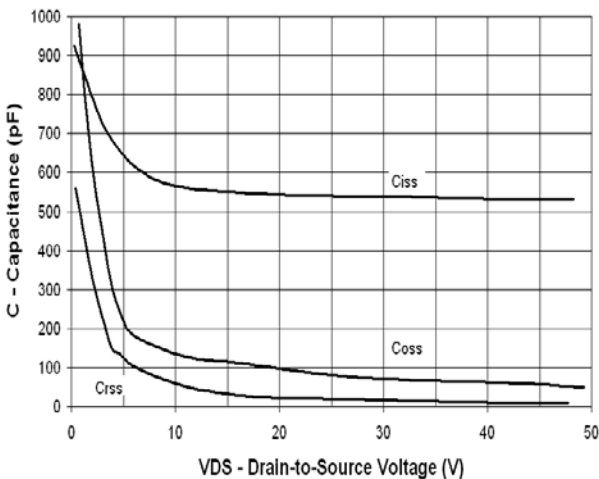
On State Resistance vs. Junction Temperature



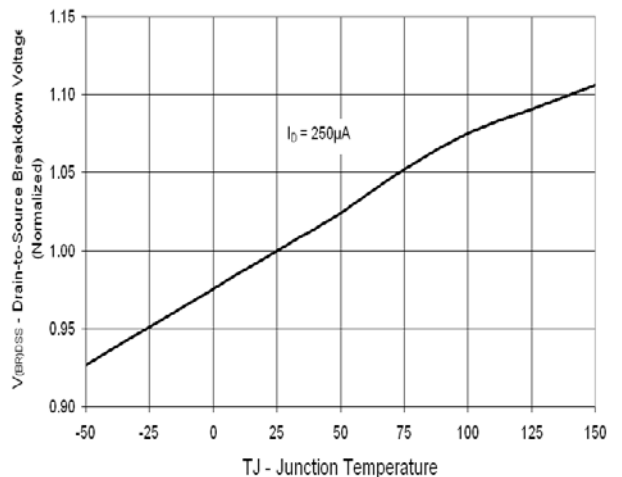
Gate Threshold Voltage vs. Junction Temperature



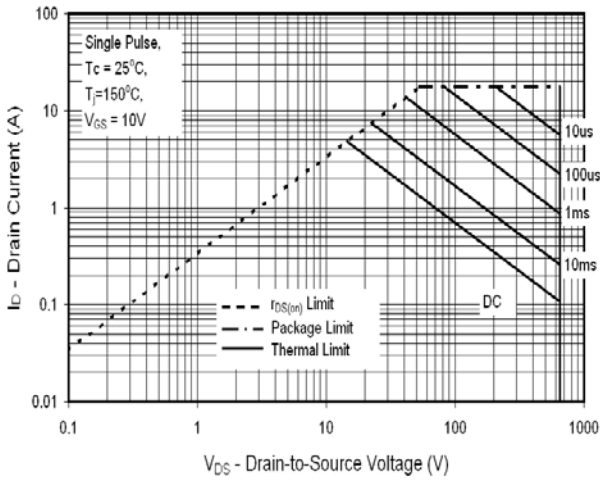
Capacitance



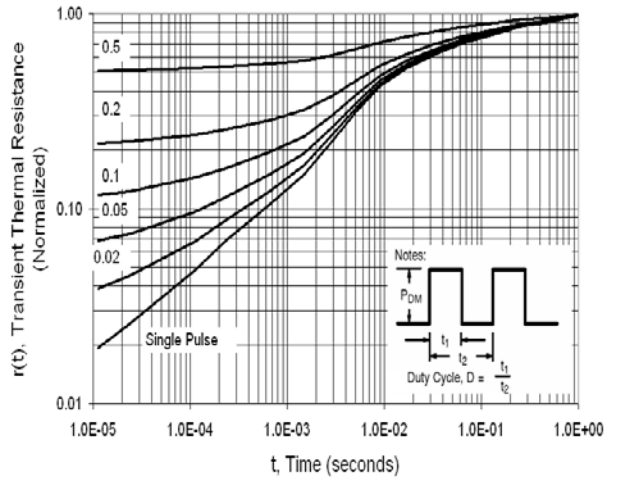
Drain-to-Source Breakdown Voltage vs. TJ

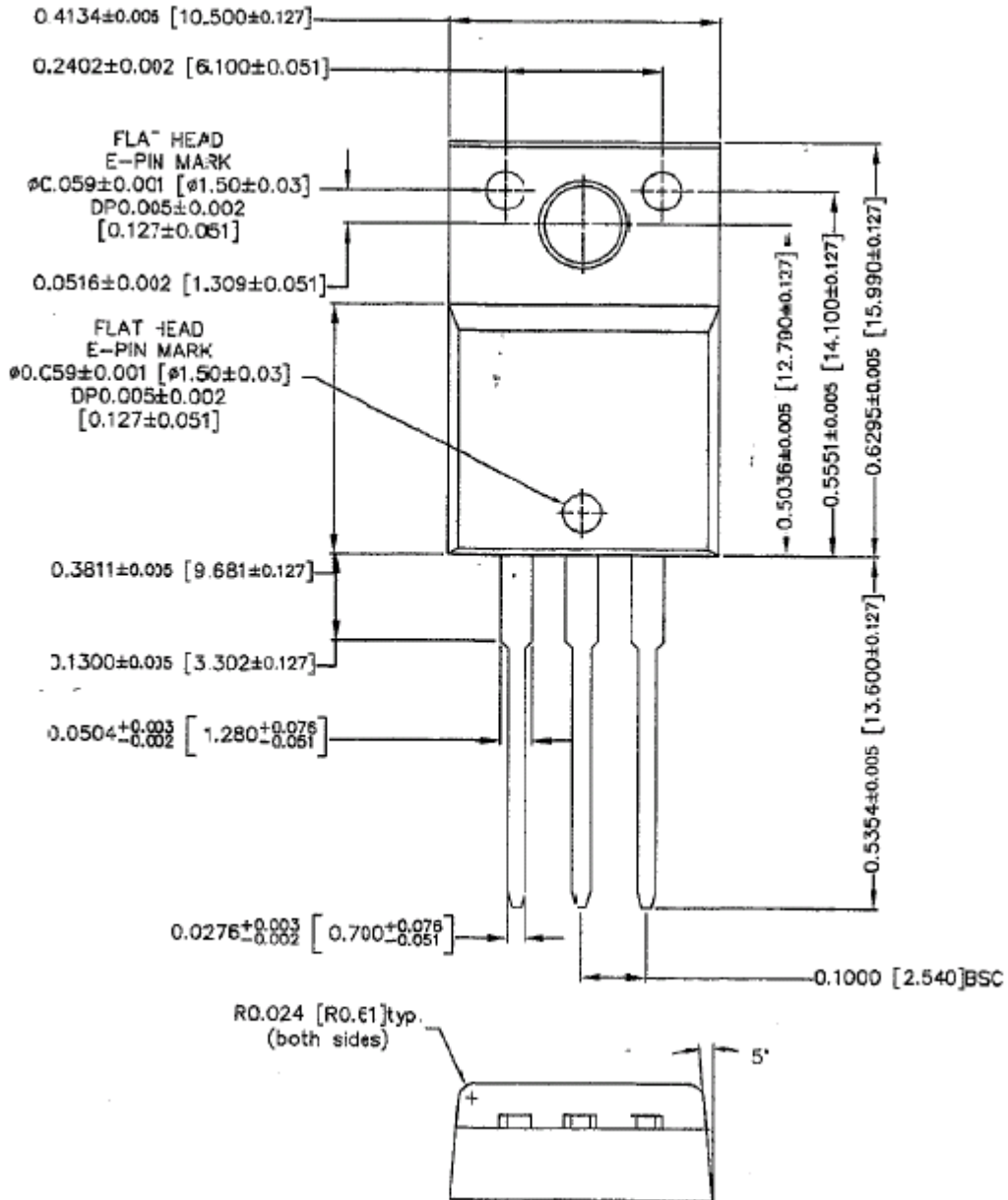


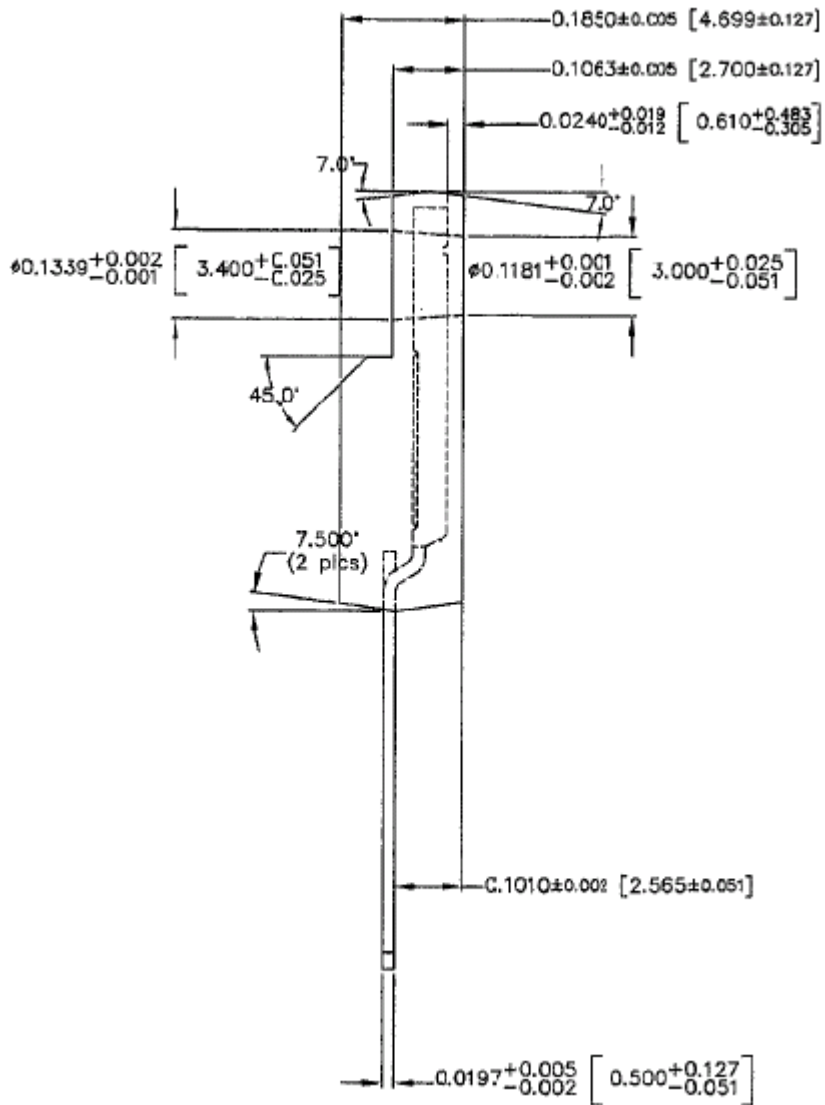
Maximum Rated Forward Biased Safe Operating Area

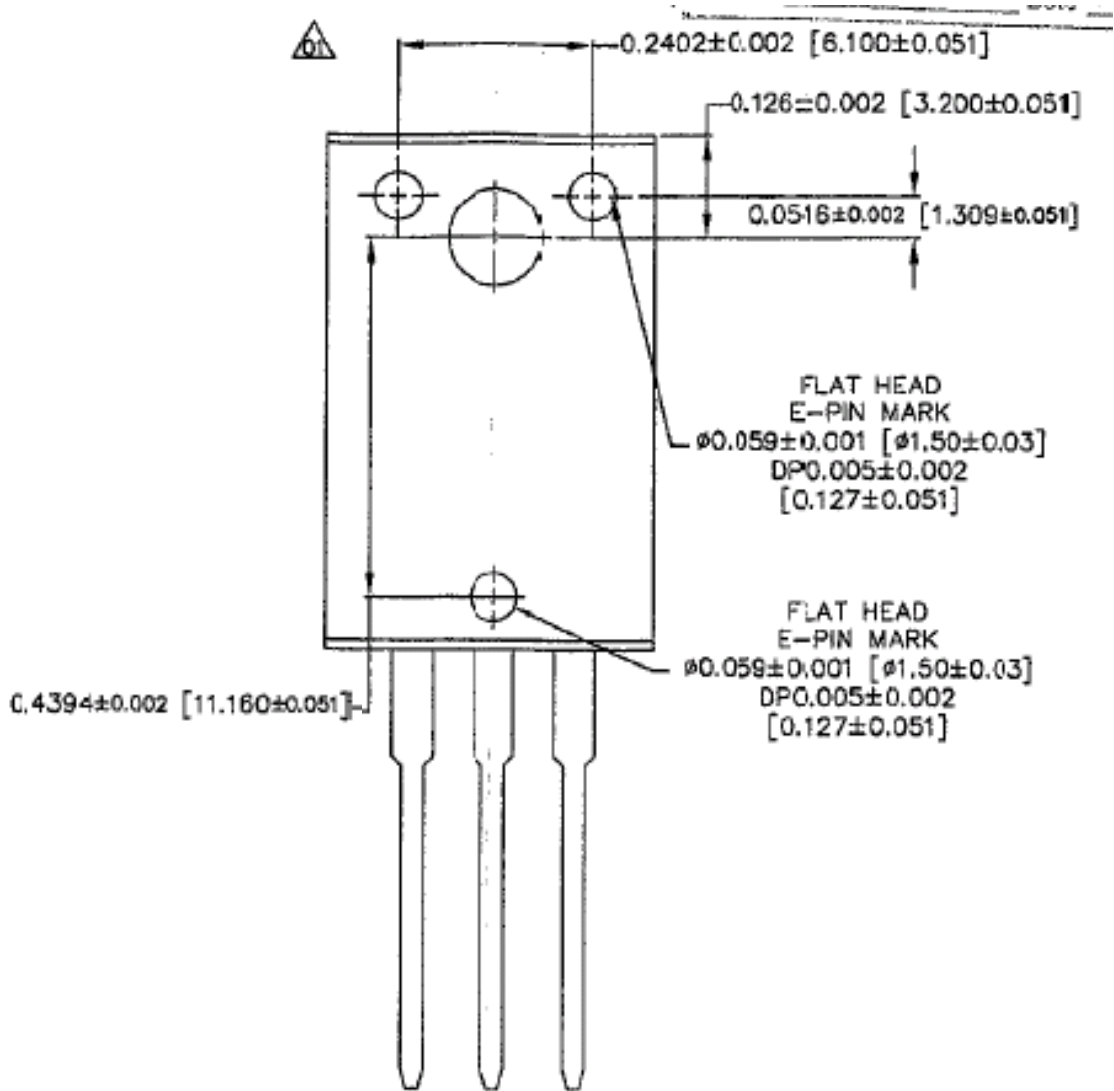


Transient Thermal Response, Junction-to-Case









ICEMOS SUPERJUNCTION PATENT PORTFOLIO

ICEMOS GRANTED PATENTS

US7,429,772
US7,439,178
US7,446,018
US7,579,607
US7,723,172
US7,795,045
US7,846,821
US7,944,018
US8,012,806
US8,030,133

3D SEMI PATENTS LICENSED TO ICEMOS

US7,041,560B2
US7,023,069B2
US7,364,994
US7,227,197B2
US7,304,944B2
US7,052,982B2
US7,339,252
US7,410,891
US7,439,583
US7,227,197B2
US6,635,906
US6,936,867
US7,015,104
US9,109,110
US7,271,067
US7,354,818
US7,052,982,
US7,199,006B2

Note: additional patents in China, Korea, Japan, Taiwan, Europe have also been granted to IceMOS and 3D Semi for Superjunction MOSFETs with 70 additional Patent applications in process in the USA and the above listed countries.