maspower

MSG40T120FH

High speed Trench Fieldstop IGBT

General Description

This IGBT is produced using advanced trench fieldstop IGBT technology, which provides low $V_{CE(sat)}$, high switching performance and excellent quality.

Features

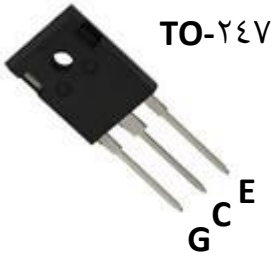
- **High Speed Switching**
- **Positive Temperature coefficient for easy paralleling**
- **High ruggedness&good thermal stability**
- **Including fast free-wheeling diode**
- **Very tight parameter distribution**

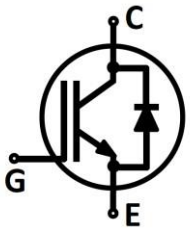
Applications

Characteristics		Symbol	Rating	Unit
Collector-emitter voltage		V_{CE}	١٢٠٠	V
Gate-emitter voltage		V_{GE}	±20	V
Collector current	T_C=25℃	I_C	٨٠	A
	T_C=100℃		٤٠	
Pulsed collector current, t_p limited by T_{jmax}		I_{CM}	١٢٠	A
Diode forward current @T_C=100℃		I_F	٤٠	A
Diode pulsed collector current, t_p limited by T_{jmax}		I_{FM}	١٢٠	A

Short circuit withstand time **V_{GE}=15V, V_{CC}=600V, T_j=25°C** **Allowed number of short circuit < 1000** **Time between short circuits ≥ 1.0s**		**t_{sc}**	٣	**μs**
Power dissipation	**T_c=25℃**	**P_{tot}**	٣١٢	**W**
	T_c=100℃		١٢٥	
Operating junction temperature		**T_j**	**-55~150**	℃
Storage temperature		**T_{stg}**	**-55~150**	

■ **Welding**





Absolute Maximum Ratings

Thermal Characteristics

Characteristics	Symbol	Rating	Unit
Thermal resistance junction-to-case for IGBT	R_{thJC}	٠,٤٠	℃/W
Thermal resistance junction-to-case for Diode	R_{thJCD}	١,٢	
Thermal resistance junction-to-ambient	R_{thJA}	٤٠	

Electrical Characteristics (T_j =25℃ unless otherwise specified)

Characteristics	Symbol	Test Condition	Min	Typ	Max	Unit
Static Characteristics						
Collector-emitter breakdown voltage	BV_{CES}	V_{GE}=0V, I_C=0.5mA	١٢٠٠	-	-	V
Collector-emitter saturation voltage	$V_{CE(sat)}$	V_{GE}=15V, I_C=40A				
		T_j=25℃	-	٢,٢	٢,٧	
		T_j=150℃	-	٣,١	-	
Gate-emitter threshold voltage	$V_{GE(th)}$	I_C=1.5mA, V_{CE}= V_{GE}	٥	٥,٨	٦,٥	
Zero gate voltage collector current	I_{CES}	V_{CE}=1200V, V_{GE}=0V				mA
		T_j=25℃	-	-	٠,١	
		T_j=150℃	-	-	٤	
Gate-emitter leakage current	I_{GES}	V_{CE}=0V, V_{GE}=20V	-	-	٢٠٠	nA
Transconductance	g_{FS}	V_{CE}=20V, I_C=40A	-	٤٣	-	S
Dynamic Characteristics						
Input capacitance	C_{iss}	V_{CE}=25V	-	٦٨٠٠	-	pF
Output capacitance	C_{oss}		-	٢٠٠	-	

Reverse transfer capacitance	C_{rss}	V_{GE}=0V f =1MHz	-	٦٠	-	
Gate charge	Q_G	V_{CC}=600V, I_C=40A V_{GE}=15V	-	٢٤٠	-	nC

Characteristics	Symbol	Test Condition	Min	Typ	Max	Unit
Switching Characteristics						
Turn-on delay time	$t_{d(on)}$	T_j=25℃	-	٧٣	-	ns
Rise time	t_r	V_{CC}=600V	-	٨١	-	
Turn-off delay time	$t_{d(off)}$	I_C=40A	-	٢٨٤	-	
Fall time	t_f	V_{GE}=15/0V	-	٤٧	-	
Turn-on switching energy	E_{on}	R_G=12Ω	-	٢,٥	-	mJ
Turn-off switching energy	E_{off}	L_{load}=500μH	-	١,٤	-	
Total switching energy	E_{ts}		-	٣,٩	-	
Turn-on delay time	$t_{d(on)}$	T_j=150℃	-	٦٥	-	ns
Rise time	t_r	V_{CC}=600V	-	٧٥	-	
Turn-off delay time	$t_{d(off)}$	I_C=40A	-	٣١٦	-	
Fall time	t_f	V_{GE}=15/0V	-	٧٥	-	
Turn-on switching energy	E_{on}	R_G=12Ω	-	٢,٤	-	mJ
Turn-off switching energy	E_{off}	L_{load}=500μH	-	١,٨	-	
Total switching energy	E_{ts}		-	٤,٢	-	
Diode Characteristics						
Forward voltage	V_F	I_F=40A, T_j=25℃	-	٢,٣	٢,٥	V
		I_F=40A, T_j=150℃		٢,١	-	

Reverse recovery time	t_{rr}	T_j=25℃	-	١٤٠	-	ns
Reverse recovery charge	Q_{rr}	V_R=600V, I_F=40A di_F/dt=500A/μs	-	٢,٢	-	μC
Reverse recovery current	I_{rrm}		-	٢٩	-	A
Reverse recovery time	t_{rr}	T_j=150℃	-	١٨٠	-	ns
Reverse recovery charge	Q_{rr}	V_R=600V, I_F=40A di_F/dt=500A/μs	-	٣,٦	-	μC
Reverse recovery current	I_{rrm}		-	٣٥	-	A

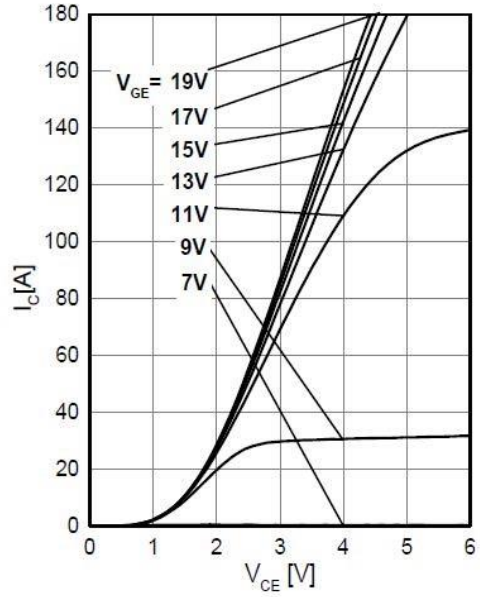


Figure 1. Typical output characteristic
(I_C=f(V_{CE}), T_j= 25°C)

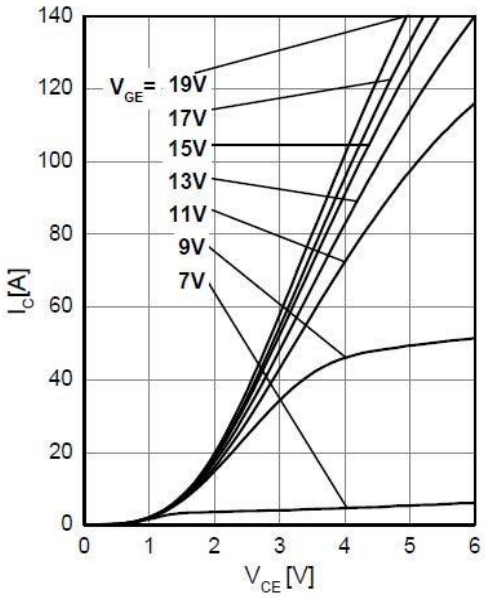


Figure 2. Typical output characteristic
(I_C=f(V_{CE}), T_j= 150°C)

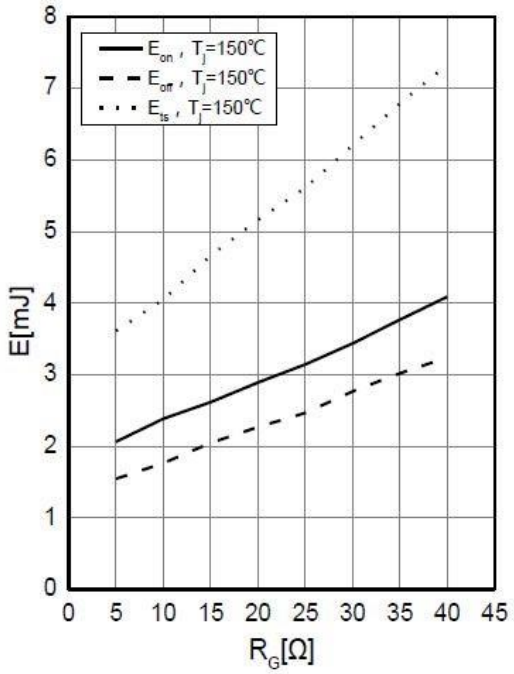
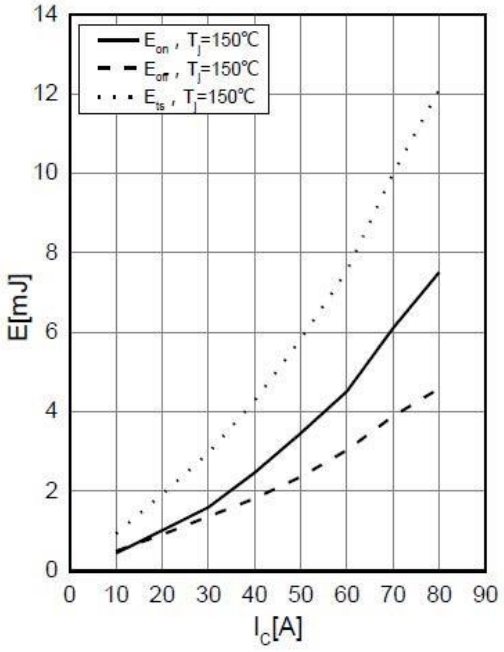


Figure 3. Typical switching energy losses as a function of



gate resistor (inductive load, V_{CC}=600V, V_{GE}=0/15V, Ic=40A

Dynamic test circuit in Figure D)

Figure 4. Typical switching energy losses as a function of collector current (inductive load, V_{CE}=600V, V_{GE}=0/15V, R_G=12Ω, Dynamic test circuit in Figure D)

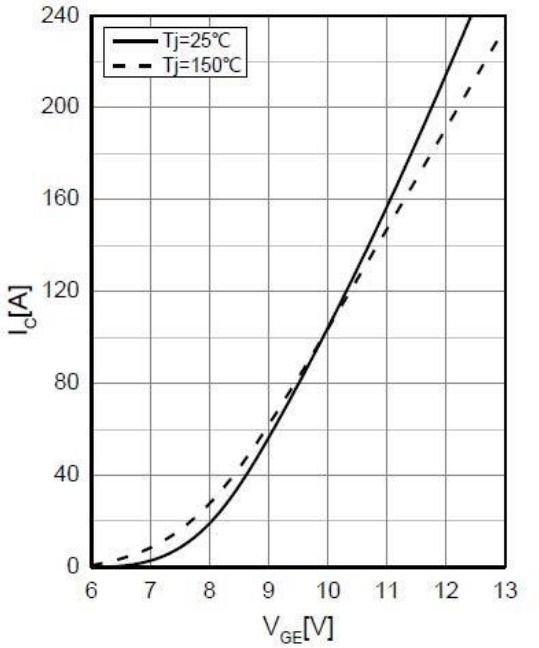


Figure 4. Typical transfer characteristic

(I_C=f(V_{GE}), V_{CE}=20V)

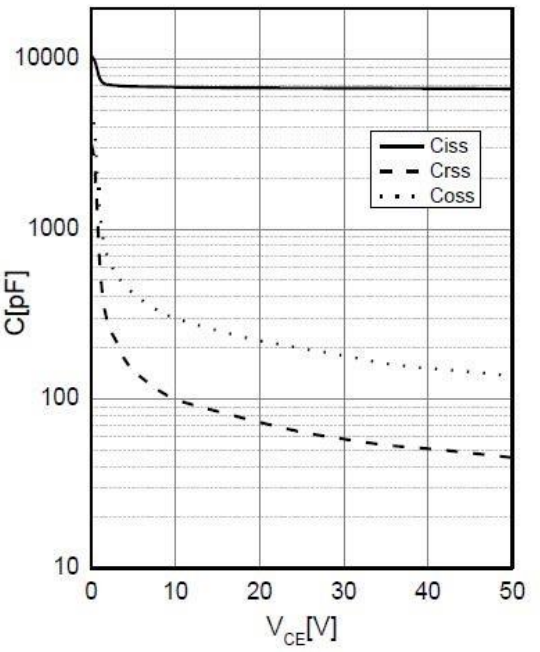


Figure 7. Typical capacitance characteristic
(V_{GE}=0V, f= 1 MHz)

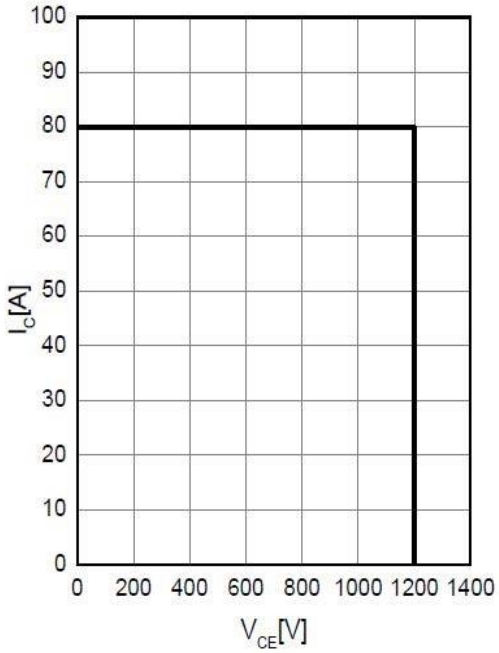
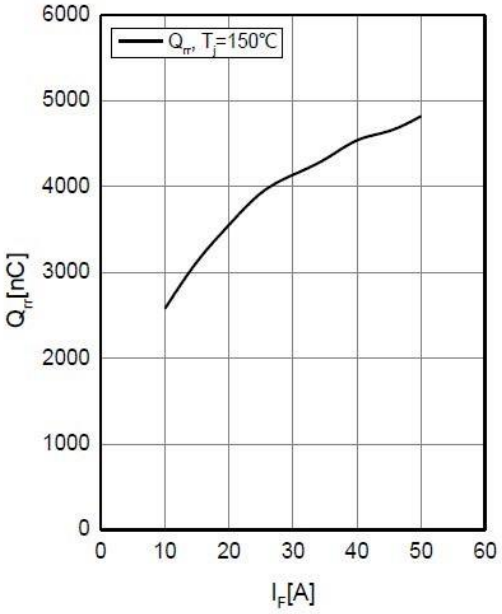
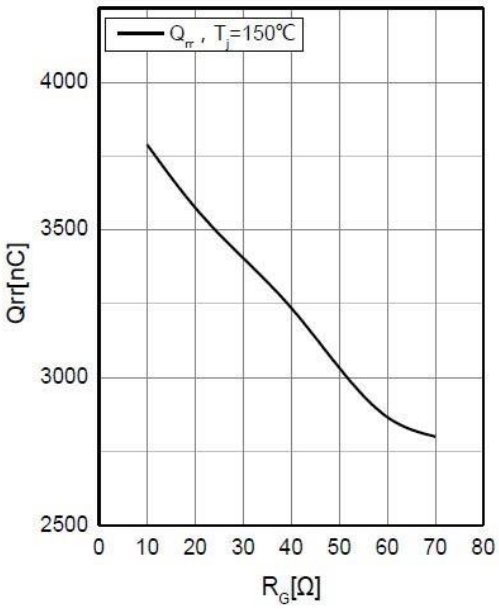


Figure 6. Reverse bias safe operating area
(T_j = 150°C)





($Q_{rr}=f(I_F)$, $I_F=25A, V_{CE}=600V$)

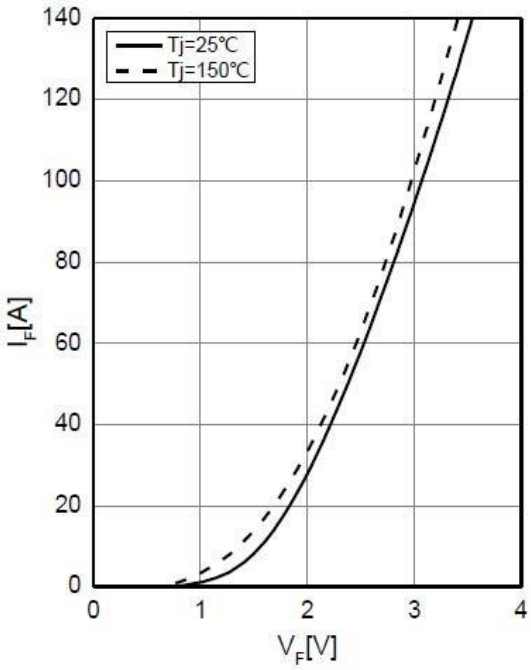


Figure 8. Typical forward characteristic of Diode

$I_F=f(V_F)$

Figure 9. Typical reverse recovery charge

($Q_{rr}=f(I_F)$, $R_G=10\Omega, V_{CE}=600V$)

Figure 10. Typical reverse recovery charge

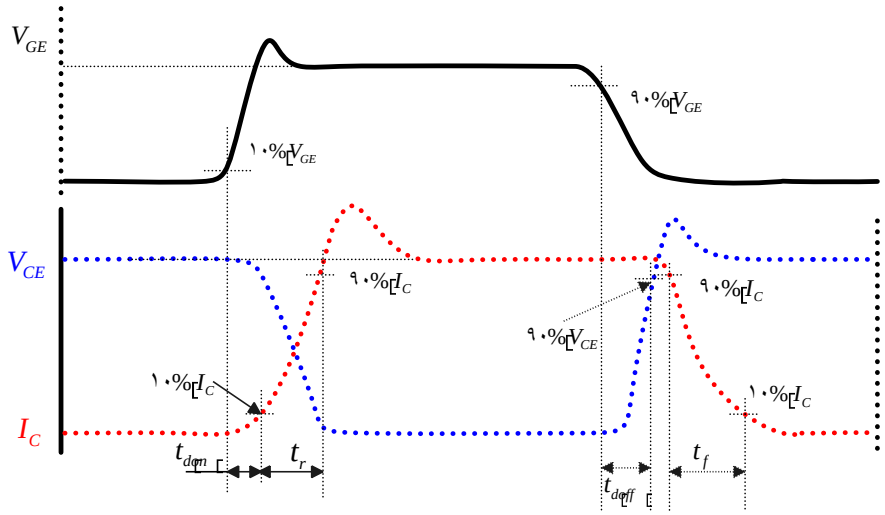


Figure A. Definition of switching times

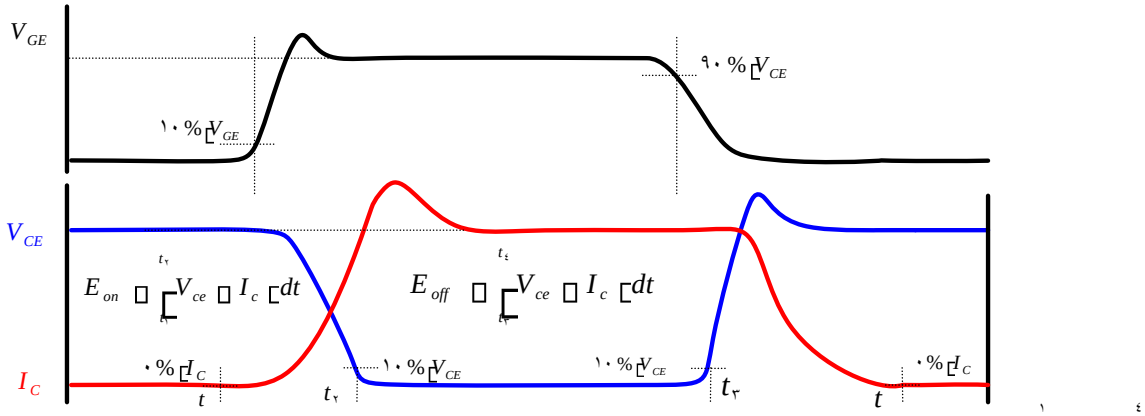
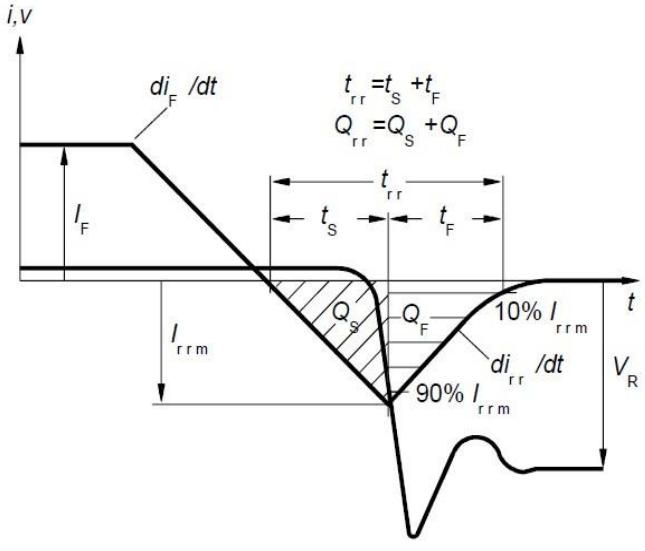


Figure B. Definition of switching losses



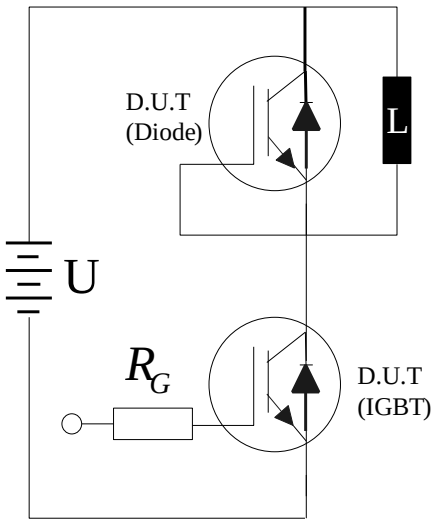
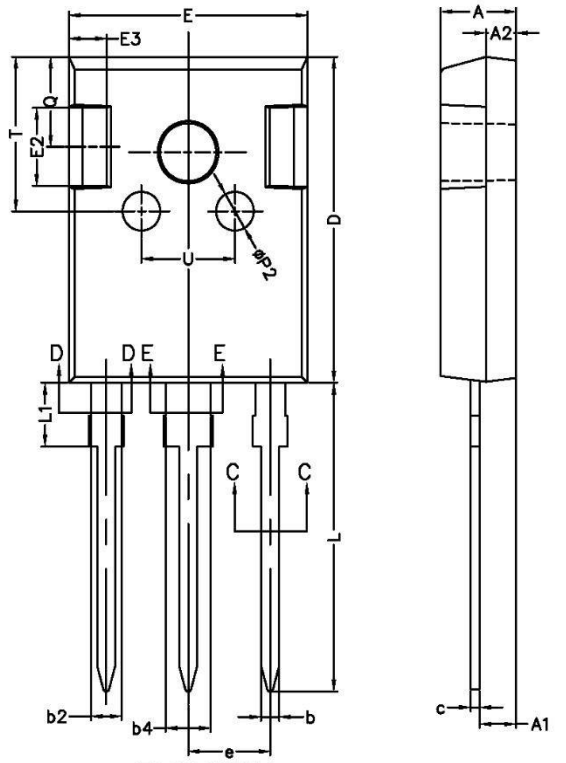
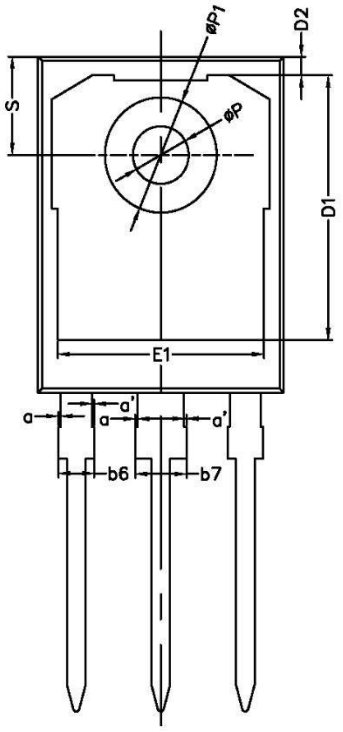


Figure C. Definition of diodes switching characteristics **Figure D. Dynamic test circuit TO-247**





COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	4.90	5.00	5.10
A1	2.31	2.41	2.51
A2	1.90	2.00	2.10
⚠2 a	0	–	0.15
⚠2 a'	0	–	0.15
b	1.16	–	1.26
b1	1.15	1.2	1.22
b2	1.96	–	2.06
b3	1.95	2.00	2.02
b4	2.96	–	3.06
b5	2.95	3.00	3.02
⚠2 b6	–	–	2.25
⚠2 b7	–	–	3.25
c	0.59	–	0.66
c1	0.58	0.60	0.62
D	20.90	21.00	21.10
D1	16.25	16.55	16.85
D2	1.05	1.20	1.35
E	15.70	15.80	15.90
E1	13.10	13.30	13.50
E2	4.90	5.00	5.10
E3	2.40	2.50	2.60
⚠2 e	5.34	5.44	5.54
L	19.80	19.92	20.10
L1	–	–	4.30
P	3.50	3.60	3.70
P1	–	–	7.40
P2	2.40	2.50	2.60
Q	5.60	–	6.00
⚠2 S	6.05	6.15	6.25
T	9.80	–	10.20
U	6.00	–	6.40

NOTES:
1.ALL DIMENSIONS REFER TO JEDEC STANDARD TO-247 AD DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.
2.EJECTION MARK DEPTH $0.10^{+0.15}_{-0.05}$.