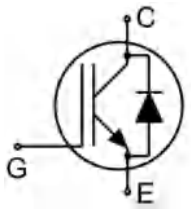
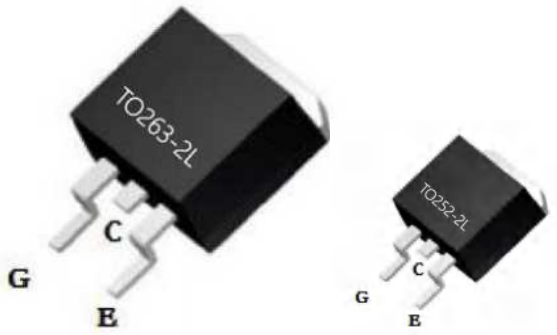
Trench Field-Stop Technology IGBT

YZPST-6H60CX1G3

Features

- 600V, 6A
- $V_{CE(sat)(typ.)}$ =1.75V@V_{GE}=15V, I_C=6A
- Low Q_g
- Maximum Junction Temperature 175℃
- Pb-free Lead Plating; RoHS Compliant





Applications

- Solar Converters
- Uninterrupted Power Supply
- Welding Converters
- Mid to High Range Switching Frequency Converters

Key Performance and Package Parameters

Order codes	V_{CE}	I_C	V_{CEsat}, T_{vj}=25℃	T_{vjmax}	Marking	Package
60H060CX1R3	650V	6A	1.75V	175℃	6H60CX1R3	TO263-2L
60H060CX1G3	650V	6A	1.75V	175℃	6H60CX1G3	TO252-2L

Absolute Maximum Ratings

Symbol	Parameter	Value	Unit
V_{CES}	Collector-Emitter Voltage	600	V
V_{GES}	Gate-Emitter Voltage	±20	V
I_C	Continuous Collector Current (T_C=25℃)	12	A
	Continuous Collector Current (T_C=100℃)	6	A
I_{CM}	Pulsed Collector Current (Note 1)	18	A
P_D	Maximum Power Dissipation (T_C=25℃)	89	W
	Maximum Power Dissipation (T_C=100℃)	44	W
T_J	Operating Junction Temperature Range	-40 to 175	℃
T_{STG}	Storage Temperature Range	-55 to 150	℃

Thermal Data

Symbol	Parameter	Conditoins	Max.	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case for IGBT		1.68	℃/W
$R_{\theta JC}$	Thermal Resistance, Junction to Case for Diode		2.6	℃/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	TO263-2L	62	℃/W
		TO252-2L	80	℃/W

Electrical Characteristics (T_c=25℃ unless otherwise noted.)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
BV_{CES}	Collector-Emitter Breakdown Voltage	V_{GE}=0V, I_C=200uA	600	---	---	V
I_{CES}	Collector-Emitter Leakage Current	V_{CE}=600V, V_{GE}=0V	---	---	40	uA
I_{GES}	Gate Leakage Current, Forward	V_{GE}=20V, V_{CE}=0V	---	---	100	nA
	Gate Leakage Current, Reverse	V_{GE}=-20V, V_{CE}=0V	---	---	100	nA
$V_{GE(th)}$	Gate Threshold Voltage	V_{GE}=V_{CE}, I_C=200uA	3.2	3.9	4.8	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	V_{GE}=15V, I_C=6A, T_j=25℃	---	1.75	2.10	V
		V_{GE}=15V, I_C=6A, T_j=150℃	---	2.05	---	V
Q_G	Total Gate Charge	V_{CC}=400V V_{GE}=15V I_C=6A	---	11.5	---	nC
Q_{GE}	Gate-Emitter Charge		---	3.5	---	nC
Q_{GC}	Gate-Collector Charge		---	3.5	---	nC
$t_{d(on)}$	Turn-on Delay Time	V_{CC}=400V V_{GE}=±15V I_C=6A R_G=10Ω Inductive Load T_C=25℃	---	12	---	ns
t_r	Turn-on Rise Time		---	6	---	ns
$t_{d(off)}$	Turn-off Delay Time		---	14	---	ns
t_f	Turn-off Fall Time		---	154	---	ns
E_{on}	Turn-on Switching Loss		---	91	---	uJ
E_{off}	Turn-off Switching Loss		---	95	---	uJ
E_{ts}	Total Switching Loss		---	186	---	uJ
$t_{d(on)}$	Turn-on Delay Time	V_{CC}=400V V_{GE}=±15V I_C=6A R_G=10Ω Inductive Load T_C=150℃		3		ns
t_r	Turn-on Rise Time			6		ns
$t_{d(off)}$	Turn-off Delay Time			18		ns
t_f	Turn-off Fall Time			214		ns
E_{on}	Turn-on Switching Loss			48		uJ
E_{off}	Turn-off Switching Loss			211		uJ
E_{ts}	Total Switching Loss			259		uJ
C_{ies}	Input Capacitance	V_{CE}=25V V_{GE}=0V f =1MHz	---	313	---	pF
C_{oes}	Output Capacitance		---	34	---	pF
C_{res}	Reverse Transfer Capacitance		---	5	---	pF
SCSOA	Short Circuit Safe Operation Area	V_{GE}=15V, V_{CC}≤400V, $T_{J,start}$≤25℃	9	---	---	uS

Diode Characteristics (T_C=25℃ unless otherwise noted)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	I_F=6A, T_j=25℃	---	1.37	2.10	V
		I_F=6A, T_j=150℃	---	1.20		V
t_{rr}	Diode Reverse Recovery Time	VR=400V I_F=6A dI_F/dt=20A/us T_C=25℃	---	46.5	---	ns
I_{rr}	Diode peak Reverse Recovery Current		---	0.35	---	A
Q_{rr}	Diode Reverse Recovery Charge		---	8.5	---	nC
t_{rr}	Diode Reverse Recovery Time	VR=400V I_F=6A dI_F/dt=20A/us T_C=150℃	---	230	---	ns
I_{rr}	Diode peak Reverse Recovery Current		---	1	---	A
Q_{rr}	Diode Reverse Recovery Charge		---	115	---	uC

Note1：Repetitive rating, pulse width limited by maximum junction temperature

Typical Characteristics

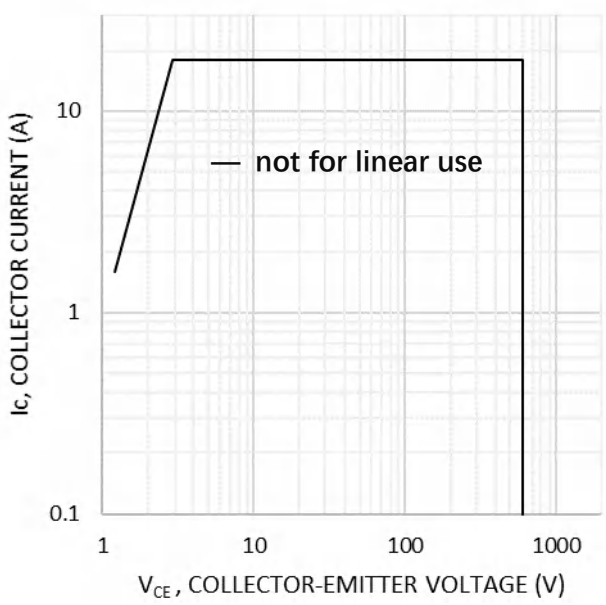


Fig. 1 Forward bias safe operating area (D=0, T_c=25℃, T_{vj}≤175℃; V_{GE}=15V)

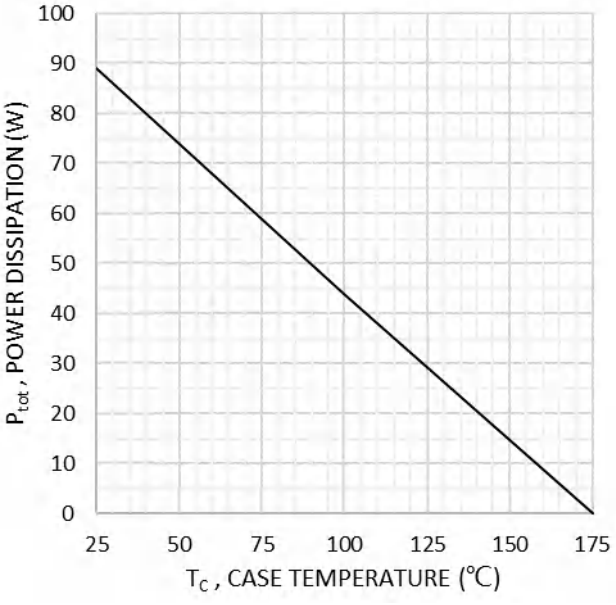


Fig. 2 Power dissipation as a function of case temperature (T_{vj}≤175℃)

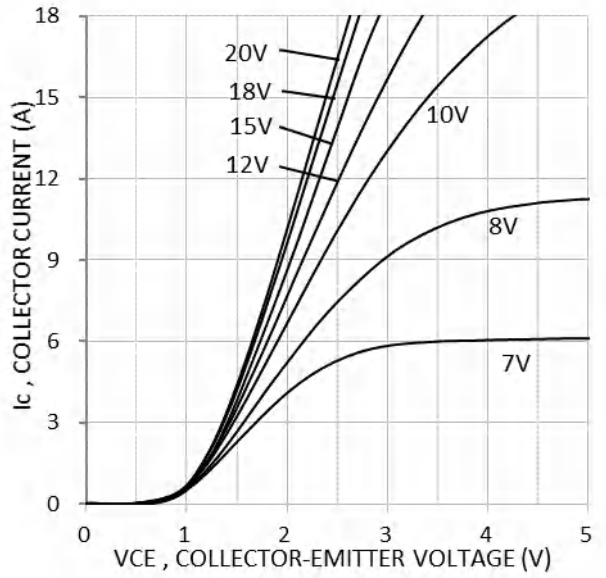


Fig. 3 Typical output characteristic (T_{vj}=25℃)

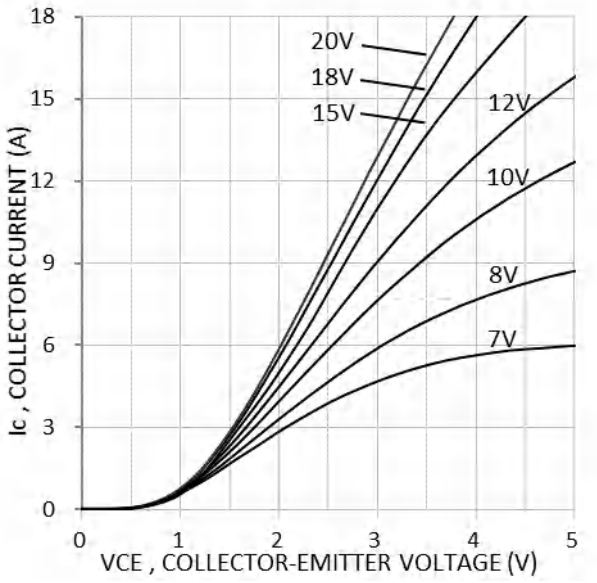


Fig. 4 Typical output characteristic (T_{vj}=150℃)

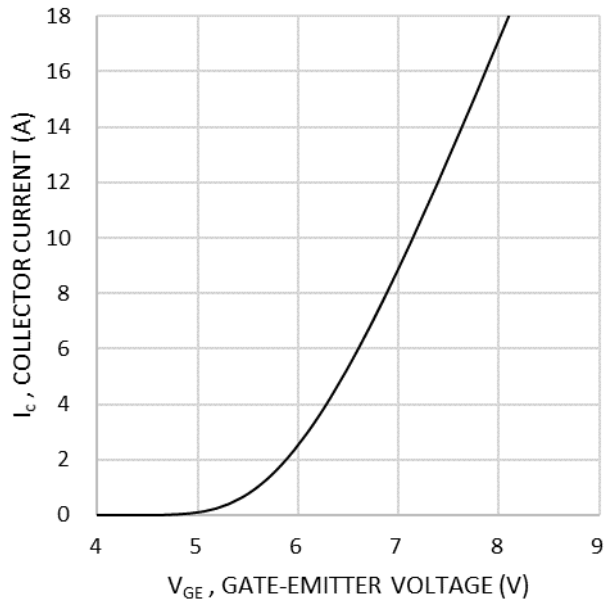


Fig. 5 Typical transfer characteristics (V_{CE}=10V)

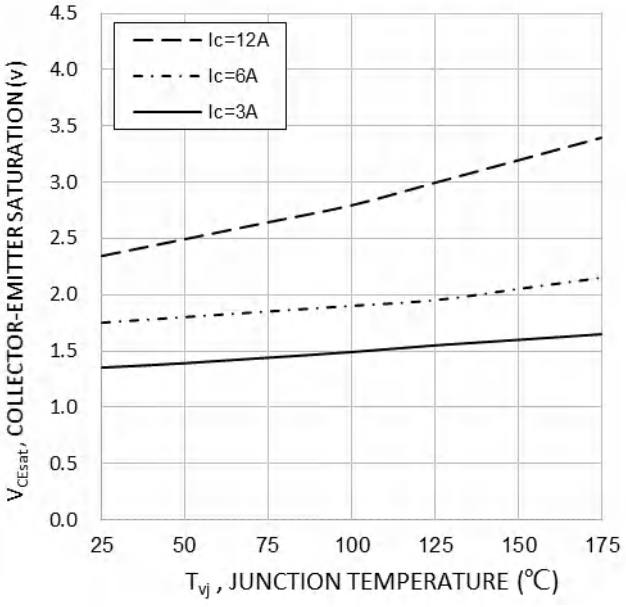


Fig. 6 Typical collector-emitter saturation voltage as a function of junction temperature (V_{GE}=15V)

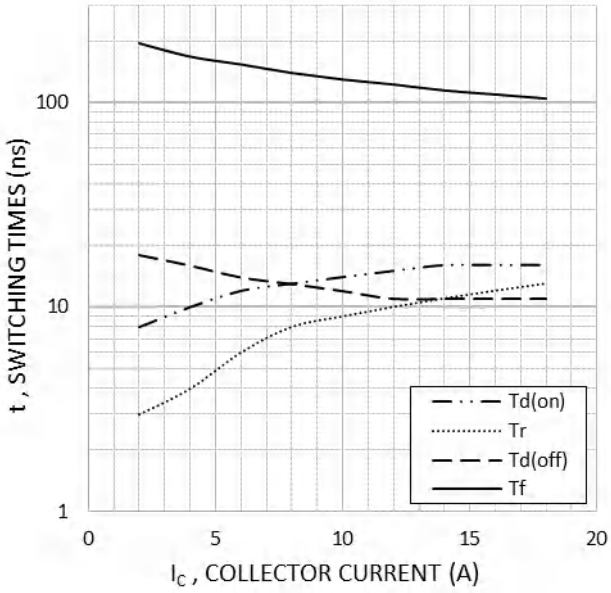


Fig. 7 Typical switching times as a function of collector current (inductive load, T_{yj}=25℃, V_{CE}=400V, V_{GE}=15/0V, r_G=10Ω)

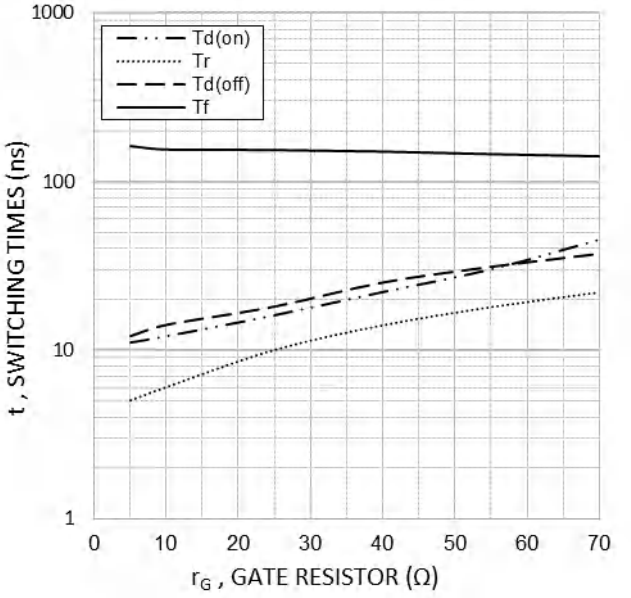


Fig. 8 Typical switching times as a function of gate resistor (inductive load, T_{yj}=25℃, V_{CE}=400V, V_{GE}=15/0V, I_C=6A)

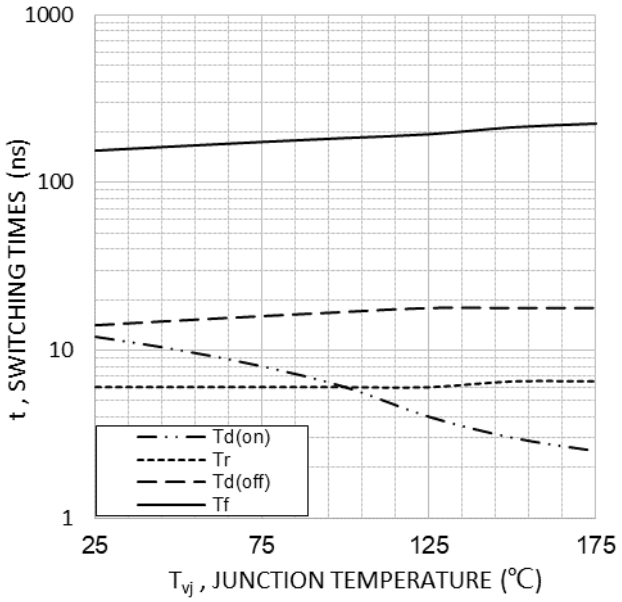


Fig. 9 Typical switching times as a function of junction temperature (inductive load, V_{CE}=400V, V_{GE}=15/0V, I_C=6A, r_G=10Ω)

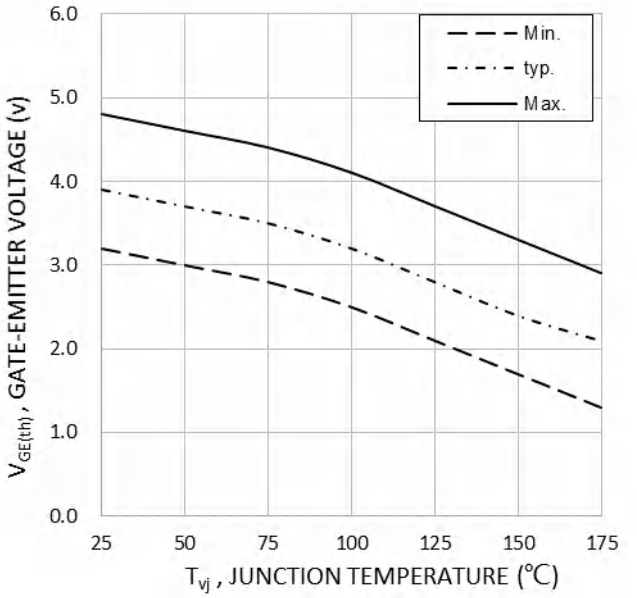


Fig. 10 Gate-emitter threshold voltage as a function of junction temperature (I_C=0.2mA)

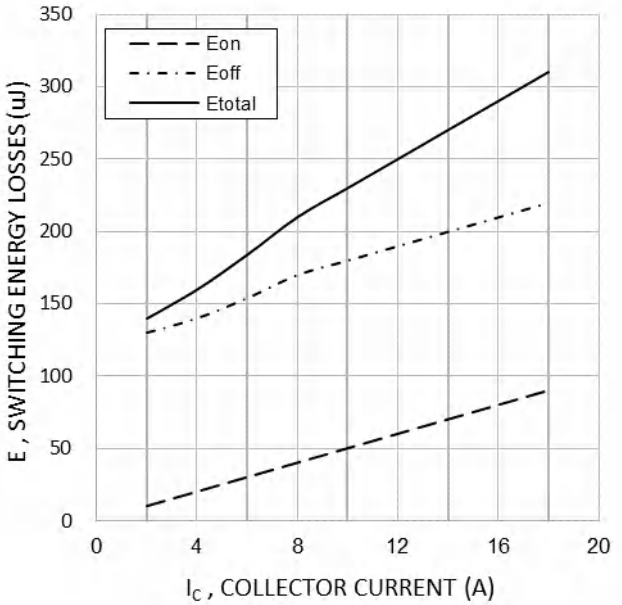


Fig. 11 Typical switching energy losses as a function of collector current (inductive load, T_{yj}=25℃, V_{CE}=400V, V_{GE}=15/0V, r_G=10Ω)

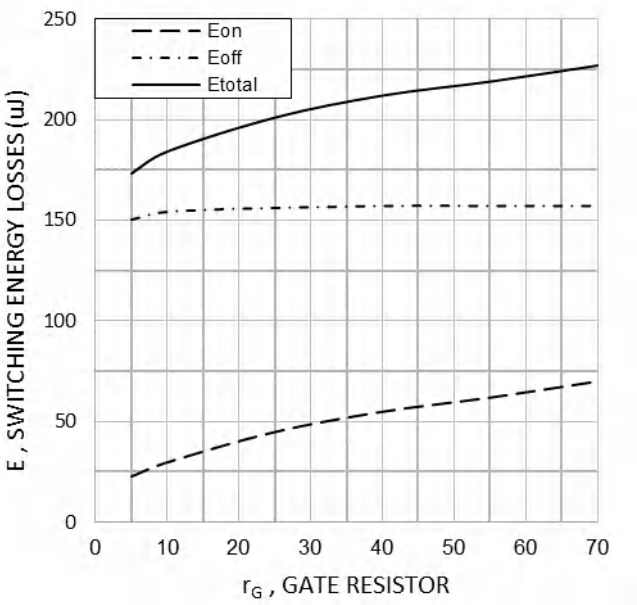


Fig. 12 Typical switching energy losses as a function of gate resistor (inductive load, T_{yj}=25℃, V_{CE}=400V, V_{GE}=15/0V, I_C=6A)

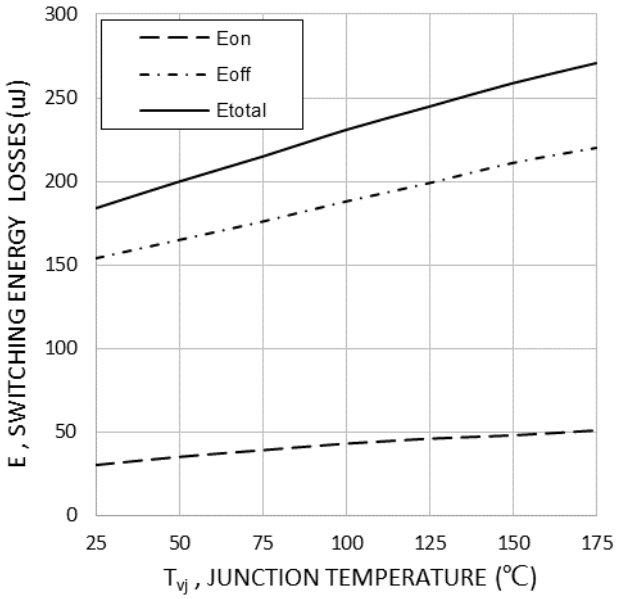


Fig. 13 Typical switching energy losses as a function of junction temperature (inductive load, V_{CE}=600V, V_{GE}=15/0V, I_C=50A, r_G=10Ω)

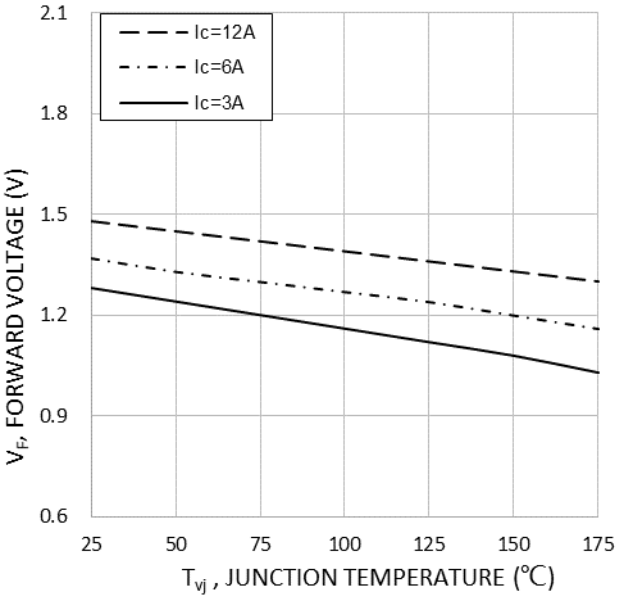


Fig. 14 Typical diode forward voltage as a function of junction temperature

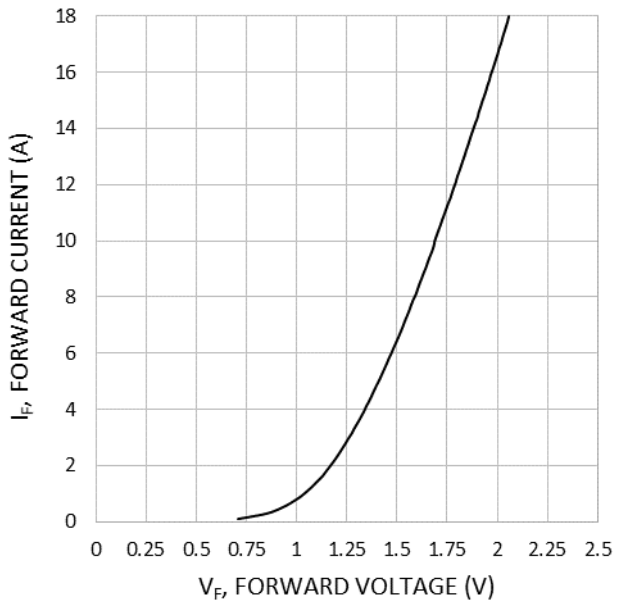


Fig. 15 Typical diode forward current as a function of forward voltage

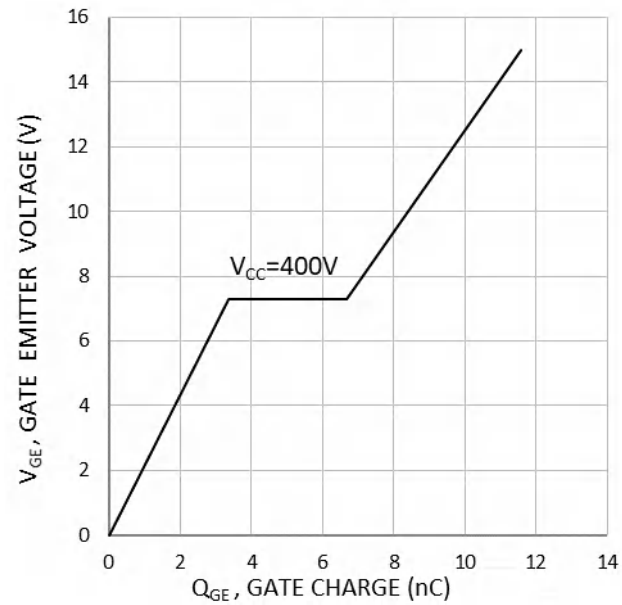


Fig. 16 Typical gate charge (I_C=6A)

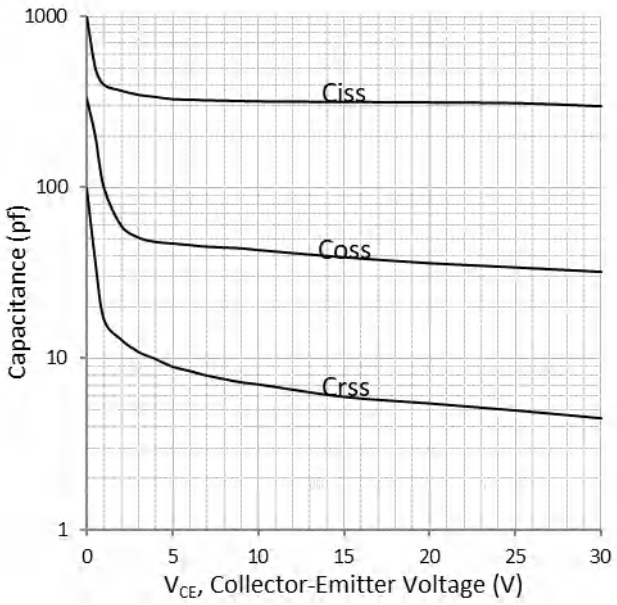


Fig. 17 Typical capacitance as a function of collector-emitter voltage (V_{GE}=0V, f=1MHz)

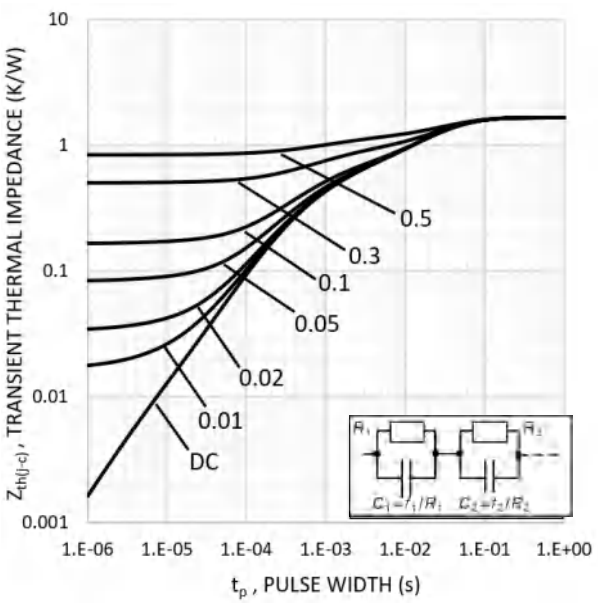


Fig. 18 IGBT transient thermal impedance (D=t_p/T)

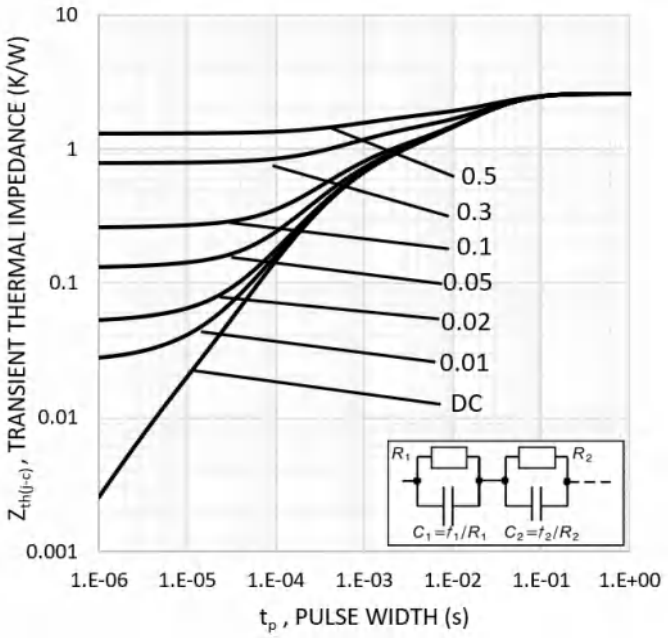
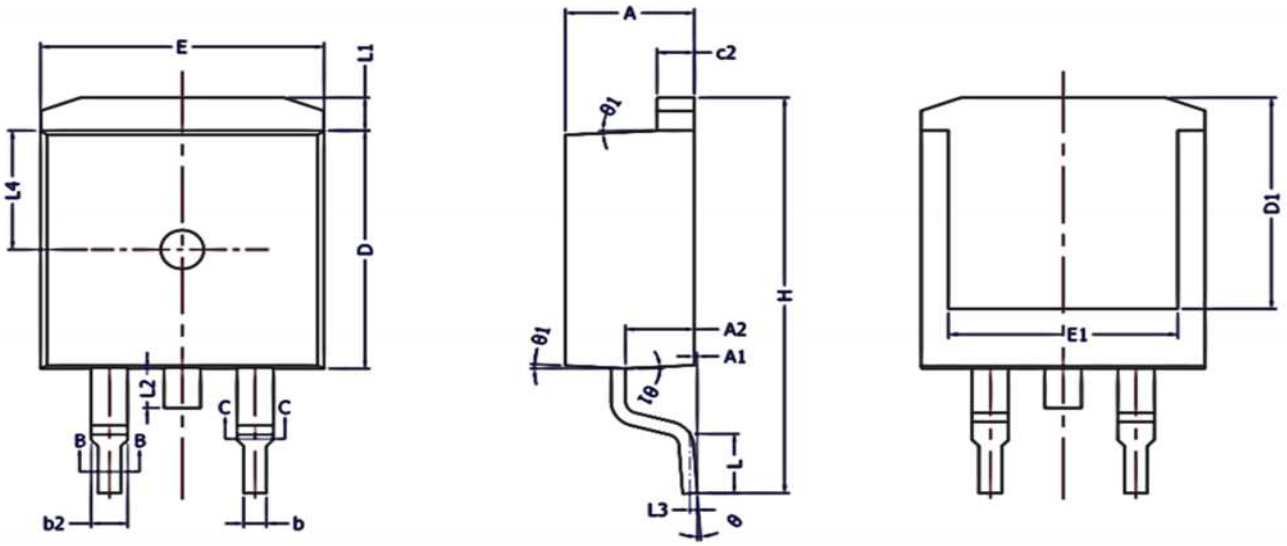
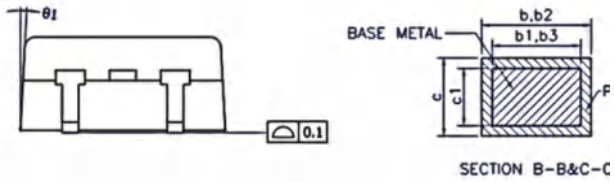


Fig. 19 FRD transient thermal impedance (D=t_p/T)

Package Information

TO-263-2L





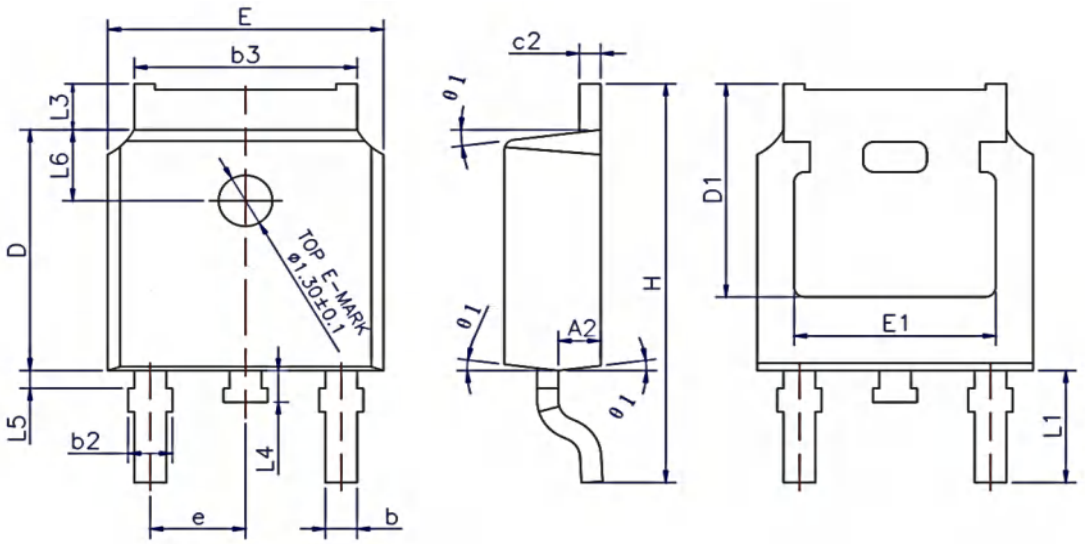
COMMON DIMENSIONS
(UNITS OF MEASURE =MILLIMETER)

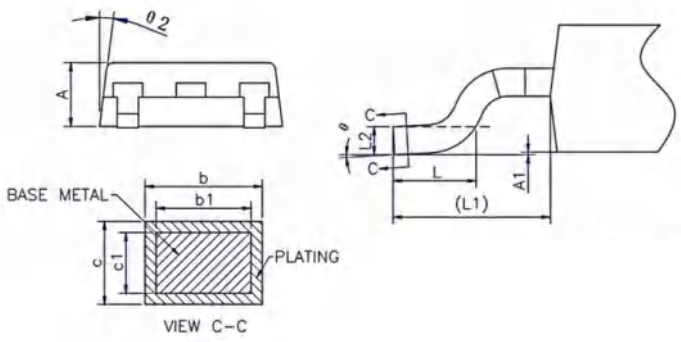
SYMBOL	MIN	NOM	MAX
A	4.40	4.50	4.60
A1	0	0.10	0.25
A2	2.20	2.40	2.60
b	0.76	---	0.89
b1	0.75	0.80	0.85
b2	1.23	---	1.37
b3	1.22	1.27	1.32
c	0.47	---	0.60
c1	0.46	0.51	0.56
c2	1.25	1.30	1.35
D	9.10	9.20	9.30
D1	8.00	---	---
E	9.80	9.90	10.00
E1	7.80	---	---
e	2.54 BSC		
H	14.90	15.30	15.70
L	2.00	2.30	2.60
L1	1.17	1.27	1.40
L2	---	---	1.75
L3	0.25BSC		
L4	4.60 REF		
θ	0°	---	8°
θ1	1°	3°	5°

NOTES:
ALL DIMENSIONS REFER TO JEDEC STANDARD TO-263 AB
DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.

Package Information

TO-252-2L





COMMON DIMENSIONS
(UNITS OF MEASURE =MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	2.20	2.30	2.38
A1	0	—	0.10
A2	0.90	1.01	1.10
b	0.72	—	0.85
b1	0.71	0.76	0.81
b2	0.72	—	0.90
b3	5.13	5.33	5.46
c	0.47	—	0.60
c1	0.46	0.51	0.56
c2	0.47	—	0.60
D	6.00	6.10	6.20
D1	5.25	—	—
E	6.50	6.60	6.70
E1	4.70	—	—
e	2.186	2.286	2.386
H	9.80	10.10	10.40
L	1.40	1.50	1.70
L1	2.90 REF		
L2	0.508 BSC		
L3	0.90	—	1.25
L4	0.60	0.80	1.00
L5	0.15	—	0.75
L6	1.80 REF		
θ	0°	—	8°
θ1	5°	7°	9°
θ2	5°	7°	9°

NOTES:
ALL DIMENSIONS REFER TO JEDEC STANDARED TO-252 AA DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS

Revision History

Ver.	Date	Change Notice
1.0	2021/06/30	Released