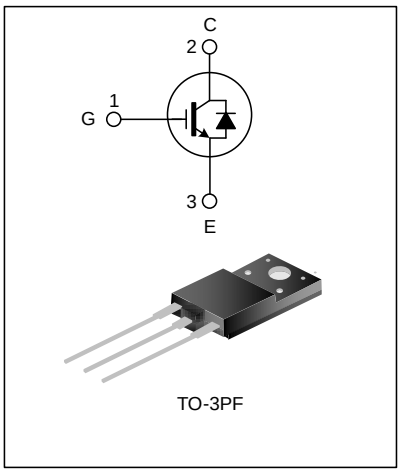
40A, 600V FIELD STOP IGBT

DESCRIPTION

The SGTP40V60SD2PF field stop IGBT adopts Silan Field Stop V technology, features low conduction loss and switching loss. This device is applicable to photovoltaic, UPS, SMPS, and PFC fields.



FEATURES

- 40A, 600V, $V_{CE(sat)(typ.)}$=1.35V@I_C=40A
- Low conduction loss
- Ultra-fast switching
- High input impedance
- T_{Jmax}=175°C

NOMENCLATURE

SGT P 40 V 60 S D 2 PF

IGBT series
Technical grade

Current, 40: 40A

N : N Channel
NE : N-channel planar gate with ESD
T : Field Stop 3/4
U : Field Stop 4+
V : Field Stop 5
W: Field Stop 6
X : Field Stop 7

Voltage, 65: 650V,
120: 1200V

Package
PF : TO-3PF

1,2,3··· : Version No.

Blank: Standard diode
M : Standard Diode, full range
R : Rapid Diode
B : Rapid Diode, full range
S : Soft Diode, full range

D : Packaged with fast recovery diode
R : RC IGBT

L : Ultra low switching, recommended frequency ~2kHz
Q : Low switching, recommended frequency 2~20kHz
S : Standard frequency, recommended frequency 5~40kHz
F : Fast switching, recommended frequency10~60kHz
UF : Ultra fast switching, recommended frequency 40kHz~

ORDERING INFORMATION

Part No.	Package	Marking	Hazardous Substance Control	Packing Type
SGTP40V60SD2PF	TO-3PF	40V60SD2	Halogen free	Tube

ABSOLUTE MAXIMUM RATINGS (UNLESS OTHERWISE NOTED, T_C=25°C)

Characteristics		Symbol	Ratings	Unit
Collector to Emitter Voltage		V_{CE}	600	V
Gate to Emitter Voltage		V_{GE}	±20	V
Transient Gate to Emitter Voltage (t_p≤10μs, D<0.010)		V_{GE}	±30	V
Collector Current	T_C=25°C	I_C	80	A
	T_C=100°C		40	
Pulsed Collector Current		I_{CM}	160	A
Diode Current	T_C=25°C	I_F	10	A
	T_C=100°C		5	
Diode Pulsed Current		I_{FM}	15	A
Power Dissipation (T_C=25°C)		P_D	60	W
Operating Junction Temperature		T_J	-40～+175	°C
Storage Temperature Range		T_{stg}	-55～+150	°C

THERMAL CHARACTERISTICS

Characteristics	Symbol	Test conditions	Min.	Typ.	Max.	Unit
Thermal Resistance, Junction to Case (IGBT)	$R_{\theta JC}$	--	--	--	2.5	°C/W
Thermal Resistance, Junction to Case (FRD)	$R_{\theta JC}$	--	--	--	5.3	°C/W
Thermal Resistance, Junction to Ambient (IGBT)	$R_{\theta JA}$	--	--	--	40	°C/W
Soldering temperature (in line)	T_{sold}	15^{+2}_{-0} sec, 1time	--	--	260	°C

ELECTRICAL CHARACTERISTICS OF IGBT (UNLESS OTHERWISE NOTED, T_C=25°C)

Characteristics	Symbol	Test conditions	Min.	Typ.	Max.	Unit
Collector to Emitter Breakdown Voltage	BV_{CE}	V_{GE}=0V, I_C=250μA	600	--	--	V
C-E Leakage Current	I_{CES}	V_{CE}=600V, V_{GE}=0V	--	--	100	μA
G-E Leakage Current	I_{GES}	V_{GE}=20V, V_{CE}=0V	--	--	±100	nA
G-E Threshold Voltage	$V_{GE(th)}$	I_C=250μA, V_{CE}=V_{GE}	3.2	4.5	5.8	V
Collector to Emitter Saturation Voltage	$V_{CE(sat)}$	I_C=40A, V_{GE}=15V, T_C=25°C	--	1.35	1.7	V
		I_C=40A, V_{GE}=15V, T_C=175°C	--	1.55	--	V
Input Capacitance	C_{ies}	V_{CE}=30V V_{GE}=0V f=1MHz	--	3018	--	pF
Output Capacitance	C_{oes}		--	53	--	
Reverse Transfer Capacitance	C_{res}		--	10	--	
Turn-On Delay Time	$T_{d(on)}$	V_{CE}=400V I_C=40A R_g=10Ω V_{GE}=15V inductive load T_C=25°C	--	39	--	ns
Rise Time	T_r		--	46	--	
Turn-Off Delay Time	$T_{d(off)}$		--	150	--	
Fall Time	T_f		--	25	--	
Turn-On Switching Loss	E_{on}		--	0.88	--	mJ
Turn-Off Switching Loss	E_{off}		--	0.62	--	
Total Switching Loss	E_{st}		--	1.50	--	
Turn-On Delay Time	$T_{d(on)}$	V_{CE}=400V I_C=20A R_g=10Ω V_{GE}=15V inductive load T_C=25°C	--	37	--	ns
Rise Time	T_r		--	19	--	
Turn-Off Delay Time	$T_{d(off)}$		--	156	--	
Fall Time	T_f		--	33	--	
Turn-On Switching Loss	E_{on}		--	0.31	--	mJ
Turn-Off Switching Loss	E_{off}		--	0.32	--	
Total Switching Loss	E_{st}		--	0.63	--	
Total Gate Charge	Q_g	V_{CE}=480V, I_C=40A, V_{GE}=15V	--	110	--	nC
Gate to Emitter Charge	Q_{ge}		--	21	--	
Gate to Collector Charge	Q_{gc}		--	29	--	

ELECTRICAL CHARACTERISTICS OF FRD (UNLESS OTHERWISE NOTED, T_C=25°C)

Characteristics	Symbol	Test conditions	Min.	Typ.	Max.	Unit
Diode Forward Voltage	V_{FM}	I_F=5A, T_C=25°C	--	1.4	2.0	V
		I_F=5A, T_C=175°C	--	1.2	--	
Diode Reverse Recovery Time	T_{rr}	I_{ES}=5A, dI_{ES}/dt=100A/μs, V_R=50V, T_C=25°C	--	35	--	ns
Diode Reverse Recovery Charge	Q_{rr}		--	42	--	nC
Diode Reverse Recovery Current	Irm		--	2.4	--	A

ELECTRICAL CHARACTERISTICS OF IGBT (UNLESS OTHERWISE NOTED, T_C=150°C)

Characteristics	Symbol	Test conditions	Min.	Typ.	Max.	Unit
Turn-On Delay Time	$T_{d(on)}$	V_{CE}=400V I_C=40A R_g=10Ω V_{GE}=15V inductive load T_C=150°C	--	38	--	ns
Rise Time	T_r		--	43	--	
Turn-Off Delay Time	$T_{d(off)}$		--	187	--	
Fall Time	T_f		--	35	--	
Turn-On Switching Loss	E_{on}		--	0.92	--	mJ
Turn-Off Switching Loss	E_{off}		--	0.93	--	
Total Switching Loss	E_{st}		--	1.85	--	
Turn-On Delay Time	$T_{d(on)}$	V_{CE}=400V I_C=20A R_g=10Ω V_{GE}=15V inductive load T_C=150°C	--	36	--	ns
Rise Time	T_r		--	18	--	
Turn-Off Delay Time	$T_{d(off)}$		--	201	--	
Fall Time	T_f		--	43	--	
Turn-On Switching Loss	E_{on}		--	0.33	--	mJ
Turn-Off Switching Loss	E_{off}		--	0.43	--	
Total Switching Loss	E_{st}		--	0.76	--	

TYPICAL CHARACTERISTICS

Figure 1. Typical Output Characteristics

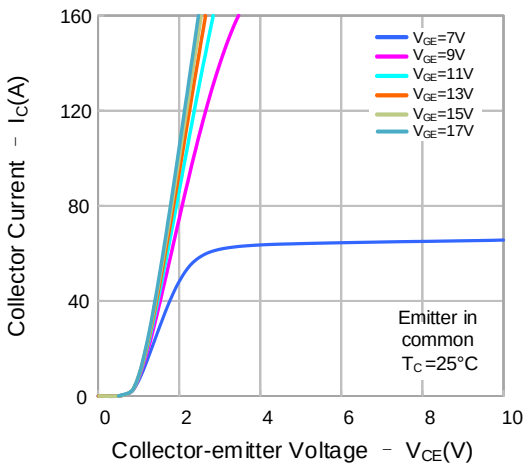


Figure 2. Typical Output Characteristics

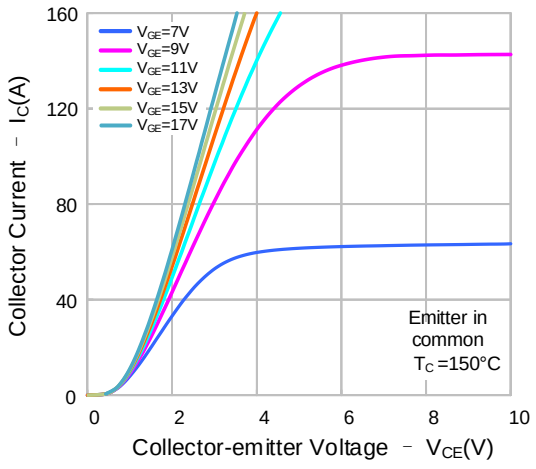


Figure 3. Typical Saturation Voltage Characteristics

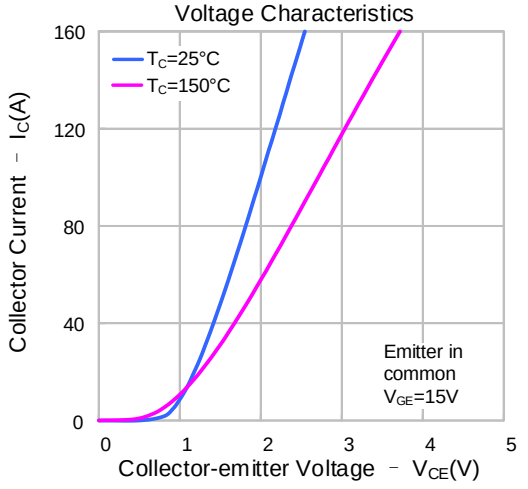


Figure 4. Transmission Characteristics

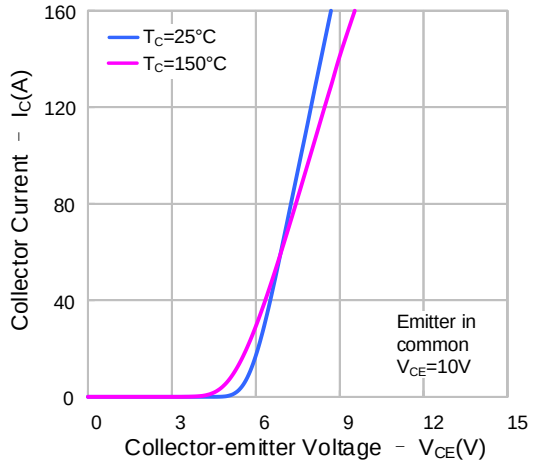


Figure 5. Saturation Voltage Drop vs. V_{GE}

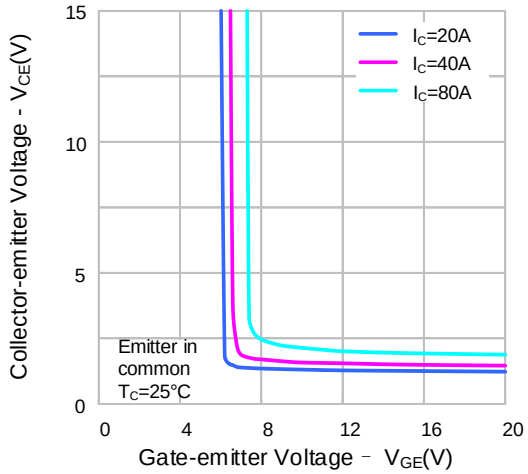
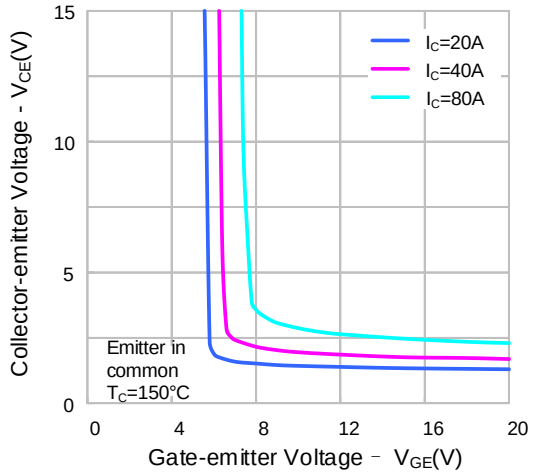


Figure 6. Saturation Voltage Drop vs. V_{GE}



TYPICAL CHARACTERISTICS (CONTINUED)

Figure 7. Saturation Voltage Drop vs. Temperature

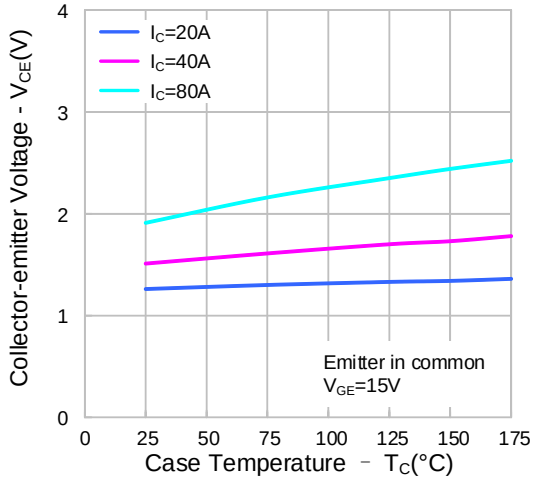


Figure 8. Capacitance Characteristics

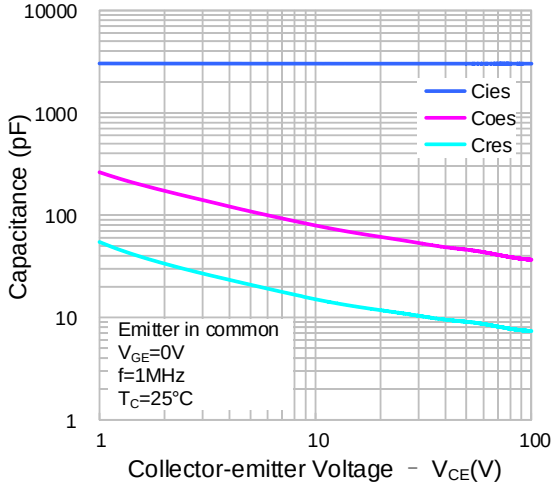


Figure 9. Gate Charge Characteristics

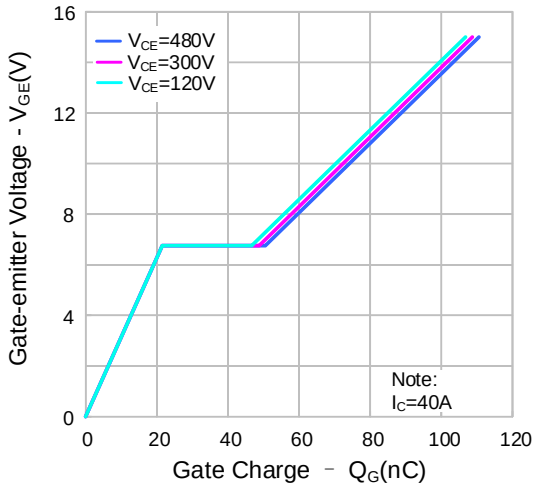


Figure 10. Forward Characteristics

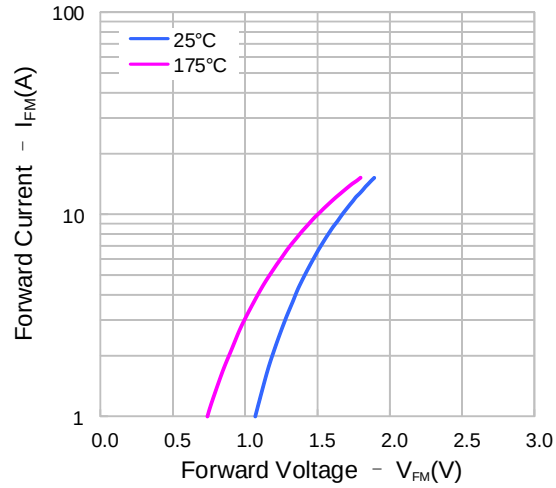


Figure 11. Turn-on Characteristics vs. Gate Resistance

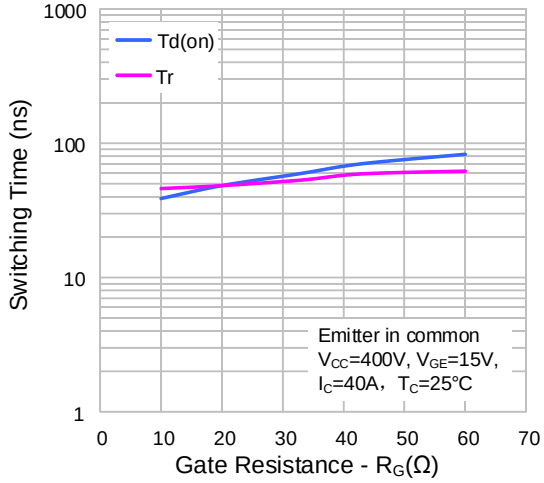
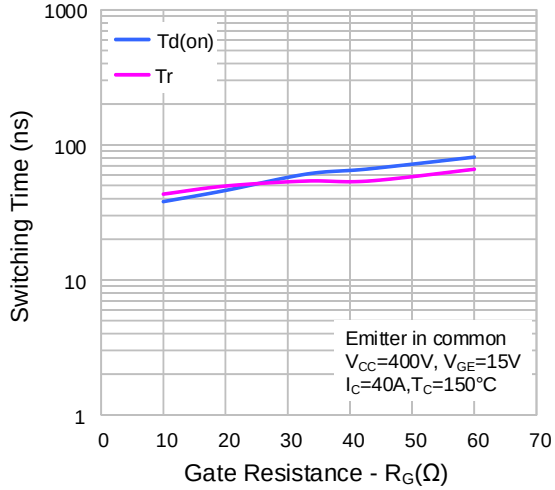


Figure 12. Turn-on Characteristics vs. Gate Resistance



TYPICAL CHARACTERISTICS (CONTINUED)

Figure 13. Turn-off Characteristics vs. Gate Resistance

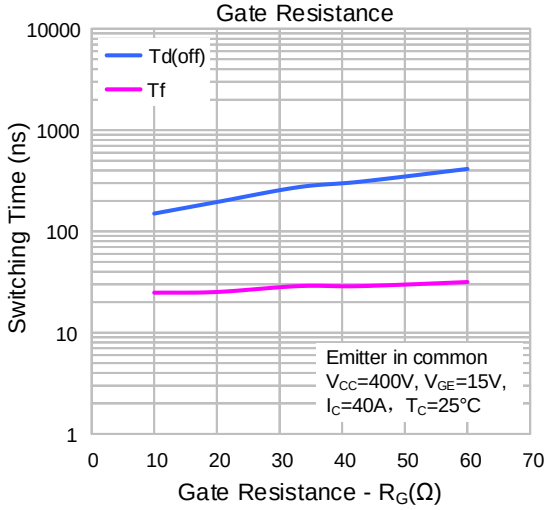


Figure 14. Turn-off Characteristics vs. Gate Resistance

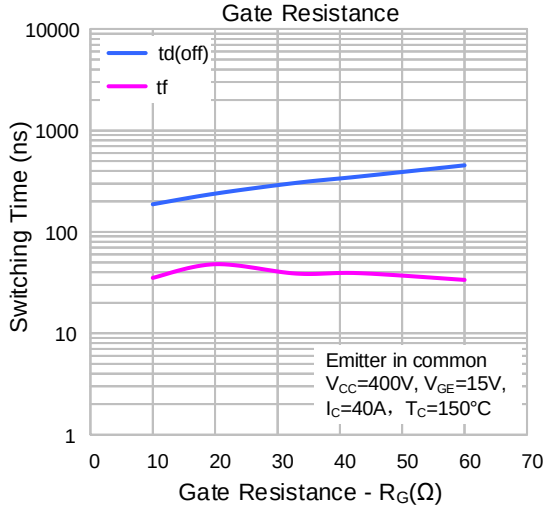


Figure 15. Switching Loss vs. Gate Resistance

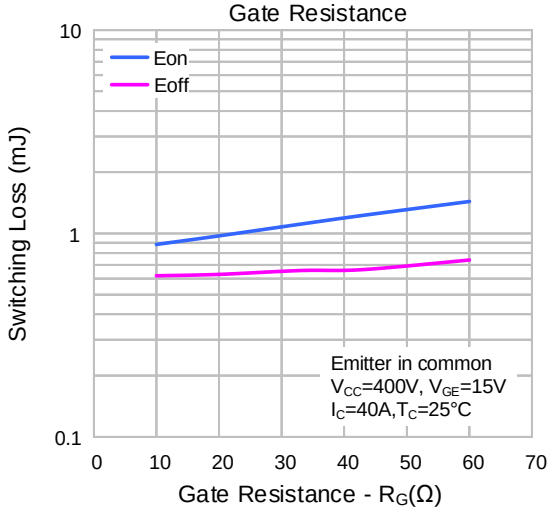


Figure 16. Switching Loss vs. Gate Resistance

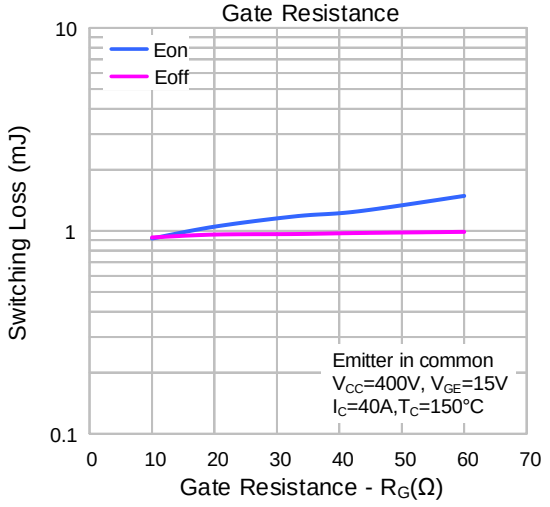


Figure 17. Turn-on Characteristics vs. Collector Current

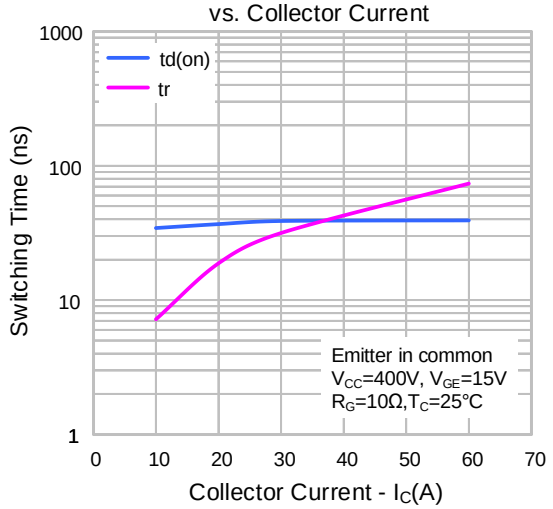
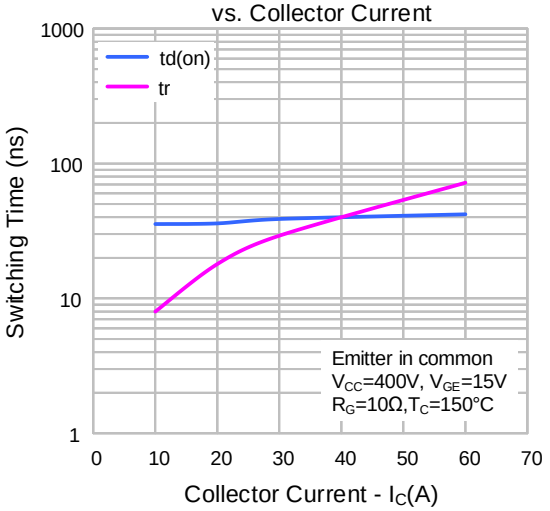


Figure 18. Turn-on Characteristics vs. Collector Current



TYPICAL CHARACTERISTICS (CONTINUED)

Figure 19. Turn-off Characteristics vs. Collector Current

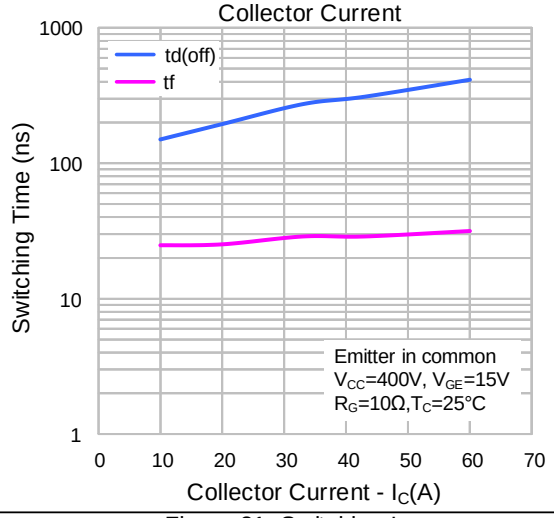


Figure 20. Turn-off Characteristics vs. Collector Current

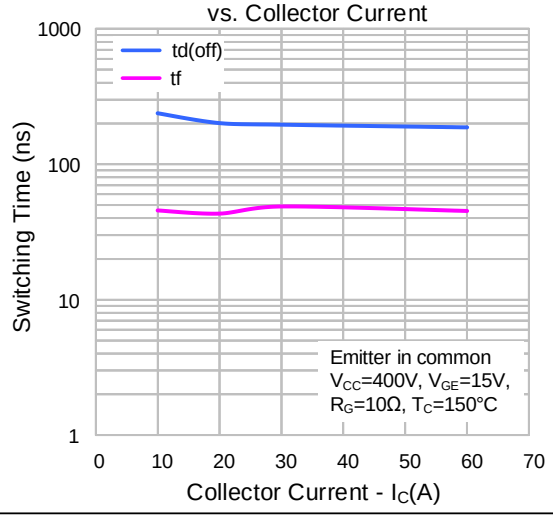


Figure 21. Switching Loss vs. Collector Current

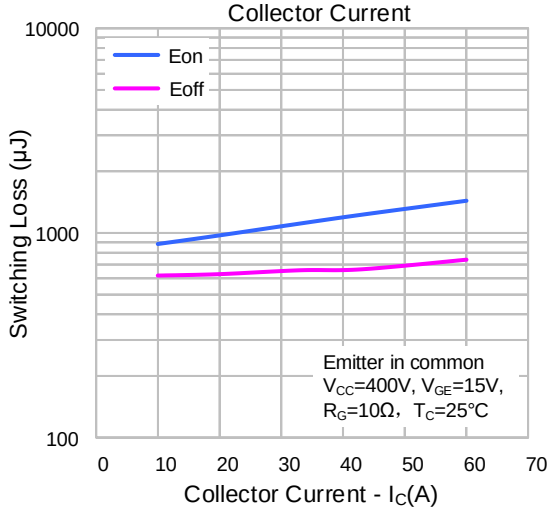


Figure 22. Switching Loss vs. Collector Current

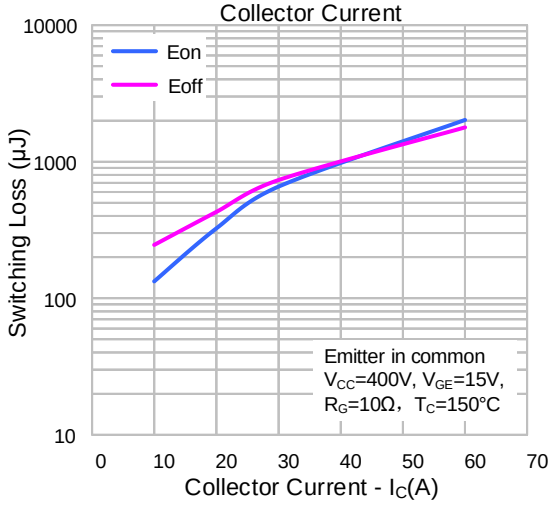


Figure 23. Reverse Recovery Time vs. Forward Current

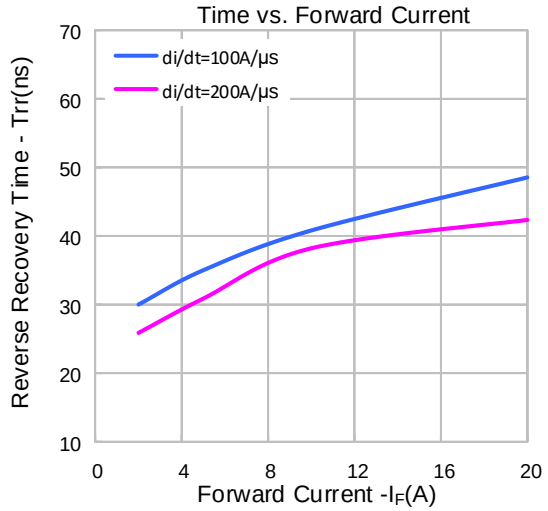
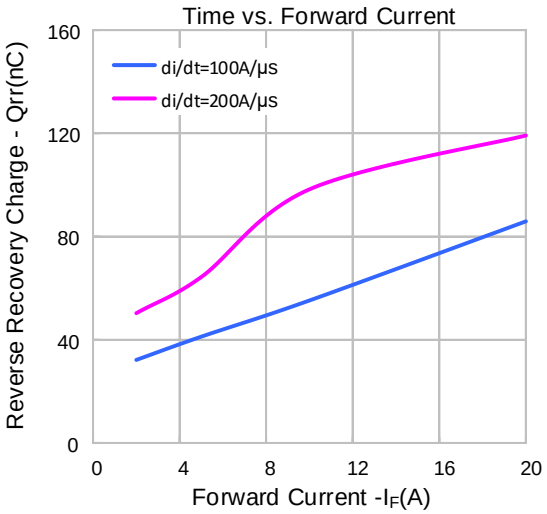


Figure 24. Reverse Recovery Time vs. Forward Current



TYPICAL CHARACTERISTICS (CONTINUED)

Figure 25. Peak Reverse Recovery Current vs. Forward Current

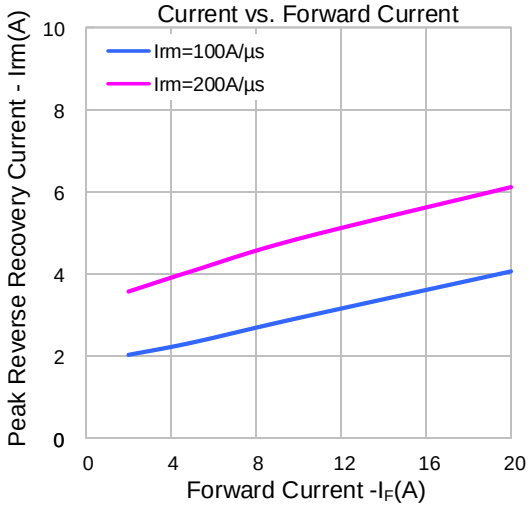


Figure 26. Tb Slope vs. Forward Current

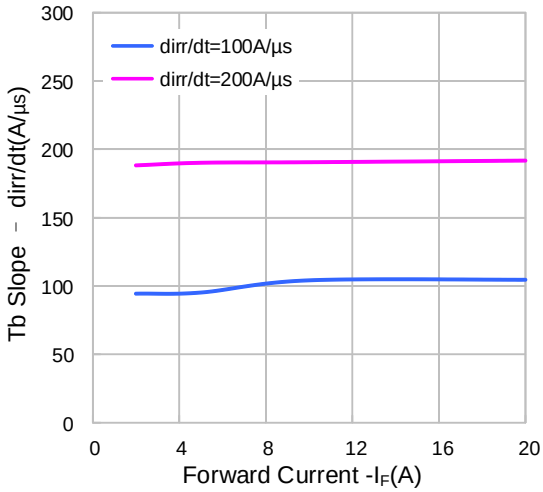


Figure 27. Max. Safe Operating Area

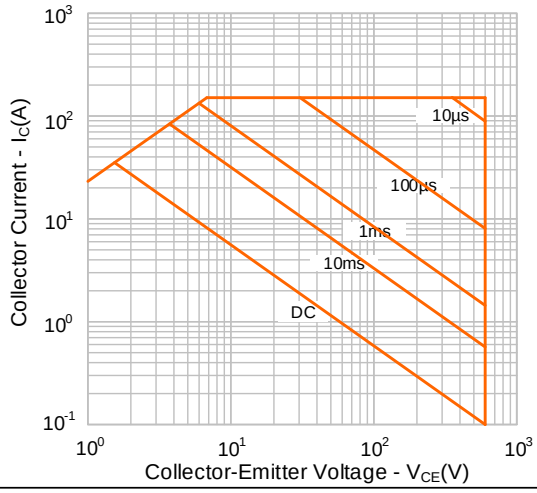


Figure 28. Transient Thermal Impedance vs. On-pulse Duration (IGBT)

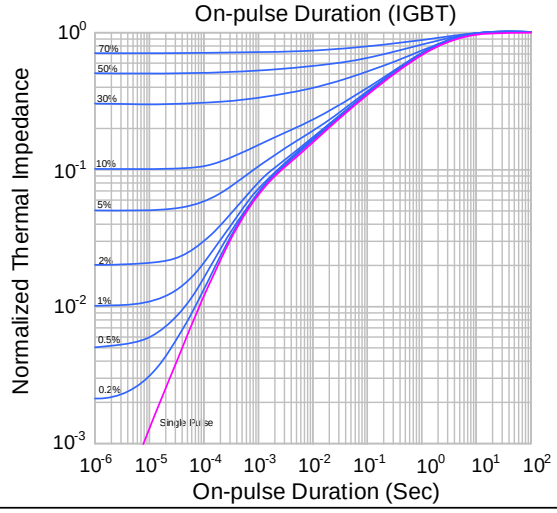
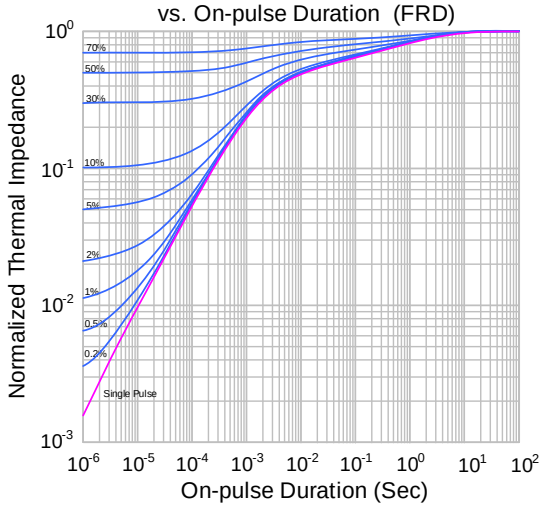
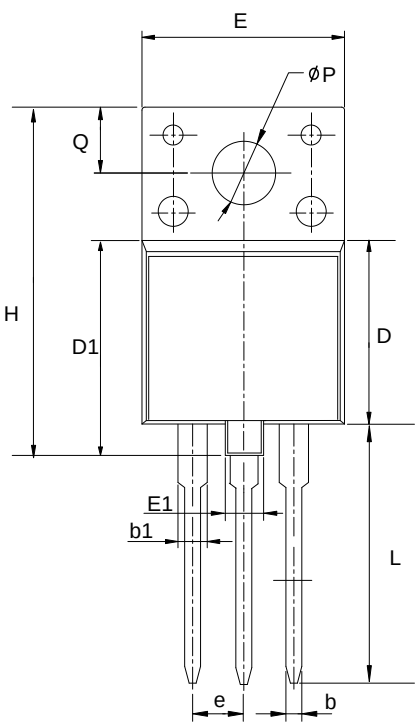


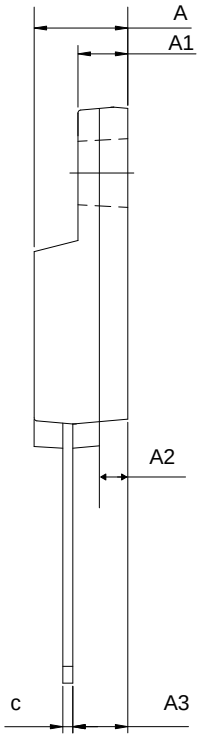
Figure 29. Transient Thermal Impedance vs. On-pulse Duration (FRD)



PACKAGE OUTLINE

TO-3PF **UNIT: mm**





SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	5.20	5.50	5.80
A1	2.80	3.00	3.20
A2	1.70	2.00	2.30
A3	3.00	3.40	3.80
b	0.65	0.80	0.95
b1	1.80	2.00	2.20
c	0.70	0.90	1.10
D	14.30	—	15.50
D1	16.30	—	17.70
E	15.30	15.50	15.70
E1	3.80	4.00	4.20
e	5.15	5.45	5.75
H	26.10	26.50	26.90
L	18.50	—	19.70
ØP	3.40	3.60	3.80
Q	4.30	4.50	4.70

MOS DEVICES OPERATE NOTES:

Electrostatic charges may exist in many things. Please take following preventive measures to prevent effectively the MOS electric circuit as a result of the damage which is caused by discharge:

- The operator must put on wrist strap which should be earthed to against electrostatic.
- Equipment cases should be earthed.
- All tools used during assembly, including soldering tools and solder baths, must be earthed.
- MOS devices should be packed in antistatic/conductive containers for transportation.

Important notice :

1. Silan reserves the right to make changes of this instruction without notice.
2. Customers should obtain the latest relevant information when purchasing and should verify whether such information is latest and complete. Please read this instruction and application manual and related materials carefully before using products, including the circuit operation precautions, etc.
3. It is neither tested nor verified in accordance with AEC-Q series standards testing or application requirements. Silan does not give any warranties as to the suitability of the Silan's product for any specific use. The design intent, design definition and design of the product are not intended for application (the application stated in this instruction includes use, etc.) in transportation equipment, medical equipment, life-saving equipment, aerospace equipment, non-civil equipment or non-civil use, etc. (the equipment stated in this instruction includes systems, devices, etc., all referred to as equipment).The product should not be used in any equipment or system whose manufacture, use or sale is prohibited under any applicable laws or regulations("unintended use"). If the product is used for unintended use, therefore the full risks of such products application are borne by the customer and Silan assumes no liability for the product used for the unintended use. If the customer intends to use the Silan's product in a application where malfunction or failure can be reasonably be expected to result in personal injury, or serious property, or environment damage, the customer shall make adequate assessment, testing and verification, and Silan shall not be liable for such applications.
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Part No.:	SGTP40V60SD2PF	Document Type:	Datasheet
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Rev.: 1.0

Revision History:

1. First release